

Cable/Harness Molded Backshell Design

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1. [E] PURPOSE

This document provides design construction details for potted, poured, or injection molded backshells used in conjunction with connectors in cable and harness assemblies. Cable and harness drawings reference this document to provide additional design details about molded backshells that would normally be provided on the drawing itself. This document provides a consistent manner of showing molded backshell construction details in a manner acceptable to manufacturing and engineering and reduces time spent duplicating information on each drawing. In addition, this document provides molding details or processes that are "approved by L3 Engineering" as stated in some L3 cable and harness heritage drawings mold notes. Some heritage mold notes do not call out specific molding materials and this document also specifies those materials.

2. [-] SCOPE

This document is intended for all L3 cable and harness drawings with molded or encapsulated connector backshells. Newer cable and harness documentation will reference this document directly. Heritage cable and harness drawings with older connector backshell molding notes will also reference this document through the use of Internal Standard IS-001. IS-001 provides for an update to the heritage mold notes to reference this document.

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3. [-] APPLICABLE DOCUMENTS

The following documents are referenced within this document.

3.1 [E] GOVERNMENT DOCUMENTS

Document	<u>Title</u>
Mil-M-24041	Molding and Potting Compound,
	Chemically Cured, Polyurethane

3.2 [E] OTHER PUBLICATIONS

Industry Standards

Document	<u>Title</u>
IPC-620	Requirements and Acceptance
	for Cable and Wire Harness
	Assemblies

L3 Documents and Drawings

Document	Title
IS-001	Use of Non-Specified Hardware/Material
<u>WS-003</u>	Cable Harness Assembly
<u>W-432</u>	Practices for EMC-Electromagnetic Compatibility
<u>W-536</u>	Acceptable Molded Material Repair
60102381	Interpreting L3 Cable/Harness Drawings
<u>1000419170</u>	CSW Injection Mold Material Qualification Test - Low Operating
	Temperature

4. [C] ACRONYMS AND DEFINITIONS

4.1 [G] ACRONYMS

CSW – L3 Communication Systems - West N/A – Not Applicable N/T – Not Tested P/N – Part Number M/N – Material Number

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4.2 [C] DEFINITION	5				
Backshell -	An extension platform, ad ergonomic sl	n of a connector u d strain relief, co hape.	used to provide a b ntact protection, ar	anding nd	
Contact -	Electrically conductive metal used as a mechanical interface to form a mating junction for electrical circuits. Connectors are used to envelope and embody multiple contacts.				
EMI -	An acronym for electromagnetic interference - an electromagnetic field that affects an electrical circuit due to either electromagnetic induction or radiation emitted from an internal or external source.				
First Shot -	Same as Init	ial Molding.			
Initial Molding -	A molding p an existing f over-moldin	rocess used to en orm or shape and g.	capsulate wires for l provide the basic	il, braids or shape for	
Molding Compound	d -Material use	ed to form a mole	led backshell.		
Mold Release -	A compound sticking and	l applied to the su deliver full recov	urface of a mold to very of the molded	prevent part.	
Second Shot -	Same as Ove	er-molding.			
Over-molding -	Molding process over an existing form or shape to create a finished shape; often referred to as second shot molding or final molding. In some cases initial molding and over-molding can be combined into one operation.				
Thermoplastic –	A polymer plastic that softens at a given temperature and solidifies when cooled.				
Thermoset –	A temperature cured polymer that irreversibly sets when cured at a given temperature.				

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5. [-] L3 ENGINEERING APPROVED BACKSHELL MOLDING MATERIALS

5.1 [G] APPROVED INITIAL MOLDING MATERIALS

Material	L3/Supplier & Part Number	Min Op Temp	Max Op Temp	Allowed Mold Release	Allowed Additives
Units	N/A	°F (°C)	°F (°C)	N/A	N/A
Polyurethane (Black)	Mil-M-24041 Category A or B, Type I or II Cytec EN-1556, PPG PR-1592 or PR-1547 (L3 P/N 7919399-XXX or 1000367789)	-70 (-57)	300 (149)	40015088- 000	N/A
Polyester (Black)	40014298-004 ³		Inactive fo	or New Design	
Polypropylene (Black)	7192764-000	-67 (-55) ¹	248 (120)	7184436-00X	N/A
Black Epoxy	S1125 or 7917693-ANY	-67 (-55)	302 (150)	1000371757	7181837
Gray Epoxy	7910812-002	-67 (-55)	180 (82)	1000371757	7181837
Amber Hot Melt ²	1000405169	-67 (-55)	300 (149)	N/A	N/A
Key Tough-Seal 21	1000109516	-67 (-55)	302 (150)	N/A	N/A
Stycast 2651/Catalyst 9	1000140139	-67 (-55) ¹	266 (130)	N/A	N/A
Stycast 2651/Catalyst 11	1000157044	-67 (-55)	311 (155)	N/A	N/A
Sarlink TPV 4180	1000140140	-67 (-55) ¹	212 (100)	N/A	N/A
RTV8111	1000205803^4	-65 (-54)	400 (204)	N/A	N/A

If the parts list contains only one of the approved polyurethane part numbers, manufacturing may use the other depending on availability. Design engineering considers these part numbers to be functionally equivalent (frozen or 2-part) in the final cured state. Any deviation from the parts list shall be documented in SAP ME for the shop order it is used on.

1 See Test Report 1000419170.

- 2 Amber Hot Melt 1000405169 may reflow or soften during post processing steps. Post processing step must not adversely affect connector or contact operation.
- 3 Polyester 40014298-004 inactive for new design due to obsolescence of one ingredient used to prevent moisture absorption.

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4. 1000205803 may be used to facilitate re-workable backshells.

5.2 [G] APPROVED FINAL MOLDING MATERIALS

Material	L3/Supplier & Part Number	Min Op Temp	Max Op Temp	Preferred Mold Release	Allowed Additives
Units	N/A	°F(°C)	°F(°C)	N/A	N/A
Polyurethane (Black)	Mil-M-24041 Category B, Type I or II Cytec EN-1556 or PPG PR-1592 (L3 P/N 7919399-001 or -004 or 1000367789)	-70 (-57)	300 (149)	40015088-000	N/A
Polyester (Black)	40014298-004 ²	Inactive for New Design			
Polypropylene (Black)	7192764-000	-67 (-55) ¹	248 (120)	7184436-00X	N/A
Stycast 2651/Catalyst 9	1000140139	-67 (-55) ¹	266 (130)	N/A	N/A
Stycast 2651/Catalyst 11	1000157044	-67 (-55)	311 (155)	N/A	N/A
Sarlink TPV 4180	1000140140	$-67 (-55)^1$	212 (100)	N/A	N/A
Black Epoxy	S1125 or 7917693-ANY	-67 (-55)	302 (150)	1000371757	N/A

If the parts list contains only one of the approved polyurethane part numbers, manufacturing may use the other depending on availability. Design engineering considers these part numbers to be functionally equivalent (frozen or 2-part) in the final cured state. Any deviation from the parts list shall be documented in SAP ME for the shop order it is used on.

1 See Test Report 1000419170.

2 Polyester 40014298-004 inactive for new design due to obsolescence of one ingredient used to prevent moisture absorption.

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6. [-] MOLDED BACKSHELL DESIGN

The following sections provide details on the different steps for approved L3 molded backshell designs used for cable and harness products at L3.

6.1 [-] INITIAL ENCAPSULATION

The initial encapsulation and contact sealing processes may be used together or independently to encapsulate wires, shields, sleeves, and contacts during the over-molding process.

6.1.1 [E] CONTACT SLEEVING

Exposed contacts not covered by seals or dielectric must be insulated to prevent shorting from contact movement, braids or foil during molding.

6.1.1.1 Use M235053/8-XXX to insulate contacts prior to sealing or encapsulation when needed to prevent shorting.

6.1.2 [G] CONTACT SEALING

Contacts shall be sealed to prevent the escape of molding material. Encapsulation of the connector contacts may be necessary to meet workmanship and design requirements using allowed materials listed in 5.1.

- 6.1.2.1 Addition of an insert support plate for sealing may be used provided it does not interfere with wire insulation or connector strain relief, is encapsulated per 6.1.1, and is defined in the build process.
- 6.1.2.2 Appropriate sealing plugs such as MS27488 or similar may be used to prevent escape of molding material per 6.1.2.
- 6.1.2.3 Connector grommet alterations permitted providing the initial encapsulation process meets the dielectric withstanding voltages for the cable assembly.

6.1.3 [E] WIRE ENCAPSULATION OR INITIAL MOLDING

Wires, shields, and sleeves may require initial encapsulation to complete the over-molding process of a molded connector.

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- 6.1.3.1 Initial encapsulation material not specified on the drawing shall use an approved material per section 5.1.
- 6.1.3.2 Any mold release used shall not leave a film or residue on the final product which affects performance, and as such will not be on the parts list. The use of a mold release is a manufacturing decision to be made by a trained operator. Preferred mold release for a given material is listed in section 5.1.
- 6.1.3.3 Shield and over-braid terminations at foil/solder may be installed after initial encapsulation provided 6.2 is not violated.
- 6.1.3.4 Use solder 7910771-004 when molding.

6.2 [-] MAINTAINING SHIELD INTEGRITY IN BACKSHELL

Molded backshell designs shall maintain full shield coverage (faraday cage) over the signal wires and shields of the cable/harness. The wiring diagram on the cable/harness drawing will depict shielding requirements.

If the metal portion of the backshell (faraday cage) is exposed, the metal backshell shall use the same base material and finish as the connector or galvanically equivalent (maximum anodic index delta of 0.25 volts) material and finish.

If the metal backshell (faraday cage) is not exposed (fully over molded), base material and finish do not need to be the same as the connector. If the backshell is threaded, it shall be torqued per 60083155 or the manufacturer recommendations.

6.2.1 [G] SHIELDED CABLE AND HARNESS ASSEMBLIES

- 6.2.1.1 Molded backshells shall continue the electrical shielding enclosure of the over-braid to fully surround the shielded portion of the cable and harness assembly with an electrically conductive material. The backshell shield completes an electrical grounding connection from the over-braid through the backshell (adapter or platform) to the connector shell using an approved termination method listed below:
 - 6.2.1.1.1 Copper foil P/N 7184944-ANY shall be soldered directly to connector shell (reference figure 1).
 - 6.2.1.1.2 Integral connector banding platform (reference figure 2).
 - 6.2.1.1.3 Threaded banding platforms (reference figure 3).
 - 6.2.1.1.4 Custom threaded banding platforms (reference figure 4).
 - 6.2.1.1.5 Custom threaded solder platforms (reference figure 5).
 - 6.2.1.1.6 Copper foil to threads with solder and clamps 7185011-sized to fit (reference figure 6). When using this method, fold the foil (two layers, adhesive in, under the clamp) to make contact with the threads.

6.2.2 [G] UNSHIELDED CABLE AND HARNESS ASSEMBLIES

6.2.2.1 Connectors not fully shielded shall be over molded per the drawing.



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Figure 4 Tin Plated Brass on Composite



Figure 5 Tin Plated Brass on Conductive Zinc on Conductive Zinc (amber for reference only)



Figure 6 Copper Foil with Solder and Clamp (final 2nd shot omitted for clarity)

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6.3 [-] FINAL MOLDING

The final molding material defines the finished form of the connector backshell and is exposed to the environmental conditions of the cable and harness assembly. There are two types of final moldings that are used by L3; Injection molding and pour/potted molding. The material selected will dictate which molding method is used.

6.3.1 [F] FINAL INJECTION MOLDING

Injection molding is a high pressure mold process that uses a thermoplastic type of mold material.

- 6.3.1.1 Molding material not specified on drawing shall use an approved material per section 5.2.
- 6.3.1.2 Use of tape L3 P/N 7186328 or 40014362, or lacing tie 7910884 to constrain wires and prevent damage is acceptable provided it is removed after injection molding or is fully encapsulated during final molding.
- 6.3.1.3 Mold profiles shall not interfere with hardware operation.

6.3.2 [C] FINAL ENCAPSULATION (POUR/POTTED) MOLDING

Encapsulation molding is a low pressure mold process that uses a thermoset type of mold material.

- 6.3.2.1 Molding material not specified on drawing shall use an approved material per section 5.2.
- 6.3.2.2 Use of tape L3 P/N 7186328 or 40014362, or lacing tie 7910884 to constrain wires and prevent damage is acceptable provided it is removed after encapsulation molding or is fully encapsulated during final molding.
- 6.3.2.3 Any mold release used shall not leave a film or residue on the final product which affects performance, and as such will not be on the parts list. The use of a mold release is a manufacturing decision to be made by a trained operator. Preferred mold release for a given material is listed in section 5.2.
- 6.3.2.4 Mold profiles shall not interfere with hardware operation.

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7. [-] NOTES

7.1 [-] REVISION LEVEL

Changes to this specification are controlled by paragraph rather than by sheet to facilitate word processing and change control. The revision level for this specification is the latest revision letter of any paragraph, figure, or table. Each paragraph, figure, or table has its revision letter enclosed in brackets between its number and its title or caption. The letter for paragraphs, figures, and tables should not be confused with security markings. Security markings are typically enclosed in parentheses rather than brackets.

7.1.1 [-] **REVISION INDEX**

The table of contents, list of figures, and list of tables following the title sheet serve as the revision index for all paragraphs, figures, and tables within this specification. This index identifies the portion of the specification affected by the latest change.

7.1.2 [F] REVISION HISTORY

The revision chronology for changes to this specification is given below.

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REV	DATE	ENGINEER	APPROVAL		DESCRIPTION
			ENGR	PUBS	
-	3/29/2013	Benjiman Potter			Initial Release
А	4/15/2013	Benjiman Potter			Add P/N 7181837 to section 6.1.1 & 6.1.2
В	6/6/2013	Kim Riding			Added mold release to section 5.1 and 5.2. Revised section 6.1.1.
С	5/12/2014	M. Byrne			Added clarity to mold release usage, updated sections 4.2, 5.1, 5.2, 6.1.3, 6.3.2.
D	3/3/2016	K. Bockholt			Revised low temp properties in 5.1 and 5.2 per Test Report 1000419170. Revised 6.1.1 to convey functional requirements.
E	7/5/2016	K. Bockholt			Added Category A and PR-1547 to Polyurethane in 5.1. Added Amber 1000405169 to 5.1. Reformatted 5.1 and 5.2 swapping columns/rows. Created Additive column for 5.1 (thickener) and 5.2. Deleted previous paragraphs 6.1.2.1, 6.1.2.2, 6.1.3.1.1, 6.2.1.1.3.1, 6.2.1.1.3.2, 6.2.1.1.4.1, 6.2.1.1.4.2, 6.2.1.1.5.1, 6.2.1.1.5.2, 6.2.2.2.1.1 and 6.2.2.2.1.2. Changed text under Figures 1 thru 5 to focus on materials. Added two paragraphs to 6.2.
F	5/3/2018	K. Bockholt			Added approved mold materials to 5.1 and 5.2. Added new sections 6.3.1.3. and 6.3.2.4
G	6/18/2020	K. Bockholt			Added approved mold materials to 5.1 and 5.2. Added new backshell FIGURE 6 and related items. Added sealing plugs and grommet alterations. Added solder part number.

8. [-] RECORDS

There are no records associated with this document.