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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 coacting parts of the braking system. This SAE Standard includes hoses for hydraulic, air, and vacuum brakes.]

HYDRAULIC-BRAKE HOSE (SAE 40R1) ASSEMBLY SPECIFICATION FOR ⅛-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 TEST[a], 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

[a] 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 (± 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 ½ in. to ⅝ in. from either side of the center (total 1 in. to 1¼ 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 Test[1]—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 ¼-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 ⅛-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 ¼ 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 (±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 15½ 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.

[1]Conformance 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 ½ in. to ⅝ in. from either side of the center (total 1 in. to 1¼ 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 3½ in. The hose shall not crack or break.

Ozone Test[1]—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 automotve 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

compressed between the nipple and sleeve. Reusable end fittings on Types A and B shall be of such design and construction that they may be used on all constructions of both types of hose.

Dichromate Dip—All zinc plated end fittings are to be dichromate dipped.

Salt Spray Test—Hose assembly end connections shall withstand 24 hr exposure to salt spray when tested in accordance with ASTM B 117 Method of Salt Spray (Fog) Testing. Conformance to this requirement shall be determined by observation of the exterior of the fitting.

Hose Identification—The type of hose, the name or trademark of the hose manufacturer, and/or the hose assembler shall appear on the outer cover of the hose at intervals not greater than 15 in. apart. The color of the branding shall be red for Types A, B, C, D, E, and F hose.

Retests and Rejections—Any hose which fails in one or more tests may be resampled and retested for which purpose two additional samples shall be selected from the hose for the test that failed to meet the requirements. Failure of either of the retested samples shall be cause for final rejection.

Sizes—The hose shall conform to the dimensional requirements given in Table 3.

Type C Wire, Outside Diameter—The outside diameter over the wire reinforcement of Type C shall conform to the following:

TYPE C, OD OVER WIRE

ID, in.	Wire OD, in.
1/4	7/16 ± 3/128
3/8	19/32 ± 3/128
1/2	23/32 ± 1/32

Samples for Tests—A representative sample of hose approximately 6 ft in length shall be selected from each lot to be tested. If a single length of 6 ft is not available, several sections, each of sufficient length to provide the required test specimens, may be taken.

Test Requirements—All measurements and tests necessary for determining the conformity of the hose with these specifications shall be made in accordance with ASTM D 622, Methods of Testing Automotive Air Brake and Vacuum Brake Hose.

To qualify hose under this specification, all of the requirements shown under Qualification Tests and Inspection Tests must be met. Production shipments or lots of the qualified hose shall meet the requirements shown under Inspection Tests, but the user may in addition, if he so desires, test hose from any or all such production shipments or lots to the requirements under the Qualification Tests.

Qualification Tests

Aging Test—The hose shall show no cracks, charring, or disintegration externally or internally when straightened after being bent over a form having the radius given in Table 4 after a period of 70 hr in an oven at 100 ± 1 C (212 ± 1.8 F).

[2]The manufacturers of vacuum-brake hose shall obtain the date code from the Rubber Manufacturers Association, Inc., 444 Madison Avenue, New York, N. Y. 10022.

Cold Test—After being subjected to this test, the hose shall show no signs of cracking or breaking.

Length Change—Types A, C, D and E hose shall not contract in length more than 3% nor elongate more than 5% when tested under a pressure of 200 psi.

Types B and F hose shall not contract in length more than 7% when tested under a pressure of 200 psi. Under the same test the hose shall not elongate.

Ozone Test—The outer cover of the hose shall show no cracking when examined under 7 power magnification after a period of 70 hr in the ozone cabinet at 50 parts of ozone per 100 million of air by volume at 104 F.

Inspection Tests—The hose shall conform to the following test requirements:

Adhesion—The minimum load required by the machine method to separate the tube from the plies, the plies, and the cover from the plies shall be 8 lb. This test is to be made only on the original unaged specimens.

Air-Pressure Test—The hose and couplings shall show no leakage under air pressure of 200 psi for 5 min.

Burst Test—The minimum bursting strength of Types A and B hose shall be 900 psi when tested with hydrostatic pressure. The minimum bursting strength of Type F hose shall be 1000 psig when tested with hydrostatic pressure.

The minimum bursting strength of Types C and D hose when tested with hydrostatic pressure shall be as follows:

3/16 and 1/4 in.	10,000 psi
5/16 in.	9,000 psi
3/8 and 13/32 in.	8,000 psi
1/2 in.	7,000 psi
5/8 in.	6,000 psi

The minimum bursting strength of Type E hose when tested with hydrostatic pressure shall be as follows:

3/16 in. and 1/4 in.	6,000 psi
5/16 in. and 13/32	4,000 psi
1/2 in.	3,500 psi
5/8 in.	3,000 psi

TABLE 4 — AIR-BRAKE HOSE AGING TEST, SAE 40R2

	Hose Size, Inside Diameters, in.						
	1/4	5/16	3/8	7/16	1/2	5/8	5/8 Special
Types A-E: Length of Specimen, in.	9	10	10	11	11	12	14
Radius of form	1-1/2	1-3/4	1-3/4	2	2	2-1/4	2-1/2
	3/16	5/16	13/32	1/2	5/8		
Type F: Length of Specimen, in.	9	11	12	15	19		
Radius of form	1-1/2	2	2-5/16	2-3/4	3-1/4		

TABLE 3 — AIR-BRAKE HOSE DIAMETER, SAE 40R2

Size, in.	Inside Diameter Tolerance, in.				Types A and B OD, in.		Type C OD, in.		Type D OD, in.		Type E OD, in.		Type F OD, in.	
	Type A	Type B	Type C	Types D, E and F	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
3/16[a]	±1/64	±3/128	—	+0.016 +0.005	1/2	9/16	—	—	0.500	0.539	0.472	0.510	0.468	0.507
1/4	±1/64	±3/128	±1/64	+0.020 −0.008	19/32	21/32	19/32	21/32	0.562	0.602	0.535	0.573	—	—
5/16	±1/64	±3/128	—	+0.023 −0.008	21/32	23/32	—	—	0.656	0.695	0.598	0.636	0.593	0.632
3/8	±1/64	±3/128	±1/64	—	21/32	23/32	3/4	13/16	—	—	—	—	—	—
13/32	—	—	—	+0.023 −0.008	—	—	—	—	0.742	0.789	0.714	0.760	0.742	0.788
7/16	±1/64	±1/32	—	—	25/32	27/32	—	—	—	—	—	—	—	—
1/2	±1/64	±1/32	±3/128	+0.023 −0.008	27/32	29/32	7/8	15/16	0.898	0.945	0.808	0.854	0.837	0.883
5/8	±1/64	±1/32	—	+0.023 −0.008	1-3/32	1-1/32	—	—	1.054	1.101	0.933	0.979	0.953	1.015
5/8 Special	±1/64	±1/32	—	—	1-11/32	1-13/32	—	—	—	—	—	—	—	—

[a] 3/16 in. size Types A and B may be single-ply reinforcement.

Tensile Test—The hose assembly complete with coupling shall withstand a minimum pull of 325 lb without separation from the couplings or rupture of the hose structure, except that 3/16 and 1/4 in. sizes of Types A and B shall withstand minimum pull of 250 lb without separation from the coupling or rupture of the hose structure.

Volume Increase of Tube in Types A, B, C, D, and E, and Cover Types, A, B, and C—A specimen prepared from the inner tube and from the cover of the hose shall show a volume increase when measured after removal from the ASTM No. 3 Oil, in which it has been immersed for 70 hr at 212 F of not more than 100%.

VACUUM-BRAKE HOSE (SAE 40R3)

GENERAL REQUIREMENTS

For the purposes of clearly identifying the scopes and simplification of the specification, the vacuum-brake hose specification is divided into three parts as follows:

Part I (SAE 40R3H)—Heavy-Duty Type—for service or trucks, truck-trailer combinations, and so forth.

Part II (SAE 40R3L)—Light-Duty Type—for service in conjunction with the power-braking system on passenger cars and light trucks.

Part III (SAE 40R3M)—Oil Resisting Heavy Duty Type—for specific use as manifold connections, but also may be used for all services specified for Heavy Duty Type SAE 40R3H.

Manufacture—The construction of hose for this service embodies a smoothbore tube of flexible material, reinforced with cord or duck plies, or a combination of both, together with an abrasive-, weather-, and sunlight-resistant cover. The hose shall be so manufactured as to comply with the test requirements set forth in this SAE Standard.

End Connections—All zinc plated end connections are to be dichromate dipped.

Salt Spray Test—Hose assembly end connections shall withstand 24 hr exposure to salt spray when tested in accordance with ASTM B 117. Conformance to this requirement shall be determined by observation of the exterior of the fitting.

Hose Identification—The name or trademark and date code shall appear on the outer cover of the hose at intervals not greater than 36 in. apart.[2]

Retests and Rejections—Any hose which fails in one or more tests shall be resampled and retested, for which purpose two additional samples shall be selected from the lot for the test that failed to meet the requirements. Failure of either of the retested samples shall be cause for final rejection of the lot.

Samples for Test—A representative sample of hose approximately 15 ft in length shall be selected from each lot to be tested. If a single length of 15 ft is not available, several sections, each of sufficient length to provide the required test specimens, may be taken. The samples shall be not less than 7 nor more than 120 days old.

Test Requirements—All measurements and tests necessary for determining the conformity of the hose with these specifications shall be made in accordance with ASTM D 622, Methods of Testing Automotive Air Brake and Vacuum Brake Hose.

To qualify hose under this specification, all of the requirements shown under Qualification Tests and Inspection Tests must be met. Production shipments or lots of the qualified hose shall meet the requirements shown under Inspection Tests, but the user may in addition, if he so desires, test hose from any or all such production shipments or lots to the requirements under Qualification Tests.

Tube Tensile—The tube tensile shall be as specified in Parts I, II, and III.

Tube Elongation—The tube elongation shall be as specified in Parts I, II, and III.

Tube Volume Increase—The tube volume increase shall be as specified.

Qualification Tests

Aging Test—The hose shall show no cracks, charring, or disintegration externally or internally when straightened after being bent over a form having the radius given in Table 6 for Heavy-Duty Type and Table 8 for Light-Duty Type, after a period of 70 hr in an air oven at 100 ± 1 C (212 ± 1.8 F).

Cold Test—After being subjected to this test, the hose shall show no signs of cracking or breaking.

Ozone Test—The outer cover of the hose shall show no cracking when examined under 7 power magnification after a period of 70 hr in the ozone cabinet at 50 parts of ozone per 100 million of air by volume at 104 F.

Inspection Tests

Burst Test—The hose shall not burst, leak, or show signs of failure at a hydrostatic pressure lower than specified in Table 6 for Heavy-Duty Type and Table 8 for Light-Duty Type.

Vacuum Test—The collapse of the outside diameter of the hose under internal vacuum of 26 in. of Hg for 5 min shall not exceed 1/16 in.

Bend Test—The collapse of the outside diameter of the hose at the middle point of the test length when bent until the ends touch shall not exceed the values given in Table 6 for Heavy-Duty Type and Table 8 for Light-Duty Type.

Deformation Test—A specimen 1 in. long shall be compressed five times to a collapsed inside diameter (dimension D) in Table 6 for Heavy-Duty Type and Table 8 for Light-Duty Type. The load required in the first compression and in the fifth compression shall be as specified in the detailed sections for Heavy-Duty and Light-Duty Hose. After the test, the specimen shall immediately return to at least 90% of the original outside diameter.

Swell Test—The hose shall be filled with Reference Fuel A and held 48 hr at room temperature, after which the Reference Fuel A shall be removed, and immediately a steel ball of the diameter given in Table 6 for Heavy-Duty Type and Table 8 for Light-Duty Type shall pass through the hose freely. The sample shall then show no leakage in vacuum test under 26 in. of Hg for 10 min, after which there shall be no separation of the inner tube from the fabric reinforcement of the hose.

NOTE: For light-duty hose, the ball diameter is calculated as specified under Part II, Swell Test.

Adhesion Test—The minimum load required to separate the tube from plies, the plies, and the cover from the plies shall be 8 lb. This test is to be made only on original, not aged, specimens.

Cover Tensile—The cover tensile shall be as specified in Part I and Part II.

Cover Elongation—The cover elongation shall be as specified in Part I and Part II.

Cover Volume Increase—The cover volume increase shall be as specified.

Applicable Requirements—All applicable requirements in this section on General Requirements shall be part of the Heavy-Duty Type (SAE 40R3H), Light-Duty Type (SAE 40R3L) specifications, and Oil Resisting Heavy-Duty Type (SAE 40R3M).

PART I—HEAVY-DUTY TYPE (SAE 40R3H)

Scope—This specification covers vacuum hose intended for use in the braking systems of single vehicles or as connecting or transmission lines in combination of vehicles or systems thereof.

Sizes—The hose shall conform to the dimensional requirements given in Table 5.

Test Requirements—The hose shall conform to all of the requirements of Table 6 and the applicable requirements in the section on General Requirements.

TABLE 5—HEAVY-DUTY VACUUM-BRAKE HOSE DIAMETERS, SAE 40R3H

	Hose Size					
Inside diameter, in.	1/4	3/8	1/2	5/8	3/4	1
Tolerance plus	0.008	0.008	0.008	0.008	0.008	0.010
Tolerance minus	0.020	0.020	0.020	0.020	0.020	0.022
Outside diameter, in.	9/16	13/16	15/16	1-1/16	1-3/16	1-15/32
Tolerance plus	1/32	1/32	1/32	1/32	1/32	1/32
Tolerance minus	1/32	1/32	1/32	1/32	1/32	1/32

TABLE 6—HEAVY-DUTY VACUUM-BRAKE HOSE TEST REQUIREMENTS SAE 40R3H

Hose	Tests						
	Aging		Bend		Deformation	Burst	Swell
ID, in.	Specimen Length, in.	Radius of Form, in.	Specimen Length, in.	Maximum Collapse of OD, in.	Collapsed ID (Dimension D), in.	Psi	Diameter of Ball, in.
1/4	9	1-1/2	8	3/32	1/16	1200	3/16
3/8	10	1-3/4	12	5/32	3/32	1200	5/16
1/2	11	2	16	7/32	1/8	1000	13/32
5/8	12	2-1/4	22	7/32	5/32	1000	17/32
3/4	14	2-1/2	28	7/32	3/16	800	5/8
1	16	3-1/4	36	9/32	1/4	800	7/8