Process Technology

- Dispersing
- Homogenizing
- Emulsifying
- Mixing
- Stirring
- Wet milling
The machine program of IKA®-WERKE is as manifold as mixing technology itself. We are specially dealing with mixing and dispersing of materials that are generally not mixable. This sounds like a contradiction!

In order to meet the variety of applications, we have developed a new modular construction series. With this series of machines it became possible to carry out different process steps like dispersing with “high-shear”, milling or continuous mixing of solids and liquid with only a few modules. A very economic solution!

For the discontinuous processing technology we offer of course also a complete program of stirring, mixing and dispersing machines.

Doing research on new things and preserve proven technologies, that is IKA’s philosophy. Together with our customers and with research institutions we are permanently developing and testing new technologies, materials and applications.

Stands
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Dispersing in batch operation
- ULTRA-TURRAX® 17

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- Series 2000 5
- ULTRA-TURRAX® UTL 2000 7
- DISPAX-REACTOR® DR 2000 8
- DISPAX-REACTOR® DRS 2000 9
- Colloid mill MK 2000 10
- Cone mill MKO 2000 11
- Solid-liquid-mixer CMS 2000 12
- Solid-liquid-mixer MHD 2000 13
As manifold as the mixing technology may be, there are some, only slightly differing, requirements arising again and again. IKA® developed a modular construction series which allows to use different working modules for the different applications, using in most of the cases the same drive unit.

Experienced engineers in co-operation with users have bundled up their know-how and developed an innovative package for the use in practice.

These are the main characteristics of the IKA® modular series:

- Vertical position and thus complete emptying
- Product space nearly free of dead spots
- Best quality surface finish
- CIP- and SIP-capability
- Extended mixing- and dispersing methods
- Low noise level
- Especially suited for application in food and pharmaceutical industry
Modular construction – System with great future

- Wet milling: Module MKO 2000
- Incorporation of powders: Module CMS 2000
- Incorporation of powders: Module MHD 2000
- Drive unit
Sophisticated up to the details

The details make the difference!
A stable and flexible belt drive with three-phase motor of variable power is mounted in the base frame of the IKA® machines. A shear stress that is constant for all machine sizes allows a reliable scale-up.
A special mechanical seal in cartridge-construction cares for high reliability as well as easy and quick assembly. IKA® uses best-quality materials which respond to highest mechanical requirements and are resistant to corrosion.
In close co-operation with our customers the generators have been further improved in order to achieve better dispersing and solving effects. Now also generators made of special materials like ceramics, carbides, stellite, etc. are available.
It is for granted that we turn our special attention to surface qualities and lack of dead spots and take all regulations of the FDA and EHEDG into consideration.
Surfaces acc. to pharmaceutical requirements
It was a special honour for IKA® to receive the award shown on the right side, confirming the unlimited use of the MHD 2000 in the chemical process technology. This machine has been developed for the inline or continuous mixing of solids in liquids.

Moreover, the Food and Drug Administration (FDA) granted to IKA® the 3A-sanitary approval for the complete new line of series 2000 machines. Another proof for IKA® professional know-how.

Regular patent applications testify to the steady development, whereas ISO certification is securing the high quality standard.

IKA® LABOR-PILOT 2000/4
The smallest one from the modular construction series 2000. Equipped with the same mixing, milling and dispersing tools as its big brothers, it is the ideal device for development of recipes, adaptation of processes and of course for technical specifying of production size machines. It should not be missing in any laboratory!
A single-stage dispersing machine for production of emulsions as well as suspensions with relatively rough but narrow distribution range. The high shear rates result in a good stability of the mixtures. Different generators (rotor + stator) enable a further adaptation to the process aim and the rheology.

The machines of all sizes are working with the same circumferential speed of the rotor, thus allowing a good scale-up. Motors of all protection types, including flame-proof motors, are available. Working is possible with pressures up to 16 bar and temperatures of up to an average of 120°C. In case of higher viscosities a preceding positive-displacement pump may be used. The ULTRA-TURRAX® is self-cleaning, i.e. without dead spots, with surfaces of highest quality and thus CIP-capable.

### Applications
- Sauces
- Fruit juices
- Marmalades
- Sugar solutions
- Colours
- Binders
- Molten resins
- Lotions
- Glues
- Stabilizers
A three-stage high-shear dispersing machine for the production of macro-emulsions and very fine suspensions. Due to the three generators (rotor + stator) in direct series a narrow distribution range, smaller droplets and particles and thus a longer stability of the mixture are reached. The generators are easily interchangeable, by which a further adaptation to the respective application becomes possible. Same speed and shear rate for all machine sizes enables an exact scale-up. Drives and process parameters like temperature, pressure and viscosities are the same as for the ULTRA-TURRAX®.

CIP and SIP capability are also given for these machines and they are therefore of great use especially for the production of food and pharmaceutical products.
It is well known that high speeds resp. shear rates are most important for achieving finest micro-emulsions. The DISPAX-REACTOR® DRS combines extremely high shear rates of up to 190,000 s⁻¹ with finest generator geometry.

The DRS disposes of two generators. Due to the high circumferential speed a third step became unnecessary. The operation parameters are the same as for ULTRA-TURRAX® and DISPAX-REACTOR® DR. Moreover, the DRS is especially suited for the production of pharmaceuticals.
The colloid mill MK 2000 is especially used for the production of colloidal solutions, i.e. extremely fine suspensions and also emulsions. Besides with high speeds and small gaps the MK is working with friction. Therefore one is talking about wet-milling. The cones of rotor and stator have a large gap width at the entrance and a very narrow one at the exit. Additional deviations in the course of the generator cause increased turbulences. A very efficient milling geometry, best surface finish and excellent material qualities are distinguishing characteristics of the MK 2000. Other process parameters like for DISPAX-REACTOR® DR and DRS.
**Applications**

same as for the colloid mill, but even finer distribution and particle size reduction range

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**MKO 2000/…**

The cone mill MKO 2000 is a further development of the colloid mill. Due to an innovative milling technology the cone mill produces, by particle size reduction and wet milling, even finer suspensions than the colloid mill. This is achieved by smallest milling gaps in connection with an infinite gap adjustment and conical milling tools. An excellent milling effect is caused by very hard surfaces with a rough structure. The milling surfaces consist of high-quality materials like metal carbides or ceramics of different grain size. Therefore the milling tools in the very heavy strained shear zone are well protected against wear and tear. With the cone mill low as well as high viscous products can equally be processed.

<table>
<thead>
<tr>
<th>Type</th>
<th>Size</th>
<th>Max. flow capacity, ref. H2O min. gap, at 50 Hz, l/h</th>
<th>Drive speed 50 Hz, 1/min</th>
<th>Motor power IP 55 kW</th>
<th>Connections inlet/outlet</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cone Mill</td>
<td>MKO 2000/4 LABOR-PILOT</td>
<td>75</td>
<td>8.050</td>
<td>1.5</td>
<td>DN 25 / DN 15</td>
</tr>
<tr>
<td></td>
<td>MKO 2000/5</td>
<td>150</td>
<td>6.000</td>
<td>5.5</td>
<td>DN 40 / DN 32</td>
</tr>
<tr>
<td></td>
<td>MKO 2000/10</td>
<td>500</td>
<td>4.200</td>
<td>15</td>
<td>DN 50 / DN 50</td>
</tr>
<tr>
<td></td>
<td>MKO 2000/20</td>
<td>1.500</td>
<td>3.000</td>
<td>37</td>
<td>DN 80 / DN 65</td>
</tr>
<tr>
<td></td>
<td>MKO 2000/30</td>
<td>3.000</td>
<td>1.500</td>
<td>55</td>
<td>DN 150 / DN 125</td>
</tr>
<tr>
<td></td>
<td>MKO 2000/50</td>
<td>6.000</td>
<td>1.100</td>
<td>160</td>
<td>DN 200 / DN 150</td>
</tr>
</tbody>
</table>
Powder incorporation and wetting discontinuous

Applications

- Alumina suspensions
- Starch solutions
- Calcium carbonate suspensions

All applications where big quantities of solids have to be incorporated.

Dust- and lump-free incorporation of powders is one of the most frequent processing steps. The machine of type CMS 2000 is equipped with a specially designed rotor, which on the one hand sucks the liquid from a tank and on the other hand the powder from any container. The machine is working in circulating operation until the complete quantity of powder is fed. Dispersing can then be continued with closed powder inlet. Depending on the product resp. the powder characteristics, solids concentrations of up to 80% can be achieved. In case of very high viscosities an additional pump may be preceded.

<table>
<thead>
<tr>
<th>Type</th>
<th>Max. total capacity l/h</th>
<th>Powder incorporation kg/h</th>
<th>Motor power IP 55 kW</th>
<th>Connections inlet solid/inlet liquid/outlet</th>
</tr>
</thead>
<tbody>
<tr>
<td>CMS 2000/05</td>
<td>15.000</td>
<td>60 – 2.500</td>
<td>7.5</td>
<td>DN 25 / DN 32 / DN 32</td>
</tr>
<tr>
<td>CMS 2000/10</td>
<td>35.000</td>
<td>150 – 5.500</td>
<td>18.5</td>
<td>DN 40 / DN 50 / DN 50</td>
</tr>
<tr>
<td>CMS 2000/20</td>
<td>60.000</td>
<td>200 – 8.500</td>
<td>37</td>
<td>DN 50 / DN 80 / DN 80</td>
</tr>
<tr>
<td>CMS 2000/30</td>
<td>100.000</td>
<td>400 – 14.000</td>
<td>90</td>
<td>DN 80 / DN 125 / DN 125</td>
</tr>
<tr>
<td>CMS 2000/50</td>
<td>200.000</td>
<td>700 – 28.000</td>
<td>160</td>
<td>DN 125 / DN 150 / DN 150</td>
</tr>
</tbody>
</table>
For very big production quantities we recommend the MHD 2000 mixing machines. The liquid and the solids (powders or granules) are mixed continuously and dust-free. The materials to be mixed are fed in proportional quantities, premixed in the machine and then dispersed, so that you will receive a finished final product. The slightly increased dosing effort is compensated by much smaller tank capacities, and additional expensive and heavy other mixing machines are no more needed. Additionally the MHD offers higher flexibility in the production and a constant product quality.

<table>
<thead>
<tr>
<th>Type</th>
<th>Size</th>
<th>Max. total capacity</th>
<th>Max. solids capacity at bulk density 0,7 kg/dm³</th>
<th>Motor power IP 55</th>
<th>Connections inlet solid/liquid</th>
<th>outlet</th>
</tr>
</thead>
<tbody>
<tr>
<td>MHD 2000/4 LABOR-PILOT</td>
<td>200</td>
<td>100</td>
<td>1,5</td>
<td>DN 50 / DN 15 / DN 15</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MHD 2000/50</td>
<td>700</td>
<td>180</td>
<td>5,5</td>
<td>DN 50 / DN 25 / DN 32</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MHD 2000/10</td>
<td>2.500</td>
<td>900</td>
<td>7,5</td>
<td>DN 65 / DN 32 / DN 50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MHD 2000/20</td>
<td>7.000</td>
<td>1.800</td>
<td>15</td>
<td>DN 80 / DN 50 / DN 65</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MHD 2000/30</td>
<td>20.000</td>
<td>6.200</td>
<td>30</td>
<td>DN 150 / DN 80 / DN 125</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MHD 2000/50</td>
<td>40.000</td>
<td>13.500</td>
<td>75</td>
<td>DN 200 / DN 100 / DN 150</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Since decades ULTRA-TURRAX® is a common term representing quality and reliability. The machines are used for the production of any kind of emulsions, suspensions as well as lysoles. A variety of generators (rotor + stator) enable further adaptations to the respective mixing task. Moreover, different types of seals allow different fitting positions as well as working under pressure up to 10 bar and with temperatures up to approx. 160°C.

The models UTC, UTL and UTE are basically only differing in their design, respectively in the type of seal. Nevertheless, the generators are always the same so that the same mixing result is achieved. The UTE model has to be preferred in case of varying filling levels in the container.

**Sealing type KD**  
(mechanical seal)

**Sealing type KT**  
(lip seal)
Applications

- Creams
- Waxes
- Polishing agents
- Gelling agents
- Disperse dyes
- Polymer emulsions

Others see UTL 2000/... page 9
Applications

- Creams
- Waxes
- Polishing agents
- Gelling agents
- Disperse dyes
- Polymer emulsions

others see UTL 2000/... page 9

ULTRA-TURRAx® UTE for bottom entry, mainly used in case of varying filling levels and when strong spouts and air inclusions have to be avoided. Suitable for operation with pressures from 0,1 up to 16 bar and temperatures from -40° up to 160°C.

<table>
<thead>
<tr>
<th>Type</th>
<th>Size</th>
<th>Max. recom. volume, ref. H2O</th>
<th>Motor power IP 55</th>
<th>Speed</th>
<th>Tip Speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>UTE 60</td>
<td>70</td>
<td>1,85 - 2,5</td>
<td>3.000</td>
<td>23</td>
<td></td>
</tr>
<tr>
<td>UTE 115</td>
<td>400</td>
<td>2,5 - 5,5</td>
<td>3.000</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>UTE 150</td>
<td>750</td>
<td>5,5 - 11</td>
<td>3.000</td>
<td>21</td>
<td></td>
</tr>
<tr>
<td>UTE 220</td>
<td>1.200</td>
<td>11 - 15</td>
<td>1.500</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>UTE 250</td>
<td>1.500</td>
<td>15 - 18,5</td>
<td>1.500</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>UTE 280</td>
<td>2.500</td>
<td>22 - 24</td>
<td>1.500</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>UTE 300</td>
<td>4.000</td>
<td>30</td>
<td>1.500</td>
<td>21</td>
<td></td>
</tr>
</tbody>
</table>
The IKA-ROTOTRON® is a jet-flow agitator. Its efficiency is located between that of a normal stirrer and a dispersing machine with rotor-stator-system. It is mainly used when a mixing product has to be intensively circulated, even at high viscosities (up to approx. 15,000 mPa·s), as well as for unfavourable container dimensions and shapes. The special geometry of the rotor and the jet-tube allows low drive powers at nevertheless high and directed circulation capacity. The machines can be fitted in any position. Seals and operation parameters correspond to those of the ULTRA-TURRAX® UTC (see page 16). When working with higher viscosities a switch for reversing of the flow direction is recommended.

### Applications

Mixing and solving of:
- Flocculents
- Gels

... and suspending of:
- Polishes
- Enamels

... and homogenizing of:
- Bath essences
- Latex-emulsionen

... and gassing of:
- Waste water
- Bioreactors

### ROTOTRON®

<table>
<thead>
<tr>
<th>Type</th>
<th>Recom. volume, ref. H₂O</th>
<th>Motor power IP 55</th>
<th>Speed 1/min</th>
<th>Max. length</th>
<th>Circulation capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>RT 115</td>
<td>200 – 1,000</td>
<td>1,5 - 3</td>
<td>3,000</td>
<td>1,600</td>
<td>25</td>
</tr>
<tr>
<td>RT 150</td>
<td>1,000 – 5,000</td>
<td>3 - 4,6</td>
<td>3,000</td>
<td>1,600</td>
<td>60</td>
</tr>
<tr>
<td>RT 220</td>
<td>max. 10,000</td>
<td>5,5 - 8</td>
<td>1,500</td>
<td>2,300</td>
<td>110</td>
</tr>
<tr>
<td>RT 250</td>
<td>max. 15,000</td>
<td>7,5 - 12</td>
<td>1,500</td>
<td>2,300</td>
<td>145</td>
</tr>
<tr>
<td>RT 280</td>
<td>max. 20,000</td>
<td>11 - 15</td>
<td>1,500</td>
<td>2,300</td>
<td>200</td>
</tr>
<tr>
<td>RT 350</td>
<td>max. 30,000</td>
<td>15 - 24</td>
<td>1,000</td>
<td>2,600</td>
<td>225</td>
</tr>
</tbody>
</table>
The name IKA-TURBOTRON® stands for the classical stirrers. These can be equipped with the different stirring tools shown on this page. According to the variety of stirring tasks and operation conditions the most different drives, sealing systems and speeds are used.

For determination of these data the optimum dimensions and installation positions have always to be considered (see sketches on page 21). Depending on the process, the machines can be used under vacuum as well as pressure and in a wide temperature range. Particularly for application in the food and pharmaceutical industry special materials and of course finest polishes are available.

Nomenclature:
RK-00-P-800

<table>
<thead>
<tr>
<th>Type</th>
<th>Recom. volume, ref. H₂O l</th>
<th>Motor power kW</th>
<th>Speed 1/min</th>
<th>Max. length mm</th>
<th>Ø mm</th>
<th>Stirring tool</th>
</tr>
</thead>
<tbody>
<tr>
<td>RK / RF 00</td>
<td>500 / 1.000</td>
<td>0.37 / 0.55</td>
<td>1.000 / 1.500</td>
<td>800 / 1.500</td>
<td>125 / 125</td>
<td>100 / 100</td>
</tr>
<tr>
<td>RK / RF 01</td>
<td>1.000 / 2.000</td>
<td>0.55 / 0.75</td>
<td>1.500 / 1.000</td>
<td>1.000 / 1.500</td>
<td>125 / 160</td>
<td>100 / 130</td>
</tr>
<tr>
<td>RK / RF 02</td>
<td>1.500 / 3.000</td>
<td>0.75 / 1.5</td>
<td>1.000 / 750</td>
<td>1.000 / 1.750</td>
<td>160 / 220</td>
<td>130 / 200</td>
</tr>
<tr>
<td>RK / RF 03</td>
<td>2.000 / 4.000</td>
<td>1.1 / 2.2</td>
<td>1.000 / 1.000</td>
<td>1.25 / 1.500</td>
<td>190 / 220</td>
<td>160 / 160</td>
</tr>
<tr>
<td>RK / RF 04</td>
<td>2.500 / 5.000</td>
<td>1.5 / 3</td>
<td>750 / 1.000</td>
<td>1.500 / 1.500</td>
<td>220 / 250</td>
<td>200 / 200</td>
</tr>
<tr>
<td>RK / RF 05</td>
<td>3.000 / 6.000</td>
<td>2.2 / 4</td>
<td>750 / 750</td>
<td>1.750 / 1.750</td>
<td>250 / 250</td>
<td>220 / 250</td>
</tr>
<tr>
<td>RK / RF 06</td>
<td>3.500 / 8.000</td>
<td>3 / 5.5</td>
<td>1.000 / 750</td>
<td>1.750 / 1.750</td>
<td>220 / 300</td>
<td>200 / 300</td>
</tr>
<tr>
<td>RK / RF 07</td>
<td>4.000 / 12.000</td>
<td>4 / 7.5</td>
<td>1.000 / 750</td>
<td>1.750 / 2.000</td>
<td>250 / 350</td>
<td>220 / 325</td>
</tr>
</tbody>
</table>

Diameter anchor stirrer adapted to vessel diameter.
### TURBOTRON®

**RFG / RKG**

- **anchor stirrer**
- **propeller stirrer**
- **disk stirrer**
- **turbine stirrer**
- **toothed disk stirrer**

#### Type Recom. volume, ref. H₂O Motor power Speed Max. length Stirring tool

<table>
<thead>
<tr>
<th>Type</th>
<th>Recom. volume, ref. H₂O</th>
<th>Motor power kW</th>
<th>Speed 1/min</th>
<th>Max. length mm</th>
<th>Stirring tool</th>
</tr>
</thead>
<tbody>
<tr>
<td>TURBOTRON®</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RKG / RFG 00</td>
<td>1.000 / 1.000</td>
<td>0.55 / 0.55</td>
<td>250 / 250</td>
<td>1.250 / 1.500</td>
<td>250 / 200</td>
</tr>
<tr>
<td>RKG / RFG 01</td>
<td>1.500 / 1.500</td>
<td>0.75 / 0.75</td>
<td>250 / 250</td>
<td>1.250 / 1.500</td>
<td>300 / 265</td>
</tr>
<tr>
<td>RKG / RFG 02</td>
<td>3.000 / 3.000</td>
<td>1.5 / 1.5</td>
<td>250 / 250</td>
<td>1.500 / 1.500</td>
<td>350 / 325</td>
</tr>
<tr>
<td>RKG / RFG 03</td>
<td>4.000 / 6.000</td>
<td>2.2 / 3</td>
<td>250 / 250</td>
<td>1.500 / 1.750</td>
<td>350/400 / 350/405</td>
</tr>
<tr>
<td>RKG / RFG 04</td>
<td>5.000 / 8.000</td>
<td>3 / 4</td>
<td>250 / 250</td>
<td>1.750 / 2.000</td>
<td>400/450 / 405/450</td>
</tr>
<tr>
<td>RKG / RFG 05</td>
<td>6.000 / 12.000</td>
<td>4 / 5.5</td>
<td>250 / 250</td>
<td>2.000 / 2.500</td>
<td>450/500 / 450/500</td>
</tr>
<tr>
<td>RKG / RFG 06</td>
<td>8.000 / 15.000</td>
<td>5.5 / 7.5</td>
<td>250 / 250</td>
<td>2.000 / 2.750</td>
<td>500/5  / 500/525</td>
</tr>
<tr>
<td>RKG / RFG 07</td>
<td>12.000 / 20.000</td>
<td>7.5 / 9.2</td>
<td>250 / 250</td>
<td>2.000 / 3.000</td>
<td>± 525/550</td>
</tr>
</tbody>
</table>

* Diameter anchor stirrer adapted to vessel diameter*
The shown stands are supplementary equipment to our stirrers and the ULTRA-TURRAX® UTC. Lifting and lowering are either done by a hydraulic hand pump or by an electric motor. The stands may also be equipped with swivelling brackets. The mixing vessels are secured by an adjustable vessel fastening device.

Electric lockings make sure that the stirrer can only be operated when it is emerged into the vessel and the vessel is firmly fixed. The lifting height can be adjusted acc. to the requirements. For use in food and pharmaceutical production polished stainless steel stands are available.
Spare parts and repairs

For securing a quick and smooth supply of spare parts, also in case of repairs, IKA®-WERKE is keeping a modern parts stockroom with continuous stock supervision.

Research and development

A well equipped pilot plant with all necessary trial machines as well as measuring and documentation possibilities is at our customers’ disposal. Existing processes can be optimized by trials and new procedures can be developed.

This pilot plant is of course also intensively used by our own design department for optimization of existing and development of new machines and processes.

Quality assurance

Every single IKA® product is submitted to a final quality assurance control before it leaves our workshop, in order to test its complete functionality and to ensure a smooth integration into the customer’s production line.