

§ 572.174 Thorax assembly and test procedure.

(a) The thorax consists of the part of the torso assembly designated as the upper torso (drawing 420-3000) (incorporated by reference, see § 572.170).

(b) When the anterior surface of the thorax of a completely assembled dummy (drawing 420-0000) (incorporated by reference, see § 572.170) is impacted by a test probe conforming to section 572.177 at 6.00 ± 0.12 m/s (22.0 ± 0.4 ft/s) according to the test procedure in paragraph (c) of this section:

(1) Maximum sternum displacement (compression) relative to the spine, measured with chest deflection transducer (drawing SA572-T4, included in drawing 420-0000) (incorporated by reference, see § 572.170), must be not less than 37 mm (1.46 in) and not more than 46 mm (1.81 in). Within this specified compression corridor, the peak force, measured by the impact probe as defined in section 572.177 and calculated in accordance with paragraph (b)(3) of this section, shall not be less than 2.0 kN (450 lbf) and not more than 2.45 kN (551 lbf). The peak force after 20 mm (0.79 in.) of sternum displacement but before reaching the minimum required 37 mm (1.46 in.) sternum displacement limit shall not exceed 2.52 kN (567 lbf).

(2) The internal hysteresis of the ribcage in each impact as determined by the plot of force vs. deflection in paragraph (a)(1) of this section shall be not less than 69 percent but not more than 85 percent. The hysteresis shall be calculated by determining the ratio of the area between the loading (from time zero to maximum deflection) and unloading portions (from maximum deflection to zero force) of the force deflection curve to the area under the loading portion of the curve.

(3) The force shall be calculated by the product of the impactor mass and its measured deceleration.

(c) *Test Procedure.* The test procedure for the thorax assembly is as follows:

(1) The dummy is clothed in a form fitting cotton stretch above-the-elbow sleeved shirt and above-the-knees pants. The weight of the shirt and pants shall not exceed 0.14 kg (0.30 lb) each.

(2) Torque the lumbar cable (drawing 420-4130) (incorporated by reference, see

§ 572.170) to 0.9 ± 0.2 N-m (8 ± 2 in-lbf) and set the lumbar adjustment angle to 12 degrees. Set the neck angle to 16 degrees.

(3) Soak the dummy in a controlled environment at any temperature between 20.6 and 22.2 °C (69 and 72 °F) and a relative humidity between 10 and 70 percent for at least four hours prior to a test.

(4) Seat and orient the dummy on a seating surface without back support as shown in Figure T4, with the limbs extended horizontally and forward, parallel to the midsagittal plane, the midsagittal plane vertical within ± 1 degree and the ribs level in the anterior-posterior and lateral directions within ± 0.5 degrees.

(5) Establish the impact point at the chest midsagittal plane so that the impact point of the longitudinal centerline of the probe coincides with the midsagittal plane of the dummy within ± 2.5 mm (0.1 in) and is 12.7 ± 1.1 mm (0.5 ± 0.04 in) below the horizontal-peripheral centerline of the No. 3 rib and is within 0.5 degrees of a horizontal line in the dummy's midsagittal plane.

(6) Impact the thorax with the test probe so that at the moment of contact the probe's longitudinal centerline falls within 2 degrees of a horizontal line in the dummy's midsagittal plane.

(7) Guide the test probe during impact so that there is no significant lateral, vertical, or rotational movement.

(8) No suspension hardware, suspension cables, or any other attachments to the probe, including the velocity vane, shall make contact with the dummy during the test.

§ 572.175 Upper and lower torso assemblies and torso flexion test procedure.

(a) The test objective is to determine the stiffness of the molded lumbar assembly (drawing 420-4100), abdominal insert (drawing 420-4300), and chest flesh assembly (drawing 420-3560) on resistance to articulation between the upper torso assembly (drawing 420-3000) and lower torso assembly (drawing 420-4000) (all incorporated by reference, see § 572.170).

(b) When the upper torso assembly of a seated dummy is subjected to a force continuously applied at the head to

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neck pivot pin level through a rigidly attached adaptor bracket as shown in Figure T5 according to the test procedure set out in paragraph (c) of this section:

(1) The lumbar spine-abdomen-chest flesh assembly shall flex by an amount that permits the upper torso assembly to translate in angular motion relative to the vertical transverse plane 35 ± 0.5 degrees at which time the force applied must be not less than 180 N (40.5 lbf) and not more than 250 N (56.2 lbf).

(2) Upon removal of the force, the torso assembly must return to within 8 degrees of its initial position.

(c) *Test Procedure.* The test procedure for the upper/lower torso assembly is as follows:

(1) Torque the lumbar cable (drawing 420-4130) (incorporated by reference, see §572.170) to 0.9 ± 0.2 N-m (8 ± 2 in-lbf) and set the lumbar adjustment angle to 12 degrees. Set the neck angle to 16 degrees.

(2) Soak the dummy in a controlled environment at any temperature between 20.6 and 22.2 °C (69 and 72 °F) and a relative humidity between 10 and 70 percent for at least four hours prior to a test.

(3) Assemble the complete dummy (with or without the legs below the femurs) and attach to the fixture in a seated posture as shown in Figure T5.

(4) Secure the pelvis to the fixture at the pelvis instrument cavity rear face by threading four ¼-inch cap screws into the available threaded attachment holes. Tighten the mountings so that the test material is rigidly affixed to the test fixture and the pelvic-lumbar joining surface is 18 degrees from horizontal and the legs are parallel with the test fixture.

(5) Attach the loading adaptor bracket to the spine of the dummy as shown in Figure T5.

(6) Inspect and adjust, if necessary, the seating of the abdominal insert within the pelvis cavity and with respect to the chest flesh, assuring that the chest flesh provides uniform fit and overlap with respect to the outside surface of the pelvis flesh.

(7) Flex the dummy's upper torso three times between the vertical and until the torso reference frame, as shown in Figure T5, reaches 30 degrees

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from the vertical transverse plane. Bring the torso to vertical orientation and wait for 30 minutes before conducting the test. During the 30-minute waiting period, the dummy's upper torso shall be externally supported at or near its vertical orientation to prevent it from drooping.

(8) Remove all external support and wait two minutes. Measure the initial orientation angle of the torso reference plane of the seated, unsupported dummy as shown in Figure T5. The initial orientation angle may not exceed 20 degrees.

(9) Attach the pull cable and the load cell as shown in Figure T5.

(10) Apply a tension force in the midsagittal plane to the pull cable as shown in Figure T5 at any upper torso deflection rate between 0.5 and 1.5 degrees per second, until the angle reference plane is at 35 ± 0.5 degrees of flexion relative to the vertical transverse plane.

(11) Continue to apply a force sufficient to maintain 35 ± 0.5 degrees of flexion for 10 seconds, and record the highest applied force during the 10-second period.

(12) Release all force at the attachment bracket as rapidly as possible, and measure the return angle with respect to the initial angle reference plane as defined in paragraph (c)(7) of this section three minutes after the release.

§572.176 Knees and knee impact test procedure.

(a) The knee assembly for the purpose of this test is the part of the leg assembly shown in drawing 420-5000 (incorporated by reference, see §572.170).

(b) When the knee assembly, consisting of lower upper leg assembly (420-5200), femur load transducer (SA572-S10, included in drawing 420-0000) or its structural replacement (420-5121), lower leg assembly (420-5300), ankle assembly (420-5400), and foot molded assembly (420-5500) (all incorporated by reference, see §572.170) is tested according to the test procedure in subsection (c) of this section:

(1) The peak resistance force as measured with the test probe-mounted accelerometer must not be less than 2.6