**METRIC/INCH-POUND**

KSC-STD-132
Revision F

# POTTING AND MOLDING ELECTRICAL CABLE ASSEMBLY TERMINATIONS,

# STANDARD FOR

## Export Control Determination

**NOT EXPORT CONTROLLED**

This document has been reviewed by the KSC Export Control Office and it has been determined that it does not meet the criteria for control under the International Traffic in Arms Regulations (ITAR) or Export Administration Regulations (EAR).

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## September 28, 2026

## ENGINEERING DIRECTORATE

National Aeronautics and
Space Administration

**John F. Kennedy Space Center**

KDP-KSC-T-5407 Rev Basic

# POTTING AND MOLDING ELECTRICAL CABLE ASSEMBLY TERMINATIONS,

# STANDARD FOR

Approved by:

//signed copy on file//

Becky Murray, Acting Director
Engineering

**September 28, 2026**

## JOHN F. KENNEDY SPACE CENTER, NASA

## RECORD OF REVISIONS/CHANGES

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| D | | General revision. | October 24, 2008 |
| | D-1 | Updated references and information on curing. Added illustration of overall shield termination (Figure 8). Added guidance on fabricating molds (Appendix B). | February 18, 2015 |
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| | D-3 | Updated temperature and humidity conditions in 5.1.3. | March 3, 2017 |
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| | | | |
|---|---|---|---|
| E | | 1. Added references to KT02415 Adapter Stainless Steel Molding 360° Shield Termination.<br>2. Added references to NASA-STD-8739.4 Workmanship Standard for Crimping, Interconnecting Cables, Harnesses and Wiring.<br>3. Removed references to MSFC-SPEC-40M38277, MSFC-SPEC-40M38298, MSFC-SPEC-40M39569, SAE AS50151, MILK-DTL-22992, MIL-DTL-26482, MIL-DTL-38999, 79K14177.<br>4. Revised sections 4.1.3.1, 4.1.3.2, deleted sections 4.1.3.3, 5.2.2.5<br>5. Deleted NOTE in section 4.1.<br>6. Added NOTE in section 5.2<br>7. Revised Appendix A.<br>8. Provided additional guidance, clarification and minor edits throughout the document. | June 28, 2023 |
| F | | 1. Section 4.1.1 - Clarified title, removed Mold release, modified Shore D range, added PR-1535 Amber as an approved material, added pre-potting tape.<br>2. Section 4.1.2 – Clarified title, adding MEK caution, added additional mold release compound, removed ‘approved equivalent’ from mold release and sealant, removed pre-potting tape.<br>3. Changed ‘approved equivalent’ to ‘equivalent’ in Sections 4.3.7, 4.3.9, 4.3.10, 4.3.11, 4.3.12<br>4. Section 5.1.2 – Deleted specifics and reworded to ensure proper and adequate ventilation are the responsibility of the potting/molding facility and responsible safety agency.<br>5. Section 5.2.1.1.2 – Reworded to read contaminants and to be removed using isopropyl alcohol only<br>6. Section 5.2.3.5 e – Added note concerning AS23053 heatshrink.<br>7. Section 5.2.5 – Replaced shall with recommended.<br>8. Section 5.5.4.3 – Added words on evidence of gaps or de-bonding. | September 28, 2026 |

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## ABBREVIATIONS, ACRONYMS, AND SYMBOLS

| | |
|---|---|
| °C | degree Celsius |
| °F | degree Fahrenheit |
| APPROX | approximately |
| CL | centerline |
| CPE | chlorinated polyethylene |
| conn | connector |
| dim | dimension |
| EAR | Export Administration Regulations |
| EDM | electrical discharge machining |
| FSCM | Federal supply code for manufacturers |
| ft | foot |
| in | inch |
| ITAR | International Traffic in Arms Regulations |
| kPa | kilopascal |
| KSC | John F. Kennedy Space Center |
| m | meter |
| MAX | maximum |
| MEK | methyl-ethyl-ketone |
| MIL | military |
| MIN | minimum |
| mm | millimeter ($1 \times 10^{-3}$ m) |
| MS | mold size |
| MSFC | George C. Marshall Space Flight Center |
| MTG | mounting |
| NASA | National Aeronautics and Space Administration |
| no. | number |
| psi | pound per square inch |
| PVC | polyvinyl chloride |
| R | radius |
| RECP | receptacle |
| REF | reference |
| REQD | required |
| RFI | radio frequency interference |
| SDS | Safety Data Sheet |
| SPEC | specification |
| STD | standard |
| TYP | typical |
| UV | ultraviolet |

## 1. SCOPE

The purpose of this document is to establish a standard process for potting and molding electrical cable assembly terminations using epoxy-resin potting compositions and elastomeric dielectric compounds.

This standard describes the materials and methods to be used in potting and molding electrical cable assembly terminations with epoxy-resin potting compositions and elastomeric dielectric compounds and describes the facilities and equipment required to perform the potting and molding processes. The standard dimensional requirements for molding specific types of cable assemblies are specified in 120E0600001, KT02415, and Appendix A. Appendix B is a Guideline for Fabricating Molds Used with Elastomeric Compounds to Mold Electrical Connectors and Cable Sheaths.

## 2. APPLICABLE DOCUMENTS

The following documents form a part of this document to the extent specified herein. When this document is used for procurement, including solicitations, or is added to an existing contract, the specific revision levels, amendments, and approval dates of said documents shall be specified in an attachment to the Solicitation/Statement of Work/Contract. The specific revision levels amendments and approval of said documents shall be specified in an attachment to the Solicitation/Statement of Work/Contract/Task Order.

### 2.1 Government Specifications

John F. Kennedy Space Center (KSC), NASA

| | |
|---|---|
| KSC-E-165 | Electrical Ground Support Equipment Fabrication, Specification for |

Federal

| | |
|---|---|
| ASTM D 740 | Standard Specification for Methyl Ethyl Ketone |
| ASTM D 4080 | Standard Specification for Trichloroethylene, Technical and Vapor-Degreasing Grade |

Military

| | |
|---|---|
| SAE-AMS-DTL-23053 | Insulation Sleeving, Electrical, Heat Shrinkable, General Specification for |

### 2.2 Government Standards

Military

| | |
|---|---|
| MIL-STD-171 | Finishing of Metal and Wood Surfaces |

### 2.3 Government Drawings

John F. Kennedy Space Center (KSC), NASA

| | |
|---|---|
| 120E0600001 | Adapter Connector Molding 360° Shield Termination |
| 120E3100003 | Electrical Cable Fabrication Requirements |
| KT02415 | Adapter Stainless Steel Molding 360º Shield Termination |

National Aeronautics and Space Administration

| | |
|---|---|
| NASA-STD-8739.4 | Workmanship Standard for Crimping, Interconnecting Cables, Harnesses, and Wiring |

Copies of specifications, standards, drawings, and publications required by contractors in connection with the application of this procedure should be obtained from the procuring activity or as directed by the Contracting Officer.

### 2.4 Order of Preference

In the event of conflict between the documents referenced herein and the contents of this document, the contents of this document shall supersede except where otherwise noted. The applicable NASA contract or purchase/procurement order shall take precedence over the contents of this document in the event of conflicting requirements. Nothing in this document supersedes applicable laws and regulations unless a specific exemption has been obtained. The Contracting Officer or other authorized Government official shall be notified of any such conflict in documentation.

## 3. DEFINITIONS

For the purpose of this standard, the following definitions shall apply.

a. **abrade:** to remove gloss or roughen surface using an abrasive such as sandpaper.

b. **chlorinated polyethylene (CPE):** a rugged thermoplastic polymer with high ultraviolet (UV), chemical, tear, and ignition resistance. CPE is also an electrical insulator.

c. **elastomeric:** adjective for a rubberlike synthetic polymer, such as silicone rubber and polyurethane.

d. **epoxy:** a durable, corrosion-resistant resin used in coatings.

e. **mix:** to completely blend two or more materials or compounds into one uniform homogenous mass.

f. **molding:** a process for creating a physical form to protect a cable termination from hazards in the operating environment, as well as to provide strain relief.

g. **neoprene:** a synthetic rubber produced by the polymerization of chloroprene; it is highly resistant to oil, heat, light, and oxidation.

h. **polyvinyl chloride (PVC):** any of a family of polymers derived from vinyl chloride. They have many uses in various forms, as in rigid plastic pipes and filmy food wrappers.

i. **polyethylene:** any of several thermoplastic resins made by the polymerization of ethylene; used in making translucent, lightweight, and tough plastics, fibers, etc.

j. **potting:** a process for creating a physical form to protect a cable connector from hazards in the operating environment, to help insulate bare wire terminations in the connector from each another.

k. **primer:** a precoating material used to facilitate adhesion of the final coat.

l. **sheath:** a protective cable jacket.

m. **wicking:** the action of drawing a liquid or molten material through capillary action.

# 4. GENERAL REQUIREMENTS

## 4.1 Materials

The following materials, substitutions, or deviations, as approved by the cognizant design activity, shall be used.

### 4.1.1 Potting

a. **Potting Materials:** The following potting compounds, or approved equivalent, shall be used. Elastomeric compounds (ex, PR-1535) shall not be used as potting material in solder-type connectors.

| Material | Source |
|---|---|
| STYCAST Epoxy 2651<br>Shore D Hardness: 88 +/- 10<br>(2651 variants shall not be used) | Emerson & Cuming |
| Scotch-Weld Epoxy Adhesive EC-2216 Gray B/A<br>Shore D Hardness 65 +/- 15 | 3M |
| PR-1535 Amber*<br>Shore A Hardness: 76-99<br>(* Not to be used in solder-type connectors) | PRC-DeSoto / PPG Aerospace |

b. **Primers:** Primers shall be of the type recommended by the manufacturer of the material.

c. **Solvent Cleaners:** Solvents used for cleaning purposes shall conform to the requirements of ASTM D 740 and ASTM D 4080, as applicable.

d. **Tape:** When required, the following tape, or equivalent, shall be used to build up the dam above the connector for prepotting:

| Material | Source |
|---|---|
| Tape, electrical, plastic, polytetraflouroethylene | CHR Industries |

#### 4.1.2 Molding

a. **Methyl-Ethyl-Ketone (MEK):** The MEK solvent cleaner shall conform to ASTM D 740.

- WARNING: Keep away from ignition sources, keep containers tightly closed, wear proper protective gear, avoid breathing vapors, and use only in well-ventilated areas.
- MEK shall not be stored in or used from an open container. Only containers approved by the responsible safety agency shall be used.

b. **Molding Material:** The following, or approved equivalent, molding compound shall be used.

| Material | Source |
|---|---|
| PR-1535 Compound<br>Shore A Hardness: 76-99 | PRC-DeSoto / PPG Aerospace |

c. **Mold Release:** The following mold-release compounds shall be used:

| Material | Source |
|---|---|
| 225 Mold Release | Valspar Corporation |
| ReleaSys 89S Mold Release | Miller-Stephenson |

d. **Primers:** Primers, when required, shall be of the type recommended by the manufacturer of the material.

e. **Sealant:** When required, the following repair and sealant material shall be used:

| Material | Source |
|---|---|
| 3145 RTV Adhesive/Sealant, acetic-acid-free | Dow Corning Corporation |

### 4.1.3 Storage and Shelf Life of Materials

#### 4.1.3.1 Storage

All compounds shall be stored in a secure, environmentally controlled location and within temperature ranges as per manufacturer's recommendations.

All containers shall be labeled as to contents, before and after mixing, and shall show the shelf life expiration date.

#### 4.1.3.2 Shelf Life of Materials

When properly stored and handled, the rated shelf life of each compound shall conform to manufacturer's specification.

Potting and molding compound shelf life extension:

- Most potting and molding compounds are shelf life extendible products. Generally, properly stored compounds can get up to two extensions.
- Procedure:
  - Ensure compounds have been properly stored.
  - For two-part compounds, prepare each compound per manufacturer's

recommendations.

- Mix the proper amounts of each compound together.
- Pour into a sample cup for testing.
- Test for stated work life and hardness.

**NOTE**

The manufacturer will only certify product to the date and temperature stated on product label. The use of material beyond its stated shelf life is the sole responsibility of the user. Materials which are beyond their stated shelf life may still be usable, but users must make their own determination of fitness for use for any particular application. Dispensing, handling, and cured performance properties are factors which should be considered in making this determination.

### 4.2 Configuration and Dimensions

Unless otherwise specified in engineering drawings, configurations and dimensions shall be in accordance with Figure 1 in Appendix A.

### 4.3 Equipment

The following equipment, substitutions, or deviations, as approved by the cognizant design activity, shall be used.

#### 4.3.1 Vacuum Chamber

For mixing methods that entrap air into the mixture, an evacuation system consisting of a pump and a vacuum chamber capable of evacuation to a maximum absolute pressure of 3.4 kilopascals (kPa) (0.5 pound per square inch [psi]) shall be used to minimize entrapment of air in the molding and potting materials.

**NOTE**

It is recommended that an integral mixer be used with the vacuum chamber to accommodate materials with a short pot life.

#### 4.3.2 Mixing Containers

Mixing containers shall be of a nonporous material such as metal, glass, or plastic.

### 4.3.3 Air Pressurization Equipment

Air-pressurization equipment shall be capable of delivering filtered air having a maximum relative humidity of 5 percent at a minimum gage pressure of 34.5 kPa (5 psi), and maximum gage pressure of 620 kPa (90 psi), with sufficient capacity and pressure control to permit operation anywhere within this range.

### 4.3.4 Brushes

Brushes shall have nonmetallic bristles. All brushes (new and used) must be cleaned to remove all dirt and grease from the bristles and stored in a clean container until used.

### 4.3.5 Weighing Equipment

Weighing equipment shall include a gram balance and a pound balance. The gram balance shall have a 250-gram weighing capacity and shall be accurate to 1.0 gram. The pound balance shall have a 30-pound weighing capacity and shall be accurate to 0.1 pound.

### 4.3.6 Holding Rack

A holding rack fitted with holding clamps shall be constructed to hold the cable components rigid and in proper alignment.

### 4.3.7 Injection Gun

A manual-, semiautomatic-, or automatic-powered injection gun, Semco Application System, Model 250-A, PN 250125, 12 ounces with handle, (or equivalent) shall be used for injecting the potting compound into the connectors. When using potting compounds specified in this standard, disposable polyethylene nozzles, plungers, and liners are required for the injection gun. The gun capacity and nozzle size shall depend on the quality and type of connectors being potted or molded. Extra care shall be taken to provide the air gun with adequate isolation between the pressurized air and compound to avoid aeration of the mixture.

### 4.3.8 Cable Molds

Cable molds shall be easy to assemble, impervious to temperature change, strong and solid in construction, and easy to remove after the molding material has set. Appendix B contains a Guideline for Fabricating Molds Used with Elastomeric Compounds to Mold Electrical Connectors and Cable Sheaths.

### 4.3.9 Thermometer

The thermometer shall be an immersion type, ThermoFisher item #110C230FW-THERM LG-20/110C ME DS or equivalent capable of measuring temperatures between –18 degrees Celsius (°C) and +110 °C (0 degree Fahrenheit [°F] and 230 °F).

#### 4.3.10 Abrasive Paper

The abrasive paper shall be sanding sheets, no. 60 grit, or equivalent.

#### 4.3.11 Metal Spatula

The spatula shall be a Dexter-Russell traditional baker's spatula, ID 1730, PN S24912, 30.48-centimeter (cm) (12-inch [in]) stainless steel blade, wooden handle, or equivalent.

#### 4.3.12 Hot Plate

The hot plate shall be a Barnstead International Thermolyne type 2200, model HPA2245MQ, or equivalent adjustable up to 400 °C (752 °F).

#### 4.3.13 Curing Apparatus

The molding and potting area shall be equipped with an approved curing apparatus. The curing apparatus may be an air-circulating oven, infrared equipment, heater strips, or rods. The curing apparatus shall maintain a curing temperature as recommended by the manufacturer's curing temperature requirement within ± 10 °C (± 18 °F) and shall provide a means of preventing hot spots during the curing process.

## 5. DETAILED REQUIREMENTS

### 5.1 Facilities

#### 5.1.1 Molding and Potting Area

The dimensions of an acceptable molding and potting area shall be governed by the volume of workload. The area shall be of sufficient size to permit proper processing of cables. The area shall contain sufficient equipment and supplies to prevent the need for an overlap of operations.

#### 5.1.2 Ventilating

The facility shall be provided with adequate ventilation equipment to protect users from hazards associated with potting and molding operations. Ventilation equipment shall be capable of removing hazardous vapors to the outside and introduce sufficient fresh air in the air-conditioning system (see 5.1.3) to accommodate the volume of compounds, solvents, and primers being used per hour. Force-fed, positive-pressure ventilation is necessary where vapors are generated. Pressure inside the potting and molding facility should be maintained at a pressure 250 kPa to 500 kPa (1 in to 2 in) of water higher than the ambient pressure outside the facility. Vapors and foreign matter shall be exhausted away from, down, and to the outside to avoid inhalation by the operator. The facility safety personnel shall determine proper ventilation in ratio to the quantity of material being used.

### 5.1.3 Environmental Conditions

The temperature and humidity of the molding and potting facility shall be in conformance with the material manufacturer's specification for handling and storage. Cure times may be adjusted according to the facility's temperature and humidity. Automatic equipment shall be installed to maintain these conditions. These conditions shall be maintained throughout all areas where mixing or other handling of potting or molding materials occur or where these materials pass after being opened or relieved of their protective packaging. Workroom lighting should provide 1,076.4 lux (100 foot-candles) normal, 807.3 lux (75 foot-candles) minimum, at 760 millimeters (mm) (30 in) above the floor.

### 5.1.4 Cleanliness

The potting and molding facility shall be isolated from such contaminants as dust, metallic particles, water, oil, and grease. Bench tops shall be protected from spillage by disposable coverings, and floors shall be cleaned frequently. Cleaning agents used within the facility shall be as specified in 4.1.1.c, and the cleaning process shall be as specified in 5.2.1.1.2.

### 5.1.5 Health and Safety Precautions

WARNING: When carelessly handled, the chemicals used for molding and potting may cause severe physiological reactions. The chemicals involved are safe when properly handled by trained personnel and when the following precautions are carefully observed:

a. Avoid ingestion and inhalation of vapors.

b. Avoid contact of solvents, primers, and compounds with the skin. Special care shall be taken to prevent contact with open breaks on the skin. Skin areas that do become exposed shall be cleaned with a cleaner and then with a nonabrasive soap and clean water. Cleansed jars, bottles, tools, or containers shall be individually used by personnel.

c. Eyes or mucous membrane accidentally contaminated shall be flushed with water and receive medical attention immediately.

d. Water deluge or flushing sink and eyewash fountain are recommended in juxtaposition to operations involving toxic skin-contaminate and inhalant materials.

e. Protective clothing shall be changed regularly and, when soiled by potting and molding materials, shall be laundered prior to reuse.

f. No smoking or flames shall be allowed within a room where compounds, primers, and solvents are being used. NO SMOKING and NO FOOD, BEVERAGES, OR TOBACCO ALLOWED IN THIS AREA signs shall be displayed in conspicuous places. Before smoking or eating outside the facility, personnel shall thoroughly clean exposed skin areas.

g. An emergency shower or eyewash fountain combination is recommended immediately outside the facility room.

h. Exits should be unobstructed from any point or area. Panic hardware shall be provided

inside of exit doors.

i. Solvents, potting and molding compounds, and other flammable materials shall be stored only in ventilated metal cabinets or containers. Appropriate fire extinguishers shall be provided at 9 meter (m) (30 foot [ft]) intervals throughout the facility.

**NOTE**

Supervisors shall conduct periodic inspections of personnel for physiological reactions such as itching rashes, blisters, cracks, defatted areas, and any dermatitis symptoms. Personnel exhibiting any physiological reaction shall be removed from contact with plastic and rubber chemicals until approved for continuance by the applicable medical office.

j. In addition to Hazardous Commodity Training, operations personnel should review relevant Safety Data Sheets (SDSs) (via the KSC internal homepage) on an as-needed basis to become familiar with chemical hazards.

### 5.1.6 Inspection

Facilities will be subjected to inspection for compliance with the requirements of this procedure by an authorized procuring-activity representative.

### 5.1.7 Personnel

Training and certification of personnel shall be as follows:

a. The fabricating organization shall provide operator and inspection training in the use of equipment and material employed including familiarization with the NASA specifications and procedures to be used in the work. Personnel shall be certified as inspectors or operators.

b. The fabricating organization shall maintain appropriate training records, including the qualifying samples, for each individual trained. The fabricating organization shall also submit an outline of a training program to the contracting officer or designee for review.

c. The KSC quality surveillance representative or delegated representative may review the outline for compliance with item a. above and will recommend approval or disapproval to the contracting officer.

d. The KSC quality surveillance representative or the delegated representative may require any individual to demonstrate proficiency in any area in which the representative has reason to question the quality of work being performed.

## 5.2 Preparation for Potting and Molding

**NOTE**

Terminated connectors that have exposed conductor-to-contact terminations (i.e., solder contacts) shall be potted with epoxy. For shrink boot applications, potting shall be performed prior to boot installation. For potting adapter or standard backshell applications, potting shall be performed after backshell installation. Refer to Instruction #6 in 120E3100003 for further information.

### 5.2.1 Preparation of Cable Assemblies

Prior to potting or molding, the cable assemblies shall pass an inspection for materials, workmanship, electrical continuity, short circuits, and isolation as specified by KSC-E-165. In all cases of shielding, bonding, and grounding, the applicable specification and design requirements for electrical configuration shall govern. All potting applications shall be coordinated with and shall conform to the basic electrical requirements for both shielded and unshielded cables.

In preparation of cable assemblies, the following items shall apply, as applicable:

#### 5.2.1.1 Adhesion

##### 5.2.1.1.1 Pretest

Pretest (see 5.2.3 and 5.2.3.1) all conductor jacket and sheath material to assure that proper adherence with the polyurethane molding or potting compounds can be achieved.

**NOTE**

When any of the insulation, jacket, or sheath material will not adhere properly, heat-shrinkable tubing conforming to SAE-AMS-DTL-23053/1 or /5 may be used as a base material where the polyurethane would be in contact with the jacket or sheath.

##### 5.2.1.1.2 Cleaning

To ensure proper adhesion of the potting compound to all components of the connector, the inner body of the connector, wires, boot, and all other materials that will contact the compounds must be clean and free of any trace of contaminants. Any contaminated surface shall be cleaned by using a small stiff-bristled brush and isopropyl alcohol.

**CAUTION**

Do not expose wire insulation to the cleaning solvent beyond the time required for adequate cleaning.

#### 5.2.1.2 Potting or Molding Over Epoxy

When potting or molding over epoxy, abrade, break sharp edges, and clean surface outside of the conductor bundle (see 5.2.2.3 and 5.2.2.4).

### 5.2.2 Preparation of Connectors

#### 5.2.2.1 Protection Caps

Protection caps shall be used at all times, including shipment, except during processes requiring mating connectors.

#### 5.2.2.2 Mating Connectors

Mating connectors are recommended for use when potting or molding connectors with resilient rubber inserts. If mating connectors are not used, the fabricator must ensure that the contacts will stay in alignment and positions. After mating connectors, back off coupling nut sufficiently to decompress insert materials. Salvaged connectors may be used for mating if pins, sockets, or other mating parts are not damaged.

#### 5.2.2.3 Abrading

Mask or otherwise protect conductors and finish of connectors and adapters in areas not specified to be abraded during the abrasion operation. Roughen (abrade) the rear surfaces of connectors that will contact potting or molding materials, using sandpaper or other approved materials to remove slick surfaces. Carefully remove all grit from assembly. Clean all connector threads and coupling nuts with isopropyl alcohol to remove all grease, lubricants, and foreign matter. Abrade rear threads of connector and threads of metal potting-molding adapter (where used) with sandpaper or other approved material so that the smooth surface is removed. Do not abrade connector-front mating threads, mating threads of coupling nut, or any surfaces that do not contact potting or molding materials except connector-adapter interfaces. Abrade and prime flat butt surfaces of connectors, where applicable, to ensure adhesion of polyurethane. This process is required for jam-nut connectors and shall apply for similar-type connectors.

#### 5.2.2.4 Priming

On surfaces that will contact potting or molding compound, check for cleanliness, prime with primer supplied by manufacturer of the potting compound to be used, and apply primer in accordance with the manufacturer’s instructions. Check rear connection threads and mating-thread areas of adapter for cleanliness; prime with thread-seize primer; and coat with thread-seize compound (Loctite® 609 or equivalent).

### 5.2.3 Preparation of Cable

Proper preparation of cable assemblies depends on the applicable molding or potting compound

and primer for the sheath material to be used. To determine whether the sheath material is neoprene, polyvinyl chloride (PVC), or chlorinated polyethylene (CPE), touch a hot soldering iron to a scrap portion of the sheath material. If the sheath is PVC, it will melt and string out. If it is neoprene, the immediate area touched will crack and harden. If it is polyethylene, it will melt but not string out.

#### 5.2.3.1 Primer

There are many types and formulations of neoprene, PVC, and CPE jacket material. The use of a primer may be necessary for some of these. Primers shall be of the type recommended by the manufacturer of the material. For CPE test production samples, see 5.2.3.5. Cable jacket that will reside within the mold form shall be free of any foil tape or other non-jacket material prior to priming.

#### 5.2.3.2 Wicking

To prevent wicking from occurring during cable molding or potting operations using elastomeric compounds where cable jacket (sheath) material used is shrink tubing, seal the cable jacket (sheath) terminations with an elastomeric dielectric sealant (see 4.1.2). The seal shall be made at the jacket (sheath) termination and sealant flow shall be directed around and through all conductors. The sealant shall not exceed 6.4 mm (1/4 in) above termination into the jacket (sheath). The diameter of the seal shall not exceed the cable diameter, including the cable jacket (sheath), and the overall length shall be 19.0 mm (3/4 in) maximum. The sealant shall be processed in accordance with the manufacturer's instructions.

#### 5.2.3.3. Preparation of Neoprene Sheath

Neoprene sheath cables shall be prepared as follows:

a. Use MEK to remove all grease, oil, wax, and other contaminants from the area to be covered by the molding or potting compound.

b. The sheath shall be abraded 6.35 mm (1/4 in) ± 1.5 mm (1/16 in) above the area to be covered with the molding compound. Trimming may be necessary to allow entry into some backshells.

c. Clean the abraded area with a nonmetallic bristled brush.

d. Wipe the abraded area with a clean cloth dampened with MEK, changing the wiping area of the cloth as it becomes soiled. Wipe the cable dry with a clean cloth or dry with a jet of clean, dry air. A disposable wiper may be used in lieu of the cloth.

e. If a primer is required, prime the abraded sheath area with the correct primer for the approved compound. The primer shall be applied 6.35 mm (1/16 in) ± 1.5 mm (1/16 in) above the area to be covered with the molding or potting compound. Allow to dry as instructed by the manufacturer.

#### 5.2.3.4 Preparation of PVC Sheath

PVC sheath cables shall be prepared as follows:

a. Brush or wipe the sheath 6.35 mm (1/4 in) ± 1.5 mm (1/16 in) above the area to be covered with the molding and potting compound with uncontaminated MEK until the surface becomes tacky.

b. If a primer is required, prime the tacky area with the correct primer for the approved compound. The primer shall be applied 6.35 mm (1/4 in) ± 1.5 mm (1/16 in) above the prepared surface to be covered with the molding and potting compound. Allow to dry as instructed by the manufacturer.

#### 5.2.3.5 Preparation of CPE and AS23053 Sheaths

a. Use MEK to remove all grease, oil, wax, and other contaminants from the area to be covered by the molding or potting compound.

b. The sheath shall be abraded 6.35 mm (1/4 in) ± 1.5 mm (1/16 in) above the area to be covered with the molding compound. Trimming may be necessary to allow entry into some backshells.

c. Clean the abraded area with a nonmetallic bristled brush.

d. Wipe the abraded area with a clean cloth dampened with MEK, changing the wiping area of the cloth as it becomes soiled. Wipe the cable dry with a clean cloth or dry with a jet of clean, dry air. A disposable wiper may be used in lieu of the cloth.

e. If a primer is required, prime the abraded sheath area with the correct primer for the approved compound. The primer shall be applied 6.35 mm (1/4 in) ± 1.5 mm (1/16 in) above the area to be covered with the molding or potting compound. Allow to dry as instructed by the manufacturer. Note: Primer not required for AS23053 type jackets.

### 5.2.4 Potting Setup

Potting setup shall be as follows and shall meet the requirements in 120E3100003:

a. Assemble the mating connector (see 5.2.2.2) to ensure proper contact alignment during potting. The mating connector shall remain in place until sufficient curing time has elapsed.

b. Clamp the connector in an upright, level, and secure position to prevent any movement of the components. The wire or cable shall be clamped in a vertical position to avoid any strain on the terminal joints.

c. The wire bundle shall be centered with respect to the connector and potting boot. Bundling shall not cause conductors to impose lateral strain on terminals. Unless otherwise specified, lateral clearance to surface of potting boot shall be 1.5 mm (1/16 in) minimum for all internal parts and end of sheath.

### 5.2.5 Mold Preparation

It is recommended that molds be prepared as follows and shall meet the requirements in 120E3100003:

a. Examine and clean all surfaces and vent ports prior to each use.

b. Dip molds in SS bucket, positioned inside vent hood, or use aerosol spray of approved mold release and air dry on drip table/rack positioned inside vent hood. See Figure 6.

**CAUTION**

If electronic devices are inserted into the molding, be aware of specified high-temperature limit for the devices.

**NOTE**

If a mold is being used for the first time, the molding release application and drying procedure in step b. above shall be performed twice.

### 5.2.6 Molding Setup

The mold shall be assembled as follows:

**NOTE**

Prior to potting or assembly into a mold, electrical connectors shall be inspected for coupling-nut binding. The coupling nut must rotate as freely as required for proper connector engagement.

a. Examine the cable assembly and determine that preparation procedures for neoprene, PVC, or CPE, as applicable, are complete as outlined in 5.2.3.

b. Examine the assembly for freedom from contamination and foreign particles.

c. Unless otherwise specified, lateral clearance to the surface of the mold shall be 1.5 mm (1/16 in) minimum from all internal parts and from the end of the cable sheath.

d. When inserting the cable sheath into the mold, the sheath should be pressed as far as possible toward the connector to afford slack in conductors. Shield rings should be checked to ascertain that they are within ± 10 degrees perpendicular to the axis of the cable.

e. Before assembly of mold halves, all requirements of configurations and dimensions should be fully checked against Table 1 in Appendix A and the design drawings as specified. Where configuration and dimensional requirements are hampered, consult cognizant design activity before molding.

f. Assemble the two half-sections of the mold around the cable assembly.

g. Before tightening the clamping screws, examine the assembly for correct alignment and positioning of the cable and connector.

h. Tighten the clamping screws sufficiently to prevent leakage of the compound.

i. Clamp the assembled mold and cable in a vertical, level, and secure position with the cable connector down. The cable shall be vertically clamped above the mold to maintain alignment.

j. The mold shall be clamped to restrict movement while compound is injected.

## 5.3 Preparation of Compounds

### 5.3.1 Epoxy Potting Compounds

#### 5.3.1.1 Two-Part Compounds

Verify that the two-part material, resin, and activator shelf life have not expired. For automated meter/mix/dispense machines, follow manufacturer's instructions for compound preparation and injection. For manual preparation, use the following steps in preparing the compound for application:

a. Place both parts (in the proper proportional ratios) in a clean, dry, nonporous container having a capacity of at least four times the volume of the combined parts. Blend the parts thoroughly by mechanical agitation or by stirring with a clean metal spatula. Avoid fast stirring that may entrap excessive air and reduce application life.

b. Place the container in a vacuum chamber and reduce the pressure to a maximum absolute pressure of 3.4 kPa (0.5 psi). Maintain this pressure until foaming subsides, but not more than 20 minutes.

c. Transfer the mixed compound from the mixing container to the injection-gun cartridge by carefully and slowly pouring the compound down the inside of the cartridge, using care not to entrap air, until the desired level in the cartridge is reached. Put the plastic plunger in place and insert the cartridge into the gun.

**NOTE**

Do not degas the compound by use of a centrifuge.

#### 5.3.1.2 Proportioned Disposable Cartridge Epoxy (SemKit)

Prepare per manufacturer's instructions.

### 5.3.2 Preparation of Elastomeric Molding Compounds

#### 5.3.2.1 Liquid

The liquid compound shall be two-part units, consisting of base resin and activator. Verify that

the shelf life of the compounds has not expired. For automated meter/mix/dispense machines, follow manufacturer's instructions for compound preparation and injection. For manual preparation, use the following steps:

**CAUTION**

Use premeasured kits as supplied by the manufacturer. Do not use broken or partially used kits.

a. Examine the contents of the base resin and activator for solidification.

b. If either of the parts has thickened, solidified, or crystallized, heat the part to the manufacturer's recommended temperature. When heating, a thermometer shall be used to determine the actual material temperature. Stirring is essential during heating to assure uniformity and to hasten the melting procedure. Allow both parts to cool in room ambient temperature at 21 °C to 24 °C (70 °F to 75 °F) before mixing. Do not artificially cool the material.

c. Place the base resin and activator in a clean, dry nonporous container having a capacity of at least six times the volume of the combined parts. Blend the parts thoroughly by mechanical agitation or by stirring with a clean metal spatula. Avoid fast stirring that may entrap excessive air and reduce application life.

d. Place the container in a vacuum chamber and reduce the pressure to a maximum absolute pressure of 3.4 kPa (0.5 psi). Maintain this pressure until foaming subsides, but not more than 20 minutes.

**NOTE**

Do not degas the compound by use of a centrifuge.

e. Transfer the degassed compound into the injection-gun cartridge by flowing the compound down the inside of the cartridge, using care not to entrap air.

f. Put the plastic plunger in the cartridge next to the molding and potting material. Exercise care not to entrap air while inserting the plunger.

#### 5.3.2.2 Thawing of Premixed, Frozen Cartridges

It is recommended that the thawing time and temperature of the frozen cartridges be closely controlled to obtain sufficient application life. An increase in either thawing time or temperature will reduce application life, and a decrease in either thawing time or thawing temperature will result in an incomplete thaw. The results are the responsibility of the molding facility. The following steps are recommended for thawing premixed, frozen cartridges:

a. When stored at –4 °C to –7 °C (–40 °F to –45 °F), remove the cartridge from storage and thaw for 30 minutes ± 1 minute at 49 °C ± 5 °C (120 °F ± 9 °F). When stored at –26 °C to –28 °C (–78 °F to –83 °F), remove the cartridge from storage and thaw for 40 minutes ± 1 minute at 49 °C ± 5 °C (120 °F ± 9 °F).

**NOTE**

A heating block or controlled heat lamps may be used for thawing frozen cartridges. Other thawing methods may be used upon approval by the procuring activity.

b. During the thawing process, the cartridge shall be maintained in an upright position, nozzle-end down with cap plug in place, to prevent air from entering and becoming trapped within the compound.

c. Completely thaw and check the plunger to make sure that no air is entrapped.

d. When once thawed, premixed frozen cartridges shall not be refrozen. The cartridges shall not be used after application life has expired.

### 5.4 Potting Instructions

Epoxy or elastomeric compound shall be used for potting, as specified by the contracting officer. The following suggested potting techniques vary from shop to shop because of equipment, facilities, or experience of personnel.

#### 5.4.1 Inspection

Examine cable assembly and determine that preparation procedures, as applicable, are complete and that assembly is free of contamination and foreign particles. Provide a small sample of the potting compound for later Shore hardness testing. The sample shall be cured in the same environment as the connector(s) being potted.

#### 5.4.2 Injection

a. Ensure that a cartridge of prepared compound is ready for use with the injection gun.

b. When an air-powered injection gun is to be used, attach the injection gun to the air supply (see 4.3.3 and 4.3.7) using the applicable hose connection. Attach the correct-size gun nozzle suitable for the potting job and adjust air pressure for a slow, even flow of compound [approximately 69 kPa to 103 kPa (10 psi to 15 psi) (gage)].

c. Test the injection gun for a free and even flow of compound from the nozzle.

d. Carefully insert the nozzle tip near the bottom of the connector for flow of compound around terminals (see alternate step e., below). Set the compound flow evenly by keeping the nozzle tip at the swell level. Avoid air entrapment during the flow operation.

e. When necessary, drill a 6.4 mm (1/4 in) access hole in the boot 6.4 mm (1/4 in) above the back edge of the connector and insert nozzle tip. Tape hole when filling is complete.

f. If the compound rises unevenly, reposition the nozzle to allow level distribution. When repositioning the nozzle, the flow of compound should be stopped. Lifting the nozzle

while the compound is flowing will cause folding and voids in the fill.

g. Continue injection of the compound until the boot is full or predetermined level is attained. Allow the compound to settle for 5 minutes. This lets any entrapped air escape. When the compound settles, replenish to the required convex level. Do not allow the compound to enter the bonding holes on the molding adapter.

h. Cover exposed connections with compound.

i. If no injection gun is available, introduce the compound into the prepared connector by carefully hand-pouring the compound down one side of the connector in such a manner as to allow the compound to flow between the wires and contacts, entrapping a minimum amount of air. Fill the connector to the predetermined level, allow to set for 5 minutes, then fill to the required convex level.

j. The use of a heat gun is approved to aid in removing surface air bubbles as the compound settles during its work life. Past the work life of the compound, bubbles and/or voids greater than 1/8” shall be cause for rejection.

### 5.4.3 Curing

Curing schedules shall be selected from those recommended by the manufacturer. Cure conditions (time and temperature) may vary based on application requirements, curing equipment, oven loading and actual oven temperatures.

### 5.4.4 Inspection After Curing

#### 5.4.4.1 Connectors

After curing, inspect pins for length and condition according to NASA-STD-8739.4.

#### 5.4.4.2 Potting

The potted cable shall be inspected by Quality Assurance personnel for hardness, general appearance, and quality of workmanship. The surfaces of the potted area shall be free from voids, bubbles, tackiness, soft spots, cracks, lumps, or any defect indicative of low quality or poor workmanship. Voids and bubbles less than 1/8” shall not be cause for rejection. The hardness shall be determined by three readings of a Shore Instrument and Manufacturing Company durometer, or approved equivalent, using D scale for epoxy or A scale for elastomeric compound. The hardness of the cured material shall conform to the approved products list hardness rating for each applicable listed product.

**CAUTION**

Inspection personnel shall use care in handling assemblies potted with epoxy resins. The rigid, sharp edges of the cured resins in contact with the cable sheath may cut, mar, or mutilate the sheath material if the cable is forcefully handled.

### 5.4.5 Repair

Rework or repair of individual defects shall be at the discretion of the procuring activity. Repairable or reworkable defects shall be limited to those capable of being repaired or reworked without affecting serviceability or leaving undesirable latent defects. After repair or rework, the assembly shall be inspected to determine conformance to 5.4.4.

## 5.5 Molding Instructions

The following suggested molding techniques may vary from shop to shop because of equipment, facilities, or experience of personnel.

### 5.5.1 Inspection

Prior to molding, examine the setup and determine that preparation, in accordance with 5.2.6, has been made and is in order. Provide a small sample of the molding compound for later Shore hardness testing. The sample shall be cured in the same environment as the connector(s) being molded.

### 5.5.2 Injection

a. The injection gun should have a cartridge of prepared compound inserted and ready for use.

b. Attach the injection gun to the air supply (see 4.3.7) using the applicable hose connection. Attach the correct size gun nozzle suitable for the molding job and adjust air pressure for slow, even flow of compound (approximately 69 kPa to 103 kPa [10 psi to 15 psi (gage)]).

c. Test the injection gun for free and even flow of compound from the nozzle.

d. Place the nozzle of the loaded cartridge into the injection port or mold, maintaining the required pressure. Force the molding compounds slowly into the mold until the compound emerges from the vent holes.

e. Slowly withdraw the gun nozzle from the injection port and maintain the required pressure on the gun to allow the injection port to be filled with compound. Plug the injection port and allow the compound to settle in the mold.

f. Allow 15 to 20 minutes for settling, then inject additional compound into the mold until

the compound is flowing from the vents. Slowly withdraw the gun nozzle from the injection port, maintaining the required pressure on the gun to allow the injection port to be filled with compound.

g. Plug the injection port on the side of the mold.

### 5.5.3 Curing

#### 5.5.3.1 Curing Schedule

Curing schedules shall be selected as recommended by the manufacturer. Cure conditions (time and temperature) may vary based on application requirements, curing equipment, oven loading and actual oven temperatures.

#### 5.5.3.2 Molded Assembly

The molded assembly shall be submitted for inspection only after the assembly has been fully cured and cooled to room temperature.

### 5.5.4 Inspection After Curing

#### 5.5.4.1 Inspection Test

The molded cable shall be inspected by Quality Assurance personnel for hardness, general appearance, and quality of workmanship. The hardness shall be determined by three readings using a Shore Instrument and Manufacturing Company scale durometer, or an approved equal. The hardness of the cured compound shall conform to the approved products list hardness rating for each applicable listed product. The molded or potted surfaces shall be free of surface bubbles, blisters, tackiness, gas pockets, and other defects.

**NOTE**

Some rejected assemblies may be used as test fixtures or emergency spares or may otherwise be acceptable to the United States Government. Other rejected assemblies may possibly be reworked or used for mating purposes; therefore, potted or molded assemblies that have been disqualified or rejected shall not be destroyed until the cognizant design activity has been notified and discrepancies have been discussed with an inspection representative.

#### 5.5.4.2 Transparency

When drawings specify clear or transparent molding, some coloration or cloudiness is allowable.

Degree of transparency shall be such that after curing, shield rings, conductors, and other internal details shall be visible under ordinary light approximately 430.6 lux (40 foot-candles) to the unaided eye. Bubbles from trapped voids shall be permissible if not more than 3.2 mm (1/8 in) in diameter and not closer than 1.6 mm (1/16 in) to conductor terminations or mold outer surface.

There shall be no more than five visible bubbles as described above, per cubic inch, in any one mold.

#### 5.5.4.3 Adhesion

After full cure and after the assembly has cooled to room temperature, the cable shall be flexed five times at the tapered molded portion to determine whether the material is securely bonded to the cable. Separation of the material from the cable or connector shall be cause for rejection. If any gap or de-bonding is evident after flexing, refer to Repair and Rework section below. In no instance shall undue force be applied in order to determine adhesion. A blunt probe made of wood or plastic shall be used to test the adhesion of the molding or potting compound the electrical connector. Care shall be taken to avoid damage to the assembly during inspection.

#### 5.5.4.4 Connectors

After curing, inspect pins for length and condition according to NASA-STD-8739.4.

### 5.6 Repair and Rework

#### 5.6.1 Repairable Defects

Repairable defects shall consist of those defects capable of repair without affecting serviceability or without leaving undesirable latent effects as determined by the procuring activity. After repair, the assembly shall again be inspected to determine conformance to 5.5.4.1 and 5.5.4.4.

#### 5.6.2 Rework Procedure

#### 5.6.2.1 Minor Cavity

In situations where a minor cavity defect is present on a molded surface, the following rework procedure is permissible:

a. Determine that the rework surface is clean.

b. Remove contaminants by wiping with MEK.

c. Prepare approved patch compound in accordance with the manufacturer's instructions and fill the cavity with mixed compound.

d. Position a sheet of polyethylene film, or other proper mold, over the filled cavity and tape securely in place using heat-resistant, pressure-sensitive tape or mold-tightening screws.

e. Cure according to the manufacturer's instructions.

f. Remove tape and polyethylene film, or the mold.

#### 5.6.2.2 Major Cavities

In situations where major cavity defects are present on the molded surface, the following rework procedure is permissible:

**NOTE**

Where the cavity defects are present only in the taper portion of the mold, confine the rework procedure to this taper portion of the mold only.

a. Mask the entire outside of the electrical connector with four or more tape wraps. Mask cable sheath immediately adjacent to the termination of the taper portion of the cable molding with four or more tape wraps.

b. Use a high-speed rotary tool, equipped with a cutter bit to remove a maximum of 2.54 mm (0.100 in) ± 0.064 mm (0.0025 in) from the entire surface or from the taper portion only of the cable molding.

**CAUTION**

Extreme care must be exercised by the operator to avoid nicking or in any manner touching the cutter to the electrical connector or cable sheath.

c. Clean the area to be repaired with a nonmetallic bristled brush or apply a jet of clean, dry air 620 kPa (90 psi) (gage) maximum to the area.

d. Using a mold identical to the mold with which the original molding was accomplished, remold in accordance with 5.5.2.

e. Curing shall be completed in accordance with 5.5.3.

### 5.6.3 Inspection

All rework shall be inspected as outlined in 5.5.4.

## 5.7 Reports

Reports shall be as required by the procuring activity.

# 6. NOTES

## 6.1 Intended Use

This standard is intended to be used in the establishment of uniform engineering practices and methods and to ensure the inclusion of essential requirements in the fabrication of electrical terminations for cables used in instrumentation and control systems of facilities, systems, and equipment used to support the operations of test, checkout, servicing, and launch of space vehicles and payloads at KSC.

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## APPENDIX A. MOLD ADAPTER CONFIGURATION AND DIMENSIONS

This Appendix details mold adapter definitions and dimensions. Mold sizes are provided in the Last Column of the Mold Adapter drawings, 120E0600001 and KT02415. Table 1 provides dimensions defined in Figure 1.

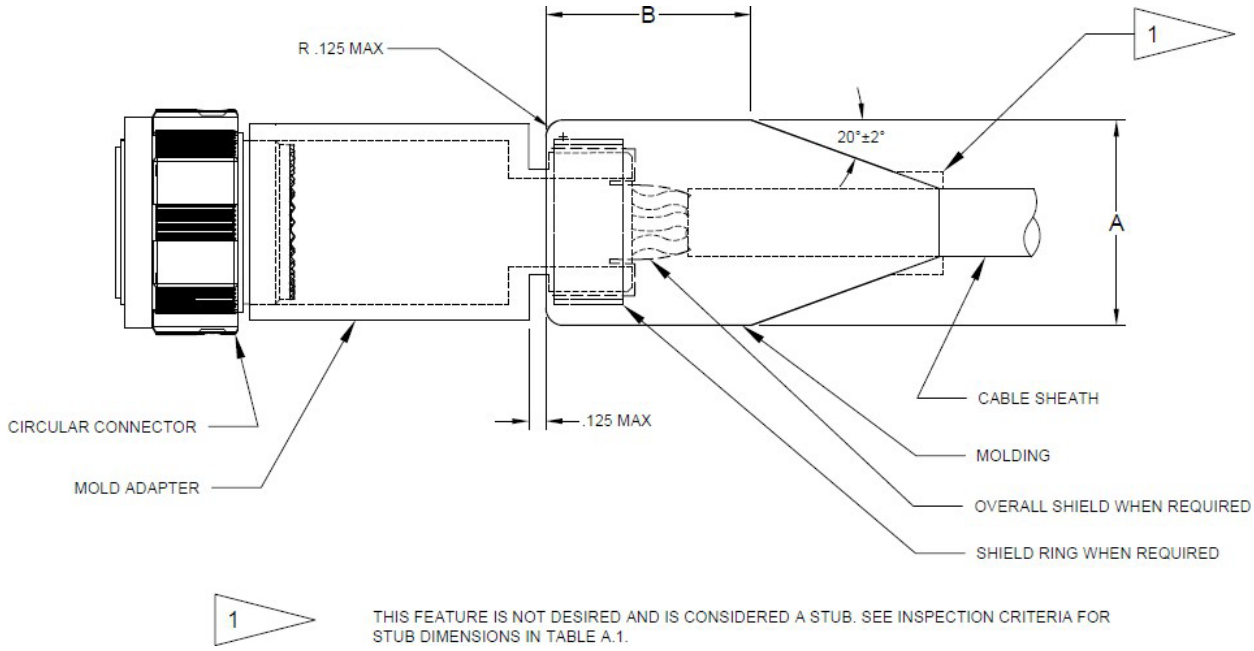



**Figure 1. Mold Adapter Definitions and Dimensions**

## Table 1. Mold Size Dimensions

| | A | B | | |
|---|---|---|---|---|
| | MOLD DIAMETER | BARREL LENGTH | Mold Stub Diameter | Mold Stub Length |
| MOLD SIZE (MS) | In (-.040/+.125) | In (-.125/+.125) | In (max) * | In (max) |
| #8 | 0.853 | 0.800 | 0.125 | 0.125 |
| #10 | 1.120 | 1.000 | 0.125 | 0.250 |
| #12 | 1.188 | 1.000 | 0.250 | 0.250 |
| #14 | 1.312 | 1.000 | 0.250 | 0.250 |
| #16 | 1.430 | 1.000 | 0.250 | 0.250 |
| #18 | 1.567 | 1.370 | 0.250 | 0.375 |
| #20 | 1.760 | 1.370 | 0.375 | 0.500 |
| #22 | 2.000 | 1.500 | 0.375 | 0.500 |
| #24 | 2.000 | 1.750 | 0.375 | 0.500 |
| #28 | 2.250 | 1.875 | 0.500 | 0.750 |
| #32 | 2.500 | 2.000 | 0.500 | 0.750 |
| #36 | 2.750 | 2.250 | 0.500 | 0.750 |
| #40 | 3.000 | 3.000 | 0.500 | 0.750 |
| * - Mold Stub Diameter = Cable Diameter plus Dimension in Table | | | | |

# APPENDIX B. GUIDELINE FOR FABRICATING MOLDS USED WITH ELASTOMERIC COMPOUNDS TO MOLD ELECTRICAL CONNECTORS AND CABLE SHEATHS

## B.1 Introduction

This guideline provides information to aid electrical cable fabricators to meet the requirements of KSC-STD-132. These guidelines include information on making patterns (also known as "billets"); mold boxes in which patterns are placed for casting molding compound in order to make mold halves; and machining, assembling, and preparing molds to the cable assembly.

Although requirements are stated in the main text of KSC-STD-132, some text is repeated here for reference and clarity. This guideline covers both the shop and field processes for potting and molding (prepotting and overmolding) KSC electrical cable assemblies.

Mold boxes and patterns may be fabricated using alternate techniques and materials with engineering approval. Details on materials used and conformance to mechanical requirements stated herein shall be provided.

## B.2 Reference Documents

a. 120E0600001 or KT02415, Adapter Connector Molding 360° Shield Termination, provides dimensions for patterns, molds, and marking.

b. 120E3100003, Electrical Fabrication Requirements, provides an overall reference to other related requirements.

## B.3 Definitions

For the purpose of this document, the following definitions shall apply.

**pattern (also called "billet"):** a physical representation of a completed cable mold that has been split into equal halves. Each half is attached to the inside of a mold box's side for alignment and to cast the mold. See Figure 2.

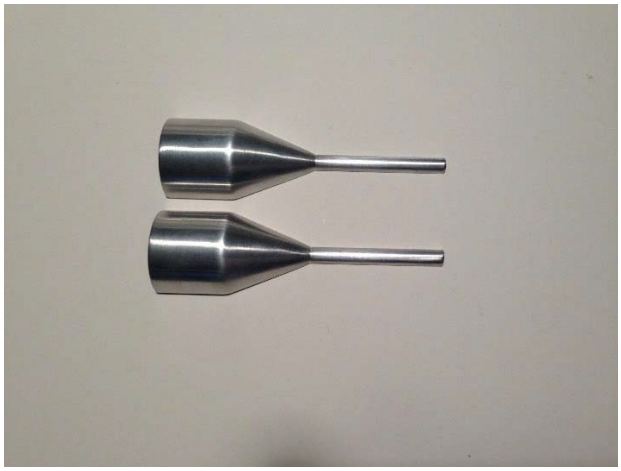


**Figure 2. Typical Pattern (also called "Billet")**

**mold box:** a container used to cast a mold half. Two mold boxes are required to cast the mold pattern, or one mold box could be used twice to provide the complete pattern. See Figure 3.

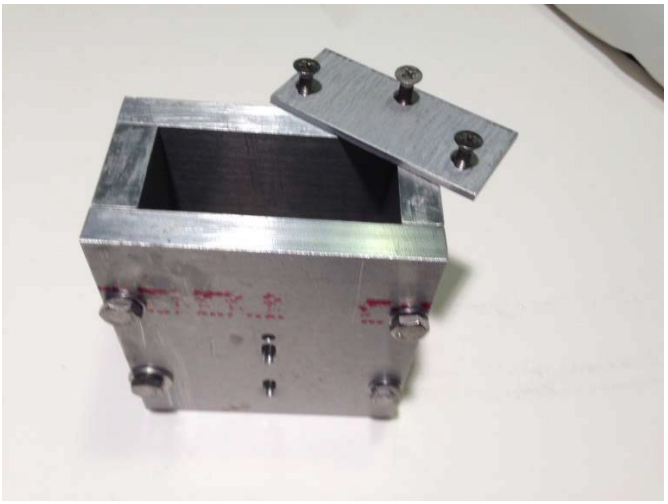


**Figure 3. Typical Mold Box with Bottom Insert Resting on Top**

**mold:** the hollow epoxy-based container used to give shape to a two-part mix of liquid elastomeric compound cast into a mold box. See Figure 4.



**Figure 4. Completed Mold Halves with Completed Cable Assembly End**

**molded cable assembly:** the overmolded encapsulation of a connector backshell to a cable sheath for a cable assembly. See Figure 5.



**Figure 5. Typical Cable Assembly Showing One End Terminated**

## B.4 General Guidelines

a. Pattern dimensions should be consistent with connector molding ring adapter sizes and cable sheath diameters to prevent leakage of the polyurethane molding compound. Patterns are best made using aluminum 6061-T6 polished on the mold facing surfaces to at least a 25 microfinish; however, a smaller microfinish is preferable to ensure a glossy end product. Patterns can be made from bar stock, turned in a lathe to the correct size, and precisely parted using an electrical discharge machining (EDM) resulting in no more than 0.254 mm (0.010 in) out-of-round when the halves are mated. The use of the EDM process is recommended. The patterns can also be made from two aluminum blocks joined together with flat surfaces and the block's ends tack-welded then machined in a lathe to meet the correct size.

b. Mold boxes should be made using aluminum 6061-T6 stock plates that are 0.375 in to 0.500 in thick. The inside dimensions of the mold box should accommodate an adequate thickness of the Magnolia 1012 or Magnobond 6021A/6004B epoxy to provide strength and sufficient mass to maintain proper heat distribution when curing the polyurethane compound. Alignment of the mold halves is important to ensure the polyurethane cable mold is symmetrical. A mold release is needed in the mold's cavity to prevent a pattern from sticking to the epoxy mold.

c. Mold details include alignment of the mold halves to drill the clamping bolt holes using an internal plastic alignment "shop aid" to match the position of each mold half when mated to accurately drill the bolt holes. An alternate alignment method is to mate and match the pattern halves, rotating them from the casting position and placing them back into the mold's cavity, and then to close and clamp the mold and drill the holes. There should be at least two bolt holes on each side of the mold to provide clamping and proper sealing to prevent any polyurethane compound leakage. Alignment pins could be considered for ensuring acceptable alignment; however, maintaining close tolerance of the bolt hole's internal diameter and the bolt's outer diameter can achieve proper alignment. Once the mold halves have been bolted together, fill holes and vent holes can be added to the mold. Holes are needed for accessing the mold cavity to fill and vent the epoxy mold.

d. Machining the mold is necessary for providing precision holes for clamping the mold halves together, providing a hole to insert liquid polyurethane into the mold cavity, venting the cavity as it is being filled, determining the cavity is completely filled, and releasing any bubbles that may have developed while filling. Drilling a proper size hole in the aluminum plate is necessary for assembling the mold to the molding ring adapter. A proper-size hole is also necessary on the rear of the mold for clamping the cable sheath.

e. Mold boxes may be fabricated using 3D printing technology with engineering approval. Details on materials used and conformance to mechanical requirements stated herein shall be provided.

## B.5 Detailed Guidelines

### B.5.1 Pattern Details

a. Dimensions for the patterns can be found in Appendix A for mold sizes called out in 120E0600001 or KT02415.

b. The connector end of the pattern should have a slight radius, approximately 1.5875 mm (1/16 in) into 3.175 mm (1/8 in), where the pattern interfaces with the aluminum end plate inside the mold box. This interface should never be 90 degrees because right angles tend to attract and capture bubbles in the mold compound while the mold cavity is being filled with the mold compound Magnolia 1012 or Magnobond 6021A/6004B epoxy. Note the 20-degree taper of the pattern that provides strain relief between the connector and the cable.

c. The pattern's cable sheath end should measure 6.35 mm (1/4 in) diameter and extend beyond the top of the Magnolia 1012 or Magnobond 6021A/6004B epoxy mold. This provides a 6.35 mm (1/4 in) hole in the mold in order to provide a center for the correct-size hole in the mold for clamping the cable sheath.

d. The outside diameter of the finished molded assembly should be approximately 3.175 mm (1/8 in) or larger in diameter than the diameter of the molding ring adapter's largest diameter, Dimension G in 120E0600001 or KT02415.

e. The pattern should be turned to size from a round aluminum 6061-T6 bar stock of a size nearest the final outside diameter of the pattern and cut precisely in half using an EDM that removes no more than 0.254 mm (0.010 in) of material during the cut. This should be the least expensive method for fabricating the patterns.

f. The finished side that will contact the mold should be polished to achieve at least a 25 microinch surface, preferably less for an almost mirror finish.

g. The flat or underneath side surface should be permanently marked to identify its use for making other molds. This flat side should have two holes along the center of the long axis to mount the pattern inside the mold box.

h. The holes should be drilled and tapped for 1/4-20 in machine screws approximately 25.39 mm (1.0 in) apart on the center of the long axis to mount patterns inside the mold box. These holes should match the holes located in the mold box.

i. The finished mold halves should be stored together and wrapped in a soft material to prevent any damage or scratches to the pattern's surfaces.

j. Patterns should be marked to identify their use, be protected in storage, and be capable of multiuse applications.

k. Multiuse means "many times," as well as for use with different-diameter cable sheaths.

l. The pattern should be coated with paste wax, such as Meguiar's Cleaner Paste Wax (part number A1214) or equivalent, to prevent the pattern from sticking to the Magnolia 1012 or Magnobond 6021A/6004B epoxy in the mold box.

**NOTE**

Valspar 225 or ReleaSys 89S mold release is used on cable molds only before being filled with polyurethane molding compound to prevent the finished molded cable from sticking to the Magnolia 1012 or Magnobond 6021A/6004B epoxy mold.

m. A drawing/sketch should be made to document each pattern's dimensions.

### B.5.2 Mold Boxes Details

a. Mold boxes should be made using aluminum 6061-T6 stock plates that are 0.375 in to 0.500 in thick.

b. The inside dimensions of the mold box should allow a minimum thickness of 15.875 mm (5/8 in) from the inside of the mold cavity to the outer sides of the mold.

c. For each mold, two mold boxes should be drilled alike for attaching the patterns inside the mold box so that the resultant mold will be aligned.

d. Magnolia epoxy (part number 1012) or Magnobond 6021A/6004B should be used to cast the molds.

e. The inside of the mold box should be coated with paste wax, such as Meguiar's Cleaner Paste Wax (part number A1214) or equivalent, to prevent the pattern from sticking to the Magnolia 1012 or Magnobond 6021A/6004B epoxy in the mold box.

f. Dimensions for fabricating mold boxes have not been formally documented. These dimensions can be determined by the pattern size.

g. The material presently used to fabricate the mold boxes is 1/2 in-thick aluminum 6061- T6. A 3/8 in-thick plate could be substituted, but no less thickness should be considered because the mold box needs metal mass in order to be strong and to conduct heat evenly to the Magnolia 1012 or Magnobond 6021A/6004B epoxy during the curing time in the oven.

h. The mold boxes should be marked to identify their application for use with different molds. See 120E0600001 or KT02415, sheets 2 through 5, which specify the mold sizes in the last column to the right. Mold boxes will need an aluminum plate placed in the bottom for insertion to the bottom of the epoxy mold. See Figure 3.

### B.5.3 Mold Details

a. A 1/8 in aluminum 6061-T6 plate, sized to fit snugly inside the mold box, is placed at the bottom and secured with fasteners that will be cast into the bottom of the mold material. This plate strengthens the forward part of the mold to prevent the epoxy from breaking where it meets the molding ring adapter groove. See Figure 3.

b. The pattern halves should be bolted snug-tight inside the mold boxes.

c. Machining may begin once the mold half is cast, cured, and returned to room temperature, and the mold halves are aligned, mated, and temporarily clamped.

d. Before machining, a drawing/sketch should be made for each type of mold assembly and kept as a record during fabrication.

e. Bolt holes for clamping should be drilled precisely to ensure proper alignment. When using 3/8 in bolts for clamping, the bolt holes should be drilled no larger than 0.385 in to ensure a compliant alignment.

f. There should be at least two bolt holes on each side of the mold. Once the bolt holes are drilled, four bolts should be used to clamp the two mold halves together.

g. After the mold halves are bolted together, the hole for mating the aluminum plate to the molding ring adapter can be drilled, as specified in 120E0600001 or KT02415, Column M, sheets 2 through 5.

h. After measuring the cable sheath diameter, the hole for clamping the cable sheath can be drilled in the rear of the mold.

i. A fill hole is drilled to accommodate a 1/4-20 inch plug. It is located close to the bottom of the mold to ensure that the compound rises from the bottom to the top in the mold cavity. See Figure 4.

j. After these holes have been drilled, the mold is opened and each half can be machined to provide two vent holes at the top of the cavity mold.

k. The vent hole should be approximately 4.7625 mm (3/16 in) wide by 3.175 mm (1/8 in) deep, making the total size of 4.7625 mm (3/16 in) by 6.35 mm (1/4 in) deep when reassembled. Note the typical finished cable assembly shown in Figure 5.

l. Before being used, the Magnolia 1012 or Magnobond 6021A/6004B epoxy mold halves are dipped in Valspar 225 or ReleaSys 89S mold release and placed in a rack to drip-dry. See Figure 6.



**Figure 6. Drip Table/Rack and Tilted Mold Boxes for Releasing Entrained Air**

a. Before the mold is closed, the cable assembly's configuration is visually checked to verify that the cable assembly fabrication requirements of 120E3100003 have been met.