Designation: F 1054 – 01

Standard Specification for Conical Fittings[1]

This standard is issued under the fixed designation F 1054; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This specification specifies dimensions and gaging requirements for cones and sockets intended for connecting anesthetic and respiratory care equipment including, but not limited to, breathing systems (resuscitators, ventilators, and anesthesia gas machines), anesthetic gas scavenging systems, and vaporizers. This specification gives requirements for the following cones and sockets:

1.1.1 15- and 22-mm sizes intended for general use in breathing systems;

1.1.2 22-mm size latching connectors (including performance requirements) intended for general use in breathing systems;

1.1.3 23-mm size intended for use with vaporizers intended for use outside the breathing system; and

1.1.4 30-mm size intended for the connection of a breathing system to an anesthetic gas scavenging system.

1.2 It is expected that standards for particular medical devices will provide details on the application and implementation of these conical connectors.

2. Referenced Documents

2.1 *ASTM Standards:*

F 1205 Specification for Anesthesia Breathing Tubes[2]

2.2 *ISO Standards:*[3]

ISO R129 Engineering Drawings—Dimensioning

ISO 1302 Technical Drawings—Methods of Indicating Surface Texture on Drawings

ISO 3040: 1990, Technical Drawings—Dimensioning and Tolerancing—Cones

ISO 4135: 1995, Vocabulary

3. Terminology

3.1 *Definitions:*

3.1.1 *22-mm latching connector*—female connector for engagement with a male connector of 22-mm size complying with this specification, and that has a feature to reduce the possibility of accidental disconnection.

3.1.2 Additional terms used in this specification are defined in accordance with ISO 4135.

4. Conical Connectors Made of Metal

4.1 *General Requirements*—The dimensions of conical connectors made of metal including those made of composite materials in which the mating surfaces are metal, shall be as shown in Figs. 1-3 and Table 1.

NOTE 1—See Annex A5 for dimensions of plug and ring gages for the connectors.

4.2 *Additional Requirements for Conical Connectors of 22-mm Size*:

4.2.1 If a 22-mm male conical connector incorporates a circumferential groove or grooves, the total width of the groove or grooves at the surface shall not exceed 8 mm.

4.2.2 If a 22-mm male conical connector incorporates a recess, the recess shall be as shown in Fig. 2.

4.2.3 If a 22-mm male conical connector incorporates a shoulder, the shoulder or equivalent construction shall be as shown in Fig. 3.

5. Conical Connectors Made of Materials Other Than Metal

5.1 *General Requirements*—Conical connectors made of materials other than metal shall meet the following requirements when they are type tested with gages having dimensions as shown in Fig. A1.1 and Table A1.1.

5.1.1 Conical connectors made of materials other than metal shall meet the dimensional requirements in Fig. 1 and Table 1, with the exception that the Dimensions A and B and Ratio F may vary from those shown.

5.1.2 When the connector is engaged in the appropriate plug or ring test gage shown in Fig. A1.1 and Table A1.1, its leading edge shall lie between the minimum and maximum diameter steps of the gage when an axial force of 35 ± 3.5 N for 15-mm connectors, and 50 ± 5 N for 22- and 30-mm connectors, is applied and while maintaining the same axial force the

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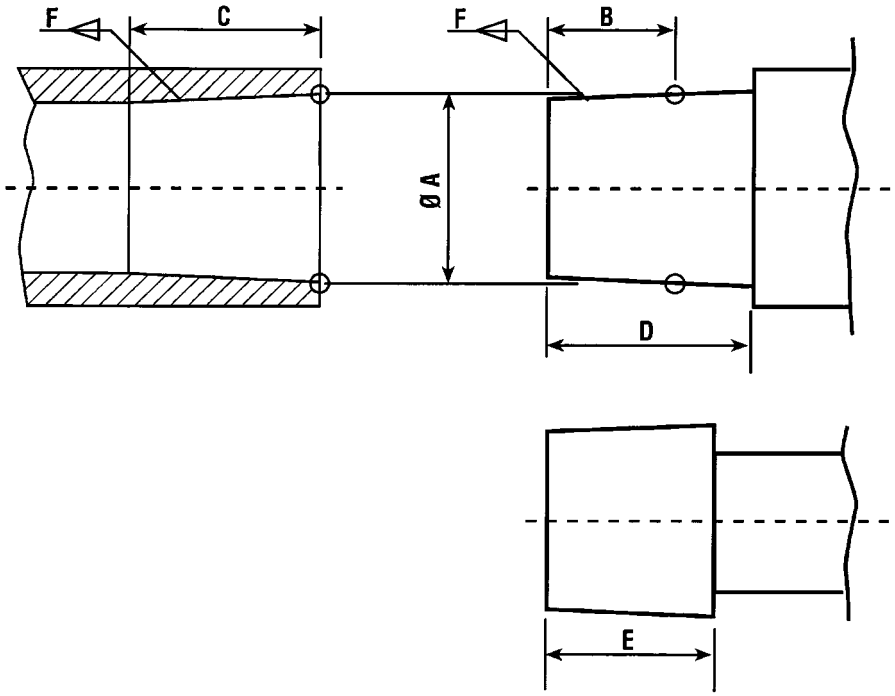
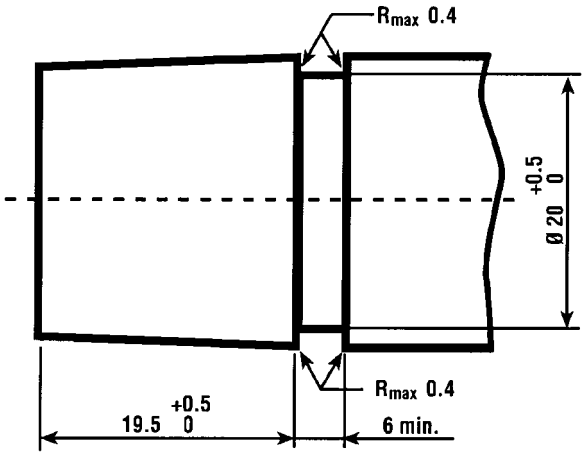
[2] *Annual Book of ASTM Standards*, Vol 13.01.

[3] Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036.



Ø = Diameter (per ISO R129).
∇ = Taper [per unit of length on diameter (ISO 3040)]. Note: Symbol is turned 90° to the left in diagram above.
Note: Maximum radius on the entrance to the female connector and on the leading edge of the male cone should be not less than 0.5 mm and not more than 0.8 mm.

FIG. 1 Conical Connectors Made of Metal (All dimensions in millimetres)



Note: Circumferential grooves may be incorporated on the surface of the male cone if required (see 4.2.1).

FIG. 2 Conical Connector of 22-mm Size Made of Metal—Supplementary Dimensions (All dimensions in millimetres)

connector is rotated up to 20°. The connectors and gages shall be maintained at a temperature of 20 ± 3°C during the test.

NOTE 2—Because connectors made from plastic materials, for example, polyamide, polyacetal, polycarbonate, polysulfone, and so forth, may vary greatly in their physical characteristics, it is not considered practicable to specify their dimensions; for this reason, gaging requirements have been included. It is also considered impracticable to generalize on matters, such as cold flow and thermal instability, as well as possible changes in physical characteristics with solvents, and so forth.

5.1.3 It is the responsibility of the manufacturer to make certain that adequate tests have been carried out to ensure that a suitable material is chosen for the connectors.

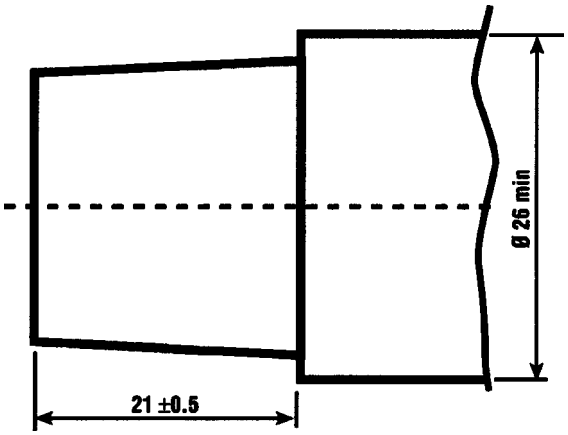
5.2 *Additional Requirements for Conical Connectors of 22-mm Size*—The requirements given in 4.2 apply.

6. 22-mm Latching Connectors

6.1 22-mm latching connectors shall not become disconnected when tested in accordance with Annex A2.

6.2 22-mm latching connectors shall have a leakage rate of less than 5 mL/min (corrected to 20°C and 101.3 kPa) when tested in accordance with Annex A3.

6.3 22-mm latching connectors shall meet the requirements specified in 6.1 and 6.2 after being subjected to the drop procedure described in Annex A4.



Note: Circumferential grooves may be incorporated on the surface of the male cone, if required (see 4.2.1).

FIG. 3 Connector Intended for Face Mask (with Shoulder) (All dimensions in millimetres)

TABLE 1 Conical Connectors Made of Metal—Dimensions (see Fig. 1)

Connector Size, mm	A Diameter, mm	B Gage Point, mm	C Length of Taper, mm	D Clearance to Shoulder (if Present), mm	E Length to Taper, mm	F Taper per Unit of Length on Diameter
15	15.47 ± 0.04	10	≥16	≥16	≥14.5	1:40
22	22.37 ± 0.04	15	≥21	see Fig. 2	see Fig. 2	1:40
23	23.175 ± 0.02	13	≥18	≥18	≥15	1:36
30	30.9 ± 0.05	14	≥18	≥18	≥14	1:20

6.4 22-mm latching connectors which are intended for reuse shall meet the requirements specified in 6.1-6.3 after being subjected to the cleaning, disinfection, or sterilization procedures recommended by the manufacturer.

7. Keywords

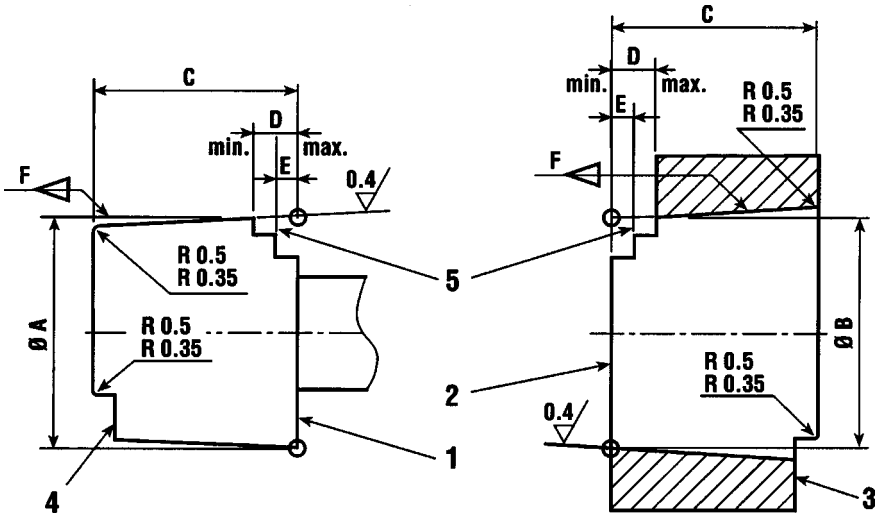
7.1 anesthetic equipment; cones; sockets

ANNEXES

(Mandatory Information)

A1. PLUG AND RING TEST GAGES FOR CONICAL CONNECTORS MADE OF MATERIALS OTHER THAN METAL

A1.1 *General*—Fig. A1.1 and Table A1.1 give details of plug and ring gages for use in checking conical connectors made of materials other than metals.



0.4 with symbol = surface roughness (per ISO 1302)—values in micrometres.
1. Face A.
2. Face B.
3. Step to check mating gages ground flush to Face A.
4. Step to check mating gages ground flush to Face B.
5. Basic steps.
Note: Basic and mating gage steps are optional.

FIG. A1.1 Plug and Ring Test Gages for Conical Connectors Made of Materials Other than Metal

TABLE A1.1 Plug and Ring Test Gages for Conical Connectors Made of Materials Other Than Metal—Dimensions (see Fig. 1)

Connector Size, mm	A, mm	B, mm	C, mm	D, mm	E, mm	F	Tolerance on Taper per Unit of Length on Diameter, mm
15	15.525 ± 0.005	15.165 ± 0.005	14.5 ± 0.005	4.3 ± 0.005	2.2 ± 0.005	1:40	0.025 ± 0.0002
22	22.425 ± 0.005	21.94 ± 0.005	19.5 ± 0.005	5.2 ± 0.005	2.2 ± 0.005	1:40	0.025 ± 0.0002
30	30.98 ± 0.005	30.12 ± 0.005	17.25 ± 0.005	3.1 ± 0.005	1.6 ± 0.005	1:20	0.050 ± 0.0002

A2. TEST FOR SECURITY OF ENGAGEMENT OF 22-MM LATCHING CONNECTOR TO MALE CONICAL CONNECTOR

A2.1 Condition a male 22-mm conical connector complying with Fig. 2 and the 22-mm latching connector for 1 h at a temperature of 35 ± 3°C and relative humidity of at least 80 %, and carry out the tests under the same conditions.

A2.2 Engage the 22-mm latching connector with the male connector in accordance with the manufacturer's instructions.

A2.3 After 1 min of engagement without activation of any disengagement mechanism, apply an axial separation force of 50 ± 5 N for 10 s. Unless the 22-min latching connector permits free radial rotation, also apply a torque of 25 ± 5 N cm at a rate not exceeding 20 N/s.

A2.4 Observe whether the assembled connectors become disengaged.

NOTE A2.1—Examples of suitable apparatus that can be used to test security of engagement, together with a more detailed test procedure are given in Annex A6.

A3. TEST FOR LEAKAGE FROM 22-MM LATCHING CONNECTORS

A3.1 Take the engaged male connector and 22-mm latching connector that have been tested as described in Annex A2 and condition them at 35 ± 3°C.

A3.2 Using air, apply an internal static pressure of 8 ± 0.5 kPa above ambient to the assembly and determine the leakage rate from the assembly, for example, by pressure drop or volumetric methods.

A4. DROP PROCEDURE FOR 22-MM LATCHING CONNECTORS

A4.1 Condition a male conical connector complying with Fig. 2 and the 22-mm latching connector for 1 h at a temperature of 20 ± 3°C and relative humidity of at least 80 % and carry out the tests under the same conditions.

A4.2 Engage the 22-mm latching connector with the male conical connector in accordance with the manufacturer's instructions. Attach the male conical connector to a breathing tube complying with Specification F 1205 and having a length of 2 m.

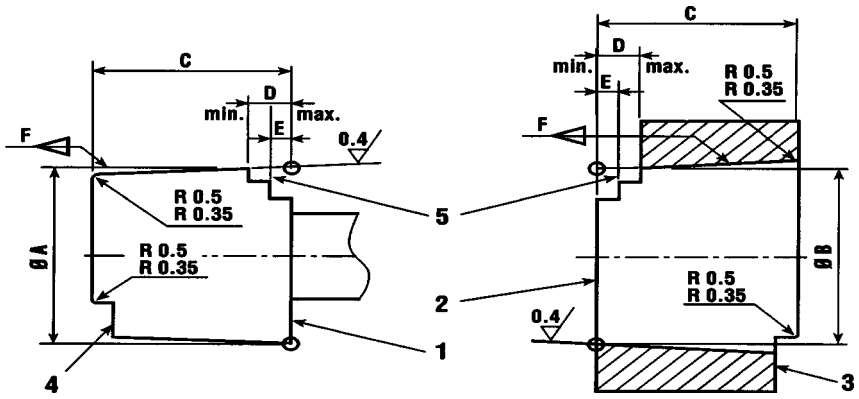
A4.3 Attach the opposite end of the breathing tube to a point 1-m above a 50-mm thick hardwood board, for example, hardwood having a density greater than 700 kg/m^3, standing on a rigid base, for example, a concrete block.

A4.4 Raise the engaged connectors to a point 1 m above the board and 2 m distant from the other end of the breathing tube and release them so that they fall onto the hardwood board. Repeat this five times.

A4.5 Proceed with the desired test.

A5. PLUG AND RING GAGES FOR CONICAL CONNECTORS MADE OF METAL

A5.1 *General*—Fig. A5.1 and Table A5.1 give details of plug and ring test gages that may be used to check metal conical connectors.



0.4 with symbol = surface roughness (per ISO 1302)—values in micrometres.
1. Face A.
2. Face B.
3. Step to check mating gages ground flush to Face A.
4. Step to check mating gages ground flush to Face B.
5. Basic steps.

Note: Basic and mating gage steps are optional.

FIG. A5.1 Plug and Ring Test Gages for Conical Connectors Made of Metal (All dimensions in millimetres)

TABLE A5.1 Plug and Ring Test Gages for Conical Connectors Made of Metal—Dimensions (see Fig. 1)

Connector Size, mm	A, mm	B, mm	C, mm	D, mm	E, mm	F	Tolerance on Taper per Unit of Length on Diameter, mm
15	15.51 ± 0.005	15.18 ± 0.005	14.5 ± 0.005	3 ± 0.005	1.6 ± 0.005	1:40	0.025 ± 0.0002
22	22.41 ± 0.005	21.955 ± 0.005	19.5 ± 0.005	3 ± 0.005	1.6 ± 0.005	1:40	0.025 ± 0.0002
23	23.195 ± 0.003	22.794 ± 0.003	16 ± 0.005	1.33 ± 0.005	0.72 ± 0.005	1:36	0.0278 ± 0.0002
30	30.95 ± 0.005	30.15 ± 0.005	17 ± 0.005	1.9 ± 0.005	1 ± 0.005	1:20	0.050 ± 0.0002

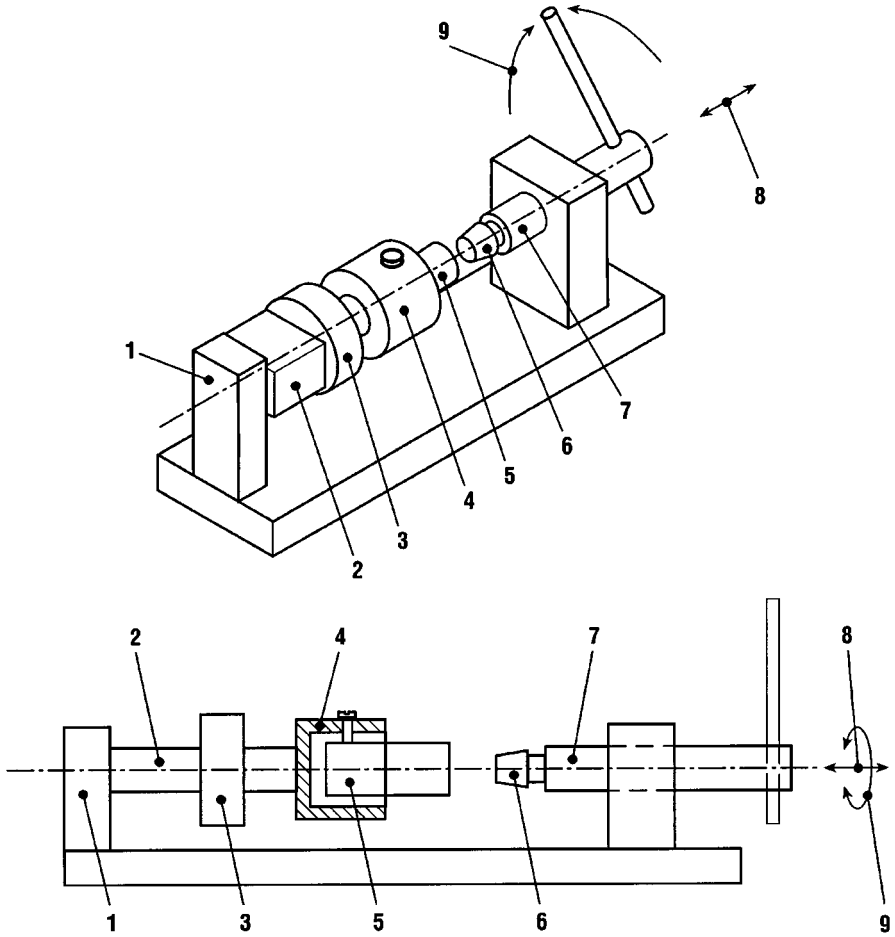
A6. EXAMPLES OF APPARATUS AND METHODS FOR TESTING THE SECURITY OF ENGAGEMENT OF 22-MM LATCHING CONNECTORS

A6.1 *Method 1—Bench-Mounted Test Equipment*:

A6.1.1 *Apparatus*:

A6.1.1.1 A typical bench-mounted apparatus for testing the security of engagement of 22-mm latching connectors is shown in Fig. A6.1. The male test piece should be a 22-mm male conical connector dimensioned as shown in Fig. 2 but with all of the tolerances reduced to ±0.0005 mm and a surface finish of 0.4 µm.

NOTE A6.1—There are a number of methods for applying the test forces, and Fig. A6.1 is illustrative of only one approach. Other methods



0.4 with symbol = surface roughness (per ISO 1302)—values in micrometres.
1. Rigid support.
2. Axial load meter.
3. Torque meter.
4. Holder.
5. 22-mm latching connector under test.
6. 22-mm male test piece.
7. Free to slide and rotate.
8. Application of adjustable axial force.
9. Application of adjustable torque.

FIG. A6.1 Example of Apparatus for Testing the Security of Engagement of 22-mm Latching Connectors (Method 1—Bench-Mounted)

include the use of gravity loading by weights and liquid containers.

A6.1.1.2 The apparatus should ensure that the tensile force can be applied in a truly axial direction and that the torque can be applied without changing the tensile force. To minimize the effects of friction, the tensile force should be measured directly between the 22-mm latching connector and the male test piece.

A6.1.2 *Procedure*:

A6.1.2.1 Secure the 22-mm latching connector to be tested in the self-centering holder of apparatus (see A6.1.1) ensuring that the method of securing the 22-mm latching connector does not deform the section(s) that are intended to engage with the male test piece.

A6.1.2.2 Condition the 22-mm latching connector and the apparatus at a temperature of 35 ± 3°C and a relative humidity of at least 80 % for 1 h.

NOTE A6.2—If a number of 22-mm latching connectors are to be tested, some may be conditioned at the required temperature and relative humidity without being secured to the apparatus, provided that they are conditioned again for at least 5 min after being secured to the apparatus.

A6.1.2.3 Engage the 22-mm latching connector with the male test piece in accordance with the manufacturer's instructions.

A6.1.2.4 After 1 min, attach the force measuring device and apply an axial separation force at a rate not exceeding 20 N/s, until a force of 50 ± 5 N is reached. Maintain this force for 10 s without activating any disengagement mechanism, and observe whether the engaged 22-mm latching connector and male test piece become disconnected.

A6.1.2.5 Without reducing the tensile load and without activation of any disengagement mechanism, apply a torque of 25 ± 5 N cm or rotate the male test piece through an angle of 20°, whichever occurs first. Maintain this torque or position for 10 s and observe whether the engaged 22-mm latching connector and male test piece become disconnected.

A6.2 *Method 2—Hand-Held Test Equipment*:

A6.2.1 *Apparatus*—A typical hand-held apparatus for testing the security of engagement of 22-mm latching connectors is shown in Fig. A6.2.

A6.2.2 *Procedure*:

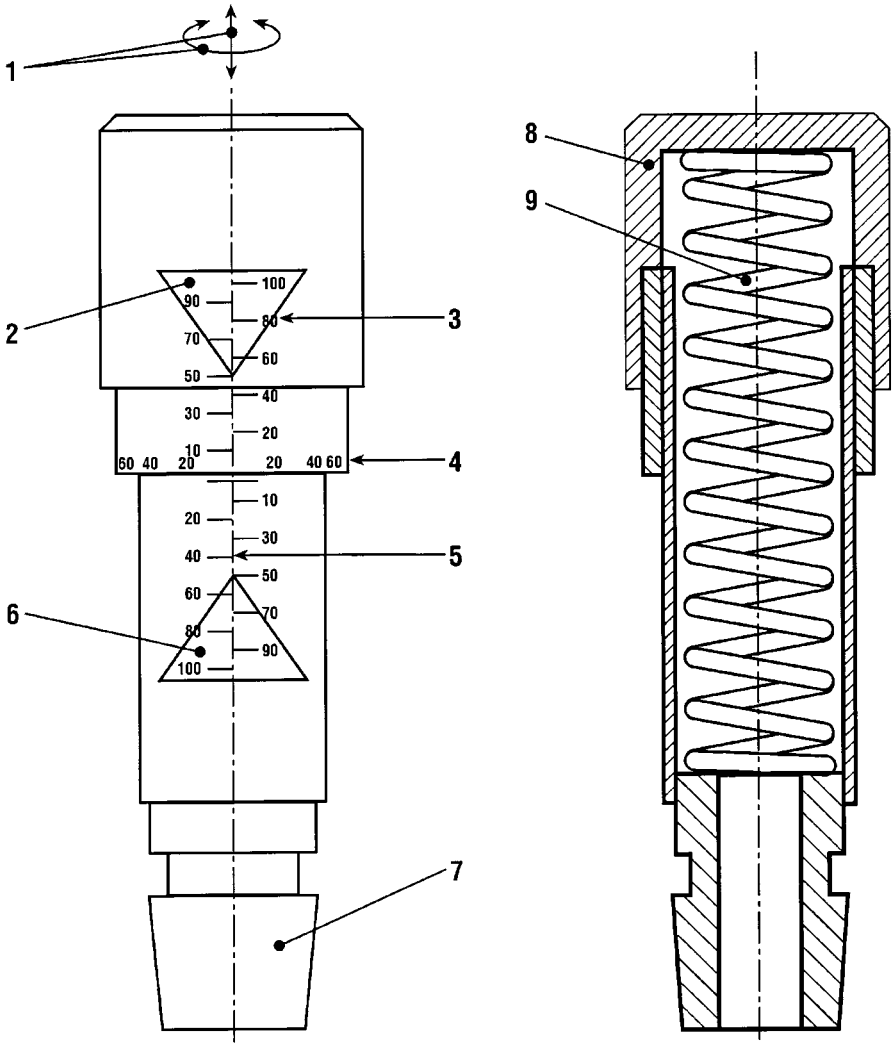
A6.2.2.1 Condition the 22-mm latching connector and the apparatus at a temperature of 35 ± 3°C and a relative humidity of at least 80 % for 1 h.

A6.2.2.2 Engage the 22-mm latching connector with the male test piece on the apparatus in accordance with the manufacturer's instructions.

A6.2.2.3 After 1 min, manually apply an axial separation force at a rate not exceeding 20 N/s, until a force of 50 ± 5 N is reached. Maintain this force for 10 s without activation of any disengagement mechanism, and observe whether the engaged 22-mm latching connector and male test piece become disconnected.

A6.2.2.4 Without reducing the tensile load and without activation of any disengagement mechanism, apply a torque of 25 ± 5 N cm or rotate the male test piece through an angle of 20°, whichever occurs first. Maintain this torque or position for 10 s and observe whether the engaged 22-mm latching connector and male test piece become disconnected.

A6.2.2.5 Repeat the procedure described in A6.2.2.4 with the torque applied in the opposite direction.



1. Application of torque or push or pull by hand.
2. Area of scale indicating acceptable pull and twist forces.
3. Pull-force scale.
4. Torque scale.
5. Push-force scale.
6. Area of scale indicating acceptable push and twist forces.
7. 22-mm male test piece.
8. Knob.
9. Coil spring fixed at both ends.

FIG. A6.2 Example of Apparatus for Testing the Security of Engagement of 22-mm Latching Connectors (Method 2—Hand-Held)