Vortex products are compliant with the RoHS Directive and Reach Regulation.
The All-in-One Coolant Pump —
Saves the cost of various components,
Requires no maintenance, and
Performs well in tough conditions.

Existing Flow (Conventional coolant unit)

Proposal by VORTEX

VORTEX E Series: 268mm W x 783mm H x 268mm D

The ratio of space by volume is approximately 1/50. Vortex greatly expands the working space and reduces hassle, offering an easy-to-work and efficient environment.
The Vortex will never be clogged, and require no maintenance — even in a dirty tank like this.

Our special Turbulence™ design generates turbulence. The combined action of the turbulence and centrifugal force washes away chips from the filter automatically. Filter maintenance is no longer required — no more cumbersome cleaning work. Of course, a clog-free filter ensures a constant flow rate. The coolant fluid is supplied to the machining center at a stable pressure.

On the left is a photograph of an actual Vortex (after 7,000 hours of operation) installed in this tank. The filter obviously remains clean.
Chip recovery is simple! — the Vortex separates and ejects chips in lumps.

The Vortex cleans the coolant, but that is not all. It also performs cumbersome chip collection well. The separated chips are pushed out of the drain port and dumped into a bucket in lumps. Chip recovery is incomparably simpler than the conventional system. The Vortex can be used in combination with your existing chip conveyor system to collect and recycle chips.
“Let’s cut out waste of time, extra labor, and hassle!” That’s what I’ve been saying all along as a member of a manufacturing team.

I have always felt as I worked around the coolant system every day there is so much waste of time, extra labor, and hassle. It is a very dirty area and not exactly the kind of area I would love to step into. Yet, I must get in there to care for the system before the pressure drops and causes the machining center to stop.

It is extremely difficult to service a large coolant unit that is located, for example, in the back of a machine where the space is small and limited. The line must be stopped during maintenance work, and reduces our production efficiency.

Another thing that is often overlooked is the fact that the pump is constantly running at the full speed, wasting power. We would never achieve savings in power consumption, let alone our mission of preventing global warming by cutting down on CO₂ emission.

Yuji Kawano
Fellow, VORTEX Business Dept.
The Turbulence™ filter is built in. This is the High-Spec Series that washes chips away automatically.
Our special Turbulence™ design generates turbulence. The combined action of the turbulence and centrifugal force washes away chips from the filter automatically. The result is a maintenance-free unit with a stable high pressure and large flow rate.

*Chips larger than 20µm in size removed (when using aqueous solution containing 2% or more water-soluble coolant fluid).

You have two options — the powerful plunger pump and the high-efficiency Trochoid™ pump — depending on your application.

Compatible types of fluid
- Aqueous solution containing 2% or more water-soluble coolant fluid
- Water-insoluble coolant fluid of 15mm²/s or less viscosity*
- Not for lubricant oil or fuel oil
- Not for clear water, purified water, water solutions without rust-preventive property, viscous fluids, corrosive liquid, solvents, and oils

*EP is limited to use with water-soluble coolants.

Relief valve is built into the unit

All components of a coolant system are consolidated into a single Vortex unit. No line and suction filters are required. The use of a Vortex results in huge energy savings over the conventional centrifugal pumps. The electric power cost is greatly reduced.


Center Through pressure: 1.1MPa

*Calculated on the basis of operating time 8h/day, operating days 365/year, and the electric power cost ¥20/kWh.

Comparison of power consumption during machining operation

Plunger Pump

Conventional centrifugal pump

Trochoid™ Pump

Comparison of annual electric power costs

Up to 42% reduction in the electric power cost is possible.
**EP**

**Plunger-type, All-in-one High-pressure Pump**

- **Turbulence™ filter**
  Special turbulence cleans the filter automatically, rendering the filter clog free.

- **Plunger pump / 7.0MPa~3.0MPa**
  Piston action pushes fluid at high to medium pressure. *3.0MPa model is scheduled for future release.*

- **Compatible with the TAZUNA™ fluid control system (software)**
  TAZUNA™ reduces the electric power cost further by approximately 20%. The pressure and flow rate are automatically adjusted.

**Dimensional Drawing (typical)**

**Specifications**

<table>
<thead>
<tr>
<th>Model Numbering System</th>
</tr>
</thead>
<tbody>
<tr>
<td>TOP—YTH 1 2 - 3 EVD 4 5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Motor capacity</th>
<th>Motor type</th>
<th>E: Filtering method</th>
</tr>
</thead>
<tbody>
<tr>
<td>2200: 2.2kW</td>
<td>A1: AC 200V, 3 phase electric induction motor</td>
<td>E: Turbulence™ filter type</td>
</tr>
<tr>
<td>2400: 3.0kW</td>
<td>A6: AC 200/220V 50/60Hz 3 phase electric induction motor</td>
<td></td>
</tr>
<tr>
<td>2800: 4.0kW</td>
<td>A7: AC 200V 60Hz 3 phase electric induction motor with CE marking</td>
<td></td>
</tr>
<tr>
<td>3200: 5.5kW</td>
<td>A10: AC 200V 60Hz 3 phase electric induction motor with CE marking</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Relief valve setting (MPa)</th>
</tr>
</thead>
<tbody>
<tr>
<td>70: 7.0MPa</td>
</tr>
<tr>
<td>60: 6.0MPa</td>
</tr>
<tr>
<td>40: 4.0MPa</td>
</tr>
<tr>
<td>30: 3.0MPa</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Pump capacity</th>
<th>Filtering performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>P008: Plunger pump, 8cc/rev.</td>
<td>C: 20µm</td>
</tr>
<tr>
<td>P010: Plunger pump, 10cc/rev.</td>
<td></td>
</tr>
<tr>
<td>P016: Plunger pump, 16cc/rev.</td>
<td></td>
</tr>
</tbody>
</table>

**Drawings in PDF**
Drawings may be downloaded from the VORTEX website.
# Performance Curves

**Water-soluble coolant (general performance)**

Oil used: JIS K2241, Type A3 solution containing 2% water-soluble cutting fluid

### 50Hz

**P-Q Curve**

**Required Power**

### 60Hz

**P-Q Curve**

**Required Power**
Trochoid™-type, All-in-one Medium-pressure Pump

**Trochoid™ pump / 2.0 MPa, 1.5 MPa**
A rotor turning in a trochoidal curve generates pressure to suck and discharge fluid. This is an extremely efficient self-priming pump.

**Turbulence™ filter**
Special turbulence clears the filter automatically, rendering the filter clog free.

**Compatible with the TAZUNA™ fluid control system (software)**
TAZUNA™ reduces the electric power cost further by approximately 20%. The pressure and flow rate are automatically adjusted.

---

**Model Numbering System**

**TOP—YTH 1 2 - 3 E VD 4 5**

- **Motor capacity**
  - 750: 0.75kW
  - 1500: 1.5kW

- **Motor type***
  - D1: DC brushless motor
  - A1: AC 200V, 3 phase electric induction motor
  - A6: AC 200V 3 phase electric induction motor with CE marking

- **Relief pressure setting (MPa)**
  - 20: 2.0MPa
  - 15: 1.5MPa

- **Filtering performance**
  - A: 100µm
  - B: 50µm
  - C: 20µm

---

**Specifications**

<table>
<thead>
<tr>
<th>Model</th>
<th>Motor capacity</th>
<th>Type</th>
<th>Pump capacity (L/min)</th>
<th>Maximum pressure (MPa)</th>
<th>L</th>
<th>C</th>
<th>W</th>
<th>Q</th>
<th>H</th>
<th>φD</th>
<th>φO</th>
<th>Approx. weight (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>YTH750A1-T208EVD</td>
<td>0.7kW</td>
<td>AC standard</td>
<td>12.0/14.4</td>
<td>2.0</td>
<td>618.3</td>
<td>274.8</td>
<td>83.5</td>
<td>214.8</td>
<td>20</td>
<td>343.5</td>
<td>233</td>
<td>170</td>
</tr>
<tr>
<td>YTH750A2-T208EVD</td>
<td>0.7kW</td>
<td>AC with CE marking</td>
<td>24.0/28.8</td>
<td>2.0</td>
<td>680.3</td>
<td>294.8</td>
<td>113.5</td>
<td>234.8</td>
<td>40</td>
<td>422.5</td>
<td>312</td>
<td>202</td>
</tr>
<tr>
<td>YTH1500A1-T216EVD</td>
<td>1.5kW</td>
<td>AC standard</td>
<td>24.0/28.8</td>
<td>2.0</td>
<td>717.3</td>
<td>594.8</td>
<td>113.5</td>
<td>234.8</td>
<td>40</td>
<td>422.5</td>
<td>312</td>
<td>202</td>
</tr>
<tr>
<td>YTH1500A2-T216EVD</td>
<td>1.5kW</td>
<td>AC with CE marking</td>
<td>24.0/28.8</td>
<td>2.0</td>
<td>665.3</td>
<td>370.5</td>
<td>172</td>
<td>0</td>
<td>143.5</td>
<td>28</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Different voltages are available.

---

**Drawings in PDF**
Drawings may be downloaded from the VORTEX website.
### Performance Curves

**Water-soluble coolant (general performance)**

- Oil used: JIS K2241, Type A3 solution containing 2% water-soluble cutting fluid

**Spindle Oil (general performance)**

- Oil used: ISO VG2 equivalent

#### 50Hz

- **P-Q Curve**
- **Required Power**

#### 60Hz

- **P-Q Curve**
- **Required Power**
The Double-cyclone Filter is Built In.

This is a VORTEX Basic Series.
Features of the C series

World’s First — All-in-one, Medium-pressure Coolant Pump

This is a basic Vortex model consolidating a large coolant system into one unit. Simply replace a conventional medium-pressure pump with a C series pump to reduce the occupied space to 1/100th by volume. The plant space is in effect greatly expanded and production efficiency improves.

- Maximum operating pressure: 2.0MPa
- Maximum discharge: 28.8 liters/min.
- No suction filter is required.
- No clean tank is required.
- No transfer pump is required on the dirty-tank end.
- No plumbing is required to interconnect various components.

A proprietary double-cyclone filtering system removes chips*. The first and second cyclones remove relatively large and fine chips, respectively. The line-filter cleaning cycle is extended by 24 times.

*Chips larger than 20µm in size removed (when using aqueous solution containing 2% or more water-soluble coolant fluid).

The C Series uses a Trochoid™ pump which excels in fluid control efficiency. The double-cyclone system sorts out chips and enables direct connection to the dirty tank.

- Compatible types of fluid
  - Aqueous solution containing 2% or more water-soluble coolant fluid
  - Not for water-insoluble coolant fluid, lubricant oil or fuel oil
  - Not for clear water, purified water, aqueous solutions without rust-preventive property, viscous fluids, corrosive liquid, solvents, and oils
- Relief valve is built into the unit.

Compatible types of chips

<table>
<thead>
<tr>
<th>Material</th>
<th>Iron</th>
<th>Casting</th>
<th>Aluminum</th>
<th>Copper</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compatibility</td>
<td>Excellent</td>
<td>Excellent</td>
<td>Good</td>
<td>Excellent</td>
</tr>
</tbody>
</table>

Filtering performance

- Suction strainer: 2mm (Solids larger than this must be removed in the tank.)
- Filter: 50µm: 95% (specific gravity 2.7), 100µm: 99% (specific gravity 2.7)
  Note: No problems in using a Trochoid™ pump

Comparison of power consumption during machining operation

Comparison of annual electric power costs

Huge Energy Saving Effect Reduces Utility Costs*

The use of a Vortex results in huge energy savings over the conventional centrifugal pumps. The electric power cost is greatly reduced.

- Center Through pressure: 1.1MPa

*Calculated on the basis of operating time 8h/day, operating days 365/year, and the electric power cost ¥20/kWh.

Up to 42% reduction in the electric power cost is possible.

Material Compatibility

<table>
<thead>
<tr>
<th>Material</th>
<th>Iron</th>
<th>Casting</th>
<th>Aluminum</th>
<th>Copper</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compatibility</td>
<td>Excellent</td>
<td>Excellent</td>
<td>Good</td>
<td>Excellent</td>
</tr>
</tbody>
</table>

Comparison of annual electric power costs

- Conventional centrifugal pump: ¥61,260
- VORTEX: ¥35,460

Huge Energy Saving Effect Reduces Utility Costs*

The use of a Vortex results in huge energy savings over the conventional centrifugal pumps. The electric power cost is greatly reduced.

- Center Through pressure: 1.1MPa

*Calculated on the basis of operating time 8h/day, operating days 365/year, and the electric power cost ¥20/kWh.
CT
Cyclone-type, All-in-one Medium-pressure Pump

Double-cyclone filter
Two layers of double cyclones (one large cyclone and six small cyclones) remove chips from the coolant fluid.

Trochoid™ pump / 2.0MPa, 1.5MPa
A rotor turning in a trochoidal curve generates pressure to suck and discharge fluid. This is an extremely efficient self-priming pump.

Compatible with the TAZUNA™ fluid control system (software)
TAZUNA™ reduces the electric power cost further by approximately 20%. The pressure and flow rate are automatically adjusted.

Model Numbering System
TOP—YTH ① ② - ③ C VD ④

① Motor capacity
750: 0.75kW
1500: 1.5kW

② Motor type*
A1: AC 200V, 3 phase electric induction motor
A2: AC 200/220V 50/60Hz
3 phase electric induction motor with CE marking

③ Rotor capacity
T208: Trochoid™ pump, 8cc/rev.
T216: Trochoid™ pump, 16cc/rev.

④ Relief pressure
setting (MPa)
15: 1.5MPa

 avaliações

Motor capacity Type Pump capacity [L/min] Maximum pressure [MPa]

<table>
<thead>
<tr>
<th>Model</th>
<th>Item</th>
<th>Motor capacity</th>
<th>Type</th>
<th>Pump capacity [L/min]</th>
<th>Maximum pressure [MPa]</th>
</tr>
</thead>
<tbody>
<tr>
<td>YTH750A1-T208CVD</td>
<td>0.75kW</td>
<td>AC standard</td>
<td>12.0/14.4</td>
<td>579.2</td>
<td>235.7</td>
</tr>
<tr>
<td>YTH750A2-T208CVD</td>
<td>0.75kW</td>
<td>AC with CE marking</td>
<td>12.0/14.4</td>
<td>629.3</td>
<td>289.7</td>
</tr>
<tr>
<td>YTH1500A1-T216CVD</td>
<td>1.5kW</td>
<td>AC standard</td>
<td>24.0/28.8</td>
<td>641.2</td>
<td>356.7</td>
</tr>
<tr>
<td>YTH1500A2-T216CVD</td>
<td>1.5kW</td>
<td>AC with CE marking</td>
<td>24.0/28.8</td>
<td>678.2</td>
<td>396.7</td>
</tr>
</tbody>
</table>

*Different voltages are available.

Specifications

CT series

Drawings in PDF
Drawings may be downloaded from the VORTEX website.
Performance Curves

Water-soluble coolant (general performance)

Oil used: JIS K2241, Type A3 solution containing 2% water-soluble cutting fluid

- T208
- T216

50Hz

P-Q Curve

Required Power

Spindle Oil (general performance)

Oil used: ISO VG2 equivalent

- T208
- T216

50Hz

P-Q Curve

Required Power

60Hz

P-Q Curve

Required Power

Oil used: JIS K2241, Type A3 solution containing 2% water-soluble cutting fluid

Spindle Oil (general performance)

Oil used: ISO VG2 equivalent

C Series
A Fluid Control System
It Reduces Annual Electric Power Cost by Up to 62%.

62% DOWN
A Fluid Control System That Reduces Annual Electric Power Cost by Up to 62%

The use of Vortex pumps cuts the annual electric power cost by about 42%. Additional savings of about 20% would be achieved, or a total of 62%, through the use of the TAZUNA™ fluid control system. Trimming the production costs is a way to improve your competitiveness. The saving impact will be greater in a plant with a multiple of machining center operating. Reduction in power consumption enables trimming of CO₂ and is an effective measure against global warming.

Power Consumption Graph on a Test Operation

- The energy-saving effect will vary due to the difference in machining pressures and drill diameters.
- The calculation is based on operation 8 hours/day, 365 days/year, and the electric power billed at ¥20/kWh.

Comparison of Annual Electric Power Bills

<table>
<thead>
<tr>
<th></th>
<th>Conventional centrifugal pump</th>
<th>VORTEX</th>
<th>VORTEX with TAZUNA™</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electric power cost (JPY)</td>
<td>¥61,260</td>
<td>¥35,460</td>
<td>¥23,560</td>
</tr>
<tr>
<td>Approx. 42% Reduction</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Approx. 62% Reduction</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Features of TAZUNA™

- Additional savings in energy
  TAZUNA™ adjusts the motor within the Vortex pump to an optimum speed for the drill diameter in use to achieve significant energy savings and CO₂ reduction.
- Improving machining accuracy
  The system is compatible with any drill diameter. Automatic control of the pressure to an optimum value stabilizes the machining accuracy.
- No initial settings required
  An automatic drill identification system is pre-installed. The system is ready for use. No initial setting and other cumbersome programming are required (for different drills) on the machining end.
- A variety of interface
  Various input and output ports are standard features: digital I/O (8/8), analog I/O (4/4), high-speed input ports (3P), RS485 communication ports (2), selector SW (8), 16P rotary SW (4).
- Flexibly programmable
  The system may be programmed to suit given specifications, allowing the user to customize the system to accomplish a variety of energy-saving control.
- Compact and low cost
  The circuit board is a compact and low-cost single card, complete with required interface.

TAZUNA™ Fluid control System (Software)*

TAZUNA™ is an automatic fluid control system (software) developed by NOP. The system uses a pressure sensor to identify the drill diameter being used by the machining center. It continuously controls the Vortex, adjusting the pressure and flow rate instantaneously according to the drill movement. The absence of unneeded pressure means no extra pressure is wasted through the relief valve. The power consumption is greatly reduced while maintaining machining accuracy.
Automatic Drill Identification System

The system senses the pressure to identify the drill hole diameter. It then selects an optimum machining pressure for the hole diameter by reference to its database. The machining pressure may be fine adjusted to suit different work and cutting fluids. The user’s own database may also be stored independently.

A Flowchart for the Automatic Drill Identification System

1. In the unload status (the status other than machining in action), the system runs at the designated speed in the chip removal mode.
2. Following a coolant on input, the speed changes to the drill-identification speed, and identifies the drill hole diameter.
3. The system continuously controls the rotational speed to give an optimum machining pressure and flow rate during the machining of work.
4. On completion of the drilling, the system returns to the unload status.

A Sample Installation

The system may be customized to suite the user.

Control for a constant pressure and flow rate
Servo quantitative control
Electro-magnetic proportional control valve

The pressure and flow rate are controlled at a constant value regardless of the fluid temperature and deterioration by feeding back the pressure and flow rate signals.

The rotational angle and displacement are sensed for quantitative position control by feeding back the potentiometer signals.

An analog output is linked to an electro-magnetic proportional valve for control of the pressure at an optimum value.

■ Specifications for the Control Circuit Board

The board is equipped with assorted IF, enabling control other than the automatic drill identification system.

Control Circuit Board

General specifications

<table>
<thead>
<tr>
<th>Feature</th>
<th>TAZ-101 (Full I/F)</th>
<th>TAZ-102 (Half I/F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ambient temperature</td>
<td>-10<del>40°C (when operating), -20</del>60°C (in storage)</td>
<td>-10<del>40°C (when operating), -20</del>60°C (in storage)</td>
</tr>
<tr>
<td>Ambient humidity</td>
<td>10<del>90% (when operating), 10</del>90% (in storage)</td>
<td></td>
</tr>
<tr>
<td>Installed location</td>
<td>Indoors (free of corrosive gas or dust)</td>
<td></td>
</tr>
<tr>
<td>Input power</td>
<td>DC 24V±10%</td>
<td></td>
</tr>
<tr>
<td>Power consumption</td>
<td>10W</td>
<td></td>
</tr>
<tr>
<td>External dimensions</td>
<td>160mm (6.3&quot;) W x 95mm (3.8&quot;) D x 20mm (0.8&quot;) H</td>
<td></td>
</tr>
</tbody>
</table>

Input specifications

<table>
<thead>
<tr>
<th>Feature</th>
<th>Digital</th>
<th>Analog</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of input ports</td>
<td>8 ports</td>
<td>4 ports</td>
</tr>
<tr>
<td>Input signal type</td>
<td>DC voltage-free contact input</td>
<td>On sync input: NPN open-collector transistor</td>
</tr>
<tr>
<td>On source input: PNP open-collector transistor</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sync input/source input are selectable at a jumper pin.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Input operation indicator</td>
<td>An LED (red) is lit when input is on.</td>
<td></td>
</tr>
<tr>
<td>Number of input ports</td>
<td>4 ports</td>
<td>2 ports</td>
</tr>
<tr>
<td>Input range</td>
<td>DC 0-10V, DC 4-20mA</td>
<td>On DC 0-10V: Approx. 10mA (in 1024 steps)</td>
</tr>
<tr>
<td>On DC 4-20mA: Approx. 16mA (in 1024 steps)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Resolution</td>
<td>1024 steps</td>
<td></td>
</tr>
<tr>
<td>High-speed counter</td>
<td>3 ports (A-phase input, B-phase input, 2-phase input).</td>
<td>1 or more ports (A-phase input, 2-phase input, 3-phase input).</td>
</tr>
<tr>
<td>Compatible with open-collector output encoder</td>
<td>Compatible with differential-line drive output encoder</td>
<td></td>
</tr>
<tr>
<td>Maximum response time</td>
<td>85µs</td>
<td>5MHz</td>
</tr>
</tbody>
</table>

Output specifications

<table>
<thead>
<tr>
<th>Feature</th>
<th>Digital</th>
<th>Analog</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of output ports</td>
<td>6 ports (with independent common)</td>
<td>2 ports</td>
</tr>
<tr>
<td>Maximum load</td>
<td>Maximum load voltage DC 300V, resistive load, maximum 0.5A (per output port)</td>
<td>2 ports (with independent common)</td>
</tr>
<tr>
<td>Output operation indicator</td>
<td>An LED (red) is lit when output is on.</td>
<td>1 port (with independent common)</td>
</tr>
<tr>
<td>Maximum response time</td>
<td>10ms</td>
<td></td>
</tr>
<tr>
<td>Number of relay output ports</td>
<td>4 ports (with independent common)</td>
<td></td>
</tr>
<tr>
<td>Maximum load</td>
<td>Load voltage AC 125V, DC 125V, resistive load, 0.5A (per output port)</td>
<td></td>
</tr>
<tr>
<td>Output operation indicator</td>
<td>An LED (red) is lit when output is on.</td>
<td></td>
</tr>
<tr>
<td>Maximum response time</td>
<td>10ms</td>
<td></td>
</tr>
<tr>
<td>Output range</td>
<td>DC 0-10V, DC 4-20mA</td>
<td>On DC 0-10V: Approx. 10mA (in 1024 steps)</td>
</tr>
<tr>
<td>On DC 4-20mA: Approx. 16mA (in 1024 steps)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Resolution</td>
<td>1024 steps</td>
<td></td>
</tr>
</tbody>
</table>

CPU specifications

<table>
<thead>
<tr>
<th>Feature</th>
<th>Processor</th>
<th>Number of bits</th>
<th>Memory</th>
<th>Speed</th>
<th>Cache</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>DSPIC33FJ128MC710A (Single-chip microcontroller by Microchip Technology Inc.)</td>
<td>16-bit</td>
<td>RAM: 16KB</td>
<td>40MHz</td>
<td>2kB D/A memory</td>
</tr>
<tr>
<td></td>
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<td>ROM: 128KB</td>
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</tr>
</tbody>
</table>

Operation indicator specifications

On normal operation: RUN LED (green) is lit.
On error: FAIL LED (red) is lit.
Error No. is displayed (on 7-segment LED).
**Series name** | **Specifications for pump proper** | **Specifications for pump proper**
---|---|---
**Pump model** | P008 | P010 | P016 | P008 | P010 | P016
**Discharge capacity [l/min]** | 12.0/14.4 | 15.0/18.0 | 24.0/28.8 | 12.0/14.4 | 24.0/28.8 | 12.0/14.4
**Compatible fluid** | Water-soluble coolant fluid | Water-soluble coolant fluid | Water-soluble coolant fluid | Water-soluble coolant fluid | Water-soluble coolant fluid | Water-soluble coolant fluid
**Maximum absolute viscosity (mm²/s) [Filtration rating]** | 15 (20µm) | 20µm | 20µm | 15 (20µm), 55 (50µm), 100 (100µm) | 22 | 22
**Liquid temperature range (°C)** | -5~60 | -5~60 | -5~60 | -5~60 | -5~60 | -5~60
**Rotational speed / (r/min)** | 1500/1800 | 1500/1800 | 1500/1800 | 1500/1800 | 1500/1800 | 1500/1800
**Maximum pressure (MPa)** | 7.0 | 7.0 | 7.0 | 2.0 | 2.0 | 2.0
**Filter type** | Wire screen filter | Wire screen filter | Wire screen filter | Filter type | Wire screen filter | Filter type
**Filtration rating** | 20µm | 20µm | 20µm | 16 | 16 | 16
**Remarks** | Install a plate filter of #60 or finer mesh on the suction end of the tank. | Install a plate filter of #60 or finer mesh on the suction end of the tank. | Install a plate filter of #60 or finer mesh on the suction end of the tank. | Remarks | Remarks | Remarks
**Painted color of the pump section** | Flat black (Approximately Munsell N1.0) | Flat black (Approximately Munsell N1.0) | Flat black (Approximately Munsell N1.0) | Painted color of the pump section | Painted color of the pump section | Painted color of the pump section
**Relief valve specifications** | Relief valve specifications | Relief valve specifications | Relief valve specifications | Relief valve specifications | Relief valve specifications | Relief valve specifications
**Type** | External return type | External return type | External return type | Type | Type | Type
**Relief pressure setting (MPa)** | 7.0 | 7.0 | 7.0 | 4.0 | 4.0 | 4.0

**Motor specifications**

**Model No.** | 2200A1 | 2200A6 | 2200A7 | 750A1 | 750A2 | 750D1* | 1500D1*
**Specifications** | 3-phase, squirrel-cage induction motor, totally enclosed, external fan, flange-mounting configuration | 3-phase, squirrel-cage induction motor, totally enclosed, external fan, flange-mounting configuration | 3-phase, squirrel-cage induction motor, totally enclosed, external fan, flange-mounting configuration | DC brushless motor, totally enclosed, external fan, flange-mounting configuration | DC brushless motor, totally enclosed, external fan, flange-mounting configuration | DC brushless motor, totally enclosed, external fan, flange-mounting configuration | DC brushless motor, totally enclosed, external fan, flange-mounting configuration
**Output (kW)** | 2.2 | 2.2 | 2.2 | 0.75 | 1.5 | 0.75 | 1.5
**Frequency (Hz)** | 50/60/60 | 50/60/60 | 50/60/60 | 50/60/60 | 50/60/60 | 50/60/60 | 50/60/60
**Rotational speed / (r/min)** | 1400/1680/1710 | 1440/1740/1740 | 1440/1740/1740 | 1410/1690/1720 | 1410/1690/1720 | 1410/1690/1720 | 1440/1730/1730 | 1440/1730/1730 | 1440/1730/1730 | 1440/1730/1730 | 1440/1730/1730
**Rating** | Continuous | Continuous | Continuous | Continuous | Continuous | Continuous | Continuous | Continuous | Continuous | Continuous | Continuous
**Current (A)** | 9.8/9.8/9.5 | 10.4/10.2/9.2 | 10.4/10.2/9.2 | 3.8/3.8/3.4 | 7.0/6.2/6.0 | 4.1/3.7/3.4 | 7.3/6.7/6.1 | 5.0 | 8.4
**Number of phases** | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3
**Number of poles** | 4P | 4P | 4P | 4P | 4P | 4P | 4P | 4P | 4P | 4P | 4P
**Insulation class** | E | B | B | E | E | E | E | E | E | E | E
**Approximate weight (kg)** | 23 | 23 | 23 | 16 | 18 | 19 | 26 | 10 | 13 | 1616
**Protection rating** | IP44 | IP54 | IP54 | IP44 | IP44 | IP44 | IP44
**Efficiency class** | IE1 | IE2 | IE2 | IE1 | IE2 | IE2 | IE2 | IE2 | IE2 | IE2 | IE2 | IE2
**Compliance CE** | — | Yes | Yes | — | — | — | — | — | — | — | — | —

*Applicable only to Model ET.