Compact Gas Conditioning
MAK10

Application
The compact gas conditioning systems series MAK10 are used for continuous extractive gas analysis. They serve primarily for exact constant lowering of the sample gas dew point and thus for drying of the humid sample gas flow. In this way water vapour cross sensitivities and volumetric errors are minimized and damages of the sensible analyzer are avoided. With optional components like condensate pumps, pre-separators, filters, liquid sensors, flow meters and sample gas pumps devices of series MAK10 can be upgraded to complete compact quick and simple integrable conditioning systems. The flexible modular design guarantees an optimum adaption to every measuring task.

Technology
The precise proportional temperature control in combination with the long-lasting hot-gas bypass system and the innovative corrosion resistant heat exchangers achieves low extremely constant dew points. Also load fluctuations and high thermal stress is compensated reliably. The hydrophobic corrosion resistant PTFE coating and the very short retention time in the heat exchanger ensure a lowest possible gas dissolution rate.

Functions
An electronic system controls dew point and cooling air temperature. Potential free alarm contacts allow remote monitoring of the device. The operating parameters are stored in a log book for diagnosis. An operation hours counter controls the service intervals. Available housing versions are wall mounting housing, 19“-rack, or mobile housing.

✓ High performance compressor cooler
✓ Long lasting hot-gas bypass system without switching the compressor
✓ Corrosion resistant PTFE / PVDF heat exchanger
✓ Very compact design
✓ Digital display for temperature, alarms, logbook, operating hours counter and service interval indication
✓ Modular upgradeable and application dependently configurable
✓ 1 - 4 gas paths
✓ Integrable filters, flow meters, flow alarms, liquid sensors, gas pumps, pre-separators und acid dosing
✓ Wall mounting, 19“-rack, or mobile housing
Technical Data

<table>
<thead>
<tr>
<th>Model</th>
<th>MAK10-1</th>
<th>MAK10-2</th>
<th>MAK10-3</th>
<th>MAK10-4</th>
<th>MAK10-1 PS1</th>
<th>MAK10-2 PS2</th>
</tr>
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<tbody>
<tr>
<td>Type</td>
<td>MAK10-1101-4-00-F</td>
<td>MAK10-2202-4-00-F</td>
<td>MAK10-3303-5-00-F</td>
<td>MAK10-4404-5-00-F</td>
<td>MAK10-1112-4-00-F</td>
<td>MAK10-2224-5-00-F</td>
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<tr>
<td>Number of gas paths</td>
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<td>3</td>
<td>4</td>
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<td>2</td>
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<td>Number of condensate pumps</td>
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<td>Number of pre-separators</td>
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<td>-</td>
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</tr>
</tbody>
</table>

Material of gas paths
- Cooling transmission / storage: aluminium tube / copper rod
- Cooling surface: PTFE coating
- Housing / sealings: PVDF / FPM

Operating data
- Gas flow V at 65°C dp:
  - MAK10-1: 1 x 125 l/hr
  - MAK10-2: 2 x 125 l/hr
  - MAK10-3: 3 x 125 l/hr
  - MAK10-4: 4 x 125 l/hr
  - MAK10-1 PS1: 1 x 150 l/hr
  - MAK10-2 PS2: 2 x 150 l/hr
- Gas flow V at 55°C dp:
  - MAK10-1: 1 x 175 l/hr
  - MAK10-2: 2 x 175 l/hr
  - MAK10-3: 3 x 175 l/hr
  - MAK10-4: 4 x 175 l/hr
  - MAK10-1 PS1: 1 x 200 l/hr
  - MAK10-2 PS2: 2 x 200 l/hr
- Gas inlet temperature: °C max. 140
- Ambient temperature: °C +5 to +45
- Operating pressure: bar 0,2 to 2,2
- Outlet dew point: °C 3,0 ± 0,3 at constant conditions
- Dead space per gas path: ml 26
- Ready for start up: min < 5 < 10 < 15 < 15 < 5 < 10
- Cooling capacity: KJ/h 792

Design data
- Dimensions (W x H x D): mm 310 x 266 x 321
- Weight without options: kg 16,0
- Housing: wall mounting (19" rack and mobile optional) / RAL 7035
- Connections: gas: PVDF DN 4/6 / condensate: PVDF DN 4/6

Electrical data
- Mains connection: plug
- Digital display: temperature (outlet dew point resp. ambient), operating status, alarm and alarm storage, service control, operating hours, condensate pump control
- Alarm set-points: °C < +2.0 / > +10.0
- Protection rate: IP 20 EN 60529 / EN 61010
- Conformity: CE / cMETus
- Power supply: 230V 50/60Hz or 115V 50/60Hz
- Power consumption: W 170 - 195

Options
- Condensate pump
- PTFE or glass fibre depth filter, length 70mm or 90mm
- Sample gas pump N86 IP00 or IP20
- Flow meter for max. 150 or 250 or 500 l/h
- Flow meter with light barrier and electronic
- Liquid sensor internal or external incl. electronic
- Pre-separator incl. condensate pump
- Acid dosing incl. condensate pump
- Docking Station
- 19"-rack
- Carrying handles
- Voltage 115V 50/60H

Due to the large number of options a big variety of individual configurations of the MAK10 is possible. Basically devices with 3-4 heat exchangers, 3-4 condensate pumps, 1-2 sample gas pumps, 2 filters and 2 flow meters need additionally always the docking station. Thereby the housing width changes from 310mm to 449mm. For your individual configuration of a MAK10 please contact our sales team in Erkelenz.
MAK10 Heat-Exchanger System

More efficiency, no energy losses, even at high ambient temperatures
✓ Coldness transfer through copper and aluminium
✓ Best thermal conductance values 300/204 W/m°K
✓ Coldness transferred from the inside outwards
✓ Extremely compact design
✓ Optimal shielding from the environment

High and constant dryness rate even at extreme load changes
✓ PTFE-coated, hydrophobic surface
✓ Immediate formation of large condensate droplets
✓ Spiral performing stream goes downwards
✓ Consistent use of gravity
✓ Discharge of condensate at the lowest point
✓ Inner copper rod as cold storage

Exceptionally low gas dissolution rates enable accurate analysis
✓ Very low dead volume
✓ Extremely short retention time of the gas in the system
✓ Small heat-exchanger surface
✓ Rapid saturation of the surface
✓ Reduced response-time of gas to condensate
✓ Minimized contact surface of sample gas and condensate
✓ On three sides evacuated condensate spiral stream
✓ Coating reduces electrostatics

Reliability and sustainability reduce time and efforts for maintenance
✓ Exchangeable heat-exchangers
✓ Optimum chemical resistance
✓ No abrasive wear-out
✓ Self-cleaning effects, no contamination
✓ Maintenance-free system
✓ Proven and safe technology
✓ Monitored quality
✓ More than 10,000 systems in successful operation
MAK10 Model Examples

MAK10-2
✓ 2 heat exchangers PTFE / PVDF
✓ 2 gas paths (2 x 175 l/h)
✓ 2 condensate pumps
✓ 1 MAK-alarm contact

MAK10-2 mobile version
✓ 2 heat exchanger PTFE / PVDF
✓ 1 gas path (1 x 175 l/h)
✓ 2 condensate pumps
✓ 1 depth filter
✓ 1 liquid sensor and electronic
✓ 1 flow meter
✓ 1 MAK- / 1 sensor alarm contact

MAK10-2 PS2
✓ 2 heat exchangers PTFE / PVDF
✓ 2 gas paths (2 x 200 l/h)
✓ 2 pre-separators
✓ 4 condensate pumps
✓ 2 depth filters
✓ 2 liquid sensors and electronics
✓ 1 MAK- / 2 sensor alarm contacts

MAK10-2 19"-rack version
✓ 2 heat exchangers PTFE / PVDF
✓ 1 gas path (1 x 175 l/h)
✓ 2 condensate pumps
✓ 1 depth filter
✓ 1 liquid sensor and electronic
✓ 1 flow meter
✓ 1 MAK- / 1 sensor alarm contact
Configuration examples

MAK10-1

MAK10-2

MAK10-3

MAK10-4

① Heat exchanger
② Condensate pump
③ Condensate pre-separator
④ Depth filter
⑤ Sample gas pump
⑥ Flow meter
⑦ Electronic
⑧ Liquid sensor
⑨ Light barrier
Integrated components / options

Condensate pump
- Reliable continuous condensate removal
- Low rotation speed, long lasting pump tube

Condensate pre-separator
- Separation of free condensate and solid particles
- Sample gas pre-cooling for inlet dew points >65°C

PTFE or glass fibre depth filter
- Reliable filtration of solid particles
- Quick and simple filter change

Flow meter
- Exact dosing, with fine adjustment needle valve
- Optional with light barrier

Liquid sensor
- Protects against condensate break through
- Reliable detection of smallest amounts of liquid

Electronic
- Control / alarm for liquid sensors / light barriers
- Potential free switch contact

Sample gas pump
- Pure pumping of sample gases
- Perfect integration in the sample gas cooler