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## AEROSPACE STANDARD

# AS 861

### MINIMUM GENERAL STANDARDS FOR OXYGEN SYSTEMS

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Revised

1. **PURPOSE** - This standard defines minimum general standards for the design, fabrication, testing, and packaging of oxygen breathing equipment.
2. **SCOPE** - This standard covers all types of oxygen breathing equipment used in non-military aircraft. It is intended that this standard supplement the requirements of the detail specification or drawings of specific components or assemblies, e.g., regulators, masks, cylinders, etc. Where a conflict exists between this and detail specifications, detail specifications shall take precedence.
3. **GENERAL REQUIREMENTS**
  - 3.1 **Materials and Workmanship**
    - 3.1.1 **Materials**
      - (a) Wherever possible, materials conforming to appropriate government or industry specifications or standards shall be used. In all cases materials shall be of the type, grade and quality which experience and/or tests have demonstrated to be suitable for the purpose intended.
      - (b) Only materials having physical and chemical properties compatible with an oxygen environment shall be used.
      - (c) Any material which is subject to accelerated deterioration or is otherwise adversely affected by continuous service usage with oxygen shall not be used.
      - (d) Non-metallic materials shall be resistant to lubricants, hydraulic fluids, fuels, chemicals, fire, and environmental temperature conditions likely to be encountered in service.
      - (e) Wherever possible, consideration shall be given to designs that do not require lubricants to meet operational and service life requirements. When a requirement for lubricants exists, only those approved specifically for use in oxygen systems shall be utilized.
      - (f) The curing date (month and year) shall be stamped legibly on all rubber or rubber-like parts except those which have insufficient area.
      - (g) Dissimilar metals shall not be used in direct contact with each other unless they have been protected adequately against electrolytic corrosion. The following is a grouping of metals wherein the metals in the same group are considered similar to each other and the metals in different groups dissimilar to each other:

Section 8.3 of the SAE Technical Board rules provide that: "All technical reports, including standards approved and practices recommended, are advisory only. Their use by anyone engaged in industry or trade is entirely voluntary. There is no agreement to adhere to any SAE standard or recommended practice, and no commitment to conform to or be guided by any technical report. In formulating and approving technical reports, the Board and its Committees will not investigate or consider patents which may apply to the subject matter. Prospective users of the report are responsible for protecting themselves against liability for infringement of patents."

- 2 -

- Group I Magnesium and its alloys, Aluminum Alloys 5052, 5056, 5356, 6061, and 6063
- Group II Cadmium, zinc, and aluminum, and their alloys, including the aluminum alloys listed in Group I.
- Group III Iron, lead, and tin, and their alloys (except corrosion resistant steels).
- Group IV Copper, chromium, nickel, silver, gold, platinum, titanium, cobalt, and rhodium and their alloys; corrosion resistant steels; and graphite.

(h) Air Force-Navy or military standard parts identified by AN or MS part numbers shall be used in the design of all oxygen components and assemblies wherever practicable.

3.1.1.1 Finish - All materials which are not inherently corrosion resistant shall be finished with a protective treatment or coating to minimize the effects of exposure to oxygen and the atmospheric conditions which may be encountered in service.

- (a) Protective coatings subject to cracking, peeling, or scaling with age or with extremes of atmospheric conditions shall not be used.
- (b) Generally, protective finishes shall be applied to individual parts prior to assembly if parts are assembled by mechanical means and after assembly if parts are assembled by fusion methods.
- (c) Aluminum alloys must be protected with Iridite or Alodine per MIL-C-5541 or anodized per MIL-A-8625. Clear anodized protective coatings are preferred. Coloring by a thinly dispersed organic dye in the aluminum oxide coating is acceptable. Surface dye or paint are not acceptable as protective finishes on any parts or surfaces which will be exposed directly to oxygen under pressure.
- (d) Plating such as silver, gold, or zinc on low carbon steel or copper bearing alloys is acceptable in liquid oxygen environment, provided it is not used on wear surfaces. Colored plating is not acceptable.
- (e) Cadmium plating shall not be used in contact with oxygen.

3.1.2 Workmanship - Workmanship shall be in accordance with high grade manufacturing practices. Particular attention shall be given to neatness, cleanliness, and every effort shall be made to assure high quality soldering, wiring, welding, brazing, painting, plating, etc.

- 3 -

- 3.1.3 Construction - All oxygen assemblies and/or components shall be so constructed that parts will not work loose during normal service usage and shall withstand the stresses and strains, jars, vibration, and other conditions incidental to shipping, storage, installation and service without adverse effects.
- 3.2 Environmental Requirements - Oxygen assemblies and/or components shall be designed and constructed to operate or function in accordance with the requirements of the detail specification and/or drawings under environmental conditions likely to be encountered in storage and when installed for service, such as vibration, sand, dust, salt spray, humidity, and fungus.
- 3.3 Performance
- 3.3.1 Endurance and Vibration - The component shall meet the endurance and vibration requirements of the applicable specification governing its design.
- 3.3.2 Low and High Temperature Exposure - The component shall operate in accordance with the requirements of the applicable specification at standard conditions (Paragraph 5.2.2) after being exposed to a temperature of -65° F for a period of 24 hours. This test shall be repeated after the component has been exposed to a temperature of 160° F for 24 hours.
- 3.3.3 Extreme Temperature Operation - The component shall operate in accordance with the requirements of the applicable specification while stabilized at a temperature of -40° F and a temperature of 120° F.
- 3.3.4 Service Life - The component shall meet the service life requirements of the applicable specification controlling its design. The component shall also meet the requirements of Paragraphs 3.3.5 and 3.3.6 of this specification.
- 3.3.5 Service Period - The service period is defined as the period of time or number of cycles during which the component will be in use or operate, as required by the applicable specification.
- 3.3.6 Overhaul Period - The overhaul period of the component is defined as the period of time, as required by the detail specification, the component will be in use, or operate without overhaul or replacement of parts.
- 3.3.7 Interchangeability - The oxygen component and all replaceable detail parts, identified with the same part numbers, shall be physically and functionally interchangeable by proper dimensioning and tolerance control.
- 3.4 Numbering and Identification
- 3.4.1 Manufacturer's Part Number - The manufacturer shall assign part numbers to all items and normally replaceable units thereof, assemblies, and sub-assemblies. The number of digits in the part numbers shall not exceed 15.

3.4.2 Manufacturer's Part Number Change - When a manufacturer's part number is changed, the purchaser shall be notified of such change prior to shipment of parts under the new part number.

3.4.3 Identification Plate

3.4.3.1 Material and Attachment - Unless otherwise specified, an identification plate or tag, conforming to the requirements of MIL-P-6906, shall be attached securely to the component by means of rivets or screws. On parts where this means of attachment is not practicable, a suitable adhesive is acceptable. Unmountable tags shall be secured to the component in accordance with the detail specification or drawing.

3.4.3.2 Location - The identification tag or plate shall be attached so that it can be read easily and in an area not subject to damage during normal service usage. Also, it shall be located so that it does not interfere with moving parts, access holes, or servicing of the component.

3.5 Warning Tags - A concerted effort shall be made to design components so that special warning tags or decals are not required. However, if such tags or decals are necessary to obtain proper performance of the component, they shall conform to the requirements of Paragraph 3.4.3.

4. DETAIL REQUIREMENTS

4.1 Human Factors - The item shall be designed and constructed with consideration given to the following design principles:

- (a) Replaceable items shall be designed so that they can be readily inspected, tested, serviced, adjusted, repaired, or replaced with minimum disturbance of other parts and minimum use of special tools or technical skills.
- (b) External contours, and those internal contours normally subject to contact by personnel, shall be designed to eliminate, so far as practicable, all sharp corners, edges, or other projections which might cause injury to personnel.

4.2 Acoustical Noise Levels - Sound levels generated by an item which is to be located in areas occupied by personnel shall be sufficiently low so as not to interfere with oral communication, comfort, or audibility of sound warning signals, nor adversely affect personnel or adjacent equipment performance.

4.3 Qualification Test - The component furnished in accordance with the applicable specification shall be a product which has been tested and passed the qualification tests as outlined in the applicable specification.

- 5 -

- 4.4 Strength Requirements - The component shall meet the strength requirements of the applicable specification governing its design.
- 4.5 Handling Resistance - The item shall be capable of withstanding any normal handling incidental to inspection, testing, storage, shipping, and installation without damage, failure, or permanent deformation. Unless otherwise specified, the above requirement shall apply irrespective of the attitude of the item.
5. QUALITY ASSURANCE PROVISIONS
- 5.1 Qualification Tests - The manufacturer shall perform the tests noted in the applicable specification for procurement of the component.
- 5.2 Test Conditions
- 5.2.1 Gas - Unless otherwise specified, the high pressure gas used in testing the component shall be oxygen as specified in the detail specification, or water-pumped nitrogen conforming to specification MIL-N-6011; or water-pumped air equivalent in dryness to specification MIL-N-6011 nitrogen (correction factor shall be specified per use as appropriate).
- 5.2.2 Pressure and Temperature - Unless otherwise specified standard conditions shall be as specified in MIL-E-5272.
- 5.2.3 Vibration - Vibration, flutter or chatter occurring during testing of the component shall be classified as a failure unless such vibration, flutter or chatter can be shown to be erroneously induced by the test apparatus.
- 5.2.4 Prior Tests - Components which have passed the qualification tests and have been subsequently modified sufficiently to affect performance or interchangeability shall pass the qualification tests again prior to acceptance. If it can be shown by engineering data that a modified component is physically and functionally similar to the old part which has passed the qualification test, all or part of the qualification tests for the modified unit may be waived by the purchaser. Requests for qualification by similarity shall include substantiated evidence showing that the effect of environmental testing and that the structure and operational stresses and strains on the individual parts of the modified unit are of equal magnitude to those in the similar unit previously tested.
- 5.2.5 Production Tests - Production tests shall be performed by the manufacturer of the assembly or component in accordance with the requirements of the applicable specification.