Advantages

+ Very good controllability and pressure hold function
+ Very good pulsation behavior
+ Very high overall efficiency
+ Low noise emission
+ Multiple flow capable
By rotation of the gears inside the pump, the pressure fluid (usually hydraulic oil) is drawn into the cavity between the pinion and internal gear. Optimized cross-sectional areas on suction side as well as on pressure side allow operation over a wide range of speed.

In the radial direction, the gear chambers are closed by gear meshing and the filler piece. In the axial direction, the axial plates seal the pressure chamber with the minimal possible gap. This design minimizes volume losses and increases efficiency.

Calculations

Pump flow: \[ Q = V_{g,\text{rev}} \cdot n \cdot \eta_v \cdot 10^{-3} \text{ [l/min]} \]

Power: \[ P = \frac{Q \cdot \Delta p}{600 \cdot \eta_g} \text{ [kW]} \]

- \( V_{g,\text{rev}} \): pump volume per revolution [cm³]
- \( n \): Speed [rpm]
- \( \eta_v \): Volumetric efficiency
- \( \eta_g \): Overall efficiency
- \( \Delta p \): Differential pressure [bar]

Technical data

<table>
<thead>
<tr>
<th>Design</th>
<th>Internal gear pump with radial and axial sealing gap compensation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td>IPVAP</td>
</tr>
<tr>
<td>Mounting types</td>
<td>SAE hole flange; ISO 3019/1</td>
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<tr>
<td>Line mounting</td>
<td>SAE suction and pressure flange J 518 C Code 61</td>
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<tr>
<td>Sense of rotation</td>
<td>Right hand rotation</td>
</tr>
<tr>
<td>Mounting position</td>
<td>any</td>
</tr>
<tr>
<td>Shaft load</td>
<td>For details please contact your J.M. Voith SE &amp; Co, KG representative</td>
</tr>
<tr>
<td>Input pressure</td>
<td>0.8 ... 3 bar absolute pressure</td>
</tr>
<tr>
<td>Pressure fluid</td>
<td>HLP mineral oils DIN 51524, part 2 or 3</td>
</tr>
</tbody>
</table>
| Viscosity range of the pressure fluid | 10 ... 300 mm²/s⁻¹ (cSt), up to \( n = 1800 \) rpm  
0 ... 100 mm²/s⁻¹ (cSt), up to \( n_{\text{max}} \) |
| Permissible start viscosity | max. 2000 mm²/s⁻¹ (cSt)                                      |
| Permissible temperature of the pressure fluid | -20 ... +80 °C                                               |
| Required purity of the pressure fluid according to NAS 1638 | Class 19/17/14 (ISO 4406), Class 8 (NAS 1638)                |
| Filtration | Filtration quotient min. \( \beta_{20} \geq 75 \), recommended \( \beta_{10} \geq 100 \) (longer life) |
| Permissible ambient temperature | -20 ... +60 °C                                               |
## Characteristics

<table>
<thead>
<tr>
<th>Type, Size – delivery</th>
<th>Displacement per revolution [cm³]</th>
<th>Speed min. [rpm]</th>
<th>Speed max. [rpm]</th>
<th>Delivery at 1500 rpm [l/min]</th>
<th>Continuous pressure [bar]</th>
<th>Peak pressure at 1500 rpm [bar]</th>
<th>Moment of inertia [kg cm²]</th>
</tr>
</thead>
<tbody>
<tr>
<td>IPVAP 3 – 3.5</td>
<td>3.6</td>
<td>400</td>
<td>3600</td>
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<td>300</td>
<td>320</td>
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<td>7.8</td>
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<td>320</td>
<td>0.42</td>
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<td>3600</td>
<td>9.6</td>
<td>300</td>
<td>320</td>
<td>0.49</td>
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<tr>
<td>IPVAP 3 – 8</td>
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<td>400</td>
<td>3600</td>
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<td>300</td>
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<td>0.70</td>
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<td>400</td>
<td>3600</td>
<td>19.9</td>
<td>300</td>
<td>320</td>
<td>2.25</td>
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<td>400</td>
<td>3400</td>
<td>23.7</td>
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<tr>
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<td>20.7</td>
<td>400</td>
<td>3200</td>
<td>31.0</td>
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<td>320</td>
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<td>3000</td>
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<td>300</td>
<td>320</td>
<td>3.70</td>
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<tr>
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<td>400</td>
<td>2800</td>
<td>48.9</td>
<td>250</td>
<td>280</td>
<td>4.44</td>
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<td>320</td>
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<td>315</td>
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<td>400</td>
<td>2200</td>
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<td>14.40</td>
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<td>400</td>
<td>2600</td>
<td>96.1</td>
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<td>320</td>
<td>25.73</td>
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<td>2400</td>
<td>121.0</td>
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<td>315</td>
<td>30.90</td>
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<td>2100</td>
<td>151.9</td>
<td>250</td>
<td>300</td>
<td>36.10</td>
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<td>IPVAP 6 – 125</td>
<td>126.2</td>
<td>400</td>
<td>1800</td>
<td>189.3</td>
<td>210</td>
<td>250</td>
<td>43.70</td>
</tr>
</tbody>
</table>

The values given apply for
- Pumping of mineral oils with a viscosity of 20…40 mm²s⁻¹
- An input pressure of 0.8…3.0 bar absolute

Notes
- Peak pressures apply for 15% of operating time with a maximum cycle time of 1 minute.
- Please inquire about peak pressures at non-standard speeds.
- Due to production tolerances, the pump volume may be reduced by up to 1.5%.
Diagram IPVAP 3, IPVAP 4 – Continuous pressure depending on the speed

Diagram IPVAP 5 – Continuous pressure depending on the speed
Diagram IPVAP 6 – Continuous pressure depending on the speed

- IPVAP 6-64
- IPVAP 6-80
- IPVAP 6-100
- IPVAP 6-125

max. speed IPVAP 6
**IPVAP 3. Rotation and Dimensions**

**Pressure port (P)  Suction port (S)**

<table>
<thead>
<tr>
<th>Type / Delivery</th>
<th>c [mm]</th>
<th>g [mm]</th>
<th>h [mm]</th>
<th>i [mm]</th>
<th>k [mm]</th>
<th>l Thread</th>
<th>r [mm]</th>
<th>v [mm]</th>
<th>w Thread</th>
<th>Weight [kg]</th>
<th>SAE Flange No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>IPVAP 3 – 3.5</td>
<td>35</td>
<td>9</td>
<td>14</td>
<td>38.1</td>
<td>17.5</td>
<td>M8 x 13</td>
<td>38.1</td>
<td>17.5</td>
<td>M8 x 13</td>
<td>3.4</td>
<td>10 10</td>
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<tr>
<td>IPVAP 3 – 5</td>
<td>39</td>
<td>11</td>
<td>14</td>
<td>38.1</td>
<td>17.5</td>
<td>M8 x 13</td>
<td>38.1</td>
<td>17.5</td>
<td>M8 x 13</td>
<td>3.6</td>
<td>10 10</td>
</tr>
<tr>
<td>IPVAP 3 – 6.3</td>
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<td>11</td>
<td>19</td>
<td>47.6</td>
<td>22.3</td>
<td>M10 x 15</td>
<td>38.1</td>
<td>17.5</td>
<td>M8 x 13</td>
<td>3.8</td>
<td>10 11</td>
</tr>
<tr>
<td>IPVAP 3 – 8</td>
<td>46.5</td>
<td>13</td>
<td>19</td>
<td>47.6</td>
<td>22.3</td>
<td>M10 x 15</td>
<td>38.1</td>
<td>17.5</td>
<td>M8 x 13</td>
<td>4.0</td>
<td>10 11</td>
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<tr>
<td>IPVAP 3 – 10</td>
<td>51.5</td>
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<td>21</td>
<td>52.4</td>
<td>26.2</td>
<td>M10 x 15</td>
<td>38.1</td>
<td>17.5</td>
<td>M8 x 13</td>
<td>4.2</td>
<td>10 12</td>
</tr>
</tbody>
</table>

**IPVAP 3, Design**

**Rotation**

**Mounting Flange**

**Shaft End**

**Standard**

Rotation clockwise

1

SAE 2-hole flange

0

Parallel shaft with keyway connection

1
**IPVAP 4, rotation and dimensions**

### Pressure port (P)

### Suction port (S)

<table>
<thead>
<tr>
<th>Type / Delivery</th>
<th>c [mm]</th>
<th>g [mm]</th>
<th>h [mm]</th>
<th>i [mm]</th>
<th>k [mm]</th>
<th>l Thread</th>
<th>r [mm]</th>
<th>v [mm]</th>
<th>w Thread</th>
<th>Weight [kg]</th>
<th>SAE Flange No.</th>
</tr>
</thead>
<tbody>
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<td>48.5</td>
<td>13</td>
<td>23</td>
<td>52.4</td>
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<td>M10 x 15</td>
<td>38.1</td>
<td>17.5</td>
<td>M8 x 13</td>
<td>7.1</td>
<td>10</td>
</tr>
<tr>
<td>IPVAP 4 – 16</td>
<td>52.5</td>
<td>14</td>
<td>25</td>
<td>52.4</td>
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<td>M10 x 15</td>
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<td>M8 x 13</td>
<td>7.3</td>
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<td>18</td>
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<td>47.6</td>
<td>22.3</td>
<td>M10 x 15</td>
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<td>11</td>
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<td>18</td>
<td>30</td>
<td>58.7</td>
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<td>M10 x 15</td>
<td>47.6</td>
<td>22.3</td>
<td>M10 x 15</td>
<td>8.3</td>
<td>11</td>
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<td>IPVAP 4 – 32</td>
<td>73</td>
<td>18</td>
<td>32</td>
<td>58.7</td>
<td>30.2</td>
<td>M10 x 15</td>
<td>47.6</td>
<td>22.3</td>
<td>M10 x 15</td>
<td>9.1</td>
<td>11</td>
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</tbody>
</table>

**IPVAP 4, design**

<table>
<thead>
<tr>
<th>Rotation</th>
<th>Mounting flange</th>
<th>Shaft end</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rotation clockwise</td>
<td>1</td>
<td>SAE 2-hole flange</td>
</tr>
</tbody>
</table>
IPVAP 5, rotation and dimensions

Pressure port (P)

Suction port (S)

<table>
<thead>
<tr>
<th>Type / Delivery</th>
<th>c [mm]</th>
<th>g [mm]</th>
<th>h [mm]</th>
<th>i [mm]</th>
<th>k [mm]</th>
<th>l Thread</th>
<th>r [mm]</th>
<th>v [mm]</th>
<th>w Thread</th>
<th>Weight [kg]</th>
<th>SAE Flange No.</th>
</tr>
</thead>
<tbody>
<tr>
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<td>65</td>
<td>18</td>
<td>32</td>
<td>58.7</td>
<td>30.2</td>
<td>M10 x 15</td>
<td>47.6</td>
<td>22.3</td>
<td>M10 x 15</td>
<td>13.0</td>
<td>11</td>
</tr>
<tr>
<td>IPVAP 5 – 40</td>
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<td>19</td>
<td>35</td>
<td>69.9</td>
<td>35.7</td>
<td>M12 x 20</td>
<td>52.4</td>
<td>26.2</td>
<td>M10 x 15</td>
<td>14.1</td>
<td>12</td>
</tr>
<tr>
<td>IPVAP 5 – 50</td>
<td>78</td>
<td>21</td>
<td>40</td>
<td>69.9</td>
<td>35.7</td>
<td>M12 x 20</td>
<td>52.4</td>
<td>26.2</td>
<td>M10 x 15</td>
<td>15.9</td>
<td>12</td>
</tr>
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<td>89</td>
<td>23</td>
<td>40</td>
<td>69.9</td>
<td>35.7</td>
<td>M12 x 20</td>
<td>52.4</td>
<td>26.2</td>
<td>M10 x 15</td>
<td>17.3</td>
<td>12</td>
</tr>
</tbody>
</table>

IPVAP 5, design

Rotation

Mounting flange

Shaft end

Standard

Rotation clockwise

1

SAE 2-hole flange

0

Parallel shaft with keyway connection

1
IPVAP 6, rotation and dimensions

Pressure port (P)  Suction port (S)

<table>
<thead>
<tr>
<th>Type / Delivery</th>
<th>c [mm]</th>
<th>g [mm]</th>
<th>h [mm]</th>
<th>i [mm]</th>
<th>k [mm]</th>
<th>l Thread</th>
<th>r [mm]</th>
<th>v [mm]</th>
<th>w Thread</th>
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<td>23</td>
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<td>M12 x 20</td>
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<td>26.2</td>
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<td>12</td>
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<tr>
<td>IPVAP 6 – 80</td>
<td>88</td>
<td>23</td>
<td>45</td>
<td>77.8</td>
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<td>M12 x 20</td>
<td>69.9</td>
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<td>M12 x 20</td>
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<td>50</td>
<td>77.8</td>
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<td>M12 x 20</td>
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<td>M12 x 20</td>
<td>34.0</td>
<td>14</td>
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IPVAP 6, design

<table>
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<tbody>
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<td></td>
</tr>
<tr>
<td>Rotation clockwise</td>
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</tbody>
</table>
Measurement values – Airborne noise level (measuring location 1 m axial)

### Measurement conditions
- Speed: 1500 rpm
- Viscosity of pressure fluid: 46 mm²s⁻¹
- Operating temperature: 40 °C

### Note
Measurement taken in a low-noise room. In an anechoic room, the measurements are approx. 5 dB(A) lower.
Measurement values – Efficiency $\eta_g$ and $\eta_v$

**IPVAP 3**

- Operating pressure $p$ [bar]
- Efficiency in %
- $\eta_g$
- $\eta_v$

- IPVAP 3 – 10
- IPVAP 3 – 6.3
- IPVAP 3 – 3.5
- IPVAP 3 – 8
- IPVAP 3 – 5

**IPVAP 4**

- Operating pressure $p$ [bar]
- Efficiency in %
- $\eta_g$
- $\eta_v$

- IPVAP 4 – 32
- IPVAP 4 – 20
- IPVAP 4 – 13
- IPVAP 4 – 25
- IPVAP 4 – 16

**IPVAP 5**

- Operating pressure $p$ [bar]
- Efficiency in %
- $\eta_g$
- $\eta_v$

- IPVAP 5 – 64
- IPVAP 5 – 40
- IPVAP 5 – 50
- IPVAP 5 – 32

**IPVAP 6**

- Operating pressure $p$ [bar]
- Efficiency in %
- $\eta_g$
- $\eta_v$

- IPVAP 6 – 125
- IPVAP 6 – 80
- IPVAP 6 – 100
- IPVAP 6 – 64

**Measurement conditions**
- Speed: 1500 rpm
- Viscosity of pressure fluid: 46 mm²s⁻¹
- Operating temperature: 40 °C
SAE-Flange, SAE J 518 C Code 61, single-piece

![Diagram of SAE Flange](image)

<table>
<thead>
<tr>
<th>SAE flange no.</th>
<th>A</th>
<th>B [mm]</th>
<th>C [mm]</th>
<th>D [mm]</th>
<th>E (^1) [mm]</th>
<th>i [mm]</th>
<th>k [mm]</th>
<th>S (^2) Thread</th>
<th>max. pressure [bar]</th>
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</thead>
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<tr>
<td>10</td>
<td>G ½</td>
<td>46</td>
<td>54</td>
<td>36</td>
<td>18.66 – 3.53</td>
<td>38.1</td>
<td>17.5</td>
<td>M 8</td>
<td>345</td>
</tr>
<tr>
<td>11</td>
<td>G ¾</td>
<td>50</td>
<td>65</td>
<td>36</td>
<td>24.99 – 3.53</td>
<td>47.6</td>
<td>22.3</td>
<td>M10</td>
<td>345</td>
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<td>G 1</td>
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<td>70</td>
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<td>M10</td>
<td>345</td>
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<td>13</td>
<td>G 1-¼</td>
<td>68</td>
<td>79</td>
<td>41</td>
<td>37.69 – 3.53</td>
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<td>M10</td>
<td>276</td>
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<tr>
<td>14 (^3)</td>
<td>G 1-½</td>
<td>82</td>
<td>98</td>
<td>50</td>
<td>47.22 – 3.53</td>
<td>69.9</td>
<td>35.7</td>
<td>M12</td>
<td>345(^4)</td>
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<tr>
<td>30</td>
<td>G 1-½</td>
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<td>93</td>
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<tr>
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<td>G 2</td>
<td>90</td>
<td>102</td>
<td>45</td>
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<td>42.9</td>
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<tr>
<td>16</td>
<td>G 2-½</td>
<td>105</td>
<td>114</td>
<td>50</td>
<td>69.44 – 3.53</td>
<td>88.9</td>
<td>50.8</td>
<td>M12</td>
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<td>17</td>
<td>G 3</td>
<td>124</td>
<td>134</td>
<td>50</td>
<td>85.32 – 3.53</td>
<td>106.4</td>
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<td>M16</td>
<td>138</td>
</tr>
<tr>
<td>18</td>
<td>G 4</td>
<td>146</td>
<td>162</td>
<td>48</td>
<td>110.72 – 3.53</td>
<td>130.2</td>
<td>77.8</td>
<td>M16</td>
<td>34</td>
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</tbody>
</table>

Wrench torque for screws according to ISO 6162

\(^1\) Round seal ring (O-Ring) ISO-R 1629 NBR

\(^2\) Screw EN ISO 4762

\(^3\) Special design, deviation from SAE J 518 C Code 61

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Pump combinations
- IPVAP and IPCAP pumps of identical or different sizes can be combined in multiflow pumps.
- All sizes of the relevant pump volume are available as two- or three-flow pumps; four-flow pumps must be designed by J.M. Voith SE & Co. KG.
- The pumps are arranged in increasing order according to frame size and delivery.

Selection
1. Determine pressure ranges and define the appropriate pump serie(s)
2. Determine pump volume and select the appropriate size
3. Define sequence of the pumps
4. Check the torques

Mounting, assembly
Multi-flow pumps are generally mounted to the drive by means of a flange.

<table>
<thead>
<tr>
<th>Rotation and suction</th>
<th>Mounting flange</th>
<th>Shaft end</th>
</tr>
</thead>
<tbody>
<tr>
<td>clockwise (cw)</td>
<td>SAE-2-hole-flange</td>
<td>1</td>
</tr>
<tr>
<td>0</td>
<td>SAE-2-hole-flange (variant)</td>
<td>1</td>
</tr>
<tr>
<td>Special design</td>
<td>4</td>
<td>7</td>
</tr>
</tbody>
</table>

Multi-flow pumps, pump combinations, sequence in order of type and size

[Diagram showing pump combinations: IPVAP 6, IPCA 6, IPVAP 5, IPCA 5, IPVAP 4, IPCA 4, IPVAP 3, IPCA 3, IPVAP 4, IPCA 4, IPVAP 3, IPCA 3]
Type code

IPVAP 3 - 3.5 1 0 1

Shaft end
1 Parallel shaft with keyway

Mounting flange
0 SAE 2-hole
7 SAE 2-hole, variant

Rotation, suction port
1 Clockwise rotation, radial suction port radial

Delivery

<table>
<thead>
<tr>
<th>Site</th>
<th>Delivery</th>
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</thead>
<tbody>
<tr>
<td>3</td>
<td>3.5 5 6.3 8 10</td>
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<tr>
<td>4</td>
<td>13 16 20 25 32</td>
</tr>
<tr>
<td>5</td>
<td>32 40 50 64</td>
</tr>
<tr>
<td>6</td>
<td>64 80 100 125</td>
</tr>
</tbody>
</table>

Size

Type of internal gear pump

Type code for multiple flow capable variants

IPVAP 4/ - 20/ 1 7 1
following multiple flow capable pump stage of the same size, freely selectable delivery volumes

IPVAP 4/3 - 20/ 1 7 1
following multiple flow capable predetermined pump stage of the same or smaller size, freely selectable delivery volumes