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Quality & Serviceability Requirements for Aircraft Cylinder Assemblies Charged with Aviator's Breathing Oxygen

RATIONALE

This Technical document has been stabilized by the Technical Committee and will no longer be subjected to periodic reviews for currency. Users are responsible for verifying references and continued suitability of technical requirements. AS 1065 focused mainly on quality control, handling and filling of the cylinder. These requirements are covered in greater detail by other SAE and Compressed Gas Association (CGA) documents refered to in the referenced documents.

STABILIZED NOTICE

This document has been declared "Stabilized" by the A-10 Committee and will no longer be subjected to periodic reviews for currency. Users are responsible for verifying references and continued suitability of technical requirements. Newer technology may exist.

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1. SCOPE

1.1 This specification covers the servicing of gaseous oxygen cylinders used for breathing purposes in civil aircraft. (Refer to AIR 1059 on Transfilling & Maintenance of Oxygen Cylinders.)

2. REQUIREMENTS

2.1 Quality - All oxygen gas purchased or manufactured for filling aviator's breathing oxygen cylinders shall comply with Military Specification MIL-O-27210. When oxygen is purchased for this purpose, the oxygen manufacturer's delivery ticket shall bear a certification that prescribed tests under the above specification have been performed prior to delivery. Records of such delivery shall be maintained by the cylinder filler for a period of five years.

2.2 Purity - Oxygen gas in serviced cylinders shall contain not less than 99.5 percent oxygen by volume, when tested as specified in paragraph 3.4.1.

2.3 Moisture - The oxygen gas in serviced cylinders shall contain not more than 0.02 milligrams of water per liter of gas at 70 F and 760 MM. Hg when tested per 3.4.3. This level of moisture is equivalent to 25 ppm by volume or a -64 F dew point.

2.4 Filling Pressure - The pressure of each sample cylinder shall be checked in accordance with paragraph 3.4.4.

2.5 Leakage - Cylinders, and valves installed therein, shall not leak when tested as specified in paragraph 3.4.5.

2.6 Compliance Responsibility - The filling agency is responsible for assuring that the cylinder being recharged complies with applicable I.C.C. regulations even when the cylinder being recharged is a fixed part of the aircraft oxygen system.

2.7 Drying - Internal drying of cylinders shall be accomplished whenever a cylinder has been completely emptied or contains odors or moisture. Drying is to be performed by heating in an oven or water bath while simultaneously maintaining a vacuum in the inside of the cylinder, or by passing hot, dry, oil free air or nitrogen through the cylinder. After the drying process has been completed, each cylinder should be evacuated by drawing a vacuum of 27 inches of mercury for a minimum period of thirty minutes prior to the oxygen refill procedure. Each cylinder requiring drying shall be tested for moisture content after filling.

3. SAMPLING, FILLING, INSPECTION AND TEST PROCEDURES

3.1 The cylinder filler is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified, the cylinder filler may utilize his own or any other inspection facilities and services acceptable to the buyer. Records of the cylinder filling, cylinder examination and tests shall be kept complete and available for five years. The buyer reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure that gas and cylinders conform to prescribed requirements.

3.2 100 Percent Inspection Requirements - Each cylinder serviced must be inspected as follows: for odor, per paragraph 3.4.2; for filling pressure, per paragraph 3.4.4; for leakage, per paragraph 3.4.5 and for pressure gage accuracy, per paragraph 3.4.6.

3.3 Sampling Requirements.

3.3.1 Each set of cylinders charged on a manifold at one time, or charged from the same bank of supply cylinders, shall make up one lot. The number of samples shall conform to Table I for lot size or fraction thereof.

NOTE: An operator, who services cylinders on aircraft, would sample a cylinder charged from his supply bank whenever a cylinder in his supply bank is changed.

TABLE I - Inspection Samples*

Number of Sample Cylinders	Lot Size (Total Number of Cylinders Being Charged)
1	1 - 10
2	11 - 40
3	41 - 70
4	71 & Up

*Each cylinder selected for testing shall have approximately 1 cubic foot NTPD of gas withdrawn before sampling for tests.

3.3.1.1 In cases where gaseous oxygen is compressed into cylinders from the vaporization of liquid oxygen, the following alternate procedure for sampling shall be followed: From the initial filling of the liquid storage each day, or upon addition of quantities of liquid oxygen to the system, cylinders from the first manifold charged shall be sampled in accordance with Table I. The last cylinder filled in each group should also be sampled to check for boil-off of previously frozen out contaminants.

3.4 Test Procedure - All chemical tests shall be made with analytical reagent grade chemicals and distilled water. Samples taken in accordance with paragraph 3.3, shall be tested: for purity, using paragraph 3.4.1.1, or other method approved by the procuring activity; for odor, in accordance with paragraph 3.4.2; for moisture, in accordance with paragraph 3.4.3; for pressure, in accordance with paragraph 3.4.4; and for leakage, in accordance with paragraph 3.4.5.

3.4.1 Purity - All oxygen gas selected as specified in paragraph 3.3.1 shall be tested for purity in accordance with paragraph 3.4.1.1.

3.4.1.1 Purity Test - The test for purity shall be conducted as follows: Place a sufficient quantity of mercury in a 100 cubic centimeter calibrated gas measuring burette provided with a two-way stopcock and a two-way outlet, and properly connected with a liquid leveling tube. Connect one of the outlet tubes of the burette with a gas pipette of suitable capacity. Place in the pipette a coil of copper wire which extends to the uppermost portion of the bulb, and add about 125 cc of ammonium chloride-ammonium hydroxide test solution (made by mixing equal volumes of water and 27% concentrated ammonia; then saturate with ammonium chloride). Draw the liquid (free from air bubbles) through the capillary opening connection and stopcock opening in the burette by reducing the pressure in the burette tube and opening the stopcock controlling connection with the gas pipette. Then close the stopcock. Having completely filled the burette, the other stopcock opening, and the other intake tube with mercury, draw into the burette exactly 100 cc of oxygen by reducing the pressure in the tube. Close the stopcock.

Increase the pressure on the oxygen in the burette tube, and open the stopcock controlling the connection with the gas pipette. Force the entire volume of gas into the pipette. Close the stopcock, and rock the pipette gently, providing frequent contact of the liquid, gas, and copper spiral. At the end of 15 minutes most of the gas will have been absorbed by the liquid. At this time, to facilitate absorption of the last portion of the oxygen, draw some of the liquid into the burette tube, and force the residual gas back upon the surface of the liquid in the gas pipette. Again rock the pipette until no further diminution in the volume of the gas occurs. Draw the residual gas, if any, into the burette tube, and measure its volume. The volume of gas remaining undissolved shall not exceed 1/2 cc. The ammonium chloride-ammonium hydroxide solution should be used for leveling purposes if desired.

3.4.2 Odor - Each cylinder serviced as well as those selected as specified in paragraph 3.3.1 shall be subjected to the following test: The cylinder valve shall be cracked and the escaping gas smelled. Pure oxygen is odorless and tasteless. Cylinders received for refill which have an odor present shall be treated in accordance with paragraph 2.7 before filling. Filled cylinders having an odor shall be rejected.

3.4.3 Moisture - The moisture content shall be determined by use of an electrolytic type moisture meter or other method or equipment satisfactory for the purpose.

3.4.4 Filling Pressure - The cylinder shall be filled to the pressure at 70 F as recommended by the cylinder or equipment manufacturer and indicated by a decal, label or other means. In the absence of any such label or indication, the maximum filling pressure shall be that which is stamped on the shoulder of the cylinder; as for example, 3AA 1800 signifies a filling pressure of 1800 psig. The cylinder pressure shall be determined by a lab type gage for an accuracy of ± 5% of the filling pressure.

NOTE: Cylinders should be refilled slowly enough to avoid heat of rapid recompression and to avoid need to recheck pressure after cool-down of cylinder.

3.4.5 Leakage - Each filled cylinder shall be tested for leakage either by brushing an approved leak check solution over the cylinder and all portions of the valve or by submerging in water the cylinder and those portions of the valve and gage which will not be damaged by submersion. Continued bubbling indicates leakage and is cause for rejection. This must be distinguished from bubbling caused by escape of air entrapped in crevices and corners. Also a test shall be conducted with outlet capped and "valve opened". Any leakage, visible within five minutes, around valve stem or packing gland is cause for rejection. If cylinder valve is equipped with a gage, check for leakage at gage-valve connection and in gage body.

3.4.6 Pressure Gage Accuracy - Cylinders which have pressure gages as an integral part of the valve assembly shall, in addition to the foregoing, be tested per paragraph 3.4.6.1.

3.4.6.1 Check that cylinder gage reading is within 50 psi of the gage reading on the refilling equipment. Inaccurate gages should be replaced.

NOTE: On some cylinder assemblies incorporating an integral pressure reducer, a filler valve is used which has a pressure drop of 25 or higher psig. This type of assembly requires that the gage be removed for test or an allowance be made for the pressure drop.