ENGINEERING
TOMORROW

Application guidelines

Danfoss rotary compressors
VRN

R290, R454C – CDS203 drive

http://cc.danfoss.com

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

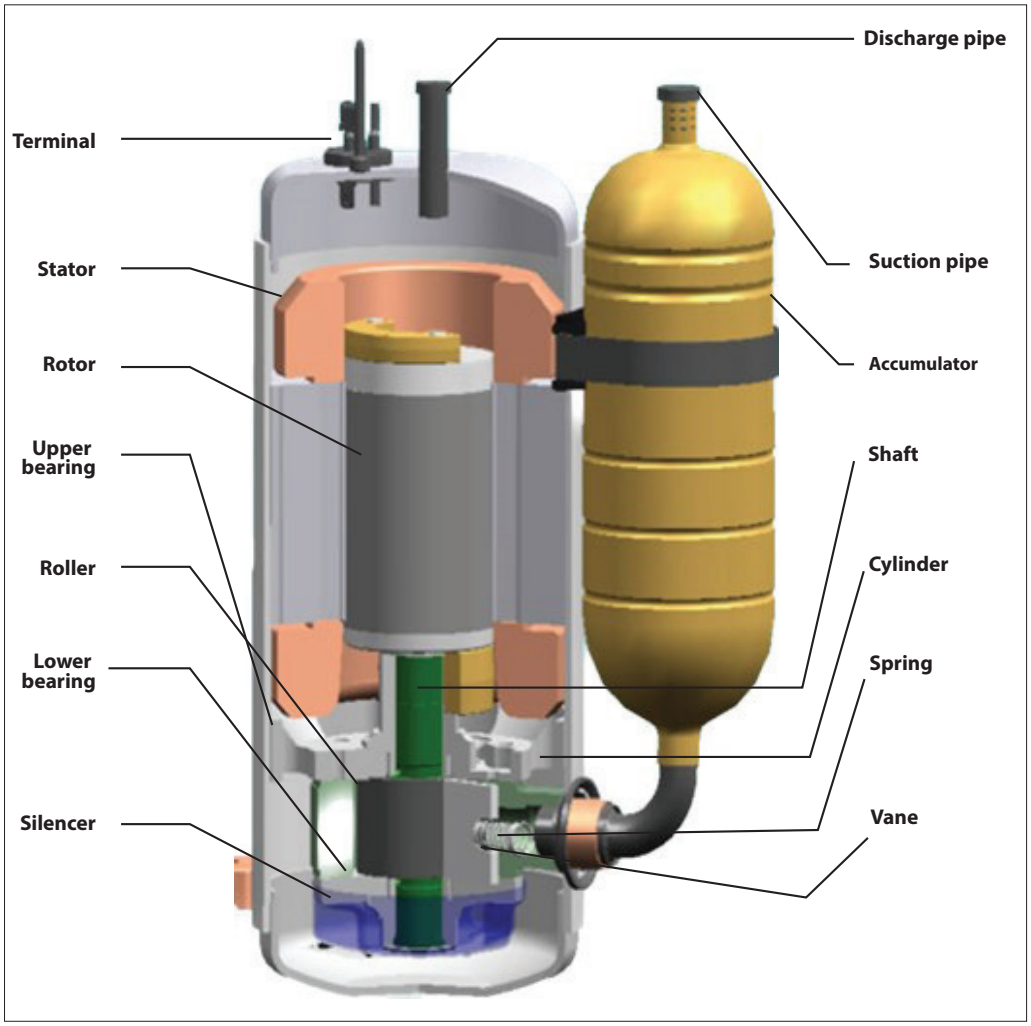
 This icon indicates instructions to avoid safety risk.

 This icon indicates instructions to avoid reliability risk.

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

Danfoss rotary variable speed compressor VRN for R290 and R454C is optimized for heat pump application. Moreover, it benefits from an improved design to achieve the highest efficiency and increased life time.

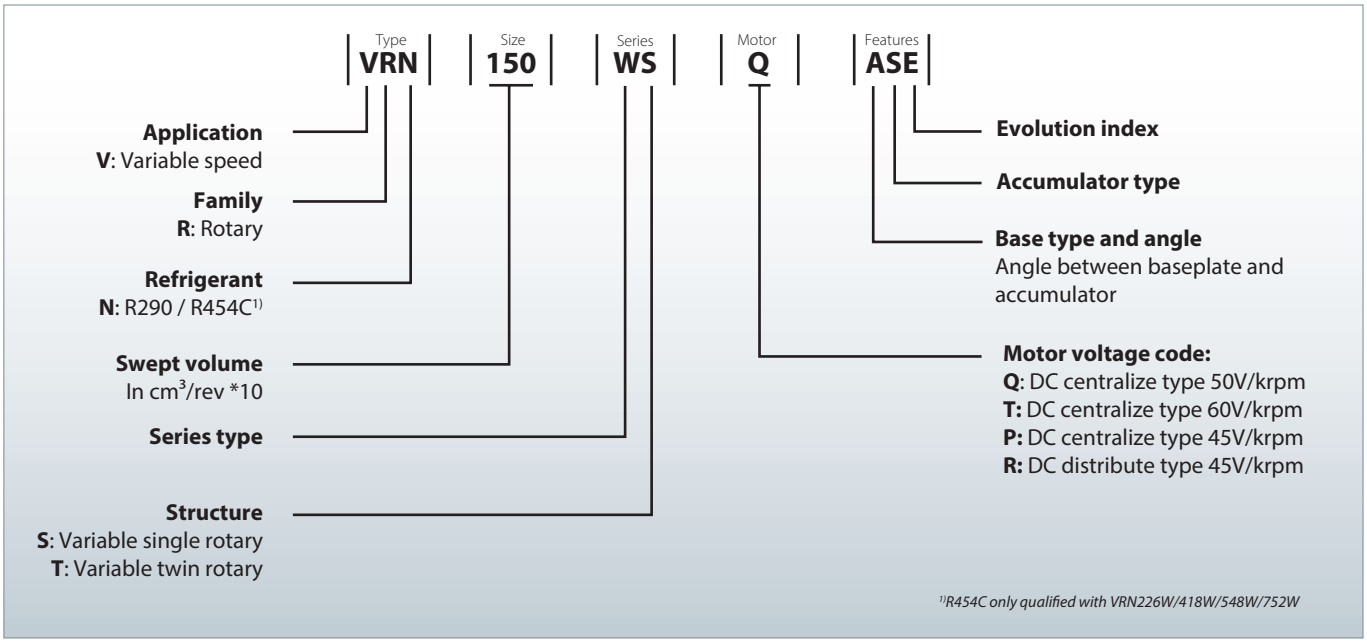
NOTE: R290 is classified as A3 flammable refrigerant.



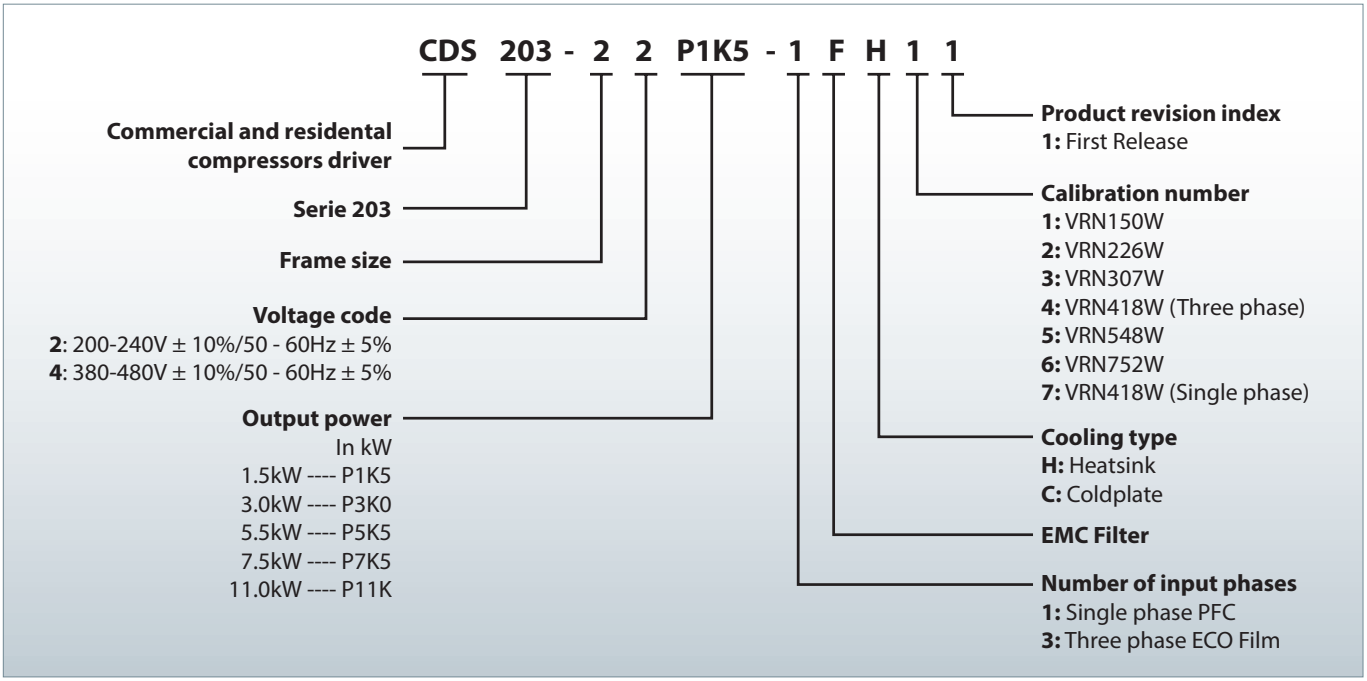
Compressor model designation

Nomenclature

Compressor nomenclature



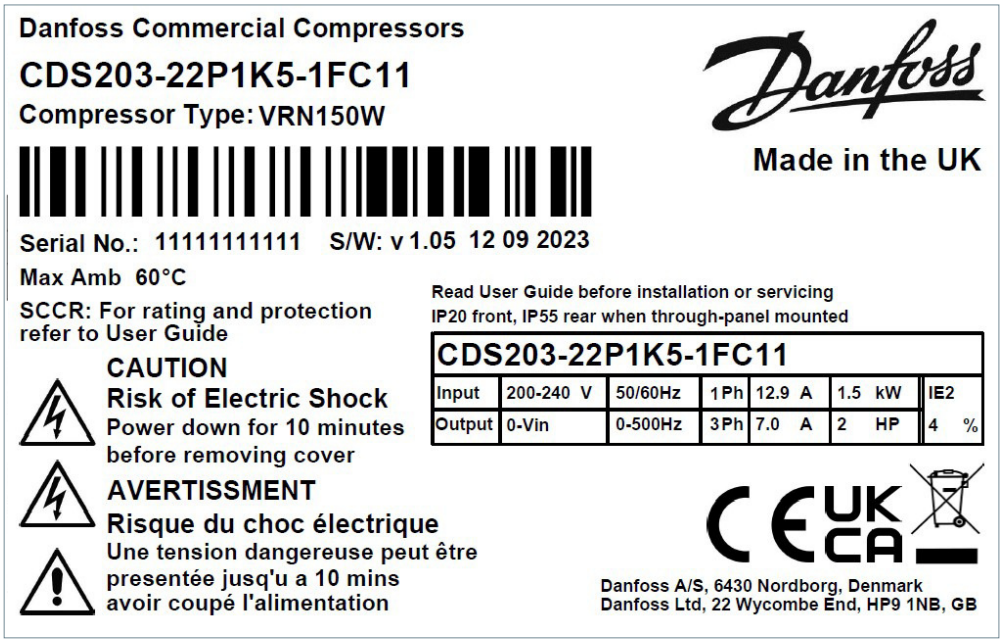
Frequency converter nomenclature



Compressor model designation

Compressor labels

Driver labels



Technical specifications

Compressor size

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

Detailed performances can be found in datasheets and in selection programs.

Compressor and frequency converter combinations

the code number tables from the "Ordering information and packaging" section provides the appropriate frequency converter for each compressor model.

⚠ **Note this compressor is equipped with a four-pole or six-pole electrical motor so the applied frequency from the inverter please refer to the table below:**

		VRN150WSQASE		VRN226WTPAGE		VRN307WTRBQA		VRN418WTRBQA		VRN548WTRBRA		VRN752WTTENA	
Pole		6		6		4		4		4		6	
		min	max	min	max	min	max	min	max	min	max	min	max
Compressor speed	rps	17	120	15	120	15	120	15	120	15	110	15	120
	rpm	1000	7200	900	7200	900	7200	900	7200	900	6600	900	7200
Drive output frequency	Hz	50	360	45	360	30	240	30	240	30	220	45	360

The VRN compressors and CDS203 drives match up list

Compressor reference models name	Drive Model name		Drive Voltage
	Cold plate Version	Heatsink Version	
VRN150WSQASE	CDS203-22P1K5-1FC11	CDS203-22P1K5-1FH11	200-240V/1ph/50&60Hz
VRN226WTPAGE	CDS203-22P3K0-1FC21	CDS203-22P3K0-1FH21	
VRN307WTRBQA	CDS203-22P3K0-1FC31	CDS203-22P3K0-1FH31	
VRN418WTRBQA	CDS203-22P4K0-1FC71	CDS203-22P4K0-1FH71	
VRN307WTRBQA	CDS203-24P5K5-3FC31	CDS203-24P5K5-3FH31	380-480V/3ph/50&60Hz
VRN418WTRBQA	CDS203-24P5K5-3FC41	CDS203-24P5K5-3FH41	
VRN548WTRBRA	CDS203-24P11K-3FC51	CDS203-24P11K-3FH51	
VRN752WTTENA	CDS203-24P11K-3FC61	CDS203-24P11K-3FH61	

Compressor specifications

Compressor model	Swept volume		Displacement										Oil charge		Net weight	
			1800 rpm		3000 rpm		3600 rpm		6600 rpm		7200 rpm					
	(cm^3/rev)	(cu.in/rev)	(m^3/h)	(cu.ft/h)	(m^3/h)	(cu.ft/h)	(m^3/h)	(cu.ft/h)	(m^3/h)	(cu.ft/h)	(m^3/h)	(cu.ft/h)	(dm^3)	(oz)	(kg)	(lbs)
VRN150WS	15	0.92	1.6	57	2.7	95	3.2	114	5.9	208	6.5	230	0.48	16	8.9	20
VRN226WT	22.6	1.38	2.4	86	4.1	144	4.9	172	8.9	314	9.8	346	0.63	21	10.4	23
VRN307WT	30.7	1.87	3.3	117	5.5	195	6.6	234	12.2	431	13.3	470	0.84	28	17.5	39
VRN418WT	41.8	2.55	4.5	159	7.5	266	9	319	16.6	586	18.1	639	0.84	28	18	40
VRN548WT	54.8	3.34	5.9	209	9.9	348	11.8	418	21.7	766	-	-	1.15	39	18.9	42
VRN752WT	75.2	4.59	8.1	286	13.5	477	16.2	572	29.8	1052	32.5	1148	2.00	68	26.5	58

Frequency converter specifications

"For the detail information of the drive specification please refer to the user guide of CDS203(AB455227823946en-000101)"

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
- Standardization of refrigerants and lubricants
- Refrigerant cost
- Refrigerant availability

R290

R290 is a technically splendid refrigerant with a high thermodynamic efficiency and has been used as refrigerant for almost 100 years serving a variety of applications with many different capacities.

R290 is non-toxic, but highly flammable, and under certain atmospheric concentrations easily reacts with oxygen and burns or create an explosion.

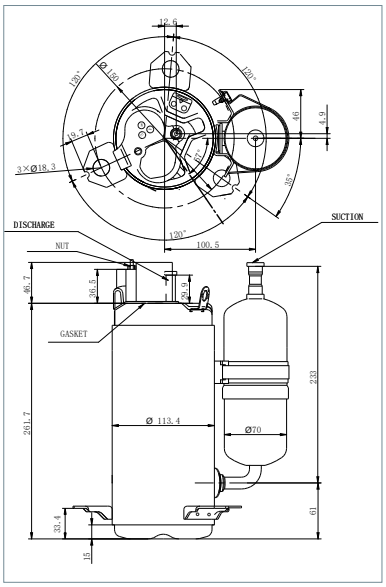
R290 is categorized as an A3 refrigerant according to ISO817 classification.

Please refer to European regulation and directives about the use if refrigerant of the A3 safety group (EN378,EN60335), Outside Europe refer to the local regulation.

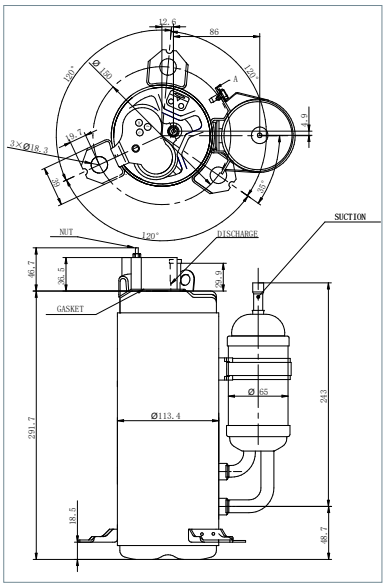
R454C

R454C is a HFO refrigerant blend (R32: 21.5%; R1234yf: 78.5%) and has no Ozone Depletion Potential (ODP=0). It has a low Global Warming Potential (GWP=148). It is a near-azeotropic mixture with temperature glide around 1K. R454C is classied as A2L with low ammability properties.

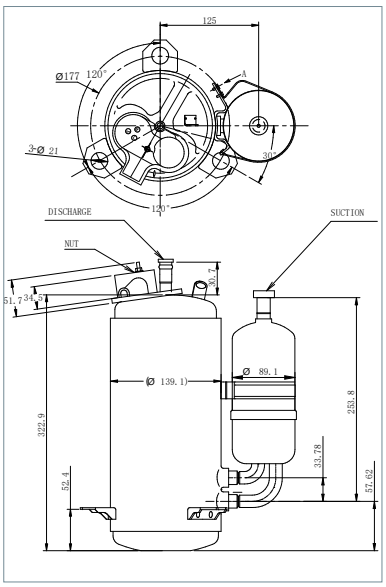
Dimensions



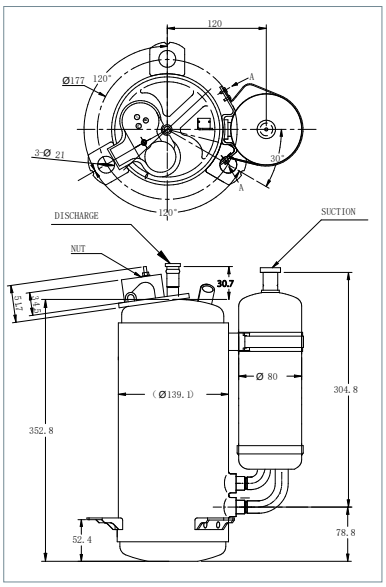
VRN150WS



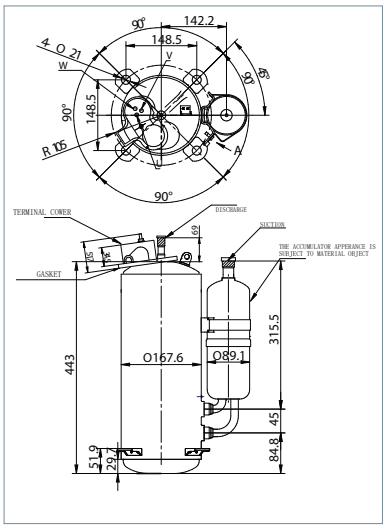
VRN226WT



VRN307WT / VRN418WT

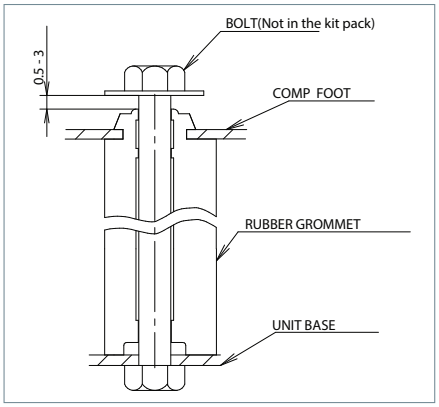


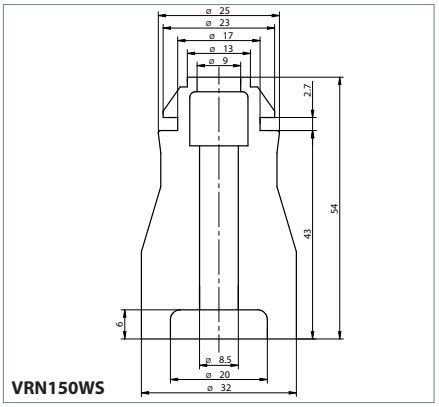
VRN548WT

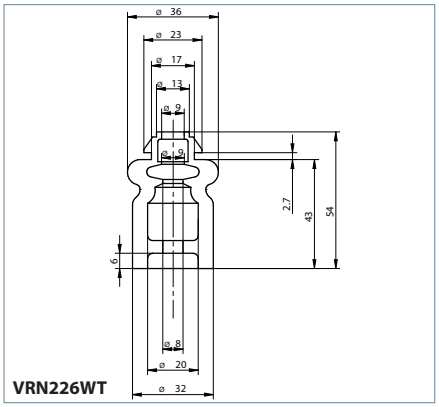


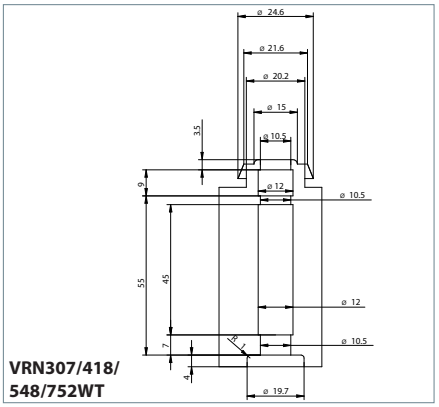
VRN752WT

Mounting grommet









Connection details

	VRN150 (in mm)	VRN226 (in mm)	VRN307/418/548 (in mm)	VRN752 (in mm)
Suction connection (Brazed)	12.9	12.9	16.2	22.2
Discharge connection (Brazed)	8.2	9.7	9.7	19.2

Supply voltage

Because VRN compressors are powered by a frequency converter, the mains frequency, 50 or 60 Hz, is no longer an issue. Only the mains voltage is to be taken into account. Never connect the VRN compressor directly to the mains power supply in case the inverter gets damaged.

Voltage code	Mains voltage range of drive
2	200-240V ± 10% /Single phase/ 50 - 60Hz ± 5%
4	380-480V ± 10% /Three phase/ 50 - 60Hz ± 5%

Compressor electrical specifications

Model	RW(Ω) at 20°C line to line
VRN150WS	1.867Ω±7%
VRN226WT	0.930Ω±7%
VRN307WT	0.502Ω±7%
VRN418WT	0.502Ω±7%
VRN548WT	0.502Ω±7%
VRN752WT	0.499Ω±7%

RW: Winding resistance per winding, measured at motor terminals

MOC (Max Operating Current)

Max. operating current is the max. continuous current output from drive to compressor within operating map.

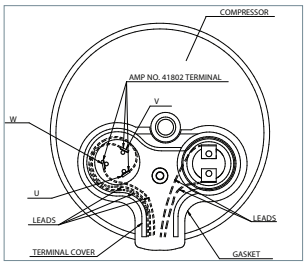
MOC is tested at max. load condition with nominal voltage. It can be used to select the size of cables to install between the drive and the compressor.

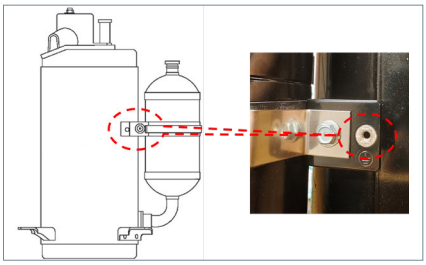
MRC (Max Rated Current)

Maximum rated current is the current at the input of drive and value is the current rating of drive. It can be used to select the size of cables and contactors by adding a safety coefficient.

Wiring connections

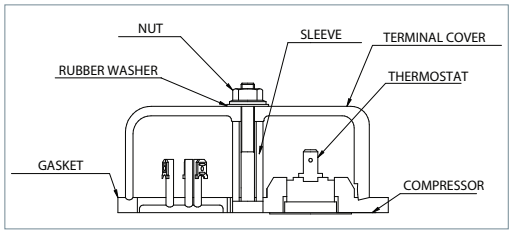
Terminal cover must be fitted and gasket or similar protection component must be used before energizing the compressor to against accidental contact with electrical parts inside.
The drawing shows electrical terminal labelling and should be used as a reference when wiring the compressor. The terminals are labelled U, V, and W.
Ground conductor and its shield shall be fixed with the dedicated screw on the suction accumulator bracket.





Terminal cover mounting and removal

The terminal cover and gasket should be installed prior via the drawing to operation of the compressor.
The torque enforced on the nut is 1.5±0.3N.m.



Fuse/ Circuit breaker/ Wire size

Danfoss recommends using the Fuse/ Circuit breaker/ Wire listed below.

- Suitable fuses to provide wiring protection of the input power cable should be installed in the incoming supply line.

  The fuses must comply with any local codes or regulations in place.

  In general, type gG (IEC 60269) or UL type J fuses are suitable; however, in some cases type aR fuses may be required.

  The operating time of the fuses must be below 0.5 seconds.
- Where allowed by local regulations, suitably dimensioned type B MCB circuit breakers of equivalent rating may be utilized in place of fuses, providing that the clearing capacity is sufficient for the installation.
- The maximum permissible short circuit current at the CDS203 drive Power terminals as defined in IEC60439-1 is 100kA.

Part Number	Power Rating		MRC (Max rating current)	Fuse	Recommended Input Cable Size	MOC (Max operating current)	Recommended Output Cable Size	Maximum Motor Cable Length	
	kW	HP	A	A	mm2	A	mm2	m	ft
CDS203-22P1K5-1FC11 CDS203-22P1K5-1FH11	1.5	2	12.3	16	2.5	5.7	1.5	10	33
CDS203-22P3K0-1FC21 CDS203-22P3K0-1FH21	3	3	21.4	25	4	10	1.5	10	33
CDS203-22P3K0-1FC31 CDS203-22P3K0-1FH31	3	3	25.7	30	6	12	1.5	10	33
CDS203-22P4K0-1FC71 CDS203-22P4K0-1FH71	4	5.5	34.9	40	6	16	2.5	10	33
CDS203-24P5K5-3FC31 CDS203-24P5K5-3FH31	5.5	7.5	9	10	1.5	12	1.5	10	33
CDS203-24P5K5-3FC41 CDS203-24P5K5-3FH41	5.5	7.5	11.5	16	2.5	14	2.5	10	33
CDS203-24P11K-3FC51 CDS203-24P11K-3FH51	11	15	16.3	20	2.5	21	4	10	33
CDS203-24P11K-3FC61 CDS203-24P11K-3FH61	11	15	22	25	4	24	4	10	33

⚠ Use temperature resistant cables, suitable to at least +125 °C. The compressor shell can get hot, avoid contact.

The wire size in the guidelines are recommendation. The needed cable size should be specified by the OEM depending on the unit design, ambient temperature, the wire material, current, etc.

Compatibility with RCD

In normal operation, CDS203 Drives can cause a DC current in the protective grounding conductor.

If a Residual Current Device [RCD] is placed in the supply side of the CDS203 Drive to protect against direct and/or indirect contact, it is mandatory to use a Type B.

RCD term also includes here all possible protection device that monitor the residual current like Residual-current Circuit Breaker [RCCB], Residual-current Circuit Breaker with Overcurrent protection [RCBO].

Soft-start control

The CDS203 frequency converter generates by design a compressor soft start with a default initial ramp up refer to 'Manage speed limit'.

Basically, seen from the mains, the inrush peak reaches a level which is only a few percent more than the rated nominal current.

Current inrush will not exceed the frequency converter maximum current.

Phase sequence and reverse rotation protection

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

- CDS terminal U to VRN terminal U
- CDS terminal V to VRN terminal V
- CDS terminal W to VRN terminal W

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

Mains connection to the CDS frequency converter order has no influence on the output phase sequence which is managed by the frequency converter.

IP rating

For the models from VRN307 to VRN752, The compressor terminal box IP rating according to IEC529 is IP21.

Element	Numerals or letters	Meaning for the protection of equipment
First characteristic numeral	0 1 2 3 4 5 6	Against ingress of solid foreign objects (non protected) ≥ 50 mm diameter ≥ 12.6 mm diameter ≥ 2.5 mm diameter ≥ 1.0 mm diameter dust protected dust tight
Second characteristic numeral	0 1 2 3 4 5 6 7 8	Against ingress of water with harmful effects (non protected) vertically dripping dripping (15° tilted) spaying splashing jetting powerful jetting temporary immersion continuous immersion

Motor protection

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

Voltage imbalance

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

Approvals and certificates

VRN compressors comply with the following approvals and certificates.

CE (European Directive)	CE	

Conformity to directives

Pressure equipment directive 2014/68/EU

Machinery directive 2006/42/EC annex II b

Low voltage directive 2014/35/EU

Products	VRN150W	VRN226W	VRN307W	VRN418W	VRN548W	VRN752W
Refrigerating fluid	R290	R290, R454C	R290	R290, R454C	R290, R454C	R290, R454C
Category PED	I					II
Evaluation module	no scope					A2
Service temperature - Ts	-25 °C < Ts < 125 °C					-25 °C < Ts < 125 °C
Service pressure (High side) - Ps	31.3 bar(g)					44 bar(g)
Declaration of conformity	Contact Danfoss					
Marking of conformity	CE					

Internal free volume

Products	Internal free volume at HP side without oil (lite/cu.inch)
VRN150WS	1.2/73
VRN226WT	1.2/73
VRN307WT	1.5/92
VRN418WT	1.5/92
VRN548WT	1.5/92
VRN752WT	3.2/195

Declaration related to A3

Danfoss marks rotary compressors that are qualified for A3 refrigerants with flammable mark on the label indicating the usage of such refrigerants. Systems using flammable refrigerants must be executed correctly while observing safety rules, as specified in corresponding safety standards such as, but not limited to EN 378. They must comply with any and all applicable legislation and regulations.

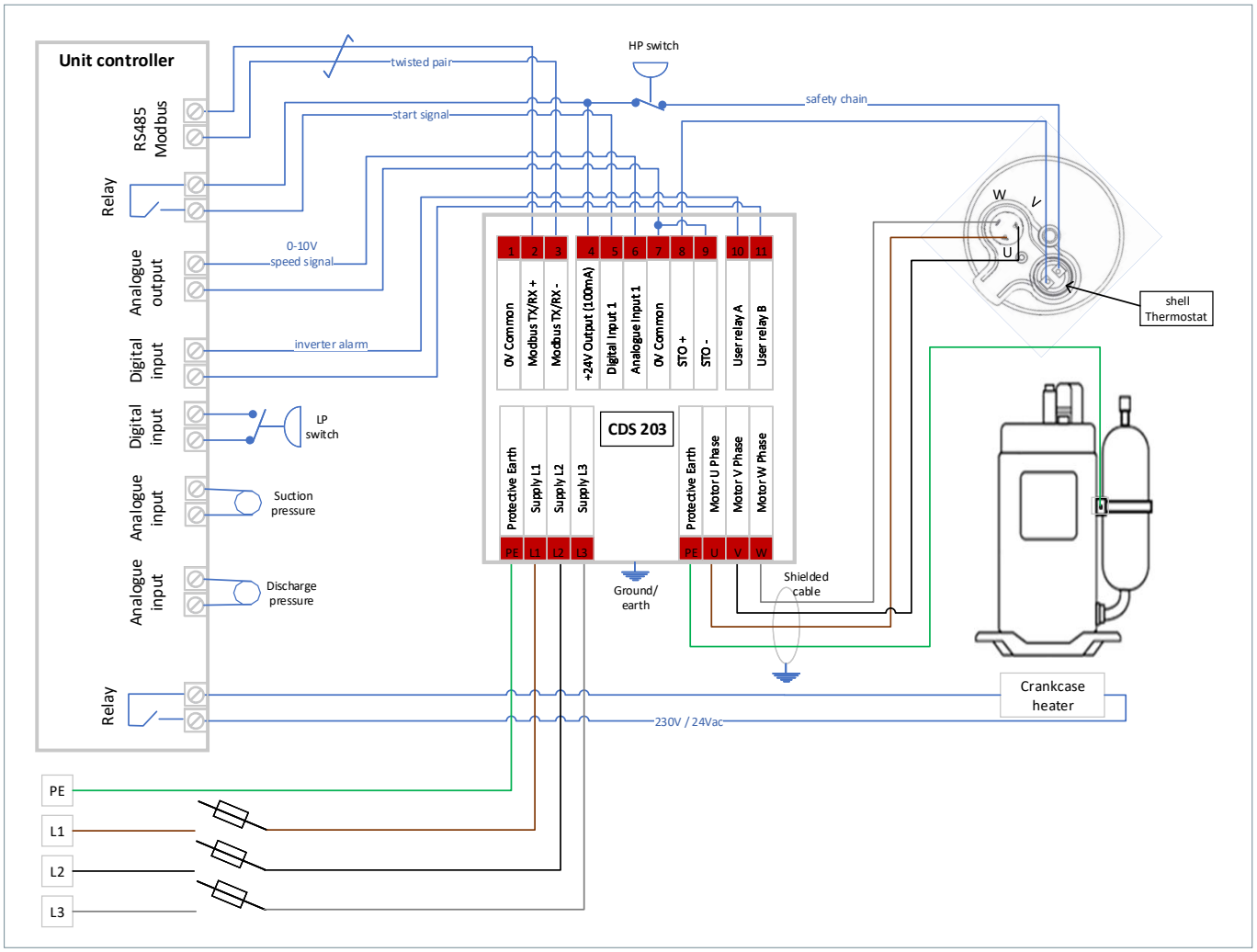
Ensuring compliance remains the user's responsibility.

Typical control architecture

The frequency converter is pre-set for speed open loop control. This means that the speed set-point is given by a 0-10V, where 0V corresponds to the minimum compressor speed and 10V is maximum compressor speed.

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

Below is the Danfoss proposed system configuration and wiring.



EMC Compliant Installation

The CDS203 Drive is designed in compliance with stringent EMC standards. All models are supplied with an internal EMC filter, which is specifically designed to reduce the emissions in conformity with harmonized European Standards. It is the installers responsibility that the device or system within which the CDS203 Drive is incorporated, is in compliance with the Standards in force in the country of use. The relevant EMC directive in force in the European Union is the EMC 2014/30/EU.

The CDS203 Drive is intended to be incorporated inside fixed installation devices, only installed by skilled individuals.

NOTE It is the responsibility of the installer to ensure that the final product containing the CDS203 Drive complies with any standard necessary for that final product.

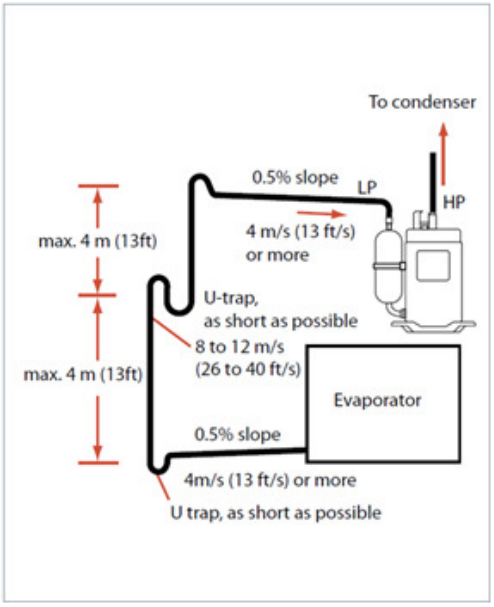
General requirements

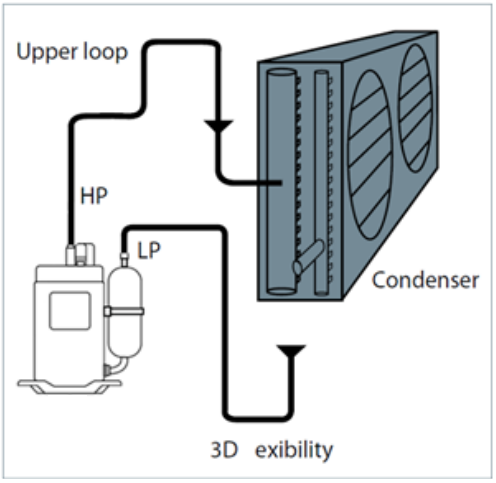
Proper piping practices should be employed to:

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

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

General recommendations are described in the figures below:





3. Piping should be designed with adequate three-dimensional flexibility to avoid excess vibration. It should not be in contact with the surrounding structure, unless a proper tubing mount has been installed.

For more information on noise and vibration, see section on: "Sound and vibration management".

General requirements

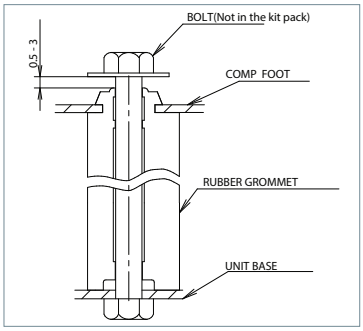
Compressors used in single applications must be mounted with flexible grommets.

During operation, the maximum inclination from the vertical plane must not exceed 7 degrees.

Single requirements

All compressors are delivered with four or three (depends on the model) rubber grommets. Compressors must always be mounted with these grommets.

The bolts are not applied with the grommets.



Requirement

R In qualification procedure, recommend having the OSG sample to check the oil, 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.

The rotary compressor do not have OSG, during the qualification if you need a samples with OSG please contact Danfoss local team for the requirement.

System evaluation

Single compressor

1. Pay special attention to “Piping design” on field

Test, criteria and solutions

Test N°	Purpose	Test condition	Pass criteria	Solutions
1	Check proper oil return	 Lowest foreseeable evaporation, and highest foreseeable condensation. **Minimum speed running** 6 hours.	Oil level must be visible or full in the sight glass when the compressor is running.	Adjust oil boost function, for more details see section “Oil management logic”.

***Oil separator**

Usually in this kind of compact system oil separator is not mandatory, once you want to equipe, please contact Danfoss

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.

Mitigations methods:
We can consider two means to reduce compressors sound radiations:
1. Acoustic hoods are quick and easy to install and do not increase the overall size of the compressors.
2. Use of sound-insulation materials on the inside of unit panels is also an effective means to reduce radiation.

Sound levels are as follows:
- For compressors running alone:

Danfoss model name	RPS	Sound powerdB(A)
VRN150WSQASE	78	74
VRN226WTPAGE	78	74
VRN307WTRBQA	78	74
VRN418WTRBQA	78	75
VRN548WTRBRA	72	77
VRN752WTTENA	78	84

Sound power are given at -3/38/5/0 conditions, measured in free space
The switching frequency of the driver will impact the sound level of the compressor, usually higher switching frequency will bring lower sound level. But the efficiency of the drive will be lower.
Maximum sound is +3dBA

Mechanical vibrations

A compressor generates some vibrations that propagate into the surrounding parts and structure. When system structure natural frequencies are close to running frequency, vibrations are amplified due to resonance phenomenon.

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

Mitigations methods:
1. Danfoss VRN rotary compressors are designed to produce minimal vibration during operations. To ensure minimum vibrations transmission to the structure, strictly follow mounting requirements (mounting grommets etc..). For further information on mounting requirements, please refer to “Design compressor mounting”.

2. Ensure that there is no direct contact (without insulation) between vibrating components and structure.

3. Resonance phenomenon
To avoid resonance phenomenon, pipings and frame must have natural frequencies as far as possible from running frequencies.

This could be challenging on a variable system as all resonant frequencies between min speed to maximum speed will be exited.

It is mandatory to check that piping vibrations are acceptable across speed range. This test can be done by increasing slowly speed and monitoring piping behavior through, strain gage, acceleration, or displacement measurement. As alternative visual check with strobe light can also emphasis high piping displacement.

If some resonant frequencies generate high piping vibration, problem can be solved by increasing piping stiffness with brackets or changing layout. Dampers can also be installed to mitigate vibration.

If some frequencies continue to produce unacceptable vibration levels, speed by-pass is adjustable in the frequency converter, in order to avoid some frequency ranges. Four by-pass ranges are adjustable, and settings can be made in parameter group 3-01~3-04.

Gas pulsation

The Danfoss VRN rotary compressor has been designed and tested to ensure that gas pulsation is optimized for the most commonly encountered air conditioning pressure ratio.

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

Manage superheat

	During normal operation, refrigerant enters the compressor as a superheated vapor. Liquid flood back occurs when a part of the refrigerant entering the compressor is still in liquid state.	Liquid flood back can cause oil dilution and, in extreme situations lead to liquid slugging that can damage compression parts.
Requirement	In steady state conditions the expansion device must ensure a minimum 5K suction superheat.	
System evaluation	Liquid flood back test should be performed on unit as following table.	

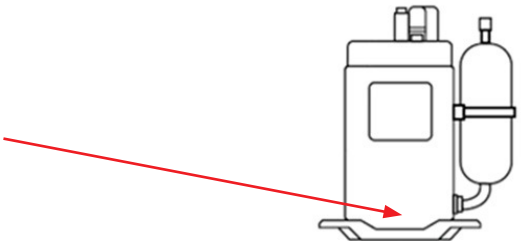
Test, criteria and solutions

Test N°	Purpose	Test condition	Pass criteria	Solutions
Liquid flood back test	Steady-state	Liquid flood back testing must be carried out under expansion valve threshold operating conditions: •Lowest foreseeable evaporation, and highest foreseeable condensation. •Minimum speed running. For reversible system, perform test in both heating and cooling mode 	Suction superheat >5K	Check expansion valve selection and setting. -For Thermostatic expansion valve (TXV) check bulb position... -For Electronic expansion valve (EXV) check measurement chain and PID....
	Transient	Tests must be carried out with most unfavorable conditions : • fan staging, • compressor staging • …	Oil superheat shall not be more than 5 min below the safe limit defined in the Dilution Chart. (See graph above)	

The oil sump superheat has to be higher than 6K.

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

The Oil sump superheat is defined as: (Oil temperature - condensing 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 lifetime. 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 from happening at each start.
· Right after start, liquid refrigerant must not flow massively to compressor.
· The protective measures must be taken to limit risk of liquid slugging and extreme dilution at start.

System evaluation

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 stops including in power shut down situation

For an efficient protection against off cycle migration, the following components can be used :
• Liquid Line Solenoid Valve*+ pump-down cycle**
• External Non-Return Valve
• Crankcase heater power and heating time recommendation is as below

VRN150W – 226W												
The environment temperature (°C)	0			-10			-20			-30		
Recommended power of the electric heating (W)	30	40	60	30	40	60	30	40	60	30	40	60
Preheating time (h)	≥1.0	≥0.8	≥0.5	≥1.7	≥1.0	≥0.7	≥2.7	≥1.6	≥0.9	≥4.0	≥2.4	≥1.2

VRN307W – 548W												
The environment temperature (°C)	0			-10			-20			-30		
Recommended power of the electric heating (W)	40	60	90	40	60	90	40	60	90	40	60	90
Preheating time (h)	≥1.5	≥1.0	≥0.6	≥2.1	≥1.3	≥0.9	≥2.9	≥1.8	≥1.1	≥4.3	≥2.4	≥1.4

VRN307W – 548W												
The environment temperature (°C)	0			-10			-20			-30		
Recommended power of the electric heating (W)	40	90	120	40	90	120	40	90	120	40	90	120
Preheating time (h)	≥2.6	≥1.1	≥0.8	≥3.8	≥1.4	≥1.0	≥5.9	≥1.8	≥1.3	≥10.5	≥2.3	≥1.5

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

****Pump-down cycle**
By decreasing pressure in the sump, pump down:
• Evacuates refrigerant from oil
• Set the sump saturating pressure much lower than ambiance temperature and due to that, avoid refrigerant condensation in the compressor.

For more details on pump-down cycle see section "Control Logic".

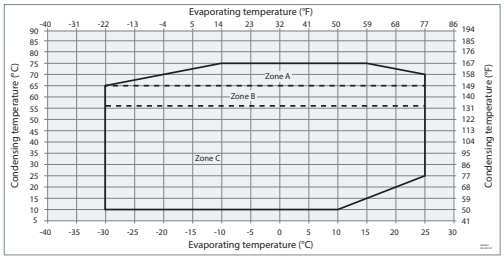
Requirement

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

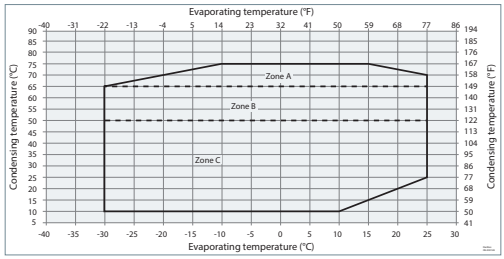
Moreover, the discharge gas temperature must not exceed 115°C (239°F). Steady-state operation envelope is valid for a suction superheat above 5K.

R290 single envelope control

VRN150 Operating map SH 5K

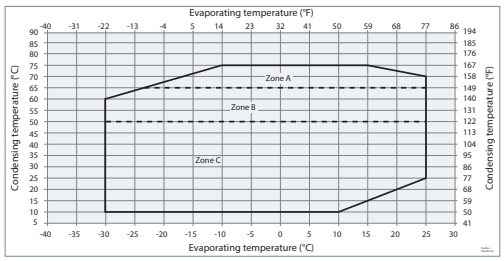


VRN226-307 Operating map SH 5K

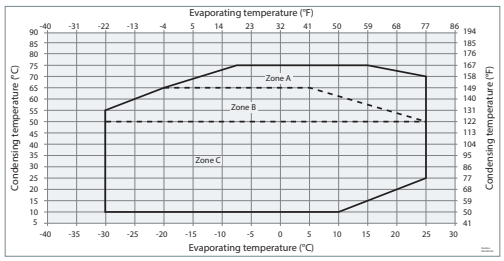


"For VRN307WT, when operation with single phase drive, at lower voltage you can observe a derating of the compressor"

VRN418-548 Operating map SH 5K



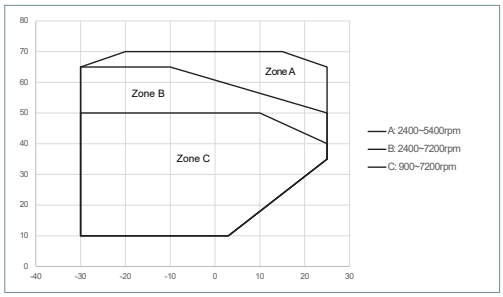
VRN752 Operating map SH 5K



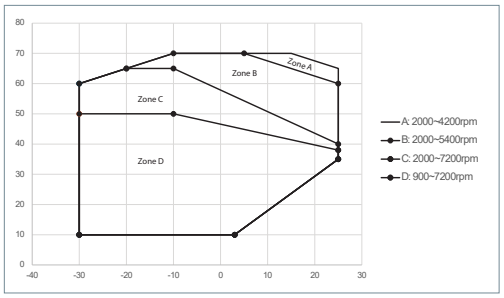
Model	Speed limitation on operating map (rpm)					
	Zone A		Zone B		Zone C	
	Min.	Max.	Min.	Max.	Min.	Max.
VRN150	2100	5000	2100	7200	1000	7200
VRN226	2400	5400	2400	7200	900	7200
VRN307	2000	5400	2000	7200	900	7200
VRN418	2000	5400	2000	7200	900	7200
VRN548	2000	5400	2000	6600	900	6600
VRN752	2000	5400	2000	7200	900	7200

R454C single envelope control

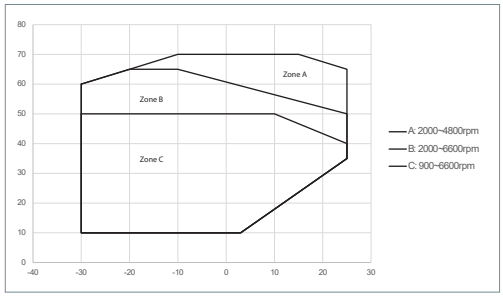
VRN226 Operating map SH 5K



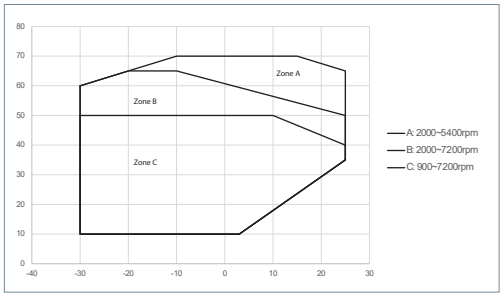
VRN418 Operating map SH 5K



VRN548 Operating map SH 5K



VRN752 Operating map SH 5K



Model	Speed limitation on operating map (rpm)							
	Zone A		Zone B		Zone C		Zone D	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
VRN226	2400	5400	2400	7200	900	7200	–	–
VRN418	2000	4200	2000	5400	2000	7200	900	7200
VRN548	2000	4800	2000	6600	900	6600	–	–
VRN752	2000	5400	2000	7200	900	7200	–	–

Pressure settings		R290
Working range high side	bar(g)	6.30-27.48
Working range low side	bar(g)	0.67-8.51
Maximum high pressure safety switch setting*	bar(g)	30.3
Minimum low pressure safety switch setting	bar(g)	0.5

*Maximum allowable pressure on high pressure side according to PED regulation.

System evaluation

To manage operating envelop, an advanced envelope protection principle needs to be used with variable speed compressors.

This solution offers much better protection than basic protection, and also offers the possibility to adjust running conditions to avoid tripping (for example reduce compressor speed when reaching high pressure limit).

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

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

On top of suction and discharge pressure limitations, the discharge T° must remain below 115°C (239°F).

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

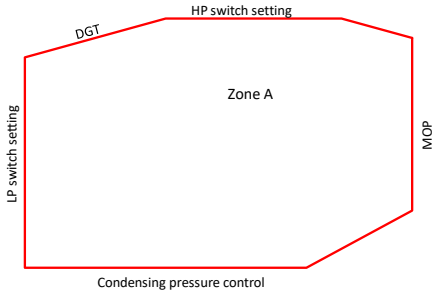
The whole envelope can be used on the whole speed range, see "Single application envelope"

Depending on speed range needed, two types of controls to be considered as below

- Speed range limited by Zone A (Maximum and Minimum speed limited)
- Speed range limited by Zone B (Minimum speed limited) and full speed range Zone C

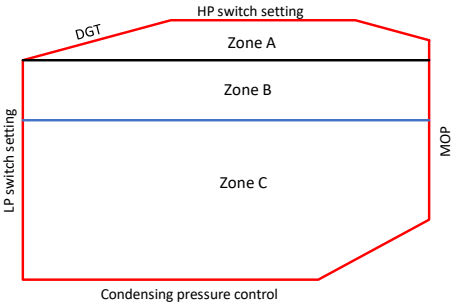
Single envelope control: Limit speed range from A

Controller do not need to manage speed limitation according to operating conditions.

Protection required • HP switch* • LP switch* • DGT set @ 115°C (239°F) if necessary see "Discharge T° protection" • Measurements of suction and discharge pressure, unit controller with is permanently maintaining compressor within its envelope. • Drive setting: parameter 1-02[Minimum Speed Limit (rpm)]: set value according to the Zone A values in "Single envelope control". parameter 1-01[Maximum Speed Limit (rpm)]: set value according to the Zone A values in "Single envelope control".	

Multiple envelope control: Maximum or minimum speed allowed

Controller needs to manage speed limitation according to operating conditions.

Protection required • HP switch* • LP switch* • DGT set @ 115°C (239°F) if necessary see §Discharge T° protection •Measurements of suction and discharge pressure, unit controller is permanently maintaining compressor within its envelope **with right minimum speed** •drive setting: parameter 1-02[Minimum Speed Limit (rpm)]: Keep default values in "Single envelope control". parameter 1-01[Maximum Speed Limit (rpm)]: Keep default values in "Single envelope control".	See "Test, criteria and solutions" Zone B means the area below the black line(Including the Zone C area) 

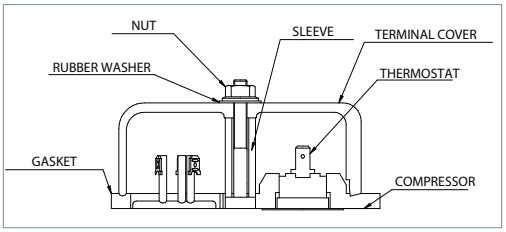
*for more details see "Control Logic"

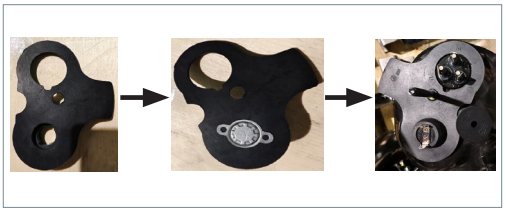
Test N°	Purpose	Test condition	Pass criteria	Solutions
1	Check reaction of system to oil boost	Stabilized the system in area below minimum speed (3000RPM) until oil boost happen	No unsafeties happen Superheat requirement fulfilled	Modify ramp-up Modify superheat control

Shell temperature protection

The thermostat delivered with compressor must be linked to the safety chain (see Figure in paragraph “Safety control logic requirement”) to protect the compressor for the abnormal shell temperature.

- The thermostat must be assembled properly with the gasket and terminal cover.





MOP (Max operating pressure) control

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

This protection can be achieved by using MOP function on expansion device. MOP is a feature of EXV and TXV that limit the maximum suction pressure of the unit. MOP setting must be equal or lower than max evaporating temperature stated in operating envelope 25°C .

With variable speed compressors, complementary to MOP of expansion device, the unit controller can increase compressor speed to keep evaporating temperature lower than limit.

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

Condensing pressure control

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

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

Pressure ratio

In steady state, the pressure ratio must be inside envelope. 2 types of control can be considered:

- Set the minimum condensing T° at 10°C (50°F) together with MOP set at 25°C (77°F).

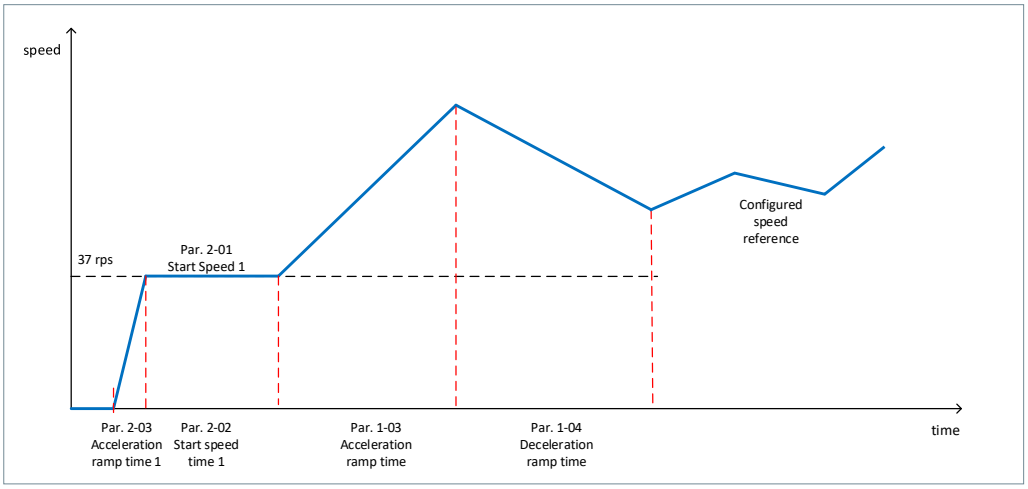
•Unit controller monitors permanently Condensing and Evaporating T°, and adjust compressor speed or condensing T° to keep running conditions within envelope.

Speed limit requirement

R Speed limit guarantees compressor reliability and must be respected. In drive control logic, default setting values have been qualified by Danfoss.

It is possible to change the default values if the changes have been qualified by OEM.

Start up and sequence control



Par	Description	Default value
1-03	Acceleration Ramp Time from 0rps to Rated Speed	120s
1-04	Deceleration Ramp Time from Rated Speed to 0rps	120s
2-01	Start Speed 1	37rps
2-02	Start Speed 1 Time	60s
2-03	Start Speed 1 Acceleration Ramp 0rps to Start Speed 1	30s

Primary Command Source

The primary command source setting makes a significant difference to how the drive is operated or controlled. The following table provides the list of the control commands

Primary command source	
0	Modbus
1 * default	Terminal
2	Terminal A1 start
3	User PI
4	Slave

Safety control logic requirements

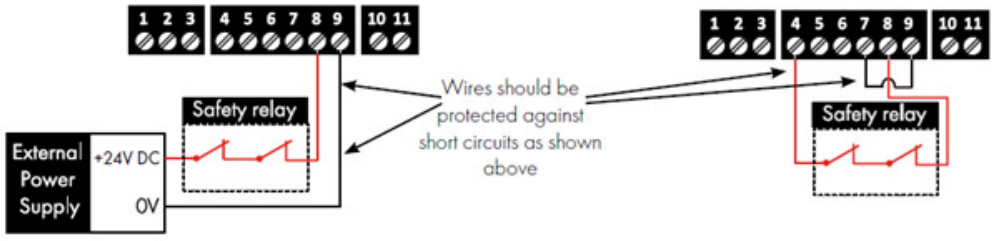
	Tripping conditions		Re-start conditions	
	Value	Time	Value	Time
HP switch	See Pressure settings table from section "Manage operating envelope"	Immediate, no delay. No by- pass	Conditions back to normal. Switch closed again	Manual reset
LP safety switch				Maximum 5 auto reset during a period of 12 hours, then manual reset.

High pressure

According to EN378-2, a high-pressure (HP) safetyswitch is required to shut down the compressor. The high-pressure switch can be set to lower values depending on the application andambient conditions.

The HP switch must never be bypassed or delayed, and must either be placed in a lockout circuit or consist of a manual reset device to prevent cycling around the high-pressure limit. If a discharge valve is used, the HP switch must be connected to the service valve gauge port, which must not be isolated.

The HP switch can be connected to CDS203 STO (Safe Torque Off) input as shown on the illustration. Or integrated directly in the safety chain as described in Typical control architecture.



NOTE The Maximum cable length from Voltage source to the drive terminals should not exceed 25 metres.

Low pressure

A low-pressure (LP) safety switch must be used.

For systems without pump-down, the LP safety switch must either be a manual lockout device or an automatic switch wired into an electrical lockout circuit. The LP switch tolerance must not allow for vacuum operations of the compressor.

LP switch settings for pump-down cycles with automatic reset are also listed in the table below. Lock-out circuit or LP switch or series with other safety devices can be integrated directly in the safety chain of the compressor or it can be treated by the unit controller.

Electronic expansion valve

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

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

Ramp-down of the EXV must be longer than the ramp-down of the compressor, also to avoid low pressure operation (except with pump-down).

EXV should be closed, and remain closed, when the compressor is off, to avoid any liquid refrigerant entering the compressor.

Reverse rotation protection

Due to drive protection, compressors could work properly even if the power connection between the drive and mains are dis-matched. However, the wires between compressor and drive must be connected accordingly. To protect compressors from reverse rotation, pressure difference could be checked as a reference value. Use pressure sensors to monitor pressure difference between discharge and suction of the compressor, and for normal operation, discharge pressure should be at least 1 bar higher than suction pressure within 30 s running after compressor starting.

Short cycle protection

Short cycle protection is typically managed by the unit controller, therefore the short cycle protection on the CDS203 is disabled by default.

Short cycle is the compressor frequently starting and stopping within short periods, instead of running continuously for a normal cycle.

The compressor requirements for short cycle protection are described in the table below, to be programmed either on the PLC controller or in CDS203.

For more information about this function in the drive, please refer to CDS203 user guide (AB465036026478en).

Parameter	Description	Factory Setting (seconds)	Compressor Requirement	CDS203 Set Value (seconds)	Purpose	How it works
2-10	Minimum off time	6	3 minutes	180	Ensure balanced suction and discharge pressure prior to start	When set greater than 0, this parameter defines the minimum time that the drive must be stopped before allowing a re-start. This time is also valid from first power up.
2-11	Minimum on time	0	3 minutes	180	Get oil back from circuit to compressor sump	When set greater than 0, this parameter defines a minimum time that the drive must run for once it has started. It will delay a stop command if the time set in this parameter has not elapsed. The STO input and a coast stop overrides this function.
2-12	Re-start delay (interval between starts)	0	10 minutes	600	Maximum 6 starts per hour	When set greater than 0, this parameter defines a minimum time that must elapse from a previous start-up, before permitting another re-start.

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 reaches the cut-out pressure, compressor is stopped, and liquid solenoid valve or electronic expansion valve remains closed. A non-return valve in the discharge line is Mandatory.

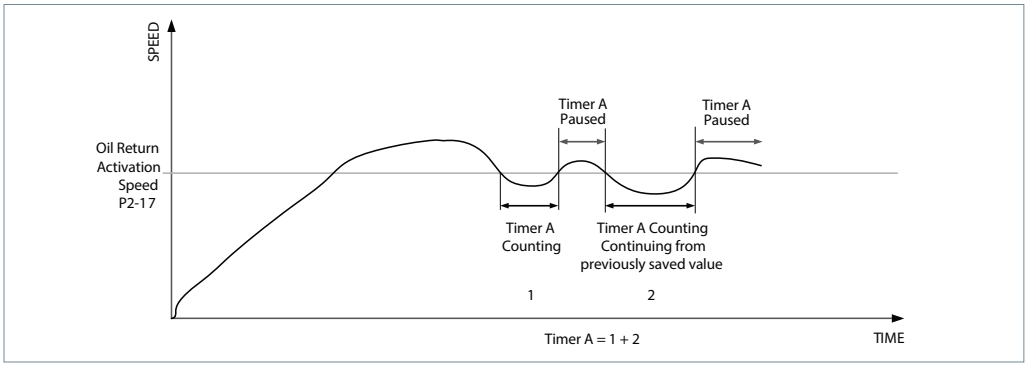
Oil return requirement

In some refrigeration systems or heat pumps, it is possible for the oil to migrate to various parts of the circuit leaving a shortage of oil in the sump to lubricate the moving parts of the compressor. This can result in permanent damage to the compressor and systems are consequently designed to mostly mitigate this issue. Where system design can support the mitigation of excessive oil migration, the transit time of the oil and refrigerant through the system can also influence the problem of oil migration, particularly if the compressor has been operating at a low speed for a period of time. For this reason, it is sometimes necessary to reduce the transit time by speeding up the compressor for a fixed period of time after continued operation at lower speeds, thus ensuring the return of migrated oil to the compressor itself. Please refer to section “Manage oil in the circuit””.

CDS Drive oil boost function

When the feature has been activated, if the speed demand increases above the 'Oil Return Boost Speed', the compressor speed will increase but it will be prevented from falling below the 'Oil Return Boost Speed' until the 'Oil Return Time' has elapsed.

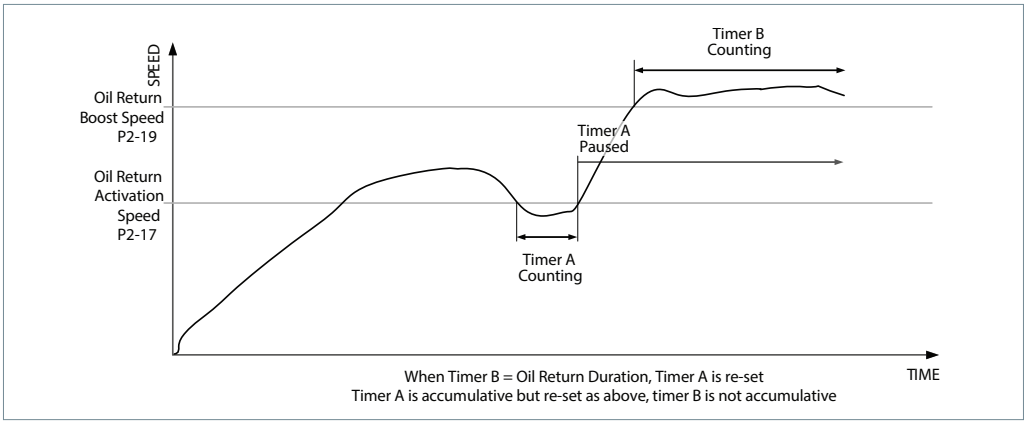
Timers to operate as shown below:



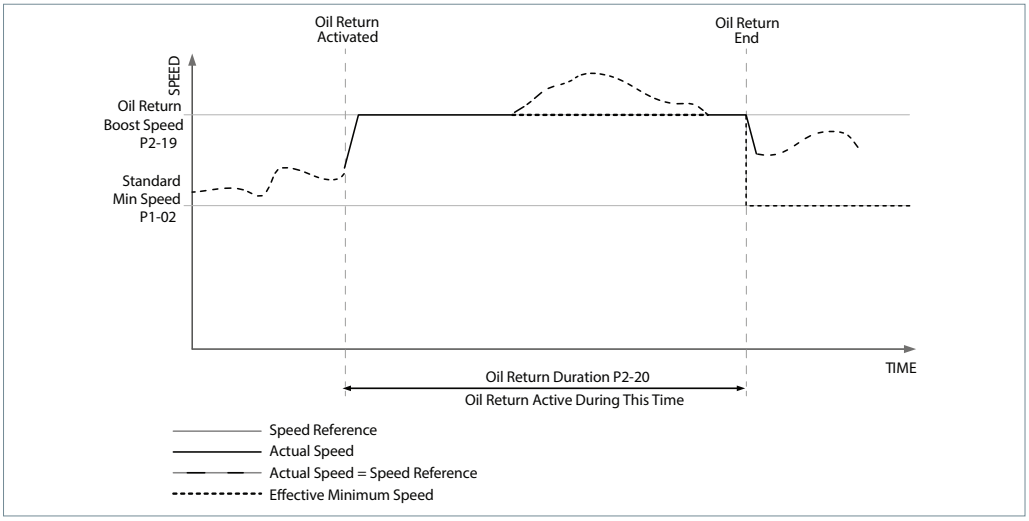
The above illustrates that the timer will count when the speed is below the activation speed and the value in the timer will be held and used the next time that the speed falls below the activation speed – this is a cumulative timer.

The Oil return minimum speed will then be implemented as a minimum speed clamp when timer A has reached the value set in P2-18.

The timer (Timer A) is re-set when the drive speed has been equal to or greater than the Oil Return Speed for the Oil Return Time as shown below (or when the drive has stopped):



When the timer is re-set (Timer A), the minimum speed clamp is returned to the value set in P1-02 and P2-19 is ignored until the next activation of the Oil Return Feature.



If the drive run command is removed whilst the oil-return feature is active, the drive will follow the selected ramps to a stop and normal operation will commence on next start. The only deviation from this would be if the minimum on time set in the drive had not yet been observed, and the drive would continue to operate as indicated above until the minimum on time had been observed.

It must also be noted that it is the responsibility of the OEM or machine builder to ensure that the system is designed and built in a manner that ensures suitable oil return. The implementation of this oil return feature cannot overcome inadequacies in the system design in all cases. It is also very important to note that the activation of this feature when the condensing fans are not enabled could also significantly adjust the pressures and temperatures in the system causing the main controller to shut down the system.

This feature is configured by the following four parameters:

When this feature is activated, bit-14 of the status word will be HIGH (logic 1) and the status LED will indicate as follows:

LED 1 – constant green

LED 2 – fast flashing yellow

Parameter	Mod	Description	Default	Min	Max	Units
2-17	217	Oil Return Activation Speed	50	P1-02	P1-01	rps
2-18	218	Oil return Activation Time	1800	0	6000	s
2-19	219	Oil Return Min Speed	70	P1-02	P1-01	rps
2-20	220	Oil Return Time	60	0	600	s

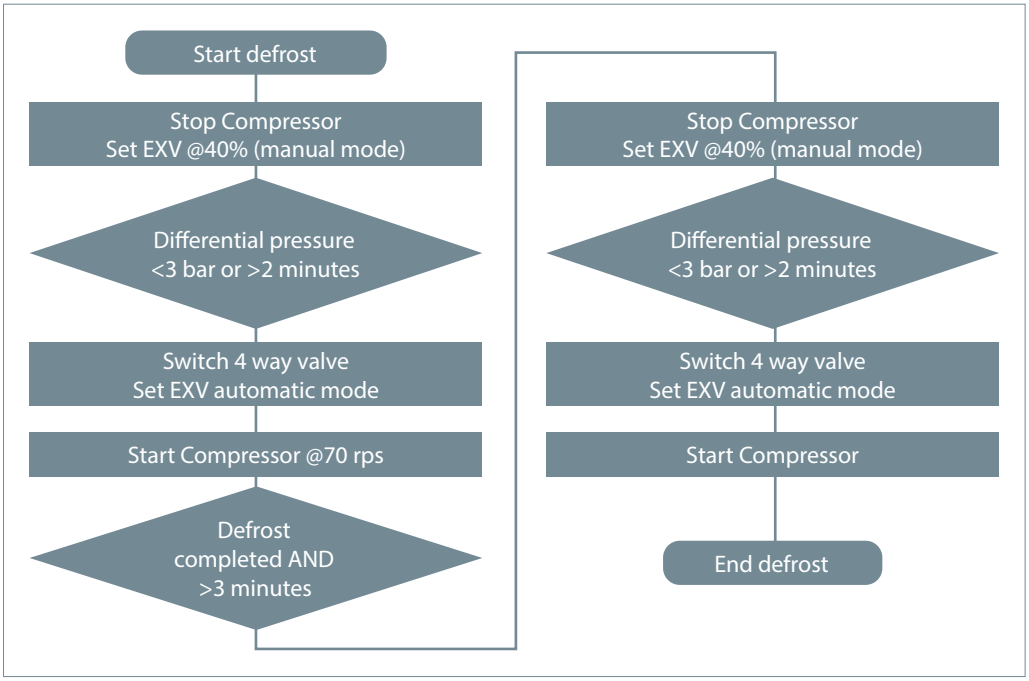
4 Way valve control and defrost logic

The main challenge of a system equipped with a 4-way valve is during the time of the switch period. After that switch, condenser becomes evaporator and vice versa. Pressurized liquid in condenser directly flows to the compressor suction and lead to oil dilution and in extreme case, liquid slugging.

Liquid flood back due to reversing cycle can be reduced by using pressure to transfer liquid refrigerant from one exchanger to the other before the 4-way valve switch. Following flow chart describes the sequence.

Time and pressure difference have to be fine tuned during system qualification. EXV Opening degree and time have to be set to keep a minimum pressure difference to allow 4-way valve switch.

In any case, defrost logics must respect requirements and tests described in Manage Superheat and Operating envelope data sections.



Locked Rotor Protection

During an attempted start of a compressor with a locked rotor, the precise outcome will depend on the level of current that flows into the motor windings and subsequently, one of the following protection modes will activate:

H-OI	Hardware overcurrent
OI	Software overcurrent
It	Motor Overload
Locked Rotor	Motor rotor is locked

Drive alarm handling

Drive alarms can be a problem with the drive itself or with the compressor. It is necessary to identify the alarm code to determine appropriate trouble shooting actions.

Alarms will trip the compressor; therefore, the unit controller must get feedback that the drive is in a fault condition. The feedback is typically via drive Relay output or via modbus.

Alarm reset

The parameter 2-13 Re-start Function / Automatic restart defines the number of attempts to re-starts after a trip. Alarms are reset automatically after 30s and the compressor restarts.

If the specified number of automatic resets is reached, the drive requires manual reset or a power cycle.

The restart function /automatic restart (par. 2-13) is only operative in terminal mode.

If the par. 1-11 Primary Command Source is [0] Modbus serial communication, the OEM controller must send a reset via control word, register 1 bit 3.

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

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

Requirements

VRN compressors are delivered with moisture level as the values in the table below.
At the time of commissioning, system moisture content may be up to the levels below.

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

Danfoss model name	Moisture level (mg)
VRN150WS	150
VRN226WT	200
VRN307WT	250
VRN418WT	300
VRN548WT	300
VRN752WT	800

Solutions

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

For new installations with VRN compressors with POE oil, Danfoss recommends using the Danfoss DML (100% molecular sieve) solid core filter drier.

Compressor storage

- Store the compressor where is not exposed to rain, corrosive or flammable atmosphere.

- Store the compressor between -35°C and 70°C (-31°F and 158°F) when it is charged with nitrogen.

- Store the compressor between -35°C and 55°C (-31°F and 131°F) when it is charged with refrigerant.

Compressor holding charge

Each compressor is shipped with a nominal dry nitrogen holding charge between 0.3 and 0.4 bar and is sealed with elastomer plugs.

An opened compressor must not be exposed to air for more than 5 minutes to avoid moisture is captured by the POE oil.

Handling

The VRN compressors are not in the big weight, the compressor should be carried carefully to avoid drop, drag, impact and should not apply partial force on projection parts such as pipe, hermetic terminals, foot during carrying and processing.

Maintain the compressor in an upright position during all handling maneuvers (maximum of 15° from vertical).

Danfoss model name	Net weight (kg)
VRN150WS	8.9
VRN226WT	10.4
VRN307WT	17.5
VRN418WT	17.3
VRN548WT	18.9
VRN752WT	26.5

Piping assembly

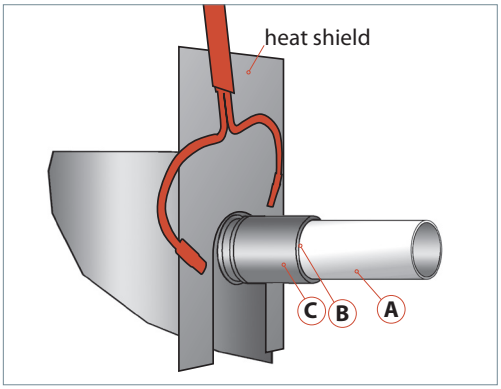
Good practices for piping assembly is a pre-requisite to ensure compressor service life (system cleanliness, brazing procedure...)

System cleanliness

Circuit contamination possible cause	Requirement
Brazing and welding oxides	During brazing, flow nitrogen through the system
Filings and particles from the removal of burrs in pipework	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 5 minutes to avoid moisture captured by POE 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.
- To enhance the resistance to rust, a varnish on the connection is recommended.



These general recommendations are valid for the initial assembly. For a replacement, due to the possible presence of R290 and R454C in traces, all safety rules applicable locally shall be fulfilled.

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

System pressure test and leak detection

The compressor has been strength tested and leak proof tested at the factory. For system tests:

- Always use an inert gas such as Nitrogen or Helium.
- Perform a leak detection test on the complete system.
- Do not exceed the following pressures:

Maximum compressor test pressures	
Maximum compressor test pressure	VRN150-548: 34.4bar / 498.9psi VRN752: 48.4bar / 701.98psi

Vacuum evacuation and moisture removal

Requirements:
- Never use the compressor to evacuate the system.
- Connect a vacuum pump to both the LP and HP sides.
- Do not use a megohmmeter nor apply power to the compressor while it is under vacuum as this may cause internal damage.
- Evacuate the system to a pressure of 150 µm Hg (0.2 mbar) absolute.

Recommendations:
- The quantity of water should be less than 0.15ml.
- Alternate vacuum phases and break vacuum. with Nitrogen to improve moisture removal.

Refrigerant charging

Initial charge:
- For the initial charge, the compressor must not run.
- Charge refrigerant as close as possible to the nominal system charge.

- This initial charging operation must be done in liquid phase between the condenser outlet and the filter drier.

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

Dielectric strength and insulation resistance tests

The tests are performed on each compressor at the factory between each phase and ground.

- Carry out a dielectric strength test by short-circuiting terminals U, V and W. Energize by max. 2200 V DC(hi-pot) for one second between this short-circuit and the chassis, and leakage current must be less than 5 mA. When running dielectric strength tests of the entire installation, frequency converter and compressor electrical motor compressor test can be conducted together. When conducting a dielectric strength test, make sure the system is not under vacuum: this may cause electrical motor compressor failure.

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

Please note, it is not recommended that a dielectric strength test be carried out too often as it may damage the motor. Nevertheless, if such a test is necessary, it must be performed at a lower voltage.
- Insulation resistance is measured with a 500 V DC megohm tester and must be higher than 50 megohm.
- 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.

Preliminary check

⚠ Check electrical power supply:

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

Initial start-up

- Do not provide any power to the drive unless suction and discharge service valves on compressor are open, if installed.
- Energize the drive. The compressor must start, according to defined ramp-up settings. If the compressor does not start, check wiring conformity.
- Check the frequency converter control panel: If any alarm is displayed check the wiring and in particular the polarity of the control cables. If an alarm is shown, refer to the frequency converter application manual. Verify in particular the combination of compressor, frequency converter and refrigerant.
- Check current draw and voltage levels on the mains. The values for the compressor electrical motor can be directly displayed on the frequency converter control panel.
- Check current draw and voltage levels on the mains. When you order the CDS203 LCP, the values for the compressor electrical motor can be directly displayed on the LCP.

System monitoring

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

- Proper metering device operation and desired superheat readings
- Suction and discharge pressure are within acceptable levels
- Correct oil level in compressor sump indicating proper oil return (Just in qualification period, need to order the customized OSG sample)
- Low foaming in sight glass (Just in qualification period, need to order the customized OSG sample)
- Compressor oil sump temperature 10K (18°F) above condensing temperature to show that there is no refrigerant migration taking place.
- Acceptable cycling rate of compressors, including duration of run times.

A short cycling protection is provided in the CDS frequency converter. It is factory preset "enabled" with the following parameters in:
P2-10 - Minimum Off Time: 180 seconds
P2-11 - minimum On time: 180 seconds.

This minimum run time is set to guaranty long enough running time at start up in order to create enough refrigerant flow velocity in the system to recover the oil to the compressor sump.

- Current draw of compressor within acceptable values (RLA ratings)
- No abnormal vibrations and noise.

Oil level checking and top-up

There is no preassemble oil sight glass on the rotary compressor, but in qualification period, Danfoss can provide customized oil sight glass samples for the customer for the oil level checking, please contact the local sales or after service people.

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

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

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

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

Top-up the oil while the compressor is idle. Use the Schrader connector or any other accessible connector on the compressor suction line and a suitable pump.

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

Compressor Industrial pack

Compressors are not packed individually but are shipped all together on one pallet. They can be ordered in quantities of full pallets only according to below table.

Model	Layer of each pallet	Qty/Pallet	Size (mm)	Stack code in warehouse	Stack code in transportation
VRN150WSQASE	2	72	1080×1080×700	3	2
VRN226WTPAGE	2	72	1080×1080×700	3	2
VRN307WTRBQA	2	50	1150×1050×1010	2	2
VRN418WTRBQA	2	50	1150×1050×1010	2	2
VRN548WTRBRA	2	50	1150×1050×1010	2	2
VRN752WTTENA	1	16	1150×1050×675	3	2

Frequency converter Industrial pack

Model	Layer of each pallet	Qty/Pallet	Size (mm)
CDS203-22P1K5-1FH(C)11	2	72	1200×800×1360
CDS203-22P3K0-1FH(C)21	2	72	1200×800×1360
CDS203-22P3K0-1FH(C)31	2	50	1200×800×1360
CDS203-22P4K0-1FH(C)71	2	50	1200×800×1360
CDS203-24P5K5-3FH(C)31	2	50	1200×800×1360
CDS203-24P5K5-3FH(C)41	2	50	1200×800×1360
CDS203-24P11K-3FH(C)51	2	50	1200×800×1360
CDS203-24P11K-3FH(C)61	2	16	1200×800×1360

Frequency converter single pack

Single pack codes only for sampling or replacement; for standard order, industrial pack has to be ordered.

Model	Size (mm)
CDS203-22P1K5-1FH(C)11	345×205×205
CDS203-22P3K0-1FH(C)21	345×205×205
CDS203-22P3K0-1FH(C)31	345×205×205
CDS203-22P4K0-1FH(C)71	345×205×205
CDS203-24P5K5-3FH(C)31	345×205×205
CDS203-24P5K5-3FH(C)41	345×205×205
CDS203-24P11K-3FH(C)51	345×205×205
CDS203-24P11K-3FH(C)61	345×205×205

Ordering codes

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

Industrial pack

Model	Drive voltage available		Sales codes for mass production				Sales code for sample	
			Industrial pack					
			Compressors only; No kit pack	MOQ	Kit pack	MOQ	Sample (Kit pack included)	MOQ
VRN150WSQASE	200-240V 1ph 50/60Hz	-	126F2025	72	126F9029	72	126X2025	1
VRN226WTPAGE	200-240V 1ph 50/60Hz	-	126F2021	72	126F9030	72	126X2021	1
VRN307WTRBQA	200-240V 1ph 50/60Hz	360-440V 3ph 50/60Hz	126F2022	50	126F9028	50	126X2022	1
VRN418WTRBQA	200-240V 1ph 50/60Hz	360-440V 3ph 50/60Hz	126F2023	50	126F9028	50	126X2023	1
VRN548WTRBRA	-	360-440V 3ph 50/60Hz	126F2024	50	126F9028	50	126X2024	1
VRN752WTTENA	-	360-440V 3ph 50/60Hz	126F2026	16	126F9031	16	126X2026	1

CDS203 converter order information

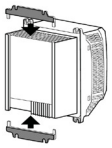
CDS203 Heatsink version

Model name	Compressor reference	Voltage	Power Rating (kW)	Single Pack		Industrial Pack	
				Sales Code	MOQ (Quantity per pallet)	Sales Code	MOQ (Quantity per pallet)
CDS203-22P1K5-1FH11	VRN150W	200-240V/1ph/50/60Hz	1.5	116B1001	1	116F1001	72
CDS203-22P3K0-1FH21	VRN226W		3	116B1002	1	116F1002	72
CDS203-22P3K0-1FH31	VRN307W		3	116B1003	1	116F1003	50
CDS203-22P4K0-1FH71	VRN418W		4	116B1004	1	116F1004	50
CDS203-24P5K5-3FH31	VRN307W	380-480V/3ph/50/60Hz	5.5	116B1005	1	116F1005	50
CDS203-24P5K5-3FH41	VRN418W		5.5	116B1006	1	116F1006	50
CDS203-24P11K-3FH51	VRN548W		11	116B1007	1	116F1007	50
CDS203-24P11K-3FH61	VRN752W		11	116B1008	1	116F1008	16

CDS203 Coldplate version

Model name	Compressor reference	Voltage	Power Rating (kW)	Single Pack		Industrial Pack	
				Sales Code	MOQ (Quantity per pallet)	Sales Code	MOQ (Quantity per pallet)
CDS203-22P1K5-1FC11	VRN150W	200-240V/1ph/50/60Hz	1.5	116B2001	1	116F2001	72
CDS203-22P3K0-1FC21	VRN226W		3	116B2002	1	116F2002	72
CDS203-22P3K0-1FC31	VRN307W		3	116B2003	1	116F2003	50
CDS203-22P4K0-1FC71	VRN418W		4	116B2004	1	116F2004	50
CDS203-24P5K5-3FC31	VRN307W	380-480V/3ph/50/60Hz	5.5	116B2005	1	116F2005	50
CDS203-24P5K5-3FC41	VRN418W		5.5	116B2006	1	116F2006	50
CDS203-24P11K-3FC51	VRN548W		11	116B2007	1	116F2007	50
CDS203-24P11K-3FC61	VRN752W		11	116B2008	1	116F2008	16

Panel mounting kit



Code no	Description	Application	Packaging	Pack size
116B9001	Panel Mounting Brackets for CDS203 FS2	CDS203 FS2 Drives	Single pack	1

LCP

Code no	Description	Application	Packaging	Pack size
116B9002	CDS203-LCP	CDS203 Drives	Single pack	1

USB cable gateway for CoolSetting

Code no	Description	Application	Packaging	Pack size
116B9003	USB cable gateway for CoolSetting	CDS203 Drives	Single pack	1

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Danfoss Commercial Compressors

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

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

Danfoss Turbocor Compressors

Danfoss Inverter Scrolls

Danfoss Scrolls

Danfoss Maneurop Reciprocating Compressors

Danfoss Optyma Condensing Units

Danfoss Light Commercial Refrigeration Compressors

Our products can be found in a variety of applications such as rooftops, chillers, residential air conditioners, heat pumps, cold-rooms, supermarkets, milk tank cooling and industrial cooling processes.

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