

NAVISTAR, INC.		
Material, Parts, and Process Specifications (MPAPS)		NUMBER: MPAPS K-15
		Former Designation: CEMS D-15 Part II
O Ring Material and Design		CURRENT Rev. No.: 1408
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PRINTED COPIES OF THIS DOCUMENT MUST BE VERIFIED FOR CURRENT REVISION		
<i>This specification may involve hazardous materials, equipment, and procedures. This specification does not purport to address all of the safety issues associated with its use. The user is responsible to consult appropriate safety and health practices and to determine the applicability of regulatory limits prior to use.</i>		
Change Notice: Changed to new MPAPS format; editorial changes.		

1.0 SCOPE

This specification provides basic material application information for elastomeric O-rings, along with design requirements via a checklist in MPAPS K-15 Appendix.

NOTE: The material classes called out here refer to the general elastomer families (FKM, EPDM, Nitrile, etc., in the Engineering Standards Parts specifications) and the physical property tests called out are short term tests that provide only a general indication of material and fluid compatibility, not long term seal performance. Within each elastomer class (family), there are many different compound numbers (formulations) available; every supplier has their specific rubber compounds with different performance characteristics. In most cases, specific compound numbers will be required for print sign-off to define and lock down qualified compounds that have passed long term tests. Consult Materials Engineering for guidance. Refer to MPAPS K15-5003A for approved FKM compound numbers from various suppliers.

For seal joints where specific elastomer compound control is not required, one can refer to the Engineering Standard Parts specifications, Sections S and SM, for O-ring part numbers.

2.0 INTRODUCTION

“O” ring seals are used to prevent leakage in joints of systems carrying various types of fluids at various pressure levels.

2.1 Restricted Chemical Substances

Effective January 1, 2007, all product supplied to the requirements of this specification must comply with the requirements of the MPAPS B-50 specification.

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4.0 REFERENCE DOCUMENTS

Unless otherwise specified, the latest issue of all referenced standards shall apply. The following standards, specifications and regulations are referenced in this specification.

Quality System Standard <i>ISO 9001 or TS-16949</i>	ASTM D 573
NAVISTAR MPAPS B-50	ASTM D 1414
NAVISTAR Manufacturing Standard MS-D-13	ASTM D 1415
CFR Title 29, Part 1910	ASTM D 1418
NAVISTAR CEMS DT-1	ASTM D 2000
NAVISTAR CEMS DT-6	SAE J200

5.0 CLASSIFICATION OF COMPOUNDS

The O ring seal materials are classified by material type, hardness, and application. Six classes of compounds are covered by this specification, listed with their intended usage, in Table I below.

TABLE I - CLASSIFICATION OF COMPOUNDS

Designation				Typical Material (Rubber)	Hardness Shore A	Application	Resistant to
NAVISTAR Class	Obsolete NAVISTAR Class	Approx ASTM D 1418	Approx SAE J200, ASTM D 2000				
3	-	EPDM	CA	ethylene propylene	70 - 80	static	nonmineral oils, alcohols, brake fluids or fire resistant fluids such as phosphate esters
3A	-	EPDM	CA	ethylene propylene	85 - 95	same as Class 3 – for use with greater pressures and more severe operating conditions	same as Class 3
5	1,2	NBR	BK	nitrile	70 – 80	static and dynamic close tolerances	gasoline, oils, hydraulic fluids, water and 50:50 water – ethylene glycol
6	4	NBR	BK	nitrile	85 – 95	same as Class 5 – for use with greater pressures and more severe operating conditions	same as Class 5
7	-	FPM	HK	fluoro-carbon	70 – 80	static and light dynamic duty and high temperature	hydraulic fluids, fuels and lubricants at temperatures -40°C (-40°F) to 230°C (450°F) *
8	-	FPM	HK	fluoro-carbon	85 – 95	same as Class 7 – for use with greater pressures	same as Class 7 *

*Certain base-resistant FPM, Class 7 and 8 Compound Numbers will perform satisfactorily in water and water-ethylene glycol environments. The appropriate materials engineering department should be consulted regarding these applications of Class 7 and 8 rings.

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5.1 Engineering Qualification

Production material can be furnished under this specification only after formal Engineering Qualification. The appropriate purchasing department (refer to the Corporate Purchasing Delegation Manual available from Purchasing and Supplier Development), or Group Engineering facility provided the delegated buyers are notified, will request Materials Engineering, or a Materials Engineering designated facility, to conduct the Engineering Qualification tests with the supplier furnishing all the required samples. Materials submitted for qualification will be accompanied by detailed test information and also by certification that the material meets all requirements of this specification.

After the material has been tested by the approved facility, the design engineering departments will be notified and, if appropriate, invited to conduct performance tests as deemed necessary. On completion of these tests, the purchasing departments involved and all engineering departments will be notified that the material has been either qualified or rejected.

Material subsequently supplied to this specification will have the same formulation as the qualification samples. Any change in composition or method of manufacture will void the qualification and preclude the materials usage for NAVISTAR. After reviewing the details of the proposed change in material composition or method of manufacture, the appropriate International purchasing and engineering departments and Materials Engineering may elect to waive requalification evaluations and grant qualification to the product.

Samples submitted for test will consist of 200 SAE 214 O rings and 6 ASTM test buttons and slabs.

6.0 GENERAL REQUIREMENTS

Requirements for rings of Classes 3, 3A, 5, 6, 7, and 8 are shown in Tables II, III, IV, V, and VI. Inspection tests will be conducted on production rings except where size makes this impractical. In these instances, the supplier will furnish the same compound in SAE 214 O rings, unless other suitable size O rings are specifically requested by the NAVISTAR manufacturing plant.

TABLE II - PROPERTY REQUIREMENTS FOR CLASSES 3 AND 3A

PROPERTY		CLASS 3	CLASS 3A
ORIGINAL PROPERTIES			
Hardness, Shore A		70 to 80	85 to 95
Tensile Strength, min	psi	1200	1000
	MPa	8.3	6.9
Ultimate Elongation, % min		100	80
Modulus at 100%	psi	400	800
	MPa	2.8	8.5
HEAT AGED PROPERTIES			
Aged 70 hours at Aging Temp		100°C (212°F)	100°C (212°F)
Hardness, points change from original hardness, max		+10	+10
Tensile Strength, % change from original tensile strength, max		-15	-20
Elongation, % change from original elongation, max		-45	-50

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COMPRESSION SET PROPERTIES			
Compression Set, 70 hours at set temperature		100°C (212°F)	100°C (212°F)
Compression Set, % max	thickness to 0.110 inch (2.8 mm), incl	50	50
	thickness over 0.110 inch (2.8 mm)	45	45
FLUID AGED PROPERTIES CLASS 3			CLASS 3A
70 hours at Aging Temp		100°C (212°F)	100°C (212°F)
Type of Fluid		hydraulic brake fluid per SAE J 1703	hydraulic brake fluid per SAE J 1703
Hardness, points change from original		-15 max	-15 max
Tensile Strength, % change from original, max		-45	-45
Elongation, % change from original, max		-45	-50
Volume, % change from original		+15 max	0 to +20
LOW TEMPERATURE AGED PROPERTIES CLASS 3			CLASS 3A
		Aged as Received	Aged as Received
Aged 5 hours at Aging Temp		-40°C (-40°F)	-30°C (-22°F)
Figure 8 Bend Test		no cracks	no cracks

TABLE III – PROPERTY REQUIREMENTS FOR CLASS 5

PROPERTY			CLASS 5	
ORIGINAL PROPERTIES				
Hardness, Shore A		sheet specimens	70 to 80	
		rings	70 to 80	
Tensile Strength, min	ring thickness	thru 0.175 inch		1750 psi (12.1 MPa)
		thru 4.4 mm		
		over 0.175 in thru 0.250 in		1575 psi (10.9 MPa)
		over 4.4 mm thru 6.4 mm		
		over 0.250 inch		1400 psi (9.7 MPa)
		over 6.4 mm		
Ultimate Elongation, % min, rings			225	
Modulus, min, rings		at 50 % elongation	--	
		at 100% elongation	400 psi (3.0 MPa)	
HEAT AGED PROPERTIES				
Aged 70 hours at Aging Temp			125°C (257°F)	
Hardness, points change from original hardness, rings			0 to +7	
Tensile Strength, % change from original tensile, rings			-15 to +20	
Elongation, % change from original elongation, rings			0 to −40	

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