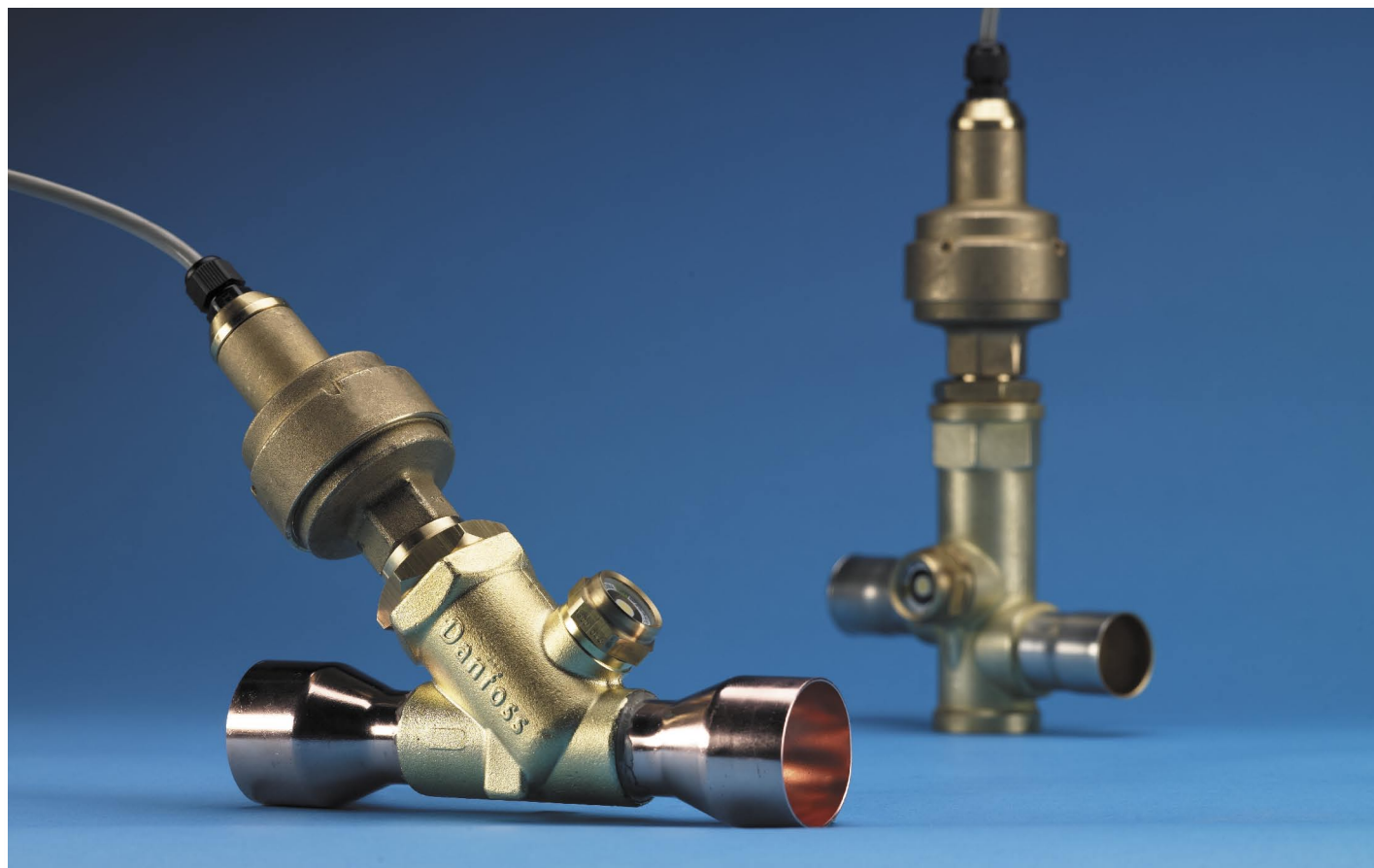


## Danfoss introduces the new ETS Electronically Controlled Stepper Motor Expansion Valve



ETS is a series of electrically operated expansion valves for precise liquid injection in evaporators for air conditioning and refrigeration applications.

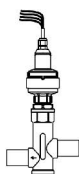
The valve piston and linear positioning design is fully balanced, providing bi-flow feature as well as solenoid tight shut-off function in both flow directions.

The ETS needs a current or voltage driver as partner to be operated. EKC316 from Danfoss and EVD 200/300 from Carel are examples of qualified partners.

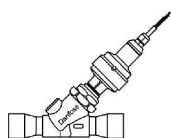
### Facts, Features & Benefits:

- Precise positioning for optimal control of liquid injection.
- ETS 50 and 100 are designed for HFC/HCFC conditions including R410A, providing 45.5 bar (659.9 psig) working pressure.  
ETS 250 and 400 are designed for HFC/HCFC conditions, providing 34 bar (448 psig) working pressure.
- Balanced design providing bi-flow operation as well as solenoid tight shut-off function in both flow directions at MOPD 33 bar (478.6 psig).
- ETS 50 and 100 have bi-metal connections providing "waterless brazing", improved process and productivity.
- ETS 250 and 400 are both designed with built-in sight glass.  
A built-in sight glass is an option for ETS 50 and 100.
- Cable connectors on request.
- For manual operation and service of ETS valves and AST-g service driver is available. For further information please contact Danfoss (Commercial Refrigeration & Air Conditioning Controls).

## Technical data:



Parameter	ETS 50B / ETS 100B
Compatibility	HFC, HCFC
CE marking	Yes
MOPD	33 bar (478.6 psi)
Max. working pressure (PS/MWP)	45.5 bar (659.9 psi)
Refrigerant temperature range	-40°C to 10°C (-40°F to 50°F)
Ambient temperature	-40°C to 60°C (-40°F to 140°F)
Total stroke	13 mm / 16 mm (0.5 in. / 0.6 in.)
Motor enclosure	IP 67



Parameter	ETS 250 / ETS 400
Compatibility	HFC, HCFC
CE marking	Yes
MOPD	33 bar (478.6 psi)
Max. working pressure (PS/MWP)	34 bar (493 psi)
Refrigerant temperature range	-40°C to 10°C (-40°F to 50°F)
Ambient temperature	-40°C to 60°C (-40°F to 140°F)
Total stroke	17.2 mm (0.68 in.)
Motor enclosure	IP 67

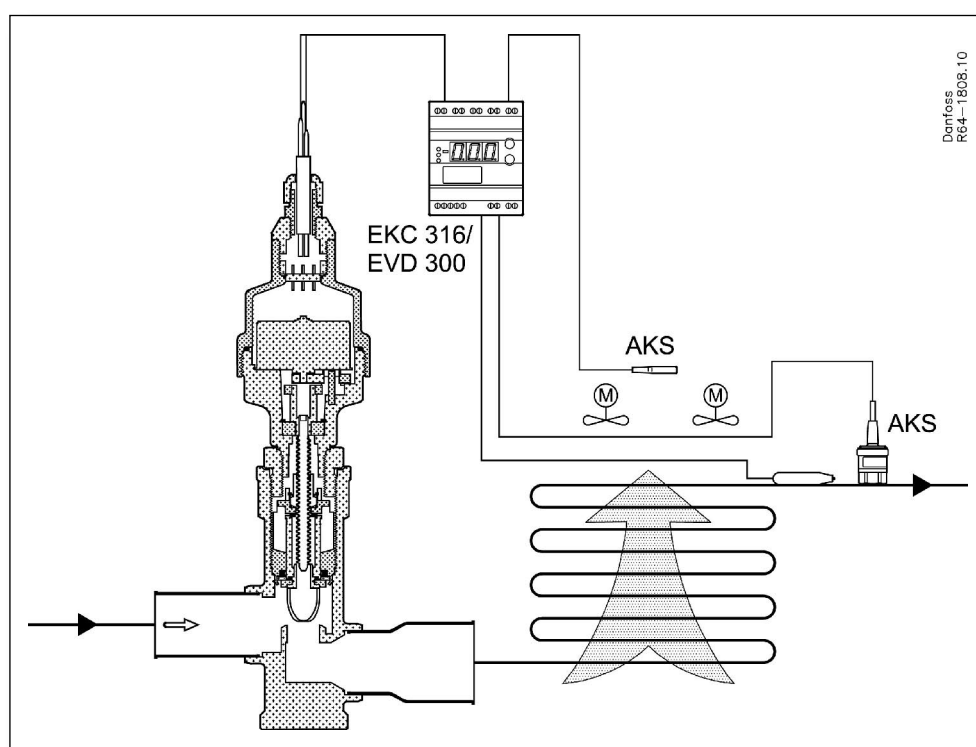
## Electrical data:

Parameter	ETS 50-400
Stepper motor type	Bi-polar - permanent magnet
Step mode	2 phase full step
Phase resistance	52Ω ±10%
Phase inductance	85 mH
Holding current	Depends on application. Full current allowed (100% duty cycle)
Step angle	7.5° (motor), 0.9° (lead screw), Gearing ratio 8.5:1. (38/13) <sup>2</sup> :1
Nominal voltage	(Constant voltage drive) 12 V dc -4% +15%, 150 steps/sec.
Phase current	(Using chopper drive) 100 mA RMS -4% +15%,
Max. total power	Voltage / current drive: 5.5 / 1.3 W (UL: NEC class 2)
Step rate	150 steps/sec. (constant voltage drive) 0-300 steps/sec. 300 recommended (chopper current drive)
Total steps	ETS 50: 2625 [+160 / -0] steps ETS 100: 3530 [+160 / -0] steps ETS 250 and 400: 3810 [+160 / -0] steps
Full travel time	ETS 50: 17 / 8.5 sec. (voltage / current) ETS 100: 23 / 11.5 sec. (voltage / current) ETS 250 and 400: 25.4 / 12.7 sec. (voltage / current)
Lifting height	ETS 50: 13 mm (0.5 in.) ETS 100: 16 mm (0.6 in.) ETS 250-400: 17.2 mm (0.7 in.)
Reference position	Overdriving against the full close position
Electrical connection	4 wire 0.5 mm <sup>2</sup> (0.02 in <sup>2</sup> ), 2 m (6.5 ft) long cable

## Stepper motor switch sequence:

	STEP	Coil I		Coil II		
		Red	Green	White	Black	
↑ CLOSING ↑	1	+	-	+	-	↓ OPENING ↓
	2	+	-	-	+	
	3	-	+	-	+	
	4	-	+	+	-	
	1	+	-	+	-	

## Valve operation:



The ETS valves operate modulating by electronically controlled activation of the AST stepper motor.

The motor is a type 2-phase bipolar, which stays in position; unless power pulses from a driver initiate the two discrete sets of motor stator windings for rotation in either direction.

The direction depends on the phase relationship of the power pulses, which number again is decisive for the travel.

The motor is operating the spindle, which rotating movements are transformed into linear motion by the transmission in the cage assembly.

The AST motor housing has a glass sealed 2 m (6.5 feet) cable connection as standard, which can be customized in length and plug/socket combinations.

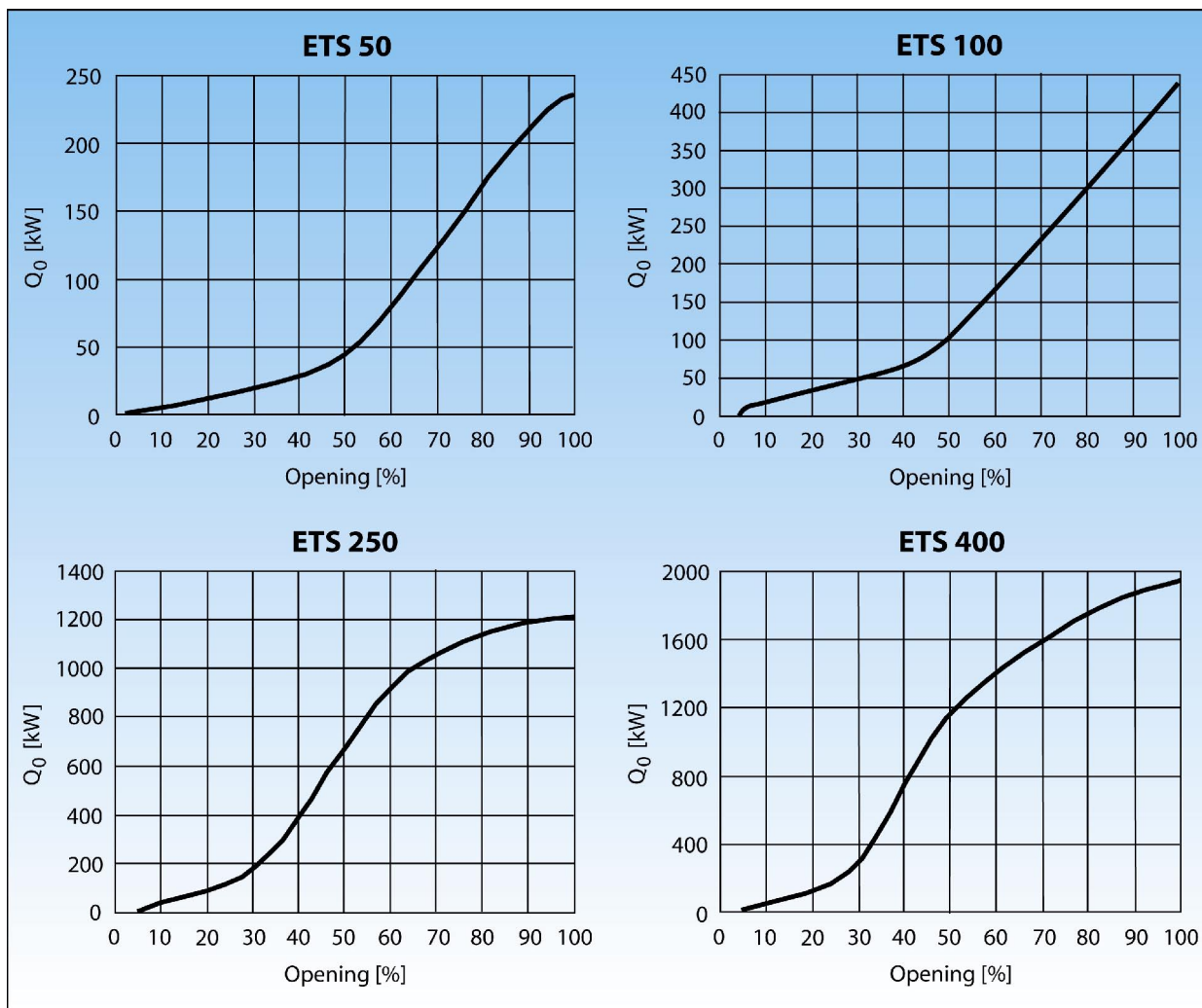
The valve cone is V-port respectively exponential, combining the best performance qualities at part load conditions as well as providing a 0-resistance maximum capacity.

The cage and orifice design is fully power balanced, giving identical bi-flow performance capabilities and nearby identical maximum capacities.

The port design includes a shut-off function with "solenoid" tightness in both flow directions. Closed position is also the mechanical stop acting as reference point to reset the controller. By overdriving permanently while closed endures that the reference number in steps always is correct.

Operating the ETS series requires a controller with either 12 V dc voltage drive (5.5 W) or using chopper drive (100 mA RMS).

## Valve operation:



Capacity based on: R407C,  $T_e = 5^\circ\text{C}$  (41°F),  $T_c = 32^\circ\text{C}$  (89.6°F),  $T_l = 28^\circ\text{C}$  (82.4°F)

## Capacities:

Type	Rated capacity <sup>1)</sup>									
	R410A		R407C		R22		R134a		R404A	
	kW	TR	kW	TR	kW	TR	kW	TR	kW	TR
ETS 50B <sup>2)</sup>	262.3	75.7	240.5	69.1	215	62	170	48.9	161.4	46.3
ETS 100B	488.4	140.9	447.8	128.7	400.4	115.4	316.5	91.2	300.5	86.6
ETS 250	-	-	1212	349	1106	319	874	252	828	239
ETS 400	-	-	1933	556	1764	509	1394	402	1320	381

<sup>1)</sup> The Rated capacity is based on:  
 Evaporating temperature  $t_e$ :  $5^\circ\text{C}$  (40°F)  
 Liquid temperature  $t_l$ :  $28^\circ\text{C}$  (82°F)  
 Condensing temperature  $t_c$ :  $32^\circ\text{C}$  (90°F)  
 Full stroke opening.

<sup>2)</sup> ETS 25B is available upon request. Please contact Danfoss.  
**Note:** ETS 25B is half the capacity of ETS 50B.