

NAVISTAR, INC.		
Material, Parts, and Process Specifications (MPAPS)		NUMBER: MPAPS D-28
		Former Designation: CEMS D-28
TITLE: Plastic Parts and Resins	CURRENT REV No.: 1402	DATE: February 2014
WRITTEN/EDITED BY: Materials Engineering	APPROVED BY: Materials Engineering	SUPERSEDES: CEMS D-28 - December 2006
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: Added RA for Izod impact, corrected technical information in Section 12, editorial changes.		

1.0 SCOPE

This specification provides a system for describing and specifying the significant requirements of a plastic part. The system includes the specification of both basic resin properties and specific performance requirements of the finished molded part.

2.0 INTRODUCTION

This specification is not applicable to fiberglass reinforced thermosetting polyesters such as SMC. Fiberglass reinforced polyester parts are covered in CEMS D-22. The specification is based upon the principle that requirements for plastic parts are best described in terms of the performance characteristics desired in the finished molded part. However, it is recognized that specification of some basic resin properties is often required and/or is helpful as guidance in selecting a material that will be capable of meeting the part performance requirements.

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 Specifying on Drawings

While this line call-out system provides the means for close characterization and specification of each property and combination of properties in a broad range of plastic parts, it is subject to possible misapplications since property combinations impossible to achieve with currently available commercial materials and processing techniques can be coded. Materials Engineering should be consulted before specifying line call-outs on engineering drawings and blueprints.

3.0 CONTENTS

	PAGE
INTRODUCTION	1
REFERENCE DOCUMENTS	2
GENERAL REQUIREMENTS	2
PART MARKING REQUIREMENTS	18
QUALITY	18
SOURCE APPROVAL AND QUALITY CONTROL	19
DESIGNATION ON DRAWINGS	19
PACKING AND SHIPPING	19

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FEBRUARY 2014



Documents

Page 1 of 20

Document Sharing Hub

NUMBER: MPAPS D-28	TITLE: PLASTIC PARTS AND RESINS	REVISION: 1402
------------------------------	---	--------------------------

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 256	ASTM D 790	ASTM D 2584
NAVISTAR Manufacturing Standard MS-D-13	ASTM D 570	ASTM D 792	ASTM D 3012
NAVISTAR Design Standard A-16	ASTM D 573	ASTM D1203	ASTM D 3418
CFR Title 29, Part 1910	ASTM D 638	ASTM D 1238	ASTM D 3835
NAVISTAR CEMS DT-4	ASTM D 648	ASTM D 1505	ASTM G 53
NAVISTAR CEMS G-5	ASTM D 695	ASTM D 1525	ASTM G 2565
Federal Motor Vehicle Safety Std. 302	ASTM D 785	ASTM D 2240	SAE J 369
NAVISTAR MPAPS B-50	ASTM D 789	ASTM D 2445	SAE J 1344
NAVISTAR MPAPS GT-31	SAE J1960	SAE J1885	SAE J2412
	SAE J2527	SAE J2413	ASTM G155

5.0 CLASSIFICATION OR GRADE DESIGNATION

Plastic parts are classified by material type and properties.

6.0 GENERAL REQUIREMENTS

6.1 General Resin Characteristics

The general type of plastic resin used to manufacture the part will be identified by an alphabetical symbol in the line call-out. The symbol used for base resins will be as defined in Table 1. Symbols used for polymer blends (alloys) will be as defined in Table 2.

6.1.1 POM in the above example is a standard symbol for the polyoxymethylene family of plastics with common trade names such as ACETAL, Celcon, and Delrin.

6.1.2 ABS+PC in the above example is a standard symbol for the acrylonitrile / butadiene / styrene + polycarbonate family of plastic alloys with common trade names such as Bayblend, Cycloloy EHA, Proloy, and Pulse.

6.2 General Part Requirements

Parts will be uniform in density, color, texture, finish, electrical, and mechanical properties; and free of porosity, warpage, checks or cracks, chipped edges, blisters, and uneven surfaces. Unless more specifically defined on engineering drawings, appearance and finish of parts will conform to good commercial practice (free of gates, flash, ridges, roughness, and tool marks; and of mold lubricants and other contamination).

6.3 Additional Part/Resin Characteristics/Properties (Requirements)

General characteristics of resins and parts are described by alpha-suffix symbols as shown in Table 3. Characteristics shown in Table 3, which are applicable to both resin and molded part designations, are indicated with an asterisk (*). More specific properties of resins and/or parts are described by an expanded line call-out specification consisting of alpha-numeric suffix symbols as described in Table 4.

6.3.1 Example 1

ASA, A3A46A64DF1060K40M16R2200S75YB2400AC1AE6, MPAPS D-28

6.3.1.1 Resin Material Specification Requirements (see Tables 1, 2, 3 and 4)

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FEBRUARY 2014



Documents

Page 2 of 20

Document Sharing Hub

NUMBER: MPAPS D-28	TITLE: PLASTIC PARTS AND RESINS	REVISION: 1402
------------------------------	---	--------------------------

ASA	=	Acrylonitrile / Styrene / Acrylate Resin
A3	=	Copolymer resin to be used.
A46	=	U.V. Stabilizer to be added.
A64	=	Injection molding process grade.
DF1060	=	Specific Gravity, 1.060 ± 0.05
K40	=	Tensile Strength (Ultimate) to equal 40 MPa at a minimum.
M16	=	Flexural Modulus to equal 1600 MPa at a minimum.
R2200	=	Impact resistance of resin to withstand 200 in-lbs of force at -30°C.
S75	=	75°C minimum deflection temperature at 1820 kPa.
YB2400	=	Accelerated Weather Resistance per Xenon-arc type light (exterior) for 2400 kJ.
AC1	=	Integrally colored part; color to be specified on part drawing.
AE6	=	Surface finish: comparable to SPE/SPI #6 finish.

6.3.2 Example 2

ABS+PC, C20DD1060R140AA95ABAC3, MPAPS D-28

6.3.2.1 Resin Requirements (see Tables 1, 2, 3 and 4)

ABS+PC	=	Acrylonitrile/butadiene/styrene plus Polycarbonate Resin Blend
C20	=	20% Regrind Maximum
DD1060	=	Specific Gravity, 1.060 ± 0.02
R140	=	Gardner Impact Resistance @ 23°C, 40 Joules
AA95	=	Dimensional Stability, 4 Hours @95° C
AB	=	Source is restricted to vendors approved by Engineering.
AC3	=	Integrally colored and painted part; specified color and paint grade to be called out on the part drawing.

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FEBRUARY 2014



Documents

Page 3 of 20

Document Sharing Hub

NUMBER: MPAPS D-28	TITLE: PLASTIC PARTS AND RESINS	REVISION: 1402
------------------------------	---	--------------------------

TABLE 1
STANDARD SYMBOLS FOR DESIGNATING PLASTIC MATERIALS

<u>Plastic "Family" Name</u>	<u>Standard Symbol^o</u>	<u>Example of Common Names and/or Trade Names[‡]</u>
Acrylonitrile/butadiene	AB	
Acrylonitrile/butadiene/acrylate	ABA	
Acrylonitrile/butadiene/styrene	ABS	ABS, Absafil, Cyclocac, Cadon Lustran, Novodur, Terluran
Acrylonitrile/ethylene/styrene	AES	Rovel
Acrylonitrile/methyl methacrylate	AMMA	
Acrylonitrile/styrene/acrylate	ASA	Luran, Centrex
Carboxymethyl cellulose	CMC	
Casein	CS	
Cellulose acetate	CA	Ampol, Cellidor, Ethocel, Tenite
Cellulose acetate butyrate	CAB	Ethocel, Tenite, Uvex
Cellulose acetate propionate	CAP	Cellidor, Ethocel, Tenite
Cellulose nitrate	CN	Nitrocellulose
Cellulose propionate	CP	Cellidor, Ethocel, Tenite
Chlorinated polyethylene	CPE	Penton, Thermo, Tyrin
Chlorinated poly (vinyl chloride)	CPVC	
Cresol-formaldehyde	CF	
Ethyl cellulose	EC	Ethocel
Epoxide; epoxy	EP	Araldite, Corvel, Epon, Epotuf
Ethylene/ethyl acrylate	EEA	
Ethylene/methacrylic acid	EMA	IONOMER, Formion, Surlyn
Ethylene/tetrafluoroethylene	ETFE	
Ethylene/vinyl acetate	EVAC (EVA)	Elvax, Microthane
Furan formaldehyde	FF	
Melamine-formaldehyde	MF	Cymel, Diaron, Isomin, Melmac
Perfluro (ethylene propylene); Tetrafluorethylene/hexafluro propylene	FEP	Fluorocomp, Teflon
Polyamide	PA	NYLON, Capron, Celanese, Durethan, Rilsan, Ultramid, Vydyne, Wellamid, Zytel
Polyamide-mide	PAI	Torlon
Polyarylamid (polyaramide)	PARA	ARAMID, Mindel, Vespel
Polyarylether	PAE	
Polyarylsulfone	PASU	Astrel
Polybutene-1	PB	Duraflex
Polycarbonate plastics	PC	Calibre, Lexan, Merlon, Macrolon
Polychlorotrifluoroethylene	PCTFE	Aclar, Halon, Kel-F

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FEBRUARY 2014



Documents

Page 4 of 20

Document Sharing Hub

NUMBER: MPAPS D-28	TITLE: PLASTIC PARTS AND RESINS	REVISION: 1402
------------------------------	---	--------------------------

Poly (diallyl phthalate)	DAP	Dapon, Durez, Poly-Dap
Phenol-formaldehyde	PF	PHENOLIC, Durez, Plenco
Pheno-furfural	PFF	
Polyester, thermosplastic;		
Polyarlate (polyaryl terephthalate)	PAT	Ardel, Arylon, Durel, Econol
Copolyester (polyaryl terephthalate)	ARP	Vectra, Xydar
- Liquid Crystal Polymer		
Polybutylene terephthalate	PBT	Celanex, Petlon, Petra, Poca B. Rynite, Ultradur, Valox, Wellite
Polyether block amide	PEBA	Dynyl, Estamid(ester), Pebax
Polyethylene terephthalate	PET	Hostadur, Impet, Petlon, Petra, Rynite, Ultradur, Valox, Wellpet
Polyester, thermoset (unsaturated)	UP	BMC, SMC, XMC, Derakene, Premi-Glas Selectron, Vibrin-Mat
Polyetherimide	PEI	Ultom
Polyetherketone	PEK	Victrex PEK
Polyether-etherketone	PEEK	Kadel, Victrex PEEK
Polyethersulfone	PESU	Ultrason, Victrex
Polyethylene	PE	Alathon, Escorene, Dylan, Fortiflex Hi-Fax, Hostalen, Marlex, Lupolen, Paxon, Poyfort, Solair, ultrex
Polyethylene oxide	PEOX (PEO)	Hostalen
Polyimide	PI	Envex, Gemon, Kamax, Kinel, Pyralin, Skybond, Vespel
Polyimidsulfone	PISU	PISO
Polyisobutylene	PIB	Oppanol B
Polymethyl methacrylate	PMMA	ACRYLIC, Acrylite, Diakon, Oroglass Plexiglas, Vedril
Poly (4-methylpentene-1)	PMP	TPX
Poly (P-oxybenzoate)	POB	Ekkcel
Polyoxymethylene; polyformaldehyde	POM	ACETAL, Celcon, Delrin, Hostaform, Ultraform
Polyphenylene ether plastics	PPE (POP)	Noryl, Prevex (See Blends – Table 2)
Polypropylene	PP	Azdel, Daplen, Escorene, Hostalen, Marlex, Moplen, Novolen, Oleflo, Polyfort, Profac, Tenite
Polypropylene oxide	PPOX	
Polyphenylene sulfide	PPS	Fortron, Rytan
Polyphenylene sulfone	PPSU	Udel, Mindel, Radel, Ultrason
Polystyrene	PS	Dylen, Duraton, Lustrex, Polystyrol, Styron, Tuf-Flex, Styron, Polystyrol SB
Polytetrafluoroethylene	PTFE	Fluon, Halon, Hostafon, Teflon, Tetran

^v, [‡], see page 7 for footnotes.

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FEBRUARY 2014



Documents

Page 5 of 20

Document Sharing Hub

NUMBER: MPAPS D-28	TITLE: PLASTIC PARTS AND RESINS	REVISION: 1402
------------------------------	---	--------------------------

TABLE 1 (Continued)
STANDARD SYMBOLS FOR DESIGNATING PLASTIC MATERIALS

<u>Plastic "Family" Name</u>	<u>Standard Symbol^o</u>	<u>Example of Common Names and/or Trade Names[‡]</u>
Polyurethane, thermosplastic		See Thermoplastic Elastomers
Polyurethane, thermoset (unsaturated)	PUR	Adiprane, Bayflex, Casthetane, Cyanaprene, Desmopan, Sectrim
Polyvinyl acetate	PVAC	Gelva, Vinylite
Polyvinyl alcohol	PVAL	Evanol, Gelvatol
Polyvinyl butyral	PVB	Butvar, Vinylite
Polyvinyl chloride acetate	PVCA	
Polyvinyl chloride	PVC	Apex, Geon, Gracon, Pliovic, Polyvin, Unichem, Trosiplast, Vinoflex, Vinylite
Polyvinyl chloride acetate	PVCA	
Polyvinyl fluoride	PVF	Tedlar
Polyvinyl formal	PVFM	Formvar
Polyvinylidene chloride	PVDC	Saran
Polyvinylidene fluoride	PVDF	Kynar
Polyvinylcarbazole	PVK	Luvican
Polyvinylpyrrolidone	PVP	
Silicone	SI	
Styrene/acrylonitrile	SAN	Forsacryl, Lustran, Luran, Tyril
Styrene/butadiene	SB	Andrez, Elexar, K-Resins, Pliolite, Polystyrol, Styrolux
Styrene/maleic anhydride plastics	SMA	Cadon, Dylark (see BLENDS-Table 2)
Styrene/methylstyrene	SMS	
Thermoplastic elastomer	TPE	
Polyether block amide	PEBA	Pebax, Dynyl
Polyolefinic	TPO	Ferroflex, Moplen, Polytrope, Renflex, Santoprene, Telcar, Vistaflex
Ether ester block copolymer	TEEE (EEBC)	Hytrel L, Lomod, Riteflex BP
Polyurethane	TPU (TPUR)	Bayflex, Cytar, Estane, Orthane, Pellathane, Polypur, Texin
Polyurethane, Rigid	RTPU	Isoplast
Styrene block copolymer	TES (SEBS)	Elexar, Kraton
Ultra high molecular weight polyethylene	UHMWPE	
Urea-formaldehyde	UF	Plaskon, Skanopal
Vinyl chloride/ethylene	VCE	
Vinyl chloride/ethylene/methyl acrylate	VCEMA	

^o, [‡], see page 7 for footnotes.

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FEBRUARY 2014



Documents

Page 6 of 20

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