

VINYL ESTER BMC - INJECTION COMPRESSION MOLDED

GMP.UP.007

1 SCOPE. This specification covers the properties for vinyl ester bulk molding compound. The material is intended for molded-in-color parts produced by injection-compression process without post curing.

1.1 MATERIAL DESIGNATIONS. Material has 25% randomly oriented glass fiber at a initial length of 12.7 mm.

1.2 APPLICATIONS. Parts operating in the range of -40 to 150°C.

2 REFERENCED STANDARDS.

GM9077P	ASTM D3763	ISO 2577
ACCM-T-001	ASTM D4065	ISO 6427
ASTM D570	ASTM D4812	ISO 6603-2
ASTM D638	ISO 162	ISO 6721
ASTM D790	ISO 178	ISO R527
ASTM D792	ISO 180	
ASTM D955	ISO 1183	

3 TEST PROCEDURES. Tests shall be conducted using the latest issue of the test methods indicated. Suitable precautions should be taken to ensure that applicable safe limits are not exceeded when conducting test procedures, processes, and/or handling the materials required by this specification.

3.1 Determine material properties using test specimens cut from unannealed injection-compression molded plaques using a surface edge finishing method outlined in Automotive Composites Consortium Manual, ACCM-T-001, item 7.3. These plaques shall be molded using the mold temperatures, mold pressure and cure cycle that will be used to mold production parts. Use the mold configuration shown in Figure 1. Plaques shall be 2.5 ± 0.1 mm thick. Weight variation between plaques shall not exceed ± 3.0%. Do not use the area (50 mm parallel x 120 mm perpendicular to the flow) adjacent to the gate. Plaque flatness limits are warp and twist of 0.0 to 2.1% respectively.

3.2 Raw materials used for molding shall be within their vendor defined shelf life. Plaques shall be uniform in appearance and free from blisters, pregels, knit lines, cracks, and surface contamination. Porosity shall be 1 pit max per 625 mm². Surfaces shall also be free of external mold release.

3.3 An equal number of specimens shall be cut from both the longitudinal and transverse plaque directions for each mechanical property. The specimens shall be tested and the results averaged. The average value is the material property value. This value is compared to the required value shown in the Compound Properties table(s).

3.4 Tests shall be conducted 40 h min after molding and immediately following a conditioning period of 24 h min @ 22 ± 3°C and 50 ± 5% RH unless otherwise specified. All testing shall be done on unannealed samples.

3.5 The supplier and purchaser shall negotiate data and test requirements for quality control purposes.

4 COMPOUND PROPERTIES.

4.1 COMPOUND PROPERTIES (GRAY AND BLACK). See Table 1.

4.2 CONSTITUENT MATERIALS. Individual specifications for the materials which constitute the BMC molding compound shall be established by the molder. Incoming materials shall be approved to those specifications by the molders laboratory before release for production. Test results shall be maintained by the molder and be available for General Motors review.

5 SUGGESTED COMPOUND VERIFICATION.

Inherent compound properties and test procedures that may be used to identify this material are listed below. The test value and test procedure requirements are identical to those listed in Section 4, Compound Properties.

Filler Content
Glass Fiber Content
Infrared Characterization Scan
Specific Gravity

6 COMPOUND AND SOURCE APPROVAL.

Each vehicle group and component division will have its own approved compound list derived from the corporate plastics file. No shipment shall be made by a new source until a sample of the compound manufactured at a production facility has been approved by the appropriate vehicle group and/or component division. Shipment receipt and certification requirements will vary among receiving locations.

6.1 A completed copy of the GM Material Safety Data Sheet (available from a GM laboratory or engineering department) must be submitted with any new submissions or when a composition change has occurred.

7 IDENTIFICATION. The molding compound shall be identified by the specification code, the manufacturer's identification code and lot number, along with any additional vehicle group and component division requirements.

8 INSPECTION AND REJECTION. The purchaser reserves the right to sample incoming shipments even though it is the responsibility of the supplier to meet the requirements stated without dependence upon the purchaser's inspection. The supplier (whether prime contractor or subcontractor) will forfeit qualification if a change is made in material, processing methods, testing methods, or location of manufacture without prior written request to and subsequent approval from the purchaser.

9 GENERAL INFORMATION. This standard was originated by GM Powertrain in conjunction with the Sheet Molding Specialist Team in September 1992 and approved in September 1993.

VINYL ESTER BMC - INJECTION COMPRESSION MOLDED **GMP.UP.007**

TABLE 1 - COMPOUND PROPERTIES (GRAY AND BLACK)

Properties	Test Values	Test Methods
Glass Fiber Reinforcement	21.7 - 29%	ISO 6427, methylene chloride extraction of uncured material on a 40 mesh screen for acid insoluble fillers. GM9077P for acid soluble fillers.
Specific Gravity	1.70 - 1.77	ASTM D792, Method A or ISO 1183, Method A.
Flexural Modulus @ +23°C Secant 0.5 mm deflection Secant 2.5 mm deflection	8388 MPa min Samples break	ASTM D790 Method I, or ISO 178, Method 1. 1.3 mm/minute, 50 mm span, 25 mm wide specimen, secant calculations at 0.5 and 2.5 mm deflection.
Flexural Modulus @ +150°C	5146 MPa min	ASTM D4065 or ISO 6721.
Flexural Strength	80.7 MPa min	ASTM D790, Method I, or ISO 178, Method 1. 1.3 mm/minute, 50 mm span, 25 mm wide specimen.
Tensile Strength at Break	32.6 MPa min	ASTM D638, Type 1 bar, 5 mm/minute or ISO R527.
Tensile Modulus	11 063 MPa min	ASTM D638, Type 1 bar, 5 mm/minute or ISO R527.
Unnotched Izod Impact	65.9 J/m min	ASTM D4812 or ISO 180.
Mold Shrinkage Parallel Transverse Avg. See NOTE 1.	0.088 - 0.116% 0.237 - 0.279% 0.165 ± 0.195%	ASTM D955 or ISO 2577. Measure on test plaques (Figure 1) over min span of 200 mm in both parallel and transverse to the direction of flow. Report shrink after 48 h. Average the shrinkage from both directions.
Glass Transition Temperature	172°C min	ASTM D4065 or ISO 6721. Peak in tan delta. Temperature scan from -40 to 200°C @ 5°C/minute. Three point bending at a frequency of 1 Hz.
Moisture Absorption	0.18% max	ASTM D570 or ISO 162. Specimen 12 x 36 mm. 24 h @ 23°C.
High Speed Instrumented Impact Maximum Load Deflection to max Load Energy to max Load Total Energy	680 N min 6 mm max 1.8 J min 2.3 J min	ASTM D3763 or ISO 6603-2. Speed of testing, 150 mm/minute.

NOTE 1: This property assures reproducible mold shrinkage, but does not indicate the shrinkage to be used to cut tools for production parts.