

NAVISTAR, INC.		
Material, Parts, and Process Specifications (MPAPS)		NUMBER: MPAPS F-30
		Former Designation: CEMS D-30
TITLE: Coolant Hose		CURRENT REV No.: 1704
		DATE: Apr. 2017
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<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>		

1.0 APPLICATION

This specification covers general requirements, property and performance requirements, identification, quality, packing and shipping, and source approval and quality control requirements for coolant hoses used on Navistar vehicles as assembled in Navistar plants and for field service applications.

2.0 SCOPE

This specification covers requirements of straight and preformed hose intended for use as radiator hose, heater hose and other flexible conduits for engine cooling systems.

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.

2.2 Hose Connections

Effective April 2012 on all releases subsequent to this date, hose dimensions and tolerances shall meet MPAPS F-1.

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4.0 REFERENCE DOCUMENTS

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

Quality System Standard ISO 9001 or TS-16949	NAVISTAR TMS-6018	ASTM D 412
NAVISTAR Supplier Packing and Shipping Std. D-13	NAVISTAR TMS-6025	ASTM D 413
NAVISTAR Engineering Design Std. A-16	NAVISTAR TMS-6026	ASTM D 471
CFR Title 29, Part 1910	NAVISTAR MPAPS-6032	ASTM D 573
ASME/ANSI Y 14.5M-1994*	NAVISTAR MPAPS-6036	ASTM D 624
NAVISTAR MPAPS A-9	ASTM A 764	ASTM D 1171
NAVISTAR MPAPS A-37	ASTM B 117	ASTM D 1193
NAVISTAR MPAPS B-1	ASTM D 380	ASTM D 2240
NAVISTAR MPAPS DT-9	ASTM D 395	SAE J20
NAVISTAR TMS-6017	NAVISTAR MPAPS B-50	SAE J1684
NAVISTAR MPAPS P-9543	NAVISTAR MPAPS F-2	ASTM D 1418
NAVISTAR MPAPS F-1058	NAVISTAR MPAPS C-1059	ASTM D 5827
ASTM D 3321	ASTM D 1287	
ASTM D 6130	NAVISTAR MPAPS F-1	

**Conformance to the 1994 version of ASME Y14.5M is required.*

5.0 CLASSIFICATION AND CONSTRUCTION

Grade designations are used to specify the tube and cover stocks. Suffix designations are used to specify the manufacturing method used to make the hose and the reinforcement fibers allowed.

Note: New hoses released to this specification shall be limited to 1A, 1BF, 1BDF 2A, 2BF and 2BDF. Alternate constructions shown below are not allowed. 1BF and 2BF can be supplied as a substitution to 1A and 2A respectively with engineering approval as documented by an SREA (Supplier Request for Engineering Approval).

5.1 Grades

5.1.1 Grade 1 – This grade covers a premium, long life hose used in engine coolant systems (including heater) and clean air supply lines. This hose is not recommended for use in fuel, oil, or hydraulic fluid applications. The tube and cover stocks shall be made from an EPDM (a terpolymer of ethylene, propylene and diene, see ASTM D 1418 for naming conventions), similar to SAE J20 Type EC Class D-1. It is generally preferred that peroxide cured compounds are used, especially for 1B constructions, but it is not required at this time. The tube shall be zinc free and the cover shall be non-blooming.

5.1.2 Grade 2 – This grade covers a silicone based hose used in engine coolant systems (including heater) and clean air supply lines. This hose may be used where extreme temperature conditions exist that justify its high cost or where a customer requires its use. This hose is not recommended for use in fuel, oil, or hydraulic fluid applications. The tube and cover stocks shall be made from polysiloxane elastomers, similar to SAE J20 Class A.

5.1.3 Grade 3 – This grade covers a lower cost version of Grade 1 where long life or heat resistance is not an issue. Typical applications may include bus heater hoses or lower (cold-side) radiator hoses for medium duty trucks and buses. This shall not be used in heavy duty or severe service application requiring or advertising long life.

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5.2 Suffix Letters

5.2.1 Suffix A – bulk, straight hose through 38 mm (1 ½ inch) ID suitably reinforced with ply or plies of spiraled, knitted or braided aramid yarn. Grade 3 hoses may be constructed from lower cost reinforcements, such as Rayon, with prior Materials Engineering approval.

5.2.2 Suffix B – Preformed hose reinforced with ply or plies of knitted or spiraled aramid yarn. Grade 3 hoses may be constructed from lower cost reinforcements, such as Rayon, with prior Materials Engineering approval.

5.2.3 Suffix C – Straight hose over 25.4 mm (1 inch) ID reinforced with wrapped plies of woven cord nylon or aramid fabric. A Grade 3 construction is not available at this time.

5.2.4 Suffix D– Spring Required. If D suffix is not designated on the drawing, a spring shall not be supplied.

5.2.5 Suffix X – No longer used, all notes referring to Suffix X shall meet Suffix Y requirements.

5.2.6 Suffix Y – This is an additional requirement that may be added to Suffix B construction to limit the amount of swell allowed and requires a lock stitch knit to be used when using a knitted reinforcement or other non-expanding types of reinforcement. The use of this requirement may limit design flexibility further than described in MPAPS F-1 and should be thoroughly reviewed with the supplier prior to release.

5.2.7 Suffix Z – This is an additional requirement for high impulse and torsion applications. Typically, this is required for large bore engine applications using short hose connectors with pipe. The suffix requires a meta-aramid or an approved hybrid para-meta aramid reinforcement to meet the increased requirements.

5.2.8 Suffix PG – This is a place holder for the development of hoses in neat propylene glycol coolant systems. Contact Materials Engineering for further information and requirements for this application.

5.2.9 Suffix E – Peroxide cure only. This is recommended for big bore engines.

5.2.10 Suffix F – Increased operating condition hoses for International Big Bore engines. This includes the requirements of Suffix E (if required), Y and Z plus higher burst and operating pressure requirements.

5.2.11 Suffix U – When a suffix U or TMS-6047 is referenced contact Navistar Materials Engineering for requirements.

5.3 Conversion of Previous Specifications

Previous versions of CEMS/MPAPS D-30 convert to the new format as follows: Types A, B and C directly convert to suffixes A, B and C. Classes 1, 2, 4, and 5 become Grade 1 unless specified for an oil or fuel application - then see MPAPS-6032 Type 1. For Class 3 use Grade 2. TMS-6026 becomes Grade 1A. TMS-6017 is Grade 1B. TMS-6025 is Grade 1C. TMS-6018 Type I is Grade 2C. TMS-6018 Type II is Grade 2B. TMS-6018 Type III is Grade 2A or 2B as appropriate.

5.4 Spring Insert (Vacuum side only)

If necessary, the use of a steel spring insert shall be specified on the Engineering drawing or by use of the D suffix. Unless otherwise specified, the steel spring insert shall be formed of a wire having a minimum diameter of 1.57 mm (a larger diameter wire may be used at the supplier's discretion). The spring shall exhibit a 25 mm pitch (a pitch of up to 35 mm is acceptable with larger diameter wire) and an O.D. approximately 3.0 mm less than the nominal I.D. of the hose. The length of the spring

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shall be such that a minimum of 60 mm of free hose length remains on each end of the hose for ease of assembly and clamping. The wire shall be cold drawn carbon steel spring wire, Type 1 or Type 2, per MPAPS A-9, mechanically-coated or electroplated with zinc after forming, or cold drawn carbon steel galvanized spring wire, Class I or Class II, per ASTM

A 764. Galvanized coating weight shall be such as to withstand 96 hours salt spray test (as per ASTM B 117) without visible red rust.

5.4.1 Stainless steel may be used as an optional material to the galvanized steel listed above. The wire shall be 18-8 stainless steel, full hard, MPAPS A-37.

5.4.2 Any other material must be approved by the NAVISTAR Materials Engineering Group before use.

6.0 GENERAL REQUIREMENTS

Materials and hoses shall meet the appropriate requirements of SAE J20. Test methods are listed in section 8.0 and shall conform to the practices of SAE J20 and ASTM D 380 as well as good lab practices and statistical techniques as appropriate.

6.1 Properties of Tube and Cover

Properties of the tube and cover shall conform to the requirements shown in Table I when tested in accordance with "Methods of Test", Section 8. Minimum tube thickness will be 0.06 in. (1.59 mm). Minimum cover thickness will be 0.03 in. (0.80 mm). For thin cover layers (below 0.045 in.), it is allowable to use ASTM cured sheets per ASTM procedure due to increased variability with thinner rubber test pieces.

6.2 Hose Requirements

Hose purchased to this specification shall meet the following requirements when tested in accordance with "Methods of Test", Section 8.

6.2.1 Kink Resistance (Suffix A only)

Hose outside diameter will not collapse more than 25 percent.

6.2.2 Vacuum Collapse (Suffix A only)

Hose outside diameter will not collapse more than 25 percent.

6.2.3 Cold Flexibility

Specimens will not crack, check or break.

6.2.4 Burst Strength

Hose tested as received and after 168 hour (see Table I for temperature) oven aging will meet the minimum burst strength requirements in Tables III and IV.

6.2.5 Bloom

No visible bloom when examined with the naked eye as compared to a control sample. The sample shall remain reasonably unchanged in appearance throughout the cycle.

6.2.6 Electrochemical Resistance (Grades 1 & 3 Only)

Hose tube material shall not exhibit striations when examined at 10X.

6.2.7 Adhesion

Hose shall meet minimum adhesion strength of the cover to tube or the cover-tube to reinforcement of 1.05 kN/m (6.0 lb/in).

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6.2.8 Hot Swell

Appropriate limits for the standard hose need to be developed; it is currently expected to be around 15%. When no suffix requirement is given, this requirement is report only. When suffix “Y” is specified, no more than 8% of hot swell is allowed.

6.2.9 Chemical Interaction

Test by either method using each of the long-life coolants C, D and F listed in Table V. If PG is specified, then this test shall be run only using that fluid. Test shall utilize hose from production process and include any process aids or lubricants that would be present in production hoses. No more than 8% precipitate and chemical analysis limits as shown in Table XV. Color photography showing agitated fluids in clear glass containers compared to un-aged coolant samples shall be included in the report. As these limits and requirements are still under evaluation and development, full and complete analytical reports should be submitted for review to NAVISTAR Materials Engineering prior to committing additional work. While this work is intended primarily for qualification, re-qualification of materials to this specification should be completed periodically (per agreement with the supplier and NAVISTAR). The full interaction is not required to be completed for re-qualification; a limited test schedule may be done with agreement of NAVISTAR Materials Engineering. *Note: PG are required to perform this test but chemical analysis requirements have not been determined. Submit fluids for evaluation to Navistar Materials Engineering.*

6.3 Hose Assembly Requirements

Hose and hose assemblies purchased to this specification shall meet the following requirements when tested in accordance with “Methods of Test”, Section 8. Test assemblies shall be made with production materials whenever possible. See MPAPS F-1 for guidance on pipe end/bead configurations. Contact NAVISTAR’s Design Responsible Engineer for assistance in identifying production parts to be used in the test assembly. Inspect, measure and report the relevant dimensions of the parts used in the test. The test assembly should represent manufacturing assembly conditions, lubricants and torque rates/values as closely as possible. Clamp hose using production clamps and torque values with one test set to the minimum torque and one test set to maximum of torque. When appropriate, measure and report the residual torque of each fastener. When crimp assembly techniques are used, crimp separate sets of test samples to minimum and maximum crimp diameters.

6.3.1 Cold Leakage

Hoses tested with selected production fittings and clamps shall not have a greater than 3% weight change. No visible fluid leakage shall be permitted during the test.

6.3.2 Fitting Insertion-Extraction Force

Required: Less than 188N, an approved assembly lubricant may be used. See MPAPS F-1.

6.3.3 Impulse - Vibration Durability– Suffix Z only

This method and requirement is under development. Hoses tested with selected production fittings and clamps shall not rupture and shall not have any visible fluid leakage during the test or after proof testing. The hose shall retain 80% of original burst.

7.0 QUALITY

All hose produced to this specification shall be clean and free of dirt, grease, and contamination. Inside surfaces of hose shall be free of any substance which could interfere with attaining a satisfactory

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clamping load or which could act as a lubricant resulting in unsatisfactory retention on fittings. Any internal release agents shall be flushed from the inside of the hose. All rubber debris from cutting and processing shall be removed. There shall be no fabric or flash exposed on the ID of the hose. Parts shall be free of voids and/or reinforcement splices. Parts and assemblies will meet the cleanliness requirements of MPAPS F-2.

7.1 Tube Assemblies

Tube assemblies shall be free from grease, scale, chips, carbon or any other contaminant, which cannot be removed by normal cleaning. The OD in the area of any bend shall not be less than 85% of the nominal tubing OD (15% max flatness). The wall thickness of the tubing after bending shall be 70% min of the original dimension. The walls of the tubing (interior and exterior) in the area of the bend shall not contain surface defects that exceed 0.25 mm (0.010 in) in depth.

7.2 Assembly Cleaning

The supplier of the hose assemblies shall be responsible for cleaning all assemblies to remove all evidence of foreign matter from the interior of the assemblies visible to the naked eye.

7.3 Suffix A

Dimensional tolerance for length shall conform to the requirements of SAE J20 20R1 Coolant Hose. Tolerances for OD, ID, and wall thickness shall conform to MPAPS F-1.

7.4 Suffix B and F

Hose supplied shall conform to MPAPS F-1 for parts released after April 2012. Earlier released parts may still conform to SAE J20 dimensional requirements for SAE 20R4 hose except for applications less than 26 mm ID then Suffix A, Table VI dimensions apply until they are revised, then MPAPS F-1 shall apply.

Note: These tolerances take precedence over standard blueprint tolerances unless it is a tolerance noted directly on the design drawing (except for ID then this specification and MPAPS F-1 always take precedence) and/or the blueprint/drawing is developed utilizing Geometric Dimensioning and Tolerancing (GD&T; refer to ASME/ANSI Y14.5M-1994). When GD&T is used on the drawing, those tolerances take precedence. [For proper application and use of GD&T tolerance information on drawings, refer to NAVISTAR Design Template DM123448000201].*

7.4.1 Wall Thickness

Due to the forming operation, wall thickness in the formed areas may vary from a min. value of 0.17 inch (4.3 mm) to a max. value of .30 inch (7.6 mm). However, within 1.4 inches of each end of the hose, the average of four wall thickness measurements shall conform to the standard wall thickness tolerance for MPAPS F-1.

7.4.2 Length

ARM length tolerances shall conform to the following MPAPS F-1.

7.5 Suffix C

Tolerances for ID, OD, and length of straight hose shall conform to the requirements for MPAPS F-1.

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7.6 Quality Control Plan

A Quality Control Plan for this product will be established by mutual agreement between NAVISTAR and the supplier. Unless specific exception is noted, the following characteristics, where applicable*, shall be included in the plan as features for management by statistical process control. **

Bulk Hose:

1. INSIDE DIAMETER
2. WALL THICKNESS

Bulk Tubing

1. OUTSIDE DIAMETER



Formed Hose or Cut Length Straight

1. INSIDE DIAMETER
2. OVERALL LENGTH

Hose-Tube Assemblies

1. OVERALL LENGTH

* *Other Characteristics for inclusion in the control plan may be specified on the engineering drawing and/or purchase order.*

** *See Engineering Design Standard A-16*

7.7 Qualification

Material and processes submitted for approval to this specification shall include the following:

7.7.1 Report: A detailed and signed test report documenting testing to this specification prepared as per MPAPS P-9543. The report will include actual test data not merely test summaries showing statistically significant (95% confidence) evidence of compliance to the relevant specifications.

7.7.2 Failure Modes: Test samples or photographs showing failure modes for each destructive test as necessary to fully describe those failure modes. Descriptions are adequate if the mode is easily understandable (no trade names or internal names to be used) and not unexpected. Unexpected failure modes shall be described or pictured as completely as possible.

7.7.3 Test Procedure: The procedure used for preparing, curing and assembling materials for test. Include any chemicals or assembly aids and how they were used. Proprietary information is not required but sufficient information is required to show that production representative methods are used.

7.7.4 Analysis: A detailed analysis of the test results including assumptions made, unexpected results, and an explanation of any non-compliant results – this does not mean non-compliance will be allowed though test results will be judged on a whole and test failures and aberrations should be reported completely.

7.7.5 Submission: The material and test report shall be submitted to:

Chief Engineer, Materials Engineering
Materials Engineering Lab
Navistar, Inc.
10400 W. North Ave
Melrose Park, IL 60160

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