Specification

PROCUREMENT SPECIFICATION FOR CABLES

SEAKR

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1 SCOPE

This specification shall be used for the procurement and assembly of cables and wire harnesses. Verification of cables shall be accomplished through the use of provisions defined herein. Detailed requirements, specific characteristics, and dimensions of the cable are specified in the cable drawing and may be supplemented by additional notes on the Purchase Order (PO). There shall be no substitutions or additional exceptions without written approval from SEAKR.

1.1 CLASSIFICATION

Unless otherwise specified, the required product class for the cable assembly is listed on the cable drawing, in accordance with IPC/WHMA-A-620. There are three classes to which a cable can be assembled to:

1. Class 1 – General Electronic Products
2. Class 2 – Dedicated Service Electronic Products
3. Class 3 – High Performance/Harsh Environment Electronic Products

2 APPLICABLE DOCUMENTS

Cable assembly drawings may reference SEAKR Engineering Work Instructions (SEWIs) or SEAKR Engineering Procedures (SEPs). These are for internal reference. The manufacturer shall follow the government and industry standards listed below instead of SEWIs and SEPs.

2.1 GOVERNMENT/MILITARY SPECIFICATIONS AND STANDARDS

The following specifications and standards form a part of this specification to the extent specified herein. Unless otherwise specified, the applicable issues of these documents shall be those in effect on the date of the procurement. All other requirements shall default to Industry Standards.

- ASME Y14.100, Engineering Drawing Practices
- NASA-STD-8739.4, Crimping, Interconnecting Cables, Harnesses and Wiring
- NASA-STD-8739.3, Soldered Electrical Connections

2.2 INDUSTRY STANDARDS

The following specifications and standards form a part of this specification to the extent specified herein. The applicable issues of these documents shall be those in effect by the responsible industry association or society on the date of procurement.

- IPC/WHMA-A-620, Requirements and Acceptance for Cable and Wire Harness Assemblies
- IPC J-STD-001, Requirements For Soldered Electrical And Electrical Assemblies
- S-311-P-10, Connector, Electrical, Rectangular, Miniature, Polarized Shell, Rack And Panel, For Space Flight Use
- 408-6609, Amplimite Connector Instruction Sheet
- ASTM E595, Standard Test Method for Total Mass Loss and Collected Volatile Condensable Materials from Outgassing in a Vacuum Environment.
- ANSI/ESD-S20.20, Protection of Electrical and Electronic Parts, Assemblies and Equipment
- IPC-WP-114, Guidance for the Development and Implementation of a White Plague Control Plan

2.3 ORDER OF PRECEDENCE

The following order of precedence shall apply in the event of a conflict between the procurement document(s), the text of this document and the references cited herein.

1. Purchase Order
2. Cable Assembly Drawing or Source Control Drawing
3. This specification
4. Other applicable documents referenced herein

2.4 ABBREVIATIONS

The abbreviations used in this document are defined below:

- PO: Purchase Order
- UUT: Unit Under Test
- TVAC: Thermal Vacuum
- ESD: Electrostatic Discharge
- FOD: Foreign Object Debris
- SCD: Source Control Drawing
- AWG: American Wire Gauge
- FIFO: First In, First Out
- EIDP : End Item Data Package

3 CABLE ASSEMBLY REQUIREMENTS

3.1 GENERAL

Cables delivered shall be of the material, design, and construction specified on the Purchase Order, the assembly or source control drawing, the Product Structure, and this specification.

3.2 PRECAUTIONS

Electrostatic sensitive parts and assemblies/boxes which contain electrostatic sensitive parts shall be adequately protected from electrostatic discharge damage, per ANSI/ESD-S20.20.

3.3 FOD ELIMINATION

Operational areas, work items, tools, connector(s), and wire must remain clean and clear of Foreign Object Debris.

3.4 CRIMPED CONTACTS

All crimped contacts shall be performed in accordance with NASA-STD-8739.4 or IPC/WHMA-A-620. However, all crimp pull tests need to meet the requirements of NASA-STD-8739.4 (see section 3.4.1).

3.4.1 Crimp Pull Test

All cable assemblies with closed barrel contact crimps are subject to crimp pull tests. Crimp pull tests shall be performed on a three piece sample prior to the cable assembly crimps. Only one, three piece sample, is required for all cables built during a work shift for the particular wire gauge (AWG) and contact combination.

Crimp pull tests shall be performed per NASA-STD-8739.4. Crimps shall be pull tested beyond the minimum value, but do not need to be pull tested to failure. No post build pull test is required (This is an exception to NASA-STD-8739.4). All pull tests shall be properly documented and included in the EIDP (see section 5.1).

Open-barrel type contacts and shield crimp ferrules do not require a three piece sample pull test, but shall be visually inspected.

3.4.2 Crimp Tools and Testers

The manufacturer is responsible for ensuring crimp tools and testers requiring calibration are properly calibrated.

3.5 SOLDERING

Soldering shall be performed according to NASA-STD-8739.3 and NASA-STD-8739.4, or IPC/WHMA-A-620 and IPC J-STD-001. Wires directly soldered to connector contacts shall be covered with clear heat shrink, every other contact at minimum, to prevent shorting.

3.6 AMPLIMITE BACKSHELLS

Cable assemblies requiring the use of Amplimite backshells and crimp ferrules, shall be installed per instruction sheet 408-6609.

3.7 ADDITIONAL TESTING

Any additional electrical/mechanical testing required will be called out on the cable assembly drawing, or source control drawing.

3.8 SERIALIZATION

All SEAKR cable assemblies shall be serialized and labeled appropriately, per the cable drawing. Serial number information can be found on the PO. See Section 3.10 for label formatting instructions.

3.9 MATERIAL

All SEAKR cable assembly drawings will define whether there is a direct connection to the Unit Under Test, and/or if the assembly is for internal TVAC use. The direct connection information can be found in either the Cable Characteristics Table, or the Cable Diagram and General Notes section, as well as the Label Information Table. If the cable is for internal TVAC, "INT TVAC" will be located in the title or cable description, as well as "TVAC OK" in the Label Information Table. Material substitutions on internal TVAC cables are not allowed without prior written approval from SEAKR. For non-internal TVAC or direct connect assemblies, some material substitutions may be allowed without prior approval from SEAKR. Please see section 3.9.1 for more information.

3.9.1 Component Substitutions

If the supplier is providing materials, and cable assemblies are not for internal TVAC, some alternate components can be substituted without prior SEAKR approval. These include (see Section 3.9.1.1):

- Heat shrink
- Solder
- Kapton tape
- Lacing tape
- Labels

If the supplier is providing any other materials and needs to make a component substitution from the listed manufacturer and/or manufacturer part number on the Product Structure, the SEAKR responsible buyer or engineer must be contacted to authorize the change.

3.9.1.1 Heat Shrink, Lacing Tape, Kapton Tape, Labels

On non-internal TVAC assemblies where heat shrink, lacing tape, labels, and/or Kapton tape are called out in a drawing and/or Product Structure, any alternate size of the same, or similar material is acceptable for use so long as the finished product meets the inspection criteria for the application.

For internal TVAC assemblies, no substitutions are allowed without SEAKR approval.

3.9.2 Prohibited Materials

All non-TVAC cable assemblies with connectors connecting directly to the UUT shall not use the following prohibited materials at the mating interface (only applies to connectors with "Direct Connect OK" labels):

- Pure Tin (Sn), defined as an alloy containing >97% Sn
- Pure Cadmium (Cd), or Cd alloy containing greater than 5% Cd by weight, not over-plated by an approved material
- Pure Zinc (Zn), or Zn alloy containing greater than 10% Zn by weight, not over-plated by an approved material
- Un-plated Brass

All internal TVAC cable assemblies must not contain the prohibited materials listed above within the entire assembly.

3.9.3 Outgassing

All internal TVAC rated cables must meet the following outgassing requirements:

1. Materials tested for TVAC compatibility shall comply with ASTM E595
2. No material shall have a total mass loss (TML) greater than 1.0% and a collected volatile condensable material (CVCM) greater than 0.10%.
3. Zinc, cadmium, selenium, or brass alloys that are not over-plated by an approved material, such as gold, nickel, or Sn/Pb solder, at least 30 micro-inches in thickness, are prohibited on TVAC assemblies.

3.9.4 Material Handling and Storage

Material handling and storage shall be in accordance with applicable manufacturers' datasheets. Raw material storage and handling shall be controlled to ensure and prolong shelf life. For shelf life sensitive materials, first-in, first-out (FIFO) stock rotation plans shall be used and shelf life expiration dates will be marked on the container. Expired materials may be used if approved by the Materials and Processes group at SEAKR. When released from primary storage areas, material shall be handled and controlled to minimize contamination and damage.

3.10 LABELS

Cable assemblies shall be labeled per the SEAKR cable drawing with a minimum font size of 12, using a legible, non-italicized font.

3.11 DIMENSIONAL REQUIREMENTS

Cable assembly length and tolerance requirements are located in every SEAKR cable drawing. Any deviation from the provided length and tolerance requirement must be approved by SEAKR.

4 QUALITY ASSURANCE PROVISIONS

4.1 ACCEPTANCE

4.1.1 Assembly Inspection

The assembly shall be inspected for quality per IPC-WHMA-A-620 and NASA 8739.4.

4.1.2 Visual Examination

The cable assemblies shall be visually examined to verify that the design, construction, physical dimensions, markings, and workmanship are in accordance with the requirements of the PO, the assembly drawing, and this specification.

4.1.3 Deviations and Waivers

Deviations and waivers to the PO, drawing, or this specification shall be submitted to SEAKR for approval. Written approval for any deviation or waiver shall be listed on the PO prior to delivering product and shall be included as part of the standard end item data package.

4.1.4 Rework or Repair

All rework or repair activities shall be approved by SEAKR prior to the work being started. If rework is done to a cable, a new certificate of compliance (section 5.1) shall be provided by the supplier. If wires need to be crimped to new contacts, a new pull test (section 3.4) shall be performed and the documentation of that pull test shall be provided by the supplier.

4.2 SOURCE INSPECTION

SEAKR reserves the right to verify that all the requirements of this specification have been met in accordance with the PO and prior to shipment. Periodic surveillance and/or inspection of all phases of manufacturing, testing and inspection may be also conducted.

4.3 CONTRACT SERVICES

All subcontracted manufacturing processes shall be approved by SEAKR in advance of PO acceptance. The manufacturer shall flow down the applicable requirements of this specification to the subcontractor. The manufacturer assumes all responsibility that the subcontracted service has demonstrated the ability to meet the applicable requirements of this specification. SEAKR reserves the right to audit the manufacturer's subcontractors.

5 PREPARATION FOR DELIVERY

Supplier shall maintain ESD-safe packaging procedures for plated copper conductors and insulated wire assemblies. Procedures shall be established to mitigate concerns for red and white plagues, in accordance with guidance provide by IPC-J-STD-001 and IPC-WP-114, respectively. Cable assemblies shall be protected adequately for shipment by using suitable packing materials and placing them in a shipping container or box. Cable minimum bend radius shall be followed in packaging.

5.1 END ITEM DATA PACKAGE (EIDP)

Each cable assembly shall have an EIDP included with each delivery. The data package must include as a minimum:

1. Certificate of Compliance (C of C) which shall include the following:
    a. Specific statement on the C of C indicating the compliance to the requirement(s) specified on the drawing and this document. Supplier shall list the revision number of both documents.
    b. SEAKR Engineering Part Number
    c. Serial Number
    d. Purchase Order Number
    e. Date
    f. Statement of no prohibited materials used (internal TVAC cables only).
    g. Signature of an authorized Quality Assurance representative
2. A Manufacturer Certificate of Conformance is required for all subcomponents with the status: Flight. SEAKR will provide a list of all subcomponents and their Flight status in the quoting process.
3. Contact Pull Test reports, required for all cables with closed-barrel contact crimps.
4. Electrical test report, if required. Any required reports will be called out on the drawing, and/or PO note when applicable.
5. All applicable SEAKR approved waiver or deviation request documentation (section 4.1.3).
6. All applicable rework or repair documentation, if a rework or repair was performed (section 4.1.4).

The component and cable assembly manufacturer's standard format for documentation and data package is acceptable. All assembly documentation shall be available for SEAKR Engineering review.

6 SUPPLIER RESPONSIBILITY

6.1 TRAINING

Training and testing practices shall be employed by the manufacturer to establish, evaluate, and maintain the skills of personnel engaged in production, testing, or inspection of cable assemblies manufactured for SEAKR. The training program shall be documented as to form, content, and frequency. The manufacturer shall define training requirements which assure operator knowledge of internal, NASA and/or IPC standards, as well as proficiency to perform assigned tasks. The methods of updating operators to changes in internal standards and to assure continued proficiency shall be addressed. Records showing the basis of operator acceptability shall be on file including instruction and evaluations received.