

**BATTLEFIELD MAINTENANCE SYSTEMS  
DESCRIPTION FOR PURCHASE**

**CONTAINERIZED RECOMPRESSION CHAMBER, DIVERS: 100 PSIG  
NSN 4220-01-471-0096**

**1. SCOPE**

**1.1 Scope.** This Description for Purchase covers a containerized, transportable, divers recompression chamber, 100 psig.

**1.2 General.** This Description for Purchase establishes the design, construction and testing requirements for a containerized, double-lock, 100 psig, transportable, aluminum or steel recompression chamber within an 8ft x 8ft x 20ft, rigid, ISO shelter. For the purposes of this Description for Purchase, the complete chamber system including shelter with environmental control units shall be referred to as the "unit." Design, construction, components, operating and maintenance procedures shall be appropriate for use with a life support system.

**2. APPLICABLE DOCUMENTS**

**2.1 Government documents.**

**2.1.1 Specifications and standards.** The following specifications and standards form part of this Description for Purchase to the extent specified herein. Unless otherwise specified, the issues of these documents shall be those listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS) and supplement thereto, cited in the solicitation.

Beneficial comments (recommendations, additions, and/or deletions) and any pertinent data which may be of use in improving this document should be addressed to Commander, U.S. Army TACOM-ARDEC, ATTN: Battlefield Maintenance Systems, AMSTA-AR-WEP(R), Rock Island, Illinois 61299-7300.

**SPECIFICATIONS  
FEDERAL**

BB-N-411 - Nitrogen, Technical.  
BB-A-1034 - Compressed Air, Breathing.

**MILITARY**

MIL-C-53072 - Chemical Agent Resistant Coating (CARC) System  
Application Procedures and Quality Control Inspection

**STANDARDS**

None

**HANDBOOKS**

**DEPARTMENT OF DEFENSE**

MIL- HDBK- 1221 - Department of Defense Handbook, Evaluation of  
Commercial Off-The-Shelf (COTS) Manuals

**2.1.2 Other Government documents and publications.** The following other Government documents and publications form a part of this specification to the extent specified herein. Unless otherwise stated, the issue shall be those in effect on the date stated in the solicitation.

**DEPARTMENT OF THE ARMY**

FM 20-11 - U.S. Army Military Diving Field Manual

(Application for copies should be addressed to the Commandant, US Army Engineer School ATTN: ATZT-DT-DS-P, Fort Leonard Wood, MO 65473-8929. This publication is also available on the Army Doctrinal and Training Digital Library (ADTDL) at <http://155.217.58.58>)

**OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA)**

OSHA 29 CFR 1910.430

(Applications for copies should be addressed to Superintendent of Documents, US Government Printing Office, Washington, D.C. 20402.)

(Copies of specifications, standards, handbooks, drawings, publications, and other Government documents required by contractors in connection with specific acquisition functions should be obtained from the contracting activity or as directed by the contracting officer.)

**2.2 Other publications.** The following documents form a part of this Description for Purchase to the extent specified herein. Unless otherwise specified, the issues of this Description for Purchase which are DOD adopted shall be those listed in the issue of the DODISS specified in the solicitation. Unless otherwise specified, the issues of documents not listed in the DODISS shall be the issue of the non-Government documents which are current on the date of the solicitation.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

Boiler and Pressure Vessel Code, Section VIII, Division 1, Rules for Construction of Pressure Vessels.

Safety Standards for Pressure Vessels for Human Occupancy, ASME PVHO-1.

(Applications for copies should be addressed to the American Society of Mechanical Engineers, 345 East 47th Street, New York, NY 11017.)

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM-D-3951, Standard Practice for Commercial Packaging

(Applications for copies should be addressed to ASTM 1916 Race St. Philadelphia, PA 19103.)

(Non-Government standards and other publications are normally available from the organizations which prepare or which distribute the documents. These documents also may be available in or through libraries or other informational services.)

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI MH10.8M – Materials Handling – Unit Loads and Transport Packages - Bar Code Systems

(Application for copies should be addressed to the American National Standards Institute, Inc., 1430 Broadway, New York, NY 10018.)

**2.3 Drawings.** The following drawings are applicable to this Description for Purchase.

Drawing Number

Drawing Title

13226E7350

SHELTER, ISO, 8X8X20 NOM., RIGID

(Application for copies should be addressed to Commander, U.S. Army TACOM-ARDEC, ATTN: Battlefield Maintenance Systems, AMSTA-AR-WEP(R), Rock Island, Illinois 61299-7300.)

**2.4 Order of precedence.** In the event of a conflict between the text of this Description for Purchase and the references cited herein, the text of this Description for Purchase shall take precedence. Nothing in this Description for Purchase, however, shall supersede applicable laws and regulations unless a specific exemption has been obtained. The contracting officer shall request in writing from U.S. Army TACOM-ARDEC, Battlefield Maintenance Systems, AMSTA-AR-WEP(R) Technical Representative any issue regarding clarification to resolve conflicts between the contractor and manufacturer prior to formal response answering manufacturer conflicts or questions.

### 3. REQUIREMENTS

**3.1 Description.** The containerized 60 inch diameter, 100 psig, double-lock recompression chamber shall be of aluminum or steel construction and shall include the following features:

- **Structural systems:** Portable, skid or pedestal mounted recompression chamber; 8ft x 8ft x 20ft, rigid, International Organization of Standardization (ISO) shelter enclosure; electrical and environmental conditioning supply/return penetrations; relief valve (set at 110 psig); lifting, tie-down and forklift provisions (chamber and shelter individually and as a unit).
- **Life support systems:** Air supply and exhaust systems; oxygen built-in-breathing-system (BIBS) inhalators and overboard dump system; high pressure oxygen storage system and reducing station; environmental control system; oxygen analyzer; CO2 analyzer; CO2 scrubber. All exhaust systems shall exhaust outside the shelter. A secondary exhaust route with flow meter shall be provided.
- **Electrical systems:** Communications; lighting; temperature probes and monitor; ground fault interrupter; DC power supply (24VDC); line voltage protector.
- **Secondary systems:** Fire resistant bedding; fire suppression system; a patient transfer device (slide); intravenous hanger; hearing protectors; medical first-aid kits; stainless steel buckets; shelter power cables; non-standard tools; and sectional grounding rod assembly.

The gross weight of the unit and all components shall not exceed 14,000 lbs. The unit shall have a control station with the necessary controls and instrumentation to operate the unit and to provide recompression treatment.

**3.2 Acceptance Testing.** Each unit shall be subjected to inspections and acceptance tests in accordance with 4.2.

**3.3 Material.** Material shall be as specified herein. Materials not specified shall be selected by the contractor and shall be subject to all provisions of this Description for Purchase. Only materials in accordance with ASME / PVHO-1 and ASME Boiler and Pressure Code,

Section VIII, Division 1, Rules for Construction of Pressure Vessels shall be used. Material, manufacturers, and equipment used in construction of and in support of the chamber is limited to those vendors and equipment meeting ASME / PVHO-1 and ASME Boiler and Pressure Code, Section VIII, Division 1, Rules for Construction of Pressure Vessels requirements. No fittings shall be made of flammable material. Materials, such as cured paints, insulation, adhesives, plastic, fabrics, fittings, and other equipment containing material or components that give off noxious fumes at any temperature below 200° F or could cause occupational illness, shall not be installed or applied within the chamber. All components installed in the oxygen system shall be compatible with oxygen service.

**3.3.1 Material deterioration prevention and control.** The recompression chamber shall be fabricated from compatible materials, inherently corrosion resistant or treated to provide protection against various forms of corrosion and deterioration that may be encountered in any of the applicable operating and storage environments to which the chamber may be exposed.

**3.3.2 Dissimilar metals.** Dissimilar metals shall not be used in intimate contact with each other unless protected against galvanic corrosion.

**3.3.3 Identification of materials and finishes.** The contractor shall identify and document the specific material, material finish or treatment for use with component and sub-component, and shall make information available upon request to the contracting officer or designated representative. Finishes applied to pressure-containing elements shall not be of a type likely to permit the development of hidden pitting.

**3.3.4 Ozone depleting substances.** Ozone depleting substances (ODS) shall not be used in the performance of this Description for Purchase.

**3.4 Components.** Brand name components describe items known to be satisfactory for their intended use. This class of components may be utilized provided they meet all requirements in accordance with ASME / PVHO-1 and ASME Boiler and Pressure Code, Section VIII, Division 1, Rules for Construction of Pressure Vessels where applicable. No equipment shall be made of material that is flammable when subjected to a direct flame at one (1) atmosphere. All components shall be capable of operating from -10° F to +135°. Provisions for securing components for transport and storage while not in use shall be provided.

**3.5 Safety.** Electrical equipment, wires, and connectors shall be effectively grounded or insulated to protect all persons and objects from electrical shock hazard. Nonfunctional sharp edges, projecting points, and excessive length of fastening devices shall be avoided. All internal and external electrical circuits shall be weatherproof and explosion-proof where appropriate. The recompression chamber shall be in accordance with applicable sections of OSHA 29 CFR part 1910.430.

**3.5.1 Warning.** A warning sign shall be posted inside and outside of the recompression chamber as follows:

WARNING  
FIRE/EXPLOSION HAZARD

No matches, lighters,  
electrical appliances,  
or flammable materials  
permitted in chamber.

A warning sign shall be posted near the relief valve gag valve as follows:

WARNING

This relief valve gag valve must remain in  
the open position at all times during normal  
chamber operation and when chamber is  
secured. Close only in event of relief valve  
failure and chamber depressurization is  
imminent.

A warning sign shall be posted near the overboard dump for the oxygen system as follows:

WARNING  
FIRE/EXPLOSION HAZARD

No matches, lighters, electrical appliances,  
or flammable materials permitted in this area.

Lettering for warning signs located on the inside of the shelter shall be as follows: "WARNING" shall be red and 2 inches tall. "FIRE / EXPLOSION HAZARD" shall be 1-inch tall black letters. All other lettering shall be black and 1/2 inch tall. Background shall be white. Lettering for warning signs located on the outside of the shelter shall be as follows: "WARNING" shall be 2 inch tall black letters. "FIRE / EXPLOSION HAZARD" shall be 1 inch tall black letters. All other lettering shall be black and 1/2 inch tall. Background shall be standard O.D. green.

**3.6 Maintainability.** All major assemblies shall be accessible for servicing, repair and replacement without the removal of other major assemblies. External electrical components and analyzers, where practical, shall be panel mounted with access to the components through the removal of the panel mounting hardware only. Covers and guards, which must be removed for component adjustment or repair, shall be equipped with quick-disconnect fasteners. All recompression chamber fasteners shall be corrosion resistant material. Shelter fasteners shall be corrosion resistant material or shall be treated to be corrosion resistant. All screw threads shall be in accordance with ASME / PVHO-1 and the standard commercial practice of the recompression chamber industry. Maximum use shall be made of interchangeable hardware and fasteners. All maintenance, assembly, or disassembly operations shall be accomplished with common tools and any special tools furnished with the unit.

### **3.7 Construction.**

**3.7.1 Recompression chamber.** The recompression chamber shall be fabricated, tested, and certified in accordance with the ASME Boiler and Pressure Vessel Code, Section VIII, Division 1, Rules for Construction of Pressure Vessels as supplemented by the Safety Standards for Pressure Vessels for Human Occupancy, ASME PVHO-1. The chamber shall bear the ASME stamp. No welding or other actions shall be permitted after the chamber has been ASME certified.

**3.7.1.1 Recompression chamber certification.** Documentation is required to verify that construction, fabrication, assembly, and testing procedures meet engineering standards necessary to deliver a safe, mission-reliable recompression chamber. All written construction, fabrication, and assembly processes, which affect the designed performance of the chamber, must be identified. Documentation must include fabrication drawings and specifications as well as supplemental information that is not necessarily specified on the drawings but which does affect the process. Supplemental information includes work procedures, process instructions, welding and brazing procedures, assembly procedures, cleaning procedures, quality assurance inspection procedures, and any other processes, procedures, or instructions required for construction of the chamber. The certification of the chamber is detailed in ASME / PVHO-1.

**3.7.1.2 Recompression chamber design** The 60 inch diameter, double-lock, recompression chamber shall be designed to a maximum working pressure of 100 psig. The basic construction material for the pressure vessel and miscellaneous structures shall be aluminum or steel at the choice of the contractor. All materials shall be in accordance with ASME / PVHO-1 and ASME Boiler and Pressure Vessel Code, Section VIII, Division 1, Rules for Construction of Pressure Vessels. The recompression chamber shall have a skid mounted or pedestal type base and be mounted in an 8ft x 8ft x 20ft, rigid, ISO shelter and outfitted with the following equipment/systems:

- **Structural systems:** Medical lock, (contractor optional, see 3.7.1.2.1.1); electrical and environmental conditioning supply/return penetrations; no less than three (3) view ports; relief valve (set at 110 psig); lifting, tie-down and forklift provisions (chamber and shelter individually and as a unit).
- **Life support systems:** Air supply and exhaust systems; oxygen BIBS inhalators and overboard dump system; high pressure oxygen storage system and reducing station; environmental control system; oxygen analyzer; CO2 analyzer; CO2 scrubber. All exhaust systems shall exhaust outside the shelter. A secondary exhaust route with flow meter shall be provided.
- **Electrical systems:** Communications; individually controlled adjustable lighting; temperature probes and monitor; ground fault interrupter; DC power-supply; line voltage protector.

- **Secondary systems:** Fire resistant bedding; fire suppression system; a patient transfer device (slide); intravenous hanger; hearing protectors; power cables; medical first-aid kits; stainless steel buckets; self contained breathing apparatus; non-standard tools.

**3.7.1.2.1 Recompression chamber structural systems.** The recompression chamber's structural systems consist of a skid mounted or pedestal mounted, two (2) compartment pressure vessel including doors, penetrations, view ports, and medical lock, (the medical lock is at the option of the contractor, see 3.7.1.2.1.1). The chamber and associated support equipment shall be installed in an 8ft x 8ft x 20ft, rigid, ISO shelter that serves as a weatherproof work area. The chamber shall have fork-lift, slinging and tie-down provisions for installation into the shelter. The chamber, ISO shelter, and all support equipment shall be designed for rough handling and shall withstand a minimum tilt angle of 35 degrees during loading and offloading of the fully loaded shelter and recompression chamber on the U.S. Army Heavy Expanded Mobility Tactical Truck - Load Handling System (HEMTT-LHS).

**3.7.1.2.1.1 Pressure vessel.** The design and construction of the pressure vessel shall be in accordance with the ASME / PVHO –I and ASME Boiler and Pressure Vessel Code, Section VIII, Division 1, Rules for Construction of Pressure Vessels. The recompression chamber shall be 60 inches inside diameter and have one (1) inner lock, (IL), long enough to allow a person to lay down and equipped to provide recompression treatment, and one (1) outer lock, (OL), for the transport of personnel and equipment to and from the IL without treatment interruption. A medical lock for the rapid transport of supplies to and from the IL is not required, but may be provided at the option of the contractor. The medical lock, if provided by the contractor, shall be designed for easy transport of supplies and to prevent accidental openings and shall be welded to the exterior hull of the IL. The IL and OL shall be equipped with aluminum or steel floor plates, and shall be grounded to the folding chamber bunk, bench and folding shelf/seat provided in the IL.

**3.7.1.2.1.2 Doors.** Two (2) chamber doors shall be provided. Doors from outside to the OL and from the OL to the IL shall be at least 28 inches in diameter, hinged to open inward, and be chamber pressure sealed using an O-ring seal. The chamber doors shall not have any type of positive closure mechanism. A method for securing the doors from the outside during shipment shall be provided. If a medical lock is provided, the medical lock shall have two (2) doors sized commensurate with the medical lock diameter. The inner door shall be hinged to open inward, and be chamber pressure seated using an O-ring seal. The outer door shall be hinged to open outward, have a positive closure mechanism using an O-ring seal. Opening and closing any of the doors shall not interfere with any other functional element of the chamber.

**3.7.1.2.1.3 Relief valve.** The recompression chamber shall be equipped with a relief valve on the IL that is set to relieve (lift) at 110 psig. The relief valve must not present a hazard to the operator, diver, or occupant by causing rapid decompression should it be actuated by a malfunction or extreme pressure. In addition, a gag valve shall be installed between the relief valve and the chamber pressure vessel. The gag valve shall be a "V" turn ball valve sized to be compatible with the relief valve and safety wired with frangible wire in the open position. The

gag valve must be within reach of the operator for emergency use.

**3.7.1.2.1.4 Penetrations.** All vents, drains, exhausts, or other exits from the pressure vessel which are not in use during recompression chamber operation shall be equipped with a means of positively securing or locking against accidental opening or closing.

**3.7.1.2.1.5 View ports.** No less than three (3) view ports shall be provided and located to allow viewing from a standing position outside the recompression chamber. Two (2) view ports shall be provided on the operator side of the IL and one (1) view port shall be provided on the operator side of the OL. Consideration should be given to the location of the operator side station when locating the view ports. It is preferred to have the operator's control station panel located at the end of the IL rather than at the side, (see 3.7.1.2.2.9). View port material shall conform to the Safety Standard for Pressure Vessels for Human Occupancy, ASME / PVHO-1. View port configuration shall have at least 6 inch diameter clear viewing area.

**3.7.1.2.1.6 Recompression chamber skids or pedestals.** The chamber shall be mounted on skids or pedestals of the contractor's own choosing. The skids or pedestals shall be constructed of the same material as the recompression chamber. If skids are used, they shall be positioned longitudinally to the chamber and designed to accommodate handling by a forklift truck. Forklift channels shall be at least 11 inches wide and 3 inches deep. Center to center distance of the channels shall be not less than one-third of the skid length and not more than 64 inches. Skids may be used as an anchor point for mounting the chamber to the floor of the shelter. If pedestals are used, the design of the pedestals shall be of the contractor's own design and sufficient to support the weight of the fully loaded recompression chamber. Pedestals shall have a sufficient base plate for equal distribution of weight and for mounting the chamber to the shelter floor. The method used for mounting the chamber to the shelter floor shall be designed for rough handling and shall withstand a minimum tilt angle of 35 degrees during loading and offloading of the fully loaded shelter and recompression chamber on the Heavy Expanded Mobility - Tactical Truck Load Handling System (HEMTT- LHS).

**3.7.1.2.1.7 Recompression chamber slinging provisions.** Permanently affixed slinging provisions that enable the chamber to be lifted in and out of the shelter shall be provided and shall conform to the standard commercial practice of the recompression chamber industry. When employed, slinging provisions shall not damage or interfere with other functional elements of the chamber. Slinging provisions shall be labeled "LIFT HERE."

**3.7.1.2.2 Recompression chamber life support systems.** Life support systems include all items required to provide a safe environment for all recompression chamber personnel. The chambers' life support systems include breathing gas supplies, CO2 scrubber, and exhausts and environmental conditioning and monitoring.

**3.7.1.2.2.1 Piping systems.** Piping systems shall be designed to withstand, without failure, all anticipated service loading including, but not limited to, weight of pipe, fittings, and valves; internal pressure (static and cyclic); deflections and rotations of structures and equipment at points of piping attachment; thermal effects; shock and vibration; and mechanical loads caused

by system operation. All piping, hoses, valves, gages, filters, etc. must be marked or labeled to indicate function, content, and direction of flow in accordance with the best commercial practices of the recompression chamber industry. The valve and gage labels shall be numbered sequentially. The hand wheel or operating lever of all system valves shall be color coded. All manually operated piping components shall be readily accessible and easily operated under normal and emergency conditions. Valves shall be positioned to preclude accidental operation. Hull stop valves shall be positioned as close to the corresponding hull penetration as practical. All hull penetrations shall have double valve protection. The number of joints shall be kept to a minimum. All components shall be in accordance with ASME / PVHO-1. All welding, fabrication and inspections shall be in accordance with ASME / PVHO-1. The contractor shall provide certification to ensure that all welding and inspection personnel are qualified to perform the required welds and inspections in accordance with ASME / PVHO -1. All connections between systems mounted to the shelter and systems mounted to the chamber shall be made with flexible hose conforming to the requirements of ASME / PVHO -1.

**3.7.1.2.2.2 Pressure gages.** Pressure gages shall be provided to monitor the depth in the recompression chamber and to monitor air and oxygen system pressures. (The chamber air supply pressure is monitored at the portable reducing station.) All gages shall be provided with a gage isolation valve that is readily accessible and may be closed to isolate a defective gage from the system. Gages shall be located so that they may be read by personnel at the normal operating position for which the display is intended. The chamber shall have three (3) gages for the inner lock, (IL) (one located near the IL view port and two(2) on the operator's console) and two (2) gages for the outer lock, (OL) (both located on the operator's console) to independently monitor the depth. Gauges shall be helical Bourdon tube gages, shall have a range of no less than 0-250 feet of sea water, marked in increments of no greater than 1 foot, and an accuracy of no less than 0.25% full scale. Each gage shall be installed and shock mounted in accordance with ASME / PVHO -1. Gages for the oxygen system shall be provided at each bank and upstream and downstream of the pressure-reducing valve. The oxygen system shall be equipped with a primary and secondary pressure reducer.

**3.7.1.2.2.3 Air system.** The piping and valves shall be arranged to permit control of the air supply and ventilation (for both locks) from outside of the recompression chamber only. Inlet ports and exhaust ports shall be located with sufficient separation to prevent stratification of the air. Inlet ports inside the chamber shall be furnished with diffusers/silencers. Exhaust ports inside the chamber shall be guarded. Silencers shall also be installed on the exhaust lines outside the shelter. See 3.7.2. Dual inlet connections shall be provided on the air system. The dual inlet connections shall be parallel and horizontal. The low pressure air inlet and down stream air system shall be designed for a working pressure of 400 psig. The high pressure air inlet shall be designed for 5000 psig service. Air system control valves shall be 1/4 turn, full open to full closed ball valves with lever type operators. All air system components shall be cleaned in accordance with U.S. Army Military Diving Field Manual FM 20-11. Cleaned components and open-ended piping shall be bagged or sealed to preserve cleanliness. Air system components shall be designated "AMP" or "AHP" as appropriate and color-coded black. Exhaust system components shall be designated "E" and color-coded silver.

**3.7.1.2.2.4 Oxygen system.** The recompression chamber shall be equipped with a system for delivering oxygen to personnel in the IL and OL. The design pressure of the system shall be 3,000 psig. The system shall consist of at least a 2,400 psig pressure source (two (2) banks of K size flasks, two (2) flasks per bank with storage provided for two (2) additional flasks). A four (4) station manifold with four (4) (B) demand-type oxygen inhalators with overboard discharge capability shall be provided in the IL and a two (2) station manifold with two (2) (B) demand-type oxygen inhalators with overboard discharge capability shall be provided in the OL. A pressure-reducing valve shall be provided that is capable of dropping the pressure to 100 psig or less. The regulator must be sized to supply adequate flow to the inhalators. A 25 micron filter shall be installed directly upstream of the reducing valve. Oxygen flask connections shall be made with hand tight nuts to ease flask change out. Each flask and each bank shall have an isolation valve in order to facilitate flask change out during operation. An overboard dump system (backpressure regulator) shall be provided for eliminating exhaled oxygen. See 3.7.2. Oxygen piping shall be designed in such a manner as to virtually eliminate leaks. The number of mechanical joints shall be kept to a minimum and should be restricted to the pressure source connection and the inhalator connections. All system components shall be oxygen cleaned in accordance with U.S. Army Military Diving Field Manual FM 20-11. Cleaned components and open-ended piping shall be bagged or sealed to preserve cleanliness. No ¼ turn valves shall be used on the high pressure side of the oxygen system. Oxygen system components shall be designated "OX" and color coded green.

**3.7.1.2.2.5 Oxygen analyzer.** An oxygen analyzer shall be provided to monitor the percentage of oxygen inside the IL. The analyzer shall be located at the control station outside of the recompression chamber. The analyzer shall be capable of sensing 0-25% oxygen content with a resolution of no less than 0.25% and a sensitivity of no less than 0.5% full scale. High and low level alarms, both visual and audible should be provided. The response time of the cell sensor shall be no greater than 10 seconds with an expected life of six (6) months minimum. The analyzer shall be powered by dry cell batteries, the DC power supply, or 110 VAC supplied from the chamber electrical system.

**3.7.1.2.2.6 CO2 analyzer.** A CO2 analyzer shall be provided to monitor the percentage of CO2 inside the IL. A filter sized in accordance with the analyzer requirements shall be provided. The analyzer readout shall be located at the control station outside of the recompression chamber. The analyzer shall be capable of sensing 0-1,000 parts per million (ppm) CO2 with a resolution of no less than 0.1 ppm and a sensitivity (electronic) of no less than ±0.02% full scale. A high level alarm, both visual and audible should be provided. The response time of the sensor shall be no greater than 15 seconds. The analyzer shall be powered by the DC power supply or 110 VAC supplied from the chamber electrical system.

**3.7.1.2.2.7 CO2 scrubber.** A CO2 scrubber shall be provided in the IL to scrub the atmosphere in order to maintain the partial pressure of CO2 inside the recompression chamber below 1.5% surface equivalent (11.4 mm Hg). The scrubber shall use non-powdering Soda Lime as the CO2 absorbent and have a sealed, spark proof (no brushes) motor. The scrubber

shall have a flow rate of 20 actual cubic feet per minute (acfm) at one (1) atmosphere minimum and be pressure resistant to a minimum of 200 psig. The scrubber shall be powered by the DC power supply.

**3.7.1.2.2.8 Recompression chamber environmental control system.** An environmental control system shall be provided to control the temperature and humidity inside the IL during recompression treatment. The system shall be composed of an internal conditioning unit, installed in the IL, and an external supply unit. The internal unit shall consist of a heat exchanger, for heating and cooling, and a circulating fan rated at 70 acfm minimum. The fan shall be powered by a sealed, spark proof (no brushes) motor. The external supply unit shall be a source of chilled and heated fluid (water/propylene glycol mixture) and a circulating pump. Space inside the shelter shall be provided for the external recompression chamber environmental control system. The external supply unit shall be vented to the outside and be supplied with a close out and rain panel.

**3.7.1.2.2.9 Control station.** All recompression chamber controls and instruments shall be arranged to establish a central control station outside of the chamber. The arrangement and location of the control station shall be such that all controls can be operated from a standing position and in close proximity to the IL view ports. The position and location of the control station shall not interfere with personnel traffic within the shelter during operation of the recompression chamber. The preferred location for the control panel is at the end of the recompression chamber to allow more room for personnel travel. The control station shall be divided into an electrical section and a piping section. An adjustable illumination system shall be provided over the control station. If a 110 VAC, 60Hz system is furnished, it shall be wired through the ground fault interrupter if wired as part of and in contact with the chamber system instead of the shelter system, (see 3.7.1.2.3.4). All gages and instruments shall be mounted plumb and straight. Each gage and instrument shall be identified with a label plate mounted above the gage or instrument. Controls shall be arranged to facilitate sequential operations. A flow diagram shall be provided for the air system, ventilation system and the oxygen system. Each diagram shall be color coded and marked to indicate piping, valves, gages and instruments and shall be engraved, etched, or painted on the control station panel adjacent to the corresponding system components.

**3.7.1.2.3 Recompression chamber electrical systems.** The electrical systems associated with the recompression chamber include communications, lighting, ground fault interrupter, line voltage protection (AC), and a 24VDC power supply. The electrical system of the shelter is covered in 3.7.3.4. All instruments and control equipment, where practical, shall be suitable for panel mounting on the electrical side of the control station. All electrical powered equipment or enclosures shall be adequately grounded to prevent shock hazards to personnel. All electrical system materials and components shall, as a minimum, be in accordance with the latest standard practices of the commercial diving recompression chamber industry. All electrical system switches, breakers, and operational components must be marked or labeled to indicate function and shall be numbered sequentially.

**3.7.1.2.3.1 Recompression chamber power distribution.** All electrical power distribution circuits shall be from an ungrounded electrical system fed from isolating transformers to minimize shock and insure continuity of service. Equipment connected to the power distribution system shall not be grounded to the recompression chamber or the shelter. All equipment designed to employ chassis grounds must be isolated from the electrical power system by a transformer to a suitable isolation device. To minimize corrosion due to electrolysis, the use of the chamber pressure vessel as an electrical conductor or as a common reference is prohibited.

**3.7.1.2.3.2 Recompression chamber wiring.** Cables and wires installed inside of the recompression chamber shall be protected from personnel movement within the chamber. Cables shall be non-wicking and shall be capable of withstanding 1.25 times the maximum operating pressure of the chamber. Electrical insulating materials shall be nonflammable and nontoxic. Teflon-coated wire or kapton polyimide film over FEP-type insulation are acceptable and preferred. Conventional switches, outlets, and other wiring devices must not be installed in the chamber. All electrical connectors shall be circular threaded pin and socket type, in accordance with the latest standard practices of the commercial diving recompression chamber industry. Connector pins and sockets shall be corrosion resistant or plated to prevent corrosion and electrical discontinuities. Electrical connectors shall be designed to prevent incorrect connection. Color coding or other visual identification alone is not sufficient.

**3.7.1.2.3.3 Communications.** The recompression chamber shall have a primary and secondary voice communications system. Each system shall provide communications between the OL, IL and the control station.

**3.7.1.2.3.3.1 Primary communications.** The primary communications system shall be provided through an amplified intercom console with dual microphone/reproducer units. The console shall have separate, selectable channels for the IL and OL; individual volume controls for the operator and both locks; push-to-talk microphone with no less than a four (4) foot cord; 12 Watt audio power maximum to all speakers; power and battery status indicator; and be powered by 110 VAC, 60 Hz with an emergency battery backup power supply with automatic charging. The console shall be located on the control station and be panel mounted. The dual microphone/reproducer unit shall have a frequency range of 300 Hz to 12kHz; an 8 ohm, 5 watt rating; an on/off switch; and a headset connector jack. The input shall be a male pin connector in accordance with the latest standard practice of the commercial communications industry. A unit, including a headset with a boom microphone, shall be installed both in the IL and in the OL. A headset with a boom microphone, shall also be installed at the control station.

**3.7.1.2.3.3.2 Secondary communications.** The secondary communications system shall be provided through a sound powered telephone system. The system shall consist of three (3) noise attenuating handsets, jack plates, and wiring accessories to establish a three (3) station system. Each station shall have a jack plate. One station shall be on the control station and the other stations inside the chamber; one (1) in the IL and the other in the OL.

**3.7.1.2.3.4 Ground fault interrupter.** A ground fault interrupter that will serve to disconnect electrical service thereby isolating the recompression chamber from potentially dangerous electrical shocks shall be provided. The interrupter shall have the following characteristics: double-pole type construction; a trip current of 0.75 micro-amps maximum; a trip time of 15 millisecond maximum; a full load rating suitable for the chamber service, with a suitably sized circuit breaker; and an isolation transformer as a backup safety feature. The interrupter shall be installed in the vicinity of the electrical side of the control station.

**3.7.1.2.3.5 Power supply.** A power supply that shall serve to handle rough AC input voltages and provide steady DC output shall be provided. The output voltage shall be based on the recompression chamber equipment requirements. The output current shall be no less than 125% of the chamber equipment requirements. The supply shall be installed in the vicinity of the electrical side of the control station.

**3.7.1.2.3.6 Temperature monitor and temperature probe.** The temperature monitor shall have a range no less than 0-150° F with a resolution of no less than 0.2° F. The monitor shall have an electronic accuracy of no less than ±0.02% full scale and be powered by 110 VAC or the DC power supply and include spike, transient and surge suppression. A built-in battery backup shall be included with the monitor. Fully adjustable high and low level alarms, both visual and audible, should be provided. The monitor shall be installed on the electrical side of the control station. Temperature probes compatible with the monitor shall be installed in the IL.

**3.7.1.2.3.7 Lighting.** An external lighting system utilizing light pipes shall be provided to illuminate the IL and OL. Three (3) separate systems shall be used; one (1) for the OL and two (2) for the IL. A common power supply may be used provided individual control of each light is provided. The light level shall be continuously adjustable from 0.1 foot-candle to full brightness.

**3.7.1.2.3.8 Line voltage protection.** A surge and spike voltage suppresser that shall limit excessive voltage excursions shall be provided. The suppresser shall be in accordance with the latest standard practices of the commercial recompression chamber industry.

**3.7.1.2.4 Recompression chamber secondary systems.** The secondary systems are comprised of fire retardant bedding, medical first-aid kit, a patient transfer device (slide), an intravenous hanger, hearing protectors, fire suppression system, and self contained breathing apparatus.

**3.7.1.2.4.1 Fire resistant bedding.** Fire resistant bedding shall be provided in order to provide adequate cover and comfort to the patient(s) and tender(s) during recompression treatment. The bedding shall be made of fire resistant material in accordance with the U.S. Army Military Diving Field Manual FM 20-11. Two (2) sets each of blankets, sheets, pillows, pillow slips, and mattress jackets shall be provided per chamber. One (1) mattress shall be provided per chamber. The contractor shall provide manufacturer's certification that the fire resistant bedding meets the criteria as described in the U.S. Army Military Diving Field Manual FM 20-11.

**3.7.1.2.4.2 Medical first-aid kit.** A primary and secondary emergency medical first-aid kit as described in the U.S. Army military Diving Field Manual FM 20-11 shall be provided (excluding controlled medical supplies). The primary first-aid kit shall have a permanent mounting position inside the IL. The secondary first-aid kit shall have a permanent mounting position outside the chamber entrance.

**3.7.1.2.4.3 Fire suppression system.** Two (2) portable fire suppression systems shall be provided for each unit. One shall have a permanent mounting position located inside the IL and one shall have a permanent mounting position located outside the chamber entrance. Each fire suppression system shall consist of a water-type, stainless steel fire extinguisher. The extinguisher shall have a volume of no less than 2 ½ gallons, a working pressure of no less than 150 psig, pressure gage, pressure relief valve, and fill valve. Extinguishers containing Halon, CO<sub>2</sub>, carbon tetrachloride, or dry powder are prohibited.

**3.7.1.2.4.4 Patient transfer device (slide).** A slide shall be provided that aids in placing a patient inside the recompression chamber. The slide shall be constructed of aluminum or steel and shall bridge the OL to allow sliding a patient into the IL. The slide shall not have any sharp edges that could damage the chamber or cause personnel injury. The slide shall have a permanent storage position inside the shelter when not in use.

**3.7.1.2.4.5 Intravenous hanger.** A means shall be provided for hanging an IV inside the IL. The hanger shall be located in close proximity to the bunk and may be removable.

**3.7.1.2.4.6 Hearing protectors.** Six (6) sets of hearing protectors configured for recompression chamber use shall be provided. A place for storing the hearing protection shall be provided in each lock, (four (4) in the IL and two (2) in the OL).

**3.7.1.2.4.7 Self contained breathing apparatus.** Two (2) Self Contained Breathing Apparatus (SCBA) kits shall be provided for each recompression chamber for entrance into the recompression chamber after a fire. The SCBA's shall be permanently stored near the recompression chamber entrance in such a way as to provide easy emergency access.

**3.7.2 Interface requirements.** Provisions shall be made for piping the recompression chamber exhaust air and oxygen outside the shelter. Piping or exhausts shall not project outside of the shelter envelope. The chamber shall be mounted to the shelter deck by a semi-permanent method. Additional space in the shelter shall be reserved for a portable high-pressure air Chamber Reducing Station (CRS), (provided by the Government). (Reference U.S. Army Technical Manual TM 5-4220-231-14&P, Part No. 13229E4555). The CRS is not part of this specification, but provisions shall be made for its stowage. The CRS shall be located in close proximity to the control panel for easy access by the operator. A means for securing the CRS near the control panel shall be provided. The CRS is approximately 35 inches wide by 28 inches high by 17 inches deep and weighs 225 lbs. Penetrations through the shelter wall for one (1) high pressure (5,000 psi) and two (2) low pressure (300 psi) air hoses from the air supply sources to the CRS are required. The penetrations shall not have any sharp

edges that could abrade or cut the air hose and they must be able to be sealed when not in use. A means of securing the high pressure hose, strain relief device to the inside and outside of the shelter shall be provided. All shelter external openings/fixtures shall be flush with external surfaces to avoid damage during transportation.

**NOTE:** The contractor has the option of providing a permanent chamber reducing station mounted in the control panel instead of the portable Chamber Reducing Station (CRS), (provided by the Government). The permanent chamber reducing station shall be designed to accommodate one (1) high pressure (5,000psi) and two (2) low pressure (300 psi) air hoses from supply sources outside of the shelter.

**3.7.3 Shelter.** The recompression chamber shall be mounted in a standard International Organization of Standardization (ISO) container that shall provide protection to the chamber during transportation, loading and off-loading, and a work area during treatments. The shelter maximum external dimensions shall be 8 feet x 8 feet x 20 feet nominally (ISO "1C"). A means for leveling the shelter at each corner shall be provided. The leveling device shall be of the contractor's own design and shall be capable of extending up to and including 18 inches in length for leveling purposes. The ceiling and walls of the shelter shall be designed and constructed in such a way as to provide an insulated surface as needed to increase the performance efficiency of the environmental control unit (ECU). The shelter's interior configuration shall be of the contractor's own design and shall be equipped with but not limited to the following: interior lighting; environmental conditioning and ventilation; desk / workbench combination tools and parts storage cabinets; book storage shelf or cabinet; oxygen bottle storage rack/stand; storage space including securable storage for medical supplies as outlined in the U.S. Army Military Diving Field Manual FM 20-11; storage space for a sectional grounding rod assembly; storage space for CO2 absorbent; and storage space for camouflage netting. The personnel end panel shall have double doors which swing outward to allow for free access by patient (both ambulatory and non-ambulatory) and tender(s) to enter the recompression chamber without difficulty. The hard surface rear end panel or side panel nearest the rear end panel shall be equipped with an emergency access door. The modified, empty shelter shall not exceed 4,500 lbs.

**3.7.3.1 Shelter lifting provisions.** The shelter shall have fork-lift and lifting provisions, in accordance with the latest commercial practices of the ISO container industry, that will facilitate the lifting and transportation of the fully loaded shelter container by way of forklift, crane, rail car, boat, truck, trailer, and aircraft.

**3.7.3.2 Shelter doors.** The shelter shall be equipped with doors that will allow the entrance and exit of personnel and the loading and unloading of support equipment in and out of the shelter. The design configuration and position of the doors shall be of the contractor's own design and shall be in accordance with International Organization of Standardization (ISO) standards. A means shall be provided to hold the doors in the open position. All locking device handles shall be furnished with provisions for padlocking and sealing. The doors, when closed, shall form a weatherproof seal.

**3.7.3.3 Shelter environmental control system.** The shelter shall be equipped with an environmental control unit (ECU, air conditioner/heater/ventilator). The ECU shall be permanently installed inside the shelter and shall provide adequate air conditioning, heating, and ventilation for the interior of the shelter during operation of the recompression chamber. Closeout panels shall be provided to secure all openings when the chamber and shelter are not in use. Ducting shall be installed, where necessary, to provide for even distribution of conditioned air. A fan assembly (air movement of 700 cfm) shall be provided for emergency use when the air conditioner/heater is not available. Appropriate switches shall be provided to control fan speed and temperature.

**3.7.3.4 Shelter electrical characteristics.** The shelter shall be equipped with one (1) 100ft long, power cable capable of handling the total power requirements of the recompression chamber, ISO shelter, and all support equipment. The power cable shall be fabricated in accordance with the latest standard practices of the commercial containerized recompression chamber industry and shall connect to a military generator set (not part of this Description for Purchase). The cable shall be designed for outdoor use and cable insulation shall remain flexible, without peeling or cracking at temperatures down to -30 degrees F. The shelter shall be equipped with a power distribution box and distribution panel to provide the following:

- Circuit breakers for all circuits within the shelter.
- Power to the fan receptacle mounted on the power distribution box.
- AC power metering circuits.
- Power to the Environmental Control Units (ECUS).
- Power to all support equipment.
- Electrical distribution to receptacles and light fixtures.

The contractor shall provide two (2) receptacles outside of the shelter on the power panel and as many as required on the inside of the shelter to run all equipment.

**3.7.3.5 Shelter lighting.** The shelter shall be equipped with overhead light fixtures each containing two (2) mercury free, fluorescent bulbs, one red and one white that work independently of one another. The system shall include a blackout light switch and door switch. The shelter shall contain one (1) emergency lantern that automatically lights on loss of shelter power. The emergency lantern shall be mounted near the control panel. The shelter shall include emergency lamps, which illuminate the interior of the recompression chamber IL and OL through the view-ports automatically on the loss of shelter power. Lighting intensity for overhead lighting shall be adjustable.

**3.7.3.6 Shelter Certification.** The finished shelter assembly shall be certified as an 8 ft x 8 ft x 20 ft ISO container in accordance with applicable Coast Guard requirements for such containers for various types of transport including motor carrier truck, rail, sea, and air.

**3.8 Installation and calibration.** All components shall be installed and calibrated in accordance with the component manufacturers' instructions and recommendations.

**3.9 Noise levels.** Noise levels inside the recompression chamber and inside the shelter shall not exceed 85 dba under normal operating conditions when measured in accordance with paragraph 4.3.3.12.

**3.10 Treatment and painting.**

**3.10.1 Shelter Treatment and painting.** All surfaces of the ISO shelter, requiring paint, shall be cleaned, treated, and painted with a chemical agent resistant coating. Interior paint application and inspection shall be in accordance with the latest standard practices of the commercial containerized recompression chamber industry. Exterior paint application and inspection shall be in accordance with MIL-C-53072. The exterior of the shelter shall be painted in a standard black, green, and brown camouflage pattern in accordance with U.S. Army Drawing No. 13226E7350.

**3.10.2 Recompression chamber treatment and painting.** Recompression chambers of steel construction shall be painted in accordance with the U.S. Army Military Diving Field Manual FM 20-11. Recompression chambers of aluminum construction shall not be painted.

**3.11 Identification marking.** Each shelter and recompression chamber unit shall be identified with corrosion-resistant identification plates. The plates shall be permanently and legibly marked in accordance with the standard commercial practice of the recompression chamber industry. The plates shall be attached in a conspicuous location. The shelter identification plate shall be written in the English language and shall include, but not be limited to the following information: National Stock Number (NSN), Nomenclature, Contract Number, Manufacturer's Name, Address, and Model Number, Serial Number, Outside Dimensions, Loading Capacity, Shipping Weight, Cube, and Center of Gravity. The recompression chamber identification plate shall be written in the English language and shall include but not be limited to the following information: National Stock Number (NSN), Nomenclature, Contract number, Manufacturer's Name, Address, and Model Number, Serial Number, Outside Dimensions, psig Rating, Loading Capacity, Shipping Weight, Cube, and Center of Gravity. The identification plate shall also provide space for permanent inspection and ASME certification stamps.

**3.12 Instruction plates.** Each unit shall be equipped with instruction plates or diagrams, including warnings and cautions, describing any special or important procedures to be followed in lifting, transporting, leveling, assembling, operating or servicing the shelter and recompression chamber unit. Instruction plates shall be corrosion resistant and shall be attached in a conspicuous location. The plates shall be permanently and legibly marked in the English language in accordance with the standard commercial practice of the recompression chamber industry.

**3.13 Special tools.** The contractor shall provide each unit with one (1) set of all special tools required for instrument calibration, and equipment maintenance.

**3.14 Workmanship.** All parts, components, and assemblies of the unit including castings, forgings, molded pans, stampings, bearings, seals, machined surfaces, and welded or

brazed parts shall be clean and free from sand, dirt, fins, pits, sprues, scales, or any damaging extraneous material. The unit shall be free of any defect that could impair its operation or serviceability.

**3.15 Vendor supplied documentation.** The contractor shall provide all documentation that is normally supplied by the commercial vendors for all procured commercial equipment used in the fabrication and assembly of the containerized recompression chamber. The documentation shall include, but not be limited to, operating instructions, warranty information, repair and maintenance instructions, equipment and parts descriptions, electrical schematics, diagrams, assembly drawings, and parts lists. One (1) copy of each vendor supplied documentation shall be provided to the Government in an indexed binder for each recompression chamber unit. The contractor shall provide the Government a copyright release letter giving the Government the right to reproduce and use the vendor supplied documentation included with the commercial equipment.

**3.16 Technical manuals.** The contractor shall provide technical manuals for the complete operation and maintenance of the recompression chamber unit, (this includes the shelter, recompression chamber, and all supporting equipment). The technical manuals shall include, but not be limited to, normal operating procedures, emergency operation procedures, maintenance and repair procedures and diagrams, and parts lists. One (1) copy of each technical manual shall be provided to the government in an indexed binder for each recompression chamber unit. The contractor shall provide the Government a draft of the commercial manual, for approval, sixty (60) days prior to final publication. Military Handbook, MIL-HDBK-1221 will serve as the guideline for the commercial manual. The following data shall be applied to the front cover: National Stock Number (NSN); end item nomenclature; contract number; and commercial and Government entity code. The contractor shall provide the Government a copyright release letter giving the Government the right to reproduce and use the commercial manuals included with the recompression chamber unit.

#### **4. QUALITY ASSURANCE PROVISIONS**

**4.1 Quality assurance (QA) program.** A QA program is required that shall be a planned and systematic pattern of all the actions necessary to provide adequate confidence that the unit conforms to established technical requirements. QA considerations are required in all areas that affect the safety of the operators and occupants. The QA provisions shall result in recorded data related to:

- Configuration management.
- Material control.
- Fabrication and manufacturing control
- Cleaning control.
- Re-entry control.
- Testing and inspection control.
- Acceptance Inspection Equipment (AIE).

- Quality System.
- Metrology and Calibration.

**4.1.1 Fabrication and manufacturing control.** The QA program shall insure that the unit has been manufactured in accordance with ASME / PVHO-1 and ASME Boiler and Pressure Vessel Code, Section VIII, Division 1, Rules for Construction of Pressure Vessels and in accordance with the approved drawings and manufacturing processes. All fabrication records required by the fabrication specifications and drawings shall be completed, signed, and dated.

**4.1.2 Testing and inspection control.** A testing and inspection control system shall be implemented to insure that materials and components are in conformance with the specified requirements. Records of all inspections and tests shall be maintained and shall indicate the nature and number of observations made, the number and type of deficiencies found and the nature of the corrective action taken. All test and inspection documents shall clearly show the following as a minimum:

- The testing activity.
- The items, subsystem, and system tested.
- That test results either meet or exceed requirements. Departures from test requirements must be justified, documented and approved by the contracting officer.
- The dated signatures of individuals responsible for testing and evaluation of test data.

The inspection system shall serve to verify that the latest applicable drawings, specifications and process controls, with all authorized changes incorporated, are used for fabrication, inspection and testing. The Inspection system shall describe the training and qualification of the inspectors. The inspection system shall also provide for calibration of inspection equipment.

**4.2 Inspections.** The inspection requirements specified herein are classified as follows:

- Quality conformance inspection.
- Inspection of packaging.

**4.2.1 Quality conformance inspection.**

**4.2.1.1 Examination.** Each unit shall be examined for the following defects. Presence of any one (1) defect shall be cause for rejection. Prior to shipment, all defects shall be corrected.

101. Material not as specified.
102. Materials are not resistant to corrosion or deterioration or treated to be resistant to corrosion or deterioration for the applicable storage and operating environment as specified.
103. Dissimilar metals as specified in 3.3.2 are not effectively insulated from each other as specified.

104. Contractor does not have documentation available for Identification of material, material finishes, or treatments.
105. Safety devices not as specified.
106. Warning signs missing or not as specified.
107. Ease of maintenance not as specified.
108. Identification markings and instruction plates not as specified.
109. Interchangeability not as specified.
110. Assembly incomplete, components missing or not as specified.
111. Workmanship not as specified.
112. Parts, tools and items to be furnished with the unit missing or not as specified.
113. Controls not as specified.
114. Configuration not as specified.
115. Communications not as specified.
116. Instrumentation not as specified.
117. Lighting system not as specified.
118. Electrical/power systems not as specified.
119. Environmental systems not as specified.
120. Dimensions and weight not as specified.
121. Handling provisions not as specified.
122. Records of certification documentation as required by ASME/PVHO-1 for recompression chamber certification not as specified.
123. Non-destructive testing of all welds within the scope of certification in accordance with ASME Boiler and Pressure Vessel Code, Section VIII Division 1 not as specified.
124. Pressure vessel fabrication and welds within the scope of certification in accordance with ASME Boiler and Pressure Vessel Code, Section VIII, Division 1 not as specified.

#### **4.2.2 Inspection of packaging.**

**4.2.2.1 Examination.** The preservation, packing, and marking of each unit shall be examined for the following defects. Presence of any one (1) defect shall be cause for rejection. Prior to shipment, all defects shall be corrected.

125. Materials, containers, or procedures not as specified.
126. Preservation in accordance with ASTM-D-3951 not as specified.
127. Packing in accordance with ASTM-D-3951 not as specified.
128. Recompression chamber not secured within shelter for level A or C.
129. Marking illegible, incorrect, incomplete, or missing.

**4.2.3 Responsibility for inspection.** Unless otherwise specified in the contract or purchase order, the contractor is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or purchase order, the

contractor may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, subject to approval by the Government. The Government reserves the right to perform any of the inspections set forth in this specification where such inspections are deemed necessary to insure supplies and services conform to prescribed requirements.

**4.2.3.1 Responsibility for compliance.** All items must meet all requirements of sections 3 and 5 of this specification. The inspection set forth in this specification shall become a part of the contractors overall inspection system or quality program. The absence of any inspection requirements in this specification shall not relieve the contractor of the responsibility of assuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling in quality conformance does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to acceptance of defective material.

**4.2.3.2 Component and material inspection.** The contractor is responsible for insuring that components and materials used are manufactured, examined and tested in accordance with referenced specifications and standards. All records, calculations and computations, welder certifications, x-rays of all pressure vessel welds, non-destructive test results, cleaning procedures and results, and inspector qualifications shall be consolidated into individual serial numbered books for each chamber built and shall be provided with each chamber.

**4.3 Testing.** A written test program outlining a comprehensive and integrated series of tests which will fully demonstrate the adequacy of all systems and equipment is required. The test program shall consist of the following elements:

- A. A test procedure index which is a listing of all the individual test procedures with an identification number, title, latest revision number, and date of issue.
- B. A test plan which indicates the sequence in which the individual test procedures are to be accomplished.
- C. The individual test procedures including pressure vessel strength and gas tightness; piping system strength, tightness and cleanliness; life support system operation including breathing gas purity control; electrical system integrity and operating; and safety feature operation.

The test program, as well as the individual test procedures, shall be submitted for approval thirty (30) days prior to the conduct of any test procedure. The format of the test procedures shall include in a single document both the test procedure and the data to be collected.

**4.3.1 Test conditions.** Unless otherwise specified in a test, tests shall be performed without protection and at the climatic conditions existing at the place of the test. Operational tests shall be performed with the recompression chamber installed in the shelter.

**4.3.2 Proof tests.** Proof tests are performed to demonstrate that the components, materials, and fabrication of the systems conform to the design. Proof tests include hydrostatic strength tests, cleaning, gas tightness tests, valve seat tightness test, system pressure drop test.

and electrical dielectric and insulation resistance tests. These tests shall be performed by the contractor or certificates of conformance from component suppliers shall be provided.

#### NOTE

**All tests on the ISO container, recompression chamber, and support equipment shall be performed in the following sequence:**

**4.3.2.1 Pressure vessel test.** The recompression chamber pressure vessel shall be hydrostatic tested in accordance with ASME / PVHO-1 and the ASME Boiler and Pressure Vessel Code, Section VIII, Division 1. Failure of any ASME test shall constitute failure of this test. Presence of the ASME official code U-symbol stamped or marked on this vessel and the furnishing of a copy of the ASME data sheet, form U-1 may be accepted as evidence that the vessel conforms to the boiler and Pressure Vessel Code, Section VIII, Division 1. Presence of the ASME official code U-symbol does not relieve the manufacturer of providing all required documentation to the Government for system certification.

**4.3.2.1.1 Pressure vessel cleaning.** After successfully completing the hydrostatic test, the pressure vessel shall be cleaned using a solution of 0.1 ounce of non-ionic detergent per gallon of potable water. Thoroughly scrub the interior surfaces of the recompression chamber then rinse with potable water. Collect a 2 ½ liter sample of the rinse water and shake the sample for a few seconds. If any bubbles form and remain on the surface of the sample for longer than one (1) minute, continue to rinse the chamber and sample until all of the bubbles dissolve within one (1) minute. Visually inspect the chamber for hydrocarbon removal using an ultraviolet (UV) light (3,600 to 3,900 angstrom wave-length). Under UV light, hydrocarbons may exhibit fluorescence. If the results are unsatisfactory, re-clean the chamber.

**4.3.2.1.2 Pressure vessel tightness test.** After successfully cleaning the recompression chamber, perform tightness test in accordance with ASME/PVHO-1. Dry, oil free nitrogen in accordance with BB-N-411, Type I, Grade B, Class 1 or compressed air in accordance with BB-A-1034, Grade A shall be the test medium.

**4.3.2.2 Piping system tests.** Piping system tests shall be conducted in accordance with ASME/PVHO-1. Piping Systems shall be hydrostatically tested at 1.5 times the maximum operating pressure of the applicable system in order to verify system strength. Water, potable or Grade B, shall be the test medium used for all hydrostatic tests. Piping systems shall be tightness tested at the maximum operating pressure of the applicable system in order to verify system integrity. Dry, oil-free nitrogen in accordance with BB-N-411, Type I, Grade B, Class I (oxygen system) or compressed air in accordance with BB-A-1034, Grade A (air systems) shall be the test medium. The appropriate level of cleanliness in accordance with U.S. Army Military Diving Field Manual FM 20-11 shall also be demonstrated.

**4.3.2.3 Electrical system tests.** All electrical components shall be subjected to a general examination, dielectric withstanding voltage test, and an insulation resistance test. The examination and tests shall be performed in accordance with the latest standard practices of the

commercial containerized recompression chamber industry. The test procedure shall specify not only the acceptance criteria but also the required test conditions such as pressure and length of exposure time.

**NOTE**

Because of the destructive nature of AC dielectric testing, this type of testing shall be limited to the manufacturer's plant tests as part of standard commercial testing procedures.

Insulation resistance tests on electronic equipment or equipment that would be damaged by the test shall be limited to the power cords and not the equipment itself.

**4.3.3 Operational and integration test.** These tests are intended to confirm the adequacy of design, operational characteristics and procedures, and the integration of subsystems of the recompression chamber system.

**4.3.3.1 Air operational test.** A test shall be conducted to demonstrate that the recompression chamber can provide the recompression treatment conditions specified in the U.S. Army Military diving Field Manual FM 20-11. The test shall consist of operating the IL to meet the depth/time profile of treatment table 2A. At each stop, the OL and medical lock shall be cycled by pressurizing to equal the IL pressure. Any equipment failure or failure of the chamber to meet the controlled treatment conditions specified shall constitute failure of this test.

**4.3.3.1.1 Air ventilation system test.** A test shall be conducted to determine if the recompression chamber can meet minimum and maximum air ventilation rate requirements as specified in the U.S. Army Military Diving Field Manual FM 20-11. Tests shall be conducted to meet the following conditions:

<u>Air supply pressure</u>	<u>Chamber depth</u>	<u>Ventilation rate</u>
200 psig	60 fsw	70.4 scfm
200 psig	10 fsw	10.4 scfm

A steady state ventilation rate for each condition shall be maintained for ten (10) minutes. Failure to meet the ventilation rate under the conditions specified shall constitute failure of this test.

**4.3.3.2 Oxygen analyzer test.** A test shall be conducted to demonstrate that the oxygen analyzer functions properly and has adequate response time. A separate, calibrated sensing system (gas sample or other suitable method) shall be utilized to verify the accuracy of the tested analyzer. Any equipment malfunction or failure of the equipment to provide an accurate, rapid indication of the oxygen content shall be cause for failure of this test.

**4.3.3.3 Oxygen operational test.** A test shall be conducted to demonstrate that the oxygen BIBS can provide oxygen treatment conditions consistent with the U.S. Army Military Diving Field Manual FM 20-11. The test shall consist of donning and using each inhalator under the following conditions:

<u>Chamber depth</u>	<u>Test duration</u>
10 fsw	5 minutes
30 fsw	5 minutes
60 fsw	5 minutes

Any equipment malfunction or failure of the equipment to provide breathable oxygen to the user without excessive inhalation/exhalation resistance or leakage shall be cause for failure of this test.

### **CAUTION**

During testing, precautions shall be taken to prevent the tester from being subjected to oxygen depth/time limits in excess of guidance provided by the U.S. Army Military Diving Field Manual FM 20-11.

**4.3.3.4 CO<sub>2</sub> scrubber and analyzer.** A test shall be conducted to demonstrate that the CO<sub>2</sub> scrubber unit can remove CO<sub>2</sub> from the recompression chamber atmosphere and that the analyzer can detect CO<sub>2</sub> present in the breathing atmosphere inside the chamber. The test will be unmanned and shall use a CO<sub>2</sub> cylinder to introduce CO<sub>2</sub> into the chamber at a rate of 5.1 l/min. The scrubber shall maintain the CO<sub>2</sub> level inside the chamber below 1.5% surface equivalent (11.4 mmHg) while the analyzer detects the CO<sub>2</sub> level. A separate, calibrated sensing system (gas sample or other suitable method) shall be used to verify the accuracy of the tested analyzer. The test shall be conducted for a duration of one (1) hour at a depth of 165 fsw. Any equipment malfunction or failure of the equipment to adequately scrub and monitor the atmosphere shall be cause for failure of this test.

**4.3.3.5 Environmental control units.** A test shall be conducted to demonstrate that the environmental control units (ECU) of the recompression chamber and the shelter can provide continuous heating and cooling in order to maintain a constant temperature inside the chamber at various ambient conditions.

Test number 1: The doors of the shelter shall be open to allow the temperature inside the shelter to equalize with the ambient temperature (outside the shelter) at 110° F ±5° F. At a depth of 165fsw, operate the chambers' ECU as required for six (6) hours to achieve and maintain a temperature inside the chamber of 80° F ±5° F.

Test number 2: With the temperature inside and outside of the shelter at 110° F ±5° F, close the doors of the shelter. Operate the chamber and shelter ECU's as required for two (2) hours, at a depth of 165fsw, to achieve and maintain a temperature inside the chamber and inside the shelter of 80° F ±5° F.

Test number 3: Reduce the ambient temperature to 10° F ±5° F. The doors of the shelter shall be open to allow the temperature inside the shelter to equalize with the ambient temperature. At a depth of 165fsw, operate the chambers' ECU as required for six (6) hours to achieve and maintain a temperature inside the chamber of 80° F ±5° F.

Test number 4: With the temperature inside and outside of the shelter at  $10^{\circ}\text{F} \pm 5^{\circ}\text{F}$ , close the doors of the shelter. Operate the chamber and shelter ECU's as required for two (2) hours, at a depth of 165fsw, to achieve and maintain a temperature inside the chamber of  $80^{\circ}\text{F} \pm 5^{\circ}\text{F}$  and inside the shelter of  $60^{\circ}\text{F} \pm 5^{\circ}\text{F}$ .

Failure to meet the standards of the test as stated above shall constitute failure of this test. To meet the standards of the test each phase must be successfully completed.

**4.3.3.6 Communications test.** A test shall be conducted to demonstrate that the communications systems can provide voice communications between the control station, IL, and OL. The tests shall demonstrate both primary and secondary system operation. With the recompression chamber at ambient pressure and with the  $\text{CO}_2$  scrubber and environmental control unit operating, each mode of communication shall be used to establish contact between the stations specified:

Primary and Secondary System

Between control station and IL

Between control station and OL

Between control station, and both the IL and OL (round robin)

Failure of the equipment to establish communications as specified or excessive static, hum, squeal, or feedback in the system which prevents the communications from being intelligible shall be cause for failure of this test.

**4.3.3.7 Ground fault interrupter.** A test shall be conducted by the manufacturer, in accordance with the latest standard practices of the commercial containerized recompression industry, to demonstrate that the ground fault interrupter shall prevent any electrical current from passing through the ground fault interrupter to the recompression chamber in the event of an outside power surge. The test will be considered a failure if the ground fault interrupter does not meet the requirements of 3.7.1.2.3.4. An electrical device of the testers choosing shall be connected to the chamber side of the interrupter to record the amounts of electrical current (if any), flowing around the interrupter. The ground fault interrupter shall not be connected to the chamber electrical system during this test.

**4.3.3.8 Line voltage protector.** A test shall be conducted by the manufacturer, in accordance with the latest standard practices of the commercial containerized recompression chamber industry, to demonstrate that the line voltage protector functions properly. The test will be considered a failure if the line voltage protector does not meet the specifications of 3.7.1.2.3.8.

**4.3.3.9 Temperature monitor and probe.** A test shall be conducted to demonstrate the temperature monitor and probe will monitor fluctuations in the recompression chamber environment. The probe/monitor system calibration shall be verified after installation in the

chamber. Failure of the temperature monitor and probe to meet the calibration data shall constitute failure of this test.

**4.3.3.10 Lighting tests.** The IL/OL lighting system shall be turned on to approximately 50% of full illumination and operated for one hour. During operation the system shall be cycled twenty times from the off position to 70% of full illumination. Do not operate the lighting system above 70% of full illumination. Failure of the lighting system to provide variable illumination for both locks or malfunction of any lighting component shall constitute failure of this test. Bulb failure shall not constitute failure of this test.

**4.3.3.11 Fire resistant bedding.** The contractor shall provide manufacturer's certification that the fire resistant bedding meets the criteria as described in the U.S. Army Military Diving Field Manual FM 20-11. Failure of the contractor to provide this certification will constitute failure of this requirement.

**4.3.3.12 Noise levels.** Noise measurements shall be taken while operating the recompression chamber under normal conditions (CO<sub>2</sub> scrubber and ECU operating), and while ventilating the chamber at 70.4 cfm. Non-conformance to 3.9 shall require the installation of a warning sign outside of the chamber.

**4.3.3.13 Lifting attachments.** Lift the fully loaded ISO shelter unit in its normal travel position using only the permanently affixed lifting attachments. Determine the force and angle of application for each attachment and clearance between each sling and the unit. Anchor the unit and subject each attachment to a load equal to 2 1/2 times the load determined above at the same angle. Apply each load for not less than 2 minutes. Any weld failures, or permanent deformation of the ISO shelter, lifting attachments, or structural members, shall constitute failure of this test.

**4.3.3.14 Loading and offloading handling test.** Load and offload the fully loaded ISO shelter unit with recompression chamber and support equipment onto a Heavy Expanded Mobility Tactical Truck - Load Handling System (HEMTT-LHS). This test shall be repeated for a total of three (3) consecutive cycles at a minimum tilt angle of 35 degrees using the truck load handling system. After the loading and offloading handling test, a visual inspection of the ISO shelter, recompression chamber, and all support equipment shall be performed. Any visible weld failures, permanent deformation or structural damage of the ISO shelter, recompression chamber, or support equipment, shall constitute failure of this test. Any equipment separated from its permanent anchor or temporary storage position shall constitute failure of this test.

**4.3.3.15 Air pressure and leak test.** An air pressure and leak test shall be performed on the complete recompression chamber system in accordance with the U.S. Army Military diving Field Manual FM 20-11. Failure of any part of the complete system to meet the requirements of this test shall constitute failure of the whole system.

**4.3.3.16 Air purity test.** An air purity test shall be performed on the complete recompression chamber system in accordance with U.S. Army Military diving Field manual FM

20-11 and BB-A-1034. An air sample shall be taken from the recompression chamber exhaust and tested in accordance with the U.S. Army Military Diving Field Manual FM 20-11. Failure of the final air sample to meet the air purity requirements as specified in BB-A-1034 shall constitute failure of the whole system.

## **5. PACKAGING**

5. Preservation, Packaging and Packing shall be Commercial in accordance with ASTM D 3951, and the following additional requirements. The unit package quantity shall be 1 Recompression Chamber and all its components, accessories and associated parts.

### **5.1 ADDITIONAL REQUIREMENTS**

#### **5.1.1 NO CONTACT PRESERVATIVE SHALL BE USED ON ANY SYSTEM COMPONENT**

5.1.2 No part of the Recompression Chamber may be disassembled as a means to protect parts that are vulnerable to damage. All parts vulnerable to damage shall be protected against damage, during storage and shipment, while assembled in place.

5.1.3 All openings into the Recompression Chamber shall be sealed to prevent the entry of any foreign matter. The methods used to seal the openings shall be clean and not be a cause of any foreign matter to enter the chamber or any of its parts, also it shall not cause any damage to the substrate.

5.1.4 The view ports, gauges, handles, knobs, switches and any other parts protruding from the chamber shall all be protected by a covering of corrugated cardboard.

5.1.5 Technical publications shall be placed in a box and secured in place in the recompression chamber.

5.1.6 All loose items shall be placed in boxes and cushioned inside the box to prevent movement and corrosion (especially galvanic corrosion) and the boxes secured in place to prevent movement, whatever the mode of transportation. The doors of the chamber shall be closed and secured the chamber itself and all flooring shall be secured to prevent its movement within the shelter.

## **5.2 MARKING**

### **5.2.1 MARKING REQUIREMENTS:**

5.2.2 Container markings shall be in capital letters of equal height, shall be proportionate to the available marking space and shall contain the following information in the order listed:

- a. NSN/NATO stock number.
- b. CAGE code of the company awarded the contract, and part number of the item as specified in the contract.
- c. Quantity and unit of issue.
- d. Level of protection and date packed.
- e. Contract or purchase order number.

**5.2.3** Markings on the shipping container shall be grouped into three distinct categories, identification markings, contract data markings and address markings.

**5.2.3.1 Identification Markings:**

- a. NSN/NATO stock number.
- b. CAGE code of the company awarded the contract, and part number of the item as specified in the contract.
- c. Quantity and unit of issue.
- d. Level of protection and date packed.
- e. Gross weight and cube.
- f. Item description or nomenclature.

**5.2.3.2 Contract Data Marking:**

The contract data marking placed under the identification markings, shall consist of the contract or purchase order number.

**5.2.3.3 Address Markings:**

The address markings placed to the right of the identification and contract data markings (if space is available) shall consist of the following information in the order shown.

- a. Control number or reference number (as a minimum, the Transportation Control Number (TCN) Shall be provided as the single standard shipment identification number).
- b. FROM MILITARY: Name and address of consignor (DOD Activity Address Code) and in the clear address if applicable.
- c. FROM CONTRACTOR: Name and address of the contractor (including nine-digit zip code).  
When supplies are shipped from a subcontractor, only the name and address of the company awarded the contract the contract shall be used.
- d. TO: Name and address of consignee (DOD Activity Address Code (DODAAC) and in the clear address if applicable.
  - e. Piece number and total pieces (if more than one shipping container is used for the order).

**5.2.4** In addition to the above information, the NSN/NATO stock number shall be bar coded on the unit packs and intermediate containers. The following shall be bar coded on the shipping container. All bar coding shall use the 3 of 9 format in accordance with ANSI MH10.8M.

NSN/NATO stock number.

Contract or order number.

CAGE code of the company awarded the contract.

Contract Line Item Number (CLIN) if applicable.

## **6. NOTES**

**6.1 Intended use.** The containerized recompression chambers are intended to provide a means of recompression treatment and surface decompression for deep-sea engineer divers afflicted with gas embolism or decompression sickness.

**6.2 Inspection and acceptance tests.** When inspection and acceptance testing is required, the contracting officer should include specific instructions in acquisition documents regarding arrangements for inspections and acceptance testing.

**6.3 Provisioning.** The contracting officer should include provisioning requirements for repair parts and special tools as necessary, and instructions on shipment. A suggested paragraph is as follows:

"Shipment of units shall include repair parts, special tools, operational instructions, and accessories, unless exceptions are provided elsewhere in the contract.

## INSTRUCTION TO OFFERORS:

### 1. Proposal Instructions:

1.1. Offerors must comply with the following instructions. Deviations from the instructions may result in an offer being considered inadequate for evaluation purposes and may not be eligible for award.

1.2. It is the responsibility of the offeror to prepare a clear, concise, complete, detailed, and logically organized proposal for evaluation. Offerors are cautioned that elaborate sales brochures, expensive bindings, and other presentation aids that are not necessary to the effective communication of the requested information are neither required nor desired. In the eyes of the government, superfluous material will not enhance an offeror's proposal, nor improve an offeror's chance of winning an award.

1.3. Format. Proposals in response to this procurement are to be submitted in electronic format. Hard copy bids will not be accepted. However, the technical information as described below (2) shall be submitted in hard copy to TACOM-Rock Island, AMSTA-LC-CTTE, attention, Linda Hultman, Rock Island, Illinois, 61299-7630.

1.4. Authorship. Any portion of the proposal that is written or prepared by someone other than an employee of the offeror shall be identified, and the relationship of the writer or preparer to the offeror shall be indicated.

1.5. Detailed Description of the Proposal. The proposal shall consist of the following parts. Each part shall be completed in detail as described.

1.6. Proposal Part 1 shall be a duly signed, executed, and fully completed Standard Form 1449 and all sections of the solicitation. Submit in electronic format.

1.7. Proposal Part 2 shall be the technical proposal submitted in hard copy to the above address (see 1.3).

1.8. Proposal Part 3 shall be past performance data. Submitted in electronic format with proposal information.

2. Technical. Each offeror shall provide the government a preliminary design package, showing how they propose to meet the Government's requirements for a diver's 100 psig, containerized recompression chamber, in accordance with ASME/PVHO-1 and Description for Purchase DFP-388 in the following areas:

## 2.1. Sub-factor 1 – Preliminary Design Package.

A. The offeror shall provide the government a preliminary design package, based on the offeror's own design, of the containerized recompression chamber as it conforms in accordance with ASME/PVHO-1 and the Description for Purchase DFP-388 and all standards and specifications stated therein. The offeror's preliminary design package must contain a clear description of the offeror's proposed design. The offeror must describe the proposed material, method of construction, expected weight, operation, durability, and any other features of his design relative to the requirements of ASME/PVHO-1 and the Description for Purchase DFP-388, and all standards and specifications stated therein. The following items are also of particular interest:

1. The steps and associated effort required to set up the containerized recompression chamber, and prepare it for storage and transport.

2. The placement of all controls relative to personnel.

3. The proposed placement of the recompression chamber, control panel, oxygen storage tanks, environmental control units for inside the recompression chamber and inside the container, combination workbench, desktop storage cabinet, and all support equipment for inside and outside the recompression chamber within the container. The offeror must provide a clear description of his proposed placement of all equipment within the recompression chamber, and within the container with regards to the following; efficient use of space, accessibility of all controls and equipment, ergonomics, design simplicity, equipment storage design for security, durability and easy inventory, quality of construction, accessibility of equipment for maintenance, and safety considerations. The proposed explanation of equipment placement shall include the following:

a. A total equipment placement layout.

b. The grouping of items normally used together.

c. The visible cues used to assist the operator in determining an item is not in its designated storage location.

d. The methods used to enable the operator to inventory the contents and to rapidly identify any missing items.

e. The estimated operating noise levels inside and outside of the recompression chamber shelter.

f. Estimated gross weight of the fully loaded containerized recompression chamber.

B. The overall preliminary design package documentation shall include, but not be limited to the following:

1. Engineering design drawings, equipment layout drawings, electrical schematics, piping diagrams, and production and assembly drawings.

2. A technical information package, including, photographs, technical descriptions of parts, and support equipment.

3. Recompression chamber operation and maintenance procedures.

Printed media and photographs shall be provided on 8.5 inch x 11 inch paper and bound loose with the rest of the proposal. Drawings listed in B.1 above shall be prepared to scale by the offeror and included with the proposal. The offeror shall have the option to determine the drawing size and format.

2.2. Offeror's Capabilities, Sub-factors 2 through 6:

2.2.1. Sub-factor 2 – Design and Development Capabilities. The offeror shall describe his capability for the design of the containerized recompression chamber. Included in this description shall be a list of design staff personnel with a description of their relevant skills, abilities, and experience. The offeror shall also describe his company's ability to develop a product to the point of manufacturing on a production basis. The description should include the company's process of taking a product from concept stage to first production parts. The offeror shall describe a containerized recompression chamber his company has manufactured in the past which is indicative of the offeror's ability to successfully develop and produce a product equal to or more sophisticated than the offeror's proposed design.

2.2.2. Sub-factor 3 – Production Capacity. The offeror shall describe the production capacity of his plant as it exists at the time of proposal preparation. The description shall specifically address the offeror's current capacity to produce his proposed design. The description shall include available equipment, people, and space, taking into account the effect of the production of other products upon this available capacity. The description shall identify any production tasks that will be performed by a sub-contractor, and the proposed subcontractor(s) shall be identified.

2.2.3. Sub-factor 4 – Quality Assurance and Test Capabilities. Each offeror shall describe the following (6 page limit):

A. Testing: The offeror shall describe his plan and capability to perform the testing as required by DFP-388. The description shall identify any testing that will be performed by a subcontractor. The proposal shall include verification that proposed

subcontractor (s) have the requisite test facilities and have schedule openings to accommodate the testing during the required timeframe

B. Quality System:

1. What is the standard that your quality system complies with, e.g. ISO, industry, etc.?
2. How is your system applied to all processes, i.e. production, contracting fabrication, processing, inspection, testing, maintenance, packaging, preservation, shipping, storage, buying, receiving, etc.?
3. How do you monitor and audit your system to assure effectiveness and continuous process improvement?
4. What metrics do you use to track progress and status of goods or services to include, but not limited to, actual production, support services and customer feedback?
5. How do you handle product deficiencies and implement corrective action?
6. Give examples and feedback on the satisfaction of your customers and the market acceptance of your product.

C. Calibration and metrology system: each offeror shall describe (2 page limit) what is done to assure the following:

1. Test equipment design, if required, undergoes a review and independent approval process?
2. Production tooling, if used as media for inspection, is proven for accuracy and included in your calibration system?
3. Acceptance inspection equipment is periodically calibrated?
4. All gauging, if used, is traceable to calibration records?
5. Test software is properly controlled and identified.
6. Test and measuring equipment is traceable to a standard approved by the National Institute of Standards & Technology (NIST or equivalent organization).

D. Process control system: Each offeror shall describe the following (4 page limit):

1. What determines which processes will be monitored?
2. How do you qualify your processes?
3. How do you monitor variation (s) in your processes? Give two examples.
4. How are personnel trained and qualified?
5. How do you accomplish re-certification?
6. How do you decide which requirements to flow down to your vendors?
7. How is the data and information that is generated used?

2.2.4. Sub-factor 5 – Supply Support Capabilities. The offeror shall describe his long term (15) year capability to provide commercially available repair parts (not stocked by the government). The description shall identify any supply support tasks that will be performed by a subcontractor and the proposed subcontractor(s) shall be identified.

2.2.5. Sub-factor 6 – Publishing Capabilities. The offeror shall describe his capability to produce technical manuals as required by the description for purchase, DFP-388. The description shall identify any publishing tasks that will be performed by a subcontractor, and the proposed subcontractor(s) shall be identified.

### 3. Price

3.1. Price will be considered on an “all or none” basis, therefore, the offeror shall enter firm fixed unit prices for each quantity and each pricing period on the price evaluation sheet (addendum 004 of the solicitation). All unit prices will be binding. The Government reserves the right to require the submission of any information necessary to validate the reasonableness of an offer.

### 4. Past Performance

4.1. Offerors are required to submit past performance information in accordance with clause 52.212-1, paragraph b (10). This clause is in full text at addendum 005 of the solicitation. The offeror shall include a description of previous U.S. Government, and/or commercial contracts that are relevant/similar in size, scope, and complexity to the effort required in this solicitation and performed, and/or delivered within the last three (3) years previous to the date of the solicitation.

4.2. For each recent, relevant past contract, offerors should provide the following information:

- a. Contract Number
- b. Contract Type
- c. Award price/Cost
- d. Original delivery schedule
- e. Final, or projected final, delivery schedule, explanation of requirements not met and any corrective actions taken.
- f. Your (and any significant subcontractors) CAGE/DUNNS numbers and email address.
- g. Government or commercial contracting activity address.
- h. Procuring Contracting Officer's name, telephone/fax numbers and email address.
- i. Government or commercial contracting activity technical representative, names, telephone/fax numbers and email address.
- j. Government DCMC location and address. The Administrative Contracting Officer, Industrial Specialist, Quality Representative names, addresses, telephone/fax numbers and email address.
- k. Description of the relevant contract scope of work and similarities between the scope of work in this solicitation.

## EVALUATION OF OFFERS:

1. Basis for award: The selection of an offeror for award will be based on an evaluation of proposals in three areas: Technical, Price, and Past Performance. Technical is slightly more important than price. Price is slightly more important than past performance. A single award will be made to that offeror whose proposal offers the best value to the Government based on integrated assessment of these elements. Consequently, the Government may award to other than the low offeror. Where an otherwise superior proposal is not affordable or is unreasonably priced, where two proposals are otherwise considered equal, or where the advantages of a superior proposal are not worth the price premium, price could be the deciding element.

2. Technical. The technical evaluation will be based on the criteria in Addendum 001, Description for Purchase, DFP-388 and the Instructions to Offerors, Addendum 002. The technical area will be evaluated for the following sub-factors. These sub-factors are listed in order of importance:

2.1. Sub-factor 1 – Preliminary Design Package: The quality and completeness of the preliminary design package will be assessed, and the offeror rated on merits and feasibility of his proposed design of the containerized recompression chamber. Special attention will be given to the proposed design as it conforms to ASME/PVHO-1, the Description for Purchase, DFP-388, and all standards and specifications stated therein. The offeror's preliminary design package will be assessed, and the offeror rated on merits of his technical description of the proposed material, method of construction, expected weight, operation, durability, and any other feature of his design relative to the requirements as stated in ASME/PVHO-1 and the Description for Purchase, DFP-388. The offeror's design will be evaluated for the quality and completeness of all the items listed in the Instruction to Offerors, paragraph 2.1.

2.2. Offerors's Capabilities, Sub-factors 2 through 6:

2.2.1. Sub-factor 2 – Design and Development Capabilities: The relative experience and education of the offeror's key individuals will be assessed. Design knowledge of Hyperbaric Chambers will be assessed based on depth, quality, and applicability of the offeror's knowledge and experience in applying the principles of systems engineering, configuration management, human (ergonomic) engineering, and concurrent engineering. Development capability will be assessed based on the similarities of the offeror's past product to the diver's 100 psig, containerized recompression chamber as described in the Description for Purchase, DFP-388. Particular attention will be paid to the offeror's past experience in the design, manufacture, testing, and certification of containerized recompression chambers.

2.2.2. Sub-factor 3 – Production Capacity: The quality and completeness of the information provided will be assessed, and the offeror rated on his ability to absorb the workload represented by the solicitation quantities.

2.2.3. Sub-factor 4 – Quality Assurance and Test Capabilities: The quality and completeness of the information provided will be assessed, and the offeror rated on his ability to assure the quality of his products. His quality assurance procedures will be evaluated for their conformance to generally accepted norms, including the items listed in the Instruction to Offerors, paragraph 2.2.3. Particular attention will be paid to the completeness of his plans for accomplishing the testing.

a. Testing: The Government will review the offeror's proposed test plan and capabilities including those of subcontractors (if necessary) to assess the likelihood of adequate and complete performance of the required tests.

b. Quality System: The Government will determine the offeror's likelihood of being successful in performing the requirements of this solicitation. Offerors with established managed and systemic approaches to doing business tend to produce fully conforming items in accordance with contract requirements.

c. Calibration and Metrology System: Assessment will be based upon offeror's data to determine how well this system will control the accuracy and precision of measuring equipment, test equipment, and standards.

d. Process Control System: Assessment will be based upon offeror's data to determine how well the process control system will conform to all contractual requirements.

2.2.4. Sub-factor 5 – Supply Support Capability: The quality and completeness of the information provided will be assessed, and the offeror rated on his knowledge and experience with supply support. Particular attention will be paid to the speed and convenience of the service offered, the extent of the offeror's distribution network, and any prior experience with the Government's Logistics System. Stability of the manufactures of all sub-component parts and the likelihood of the component parts being available over the next fifteen (15) years is critical.

2.2.5. Sub-factor 6 – Publishing Capabilities: The quality and completeness of the information provided will be assessed, and the offeror rated on his knowledge and experience with publishing technical manuals. Particular attention will be paid to any prior experience producing technical manuals. Maintenance information and procedures, as well as exploded views of component parts are critical.

### 3. Price

3.1. The price evaluation sheet is provided as addendum 004 to the solicitation. Offerors are instructed to complete all outlined boxes on the price evaluation sheet. Proposals offering prices for quantities other than those solicited, or proposals offering prices for less than all pricing periods, will not be considered. Evaluations will be conducted as follows:

Proposed unit prices for each quantity will be multiplied by the assigned weight for that quantity (the "weight" is the most current assessment of the likelihood, expressed as a percentage, that the actual order quantity will fall within that quantity). For pricing periods with more than one quantity, the weighted prices will be added together resulting in a single weighted unit price for each pricing period. The weighted unit price will then be multiplied by the estimated total quantity to be ordered within that pricing period, resulting in an evaluated production price. The evaluated production price for all pricing periods will be totaled to arrive at a total evaluation price.

3.1.1. No funding is forecasted for pricing period 2. The estimated quantity of 1 for pricing period 2 is for evaluation purposes only.

### 4. Past Performance

4.1. Past Performance will be evaluated in accordance with FAR part 13.106-2. Evaluation will be based on the offeror's submission of information as instructed in clause 52.212-1, addendum 005 of the solicitation and the Instruction to Offerors, addendum 002 of the solicitation. The Government will focus its past performance on all aspects of contract performance. In evaluating offerors past performance history, we will look at contract technical performance, was the American Society of Mechanical Engineers-Pressure Vessels for Human Occupancy a requirement (ASME-PVHO), and was it met, adherence to contract delivery schedules, cooperative behavior in business relations and commitment to customer satisfaction. Evaluators will consider recent and relevant contracts for the same or similar items. Offerors are reminded that the Government may elect to consider data obtained from other sources.



52.212-1 Instructions to Offerers--Commercial Items.

As prescribed in 12.301 (b)(1), insert the following provision:

INSTRUCTIONS TO OFFERORS--COMMERCIAL ITEMS (NOV 1999)

(a) Standard industrial classification (SIC) code and small business size standard. The SIC code and small business size standard for this acquisition appear in Block 10 of the solicitation cover sheet (SF 1449). However, the small business size standard for a concern which submits an offer in its own name, but which proposes to furnish an item which it did not itself manufacture, is 500 employees.

(b) Submission of offers. Submit signed and dated offers to the office specified in this solicitation at or before the exact time specified in this solicitation. Offers may be submitted on the SF 1449, letterhead stationery, or as otherwise specified in the solicitation. As a minimum, offers must show--

(1) The solicitation number;

(2) The time specified in the solicitation for receipt of offers;

(3) The name, address, and telephone number of the offeror;

(4) A technical description of the items being offered in sufficient detail to evaluate compliance with the requirements in the solicitation. This may include product literature, or other documents, if necessary;

(5) Terms of any express warranty;

(6) Price and any discount terms;

(7) 'Remit to' address, if different than mailing address;

(8) A completed copy of the representations and certifications at FAR

52.212-3 ;

(9) Acknowledgment of Solicitation Amendments;

(10) Past performance information, when included as an evaluation factor, to include recent and relevant contracts for the same or similar items and other references (including contract numbers, points of contact with telephone numbers and other relevant information); and

(11) If the offer is not submitted on the SF 1449, include a statement specifying the extent of agreement with all terms, conditions, and provisions included in the solicitation. Offers that fail to furnish required representations or information, or reject the terms and conditions of the solicitation may be excluded from consideration.

(c) Period for acceptance of offers. The offeror agrees to hold the prices in its offer firm for 30 calendar days from the date specified for receipt of offers, unless another time period is specified in an addendum to the solicitation.

(d) Product samples. When required by the solicitation, product samples shall be submitted at or prior to the time specified for receipt of offers. Unless otherwise specified in this solicitation, these samples shall be submitted at no expense to the Government, and returned at the sender's request and expense, unless they are destroyed during preaward testing.

(e) Multiple offers. Offerors are encouraged to submit multiple offers presenting alternative terms and conditions or commercial items for satisfying the requirements of this solicitation. Each offer submitted will be evaluated separately.

(f) Late submissions, modifications, revisions, and withdrawals of offers. (1) Offerors are responsible for submitting offers, and any modifications, revisions, or withdrawals, so as to reach the Government office designated in the solicitation by the time specified in the solicitation. If no time is specified in the solicitation, the time for receipt is 4:30 p.m., local time, for the designated Government office on the date that offers or revisions are due.

(2) (i) Any offer, modification, revision, or withdrawal of an offer received at the Government office designated in the solicitation after the exact time specified for receipt of offers is "late" and will not be considered unless it is received before award is made, the Contracting Officer determines that accepting the late offer would not unduly delay the acquisition; and--

(A) If it was transmitted through an electronic commerce method authorized by the solicitation, it was received at the initial point of entry to the Government infrastructure not later than 5:00 p.m. one working day

prior to the date specified for receipt of offers; or

(B) There is acceptable evidence to establish that it was received at the Government installation designated for receipt of offers and was under the Government's control prior to the time set for receipt of offers; or

(C) If this solicitation is a request for proposals, it was the only proposal received.

(ii) However, a late modification of an otherwise successful offer, that makes its terms more favorable to the Government, will be considered at any time it is received and may be accepted.

(3) Acceptable evidence to establish the time of receipt at the Government installation includes the time/date stamp of that installation on the offer wrapper, other documentary evidence of receipt maintained by the installation, or oral testimony or statements of Government personnel.

(4) If an emergency or unanticipated event interrupts normal Government processes so that offers cannot be received at the Government office designated for receipt of offers by the exact time specified in the solicitation, and urgent Government requirements preclude amendment of the solicitation or other notice of an extension of the closing date, the time specified for receipt of offers will be deemed to be extended to the same time of day specified in the solicitation on the first work day on which normal Government processes resume.

(5) Offers may be withdrawn by written notice received at any time before the exact time set for receipt of offers. Oral offers in response to oral solicitations may be withdrawn orally. If the solicitation authorizes facsimile offers, offers may be withdrawn via facsimile received at any time before the exact time set for receipt of offers, subject to the conditions specified in the solicitation concerning facsimile offers. An offer may be withdrawn in person by an offeror or its authorized representative if, before the exact time set for receipt of offers, the identity of the person requesting withdrawal is established and the person signs a receipt for the offer.

(g) Contract award (not applicable to Invitation for Bids). The Government intends to evaluate offers and award a contract without discussions with offerors. Therefore, the offeror's initial offer should contain the offeror's best terms from a price and technical standpoint. However, the Government reserves the right to conduct discussions if later determined by the Contracting Officer to be necessary. The Government may reject any or all offers if such action is in the public interest; accept other than the lowest offer; and waive informalities and minor irregularities in offers received.

(h) Multiple awards. The Government may accept any item or group of items of an offer, unless the offeror qualifies the offer by specific limitations. Unless otherwise provided in the Schedule, offers may not be submitted for quantities less than those specified. The Government reserves the right to make an award on any item for a quantity less than the quantity offered, at the unit prices offered, unless the offeror specifies otherwise in the offer.

(i) Availability of requirements documents cited in the solicitation.

(1)(i) The GSA Index of Federal Specifications, Standards and Commercial Item Descriptions, FPMR Part 101-29, and copies of specifications, standards, and commercial item descriptions cited in this solicitation may be obtained for a fee by submitting a request to--

GSA Federal Supply Service Specifications Section  
Suite 8100, 470 L'Enfant Plaza, SW  
Washington, DC 20407  
Telephone (202) 619-8925  
Facsimile (202) 619-8978.

(ii) If the General Services Administration, Department of Agriculture, or Department of Veterans Affairs issued this solicitation, a single copy of specifications, standards, and commercial item descriptions cited in this solicitation may be obtained free of charge by submitting a request to the addressee in paragraph (i)(1)(i) of this provision. Additional copies will be issued for a fee.

(2) The DOD Index of Specifications and Standards (DODISS) and documents listed in it may be obtained from the:

Department of Defense Single Stock Point (DoDSSP)  
Building 4, Section D,  
700 Robbins Avenue  
Philadelphia, PA 19111-5094  
Telephone (215) 697-2667/2179  
Facsimile (215) 697-1462.

(i) Automatic distribution may be obtained on a subscription basis.

(ii) Order forms, pricing information, and customer support information may be obtained--

(A) By telephone at (215) 697-2667/2179; or

(B) Through the DoDSSP Internet site at <http://www.dodssp.daps.mil>.

(3) Nongovernment (voluntary) standards must be obtained from the organization responsible for their preparation, publication or maintenance.

(j) Data Universal Numbering System (DUNS) Number. (Applies to offers exceeding \$25,000.) The offeror shall enter, in the block with its name and address on the cover page of its offer, the annotation 'DUNS' followed by the DUNS number that identifies the offeror's name and address. If the offeror does not have a DUNS number, it should contact Dun and Bradstreet to obtain one at no charge. An offeror within the United States may call 1-800-333-0505. The offeror may obtain more information regarding the DUNS number, including locations of local Dun and Bradstreet Information Services offices for offerors located outside the United States, from the Internet home page at <http://www.customerservice@dnb.com>. If an offeror is unable to locate a local service center, it may send an e-mail to Dun and Bradstreet at [globalinfo@mail.dnb.com](mailto:globalinfo@mail.dnb.com).

(End of provision)

[64 FR 51840, September 24, 1999]

52.212-4 Contract Terms and Conditions--Commercial Items.

As prescribed in 12.301 (b)(3), insert the following clause:

CONTRACT TERMS AND CONDITIONS--COMMERCIAL ITEMS (MAY 1999)

(a) Inspection/Acceptance. The Contractor shall only tender for acceptance those items that conform to the requirements of this contract. The Government reserves the right to inspect or test any supplies or services that have been tendered for acceptance. The Government may require repair or replacement of nonconforming supplies or reperformance of nonconforming services at no increase in contract price. The Government must exercise its post-acceptance rights--

(1) Within a reasonable time after the defect was discovered or should have been discovered; and

(2) Before any substantial change occurs in the condition of the item, unless the change is due to the defect in the item.

(b) Assignment. The Contractor or its assignee's rights to be paid amounts due as a result of performance of this contract, may be assigned to a bank, trust company, or other financing institution, including any Federal lending agency in accordance with the Assignment of Claims Act (31 U.S.C. 3727).

(c) Changes. Changes in the terms and conditions of this contract may be made only by written agreement of the parties.

(d) Disputes. This contract is subject to the Contract Disputes Act of 1978, as amended (41 U.S.C. 601-613). Failure of the parties to this contract to reach agreement on any request for equitable adjustment, claim, appeal or action arising under or relating to this contract shall be a dispute to be resolved in accordance with the clause at FAR 52.233-1, Disputes, which is incorporated herein by reference. The Contractor shall proceed diligently with performance of this contract, pending final resolution of any dispute arising under the contract.

(e) Definitions. The clause at FAR 52.202-1, Definitions, is incorporated herein by reference.

(f) Excusable delays. The Contractor shall be liable for default unless nonperformance is caused by an occurrence beyond the reasonable control of the Contractor and without its fault or negligence such as, acts of God or the public enemy, acts of the Government in either its sovereign or contractual capacity, fires, floods, epidemics, quarantine restrictions, strikes, unusually severe weather, and delays of common carriers. The Contractor shall notify the Contracting Officer in writing as soon as it is reasonably possible after the commencement of any excusable delay, setting forth the full particulars in connection therewith, shall remedy such occurrence with all reasonable dispatch and shall promptly give written notice to the Contracting Officer of the cessation of such occurrence.

(g) Invoice. The Contractor shall submit an original invoice and three copies (or electronic invoice, if authorized,) to the address designated in the contract to receive invoices. An invoice must include--

(1) Name and address of the Contractor;

(2) Invoice date;

(3) Contract number, contract line item number and, if applicable, the order number;

(4) Description, quantity, unit of measure, unit price and extended price of the items delivered;

(5) Shipping number and date of shipment including the bill of lading number and weight of shipment if shipped on Government bill of lading;

(6) Terms of any prompt payment discount offered;

(7) Name and address of official to whom payment is to be sent; and

(8) Name, title, and phone number of person to be notified in event of defective invoice. Invoices will be handled in accordance with the Prompt Payment Act (31 U.S.C. 3903) and Office of Management and Budget (OMB) Circular A-125, Prompt Payment. Contractors are encouraged to assign an identification number to each invoice.

(h) Patent indemnity. The Contractor shall indemnify the Government and its officers, employees and agents against liability, including costs, for actual or alleged direct or contributory infringement of, or inducement to infringe, any United States or foreign patent, trademark or copyright, arising out of the performance of this contract, provided the Contractor is reasonably notified of

such claims and proceedings.

(i) Payment. Payment shall be made for items accepted by the Government that have been delivered to the delivery destinations set forth in this contract. The Government will make payment in accordance with the Prompt Payment Act (31 U.S.C. 3903) and Office of Management and Budget (OMB) Circular A-125, Prompt Payment. If the Government makes payment by Electronic Funds Transfer (EFT), see 52.212-5 (b) for the appropriate EFT clause. In connection with any discount offered for early payment, time shall be computed from the date of the invoice. For the purpose of computing the discount earned, payment shall be considered to have been made on the date which appears on the payment check or the specified payment date if an electronic funds transfer payment is made.

(j) Risk of loss. Unless the contract specifically provides otherwise, risk of loss or damage to the supplies provided under this contract shall remain with the Contractor until, and shall pass to the Government upon:

(1) Delivery of the supplies to a carrier, if transportation is f.o.b. origin; or

(2) Delivery of the supplies to the Government at the destination specified in the contract, if transportation is f.o.b. destination.

(k) Taxes. The contract price includes all applicable Federal, State, and local taxes and duties.

(l) Termination for the Government's convenience. The Government reserves the right to terminate this contract, or any part hereof, for its sole convenience. In the event of such termination, the Contractor shall immediately stop all work hereunder and shall immediately cause any and all of its suppliers and subcontractors to cease work. Subject to the terms of this contract, the Contractor shall be paid a percentage of the contract price reflecting the percentage of the work performed prior to the notice of termination, plus reasonable charges the Contractor can demonstrate to the satisfaction of the Government using its standard record keeping system, have resulted from the termination. The Contractor shall not be required to comply with the cost accounting standards or contract cost principles for this purpose. This paragraph does not give the Government any right to audit the Contractor's records. The Contractor shall not be paid for any work performed or costs incurred which reasonably could have been avoided.

(m) Termination for cause. The Government may terminate this contract, or any part hereof, for cause in the event of any default by the Contractor, or if the Contractor fails to comply with any contract terms and conditions, or fails to provide the Government, upon request, with adequate assurances of future performance. In the event of termination for cause, the Government shall not be liable to the Contractor for any amount for supplies or services not accepted, and the Contractor shall be liable to the Government for any and all rights and remedies provided by law. If it is determined that the Government improperly terminated this contract for default, such termination shall be deemed a termination for convenience.

(n) Title. Unless specified elsewhere in this contract, title to items furnished under this contract shall pass to the Government upon acceptance, regardless of when or where the Government takes physical possession.

(o) Warranty. The Contractor warrants and implies that the items delivered hereunder are merchantable and fit for use for the particular purpose described in this contract.

(p) Limitation of liability. Except as otherwise provided by an express or implied warranty, the Contractor will not be liable to the Government for consequential damages resulting from any defect or deficiencies in accepted items.

(q) Other compliances. The Contractor shall comply with all applicable Federal, State and local laws, executive orders, rules and regulations applicable to its performance under this contract.

(r) Compliance with laws unique to Government contracts. The Contractor agrees to comply with 31 U.S.C. 1352 relating to limitations on the use of appropriated funds to influence certain Federal contracts; 18 U.S.C. 431 relating to officials not to benefit; 40 U.S.C. 327, et seq., Contract Work Hours and Safety Standards Act; 41 U.S.C. 51-58, Anti-Kickback Act of 1986; 41 U.S.C. 265 and 10 U.S.C. 2409 relating to whistle blower protections; 49 U.S.C. 40118,

Fly American; and 41 U.S.C. 423 relating to procurement integrity.

(s) Order of precedence. Any inconsistencies in this solicitation or contract shall be resolved by giving precedence in the following order:

(1) The schedule of supplies/services.

(2) The Assignments, Disputes, Payments, Invoice, Other Compliances, and Compliance with Laws Unique to Government Contracts paragraphs of this clause.

(3) The clause at 52.212-5 .

(4) Addenda to this solicitation or contract, including any license agreements for computer software.

(5) Solicitation provisions if this is a solicitation.

(6) Other paragraphs of this clause.

(7) The Standard Form 1449.

(8) Other documents, exhibits, and attachments.

(9) The specification.

(End of clause)

[64 FR 10542, March 4, 1999]

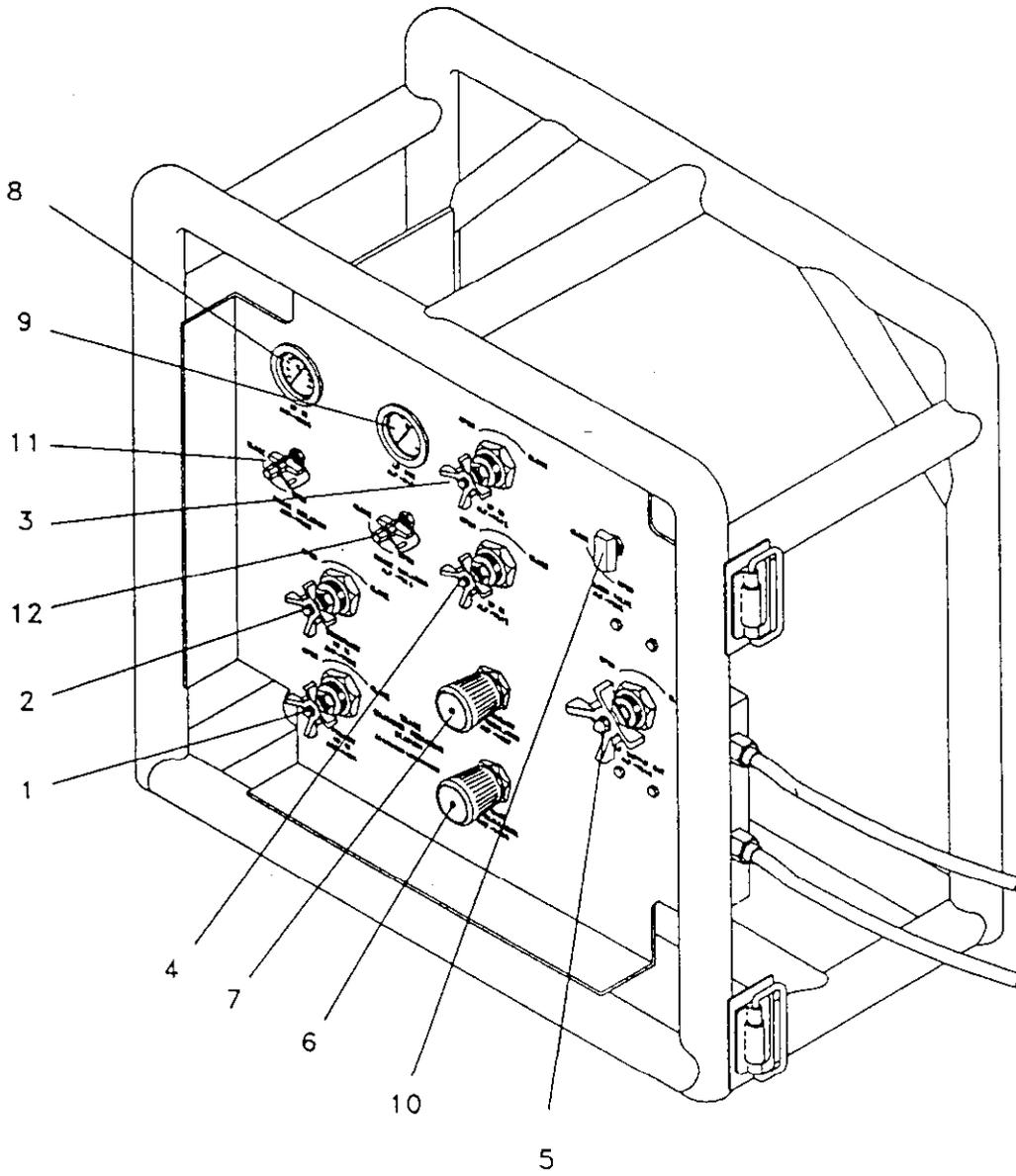


Figure 2-4 Chamber Reducing Station Control Panel

2-1 d. Chamber Reducing Station (CRS) Controls and Indicators (Refer to Figure 2-4).

INDEX	NAME	ID #	POSITION	FUNCTION
1	PRIMARY HP IN	AHPV601	OPEN CCW	ALLOWS HP AIR TO BE SUPPLIED FROM THE DASS TO PRIMARY REGULATOR AND THE DOME LOADER
2	SECONDARY HP IN	AHPV606	OPEN CCW	ALLOWS HP AIR TO BE SUPPLIED FROM THE DASS TO SECONDARY REGULATOR
3	LP IN PRIMARY SUPPLY	ALPV612	OPEN CCW	ALLOWS LP AIR TO FLOW FROM PRIMARY LP COMPRESSOR STORAGE TANK
4	LP IN SECONDARY SUPPLY	ALPV613	OPEN CCW	ALLOWS LP AIR TO FLOW FROM SECONDARY LP COMPRESSOR STORAGE TANK
5	LP SUPPLY OUT	ALPV610	OPEN CCW	ACTIVATES FLOW OF BREATHING AIR TO RECOMPRESSION CHAMBER
6	PRIMARY HP REGULATOR	AHPV602	INCREASE LP-CW DECREASE LP-CCW	HAND LOADED REGULATOR WHICH REDUCES PRIMARY HP AIR TO DESIRED OPERATING LP PILOT AIR TO THE DOME LOADER
7	SECONDARY HP REGULATOR	AHPV607	INCREASE LP-CW DECREASE LP-CCW	HAND LOADED REGULATOR WHICH REDUCES SECONDARY HP AIR TO DESIRED OPERATING LP
8	HP IN GAGE	AHPG615	0 - 6000 PSIG	INDICATES HP AIR SUPPLY FROM THE AIR STORAGE UNIT
9	LP OUT GAGE	ALPG616	0 - 500 PSIG	INDICATES LP AIR BEING SUPPLIED TO MANIFOLD
10	BLEED VALVE	ALPV608	OPEN CCW	ALLOWS LP AIR PRESSURE TO BE BLED OFF FROM THE CRS

2-1 d. Chamber Reducing Station (CRS) Controls and Indicators - (Con't).

INDEX	NAME	ID #	POSITION	FUNCTION
11	PRIMARY GAGE ISOLATION HP IN	AHPV605	OPEN CCW	ACTIVATES HP SUPPLY AIR GAGE
12	GAGE ISOLATION LP OUT	ALPV614	OPEN CCW	ACTIVATES LP SUPPLY AIR TO MANIFOLD PRESSURE GAGE

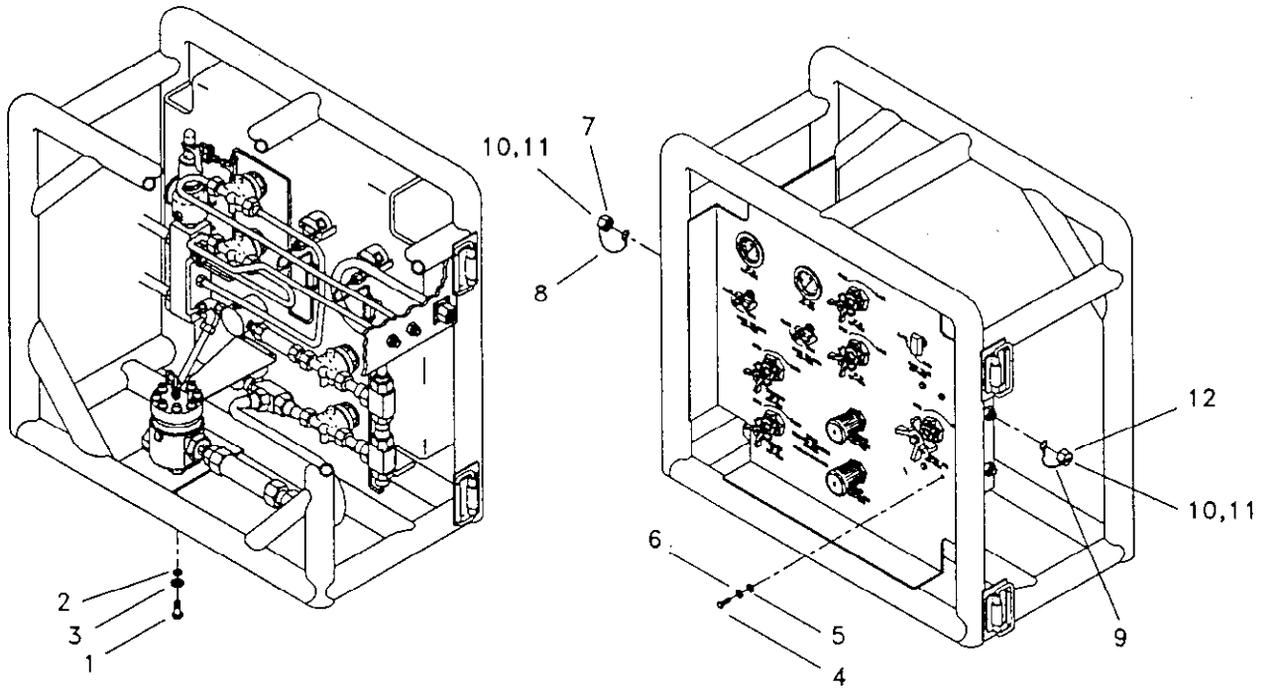


Figure 39. Chamber Reducing Station (CRS)  
Miscellaneous Hardware

## SECTION II. REPAIR PARTS LIST

TM 5-4220-231-14&amp;P

(1) ITEM NO.	(2) SMR CODE	(3) CAGE	(4) PART NUMBER	(5) DESCRIPTION AND USABLE ON CODES (UOC)	(6) QTY
				GROUP 04 CHAMBER REDUCING STATION (CRS) FIG. E-39 Miscellaneous Hardware	
1	PAFZZ		MS353U7-360	Bolt, Dome Loader	1
2	PAFZZ		MS15795-814	Washer, Flat	2
3	PAFZZ		MS35338-141	Washer, Lock	2
4	PAFZZ		MS35307-310	Bolt, Manifold Block	4
5	PAFZZ		MS15795-810	Washer, Flat	4
6	PAFZZ		MS35338-139	Washer, Lock	4
7	PAFZZ	18000	23059	Protective Cap, Low Pressure	4
8	PAFZZ	84256	L-5-76-V	Lanyard	2
9	PAFZZ	84256	L-11-76-V	Lanyard	2
10	PAFZZ		MS51967-65	Screw	4
11	PAFZZ		MS17830-3C	Nut	4
12	PAFZZ	97403	13229-E-4641	Protective Cap Assy, High Pressure	1
				END OF FIGURE	