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SURFACE VEHICLE RECOMMENDED PRACTICE

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Submitted for recognition as an American National Standard

AUTOMOTIVE PLASTIC PARTS SPECIFICATION

1. ***Scope***—This recommended practice provides a system for specifying significant requirements of automotive plastic parts or specimens taken from said parts. It should apply to parts only and not to the materials produced for the manufacture of parts used in the automotive and related industries.

1.1 It is based on the principle that plastic parts should be described, insofar as possible, in terms of specific performance characteristics desired in the molded part; and that an infinite number of such descriptions can be formulated by the use of one or more standard statements (based on standard tests), each designating a quality level of a property or characteristics. Thus, users of plastic parts can, by selecting different combinations of performance characteristics, specify different combinations of requirements desired in various parts.

1.2 The system includes a letter numbered symbol for each quality level of each property or characteristic. The user shall include a symbol for specifying the generic material (i.e., SAE J1344, Marking of Plastic Parts).

1.3 The property tables included in this recommended practice are contained in two sections of the document. The tables which appear in the body of the document have been found acceptable and useful for describing finished plastic parts. The property tables contained in the Appendix have, likewise, been found useful for describing finished plastic parts, but have not yet been fully accepted. In some cases, more development work is required in test methods or to complete the table. These tables have been included in the document to minimize the use of the Z suffix for those properties which have been partially defined. The use of the tables in the Appendix require that agreement as to their interpretation be reached between the supplier and user. As these property tables are fully developed and more experience is gained with them, they will be moved into the main body of the document.

2. ***Guidelines for the Use of This Standard***—Items which must be considered when using the line call-out system of SAE J1345 are as follows:

2.1 It is not intended that all property tables be used to describe every part. Tables are to be selected according to the application and need.

2.2 The first letter given designates the property table and type of requirement to be considered. These letters may be appended by additional letters and are always appended by an additional number of symbols to fully define the characteristic specified for the designated property.

2.3 The system is not to be used to invent properties of materials used, but must adapt to the part in question, using commercially available materials.

2.4 Knowledge of plastic materials and plastic part requirements is necessary for effective use of this system.

2.5 Properties determined on test specimens cut from parts, in most cases, will not be the same as on standard specimens molded from the same resin and may differ significantly.

2.6 Appropriate testing of specimens cut from parts must be conducted to establish specification limits.

2.7 Plastic resin specifications or resin manufacturer data sheet values should not be used to specify plastic part requirements.

3. Requirements

3.1 General Characteristics—The general type of material used to manufacture the part shall be identified by a symbol following the SAE J1345 specification number. The symbol used shall be as defined in J1344, Standard Symbols. Parts shall be uniform in density, color, texture, finish, electrical and mechanical properties; and free of porosity, warpage, checks or cracks, chipped edges, and blisters. Appearance and finish of parts shall conform to good commercial practice (reasonably free of gates, flash, ridges, roughness, and tool marks; and of mold lubricants and other contamination).

3.2 Other Characteristics—Parts described by basic number appended by suffix letter-number symbols[1] —Example: SAE J1345 ABS (C20, DF1060, M230, AAC83)—shall conform to additional requirements outlined in tables. (See Section 5.)

4. Tests—The requirements designated by the specification call-out shall be determined by the latest issue of the test methods indicated and apply only to parts as molded and not to parts that have been subjected to service. Tests shall be conducted 40 h, minimum, after sample preparation and immediately following a conditioning period of 24 h, minimum, in standard laboratory atmosphere (23 ± 2°C and 50 ± 5% relative humidity), unless otherwise specified. (The two time periods may run concurrently.) The maximum time between production and testing shall be as agreed upon between supplier and user.

4.1 Specimens for the ASTM tests specified herein shall be taken from parts where size and configuration permit. User shall indicate on the part drawing the areas where physical specimens are to be taken along with instructions of when and how the specimens are to be taken. It may be necessary to specify alternate functional tests for parts which do not allow for the specified ASTM sample sizes.

4.2 All tests of parts molded of moisture-sensitive materials shall be conducted on "dry as molded" test specimens which have been sealed in water vapor impermeable containers immediately after molding. Individual specimens shall not be removed from closed containers until immediately before testing.

[1] Numerals shown for each symbol represent the range of values which are expected to be available to, and most commonly used by, the automotive and related industries. They represent, also, what are felt to be reasonable and workable increments of values for each property. Use of numbers (or increments) shown will keep to a minimum the variety of values which must be considered in communications between purchaser, supplier, etc. However, where a property of any plastic part cannot be defined adequately by one of the numerals, the user may substitute any numeral which correlates with the published numerals, the test conditions given, etc. F350 is an understandable expansion of the symbols shown for melting point.

5. Property Tables—Index

5.1 Main Suffixes

SAE J1345	Characteristic	Test Method (ASTM, Unless Otherwise Specified)
B	Reinforcement and/or filler	As agreed
C	Regrind	None, See property table
D	Specific gravity	D792, D1505, D1622
E	Viscosity	D1238, D789
H	Oxidative stability	D2445, D3012
M	Flexural modulus	D790
T	Cold flex temperature	See property table
Z	Other characteristics	As agreed
AA	Dimensional stability	See property table
AD	Surface finish	See property table

5.2 Appendix Suffixes

SAE J1345	Characteristic	Test Method (ASTM, Unless Otherwise Specified)
F	Melting point	D789, D3418
G	Water absorption, volatile loss	D570, D1203, as agreed
J	Hardening	D2240, D785, D2583
K	Tensile strength	D638
L	Ultimate elongation	D638
N	Flexural strength	D790
Q	Compressive strength	D695
R	Impact resistance	As agreed
U	Flammability	SAE J369
W	Heat resistance	D638, D573
X	Humidity aging	D638, See property table
Y	Accelerated weather resistance	See property table
AB	Surface texture	See property table
AC	Thermal cycle resistance	B117, D2246

TABLE 1—PLASTIC PART REQUIREMENTS—PROPERTY TABLE

Suffix Symbol B	Property Description and Test Method
BA11—BA675 thru BM11—BM675	REINFORCEMENT AND/OR FILLER. Shall be described by amending the suffix B symbol using the following letter designations: A = Glass fibers B = Glass spheres C = Carbon fibers D = Wood flour E = Mineral fillers, for example, flour, calcium, carbonate, talc, mica, clay, etc. F = Cotton flock G = Sisal H = Dimethyl polysiloxane (Polymeric silicone) J = PTFE fibers K = PTFE granules L = Graphite M = Molybdenum disulfide The reinforcement, expressed as mass percent, shall be specified by the second, or second and third numeral(s) following the amended suffix B symbol with a tolerance as indicated by the first numeral following the amended suffix B symbol (see table below).

Numeral Designation	Tolerance	Numeral Designation	Tolerance
BA1—BM1	min value	BA4—BM4	±1.0
BA2—BM2	max value	BA5—BM5	±2.0
BA3—BM3	±0.5	BA6—BM6	±3.0

Examples: (Single filler) BA630 = 30 ± 3% (27-33%) glass fibers
(Mixed filler) BA625, BM35 = 25 ± 3% (22-28%) glass fibers with 5 ± 0.5% (4.5-5.5%) molybdenum disulfide

Note: The test method shall be as agreed upon between supplier and user.

Suffix Symbol C	Property Description and Test Method
CO—C100	REGRIND. Salvage material generated during the molding process when uniformly blended may be used to a percent not exceeding the value following the C suffix. The use of regrind does not preclude the part from meeting the other specified characteristics of part performance. Example: C25 = 25% max

Suffix Symbol D	Property Description and Test Method
DA800—DA2000 thru DF800—DF2000	SPECIFIC GRAVITY. As determined by ASTM D792 (Method A), shall be within the tolerance indicated by the letter following the D suffix (see below) and the value shall be as indicated by the numerals following the D suffix times the factor 0.001. ASTM D1505 may be used in place of ASTM D792 providing density is converted to specific gravity. Apparent density of rigid cellular plastic parts—structural foams—may be determined by ASTM D1622.

Numeral Designation	Tolerance	Numeral Designation	Tolerance
DA	min value	DD	±0.03
DB	max value	DE	±0.05
DC	±0.02	DF	±0.005

Example: DF895 = 0.895 ± 0.005

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TABLE 1—PROPERTY TABLE (CONTINUED)

Suffix Symbol E	Property Description and Test Method
	VISCOSITY. Either one of the following two methods shall apply dependent upon the presence or absence of an amending letter to the E suffix symbol.
E20—E2500	When the suffix E symbol is not amended by a letter, then the following method shall apply: RELATIVE VISCOSITY. As determined by the test method for relative viscosity described in ASTM D789, shall be no less than the numeral(s) of the E symbol. Example: E80 = 80 min
EA2—EA250 thru ET2—ET250	When the suffix E symbol is amended by a letter, the following method shall apply: FLOW RATE. As determined by the test method for flow rate listed in ASTM D1238, shall be within ±30% of the value indicated by the numeral of the E suffix symbol times the factor 0.1 g/10 min. The standard test conditions for the test shall be given by the letter following the suffix E symbol as described in the table of ASTM D1238. Example: EL8 = 0.8 ± 30% g/10 min (Condition L)
Suffix Symbol H	**Property Description and Test Method**
H1, H3, H7, H14	OXIDATIVE STABILITY. Specimens taken from molded part and exposed to Test for Thermal Oxidative Stability, ASTM D2445, for the period of time indicated by the numeral at the suffix H symbol, shall be determined by removing specimens from test apparatus, placing on a flat surface, and subjecting to a light compressive force. H1 = 1 day (24 h), H3 = 3 days, H7 = 7 days, H14 = 14 days
HA1, HA3, HA7, HA14	When the suffix H symbol is amended by the letter A, then ASTM D3012, Test for Thermal Oxidative Stability Characteristics of Plastics, shall be used. Note: Specimen size shall approximate the form of pellets or granules from which the material was supplied for molding.
Suffix Symbol M	**Property Description and Test Method**
M10—M2500	FLEXURAL MODULUS. Secand modulus of elasticity shall be determined as specified by ASTM D790 at 2.5 mm deflection. The value so determined shall be no less than the numerical value following the suffix times the factor 10 MPa. Example: M200 = 2000 MPa min
MA10—MA2500	When the suffix M symbol is amended by the addition of the letter A, then the tangent modulus of elasticity shall be determined by ASTM D790 instead of secant modulus.

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TABLE 1—PROPERTY TABLE (CONTINUED)

Suffix Symbol T	Property Description and Test Method
T118—T150 T218—T250 T318—T350	COLD FLEX TEMPERATURES. Specimens approximately 12.5 x 125 mm x part substrate thickness shall not fracture or crack when rapidly flexed around a mandrel of diameter as indicated by the first numeral following the suffix symbol. The test shall be conducted after 4 h exposure at the temperature indicated by the second and third numerals following the suffix T symbol times the factor –1°C. T118—T150 = 12.5 mm diameter mandrel T218—T250 = 25 mm diameter mandrel T318—T350 = 50 mm diameter mandrel Example: T230 = No fracture when flexed around a 25 mm diameter mandrel after 4 h at –30°C Note: The painted surface of the specimen or the highest stressed surface of the specimen shall be positioned on the mandrel so this surface forms the greatest radius when flexed.
Suffix Symbol AA	**Property Description and Test Method**
AA70—AA260 AAB70—AAB260 thru AAG70—AAG260	DIMENSIONAL STABILITY. Parts shall conform to the dimensions and tolerances shown on engineering drawings after 4 h exposure in an oven at the temperature indicated by the numeral of the suffix AA symbol expressed in degrees Celsius. Where appropriate, parts shall be held during measuring and heating in a manner similar to that encountered during actual use of the part. Example: AA85 = 85°C Where 4 h exposure is not appropriate, other exposure periods may be specified by amending the suffix symbol as follows: AAB = 1 h AAC = 2 h AAD = 8 h AAF = 16 h AAG = 24 h Example: AAC85 = 2 h at 85°C Note: This test method is generally intended for small plastic parts. For large plastic parts, the test method described under suffix symbol W (see Appendix) may be used instead of the above.
Suffix Symbol AD	**Property Description and Test Method**
AD1—AD12	SURFACE FINISH. As determined by method below, shall not exceed the value shown by the suffix AD symbol times the factor 2.5 µm R_a (100 µin R_a). Select four significant areas[a] on the panel or part, each large enough to permit a "trace" 50 mm long by a "remote stylus" of a "microrecorder,"[b] or equivalent. At each area, pass stylus over a 50 mm line, taking separate readings to determine "short term waviness" of each area. [a] Since curved surfaces are nearly impossible to evaluate, care should be exercised in selecting the 50 mm spans for the test readings. They should be as nearly flat as possible. [b] Marketed by Micrometrical Division of Bendix Corporation.
Suffix Symbol Z	**Property Description and Test Method**
Z1, Z2, Z3	OTHER CHARACTERISTICS. Shall be specified by the user. (Note: Symbol Z when added to specification number indicates the existence of requirements other than those designated by symbols explained in the tabulation above. These are normally shown in the body of engineering drawings under a heading "Supplementary Part Requirement.")

PREPARED BY THE SAE NONMETALLIC MATERIALS COMMITTEE

APPENDIX

Note: Prior to the Use of the Following, Refer to Paragraph 1.3

Suffix Symbol F	Property Description and Test Method
F80—F300	MELTING POINT. As determined by the test method for melting point listed in ASTM D789, shall be within a tolerance of ±5°C of the value indicated by the numeral of the suffix F symbol expressed in degrees Celsius. Example: F85 = 85 ± 5°C
FA80—FA300	When the suffix F symbol is amended by a letter, an alternate method of determining melting point referred to as differential scanning calorimetry per ASTM D3418, shall apply.
Suffix Symbol G	**Property Description and Test Method**
G1—G100	WATER ABSORPTION. As determined by ASTM D570 (24 h immersion), shall not exceed the value shown by the suffix G times the factor 0.1%. The test temperature and time shall be as agreed upon between the supplier and user. Example: G35 = 3.5% max
GA1—GA100 thru GF1—GF100	When the G suffix symbol is amended by a letter following the G symbol, then the following method shall apply. VOLATILE LOSS. As determined by the test method described in ASTM D1203 (Method B), shall not exceed the value indicated by the numeral or numerals following the suffix symbol times the factor 0.1%. Where the test temperature is not appropriate, other temperatures may be specified by amending the suffix symbol as follows: GA = 70°C GD = 105°C GB = 80°C GE = 120°C GC = 100°C GF = 150°F Example: GA35 = 3.5% max at 70°C
Suffix Symbol J	**Property Description and Test Method**
	HARDNESS. Shall be determined by one of the following methods depending upon the amending letter to the suffix J symbol.
JA10—JA95 JD10—JD95	DUROMETER. When the suffix J symbol is amended by the letter A or D, hardness shall be determined by the test method described in ASTM D2240 using either the A or D scale as indicated by the amending letter. The hardness shall be as shown by the numerical value following the amending letter with a tolerance of ±5 points for Durometer A values and ±3 points for Durometer D values. Example: JA55 = 55 ± 5 (A); JD45 = 45 ± 3 (D)
JB20—JB80	BARCOL HARDNESS. When suffix J symbol is amended by the letter B, hardness shall be determined by the test method described in ASTM D2583 and the hardness shall be no less than the numerical value following the amending letter. Example: JB70 = Barcol 70 min

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APPENDIX—PROPERTY TABLE (CONTINUED)

Suffix Symbol J (Continued)	Property Description and Test Method
JE10—JE150 JK10—JK150 JL10—JL150 JM10—JM150 JR10—JR150	ROCKWELL HARDNESS. When the suffix J symbol is amended by the letters E, K, L, M, or R, hardness shall be determined by the test method described in ASTM D785 using the Rockwell scale as indicated by the amending letter. The hardness shall be no less than the numerical value following the amending letter. Example: JM90 = Rockwell 90M min
Suffix Symbol K	**Property Description and Test Method**
K5—K200	TENSILE STRENGTH—ULTIMATE (for materials which do not exhibit a definite yield point) and YIELD STRENGTH (for materials which do exhibit this property), shall be determined by ASTM D638 using the 0.2% offset method. Speed of test shall be as designated in the appendices of ASTM D638 or as agreed upon between supplier and user for those materials not listed. The value determined shall be no less than the numeral or numeral(s) following the suffix K symbol expressed in MPa. Example: K14 = 14 MPa min
Suffix Symbol L	**Property Description and Test Method**
L1—L750	ULTIMATE ELONGATION. As determined by ASTM D638, shall be no less than the numerical value following the suffix L symbol. Speed of the test shall be as designated in the appendices of ASTM D638, or as agreed upon between supplier and user for those materials not listed. Example: L40 = 40% min
Suffix Symbol N	**Property Description and Test Method**
N5—N550	FLEXURAL STRENGTH. Flexural strength shall be determined as specified by ASTM D790. The value determined shall be no less than the numerical value of the suffix N symbol expressed in MPa. Example: N37 = 37 MPa min
Suffix Symbol Q	**Property Description and Test Method**
Q1—Q350	COMPRESSIVE STRENGTH. As determined by ASTM D695, shall be no less than the numerical value following the suffix Q symbol expressed in MPa. Example: Q20 = 20 MPa min
Suffix Symbol R	**Property Description and Test Method**
R11—R199 R21—R299 R31—R399 R41—R499	IMPACT RESISTANCE. Parts shall show no evidence of cracking when impact tested at the point or points indicated on engineering drawing. The test method shall be agreed upon between supplier and user. Immediately following exposure of part to one of the following conditions (as specified by the first numeral of the suffix R symbol) while part is at test temperature, the part shall be impacted utilizing a minimum energy (as indicated by the second, or second and third numeral of this symbol) times the factor 0.1 J. R11—R199 = 4 h at 23 ± 2°C R21—R299 = 4 h at –30 ± 2°C R31—R399 = Expose per suffix W symbol (see Appendix), followed by 4 h at 23 ± 2°C R41—R499 = Expose per suffix W symbol (see Appendix), subject to 2 h at 23 ± 2°C, and to 4 h at –30 ± 2°C

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APPENDIX—PROPERTY TABLE (CONTINUED)

Suffix Symbol U	Property Description and Test Method
U1—U5	FLAMMABILITY. Specimens taken from the part as received (unless otherwise specified) shall have a flammability rating as indicated by the first numeral following the U suffix symbol when tested per SAE J369. U1 = DN1 Does not ignite. Material does not support combustion during or after ignition. U2 = SE Self-extinguishing. Material ignites but does not burn to the timing zone. U3 = SE/NBR Self-extinguishing/no burn rate. Material ignites but stops burning before it has burned for 60 s from start of timing, and does not burn more than 50 mm from the point where timing was started. U4 = SE/B100 Self extinguishing/with a maximum burn rate of 100 mm/min. Material does not burn nor transmit a flame front across its surface at a rate of more than 100 mm/min. Material stops burning before it has burned for 60 s from start of timing, and it has not burned more than 50 mm from the point where timing was started. Burn rate calculated from formula below. U5 = B100 Maximum burn rate of 100 mm/min. Calculated from formula below: $$B = 60\frac{D}{T}$$ Where: B = Burn rate in millimeters per minute D = Distance the flame travels in millimeters T = Time in seconds for the flame to travel "D" millimeters
Suffix Symbol W	**Property Description and Test Method**
W1100 thru W9999	HEAT RESISTANCE. Tensile test specimens shall be exposed in an air circulating oven[a] for the time and temperature as indicated respectively for the first and second numerals following the suffix W symbol. After the exposure period, the maximum change in tensile strength and elongation allowed when measured according to ASTM D638[b] shall be as indicated by the third and fourth numerals following the suffix W symbol. (See Table A-1). [a] The air circulating oven shall be as described in ASTM D573. [b] The test specimens shall be conditioned after the exposure period for the same time period and at the same temperature and relative humidity used for determining initial tensile and elongation. Examples: W2757 = After 72 h at 150°C, there shall be no more than a ±25% change in tensile strength and a ±40% change in elongation

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APPENDIX—PROPERTY TABLE (CONTINUED)

Suffix Symbol W (Continued)	Property Description and Test Method
	W2707 = After 72 h at 150°C, there shall be no more than a 40% change in elongation. Changes in tensile strength are not specified W9757 = After 4 h at 150°C, there shall be no more than a ±25% change in tensile strength and a ±40% change in elongation
Suffix Symbol X	**Property Description and Test Method**
X1100 thru X9999	HUMIDITY AGING. Tensile test specimens shall be exposed at 95-100% relative humidity for a time and temperature as designated by the first and second numerals following the suffix X symbol. After the exposure period, the maximum change in tensile strength and elongation allowed when measured according to ASTM D638 shall be as indicated by the third and fourth numerals following the suffix X symbol. (See Table A-1.) Examples: X4236 = After 1 week at 80°C and 95-100% relative humidity, there shall be no more than a ±15% change in tensile strength and a ±30% change in elongation X4206 = After 1 week at 80°C and 95-100% relative humidity, there shall be no more than a ±30% change in elongation. A change in tensile strength is not specified. X9236 = After 24 h at 80°C and 95-100% relative humidity, there shall be no more than a ±15% change in tensile strength and a ±30% change in elongation
Suffix Symbol Y	**Property Description and Test Method**
YA1—YA100 thru YH1—YH100	FLUORESCENT UV CONDENSATION. Samples taken from a finished part, specimen size 75 x 300 mm approximately, shall be exposed in the QUV Cyclic Ultraviolet Weathering Tester[a] or Atlas UVCON for a total number of cycles as indicated by the numerals following the YA thru YH symbols. Each cycle shall consist of 8 h ultraviolet humidity exposure at 70 ± 3°C followed by 4 h of 100% condensity humidity exposure at 49 ± 4°C. Following the exposure cycles, 60° glossmeter reading taken on the exposed specimens shall be no less than the value indicated by the letter following the Y suffix symbol. In addition, the samples shall show no objectionable appearance changes such as yellowing, bronzing, checking, water spotting, etc.
YR1—YR2000 thru YY1—YY2000	LIGHT AND WATER EXPOSURE APPARATUS (CARBON ARC TYPE). Samples taken from a finished part, specimen size 78 x 191 mm approximately, shall be exposed in the Atlas XW weatherometer for the total number of hours indicated by the numerals following the YR thru YY symbols. The weatherometer shall utilize a cycle of 102 min of light followed by 18 min of light and spray. The light shall be filtered by Corex D glass and the water spray shall be delivered through four number F80 nozzles at a 12-18 psi nozzle pressure. Following the exposure, evaluate as noted for the fluorescent UV condensation.

Designation	Min Reading	Designation	Min Reading
YA/YR	40	YE/YV	75
YB/YS	50	YF/YW	80
YC/YT	60	YG/YX	85
YD/YU	70	YH/YY	90

[a] The QUV Ultraviolet Weathering Test as supplied by the Q-Panel Co., 15610 Industrial Parkway, Cleveland, OH 44135.

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APPENDIX—PROPERTY TABLE (CONTINUED)

Suffix Symbol AB	Property Description and Test Method
AB1—AB100	SURFACE TEXTURE. On parts where appearance is important, it is often desirable to control the surface to reduce reflections and glare, hide flow and knit lines, sink marks, and other minor blemishes. The following symbols indicate finishes commonly used in the plastics industry: AB1—As defined by Society of Plastic Engineers/Society of Plastics Industry (SPE/SPI)[a] #1 Finish—A smooth, polished, and even finish completely free of tool marks, dents, nicks, and scratches (such as produced from a steel mold which has been polished to 0.25 μm R_a). AB2—As defined by SPE/SPI[a] #2 Finish. Similar to AB1, except fine tool marks not polished out. Mold will be polished to 0.80 μm R_a or better. AB3—As defined by SPE/SPI[a] #3 Finish. Produced from machine mold with little or no polishing. AB4—As defined by SPE/SPI[a] #4 Finish. Similar to AB3, except more pronounced machine marks. Mold not polished. AB5—As defined by SPE/SPI[a] #5 Finish. Produced from vapor honed mold. AB6—As defined by SPE/SPI[a] #6 Finish. Produced from etched or grit blasted mold. _____ [a] A surface comparator known as "SPI Mold Finishes Kit" is available from: Society of Plastic Industries, Inc. 3150 Des Plaines Avenue Des Plaines, IL 60018
Suffix Symbol AC	**Property Description and Test Method**
AC1—AC4	THERMAL CYCLE RESISTANCE. Parts shall be subjected to the test cycle indicated by the numeral following the suffix symbol. At the conclusion of the test, the parts shall show no objectionable material degradation, shrinkage, blistering, distortion, or other effects which would detract from appearance or affect performance. AC1 = Normally used for exterior parts above the beltline. AC2 = Normally used for exterior parts below the beltline. AC3 = Normally used for interior parts above the beltline. AC4 = Normally used for interior parts below the beltline.

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