

The Blayson Technical Centre

Wax Testing

21 September 2011

Wax Testing & Development

- Blayson has developed its wax testing over 50 years
- Successively developed in several stages leading to today's state of the art facility
- The Technical Centre offers the investment casting industry the leading capability in wax testing and control



Capabilities & Responsibilities

- Quality control of wax production
 - Across the Blayson Group companies
- Quality assurance, certified to ISO 9001
- Wax evaluation and technical reports
- Research & Development
- Collaboration with external institutions



Laboratory Testing

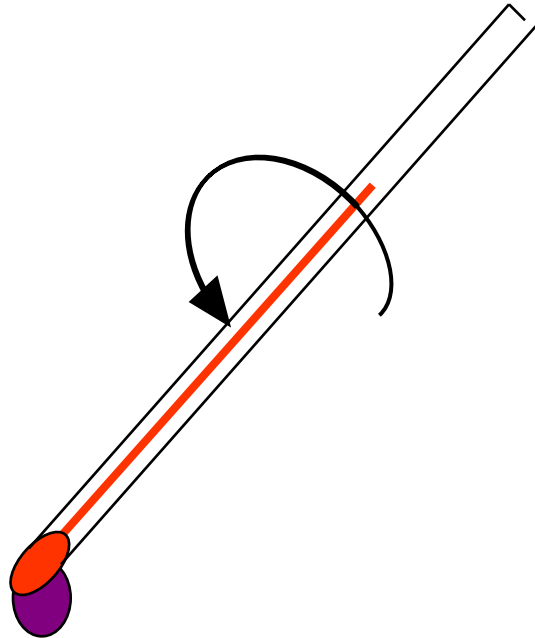
- A range of physical tests are carried out to ensure a wax meets its agreed specification
- Tests have progressed over time in order to meet the increasing demands of the industry
- The latest tests being designed and implemented by Blayson are process related

Standard Wax Tests

- Congealing Point
- Melting Point
- Viscosity (flow characteristics)
- Ash content (% non combustibles)
- Penetration (hardness)
- Filler content

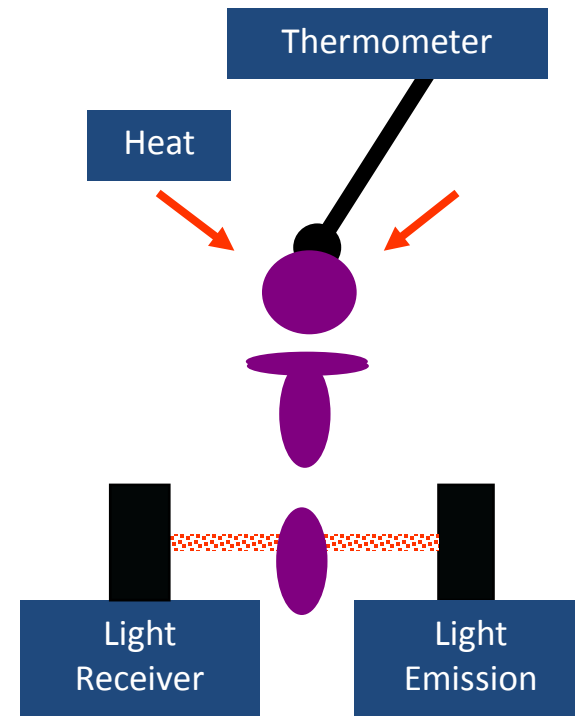
Congealing Point Test

Congealing Point is the temperature at which wax will cease to flow under the effect of gravity



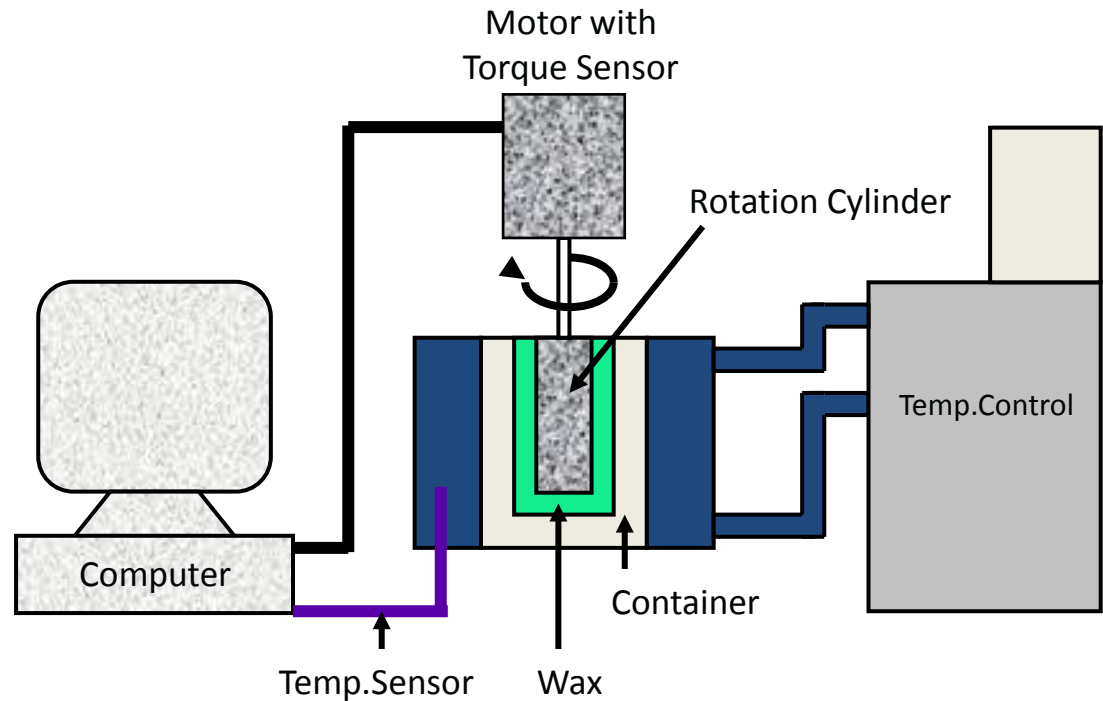
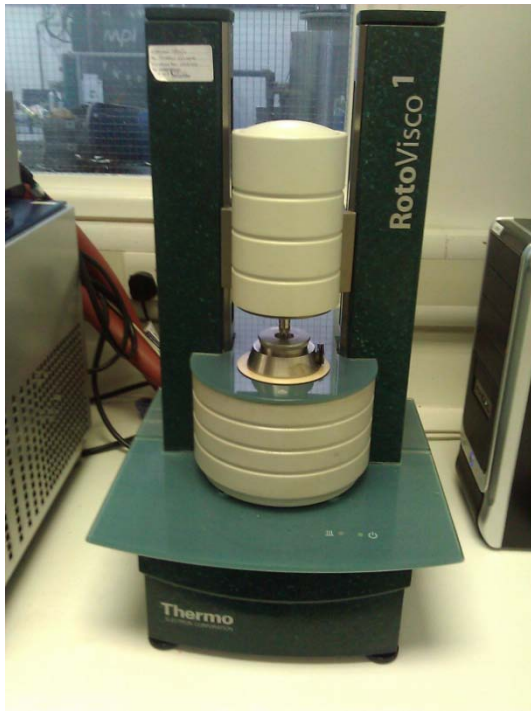
Drop Melt Point

- The drop melt point is the temperature at which wax melts
- A light beam is broken by the drop of molten wax and the temperature at which this occurs is recorded



Viscosity

- Viscosity is a measure of the change in fluidity of a wax with temperature
- The change in fluidity is measured at a constant shear rate



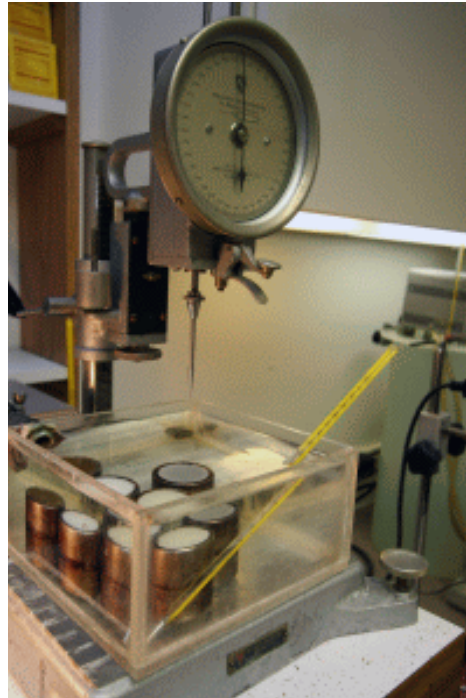
Ash Content

- The ash content is the percentage of non-combustible compounds remaining after burning a measured quantity of wax in air



Penetration Test

- The penetration test gives a guide to the hardness of a wax
- A calibrated weight is applied to a wax sample and the depth of penetration is measured



Specialised Wax Tests

- Rheometry
- Mechanical strength
- Melt speed
- DSC
- Infra red
- Volumetric expansion

Specialist Tests

- **Rheometry** - shows the flow properties of wax through all its phases from liquid to solid
- **Mechanical strength** - a standard three-point-bend test is used to determine the load bearing ability of a wax
- **DSC** - quantifies the energy required to melt a wax
- **Melt Speed Test** - gives an insight into the way a wax melts
- **Volumetric Expansion** - determines expansion during the melting phase



Blayson Technical Centre

Control of Wax Injection

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Process Based Testing

Product Name	Heating Point	Oil Content	Packing	Color	Application Area
Mermax B 59-60	0,5	38 kgs	ca. cardboard bag	White	Candle Cores, Tealight, Density Sheet Furniture
Mermax H 58-60	0,5	38 kgs	ca. cardboard bag	White	Candle Cores, Tealight, Density Sheet Furniture
Mermax S1 56-58	0,5-1,5	38 kgs	ca. cardboard bag	White	Candle Cores, Tealight, Density Sheet Furniture
Mermax SP 54-56	1,5-2,0	38 kgs	ca. cardboard bag	White	Candle Cores, Tealight, Density Sheet Furniture
Mermax MP 52-54	2,5-4,0	25 kgs	Sack	White	Candle Match Emulsion Tealight
Mermax YP 58-69	6,0-8,0	25 kgs	Sack	Yellow	Tealight Acacia/rose Emulsion Paper
Mermax HH 60-62	6,0-8,0	25 kgs	Sack	Cream	WPC Chrysoard Match Industry
Mermax HT 60-62	6,0-8,0	25 kgs	Sack	Yellow	WPC Chrysoard Match Industry
Mermax BH 64-68	6,0-8,0	25 kgs	Sack	Cream	Candle Emulsion against water vapor coating WPC Chrysoard and Wood Industry
Mermax HOF 58-60	4,0-8,0	25 kgs	Sack	Yellow	WPC Chrysoard and Wood Industry
Mermax HOF-H 58-60	4,0-8,0	25 kgs	Sack	Cream	WPC Chrysoard and Wood Industry
Mermax HS 56-58	1,0-2,0	38 kgs	cardboard Bag	White	Candle Cores, Tealight, Paper Emulsion
Mermax ES 60	60-64	0,5	cardboard Bag	White	Candle Cores, Tealight, Paper Emulsion
POLMAX 70-72	0,5	35 kgs	Sack	GREY	Candle Cores, Tealight, Paper Emulsion

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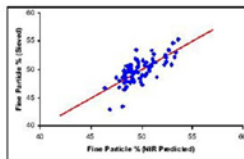
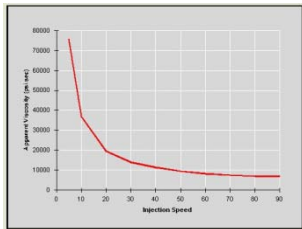
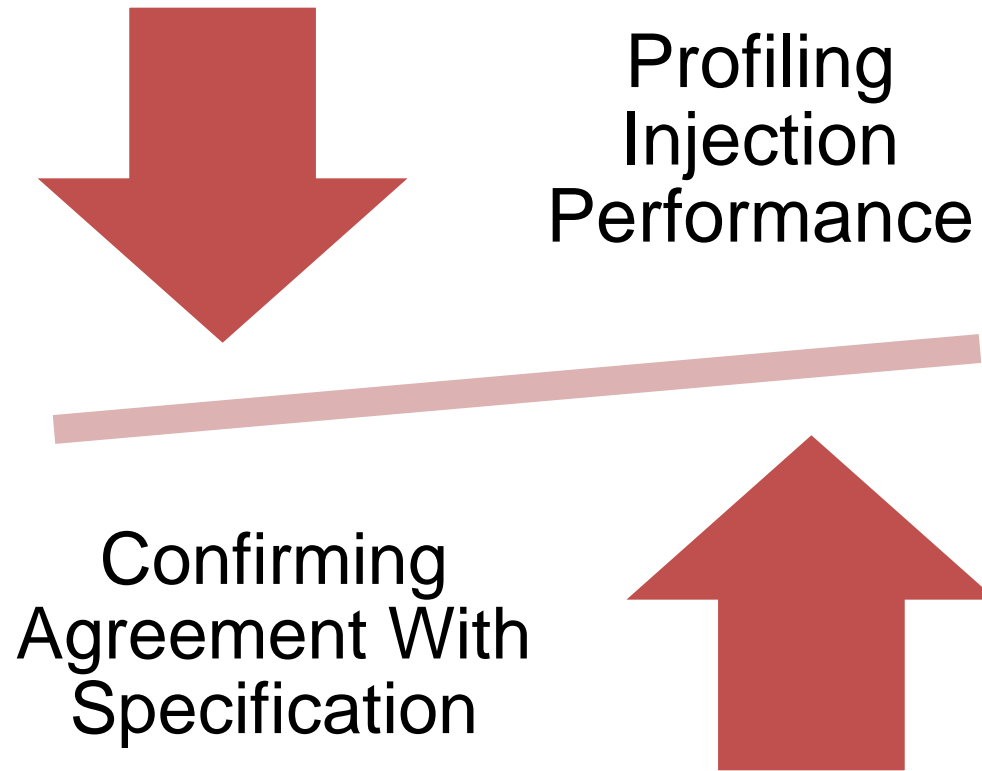


Figure 1. The result of a passive multivariate model built with limited variation using historical data on the process to predict the final blend particle size. A better model would be obtained if there were a wider range of particle sizes in the data set used to construct the model, but the data set is limited to ranges typically encountered in manufacturing



- Current industry testing ensures a product meets a specification
- Standard tests do not show all aspects of injection performance
- Blayson has implemented a series of process based tests
 - Injection flow
 - Batch dimensional analysis
 - Wax cavitation

Blayson Wax Testing Procedure



The Purpose of Batch to Batch Injection



Control Method

Process Controls

- Close Control of Wax and Die Temperatures
- Ability to Review Via External Thermocouples

Control of Techniques

- Individual Method Cards
- Specifications Generated Via Capability Analysis of Results and Agreed with Customers.

Review of Results

- Results Monitored Using Minitab® Software
- Wax Not Released Without Injection Capability

Dimensional Capability



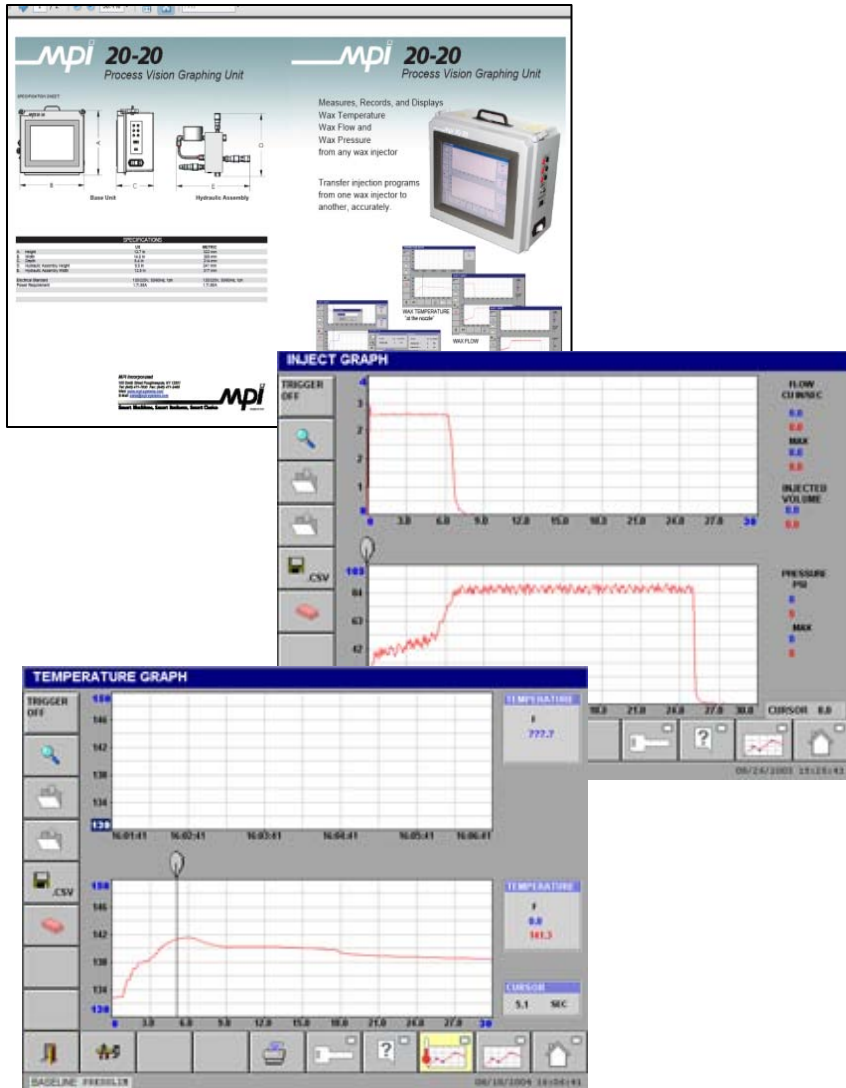
- Blayson uses temperature conditioned test pieces
- A capability is established from the results which must meet the agreed specification before the wax can be approved

Fluidity Analysis



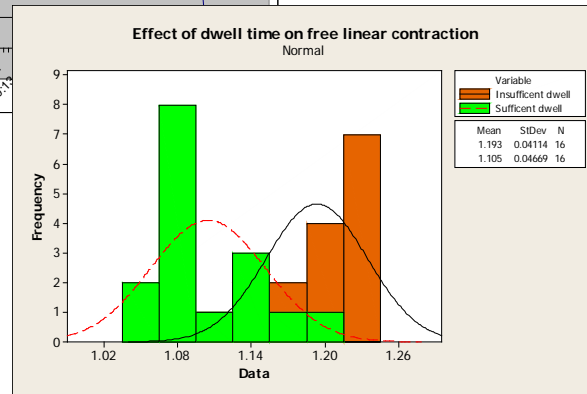
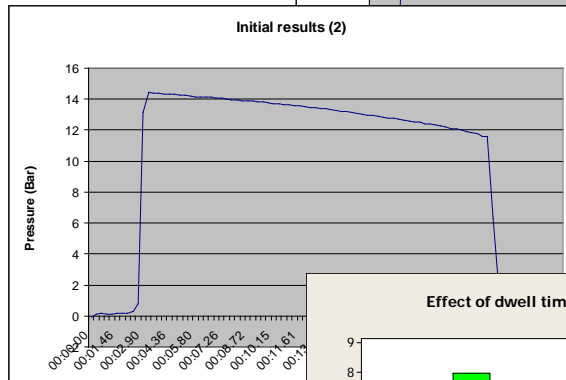
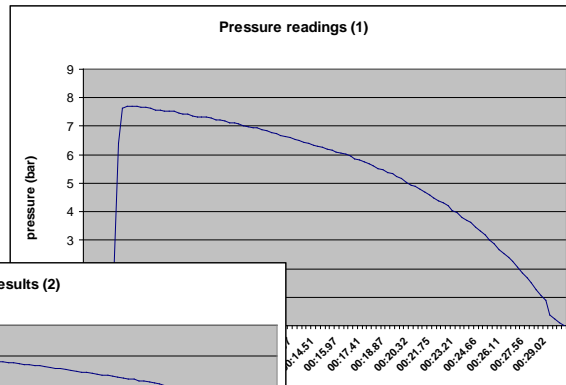
- Fluidity analysis involves the use of a spiral die with a graduated channel
- Under fixed conditions a number of injections are made and averaged to give a mean for comparison to the specification
- This test emulates foundry injection conditions

Injection Profile



- To obtain a graphical view of injection performance Blayson uses the MPi 20/20 vision unit
- This shows the pressure, flow and wax temperature during injection
- This ensures injection repeatability and provides a record

Monitoring Injection Pressure



- To monitor pressure within a die a Kistler Piezoelectric probe is used
- This shows the pressure achieved within the die and also the injection cycle
- Its use ensures a correct and complete injection takes place

Technical Partnership

