# MELT FLOW INDEXER

# MODEL MFI-S

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Contents:

## INTRODUCTION TO MELT FLOW MEASUREMENT

## MELT MASS-FLOW RATE AND MELT VOLUME-FLOW RATE

The measured flow of a thermoplastic material through a die following specified conditions of length, diameter, temperature and pressure is known as either its Melt Mass-Flow Rate (MFR) or Melt Volume-Flow Rate (MVR).

Differing standard conditions of extrusion temperatures and pressures are used for the varying polymer types, however, for comparison purposes different samples of the same polymer should be tested under identical conditions.

The MFR/MVR apparatus should be regarded as a simple rheometer operating at conditions of low shear. Although the applied shear stresses and the resultant shear rates are very much lower than those utilised in most processes, the results obtained do provide useful data and an indication as to the relative ease with which the materials will flow when processed.

Should a process require a relatively high rate of shear, (typically injection moulding) then a polymer of high MFR/MVR is generally selected as this is an indication of easier flow than one of low MFR/MVR.

The MFR/MVR is also a measure of the molecular weight of a sample and is, therefore, indicative of the mechanical strength of the material. Average molecular weight and MFR/MVR are indirectly proportional, so that although a sample will process more readily, its strength and resistance to stress is likely to be poor.

The Melt Flow Indexer has other test uses i.e. by performing the MFR/MVR test under two or more differing loads, the useful data on the rheological properties of the material can be determined.

A useful measure of the shear stress/shear rate relationship can be made by measuring the samples MFR/MVR at the standard and at the higher load. Increasing the test load (for polythene's) from the standard 2.16 kgs to 21.6 kgs increases the level of shear rate by a factor between 50 and 100:1, depending on the MWD of the sample and the arithmetic ratio: MFR 21.6 kgs/MFR 2.16 kgs gives a measure of flow parameters.

Depending on the MFR at 2.16kg load, the value at 21.6kg load can be equivalent to the shear rates of more than 100 secs-1 coming possibly into the range of extrusion processes. The facility also exists to measure flow parameters at different temperatures, giving an insight as to the temperature sensitivity of the sample.

It is wrongly assumed that two polymer samples having the same MFR/MVR will behave in the same way with respect to output (shear rate) when tested under the same set of conditions. They could, however, behave quite differently when subjected to higher pressure (shear stress) as required for moulding or extrusion process.
Should the samples have differing MOLECULAR WEIGHT DISTRIBUTIONS (MWD) the increase in shear stress will differ as well. Generally speaking, a

larger MWD corresponds with a greater shear sensitivity, i.e. a higher rate of change in shear rate per unit increase in shear stress.

Further information available from Melt Indexers are the measurement of “Die Swell” and “Drawdown”.
Die Swell is the arithmetic ratio between the cooled extrudate at ambient temperature and the die diameter.
Drawdown is the extending of the polymer extrudate by its own weight as it is extruded.
Both these factors provide useful information for the blow Moulding Industry.

## THE HANATEK MELT FLOW INDEXER

The HANATEK Melt Flow Indexer has been designed in accordance with BS 2782 Method 720A and conforms to DIN 53735, NF: T 51 - 106, UNI 5640 - 74, UNE 53098, ISO 1133.91e and 1238 90b.

The unit comprises a cylindrical barrel with a precise honed bore of 9.55mm diameter. The barrel is fully insulated, held by dual casing and separated by a ceramic disc. This minimises heat transfer from barrel to casing such that at operating temperature, the outer casing is still cool to touch.

The barrel is mounted in a stainless steel bracket, Bolted solidly to the rigid up right. This prevents barrel movement at all times.

The barrel is heated by three differing wattage heater elements, each with its own controller and PT100 sensor.  This enables temperature stability to be reached within approximately 15 minutes and the total barrel length to be controlled to + / - 0.2 deg. C achieving that at the pre - heat stage.

Each heater element is controlled by an independent microprocessor based temperature controller.  Once the required temperature is established, the centre Controller may be switched off to conserve power.  Another feature of each controller is that the “Set - point” and “Actual” temperature are displayed at the same time giving a constant check of barrel performance.

The HANATEK piston is built of solid steel and built precisely to the standard. The insulting sleeve and piston together are tarred to precisely 130gms.  If weights above 10kgs are required to be used then the optional weight lift system (advanced MFI unit) and should be purchased and utilised.

HANATEK dies are made from tungsten carbide and are built precisely to the standard.  The polished bore is 2.0955mm.

**WARNING - DURING SET UP, TESTING AND CLEANING THE HANATEK MFI HAS HOT AREAS AROUND THE BARREL THAT CONSTITUTE BURNING HAZARDS- CARE SHOULD BE TAKEN AT ALL TIMES.**

**SUITABLE PROTECTIVE EYEWEAR/CLOTHING/HEATPROOF GLOVES SHOULD BE WORN WHERE NECESSARY.**
**CARE SHOULD ALSO BE TAKEN WHEN HANDLING WEIGHTS**

**ASSEMBLY**

1.0 Unpack the unit carefully and check the contents against the packing list.

2.0 Place the instrument on a suitable sturdy bench- AWAY FROM STRONG DRAUGHTS

3.0 Ensure the instrument is level before use.

Place a spirit level centrally, on top of the barrel and adjust the adjustable feet till the spirit level bubble remains central. This is important and must be periodically checked and adjusted every time the equipment is moved.

**SET UP**

1.0 Check the barrel, piston, die and weights are clean and undamaged before use.

**DAMAGED DIES MUST BE REPLACED IMMEDIATELY- THIS ENSURES CONSISTENT TEST RESULTS THAT COMPLY WITH THE RELEVANT STANDARDS.**

Ensure the die retaining slide plate is in position.

2.0 Place the die into the top of the barrel and listen to it falling freely to the bottom.

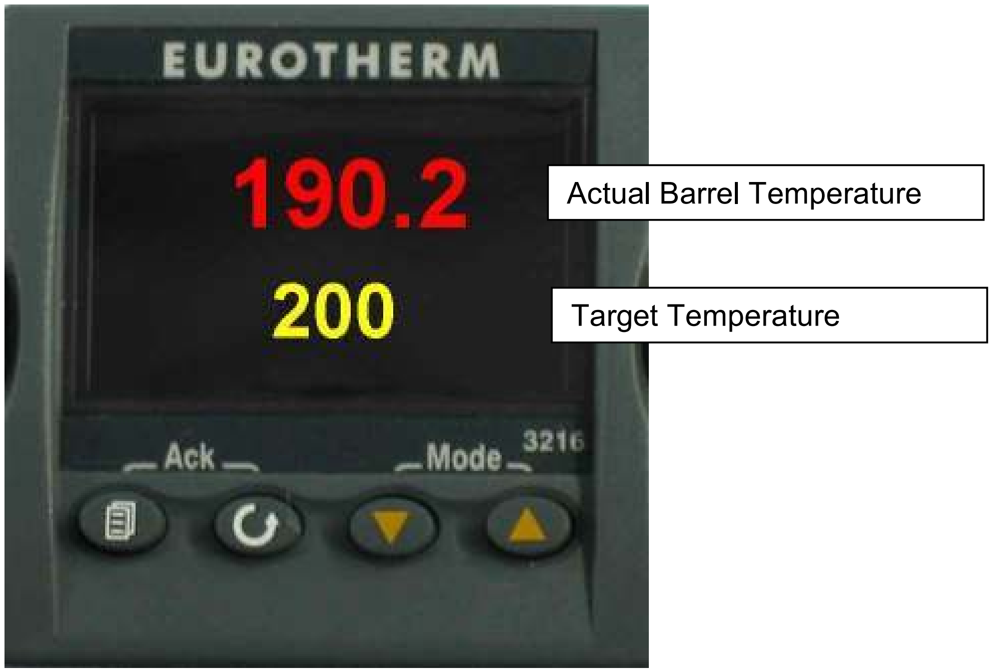
**IF THE DIE DOES NOT FALL FREELY IS AN INDICATION THAT THERE IS POLYMER CONTAMINATION ON THE DIE AND/OR BARREL- PLEASE REPEAT THE CLEANING PROCESS.**

3.0 Place the piston in the barrel.

4.0 Power Up the Instrument

Use the supplied mains lead to connect the Hanatek MFI to a suitable mains supply.
Flick the power ON/OFF switch at the rear of the instrument to the ON position.

5.0 Set the required test temperature on the 3 temperature units.




Suggested testing temperatures for different polymer types are outlined in BS2782.

Use the up/down buttons to select the target temperature.
The instrument will display target temperature (bottom) and the actual Temperature (top).
If the target temperature is above the actual temperature the instrument will begin heating the barrel.

6.0 Wait until the temperature on all three controllers reaches the set point.

The temperature on all three controllers should stabilise +/- 0.2 Degrees from the test temperature.

The instrument should be left in this state for ten minutes to ensure complete temperature equilibrium for the barrel, die and piston.

**PREPARE THE SAMPLE**

Additional Equipment Required-

Precision Balance (minimum accuracy 0.005 g)
Stopwatch
Minimum of 7 identical small Pyrex Beakers.

1.0 Ensure the instrument has been stabilised at the correct temperature (see test set up).

2.0 Set aside a small sample of the granulated polymer to be tested in a small pyrex beaker (approximately 4g sample is the correct amount).

3.0 Note- Many polymers are Hygroscopic (they absorb moisture from the air). Absorbed moisture will significantly affect MFI values.
Polymers should therefore be pre-conditioned to match production conditions. Hanatek supply polymer sample drying apparatus for this purpose (contact us for more details).

**4.0 CAREFULLY remove the piston- it is HOT; wear protective heat proof gloves if necessary. Place the piston in the tool rack at the side of the instrument.**

5.0 Charge the piston with the polymer

Charge the barrel with the sample, a little at a time, tamping down each time with the charging tool to exclude any air bubbles.

**The standard allows a maximum of 1 minute to completely charge the sample into the barrel. This process should be timed with the attached Triple timer or using a stopwatch.**

6.0 Prepare the piston for the test.

Take the piston from the tool rack and place it in the MFI Barrel. Put the support collar round the barrel and place the selected weight on the top of the piston.

The weight will force the piston down until the instrument is in the correct pre-test position.

**START THE TRIPLE TIMER OR NOTE THE CURRENT TIME ON THE STOP WATCH. THE SAMPLE MUST BE CONDITIONED FOR A DETERMINED TIME. THE RECOMMENDED CONDITIONING TIME IS 6 MINUTES FOR MOST SAMPLES.**

Any polymer excluded from the die orifice is waste and should be removed using the cut off knife and discarded.

**TEST THE SAMPLE**

1.0 Once the conditioning time has passed, remove the collar and watch the piston descend under the weight.

2.0 When the first mark on the piston is entering the barrel, cut off and discard the extrudate and start or note the timer.

3.0 At the end of each cut off interval, cut off and retain, in sequence, the extrudate, keeping rigidly to the time interval set.

**A MINIMUM OF 5 CUT OFFS SHOULD BE TAKEN DURING A SINGLE TEST.**

**THE TEST MUST BE COMPLETE BEFORE THE SECOND MARK ON THE PISTON ENTERS THE BARREL**

The groove marks on the piston are 30mm apart.

Recommended sample charge weights and cut-off intervals are given in the standards.

4.0 Weigh and note each sample in sequence.

**CALCULATE RESULTS**

1.0 Weigh each sample on scales of accuracy 0.0005 gms.

2.0 Calculate the average weight of the samples to 3 significant figures.

3.0 Calculate the Melt Flow Rate in grams per 10 minutes i.e.

$$MFR = \frac{10W}{T}$$

W = average weight of sample
T = extrusion time per sample in minutes

The Melt Flow Rate Spread is a good indication of thermal instability. In the event of the material cross-linking, the MFR will tend to become lower, and the extrudate lighter; whereas in the case of chain-scission, the MFI tends to increase and the samples become heavier.

Spread values are calculated from the following formulas and expressed as a percentage:-

$$\text{Total MFR Spread} = 100 \frac{(\text{Max. Wt. - Min. Wt})}{\text{Average Weight}}$$

$$\text{Lower MFR Spread} = 100 \frac{(\text{Ave. Wt. - Min. Wt.})}{\text{Average Weight}}$$

$$\text{Upper MFR Spread} = \frac{100 \ (\text{Max. Wt. - Ave. Wt.})}{\text{Average Weight}}$$

**Cross Sectional Area:-** ( (barrel area - piston area) / 2) + piston area (units: cm2)

**Swept Volume:-** piston travel x cross sectional area (units: cm3)

**MELT DENSITY:-** (average weight/cut-off time) / (swept volume/test time) (units: gms/cm3)

**MELT FLOW INDEX:-** (Melt Density x Swept Volume x 600) / test time (units gms/10 minutes)

## CLEAN THE INSTRUMENT

**CLEANING THE INSTRUMENT IS BEST ACHIEVED WHILST COMPONENTS ARE HOT, HEATPROOF GLOVES SHOULD BE WORN AT ALL TIMES.**

1.0 Once the test has been completed, the remaining polymer can be extruded from the orifice by manually pushing down on the weight.

2.0 Once all remaining polymer has been extruded and discarded, pull out the die retaining slide so that the die drops out of the bottom of the barrel.

**TO AVOID DAMAGING THE DIE CATCH IT IN A SMALL PYREX BEAKER OR THE PALM OF A HEATPROOF GLOVE.**

Whilst still hot, use the die broach to remove any polymer from inside the orifice. Use the cut off knife to scrape any remaining plastic from the outside of the die.

Place the clean die to one side.

3.0 Use the cut off knife to remove any material from the die retainer slide.

4.0 Remove the piston from the barrel. Scrape any remaining polymer from the piston shaft using the cut off knife. Use a cleaning patch to remove any further residue.

Place the clean piston in the tool rack on the side of the instrument.

5.0 Place a cleaning patch over the upper barrel opening. Force the cleaning patch through the barrel with the cleaning tool. Repeat this with a new patch three times or until the patch is uncontaminated after being passed through the barrel.

6.0 To test the cleanliness of the barrel, replace the die retaining slide at the bottom of the barrel and drop in the die. It should fall unimpeded through the barrel.

**OPTIONAL EXTRAS**

a. Automatic Cut-Off Mechanism - solenoid operated. Model 4040

b. Motorised Weight Lifter. Model 4030

Lowers and raises weights on the piston and provides a vertical guide to ensure that the weight exerts a force directly and vertically onto the piston head.

c. Quality Melt Analyser. Model 3010

Microprocessor electronics that include:-

i) real time clock-auto-timer

ii) calculates test results

iii) printer, which provides ticket print-out of results

iv) RS232 Comms Port. port for IBM Compatible P.C. or RS 422 for polling.

d. Programme for Reporting MFI 40 times in any Test. Model 401

Calculates the Standard Deviation. Re-calculates the MFI, omitting from the final calculations those values exceeding the average value by more than 1 Standard Deviation.
Results can be profiled at the end of the test on an IBM compatible P.C. giving a visual indication of material degradation.

g. Test Area Temperature Monitor. (Factory fitted option)

Pt100 fitted 12mm above the Die.

h. Portable, Calibrated, digital Temperature Indicator

Calibrated by PIRA International.

i. Barrel Temperature Monitor. SPA 120

This unit can simultaneously measure the temperature in the barrel at four different points, making it easy to meet the requirement of BS2782/ISO 1133 1997.

**SPARES**

| DESCRIPTION | PART NUMBER |
| --- | --- |
| Piston | SPA135 |
| Die - Standard 2.0955mm bore | SPA001 |
| Die Broach | SPA057 |
| Die Plug Gauge | SPA078 |
| Die Plug (to prevent the flow of material before test) | SPA084 |
| Die Ejector | SPA061 |
| Cleaning Tool | SPA060 |
| Charging Tool | SPA059 |
| Cut-off Knife | SPA058 |
| Cleaning Patches (45/box) | SPA063 |
| Mirror | SPA121 |
| Spirit Level | SPA122 |
| PT100 Sensor | SPA123 |
| Triple Timer | SPA124 |
| Temperature Controller | SPA125 |
| Piston Support Collar 67mm | SPA126 |

## SERVICE

**Contact- HANATEK Instruments:**

**Telephone No:** **+44 (0)1424 739623**

**Fax Number:** **+44 (0)1424 730600**

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## Appendix A- THERMOPLASTIC MATERIALS AND THEIR ABBREVIATIONS

### POLYOLEFINES

| | |
|---|---|
| P/E | Polyethylene |
| LDPE | Low Density P/E |
| LLDPE | Linear Low Density P/E |
| MDPE | Medium Density P/E |
| HDPE | High Density P/E |
| HMWPE | High Molecular Weight P/E |
| UHMWPE | Ultra High Molecular Weight P/E |
| P/P | Polypropylene |
| EVA | Ethylene Vinyl Acetate |
| EPDM | Elastomer Modified P/E - P/P |

### CELLULOSICS

| | |
|---|---|
| C/A | Cellulose/Acetate |
| C/P | Cellulose/Propionate |
| CAB | Cellulose/ Acetate/Butyrate |

### ACRYLICS

| | |
|---|---|
| PMMA | Polymethylmethacrylate. |

### ACETALS

| | |
|---|---|
| POM | Polyoxymethylene |

**Appendix B- TRIPLE TIMER- SUGGESTED OPERATION**

The unit is powered by a AAA 1.5v battery.


Suggested use:-

a) Timer 1. Set charge time, 1 minute.
b) Timer 2. Add pre-heat time to a) and set as pre-heat time.
c) Timer 3. Add cut-off interval to b) time and set as cut-off interval.

To set timer:- Move top switch to “set” position.
Move large switch to T1 position.
Set 1 minute.
Move large switch to T2 position.
Set required pre-heat time.
Move large switch to T3 position.
Set required cut-off interval.
Move bottom slide switch to T1, T2 and T3 position and top switch to “Lock”.

Press start button to simultaneously start all three timers.
Each timer will alarm at its time-out sequence. The times can be stored or reset each time as required.

The weights are colour coded. a heat sealed chart provides the colour code for a required load. Up to 10kgs, no single weight weighs heavier than 2.84kgs which is well within the health and safety at work Act.

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# OPERATING MANUAL

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The barrel is heated by three differing wattage heater elements, each with its own controller and PT100 sensor. This enables temperature stability to be reached within approximately 15 minutes and the total barrel length to be controlled to + / - 0.2 deg. C achieving that at the pre - heat stage.

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If weights above 10kgs are required to be used then the optional weight lift system (advanced MFI unit) and should be purchased and utilised.

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**CARE SHOULD ALSO BE TAKEN WHEN HANDLING WEIGHTS**

**ASSEMBLY**

1.0 Unpack the unit carefully and check the contents against the packing list.

2.0 Place the instrument on a suitable sturdy bench- AWAY FROM STRONG DRAUGHTS

3.0 Ensure the instrument is level before use.

Place a spirit level centrally, on top of the barrel and adjust the adjustable feet until the spirit level bubble remains central. This is important and must be periodically checked and adjusted every time the equipment is moved.

**SET UP**

1.0 Check the barrel, piston, die and weights are clean and undamaged before use.

**DAMAGED DIES MUST BE REPLACED IMMEDIATELY- THIS ENSURES CONSISTENT TEST RESULTS THAT COMPLY WITH THE RELEVANT STANDARDS.**

Ensure the die retaining slide plate is in position.

2.0 Place the die into the top of the barrel and listen to it falling freely to the bottom.

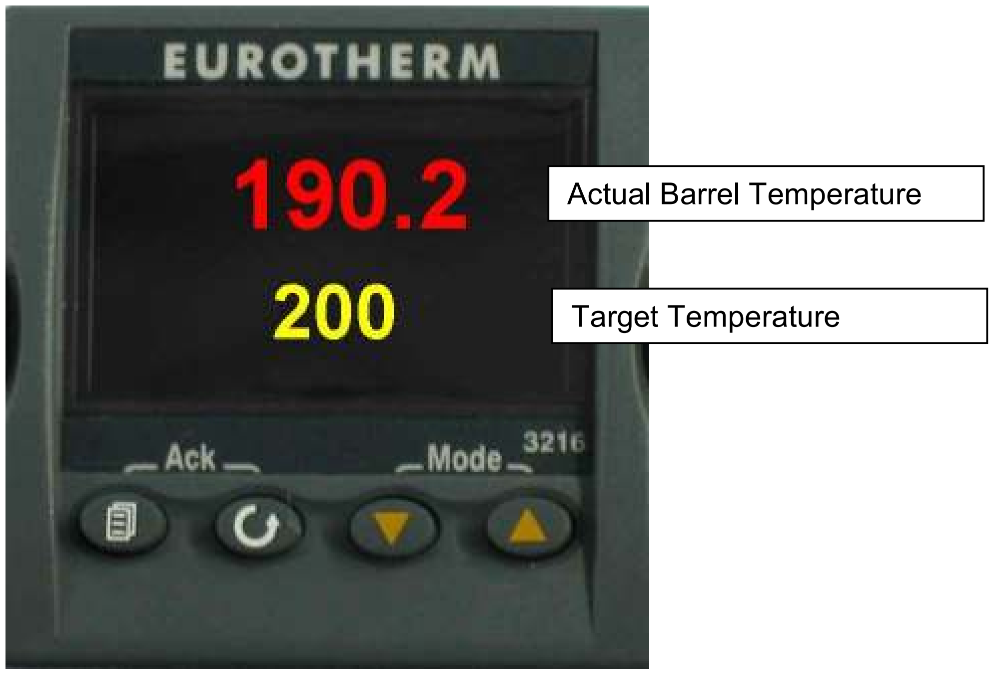
**THE DIE DOES NOT FALLING FREELY IS AN INDICATION THAT THERE IS POLYMER CONTAMINATION ON THE DIE AND/OR BARREL- PLEASE REPEAT THE CLEANING PROCESS.**

3.0 Place the piston in the barrel.

4.0 Power Up the Instrument

Use the supplied mains lead to connect the Hanatek MFI to a suitable mains supply.
Flick the power ON/OFF switch at the rear of the instrument to the ON position.

5.0 Set the required test temperature on the 3 temperature units.




Suggested testing temperatures for different polymer types are outlined in BS2782.

Use the up/down buttons to select the target temperature.
The instrument will display target temperature (bottom) and the actual Temperature (top).
If the target temperature is above the actual temperature the instrument will begin heating the barrel.

6.0 Wait until the temperature on all three controllers reaches the set point (approximately 15 minutes from power-up).
The temperature on all three controllers should stabilise +/- 0.2 Degrees from the test temperature.

The instrument should be left in this state for ten minutes to ensure complete temperature equilibrium for the barrel, die and piston.

**PREPARE THE SAMPLE**

Additional Equipment Required-

Precision Balance (minimum accuracy 0.005 g)
Stopwatch
Minimum of 7 identical small Pyrex Beakers.

1.0 Ensure the instrument has been stabilised at the correct temperature (see test set up).

2.0 Set aside a small sample of the granulated polymer to be tested in a small pyrex beaker (approximately 4g sample is the correct amount).

3.0 Note- Many polymers are Hygroscopic (they absorb moisture from the air). Absorbed moisture will significantly affect MFI values. Polymers should therefore be pre-conditioned to match production conditions. Hanatek supply polymer sample drying apparatus for this purpose (contact us for more details).

**4.0 CAREFULLY remove the piston- it is HOT; wear protective heat proof gloves if necessary. Place the piston in the tool rack at the side of the instrument.**

5.0 Charge the instrument with the polymer

Charge the barrel with the sample, a little at a time, tamping down each time with the charging tool to exclude any air bubbles.

**The standard allows a maximum of 1 minute to completely charge the sample into the barrel. This process should be timed with the attached Triple timer or using a stopwatch.**

6.0 Prepare the piston for the test.

Take the piston from the tool rack and place it in the MFI Barrel. Put the support collar round the barrel and place the selected weight on the top of the piston.

The weight will force the piston down until the instrument is in the correct pre-test position.

**START THE TRIPLE TIMER OR NOTE THE CURRENT TIME ON THE STOP WATCH. THE SAMPLE MUST BE CONDITIONED FOR A DETERMINED TIME. THE RECOMMENDED CONDITIONING TIME IS 6 MINUTES FOR MOST SAMPLES.**

Any polymer extruded from the die orifice is waste and should be removed using the cut off knife and discarded.

**TEST THE SAMPLE**

1.0 Once the conditioning time has passed, remove the collar and watch the piston descend under the weight.

2.0 When the first mark on the piston is entering the barrel, cut off and discard the extrudate and start or note the timer.

3.0 At the end of each cut off interval, cut off and retain, in sequence, the extrudate, keeping rigidly to the time interval set.

**A MINIMUM OF 5 CUT OFFS SHOULD BE TAKEN DURING A SINGLE TEST.**

**THE TEST MUST BE COMPLETE BEFORE THE SECOND MARK ON THE PISTON ENTERS THE BARREL**

The groove marks on the piston are 30mm apart.

Recommended sample charge weights and cut-off intervals are given in the standards.

4.0 Weigh and note each sample in sequence.

**CALCULATE RESULTS**

1.0 Weigh each sample on scales of accuracy 0.0005 gms.

2.0 Calculate the average weight of the samples to 3 significant figures.

3.0 Calculate the Melt Flow Rate in grams per 10 minutes i.e.

$$MFR = \frac{10W}{T}$$

W = average weight of sample
T = extrusion time per sample in minutes

The Melt Flow Rate Spread is a good indication of thermal instability. In the event of the material cross-linking, the MFR will tend to become lower, and the extrudate lighter; whereas in the case of chain-scission, the MFI tends to increase and the samples become heavier.

Spread values are calculated from the following formulas and expressed as a percentage:-

$$\text{Total MFR Spread} = 100 \ \frac{(\text{Max. Wt. - Min. Wt})}{\text{Average Weight}}$$

$$\text{Lower MFR Spread} = 100 \ \frac{(\text{Ave. Wt. - Min. Wt.})}{\text{Average Weight}}$$

$$\text{Upper MFR Spread} = 100 \ \frac{(\text{Max. Wt. - Ave. Wt.})}{\text{Average Weight}}$$

**Cross Sectional Area:-** ( (barrel area - piston area) / 2) + piston area (units: cm2)

**Swept Volume:-** piston travel x cross sectional area (units: cm3)

**MELT DENSITY:-** (average weight/cut-off time) / (swept volume/test time) (units: gms/cm3)

**MELT FLOW INDEX:-** (Melt Density x Swept Volume x 600) / test time (units gms/10 minutes)

## CLEAN THE INSTRUMENT

**CLEANING THE INSTRUMENT IS BEST ACHIEVED WHILST COMPONENTS ARE HOT, HEATPROOF GLOVES SHOULD BE WORN AT ALL TIMES.**

1.0 Once the test has been completed, the remaining polymer can be extruded from the orifice by manually pushing down on the weight.

2.0 Once all remaining polymer has been extruded and discarded, pull out the die retaining slide so that the die drops out of the bottom of the barrel.

**TO AVOID DAMAGING THE DIE CATCH IT IN A SMALL PYREX BEAKER OR THE PALM OF A HEATPROOF GLOVE.**

Whilst still hot, use the die broach to remove any polymer from inside the orifice. Use the cut off knife to scrape any remaining plastic from the outside of the die.

Place the clean die to one side.

3.0 Use the cut off knife to remove any material from the die retainer slide.

4.0 Remove the piston from the barrel. Scrape any remaining polymer from the piston shaft using the cut off knife. Use a cleaning patch to remove any further residue.

Place the clean piston in the tool rack on the side of the instrument.

5.0 Place a cleaning patch over the upper barrel opening. Force the cleaning patch through the barrel with the cleaning tool. Repeat this with a new patch three times or until the patch is uncontaminated after being passed through the barrel.

6.0 To test the cleanliness of the barrel, replace the die retaining slide at the bottom of the barrel and drop in the die. It should fall unimpeded through the barrel.

**OPTIONAL EXTRAS**

a. Automatic Cut-Off Mechanism - solenoid operated. Model 4040

b. Motorised Weight Lifter. Model 4030

Lowers and raises weights on the piston and provides a vertical guide to ensure that the weight exerts a force directly and vertically onto the piston head.

c. Quality Melt Analyser. Model 3010

Microprocessor electronics that include:-

i) real time clock-auto-timer

ii) calculates test results

iii) printer, which provides ticket print-out of results

iv) RS232 Comms Port. port for IBM Compatible P.C. or RS 422 for polling.

d. Programme for Reporting MFI 40 times in any Test. Model 401

Calculates the Standard Deviation. Re-calculates the MFI, omitting from the final calculations those values exceeding the average value by more than 1 Standard Deviation. Results can be profiled at the end of the test on an IBM compatible P.C. giving a visual indication of material degradation.

g. Test Area Temperature Monitor. (Factory fitted option)

Pt100 fitted 12mm above the Die.

h. Portable, Calibrated, digital Temperature Indicator

Calibrated by PIRA International.

i. Barrel Temperature Monitor. SPA 120

This unit can simultaneously measure the temperature in the barrel at four different points, making it easy to meet the requirement of BS2782/ISO 1133 1997.

**SPARES**

| DESCRIPTION | PART NUMBER |
|---|---|
| Piston | SPA135 |
| Die - Standard 2.0955mm bore | SPA001 |
| Die Broach | SPA057 |
| Die Plug Gauge | SPA078 |
| Die Plug (to prevent the flow of material before test) | SPA084 |
| Die Ejector | SPA061 |
| Cleaning Tool | SPA060 |
| Charging Tool | SPA059 |
| Cut-off Knife | SPA058 |
| Cleaning Patches (45/box) | SPA063 |
| Mirror | SPA121 |
| Spirit Level | SPA122 |
| PT100 Sensor | SPA123 |
| Triple Timer | SPA124 |
| Temperature Controller | SPA125 |
| Piston Support Collar 67mm | SPA126 |
| Pyrex Sample Dishes | SPA127 |
| Polymer Drying Block | PBK01 |
| Heat Resistant Gloves | SPA128 |

**SERVICE**

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**Spares:** **www.mfispares.com**

## Appendix A- THERMOPLASTIC MATERIALS AND THEIR ABBREVIATIONS

### POLYOLEFINES

| | |
|---|---|
| P/E | Polyethylene |
| LDPE | Low Density P/E |
| LLDPE | Linear Low Density P/E |
| MDPE | Medium Density P/E |
| HDPE | High Density P/E |
| HMWPE | High Molecular Weight P/E |
| UHMWPE | Ultra High Molecular Weight P/E |
| P/P | Polypropylene |
| EVA | Ethylene Vinyl Acetate |
| EPDM | Elastomer Modified P/E - P/P |

### CELLULOSICS

| | |
|---|---|
| C/A | Cellulose/Acetate |
| C/P | Cellulose/Propionate |
| CAB | Cellulose/ Acetate/Butyrate |

### ACRYLICS

| | |
|---|---|
| PMMA | Polymethylmethacrylate. |

### ACETALS

| | |
|---|---|
| POM | Polyoxymethylene |

**Appendix B- TRIPLE TIMER- SUGGESTED OPERATION**

The unit is powered by a AAA 1.5v battery.


Suggested use:-

a) Timer 1. Set charge time, 1 minute.
b) Timer 2. Add pre-heat time to a) and set as pre-heat time.
c) Timer 3. Add cut-off interval to b) time and set as cut-off interval.

To set timer:- Move top switch to “set” position.
Move large switch to T1 position.
Set 1 minute.
Move large switch to T2 position.
Set required pre-heat time.
Move large switch to T3 position.
Set required cut-off interval.
Move bottom slide switch to T1, T2 and T3 position and top switch to “Lock”.

Press start button to simultaneously start all three timers.
Each timer will alarm at its time-out sequence. The times can be stored or reset each time as required.

## EC DECLERATION OF CONFORMITY

**WE** Rhopoint Instruments Ltd, Beeching Road,
Bexhill on Sea, East Sussex, TN39 3LG

**DECLARE UNDER OUR SOLE RESPONSIBILITY THAT THE PRODUCTS**

Hanatek MFI

**TO WHICH THIS DECLERATION RELATES ARE IN CONFORMITY WITH THE FOLLOWING STANDARDS**

EN 61326-1: 2006

**FOLLOWING THE PROVISIONS OF DIRECTIVES**

2004/108/EC

Rhopoint Instruments Ltd
08 January 2008

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John Briggs, Managing Director