

METRIC

DOD-N-70333

18 June 1985

MILITARY SPECIFICATION

NUT, PLAIN AND SELF-LOCKING,
CLINCH, METRIC (SELF-CLINCHING, KNURLED COLLAR)
FIXED AND FLOATING, GENERAL SPECIFICATION FOR

This specification is approved for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers metric nuts which are permanently attached to a structure by pressing the nut shank into a single hole. Anti-rotation is provided by the penetration of the knurl into structural material and push-out resistance results from cold flow of the structure material into a groove in the shank of the nut.

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications, standards, and handbooks. The following specifications, standards and handbooks form a part of this specification to the extent specified herein. Unless otherwise specified, the issues shall be those listed in the issue of the Department of Defense Index of Specifications and Standards (DoDISS) and supplement thereto, cited in the solicitation.

SPECIFICATIONS

FEDERAL

QQ-S-365 - Silver Plating, Electrodeposited, General Requirements for
QQ-P-416 - Plating, Cadmium (Electrodeposited)
PPP-H-1581 - Hardware (Fasteners and Related Items), Packaging of

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document, should be addressed to: Commander, US Army Armament, Munitions and Chemical Command, ATTN AMSMC-TDA-S(D), Dover, New Jersey 07801-5001 by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

TSC 5310

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MILITARY

MIL-I-6866 - Inspection, Penetrant Method of
 MIL-I-6868 - Inspection Process, Magnetic Particle
 MIL-L-46010 - Lubricant, Solid Film Heat Cured, Corrosion Inhibiting
 DOD-N-70333/1 - Nut, Plain and Self-Locking, Clinch, Fixed, Metric (Self-Clinching, Knurled Collar)
 DOD-N-70333/2 - Nut, Plain and Self-Locking, Clinch, Floating, Metric (Self-Clinching, Knurled Collar)

STANDARDS

FEDERAL

FED-STD-H28/20 - Screw-Thread Standards for Federal Services, Section 20, Inspection Methods for Acceptability of UN, UNR, UNJ, M and MJ Screw-Threads
 FED-STD-H28/21 - Screw Thread Standards for Federal Services, Section 21, Metric Screw-Threads

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MIL-STD-105 - Sampling Procedures and Tables for Inspection by Attributes
 MIL-STD-1312 - Fasteners, Test Methods

(Copies of specifications, standards, handbooks, drawings and publications required by manufacturers in connection with specific acquisition functions should be obtained from the contracting activity or as directed by the contracting officer.)

2.2 Other publications. The following documents form a part of this specification to the extent specified herein. Unless otherwise specified, the issues of the documents that are adopted by DoD shall be those in the DoDISS cited in the solicitation. Unless otherwise specified, the issues of documents which have not been adopted shall be the issue of the nongovernment documents which are current on the date of the solicitation.

AEROSPACE MATERIAL SPECIFICATION (AMS)

AMS 5085 - Steel Sheet, Strip, and Plate
 AMS 5525 - Steel Sheet, Strip, and Plate, Corrosion and Heat Resistant
 AMS 5731 - Steel Bars, Forgings, Tubing and Rings, Corrosion and Heat Resistant
 AMS 5734 - Steel Bars, Forgings, and Tubing, Corrosion and Heat Resistant
 AMS 6322 - Steel Bars, Forgings, and Rings
 AMS 6382 - Steel Bars, Forgings, and Rings

(Application for copies should be addressed to the Society of Automotive Engineers, Inc., 400 Commonwealth Drive, Warrendale, PA 15096)

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI B46.1 - Surface Texture

(Application for copies should be addressed to ANSI, 1430 Broadway, New York, NY 10018.)

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AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A380 - Cleaning and Descaling Stainless Steel Parts, Equipment and Systems

ASTM A581 - Free-Machining Stainless and Heat-Resisting Steel Wire.

(Application for copies should be addressed to ASTM, 1916 Race Street, Philadelphia, PA 19103.)

(Nongovernment documents are normally available from the organizations which prepare or which distribute the documents. These documents also may be available in or through libraries or other informational services.)

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

3 REQUIREMENTS

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

3.2 Material. Recycled and reclaimed materials shall be used to the maximum extent practicable. Nuts shall be made from the following materials, as specified in the applicable specification sheet (See 3.1) when inspected in conformance with 4.6.2.

3.2.1 Alloy steel. The alloy steel fixed nut and floating nut shall be made from grade 8740 (UNS G87400) conforming to AMS 6322 or grade 4140 (UNS G41400) conforming to AMS 6382. Optional floating nut element material shall be grade 1050 (UNS G10500) conforming to AMS 5085.

3.2.2 Corrosion-resistant steel. The corrosion-resistant steel fixed nut shall be made from type 303 (UNS S30300) conforming to ASTM A581, condition A or B, or type A286 (UNS S66286) conforming to AMS 5731 or AMS 5734. Floating nut shall be made from type A286 (UNS S66286) conforming to AMS 5731 or AMS 5734. Optional floating nut element material shall be type A286 (UNS S66286) conforming to AMS 5525.

3.3 Protective finish and surface treatment.

3.3.1 Cadmium plating. Alloy steel nuts shall be cadmium plated in accordance with QQ-P-416, Type II, Class 3, 5 micrometers (μm) thick, when inspected in conformance with 4.6.3.1.

3.3.2 Silver plating. Corrosion-resistant steel, type A286 fixed nuts and floating nut elements with internal thread locking feature shall be silver plated in accordance with QQ-S-365, Type II, Grade B, 5 μm thick, when inspected in conformance with 4.6.3.1.

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3.3.3 Cleaning, descaling and passivation Corrosion-resistant steel nuts shall be cleaned, descaled and passivated in accordance with ASTM A380 when inspected in conformance with 4.6.3.2.

3.3.4 Lubricant. Nuts with internal thread locking feature shall be coated with a solid film lubricant in accordance with MIL-L-46010 when inspected in conformance with 4.6.3.3.

3.4 Design, dimensions and tolerances. Designs, dimensions, and tolerances shall conform to the requirements of the applicable specification sheet (See 3.1) and shall apply after application of the plating or cleaning, descaling and passivation treatment and prior to the application of solid film lubricant.

3.4.1 Threads. Threads shall be right hand MJ profile in accordance with FED-STD-H28/21 and the applicable specification sheet (See 3.1).

3.4.1.1 Internal threads. Internal threads shall be tolerance class 4H6H for thread sizes through MJ5x0.8 and tolerance class 4H5H for thread sizes greater than MJ5x0.8. Thread gaging shall be performed after plating and prior to the application of solid film lubricant. For nuts with internal thread locking feature, the "GO" plug gage shall enter a minimum of 3/4 turn before engagement of the locking feature when inspected in conformance with 4.6.4.1.

3.4.2 Internal thread locking feature. The internal thread of the nut shall be distorted to impose friction between the nut and the inserted item. The feature shall not operate by means of separate movement from the installation, nor depend upon axial load on the inserted items, but shall be an integral part of the nut wall.

3.4.2.1 Self-locking torque. When the nut is properly installed in the parent material, the locking feature shall provide a locking torque with a mating screw or bolt of tolerance class 4h, that is within the limits specified in table I when tested as specified in 4.7.2. Nuts shall not be subjected to self-locking tests after testing as specified in 4.7.3.

TABLE I. Self-locking torque.

INTERNAL THREAD SIZE	MAX LOCKING TORQUE N·m	MIN BREAKAWAY TORQUE N·m
MJ2.5x0.45	0.45	0.06
MJ3x0.5	0.60	0.09
MJ3.5x0.6	0.75	0.12
MJ4x0.7	0.90	0.14
MJ5x0.8	1.60	0.23
MJ6x1	2.80	0.36

3.5 Surface texture. The surface texture of the nut prior to plating, where applicable, shall not exceed the values specified in the applicable specification sheet (See 3.1) and shall be in accordance with ANSI B46.1 when inspected in conformance with 4.6.5.

3.6 Metallurgical properties.

3.6.1 Discontinuities. The nut shall not contain discontinuities, that is, laps, seams and inclusions which equal or exceed the limitations specified herein. Care must be exercised not to confuse cracks with discontinuities. When visual inspection discloses discontinuities which show cause for further examination, magnetic particle or penetrant inspection, as applicable, shall be as specified in 4.6.6 for size MJ5 and larger.

3.6.1.1 Cracks. (see 6.3.1) The nut shall be free from cracks in any direction or location when inspected in conformance with 4.6.6.

3.6.1.2 Laps and seams. (see 6.3.2 and 6.3.3) The nut may show evidence of laps and seams except the depth shall not exceed 0.2 mm for MJ2.5 through MJ3.5 and 0.25 mm for MJ4 through MJ6 when inspected in conformance with 4.6.6.

3.6.1.3 Inclusions. (see 6.3.4) Small inclusions in parts of the nut which are not indicative of unsatisfactory quality are permissible except the depth shall not exceed 0.2 mm for MJ2.5 through MJ3.5 and 0.25 mm for MJ4 through MJ6 when inspected in conformance with 4.6.6.

3.7 Mechanical properties.

3.7.1 Hardness. The nut shall meet the hardness as specified in the applicable specification sheet (see 3.1) when tested in accordance with 4.7.1.

3.7.2 Resistance to push-out. When properly installed in accordance with the applicable specification sheet (see 3.1), the nut shall have a minimum resistance to push-out from the parent material as specified in the applicable specification sheet (see 3.1). The values are based on nuts installed in a test panel having an ultimate tensile strength of 310 MPa when tested in conformance with 4.7.3 without loosening, cracking or thread damage.

3.7.3 Resistance to torque-out. When properly installed in accordance with the applicable specification sheet (see 3.1), the nut shall have a minimum resistance to torque-out from the parent material as specified in the applicable specification sheet (see 3.1). The values are based on nuts installed in a test panel having an ultimate tensile strength of 310 MPa when tested in conformance with 4.7.4.

3.8 Workmanship. Workmanship shall be consistent with the type of product, finish and class of thread fit specified. Nuts shall be of uniform quality and free from defects which would be detrimental to the performance of the nut.

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4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the contractor is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or purchase order, 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 deemed necessary to assure supplies and services conform to prescribed requirements.

4.1.1 Responsibility for compliance. All items must meet all section 3 and 5 requirements. The inspection set forth in this specification shall become a part of the contractor's overall inspection system or quality program. The absence of any inspection requirements in the specification shall not relieve the contractor of the responsibility of assuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling in quality conformance does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to acceptance of defective material.

4.1.2 Test panel fabrication. Test panel shall be of suitable thickness and hardness for the nut being tested as specified in the applicable specification sheet (see 3.1). Larger test panel for multiple testing of nuts is permissible except for test of 4.7.4.

4.1.3 Test sample installation. Sample nuts shall be installed in accordance with the applicable specification sheet (see 3.1) in test panels specified in 4.1.2.

4.1.3.1 Inspection of installed nuts. The nut installed as specified in 4.1.3 shall be visually inspected under 10 diameters magnification. The presence of cracks in either test panel or nut as a result of installation shall be cause for rejection. When visual inspection discloses a condition which show cause for further examination, the specimen shall be penetrant inspected in accordance with MIL-I-6866.

4.1.3.2 Test bolts and screws. Bolts and screws for use in all tests shall have tolerance class 4h6h threads in accordance with FED-STD-H28/21.

4.1.3.2.1 Bolts and screws used for the test of 4.7.2 shall be corrosion-resistant steel, cleaned, descaled and passivated in accordance with ASTM A380. Cadmium plated, non-corrosion-resistant steel bolts and screws shall be used for testing alloy steel nuts.

4.1.4 Test equipment and inspection facilities. The manufacturer shall insure that test and inspection facilities of sufficient accuracy; quality and quantity are established and maintained to permit performance of required inspections.

4.2 Quality conformance inspection. Quality conformance inspection shall be as specified in table II.

4.2.1 Inspection lot. An inspection lot shall consist of all nuts covered by a single applicable specification sheet (see 3.1) manufactured from the same mill run of material and produced under essentially the same conditions and offered for inspections at one time.

4.2.2 Rejected lots. If an inspection lot is rejected, the contractor may rework it to correct the defects, or screen out the defective units and resubmit for reinspection. A resubmitted lot shall be inspected using tightened inspection. Such lots shall be separated from new lots and clearly identified as reinspected lots.

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TABLE II. Quality conformance inspection.

INSPECTION	REQUIREMENT PARAGRAPH	TEST METHOD PARAGRAPH
<u>Group A</u>		
Visual & Dimensional	3.4	4.6.1
Material	3.2	4.6.2
Protective finish & surface treatment	3.3 (as applicable)	4.6.3 (as applicable)
Workmanship	3.8	4.6.1
Packaging	5.1	4.5
<u>Group B</u>		
Threads	3.4.1 thru 3.4.2	4.6.4
Surface texture	3.5	4.6.5
<u>Group C</u>		
Self-locking torque	3.4.2.1	4.7.2
Cracks	3.6.1.1	4.6.6
Laps and seams	3.6.1.2	4.6.6
Inclusions	3.6.1.3	4.6.6
Hardness	3.7.1	4.7.1
Resistance to push-out	3.7.2	4.7.3
Resistance to torque-out	3.7.3	4.7.4

4.3 Classification of defects. Classification of defects shall be in accordance with MIL-STD-105 and table III.

4.3.1 Defect noncompliance. A nut exhibiting one or more defects shall be considered defective.

4.4 Inspection sampling. Inspection sampling shall be in accordance with MIL-STD-105 and the applicable inspection level and Acceptable Quality Level (AQL) specified in table III.

4.5 Inspection of packaging. The sampling and inspection of the preservation, packing, and container marking shall be in accordance with requirements of PPP-H-1581.

4.6 Methods of inspection.

4.6.1 Visual and dimensional. The nut shall be examined to verify that physical dimensions, surface texture, and workmanship are in accordance with the applicable requirements of 3.4, 3.5 and 3.8.

4.6.2 Material inspection. Material inspection shall consist of certification supporting verifying data that the materials used in fabricating the nut are in accordance with the applicable requirements of 3.2.

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TABLE III. Classification of defects and inspection sampling for nut.

CATEGORY	DEFECT	INSPECTION METHOD
<u>Critical</u>	<u>None defined</u>	
<u>MAJOR</u>	AQL = 1.5 percent defective, Level II	
101	Design, dimensions & tolerances incorrect (3.4)	Standard Measuring and Test Equipment (SMTE)
102	Threads not as specified (3.4.1)	SMTE
103	Internal thread locking feature missing (3.4.2)	Visual
104	Surface texture (3.5)	SMTE
105	Discontinuities including cracks, laps & seams and inclusions (3.6.1)	SMTE
106	Protective finish and surface treatment (3.3 as applicable)	Visual
107	Mechanical properties (3.7)	SMTE
<u>MINOR</u>	AQL = 4.0 percent defective, Level II	
201	Overall length (3.4)	SMTE
202	Workmanship (3.8)	Visual

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4.6.3 Protective finish and surface treatment inspection.

4.6.3.1 Protective finish inspection. Sample nuts shall be inspected for minimum thickness and continuity of plating in accordance with QQ-P-416 and 3.3.1 or in accordance with QQ-S-365 and 3.3.2.

4.6.3.2 Cleaning, descaling and passivation inspection. Sample nuts shall be inspected for cleaning, descaling and passivation in accordance with ASTM A380 and 3.3.3.

4.6.3.3 Lubricant inspection. Sample nuts shall be examined visually and microscopically at a magnification of 12X for uniformity in color, smoothness and evidence of cracks, scratches, pinholes, blisters, bubbles, runs, sags, foreign matter, grit, rough particles, separation of ingredients, and any other surface imperfections in accordance with MIL-L-46010 and 3.3.4.

4.6.4 Thread inspection.

4.6.4.1 Internal threads inspection. Sample nuts shall have their internal threads inspected in accordance with FED-STD-H28/20, system 21 and 3.4.1.1.

4.6.5 Surface texture inspection. Sample nuts shall be inspected for surface texture with any of the surface examination and measurement methods specified in ANSI B46.1 in accordance with the requirements of 3.5.

4.6.6 Metallurgical properties inspection. Sample nuts shall be inspected for discontinuities in accordance with 3.6. Any crack detected during visual examination shall be cause for rejection of the lot. When visual evidence of discontinuities shows cause for further inspection, sample nuts shall be subjected to magnetic particle inspection in accordance with MIL-I-6868 for alloy steel and penetrant inspection in accordance with MIL-I-6866 for corrosion-resistant steel. Magnetic particle or penetrant inspection alone shall not be cause for rejection. If indications are considered cause for rejection, representative samples shall be taken from those nuts showing indications and those samples shall be further examined. Samples shall be sectioned and discontinuities measured under 10X magnification. The inspection shall be performed on finished nuts free of lubrication and subsequent to any processing operation which could adversely affect the nuts. Requirements for dye as an indication of particle inspection may be waived.

4.7 Mechanical properties inspection. In lieu of the mechanical properties sampling inspection of 4.7, mechanical properties inspection may consist of certification supporting verifying data that the nut has met the requirements of 3.7.

4.7.1 Hardness test. Sample nuts shall be tested for hardness to meet the requirements of 3.7.1 in accordance with MIL-STD-1312, test 6.

4.7.2 Self-locking torque test. Sample nuts shall be installed in accordance with 4.1.3 to meet the requirements of 3.4.2.1. Bolts and screws shall be in accordance with 4.1.3.2 and shall have sufficient thread length to extend beyond the locking feature a minimum of two pitches (including thread chamfer). A new bolt or screw and a new sample nut shall be used for each complete fifteen cycle test. Bolts and screws shall assemble freely, with the fingers, up to the locking feature. The bolt or screw shall be engaged or disengaged from the assembled nut self-locking area for 15 full installation and removal cycles without axial load on the nut. The test shall be run at a rate slow enough to yield a dependable measure of torque and to avoid heating of the bolt or screw. A bolt or screw shall be considered fully installed when two threads extend past the end of the nut locking feature; the removal cycle shall be considered complete when the locking feature is disengaged.

4.7.2.1 Maximum locking torque test. Maximum locking torque shall be the maximum torque value encountered on any installation or removal cycle, and shall not exceed the values specified in table I in accordance with the requirements of 3.4.2.1. Maximum locking torque readings shall be recorded on the first, seventh, and fifteenth installation cycles.

4.7.2.2 Minimum breakaway torque test. Minimum breakaway torque shall be the minimum torque required to start removal of the bolt or screw from a fixed position located between the first 1/4 turn to 1 turn of the removal cycle. Minimum breakaway torque readings shall be recorded at the start of the first, seventh and fifteenth removal cycles. The torque for any cycle shall not be less than the applicable value specified in table I in accordance with the requirements of 3.4.2.1.

4.7.3 Resistance to push-out test. Sample nuts shall be installed in accordance with 4.1.3. A mating test screw or bolt in accordance with 4.1.3.2 shall be engaged in the nut. The push-out load shall be steadily applied to the test screw or bolt directly in line with the axis of the nut thread in accordance with figure 1. Sufficient support shall be provided for the test panel to prevent its collapse. Failure of the nuts to withstand the push-out loads in accordance with the requirements of 3.7.2 shall be cause for rejection.

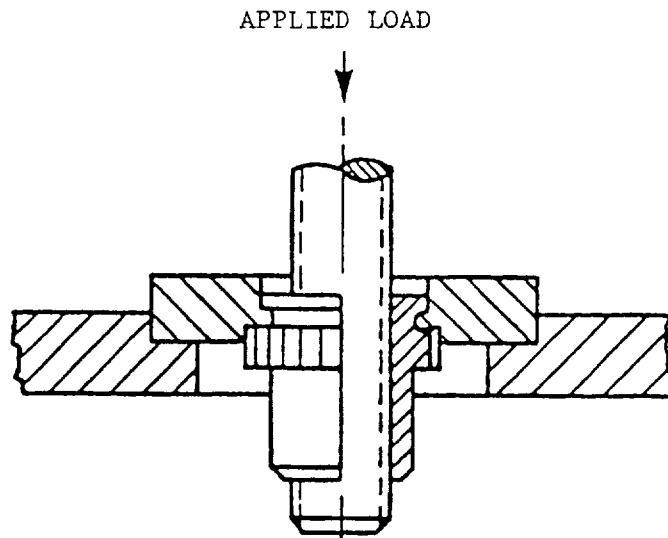


FIGURE 1. Push-out test.

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4.7.4 Resistance to torque-out test. Sample nuts shall be installed in accordance with 4.1.3. A mating test screw, bolt or torque stud in accordance with 4.1.3.2 whose shoulder diameter is less than the diameter of the mounting hole to seat against the base of the nut. The threads of the test screw, bolt or torque stud shall extend through the nut sufficiently to accept a check nut. The check nut shall be torqued against the top of the nut being tested to resist the counter-clockwise torque-out test. Torque shall be applied with torque measuring device to the engaged screw, bolt or torque stud; first in a clockwise direction and then in a counter-clockwise direction. Failure of the nuts to withstand the torque-out loads in accordance with 3.7.3 shall be cause for rejection.

5. PACKAGING

5.1 Packaging requirements. The requirements for packaging shall be in accordance with PPP-H-1581 (see 6.2).

6. NOTES

6.1 Intended use. Nuts covered by this specification are intended for use as general purpose metric, locked-in fasteners with or without an internal metallic locking feature to resist rotation of a bolt or screw.

6.1.1 Nuts covered by this specification are used in thin sheets of aluminum, brass or copper where an internal thread is required to provide strength and security. Alloy steel nuts are for use in materials with a hardness of 28 HRC maximum and corrosion-resistant steel nuts are for use in materials with a hardness of 90 HRB maximum. The self-locking types with internal thread lock torque values specified in the applicable specification sheet (see 3.1) will prevent the screw or bolt from loosening due to vibration.

6.2 Ordering data. Acquisition documents should specify the following:

- a. Title, number and date of this specification and the applicable specification sheet.
- b. Applicable specification sheet part number (see 3.1).
- c. Level (degree) of protection, in accordance with PPP-H-1581 ordering data (see 5.1).

6.3 Definitions.

6.3.1 Crack. A crack is defined as a clean crystalline break passing through the grain or grain boundary without the inclusion of foreign elements.

6.3.2 Lap. A surface defect appearing as a seam caused by folding over metal, fins or sharp corners, and then rolling or forging, but not welding them into the surface.

6.3.3 Seam. An elongated discontinuity caused by a defect, which has been closed by rolling or forging mechanically, but not united.

6.3.4 Inclusions. Particles of non-metallic impurities such as oxides, sulfides and silicates, which are mechanically held in the steel during solidification.

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Custodians:

Army - AR
Navy - AS
Air Force - 99

Preparing activity:

Army - AR

(Project 5310-1325)

Review activities:

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Air Force - 82
NSA - NS
DLA - IS

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Navy - MC

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