



# SPECIFICATION

## Specification for Piping Modification

| APPROVALS   | DATE   | REV | DCN NO.          | BY | CHECK | DCC | DATE |
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**SPECIFICATION****Specification for Piping Modification****1.0 PURPOSE**

This specification defines the scope of work to be provided by the contractor for the modification of Vacuum and Class 100 Air piping for the LIGO Vacuum Equipment. (Note: Class 100 air is equal to Class 5 current Standards)

**2.0 Scope**

The contractor is to provide all material and labor to detail design, procure, fabricate, test, clean and deliver to the site Vacuum, Class 100 Air piping, and Annulus tubing, as directed by the Buyer.

**3.0 Materials**

3.1 All materials shall be in accordance with E1000713 "Specification for Piping Design and Materials".

3.2 All flex sections are to meet the following requirements:

Note: Flex sections are intended to act as vibration/sound isolators.

**3.2.1 Vacuum and Class 100 Air Headers**

Flex sections are to be vacuum compatible stainless steel, with full penetration welds, low stiffness bellows without metal braids.

All flex sections are to be cleaned, tested and packaged for UHV service, as manufactured by A&N Corp., Varian Vacuum Products or approved equal.

**3.2.2 Cooling Water Supply / Return and Instrument Air Headers**

Flex sections are to be Safeflex SFU-CT as manufactured by Mason Industries or approved equal.

**4.0 Fabrication and Testing**

4.1 Pipe spool sections shall be prefabricated using only approved welding procedures in lengths appropriate to allow installation in the vacuum equipment area without requiring welding. Fabrication shall be done in accordance with specified codes.

4.1.1 Fabrication shall be performed in a clean building which provides protection from carbon steel, hydrocarbons, or other contamination.



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- 4.2 Each spool section run shall have one fixed and one rotatable CF flange to permit easy assembly of the piping system. Flex sections shall be provided needed. Branches shall terminate in fittings as designated on the P&I Diagrams. Blind flanges shall be provided as indicated including gaskets and hardware. Where ISO Quick flanges are designated on piping drawings, use 304 stainless steel centering rings with Viton o-rings. Spool drawings shall be submitted to Buyer for approval prior to fabrication.
- 4.3 Each spool section is to be helium leak checked after welding by evacuating and spraying with helium, and show no detectable leaks with a helium mass spectrometer at a sensitivity of  $1 \times 10^{-9}$  torr l/s. Spools shall be given unique serial numbers (1 to xx) to control testing documentation.
- 4.4 Each spool section shall be pressure washed with hot water using approved detergent (Oakite Inpro-Clean 1300)\* and then rinsed with de-ionized water to remove all dirt and hydrocarbons. After drying with clean, filtered hydrocarbon free air or nitrogen, the section shall be checked for contamination using a white glove. Any discoloration or visible particles shall be cause for rejection and the piece shall be rewashed. If contamination is localized, the area may be cleaned using isopropyl alcohol and lint free cloths.  
  
\* Per manufacturer's specifications and not to exceed 5% Inpro-Clean 1300 in solution.  
NOTE: This cleaning requirement also applies to contractor provided spools of piping, materials used between Class 100 Air Compressors and stainless steel O.D. tubing air headers.
- 4.5 After drying the section shall be properly labeled and capped to provide an airtight seal. The seal shall be maintained up to the time the section is to be installed.