

# **SIHI<sup>®</sup> Dry PD H Series** **Single-stage, dry-running vacuum pumps for process applications**

Models H250, H400, H630, H750 and H1000



## Deep vacuum in a clean, dry-running design

SIHI® Dry PD H Series vacuum pumps were specifically developed for use in chemical, pharmaceutical and other process applications requiring deep vacuum. Unlike conventional twin-screw vacuum pumps, SIHI Dry PD H Series pumps do not require fluids for lubricating. Their dry-running design eliminates fluid acquisition and disposal costs while allowing uncontaminated solvent and process vapors to be recovered downstream. Moreover, the SIHI Dry PD H Series was designed to perform maximum pumping speed at low inlet pressure offering the highest efficiency and lowest power consumption.

### Benefits

- **High reliability**, even under harsh process conditions, due to particle and liquid carryover possibility and safe handling of condensable, corrosive or toxic media
- **High availability** due to integrated condition monitoring with pre-failure detection and data logging
- **Minimal downtime** due to self-draining, top-down flow and simple on-site serviceability by own staff
- **Low total cost of ownership** due to elimination of lubrication and mechanical seals, low-maintenance costs and energy-efficient design

### Applications

SIHI Dry PD H Series dry-running vacuum pumps are engineered to develop deep vacuum under demanding process conditions, including those in classified areas.

#### Principle industries

- Chemical
- Fine chemical
- Pharmaceutical

#### Key vacuum applications

- Distillation
- Drying
- Batch reactors



Figure 1:  
SIHI Dry H400 pump

### General technical data

| Parameter                         | Units            | H250                                                               | H400        | H630                    | H750                 | H1000       |
|-----------------------------------|------------------|--------------------------------------------------------------------|-------------|-------------------------|----------------------|-------------|
| Max. suction capacity             | m³/h (cfm)       | 270 (159)                                                          | 400 (235)   | 600 (353)               | 750 (441)            | 950 (559)   |
| Final pressure                    | mbar a (mtorr a) | < 0.1 (75)                                                         | < 0.02 (15) | < 0.02 (15)             | 0.1 (75)             | < 0.02 (15) |
| ATEX                              | Cat 2            | Ex II 2 G IIC T3 / T4 Gb                                           |             | Ex II 2 G IIC T3 Gb     |                      |             |
|                                   | Cat 1            | Ex II 1/2 G IIC/ IIC T4 Ga/Gb                                      |             |                         |                      |             |
|                                   |                  | Ex II 1/2 G IIB3/ IIC T4 Ga/Gb                                     |             |                         |                      |             |
| Absorbed power at final pressure  | kW (hp)          | 5 (6.7)                                                            | 7 (9.4)     | 10 (13.4)               | 14 (18.8)            | 18 (24.1)   |
| Max. backpressure                 | mbar g (torr g)  | 100 (75)                                                           |             |                         |                      |             |
| Gas inlet temperature             | °C (°F)          | 0 to + 100 (2G) / 0 to + 60 (1G) (32 to 312 (2G) / 32 to 140 (1G)) |             | 0 to + 100 (32 to 212)  |                      |             |
| Gas outlet temperature            | °C (°F)          | ≤ 130 (T4) / ≤ 160 (T3) (≤ 266 (T4) / ≤ 320 (T3))                  |             | ≤ 160 (T3) (≤ 320 (T3)) |                      |             |
| Sound pressure level <sup>1</sup> | dB (A)           | < 63                                                               |             | < 64                    | < 73                 |             |
| Pump weight                       | Kg (lb)          | approx. 600 (1,323)                                                |             |                         | approx. 1000 (2,205) |             |

**Electrical data**

| Parameter              | Units   | H250                       | H400 | H630        | H750      | H1000     |
|------------------------|---------|----------------------------|------|-------------|-----------|-----------|
| Power connection       | -       | L1, L2, L3, PE (without N) |      |             |           |           |
| Voltage                | VAC     | 400 to 500 ± 10%           |      |             |           |           |
| Frequency              | Hz      | 47 to 63                   |      |             |           |           |
| Protection             | -       | IP54                       |      |             |           |           |
| Max. power consumption | kW (hp) | 12 (16.1)                  |      | 19.5 (26.1) | 26 (34.9) | 30 (40.2) |
| Pre-fuse (three-pole)  | A       | 25                         |      | 50          | 63        |           |

**Purge gas**

| Parameter                            | Units         | H250                                        | H400 | H630 | H750 | H1000 |
|--------------------------------------|---------------|---------------------------------------------|------|------|------|-------|
| Medium                               | -             | N <sub>2</sub>                              |      |      |      |       |
| Gas quality                          | -             | min class 2.4.1 (according ISO 8573-1:2010) |      |      |      |       |
| Purge gas consumption (in operation) | Nl/min (SCFM) | 20 (0.71)                                   |      |      |      |       |
| Pressure                             | bar g (psig)  | 3 to 8 (43.5 to 116)                        |      |      |      |       |

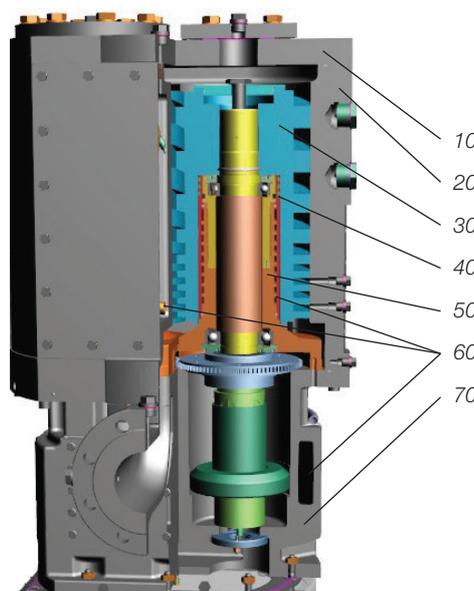
**Cooling water**

| Parameter                              | Units        | H250                                                                  | H400 | H630                     | H750                      | H1000 |
|----------------------------------------|--------------|-----------------------------------------------------------------------|------|--------------------------|---------------------------|-------|
| Medium                                 | -            | water, conductivity > 50 µS (demineralized water on request)          |      |                          |                           |       |
| Medium temperature                     | °C (°F)      | +10 to +20 (T4) / +10 to +40 (T3)<br>(50 to 68 (T4) / 50 to 104 (T3)) |      | +10 to +40<br>(50 to 40) | +10 to +30<br>(50 to 104) |       |
| Max. admissible static medium pressure | bar g (psig) | 6 (87)                                                                |      |                          | 6 (87)                    |       |
| Min. flow rate                         | l/min (gpm)  | > 8 (2.1)                                                             |      |                          | 60 (15.9)                 |       |

**Material design**

Wetted parts, process and coolant media sides

| Parameter                  | Item number | H250                                        | H400 | H630 | H750 | H1000 |
|----------------------------|-------------|---------------------------------------------|------|------|------|-------|
| Casing cover               | 10          | 1.0553                                      |      |      |      |       |
| Casing                     | 20          | EN-GJS-400-18-LT                            |      |      |      |       |
| Twin screws                | 30          | 1.4122                                      |      |      |      |       |
| Labyrinth seal             | 40          | EN-GJL-250                                  |      |      |      |       |
| Bearing cartridge          | 50          | 1.4122                                      |      |      |      |       |
| Coolant loop               | 60          | Brass, EPDM / Stainless steel, Copper / GJS |      |      |      |       |
| Motor casing               | 70          | EN-GJS-400-18-LT                            |      |      |      |       |
| Inlet strainer (not shown) |             | Stainless steel / PTFE                      |      |      |      |       |



## Features and benefits

### Built for harsh processes

#### Tolerates particle and liquid carryover without any suction side filter

- Top-down flow avoids particle deposits inside of the pump
- No wear caused by particle carryover due to contact-free principle
- Optional integrated liquid cleaning by flushing module
- Particle carryover and pump drying by optional integrated gas flushing module

#### Handling of condensable and corrosive media

- Prevention of condensation inside of the pump by optional integrated gas dilution module
- Optional integrated liquid cleaning by flushing module
- Reduction of condensation by temperature-controlled operation

#### Safe handling of toxic media

- Hermetical, tight execution
- Pump internal secondary cooling loop, decoupled from customer cooling water

### Improved product quality

#### High pumping performance

- Remarkably high pump speed at low pressure allows higher flow rate of process gases
- Lower final pressure

#### Zero process contamination

- Truly dry and contact-free principle, free of any service liquids
- Absolutely free of gear oil due to electronically synchronized shafts

### Engineered for easy system integration

#### Certified explosion protection

- ATEX-certified, even without flame arrester in Category 2 systems
- No source of ignition due to consequential contact-free operation

#### Customized vacuum system solutions

- Pre-engineered modules match all individual process needs

#### No pressure control valve necessary

- Adjustable suction capacity due to variable rotational speed

#### An integrated solution

- Pre-engineered modules are completely mounted and tested
- Small-footprint design saves useful space

#### No PLC Control necessary with optional HMI

- Self-controlled, pre-engineered modules
- Local control via human machine interface (HMI) panel
- Data access via Ethernet

#### Easy communication

- Availability of bus standards as well as I/O interface
- Optional equipped with HMI



Pump system control with human machine interface (HMI)

### Fast installation and startup

#### Self-controlled vacuum system

- Completely assembled, wired, tested and self-controlled vacuum system allows easiest commissioning

### Lower maintenance costs and downtime

#### No oil checks, exchanges and disposals required

- Free of oil as service liquid
- No gear oil

#### No wearing

- Consequent contact-free principle
- Long-life bearings
- Contact-free sealings

#### Continuous condition analysis

- Data logging
- Online monitoring of pump status
- Simple failure codes

### Easy to clean and service

#### Only cleaning on demand

- Condition monitoring by independent data record of both shafts
- Pre-failure detection

#### Designed for in situ cleaning and on-site service

- Easy dismantling of the pump casing without bearing removal
- No high-tech workshop required
- Can be done on-site by own staff
- Independency on third party service

### Lower operating costs

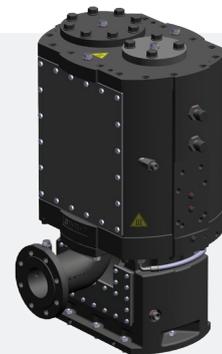
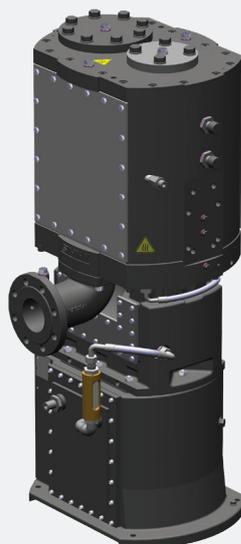
#### Low power consumption

- High-tech screws' design optimized for highest efficiency
- Frequency control allows to improve energy-efficient operation by operator

#### Easiest cleaning on-site

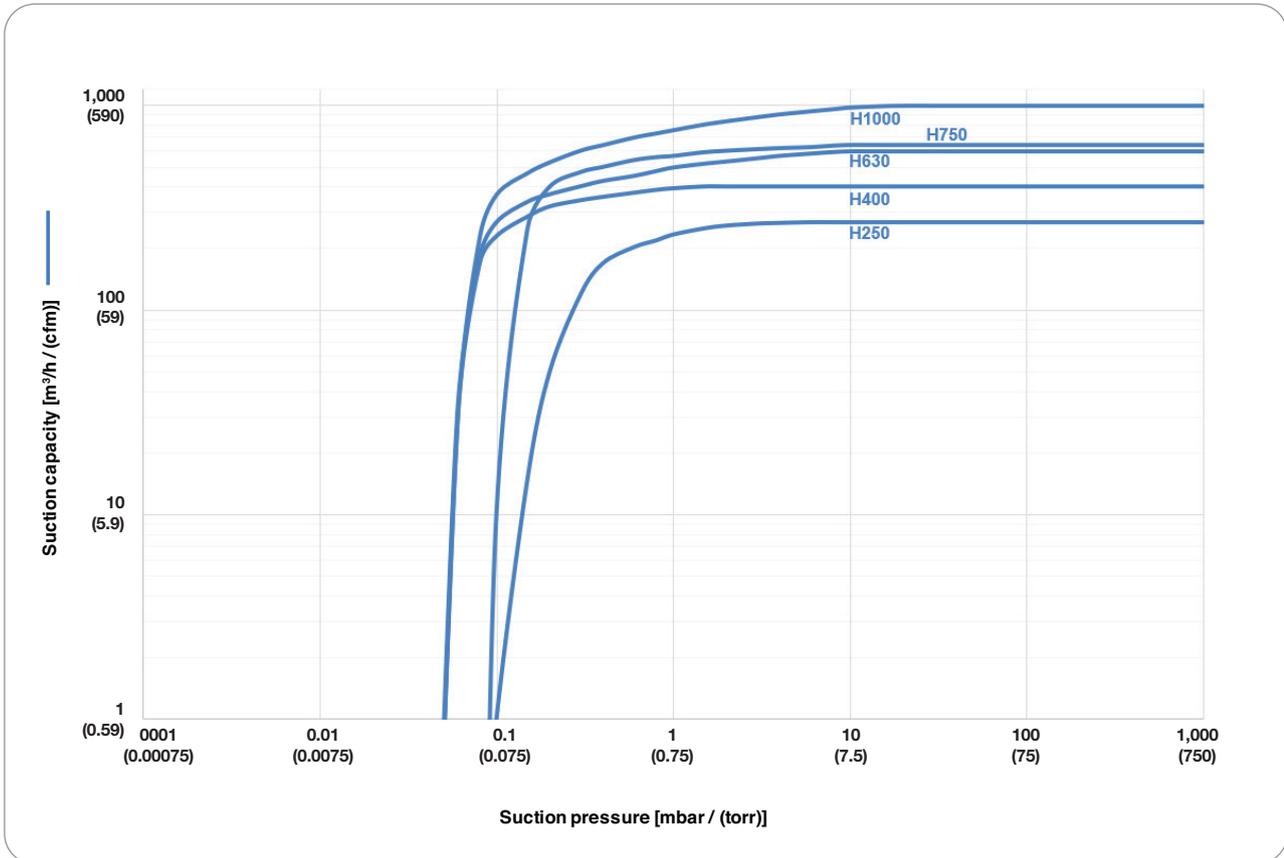


#### Easiest service on-site



## Suction capacity curves

Operating points below the characteristic curve are achievable by speed variation, depending on the system execution.



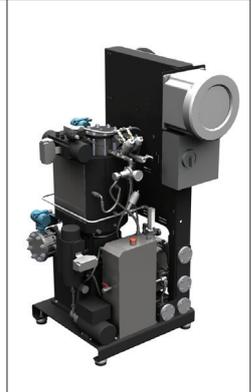
The operating data is valid under following conditions:

- Process media: Dry air 20°C (68°F)
- Cooling media inlet: Water 25°C (77°F)
- Discharge pressure: 1,013 mbar (760 torr) atmospheric pressure
- The suction volume is related to the pressure at the suction nozzle.

Tolerance on operating data is ± 10%.

## Pre-engineered systems

SIHI Dry PD H Series pumps are available in cost-effective standard packages to ensure peak performance and minimize engineering delays. These fully tested and documented pre-engineered systems enable you to deploy a completely new system quickly or upgrade an existing one.

| Modules                  |                                              | Pre-engineered systems                                                              |                                                                                      |                                                                                       |
|--------------------------|----------------------------------------------|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
|                          |                                              | Standard                                                                            | Configured                                                                           | Premium                                                                               |
| Vacuum pump              | SIHI Dry H250, H400 and H630                 | X                                                                                   | X                                                                                    | X                                                                                     |
| Control                  | Control FX                                   | X                                                                                   | X                                                                                    |                                                                                       |
|                          | Control Profibus DP with HMI                 |                                                                                     |                                                                                      | X                                                                                     |
| Supply unit              | Supply unit                                  |                                                                                     |                                                                                      | X                                                                                     |
|                          | Protective motor switch                      |                                                                                     |                                                                                      | X                                                                                     |
| Purge gas                | Purge gas system                             | X                                                                                   | X                                                                                    | X                                                                                     |
| Base frame               | Base frame                                   |                                                                                     | X                                                                                    | X                                                                                     |
|                          | Rack                                         |                                                                                     |                                                                                      | X                                                                                     |
| Cooling                  | Direct cooling without flanges               | X                                                                                   |                                                                                      |                                                                                       |
|                          | Secondary cooling circuit                    |                                                                                     | X                                                                                    | X                                                                                     |
| Shut-off valve suction   | Butterfly valve                              |                                                                                     | X                                                                                    | X                                                                                     |
| Flushing                 | Threaded                                     |                                                                                     | X                                                                                    | X                                                                                     |
| Gas dilution             | Standard                                     |                                                                                     | X                                                                                    | X                                                                                     |
| Shut-off valve discharge | Butterfly valve                              |                                                                                     | X                                                                                    | X                                                                                     |
| Sensors                  | Evaluated Pt100 sensor in cooling jacket     | X                                                                                   | X                                                                                    | X                                                                                     |
|                          | Evaluated Pt100 sensor on discharge side     | X                                                                                   | X                                                                                    | X                                                                                     |
|                          | Evaluated Pt100 sensor on suction side       |                                                                                     |                                                                                      | X                                                                                     |
|                          | Evaluated pressure-side pressure transmitter | X                                                                                   | X                                                                                    | X                                                                                     |
|                          | Evaluated suction-side pressure transmitter  |                                                                                     | X (not evaluated)                                                                    | X                                                                                     |
|                          |                                              |  |  |  |

## Pre-engineered systems – Standard

This system configuration provides basic equipment for the operation of the vacuum pump. The scope of supply includes the following components:

| Modules     |                                      | Description                                                                                                                                                                |
|-------------|--------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Vacuum pump | SIHI Dry H250, H400 and H630         | <ul style="list-style-type: none"> <li>• Pump</li> <li>• Suction sieve</li> <li>• Integrated motors</li> <li>• Integrated drive control</li> </ul>                         |
| Control     | Control FX                           | <ul style="list-style-type: none"> <li>• SIHI Control FX fixed-sequence control with sensor evaluation</li> <li>• Integrated communication interface</li> </ul>            |
| Purge gas   | Purge gas system                     | <ul style="list-style-type: none"> <li>• Purge gas control unit Ex-p</li> </ul>                                                                                            |
| Cooling     | Direct cooling without flanges       | <ul style="list-style-type: none"> <li>• Customer's coolant system is directly connected to the pump. A strainer is installed in order to protect the pump.</li> </ul>     |
| Sensors     | Thermometer and pressure transmitter | <ul style="list-style-type: none"> <li>• Evaluated Pt100 sensor in cooling jacket and on discharge side</li> <li>• Evaluated pressure-side pressure transmitter</li> </ul> |

### Available communication interfaces:

#### I/O interface

- Digital I/O
  - Ex – p Release / Start / Stop / Reset / Operation / Failure / Warning
- Analog I/O
  - Set value speed / Vital status / Current speed value

#### Bus – Communication

- CANopen Slave ISO11898
- Pump control (see I/O)
- Display of operation mode

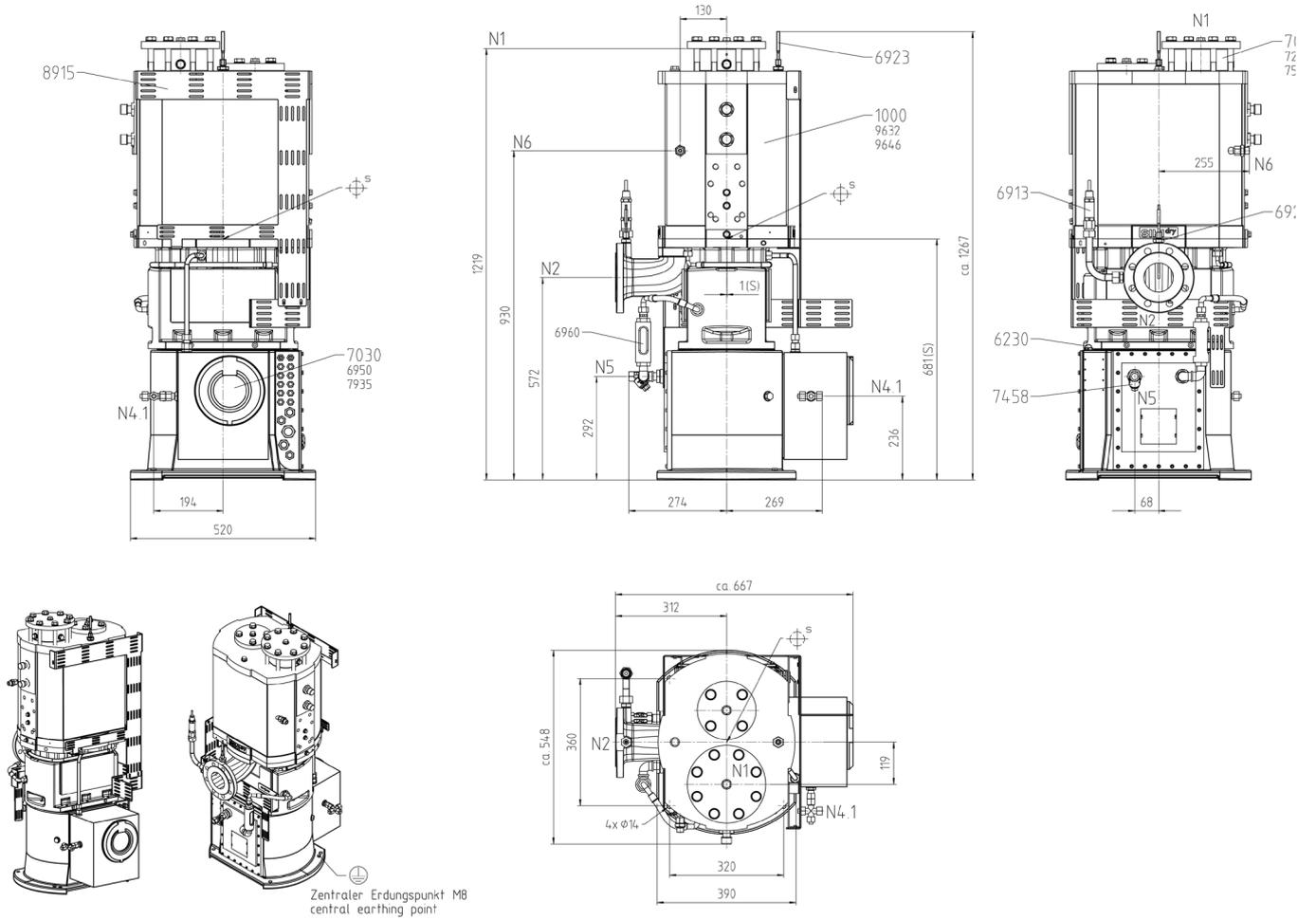
#### Bluetooth® – Communication

- On-site operation via tablet-PC, SIHI BT remote app via Bluetooth communication and vacuum pump integrated SIHI Control FX sequence control

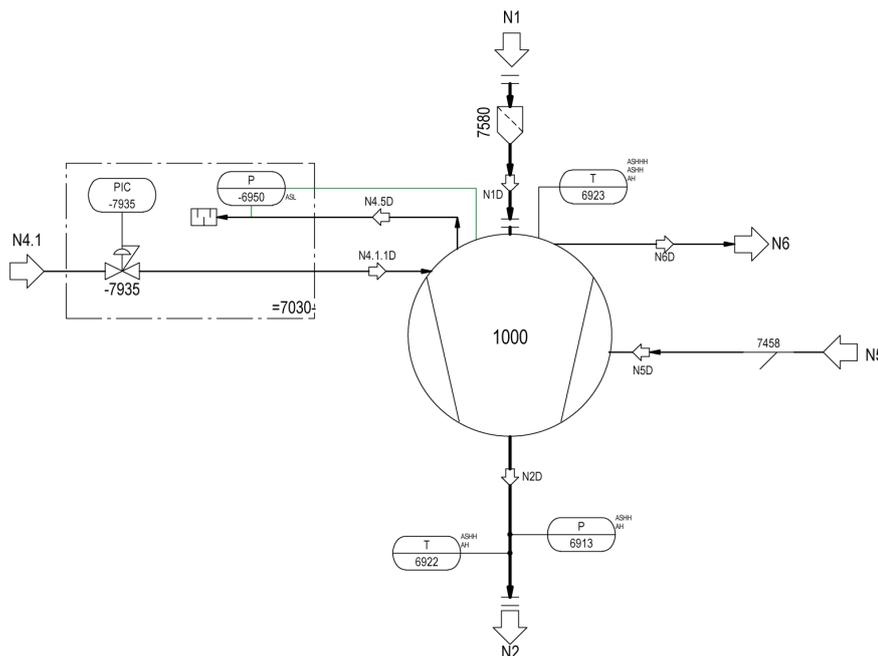


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Dimensions for H400 (mm)



P&ID



## Pre-engineered systems – Configured

This system configuration provides an extended basic equipment for the operation of the vacuum pump. The scope of supply includes the following components:

| Modules                  |                                      | Description                                                                                                                                                                                                                                               |
|--------------------------|--------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Vacuum pump              | SIHI Dry H250, H400 and H630         | <ul style="list-style-type: none"> <li>• Pump</li> <li>• Suction sieve</li> <li>• Integrated motors</li> <li>• Integrated drive control</li> </ul>                                                                                                        |
| Control                  | Control FX                           | <ul style="list-style-type: none"> <li>• SIHI Control FX fixed-sequence control with sensor evaluation and control sequences such as Start, Stop, Warm up, Standby, Vacuum, Cleaning and Failure</li> <li>• Integrated communication interface</li> </ul> |
| Purge gas                | Purge gas system                     | <ul style="list-style-type: none"> <li>• Purge gas control unit Ex-p</li> </ul>                                                                                                                                                                           |
| Base frame               | Base frame                           | <ul style="list-style-type: none"> <li>• Base frame with machine feet</li> </ul>                                                                                                                                                                          |
| Cooling                  | Secondary cooling                    | <ul style="list-style-type: none"> <li>• Secondary cooling circuit with cooling pump</li> </ul>                                                                                                                                                           |
| Shut-off valve suction   | Butterfly valve                      | <ul style="list-style-type: none"> <li>• Controlled, suction shut-off valve</li> </ul>                                                                                                                                                                    |
| Flushing                 | Threaded                             | <ul style="list-style-type: none"> <li>• Controlled N<sub>2</sub> flush and cleaning valve</li> </ul>                                                                                                                                                     |
| Gas dilution             | Standard                             | <ul style="list-style-type: none"> <li>• Controlled gas dilution module</li> </ul>                                                                                                                                                                        |
| Shut-off valve discharge | Butterfly valve                      | <ul style="list-style-type: none"> <li>• Controlled discharge shut-off valve</li> </ul>                                                                                                                                                                   |
| Sensors                  | Thermometer and pressure transmitter | <ul style="list-style-type: none"> <li>• Evaluated Pt100 sensor in cooling jacket</li> <li>• Evaluated Pt100 sensor in discharge side</li> <li>• Evaluated pressure-side pressure transmitter</li> <li>• Suction-side pressure transmitter</li> </ul>     |

### Available communication interfaces:

#### I/O interface

- Digital I/O
  - Ex – p Release / Start / Stop / Reset / Operation / Failure / Warning
- Analog I/O
  - Set value speed / Vital status / Current speed value

#### Bus – Communication

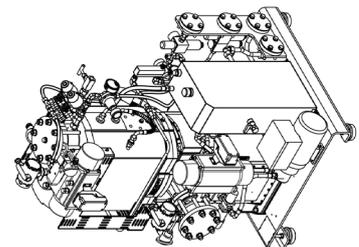
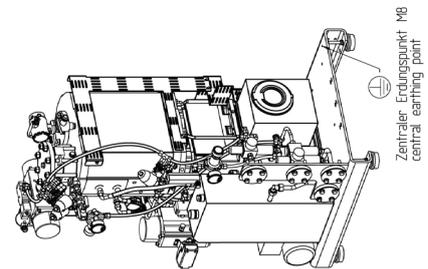
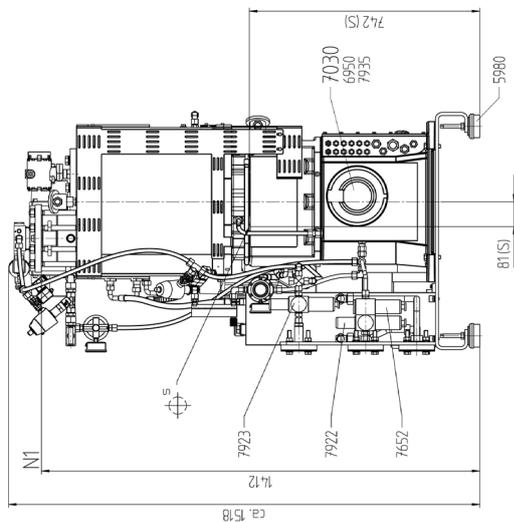
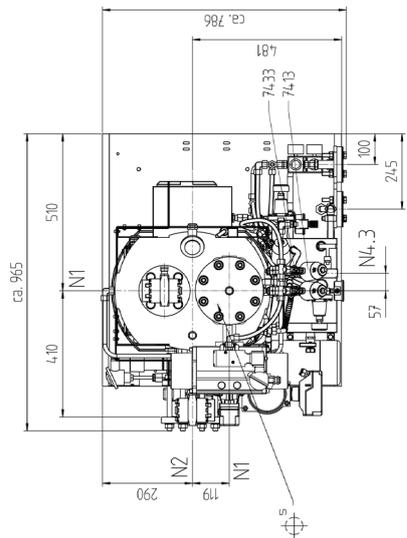
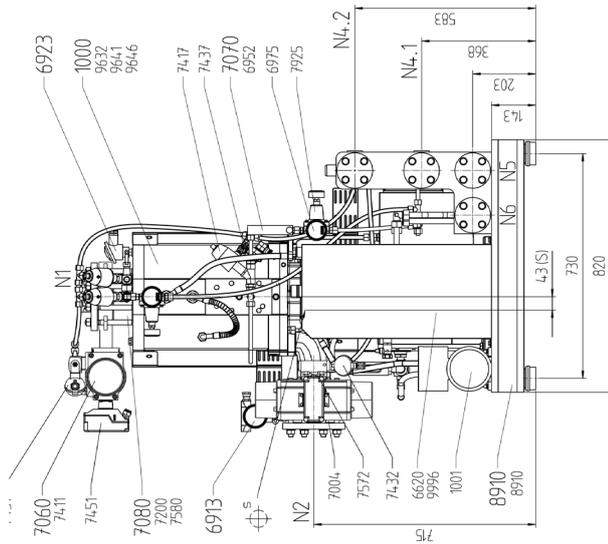
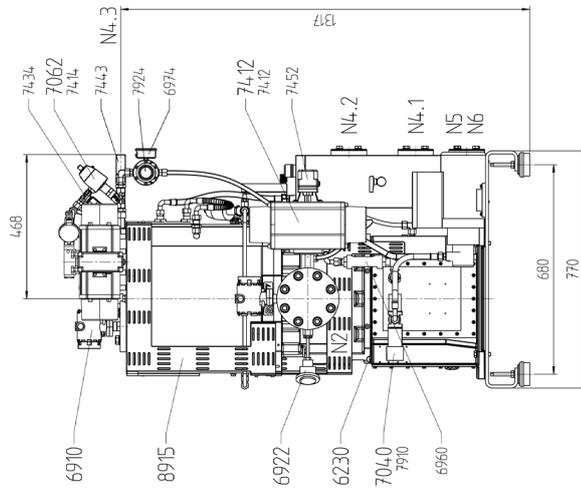
- CANopen Slave ISO11898
- Pump control (see I/O)
- Display of operation mode

#### Bluetooth – Communication

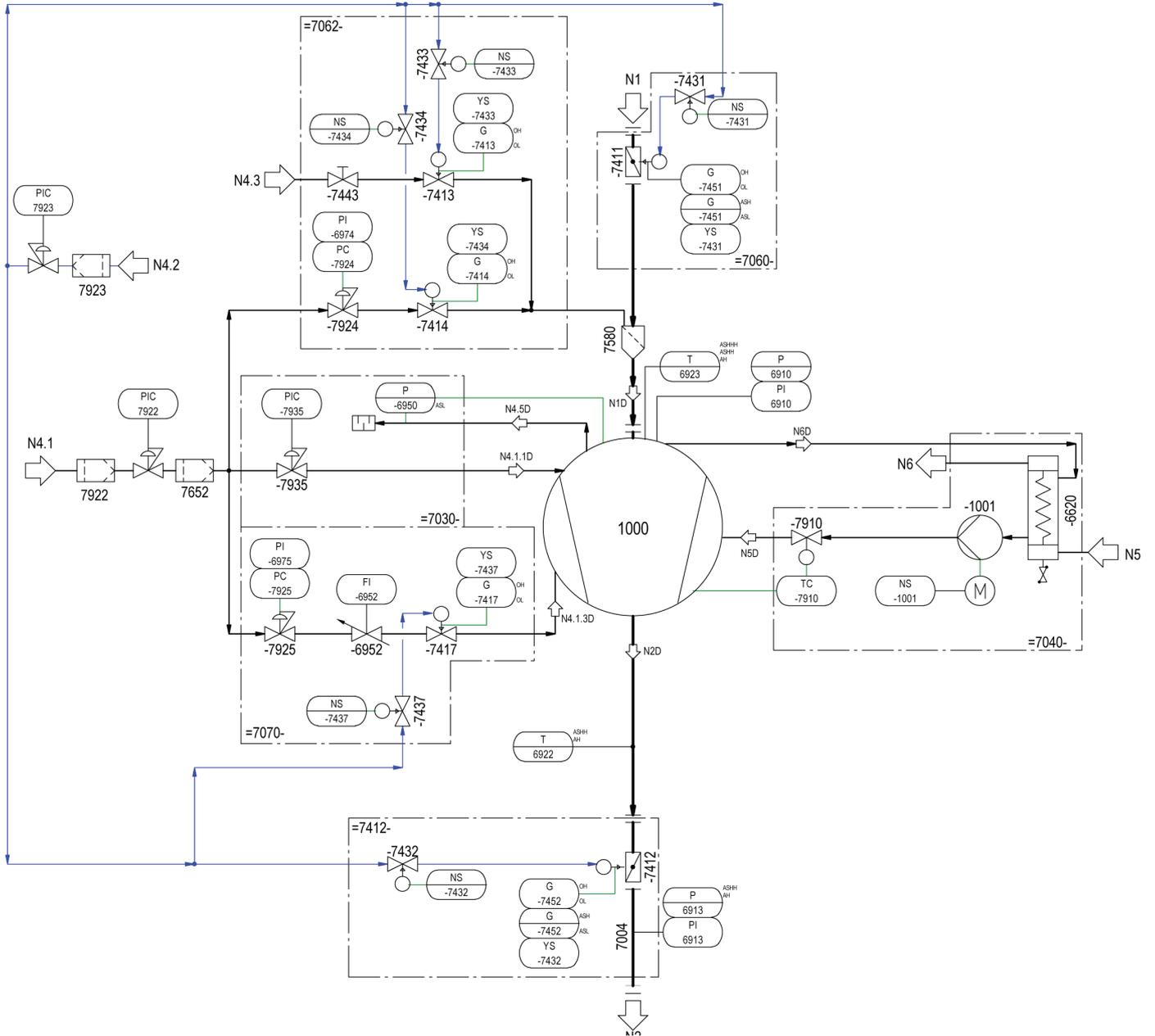
- On-site operation via tablet-PC, SIHI BT remote app via Bluetooth communication and vacuum pump integrated SIHI Control FX sequence control



Dimensions for H400 (mm)



P&ID



## Pre-engineered systems – Premium

In addition to the extended basic equipment, this system configuration includes a supply and control unit with HMI display. This allows convenient on-site operation and visualization of the vacuum pump status. The scope of supply includes the following components:

| Modules                  |                                        | Description                                                                                                                                                                                                                                                                                                                                                                                                                    |
|--------------------------|----------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Vacuum pump              | SIHI Dry H250, H400 and H630           | <ul style="list-style-type: none"> <li>Pump</li> <li>Suction sieve</li> <li>Integrated motors</li> <li>Integrated drive control</li> </ul>                                                                                                                                                                                                                                                                                     |
| Control                  | Control Profibus DP with HMI           | <ul style="list-style-type: none"> <li>Standard control with sequence control and sensor evaluation</li> <li>Programmable sequence control with different operation modes such as Start, Stop, Warm up, Standby, Vacuum, Injection Cleaning, Post Run and Failure</li> <li>Variable control parameters such as: Warm up Temperature / Flush Drying Time / Standby Speed</li> <li>Integrated communication interface</li> </ul> |
| Supply unit / operation  | Supply unit<br>Protective motor switch | <ul style="list-style-type: none"> <li>Plug-in solution with integrated transformer for 24 VDC control voltage generation to supply:                             <ul style="list-style-type: none"> <li>Display control unit</li> <li>SIHI Dry power supply switch</li> <li>Cooling pump motor overload switch</li> </ul> </li> </ul>                                                                                          |
| Purge gas                | Purge gas system                       | <ul style="list-style-type: none"> <li>Purge gas control unit Ex-p</li> </ul>                                                                                                                                                                                                                                                                                                                                                  |
| Base frame               | Base frame and rack                    | <ul style="list-style-type: none"> <li>Rack for supply unit, control unit and motor overload switch</li> <li>Base frame with machine feet</li> </ul>                                                                                                                                                                                                                                                                           |
| Cooling                  | Secondary cooling circuit              | <ul style="list-style-type: none"> <li>Secondary cooling circuit with cooling pump</li> </ul>                                                                                                                                                                                                                                                                                                                                  |
| Shut-off valve suction   | Butterfly valve                        | <ul style="list-style-type: none"> <li>Controlled suction shut-off valve</li> </ul>                                                                                                                                                                                                                                                                                                                                            |
| Flushing                 | Threaded                               | <ul style="list-style-type: none"> <li>Controlled N<sub>2</sub> flush and cleaning valve</li> </ul>                                                                                                                                                                                                                                                                                                                            |
| Gas dilution             | Standard                               | <ul style="list-style-type: none"> <li>Controlled gas dilution module</li> </ul>                                                                                                                                                                                                                                                                                                                                               |
| Shut-off valve discharge | Butterfly valve                        | <ul style="list-style-type: none"> <li>Controlled discharge shut-off valve</li> </ul>                                                                                                                                                                                                                                                                                                                                          |
| Sensors                  | Thermometer and pressure transmitter   | <ul style="list-style-type: none"> <li>Evaluated Pt100 sensor in cooling jacket, suction and discharge side</li> <li>Evaluated pressure-side pressure transmitter</li> <li>Evaluated suction-side pressure transmitter</li> </ul>                                                                                                                                                                                              |

### Pump system control with HMI display (control unit) and sequence control

- Programmed standard control with control sequences such as Start, Stop, Warm up, Standby, Vacuum, Injection Cleaning, Post Run and Failure
- Dirt detection
- Identification bearing lifetime end
- Detailed display of operation mode
- Programmable performance field

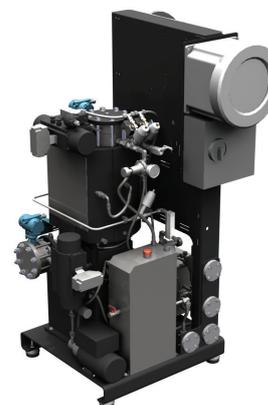
### Communication interfaces

#### Bus – Communication

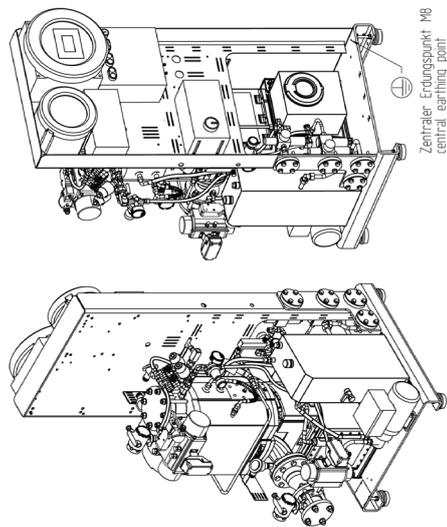
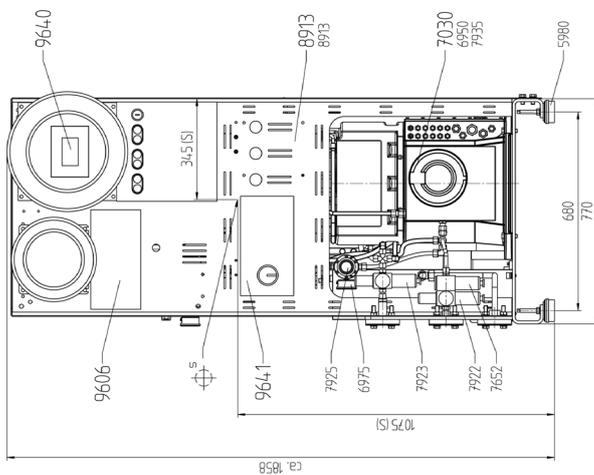
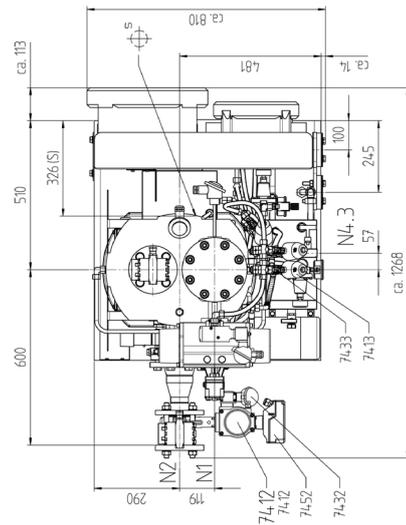
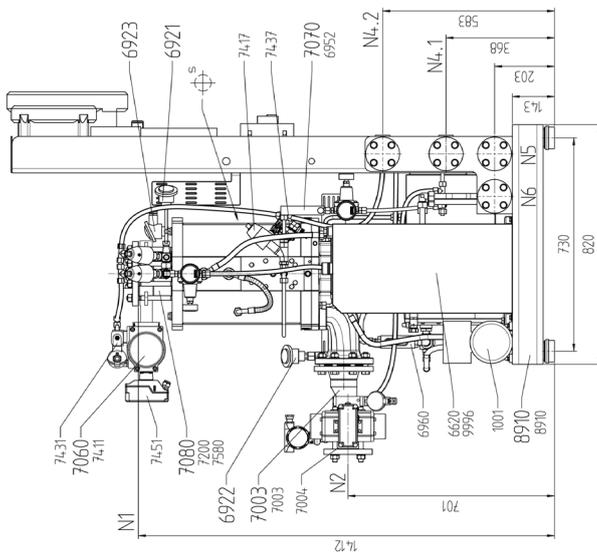
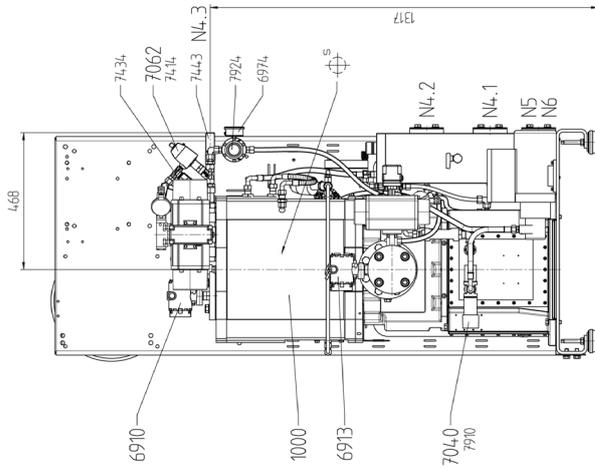
- Profibus DP (IEC 61158)
- Pump control (see control)
- Display of operation mode

#### On-site display

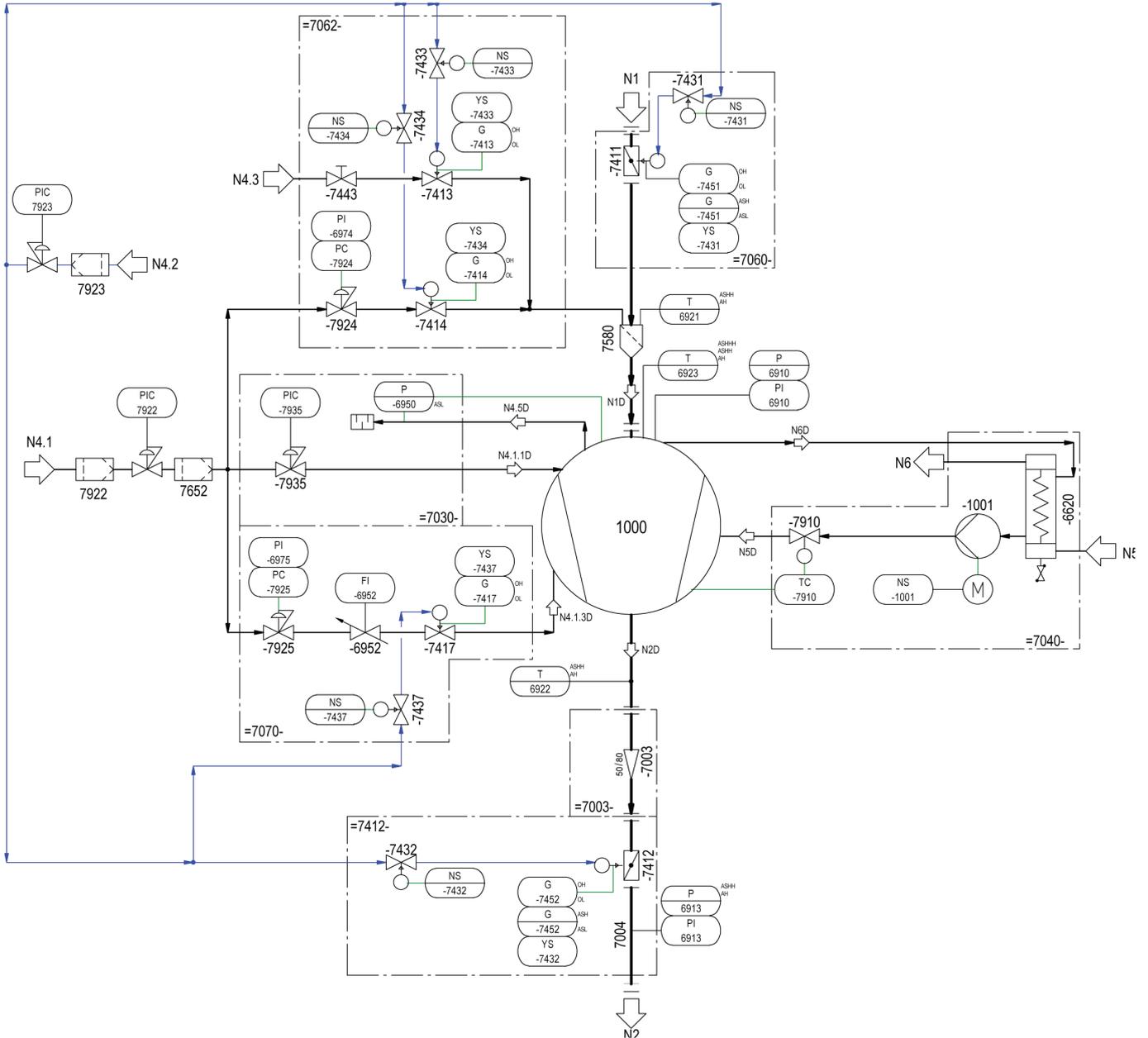
- Visualisation
- On-site operation
- Data logger



Dimensions for H400 (mm)



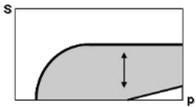
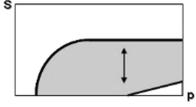
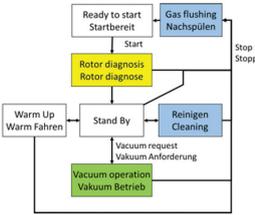
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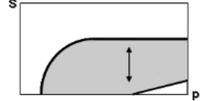
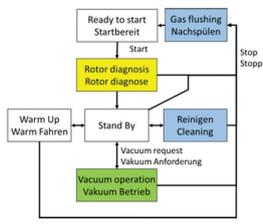


## Standard modules for specific applications

SIHI Dry H Series vacuum pump systems can be configured from pre-engineered modules to meet exact system requirements. Numerous modules are available.

| Vacuum pump                                                                                                                               | Execution                                                                                                                                             | Features                                                                                  |
|-------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|
| <p><b>SIHI Dry H250, H400, H630, H750 and H1000</b></p>  | <ul style="list-style-type: none"> <li>• Pump</li> <li>• Suction strainer</li> <li>• Integrated motors</li> <li>• Integrated drive control</li> </ul> | <p>Two screw-shaped displacing bodies rotating in opposite directions without contact</p> |

| Control                                                                                                                                                                                                                                             | Execution                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Features                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
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| <p><b>Basic</b></p>                                                                                                                                                                                                                                 | <ul style="list-style-type: none"> <li>• Integrated in pump</li> <li>• Control of internal temperature</li> <li>• Control of torque</li> <li>• Electrical overload protection</li> <li>• On-site operation via tablet-PC, SIHI BT remote app via Bluetooth communication</li> </ul>                                                                                                                                                                                                                                                                                                                      | <p><b>Operations:</b> Start, stop</p> <p><b>Status messages:</b> Failure signal</p> <p><b>No valve control</b></p> <p><b>No sensor evaluation</b></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <p><b>Dynamic</b></p> <p>Characteristic:</p>                                                                                                                     | <p>Like control variant <b>Basic</b>, additionally:</p> <ul style="list-style-type: none"> <li>• Variable speed via integrated frequency converter</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                            | <p><b>Operations:</b> Start, stop, variable speed</p> <p><b>Status messages:</b> Failure signal</p> <p><b>No valve control</b></p> <p><b>No sensor evaluation</b></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <p><b>SIHI Control Fx</b></p> <p>Characteristic:</p>  <p>Sequence chart:</p>  | <p>Like control variant <b>Dynamic</b>, additionally:</p> <ul style="list-style-type: none"> <li>• On-site operation via tablet-PC, SIHI BT remote app via Bluetooth communication and vacuum pump integrated SIHI Control FX sequence control</li> <li>• Fixed parameter</li> <li>• Data logger</li> <li>• Detailed status messages</li> <li>• Control of internal temperature</li> <li>• Control of torques</li> <li>• Electrical overload protection</li> <li>• Programmed valve control (for all standard valves)</li> <li>• Input for digital signals</li> <li>• Digital status messages</li> </ul> | <p><b>Communication:</b> Via CAN Bus</p> <p><b>Operations:</b> Start, stop, vacuum, cleaning, post run</p> <p><b>Speed set value:</b> Digital</p> <p><b>Display of operation, modes such as:</b> No Failure, Operation Warning, Failure, Failure messages, etc.</p> <p><b>Valve control:</b></p> <ul style="list-style-type: none"> <li>• Valve, suction side</li> <li>• Valve, discharge side</li> <li>• Gas dilution</li> <li>• Cleaning (liquid flushing)</li> <li>• Gas flushing (N<sub>2</sub> flushing)</li> </ul> <p><b>Sensor evaluations:</b></p> <ul style="list-style-type: none"> <li>• Limit switch, suction side valve</li> <li>• Limit switch, discharge side valve</li> <li>• Pressure transmitter</li> <li>• Temperature sensor</li> </ul> <p><b>Digital inputs:</b> Start, Stop, Vacuum, Cleaning, T<sub>min</sub> (Warm up), X<sub>max</sub> (Maximum value evaluation for temperature and pressure)</p> <p><b>Digital status messages:</b> No Failure, Operation, Warning, Failure, Vacuum, Cleaning</p> |

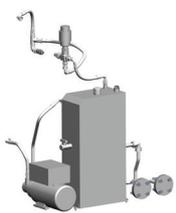
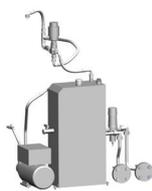
| Control                                                                                                                                                                                                                                                                                                                                              | Execution                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Features                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
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| <p><b>Control Profibus DP</b></p>  <p><b>Characteristic:</b></p>  <p><b>Sequence chart:</b></p>  | <ul style="list-style-type: none"> <li>Control and supply unit mounted directly on the vacuum system</li> <li>On-site operation via HMI</li> <li>Variable parameters for process optimizing as: Pre-run, flushing, post-run timers</li> <li>Data logger</li> <li>Ethernet connection for additional monitoring respectively, connection of modem for remote maintenance</li> <li>Detailed status messages</li> <li>Control of internal temperature</li> <li>Control of torques</li> <li>Electronical overload protection</li> <li>Integrated pressure control</li> <li>Programmed valve control (for standard valves)</li> <li>Input for digital signals</li> <li>Digital status messages</li> <li>Cooling pump control (including post-run)</li> <li>Cooling pump status message via bus available</li> </ul> | <p><b>Housing:</b> Coated aluminium/ polyester resin</p> <p><b>Communication:</b> via Profibus DP (IEC 61158)</p> <p><b>Operations:</b> Start, stop, vacuum, cleaning, post run</p> <p><b>Speed set values:</b> Digital, via Profibus</p> <p><b>Display of operation, modes such as:</b> No Failure, Operation Warning, Failure, Failure messages, etc.</p> <p><b>Valve control:</b></p> <ul style="list-style-type: none"> <li>Valve, suction side</li> <li>Valve, discharge side</li> <li>Gas dilution</li> <li>Cleaning (liquid flushing)</li> <li>Gas flushing (N<sub>2</sub> flushing)</li> </ul> <p><b>Sensor evaluations:</b></p> <ul style="list-style-type: none"> <li>Limit switch, suction side valve</li> <li>Limit switch, discharge side valve</li> <li>Pressure transmitters</li> <li>Temperature sensors</li> </ul> <p><b>Digital inputs:</b> Start, Stop, Vacuum, Cleaning, T<sub>min</sub> (Warm up), X<sub>max</sub> (Maximum value evaluation for temperature and pressure)</p> <p><b>Digital status messages:</b> No Failure, Operation, Warning, Failure, Vacuum, Cleaning</p> |

| Supply unit / operation                                                                                                   | Execution                                                                                                                                                                                                                                                                                                                                                                                                                     | Features                                                                                                                                                                  |
|---------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p><b>Supply unit</b></p>              | <ul style="list-style-type: none"> <li>Plug-in solution with integrated transformer for 24 VDC control voltage generation for display control unit</li> <li>SIHI Dry – Ex-p circuit switch (separation of SIHI Dry supply voltage and communication line with contactors)</li> <li>Wired and mounted on common rack</li> <li>Main switch (lockable)</li> <li>Installation of SIHI Dry and supply unit in Ex-zone 1</li> </ul> | <p><b>Housing:</b> Coated aluminium/ polyester resin</p> <p><b>Electrical connection:</b></p> <p><b>Frequency:</b> 50 Hz</p> <p><b>Voltage:</b> 3 x 400 – 500 VAC, PE</p> |
| <p><b>Protective motor switch</b></p>  | <ul style="list-style-type: none"> <li>Coolant pump is controlled via control unit (9X) started and stopped</li> <li>Motor overload switch (externally accessible)</li> <li>Wired and mounted on common rack</li> </ul>                                                                                                                                                                                                       | <p><b>Housing:</b> Coated aluminium/ polyester resin</p> <p><b>Electrical connection:</b></p> <p><b>Frequency:</b> 50 Hz</p> <p><b>Voltage:</b> 3 x 400 – 500 VAC, PE</p> |

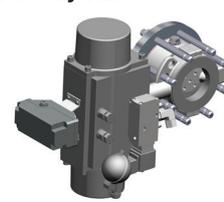
| Purge gas                                                                                                        | Execution                                                                                                                                                                                                        | Features                                                                           |
|------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|
| <p><b>Purge gas system</b></p>  | <p>Motor and electronics of SIHI Dry are kept under overpressure with shielding gas. It permits pump installation within a hazardous area. The purge gas system controls the necessary operating conditions.</p> | <p><b>Housing:</b> Stainless steel</p> <p><b>Connection:</b> DN12 pipe fitting</p> |

| Base frame                                                                                                 | Execution                                                                                                                                         | Features |
|------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| <p><b>Base frame</b></p>  | <p>Pump (if applicable with secondary cooling circuit and/or emission condenser) are mounted together on a base frame with four machine feet.</p> |          |
| <p><b>Rack</b></p>       | <p>Additionally to base frame:<br/>Rack assembly for supply unit and control unit</p>                                                             |          |

| Cooling                                                                                                                                  | Execution                                                                                                                           | Features                                                                                                                            |
|------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|
| <p><b>Direct cooling</b></p>                          | <p>The connection to customer's coolant system is realized with flanges (requires base frame).</p>                                  | <p><b>Material execution:</b><br/>service side pipe/fittings: 1.4571/NBR</p> <p><b>Cooling water connections:</b> 2 x DN25 PN40</p> |
| <p><b>Direct cooling with thermostatic valve</b></p>  | <p>Additionally to direct cooling:<br/>A temperature controller is installed to adapt the current demand of customer's coolant.</p> | <p><b>Like direct cooling, additionally:</b></p> <p><b>Material execution:</b><br/>service side thermostatic valve: Brass</p>       |

| Cooling                                                                                                                                   | Execution                                                                                                                                                                                                                                                                                             | Features                                                                                                                                                                                                                                                                                                                                |
|-------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p><b>Secondary cooling circuit</b></p>                  | <p>Closed cooling loop for SIHI Dry</p> <ul style="list-style-type: none"> <li>Internal secondary cooling loop is decoupled from customer side cooling water</li> <li>Protection against contamination and calcification</li> <li>Homogeneous tempered SIHI Dry via temperature controller</li> </ul> | <p><b>Material execution</b> service side:<br/>Cooling loop: 1.4571<br/>Pipe / fittings: 1.4571</p> <p><b>Cooling water connections:</b> 2x DN25 PN40</p> <p><b>Electrical connection:</b></p> <p><b>Frequency:</b> 50 Hz<br/><b>Voltage:</b> 3 x 400 VAC, PE<br/>or 3 x 500 VAC, PE</p>                                                |
| <p><b>Secondary cooling with thermostatic valve</b></p>  | <p>Additionally to secondary cooling circuit:<br/>A temperature controller is installed to adapt the current demand of customer's coolant.</p>                                                                                                                                                        | <p><b>Like secondary cooling, additionally:</b></p> <p><b>Material execution</b> service side thermostatic</p> <p><b>Valve:</b> 1.4581<br/><b>Voltage:</b> 3 x 400 VAC, PE<br/>or 3 x 500 VAC, PE</p>                                                                                                                                   |
| Shut-off valve, suction side                                                                                                              | Execution                                                                                                                                                                                                                                                                                             | Features                                                                                                                                                                                                                                                                                                                                |
| <p><b>Butterfly valve</b></p>                          | <p>Isolation of the vacuum pump from the reactor:</p> <ul style="list-style-type: none"> <li>Entry of medium into the working chamber after process is prevented</li> <li>Backflow through the pump and resulting ventilation of the reactor are avoided.</li> </ul>                                  | <p><b>Scope of supply:</b></p> <ul style="list-style-type: none"> <li>Valve, PFA/PTFE conductive lined</li> <li>Drive, designed for control pressure of 3 to 6 barg (43 to 87 psig), closed by spring energy</li> <li>Solenoid valve</li> <li>Limit switch</li> </ul>                                                                   |
| Gas and liquid flushing                                                                                                                   | Execution                                                                                                                                                                                                                                                                                             | Features                                                                                                                                                                                                                                                                                                                                |
| <p><b>Flanged</b></p>                                  | <p>The gas flushing using inert gas allows drying or also the discharge of residual gases from the work chamber. In addition, a liquid flush can remove particles or deposits.</p> <p>The flushing can be activated by a cleaning request, post-run or injection flushing.</p>                        | <p><b>Scope of supply:</b></p> <ul style="list-style-type: none"> <li>2/2-ways-valve, DN25, stainless steel / PTFE with drive, designed for control pressure of 3 to 6 barg (43 to 87 psig), closed by spring energy</li> <li>Solenoid valve</li> <li>Pressure reducer</li> <li>Needle valve</li> <li>Stainless steel piping</li> </ul> |
| <p><b>Threaded</b></p>                                 | <p>Like above, but threaded connections instead of flange connections.</p>                                                                                                                                                                                                                            | <p><b>Scope of supply:</b></p> <ul style="list-style-type: none"> <li>2/2-ways-valve, G 1/2 in, stainless steel / PTFE with drive, designed for control pressure of 3 to 6 barg (43 to 87 psig), closed by spring energy</li> <li>Solenoid valve</li> <li>Pressure reducer</li> <li>Needle valve, stainless steel</li> </ul>            |
| Connection, suction side                                                                                                                  | Execution                                                                                                                                                                                                                                                                                             | Features                                                                                                                                                                                                                                                                                                                                |
| <p><b>Adapter</b></p>                                  | <p>Adapter for installation of sensors and/or flushing valves on suction side for systems with flame arresters.</p>                                                                                                                                                                                   | <p><b>Material execution:</b> Stainless steel 1.4571</p>                                                                                                                                                                                                                                                                                |

| Gas dilution                                                                                                       | Execution                                                                                                                             | Features                                                                                                                                                                                                                                                                                                                                                                      |
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| <p><b>For H250 to H630</b></p>    | <p>To minimize deposits and corrosion, dry inert gas (e.g., nitrogen) is injected into the working space of the SIHI Dry pump.</p>    | <p><b>Scope of supply:</b></p> <ul style="list-style-type: none"> <li>• 2/2-ways-valve, G 1/2 in, stainless steel / PTFE with drive, designed for control pressure of 3 to 6 barg (43 to 87 psig), closed by spring energy</li> <li>• Solenoid valve</li> <li>• Flow indicator (430 to 4,300 NI/h, 15.2 to 152 SCFM) with needle valve</li> <li>• Pressure reducer</li> </ul> |
| <p><b>For H750 and H1000</b></p>  | <p>To minimize deposits and corrosion, cooled exhaust gas from the emission condenser is returned to the SIHI Dry working chamber</p> | <p><b>Material execution:</b> Stainless steel 1.4571</p>                                                                                                                                                                                                                                                                                                                      |

| Shut-off valve, cooling discharge side                                                                                                                            | Execution                                                                                                                                                                 | Features                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p><b>Butterfly valve</b></p>                                                   | <p>Isolation of the vacuum pump from the exhaust line.<br/>The pump will be decoupled from the vent system and is protected from condensable media during standstill.</p> | <p><b>Scope of supply:</b></p> <ul style="list-style-type: none"> <li>• Valve, PFA/PTFE, conductive lined</li> <li>• Drive designed for control pressure of 3 to 6 barg (43 to 87 psig), closed by spring energy</li> <li>• Solenoid valve</li> <li>• Limit switch</li> <li>• Stainless steel measuring branch</li> </ul>                                                                                                                                                                                                                                                                              |
| <p><b>Discharge condenser for H250 and H400</b></p>                            | <p>Discharge condenser for condensation of vapors.</p>                                                                                                                    | <p><b>Type:</b></p> <ul style="list-style-type: none"> <li>• Plate and shell – condenser</li> <li>• Exchange area 2.1 m<sup>2</sup></li> </ul> <p><b>Material execution (product / service side):</b><br/>Stainless steel / stainless steel<br/>or<br/>Stainless steel / steel</p> <p><b>Connections:</b></p> <ul style="list-style-type: none"> <li>• Process side: DN50/PN16</li> <li>• Service side: DN25/PN16</li> </ul>                                                                                                                                                                           |
| <p><b>Emission condenser for H630, H750 and H1000</b></p>                      | <p>To minimize deposits and corrosion, cooled exhaust gas from the emission condenser is returned to the SIHI Dry working chamber.</p>                                    | <p><b>Type:</b></p> <ul style="list-style-type: none"> <li>• Tube &amp; shell – Condenser</li> <li>• Exchange area 1,7 m<sup>2</sup></li> </ul> <p><b>Material execution (product / service side):</b></p> <ul style="list-style-type: none"> <li>• Stainless steel / Stainless steel</li> </ul> <p><b>Material executionConnections:</b></p> <ul style="list-style-type: none"> <li>• Process side: DN50/PN16</li> <li>• Service side: DN25/PN16</li> <li>• Gas feedback: DN80/PN16</li> <li>• Ventilation: G 1/8"</li> <li>• Drain service port: G 1/2"</li> <li>• Measuring port: G 1/2"</li> </ul> |
| <p><b>Emission condenser with shut-off valve for H630, H750 and H1000</b></p>  | <p>Additionally to Emission condenser for H750 and H1000:<br/>Shut-off valve</p> <p>Like mission condenser for H750 and H1000, additionally:</p>                          | <p><b>Scope of supply:</b></p> <ul style="list-style-type: none"> <li>• Valve, PFA/PTFE- conductive lined</li> <li>• Drive, designed for control pressure of 3...6 bar g, closed by spring energy</li> <li>• Solenoid valve (Ex-e)</li> <li>• Limit switch (Ex-d)</li> </ul>                                                                                                                                                                                                                                                                                                                           |

| Connection, discharge side                                                                                      | Execution                                                                             | Features                                          |
|-----------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------|
| <p><b>Transition pipe</b></p>  | <p>For connection of components on the discharge side, i.e., discharge condenser.</p> | <p><b>Material execution:</b> Stainless steel</p> |

| Sensors                                                                                                                | Execution                                                                                                                                                                                                                                                             |  |
|------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| <p><b>Resistance thermometer</b></p>  | <p>Resistance thermometer (Pt100) for measuring temperature on suction side <b>and/or</b></p> <p>Resistance thermometer (Pt100) for measuring coolant temperature <b>and/or</b></p> <p>Resistance thermometer (Pt100) for measuring temperature on discharge side</p> |  |
| <p><b>Pressure transmitter</b></p>   | <p>Pressure transmitter for measuring of suction pressure <b>and/or</b></p> <p>Pressure transmitter for measuring dynamic pressure or exhaust pressure</p>                                                                                                            |  |

| Accessories                                                                                                      | Execution                                                                                                                                                             | Feature                                                                                                           |
|------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------|
| <p><b>Flame arrester</b></p>  | <p>Besides the necessary measurement devices, flame arresters (IIB3 for H250 and H400 or IIC for H250) are equipped to fulfil the requirements of a cat 1 system.</p> | <p><b>Material execution:</b> Flame arrester IIB3: stainless steel</p> <p>Flame arrester IIC: stainless steel</p> |



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**PUTB000255 (EN/A4)** August 2020

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