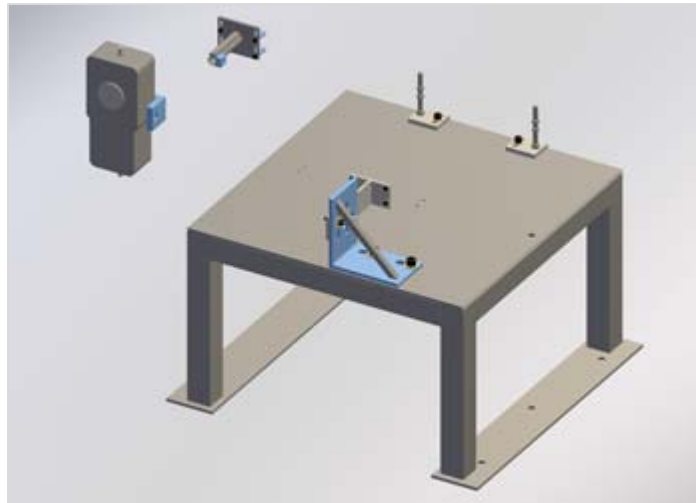


# Lumbar Flexion Test Fixture User Manual





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## ***User Manual Description***

This manual describes the use, maintenance and calibration of the Lumbar Flexion Test Fixture part number TE-800-000. The fixture is used to perform the lumbar flexion test on the Hybrid II (Subpart B) dummy specified in the U.S. Code of Federal Regulations Title 49 Transportation Part 572.

## ***Test Fixture Background***

The FTSS Lumbar Flexion Test Fixture allows the user to perform the tests specified in 49CFR Part 572 Subpart B. The test is specified in parts 572.9 Lumbar spine, abdomen, and pelvis sections (a), (b) and (c) and under test conditions and instrumentation part 572.11 Figures 5 through 9 LUMBAR FLEXION TEST, SUPPORT BRACKET, MOUNTING BRACKET, AND BEDPLATE. The upper torso lumbar spine and lower torso are tested as an assembly with this fixture. The fixture may also be used to test a Hybrid II Lower torso specified with modification for use in the DOT-SID Subpart F or the Hybrid III SID Subpart M.

## ***Description of Test***

The lumbar flexion test is performed on the assembled upper torso, abdominal insert lumbar spine assembly, lower torso, and upper legs of the Hybrid II dummy referred to in this manual as the "Lumbar Test Assembly". This assembly is mounted on the test fixture using the fixture brackets. A push plate for applying bending force is mounted to the spine box.

The dummy is flexed forward 50 degrees and released; the spine angle is then set so that the back is angled 3 degrees forward. An inclinometer is mounted to the push plate. One operator pushes the dummy forward with a force gage at a rate of .5 to 1.5 degrees/second while the second operator records force and angle to 40 degrees after a 10 second dwell. The torso is release and allowed to spring back which it must do to within 12 degrees of its initial position. The force readings taken at prescribed angles during the test must be within prescribed limits (ref. 572.9 (b)) are:

<b>Flexion (degrees)</b>	<b>Force (<math>\pm 6</math> pounds)</b>
0	0
20	28
30	40
40	52

## ***Test Fixture Description***

The Lumbar Flexion Test Fixture consists of a table assembly with fixtures and gauges for attaching the lumbar test assembly, applying the bending force and measuring the rotation angle.

The main component of the fixture is the base which is designed to rest on the test lab floor. The base rests on mounting plates having holes for lag screws to mount the fixture to the floor.

A support bracket is bolted to the base and a mount bracket bolts to the support. Dowel pins prevent the mount bracket from rotating. The test assembly is attached to the mount bracket through the instrument cavity in the pelvis with four 10-24 X ½ SHCS and four flat washers. The femur load links of the test assembly are supported to the table by two knee adjustment plate assemblies.

A push plate assembly is mounted to the back of the thoracic spine box using four standoffs and 10-32 SHCS.

A force push scale is supplied for applying the bending force and an inclinometer is supplied for reading the angle.

The test fixture base dimensions are 15.3 in. High X 26-¾ in. wide X 25 in. long. (389 mm X 680 mm X 635 mm) measured including the mounting feet and the weight is 127 lbs (57.6 kg).



## ***Safety Precautions***

- **Warning:** Two operators are required to run the test. Only trained, experienced operators should use the test fixture and conduct the tests. One operator applies force to the test assembly and reads the force gauge. The second operator calls out the angle and records the data.
- Before placing the lumbar test assembly onto the fixture, insure that the main bracket bolts are tight. Check the floor area around the fixture and clear it of all obstructions that could interfere with the personnel performing the text.
- **Caution:** The test fixture is designed for testing only Hybrid II 50<sup>th</sup> adult dummies. To prevent injury or damage to the dummy or the fixture, do not test any other dummy on this fixture.

## ***Installation Requirements***

The test fixture sits on the lab floor. It may be lagged down through the holes in the base floor plates. The fixture requires a 6 foot X 6 foot clear floor space. This allows room to assemble the test assembly to the fixture and for one test operator to apply bending force to the back of the test assembly when mounted on the fixture.

The fixture is manually operated with mechanical gauges; no electric power is needed. Adequate lighting is required.

Lab temperature must be maintained from 66 °F to 78 °F and Relative Humidity from 10% to 70% to run the test within specifications. Dummies to be tested must be in this environment for at least 4 hours before testing.

## ***Installation***

The Lumbar Flexion Test Fixture has minimal installation requirements for ease of setup and operation.

1. Remove any packaging material from the fixture.
2. For proper operation, the fixture must be installed on a level floor. Verify that the table is level within +/-0.5 degrees in both horizontal directions.
3. Use two qualified people place the heavy fixture on the floor in the desired position. Mark the location for lag screws if so desired. Move the table, drill for the screws, reset the table and lag it to the floor. Wear gloves and avoid pinching fingers while moving the fixture.

## ***Instrumentation***

The lumbar flexion test requires the measurement of applied force, torso deflection angle, and angular speed.

Force is measured with a Chatillon DG-200 200 lb mechanical force gauge, part number 6002403, with handle set assembly SPK-DG-Handle, part number 6002404.

Torso rotation angle is measured with a magnetic base inclinometer, part number TE-851.

The angular speed is determined by wall clock or wrist watch with sweep second hand or stopwatch (not supplied). The recording operator enters force, angle, and time on a data sheet from which the speed may be calculated.

The Lumbar Flexion Test Fixture uses mechanical gauges; it does not use a data acquisition system.

## ***Test Set-Up Procedure***

1. **Notice:** Insure that the two people performing the set-up are fully checked out on the procedure and are capable of handling, disassembling and assembling the dummy which has a total weight of 164 lbs. Moving and manipulating the entire dummy requires at least two people to avoid undue physical stress. Also while performing these procedures check for damaged and torn parts and flesh. Repair all defects before performing the tests.
2. Bend the Hybrid II dummy backward at the waist and remove the abdominal insert.
3. Remove the knees, lower legs, and feet from the dummy by removing the front screw from each upper leg (3/8-16 X 2 SHCS). Set the screws aside.
4. Unscrew the 1/2-20 X 2-1/4 SHCS in the shoulder yokes and remove the arms from the dummy. Reinsert the SHCS into the shoulder yokes. Inspect the fiberglass washers to insure that they are on the inside of the shoulder yoke lugs.
5. Remove the chest jacket from the dummy.

6. Remove the head, neck, neck bracket and leather upper thorax padding cover by unscrewing the four 5/16-24 X 3/4 SHCS that hold the neck bracket to the spine box. Alternatively the head may be removed from the neck by taking off the skull cap by removing four 1/4 -20 X 1 SHCS and unscrewing the 1/4 -20 X 3/4 FHCS holding the skull to the neck. Then the neck bracket may be removed as it is easier to access the screws holding it to the spine box.
7. Insert a standoff into each of four of the holes in a rectangular pattern in the back of the spine box instrument cavity. Replace the chest jacket on the dummy with the standoffs protruding through the holes provided for them in the chest jacket and the jacket unzipped.
8. Loosely attach the push plate to the standoffs with four 10-24 X 1/2 SHCS. Using a scale set the height of the intersection of the centerline of the push plate tube and the back surface of the spine box at 15.2 inches above the top surface of the aluminum lumbar to pelvic adapter (dummy part number ATD-7116) bolted to the pelvis. Keep the push plate tube level crosswise. Tighten the screws to hold the push plate in position and zip up the chest jacket.
9. Remove the instrument cavity cover from the back of the pelvis by unscrewing the four 10-24 X 3/8 SHCS.
10. Insert the mount weldment bracket into the pelvic instrument cavity in the pelvis back of the pelvis so that the dowel pins in the blade are pointing to the dummy's right and are below the clearance holes. Fasten it with four 10-24 X 1/2 SHCS and four number 10 flat washers.
11. Position the test assembly onto the fixture so that the dowel pins on the bracket mount weldment engage the holes in the support bracket. Fasten the bracket is mounted securely using the 5/16-24 X 1 SHCS, 5/16 flat washers, and 5/16-24 hex nuts.
12. Loosen the femur friction plungers in the pelvis. Remove the threaded rods from the knee adjustment plates and remove the top nuts from each rod. Thread a rod through each knee and replace the nuts to hold the rod in.
13. Loosen the bolts securing the knee adjustment plates, reposition the legs and screw the rods back into the plates. Adjust the nuts so that the leg bones point down at approximately 6 degrees so that the back plane of each thigh flesh is parallel to the front plane of the pelvis while the link rods are parallel to the midsagittal plane of the dummy.
14. Set the torque on the femur friction plungers in the pelvis to 240 in-lbs.
15. Connect the 6 inch extension to the push scale so it extends in the direction of approximate zero force and connect a pointed tip to the end of the extension. Mount the handle assembly to the scale.
16. Note: SHCS = Socket Head Cap Screw.
17. You are now ready to conduct the test.



## ***Test Procedure***

1. Pre-flex: The first test operator flexes the thorax forward 50° and then rearward as necessary to return it to an upright seated position with the backplate of the spine box instrument cavity 3° forward of vertical which sets the angle of the flat plate welded onto the top of the push plate tube to 3° above horizontal. Measure this angle by setting the magnetic side of the inclinometer on the flat surface.
2. The first test operator inserts the push scale into the tube on the push plate. Without applying force to the push plate or allowing the extension to touch the side of the tube he zeros the scale.
3. Flexion Test: The first test operator uses the push scale with the extension, point and handle assembly to bend the torso forward at between .5 and 1.5 degree/second. The extension rod must be centered in the push tube during this process.
4. Recording: The second operator calls out the angles at 20°, 30°, and 40°. The first operator reads the force at 20° and 30° and the second operator records them. At 40° the first operator holds the torso steady with the scale and reads the force after 10 seconds; the time is determined by the second operator.
5. After the last reading the second operator removes the inclinometer from the push tube assembly and then the first operator quickly pulls the force gage out of the tube allowing the torso to spring back to the upright position. Caution: understand and perform this step properly to avoid breaking the inclinometer or having the torso or scale hit an operator.
6. Replace the inclinometer on the push tube and read the angle after 3 minutes. The angle must return to within 12° of its initial angle (3°).
7. Wait 30 minutes before performing the test again on the same components.
8. A sample data recording sheet is appended.

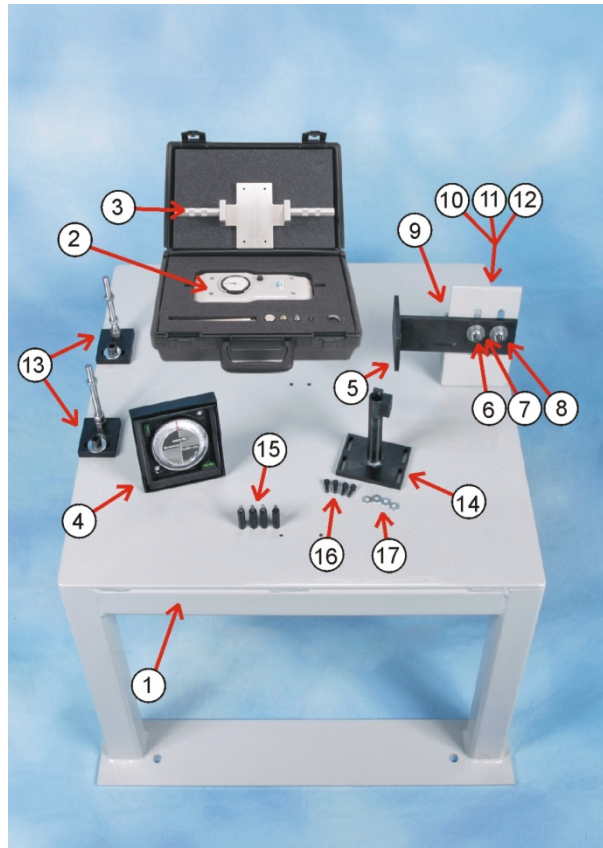
## ***Calibration***

The force and angle gauges should be calibrated by a certified calibration lab at regular intervals of 6 months to one year.

## ***Maintenance***

Inspect the fixture regularly. Replace broken or worn parts. Tighten the bolts holding the support bracket to the base.

## Appendix A – Part Identification



ITEM	PART NUMBER	DESCRIPTION
1	TE-800-005	LUMBAR FLEXION TABLE WELDMENT
2	6002403	SCALE PUSH 200 LB
3	6002404	PUSH SCALE HANDLE SET
4	TE-851	INCLINOMETER 1100-2VM W/MAGNET
5	TE-503	MOUNT WELDMENT BRACKET
	9000624	SCREW, SHCS 10-24 X ½ (Not Shown)
6	9000547	SCREW, SHCS 5/16-24X1
7	9003022	WASHER FLAT .328 ID X .625 OD X .042 THK
8	9000341	NUT HEX 5/16-24
9	TE-502	SUPPORT BRACKET
10	9000102	SCREW, SHCS ½-20 X 1
11	9000295	WASHER 1/2 FLAT
12	9000057	HEX NUT ½-20
13	TE-800-006	KNEE ADJUSTMENT PLATE
14	TE-505	PUSH PLATE ASSY
15	TE-505-001	STANDOFF ASSY
16	9000147	SCREW SHCS 10-32 X 1/2
17	900054	WASHER, FLAT #10 x .500 X .049

## Appendix B - Hybrid II Lumbar Flexion Test Data Sheet

Date:		Time:		Test I.D. No:		Operator 1:	
Temp. °F:		R.H. %				Operator 2:	
Dummy No.		Pelvis No.		Lumbar Spine No:		Chest Flesh No:	
Force @ 20°, lbs. <b>Spec:</b> <b>22/34</b>	Time t <sub>20</sub> @20°, sec	Force @ 30°, lbs. <b>Spec:</b> <b>34/46</b>	Time t <sub>30</sub> @ 30°,Sec	Force @ 40° held 10 sec, lbs. <b>Spec:</b> <b>46/58</b>	<sup>2</sup> First Time t <sub>40</sub> , @ 40° sec	<sup>3</sup> Average angular rate R deg/sec <b>Spec.</b> <b>.5/1.5</b>	Return angle after 3 minutes <b>Spec:</b> <b>within 12</b> <b>o</b>

**Notes:**

- 1: Measure time from start of forward push using stopwatch or clock sweep second hand.
- 2: First Time @ 40°. Record time as 40° is reached at start of 10 second hold period.
- 3: Average angular rate  $R = (t_{20}/20 + t_{30}/30 + t_{40}/40)/3$