Nat’l Highway Traffic Safety Admin., DOT

§ 572.137 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, impact vanes, etc., must meet the requirements of §572.134(c)(7). The impactor shall have a mass of 13.97 ±0.23 kg (30.8 ±0.5 lbs) and a minimum mass moment of inertia of 3646 kg-cm² (3.22 lbs-in-sec²) in yaw and pitch about the CG of the probe. One-third (1/3) 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 152.4 ±0.25 mm (6.00 ±0.01 in) diameter face with a minimum/maximum edge radius of 7.6/12.7 mm (0.3/0.5 in). The impactor shall have a 152.4–152.6 mm (6.0–6.1 in) diameter cylindrical surface extending for a minimum of 25 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 of not less than 1000 Hz, which may be determined using the procedure listed in Docket No. NHTSA–6714–14.

(b) The test probe for knee 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, impact vanes, etc., must meet the requirements of §572.136(c)(6). The impactor shall have a mass of 2.99±0.23 kg (6.6±0.5 lbs) and a minimum mass moment of inertia of 209 kg-cm² (0.177 lb-in-sec²) in yaw and pitch about the CG of the probe. One-third (1/3) of the weight of suspension cables and any attachments to the impact probe may 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 76.2 ±0.2 mm (3.00 ±0.01 in) diameter face with a minimum/maximum edge radius of 7.6/12.7 mm (0.3/0.5 in). The impactor shall have a 76.2–76.4 mm (3.0–3.1 in) diameter cylindrical surface extending for a minimum of 12.5 mm (0.5 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 of not less than 1000 Hz, which may be determined using the procedure listed in Docket No. NHTSA–6714–14.

(c) Head accelerometers shall have dimensions, response characteristics, and sensitive mass locations specified in drawing SA572–S4 and be mounted in the head as shown in drawing 880105–000 sheet 3 of 6.

(d) The upper neck force/moment transducer shall have the dimensions, response characteristics, and sensitive axis locations specified in drawing SA572–S11 and be mounted in the head neck assembly as shown in drawing 880105–000, sheet 3 of 6.

(e) The thorax accelerometers shall have the dimensions, response characteristics, and sensitive mass locations specified in drawing SA572–S4 and be
mounted in the torso assembly in triaxial configuration within the spine box instrumentation cavity and as optional instrumentation in uniaxial for-and-aft oriented configuration arranged as corresponding pairs in three locations on the sternum on and at the spine box of the upper torso assembly as shown in drawing 880105–000 sheet 3 of 6.

(f) The optional lumbar spine force-moment transducer shall have the dimensions, response characteristics, and sensitive axis locations specified in drawing SA572–S15 and be mounted in the lower torso assembly as shown in drawing 880105–450.

(g) The optional iliac spine force transducers shall have the dimensions and response characteristics specified in drawing SA572–S16 and be mounted in the torso assembly as shown in drawing 880105–450.

(h) The pelvis accelerometers shall have the dimensions, response characteristics, and sensitive mass locations specified in drawing SA572–S4 and be mounted in the torso assembly in triaxial configuration in the pelvis bone as shown in drawing 880105–000 sheet 3.

(i) The single axis femur force transducer (SA572–S14) or the optional multiple axis femur force/moment transducer (SA572–S29) shall have the dimensions, response characteristics, and sensitive axis locations specified in the appropriate drawing and be mounted in the femur assembly as shown in drawing 880105–500 sheet 3 of 6.

(j) The chest deflection transducer shall have the dimensions and response characteristics specified in drawing SA572–S51 and be mounted to the upper torso assembly as shown in drawings 880105–300 and 880105–000 sheet 3 of 6.

(k) The optional lower neck force/moment transducer shall have the dimensions, response characteristics, and sensitive axis locations specified in drawing SA572–S27 and be mounted to the upper torso assembly as shown in drawing 880105–000 sheet 3 of 6.

(l) The optional thoracic spine force/moment transducer shall have the dimensions, response characteristics, and sensitive axis locations specified in drawing SA572–S28 and be mounted in the upper torso assembly as shown in drawing 880105–000 sheet 3 of 6.

(m) The outputs of acceleration and force-sensing devices installed in the dummy and in the test apparatus specified by this part shall be recorded in individual data channels that conform to SAE Recommended Practice J211/10, Rev. Mar95 “Instrumentation for Impact Tests—Part 1—Electronic Instrumentation,” and SAE Recommended Practice J211/2, Rev Mar95 “Instrumentation for Impact Tests—Part 2—Photographic Instrumentation”, (refer to §§ 572.130(a)(3) and (4) respectively) except as noted, with channel classes as follows:

1. Head acceleration—Class 1000
2. Neck:
   1. Forces—Class 1000
   2. Moments—Class 600
   3. Pendulum acceleration—Class 100
3. Rotation potentiometer—Class 60 (optional)
4. Thorax:
   1. Rib acceleration—Class 1000
   2. Spine and pendulum accelerations—Class 180
   3. Sternum deflection—Class 600
   4. Forces—Class 1000
   5. Moments—Class 600
5. Lumbar:
   1. Forces—Class 1000
   2. Moments—Class 600
   3. Torso flexion pulling force—Class 60 if data channel is used
6. Pelvis:
   1. Accelerations—Class 1000
   2. Iliac wing forces—Class 180
   3. Femur forces and knee pendulum—Class 600

(o) The mountings for sensing devices shall have no resonance frequency less than 3 times the frequency range of the applicable channel class.

(p) Limb joints must be set at one G, barely restraining the weight of the limb when it is extended horizontally. The force needed to move a limb segment shall not exceed 2G throughout the range of limb motion.

(q) Performance tests of the same component, segment, assembly, or
fully assembled dummy shall be separated in time by not less than 30 minutes unless otherwise noted.

(r) Surfaces of dummy components may not be painted except as specified in this subpart or in drawings subtended by this subpart.

(65 FR 6392, Mar. 1, 2000, as amended at 67 FR 46415, July 15, 2002; 74 FR 29894, June 23, 2009)
FIGURE 01
NECK FLEXION TEST SETUP SPECIFICATIONS

PENDULUM CENTERLINE

PENDULUM (REF. FIG. 22 CFR 49 §572.33)

ACCELEROMETER

PENDULUM STRIKER PLATE

DIRECTION OF PENDULUM FLIGHT

3.2 ±0.5 mm
(0.125 ± 0.02 in)

BRACKET - NECK ADJUSTING - UPPER (P/N 880105-207)

BIB SIMULATOR (P/N 880105-210)

NECK ASSY (P/N 880105-250)

BRACKET - NECK ADJUSTING - LOWER (P/N 880105-208)

MOUNTING SCREW CENTERLINE

6-AXIS UPPER NECK LOAD CELL (SA572-S11)

D-PLANE * PERPENDICULAR TO PENDULUM CENTERLINE ±1°

OCCIPITAL CONDYLES

* D-PLANE IS DEFINED AS AN IMAGINARY PLANE PERPENDICULAR TO THE SKULL CAP/SKULL INTERFACE.

HEAD ASS'Y (P/N 880105-100X)
FIGURE O2
NECK EXTENSION TEST SETUP SPECIFICATIONS

PENDULUM CENTERLINE

PENDULUM (REF. FIG. 22 CFR 49 §572.33)

ACCELEROMETER

BRACKET - NECK ADJUSTING - LOWER (P/N 880105-208)

BRACKET - NECK ADJUSTER - UPPER (P/N 880105-207)

BIB SIMULATOR (P/N 880205-210)

NECK ASS'Y (P/N 880105-250)

MOUNTING BOLT CENTERLINE

6-AXIS UPPER NECK LOAD CELL (SA572-S11)

D-PLANE * PERPENDICULAR TO PENDULUM CENTERLINE ±1°

PENDULUM STRIKE PLATE

DIRECTION OF PENDULUM FLIGHT

38.1 ± 0.5 mm (1.50 ± 0.02 in)

OCCIPITAL CONDYLES

HEAD ASS'Y (P/N 880105-100X)

* D-PLANE IS DEFINED AS AN IMAGINARY PLANE PERPENDICULAR TO THE SKULL CAP/SKULL INTERFACE.
FIGURE 03
THORAX IMPACT TEST SETUP SPECIFICATIONS

"0" INDEX MARKS ALIGNED (REF. DWG. 880105-207 AND 880105-208)

NO. 3 RIB CENTERLINE HORIZONTAL ±0.5°

PELVIC ANGLE MEASUREMENT REFERENCE SURFACE (7° ±2°)

PELVIC ADAPTER BLOCK (P/N 880105-1094)

COMPLETE DUMMY ASSEMBLY 880105-000

12.7 ±1.0 mm (0.50 ±0.04 in)

IMPACT PROBE WEIGHT INCLUDING ALL INSTRUMENTATION AND 1/3 OF SUPPORT CABLE WEIGHT *
13.97 ±0.023 kg (30.8 ± 0.05 lb)

FLAT, SMOOTH, RIGID, CLEAN, DRY SEATING SURFACE HORIZONTAL ± 0.5°

* 1/3 CABLE WEIGHT NOT TO EXCEED 5% OF THE TOTAL IMPACT PROBE WEIGHT
FIGURE O5
KNEE IMPACT TEST SETUP SPECIFICATIONS

- **RIGID FIXTURE**
- **FEMUR LOAD CELL** (SA572-S14, SINGLE AXIS, OR SA572-S29, SIX CHANNEL) OR STRUCTURAL REPLACEMENT (78051-319) HORIZONTAL ±0.5°
- **ANKLE PIVOT**
- **66°**
- **COMPLETE LEG ASSEMBLY** (880105-560-1 (LH), 880105-560-2 (RH)) WITH UPPER LEG WELDMENT AND UPPER LEG FLESH REMOVED.
- **FOOT ASSEMBLY** (880105-650 (LH), 880105-651 (RH))
- **IMPACT PROBE SUPPORT CABLES** MOUNTING BOLTS TORQUE TO 40.7 Nm (30 lb. ft.)
- **ADJUST KNEE PIVOT** JOINT TO 1-2 g PRIOR TO EACH TEST
- **ACCELEROMETER MOUNTED WITH SENSITIVE AXIS IN LINE WITH CENTERLINE OF TEST PROBE LONGITUDINAL AXIS**
- **TEST PROBE CENTERLINE HORIZONTAL ±2°**
- **IMPACT PROBE WEIGHT INCLUDING ALL INSTRUMENTATION AND 1/3 OF SUPPORT CABLE WEIGHT**: 2.99 ±0.023 kg (6.6 ± 0.05 lb.)

*1/3 CABLE WEIGHT NOT TO EXCEED 5% OF THE TOTAL IMPACT PROBE WEIGHT*