CONTAMINATION CONTROL PLAN

FOR

LIGO VACUUM EQUIPMENT

Hanford, Washington
and
Livingston, Louisiana

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PROCESS SYSTEMS INTERNATIONAL, INC. | SPECIFICATION

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1.0 PURPOSE

This plan defines measures to be taken to limit contamination of the ultra high vacuum surfaces of the LIGO vacuum equipment during fabrication, assembly and installation by particulate and hydrocarbons.

2.0 RESPONSIBILITIES

2.1 Material vendors, PSI and its subcontractors shall handle materials in accordance with the various specifications relating to them. These specifications define measures to be taken to limit contamination, including by carbon steel.

2.2 Personnel performing cleaning operations shall be trained by the manufacturing engineering department in the proper procedures.

2.3 Personnel performing work inside cleanrooms shall be trained by the manufacturing engineering group in the required cleanroom procedures and behavior.

2.4 All personnel shall be trained by the manufacturing engineering department in the philosophy and specific provisions of this plan.

3.0 REFERENCE DOCUMENTS

The following documents shall be used in conjunction with this plan:

PSI Specification V049-2-015, Cleaning Procedure
PSI Specification V049-2-118, Cleanroom Activities
PSI Material Specifications

4.0 GENERAL

While it is critical that all vacuum surfaces (internal surfaces and flange faces) be kept free of contamination, exterior surfaces must also be kept clean. This will not only facilitate keeping the interior surfaces clean, but it is necessary in order to maintain the cleanrooms at Class 100. Care shall be taken to minimize exposure to corrosive environments, such as those containing chloride compounds.

5.0 HYDROCARBON CONTROL

5.1 Material vendors, PSI and its subcontractors shall handle materials in accordance with the various specifications relating to them. These specifications define measures to be taken to limit contamination, including by carbon steel.

5.2 Contact of stainless steel by uncontrolled materials shall be avoided. This includes materials such as work gloves, work boots and unprotected shop floors.

5.3 Liquids, gases or vapors containing hydrocarbons or other contaminants shall not be allowed to come into contact with the stainless steel at any time. This includes fluids such as machining lubricants.

5.4 Leak testing shall be done only with the use of oil-free vacuum pumps.

6.0 PARTICULATE CONTROL

6.1 Material Protection

Materials shall be handled in such a manner as to limit contamination, including by carbon steel. This includes the following precautions:

6.1.1 No carbon steel hooks, fork lift forks, grapples or chains shall be allowed to contact the stainless steel.

6.1.2 Raw materials shall not be stored in direct contact with materials of different composition, but shall be separated by suitable spacers or sheeting. Depending on the parts level of cleanliness (raw material vs. cleaned part).

6.1.3 Stored materials (raw materials or work in process) shall be protected from the shop atmosphere when not being handled (or worked on) by plastic sheets or similar protective covers.

6.1.4 During transportation, components shall be shrink wrapped in plastic and shipped in closed trucks or under tight fitting tarpaulins.

6.1.5 Finished components shall be shipped to the sites under vacuum.

5.2 Cleanrooms

From the time that a vessel or other component has received its final washing, it shall not be opened unless it is inside a Class 100 cleanroom.

5.2.1 During Assembly

Immediately after washing, components shall be moved directly into a cleanroom without being exposed to the shop atmosphere. In the cleanroom, the component shall be closed to protect it from particulate contamination. This closure may be by joining to a mating piece, installation of covers, or wrapping or double bagging in plastic. The closure shall not be breached unless the component is inside a cleanroom.

5.2.2 During Installation

Components shall be moved into position and prepared to the greatest extent possible before breaching the protective wrapping or bagging. The outer protection is then removed, and a portable soft-wall cleanroom is moved into position over the component before it is opened. Once the cleanroom is in position and a Class 100 environment is established, Class 100 air is used to break the vacuum inside the component. Once atmospheric pressure has been reached, covers may be removed for final installation of the component. The component and all of its access ports and openings shall be closed or connected to another component before the cleanroom can be moved or shut down.