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(R) Transmission Oil Cooler Hose**1. Scope**

This SAE Standard covers hose intended for use with automatic transmission cooling system applications. Type A hoses are intended for original equipment or replacement applications while Type B hoses are intended for aftermarket auxiliary cooler applications only. The reference fluid for tests requiring the use of automatic transmission fluid (ATF) shall be Dexron III, Mercon 5 or equivalent ATF that is agreed to by hose manufacturer and customer.

1.1 Rationale

This specification is being revised to add definitions for Type and Class of hoses and to add a 165 °C class hose. The hose dimensions have been modified to allow for a greater range of hose sizes.

2. References**2.1 Applicable Publications**

The following publications form a part of this specification to the extent specified herein. The latest issue of SAE publications shall apply.

2.1.1 SAE PUBLICATIONS

Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

SAE J343—Tests and Procedures for SAE 100R Series Hydraulic Hose and Hose Assemblies

2.1.2 ASTM PUBLICATIONS

Available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.

ASTM D 380—Test Methods for Testing Rubber Hose

ASTM D 413—Test Methods for Rubber Property—Adhesion to Flexible Substrate

ASTM D 1149—Test Method for Rubber Deterioration—Surface Ozone Cracking in a Chamber (Flat Specimens)

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3. Definitions

Hoses shall be defined by Type and Class as follows:

3.1 Type

Type refers to the operating and burst pressure rating of the hose.

Type A hoses are defined as having a maximum operating pressure of 1.7 MPa and minimum burst pressure of 6.9 MPa.

Type B hoses are defined as having a maximum operating pressure of 1.0 MPa and minimum burst pressure of 4.1 MPa.

3.2 Class

Class refers to the temperature rating of the hose.

Class 1 hoses have a temperature rating of -40°C . to 125°C .

Class 2 hoses have a temperature rating of -40°C . to 150°C .

Class 3 hoses have a temperature rating of -40°C . to 165°C .

4. Dimensions

The dimensions and tolerances are listed in Table 1. Concentricity based on total indicator reading between the bore and the outer surface shall not exceed 0.8 mm.

TABLE 1—DIMENSIONS AND TOLERANCES

Hose Size ⁽¹⁾		Inside Diameter Tolerance		Outside Diameter Tolerance		Wall Thickness	
mm	in	mm	in	mm	in	mm	in
7 to 11	0.276 to 0.433	+/- 0.50	+/- 0.020	+/- 0.80	+/- 0.031	2.94	0.116
>11 to 14	>0.433 to 0.551	+/- 0.59	+/- 0.023	+/- 0.80	+/- 0.031	3.44	0.135

1. inside hose diameter

5. Qualification Tests

5.1 Original Burst Test

When hydrostatically tested in accordance with ASTM D 380, two hose samples, with a minimum of 460 mm in length, shall not burst or leak below the burst pressure defined in Table 2.

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TABLE 2—BURST PRESSURE

Hose Size	Type A MPa	Type A psi	Type B MPa	Type B psi
All Sizes	6.9	1000	4.1	600

5.2 Ozone Test

Test procedure and apparatus shall be in accordance with ASTM D 1149. A hose specimen of sufficient length shall be bent around a mandrel of non-ozone absorbing material with diameter as specified in Table 3. Both ends shall be tied at their crossing with enameled copper or aluminum wire. After mounting, the specimen shall be allowed to rest in an ozone-free atmosphere for 24 h at room temperature of $23\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$. The mounted specimen shall be placed in a test chamber with an ozone partial pressure of $100\text{ mPa} \pm 5\text{ mPa}$ at a temperature of $40\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$. After 70 h to 72 h of exposure, the specimen shall be removed, allowed to cool to a temperature of $23\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$ and then visually inspected under 7X magnification. There shall be no evidence of surface cracking except for the area immediately adjacent to the wire, which shall be ignored.

TABLE 3—TEST FIXTURE DIMENSIONS

Hose Size mm	Hose Size in	Mandrel Diameter, Ozone Test (mm)	Mandrel Diameter, Cold Flex (mm)	Bend Radius, Impulse (mm) Minimum
7.0 to 8.0	0.276 to 0.315	108–121	135–151	31.8
>8.0 to 9.0	>0.315 to 0.354	114–127	143–159	36.0
>9.0 to 11.0	>0.354 to 0.433	121–134	151–167	40.2
>11.0 to 14.0	>0.433 to 0.551	152–165	190–206	50.8

5.3 Automatic Transmission Fluid Resistance Test

Class 1 hose shall be filled with reference fluid and aged for 168 h at $125\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$. Class 2 hose shall be filled with reference fluid and aged for 70 h at $150\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$. Class 3 hose shall be filled with reference fluid and aged for 70 h at $165\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$. Six specimens of aged hose shall then be subjected to the tests described as follows so that each specimen is subjected to one and only one of the tests.

5.3.1 VACUUM COLLAPSE TEST

Measure the O.D. of the hose along its narrowest dimension with calipers. Seal one end air tight, and connect the other to a vacuum source. Then expose to a vacuum of 508 mm of Hg for 30 s, and measure the O.D. of the hose along its narrowest dimension under vacuum. The O.D. of the hose must not collapse more than 25% when compared to the O.D. of the hose before exposure of vacuum.

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5.3.2 KINK RESISTANCE

Hose shall not kink when tested as follows: Use a board approximately 20 mm thick with hole diameter, center distance and sample length as shown in Table 4. Insert one end of the hose into the board with the end flush on the opposite side of the board. Carefully bend the hose along its natural curvature, and insert the other end carefully into the second hole until it projects 65 mm out the other side. After the hose has been in this position for 5 min, a steel ball having the diameter specified in Table 4 must be able to roll from one end of the hose to the other.

TABLE 4—KINK RESISTANCE DIMENSIONS

Nominal Hose Size mm	Nominal Hose Size in	Hose Sample (Length) mm	Hole Center Distance (mm)	Diameter of Hole (mm)	Diameter of Ball (mm)
7.0 to 8.0	0.276 to 0.315	275	45	15.5–16.0	3.9–4.0
>8.0 to 9.0	>0.315 to 0.354	275	50	16.0–16.5	4.3–4.4
>9.0 to 11.0	>0.354 to 0.433	300	75	17.0–17.5	4.7–4.8
>11.0 to 14.0	>0.433 to 0.551	300	100	21.0–21.5	6.2–6.3

5.3.3 BURST TEST

When hydrostatically tested in accordance with ASTM D 380, two hose samples, a minimum of 460 mm in length, shall not burst or leak below the burst pressure defined in Table 2.

5.3.4 COLD FLEXIBILITY

The hose shall be placed in a cold box in a straight position for 70 h at $-40 \text{ }^{\circ}\text{C} \pm 2 \text{ }^{\circ}\text{C}$. While still in the cold box, the hose shall be bent 180 degrees around a mandrel within 4 s to 8 s. The mandrel shall have the diameter specified in Table 3 and shall be stabilized at $-40 \text{ }^{\circ}\text{C} \pm 2 \text{ }^{\circ}\text{C}$ before bending the hose around it. The hose shall not fracture and shall not show any cracks, checks, or breaks in the tube or cover.

5.3.5 ADHESION

The minimum force required to separate the reinforcement from cover and tube shall be 1.4 N/mm of width as tested against the machine method in ASTM D 413.

5.4 Hot Oil Circulation Test

Reference fluid shall be circulated through Class 1 hose at $125 \text{ }^{\circ}\text{C} \pm 3 \text{ }^{\circ}\text{C}$ for 1000 h at a pressure of $0.34 \text{ MPa} \pm 0.02 \text{ MPa}$. Reference fluid shall be circulated through Class 2 hose at $150 \text{ }^{\circ}\text{C} \pm 3 \text{ }^{\circ}\text{C}$ for 1000 h at a pressure of $0.34 \text{ MPa} \pm 0.02 \text{ MPa}$. Reference fluid shall be circulated through Class 3 hose at $165 \text{ }^{\circ}\text{C} \pm 3 \text{ }^{\circ}\text{C}$ for 1000 h at a pressure of $0.34 \text{ MPa} \pm 0.02 \text{ MPa}$. After completing the circulation test, the hose shall not leak or burst when tested to 50% of the pressure in Table 2.