

MedX medical machines provide two phases of operation:

1. Static testing (torque readings of isometric contractions at selected angular positions).

2. Dynamic exercise (lifting and lowering a selected level of weight stack resistance).

Inherent in each of these tests is a rangeof-motion assessment (ROM), which can be considered a third function of each machine.

The computer system monitors and records each of these operations, but does not control the patient in any way.

The clinician must set the patient into the machine, instruct them what to do, and use the machine's software to execute each function. The clinician can also use the software to crunch data and issue reports.

Thorough exploration of this manual is necessary to gain full command of this equipment's capabilities. This section is devoted to the barebone basics of mechanical operation of the equipment. On the Lumbar Extension Machine, a computer monitor stationed atop the footboard provides visual feedback to the patient.

Checklist Exercises

The checklists that follow — 104 points on the Lumbar and 100 points on the Cervical — were adapted directly from the hands-on spinal certificatin test at the University of Florida.

As an exercise to assess skill with operating the machinery, it involves an isometric test followed by a dynamic exercise set, immediately followed by another isometric test. This is also known as the FRT (fatigue response test (see pages 3-9, 10). Performing this exercise successfully indicates a solid command of the technology.

104-POINT CHECKLIST Lumbar Machine Patient Test, Exercise Sessions

PT PREPARATION

- 1. Greet pt., explain purpose of visit
- 2. Have pt. perform static stretches
- 3. Have pt. void, if necessary
- 4. Have pt. remove belt & empty pockets

CALIBRATION

- 5. Move to calibrate, calibration update
- 6. CounterWeight (CW) unlocked
- 7. Angle selector locked at 18°
- 8. Loosen chain, remove pins from weightstack
- 9. Pot/SG count #'s within range
- [if not within range, contact

MedX Tech Support 800-528-3159]

TEST SETUP

- 10. Select file for test (retrieve or new)
- 11. Explain: -test sequence (pre/dyn/post)
 - 12. need for stabilization (isolation)
 - 13. should feel pressure from restraints
 - 14. should not feel pain/numbness
 - 15. should not feel dizzy, short of breath, etc.







The lap belt, left, and thigh restraint, right.

Lumbar Machine Patient Test, Exercise Sessions (cont.)







After tightening lap belt (left photo) and foot board (above), have patient lean to touch toes while you see if pad rotates (photos directly left).







Also have patient attempt to raise his or her heals. If there is much lift, or any rotation in the pelvic pad, continue tightening restraints.

- 16. Align iliac crests whh centerline of pelvic restraints
- 17. Secure thigh restraint
- 18. Select femur restraint ht. (legs parallel to seat; 15°)
- 19. Position feet on footboard (toes turned inward)
- 20. Secure femur restraint (heels $\leq 1/2$ inch)
- 21. Check for pelvic rotation (pt. reach for toes)
- 22. Adjust head pad (base of occipital bone)
- 23. Find max angle extension
- 24. Engage angle selector, flip switch (or press F10)
- 25. Find max angle flexion (no pelvic restraint rotation)
- 26. Engage angle selector, flip switch
- 27. Move pt. to upright position, engage angle selector
- 28. Explain TDC & have pt. find angle (check twice)
- 29. Engage angle selector, flip switch
- 30. level and lock CW at angle of TDC.
- 31. Move pt. to 0° or greatest angle of extension
- 32. Engage angle selector, flip switch [act. strain gauge]
- 33. Zero torso mass with CW adjustment
- 34. Flip switch to accept
- 35. Move pt. to upright position, engage angle selector
- 36. Loosen restraints (release to pt. comfort)
- 37. Enter gauge reading
- 38. Enter femur restraint height (patient positioning)
- 39. Enter seat pad if applicable (patient positioning)
- 40. Type test remark (PRE FRT)

Lumbar Machine Patient Test, Exercise Sessions (cont.)



- 41. Explain isometric test: -multiple testing angles
 - 42. 10 sec rest between angles
 - 43. demonst. force application
 - 44. don't push w/head; legs ok
 - 45. build force slowly (3-1-3 s)
 - 46. maintain loose grip
 - 47. exhale during contraction
 - 48. max effort for test accuracy
 - 49. don't push until instructed
- 50. Ask if pt. understands test instructions
- 51. Press ENTER to bring up isometric test grid
- 52. Tighten and check restraints

PRE FRT (ISOMETRIC) TEST

- 53. Move pt. to full flexion, engage angle selector
- 54. Have pt. relax, record SE at each angle
- 55. Force built slowly (3-1-3 s)
- 56. Exhale during contraction
- 57. Peak effort reached (contractions not cut short)
- 58. Encourage / motivate patient
- 59. Maintain pelvic stabilization (check restraints)
- 60. 10 sec rest between angles / stretch patient
- 61. Move patient to upright position
- 62. Engage angle selector
- 63. Loosen restraints (release to pt. comfort)
- 64. Press ENTER to save test

Position head (occipital lobe) pad, left, and after locating the patient's TDC (top dead center), set the counterweight (this photo and the one below).







Make sure the patient understands that this system is an effort-dependent measurement. For both valid testing and effective exercise, the patient must give an all-out effort.

Lumbar Machine Patient Test, Exercise Sessions (cont.)

DYNAMIC EXERCISE

- 65. Determine correct wt. load for DYN (50% max TFT)
- 66. Set exercise weight on weightstack, tighten chain
- 67. Enter exercise weight
- 68. Enter DYN remarks (DYN), bring up test grid
- 69. Explain DYN: -speed of movement (2-1-4 s)
 - 70. as many reps as possible
 - 71. full ROM (listen for tone)
 - 72. fatigue sensation
 - 73. exhale during contraction
 - 74. maintain loose grip
 - 75. don't push until instructed
- 76. Ask if pt. understands test instructions
- 77. Tighten & check restraints
- 78. Move pt. to full flexion, engage angle selector
- 79. Release MA lock
- 80. Flip switch as patient begins to move
- 81. Controlled speed of movement \geq 7.0 s per rep)
- 82. Pt. moves through full ROM (tone)
- 83. Pt. motivation (last repetition = partial or 140 s limit)
- 84. Flip switch to end DYN (while pt. in full flexion)
- 85. Engage MA lock
- 86. Move patient to upright position
- 87. Engage angle selector
- 88. Loosen restraints (release to pt. comfort)
- 89. Press ENTER to save DYN

POST FRT (ISOMETRIC) TEST

90. Enter test remarks (POST FRT w_ , r_ , t_)

- 91. No more than 70 s rest (50 to 70 s)
- 92. Tighten & check restraints
- 93. Move pt. to full flexion, engage angle selector
- 94. Have pt. relax, record SE at each angle
- 95. Force built slowly (3-1-3 s)



The angle selector (left hand), movement arm lock (right hand), along with the force/ angle switch are located to the patient's right side of machine.



- 96. Exhale during contraction
- 97. Peak effort reached (contractions not cut short)
- 98. Encourage / motivate patient
- 99. Maintain pelvic stabilization (check restraints)
- 100. 10 sec rest between angles / stretch patient
- 101. Move patient to upright position
- 102. Engage angle selector
- 103. Loosen restraints, remove pt. from machine
- 104. Press ENTER to save test

3. Equipment Operation

100-POINT CHECKLIST Cervical Machine Patient Test, Exercise Sessions

PT. PREPARATION

- 1. Greet pt., explain purpose of visit
- 2. Have pt. perform static stretches
- 3. Have pt. void, if necessary
- 4. Have pt. empty shirt pockets
- 5. Have pt. remove hair accessories, glasses, etc.

CALIBRATION

- 6. Move to calibrate, calibration update
- 7. Counterweight (CW) unlocked
- 8. Angle selector locked at 90°
- 9. Loosen chain, remove pins from weightstack
- 10. Lock gate
- 11. Pot/SG count #'s within range
- [if out of range, contact MedX Tech Support, 800-528-3159]

TEST SET-UP

- 12. Select file for test (retrieve or new)
- 13. Explain: -test sequence (iso/dyn)
 - 14. need for stabilization (isolation)
 - 15. should feel pressure from restraints
 - 16. should not feel pain/numbness
 - 17. should not feel dizzy, short of breath, etc.
- 18. Instruct patient to sit upright
- 19. Place movement arm out of the way
- 20. Align adam's apple with machine axis (seat ht.)
- 21. Fasten seat belt & shoulder harness (loosely)
- 22. Lock gate, (snug torso restraint)
- 23. Select light wt. (1-2 wt. plates)
- 24. Tighten chain
- 25. Have pt. move to full flex., engage angle selector
- 26. Release MA lock
- 27. Have pt. perform 5-6 slow reps thru full ROM



Angle selector.



Seat height setting.

3. Equipment Operation

Cervical Machine Patient Test, Exercise Sessions (cont.)

- 28. Adjust seat ht. to eliminate head sliding on pad
- 29. Have pt. move to full flexion
- 3O. Engage MA lock
- 31. Move pt. to upright position (MA out of way)
- 32. Engage angle selector
- 33. Release gate, tighten harness (secure)
- 34. Lock gate, tighten torso restraint (secure)
- 35. Check restraints (shoulder shrug)
- 36. Find max angle extension
- 37. Engage angle selector, flip switch (or press F10)
- 38. Find max angle flexion
- 39. Engage angle selector, flip switch
- 40. Locate TDC with pt. looking straight ahead
- 41. Engage angle selector at pt's TDC, flip switch
- 42. Level and lock CW at angle of TDC
- 43. Move patient to 18° (or greatest angle of extension, if more upright)
- 44. Engage angle selector, flip switch
- 45. Zero head mass with CW adjustment
- 46. Flip switch to accept
- 47. Move pt. to upright position, engage angle selector
- 48. Loosen torso restraint (release to pt. comfort)
- 49. Enter gauge reading
- 50. Enter seat height (patient positioning)
- 51. Enter seat pad, if applicable (patient positioning)
- 52. Turn stored energy OFF (test options)
- 53. Type test remark (Initial IM)
- 54. Explain 1M test: -multiple testing angles
 - 55. 10 sec rest between angles
 - 56. demonstrate force application
 - 57. apply force wI back of head
 - 58. build force slowly (3-1-3 s)
 - 59. rest hands on gate / cross on lap
 - 60. exhale during contraction
 - 61. max effort for test accuracy
 - 62. don't push until instructed



Once shoulder straps are applied, and gate is closed, see if the patient can elevate (shurg) his or her shoulders (loer photo). If there's any perceptible movement, tighten restraints.



Cervical Machine Patient Test, Exercise Sessions (cont.)

- 63. Ask if pt. understands test instructions
- 64. Press ENTER to bring up isometric test grid
- 65. Tighten and check restraints

ISOMETRIC TEST

- 66. Move pt. to full flexion, engage angle selector
- 67. Force built slowly (3-1-3 s)
- 68. Exhale during contraction
- 69. Peak effort reached (contractions not cut short)
- 70. Encourage / motivate patient
- 71. Maintain torso stabilization (check restraints)
- 72. 10 sec rest between angles / stretch patient
- 73. Move patient to upright position
- 74. Engage angle selector
- 75. Loosen torso restraints (release to pt. comfort)
- 76. Press ENTER to save test

DYNAMIC EXERCISE

- 77. Determine correct wt. load for DYN (80% max TFT)
- 78. Set exercise weight on weightstack, tighten chain
- 79. Enter exercise weight
- 80. Enter DYN remarks (DYN), bring up test grid
- 81. Explain DYN: -speed of movement (2-1-4 s)
 - 82. as many reps as possible
 - 83. full ROM (listen for tone)
 - 84. fatigue sensation
 - 85. exhale during contraction
 - 86. don't push until instructed
- 87. Ask if pt. understands test instructions
- 88. Tighten & check restraints
- 89. Move pt. to full flexion, engage angle selector
- 90. Release MA lock
- 91. Flip switch as patient begins to move
- 92. Controlled speed of movement (\geq 7.0 s per rep)
- 93. Pt. moves through full ROM (tone)



- 94. Pt. motivation (last repetition = partial or 140 s limit)
- 95. Flip switch to end DYN (while pt. in full flexion)
- 96. Engage MA lock
- 97. Move patient to upright position
- 98. Engage angle selector
- 99. Loosen restraints, remove pt. from machine
- 100. Press ENTER to save DYN

Clinical Fatigue Response Testing

Purpose

The Fatigue Response Test (FRT) is a 3-part test procedure designed to measure the endurance characteristics of a specific muscle group. Information obtained from the FRT can be used to further delineate an exercise prescription based upon the patient's amount of fatigue consequent to the test. It is recommended that the FRT be administered clinically under the following conditions:

- 1) The patient is not limited by joint pain when performing dynamic exercise
- 2) The patient is able to exercise to volitional muscular fatigue
- 3) The patient has demonstrated reliable efforts with previous isometric testing
- 4) The patient has not responded to the recommended standard protocol

Two tests of functional strength. The top of the shaded area shows the level of fresh strength, while the bottom shows remaining strength after the subject was exercised. The shaded area between the two curves is fatigue from the exercise. The dips in the midrange of movement indicate abnormal function. The fact that the same abnormal shape was produced during both tests indicates valid test results.



Procedure

To perform the FRT, a patient is seated and restrained in the MedX machine in order to isolate the target muscle group. The patient then performs a series of maximal effort isometric contractions at multiple joint angles through a pain-free ROM (Pre FRT). After a brief rest, the patient performs as many dynamic variable resistance repetitions as possible using a weightload equal to 50% (lumbar extension) or 80% (cervical extension) of the peak torque from the Pre FRT. Each repetition should be performed through the full painfree ROM in a slow, controlled manner. The patient should perform the concentric portion of the repetition for 2 seconds, pause at full contraction for 1 second, then complete the eccentric portion over a 4 second period (total 7 seconds per repetition). Repetitions should be performed until the patient is unable to move the weightload through a full ROM (volitional fatigue). Immediately following the dynamic repetitions (within 1 minute) the patient performs maximal effort isometric contractions at the same joint angles selected for the Pre FRT (Post FRT). The patient is then released from the machine.

Interpretation

The difference between the Pre FRT and Post FRT isometric tests represents the fatiguing effect of the dynamic exercise. The amount of fatigue (inroad) will vary among individuals, and is indicative of the fiber type characteristics of the lumbar extensor musculature. For example, an inroad \geq 30% reflects fatigue characteristics of fast twitch muscle fibers, which have a low tolerance to exercise (poor endurance). An inroad \leq 10% reflects fatigue characteristics of slow twitch muscle fibers, which have a high tolerance to

Clinical Fatigue Response Testing (cont.)

exercise (high endurance). An inroad between 10% and 30% reflects fatigue characteristics of an unknown mixture of fast and slow twitch muscle fibers, with a moderate tolerance to exercise (moderate endurance).

Exercise Prescription

When a motivated individual fails to demonstrate progress (progressive increase in isometric strength, progressive increase in dynamic weightloads) using the standard treatment protocol, his/her exercise prescription may need to be altered based upon the findings from the FRT. Use the following table as a guide:

Percent Fatigue from FRT	Muscle Group	Time Under Load	Repetition Range	Exercise Frequency
≤ 10%	Lumbar/Cervical	105 – 140s	15 - 20	2X/WK
≥ 30%	Lumbar	56 - 84s	8 - 12	1X/WK
	Cervical	70 - 105s	10 - 15	1X/WK

DOs and DON'Ts of Testing

- **1. ALWAYS** have one hand on the movement arm and one hand on the angle selector when moving from angle to angle (excluding Cervical Extension machine).
- **2. NEVER** disengage the angle selector while in the dynamic mode (when movement arm lock is down).
- **3. NEVER** exceed a patient's range of motion.
- **4. COMMUNICATE** with the patient before and during testing and training. Explain what they should feel, where they should feel it, and what they should not feel.
- **5. REMEMBER** that you are performing an effort-dependent measurement of spinal function. You must get the patient's maximal effort.
- 6. MAINTAIN proper body stabilization throughout the testing/training session.
- **7. DON'T** cut an isometric contraction short. Allow enough time for motor unit/muscle fiber recruitment.
- **8. SELECT** the proper weightload for training. **CHECK** your selection by getting eye-level to the weight stack.
- **9. MOTIVATE** the patient. They will always reach momentary mental failure before reaching momentary muscular failure. The last repetition of a set should be a partial one, performed in a slow, controlled manner.
- **10. DON'T** allow the patient to exercise too quickly. Each repetition should take approximately 7 seconds (2 second concentric, 1 second hold, 4 seconds eccentric). The average time per repetition (total exercise time divided by total number of repetitions) should fall between 6.5 and 8.0 seconds per repetition.
- **11. RELY** on patient feedback, but do not allow the patient to control the test. This is especially important during the stabilization procedure, and dynamic training.
- 12. DON'T get button/lever happy. When in doubt or confused, STOP and READ THE SCREEN.