



Statement of Work

Fabrication of Hermetically Sealed Electronics Enclosures

The following documents are incorporated into and made a part of this purchase order. Click on the following LIGO Document Control Center (DCC) links to access these documents or go online to the LIGO Public DCC at <https://dcc.ligo.org/> to access the DCC#.

1.0 Terms

Commercial Terms and Applicable LIGO Specifications: the documents listed below are invoked for this Statement of Work and comprise additional requirements which are integral to this Statement of Work.

<u>DCC #</u>	<u>Description</u>
C080185-v1	Commercial Items or Services Contract General Provisions
Q0900001-v5	Advanced LIGO Supplier Quality Requirements
Q1100003-v1	Acceptable Quality Level (AQL) for Inspection of LIGO Components
E0900364-v8	Metal Components for use in the Advanced LIGO Vacuum System
F0810001-v4	Technical Direction Memorandum

2.0 Quality System

Referring to the above referenced LIGO Specification Q0900001, Suppliers should include a copy of their current ISO 9001, AS9100, or TS16949 certification in their bid package. Suppliers lacking current certification must send a copy of their Quality Manual with their bid package.

3.0 End Item Data Package

- At the time of delivery of the parts, the Supplier shall also provide the following data, as a minimum:
- Any as-built modifications (with approval of the LIGO Contracting Officer) as mark-ups to the drawings
 - Certificate or statement of compliance with all contract and drawing process restrictions.
 - Helium leak test data for the sealed enclosures.

4.0 Scope

This SOW is for the manufacture, hermetic sealing, leak testing, and delivery of custom electronics enclosures, to be used by the Customer in ultra-high vacuum chambers. There are two types of enclosures to be produced, differing in size and in the types of electrical feed-throughs:

<u>Type</u>	<u>DCC #</u>	<u>Description</u>
ASC	D1102004-v6	Drawing for the main body of enclosure
	D1102005-v2	Drawing for the lid of the enclosure
LSC	D1101994-v3	Drawing for the main body of enclosure
	D1101995-v2	Drawing for the lid of the enclosure

4.1 Electrical Feed-throughs

Each enclosure type includes three different types of hermetic electrical feed-throughs. All of these feed-throughs are to be designed and supplied by the Supplier.

Feed-through requirements common to all types:

- Feed-throughs are to be laser welded into the enclosures
- Insulating material is to be ceramic
- Pin material (where applicable) is to be beryllium copper with gold flash

<i>Feed-through type</i>	<i>ASC</i>	<i>LSC</i>
Multi-pin	<ul style="list-style-type: none"> • 25 pin D-subminiature connector, with screw terminals for mating connector (supplied by Customer) • Exterior of enclosure: male pins • Interior of enclosure: 6 inches of insulated 24 AWG wire color coded according to the 25-pair color code. First pair on pins 1-14, then 2-15, 3-16, etc. 	
RF coaxial	<ul style="list-style-type: none"> • 5-way coaxial feed-through, with SMP (limited detent type on inside, no detent on outside) connectors, in a DB25 form factor • Ultra-high vacuum compatible mating connectors on enclosure exterior to be supplied by Supplier; permissible materials for mating connector body: <ul style="list-style-type: none"> ○ PEEK: Victrex grade TDS-450G ○ Ceramic (UHV compatible) • Connector is to be compatible with RG-316 cable 	
	2 such feed-throughs on each enclosure	1 such feed-through on each enclosure
Photodiode header <i>Note: see enclosure drawings for orientation of header with respect to the enclosure</i>	<ul style="list-style-type: none"> • 12 pin header • Exterior of enclosure: to accept the photodiode package, OSI Optoelectronics, model FDI-InGaAs-Q3000 • Interior of enclosure: solid pin, 0.025" to 0.035" in diameter, extending 0.22" to 0.25" from the connector base 	<ul style="list-style-type: none"> • 3 pin header • Exterior of enclosure: to accept the photodiode package, Perkin Elmer C30642G • Interior of enclosure: solid pin, 0.025" to 0.035" in diameter, extending 0.22" to 0.25" from the connector base

4.2 Leak checking

Each enclosure, once it has been populated with electronics by the Customer (see below), is to be leak checked and verified to be leak free by the Supplier. The leak checking is to be performed by filling the enclosure with helium (1 atmosphere), and verifying the absence of leaks at a leak rate not to exceed 10^{-9} cc/sec of helium.

4.3 Summary of Supplier Scope

The Supplier is required to perform the following tasks:

- Machine the enclosures and mating lids per the Customer supplied drawings
- Design and manufacture the hermetic electrical feed-throughs
- Laser weld the feed-throughs into the enclosures
- Laser weld the lids onto the enclosures
- Fill the enclosures with helium, seal, and leak check each unit

4.4 Process Sequencing

In order for the Customer to incorporate electronics into the enclosures, the following process sequence will be followed:

- i. After the electrical feed-throughs are welded in the enclosure (by the Supplier), the units will be shipped to Caltech to have circuit boards and other elements installed.
- ii. The populated enclosures will then be shipped back to the Supplier, where the lids will be welded on and the leak checking performed.
- iii. The sealed, leak-checked units are shipped back to Caltech.

Note: Due to a staged implementation of the finished enclosures on the LIGO instruments, the populated enclosures will likely be shipped back to the Supplier in several shipments, spread out in time. The overall duration of the procurement, from issuance of the purchase order until the final enclosure is sealed and leak-checked, will be 18 months or less.

5.0 Quantity Required:

The quantities required for the two types are as follows:

Type	Quantity
LSC (D1101994 & D1101995)	10 (of each)
ASC (D1102004 & D1102005)	18 (of each)

6.0 Delivery Requirements:

The deliveries are FOB at these destinations, i.e. the Supplier has responsibility for shipping title and control of goods until they are delivered and the transportation has been completed. The Supplier selects the carrier and is responsible for the risk of transportation and for filing claims for loss or damage. The Supplier is responsible for providing shipping containers and transportation which protects these parts from damage from the transportation environment (weather, handling, accidents, etc.) and maintains their cleanliness in their original condition.

Ship To:

LIGO Laboratory
Attn: Rich Abbott
California Institute of Technology
Mail Stop #100-36
Pasadena, CA 91125

7.0 Delivery Schedule:

Partial deliveries are acceptable to meet the following schedule:

	Quantity	Ship Date
LSC type	4	12 weeks ARO
	6	16 weeks ARO
ASC type	4	12 weeks ARO
	14	16 weeks ARO

Turn-around time for final sealing and leak-checking. When the populated enclosures are shipped back to the Supplier for final sealing and leak-checking, the finished units should be shipped back to the Customer within 3 weeks of receipt.

8.0 Photodiode package drawings:

