INCH-POUND
A-A-59720
October 23, 2002

COMMERCIAL ITEM DESCRIPTION

SEALING AND LOCKING COMPOUNDS, SINGLE-COMPONENT

The General Services Administration has authorized the use of this Commercial Item Description, for all federal agencies.

1. Abstract. This description covers requirements for single-component compounds and their primers suitable for sealing and locking metal parts. The compounds cure to an insoluable state when confined between closely fitting metal surfaces or when applied to surfaces treated with a compatible primer.

2. Salient characteristics. Salient characteristics shall be in accordance with 2.1 through 2.4.2. Preproduction testing for compliance with all characteristics that require testing (2.1.1.2, 2.1.2 and 2.2 through 2.4.2) shall be performed on the current formulation and every time there is a formulation change. Production testing of each batch is not required. However, production testing for compliance with 2.1.1.2 shall be performed every four years. Tests shall be conducted as specified on unpolymerized and polymerized compounds and, unless otherwise specified, shall be conducted at a temperature of 75°F +/- 5°F and a relative humidity of 50 +/- 5 percent.

Beneficial comments, (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commander, Naval Sea Systems Command, ATTN 05Q, 1333 Isaac Hall Avenue SE, STOP 5160, Washington Navy Yard, DC 20376-5160.

AMSC N/A FSC 8030

2.1 Formulation. The locking compounds shall have nominal compositions in accordance with Table 1.

Table 1 - Nominal Composition of Locking Compounds and Primer

Ingredients	Weight Percentage			
Grades	Compound AV	Compound AVV	Compound HT	Primer PR-N
Polyglycol dimethacrylate	80-85	60-65	-	-
Bisphenol A fumerate resin	-	30-35	-	-
Saccharin	-	1-3	0.1-1	-
Cumene Hydroperoxide	5-7	1-3	1-3	-
N, N-Dialkytoluidines	-	0.1-1	0.1-1	-
Cellulose Ester	1-3	-	-	-
Polyglycol dioctanoate	1-3	-	-	-
Tributylamine	1-3	-	-	-
Aromatic dimethacrylate ester	-	-	75-80	-
Maleimide resin	-	-	10-15	-
Hydroxyalkyl methacrylate	-	-	1-3	-
Methyl alcohol	-	-	1-3	-
Silica, amorphous, fumed	-	-	1-3	-
1-Acetyl-2-phenylhydrazine	-	-	0.1-1	-
Maleic acid	-	-	0.1-1	-
2-Ethylhexanoic acid	-	-	-	0.1-1
Organo-copper compound	-	-	-	0.1-1
Trialkylammonium Caboxylate	-	-	-	0.1-1
Acetone	-	-	-	95-100

2.1.1 Detrimental materials.

2.1.1.1 Prohibited materials. During the manufacturing processes, tests, inspections, and storage, mercury or mercury compounds shall not be intentionally added to or come in contact with the product at any time.

2.1.1.2 Chemical impurities. The amount of the following materials in the locking compound or primer shall not exceed the limits specified below when tested in accordance with 2.1.1.3 in the cured state:

(a) Total chlorides, bromides and fluorides shall each not exceed 0.0250 weight percent (250 ppm) (µg/g).

(b) Water leachable sulfur shall not exceed 0.0250 weight percent (250 ppm) (µg/g).

(c) Total antimony, bismuth, cadmium, lead, tin, zinc and phosphorus shall each not exceed 0.0250 weight percent (250 ppm) (µg/g).

2.1.1.3 Chemical impurities – Test procedure.

2.1.1.3.1 Halogen content determination.

2.1.1.3.1.1 Halogen content (consisting of fluorine, chlorine, and bromine) shall be determined by decomposing the product using Parr Bomb or Pyro hydrolysis techniques and analysis of the residue by ion chromatography, specific ion electrode, or spectrophotometric methods. Other equivalent methods may be utilized.

2.1.1.3.2 Water leachable sulfur test.

2.1.1.3.2.1 The water leaching test shall be performed as follows:

a. Cut one specimen from the selected sample, weighing approximately 15 grams, and record its exact weight to 0.1 gram. The sample weight may be adjusted provided the ratio of sample weight to final volume of solution is maintained (i.e. 15g/500ml).

b. Cut the specimen into small pieces not greater than 1/4 inch in any dimension.

c. Place the specimen in an 800 milliliter (ml) or larger beaker.

d. Add approximately 400 ml of distilled water per 15 grams of sample weight to the beaker.

e. Cover the beaker with a watch glass and heat for one hour minimum at 200-212°F.

f. Allow the beaker to cool to room temperature.

g. Vacuum filter the leachate from the beaker separately through a prewashed filter (No. 41 Whatman or equivalent coarse porosity filter) and a Buchner funnel. Wash the beaker thoroughly with distilled water using ten or more washes and vacuum filter the wash solutions. Dilute the filtrate to 500 ml, or the appropriate volume to maintain a 15 g/500 ml ratio.

h. If necessary, store the filtrate in a cleaned polyethylene or glass container covered to prevent evaporation.

i. Prepare a control filtrate with no specimen following the instruction in d through h.

2.1.1.3.2.2 Determination of leachable sulfur concentration. Using aliquots from the control filtrate and the sample filtrate in 2.1.1.3.2.1.g, determine the concentration of sulfur as follows:

a. Place 25 ml of the filtrate in a 50 ml or larger clean beaker properly identified.

b. Add distilled water saturated with bromine drop by drop while stirring until a red-brown color persists. Then cover the beaker with a watch glass.

c. Heat the solution in the covered beaker on a hot plate until the bromine color disappears.

d. Allow the solution to cool to room temperature.

e. Transfer the solution to a volumetric flask and add distilled water rinses from the beaker to make up a final volume that is consistent with the sulfate test method. Determine the sulfate ion concentration of this final diluted volume using an appropriate method of ASTM D 516.

f. Use the following formula to obtain the water-leachable sulfur concentration of the filtrate:

$$\text{Sulfur, } \mu g/g \text{ (ppm)} = C \times V_s \times V \times 0.334/(25.0 \times M)$$

Where:

C = concentration of sulfate ion (SO_4^{2-}) in filtrate, in milligrams per liter, determined in step e.

V_s = final volume of solution in milliliters per 2.1.1.3.2.1.g

V = milliliters of final diluted volume, and

M = grams of the test specimen, prepared per 2.1.1.3.2.1.a

2.1.1.3.2.3 Ion chromatography analysis in accordance with ASTM D 4327 and inductively coupled plasma analysis are acceptable alternates for the ASTM leachate analysis of 2.1.1.3.2.2 specified above.

2.1.1.3.2.4 The leachable sulfur concentration for primer shall be determined by testing the residue that is present after evaporation. The leachable sulfur concentration for compounds shall be determined with material that has been polymerized.

2.1.1.3.3 Analysis for metals and phosphorus

2.1.1.3.3.1 The individual concentrations of antimony, bismuth, cadmium, lead, tin, zinc and phosphorus shall be determined by atomic absorption, plasma emission, emission spectrographic or X-ray fluorescence methods, as appropriate. Other equivalent methods may be utilized.

2.1.2 The compounds and the primer shall have been certified and assigned a “Limited” or “Permitted” usage category in accordance with the Nuclear Powered Submarine Atmosphere Control Manual (NAVSEA S9510-AB-ATM-010/(U).

2.1.3 The compounds and primer shall not contain any Class I or Class II ozone depleting substances as designated by the Environmental Protection Agency in Code of Federal Regulations 40 (CFR) Part 82.

2.1.4 Locking compounds shall not be a Resource Conservation and Recovery Act (RCRA) hazardous waste in the unused or used forms or generate a hazardous when being applied due to the mixture rule, except for PR-N. PR-N has the potential to generate hazardous waste. The EPA hazardous waste number for PR-N is D001 (Hazardous waste per 40CFR 261.21/Acetone).

2.2 Properties, unpolymerized.

2.2.1 Viscosity. The unpolymerized compound shall have a viscosity within the range, as applicable, specified in Table 2, when tested as specified in 2.2.1.1.

Table 2 - Unpolymerized Viscosity and Polymerized Prevailing Torque of Locking Compounds

Grade	Viscosity, centipoises (pascal-seconds)	Prevailing Torque, in-lbs (newton-meters)
AV	100-250 (0.10-0.25)	100-250 (11.3-28.2)
AVV	1,000-10,000 (1.0-10.0)	100-250 (11.3-28.2)
HT	4,000-15,000 (4.0-15.0)	100 minimum (11.3 minimum)

2.2.1.1 The viscosity shall be determined by ASTM D445 or by method B of ASTM D1084. For ASTM D445 conversion to centipoises shall be made by multiplying the centistokes by the density of the compound.

2.2.2 Flash point. The unpolymerized compound shall have a flash point of not less the 200°F (93°C) when tested as specified in 2.2.2.1.

2.2.2.1 The flash point shall be determined with a tag closed tester using ASTM D 56.

2.2.3 Corrosivity. The unpolymerized compound shall not be corrosive to steel, aluminum alloy, or brass when tested as specified in ASTM D 5363.

2.2.4 Storage stability. The unpolymerized compound packaged in original bottles shall not show excessive deterioration when stored for 10 days at 120°F +/- 3°F (48.9°C +/- 1.7°C) and tested as specified in 2.2.4.1.

2.2.4.1 Five bottles of each size container shall be conditioned for 10 days at 120°F +/- 3°F (48.9°C +/- 1.7°C). After cooling to room temperature, the compound shall be tested for viscosity (see 2.2.1) and prevailing torque after normal curing (see 2.3.1). An increase in viscosity in excess of 50 percent, or failure of the compound to meet the prevailing torque specified in Table 2 shall constitute excessive deterioration.

2.2.5 Workmanship. The unpolymerized compound shall be smooth and homogeneous after shaking, free from lumps, caked material, and particles of foreign matter when examined.

2.2.6 Ultraviolet fluorescence. Grades AV and AVV of the unpolmerized compound shall fluoresce under ultraviolet illumination when tested in accordance with ASTM D 5363.

2.3 Properties, polymerized.

2.3.1 Prevailing torque after normal curing. Prevailing torque is the torque measured at 180° rotation of the nut when tested as specified in 2.3.1.1. The polymerized compound shall have an average prevailing torque within the range specified in Table 2.

2.3.1.1 Prevailing torque shall be determined as specified in ASTM D 5649 using unplated, 3/8-inch size, 24 threads per inch, Unified National Fine thread series, Class 2 fit (3/8-24 UNF2) Grade 2 bolts in accordance with SAE J429. Nuts shall conform to Federal Specification FF-N-836. The bolts shall have a minimum length of one inch.

2.3.2 Prevailing torque after immersion in solvents. The prevailing torque of each grade of compound shall not be less then the minimum value specified in Table 2 after immersion in the solvents specified in Table 3 when tested in accordance with in ASTM D 5363. The specimens used in the solvent resistance test shall be as specified in 2.3.1.1. The solvent resistance testing of grade HT shall be as specified in 2.3.2.1.

Table 3 - Solvents and Applicable Solvent Specifications

Solvent	Applicable Solvent Specification
Reagent water	ASTM D1193
Isopropyl alcohol	ATM D 770
Automatic transmission fluid	SAE J311b
Unleaded gasoline	ASTM D 439
Ethylene glycol	ASTM D 2693
Jet reference fuel	SAE AMS 2629
Lubricating oil[1/]	2190TEP per MIL-L-17331
Substitute ocean water[1/]	ASTM D 1141
Note: [1/] Grades AV and AVV are not required to be tested with lubricating oil and substitute ocean water solvents.	

2.3.2.1 For grade HT solvent resistance tests, prevailing torque shall be determined as specified in ASTM D 5649 using unplated, 3/8-inch size, 16 threads per inch, Unified National Course thread series, Class 2 fit (3/8-16UNC-2). Each bolt material specified in Table 4 shall be tested. The bolts shall have a minimum length of 1 inch. The prevailing torque shall not be less then the minimum value specified in Table 2 after immersion in the solvents specified in Table 3 when tested in accordance with in ASTM D 5363. The exceptions are that the minimum acceptable prevailing torque is 75 in-lbs for 70/30 copper-nickel in ethylene glycol and transmission fluid and for titanium in lubricating oil.

Table 4 - Fastener Hardware for Grade HT Solvent Resistance Tests

Alloy Group	Bolt Material	Nut Material
Iron Base Alloys[1/]	SAE J429 Grade 5 bolts	Nuts to FF-N-836
	Steel, AISI 4140 ASTM A193 Grade B7	ASTM A194, Grade 4 or Grade 7
	304 Stainless Steel ASTM F593, Group 1	304 Stainless Steel ASTM F594 Group 1
Copper Base Alloys	70/30 Copper Nickel ASTM B151, Alloy C71500	70/30 Copper Nickel ASTM B151, Alloy C71500
	Nickel Aluminum Bronze ASTM B124 or B150, Alloy C63200	Nickel Aluminum Bronze ASTM B124 or B150, Alloy C63200
Nickel Base Alloys	K-Monel QQ-N-286, Class A	Monel 400 QQ-N-281, Class A
	Alloy 625 ASTM B446, Grade 1	Alloy 625 ASTM B446, Grade 1
Titanium Base Alloys[1/]	Titanium ASTM B348, Grade 2	Titanium ASTM B348, Grade 2

Note:

[1/] Primer PR-N shall be applied to titanium and 304 stainless steel fasteners prior to application of the locking compound.

2.3.3 Speed of curing. The prevailing torque of each grade of compound after six hours of normal curing shall be not less than 50 percent, and after 24 hours not less than 100 percent of the minimum specified value in Table 2, when tested as specified in 2.3.1.1.

2.3.4 Hot Strength. The prevailing torque shall not be less than 60 percent of the minimum value specified in Table 2, after two hours exposure; for grade AV to a temperature of 200° +/- 10°F (93° +/- 5.5°C), for grade AVV to a temperature of 300° +/- 10°F (149° +/- 5.5°C), and for grade HT to a temperature of 425° +/- 10°F (218° +/- 5.5°C). The testing shall be as specified in ASTM D5363.

2.3.5 Heat aging. The prevailing torque for each grade of compound shall not be less than 50 percent of the minimum prevailing torque specified in Table 2 when grade AV and AVV are aged at 300° +/- 10°F (149° +/- 5.5°C) or grade HT is aged at 425° +/- 10°F (218° +/- 5.5°C) for 1000 +/- 2 hours and tested as specified in ASTM D 5363.

2.3.6 Low temperature torque. The prevailing toque at -65°F +/- 2°F (-53.9°C +/- 1°C) shall not be less than the minimum values specified in Table 2 when tested as specified in ASTM D 5363.

2.3.7 Fluid tightness. The compound shall be capable of making leak-tight assemblies when tested as specified in ASTM D 5657.

2.4 Primer properties.

2.4.1 Grade PR-N (speed of curing). Grade PR-N primer, when applied to unpolished and untreated cadmium or zinc surfaces, shall cause polymerization of the compounds specified herein after 6 hours of normal curing to provide a prevailing torque not less than 50 percent and after 24 hours not less than 100 percent of the minimum value specified in Table 2. Primer shall be applied by dipping the fastener components therein and allowing to dry in air. The prevailing torque determinations shall be as specified 2.3.1.1.

2.4.2 Storage stability. The primer, packaged in original bottle shall meet the requirements of this specification when conditioned for 10 days at 120°F (49°C) and tested as specified in 2.4.2.1.

2.4.2.1 Five bottles of primer shall be conditioned for 10 days at 120° +/- 3°F (49° +/- 1.7°C). After cooling to room temperature, each bottle shall be tested for speed of cure (see 2.4.1). Each of the five bottles tested must pass.

2.4.5 Product form. Primer shall be supplied in bottles only. Aerosol cans are prohibited.

3. Regulatory requirements. All appropriate regulator requirements that apply to items offered on the commercial market shall apply to those offered to the Government.

4. Quality assurance provisions.

4.1 Contractor certification. The contractor shall certify and maintain substantiating evidence that the product offered meets the salient characteristics of this Commercial Item Description in accordance with the required frequency of testing specified in 2, and that the product conforms to the producer's own drawings, specifications, standards, and quality assurance practices, and is the same product offered for sale in the commercial marketplace. The Government reserves the right to require proof of such conformance prior to first delivery and thereafter as may be provided for under the provisions of the contract.

4.2 Preproduction requirements. Prior to supplying material to this Commercial Item Description, the supplier shall provide objective evidence of successful completion of preproduction testing, consisting of 2.1.1.2, 2.1.2, and 2.2 through 2.4.2. Preproduction testing shall be repeated if the locking compound formulation is changed. Products previously tested and certified to primer N and to grades AV and AVV of MIL-S-22473 satisfy the preproduction requirements of this specification for primer PR-N and grades AV and AVV unless processing or formulation changes are made.

4.3 Production requirements. The supplier shall certify compliance with 2.1.1.1 and shall provide objective evidence of compliance with 2.1.1.2 (chemical impurities) in accordance with the frequency of testing specified in 2. The preproduction tests required by 4.2 are not required on each production lot.

5. Preservation, packaging, labeling and marking. The locking compounds shall be premixed and unit packed. Preservation, labeling, marking and other packaging requirements shall be as specified in the contract or order, except as a minimum, the following marking shall appear on the innermost container and all other containers or packaging in prominent letters:

(a) As appropriate:

Locking Compound AV per CID A-A-59720

Locking Compound AVV per CID A-A-59720

Locking Compound HT per CID A-A-59720

Primer PR-N per CID A-A-59720

(b) Store in a cool place

(c) Date of manufacture

(d) Manufacturer's instructions for use.

(e) WARNING! VAPOR ABOVE TLV IS IRRITATING TO EYES, NOSE AND THROAT AND CAN CAUSE HEADACHE, DIZZINESS, NAUSEA. AVOID PROLONGED BREATHING OF VAPORS. KEEP AWAY FROM EYES. WEAR SAFETY GLASSES OR GOGGLES. AVOID PROLONGED SKIN CONTACT. WEAR RUBBER OR PLASTIC GLOVES. VENTILATION MUST BE ADEQUATE TO AVOID EXCEEDING TLV.

6. Notes.

6.1 Intended use. These compounds are primarily intended to prevent the rotation of fasteners. Use of the compounds is limited by the gap between the mating parts and the service temperature. Locking compounds are typically limited to dry applications that may have incidental contact with fluids. Applications involving continuous fluid contact should be addressed on a case basis.

6.1.1 Joint gap. Grade AV is recommended for a maximum radial gap of 0.005 inch. Grade AVV is recommended for radial gaps that are in excess of 0.005 inch. For most applications the appropriate locking compound may be selected based on the nominal diameter of the fastener, as shown in Table 5, in lieu of measuring the specific joint gap.

Table 5 - Recommended Applications Limits for Locking Compounds

Normal Operating Temperature of Joint	Recommended Locking Compound 1/, 2/, 3/	
	Fastener diameter – 3/4 inch or less	Fastener diameter – Over 3/4 inch
200°F maximum	Grade AV	Grade AVV
200°F to 300°F	Grade AVV	Grade AVV
300°F to 425°F	Grade HT	Grade HT

Note 1/ Grade AV is the preferred compound for fasteners with diameters of up to 3/4 inch diameter.

Note 2/ Grade AVV is the preferred compound for fasteners with diameters over 3/4 inch and through 2-1/4 inch. Grade AVV may also be used for fasteners up to 3/4 inch in diameter if the application temperature exceeds 200°F (300°F maximum). However, because the disassembly torque (at ambient temperature) may be two times greater than Grade AV, it may be necessary to heat the joint above 300°F during disassembly to avoid fastener failure.

Note 3/ Grade HT is used for fasteners where the operating temperature exceeds 300°F (425°F maximum) and the need for subsequent disassembly is remote. Grade HT is considered a permanent locking compound and subsequent disassembly is very difficult. It may necessary to heat the joint above 450°F for disassembly.

6.1.2 Maximum temperature. A-A-59720 materials may be used where the normal operating temperature of the joint assembly (i.e., not the maximum service rating of the component or system, or normal system operating temperature) does not exceed 200°F for grade AV, 300°F for grade AVV and 425°F for grade HT. These materials degrade at higher temperatures.

6.1.3 Primer. Primer PR-N is intended to be applied to passive or inert material surfaces such as stainless steel, titanium alloys, bright plating and natural or chemical black oxide on steel prior to the application of the locking compound. The primer facilitates curing of locking compounds on inert surfaces.

6.1.3.1 Primer PR-N will be a hazardous waste (hazardous waste number D001 - Ignitability) in the unused form if a bottle containing this product is disposed of as waste.

6.1.3.2 Primer PR-N should be applied with a brush. The amount of material on the brush should be controlled so that the primer evaporates from the brush during use (i.e. the brush must be dry after primer application). This is intended to prevent the brush from being considered hazardous waste.

6.2 Suggested source of supply.

Grade AV	Loctite AV Threadlocker
Grade AVV	Loctite AVV Threadlocker
Grade HT	Loctite 272 Threadlocker
Primer PR-N	Loctite Activator 7649 (Primer N)

Manufacturer: Loctite Corporation, 1001 Trout Brook Crossing, Rocky Hill, CT 06067)

6.3 Source of Reference Documents.

6.3.1 ASTM Standards are available from the American Society for Testing and Materials, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.

6.3.2 The Code of Federal Regulations (CFR) is available from the Superintendent of Documents, Government Printing Office, Washington, DC 20402.

6.3.3 NAVSEA S9510-AB-ATM-010/(U) is available from the Naval Sea Systems Command, ATTN 05L2, 1333 Isaac Hull Avenue SE STOP 5122, Washington Navy Yard, DC 20376-5122.

6.3.4 Requests for certification of locking compounds not listed in Appendix A of NAVSEA S9510-AB-ATM-010/(U) can be made in writing to Commander, Naval Sea Systems Command, ATTN 05L2, 1333 Isaac Hull Avenue SE STOP 5122, Washington Navy Yard, DC 20376-5122. Contingent upon successful completion of an evaluation, NAVSEA 05L2 will certify the material and include the product in Appendix A. The supplier of the material will cover the cost of any needed tests.

Custodians
- Army – MR
- Navy – AS
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Preparing Activity:
- Navy – SH
- Project 8030-0813

Review Activities
- Army – CR, CR4, MD, MI
- Navy – OS
- Air Force – 84, 99
- Other - DS