

NAVISTAR, INC.		
Material, Parts, and Process Specifications (MPAPS)		NUMBER: MPAPS A-2
		Former Designation: CEMS A-2
TITLE: Cold Finished Steel Bars		CURRENT REV No.: 1801
		DATE: Jan. 2018
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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

Cold finished bars are free from scale, have closer dimensional tolerances, better machinability, and offer improved mechanical properties. They are also more expensive than hot rolled bar products.

2.0 SCOPE

2.1 This specification covers requirements for general applications of carbon and alloy cold finished steel bars. Whenever applicable the specification should be used in conjunction with MPAPS A-0, Part II, Navistar System of Steel Classification. Unless otherwise specified, the appropriate ASTM Specifications shall apply to this specification.

2.2 Requirements for cold finished steel bars not included in this specification are in the following Corporate Engineering Materials Specifications:

Wrought Corrosion and Heat Resisting Steel MPAPS A-37

HSLA Grade 50 or similar Materials MPAPS A-43

2.3 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 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.

ISO 9001/TS 16949 – Quality Management Systems-- Requirements

CFR Title 29, Part 1910 – Occupational Health and Safety Standards

NAVISTAR ISQ-001-QM – Integrated Supplier Quality Requirements

NAVISTAR D-13 – Supplier Packing and Shipping Standard.

NAVISTAR EDS-A16 – Key Control Characteristics (KCC)

NAVISTAR MPAPS B-50 – Restricted Chemical Substances

NAVISTAR MPAPS A-0, Part I: Chemical Composition of Standard Steels

NAVISTAR MPAPS A-0, Part II: System of Steel Classification for Standard Steels

NAVISTAR MPAPS A-43: High Strength Low Alloy (HSLA) Steel Plate/Bar

ASTM A29: Standard Specification for General Requirements for Steel Bars, Carbon and Alloy, Hot-Wrought

ASTM A370: Standard Test Methods and Definitions for Mechanical Testing of Steel Products

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ASTM A108: Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished

ASTM A311: Standard Specification for Cold-Drawn, Stress-Relieved Carbon Steel Bars Subject to Mechanical Property Requirements

ASTM A322: Standard Specification for Steel Bars, Alloy, Standard Grades

ASTM A400: Standard Practice for Steel Bars, Selection Guide, Composition, and Mechanical Properties

ASTM A434: Standard Specification for Steel Bars, Alloy, Hot-Wrought or Cold-Finished, Quenched and Tempered

4.0 REQUIREMENTS

Cold finished bars are classified by chemistry and identified by SAE/ASTM steel grade designation

Material supplied shall meet the applicable requirements of ASTM A29, ASTM A108, ASTM A311 and ASTM A322.

4.1 Chemical Composition

4.1.1 Bars purchased to this specification shall conform to the required analysis for the appropriate steel in MPAPS A-0, Part I, Chemical Composition of Standard Steels.

4.1.2 Steels with an “SR”, “SS” or “SSA” suffix shall have the same chemical composition as those without a suffix. 4145 SS and 4145 SSA shall meet the chemical composition requirements for SAE 4145, except the carbon content shall be 0.40-0.50 percent with lead, tin, or tellurium additions permissible.

4.1.3 The most readily available cold drawn steels are 1018 and 1045. Effort should be made to standardize on these grades.

4.2 Mechanical Properties

Mechanical properties for as cold drawn bars are not guaranteed, nor are those for turned and polished or turned, ground, and polished bars which have properties of hot rolled bars. See “Appendix - General Information.”. A useful guide for selecting appropriate bar stock and processing methods to achieve required properties is found in ASTM A400.

Required tensile properties for cold drawn, stress relieved steel bars are shown in Table I. See “Methods of Test,” page 5, and “Appendix - General Information.”

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TABLE I
MECHANICAL PROPERTY REQUIREMENTS -
COLD DRAWN, STRESS RELIEVED STEEL BARS
(Special Cold Drawn, High Tensile)

Size, incl		Steel Designation	International Code MPAPS Part II	Rounds, Squares		
Inches	mm			Yield strength,		elongation 2 in (50.8 mm)
				psi	MPa	percent, min
0.375 to 2.000	9.52 to 50.80	1040 SR	2-421	90 000	621	10
		1045 SR		100 000	689	10
		1137 SR		90 000	621	11
		1141 SR		100 000	689	11
		1144 SR		100 000	689	10
		1144 SS **	no code	125 000	862	10 ⁽¹⁾
		1541 SS **		130 000	896	12 ⁽¹⁾
		4145 SS **		130 000	896	10 ⁽¹⁾
		4145 SSA **		165 000	1138	9 ⁽¹⁾
1.000 to 2.500	25.40 to 63.50	International “50” SR	no code	80 000 ⁽¹⁾	552 ⁽¹⁾	18 ⁽¹⁾
2.001 to 2.500	50.82 to 63.50	1137 SR	no code	90 000	621	11
		1045 SR	2-422	100 000	689	10
		1141 SR		100 000	689	11
		1144 SR		100 000	689	10
		1144 SS**	no code	125 000	862	10 ⁽¹⁾
		4145 SS**		130 000	896	10 ⁽¹⁾
		4145 SSA**		65 000	1138	9 ⁽¹⁾
2.501 to 3.000	63.52 to 76.20	1137 SR	no code	90 000	621	10
		1045 SR	2-422	100 000	689	10
		1141 SR		100 000	689	10
		1144 SR		100 000	689	10
		4145 SS**	no code	130 000	896	10 ⁽¹⁾
		4145 SSA**		165 000	1138	9 ⁽¹⁾
3.001 to 3.500	76.22 to 88.90	4145 SS**	no code	130 000	896	10 ⁽¹⁾
		4145 SSA**		165 000	1138	9 ⁽¹⁾
3.001 to 4.000	76.22 to 101.60	1045 SR	2-422	90 000	621	9
		1141 SR		90 000	621	9
		1144 SR		90 000	621	9

* If cold drawn, stress relieved steel bars are ordered in 40 000 lb (18 Mg) minimum quantities, the yield strength shall be held to a maximum of 20 000 psi (138 MPa) over the specified minimum yield strength.

** Special Steels. Additional minimum requirements.

Steel	Tensile Strength		Hardness RC
	Psi	MPa	
1144 SS	140 000	965	30
1541 SS	150 000	1034	33
4145 SS	150 000	1034	32
4145 SSA	180 000	1241	38

In event of disagreement between hardness and tensile strength, the tensile strength shall govern.

⁽¹⁾ Typical value; not a requirement.

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4.3 Dimensional Tolerances

Material purchased to this specification shall conform to the dimensional tolerances in ASTM A108 The diameter tolerances for round bars shown in Table II below and Table IV, page 5, are extracted for convenience. Tolerances for 1144 SS, 4145 SS, and 4145 SSA cold drawn round bars shall be as shown in Table III. See "Appendix - General Information" for square, hexagon, and flat bar tolerances.

TABLE II - ROUNDS
COLD DRAWN AND TURNED AND POLISHED, DIAMETER TOLERANCES, MINUS

Heat Treatments and Bar Diameter		Carbon Steel						
		Maximum of Carbon Range, Percent, Incl						
		0.28 and under	0.29 to 0.55	over 0.55	to 0.55	over 0.55	all carbon ranges	Alloy Steel
Applicable Heat Treatments	before cold finishing	no heat treatment or anneal, spheroidize anneal, normalize			no heat treatment or anneal, spheroidize anneal, normalize		quench and temper or normalize and temper	For alloy bar tolerances, increase the carbon bar tolerances of similar size, carbon range and heat treatment by 0.001 inch (0.03 mm)
	after cold finishing	None			stress relieve or anneal		None	
Bar Diameter, inches, incl	Cold Drawn or Turned and Polished, inch							
	to 1.500	0.002	0.003	0.005	0.004	0.005	0.005	
	1.501 to 2.500	0.003	0.004	0.006	0.005	0.006	0.006	
	2.501 to 4.000	0.004	0.005	0.007	0.006	0.007	0.007	
	Turned and Polished Only, inch							
	4.001 to 6.000	0.005	0.006	0.008	0.007	0.008	0.008	
	6.001 to 8.000	0.006	0.007	0.009	0.008	0.009	0.009	
	8.001 to 9.000	0.007	0.008	0.010	0.009	0.010	0.010	
	9.001 and over	0.008	0.009	0.011	0.010	0.011	0.011	
Bar Diameter, mm, incl	Cold Drawn or Turned and Polished, mm							
	to 38.10	0.05	0.08	0.13	0.10	0.13	0.13	
	38.12 to 63.50	0.08	0.10	0.15	0.13	0.15	0.15	
	63.52 to 101.60	0.10	0.13	0.18	0.5	0.18	0.18	
	Turned and Polished Only, inch							
	101.62 to 152.40	0.13	0.15	0.20	0.18	0.20	0.20	
	152.42 to 203.20	0.15	0.18	0.23	0.20	0.23	0.23	
	203.22 to 228.60	0.18	0.20	0.25	0.23	0.25	0.25	
	228.62 and over	0.20	0.23	0.28	0.25	0.28	0.28	

TABLE III - ROUNDS
COLD DRAWN, 1144, 4145 SS AND 4145 SSA, DIAMETER TOLERANCES, MINUS

Bar Diameter, incl		1144 SS		4145 SS & 4145 SSA	
inches	mm	inch	mm	inch	mm
0.250 to 0.4374	6.35 to 11.10	0.004	0.10	-	-
0.4375 to 1.500	11.11 to 38.10	0.005	0.13	0.005	0.13
1.501 to 2.500	38.12 to 63.50	0.006	0.15	0.006	0.15
2.501 to 3.500	63.52 to 76.20	-	-	0.007	0.18

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**TABLE IV - ROUNDS
COLD DRAWN, GROUND AND POLISHED; TURNED, GROUND, AND POLISHED,
DIAMETER TOLERANCES, MINUS**

Bar Diameter incl		Resulfurized Carbon Grades Unheat Treated Carbon and Alloy Grades		Nonresulfurized Carbon Grades, Heat Treated Carbon and Alloy Grades*	
inches	mm	Inch	mm	Inch	mm
to 1.500	to 38.10	0.001	0.03	0.001	0.03
1.501 to 2.499	38.12 to 63.47	0.0015	0.04	0.0015	0.04
2.500 to 3.000	63.50 to 76.20	0.002	0.05	0.002	0.05
3.001 to 4.000	76.22 to 101.60	0.003	0.08	0.003	0.08
Turned, Ground and Polished Only					
4.001 to 6.000	101.62 to 152.40	0.004	0.10	0.005	0.13
6.001 and over	152.42 and over	0.005	0.13	0.006	0.15

* For alloy grades, applies only to quench and tempered, normalized and tempered or any similar double treatment prior to turning.

5.0 QUALITY

Material purchased to this specification shall be manufactured from special quality hot rolled bars, unless otherwise specified. The bars shall be commercially free from injurious defects and shall have a smooth bright surface consistent with the method of cold finishing.

5.1 Methods of Test

Perform the tensile test according to ASTM A 370.

6.0 QUALIFICATION

Engineering qualification of sources is required in advance of production shipments. Samples shall be accompanied by test data certifying that all requirements of the specification have been met.

6.1 Quality Control Plan

A Quality Control Plan for products supplied to the requirements of this specification 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.**



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

** See NAVISTAR Engineering Design Standard A-16

7.0 SOURCE APPROVAL AND QUALITY CONTROL

7.1 Supplier Requirements

All suppliers to NAVISTAR are subject to the requirements defined in ISQ-001-QM- NAVISTAR *Integrated Supplier Quality Requirements*. Suppliers must be compliant with ISO 9001 or TS 16949 and fulfill all AIAG PPAP (Production Part Approval Process) documentation and all approval requirements as indicated in NAVISTAR ISQ-001-QM.

7.2 Approval

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