MILITARY SPECIFICATION

CONCENTRATOR, OXYGEN, GGU-7/A

This specification is approved for use by the Naval Air Systems Command, Department of the Navy, and is available for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers the requirements for one type of oxygen concentrator which, as part of an on-board oxygen generation system (OBOGS), separates oxygen from air and provides it as a breathing gas to the aircrew member.

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications, standards, and handbooks. Unless otherwise specified, the following specifications, standards, and handbooks of the issue listed in that issue of the Department of Defense Index of Specifications and Standards (DoDISS) specified in the solicitation form a part of this specification to the extent specified herein.

SPECIFICATIONS

FEDERAL

PPP-B-601	-	Boxes, Wood, Cleated-Plywood.
PPP-B-621	-	Box, Wood, Nailed and Lock Corner.
PPP-B-636	-	Boxes, Shipping, Fiberboard.
PPP-B-640	-	Box, Fiberboard, Corrugated, Triple-Wall.

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MIL-P-116	-	Preservation, Methods of.
DOD-D-1000	-	Drawing, Engineering and Associated List.
MIL-E-5400	-	Electronic Equipment Airborne, General Specification for.
MIL-N-18307	-	Nomenclature and Identification for Electric, Aeronautical, and Aeronautical Support Equipment Including Ground Support Equipment.
MIL-S-19500	-	Semiconductor Device, General Specification for.
MIL-G-27617	-	Grease, Aircraft and Instrument, Fuel and Oxidizer Resistant.

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Engineering Specifications and Standards Department (Code 93), Naval Air Engineering Center, Lakehurst, NJ 08733, by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

MIL-M-38510	-	Microcircuit, General Specification for.
MIL-H-46855	-	Human Engineering Requirements for Military Systems, Equipment and Facilities.
MIL-C-81302	-	Cleaning Compound, Solvent, Trichlorotrifluoroethane.
MIL-T-81533	-	1,1,1 Trichloroethane (Methyl Chloroform), Inhibited, Vapor degreasing.

STANDARDS

FEDERAL

FED-STD-101	-	Preservation, Packaging, and Packing Materials, Test Procedures.

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DOD-STD-100	-	Engineering Drawing Practices.
MIL-STD-105	-	Sampling Procedures and Tables for Inspection by Attributes.
MIL-STD-129	-	Marking for Shipment and Storage.
MIL-STD-130	-	Identification Marking of U.S. Military Property.
MIL-STD-143	-	Standards and Specifications, Order of Precedence for the Selection of.
MIL-STD-210	-	Climatic Extremes for Military Equipment.
MIL-STD-454	-	Standard General Requirements for Electronic Equipment.
MIL-STD-461	-	Electromagnetic Emission and Susceptibility Requirements for Control of Electromagnetic Interference.
MIL-STD-462	-	Electromagnetic Interference Characteristics, Measurement of.
MIL-STD-470	-	Maintainability Program Requirements (for Systems and Equipment).
MIL-STD-471	-	Maintainability Verification/Demonstration/Evaluation.
DOD-STD-480	-	Configuration Control - Engineering Changes, Deviations and Waivers.
MIL-STD-482	-	Configuration Status Accounting Data Elements and Related Features.
MIL-STD-483	-	Configuration Management Practices for Systems, Equipment, Munitions and Computer Programs.
MIL-STD-490	-	Specification Practices.
MIL-STD-704	-	Aircraft Electric Power Characteristics.
MIL-STD-756	-	Reliability Prediction.
MIL-STD-781	-	Reliability Design Qualification and Production Acceptance Tests: Exponential Distribution.
MIL-STD-785	-	Reliability Program for Systems and Equipment Development and Production.
MIL-STD-794	-	Parts and Equipment, Procedures for Packaging and Packing of.
MIL-STD-810	-	Environmental Tests Methods.
MIL-STD-875	-	Type Designation Systems for Aeronautical and Support Equipment.

MIL-STD-882	-	System Safety Program Requirements.
MIL-STD-883	-	Test Methods and Procedures for Microelectronics.
MIL-STD-965	-	Parts Control Program.
MIL-STD-1304	-	Reports; Reliability and Maintainability Engineering Data.
MIL-STD-1472	-	Human Engineering Design Criteria for Military Systems, Equipment and Facilities.
MIL-STD-1521	-	Technical Reviews and Audits for Systems Equipment and Computer Programs.
MIL-STD-1523	-	Age Controls of Age-Sensitive Elastomeric Materials.
MIL-STD-1629	-	Procedures for Performing a Failure Mode, Effects and Criticality Analysis.
MIL-STD-2084	-	General Requirements for Maintainability of Avionics and Electronic Systems and Equipment.
MS90341	-	Mounting Bracket, Mating Portion for 5 and 10 Liter Liquid Oxygen Converters.

HANDBOOKS

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MIL-HDBK-217	-	Reliability Prediction of Electronic Equipment.
MIL-HDBK-304	-	Package Cushioning Design.
MIL-HDBK-472	-	Maintainability Prediction.

2.1.2 Other Government documents, drawings, and publications. The following other Government documents, drawings, and publications form a part of this specification to the extent specified herein.

DRAWINGS

NAVAL AIR SYSTEMS COMMAND

1438AS101	-	Concentrator, Oxygen.

PUBLICATIONS

NAVAL MATERIAL COMMAND

NAVMAT P-9492	-	Navy Manufacturing Screening Program.

NAVAL AIR SYSTEMS COMMAND

AD-1350	-	Engineering Drawings and Associated Data.
AS-4613	-	Application and Derating Requirement for Electronic Components, General Specification for.
SD-24	-	General Specification for Design and Construction of Aircraft Weapon Systems.

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

2.1.3 Order of precedence. In the event of a conflict between the text of this specification and the references cited herein, the text of this specification shall take precedence.

3. REQUIREMENTS

3.1. Qualification. The oxygen concentrators furnished under this specification shall be products which are qualified for listing on the applicable qualified products list at the time set for opening of bids (see 4.3 and 6.3).

3.2 First article. When specified, a sample shall be subjected to first article inspection (see 4.4 and 6.4).

3.3 Selection of specifications and standards. Specifications and standards for necessary commodities and services not specified herein or in the applicable detail specifications shall be selected in accordance with MIL-STD-143.

3.4 Parts, materials and processes. The selection and application of parts, materials and processes shall be in accordance with MIL-E-5400 for Class I equipment and the following:

a. All electrical, electronics and electromechanical parts shall be subject to 100 percent screening. Nonstandard parts and military standard parts without established reliability shall be screened to the requirements of the most similar military standard or standard established reliability part.

b. All integrated circuits shall be selected in accordance with MIL-M-38510 and, as a minimum, screened to MIL-STD-883, Method 5004, Class B. As a minimum, hybrid circuits shall be screened to MIL-STD-883, Method 5008.

c. Semi-conductor devices shall be selected in accordance with MIL-S-19500 and, as a minimum, screened to JANTX levels.

d. Passive components shall be selected from established reliability (ER) military specifications.

e. Nonrepairable subassemblies shall be in accordance with MIL-E-5400. To be considered for approval as a nonrepairable (disposal-on-failure) subassembly, the unit production cost shall be $1,000 or less and the reliability (MTBF) shall be 6,000 flight hours or greater.

f. All nonrepairable parts shall be available from at least two qualified sources. All second source devices and components shall be physically and functionally interchangeable.

g. All parts shall be used and derated in accordance with AS-4613 for Class A equipment.

h. All fasteners, including bolts, screws, nuts, rivets, washers, hinges and couplings shall be in accordance with SD-24.

3.4.1 Modules. The electronic portions of the concentrator shall be functionally modularized.

3.4.2 Solid-state design. No electron tubes shall be utilized in the design of the concentrator. Semi-conductor transistors and diodes shall be in accordance with MIL-STD-454, Requirement 30.

3.4.3 Parts control program. The contractor shall establish and implement a parts control program in accordance with MIL-STD-965, Procedure I.

3.4.4 Nonstandard parts and materials approval. Approval for the use of nonstandard parts and materials shall be obtained, as outlined in MIL-E-5400, with the request submitted in accordance with MIL-STD-965.

3.5 Materials. Materials shall conform to referenced specifications and shall be as specified herein and on referenced drawings. Materials which are not covered by specifications, or which are not specifically described herein, shall be of the best quality, of the lightest practicable weight and suitable for the purpose intended.

3.5.1 Metal parts. All metal parts shall be of a corrosion resistant material or treated in a manner to render them adequately resistant to corrosion.

3.5.1.1 Dissimilar metals. Unless suitably protected against electrolytic corrosion, dissimilar metals shall not be used in intimate contact with each other. The requirements of MIL-STD-454, Requirement 16 for Class 2 equipment shall apply.

3.5.2 Nonmetallic materials. Any nonmetallic material that is adversely affected by continued use with oxygen shall not be used.

3.5.2.1 Age. Elastomer components shall be controlled in accordance with MIL-STD-1523 (see 6.2.2).

3.5.2.2 Ozone resistant. Elastomer components shall be composed of an ozone-resistant composition which shall not bloom.

3.5.2.3 Fungus-proof materials. All materials used in the concentrator construction shall be incapable of supporting fungoid growth, as defined in MIL-STD-810.

3.5.3 Protective treatment. When materials are used in the construction of the concentrator that are subject to deterioration when exposed to environmental conditions likely to occur during service usage, they shall be protected against such deterioration in a manner that will in no way prevent compliance with the performance requirements of this specification. Protective coating which might crack, chip or scale during normal service life or under extremes of environmental conditions shall not be used.

3.6 Design and construction. The design and construction of the concentrator shall be in accordance with MIL-E-5400 and envelope Drawing 1438AS101. The concentrator shall be a self-contained unit capable of providing the breathing supply requirements specified herein. Input pressurized and temperature regulated air shall be processed to provide a moisture reduced, oxygen enriched output breathing gas.

3.6.1 Aircraft resources.

3.6.1.1 Air supply. The concentrator shall operate with air supplied at pressure from 8 to 250 psig and at temperatures from -15 to +250°F. Air consumption shall not exceed 55 pounds per hour (NTP) with 25 psig input pressure, and 120 pounds per hour with 250 psig input pressure. The unit shall be capable of withstanding a static inlet proof pressure of 280 psig without damage.

3.6.1.2 Electrical power. The concentrator shall operate from a DC power source, in accordance with MIL-STD-704, with a voltage range for operation of 18.0 to 31.5 volts DC. Total power consumption, including heater and accessories operation, shall be not greater than 660 watts at 28 VDC. Maximum power, without heater and accessories operation, shall be not greater than 75 watts at 28 VDC.

3.6.2 Pressure regulation. The concentrator shall have a pressure reducer which will regulate an input pressure of 250 psig to a maximum of 72 psig at the outlet port. The reducer shall incorporate a relief valve that shall not permit an outlet pressure greater than 100 psig.

3.6.3 Inlet air filtration. The concentrator shall have an inlet air filter capable of filtering 0.6 micron particles. The filter shall have a working surface of approximately 20 square inches.

3.6.4 Installation, mounting and servicing. The concentrator shall be capable of being installed onto an MS90341 configured liquid oxygen converter tray.

3.6.5 Fluid plumbing and electrical interface. The fluid plumbing ports and the electrical connector for the concentrator shall be as defined and located in Drawing 1438AS101. The fluid plumbing ports include the inlet air port, outlet product port and the overboard vent port. The concentrator shall be capable of meeting the performance requirements specified herein with a smooth base straight. tube 0.56 inch inside diameter and 4 feet long connected to the overboard vent port.

3.6.6 Weight. The total weight of the concentrator shall be not greater than 42 pounds.

3.6.7 Reliability.

3.6.7.1 Reliability reports. Reliability reports shall be prepared in accordance with MIL-STD-1304 (see 6.2.2).

3.6.7.2 Reliability program plan. A reliability program plan shall be prepared in accordance with MIL-STD-785 (see 6.2.2). The plan shall define and detail the plans, procedure, schedule and controls for assuring that quantitative reliability requirements are fulfilled for all equipment, spares, and repair parts. The plan shall include all technical and management resources of the reliability program, and shall identify one specific individual who shall be responsible for the program.

3.6.7.3 Reliability analysis and predictions. A reliability analysis of the concentrator shall be prepared in accordance with MIL-STD-785 and MIL-HDBK-217 (see 6.2.2). The reliability of each unit of hardware breakdown structure shall be predicted. The prediction shall be based on conservative estimates of the reliability exhibited by similar units existing on the date of prediction and shall not postulate the reliability that could be achieved after protracted development efforts. The prediction shall be revised as necessary to account for actual failures experienced during testing.

3.6.7.4 Failure modes, effects and criticality analysis. A failure modes, effects and criticality analysis (FMECA) shall be prepared in accordance with MIL-STD-785 and MIL-STD-1629 (see 6.2.2). The analysis shall be performed on each reliability functional block, representing each unit or hardware breakdown structure, by determining the various modes of failure for these blocks and assessing the importance of the failures. For each identified mission critical function, the analysis shall be further expanded to the lowest level of hardware practicable to insure the identification of all major and critical failure modes for possible subsequent elimination. The analysis shall be revised as necessary to account for the elimination of design weaknesses. A justification shall be included for each major and critical failure mode not eliminated by design change.

3.6.7.5 Quantitative reliability requirements. When tested in accordance with MIL-STD-781, the specified mean time between failure (MTBF) for the concentrator when operated under any combination of the loads and environmental conditions specified herein shall have a specified MTBF of 2000 hours.

3.6.7.6 Operational stability. The concentrator shall operate continuously or intermittently without the necessity for readjustment during normal use. Unscheduled readjustments constitute a failure and shall be recorded as such.

3.6.7.7 Operating life. The concentrator shall have a minimum operating life of 6,000 hours with minimal servicing and scheduled replacement of parts in accordance with an approved maintenance plan. Parts requiring scheduled replacement shall be approved for use by the contracting activity.

3.6.7.8 Storage life. The concentrator shall be designed to meet the performance and service life requirements of this specification after 5 years storage under worldwide climatic conditions specified in MIL-STD-210, when packaged in accordance with MIL-STD-794, Level A, and MIL-P-116, Method IIb.

3.6.7.9 Stress analysis. A part stress analysis shall be performed in accordance with MIL-STD-756 using the failure rate calculations of MIL-HDBK-217.

3.6.7.10 Failure data collection, analysis, and corrective action. A failure data collection system shall be required in accordance with MIL-STD-785.

3.6.7.11 Failure summary. A failure summary shall be prepared and updated in accordance with MIL-STD-1304. The identification of the failed item, description of the failure, failure cause (e.g., design, workmanship, etc.), criticality classification and action taken to restore operation shall also be included in each failed item listing.

3.6.7.12 Reliability program reviews. Scheduled reliability program reviews shall be held as an integral part of the contractor's program reviews in accordance with MIL-STD-785.

3.6.8 Maintainability.

3.6.8.1 Maintainability reports. Maintainability reports shall be prepared in accordance with MIL-STD-1304 (see 6.2.2).

3.6.8.2 Maintainability program plan. A maintainability program plan shall be prepared in accordance with MIL-STD-470, MIL-STD-2084 and this specification (see 6.2.2). The plan shall define and detail the plans, procedures, schedule and controls for assuring that the maintainability requirements of the system are achieved. The plan shall include all technical and management resources of the maintainability program, and shall identify one specific individual who shall be responsible for the program.

3.6.8.3 Quantitative maintainability requirements.

3.6.8.3.1 Unscheduled maintenance - Organizational level. The Mean Time To Repair (MTTR) for the concentrator at the Organizational level shall be not greater than 20 minutes. The MTTR calculation shall include the time to verify a fault or failure condition, the time to remove and replace the concentrator and the time to verify the effectiveness of the corrective action and system readiness.

3.6.8.3.2 Unscheduled maintenance - Intermediate level. The MTTR for the concentrator at the Intermediate level shall be not greater than 40 minutes. The maximum time to repair the concentrator at the Intermediate level shall be not greater than 2.0 hours for 95 percent of the repair actions. The repair time shall include all actions necessary to restore the faulty concentrator at the Intermediate level.

3.6.8.3.3 Unscheduled maintenance - Depot level. The concentrator shall not have Depot level maintenance requirements.

3.6.8.4 Maintainability analysis and prediction. A maintainability analysis of the equipment shall be prepared in accordance with MIL-STD-470 (see 6.2.2). The analysis shall include prediction and identification of all significant functional faults. The faults shall be related to the fault detection and fault isolation characteristics of the equipment. The time-to-repair parameter estimates of the maintainability analysis shall reflect the design approach toward achievement of the quantitative requirement of 3.6.8.3. The prediction technique shall be in accordance with MIL-HDBK-472, Procedure II, Part I, for corrective maintenance.

3.6.9 System safety. The contractor shall conduct a safety program in accordance with MIL-STD-882 for Category I and II hazard (see 6.2.2). The design requirements for safety shall be in accordance with MIL-STD-454, Requirement 1.

3.6.10 Human engineering. Human performance and human engineering design criteria for the concentrator shall be in accordance with MIL-STD-1472 (see 6.2.2). The contractor shall conduct a human engineering program using the applicable sections of MIL-H-46855 as a guide.

3.6.11 Interchangeability. The concentrator shall meet the interchangeability requirements of MIL-E-5400, which includes MIL-STD-454, Requirement 7. In addition, all parts, subassemblies and assemblies having the same part number shall be identical in accordance with DOD-STD-480 and DOD-STD-100. When any unit or part is interchanged, the concentrator shall meet all performance limits without adjustment of any controls or modification of any part or subassembly.

3.6.12 Nomenclature, nameplates and identification marking. Nomenclature and serial number assignment, nameplate approval and equipment identification marking shall be in accordance with MIL-N-18307. Type designation shall be in accordance with MIL-STD-875 as assigned by the Government. Parts and assemblies which are not assigned a Government type designation shall be marked in accordance with MIL-STD-130, MIL-E-5400 and MIL-STD-454, Requirement 67.

3.6.13 Configuration.

3.6.13.1 Configuration management. The concentrator furnished in accordance with this specification shall be developed and produced under a program for managing system configuration as specified in DOD-STD-480, MIL-STD-482, MIL-STD-483 and MIL-STD-490 (see 6.2.2). The program shall apply during all stages of design and production. The program shall establish means for controlling and accounting of all changes to the established physical configuration, or changes in processes or conditions imposed during manufacturing, assembly or inspection.

3.6.13.1.1 Drawings. Drawings shall be in accordance with DOD-D-1000, DOD-STD-100 and AD-1350 (see 6.2.2).

3.6.14 Cleanliness.

3.6.14.1 Degreasing. Prior to assembling the concentrator and its subassemblies, all internal surfaces shall be degreased by flushing with a cleaning compound, MIL-C-81302 or using a vapor phase degreaser in accordance with MIL-T-81533. Components shall be cleaned by immersing, scrubbing or pressure spray with MIL-C-81302 cleaning compound or ultrasonics may be used in conjunction with vapor degreasing or MIL-C-81302 cleaning compound. After completion of the cleaning and when assembled, a General Electric, Type H, leak detector, or equivalent Halide testing apparatus, shall be used to determine the absence of the cleaning compound.

3.6.14.2 Lubricants. Lubricants qualified to MIL-G-27617 may be used sparingly on seals and straight threads if assembly difficulty is encountered.

3.7 Performance.

3.7.1 Operational.

3.7.1.1 Sea level. The oxygen concentration of the concentrator output, when tested as specified in 4.8.2.1, shall meet the minimum values specified in Table I.

3.7.1.2 Altitude. The concentrator, when tested as specified in 4.8.2.2, shall show no evidence of functional, electrical or material failure and oxygen concentration of the product output shall be as specified in Table II.

3.7.2 Pressure. The concentrator shall satisfy the pressure requirements detailed below.

3.7.2.1 Pressure reducer. The pressure reducer of the concentrator, when tested as specified in 4.8.3.1, shall provide a maximum output pressure of 72 psig with an inlet pressure of 250 psig and an output pressure of 27 ± 2.5 psig with an inlet pressure of 27 ± 2.5 psig.

3.7.2.2 Leakage rate. The initial outlet pressure of the concentrator, when tested as specified in 4.8.3.2, shall be a maximum of 72 psig and the outlet pressure after 5 minutes shall be not greater than 5 psig below the initial outlet pressure.

3.7.3 Capacity. The concentrator, when tested as specified in 4.8.4, shall be capable of providing an average steady state flow of 70 lpm (NTP) with an input pressure of 8 psig at sea level.

3.7.4 Voltage variation. The oxygen concentration of the product output of the concentrator, when tested as specified in 4.8.5, shall be a minimum of 87 percent oxygen and the current required shall be not greater than 27 amperes.

3.7.5 Oxygen contamination. The gas contaminants in the concentrator's product output, when tested as specified in 4.8.6, shall be not greater than the maximum level specified in Table III. Argon and nitrogen are not considered contaminants.

3.7.6 Electromagnetic interference/electromagnetic compatibility. The concentrator, when tested as specified in 4.8.7, shall show no evidence of functional, electrical or material failure during or after emission and susceptibility testing, and shall not exceed the limits specified for Class A1 equipment, Category A1b.

3.7.7 High temperature. The concentrator product output, when tested as specified in 4.8.8, shall be greater than 70 percent oxygen concentration for a 13.1 lpm (NTP) steady state output flow rate and 48 percent oxygen concentration for a 26.2 lpm (NTP) steady state output flow rate. The concentrator shall not show any evidence of functional, electrical or material failure during or after the high temperature exposure.

3.7.8 Low temperature/altitude. The oxygen concentration of the concentrator product output, when tested as specified in 4.8.9, shall be as specified in Table IV. The concentrator shall not show any evidence of functional, electrical or material failure during or after the low temperature/altitude exposure.

3.7.9 Temperature shock. The concentrator, when tested as specified in 4.8.10, shall show no evidence of functional, electrical or material failure following temperature shock exposure.

3.7.10 Temperature/altitude. The concentrator, when tested as specified in 4.8.11, shall show no evidence of functional, electrical or material failure, during or after any temperature or temperature/altitude exposure and the oxygen concentration of the product output shall be as specified in Tables IV and V, as applicable.

3.7.11 Humidity. The concentrator, when tested as specified in 4.8.12, shall show no evidence of functional, electrical or material failure following humidity exposure.

3.7.12 Temperature/humidity/altitude. The concentrator, when tested as specified in 4.8.13, shall show no evidence of functional, electrical or material failure following temperature/humidity/altitude exposure.

3.7.13 Acceleration. The concentrator, when tested as specified in 4.8.14, shall show no evidence of functional, electrical or material failure during or following acceleration exposure, and the oxygen concentration of the product output during the operational tests shall be a minimum of 87 percent.

3.7.14 Vibration. The concentrator, when tested as specified in 4.8.15, shall not show any evidence of functional, electrical or material failure during or after any vibration cycle, and the oxygen concentration of the product output during the operational cycles shall be a minimum of 87 percent.

3.7.15 Shock. The concentrator, when tested as specified in 4.8.16, shall not show evidence of functional, electrical or material failure following shock exposure.

3.7.16 High temperature/altitude. The concentrator, when tested as specified in 4.8.17, shall show no evidence of functional, electrical or material failure during or after high temperature/altitude exposure, and the oxygen concentration of the product output shall be as specified in Table V.

3.7.17 Salt fog. The concentrator, when tested as specified in 4.8.18, shall show no evidence of functional, electrical or material failure following salt fog exposure.

3.7.18 Dust. The concentrator, when tested as specified in 4.8.19, shall show no evidence of functional, electrical or material failure following dust exposure.

3.8 Workmanship. The concentrators shall be uniform in quality and shall be free from irregularities, defects, or foreign material which could adversely affect safety, performance, reliability, or durability.

4. QUALITY ASSURANCE PROVISIONS

4.1 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, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.2 Classification of inspections. The inspection requirements specified herein are classified as follows:

a. Qualification inspection. Qualification inspection consists of the examinations and tests performed on samples submitted for approval as a qualified product (see 4.3).

b. First article inspection. First article inspection consists of examinations and tests performed on samples which are representative of the production item after award of a contract to determine that the production item conforms to the requirements of this specification (see 4.4).

c. Quality conformance inspection. Quality conformance inspection consists of examinations and tests performed on individual products or lots to determine conformance of the products or lots with the requirements set forth in this specification (see 4.5).

d. Quality conformance verification inspection. Quality conformance verification inspection consists of examinations and tests performed on individual products or lots to verify conformance of the products or lots with requirements set forth in this specification (see 4.6).

4.3 Qualification inspection. Qualification inspection shall consist of the examinations and tests specified in Table VI.

4.3.1 Samples. Qualification samples shall consist of four complete concentrators and one set of manufacturer's drawings. Samples shall be forwarded to a test facility set forth in the letter of authorization to submit samples (see 6.3). The samples shall be plainly identified by securely attached durable tags marked with the following information:

> Sample submitted by (name), (date) for qualification inspection in accordance with the requirements of MIL-C-85521(AS) and number under authorization (reference authorizing letter and number) (see 6.3).

4.3.2 Retention of qualification. The retention of qualification shall consist of verification to determine compliance of the qualified concentrator with the requirements of this specification. Every two years, each manufacturer will be requested to forward to the Government certification signed by a responsible official of management, attesting that the listed product(s) is still available from the listed plant, can be produced under the same conditions as originally qualified; i.e., same process, materials, construction, design, manufacturer's part number, or designation; and meets the requirements of the current issue of the specification. Failure to provide the certification will be cause for removal from the Qualified Products List (QPL). After completion of the certification review, the QPL shall be reprinted to show the date of validation.

4.4 First article inspection. First article inspection shall consist of the examinations and tests specified in Table VII.

4.4.1 Samples. Unless otherwise specified, as soon as practicable, after the award of the contract or order, the manufacturer shall submit two complete concentrators. The samples shall be representative of the construction, workmanship,

components and materials to be used during production. When a manufacturer is in continuous production of these units from contract to contract, submission of further first article samples on a new contract or whether first article reliability test is required on a new contract may be waived at the discretion of the acquiring activity (see 6.2.1d and 6.2.1e). Approval of the first article samples or the waiving of the first article inspection does not waive the requirements of submitting to the quality conformance inspection. The first article inspection samples shall be furnished to the Government as directed by the contracting officer (see 6.2.1e).

4.4.1.1 Documentation. Upon completion of the first article inspection, all the applicable inspection reports and when applicable, recommendations and comments pertinent for use in monitoring production shall be made available to the cognizant Government activity (see 6.2.1f and 6.2.2). The concentrators will be returned to the manufacturer for use in monitoring production.

4.5 Quality conformance inspection. Quality conformance inspection shall consist of the examinations and tests specified in Table VIII. The sampling and inspection levels and acceptance criteria shall be as specified in MIL-STD-105.

4.5.1 Sampling.

4.5.1.1 Inspection lot.

4.5.1.1.1 Concentrators. An inspection lot size shall be expressed in units of one concentrator made under essentially the same conditions and from the same materials and components. The sample unit shall be one concentrator.

4.5.1.1.2 Packaging. An inspection lot size shall be expressed in units of one fully prepared shipping container, containing concentrators, fully prepared for delivery, made from essentially the same materials and components. The sample unit shall be one shipping container, containing concentrators, fully prepared for delivery with the exception that it need not be sealed.

4.5.1.2 Sampling for tests and examinations of concentrators. The sample size, acceptance criteria, tests and examinations required for the concentrators shall be as specified in Table VIII.

4.6 Quality conformance verification inspection. At the option of the Government and upon completion of the quality conformance inspection requirements of 4.5, a random sample, one for every 50 or fraction thereof, shall be selected from each lot of concentrators. Each concentrator, selected as a sample unit, shall be forwarded to a laboratory designated at the time of award (see 6.2.1f). The designated laboratory shall conduct the following tests and examinations:

a. Visual examination
b. Sea level test
c. Pressure tests
d. Voltage variation
e. Low temperature/altitude

The tests may be conducted in any order. The serial numbers of the units in the lot, represented by the sample units, shall be included with the data accompanying the samples to the laboratory. The Government activity responsible for conducting the quality conformance verification program (see 6.2.1g) shall report the results of the tests and examinations to the designated inspection and acceptance activity specified in the acquisition document. Final acceptance of the lot from which the sample units were selected shall be based upon successful completion of the inspection program by the cognizant Quality Assurance Representative/Specialist at the contractor's facility; applying the applicable acceptance criteria specified in Table VIII.

4.7 Test conditions. Unless otherwise specified, tests shall be conducted at local ambient temperatures and barometric pressure. Corrections shall be made to provide agreement with the temperature and pressure calibration of the instruments. Inspection data provided by any instrument not calibrated to normal temperature and pressure (NTP) conditions shall be corrected to determine NTP requirements. NTP conditions are 29.92 inches of mercury (101.3kPa) and 70°F (21.1°C).

4.8 Inspection methods.

4.8.1 Visual examination.

4.8.1.1 Concentrators. Every concentrator shall be examined visually for critical defects to determine conformance to this specification. In addition, every concentrator, selected as a sample unit from the lot, shall be visually examined for minor defects to determine conformance to this specification. The classification of defects, Table IX, shall be used to classify the defects found.

4.8.1.1.1 Dimensions. Each concentrator, selected as a sample unit from the lot, shall be checked dimensionally to determine conformance to the dimensions specified on Drawing 1438AS101.

4.8.1.2 Packaging. Each of the fully prepared shipping containers, containing concentrators, selected as a sample unit from the lot, shall be examined to determine that the packaging, packing and marking conform to this specification. The list of defects, Table X, shall be used to enumerate the defects found.

4.8.2 Operational test.

4.8.2.1 Sea level test. The concentrator shall be connected to a source of rated electrical power and the inlet connected to an air pressure source capable of delivering 8 through 250 psig. The electrical power shall be applied to the concentrator and then the inlet air supply turned on and the reverse sequence shall be followed during shutdown. Electrical power shall always be supplied to the unit while there is an inlet flow of air. The inlet and outlet gas pressure shall be monitored and the output flow shall be set to specific steady state flow rates using an external output regulator. The output flow rate shall be measured by a float type meter or equivalent. A 4 foot long, 5/8 inch diameter tube or hose shall be connected to the overboard vent. The concentrator product output shall pass the requirements specified in 3.7.1.1.

4.8.2.2 Altitude test. The concentrator shall be mounted in an altitude chamber and the sea level test shall be repeated, except the altitude and corresponding flow rates shall be as specified in Table II. Each flow rate shall be tested with inlet air pressure of 25 and 60 psig (referenced to the test altitude). The concentrator product output shall pass the requirements specified in 3.7.1.2.

4.8.3 Pressure tests.

4.8.3.1 Pressure reducer. The pressure reducer test may be combined with the sea level test of 4.8.2.1. An inlet pressure of 250 psig shall be applied and the output pressure shall pass the requirements specified in 3.7.2.1. The test shall be repeated with an inlet pressure of 27 ± 2.5 psig.

4.8.3.2 Leakage rate. The output line of the concentrator shall be closed and an input pressure of 250 psig applied for a minimum of one minute. The input pressure shall then be released and the outlet pressure recorded. Outlet pressure shall again be recorded 5 minutes after the first outlet pressure reading. The concentrator shall pass the requirements specified in 3.7.2.2.

4.8.4 Capacity test. The inlet air pressure of the concentrator shall be set at 8 psig. The maximum steady state flow available shall be drawn from the outlet. The flow shall be recorded and pass the requirements specified in 3.7.3.

4.8.5 Voltage variation. The concentrator shall be operated with an input voltage of 31.5 volts DC, an input air pressure of 25 psig, and an outlet flow of 13.1 lpm. Electrical amperes and the oxygen concentration of the product output shall be recorded. The test shall be repeated with an input voltage of 18 volts DC. The amount of electrical amperes the concentrator draws and the oxygen concentration of the product output shall pass the requirements specified in 3.7.4.

4.8.6 Oxygen contamination. The concentrator shall be operated with 28 VDC power, inlet air at 25 psig and an outlet flow of 26.2 lpm. The pressurized input air shall contain, at least, the level of contaminants listed in Table XI. The oxygen output shall be analyzed for contaminants and shall pass the requirements specified in 3.7.5.

4.8.7 Electromagnetic interference/electromagnetic compatibility. The concentrator shall be tested in accordance with MIL-STD-461 and MIL-STD-462. During operation, the concentrator shall be supplied with inlet air at 25 psig with an outlet flow of 13.1 lpm. The concentrator shall pass the requirements specified in 3.7.6.

4.8.8 High temperature test. The concentrator shall be subjected to a high temperature test in accordance with MIL-STD-810, Method 501.1, Procedure I. After conditioning, and while still at an ambient temperature of 160°F, electrical power and inlet air with a temperature of 250 ± 5°F and pressure of 40 psig shall be applied to the concentrator. These conditions shall be maintained for four hours, with an output flow rate of 13.1 lpm maintained throughout this period. With output flow rate changed to 26.2 lpm at the end of the four hour operating period, oxygen concentrations of the output product shall pass the requirements specified in 3.7.7.

4.8.9 Low temperature/altitude test. The concentrator shall be conditioned in a temperature altitude chamber at -65 ± 5°F for four hours while operating with inlet air at a temperature of -10, +0, -5°F, pressure of 40 psig, and outlet flow of 13.1 lpm. After the four hour conditioning period, the oxygen concentration shall be recorded. Inlet air pressures, outlet flow rates and chamber altitudes shall then vary in accordance with Table IV. The oxygen concentration of the concentrator product output shall pass the requirements specified in 3.7.8.

4.8.10 Temperature shock test. The concentrator shall be subjected to the temperature shock test in accordance with MIL-STD-810, Method 503.1, Procedure I. The concentrator shall then be subjected to and pass the sea level operation test, pressure reducer and leakage test and the voltage variation test. The concentrator shall pass the requirements specified in 3.7.9.

4.8.11 Temperature/altitude test. The concentrator shall be subjected to the temperature/altitude test in accordance with MIL-STD-810, Method 504.1, Procedure I, Equipment Category 5. The applicable operating conditions for inlet air pressure, inlet air temperature and outlet flow rate specified in Tables IV and V shall be used for those steps which require operation at low and high ambient temperatures, respectively. The concentrator shall be subjected to and pass the sea level operation test, pressure reducer and leakage test and voltage variation test after completion of each step. The concentrator shall pass the requirements specified in 3.7.10.

4.8.12 Humidity. The concentrator shall be subjected to the humidity test in accordance with MIL-STD-810, Method 507.1, Procedure II. The concentrator shall not be operating during the exposure. Within one hour after completion of the test, the concentrator shall be subjected to and pass the sea level operation test, pressure reducer and leakage test and the voltage variation test. The concentrator shall pass the requirements specified in 3.7.11.

4.8.13 Temperature/humidity/altitude. The concentrator shall be subjected to the temperature/humidity/altitude test in accordance with MIL-STD-810, Method 518.1, Procedure I. The concentrator shall not be operating during the exposure. The concentrator shall then be subjected to and pass the sea level operation test, pressure reducer and leakage test and the voltage variation test. The concentrator shall pass the requirements specified in 3.7.12.

4.8.14 Acceleration test. The concentrator shall be subjected to the acceleration test in accordance with MIL-STD-810, Method 513.2, Procedures I and II, carrier based aircraft category, maximum G level in all axes. During each Procedure II run, the concentrator shall be operating with 25 psig inlet air pressure and 13.1 lpm outlet flow. The concentrator shall be subjected to and pass the sea level operation test, pressure reducer and leakage test and the voltage variation test after completion of each procedure. The concentrator shall pass the requirements specified in 3.7.13.

4.8.15 Vibration test. The concentrator shall be subjected to the vibration test in accordance with Table XII and Figure 1. The test shall be performed in accordance with the random vibration test techniques of MIL-STD-810. The test sequence shall be Performance B, Performance A, then Endurance A for each of the

three mutually perpendicular axes. The concentrator shall be hard mounted to a rigid fixture capable of transmitting the vibration conditions specified. The concentrator shall be operating during performance tests with a 25 psig inlet pressure and 13.1 lpm output, but shall not be operating during nor be connected to external supplies during the endurance test. After completion of each axis, the concentrator shall be subjected to and pass the sea level operation test, pressure reducer and leakage test and the voltage variation test. The concentrator shall pass the requirements specified in 3.7.14.

4.8.16 Shock test. The concentrator shall be subjected to the shock test in accordance with MIL-STD-810, Procedure I, Basic Design, Figure 516.2-1, 20 G peak 11 ms nominal duration and Procedure II, transit drop, Table 516.2-1, for under 100 pound category. The concentrator shall not be operational during either procedure. The concentrator shall be subjected to and pass the sea level operation test, pressure reducer and leakage test and the voltage variation test after each procedure. The concentrator shall pass the requirements specified in 3.7.15.

4.8.17 High temperature/altitude test. The test shall be conducted in a temperature/altitude chamber. An ambient temperature of 160°F shall be maintained throughout the test. Test readings must be taken during the intervals stated in Table V. The times are cumulative. The initial air inlet temperature must be 250 ± 5°F. The inlet air temperature output flow rates and chamber altitudes shall be as specified in Table V. Inlet pressure during the test shall be 25 psig (referenced to test altitude). The oxygen concentration of the product output of the concentrator shall pass the requirements specified in 3.7.16.

4.8.18 Salt fog test. The concentrator shall be subjected to the salt fog test in accordance with MIL-STD-810, Method 509.1, Procedure I, except the salt fog solution shall be as specified in Table XIII. The concentrator shall not be operating during the exposure. The concentrator shall be subjected to and pass the sea level operation test, pressure reducer and leakage test and the voltage variation test after salt fog exposure and again 48 hours later. The concentrator shall pass the requirements specified in 3.7.17.

4.8.19 Dust test. The concentrator shall be subjected to the dust test in accordance with MIL-STD-810, Method 510.1, Procedure I. The concentrator shall not be operating during the exposure. The concentrator shall then be subjected to and pass the sea level operation test, pressure reducer and leakage test and the voltage variation test. The concentrator shall pass the requirements specified in 3.7.18.

4.8.20 Reliability tests.

4.8.20.1 Reliability demonstration.

4.8.20.1.1 Qualification inspection. A minimum of two concentrators shall be tested to show compliance with the reliability requirement as specified in 3.6.7.5. The test shall be conducted in accordance with MIL-STD-781, Test Plan XIVC. Environmental profiles shall be in accordance with Figures 2 and 3.

4.8.20.1.2 First article inspection. A minimum of two concentrators shall be tested to show compliance with the reliability requirement as specified in 3.6.7.5. The test shall be conducted in accordance with MIL-STD-781, Test Plan XXC. Environmental profiles shall be in accordance with Figures 2 and 3.

4.8.20.2 Reliability acceptance test. The reliability acceptance test shall be performed in accordance with the recommendations of NAVMAT P-9492, as follows:

a. A random vibration screen shall be applied to each production unit. The units shall be hard mounted to a shake table such that the axis of vibration is perpendicular to the printed circuit board. The units shall then be shaken for at least ten minutes to the power spectral density characteristics shown in Figure 4.

b. The random vibration screen shall be followed by two failure free temperature cycles. The temperature cycle and equipment on and off time shall be as defined in Figure 5.

c. All failures occurring during the vibration and temperature screens shall be evaluated and effective corrective actions determined and submitted for acquiring activity approval.

d. Quality conformance tests shall be conducted prior to and after the reliability acceptance test.

4.8.20.3 Reliability assurance for spares and repair parts. Portions of the concentrators, components or parts which are supplied as spares or repair parts shall receive a reliability screening test which is not less in duration nor severity of stress than the same item received when tested as an integral portion of the system in which it was installed. Details of the reliability screening test to be performed shall be included in the reliability program plan, the drawing for the item and in the contractor's test procedures.

4.8.21 Maintainability qualification test. A maintainability demonstration shall be conducted in accordance with MIL-STD-471, Notice 1, Method 9 to verify the maintainability requirements specified in 3.6.8.3. The sample size and fault selection shall be in accordance with MIL-STD-471. The acquiring activity reserves the right to provide and select the technicians to perform Organizational and Intermediate maintenance level demonstrations. The contractor shall provide adequate training to qualify the military technician(s) to perform the maintainability demonstrations. The technical documentation to be used shall be limited to the equipment technical manual.

4.8.22 Configuration.

4.8.22.1 Functional configuration audit (FCA). A FCA shall be conducted by the manufacturer with Government representatives in accordance with MIL-STD-1521, prior to establishment of the test baseline. The objective of the FCA shall be to verify that the performance of the concentrator and its components and subsystems comply with the requirements of this specification.

4.8.22.2 Testing baseline configuration audit (TBCA). A TBCA shall be conducted by the manufacturer with Government representatives in accordance with MIL-STD-1521. The objective of the TBCA is to formally examine the system against its technical documentation.

4.8.22.3 Physical configuration audit (PCA). A PCA shall be conducted after all testing is completed and accepted, in accordance with MIL-STD-1521, to formally examine the production version of the system against its technical documentation in order to establish a final (production) baseline.

4.8.22.4 Production physical configuration audit (PPCA). This inspection is conducted on the first production equipment produced. It shall include verification of the exact relationship of the equipment to its released/approved engineering documentation. This will be accomplished by verifying that part numbers on drawings, parts list and instructions agree with hardware and that all approved changes have been incorporated (see 6.2.2).

5. PACKAGING

5.1 Preservation. Unless otherwise specified in the contract or order, preservation shall be Level A, using Method IIb of MIL-P-116, with one concentrator per unit package (see 6.2.1h). Preservatives shall not be used. All openings in the concentrator assembly shall be closed with suitable closures to prevent entry of dirt or foreign matter during shipment and storage.

5.1.1 Cushioning. Cushioning protection provided shall ensure that transmission of shock to the item is limited to 20 G's based upon the guidelines of MIL-HDBK-304 for appropriate drop height and test procedure indicated by Method 5007.1 of FED-STD-101.

5.2 Packing. Packing shall be Level A, B or C, as specified in the contract or order (see 6.2.1h).

5.2.1 Level A. Each unit, packaged as specified in 5.1, shall be packed for shipment in containers conforming to PPP-B-601 or PPP-B-621, Overseas Type.

5.2.2 Level B. Each unit, packaged as specified in 5.1, shall be packed for shipment in containers conforming to PPP-B-601 or PPP-B-621, Domestic Type; fiberboard boxes conforming to PPP-B-636 or PPP-B-640, Weather Resistant may be used provided that the gross weight is not greater than the applicable specification limitation.

5.2.3 Level C. Each unit, packaged as specified in 5.1, shall be packed in exterior-type shipping containers conforming to rules and regulations pertaining to mode of transportation and acceptable to the carrier utilized at the lowest tariff rate possible and will ensure safe transportation. Contractor's commercial/industrial packing procedure may be used when the above criteria are met.

5.3 Marking. The exterior and interior containers shall be marked in accordance with MIL-STD-129. In addition, the following precautionary marking shall be required on each unit package and shipping container:

CAUTION

DO NOT ALLOW PETROLEUM CONTAMINANTS OF ANY KIND TO BE USED/STORED ON OR ABOUT THESE CONTAINERS.

5.4 Special requirements. All wrappings, cushioning, dunnage and containers used in preservation, packaging and packing of oxygen concentrators shall be completely free of contamination by oil or grease.

6. NOTES

6.1 Intended use. The concentrator covered by this specification is intended to be used in military aircraft breathing systems for generation of oxygen enriched air as required for aircrewman breathing during ground and flight conditions.

6.2 Ordering data.

6.2.1 Acquisition requirements. Acquisition documents should specify the following:

a. Title, number and date of this specification.

b. Government part number.

c. Quantity desired.

d. Whether first article reliability test is required (see 4.4.1).

e. Whether first article inspection is waived (see 4.4.1).

f. Name and address of the first article inspection laboratory (see 4.4.1) and the name of the Government activity responsible for conducting the first article inspection program (see 4.4.1.1).

g. If required, name and address of the quality conformance verification inspection laboratory (see 4.6) and the name of the Government activity responsible for conducting the quality conformance verification inspection program (see 4.6).

h. Applicable levels of preservation, packaging, and packing (see 5.1 and 5.2); including marking requirements (see 5.3) and special requirements (see 5.4).

6.2.2 Data requirements. When this specification is used in an acquisition which incorporates a DD Form 1423, Contract Data Requirements List (CDRL), the data requirements identified below shall be developed as specified by an approved Data Item Description (DD Form 1664) and delivered in accordance with the approved CDRL incorporated into the contract. When the provisions of DAR 7-104.9 (n) (2) are invoked and the DD Form 1423 is not used, the data specified below shall be delivered by the contractor in accordance with the contract or purchase order requirements. Deliverable data required by this specification is cited in the following paragraphs:

Paragaph no.	Data requirements	Applicable DID no.
3.5.2.1	Certificate of compliance for the age of elastomer components	DI-E-2121
3.6.7.1 and 3.6.8.1	Reliability and Maintainability Reports	UDI-R-21137
3.6.7.2	Reliability Program Plan	DI-R-7079
3.6.7.3	Reliability Prediction Report	DI-R-7082
3.6.7.4	Failure Modes Effects and Criticality Analysis Report	DI-R-7085
3.6.8.2	Maintainability Program Plan	DI-R-7103
3.6.8.4	Maintainability Prediction Report and Maintainability Analysis Report	DI-R-7108 and DI-R-7109
3.6.9	System Safety Program Plan and System Safety Hazard Analysis Report	DI-R-7047 and DI-R-7048
3.6.10	Human Engineering Design Approach	DI-H-7057
3.6.13.1	Configuration Management Plan	DI-E-2035
3.6.13.1.1	Drawings, Engineering and Associated Lists	DI-E-7031
4.4.1.1	First Article Inspection Report	DI-T-4902
4.8.22.4	ECP's and Requests for Deviations and Waivers; Notice of Revision/Specification Change; and Test and Demonstration Report	DI-E-2037 DI-E-1126A and DI-T-1906

(Data item descriptions related to this specification and identified in Section 6 will be approved and listed in DOD 5000.19L, Vol II, AMSDL. Copies of data item descriptions required by the contractors in connection with specific acquisition

functions should be obtained from the Naval Publications and Forms Center or as directed by the contracting officer.)

6.3 Qualification. With respect to products requiring qualification, awards will be made only for products which are, at the time set for opening of bids, qualified for inclusion in Qualified Products List (QPL-85521) whether or not such products have actually been so listed by that date. The attention of the contractors is called to these requirements, and manufacturers are urged to arrange to have the products that they propose to offer to the Federal Government tested for qualification in order that they may be eligible to be awarded contracts or purchase orders for the products covered by this specification. The activity responsible for the Qualified Products List is Commander, Naval Air Systems Command, Washington, DC 20361; however, information pertaining to qualification of products may be obtained from the Naval Air Development Center (Code 6031), Warminster, PA 18974. Prior to submission of the samples for qualification inspection, the manufacturer shall submit a request to the Naval Air Development Center (Code 6031), indicating a date on which the samples can be forwarded and also request an authorization number to accompany the samples.

6.3.1 Documentation. When requested, the manufacturer shall make available engineering drawings and inspection reports in accordance with SD-6.

6.4 First article. When a first article inspection is required, the item will be tested and should be a first article sample. The contracting officer should include specific instructions in acquisition documents regarding arrangements for examinations, tests and approval of the first article.

6.5 Laboratory information. The successful bidder will be furnished with the name of the quality conformance verification inspection laboratory and the Government activity responsible for conducting the inspection program at the time of award. Samples from a rejected lot shall not be resubmitted for tests and examinations, as required by 4.6, without the approval of the contracting officer.

Preparing Activity:
Navy - AS

(Project 1660-N472)

TABLE I. Sea level operation. 1/

Inlet air pressure (psig)	Steady state output flow (liters/minute, NTP)	Minimum oxygen concentration (percent) 5/
8 2/	5	48
8	10	37
8 2/	13.1	33
8	26.2	26
8 2/	35	25
25 2/	5	93
25 2/	13.1	87
25	35	49
25	70	34
25 2/	100	27
80 - 100 peak 3/	13.1	93
80 - 100 peak	26.2	74
80 - 100 peak	70	44
80 - 100 peak	100	36
230 - 250 peak 4/	13.1	93
230 - 250 peak	26.2	86
230 - 250 peak	70	64
230 - 250 peak	100	50

TABLE I. Sea level operation. 1/ - Continued

1/ Inlet air and ambient temperatures = 80 ± 20°F.

2/ Minimum test points required for quality conformance. Test all points on first article and qualification tests.

3/ Peak input pressures in the range of 80 - 100 psig. Input pressures may drop below 80 psig during part of cycle.

4/ Peak input pressures in the range of 230 - 250 psig. Input pressure may drop below 230 psig during part of cycle.

5/ Minimum oxygen concentrations (measured) to be rounded to nearest percent.

TABLE II. Altitude operation. 1/

Altitude (feet)	Steady state outlet flow (liters/minute, NTP) 2/	Minimum oxygen concentration (percent) 3/	
		25 psig	60 psig
10,000	8.4	92	92
	16.8	80	90
	40	48	62
	70	36	46
20,000	5.4	93	93
	10.8	92	92
	40	56	66
	70	42	51
30,000	3.2	93	93
	6.4	93	93
	9	94	94
	15	94	94
40,000 and 50,000	2.3	93	93
	4.6	93	93
	9	94	94
	15	94	94

1/ Inlet air and ambient temperatures = 80 ± 20°F.

2/ 70°F, 14.7 psia.

3/ Minimum oxygen concentration (measured) to be rounded to nearest percent.

TABLE III. Product mixture contaminants.

Gas contaminant	Maximum level
Carbon monoxide	50 2/
Carbon dioxide	1000 2/
Water vapor	0.2 mg/liter at NTP
Nitrogen dioxide	5 2/
Hydrocarbons:	
Alkanes (straight chain)	50 2/
Aromatics	1.0 2/
Total gaseous impurities (excluding moisture) 1/	0.5 percent by volume

1/ Gases, other than those noted in table, may be present, provided no physiological hazard is created.

2/ Parts per million by volume.

TABLE IV. Low temperature/altitude tests. 1/

Altitude (feet)	Inlet pressure (psig) 2/	Steady state output flow rate (lpm, NTP) 3/	Minimum oxygen concentration (percent) 4/
Sea level	40	13.1	87
30,000	25	6.4	93
40,000	25	4.7	93
50,000	25	9.4	94

1/ Inlet air temperature = -15°F and ambient temperature = -65°F.

2/ Pressure referenced to test altitude.

3/ 70°F, 14.7 psia.

4/ Minimum oxygen concentrations (measured) to be rounded to nearest percent.

TABLE V. High temperature/altitude tests.

Altitude (feet)	Steady state output flow rate (lpm, NTP) 1/	Time (minutes)	Inlet air temperature (°F)	Minimum oxygen concentration (percent) 2/
Sea level	26.2	15	250	45
10,000	19.1	20	200	65
20,000	15.4	20	200	85
30,000	9.6	20	160	93
40,000	7.5	20	160	94
50,000	7.8	20	160	94

1/ 70°F, 14.7 psia.

2/ Minimum oxygen concentrations (measured) to be rounded to nearest percent.

TABLE VI. Qualification inspection.

Inspection	Paragraph	
	Requirement	Inspection method
Visual examination	-	4.8.1
Operational tests	3.7.1	4.8.2
Pressure tests	3.7.2	4.8.3
Capacity	3.7.3	4.8.4
Voltage variation	3.7.4	4.8.5
Oxygen contaminants	3.7.5	4.8.6
EMI/EMC	3.7.6	4.8.7
High temperature performance	3.7.7	4.8.8
Low temperature /altitude	3.7.8	4.8.9
Temperature shock	3.7.9	4.8.10
Temperature/altitude	3.7.10	4.8.11
Humidity	3.7.11	4.8.12
Temperature/humidity/altitude	3.7.12	4.8.13
Acceleration	3.7.13	4.8.14
Vibration	3.7.14	4.8.15
Shock	3.7.15	4.8.16

TABLE VI. Qualification inspection. - Continued

Inspection	Paragraph	
	Requirement	Inspection method
High temperature/altitude	3.7.16	4.8.17
Salt fog	3.7.17	4.8.18
Dust	3.7.18	4.8.19
Reliability	3.6.7.5	4.8.20.1.1
Maintainability	3.6.8.3	4.8.21
Configuration	3.6.13	4.8.22

TABLE VII. First article inspection.

Inspection	Paragraph	
	Requirement	Inspection method
Visual examination	-	4.8.1
Operational tests	3.7.1	4.8.2
Pressure tests	3.7.2	4.8.3
Voltage variation	3.7.4	4.8.5
High temperature	3.7.7	4.8.8
Low temperature/altitude	3.7.8	4.8.9
Reliability	3.6.7.5	4.8.20.1.2

TABLE VIII. Quality conformance inspection.

Inspection	Method	Sample size	Acceptance criteria
Visual examination (see classification of defects)	4.8.1.1	Every concentrator for critical defects. Inspection Level II for minor defects.	Reject all units with any critical defect. An acceptable quality level of 2.5 defects per hundred units for minor defects.
Dimensions	4.8.1.1.1	Inspection Level S-1 1/	Acceptance number zero, rejection number 1.
Sea level test	4.8.2.1	Every concentrator	Reject all defective units.
Pressure tests	4.8.3	Every concentrator	Reject all defective units.
Voltage variation	4.8.5	Inspection Level S-1 1/	Acceptance number zero, rejection number 1.
High temperature	4.8.8	Inspection Level S-1 1/	Acceptance number zero, rejection number 1.
Low temperature/altitude	4.8.9	Inspection Level S-1 1/	Acceptance number zero, rejection number 1.
Reliability	4.8.20.2	Every concentrator	Reject all defective units.
Packaging	4.8.1.2	Inspection Level S-1	Total acceptable quality level of 4.0 percent defective.

1/ The sample size shall be based only on the applicable sample size code letter corresponding to the specified inspection level of MIL-STD-105.

TABLE IX. Classification of defects for visual examination of the concentrator.

Critical	Minor
1. Material imperfections - foreign matter embedded.	201. Marking - missing, insufficient, incorrect, illegible or not permanent.
2. Surface - unclean, rough, misaligned, or containing cracks, nicks or other flaws.	202. Color not as specified.
3. Any component missing, malformed, fractured or otherwise damaged.	
4. Any component loose or otherwise not securely retained.	
5. Incorrect assembling or improper positioning of components.	
6. Any functioning part that works with difficulty.	
7. Faulty workmanship or other irregularities.	

TABLE X. List of defects for packaging.

Item	Defects
Exterior and interior markings	Missing, incorrect, incomplete, illegible, of improper size, location, sequence or method of application; markings not the same on the interior and exterior containers.
Packaging and packing materials	Any non-conforming component; any component missing, damaged or otherwise defective.
Workmanship	Inadequate application of the components such as incomplete closure of the unit package, intermediate package, container flaps, loose strappings, etc.; bulging or distortion of the containers.
Exterior and interior weight or content	Number per container is more or less than required; gross or net weight exceeds the requirements.

TABLE XI. Contaminated input air mixture.

Gas contaminant	Minimum level (parts per million by volume)
Carbon dioxide	5,000
Carbon monoxide	50
Ethanol	1,000
Fluorine	0.1
Hydrogen peroxide	1
Aviation fuels	250
Methyl alcohol	200
Methyl bromide	20
Nitrogen oxides	5
Acrolein	0.1
Oil breakdown products	0.1
Ozone	0.1

TABLE XII. Vibration levels.

	Horizontal and lateral axes			Vertical axis		
	I(g^2/Hz)	II(g^2/Hz)	Time	I(g^2/Hz)	II(g^2/Hz)	Time
Performance A	0.01	0.5	5 min.	0.01	0.75	5 min.
Performance B	0.0005	0.07	25 min.	0.0005	0.07	25 min.
Endurance A	0.01	0.5	6 hr.	0.01	0.75	6 hr.

TABLE XIII. Salt fog solution.

Salt	Grams per liter
Sodium chloride	24.540
Magnesium chloride	11.110
Sodium sulfate	4.094
Calcium chloride	1.159
Potassium chloride	0.695
Sodium bicarbonate	0.201
Potassium bromide	0.101
Strontium chloride	0.042
Boric acid	0.027
Sodium fluoride	0.003

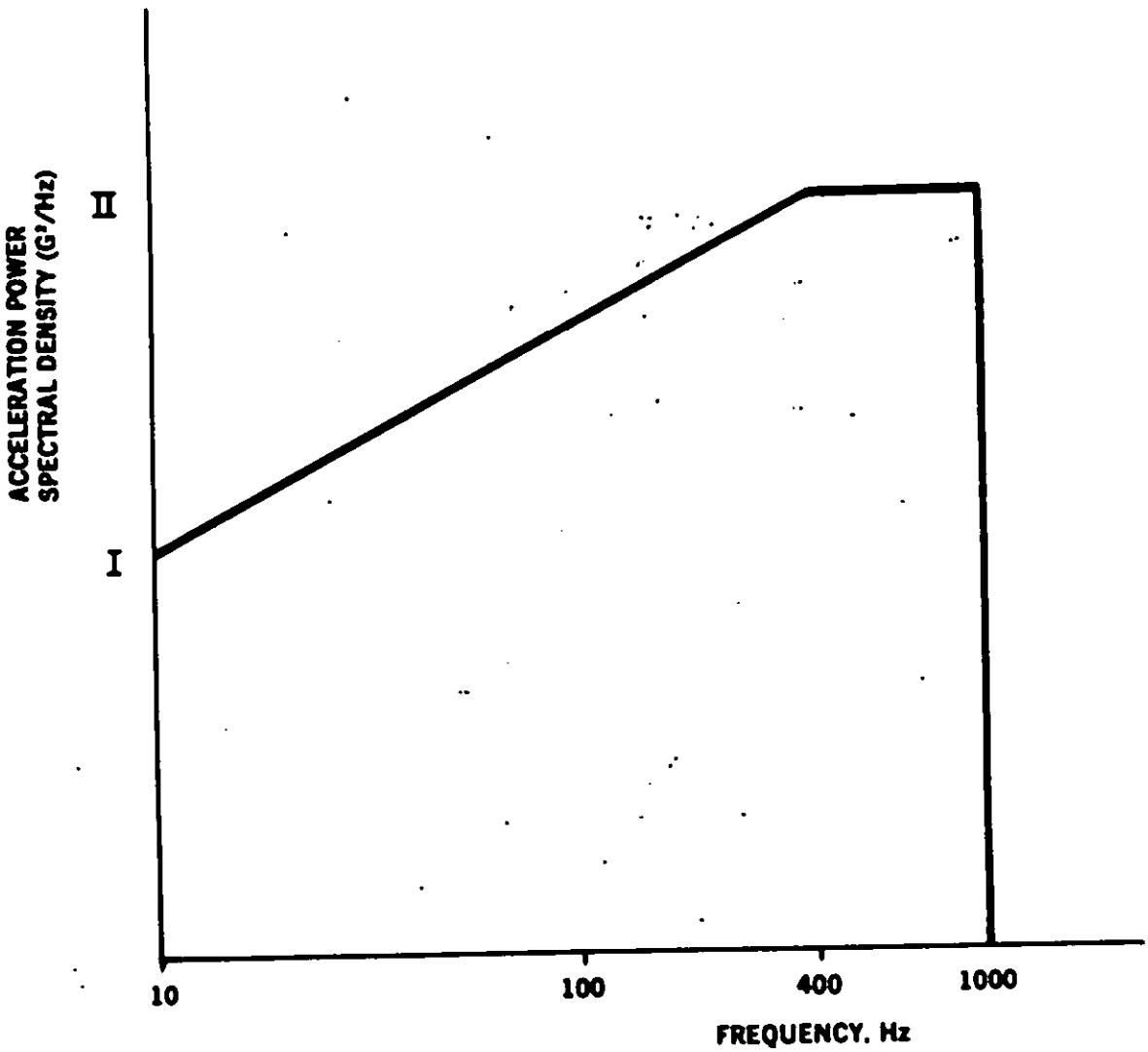

FIGURE 1. Random vibration envelope (qualification).

* U.S. GOVERNMENT PRINTING OFFICE: 1983—605-034/4042

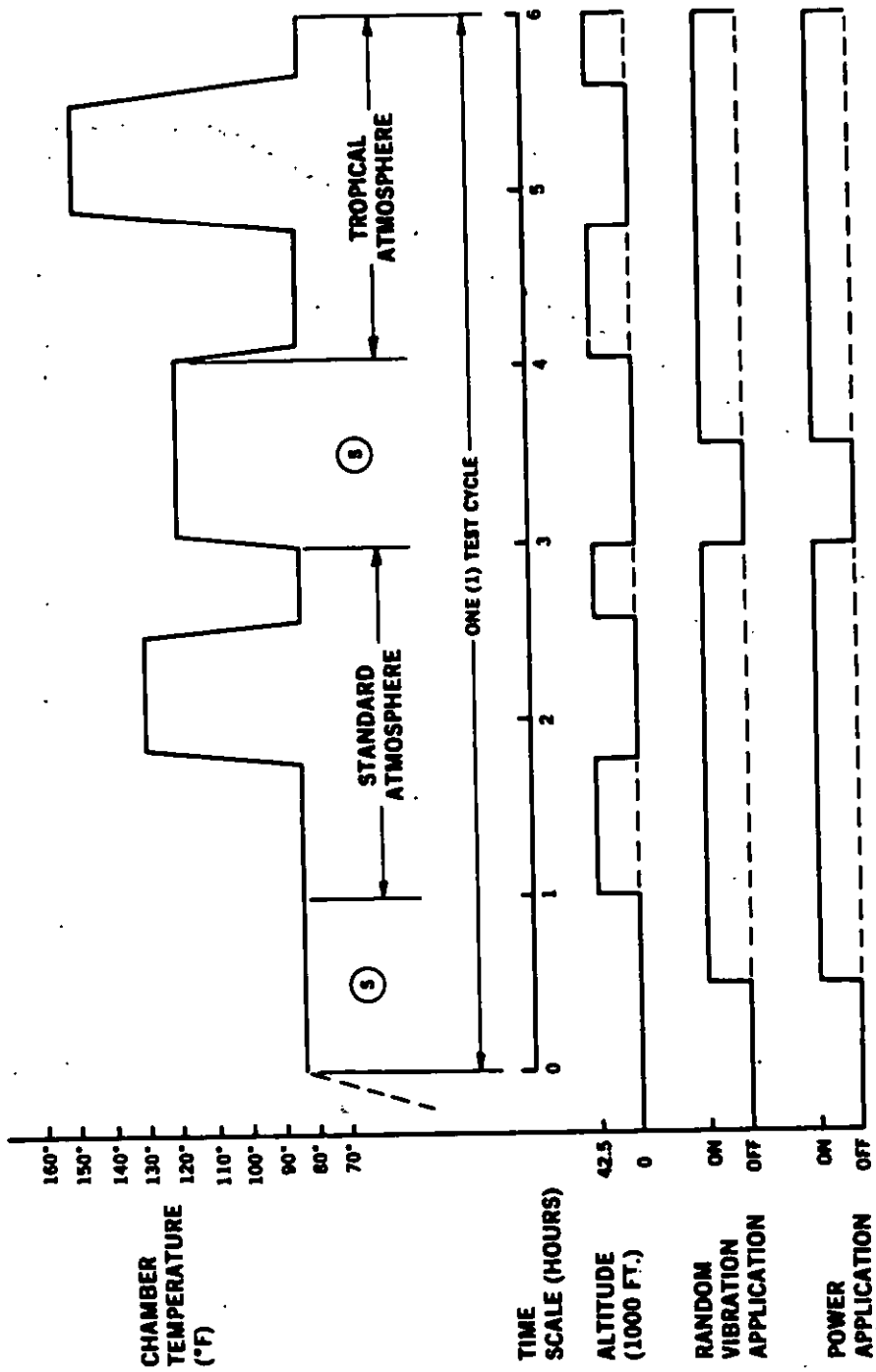

FIGURE 2. Concentrator reliability test cycle.

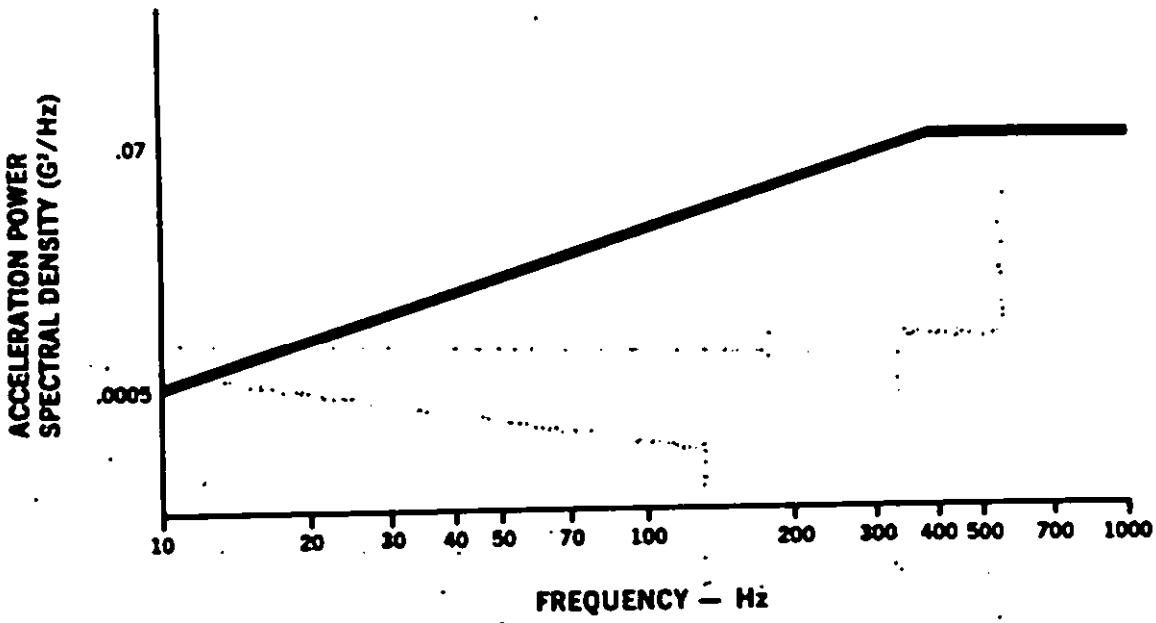

FIGURE 3. Random vibration envelope (reliability demonstration).

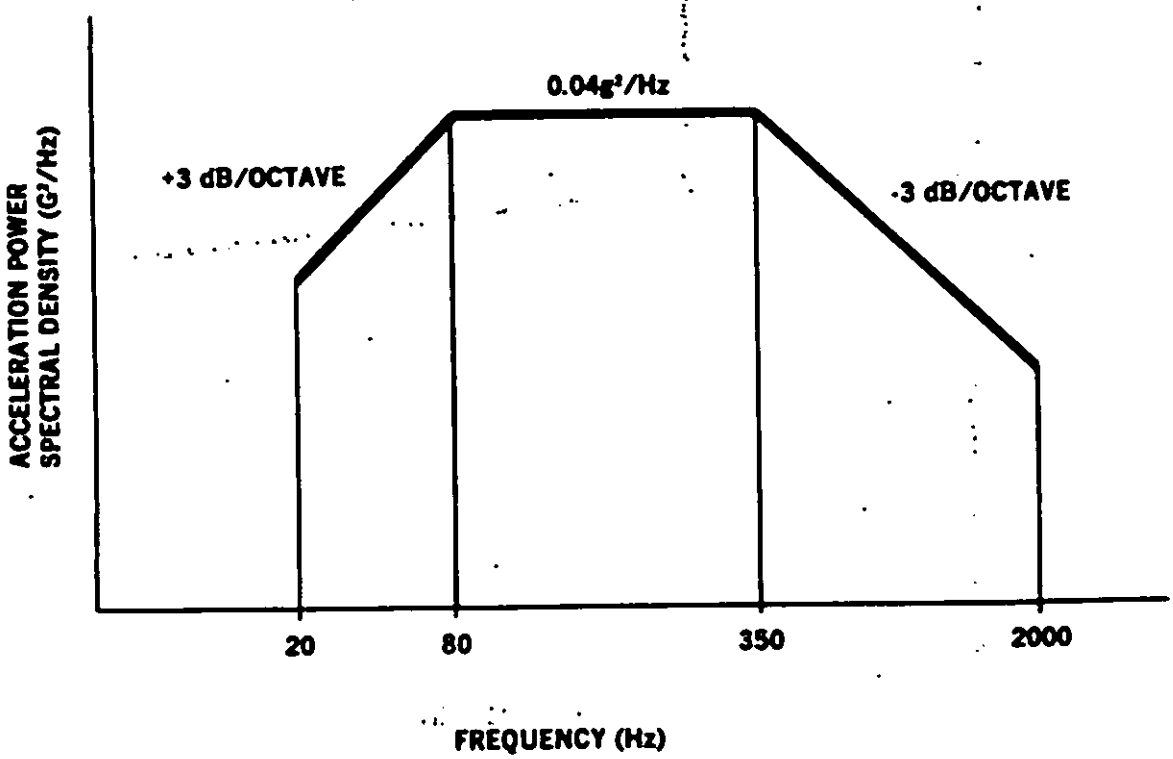

FIGURE 4. Random vibration envelope (reliability acceptance).

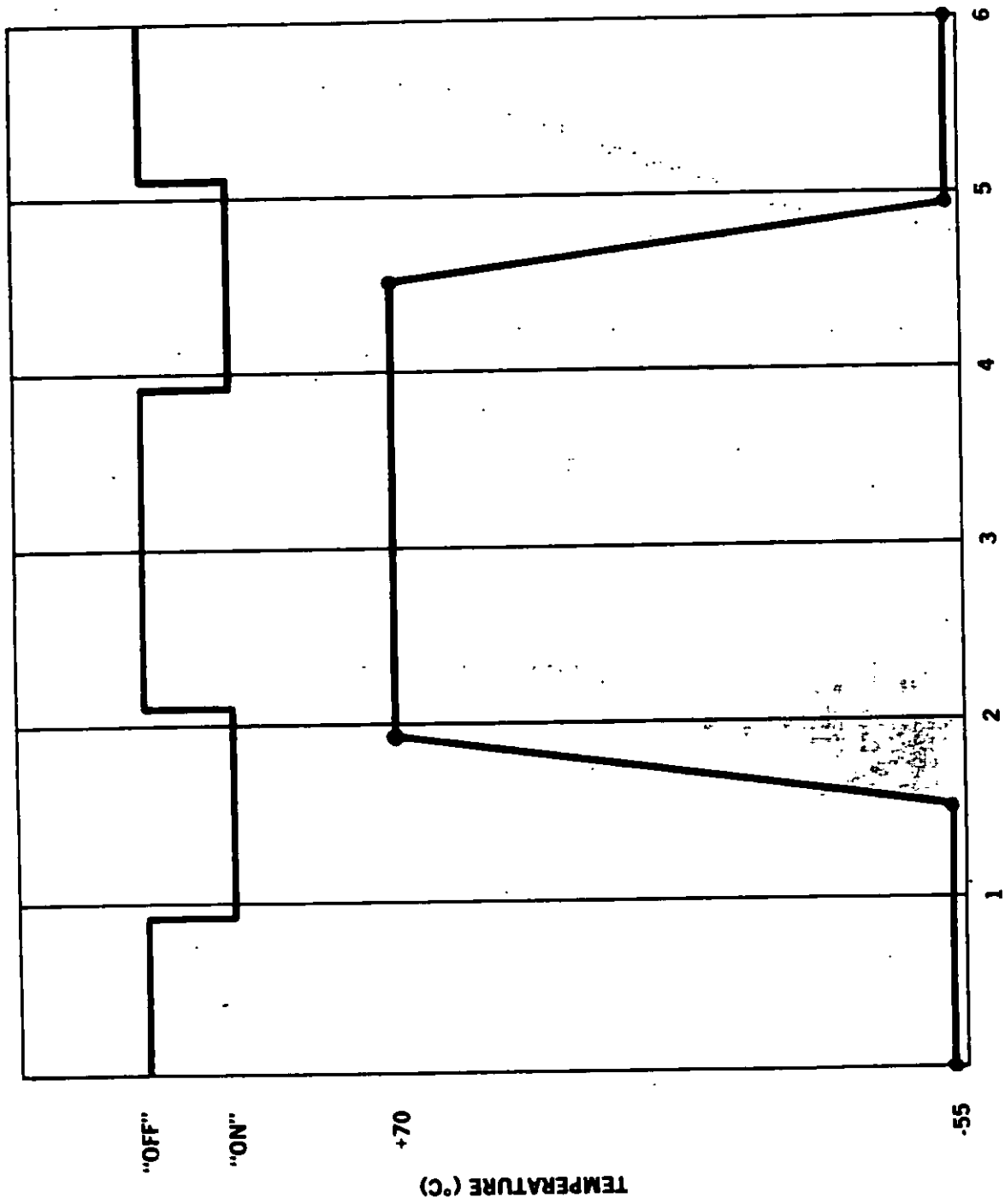

FIGURE 5. Concentration temperature cycle.

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

(See Instructions – Reverse Side)

1. DOCUMENT NUMBER	2. DOCUMENT TITLE
MIL-C-85521(AS)	Concentrator, Oxygen, GGU-7/A

3a. NAME OF SUBMITTING ORGANIZATION	4. TYPE OF ORGANIZATION *(Mark one)*
	☐ VENDOR ☐ USER ☐ MANUFACTURER ☐ OTHER *(Specify)*: _____
b. ADDRESS *(Street, City, State, ZIP Code)*	

5. PROBLEM AREAS

a. Paragraph Number and Wording:

b. Recommended Wording:

c. Reason/Rationale for Recommendation:

6. REMARKS

7a. NAME OF SUBMITTER *(Last, First, MI)* – Optional	b. WORK TELEPHONE NUMBER *(Include Area Code)* – Optional
c. MAILING ADDRESS *(Street, City, State, ZIP Code)* – Optional	8. DATE OF SUBMISSION *(YYMMDD)*

DD FORM 82 MAR 1426

PREVIOUS EDITION IS OBSOLETE.