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 range-of-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 bare-bone basics of mechanical operation of the equipment.

**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 certification 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.
3. Equipment Operation

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.
3. Equipment Operation

16. Align iliac crests with 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 ≤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)

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 heels. If there is much lift, or any rotation in the pelvic pad, continue tightening restraints.
3. Equipment Operation

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

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
66. 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 ≥ 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)
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
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
28. Adjust seat ht. to eliminate head sliding on pad
29. Have pt. move to full flexion
30. 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 1M)
54. Explain 1M test: -multiple testing angles
   55. 10 sec rest between angles
   56. demonstrate force application
   57. apply force w/ 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 (≥ 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

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 > 30% reflects fatigue characteristics of fast twitch muscle fibers, which have a low tolerance to exercise (poor endurance). An inroad < 10% reflects fatigue characteristics of slow twitch muscle fibers, which have a high tolerance to
exercising (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 exercising (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:

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

Clinical Fatigue Response Testing (cont.)
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**.