



# SERVICE MANUAL

## *SHEX1619DG*

### *EXTREME ENVIRONMENT SHAKERS*



Ohaus Corporation 7 Campus Drive, Suite 310, Parsippany, NJ 07054, USA +1 973 377 9000





# SERVICE MANUAL

## *SHEX1619DG*

### *EXTREME ENVIRONMENT SHAKERS*



The information contained in this manual is believed to be accurate at the time of publication, but Ohaus Corporation assumes no liability arising from the use or misuse of this material. Reproduction of this material is strictly prohibited.

Material in this manual is subject to change.

© Copyright 2018 Ohaus Corporation, all rights reserved.  
TM Registered trademark of Ohaus Corporation.

**CHAPTER 1 GETTING STARTED**

1.1	Introduction .....	5
1.2	Definition of Signal Warnings and Symbols .....	6
1.3	Safety Precautions .....	7
1.4	Service Facilities .....	8
1.5	Tools and Test Equipment Required .....	9
1.6	Specifications .....	10
1.6.1	Admissible Ambient Conditions: Use only in closed rooms .....	11
1.7	Controls .....	12

**CHAPTER 2 TROUBLESHOOTING**

2.1	Troubleshooting .....	13
2.1.1	General Procedures for Troubleshooting .....	13
2.2	Problem Solver .....	14

**CHAPTER 3 MAINTENANCE PROCEDURES**

3.1	Preventive Maintenance .....	15
3.1.1	Preventive Maintenance Checklist .....	15
3.1.2	Replacement Part General Procedure .....	15
3.2	Opening the Extreme Environment Shaker .....	16
3.3	Replacing the Fuses .....	17
3.4	Replacing the Shaker Base .....	18
3.5	Replacing the Shaker V-Belt .....	19
3.6	Replacing the Motor Assembly .....	19
3.7	Reattaching the Red Feet .....	21
3.8	Replacing the Control Assembly .....	21

**CHAPTER 4 FINAL TESTING**

4.1.	Final Testing .....	21
4.2	Speed Calibration Test .....	21
4.3	HI-POT Test .....	21
4.4	Max Speed Load Test .....	22
4.5	Noise Test .....	23
4.6	Speed Accuracy and Timer Test .....	24

## 1.1 INTRODUCTION

This spare parts service manual contains the information needed to perform routine maintenance and service on the Ohaus Extreme Environment Shaker. Familiarity with the unit's Instruction Manual is assumed. The contents of this manual are summarized below:

**Chapter 1 Getting Started** – Contains information on service facilities, tools and test equipment, specifications, and the control functions of the Extreme Environment Shaker.

**Chapter 2 Troubleshooting** – Contains a diagnostic guide and error code table.

**Chapter 3 Maintenance Procedures** – Contains preventive maintenance procedures and disassembly, repair and replacement procedures.

**Chapter 4 Final Testing** – Contains a speed calibration test, HI-POT test, Max Speed Load Test, Noise Test, Speed Accuracy & Timer Test.

## 1.2 Definition of Signal Warnings and Symbols.

Safety notes are marked with signal words and warning symbols. These show safety issues and warnings. Ignoring the safety notes may lead to personal injury, damage to the instrument, malfunctions, and false results.

### Signal Words

**WARNING** for a hazardous situation with medium risk, possibly resulting in severe injuries or death if not avoided.

**CAUTION** for a hazardous situation with low risk, resulting in damage to the device or the property, loss of data, or minor injuries if not avoided.

**Attention** (no symbol)  
for important information about the product.

**Note** (no symbol)  
for useful information about the product.

### Warning Symbols



General Hazard



Electrostatic discharge sensitive



Electric Shock Hazard



Hot surface

### 1.3 Safety Precautions



**CAUTION:** Read all safety warnings before installing, making connections, or servicing this equipment. Failure to comply with these warnings could result in personal injury and/or property damage. Retain all instructions for future reference.

- AC mains powered:
  - Verify that the local AC power supply is within the input voltage range printed on the equipment's data label. - Only connect the AC power cord to a compatible grounded electrical outlet.
- Do not position the Extreme Environment Shaker such that it is difficult to disconnect the power cord from the power receptacle.
- Only run unit on a sturdy, clean work surface
- This equipment is intended for indoor use and should only be operated in dry locations.
- Operate the equipment only under ambient conditions specified in the user instructions.
- Do not operate the equipment in hazardous or unstable environments.
- Disconnect power from the equipment before cleaning or servicing the equipment.
- Service should only be performed by authorized personnel.
- Use electrostatic protection measures when handling the printed circuit board or any electronic components.
- Only use original replacement parts and accessories.
- Do not run the unit with any cracked or broken sample tubes or lids.
- Avoid cold starts: Unit is not designed to start after being in a cold room environment. Bring unit into cold room from a room temperature environment, operate and remove unit from cold room as soon as operation is complete.

#### **1.4 SERVICE FACILITIES**

To service an Extreme Environment Shaker, the service area should meet the following requirements:

- Should be temperature controlled and meet Extreme Environment Shaker specifications for temperature environmental requirements.
- Must be free of vibrations such as fork lift trucks close by or large motors.
- Area must be clean and free of excessive dust.
- Work surface must be stable and level.
- No lubrication or other technical user maintenance is required.
- Should be given care normally required for any electrical appliance.
- Avoid wetting or unnecessary exposure to fumes.
- Do not use a cleaning agent or solvent on the front panel which is abrasive to plastics.
- Always ensure the power is disconnected from the unit prior to any cleaning.
- Ensure the unit is plugged into the appropriate power source (120 or 230V)



## 1.5 TOOLS AND TEST EQUIPMENT REQUIRED

The service shop should contain the following equipment:

1. Standard hand tools.
2. Standard Electronics tool kit.
3. Soft, lint-free cleaning cloth and alcohol wipes
4. Anti-static bags, wrist strap, and mat for PCBs
5. Turn table
6. Small pliers
7. #1 and #2 Philips Head Screwdrivers
8. Small and large Flat Head Screw Drivers
9. 7/16" Nut Driver
10. Loctite (#248, #242)
11. 3/16" Hex Key
12. Adjustable Wrench
13. Hook force dial gauge
14. Hand drill
15. Manual torque driver (set at 28 inch pounds)
16. Test chamber
17. Tests Weights (5 lbs / 2.3 kg, 16lbs / 7.3 kg, 35 lbs / 15.9 kg)
18. Test mat with double sided tape
19. Digital Photo Tachometer
20. Stop watch
21. Safety Glasses
22. Gloves (Rubber, Latex, or similar material)
23. Cotton Swabs
24. 230V Power Source (California Tester Power Supply or equivalent)
25. Megger 230315 HIPOT Insulation Tester or equivalent.

## 1.6 SPECIFICATIONS

**Shaker dimensions LxWxH:** 11.5 x 13.9 x 5.8" (29.2 x 35.3 x 14.7 cm)

**Remote dimensions LxW:** 13 x 11" (33 x 27.9cm)

**Electrical (50/60 Hz)** 120 volts: 0.5 amps, 30 watts  
230 volts: 0.3 amps, 35 watts

**Fuses:** 5mm x 20mm, 5 amp quick acting, 250V

**Speed Range:** 15 to 500 rpm

**Speed Accuracy** Above 100rpm:  $\pm 1\%$  of set speed  
Below 100rpm:  $\pm 1$ rpm

**Orbit:** 0.75" (19mm)

**Capacity:** ~35lbs (16kg) @ 75 rpm  
~5lbs (2.3kg) @ 500 rpm

**Timer:** 1 second to 160 hours

**Controls:** See section 1.7

**Ship Weight:** 49lbs (22.2 kg)

### 1.6.1 Admissible Ambient Conditions: Use only in closed rooms

Indoor use only.

Altitude	0 to 6,562 ft (2000 M) above sea level.
Temperature range	Shaker: -10°C to 60 °C (14° to 140°F) Controller: -10 °C to 50 °C (14° to 122 °F)
Non-Operating Temperature Range	-20 to 65 °C (-4 to 149 °F)
Atmospheric humidity	Maximum 100% relative humidity, condensing
Non-Operating Humidity	Maximum 80% relative humidity, non-condensing
Installation Category	II
Voltage fluctuations	Mains supply voltage fluctuations up to +/- 10% of the nominal range
Over voltage category	II
Pollution degree	2
Power load	35W
Current consumption	0.5 A (120V) or 0.3 A (230V)
Power supply voltage	108 V – 132 V or 207 V – 253 V
Power line fuse	5mm x 20mm, 5 Amp Fuse

## 1.7 CONTROLS

### Control Panel - Digital Extreme Environment Shaker

The front panel of the Extreme Environment Shaker contains all the controls and displays needed to operate the unit.

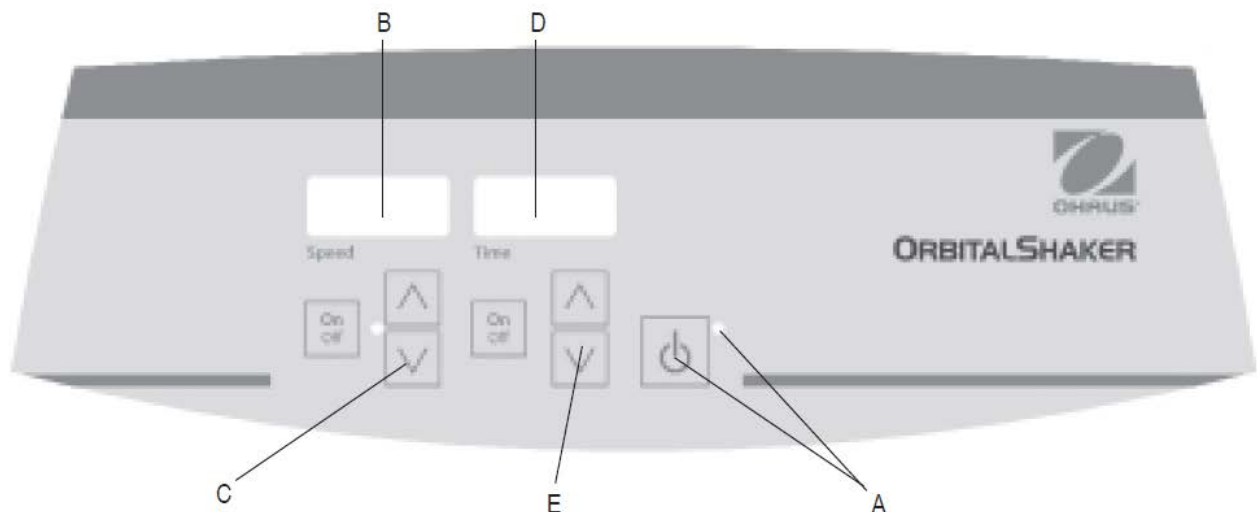
A. Standby button/standby indicator light: The standby indicator light will illuminate when the unit is plugged in. The unit will be in standby mode. Press the standby button to start the speed and time functions. The standby indicator light will shut off. Press the standby button again and the unit will once again be in standby mode.

B. Speed display: Displays the speed of the shaker.

C. Up/down arrows: For set-point control. On/off button starts/stops shaking function.

D. Time display: Displays accumulated time (continuous mode) or how much time is remaining (timed mode). The display range is from 0 to 9,999 minutes in one (1) second increments. The display will indicate minutes and seconds until the timer reaches 99 minutes and 59 seconds (99:59), then the display will automatically display minutes up to 9,999.

E. Up/down arrows for setpoint control. On/off button starts/stops the timer function.



## 2.1 TROUBLE SHOOTING

This section of the manual contains troubleshooting information. To isolate specific problems, use Table 2-1, Problem Solver. Follow all directions step by step. Make certain that the work area is clean. Handle Extreme Environment Shaker components with care. Use appropriate Electro-Static Protection Devices.

### 2.1.1 General Procedures for Troubleshooting

1. Do the most obvious, user-level remedies.
2. **Visual Check:** Examine the tray for signs of bending, twisting or corrosion.
  - Clean the unit and operating table before evaluating any mechanical problems. Remove any debris inside the Housing.
  - Examine the Housing for dents
  - Examine the tray for corrosion due to high humidity or exposure to chemicals.
3. Check that internal parts are clean and free of debris.
4. Use the Problem Solver (Table 2-1) to locate the symptom. Follow the suggested remedies in the order they appear.
5. Check the cables leading to the PCBs for cuts, abrasions or other signs of excessive wear and tear
6. Replace all damaged parts. See Spare Parts list.

If a problem arises that is not covered in this manual, contact Ohaus: [www.ohaus.com](http://www.ohaus.com).

## 2.2 PROBLEM SOLVER

TABLE 2-1. PROBLEM SOLVER		
Symptom	Possible Cause	Remedy
Unit will not run	Blown fuse	Add or replace fuse as necessary. If problem persists, replace the control assembly. If problem persists, contact your Ohaus representative for repair.
Unit is excessively noisy	Sensor fan misaligned Motor misaligned	Ensure that tray is secured tightly. Replace the Motor Assembly if misaligned. If problem persists, contact your Ohaus representative for repair.
Unit not shaking at proper speed.	Speed is not properly calibrated.	Perform speed calibration test on section 4.2. If problem persists, contact your Ohaus representative for repair.
E3	Mechanical obstruction Drive system failure Ceased bearing Drive belt broken	Remove and replace mechanical obstruction. If the drive system has failed, replace the entire shaker base. If the problem persists, contact your Ohaus representative for repair.
E4	Improper positioning of load Maximum load exceeded.	Ensure the load is evenly distributed and does not exceed the maximum load capacity for the unit. If problem persists, please contact your Ohaus representative for repair.
Unit is shaking irregularly.	There is a damaged mechanical part inside the unit.	Inspect the belt and set to proper tension or replace if necessary. If problem persists, replace the shaker base. If problem persists, replace the motor assembly. If problem still persists, replace the control assembly.
Unit does not show the display and beeps upon start up.	PCB or PCB connections are damaged.	Reconnect wires and connections to the main PCB. If problem persists, replace the control assembly.
Timer is imprecise.	PCB is dysfunctional.	Replace the control assembly.
Decorative red foot has fallen off the unit.	Feet were damaged from use or transportation of the unit.	See "Reattaching the Red Feet" in section 3.7. If the foot is lost or cannot be fastened properly, the unit will still be functional. The feet are for aesthetic purposes only.

### 3.1 PREVENTIVE MAINTENANCE

Extreme Environment Shakers should be carefully handled, stored in a clean, dry, dust-free area, and cleaned periodically. Follow these precautionary steps:

- When an Extreme Environment Shaker has had chemicals or liquids spilled on it, all exterior surfaces should be cleaned as soon as possible with a damp cloth.
- Do not leave a sample on the Extreme Environment Shaker when it is not in use.

#### 3.1.1 Preventive Maintenance Checklist

The Extreme Environment Shaker should be inspected and checked regularly, as follows:

1. Remove the mat to inspect and clean the area around the tray.
2. Clean the outside using a damp cloth.



#### **CAUTION**

**DO NOT USE CHEMICAL CLEANERS OR SOLVENTS OF ANY TYPE. SOME CLEANERS ARE ABRASIVE AND MAY AFFECT THE FINISH.**

3. Check the Power Cord for broken or damaged insulation.
4. Make a visual inspection for faulty connectors, wiring, and loose hardware.

#### 3.1.2 Replacement Part General Procedure

1. Be aware of tool and Loctite requirements for each step. The listed tool is typically the tool used for assembly of the unit, it may be easier to use other tools for disassembly.
2. It may be necessary to use the heat gun to loosen Loctite bonds present on most hardware
  - Do not use the heat gun / soldering iron around plastic parts such as the top and bottom housing of the unit. More direct heat can be applied to hardware in these areas if necessary.
  - Be aware of overheating or unintentionally loosening Loctite bonds other than those required.
3. After a part is replaced, some steps for reassembly of the unit are shown. If a step in reassembly is not shown, reassemble the unit using the reverse procedure of disassembly.

4. If a part requires multiple screws for reassembly, it is recommended to hand tighten all screws before using a torque driver to secure them into place. Torque to the maximum torque of the specified torque driver unless otherwise stated.
5. After reinstalling the replacement part(s) perform all the final tests in Chapter 4 to confirm the spare parts were installed correctly and the unit is completely functional.
6. Parts or assemblies may be updated without any updates to this manual. Always inspect the unit before disassembly for any major changes and reassemble accordingly.

### **3.2 OPENING THE EXTREME ENVIRONMENT SHAKER**

Common hand tools are sufficient to disassemble the Extreme Environment Shaker. Turn the Extreme Environment Shaker off and unplug the power cord before you begin.

**Warning: Disconnect from power supply and allow the Extreme Environment Shaker to cool!**



**Use electrostatic protection when servicing!**

Electrostatic damage is difficult to detect, because the faults it causes are not clear-cut. To avoid electrostatic damage during production, conducting floors, controlled air humidity, and EMC mats are used. When servicing the unit it is also advisable – as soon as the instrument is opened – to neutralize electrostatic charges.

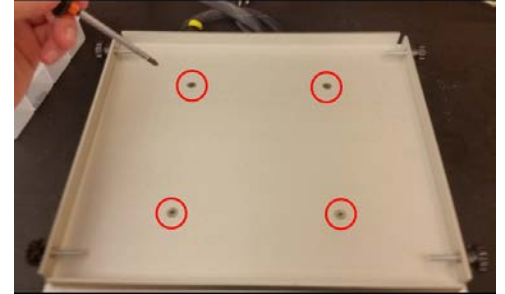


### 3.2 OPENING THE EXTREME ENVIRONMENT SHAKER (cont)



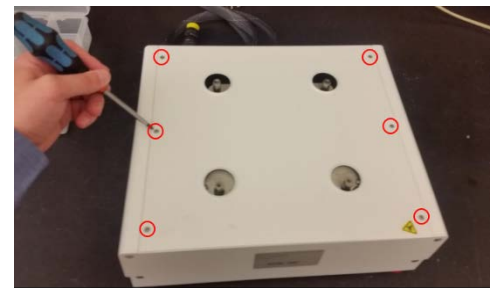
Step 1

1. Remove the black mat from the top plate of the unit.



Step 2

2. Remove 4 screws on the tray using a #2 Philips Head Screw Driver. Apply Loctite #242 when reinstalling.



Step 3

3. Remove 6 screws from the top plate using a #2 Philips Head Screw Driver. Apply Loctite #242 when reinstalling.

### 3.3 REPLACING THE FUSES

1. Locate the power supply on the back of the control assembly and then use a flat head screw driver to pry open the fuse drawer. Replace the blown fuses with the spare fuses and then reinsert the fuse drawer.



3.3: Step 1

### 3.4 REPLACING THE SHAKER BASE

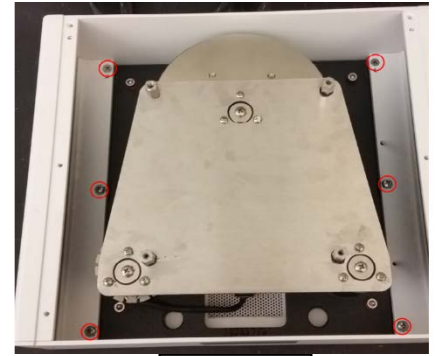
1. Complete all 3 steps in section 3.2: Opening the Extreme Environment Shaker.

2. Remove six screws from inside the unit as shown using a #2 Philips Head Screw Driver. The front, back, and side panels can now be displaced. Apply Loctite #242 when reinstalling.

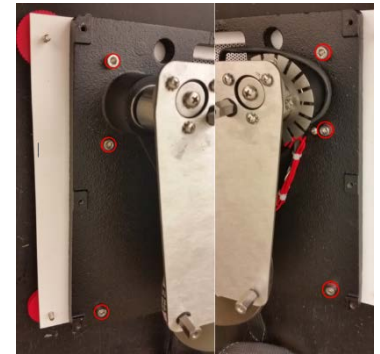
3. Remove six screws from the shaker base using a 3/16" Allen key. Apply Loctite #242 when reinstalling.

4. Remove six screws (four on the rubber feet) from the back of the unit using a #2 Philips Head Screw Driver.

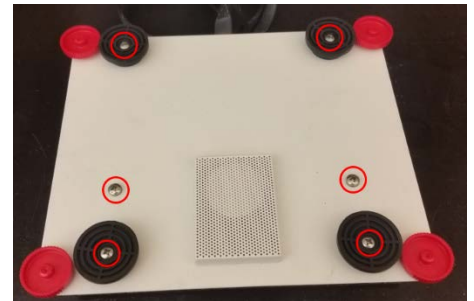
5. Replace the old shaker base with the replacement shaker base. Reassemble the unit using the reverse procedure of disassembly.



Step 2



Step 3



Step 4



Step 5

### 3.5 REPLACING THE SHAKER V-BELT

1. Complete steps 1-2 in section 3.4: Replacing the Shaker Base.

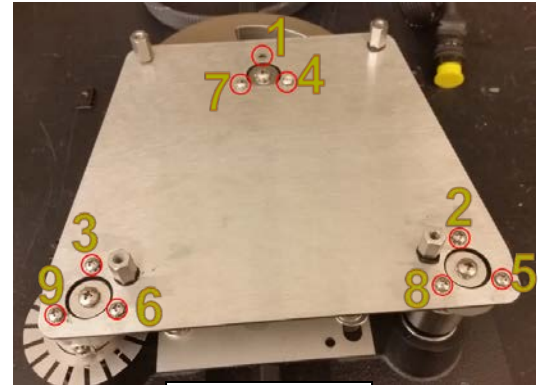
2. Remove 9 screws from the midplate on the shaker base using a Philips Head Screw Driver. When reinstalling, use Loctite #248 and torque to 28 inch pounds. Install the screws in the order shown by the yellow numbers.

3. Use a 7/16" Nut Driver or an adjustable wrench to loosen the two hex screws securing the motor assembly until the belt is loose enough to pry off.

4. Insert the replacement belt and then tension the V-belt to 8 pounds. Use the hook force dial gauge on the hole in the motor plate and apply force with the wrench until the gauge reads 8 pounds.

### 3.6 REPLACING THE MOTOR ASSEMBLY.

1. Complete steps 1-3 on section 3.5: Replacing the Shaker V-Belt. Completely remove the hex screws on step #3.



3.5: Step 2



3.5: Step 3



3.5: Step 4



3.6: Step 1

2. Remove two screws on the shaker base that are on the clamps securing the motor's wires using a Philips head screw driver. Apply Loctite #242 when reinstalling.

3. Remove two screws from the sensor bracket in order to displace it from the shaker base using a Philips head screw driver. Apply Loctite #242 when reinstalling.

4. Remove two screws from the sensor bracket to release the reed sensor using a Philips head screw driver. Apply Loctite #242 when reinstalling.

5. Replace the old motor assembly with the replacement motor assembly. Use the reverse process of disassembly to reassemble the entire unit. See section 3.5, Step #4 to tension the shaker belt correctly.



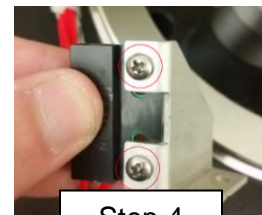
Step 2A



Step 2B



Step 3



Step 4

### 3.7 REATTACHING THE RED FEET.

1. Hand tighten the red aesthetic feet by rotating them clockwise into the unit. If the red feet cannot be reattached, the unit will still be functional.



Step 5

### 3.8 REPLACING THE CONTROL ASSEMBLY.

1. Detach the motor assembly from the control assembly and then replace the defective control assembly with the replacement part.



3.8: Step 1



3.7: Step 1

## 4.1 FINAL TESTING

After and during the servicing of the Extreme Environment Shaker, various performance tests should be done to determine if the unit meets specifications. Tests 4.3-4.6 are to be completed after replacing a spare part. The speed calibration test is only necessary if referenced on the Problem Solver Table (Table 2-1).



### NOTE:

Make sure the test area is free from drafts and the surface the Extreme Environment Shaker rests on is level and vibration-free.

## 4.2 Speed Calibration Test

1. Turn unit on. Speed and time displays will be illuminated.
2. Press and hold the standby button and momentarily press the speed on/off button. The speed display should read "CAL".
3. The unit will run for approximately one (1) minute and automatically calibrate.

## 4.3 HI-POT Test (Mandatory)

1. Verify the Hi-Pot Tester is in the 'OFF' position and the TESTER GROUNDED indicator is 'ON', the LEAKAGE SENSITIVITY CONTROL is in the '12MA' position, the GROUND CHECK/BYPASS switch is in the 'GROUND CHECK' position, and the meter reads '0 VOLTS'.
2. Plug the unit to be tested into OUTPUT plug located on the front of the Hi-Pot Tester.
3. Press the CONT push button, the HV ON indicator should come "ON".
4. Slowly increase the VOLTAGE CONTROL knob to '1400' volts. This potential must be maintained for two seconds with any failure conditions (there is an audible buzzer and FAILURE indicator that will indicate a failure condition).
5. Press the HV OFF push button, the HV ON indicator should go "OFF".
6. Adjust the VOLTAGE CONTROL knob to the "0" position.
7. Press the On/Off rocker switch to the "Off" position.
8. Disconnect black RETURN test probe.
9. The AC Hi-pot testing of the unit is now complete and the unit can be disconnected from the tester. If a failure condition occurs, the source of the failure must be corrected and the proper production records maintained. If no failure condition occurs, the unit has passed this test and the proper production records must be maintained.



#### 4.4 Max Speed Load Test

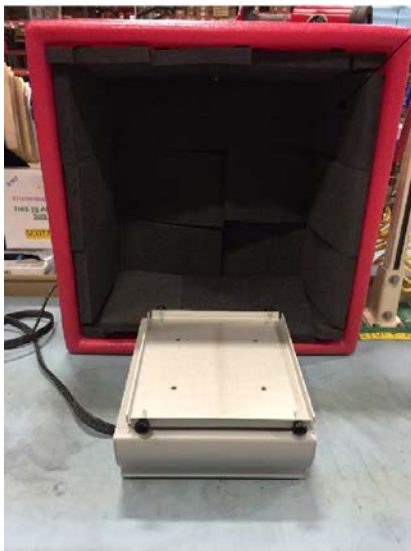
1. Secure each weight with the thumbscrews while running the unit at the following specifications:
  - a. 35 lbs for 2 hours @15 RPM
  - b. 16 lbs for 1 minute @500 RPM
  - c. 5 lbs for 1 minute (@ any RPM)

Secure each weight  
with Thumbscrew.



## 4.5 Noise Test

1. Place unit inside the test chamber as shown in Picture #1. If unit fails the noise test, set the entire unit aside for root cause analysis using Table 2-1.
2. Set unit to 500 RPM, with no load as shown in Picture #2.
3. Cover unit completely as shown in Picture #3. Make sure that no other units are running on the same workbench and that all four sides of the test chamber are seated against the surface of the table.
4. Turn the sound monitor to the "ON" position.
5. Give the sound monitor about 1 minute for the decibel to stabilize. If the level on the monitor is 90.0 or above, then the unit is too noisy and should be turned back for repair. If the decibel level is 89.9 or below, then the unit has passed the sound test.
6. Plug the unit into the appropriate electric source (230 units use a California Tester Power Supply or equivalent and are run at 50Hz).
7. Remove the rubber mat and set it aside until testing is complete.



PICTURE 1



PICTURE 2



PICTURE #3

## 4.6 Speed Accuracy and Timer Test

1. Set the speed to 15 RPM and press the speed on/off button to start the shaker. Allow unit to run for 10 minutes and verify no errors occur. Measure the speed using the photo tachometer and record the results.

Pass Requirements: 15 RPM +/- 1 RPM

2. Set the speed to 100 and allow the unit to run for 2 minutes. Again, verify that no errors occur. Ensure the unit does not make a knocking sound during these tests. Measure the speed using the photo tachometer and record the results.

Pass Requirements: 100 RPM +/- 1 RPM

3. Set the speed to 500 and allow the unit to run for 2 minutes. Again, verify that no errors occur. Ensure the unit does not make a knocking sound during these tests. Measure the speed using the photo tachometer and record the results.

Pass Requirements: 500 RPM +/- 5 RPM

4. Set the unit back to 15 RPM and wait for the tray to slow down. Leave the unit shaking and set the timer to 10 seconds. Press the on/off button for the timer and verify that when the timer counts down, the tray stops and the unit beeps.

5. Press the up and down arrows simultaneously to reset the timer to read "0".

6. Using the remote, set the shaker to 30 RPM.

7. Let shaker run for 24 hours.

8. After 24 hours, ensure unit is still shaking and all the displays are working properly.

9. Turn off shaker and remove from incubator. Place mat on w/adhesive.

