



NAVAIR LAKEHURST

MATERIAL & PROCESS REQUIREMENTS (MPR)

MPR1212

CASTABLE POLYURETHANE REQUIREMENTS FOR ALRE AND SE APPLICATIONS

REVISION T

19 November 2018

MATERIALS ENGINEERING, CODE 4.3.4
NAVAL AIR WARFARE CENTER, AIRCRAFT DIVISION
LAKEHURST, NEW JERSEY 08733

DISTRIBUTION D: DISTRIBUTION AUTHORIZED TO DOD AND DOD CONTRACTORS ONLY;
CRITICAL TECHNOLOGY. 19 November 2018. OTHER REQUESTS FOR THIS DOCUMENT SHALL BE
REFERRED TO COMMANDING OFFICER, NAVAL AIR WARFARE CENTER, AIRCRAFT DIVISION,
LAKEHURST, NJ 08733.

WARNING - THIS DOCUMENT CONTAINS TECHNICAL DATA WHOSE EXPORT IS RESTRICTED BY
THE ARMS EXPORT CONTROL ACT (TITLE 22, U.S.C SEC 2751 ET SEQ.) OR EXECUTIVE ORDER
12470. VIOLATIONS OF THESE EXPORT LAWS ARE SUBJECT TO SEVERE CRIMINAL PENALTIES.

DESTRUCTION NOTICE, FOR UNCLASSIFIED, LIMITED DOCUMENTS, DESTROY BY ANY
METHOD THAT WILL PREVENT DISCLOSURE OF CONTENTS OR RECONSTRUCTION OF THE
DOCUMENT.

**CASTABLE POLYURETHANE REQUIREMENTS
FOR ALRE AND SE APPLICATIONS**

Originator: Michael Bless
Materials Engineering

Revised by: Brittany O'Neill
Materials Engineering
Code 4.3.4.2

Approved by: David Piatkowski
Supervisor, Materials Engineering
Code 4.3.4

2018LK00086

Submitted By: O'NEILL.BRITTAN Y.1502889806 <small>Digitally signed by O'NEILL.BRITTANY.1502889806 DN: c=US, o=U.S. Government, ou=DoD, ou=PKI, ou=USN, cn=O'NEILL.BRITTANY.1502889806 Date: 2018.11.19 11:37:58 -05'00'</small>	Reviewed By: FIRTH.MICHAEL.T .1257457962 <small>Digitally signed by FIRTH.MICHAEL.T.1257457962 DN: c=US, o=U.S. Government, ou=DoD, ou=PKI, ou=USN, cn=FIRTH.MICHAEL.T.1257457962 Date: 2018.11.21 10:42:54 -05'00'</small>	Approved By: PIATKOWSKI.DAVID .M.1229016411 <small>Digitally signed by PIATKOWSKI.DAVID.M.1229016411 DN: c=US, o=U.S. Government, ou=DoD, ou=PKI, ou=USN, cn=PIATKOWSKI.DAVID.M.1229016411 Date: 2018.11.20 16:08:01 -05'00'</small>
Brittany O'Neill 11/19/18	Michael Firth 11/21/18	David Piatkowski 11/20/18

CASTABLE POLYURETHANE REQUIREMENTS FOR ALRE AND SE APPLICATIONS

1. SCOPE

- 1.1 Scope. This MPR covers material and processing requirements for cast polyurethane compounds for Aircraft Launch and Recovery Equipment (ALRE) and Support Equipment (SE) applications. Detailed processing instructions are provided for casting polyurethanes directly to metal inserts and backing plates.
- 1.2 Classification. The cast polyurethane compounds covered by this MPR are defined by Hardness, Type, Class, Grade, and Color, as follows.
- 1.2.1 Hardness. The hardness of polyurethanes shall be Durometer Type A or D, tested in accordance with ASTM-D2240. The resulting number will be incorporated into the part number.
- 1.2.2 Type. The type of polyurethane is defined by tear strength, tested in accordance with ASTM-D624:
- Type I - Tear strength of less than 200 pound-force per inch (lbf/in) ^{1/}
- Type II - Tear strength equal to or greater than 200 lbf/in
- ^{1/} To convert lbf/in to kilonewtons/meter (kN/m), multiply by 0.175. 200 lbf/in = 35 kN/m
- 1.2.3 Class. The class of polyurethane, with respect to environmental resistance, is defined as follows:
- Class 1 - Hydrolysis and UV stabilized for outdoor use.
- Class 2 - Not suitable for outdoor use.
- 1.2.4 Grade. The grade of polyurethane is defined by ultimate tensile strength (UTS), tested in accordance with ASTM-D412, Method A:
- Grade A - UTS of 2500-3500 pounds per square inch (psi)
- Grade B - UTS greater than 3500 psi
- 1.2.5 Color. Unless otherwise defined in the drawing or procurement document, the color of the cast polyurethane shall be a visual match to SAE AMS-STD-595 color number 34125, tested in accordance with ASTM-D1729.

CASTABLE POLYURETHANE REQUIREMENTS FOR ALRE AND SE APPLICATIONS

- 1.3 Compound Identifying Number. To specify a compound to this MPR, the format shown in Table I should be used to create an identification number. An example of the resulting number: MPR1212-90A-II-1-A-34125. When a cast polyurethane compound needs to be specified with a physical property outside of this MPR, consult NAVAIR Lakehurst, Materials Engineering Division, Code 4.3.4.2, for recommendations.

Table I. Compound Identification Number.

Specification Identifier		Hardness (see 1.2.1)		Type (see 1.2.2)		Class (see 1.2.3)		Grade (see 1.2.4)		Color (see 1.2.5)
MPR1212	-	(#)A or D	-	I or II	-	1 or 2	-	A or B	-	SAE AMS-STD-595 color number

2. APPLICABLE DOCUMENTS

- 2.1 Government documents. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

OTHER GOVERNMENT DOCUMENTS

MPR1223 - Abrasive Blast Preparation of Steel Surfaces

MPR1233 - Abrasive Blast Preparation of Aluminum Surfaces

(Copies of these documents are available online at <https://assist.dla.mil>.)

- 2.2 Non-Government Publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

ASTM INTERNATIONAL

ASTM-D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers - Tension

ASTM-D429 - Standard Test Methods for Rubber Property - Adhesion to Rigid Substrates

ASTM-D624 - Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers

ASTM-D1729 - Standard Practice for Visual Appraisal of Colors and Color Differences of Diffusely-Illuminated Opaque Materials

ASTM-D2240 - Standard Test Method for Rubber Property- Durometer Hardness

CASTABLE POLYURETHANE REQUIREMENTS FOR ALRE AND SE APPLICATIONS

ASTM-D3137 - Standard Test Method for Rubber Property- Hydrolytic Stability

ASTM-D4329 - Standard Practice for Fluorescent Ultraviolet Lamp Apparatus Exposure of Plastics

(Copies of these documents are available from ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959 or www.astm.org.)

SOCIETY OF AUTOMOTIVE ENGINEERS (SAE) INTERNATIONAL

SAE-AMS-STD-595 - Colors Used in Government Procurement

(Copies of this document are available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001 or www.sae.org.)

SSPC: The Society for Protective Coatings and NACE International

SSPC-SP1 - Surface Preparation Standard No. 1 – Solvent Cleaning

(Copies of this document are available from SSPC: The Society for Protective Coatings, 40 24th Street, Sixth Floor, Pittsburgh, PA 15222, or NACE International, 1440 South Creek, Houston, TX 77084-4906).

3. REQUIREMENTS

- 3.1 First Article. When specified by engineering drawing or contract, the process and formulation shall be subjected to first article inspection in accordance with Section 4.2.
- 3.2 Materials. Pre-polymer mixtures ratios and ingredient additions shall be as defined by the polyurethane manufacturers. Processing details, such as polyurethane pre-heat temperatures, mix temperatures, degassing requirements, and pot life limitations shall be determined by the polyurethane manufacturer.
- 3.3 Hardness. The hardness of the cast polyurethane shall be as specified on the engineering drawing or contract when tested in accordance with Section 4.2.1.
- 3.4 Tear Strength. When tested as specified in Section 4.2.2, the tear strength for Type I compounds shall be less than 200 lbf/in and the tear strength for Type II compounds shall be equal to or greater than 200 lbf/in.
- 3.5 Environmental Resistance.
 - 3.5.1 Hydrolytic Stability. When tested as specified in Section 4.2.3, the tensile strength for Class 1 compounds shall not be reduced by more than 10% of the compound's original tensile strength.
 - 3.5.2 Ultraviolet Resistance. When tested as specified in Section 4.2.3, the tensile strength for Class 1 compounds shall not be reduced by more than 10% of the compound's

CASTABLE POLYURETHANE REQUIREMENTS FOR ALRE AND SE APPLICATIONS

original tensile strength.

- 3.6 Ultimate Tensile Strength. When tested as specified Section 4.2.4, the ultimate tensile strength of Grade A compounds shall be between 2500 and 3500 psi and the ultimate tensile strength of Grade B compounds shall be greater than 3500 psi.
- 3.7 Color. The color of the cast polyurethane shall meet the requirements specified on the engineering drawing or contract. All colors shall be a visual match to the stated color number of SAE AMS-STD-595. All properties of the polyurethane required for acceptance shall be determined following pigmenting to the final color required for the product.
- 3.8 Casting Directly to Metal. When the polyurethane is cast directly to a metal substrate, the following requirements shall be met.
 - 3.8.1 Surface Preparation.
 - 3.8.1.1 Metal bonding surfaces shall be cleaned or degreased in accordance with SSPC-SP1 to remove grease, oil, and like substances from the surface of the part. Cleaning materials and/or processes shall not damage the surfaces.
 - 3.8.1.2 Steel surfaces shall be abrasive blasted in accordance with MPR1223. Aluminum surfaces shall be abrasive blasted in accordance with MPR1233.
 - 3.8.1.3 No more than two hours shall elapse between abrasive blasting and application of a primer. No more than eight hours shall elapse between application of the primer and polyurethane application.
 - 3.8.2 Primer
 - 3.8.2.1 The choice of primer material is at the option of the contractor. A primer formulated for this type of application shall be chosen specifically. The function of the primer is to enhance the adhesion of the polyurethane to the metal surface.
 - 3.8.3 Primer Application.
 - 3.8.3.1 Abrasive blasted metal inserts or backing plates shall be primed prior to casting polyurethane.
 - 3.8.3.2 Primer shall be applied in accordance with manufacturer's instructions, including application method and dry film thickness.
 - 3.8.3.3 Metal inserts or backing plates may require pre-heating prior to application of the primer, or post-curing prior to casting polyurethane as required by the primer or polyurethane manufacturer.
 - 3.8.3.4 The properly prepared, primed inserts or backing plates shall be protected from contamination, including fingerprints, prior to insertion into part molds.
 - 3.8.3.5 When tested as specified in Section 4.2.5, the adhesive strength of the polyurethane to metal substrate shall be at least 100 lbf/in.

CASTABLE POLYURETHANE REQUIREMENTS FOR ALRE AND SE APPLICATIONS

- 3.9 Casting of Polyurethane.
- 3.9.1 Polyurethane resins, additives, curing agents, and pigments shall be thoroughly mixed, degassed, and heated as required by the manufacturer prior to pouring into molds.
- 3.9.2 Mixed polyurethane shall be cast into the molds within the pot life of the mixture.
- 3.9.3 The molded parts shall be cured immediately following polyurethane addition to the mold. Cure temperature and duration shall be as determined by the manufacturer to achieve final cure mechanical properties.
- 3.9.4 The manufacturer shall submit a process report to the engineering activity that includes the information in Table 1, as a minimum. The manufacturer shall detail their manufacturing process, including all times and temperatures for pre-heating, mixing, application, and curing.

Table 1. Manufacturer Process Report Requirements

Component	Quantity / Concentration / Ratio / Chemical composition	Product Name/ Designation
Resin(s)		
Curing Agent		
Additives (if used)		
Pigments		
Primer (if used)		
Polyurethane (PU) manufacturer's Lot #		
PU manufacturer's NCO		

4. QUALITY ASSURANCE PROVISIONS

- 4.1 Responsibility for inspection. Unless otherwise specified in the contract, the contractor is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract, the contractor may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are

CASTABLE POLYURETHANE REQUIREMENTS FOR ALRE AND SE APPLICATIONS

deemed necessary to assure that supplies and services conform to the prescribed requirements.

- 4.2 First article inspection. First article inspection shall be performed on a random sample drawn from the first production lot and include the following tests:
 - 4.2.1 Durometer hardness of the urethane shall be determined on a finished part in accordance with ASTM-D2240.
 - 4.2.2 Tear resistance shall be determined with a separate specimen poured specifically in accordance with ASTM-D624.
 - 4.2.3 Environmental resistance shall be determined by a percentage of change in tensile strength and elongation in accordance with ASTM-D3137 and ASTM-D4329. Six dumbbell test samples shall be cut from the same sheet of test material poured specifically for this test. The samples shall be conditioned at 185°F for 96 hours while an ultraviolet A 340 lamp is cycled on for 8 hours and off for 4 hours during that time. After 96 hours of dry aging, the samples shall undergo wet aging at 50% relative humidity (RH) at 73.4°F for 56 hours. Before testing for degradation, the samples shall stabilize at 73°F and 20% RH for at least 24 hours but not more than 96 hours.
 - 4.2.4 Ultimate tensile strength and elongation shall be determined with a separate specimen poured specifically and tested in accordance with ASTM-D412, Method A.
 - 4.2.5 The 90° Peel Adhesion Test shall be determined with a separate specimen prepared specifically by ASTM-D429, Method B.
- 4.3 Quality conformance inspection.
 - 4.3.1 Once a contractor has passed the first article testing for a new production lot, quality conformance inspections shall be performed in accordance with 4.2.1, 4.2.2, 4.2.3, 4.2.4, and 4.2.5 and following the lot requirements of 4.4
- 4.4 Lot.
 - 4.4.1 A production specimen shall be prepared during manufacture of the production parts. One specimen per contract quantity or one per lot of one hundred parts where contract quantity exceeds one hundred parts shall be prepared.
 - 4.4.2 Whenever possible, the specimen shall be formed, by sawing, cutting and buffing from an actual part selected at random from the lot unless otherwise specified. If the configuration of the part does not permit this, original specimens shall be prepared, cast, and cured alongside parts belonging to that particular lot.
- 4.5 Testing arresting gear impact pad NSN 2040-00-814-5903.
 - 4.5.1 First Article Testing.
 - 4.5.1.1 Out of the first lot of one hundred (100) to be manufactured under a new contract, three pads shall be selected at random and forwarded to the NAVAIR Lakehurst Code 4.3.4

CASTABLE POLYURETHANE REQUIREMENTS FOR ALRE AND SE APPLICATIONS

Joint Base MDL, NJ 08733 for first article testing. Each of the three pads shall be subject to the following tests:

- 4.5.1.2 Durometer hardness testing, per Section 4.2.1 above, at 20 places selected at random on the pad.
- 4.5.1.3 Tear Resistance, Tensile Strength and Elongation, per Section 4.2.2 and 4.2.4 above, performed on 2 specimens poured alongside the test pad.
- 4.5.1.4 Adhesion, per Section 4.2.5 above, performed on 5 specimens cut from the pad. Specimens shall be removed from sites randomly spaced along the longitudinal axis of the pad, commencing at one edge and termination at the opposite edge of the pad.
- 4.5.1.5 Environmental resistance, per Section 4.2.3 above, performed on eight specimens poured alongside the test pad.
- 4.5.1.6 All values obtained in the testing of all three pads must meet the minimum requirements of Table 2 below in order to obtain approval for full scale production.

Table 2: Acceptable Results for Impact Pads

Hardness	Type A90 minimum
Tear Resistance	400 pli minimum
Environmental Resistance	No drying, cracking, or color fading evident at completion of test. 10% loss in tensile strength and/or elongation at maximum.
Ultimate Tensile Strength	2500 ± 300 psi
Elongation	300% minimum
90° Peel Adhesion	100 lb/in minimum

4.5.2 Quality conformance inspection.

- 4.5.2.1 Once a contractor has passed the first article testing for a new production lot, quality conformance inspections shall be performed in accordance with 4.5.1.2, 4.5.1.3, 4.5.1.4, 4.5.1.5, and following the lot requirements of 4.4.

4.6 Porosity.

- 4.6.1 Any visible evidence of internal porosity in an opaque polyurethane part, disclosed during the cutting of the specimens from actual parts to meet test requirements of Section 4, shall be considered disqualifying for that lot. THE ONLY EXCEPTION is if the porosity is in a non-critical, low-stress region of the part, as determined by a NAVAIR engineering representative or designee, and if the bubbles are 1/16 inch or less in diameter.

**CASTABLE POLYURETHANE REQUIREMENTS
FOR ALRE AND SE APPLICATIONS**

- 4.6.2 Any visible evidence of internal porosity, disclosed by holding a translucent polyurethane part up to bright light, shall be considered disqualifying for that part. THE ONLY EXCEPTION is if the porosity is in a non-critical, low-stress region of the part, as determined by a NAVAIR engineering representative or designee, and if the bubbles are 1/16 inch or less in diameter.
- 4.6.3 Surface defects consisting of bubbles that have broken the surface leaving hemispherical depressions shall be considered disqualifying. THE ONLY EXCEPTION is if the porosity is in a non-critical, low-stress region of the part, as determined by a NAVAIR engineering representative or designee, and if the bubbles are 1/8 inch or less in diameter.

CASTABLE POLYURETHANE REQUIREMENTS
FOR ALRE AND SE APPLICATIONS

DOCUMENT REVISION HISTORY

Revision N 28 March 1983
Revision P 03 Jan 1984
Revision O 15 April 1987
Revision R 19 Oct 1990

DISTRIBUTION LIST

INTERNAL

EXTERNAL

REVISION LIST

REVISION	PAGES AFFECTED	DATE OF REVISION
T	All pages revised. New technical requirements. Document reformatted.	19 November 2018

Jude Masters

From: Langer, Joshua D CIV (USA) <joshua.langer1@navy.mil>
Sent: Tuesday, November 10, 2020 7:24 AM
To: jmasters@americanurethane.com
Subject: Navair Spec urethane
Attachments: MPR1212rTs11.pdf
Signed By: joshua.langer1@navy.mil

Jude,

I am reaching out to you to inquire about a material you have used on a past project with us. The drawing spec'd out the material to be IAW Navair spec MPR1212rTs11. Would you be able to provide the name of the material that was used to meet that spec? The reason I am asking is because we have American Urethane currently listed as the recommended vendor. I think it would make sense to also list the recommended material if we already know one meets the spec.

See attached for the spec.

V/R,
Joshua Langer