



O-Ring Requirements for Fuel Line Quick Connects

1 Scope

This specification describes o-ring materials intended for nylon or other fuel line quick connect fittings used in conventional gasoline fuel systems where exposure to alcohol concentrations on an intermittent basis with gasoline are anticipated. For quick connect o-rings with up-graded alcohol resistance see GM6269M. Because a variety of material compounds can satisfy the functional requirements, the approved materials are classified by type. Material approvals to this specification cannot be transferred for any other end use applications.

1.1 Material Description. This specification covers four types of elastomeric seals. The seals are differentiated based on chemistry and performance.

1.1.1 Type I: Fluorosilicone (FVMQ)/Fluorocarbon (FKM) Blend, inner o-ring.

SAE J200M4HK 707 or 807 Z1 through Z11 (see Table 1 for suffix requirements).

1.1.2 Type II: Fluorosilicone (FVMQ), outer o-ring.

SAE J200M4HK 707 or 807 Z1 through Z11 (see Table 1 for suffix requirements).

1.1.3 Type III: Fluorocarbon (FKM containing 70 wt% Fluorine), inner o-ring.

SAE J200M2HK 810 Z1 through Z11 (see Table 1 for suffix requirements).

1.1.4 Type IV: Low durometer Fluorocarbon (FKM containing 70 wt% Fluorine), inner o-ring.

SAE J200M2HK 610 Z1 through Z11 (see Table 1 for suffix requirements).

Note: Straight fluorosilicone, Type II is more flexible at low temperature, has improved alcohol resistance and lower compression set than the blended, Type I materials. Type II material is used in areas that require better sealing at low temperatures.

Note: Type III is an alternative to Type I for the inner o-ring. Type IV is an alternative to Type III

where a softer, lower-durometer o-ring is required.

2 References

Note: Only the latest approved standards are applicable unless otherwise specified.

2.1 External Standards/Specifications

ASTM D624	ASTM D3182
ASTM D1329	SAE J200
ASTM D1414	SAE AS568-214
ASTM D2240	

2.2 GM Standards/Specifications

GM213M	GM9080P
GM6269M	GM9676P
GM6406M	GMW3001
GM9055P	GMW3059
GM9060P	

2.3 Additional References

CPC Chart #10093203

3 Requirements

3.1 Requirements on Delivery. RMA guidelines from the latest edition of the o-ring (OR) technical bulletins, inspection (OR-1) dimensions (OR-6), and specifications (OR-9) shall be followed with noted exceptions.

3.2 Requirements on Test Specimens. With noted exceptions, all data is generated from SAE AS568-214 o-rings tested to ASTM D1414 requirements. Test samples from ASTM slabs must be molded per ASTM D3182 requirements.

Material specification values reported are based on a 6 sigma limit spread in data from a minimum of five production lots, five samples per lot (for qualification). New materials (not a commercial compound) will be tentatively approved based on a 1 to 3 pilot lots and one production lot. A material lot is a batch or batches of a com-

compound mixed within a 24-h period, which is tested and approved under the same code designation. A part lot is a run of parts from the same material lot.

Materials approved to this specification can only be used in the connector designs in which they were performance tested. Thus, a connector source cannot use o-ring material tested in and approved for another source's connector design. Physical property data developed to initially qualify a material need not be repeated when only functional testing is required to approve the material for use in another connector design. Materials are not approved until all data is received and it passes the functional test requirements per Section 3.4. Connector sources must report bench test results to materials engineering so the material can be added to the approval list. Dependent on the similarity of proposed new materials for approval to other materials already approved, and dependent on what database of test data is available for the material, the requirements for Engineering Source Approval may be modified by the GM Materials Engineer issuing the approval.

Specification ranges involving multiple sources are determined by the lowest and highest 3 sigma value (not necessarily from the same source). Source capability is not measured to the specification range (table), but the specific manufacturer's process data. Data and tests for SPC purposes must be negotiated between the supplier and the end user.

Shelf Life. The materials shall be packed to prevent permanent deformation when shipped or stored. It must meet all requirements of this specification after 1 year of storage at 50°C.

3.3 Compound Requirements.

3.3.1 See Table 1 for Z1 through Z11 compound suffix requirements.

3.3.2 Density (Z8). The engineer has the option of requesting the value on the part detail drawing.

3.3.3 Sour Gas (Z9)

3.3.3.1 Mix 3.8 ml of 70% t-butyl hydroperoxide per 1000 ml of Indolene. Stir vigorously. Allow the water to settle out of the mixture (no less than 3 hours). Decant the fuel into a new container.

3.3.3.2 Remove 5 ml of fuel for the peroxide number measurement per GM9055P. The peroxide number should equal 50 ± 3 initially.

3.3.3.3 Measure peroxide number twice each week.

3.3.3.4 Change sour gas if peroxide number is less than 40 or greater than 55.

3.3.4 Resistance to 80% Fuel C/20% Methanol (Z10 and Z11). Place the Z10 and Z11 samples in freshly made blend solution each week to maintain a proper alcohol concentration. Water-cooled condensers should be used for better blend ratio maintenance.

3.4 Performance Requirements.

3.4.1 Molded o-rings must be tested and evaluated with nylon fuel lines to the following component and system requirements without failure:

GM9060P	GM213M
GM9080P	GM6406M
GM9676P	

System components are listed on CPC Chart #10093203.

3.4.2 Molded o-rings tested and evaluated with other fuel lines must meet the following component and system requirements:

GM9060P

As specified on engineering drawing

System components are listed on CPC Chart #10093203.

4 Manufacturing Process

Not applicable.

5 Rules and Regulations

5.1 All materials supplied to this specification must comply with the requirements of GMW3001, **Rules and Regulations for Material Specifications**.

5.2 All materials supplied to this specification must comply with the requirements of GMW3059, **Restricted and Reportable Substances for Parts**.

6 Approved Sources

Tentative source approval will be granted based on 6 sigma statistical data from prototype/lab material on a minimum of 5 samples per lot. Full approval will be granted after successful completion of GM engineering evaluation, a plant trial and specification requirements on 5 production lots.

Engineering qualification of an approved source is required for this specification. Only sources listed in the GM Materials File (i.e., MATSPC) under this specification number have been qualified by engineering as meeting the requirements of this specification.

7 Coding System

This material specification shall be referenced in other documents, drawings, VTS, CTS, etc. as follows:

"GM6268M Type N"

where N= I, II, III, or IV

8 Release and Revisions

8.1 Release. This standard was originated in 1990 by CPC Engineering.

8.2 Revisions.

Rev	Approval Date	Description (Organization)
B	AUG 2002	Added Type III, Revised Table (Miscellaneous Rubber Specialist Team)
C	MAR 2004	Added Type IV, Revised Table (Miscellaneous Rubber Specialist Team)



Table 1: Compound Requirements

Test Property	Test Method	Unit	Type I	Type II	Type III	Type IV
Durometer	ASTM D2240	Shore A	See 1.1.1	See 1.1.2	75 ± 5	65 ± 5
50% Tensile Modulus (Z1)	ASTM D 1414	MPa	2.8 min	1.0 min	2.0 min	1.0 min
Elongation (Z2)	ASTM D 1414	%	115 min	140 min	175 min	200 min
Tension Set (Z3)	ASTM D 1414	%	6 max	6 max	6 max	6 max
Tear Strength (Z4)	ASTM D 624	kN/m	11 min	11 min	14 min	14 min
Heat Resistance (Z5)	ASTM D 1414, 70 h at 225°C	%	0 to +35	0 to +30	-20 to +20	-20 to +20
Change in 50% Modulus		%	-30 to 0	-45 to 0	-20 to +20	-20 to +20
Change in Elongation						
Compression Set (Z6)	ASTM D 1414, 22 h at 100°C	%	30 max	15 max	25 max	25 max
Low Temperature (Z7) Retraction TR10	ASTM D 1329	°C	-20 max	-55 max	-5 max	-5 max
Density (Z8)	ASTM D 1414		± 0.02	± 0.02	± 0.02	± 0.02
Resistance to Sour Gas (Z9)	ASTM D 1414, 168 h at 60°C	%	-45 to 0	-42 to 0	-60 to 0	-60 to 0
Change in Tensile		%	-25 to 0	-30 to +13	-30 to +30	-30 to +30
Change in Elongation		%	-50 to 0	-50 to 0	-50 to 0	-50 to 0
Change in Tear Strength		%	0 to +20	0 to +30	0 to +35	0 to +35
Change in Volume						
Resistance to 80% Fuel C/20% MeOH (Z10)	ASTM D 1414, 70 h at 23°C	%	-70 to 0	-60 to 0	-30 to 0	-30 to 0
Change in Tensile		%	-50 to 0	-33 to +20	-10 to +10	-10 to +10
Change in Elongation		%	-70 to 0	-50 to 0	-35 to 0	-35 to 0
Change in Tear Strength		%	0 to +40	0 to +35	-10 to +10	-10 to +10
Change in Volume						
Long Term Resistance to 80% Fuel C/20% MeOH (Z11)	ASTM D 1414, 1008 h at 49°C	%	-75 to 0	-65 to 0	-55 to 0	-55 to 0
Change in Tensile		%	-65 to +25	-50 to 0	-20 to 0	-20 to 0
Change in Elongation		%	-75 to 0	-60 to 0	-50 to 0	-50 to 0
Change in Tear Strength		%	0 to +40	0 to +35	0 to +25	0 to +25
Change in Volume						

¹ Initial Qualifying Test Only