

ENGINEERING  
TOMORROW

*Danfoss*

Application Guide

# Scroll compressors **DSH090 to DSH600**

R410A - R454B - R452B, 50Hz - 60Hz



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## Safety and warnings

Danfoss 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 advise 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.

## Introduction

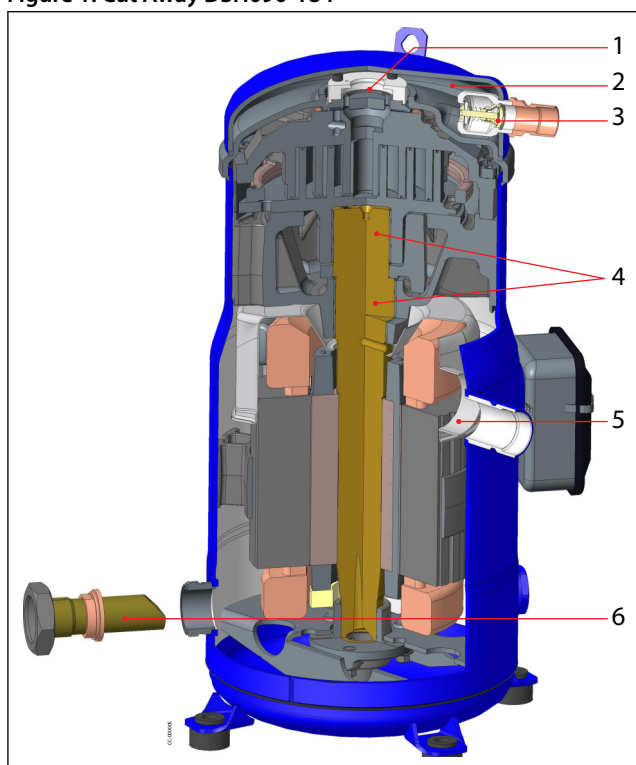
### Product description

Danfoss scroll compressor DSH for R410A, R454B and R452B is available as single compressor and can be assembled in tandem or trio combinations.

DSH series scroll compressor benefit from an improved design to achieve the highest efficiency and increased life time.

### Cut Away DSH090-184

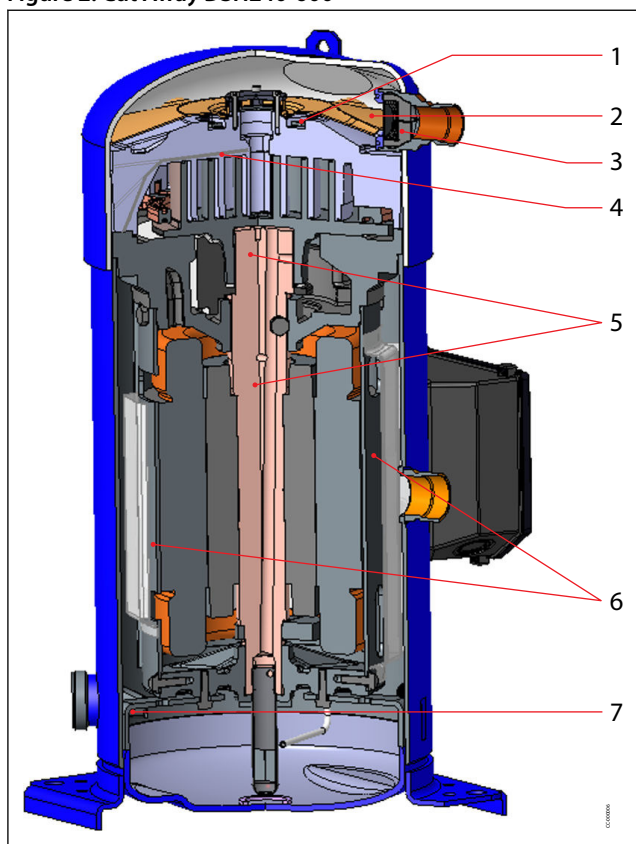
Figure 1: Cut Away DSH090-184



- |   |  |
|---|--|
| 1 | Intermediate discharge valves (IDVs) increase seasonal efficiency                          |
| 2 | Heat shield lowers the heat transfer between discharge and suction gas and the sound level |
| 3 | Internal Non Return Valve (INRV) prevents excessive leak rate from high pressure side      |
| 4 | Lead free polymer bearings improve behavior under poor lubrication conditions              |
| 5 | Patented motor cap for optimal motor cooling and higher resistance to liquid slugging      |
| 6 | Organ pipe masters oil circulation in manifold configuration.                              |

## Cut Away DSH240-600

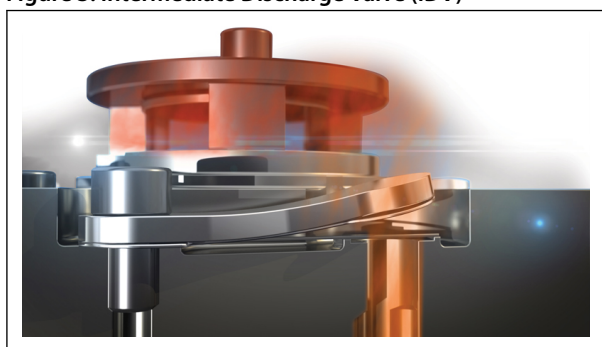
Figure 2: Cut Away DSH240-600



- |   |  |
|---|--|
| 1 | Intermediate discharge valves (IDVs) increase seasonal efficiency                          |
| 2 | Heat shield lowers the heat transfer between discharge and suction gas and the sound level |
| 3 | Internal Non Return Valve (INRV) prevents excessive leak rate from high pressure side      |
| 4 | Integrated discharge gas temperature protection (DGT)                                      |
| 5 | Lead free polymer bearings improve behavior under poor lubrication conditions              |
| 6 | Patented gas path flow with gas intake design induce higher resistance to liquid slugging  |
| 7 | Organ pipe masters oil circulation in manifold configuration                               |

## How do IDVs work?

Figure 3: Intermediate Discharge Valve (IDV)



Danfoss Intermediate Discharge Valves (IDVs) are located close to the discharge side of the compressor. They reduce excessive compression of refrigerant under part-load conditions while maintaining the same cooling capacity. The IDVs open when discharge pressure falls below the built-in optimization point. They adapt the effort of the motor to the varying load and pressure conditions in the system, thus reducing the effort of the motor and its electrical consumption and improving the system's seasonal energy efficiency.

## Product identification

### Name Plate

Figure 4: Name Plate

|   |  |   |  |
|---|--|---|--|
| 1 | Model no : <b>DSH485B4APC</b>  | 1 | Model number   |
| 2 | Serial no : <b>JC112345678</b>   | 2 | Serial number  |
| 3 | CE, UL, ENEC, 0038, 089  | 3 | Approvals  |
| 4 | Refrigerant: R410A R452B R454B<br>PROTECTED BY DOMESTIC AND FOREIGN PATENTS  | 4 | Refrigerant  |
| 5 | H 380-415V 3~50Hz<br>460V 3~60Hz<br>LR 344A MAX OPER. 91 A<br>Thermally protected system<br>P.E.D.<br>Marking LP Side HP Side<br>PS 31,20 bar 48,70 bar<br>TS Max 52,0 C 150 C<br>TS Min -35,0 C -35 C<br>Volume 28,5 L 3,9 L<br>Lubricant: P.O.E. 160SZ | 5 | Supply voltage, Starting current & Maximum operating current |
| 6 |  | 6 | Housing service pressure                                     |
| 7 |  | 7 | Factory charged lubricant                                    |

### Nomenclature

The example below presents the compressor nomenclature which equals the technical reference as shown on the compressor nameplate. Code numbers for ordering are listed in section [Ordering](#).

| Family, lubricant & refrigerant   | Nominal capacity  | Approvals       | Voltage   | Version   | Evolution index               |
|---|---|-----------------|---|---|-------------------------------|
| <b>DSH</b>  | <b>485</b>  | <b>B</b>        | <b>4</b>  | <b>AB</b>   | <b>C</b>                      |
| <b>Family, lubricant &amp; refrigerant</b><br><b>DSH:</b> Scroll, POE lubricant, R410A and R454B/R452B (according to version) | <b>Nominal capacity</b><br>in thousand Btu/h at 60Hz ARI conditions | <b>UL index</b> | <b>Motor voltage code</b><br><b>3:</b> 200-230V/3~/60Hz<br><b>4:</b> 380-415V/3~/50Hz - 460V/3~/60Hz<br>for DSH240: 380-400V/3~/50Hz - 460V/3~/60Hz<br><b>7:</b> 575V/3~/60Hz<br><b>9:</b> 380-400V/3~/60Hz<br>for DSH240 to DSH381: 380V/3~/60Hz | <b>Motor protection</b><br><b>A:</b> Electronic module, 24V AC, R410A only<br><b>B:</b> Electronic module, 110-240V, R410A only<br><b>P:</b> Electronic module, 110-240V, R410A/R454B/R452B<br><b>X:</b> Electronic module, 24V AC, R410A/R454B/R452B<br><b>L:</b> Internal overload protector, R410A/R454B/R452B | <b>Evolution index</b><br>A~Z |
|   |   |                 |   | <b>Suction and discharge connections</b><br><b>A:</b> Brazed connections  |                               |

## Compressors serial number

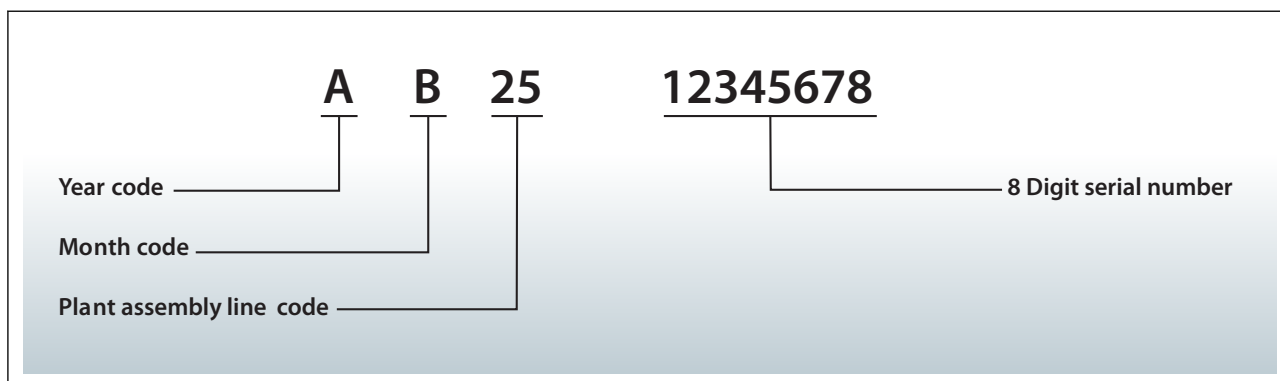


Table 1: Serial number code legend table

| Year code  |      | Month code |      | Plant assembly line code |      |
|------------|------|------------|------|--------------------------|------|
| Year       | Code | Month      | Code | Plant                    | Code |
| 1990, 2010 | A    | January    | A    | Trévoux, France          | 11   |
| 1991, 2011 | B    | February   | B    |                          |      |
| 1992, 2012 | C    | March      | C    |                          |      |
| 1993, 2013 | D    | April      | D    | Wuqing, China            | 25   |
| 1994, 2014 | E    | May        | E    |                          |      |
| 1995, 2015 | F    | June       | F    |                          |      |
| 1996, 2016 | G    | July       | G    |                          |      |
| 1997, 2017 | H    | August     | H    |                          |      |
| 1998, 2018 | J    | September  | J    |                          |      |
| 1999, 2019 | K    | October    | K    |                          |      |
| 2000, 2020 | L    | November   | L    |                          |      |
| 2001, 2021 | M    | December   | M    |                          |      |
| 2002, 2022 | N    |            |      |                          |      |
| 2003, 2023 | P    |            |      |                          |      |
| 2004, 2024 | Q    |            |      |                          |      |
| 2005, 2025 | R    |            |      |                          |      |
| 2006, 2026 | S    |            |      |                          |      |
| 2007, 2027 | T    |            |      |                          |      |
| 2008, 2028 | U    |            |      |                          |      |
| 2009, 2029 | V    |            |      |                          |      |

## Certificates, declarations and approvals

### Certificates, declarations, and approvals

DSH scroll compressors comply with the following approvals and certificates. Certificate are listed on:

[Documentation for Commercial Compressor | Danfoss](#)

**Table 2: Certificates, declarations, and approvals**

| Certificates, declarations, and approvals        | Certification logo | Models          |
|--|--------------------|-----------------|
| CE 0062, CE 0038 or CE 0094 (European Directive) |                    | All DSH models  |
| UL (Underwriters Laboratories)                   |                    | All DSH models  |
| Other approvals / certificates                   |                    | Contact Danfoss |

### Low voltage directive 2014/35/EU

**Table 3: Low voltage directive 2014/35/EU**

| Products                  | DSH models      |
|---------------------------|-----------------|
| Declaration of conformity | Contact Danfoss |

### Machines directive 2006/42/EC

**Table 4: Machines directive 2006/42/EC**

| Products                                    | DSH models      |
|---|-----------------|
| Manufacturer's declaration of incorporation | Contact Danfoss |

### Pressure equipment directive 2014/68/EU

**Table 5: Pressure equipment directive 2014/68/EU**

| Products                                    | DSH090 to 184   | DSH240-295                                | DSH381-485-600                            |
|---|---|---|---|
| Category PED R410A                          | II  | II  | III                                       |
| Category PED R452B / R454B                  | III   | III                                       | IV  |
| Maximum / Minimum temperature - Ts          | -35°C < Ts < 55°C<br>-31°F < Ts < 131°F   | -35°C < Ts < 52°C<br>-31°F < Ts < 125.6°F | -35°C < Ts < 52°C<br>-31°F < Ts < 125.6°F |
| Maximum allowable pressure (Low side) - Ps  | R410A : 33.3 bar (g) / R452B and R454B : 31.2 bar(g)<br>R410A : 483 psig / R452B and R454B : 453 psig | 31.2 bar(g)<br>451 psig                   | 31.2bar(g)<br>451psig                     |
| Maximum allowable pressure (High side) - Ps | 48.7 bar(g)<br>706 psig   | 48.7 bar(g)<br>706 psig                   | 48.7 bar(g)<br>706 psig                   |
| Declaration of conformity                   | Contact Danfoss   | Contact Danfoss                           | Contact Danfoss                           |

### Internal free volume

**Table 6: Internal free volume**

| Products | Internal free volume without oil |           |                    |           |         |           |
|----------|----------------------------------|-----------|--------------------|-----------|---------|-----------|
|          | Low pressure side                |           | High pressure side |           | Total   |           |
|          | [litre]                          | [cu.inch] | [litre]            | [cu.inch] | [litre] | [cu.inch] |
| DSH090   | 11.7                             | 714       | 0.7                | 43        | 12.4    | 757       |
| DSH105   | 13.6                             | 830       | 0.7                | 43        | 14.3    | 873       |
| DSH120   | 13.6                             | 830       | 0.7                | 43        | 14.3    | 873       |
| DSH140   | 13.6                             | 830       | 0.7                | 43        | 14.3    | 873       |
| DSH161   | 13.6                             | 830       | 0.7                | 43        | 14.3    | 873       |
| DSH184   | 13.9                             | 848       | 0.7                | 43        | 14.6    | 891       |
| DSH240   | 27.5                             | 1678      | 2.9                | 177       | 30.4    | 1855      |
| DSH295   | 27.1                             | 1654      | 2.8                | 171       | 29.9    | 1825      |
| DSH381   | 31.1                             | 1898      | 4.0                | 244       | 35.1    | 2142      |
| DSH485   | 28.5                             | 1739      | 3.9                | 238       | 32.4    | 1977      |
| DSH600   | 30.1                             | 1837      | 4.0                | 244       | 34.1    | 2081      |

## Refrigerants

### General Information

When choosing a refrigerant, different aspects must be taken into consideration:

- Legislation (now and in the future)
- Safety
- Application envelope in relation to expected running conditions
- Compressor capacity and efficiency
- Compressor manufacturer recommendations & Guidelines

Additional points could influence the final choice:

- Environmental considerations
- Standardisation of refrigerants and lubricants
- Refrigerant cost
- Refrigerant availability

### R410A

R410A is a HFC blend (R32: 50%; R125: 50%) with a zero Ozone Depletion Potential (ODP=0) and a Global Warming Potential of 1924/AR5 (2088/AR4). It is a near-azeotropic mixture with a temperature glide less than 0.2 K.

With its high net refrigeration effect coupled to a high density, the R410A has appeared in last decade to be the preferred refrigerant for use in commercial air conditioners and heat pumps.

### R452B

R452B is a HFO/HFC blend (R32: 67%; R125: 7%; R1234yf: 26%) with a zero Ozone Depletion Potential (ODP=0) and a low Global Warming Potential (GWP: 676/AR5 ; 698/AR4). It is a near-azeotropic mixture with a temperature glide around 1 K.

R452B has very close capacities versus R410A and due to its very limited discharge temperature difference it appears today as the best candidate for a direct drop in of R410A.

R452B is classified A2L with low flammability properties. Please refer to European regulations and directives about the use of refrigerant of the A2L safety group ( EN378, EN60335). Outside Europe refer to the local regulation.

### R454B

R454B is a HFO/HFC blend (R32 :68.9%; R1234yf: 31.1%) with a zero Ozone Depletion Potential (ODP=0) and a low Global Warming Potential (GWP: 467/AR5; 466/AR4). It is a near-azeotropic mixture with a temperature glide around 1 K.

R454B has very close match to R410A in terms of capacity and discharge temperature difference, and it offers better efficiencies compared to R410A.

R454B is classified A2L with low flammability properties. Please refer to European regulations and directives about the use of refrigerant of the A2L safety group (EN378, EN60335). Outside Europe refer to the local regulation

## Technical specification

### 50-60 Hz data Single compressor

Table 7: Technical specification 50-60 Hz data Single compressor

| Model  | Nominal<br>tons 60 Hz | Swept volume         |           | Displacement (50 Hz) <sup>(1)</sup> |         | Displacement (60 Hz) <sup>(2)</sup> |         | Oil charge      |     | Net weight <sup>(3)</sup> |     |
|--------|-----------------------|----------------------|-----------|-------------------------------------|---------|-------------------------------------|---------|-----------------|-----|---------------------------|-----|
|        | TR                    | cm <sup>3</sup> /rev | cu.in/rev | m <sup>3</sup> /h                   | cu.ft/h | m <sup>3</sup> /h                   | cu.ft/h | dm <sup>3</sup> | oz  | kg                        | lbs |
| DSH090 | 7.5                   | 88.4                 | 5.39      | 15.4                                | 544     | 18.6                                | 657     | 3               | 102 | 58                        | 128 |
| DSH105 | 9                     | 103.5                | 6.32      | 18                                  | 636     | 21.8                                | 770     | 3.3             | 112 | 64                        | 141 |
| DSH120 | 10                    | 116.9                | 7.13      | 20.3                                | 717     | 24.6                                | 869     | 3.3             | 112 | 64                        | 141 |
| DSH140 | 12                    | 133                  | 8.12      | 23.1                                | 816     | 27.9                                | 985     | 3.3             | 112 | 67                        | 148 |
| DSH161 | 13                    | 151.7                | 9.26      | 26.4                                | 932     | 31.9                                | 1127    | 3.3             | 112 | 69                        | 152 |
| DSH184 | 15                    | 170.3                | 10.39     | 29.6                                | 1045    | 35.8                                | 1264    | 3.6             | 122 | 71.5                      | 158 |
| DSH240 | 20                    | 227.6                | 13.89     | 39.6                                | 1398    | 47.8                                | 1688    | 6.1             | 206 | 114                       | 251 |
| DSH295 | 25                    | 276.2                | 16.85     | 48.1                                | 1699    | 58                                  | 2048    | 6.1             | 206 | 117                       | 258 |
| DSH381 | 30                    | 345                  | 21.05     | 60                                  | 2119    | 72.3                                | 2553    | 6.1             | 206 | 162                       | 357 |
| DSH485 | 40                    | 442.6                | 27.01     | 77                                  | 2719    | 92.9                                | 3281    | 6.1             | 206 | 176                       | 388 |
| DSH600 | 50                    | 553                  | 33.75     | 96.2                                | 3397    | 116.1                               | 4100    | 6.1             | 206 | 215                       | 474 |

<sup>(1)</sup> Displacement at nominal speed: 2900rpm at 50 Hz

<sup>(2)</sup> Displacement at nominal speed: 3500rpm at 60 Hz

<sup>(3)</sup> Net weight with oil charge

## Performance data

### R410A 50-60 Hz, Single compressor

Table 8: 50-60 Hz Performance data

| Model |        | Nominal tons<br>60 Hz | Nominal cooling capacity |        | Power input | COP  | E.E.R.  |
|-------|--------|-----------------------|--------------------------|--------|-------------|------|---------|
|       |        | TR                    | W                        | Btu/h  | kW          | W/W  | Btu/h/W |
| 50Hz  | DSH090 | 7.5                   | 20048                    | 68402  | 6.57        | 3.05 | 10.40   |
|       | DSH105 | 9.0                   | 23578                    | 80449  | 7.69        | 3.07 | 10.47   |
|       | DSH120 | 10.0                  | 26787                    | 91396  | 8.65        | 3.10 | 10.57   |
|       | DSH140 | 12.0                  | 30370                    | 103621 | 9.74        | 3.12 | 10.64   |
|       | DSH161 | 13.0                  | 34894                    | 119059 | 11.09       | 3.15 | 10.74   |
|       | DSH184 | 15.0                  | 39036                    | 133191 | 12.42       | 3.14 | 10.72   |
|       | DSH240 | 20.0                  | 52730                    | 179920 | 17.04       | 3.09 | 10.56   |
|       | DSH295 | 25.0                  | 64520                    | 220149 | 20.35       | 3.17 | 10.82   |
|       | DSH381 | 30.0                  | 80707                    | 275379 | 25.83       | 3.12 | 10.66   |
|       | DSH485 | 40.0                  | 104687                   | 357202 | 32.39       | 3.23 | 11.03   |
| 60Hz  | DSH600 | 50.0                  | 128864                   | 439698 | 40.60       | 3.17 | 10.83   |
|       | DSH090 | 7.5                   | 27471                    | 93730  | 8.60        | 3.19 | 10.90   |
|       | DSH105 | 9.0                   | 32279                    | 110136 | 10.06       | 3.21 | 10.94   |
|       | DSH120 | 10.0                  | 36629                    | 124977 | 11.31       | 3.24 | 11.05   |
|       | DSH140 | 12.0                  | 41510                    | 141631 | 12.81       | 3.24 | 11.06   |
|       | DSH161 | 13.0                  | 47222                    | 161122 | 14.77       | 3.20 | 10.91   |
|       | DSH184 | 15.0                  | 53157                    | 181371 | 16.44       | 3.23 | 11.03   |
|       | DSH240 | 20.0                  | 71760                    | 244852 | 22.46       | 3.20 | 10.90   |
|       | DSH295 | 25.0                  | 87610                    | 298934 | 26.96       | 3.25 | 11.09   |
|       | DSH381 | 30.0                  | 110116                   | 375726 | 34.41       | 3.20 | 10.92   |
|       | DSH485 | 40.0                  | 143956                   | 491192 | 43.03       | 3.35 | 11.42   |
|       | DSH600 | 50.0                  | 175344                   | 598291 | 53.80       | 3.26 | 11.12   |

#### NOTE:

**TR:** Ton of Refrigeration,

**COP:** Coefficient Of Performance

**EER:** Energy Efficiency Ratio

Standard rating conditions For 50 Hz: Evaporating temperature: 5°C (41°F), Condensing temperature: 50°C (122°F), Superheat: 10K (18°F), Subcooling: 0K (0°F)

For 60 Hz: Evaporating temperature: 7.2°C (45°F), Condensing temperature: 54.4°C (130°F), Superheat: 11.1K (20°F), Subcooling: 8.3K (15°F)

Subject to modification without prior notification.

Data given for motor code 4 compressor with above conditions



For regular updates and detailed capacities, please refer to [Coolselector®2](#).

## R452B 50-60 Hz, Single compressor

Table 9: 50-60 Hz Performance data

| Model |        | Nominal cooling capacity |        | Power input | COP  | E.E.R.  |
|-------|--------|--------------------------|--------|-------------|------|---------|
|       |        | W                        | Btu/h  | kW          | W/W  | Btu/h/W |
| 50Hz  | DSH090 | 19590                    | 66839  | 6.46        | 3.03 | 10.35   |
|       | DSH105 | 23451                    | 80016  | 7.40        | 3.17 | 10.81   |
|       | DSH120 | 26366                    | 89961  | 8.24        | 3.20 | 10.92   |
|       | DSH140 | 30180                    | 102974 | 9.35        | 3.23 | 11.01   |
|       | DSH161 | 34855                    | 118924 | 10.58       | 3.30 | 11.25   |
|       | DSH184 | 38779                    | 132313 | 11.83       | 3.28 | 11.18   |
|       | DSH240 | 52130                    | 177873 | 16.1        | 3.23 | 11.02   |
|       | DSH295 | 63995                    | 218359 | 19.4        | 3.30 | 11.27   |
|       | DSH381 | 78977                    | 269477 | 24.8        | 3.19 | 10.89   |
| 60Hz  | DSH485 | 102623                   | 350160 | 30.69       | 3.34 | 11.41   |
|       | DSH090 | 26652                    | 90936  | 8.38        | 3.18 | 10.85   |
|       | DSH105 | 31925                    | 108929 | 9.64        | 3.31 | 11.30   |
|       | DSH120 | 35779                    | 122078 | 10.89       | 3.29 | 11.21   |
|       | DSH140 | 40984                    | 139838 | 12.51       | 3.28 | 11.18   |
|       | DSH161 | 46938                    | 160152 | 13.84       | 3.39 | 11.57   |
|       | DSH184 | 52181                    | 178040 | 15.81       | 3.30 | 11.26   |
|       | DSH240 | 70756                    | 241427 | 21.4        | 3.31 | 11.30   |
|       | DSH295 | 86418                    | 294866 | 25.5        | 3.39 | 11.57   |
|       | DSH381 | 105020                   | 358339 | 32.5        | 3.23 | 11.02   |
|       | DSH485 | 138878                   | 473866 | 40.92       | 3.39 | 11.58   |

### NOTE:

**TR:** Ton of Refrigeration,

**COP:** Coefficient Of Performance

**EER:** Energy Efficiency Ratio

Standard rating conditions For 50 Hz: Evaporating temperature: 5°C (41°F), Condensing temperature: 50°C (122°F), Superheat: 10K (18°F), Subcooling: 0K (0°F)

For 60 Hz: Evaporating temperature: 7.2°C (45°F), Condensing temperature: 54.4°C (130°F), Superheat: 11.1K (20°F), Subcooling: 8.3K (15°F)

Subject to modification without prior notification.

Data given for motor code 4 compressor with above conditions



For regular updates and detailed capacities, please refer to [Coolselector®2](#).

## R454B 50-60 Hz, Single compressor

Table 10: 50-60 Hz Performance data

| Model |        | Nominal cooling capacity |        | Power input | COP  | E.E.R.  |
|-------|--------|--------------------------|--------|-------------|------|---------|
|       |        | W                        | Btu/h  | kW          | W/W  | Btu/h/W |
| 50Hz  | DSH090 | 19346                    | 66010  | 6.37        | 3.03 | 10.36   |
|       | DSH105 | 22940                    | 78270  | 7.26        | 3.16 | 10.78   |
|       | DSH120 | 26220                    | 89463  | 8.16        | 3.21 | 10.97   |
|       | DSH140 | 29879                    | 101946 | 9.28        | 3.22 | 10.98   |
|       | DSH161 | 34151                    | 116525 | 10.45       | 3.27 | 11.15   |
|       | DSH184 | 37926                    | 129403 | 11.70       | 3.24 | 11.06   |
|       | DSH240 | 50691                    | 172964 | 15.92       | 3.18 | 10.87   |
|       | DSH295 | 62304                    | 212589 | 19.07       | 3.27 | 11.15   |
|       | DSH381 | 78379                    | 267438 | 24.41       | 3.21 | 10.96   |
|       | DSH485 | 101653                   | 346851 | 30.39       | 3.34 | 11.41   |

## Scroll compressors, DSH090 to DSH600 | Performance data

| Model |        | Nominal cooling capacity |        | Power input | COP  | E.E.R.  |
|-------|--------|--------------------------|--------|-------------|------|---------|
|       |        | W                        | Btu/h  | kW          | W/W  | Btu/h/W |
| 60Hz  | DSH090 | 26320                    | 89804  | 8.18        | 3.22 | 10.98   |
|       | DSH105 | 31296                    | 106782 | 9.49        | 3.30 | 11.25   |
|       | DSH120 | 35528                    | 121223 | 10.66       | 3.33 | 11.37   |
|       | DSH140 | 40482                    | 138126 | 12.19       | 3.32 | 11.33   |
|       | DSH161 | 45966                    | 156834 | 13.79       | 3.33 | 11.38   |
|       | DSH184 | 51267                    | 174922 | 15.36       | 3.34 | 11.39   |
|       | DSH240 | 68133                    | 232478 | 20.81       | 3.27 | 11.17   |
|       | DSH295 | 83489                    | 284872 | 24.94       | 3.35 | 11.42   |
|       | DSH381 | 105020                   | 358339 | 32.50       | 3.23 | 11.02   |
|       | DSH485 | 137206                   | 468160 | 40.43       | 3.39 | 11.58   |

### NOTE:

**TR:** Ton of Refrigeration,

**COP:** Coefficient Of Performance

**EER:** Energy Efficiency Ratio

Standard rating conditions For 50 Hz: Evaporating temperature: 5°C (41°F), Condensing temperature: 50°C (122°F), Superheat: 10K (18°F), Subcooling: 0K (0°F)

For 60 Hz: Evaporating temperature: 7.2°C (45°F), Condensing temperature: 54.4°C (130°F), Superheat: 11.1K (20°F), Subcooling: 8.3K (15°F)

Subject to modification without prior notification.

Data given for motor code 4 compressor with above conditions



For regular updates and detailed capacities, please refer to [Coolselector®2](#).

## Sound and vibration data

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 - Single

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 11: Compressor sound radiation (R410A/R452B/R454B Max. DGT 135°C)**

| Compressor model      | 50 Hz             |                                  | 60 Hz             |                                  | Acoustic hood code number           |
|-----------------------|-------------------|----------------------------------|-------------------|----------------------------------|-------------------------------------|
|                       | Sound power dB(A) | Attenuation dB(A) <sup>(1)</sup> | Sound power dB(A) | Attenuation dB(A) <sup>(1)</sup> |                                     |
| DSH090                | 73                | 6                                | 76                | 6                                | 120Z0034                            |
| DSH105                | 75                | 6                                | 78                | 6                                | 102Z0035                            |
| DSH120                | 75                | 6                                | 78                | 6                                | 120Z0035                            |
| DSH140                | 76                | 6                                | 79                | 6                                | 120Z0035                            |
| DSH161                | 76                | 6                                | 79                | 6                                | 120Z0035                            |
| DSH184                | 78                | 6                                | 81                | 6                                | 120Z0135                            |
| DSH240                | 82                | 6                                | 85                | 4                                | 120Z0022                            |
| DSH295                | 82                | 6                                | 85                | 4                                | 120Z0022                            |
| DSH381                | 89                | 6                                | 91                | 4                                | 120Z0022<br>120Z0579 <sup>(2)</sup> |
| DSH485 <sup>(3)</sup> | 89                | 4                                | 91                | 4                                | 120Z0022                            |
| DSH600                | 91                | /                                | 93                | /                                | /                                   |

<sup>(1)</sup> Attenuation given with acoustic hood

<sup>(2)</sup> For DSH381 code 3

<sup>(3)</sup> No acoustic hood available for DSH485 code 3 and DSH600

**Table 12: Compressor sound radiation(R452B/R454B Max. DGT 150°C)**

| Compressor model | 50 Hz             |                                  | 60 Hz             |                                  | Acoustic hood code number |          |
|------------------|-------------------|----------------------------------|-------------------|----------------------------------|---------------------------|----------|
|                  | Sound power dB(A) | Attenuation dB(A) <sup>(1)</sup> | Sound power dB(A) | Attenuation dB(A) <sup>(1)</sup> | Body                      | Top      |
| DSH090           | 73                | 4                                | 76                | 4                                | 120Z0490                  | 120Z0493 |
| DSH105           | 75                | 4                                | 78                | 5                                | 120Z0491                  | 120Z0493 |
| DSH120           | 75                | 4                                | 78                | 5                                | 120Z0491                  | 120Z0493 |
| DSH140           | 76                | 4                                | 79                | 5                                | 120Z0491                  | 120Z0493 |
| DSH161           | 76                | 4                                | 79                | 5                                | 120Z0491                  | 120Z0493 |
| DSH184           | 78                | 5                                | 81                | 6                                | 120Z0492                  | 120Z0493 |

<sup>(1)</sup> Attenuation given with acoustic hood

#### **NOTE:**

Sound power and attenuation are given at ARI conditions, measured in free space

For compressors running simultaneously,

- The global sound level of "n" identical compressors is:

$$L_{\text{GLOBAL}} = L_i + 10 \log_{10} n$$

Example for the trio

$$DSH720 = 3 \times DSH240 (50 \text{ Hz})$$

$$L_{\text{DSH240}} = 82\text{dB(A)}$$

$$L_{\text{DSH720}} = 82 + 10 \log_{10} 3 = 86.8\text{dB(A)}$$

- The global sound level of “n” different compressors with respectively Li sound level is:

$$L_{\text{GLOBAL}} = 10 \log_{10} \left( \sum_{i=1}^n 10^{0.1 L_i} \right)$$

Example for the tandem

DSH424 = DSH184+DSH240 (50 Hz)

$L_{\text{DSH184}} = 78\text{dB(A)}$ ,  $L_{\text{DSH240}} = 82\text{dB(A)}$

$$L_{\text{DSH424}} = 10 \log_{10}(10^{0.1 \times 78} + 10^{0.1 \times 82}) = 83.5\text{dB(A)}$$

### **Mechanical vibrations**

A compressor generates some vibrations that propagate into the surrounding parts and structure. The vibration level of a DSH compressor alone does not exceed 120µm peak to peak for DSH090 to DSH184, and 154µm peak to peak for DSH240 to DSH600. 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.

## Operating envelope data

**R** The **Operating envelope** for DSH scroll compressors guarantees reliable operations of the compressor for steady-state operation.

Steady-state operation envelope is valid for a suction superheat within 5K to 30K range at nominal Voltage.

### Operating envelope

Figure 5: R410A - DSH090 to DSH184

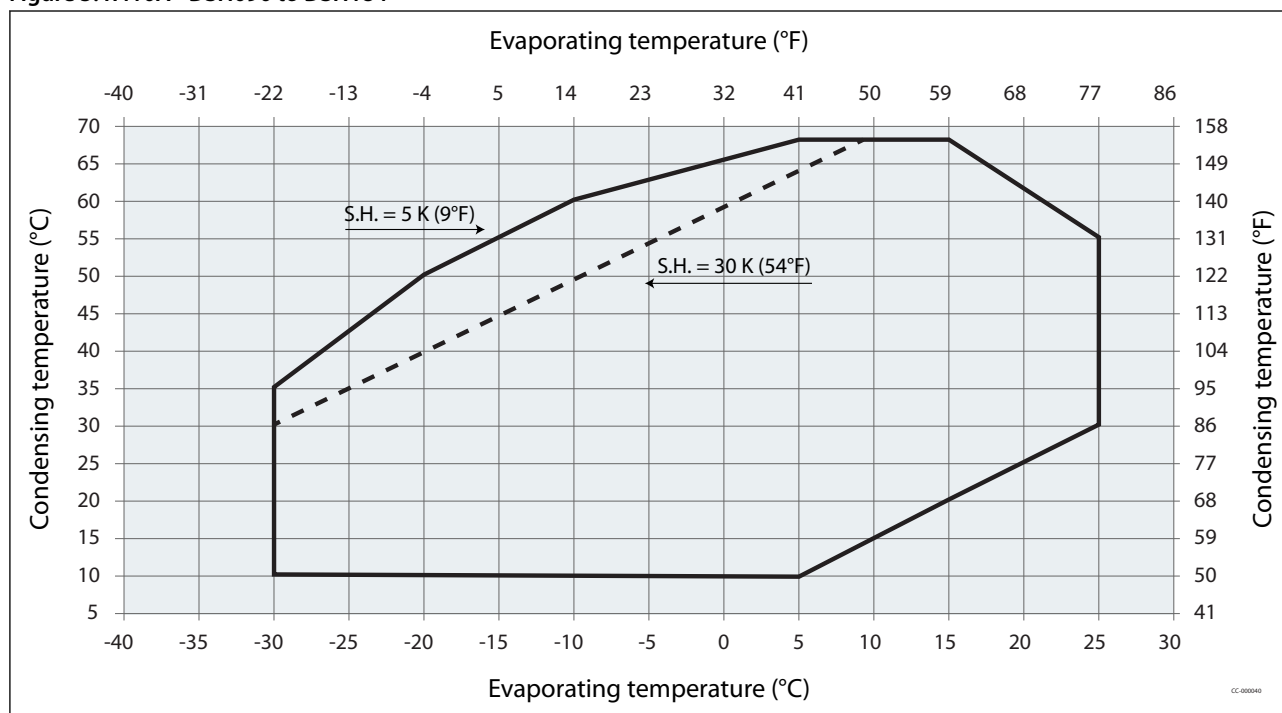


Figure 6: R410A - DSH240 to DSH600

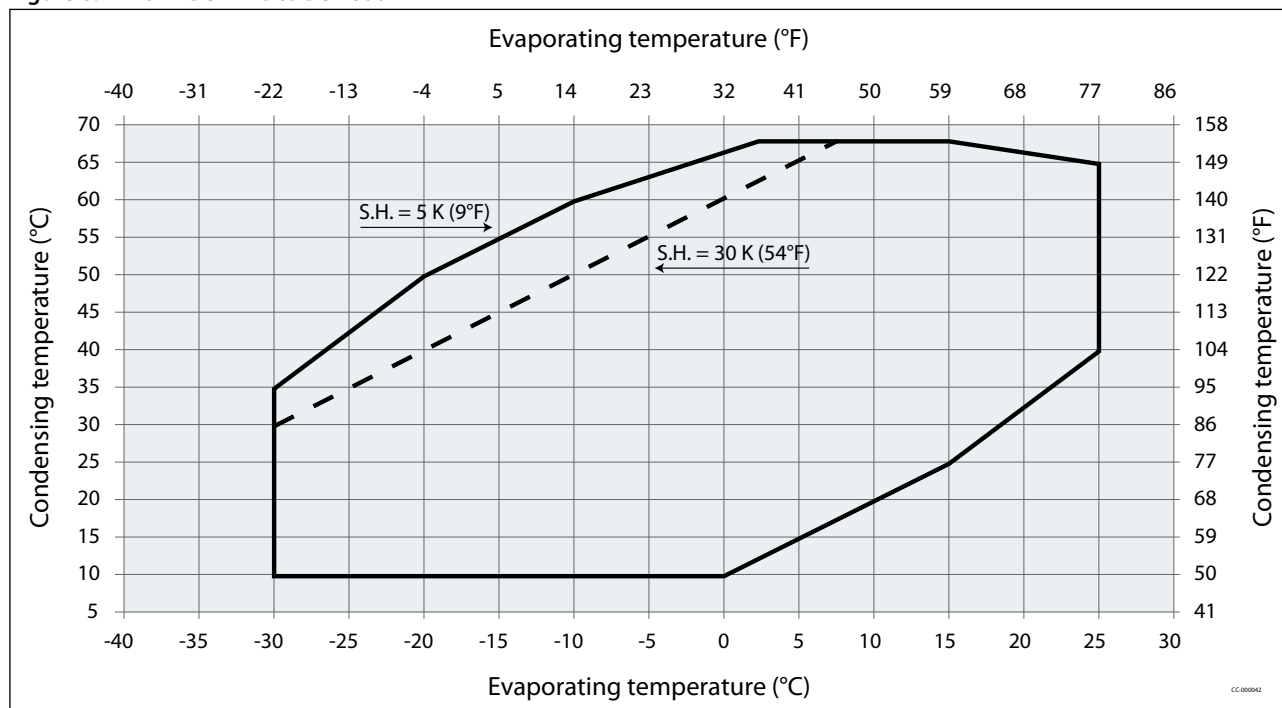


Figure 7: R452B / R454B - DSH090 to DSH105 (Max. DGT 150°C)

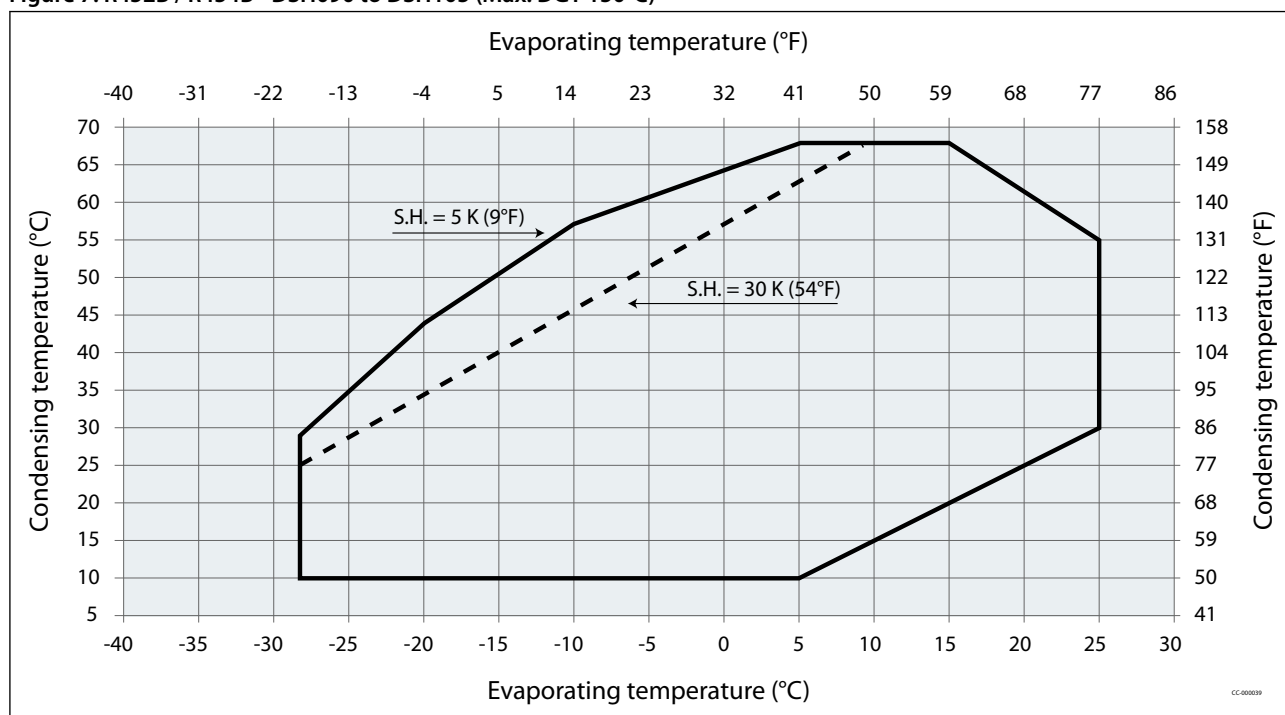


Figure 8: R452B / R454B - DSH120 to DSH184 (Max. DGT 150°C)

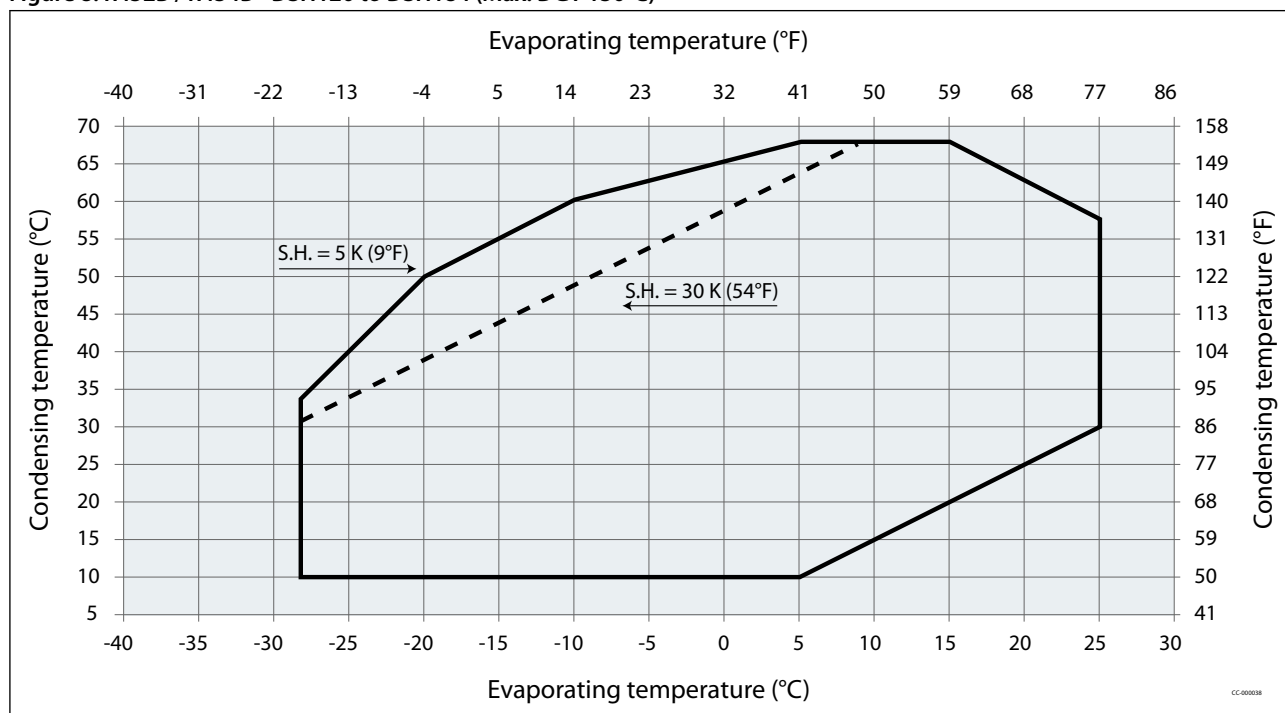
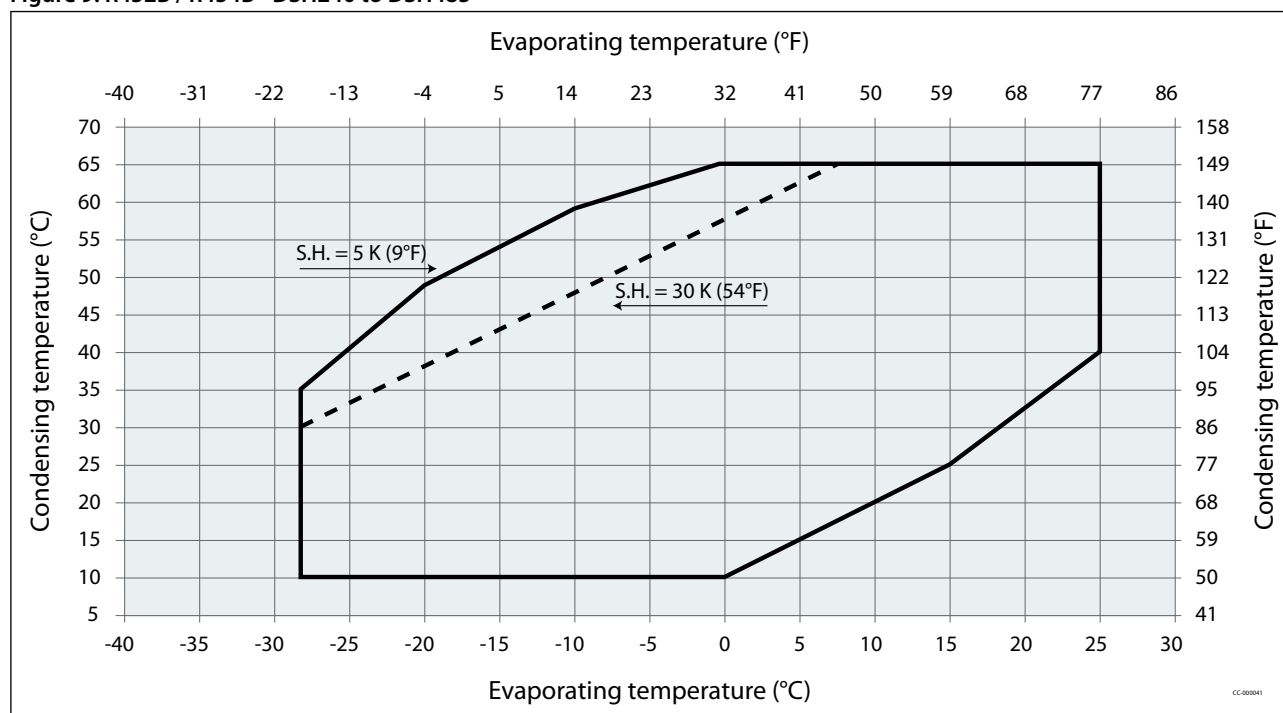


Figure 9: R452B / R454B - DSH240 to DSH485



### NOTE:

The application envelope of a cross-platform manifold results in the conjunction of map limitations of compressors composing the tandem.

## Pressure settings

Table 13: Pressure settings

| Pressure settings                             |        | R410A   | R452B / R454B (DSH240-485) | R452B / R454B (DSH090-184) |
|---|--------|---|----------------------------|----------------------------|
| Working range high side                       | bar(g) | 9.9-44.7  | 9-39.2                     | 9-41.7                     |
|   | psig   | 144-648   | 131-569                    | 131-605                    |
| Working range low side                        | bar(g) | 1.7-15.5  | 1.7-14.4                   | 1.7-14.4                   |
|   | psig   | 25-225  | 25-209                     | 25-209                     |
| Maximum high pressure safety switch setting   | bar(g) | 46.1  | 40.6                       | 43.1                       |
|   | psig   | 669   | 589                        | 625                        |
| Minimum low pressure safety switch setting    | bar(g) | 1.5   | 1.5                        | 1.5                        |
|   | psig   | 22  | 22                         | 22                         |
| Minimum low pressure pump-down switch setting | bar(g) | 1.5 bar below nominal evap. pressure with minimum of 1.7 bar(g) |                            |                            |
|   | psig   | 22 psi below nominal evap. pressure with minimum of 25 psig     |                            |                            |

## High and low pressure protection

**⚠** Low-pressure (LP) and high-pressure (HP) safety switches must never be bypassed nor delayed and must stop all the compressors.

LP switch auto restart must be limited to 5 times within 12 hours.

**⚠** HP safety switch must be reset manually.

Depending on application operating envelope, you must define HP and LP limits within operating envelope and pressure setting table above.

## Dimensions

### Single compressors

Figure 10: Outline drawing number 1

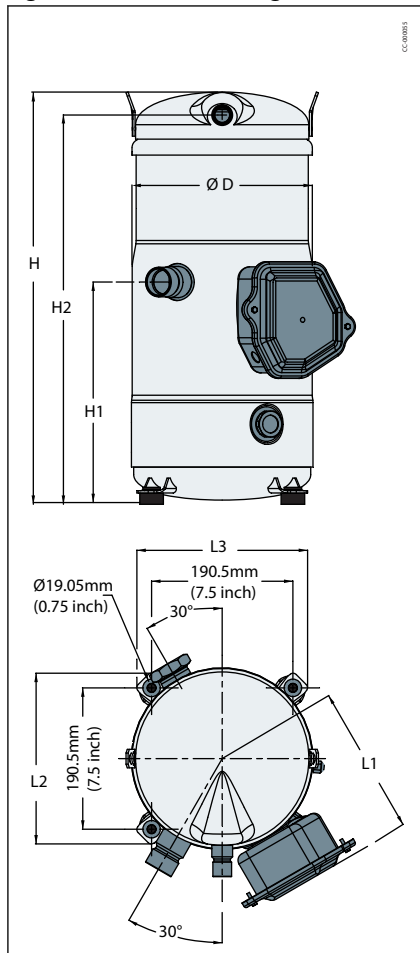


Figure 11: Outline drawing number 2

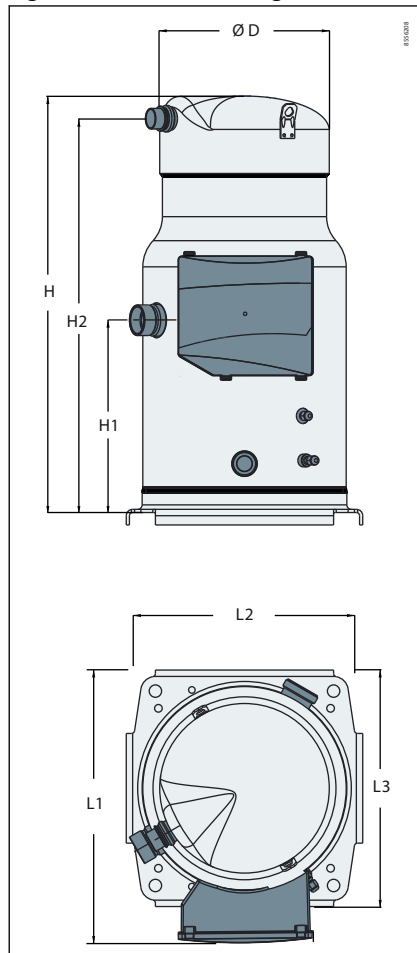


Figure 12: Outline drawing number 3

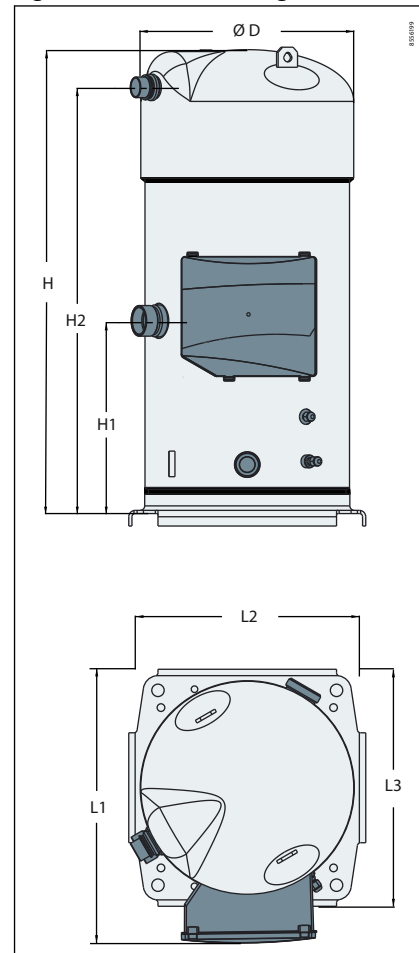


Table 14: Single compressors

| Compressor model   | Motor voltage code | D   |       | H   |       | H1  |       | H2  |       | L1  |       | L2  |       | L3  |       | Outline drawing number |         |
|--------------------|--------------------|-----|-------|-----|-------|-----|-------|-----|-------|-----|-------|-----|-------|-----|-------|------------------------|---------|
|                    |                    | mm  | inch  | mm  | inch  | mm  | inch  | mm  | inch  | mm  | inch  | mm  | inch  | mm  | inch  |                        |         |
| DSH090             | 3,4,7,9            | 243 | 9.57  | 485 | 19.09 | 235 | 9.25  | 451 | 17.76 | 180 | 7.09  | 230 | 9.06  | 230 | 9.06  | 1                      | 8560176 |
| DSH105-120-140-161 | 4,7,9              | 243 | 9.57  | 542 | 21.34 | 278 | 10.94 | 509 | 20.04 | 180 | 7.09  | 230 | 9.06  | 230 | 9.06  | 1                      | 8560177 |
| DSH105-120-140-161 | 3                  | 243 | 9.57  | 542 | 21.34 | 278 | 10.94 | 509 | 20.04 | 201 | 7.91  | 230 | 9.06  | 230 | 9.06  | 1                      | 8560041 |
| DSH184             | 3,4,7,9            | 243 | 9.57  | 558 | 21.97 | 299 | 11.77 | 524 | 20.63 | 201 | 7.91  | 230 | 9.06  | 230 | 9.06  | 1                      | 8560178 |
| DSH240             | 3,4,7,9            | 320 | 12.6  | 653 | 25.71 | 302 | 11.87 | 618 | 24.33 | 427 | 16.81 | 371 | 14.61 | 371 | 14.61 | 2                      | 8556208 |
| DSH295             | 3,4,7,9            | 320 | 12.6  | 653 | 25.71 | 302 | 11.87 | 618 | 24.33 | 427 | 16.81 | 371 | 14.61 | 371 | 14.61 | 2                      | 8556208 |
| DSH381             | 4,7,9              | 333 | 13.11 | 726 | 28.58 | 302 | 11.87 | 667 | 26.26 | 429 | 16.89 | 371 | 14.61 | 371 | 14.61 | 3                      | 8556199 |
| DSH381             | 3                  | 333 | 13.11 | 726 | 28.58 | 302 | 11.87 | 667 | 26.26 | 478 | 18.82 | 371 | 14.61 | 371 | 14.61 | 3                      | 8556239 |
| DSH485             | 4,7,9              | 333 | 13.11 | 726 | 28.58 | 302 | 11.87 | 667 | 26.26 | 429 | 16.89 | 371 | 14.61 | 371 | 14.61 | 3                      | 8556198 |
| DSH485             | 3                  | 333 | 13.11 | 726 | 28.58 | 302 | 11.87 | 667 | 26.26 | 446 | 17.56 | 371 | 14.61 | 371 | 14.61 | 3                      | 8556237 |
| DSH600             | 4, 7               | 333 | 13.11 | 799 | 31.46 | 302 | 11.87 | 732 | 28.82 | 429 | 16.89 | 371 | 14.61 | 371 | 14.61 | 3                      | 8556192 |

## Tandem assemblies

Figure 13: Outline drawing number 1

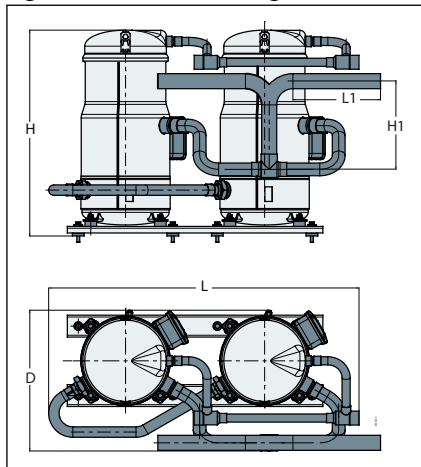


Figure 14: Outline drawing number 2

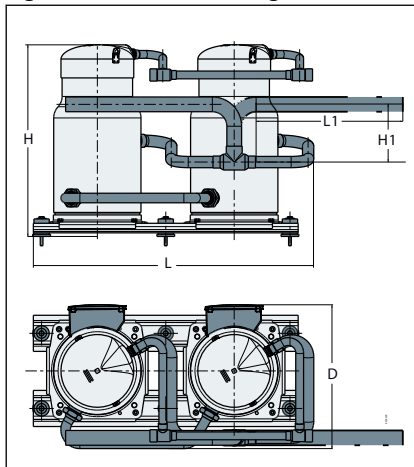


Figure 15: Outline drawing number 3

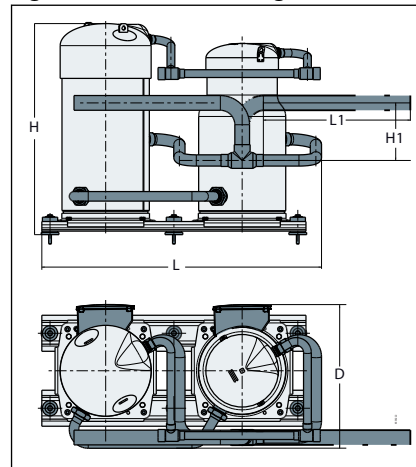


Figure 16: Outline drawing number 4

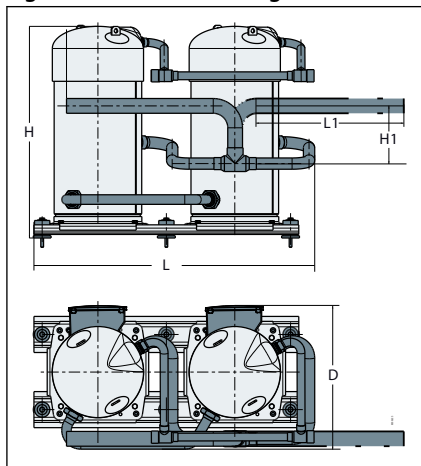


Figure 17: Outline drawing number 5

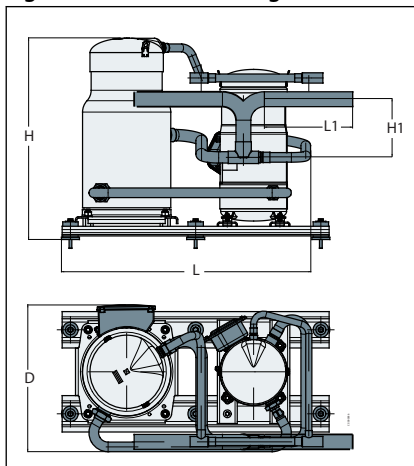


Table 15: Tandem assemblies

| Tandem model | Motor voltage code | Composition     | L   |       | D   |       | H   |       | L1  |       | H1  |      | Outline drawing number |         |
|--------------|--------------------|-----------------|-----|-------|-----|-------|-----|-------|-----|-------|-----|------|------------------------|---------|
|              |                    |                 | mm  | inch  | mm  | inch  | mm  | inch  | mm  | inch  | mm  | inch |                        |         |
| DSH180E      | 3, 4, 7, 9         | DSH090 + DSH090 | 850 | 33.46 | 384 | 15.12 | 507 | 19.96 | 240 | 9.45  | 242 | 9.53 | 1                      | 8560115 |
| DSH195U      | 3, 4, 7, 9         | DSH090 + DSH105 | 850 | 33.46 | 386 | 15.2  | 565 | 22.24 | 240 | 9.45  | 242 | 9.53 | 1                      | 8556233 |
| DSH210U      | 3, 4, 7, 9         | DSH090 + DSH120 | 850 | 33.46 | 386 | 15.2  | 565 | 22.24 | 240 | 9.45  | 242 | 9.53 | 1                      | 8556233 |
| DSH210E      | 3, 4, 7, 9         | DSH105 + DSH105 | 850 | 33.46 | 384 | 15.12 | 565 | 22.24 | 240 | 9.45  | 242 | 9.53 | 1                      | 8560114 |
| DSH230U      | 3, 4, 7, 9         | DSH090 + DSH140 | 850 | 33.46 | 386 | 15.2  | 565 | 22.24 | 240 | 9.45  | 242 | 9.53 | 1                      | 8556233 |
| DSH240E      | 3, 4, 7, 9         | DSH120 + DSH120 | 850 | 33.46 | 384 | 15.12 | 565 | 22.24 | 240 | 9.45  | 242 | 9.53 | 1                      | 8560114 |
| DSH251U      | 3, 4, 7, 9         | DSH090 + DSH161 | 850 | 33.46 | 386 | 15.2  | 565 | 22.24 | 240 | 9.45  | 242 | 9.53 | 1                      | 8556233 |
| DSH260U      | 3, 4, 7, 9         | DSH140 + DSH120 | 850 | 33.46 | 386 | 15.2  | 565 | 22.24 | 240 | 9.45  | 242 | 9.53 | 1                      | 8556230 |
| DSH274U      | 3, 4, 7, 9         | DSH090 + DSH184 | 850 | 33.46 | 428 | 16.85 | 580 | 22.83 | 240 | 9.45  | 242 | 9.53 | 1                      | 8556232 |
| DSH281U      | 3, 4, 7, 9         | DSH161 + DSH120 | 850 | 33.46 | 386 | 15.2  | 565 | 22.24 | 240 | 9.45  | 242 | 9.53 | 1                      | 8556230 |
| DSH280E      | 3, 4, 7, 9         | DSH140 + DSH140 | 850 | 33.46 | 384 | 15.12 | 565 | 22.24 | 240 | 9.45  | 242 | 9.53 | 1                      | 8560114 |
| DSH289U      | 3, 4, 7, 9         | DSH105 + DSH184 | 850 | 33.46 | 428 | 16.85 | 580 | 22.83 | 240 | 9.45  | 242 | 9.53 | 1                      | 8556231 |
| DSH301U      | 3, 4, 7, 9         | DSH161 + DSH140 | 850 | 33.46 | 386 | 15.2  | 565 | 22.24 | 240 | 9.45  | 242 | 9.53 | 1                      | 8556230 |
| DSH304U      | 3, 4, 7, 9         | DSH120 + DSH184 | 850 | 33.46 | 428 | 16.85 | 580 | 22.83 | 240 | 9.45  | 242 | 9.53 | 1                      | 8556231 |
| DSH322E      | 3, 4, 7, 9         | DSH161 + DSH161 | 850 | 33.46 | 384 | 15.12 | 565 | 22.24 | 240 | 9.45  | 242 | 9.53 | 1                      | 8560114 |
| DSH324U      | 3, 4, 7, 9         | DSH140 + DSH184 | 850 | 33.46 | 428 | 16.85 | 580 | 22.83 | 240 | 9.45  | 242 | 9.53 | 1                      | 8556231 |
| DSH345U      | 3, 4, 7, 9         | DSH161 + DSH184 | 850 | 33.46 | 428 | 16.85 | 580 | 22.83 | 240 | 9.45  | 242 | 9.53 | 1                      | 8556231 |
| DSH368E      | 3, 4, 7, 9         | DSH184 + DSH184 | 850 | 33.46 | 428 | 16.85 | 580 | 22.83 | 240 | 9.45  | 242 | 9.53 | 1                      | 8560113 |
| DSH360X      | 3, 4, 7, 9         | DSH120 + DSH240 | 903 | 35.55 | 533 | 20.98 | 731 | 28.78 | 359 | 14.13 | 211 | 8.31 | 5                      | 8560128 |
| DSH424X      | 3, 4, 7, 9         | DSH184 + DSH240 | 903 | 35.55 | 533 | 20.98 | 731 | 28.78 | 359 | 14.13 | 211 | 8.31 | 5                      | 8556259 |
| DSH456X      | 3, 4, 7, 9         | DSH161 + DSH295 | 903 | 35.55 | 533 | 20.98 | 731 | 28.78 | 359 | 14.13 | 211 | 8.31 | 5                      | 8560128 |

## Scroll compressors, DSH090 to DSH600 | Dimensions

| Tandem model | Motor voltage code | Composition     | L    |       | D   |       | H   |       | L1  |       | H1  |      | Outline drawing number |         |
|--------------|--------------------|-----------------|------|-------|-----|-------|-----|-------|-----|-------|-----|------|------------------------|---------|
|              |                    |                 | mm   | inch  | mm  | inch  | mm  | inch  | mm  | inch  | mm  | inch |                        |         |
| DSH479X      | 3, 4, 7, 9         | DSH184 + DSH295 | 903  | 35.55 | 533 | 20.98 | 731 | 28.78 | 359 | 14.13 | 211 | 8.31 | 5                      | 8556259 |
| DSH565X      | 3, 4, 7, 9         | DSH184 + DSH381 | 903  | 35.55 | 533 | 20.98 | 803 | 31.61 | 359 | 14.13 | 211 | 8.31 | 5                      | 8556260 |
| DSH482E      | 3, 4, 7, 9         | DSH240 + DSH240 | 1025 | 40.35 | 527 | 20.75 | 701 | 27.6  | 535 | 21.06 | 211 | 8.31 | 2                      | 8556228 |
| DSH535U      | 3, 4, 7, 9         | DSH240 + DSH295 | 1025 | 40.35 | 527 | 20.75 | 701 | 27.6  | 535 | 21.06 | 211 | 8.31 | 2                      | 8556228 |
| DSH590E      | 3, 4, 7, 9         | DSH295 + DSH295 | 1025 | 40.35 | 527 | 20.75 | 701 | 27.6  | 535 | 21.06 | 211 | 8.31 | 2                      | 8556228 |
| DSH620U      | 4, 7, 9            | DSH240 + DSH381 | 1025 | 40.35 | 527 | 20.75 | 774 | 30.5  | 535 | 21.06 | 211 | 8.31 | 3                      | 8556222 |
| DSH620U      | 3                  | DSH240 + DSH381 | 1025 | 40.35 | 576 | 22.68 | 774 | 30.5  | 535 | 21.06 | 211 | 8.31 | 3                      | 8556222 |
| DSH675U      | 4, 7, 9            | DSH295 + DSH381 | 1025 | 40.35 | 527 | 20.75 | 774 | 30.5  | 535 | 21.06 | 211 | 8.31 | 3                      | 8556222 |
| DSH675U      | 3                  | DSH295 + DSH381 | 1025 | 40.35 | 576 | 22.68 | 774 | 30.5  | 535 | 21.06 | 211 | 8.31 | 3                      | 8556222 |
| DSH725U      | 4, 7, 9            | DSH240 + DSH485 | 1025 | 40.35 | 546 | 21.5  | 774 | 30.5  | 535 | 21.06 | 211 | 8.31 | 3                      | 8556207 |
| DSH725U      | 3                  | DSH240 + DSH485 | 1025 | 40.35 | 563 | 22.17 | 774 | 30.5  | 535 | 21.06 | 211 | 8.31 | 3                      | 8556207 |
| DSH760E      | 4, 7, 9            | DSH381 + DSH381 | 1025 | 40.35 | 527 | 20.75 | 774 | 30.5  | 535 | 21.06 | 211 | 8.31 | 4                      | 8556223 |
| DSH760E      | 3                  | DSH381 + DSH381 | 1025 | 40.35 | 576 | 22.68 | 774 | 30.5  | 535 | 21.06 | 211 | 8.31 | 4                      | 8556223 |
| DSH780U      | 4, 7, 9            | DSH295 + DSH485 | 1025 | 40.35 | 546 | 21.5  | 774 | 30.5  | 540 | 21.26 | 211 | 8.31 | 3                      | 8556220 |
| DSH780U      | 3                  | DSH295 + DSH485 | 1025 | 40.35 | 563 | 22.17 | 774 | 30.5  | 540 | 21.26 | 211 | 8.31 | 3                      | 8556220 |
| DSH865U      | 4, 7, 9            | DSH381 + DSH485 | 1025 | 40.35 | 546 | 21.5  | 774 | 30.5  | 540 | 21.26 | 211 | 8.31 | 4                      | 8556224 |
| DSH865U      | 3                  | DSH381 + DSH485 | 1025 | 40.35 | 563 | 22.17 | 774 | 30.5  | 540 | 21.26 | 211 | 8.31 | 4                      | 8556224 |
| DSH970E      | 4, 7, 9            | DSH485 + DSH485 | 1025 | 40.35 | 546 | 21.5  | 774 | 30.5  | 540 | 21.26 | 211 | 8.31 | 4                      | 8556205 |
| DSH970E      | 3                  | DSH485 + DSH485 | 1025 | 40.35 | 563 | 22.17 | 774 | 30.5  | 540 | 21.26 | 211 | 8.31 | 4                      | 8556205 |
| DSH895U      | 4, 7               | DSH295 + DSH600 | 1050 | 41.39 | 550 | 21.65 | 870 | 34.25 | 545 | 21.46 | 206 | 8.11 | 4                      | 8556250 |
| DSH1085U     | 4, 7               | DSH485 + DSH600 | 1058 | 41.65 | 550 | 21.65 | 870 | 34.25 | 545 | 21.46 | 206 | 8.11 | 4                      | 8556248 |
| DSH1200E     | 4, 7               | DSH600 + DSH600 | 1085 | 42.72 | 550 | 21.65 | 870 | 34.25 | 545 | 21.46 | 206 | 8.11 | 4                      | 8556247 |

### **NOTE:**

Tandems to be achieved by assembly of individual compressors.

By convention, the last letter of tandems designation have been set to help to discern easily which type of manifold we are considering

**U** : Uneven tandem

**E** : Even tandem

**X**: Crossplatform (medium-large) tandem

## Trio assemblies

Figure 18: Outline drawing number 6

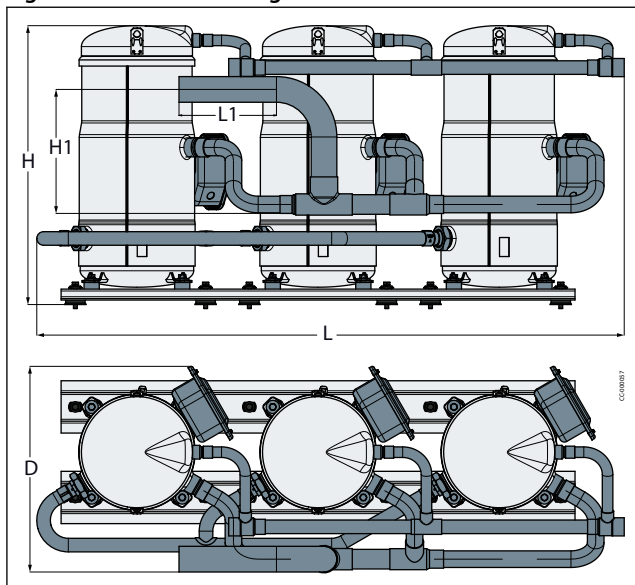


Figure 19: Outline drawing number 7

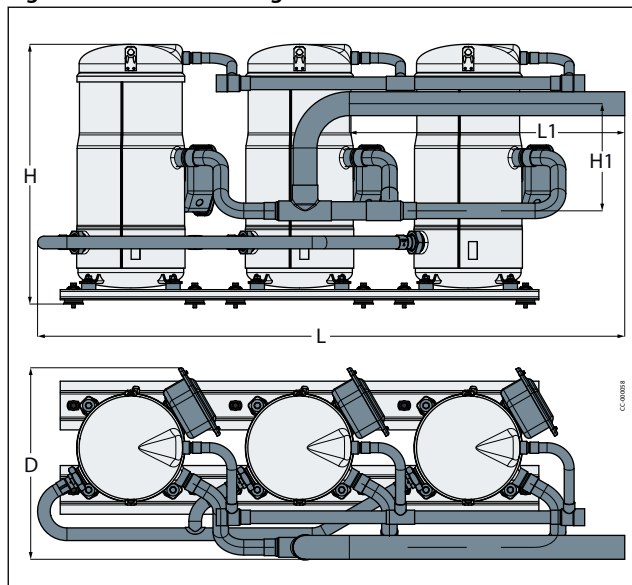


Figure 20: Outline drawing number 8

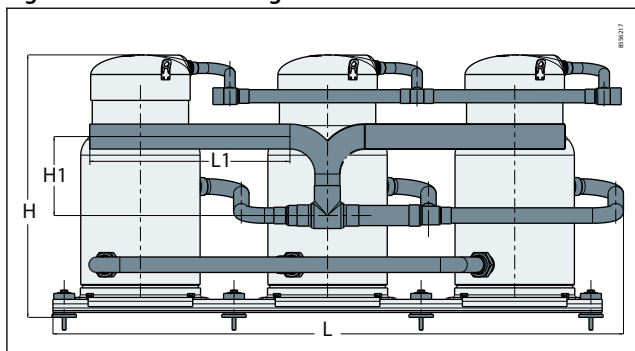


Figure 21: Outline drawing number 9

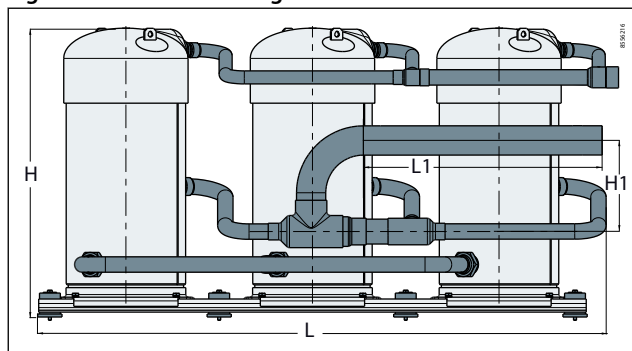


Table 16: Trio assemblies

| Trio model | Motor voltage code | Composition         | L    |       | D   |       | H   |       | L1 (Minimum) |       | H1  |       | Outline drawing number |         |
|------------|--------------------|---------------------|------|-------|-----|-------|-----|-------|--------------|-------|-----|-------|------------------------|---------|
|            |                    |                     | mm   | inch  | mm  | inch  | mm  | inch  | mm           | inch  | mm  | inch  |                        |         |
| DSH420T    | 3, 4, 7, 9         | 3×DSH140            | 1230 | 48.4  | 402 | 15.8  | 571 | 22.5  | 205          | 8.1   | 242 | 9.5   | 6                      | 8560134 |
|            |                    |                     | 1326 | 52.2  | 402 | 15.8  | 571 | 22.5  | 622          | 24.5  | 242 | 9.5   | 7                      | 8560134 |
| DSH483T    | 3, 4, 7, 9         | 3×DSH161            | 1230 | 48.4  | 402 | 15.8  | 571 | 22.5  | 205          | 8.1   | 242 | 9.5   | 6                      | 8560134 |
|            |                    |                     | 1326 | 52.2  | 402 | 15.8  | 571 | 22.5  | 622          | 24.5  | 242 | 9.5   | 7                      | 8560134 |
| DSH552T    | 3, 4, 7, 9         | 3×DSH184            | 1236 | 48.7  | 433 | 17.0  | 587 | 23.1  | 205          | 8.1   | 242 | 9.5   | 6                      | 8560133 |
|            |                    |                     | 1326 | 52.2  | 433 | 17.0  | 587 | 23.1  | 622          | 24.5  | 242 | 9.5   | 7                      | 8560133 |
| DSH720T    | 3, 4, 7, 9         | 3×DSH240            | 1467 | 57.76 | 543 | 21.38 | 701 | 27.6  | 535          | 21.06 | 211 | 8.31  | 8                      | 8556217 |
| DSH885T    | 3, 4, 7, 9         | 3×DSH295            | 1467 | 57.76 | 543 | 21.38 | 701 | 27.6  | 535          | 21.06 | 211 | 8.31  | 8                      | 8556217 |
| DSH971T    | 4, 7, 9            | 2×DSH295 + DSH381   | 1524 | 60    | 545 | 21.46 | 774 | 30.5  | 535          | 21.06 | 211 | 8.31  | 9                      | 8556317 |
| DSH1140T   | 4, 7, 9            | 3×DSH381            | 1467 | 57.76 | 545 | 21.46 | 774 | 30.5  | 535          | 21.06 | 211 | 8.31  | 9                      | 8556229 |
| DSH1140T   | 3                  | 3×DSH381            | 1467 | 57.76 | 594 | 23.39 | 774 | 30.5  | 535          | 21.06 | 211 | 8.31  | 9                      | 8556229 |
| DSH1245T   | 4, 7, 9            | 2×DSH381 + DSH485   | 1520 | 59.84 | 573 | 22.56 | 774 | 30.5  | 535          | 21.06 | 211 | 8.31  | 9                      | 8556234 |
| DSH1245T   | 3                  | 2×DSH381 + DSH485   | 1520 | 59.84 | 594 | 23.39 | 774 | 30.5  | 535          | 21.06 | 211 | 8.31  | 9                      | 8556234 |
| DSH1350T   | 4, 7, 9            | DSH381 + 2 × DSH485 | 1520 | 59.84 | 573 | 22.56 | 774 | 30.5  | 640          | 25.19 | 244 | 9.61  | 9                      | 8556235 |
| DSH1350T   | 3                  | DSH381 + 2×DSH485   | 1520 | 59.84 | 590 | 23.23 | 774 | 30.5  | 640          | 25.19 | 244 | 9.61  | 9                      | 8556235 |
| DSH1455T   | 4, 7, 9            | 3×DSH485            | 1520 | 59.84 | 573 | 22.56 | 774 | 30.5  | 640          | 25.19 | 244 | 9.61  | 9                      | 8556216 |
| DSH1455T   | 3                  | 3×DSH485            | 1520 | 59.84 | 590 | 23.23 | 774 | 30.5  | 640          | 25.19 | 244 | 9.61  | 9                      | 8556216 |
| DSH1570T   | 4, 7               | 2×DSH485 + DSH600   | 1584 | 62.36 | 573 | 22.56 | 870 | 34.25 | 628          | 24.72 | 257 | 10.12 | 9                      | 8556246 |
| DSH1685T   | 4, 7               | DSH485 + 2×DSH600   | 1584 | 62.36 | 573 | 22.56 | 870 | 34.25 | 628          | 24.72 | 257 | 10.12 | 9                      | 8556245 |
| DSH1800T   | 4, 7               | 3×DSH600            | 1605 | 63.19 | 573 | 22.56 | 870 | 34.25 | 628          | 24.72 | 257 | 10.12 | 9                      | 8556244 |

**NOTE:**

Trio to be achieved by assembly of individual compressors

## Mechanical connections

### Connection Details

Table 17: Connection Details







| Connection Details                |   | DSH090                                       | DSH105-120-140-161-184        | DSH240-295-38                                  | DSH485                             | DSH600                             |
|-----------------------------------|---|--|-------------------------------|--|------------------------------------|------------------------------------|
| Suction connection                |  | Brazed 1"1/8                                 | Brazed 1"3/8                  | Brazed 1"5/8                                   | Brazed 1"5/8                       | Brazed 2"1/8                       |
| Discharge connection              |  | Brazed 7/8"                                  | Brazed 7/8"                   | Brazed 1"1/8                                   | Brazed 1"3/8                       | Brazed 1"3/8                       |
| Oil sight glass                   |  | Threaded<br>(1"1/8 – 18 UN-<br>EF)           | Threaded<br>(1"1/8 – 18 UNEF) | Threaded<br>(1"1/8 – 18 UN-<br>EF)             | Threaded<br>(1"1/8 – 18 UN-<br>EF) | Threaded<br>(1"1/8 – 18 UN-<br>EF) |
| Oil equalization connection       |  | Rotolock 1"3/4                               | Rotolock 1"3/4                | Rotolock 2"1/4                                 | Rotolock 2"1/4                     | Rotolock 2"1/4                     |
| Oil drain connection              |  | None   |                               | Female ¼" Flare incorporating a Schrader valve |                                    |                                    |
| Low pressure gauge port (Shrader) |  | Male ¼" Flare incorporating a Schrader valve |                               |  |                                    |                                    |
| Outline drawing                   |   | 1  | 1                             | 2  | 2                                  | 2                                  |

Figure 22: Outline drawing 1

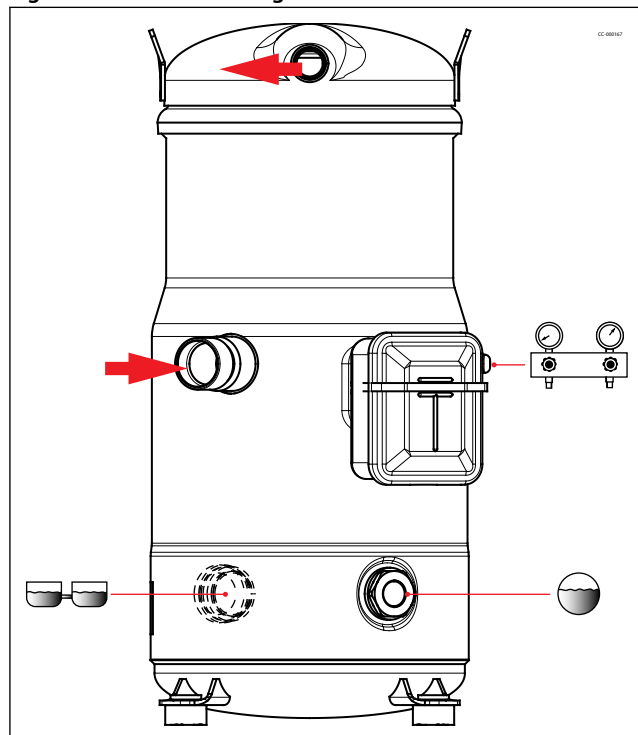
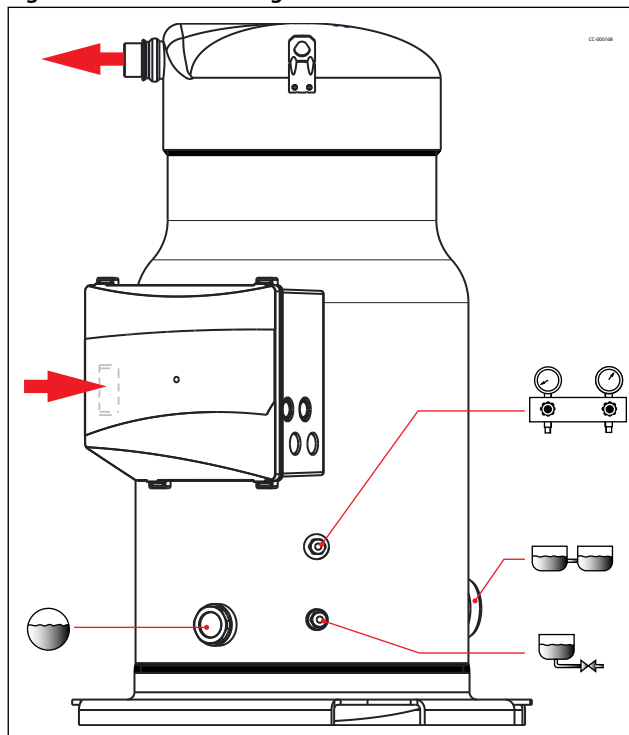


Figure 23: Outline drawing 2



### Design compressor mounting

#### General requirements

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

Compressors used in parallel applications must be mounted with rigid spacers onto rails (or directly on rails according to compressor models) and the manifold assembly must be mounted with flexible grommets onto the frame.

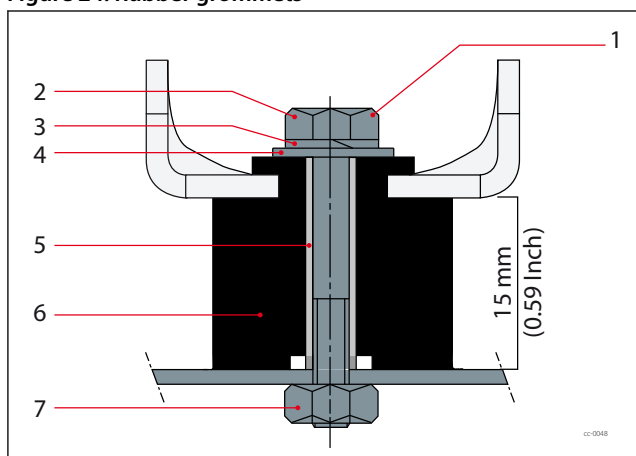
During operation, the maximum inclination from the vertical plane must not exceed 3 degrees.

## Single requirements DSH090-105-120-140-161-184 mounting

Compressors DSH090-105-120-140-161-184 are delivered with rubber grommets and steel mounting sleeve used to isolated the compressor from the base frame.

The grommets must be compressed until contact between the flat washer and the steel mounting sleeve is established. The required bolt size for the DSH090-105-120-140-161-184 compressors is HM8-40. This bolt must be tightened to a torque of 15Nm.

**Figure 24: Rubber grommets**



- |   |                               |
|---|-------------------------------|
| 1 | Tightening torque 15 Nm       |
| 2 | HM 8 bolt (4 pcs)             |
| 3 | Lock washer (4 pcs)           |
| 4 | Flat washer (4 pcs)           |
| 5 | Steel mounting sleeve (4 pcs) |
| 6 | Rubber grommet (4 pcs)        |
| 7 | Nut (4 pcs)                   |

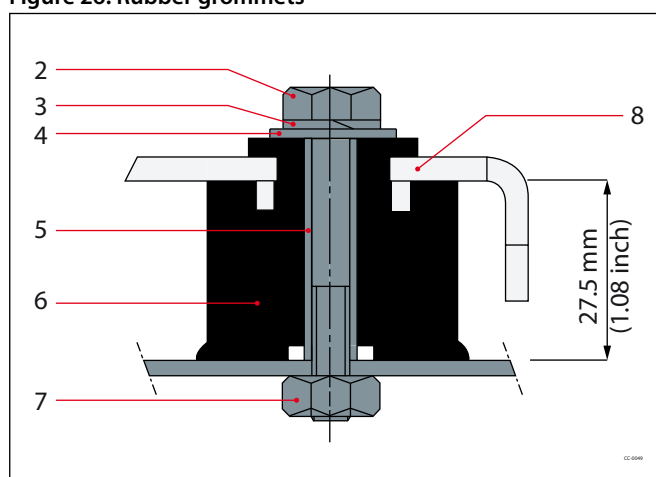
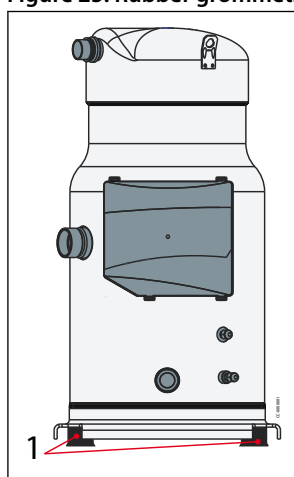
Part 2, 3, 4, 5, 6 and 7 are delivered along with compressor

## Single requirements DSH240-295-381-485 -600 mounting

To be used in single applications, an additional accessory including flexible grommets is necessary kit 8156138.

The grommets must be compressed until contact between the flat washer and the steel mounting sleeve is established. The required bolt size for the DSH240-295-381-485-600 compressors is HM8-55. This bolt must be tightened to a torque of 21Nm.

**Figure 25: Rubber grommets from kit 8156138** **Figure 26: Rubber grommets**



- |   |                                  |   |                               |
|---|----------------------------------|---|-------------------------------|
| 1 | Rubber grommets from kit 8156138 | 5 | Steel mounting sleeve (4 pcs) |
| 2 | HM 8 bolt (4 pcs)                | 6 | Rubber grommet (4 pcs)        |
| 3 | Lock washer (4 pcs)              | 7 | Nut (4 pcs)                   |
| 4 | Flat washer (4 pcs)              | 8 | Compressor base plate         |

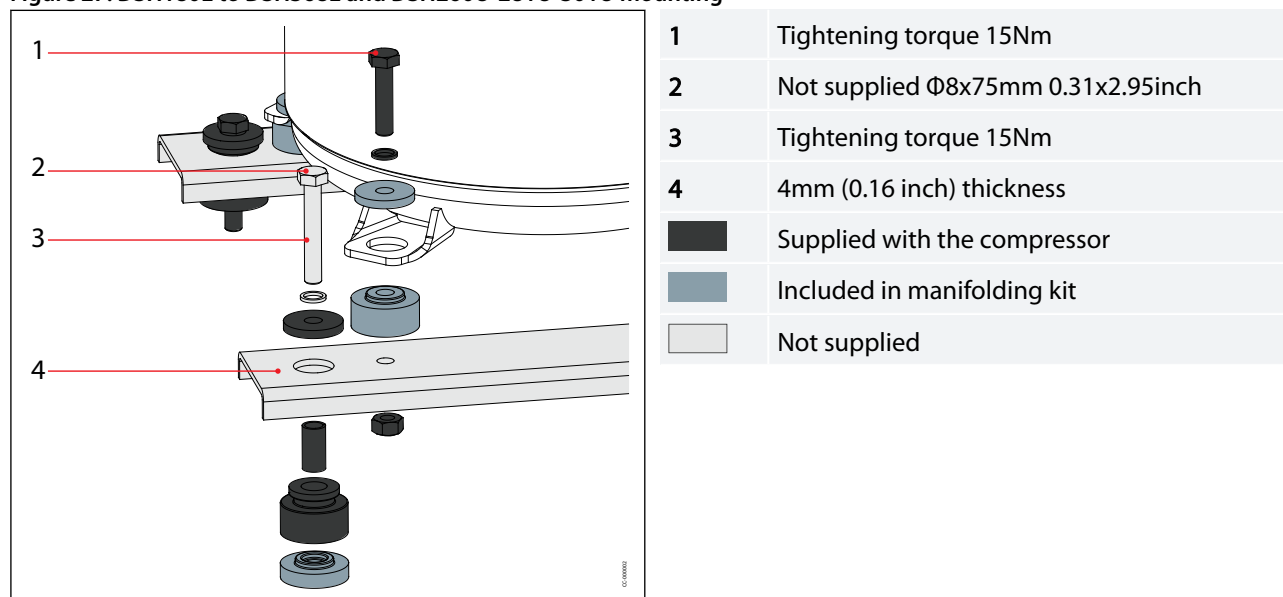
## Manifolding requirements DSH180E-210E-240E-280E-322E-368E and DSH260U-281U-301U mounting

The compressors must be mounted with rigid mounting spacers on rails. Rubber grommets and spacers must be installed below the rails.

The rigid mounting spacers are included in tandem accessory kits. The rubber grommets are supplied with compressor.

For more details about parallel mounting feet, please see parallel unit outline drawing.

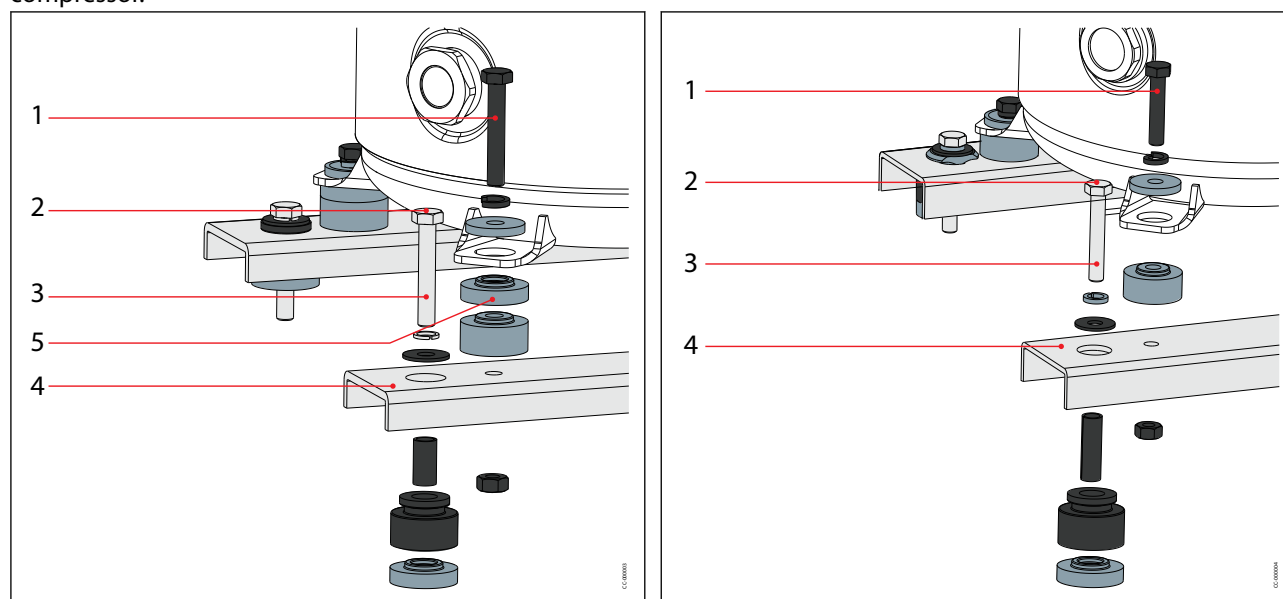
Figure 27: DSH180E to DSH368E and DSH260U-281U-301U mounting



## Manifolding requirements DSH195U-210U-230U-251U-274U-289U-304U-324U-345U mounting

The compressors must be mounted with rigid mounting spacers on rails. Rubber grommets and spacers must be installed below the rails.

The rigid mounting spacers are included in tandem accessory kits. The rubber grommets are supplied with compressor.






|   |                              |   |  |
|---|------------------------------|---|--|
| 1 | Tightening torque 15Nm       | 5   | Additional rigid spacer (Refer to table below) |
| 2 | Not supplied HM8mm 0.31 inch |  | Supplied with the compressor                   |
| 3 | Tightening torque 15 Nm      |  | Included in manifolding kit                    |
| 4 | 4mm (0.16 inch) Thickness    |  | Not supplied                                   |

Table 18: Additionnal rigid spacer

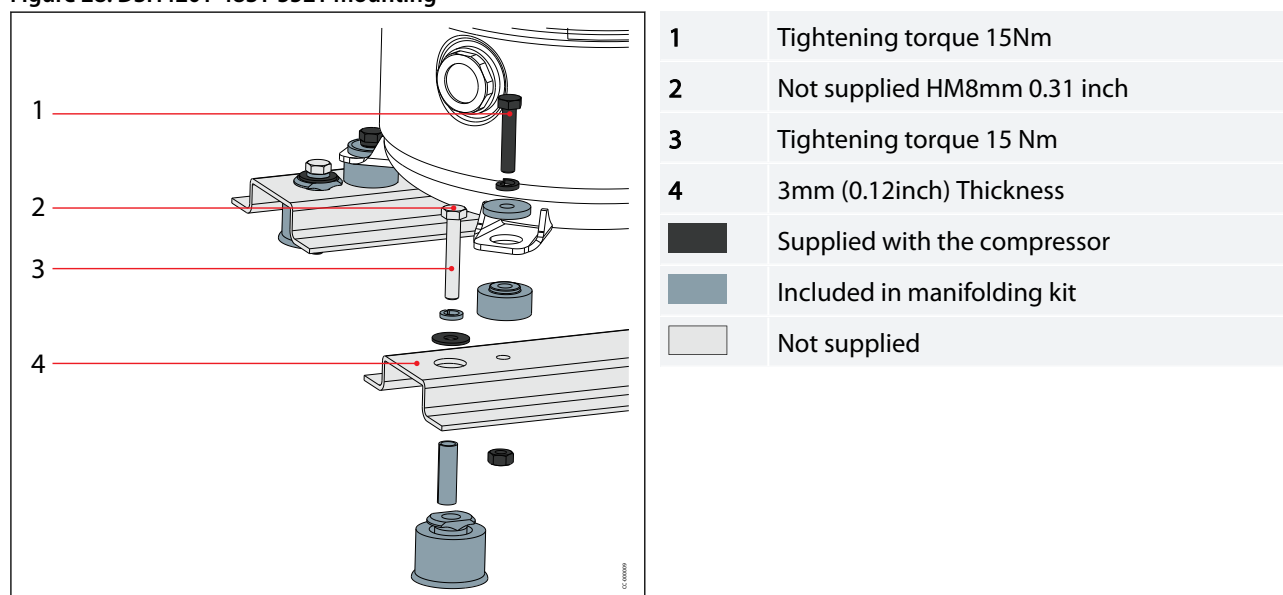
| Tandem                                | Additional rigid spacer (to be added on the smallest compressor of the tandem) |
|---------------------------------------|--|
| DSH195U-210U-230U-251U-289U-304U-345U | 7 mm   |
| DSH274U                               | 14 mm  |

### Tandem requirements DSH420T-483T-552T

The compressors must be mounted with rigid mounting spacers on rails. Rubber grommets and spacers must be installed below the rails.

The rigid mounting spacers and rubber grommets are included in tandem accessory kits.

Figure 28: DSH420T-483T-552T mounting

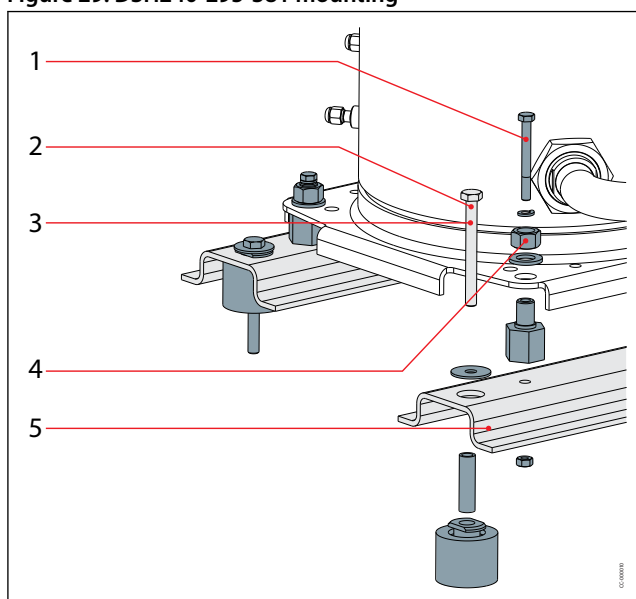


### Tandem requirements DSH360X-424X-456X-479X-565X mounting

The large compressor, DSH240, 295 or 381, is mounted with rigid spacers on the rails.

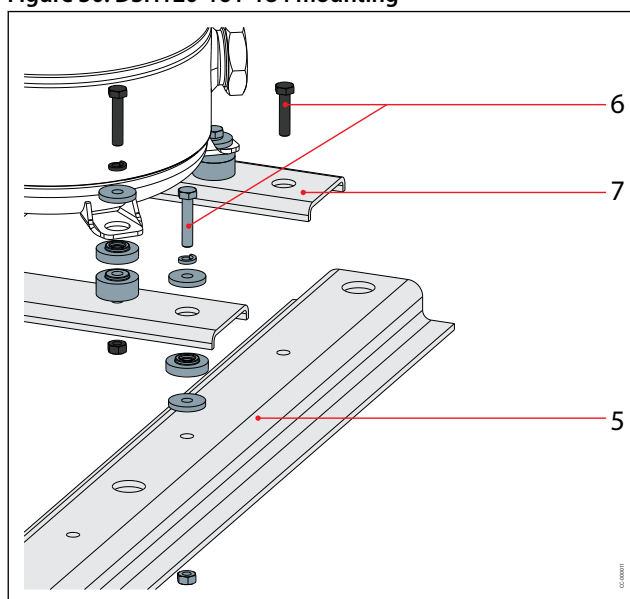
The DSH120, 161 or 184 compressor is fixed on beams by rigid spacer, and the beams are mounted with rigid spacers on the rails. Rubber grommets and spacers must be installed below the rails.

Figure 29: DSH240-295-381 mounting



|   |                                 |
|---|---------------------------------|
| 1 | Tightening torque 16Nm          |
| 2 | Not supplied $\Phi 10\text{mm}$ |
| 3 | Tightening torque 50Nm          |
| 4 | Tightening torque 55Nm          |
| 5 | 5mm (0.2inch) thickness         |

Figure 30: DSH120-161-184 mounting



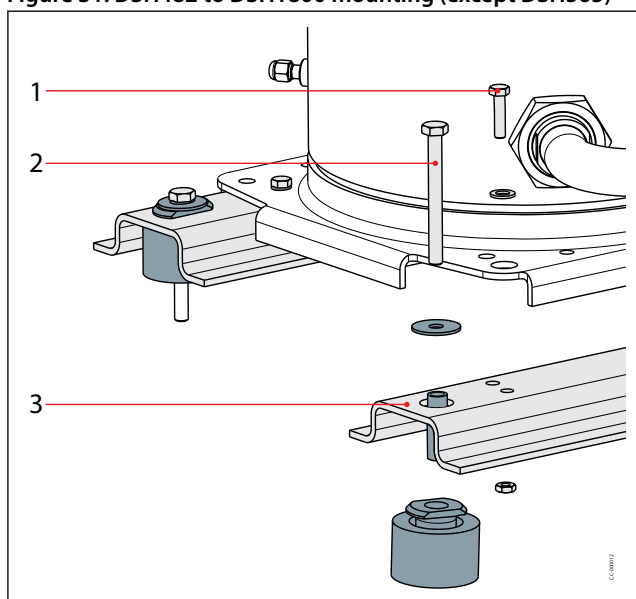
|   |                              |
|---|------------------------------|
| 6 | Tightening torque 15Nm       |
| 7 | 4mm (0.16inch) thickness     |
|   | Supplied with the compressor |
|   | Included in manifold kit     |
|   | Not supplied                 |

### Tandem requirements DSH482 to DSH1800 mounting (except DSH565)

For parallel mounting, the compressors can be mounted directly on the rails. Rubber grommets and spacers must be installed below the rails.

These parts are included in accessories.

Figure 31: DSH482 to DSH1800 mounting (except DSH565)



|   |  |
|---|--|
| 1 | HM10 x 30 class 10.9 Tightening torque 50 Nm   |
| 2 | HM10 x 100 class 10.9 Tightening torque 50Nm   |
| 3 | Thickness : 5mm (0.2 inch) (6mm (0.24 inch) for manifold configurations using one or several DSH600) |
|   | Included in tandem/trio kit  |
|   | Not supplied   |

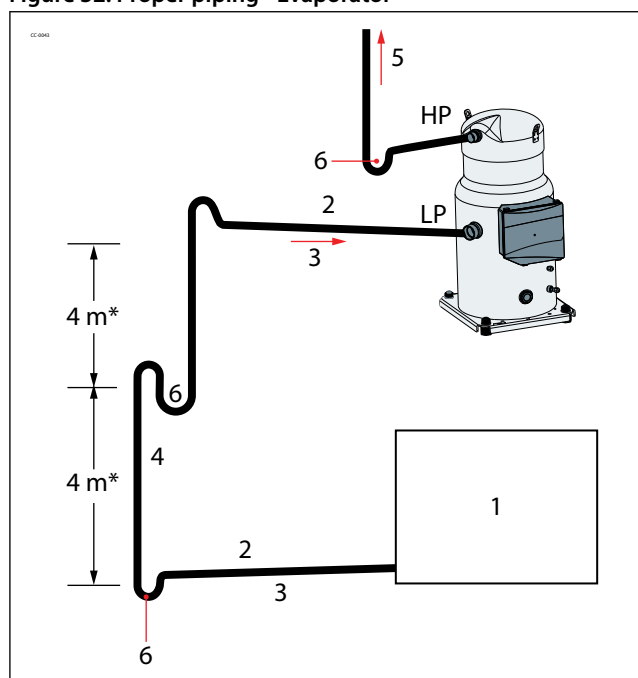
## Design piping

### General requirements

Proper piping practices should be employed to:

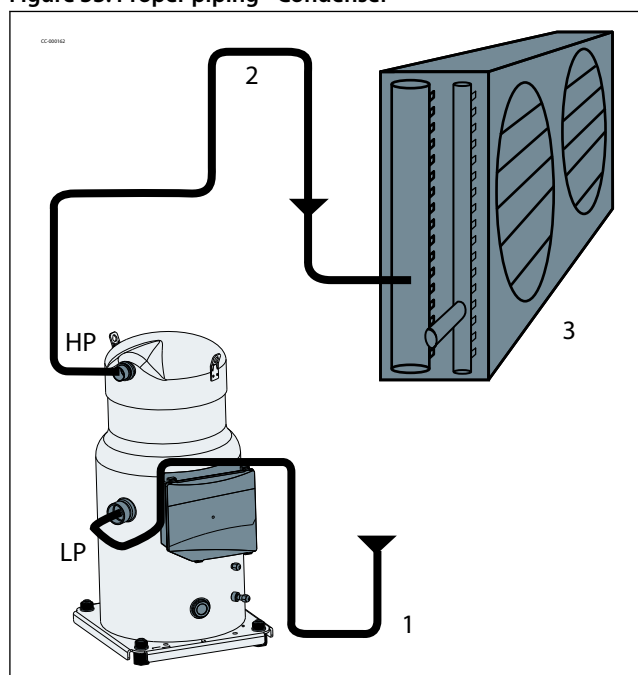
1. Ensure adequate oil return, even under minimum load conditions (refrigerant speed, piping slopes...). For validation tests see section Manage oil in the circuit.
2. Avoid condensed liquid refrigerant from draining back to the compressor when stopped (discharge piping upper loop). For validation tests see section Manage off cycle migration.
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 Sound and vibration data.

Figure 32: Proper piping - Evaporator



|   |                              |
|---|------------------------------|
| 1 | Evaporator                   |
| 2 | 0.5% slope                   |
| 3 | 4m/s or more                 |
| 4 | 8 to 12 m/s                  |
| 5 | To condenser                 |
| 6 | U-trap, as short as possible |
| * | Max.                         |

Figure 33: Proper piping - Condenser



|   |                |
|---|----------------|
| 1 | 3D flexibility |
| 2 | Upper loop     |
| 3 | Condenser      |

## Tandem and trio requirements (Static)

Tandem and trio use static oil balancing principle to equalize oil level between the compressors by gravity. This is ensured by a precise suction and oil equalization piping design.

The discharge line has no impact on oil balancing. It is shown with tee, to indicate that both left and right side discharge headers are possible.

By default, DSH tandems and trios are not factory-built. To complete an assembly in the field, you will need:

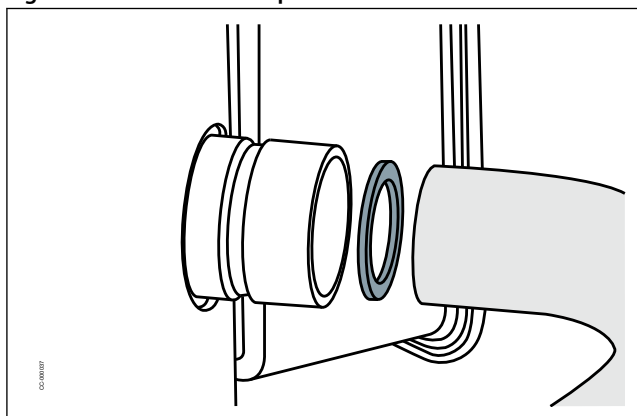
- Tubings, according to specific outline drawings indicated in the following table.
- Manifolding accessory kit.
- Compressors.



**R** Suction and oil equalization piping drawings must be respected (diameters, minimum straight lengths, ...)

## Suction washer position

**R** Depending on manifold configuration, it is essential to equalize the pressure of compressor sumps. Hence, a suction washer must be added on certain compressors according to the table. Suction washers are included in tandem or trio accessory kits as described in the illustrations.

Figure 34: Suction washer position



|   |  |
|---|--|
|  | Included in tandem or trio accessory kit |
|  | Not supplied                             |

By convention, the compressor order (No.1, No.2 ...) is defined counting from left to right, placed on the side facing the electrical boxes of the compressors (see example below on a trio)

Figure 35: Example of right suction

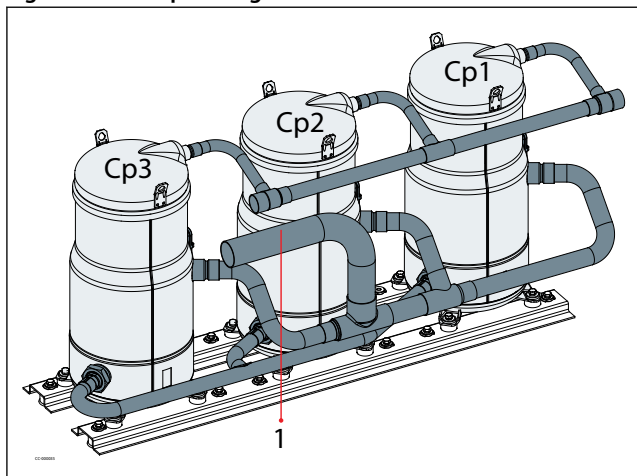
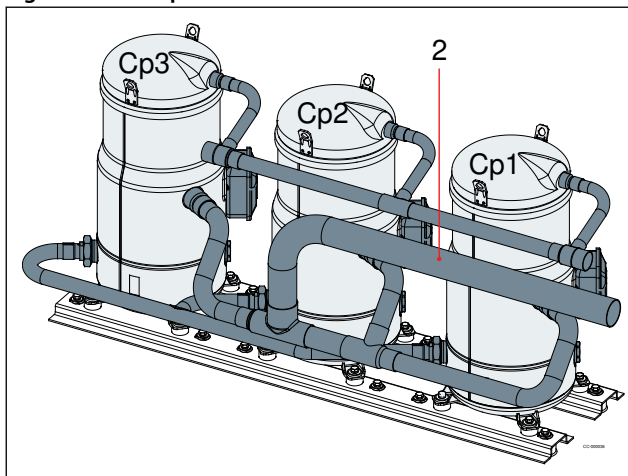


Figure 36: Example of left suction



## Scroll compressors, DSH090 to DSH600 | Mechanical connections

|     |                                |     |              |
|-----|--------------------------------|-----|--------------|
| 1   | Trio models with Right suction | Cp2 | Compressor 2 |
| 2   | Trio models with Left suction  | Cp3 | Compressor 3 |
| Cp1 | Compressor 1                   |     |              |

### Tandem models

Table 19: Tandem models

| Tandem model | Composition Cp1 + Cp2 | Suction | Dis-charge | Oil equaliza-tion | Outline drawing number | Suction from  | Washer inner di-<br>ameter             | Washer in suction<br>of | Tandem kit<br>code |
|--------------|-----------------------|---------|------------|-------------------|------------------------|---------------|--|-------------------------|--------------------|
| DSH180E      | DSH090+DSH090         | 1"5/8   | 1" 3/8     | 1" 1/8            | 8560115                | Left<br>Right | Not needed                             | -                       | 120Z0634           |
| DSH195U      | DSH090+DSH105         | 1"5/8   | 1" 3/8     | 1" 1/8            | 8556233                | Left<br>Right | 25mm(0.98 inch)<br>26mm(1.02 inch)     | Cp2<br>Cp2              | 120Z0694           |
| DSH210U      | DSH090+DSH120         | 1"5/8   | 1" 3/8     | 1" 1/8            | 8556233                | Left<br>Right | 27mm(1.06 inch)<br>27mm(1.06 inch)     | Cp2<br>Cp2              | 120Z0694           |
| DSH210E      | DSH105+DSH105         | 1"5/8   | 1" 3/8     | 1" 1/8            | 8560114                | Left<br>Right | Not needed                             | -                       | 120Z0634           |
| DSH230U      | DSH090+DSH140         | 1"5/8   | 1" 3/8     | 1" 1/8            | 8556233                | Left<br>Right | 23mm(0.91 inch)<br>23mm(0.91 inch)     | Cp1<br>Cp1              | 120Z0694           |
| DSH240E      | DSH120+DSH120         | 1"5/8   | 1" 3/8     | 1" 1/8            | 8560114                | Left<br>Right | Not needed                             | -                       | 120Z0634           |
| DSH251U      | DSH090+DSH161         | 1"5/8   | 1" 3/8     | 1" 1/8            | 8556233                | Left<br>Right | 21mm(0.83 inch)<br>21mm(0.83 inch)     | Cp1<br>Cp1              | 120Z0694           |
| DSH260U      | DSH140+DSH120         | 1"5/8   | 1" 3/8     | 1" 1/8            | 8556230                | Left<br>Right | 27mm(1.06 inch)<br>27mm(1.06 inch)     | Cp1<br>Cp1              | 120Z0692           |
| DSH274U      | DSH090+DSH184         | 1"5/8   | 1" 3/8     | 1" 1/8            | 8556232                | Left<br>Right | 20mm(0.79 inch)<br>20mm(0.79 inch)     | Cp1<br>Cp1              | 120Z0693           |
| DSH281U      | DSH161+DSH120         | 1"5/8   | 1" 3/8     | 1" 1/8            | 8556230                | Left<br>Right | 25mm(0.98 inch)<br>25mm(0.98 inch)     | Cp1<br>Cp1              | 120Z0692           |
| DSH280E      | DSH140+DSH140         | 1"5/8   | 1" 3/8     | 1" 1/8            | 8560114                | Left<br>Right | Not needed                             | -                       | 120Z0634           |
| DSH289U      | DSH105+DSH184         | 1"5/8   | 1" 3/8     | 1" 1/8            | 8556231                | Left<br>Right | 23mm(0.91 inch)<br>23mm(0.91 inch)     | Cp1<br>Cp1              | 120Z0693           |
| DSH301U      | DSH161+DSH140         | 1"5/8   | 1" 3/8     | 1" 1/8            | 8556230                | Left<br>Right | 27.5mm(1.08 inch)<br>26mm(1.02 inch)   | Cp1<br>Cp1              | 120Z0692           |
| DSH304U      | DSH120+DSH184         | 1"5/8   | 1" 3/8     | 1" 1/8            | 8556231                | Left<br>Right | 24mm(0.94 inch)<br>24mm(0.94 inch)     | Cp1<br>Cp1              | 120Z0694           |
| DSH322E      | DSH161+DSH161         | 1"5/8   | 1" 3/8     | 1" 1/8            | 8560114                | Left<br>Right | Not needed                             | -                       | 120Z0634           |
| DSH324U      | DSH140+DSH184         | 1"5/8   | 1" 3/8     | 1" 1/8            | 8556231                | Left<br>Right | 25mm(0.98 inch)<br>25mm(0.98 inch)     | Cp1<br>Cp1              | 120Z0694           |
| DSH345U      | DSH161+DSH184         | 1"5/8   | 1" 3/8     | 1" 1/8            | 8556231                | Left<br>Right | 27.5mm(1.08 inch)<br>27.5mm(1.08 inch) | Cp1<br>Cp1              | 120Z0694           |
| DSH360X      | DSH120+DSH240         | 2"1/8   | 1" 3/8     | 1" 3/8            | 8560128                | Left<br>Right | 24mm(0.94 inch)<br>25mm(0.98 inch)     | Cp1<br>Cp1              | 120Z0781           |
| DSH368E      | DSH184+DSH184         | 1"5/8   | 1" 3/8     | 1" 1/8            | 8560113                | Left<br>Right | Not needed                             | -                       | 120Z0634           |
| DSH424X      | DSH184+DSH240         | 2"1/8   | 1" 3/8     | 1" 3/8            | 8556259                | Left<br>Right | 35.5mm(1.4 inch)<br>35.5mm(1.4 inch)   | Cp2<br>Cp2              | 120Z0781           |
| DSH456X      | DSH161+DSH1295        | 2"1/8   | 1" 3/8     | 1" 3/8            | 8560128                | Left<br>Right | 25mm(0.98 inch)<br>26mm(1.02 inch)     | Cp1<br>Cp1              | 120Z0781           |
| DSH479X      | DSH184+DSH295         | 2"1/8   | 1" 3/8     | 1" 3/8            | 8556259                | Left<br>Right | 26mm(1.02 inch)<br>26mm(1.02 inch)     | Cp1<br>Cp1              | 120Z0781           |
| DSH482E      | DSH240+DSH240         | 2"1/8   | 1" 5/8     | 1" 3/8            | 8556228                | Left<br>Right | Not needed                             | -                       | 120Z0792           |
| DSH535U      | DSH240+DSH295         | 2"1/8   | 1" 5/8     | 1" 3/8            | 8556228                | Left<br>Right | 31mm(1.22 inch)<br>31mm(1.22 inch)     | Cp1<br>Cp1              | 120Z0796           |

## Scroll compressors, DSH090 to DSH600 | Mechanical connections

| Tandem model | Composition Cp1 + Cp2 | Suction | Dis-charge | Oil equaliza-tion | Outline drawing number | Suction from | Washer inner di-<br>ameter | Washer in suction<br>of | Tandem kit<br>code |
|--------------|-----------------------|---------|------------|-------------------|------------------------|--------------|----------------------------|-------------------------|--------------------|
| DSH565X      | DSH184+DSH381         | 2"1/8   | 1" 3/8     | 1" 3/8            | 8556260                | Left         | 24mm(0.94inch)             | Cp1                     | 120Z0781           |
|              |                       |         |            |                   |                        | Right        | 24mm(0.94inch)             | Cp1                     |                    |
| DSH590E      | DSH295+DSH295         | 2"1/8   | 1" 5/8     | 1" 3/8            | 8556228                | Left         | Not needed                 | -                       | 120Z0792           |
|              |                       |         |            |                   |                        | Right        |                            |                         |                    |
| DSH620U      | DSH240+DSH381         | 2"1/8   | 1" 5/8     | 1" 3/8            | 8556222                | Left         | 29mm(1.14 inch)            | Cp1                     | 120Z0791           |
|              |                       |         |            |                   |                        | Right        | 29mm(1.14 inch)            | Cp1                     |                    |
| DSH675U      | DSH295+DSH381         | 2"1/8   | 1" 5/8     | 1" 3/8            | 8556222                | Left         | 31mm(1.22 inch)            | Cp1                     | 120Z0796           |
|              |                       |         |            |                   |                        | Right        | 31mm(1.22 inch)            | Cp1                     |                    |
| DSH725U      | DSH240+DSH485         | 2"1/8   | 1" 5/8     | 1" 5/8            | 8556207                | Left         | 24mm(0.94inch)             | Cp1                     | 120Z0786           |
|              |                       |         |            |                   |                        | Right        | 24mm(0.94inch)             | Cp1                     |                    |
| DSH760E      | DSH381+DSH381         | 2"1/8   | 1" 5/8     | 1" 3/8            | 8556223                | Left         | Not needed                 | -                       | 120Z0792           |
|              |                       |         |            |                   |                        | Right        |                            |                         |                    |
| DSH780U      | DSH295+DSH485         | 2"5/8   | 1" 5/8     | 1" 5/8            | 8556220                | Left         | 27mm(1.06 inch)            | Cp1                     | 120Z0787           |
|              |                       |         |            |                   |                        | Right        | 27mm(1.06 inch)            | Cp1                     |                    |
| DSH865U      | DSH381+DSH485         | 2"5/8   | 1" 5/8     | 1" 5/8            | 8556224                | Left         | 30mm(1.18 inch)            | Cp1                     | 120Z0788           |
|              |                       |         |            |                   |                        | Right        | 30mm(1.18 inch)            | Cp1                     |                    |
| DSH895U      | DSH295+DSH600         | 2"5/8   | 1" 5/8     | 1" 5/8            | 8556250                | Left         | Not needed                 | -                       | 120Z0726           |
|              |                       |         |            |                   |                        | Right        |                            |                         |                    |
| DSH970E      | DSH485+DSH485         | 2"5/8   | 1" 5/8     | 1" 5/8            | 8556205                | Left         | Not needed                 | -                       | 120Z0785           |
|              |                       |         |            |                   |                        | Right        |                            |                         |                    |
| DSH1085U     | DSH485 + DSH600       | 2"5/8   | 1" 5/8     | 1" 5/8            | 8556248                | Left         | Not needed                 | -                       | 120Z0726           |
|              |                       |         |            |                   |                        | Right        | 38mm(1.5 inch)             | Cp2                     | 120Z0821           |
| DSH1200E     | DSH600 + DSH600       | 2"5/8   | 1" 5/8     | 2" 1/8            | 8556247                | Left         | Not needed                 | -                       | 120Z0726           |
|              |                       |         |            |                   |                        | Right        |                            |                         |                    |

### NOTE:

Note: For cross platform tandem application, which tandem model name ending with X, a external non-return valve (NRV) is highly recommended to install on DSH120/161/184 no internal non return valve model's discharge line.

### Trio models

Table 20: Trio models

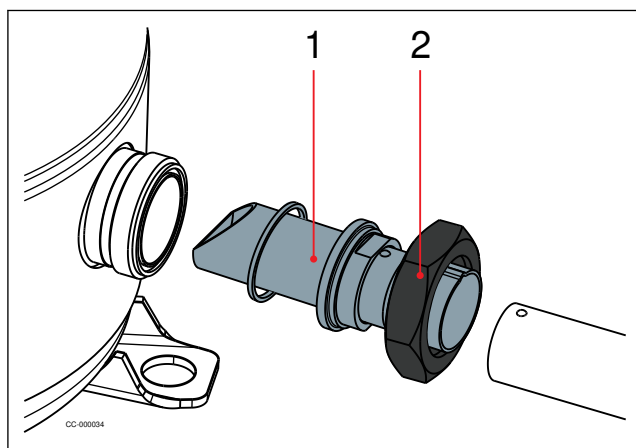
| Trio model | Composition Cp1 + Cp2<br>+Cp3 | Suction | Dis-charge | Oil equaliza-tion | Outline drawing number | Suction from | Washer inner di-<br>ameter | Washer in<br>suction of | Trio kit code |
|------------|-------------------------------|---------|------------|-------------------|------------------------|--------------|----------------------------|-------------------------|---------------|
| DSH420T    | DSH140+DSH140 +DSH140         | 2"1/8   | 1" 3/8     | 1" 1/8            | 8560134                | Left         | 26mm(1.02 inch)            | Cp1                     | 120Z0714      |
|            |                               |         |            |                   |                        |              | 25mm(0.98 inch)            | Cp3                     |               |
|            |                               |         |            |                   |                        | Right        | 26mm(1.02 inch)            | Cp1                     |               |
|            |                               |         |            |                   |                        |              | 24mm(0.94inch)             | Cp3                     |               |
| DSH483T    | DSH161+DSH161 +DSH161         | 2"1/8   | 1" 3/8     | 1" 1/8            | 8560134                | Left         | 26mm(1.02 inch)            | Cp1                     | 120Z0714      |
|            |                               |         |            |                   |                        |              | 25mm(0.98 inch)            | Cp3                     |               |
|            |                               |         |            |                   |                        | Right        | 26mm(1.02 inch)            | Cp1                     |               |
|            |                               |         |            |                   |                        |              | 25mm(0.98 inch)            | Cp3                     |               |
| DSH552T    | DSH184+DSH184 +DSH184         | 2"1/8   | 1" 3/8     | 1" 1/8            | 8560133                | Left         | 26mm(1.02 inch)            | Cp1                     | 120Z0714      |
|            |                               |         |            |                   |                        |              | 25mm(0.98 inch)            | Cp3                     |               |
|            |                               |         |            |                   |                        | Right        | 25.5mm(1.00 inch)          | Cp1                     |               |
|            |                               |         |            |                   |                        |              | 25mm(0.98 inch)            | Cp3                     |               |
| DSH720T    | DSH240+DSH240+DSH240          | 2"5/8   | 1" 5/8     | 1" 5/8            | 8556217                | Left         | 30 mm(1.18 inch)           | Cp3                     | 120Z0784      |
|            |                               |         |            |                   |                        | Right        | 34.5 mm(1.36 inch)         | Cp1 & Cp3               | 120Z0794      |
| DSH885T    | DSH295+DSH295+DSH295          | 2"5/8   | 1" 5/8     | 1" 5/8            | 8556217                | Left         | 30 mm(1.18 inch)           | Cp3                     | 120Z0784      |
|            |                               |         |            |                   |                        | Right        | 34.5 mm(1.36 inch)         | Cp1 & Cp3               | 120Z0794      |
| DSH971T    | DSH295+DSH295+DSH381          | 2"5/8   | 1" 5/8     | 1" 5/8            | 8556317                | Left         | Not needed                 | -                       | 120Z0790      |
|            |                               |         |            |                   |                        | Right        | Not needed                 | -                       | 120Z0790      |
| DSH1140T   | DSH381+DSH381+DSH381          | 2"5/8   | 1" 5/8     | 1" 5/8            | 8556229                | Left         | 31 mm(1.22 inch)           | Cp1                     | 120Z0783      |
|            |                               |         |            |                   |                        | Right        | 29 mm(1.14 inch)           | Cp3                     | 120Z0782      |
| DSH1245T   | DSH381+DSH381 +DSH485         | 2"5/8   | 2" 1/8     | 1" 5/8            | 8556234                | Left         | 29 mm(1.14 inch)           | Cp1                     | 120Z0789      |
|            |                               |         |            |                   |                        | Right        | 29 mm(1.14 inch)           | Cp1                     |               |

| Trio model | Composition Cp1 + Cp2 +Cp3 | Suction | Dis-charge | Oil equaliza-tion | Outline drawing number | Suction from | Washer inner di-<br>ameter | Washer in<br>suction of | Trio kit code |
|------------|----------------------------|---------|------------|-------------------|------------------------|--------------|----------------------------|-------------------------|---------------|
| DSH1350T   | DSH381+DSH485 +DSH485      | 3"1/8   | 2" 1/8     | 1" 5/8            | 8556235                | Left         | 29 mm(1.14 inch)           | Cp3                     | 120Z0789      |
|            |                            |         |            |                   |                        | Right        | 29 mm(1.14 inch)           | Cp3                     |               |
| DSH1455T   | DSH485+DSH485+DSH485       | 3"1/8   | 2" 1/8     | 1" 5/8            | 8556216                | Left         | 33 mm(1.3 inch)            | Cp2 & Cp3               | 120Z0793      |
|            |                            |         |            |                   |                        | Right        | 29 mm(1.14 inch)           | Cp3                     |               |
| DSH1570T   | DSH485+DSH485+DSH600       | 3"1/8   | 2" 1/8     | 1" 5/8            | 8556246                | Left         | 36mm(1.42 inch)            | Cp3                     | 120Z0822      |
|            |                            |         |            |                   |                        | Right        | 36mm(1.42 inch)            | Cp3                     | 120Z0822      |
| DSH1685T   | DSH485+DSH600+DSH600       | 3"1/8   | 2" 1/8     | 1" 5/8            | 8556245                | Left         | 42mm (1.65 inch)           | Cp2                     | 120Z0819      |
|            |                            |         |            |                   |                        | Right        | 41mm (1.61 inch)           | Cp3                     | 120Z0820      |
| DSH1800T   | DSH600+DSH600+DSH600       | 3"1/8   | 2" 1/8     | 1" 5/8            | 8556244                | Left         | Not needed                 | -                       | 120Z0712      |
|            |                            |         |            |                   |                        | Right        |                            |                         |               |

## Oil equalization design DSH180E to DSH368E

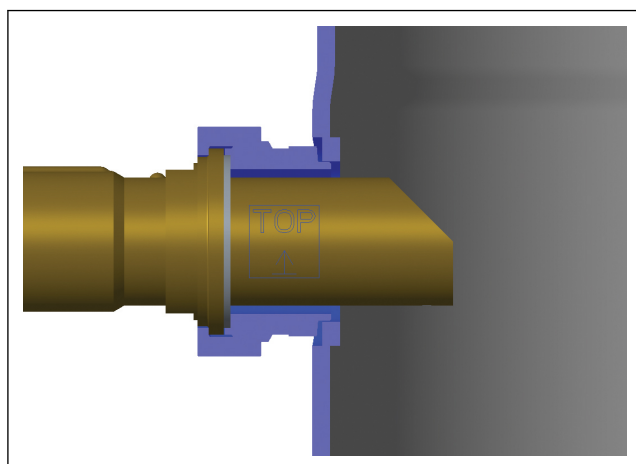
The oil level is balanced by a pipe of 1"1/8 oil equalization line.

In order ensure best oil balance, the organ pipe need to be mounted inside the oil equalization port as indicated on below picture. To connect the equalization line on rotolock connections, the organ pipe adaptor and teflon gasket are included in the tandem kit must be used.



|   |                              |
|---|------------------------------|
| 1 | Organ pipe                   |
| 2 | Tightening torque 100Nm      |
|   | Supplied with the compressor |
|   | Included in tandem kit       |

The organ pipe needs to be installed in the direction indicated by the label attached on pipe surface, which will ensure best oil balance.



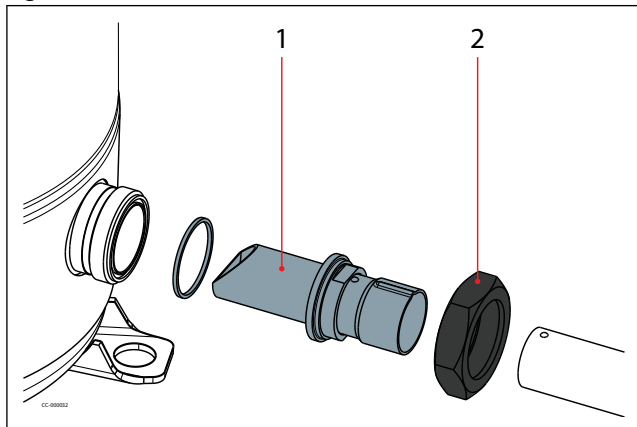
## Oil equalization design DSH360X-424X-456X-479X-565X

The oil level is balanced by a pipe of 1"3/8 oil equalization line.

In order to ensure best oil balance, the organ pipe need to be mounted inside the DSH120, 161 or 184 oil equalization port as indicated on below picture. DSH240, 295 or 381 has integrated organ pipe inside the oil equalization port.

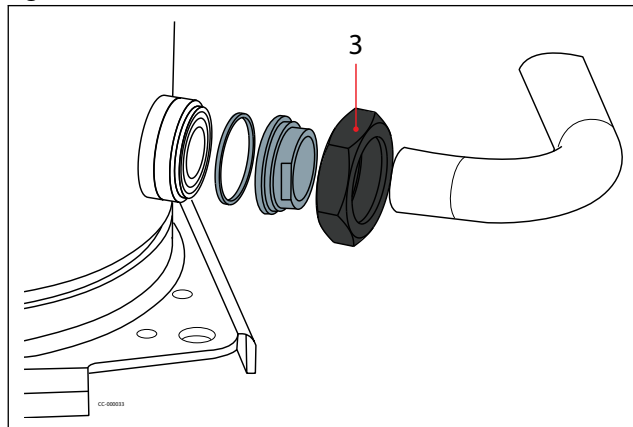
To connect the equalization line on rotolock connections, the organ pipe, adaptor sleeves, Teflon gaskets included in the tandem accessory kit must be used.

Figure 37: For DSH120, DSH161 or DSH184



|   |                         |
|---|-------------------------|
| 1 | Organ pipe              |
| 2 | Tightening torque 100Nm |
| 3 | Tightening torque 145Nm |

Figure 38: DSH240, DSH295 or DSH381

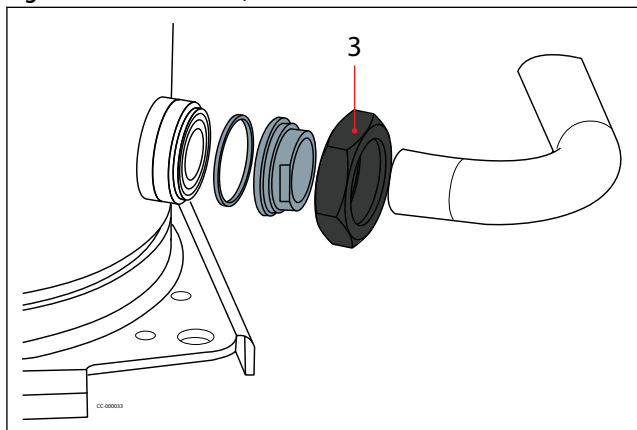




|                              |
|------------------------------|
| Supplied with the compressor |
| Included in tandem kit       |

### Oil equalization design DSH482-535, DSH590 to DSH1800

The oil level is balanced by a pipe of 1"3/8 or 1"5/8. To connect the equalization line on rotolock connections, the adaptor sleeves included in the tandem or trio accessory kit must be used.

Figure 39: DSH482-535, DSH590 to DSH1800



|   |                              |
|---|------------------------------|
| 3   | Tightening torque 145Nm      |
|  | Supplied with the compressor |
|  | Included in tandem kit       |

## Electrical connections

### Wiring connections

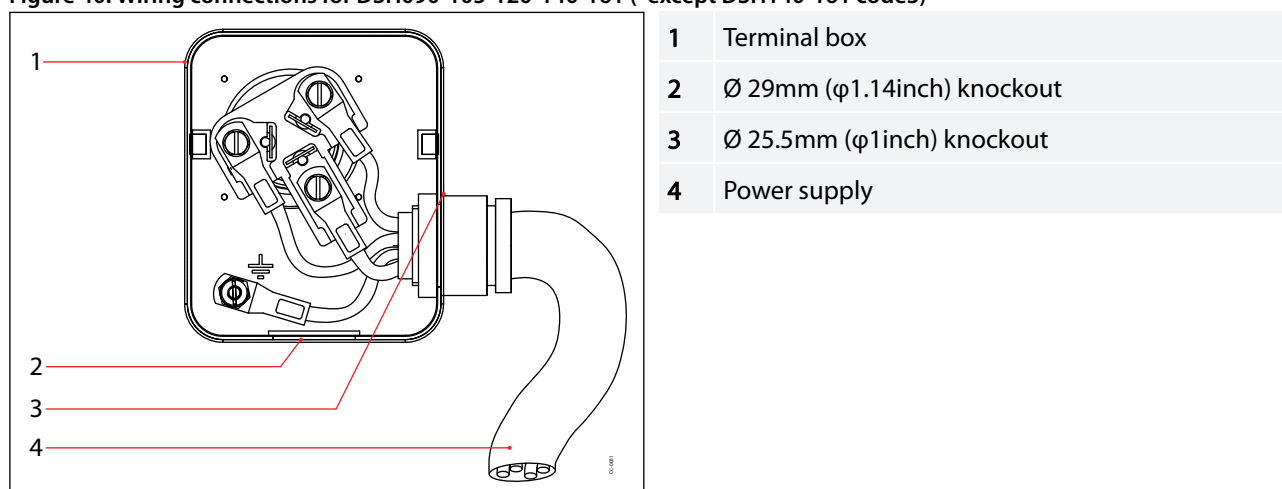
According to compressor model, electrical power is connected to the compressor terminals either by 4.8mm (10-32) screws or by M5 studs and nuts. In both cases the maximum tightening torque is 3 Nm.

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

#### DSH090-105-120-140-161 (\*except DSH140-161 code3)

The terminal box is provided with a Ø 25.5mm (φ1 inch) (ISO25) and a Ø 29mm (φ1.14) (PG21) knockouts.

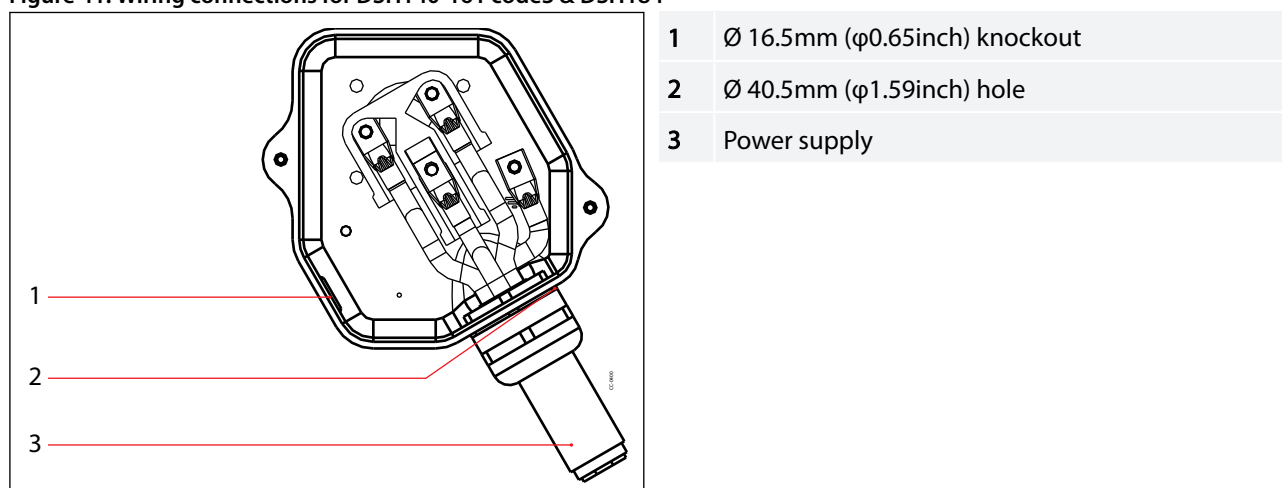
Figure 40: Wiring connections for DSH090-105-120-140-161 (\*except DSH140-161 code3)



#### DSH140-161 code3 & DSH184

The terminal box is provided with a Ø 40.5mm (φ1.59inch) hole (ISO40) for power supply and a Ø 16.5mm (φ0.65inch) knockout (ISO16).

Figure 41: Wiring connections for DSH140-161 code3 & DSH184



#### DSH240-295-381\*-485\* -600 (\*except code 3)

The terminal box is provided with 2 triple knockouts and 1 single knockout for power supply and 4 double knockouts for the safety control circuit.

The 3 power supply knockouts accommodate the following diameters:

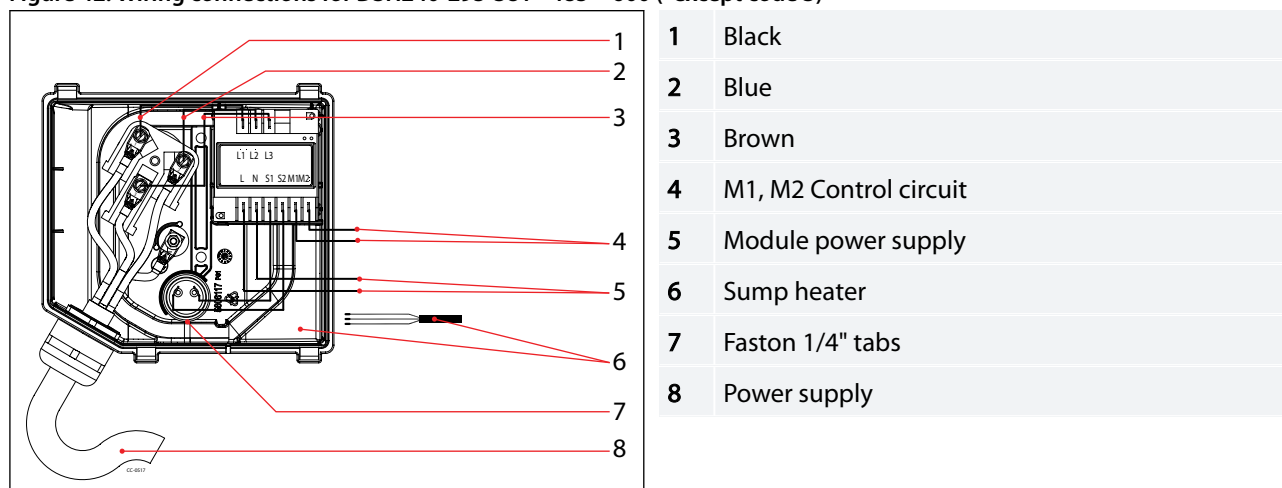
## Scroll compressors, DSH090 to DSH600 | Electrical connections

- Ø 50.8mm (φ 2inch) (UL 1"1/2 conduit) & Ø 43.7mm (φ 1.72inch) (UL 1"1/4 conduit) & Ø 34.5mm (φ 1.36 inch) (UL 1" conduit)
- Ø 40.5mm (φ 1.59inch) (ISO40) & Ø 32.2mm (φ 1.27inch) (ISO32) & Ø 25.5 mm (φ 1 inch) (ISO25)
- Ø 25.5 mm (φ 1 inch) (ISO25)

The 4 others knockouts are as follows:

- Ø 22.5mm (φ 0.89inch) (PG16) (UL 1/2") & Ø 16.5mm (φ 0.65inch) (ISO16) (x2)
- Ø 20.7mm (φ 0.81inch) (ISO20 or PG13.5) (x2)

**Figure 42: Wiring connections for DSH240-295-381\*-485\* -600 (\*except code 3)**

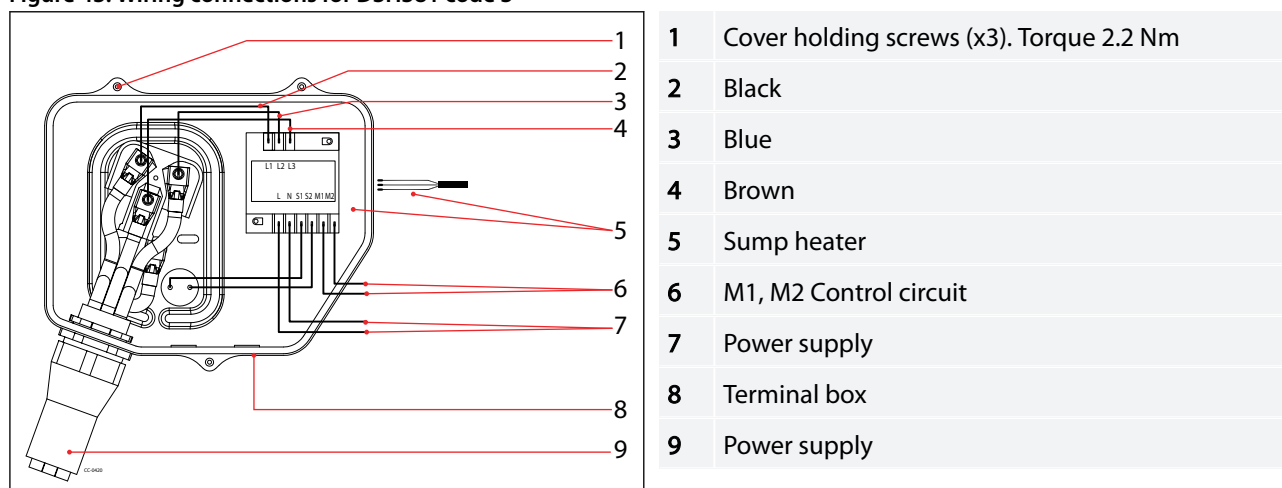


### DSH381 code 3

The terminal box is provided with:

- Ø 50.5mm (φ 1.98inch) (ISO 50 & UL1"1/2 conduit) hole with possible Ø 63.5mm (φ 2.5inch) (ISO63 and UL 2"conduit) knockout for power supply
- 2 x Ø 22.5mm (φ 0.89inch) (PG16 and UL 1/2" conduit) knockouts for safety control circuit.

**Figure 43: Wiring connections for DSH381 code 3**



### DSH485 code 3

The terminal box is provided with 2 triple knockouts for power supply, 2 double knockouts and 3 simple knockouts for the safety control circuit.

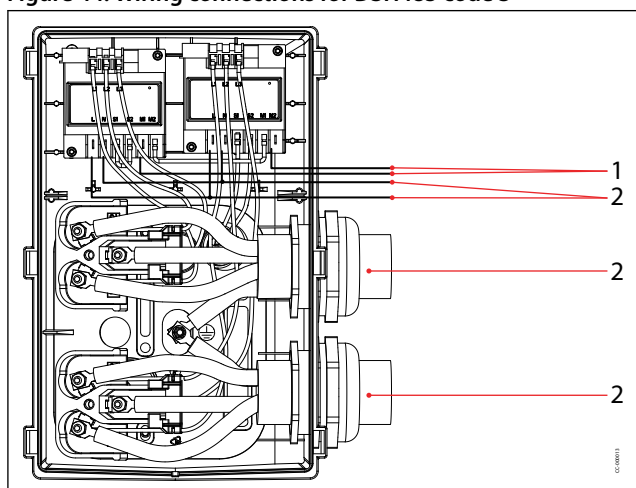
The 2 power supply knockouts accommodate the following diameters:

- Ø 63.5mm (φ 2.5inch) (ISO63 and UL 2"conduit) & Ø 54.2mm (φ 2.13inch) (PG42)& 43.7mm (UL 1"1/4 conduit)

The 5 other knockouts are as follows:

- Ø 22.5mm (φ 0.89inch) (PG16) (UL 1/2") & Ø 16.5mm (φ 0.65 inch) (ISO16)
- Ø 25.5mm (φ 1inch) (ISO25) & 20mm (φ 0.79inch) (ISO20 or PG13.5)
- Ø 22.5mm (φ 0.89inch) (PG16) (UL 1/2")
- Ø 25.5mm (φ 1inch) (ISO25) (x2)

Figure 44: Wiring connections for DSH485 code 3



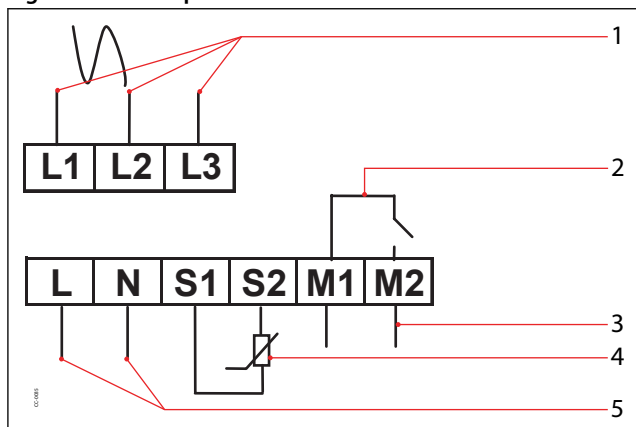
- |   |                        |
|---|------------------------|
| 1 | M1, M2 Control circuit |
| 2 | Power supply           |

## Motor protection module

The motor protection modules come preinstalled within the terminal box. Phase sequence protection connections and thermistor connections are pre-wired and should not be removed.

The module must be connected to a power supply of the appropriate voltage. The module terminals are 6.3mm (0.25inch) size Faston type.

Figure 45: Motor protection module



- |   |                          |
|---|--------------------------|
| 1 | Phase sequence input     |
| 2 | Internal control contact |
| 3 | Safety circuit           |
| 4 | Thermistor connection    |
| 5 | Module power             |

## Electrical Specifications

### Motor voltage

Danfoss scroll compressors DSH are available in four different motor voltages as listed below.

Table 21: Motor voltage

| Frequency | Motor voltage code | Code 3       | Code 4                                      | Code 7   | Code 9                                  |
|-----------|--------------------|--------------|---|----------|---|
| 50 Hz     | Nominal voltage    | -            | 380-415V-3ph<br>380-400V-3ph <sup>(1)</sup> | -        | -                                       |
| 60 Hz     | Nominal voltage    | 200-230V-3ph | 460V-3ph                                    | 575V-3ph | 380-400V-3ph<br>380V-3ph <sup>(2)</sup> |

<sup>(1)</sup> DSH240-4

<sup>(2)</sup> DSH240-9 to DSH381

## NOTE:

**Voltage range:** Nominal voltage  $\pm 10\%$ . The voltage range indicates where the compressor can run in the majority of the application envelope. A boundary voltage supply which accumulates under specific conditions such as high ambient, high superheat, or map boundary conditions, may lead to a compressor trip.

## Voltage imbalance

The maximum allowable voltage imbalance is 2%. Voltage imbalance causes high amperage over one or several phases, which in turn leads to overheating and possible motor damage. Voltage imbalance is given by the formula:

$$\% \text{ voltage imbalance} = \frac{|V_{avg} - V_{1-2}| + |V_{avg} - V_{1-3}| + |V_{avg} - V_{2-3}|}{2 \times V_{avg}} \times 100$$

|             |                                 |
|-------------|---------------------------------|
| <b>Vavg</b> | Mean voltage of phases 1, 2, 3. |
| <b>V1-2</b> | Voltage between phases 1 and 2. |
| <b>V1-3</b> | Voltage between phases 1 and 3. |
| <b>V2-3</b> | Voltage between phases 2 and 3. |

## IP rating

The compressor terminal box according to IEC60529 is IP54 for all models when correctly sized IP54 rated cable glands are used.

First numeral, level of protection against contact and foreign objects

**5** - Dust protected

Second numeral, level of protection against water

**4** - Protection against water splashing

## Terminal box temperature

The temperature inside the terminal box must not exceed 70°C (158°F). Consequently, if the compressor is installed in an enclosure, precautions must be taken to avoid that the temperature around the compressor and in the terminal box would rise too much. A ventilation installation on the enclosure panels may be necessary. If not, the electronic protection module may not operate properly. Any compressor damage related to this will not be covered by Danfoss warranty. In the same manner, cables must be selected in a way that ensures the terminal box temperature does not exceed 70°C (158°F).

## Three phase electrical characteristics

Table 22: Motor voltage code 3

| Compressor model | LRA | MCC | Max. operating current | Winding resistance |
|------------------|-----|-----|------------------------|--------------------|
|                  | A   | A   | A                      | $\Omega$           |
| DSH090           | 203 | 43  | 38                     | 0.39               |
| DSH105           | 267 | 51  | 45                     | 0.27               |
| DSH120           | 267 | 61  | 48                     | 0.27               |
| DSH140           | 304 | 64  | 56                     | 0.24               |
| DSH161           | 315 | 69  | 64                     | 0.22               |
| DSH184           | 351 | 75  | 71                     | 0.22               |
| DSH240           | 485 | 105 | 103                    | 0.16               |
| DSH295           | 560 | 128 | 112                    | 0.13               |
| DSH381           | 717 | 170 | 152                    | 0.09               |
| DSH485           | 761 | 203 | 185                    | 0.07               |

Table 23: Motor voltage code 4

| Compressor model | LRA | MCC  | Max. operating current | Winding resistance |
|------------------|-----|------|------------------------|--------------------|
|                  | A   | A    | A                      | Ω                  |
| DSH090           | 98  | 22   | 19                     | 1.47               |
| DSH105           | 142 | 25   | 22                     | 1.05               |
| DSH120           | 142 | 29   | 24                     | 1.05               |
| DSH140           | 147 | 30   | 28                     | 0.92               |
| DSH161           | 158 | 35   | 31                     | 0.83               |
| DSH184           | 197 | 38.6 | 36                     | 0.83               |
| DSH240           | 215 | 51   | 49                     | 0.62               |
| DSH295           | 260 | 62   | 56                     | 0.52               |
| DSH381           | 294 | 79   | 72                     | 0.45               |
| DSH485           | 344 | 106  | 91                     | 0.28               |
| DSH600           | 427 | 117  | 116                    | 0.23               |

Table 24: Motor voltage code 7

| Compressor model | LRA | MCC | Max. operating current | Winding resistance |
|------------------|-----|-----|------------------------|--------------------|
|                  | A   | A   | A                      | Ω                  |
| DSH090           | 84  | 18  | 14                     | 2.34               |
| DSH105           | 103 | 22  | 17                     | 1.57               |
| DSH120           | 103 | 24  | 19                     | 1.57               |
| DSH140           | 122 | 26  | 22                     | 1.38               |
| DSH161           | 136 | 29  | 24                     | 1.32               |
| DSH184           | 135 | 35  | 28                     | 1.32               |
| DSH240           | 175 | 41  | 38                     | 0.94               |
| DSH295           | 210 | 45  | 44                     | 0.82               |
| DSH381           | 235 | 60  | 58                     | 0.56               |
| DSH485           | 296 | 76  | 71                     | 0.36               |
| DSH600           | 338 | 93  | 91                     | 0.38               |

Table 25: Motor voltage code 9

| Compressor model | LRA | MCC | Max. operating current | Winding resistance |
|------------------|-----|-----|------------------------|--------------------|
|                  | A   | A   | A                      | Ω                  |
| DSH090           | 124 | 26  | 23                     | 1.05               |
| DSH105           | 160 | 33  | 26                     | 0.72               |
| DSH120           | 160 | 35  | 29                     | 0.72               |
| DSH140           | 168 | 37  | 33                     | 0.62               |
| DSH161           | 177 | 41  | 37                     | 0.57               |
| DSH184           | 239 | 51  | 41                     | 0.57               |
| DSH240           | 260 | 60  | 58                     | 0.42               |
| DSH295           | 310 | 72  | 69                     | 0.36               |
| DSH381           | 382 | 90  | 88                     | 0.24               |
| DSH485           | 475 | 111 | 109                    | 0.16               |

### LRA (Locked Rotor Amp)

Locked Rotor Amp value is the higher average current as measured on mechanically blocked compressors tested under nominal voltage. The LRA value can be used as a rough estimation for the starting current. However, in most cases, the real starting current will be lower. A soft starter can be applied to reduce starting current (see section [Soft starts](#)).

### MCC (Maximum Continuous Current)

The MCC is the current at which the motor protection trips under maximum load and low voltage conditions. This MCC value is the maximum at which the compressor can be operated in transient conditions and out of the application envelope. Above this value, the internal motor protection or external electronic module will cut-out the compressor to protect the motor.

### MOC (Maximum Operating Current)

The max operating current is the amperage the compressor will draw when it operates at maximum load of operating envelope within the voltages printed on the nameplate.

MOC can be used as a basis for contactors selection.

### Winding resistance

Winding resistance is the resistance between phases at 25°C (77°F) (resistance value +/- 7%). Winding resistance is generally low and it requires adapted tools for precise measurement. Use a digital ohm-meter, a "4 wires" method and measure under stabilised ambient temperature. Winding resistance varies strongly with winding temperature. If the compressor is stabilised at a different value than 25°C (77°F), the measured resistance must be corrected using the following formula:

$$R_{t_{amb}} = R_{25^{\circ}\text{C} (77^{\circ}\text{F})} \frac{a + t_{amb}}{a + t_{25^{\circ}\text{C} (77^{\circ}\text{F})}}$$

|   |  |
|---|--|
| $t_{25^{\circ}\text{C}}$                      | reference temperature = 25°C (77°F)    |
| $t_{amb}$                                     | temperature during measurement °C (°F) |
| $R_{25^{\circ}\text{C} (77^{\circ}\text{F})}$ | winding resistance at 25°C (77°F)      |
| $R_{amb}$                                     | winding resistance at $t_{amb}$        |
| $a$   | Coefficient $a = 234.5$                |

### Motor protection

#### DSH090 to DSH184

Compressor models DSH 090 to 184 are provided with internal overload motor protection to prevent against excessive current and temperature caused by overloading, low refrigerant flow or phase loss. The cutout current is the MCC value listed in table "Three phase electrical characteristics".

The protector is located in star point of motor and, should it be activated, will cut out all three phases. It will be reset automatically.

While not compulsory, an additional thermal magnetic motor circuit breaker is still advisable for either alarm or manual reset.

Then it must be set below MCC value (at max operating current):

- When the motor temperature is too high, then the internal protector will trip.
- When the current is too high the thermal magnetic motor circuit breaker will trip before the internal protection therefore offering possibility of manual reset.

#### DSH240 to DSH600

Compressor models DSH240-295-381-485-600 are delivered with a pre-installed motor protection module inside the terminal box. This device provides efficient and reliable protection against overheating and overloading as well as phase loss/reversal.

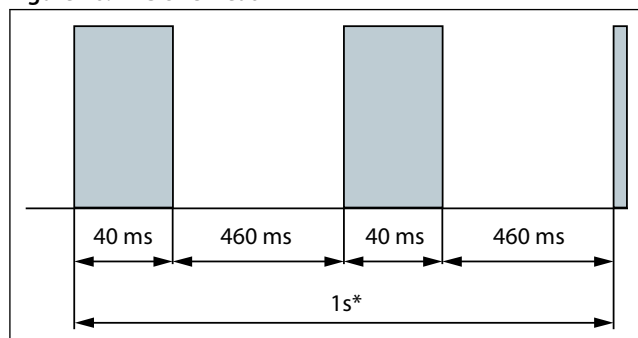
The motor protector comprises a control module and PTC sensors embedded in the motor winding.

The motor temperature is being constantly measured by a PTC thermistor loop connected on S1-S2. If any thermistor exceeds its response temperature, its resistance increases above the trip level (4.500 Ω) and the output relay then trips – i.e. contacts M1-M2 are open. After cooling to below the response temperature (resistance < 2.750 Ω), a 5-minute time delay is activated.

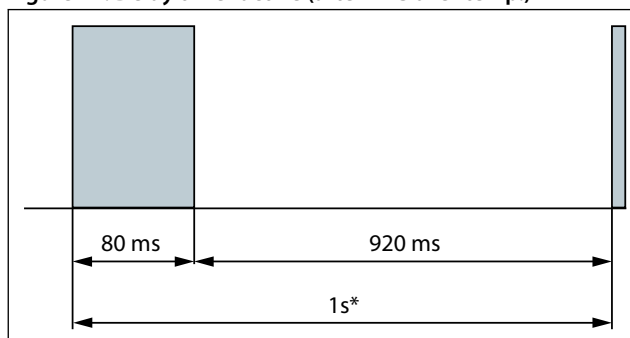
After this delay has elapsed, the relay is once again pulled in – i.e. contacts M1-M2 are closed. The time delay may be cancelled by means of resetting the mains (L-N -disconnect) for approximately 5 sec.

A red/green twin LED is visible on the module (except on DSH485-3). A solid green LED denotes a fault free condition. A blinking red LED indicates an identifiable fault condition:

**Figure 46: PTC Overheat**



**Figure 47: Delay timer active (after PTC over temp.)**



\* approx. 1 second

While not compulsory, an additional thermal magnetic motor circuit breaker is still advisable for either alarm or manual reset.

Then it must be set below MCC value (at max operating current):

- When the motor temperature is too high, then the internal PTC over temp. and module is activated.
- When the current is too high the thermal magnetic motor circuit breaker will trip before the module activate therefore offering possibility of manual reset.

## Phase sequence and reverse rotation protection

Use a phase meter to establish the phase orders and connect line phases L1, L2 and L3 to terminals T1, T2 and T3, respectively.

### DSH090 to DSH184

Compressor models DSH 090 to 184 incorporates an internal reverse vent valve which will react when the compressor is run in reverse and will allow refrigerant to circulate through a by-pass from the suction to the discharge. Although reverse rotation is not destructive for these models, it should be corrected as soon as possible. Repeated reverse rotation over 24 hours may have negative impact on the bearings.

Reverse rotation will be obvious to the user as soon as power is turned on: the compressor will not build up pressure, the sound level will be abnormally high and power consumption will be minimal. If reverse rotation symptoms occur, shut the compressor down and connect the phases to their proper terminals. If reverse rotation is not halted, the compressor will cycle off-on the motor protection.

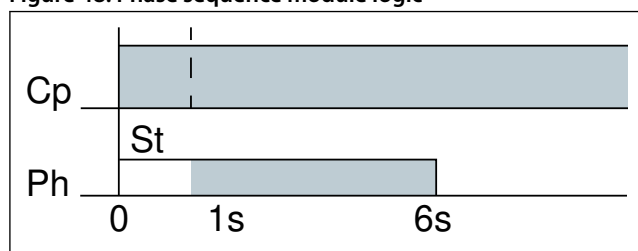
### DSH240 to DSH600

Use a phase meter to establish the phase orders and connect line phases L1, L2 and L3 to terminals T1, T2 and T3, respectively.

Compressor models DSH 240 to 600 are delivered with an electronic module which provides protection against phase reversal and phase loss at start-up.

The phase sequencing and phase loss monitoring functions are active during a 5-sec window 1 second after compressor start-up (power on L1-L2-L3).

Figure 48: Phase sequence module logic



**Cp** Compressor

**Ph** Phase monitoring

**St** start

Should one of these parameters be incorrect, the relay would lock out (contact M1-M2 open). The red LED on the module will show the following blink code (except on DSH485-3):

Figure 49: In case of phase reverse error

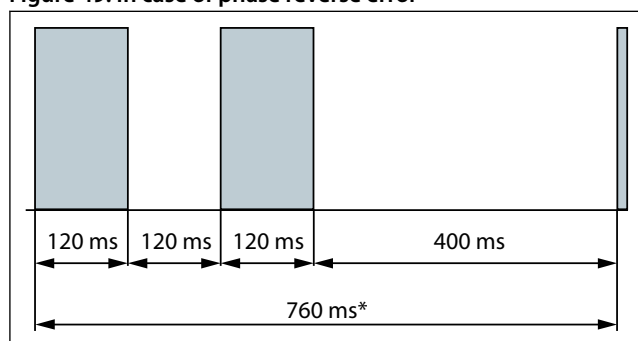
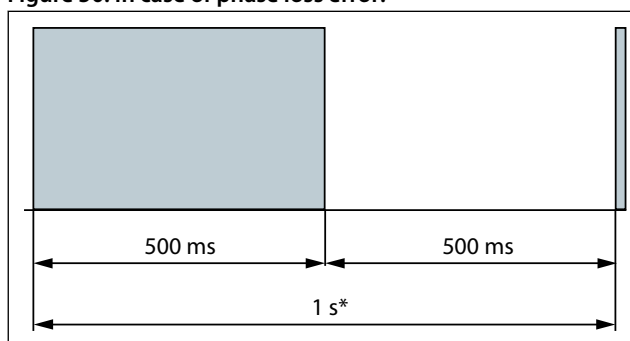


Figure 50: In case of phase loss error:



\* Approximate

The lockout may be cancelled by resetting the power mains (disconnect L-N) for approximately 5 seconds.

For more detailed information see "Instructions for electronic module" [AN160986418236](#).

## Application

### Manage oil in the circuit

#### Requirement

**R** 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. For DSH140-184 medium trio models, top-up oil quantity 1L at least as mandatory.



#### System evaluation

Table 26: Manage oil in the circuit - System evaluation

| Split type | Single compressor | Manifold compressors |
|------------|-------------------|----------------------|
| Non split  | Test No.1         | Test No.1+2          |
| Split      | Test No.1+3       | Test No.1+2+3        |

#### Test, criteria and solutions

Table 27: Manage oil in the circuit - Test, criteria and solutions

| Test No. | Purpose                     | Test conditions   | Pass criteria   | Solutions   |
|----------|-----------------------------|---|---|---|
| 1        | Check proper oil return     | <p><b>A</b></p>  <p>Lowest foreseeable evaporation, and highest foreseeable condensation.<br/><b>Minimum number of compressor</b> running for 6 hours.<br/>For reversible system, perform test in both heating and cooling mode.</p>  | 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.  | <ol style="list-style-type: none"> <li>Top-up with oil, generally 3% of the total system refrigerant charge (in weight). Above 3% look for potential oil trap in the system.</li> <li>Integrate a function in control logic to run all compressors simultaneously in order to boost oil return (for more details see section <b>Control logic</b>)</li> <li>Oil separator can be added</li> </ol> |
| 2        | Check oil balancing         | <p><b>A</b></p>  <p>Lowest foreseeable evaporation and highest foreseeable condensation and nominal capacity condition for tandem 2 compressors running for 6 hours, for trio, compressor running follow the running sequence:<br/>(1+2+3)2hrs → (1+2)2hrs → (2+3)2hrs → (1+3)2hrs<br/>For reversible system, perform test in both heating and cooling mode.</p> | Oil level must be visible or full in the sight glass when the compressors are running and when all compressors of the circuit are stopped | <ol style="list-style-type: none"> <li>Top-up with oil, generally 3% of the total system refrigerant charge (in weight).</li> <li>Check that manifold piping is conform to Danfoss requirements.</li> <li>Integrate a function in control logic to stop manifold periodically in order to balance oil (for more details see section <b>Control logic</b>)</li> </ol>                              |
| 3        | Oil return in split systems | Since each installation is unique, test 1 and 2 can not fully validate the oil return. Oil level must be checked and adjusted at commissioning.   | 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.  | <ol style="list-style-type: none"> <li>Pay special attention to "Piping design"</li> <li>Oil separator is strongly recommended, especially in case of part load.</li> </ol>   |

### Manage sound and vibration

#### Sound radiations

Mitigations methods: We can consider two means to reduce compressors sound radiations:

- 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 tables above for sound levels, attenuation and code numbers.
- Use of sound-insulation materials on the inside of unit panels is also an effective mean to reduce sound radiation.

**NOTE:**

During compressor shut down, a short reverse rotation sound is generated. The duration of this sound depends on the pressure difference at shut down and should be less than 3 seconds. This phenomenon has no impact on compressor reliability.

## Gas pulsation


DSH has been designed and tested to ensure that gas pulsation is optimized for the most commonly encountered air conditioning pressure ratio. Manifolder 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.

## Mitigation Methods

1. To ensure minimum vibrations transmission to the structure, strictly follow Danfoss mounting requirements (mounting feet, rails etc.). For further information on mounting requirements, please refer to section [Design compressor mounting](#).
2. Ensure that there is no direct contact (without insulation) between vibrating components and structure.
3. To avoid resonance phenomenon, pipings and frame must have natural frequencies as far as possible from running frequencies (50 or 60 Hz). Solutions to change natural frequencies are to work on structure stiffness and mass (brackets, metal sheet thickness or shape...)

## Manage Operating envelope


 The **Operating envelope** for DSH scroll compressors guarantees reliable operations of the compressor for steady-state operation.

Steady-state operation envelope is valid for a suction superheat within 5K to 30K range at nominal Voltage.

## High and low pressure protection

 Low-pressure (LP) and high-pressure (HP) safety switches must never be bypassed nor delayed and must stop all the compressors.

LP switch auto restart must be limited to 5 times within 12 hours.

 HP safety switch must be reset manually.

Depending on application operating envelope, you must define HP and LP limits within operating envelope and pressure setting table above.

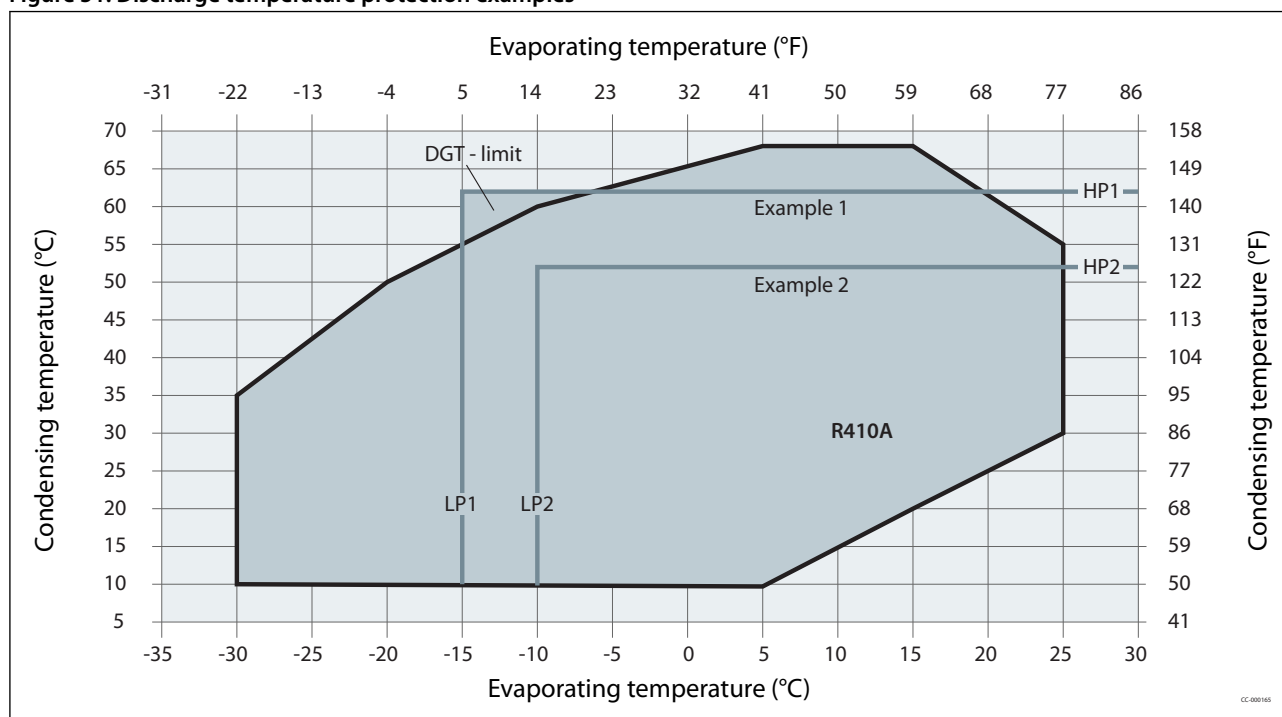
## Discharge temperature protection

DSH240 to DSH600 include an integrated discharge temperature protection. Excessive discharge temperature will result in tripping of electronic module output relay.

This protection, effective for suction superheat above 5K (9°), should be considered as a compressor safety device and its purpose is not to ensure operation map control.

In case of basic map control by pressure switches that can not ensure totally that the compressor will remain in its operating envelope, an additional external discharge protection is required. (see below [Figure 51: Discharge temperature protection examples](#))

Figure 51: Discharge temperature protection examples



**Example 1** (R410A, SH = 11K)

LP switch setting: LP1 = 3.8 bar (g) (-15°C), HP switch setting: HP1 = 38 bar (g) (62°C)

Risk of operation beyond the application envelope.

DGT protection required.

**Example 2** (R410A, SH = 11K)

LP switch setting: LP2 = 4.7 bar (g) (-10°C), HP switch setting: HP2 = 31 bar (g) (52°C)

No risk of operation beyond the application envelope.

No DGT protection required.

DSH090 to 184 have no integrated discharge temperature protection, an external protection is required.

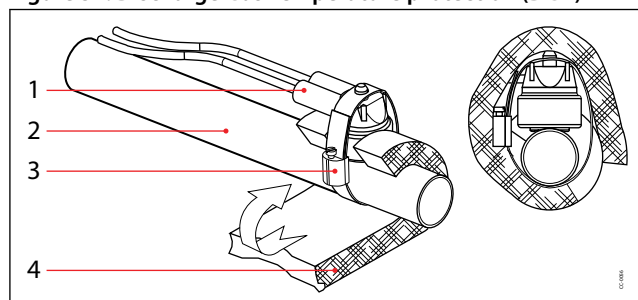
This external protection device can be a thermostat or a temperature sensor. The discharge gas temperature protection must trip the power supply when it reaches the setting point to protect the compressor from overheating.

For R410A application the discharge gas protection should be set to open at a maximum discharge gas temperature of 135°C(275°F). The discharge gas thermostat accessory kit (code 7750009) is recommended.

For R452B/R454B application, the discharge gas protection should be set to open at a maximum discharge gas temperature of 150°C(302°F). A PT1000 is recommended.

The discharge gas thermostat or sensor must be attached to the discharge line within 150mm (5.91 inch) from the compressor discharge port and must be thermally insulated and tightly fixed on the pipe (see [Figure 52: Discharge Gas Temperature protection \(DGT\)](#))

Figure 52: Discharge Gas Temperature protection (DGT)



- |   |                                  |
|---|----------------------------------|
| 1 | Thermostat or temperature sensor |
| 2 | Discharge line                   |
| 3 | Bracket                          |
| 4 | Insulation                       |

## System evaluation

HP and LP must be monitored to respect operating envelope limitation. We consider two types of operating envelope management: Basic and Advanced.

**Table 28: System evaluation**

| Basic  | Advanced  |
|--|---|
| <ul style="list-style-type: none"> <li>• HP and LP switch</li> <li>• MOP (Max Operating Pressure) ensured by expansion device</li> <li>• Condensing pressure control</li> <li>• DGT external setting points: R410A max 135°C (275°F), R454B/R452B max 150°C (302°F)</li> </ul> | <ul style="list-style-type: none"> <li>• HP and LP sensor</li> <li>• Operating envelope limits integrated into control logic</li> <li>• Temperature measurement (monitoring by sensor)</li> </ul> |
|  |   |

## 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 the compressor.

## Requirement

In steady state conditions the expansion device must ensure a suction superheat within 5K to 30K (9 to 54°F).

## System evaluation


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

**Table 29: System evaluation**

| Application    | Tests to perform                       |
|----------------|--|
| Non reversible | Liquid flood back test                 |
| Reversible     | Liquid flood back test<br>Defrost test |

## Test, criteria and solutions

Table 30: Test, criteria and solutions

| Test                   | Purpose                                     | Test condition   | Pass criteria  | Solutions   |
|------------------------|---|--|--|---|
| Liquid flood back test | Steady-state                                | <p><b>A</b></p>  <p>Liquid flood back testing must be carried out under expansion valve threshold operating conditions:</p> <ul style="list-style-type: none"> <li>Lowest foreseeable evaporation, and highest foreseeable condensation.</li> <li>Minimum number of compressor running.</li> </ul> <p>For reversible system, perform test in both heating and cooling mode.</p> | Suction superheat >5K (9°F) and the oil superheat shall not be more than 60 sec below the safe limit defined in the Dilution Chart. (see <a href="#">Dilution Chart - DSH090 to DSH184 R410A</a> ) | <ol style="list-style-type: none"> <li>Check expansion valve selection and setting. <ul style="list-style-type: none"> <li>For Thermostatic expansion valve (TXV) check bulb position...</li> <li>For Electronic expansion valve (EXV) check measurement chain and PID....</li> </ul> </li> <li>Add a suction accumulator <sup>(1)</sup></li> </ol> |
|                        | Transient                                   | <p>Tests must be carried out with most unfavorable conditions :</p> <ul style="list-style-type: none"> <li>fan staging,</li> <li>compressor staging</li> <li>...</li> </ul>  | Oil superheat shall not be more than 60 sec per hour below the safe limit defined in the Dilution Chart. (see <a href="#">Dilution Chart - DSH090 to DSH184 R452B / R454B</a> )                    |   |
| Defrost test           | Check liquid floodback during defrost cycle | Defrost test must be carried out in the most unfavorable conditions (at 0°C (32°F) evaporating temperature).   | Oil superheat shall not be more than 60 sec per hour below the safe limit defined in the Dilution Chart. (see <a href="#">Dilution Chart - DSH240 to DSH600 R410A/ R452B / R454B</a> )             | <ol style="list-style-type: none"> <li>Check defrost logic. In reversible systems, the defrost logic can be worked out to limit liquid floodback effect. (for more details see <a href="#">Control logic</a>).</li> <li>Add a suction accumulator <sup>(1)</sup></li> </ol>   |

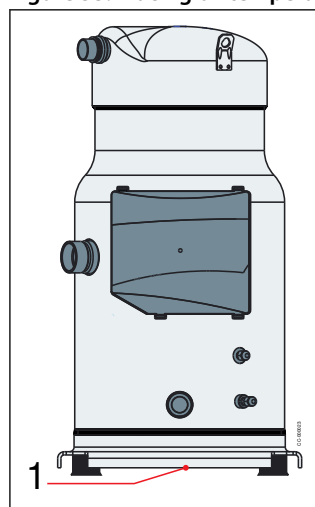
<sup>(1)</sup> Suction accumulator offers protection by trapping the liquid refrigerant upstream from the compressor. The accumulator should be sized at least 50 % of the total system charge. Suction accumulator dimensions can impact oil return (gas velocity, oil return hole size...), therefore oil return has to be checked according to section [Manage oil in the circuit](#).

## Placing oil temperature sensor

Oil temperature sensor must be placed on the bottom of the baseplate. Some thermal paste shall be used to improve the conductivity. The sensor must also be correctly thermally insulated from the ambience.

The Oil superheat is defined as: (Oil temperature - Evaporating temperature)

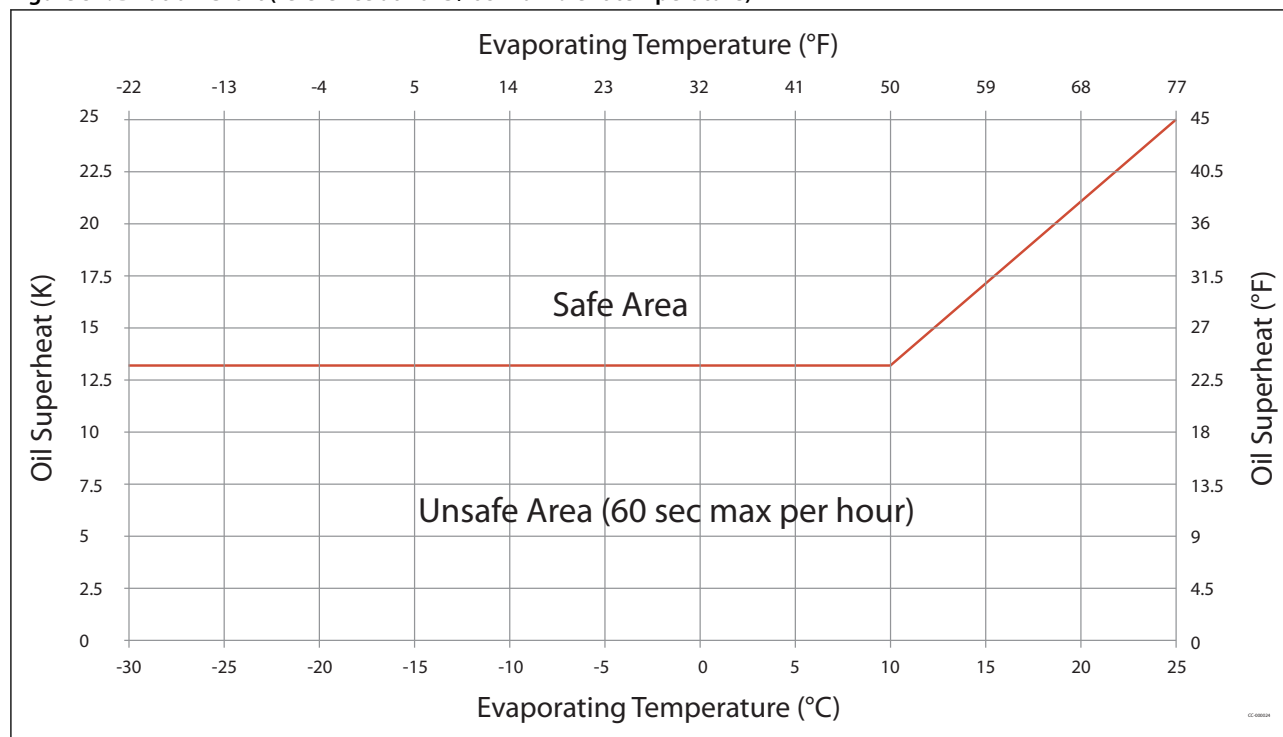
Figure 53: Placing oil temperature sensor



- Oil temperature sensor must be placed on the bottom of the baseplate.

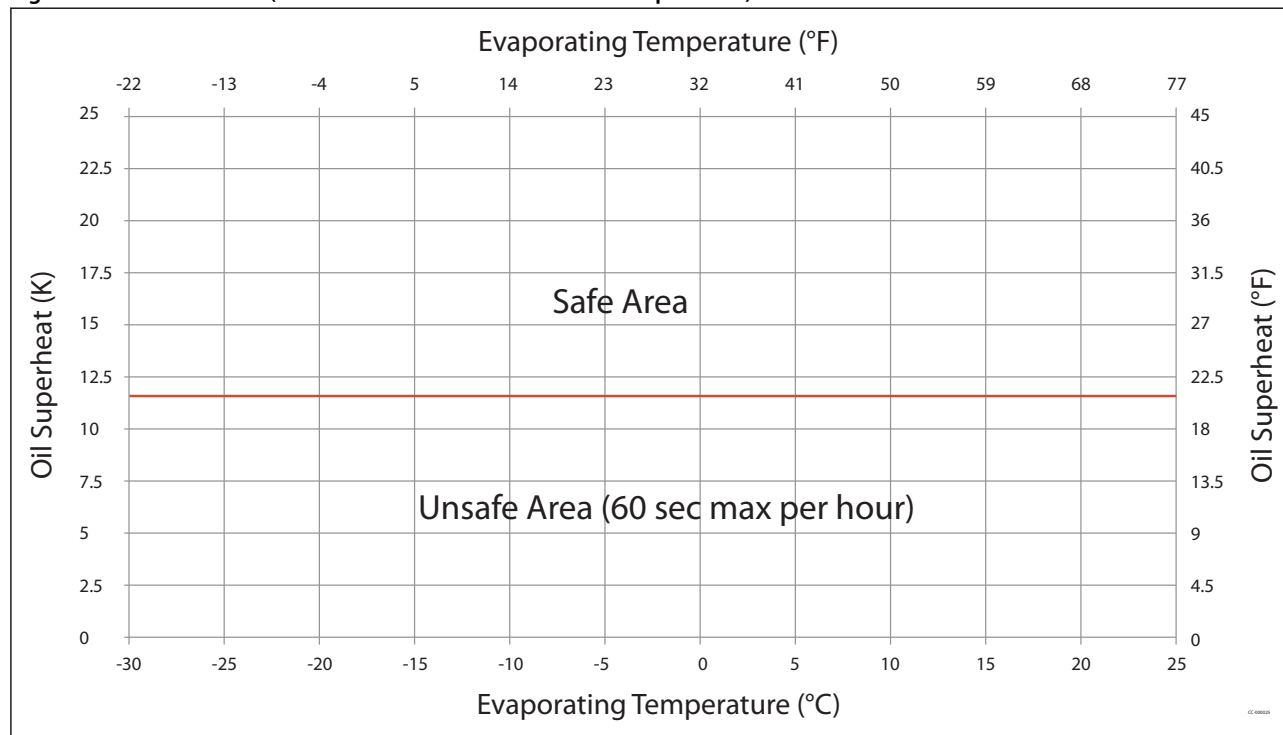
## Dilution Chart - DSH090 to DSH184 R410A

Figure 54: Dilution Chart (reference at 20°C / 68°F ambient temperature)



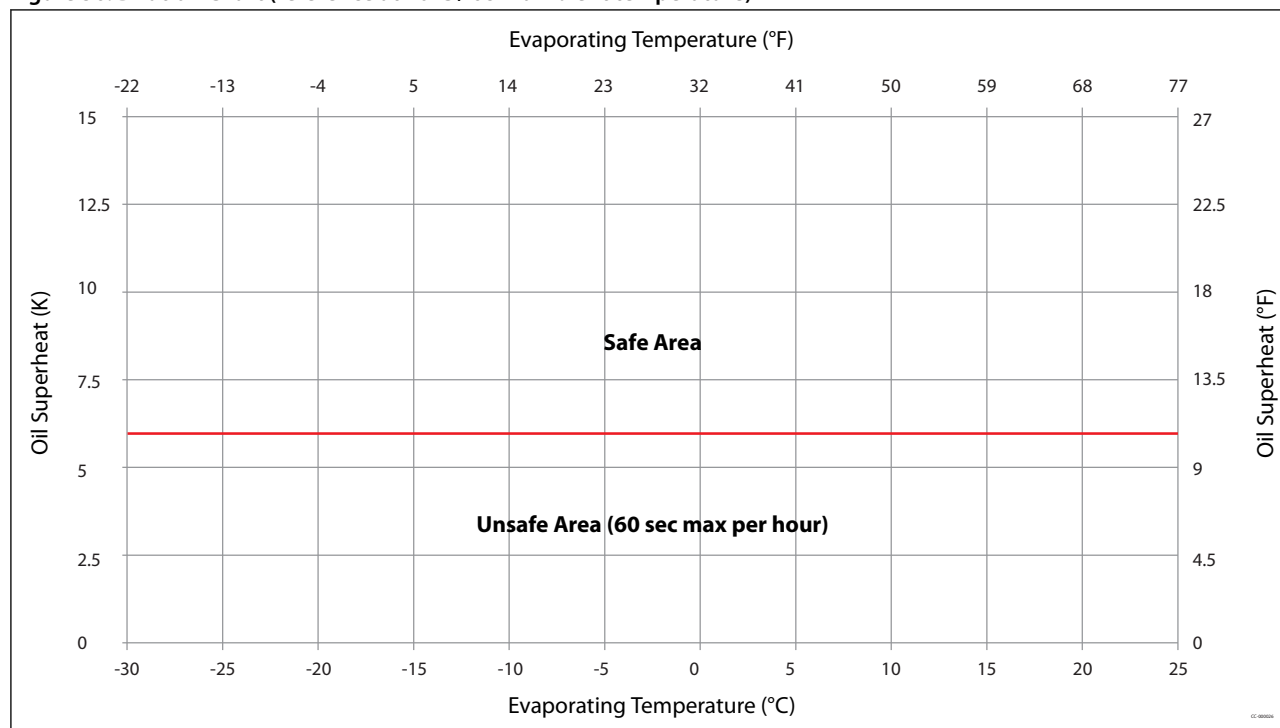
## Dilution Chart - DSH090 to DSH184 R452B / R454B

Figure 55: Dilution Chart (reference at 20°C / 68°F ambient temperature)



## Dilution Chart - DSH240 to DSH600 R410A/ R452B / R454B

Figure 56: Dilution Chart (reference at 20°C / 68°F ambient temperature)



## Manage off cycle migration

**R** 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 31: System charge

| Application | BELOW charge limit  | ABOVE charge limit   |
|-------------|---|--|
| All         | Ensure tightness between condenser & evaporator when system is OFF <ul style="list-style-type: none"> <li>• Thermostatic expansion Valve (TXV) , Liquid Line Solenoid Valve LLSV strongly recommended</li> <li>• Electronic expansion valve (EXV) must close when system stop including in power shut down situation</li> <li>• With R452B or R454B, an External Non-Return Valve is recommended</li> </ul> |  |
| Non split   | No test or additional safeties required   | <ul style="list-style-type: none"> <li>• Surface Sump Heater</li> <li>• External Non-Return Valve</li> </ul> |
| Split       | Since each installation is unique, refrigerant charge may vary <ul style="list-style-type: none"> <li>• Surface Sump Heater</li> <li>• Liquid Line Solenoid Valve+ pump-down cycle</li> <li>• External Non-Return Valve</li> </ul>  |  |

### Surface Sump heater

The surface sump heater are designed to protect the compressor against off-cycle migration of refrigerant.

For DSH090-105-120-140-161-184, 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 be referred to [Table 32: surface sump selection principle](#)

Figure 57: DSH090 to 184

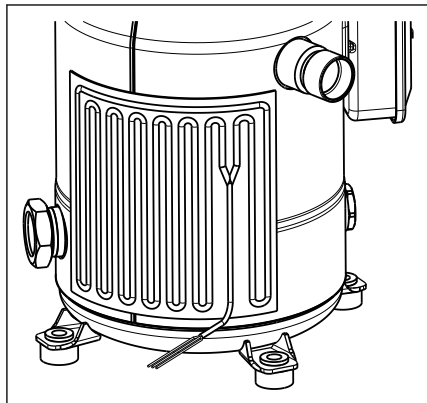
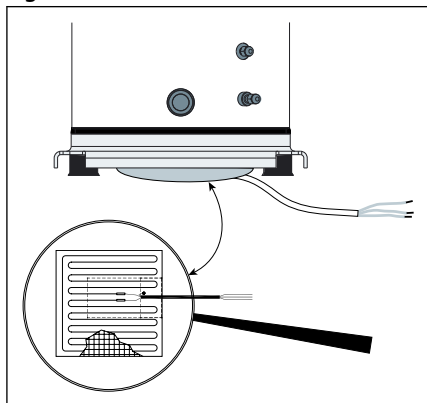


Table 32: surface sump selection principle

| Compressor Surrounding Ambient                                      | Surface Sump Heater                         |
|---|---|
| Unit has enclosure, no wind   | 48W SSH                                     |
| Unit has no enclosure, with wind                                    | 80W SSH                                     |
| Unit has no enclosure, wind >5m/s (ft/s)& ambient temperature <-5°C | 80W SSH + additional SSH/thermal insulation |

For DSH240-295-381-485-600, the 56W surface sump heater is located below the sump, associated with a thermal insulation.

Figure 58: DSH240 to DSH485



The heater must be turned on whenever all the compressors are off. Surface sump heater accessories are available from Danfoss (see section [Accessories and Spare parts](#)).

### Liquid line solenoid valve (LLSV)

A Liquid line solenoid valve (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 system:

- evacuates refrigerant from oil
- set the sump saturating pressure much lower than ambience temperature and due to that, avoid refrigerant condensation in the compressor.

Pump-down must be set higher than 1.7bar(g) (25 psig). For more details on pump-down cycle see section [Control logic](#).

### External non-return valve

External non-return valve is only for DSH090-105-120-140-161-184 no internal non return valve models.

### Charge limits

Table 33: Charge limits for single models

| Models | Composition | Refrigerant charge limit |     |
|--------|-------------|--------------------------|-----|
|        |             | kg                       | lbs |
| DSH090 | -           | 8                        | 18  |
| DSH105 | -           | 10                       | 22  |
| DSH120 | -           | 10                       | 22  |
| DSH140 | -           | 10                       | 22  |
| DSH161 | -           | 10                       | 22  |
| DSH184 | -           | 10                       | 22  |
| DSH240 | -           | 15                       | 33  |
| DSH295 | -           | 15                       | 33  |
| DSH381 | -           | 17                       | 37  |
| DSH485 | -           | 17                       | 37  |
| DSH600 | -           | 17                       | 37  |

Table 34: Charge limits for Tandem models

| Models  | Composition     | Refrigerant charge limit |     |
|---------|-----------------|--------------------------|-----|
|         |                 | kg                       | lbs |
| DSH180E | 2×DSH090        | 12                       | 26  |
| DSH195U | DSH090 + DSH105 | 12                       | 26  |
| DSH210U | DSH090 + DSH120 | 12                       | 26  |
| DSH210E | 2×DSH105        | 12                       | 26  |
| DSH230U | DSH090 + DSH140 | 12                       | 26  |
| DSH240E | 2×DSH120        | 12                       | 26  |
| DSH251U | DSH090 + DSH161 | 12                       | 26  |
| DSH260U | DSH140 + DSH120 | 12                       | 26  |
| DSH274U | DSH090 + DSH184 | 12                       | 26  |
| DSH281U | DSH161 + DSH120 | 12                       | 26  |
| DSH280E | 2×DSH140        | 14                       | 31  |
| DSH289U | DSH105 + DSH184 | 12                       | 26  |
| DSH301U | DSH161 + DSH140 | 14                       | 31  |
| DSH304U | DSH120 + DSH184 | 12                       | 26  |
| DSH322E | 2×DSH161        | 14                       | 31  |
| DSH324U | DSH140 + DSH184 | 14                       | 31  |
| DSH345U | DSH161 + DSH184 | 14                       | 31  |
| DSH368E | 2×DSH184        | 14                       | 31  |
| DSH360X | DSH120 + DSH240 | 14                       | 31  |
| DSH424X | DSH184 + DSH240 | 14                       | 31  |
| DSH456X | DSH161 + DSH295 | 14                       | 31  |
| DSH479X | DSH184 + DSH295 | 14                       | 31  |
| DSH565X | DSH184 + DSH381 | 14                       | 31  |
| DSH482E | 2×DSH240        | 21                       | 46  |
| DSH535U | DSH240 + DSH295 | 21                       | 46  |
| DSH590E | 2×DSH295        | 25                       | 55  |
| DSH620U | DSH240 + DSH381 | 21                       | 46  |
| DSH675U | DSH295 + DSH381 | 25                       | 55  |
| DSH760E | 2×DSH381        | 29                       | 64  |
| DSH725U | DSH240 + DSH485 | 21                       | 46  |
| DSH780U | DSH295 + DSH485 | 25                       | 55  |
| DSH865U | DSH381 + DSH485 | 29                       | 64  |
| DSH895U | DSH295 + DSH600 | 25                       | 55  |

| Models   | Composition     | Refrigerant charge limit |     |
|----------|-----------------|--------------------------|-----|
|          |                 | kg                       | lbs |
| DSH970E  | 2×DSH485        | 34                       | 75  |
| DSH1085U | DSH485 + DSH600 | 34                       | 75  |
| DSH1200E | DSH600 + DSH600 | 44                       | 97  |

Table 35: Charge limits for Trio models

| Models   | Composition       | Refrigerant charge limit |     |
|----------|-------------------|--------------------------|-----|
|          |                   | kg                       | lbs |
| DSH420T  | 3×DSH140          | 14                       | 31  |
| DSH483T  | 3×DSH161          | 14                       | 31  |
| DSH552T  | 3×DSH184          | 14                       | 31  |
| DSH720T  | 3×DSH240          | 21                       | 46  |
| DSH885T  | 3×DSH295          | 25                       | 55  |
| DSH971T  | 2×DSH295 + DSH381 | 25                       | 55  |
| DSH1140T | 3×DSH381          | 29                       | 64  |
| DSH1245T | 2×DSH381 + DSH485 | 29                       | 64  |
| DSH1350T | DSH381 + 2×DSH485 | 29                       | 64  |
| DSH1455T | 3×DSH485          | 34                       | 75  |
| DSH1570T | 2×DSH485 + DSH600 | 34                       | 75  |
| DSH1685T | DSH485 + 2×DSH600 | 34                       | 75  |
| DSH1800T | 3×DSH600          | 44                       | 97  |

## Power supply and electrical protection

### Wiring information Requirements

- Protect the compressor from short circuit and overcurrent by a thermal magnetic motor circuit breaker set to Max. operating current or lower (see table in section **Three phase electrical characteristics**). For DSH090-105-120-140-161-184, phase sequence protection is strongly recommended.
- Compressor models DSH240-295-381-485-600 are delivered with a pre-installed motor protection module inside the terminal box that must be powered on.
- HP safety switch, DGT (only for DSH090 to DSH184) and electronic module relay output (M1-M2, only for DSH240 to DSH600) must be wired in the safety chain. Other safety devices such as LP can be either hardware or software managed.
- Provide separate electrical supply for the heaters so that they remain energized even when the machine is out of service (e.g. seasonal shutdown).

The wiring diagrams below are examples for a safe and reliable compressor wiring:

Figure 59: Compressor model DSH 090 - 105 - 120 - 140 - 161 - 184

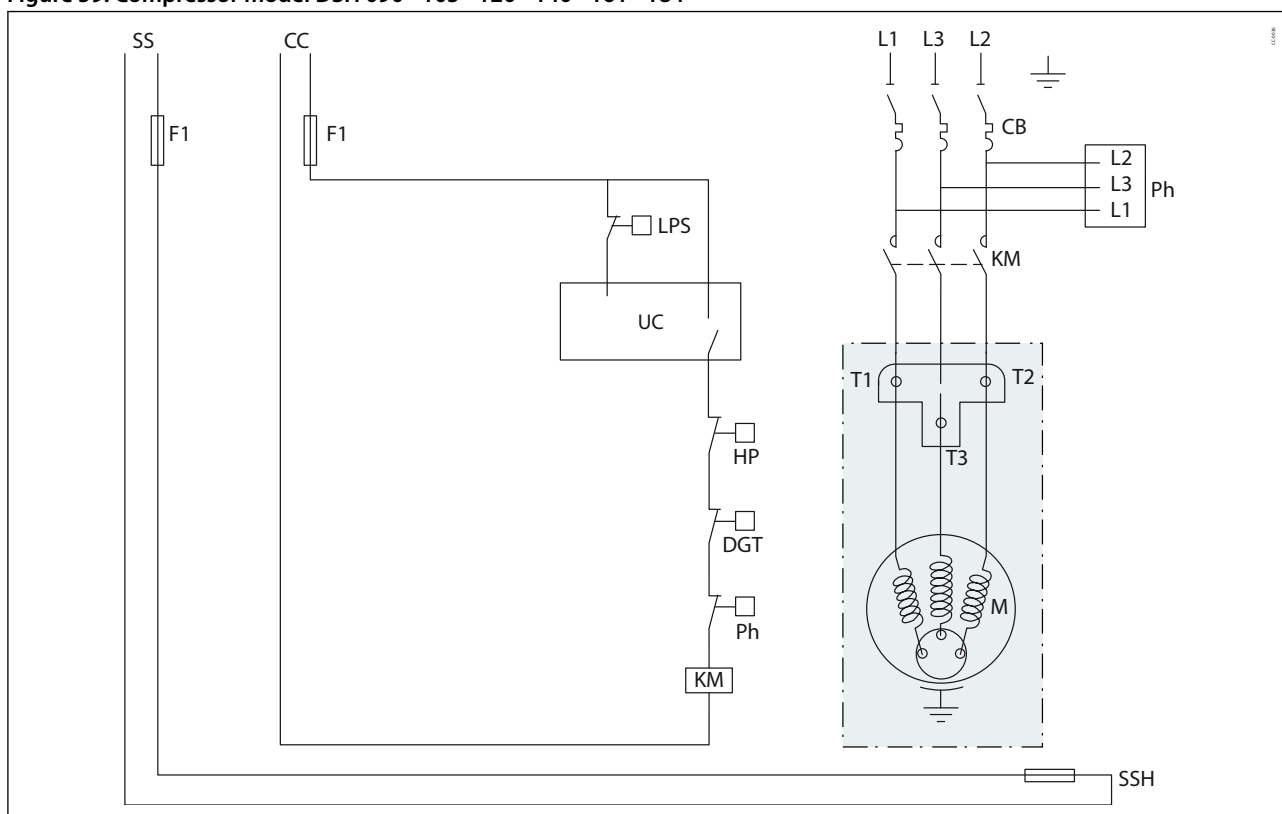


Figure 60: Compressor model DSH240-295-381

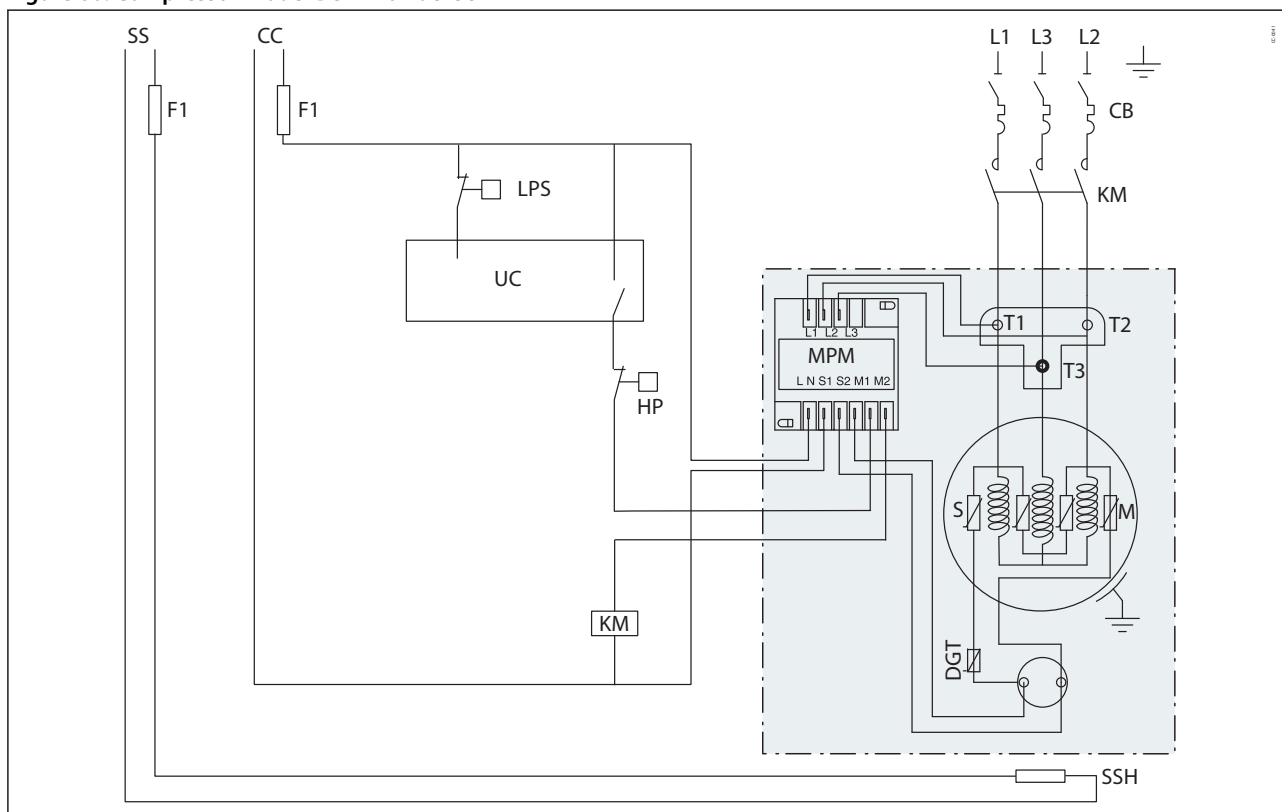


Figure 61: Compressor model DSH485 (except code 3) and model DSH600

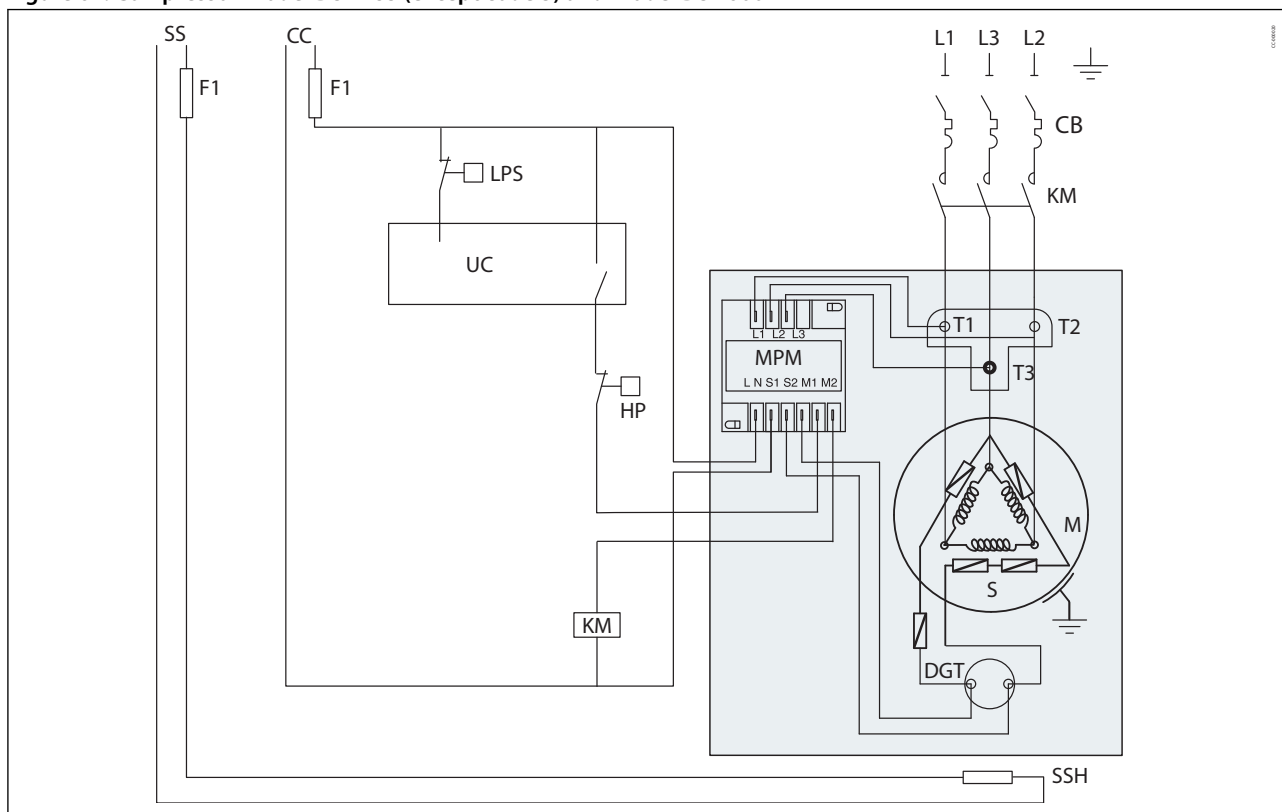
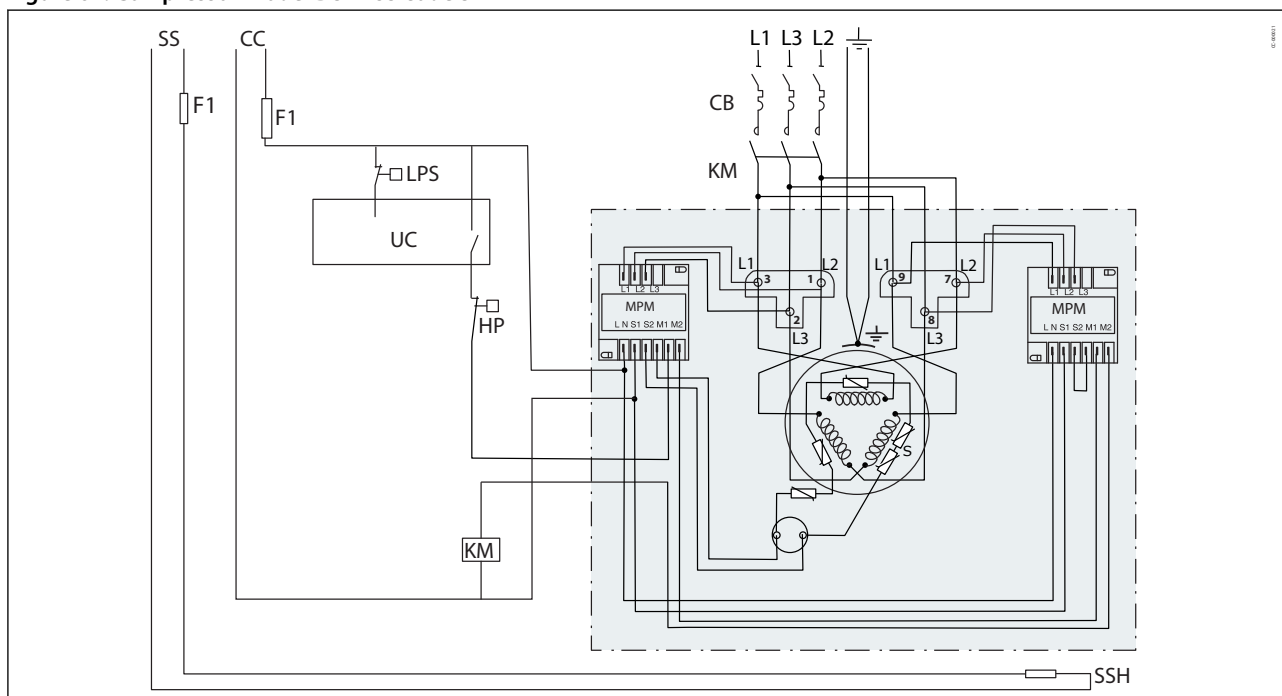


Figure 62: Compressor model DSH485 code 3



|            |   |            |  |
|------------|---|------------|--|
| <b>CB</b>  | Thermal magnetic motor circuit breaker            | <b>M</b>   | Compressor motor                                   |
| <b>CC</b>  | Control circuit                                   | <b>MPM</b> | Motor Protection Module                            |
| <b>DGT</b> | Discharge gas thermistor (embedded in compressor) | <b>Ph</b>  | Phase sequence relay                               |
| <b>F1</b>  | Fuses   | <b>S</b>   | Thermistor chain (motor and discharge temperature) |
| <b>HP</b>  | High pressure safety switch                       | <b>SS</b>  | Seperate supply                                    |
| <b>KM</b>  | Compressor contactor                              | <b>SSH</b> | Surface sump heater                                |
| <b>LPS</b> | Safety pressure switch                            | <b>UC</b>  | Unit Controller                                    |

## Soft starts

**R** Soft starters are designed to reduce the starting current of 3-phase AC motors. Soft starters can be used on DSH compressor but, in order to ensure proper lubrication of compressor parts, the settings must ensure that the compressor start-up time is always less than 0.5 seconds.

Ramp-down must be set to minimum to ensure proper discharge valve closing.

**I** In case of use with R454B or R452B make sure that the softstarter selected is compatible with A2L refrigerants.

## Control logic

### Safety control logic requirements

Table 36: Safety control logic requirements

| Safeties   | Tripping conditions   |                                 | Re-start conditions                            |  |
|--|---|---------------------------------|--|--|
|  | Value   | Time                            | Value  | Time   |
| HP safety switch   | See Pressure settings table from section <b>Operating envelope data</b> | Immediate, no delay. No by-pass | Conditions back to normal. Switch closed again | Manual reset   |
| LP safety switch   |   |                                 |  | Maximum 5 auto reset during a period of 12 hours, then manual reset. |
| Electronic module (Motor protection, DGT) <sup>(1)</sup> | Contact M1-M2 opened  |                                 |  |  |

<sup>(1)</sup> Only for DSH240 to DSH600.

### Cycle rate limit requirements

Danfoss requires a minimum compressor running time of 2 minutes to ensure proper oil return and sufficient motor cooling.

Additionally, compressor must not exceed 12 starts per hour. 12 starts per hour must not be considered as an average, this is the maximum number of starts acceptable to keep a good regulation accuracy during low load.

### Oil management logic recommendations

In some cases, oil management can be enhanced by control logic:

- If oil return test failed, a function can be integrated in control logic to run all compressors simultaneously during 2 minutes every hour in order to boost oil return. Time and delay can be fine-tuned by oil return test N°1 in section **Manage oil in the circuit**. During oil boost, pay special attention to superheat management to avoid liquid flood back.
- In trio system, after running long time in same state with 2 or 3 compressors, (1+2+3) or (1+2), (2+3) or (3+1), oil unbalance may appears. A function can be implemented in control logic to stop all compressors during one minute every two hours in order to balance oil. Time and sequence can be fine-tuned during Oil balancing test in section **Manage oil in the circuit**.

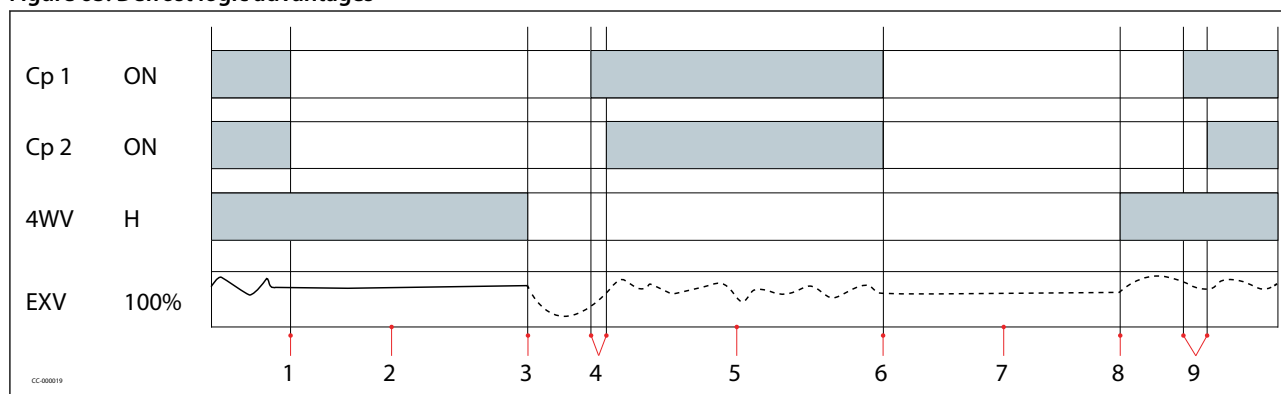
## Defrost logic recommendations / Reversible systems

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. Reducing refrigerant flooding to compressor by transferring liquid refrigerant from one exchanger to the other before reversing valve thanks to pressures.

The following defrost logic combines both advantages:

Figure 63: Defrost logic advantages



|             |  |
|-------------|--|
| <b>Cp 1</b> | Compressor 1   |
| <b>Cp 2</b> | Compressor 2   |
| <b>ON</b>   | On   |
| <b>H</b>    | Heating  |
| <b>1</b>    | Defrost start. Stop all compressors  |
| <b>2</b>    | 4 Way Valve (4WV) stays in heating mode. EXV opened to transfer liquid from outdoor to indoor exchanger thanks to pressure difference. |
| <b>3</b>    | When pressures are almost balanced*, change 4WV to cooling mode.   |
| <b>4</b>    | Start Cp1 and Cp 2 with 0.5 seconds delay between 2 successive starts  |
| <b>5</b>    | Defrost  |
| <b>6</b>    | Defrost end. Stop all compressors  |
| <b>7</b>    | 4 WV stays in cooling mode. EXV opened to transfer liquid from indoor to outdoor exchanger thanks to pressure difference               |
| <b>8</b>    | When pressures are almost balanced <sup>(*)</sup> , change 4WV to heating mode.  |
| <b>9</b>    | Start Cp1 and Cp 2 with 0.5 seconds delay between 2 successive starts  |

\* EXV Opening degree and time have to be set to keep a minimum pressure for 4 way valve moving. In any case, defrost logics must respect requirements and tests described in sections Manage superheat and Operating envelope data.

In reversible systems, to ensure compressor reliability, the 4-way valve must not reverse when the compressor is stopped due to heating or cooling demand (stop on thermostat).

## 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 1.5bar (22psi) below nominal evaporating pressure with minimum of 1.7bar(g) (25psig). 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.

### Non Return Valve (NRV)

For DSH090 to DSH184 no internal return valve models, an external Non Return Valve (NRV) in the discharge line is recommended.

DSH240 to DSH600 compressors integrate tight internal non return valve (INRV), therefore no external Non Return Valve (NRV) is needed.

## Reduce moisture in the system

### Excessive air and moisture

- can increase condensing pressure and cause 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

- The compressors are delivered with < 100ppm moisture level.
- At the time of commissioning, system moisture content may be up to 100ppm.
- During operation, the filter drier must reduce this to a level between 20 and 50ppm.

## 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 of compressors with polyolester 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 (-31°F) and 70°C (158°F) when charged with nitrogen and between -35°C (-31°F) and Ts max value (see section [Pressure equipment directive 2014/68/EU](#)) when charged with refrigerant.

### Compressor holding charge

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

Respect the following sequence to avoid discharge check valve gets stuck in open position:

- Remove the suction plug first
- Remove the discharge plug afterwards

**R** An opened compressor must not be exposed to air for more than 20 minutes to avoid moisture is captured by the POE oil.

## Handling

**R** Each Danfoss DSH scroll compressor is equipped with two lift rings on the top shell.

- Always use both these rings 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.
- For tandem and trio assemblies, use a spreader bar and all compressor rings as shown in picture below.
- 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).

Figure 64: Heavy



Figure 65: Correct

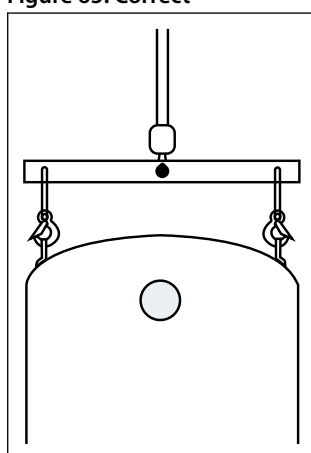


Figure 66: Incorrect

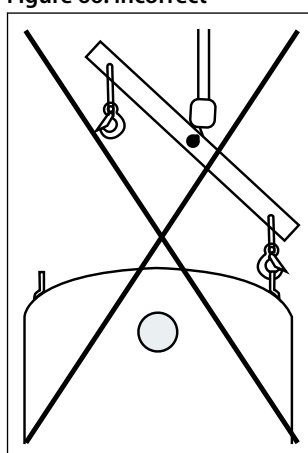
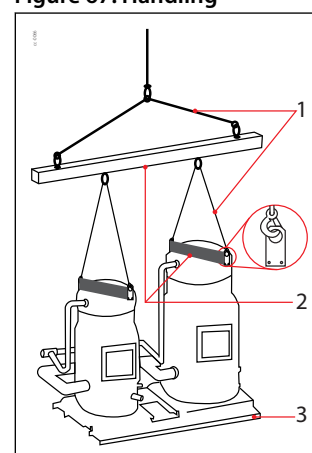


Figure 67: Handling



- |   |               |
|---|---------------|
| 1 | Slings        |
| 2 | Spreader bars |
| 3 | Frame         |

## Piping assembly

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

Table 37: System cleanliness

| Circuit contamination possible cause: | Requirement:   |
|---------------------------------------|--|
| Brazing and welding oxides            | During brazing, flow nitrogen through the system.  |
| Particles and burrs                   | Remove any particles and burrs generated by tube cutting and hole drilling.  |
| Moisture and air                      | Use only clean and dehydrated refrigeration grade copper tubing.<br>Opened compressor must not be exposed to air more than 20 minutes to avoid moisture captured by oil. |

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.
- It is recommended to use double-tipped torch using acetylene to ensure a uniform heating of connection.
- For discharge connections brazing time should be less than 2 minutes to avoid NRVI damages if any.
- To enhance the resistance to rust, a varnish on the connection is recommended.

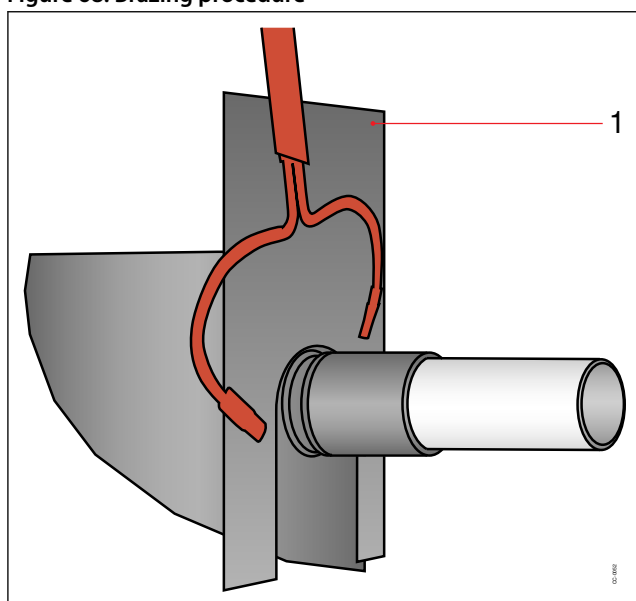
DSH compressors connectors are made of steel copper coated, which benefit to protect against corrosion and facilitate adhesion during brazing operation.

As per standards practice in the refrigeration industry, Danfoss Commercial Compressor recommend to use of silver cadmium free solder alloy and flux (added or flux coated rods). The significant silver content in these brazing alloy will help the brazing operation, providing an excellent fluidity and a limited heating temperature. It will bring also a good resistance to corrosion, a proper elongation compatible with system vibration, and good behavior under thermal variation improving the strength of connection and limiting fractures and refrigerant leaks. (Crucial with A2L refrigerants) A typical content of 34% Ag (Silver) is recommended by Danfoss.

The use of self-flux alloys (as phosphorous alloys) is not recommended by Danfoss. This type of brazing require a higher working temperature, that may overheat the connectors, damaging the thin layer of copper ,resulting in phosphides creation and joint zone embrittlement.

For more detailed information see " Brazing technique for compressors connectors" [AP192186420580](#).

**Figure 68: Brazing procedure**



**1** Heat shield

**⚠** Before eventual un-brazing of the compressor or any system component, the refrigerant charge must be removed and the installation vacuumed (especially with A2L refrigerants).

## 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 indicated in table below

**Table 38: System pressure test and leak detection**

| Maximum compressor test pressures               | DSH090-105-120-140-161-184  | DSH240-295-381-485-600  |
|---|---|---|
| Maximum compressor test pressure high side (HP) | 53.6 bar (g) (777 psig)<br>HP-LP<37 bar (537 psi)                                 | 53.6 bar (g) (777 psig)<br>HP-LP<37 bar (537 psi)   |
| Maximum compressor test pressure low side (LP)  | 36.7 bar (g) (532 psig)<br>LP-HP<5bar (73psi)<br>Maximum speed 4.8bar/s (70psi/s) | 34.3bar (g) (497psig)<br>LP – HP <5bar (73psi)<br>Maximum speed 4.8bar/s (70psi/s) <sup>(1)</sup> |

<sup>(1)</sup> On models with internal non return valve in discharge fitting, or if an external non return valve is present on the discharge line, the maximum pressurizing speed must be respected to ensure pressure equalization between LP and HP side over scroll elements.

## 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  $\mu$ m 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 before evaporator, 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” AP000086421422.


### Dielectric strength and insulation resistance tests

Several tests have been performed on each compressor at the factory between each phase and ground.

- Dielectric strength test is done with a high potential voltage (hi-pot) of  $2U_n + 1000V$  AC at least, and leakage current must be less than 5 mA.
- Insulation resistance is measured with a 500 V DC megohm tester and must be higher than 1 megohm.

Recommendations:

- Additional dielectric test is not recommended as it may reduce motor lifetime. Nevertheless, if such as test is necessary, it must be performed at a lower voltage.
- Insulation resistance test can be done.
- The presence of refrigerant around the motor windings will result in lower resistance values to ground and higher leakage current readings. Such readings do not indicate a faulty compressor. To prevent this, the system can be first operated briefly to distribute refrigerant.

 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. For DSH090-184 compressors equipped with internal reverse vent valve which can protect compressor without damage within duration below 24h. For more details refer to section [Phase sequence and reverse rotation protection](#).

For DSH240 to DSH600 compressors equipped with an electronic module, reverse rotation will be automatically detected. For more details refer to section [Motor protection](#).

- Voltage and voltage unbalance within tolerance: For more details refer to section [Motor voltage](#).

### Initial start-up

- Surface sump heaters must be energized at least 6 hours in advance to remove refrigerant.
- A quicker start-up is possible by “jogging” the compressor to evacuate refrigerant. Start the compressor for 1 second, then wait for 1 to 2 minutes. After 3 or 4 jogs the compressor can be started. This operation must be repeated for each compressor individually.

### System monitoring

The system must be monitored after initial startup for a minimum of 60 minutes to ensure proper operating characteristics such as:

- Correct superheat and subcooling.
- Current draw of individual compressors within acceptable values (max operating current).
- No abnormal vibrations and noise.
- Correct oil level.

If Oil Top-up is needed, it must be done while the compressor is idle. Use the schrader connector or any other accessible connector on the compressor suction line. Always use original Danfoss POE oil 160SZ from new cans. For more detailed information see “Lubricants filling in instructions for Danfoss Commercial Compressors” TI 2-025-0402.

### **Dismantle and disposal**



site.

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

## Packaging

### Single pack



Table 39: Single pack packaging

| Compressor model | Length |      | Width |      | Height |      | Gross weight |     |
|------------------|--------|------|-------|------|--------|------|--------------|-----|
|                  | mm     | inch | mm    | inch | mm     | inch | kg           | lbs |
| DSH090           | 565    | 22.2 | 470   | 18.5 | 718    | 28.3 | 69           | 152 |
| DSH105           | 565    | 22.2 | 470   | 18.5 | 718    | 28.3 | 76           | 168 |
| DSH120           | 565    | 22.2 | 470   | 18.5 | 718    | 28.3 | 76           | 168 |
| DSH140           | 565    | 22.2 | 470   | 18.5 | 718    | 28.3 | 79           | 174 |
| DSH161           | 565    | 22.2 | 470   | 18.5 | 718    | 28.3 | 81           | 179 |
| DSH184           | 565    | 22.2 | 470   | 18.5 | 718    | 28.3 | 84           | 185 |
| DSH240           | 760    | 29.9 | 600   | 23.6 | 992    | 39   | 124          | 273 |
| DSH295           | 760    | 29.9 | 600   | 23.6 | 992    | 39   | 127          | 279 |
| DSH381           | 760    | 29.9 | 600   | 23.6 | 992    | 39   | 174          | 383 |
| DSH485           | 760    | 29.9 | 600   | 23.6 | 992    | 39   | 191          | 420 |
| DSH600           | 760    | 29.9 | 600   | 23.6 | 992    | 39   | 230          | 507 |

### Industrial pack



Table 40: Industrial pack packaging

| Compressor model | Compressors per pack | Length |      | Width |      | Height |      | Gross weight |      | Static stacking pallets |
|------------------|----------------------|--------|------|-------|------|--------|------|--------------|------|-------------------------|
|                  |                      | mm     | inch | mm    | inch | mm     | inch | kg           | lbs  |                         |
| DSH090           | 8                    | 1150   | 45.3 | 950   | 37.4 | 680    | 26.8 | 494          | 1089 | 2                       |
| DSH105           | 8                    | 1150   | 45.3 | 950   | 37.4 | 750    | 29.5 | 544          | 1199 | 2                       |
| DSH120           | 8                    | 1150   | 45.3 | 950   | 37.4 | 750    | 29.5 | 544          | 1199 | 2                       |
| DSH140           | 8                    | 1150   | 45.3 | 950   | 37.4 | 750    | 29.5 | 566          | 1248 | 2                       |
| DSH161           | 8                    | 1150   | 45.3 | 950   | 37.4 | 750    | 29.5 | 582          | 1283 | 2                       |
| DSH184           | 8                    | 1150   | 45.3 | 950   | 37.4 | 750    | 29.5 | 606          | 1336 | 2                       |
| DSH240           | 6                    | 1150   | 45.3 | 965   | 38   | 768    | 30.2 | 693          | 1528 | 2                       |
| DSH295           | 6                    | 1150   | 45.3 | 965   | 38   | 768    | 30.2 | 712          | 1570 | 2                       |
| DSH381           | 4                    | 1150   | 45.3 | 965   | 38   | 800    | 31.5 | 678          | 1494 | 2                       |
| DSH485           | 4                    | 1150   | 45.3 | 965   | 38   | 800    | 31.5 | 744          | 1640 | 2                       |
| DSH600           | 4                    | 1150   | 45.3 | 965   | 38   | 800    | 34.7 | 900          | 1984 | 2                       |

## Ordering

### DSH Compressor code numbers

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

Compressors DSH090 to DSH184 are delivered with flexible grommets.

For compressors DSH240 to DSH600 use in single applications, flexible grommets are available as accessory kit 8156138.

### Single pack

#### Compressors compatible R454B, R452B and R410A

Figure 69: Single pack



Table 41: Single pack compressors compatible R454B, R452B and R410A

| Compressor model | Connections | Motor protection               | Code no.     |                                     |                 |              |
|------------------|-------------|--------------------------------|--------------|-------------------------------------|-----------------|--------------|
|                  |             |                                | 3            | 4                                   | 7               | 9            |
|                  |             |                                | 200-230/3/60 | 380-400 (415)/3/50<br>460/3/60      | 575/3/60        | 380-400/3/60 |
| DSH090           | Brazed      | Internal                       | -            | 120H1182<br>120H1511 <sup>(1)</sup> | -               | -            |
| DSH105           | Brazed      | Internal                       | -            | 120H1190<br>120H1521 <sup>(1)</sup> | -               | -            |
| DSH120           | Brazed      | Internal                       | -            | 120H1198<br>120H1531 <sup>(1)</sup> | -               | -            |
| DSH140           | Brazed      | Internal                       | -            | 120H1206<br>120H1541 <sup>(1)</sup> | -               | -            |
| DSH161           | Brazed      | Internal                       | -            | 120H1214<br>120H1551 <sup>(1)</sup> | -               | -            |
| DSH184           | Brazed      | Internal                       | -            | 120H1222<br>120H1561 <sup>(1)</sup> | -               | -            |
| DSH240           | Brazed      | Module 24V AC <sup>(2)</sup>   | -            | 120H1376                            | -               | -            |
| DSH240           | Brazed      | Module 110-240V <sup>(2)</sup> | -            | 120H1374                            | -               | -            |
| DSH295           | Brazed      | Module 24V AC <sup>(2)</sup>   | -            | 120H1372                            | -               | -            |
| DSH295           | Brazed      | Module 110-240V <sup>(2)</sup> | -            | 120H1370                            | -               | -            |
| DSH381           | Brazed      | Module 24V AC <sup>(2)</sup>   | -            | 120H1368                            | -               | -            |
| DSH381           | Brazed      | Module 110-240V <sup>(2)</sup> | -            | 120H1366                            | -               | -            |
| DSH485           | Brazed      | Module 24V AC <sup>(2)</sup>   | -            | 120H1364                            | -               | -            |
| DSH485           | Brazed      | Module 110-240V <sup>(2)</sup> | -            | 120H1362                            | -               | -            |
| DSH600           | Brazed      | Module 24V AC <sup>(2)</sup>   | -            | contact Danfoss                     | contact Danfoss | -            |
| DSH600           | Brazed      | Module 110-240V <sup>(2)</sup> | -            | contact Danfoss                     | contact Danfoss | -            |

<sup>(1)</sup> DSH090-105-120-140-161-184 with internal non return valve. DSH240-295-381-485-600 are all with internal non return valve.

<sup>(2)</sup> Electronic motor protection, module located in terminal box.

### Mounting kit for DSH240-295-381-485 single compressor applications : Ref 8156138

## Compressors compatible R410A only

Table 42: Single pack compressors compatible R410A only

| Compressor model | Connections | Motor protection               | Code no.                            |                                |                                     |                                     |
|------------------|-------------|--------------------------------|-------------------------------------|--------------------------------|-------------------------------------|-------------------------------------|
|                  |             |                                | 3                                   | 4                              | 7                                   | 9                                   |
|                  |             |                                | 200-230/3/60                        | 380-400 (415)/3/50<br>460/3/60 | 575/3/60                            | 380-400/3/60                        |
| DSH090           | Brazed      | Internal                       | 120H1180<br>120H1507 <sup>(2)</sup> | -                              | 120H1184<br>120H1513 <sup>(2)</sup> | 120H1186<br>120H1515 <sup>(2)</sup> |
| DSH105           | Brazed      | Internal                       | 120H1188<br>120H1517 <sup>(2)</sup> | -                              | 120H1192<br>120H1523 <sup>(2)</sup> | 120H1194<br>120H1525 <sup>(2)</sup> |
| DSH120           | Brazed      | Internal                       | 120H1196<br>120H1527 <sup>(2)</sup> | -                              | 120H1200<br>120H1533 <sup>(2)</sup> | 120H1202<br>120H1535 <sup>(2)</sup> |
| DSH140           | Brazed      | Internal                       | 120H1204<br>120H1537 <sup>(2)</sup> | -                              | 120H1208<br>120H1543 <sup>(2)</sup> | 120H1210<br>120H1545 <sup>(2)</sup> |
| DSH161           | Brazed      | Internal                       | 120H1212<br>120H1547 <sup>(2)</sup> | -                              | 120H1216<br>120H1553 <sup>(2)</sup> | 120H1218<br>120H1555 <sup>(2)</sup> |
| DSH184           | Brazed      | Internal                       | 120H1220<br>120H1557 <sup>(2)</sup> | -                              | 120H1224<br>120H1563 <sup>(2)</sup> | 120H1226<br>120H1565 <sup>(2)</sup> |
| DSH240           | Brazed      | Module 24V AC <sup>(1)</sup>   | 120H1291                            | 120H1331                       | 120H1299                            | 120H1315                            |
| DSH240           | Brazed      | Module 110-240V <sup>(1)</sup> | 120H1289                            | 120H1329                       | 120H1298                            | 120H1313                            |
| DSH295           | Brazed      | Module 24V AC <sup>(1)</sup>   | 120H1287                            | 120H1327                       | 120H1297                            | 120H1311                            |
| DSH295           | Brazed      | Module 110-240V <sup>(1)</sup> | 120H1285                            | 120H1325                       | 120H1296                            | 120H1309                            |
| DSH381           | Brazed      | Module 24V AC <sup>(1)</sup>   | 120H1283                            | -                              | 120H1295                            | 120H1307                            |
| DSH381           | Brazed      | Module 110-240V <sup>(1)</sup> | 120H1281                            | -                              | 120H1294                            | 120H1305                            |
| DSH485           | Brazed      | Module 24V AC <sup>(1)</sup>   | 120H1344                            | -                              | 120H1293                            | 120H1303                            |
| DSH485           | Brazed      | Module 110-240V <sup>(1)</sup> | 120H1460                            | -                              | 120H1292                            | 120H1301                            |
| DSH600           | Brazed      | Module 24V AC <sup>(1)</sup>   | -                                   | 120H1380                       | -                                   | -                                   |
| DSH600           | Brazed      | Module 110-240V <sup>(1)</sup> | -                                   | 120H1378                       | -                                   | -                                   |

<sup>(1)</sup> Electronic motor protection, module located in terminal box

<sup>(2)</sup> DSH090-105-120-140-161-184 with internal non return valve. DSH240-295-381-485-600 are all with internal non return valve

## Mounting kit for DSH240-295-381-485-600 single compressor applications : Ref 8156138

## Industrial pack

## Compressors compatible R454B, R452B and R410A

Figure 70: Industrial pack



Table 43: Industrial pack compressors compatible R454B, R452B and R410A

| Compressor model | Connections | Motor protection | Code no.     |                                     |          |              |
|------------------|-------------|------------------|--------------|-------------------------------------|----------|--------------|
|                  |             |                  | 3            | 4                                   | 7        | 9            |
|                  |             |                  | 200-230/3/60 | 380-400 (415)/3/50<br>460/3/60      | 575/3/60 | 380-400/3/60 |
| DSH090           | Brazed      | Internal         | -            | 120H1183<br>120H1512 <sup>(1)</sup> | -        | -            |
| DSH105           | Brazed      | Internal         | -            | 120H1191<br>120H1522 <sup>(1)</sup> | -        | -            |
| DSH120           | Brazed      | Internal         | -            | 120H1199<br>120H1532 <sup>(1)</sup> | -        | -            |

## Scroll compressors, DSH090 to DSH600 | Ordering

| Compressor model | Connections | Motor protection               | Code no.     |                                     |          |              |
|------------------|-------------|--------------------------------|--------------|-------------------------------------|----------|--------------|
|                  |             |                                | 3            | 4                                   | 7        | 9            |
|                  |             |                                | 200-230/3/60 | 380-400 (415)/3/50<br>460/3/60      | 575/3/60 | 380-400/3/60 |
| DSH140           | Brazed      | Internal                       | -            | 120H1207<br>120H1542 <sup>(1)</sup> | -        | -            |
| DSH161           | Brazed      | Internal                       | -            | 120H1215<br>120H1552 <sup>(1)</sup> | -        | -            |
| DSH184           | Brazed      | Internal                       | -            | 120H1223<br>120H1562 <sup>(1)</sup> | -        | -            |
| DSH240           | Brazed      | Module 24V AC <sup>(2)</sup>   | -            | 120H1375                            | -        | -            |
| DSH240           | Brazed      | Module 110-240V <sup>(2)</sup> | -            | 120H1373                            | -        | -            |
| DSH295           | Brazed      | Module 24V AC <sup>(2)</sup>   | -            | 120H1371                            | -        | -            |
| DSH295           | Brazed      | Module 110-240V <sup>(2)</sup> | -            | 120H1369                            | -        | -            |
| DSH381           | Brazed      | Module 24V AC <sup>(2)</sup>   | -            | 120H1367                            | -        | -            |
| DSH381           | Brazed      | Module 110-240V <sup>(2)</sup> | -            | 120H1365                            | -        | -            |
| DSH485           | Brazed      | Module 24V AC <sup>(2)</sup>   | -            | 120H1363                            | -        | -            |
| DSH485           | Brazed      | Module 110-240V <sup>(2)</sup> | -            | 120H1361                            | -        | -            |

<sup>(1)</sup> DSH090-105-120-140-161-184 with internal non return valve. DSH240-295-381-485-600 are all with internal non return valve.

<sup>(2)</sup> Electronic motor protection, module located in terminal box

## Compressors compatible R410A only

Table 44: Industrial pack compressors compatible R410A only

| Compressor model | Connections | Motor protection               | Code no.                            |                                |                                     |                                     |
|------------------|-------------|--------------------------------|-------------------------------------|--------------------------------|-------------------------------------|-------------------------------------|
|                  |             |                                | 3                                   | 4                              | 7                                   | 9                                   |
|                  |             |                                | 200-230/3/60                        | 380-400 (415)/3/50<br>460/3/60 | 575/3/60                            | 380-400/3/60                        |
| DSH090           | Brazed      | Internal                       | 120H1181<br>120H1508 <sup>(2)</sup> | -                              | 120H1185<br>120H1514 <sup>(2)</sup> | 120H1187<br>120H1516 <sup>(2)</sup> |
| DSH105           | Brazed      | Internal                       | 120H1189<br>120H1518 <sup>(2)</sup> | -                              | 120H1193<br>120H1524 <sup>(2)</sup> | 120H1195<br>120H1526 <sup>(2)</sup> |
| DSH120           | Brazed      | Internal                       | 120H1197<br>120H1528 <sup>(2)</sup> | -                              | 120H1201<br>120H1534 <sup>(2)</sup> | 120H1203<br>120H1536 <sup>(2)</sup> |
| DSH140           | Brazed      | Internal                       | 120H1205<br>120H1538 <sup>(2)</sup> | -                              | 120H1209<br>120H1544 <sup>(2)</sup> | 120H1211<br>120H1546 <sup>(2)</sup> |
| DSH161           | Brazed      | Internal                       | 120H1213<br>120H1548 <sup>(2)</sup> | -                              | 120H1217<br>120H1554 <sup>(2)</sup> | 120H1219<br>120H1556 <sup>(2)</sup> |
| DSH184           | Brazed      | Internal                       | 120H1221<br>120H1558 <sup>(2)</sup> | -                              | 120H1225<br>120H1564 <sup>(2)</sup> | 120H1227<br>120H1566 <sup>(2)</sup> |
| DSH240           | Brazed      | Module 24V AC <sup>(1)</sup>   | 120H1290                            | 120H1330                       | -                                   | 120H1314                            |
| DSH240           | Brazed      | Module 110-240V <sup>(1)</sup> | 120H1288                            | 120H1328                       | -                                   | 120H1312                            |
| DSH295           | Brazed      | Module 24V AC <sup>(1)</sup>   | 120H1286                            | 120H1326                       | -                                   | 120H1310                            |
| DSH295           | Brazed      | Module 110-240V <sup>(1)</sup> | 120H1284                            | 120H1324                       | -                                   | 120H1308                            |
| DSH381           | Brazed      | Module 24V AC <sup>(1)</sup>   | 120H1282                            | -                              | -                                   | 120H1306                            |
| DSH381           | Brazed      | Module 110-240V <sup>(1)</sup> | 120H1280                            | -                              | -                                   | 120H1304                            |
| DSH485           | Brazed      | Module 24V AC <sup>(1)</sup>   | 120H1343                            | -                              | -                                   | 120H1302                            |
| DSH485           | Brazed      | Module 110-240V <sup>(1)</sup> | -                                   | -                              | -                                   | 120H1300                            |
| DSH600           | Brazed      | Module 24V AC <sup>(1)</sup>   | -                                   | 120H1381                       | -                                   | -                                   |
| DSH600           | Brazed      | Module 110-240V <sup>(1)</sup> | -                                   | 120H1379                       | -                                   | -                                   |

<sup>(1)</sup> Electronic motor protection, module located in terminal box

<sup>(2)</sup> DSH090-105-120-140-161-184 with internal non return valve. DSH240-295-381-485-600 are all with internal non return valve.

## Accessories and Spare parts

### Solder sleeve adapter set

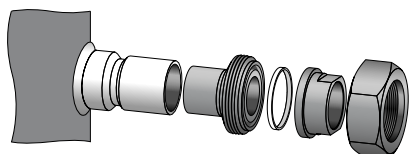


Table 45: Solder sleeve adapter set

| Code no. | Description  | Application            | Packaging | Pack size |
|----------|--|------------------------|-----------|-----------|
| 120Z0125 | Rotolock adaptor set (1"3/4 ~ 1"1/8) , (1"1/4 ~ 7/8")  | DSH090 (R410A)         | Multipack | 8         |
| 120Z0405 | Rotolock adaptor set (1"3/4 ~ 1"3/8) , (1"1/4 ~ 7/8")  | DSH105 to 184 (R410A)  | Multipack | 8         |
| 7765028  | Rotolock adaptor set (2"1/4 ~ 1"5/8) , (1"3/4 ~ 1"1/8) | DSH240-295-381 (R410A) | Multipack | 6         |
| 120Z0504 | Rotolock adaptor set (2"1/4 ~ 1"5/8) , (1"3/4 ~ 1"3/8) | DSH485 (R410A)         | Multipack | 6         |

### Rotolock adapter

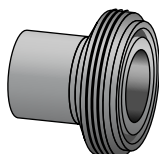


Table 46: Rotolock adapter

| Code no. | Description                          | Application                   | Packaging | Pack size |
|----------|--------------------------------------|-------------------------------|-----------|-----------|
| 120Z0367 | Adaptor (1"1/4 Rotolock - 7/8" ODS)  | Models with 7/8" ODF (R410A)  | Multipack | 10        |
| 120Z0364 | Adaptor (1"3/4 Rotolock - 1"1/8 ODS) | Models with 1"1/8 ODF (R410A) | Multipack | 10        |
| 120Z0431 | Adaptor (1"3/4 Rotolock - 1"3/8 ODS) | Models with 1"3/8 ODF (R410A) | Multipack | 10        |
| 120Z0432 | Adaptor (2"1/4 Rotolock - 1"5/8 ODS) | Models with 1"5/8 ODF (R410A) | Multipack | 10        |

### Gaskets



Table 47: Gaskets

| Code no. | Description   | Application                           | Packaging     | Pack size |
|----------|---------------|---------------------------------------|---------------|-----------|
| 8156131  | Gasket, 1"1/4 | Models with 1"1/4 rotolock connection | Multipack     | 10        |
| 7956002  | Gasket, 1"1/4 | Models with 1"1/4 rotolock connection | Industry pack | 50        |
| 8156132  | Gasket, 1"3/4 | Models with 1"3/4 rotolock connection | Multipack     | 10        |
| 7956003  | Gasket, 1"3/4 | Models with 1"3/4 rotolock connection | Industry pack | 50        |
| 8156133  | Gasket, 2"1/4 | Models with 2"1/4 rotolock connection | Multipack     | 10        |
| 7956004  | Gasket, 2"1/4 | Models with 2"1/4 rotolock connection | Industry pack | 50        |

### Solder sleeve



Table 48: Solder sleeve

| Code no. | Description  | Application                                   | Packaging | Pack size |
|----------|--|---|-----------|-----------|
| 8153004  | Solder sleeve P02 (1"3/4 Rotolock - 1"1/8 ODF)     | Models with 1"3/4 rotolock connection (R410A) | Multipack | 10        |
| 8153008  | Solder sleeve P04 (1"1/4 Rotolock - 3/4" ODF)      | Models with 1"1/4 rotolock connection (R410A) | Multipack | 10        |
| 8153012  | Rotolock connector P05 (1"1/4 Rotolock - 7/8" ODF) | Models with 1"1/4 rotolock connection (R410A) | Multipack | 10        |

| Code no. | Description                                    | Application                                   | Packaging | Pack size |
|----------|--|---|-----------|-----------|
| 8153013  | Solder sleeve P07 (1"3/4 Rotolock - 7/8" ODF)  | Models with 1"3/4 rotolock connection (R410A) | Multipack | 10        |
| 8153003  | Solder sleeve P10 (1"3/4 Rotolock - 1"3/8 ODF) | Models with 1"3/4 rotolock connection (R410A) | Multipack | 10        |
| 8153006  | Solder sleeve P03 (2"1/4 Rotolock - 1"5/8 ODF) | Models with 2"1/4 rotolock connection (R410A) | Multipack | 10        |

## Rotolock nut



Table 49: Rotolock nut

| Code no. | Description         | Application                            | Packaging | Pack size |
|----------|---------------------|--|-----------|-----------|
| 8153123  | Rotolock nut, 1"1/4 | Models with 1-1/4" rotolock connection | Multipack | 10        |
| 8153124  | Rotolock nut, 1"3/4 | Models with 1-3/4" rotolock connection | Multipack | 10        |
| 8153126  | Rotolock nut, 2"1/4 | Models with 2-1/4" rotolock connection | Multipack | 10        |

## Motor protection modules



Table 50: Motor protection modules

| Code no. | Description                                   | Application                             | Packaging   | Pack size |
|----------|---|---|-------------|-----------|
| 120Z0584 | Electronic motor protection module, 24 V AC   | DSH240-295-381-485*-600(*except code 3) | Single pack | 1         |
| 120Z0585 | Electronic motor protection module, 110/240 V | DSH240-295-381-485*-600(*except code 3) | Single pack | 1         |
| 120Z0624 | Electronic motor protection module, 24V AC    | DSH485 code 3                           | Single pack | 1         |

## Surface sump heaters

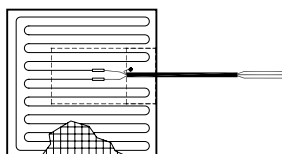


Table 51: Surface sump heaters

| Code no. | Description   | Application            | Packaging     | Pack size |
|----------|---|------------------------|---------------|-----------|
| 120Z0667 | 48W 24V surface sump heater CE and UL                     | DSH090 to 184          | Single pack   | 1         |
| 120Z0668 | 48W 230V surface sump heater CE and UL                    | DSH090 to 184          | Single pack   | 1         |
| 120Z0669 | 48W 400V surface sump heater CE and UL                    | DSH090 to 184          | Single pack   | 1         |
| 120Z0670 | 48W 460V surface sump heater CE and UL                    | DSH090 to 184          | Single pack   | 1         |
| 120Z0671 | 48W 575V surface sump heater CE and UL                    | DSH090 to 184          | Single pack   | 1         |
| 120Z0388 | 80W 24V surface sump heater CE and UL                     | DSH090 to 184          | Multipack     | 8         |
| 120Z0389 | 80W 230V surface sump heater CE and UL                    | DSH090 to 184          | Multipack     | 8         |
| 120Z0390 | 80W 400V surface sump heater CE and UL                    | DSH090 to 184          | Multipack     | 8         |
| 120Z0391 | 80W 460V surface sump heater CE and UL                    | DSH090 to 184          | Multipack     | 8         |
| 120Z0402 | 80W 575V surface sump heater CE and UL                    | DSH090 to 184          | Multipack     | 8         |
| 120Z0769 | 56W 24V surface sump heater + bottom insulation, CE & UL  | DSH240-295-381-485-600 | Industry pack | 12        |
| 120Z0770 | 56W 230V surface sump heater + bottom insulation, CE & UL | DSH240-295-381-485-600 | Industry pack | 12        |
| 120Z0771 | 56W 400V surface sump heater + bottom insulation, CE & UL | DSH240-295-381-485-600 | Industry pack | 12        |
| 120Z0772 | 56W 460V surface sump heater + bottom insulation, CE & UL | DSH240-295-381-485-600 | Industry pack | 12        |
| 120Z0773 | 56W 575V surface sump heater + bottom insulation, CE & UL | DSH240-295-381-485-600 | Industry pack | 12        |

## Discharge temperature protection



Table 52: Discharge temperature protection

| Code no. | Description              | Application   | Packaging     | Pack size |
|----------|--------------------------|---------------|---------------|-----------|
| 7750009  | Discharge thermostat kit | DSH090 to 184 | Multipack     | 10        |
| 7973008  | Discharge thermostat kit | DSH090 to 184 | Industry pack | 50        |

## Mounting hardware



Table 53: Mounting hardware

| Code no. | Description  | Application   | Packaging   | Pack size |
|----------|--|---|-------------|-----------|
| 120Z0066 | Mounting kit for scroll compressors. Grommets, sleeves, bolts, washers                                   | DSH090 to 184   | Single pack | 1         |
| 8156138  | Mounting kit for scroll compressors. Grommets, sleeves, bolts, washers                                   | DSH240 to 600 in single installation  | Single pack | 1         |
| 7777045  | Mounting kit for scroll compressors. including hexagon rigid spacers, Grommets, Sleeves, Bolts, Washers  | DSH240 to 600 Manifold installations 50 Hz when mounting directly on rail is not wished | Single pack | 1         |
| 120Z0495 | Mounting kit for scroll compressors. including triangle rigid spacers, Grommets, Sleeves, Bolts, Washers | DSH240 to 600 Manifold installations 60 Hz when mounting directly on rail is not wished | Single pack | 1         |

## Lubricant



Table 54: Lubricant

| Code no. | Description                  | Packaging | Pack size |
|----------|------------------------------|-----------|-----------|
| 7754023  | POE lubricant, 1 litre can   | Multipack | 12        |
| 120Z0571 | POE lubricant, 2.5 litre can | Multipack | 4         |

## Terminal boxes, covers and T-block connectors



Table 55: Terminal boxes, covers and T-block connectors

| Code no. | Description  | Application  | Packaging   | Pack Size |
|----------|--|--|-------------|-----------|
| 120Z0413 | Terminal box cover   | DSH184 - DSH140 code3 - DSH161 code3                 | Single pack | 1         |
| 8156135  | Service kit for terminal box 96 x 115 mm, including 1 cover, 1 clamp | DSH090 to 161 (except DSH140 code3 and DSH161 code3) | Multipack   | 10        |
| 8173230  | T block connector 52 x 57 mm   | DSH090 to 161 (except DSH140 code3 and DSH161 code3) | Multipack   | 10        |
| 8173021  | T block connector 60 x 75 mm   | DSH184 - DSH140 code3 - DSH161 code3                 | Multipack   | 10        |
| 120Z0774 | T block connector 80 x 80 mm   | DSH240-600   | Multipack   | 10        |
| 120Z0458 | Terminal box 210 x 190 mm, incl. cover                               | DSH240-295-381*-485*-600(*except code 3)             | Single pack | 1         |
| 120Z0604 | Terminal box 210x340mm, incl. cover                                  | DSH485 code 3  | Single pack | 1         |

## Acoustic hoods



Table 56: Acoustic hoods

| Code no. | Description                              | Application                             | Packaging   | Pack Size |
|----------|--|---|-------------|-----------|
| 120Z0034 | Acoustic hood for scroll compressor      | DSH090                                  | Single pack | 1         |
| 120Z0035 | Acoustic hood for scroll compressor      | DSH105 to 161 (except DSH161-140 code3) | Single pack | 1         |
| 120Z0135 | Acoustic hood for scroll compressor      | DSH184 - DSH140 code3 - DSH161 code3    | Single pack | 1         |
| 120Z0022 | Acoustic hood for scroll compressor      | DSH240-295-381*-485*(* except code 3)   | Single pack | 1         |
| 120Z0579 | Acoustic hood for scroll compressor      | DSH381 code 3                           | Single pack | 1         |
| 120Z0490 | Acoustic hood body for scroll compressor | DSH090 R454B/R452B Max. DGT150°C        | Single pack | 1         |
| 120Z0491 | Acoustic hood body for scroll compressor | DSH105-161 R454B/R452B Max. DGT150°C    | Single pack | 1         |
| 120Z0492 | Acoustic hood body for scroll compressor | DSH184 R454B/R452B Max. DGT150°C        | Single pack | 1         |
| 120Z0493 | Acoustic hood top for scroll compressor  | DSH090-184 R454B/R452B Max. DGT150°C    | Single pack | 1         |

## Miscellaneous



Table 57: Miscellaneous

| Code no. | Description                                      | Packaging   | Pack Size |
|----------|--|-------------|-----------|
| 8156019  | Sight glass with gaskets (black & white)         | Multipack   | 4         |
| 8156129  | Gasket for oil sight glass, 1"1/8 (white teflon) | Multipack   | 10        |
| 7956005  | Gasket for oil sight glass, 1"1/8 (white teflon) | Multipack   | 50        |
| 8154001  | Danfoss Commercial Compressors blue spray paint  | Single pack | 1         |

## Tandem kits

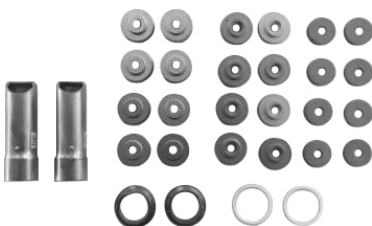


Table 58: Tandem kits

| Code no. | Description                                      | Application                              | Packaging   | Pack Size |
|----------|--|--|-------------|-----------|
| 120Z0634 | Suction washer, rigid spacer, organ pipe, gasket | DSH180E-210E-240E-280E-322E-368E         | Single pack | 1         |
| 120Z0692 | Suction washer, rigid spacer, organ pipe, gasket | DSH260U-281U-301U                        | Single pack | 1         |
| 120Z0693 | Suction washer, rigid spacer, organ pipe, gasket | DSH274U-289U                             | Single pack | 1         |
| 120Z0694 | Suction washer, rigid spacer, organ pipe, gasket | DSH195U-210U-230U-251U-304U-324U-345U    | Single pack | 1         |
| 120Z0781 | Kit tandem crossplatform                         | DSH360X-424X-456X-479X-565X              | Single pack | 1         |
| 120Z0792 | Kit Tandem, Solid, OEL 1" 3/8                    | DSH482.590.760E                          | Single pack | 1         |
| 120Z0796 | Kit Tandem, solid, washer 31mm, OEL 1" 3/8       | DSH535.675U                              | Single pack | 1         |
| 120Z0791 | Kit Tandem, solid, washer 29mm, OEL 1" 3/8       | DSH620U                                  | Single pack | 1         |
| 120Z0786 | Kit Tandem, Solid, washer 24mm, OEL 1"5/8        | DSH725U                                  | Single pack | 1         |
| 120Z0788 | Kit Tandem, Solid, washer 30mm, OEL 1"5/8        | DSH865U                                  | Single pack | 1         |
| 120Z0787 | Kit Tandem, Solid, washer 27mm, OEL 1"5/8        | DSH780U                                  | Single pack | 1         |
| 120Z0785 | Kit Tandem, Solid, OEL 1"5/8                     | DSH970E                                  | Single pack | 1         |
| 120Z0726 | Kit Tandem, spacer 30mm                          | DSH895U.DSH1085U (left suction).DSH1200E | Single pack | 1         |
| 120Z0821 | Kit Tandem, spacer 30mm, washer 38mm             | DSH1085U (right suction)                 | Single pack | 1         |

## Trio kits

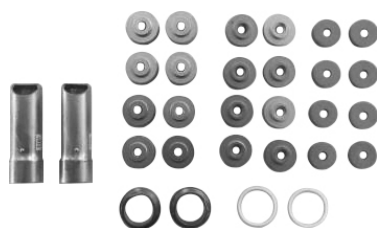


Table 59: Trio kits

| Code no. | Description   | Application                       | Packaging   | Pack Size |
|----------|---|-----------------------------------|-------------|-----------|
| 120Z0712 | Washers, grommets, sleeve for oil connect                 | DSH1800T                          | Single pack | 1         |
| 120Z0714 | Organ pipe, sleeves, rigid spacer, gasket, rubber grommet | DSH420T                           | Single pack | 1         |
| 120Z0714 | Organ pipe, sleeves, rigid spacer, gasket, rubber grommet | DSH483T                           | Single pack | 1         |
| 120Z0714 | Organ pipe, sleeves, rigid spacer, gasket, rubber grommet | DSH552T                           | Single pack | 1         |
| 120Z0782 | Kit Trio,solid,washer 31mm, OEL 1"5/8                     | DSH1140T (right suction)          | Single pack | 1         |
| 120Z0783 | Kit Trio,solid,washer 29/31mm,OEL 1"5/8                   | DSH1140T (left suction)           | Single pack | 1         |
| 120Z0784 | Kit Trio,solid,washer 30mm, OEL 1"5/8                     | DSH720T.885T (left suction)       | Single pack | 1         |
| 120Z0789 | Kit Trio,solid,washer 29mm, OEL 1"5/8                     | DSH1245T.1350T                    | Single pack | 1         |
| 120Z0790 | Kit trio,solid,OEL 1"5/8                                  | DSH971T                           | Single pack | 1         |
| 120Z0793 | Kit Trio,solid,washer 33mm, OEL 1"5/8                     | DSH1455T (left and right suction) | Single pack | 1         |
| 120Z0794 | Kit Trio,solid,washer 34,5mm, OEL 1"5/8                   | DSH720T.885T (right suction)      | Single pack | 1         |
| 120Z0819 | Kit Trio, spacer 30mm, washer 42mm                        | DSH1685T (left suction)           | Single pack | 1         |
| 120Z0820 | Kit Trio, spacer 30mm, washer 41mm                        | DSH1685T (right suction)          | Single pack | 1         |
| 120Z0822 | Kit Trio, spacer 30mm, washer 36mm                        | DSH1570T                          | Single pack | 1         |

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