

**PROCESS SPECIFICATION FOR LOW HYDROGEN,
TYPE 304L STAINLESS STEEL VACUUM PRODUCTS**

LIGO Specification 1100007

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1. SCOPE

This document specifies the steps required to produce products for vacuum service with hydrogen outgassing rates of less than 1×10^{-13} torr·liter/s·cm² and water outgassing rates of less than 1×10^{-16} torr·liter/s·cm², made of Type 304L stainless steel, of no more than .13 inch thickness. It includes specifications for an air bake of the raw material, welding, cleaning, and a vacuum bake when put into service.

2. TECHNICAL REQUIREMENTS

2.1 Initial Material Description The material to be processed shall be conventional Type 304L stainless steel, with thickness of .13 inch or less. It may be in sheet or coil form.

2.2 Raw Material Baking Air bake all material at $440 \pm 8^\circ\text{C}$ for 36 hours. Material shall be positioned on a raised grating with its surface vertical to promote convective flow over the surface. If the oven is fuel fired, combustion products shall not come into contact with the baked material. Supply an oil-free, dry air (dew point, -29°C) purge (5–10 CFM) to the oven during bake and cooling. Do not open oven until material has cooled to below 100°C .

2.3 Welding All welding exposed to vacuum shall be done by the inert-gas tungsten-arc process. Filler wire may be used if the wire treatment procedure has been approved by Caltech. For all welding, use an inert gas purge on the vacuum side of the weld.

2.4 Cleaning The cleaning procedure shall be approved by Caltech.

2.5 Vacuum Baking After final assembly and installation, and after leak tests and repairs are complete, the surfaces exposed to vacuum shall be simultaneously baked to reduce water outgassing: bake under vacuum for a period of 30 days at a temperature of 140°C with a pumping capacity for water of 3×10^{-4} liter/s·cm² of exposed surface. Temperatures and partial pressures shall be monitored and recorded.



3. RELIABILITY AND QUALITY ASSURANCE REQUIREMENTS

Material samples from all air baked raw material shall be tested to confirm acceptable outgassing levels for hydrogen. No material shall be used for fabrication until its acceptability is assured.