

OXYGEN SERVICE CLEANING, INSPECTION, AND PACKAGING PROCEDURE

Prepared By: Allen Bishop	Document #: HIE 02 1.G
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1. Scope

The purpose of this document is to outline and describe the general requirements and procedures used at Haygor Instrument & Company, Inc. for cleaning, inspecting, and packaging of components and systems used in liquid or gaseous oxygen service.

2. References

This procedure complies with Compressed Gas Association CGA G-4.1 standard. Haygor Instrument may also make reference to and comply with customer specifications appropriate to the product upon request.

3. Qualified Personnel

Technicians are trained on site at our facility and undergo supervision during this procedure.

4. Clean Room

This cleaning procedure is performed in a designated Clean Room which is free of dust, oil mist, and other hydrocarbons. All required tools, tables, baths, hardware, etc. which are utilized and retained in the Clean Room and designated only to be used in the Clean Room are maintained by cleaning Technicians and are cleaned before each use. Job required tools, tabletops, baths, hardware, etc. are cleaned and inspected per this procedure prior to starting each specific job or prior to each batch of 100 pieces as well as the end of each work day. The Clean Room is inspected daily by cleaning personnel and management.

5. Cleaning Agents

Cleaning agents listed below will be used unless otherwise specified by the customer.

5.1. EnSolv-GCS® is an acceptable solvent cleaning agent for this procedure. EnSolv-GCS® is visually inspected for cleanliness under white light before each use by comparing to clean solvent.

(EnSolv-GCS® is recycled and reused at our facility. Solvent Washer model SW8 uses a state of the art distillation process to reclaim the EnSolv-GCS®. The resultant contaminates are disposed of at an approved disposal site.)

5.2. Blue Gold® solution is an acceptable aqueous cleaning agent for this procedure. Blue Gold® Solution consists of minimum 5% Blue Gold® and 95% water. This solution is heated and used at 140 Deg.F., and must maintain a PH level above 12.5. The PH level is recorded daily. The PH level of at least 12.5 is acquired and maintained by adding Blue Gold® or adding water. Blue Gold® Solution is visually inspected before each use for cleanliness by color comparison. If the cleanliness inspection fails, then the used solution is disposed of properly and a new solution is compiled.

6. Oxygen Compatible Grease

If assemblies require the use of grease for proper functionality, Fluorolube GR290 will be used as an oxygen compatible lubricant unless otherwise specified by the customer.



7. Receiving Inspection

7.1. All assemblies and parts will be visually inspected for any damage or incompatibility for oxygen use prior to any cleaning being performed. Any damage or incompatible product will be reported to management for immediate notice to the customer. Photos and notations are created and kept on file.

7.2. A Shop Order is created at the time of receipt and will accompany the material. The Shop Order includes work instructions for the cleaning personnel as well as the cleaning agent if specified by the customer.

8. Assemblies

Assemblies are disassembled into component parts. Components or subassemblies NOT required to be cleaned for oxygen service are removed and isolated. These components or subassemblies not required to be cleaned may be kept in a designated area outside of the Clean Room. All other parts that require cleaning are passed to the Pre-Clean area and ultimately to the Clean Room for cleaning and inspection. After all parts that require cleaning have been completed and all inspections pass, the assembly is re-assembled and any required testing is performed with dry nitrogen before final labeling and packaging. All testing is performed in a clean environment.

9. Pre-cleaning

Pre-cleaning may be performed outside of the Clean Room in a designated Pre-cleaning area. Pre-cleaning is accomplished by grinding, wire brushing, blast cleaning, swabbing or a combination of the above. Parts may also be rinsed or flushed with either EnSolv-GCS® or Blue Gold® Solution. If Blue Gold® Solution is used, parts will then be rinsed with water. After processing, the part is allowed to dry, and, if necessary, blown off with dry nitrogen or filtered clean dry air.

10. Cleaning Process

Unless specifically noted in this section, sections 10.1 and/or 10.2 will apply to all parts being cleaned.

10.1. Cleaning Process using EnSolv-GCS®

Parts are cleaned using EnSolv-GCS®. This process includes soaking, rinsing, flushing, or swabbing the areas which will be exposed to oxygen. Parts requiring soaking will be immersed and soaked in an agitating bath or ultrasonic tank containing EnSolv-GCS® for a minimum of 5 minutes. Parts requiring flushing will be flushed for a minimum of 5 minutes. After processing, the unit is allowed to dry, and, if necessary, blown off with dry nitrogen or filtered clean dry air before being inspected.

10.2. Cleaning Process using Blue Gold® Solution

Parts are cleaned using Blue Gold® Solution. This process includes soaking or flushing of parts in an agitated bath containing the Blue Gold® Solution for a minimum of 10 minutes. Swabbing areas which will be exposed to oxygen are also acceptable. Large parts such as pipe and vessels may be cleaned by the use of pressure washing using Blue Gold® Solution which is pumped into the pressure washer. Each part is then rinsed with water to remove the Blue Gold® Solution. After processing, the unit is allowed to dry, and, if necessary, blown off with dry nitrogen or filtered clean dry air before being inspected.



10.3. Cleaning Process specific to cleaning Pressure Gauges

Pressure gauges are evacuated and flushed with EnSolv-GCS® a minimum of five times. Each time the EnSolv-GCS® is removed it is inspected per the specifications listed in section 11.4. This procedure is continued until the removed solvent passes all inspections as stated in section 11.4. The external process connection is swabbed using EnSolv-GCS® and inspected. Following this procedure the gauge is dried to remove excess EnSolv-GCS®. Drying is accomplished by vacuum and purging with dry nitrogen.

10.4. Cleaning Process specific to Tube ID cleaning

Tube ID cleaning is performed by blowing EnSolv-GCS® soaked swabs through each straight piece of tubing using clean filtered dry air. Each swab is visually inspected as stated in section 11.3. This procedure is continued until the removed swab passes all inspections as stated in section 11.3. Each tube is then blown through with clean filtered dry air or nitrogen.

11. Inspection Process

11.1. White Light Inspection

Each part is visually inspected in the Clean Room under strong white light for the presence of large amounts of moisture, oils, greases, and accumulation of lint fibers. If this inspection is found acceptable then the parts are inspected using ultraviolet black light inspection as stated in section 11.2. If this inspection fails showing evidence of any of the criteria stated in this inspection, then the part will be re-cleaned starting with the pre-cleaning stage and re-inspected. The cleaning and inspection process will continue to be performed until the part is found acceptable and passes inspection.

11.2. Ultraviolet Black Light Inspection

Ultraviolet Black Light inspection is performed using at least one of the following UV Black Lights. Spectroline® Model BIB-150P (150 watts, 365 nm wavelength, 4,500 $\mu\text{w}/\text{cm}^2$ at 15"); Spectroline® OPTI-LUX 365 (LED bulb, 365 nm wavelength, 9,000 $\mu\text{w}/\text{cm}^2$ at 15"); Spectroline® OPTIMAX 365 (LED bulb, 365 nm wavelength, 18,000 $\mu\text{w}/\text{cm}^2$ at 15").

Each part is inspected using ultraviolet (black light) examination in complete darkness, in the Clean Room. If the examination reveals no hydrocarbon fluorescence such as a blotch, blot, smear, or film then the unit is considered clean and passes inspection. If the inspection fails, showing evidence of hydrocarbons, then unit will be re-cleaned starting with the pre-cleaning stage and re-inspected. The cleaning process will be performed until the unit is found acceptable and passes inspection. The cleaning and inspection process will continue to be performed until the part is found acceptable, passes inspection, and meets all inspection criteria.

11.3. Swab Inspection

Parts or assemblies that are not accessible or where it is impossible to perform the direct visible inspections stated in sections 11.1 and 11.2 will require a swab inspection. Swab inspection is performed by swabbing the entire cleaned area and then visually inspecting the swab using the inspection methods described in sections 11.1 and 11.2. If the examination reveals no hydrocarbon fluorescence such as a blotch, blot, smear, or film then the unit is considered clean and passes inspection. If the inspection fails, showing evidence of hydrocarbons, then unit will be re-cleaned starting with the pre-cleaning stage and re-inspected. The cleaning and inspection



process will continue to be performed until the part is found acceptable, passes inspection, and meets all inspection criteria.

11.4. Solvent Comparison Inspection

Parts or assemblies that are not accessible or where it is impossible to perform the direct visible inspections as stated in sections 11.1 and 11.2 or the swab inspection as stated in section 11.3 will require a solvent comparison inspection. Solvent comparison inspection is performed by removing a 1 fluid oz. sample of EnSolv-GCS® from a part or component that was filled or flushed with EnSolv-GCS® and comparing it to a standard known clean sample of EnSolv-GCS®. The two samples are then compared using the inspection methods described in sections 11.1 and 11.2. If the examination reveals no discoloration or hydrocarbon fluorescence then the unit is considered clean and passes inspection. If the inspection fails, showing evidence of hydrocarbons, then unit will be re-cleaned starting with the pre-cleaning stage and re-inspected. The cleaning process will be performed until the unit is found acceptable and passes inspection. The cleaning and inspection process will continue to be performed until the part is found acceptable, passes inspection, and meets all inspection criteria.

12. Labeling and Certification Letter

- 12.1 After each part or assembly passes inspection it is affixed a label stating “Cleaned for Oxygen Service” including the date and inspector’s name.
- 12.2 Small parts or parts where the entire area is considered a wetted part will have the label affixed to the outside of the bag referenced in section 13.
- 12.3 The Inspector and Cleaning Technician are required to sign and date the Shop Order as well as stating the cleaning agent used.
- 12.4 A signed Letter of Certification stating the assemblies or parts have been Cleaned for Oxygen Service is completed and will accompany the completed job. The Letter of Certification will reference this procedure and any other customer required procedures that were followed throughout the process. It will also include a list of all parts and/or assemblies that were cleaned.

13. Packaging

If applicable, protective covers are cleaned and inspected using the above procedure and attached to the process connections. After labeling and protective covers are installed, the parts or assemblies are double bagged using 6 mil Polyethylene bag material, vacuum packaged, and heat sealed. Large assemblies with small external process connections or small diameter tubing are capped with cleaned plastic caps and sealed using heat shrink. Parts larger than 12” or assemblies with large external connections will be double bagged with 6 mil Polyethylene bag material and sealed using .0009” stretch wrap.

Upon request, Levosil® Desiccant bags will be inserted and included during the bagging process. If the desiccant bags are not visible, a label will be provided indicating the number of desiccant bags placed inside the product.

14. Final QC Inspection

Final Quality Control inspection is performed by the Technician and Quality Control personnel who will inspect and verify all labeling, paperwork, and packaging of the completed job before shipping. Compliance will be documented on Form OCSF 1 (Oxygen Cleaning, Inspection and Packaging Checklist).