5.15 APPENDIX B - CLEANLINESS SPECIFICATION FOR GASEOUS/LIQUID OXYGEN SERVICE IN GLENN TEST FACILITY SYSTEMS

5.15. 1 Scope

This specification establishes the minimum requirements for system and component cleanliness for Glenn test facility gaseous and liquid oxygen service. It reflects the requirements of KSC C 123H, 1995; MSFC HDBK 527, Rev. F; JSC SN C 0005, Rev. A; and MSFC Spec 164B. It includes the acceptable minimum cleanliness, cleaning, packaging, and verification requirements.

Rigid procedures shall be followed in preparing, assembling, testing, and packaging components to assure cleanliness and to avoid the inherent danger of oxygen reacting with grease, oil, or other foreign matter. Any procedure not complying with this specification must be submitted to the Assurance Management Office, the Area Safety Committee and the designated Authority Having Jurisdiction for approval.

This specification does not preclude the supplier's responsibility for providing a product that meets the system performance requirements and acceptability for oxygen use. It shall be considered an integral part of the purchase agreement between the vendor and NASA Glenn.

5.15.2 Requirements

Materials: All materials used shall have been previously determined to be compatible with oxygen and should be widely accepted throughout the aerospace industry. All materials shall be approved by the Glenn Assurance Management Office and/or the Area Safety Committee.

Lubricants: Liquid oxygen is a powerful oxidizing agent, so a petroleum-based lubricant must not be used. Special lubricants such as the fluorolubes or the perfluorocarbons, which have been tested and found suitable for oxygen service, may be used. All lubricants shall be approved by the Glenn Assurance Management Office and/or the Area Safety Committee.

Cleanliness: All component parts shall be free of burrs, chips, scale, slag, or foreign matter and shall be cleaned prior to assembly. Inspection for cleanliness shall consist of the following.

Visual inspection: Visible contamination shall require recleaning of the surface. Discoloration due to welding will be permitted, providing no scale or rust is associated with the discoloration. Visual inspection aided by an ultraviolet light source (3200 to 3800 angstrom wavelength) shall show no evidence of fluorescence from contamination.

White cloth inspection: Surfaces shall be rubbed in two directions with a clean, lint-free white cloth. Any evidence of oil, rust, stain, scale, or foreign matter will be cause for rejection. The cloth may be examined under natural or ultraviolet light. Use of ultraviolet light (3200 to 3800 angstrom wavelength) shall show no evidence of fluorescence from contamination.

Solvent rinse: Sufficient quantities of solvent rinse shall be used so as to yield 100-milliliters/square foot of internal surface area. The solvent rinse shall be performed by either sloshing or agitating the fluid around the inside surface of the components and straining it through a 5-micron, or finer, filter. Further instructions are found in ASTM MNL 36, January 2000.

CONTAMINATION LIMITS

a. Solid Particles

Particle size, microns	Maximum number per 100-ml sample (Millipore test)
<100 100 to 250 251 to 300 >300	Unlimited 93 3 0

b. Fibers

Fiber length (up to 25 um diameter), microns	Maximum number of 100-ml sample (Millipore test)
0 to 500 501 to 1000 1001 to 1875	20 3 >1875 None

c. Nonvolatile residue

Maximum residue, mg/square foot 1.0

d. Hydrocarbon limit

Method Result	Result
Ultraviolet Light Infrared spectrophotometer	No fluorescence 5 ppm hydrocarbon

e. Total solids and fibers

25 mg/square foot (maximum)

Assembly: The component parts shall be individually cleaned prior to assembly. Precautions shall be used during handling and assembly to preclude contamination of component parts. Final assembly and inspection shall be done in a laminar-airflow clean work area whenever possible.

Cleaning: Cleaning shall consist of the typical cleaning, rinsing, and drying procedures used throughout the aerospace industry:

a. Cleaning shall consist of a thorough flushing of all surfaces with aqueous detergent solutions.
b. Rinsing shall consist of a thorough rinsing and flushing with de-mineralized water, followed by rinsing and flushing with isopropyl alcohol.
c. Drying shall consist of blowing dry with filtered gaseous nitrogen or oil-free air.

Inspection: Inspection of cleaned components shall be performed by the solvent rinse method where possible. (This is generally done during the final cleaning stages and just prior to the drying operation.) The solvent shall be used at a rate of 100 milliliters per square foot of internal wetted surface area. (For all components having less than one square foot of internal wetted surface area, use 100 ml of solvent.) The solvent rinse shall be performed by either sloshing or agitating the fluid around the inside surface of the component to ensure dislodgment of particles. The rinse shall be poured through a filter sized to detect all particles greater than 100 microns. The assembled component, or any part thereof, shall be recleaned if it fails to pass the inspection(s).

The Glenn Project Assurance Office and/or Area Safety Committee reserve the right to inspect the finished component for cleanliness.

Packaging: On finished components, seal all openings with appropriate blind flanges, plugs, or caps, or securely tape polyethylene sheeting (at least 0.008-inch thick (0.20 millimeters)) to prevent contamination, making sure the tape does not touch any cleaned surface. Components shall then be double packed and sealed with polyethylene (0.006-inch thick minimum (0.15 millimeters)) before they are put into a shipping container. Pad sharp edges before packaging to preclude puncturing the package. Exercise care in packaging to prevent shredded or abraded polyethylene material from becoming a contaminant.

Verification: Finished components shall be affixed with a tag, label, or stamp showing that they meet the requirements specified herein for oxygen services.

5.15.3 Pressure Gauges and Transducers

Pressure gauges and transducers represent a cleaning challenge because of the small, inaccessible internal passages. In general, customized equipment for flushing is required, such as small diameter tubing to flush Bourdon tubes. Cleaning, inspection, and packaging of pressure gauges and transducers shall conform to those paragraphs in Section 5.15.2 of this specification. The following table lists the current GRC cleaning specifications for oxygen service gauges and transducers.

GLENN PERFORMANCE SPECIFICATION

(a) Oxygen-clean certification of pressure gauges and transducers

Hydrocarbon contamination level insolvent wash with IR scan method	< 5 ppm of hydrocarbon in a 50 cubic cm sample
Visual borescope	No scale, heavy rust, or particles

(b) Particles

Particle size, microns	Maximum number per square foot
<100 100 to 250 251 to 500 >500	Unlimited 1073 27 0

(c) Fibers

Fiber length, microns (Up to 25 microns) diameter	Maximum number per square feet
0 to 500 501 to 1000 1000 to 1875 >1875	20 3 1 0