



# Industrial air coolers THOR

Standard coolers with Cu tubing





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## Model indication

THOR-**B** - **426** - **8** - **H1/6** - **400** - **G ...**

①
②
③
④
⑤
⑥
⑦
⑧

Pos.	Reference	Options
1	Air direction	B = Blow through Z = Draw through
2	Cooler module	1 - 7
3	Number of fans	1 - 7
4	Tube rows	4, 6 or 8 tube rows
5	Fin spacing	4, 6, 7, 8, 10 or 12 mm
6	Circuiting design	2H, H1, H2 ...
7	Current	400 = 230/400/50/3 230 = 230/50/1
8	Options	For a full survey of all available options see page 4

## Eurovent

Within Europe, a wide variety of published data on capacities are in use, generally depending on national standards. Most in use by the leading manufacturers are national and international standards like DIN, ENV, NEN-EN and ASHRAE. Due to this, customers have not been able to make objective product comparisons, since data published on capacities were based on  $DT_1$ , DTM, dry or wet conditions, with or without certification, etc.



To meet the European requirements on EN standards, the European Refrigeration Industry embodied by Eurovent has set standards to guarantee an independent certification procedure for forced convection air cooled condensers based on NEN-EN 327 and unit air coolers based on NEN-EN 328. Being an active member of Eurovent, the capacities of the Alfa Laval commercial cooler programme, as given in the technical documentation, are based on NEN-EN 328 (evaporating temperature  $t_0 = -8\text{ °C}$ , 8 K temperature difference between air-on temperature and evaporating temperature ( $DT_1$ )).

In order to enable air cooler selection for operating conditions, technical documentation should also give capacities for humid/frosted conditions. According to Eurovent these 'frosted conditions' are to be calculated by multiplying 'dry capacities' with a factor 1.15. These data can be found in the capacity tables, in the columns marked "frosted".

## Capacities

**Frosted conditions**

- Lightly frosted coil.
- Relative humidity 85 %.
- Suction gas superheating 62% of the temperature difference ( $DT_1$ ), with a minimum of 3.5 K.
- Refrigerant liquid temperature 30 °C (for  $t_0 = -20\text{ °C}$  and below: liquid temperature 10 °C).

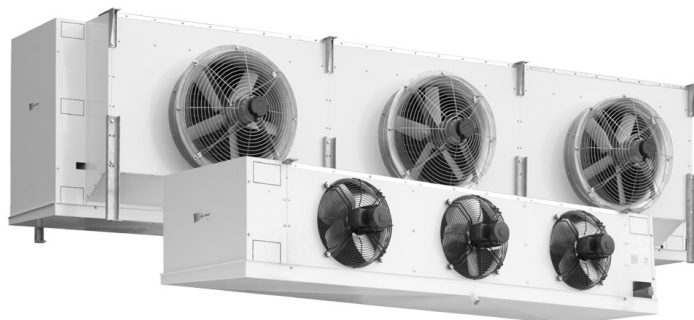
**Evaporating temperature  $t_0$** 

Evaporating temperature  $t_0$  is the saturated temperature according to the pressure at the suction outlet of the cooler.

**Dry conditions**

Cooling capacity where no condensation or ice build-up occurs on the coil (100% sensible cooling). This condition is used by Eurovent to standardise capacity ratings but should not be used when selecting coolers.

For cooler selection use the columns marked "frosted".



### General Information

The THOR series is a wide and flexible range of industrial air coolers fitted with blow-through or draw-through fans.

Application area: evaporating temperatures of +5 down to -40 °C using either halogen refrigerants, CO<sub>2</sub> or secondary refrigerants.

Capacities (Eurovent SC 2) 5 up to 123 kW.

Air flow 4,000 up to 68,000 m<sup>3</sup>/h.

These models have been highly standardised in construction and dimensions, while maintaining flexibility in fin spacings, coil construction and circuiting design.

### Other THOR models



#### THOR-D

Low silhouette dual discharge air coolers.



#### THOR-F

Air cooler models THOR-F have been optimized for the refrigerated storage of agricultural products. These cooler models are characterised by an optimised capacity / air volume ratio and a relatively low profile.



#### THOR-A

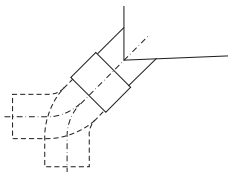
For airsock application Alfa Laval has developed a special airsock cooler range. These THOR-A models are fitted with an airsock ring and fan motors capable of supplying the extra external pressure that is required for the proper functioning of airsocks.

All THOR, THOR-D, THOR-F and THOR-A models are also available with stainless steel tubing (TYR range).

### Two-Year Guarantee

Because Alfa Laval has the fullest confidence in the product quality, a two-year full guarantee is given.

### Product Configuration

- Finned coil
  - 7 coil block modules
  - 4, 6 or 8 tube rows deep
  - Cu ripple fin tubing  $\varnothing$  5/8" (smooth tubing for brine)
  - Tube pitch 50 x 50 mm square
  - Corrugated Alu-fins
  - Fin spacings 4, 6, 7, 8, 10 and 12 mm.
- 1- 7 Fans, blowing or drawing through the coil, available in a range of different executions. Diameters  $\varnothing$  406 mm up to  $\varnothing$  710 mm. Fan motor protection class IP55.
- Corrosion resistant casing material: Aluminium/Sendzimir, white epoxy coated (RAL 9003).
- Hinged, enclosed end covers (modules 1 - 4). Larger modules fitted with easily removable end covers.
- Hinged drip tray. Drain(s) 32 mm PVC connection, freely adjustable into either horizontal or vertical position.
 
- Refrigerant distribution optimised to refrigerant applied.
- Refrigerant connections on right hand side (fan side view).
- Fitted with schröder valve on the suction connection for testing purposes.
- Sufficient room for fitting the expansion valve inside.
- Suitable for dry expansion or pumped system.
- Stickers indicate fan direction and refrigerant in/out.
- Delivery in mounting position. Coolers are mounted on wooden beams. Installation can take place with use of a forklift.
- Design pressure 33 bar (H(C)FC) or 6 bar (brine). Higher design pressures on request. Each heat exchanger is leak tested with dry air and finally supplied with a nitrogen pre-charge.



## Options

**Defrost systems**

- Hot gas coil in driptray
- Electric defrost
- Hot glycol defrost
- Water defrost

**G1, G2**  
**E1, E2, E4, E5**  
**HW1, HW2**  
**W**

*Electric defrost for air coolers with pumped refrigerant circulation or in glycol execution on special request only.*

**Fan ring heater**

**FRH**

**Driptray insulation**

- Styropore 10 mm + cladding **I 2**  
*not in combination with electric defrost*
- Foamglass 25 mm + cladding **I 3**

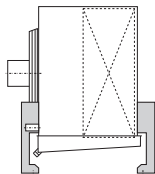

**Refrigerant connections left**  
 (fan side view)

**L**

**Mounting feet**

**MF**

*For floor mounting, THOR coolers can be equipped with hot dip galvanized steel mounting feet. The positioning of these is the same as the suspension brackets for ceiling mounting.*

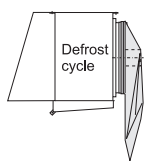
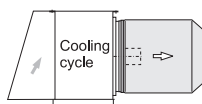

**Isolating switch (mounted)**

**ISM**

**Shut up® system**

**S + SH**

*for THOR-Z only. The system comprises a shut up sock (S) and an inlet hood (SH) to enhance defrost efficiency.*

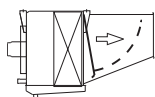


*The use of a shut-up® system may lead to a decline in cooling capacity up to max. 5 percent. Please take this into account during selection. When working conditions are such that condensation would freeze during the derosting period, the inlet hood should be insulated.*

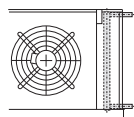
**Diffuser + defrost damper**

**D/DO**

*Discharge diffuser to increase air throw (D), can also be fitted with a defrost damper valve (O) that closes automatically when the fans are stopped. THOR-B only.*


**Secondary refrigerant**

*Air coolers for secondary refrigerant application can be selected with our selection software. Extra information on request.*


**Stainless steel 304 casing**

**SSC**

**Fan motors 400/60/3 or 230/60/1**

 Non-standard executions *(on request only)*
**Special fan motors**

- Dual fan speed motors
- Variable fan speed motors
- EC fans
- Alternative electrical supply 460/60/3
- Fans for extra external pressure 125 Pa (modules 5, 6 and 7)

**P**

**Built in heater coil sections**

## Fan Ring Heater (FRH, 230 Volt)

incl. mounting gear

Cooler module	Fan diameter mm	Ring heater power W
1	406	400
2	457	450
3	508	500
4	560	500
5	560	500
6	630	325
7	710	350

## Driptray Insulation ( I )

For specific operational conditions the air coolers can be fitted with driptray insulation.

Insulation of the driptray is recommended for air coolers with hot gas defrosting used at a room temperature below - 5 °C. For areas with high relative humidity it may also be necessary to insulate other parts of the casing. At extra cost this driptray insulation can be combined with the usual epoxy coating.

*Note : When selecting driptray insulation the overall height "B" of the coolers (see page 20 and 22) increases by the thickness of the insulation material applied.*

Selection Example DT<sub>1</sub>

Refrigerant .....	R 404A dx
Selected fin spacing .....	7 mm
Required cooling capacity .....	23 kW
Air-on temperature .....	+2 °C
Evaporating temperature .....	-5 °C

- 1)  $DT_1 = +2 - (-5) = 7 \text{ K}$
- 2) Correction factor  $DT_1 / R 404A : 1.15$
- 3) Multiply required capacity  
with correction factor :  $23 \times 1.15 = 26.5 \text{ kW}$ .
- 4) Cooler models can be selected in columns 'capacity / frosted' on pages 9 and 10 with a nominal capacity of 26.5 kW.

For the above mentioned conditions the following THOR models can be selected :

- THOR 146-7, nom. cap. 27.1 kW
- THOR 238-7, nom. cap. 29.5 kW
- THOR 328-7, nom. cap. 26.8 kW
- THOR 426-7, nom. cap. 27.6 kW

Depending on parameters such as *air flow*, *number of fans* and *cooler dimensions* (see tables) a final cooler model selection can take place.

Capacity values under 'Dry Conditions' are reference values for Eurovent conditions.

Standard condition	Air on temp. °C	Evaporating temperature °C	Factor dry frosted
SC1	10	0	1.35
SC2	0	-8	1.15
SC3	-18	-25	1.05
SC4	-25	-31	1.01

SC 2 : Nominal capacity for cooling design.

Air-on temperature is the air temperature at the intake side of the coil block.

## Correction factors

DT1 K	Evaporating temperature °C									
	+5	0	-5	-8	-10	-15	-20	-25	-30	-35
<b>R-404A dx</b>										
6	1.28	1.32	1.38		1.44	1.51	1.58	1.64	1.69	1.72
7	1.06	1.10	1.15		1.20	1.27	1.33	1.39	1.44	1.48
8	0.89	0.93	0.97	1.00	1.03	1.09	1.15	1.21	1.26	1.29
9	0.77	0.80	0.84		0.89	0.95	1.00	1.06	1.11	1.15
10	0.67	0.70	0.74		0.78	0.83	0.89	0.95	1.00	1.04
11	0.59	0.62	0.65		0.70	0.74	0.80	0.85	0.90	0.94
<b>R-134a dx</b>										
6	1.34	1.42	1.50		1.60	1.71	1.82	1.94		
7	1.11	1.17	1.25		1.34	1.43	1.54	1.64		
8	0.94	0.99	1.06		1.14	1.23	1.32	1.42		
9	0.81	0.86	0.92		0.99	1.07	1.16	1.25		
10	0.70	0.75	0.80		0.87	0.94	1.03	1.11		
11	0.62	0.66	0.71		0.77	0.84	0.92	1.00		
<b>R-22 dx</b>										
6	1.34	1.39	1.45		1.52	1.59	1.66	1.73	1.78	1.81
7	1.11	1.15	1.21		1.27	1.33	1.40	1.47	1.52	1.55
8	0.94	0.98	1.03		1.08	1.14	1.21	1.27	1.32	1.36
9	0.81	0.84	0.89		0.94	1.00	1.06	1.12	1.17	1.21
10	0.70	0.74	0.78		0.82	0.88	0.94	1.00	1.05	1.09
11	0.62	0.65	0.69		0.73	0.78	0.84	0.90	0.95	0.99
<b>R-404A pumped system</b>										
6	1.00	1.07	1.13		1.19	1.24	1.29	1.34	1.39	1.44
7	0.82	0.88	0.94		1.00	1.05	1.10	1.15	1.20	1.25
8	0.70	0.75	0.80		0.85	0.90	0.95	1.00	1.05	1.11
9	0.60	0.65	0.69		0.74	0.79	0.84	0.89	0.94	1.00
10	0.52	0.56	0.61		0.65	0.70	0.75	0.80	0.85	0.91
11	0.46	0.50	0.54		0.58	0.62	0.67	0.72	0.78	0.84
<b>R-22 pumped system</b>										
6	1.13	1.21	1.28		1.34	1.39	1.44	1.48	1.53	1.58
7	0.92	0.98	1.05		1.10	1.16	1.21	1.25	1.30	1.36
8	0.76	0.82	0.88		0.93	0.98	1.03	1.08	1.14	1.20
9	0.64	0.70	0.75		0.80	0.85	0.90	0.95	1.01	1.07
10	0.55	0.60	0.65		0.70	0.74	0.79	0.84	0.90	0.97
11	0.48	0.52	0.57		0.61	0.66	0.71	0.76	0.82	0.89

Correction factors for other refrigerants, alternative fin materials, coatings and optional coil block configurations on request.

## Capacities R-404A

Fin spacing 10 mm

Cooler model THOR	Capacities kW		Air flow m <sup>3</sup> /h	Coil surface m <sup>2</sup>	Int. vol. dm <sup>3</sup>	Weight kg	Dimensions		Fans		Air throw (m) THOR-B THOR-Z	Sound press. dB(A)	
	Frosted	Dry cond.					Length A mm	Height B mm	Cap. kW	Nr			
	t <sub>0</sub> =-8°C DT <sub>1</sub> =8K	t <sub>0</sub> =-8°C DT <sub>1</sub> =8K											
314 - 10	6.4	5.6	7210	26.0	17	86	1320	880	0.37	1	27	33	63
316 - 10	8.8	7.7	7130	38.9	25	97	1320	880	0.37	1	27	33	63
318 - 10	11.1	9.7	7050	51.9	33	109	1320	880	0.37	1	27	33	64
324 - 10	12.8	11.2	14400	51.9	27	137	2120	880	0.37	2	27	33	66
326 - 10	17.7	15.4	14300	77.9	40	160	2120	880	0.37	2	27	33	66
328 - 10	22.2	19.3	14100	103.8	54	183	2120	880	0.37	2	27	33	67
334 - 10	18.9	16.4	21600	77.9	37	188	2920	880	0.37	3	27	33	68
336 - 10	27.0	23.5	21400	116.8	56	222	2920	880	0.37	3	27	33	68
338 - 10	33.2	28.8	21200	155.8	74	257	2920	880	0.37	3	27	33	68
344 - 10	25.7	22.3	28800	103.8	47	239	3720	880	0.37	4	27	33	69
346 - 10	35.4	30.8	28500	155.8	71	285	3720	880	0.37	4	27	33	69
348 - 10	44.5	38.7	28200	207.7	95	331	3720	880	0.37	4	27	33	70
354 - 10	44.5	38.7	36100	129.8	58	290	4520	880	0.37	5	27	33	70
356 - 10	32.1	27.9	35700	194.7	86	347	4520	880	0.37	5	27	33	70
358 - 10	44.7	38.9	35300	259.6	115	405	4520	880	0.37	5	27	33	71
364 - 10	55.9	48.6	43300	155.8	68	341	5320	880	0.37	6	27	33	71
366 - 10	37.8	32.9	42800	233.6	102	410	5320	880	0.37	6	27	33	71
368 - 10	54.0	47.0	42300	311.5	136	479	5320	880	0.37	6	27	33	71
414 - 10	66.3	57.6	9020	32.4	19	97	1520	880	0.75	1	29	35	65
416 - 10	8.0	7.0	8910	48.7	29	112	1520	880	0.75	1	29	35	65
418 - 10	11.1	9.7	8810	64.9	38	126	1520	880	0.75	1	29	35	65
424 - 10	13.9	12.1	18000	64.9	32	157	2520	880	0.75	2	29	35	68
426 - 10	16.0	13.9	17800	97.3	48	186	2520	880	0.75	2	29	35	68
428 - 10	22.3	19.4	17600	129.8	64	215	2520	880	0.75	2	29	35	68
434 - 10	27.9	24.3	27000	97.3	45	217	3520	880	0.75	3	29	35	69
436 - 10	24.0	20.9	26700	146.0	67	260	3520	880	0.75	3	29	35	69
438 - 10	33.4	29.0	26400	194.7	90	303	3520	880	0.75	3	29	35	70
444 - 10	41.5	36.1	36100	129.8	58	277	4520	880	0.75	4	29	35	71
446 - 10	32.1	27.9	35700	194.7	86	334	4520	880	0.75	4	29	35	71
448 - 10	44.7	38.9	35300	259.6	115	392	4520	880	0.75	4	29	35	71
454 - 10	55.9	48.6	45100	162.2	70	337	5520	880	0.75	5	29	35	72
456 - 10	56.2	48.9	44600	243.4	106	409	5520	880	0.75	5	29	35	72
458 - 10	68.7	59.8	44100	324.5	141	481	5520	880	0.75	5	29	35	72
464 - 10	48.0	41.8	54100	194.7	83	396	6520	880	0.75	6	29	35	72
466 - 10	66.9	58.2	53500	292.0	125	483	6520	880	0.75	6	29	35	72
468 - 10	79.6	69.2	52900	389.4	166	569	6520	880	0.75	6	29	35	73



## Fans

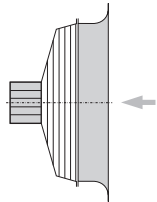
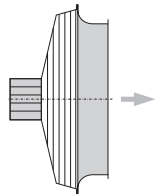
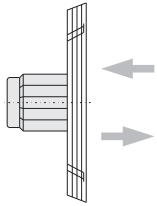
In view of its flexible construction, in principle THOR can be supplied with any desired fan.

Depending on the application there is a standard series of fans which match THOR perfectly.

These fans can be supplied in both blow-through and draw-through versions.

### Execution

The fans are fitted with balanced aluminium or polyamide fan blades. Plate fans are fitted with robust electrolytically galvanized and epoxy coated fan guards according to DIN 31001 and are mounted in vibration dampers. Short case fans are fitted with stainless steel fan guards.



Enclosed design spray-tight motors, protection class IP-55.

All motors, with the exception of the 0.37 kW, 230/50/1 motor, are equipped with a thermal safety device built in the windings, connected to separate terminals in the box.

This safety device can therefore be integrated into the control circuit. The electrical control should be arranged preferably with a manual reset device in order to prevent continuous on/off switching (tripping) of the motors.

Cable inlet ranges from 7 up to 12 mm.

## Air throw

Air throws as given in the tables are for ceiling mounted coolers at  $t = 20\text{ °C}$ , an unrestrained air flow in the cold room and a minimal air velocity of 0.25 m/s at air throw distance.

## Sound pressure dB(A)

Sound pressure as given in the tables are sound pressure levels in dB(A) according to EN 13487 at 5 m distance in free field conditions. Values may deviate depending on situations at site. The table below gives calculated sound pressure corrections at various distances.

Distance m	Correction dB(A)
1	+ 14
2	+ 8
3	+ 4
4	+ 2
5	0
10	- 6
20	-12
50	-20

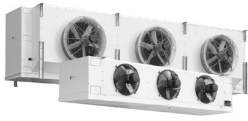
## Fans 50 Hz / 1500 rpm

Fan motor W	Motor voltage* V	Electric capacity		Adj. values overload relays A			Cable inlet
		nom. kW	abs. kW***	0°C	-20°C	-40°C	
250	230/400/3	0.25	0.37	1.1	1.1	1.2	2 x M20 x 1.5
220	230/1	0.22	0.37	2.6	2.8	2.9	2 x M20 x 1.5
370	230/400/3	0.37	0.50	1.4	1.4	1.5	2 x M20 x 1.5
370	230/1**	0.37	0.50	3.7	4.0	-	2 x M20 x 1.5
550	230/400/3	0.55	0.70	1.7	1.8	2.0	2 x M20 x 1.5
550	230/1	0.55	0.70	5.5	6.0	6.2	2 x M20 x 1.5
750	230/400/3	0.75	0.70	2.1	2.3	2.4	2 x M20 x 1.5
1200	230/400/3	1.20	1.20	3.0	3.2	3.4	2 x M20 x 1.5
2400	230/400/3	2.40	2.80	6.8	7.3	7.8	2 x M20 x 1.5

\* Motor windings 230 Volt.

\*\* These 230/50/1 motors are suitable for temperatures down to -20 °C and are not provided with a thermal safety device in the windings.

\*\*\* Absorbed fan motor energy is measured in under laboratory conditions at ambient temperature 20 °C. These values may vary depending on local conditions.



### Defrost Systems

Several forced defrost systems are available. Each defrost system is optimised for specific applications and ambient conditions.

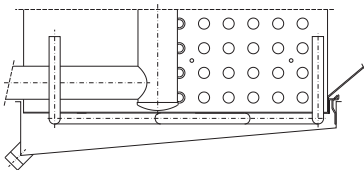
Recommended Defrost System						
Air in Temperature °C	+5	0	-5	-15	-25	-35
Hotgas defrost G 1		■				
G 2 G 2 + I			■	■	■	
Electric Defrost E1 E1 + I 3		■	■	■	■	
E2 E2 + I 3		■	■	■	■	
E4		■				

Temperatures may vary depending on operating conditions.

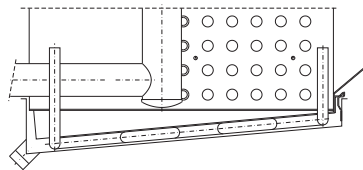
### Hot Gas Defrost (G)

The driptray can be fitted with a copper defrost coil (G) to bring it rapidly up to temperature by means of hot gas. The following G-systems are available :

- G1** For modules 1, 2, 3 and 4 only :  
*Air on temperature down to - 5 °C.*  
Defrost coil under the coil block.
- G2** *Air on temperature down to - 25 °C.*  
Defrost coil in the drip tray.
- G2 + I** *Air on temperature down to - 35 °C.*  
G2, additionally equipped with an insulated double driptray.



**Hot gas defrost G1**  
For modules 1, 2, 3 and 4 only.



**Hot gas defrost G2**

### Electric Defrost (E)

Stainless steel heater elements placed in additional tubes between the evaporator tubes. The elements for the driptray are fitted to the bottom of the inner tray.

Both coil and driptray have the same elements. Standard voltage per element 230 V.  
Connection to 230 V / 1 phase or 400 V / 3 phase, connected in star with Zero-Wire. Total defrost power is given for 400 V / 3 phase with Zero-Wire.

All elements can be withdrawn at the refrigerant connection side. The driptray elements can be taken out after removal of the outer tray.

The heater elements are pre-wired and are connected to one or more terminal boxes.

Depending on the ambient temperature and air humidity a number of E-executions are available.

- E1** *Air on temperature down to - 25 °C.*  
Electric stainless steel defrost elements in the driptray. For use in combination with for example hot gas defrost in the coil block.
- E1 + I 3** *Air on temperature down to - 35 °C.*  
E1, additionally equipped with an insulated double driptray. Recommended for general use in the low-temperature region.
- E2** *Air on temperature down to - 25 °C.*  
Electric stainless steel defrost elements in the coil block and driptray. Recommended for general use.
- E2 + I 3** *Air on temperature down to - 35 °C.*  
E2, additionally equipped with an insulated double driptray. Recommended for general use in the low-temperature region.
- E4** *Air on temperature down to - 5 °C.*  
Electric stainless steel defrost elements in the coil block and driptray, low duty.
- E5** Electric defrost in diffuser for defrost damper.  
(THOR-B only)

### Hot Glycol Defrost (HW)

- HW1** Hot glycol defrost in coil and driptray.  
*High temperatures.*
- HW2** Hot glycol defrost in coil and driptray.  
*Low temperatures.*

### Water Defrost (W)

- W** Water defrost system for defrosting in the temperature range to -20 °C.

### **Alfa Laval in brief**

Alfa Laval is a leading global provider of specialized products and engineered solutions.

Our equipment, systems and services are dedicated to helping customers to optimize the performance of their processes. Time and time again.

We help our customers to heat, cool, separate and transport products such as oil, water, chemicals, beverages, foodstuffs, starch and pharmaceuticals.

Our worldwide organization works closely with customers in almost 100 countries to help them stay ahead.

### **How to contact Alfa Laval**

Up-to-date Alfa Laval contact details for all countries are always available on our website at [www.alfalaval.com](http://www.alfalaval.com)