

# Minimum Film-Forming Temperature Bar MFFT

Designed to conform to : ISO 2115 and ASTM 2354



The Rhopoint MFFT is the industry leading instrument for measuring the minimum film forming temperature of water based materials. Definition - "MFFT is the lowest temperature at which a latex, emulsion or adhesive will uniformly coalesce when laid on a substrate as a thin film." An accurate MFFT value allows the formulation of products that cure correctly under specified application conditions.

The Rhopoint MFFT works by holding a very accurate temperature gradient across a nickel plated copper platen. A flow of dried air across the platen stops condensation forming and gives repeatable test conditions.

## Features

- Self - Contained bench-top instrument for the determination of the minimum film - forming temperatures of synthetic latices, emulsions, polymers & adhesives
- Electrically - controlled heating & cooling with integral air processor
- Designed to conform to ISO 2115 and ASTM 2354

## Sample Applications

This instrument was originally designed for the paint industry (hence name) but now has many other applications outside the paint industry where an accurate temperature gradient plate is required including: foods, cosmetics, confectionery (e.g. chocolate), wrapping papers, adhesives, latexes and emulsions, polymers, failure temperature of grease-resistant paper, food packaging, melt point of waxes, thermal transfer ribbons, temperature optimisation, epoxy resin cure

## Minimum Film-Forming Temperature Bar Description

A nickel plated copper platen is electronically cooled at one end and warmed at the other end. Air or nitrogen is caused to flow over the surface, from cool end to warm end as a uniform blanket. To achieve the required degree of uniformity the air or gas is delivered via a carefully designed sintered metal distribution block; the design is such that freezing does not take place at the inlet.

For use with air, a drying system is incorporated into the housing together with a flow controller. The air dryer contains indicator crystals which are clearly visible in a transparent container. The complete air conditioning system is readily accessible at the side of the instrument.

Water at normal mains pressure removes the excess heat from the coolers. Quick release couplings are provided. Water is normally drawn from a laboratory tap and the outlet is run to a drain by gravity. Alarms, both audible and visual are actuated in the event of cooling water supply failure.

## Principle of Operation

The “minimum film-forming temperature” has been described as “the minimum temperature at which a water-borne synthetic latex or emulsion will coalesce when laid on a substrate as a thin film. When this process occurs, in the absence of pigmentation or other opacifying materials, a clear transparent film is formed. At lower temperatures than the minimum, a white, powdery, cracked film will result”.

The minimum film-forming temperature is usually closely related to the glass transition temperature  $T_g$  but not synonymous with it; whilst the  $T_g$  may be determined by predicted calculation, the minimum film-forming temperature is best determined by the use of a MFFT Bar; the basic principles of which are described in ASTM D2354. Early instruments were usually cumbersome, inaccurate and slow to achieve equilibrium. I.C.I. plc devised a simple integrated instrument which was able to achieve the desired results quickly and efficiently. The initial development was carried out in I.C.I. Paints' laboratories. Temperature sensors are mounted at intervals under the surface of the platen. These are used to control the temperature of the platen in accordance with the chosen programme. They are also used to indicate the platen temperatures down the length of the bar, or they can be switched to indicate differential temperatures between adjacent sensing points, so providing an instantaneous indication of temperature gradient.

A roving probe temperature sensor is provided to facilitate temperature measurement at every point on the platen, it also serves to check the static sensors. A hinged perspex cover over the platen provides thermal insulation whilst allowing visual inspection of the determination as it progresses. A transparent cursor is mounted on the cover to simplify the identification of the exact minimum film-forming temperature.

## Programmes

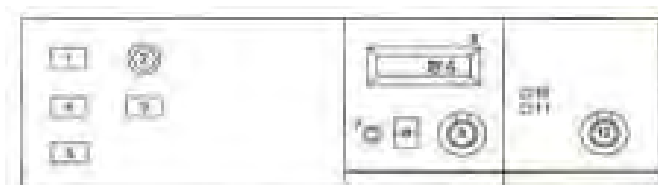
Two models of the MFFT are available:

- MFFT-60: The standard model, which can operate over SIX different temperature ranges (1 - 6 in the table).
- MFFT-90: An extended range model, which can operate over NINE different temperature ranges (1 - 9 in the table).

Range	1	2	3	4	5	6	7	8	9
Cool end (°C)	-5	0	5	15	23	33	43	53	63
Warm end (°C)	13	18	23	33	50	60	70	80	90

## Operation

In practice the instrument is switched on and the programme chosen, air and water having been connected. An equilibrium condition is noted after about 20 minutes (the time may be less dependant on the programme chosen). At equilibrium the heating cooling lamps illuminate at very low frequency. Several tracks are laid down in quick succession using an applicator, normally a 75 micron cube applicator. The tracks may be laid down left to right or right to left, but the most common form is a U horizontal, with the track starting and finishing at the right, warm end. Two tracks are normally laid down last as a control, using an emulsion of known MFFT.



Alarm and ON Module	Indication Module	Control Module
1 Mains switch -On/ Off	6 Temp. display	10 Heating LED
2 Coolant failure alarm	7 Probe socket	11 Cooling LED
3 Coolant failure lamp	8 Temp. mode switch	12 Programme selector
4 Heating lamp indicator	9 Temp. sensor selector	
5 Cooling lamp indicator		

A clearly defined limit of coalescence will show in about 80 minutes and the cursor may then be used to read off the MFFT temperature. Pigmented emulsions may be tested but the determination is more difficult to see. Most operators, however, find that they can readily discern the determination temperature. This can be proven by gently scraping the surface of the film using a wooden spatula.

## Technical Specifications

<b>Platen</b>	Copper, dull nickel plated (other options available)
<b>Platen dimensions</b>	483mm x 235mm
<b>Parallel tracks</b>	Using 75 mic Cube Applicator supplied: max 10
<b>Weight</b>	38kg
<b>Dimensions</b>	550mm wide x 350mm high x 610mm deep
<b>Temperature sensing</b>	10 points on centreline at width intervals 37mm
<b>Display</b>	Point temperature and temperature differential between adjacent points
<b>Sensor accuracy</b>	0.1 degrees C + 0.07 C
<b>Indication</b>	Lamps: Instrument ON, heating, cooling
<b>Alarms</b>	Audible and visual for water flow failure

**Services required**

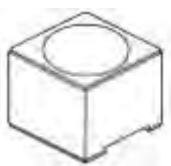
<b>Mains</b>	220-240 volts a.c.
<b>Air</b>	4 litres/min @ 100 psig
<b>Water</b>	Normal mains supply
<b>Water drain</b>	Gravity

**Shipping Details**

Carton dimensions	737mm x 470mm x 661mm
Gross Weight	48kg

**Shipping List****Complete Instrument Comprises**

- MFFT Instrument
- Mains cable
- Air connector
- Water connectors
- Roving temperature sensortype 166-177 C.
- Cube applicator. 75 mic cube →
- Guide bar
- Quantity - Dessicant
- Quantity - Indicator crystals
- 5 Hypodermic type dispensers
- Spatula
- Spare fuses
- Instruction book

**Special options**

Extended range by the addition of three programmes, 43-70, 53-80, 63-90 deg C.

Unplated copper platen

Unit for nitrogen supply, no air processor fitted

**Optional accessories**

Additional cube applicators

Frame for up to 5 applicators

**Optional Extras****MFFT Water Re-circulation Unit**

The New MFFT re-circulating unit from Rhopoint allows the operation of the Minimum Film Forming Temperature instruments in laboratories that do not have access to a suitable water supply or wish to have the environmentally friendly option of recirculating the cooling water from the instrument. Placed on a desk top or in cupboard underneath the instrument, the recirculation unit is quiet enough to be operated in a working laboratory.

**Features**

- Environmentally friendly- the unit re-cycles waste water from the MFFT
- Quiet operation- 55dB(A) @ 1 metre
- 2 Years parts, one year labour warranty
- Plug in and use- cooling preset by Rhopoint
- Low cost of purchase and operation
- 330 x 315 x 515mm