



SURFACE VEHICLE STANDARD

J20™

FEB2022

Issued 1944-01
Reaffirmed 2015-03
Revised 2022-02

Superseding J20 MAR2015

Coolant System Hoses

RATIONALE

Tables 6a and 6b revised for nominal size mm; changed to nominal hose size and clarified note for in-between hose sizes. Added 3.6.4. Added Section 14 for fatigue resistant designator which defines the pressure cycle requirements and wave form.

1. SCOPE

This SAE Standard covers reinforced and flexible hoses intended for use in water and ethylene glycol-based engine-coolant system applications.

2. REFERENCES

2.1 Applicable Documents

The following publications form a part of the specification to the extent specified herein. Unless otherwise indicated, the latest issue of SAE publications shall apply.

2.1.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), www.sae.org.

SAE J1231	Beaded Ends for Hose Connections and Hose Fittings
SAE J1508	Hose Clamp Specifications
SAE J1610	Test Method for Evaluating the Sealing Capability of Hose Connections with a PVT Test Facility
SAE J1638	Compression Set of Hoses or Solid Discs
SAE J1684	Test Method for Evaluating the Electrochemical Resistance of Coolant System Hoses and Materials
SAE J2370	Geometric Dimensions and Tolerancing for Curved Hose
SAE J2387	Dimensions and Tolerances for Coolant System Hoses
SAE J2605	Non-Contact Hose Measurement Study 1

SAE Executive Standards Committee Rules provide that: "This report is published by SAE to advance the state of technical and engineering sciences. The use of this report is entirely voluntary, and its applicability and suitability for any particular use, including any patent infringement arising therefrom, is the sole responsibility of the user."

SAE reviews each technical report at least every five years at which time it may be revised, reaffirmed, stabilized, or cancelled. SAE invites your written comments and suggestions.

Copyright © 2022 SAE International

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording, or otherwise, without the prior written permission of SAE.

TO PLACE A DOCUMENT ORDER: Tel: 877-606-7323 (inside USA and Canada)
Tel: +1 724-776-4970 (outside USA)
Fax: 724-776-0790
Email: CustomerService@sae.org
<http://www.sae.org>

SAE WEB ADDRESS:

Full document details: SAE J20_202202

For more information on this standard, visit
https://www.sae.org/standards/content/J20_202202/

Documents
Document Sharing Hub

2.1.2 ASTM Publications

Available from ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959, Tel: 610-832-9585, www.astm.org.

ASTM D380	Methods of Testing Rubber Hose
ASTM D395	Test Methods for Rubber Property Compression Set
ASTM D412	Test Method for Rubber Properties in Tension
ASTM D413	Test Methods for Rubber Property Adhesion to Flexible Substrate
ASTM D471	Test Method for Rubber Property Effect of Liquids
ASTM D573	Test Method for Rubber Deterioration in an Air Oven
ASTM D1149	Test Method for Rubber Deterioration Surface Ozone Cracking in a Chamber (Flat Specimens)
ASTM D2240	Test Method for Rubber Property Durometer Hardness

2.1.3 Military Specification Publications

Available from Department of Defense Specification, Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094, Tel: 215-697-2179, <http://assist.daps.mil> or <http://stinet.dtic.mil>.

MIL-HDBK-695 Rubber Products: Recommended Shelf Life

2.1.4 ARPM Publications

Available from Association for Rubber Products Manufacturers, 7321 Shadeland Station Way, Suite 285, Indianapolis, IN 46256, Tel: 317-863-4072, www.arpminc.com.

IP-2 Hose Handbook

2.1.5 ISO Publications

Copies of these documents are available online at <http://webstore.ansi.org/>.

ISO 9001 Quality Systems - Model for Quality Assurance in Design, Development, Production, Installation and Servicing

2.2 Related Publications

The following publications are provided for information purposes only and are not a required part of this SAE Technical Report.

2.2.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), www.sae.org.

SAE J20-1	Coolant Hose (Supplement to SAE J20 for Government Use Replacing Part of MS52130)
SAE J20-2	Coolant Hose - Normal Service Type Convolute, Wire Support Hose (Supplement to SAE J20 for Government Use Replacing Part of MS51008)

3. DEFINITIONS OF HOSE TYPES

3.1 SAE 20R1

Heavy-duty type for service in heavy-duty application. This type is available in two wall thicknesses as indicated in 6.3.

3.2 SAE 20R2

Flexible heavy-duty wire embedded type for the same service as SAE 20R1.

3.3 SAE 20R3

Heater hose for normal service.

3.4 SAE 20R4

Radiator hose for normal service.

3.5 SAE 20R5

Convuluted wire supported type for normal service.

3.6 HOSE SPECIAL DESIGNATORS FOR SAE 20RXY

X refers to the hose type. Y designators may be used for hoses with special features. Multiple Y designators may be used if needed.

3.6.1 HT

This high temperature designation is for any hose type, SAE 20R1 to SAE 20R5, which is required to operate in an environment above 125 °C. (See Section 11.)

3.6.2 EC

This electrochemical designation is for any hose type, SAE 20R1 to SAE 20R5, which is required to have electrochemical resistance as defined by SAE J1684. (See Section 12.)

3.6.3 LT

This low temperature designation is for any hose type, SAE 20R1 to SAE 20R5, which is required to operate in an environment down to -55 °C. (See Section 13.)

3.6.4 FR

This fatigue resistant designation is for any pre-shaped hose type SAE 20R1, 20R3, or 20R4 which is required to operate in a high-fatigue pressure cycling environment. (See Section 14.)

3.7 HOSE CLASSES

Compounds based on different synthetic rubber grades are specified and designated (see 5.2 for test methods):

Class A—High-temperature resistant

Class B—High oil resistant

Class C—Medium oil resistant

Class D-1—Low oil resistant, improved service

Class D-2—Low oil resistant, standard service

Class D-3—Low oil resistant, high-temperature resistant, premium service

Class E—Low oil resistant, fiber elastomer composite

Physical characteristics for each hose class are shown in Table 1.

Table 1 - Coolant system hose elastomeric material, physical properties

SAE Designation Typical Elastomer	Class A Silicone	Class B NBR	Class C CR	Class D-1 EPDM	Class D-2 EPDM	Class D-3 EPDM	Class E EPDM/Fiber
Typical Temperature Range, °C	-55 to 175	-40 to 100	-40 to 100	-40 to 125	-40 to 125	-40 to 150	-40 to 125
Original Properties							
Durometer, points Shore A	55 to 75	55 to 75	55 to 75	55 to 75	55 to 75	55 to 75	65 to 85
Tensile, min, MPa	5.5	8.5	7.0	7.0	5.0	7.0	5.0
Elongation, min, %	200	250	200	250	150	250	100
Oven Aging Conditions							
Change Limits, Hours/°C	70/175	70/100	70/100	70/125	70/125	168/150	70/125
Durometer, points Shore A	+10	+15	+20	+15	+15	+15	+15
Tensile, max, %	-15	-15	-20	-20	-20	-35	-20
Elongation, max, %	-40	-50	-50	-50	-50	-65	-50
Oil Immersion Change Limits							
ASTM No. 3 Oil or IRM 903 (IRM 903 is being phased in to replace ASTM No. 3)							
Hours/°C	70/100	70/100	70/100	—	—	—	—
Volume, max, %	0 to +45	-5 to +25	+80	—	—	—	—
Tensile, max, %	-40	-20	-50	—	—	—	—
Coolant Immersion (Tube only)							
Change Limits							
Hours/at Boiling Point	70	70	70	70	70	168	70
Volume, %	0 to +40	0 to +20	0 to +20	-5 to +20	-5 to +20	-5 to +20	-5 to +20
Durometer, points Shore A	-10 to +10	-10 to +10	-10 to +10	-10 to +10	-10 to +10	-10 to +10	-10 to +10
Tensile, max, %	-30	-20	-20	-20	-20	-20	-20
Elongation, max, %	-25	-40	-40	-50	-25	-25	-25
Compression Set °C	125	100	100	125	125	125	125
70 h, max, %	40	50	75	75	85	75	85
Cold Flexibility (°C) ⁽¹⁾	-40	-40	-40	-40	-40	-40	-40

⁽¹⁾ LT designator extends the low temperature flexibility to -55 °C.

3.8 MARKING

The outer cover will be printed with the designation SAE 20RXY (the X being the hose type and Y any special designator(s) such as "LT"), class, size of the inside diameter in millimeters, hose manufacturer's code marking, and any other identification as agreed upon between user and manufacturer/supplier. It is recommended that this marking shall appear on the outer cover of the hose at intervals not greater than 380 mm.

3.8.1 SMALL ID OR SHORT HOSE

If there is insufficient space on the hose for the required marking due to size or configuration, the marking shall be agreed upon by the customer and the manufacturer/supplier.

4. DIMENSIONAL REQUIREMENTS

Geometric dimensioning and tolerancing requirements are outlined in SAE J2370. The following requirements are minimal standards:

4.1 Tube and Cover Thickness

Minimum thickness shall be 1.6 mm for the tube and 0.8 mm for the cover.

NOTE: This requirement does not apply for hoses without distinctive tube and cover construction.

4.2 Length Tolerance

- a. Straight hose: Unless otherwise specified by the customer or manufacturer, commercial tolerances will be used. See Table 2.

Table 2 - Length tolerance

Length mm	Precision Tolerance mm	Commercial Tolerance mm
0-300	±3.2	+9.7-3.2
>300	±1%	+3%-1%

- b. Curved hose: The tolerances on arm lengths, measured from end to intersection of nearest centerline, shall be as shown in Table 3.

Table 3 - Tolerance on arm length

Arm Length mm	Precision Tolerance mm	Commercial Tolerance mm
0-300.0	±4.0	±6.4
300.1-610.0	±4.8	±7.2
610.1-910.0	±6.4	±9.7
910.1-1220.0	±9.7	±11.2
1220.1-1830.0	±12.7	±15.9
Over 1830	±1%	±2%

4.3 General Layout Tolerances, Curved Hose

Dimensions locating bend intersections and centerline radii are to establish the theoretical design centerline of the hose. Actual outside contour of hose must be held within a total range of 9.6 mm of all planes with respect to theoretical outside contour of hose. For hose check, hose ends should first be placed in theoretical design position before checking (hose may have to be flexed to correct for any distortion caused by handling or during shipment). SAE arm length tolerances shall apply.

Tolerances apply to all arm and body lengths in addition to contour tolerances. Dimensions covering more than one arm or body length are reference only and have no tolerances. The wall thickness within bends of a curved hose may differ from the wall thickness of the straight by no more than 33%.

When an alignment mark is required for assembly operations, the basic identifier in Figure 1 is recommended.