

FED. SUPPLY CLASS

5310

1. SCOPE

1.1 Scope. This specification covers self-locking nuts for use in temperatures of 250 °F, 450 °F, and 800 °F (see 6.1).

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3 and 4 of this specification. This section does not include documents cited in other sections of this specification or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements and documents cited in sections 3 and 4 of this specification, whether or not they are listed.

2.1.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS) and supplement thereto, cited in the solicitation (see 6.2).

SPECIFICATIONS

FEDERAL

AMS-QQ-A-250/12 Aluminum Alloy 7075, Plate and Sheet
GGG-W-636 Wrench (Box, Open End, and Combination)
GGG-W-641 Wrench, Socket (and Sockets, Handles, and Attachments for Socket Wrenches, Hand)
TT-E-751 Ethyl Acetate, Technical
TT-I-735 Isopropyl Alcohol
TT-N-97 Naphtha, Aromatic

Copies can be obtained from the Department of Defense Single Stock Point (DODSSP). <http://dodssp.daps.dla.mil>

MILITARY

MIL-DTL-5541 Chemical Conversion Coatings on Aluminum and Aluminum Alloys
MIL-S-7742 Screw Threads, Standard, Optimum Selected Series: General Specification for
MIL-A-8625 Anodic Coatings, for Aluminum and Aluminum Alloys
AMS-S-8802 Sealing Compound, Temperature-Resistant Integral Fuel Tanks and Fuel Cavities, High-Adhesion
AS8879 Screw Threads, Controlled Radius Root with Increased Minor Diameter, General Specification for
MIL-PRF-23377 Primer Coating, Epoxy Polyamide, Chemical and Solvent Resistant
MIL-PRF-81733 Sealing and Coating Compound, Corrosion Inhibitive

Copies can be obtained from the Department of Defense Single Stock Point (DODSSP). <http://dodssp.daps.dla.mil>

THE INITIAL RELEASE OF THIS DOCUMENT SUPERSEDES MLL-DTL-25027 REVISION H, AMENDMENT 1.

THIRD ANGLE PROJECTION	CUSTODIAN NATIONAL AEROSPACE STANDARDS COMMITTEE	REVISION 1
PROCUREMENT SPECIFICATION NONE	TITLE NUT, SELF-LOCKING, 250 °F, 450 °F, AND 800 °F	CLASSIFICATION PART STANDARD NASM25027 SHEET 1 OF 26

STANDARDS/HANDBOOKS

MILITARY

MIL-STD-129	Marking for Shipment and Storage
AN503	Screw and Machine, Drilled Fillister Head, Coarse Thread
MIL-HDBK-57	Fastener Manufacturers' Identification Symbols, Listing of

Copies can be obtained from the Department of Defense Single Stock Point (DODSSP). <http://dodssp.daps.dla.mil>

2.2 Non-Government publications. The following document(s) form a part of this document to the extent specified herein. Unless otherwise specified, the issues of the documents which the DoD adopted are those listed in the issue of the DoDISS cited in the solicitation (see 6.2).

Aerospace Industries Association

NAS9703 THRU NAS9724	Bolt, Hex Head, Alloy Steel, Close Tolerance, Minimum Major, Long Threads.
NAS9603 THRU NAS9624	Bolt, Hex Head, A286 Cres, Close Tolerance, Minimum Major, Long Threads.
NAS1589	Fasteners, Threaded, Corrosion and Heat Resistant, 1200° F
NASM6812	Bolt, Aircraft
NAS410	Qualification of Inspection, Personnel (Magnetic Particle and Penetrant)
NASM1312-1	Salt Spray
NASM1312-7	Vibration
NASM1312-8	Tensile Strength
NASM1312-9	Stress Corrosion
NASM1312-14	Stress Durability (Internally Threaded Fasteners)
NASM1312-31	Fastener Test Methods, Method 31, Torque

Copies can be obtained from the Aerospace Industries Association, 1000 Wilson Blvd., Suite 1700, Arlington, VA 22209. www.aia-aerospace.org

ASME

ASME B46.1	Surface Texture (Surface Roughness, Waviness and Lay)
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Copies can be obtained from ASME, Three Park Ave., New York, NY 10016-5990. www.asme.org

American Society for Quality

ASQ Z1.4	Sampling Procedures and Tables for Inspection by Attributes
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Copies can be obtained from the American Society for Quality, 600 North Plankinton Ave., Milwaukee, WI 53203. www.asq.org

SAE INTERNATIONAL

AMS-QQ-P-416	Plating, Cadmium (Electrodeposited)
AMS2410	Silver Plating, Nickel Strike - High Bake
AMS2411	Plating, Silver, for High Temperature Applications
AMS2750	Pyrometry
AS1310	Fastener Torque for Threaded Applications, Definitions of
AS5272	Lubricant, Solid Film, Heat Cured, Corrosion Inhibiting

Copies can be obtained from SAE International, 400 Commonwealth Dr., Warrendale, PA 15096-0001. www.sae.org

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ASTM International

ASTM A 342/A 342M	Permeability of Feebly Magnetic Materials, Test Methods For
ASTM A967	Chemical Passivation Treatments for Stainless Steel Parts
ASTM D740	Methyl Ethyl Ketone
ASTM D3951	Packaging, Commercial
ASTM E1417	Liquid Penetrant Examination, Standard Practice For
ASTM E1444	Magnetic Particle Examination, Standard Practice For

Copies can be obtained from ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA 19428-2959. www.astm.org

2.3 Order of precedence. In the event of a conflict between the text of this document and the references cited herein (except for related associated detail specifications, specification sheet, or MS sheets), the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 Part Standards. The individual item requirements shall be as specified herein and in accordance with the applicable Part Standards. In the event of any conflict between requirements of this specification and the standard, the latter shall govern.

3.2 Qualification. The nut manufacturer shall be responsible for conducting qualification tests and furnishing part drawings, certified qualification test reports (if required by the purchaser) and test samples. The nuts furnished under this specification shall be produced using the same manufacturing methods as used to produce nuts that have passed qualification tests. The purchaser may apply any or all tests specified herein to any product represented as meeting this specification, at any time, to verify conformance.

3.2.1 Retention of qualification. To maintain product qualification status, manufacturers shall maintain on file, a certified qualification test report (See 4.3.2) available for inspection by the procuring activity. The retention of a certified qualification test report by the manufacturer signifies that the manufacturer has demonstrated compliance to the qualification requirements of this specification. Products previously qualified through government-certified qualification tests and reports shall be considered qualified to this specification.

3.3 Materials.

3.3.1 250 °F nuts. The threaded and load-carrying elements of the 250 °F nuts shall be fabricated from noncorrosion resistant steel, corrosion-resistant steel, aluminum alloy, nickel-copper alloy or copper-base alloy in accordance with the applicable standard. The sulfur or phosphorus content of noncorrosion-resistant steel shall not be greater than .050 percent by weight for thread sizes .164-32 inch and above when the nut is heat treated to 36 HRC or greater.

3.3.2 450 °F nuts. The threaded and load-carrying elements of the 450 °F nuts shall be fabricated from noncorrosion-resistant steel or corrosion-resistant steel. The sulfur content or the phosphorus content of noncorrosion-resistant steel shall not be greater than .050 percent by weight for thread sizes .164-32 and above when the nut is heat treated to 36 HRC or greater.

3.3.3 800 °F nuts. The 800 °F nuts shall be fabricated from corrosion-resistant steel.

3.4 Design. Nut design shall conform to the applicable standard.

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3.5 Construction. The self-locking nut or nut element shall be a self-contained unit, including the self-locking device. The locking device shall not operate by separate movement from the installation and shall not depend on pressure on the bearing surface for locking action. Tool marks resulting from producing the self-locking feature shall blend smoothly without abrupt change. For wrenchable nuts, dimensions across flats and corners shall be applicable prior to incorporation of the locking feature.

3.5.1 Bearing surface. The bearing surface shall be normal to the axis of the pitch diameter of the threads within the values shown in Figure 1. The bearing surface roughness average shall not be greater than 125 microinches in accordance with ASME B46. 1 (see 4.5.1.1).

3.5.2 Threads. Unless otherwise specified, the threads shall be Class 3B in accordance with AS8879 ~~MIL-S-8879~~ prior to the incorporation of the locking feature. Threads used for the locking feature may be displaced or deformed in any manner which produces self-locking nuts conforming to this specification. The nut, after incorporation of the locking feature and prior to lubrication, shall allow the "go" gage to enter not less than a half turn. When the application of a lubricant prevents the use of standard gages, the nuts shall permit a minimum free rotation of three quarters of a turn (270 degrees) on the test bolt, having Class 3A threads.

3.5.3 Plate nut rivet-bolt hole spacing. Plate nut attaching rivet-bolt hole spacing shall be in accordance with the applicable standard (see 4.5.1.2).

3.6 Plating or surface treatment.

3.6.1 Noncorrosion-resistant steel nuts. Unless otherwise specified, nuts fabricated from noncorrosion-resistant steel shall be cadmium plated in accordance with AMS-QQ-P-416 ~~QQ-P-416~~, Type II, Class 2 except nuts that are heat treated to 39 HRc or higher and cadmium plated shall be baked for not less than 23 hours at 375° +/- 25° F starting within 2 hours after plating to provide hydrogen embrittlement relief. The baking process shall be controlled in accordance with AMS 2750.

3.6.1.1 Zinc plated nuts. Nuts that are heat treated to 39 HRc or higher and zinc plated shall be baked for not less than 3.5 hours at 375 °F +/- 25° starting within 4 hours after plating to provide hydrogen embrittlement relief.

3.6.2 Corrosion-resistant steel nuts. Unplated nuts, parts or components fabricated from corrosion-resistant steel shall be passivated in accordance with ASTM A967. Staining requirements of ASTM A967 do not apply to parts that receive a supplementary coating or lubricant after passivation.

3.6.2.1 800° F corrosion-resistant steel nuts. Unless otherwise specified, the threads of 800° F corrosion-resistant steel nuts shall be silver plated in accordance with AMS 2410 or AMS 2411. Application of such finish to the exterior surface of the nut or nut retaining cage may be omitted.

3.6.3 Plate nuts. No plating finish shall be applied in the area of the projection weld nibs of projection weld plate nuts.

3.6.4 Aluminum alloy nuts. Unless otherwise specified, nuts fabricated from aluminum alloy shall be anodized in accordance with MIL-A-8625 or chemically surface treated in accordance with MIL-DTL-5541 ~~MIL-C-5541~~. No protective finish need be applied to clad aluminum-plate nut retainers or gang channels. For identification, the threaded element of the high-strength aluminum alloy nuts, from .112-40 through .250-28 size of the regular type and from .112-40 through .190-32 size of the shear type, shall be dyed blue. When the threaded element of the nut assembly is not exposed, the exposed portion of the nut shall be dyed blue.

3.6.5 Copper-base alloy nuts. Unless otherwise specified, nuts fabricated from copper-base alloy shall be cadmium plated in accordance with AMS-QQ-P-416, Type II, Class 2.

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3.7 Lubrication. Nuts may be lubricated to prevent nut-bolt seizure, provided the lubricant has passed the applicable tests (see 4.5.2). The qualification test report shall identify the lubricant and shall classify it as either solid (dry) film or soluble film. The lubricant shall not be changed without requalification of the nut, except as noted in 3.7.1.

3.7.1 Solid (dry) film lubricant. When specified, the 250 °F and 450 °F nuts shall be coated with graphite-free solid (dry) film lubricant. If lubricant is in accordance with AS5272, Type I, no testing of lubricant is required; if lubricant does not meet the requirements of AS5272, Type I, then lubricant shall be subjected to and pass the applicable tests (see 4.5.2 through 4.5.2.5). Nickel and/or copper plate as a pretreatment for the application of solid (dry) film is optional.

3.7.2 Soluble lubricant. Soluble lubricant coated panels shall be composed of the same material and contain the same finish as the nut (see 4.5.2.1, 4.5.2.2, 4.5.2.5 and 4.5.2.6).

3.8 Mechanical properties.

3.8.1 Axial tensile strength. The nuts shall have a minimum axial tensile strength as specified in Table I (see 4.5.3.1).

3.8.2 Torque.

3.8.2.1 Wrench torque. Wrenchable nuts when tested in accordance with 4.5.3.2 shall withstand the wrench torque values specified in Table II. There shall be no permanent deformation that may interfere with the use of a box or open end wrench conforming to GGG-W-636.

3.8.2.2 Locking torque.

3.8.2.2.1 Maximum locking torque. The torque required for installation and/or removal shall not be greater than the values specified in Tables III and IV as applicable (see 4.5.3.3.2 and 6.1.2).

3.8.2.2.2 Minimum breakaway torque. The torque required to start the unseated nut in the removal direction shall be measured and shall not be less than the values specified in Table III for the minimum breakaway (see 4.5.3.3.3).

3.8.2.2.3 Permanent set. The nuts shall meet the minimum breakaway torque requirements on minimum material condition bolts or studs, subsequent to installation on maximum material condition bolts or studs, when tested in accordance with 4.5.3.4. The nuts shall not exceed the maximum locking torque nor be below the minimum breakaway torque values specified in Table III when subjected to this test.

3.8.2.3 Torque out. Torque out values for floating and retained nonfloating plate nuts, gang channel nuts, and Attached Retention Element (A.R.E.) nuts with no axial load on the bearing surface of the nut, shall not be less than the values listed in Table V (see 4.5.3.4). This test is not applicable to wrenchable nuts.

3.9 Push out. Push out values for the floating and nonfloating plate nuts, gang channel nuts, and (A.R.E.) nuts shall be not less than the values listed in Table VI when tested in accordance with 4.5.3.5.

3.10 Vibration. Self-locking nuts shall show no evidence of failure when tested in accordance with 4.5.3.6. Failure to meet this requirement will be cause for rejection of the lot represented by the test sample.

3.11 Discontinuities. Discontinuities shall not be greater than depths specified in Table VII (see 4.5.4 and Figures 2 and 2a). Care must be taken not to confuse cracks with discontinuities. Cracks as defined in 6.1.2 are not permitted in any location.

3.12 Stress embrittlement (durability). Noncorrosion-resistant steel cadmium or zinc plated nuts that are heat treated to 39 HRC or higher shall show no evidence of cracking or fracture when subjected to the applicable stress embrittlement tests (see 4.5.5.1 and 4.5.5.2). Stress embrittlement testing is not required for .138-inch and smaller size nuts.

3.13 Stress corrosion. Aluminum alloy nuts shall show no evidence of cracking when subjected to the stress corrosion tests (see 4.5.6 and 4.5.6.1).

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3.14 Magnetic permeability. The magnetic permeability of the corrosion-resistant steel nuts shall be less than 2.0 (air = 1.0) for a field strength of $H = 200$ oersteds (see 4.5.7).

3.15 Manufacturer's identification. Nut thread sizes .190-inch diameter and larger manufactured after 30 June 1985 shall be permanently marked with the trademark or symbol of the manufacturer. The symbol or trademark must be listed in MIL-HDBK-57. On solid (dry) film lubricated parts, the marking shall be legible after solid (dry) film lubricant removal. However, the color of the nonmetallic locking element may be used if the color has been established as the manufacturer's trademark or symbol.

3.15.1 Copper-base alloy nuts. Unless otherwise specified, copper-base alloy nuts shall be identified as specified on the applicable standard.

3.16 Workmanship. Workmanship shall be consistent with the type of product, finish, and the class of thread fit specified. Sharp edges shall be broken; loose or hanging burrs and slivers which might become dislodged under usage shall be removed.

4. VERIFICATION

4.1 Inspection conditions. Unless otherwise specified, all inspections shall be performed in accordance with the test conditions specified in the applicable test method documents or paragraphs in this specification.

4.2 Classification of inspection. The inspections specified herein are classified as follows:

- a. Qualification inspection (4.3)
- b. Quality conformance inspection (4.4)

4.3 Qualification inspection. Qualification inspection shall consist of the inspections listed in table XIII (see 6.4).

4.3.1 Sample. Test samples shall be of the same material and manufactured by the same method as production parts. The number of nuts to be subjected to qualification tests shall be as specified in table XIII. Complete identification (e.g. trade name) of the lubricant used on the nuts shall be included in the qualification test report.

4.3.2 Certified test report. The manufacturer shall maintain on file a certified test report showing that the manufacturer's product satisfactorily conforms to this specification. The test report shall include actual results of the tests specified herein. The manufacturer shall also maintain a dated drawing that completely describes the manufacturer's product. The drawing shall specify all dimensions. The test report shall include composition of material selected, coating or plating applied, forming process (machined, stamped, forged or drawn), and the Rockwell hardness and heat treatment. The drawing shall also specify the manufacturer's part number for each size.

4.3.3 Retention of qualification. Requalification will be required in the event any change is made in the product design, construction, materials, method of manufacture, heat treatment, finish, lubricant or manufacturer's part-number or designation.

4.4 Quality conformance inspection. Quality conformance inspections shall consist of the tests specified in table XIV. The purchaser may apply any or all tests specified herein to any product represented as meeting this specification, at any time, to verify conformance.

4.4.1 Selection of samples. Sample nuts shall be selected at random from each lot as specified herein.

4.4.1.1 Inspection lot. An inspection lot shall consist of finished nuts which are of the same type and diameter manufactured from one material heat using the same process, heat treated in the same manner and produced as one continuous run or part thereof.

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4.4.1.2 Sampling plan A. Sample sizes for inspection of product characteristics delineated in paragraph 4.4.1.2.1 shall be in accordance with ASQ Z1.4 as follows:

Major A - Inspection Level S-4
Major B - Inspection Level S-3
Minor - Inspection Level S-2
Acceptance = 0 Rejection = 1

4.4.1.2.1 Product Characteristics. The following characteristics shall be inspected.

Major A:
Self-locking feature missing

Major B:
101 Thread fit
102 Bearing surface squareness
103 Surface finish, plating or surface treatment
104 Rivet hole location and alignment (plate nuts only)
105 Height of nut

Minor:
201 Dimensions of wrenching element (wrenchable nuts only; see 3.5)
202 Loose or hanging burrs
203 All other dimensional characteristics not covered above

4.4.1.3 Sampling plan B. For the axial strength test (4.5.3.1), the sample shall be selected in accordance with Table VIII or IX, as specified herein. Samples for magnetic permeability will be selected in accordance with Table IX.

4.4.1.4 Sampling plan C. For the locking torque, the torque out, and push out tests (4.5.3.3, 4.5.3.4 and 4.5.3.5, respectively), sampling shall be in accordance with the attribute plan shown in Table IX. The acceptance or rejection numbers shall apply to all of the individual inspections for the locking torque, torque out, and push out tests taken separately; i.e., a nut shall be classified defective if it fails any of these inspections.

4.4.1.5 Sampling plan D. For the discontinuities test (4.5.4), sampling shall be random in accordance with ASQ Z1.4, Level S-3. Failure of any nut sample to meet the requirements of Figure 2a and Table VII after micro-examination in accordance with 4.5.4 shall be cause for rejection of the lot.

4.5 Inspection methods.

4.5.1 Examination of product. The nuts shall be examined for conformance to this specification and applicable standards with respect to material, workmanship, dimensions, design and construction, and finish.

4.5.1.1 Bearing surface. Prior to incorporation of the locking feature the nut shall be assembled on a Class 3A threaded member having a minimum thread length equal to the nut height. The bearing surface values shall be measured with a feeler gage after contact when the nut is turned finger tight on a table squareness gage having a seating surface diameter equal to "W" (see Figure 1).

4.5.1.2 Plate nut rivet-bolt hole spacing. Plate nut rivet-bolt hole spacing may be determined by suitable variable gages or by means of a functional alignment gage specified in Figure 3.

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4.5.2 Lubricant coatings.

4.5.2.1 Effect of the coating on the ability of cadmium plating to prevent galvanic corrosion Four panels made of the same material as the finished fastener shall be cadmium plated in accordance with AMS-QQ-P-416, Type II, Class 2. Two of the panels shall be coated with the candidate lubricant and two with any product in accordance with AS5272, Type I. The panels shall then be scribed with an "X" extending to .250-inch from each corner, and subjected to a 96-hour salt spray test in accordance with NASM1312-1. After exposure, there shall be no significant difference in corrosion when a comparison is made between the panels with the candidate lubricant and those panels coated with a lubricant in accordance with AS5272, Type I.

4.5.2.2 Effect of the coating on structural materials in contact with the fastener. Corrosion test specimens shall be panels with four test fasteners per panel. The four fasteners shall be cadmium plated in accordance with AMS-QQ-P-416, Type II, Class 2. Two fasteners shall be overcoated with the candidate lubricant and two with any product in accordance with AS5272, Type I. Duplicate specimen sets of the following alloys and finishes shall be subjected to a 96-hour salt spray test in accordance with NASM1312-1.

- a. Bare 7075-T6 aluminum alloy and bare 2024-T6 aluminum alloy treated in accordance with MIL-DTL-5541, Class IA.
- b. Bare 7075-T6 aluminum alloy and bare 2024-T6 aluminum alloy anodized in accordance with MIL-A-8625, Type II, Class 1.
- c. Clad 7075-T6 aluminum alloy and clad 2024-T6 aluminum alloy treated in accordance with MIL-DTL-5541.
- d. Untreated titanium alloy.
- e. Untreated 300 series corrosion resistant steel.

After exposure, the specimens shall be disassembled and there shall be no significant difference in corrosion on either the fasteners or panel faying surface when a comparison is made between the fasteners coated with the candidate lubricant and fasteners coated with a lubricant in accordance with AS5272, Type I.

4.5.2.3 Behavior of coating with paint. Corrosion test specimens shall be of the same aluminum alloys and treatments as specified in 4.5.2.2b and c, and painted with two coats of primer in accordance with MIL-PRF-23377, Class 2. The specimens shall be subjected to a 96-hour salt spray test in accordance with NASM1312-1. After exposure, there shall be no significant difference in corrosion, blistering, or loss of adhesion of the paint when a comparison is made between the fasteners coated with the candidate lubricant and fasteners coated with a lubricant in accordance with AS5272, Type I.

4.5.2.4 Effect of coating on sealing materials. Corrosion test specimens shall be of the same aluminum alloys and treatments as specified in 4.5.2.2b and c, except that sealant materials in accordance with AMS-S-8802 and MIL-PRF-81733 shall be applied to the fasteners. A specimen panel shall be prepared for each sealant material. Before the application of the sealant material, the fasteners and panels shall be cleaned by scrubbing and rinsing with solvent formulated in accordance with Table XII. After rinsing, and while still wet, the specimens shall be wiped dry with a clean, non-oily wiping cloth. The specimen shall be subjected to a 96-hour salt spray test in accordance with NASM1312-1. After exposure, there shall be no significant difference in loss of adhesion or degradation of sealant material when a comparison is made between the fasteners coated with the candidate lubricant and fasteners coated with lubricant in accordance with AS5272, Type I.

4.5.2.5 Effect of lubricant on stress corrosion resistance of aluminum fasteners. The lubricated threaded fastener shall be scratched through to the basis metal. Torque shall be applied against the aluminum alloy panels to induce 90,000 psi in mating bolt. The assembly shall be salt-spray tested for 96 hours in accordance with NASM1312-1. After exposure, the lubricated fastener shall not have any cracks which can be determined under 10X magnification.

4.5.2.6 Soluble lubricant removability. Soluble lubricant coated panels, made of the same material and containing the same finish as the fastener, shall be submerged for 10 minutes +/-1 minute in the cleaner specified in Table XII. The panel shall then be wiped dry with a clean cloth. Failure of all lubricants to be removed from the panel by the above process shall be cause for rejection.

4.5.3 Mechanical properties.

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