



# SPECIFICATION

## SPECIFICATION FOR SS ROLLING AND MACHINING

APPROVALS	DATE	REV	DCN NO.	BY	CHECK	DCC	DATE
AUTHOR:							
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APPROVED:							
DCC RELEASE							

### TABLE OF CONTENTS

- 1.0 Scope
- 2.0 Schedule
- 3.0 General Requirements
- 4.0 Codes and Standards
- 5.0 Fabrication Requirements
- 6.0 Materials
- 7.0 Identification
- 8.0 Required Documentation
- 9.0 Shop Testing
- 10.0 Cleaning
- 11.0 Storing and Shipping
- 12.0 Inspection and Quality Requirements
- 13.0 Non-Escort Privileges and Inspection Right

### ATTACHMENTS:

- A. List of Machining and Rolling Requirements



## SPECIFICATION FOR SS ROLLING AND MACHINING

### 1.0 SCOPE

- 1.1 This specification covers the minimum requirements for Stainless Steel machining and rolling of shells for the LIGO vacuum components.
- 1.2 All attachments are incorporated herein by reference and made a part of this specification.
- 1.3 The specified equipment is intended for use as part of the Vacuum Equipment supplied for the Laser Interferometer Gravitational-Wave Observatory (LIGO).
- 1.4 Information contained in this specification and its attachments is proprietary in nature and shall be kept confidential. It shall be used only as required to respond to the specification requirements, and shall not be disclosed to any other party.
- 1.5 The Seller shall be responsible for coordination of all their sub-suppliers and for overall guarantees relating to mechanical or material compatibility. It is the specific responsibility of the Seller to invoke all reference specifications as applicable on each sub-supplier purchase order.
- 1.6 The Seller may not subcontract any part of the fabrication work required herein except for Rolling of shells and machining of SS without approval of the Buyer.

### 2.0 SCHEDULE

1. Per purchase order.

### 3.0 GENERAL REQUIREMENTS

- 3.1 It shall be the responsibility of the Seller to call attention to any apparent conflicts between specifications, the Purchase Order, or Buyer's drawings and request an interpretation from the Buyer. The Seller is not to assume which instruction shall govern. In no case is the Seller to fabricate any component on the basis of Buyer's drawings or calculations if such drawings or calculations are in conflict with applicable code requirements.
- 3.2 If the Seller uses BUYER's design CAD files to program computer driven equipment, the Seller shall verify the drawings files are true full scale and have converted properly to the Seller's system prior to the fabrication process.
- 3.3 The components covered by this specification are to be used in ultra-high vacuum service and require strict cleanliness and contamination prevention throughout the material handling, fabrication and shipping process. All storage for these components shall be done in the area isolated to prevent contamination from smoke, dust and oily vapors from other manufacturing areas.
- 3.4 Stainless steel sheet or indoor-outdoor carpeting shall be used to protect the SS plates during rolling operations. Carbon Steel or iron shall not touch the SS components.

### 4.0 CODES AND STANDARDS

- 4.1 Priority of Codes and Documents
  1. This Specification
  2. Fabrication drawings
  3. Codes (highest priority - where applicable)

**SPECIFICATION FOR SS ROLLING AND MACHINING**

- 4.2 The following codes and standards shall be applicable to the fabrication of the equipment:
- 4.2.1 American Society of Mechanical Engineers (ASME)
- a. ASME Boiler and Pressure Vessel Code, 2007 Edition and all published Addenda.
- |              |  |
|--------------|--|
| Section II   | Material Specifications                            |
|              | Part A, Ferrous                                    |
|              | Part B, Nonferrous                                 |
|              | Part C, Welding Rods, Electrodes and Filler Metals |
| Section VIII | Pressure Vessels, Division I (Stamp Not Required)  |
| Section IX   | Welding and Brazing Qualification                  |
- 4.3 Any apparent conflicts between the requirements given herein and the applicable ASME Specification shall be brought to the attention of THE BUYER for clarification.

**5.0 FABRICATION REQUIREMENTS****5.1 General**

- 5.1.1 Mechanical design requirements of Shell Rolling and Machining shall be shown on the Seller design drawings.  
Tolerances shall be adhered to as specified on the detail drawings.

**5.2 Rolling Of Shells**

- 5.2.1 Carbon steel rollers shall be covered with heavy (paper or carpet) or S/S during the rolling process to prevent carbon steel contamination of the stainless steel.
- 5.2.2 The seam edges of plates to be rolled are to be pre-worked to assure roundness of the final cylinder.
- 5.2.3 Rollup plates may have sheared edges only when the sheared edge is dressed with carbide cutters to remove any carbon steel contamination. This is to be done by the rolling Vendor. Allowable cutting methods are plasma flame, water jet, and laser or carbide cutters. Grinding is allowed if all grinding area is final cleaned with a carbide tool.
- 5.2.4 Final bevels are to be made with carbide cutting tools only. Optional methods must be approved by the Buyer before use.
- 5.2.5 Moving of plates shall be performed so as not to contaminate the plate with carbon steel. Covering carbon steel forks, hooks, lifting mechanisms with SST or heavy paper or carpet shall be done. Moving of plates with suction cups are permissive as long as they are carbon and oil free.



SPECIFICATION FOR SS ROLLING AND MACHINING

5.3 Machining of Parts

5.3.1 O-Ring Groove and Sealing Surfaces (32 RMS) Requirements

All flange o-ring and sealing surfaces shall meet the following requirements:

Basic finish required: 32 RMS, concentric lay (finish tolerance +/- 8 RMS)

The following processes are not allowed: grinding, honing, lapping, polishing, buffing, sanding, blasting, or any other process that disturbs the concentric machining lay, imbeds material into the surface, or smears the surface.

In addition to out of tolerance dimensions, the following machining problems will be cause of piece rejection: ridges, chatter, waviness, scratches or marks along or across the concentric lay, tool marks, dents, gouges, burrs, sharp edges.

5.3.2 Machining Fluids

No iron, carbon steel or other contaminants (such as grease, oil or hydrocarbons) are to come in with Machined Parts during material handling and fabrication. Machining, cleaning fluids or any other materials or fluids contacting the raw material or finish component shall be water soluble, and shall meet the limitations of Table 5.3.

TABLE 5.3

Maximum Concentration Limits

<u>Contaminant</u>	<u>Limit</u>
Water Leachable Chlorides	100 PPM
Total Halogens (including Water Leachable Chlorides)	1000 PPM
Total Sulfur	1000 PPM
Hydrocarbons	None Allowed

5.4 Cleanliness

No grinding with abrasive wheels, cloth or stones is allowed on the internal vacuum surface unless specified in this specification. This material is intended for use in a high vacuum application.

Potential hydrocarbon contamination shall be prevented. Also, the material shall be wrapped and covered at all times the material is not being processed to minimize possible exposure to contaminants. The components shall be cleaned (per 10.0) prior to shipment.

5.5 Welding

5.5.1 Welding to the interior component surface is **NOT** allowed. TIG welding of fixtures to the exterior repads is acceptable. All other welding to the component shall be approved by the Buyer prior to welding.

Shells shall not be tacked after rolling - ship to THE FABRICATION SHOP un-tacked.



## SPECIFICATION FOR SS ROLLING AND MACHINING

### 6.0 MATERIALS

- 6.1 Any materials damaged or contaminated by the Seller shall be replaced by the Seller.
- 6.2 Material identification shall be maintained during all manufacturing operations. If material identity is lost, the plate shall be re-qualified by making all tests that were required by the material specification or as indicated in this specification at the seller's expense. CMTRS must be provided to THE BUYER for the above material and traceability of all materials must be maintained.

### 7.0 Identification

- 7.1 Marking the materials with marking fluids, die stamps, crayons, paints and/or electro-etching is not permitted. A vibratory tool with a minimum tip radius of .005" is acceptable for marking the outside only of the rolled or finished shell. All other marking methods must be approved by the purchaser prior to use. All parts shall be marked on outside surface only. Marking on interior boundary vacuum boundary surfaces is not allowed. The minimum marking is to be the heat/lot number.
- 7.2 Finished parts, i.e. machined flanges or rolled shells made to THE BUYER drawings, are to be marked with a part number which is the drawing number for single parts, or the drawing number plus the item number as shown on the body of the drawing.

### 8.0 Required Documentation

Seller shall furnish documentation in accordance with purchase order requirements. The following is a list of minimum documentation required.

- 8.1 General Requirements
- 8.1.1 All shop drawings (if used) shall be submitted to the Buyer for approval prior to fabrication.
- 8.4 Test and Quality Assurance Documentation
- Buyer requires two (2) copies of the following documentation for each vacuum flange.
1. Dimensional check report verifying component dimensions are within tolerance.
  2. RMS and dimensional check on flange surfaces (for machined flanges).

### 9.0 SHOP TESTING

- 9.1 Testing shall be per the Seller's Q. A. Plan.

### 10.0 CLEANING

- 10.1 Cleaning before shipment to Fabrication shop shall be per Vendor's standard detergent steam cleaning procedure. The Vendor's Water quality shall be checked before use in the steam cleaner.

**SPECIFICATION FOR SS ROLLING AND MACHINING****11.0 Storage and Shipping**

- 11.1 Shipping covers or Wooden Crates shall be used on all flanges for shipment. The use of tape or plastic sheet alone as a shipping cover is not acceptable.
- 11.2 The vacuum components shall be covered with a tarp immediately after cleaning operations have been completed to minimize contamination.
- 11.3 Finished flange surfaces and rolled shells must be covered and protected during all fabrication steps and during shipment to the fabrication shop.
- 11.4 Shell roll-ups will be shipped with no tacks (long seam) on a new wood pallet or shipping frame, shrink wrapped and covered with waterproof tarps during shipment on the truck.

**12.0 INSPECTION AND QUALITY REQUIREMENTS**

- 12.1 The Seller shall have in effect in their shops and at sub-suppliers, an inspection, testing and documentation program that will ensure that the equipment furnished under the specification will meet in all respects the requirements of the specification. The responsibility for inspection rests with the Seller. However, the Buyer reserves the right to inspect equipment at any time during fabrication to assure that the materials and workmanship are in accordance with this specification. The Buyer's inspector may need to personally witness that certain critical dimensions are within the specified tolerances while the fabricated parts are set-up and indexed in the Seller's computer controlled equipment.
- 12.2 The Seller shall notify the Buyer 5 working days prior to Critical Inspections as defined at the FDR.

**13.0 NON-ESCORT PRIVILEGES AND INSPECTION RIGHT**

Non-escort privileges for Buyer, Owner, Government and Owner representatives to all areas of the facilities where the work is being performed shall be provided. This will include access to all areas where material is being processed and stored.

The Quality Plan shall indicate which operations require to witness or verification The Seller will furnish an agreed upon amount of notification prior to the start of each critical activity.

It is not intended that the Buyer's shop inspection shall relieve the Seller in any way whatsoever of his obligation to maintain an adequate test inspection and documentation program of his own, or of any other obligation under the specification. Furthermore, the fact that Buyer's shop inspector may inadvertently overlook a deviation from some requirement of this specification shall not constitute a waiver of that requirement or of the Seller's obligation to correct the condition when it is discovered, or any other obligation under the specification.



**SPECIFICATION**

**SPECIFICATION FOR SS ROLLING AND MACHINING**

ATTACHMENT A

LIST OF MACHINING AND ROLLING REQUIREMENTS

(TO BE SPECIFIED BY THE SELLER)