Danfoss scroll compressors
VZH088-117-170
Single
R410A

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General Information

Danfoss scroll compressors are designed and manufactured according to the state of the art and to valid European and US regulations. Particular emphasis has been placed on safety and reliability. Related instructions are highlighted with the following icons:

⚠️ This icon indicates instructions to avoid safety risk.

⚠️ This icon indicates instructions to avoid reliability risk.

The purpose of this guideline is to help customers qualify compressors in the unit. You are strongly advised to follow these instructions. For any deviation from the guidelines, please contact Danfoss Technical Support. In any case, Danfoss accepts no liability as a result of the improper integration of the compressor into the unit by the system manufacturer.
Features

- High speed oil circulation minimized by separating oil and gas flows with a sump oil return tube.
- Oil injection control optimizes the oil circulation.
- Reinforced high grade cast iron scroll set. 2 ranges for high and low pressure ratio.
- A patented oil injection system ensures optimal efficiency at low speed by improving scroll set sealing.
- Lead free polymer bearing with excellent performance under diverse loads and speeds.
- Permanent magnet motor with high efficiency at all speeds.
- Oil strainer controls the risk of system debris in the oil injection circuit.
- Gearotor oil pump ensures low speed bearing lubrication.
Compressor model designation

Compressor nomenclature

- **Variable speed**
- **Family** VZH scroll
- **Lubricant** POE lubricant, R410A refrigerant
- **Swept volume** in cm³/rev
- **Design pressure ratio**
  - **A**: high PR,
  - **B**: low PR
- **Evolution index**
- **Motor protection type**
  - **N**: no internal motor protection (protection by drive)
- **Equipment version**
  - **A**: brazed connections, single version
  - **B**: brazed connections, manifold version
  - **D**: brazed connections, unified version
- **Motor voltage code to CDS303**
  - **G**: 380-480V/3~/50 & 60Hz
  - **H**: 525-600V/3~/50 & 60Hz
  - **J**: 200-240V/3~/50 & 60Hz
  *main supply voltage to frequency converter
- **Oil sight glass**
  - **Single version**: Threaded
  - **Manifold version**: None
  - **Unified version**: Threaded
- **Oil level switch**
  - **Manifold version**: Threaded
  - **Unified version**: Threaded

Frequency converter nomenclature

- **Dedicated compressor drive for VZH/VSH scroll**
  - **Serie 303**
- **High overload output power** in kW
- **RFI class**
- **Enclosure protection**
- **IP rating**
- **Main supply voltage**
  - **T2**: 200-240V/3 ph/50-60 Hz
  - **T4**: 380-480V/3 ph/50-60 Hz
  - **T6**: 525-600V/3 ph/50-60 Hz

Note:
High overload output power: output power @160% Torque
Technical specifications

Compressor size
To have the optimum compressor selection, select a compressor size which achieves the peak load system cooling capacity demand at its maximum speed.

Frequency converter variants
Different frequency converter variants are available according to:
1. Mains supply voltage
2. IP class (CDS303 drives are available in IP20 or IP55 housings)
3. RFI (Radio Frequency Interference) class H2/H3 or HX
4. Printed Circuit Board (PCB) coated or not coated.

Compressor and frequency converter combinations
When the compressor size and mains voltage have been defined in the above selection criteria, the code number tables from the "Ordering information and packaging" section provides the appropriate frequency converter sizes and up to eight corresponding code numbers for each compressor model.

⚠️ Note this compressor is equipped with a four poles electrical motor so the applied frequency from the inverter will be 50 Hz for 25 rps (1500 rpm) up to 200 Hz for 100 rps (6000 rpm).

Please refer to the table below

<table>
<thead>
<tr>
<th>Compressor speed</th>
<th>min</th>
<th>max</th>
</tr>
</thead>
<tbody>
<tr>
<td>rps</td>
<td>25</td>
<td>100</td>
</tr>
<tr>
<td>rpm</td>
<td>1500</td>
<td>6000</td>
</tr>
<tr>
<td>Drive output frequency</td>
<td>Hz</td>
<td>50</td>
</tr>
</tbody>
</table>

Detailed performances can be found in datasheets and in selection programs.
**Technical specifications**

### Compressor specifications

<table>
<thead>
<tr>
<th>Compressor model</th>
<th>Swept volume</th>
<th>Displacement</th>
<th>Oil charge</th>
<th>Net weight</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>cm³/rev cu.in/rev</td>
<td>m³/h cu.ft/h</td>
<td>m³/h cu.ft/h</td>
<td>m³/h cu.ft/h</td>
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<tr>
<td>VZHO88</td>
<td>88.4 5.39</td>
<td>7.96 281</td>
<td>15.91 562</td>
<td>19.09 675</td>
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<td>VZH117</td>
<td>116.9 7.13</td>
<td>10.52 372</td>
<td>21.04 744</td>
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<td>VZH170</td>
<td>170.2 10.38</td>
<td>15.32 541</td>
<td>30.64 1083</td>
<td>36.76 1299</td>
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</tbody>
</table>

### Frequency converter specifications

- **Mains supply voltage**: T2: 200 - 240 V ±10% (3-phase)  
  T4: 380 - 480 V ±10% (3-phase)  
  T6: 525 - 600V ±10% (3-phase)
- **Supply frequency**: 50 / 60 Hz
- **Output voltage**: 0 - 100 % of supply voltage
- **Inputs**: 6 digital (0-24V), 2 analog (0/±10V or 4-20mA, scalable)
- **Programmable outputs**: 2 digital (0-24V), 1 analog (0/4-20mA), 2 relay
- **Protection functions**: Over-current protection, low / high current handling
- **Compressor functions**: Motor protection, compressor ramp up/down control

### Oil injection control

VZH compressors are equipped with an oil injection system that makes the compression pockets more tight thus improving the isotropic efficiency of the compressor as well as controls the oil circulation ratio, at all running speeds. The frequency converter via an oil injection valve controls this system. The oil injection valve is a normally closed valve. At low speed, the valve is closed and the oil is injected to the scroll set suction ports.

The compressors are delivered with no coils. 208V-240V / 110V-120V / 24V coils are available as accessory (refer to “Accessories” section). The coil must be installed for oil injection control. Control parameters are factory preset but accessible on the parameter list as read only values.

### Bearings lubrication

Optimal bearings lubrication is ensured by a gearotor oil pump at all compressor speeds.
Dimensions

VZH088-G/H single version

VZH088-G/H manifoldered version

<table>
<thead>
<tr>
<th>Version</th>
<th>Compressor model</th>
<th>D</th>
<th>H1</th>
<th>H2</th>
<th>H3</th>
<th>H4</th>
<th>H5</th>
<th>L1</th>
<th>L2</th>
<th>L3</th>
<th>L4</th>
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<tr>
<td>Single</td>
<td>VZH088-G/H</td>
<td>220</td>
<td>8.69</td>
<td>234</td>
<td>9.23</td>
<td>451</td>
<td>17.76</td>
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<td>234</td>
<td>9.23</td>
<td>451</td>
<td>17.76</td>
<td>484</td>
<td>19.08</td>
<td>74.8</td>
<td>2.94</td>
<td>230</td>
</tr>
</tbody>
</table>
Dimensions

VZH088-G/H unified version

<table>
<thead>
<tr>
<th>Version</th>
<th>Compressor model</th>
<th>D (mm)</th>
<th>H1 (mm)</th>
<th>H2 (mm)</th>
<th>H3 (mm)</th>
<th>H4 (mm)</th>
<th>H5 (mm)</th>
<th>L1 (mm)</th>
<th>L2 (mm)</th>
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<td>19.08</td>
<td>74.8</td>
<td>2.94</td>
<td>93.8</td>
</tr>
</tbody>
</table>

Electrical box

Grommet

- Ø 33 mm (1.30 inch) hole
- Power supply
- Lock washer
- Flat washer
- Steel mounting sleeve
- Rubber grommet
- Nut
- 15 mm (0.59 inch) hole
Dimensions

VZH088-J single version

VZH088-J manifolded version

<table>
<thead>
<tr>
<th>Version</th>
<th>Compressor model</th>
<th>D</th>
<th>H1</th>
<th>H2</th>
<th>H3</th>
<th>H4</th>
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<th>L3</th>
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<td>19.08</td>
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<td>2.94</td>
<td>93.8</td>
</tr>
</tbody>
</table>

Electrical box:
- Ø 40.5 mm (1.59 inch) hole
- Ø 16.5 mm (0.65 inch) knockout

Grommet:
- HM 8 bolt
- Lock washer
- Flat washer
- Steel mounting sleeve
- Rubber grommet
- Nut

15 mm (0.59 inch) hole

Power supply

H1 = 8.69 inch
H2 = 9.23 inch
H3 = 17.76 inch
H4 = 19.08 inch
H5 = 9.05 inch
L1 = 9.05 inch
L2 = 7.5 inch
L3 = 7.81 inch
L4 = 8.69 inch

Version Compressor model
Single VZH088-J
Manifolding VZH088-J
### Dimensions

**VZH088-J unified version**

![Diagram of VZH088-J unified version](image)

| Version  | Compressor model | D   | H1  | H2  | H3  | H4  | H5  | L1  | L2  | L3  | L4  |
|----------|------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Unified  | VZH088-J         | 220.8 | 8.69 | 234.6 | 9.23 | 451.2 | 17.76 | 484.8 | 19.08 | 74.8 | 2.94 | 93.8 | 3.69 | 230 | 9.05 | 230 | 9.05 | 190.5 | 7.5 | 200.4 | 7.81 | 8560098 |

- **Electrical box**
  - Ø 48.5 mm (1.90 inch) hole
  - Ø 16.5 mm (0.65 inch) knockout

- **Grommet**
  - HM 8 bolt
  - Lock washer
  - Flat washer
  - Steel mounting sleeve
  - Rubber grommet
  - Nut
  - 15 mm (0.59 inch)
### Dimensions

**VZH117-G/H single version**

- **Compressor model**: VZH117-G/H
- **Diameter**: 220.8 mm (8.69 inch)
- **Height**: 276.9 mm (10.92 inch)
- **Mounting height**: 507.9 mm (20.02 inch)
- **Base height**: 541.6 mm (21.34 inch)
- **Power supply**: Ø 33 mm (1.30 inch) hole
- **Electrical box**: ØD 15 mm (0.59 inch)

**VZH117-G/H manifoded version**

- **Compressor model**: VZH117-G/H
- **Diameter**: 220.8 mm (8.69 inch)
- **Height**: 276.9 mm (10.92 inch)
- **Mounting height**: 507.9 mm (20.02 inch)
- **Base height**: 541.6 mm (21.34 inch)
- **Power supply**: Ø 33 mm (1.30 inch) hole
- **Grommet**: HM 8 bolt, Lock washer, Flat washer, Steel mounting sleeve, Rubber grommet, Nut

<table>
<thead>
<tr>
<th>Version</th>
<th>Compressor model</th>
<th>D</th>
<th>H1</th>
<th>H2</th>
<th>H3</th>
<th>H4</th>
<th>H5</th>
<th>L1</th>
<th>L2</th>
<th>L3</th>
<th>L4</th>
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<tr>
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<td>220.8</td>
<td>8.69</td>
<td>276.9</td>
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<td>9.05</td>
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<td>9.05</td>
<td>190.5</td>
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</table>
**Dimensions**

**VZH117-G/H unified version**

![Diagram of VZH117-G/H unified version]

**Electrical box**
- Ø 33 mm (1.30 inch) hole
- Power supply

**Grommet**
- HM 6 bolt
- Lock washer
- Flat washer
- Steel mounting sleeve
- Rubber grommet
- Nut
- 15 mm (0.59 inch)

---

**Table: Dimensions**

<table>
<thead>
<tr>
<th>Version</th>
<th>Compressor model</th>
<th>D</th>
<th>H1</th>
<th>H2</th>
<th>H3</th>
<th>H4</th>
<th>H5</th>
<th>L1</th>
<th>L2</th>
<th>L3</th>
<th>L4</th>
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<tr>
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<td>3.96</td>
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</table>
Dimensions

VZH117-J single version

VZH117-J manifoldered version

<table>
<thead>
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<th>Version</th>
<th>Compressor model</th>
<th>D</th>
<th>H1</th>
<th>H2</th>
<th>H3</th>
<th>H4</th>
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<th>L2</th>
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</table>
### Dimensions

**VZH117-J unified version**

**General Information**

- **Model**: VZH117-J
- **Compressor**: Unified
- **Version**: VZH117-J

**Table of Dimensions**

<table>
<thead>
<tr>
<th>Version</th>
<th>Compressor model</th>
<th>D</th>
<th>H1</th>
<th>H2</th>
<th>H3</th>
<th>H4</th>
<th>H5</th>
<th>L1</th>
<th>L2</th>
<th>L3</th>
<th>L4</th>
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<tr>
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<td>2.86</td>
<td>100 230 9.05 3.96 230 9.05 190.5 7.5 200.4 7.87 8S60100</td>
</tr>
</tbody>
</table>

**Electrical Box**

- Ø 40.5 mm (1.59 inch) hole
- Ø 16.5 mm (0.65 inch) knockout
- Power supply

**Grommet**

- HM 8 bolt
- Lock washer
- Flat washer
- Steel mounting sleeve
- Rubber grommet
- Nut

- 1.5 mm (0.06 inch) hole
Dimensions

VZH170-G/H single version

<table>
<thead>
<tr>
<th>Version</th>
<th>Compressor model</th>
<th>D (mm)</th>
<th>H1 (mm)</th>
<th>H2 (mm)</th>
<th>H3 (mm)</th>
<th>H4 (mm)</th>
<th>H5 (mm)</th>
<th>L1 (mm)</th>
<th>L2 (mm)</th>
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<th>L4 (mm)</th>
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<td>10.12</td>
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<td>12.97</td>
<td>644.5</td>
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<td>27.04</td>
<td>4.10</td>
<td>104.1</td>
<td>4.10</td>
<td>28 mm (1.10 inch)</td>
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<tr>
<td>Manifolding</td>
<td>VZH170-G/H</td>
<td>257</td>
<td>10.12</td>
<td>329</td>
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<td>3.3</td>
<td>104.1</td>
<td>11</td>
</tr>
</tbody>
</table>

VZH170-G/H manifoded version

Electrical box

- Cover holding screw (x2) - Torque: 2.2 Nm
- Terminal box
- Ø 40.5 mm (1.59 inch) hole
- Ø 50.5 mm (1.99 inch) knockout
- Faston 1/4" tabs
- Power supply

Grommet

- HM 8 bolt
- Lock washer
- Flat washer
- Steel mounting sleeve
- Rubber grommet
- Nut
- Compressor base plate
- 28 mm (1.10 inch)
VZH170-G/H unified version

Dimensions

<table>
<thead>
<tr>
<th>Version</th>
<th>Compressor model</th>
<th>D</th>
<th>H1</th>
<th>H2</th>
<th>H3</th>
<th>H4</th>
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</tbody>
</table>

Electrical box

- Terminal box
- Sump heater
- Powered 1/4" tabs
- Compressor base plate

Grommet

- HM 8 bolt
- Lock washer
- Flat washer
- Steel mounting sleeve
- Rubber grommet
- Nut
- 28 mm (1.10 inch)
### Dimensions

**VZH170-J single version**

- ØD:
- H1:
- H2:
- H3:
- H4:
- H5:
- L1:
- L2:
- L3:
- L4:

**VZH170-J manifolded version**

- ØD:
- H1:
- H2:
- H3:
- H4:
- H5:
- L1:
- L2:
- L3:
- L4:

#### Electrical box

- Ø 22.5 mm (0.89 inch) knockout
- Ø 50.5 mm (1.99 inch) hole
- Ø 63.5 mm (2.50 inch) knockout

#### Grommet

- 28 mm (1.10 inch)

<table>
<thead>
<tr>
<th>Version</th>
<th>Compressor model</th>
<th>D</th>
<th>H1</th>
<th>H2</th>
<th>H3</th>
<th>H4</th>
<th>H5</th>
<th>L1</th>
<th>L2</th>
<th>L3</th>
<th>L4</th>
<th>Outline drawing number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single</td>
<td>VZH170-J</td>
<td>257</td>
<td>10.12</td>
<td>329</td>
<td>12.97</td>
<td>644.5</td>
<td>25.39</td>
<td>686.5</td>
<td>27.04</td>
<td>104.1</td>
<td>4.10</td>
<td>104.1</td>
</tr>
<tr>
<td>Manifolding</td>
<td>VZH170-J</td>
<td>257</td>
<td>10.12</td>
<td>329</td>
<td>12.97</td>
<td>644.5</td>
<td>25.39</td>
<td>686.5</td>
<td>27.04</td>
<td>104.1</td>
<td>3.3</td>
<td>104.1</td>
</tr>
</tbody>
</table>
Dimensions

VZH170-J unified version

<table>
<thead>
<tr>
<th>Version</th>
<th>Compressor model</th>
<th>D</th>
<th>H1</th>
<th>H2</th>
<th>H3</th>
<th>H4</th>
<th>H5</th>
<th>L1</th>
<th>L2</th>
<th>L3</th>
<th>L4</th>
<th>Outline drawing number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unified</td>
<td>VZH170-J</td>
<td>257</td>
<td>10.12</td>
<td>329</td>
<td>12.97</td>
<td>644.5</td>
<td>25.39</td>
<td>686.5</td>
<td>27.0</td>
<td>4</td>
<td>83.6</td>
<td>3.3</td>
</tr>
</tbody>
</table>

Electrical box

Grommet

- Ø 22.5 mm (0.89 inch) knockout
- Ø 50.5 mm (1.99 inch) hole
- Ø 63.5 mm (2.50 inch) knockout

- Sump heater
- Steel mounting sleeve
- Rubber grommet
- Nut
- HM 8 bolt
- Lock washer
- Flat washer
- Compressor base plate

28 mm (1.10 inch)
Dimensions

Connection Details

<table>
<thead>
<tr>
<th>Compressor models</th>
<th>Brazed connection size</th>
<th>Rotolock adaptor set (①adaptor, ②gasket, ③sleeve, ④nut)</th>
<th>Rotolock adaptor (①adaptor only)</th>
</tr>
</thead>
<tbody>
<tr>
<td>VZH088</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Suction</td>
<td>1&quot;1/8</td>
<td>1&quot;3/4</td>
<td>12020125</td>
</tr>
<tr>
<td>Discharge</td>
<td>7/8&quot;</td>
<td>1&quot;1/4</td>
<td>12020364</td>
</tr>
<tr>
<td>VZH117</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Suction</td>
<td>1&quot;3/8</td>
<td>1&quot;3/4</td>
<td>12020405</td>
</tr>
<tr>
<td>Discharge</td>
<td>7/8&quot;</td>
<td>7/8&quot;</td>
<td>12020367</td>
</tr>
<tr>
<td>VZH170</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Suction</td>
<td>1&quot;5/8</td>
<td>2&quot;1/4</td>
<td>12020432</td>
</tr>
<tr>
<td>Discharge</td>
<td>1&quot;1/8</td>
<td>1&quot;3/4</td>
<td>12020364</td>
</tr>
</tbody>
</table>

VZH compressors are all delivered with suction and discharge brazed connections only. They are copper-plated steel connections.

Rotolock adaptors are available, refer to the information above.
### CDS303 Frequency converter

Frequency converter dimensions depend on supply voltage, IP rating and power. The table below gives an overview of the overall dimensions and different drive enclosures (B1 - B4). Details for each drive enclosure are on the following pages.

<table>
<thead>
<tr>
<th>Drive supply voltage</th>
<th>Drive power [kW]</th>
<th>Compressor voltage code</th>
<th>Compressor model</th>
<th>Drive enclosure</th>
<th>Overall drive size (H x W x L) [mm (inch)]</th>
<th>Clearance above/below [mm (inch)]</th>
<th>bracket supplied</th>
<th>Drive enclosure</th>
<th>Overall drive size (H x W x L) [mm (inch)]</th>
<th>Clearance above/below [mm (inch)]</th>
<th>bracket supplied</th>
</tr>
</thead>
<tbody>
<tr>
<td>T2: 200-240/3/50-60</td>
<td>15</td>
<td>J</td>
<td>VZH088 B4</td>
<td>595x230x242 (23.43x9.09x9.53)</td>
<td>200 (8)</td>
<td>2pcs, ø24-28k28b 1pcs, ø32-36k36b</td>
<td>C1 680x308x310 (26.78x12.13x12.20)</td>
<td>200 (8)</td>
<td>1pcs, ø32-36k36b 1pcs, ø36-40k40b</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>22</td>
<td></td>
<td>VZH117 C3</td>
<td>630x308x333 (24.8x12.13x13.15)</td>
<td>200 (8)</td>
<td>1pcs, ø32-36k36b 1pcs, ø36-40k40b</td>
<td>C1 680x308x310 (26.78x12.13x12.20)</td>
<td>200 (8)</td>
<td>1pcs, ø32-36k36b 1pcs, ø36-40k40b</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T3: 380-480/3/50-60</td>
<td>15</td>
<td>G</td>
<td>VZH088 B3</td>
<td>420x165x249 (16.5x6.5x9.76)</td>
<td>200 (8)</td>
<td>3pcs, Ø13-22</td>
<td>B1 480x242x260 (18.9x9.5x10.24)</td>
<td>200 (8)</td>
<td>3pcs, ø3-32</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>22</td>
<td></td>
<td>VZH117 B4</td>
<td>595x230x242 (23.42x9.09x9.53)</td>
<td>200 (8)</td>
<td>2pcs, ø24-28k28b</td>
<td>B2 650x242x260 (25.6x9.5x10.24)</td>
<td>200 (8)</td>
<td>3pcs, ø3-32</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T4: 525-600/3/50-60</td>
<td>18</td>
<td>H</td>
<td>VZH088 B4</td>
<td>595x230x242 (23.42x9.09x9.53)</td>
<td>200 (8)</td>
<td>2pcs, ø24-28k28b</td>
<td>- - - -</td>
<td>- - - -</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>30</td>
<td></td>
<td>VZH117 B4</td>
<td>595x230x242 (23.42x9.09x9.53)</td>
<td>200 (8)</td>
<td>2pcs, ø24-28k28b</td>
<td>- - - -</td>
<td>- - - -</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

For customers who needs other size brackets, please refer to accessories for ordering.

For dimensions, refer to the table above. The table includes overall drive size, clearance above/below, and bracket supplied for each drive enclosure.

### Dimensions

**Dimensions**

**CDS303 Frequency converter**

Frequency converter dimensions depend on supply voltage, IP rating and power. The table below gives an overview of the overall dimensions and different drive enclosures (B1 - B4). Details for each drive enclosure are on the following pages.

<table>
<thead>
<tr>
<th>Enclosure</th>
<th>Height [mm (inch)]</th>
<th>Width [mm (inch)]</th>
<th>Depth [mm (inch)]</th>
<th>Mounting hole</th>
<th>Max. Weight [kg</th>
<th>lb]</th>
</tr>
</thead>
<tbody>
<tr>
<td>B1</td>
<td>IP55</td>
<td>480 18.00</td>
<td>-</td>
<td>454 17.87</td>
<td>242 9.53</td>
<td>210 8.27</td>
</tr>
<tr>
<td>B2</td>
<td>IP55</td>
<td>650 25.59</td>
<td>-</td>
<td>624 24.57</td>
<td>242 9.53</td>
<td>210 8.27</td>
</tr>
<tr>
<td>B3</td>
<td>IP20</td>
<td>399 15.71</td>
<td>420 16.54</td>
<td>380 14.96</td>
<td>165 6.5</td>
<td>140 5.51</td>
</tr>
<tr>
<td>B4</td>
<td>IP20</td>
<td>520 20.47</td>
<td>595 23.43</td>
<td>495 19.49</td>
<td>230 9.06</td>
<td>200 7.87</td>
</tr>
<tr>
<td>C1</td>
<td>IP55</td>
<td>680 26.77</td>
<td>-</td>
<td>648 25.51</td>
<td>308 12.13</td>
<td>272 10.71</td>
</tr>
<tr>
<td>C3</td>
<td>IP20</td>
<td>550 21.65</td>
<td>630 24.80</td>
<td>521 20.51</td>
<td>308 12.13</td>
<td>270 10.63</td>
</tr>
</tbody>
</table>

A' including decoupling plate.

The dimensions are only for the physical units, but when installing in an application it is necessary to add space for free air passage both above and below the units. The amount of space for free air passage is listed in “frequency converter dimensions - Clearance above/below (mm/inch).”
Electrical data, connections and wiring

Supply voltage

Because VZH compressors are powered by a frequency converter, the mains frequency, 50 or 60 Hz, is no longer an issue. Only the mains voltage is to be taken into account. With 3 motor voltage codes, the most common mains voltages and frequencies are covered. Never connect the VZH compressor directly to the mains power supply in case of motor burnt.

VZH all published data and polynomials are based on 208V frequency converter power supply for code J and 400V for code G. When having a supply of 230V, 380V or 460V the following coefficients must be applied:

\[ I_{460} = 0.87 \times I_{400} \]
\[ I_{380} = 1.05 \times I_{400} \]
\[ I_{230} = 0.90 \times I_{208} \]

There is no modification for cooling capacity and power input. Since data published for code H is based on 575V frequency converter supply, thus there will be no coefficients modification applied for H code.

<table>
<thead>
<tr>
<th>Voltage code</th>
<th>Mains voltage range of drive</th>
</tr>
</thead>
<tbody>
<tr>
<td>J</td>
<td>200-240V / 3ph / 50Hz &amp; 60Hz (±10%)</td>
</tr>
<tr>
<td>G</td>
<td>380-480V / 3ph / 50Hz &amp; 60Hz (±10%)</td>
</tr>
<tr>
<td>H</td>
<td>525-600V /3ph / 50Hz &amp; 60Hz (±10%)</td>
</tr>
</tbody>
</table>

Compressor electrical specifications

<table>
<thead>
<tr>
<th>Compressor</th>
<th>RW (Ohm)</th>
<th>RLA (A)</th>
<th>MMT (A)</th>
</tr>
</thead>
<tbody>
<tr>
<td>VZH088-J</td>
<td>0.03</td>
<td>74.8</td>
<td>93.5</td>
</tr>
<tr>
<td>VZH117-J</td>
<td>0.02</td>
<td>88.0</td>
<td>110.0</td>
</tr>
<tr>
<td>VZH170-J</td>
<td>0.01</td>
<td>115.0</td>
<td>143.8</td>
</tr>
<tr>
<td>VZH088-G</td>
<td>0.10</td>
<td>37.5</td>
<td>46.9</td>
</tr>
<tr>
<td>VZH117-G</td>
<td>0.08</td>
<td>44.0</td>
<td>55.0</td>
</tr>
<tr>
<td>VZH170-G</td>
<td>0.05</td>
<td>61.0</td>
<td>76.3</td>
</tr>
<tr>
<td>VZH088-H</td>
<td>0.10</td>
<td>37.5</td>
<td>46.9</td>
</tr>
<tr>
<td>VZH117-H</td>
<td>0.08</td>
<td>44.0</td>
<td>55.0</td>
</tr>
<tr>
<td>VZH170-H</td>
<td>0.05</td>
<td>61.0</td>
<td>76.3</td>
</tr>
</tbody>
</table>

- **RW**: Winding resistance per winding (in CDS303 parameter list)
- **RLA**: Rated load current
- **MMT**: Maximum must trip current

Note that parameter 1-30 in the frequency converter settings reflects the winding resistance per winding. This is not the same value as measured at the motor terminals.

**RLA (Rated Load Amp)**

Rated Load Amp value is the current value at maximum load, in the operating envelope, and at maximum speed and rated drive input voltage.

**MMT (Maximum Must Trip current)**

The Maximum Must Trip current is defined for compressors not equipped with their own motor protection. This MMT value is the maximum at which the compressor can be operated in transient conditions and out of the operating envelope. The tripping current of external overcurrent protection, in this case preprogrammed in the drive, never exceeds the MMT value.

For VZH compressors, according to UL requirements, MMT value is 125% of RLA. This value is printed on the compressor nameplate.

**Wiring connections**

Electrical power is connected to the compressor terminals by Ø 4.8 mm (3/16") screws. The maximum thinning torque is 3 Nm. Use a 1/4" ring terminal on the power leads.

⚠️ Cable gland or similar protection component must be used on electrical box's knockouts to against accidental contact with electrical parts inside.
**Electrical data, connections and wiring**

**VZH088/117-G/H**
The terminal box is provided with a φ 33mm (φ1.3 inch) hole (ISO32) for power supply.

**VZH088/117-J**
The terminal box is provided with a φ 40.5mm (φ1.59 inch) hole (ISO40) for power supply and a φ 16.5mm (φ0.65 inch) knockout (ISO16).

**VZH170-G/H**
φ 40.5mm (φ 1.59inch) (ISO 40) hole with possible φ 50.5mm (φ 1.98inch)(ISO50) knockout for power supply

**VZH170-J**
φ 50.5mm (φ 1.98inch) (ISO 50 & UL1"1/2 conduit) hole with possible φ 63.5mm (φ 2.5inch) (ISO63 and UL 2"conduit) knockout for power supply.
• 2 x φ 22.5mm (φ 0.89inch) (PG16 and UL ." conduit) knockouts.
**Electrical data, connections and wiring**

### Fuses / circuit breakers

Danfoss recommends using the fuses/circuit breakers listed below to protect service personnel and property in case of component break-down in the frequency converter. For circuit breakers, Moeller types have been tested and are recommended.

<table>
<thead>
<tr>
<th>Frequency converter</th>
<th>ENS0178 compliant fuses</th>
<th>UL Compliant fuses</th>
<th>Recommended circuit breaker</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Bussmann</td>
<td>SIBA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Type RK1</td>
<td>Type J</td>
</tr>
<tr>
<td>CDS-15 kW</td>
<td>125 A</td>
<td>gG</td>
<td>KTN-R125</td>
</tr>
<tr>
<td>CDS-18.5 kW</td>
<td>125 A</td>
<td>gG</td>
<td>KTN-R125</td>
</tr>
<tr>
<td>CDS-22 kW</td>
<td>160 A</td>
<td>gG</td>
<td>FWX-150</td>
</tr>
<tr>
<td>CDS-15 kW</td>
<td>63 A</td>
<td>gG</td>
<td>KTS-R50</td>
</tr>
<tr>
<td>CDS-18.5 kW</td>
<td>63 A</td>
<td>gG</td>
<td>KTS-R60</td>
</tr>
<tr>
<td>CDS-22 kW</td>
<td>80 A</td>
<td>gG</td>
<td>KTS-R80</td>
</tr>
<tr>
<td>CDS-18.5 kW</td>
<td>40A</td>
<td>gG</td>
<td>KTS-R50</td>
</tr>
<tr>
<td>CDS-30 kW</td>
<td>63A</td>
<td>gG</td>
<td>KTS-R80</td>
</tr>
</tbody>
</table>

### Wire sizes

Below table lists maximum wiring sizes for the motor compressor power supply cables.

<table>
<thead>
<tr>
<th>From network to frequency converter</th>
<th>From frequency converter to compressor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td>mm²</td>
</tr>
<tr>
<td>200 - 240 V</td>
<td></td>
</tr>
<tr>
<td>CDS-18.5 kW</td>
<td>35</td>
</tr>
<tr>
<td>CDS-22 kW</td>
<td>50</td>
</tr>
<tr>
<td>380 - 400 V</td>
<td></td>
</tr>
<tr>
<td>CDS-18.5 Kw</td>
<td>10</td>
</tr>
<tr>
<td>CDS-22 kW</td>
<td>16</td>
</tr>
<tr>
<td>525 - 600 V</td>
<td></td>
</tr>
<tr>
<td>CDS-30kW (IP20)</td>
<td>25</td>
</tr>
<tr>
<td>CDS-30kW (IP20)</td>
<td>25</td>
</tr>
</tbody>
</table>

Note: The wire size here is the guidelines is the maximum wire size connectors can accept but not the actual needed cable. The needed cable size should be specified by the OEM depending on the unit design, ambient temperature, the wire material, current, etc.
**Soft-start control**
The CDS303 frequency converter generates by design a compressor soft start with a default initial ramp up of 2700rpm/s. Current inrush will not exceed the frequency converter maximum current.

**Phase sequence and reverse rotation protection**
The compressor will only operate properly in a single direction. If electrical connections are done correctly between the drive and the compressor terminals (compressor T1/T2/T3 and drive terminals U, V & W matching), the drive will provide correct phase supply to the compressor, and reverse rotation will be not possible:

- CDS terminal U (96) to VZH terminal T1
- CDS terminal V (97) to VZH terminal T2
- CDS terminal W (98) to VZH terminal T3

If compressor T1/T2/T3 and drive U, V & W terminals are not matching, the compressor can operate in a reverse rotation. This results in excessive noise, no pressure differential between suction and discharge, and suction line warming rather than immediate cooling. The compressor can be rapidly damaged in these conditions. If reverse rotation symptoms occur, shut the compressor down and connect the phases to their proper terminals.

Mains connection to the CDS frequency converter order has no influence on the output phase sequence which is managed by the frequency converter.
Electrical data, connections and wiring

**IP rating**
The compressor terminal box IP rating according to CEI529 is IP54 when correctly sized IP54 rated cable glands are used.

<table>
<thead>
<tr>
<th>Element</th>
<th>Numerals or letters</th>
<th>Meaning for the protection of equipment</th>
</tr>
</thead>
<tbody>
<tr>
<td>First characteristic numeral</td>
<td>0, 1, 2, 3, 4, 5, 6</td>
<td>Against ingress of solid foreign objects&lt;br&gt;(non protected)&lt;br&gt;≥ 50 mm diameter&lt;br&gt;≥ 12.6 mm diameter&lt;br&gt;≥ 2.5 mm diameter&lt;br&gt;≥ 1.0 mm diameter&lt;br&gt;dust protected&lt;br&gt;dust tight</td>
</tr>
<tr>
<td>Second characteristic numeral</td>
<td>0, 1, 2, 3, 4, 5, 6, 7, 8</td>
<td>Against ingress of water with harmful effects&lt;br&gt;(non protected&lt;br&gt;vertically dripping&lt;br&gt;dripping (15° tilted)&lt;br&gt;spaying&lt;br&gt;splashing&lt;br&gt;jetting&lt;br&gt;powerful jetting&lt;br&gt;temporary immersion&lt;br&gt;continuous immersion</td>
</tr>
</tbody>
</table>

**Motor protection**
VZH scroll compressors are not equipped with an internal motor protector. Motor protection is provided by the variable speed drive. All parameters are factory preset in order to guaranty locked rotor or overload current protection.

When a warning situation is reached in the current control, the CDS frequency converter will automatically reduce the compressor speed in order to keep the motor current of the compressor below the maximum allowed.

**Voltage imbalance**
The maximum allowable voltage imbalance between each phase is 3%. Voltage imbalance causes high amperage over one or several phases, which in turn leads to overheating and possible drive damage.
### Approval and certificates

VZH compressors comply with the following approvals and certificates:

<table>
<thead>
<tr>
<th>Approvals and certificates</th>
<th>VZH code G &amp; code J</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CE</strong> (European Directive)</td>
<td></td>
</tr>
<tr>
<td><strong>UL</strong> (Underwriters Laboratories)</td>
<td>All VZH models</td>
</tr>
<tr>
<td><strong>EMC</strong> 2014/30/EU</td>
<td>All VZH models</td>
</tr>
</tbody>
</table>

### Pressure equipment directive 2014/68/EU

<table>
<thead>
<tr>
<th>Products</th>
<th>VZH088</th>
<th>VZH117</th>
<th>VZH170</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fluids</td>
<td>Group 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Category PED</td>
<td>II</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Evaluation module</td>
<td>D1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TS - service temperature LP</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
-35°C < TS < +55°C 
-31°F < TS < 131°F  |  
-35°C < TS < +51°C 
-31°F < TS < 123.8°F  |
| PS - service pressure LP |  
33.3 bar(g) 483 psi(g) |  
33.3 bar(g) 483 psi(g) |  
30.2 bar(g) 438 psi(g) |

### Low voltage directive 2014/35/EU

<table>
<thead>
<tr>
<th>Declaration of conformity ref. Low voltage Directive 2014/35/EU</th>
<th>VZH088-117-170</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contact Danfoss</td>
<td></td>
</tr>
</tbody>
</table>

### Internal free volume

<table>
<thead>
<tr>
<th>Products</th>
<th>Internal free volume at LP side without oil</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>litre</td>
</tr>
<tr>
<td>VZH088</td>
<td>12.7</td>
</tr>
<tr>
<td>VZH117</td>
<td>15.1</td>
</tr>
<tr>
<td>VZH170</td>
<td>29.9</td>
</tr>
</tbody>
</table>
Drive installation

Direct and indirect exposure of drive to water
IP20 drives are intended for indoor or cabinet mounting. Application example: drive fitted in a machine room, basement or in an electrical cabinet together with other electric/electronic components such as the unit controller or contactors.

For outdoor use the electrical cabinet must be IP54 or the drive itself must be IP54 at least. Application example: rooftop units or condensing units.

If IP54 with LCP make sure that the gasket is applied to ensure tightness.

It is recommended to place drive at least 30cm (11.81 inches) from ground to protect against floods.

Condensation
Condensation must always be avoided. There is a specific risk of condensation when the frequency converter or some of its components are colder than moist ambient air. In this situation, the moisture in the air can condense on the electronic components.

- Operating with the frequency converter constantly connected to the mains can help to reduce the risk of condensation. Install a cabinet heater in situations where there is a real possibility of condensation due to ambient conditions.

- If the drive is IP 20, then evaluate and prevent possibility of condensation above drive. Example: condensation on metallic frame above drive, piping...

- Water resulting of condensation must not accumulate on the bottom of electric panel. Provide a drain for condensed water to run out if necessary.

- No other forced cooling then internal drive fan.

Dust Exposure
Avoid Dust forms and deposits on the surface of the drive and inside on circuit boards and the electronic components. These deposits act as insulation layers and hamper heat transfer to the ambient air, reducing the cooling capacity. The components become warmer. This causes accelerated aging of the electronic components, and the service life of the unit decreases. Dust deposits on the heat sink in the back of the unit also decrease the service life of the unit.

The drive cooling fans have small bearings into which dust can penetrate and act as an abrasive. This leads to bearing damage and fan failure.

Under the conditions described above, it is advisable to clean the frequency converter during periodic maintenance. Remove dust off the heat sink and fans and clean the filter mats.

Mechanical Mounting Clearance
For optimal cooling conditions, mount the drive on vertical position. Allow a free air passage above and below the frequency converter. See Table below:

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>a (mm/inch)</td>
<td>100/3.94</td>
<td>200/7.87</td>
<td>225/8.86</td>
</tr>
<tr>
<td>b (mm/inch)</td>
<td>100/3.94</td>
<td>200/7.87</td>
<td>225/8.86</td>
</tr>
</tbody>
</table>

*: Enclosure please refer to drive enclosure table in section “CDS303 Frequency converter”.

Horizontal mounting is NOT the preferred position, however if unavoidable, lay PCB on the left side (270°) to avoid condensation accumulation on the electronics.
Ambient temperature

The maximum ambient temperature for the drive is 50°C (122°F).

Make sure that the clearance limits described above are respected.

The drive must be installed on a wall or on a back plate to ensure proper cooling.

Do not place the drive under direct sunlight. Insulation inside the electrical panel can reduce impact of sun radiation.

Test at the unit at highest ambient maximum load is recommended. Look for over temperature drive alarm.

The drive could operate lower to -10°C (14°F) with proper operation, such as inside the cabinet, install the space heater. However, LCP may not function well under such low temperature.
**EMC**

Frequency converter (and other electrical devices) generate electronic or magnetic fields that may interfere with their environment. The electromagnetic compatibility (EMC) of these effects depends on the power and the harmonic characteristics of the devices.

The EMC product standard for frequency converters defines 4 categories (C1, C2, C3, and C4) with specified requirements for emission and immunity. Table below states the definition of the 4 categories and the equivalent classification from EN 55011.

<table>
<thead>
<tr>
<th>Category</th>
<th>Definition</th>
<th>Equivalent emission class in EN 55011</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1</td>
<td>Frequency converters installed in the first environment (home and office) with a supply voltage less than 1000 V.</td>
<td>Class B</td>
</tr>
<tr>
<td>C2</td>
<td>Frequency converters installed in the first environment (home and office) with a supply voltage less than 1000 V, which are not plug-in and not movable, and must be installed and commissioned by a professional.</td>
<td>Class A Group 1</td>
</tr>
<tr>
<td>C3</td>
<td>Frequency converters installed in the second environment (industrial) with a supply voltage lower than 1000 V.</td>
<td>Class A Group 2</td>
</tr>
<tr>
<td>C4</td>
<td>Frequency converters installed in the second environment with a supply voltage equal to or above 1000 V or rated current equal to or above 400 A or intended for use in complex systems.</td>
<td>No limit line. Make an EMC plan</td>
</tr>
</tbody>
</table>

VZH compressor with drive package achieve EMC Class A Group 1 emission and immunity requirements.

**EMC best practices**

- Use screened (shielded) cables for motor, control wiring and communication.
- Separate cables for input power, motor wiring and control wiring. Failure to isolate power, motor, control and communication cables can result in unintended behavior or reduced performance. Minimum 200 mm (7.9 in) clearance between power, motor and control cables is required.
- Ensure VFD proper grounding
- Motor cables should be as short as possible to reduce noise level and leakage currents.

**EMC correct installation of an frequency drive CDS303**

EMC qualification reports are available upon request to Danfoss technical support.
The frequency converter is pre-set for speed open loop control. This means that the speed set-point is given by a 0-10V, where 0V corresponds to the minimum compressor speed and 10V is maximum compressor speed.

The unit controller must have full control of the compressor operation and application protections such as compressor envelope control, oil return management and short cycling protection.

Below is the Danfoss proposed system configuration and wiring.
Design piping

General requirements

Proper piping practices should be employed to:

1. Ensure adequate oil return, even under minimum load conditions (refrigerant speed, piping slopes…). For validation tests see section “Manage oil in the circuit”.

2. Avoid condensed liquid refrigerant from draining back to the compressor when stopped (discharge piping upper loop). For validation tests see section “Manage off cycle migration”.

General recommendations are described in the figures below:

3. Piping should be designed with adequate three-dimensional flexibility to avoid excess vibration. It should not be in contact with the surrounding structure, unless a proper tubing mount has been installed. For more information on noise and vibration, see section on: “Sound and vibration management”.

4. The design in this guideline is for short circuit application. However, for long circuit and split system application, an oil separator and an external non-return valve are mandatory to use.
Design compressor mounting

**General requirements**
Compressors used in single applications must be mounted with flexible grommets.

**Single requirements**
Maximum inclination from the vertical plane while operating must not exceed 3 degrees.

VZH compressors come delivered with four rubber mounting grommets and metal sleeve liners that serve to isolate the compressor from the base frame. These grommets must always be used to mount the compressor in a single application. The grommets must be compressed until contact between the flat washer and the steel mounting sleeve is established. The grommets attenuate to a great extent the transmission of compressor vibrations to the base frame.

The required bolt size for the VZH088 & 117 compressors is HM8-40. This bolt must be tightened to a torque of 15 Nm (11 ft/lbs.).

The required bolt size for VZH170 compressors is HM8-55 and must be tightened to a torque of 21 Nm (15 ft/lbs.).
Manage oil in the circuit

**Requirement**

⚠️ Oil level must be visible or full in the sight glass when the compressor is running and when all compressors of the circuit are stopped.

**System evaluation**

<table>
<thead>
<tr>
<th>Test N°</th>
<th>Purpose</th>
<th>Test condition</th>
<th>Pass criteria</th>
<th>Solutions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Check proper oil return</td>
<td>Lowest foreseeable evaporation, and highest foreseeable condensation. <strong>Minimum speed running</strong> 6 hours. For reversible system, perform test in both heating and cooling mode.</td>
<td>Oil level must be visible or full in the sight glass when the compressor is running.</td>
<td>1. Top-up with oil, generally 3% of the total system refrigerant charge (in weight). Above 3% look for potential oil trap in the system. 2. Adjust oil boost function, for more details see section &quot;Oil management logic&quot;. 3. Oil separator can be added</td>
</tr>
</tbody>
</table>
Manage sound and vibration

Typical sounds and vibrations in systems can be broken down into the following three categories:

- Sound radiation (through air)
- Mechanical vibrations (through parts and structure)
- Gas pulsation (through refrigerant)

The following sections focus on the causes and methods of mitigation for each of the above sources.

### Compressor sound radiation

For sound radiating from the compressors, the emission path is air and the sound waves are travelling directly from the machine in all directions.

<table>
<thead>
<tr>
<th>Model</th>
<th>Frequency [RPS]</th>
<th>200V Without acoustic hood (dBA)</th>
<th>200V With acoustic hood (dBA)</th>
<th>400V Without acoustic hood (dBA)</th>
<th>400V With acoustic hood (dBA)</th>
<th>575V Without acoustic hood (dBA)</th>
<th>575V With acoustic hood (dBA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>VZH088</td>
<td>30</td>
<td>70</td>
<td>64</td>
<td>69</td>
<td>62</td>
<td>72</td>
<td>66</td>
</tr>
<tr>
<td></td>
<td></td>
<td>120Z0510 (single version)</td>
<td></td>
<td>120Z0509 (single version)</td>
<td></td>
<td>120Z0509 (single version)</td>
<td></td>
</tr>
<tr>
<td>VZH117</td>
<td>30</td>
<td>73</td>
<td>67</td>
<td>71</td>
<td>64</td>
<td>72</td>
<td>66</td>
</tr>
<tr>
<td></td>
<td></td>
<td>120Z0514 (single version)</td>
<td></td>
<td>120Z0513 (single version)</td>
<td></td>
<td>120Z0513 (single version)</td>
<td></td>
</tr>
<tr>
<td>VZH170</td>
<td>30</td>
<td>74</td>
<td>66</td>
<td>72</td>
<td>65</td>
<td>72</td>
<td>67</td>
</tr>
<tr>
<td></td>
<td></td>
<td>120Z0519 (single version)</td>
<td></td>
<td>120Z0517 (single version)</td>
<td></td>
<td>120Z0517 (single version)</td>
<td></td>
</tr>
</tbody>
</table>

Average sound power for reference at ARI A/C conditions measured in free space.

Note: running sound level for 575V VZH is preliminary data

Mitigations methods:

We can consider two means to reduce compressors sound radiations:

1. Acoustic hoods are quick and easy to install and do not increase the overall size of the compressors. Acoustic hoods are available from Danfoss as accessories.

Refer to the table above for sound levels, attenuation and code numbers.

2. Use of sound-insulation materials on the inside of unit panels is also an effective means to reduce radiation.
Manage sound and vibration

Mechanical vibrations
A compressor generates some vibrations that propagate into the surrounding parts and structure. The vibration level of a VZH compressor alone does not exceed 127 µm peak to peak. However, when system structure natural frequencies are close to running frequency, vibrations are amplified due to resonance phenomenon.

A high vibration level is damageable for piping reliability and generates high sound levels.

Mitigations methods:
1. Danfoss VZH scroll compressors are designed to produce minimal vibration during operations. To ensure minimum vibrations transmission to the structure, strictly follow mounting requirements (mounting feet, rails etc.). For further information on mounting requirements, please refer to “Design compressor mounting”.
2. Ensure that there is no direct contact (without insulation) between vibrating components and structure.
3. Resonance phenomenon
   To avoid resonance phenomenon, pipings and frame must have natural frequencies as far as possible from running frequencies.

Gas pulsation
The Danfoss VZH scroll compressor has been designed and tested to ensure that gas pulsation is optimized for the most commonly encountered air conditioning pressure ratio. Manifolded compressors are equivalents to lagged sources of gas pulsation. Therefore, pulse level can vary during time.

Mitigations methods:
If an unacceptable level is identified, a discharge muffler with the appropriate resonant volume and mass can be installed.
Manage speed limit

**Speed limit requirement**

> Speed limit guarantees compressor reliability and must be respected. In drive control logic, default setting values have been qualified by Danfoss. Customer could change the default values in the acceptable range if the changes have been qualified by OEM.

**Start/Stop/Ramp setting**

![Graph showing speed limit settings](image)

<table>
<thead>
<tr>
<th>Drive parameter</th>
<th>Description</th>
<th>Default value (recommended)</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.71 Start delay (s)</td>
<td>Start-up sequence: at start, compressor runs at start speed (1.74) during the Start delay (1.71)</td>
<td>60 sec</td>
<td>10-300s</td>
</tr>
<tr>
<td>1.74 Start speed (RPS)</td>
<td>During this time the speed set-point is ignored</td>
<td>30 rps</td>
<td>1800 rpm</td>
</tr>
<tr>
<td>3.41 Ramp 1 ramp up time (s)</td>
<td>Defines speed ramp up slope.</td>
<td>180 sec</td>
<td>15-3600s</td>
</tr>
<tr>
<td>3.42 Ramp 1 ramp down time (s)</td>
<td>Defines speed ramp down slope. Similar way that ramp-up.</td>
<td>180 sec</td>
<td>15-3600s</td>
</tr>
<tr>
<td>3.82 Starting/Stopping ramp time (s)</td>
<td>Fast acceleration from standstill to minimum speed with a quick ramp. The start / stop command bypasses the normal ramp time and the frequency converter ramps the compressor fast.</td>
<td>2 sec</td>
<td>0-5s</td>
</tr>
</tbody>
</table>
Manage superheat

During normal operation, refrigerant enters the compressor as a superheated vapor. Liquid flood back occurs when a part of the refrigerant entering the compressor is still in liquid state. Liquid flood back can cause oil dilution and, in extreme situations lead to liquid slugging that can damage compression parts.

**Requirement**

- In steady state conditions, the expansion device must ensure a suction superheat within 5K to 30K (9 to 54°F).
- In transient conditions, cumulative time with oil SH below 10K should not exceed 1700h during lifetime and not last more than 60s per event.

**System evaluation**

Use the table in relation with the application to quickly evaluate the potential tests to perform.

<table>
<thead>
<tr>
<th>Application</th>
<th>Tests to perform</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non reversible</td>
<td>Liquid flood back test</td>
</tr>
<tr>
<td>Reversible</td>
<td>Liquid flood back test, Defrost test</td>
</tr>
</tbody>
</table>
**Test, criteria and solutions**

<table>
<thead>
<tr>
<th>Test N°</th>
<th>Purpose</th>
<th>Test condition</th>
<th>Pass criteria</th>
<th>Solutions</th>
</tr>
</thead>
</table>
|         | Liquid flood back test | Suction superheat >5K(9°F) | Steady-state | - Liquid flood back testing must be carried out under expansion valve threshold operating conditions:  
  • Lowest foreseeable evaporation, and highest foreseeable condensation.  
  • Minimum speed running.  
  For reversible system, perform test in both heating and cooling mode. |
|         | Transient | Oil superheat shall not be more than 30 sec below the safe limit (10K/18°F) | Test must be carried out with most unfavorable conditions:  
  • Fan staging,  
  • Compressor staging  
  • … |
|         | Defrost test | Oil superheat shall not be more than 30 sec below the safe limit (10K/18°F) | Check liquid floodback during defrost cycle | - Defrost test must be carried out in the most unfavorable condition (at 0°C (32°F) evaporating temperature).  
  1. Check defrost logic in reversible systems, the defrost logic can be worked out to limit liquid floodback effect. (for more details see "Control Logic").  
  2. Add a suction accumulator*. |

*Suction accumulator offers protection by trapping the liquid refrigerant upstream from the compressor. The accumulator should be sized at least 50% of the total system charge. Suction accumulator dimensions can impact oil return (gas velocity, oil return hole size…), therefore oil return has to be checked according to section "Manage oil in the circuit".

Oil temperature sensor must be placed between oil sight glass and compressor baseplate. Some thermal paste shall be used to improve the conductivity. The sensor must also be correctly thermally insulated from the ambiance.

The Oil superheat is defined as:

(Oil temperature - Evaporating temperature)
Manage off cycle migration

Off -cycle refrigerant migration happens:
• when the compressor is located at the coldest part of the installation, refrigerant vapor condenses in the compressor.
• or directly in liquid-phase by gravity or pressure difference.

When the compressor restarts, the refrigerant diluted in the oil, or stored in evaporator, generates poor lubrication conditions, and may reduce bearings life time. In extreme situations, this leads to liquid slugging that can damage the compressor scroll set.

Requirement
- Compressor can tolerate occasional flooded start, but it should remain exceptional situation and unit design must prevent that this situation happen at each start
- Right after start, liquid refrigerant must not flow massively to compressor
- The charge limit is a threshold beyond some protective measures must be taken to limit risk of liquid slugging and extreme dilution at start.

System evaluation
Use the table below in relation with the system charge and the application to quickly define necessary safeties to implement.

<table>
<thead>
<tr>
<th>Application</th>
<th>BELOW charge limit</th>
<th>ABOVE charge limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>All</td>
<td>Ensure tightness between condenser &amp; evaporator when system is OFF • Thermostatic expansion Valve (TXV), Liquid Line Solenoid Valve LLSV** strongly recommended • Electronic expansion valve (EXV) must close when system stop including in power shut down situation</td>
<td>• Surface Sump Heater * • Electronic expansion valve (EXV) must close when system stop including in power shut down situation</td>
</tr>
<tr>
<td>Non split</td>
<td>No test or additional safeties required</td>
<td>• Surface Sump Heater * • External Non-Return Valve</td>
</tr>
<tr>
<td>Split</td>
<td>Since each installation is unique, refrigerant charge may vary • Surface Sump Heater * • Liquid Line Solenoid Valve**+ pump-down cycle*** • External Non-Return Valve</td>
<td></td>
</tr>
</tbody>
</table>

Charge limit is defined in table below:

<table>
<thead>
<tr>
<th>Models</th>
<th>Refrigerant charge limit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(kg)</td>
</tr>
<tr>
<td>Single</td>
<td></td>
</tr>
<tr>
<td>VZH088</td>
<td>6.0</td>
</tr>
<tr>
<td>VZH117</td>
<td>8.0</td>
</tr>
<tr>
<td>VZH170</td>
<td>13.0</td>
</tr>
</tbody>
</table>
**Surface Sump heater**
The surface sump heater are designed to protect the compressor against off-cycle migration of refrigerant.
For VZH088-117 the surface sump heater is located on the compressor shell.
For better standby energy consumption, Danfoss provides 48W and 80W two optional surface sump heater. The selection of surface sump heater could refer to below principle:

<table>
<thead>
<tr>
<th>Compressor Surrounding Ambient</th>
<th>Surface Sump Heater</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unit has enclosure, no wind</td>
<td>48W SSH</td>
</tr>
<tr>
<td>Unit has no enclosure, with wind</td>
<td>80W SSH</td>
</tr>
<tr>
<td>Unit has no enclosure, wind &gt;5m/s (ft/s)&amp; ambient temperature &lt;5°C</td>
<td>80W SSH + additional SSH/thermal insulation</td>
</tr>
</tbody>
</table>

For VZH170, the 56W surface sump seater is located below the sump, associated with a thermal insulation.

The heater must be turned on whenever all the compressors are off.
Surface sump heater accessories are available from Danfoss (see section “Accessories”).

**Liquid line solenoid valve (LLSV)**
A LLSV is used to isolate the liquid charge on the condenser side, thereby preventing against charge transfer to the compressor during off-cycles. The quantity of refrigerant on the low-pressure side of the system can be further reduced by using a pump-down cycle in association with the LLSV.

***Pump-down cycle***
By decreasing pressure in the sump, pump down:
- Evacuates refrigerant from oil
- Set the sump saturating pressure much lower than ambiance temperature and due to that, avoid refrigerant condensation in the compressor.
- Pump-down must be set higher than 2.3 bar(g) / 33(psig).

For more details on pump-down cycle see section “Control Logic”.
Manage operating envelope

**Requirement**

The operating envelope for VZH scroll compressors is given in the figures below and guarantees reliable operations of the compressor for steady-state operation.

Moreover, the discharge gas temperature must not exceed 135°C (275°F). Steady-state operation envelope is valid for a suction superheat within 5K to 30K (9°F to 54°F) range.

**Single envelope control**

![VZH operating map - 575V/400V/208V](image)

Note: for superheat above 10K, the envelop will narrow down based on 135°C discharge temperature restriction.

---

<table>
<thead>
<tr>
<th>Pressure settings</th>
<th>R410A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Working pressure range high side</td>
<td>High PR 13.5 - 44.5</td>
</tr>
<tr>
<td></td>
<td>Low PR 13.5 - 40</td>
</tr>
<tr>
<td>Working pressure range low side</td>
<td>High PR 195.8 - 645.4</td>
</tr>
<tr>
<td></td>
<td>Low PR 195.8 - 580.1</td>
</tr>
<tr>
<td>Maximum high pressure safety switch setting</td>
<td>2.3 - 11.6</td>
</tr>
<tr>
<td>Minimum low pressure safety switch setting</td>
<td>1.5</td>
</tr>
</tbody>
</table>
| Minimum low pressure pump-down switch setting | 1.5 bar below nominal evaporating pressure with minimum of 2.3 bar(g) | 21 psi below nominal evaporating pressure with minimum of 33 psig

*LP safety switch shall never be bypassed.*
System evaluation

VZH drive can only protect the compressor from over current. To manage operating envelope, an advanced envelope protection principle needs to be used with variable speed compressors. This solution offers much better protection than basic protection, and also offers the possibility to adjust running conditions to avoid tripping (for example reduce compressor speed when reaching high pressure limit).

The advanced protection principle is based on a permanent measurement of suction and discharge pressure. Unit controller is permanently checking that the compressor is running within the defined envelope.

When compressor reach a limit, controller can act on different parameter to avoid unit tripping.

On top of suction and discharge pressure limitations, the discharge $T^\circ$ must remain below 135°C (275°F).

Low pressure switch and high pressure switch remain necessary as an ultimate protection.

<table>
<thead>
<tr>
<th>Test</th>
<th>Purpose</th>
<th>Test conditions</th>
<th>Pass criteria</th>
<th>Solutions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Check reaction of system to oil boost</td>
<td>Stabilized the system in area below minimum speed (2400RPM) until oil boost happen</td>
<td>No safeties happen, Superheat requirement fulfilled</td>
<td>Modify ramp-up, Modify superheat control</td>
</tr>
</tbody>
</table>

* for more details see “Control Logic”
Discharge gas temperature (DGT) protection is required if the high and low pressure switch settings do not protect the compressor against operations beyond its specific application envelope. Please refer to the examples below, which illustrate where DGT protection is required (Ex. 1) and where it is not (Ex. 2).

A discharge gas temperature protection device must be installed on all heat pumps. In reversible air-to-air and air-to-water heat pumps, the discharge temperature must be monitored during development test by the equipment manufacturer.

The compressor must not be allowed to cycle on the discharge gas thermostat. Continuous operations beyond the compressor's operating range will cause serious damage to the compressor.

The discharge gas thermostat accessory kit (code 7750099) includes all components required for installation as shown on the right. DGT installation must respect below requirements:

- The thermostat must be attached to the discharge line within 150 mm (5.91 inch) from the compressor discharge port and must be thermally insulated and tightly fixed on the pipe.

- The DGT should be set to open at a discharge gas temperature of 135°C (275°F) or lower.

Example 1 (R410A, SH = 6K/10.8°F)
LP switch setting:
LP1 = 3.3 bar (g) (-15.5°C/4.1°F)
HP switch setting:
HP1 = 38 bar (g) (62°C/143.6°F)
Risk of operation beyond the application envelope. DGT protection required.

Example 2 (R410A, SH = 6K/10.8°F)
LP switch setting:
LP2 = 4.6 bar (g) (-10.5°C/13.1°F)
HP switch setting:
HP2 = 31 bar (g) (52°C/125.6°F)
No risk of operation beyond the application envelope. No DGT protection required.
MOP (Max operating pressure) control

In steady state, it is essential to prevent the compressor running when evaporating T° is higher than the specified envelope. Operating the compressor higher than maximum evaporating temperature will cause low viscosity of lubricant and lead to high dilution. Eventually the compressor will get damaged.

This protection can be achieved by using MOP function on expansion device. MOP is a feature added to EXV's (also to TXV's) that limit the maximum suction pressure of the unit. The customer would need to set this at the 15°C (59°F) limit we have on our VS operating envelope.

Regardless of EXV or TXV, customer needs to qualify the expansion device. Testing needs to be done at both max and min operating conditions to guarantee the valve closes enough on the min and opens far enough on the max.

Complementary to MOP, the unit controller can increase compressor speed to keep evaporating T° lower than limit.

Condensing pressure control

In steady state, the condensing T° must be maintained at a higher T° than specified in envelope. This can be done by using fan speed controller, or constant pressure valve. Keep condensing pressure at a minimum level is also important to maintain the pressure differential across the thermostatic expansion valve and prevent cut out on the LP protection in cold ambient.

As an alternative the unit controller can increase compressor speed to keep condensing T° lower than limit.

Minimum pressure ratio

In steady state, the pressure ratio must be a higher T° than specified in envelope. 2 type of control can be considered:

- Set the minimum condensing T° at 20°C (68°F) together with MOP set at 15°C (59°F).
- Unit controller monitors permanently Condensing and Evaporating T°, and adjust compressor speed or condensing T° to keep running conditions within envelope.
Control logic

Safety control logic requirements

<table>
<thead>
<tr>
<th>HP switch</th>
<th>LP safety switch</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tripping conditions</td>
<td>Re-start conditions</td>
</tr>
<tr>
<td>Value</td>
<td>Time</td>
</tr>
<tr>
<td>See Pressure settings table from section “Manage operating envelope”</td>
<td>Immediate, no delay. No by-pass</td>
</tr>
<tr>
<td>Maximum 5 auto reset during a period of 12 hours, then manual reset.</td>
<td></td>
</tr>
</tbody>
</table>

High pressure

According to EN378-2, a high-pressure (HP) safety switch is required to shut down the compressor. The high-pressure switch can be set to lower values depending on the application and ambient conditions. The HP switch must either be placed in a lockout circuit or consist of a manual reset device to prevent cycling around the high-pressure limit. If a discharge valve is used, the HP switch must be connected to the service valve gauge port, which must not be isolated. The HP switch must be connected to the CDS303 input 37 or an external contactor placed before and after the drive.

Low pressure

A low-pressure (LP) safety switch must be used. Deep vacuum operations of a scroll compressor can cause internal electrical arcing and scroll instability. VZH compressors exhibit high volumetric efficiency and may draw very low vacuum levels, which could induce such a problem. The minimum low-pressure safety switch (loss-of-charge safety switch) setting is given in the following table. For systems without pump-down, the LP safety switch must either be a manual lockout device or an automatic switch wired into an electrical lockout circuit. The LP switch tolerance must not allow for vacuum operations of the compressor. LP switch settings for pump-down cycles with automatic reset are also listed in the table below. Lock-out circuit or LP switch or series with other safety devices must be connected to CDS303 input 27. OEM need to set port 27 to “coast inverse or external interlock” to get rid of minimum running time restriction.

Electronic expansion valve

With variable capacity systems, an electronic expansion valve (EXV) is the strongly recommended solution to handle refrigerant mass flow variations. Danfoss recommends the use of ETS products. Ramp-up and ramp-down settings, of both EXV and compressor, must be done with great care.

Ramp-up of the EXV must be shorter than the ramp-up of the compressor, to avoid any low pressure operation on suction side of the compressor. The EXV can also be opened, up to a certain degree, before the start up of the compressor.

Ramp-down of the EXV must be longer than the ramp-down of the compressor, also to avoid low pressure operation (except with pump-down). EXV should be closed, and remain closed, when the compressor is off, to avoid any liquid refrigerant entering the compressor.

Reverse rotation protection

Due to drive protection, compressors could work properly even if the power connection between the drive and mains is dis-matched. However, the wires between compressor and drive must be connected accordingly.

To protect compressors from reverse rotation, pressure difference could be checked as a reference value. Use pressure sensors to monitor pressure difference between discharge and suction of the compressor, and for normal operation, discharge pressure should be at least 1 bar higher than suction pressure within 30 s running after compressor starting.

Short cycle protection

Short cycling protection requirements need to be implemented in OEM unit controller. Meantime, the factory default setting needs to be disabled (28-00 short cycle protection change from default setting “enable” to “disable”).

- 3 minutes minimum running time: in order to get oil return back from circuit to compressor sump
- 12 starts maximum per hour: to avoid threaten the life time of motor and other mechanics due to frequent starts, OEM needs to limit the starts cycles within 12 times per hour.
- 10s minimum OFF time: to make sure discharge valve is closed and motor is stopped before next start, OEM needs to set the minimum off time as 10 seconds.
Control logic

Defrost cycle logic
In reversible systems, the defrost logic can be worked out to limit liquid flood back effect by:
1. Running full load during defrost to share liquid refrigerant between all compressors.
2. Transferring liquid refrigerant from one exchanger to the other one thanks to pressures.

The following defrost logic combines both advantages:

<table>
<thead>
<tr>
<th>Compressor</th>
<th>4WV</th>
<th>EXV</th>
</tr>
</thead>
<tbody>
<tr>
<td>ON</td>
<td>Heating</td>
<td>100%</td>
</tr>
</tbody>
</table>

* EXV Opening degree and time have to be set to keep a minimum pressure for 4 way valve moving.

Danfoss recommend above defrost cycle logic, but the control logic is also system specified.

In any case, defrost logics must respect requirements and tests described in "Manage superheat" and "Manage operating envelope".

Pump-down logic recommendations
Pump-down is initiated prior to shutting down the last compressor on the circuit by de-energizing a liquid line solenoid valve or closing electronic expansion valve. When suction pressure reached the cut-out pressure, compressor is stopped, and liquid solenoid valve or electronic expansion valve remains closed.

Two types of pump-down exist:

- One shot pump down (preferred): when last compressor of the circuit stops, suction pressure is decreased 1.5 bar below nominal evaporating pressure. Even if suction pressure increases again, the compressor will not restart.
- Continuous pump-down: traditional pump-down, compressor restarts automatically when suction pressure increases up to 4 cycles maximum. A non-return valve in the discharge line is recommended.
Control logic

Oil boost

An insufficient oil level can be the result of low refrigerant velocity in pipes and heat exchangers. An oil boost sequence consisting of increasing refrigerant velocity for short periods, at regular time intervals can improve oil return.

Oil boost function can be done in 2 ways
1. Using internal CDS drive oil boost function
2. Program oil boost function in unit controller and use optical oil level sensor to trig it.

As oil boost logic needs to increase / decrease speed, make sure expansion device is fast enough to maintain liquid flood back within acceptable limit during those transients (§ Manage superheat).

CDS Drive oil boost function

If the compressor runs below ORM Min Speed Limit, 28.14) for more than low speed running time, 28.11, then function will override the unit controller and accelerate compressor speed to ORM Boost Speed, 28.16 for Boost duration 28.13 (28.13 does not include the ramping up time).

When the boost is finished, the compressor speed goes back to run on reference (speed setpoint) and the time counter is reset and restarting from zero.

On top of that compressor will boost to ORM Boost Speed, 28.16 at a fixed time interval as programmed in parameter 28-12.

Feedback and status message

A feedback signal can be routed back to the unit controller via programable digital output, relay_2 or Modbus when an oil boost is initiated.

The unit controller can take actions to keep the system stabilized during the oil boost period.

A status message “Oil Boost” is also displayed on the drive LCP during boost.

<table>
<thead>
<tr>
<th>Drive parameters</th>
<th>Description</th>
<th>value</th>
<th>Default</th>
</tr>
</thead>
<tbody>
<tr>
<td>05-02</td>
<td>Terminal 29 Mode</td>
<td>Output</td>
<td>Input</td>
</tr>
<tr>
<td>5-31</td>
<td>Terminal 29 Digital Output</td>
<td>Oil boost active</td>
<td>No Operation</td>
</tr>
<tr>
<td>5-40.1</td>
<td>Function Relay</td>
<td>Oil boost active</td>
<td>VLT running</td>
</tr>
<tr>
<td>16-94 (read)</td>
<td>Ext. Status Word</td>
<td>1000000hex (bit 24)</td>
<td></td>
</tr>
</tbody>
</table>

Drive parameters Description Default value Range

*28.10* Oil return management Enables/disables Oil Return Management Enable On / Off

*28.11* Low speed running Threshold for boost decision 30min 1-1440min

*28.12* Fixed boost interval Maximum time between oil return boosts 6h 1-168h

*28.13* Boost duration desired duration of oil boosts 60sec 10-255s

*28.14* ORM Min speed limit Now accessible with latest drive software Please update 50rps 3000rpm 1500-4200rpm

*28.16* ORM boost speed Now accessible with latest drive software Please update 70rps 4200rpm par. 28-14 ~ 6000rpm
1. Oil management logic for single system

The oil management system architecture for single system is described as below. The oil level is permanently monitored by OEM main controller. When oil level is below the minimal, OEM controller enters in oil boost mode to recover a proper oil level in compressor. If oil level cannot be recovered, controller stops the system.
2. Oil management description

2.1 Basic rules

This specification describes the control logic to implement in OEM controller. This control logic must be implemented and thoroughly tested by OEM.

As oil boost logic needs to increase speed, make sure expansion device is fast enough to maintain liquid flood back within acceptable limit during those transients (Manage super heat chapter).

2.2 Oil management models

The oil management control logic must include 2 steps.

Step 1 (oil boost)

If oil level sensor detects low level for more than 5 seconds, oil is trapped in the system. Oil boost is activated (VS speed is increased). It considerably increases refrigerant velocity in the system and recovers oil.

TD1 is the maximum time to complete step 1. If oil is not recovered within TD1 switch to step 2. If oil is recovered within TD1 come back to normal operation.

TD2 is the minimum interval between two step 1. In case of low oil level detection within a time <TD2, switch to step 1.

Step 2 (Protection)

If oil is still lower than limit after completed step 1, or if oil level drop within a time <TD2, controller must enter in protection mode, and stop the system in alarm.

Note: TD time is adjustable.
2.3 Steps description

2.3.1 Oil boost

**Function description**
Return oil trapped in the system to compressor by increasing refrigerant mass-flow in the system.

**Enter condition**
Low oil level in VS compressor detected by oil level sensor.

**Cancel condition**
High oil level in VS compressor detected by oil level sensor.

**Control sequence**
1. At initial state, VS (variable speed compressor) is on.
2. Low oil level detected in compressor. Reset and Start t1.
3. VS compressor speed must increase to Fboost
4. When High oil level detected in VS compressor.
   • VS compressor speed must be decreased to the initial speed
   • Reset and start t2
   • Reset t1

**OR**

$t1 > TD1$, Oil boost duration exceeds Maximum Oil boost duration

2.3.2 Protection

**Function description**
Stop the compressor to prevent short of oil running.

**Enter condition**
Low oil level in VS compressor detected by oil level sensor.

**Cancel condition**
Manual Reset

**Control sequence**
Stop VS compressor
Reset t1
Reset t2

2.4 Parameter and variable table

<table>
<thead>
<tr>
<th>Name</th>
<th>Text</th>
<th>Attribute</th>
<th>Range</th>
<th>Default</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fboost</td>
<td>Boost action frequency</td>
<td>Parameter</td>
<td>25-100</td>
<td>70</td>
<td>rps</td>
</tr>
<tr>
<td>TD1</td>
<td>Maximum oil boost duration</td>
<td>Parameter</td>
<td>10-240</td>
<td>45</td>
<td>Second</td>
</tr>
<tr>
<td>TD2</td>
<td>Interval minimum between two oil boost</td>
<td>Parameter</td>
<td>10-60</td>
<td>20</td>
<td>Minutes</td>
</tr>
<tr>
<td>t1</td>
<td>Oil boost timer</td>
<td>Variable</td>
<td></td>
<td></td>
<td>Second</td>
</tr>
<tr>
<td>t2</td>
<td>Interval minimum between two oil boost</td>
<td>Variable</td>
<td></td>
<td></td>
<td>Minutes</td>
</tr>
</tbody>
</table>
An TEKLAB LC-XN optical-electrical level sensor is fixed on the inverter compressor. The oil level sensor monitors the compressor oil level and sends oil level signal to an external relay (provided by OEM). Regarding this oil level signal, a 5±2 seconds delay is recommended to be used to consider the oil level fluctuation which may trigger false alarms.

- Lack of oil: Circuit between 2 and 3 will be opened internally, there will be no current flowing through load or coil of external relay. For relay, output is open.
- Enough oil: Circuit between 2 and 3 will be closed internally, there will be current flowing through load or coil of external relay. For relay, output is closed

For customers who needs UL certificates, please order 24V AC/DC sensor.
## Reduce moisture in the system

Excessive air and moisture
- can increase condensing pressure and cause excessively high discharge temperatures.
- can create acid giving rise to copper plating.
- can destroy the lubricating properties of the oil.

All these phenomena can reduce service life and cause mechanical and electrical compressor failure.

### Requirements

VZH compressors are delivered with < 100 ppm moisture level.
At the time of commissioning, system moisture content may be up to 100 ppm.

During operation, the filter drier must reduce this to a level between 20 and 50 ppm.

### Solutions

To achieve this requirement, a properly sized and type of drier is required. Important selection criteria's include:
- driers water content capacity,
- system refrigeration capacity,
- system refrigerant charge.

For new installations with VZH compressors with PVE oil, Danfoss recommends using the Danfoss DML (100% molecular sieve) solid core filter drier.
Assembly line procedure

**Compressor storage**
Store the compressor not exposed to rain, corrosive or flammable atmosphere between -35°C to 70°C (-31°F to 158°F) when charged with nitrogen and between -35°C (-31°F) and Ts max value (see section “Pressure equipment directive”) when charged with R410A refrigerant.

**Compressor holding charge**
Each compressor is shipped with a nominal dry nitrogen holding charge between 0.3 and 0.7 bar (4 psi and 10psi) and is sealed with elastomer plugs.

⚠️ Respect the following sequence:
- Remove the nitrogen holding charge via the suction Schrader valve to avoid an oil mist blowout.
- Remove the suction plug first and the discharge plug afterwards to avoid discharge check valve gets stuck in open position.
- An opened compressor must not be exposed to air for more than 20 minutes to avoid moisture is captured by the POE oil.

**Handling**
Each Danfoss VZH scroll compressor is equipped with one lift ring on the top shell.
- Always use one lift ring and discharge tube when lifting the compressor.
- Use lifting equipment rated and certified for the weight of the compressor or compressor assembly.
- A spreader bar rated for the weight of the compressor is highly recommended to ensure a better load distribution.

⚠️ The use of lifting hooks closed with a clasp is recommended.
- Never use the lift rings on the compressor to lift the full unit.

Maintain the compressor in an upright position during all handling manoeuvres (maximum of 15° from vertical).
Assembly line procedure

Piping assembly

Good practices for piping assembly is a pre-requisite to ensure compressor service life (system cleanliness, brazing procedure...)

System cleanliness

<table>
<thead>
<tr>
<th>Circuit contamination possible cause</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brazing and welding oxides</td>
<td>During brazing, flow nitrogen through the system</td>
</tr>
<tr>
<td>Filings and particles from the removal of burrs in pipe-work</td>
<td>Remove any particles and burrs generated by tube cutting and hole drilling</td>
</tr>
<tr>
<td>Moisture and air</td>
<td>Use only clean and dehydrated refrigeration grade copper tubing. Opened compressor must not be exposed to air more than 20 minutes to avoid moisture captured by PVE oil.</td>
</tr>
</tbody>
</table>

Brazing procedure:
- Brazing operations must be performed by qualified personnel.
- Make sure that no electrical wiring is connected to the compressor.
- To prevent compressor shell and electrical box overheating, use a heat shield and/or a heat-absorbent compound.
- Clean up connections with degreasing agent.
- Flow nitrogen through the compressor.
- Use flux in paste or flux coated brazing rod.
- Use brazing rod with a minimum of 5% silver content.
- It is recommended to use double-tipped torch using acetylene to ensure a uniform heating of connection.
- To enhance the resistance to rust, a varnish on the connection is recommended.

⚠️ Before eventual un-brazing of the compressor or any system component, the refrigerant charge must be removed.

System pressure test and leak detection

⚠️ The compressor has been strength tested and leak proof tested (<3g/year) at the factory.

For system tests:
- Always use an inert gas such as Nitrogen or Helium.
- Pressurize the system on HP side first then LP side.
- Do not exceed the following pressures:

<table>
<thead>
<tr>
<th>Maximum compressor test pressures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum compressor test pressure high side (HP)</td>
</tr>
<tr>
<td>HP-LP&lt;37bar (537psi)</td>
</tr>
<tr>
<td>Maximum compressor test pressure low side (LP)</td>
</tr>
<tr>
<td>30.2 bar(g) / (438psig) for VZH170</td>
</tr>
<tr>
<td>LP-HP&lt;5bar (73psig)</td>
</tr>
<tr>
<td>Maximum speed 4.8 bar/second (70psi/s)*</td>
</tr>
</tbody>
</table>

* If an external non return valve is present on the discharge line, maximum pressurizing speed must be respected to ensure pressure equalization between LP and HP side over scroll elements.
Assembly line procedure

Vacuum evacuation and moisture removal

Requirements:
- Never use the compressor to evacuate the system.
- Connect a vacuum pump to both the LP and HP sides.
- Evacuate the system to a pressure of 500 μm Hg (0.67 mbar/0.02 in.Hg) absolute.

Recommendations:
- Energized heaters improve moisture removal.
- Alternate vacuum phases and break vacuum with Nitrogen to improve moisture removal.

For more detailed information see “Vacuum pump-down and dehydration procedure” TI-026-0302.

Refrigerant charging

Initial charge:
- For the initial charge, the compressor must not run.
- Charge refrigerant as close as possible to the nominal system charge.
- This initial charging operation must be done in liquid phase between the condenser outlet and the filter drier.

If needed, a complement of charge can be done:
- In liquid phase while compressor is running by slowly throttling liquid in.
- Never bypass safety low pressure switch.

For more detailed information see “Recommended refrigerant system charging practice” FRCC.EN.050.

Dielectric strength and insulation resistance tests

It is not necessary to perform a Hipot test (dielectric withstand test) on frequency converters. This has already been done during factory final test.

If a Hipot test has to be done anyway, following instructions must be followed in order to not damage the frequency converter:

- Compressor not connected
- L1, L2, L3, U, V, W terminals must be shorten and connected to high voltage terminal of the testing device.
- Ground terminal (chassis) must be connected to low voltage terminal of the testing device.

- 2000VDC(for T2)/2150VDC(for T4)/2250VDC(for T6) for 1 seconds must be applied
- Ramp up time 3 seconds
- Full DC voltage must be established during 2 seconds
- The current leakage during the test must be below 1mA
- Ramp down time to 0V in 25 seconds. When running high voltage tests of the entire installation, frequency converter and compressor electrical motor compressor test can be conducted together. When conducting a high voltage test make sure the system is not under vacuum: this may cause electrical motor compressor failure.

- Do not use a megohm meter nor apply power to the compressor while it is under vacuum as this may cause internal damage.
Commissioning

Preliminary check

⚠ Check electrical power supply:
- Phase order: Reverse rotation is obvious if the compressor do not build up pressure and sound level is abnormal high. VZH compressor will only operate properly in one direction. If electrical connections are done correctly between the drive and the compressor terminals (compressor terminals T1,T2,T3 and drive terminals U, V & W matching), the drive will provide correct phase supply to the compressor, and reverse rotation will be not possible: For more details refer to "Motor protection".
- Voltage and voltage unbalance within tolerance: For more details refer to section “Motor voltage”.

Initial start-up

- Cranckcase heaters must be energized at least 6 hours in advance to remove refrigerant.
- Do not provide any power to the drive unless suction and discharge service valves on compressor are open, if installed.
- Energize the drive. The compressor must start, according to defined ramp-up settings. If the compressor does not start, check wiring conformity.
- Check the frequency converter control panel: If any alarm is displayed check the wiring and in particular the polarity of the control cables. If an alarm is shown, refer to the frequency converter application manual. Verify in particular the combination of compressor, frequency converter and refrigerant.
- Check current draw and voltage levels on the mains. The values for the compressor electrical motor can be directly displayed on the frequency converter control panel.

System monitoring

The system must be monitored after initial startup for a minimum of 60 minutes to ensure proper operating characteristics such as:
- Proper metering device operation and desired superheat readings
- Suction and discharge pressure are within acceptable levels
- Surface sump heaters must be energized at least 6 hours in advance to remove refrigerant.
- Correct oil level in compressor sump indicating proper oil return
- Low foaming in sight glass and compressor sump temperature 10K above saturation temperature to show that there is no refrigerant migration taking place
- Acceptable cycling rate of compressors, including duration of run times.

A short cycling protection is provided in the CDS frequency converter. It is factory preset “enabled” with the following parameters in:
28.01 - interval between 2 starts: 300 seconds
28.02 - minimum run time: 12 seconds.

This minimum run time is set to guaranty long enough running time at start up in order to create enough refrigerant flow velocity in the system to recover the oil to the compressor sump.
- Current draw of compressor within acceptable values (RLA ratings)
- No abnormal vibrations and noise.

Oil level checking and top-up

In installations with good oil return and line runs up to 15m (49.2 feet), no additional oil is required. If installation lines exceed 15m (49.2 feet), additional oil may be needed. 3% of the total system refrigerant charge (in kg/lb) can be used to roughly define the required oil top-up quantity (in liters) but in any case the oil charge has to be adjusted based on the oil level in the compressor sight glass.

When the compressor is running under stabilized conditions, the oil level must be visible in the sight glass.

The presence of foam filling in the sight glass indicates large concentration of refrigerant in the oil and / or presence of liquid returning to the compressor.

The oil level can also be checked a few minutes after the compressor stops, the level must be between 1/4 and 3/4 of sight glass.

When the compressor is off, the level in the sight glass can be influenced by the presence of refrigerant in the oil.

Top-up the oil while the compressor is idle. Use the schrader connector or any other accessible connector on the compressor suction line and a suitable pump. See news bulletin “Lubricants filling in instructions for Danfoss Commercial Compressors” TI 2-025-0402.
Troubleshooting

VZH Compressor not working

- yes
  - Power output from CDS303 drive?
    - CD warning
    - CD switches to Alarm

- no
  - Torque limit
  - Over current
    - Check VZH + CDS303 compatibility
    - Replace relevant part
    - Control Comp Working load/map
      - Replace relevant part
      - Mains Shut off & reset

#12

VZH blocked

- VZH to be replaced
- Check oil level
- Piping check oil return
- Reset & Start

#13

Check alarm #

#12 #13

#14

Earth Fault Output side

- Check motor cable
- Check VZH Motor resistance and isolation
- Correct the fault
- Mains shut-off before checking!
- Reset & start

#16

Short circuit Output side

- Setting Error(s)
- Come back to factory settings
- Contact your Local Danfoss

#30,31,32

Motor phase missing

#38

Internal fault

- Incompatibility Between Software & Additional option
  - Contact your Local Danfoss
Troubleshooting

**Check alarm # (Continue)**

- **#29**
  - Drive over temperature
  - Ambiant temp. Too high or fan damaged
  - Control card
  - Over temp.
  - 24V supply to terminal 37
  - Check external controls
  - Safe stop activated
  - Check 24V On 12/13 terminals
  - Direct wire
  - Clear 24V supply

- **#65**
  - Control card
  - Over temp.
  - Electrical cabinet
  - Poor ventilation
  - Check 24V On 12/13 terminals
  - 24V supply to terminal 37
  - Check external controls
  - Clear 24V supply

- **#68**
  - Control card
  - Over temp.
  - Safe stop activated
  - Check 24V On 12/13 terminals
  - 24V supply to terminal 37
  - Check external controls
  - Safe stop activated

**Check alarm # (Continue)**

- **#7**
  - DC-OV
  - Check main power supply voltage
  - Power normal
  - Internal components damage
  - Contact your Local Danfoss
  - Reset & start

- **#8**
  - DC-UV
  - Check main power supply voltage
  - Too high or too low
  - 14-11 to lower value
  - Reset & start

- **#36**
  - Main Failure
  - Check power supply voltage
  - Set 14-11 to lower value
  - Reset & start
Troubleshooting

**Check alarm # (Continue)**

- **#49**
  - Speed limit (low)
  - Wrong wiring of U/V/W
  - Compressor bearing wear
  - Compressor stopped
    - Automatic restart after 30s
    - 10 restarts before blockage (20 possible)

- **#18**
  - Start failed
  - Minimum speed not reached after 2 sec.
  - Compressor stopped, similar reason as A49
    - Automatic restart after 30s
    - 10 restarts before blockage (20 possible)
Dismantal and disposal

Danfoss recommends that compressors and compressor oil should be recycled by a suitable company at its site.
Packaging

Single pack

Packaging

Compressor single pack

<table>
<thead>
<tr>
<th>Compressor model</th>
<th>Height (mm)</th>
<th>Width (mm)</th>
<th>Depth (mm)</th>
<th>Weight (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>VZH088</td>
<td>718</td>
<td>565</td>
<td>470</td>
<td>70</td>
</tr>
<tr>
<td>VZH117</td>
<td>718</td>
<td>565</td>
<td>470</td>
<td>76</td>
</tr>
<tr>
<td>VZH170</td>
<td>765</td>
<td>515</td>
<td>450</td>
<td>112</td>
</tr>
</tbody>
</table>

Compressor industrial pack

<table>
<thead>
<tr>
<th>Compressor model</th>
<th>Nbr*</th>
<th>Length (mm)</th>
<th>Width (mm)</th>
<th>Height (mm)</th>
<th>Gross Weight (kg)</th>
<th>Static stacking pallets</th>
</tr>
</thead>
<tbody>
<tr>
<td>VZH088</td>
<td>8</td>
<td>1150</td>
<td>950</td>
<td>680</td>
<td>494</td>
<td>2</td>
</tr>
<tr>
<td>VZH117</td>
<td>8</td>
<td>1150</td>
<td>950</td>
<td>750</td>
<td>544</td>
<td>2</td>
</tr>
<tr>
<td>VZH170</td>
<td>4</td>
<td>1150</td>
<td>965</td>
<td>768</td>
<td>647</td>
<td>2</td>
</tr>
</tbody>
</table>

Frequency converter single pack

<table>
<thead>
<tr>
<th>Drive supply voltage</th>
<th>Drive power (kW)</th>
<th>IP20 Height (mm)</th>
<th>IP20 Width (mm)</th>
<th>IP20 Depth (mm)</th>
<th>Weight (kg)</th>
<th>IP55 Height (mm)</th>
<th>IP55 Width (mm)</th>
<th>IP55 Depth (mm)</th>
<th>Weight (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>T2: Code J</td>
<td>15</td>
<td>346</td>
<td>810</td>
<td>320</td>
<td>24</td>
<td>430</td>
<td>805</td>
<td>405</td>
<td>46</td>
</tr>
<tr>
<td></td>
<td>18 - 22</td>
<td>437</td>
<td>805</td>
<td>405</td>
<td>36</td>
<td>437</td>
<td>805</td>
<td>405</td>
<td>46</td>
</tr>
<tr>
<td>T4: Code G</td>
<td>15</td>
<td>349</td>
<td>500</td>
<td>330</td>
<td>13</td>
<td>346</td>
<td>810</td>
<td>320</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td>18 - 22</td>
<td>346</td>
<td>810</td>
<td>320</td>
<td>24</td>
<td>346</td>
<td>810</td>
<td>320</td>
<td>28</td>
</tr>
<tr>
<td>T6: code H</td>
<td>18.5-30</td>
<td>346</td>
<td>810</td>
<td>320</td>
<td>24</td>
<td>-</td>
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</table>
Compressor code numbers

Danfoss scroll compressors VZH can be ordered in either industrial packs or in single packs. Drive can be ordered in single packs. Please use the code numbers from below tables for ordering.

**Single pack**

<table>
<thead>
<tr>
<th>Compressor model</th>
<th>Pressure ratio</th>
<th>Equipment version</th>
<th>Technical Name</th>
<th>X=motor code</th>
</tr>
</thead>
<tbody>
<tr>
<td>VZH088</td>
<td>High</td>
<td>Single</td>
<td>VZH088AXANA</td>
<td>120G0010</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>VZH088XXANA</td>
<td>120G0011</td>
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<tr>
<td></td>
<td>High</td>
<td>Manifold</td>
<td>VZH088XXBNA</td>
<td>120G0022</td>
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<td></td>
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<td>VZH088XXBNA</td>
<td>120G0023</td>
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<tr>
<td></td>
<td>High</td>
<td>Unified</td>
<td>VZH088XXDNA</td>
<td>120G0102</td>
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<td>VZH088XXDNA</td>
<td>120G0105</td>
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<td></td>
<td>Low</td>
<td>Single</td>
<td>G 380-480V/3ph/</td>
<td>120G0002</td>
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<td></td>
<td></td>
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<td>50&amp;60Hz</td>
<td>120G0003</td>
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<td></td>
<td>Low</td>
<td>Single</td>
<td>J 200-240V/3ph/</td>
<td>120G0004</td>
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<td></td>
<td></td>
<td>50&amp;60Hz</td>
<td>120G0005</td>
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<td></td>
<td>Low</td>
<td>Manifold</td>
<td>H 525-600V/3ph/</td>
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**Industrial pack**

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<td>VZH117AXANA</td>
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<td>120G0009</td>
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<td>VZH117XXBNA</td>
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<td>VZH117XXDNA</td>
<td>120G0011</td>
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<td></td>
<td>VZH170AXANB</td>
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<tr>
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<td>VZH170XXBNA</td>
<td>120G0008</td>
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<td>VZH170XXDNA</td>
<td>120G0009</td>
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**Coils**

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<th>Coil model</th>
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<tr>
<td>208V-240V coil + adaptor</td>
<td>120Z0521</td>
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<tr>
<td>24V coil + adaptor</td>
<td>120Z0522</td>
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</tbody>
</table>
**VZH voltage code G - 380-480 Volt**

<table>
<thead>
<tr>
<th>Compressor model</th>
<th>Frequency converter</th>
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<tbody>
<tr>
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<td>Model &amp; power</td>
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<tr>
<td>VZH088-G</td>
<td>CDS303 15.0kW</td>
</tr>
<tr>
<td></td>
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<tr>
<td>VZH117-G</td>
<td>CDS303 18.5kW</td>
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<tr>
<td></td>
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</tr>
<tr>
<td>VZH170-G</td>
<td>CDS303 22.0kW</td>
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LCP: user interface 120Z0326 (accessory)

**VZH voltage code H - 525-600 Volt**

<table>
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<th>Frequency converter</th>
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<tbody>
<tr>
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<td>Model &amp; power</td>
</tr>
<tr>
<td>VZH088-H</td>
<td>CDS303 18.5kW</td>
</tr>
<tr>
<td>VZH117-H</td>
<td>CDS303 30kW</td>
</tr>
<tr>
<td>VZH170-H</td>
<td>CDS303 30kW</td>
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</table>
### VZH voltage code J - 200-240 Volt

<table>
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<th>Compressor model</th>
<th>Frequency converter</th>
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<tbody>
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<td>Model &amp; power</td>
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<tr>
<td>VZH088-J</td>
<td>CDS303 15.0kW</td>
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<td></td>
<td></td>
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<tr>
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<td></td>
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<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>VZH117-J</td>
<td>CDS303 18.5kW</td>
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<tr>
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<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>VZH170-J</td>
<td>CDS303 22.0kW</td>
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<td></td>
<td></td>
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</tr>
</tbody>
</table>

LCP: user interface 120Z0326 (accessory)
### General information
- **Model:** VZH088-J
- **Frequency:** 15.0kW
- **IP Class:** H3
- **Order Code:** 134G3474
- **RFI Class:** No 134F9361
- **Coating Code:** Yes 134X1964

### Ordering information
- **Model:** VZH117-J
- **Frequency:** 18.5kW
- **IP Class:** H3
- **Order Code:** 134G3585
- **RFI Class:** No 134F9363
- **Coating Code:** Yes 134X1965

### Accessories
- **Valves, adapters, connectors & gaskets for use on suction and discharge connections**
- **Solder sleeve adapter sets**
<table>
<thead>
<tr>
<th>Type</th>
<th>Code n°</th>
<th>Description</th>
<th>Application</th>
<th>Packaging</th>
<th>Pack size</th>
</tr>
</thead>
<tbody>
<tr>
<td>120Z0125</td>
<td>Solder sleeve adapter set (1”3/4 Rotolock, 1”1/8 ODF), (1”1/4 Rotolock, 7/8” ODF)</td>
<td>VZH088</td>
<td>Multipack</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>120Z0405</td>
<td>Solder sleeve adapter set (1”3/4 Rotolock, 1”3/8 ODF), (1”1/4 Rotolock, 7/8” ODF)</td>
<td>VZH117</td>
<td>Multipack</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>7765028</td>
<td>Solder sleeve adapter set, (2”1/4 Rotolock, 1”5/8 ODF), (1”3/4 Rotolock, 1”1/8 ODF)</td>
<td>VZH170</td>
<td>Multipack</td>
<td>6</td>
<td></td>
</tr>
</tbody>
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- **Surface sump heaters & thermostats**
<table>
<thead>
<tr>
<th>Type</th>
<th>Code n°</th>
<th>Description</th>
<th>Application</th>
<th>Packaging</th>
<th>Pack size</th>
</tr>
</thead>
<tbody>
<tr>
<td>120Z0388</td>
<td>Surface sump heater, 80 W, 24 V, CE, UL</td>
<td>VZH088-17</td>
<td>Multipack</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>120Z0389</td>
<td>Surface sump heater, 80 W, 230 V, CE, UL</td>
<td>Multipack</td>
<td>8</td>
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<td></td>
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<tr>
<td>120Z0390</td>
<td>Surface sump heater, 80 W, 400 V, CE, UL</td>
<td>Multipack</td>
<td>8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>120Z0391</td>
<td>Surface sump heater, 80 W, 460 V, CE, UL</td>
<td>Multipack</td>
<td>8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>120Z0402</td>
<td>Surface sump heater, 80 W, 575 V, CE, UL</td>
<td>Multipack</td>
<td>8</td>
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<td></td>
</tr>
<tr>
<td>120Z0360</td>
<td>Surface sump heater + bottom insulation, 56 W, 24 V, CE, UL</td>
<td>VZH170</td>
<td>Multipack</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>120Z0376</td>
<td>Surface sump heater + bottom insulation, 56 W, 230 V, CE, UL</td>
<td>Multipack</td>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>120Z0377</td>
<td>Surface sump heater + bottom insulation, 56 W, 400 V, CE, UL</td>
<td>Multipack</td>
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<tr>
<td>120Z0378</td>
<td>Surface sump heater + bottom insulation, 56 W, 460 V, CE, UL</td>
<td>Multipack</td>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>120Z0379</td>
<td>Surface sump heater + bottom insulation, 56 W, 575 V, CE, UL</td>
<td>Multipack</td>
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</tbody>
</table>

- **Discharge thermostats and sensors**
<table>
<thead>
<tr>
<th>Type</th>
<th>Code n°</th>
<th>Description</th>
<th>Application</th>
<th>Packaging</th>
<th>Pack size</th>
</tr>
</thead>
<tbody>
<tr>
<td>120Z0157</td>
<td>Discharge temperature sensor / converter kit</td>
<td>VZH all models</td>
<td>Single pack</td>
<td>1</td>
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</tr>
<tr>
<td>120Z0158</td>
<td>Discharge temperature sensor</td>
<td>VZH all models</td>
<td>Single pack</td>
<td>1</td>
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</tr>
<tr>
<td>120Z0159</td>
<td>Discharge temperature converter</td>
<td>VZH all models</td>
<td>Single pack</td>
<td>1</td>
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<tr>
<td>7750009</td>
<td>Discharge thermostat kit</td>
<td>VZH all models</td>
<td>Multipack</td>
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</table>

- **Lubricant, acoustic hoods and spare parts**
<table>
<thead>
<tr>
<th>Type</th>
<th>Code n°</th>
<th>Description</th>
<th>Application</th>
<th>Packaging</th>
<th>Pack size</th>
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</thead>
<tbody>
<tr>
<td>120Z0509</td>
<td>VZH088-G acoustic hood</td>
<td>VZH088-G/H</td>
<td>Single pack</td>
<td>1</td>
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<tr>
<td>120Z0510</td>
<td>VZH088-J acoustic hood</td>
<td>VZH088-J</td>
<td>Single pack</td>
<td>1</td>
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<tr>
<td>120Z0511</td>
<td>VZH088-G manifolding acoustic hood</td>
<td>VZH088-G/H manifolding</td>
<td>Single pack</td>
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<tr>
<td>120Z0512</td>
<td>VZH088-J manifolding acoustic hood</td>
<td>VZH088-J manifolding</td>
<td>Single pack</td>
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<tr>
<td>120Z0513</td>
<td>VZH117-G acoustic hood</td>
<td>VZH117-G/H</td>
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<tr>
<td>120Z0514</td>
<td>VZH117-J acoustic hood</td>
<td>VZH117-J</td>
<td>Single pack</td>
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<tr>
<td>120Z0515</td>
<td>VZH117-G manifolding acoustic hood</td>
<td>VZH117-G/H manifolding</td>
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<tr>
<td>120Z0516</td>
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<td>VZH117-J manifolding</td>
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<td>120Z0517</td>
<td>VZH170-G acoustic hood</td>
<td>VZH170-G/H</td>
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<td>120Z0519</td>
<td>VZH170-J acoustic hood</td>
<td>VZH170-J</td>
<td>Single pack</td>
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<td>120Z0518</td>
<td>VZH170-G manifolding acoustic hood</td>
<td>VZH170-G/H manifolding</td>
<td>Single pack</td>
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<tr>
<td>120Z0520</td>
<td>VZH170-J manifolding acoustic hood</td>
<td>VZH170-J manifolding</td>
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## Accessories

### Oil sight glass

<table>
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<th>Type</th>
<th>Code n°</th>
<th>Description</th>
<th>Application</th>
<th>Packaging</th>
<th>Pack size</th>
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</thead>
<tbody>
<tr>
<td>120Z0700</td>
<td>Oil sight glass for unified version</td>
<td>VZH088/117 unified version</td>
<td>Single pack</td>
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<td>120Z0701</td>
<td>Oil sight glass for unified version</td>
<td>VZH170 unified version</td>
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### Mounting kits

<table>
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<th>Type</th>
<th>Code n°</th>
<th>Description</th>
<th>Application</th>
<th>Packaging</th>
<th>Pack size</th>
</tr>
</thead>
<tbody>
<tr>
<td>120Z0066</td>
<td>Mounting kit for 1 scroll compressor including 4 grommets, 4 sleeves, 4 bolts, 4 washers</td>
<td>VZH088-117</td>
<td>Single pack</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>8156138</td>
<td>Mounting kit for 1 scroll compressor including 4 grommets, 4 sleeves, 4 bolts, 4 washers</td>
<td>VZH170</td>
<td>Single pack</td>
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</table>

### Terminal boxes, covers & T-block connectors

<table>
<thead>
<tr>
<th>Type</th>
<th>Code n°</th>
<th>Description</th>
<th>Application</th>
<th>Packaging</th>
<th>Pack size</th>
</tr>
</thead>
<tbody>
<tr>
<td>8173230</td>
<td>T block connector 52 x 57 mm</td>
<td>VZH088-G/H, VZH117-G/H</td>
<td>Multipack</td>
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<tr>
<td>8173021</td>
<td>T block connector 60 x 75 mm</td>
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<td>8173331</td>
<td>T block connector 80 x 80 mm</td>
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<td>120Z0146</td>
<td>Electrical box</td>
<td>VZH088-G/H/VZH117-G/H</td>
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<td>120Z0147</td>
<td>Electrical box</td>
<td>VZH170-J</td>
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<td>120Z0538</td>
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<td>VZH170-G/H</td>
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<td>120Z0149</td>
<td>Electrical box cover</td>
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<td>120Z0150</td>
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<td>120Z0537</td>
<td>Electrical box cover</td>
<td>VZH170-G/H</td>
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<td>120Z0151</td>
<td>Electrical box cover</td>
<td>VZH088-117-J</td>
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### Coil

<table>
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<th>Code n°</th>
<th>Description</th>
<th>Application</th>
<th>Packaging</th>
<th>Pack size</th>
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</thead>
<tbody>
<tr>
<td>120Z0521</td>
<td>Coil / 208-240V and adaptor</td>
<td>VZH all models</td>
<td>Single pack</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>120Z0522</td>
<td>Coil / 24V and adaptor</td>
<td>VZH all models</td>
<td>Single pack</td>
<td>1</td>
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<tr>
<td>042N4202</td>
<td>Coil 110-120V</td>
<td>VZH all models</td>
<td>Single pack</td>
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<tr>
<td>042N0156</td>
<td>Adaptor</td>
<td>VZH all models</td>
<td>Single pack</td>
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### Valve Body

<table>
<thead>
<tr>
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<th>Code n°</th>
<th>Description</th>
<th>Application</th>
<th>Packaging</th>
<th>Pack size</th>
</tr>
</thead>
<tbody>
<tr>
<td>120Z0145</td>
<td>Valve body</td>
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<td>VZH all models</td>
<td>Single pack</td>
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</tbody>
</table>

### Lubricant / oils

<table>
<thead>
<tr>
<th>Type</th>
<th>Code n°</th>
<th>Description</th>
<th>Application</th>
<th>Packaging</th>
<th>Pack size</th>
</tr>
</thead>
<tbody>
<tr>
<td>160SZ</td>
<td>7754023</td>
<td>POE lubricant, 160SZ, 1 litre can</td>
<td>VZH with R410A</td>
<td>Multipack</td>
<td>12</td>
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</tbody>
</table>

### Oil level switch

<table>
<thead>
<tr>
<th>Type</th>
<th>Code n°</th>
<th>Description</th>
<th>Application</th>
<th>Packaging</th>
<th>Pack size</th>
</tr>
</thead>
<tbody>
<tr>
<td>120Z0560</td>
<td>Oil level switch screw in- mechanical part</td>
<td>All models</td>
<td>Single pack</td>
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<tr>
<td>120Z0561</td>
<td>Oil level switch - electrical part (24V AC/DC)</td>
<td>All models</td>
<td>Single pack</td>
<td>1</td>
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</tr>
<tr>
<td>120Z0562</td>
<td>Oil level switch - electrical part (230V AC)</td>
<td>All models</td>
<td>Single pack</td>
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</tbody>
</table>
### Accessories

#### LCP's Spare parts frequency converter

<table>
<thead>
<tr>
<th>Type</th>
<th>Code n°</th>
<th>Description</th>
<th>Application</th>
<th>Packaging</th>
<th>Pack size</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>120Z0326</td>
<td>LCP display</td>
<td>Frequency converter / all models</td>
<td>Single pack</td>
<td>1</td>
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<td></td>
<td>175Z0929</td>
<td>RS cable to LCP</td>
<td>Frequency converter / all models</td>
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<td></td>
<td>130B0264</td>
<td>LCP cradle, required to mount the LCP on IP55 casings</td>
<td>Frequency converter / all models</td>
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#### Fans

<table>
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<tbody>
<tr>
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<td>130B3406</td>
<td>Fan IP55</td>
<td>VZH117 G &amp; J</td>
<td>Single pack</td>
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#### Control card

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<tr>
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<td>130B5667</td>
<td>Control card</td>
<td>Frequency converter / all models</td>
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#### Accessory bags

<table>
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<tr>
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<td>130B1300</td>
<td>Accessory bag IP20</td>
<td>VZH088-J, VZH117-G, VZH170-G</td>
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<td>VZH088-G</td>
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#### Relays card

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#### Brackets

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<th>Pack size</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>120Z0642</td>
<td>16AC bracket for VZH088/117 CDS303 drives</td>
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<td>120Z0643</td>
<td>20AC bracket for VZH088/117 CDS303 drives</td>
<td>Frequency converter</td>
<td>Single pack</td>
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Danfoss Cooling

is a worldwide manufacturer of compressors and condensing units for refrigeration and HVAC applications. With a wide range of high quality and innovative products we help your company to find the best possible energy efficient solution that respects the environment and reduces total life cycle costs.

We have 40 years of experience within the development of hermetic compressors which has brought us amongst the global leaders in our business, and positioned us as distinct variable speed technology specialists. Today we operate from engineering and manufacturing facilities spanning across three continents.

Our products can be found in a variety of applications such as rooftops, chillers, residential air conditioners, heatpumps, coldrooms, supermarkets, milk tank cooling and industrial cooling processes.

http://cc.danfoss.com

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