Danfoss

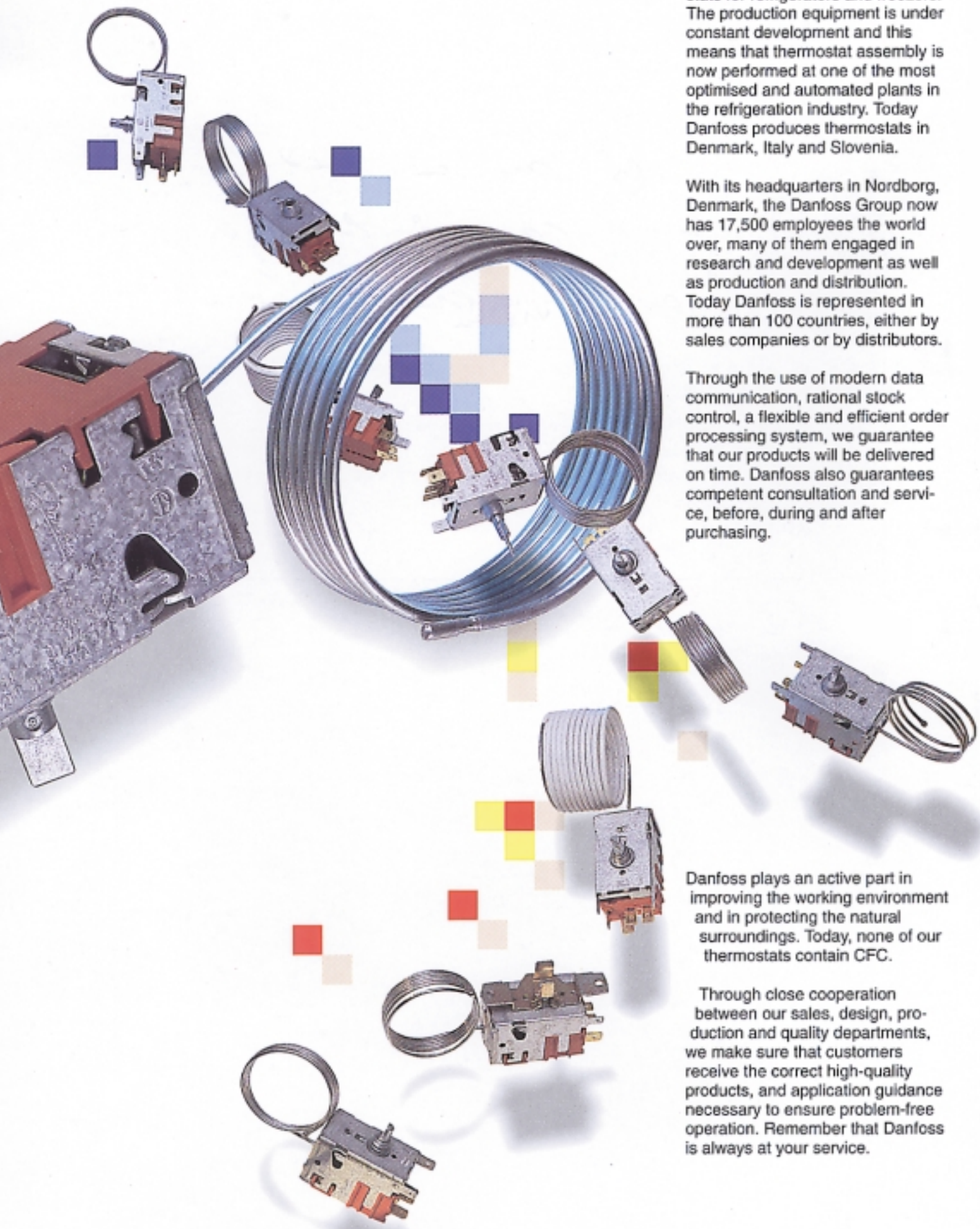
Thermostats for refrigerators and freezers

Thermostat type 077B

For almost 50 years Danfoss has developed and produced thermostats for refrigerators and freezers. The production equipment is under constant development and this means that thermostat assembly is now performed at one of the most optimised and automated plants in the refrigeration industry. Today Danfoss produces thermostats in Denmark, Italy and Slovenia.

With its headquarters in Nordborg, Denmark, the Danfoss Group now has 17,500 employees the world over, many of them engaged in research and development as well as production and distribution. Today Danfoss is represented in more than 100 countries, either by sales companies or by distributors.

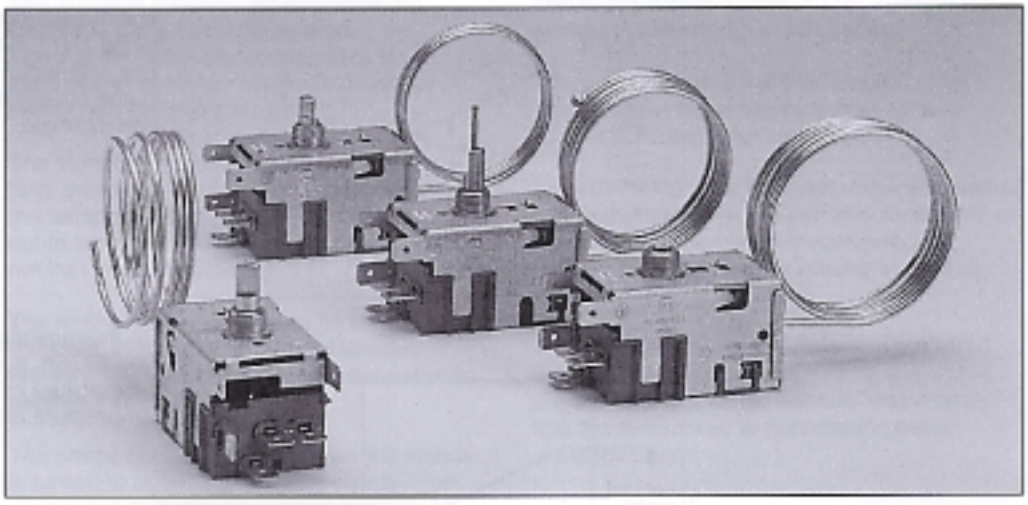
Through the use of modern data communication, rational stock control, a flexible and efficient order processing system, we guarantee that our products will be delivered on time. Danfoss also guarantees competent consultation and service, before, during and after purchasing.



Danfoss plays an active part in improving the working environment and in protecting the natural surroundings. Today, none of our thermostats contain CFC.

Through close cooperation between our sales, design, production and quality departments, we make sure that customers receive the correct high-quality products, and application guidance necessary to ensure problem-free operation. Remember that Danfoss is always at your service.

Application



Thermostat 077B is used to control the temperature in refrigerators, upright and chest freezers, liquid coolers, bottle coolers and small commercial refrigeration appliances. The thermostat can be used as an evaporator thermostat or a room thermostat.

The thermostats are available with normal function, fixed cut-in and cut-out temperature, constant or variable cut-in temperature for automatic defrost, and with a pushbutton for semi-automatic defrost.

The thermostats can be supplied with the following supplementary functions:
- Auxiliary contact
- Changeover contact
- Signal contact
- Series contact
- Reduction of temperature for super-function and indication of same

All thermostats have normal function, i.e. they cut in the compressor current circuit on rising temperature.

- Temperature control in the interval -42°C to +11°C.
- Cut-out temperature interval (difference between cut-out temperature in position cold and cut-out temperature in position warm) from 5°C to 20°C.
- Differentials (difference between cut-in and cut-out temperature) between 4°C and 15°C in position warm. For thermostats with fixed setting, from 3°C.
- With automatic defrost the cut-out temperature lies between -5°C and -42°C, the cut-in temperature between +1°C and +11°C.
- Other temperature settings can be supplied by arrangement.
- 6.3 mm or 4.8 mm tabs.
- Wide range with various extra functions and accessories.
- Approved by recognised authorities.

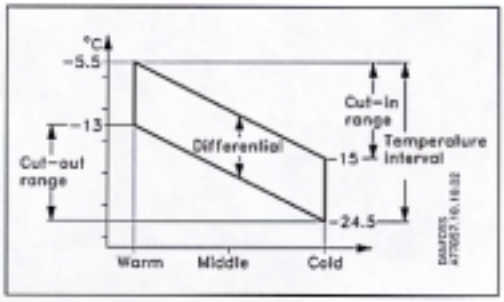
Function description

General
Danfoss 077B thermostats are designed primarily for temperature control in refrigerators and freezers.
The thermostat regulates by cutting off or cutting in current to the compressor, depending on the temperature registered by the thermostat phial.
The thermostat can be used either as an evaporator thermostat or a room thermostat. When used as an evaporator thermostat, the end 50-130 mm of the capillary tube must be used as a phial. If the thermostat is to be used as a room thermostat, the capillary tube end can be coiled. For this application, please contact Danfoss.

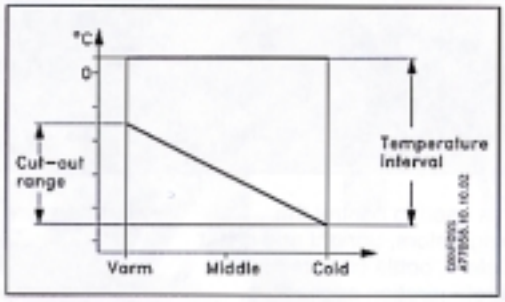
Mounting
To ensure the best function it is important to ensure that the phial (capillary tube end) makes good contact with the evaporator, or, in room thermostat applications, with the air flow. The phial must always be placed colder than the rest of the capillary tube and the thermostat itself. The thermostat must not be exposed to condensate or defrost water.

Operation
On thermostats with a temperature setting spindle, lower temperatures can be obtained by turning the spindle clockwise (from warm towards cold position). Both cut-out and cut-in temperatures can be changed by turning the spindle, except on types 077B6, 077B62 and 077B63 in which only the cut-out temperature can be changed in this way.
The thermostats can be supplied with or without stop. The stop function cuts out the compressor current circuit.

Function



The thermostats have a cut-out temperature range and a cut-in temperature range.
The differential is the difference between cut-in and cut-out temperatures.
See example.



On thermostats with fixed cut-in temperature, type 077B6, the terms "differential" and "cut-in temperature range" do not apply, only "cut-out temperature range" and "temperature interval".

The thermostats can be divided up into the following main types:

1. Thermostat with normal function, type 077B0
2. Thermostat with signal function, type 077B2/077B30
3. Thermostat with signal function and series stop contact, type 077B25
4. Thermostat with super-function and indication of same, type 077B26
5. Thermostat with push button defrost and automatic reset, type 077B4
6. Thermostat with automatic defrost and variable cut-in temperature, type 077B5
7. Thermostat with automatic defrost and fixed cut-in temperature, type 077B6

Overview of type numbers and functions, type 077B thermostats

Main type	Type number	Function description
077B0	077B0001-0199	Normal
	077B0801-0999	
	077B0201-0249	Normal with auxiliary contact
	077B0300-0300	
	077B0251-0299	Normal with fixed changeover contact setting
	077B0401-0449	Normal with changeover contact
	077B0451-0499	Normal, fixed setting
077B2	077B2001-2299	Normal with signal contact that cuts in on rising temperature
	077B2400-2449	Normal, fixed setting with signal contact that cuts in on rising temperature
	077B2501-2599	Normal with signal contact that cuts in on rising temperature + series stop contact
	077B2601-2699	Normal with super-function and signal contact that cuts in on rising temperature
	077B3001-3199	Normal with signal contact that cuts out on rising temperature
	077B3401-3449	Normal, fixed setting with signal contact that cuts out on rising temperature
077B4	077B4001-4199	Normal with push button defrost and automatic reset
077B5	077B5001-5199	Normal, large differential, automatic defrost
	077B5201-5299	Normal, large differential with auxiliary contact, automatic defrost
	077B5301-5399	Normal, large differential with changeover contact, automatic defrost
077B6	077B6001-6199	Normal, fixed cut-in temperature, automatic defrost
	077B6201-6299	Normal, constant cut-in temperature with auxiliary contact, automatic defrost
	077B6401-6499	
	077B6301-6399	Normal, fixed cut-in temperature, with changeover contact, automatic defrost

The auxiliary contact cuts out when the spindle is turned to position stop.
The auxiliary contact can be used, for example, to cut out a heating element or in series with the main switch.

The signal contact is used to give an alarm (e.g. switch on or switch off a warning lamp) if the temperature rises to 3-5°C higher than the cut-in temperature. The signal contact must not be loaded inductively.

The changeover contact can be used, for example, in connection with a Danfoss 3/2-way solencid valve in a two-temperature cabinet.

The series contact cuts out when the spindle is turned to position stop. This cuts out the connection to the main contact and signal contact.

The super-function contact cuts in when the spindle is turned to position super.

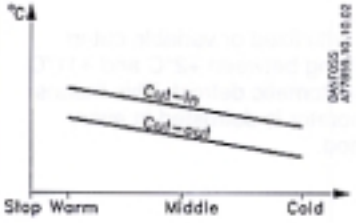
Thermostats with a fixed setting are most often used in chest freezers where the temperature must not be changed.

Type 077B4 is used for semi-automatic defrost where a pushbutton is used to activate manual defrost. After defrosting is complete, the thermostat automatically returns to normal function.

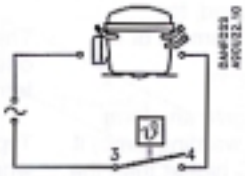
Thermostats with fixed or variable cut-in temperature lying between +2°C and +11°C are used for automatic defrost. This means that the evaporator is defrosted in every standstill period.

Type description

Function

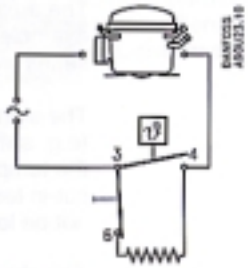


Principle

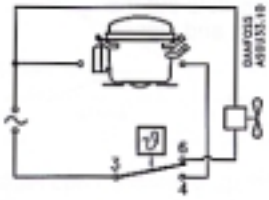


Type 077B0
Normal function

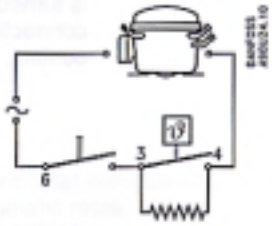
Principle



Type 077B02
Normal function with auxiliary contact



Type 077B04
Normal function with changeover contact

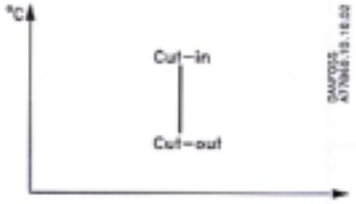


Type 077B02
Normal function with auxiliary contact

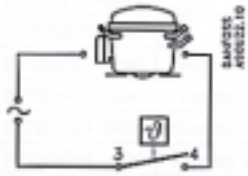
Current marking

Type	Contact	Europe			USA/Canada VAC	FLA	LRA
077B0001 – 0199 077B0800 – 0999	3 - 4	6	(6) A	250 V	240	6	36
077B0201 – 0249 077B0300 – 0399	3 - 4 3 - 6	6 6	(6) A (6) A	250 V 250 V	240 240	6 6	36 36
077B0401 – 0449	3 - 4 3 - 6	6 0.5	(6) A 0,1 A	250 V 250 V	240 240	6 0.5 A	36 NI

Function

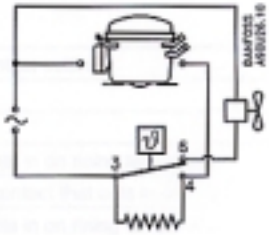


Principle



Type 077B045
Fixed setting

Principle

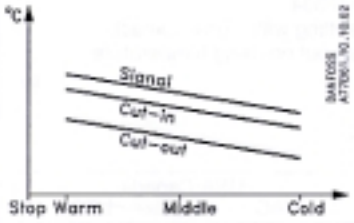


Type 077B025
Fixed setting with changeover contact

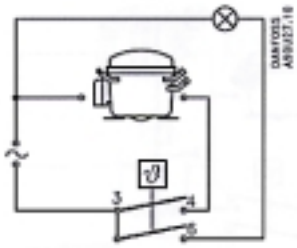
Current marking

Type	Contact	Europe			USA/Canada VAC	FLA	LRA
077B0451 – 0499	3 - 4	6	(6) A	250 V	240	6	36
077B0251 – 0299	3 - 4 3 - 6	6 0,5	(6) A (0.1) A	250 V 250 V	240 240	6 0.5 A	36 NI

Function

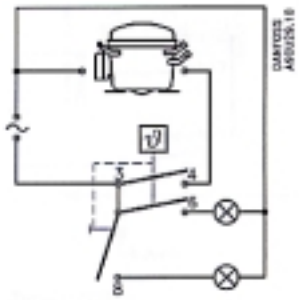


Principle

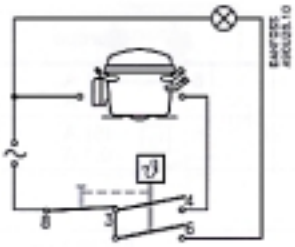


Type 077B20
Normal function with signal contact that cuts in on rising temperature

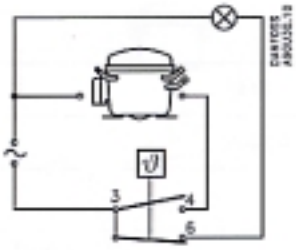
Principle



Type 077B26
Normal with super-function and signal contact that cuts in on rising temperature



Type 077B25
Normal function with signal contact that cuts in on rising temperature + series stop contact



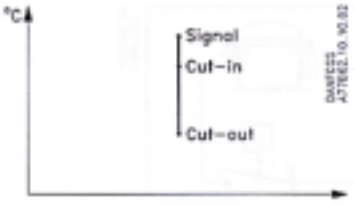
Type 077B30
Normal function with signal contact that cuts out on rising temperature

Current marking

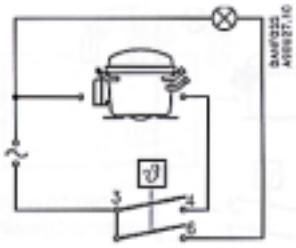
Type	Contact	Europe			USA/Canada VAC	FLA	LRA
077B2001 – 2299	3 - 4	6	(6) A	250 V	240	6	36
	3 - 6		0.1 A	250 V	240	0.1 A	NI
077B2501 – 2599	3 - 4	6	(6) A	250 V	240	6	36
	3 - 6		0.1 A	250 V	240	0.1 A	NI
	8 - 3	6	(6) A	250 V	240	6	36
077B2601 – 2699	3 - 4	6	(6) A	250 V	240	6	36
	3 - 6		0.1 A	250 V	240	0.1 A	NI
	3 - 8		0.1 A	250 V	240	0.1 A	NI
077B3001 – 3199	3 - 4	6	(6) A	250 V	240	6	36
	3 - 6		0.1 A	250 V	240	0.1 A	NI

Type description

Function

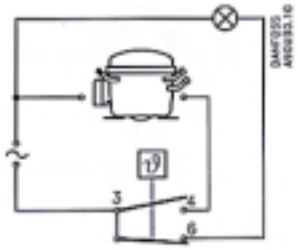


Principle



Type 077B24
Fixed setting with signal contact
that cuts in on rising temperature

Principle

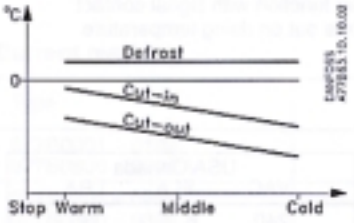


Type 077B34
Fixed setting with signal contact
that cuts out on rising temperature

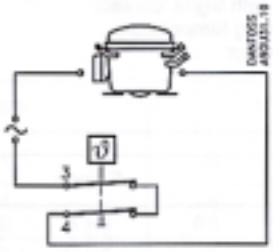
Current marking

Type	Contact	Europe			USA/Canada VAC	FLA	LRA
077B2401 – 2449	3 - 4 3 - 6	6	(6) A 0.1 A	250 V 250 V	240 240	6 0.1 A	36 NI
077B3401 – 3449	3 - 4 3 - 6	6	(6) A 0.1 A	250 V 250 V	240 240	6 0.1 A	36 NI

Function



Principle



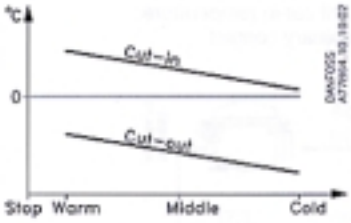
Type 077B4
Normal function with push button defrost
and automatic reset

Current marking

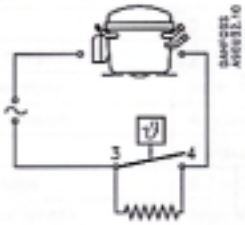
Type	Contact	Europe			USA/Canada VAC	FLA	LRA
077B4001 – 4199	3 - 4	6	(6) A	250 V	240	6	36

Type description

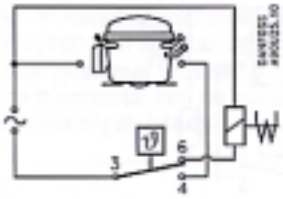
Function



Principle

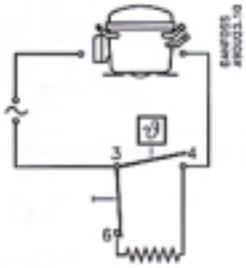


Type 077B5
Normal function
Large differential

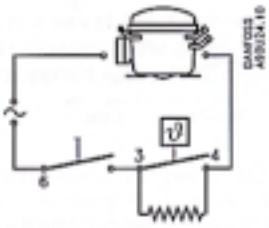


Type 077B53
Normal function
Large differential, with changeover contact

Principle



Type 077B52
Normal function
Large differential, with auxiliary contact

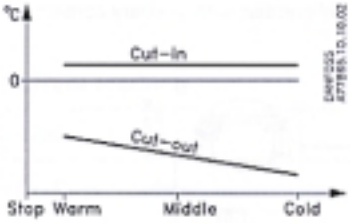


Type 077B52
Normal function
Large differential, with auxiliary contact

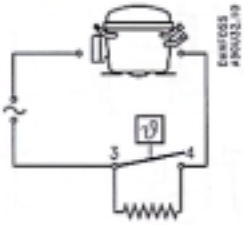
Current marking

Type	Contact	Europe			USA/Canada VAC	FLA	LRA
077B5001 – 5199	3 - 4	6	(6) A	250 V	240	6	36
077B5201 – 5299	3 - 4 3 - 6	6 6	(6) A (6) A	250 V 250 V	240 240	6 6	36 36
077B5301 – 5399	3 - 4 3 - 6	6 0,5	(6) A (0.1) A	250 V 250 V	240 240	6 0.5 A	36 NI

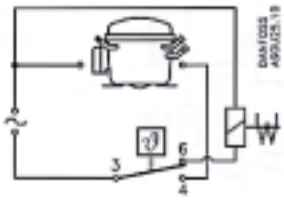
Function



Principle

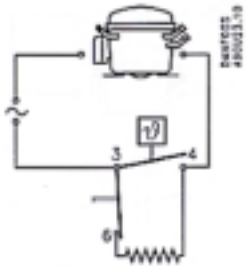


Type 077B6
Normal function
Fixed cut-in temperature

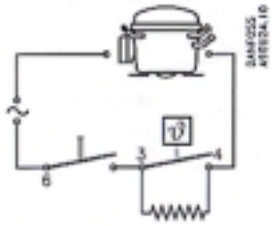


Type 077B63
Normal function
Constant cut-in temperature,
with changeover contact

Principle



Type 077B62
Normal function
Constant cut-in temperature,
with auxiliary contact



Type 077B62
Normal function
Constant cut-in temperature,
with auxiliary contact

Current marking

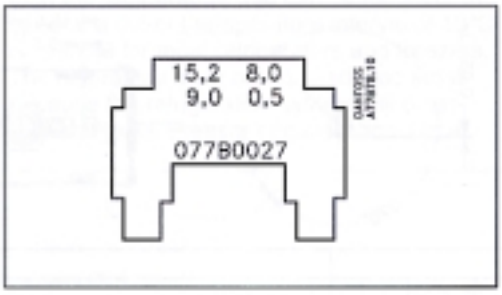
Type	Contact	Europe			USA/Canada VAC	FLA	LRA
077B6001 – 6199	3 - 4	6	(6) A	250 V	240	6	36
077B6201 – 6299	3 - 4	6	(6) A	250 V	240	6	36
077B6400 – 6599	3 - 6	6	(6) A	250 V	240	6	36
077B6301 – 6399	3 - 4	6	(6) A	250 V	240	6	36
	3 - 6	0.5	(0.1) A	250 V	240	0.5 A	NI

Technical data

Temperature interval	-42°C → +11°C
Cut-out temperature area	5°C → 20°C
Differential	3°C → 40°C (depending on spindle position and type)
Fixed cut-in temperature	+2°C → +11°C (type 077B6 only)
Signal temperature	from 3°C → 5°C higher than cut-in temperature
Barometric pressure	Adjusted at 1013 hPa (760 mm Hg)
Mounting	To be mounted with nut on connector, or connector for clip mounting
Connection tabs	6.3 × 0.8 mm or 4.8 × 0.8 mm
Capillary tube length	Standard lengths: 0.8 m, 1.0 m, 1.2 m Other lengths: 0.3 m → 2.9 m With plastic-coated tube: 0.3 m → 2.3 m Longer lengths by arrangement with Danfoss
Phial length	Standard lengths: 100 mm -> 120 mm For other thermostats, contact Danfoss
Ambient temperature	-25°C → +65°C
Weight	Approx. 100 g (depending on function and capillary tube length)

Adjustment for barometric pressures other than 1013 hPa (760 mm Hg) can be made in accordance with customer requirements.
If required, the thermostat can be supplied with plastic-coated capillary tube.

If there is a risk of the thermostat being located colder than the phial, the thermostat can be supplied with a heating element.



The code number is stamped on the thermostat.
If required, the thermostat can be supplied stamped with a customer number, and cut-in and cut-out temperatures at positions warm and cold.

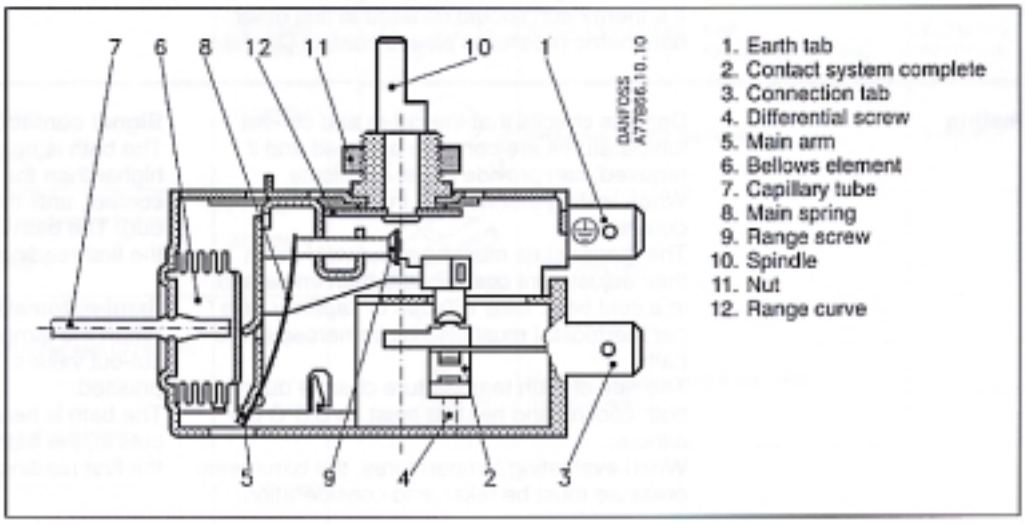
The first line gives the cut-in temperature in positions warm and cold.

The second line gives the cut-out temperature in positions warm and cold.

The third line gives the thermostat code number.

A week/year manufacturing code is stamped in the top of the thermostat.
E.g. 0861 means "week 08/1996, 1st order".

Design details



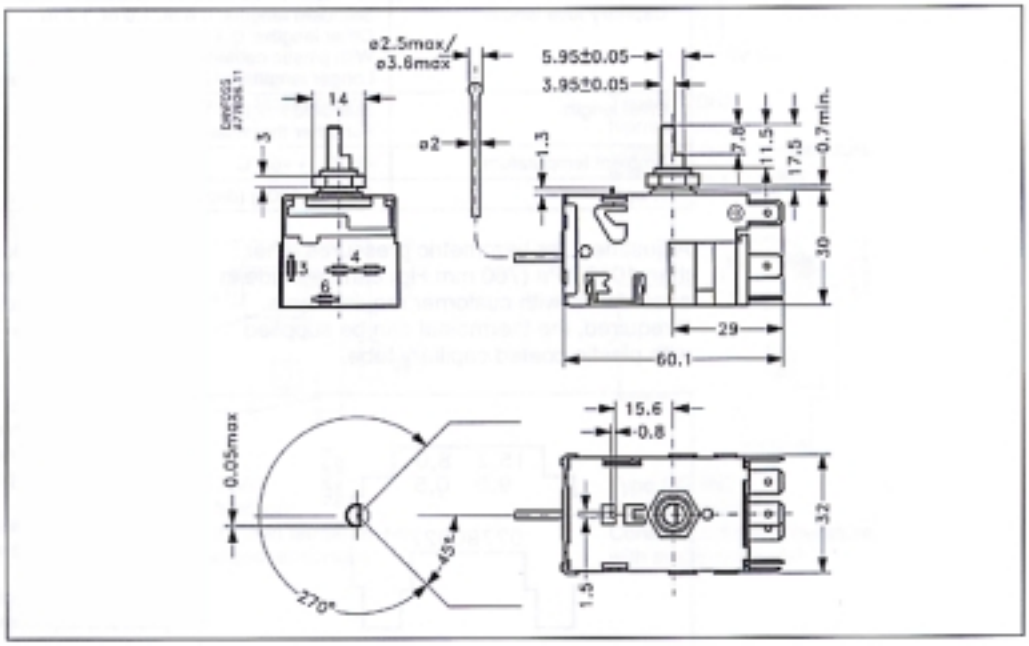
Approvals

Because thermostats are classified as individual components, some authorities stipulate that they must be subject to separate approval. With other authorities, the thermostat is approved when the whole refrigeration appliance is approved.

The thermostats are approved by the following authorities:

UK
EN 60730-2-1
USA
Canada

Dimensions



Adjustment

Correction for barometric pressure/altitude.
The thermostats are normally adjusted to suit the temperature stamped on them, at a barometric pressure of 1013 hPa (760 mm Hg).
If a thermostat should be used to suit other barometric pressures please contact Danfoss.

If adjustments are made without the approval of Danfoss, no responsibility for the thermostat concerned will be accepted by Danfoss.
It is possible to re-adjust a thermostat within certain limits, but such a step should not be taken without the approval of Danfoss.

Testing

Danfoss checks that the cut-in and cut-out temperatures are correctly adjusted and if required, can provide a test certificate.
When testing thermostats the following procedure applies:
The thermostats must be accurately set in their adjustment position and then immersed in a cold bath. Min. 160 mm of capillary tube per thermostat must also be immersed in the bath.
The rate of bath temperature change during both cooling and heating must be 0.5°C per minute.
When evaluating temperatures, the barometric pressure must be taken into consideration.

Main contact
The bath is cooled and the temperature is read when the thermostats cut out.
When all thermostats have cut out, the bath is heated. The temperature is read when the thermostats cut in again.
This process is performed twice. Only the second reading applies.

Signal contact
The bath is heated further to a temperature higher than the cut-in temperature of the main contact, until the signal contact cuts in (or cuts out). The bath temperature is read off. Only the first reading is valid.

Semi-automatic defrost
When the temperature lies between cut-in and cut-out values, the defrost pushbutton is pressed.
The bath is heated and when the thermostat cuts in, the bath temperature is read off. Only the first reading is valid.

Thermostat selection

When selecting a thermostat, the following three factors must be taken into consideration:

1. The temperature conditions in the refrigeration appliance
2. Pressure equalisation during standstill periods
3. Compressor capacity utilisation

Satisfactory conditions can be achieved by observing the following guidelines:
The thermostat range determines the temperature level in the refrigerator or freezer. The range must be chosen so that short running times do not occur in position warm. With the thermostat in position cold, in high ambient temperatures and under high load the thermostat cut-out function must remain operational. This can be done by setting the cut-out temperature about 2°C higher in position cold in relation to the temperature that can be reached. If 100% running time in position cold is required instead, the cut-out setting must be 2°C colder in position cold than the temperature that can be reached. In general a cut-out temperature interval of 10°C is suitable for most refrigerators and freezers. The differential must not be made too small because the refrigeration system will otherwise not reach pressure equalisation, i.e. a compressor with an LST starting device will be unable to start.

Based on experience, Danfoss recommends the following differentials in position warm:

Refrigerators	8 - 10°C
Chest freezers	8 - 10°C
Upright freezers	5 - 7°C
Liquid and bottle coolers	approx. 4°C

To establish appropriate data for a thermostat it is necessary to perform a number of tests on the appliance before making the final thermostat selection.
It should be remembered that during testing and later, during production, in addition to the thermostat temperature range the contact between phial and evaporator, and the phial location on the evaporator are highly important to the relationship between compressor running and standstill periods.
The phial must be placed so that it is not affected too early by injected refrigerant. Nor must it be so late in the evaporation circuit that variations in the charge quantity and the internal evaporator volume affect the phial temperature. Furthermore, the thermostat capillary tube must be in direct contact with the evaporator.

Accessories

	Mounting bracket with 4 holes Ø3.4 mm for self-tapping screws. Hole pitch 56 mm and 68 mm	077B0525
	Self tapping screws, Ø4.2 mm, for mounting bracket	681Z8093
	Front label 56 mm hole pitch 68 mm hole pitch	077A0334 077A0333
	Knob, for screw-on fitting With "0" marking – white with raised typeface	077B7621
	Knob, for central fixing and screw locking With "0" marking – white with sunken typeface	077B7610
	Disc White, for mounting together with 077B7610	077B7611
	Label White with blue scale, self-adhesive for 077B7610	077A0304
	Knob, grey	077B7624
	Disc with figures for 077B7624	077B7625
	Disc with arrow for 077B7624	077B7626

	Pushbutton for 077B4	077B4380
	Cable tab 6.3 mm	613X2078
	Adapter 6.3 → 4.8 mm AMP: 1-off 100-off in plastic bag	613X6320 077B7410
	Protective cap for cable tab	611B3011
	Protective cap	077B7601
	Multiplug housing for 4.8 mm AMP (positive lock)	077B7640

Standard range of thermostats

Application Code number	Function	Temperature °C Thermostat position Warm Cut-in/cut-out	Middle Cut-in/cut-out	Cold Cut-in/cut-out	Signal	Defrost	Capillary tube length
Refrigerators							
077B0020	Normal	+3.5/–3*	0/–7	–5.4/–12			1.0
077B0021	Normal	–2/–11*	–5.5/–15	–10/–20.5			1.0
077B0022	Normal	–8/–16*	–11/–20	–15.5/–25.5			1.0
077B0023	Normal	–10.5/–16*	–14/–20	–19.5/–26			1.0
077B4047	Normal + semi-automatic defrost	–4/–13*	–7/–17	–11/–22		+6	1.0
Chest freezers							
077B0024	Normal	–13/–21*	–16/–25	–20.5/–30			0.8
077B0025	Normal	–15/–23*	–18/–27	–22/–32			0.8
077B2020	Normal + signal contact	–15/–23*	–18/–27	–22/–32	–12*		0.8
Upright freezers							
077B0026	Normal	–17/–23*	–20/–26	–23/–30			1.2
077B2021	Normal + signal contact	–17/–23*	–20/–26	–23/–30	–14*		1.2
Two-temperature cabinets with automatic defrost							
077B5021	Normal + large differential	+9/–12	+5.5/–19	+2/–25*			1,0
077B5221	Normal + large differential + auxiliary contact	+9/–12	+5.5/–19	+2/–25*			1.0
077B6020	Fixed cut-in temperature	+3.5/–10	+3.5/–15	+3.5/–20*			1.0
077B6220	Fixed cut-in temperature + auxiliary contact	+3.5/–10	+3.5/–15	+3.5/–20*			1.0
077B6021	Fixed cut-in temperature	+3.5/–12.5	+3.5/–17.5	+3.5/–23*			1.0
077B6221	Fixed cut-in temperature + auxiliary contact	+3.5/–12.5	+3.5/–17.5	+3.5/–23*			1.0
077B6022	Fixed cut-in temperature	+3.5/–15	+3.5/–20.5	+3.5/–26*			1.0
077B6222	Fixed cut-in temperature + auxiliary contact	+3.5/–15	+3.5/–20.5	+3.5/–26*			1.0
Liquid coolers							
077B0027	Normal	+15.5/+9	+12/+5	+8/+0.5*			1.2
Bottle coolers							
077B0028	Normal	+11/+5	+7/0*	+2.5/–4.5			1.2
Absorption coolers							
077B0220	Normal + auxiliary contact	+3.5/–1*	–2/–7	–7/–12.5			1.2

* Adjustment position

The Danfoss product range includes:

- Thermostats for Refrigerators and Freezers
- Compressors for Refrigerators and Freezers
- Refrigeration and Air Conditioning Controls
- Industrial Controls
- Industrial Instrumentation
- Electrical Drives and Controls
- Heating and Ventilating Controls
- BC System Controls

- SOCLA Valves
- Comfort Controls
- Components for Burners and Boilers
- Mobile Hydraulics
- Water Hydraulics
- Compressors for Commercial Refrigeration

The Danfoss product family for the control of refrigerators and freezers consists of:

- Electromechanical thermostats, made to customer specifications (type 077B).
- Hermetic valves for use in refrigerators and freezers where two compressors are replaced by one compressor and one valve (type 090U).
- The familiar Service Thermostats.

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DK-6430 Nordborg
Denmark

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