NAVISTAR, INC.		
Material, Parts, and Process Specifications (MPAPS)	*NUMBER:* **MPAPS- A-10, PART II**	
	Former Designation: ***CEMS A-10, PART II***	
TITLE: **Mechanical Steel Tubing, Part II - Cold Drawn Butt Welded Mechanical Steel Tubing**	*CURRENT REV No.:* **1506**	*DATE:* **June 2015**
WRITTEN/EDITED BY: **W. Cook**	*APPROVED BY:* **R. Goluch**	*SUPERSEDES:* **October 2001**

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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.

Change Notice: ***Reformatted for MPAPS, Editorial Changes, combined A-10 part II appendix***

1.0 APPLICATION

This specification is in three parts:

Part I - Electrical Resistance Welded Tubing
Part II - Cold Drawn Butt Welded Mechanical Steel Tubing
Part III - Seamless Tubing

International specifications covering other tubular products used by the Company are as follows:

Welded and Seamless Steel Pipe ……..	MPAPS A-18
Structural Steel Tubing ……..	MPAPS A-38
Fluid Line Steel Tubing …….	MPAPS A-45

2.0 SCOPE

This part of the specification covers the requirements for cold drawn butt welded mechanical steel tubing used in the Company's products. Also included are two grades of electric welded tubing manufactured to butt welded tolerances. Unless otherwise specified herein, ASTM A512 "Standard Specification for Cold- Drawn Buttweld Carbon Steel Mechanical Tubing" will apply.

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.

3.0 REFERENCES 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 ISO 9001 or TS-16949	NAVISTAR MPAPS B-50
CFR Title 29, Part 1910	ASTM A512
NAVISTAR Manufacturing Std. MS-D-13	ASTM A370
NAVISTAR Engineering Design Std A-16	ASTM A1040

4.0 GENERAL REQUIREMENTS

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4.1 GRADE CLASSIFICATION

Cold drawn butt welded tubing is produced in sink drawn and mandrel drawn grades which are classified as shown in Table I. Each of these grades can be obtained in either the stress relieved or the full annealed condition. Stress relieved tubing will be supplied unless otherwise specified as full annealed.

TABLE I
GRADE CLASSIFICATION

Grade	Approx ASTM Designation	Description	General Size Availability
SD	A 512	Sink Drawn (Drawn through a die without a mandrel.)	Outside Diameters; To 3.50 in (88.9 mm) Wall Thicknesses: 0.035 to 0.500 in (0.89 to 12.70 mm)
MD		Mandrel Drawn (Drawn Simultaneously through a die and over a mandrel.)	
SDE		Sink Drawn, Electric Resistance Welded (Available only in round tubing.)	Outside Diameters; 0.50 to 3.25 inch) (12.7 to 82.6 mm) Wall Thicknesses: 0.083 to 0.281 in (2.1 to 7.1 mm))
MDE		Mandrel Drawn, Electric resistance Welded (Available only in round tubing.)	
EBS		Any mechanical steel tubing grade covered in MPAPS A-10, Parts, I, II, and III.	
CDT		Any sink or mandrel drawn tubing grade covered in MPAPS A-10, Parts, I, II, and III.	
CDM		Any mandrel drawn tubing grade covered in MPAPS A-10, Parts, I, II, and III.	

* For specific size availability for each grade, see "Appendix – General Information," MPAPS A-10 Part I.

4.2 Permissible Alternates

When a certain grade is specified on a drawing, it may be desirable for manufacturing to use another grade. The permissible alternates for each grade are shown in Table II.

TABLE II
PERMISSIBLE ALTERNATES

Specified Grade	Permissible Alternates
EBS	Any mechanical steel tubing grade covered in MPAPS A-10, Parts, I, II, and III.
SD	SDE, MD, MDE, DOM*
SDE	MDE, DOM*
CDT	Any SD or MD tubing grade covered in MPAPS A-10, Parts, I, II, and III.
CDM	Any MD tubing grade covered in MPAPS A-10, Parts, I, II, and III.
MD	MDE, DOM*
MDE	DOM*

*Requirements for Grade DOM are found in MPAPS A-10, Part I.

4.3 Grades EBS, CDT and CDM

4.3.1 Grades EBS, CDT and CDM are codes which allow manufacturing to select a tubing grade covered in Parts, I, II, or III, e.g., Grade H-F, Part I, which will satisfy both engineering and manufacturing requirements. See "Dimensional Tolerances, " Part III, for diameter and wall thickness tolerances and "Appendix – General Information," Part II, for discussion of these grades.

4.3.2 When a coded grade is specified on the engineering drawing, the selection of the appropriate tubing within that code should be made by the Plant Metallurgist of the plant ordering the tubing. The

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Plant Metallurgist should consult the various departments involved from the standpoint of cost, inventory, processing and so forth, to determine which tubing grade can be used to best advantage. The drawings and engineering specifications for individual parts should show only the coded grade.

4.3.3 When more than one plant is involved in the production of a part, it is the responsibility of the Plant Metallurgist of the originating plant to obtain the approval of the metallurgist from other fabricating works on the selection of the tubing. In general, it should be the metallurgist of the plant having the most critical operation who should decide which tubing is most suitable for his operation.

4.3.4 Outside suppliers furnishing finished parts may use any tubing grade covered within the coded grade shown on the drawing.

4.3.5 Outside suppliers of semi-finished parts requiring welding, heat treating or machining in International plants must obtain approval of the specific tubing grade and steel from the International Plant Metallurgist of the purchasing plant.

4.4 Chemical Composition

When no steel designation is specified, the Plant Metallurgist of the originating plant will select the grade of steel from those listed in Table III or IV. Tubing purchased to any SAE/ASTM steel will meet the requirements for chemical composition shown in ASTM A1040

4.5 Mechanical Properties

Expected minimum mechanical properties are shown in Tables III and IV. These properties can be specified as minimum requirements by design engineers.

TABLE III STRESS RELIEVED TUBING*

Steel Designation	Yield Strength, min		Tensile Strength, min		Elongation, % In 2 Inches (50 mm), min	Rockwell Hardness
	psi	MPa	psi	MPa		
1010	58 000	400	63 000	435	15	B 70 - 90
1015	60 000	415	66 000	455	14	B 70 -100
1018	62 000	430	68 000	470	13	B 73 -100
1020	65 000	450	71 000	490	11	B 75 - C 20
1025	67 000	460	72 000	495	11	B 78 – C 20
1030	70 000	485	80 000	550	10	B 80 – C 20
1110**	58 000	400	63 000	435	15	B 70 – 100
1115**	62 000	430	68 000	470	13	B 70 – 100

* Unless otherwise specified all tubing will be furnished in this condition, also called, "Finish annealed." Slight oxide discoloration will be present.

** Only applicable to Grades SD and MD

4.5 Mechanical Properties (Continued)

TABLE IV

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FULL ANNEALED TUBING

Steel Designation	Yield Strength, min		Tensile Strength, min		Elongation, % In 2 Inches (50 mm), min	Rockwell Hardness
	psi	MPa	psi	MPa		
1010	20 000	140	40 000	275	35	40-65
1015	25 000	170	43 000	295	34	40 min
1018	28 000	195	46 000	315	33	45 min
1020	30 000	205	50 000	345	32	50 min
1025	35 000	240	55 000	380	32	55 min
1030	40 000	275	65 000	450	30	60 min

4.6 Dimensional Tolerances

Tubing purchased to this specification will conform to the following requirements for dimensional tolerances. Grades SD and SDE tubing are normally specified by outside diameter and nominal wall thickness. Grades MD and MDE tubing are normally specified by outside diameter and inside diameters. See "Dimensional Tolerances," Part III, for requirements for Grades EBS, CDT, and CDM.

4.6.1 Round Tubing

Ovality tolerance of welded tubing is taken into consideration in the outside diameter and inside diameter tolerances. Ovality will not exceed the total applicable outside diameter tolerances.

TABLE V
DIAMETER AND WALL TOLERANCE FOR ROUND TUBING*

Grade	Outside Diameter, in (mm)	Outside Diameter				Inside Diameter				Wall Thickness, %	
		Plus		Minus		Plus		Minus			
		in	mm	in	mm	in	mm	in	mm	Plus	Minus
SD	Up to 0.50 (12.7), excl	0.004	0.10	0.0	0.0	--	--	--	--	15**	15
	0.50 to 1.50 (12.7 to 38.1), excl.	0.005	0.13	0.0	0.0	--	--	--	--	10**	10
	1.50 thru 3.00 (38.1 thru 76.2)	0.010	0.25	0.0	0.0	--	--	--	--	10**	10
SDE	0.50 to 1.50 (12.7 to 38.1) excl.	0.005	0.13	0.0	0.0	--	--	--	--	10	10
	1.50 (38.1) and Over	0.010	0.25	0.0	0.0	--	--	--	--	10	10
MD	Less than 0.156 (3.96) wall) Up to 0.50 (12.7), excl.	0.004	0.10	0.0	0.0	0.0	0.0	0.010	0.025	12.5	12.5
	0.50 to 1.50 (12.7 to 38.1), excl.	0.005	0.13	0.0	0.0	0.0	0.0	0.005***	0.13***	10	10
	1.50 (38.1) and Over	0.010	0.25	0.0	0.0	--	--	0.010	0.25	10	10
	0.156 (3.96) Wall and Over: 0.50 to 1.50 (12.7 to 38.1), excl.	0.005	0.13	0.0	0.0	0.0	0.0	0.005***	0.13***	7	7
	1.50 (38.1) and Over	0.010	0.25	0.0	0.0	0.0	0.0	0.010	0.25	7	7
MDE	0.50 to 1.50 (12.7 to 38.1), excl.	0.005	0.13	0.0	0.0	0.0	0.0	0.005	0.13	7	7
	1.50 (38.1) and Over	0.010	0.25	0.0	0.0	0.0	0.0	0.010	0.25	7	7

* These tolerances do not apply to full annealed tubing.
** Except at the weld line where the weld pad may exceed this figure.
*** Tubes with an ID less than 0.5 inch (12.7 mm) may require more than 0.005 inch (0.13 mm) ID tolerance and are subject to negotiation between purchaser and supplier.

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