

ENGINEERING
TOMORROW

Danfoss

Application Guide

Scroll compressors **DSF090 to DSF530**

Single and manifold, 50-60 Hz - R32



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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.

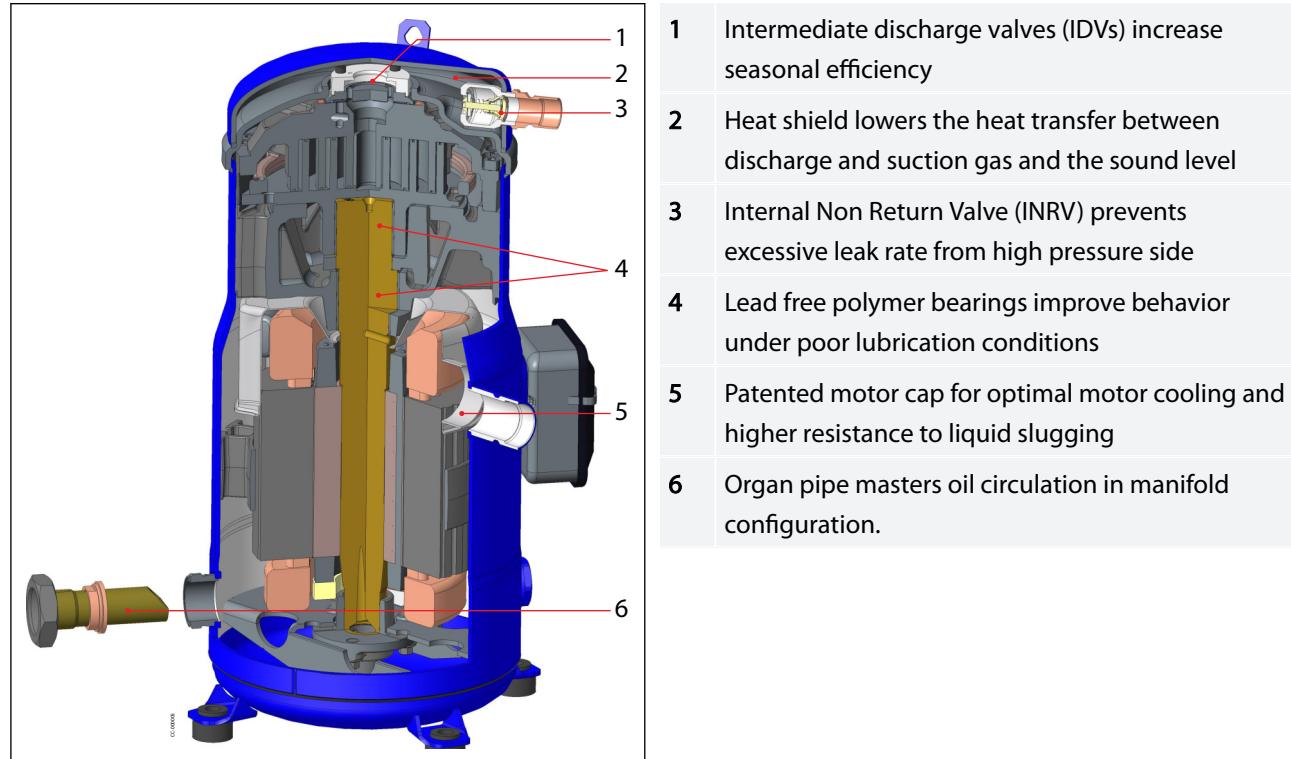
Introduction

Product description

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

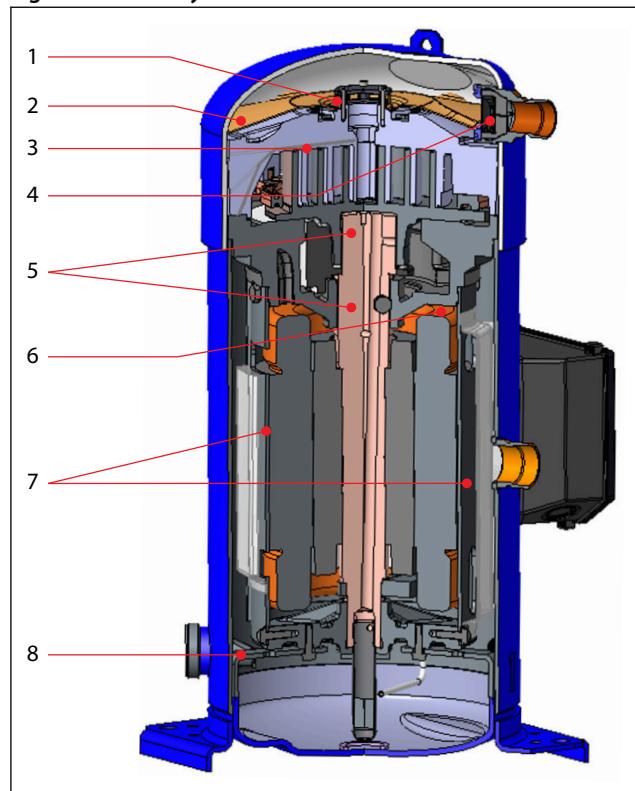
Cut Away DSF090-200

Figure 1: Cut Away DSF090-200



Cut away DSF 270-530

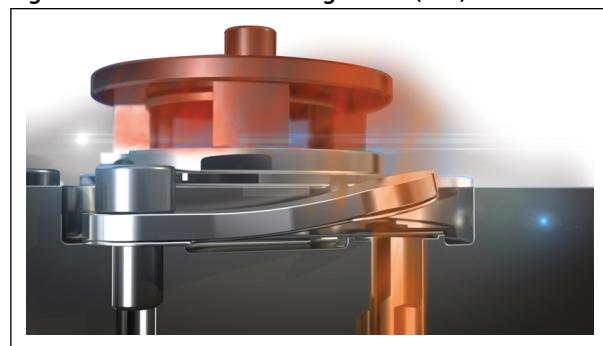
Figure 2: Cut Away DSF 270-530



| | |
|---|--|
| 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 | Integrated discharge gas temperature protection (DGT) |
| 4 | Internal Non Return Valve (INRV) prevents excessive leak rate from high pressure side |
| 5 | Lead free polymer bearings improve behavior under poor lubrication conditions |
| 6 | Patented motor cap for optimal motor cooling |
| 7 | Patented gas path flow with gas intake design induce higher resistance to liquid slugging |
| 8 | Organ pipe masters oil circulation in manifold configuration. |

How do IDVs work?

Figure 3: Intermediate Discharge Valve (IDV)

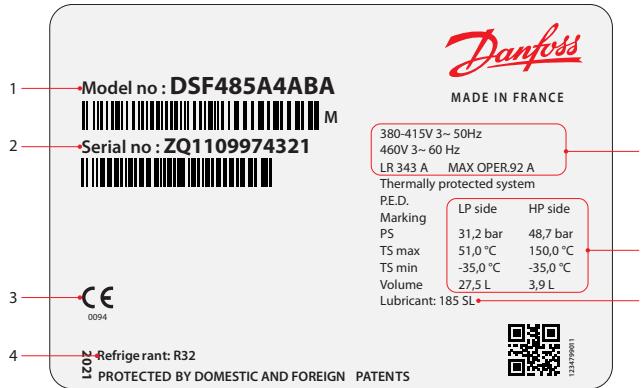


Danfoss Intermediate Discharge Valves (IDVs) are located close to the discharge side of the compressor. They reduce excessive compression of refrigerant under part-load conditions while maintaining the same cooling capacity. The IDVs open when discharge pressure falls below the built-in optimization 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

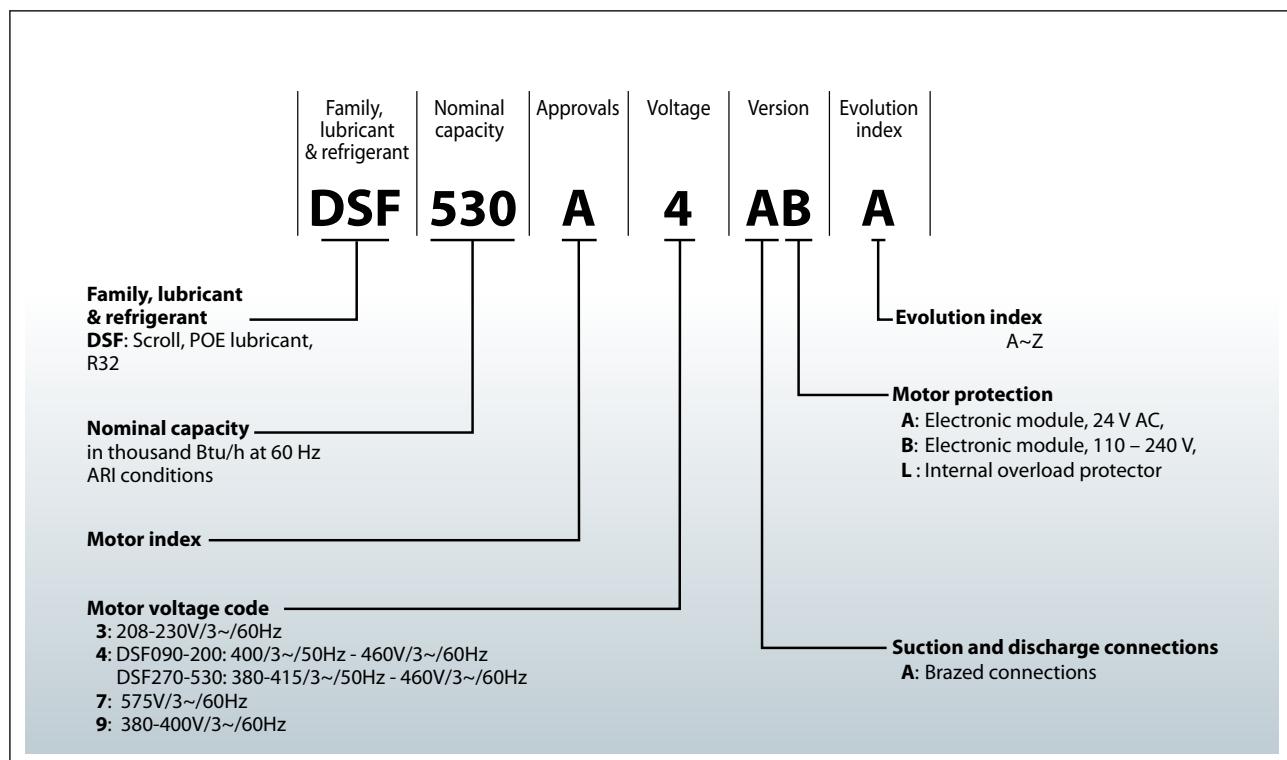
Figure 4: Name Plate



| | |
|---|--|
| 1 | Model number |
| 2 | Serial number |
| 3 | Approvals |
| 4 | Refrigerant |
| 5 | Supply voltage, Starting current & Maximum operating current |
| 6 | Housing service pressure |
| 7 | Factory charged lubricant |

Nomenclature

Danfoss scroll compressor DSF for R32 is available as single compressor and can be assembled in tandem or trio combinations. 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](#).



Compressors serial number

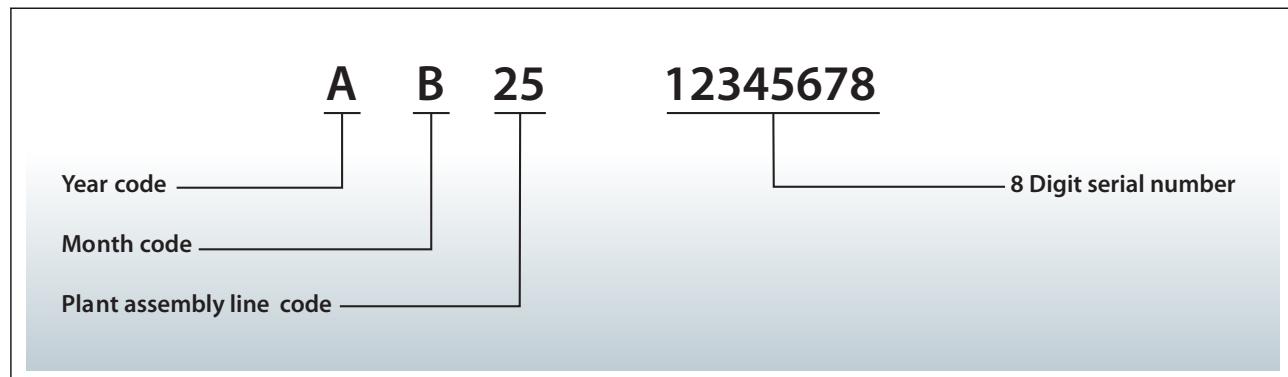


Table 1: Serial number code legend table

| 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

DSF scroll compressors comply with the following approvals and certificates.

Certificates are listed on: [Documentation for Commercial Compressor | Danfoss](#)

Table 2: Approval and certificates

| Approval and certificates | Certification logo | Models |
|---------------------------------------|---|-----------------|
| CE0062 or CE0094 (European Directive) |  | All DSF models |
| UL (Underwriters Laboratories) |  | All DSF models |
| Other approvals / certificates | | Contact Danfoss |

Low voltage directive 2014/35/EU

Table 3: Low voltage directive 2014/35/EU

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

Machines directive 2006/42/EC

Table 4: Machines directive 2006/42/EC

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

Pressure equipment directive 2014/68/EU

Table 5: Pressure equipment directive 2014/68/EU

| Products | DSF090-200 | DSF270-325 | DSF485-530 |
|---|---|---|------------|
| Refrigerant fluids | Group 1 | Group 1 | Group 1 |
| Category PED | III | III | IV |
| Maximum / Minimum temperature (Low side) - Ts | -35°C < Ts < 53°C -31°F < Ts < 127°F | -35°C < Ts < 51°C -31°F < Ts < 125.6°F | |
| Maximum allowable pressure (Low side) - Ps | 32.7bar(g) / 474psig | 31.2 bar(g) / 452 psig | |
| Maximum allowable pressure (High side) - Ps | | 48.7 bar(g) / 706 psig | |
| Declaration of conformity | | 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 |
| DSF090-100 | 11.7 | 714 | 0.7 | 43 | 12.4 | 757 |
| DSF115-175 | 13.6 | 830 | 0.7 | 43 | 14.3 | 873 |
| DSF200 | 13.9 | 848 | 0.7 | 43 | 14.6 | 891 |
| DSF270 | 27.5 | 1678 | 2.9 | 177 | 30.4 | 1855 |
| DSF325 | 27.1 | 1654 | 2.8 | 171 | 29.9 | 1825 |
| DSF485 | 28.5 | 1739 | 3.9 | 238 | 32.4 | 1977 |
| DSF530 | 28.5 | 1739 | 3.9 | 238 | 32.4 | 1977 |

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

R32

R32 is a pure HFC refrigerant with a zero Ozone Depletion Potential (ODP=0) and a low Global Warming Potential (GWP: 677/AR5; 675/AR4).

R32 leads to higher discharge temperatures than R410A but it offers higher cooling capacities and better efficiencies compared to R410A.

R32 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: 50-60 Hz data, Single compressor

| Model | Swept volume | | Displacement (50 Hz) ⁽¹⁾ | | Displacement (60 Hz) ⁽²⁾ | | Oil charge | | Net weight ⁽³⁾ | |
|--------|----------------------|-----------|-------------------------------------|---------|-------------------------------------|---------|-----------------|-----|---------------------------|-----|
| | cm ³ /rev | cu.in/rev | m ³ /h | cu.ft/h | m ³ /h | cu.ft/h | dm ³ | oz | kg | lbs |
| DSF090 | 81.3 | 4.96 | 14.2 | 500 | 17.1 | 603 | 3.0 | 102 | 58 | 128 |
| DSF100 | 88.4 | 5.39 | 15.4 | 544 | 18.6 | 657 | 3.0 | 102 | 58 | 128 |
| DSF115 | 103.5 | 6.32 | 18 | 636 | 21.8 | 770 | 3.3 | 113 | 64 | 141 |
| DSF130 | 116.9 | 7.13 | 20.3 | 717 | 24.6 | 869 | 3.3 | 113 | 64 | 141 |
| DSF155 | 133 | 8.12 | 23.1 | 816 | 27.9 | 985 | 3.3 | 113 | 67 | 148 |
| DSF175 | 151.7 | 9.26 | 26.4 | 932 | 31.9 | 1127 | 3.3 | 113 | 69 | 152 |
| DSF200 | 170.3 | 10.39 | 29.6 | 1045 | 35.8 | 1264 | 3.6 | 123 | 71.5 | 158 |
| DSF270 | 227.6 | 13.89 | 39.6 | 1398 | 47.8 | 1688 | 6.1 | 206 | 114 | 251 |
| DSF325 | 276.2 | 16.85 | 48.1 | 1699 | 58.0 | 2048 | 6.1 | 206 | 117 | 258 |
| DSF485 | 407.2 | 24.85 | 70.9 | 2502 | 85.1 | 3005 | 6.1 | 206 | 176 | 388 |
| DSF530 | 442.6 | 27.01 | 77 | 2719 | 92.9 | 3281 | 6.1 | 206 | 176 | 388 |

⁽¹⁾ Displacement at nominal speed: 2900 rpm at 50 Hz

⁽²⁾ Displacement at nominal speed : 3500 rpm at 60 Hz

⁽³⁾ Net weight with oil charge

Performance data

R32 50-60 Hz, Single compressor

Table 8: 50-60 Hz R32, Single compressor

| Model | Nominal tons 60Hz | Nominal cooling capacity | | Power input | COP | E.E.R. | |
|-------|----------------------|--------------------------|--------|-------------|-------|--------|---------|
| | | TR | W | Btu/h | kW | W/W | Btu/h/W |
| 50 Hz | DSF090 | 7.5 | 19958 | 68096 | 6.69 | 2.99 | 10.19 |
| | DSF100 | 8.5 | 21940 | 74860 | 7.13 | 3.08 | 10.50 |
| | DSF115 | 10 | 26349 | 89904 | 8.31 | 3.17 | 10.82 |
| | DSF130 | 11 | 29421 | 100384 | 9.19 | 3.20 | 10.93 |
| | DSF155 | 13 | 33772 | 115232 | 10.51 | 3.21 | 10.97 |
| | DSF175 | 15 | 39172 | 133655 | 12.07 | 3.24 | 11.07 |
| | DSF200 | 16.5 | 43329 | 147838 | 13.53 | 3.20 | 10.92 |
| | DSF270 | 22.5 | 59030 | 201416 | 17.98 | 3.28 | 11.20 |
| | DSF325 | 27 | 71480 | 243897 | 21.50 | 3.33 | 11.35 |
| | DSF485 | 40 | 107102 | 365443 | 31.67 | 3.38 | 11.54 |
| | DSF530 | 44 | 116998 | 399209 | 34.27 | 3.41 | 11.65 |
| 60 Hz | DSF090 | 7.5 | 26938 | 91911 | 8.68 | 3.10 | 10.59 |
| | DSF100 | 8.5 | 29362 | 100182 | 9.38 | 3.13 | 10.67 |
| | DSF115 | 10 | 34923 | 119157 | 10.79 | 3.24 | 11.04 |
| | DSF130 | 11 | 39465 | 134653 | 12.24 | 3.22 | 11.00 |
| | DSF155 | 13 | 45215 | 154273 | 13.82 | 3.27 | 11.16 |
| | DSF175 | 15 | 51618 | 176121 | 15.70 | 3.29 | 11.22 |
| | DSF200 | 16.5 | 57717 | 196932 | 17.63 | 3.27 | 11.17 |
| | DSF270 | 22.5 | 78270 | 267065 | 23.69 | 3.30 | 11.27 |
| | DSF325 | 27 | 95210 | 324866 | 28.54 | 3.34 | 11.38 |
| | DSF485 | 40 | 144600 | 493390 | 42.12 | 3.43 | 11.71 |
| | DSF530 | 44 | 156300 | 533311 | 45.6 | 3.43 | 11.70 |

NOTE:

TR: Ton of Refrigeration,

COP: Coefficient Of Performance

EER: Energy Efficiency Ratio

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

Standard rating conditions for 60Hz: 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**.

Tandem and trio performances

The impact of manifolding on compressor performances depends widely of the customer system itself. Therefore, it would be unrealistic to provide data that corresponds accurately to a particular system. In first approach, to support compressors selection at full load, the manifold performances can be considered as the sum of capacities of the compressors composing the manifold. For better accuracy, the customer should integrate the appropriate weighing coefficients according to his system very pressure drops and part load levels.

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

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

Sound levels for compressors running alone as follows:

Table 9: Compressor sound radiation

| Compressor model | 50 Hz | | 60 Hz | | Acoustic hood code no. |
|------------------|--------------------|--------------------|--------------------|--------------------|-------------------------------|
| | Sound power, dB(A) | Attenuation, dB(A) | Sound power, dB(A) | Sound power, dB(A) | |
| DSF090 | 74 | 4 | 77 | 4 | Body 120Z0490 Top 120Z0493 |
| DSF100 | 76 | 4 | 79 | 4 | Body 120Z0490 Top 120Z0493 |
| DSF115-175 | 78 | 4 | 81 | 5 | Body 120Z0491 Top 120Z0493 |
| DSF200 | 80 | 5 | 83 | 6 | Body 120Z0492 Top 120Z0493 |
| DSF270 | 83 | 4 | 86 | 4 | 120Z0768 |
| DSF325 | 83 | 4 | 86 | 4 | |
| DSF485 | 89 | 4 | 92 | 4 | |
| DSF530 | 89 | 4 | 92 | 4 | |

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

$$DSF810T = 3 \times DSF270$$

$$L_{\text{DSF270}} = 83 \text{ dB(A)}$$

$$L_{\text{DSF810T}} = 83 + 10 \log_{10} 3 = 87.8 \text{ dB(A)}$$

The global sound level of "n" different compressors with respectively L_i sound level is:

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

Example for the tandem

$$DSF1180T = DSF325 + DSF325 + DSF530$$

$$L_{\text{DSF325}} = 83 \text{ dB(A)}, L_{\text{DSF530}} = 89 \text{ dB(A)}$$

$$L_{\text{DSF1180T}} = 10 \log_{10} (10^{0.1 \times 83} + 10^{0.1 \times 83} + 10^{0.1 \times 89}) = 90.8 \text{ dB(A)}$$

Mechanical vibrations

A compressor generates some vibrations that propagate into the surrounding parts and structure. The vibration level of a DSF compressor alone does not exceed 120 μm peak to peak for DSF090 to DSF200, and 154 μm peak to peak for DSF270 to DSF530.. 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

⚠ The **Operating envelope data** for DSF 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 10K range at nominal Voltage.

Operating envelope

Figure 5: Operating envelope R32 DSF090 to DSF130

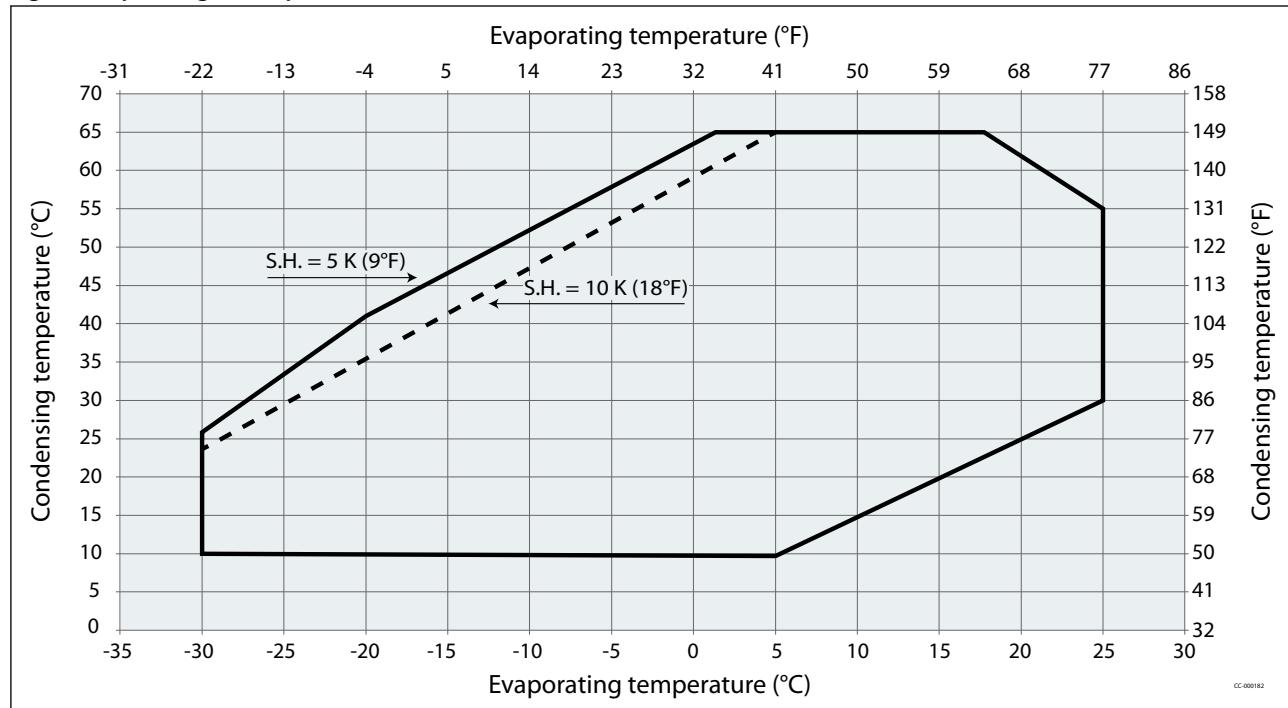


Figure 6: Operating envelope R32 DSF155 to DSF200

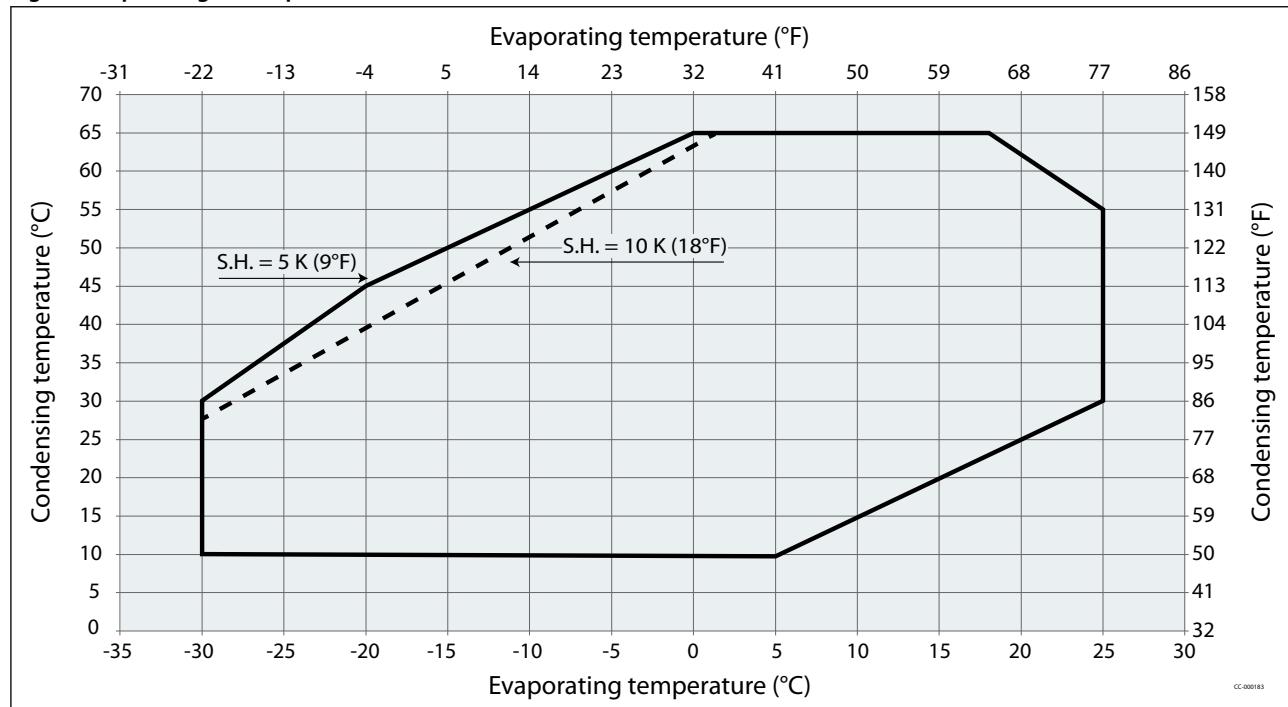
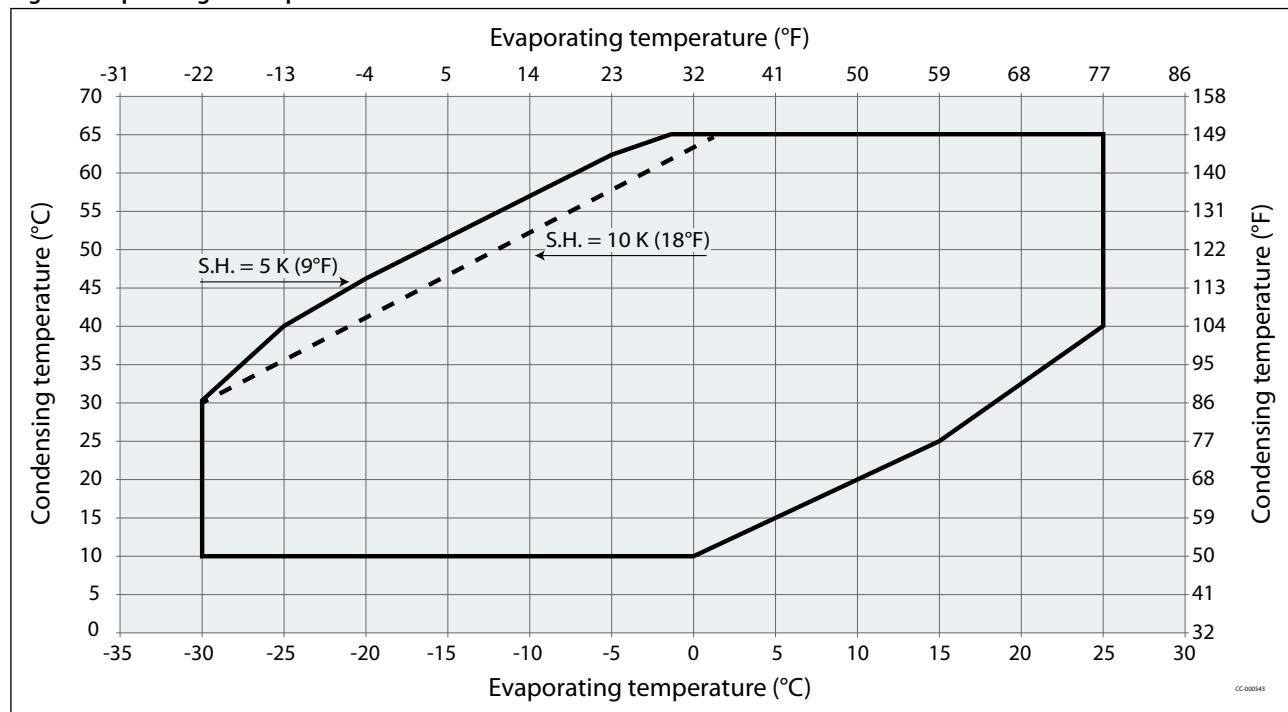


Figure 7: Operating envelope R32 DSF270 to DSF530



Pressure settings

Table 10: Pressure settings

| Pressure settings | R32 | |
|---|--------|---|
| Working range high side | bar(g) | 10 – 43 |
| | psig | 145 – 624 |
| Working range low side | bar(g) | 1.7 – 15.9 |
| | psig | 25 – 231 |
| Maximum high pressure safety switch setting | bar(g) | 44.4 |
| | psig | 645 |
| Minimum low pressure safety switch setting | bar(g) | 1.5 |
| | psig | 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 8: Outline drawing number 1

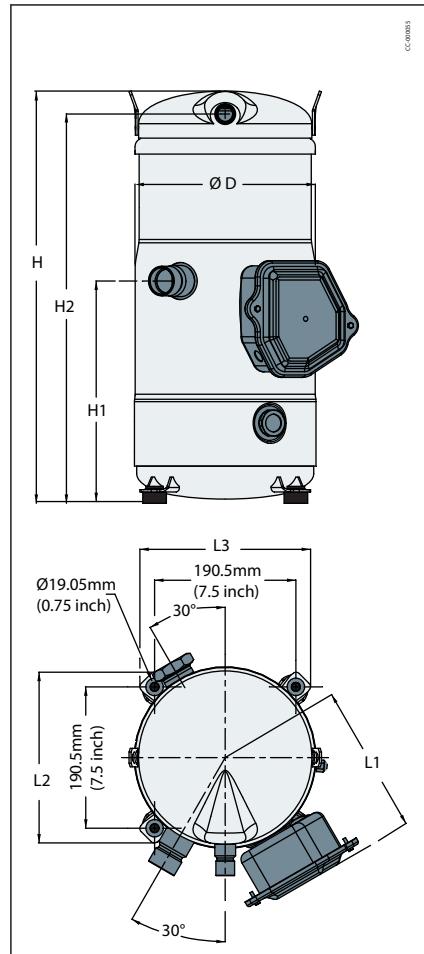


Figure 9: Outline drawing number 2

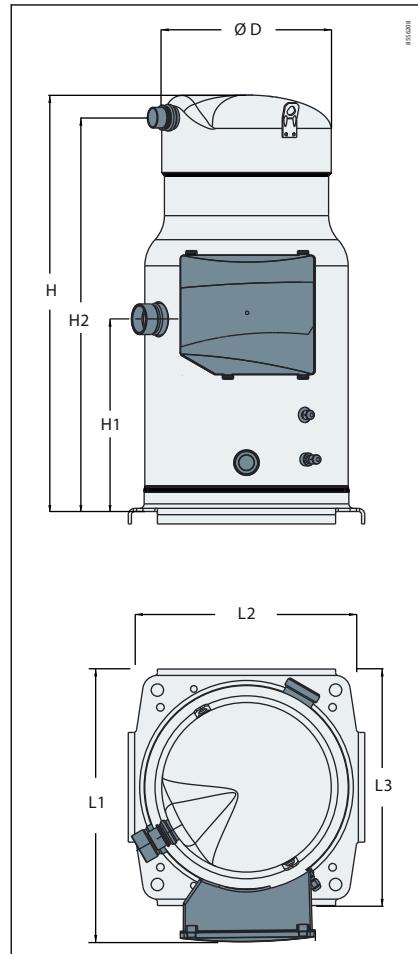


Figure 10: Outline drawing number 3

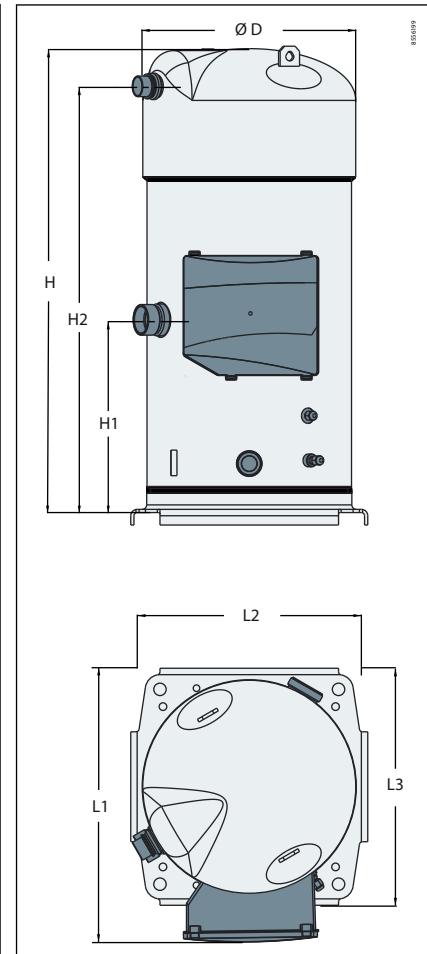
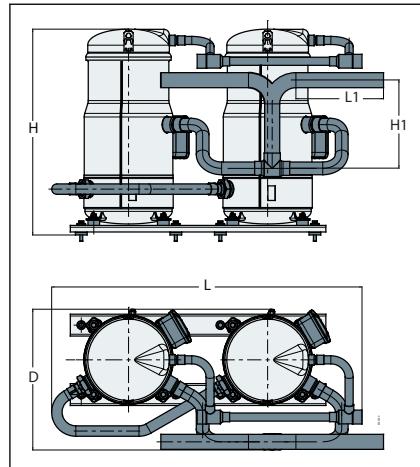
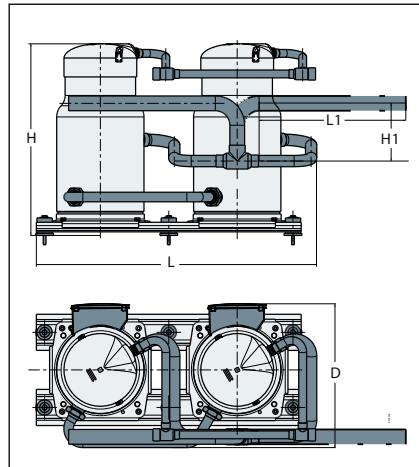
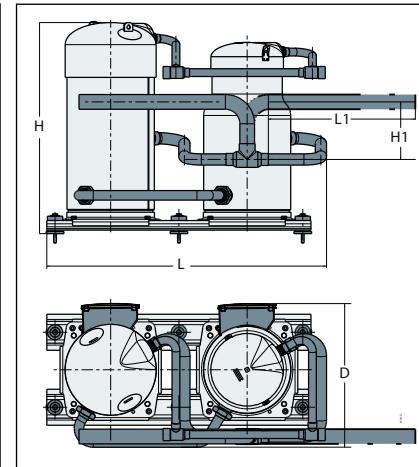
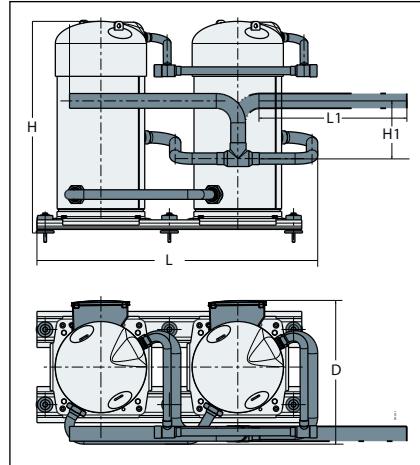
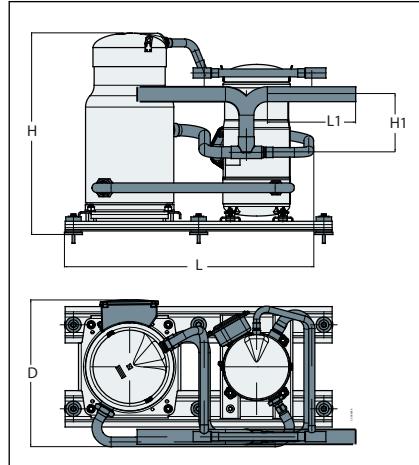


Table 11: Single compressor

| Compressor model | Motor voltage code | D | | H | | H1 | | H2 | | L1 | | L2 | | L3 | | Outline drawing no. |
|------------------|----------------------------|-----|-------|-----|-------|-----|-------|-----|-------|-----|-------|-----|-------|-----|-------|---------------------|
| | | mm | inch | |
| DSF090-100 | 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 | 8560176 |
| DSF115-175 | 3 ⁽¹⁾ , 4, 7, 9 | 243 | 9.57 | 542 | 21.34 | 278 | 10.94 | 509 | 20.04 | 180 | 7.09 | 230 | 9.06 | 230 | 9.06 | 8560177 |
| DSF115-175 | 3 | 243 | 9.57 | 542 | 21.34 | 278 | 10.94 | 509 | 20.04 | 201 | 7.91 | 230 | 9.06 | 230 | 9.06 | 8560246 |
| DSF200 | 3, 7, 9 | 243 | 9.57 | 558 | 21.97 | 299 | 11.77 | 524 | 20.63 | 201 | 7.91 | 230 | 9.06 | 230 | 9.06 | 8560235 |
| DSF200 | 4 | 243 | 9.57 | 558 | 21.97 | 299 | 11.77 | 524 | 20.63 | 180 | 7.09 | 230 | 9.06 | 230 | 9.06 | 8560234 |
| DSF270 | 3, 4, 7, 9 | 266 | 10.47 | 653 | 25.71 | 302 | 11.87 | 618 | 24.33 | 427 | 16.81 | 371 | 14.61 | 371 | 14.61 | 2 |
| DSF325 | 3, 4, 7, 9 | 266 | 10.47 | 653 | 25.71 | 302 | 11.87 | 618 | 24.33 | 427 | 16.81 | 371 | 14.61 | 371 | 14.61 | 8556208 |
| DSF485 | 3, 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 |
| DSF530 | 3, 4, 7, 9 | 333 | 13.11 | 726 | 28.58 | 302 | 11.87 | 667 | 26.26 | 429 | 16.89 | 371 | 14.61 | 371 | 14.61 | 8556198 |

⁽¹⁾ DSF115-130

Tandem assemblies

Figure 11: Outline drawing number 1

Figure 12: Outline drawing number 2

Figure 13: Outline drawing number 3

Figure 14: Outline drawing number 4

Figure 15: Outline drawing number 5

Table 12: Tandem assemblies

| Tandem model | Motor voltage code | Composition Cp1 + Cp2 | L | | D | | H | | L1 | | H1 | | Outline drawing number |
|--------------|--------------------|-----------------------|-----|-------|-----|-------|-----|-------|-----|------|-----|------|------------------------|
| | | | mm | inch | mm | inch | mm | inch | mm | inch | mm | inch | |
| DSF180E | 3, 4, 7, 9 | DSF090+DSF090 | 850 | 33.46 | 384 | 15.12 | 507 | 19.96 | 240 | 9.45 | 242 | 9.53 | 1 8560144 |
| DSF200E | 3, 4, 7, 9 | DSF100+DSF100 | 850 | 33.46 | 384 | 15.12 | 507 | 19.96 | 240 | 9.45 | 242 | 9.53 | 1 8560144 |
| DSF230E | 3, 4, 7, 9 | DSF115+DSF115 | 850 | 33.46 | 384 | 15.12 | 565 | 22.24 | 240 | 9.45 | 242 | 9.53 | 1 8560145 |
| DSF260E | 3, 4, 7, 9 | DSF130+DSF130 | 850 | 33.46 | 384 | 15.12 | 565 | 22.24 | 240 | 9.45 | 242 | 9.53 | 1 8560145 |
| DSF215U | 3, 4, 7, 9 | DSF100+DSF115 | 850 | 33.46 | 386 | 15.2 | 565 | 22.24 | 240 | 9.45 | 242 | 9.53 | 1 8560189 |
| DSF230U | 3, 4, 7, 9 | DSF100+DSF130 | 850 | 33.46 | 386 | 15.2 | 565 | 22.24 | 240 | 9.45 | 242 | 9.53 | 1 8560189 |
| DSF255U | 4, 7, 9 | DSF100+DSF155 | 850 | 33.46 | 386 | 15.2 | 565 | 22.24 | 240 | 9.45 | 242 | 9.53 | 1 8560189 |
| DSF255U | 3 | DSF100+DSF155 | 850 | 33.46 | 428 | 16.85 | 565 | 22.24 | 240 | 9.45 | 242 | 9.53 | 1 8560189 |
| DSF275U | 4, 7, 9 | DSF100+DSF175 | 850 | 33.46 | 386 | 15.2 | 565 | 22.24 | 240 | 9.45 | 242 | 9.53 | 1 8560189 |
| DSF275U | 3 | DSF100+DSF175 | 850 | 33.46 | 428 | 16.85 | 565 | 22.24 | 240 | 9.45 | 242 | 9.53 | 1 8560189 |
| DSF285U | 4, 7, 9 | DSF130+DSF155 | 850 | 33.46 | 386 | 15.2 | 565 | 22.24 | 240 | 9.45 | 242 | 9.53 | 1 8560168 |
| DSF285U | 3 | DSF130+DSF155 | 850 | 33.46 | 428 | 16.85 | 565 | 22.24 | 240 | 9.45 | 242 | 9.53 | 1 8560168 |
| DSF300U | 3, 7, 9 | DSF100+DSF200 | 850 | 33.46 | 428 | 16.85 | 580 | 22.83 | 240 | 9.45 | 242 | 9.53 | 1 8560190 |
| DSF300U | 4 | DSF100+DSF200 | 850 | 33.46 | 386 | 15.2 | 580 | 22.83 | 240 | 9.45 | 242 | 9.53 | 1 8560190 |
| DSF305U | 4, 7, 9 | DSF130+DSF175 | 850 | 33.46 | 386 | 15.2 | 565 | 22.24 | 240 | 9.45 | 242 | 9.53 | 1 8560168 |
| DSF305U | 3 | DSF130+DSF175 | 850 | 33.46 | 428 | 16.85 | 565 | 22.24 | 240 | 9.45 | 242 | 9.53 | 1 8560168 |
| DSF310E | 4, 7, 9 | DSF155+DSF155 | 850 | 33.46 | 384 | 15.12 | 565 | 22.24 | 240 | 9.45 | 242 | 9.53 | 1 8560145 |
| DSF310E | 3 | DSF155+DSF155 | 850 | 33.46 | 428 | 16.85 | 565 | 22.24 | 240 | 9.45 | 242 | 9.53 | 1 8560145 |
| DSF315U | 3, 7, 9 | DSF115+DSF200 | 850 | 33.46 | 428 | 16.85 | 580 | 22.83 | 240 | 9.45 | 242 | 9.53 | 1 8560167 |
| DSF315U | 4 | DSF115+DSF200 | 850 | 33.46 | 386 | 15.2 | 580 | 22.83 | 240 | 9.45 | 242 | 9.53 | 1 8560167 |
| DSF330U | 4, 7, 9 | DSF155+DSF175 | 850 | 33.46 | 386 | 15.2 | 565 | 22.24 | 240 | 9.45 | 242 | 9.53 | 1 8560168 |
| DSF330U | 3 | DSF155+DSF175 | 850 | 33.46 | 428 | 16.85 | 565 | 22.24 | 240 | 9.45 | 242 | 9.53 | 1 8560168 |

Scroll compressors, DSF090 to DSF530 | Dimensions

| Tandem model | Motor voltage code | Composition Cp1 + Cp2 | L | | D | | H | | L1 | | H1 | | Outline drawing number |
|--------------|--------------------|-----------------------|------|-------|-----|-------|-----|-------|-----|-------|-----|------|------------------------|
| | | | mm | inch | mm | inch | mm | inch | mm | inch | mm | inch | |
| DSF331U | 3, 7, 9 | DSF130+DSF200 | 850 | 33.46 | 428 | 16.85 | 580 | 22.83 | 240 | 9.45 | 242 | 9.53 | 1 8560167 |
| DSF331U | 4 | DSF130+DSF200 | 850 | 33.46 | 386 | 15.2 | 580 | 22.83 | 240 | 9.45 | 242 | 9.53 | 1 8560167 |
| DSF350E | 4, 7, 9 | DSF175+DSF175 | 850 | 33.46 | 384 | 15.12 | 565 | 22.24 | 240 | 9.45 | 242 | 9.53 | 1 8560145 |
| DSF350E | 3 | DSF175+DSF175 | 850 | 33.46 | 428 | 16.85 | 565 | 22.24 | 240 | 9.45 | 242 | 9.53 | 1 8560145 |
| DSF355U | 3, 7, 9 | DSF155+DSF200 | 850 | 33.46 | 428 | 16.85 | 580 | 22.83 | 240 | 9.45 | 242 | 9.53 | 1 8560167 |
| DSF355U | 4 | DSF155+DSF200 | 850 | 33.46 | 386 | 15.2 | 580 | 22.83 | 240 | 9.45 | 242 | 9.53 | 1 8560167 |
| DSF375U | 3, 7, 9 | DSF175+DSF200 | 850 | 33.46 | 428 | 16.85 | 580 | 22.83 | 240 | 9.45 | 242 | 9.53 | 1 8560167 |
| DSF375U | 4 | DSF175+DSF200 | 850 | 33.46 | 386 | 15.2 | 580 | 22.83 | 240 | 9.45 | 242 | 9.53 | 1 8560167 |
| DSF400E | 3, 7, 9 | DSF200+DSF200 | 850 | 33.46 | 428 | 16.85 | 580 | 22.83 | 240 | 9.45 | 242 | 9.53 | 1 8560146 |
| DSF400E | 4 | DSF200+DSF200 | 850 | 33.46 | 386 | 15.2 | 580 | 22.83 | 240 | 9.45 | 242 | 9.53 | 1 8560146 |
| DSF400X | 3, 4, 7, 9 | DSF130+DSF270 | 903 | 35.55 | 533 | 20.98 | 731 | 28.78 | 359 | 14.13 | 211 | 8.31 | 5 8560169 |
| DSF470X | 3, 4, 7, 9 | DSF200+DSF270 | 903 | 35.55 | 533 | 20.98 | 731 | 28.78 | 359 | 14.13 | 211 | 8.31 | 5 8560170 |
| DSF500X | 3, 4, 7, 9 | DSF175+DSF325 | 903 | 35.55 | 533 | 20.98 | 731 | 28.78 | 359 | 14.13 | 211 | 8.31 | 5 8560169 |
| DSF525X | 3, 4, 7, 9 | DSF200+DSF325 | 903 | 35.55 | 533 | 20.98 | 731 | 28.78 | 359 | 14.13 | 211 | 8.31 | 5 8560170 |
| DSF540E | 3, 4, 7, 9 | DSF270+DSF270 | 1025 | 40.35 | 527 | 20.75 | 701 | 27.6 | 535 | 21.06 | 211 | 8.31 | 2 8556228 |
| DSF595U | 3, 4, 7, 9 | DSF270+DSF325 | 1025 | 40.35 | 527 | 20.75 | 701 | 27.6 | 535 | 21.06 | 211 | 8.31 | 2 8556228 |
| DSF650E | 3, 4, 7, 9 | DSF325+DSF325 | 1025 | 40.35 | 527 | 20.75 | 701 | 27.6 | 535 | 21.06 | 211 | 8.31 | 2 8556228 |
| DSF800U | 4, 7, 9 | DSF270+DSF530 | 1025 | 40.35 | 546 | 21.5 | 774 | 30.5 | 535 | 21.06 | 211 | 8.31 | 3 8556207 |
| DSF800U | 3 | DSF270+DSF530 | 1025 | 40.35 | 563 | 22.17 | 774 | 30.5 | 535 | 21.06 | 211 | 8.31 | 3 8556207 |
| DSF970E | 4, 7, 9 | DSF485+DSF485 | 1025 | 40.35 | 546 | 21.5 | 774 | 30.5 | 640 | 25.2 | 211 | 8.31 | 4 8556205 |
| DSF970E | 3 | DSF485+DSF485 | 1025 | 40.35 | 563 | 22.17 | 774 | 30.5 | 640 | 25.2 | 211 | 8.31 | 4 8556205 |
| DSF855U | 4, 7, 9 | DSF325+DSF530 | 1025 | 40.35 | 546 | 21.5 | 774 | 30.5 | 640 | 25.2 | 211 | 8.31 | 4 8556220 |
| DSF855U | 3 | DSF325+DSF530 | 1025 | 40.35 | 563 | 22.17 | 774 | 30.5 | 640 | 25.2 | 211 | 8.31 | 4 8556220 |
| DSF1060E | 4,7,9 | DSF530+DSF530 | 1025 | 40.35 | 553 | 21.77 | 774 | 30.5 | 640 | 25.2 | 211 | 8.31 | 4 8556205 |
| DSF1060E | 3 | DSF530+DSF530 | 1025 | 40.35 | 563 | 22.17 | 774 | 30.5 | 640 | 25.2 | 211 | 8.31 | 4 8556205 |

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 16: Outline drawing number 6

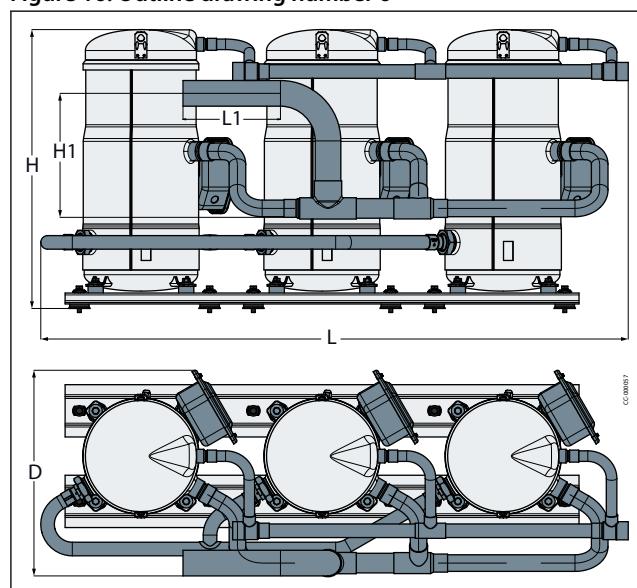


Figure 17: Outline drawing number 7

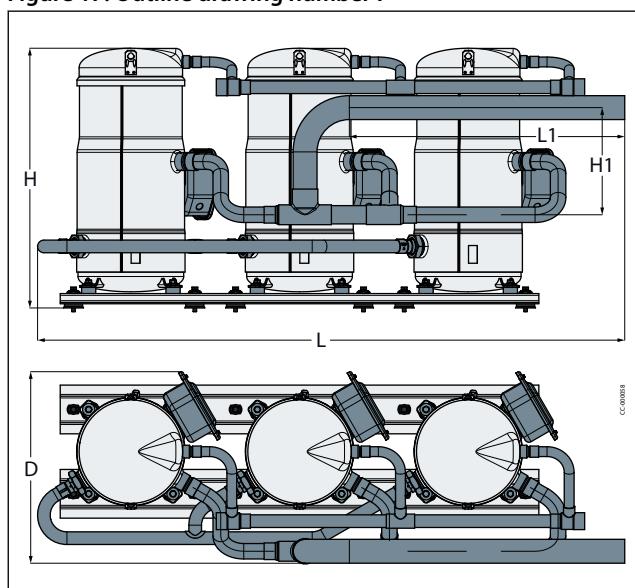


Figure 18: Outline drawing number 8

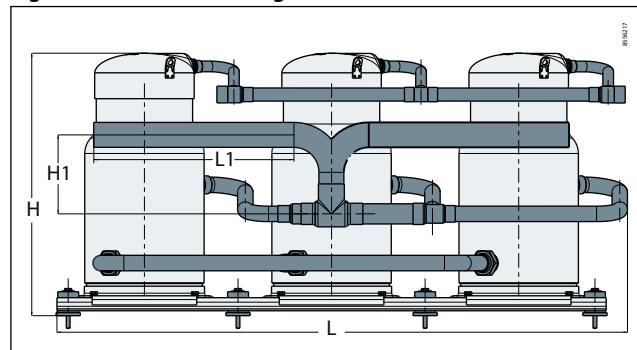


Figure 19: Outline drawing number 9

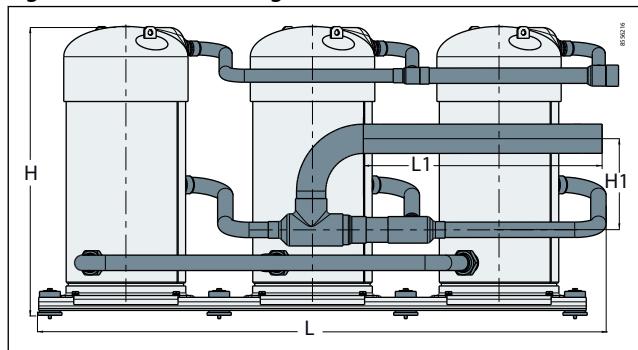


Table 13: Trio assemblies

| Trio model | Motor voltage code | Composition | L | | D | | H | | L1 | | H1 | | Outline drawing number | |
|------------|--------------------|----------------------|------|-------|-----|-------|-----|------|---------|-------|-----|------|------------------------|---------|
| | | | mm | inch | mm | inch | mm | inch | mm | inch | mm | inch | | |
| DSF465T | 4, 7, 9 | 3 x DSF155 | 1230 | 48.4 | 402 | 15.8 | 571 | 22.5 | 205 | 8.1 | 242 | 9.5 | 6 | 8560172 |
| | | | 1326 | 52.2 | 402 | 15.8 | 571 | 22.5 | 622 | 24.5 | 242 | 9.5 | 7 | 8560172 |
| DSF465T | 3 | 3 x DSF155 | 1230 | 48.4 | 433 | 17 | 571 | 22.5 | 205 | 8.1 | 242 | 9.5 | 6 | 8560172 |
| | | | 1326 | 52.2 | 433 | 17 | 571 | 22.5 | 622 | 24.5 | 242 | 9.5 | 7 | 8560172 |
| DSF525T | 4, 7, 9 | 3 x DSF175 | 1230 | 48.4 | 402 | 15.8 | 571 | 22.5 | 205 | 8.1 | 242 | 9.5 | 6 | 8560172 |
| | | | 1326 | 52.2 | 402 | 15.8 | 571 | 22.5 | 622 | 24.5 | 242 | 9.5 | 7 | 8560172 |
| DSF525T | 3 | 3 x DSF175 | 1230 | 48.4 | 433 | 17 | 571 | 22.5 | 205 | 8.1 | 242 | 9.5 | 6 | 8560172 |
| | | | 1326 | 52.2 | 433 | 17 | 571 | 22.5 | 622 | 24.5 | 242 | 9.5 | 7 | 8560172 |
| DSF 600T | 3, 7, 9 | 3 x DSF200 | 1236 | 48.7 | 433 | 17 | 587 | 23.1 | 205 | 8.1 | 242 | 9.5 | 6 | 8560171 |
| | | | 1326 | 52.2 | 433 | 17 | 587 | 23.1 | 622 | 24.5 | 242 | 9.5 | 7 | 8560171 |
| DSF 600T | 4 | 3 x DSF200 | 1236 | 48.7 | 404 | 15.8 | 587 | 23.1 | 205 | 8.1 | 242 | 9.5 | 6 | 8560171 |
| | | | 1326 | 52.2 | 404 | 15.8 | 587 | 23.1 | 622 | 24.5 | 242 | 9.5 | 7 | 8560171 |
| DSF810T | 3, 4, 7, 9 | DSF270+DSF270+DSF270 | 1467 | 57.76 | 543 | 21.38 | 701 | 27.6 | 535 min | 21.06 | 211 | 8.31 | 8 | 8556217 |
| DSF975T | 3, 4, 7, 9 | DSF325+DSF325+DSF325 | 1467 | 57.76 | 543 | 21.38 | 701 | 27.6 | 535 min | 21.06 | 211 | 8.31 | 8 | 8556217 |
| DSF1180T | 3, 4, 7, 9 | DSF325+DSF325+DSF530 | 1467 | 57.76 | 573 | 22.56 | 774 | 30.5 | 535 min | 21.06 | 211 | 8.31 | 8 | 8556310 |
| DSF1180T | 3 | DSF325+DSF325+DSF530 | 1467 | 57.76 | 590 | 23.23 | 774 | 30.5 | 535 min | 21.06 | 211 | 8.31 | 8 | 8556310 |
| DSF1385T | 3, 4, 7, 9 | DSF530+DSF530+DSF325 | 1520 | 59.84 | 573 | 22.56 | 774 | 30.5 | 640 min | 25.19 | 244 | 9.61 | 9 | 8556314 |
| DSF1385T | 3 | DSF530+DSF530+DSF325 | 1520 | 59.84 | 573 | 22.56 | 774 | 30.5 | 640 min | 25.19 | 244 | 9.61 | 9 | 8556314 |
| DSF1590T | 3, 4, 7, 9 | DSF530+DSF530+DSF530 | 1520 | 59.84 | 573 | 22.56 | 774 | 30.5 | 640 min | 25.19 | 244 | 9.61 | 9 | 8556216 |
| DSF1590T | 3 | DSF530+DSF530+DSF530 | 1520 | 59.84 | 590 | 23.23 | 774 | 30.5 | 681 min | 26.77 | 244 | 9.61 | 9 | 8556216 |

NOTE:

Trio to be achieved by assembly of individual compressors.

Mechanical connections

Connection details

Table 14: Connection details

| Connection Details | DSF090-100 | DSF115-200 | DSF270-325 | DSF485-530 |
|-----------------------------------|---|----------------|--|--|
| Suction connection | Brazed 1"1/8 | Brazed 1"3/8 | Brazed 1"5/8 | Brazed 1"5/8 |
| Discharge connection | Brazed 7/8" | Brazed 7/8" | Brazed 1"1/8 | Brazed 1"3/8 |
| Oil sight glass |  | | Threaded (1"1/8 – 18 UNEF) | |
| Oil equalization connection |  | Rotolock 1"3/4 | | Rotolock 2"1/4 |
| Oil drain connection |  | None | None | Female 1/4" Flare incorporating a Schrader valve |
| Low pressure gauge port (Shrader) |  | | Male 1/4" Flare incorporating a Schrader valve | |
| Outline drawing | 1 | 1 | 2 | 2 |

Figure 20: Outline drawing 1

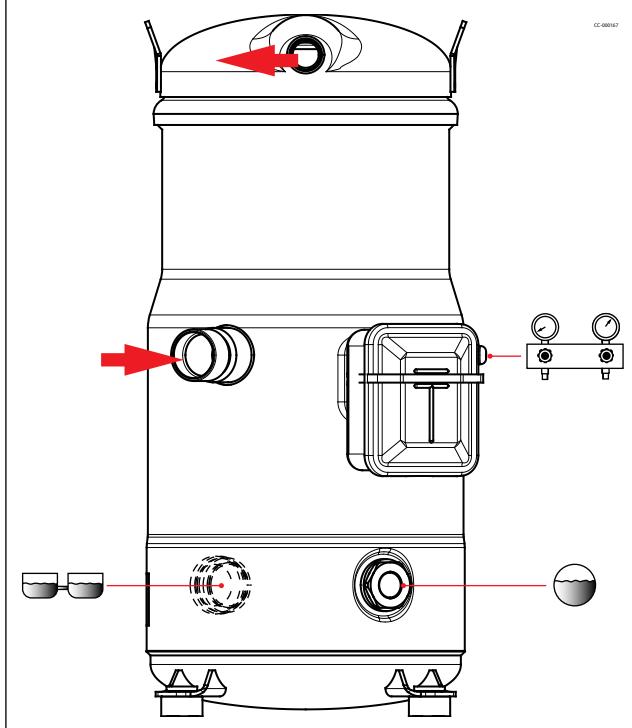
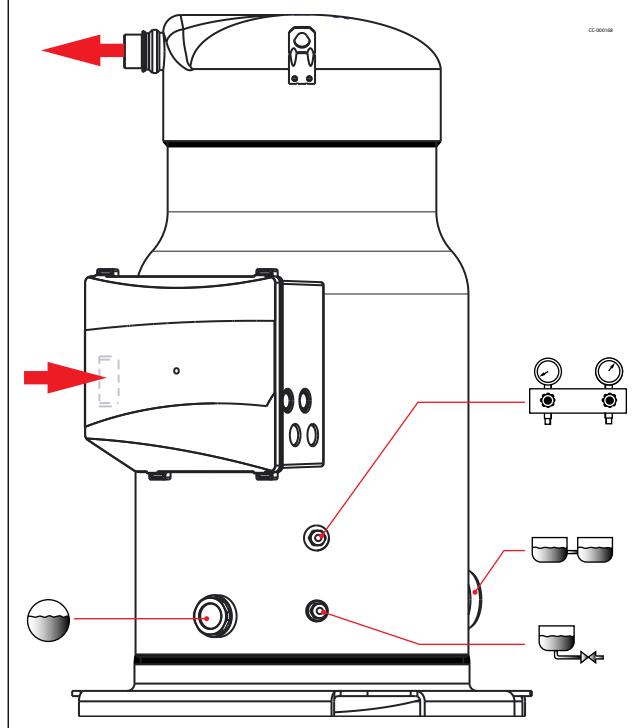


Figure 21: Outline drawing 2



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.

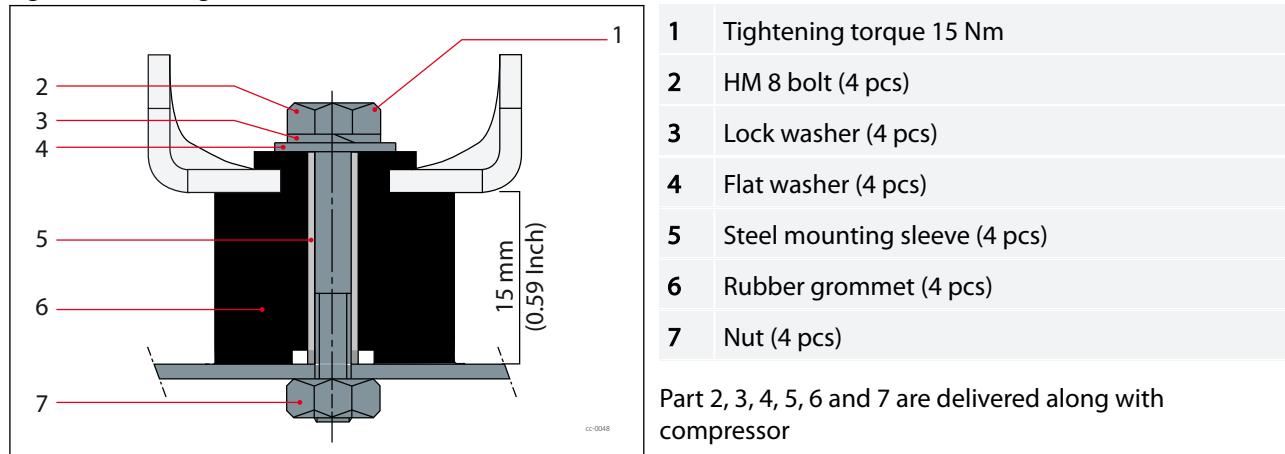
During operation, the maximum inclination from the vertical plane must not exceed 3 degrees.

Single requirements DSF090-200 mounting

Compressors DSF090-200 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 DSF090-200 compressors is HM8-40. This bolt must be tightened to a torque of 15Nm.

Figure 22: Rubber grommets



Single requirements, DSF270-325-485-530 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 DSF compressors is HM8-55. This bolt must be tightened to a torque of 21 Nm.

Figure 23: Rubber grommets from kit 8156138

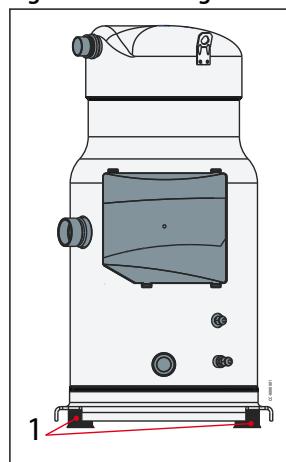
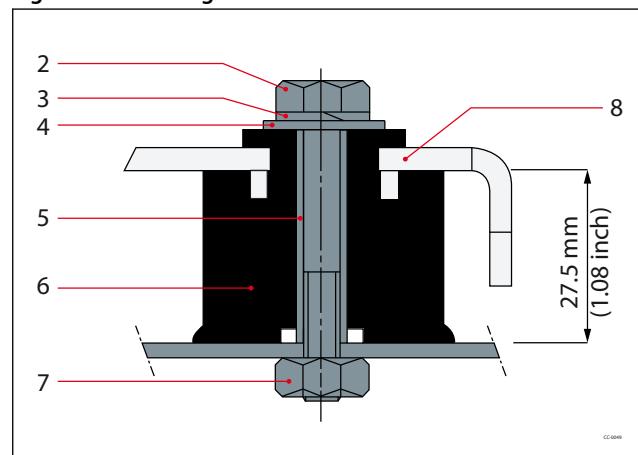


Figure 24: Rubber grommets



| | |
|---|----------------------------------|
| 1 | Rubber grommets from kit 8156138 |
| 2 | HM 8 bolt |
| 3 | Lock washer |
| 4 | Flat washer |

| | |
|---|-----------------------|
| 5 | Steel mounting sleeve |
| 6 | Rubber grommet |
| 7 | Nut |
| 8 | Compressor base plate |

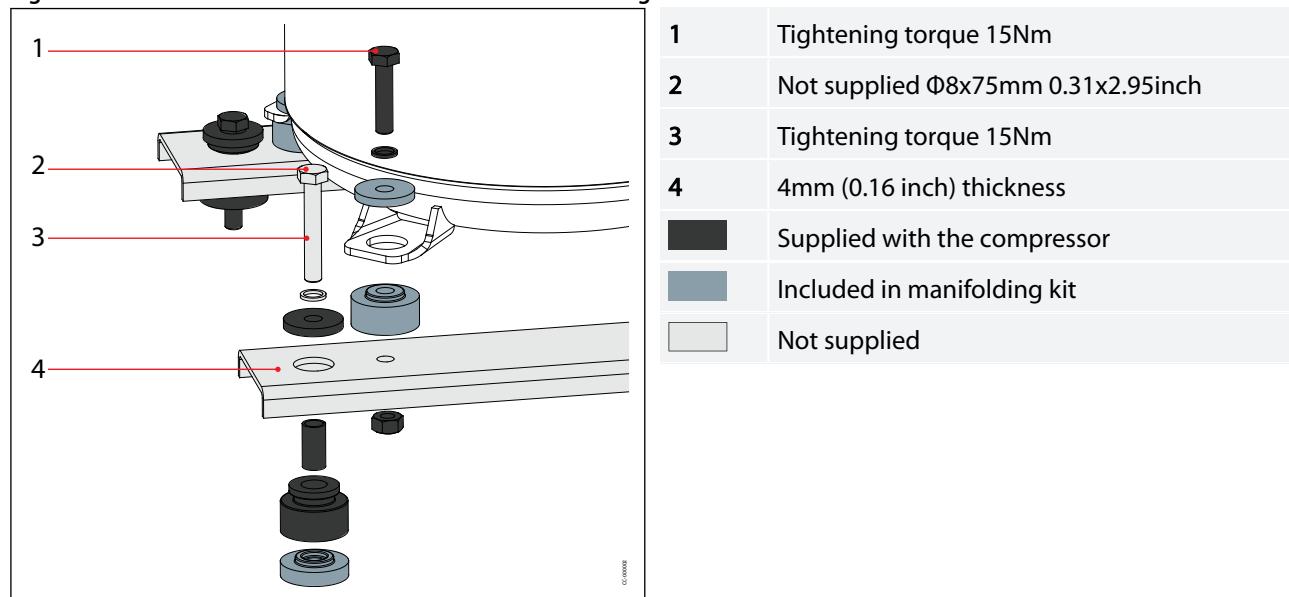
Manifolding requirements DSF 180E-400E and DSF285U-305U-330U mounting

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 25: DSF 180E-400E and DSF285U-305U-330U mounting



Manifolding requirements DSF 215U-230U-255U-275U-300U-315U-331U-355U-375U 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.

Figure 26: Smaller model of tandem

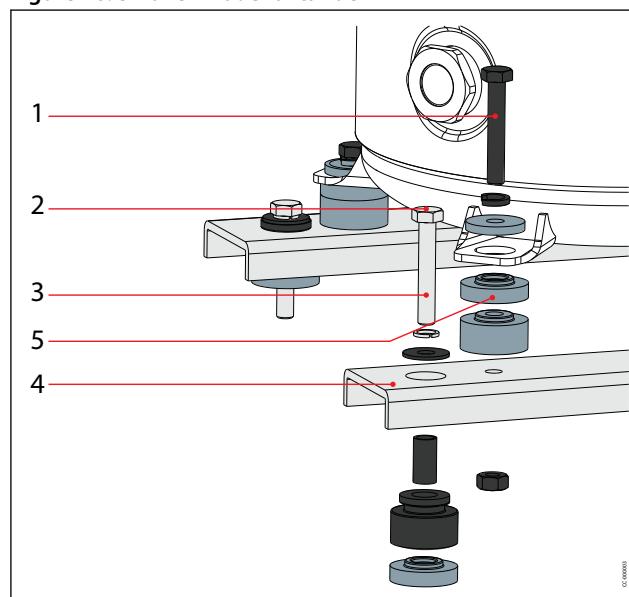
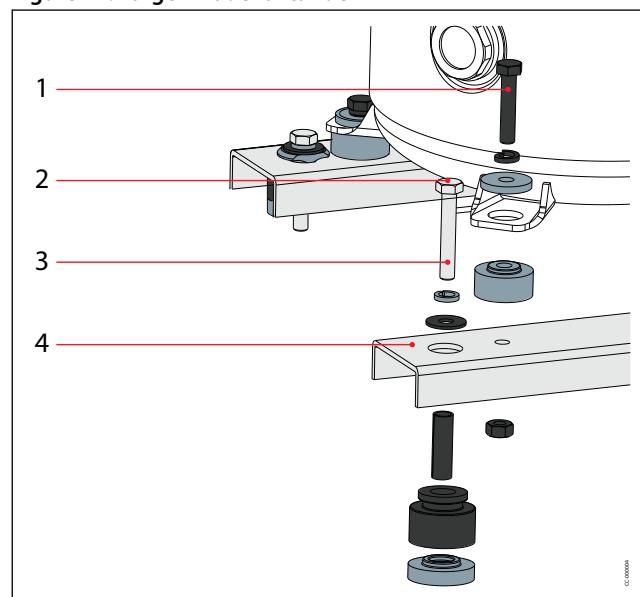


Figure 27: Larger model of tandem



| | | | |
|---|------------------------------|---|--|
| 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 |

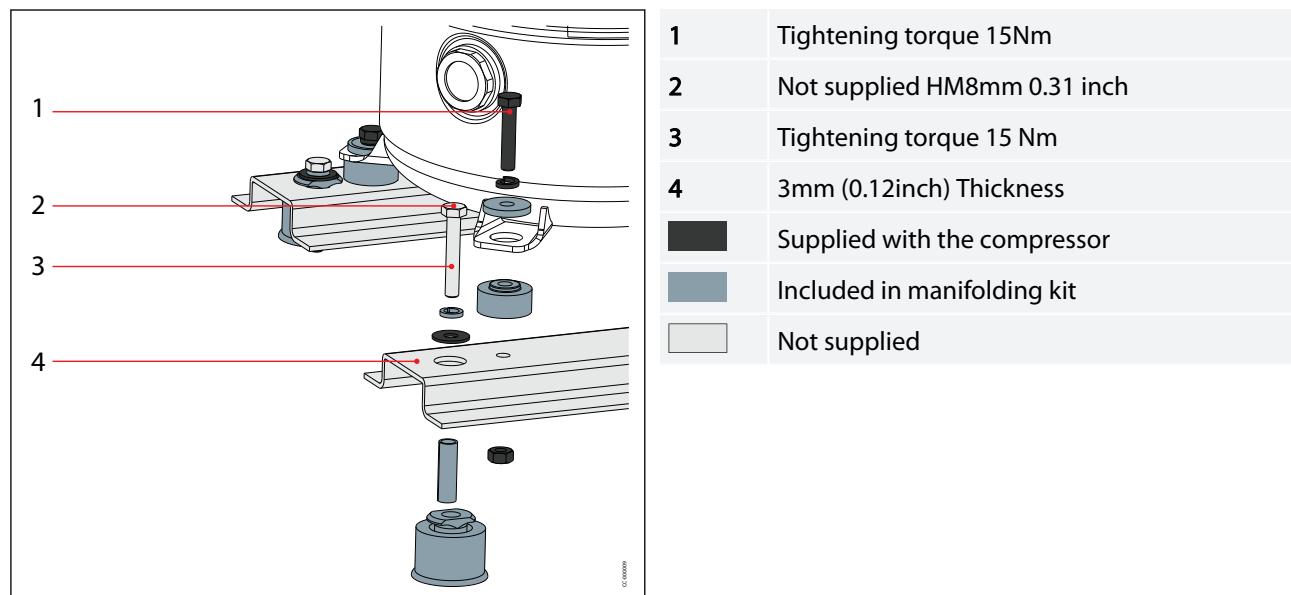
Table 15: Additional rigid spacer

| Additional rigid spacer | Additional right spacer(to be added on the smallest compressor of the tandem) |
|--|---|
| DSF215U-230U-255U-275U-315U-331U-355U-375U | 7mm |
| DSF300U | 14mm |

Tandem requirements DSF465T-525T-600T mounting

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

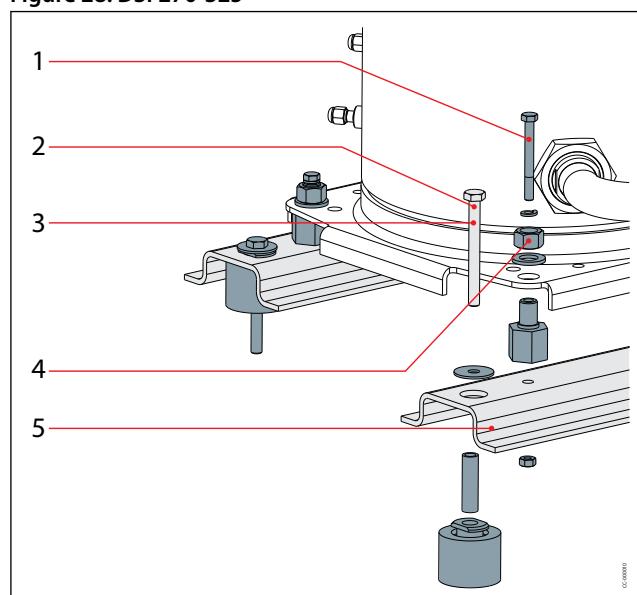
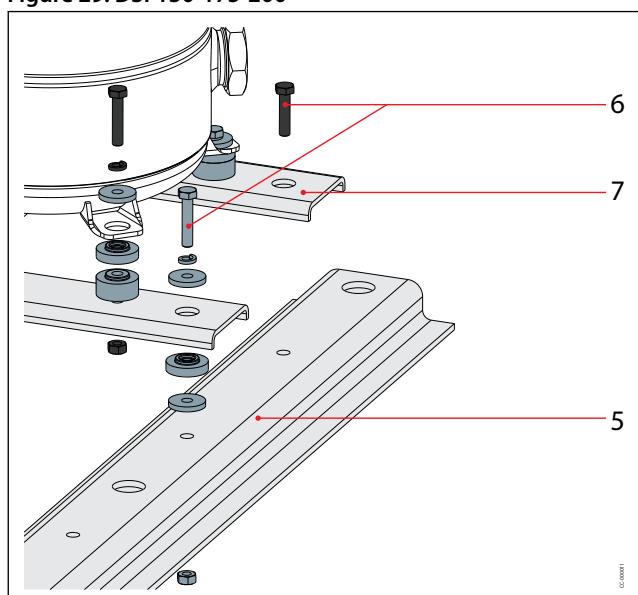
The rigid mounting spacers and rubber grommets are included in tandem accessory kits.



Tandem requirements DSF400X-470X-500X-525X mounting

The large compressor, DSF270,325, is mounted with rigid spacers on the rails.

The DSF130, 175,200 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 28: DSF270-325

Figure 29: DSF130-175-200


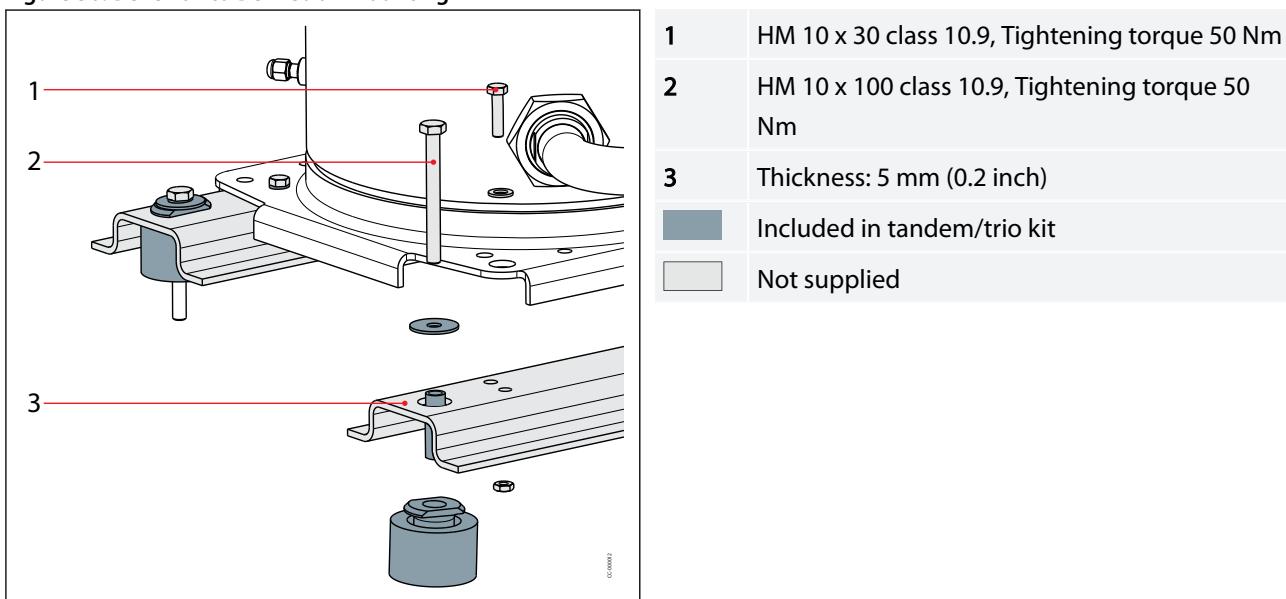
| | | | |
|---|-------------------------|---|------------------------------|
| 1 | Tightening torque 16Nm | 6 | Tightening torque 15Nm |
| 2 | Not supplied Ø10mm | 7 | 4mm (0.16inch) thickness |
| 3 | Tightening torque 50Nm | | Supplied with the compressor |
| 4 | Tightening torque 55Nm | | Included in manifolding kit |
| 5 | 5mm (0.2inch) thickness | | Not supplied |

Tandem requirements, DSF540E to DSF1590T mounting

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 30: DSF540E to DSF1590T mounting



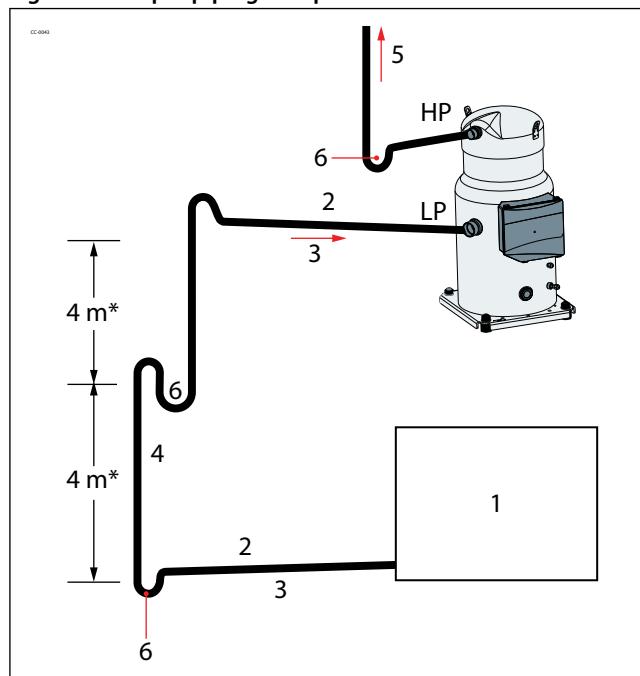
Design piping

General requirements

Proper piping practices should be employed to:

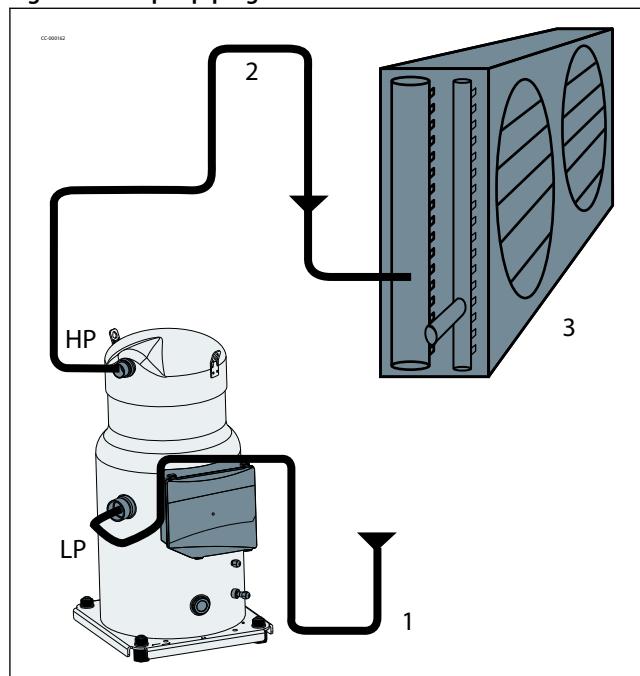
1. Ensure adequate oil return, even under minimum load conditions (refrigerant speed, piping slopes...). For validation tests see section **Manage oil** in the circuit.
2. Avoid condensed liquid refrigerant from draining back to the compressor when stopped (discharge piping upper loop). For validation 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 31: 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 32: Proper piping - Condenser



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

Tandem and Trio requirements (Static)

DSF 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, DSF tandems and trios are not factory-built.

To complete an assembly in the field, you will need:

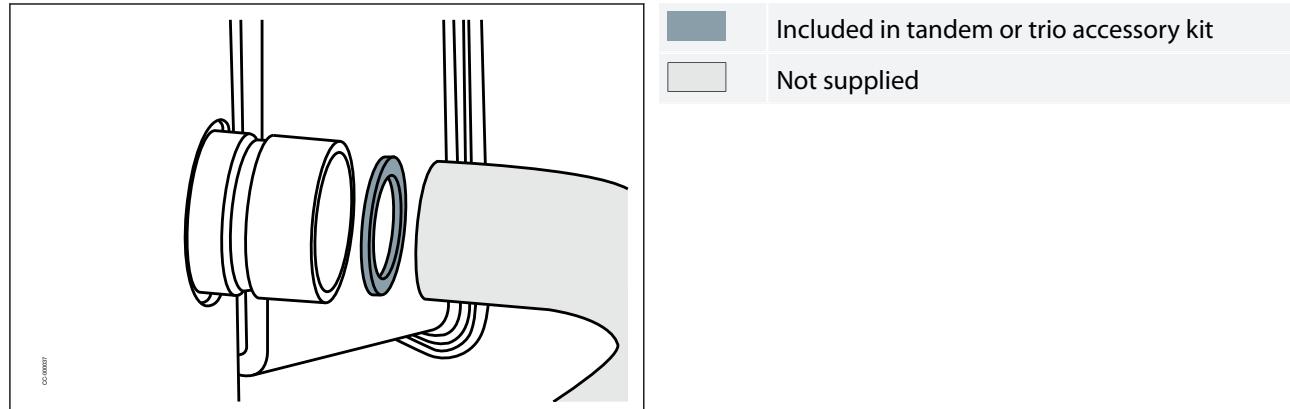
- Tubings, according to specific outline drawings indicated in the following table
- Manifolding accessory kit
- Compressors

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

Suction washer position

⚠ Depending on manifold configuration, it is essential to equalize the pressure of compressor sums. 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 33: Suction washer position



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 34: Example of right suction

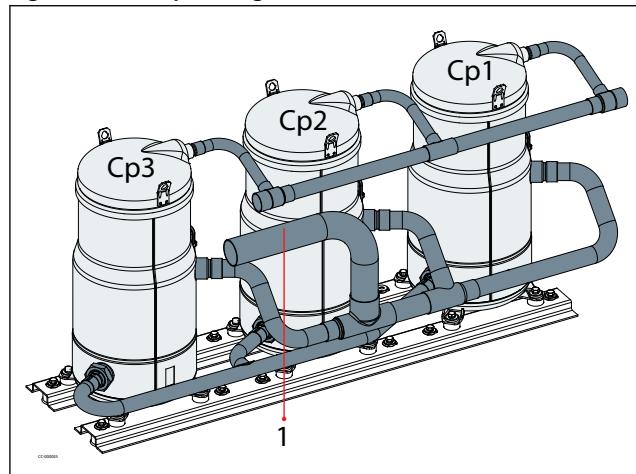
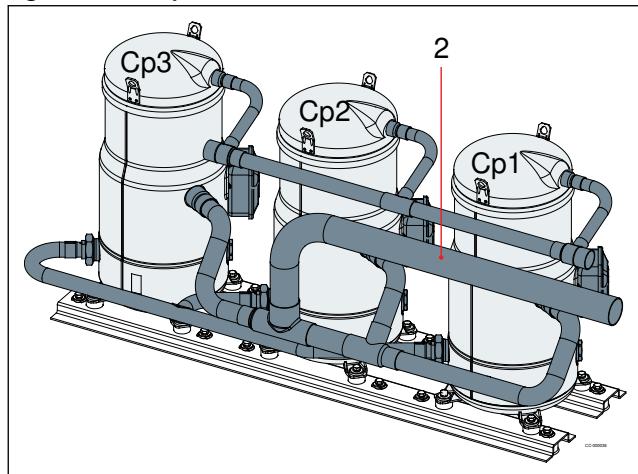


Figure 35: Example of left suction



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

Tandem models

Table 16: Tandem models

| Tandem model | Composition | Suction | Discharge | Oil equalization | Outline drawing number | Suction from | Washer inner diameter | Washer in suction of | Tandem kit code no |
|--------------|---------------|---------|-----------|------------------|------------------------|--------------|-----------------------|----------------------|--------------------|
| DSF180E | DSF090+DSF090 | 1"5/8 | 1"3/8 | 1"1/8 | 8560144 | Left | Not needed | Cp2 | 120Z0634 |
| DSF200E | DSF100+DSF100 | 1"5/8 | 1"3/8 | 1"1/8 | | Right | | | |
| DSF215U | DSF100+DSF115 | 1"5/8 | 1"3/8 | 1"1/8 | 8560189 | Left | 25 mm (0.98 inch) | Cp2 | 120Z0694 |
| | | | | | | Right | 26 mm (1.02 inch) | Cp2 | |

| Tandem model | Composition | Suction | Discharge | Oil equalization | Outline drawing number | Suction from | Washer inner diameter | Washer in suction of | Tandem kit code no |
|--------------|---------------|---------|-----------|------------------|------------------------|--------------|-----------------------|----------------------|--------------------|
| DSF230E | DSF115+DSF115 | 1"5/8 | 1"3/8 | 1"1/8 | 8560145 | Left | Not needed | | 120Z0634 |
| | | | | | | Right | | | |
| DSF230U | DSF100+DSF130 | 1"5/8 | 1"3/8 | 1"1/8 | 8560189 | Left | 27mm (1.06 inch) | Cp2 | 120Z0694 |
| | | | | | | Right | 27mm (1.06 inch) | Cp2 | |
| DSF255U | DSF100+DSF155 | 1"5/8 | 1"3/8 | 1"1/8 | 8560189 | Left | 23 mm (0.91 inch) | Cp1 | 120Z0694 |
| | | | | | | Right | 23 mm (0.91 inch) | Cp1 | |
| DSF260E | DSF130+DSF130 | 1"5/8 | 1"3/8 | 1"1/8 | 8560145 | Left | Not needed | | 120Z0634 |
| | | | | | | Right | | | |
| DSF275U | DSF100+DSF175 | 1"5/8 | 1"3/8 | 1"1/8 | 8560189 | Left | 21 mm (0.83 inch) | Cp1 | 120Z0694 |
| | | | | | | Right | 21 mm (0.83 inch) | Cp1 | |
| DSF285U | DSF130+DSF155 | 1"5/8 | 1"3/8 | 1"1/8 | 8560168 | Left | 27 mm (1.06 inch) | Cp1 | 120Z0692 |
| | | | | | | Right | 27 mm (1.06 inch) | Cp1 | |
| DSF300U | DSF100+DSF200 | 1"5/8 | 1"3/8 | 1"1/8 | 8560190 | Left | 20 mm (0.79 inch) | Cp1 | 120Z0693 |
| | | | | | | Right | 20 mm (0.79 inch) | Cp1 | |
| DSF305U | DSF130+DSF175 | 1"5/8 | 1"3/8 | 1"1/8 | 8560168 | Left | 25 mm (0.98 inch) | Cp1 | 120Z0692 |
| | | | | | | Right | 25 mm (0.98 inch) | Cp1 | |
| DSF310E | DSF155+DSF155 | 1"5/8 | 1"3/8 | 1"1/8 | 8560145 | Left | Not needed | | 120Z0634 |
| | | | | | | Right | | | |
| DSF315U | DSF115+DSF200 | 1"5/8 | 1"3/8 | 1"1/8 | 8560167 | Left | 23 mm (0.91 inch) | Cp1 | 120Z0693 |
| | | | | | | Right | 23 mm (0.91 inch) | Cp1 | |
| DSF330U | DSF155+DSF175 | 1"5/8 | 1"3/8 | 1"1/8 | 8560168 | Left | 27.5 mm (1.08 inch) | Cp1 | 120Z0692 |
| | | | | | | Right | 26 mm (1.02 inch) | Cp1 | |
| DSF331U | DSF130+DSF200 | 1"5/8 | 1"3/8 | 1"1/8 | 8560167 | Left | 24 mm (0.94 inch) | Cp1 | 120Z0694 |
| | | | | | | Right | 24 mm (0.94 inch) | Cp1 | |
| DSF350E | DSF175+DSF175 | 1"5/8 | 1"3/8 | 1"1/8 | 8560145 | Left | Not needed | | 120Z0634 |
| | | | | | | Right | | | |
| DSF355U | DSF155+DSF200 | 1"5/8 | 1"3/8 | 1"1/8 | 8560167 | Left | 25 mm (0.98 inch) | Cp1 | 120Z0694 |
| | | | | | | Right | 25 mm (0.98 inch) | Cp1 | |
| DSF375U | DSF175+DSF200 | 1"5/8 | 1"3/8 | 1"1/8 | 8560167 | Left | 27.5 mm (1.08 inch) | Cp1 | 120Z0694 |
| | | | | | | Right | 27.5 mm (1.08 inch) | Cp1 | |
| DSF400E | DSF200+DSF200 | 1"5/8 | 1"3/8 | 1"1/8 | 8560146 | Left | Not needed | | 120Z0634 |
| | | | | | | Right | | | |
| DSF400X | DSF130+DSF270 | 2"1/8 | 1"3/8 | 1"3/8 | 8560169 | Left | 24 mm (0.94 inch) | Cp1 | 120Z0709 |
| | | | | | | Right | 25 mm (0.98 inch) | Cp1 | |
| DSF470X | DSF200+DSF270 | 2"1/8 | 1"3/8 | 1"3/8 | 8560170 | Left | 35.5 mm (1.4 inch) | CP2 | 120Z0709 |
| | | | | | | Right | 35.5 mm (1.4 inch) | CP2 | |
| DSF500X | DSF175+DSF325 | 2"1/8 | 1"3/8 | 1"3/8 | 8560169 | Left | 25 mm (0.98 inch) | Cp1 | 120Z0709 |
| | | | | | | Right | 26 mm (1.02 inch) | Cp1 | |
| DSF525X | DSF200+DSF325 | 2"1/8 | 1"3/8 | 1"3/8 | 8560170 | Left | 26 mm (1.02 inch) | Cp1 | 120Z0709 |
| | | | | | | Right | 26 mm (1.02 inch) | Cp1 | |
| DSF540E | DSF270+DSF270 | 2"1/8 | 1" 5/8 | 1" 3/8 | 8556228 | Left | Not needed | | 120Z0792 |
| | | | | | | Right | | | |
| DSF595U | DSF270+DSF325 | 2"1/8 | 1" 5/8 | 1" 3/8 | 8556228 | Left | 31 mm (1.22 inch) | Cp1 | 120Z0796 |
| | | | | | | Right | | | |
| DSF650E | DSF325+DSF325 | 2"1/8 | 1" 5/8 | 1" 3/8 | 8556228 | Left | Not needed | | 120Z0792 |
| | | | | | | Right | | | |
| DSF800U | DSF270+DSF530 | 2"1/8 | 1" 5/8 | 1" 5/8 | 8556207 | Left | 24 mm (0.94 inch) | Cp1 | 120Z0786 |
| | | | | | | Right | | | |
| DSF970E | DSF485+DSF485 | 2"5/8 | 1" 5/8 | 1" 5/8 | 8556205 | Left | Not needed | | 120Z0785 |
| | | | | | | Right | | | |
| DSF855U | DSF325+DSF530 | 2"5/8 | 1" 5/8 | 1" 5/8 | 8556220 | Left | 27 mm (1.06 inch) | Cp1 | 120Z0787 |
| | | | | | | Right | | | |
| DSF1060E | DSF530+DSF530 | 2"5/8 | 1" 5/8 | 1" 5/8 | 8556205 | Left | Not needed | | 120Z0785 |
| | | | | | | Right | | | |

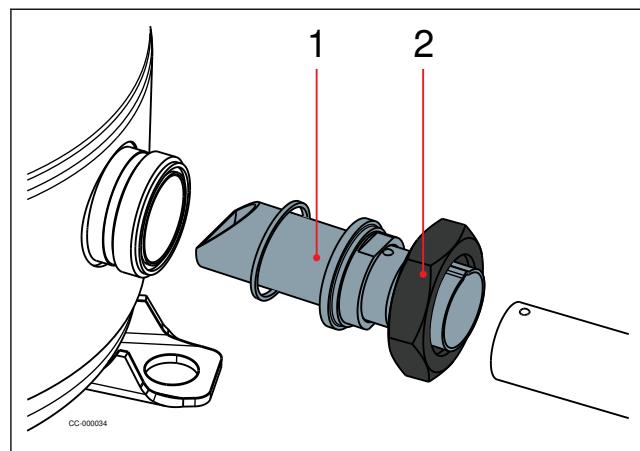
Trio models
Table 17: Trio models

| Trio model | Composition | Suction | Discharge | Oil equalization | Outline drawing number | Suction from | Washer inner diameter | Washer in suction of | Trio kit code no |
|------------|----------------------|---------|-----------|------------------|------------------------|--------------|-----------------------|----------------------|------------------|
| DSF465T | 3xDSF155 | 2"1/8 | 1"3/8 | 1"1/8 | 8560172 | Left | 26 mm (1.02 inch) | CP1 | 120Z0714 |
| | | | | | | | 25 mm (0.98 inch) | CP3 | |
| | | | | | | Right | 26 mm (1.02 inch) | CP1 | |
| | | | | | | | 24 mm (0.94 inch) | CP3 | |
| DSF525T | 3xDSF175 | 2"1/8 | 1"3/8 | 1"1/8 | 8560172 | Left | 26 mm (1.02 inch) | CP1 | 120Z0714 |
| | | | | | | | 25 mm (0.98 inch) | CP3 | |
| | | | | | | Right | 26 mm (1.02 inch) | CP1 | |
| | | | | | | | 25 mm (0.98 inch) | CP3 | |
| DSF600T | 3xDSF200 | 2"1/8 | 1"3/8 | 1"1/8 | 8560171 | Left | 26 mm (1.02 inch) | CP1 | 120Z0714 |
| | | | | | | | 25 mm (0.98 inch) | CP3 | |
| | | | | | | Right | 25.5 mm (1.00 inch) | CP1 | |
| | | | | | | | 25 mm (0.98 inch) | CP3 | |
| DSF810T | DSF270+DSF270+DSF270 | 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 |
| DSF975T | DSF325+DSF325+DSF325 | 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 |
| DSF1180T | DSF325+DSF325+DSF530 | 2"5/8 | 2" 1/8 | 1" 5/8 | 8556310 | Left | - | - | 120Z0790 |
| | | | | | | Right | 29 mm (1.14) | Cp1 & Cp2 | 120Z0815 |
| DSF1385T | DSF325+DSF530+DSF530 | 3"1/8 | 2" 1/8 | 1" 5/8 | 8556314 | Left | 26 mm (1.02) | Cp1 (DSF325) | 120Z0814 |
| | DSF530+DSF530+DSF325 | | | | | Right | 26 mm (1.02) | Cp3 (DSF325) | |
| DSF1590T | DSF530+DSF530+DSF530 | 3"1/8 | 2" 1/8 | 1" 5/8 | 8556216 | Left | 33 mm (1.3 inch) | Cp2 & Cp3 | 120Z0793 |
| | | | | | | Right | | | |

Oil equalization DSF180E-400E

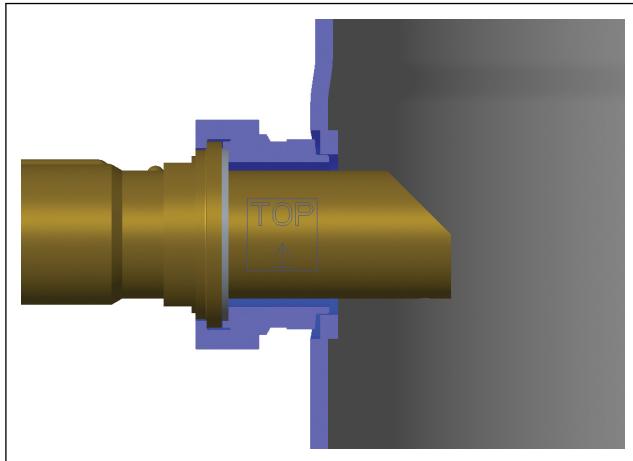
The oil level is balanced by a pipe of 1"1/8 oil equalization line.

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 DSF 400X-470X-500X-525X

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 DSF130, DSF175, DSF200 oil equalization port as indicated on below picture. DSF270, DSF325 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 36: For DSF130, DSF175, DSF200

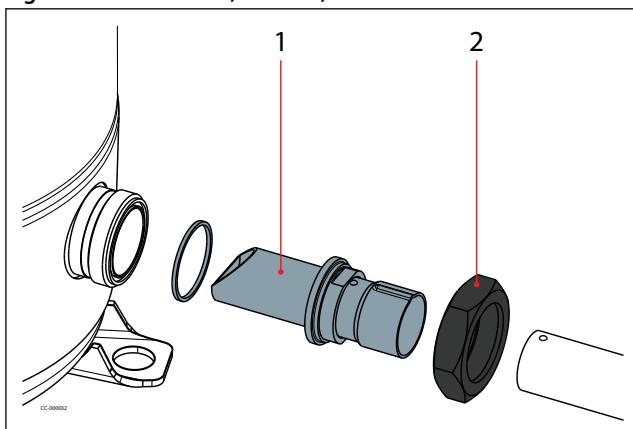
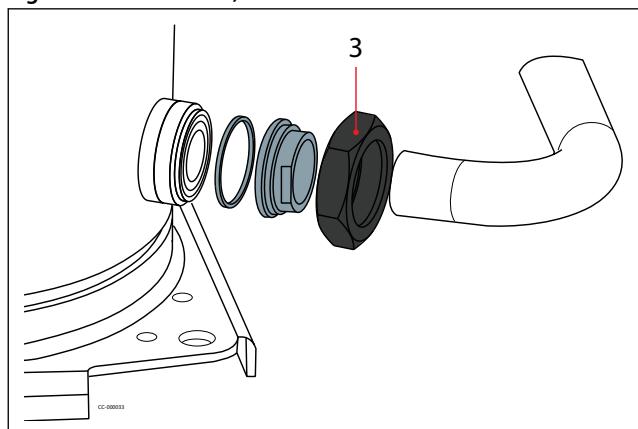


Figure 37: For DSF270, DSF325

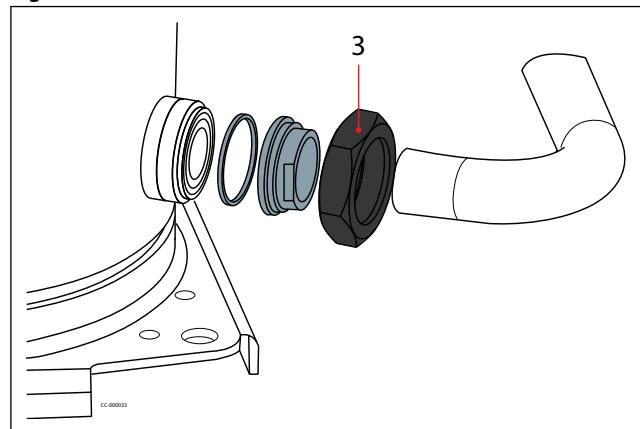


| | | | |
|---|-------------------------|---|------------------------------|
| 1 | Organ pipe |  | Supplied with the compressor |
| 2 | Tightening torque 100Nm |  | Included in tandem kit |
| 3 | Tightening torque 145Nm | | |

Oil equalization design DSF270-530

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 38: DSF270, DSF530



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

Electrical connections

Wiring connections

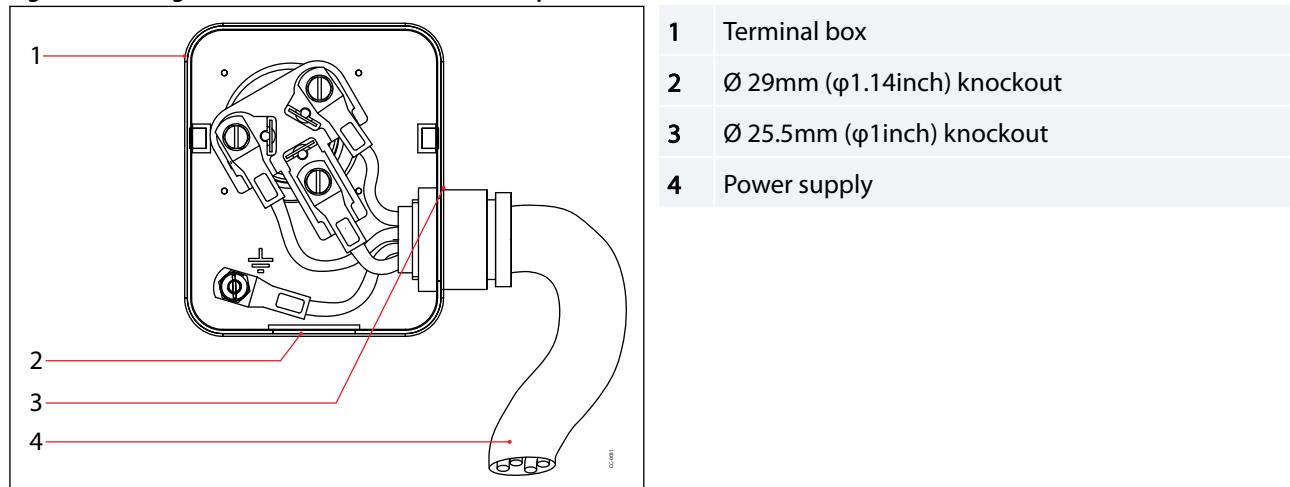
According to compressor model, electrical power is connected to the compressor terminals either by 4.8mm (10-32) screws or by M5 studs and nuts. In both cases the maximum tightening torque is 3 Nm.

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

DSF090-200(except DSF155/175 code3 DSF200 code3/7/9)

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

Figure 39: Wiring connections for DSF090-200(except DSF155/175 code3 DSF200 code3/7/9)

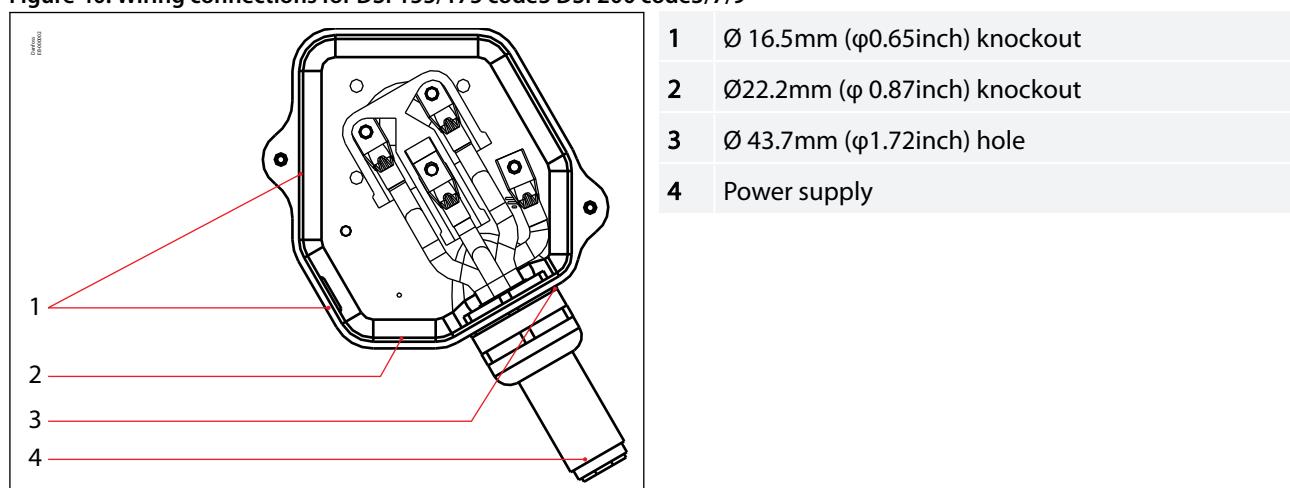


DSF155/175 code3 DSF200 code3/7/9

The terminal box is provided with a Ø 43.7mm (φ1.72inch) hole (UL 1"1/4 conduit) for power supply and 3 other knockout holes:

- Ø22.2mm (φ 0.87inch) (PG16) (UL 1/2")
- Ø16.5mm (φ 0.65inch) (ISO16) (x2)

Figure 40: Wiring connections for DSF155/175 code3 DSF200 code3/7/9



DSF270-325-485-530

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.

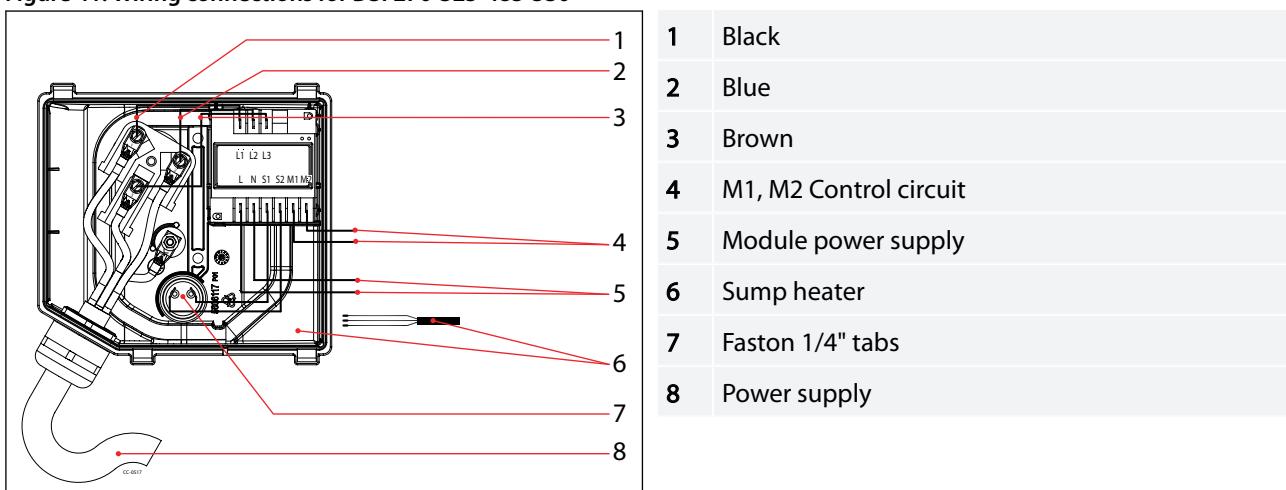
The 3 power supply knockouts accommodate the following diameters:

- Ø 50.8 mm (φ 2 inch) (UL 1"1/2 conduit) & Ø 43.7 mm (φ 1.72 inch) (UL 1"1/4 conduit) & Ø 34.5 mm (φ 1.36 inch) (UL 1" conduit)
- Ø 40.5 mm (φ 1.59 inch) (ISO40) & Ø 32.2 mm (φ 1.27 inch) (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 22.5 mm (φ 0.89 inch) (PG16) (UL 1/2") & Ø 16.5 mm (φ 0.65 inch) (ISO16) (x2)
- Ø 20.7 mm (φ 0.81 inch) (ISO20 or PG13.5) (x2)

Figure 41: Wiring connections for DSF270-325-485-530



DSF485 and DSF530 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.

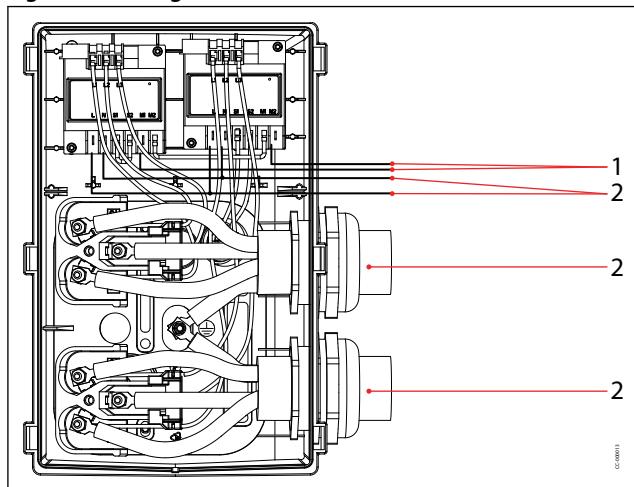
The 2 power supply knockouts accommodate the following diameters:

- 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 42: Wiring connections for DSF485 and DSF530 code 3



1 M1, M2 Control circuit

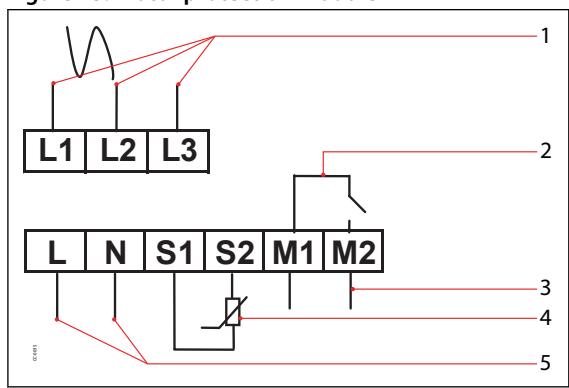
2 Power supply

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 6.3 mm (0.25 inch) size Faston type.

Figure 43: Motor protection module



L1 Black

L2 Blue

L3 Brown

1 Phase sequence input

2 Internal control contact

3 Safety circuit

4 Thermistor connection

5 Module power

Electrical specifications

Motor voltage

Danfoss scroll compressors DSF are available in motor voltage listed below.

Table 18: Motor voltage

| Frequency | Motor voltage code | Code 3 | Code 4 | Code 7 | Code 9 |
|-----------|--------------------|--------------|---|----------|--------------|
| 50 Hz | Nominal voltage | - | 380-415V-3ph 400V-3ph ⁽¹⁾ | - | - |
| 60 Hz | Nominal voltage | 208-230V-3ph | 460V-3ph | 575V-3ph | 380-400V-3ph |

⁽¹⁾ DSH090-200

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:

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

| | |
|------------------------|---------------------------------|
| V_{avg} | Mean voltage of phases 1, 2, 3. |
| V₁₋₂ | Voltage between phases 1 and 2. |
| V₁₋₃ | Voltage between phases 1 and 3. |
| V₂₋₃ | 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 19: Motor voltage code3

| Compressor model | LRA | | Max operating current | | Winding resistance |
|------------------|-----|-----|-----------------------|---|--------------------|
| | A | A | A | A | Ω |
| DSF090 | 203 | 31 | 34 | | 0.39 |
| DSF100 | 203 | 32 | 37 | | 0.39 |
| DSF115 | 267 | 38 | 44 | | 0.27 |
| DSF130 | 267 | 44 | 48 | | 0.27 |
| DSF155 | 304 | 41 | 55 | | 0.24 |
| DSF175 | 315 | 47 | 62 | | 0.22 |
| DSF200 | 351 | 56 | 70 | | 0.22 |
| DSF270 | 471 | 70 | 96 | | 0.16 |
| DSF325 | 574 | 84 | 118 | | 0.13 |
| DSF485 | 824 | 142 | 174 | | 0.17 |
| DSF530 | 824 | 137 | 190 | | 0.17 |

Table 20: Motor voltage code4

| Compressor model | LRA | | Max operating current | | Winding resistance |
|------------------|-----|------|-----------------------|---|--------------------|
| | A | A | A | A | Ω |
| DSF090 | 98 | 17.1 | 17 | | 1.47 |
| DSF100 | 98 | 17.9 | 19 | | 1.47 |
| DSF115 | 142 | 20 | 22 | | 1.05 |
| DSF130 | 142 | 22.9 | 24 | | 1.05 |

| Compressor model | LRA | RLA | Max operating current | Winding resistance |
|------------------|-----|------|-----------------------|--------------------|
| | A | A | A | Ω |
| DSF155 | 147 | 25.7 | 27 | 0.92 |
| DSF175 | 158 | 26.4 | 30 | 0.83 |
| DSF200 | 197 | 28.5 | 34 | 0.83 |
| DSF270 | 222 | 38 | 42 | 0.7 |
| DSF325 | 263 | 45 | 52 | 0.56 |
| DSF485 | 389 | 76 | 80 | 0.28 |
| DSF530 | 389 | 74 | 87 | 0.28 |

Table 21: Motor voltage code7

| Compressor model | LRA | RLA | Max operating current | Winding resistance |
|------------------|-----|-----|-----------------------|--------------------|
| | A | A | A | Ω |
| DSF090 | 84 | 12 | 13 | 2.34 |
| DSF100 | 84 | 13 | 14 | 2.34 |
| DSF115 | 103 | 17 | 16 | 1.57 |
| DSF130 | 103 | 17 | 18 | 1.57 |
| DSF155 | 122 | 18 | 21 | 1.38 |
| DSF175 | 136 | 22 | 23 | 1.32 |
| DSF200 | 135 | 24 | 26 | 1.32 |
| DSF270 | 181 | 28 | 35 | 0.94 |
| DSF325 | 212 | 34 | 43 | 0.82 |
| DSF485 | 303 | 54 | 63 | 0.67 |
| DSF530 | 303 | 56 | 68 | 0.67 |

Table 22: Motor voltage code9

| Compressor model | LRA | RLA | Max operating current | Winding resistance |
|------------------|-----|-----|-----------------------|--------------------|
| | A | A | A | Ω |
| DSF090 | 124 | 19 | 19 | 1.05 |
| DSF100 | 124 | 21 | 20 | 1.05 |
| DSF115 | 160 | 25 | 24 | 0.72 |
| DSF130 | 160 | 26 | 27 | 0.72 |
| DSF155 | 168 | 25 | 30 | 0.62 |
| DSF175 | 177 | 29 | 34 | 0.57 |
| DSF200 | 239 | 37 | 39 | 0.57 |
| DSF270 | 276 | 43 | 53 | 0.42 |
| DSF325 | 317 | 52 | 65 | 0.36 |
| DSF485 | 479 | 76 | 96 | 0.29 |
| DSF530 | 479 | 83 | 104 | 0.29 |

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](#)).

RLA (Rated Load Amperage)

The RLA values presented are simply calculated by dividing the maximum current before tripping at overload test conditions by 1.4.

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:

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

| | |
|---|--|
| $t_{25^\circ\text{C}}$ | 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 tamb |
| a | Coefficient a = 234.5 |

Motor protection

DSF090 to DSF200

Compressor models DSF090 to 200 are provided with internal overload motor protection to prevent against excessive current and temperature caused by overloading, low refrigerant flow or phase loss.

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 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.

DSF270 to DSF530

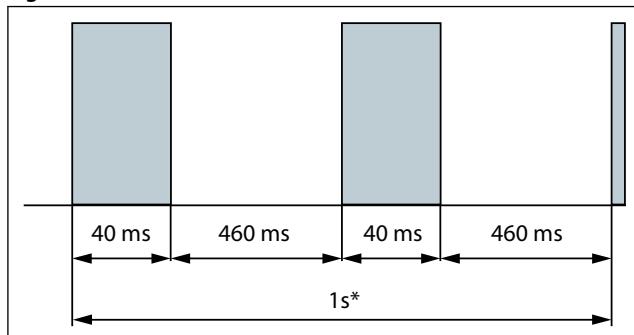
DSF compressors are delivered with a pre-installed motor protection module inside the terminal box. This device provides efficient and reliable protection against overheating and overloading as well as phase loss/reversal.

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

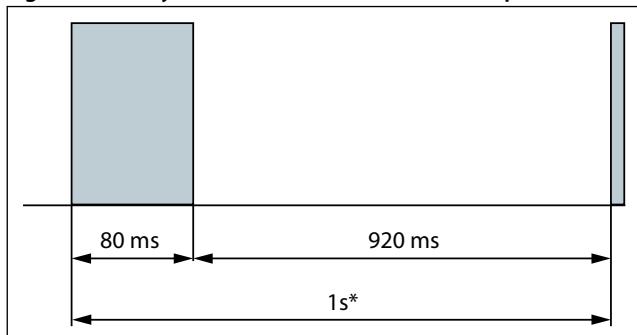
The motor temperature is being constantly measured by a PTC thermistor loop connected on S1-S2. If any thermistor exceeds its response temperature, its resistance increases above the trip level (4.500 Ω) and the output relay then trips – i.e. contacts M1-M2 are open. After cooling to below the response 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. A solid green LED denotes a fault free condition. A blinking red LED indicates an identifiable fault condition:

Figure 44: PTC Overheat


* approx. 1 second

Figure 45: 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 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.

DSF090 to DSF200

Compressor models DSF090 to 200 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.

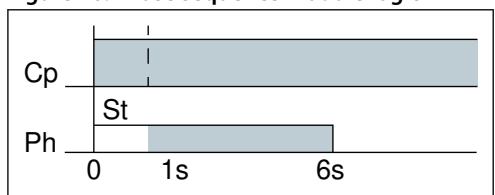
Reverse rotation will be obvious to the user as soon as power is turned on: the compressor will not build up pressure, the sound level will be abnormally high and power consumption will be minimal. If reverse rotation symptoms occur, shut the compressor down and connect the phases to their proper terminals.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

DSF270 to DSF530

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 DSF270 to 530 are delivered with an electronic module which provides protection against phase reversal and phase loss at start-up.

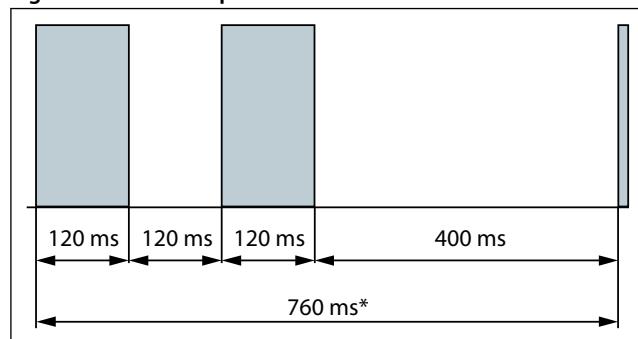
The phase sequencing and phase loss monitoring functions are active during a 5-sec window 1 second after compressor start-up (power on L1-L2-L3).

Figure 46: Phase sequence module logic


| | |
|----|------------------|
| Cp | Compressor |
| Ph | Phase monitoring |
| St | start |

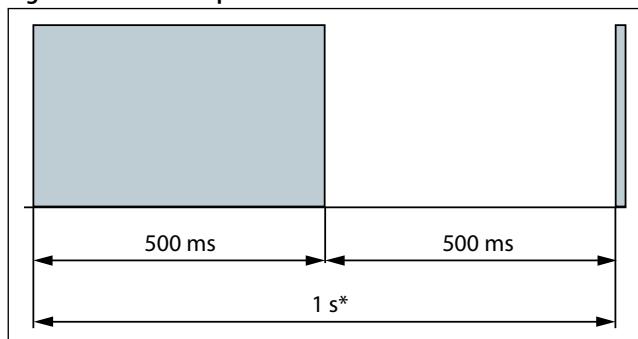
Should one of these parameters be incorrect, the relay would lock out (contact M1-M2 open). The red LED on the module will show the following blink code:

Figure 47: In case of phase reverse error



* Approximate

Figure 48: 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

 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 DSF155-200 trio models, top-up oil quantity 1L at least as mandatory.

System evaluation

Table 23: 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 24: Test, criteria and solutions

| Test No. | Purpose | Test conditions | Pass criteria | Solutions |
|----------|-----------------------------|--|---|---|
| 1 | Check proper oil return |  <p>Lowest foreseeable evaporation, and highest foreseeable condensation. Minimum number of compressor running for 6 hours. 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"> Top-up with oil, generally 3% of the total system refrigerant charge (in weight). Above 3% look for potential oil trap in the system. Integrate a function in control logic to run all compressors simultaneously in order to boost oil return (for more details see section Control logic). Oil separator can be added |
| 2 | Check oil balancing |  <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: (1+2+3)2hrs → (1+2)2hrs → (2+3)2hrs → (1+3)2hrs 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"> Top-up with oil, generally 3% of the total system refrigerant charge (in weight). Check that manifold piping is conform to Danfoss requirements. Integrate a function in control logic to stop manifold periodically in order to balance oil (for more details see section Control logic). |
| 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"> Pay special attention to "Piping design" Oil separator is strongly recommended, especially in case of part load. |

Manage sound and vibration

Sound radiations

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

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

Mitigations methods:

If an unacceptable level is identified, a discharge muffler with the appropriate resonant volume and mass can be installed.

Mitigation methods

Mitigations 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 frequency. 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 data](#) for DSF 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 10K range at nominal Voltage.

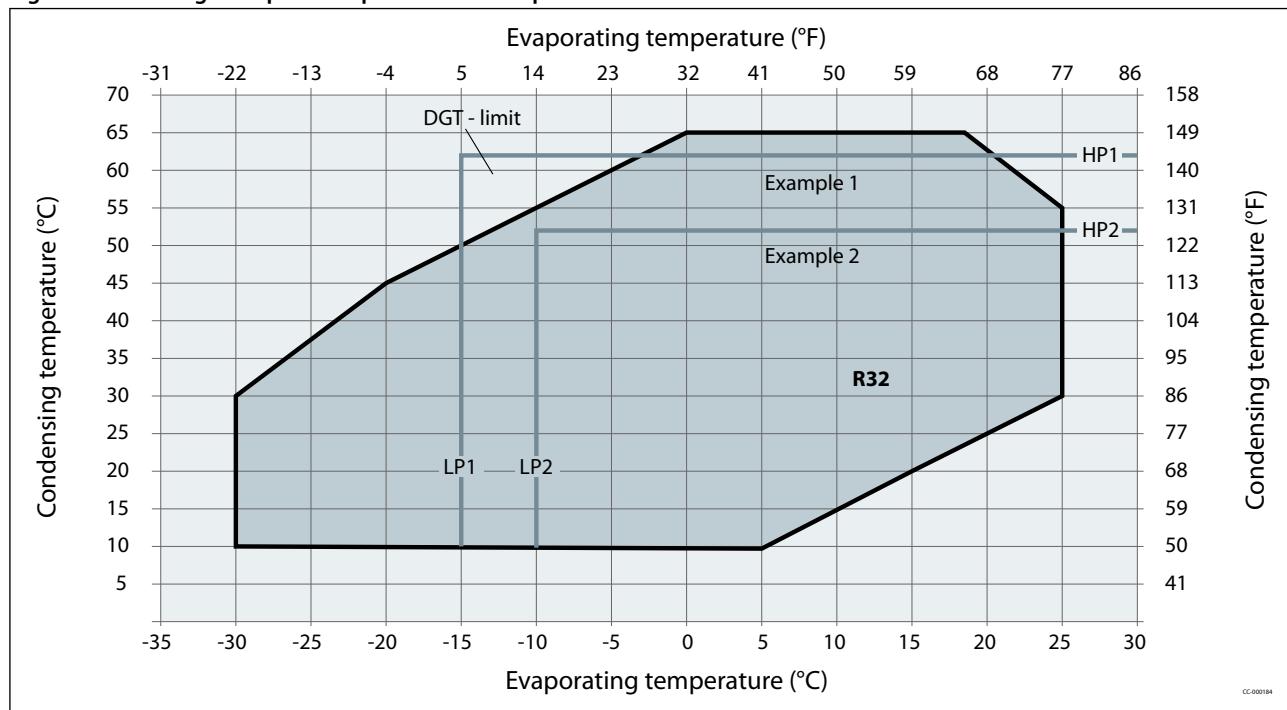
Discharge temperature protection

DSF270 to DSF530 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 5 – 10 K (9 – 18 °F), 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 [Figure 49: Discharge temperature protection examples](#))

Figure 49: Discharge temperature protection examples


Example 1 (R32, SH = 5K)

LP switch setting: LP1 = 3.9 bar (g) (-15°C), HP switch setting: HP1 = 40.2 bar (g) (62°C)

Risk of operation beyond the application envelope.

DGT protection required.

Example 2 (R32, SH = 5K)

LP switch setting: LP2 = 4.8 bar (g) (-10°C), HP switch setting: HP2 = 32 bar (g) (52°C)

No risk of operation beyond the application envelope.

No DGT protection required.

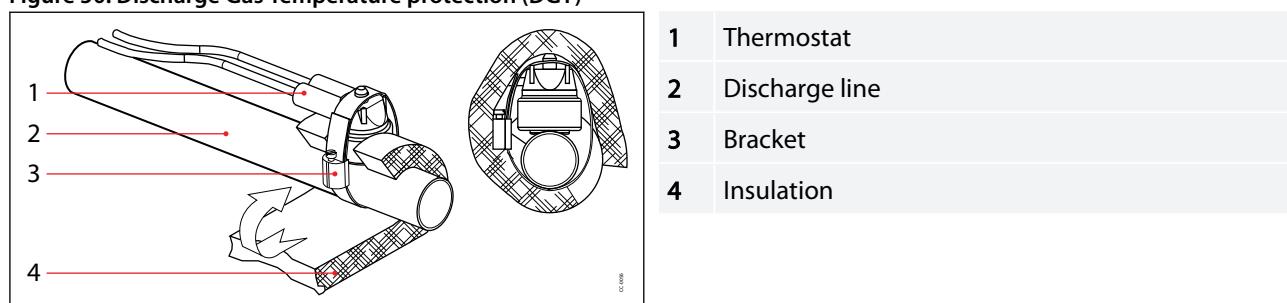
DSF090 to DSF200 have no integrated discharge temperature protection, an external protection is required.

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.

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 50: Discharge Gas Temperature protection \(DGT\)](#))

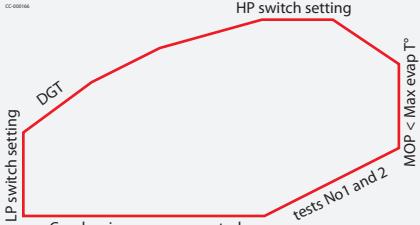
Figure 50: Discharge Gas Temperature protection (DGT)



System evaluation

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

Table 25: System evaluation

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

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 5 – 10 K (9 – 18 °F).

System evaluation

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

Table 26: System evaluation

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

Test, criteria and solutions

Table 27: Test, criteria and solutions

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

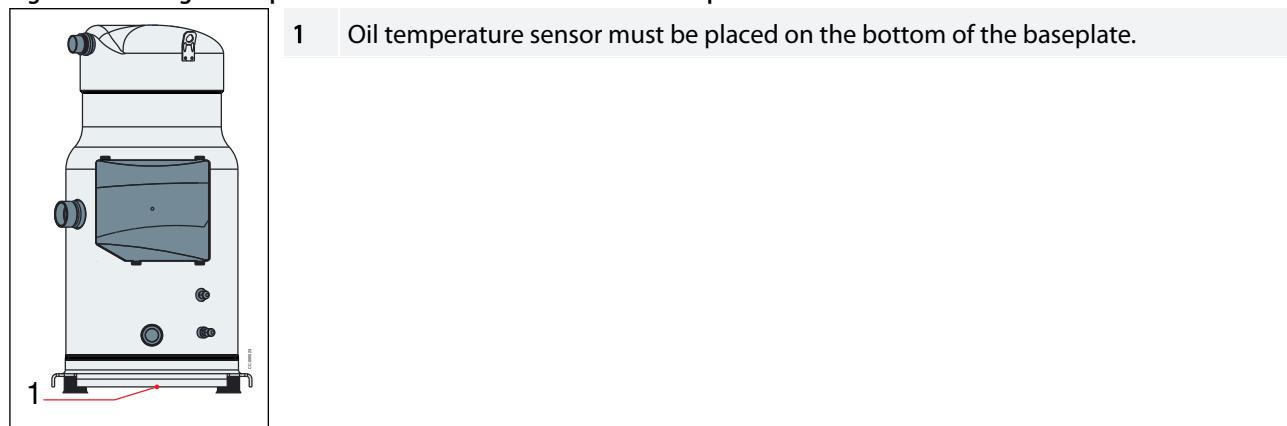
⁽¹⁾ Suction accumulator offers protection by trapping the liquid refrigerant upstream from the compressor. The accumulator should be sized at least 50 % of the total system charge. Suction accumulator dimensions can impact oil return (gas velocity, oil return hole size...), therefore oil return has to 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.

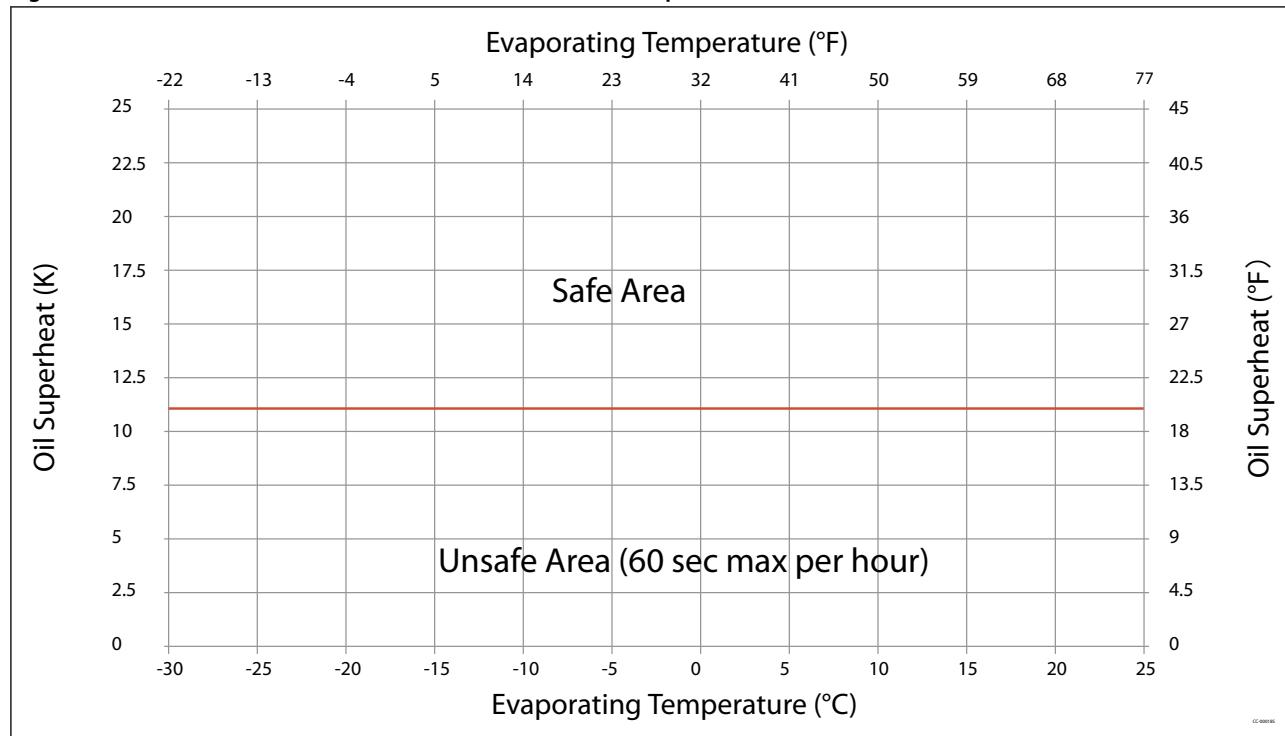
The Oil superheat is defined as: (Oil temperature - Evaporating temperature)

Figure 51: Placing oil temperature sensor on the bottom of the baseplate



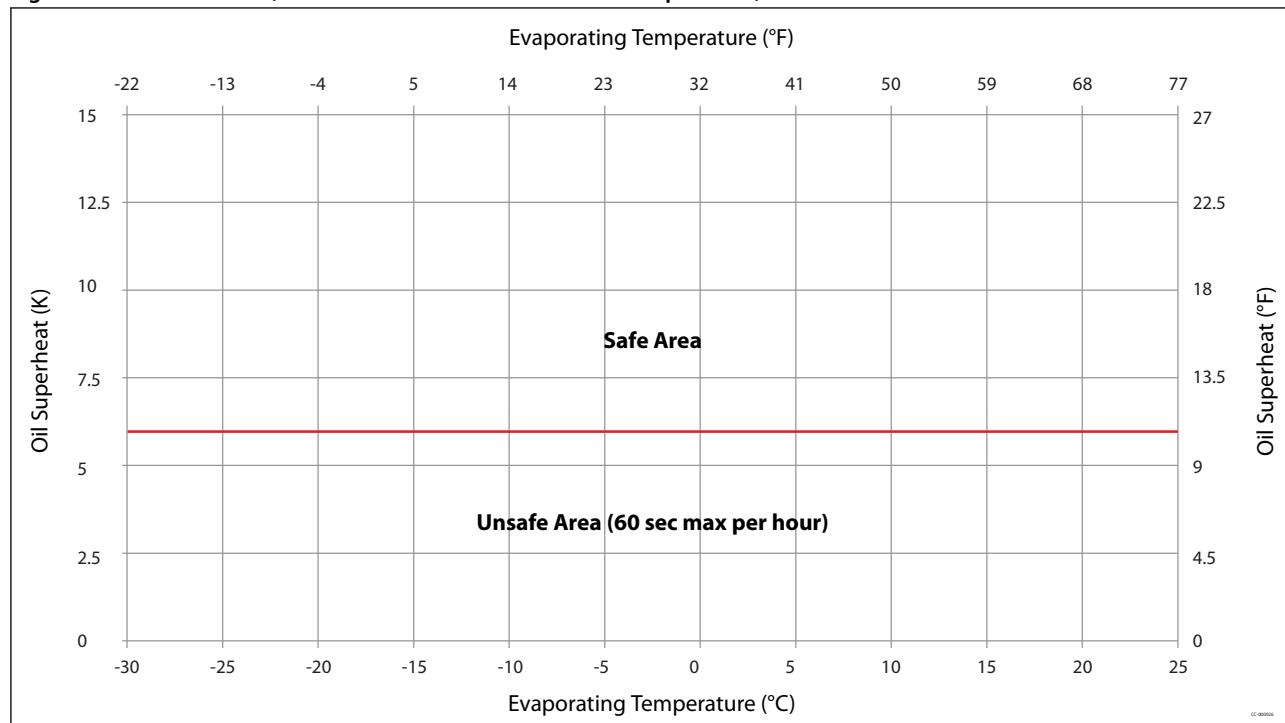
Dilution Chart - DSF090 to DSF200, R32

Figure 52: Dilution Chart (reference at 20 °C / 68 °F ambient temperature)



Dilution Chart - DSF270 to DSF570, R32

Figure 53: Dilution Chart (reference at 20 °C / 68 °F ambient temperature)



Manage off cycle migration

 Off -cycle refrigerant migration happens:

- when the compressor is located at the coldest part of the installation, refrigerant vapor condenses in the compressor.
- or directly in liquid-phase by gravity or pressure difference. When the compressor restarts, the refrigerant diluted in the oil, or stored in evaporator, generates poor lubrication conditions, and may reduce bearings life time. In extreme situations, this leads to liquid slugging that can damage the compressor scroll set.

Requirement

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

System evaluation

Use the [Table 30: Charge limits for Single models](#) and [Table 31: Charge limits for Tandem models](#) in section Charge limits, in relation with the system charge and the application to quickly define necessary safeties to implement.

Table 28: System evaluation

| Application | BELOW charge limit | ABOVE charge limit |
|-------------|---|--------------------|
| All | Ensure tightness between condenser & evaporator when system is OFF • Thermostatic expansion Valve (TXV), Liquid Line Solenoid Valve LLSV strongly recommended • Electronic expansion valve (EXV) must close when system stop including in power shut down situation | |
| Non split | No test or additional safeties required | • Crankcase heater |
| Split | Since each installation is unique, refrigerant charge may vary • Crankcase heater • Liquid Line Solenoid Valve + pump-down cycle | |

Crankcase heater

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

For DSF090-200, 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 below principle:

Figure 54: DSF090 to 200

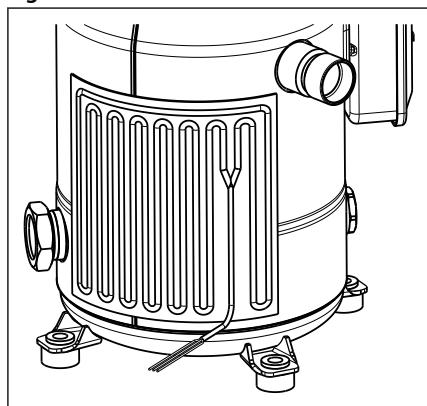
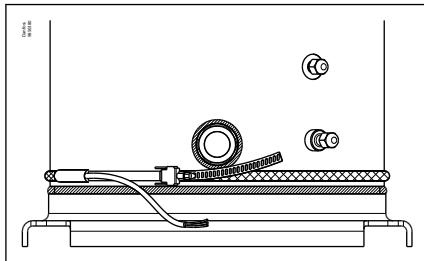


Table 29: surface sump selection principle

| 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 DSF270-530, the use of a 75W belt heater is recommended.

Figure 55: DSF 270 to 530



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

Liquid line solenoid valve (LLSV)

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

Pump-down cycle

By decreasing pressure in the sump, pump down system:

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

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

Charge limits

Table 30: Charge limits for Single models

| Models | Composition | Refrigerant charge limit | |
|--------|-------------|--------------------------|-----|
| | | kg | lbs |
| DSF090 | - | 8 | 18 |
| DSF100 | - | 8 | 18 |
| DSF115 | - | 10 | 22 |
| DSF130 | - | 10 | 22 |
| DSF155 | - | 10 | 22 |
| DSF175 | - | 10 | 22 |
| DSF200 | - | 10 | 22 |
| DSF270 | - | 15 | 33 |
| DSF325 | - | 15 | 33 |
| DSF485 | - | 17 | 37 |
| DSF530 | - | 17 | 37 |

Table 31: Charge limits for Tandem models

| Models | Composition | Refrigerant charge limit | |
|---------|---------------|--------------------------|-----|
| | | kg | lbs |
| DSF180E | DSF090+DSF090 | 12 | 26 |
| DSF200E | DSF100+DSF100 | 12 | 26 |
| DSF230E | DSF115+DSF115 | 12 | 26 |
| DSF260E | DSF130+DSF130 | 12 | 26 |
| DSF215U | DSF100+DSF115 | 12 | 26 |
| DSF230U | DSF100+DSF130 | 12 | 26 |
| DSF255U | DSF100+DSF155 | 12 | 26 |
| DSF275U | DSF100+DSF175 | 12 | 26 |
| DSF285U | DSF130+DSF155 | 12 | 26 |
| DSF300U | DSF100+DSF200 | 12 | 26 |
| DSF305U | DSF130+DSF175 | 12 | 26 |
| DSF310E | DSF155+DSF155 | 14 | 31 |

| Models | Composition | Refrigerant charge limit | |
|----------|-----------------|--------------------------|-----|
| | | kg | lbs |
| DSF315U | DSF115+DSF200 | 12 | 26 |
| DSF350E | DSF175+DSF175 | 14 | 31 |
| DSF400E | DSF200+DSF200 | 14 | 31 |
| DSF330U | DSF155+DSF175 | 14 | 31 |
| DSF331U | DSF130+DSF200 | 12 | 26 |
| DSF355U | DSF155+DSF200 | 14 | 31 |
| DSF375U | DSF175+DSF200 | 14 | 31 |
| DSF400X | DSF130+DSF270 | 14 | 31 |
| DSF500X | DSF175+DSF325 | 14 | 31 |
| DSF470X | DSF200+DSF270 | 14 | 31 |
| DSF525X | DSF200+DSF325 | 14 | 31 |
| DSF540E | 2xDSF270 | 21 | 46 |
| DSF595U | DSF270 + DSF325 | 21 | 46 |
| DSF650E | 2xDSF325 | 25 | 55 |
| DSF800U | DSF270 + DSF530 | 21 | 46 |
| DSF855U | DSF325 + DSF530 | 25 | 55 |
| DSF970E | DSF485 + DSF485 | 34 | 75 |
| DSF1060E | DSF530 + DSF530 | 34 | 75 |

Table 32: Charge limits for Trio models

| Models | Composition | Refrigerant charge limit | |
|----------|----------------------|--------------------------|-----|
| | | kg | lbs |
| DSF465T | 3 x DSF155 | 14 | 31 |
| DSF525T | 3 x DSF175 | 14 | 31 |
| DSF600T | 3 x DSF200 | 14 | 31 |
| DSF810T | 3 x DSF270 | 21 | 46 |
| DSF975T | 3 x DSF325 | 25 | 55 |
| DSF1180T | DSF325+DSF325+DSF530 | 25 | 55 |
| DSF1385T | DSF530+DSF530+DSF325 | 34 | 75 |
| DSF1590T | 3 x DSF530 | 34 | 75 |

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 DSF090-200, phase sequence protection is strongly recommended.
- DSF 270-530 compressors are delivered with a pre-installed motor protection module inside the terminal box that must be powered on.
- HP safety switch and electronic module relay output (M1-M2) 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 56: Compressor model DSF090 - 200

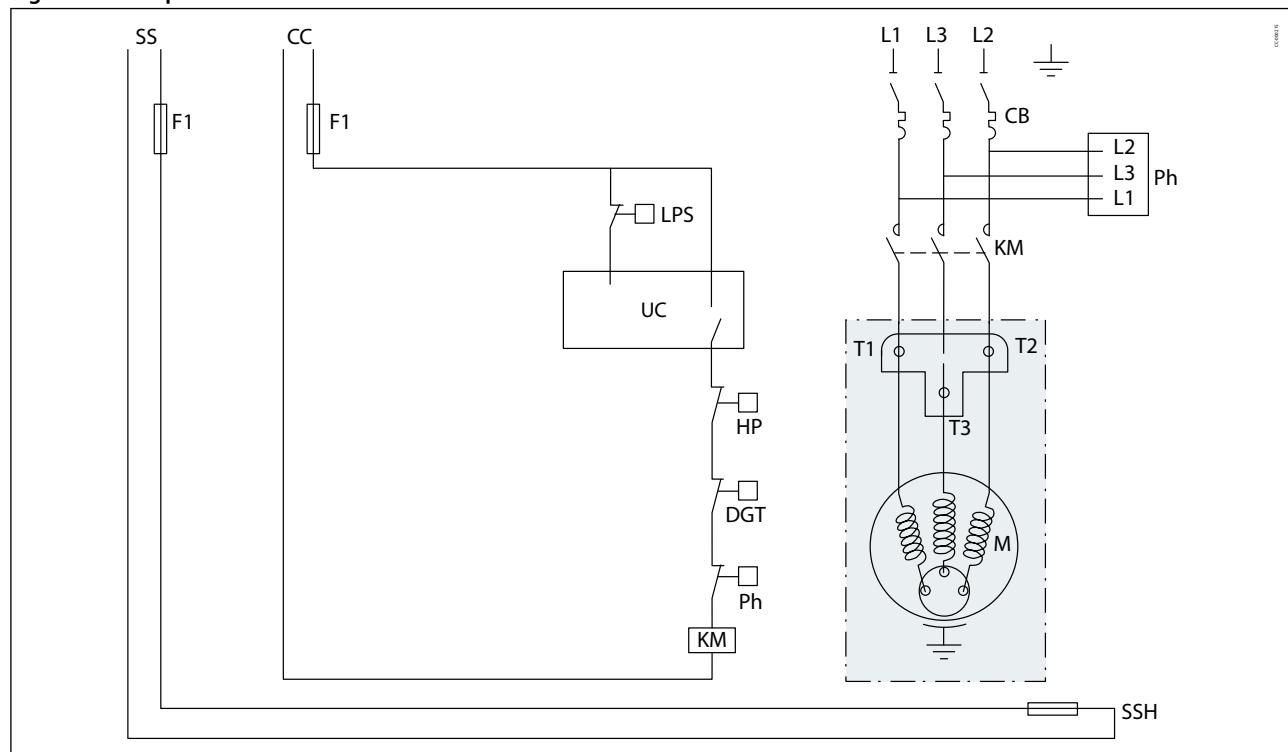


Figure 57: Compressor model DSF270 - 325

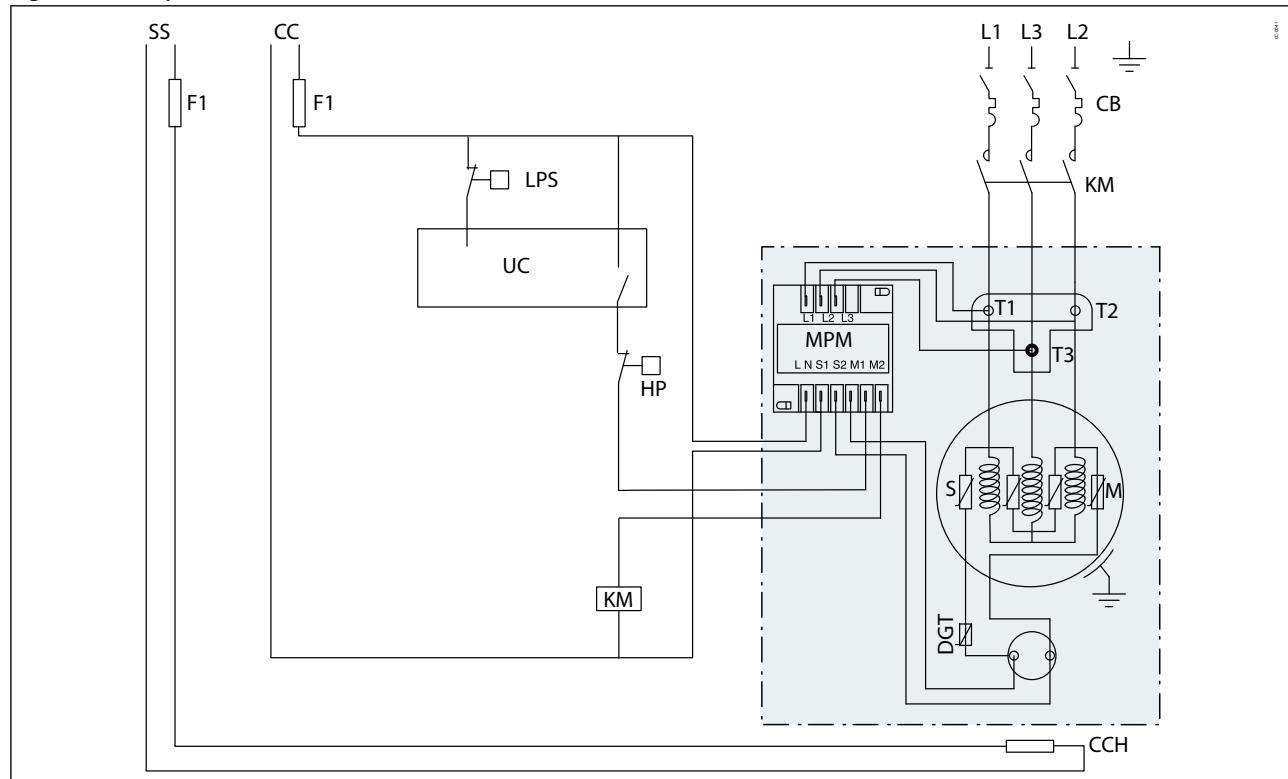
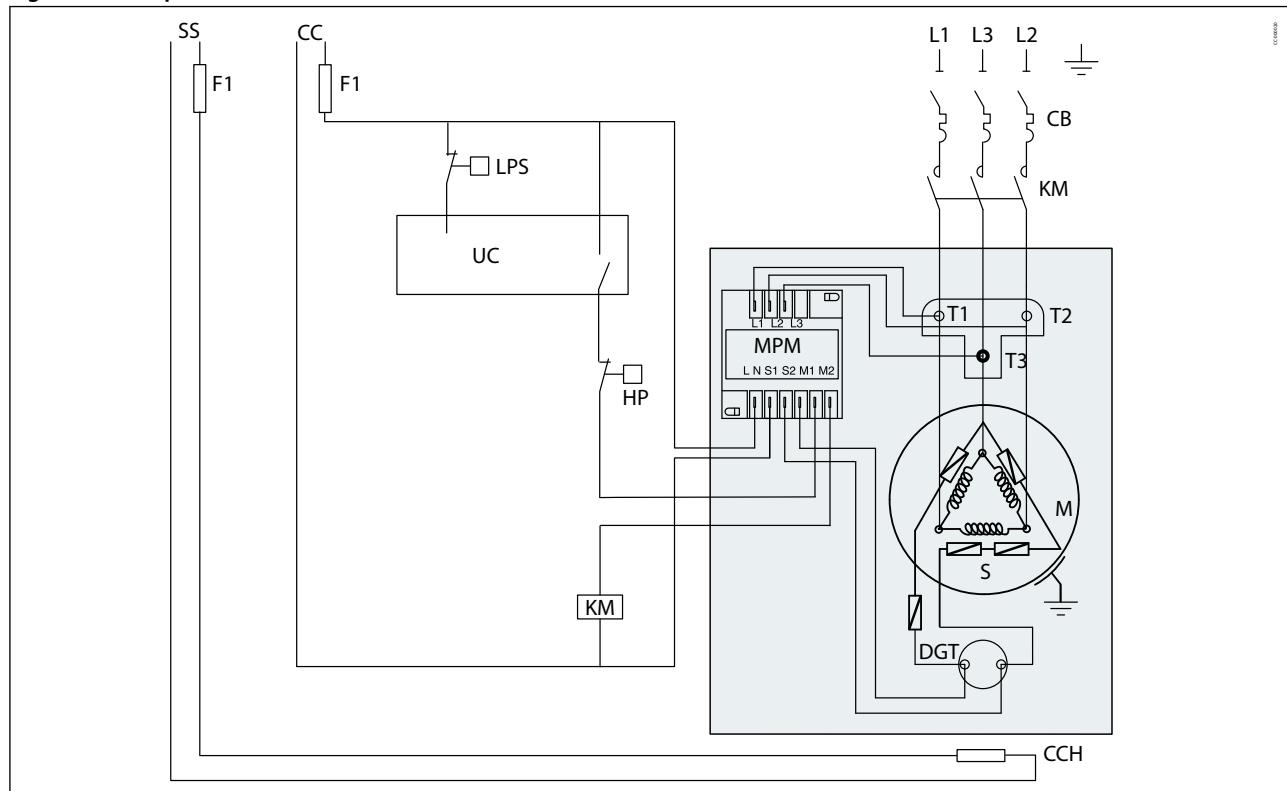


Figure 58: Compressor model DSF485 - 530



| | | | |
|-----|---|-----|--|
| CB | Thermal magnetic motor circuit breaker | LPS | Safety pressure switch |
| CC | Control circuit | M | Compressor motor |
| CCH | Crankcase heater | MPM | Motor Protection Module |
| DGT | Discharge gas thermistor (embedded in compressor) | S | Thermistor chain (motor and discharge temperature) |
| F1 | Fuses | SS | Separate supply |
| HP | High pressure safety switch | SSH | Surface sump heater |
| KM | Compressor contactor | | |

Soft starts

⚠ Soft starters are designed to reduce the starting current of 3-phase AC motors. Soft starter must be set so compressor start-up time is always less than 0.5 seconds to ensure proper lubrication of compressor parts.

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

⚠ Make sure that the soft starter selected is compatible with R32 refrigerant.

Control logic

Safety control logic requirements

Table 33: Safety control logic requirements

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

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 No.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](#).

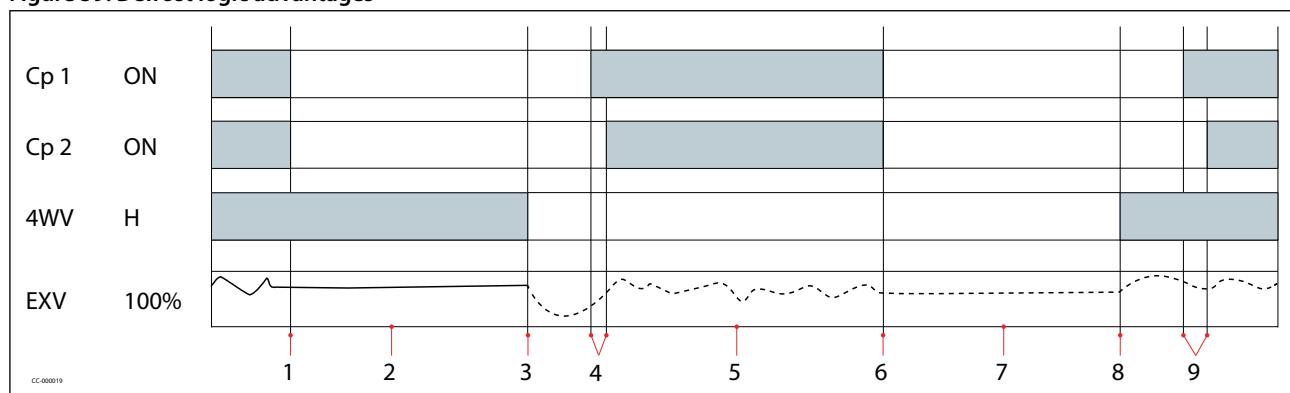
Defrost logic recommendations / Reversible systems

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 pressures.

The following defrost logic combines both advantages:

Figure 59: Defrost logic advantages



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

 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).

⁽¹⁾ 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**.

Pump-down logic recommendations

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

Two types of pump-down exist:

- One shot pump down (preferred): when last compressor of the circuit stops, suction pressure is decreased 1.5 bar (22 psi) below nominal evaporating pressure with minimum of 1.7 bar(g) (25 psig). 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)

DSF 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

DSF compressors are delivered with < 100 ppm moisture level.

At the time of commissioning, system moisture content may be up to 100 ppm.

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

Solutions

To achieve this requirement, a properly sized and type of drier is required.

Important selection criteria's include:

- driers water content capacity
- system refrigeration capacity
- system refrigerant charge

For new installations with DSF 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 0.3 bar (4 psi) and 0.7 bar (10 psi) 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

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

Compressor handling and storage

 Each Danfoss 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. The use of a spreader bar rated for the lifting lugs spacing and the weight of the compressor is necessary to ensure better load distribution. The use of lifting hooks closed with a clasp and certified to lift the weight of the compressor is also highly recommended. Always respect the appropriate rules concerning lifting objects of the type and weight of these compressors. Maintain the compressor in an upright position during all handling manoeuvres (maximum of 15° from vertical).

Never use only one lifting lug to lift the compressor. The compressor is too heavy for the single lug to handle, and the risk is run that the lug could separate from the compressor with extensive damage and possible personal injury as a result.

Store the compressor not exposed to rain, corrosive or flammable atmosphere between -35°C and Ts value when charged with refrigerant and between -35°C and 70°C when charged with nitrogen.

When the compressor is mounted as part of an installation, never use the lift rings on the compressor to lift the installation. The risk is run that the lugs could separate from the compressor or that the compressor could separate from the base frame with extensive damage and possible personal injury as a result.

Never apply force to the terminal box with the intention of moving the compressor, as the force placed upon the terminal box can cause extensive damage to both the box and the components contained inside.

Figure 60: Heavy



Figure 61: Correct

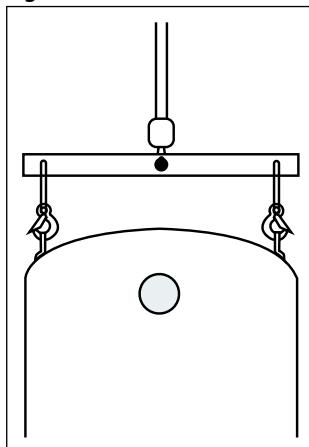
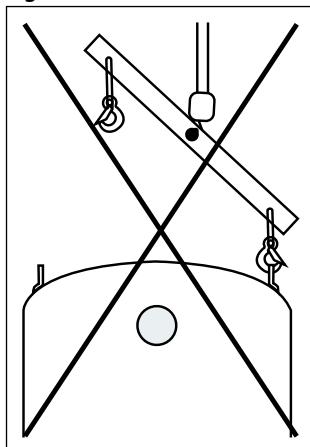


Figure 62: Incorrect



Piping assembly

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

Table 34: 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. Opened compressor must not be exposed to air more than 20 minutes to avoid moisture captured by oil. |

Brazing procedure:

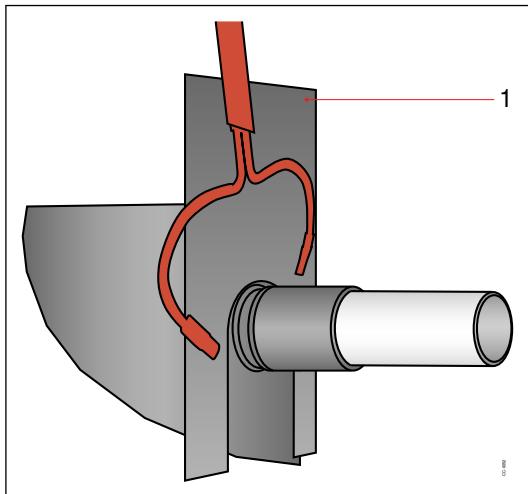
- Brazing operations must be performed by qualified personnel.
- Make sure that no electrical wiring is connected to the compressor.
- To prevent compressor shell and electrical box overheating, use a heat shield and/or a heat-absorbent compound.
- Clean up connections with degreasing agent.
- Flow nitrogen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

DSF 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 30 – 40% 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.



1 Heat shield

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

R Before eventual un-brazing of the compressor or any system component, the refrigerant charge must be removed and the installation vacuumed.

System pressure test and leak detection

R 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 35: System pressure test and leak detection

| Maximum compressor test pressures | DSF090-200 | DSF270-325-485-530 |
|---|--|---|
| Maximum compressor test pressure high side (HP) | 53.6 bar (g) (777 psig) HP-LP<37 bar (537 psi) | 53.6 bar (g) (777 psig) HP-LP<37 bar (537 psi) |
| Maximum compressor test pressure low side (LP) | 36.7 bar (g) (533 psig) LP – HP <5 bar (73 psi) Maximum speed 4.8 bar/s (70 psi/s) | 34.3 bar (g) (497 psig) LP – HP <5 bar (73 psi) Maximum speed 4.8 bar/s (70 psi/s) ⁽¹⁾ |

⁽¹⁾ DSF compressors have an internal non return valve fitting: the maximum pressurizing speed must be respected to ensure pressure equalization between LP and HP side over scroll elements.

Vacuum evacuation and moisture removal

R Requirements:

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

Recommendations:

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

For more detailed information see "Vacuum pump-down and dehydration procedure" [AP000086424630en](#).

Refrigerant charging

R 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 $2U_n + 1000$ V 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 a 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 does not build up pressure and sound level is abnormally high

DSF compressors are 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

- Crankcase 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 185SL from new cans. For more detailed information see "Lubricants filling in instructions for Danfoss Commercial Compressors" [AP000086435866](#).

Dismantle and disposal



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

Packaging

Single pack



Table 36: Single pack

| Compressor model | Length | | Width | | Height | | Gross weight | |
|------------------|--------|------|-------|------|--------|------|--------------|-----|
| | mm | inch | mm | inch | mm | inch | kg | lbs |
| DSF090 | 565 | 22.2 | 470 | 18.5 | 718 | 28.3 | 69 | 152 |
| DSF100 | 565 | 22.2 | 470 | 18.5 | 718 | 28.3 | 69 | 152 |
| DSF115 | 565 | 22.2 | 470 | 18.5 | 718 | 28.3 | 76 | 168 |
| DSF130 | 565 | 22.2 | 470 | 18.5 | 718 | 28.3 | 76 | 168 |
| DSF155 | 565 | 22.2 | 470 | 18.5 | 718 | 28.3 | 79 | 174 |
| DSF175 | 565 | 22.2 | 470 | 18.5 | 718 | 28.3 | 81 | 179 |
| DSF200 | 565 | 22.2 | 470 | 18.5 | 718 | 28.3 | 84 | 185 |
| DSF270 | 750 | 29.5 | 750 | 29.5 | 1050 | 41.3 | 128 | 282 |
| DSF325 | 750 | 29.5 | 750 | 29.5 | 1050 | 41.3 | 131 | 289 |
| DSF485 | 750 | 29.5 | 750 | 29.5 | 1050 | 41.3 | 195 | 430 |
| DSF530 | 750 | 29.5 | 750 | 29.5 | 1050 | 41.3 | 195 | 430 |

Industrial pack



Table 37: Industrial pack

| Compressor model | Nbr ⁽¹⁾ | Length | | Width | | Height | | Gross weight | | Static stacking pallets |
|------------------|--------------------|--------|------|-------|------|--------|------|--------------|------|-------------------------|
| | | mm | inch | mm | inch | mm | inch | kg | lbs | |
| DSF090 | 8 | 1150 | 45.3 | 950 | 37.4 | 680 | 26.8 | 494 | 1089 | 2 |
| DSF100 | 8 | 1150 | 45.3 | 950 | 37.4 | 680 | 26.8 | 494 | 1089 | 2 |
| DSF115 | 8 | 1150 | 45.3 | 950 | 37.4 | 750 | 29.5 | 544 | 1199 | 2 |
| DSF130 | 8 | 1150 | 45.3 | 950 | 37.4 | 750 | 29.5 | 544 | 1199 | 2 |
| DSF155 | 8 | 1150 | 45.3 | 950 | 37.4 | 750 | 29.5 | 566 | 1248 | 2 |
| DSF175 | 8 | 1150 | 45.3 | 950 | 37.4 | 750 | 29.5 | 582 | 1283 | 2 |
| DSF200 | 8 | 1150 | 45.3 | 950 | 37.4 | 750 | 29.5 | 606 | 1336 | 2 |
| DSF270 | 6 | 1150 | 45.3 | 965 | 38 | 768 | 30.2 | 693 | 1528 | 2 |
| DSF325 | 6 | 1150 | 45.3 | 965 | 38 | 768 | 30.2 | 712 | 1570 | 2 |
| DSF485 | 4 | 1150 | 45.3 | 965 | 38 | 800 | 31.5 | 744 | 1640 | 2 |
| DSF530 | 4 | 1150 | 45.3 | 965 | 38 | 800 | 31.5 | 744 | 1640 | 2 |

⁽¹⁾ Number of compressors per pack.

Ordering

Compressor code numbers

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

For compressors DSF270 to DSF530 use in single applications, flexible grommets are available as accessory kit 8156138.

Single pack



Table 38: Single pack

| Compressor model | Connections | Motor protection | Code no. | | | |
|------------------|-------------|-----------------------------------|--------------|--------------------------|----------|--------------|
| | | | 3 | 4 | 7 | 9 |
| | | | 208-230/3/60 | 380-415/3/50 460/3/60 | 575/3/60 | 380-400/3/60 |
| DSF090 | Brazed | Internal | 120H1908 | 120H1635 | 120H1906 | 120H1904 |
| DSF100 | Brazed | Internal | 120H1902 | 120H1637 | 120H1900 | 120H1898 |
| DSF115 | Brazed | Internal | 120H1896 | 120H1639 | 120H1894 | 120H1892 |
| DSF130 | Brazed | Internal | 120H1890 | 120H1503 | 120H1888 | 120H1886 |
| DSF155 | Brazed | Internal | 120H1884 | 120H1475 | 120H1882 | 120H1880 |
| DSF175 | Brazed | Internal | 120H1878 | 120H1477 | 120H1876 | 120H1874 |
| DSF200 | Brazed | Internal | 120H1872 | 120H1479 | 120H1870 | 120H1868 |
| DSF270 | Brazed | Module 24 V AC ⁽¹⁾ | 120H1611 | 120H1422 | 120H1630 | - |
| | Brazed | Module 110 – 240 V ⁽¹⁾ | 120H1609 | 120H1424 | - | 120H1621 |
| DSF325 | Brazed | Module 24 V AC ⁽¹⁾ | 120H1605 | 120H1426 | 120H1643 | - |
| | Brazed | Module 110 – 240 V ⁽¹⁾ | 120H1603 | 120H1428 | - | 120H1619 |
| DSF485 | Brazed | Module 24 V AC ⁽¹⁾ | 120H1601 | 120H1446 | 120H1642 | - |
| | Brazed | Module 110 – 240 V ⁽¹⁾ | 120H1599 | 120H1448 | - | 120H1617 |
| DSF530 | Brazed | Module 24 V AC ⁽¹⁾ | 120H1595 | 120H1430 | 120H1641 | - |
| | Brazed | Module 110 – 240 V ⁽¹⁾ | 120H1593 | 120H1432 | - | 120H1615 |

⁽¹⁾ Electronic motor protection, module located in terminal box.

NOTE:

Mounting kit for DSF270 to DSF530 single compressor applications: Ref 8156138.

Industrial pack



Table 39: Industrial pack

| Compressor model | Connections | Motor protection | Code no. | | | |
|------------------|-------------|-----------------------------------|--------------|--------------------------|----------|--------------|
| | | | 3 | 4 | 7 | 9 |
| | | | 208-230/3/60 | 380-415/3/50 460/3/60 | 575/3/60 | 380-400/3/60 |
| DSF090 | Brazed | Internal | 120H1907 | 120H1636 | 120H1905 | 120H1903 |
| DSF100 | Brazed | Internal | 120H1901 | 120H1638 | 120H1899 | 120H1897 |
| DSF115 | Brazed | Internal | 120H1895 | 120H1640 | 120H1893 | 120H1891 |
| DSF130 | Brazed | Internal | 120H1889 | 120H1502 | 120H1887 | 120H1885 |
| DSF155 | Brazed | Internal | 120H1883 | 120H1474 | 120H1881 | 120H1879 |
| DSF175 | Brazed | Internal | 120H1877 | 120H1476 | 120H1875 | 120H1873 |
| DSF200 | Brazed | Internal | 120H1871 | 120H1478 | 120H1869 | 120H1867 |
| DSF270 | Brazed | Module 24 V AC ⁽¹⁾ | 120H1610 | 120H1423 | - | - |
| | Brazed | Module 110 – 240 V ⁽¹⁾ | 120H1608 | 120H1425 | - | 120H1620 |
| DSF325 | Brazed | Module 24 V AC ⁽¹⁾ | 120H1604 | 120H1427 | - | - |
| | Brazed | Module 110 – 240 V ⁽¹⁾ | 120H1602 | 120H1429 | - | 120H1618 |
| DSF485 | Brazed | Module 24 V AC ⁽¹⁾ | 120H1600 | 120H1447 | - | - |
| | Brazed | Module 110 – 240 V ⁽¹⁾ | 120H1598 | 120H1449 | - | 120H1616 |
| DSF530 | Brazed | Module 24 V AC ⁽¹⁾ | 120H1594 | 120H1431 | - | - |
| | Brazed | Module 110 – 240 V ⁽¹⁾ | 120H1592 | 120H1433 | - | 120H1614 |

⁽¹⁾ Electronic motor protection, module located in terminal box.

Accessories and spare parts

Gaskets



Table 40: Gaskets

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

Solder sleeve



Table 41: 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 | Multipack | 10 |
| 8153006 | Solder sleeve P03 (2"1/4 Rotolock - 1"5/8 ODF) | Models with 2"1/4 rotolock connection | Multipack | 10 |

Rotolock nut



Table 42: Rotolock nut

| Code no. | Description | Application | Packaging | Pack size |
|----------|---------------------|--|-----------|-----------|
| 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 43: Motor protection modules

| Code no. | Description | Application | Packaging | Pack size |
|----------|---|------------------|-------------|-----------|
| 120Z0584 | Electronic motor protection module, 24 V AC | DSF270-530 | Single pack | 1 |
| 120Z0585 | Electronic motor protection module, 110/240 V | DSF270-530 | Single pack | 1 |
| 120Z0624 | Electronic motor protection module, 24 V AC | DSF485-530 code3 | Single pack | 1 |
| 120Z0802 | Electronic motor protection module, 110/240 V | DSF485-530 code3 | Single pack | 1 |

Crankcase heaters

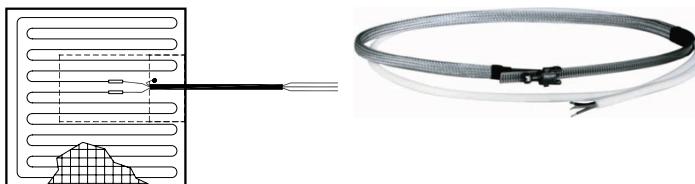


Table 44: Crankcase heaters

| Code no. | Description | Application | Packaging | Pack size |
|----------|--|---------------|---------------|-----------|
| 120Z0388 | 80W 24V surface sump heater CE and UL | DSF090 to 200 | Multipack | 8 |
| 120Z0389 | 80W 230V surface sump heater CE and UL | DSF090 to 200 | Multipack | 8 |
| 120Z0390 | 80W 400V surface sump heater CE and UL | DSF090 to 200 | Multipack | 8 |
| 120Z0391 | 80W 460V surface sump heater CE and UL | DSF090 to 200 | Multipack | 8 |
| 120Z0402 | 80W 575V surface sump heater CE and UL | DSF090 to 200 | Multipack | 8 |
| 120Z0667 | 48W 24V surface sump heater CE and UL | DSF090 to 200 | Single pack | 1 |
| 120Z0668 | 48W 230V surface sump heater CE and UL | DSF090 to 200 | Single pack | 1 |
| 120Z0669 | 48W 400V surface sump heater CE and UL | DSF090 to 200 | Single pack | 1 |
| 120Z0670 | 48W 460V surface sump heater CE and UL | DSF090 to 200 | Single pack | 1 |
| 120Z0671 | 48W 575V surface sump heater CE and UL | DSF090 to 200 | Single pack | 1 |
| 7773108 | Belt type crankcase heater, 75W, 230V, CE & UL | DSF270-530 | Multipack | 6 |
| 7973005 | Belt type crankcase heater, 75W, 230V, CE & UL | DSF270-530 | Industry pack | 50 |
| 7773118 | Belt type crankcase heater, 75W, 400V, CE & UL | DSF270-530 | Multipack | 6 |
| 120Z0464 | Belt type crankcase heater, 75W, 460V, CE & UL | DSF270-530 | Multipack | 6 |
| 120Z0465 | Belt type crankcase heater, 75W, 575V, CE & UL | DSF270-530 | Multipack | 6 |
| 120Z0870 | Belt type crankcase heater, 75W, 24V, CE & UL | DSF270-530 | Multipack | 6 |

Mounting hardware



Table 45: Mounting hardware

| Code no. | Description | Application | Packaging | Pack size |
|----------|--|---|-------------|-----------|
| 120Z0066 | Mounting kit for scroll compressors. Grommets, sleeves, bolts, washers | DSF090 to 200 | Single pack | 1 |
| 8156138 | Mounting kit for scroll compressors. Grommets, sleeves, bolts, washers | DSF270-530 in single installation | Single pack | 1 |
| 120Z0495 | Mounting kit for scroll compressors. including triangle rigid spacers, Grommets, Sleeves, Bolts, Washers | DSF270 to 530 Manifold installations when mounting directly on rail is not wished | Single pack | 1 |

Lubricant



Table 46: Lubricant

| Code no. | Description | Packaging | Pack size |
|----------|----------------------------------|-----------|-----------|
| 120Z0750 | POE lubricant 185SL, 1 litre can | Multipack | 12 |

Terminal boxes, covers and T-block connectors



Table 47: Terminal boxes, covers and T-block connectors

| Code no. | Description | Application | Packaging | Pack Size |
|----------|--|---|-------------|-----------|
| 8156135 | Service kit for terminal box 96 x 115 mm, including 1 cover, 1 clamp | DSF090 to 200(except DSF155/175 code 3 and DSF200 code 3/7/9) | Multipack | 10 |
| 8173230 | T block connector 52 x 57 mm | DSF090 to 200(except DSF155/175 code 3 and DSF200 code 3/7/9) | Multipack | 10 |
| 8173021 | T block connector 60 x 75 mm | DSF155/175 code 3, DSF200 code 3/7/9 | Multipack | 10 |
| 120Z0413 | Terminal box cover | DSF155/175 code 3, DSF200 code 3/7/9 | Single pack | 1 |
| 120Z0458 | Terminal box 210 x 190 mm, incl. cover | DSF270-325-485*-530* (*except code3) | Single pack | 1 |
| 120Z0604 | Terminal box 210x340 mm, incl. cover | DSF485-530 code3 | Single pack | 1 |
| 120Z0774 | T block connector 80x80 mm | DSF270-530 | Multipack | 10 |

Acoustic hoods



Table 48: Acoustic hoods

| Code no. | Description | Application | Packaging | Pack Size |
|----------|--|-------------|-------------|-----------|
| 120Z0768 | Acoustic hood DSF large scroll | DSF270-530 | Single pack | 1 |
| 120Z0490 | Acoustic hood body for scroll compressor | DSF090-100 | Single pack | 1 |
| 120Z0491 | Acoustic hood body for scroll compressor | DSF115-175 | Single pack | 1 |
| 120Z0492 | Acoustic hood body for scroll compressor | DSF200 | Single pack | 1 |
| 120Z0493 | Acoustic hood top for scroll compressor | DSF090-200 | Single pack | 1 |

Miscellaneous



Table 49: 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

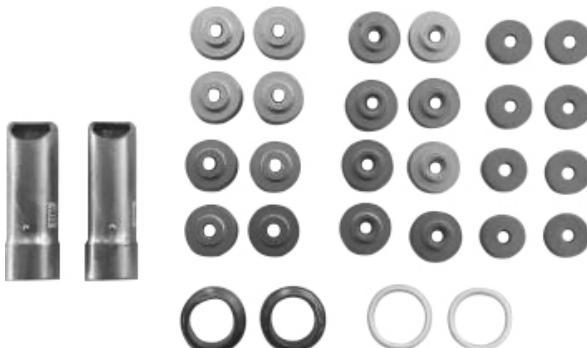


Table 50: Tandem kits

| Code no. | Description | Application | Packaging | Pack Size |
|----------|--|------------------------------|-------------|-----------|
| 120Z0634 | Suction washer, rigid spacer, organ pipe, gasket | DSF260E-310E-DSF350E-DSF400E | Single pack | 1 |
| 120Z0692 | Suction washer, rigid spacer, organ pipe, gasket | DSF285U-305U-330U | Single pack | 1 |
| 120Z0693 | Suction washer, rigid spacer, organ pipe, gasket | DSF300U-315U | Single pack | 1 |
| 120Z0694 | Suction washer, rigid spacer, organ pipe, gasket | DSF331U-355U-DSF375U | Single pack | 1 |
| 120Z0781 | Kit tandem crossplatform | DSF400X-470X-DSF500X-DSF525X | Single pack | 1 |
| 120Z0786 | Kit tandem, solid, washer 24mm, OEL 1" 5/8 | DSF800U | Single pack | 1 |
| 120Z0787 | Kit tandem, solid, washer 27mm, OEL 1" 5/8 | DSF855U | Single pack | 1 |
| 120Z0785 | Kit tandem, solid, OEL 1" 5/8 | DSF970E-1060E | Single pack | 1 |
| 120Z0792 | Kit tandem, solid, OEL 1" 3/8 | DSF540E-650E | Single pack | 1 |
| 120Z0796 | Kit tandem, solid, washer 31mm, OEL 1" 3/8 | DSF595U | Single pack | 1 |

Trio kits



Table 51: Trio kits

| Code no. | Description | Application | Packaging | Pack Size |
|----------|---|-----------------------------------|-------------|-----------|
| 120Z0714 | Organ pipe, sleeves, rigid spacer, gasket, rubber grommet | DSF465T-DSF525T-DSF600T | Single pack | 1 |
| 120Z0784 | Kit trio, solid, washer 30 mm, OEL 1" 5/8 | DSF810T-975T (left suction) | Single pack | 1 |
| 120Z0790 | Kit Trio, solid, OEL 1" 5/8 | DSF1180T (left suction) | Single pack | 1 |
| 120Z0793 | Kit trio, solid, washer 33 mm, OEL 1" 5/8 | DSF1590T (left and right suction) | Single pack | 1 |
| 120Z0794 | Kit trio, solid, washer 34.5 mm, OEL 1" 5/8 | DSF810T-975T (right suction) | Single pack | 1 |
| 120Z0814 | Kit Trio, solid, washer 26mm, OEL 1" 5/8 | DSF1385T (left and right suction) | Single pack | 1 |
| 120Z0815 | Kit Trio, solid, washer 29mm (x2), OEL 1" 5/8 | DSF1180T (right suction) | Single pack | 1 |

Online support

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