

**Manual of Operation and Instruction**

# **Model 3191 True Mold Angle Device**

**for the  
Model 4141 Gyrotory Compactor**



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# NOTES

# INTRODUCTION

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Troxler's Model 4141 Gyratory Compactor provides safe, reliable gyratory compaction of asphalt specimens at a compaction pressure of 600 kPa and 1.25° angle of gyration. The Model 3191 True Mold Angle Device (TMA) provides a real-time display of compaction angles, enabling the compactor operator to accurately and independently verify the true angle of the mold while the compactor is in operation.

To complement the TMA's real-time data display, a True Mold Angle software package is provided with the unit. This software can be used to upload and store angle measurement data on a computer.

The TMA attaches to the frame of the Model 4141, and measures the mold angle externally.

The TMA is a *passive measuring device* that does not interfere with the normal operation of the gyratory compactor. The TMA does not affect the mold angle being measured, or the relationship between the surface of the sample and the active ram head or ram foot.

Because the TMA is external to the mold, it does not limit the amount of sample that can be placed in the mold during the test. This enables the TMA to perform dynamic measurements during the preparation of actual specimens. There is no need to extrapolate or project possible angles for full-sized samples from one-quarter or half-sized samples with the TMA.

During compaction, residue from the asphalt sample may bind to the mold wall creating an uneven surface. These irregularities will adversely affect the angle measurement of an internal measuring device if its measurement probes contact the inner walls of the mold. The TMA, however, measures the angle using the external surface of the mold.

## **TWO-POINT MEASUREMENT METHOD**

The TMA measures mold angle using a simple and traditional two-point measuring method. Troxler has used this concept to measure mold angle since the company started manufacturing the original Model 4140 Gyratory Compactor.

The two-point measurement uses a simple trigonometric function to calculate gyratory compactor mold angle. Because the TMA is secured to the frame of the compactor, the angle measured is net of frame deflection and therefore is the true mold angle. The result is that the TMA gives precise and accurate true mold angle measurements in a passive and independent manner.

The TMA method reasonably assumes that the mold wall is rigid and non-deformable under normal compaction loads. The mold wall is parallel to the centerline of the mold so that the measured angle is concurrent with the cylindrical axis of the mold and specimen during compaction.

Most importantly, the TMA is capable of isolating gyratory mold angle from other compaction variables. End plate or platen deflections and translations do not affect the measured angle. Mixture surface deflections and temperature variations do not skew the results. Therefore, compliance with AASHTO T312 §4.1 and §9.5 is easily ascertained and, if necessary, corrections to gyratory mold angles can be made reliably.

# UNPACKING AND INSPECTION

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Upon receipt of the TMA from the factory, perform a complete inspection and inventory. If the shipping carton and/or any other part or accessory appears damaged, notify the carrier and your Troxler Representative **immediately**.

## NOTE

**To ensure the safe return of the TMA to Troxler for repair or maintenance, please keep the original shipping box and all packing materials.**

Check the shipping carton for the following:

- ◆ Model 3191 TMA (PN 109861)
- ◆ Molded transport case (PN 900977)
- ◆ Cable assembly, power and door interlock (PN 109700)
- ◆ Serial cable (PN 106514)
- ◆ Manual of Operation and Instruction (PN 109903)
- ◆ CD-ROM, True Mold Angle software (PN 110080)

Inspect the outside surfaces of the TMA for damage.

## COMPONENTS

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Figure 1 shows the TMA and its components. Use the figure to locate and identify the parts described in the following paragraphs.

During compaction, the TMA's *LCD (liquid crystal display) display* shows the maximum, minimum, and average compaction angles, as well as the standard deviation of the measurements.

The *Reset* button clears the TMA memory and restarts the angle measurements and standard deviation calculations.

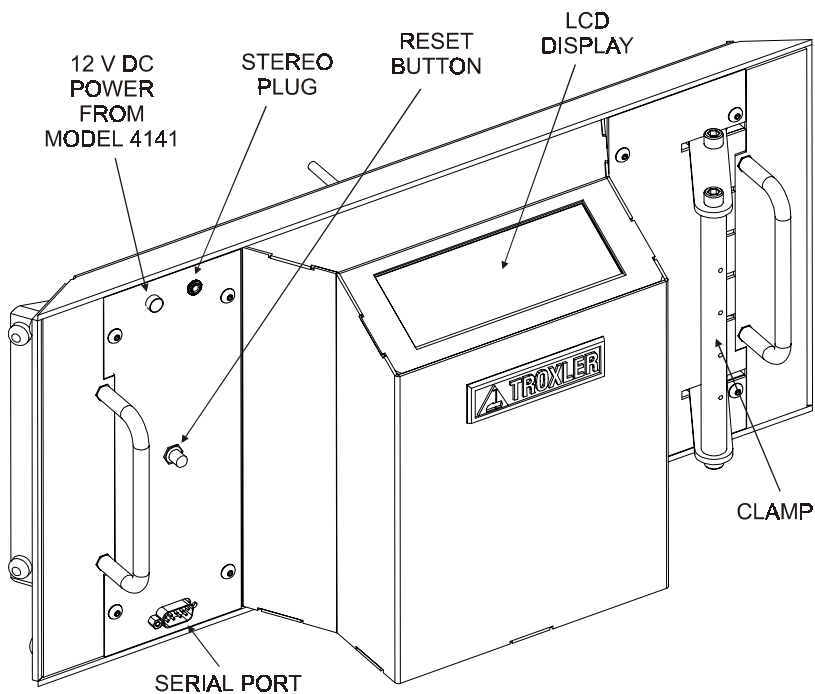
A cable assembly (not shown) provided with the TMA connects to the *12 V dc power and stereo plugs*. This assembly is made up of two cables and is used to connect the TMA to the Model 4141 Gyratory Compactor. The 12 V dc power cable connects the compactor's 12 V dc power supply to the TMA. Because the TMA is powered by the gyratory compactor, a separate power source is not necessary.

The stereo cable is used to bypass the safety interlock on the compactor door. For operator safety, the Model 4141 will not operate unless its door is properly closed, or the TMA device is in place with the stereo cable connected.

The spring-loaded *clamp* is used to secure the TMA in place on the compactor.

The *serial cable* (not shown) can be connected to the *serial port* to upload angle measurements to a PC using the TMA software provided with the unit.





*Figure 1. Model 3191 True Mold Angle Device*

## SETUP AND OPERATION

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This section describes how to use the TMA to monitor the gyration angle during the compaction of a hot mix asphalt specimen.

1. Prepare the asphalt specimen as described on page 4–3 of the Model 4141 *Manual of Operation and Instruction*.
2. Place the loaded mold into the Model 4141 compaction chamber.
3. Lift the TMA into place. Hook the fixed (left) end of the TMA around the left frame rail of the Model 4141.
4. Squeeze the spring-loaded clamp on the right end of the TMA, and push the TMA against the compactor's right frame rail. Release the clamp to secure the TMA in place.

### NOTE

**Ensure that the TMA does not rest on the compactor table.**

5. Connect the 12 V dc and stereo cables from the TMA (see Figure 1) to the appropriate connectors on the Model 4141 as shown in Figure 2.
6. If using the True Mold Angle software to upload angle data to a computer, connect the serial cable from the TMA to a serial port on the computer. Refer to page 8 for instructions on installing, starting, and using the software.
7. Compact the specimen as described on page 4–5 of the Model 4141 *Manual of Operation and Instruction*. During the compaction process, the TMA displays the maximum, minimum, and average measured mold angle, as well as the standard deviation of the measurements. This information is updated each gyration.

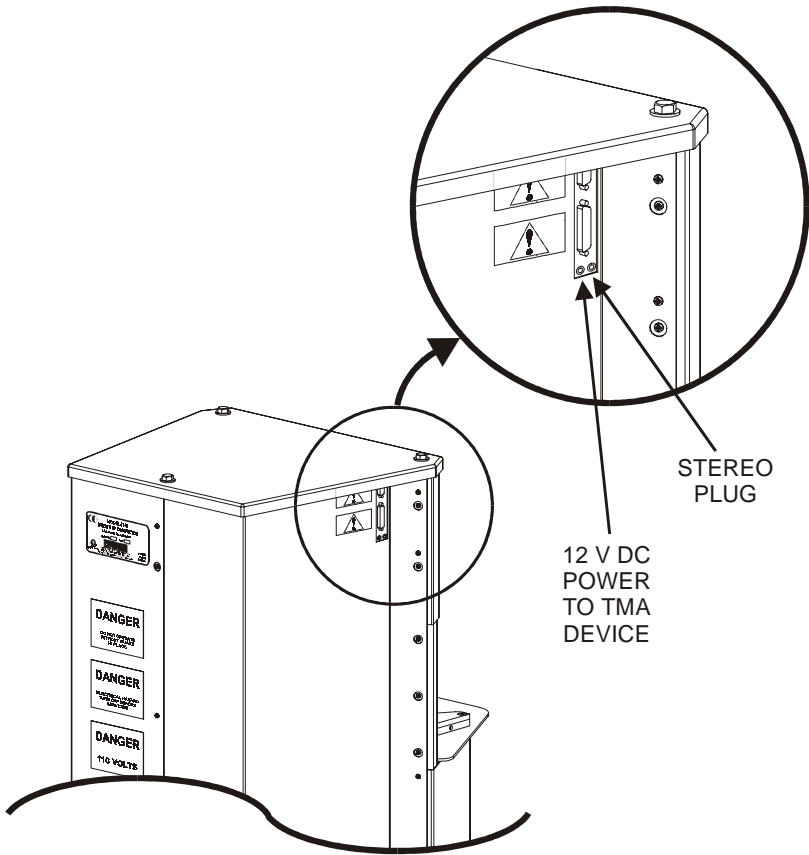
### NOTE

When processing an asphalt specimen, the average mold angle should be between 1.23° and 1.27°.

### NOTE

If excursion data is to be downloaded from the TMA to a computer, do not disconnect the 12 V dc and stereo cables from the compactor.

8. To remove the TMA from the compactor, disconnect the 12 V dc and stereo cables from the Model 4141. Squeeze the spring-loaded clamp on the right end of the TMA, and lift the TMA from the compactor.



*Figure 2. TMA Connections on the Model 4141*

# TRUE MOLD ANGLE SOFTWARE

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During a compaction cycle, the TMA measures the excursions of its upper and lower probes and uses these values to determine the gyration angle. Starting with the third gyration of the cycle, the TMA stores the excursion values and resulting angle for each gyration.

The True Mold Angle software supplied with the TMA is used to upload and store the excursion and angle data on a computer. The data is stored in a comma-delimited format, as shown in Figure 3.

The following sections provide instructions on the installation, setup, and use of the True Mold Angle software.

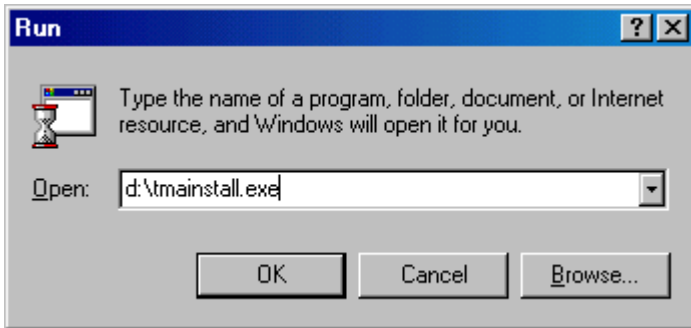
```
3,1.249,.000,6.092,.000
4,1.288,3.480,9.760,.000
5,1.286,3.476,9.748,.000
6,1.286,3.476,9.748,.000
7,1.284,3.480,9.744,.000
8,1.283,3.480,9.736,.000
9,1.284,3.480,9.740,.000
10,1.280,3.480,9.724,.000
11,1.279,3.488,9.728,.000
12,1.279,3.484,9.724,.000
13,1.279,3.484,9.724,.000
14,1.279,3.484,9.724,.000
15,1.278,3.484,9.716,.000
16,1.279,3.484,9.720,.000
17,1.279,3.484,9.724,.000
18,1.279,3.488,9.724,.000
19,1.277,3.488,9.716,.000
20,1.277,3.488,9.716,.000
21,1.278,3.488,9.720,.000
22,1.276,3.492,9.716,.000
23,1.276,3.492,9.716,.000
24,1.275,3.492,9.712,.000
25,1.277,3.492,9.720,.000
•
•
•
```

*Figure 3. Sample Data from TMA*

## **SOFTWARE INSTALLATION**

To install the True Mold Angle software:

1. Insert the True Mold Angle CD-ROM into the computer's CD-ROM drive.
2. From the Windows 95/98 desktop, click on the **Start** button in the taskbar.
3. Select **R**un. The dialog box shown in Figure 4 is displayed.
4. Type **d:\tmainstall.exe** (where *d:* is the letter designation of the CD-ROM drive) and then press the **<Enter>** key or click on the **OK** button. Follow the instructions on the screen.
5. The installation program adds a **Troxler** group to the Programs menu, with the program items: **TMA** and **Uninstall TMA**. The installation program also places a shortcut icon for the **TMA** application on the Windows desktop.



*Figure 4. Installing the True Mold Angle Software*

# STARTING THE TRUE MOLD ANGLE SOFTWARE

To start the True Mold Angle software, double-click on the **TMA** icon on the Windows 95/98 desktop or click on the **Start** button, select the **Programs** menu and the **Troxler** folder, and select the **TMA** menu item. The software briefly displays a copyright screen while loading. Upon completion, the software displays the *Main Menu* shown in Figure 5.

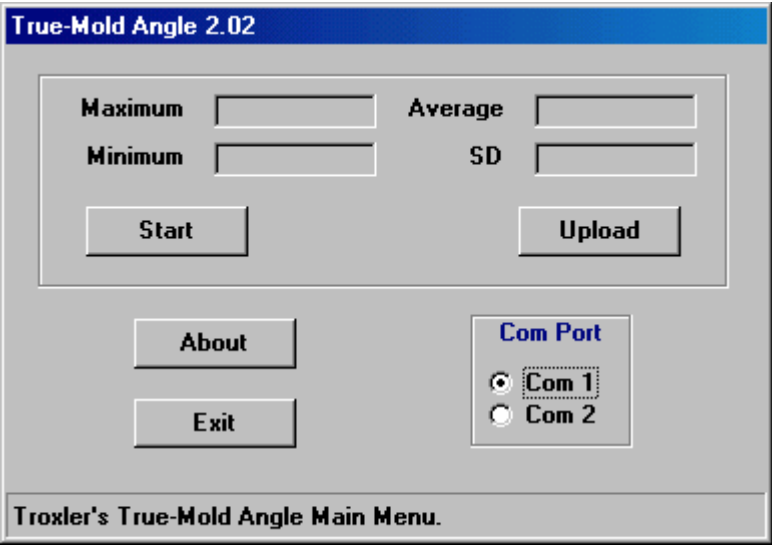


Figure 5. True Mold Angle Software Main Menu

## UPLOADING DATA

The True Mold Angle software can upload excursion data from the TMA into the computer either in real-time (during a compaction cycle) or after a compaction cycle is complete.

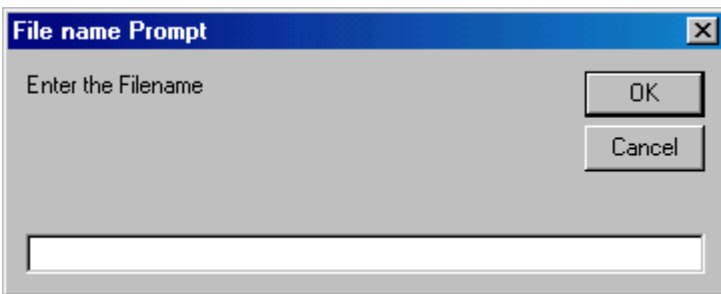
### **NOTE**

**The TMA stores only the angle data from the most recent compaction cycle. This data is available for uploading at any time until a new compaction cycle is begun or power has been removed from the TMA.**

## Uploading Data During Compaction

To acquire data from the TMA during a compaction cycle:

1. Click the **Start** button on the *Main Menu*. The software requests a file name as shown in Figure 6.
2. Enter a filename, followed by the extension *.txt*, but do not press the **<Enter>** key or click on the **OK** button.
3. Follow the directions on page 6 for operating the TMA while compacting the specimen. After the compactor has begun gyrating, press the **<Enter>** key or click on the **OK** button.
4. The command line at the bottom of the *Main Menu* displays **Initializing...**, then **Waiting for data...** During the compaction cycle, the software uploads excursion data from the TMA and writes this data into the filename entered in step 2.



*Figure 6. File Name Prompt*

## Uploading Stored Data

### NOTE

The TMA stores only the angle data from the most recent compaction cycle. This data is available for uploading at any time until a new compaction cycle is begun or power has been removed from the TMA.

To upload the excursion data stored in the TMA from the most recent compaction cycle:

1. Click the **Upload** button. The software requests a file name as shown in Figure 6.
2. Enter a filename, followed by the extension *.txt*, and then press the **<Enter>** key or click on the **OK** button.
3. The command line at the bottom of the *Main Menu* displays **Initializing...**, then **Collecting data... Please wait.** The software uploads the angle data from the TMA and writes this data into the filename entered in step 2 above.



# REPLACEMENT PARTS

Match the reference number (Ref #) shown below with the correct part in Figure 7 on the following page.

ITEM	BIN NO.	DESCRIPTION	QTY.
1	002492	STEREO JACK SOCKET	1
2	104663	SMALL TROXLER LOGO PLATE	1
3	107692	CABLE, LCD	1
4	108555	LOGIC PROBE, TMA, 319X	2
5	108835	LABEL, TRUE MOLD ANGLE	1
6	109550	ELECT. BOARD ASSY, TMA: 3191,1,2	1
7	109697	ANGLE SERIAL CABLE ASSY	1
8	109798	LOGIC PROBE BRACKET, TMA: 319X	1
9	109802	CLAMP PIVOT MOUNT, TMA: 3191	4
10	109804	COVER ASSEMBLY, TMA: 3191,1	1
11	109805	CROSSBAR, TMA: 3191,2	2
12	109807	RIGHT SIDE COVER, TMA: 3191	1
13	109809	PIVOT BAR, TMA: 3191,2	1
14	109822	LEFT SIDE COVER, TMA: 3191	1
15	109824	ALUMINUM HANDLE, TMA: 3191,1,2	2
16	109833	DIAL INDICATOR EXT, 3/16 x 2-1/4	2
17	109834	COIL SPRING, RHW, TMA: 3191,2	4
18	109852	DISPLAY BRACKET, TMA: 3191,1	1
19	109853	ELECTRONICS BRACKET, TMA: 3191,1	1
20	109854	RUBBER BUMPER, TMA: 3191,2	8
21	109855	BACKPLATE ASSEMBLY, TMA, 3191	1
22	109858	DELTRIN WASHER, TMA: 3191, 2	4
23	109859	CLAMP ARM, TMA: 3191	2
24	109911	CABLE ASSY POWER, RESET	1
25	000001-0200	LOCKWASHER #2 INT TOOTH SS	4
26	000061-1000	#2 HEX NUT SS	4
27	000106-1401	SCREW, 2-56 x .375 PHIL HD, SS	4
28	000406-4801	SCREW, 8-32 x .375 SHCS, SS	17
29	000406-4901	SCREW, 8-32 x .375 BHCS, SS	8
30	000420-4801	SCREW 8-32 X 1-1/4 SHCS SS	4
31	000806-4801	SCREW, 1/4-20 x .375 SHCS, SS	4
32	000812-4801	SCREW, 1/4-20 x .750 SHCS, SS	2
33	100-0003	HARDWARE KIT	1
34	108192-3191	LCD DISPLAY ASSY, TMA: 3191,1,2	1
35	27-5050	PUSH NUT FLAT-ROUND 3/8 OD	2
36	7607-1000	PUSH BUTTON BOOT	1
37	910-0434	#2 ROUND SPACER, 125", PLASTIC	4

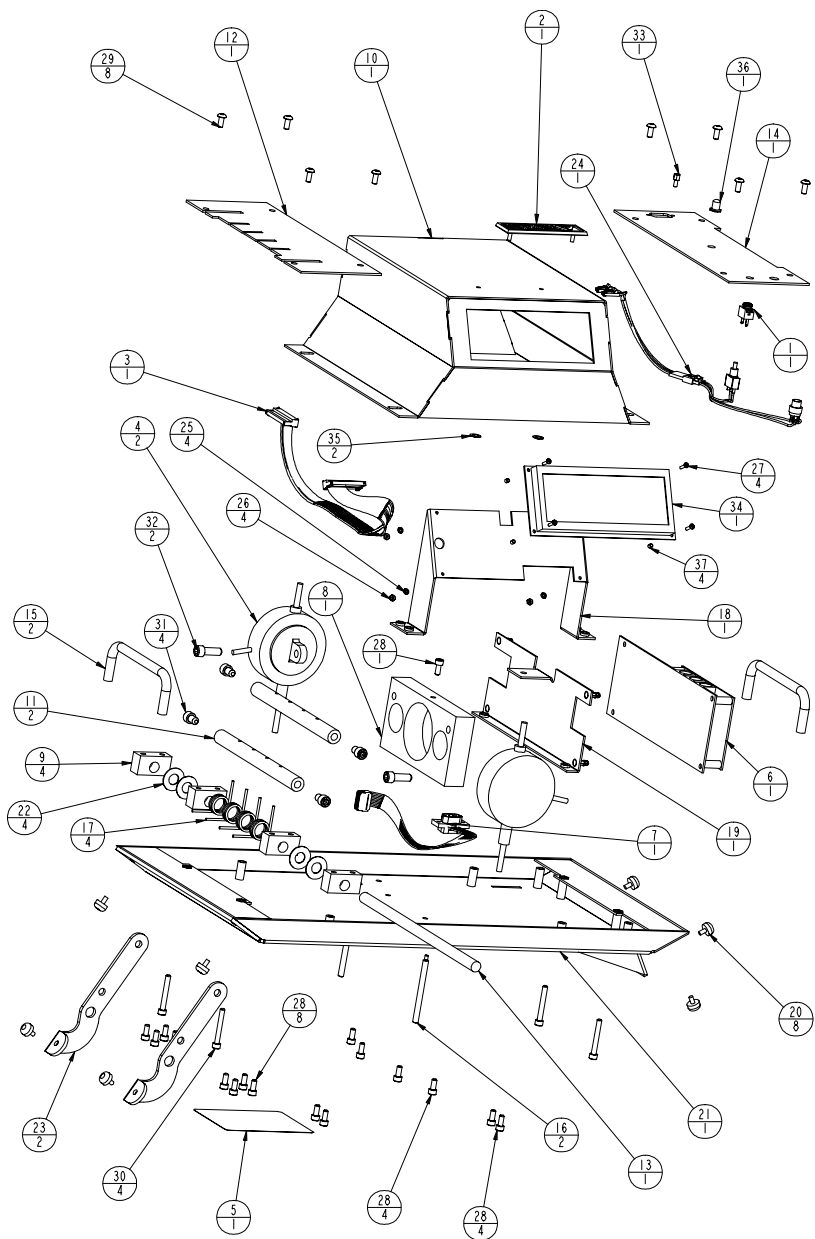


Figure 7. TMA Assembly Drawing

## RETURNING PARTS FOR SERVICE

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Items returned for service must be accompanied by an RGA (Returned Goods Authorization) number, and a description of the instrument and its problem. This information is used by Troxler shipping and service personnel to expedite the repair work.

To obtain an RGA number, please call or fax Troxler headquarters at Research Triangle Park, or one of the branch offices with your request (see list on page iii).

Please have the following information available when requesting an RGA number:

- Unit (or part) model and serial number.
- Part number/serial number (if applicable).
- Is the unit (part) still under warranty?
- Problem or difficulty you are having with the unit.
- Shipment method to Troxler and for return shipment.
- Shipping and billing address (not P.O. Box) – street address and zip.
- Phone number/contact (for questions from Troxler).
- Will estimate be required prior to performing any work on the part?
- Payment method: credit card, account number, or purchase order number. **All government agencies (city, county, state, and federal) must send purchase order numbers.**

### NOTE

**To prevent order duplication, if an order has been placed by telephone, please write “Confirming Order” on any follow-up written requests.**

# **SPECIFICATIONS**

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## **ENVIRONMENTAL CONDITIONS**

<b>Ambient Storage Temperature</b>	-55 to 85 °C (-67 to 185 °F)
<b>Ambient Operating Temperature</b>	10 to 50 °C (50 to 122 °F)
<b>Altitude Rating</b>	2000 meters maximum
<b>Humidity</b>	92% maximum

## **ELECTRICAL SPECIFICATIONS**

<b>Power Requirements</b>	12 V dc (supplied by the Model 4141 Gyratory Compactor)
<b>Serial Port:</b>	9-pin male D-subminiature connector

## **MECHANICAL SPECIFICATIONS**

<b>Size, Unit with Transport Case</b>	61L × 25W × 43H cm 24L × 10W × 17H in
<b>Weight</b>	3.6 kg (8lb)
<b>Shipping Weight, Unit with Packaging</b>	6.4 kg (14 lb)