Metering Technology

# Metering and Mixing Systems for the Production of Rotor Blades for Wind Energy Turbines

Hilger u. Kern / Dopag Group

**…and fast.**

## Accurate, dynamic...

By the year 2020, the proportion of electricity generated worldwide by wind power will increase to 12%, but an effective conversion to this technology will only be possible if the systems involved can be assured of a long life span. The promise is that mechanical parameters of the rotor blades are adhered to precisely during production.

Automated Metering and Mixing Systems must fulfil the following requirements:

- **Exact compliance to the specified metering ratio (accurate)**
- **Highly flexible output rate (dynamic)**
- **Rapid attainment of working conditions (fast)**

To comply with these requirements, Hilger u. Kern Metering and Mixing Division, has developed 3 types of metering and mixing systems for the production process of rotor blades. Rotor blades are manufactured in a three-step process and in serveral segments. Subsequently the rotor blades are glued together and coated to adjust unevenness as well as to give protection against enviromental influences. The sequence of the production process varies amongst the manufacturers of wind power turbines.

For all this special production processes Hilger u. Kern Metering and Mixing Division offers the ideal systems engineering.

- **The ELDO-MIX Gel Coat Systems to apply highly thixotropic materials onto the untreated surface of the rotor blades**
- **The ELDO-MIX Infusion Resin Systems for vacuum supported infusion (to impregnate the inserted fibre matting)**
- **The ELDO-MIX Glue Resin Systems to bond the two halves together**

## The Systems...

## ELDO-MIX Gel Coat Systems

The ELDO-MIX gel coat systems have especially been developed for processing highly thixotropic materials onto the untreated surfaces of rotor blades. With gear metering pumps, which are also suitable for abrasive fillers and magnetically coupled axial piston pumps for the B component output rates of up to 5 l/min can be achieved. The material supply of the mobile system is carried out from material pressure vessels that are installed on the chassis. Not only materials with viscosities up to the flow limit can be applied with this gel coat system but also the mixing ratios are adjustable within a wide range. This applies to Polyurethanes as well as for epoxy resins.

## ELDO-MIX Infusion Resin Systems

A deviation of less than 1% of the mixing ratio can not only be achieved with the newly developed ELDO-MIX infusion resin systems but also the output rate during production can be modified in 2% steps. At the heart of the system are solenoid coupled and leakage-free axial piston pumps, which due to the principle of construction present no internal leakage during changes in rotational speed (they operate continuously). Furthermore, they are hermetically sealed which is important when feeding the hygroscopic hardeners.

This newly developed metering system range for the processing of unfilled infusion resins combine highly accurate metering pumps with extremely fast control engineering. On the one hand, metering is carried out from a regulated by-pass in order to depart from the normal initialisation process of filling the mixing tube and on the other hand the output rate can be changed almost without limits – without exceeding the permitted tolerance limits of the metering ratio.

## ELDO-MIX Glue Resin Systems

The reliability of the bonding of both halves of the rotor blades is a fundamental aspect of the performance of a rotor blade. With the ELDO-MIX glue resin system a highly viscous adhesive is used for this process. Material feed is carried out with eccentric pumps although in the case of very low viscosity resins the use of gear metering pumps is possible. All pumps are protected with a special sealing system against wear.

The ELDO-MIX is available as a freestanding unit or as a mobile version.

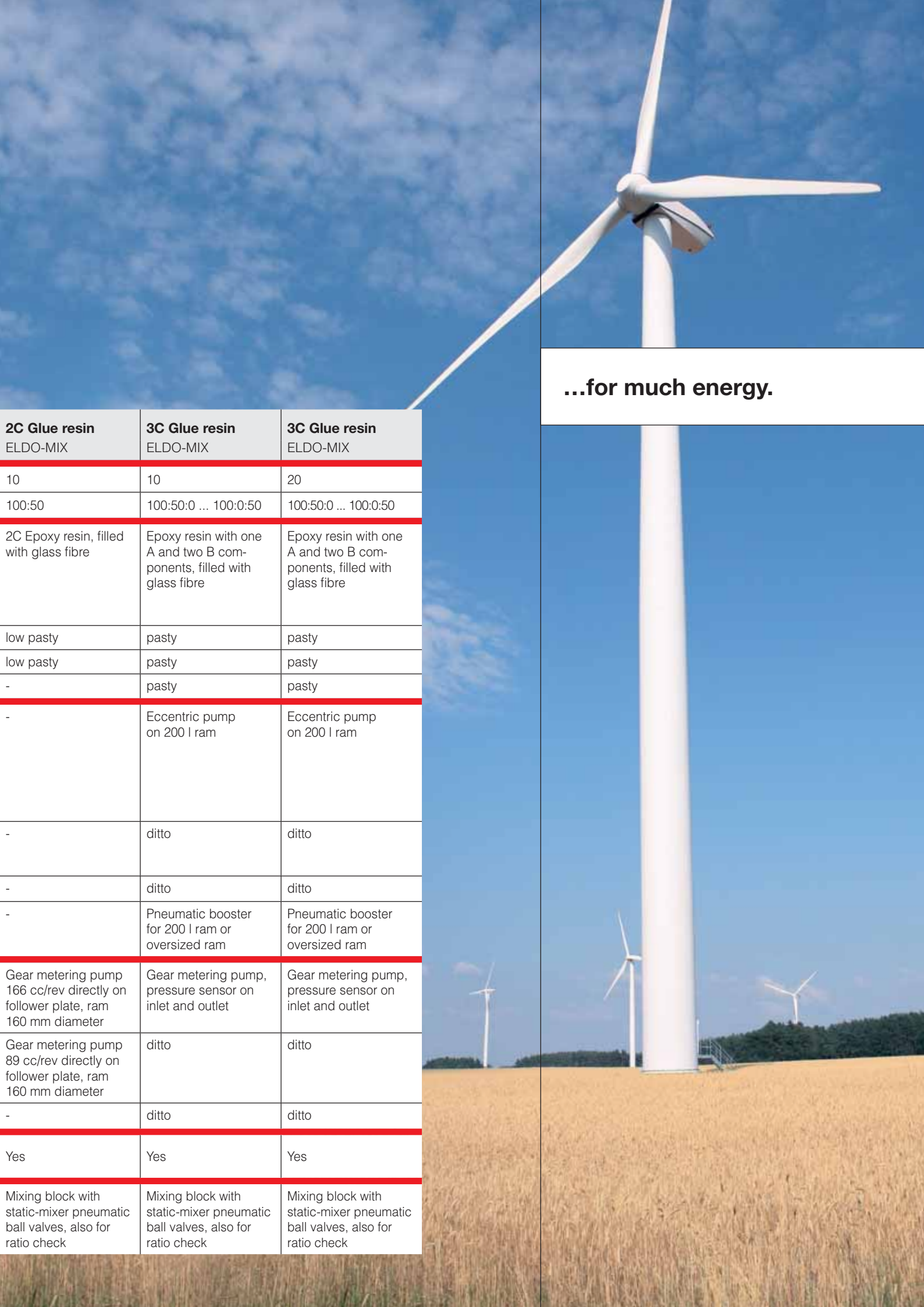
## Real time operating system for maximum availability

The MR20 metering computer with real-time operating system is integrated into all ELDO-MIX systems, the performance of which has been proved many times over in numerous Metering and Mixing Systems. Its fast regulation circuits guarantee exact adherence to specified metering ratios, a high flexible output rate and the rapid achievement of defined working conditions. The software can be modified to many different requirements and offers extensive functions – from supervision of the control unit up to process data capture. All necessary interfaces as well as inputs and outputs to connect to superior process systems and fully automated production lines are already integrated. Moreover, all systems can be equipped with a remote diagnostic modem.

| | | **2C Gel Coat** ELDO-MIX | **2C Gel Coat** ELDO-MIX | **2C/3C Infusion resin** ELDO-MIX | **2C Infusion resin** ELDO-MIX | **2C Glue resin** ELDO-MIX |
|---|---|---|---|---|---|---|
| **Output rate [l/min]** | | 5 | 3 | 20 | 60 | 12 |
| **Mixing ratio** | | 100:80 | 100:40 | 100:30:0 ... 100:0:30 | 100:30 | 100:50 |
| **Material type** | | 2C Polyurethane, filled, even abrasive | 2C Epoxy resin, filled, even abrasive | Epoxy resin with one A and two B components, A component slightly warmed to 35 °C in the material pressure vessel, no fillers | 2C Epoxy resin, A component slightly warmed to 35 °C in the material pressure vessel, no fillers | 2C Epoxy resin, filled with glass fibre |
| **Viscosity [mPas]** (Typical) | **A** | 35,000 thixotropic | 80,000 thixotropic | 1,000 | 1,000 | pasty |
| | **B** | 3,000 | 1,000 | 100 | 100 | pasty |
| | **C** | - | - | 100 | - | - |
| **Material supply** (Customized solutions possible) | **A** | Material pressure vessel 90 l, level control | Material pressure vessel 120 l, level control | Material pressure vessel 60 l on completely enclosed chassis, A component heated*, level control in all material pressure vessels | Material pressure vessel 1,500 l, level control | Eccentric pump on 200 l ram |
| | **B** | ditto | Material pressure vessel 60 l, level control | ditto | Material pressure vessel 500 l, level control | ditto |
| | **C** | - | - | ditto | - | - |
| **Comments** | | Automatically refilled in parking position from 200 l drum | Automatically refilled in parking position from 200 l drum | All refilled from customer central supply system | Refilled in „park position“ | Pneumatic booster for 200 l ram or oversized ram |
| **Metering** | **A** | Gear metering pump, glide ring seal and coated | Gear metering pump, glide ring seal and coated | Axial piston pump (optional solenoid coupled) | Axial piston pump (optional solenoid coupled) | Gear metering pump, pressure sensor on inlet and outlet |
| | **B** | Axial piston pump, solenoid coupled | Axial piston pump, solenoid coupled | Axial piston pump, solenoid coupled | Axial piston pump, solenoid coupled | ditto |
| | **C** | - | - | ditto | - | - |
| **Mixing ratio control and regulation** | | Yes | Yes | Yes | Yes | Yes |
| **Mixing** | | Hose package on boom with twin valve and static-mixer at the end | Hose package on boom with twin valve and static-mixer at the end | Static-Mixing system with 3/2 way hydraulic valves for bypass and mixing, adapter for ratio check | Mixing system with 3/2 way hydraulic valves for bypass and mixing, adapter for ratio check | Mixing block with static-mixer pneumatic ball valves, also for ratio check |

* Alternative: Electrical heated machine-cabinet.

All figures may of course vary with different applications.



**...for much energy.**

| **2C Glue resin**<br>ELDO-MIX | **3C Glue resin**<br>ELDO-MIX | **3C Glue resin**<br>ELDO-MIX |
|---|---|---|
| 10 | 10 | 20 |
| 100:50 | 100:50:0 ... 100:0:50 | 100:50:0 ... 100:0:50 |
| 2C Epoxy resin, filled with glass fibre | Epoxy resin with one A and two B components, filled with glass fibre | Epoxy resin with one A and two B components, filled with glass fibre |
| low pasty | pasty | pasty |
| low pasty | pasty | pasty |
| - | pasty | pasty |
| - | Eccentric pump on 200 l ram | Eccentric pump on 200 l ram |
| - | ditto | ditto |
| - | ditto | ditto |
| - | Pneumatic booster for 200 l ram or oversized ram | Pneumatic booster for 200 l ram or oversized ram |
| Gear metering pump 166 cc/rev directly on follower plate, ram 160 mm diameter | Gear metering pump, pressure sensor on inlet and outlet | Gear metering pump, pressure sensor on inlet and outlet |
| Gear metering pump 89 cc/rev directly on follower plate, ram 160 mm diameter | ditto | ditto |
| - | ditto | ditto |
| Yes | Yes | Yes |
| Mixing block with static-mixer pneumatic ball valves, also for ratio check | Mixing block with static-mixer pneumatic ball valves, also for ratio check | Mixing block with static-mixer pneumatic ball valves, also for ratio check |

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The Hilger u. Kern / Dopag Group, with more than 300 employees, 8 subsidiaries and 24 distributors, 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 30 years the group has developed systems and components to suit your individual needs.

Within the group Hilger u. Kern – Metering and Mixing Division, Mannheim, is the Competence Centre for the development, production and the international exclusive sale of Metering and Mixing Systems, for the production of rotor blades for wind energy turbines.