Metering Technology

compomjx

Hilger u. Kern / Dopag Group

General

There are a number of reasons why fibre-reinforced plastics are used increasingly in many areas of industry, amongst which are:

- Its high strength coupled with low weight
- Its ease of processing complex parts in small numbers
- When the usual production technique is not economically justified or even not technically possible

Such parts are used in many industries, including automotive and their subcontractors, aerospace, boat and ship building, sports equipment and leisure. The surface finish of parts produced in this way may equal the highest standards, depending on the process, the quality of the moulds and the tolerance requirements.

Additionally, against a background of increased worldwide discussion of energy efficiency relating to climate protection and sustainable stewardship of available energy resources, the trend in the use of fibre-reinforced plastics has moved from individual part production to partial or fully-automated production processes.

In the context of the overall process, it is also recognised that industry-sector-specific joining technology such as bonding, riveting or a hybrid method (bonding and conventional fastening) can be combined with each other.

FRP – Manufacturing Technology

There are three different manufacturing processes involved in the production of fibre-reinforced plastics

- RTM – Resin Transfer Moulding
- RIM – Reaction Injection Moulding
- Filament Winding

There are a number of plural component resins used with the RTM and RIM methods, including, for example

- Polyurthane
- Epoxy Resin
- Acrylic Resin
- Vinyl Ester Epoxy Resin
- Unsaturated Polyester

These resins are processed by the use of a metering and mixing machine that applies the mixed material into open or closed moulds. The moulds are prepared with layers of fibres or pre-forms and/or pre-wovens which are then impregnated by the mixed material. Once the application of the resins is completed the mould is closed to allow for curing, following which the part can be removed from the mould.

In the case of the winding technique, the glass and carbon fibres pass through an impregnation bath after which it is wound onto a winding spindle.

compomix

The compomix is a solvent free gear metering and mixing system.

The range includes four types of systems

- compomix 103 D
- compomix 103 M
- compomix 603
- compomix 603 V

The compomix is used to handle low to medium viscosity multi component media such as polyurethane, epoxy or other resins for the production of fibre-reinforced plastics.

Features and Benefits

- Variable mixing ratio with a wide range
- Variable flow rate, pressure or volume regulated
- Shot dispensing or continuous flow
- Control of the internal mould pressure
- Follow-up pressure function for optimal mould filling
- Uninterrupted dosing by automatic refilling
- Integrated evacuation (compomix 603 V)
- Solvent free

Function

Material pressure vessels are used to supply the material into the asynchronous motor driven gear pumps. Each gear pump is protected against over pressure and dry running as standard. A metering computer is used to control and monitor the system.

A particular feature is the metering accuracy regarding mixing ratios, even with varying flow rates as well as the high repeatability of the shot sizes.

The compomix systems are fitted with a static mixing system that includes a 2K Valve combined with a disposable static mixer.

Should mixed material be allowed to cure in the mixer, it can be replaced simply and inexpensively, thus avoiding a time consuming, expensive and environmental damaging flushing cycle.

compomix 103 D

compomix 103 M

Technical data

	compomix 103 D	compomix 103 M	compomix 603	compomix 603 V
Flow rate Standard	5 ml – 1.2 l/min depending on mixing ratio and viscosity	5 ml – 1.2 l/min depending on mixing ratio and viscosity	200 – 3000 ml/min	200 – 3000 ml/min
Mixing ratio	100:100 – 100:5	100:100 – 100:5	100:100 – 100:5	100:100 – 100:5
Working pressure	100 bar	100 bar	100 bar	100 bar
Mixing system	Static	Static	Static	Static
Material supply	Pressure vessels 12, 24, 45, 60, 90, 120 l	Pressure vessels 12, 24, 45 l	Pressure vessels 45, 60, 90, 120 l	Pressure vessels 45, 60, 90, 120 l
Viscosity range	10 – 80,000 mPas	10 – 80,000 mPas	10 – 80,000 mPas	10 – 80,000 mPas
Materials	PU, EP	PU, EP	PU, EP	PU, EP
Material characteristics	Unfilled, filled, abrasive MOHS hardness 7	Unfilled, filled, abrasive MOHS hardness 7	Unfilled, filled, abrasive MOHS hardness 7	Unfilled, filled, abrasive MOHS hardness 7
Power supply	3 x 400 V / 50 Hz	3 x 400 V / 50 Hz	3 x 400 V / 50 Hz	3 x 400 V / 50 Hz
Max. air inlet pressure	6 bar	6 bar	6 bar	6 bar
Dimensions L x W x H	1000 x 800 x 750 mm	1000 x 800 x 1750 mm	1940 x 1200 x 2500 mm	1940 x 1200 x 2500 mm
Weight	approx. 200 kg	approx. 400 kg	approx. 600 kg	approx. 600 kg

compomix 603

compomix 603 V

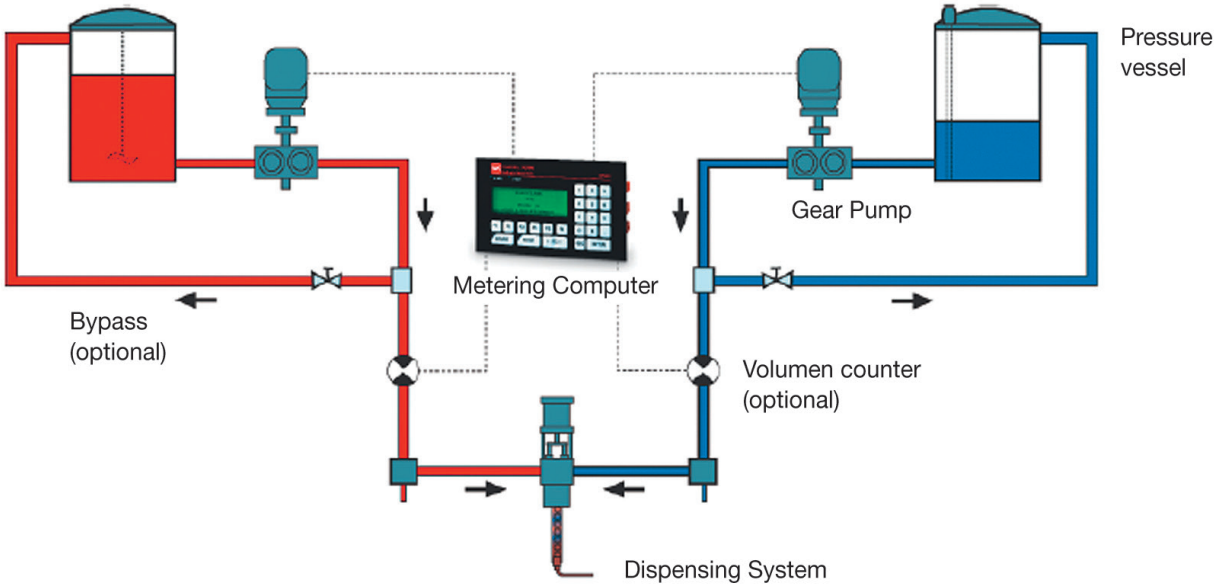
Equipment

Standard

- Control cabinet and material pressure vessels, mounted onto a movable chassis
- Gear metering pumps with over pressure protection with compomix 603 V, the gear metering pumps are mounted below the material level to feed under vacuum
- Asynchronous motors
- Metering computer MR15 with specific software for mould-filling speeds and mould pressure profiles (ramp operation when filling)
- Monitoring and regulation of the mixing ratio and the flow rate through volume counters
- Communication with external peripheral devices, for example presses, with metering computer possible
- Touch screen terminal
- Graphic display of the active metering parameters and the internal mould pressure

Optional

- Static dynamic mixing system, with optional mixing element monitoring
- Metering computer MR30
- Pressure vessels with
  - Level control
  - Agitator
  - Automatic refill
  - Connection for vacuum pumps
  - Automatic refill of the pressure vessels from drums or containers
  - Heating or stable temperature control
  - Bypass
  - Automatic degassing
  - Components made from special materials depending on the media to be processed



Operating data

The operating data of the metering system is displayed on an 8” touch screen, other optional displays can be used.

The real time data is saved periodically (adjustable from 1 to 60 second) in a CSV format.

The data can be loaded onto a USB stick via a USB port on the touch panel. The analysis can be made with an Office tool such as MS Excel.

Software

The software used with the metering computers MR15 / MR30 has been developed specifically to meet the high requirements which are necessary for the RTM-method.

- Display and calculation of the flow rate and the mixing ratio
- Display and regulation of the injection pressure, temperature, mixing ratio and flow rate
- Display malfunction in plain text, in addition visual and acoustic signal
- Pressure regulated injection, reference pressure from pump pressure A or B or internal mould pressure sensor if available
- Recording of the overall material consumption
- Programmable shot sizes, max. 50 data records / programs
- Limit values monitoring for pressure, mixing ratio and temperature

In addition, the compomix software has three further special functions unique for the application of RTM-methods.

- Metering with parameterised volume profile
- Constant pressure regulated metering
- Follow-up pressure function

The mixing ratio is regulated on the compomix.

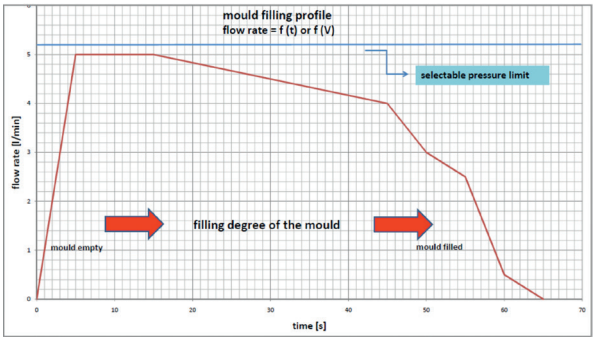
During filling, pressure inside the mould increases. This pressure can influence the mixing ratio which therefore needs to be regulated.

Both operating modes feature upper pressure monitoring.

This monitoring requires individual parameterisation as a function of mould size and flow rate.

Monitoring is necessary in order to prevent the mould from being pushed open if no mould holder or press is used.

Metering with volume profile



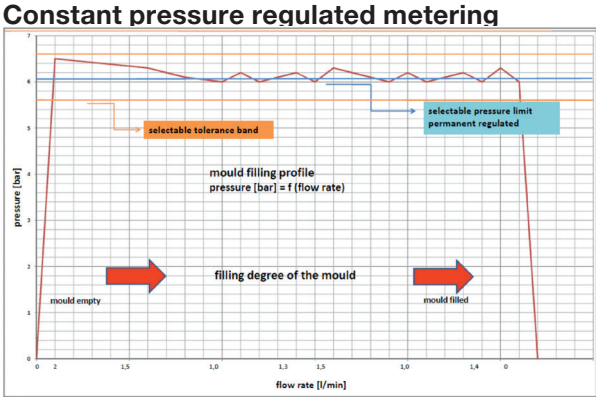
Diaphragm - Volumetric flow profile is defined by the mould filling time.

At the start of the metering cycle, the material is filled into the mould at a high flow rate.

As the level of material in the mould increases, the material flow is reduced at pre-programmed timed stages.

The volumetric flow profile is based on internal mould pressure monitoring, so should pressure in the mould reach the maximum allowed, the flow rate will be reduced automatically.

Constant pressure regulated metering



Constant pressure through volumetric flow.

With this filling principle the internal mould pressure increases through the inflowing material. Through automatic regulation of the flow rate the pressure is held within a predefined range.

Follow-up pressure function

During the filling of the mould when the resin inflates the fabric it is possible that small areas are not filled completely, which can lead to uneven spots on the surface of the component.

The follow-up pressure function of the compomix is able to prevent such failures.

This function can either be started manually or automatically, directly after the mould has been filled.

Hilger u. Kern / Dopag Group

The Hilger u. Kern / Dopag Group, with more than 250 employees, is one of the leading manufacturers of metering and mixing systems in the world for plural component polymers and single component media such as greases, oils and pastes.

For more than 35 years the group, with subsidiaries and distributors in over 30 countries, has developed systems and components to suit your individual needs.

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