



Technical Report Preprint

This report is scheduled to appear in the 1968 SAE Handbook

©Society of Automotive Engineers, Inc. 1967
SOCIETY OF AUTOMOTIVE ENGINEERS, INC.,
485 Lexington Avenue, New York, New York 10017

J40d

AUTOMOTIVE BRAKE HOSES—SAE J40d

SAE Standard

Report of Motorcoach and Motor Truck Division approved January 1942 and last revised by Hydraulic Brake Systems Actuating Committee March 1967.

[The specifications in this SAE Standard originated in the SAE-ASTM Technical Committee on Automotive Rubber (other than tires). They represent the correlation of the best information available from research investigation and production experience on the minimum constructional and performance characteristics essential for new brake-hose assemblies used as original or replacement equipment. They also represent the minimum quality recognized by car manufacturers and hose suppliers as essential for satisfactory and safe operation by the hose itself and other coating parts of the braking system. This SAE Standard includes hoses for hydraulic, air, and vacuum brakes.]

HYDRAULIC-BRAKE HOSE (SAE 40R1) ASSEMBLY SPECIFICATION FOR 1/2-IN. HOSE

Scope—This specification covers a grade of hose fabricated from braid and natural rubber or from braid and synthetic rubber, assembled with steel or brass end fittings for use on automotive hydraulic-brake equipment as flexible connections.

Manufacture—This hose shall consist of a rubber inner tube, two braids of cotton, viscose rayon, or polyester cord imbedded in and bonded to the rubber, and a rubber outer cover. The cover must be a black stock, free from sulfur bloom, which will not crack when subjected to long periods of weather aging. The inner tube of this hose must be a nonblooming stock which will effectively resist deterioration by nonmineral oil brake fluids approved by the original vehicle manufacturers.

End Connections—Exposed steel or brass end connections of the hose assembly shall be suitably protected against rust or corrosion.

Hose Identification—Each manufacturer of hose shall identify his product by one or more colored cords woven into the braid.

NOTE: The approved cord color designation for each brake-hose manufacturer shall be assigned by the Rubber Manufacturers Association, Inc., 444 Madison Avenue, New York, N.Y. 10022.

Each hose assembly must bear a distinctive designation prominently and permanently indicating the name or trade mark of the hose-assembly manufacturer.

Twenty-six sample hose assemblies from each lot are required to run a complete test in accordance with this specification. In the interest of safety any assemblies remaining intact after these tests must be destroyed by cutting through at the center of the length.

Retests and Rejections—In the event of the failure of one sample of the 26 selected at random from a lot to meet any of the following requirements, additional samples, as shown under Retest in Table 1, shall be submitted to the same test and the failure of any one of these shall be cause for rejection of the entire lot.

The temperature of the testing room shall be between 70 and 90 F (21 and 32 C). The samples to be tested shall be stabilized at room temperature previous to testing.

NOTE: The above does not apply to the samples for the cold test.

Test Requirements—The assemblies for test shall be new and unused and shall be at least 24 hr old.

All tests must be made in accordance with the latest ASTM D 571, Methods of Testing Automotive Hydraulic Brake Hose.

Constriction—The constriction of the hose assemblies shall be measured with a gage plug whose "A" dimensions shall be 0.080 in. minimum in diameter. The time required for the gage plug to drop of its own weight a distance of 3 in. into the hose assembly shall not exceed 5 sec.

Expansion—The maximum expansion of any of the hose assemblies so tested shall not exceed values in Table 2.

TABLE 1—SAMPLES REQUIRED FOR TESTS, SAE 40R1, HOSE

	Original Test	Retest
Tensile (dry).....	4	8
Tensile (water immersed).....	4	8
Volumetric expansion, Followed by Burst (dry).....	4	8
Burst (water immersed).....	4	8
Whip (dry).....	4	8
Whip (water immersed).....	4	8
Cold Flux Test.....	1	2
Ozone Test.....	1	2
	26	52

* This specification does not show any items relating to the tensile strength, elongation, and other physical characteristics of the rubber compounds and materials composing the tube, cover, and cord. The preparation of suitable test specimens for tensile strength and stretch from rubber hose of the diameter herein specified is impractical; furthermore, separate test slabs prepared from rubber compounds representing tube and cover compounds are not considered suitable.

TABLE 2—MAXIMUM EXPANSION OF FREE LENGTH HOSE, SAE 40R1 (cc/ft)

Hose, in.	1000 psi		1500 psi	
	Reg. Exp. Hose	Low Exp. Hose	Reg. Exp. Hose	Low Exp. Hose
1/8	0.66	0.33	0.79	0.42
3/16	0.86	0.55	1.02	0.72
1/4	1.04	a	1.30	a

a At present there is no 1/4 in. low expansion hose available.

Bursting Strength—When tested under hydraulic pressure, each sample of hose shall withstand a pressure of 4000 psi minimum for 2 min. The pressure shall then be increased at a rate of 25,000 ($\pm$ 10,000) psi per min until burst occurs. The minimum bursting strength for any sample shall be 5000 psi.

Whip Test—The minimum life of any one of the sample hose assemblies with free lengths ranging from 8 to 24 in. run continuously on the flexing machine shall be 35 hr.

Tensile Test—The hose assembly is fixed in the testing machine and pulled at a speed of approximately 1 in. per min. All hose assemblies so tested shall withstand a minimum pull of 325 lb without the end fittings pulling off or rupture of the hose.

Water Absorption Test—Coupled assemblies after 70 hr in water at room temperature, shall pass all burst, whip, and tensile requirements. Coupled assemblies shall have the cover removed 1/2 in. to 5/8 in. from either side of the center (total 1 in. to 1 1/4 in. cover removed) so that the outer braid is exposed. Care must be taken during removal of the cover that the outer yarn is not injured, nor shall the hose be elongated during the removal. The assembly with the portion of cover removed shall be immersed in water at room temperature for a period of 70 to 72 hr. Within 10 minutes of removal from the water, all tests, except whip test, shall be made. The whip test shall be started within 30 minutes after removal from the water.

Cold Test—The hose assembly shall be conditioned in a cold box in straight position at -65 to -70 F for 72 hr. After conditioning and without removal from the cold box, the hose shall be bent around a mandrel having a diameter of 3 in. The hose shall not crack or break.

Ozone Test¹—The outer cover of the hose shall show no cracking when tested in accordance with ASTM D622.

Salt-Spray Test—The hose assembly end connections shall withstand 24-hr exposure to salt spray when tested in accordance with ASTM B 117.

100% Pressure Test—Before shipment by the vendor, each complete hose assembly shall be given a pressure test, using air or water as the pressure medium. The test pressure shall be 1500 psi minimum for air or gas and 3000 psi minimum for liquid. Special care should be taken in case air is used, as under the pressure specified, air is explosive if a failure should occur in the hose or hose assembly. The pressure shall be held for not less than 10, nor more than 25, sec. Hose assemblies showing leaks under this test shall be rejected and destroyed.

ASSEMBLY SPECIFICATION FOR 3/16- AND 1/4-IN. HOSE

Scope—This specification covers a grade of two sizes of hose fabricated from braid and natural rubber or from braid and synthetic rubber, assembled with steel or brass end fittings for use on automotive hydraulic-brake equipment as flexible connections where standard 1/4-in. hose does not provide sufficient fluid displacement.

Manufacture—This hose shall consist of a rubber inner tube, two braids of cotton, viscose rayon, or polyester cord imbedded in and bonded to the rubber, and a rubber outer cover. The cover must be a black stock, free from sulfur bloom, which will not crack when subjected to long periods of weather aging. The inner tube of this hose must be a nonblooming stock which will effectively resist deterioration by nonmineral oil brake fluids approved by the original vehicle manufacturers.

End Connections—Exposed steel or brass end connections of the hose assembly and shall be suitably protected against rust or corrosion.

Hose Identification—Each manufacturer of hose shall identify his product by one or more colored cords woven into the braid.

NOTE: The approved cord color designation for each brake-hose manufacturer shall be assigned by the Rubber Manufacturers Association, Inc., 444 Madison Avenue, New York, N.Y. 10022.

Each hose assembly must bear a distinctive designation prominently and permanently indicating the name or trade mark of the hose-assembly manufacturer.

Twenty-six sample hose assemblies from each lot are required to run a complete test in accordance with this specification. In the interest of safety, any assemblies remaining intact after these tests must be destroyed by cutting through at the center of the length.

Retests and Rejection—In the event of the failure of one sample of the 26 selected at random from a lot to meet any of the following requirements, additional samples, as shown under Retest in Table 1, shall be submitted to the same test and the failure of any one of these shall be cause for rejection of the entire lot.

The temperature of the testing room shall be between 70 and 90 F (21 and 32 C). The samples to be tested shall be stabilized at room temperature previous to testing.

(The above does not apply to the samples for the cold test.)

Test Requirements—The assemblies for test shall be new and unused and shall be at least 24 hr old. All tests must be made in accordance with the latest ASTM D 571, Methods of Testing Automotive Hydraulic Brake Hose.

Constriction—The constriction of the hose assemblies shall be measured with a gage plug whose "A" dimensions shall be 0.120 in. minimum in diameter for the 3/16 inside diameter hose and 0.165 in. minimum in diameter for the 1/4 inside diameter hose. The time required for the gage plug to drop of its own weight a distance of 3 in. into the hose assembly shall not exceed 5 sec.

Expansion—The maximum expansion of any of the hose assemblies so tested shall not exceed values in Table 2.

Bursting Strength—When tested under hydraulic pressure, each sample of hose shall withstand a pressure of 3000 psi minimum for 2 min. The pressure shall then be increased at a rate of 25,000 ($\pm 10,000$) psi per min until burst occurs. The minimum bursting strength for any sample shall be 4500 psi.

Whip Test—The minimum life of any one of the sample hose assemblies with free lengths ranging from 8 to 15 1/2 in. run continuously on the flexing machine shall be 35 hr.

Tensile Test—The hose assembly is fixed in the testing machine and pulled at a speed of approximately 1 in. per min. All hose assemblies so tested shall withstand a minimum pull of 325 lb without the end fittings pulling off or rupture of the hose.

¹Conformance to MIL-H-13719 is acceptable in lieu of ASTM D622.

Water Absorption Test—Coupled assemblies after 70 hr in water at room temperature, shall pass all burst, whip, and tensile requirements. Coupled assemblies shall have the cover removed 1/2 in. to 5/8 in. from either side of the center (total 1 in. to 1 1/4 in. cover removed) so that the outer braid is exposed. Care must be taken during removal of the cover that the outer yarn is not injured, nor shall the hose be elongated during the removal. The assembly with the portion of cover removed shall be immersed in water at room temperature for a period of 70 to 72 hr. Within 10 minutes of removal from the water, all tests, except whip test, shall be made. The whip test shall be started within 30 minutes after removal from the water.

Cold Test—The hose assembly shall be conditioned in a cold box in straight position at -65 to -70 F for 72 hr. After conditioning and without removal from the cold box, the hose shall be bent around a mandrel having a diameter of 3 1/2 in. The hose shall not crack or break.

Ozone Test¹—The outer cover of the hose shall show no cracking when tested in accordance with ASTM D622.

Salt-Spray Test—The hose assembly end connections shall withstand 24-hr exposure to salt spray when tested in accordance with ASTM B 117.

100% Pressure Test—Before shipment by the vendor, every complete hose assembly shall be given a pressure test, using air or water as the pressure medium. The test pressure shall be 1500 psi minimum for air or gas and 3000 psi minimum for liquid. Special care should be taken in case air is used, as under the pressure specified, air is explosive if a failure should occur in the hose or hose assembly. The pressure shall be held for not less than 10, nor more than 25, sec. Hose assemblies showing leaks under this test shall be rejected and destroyed.

AIR-BRAKE HOSE (SAE 40R2)

Scope—This specification covers five types of air hose intended for use in automotive air brake systems. The system includes all air actuated equipment leading from the air brake line. These types of hose are not to be used from the air compressor to air reservoir if air temperature is in excess of 250 F. The types of hose are as follows:

Type A—Hose shall be mandrel built having a tube and friction of oil resisting rubber, reinforced with cotton or synthetic cord or duck plies or a combination of both, and a cover of oil resisting compounds utilizing polymerized chloroprene as the basic material. Assemble with reusable or permanent type metal end fittings.

Type B—Hose shall be nonmandrel built having a tube and friction of oil resisting rubber, reinforced with cotton or synthetic cord or duck plies or a combination of both, and a cover of oil resisting compounds utilizing polymerized chloroprene as the basic material. Assemble with reusable or permanent type metal end fittings.

Type C—Hose shall be mandrel built having a tube of oil resisting rubber, reinforced with one braid of high tensile steel wire and a cover of oil resisting compounds utilizing polymerized chloroprene as the basic material. A cotton braid or other suitable material may be used to anchor the cover to the hose. Assemble with permanent type metal end fittings only.

Type D—Hose shall be mandrel built having a tube of oil resisting rubber, reinforced with two cotton braids separated by a high tensile steel wire braid. All braids are to be impregnated with an oil and age resisting compound. This hose is not to be used on any line where abrasion of the outer cover will be encountered in service. Assemble with reusable type metal end fittings only.

Type E—Hose shall be mandrel built having a tube of oil resisting rubber, reinforced with two cotton or synthetic braids separated by a wire braid. All braids are to be impregnated with an oil and age resisting compound. This hose is not to be used on any line where abrasion of the outer cover will be encountered in its service. Assemble with reusable type metal end fittings only.

Type F—Hose shall be mandrel built having a tube of oil resisting rubber, reinforced with one 300 Series stainless steel braid and one fabric braid separated by an insulation layer of oil resisting rubber. The fabric braid is to be impregnated with an oil and age resistant compound. Assembled with reusable or permanent type metal end fittings.

Manufacture—The construction of hose for this service embodies a smooth bore tube of oil resisting material reinforced as described for the types of hose and having a cover of abrasive oil and age resistant compound, except on Types D, E, and F where the cover will be an impregnated cotton cover. The hose shall be so manufactured as to comply with the test requirements set forth in this SAE Standard.

Reusable End Fittings—Reusable end fittings shall consist of a nipple inserted into the bore of the hose and an outer sleeve (socket, body, or shell) engaging the nipple. The wall of the hose shall be