



SURFACE VEHICLE RECOMMENDED PRACTICE

J2044™

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(R) Quick Connect Coupling Specification for Liquid Fuel and Vapor/Emissions Systems

RATIONALE

This revision is to encompass changes in fuel and emission technology and clarification of test procedures.

SAE J2044 has been reaffirmed to comply with the SAE Five-Year Review policy.

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1. SCOPE

This SAE Recommended Practice defines the minimum functional requirements for quick connect couplings used for supply, return, and vapor/emission fuel system connections. This document also defines standard male tube end form dimensions, so as to guarantee interchangeability between all connector designs of the same male tube end form size. This document applies to automotive and light truck applications under the following conditions:

- a. Gasoline and diesel fuel delivery systems or their vapor venting or evaporative emission control systems.
- b. Operating pressure up to 500 kPa, 5 bar, (72 psig).

- c. Operating vacuum down to –50 kPa, –0.5 bar (–7.2 psi).
- d. Operating temperatures from –40 °C (–40 °F) to 115 °C (239 °F).

Quick connect couplings function by joining the connector to a mating tube end form, then pulling back to assure a complete connection. The requirements stated in this document apply to new connectors in assembly operations unless otherwise indicated. For service operations, the mating tube should be lubricated with SAE 30-weight oil before re-connecting.

Vehicle OEM fuel system specifications may impose additional requirements beyond the scope of this general SAE document. In those cases, the OEM specification takes precedence over this document.

2. REFERENCES

2.1 Applicable Publications

The following publications form a part of this specification to the extent specified herein. Unless otherwise specified, 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 724-776-4970 (outside USA), www.sae.org.

SAE J526	Welded Low-Carbon Steel Tubing
SAE J527	Brazed Double Wall Low-Carbon Steel Tubing
SAE J1645	Fuel Systems and Components—Electrostatic Charge Mitigation
SAE J1681	Gasoline, Alcohol, and Diesel Fuel Surrogates for Materials Testing
SAE J1737	Test Procedure to Determine the Hydrocarbon Losses from Fuel Tubes, Hoses, Fittings, and Fuel Line Assemblies by Recirculation
SAE J2045	Performance Requirements for Fuel System Tubing Assemblies
SAE J2587	Optimized Fuel Tank Sender Closure

2.1.2 ASTM Publication

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 B 117	Method of Salt Spray (Fog) Testing
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2.2 Related Publication

The following publication is provided for information purposes only and is not a required part of this specification.

2.2.1 SAE Publication

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

SAE J30	Fuel and Oil Hoses
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3. DEFINITIONS

3.1 Unexposed Coupling

One that has not been used or deteriorated since manufacture.

3.2 Lot

A group of couplings that can be traced to a single assembly set-up or material lot. No more than one week production in a lot.

3.3 Dimensions

Unless otherwise specified all dimensions are in millimeters (mm).

4. SIZE DESIGNATION

The size of quick connect couplings in this document are designated by three dimensions, and presented as $\epsilon \times \beta \times \alpha$, defined in Figure 1 below. Dimension ϵ designates the nominal male endform diameter. Dimension β designates the tubing or hose size suited for the stem end of the coupling. Dimension α designates the minimum straight length, of nominal diameter tubing, behind the male endform bead, required for proper installation and removal of the fitting.

EXAMPLE: 9.5 mm x 8 mm x 12 mm connector couples with a 9.5 mm male tube end, is inserted into an 8 mm flexible tube or hose and requires 12 mm clearance behind the bead on the tube end.

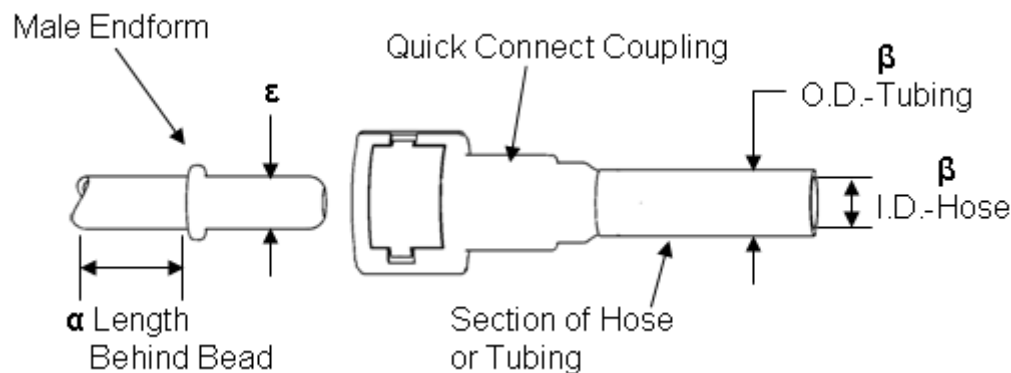


FIGURE 1 - CONNECTOR NOMENCLATURE

Details for standard coupling sizes and dimensions for standard tube end forms are shown in Table 1 and Figure 2.

NOTE: On metal or plastic tubing the OD is used to designate size. On flexible hose the ID is used to designate size.

5. TEST TEMPERATURES

Unless otherwise specified, all tests will be performed at room temperature $23\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$ ($73.4\text{ }^{\circ}\text{F} \pm 4\text{ }^{\circ}\text{F}$).

6. FUNCTIONAL REQUIREMENTS

This section defines the minimum functional requirements for quick connector couplings used in flexible tubing fuel systems.

NOTE: New connector designs using the same materials as previously tested connectors may use the original results as surrogate data for 7.1 Corrosion, 7.2 Zinc Chloride Resistance, 7.3 External chemical and Environmental Resistance, and 7.4 Fuel Compatibility.

6.1 Leak Test (In-Process)

In accordance with stringent emissions regulations, including CARB PZEV, and safety regulations, quick connector couplings must be free of leaks and micro-leaks. Production leak testing is performed to assure conformance to the requirement. Compressed air leak testing is a proven technique which provides required leak sensitivity as well as a proof test for pressure resistance. Depending on the application, test conditions for Low Pressure (vapor), high pressure (liquid) and vacuum systems are described below.

NOTE: Leak test acceptance criteria for this document are in customary leak units of flow (cc/min) or mass flow (scc/min). In the fuel system industry, an alternate leak test criteria, based on units of equivalent channel dimension rather than flow rate, have been applied. For example, see SAEJ2587 for leak criteria for fuel pump module tank interface joint. The equivalent channel specification is especially appropriate for parts such as fuel tanks with large internal volume, with high deformation with applied pressure or vacuum and where use pressures are low. Leak tests for such parts include vacuum, pressure, and accumulation methods. It can be difficult to compare the indicated leak rates for various techniques, so an equivalent channel criteria is established. The equivalent channel dimension specification is based on test data indicating that fuel system micro-leaks will plug over time. Effectively, micro-leaks plug to a near zero hydrocarbon emission level. The high pressure leak tests defined in 6.1.3 have been demonstrated, with experiment and analysis, to satisfy an equivalent channel of 15 micron diameter and 3 mm length. No further testing is recommended to validate the equivalent channel criteria. Standard leak rate conditions are defined as 101.325 kPa (14.696 psia) and 293 K (20 C).

6.1.1 Low Pressure Leak Test Procedure

- a. Insert leak test pin, shown in Figure 3, into the connector.
- b. Pressurize between the seals (for single seal connectors, the stem must be capped or sealed) with suitable air leak test equipment to 69 kPa $\pm$ 7 kPa, 0.69 bar $\pm$ 0.07 bar (10 psig $\pm$ 1 psig).

6.1.2 Low Pressure Leak Acceptance Criteria

Maximum leak rate 2 scc/min (1.19 cc/min) at stabilization.

6.1.3 High Pressure Leak Test Procedure (Liquid Fuel Only)

- a. Insert leak test pin, shown in Figure 3, into the connector.
- b. Pressurize between the seals with suitable air leak test equipment to 1034 kPa $\pm$ 35 kPa, 10.34 bar $\pm$ 0.35 bar (150 psig $\pm$ 5 psig).

6.1.4 High Pressure Test Acceptance Criteria

Maximum leak rate 5 scc/min (0.45 cc/min) at stabilization.

NOTE: Appropriate safety precautions should be taken when testing with high-pressure air. Not required for vapor/emission quick connector couplings. Vapor connectors are not generally used for high pressure applications.

6.1.5 Vacuum Leak Test Procedure (Vapor Systems only at Customer's Request)

- a. Insert leak test pin shown in Figure 3 into connector.
- b. Apply a vacuum of 7 kPa (–1.02 psig) with suitable vacuum leak test equipment.

6.1.6 Vacuum Test Acceptance Criteria

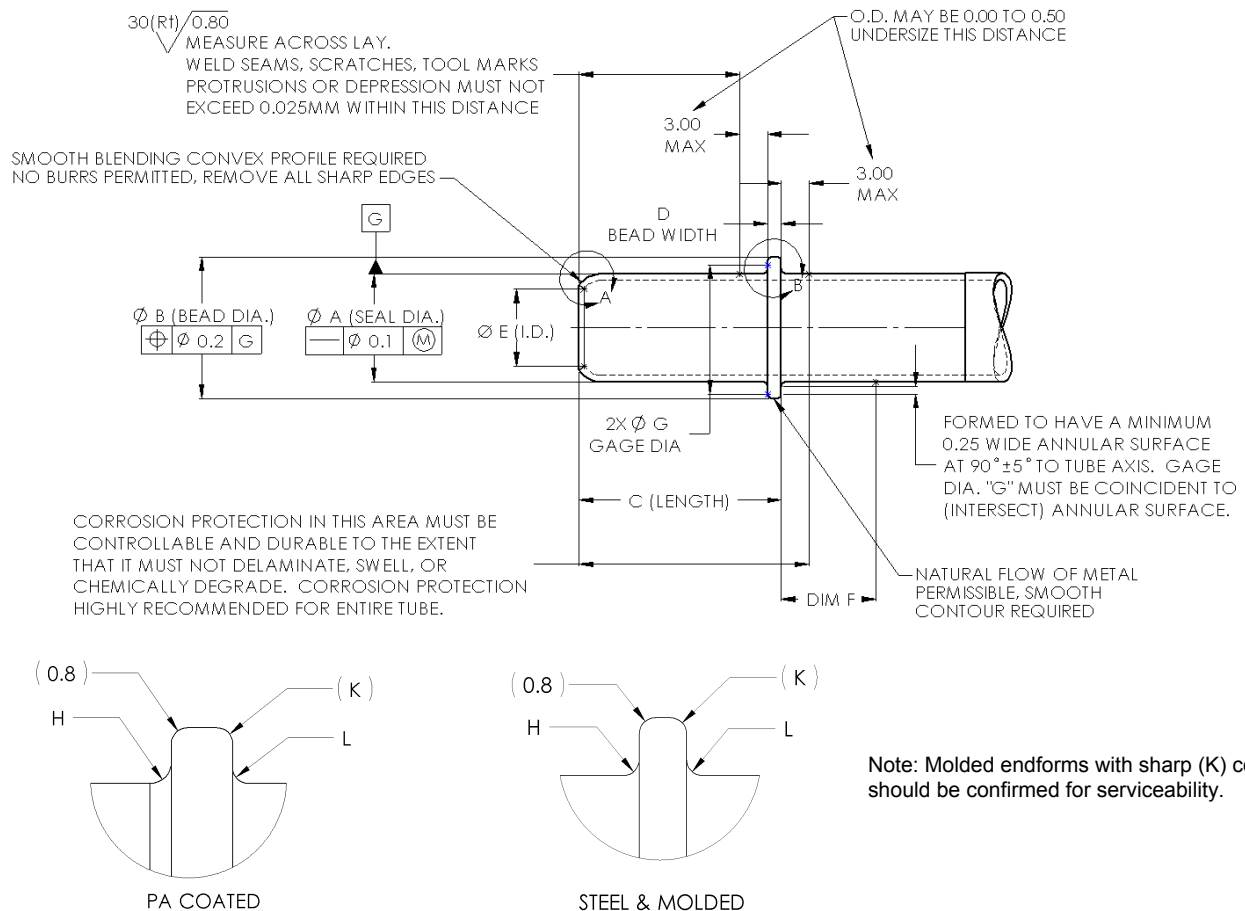
Maximum leak rate 2 scc/min (2.14 cc/min) at stabilization.

Stabilization can be determined by viewing a graphic output of actual leak rate. This will vary by connector size and leak test method. Permeation is not the same phenomenon as leaks. Permeation tests measure permeation rate.

TABLE 1 - STANDARD TUBE END-FORM DIMENSIONS

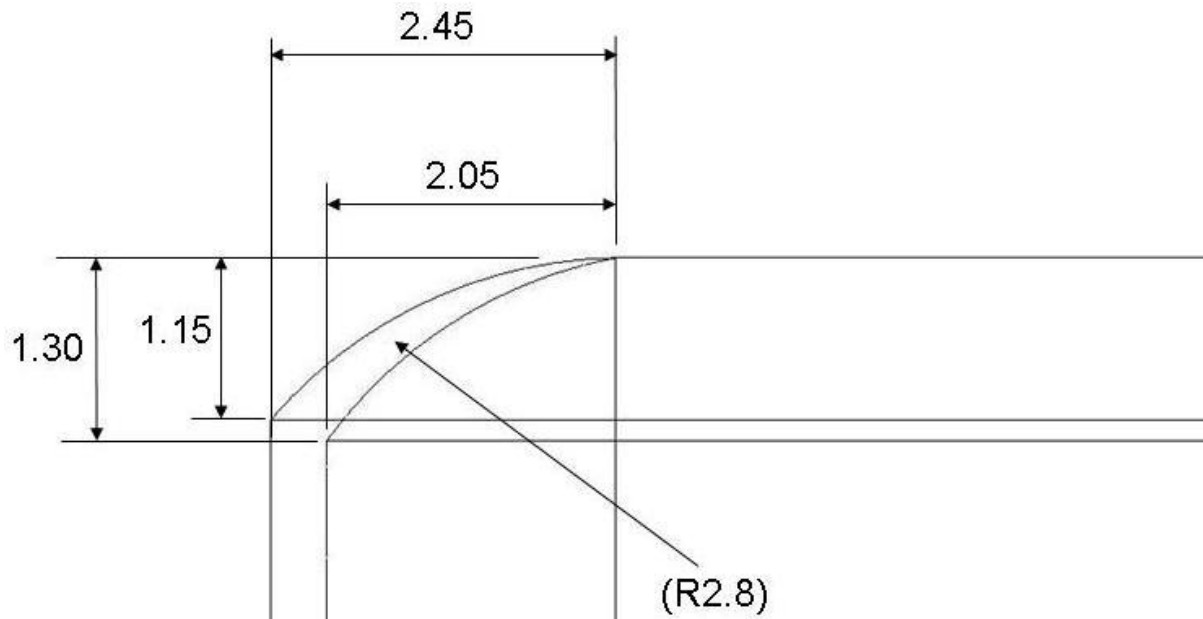
(NOMINAL) BASIC TUBE DIA.	A SEAL DIA.	B BEAD DIA.	C LENGTH	D BEAD WIDTH *-- See Note	E I.D.	F Clearance	G GAUGE DIA.	H TANGENT RADIUS	(K) BLEND RADIUS REFERENCE	L TANGENT RADIUS
3/16", 4.78 ±0.08	4.63 ±0.06	7.10 ±0.15	19.93 ±0.25	*1.57/1.93	2.20/2.70	6.9	6.08	0.5/1.0	0.5	0.3/0.5
1/4", 6.35 ±0.08	6.30 ±0.06	8.75 ±0.15	20.91 ±0.25	*1.57/1.93	3.60/4.10	9.5	7.75	0.5/1.0	0.6	0.4/0.8
5/16" 8mm, 7.94 ±0.08	7.89 ±0.06	10.98 ±0.15	21.12 ±0.25	*1.57/1.93	4.70/5.20	12.0	9.39	0.5/1.0	0.9	0.4/0.8
3/8", 9.53 ±0.08	9.49 ±0.06	12.94 ±0.21	21.12 ±0.25	*1.57/1.93	6.30/6.80	14.3	10.92	0.5/1.0	1.1	0.4/0.8
10mm ±0.08	9.89 ±0.06	13.42 ±0.21	24.74 ±0.25	** 2.34 / 2.74	6.60/7.10	15.0	11.34	0.5/1.0	1.2	0.4/0.8
7/16", 11.11 ±0.10	11.05 ±0.10	14.80 ±0.25	26.62 ±0.50	** 2.34 / 2.74	7.00/7.50	16.5	12.5	0.5/1.0	1.3	0.4/0.8
12mm ±0.10	11.80 ±0.10	16.51 ±0.25	26.62 ±0.50	** 2.34 / 2.74	7.50/8.00	18.0	13.25	0.5/1.0	1.6	0.4/0.8
1/2", 12.70 ±0.10	12.61 ±0.10	16.51 ±0.25	26.62 ±0.50	** 2.34 / 2.74	8.10/8.60	18.0	14.1	0.5/1.0	1.3	0.4/0.8
5/8", 15.88 ±0.10	15.82 ±0.10	19.18 ±0.25	26.62 ±0.50	** 2.34 / 2.74	11.10/11.90	24.0	17.27	0.5/1.0	1.1	0.4/0.8
3/4", 19.05 ±0.10	18.90 ±0.10	22.33 ±0.25	26.62 ±0.50	** 2.34 / 2.74	13.20/14.00	28.5	20.35	0.5/1.0	1.1	0.4/0.8
7/8", 22.23 ±0.15	22.70 ±0.15	25.7 ±0.5	29.50 ±0.50	** 2.34 / 2.74	16.00/16.80	33.0	24.15	0.5/1.0	1.2	0.4/0.8
1", 25.40 ±0.15	25.50 ±0.15	28.2 ±0.5	29.50 ±0.50	** 2.34 / 2.74	19.00/19.80	38.0	26.95	0.5/1.0	0.7	0.4/0.8
1 1/8", 28.58 ±0.15	28.42 ±0.15	32.3 ±0.5	42.50 ±0.50	** 2.34 / 2.74	22.70/23.70	43.0	29.87	0.5/1.0	1.3	0.4/0.8
PA Coated Endforms										
1/4", 6.35 ±0.08	6.30 ±0.06	8.75±0.15	21.31 ±0.25	*2.15 ±0.17	3.60/4.10	9.5	7.75	0.5/1.0	0.6	0.4/0.8
5/16" 8mm, 7.94 ±0.08	7.89 ±0.06	10.98±0.15	21.12 ±0.25	*2.15 ±0.17	4.70/5.20	12.0	9.39	0.5/1.0	1.1	0.4/0.8
3/8", 9.53 ±0.08	9.49 ±0.06	12.94±0.21	21.12 ±0.25	*2.15 ±0.17	6.30/6.80	14.3	10.92	0.5/1.0	0.9	0.4/0.8
10mm ±0.08	9.89 ±0.06	13.42±0.21	24.74 ±0.50	*2.15 ±0.17	6.60/7.10	15.0	11.34	0.5/1.0	1.2	0.4/0.8
12mm ±0.10	11.80 ±0.10	16.51±0.25	26.62 ±0.50	*2.15 ±0.17	7.50/8.00	18.0	13.25	0.5/1.0	1.7	0.4/0.8

NOTE: *Bead Width based on 0.028" (0.71 ± 0.08 mm) wall steel tubing for formed endforms. **Bead Width based on 0.042" (1.07 ± 0.102 mm) wall steel tubing. Formed metal tube bead width is dependant on tubing wall thickness. For formed metal tube wall thicknesses other than specified in Table 1; D= 2X wall +0.5/-0.0, bead width recommended. Nominal steel tube dimensions per SAE J526 and SAE J527. For material thicknesses other than specified in Table 1, see your Quick Connect supplier for compatibility. Molded plastic endform suitability with the various fitting types and applications, should be confirmed with the fitting manufacturer. See Appendix A for Bead Width measurement method.

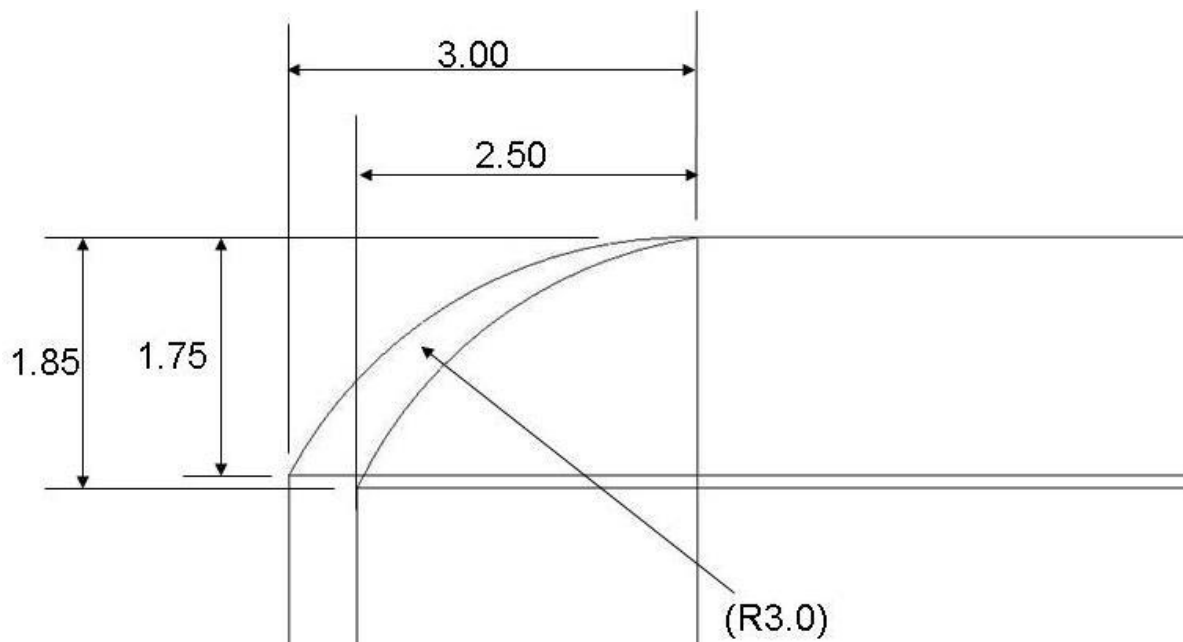


NOTE: Dimension "F" is the distance from the rear of the Bead (the retaining surface side) to the tangent of a bend or a surface that may not deviate from the nominal tube diameter. This dimension may vary by coupling manufacturer to provide sufficient clearance for latching mechanisms, release tools, redundant latches or any circumstances required by the customer.

FIGURE 2 - MATING TUBE END FORM



Tube sizes up to 10 mm (for overlay check)



Tube sizes greater than 10 mm (for overlay check)

FIGURE 2 - DETAIL A (CONTINUED)

NOTE: Nose shape must be smooth and allow insertion without seal damage. Also it must conform to the required minimum internal diameter in Table 1.