



## OPERATING MANUAL

### Micro-Deval Apparatus MD-2000, MD-2000C & MD-2000F



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## 1.0 INTRODUCTION:

This manual is a guide to the operation and maintenance of the Gilson MD-2000, MD-2000C or MD-2000F Micro-Deval Apparatus. This unit has been designed and manufactured to comply with current published specification requirements. This manual makes no attempt to describe acceptable test protocol. The operator is referred to the most current revisions of ASTM, AASHTO or other governing specifications for testing methods and procedures.

## 2.0 THEORY OF OPERATION:

The Micro-Deval Apparatus meets or exceeds the accuracy and repeatability requirements of the "Standard Test Method for Resistance of Coarse Aggregates to Degradation in the Micro-Deval Apparatus" AASHTO Designation T 327, ASTM D 6928, TexDot 845-49-40, and Ontario LS-618. As well as the "Standard Test Method for Resistance of Fine Aggregates to Degradation in the Micro-Deval Apparatus, ASTM Designation D 7428 and Ontario LS-619.

## 3.0 PRINCIPLE OF OPERATION:

The MD-2000 Apparatus is supplied with two stainless steel jars, stainless steel abrasive charges and a magnetic pickup.

A prepared aggregate specimen is placed in the abrasion jar along with an abrasive charge of stainless steel balls and water. The sealed jar is then placed on a set of rollers and turned for a period of time. At test completion, the aggregate sample is removed from the jar and tested to determine degradation resulting from abrasion.

The MD-2000 controller functions as both a timer and a jar revolution counter. Duration of the test may be controlled by either method. Most current specifications call for the test to be based on elapsed time at a specified speed. It has been demonstrated that controlling the test by counting jar revolutions via an optical encoder results in more consistent sample agitation.

In **TIME** mode, operation terminates when the timer counts down to zero from the time input by the operator. In **REVS (Revolution Counter)** mode, the user inputs the desired number of revolutions into the counter. Revolutions are then tracked via an optical encoder until they reach zero, at which point the unit will stop.

## 4.0 UNPACKING & SET-UP:

**NOTE:** Save all packaging materials in case instrument return is required.

The MD-2000 instrument is shipped in a sturdy box with additional inside packing to reduce chances of shipping damage. Inspect the outside of the box for external damage. If no apparent external shipping damage, remove internal packing and lift instrument from shipping box.

Inspect the MD-2000 instrument for shipping damage. Occasionally, damage may not be evident from outside the shipping container. If damage is found, contact both the freight carrier and Gilson immediately.

Locate instrument on smooth level floor surface. Bottom of instrument has four adjustable feet to permit leveling. Level the unit front to back and side-to-side, using the top set of rollers as a reference. A short spirit level may be placed across the rollers while leveling. Check the bottom set of rollers in the same way. Some "compromise" may be necessary to insure both sets of rollers are as level as possible. When complete, tighten the upper hex nuts on each foot against the frame to lock the feet into position.

Location must allow the free flow of air through the louvers located on both sides of the case. The MD-2000F model features a cooling fan located in the rear panel to draw additional air through the louvers. Allow adequate space between the wall and the rear of the unit for proper operation. DO NOT restrict airflow around the louvers or fan.

### WARNING!

**MD-2000** requires a 115V/60Hz grounded power supply for proper operation.

**MD-2000C** is equipped with a 115V/60Hz motor with Thermal Protection. If the motor stops operating, disconnect from the power supply, allow it to cool down, and press the manual reset button on the motor.

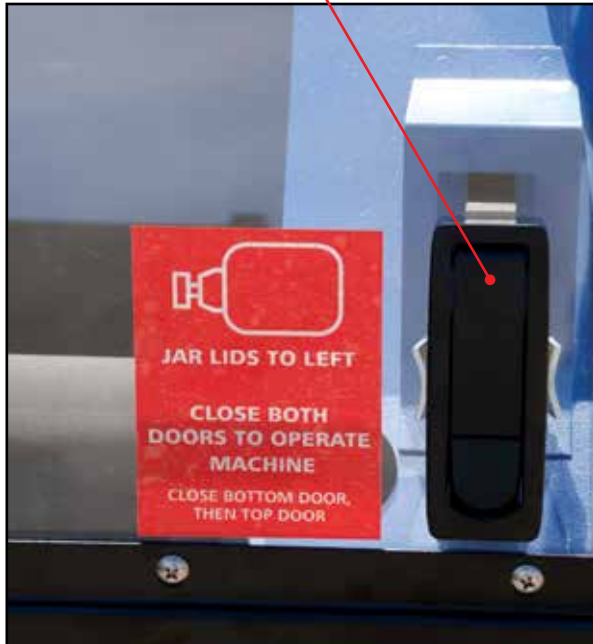
**MD-2000F** requires a 230V/50Hz grounded power supply for proper operation.

The model number and electrical requirements are clearly printed on the specification label, affixed to the rear panel of the machine, adjacent to the power inlet.

Any attempt to operate this device on a power supply or connection it is not designed for will damage the unit and void the warranty. If there are any concerns, please contact Gilson prior to connecting to the power supply.

Cabinet doors are equipped with safety interlock (see Figure 1) which will not allow operation of the MD-2000 unless both doors are properly closed.

**Top Cover Release Latch**



**Figure 1**

Top cabinet door opens first and closes last. It is designed to overlap the lower door as a safety feature.

Open both doors and inspect interior of the cabinet prior to operation. Make sure there are no impediments blocking roller rotation.

Close doors prior to operation. Bottom door closes first, top door second – overlapping bottom door.

## 5.0 CONTROLLER OPERATION:

This section describes operation of the MD-2000 electronic controller. Reading and understanding the information here will insure trouble-free operation of the unit during testing procedures.

### 5.1 Mode Selection:

The MD-2000 is equipped with a controller that allows test duration to be controlled either by elapsed time or counted jar revolutions.

Once the timer or counter mode of operation is selected, that mode becomes the default method of operation until reset by interruption of power. To change operation from one mode to another, simply disconnect the MD-2000 from its power supply, then reconnect it. If a power outage occurs, the mode must be selected again prior to use.

**TIME Mode:** In this mode, the timer determines and controls test completion. The timer must be set to the specified time. The test will then run until the timer reaches zero and stops the machine. Revolutions are displayed on the counter, but the counter does not control the test.

**REVOLUTIONS Mode:** In this mode, the counter determines and controls test completion. The counter must be set to the specified number of revolutions. The test will then run until the counter reaches zero and stops the machine. Time can be displayed on the timer, but the timer does not control the test.

**Power-On Screen:** When power is applied to the unit for the first time following a power interruption, a title screen showing the model and version number will display briefly, then the Power-on screen will appear. The user selects which method the Micro-Deval will use to control test duration. If “A” (TIME) is selected, the test will be terminated when the preset time period expires. If “B” (REVS) is selected, the test will be terminated when the preset number of jar revolutions is complete. If power is lost and reapplied, this screen will reappear.



**Power-On Screen**

**Timer Mode Screen:** This screen appears when “A” is selected from the Power-On screen and will be displayed continuously when controlling test duration by the time method. The “Time” line indicates the set point in whole minutes and will alternate the set point value with a series of flashing vertical bars. (If the desired value is displayed, the test may be started immediately by pressing the green <START> button.) To change the set point, press <OK> and the set point value will begin to flash. Adjust the set point value using the <+/-> buttons. As the buttons are held down, the rate of change will become faster, progressing from single

digits to tens, hundreds, then thousands. Once the desired value is displayed, press <OK> again to enter the new value. The next two lines are current revolutions for the top and bottom jars, updated every second. The current revolutions will be reset when the <START> button is pressed. The fourth line switches to the RPM screen by pressing <A>. Pressing <B> will display the elapsed time screen.

**RPM Screen:** Displayed when <A> is pressed from either the Timer Mode or Counter Mode screens. Revolutions counted during the last full minute are shown. Display is updated every minute and must complete one minute before the first reading is displayed. To go to the 'Elapsed Time' screen press <A>. Pressing <B> returns you to the current mode screen.



Timer Mode Screen



RPM Screen

**Revolutions Mode Screen:** This screen appears when "B" is selected from the Power-On screen and will be displayed continuously when controlling test duration by the revolutions method. The "Revs" line indicates the set point in jar revolutions and will alternate the set point value with a series of flashing vertical bars. (If the desired value is displayed, the test may be started immediately by pressing the green <START> button.) To change the set point, press <OK> and the set point value will begin to flash. Adjust the set point value using the <+/-> buttons. As the buttons are held down, the rate of change will become faster, progressing from single digits to tens, hundreds, then thousands. Once the desired value is displayed, press <OK> again to enter the new value. The next two lines are current revolutions for the top and bottom jars updated every second. Displayed revolutions will be reset when the <START> button is pressed. The fourth line switches to the RPM screen by pressing <A>. Pressing <B> will display the elapsed time screen.

**Elapsed Time Screen:** Displays time elapsed since pressing the <START> button. This screen is accessed from the 'RPM' screen, and is updated every second. While in the 'Elapsed Time' screen, press the <A> button to return to the 'Current Mode' screen. Pressing <B> will display the RPM screen.

**NOTE:** Pressing the large, red <STOP> button located on the front panel will cut power to the motor and rotation will cease. Depressing the <START> button will resume operation and reset the controller.



Revolutions Mode Screen



Elapsed Time Screen



## 6.0 INITIAL FUNCTION CHECK:

Prior to its first use, the MD-2000 should be put through a short series of functional checks to confirm proper operation.

To check for proper operation in the **Timer Mode**:

- DO NOT place jars in the machine yet.
- Following the controller instructions above, input a short test time into the timer; 1 or 2 minutes is sufficient.
- Close the doors as detailed above; bottom door first then the latching top door.
- Press the Green <START> button on the front panel to activate the drive motor and check to see that the rear roller in the top and bottom set are spinning smoothly.
- Allow the timer to count down and stop the machine.

To check for proper operation in the **Revolutions Mode**:

- First, set the controller to revolutions mode as instructed above.
- DO NOT place jars in the machine yet.

**NOTE:** For purposes of this first run with no jars, use any small number. With no jars in place, the encoder will not operate the counter.

- Press the Green <START> button (see Figure 2) to start the drive motor and check to see that the rear rollers in the top and bottom are spinning smoothly.



Figure 2

The controller will not count down when there are no jars on the rollers. After about 30 seconds, depress the red <STOP> button.

The operation of the MD-2000 may now be checked with the jars in-place.

The MD-2000 jars, steel balls and magnetic pickup tool are packed in a separate box. Inspect for external and internal damage of these items in the same manner as for the instrument cabinet. Look specifically for possible damage to the encoder decals on the jar lids (see Figure 3). The optical encoder (see Figure 4) may not function properly if these decals are damaged. Make damage claims immediately to the freight carrier.

Reflective Decal for Optical Encoder      Right Top-Dustshield



Figure 3

- Remove the lids by loosening the locking knob. Remove any contents. Lids may stick to the jar occasionally. Tap lightly with a wooden mallet if necessary.
- Divide steel balls about evenly between the two jars. Fill jars half full of tap water and secure the lids. Invert each jar to check for a watertight seal.
- If a jar leaks, inspect the seal surface for debris, warpage or damaged gasket. If watertight seal cannot be established, contact Gilson – DO NOT use the jar.
- After watertight seal is confirmed, load the jars onto the rollers. The lid of each jar must face the optical encoder on the left side of the cabinet (see Figure 5).

**NOTE:** DO NOT block the light path to the encoder (see Figure 4).

- Close the doors properly to insure the safety interlock is active and press the Green <START> button. The jars will turn and the controller will count down to zero while the revolutions counter counts up to the setpoint. Power to the motor will then cut off.

**NOTE:** Excessive tightening of the knob may result in deformation of components. Tighten only until snug and free from leaks.

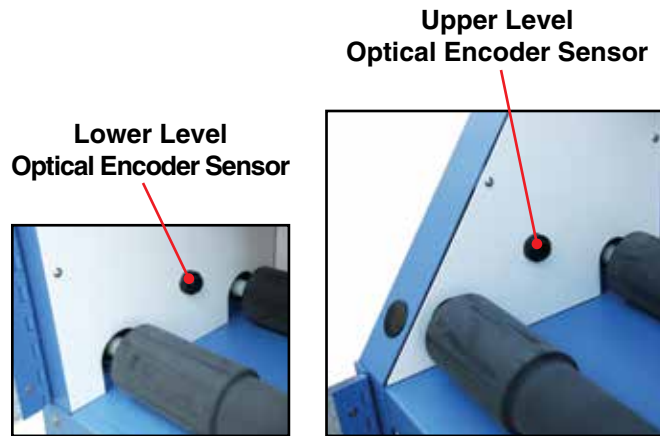


Figure 4

## 7.0 OPERATING INSTRUCTIONS:

The MD-2000 is now ready to perform a test.

For additional tests with the same time or number of revolutions, simply press the green <START> button.

**NOTE:** The counter will retain the last number displayed if power is interrupted. The instrument can resume a test after a power outage by pressing the green <START> button.

### 7.1 Performing a Test:

To perform a test with the MD-2000, first refer to the test protocol in the governing specifications and prepare the aggregate specimen as specified.

1. Load the prepared sample into the abrasion jar along with the specified amounts of abrasive charge (stainless steel balls) and water.
2. Carefully clean and dry off the rim of the jar and the lid gasket.
3. Place the lid on the jar and secure with the threaded locking knob.

4. Invert the jar and check for leaks.
5. Place the jar on its side on the roller set with the clamping end facing the optical encoder (see Figure 4).
6. Check that timer or revolutions mode is selected properly and that settings are correct. If necessary, input new settings as noted in previous section.
7. Check that there are no foreign objects or obstructions in the jar chambers.
8. Close and secure the cabinet doors; first the bottom then the top, latching door.
9. Press the green <START> button. Depending on the mode selected, the timer or the revolutions counter will then control the duration of the test and stop the machine automatically at completion.

**NOTE:** Pressing the large, red <STOP> button located on the front panel will cut power to the motor and rotation will cease. Pressing the green <START> button will resume operation.

## WARNING!

It is possible for pressure to build inside the sealed jars during testing. Use caution when removing the jar lid after completion of test.

## 8.0 MAINTENANCE:

## WARNING!

Always disconnect and lockout the power supply to this machine before performing any maintenance or repair.

No normal maintenance procedures require access to the cabinet interior. There are no lubrication points on the instrument.

### 8.1 Routine Cleaning:

The optical path from the encoder to the sensor decal on the jar lid should be periodically inspected for excessive dirt, wear or obstruction. These conditions may decrease cycle count accuracy. The encoder and decal surfaces can be cleaned with standard household cleaners.

The clear polycarbonate doors can be cleaned with soft cloths, window cleaners and warm soapy water. Cleaners with abrasives should not be used anywhere on the case, doors, encoder or jar decals.

### 8.2 Chain Replacement:

- Replacement chain is WGMD-CHAIN SUBASSY

1. Unplug Unit.
2. Open top door.

**NOTE:** If struck, the metal lip of the top door can cause personal injury and damage to the unit. Please keep the lid closed whenever possible.

3. Open bottom door.
4. Remove the 4 Phillips screws holding the front panel and lift off.
5. Remove the 4 Phillips screws holding the right mid-dustshield panel inside the bottom jar chamber. Tilt and remove.
6. Remove the 3 Phillips screws holding the right top-dustshield panel (see Figure 3). Tilt and remove. It may be difficult to move past the lock fastener holding the hinge. It may be necessary to remove the screw in this fastener if it protrudes too far.
7. At this time, you should be able to see the chain from the motor to the rear sprocket as well as the chain from the rear sprocket to the top sprocket.
8. Find the master link in the chain. Remove the retaining clip on the master link by spreading the legs apart and sliding the clip off. The link may now be separated and the chain can be removed.

### 8.3 Roller Replacement:

- Replacement idler roller is WGMD-ROLLER\_IDLE
- Replacement sprocket roller is WGMD-ROLLER\_GEAR

1. Follow steps 1 thru 7 above.

2. Repeat for the dust shield panels on the left side.
3. Open master link by spreading the legs apart and pushing the retaining clip off. Remove chain from sprockets.
4. Remove screws holding pillow blocks. To access the top pillow blocks, you will need to remove the black plastic hole plugs.

**NOTE:** One tab has been removed from these plugs to accommodate the angled front.

5. Lift rollers out of unit.
6. Loosen setscrews on pillow blocks.
7. Note orientation of sprocket for replacement later.
8. Place hardware, pillow block, spacer, and sprocket/sprocket on new roller. DO NOT tighten setscrews at this time.
9. Position the rollers in the unit and tighten the setscrews on the pillow blocks.
10. Reverse steps 1 thru 6 and test. You may notice some rubber wearing off the edges of the new rollers as they break in. This is normal and should stop as the sharp edges are radiused.

## 9.0 ADDITIONAL INFORMATION:

<b>Jar Revolution Speed:</b>	100 ±5 rpm
<b>Max Revolution Count:</b>	32,762
<b>Repeatability:</b>	±0.5 revolution
<b>Electrical:</b>	<b>MD-2000:</b> 115V/60Hz, 15amp <b>MD-2000C:</b> 115V/60Hz, 15amp <b>MD-2000F:</b> 230V/50Hz, 8amp
<b>Dimensions:</b>	20x13x39.5in (508x330x1,003mm), WxDxH
<b>Net Weight:</b>	144lb (65kg)
<b>Est. Shipping Weight:</b>	165lb (75kg)

MICRO-DEVAL APPARATUS	
Description	Model
Micro-Deval Apparatus, 115V/60Hz	MD-2000
115V/60Hz, Thermally Protected	MD-2000C
230V/50Hz	MD-2000F
Accessories	
5L Jar with Locking Cover	HMA-920
Abrasive Charge	HMA-922



## 10.0 PARTS DIAGRAM:



Figure 5