



# Standard Operating Procedure

## Melt flow indexer, TMA-400A-XNR

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<b>School:</b>	ENGINEERING	<b>Campus:</b>	Waurm Ponds	<b>Location:</b>	KE2.103
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<b>Category Rating:</b>	<b>Specific Training Required</b>				

### SCOPE & PURPOSE:

The Melt Flow Indexer (MFI) measures mass flow rate through the measurement of melt-mass flow rate manually, melt mass-flow and volume-flow rate automatically, and measuring melt density according to standards GB/T 3682-2000 and ISO 1133-2005. The instrument works within the temperature range of 50 - 400°C, and is therefore capable of measuring mass flow rate of both high melting temperature plastics (eg: polycarbonate, fluoroplastics, nylon) and low melting temperature plastics (eg: polyethylene, polypropylene, polystyrene and ABS).

### TRAINING REQUIREMENTS:

User will have completed Level 1 online and Level 2 materials labs inductions, and need to be trained by technical staff in a level 3 induction. Before using this equipment, required safety documentation must be completed and signed off by the technical staff and the user's supervisor.

### POTENTIAL HAZARDS/HEALTH EFFECTS:



Entanglement in the cutting blade.

Crushing from weights falling off the plant during installation, handling or uncontrolled movement of the piston and its load.

Cutting from coming into contact with the sharp cutting blade whilst it's moving during testing, operation, and cleaning.

Striking due to the weights being ejected from the piston, or sample material disintegrating during extrusion.

Injury due to high temperature or fire by coming into contact with specimens and/or accessories/parts of the plant.

Ergonomic need for excessive effort to install weights onto piston.

Slipping, tripping and falling due to obstacles and other factors such as obstacles and powders/pellets/granules.

Falling from a height whilst using the stepper to install specimen, piston and weights into the plant.

Toxic vapour, Fumes and dust encountered whilst installing the specimen or escaping upon opening the melting chamber and cleaning equipment.

### MANDATORY CONTROLS:

- |                  |                          |                     |            |
|------------------|--------------------------|---------------------|------------|
| ✓ Safety glasses | ✓ Heat protective gloves | ✓ Enclosed footwear | ✓ PC2 mask |
| ✓ Snorkel        | ✓ Training provided      | ✓ Risk Assessment   | ✓ Guard    |

### Precaution Requirements:

**DO NOT USE AFTERHOURS (OUTSIDE OF MON – FRI 8AM – 6PM) WITHOUT TECHNICIAN AUTHORISATION.**

- Physical and chemical properties of the sample must be known (eg: pre-assessed by DSC).
- Do not analyse plastics with melting temperatures above 400°C
- Samples must be in powder, granule, pieces, or thin film form, with particle sizes ≤9mm in one dimension to fit into the charging/melting chamber.
- If the display on the LCD monitor is abnormal, shut down the instrument and then boot again. Press the "Heat" button to restart working.



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- The **die** and **piston rod assembly** (refer to appendices) must be heated together.
- If the furnace temperature reaches more than 450°C, the instrument will alarm and stop heating.
- Refer to appendices for standard parameters.
- Ensure accessories are clean, as unclean accessories will influence testing.

### INSTRUCTIONS:

Booking Procedure: must have a booking in the outlook calendar \*G SEBE ENG Lab Eqpmt KE2.103 MFI even if free and available.

#### **Before Use:**

- Ensure power is turned off at the wall.
- Obtain the required accessories from the toolbox, instructions/manuals and the user guide from the MFI cupboard.
- Review and check the cleanliness of the unit, built-in scraper blade and accessories before operating the melt flow indexer. If required, clean accessories using the cleaning rod and gauze.
- Place required accessories next to the equipment on the aluminium plate ready for use.
- Ensure the equipment is levelled by placing the **level bar** (refer to appendices) into the charging/melting chamber, adjust if required by turning the feet of the unit
- Turn on the snorkeler extraction system using the switch located on the wall next to the DSC equipment.
- Place the sample tray (refer to appendices) below the built-in scraper and the discharge port.
- If you are not confident in the set-up or operation of the equipment, do not operate. Contact technical staff for assistance.

#### **Operation: see appendices for instrument diagram.**

- Die installation:
  - While the equipment is turned-off and is at room temperature - Push the black die release handle (located on the right side of the plant) in, to shift the die plate and partially close the charging chamber for die insertion.
  - Place the clean die in its upright position into top of the charging chamber.
  - Use the **loader bar** (refer to appendices) to gently push the die through the charging/melting chamber from the top of the chamber until it reaches the die plate.
  - Insert the piston rod assembly from top of the barrel into the charging/melting chamber.
- Instrument Preparation:
  - Turn on the power on the wall power point and then the power switch on the instrument to check if the power indicator is on.
  - Enter in the test parameters on the setting page to program your test – *refer to topic 6.3 of the instruction manual.*
  - Press the “Heat” button and wait for the instrument to reach its set temperature.
  - Wait a further 15 minutes before commencing testing to stabilise the instrument.
- Sample Preparation:
  - Weigh out the required amount of your sample based on the ‘expected MFR’ for your material according to the suggested parameters in the appendices.
  - Put on heat protective gloves ready for insertion of the sample.
- Sample Insertion: This step should be completed within 1 minute;
  - Remove the piston rod assembly and place it on the aluminium plate.
  - Insert the sample into the charging/melting chamber through the **hopper** (refer to appendices).
  - Use the **loader bar** to compact the sample down (important for ensuring the extruded product does not contain bubbles for accurate MFI calculation)
  - Re-insert the **piston rod assembly** into the charging/melting chamber.
  - If the sample melts and flows quickly and is coming out of the die, to prevent this, insert the **wire** into the bottom of the die.
  - After 4 minutes, ensure the first, lower marker of the **piston rod assembly** is level with the brass fitting – this means the sample is compacted.
  - If inserted, remove the **wire** from the bottom of the **die**.



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### • Testing Preparation:

- Remove heat protective gloves before safely stacking the standard testing load weight(s) onto the piston rod for your sample material (from heaviest to lightest) - *Refer to appendices for material standard test parameters.*
- As the piston rod moves down, cut any extruded sample that flows from the **die** by pressing the “Cut” button until the second, higher marker on the **piston rod assembly** is level with the top of the brass fitting. Discard these extruded sample piece(s).

### • Testing:

- Once the second, higher marker on the **piston rod assembly** is level with the top of the brass fitting press the “Test” button so that the built-in scrapper automatically cuts the extruded sample based on the pre-set intervals selected in the test parameters.
- Testing will cease once the number of total cuts selected in the test parameters is reached or the “Stop” button is pressed.

### • After Testing:

- Keep the indexer at the set temperature and discharge all remaining sample material.
- Carefully remove the stacked weights and place them back in the MFI cupboard.
- Put on heat protective gloves.
- Whilst still hot – around 100°C so not to burn the gauze;
  - Remove the **piston rod assembly**, clean it using gauze and place on the aluminium plate.
  - Pull the black die release handle (located on the right side of the plant) out, to shift the die plate and open the charging/melting chamber.
  - Remove the **die** from the charging/melting chamber using the **loader bar**, clean it and place on the aluminium plate.
  - Bind gauze to the **cleaning rod** and use it to clean inside of the charging/melting chamber.
- Press the “.....” Button to begin cooling of the charging chamber.

### • Result Calculation:

- Weigh the extruded sample pieces that contain no bubbles (the accuracy of the balance should be better than 0.01g) and calculate the average mass.
- Discard those whose mass are more than 15% of average value.
- Press the “Calculate” button and input the mass values of 3 – 5 of the remaining extruded sample pieces - *refer to topic 6.4.3 of the instruction manual.*

### **After Use:**

- Once the MFI reaches ambient temperature, turn the instrument off.
- Check the temperature of the accessories and once at ambient temperature, return them to the toolbox, and the toolbox to the MFI cupboard.
  - When cleaning the cleaning rod, you must not scrape with a hard object.
  - After reaching the room temperature (non-contact thermometer from the heat treatment lab can be used), place all the accessories in the storage box.
  - Return the storage box to its cabinet.

### **GENERAL CARE & MAINTENANCE:**

Use gauze for cleaning. Do not use hard objects to clean the accessories.

Wrap gauze around the cleaning rod for cleaning inside the charging/melting chamber.

Clean the inside of the die using the die cleaning rod.

Maintenance is performed as required.

### **REPAIRS & CERTIFICATION/VALIDATION SCHEDULE:**

Reporting faults/concerns of equipment procedure: Technical staff.

Temperature rectification is to be performed every 12 months – *refer to topic 7 of the instruction manual.*



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### **SPILLS/ ACCIDENT REPORTING PROCEDURE:**

Spills procedure (Chemical):

- Wear lab coat, safety glasses, gloves and PC2 mask to prevent eye and skin contamination and inhalation of vapours.
- Prevent run-off into drains.
- Contact Technical staff for assistance.
- For liquid spills use absorbent material to contain spill; for major spills use the spill kit, for minor spills use paper towel.
- For solid spills use broom/brush to sweep up into suitable container for disposal.

Report spills/incidents to: Technical Staff.

### **In case of Emergency:**

- Shut down the instrument.
- Contact Technical Staff.
- If a serious injury has occurred call 000.
- Alert others if nearby.
- Evacuate to closest assembly area.