



DEPARTMENT OF THE NAVY

PUGET SOUND NAVAL SHIPYARD  
1400 FARRAGUT AVENUE  
BREMERTON, WASHINGTON 98314-5001

IN REPLY REFER TO  
9505  
Ser 260LCM/018  
MAY 10 2002

From: Commander, Puget Sound Naval Shipyard

Subj: PROHIBITION OF SHORT LIFE GASKET MATERIALS AND APPROVAL OF UNAFLEX® MONOFILAMENT NYLON INSERTED RUBBER AS REPLACEMENT

Ref: (a) HH-P-151 Packing, Rubber-Sheet, Cloth-Insert  
(b) MIL-G-1149 Gasket Materials, Synthetic Rubber, 50 and 65 Durometer Hardness  
(c) UNAFLEX® Monofilament Nylon Inserted Rubber (Types 87, 94, 95, and 96)  
(d) MIL-STD-777 Schedule of Piping, Valves, Fittings, and Associated Piping Components for Naval Surface Ships  
(e) MIL-STD-438 Schedule of Piping, Valves, Fittings, and Associated Piping Components for Submarine Service

Encl: (1) Listing of Replacements for each Type and Class of Govt Spec Rubber Product  
(2) MIL-STD-777 and MIL-STD-438 Categories where UNAFLEX® Nylon Inserted Rubber is Approved  
(3) Commercial Performance Characteristics for UNAFLEX® Nylon Inserted Rubber  
(4) National Stock Numbers for UNAFLEX® Nylon Inserted Rubber

1. The purpose of this letter is to prohibit the use of references (a) and (b) as gaskets in many shipboard piping systems and to approve reference (c) as a replacement. Reference (a) material leaks and has low service life. Reference (b) material is subject to extrusion or blowout and has low service life.

2. Reference (c) is approved for use on surface ships and submarines for nonnuclear applications. It may be used for new installations and for replacement of existing material where drawings call out the use of reference (a) or (b). This approval permits its use in lieu of reference (a) or (b) on non-deviation drawings. There are specific types and classes of both reference (a) and (b), and each is replaced by an appropriate type of reference (c) material. Enclosure (1) lists the types and classes of each specification, and the commercial replacement. Enclosure (2) indicates reference (d) and (e) categories in which reference (c) material is approved for use.

3. Reference (a) material shall not be used for pressurized liquid systems or vacuum systems where reinforcing fibers are subjected to system fluid. Such applications lead to wicking of liquids through the fibrous material used to reinforce the rubber gasket. Other applications of reference (a) material, such as diaphragm material for

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liquid systems and gaskets for air conditioning duct, are still allowed. Reference (a) can still be used in applications where such material is not being used to create a leak tight joint, or where leakage would not result in ill effects.

4. Reference (b) use shall be strictly curtailed in flat gasket applications where there is no hard backing or anti-extrusion device on the low pressure side of the gasket material. Reference (b), Type I material shall not be used in any system with pressures exceeding 15 psig, or in vacuum. Reference (b), Type II material shall not be used in any system with pressures exceeding 50 psig. Reference (d), Note 4.43, indicates that any place reference (b) is specified, reference (a) material may be used. This use is prohibited unless conditions of this letter are met.

5. Reference (c) may also be used in systems other than those where reference (a) or (b) were prohibited. In this case, reference (c) material stands as an equal. Enclosure (2) includes such systems.


6. Reference (c) material is a commercial item of proprietary nature. There are no other known products that give equivalent performance, which is briefly described in enclosure (3). National Stock Numbers (NSNs) assigned to these commercial products are listed in enclosure (4).

7. Use of reference (a) and reference (b) material shall be limited to stock on hand. Currently, installed gaskets are not required to be removed.

8. A copy of this letter should be filed with references (d) and (e) until a formal specification for reference (c) can be issued, and these references updated.

9. Puget Sound Naval Shipyard is the Life Cycle Manager for piping components. Technical point of contact is Mr. Charlie Brady, Code 260.5LCM, DSN 439-1487, or (360) 476-1487, Fax (360) 476-1438.

10. The contents of this correspondence do not in any way change the terms of any understanding, solicitation or contract existing with the Government. Any change inferred will not be effective or binding upon the Government unless formalized by an appropriate contractual document executed by the cognizant administrative contracting officer.

  
RICHARD M. SHIPLEY  
By direction

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## Listing of Replacements for each Type and Class of Govt Spec Rubber Product

MIL-G-1149, Type I and II are two different hardness of four classes of material. Each of the four classes are made of different rubber compounds.

Class 1 is directly replaced by UNAFLEX® Type 87.

Class 2 is directly replaced by UNAFLEX® Type 96.

Class 3 is not directly replaced by any of the specified UNAFLEX® products. MIL-G-22050 may be used in its place. The required usage of this material is generally in concert with some form of hard backing or anti-extrusion device, and this use is not restricted.

Class 5 is directly replaced by UNAFLEX® Type 94.

HH-P-151 includes four classes, each made of different rubber compounds.

Class 1 is a commercial rubber which can contain many different polymers, but generally does not contain butyl. This specific class is a low cost alternative to other specific classes, and no commercial substitute is selected or suggested.

Class 2 is directly replaced by UNAFLEX® Type 87.

Class 3 is directly replaced by UNAFLEX® Type 96.

Class 4 is directly replaced by UNAFLEX® Type 94. In critical applications, and on non-deviation drawings, Class 4 material is directly replaced by UNAFLEX® Type 95.

Standardization techniques should be employed when implementing the approved UNAFLEX® products. Though direct replacement in kind is feasible, it may be more profitable to select one product to meet the requirements of a given work package.

Type 95 extended performance nitrile rubber with monofilament nylon woven fabric insert is a direct replacement for HH-P-151 Class 4 when specified on non-deviation drawings in nonnuclear applications.

Type 94 is a full performance nitrile rubber with monofilament nylon woven fabric insert and is a direct replacement for HH-P-151 Class 4 for all uses involving straight fuel (including JP-5) and oil, including waste oil.

## Listing of Replacements for each Type and Class of Govt Spec Rubber Product

Type 87 is a full performance polychloroprene rubber with monofilament nylon woven fabric insert and is a direct replacement for HH-P-151 Class 2 for all uses involving oily waste and fuel stripping.

Type 96 is a full performance styrene-butadiene rubber with monofilament nylon woven fabric insert and is a direct replacement for HH-P-151 Class 3 for all uses involving waste systems.

Types 87 and 96 can be used interchangeably in most fresh water, seawater, brine, cooling water, and waste water as direct replacements where MIL-STD-777 and MIL-STD-438 call out either HH-P-151 or MIL-G-1149. Enclosure (2) clarifies by listing only Type 96, or only Type 87, where only one type is permitted. Generally, Types 94 and 95 can be used in same systems, however, are somewhat more expensive and is usually not justified.

Type 94 is a direct replacement for gaskets specified for JP-5 sounding tubes, vents and overflows.

MIL-STD-777 and MIL-STD-438 Categories where  
UNAFLEX® Nylon Inserted Rubber is Approved

MIL-STD-777. The following categories of the standard allow the listed UNAFLEX® products. Products mentioned below as Type 87, 94, 95, and 96 all refer to this product line.

Note 4.43 indicates that any place MIL-G-1149 is specified, HH-P-151 may be used, provided the joint is not subjected to acids for pickling or cleaning. HH-P-151 shall not be used where this letter prohibits it. However, applicable UNAFLEX® products as substitutes for HH-P-151 are specifically allowed in this case, including joints subjected to acids for pickling or cleaning.

Fresh water:

C-1 Type 96, 87, or 94.

C-2 Potable water shall be Type 96 or EPDM rubber (MIL-G-22050). All other applications can be Type 96, 87, or 94 subject to Note C-2-6. Materials selected for use in steam condensate systems shall be tested for leachable chlorides not to exceed 200 ppm.

Seawater:

D-1 Type 96 or 87. MIL-G-1149 Type II may be used in suction lines but is not preferred.

D-2 Type 87.

D-3 Type 96 or 87. Type 94 or 95, AMS-G-6855 GR I, Class 80, or MIL-G-22050 Grade 2 or 3 are to be used for suction sea chest steam out connections.

N-2 Type 87

Waste water:

R-1 MIL-G-1149 Type II can be used in this system, as the application does not exceed 50 psig. However, if reinforced rubber is specified on system drawings, then Type 87 should be used. Type 94 is a valid alternative but the added expense is not justified.

R-3 and R-4 Type 96 is preferred. Type 87 is a valid alternative. Type 94 is not recommended. MIL-G-1149 Type II Class 2 is allowed.

Fuel stripping:

U-1 (Class 4). Type 94 is preferred. Type 87 is allowed as an alternative.

Enclosure (2)

MIL-STD-777 and MIL-STD-438 Categories where  
UNAFLEX® Nylon Inserted Rubber is Approved

Fuel:

H-1 Type 94 or 95 may be used in place of MIL-C-6183. See Note 1.

I-1 Type 94 or 95 may be used in place of MIL-C-6183. See Note 1.

Other systems:

H-2 Type 94 or 95 may be used in place of MIL-C-6183.

J-4 Type 94 preferred, and Type 87 is allowed. MIL-G-1149, Type II, Class 3 is allowed for locations whose normal operating pressure is 50 psig or below. MIL-G-22050 may be used as an alternative.

L-1 Type 96 or 87. Type 94 is acceptable but not justified.

M-1 Type 96 or 87.

N-1 Type 87

Y-1 Type 94 or 95 may be used in place of MIL-C-6183.

Y-2 Type 87. Type 94 is allowed but not justified.

Y-3 Type 96 or 87. Type 94 is allowed but not justified.

Y-4 Type 96 or 87. Type 94 is allowed but not justified.

Note:

S9AA0-AB-GOS-010 Section 542c states that gaskets in gasoline and JP-5 systems shall be "full face type and be compressed from the original thickness of 0.125 inches to between a minimum gasket thickness compression of 20 percent, 0.100 inches, and a maximum compression of 30 percent, 0.088 inches." In lieu of this requirement, yet consistent with its intent, use of UNAFLEX® Nylon inserted rubber in these systems as allowed by this enclosure shall be allowed in only 0.125 inch nominal thickness with no restriction on the compression of the gasket.

MIL-STD-777 and MIL-STD-438 Categories where  
UNAFLEX® Nylon Inserted Rubber is Approved

MIL-STD-438. The following categories of the standard allow the listed UNAFLEX® products. Products mentioned below as Type 87, 94, 95, and 96 all refer to this product line.

Fresh water:

B-1 Type 96, 87, or 94, subject to remarks for HH-P-151 gaskets in category B-1. Materials selected for use in steam condensate systems shall be tested for leachable chlorides not to exceed 200 ppm.

B-2 Type 96.

N Type 96, 87, or 94.

Seawater:

C-2 Type 96 or 87.

Other systems:

F-4 Type 94 preferred, and Type 87 is allowed. MIL-G-22050 may be used as an alternative.

F-5 Type 94 preferred, and Type 87 is allowed. MIL-G-22050 may be used as an alternative.

H-1 HH-P-151 is still allowed. Type 96 or 87 may be used as an alternative.

O Type 96 or 87.

Distilling plants. Type 94 should be used in place of HH-P-151 for seawater, brine, and fresh water applications exceeding 180 degrees F but less than 250 degrees Fahrenheit.



Commercial Performance Characteristics for UNAFLEX® Nylon Inserted Rubber  
Type 87, 94, 95, or 96

Salient Characteristics. Certificate of compliance to the below is required.

Construction. The finished product shall be constructed in .063 inch increments of thickness with balanced plies, having a layer of reinforcement for each increment of .063 inches. The rubber shall be completely bonded to the reinforcement, encapsulating the entire circumference of the individual reinforcing strands leaving no fluid path adjacent to the reinforcement.

Rubber requirements. The rubber shall be a single elastomer or compounding of various elastomers. The compound shall not contain natural rubber or polyester urethane. The rubber constituent shall be equal to one of the following, dependent on type designation:

ASTM D2000 designation M2-BC607-A14-B14-C12 for Type 87, or

ASTM D2000 designation M5-BG607-A14-B14-E034 for Type 94, or

ASTM D2000 designation M4-BK610-A24-B14-E034 for Type 95, or

ASTM D2000 designation M2-AA603-A13-B13-EA14 for Type 96.

Reinforcement requirements. The reinforcement shall be woven fabric of individual mono-filament nylon (polyamide thermoplastic) strands. Weave of the strands shall be open enough for rubber coating material to reach and bond with all areas of each strand's circumference. Individual strands shall only have contact with perpendicular strands.

Finished product response. The finished product shall perform as noted in the following paragraphs. Prior to all finished product testing, the test articles shall be conditioned by aging in air for 70 hours at 212°F(100°C) for Type 87, 94, and 95 and at 158°F(70°C) for Type 96.

Strength and flexibility test. Test article shall be tested for tensile strength and elongation in accordance with ASTM D412, using Die C. The properties shall be measured in two principle directions, and diagonally at  $45 \pm 5$  degrees ( $.78 \pm .08$  radians). Acceptance criteria are as follows: Tensile strength in each principle direction shall be not less than 1750 psi. Elongation in each principle direction shall be not greater than 40% and not less than ten percent. Tensile strength in the diagonal direction shall be not less than 550 psi. Elongation in the diagonal direction shall be not greater than 80 percent.

Commercial Performance Characteristics for UNAFLEX® Nylon Inserted Rubber  
Type 87, 94, 95, or 96

Sealability test. Test article shall be  $.125 \pm .010$  thick, with outside diameter matching the test fixture, and the inner diameter 1.0 inches less. Test the article in accordance with ASTM F37 Method B, at a hydrostatic pressure of 150 psi, and gasket stress of 0.300 KSI for three successive intervals of 30 minutes after normalizing for one hour using distilled water. Leakage rate shall not exceed 0.02 mL/hr per inch of seal length (based on circumference at inner diameter). Leakage measured shall result in no visually detectable moisture on outside surface of the gasket.

Marking. The finished product shall be marked with manufacturer trademark and the cure date in format of quarter and year.

Intended use. The end product is intended for use as a sheet gasket material which will subject the rubber (cover material), the reinforcing material, and bonding material to the process fluids at pressures up to 400 psig and temperatures of up to 120°F {Type 96}, 180°F {Type 87} and 250°F {Type 94 or 95} on a continuous basis.

National Stock Numbers for UNAFLEX® Nylon Inserted Rubber

Styrene-Butadiene Rubber

Type 96	1/16" thick x 36" x 50 foot roll	5330-01-490-4926
	1/8" thick x 36" x 50 foot roll	5330-01-490-5014
	1/16" thick sheet 36" x 48"	5330-01-490-5035
	1/8" thick sheet 36" x 48"	5330-01-490-5044

Polychloroprene Rubber

Type 87	1/16" thick x 36" x 50 foot roll	5330-01-490-4892
	1/8" thick x 36" x 50 foot roll	5330-01-490-5005
	1/16" thick sheet 36" x 48"	5330-01-490-5051
	1/8" thick sheet 36" x 48"	5330-01-490-5071

Butadiene Nitrile Rubber

Type 94	1/16" thick x 36" x 50 foot roll	5330-01-490-4929
	1/8" thick x 36" x 50 foot roll	5330-01-490-9769
	1/16" thick sheet 36" x 48"	5330-01-490-5075
	1/8" thick sheet 36" x 48"	5330-01-490-5086

Premium Butadiene Nitrile Rubber

Type 95	1/16" thick x 36" x 50 foot roll	5330-01-490-4936
	1/8" thick x 36" x 50 foot roll	5330-01-490-9763
	1/16" thick sheet 36" x 48"	5330-01-491-6561
	1/8" thick sheet 36" x 48"	5330-01-490-5088

# NEOPRENE CI SHEET TYPE #87

## Features:

- Plate Finish
- Nylon inserted
- For general use where an oil resistant reinforced rubber is required

**Duro:** 60

**Tensile:** 1000 PSI

**Elongation:** 400%

**Color:** Black

<b>GAUGE (INCH)</b>	<b>WIDTH (INCH)</b>	<b>LENGTH FT/ROLL</b>	<b>WEIGHT APPROX. LBS/SQ. YD</b>	<b>PLY</b>
1/16"	36 or 48	50	4.25	1
3/32"	36 or 48	50	6.99	1
1/8"	36 or 48	50	8.50	2
3/16"	36 or 48	50	12.75	2
1/4"	36 or 48	25	17.00	2

## RED RUBBER SHEET TYPE #95

### Features:

- Plate Finish
- For general gasket applications with no oil-resistant requirements

**Duro:** 75

**Tensile:** 400 PSI

**Elongation:** 200%

**Color:** Red-Brown

<b>GAUGE (INCH)</b>	<b>WIDTH (INCH)</b>	<b>LENGTH FT/ROLL</b>	<b>WEIGHT APPROX. LBS/SQ. YD</b>
1/16"	36 or 48	50	5.75
3/32"	36	50	7.75
1/8"	36 or 48	50	11.50
3/16"	36 or 48	50	17.25
1/4"	36 or 48	25	23.00

# SBR CI SHEET TYPE #96

**Features:**

- Plate Finish
- Insertion: Nylon 14.5 oz
- General use where a fabric reinforced rubber is required

**Duro:** 70**Tensile:** 400 PSI**Elongation:** 200%**Color:** Black

<b>GAUGE (INCH)</b>	<b>WIDTH (INCH)</b>	<b>LENGTH FT/ROLL</b>	<b>WEIGHT APPROX. LBS/SQ. YD</b>	<b>PLY</b>
1/16"	36 or 48	50	4.75	1
3/32"	36 or 48	50	7.13	1
1/8"	36 or 48	50	9.00	2
3/16"	36 or 48	50	13.20	2
1/4"	36 or 48	25	19.00	2

# WHITE NITRILE SHEET TYPE #94

**Features:**

- Plate Finish
- For applications where FDA requirements and good oil resistance are needed
- Non-marking

**Duro:** 60**Tensile:** 1000 PSI**Elongation:** 550%**Color:** White

GAUGE (INCH)	WIDTH (INCH)	LENGTH FT/ROLL	WEIGHT APPROX. LBS/SQ. YD
1/16"	36 or 48	50	3.84
1/8"	36 or 48	50	7.68
3/16"	36 or 48	50	11.52
1/4"	36 or 48	25	15.36
1/2"	48	25	30.20
3/4"	48	25	45.60