

## **Ham-Let Standard Operational Procedure (S.O.P # 8185 REV02) for Cleaning and Packing Components and Parts, Cleaned for Oxygen Service ("OC") and Lubricant Free ("LF") Applications.**

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### 1. Introduction / Definition:

- 1.1. CFOS is a general acronym used in the industry for Clean (Cleaned of Cleaning) For Oxygen Services (Ham-Let "OC"). It is critical that parts used for pure or high concentration oxygen service be properly cleaned to assure they are free of any contamination caused by flammable residues. Cleaning for oxygen service can be defined as removal of combustible contaminants from the surface of any equipment of system in oxygen service, including all parts that make up those components. These contaminants include, but are not limited to, organic and inorganic substances such as hydrocarbon materials like oil and greases, paper, fiber, dust, solvents, weld, slag or weld spatter, rust, sand and dirt. Basically, all organic and inorganic materials will react with gaseous or liquid oxygen at certain pressures and temperatures. The information and guidelines hereinto is limited to wetted system components and shall assist the user to properly select materials and to verify operational procedures and process.
- 1.2. "LF" is acronym for Lubricant Free products (valves and fittings). All "LF" parts are treated the same as "OC" parts and assemblies, but lubrication is prohibited.

### 2. Scope:

This documented SOP describes a set of quick guidelines, requirements and definitions for final cleaning, lubrication, assembly and packaging of standard Ham-Let components and products, as well as methods to meet these requirements, applied for oxygen service use only. It is highly recommended for system engineer or user (fabricator, OEM, s/c or end-user) to review this specification in order to determine whether it meets their particular application requirements.

### 3. Objectives:

The objectives of this specification are:

- 3.1. To ensure absence of oil and grease residues or any other surface contaminants, or foreign particles, such as stains of any sorts of dirt, tarnish, marks, heavy discoloration etc., on Ham-Let standard products and components, prior to the final assembly or packaging stage.
- 3.2. To verify that Ham-Let supplies its customers with high quality manufactured parts, properly cleaned, assembled, packed and ready for exploitation, in order to guarantee their functionality at customer end.

#### 4. Applications:

- 4.1. ASTM G93 standard practice for cleaning methods and cleanliness levels for material and equipment used in oxygen enriched environments, level C.
- 4.2. All individual components such as test fittings, tubing, tools, adapters and connectors used to assemble and test oxygen and clean valves, shall be cleaned in accordance with the above preference specification immediately prior to assembly or packaging.
- 4.3. All individual parts and components are protected from dirt, oil, grease etc., during the time between cleaning and assembling or packaging.
- 4.4. All "OC"/"LF" Ham-Let products are pre-cleaned as per this specification.

#### 5. Specification General Requirements:

- 5.1. Components shall meet the preliminary requirements of Ham-Let SOP#8184 for "Cleaning and Packing Components and Parts".
- 5.2. Components shall be cleaned, inspected, assembled, lubricated, tested, and packaged in accordance with the practices described in this documented SOP.
- 5.3. The level of cleanliness from nonvolatile residues should not exceed 66 mg/m<sup>2</sup>, as determine by ASTM G93, level C.
- 5.4. Any lubricants applied to the assembly or otherwise, after cleaning, must be approved for oxygen service. No other lubricants are permitted. Special lubricants can be provided on request.
- 5.5. Finished "OC" products (Oxygen Service) designation shall be packaged individually in a sealed plastic bag. The package shall be labeled: **"Ham-Let Special Cleaning and Packaging (SOP# 8185) ASTM G93 level C for Oxygen Service"**.
- 5.6. Finished products with "LF" (Lubricant Free) designation shall be packaged individually in a sealed plastic bag. The package shall be labeled: **"Ham-Let Special Cleaning and Packaging (SOP# 8185) ASTM G93 level C for Lubricant Free Service"**.
- 5.7. Bagged products shall be boxed for protection from any contamination and damage during shipment and storage.

#### 6. Cleaning, Drying and Inspection Procedures

- 6.1. Components shall be cleaned in multistage processes comprising hot de-ionized/RO water, rinsing for complete removal of cleaning agents, draining, and drying using computerized robotic system with accurate timing for each step, in order to ensure the consistent cleanliness of Ham-Let products.
- 6.2. Heated distilled water with cleaning agents, or alkaline, selected according to ASTM G127. This reference specification should serve as a guide for establishing a procedure to select cleaning agents, both solvent and water-based detergents, for oxygen service.
- 6.3. Ultrasonic agitation techniques based on ASTM G131.
- 6.4. Non-combustive drying for removal of rinse water from components without depositing residues.
- 6.5. The final stage of the cleaning process, is removing all oil residues from the surface by immersion the components in a special solvent having low vapor pressure, according to ASTM G127.

- 6.6. The units may be left to dry in a clean atmosphere or dried in a furnace until a full dry. Assembly or packing is done immediately after drying.
- 6.7. Personal handling finished-cleaned items shall wear clean lint-free gloves and covered shoes. "OC" components touched by bare hands shall be considered contaminated.
- 6.8. Visual examination shall be conducted for all components, in order to reveal the presence of visible grease or oil film and particular matter, such as burrs, loose adherent rust or mill scale. If any contamination is observed, the item must be re-cleaned.

7. Tools and Equipment:

All tools and equipment, including test equipment shall be inspected for cleanliness and re-cleaned (if necessary) prior to use.

8. Process Verification and Control:

- 8.1. Inspection surveillance shall be maintained at all times.
- 8.2. Qualification of process and revalidation should be conducted once a year using TOC method with ultrasonic extraction, as per ASTM G93 standard class C.
- 8.3. Visual inspection will include inspection of each part under x 3 magnification using bright illumination or ultraviolet light.
- 8.4. Tools used for assembly shall be made out of corrosion-resistant alloy, stainless steel or nickel/chromium plated steel.
- 8.5. Sampling of dry surfaces shall be examined for freedom from insoluble dirt and smut by wiping the part away using a clean white lint-free cloth. Any visible deposit on the cloth indicates a dirty metal surface and should be re-cleaned.
- 8.6. The cleaning process shall be controlled by detection of carbon residues based on ASTM G144. This practice ensures that the cleaning process meets the requirements of ASTM G93 level C.

9. Assembly, Lubrication and Testing:

- 9.1. Cleaned components shall be protected from damage and/or contamination.
- 9.2. Parts shall be assembled on clean benches in a designated area and atmosphere free of any foreign materials. Operators continuously working on assembly, or handling finish cleaned oxygen components, shall wear clean lint-free gloves and covered shoes.
- 9.3. Assembly work areas, equipment, tooling and method practices, are designed and maintained to prevent cleaned components from recontamination.
- 9.4. Non-hydrocarbon approved lubricant is applied to threads, mating parts, o-rings, and seals to prevent galling, reduce friction, and promote proper sealing.

10. Packaging, Labeling, and Certification:

- 10.1. Packing shall be carried out in area specifically designated for cleaned and degreased components/equipment.

- 10.2. End connections are covered with clean caps or plugs, as needed, to protect threads and other critical surfaces, and to prevent recontamination.
- 10.3. Each finished product is individually packaged and sealed in a labeled plastic bag.
- 10.4. Bagged products are packed in boxes, with suitable protective material.
- 10.5. Boxes are identified with Ham-Let part number, quantity and packaging data code.
- 10.6. Certificate issued on COC (Certificate of Conformance) stating: "**Cleaned For Oxygen Service**", upon customer request.
- 10.7. For "LF" designated products, certificate issued on COC stating: "**Lubricant Free**", upon customer request.

11. "Let-Lok®" Fittings "OC"

Front ferrules of "Let-Lok®" "OC" are silver plated and cleaned as mentioned above.

12. Miscellaneous:

The purpose of this SOP is to provide a general measure tool for cleanliness of a product, rather than of revising its production history. It should be noted, of course, that all standard Ham-Let components and products are repeatedly cleaned during the manufacturing process, after each stage of machining or polishing, in order to achieve a certain cleanliness level of the finished goods.