



LIGO LABORATORY
California Institute of Technology
1200 E. California Blvd.
Pasadena, CA 91125

Statement of Work In-vacuum cables

1.0 Scope

This SOW is for the fabrication of various individual parts detailed in the drawings included in this package. These parts will be assembled by the Supplier to create in-vacuum cables for use in several Advanced LIGO subsystems. These cables (and their individual parts) will be in contact with an Ultra High Vacuum (UHV) environment. **Please note that most of the parts for the assembly of the cables will be supplied by LIGO (exclusions are noted in Section 6.5).**

2.0 Document Access

Many supplemental documents and specifications are incorporated into and made a part this Statement of Work. Click on the document links to access these documents from the LIGO Document Control Center (DCC) or go online to the LIGO Public DCC at <https://dcc.ligo.org/> to access the DCC#.

3.0 Commercial Terms and Applicable LIGO Specifications:

Note: The documents listed below are invoked for this Statement of Work and comprise additional requirements which are integral to this Statement of Work.

- [LIGO-C080185-v1](#) LIGO Commercial Items or Services Contract General Provisions
- [LIGO-Q0900001-v5](#) Advanced LIGO Supplier Quality Requirements
- [LIGO-Q1100003-v1](#) Acceptable Quality Level (AQL) for Inspection of LIGO Components

4.0 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 should send a copy of their Quality Manual with their bid package.

4.1 Manufacturing process

Suppliers are to provide an assembly approach on the process that will be used. For example:

- Which cable clamping method will be used.
- Proposed design change recommendations that would improve the manufacturing process.

5.0 Parts/Assemblies to be manufactured, Quantity Required, and Inspection requirements:

Note: refer to Section 8.0 for delivery schedule and location.

All cable lengths are to be measured, and found to comply with drawing tolerances. All other dimensions on the drawing should be checked on the first article.

A hipot electrical test shall be performed to verify the insulation integrity of each insulated conductor. The test shall certify the measured insulation resistance of any conductor to adjacent conductors in a bundle AND the overall cable shield. The measured insulation resistance at a test voltage of greater than or equal to 500 VDC shall be greater than or equal to 500 mega-Ohms. It is not necessary to record each measurement, but a record of satisfactory test completion must be available upon request. LIGO will provide mating ends to be used for testing.

Drawing #	Length (in)	Description	Quantity
D1000223	216	DB25 F - DB25 F	20
D1000227	36	DB25 M - DB9 F, DB9 F Right Angle	4
D1000234	66	DB25 M - x4 microD9 F	10
D1000234	78	DB25 M - x4 microD9 F	9
D1000234	88	DB25 M - x4 microD9 F	21
D1000234	96	DB25 M - x4 microD9 F	13
D1000237	36	DB25 M - Mighty Mouse 7pin F	15
D1000568	143	DB25 M - DB25 F	8
D1000921	143	DB25 M - DB25 F	7
D1000924	216	DB25 F - DB25 F	8
D1002522	110	DB25 M - microD25 F	8
D1100148	80	DB3 F - DB3 M	6
D1100150	40	DB3 F - x2 Pin	4
D1100151	60	DB3 F - x2 Pin	6
D1100152	110	DB25 F - DB25 F	1
D1101658	108	DB25 F - DB25 F	2
D1101659	108	DB25 F - DB25 F	12
TOTAL			154

Note: refer to LIGO-L1100003 (Sec 3.0) for the AQL table.

6.0 Manufacturing:

6.1 Requirements:

Suppliers must refer to the LIGO specifications referenced in Section 3.0 for additional, and in some cases, non-industry standard requirements.

6.2 Sub-Contracted Work:

The drawings typically represent the finished part as needed for use in service. Suppliers should always contact a LIGO representative to resolve any discrepancies or uncertainties in the documentation or instructions.

6.3 Precedence:

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6.4 Special Instructions:

6.4.1 Restrictions:

Cleanliness Requirements for Cable Assembly/Manufacture:

- These cables will be used in an Ultra-High Vacuum (UHV) system. Care must be taken to maintain cleanliness while handling and machining these parts. All machines, tools, fixtures and storage containers which come into contact with the cable parts or cable assemblies should be clean, and kept clean from oxides, oils, etc. This is to avoid cross contamination before any winding/assembly takes place.
- All parts/components of the cable assembly must be as clean as possible before assembly. This can be discussed with LIGO personnel at the time of procurement.

6.4.2 Materials:

LIGO will provide all parts required to manufacture the cables with the exception noted in Section 6.5

6.4.3 Finishing:

Any required surface finish is defined in the drawings. Localized scratches, digs and blemishes should be minimized.

6.4.4 Markings:

All cables shall be serialized. Serial numbers will be provided by LIGO when needed. Each connector must be laser etched or engraved by the Supplier as outlined on the subsequent page. Arrows on pictures indicate areas where connectors should be labeled if they have not already been scribed. If the parts supplied by LIGO have existing serial numbers, they should be removed. The scribing method should result in a legible set of numbers without using any dyes or inks.

Length and position are special cases. Length is scribed only if a drawing number has multiple lengths. Position (V for vertical, H for horizontal) is scribed only if connectors are set at different angles from each other.



DB25

D# – version – length* – s/n

Example:

D1000234–v2–88–S1101234

Length required for:

D1000234

D1002522



DB9

D# – version – s/n – position*

Example:

D1000228–v2–S1000000 V

Position required for:

D1000227

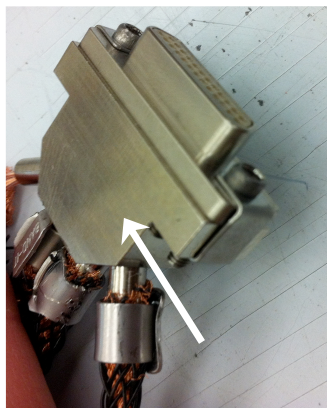


DB3

D# – version – s/n

Example:

D1100150–v1–S1107134



MicroD25

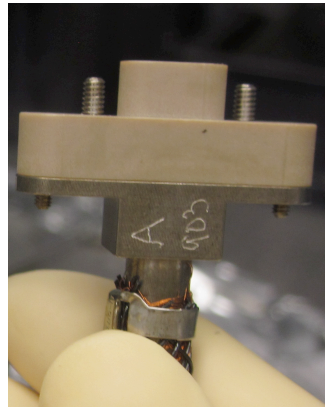
D# – version – length* – s/n

Example:

D1002522–v4–110–S1000001

Length required for:

D1002522



MicroD9

Leg (A, B, C, D) – last 3 digits of s/n

Example:

A 903



Mighty Mouse

Leg (A, B, C, D)

6.5 Exclusions:

- Supplier is not responsible for supplying or installing the helicoils.
- All microD9 and microD25 connectors require potting compound and LIGO WILL NOT supply the potting compound used in the assembly. LIGO requires that only the following epoxy be used:
EP-1730-1
CHEMICAL NAMES: Modified Epoxy
MANUFACTURER'S NAME: EPOXY PAX
ADDRESS: 711 W. 17th Street B-5, Costa Mesa, CA 92627 (949) 646-2522

7.0 End Item Data Package:

Before delivery of the parts, the Supplier shall provide the following data, as a minimum:

- Any as-built modifications (with approval of the LIGO Contracting Officer) as mark-ups to the drawings
- Material certifications
- Inspection reports of all dimensional features for the number of parts specified per the AQL number and referenced in the AQL table LIGO-L1100003 (Sec 3.0) and any other inspection requirements detailed in Section 5.0 of this SOW
- Certificate of compliance for each part number stating conformance to contract and drawing requirements

8.0 Delivery Requirements:

8.1 Shipping Containers and Packaging:

The Supplier is responsible for providing shipping containers and transportation which protect these parts from damage from the transportation environment (weather, handling, accidents, etc.). Mating edges of parts should be especially protected from damage during shipping.

8.2 Shipping Destination(s):

The deliveries are FOB at these destinations, i.e. the Supplier has the 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.

These items will be shipped to:

California Institute of Technology (CIT)
LIGO Project MS 100-36
391 S. Holliston Ave.
Pasadena, CA 91125
Attn: Kate Gushwa

8.3 Delivery Schedule:

Cables should be shipped within 8 weeks after receipt of materials. First Articles for the following drawing numbers are due **2 weeks after receipt of materials**:

- D1000227
- D1000234 66"

- D1000237
- D1002522 110"
- D1100148
- D1100150
- D1101659

Please provide separate pricing for expedited delivery according to the due dates (following First Article approval) outlined in the following table.

Drawing #	Length (in)	Description	Quantity	Due (weeks)
D1000223	216	DB25 F - DB25 F	20	2
D1000227	36	DB25 M - DB9 F, DB9 F Right Angle	4	4
D1000234	66	DB25 M - x4 microD9 F	10	2
D1000234	78	DB25 M - x4 microD9 F	9	3
D1000234	88	DB25 M - x4 microD9 F	21	5
D1000234	96	DB25 M - x4 microD9 F	13	5
D1000237	36	DB25 M - Mighty Mouse 7pin F	15	1
D1000568	143	DB25 M - DB25 F	8	3
D1000921	143	DB25 M - DB25 F	7	6
D1000924	216	DB25 F - DB25 F	8	3
D1002522	110	DB25 M - microD25 F	8	6
D1100148	80	DB3 F - DB3 M	6	4
D1100150	40	DB3 F - x2 Pin	4	4
D1100151	60	DB3 F - x2 Pin	6	4
D1100152	110	DB25 F - DB25 F	1	4
D1101658	108	DB25 F - DB25 F	2	2
D1101659	108	DB25 F - DB25 F	12	1

Please suggest an alternative delivery schedule if this is not possible. Early and/or partial deliveries are acceptable.