

# Electric expansion valve

## ETS 5T

For liquid injection into evaporators

## Description

ETS 5T is a compact and lightweight stepper motor driven electric expansion valve with a high level of reliability. It provides a precise solution for expansion and flow control.

The portfolio is available with a wide capacity range and is designed specifically for CO<sub>2</sub> systems.

ETS 5T can be applied for VRV, bus A/C, condensing units, cold room, refrigerated cabinets and other CO<sub>2</sub> applications.

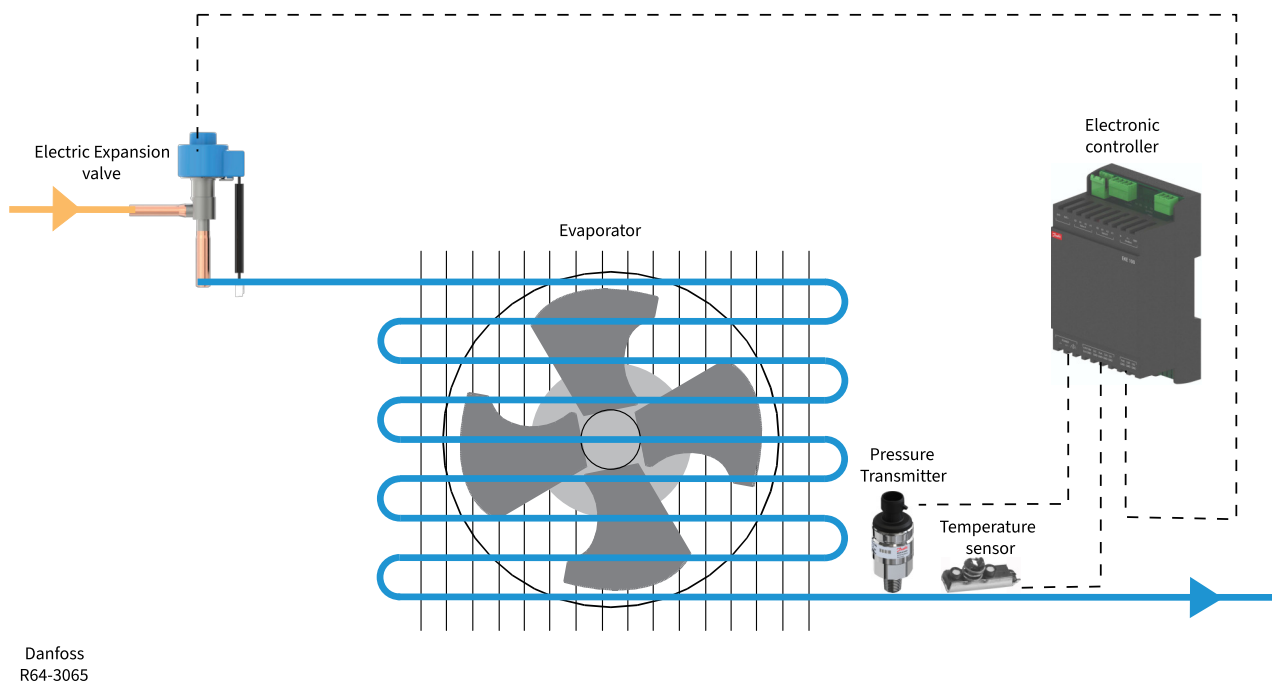
Valve operation is by means of a uni-polar/bipolar motor, and as such it is compatible with a number of electronic controllers from Danfoss or third-party vendors. With an EKE 100 series superheat controllers and AKS sensor, superheat accuracy better than  $\pm 0.5$  K can be obtained.

## Features & benefits

- Designed for R744 systems, with MWP 140 bar, MOPD 120 bar
- Optimized valve flow characteristics
- Accurate valve control, also at low opening degrees
- Bi-flow, with full performance in both flow directions
- High degree of freedom of installation orientation
- Danfoss valve drivers EKE 100/110 or EKF
- Largest nominal capacity, R744: 19.3 kw

## Applications

Figure: Typical application of ETS 5T



## Ordering

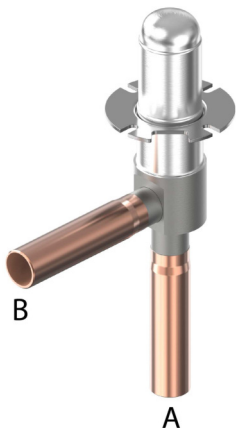
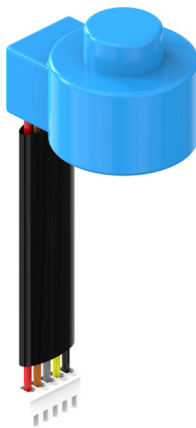
### Product code numbers

Being highly configurable, ETS 5T can be delivered with a number of different mechanical connections according to requirements. See ordering details below.

### Parts program

ETS 5T is a parts program consisting of a valve body and a separate Uni-polar/bi-polar motor coil (ETS 5T coil). Each component is purchased separately.

**Table: 5/16 inch male**

ETS 5T valve body, with L connection configuration	ETS 5T coil (stator)
 <p>The image shows a 3D rendering of the ETS 5T valve body. It has a vertical copper-colored stem labeled 'A' and a horizontal copper-colored pipe labeled 'B' connected at a 90-degree angle. The top of the valve has a silver-colored cap and a mounting flange.</p>	 <p>The image shows a 3D rendering of the ETS 5T coil (stator). It consists of a blue cylindrical top with a central screw, a black rectangular body, and a white multi-pin connector at the bottom.</p>

Besides using the ETS 5T coil as spare part, ETS 5T valve is hermetic and can not be taken apart, there are no other spare parts.

Type	Design config. Style	Orifice size [mm]	Connection type	Inlet size [in]	Outlet size [in]	Rated capacity R744 [kW]	Rated capacity R744 [TR]	Packing format	Quantity per packing format	Code number
ETS 5T08L	L	0.80	Solder, ODM	1/4 in	1/4 in	4.59	1.3	Industrial pack	40	034G6800
ETS 5T08L	L	0.80	Solder, ODM	5/16 in	5/16 in	4.59	1.3	Industrial pack	40	034G6801
ETS 5T10L	L	1.00	Solder, ODM	1/4 in	1/4 in	7.27	2.1	Industrial pack	40	034G6802
ETS 5T10L	L	1.00	Solder, ODM	5/16 in	5/16 in	7.27	2.1	Industrial pack	40	034G6803
ETS 5T14L	L	1.40	Solder, ODM	1/4 in	1/4 in	13.73	3.9	Industrial pack	40	034G6804
ETS 5T14L	L	1.40	Solder, ODM	5/16 in	5/16 in	13.73	3.9	Industrial pack	40	034G6805
ETS 5T18L	L	1.80	Solder, ODM	1/4 in	1/4 in	19.32	5.5	Industrial pack	40	034G6806
ETS 5T18L	L	1.80	Solder, ODM	5/16 in	5/16 in	19.32	5.5	Industrial pack	40	034G6807
ETS 5T08L	L	0.80	Solder, ODM	1/4 in	1/4 in	4.59	1.3	Multi pack	20	034G6850
ETS 5T08L	L	0.80	Solder, ODM	5/16 in	5/16 in	4.59	1.3	Multi pack	20	034G6851
ETS 5T10L	L	1.00	Solder, ODM	1/4 in	1/4 in	7.27	2.1	Multi pack	20	034G6852
ETS 5T10L	L	1.00	Solder, ODM	5/16 in	5/16 in	7.27	2.1	Multi pack	20	034G6853
ETS 5T14L	L	1.40	Solder, ODM	1/4 in	1/4 in	13.73	3.9	Multi pack	20	034G6854
ETS 5T14L	L	1.40	Solder, ODM	5/16 in	5/16 in	13.73	3.9	Multi pack	20	034G6855
ETS 5T18L	L	1.80	Solder, ODM	1/4 in	1/4 in	19.32	5.5	Multi pack	20	034G6856
ETS 5T18L	L	1.80	Solder, ODM	5/16 in	5/16 in	19.32	5.5	Multi pack	20	034G6857

**NOTE:**

The rated capacity is based on:

- Refrigerant: R744
- Evaporating temperature:  $T_e = -25\text{ °C}$
- Condensing temperature:  $T_c = -5\text{ °C}$
- Subcooling = 0 K
- Superheat = 0 K
- Driving steps = 480 steps

**Valve sizing using calculation software**

It is strongly recommended to use Coolselector®2 to find the correct valve for your application. The software can be downloaded from the Danfoss website. You can download it from <http://coolselector.danfoss.com>

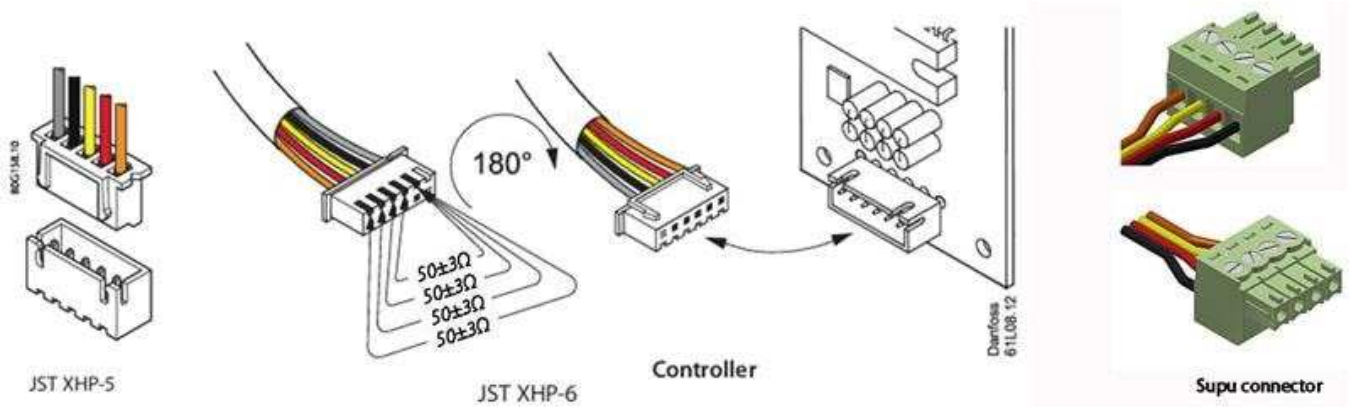
**ETS 5T coil**

Table 11: Coils for ETS 5T

Type	Cable length		Electrical connector	Pack format	Qty/pack	Code no
	[m]	[in]				
ETS 5T	0.7	27.56	Uni-polar JST XHP-5	Multi pack	20	034G3853
ETS 5T	0.7	27.56	Uni-polar JST XHP-5	Industrial pack	40	034G3854
ETS 5T	0.7	27.56	Uni-polar JST XHP-6	Industrial pack	40	034G3858
ETS 5T	1	39.37	Uni-polar JST XHP-6	Multi pack	20	034G3852
ETS 5T	1	39.37	Uni-polar JST XHP-5	Industrial pack	40	034G3871
ETS 5T	1.5	59.06	Uni-polar JST XHP-5	Multi pack	20	034G3850
ETS 5T	1.7	66.93	Uni-polar JST XHP-6	Industrial pack	40	034G3859
ETS 5T	2	78.74	Uni-polar JST XHP-5	Industrial pack	24	034G3867
ETS 5T	2.7	106.30	Uni-polar JST XHP-5	Multi pack	20	034G3851
ETS 5T	2.7	106.30	Uni-polar JST XHP-6	Industrial pack	24	034G3855
ETS 5T	2.7	106.30	Uni-polar JST XHP-6	Multi pack	20	034G3856
ETS 5T	4	157.48	Uni-polar JST XHP-5	Industrial pack	24	034G3869
ETS 5T	4	157.48	Uni-polar JST XHP-6	Industrial pack	24	034G3870
ETS 5T	1	39.37	Bi-polar SUPU MC	Industrial pack	40	034G3860
ETS 5T	1.5	59.06	Bi-polar SUPU MC	Industrial pack	40	034G3861
ETS 5T	2	78.74	Bi-polar SUPU MC	Industrial pack	24	034G3862
ETS 5T	2.7	106.30	Bi-polar SUPU MC	Industrial pack	24	034G3863
ETS 5T	4	157.48	Bi-polar SUPU MC	Industrial pack	24	034G3868
ETS 5T	1	39.37	Bi-polar SUPU MC	Multi pack	20	034G3872
ETS 5T	1.5	59.06	Bi-polar SUPU MC	Multi pack	20	034G3873
ETS 5T	2	78.74	Bi-polar SUPU MC	Multi pack	20	034G3874
ETS 5T	2.7	106.3	Bi-polar SUPU MC	Multi pack	20	034G3875
ETS 5T	1	39.37	Uni-polar JST XHP-6 (Reverse)	Industrial pack	40	034G3866
ETS 5T	1.5	59.06	Uni-polar JST XHP-6 (Reverse)	Industrial pack	40	034G3864
ETS 5T	2.7	106.30	Uni-polar JST XHP-6 (Reverse)	Industrial pack	24	034G3865




Figure: Electrical wiring



Accessories code numbers

Tools for ETS 5T service

Table: Accessories for ETS 5T

Image	Description
	Manual coil 034G3803





Overview

Product portfolio

ETS 5T is a system product whose function is controlled through a Danfoss electronic controller, or a third party vendor electronic controller that is compatible with the ETS 5T as to control functionality and connections.

Vendor electronic controller that is compatible with the ETS 5T as to control functionality and connections. Danfoss recommends the use of the EKE 100 series superheat controller together with ETS 5T. With EKE 100 series or EKE 110 for injection controller, a superheat accuracy better than 0.5 K can be obtained.

The electronic controller requires precise temperature input from a temperature sensor (refrigerant temperature) and precise pressure inputs (evaporator pressure) from a pressure transmitter.




System product

Figure: EKE100 superheat controllers



EKE superheat controllers are for DIN rail mounting and come in three versions with different combinations of inputs and output relays and different functionality.

Table: Sensors and other products for ETS 5T

Pressure transmitter (DST P310 shown)	EKF 1A/2A Stepper valve driver	EKE 2U Backup power module
		
DST P310 is a digital ratio-metric pressure transmitter.  Depending on controller type, other ratio-metric pressure transmitters can be used as well (e.g. AKS 2050).	EKF series is an economical stepper valve driver that translates analog signal provided by master controller to valve driving sequence.	EKE 2U Backup power module ensures sufficient power in case of power failures to the controller to ensure closure of the electronic valves.



Media

Table: ETS 5T media data

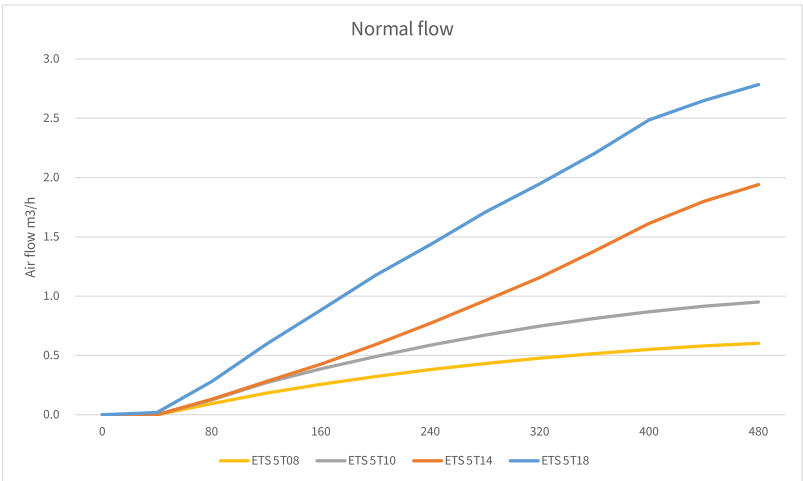
Media data	Value
Refrigerants	R744
Refrigerants oil	POE, PAG

**NOTE:** The valve must only be used in closed circuit refrigeration system, where no oxygen is present acc. EN 378, ISO5149 ASHRAE 15 or IEC 60335-2-x or equivalent standards.

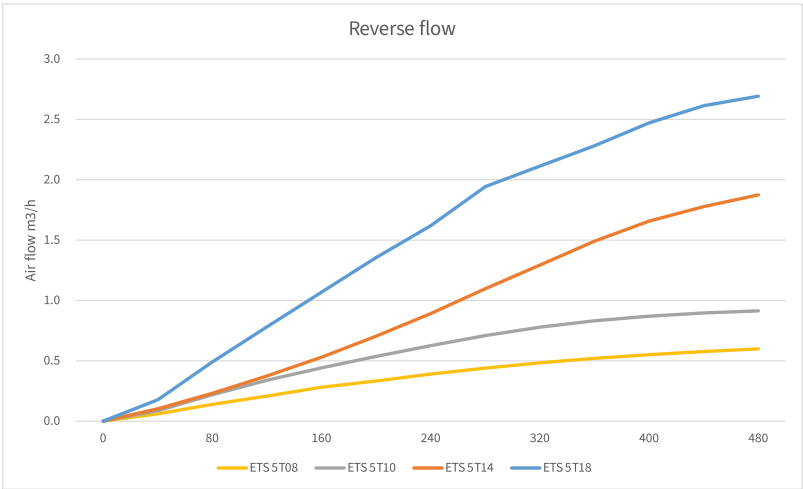
Product details

General data  
Flow characteristics

Air flow characteristics are provided for ETS 5T with normal and reverse flows.  
**Figure: Normal flow B -> A**



**Figure: Reverse flow A -> B**



- Flow characteristics**
- Measured at 1 barg differential pressure.
  - Air flow provided in m³/hour (Y axis).
  - Valve position provided by pulses in half steps (X axis).



## Design

The ETS 5T Electric expansion valves open and close to regulate refrigerant flow by means of a screw, whose rotating motion is transformed into linear motion. This occurs by the rotation of a magnet needle valve assembly which moves when electrical signals are applied to the surrounding coil. Within the coil structure, there are different winding configurations, and the polarities are changed by the electrical signals.

By application of the appropriate combination of signals, in the form of pulses, the coil forces the rotor of the valve to move in a stepwise fashion. Application of multiple pulses will make the valve mechanism move through a series of steps in the chosen direction, in order to set the valve with the required opening degree.

## Performance and environmental conditions

**Table: Pressure and temperature data in SI and Imperial units**

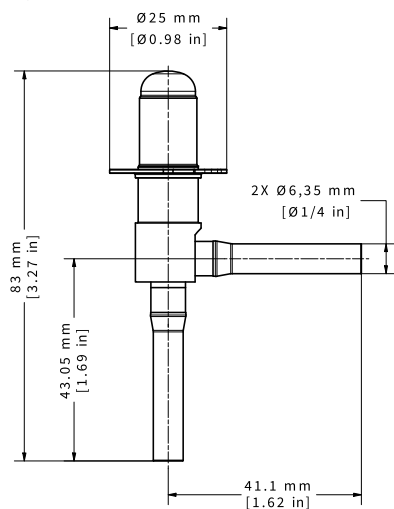
Data	Value [SI units]	Value [IMP. units]
Max working pressure (MWP)	140 barg	2030 psig
Burst pressure	3 × MWP	3 × MWP
Maximum operating pressure differential (MOPD)	120 bar for 08 – 14 with standard unipolar/bipolar Stator at full temperature range 90 bar for 18 with standard unipolar Stator at -40 – 70 °C 100 bar for 18 with standard bipolar Stator at -40 – 70 °C	
Ambient temperature	-40 – 80 °C	-40 – 176 °F
Ambient relative humidity	Max. 95 % RH	Max. 95 % RH
Fluid temperature range	-40 – 80 °C	-40 – 176 °F

**Table: Environmental conditions**

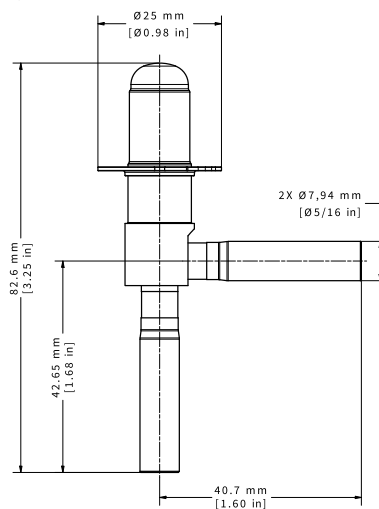
Environmental conditions	Value
Max. Internal leakage at 10 bar	< 150 SCCM
Mechanical noise	< 60 dB(A)
Enclosure rating IP (Valve and coil combined)	IP 67
Insulation class	B
Insulation resistance	> 100 MΩ
Storage temperature range	-30 – 65 °C / -22 – 158 °F
Relative humidity	Max. 95 % RH

## Dimensions

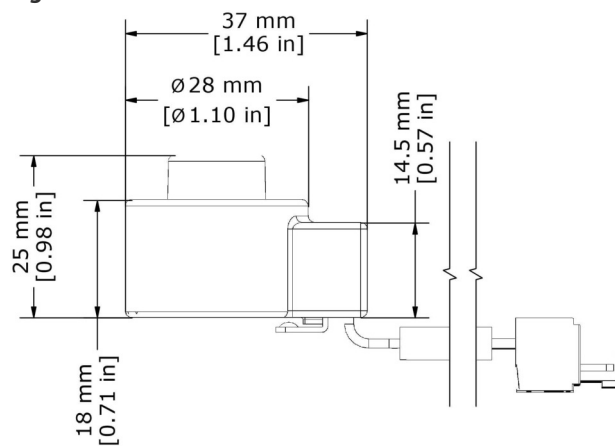
**Figure: ETS 5T 1/4 inch ODM**



**Figure: ETS 5T 5/16 ODM**



**Figure: ETS 5T coil dimensions**



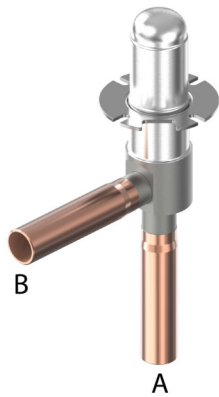


Connections

Mechanical configuration options

ETS 5T is an angleway valve designed with a valve body in steel and ODM or ODF solder connections in stainless steel with copper plating, with inlet and outlet sizes ¼ in, 5⁄16 in.

Figure: ETS SM inlet and outlet configuration



A	Outlet
B	Inlet

The copper connections are highly configurable and can be produced with the following shapes.

Table: Connection configuration

Shape L	
¼ in	5⁄16 in
ODM	ODM

**NOTE:** Not all combinations of sizes and configurations are available. The table shows currently available configurations

Table: Mechanical configuration options

L Shape	ODM with straight connectors
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## Electrical connection

Electrical connection is via a fixed cable in a number of lengths from the coil to the controller. Cables up to 4 m length are available with a JST XHP-5 / JST-XHP6 / SUPU connector. See ETS 5T [Figure: Electrical wiring](#) and [Table: Coils for ETS 5T for details](#).

## Electrical and motor specifications


Valve operation is by means of a uni-polar / bi-polar motor, designed as a separate coil that clicks onto the valve body.

**Table: Electrical and motor specifications**


Electrical and motor specifications	Value
Motor type	Unipolar / bipolar coil
Nominal voltage	12 V $\pm$ 10%
Coil resistance at 20 °C	50 Ohm $\pm$ 6%
Rated current	0.24 A
Power consumption	4.1 W
Holding current after each sequence of steps	Min. 30 ms, max. 1 s
Permanent holding current	Not allowed
Recommended excitation method possible, but not recommended excitation method	1 – 2 2 – 2
Number of pulses	480 half-step pulse (Don't over drive to more than 480 steps when open the valve)
Nominal pulse rat	31 pulses per second (PPS)
Maximum duty cycle (30s)	50%
Insulation resistance	> 100 M $\Omega$
Dielectric strength	< 5 mA

## Stepper motor switch sequence

**Table: Unipolar motor excitation sequence**

Coil	Wire	Excitation sequence 							
		1	2	3	4	5	6	7	8
A1	Orange	ON	ON	OFF	OFF	OFF	OFF	OFF	ON
B1	Red	OFF	ON	ON	ON	OFF	OFF	OFF	OFF
A2	Yellow	OFF	OFF	OFF	ON	ON	ON	OFF	OFF
B2	Black	OFF	OFF	OFF	OFF	OFF	ON	ON	ON
COM	Grey	ON	ON	ON	ON	ON	ON	ON	ON

**Table: Bipolar motor excitation sequence**

Coil	Wire	Excitation sequence 							
		1	2	3	4	5	6	7	8
A1	Orange	-	-	OFF	+	+	+	OFF	-
A2	Yellow	+	+	OFF	-	-	-	OFF	+
B1	Red	OFF	-	-	-	OFF	+	+	+
B2	Black	OFF	+	+	+	OFF	-	-	-



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Approval type	Title	Certification body	Approval topic
Manufacturer's Declaration	<a href="#">Manufacturer's declaration</a> <a href="#">034R9606.AA</a>	Danfoss	EU RoHS
Export Control Declaration	<a href="#">Electronic expansion Valve &amp; Coil</a>	Danfoss	

Compliance:  
ETS 5T complies with:

	Pressure Equipment Directive
<b>RoHS</b>	Restriction of Hazardous Substances
	Registration, Evaluation, Authorisation and Restriction of Chemicals

## Contact details

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