

INCH-POUND

MIL-PRF-32187

24 February 2005

PERFORMANCE SPECIFICATION

GASKET, HYBRID, FLAT AND RAISED FACE FLANGE, FIRE RESISTANT, SHIPBOARD USE

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

1. SCOPE

1.1 Scope. This performance specification covers hybrid gaskets designed for sealing ASME B16.5, Class 150, flat and raised face flanges in fuel and lube oil piping systems. Hybrid gaskets are fire resistant and are intended for shipboard use. Hybrid gaskets are defined as gaskets fabricated using two or more materials usually an elastomeric compound serving as the primary seal and an enveloping graphite material serving as the fire resistant seal.

1.2 Classification.

1.2.1 Types. Hybrid gaskets are classified by the following types, as specified:

- Type I - Two circular, concentric seals recessed into the surface of a metal ring; an inner elastomeric seal (primary seal) and an outer flat graphite sheet material seal (fire resistant seal).
- Type II - Two circular, concentric seals recessed into the surface of a metal ring; an inner elastomeric seal (primary seal) and an outer spiral wound graphite seal (for fire resistant seal).
- Type III - Multiple circular, concentric seals of sheet graphite material, recessed into the surface of a self-locating metal ring.

1.2.2 Sizes. Hybrid gasket sizes accommodate piping flanges with the following nominal pipe sizes (NPS) (in inches): $\frac{1}{4}$, $\frac{1}{2}$, $\frac{3}{4}$, 1, $1\frac{1}{4}$, $1\frac{1}{2}$, 2, $2\frac{1}{2}$, 3, $3\frac{1}{2}$, 4, 5, 6, 8, 10, and 12.

Comments, suggestions, or questions on this document should be addressed to: Commander, Naval Sea Systems Command, ATTN: SEA 05Q, 1333 Isaac Hull Avenue, SE, Stop 5160, Washington Navy Yard DC 20376-5160 or emailed to commandstandards@navsea.navy.mil, with the subject line "Document Comment". Since contact information can change, you may want to verify the currency of this address information using the ASSIST Online database at <http://assist.daps.dla.mil>.

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1.3 Part or identifying number (PIN). PINs to be used for hybrid gaskets acquired to this specification are created as follows:

M **32187** = **X** **X**
Prefix for Military Specification Type (see Size (see
Specification number code below) code below)

Type	PIN Code	Size (Inches)	PIN Code	Size (Inches)	PIN Code	Size (Inches)	PIN Code	Size (Inches)	PIN Code
I	1	¼	A	1¼	E	3	J	6	N
II	2	½	B	1½	F	3½	K	8	P
III	3	¾	C	2	G	4	L	10	Q
		1	D	2½	H	5	M	12	R

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3, 4, or 5 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 of documents cited in sections 3, 4, or 5 of this specification, whether or not they are listed.

2.2 Government documents.

2.2.1 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 cited in the solicitation or contract.

DEPARTMENT OF DEFENSE SPECIFICATIONS

MIL-DTL-1222 - Studs, Bolts, Screws and Nuts for Application Where a High Degree of Reliability is Required; General Specification for

(Copies of these documents are available online at <http://assist.daps.dla.mil/quicksearch/> or <http://assist.daps.dla.mil> or from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.)

2.2.2 Other Government documents, drawings, and publications. The following other Government documents, drawings, and publications 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.

BUREAU OF MEDICINE

BUMED 6270.8 - Procedures for Obtaining Health Hazard Assessments Pertaining to Operational Use of a Hazardous Material

(Copies of this document are available from Bureau of Medicine and Surgery, Department of the Navy, 2300 E Street, NW, Washington, DC 20372-5300 or online at <http://navymedicine.med.navy.mil>.)

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2.3 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.

AMERICAN PETROLEUM INSTITUTE (API)

API-STD-607 - Valve, Fire Test for Soft-Seated Quarter Turn (DoD adopted)

(Copies of this document are available from American Petroleum Institute, 1220 L Street NW, Washington, DC 20005-4070 or online at www.api.org.)

ASME INTERNATIONAL

ASME B16.5 - Pipe Flanges and Flanged Fittings: NPS ½ through 24 (DoD adopted)

(Copies of this document are available from the ASME International, 22 Law Drive, P.O. Box 2900, Fairfield, NJ 07007-2900, or online at www.asme.org.)

ASTM INTERNATIONAL

ASTM A106/A106M - Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service (DoD adopted)

ASTM D512 - Standard Test Methods for Chloride Ion in Water (DoD adopted)

ASTM D1179 - Standard Test Methods for Fluoride Ion in Water (DoD adopted)

ASTM D1246 - Standard Test Method for Bromide Ion in Water (DoD adopted)

ASTM D3223 - Standard Test Method for Total Mercury in Water (DoD adopted)

ASTM D3557 - Standard Test Methods for Cadmium in Water

ASTM D3559 - Standard Test Methods for Lead in Water (DoD adopted)

ASTM D4190 - Standard Test Method for Elements in Water by Direct-Current Argon Plasma Atomic Emission Spectroscopy

ASTM D4327 - Standard Test Method for Anions in Water by Chemically Suppressed Ion Chromatography

(Copies of these documents are available from ASTM International, 100 Barr Harbor Dr., West Conshohocken, PA 19428, or online at www.astm.org.)

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

ISO/IEC 17025 - General Requirements for the Competence of Testing and Calibration Laboratories

(Copies of this document are available from ISO, 1, rue de Varembé, CH-1211 Geneva 20, Switzerland or online at www.iso.org.)

2.4 Order of precedence. In the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specification exemption has been obtained.

3. REQUIREMENTS

3.1 Qualification. Hybrid Gaskets furnished under this specification shall be products that are authorized by the qualifying activity for listing on the applicable qualified products list before contract award (see 4.2 and 6.3). Hybrid gaskets for both flat and raised face flanges shall be qualified.

3.2 Materials. Materials shall exhibit fluid compatibility satisfactory for long-term exposure to hydrocarbons such as fuel oils and lube oils. Materials shall not break down or break apart contributing particles into system fluids. Materials shall exhibit galvanic compatibility when installed in contact or close physical proximity to carbon steel, corrosion resisting steel, bronze, or copper-nickel alloys.

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3.2.1 Detrimental materials. Detrimental materials shall not exceed the maximum concentrations as specified in Table I (see 4.5.1.3).

TABLE I. Detrimental materials.

Material	Maximum concentration permitted (ppm)
Asbestos	None permitted
Halogens (total of chloride, fluoride and bromide) <u>1/</u>	1,000
Lead	250
Cadmium plating	None permitted
Mercury and compounds (none intentionally added) <u>2/</u>	10
Sulfur	10,000

1/ Materials containing more than 1,000 parts per million (ppm) total halogens are acceptable provided only fluorine exceeds 250 ppm and total leachable halides do not exceed 250 ppm.

2/ During manufacture, fabrication, handling, packaging, and packing, hybrid gasket materials shall not come in contact with mercury or mercury compounds.

3.2.2 Toxins, carcinogens, and reproductive hazards. The material shall have no adverse effect on the health of personnel when used for its intended purpose. The material shall be assessed by the Navy Environmental Health Center (NEHC) using the administrative Health Hazard Assessment (HHA). A flowchart for this process can be found as enclosure (1) of BUMEDINST 6270.8. The HHA is a review of the material based on information submitted by the manufacturer, to assess health hazards associated with the handling, application, use and removal of the product. The material shall not cause any environmental problems during waste disposal.

3.2.3 Recycled, recovered, or environmentally preferable materials. Recycled, recovered, or environmentally preferable materials should be used to the maximum extent possible, provided that the material meets or exceeds the operational and maintenance requirements, and promotes economically advantageous life cycle costs.

3.3 Design and construction. Hybrid gasket design and construction may vary from types listed in 1.2.1 provided that the requirements of this document are met. Unless otherwise specified (see 6.2), hybrid gasket sizes shall conform to ASME B16.5, Class 150 flanges with nominal pipe sizes listed in 1.2.2.

3.3.1 Service life. Hybrid gaskets shall be designed for a minimum service life of 15 years.

3.4 Physical requirements.

3.4.1 Fire resistance. Hybrid gaskets shall be fire resistant to withstand a 30-minute exposure to a modified API-STD-607 fire test (see 4.2).

3.4.2 Structural characteristics. Hybrid gaskets shall maintain system integrity when installed in flanges exhibiting customary bolt torques, flange face finishes, and allowable degrees of misalignment. When installed, hybrid gasket compression shall not damage the surface finish of the mating flange faces.

3.4.2.1 Gasket thickness. Hybrid gaskets shall have a maximum initial uncompressed thickness of 0.18 inch. Gasket thickness shall not exceed 0.135 inch under the compressive load associated with ASME B16.5 flange configuration and torque values applied to the size and number of corresponding bolting.

3.4.3 Sealing characteristics. Hybrid gaskets shall show no visible leakage during normal system operation.

3.5 Performance requirements.

3.5.1 Operating environment. Hybrid gaskets shall prevent flange leakage in shipboard fuel and lube oil systems (excluding hydraulic systems) with operating temperatures of -20 to 250 °F. Hybrid gasket sealing integrity shall not be affected by thermal cycling (see 4.2).

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3.6 Cleanliness requirements. Surface of gaskets and related parts shall be commercially clean, for example, free of dirt, oils, grease, chips, and foreign matter.

4. VERIFICATION

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

- a. Qualification inspection (see 4.2).
- b. Conformance inspection (see 4.3).

TABLE II. Examinations and inspections.

Test requirement	Requirement paragraph	Verification paragraph	Qualification	Conformance
Examination	3.2 through 3.6	4.4	X	X
Fire test	3.1 and 3.4.1	4.5.1.1	X	
Pressure and temperature exposure test	3.1 and 3.5.1	4.5.1.2	X	
Detrimental materials	3.1 and 3.2.1	4.5.1.3	X	

4.2 Qualification inspection. Qualification inspection shall be performed on hybrid gaskets and their materials as specified herein. This inspection shall include the examination of 4.4 and the tests of 4.5.1 through 4.5.1.3.2.

4.3 Conformance inspection. Conformance inspection shall include the examination of 4.4.

4.4 Examination. Each hybrid gasket shall be examined for compliance with the requirements specified in 3.2 through 3.6. Any redesign or modification of the contractor's standard product to comply with specified requirements, or any necessary redesign or modification following failure to meet the specified requirements shall receive particular attention for adequacy and suitability. This element of inspection shall encompass all visual examinations and dimensional measurements. Noncompliance with any specified requirements or presence of one or more defects preventing or lessening maximum performance shall constitute cause for rejection.

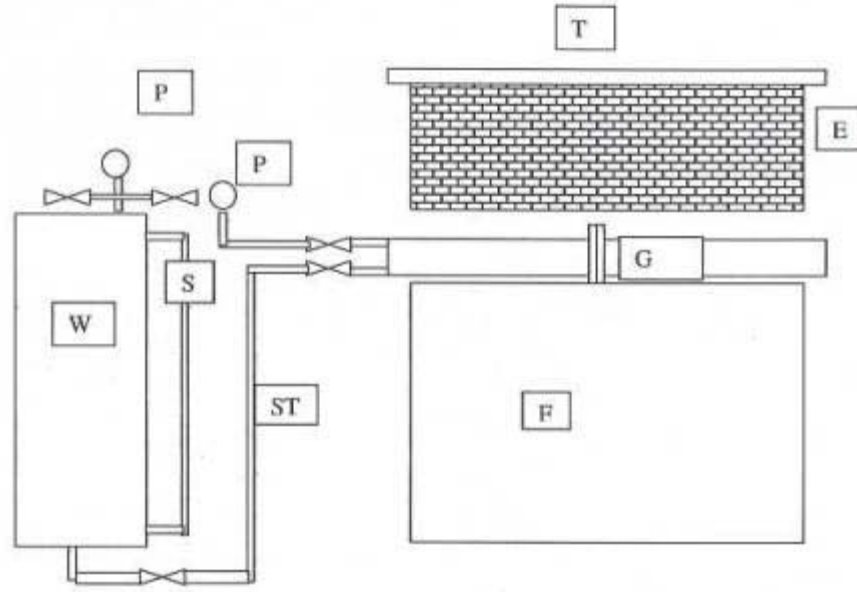
4.5 Methods of inspection.

4.5.1 Product certification. Hybrid gaskets of each size (1-inch, 4-inch, and 12-inch) shall be tested in both flat faced flanges and raised face flanges of the corresponding sizes. Gasket material samples shall be tested as applicable to 4.5.1.3.

4.5.1.1 Fire test. The hybrid gasket shall be tested in accordance with and shall meet the maximum allowable external leakage rate acceptance criteria of API-STD-607, as modified below. The test encompasses pressurizing the specimen with water, and exposing it to a hydrocarbon temperature curve as specified in the standard. During the test, leakage rate is measured by monitoring source tank levels. Testing of each size hybrid gasket shall be conducted using flat and raised face flanges and shall meet the following criteria and the requirements specified herein.

The fire test shall be conducted at a laboratory acceptable to the U S Navy. The laboratory shall comply with ISO/IEC 17025. The laboratory shall also demonstrate the ability to conduct testing in accordance with API-STD-607 by past successful testing or by demonstration of capabilities to the satisfaction of the U.S. Navy. Accreditation by a nationally recognized organization is needed to assure the U.S. Navy that the laboratory selected by the vendor is competent to conduct the testing and that they maintain an acceptable quality assurance program. An ABS surveyor or Naval Technical Authority shall certify the test laboratory. Figure 1 illustrates a typical fire test setup. Any variance in setup or test procedures requires NAVSEA approval prior to testing.

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F – Furnace
 G – Gasket/Pipe/Flange Specimen
 S – Sight Gauge
 W – Water Source Tank
 T – Furnace Top
 E – Furnace Extension Block
 P – Pressure Gauge with Steam Trap
 ST – Steam Trap

∞ - Valve

FIGURE 1. Typical modified API-STD-607 fire test setup for hybrid gasket.

4.5.1.1.1 Testing criteria. This 30-minute fire exposure test is intended to demonstrate that the gaskets will not fail catastrophically or contribute a significant amount of combustible liquid to a fire.

4.5.1.1.2 Test sample. Six gaskets, two 1-inch, two 4-inch and two 12-inch NPS, shall be tested, one sample of each size in flat face flanges and one sample of each size in raised face flanges. Each shall be installed in the applicable flange system including requirements for flange design and material, bolt design and material, torque limits in accordance with Figure 1 and the following. Piping shall be seamless carbon steel (ASTM A106/A106M, Grade A or B). Flanges shall be ASME B16.5 Class 150, socket weld, carbon steel with faces having a phonographic surface finish of 250 R(a). Flange bolts shall be MIL-DTL-1222, Grade 5, carbon steel, ½-inch diameter for 1-inch flanges, 5/8-inch diameter for 4-inch flanges, and 7/8-inch diameter for 12-inch flanges. Bolts shall be torqued to 94 ft-lbs for 1-inch NPS flanges, 187 ft-lbs for 4-inch flanges, and 582 ft-lbs for 12-inch flanges. To reduce furnace heat sink effects, all piping except 6 inches of pipe each side of the flange may be covered with 1-inch thick, 6 pcf ceramic fiber insulation.

4.5.1.1.3 Test conditions. The gasket/flange assemblies shall be subjected to the test conditions of API-STD-607 as modified herein:

- a. Substitute the test gasket/flange assembly for the test valve throughout API-STD-607.
- b. The test pressure shall be 100 psig, instead of the 30 psig used in the Fire-Test Conditions described in API-STD-607.
- c. Delete through-valve leakage collection of API-STD-607.

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d. As a further clarification, the Test Procedure in API-STD-607 applies to the flange/gasket assembly. External leakage is calculated for the total fire test period. The total fire test period is the fire exposure test period (30 minutes) plus the time to cool-down the assembly to below 212 °F.

e. Delete valve operational test of API-STD-607.

f. Delete through-valve seat leakage of API-STD-607.

4.5.1.1.4 Acceptance criteria. The flange/gasket assembly shall meet the maximum allowable external leakage rate acceptance criteria of API-STD-607 for the total fire test period. External leakage for flange/gasket assembly NPS 10 or smaller for the total fire test period, including cool-down, shall not exceed 25 milliliters per minute per NPS size. For flange/gasket assembly larger than NPS 10, the maximum allowable external leakage shall be 250 milliliters per minute (regardless of flange/gasket size). The total fire test period is the duration of the 30-minute fire test plus the cool-down period to reach 212 °F. The through-valve seat leakage of API-STD-607 is not required.

4.5.1.2 Pressure and temperature exposure test. The hybrid gasket shall meet the following pressure and temperature exposure test requirements.

4.5.1.2.1 Test sample. Six gaskets, two 1-inch, two 4-inch and two 12-inch NPS, shall be tested, one sample of each size in flat face flanges and one sample of each size in raised face flanges. Each shall be installed in the applicable flange system including requirements for flange design and material, bolt design and material, torque limits in accordance with the following. Piping shall be seamless carbon steel (ASTM A106/A106M, Grade A or B). Flanges shall be ASME B16.5 Class 150, socket weld, carbon steel with faces having a phonographic surface finish of 250 R(a). Flange bolts shall be MIL-DTL-1222, Grade 5, carbon steel, ½-inch diameter for 1-inch flanges, 5/8-inch diameter for 4-inch flanges, and 7/8-inch diameter for 12-inch flanges. Bolts shall be torqued to 94 ft-lbs for 1-inch NPS flanges, 187 ft-lbs for 4-inch flanges, and 582 ft-lbs for 12-inch flanges.

4.5.1.2.2 Test conditions. The gasket/flange assemblies shall be subjected to the test conditions as follows:

a. Clean flange face and install test hybrid gasket in test assembly.

b. Where a pump/regulator is not used to achieve and maintain pressure, calculate the amount of lube oil required to fill the flange assembly when the test conditions are at least 150 psig. Place a measured amount of lube oil, slightly greater than required in the flange assembly prior to closing.

c. Torque the flange assembly using the proper bolt tightening sequence.

d. Slowly heat the flange assembly to at least 250 °F but not to exceed 270 °F monitoring flange temperature. Since the flange may heat up faster than the lube oil, flange temperature shall be carefully monitored to ensure overheating does not occur.

e. If necessary, add small quantities of lube oil to the test assembly until at least 150 psig is obtained.

f. Monitor for at least 4 hours, checking for leakage and pressure loss. Use an ultrasonic leak detector or fluorescent dye to assist with locating leakage.

g. If leakage occurs, retorqued the flange bolts. Adjust pressure to 150 psig and verify tight seal for a 4-hour period.

h. Reduce temperature to ambient. Repeat steps d through g, then reduce temperature to ambient.

4.5.1.2.3 Acceptance criteria. The hybrid gasket shall show no visible leakage throughout the duration of the test and shall show no signs of leakage in the 30-minute period directly following the test. If the hybrid gasket leaks or fails to hold pressure after two re-torques, the gasket shall be considered inadequate.

4.5.1.3 Detrimental materials.

4.5.1.3.1 Heavy metals. Heavy metals shall be analyzed in accordance with the methods specified in ASTM D3223, D3557, D3559, or D4190 (see 3.2.1).

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4.5.1.3.2 Water leachable halides. For determination of water leachable halides, the concentration of bromide, chloride and fluoride ions in each filtrate shall be determined by ASTM D1246, D512, D1179, and D4327, as appropriate, and shall be corrected by the results of a blank determination (see 3.2.1).

5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When packaging of materiel is to be performed by DoD or in-house contractor personnel, these personnel need to contact the responsible packaging activity to ascertain packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activities within the Military Service or Defense Agency, or within the military service's system commands. Packaging data retrieval is available from the managing Military Department's or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

6. NOTES

(This section contains information of a general or explanatory nature that may be helpful, but is not mandatory.)

6.1 Intended use. Hybrid gaskets are intended for use in sealing flat and raised face flanges in fuel and lube oil piping systems installed on Navy surface ships and submarines. Hybrid gaskets are not approved for services requiring Level I and SUBSAFE levels of essentiality.

6.2 Acquisition requirements. Acquisition documents should specify the following:

- a. Title, number, and date of this specification.
- b. Quantity required.
- c. Part or identifying number (PIN) (see 1.3).
- d. Applicable National Stock Number (NSN).
- e. Specific issue of individual documents referenced (see 2.2.1 and 2.3).
- f. Packaging requirements (see 5.1).
- g. Applicable flange specification (MIL-PRF-20042, MIL-STD-777, MIL-STD-438 or ASME B16.5) flat or raised face (see 6.4).
- h. Shelf-life requirements (see 6.5).

6.3 Qualification. With respect to products requiring qualification, awards will be made only for products, which are, at the time of award of contract, qualified for inclusion in Qualified Products List QPL-32187 whether or not such products have actually been so listed by that date. The attention of the contractors is called to these requirements, and manufacturers are urged to arrange to have the products that they propose to offer to the Federal Government tested for qualification in order that they may be eligible to be awarded contracts or orders for the products covered by this specification. Information pertaining to qualification of products may be obtained from Commander, Naval Sea Systems Command, ATTN: SEA 05Q, 1333 Isaac Hull Avenue, SE, Stop 5160, Washington Navy Yard DC 20376-5160 or emailed to commandstandards@navsea.navy.mil.

6.4 Flange specification. The following documents provide useful information regarding guidance for bolting, flange geometry, flange materials and application.

- | | | |
|---------------|---|--|
| MIL-PRF-20042 | - | Flanges, Pipe, Bronze (Silver Brazing) |
| MIL-STD-438 | - | Schedule of Piping, Valves, Fittings, and Associated Piping Components for Submarine Service |
| MIL-STD-777 | - | Schedule of Piping, Valves, Fittings, and Associated Piping Components for Naval Surface Ships |

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6.5 Shelf-life. This specification covers items where shelf-life is a consideration. Specific shelf-life requirements should be specified in the contract or purchase order. The shelf-life codes are contained in the Federal Logistics Information System Total Item Record. Additive information for shelf-life management may be obtained from DoD 4140.27-M; Shelf-Life Management Manual, or the designated shelf-life Points of Contact (POC). The POC should be contacted in the following order: (1) the Inventory Control Points (ICPs), and (2) the DoD Service and Agency administrators for the DoD Shelf-Life Program. Appropriate POCs for the DoD Shelf-Life Program can be contacted through the DoD Shelf-Life Management website: <http://www.shelflife.hq.dla.mil/>.

6.6 Subject term (key word) listing.

Fire Resistant

Flat Face Flange

Fuel Oil Piping

Gasket

Hybrid Gasket

Lube Oil Piping

Raised Face Flange

Shipboard Use

Custodians:

Army – MI

Navy – SH

Preparing Activity:

Navy – SH

(Project 5330-1277-000)

Review Activities:

Army – MR

Navy - CG, NP, SA

DLA – IS

GSA - FSS

NOTE: The activities listed above were interested in this document as of the date of this document. Since organizations and responsibilities can change, you should verify the currency of the information above using the ASSIST Online database at <http://assist.daps.dla.mil>.