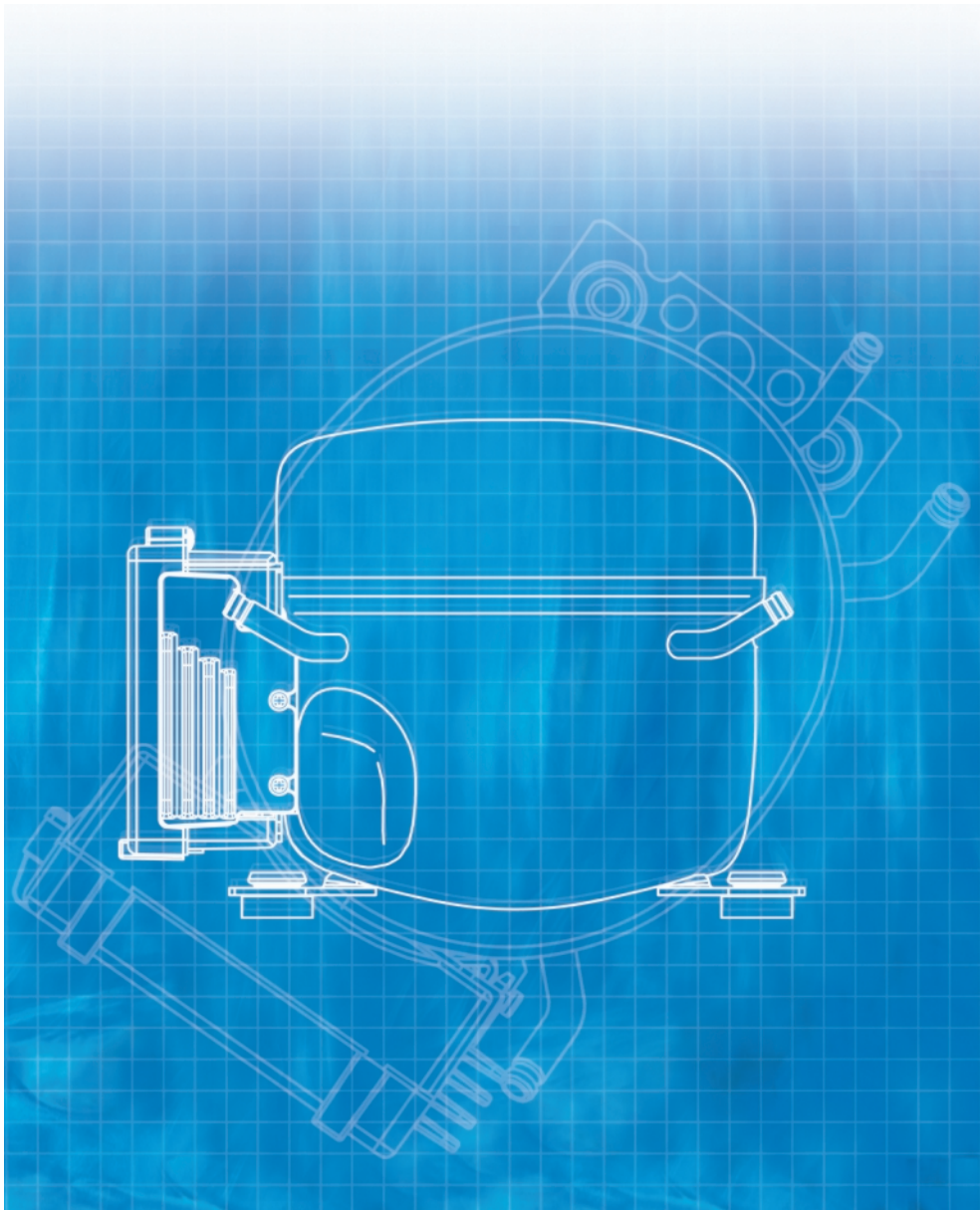
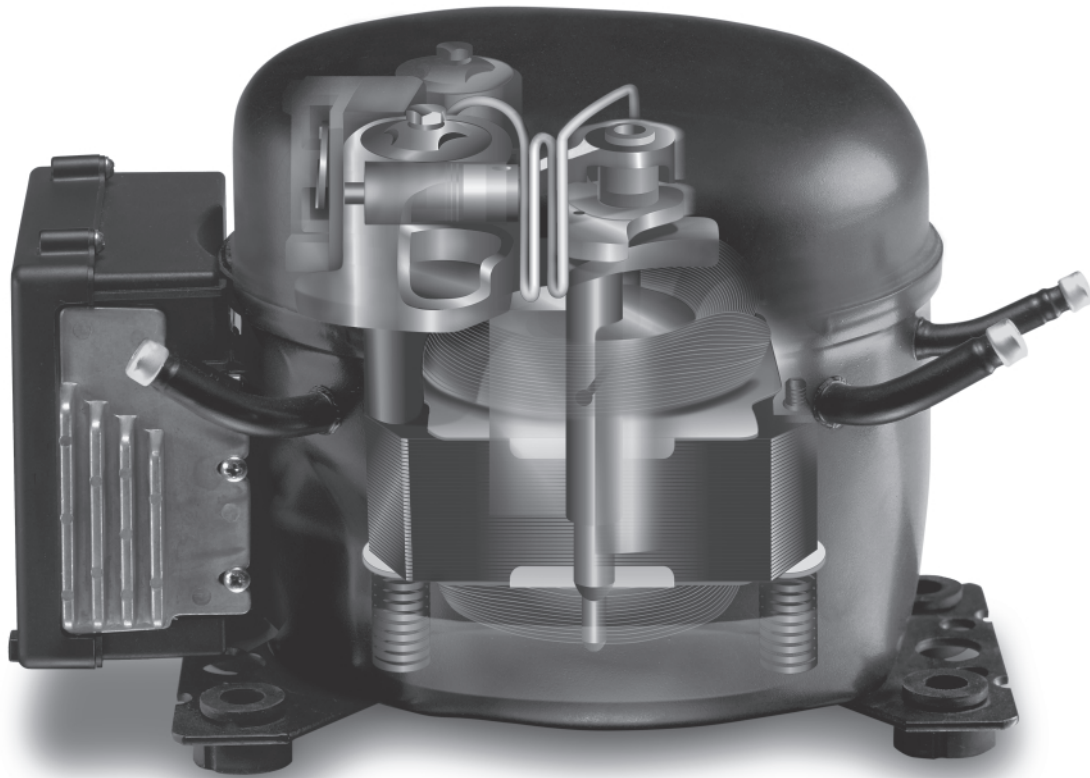


Collection of Datasheets

**Mobile Refrigeration,
R134a 220-240V 50-60Hz, 300V DC,
12/24V DC (with Power Inverter)**





1. General

The BD150F compressor is intended especially for the use in mobile applications, e.g. in vans and small trucks. It extends the application range of refrigerated transportation by increasing the capacity of Danfoss Compressors' BD series. The extension was triggered by the EU directive on active refrigeration for food transportation, particularly frozen goods, fish etc.. The compressor makes it easier to comply with legal requirements and thus keep the refrigeration chain unbroken, even in traditionally weak links such as transportation for shops and supermarkets, supplies for hotels, restaurants etc.

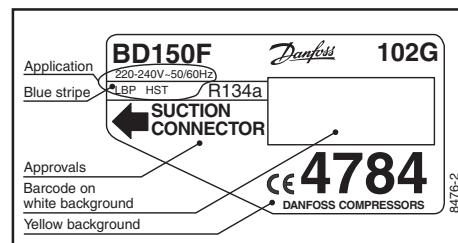
The compressor concept includes an electronic unit which can operate on 230V AC or 300V DC. The electronic unit may also be powered directly from a 12/24V DC power supply using an appropriate inverter.

In addition to being especially quiet in operation, the BD150F compressor has a high efficiency. By means of the Adaptive Energy Optimizer (AEO) the compressor capacity is automatically adapted to the cooling requirement, and thus the energy consumption is considerably reduced. It will operate under continual heeling of 30° such as occurs on yachts.

1.1 Design

The Compressor is designed with semi-direct intake. Using the wrong connector as suction connector will lead to reduced capacity and efficiency.

1.2 Type label



BD150F compressors have a yellow label with the type designation. This label has a blue stripe and the text "R134a".

The country of origin is indicated on the compressor paper label and on the compressor cover. Information can be found on our technical information sheet "Country of Origin".

1.4 Data stamping

Danfoss BD150F compressors have a manufacturing date code made by needle printing into the side of the housing.

The coding content is explained by below example.

Example (new date code):

H49477 (6 characters)

113A01B (7 characters)

Composition of line 1

H49477: Compressor type information (102H4947 = H4947)
7: internal Danfoss code

Composition of line 2

11: Production week

3: Production year

A: Production day

A = Monday, B = Tuesday, C = Wednesday, etc.

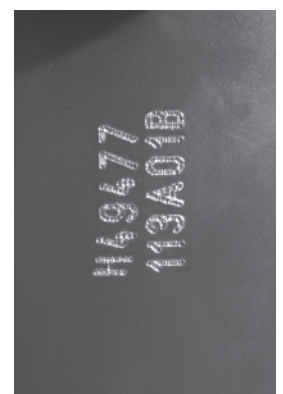
01: Production hour 00 to 23 or shift code -1, -2, -3

B: Danfoss Compressors internal production location code

A to G Germany

K to N Slovenia

R, S Mexico



1.5 Compressor dimensions

The build-in conditions (total height, weight, tube dimensions etc.) are specified on page 10 including dimensioned sketches for the compressors.

2. Selection

Controlling the compressor speed means that the compressor selection is different to standard compressors. The model is chosen according to the capacity at max. speed. This capacity will cover the load at max. ambient temperature or at fast freeze. This max. capacity will be chosen similar to the rated capacity of a standard single speed compressor for the same appliance. During normal operation the compressor runs at minimum speed, giving the highest COP, and during peak load operation at maximum speed.

2.1 Design limits

In order to secure a satisfying lifetime of the compressor, and to protect the compressor against overload, some design criteria for the appliances must be fulfilled.

Both the condensing temperature and the compressor temperature should be kept as low as possible. This can be done by using well-dimensioned condenser surfaces and by ensuring good ventilation around the compressor under all operating conditions.

In order to protect the compressor against overload, the compressor has to start and work properly through pressure peaks obtained in the highest ambient temperature and lowest obliging voltage. At peak load the condensing temperature must not exceed 70°C.

At stable operation conditions the condensing temperature must not exceed 60°C.

These limits are the same for our standard compressors and secure a protection of valves, gaskets, oil, and motor insulation.

Maximum allowable ambient temperature is 43°C.

3. Electrical equipment

The compressor is equipped with a permanent magnet rotor (PM motor) and 3 identical stator windings. The electronic unit is mounted directly on the compressor and controls the PM motor.

3.1 Electronic unit

The compressor can only operate with the electronic unit type 105N4220. No attempt must be made to start the compressor without correct electronic unit. If 230V AC is applied directly to the compressor it will be destroyed.

All connection terminals are 6.3 mm spades. RAST 5 connectors can be used.

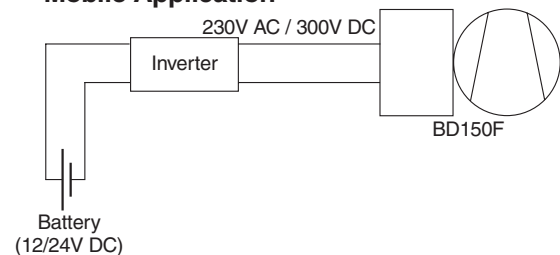
The electronic unit is working within a voltage range of:

- 160 - 254V AC /50-60Hz or
- 250 - 350V DC

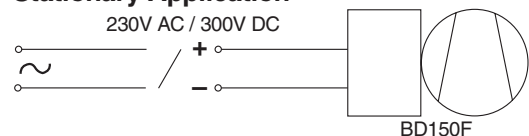
Max. allowable ambient temperature is 43°C. The electronic is provided with a built-in thermal protection which stops the compressor in case of thermal overload.

Use with 12/24V DC battery in a mobile application is possible by means of an inverter, 12/24V to 230V AC type, min. 300V peak voltage, min. 300W continuous power output.

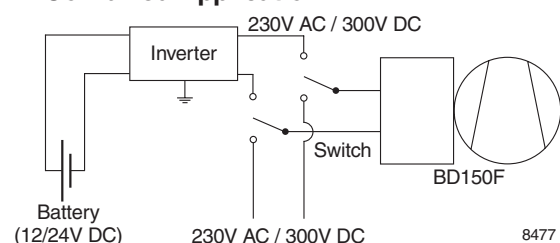
Mobile Application



Stationary Application



Combined Application



3.1.1 Installation

The connector (11) of the electronic unit (9) has to be connected to the compressor (12) first. The total unit is then fitted to the compressor housing with two screws and toothed washers through the recesses in the heatsink unit (6). All other terminals (except the earth connection under point 6) and cord relief (8) are under the cover (7).

3.1.2 Power supply

Power supply (1) is connected to L and N. Earth connection is connected to terminal (10) on the compressor housing (12).

3.1.3 Fan

A fan (2) can be connected to N and C. It will be operated with power line voltage, and cut in and out with the compressor if a conventional thermostat is used. In case an inverter is used, which delivers non-sine shaped voltage, the fan has to be chosen for this.

3.1.4 Thermostat connection

The unit (9) has 3 connection options (3) for thermostats.

a) Standard mechanical switching type of thermostat with a 230V on/off signal

The thermostat switch is connected to the terminals L and C. The compressor runs in 'adaptive control' mode, see description: Adaptive control. Thermostats with integrated heating resistors, for avoiding cross ambient switching, can not be used, as the input is of high impedance. A small current flows through the resistor when contacts are open. Thus the thermostat would always be interpreted as on.

b) Thermostat with DC signal out (5V, max. 15V)

DC signal (on - off) is connected to terminal R+ and R-, which are reinforced isolated in the compressor control. The compressor control is in 'adaptive control' - see description: Adaptive control. A fan can not be connected.

c) Electronic thermostat with frequency output (5V, max. 15V)

A square signal is connected to pins R+ and R- (5), which are reinforced isolated in the compressor control. The refrigerator thermostat is to supply the Danfoss compressor electronic unit (9) with a square signal, with min. pulse width 200 μ s. A fan can not be connected.

- If a frequency signal with more than 100 Hz is applied, the compressor goes into 'external reference control' mode.
- The compressor speed then will be controlled according to the applied frequency, multiplied by 10, see figure 2 (e.g. 230 Hz will result in a speed of 2300 rpm).
- If a frequency above the value for maximum speed is applied, the compressor will work at max. speed.
- If a constant DC signal is supplied immediately after a frequency signal, the speed will be maintained until a new frequency is supplied or until the DC signal goes low.
- A frequency signal below 200 Hz will stop the compressor. Restart frequency must be above 203 ± 2 Hz.

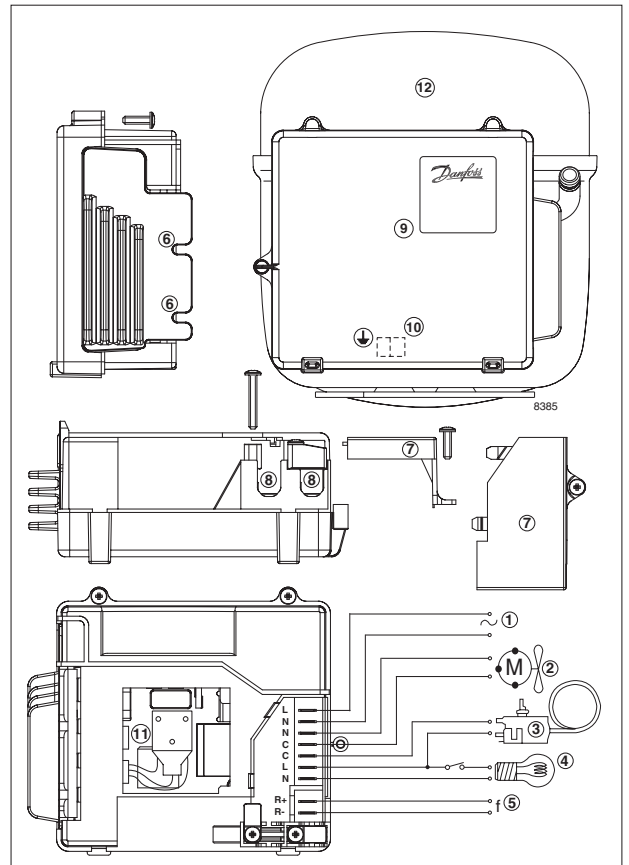
Example for compressor speed: external frequency multiplied by 10 (270 Hz => 2,700 rpm).

3.1.5 Light

A lamp (4) can be connected to terminal L and C.

3.2 Earth connection

Earth connector to be applied to compressor housing (10). The electronic unit is connected to earth through heatsink - toothed washer - screw - compressor housing.

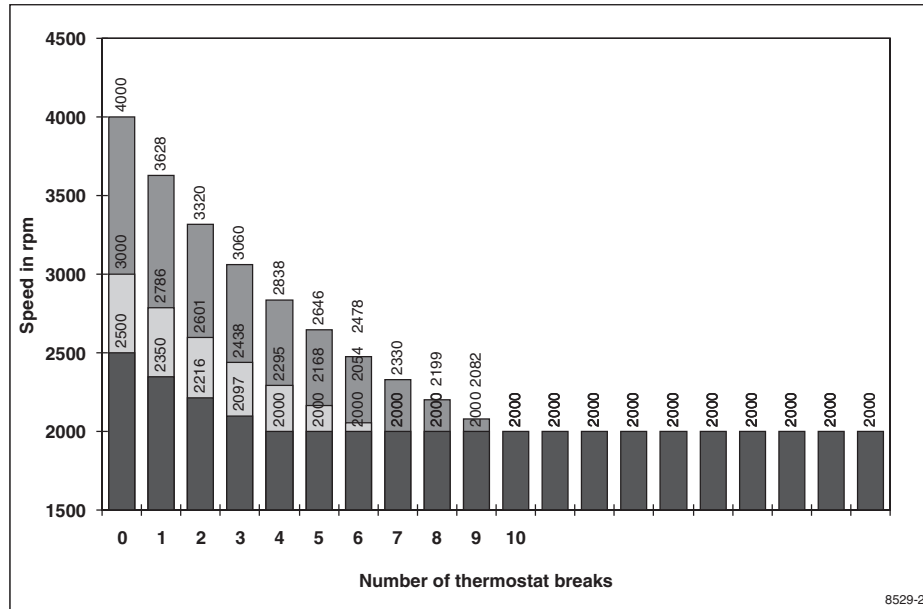


3.3 Adaptive Control

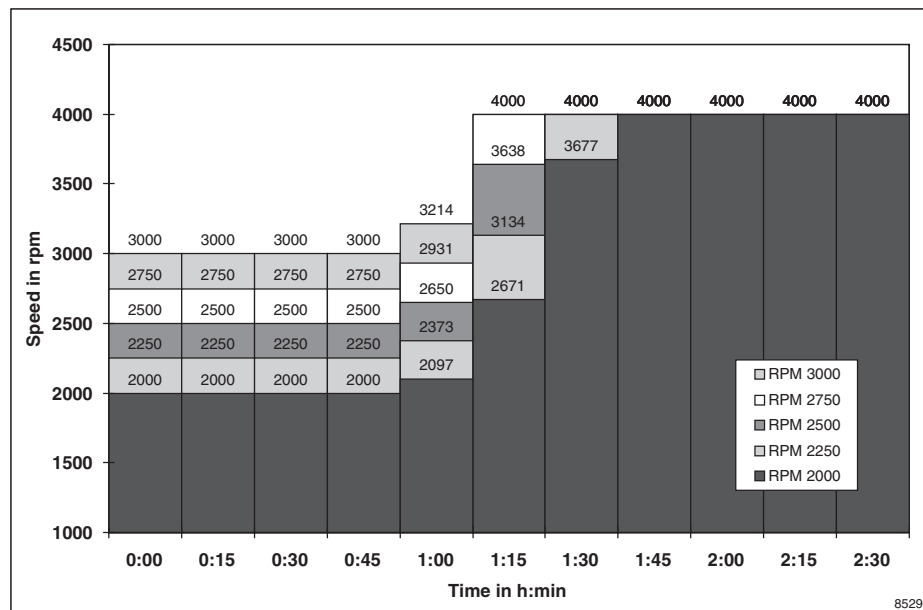
The controller in the electronic unit takes over the RPM management by using the built-in algorithm. The strategy targets for the lowest possible RPM at which the refrigerating system will work properly, because COP is highest at low speed.

- First start of the compressor after mains connection will be at 3000 rpm, on thermostat signal on.
- In the succeeding cycles the compressor will start with a speed slightly below the previous cycle as long as the running period is below 60 min.

Following this pattern the compressor will reach the lowest possible value, which is set to 2000 rpm, after a series of thermostat cycles.



- If the running period however exceeds 60 minutes, the speed is increased.
- After another 15 minutes the control unit will increase the speed slightly, then successively every 15 minutes until the max. speed is reached. Following this pattern the compressor will reach the maximum speed within a certain time, depending on the start speed, if not receiving an 'off' signal. This increase will normally occur at high ambient temperature or at loading of a freezer for freezing.



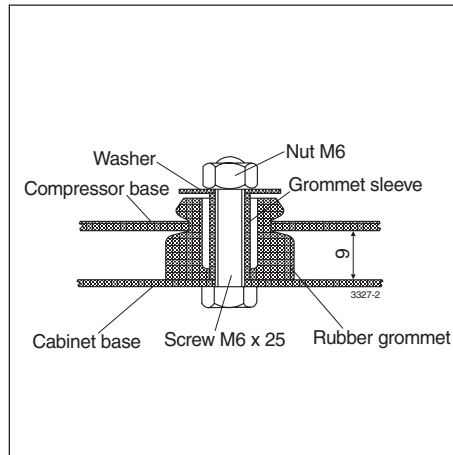
Charge determination should be done at fixed speed, with a frequency according to the speed needed, like in the description at 3.1.4 c).

- 3.4 Approval** The compressor has been approved in respect of safety by testing authorities according to EN 60335-2-34 with Annex AA. The marking appears on the compressor label.
- 3.5 Protection systems** The BD compressor protection system facilitates protection against compressor overload, start failure and electronic unit overheating.
When an overload protection is activated, the compressor enters a cycle in which it makes start attempts at about 60 seconds intervals until a successful start is achieved.
The compressor overload and start protection cuts off power to the compressor if the compressor speed drops below approximately 1,850 rpm or this motor speed is not reached during the start sequence. Possible reasons for overload protection activating could be excess refrigeration system pressures during operation or lack of pressure equalizing at start.
An overheating of the electronic unit heat sink will cause the compressor to stop. Restart will occur automatically when a normal temperature has been reached.
If a fan is installed, it will continue to run if the compressor stops due to overload or electronic unit overheating.
If a voltage outside the specified range is applied to the electronic unit, the compressor does not start, or it stops if the voltage limit is exceeded during operation. The compressor will restart automatically about 1 minute after the supply voltage has reached the reset voltage within the range in question. If a fan is installed, it will start to operate without a delay.
- 3.4 Test equipment** In case the electronic unit is supplied with 160-254V AC directly or via the inverter, the higher frequency parts adding up to the non-sine shape of the current give a demand for a bandwidth of at least 5 kHz for the energy consumption measurement equipment, to get accurate measurements.
We recommend following data:
Minimum bandwidth 10 kHz
Power factor capability < 0.2
Peak current capability 15 A
Results coming from equipment with unsatisfactory bandwidth are not predictable. A systematic deviation of several percent is easily possible to get, resulting in higher or lower values.
- 4. Moisture and impurities** The compressors are dried to a maximum moisture content 75 mg. The maximum impurity content is 50 mg.
- 5. Max. refrigerant charge** The refrigerant charge must never be too large to be contained on the condenser side of the refrigeration system. Only the refrigerant amount which is necessary for the system to function must be charged.
The refrigerant amount may be critical as regards oil foaming and liquid hammer after long standstill periods. Because of this, a limitation of refrigerant charge of 400g is recommended.
- 6. Oil charge** The compressors are supplied charged with dried and degassed oil, which is normally sufficient for the lifetime of the compressor. The refrigeration systems and the system components must be dimensioned in such a way that the oil can be lead back continuously to the compressor housing without accumulating in the system, e.g. without oil pockets and with sufficient gas velocity. The compressors use polyolester oils and are approved only for these oils and R134a.
The oil charge is 180 cm³.

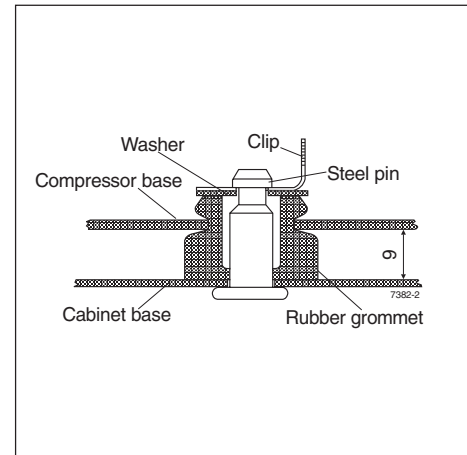
7. Mounting

Soldering problems caused by oil in the connectors can be avoided by placing the compressor on its baseplate some time before soldering it into the system. The compressor must never be placed upside down when mounting the rubber grommets in the baseplate. Instead place the compressor on its side with the connectors upwards.

7.1 Mounting accessories



Bolt joint



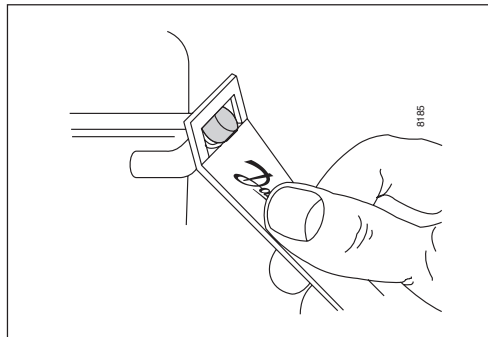
Snap-on joint

The mounting accessories for the compressors are available in two versions, with bolt joint or snap-on joint.

These rubber grommets are designed for the 16 mm holes of the baseplate:

Bolt joint for one compressor in a bag	118-1917
Bolt joint in quantities	118-1918
Snap-on in quantities	118-1919

7.2 Connectors



The compressor is equipped with DANCON connectors which consist of a thick-walled, copperplated steel tube with high corrosion resistance, and a solderability equal to that of conventional copper connectors. DANCON connectors are equipped with an aluminium cap (Capsolut) which gives a tight sealing. The seal cap is easily removed with an ordinary pair of pliers or with a special tool.

8. Condition at delivery

In quantities the compressors are delivered separated from the electronic units on pallets with the dimensions 1144 x 800 mm containing 125 compressors.

The most important performance controls carried out during manufacturing are,

- A high potential insulation test with 1650V for 1 second
- Pumping capacity
- Tightness of discharge side and discharge valve
- Tightness of compressor housing
- Check of the right oil charge
- Noise test

The compressor is supplied with sealed connectors and the sealing should not be removed before the system assembly takes place (max. 15 minutes with open connectors).

11. Warnings

No high potential test nor start tests must be carried out while the compressor is under vacuum.

Allow the compressor to assume a temperature above 10°C before starting the first time in order to avoid starting problems.

Anti-freeze agents must not be used in the compressors as such agents are damaging to several of the materials used. In particular, the ethyl or methyl alcohol contents of such anti-freeze agents have a destructive effect on the synthetic motor insulation.

12. Inverter

The inverter type 12 – BD150F and 24 – BD150F are used together with the Danfoss BD 150F compressor. It is intended for applications where 12 or 24V DC power is available. Typically an automotive application such as a van equipped with a cooling box.

There are two models of inverters, type 12 for 12V DC (Code no. 105N0912) and type 24 for 24V DC (Code no. 105N0924). The inverter is special designed for the automotive environments, and offers the same feature as the BD 150F in regards to shock and vibration stability.

The output voltage is a pure 230V AC sine-wave, with a peak voltage of 325V. The high efficiency (>90% at full load) of the inverter ensures that heat losses are reduced to a minimum which matters in a closed environment as for example in a van with a refrigerated box.

The BD150F offers the possibility to apply mains supply, which makes it possible to maintain refrigeration in a non driving situation.

The *remote switch* offers the possibility to operate the inverter remotely. In an automotive application it will typically be connected to the ignition switch. The switch is parallel coupled with the ON/OFF switch on the inverter. The terminal is marked *Remote*.

Function: When the terminal is connected to + the inverter is ON. If the terminal is open the inverter is OFF. The remote switch can be overridden by the ON/OFF switch on the inverter.

Important: The spade terminal must be isolated in order to prevent short circuit of the terminal.

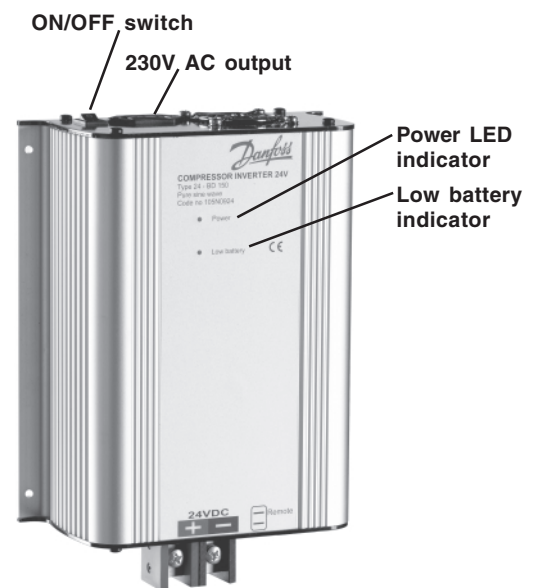
The *low battery LED* is activated when the battery voltage has dropped to a low level. At the same time the inverter shifts to standby mode. This means that the monitoring circuit is still working. All other functions are shut down, until the battery voltage is back to a safe level.

The *power LED* has 2 functions: 1.Power indication, 2.Flash pattern if certain faults occurs.

1 flash: Overload. The power consumption is bigger than the rating.

2 flashes: Thermal overload. The inverter is too hot internally.

3 flashes: Short circuit. The external electrical connections have a short circuit.



BD150F

Compressor for Mobile Refrigeration

R134a

220-240V 50-60Hz, 300V DC, 12/24V DC (with Power Inverter)

Data Sheet

General

Compressor	BD150F
Code number: Comp. without electronic unit	102G4784
Code number: Electronic unit	105N4220

Application

Application	LBP
Evaporating temperature range °C	-35 to -10
Voltage range	160-254V AC /50-60Hz 250-350V DC with power inverter for mobile use 12/24V DC (see page 2)
Starting characteristics	HST
Max. ambient temperature °C	43
Comp. cooling at ambient temp.	32°C S 38°C S 43°C S

Features

Speed range rpm	2000 - 4000
Protections	current, voltage, speed, temperature
Usage	<ul style="list-style-type: none"> mobile refrigeration, designed for use in vans, small trucks, etc. active refrigeration for food transportation expanded 230V AC range / DC input for 300V DC supply

Design

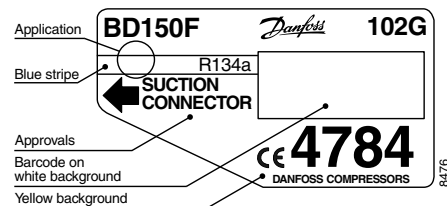
Displacement cm ³	6.49
Oil quantity cm ³	180
Maximum refrigerant charge g	400
Free gas vol. in compressor cm ³	1790
Weight: Compressor/Electronic unit kg	7.9/0.6

Motor

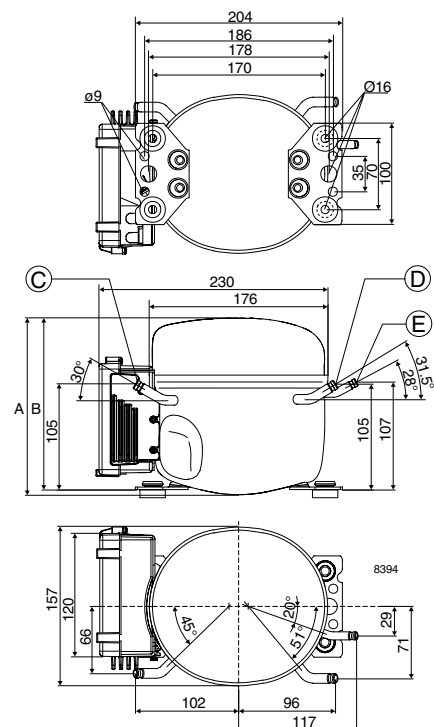
Motor type	permanent magnet
LRA (rated after 4 sec. UL984) HST A	electronic cut-off
Cut-in current HST A	6
Resistance, all 3 windings (25°C) Ω	14.0
Approvals	EN 60335-2-34 with Annex AA

Dimensions

Height mm	A	173
	B	169
Suction connector location/l.D. mm	C	6.2 ±0.09
Process connector location/l.D. mm	D	6.2 ±0.09
Discharge connector location/l.D. mm	E	5.0 +0.12/+0.20
Compressors on a pallet (without el. unit) pcs.		125



- S = Static cooling normally sufficient
- O = Oil cooling
- F₁ = Fan cooling 1.5 m/s (compressor compartment temperature equal to ambient temperature)
- F₂ = Fan cooling 3.0 m/s necessary



Capacity (EN 12900/CECOMAF)

rpm \ °C	-35	-30	-25	-23.3	-20	-15	-10
2,000	47.5	66.2	90.0	99.3	120	156	199
2,500	56.3	80.7	111	122	147	192	245
3,000	64.2	92.8	128	141	171	222	284
4,000	78.3	111	153	170	205	269	345

watt
Capacity (ASHRAE)

rpm \ °C	-35	-30	-25	-23.3	-20	-15	-10
2,000	58.6	81.7	111	123	148	192	246
2,500	69.3	99.5	137	151	182	237	302
3,000	79.1	114	158	175	211	274	350
4,000	96.6	137	189	210	253	332	427

watt
Power consumption

rpm \ °C	-35	-30	-25	-23.3	-20	-15	-10
2,000	51.8	64.6	78.3	83.3	93.1	109	125
2,500	63.0	79.8	97.6	104	116	136	156
3,000	74.2	94.2	115	123	137	161	185
4,000	96.2	120	146	155	174	203	235

watt
Current consumption

rpm \ °C	-35	-30	-25	-23.3	-20	-15	-10
2,000	0.49	0.63	0.74	0.78	0.85	0.96	1.10
2,500	0.59	0.70	0.84	0.90	1.00	1.12	1.32
3,000	0.69	0.80	0.95	1.02	1.14	1.35	1.55
4,000	0.84	1.05	1.24	1.31	1.45	1.67	1.90

A
COP (EN 12900/CECOMAF)

rpm \ °C	-35	-30	-25	-23.3	-20	-15	-10
2,000	0.92	1.03	1.15	1.19	1.28	1.43	1.59
2,500	0.89	1.01	1.13	1.18	1.27	1.41	1.57
3,000	0.87	0.99	1.11	1.15	1.24	1.38	1.53
4,000	0.81	0.93	1.05	1.09	1.18	1.32	1.47

W/W
COP (ASHRAE)

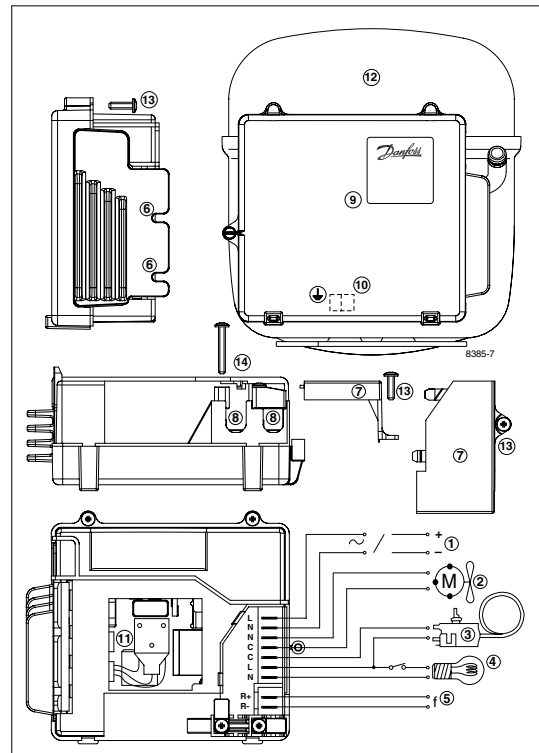
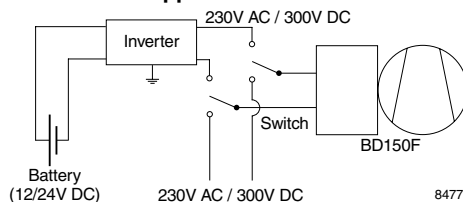
rpm \ °C	-35	-30	-25	-23.3	-20	-15	-10
2,000	1.13	1.27	1.42	1.47	1.59	1.77	1.97
2,500	1.10	1.25	1.40	1.45	1.56	1.74	1.94
3,000	1.07	1.22	1.37	1.42	1.53	1.71	1.90
4,000	1.00	1.14	1.29	1.35	1.46	1.63	1.81

W/W

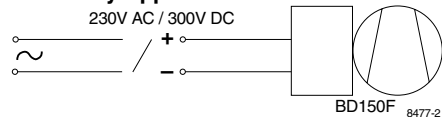
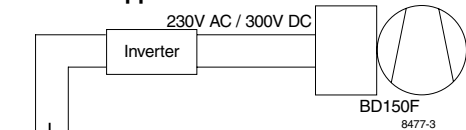
Test conditions	EN 12900/CECOMAF	ASHRAE
Condensing temperature	55°C	55°C
Ambient and suction gas temp.	32°C	32°C
Liquid temperature	55°C	32°C
Static cooling, 220V 50Hz		

Accessories

Devices	BD150F
Mounting accessories	
Bolt joint for one compressor	118-1917
Bolt joint in quantities	118-1918
Snap-on in quantities	118-1919

Combined Application

Legend

- 1: 230V AC / 300V DC power supply
- 2: Fan connection
- 3: Thermostat connection
- 4: Light connection
- 5: Signal input
- 6: Mounting recesses
- 7: Cover
- 8: Cord relief
- 9: Electronic unit
- 10: Earth connection
- 11: Connector
- 12: Compressor
- 13: Screw 3.5 x 12 mm (3 pcs.)
- 14: Screw 3.5 x 25 mm (2 pcs.)

Stationary Application

Mobile Application


The inverter should be a 12/24V DC to 230V AC type, with a peak voltage of minimum 300V. Lower peak voltages will result in lower performance at high cooling capacity (continuous output power minimum 300W).

Inverter for BD150F Compressors 12/24V DC, 230V AC

Data Sheet

Ordering

Inverter	BD150 Types
Code number: 12 - BD 150 (12V DC)	105N0912
Code number: 24 - BD 150 (24V DC)	105N0924

Electrical Specifications

Input voltage 12V DC version	12V DC nominal range 10-15V DC
Input voltage 24V DC version	24V DC nominal range 20-30V DC
Output Voltage	230V AC +/- 3%
Frequency	50Hz
Output wave form	pure sine-wave
Continuous output power	300 W
Standby consumption	5 mW
No load power consumption 12V DC version	8.5 W
No load power consumption 24V DC version	12 W
Efficiency at full load	> 90 %

Environmental Specifications

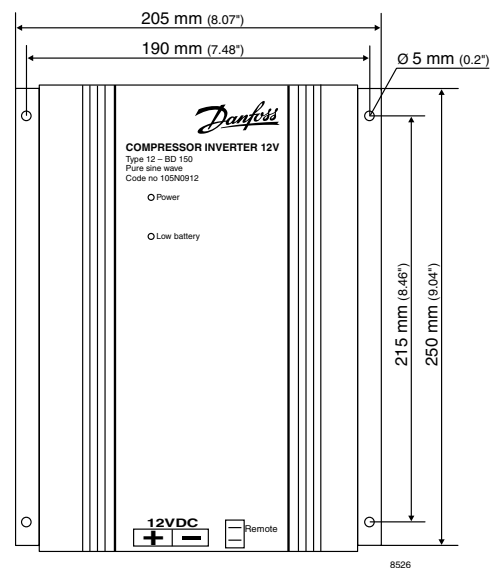
Ambient temperature during operation	-20°C to +55°C
Cooling	static air cooling
PCB protection	coated to withstand moisture

Mechanical Specifications

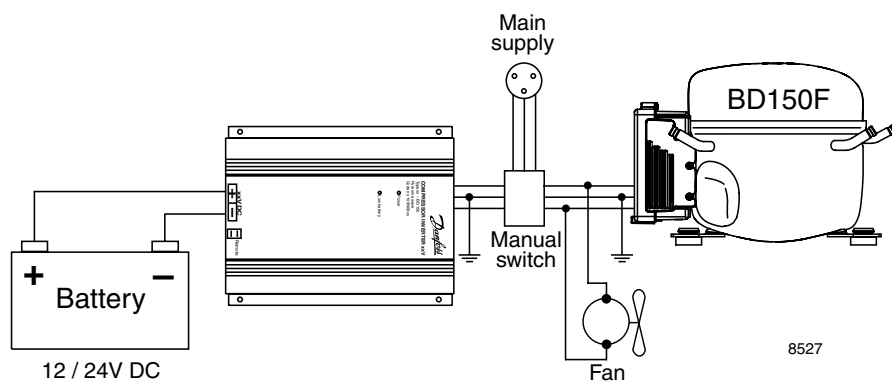
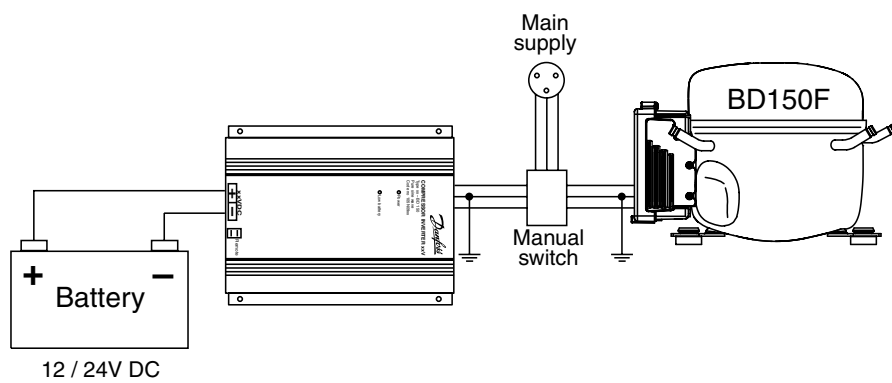
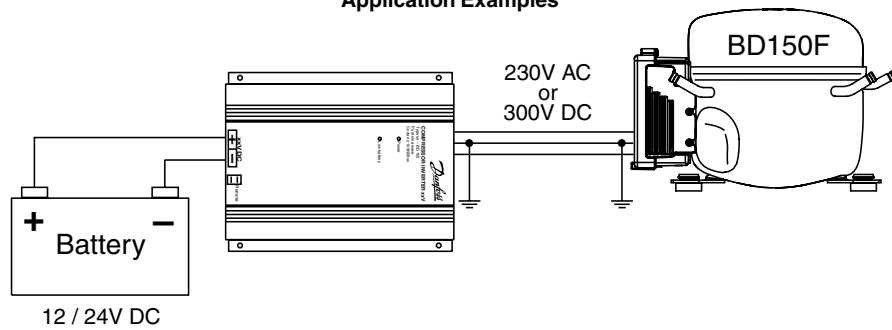
Housing	anodized extruded aluminum
Weight	4.5 kg ~ 10 lbs
AC outlet	3-pole female IEC socket
Housing dimensions in mm (L x W X H) mm	220 x 205 x 98
Mounting	Horizontal or Vertical
Alarm indication	overload, high temperature, short circuit, low battery
Enclosure	IP 21

Standards

CE marking	EMC Directive 89/336/EEC
Automotive directive	95/54/EC
Emission	EN 61000-6-3
Immunity	EN 61000-6-1
Safety	IEC 950



Application Examples



Wire dimensions

Size AWG Gauge	Cross section mm ²	Max length* 12V operation		Max length* 24V operation	
		ft.	m	ft.	m
6	16	8	2.5	16	5
4	25	13	4	26	8

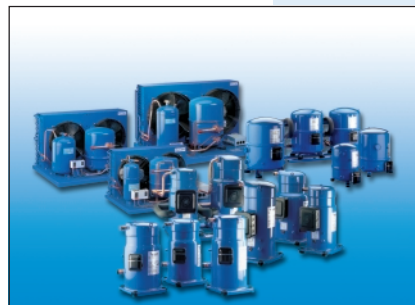
*Length between battery and electronic unit



The Danfoss product programme for the refrigeration industry contains:

Compressors for Refrigeration and Air Conditioning

A wide range of hermetic reciprocating compressors and scroll compressors as well as aircooled condensing units. The product range is applied in air conditioning units, water chillers and commercial refrigeration systems.



Compressors for Refrigerators and Freezers

Hermetic compressors and fan-cooled condensing units for household refrigeration units such as refrigerators and freezers, and for commercial installations such as sales counters and bottle coolers. Compressors for heating pump systems. 12 and 24 V compressors for refrigerators and freezers in commercial vehicles, buses, and boats.



Appliance Controls

For the regulation of refrigeration appliances and freezers Danfoss supply a CFC-free product range of electromechanical thermostats for refrigerators and electromechanical thermostats for refrigerators and freezers produced according to customer specification; Hermetic valves for refrigerator/freezer combinations and for energy saving applications; Service thermostats – for all refrigerating and freezing appliances.



Refrigeration and Air Conditioning Controls

With our full product range we cover all the requirements for mechanical and electronically controlled refrigeration systems. The functions cover: control, safety, system protection and monitoring. Our products are applied for all commercial- and industrial refrigeration applications as well as for air conditioning.



www.danfoss.com/compressors

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