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Appendix

Calibration Procedure
This manual contains comprehensive information about the operation and maintenance of the BM570 Gyratory Compactor.

Please take the time to read this manual as it contains information on the installations, maintenance and use of the BM570.

This manual is aimed at general users of the BM570, including Lab Technicians, Maintenance Technicians and Technical Users.

This manual should be strictly observed. Impact Test Equipment accepts no liability for damage caused by disregarding the information contained in this manual or other related documents.

For more information contact Impact Test Equipment – www.impact-test.co.uk
## Glossary of Terms, Abbreviations and Definitions

<table>
<thead>
<tr>
<th>Abbreviations</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>EN</td>
<td>European Norm</td>
</tr>
<tr>
<td>kPa</td>
<td>Kilo Pascal</td>
</tr>
<tr>
<td>cfm</td>
<td>Cubic Feet/Min.</td>
</tr>
<tr>
<td>mm</td>
<td>Millimetres</td>
</tr>
<tr>
<td>Hmin(mm)</td>
<td>Defined in the Standard</td>
</tr>
<tr>
<td>mPa</td>
<td>Mega Pascal</td>
</tr>
</tbody>
</table>
## Typographical Conventions

<table>
<thead>
<tr>
<th>Icon</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Caution Icon" /></td>
<td>This icon denotes a caution, which advises you of precautions to take to avoid injury to equipment or loss of data.</td>
</tr>
<tr>
<td><img src="image" alt="Info Icon" /></td>
<td>This icon denotes a note, which alerts you to important information, further information in this document or other sources such as manuals, data sheets, literature etc.</td>
</tr>
<tr>
<td>Bold</td>
<td>Bold text indicates a reference to a physical or software control, or a user interface screen.</td>
</tr>
</tbody>
</table>
**Product Overview**

This section provides an overview of the BM570

**General Description**

The gyratory compactor is the third series of gyratory compactor. It is specifically designed to meet the EN and AASHTO requirements, be high quality and user friendly.

The gyratory motion is generated with a precise eccentric which is factory calibrated to $0.82^\circ \pm 0.02^\circ$ (note: the BM570 can be set to achieve angles outside of this range). Speed of gyration is accurately controlled with an inverter and is accurate to greater than 0.5 rpm.

Load is applied with a 160mm diameter pneumatic cylinder and each compaction load controlled with a pressure regulator. The pneumatics has a switchable pressure so that 600kPa can be achieved for both 100mm and 150mm specimens. The specimen height is measured with a 250mm stroke linear transducer.

Test software allows the user to select compaction methods based on achieving a target density, or specified number of gyrations. The number of gyrations, compaction depth and density are logged to disc and displayed on screen. Percentage void content is calculated and displayed on screen.

The desktop PC is connected to the gyro through a high speed Ethernet connection.

Emulsion mixtures can be compacted using perforated moulds.
### Machine Elements

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Part Description</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Main Actuator</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>Mould Extruder</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>Front Control Panel</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>Top Safety Door</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>Bottom Safety Door</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>Air Inlet Regulator</td>
<td>1</td>
</tr>
<tr>
<td>7</td>
<td>Mould Retaining Bar Locking Pin</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>Mould Retaining Bar</td>
<td>1</td>
</tr>
<tr>
<td>9</td>
<td>Main Ram</td>
<td>1</td>
</tr>
</tbody>
</table>
## Controls

### Front Panel

1. **Air pressure gauge**
2. **Safety reset button**
3. **Power on/off button**
4. **Mould extractor raise/lower switch**

### Mould Extractor

5. **EMERGENCY STOP push button**

### Right hand side

6. **Pressure regulator switch**

### Back panel

7. **Main isolator**

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Part Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Air pressure gauge</td>
</tr>
<tr>
<td>2</td>
<td>Safety reset button</td>
</tr>
<tr>
<td>3</td>
<td>Power on/off button</td>
</tr>
<tr>
<td>4</td>
<td>Mould extractor raise/lower switch</td>
</tr>
<tr>
<td>5</td>
<td><strong>EMERGENCY STOP</strong> push button</td>
</tr>
<tr>
<td>6</td>
<td>Pressure regulator switch</td>
</tr>
<tr>
<td>7</td>
<td>Main isolator</td>
</tr>
</tbody>
</table>

Revision: Issue 4                                      Date: January 2013
Installation

This section describes the basic tasks that must be carried out when the machine is first installed, moved to a new location or if the software needs to be installed.

Location

The machine should be located in a dry and adequately ventilated room. To ensure efficient operation, it must not be placed in direct sunlight or against heat-emitting surfaces. The machine should be conveniently located to allow access all round.

Warning: be aware that cables may be stretched across the path when moving items around. To avoid hazards of this type, place a mat or a cable cover over the wire and tubing.

Electrical Supply

Warning: the following operations should only be carried out by suitable qualified staff.

The machine requires a 220-240V A.C. 50Hz supply, protected at 13A.

The detachable cord supplied with this appliance has 3 cores for use with single phase supply with neutral and earth.

The wire in the mains lead are coloured in accordance with the following code:

<table>
<thead>
<tr>
<th>Wire colour</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Green/Yellow</td>
<td>Earth</td>
</tr>
<tr>
<td>Blue</td>
<td>Neutral</td>
</tr>
<tr>
<td>Brown</td>
<td>Live</td>
</tr>
</tbody>
</table>

Note: the colours of the wires in the mains lead of this appliance might not correspond with the colour marking identifying the terminals in the wall socket.

Note: it is not recommended that the compactor is powered from a supply that contains a RCD. Use of a RCD might result in the supply tripping when the machine is switched on.
Pneumatic Supply

Warning: the following operations should only be carried out by suitably qualified staff.

The machine requires a pneumatic supply with a minimum pressure of 6bar, maximum 10bar. 7bar is required to achieve test load on 150mm diameter specimen, 10cfm. The machine is supplied with 8mm tubing for connection to the compressed air supply. The supply should be attached to the Air Inlet Regulator.

Software Installation

It is important to ensure the software is installed before the NI software. Contact us for assistance.

Connect the USB from the PC to the machine, if the PC pops up with a window asking to install new hardware then insert the disc provided which is labelled ‘BELKIN Gigabit USB 2.0 Network adapter’ and follow these steps:

- Follow the steps in the install wizard, once complete a new local area network connection will be available.
- Open ‘network connections’ which can be accessed through the settings part of the windows start menu.
- Locate the new connection and right click, and select properties. The window below should appear, ensure ‘Belkin F5D5055’ is in the text box in ‘Connect using’.
- Highlight ‘Internet Protocol (TCP/IP)’ and click the properties button.
- Select ‘use the following IP address’ and enter the values shown below:

![Internet Protocol (TCP/IP) Properties]

- Click ‘OK’ once the values have been entered to confirm.
**Operation**
This section describes how to use the compactor and its software to perform a compaction.

**Start up the Compactor**
The compactor is controlled by the PC which should be positioned to the right hand side of the machine. To turn on the machine and start the software follow this procedure:
1. Ensure the machine is connected to the electrical and pneumatic supplies.
2. Turn the isolator switch on the rear panel to the “I” position.
3. Turn the red knob on the air inlet to the “SUP” position. Ensure the pressure gauge reads 0.6mpa minimum. If the pressure is reading less than this pull the centre black knob up and ensure it is fully open.
4. Press the power button on the front panel.
5. Connect the USB to the machine and PC.
6. Turn on the PC and wait for windows to load.

**Load the software**
Click **Start >> All Programs >> CRT >> Gyratory Compactor**. The following screen will appear. The system check panel and calibration factors are for use by service engineers only.

**Performing a compaction**
To perform a compaction click **Compaction**. The following screen will appear.

**Note:** you can return at any point by clicking **Previous**.
1. Open the bottom safety door by rotating the knob and pulling the door towards you. Open the top safety door by lifting up until the magnets hold the door in place.
2. Open the mould retaining bar by lifting the retaining pin up and pulling the bar towards you.
3. Place the bottom platen into the bottom of mould. We recommend paper disks are placed between platens and material. **Note:** the 100mm bottom platen should be inserted such that the smaller diameter is towards the bottom.
4. Place a known mass of material into the mould.
5. Position top platen on top of the material.
6. Select compaction type (either number of gyrations, target density or target height).
7. Enter specimen reference (this number can be made up of any alphanumeric characters).
8. Select data file path by clicking on the file icon. Test data is stored by default in **"C" drive >> gyroratory compaction >> gyroratory data.**
9. Enter mould diameter either 100mm or 150mm.
10. Select the test type (EN 12697-31 Specimen preparation, EN 12697-31 Void Content analysis, or AASHTO T312-09).
11. Enter the material mass.
12. For EN 12697-31 Void Content analysis, enter hmin(mm).

Click next. The following screen appears:
Select the correct pressure for size of mould by turning the pressure regulator on the right hand side of machine to either **Low** for 100mm moulds or **High** for 150mm moulds.

Follow the on screen instructions:
1. Insert mould into machine.
2. Close mould retaining bar and ensure locking pin is pushed fully down.
3. Close the safety doors. Top door first then bottom door.
4. Press begin compaction when ready to start compaction.

**Note:** you can return to the test setup screen by clicking **back to setup**.

Press the safety reset switch on the front panel. The switch light turns from red to green and compaction begins: mould locks in place and main ram comes down.

**Note:** test data is plotted every 5 x gyrations.

When compaction is finished the main ram will raise and the mould is released. Open the safety doors, open the mould retaining bar and slide the mould out of the machine.

**Mould Extraction**

1. Slide the mould over the mould extraction ram. Ensure it seats under the retaining rim.
2. Turn the mould extraction switch to the up position. The mould will be extracted.
3. After the mould has been extracted turn the switch back to the down position.
**maintenance**

This section contains details on general and routine maintenance of the BM570.

**Warning:** the following operations are to be carried out by skilled staff only.

---

**Maintenance Schedule**

**Note:** the following maintenance should be carried out by skilled staff. For further information regarding maintenance contact Impact.

<table>
<thead>
<tr>
<th>ID</th>
<th>Interval</th>
<th>Description</th>
<th>Ref</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Daily</td>
<td>Ensure any foreign objects that may have fallen into the tray, crevices etc. are removed</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Daily</td>
<td>Check control panel warning lights</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Weekly</td>
<td>Visually check the hydraulic oil reservoir, if low top up and check for leaks</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Weekly</td>
<td>All tubing and fittings on the pneumatic circuits to be checked for leaks and rectified accordingly</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Weekly</td>
<td>Lubricate the main ram using a light oil eg. WD40</td>
<td>MP1</td>
</tr>
<tr>
<td>6</td>
<td>3 months</td>
<td>Service the motor</td>
<td>MP2</td>
</tr>
<tr>
<td>7</td>
<td>Yearly</td>
<td>Change air inlet filters</td>
<td></td>
</tr>
</tbody>
</table>

**MP1 - Service the motor**

Before any intervention, the motor, auxiliary circuits and/or accessories must be disconnected from the mains.

In particular:

- Check disconnection from the electrical mains.
- Provide suitable protections from exposed live parts.
- Double check that accidental restarts are not possible under any circumstances.

It is recommended that periodical checks of motor operating conditions are scheduled as a routine maintenance practice.

Check particularly on the following:

1. Check that operation is smooth and absorbed current within rated value.
2. Keep motor clean and fan cowl unobstructed by accumulation of dust or foreign particles.
3. Check that seal rings are in good condition.
4. Check that lead-in wires and all wirings are safely and tightly secured.
5. If condensate draining holes are provided, remove periodically the screws that close the holes and allow the condensate to drain.
6. Standard bearings are grease packed for life and in general no periodical maintenance is required; it is good practice however to check their condition and eventually replace them after approx. 3 years.

The motor does not have to be removed for normal inspections unless the bearings need to be replaced. In this case, the operations should be performed by specialised personnel and with appropriate tools.
MP2 – Service the gearbox

**Warning:** before doing any work on the unit, the operator must first switch off the power to the gear unit and ensure that it is out of service, as well as taking all necessary precautions against it being accidentally switched on again or its parts moving without warning (due to suspended loads or similar external factors). Furthermore all additional environmental safety precautions must be taken (e.g. elimination of residual gas or dust, etc).

- Before doing any maintenance work, activate all safety equipment and if necessary, inform persons working in the vicinity. In particular, mark off the area around the unit and prevent access to any equipment which, if activated might be the cause of unexpected health and safety hazards.
- Replace worn components with original spare parts only.
- Use the lubricants (oil and grease) recommended by the manufacturer.
- When working on the gear unit always replace gaskets and seals with new original ones.
- If a bearing requires replacement, it is good practice to also replace the other bearing supporting the same shaft.
- We recommend replacing the lubricating oil after all maintenance work.

**Note:** the above instructions are aimed at ensuring efficient and safe operation of the gear unit. The manufacturer declines all liability for injury and damage to components due to the use of non-original spare parts and non-routine work, which modifies the safety requirements without the express prior authorisation of the manufacturer. Refer to the specific spare parts catalogue when ordering spare parts for the gear unit.

**Warning:** do not dump polluting liquids, worn parts and maintenance waste into the environment. Dispose of all such materials as stipulated by applicable legislation.

- Observe the routine inspection and maintenance schedule.
- Before servicing or repairing internal components, allow the gear unit to cool down completely before opening the casing so as to avoid burns from parts which are still hot.
- Make sure, on completion of maintenance work, tighten all vent, filler and level plugs to their specified torque.
- On completion of any maintenance work, all seals must be refitted and sealed as prescribed. On gear units with double seal rings, the cavity between the two rings must be packed with synthetic grease (fluorocarbon gel 880 ITP or equivalent product with similar properties and application range) before assembly.
- Regardless of the type of gear unit, whenever a seal ring is replaced its lips should be smeared with a thin layer of grease (fluorocarbon gel 880 ITP or equivalent product with similar properties and application range) before assembly.
- Use only original spare parts for repairs.

**Routine maintenance**

Keep the gear unit at its maximum efficiency by following the routine maintenance schedule specified by the manufacturer. Good maintenance enables the unit to operate at its maximum performance over a long service life in compliance with safety regulations.
<table>
<thead>
<tr>
<th>Frequency</th>
<th>Component</th>
<th>Type of work</th>
<th>Operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1000h</td>
<td>External seals and gaskets</td>
<td>Check oil level. Check for leaks by eye</td>
<td>Maintain or replace components as required</td>
</tr>
<tr>
<td>3000h</td>
<td>For gear units with torque arm</td>
<td>Check for cracks/ageing</td>
<td>Replace if no longer fully effective</td>
</tr>
<tr>
<td>5000h</td>
<td>Gear unit seals and gaskets</td>
<td>Inspect carefully for wear/ageing of external seals</td>
<td>Replace if aged or worn</td>
</tr>
</tbody>
</table>

Depending on the temperature reached by the lubricant, it should be replaced at the intervals indicated in table below:

<table>
<thead>
<tr>
<th>Oil temperature t(°C)</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>t&lt;65</td>
<td>25000</td>
</tr>
<tr>
<td>65&lt;t&lt;80</td>
<td>15000</td>
</tr>
<tr>
<td>80&lt;t&lt;95</td>
<td>12500</td>
</tr>
</tbody>
</table>
Gyratory Asphalt Compactor
BM570

Calibration Procedure

Impact Test Equipment Ltd
www.impact-test.co.uk - www.impact-test.com
www.impact-testsets.co.uk
Gyratory Compactor Calibration Procedure

The main elements of calibration for the Gyratory Compactor are:

1. Axial stress
2. Gyration speed
3. Indicated sample height
4. Internal angle of gyration

1. **Axial Stress**
   The axial stress is calibrated using a traceable load-cell (capacity up to 14kN with a measurement accuracy of +/-10N).
   The machine has two pressure settings (Low & High) which allow the appropriate axial force to be applied to 100mm and 150mm diameter samples.
   The standard axial stress according to EN 12697-31: Annex B and AASHTO T312 is 600kPa +/- 18 kPa.
   Using the machine check panel, bring the piston down on the load-cell ensuring the pressure selector switch is set appropriate to the mould diameter in use.
   The force measured by the load-cell should be converted into stress using the following formulae:
   
   \[
   \text{Stress} = \frac{\text{Indicated Force}}{\text{Area}}
   \]
   
   Where Area = 0.007854 (100mm diameter)
   
   0.017671 (150mm diameter)

2. **Gyration speed**
   Set the machine in motion and measure the time taken (with a traceable stop watch) for 100 gyrations allowing a calculation of Gyration Speed in Gyrations/Minute to be calculated.
   The reference value is 30 (+/- 10%) gyrations per minute for EN 12697-31, and 0.5% for AASHTO T312.

3. **Indicated sample height**
   The sample height (as measured by the machine internal displacement transducer) is calibrated against steel reference blocks of known height.
   By bringing the machine piston down under load and comparing the software indicated height across the full working range, the error profile across the height range can be determined.

4. **Internal angle of Gyration**
   The internal angle of gyration is verified using a self-contained device which sits inside the compaction mould and measures the internal angle of gyration generated by the machine.
   A suitable device for internal angle verification can be supplied. Please contact Impact Test Equipment for further information or a quotation.
   
   For the EN 12697-31 standard an angle of 0.82 +/- 0.02 degrees is commonly used.
   For AASHTO T312 an angle of 1.16 +/- 0.02 degrees is used.