accelerometer as defined in § 572.146(a) and calculated in accordance with paragraph (b)(3) of this section, shall be not less than 680 N and not more than 810 N. The peak force after 12.5 mm of sternum compression but before reaching the minimum required 32.0 mm sternum compression shall not exceed 910 N.

(2) The internal hysteresis of the ribcage in each impact, as determined from the force vs. deflection curve, shall be not less than 65 percent and not more than 85 percent. The hysteresis shall be calculated by determining the ratio of the area between the loading and unloading portions 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 deceleration.

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

(1) The test dummy is clothed in cotton-polyester-based tight-fitting shirt with long sleeves and ankle-length pants whose combined weight is not more than 0.25 kg (0.55 lbs).

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

(3) Seat and orient the dummy on a seating surface without back support as shown in Figure P4, with the lower limbs extended horizontally and forward, the upper arms parallel to the torso and the lower arms extended horizontally and forward, parallel to the midsagittal plane, the midsagittal plane being vertical within ±1 degree and the ribs level in the anterior-posterior and lateral directions within ±0.5 degrees.

(4) Establish the impact point at the chest midsagittal plane so that the impact point of the longitudinal centerline of the probe coincides with the dummy's mid-sagittal plane and is centered on the center of No. 2 rib within ±2.5 mm (0.1 in.) and 0.5 degrees of a horizontal plane.

(5) Impact the thorax with the test probe so that at the moment of contact the probe's longitudinal center line is

within 2 degrees of a horizontal line in the dummy's midsagittal plane.

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

(7) 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.

[65 FR 15262, Mar. 22, 2000, as amended at 66 FR 64376, Dec. 13, 2001]

§ 572.145 **Upper and lower torso assemblies and torso flexion test procedure.**

(a) The test objective is to determine the resistance of the lumbar spine and abdomen of a fully assembled dummy (drawing 210–0000) to flexion articulation between upper and lower halves of the torso assembly (refer to § 572.140(a)(1)(iv)).

(b)(1) When the upper half of the torso assembly of a seated dummy is subjected to a force continuously applied at the occipital condyle level through the rigidly attached adaptor bracket in accordance with the test procedure set out in paragraph (c) of this section, the lumbar spine-abdomen assembly shall flex by an amount that permits the upper half of the torso, as measured at the posterior surface of the torso reference plane shown in Figure P5 of this subpart, to translate in angular motion in the midsagittal plane 45 ±0.5 degrees relative to the vertical transverse plane, at which time the pulling force applied must not be less than 130 N (28.8 lbf) and not more than 180 N (41.2 lbf), and

(2) Upon removal of the force, the upper torso assembly returns to within 10 degrees of its initial position.

(c) *Test procedure.* The test procedure is as follows:

(1) Soak the dummy in a controlled environment at any temperature between 18.9° and 25.6 °C (66 and 78 °F) and at any relative humidity between 10 and 70 percent for at least 4 hours prior to a test.

(2) Assemble the complete dummy (with or without the lower legs) and seat it on a rigid flat-surface table, as shown in Figure P5 of this subpart.

(i) Unzip the torso jacket and remove the four ¼–20×¾″ bolts which attach

the lumbar load transducer or its structural replacement to the pelvis weldment (drawing 210–4510) as shown in Figure P5 of this subpart.

(ii) Position the matching end of the rigid pelvis attachment fixture around the lumbar spine and align it over the four bolt holes.

(iii) Secure the fixture to the dummy with the four ¼–20×¾″ bolts and attach the fixture to the table. Tighten the mountings so that the pelvis-lumbar joining surface is horizontal within ±1 deg and the buttocks and upper legs of the seated dummy are in contact with the test surface.

(iv) Attach the loading adapter bracket to the upper part of the torso as shown in Figure P5 of this subpart and zip up the torso jacket.

(v) Point the upper arms vertically downward and the lower arms forward.

(3)(i) Flex the thorax forward three times from vertical until the torso reference plane reaches 30 ±2 degrees from vertical. The torso reference plane, as shown in figure P5 of this subpart, is defined by the transverse plane tangent to the posterior surface of the upper backplate of the spine box weldment (drawing 210–8020).

(ii) Remove all externally applied flexion forces and support the upper torso half in a vertical orientation for 30 minutes to prevent it from drooping.

(4) Remove the external support and after two minutes measure the initial orientation angle of the upper torso reference plane of the seated, unsupported dummy as shown in Figure P5 of this subpart. The initial orientation of the torso reference plane may not exceed 15 degrees.

(5) Attach the pull cable at the point of load application on the adaptor bracket while maintaining the initial torso orientation. Apply a pulling force in the midsagittal plane, as shown in Figure P5 of this subpart, at any upper torso flexion rate between 0.5 and 1.5 degrees per second, until the torso reference plane reaches 45 ±0.5 degrees of flexion relative to the vertical transverse plane.

(6) Continue to apply a force sufficient to maintain 45 ±0.5 degrees of flexion for 10 seconds, and record the highest applied force during the 10-second period.

(7) [Reserved]

(8) Release all force at the loading adaptor bracket as rapidly as possible and measure the return angle with respect to the initial angle reference plane as defined in paragraph (c)(4) of this section 3 to 4 minutes after the release.

§ 572.146 Test conditions and instrumentation.

(a) The test probe for thoracic impacts, except for attachments, shall be of rigid metallic construction and concentric about its longitudinal axis. Any attachments to the impactor such as suspension hardware, and impact vanes, must meet the requirements of § 572.144(c)(7) of this part. The impactor shall have a mass of 1.70 ±0.02 kg (3.75 ±0.05 lb) and a minimum mass moment of inertia 164 kg-cm^2 (0.145 lb-in-sec^2) in yaw and pitch about the CG of the probe. One-third (⅓) of the weight of suspension cables and any attachments to the impact probe must be included in the calculation of mass, and such components may not exceed five percent of the total weight of the test probe. The impacting end of the probe, perpendicular to and concentric with the longitudinal axis of the probe, has a flat, continuous, and non-deformable 50.8 ±0.25 mm (2.00 ±0.01 inch) diameter face with an edge radius of 7.6/12.7 mm (0.3/0.5 in). The impactor shall have a 53.3 mm (2.1 in) dia. cylindrical surface extending for a minimum of 25.4 mm (1.0 in) to the rear from the impact face. The probe's end opposite to the impact face has provisions for mounting an accelerometer with its sensitive axis collinear with the longitudinal axis of the probe. The impact probe has a free air resonant frequency not less than 1000 Hz limited to the direction of the longitudinal axis of the impactor.

(b) Head accelerometers shall have the dimensions, response characteristics, and sensitive mass locations specified in drawing SA 572–S4 and be mounted in the head as shown in drawing 210–0000.

(c) The neck force-moment transducer shall have the dimensions, response characteristics, and sensitive axis locations specified in drawing SA 572–S19 and be mounted at the upper neck transducer location as shown in