

High-efficiency Heating Circulator

Calio Z

Type Series Booklet



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Type Series Booklet Calio Z

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Building Services: Heating

Variable Speed Heating Circulators

Calio Z



Main applications

- Heating, ventilation, air-conditioning, cooling and circulation systems
- One-pipe systems and two-pipe systems
- Underfloor heating systems
- Boiler circuits or primary circuits
- Storage tank circuits
- Solar power systems
- Heat pumps

Fluids handled

- Heating water to VDI 2035
- Higher-viscosity fluids (water/glycol mixture up to a mixing ratio of 1:1)

Operating data

Table 1: Operating properties

Characteristic		Value
Flow rate	Q [m³/h]	≤ 70
	Q [l/s]	≤ 19,4
Head	H [m]	≤ 18
Fluid temperature	T [°C]	≥ -10
		≤ +110
Ambient temperature	T [°C]	≥ 0
		≤ +40 ¹⁾
Operating pressure	p [bar]	≤ 16
Pressure class	PN [bar]	6/10/16
Average sound pressure level	[dB (A)]	≤ 45
Screw-ended connection	G	2
Flanged connection	DN	32 - 65

¹ Ambient temperature ≤ + 30 °C at a fluid temperature > 90 °C

Design details

Design

- Maintenance-free high-efficiency wet rotor pump (glandless)
- Twin pump

Drive

- High-efficiency permanent magnet synchronous motor, brushless, self-cooling, with continuously variable differential pressure control
- Integrated motor protection
- 1~230 V AC +/- 10%
- Frequency 50 Hz/60 Hz
- Enclosure IPX4D
- Thermal class F
- Temperature class TF 110
- Energy efficiency index EEI ≤ 0.23

P1 < 400 W:

- Interference emissions EN 55014-1, EN 61000-3-2, EN 61000-3-3
- Interference immunity EN 55014-2

P1 > 400 W:

- Interference emissions EN 61800-3
- Interference immunity EN 61800-3

Bearings

- Product-lubricated special plain bearing

Connections

- Screw-ended or flanged

Operating modes

- Constant-pressure control
- Proportional-pressure control
- Temperature-governed differential pressure control (can only be activated with KSB ServiceTool)
- Open-loop control via setpoint setting
- Eco Mode

Automatic functions

- Continuously variable speed adjustment depending on the mode of operation
- 0 - 10 V with external differential pressure/speed setpoint
- 0 - 10 V as input of the actual value of the temperature or actual value of the differential pressure
- Pump changeover after 24 hours runtime of a pump
- Redundancy by automatic start-up of the stand-by pump in the event of a duty pump failure
- Dual-pump operation
- Peak load operation (can only be enabled with KSB ServiceTool)
- Setback operation
- Dynamic Control
- Remote ON/OFF

- Deblocking function
- Self-venting function
- Soft start
- Full motor protection with integrated trip electronics

Manual functions

- Setting the operating mode
- Setting the discharge head setpoint
- Setting the speed level
- Vent plug
- Locking the control panel

Signalling functions and display functions

- Periodically alternating display of flow rate, head and electrical input power
- Operating status shown on the display
- Error codes indicated on the display
- Configurable general fault messages and "in operation" messages (volt-free changeover contacts)
- Serial digital Modbus RTU interface
- Service interface for KSB ServiceTool

Designation

Example: Calio Z 40-180

Table 2: Designation key

Code	Description	
Calio Z	Type series	
40	Connection	
	30	G 2
	32	DN 32
	40	DN 40
	50	DN 50
	65	DN 65
180	Head H ²⁾ [m]	
	180	Head × 10 Example: 18 m × 10 = 180

Materials

Table 3: Overview of available materials

Part No.	Description	Material
102	Volute casing	Grey cast iron with cathodic electrocoating (EN-GJL-200)
210	Shaft	Stainless steel 1.4034
230	Impeller	Plastic with glass fibre content (PSU-GF30)
310	Bearing	Ceramics/carbon
746	Change-over flap	Plastic with glass fibre content/EPDM
817	Can	Stainless steel 1.4301

Casing parts which are in contact with the atmosphere and with the fluid handled are free from paint-wetting impairment materials.

Product benefits

- High-efficiency technology combined with speed control and efficient operation by means of **Dynamic Control** offer maximum savings.
- Future-proof by maximum energy efficiency, exceeding current energy efficiency regulations such as ErP 2015.
- All-in concept saves investment costs and commissioning costs.
- Easy-to-use combination of controls, integrated display and symbols to show the operating status
- High availability by dual-pump operation and integrated protective functions
- New Eco Mode enables additional savings of more than 40 % compared to proportional-pressure control. (⇒ Page 8)

Product information

Product information as per Regulation No. 1907/2006 (REACH)

For information as per European chemicals regulation (EC) No. 1907/2006 (REACH) see <https://www.ksb.com/en-global/company/corporate-responsibility/reach>.

² At flow rate Q = 0 m³/h

Certifications

Table 4: Overview

Label	Effective in:	Comment
	Europe	EEI ≤ 0,23

Selection information

Minimum inlet pressure

The minimum inlet pressure $p_{\min}$ at the pump suction nozzle serves to avoid cavitation noises at the indicated fluid temperature $T_{\max}$.

The indicated values are applicable up to 300 m above sea level. For installation at altitudes > 300 m, an allowance of 0.01 bar / 100 m must be added.

Table 5: Minimum inlet pressure $p_{\min}$ specified for the fluid temperature $T_{\max}$.

Fluid temperature [°C]	Minimum inlet pressure [bar]
≤ 80	0,5
81 to 95	1,5
96 to 110	2,5

Permissible fluid temperature

Table 6: Temperature limits of the fluid handled

Permissible fluid temperature	Value
Maximum	+110 °C
Minimum	-10 °C

Permissible ambient temperature

Table 7: Permissible ambient temperatures specified for the fluid temperature

Fluid temperature [°C]	Permissible ambient temperature [°C]
≤ +90	+40
> +90	+30

Description of the Modbus interface

Table 8: Technical data of the Modbus interface

Parameter	Description/value
Terminal cross-section	1,5 mm ²
Interface	RS485 (TIA-485-A) optically isolated
Bus connection	0.5 mm ² , shielded twisted pair bus cable
Cable length	1000 m max. - Stub line impermissible - For cable lengths > 30 m take suitable measures to ensure overvoltage protection.
Wave impedance	120 Ω (cable type B to TIA-485-A)
Data rates [baud]	4800, 9600, 38,400, 57,600, 115,200 (19,200 = factory setting)
Protocol	Modbus RTU standard
Data format	8 data bits - Parity EVEN / ODD / NONE 1 stop bit
Modbus address	ID #1 to #247 selectable (ID #17 = factory setting)

 Further description see operating manual of the pump set.

Description of the Eco Mode

In Eco Mode, the pump characteristic curve (1) is quadratic. Starting at the discharge head setpoint H_s , the characteristic curve intersects the discharge head axis at $H_0 = 1/4 \times H_s$. By changing the differential pressure setpoint this pump characteristic curve can be adjusted to higher or lower differential pressures or discharge heads.

Compared with the Proportional-pressure Control operating mode the Eco Mode can save more than 40 % in electrical input power.

An example of a characteristic curve of a pump in Eco Mode is shown below.

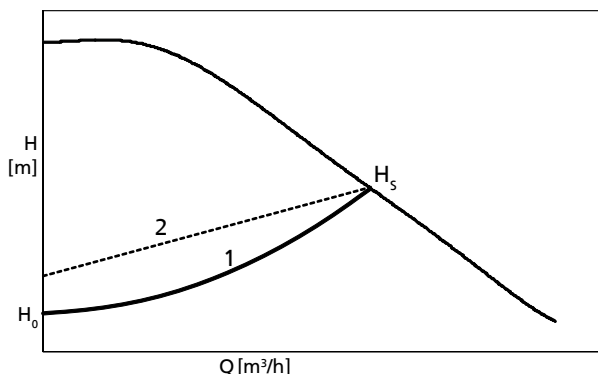


Fig. 1: Eco Mode function

1	Eco Mode characteristic curve
2	Proportional-pressure Control characteristic curve for comparison

Dynamic Control description

The dynamic control (2) system detects when the selected control curve (3) is higher than the minimum characteristic curve³⁾ (4). The control system shifts the control curve downward, and power input is reduced automatically. To ensure sufficient supply the pump set switches to a higher control curve when the minimum characteristic curve is reached. The energy input is reduced (1) without any negative impact on the supply of the building.

The pump set is operated in an optimised way, even if the system characteristic curve is unknown; the noise at the thermostatic valves is reduced.

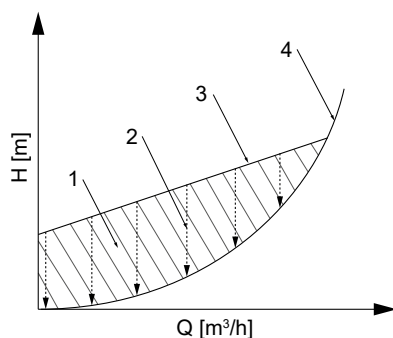


Fig. 2: Principle of dynamic control

1	Excess energy input	3	Control curve
2	Dynamic control	4	Minimum characteristic curve

Description of the characteristic curve

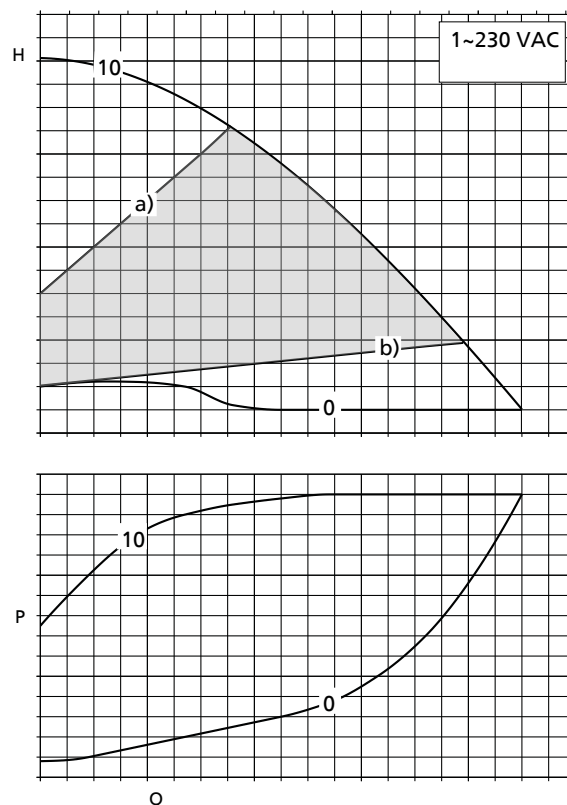


Fig. 3: Selection example

i The pump characteristic curve can be adjusted between a) and b) in increments of 1 % by turning the control element.

0	Level 0 = open-loop control, minimum speed (corresponds to a setting of 0 %)
10	Level 10 = open-loop control, maximum speed (corresponds to a setting of 100 %)
	Control range
a)	Control curve, maximum head
b)	Control curve, minimum head

³ Characteristic curve at fully open thermostatic valves

Technical data

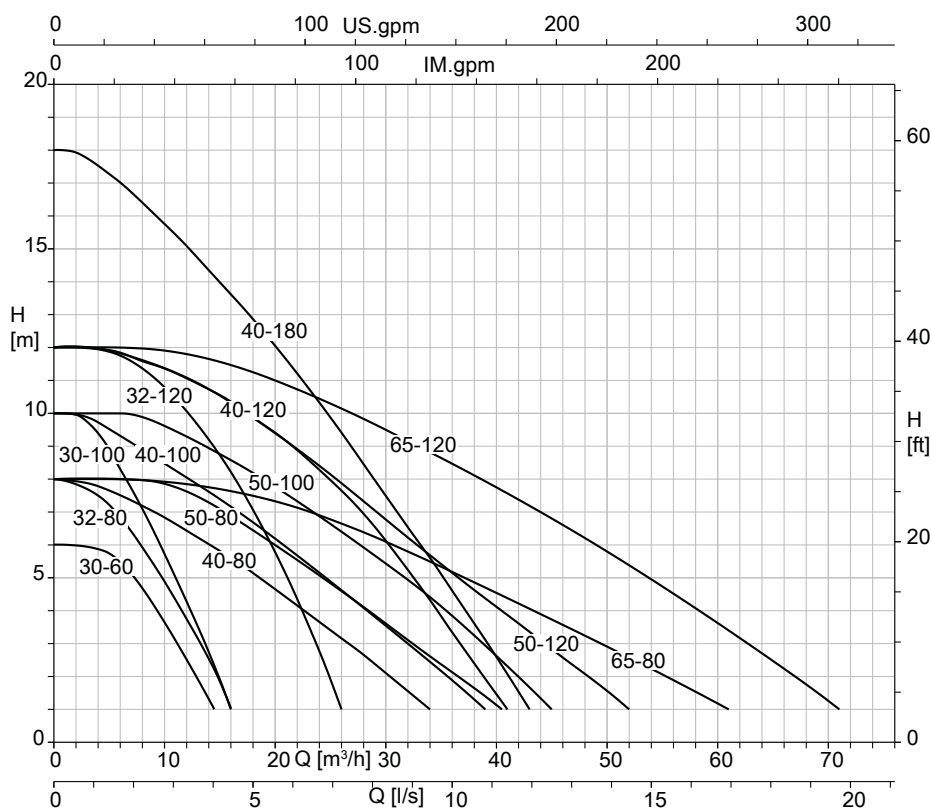
Calio Z

Table 9: Technical data

Size	Connection		PN	n		P ₁ ⁴⁾	I _N ⁴⁾	Mat. No.	[kg]
	Piping	Pump	[bar]	Min.	Max.	[W]	1~230 VAC, 50/60 Hz		
				[rpm]	[rpm]		[A]		
30-60	R 1 1/4	G 2	6/10/16	1000	3500	3,5 - 170 (320)	0,15 - 0,74 (1,40)	29134897	10,75
30-100	R 1 1/4	G 2	6/10/16	1000	4500	3,5 - 210 (410)	0,15 - 0,91 (1,80)	29134898	10,75
32-80	DN 32	DN 32	6/10/16	1000	4000	3,5 - 170 (340)	0,15 - 0,74 (1,50)	29134899	15,1
32-120	DN 32	DN 32	6/10/16	1000	4000	3,5 - 430 (780)	0,15 - 1,87 (3,40)	29134900	16,06
40-80	DN 40	DN 40	6/10/16	1000	3600	3,5 - 340 (700)	0,15 - 1,48 (3,00)	29134901	17,42
40-100	DN 40	DN 40	6/10/16	1000	4000	3,5 - 420 (850)	0,15 - 1,83 (3,70)	29134902	17,42
40-120	DN 40	DN 40	6/10/16	1000	2900	5 - 840 (1680)	0,32 - 3,65 (7,30)	29134873	28,61
40-180	DN 40	DN 40	6/10/16	1000	3500	5 - 770 (1460)	0,32 - 3,35 (6,40)	29134874	28,61
50-80	DN 50	DN 50	6/10/16	1000	3500	3,5 - 390 (660)	0,15 - 1,70 (2,90)	29134903	23,56
50-100	DN 50	DN 50	6/10/16	1000	2750	5 - 490 (960)	0,32 - 2,13 (4,20)	29134875	31,71
50-120	DN 50	DN 50	6/10/16	1000	2930	5 - 570 (1080)	0,32 - 2,48 (4,70)	29134876	31,71
65-80	DN 65	DN 65	6/10/16	1000	2850	3,5 - 590 (1100)	0,15 - 2,57 (4,80)	29134877	39,39
65-120	DN 65	DN 65	6/10/16	1000	3200	5 - 840 (1680)	0,32 - 3,65 (7,30)	29134878	39,39

Selection chart

Calio Z (parallel operation)

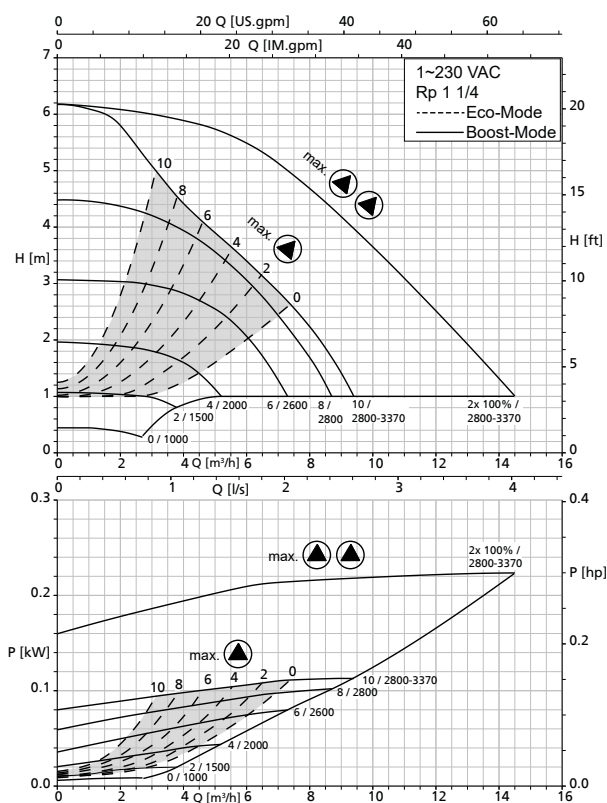


1157.541/08-EN

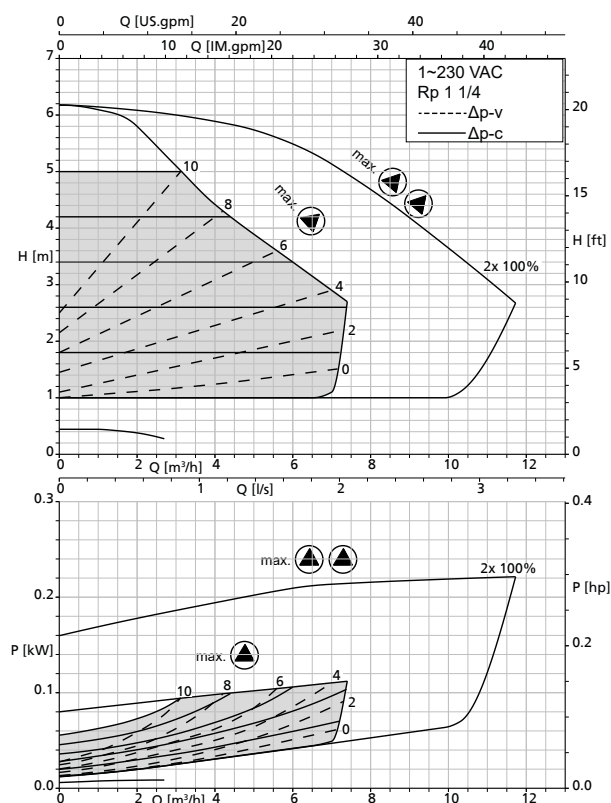
⁴ The value in parentheses applies to operation of both pump sets.

Characteristic curves

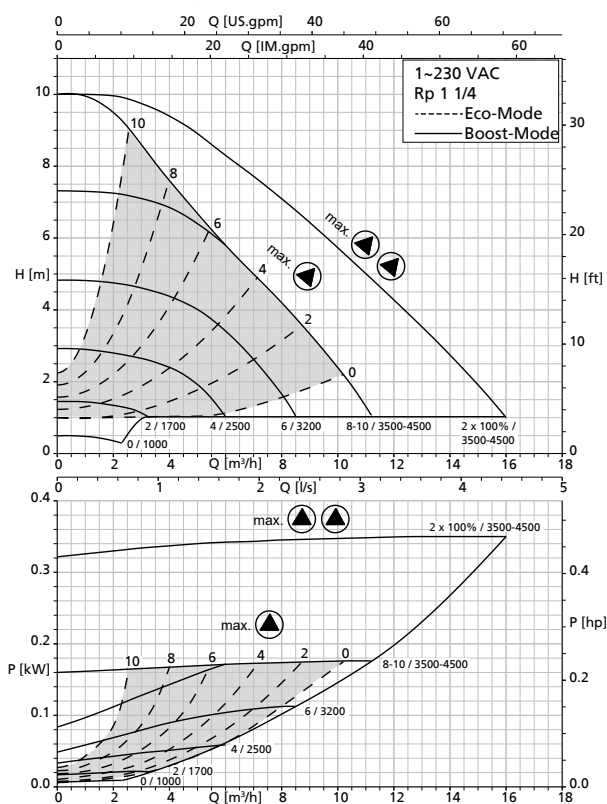
Calio Z 30-60 Open-loop Control, Eco Mode



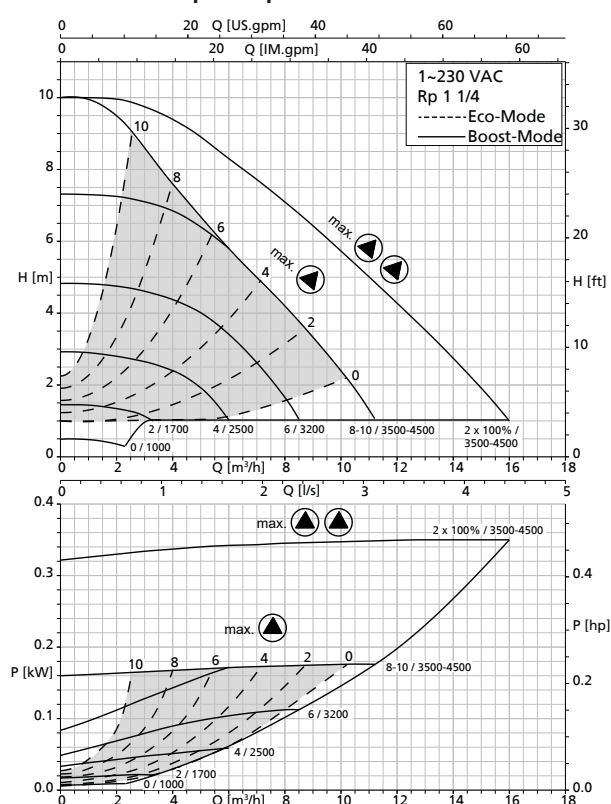
Calio Z 30-60 $\Delta p_v + \Delta p_c$

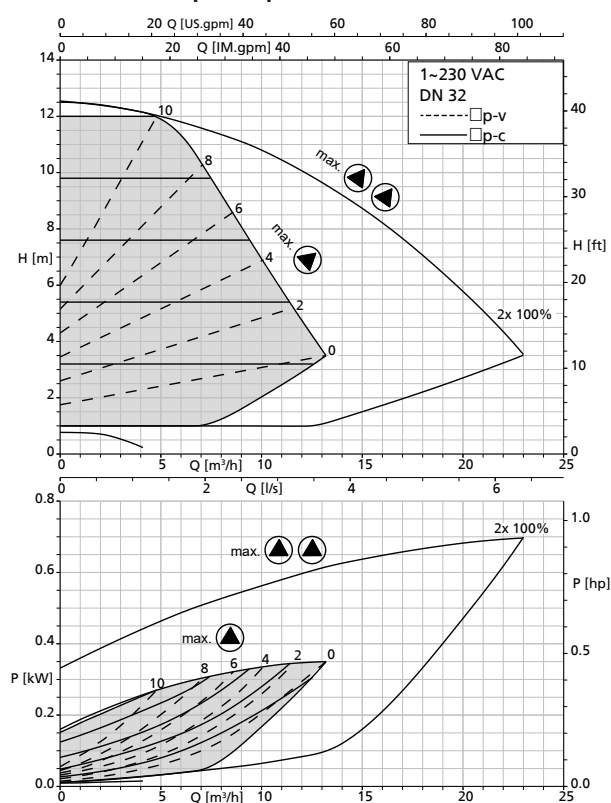
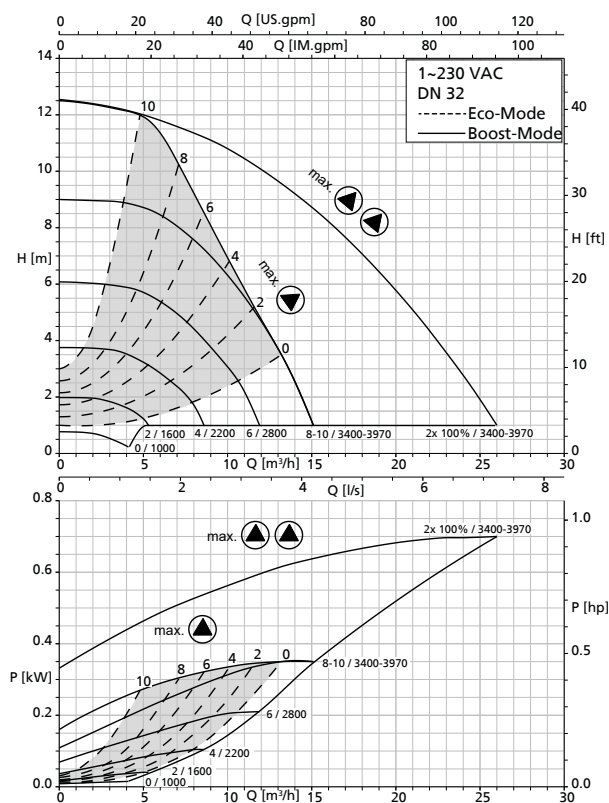
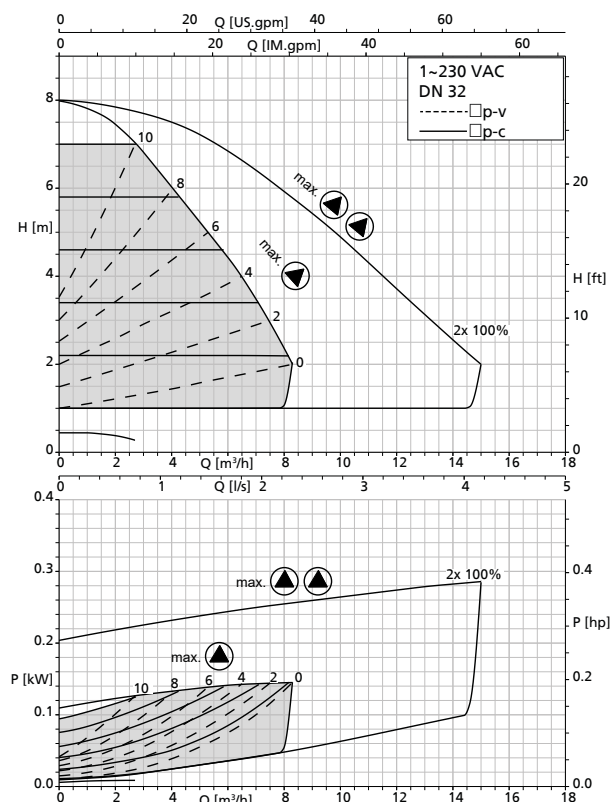
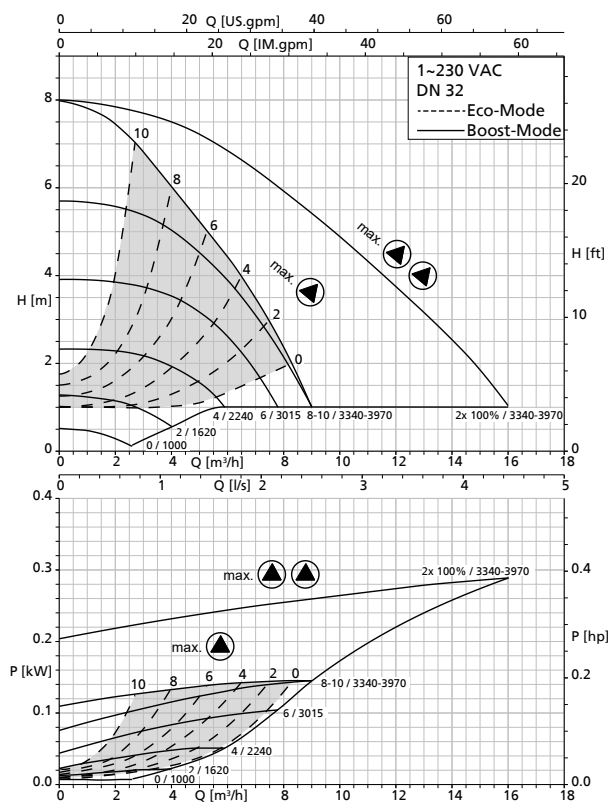


Calio Z 30-100 Open-loop Control, Eco Mode

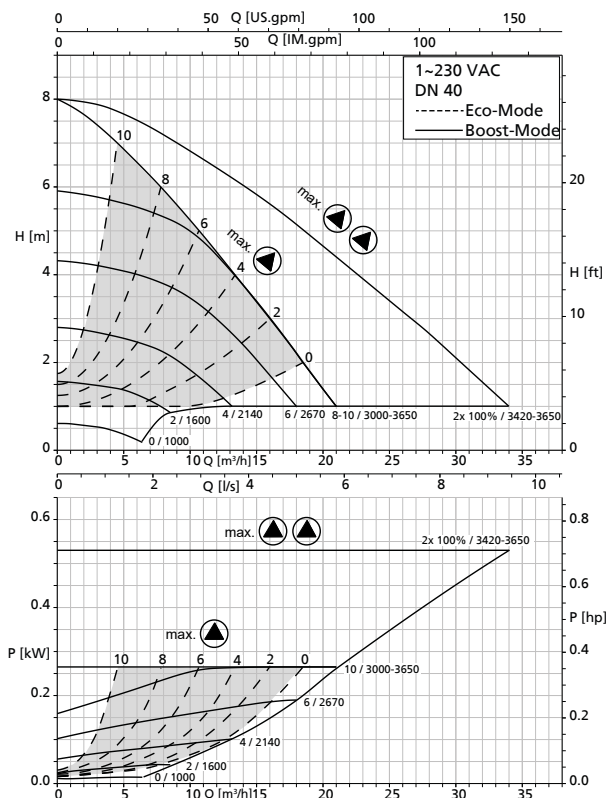


Calio Z 30-100 $\Delta p_v + \Delta p_c$

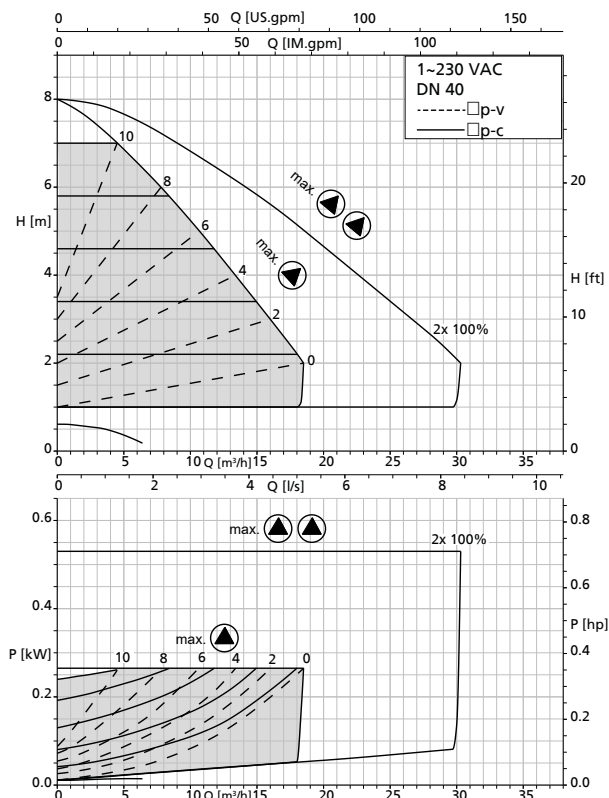




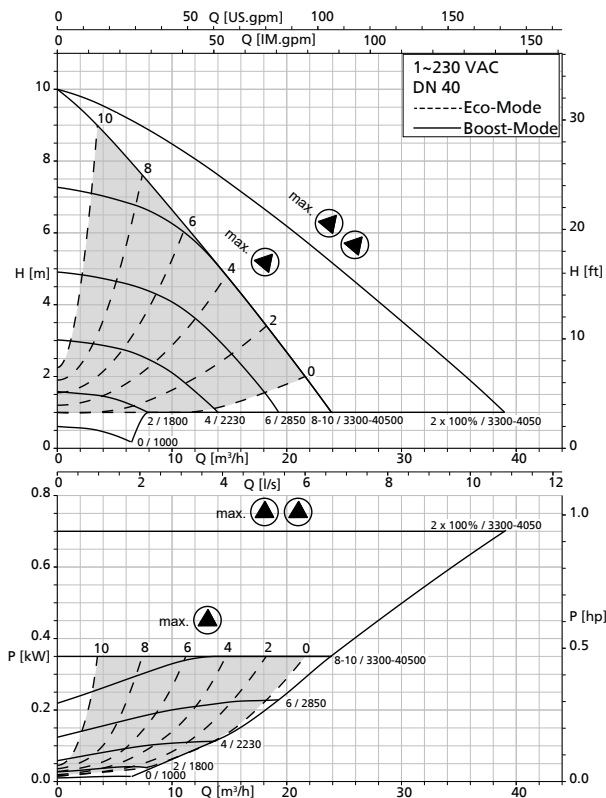
Calio Z 40-80 Open-loop Control, Eco Mode



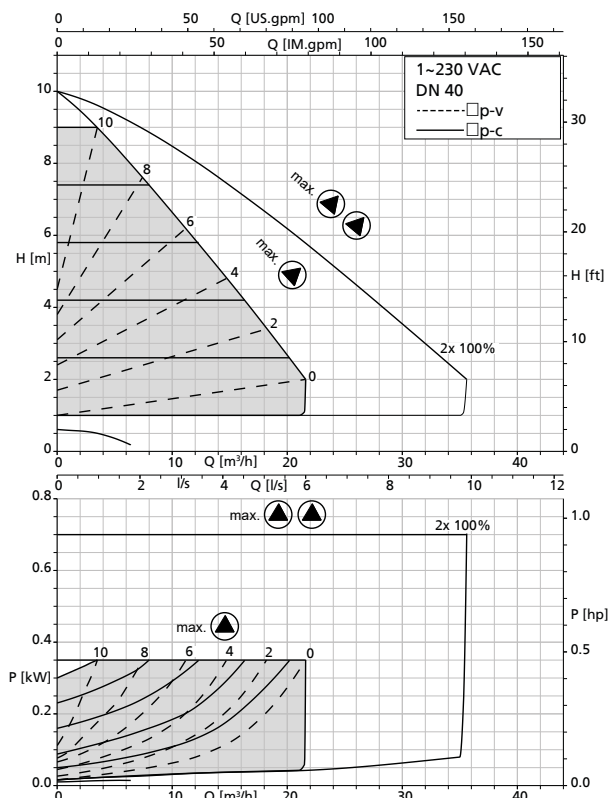
Calio Z 40-80 $\Delta p_v + \Delta p_c$



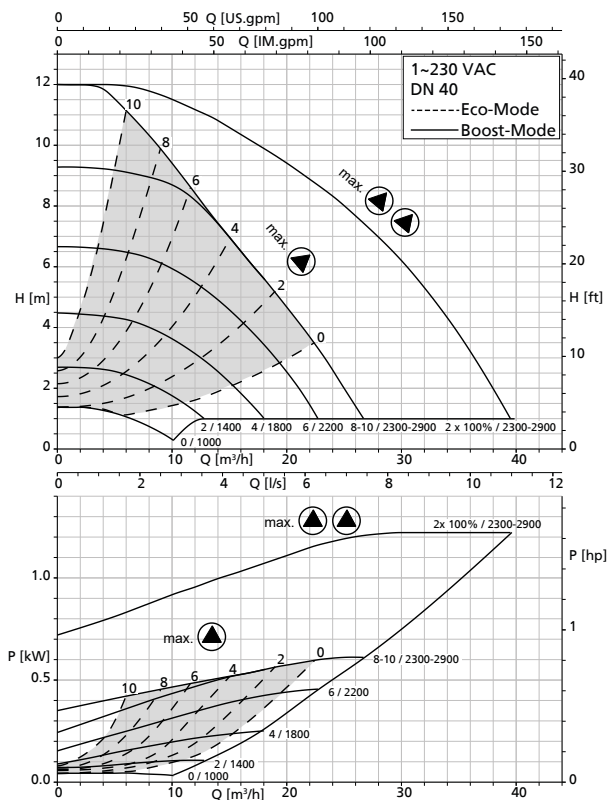
Calio Z 40-100 Open-loop Control, Eco Mode



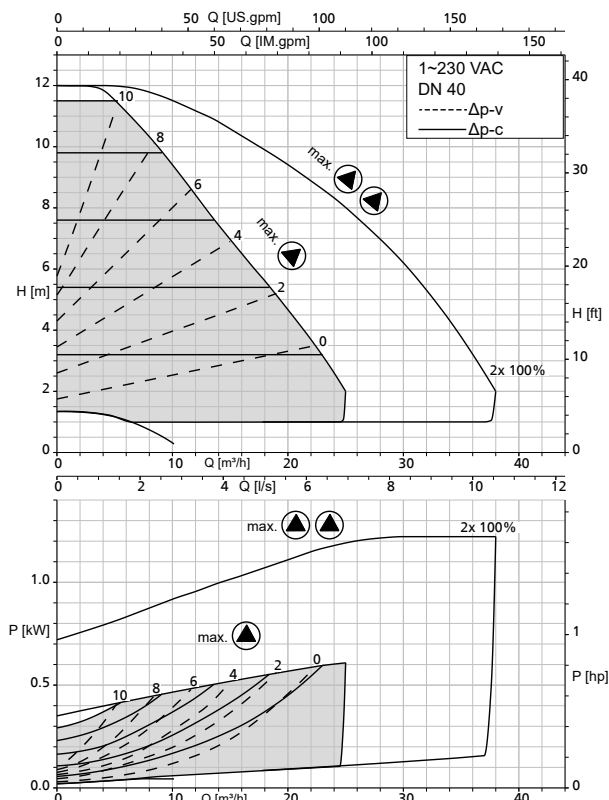
Calio Z 40-100 $\Delta p_v + \Delta p_c$



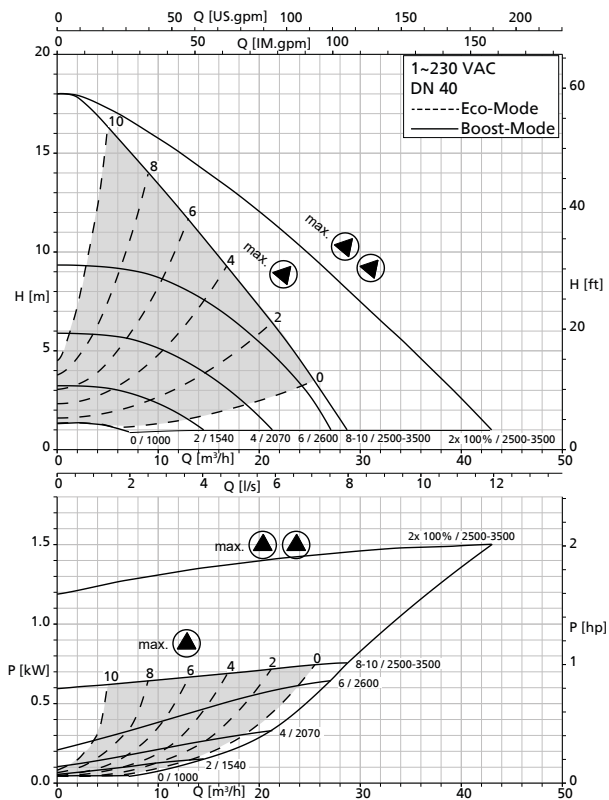
Calio Z 40-120 Open-loop Control, Eco Mode



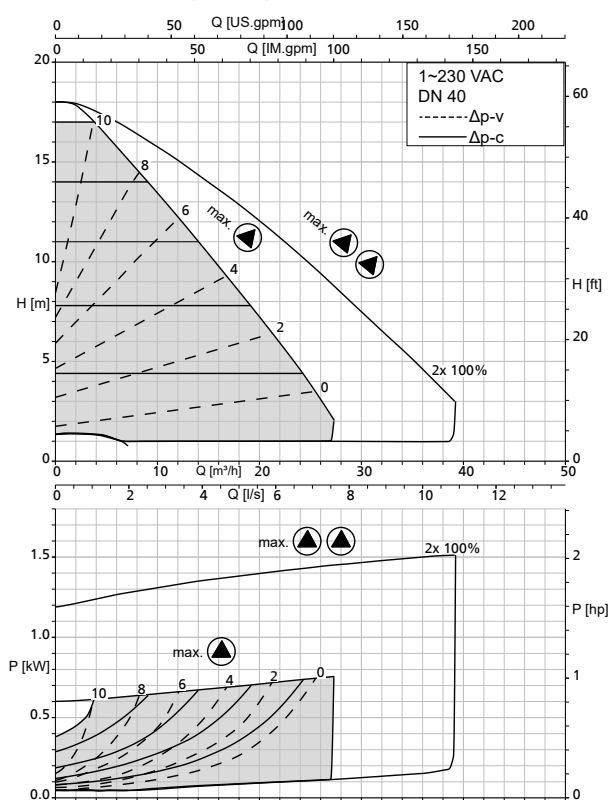
Calio Z 40-120 $\Delta p_v + \Delta p_c$



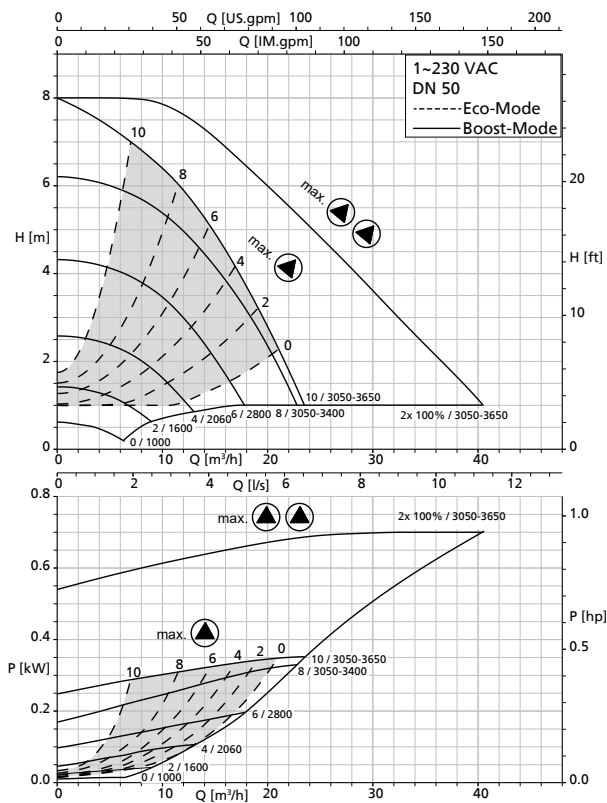
Calio Z 40-180 Open-loop Control, Eco Mode



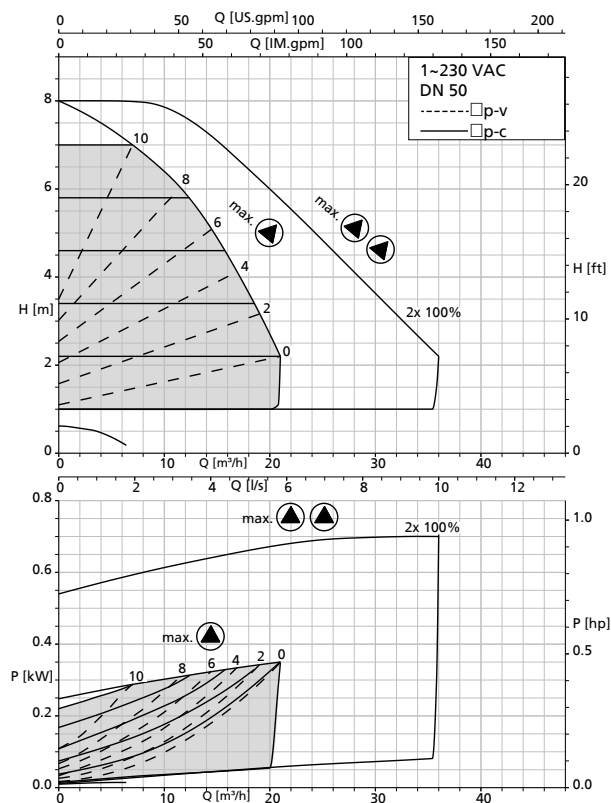
Calio Z 40-180 $\Delta p_v + \Delta p_c$



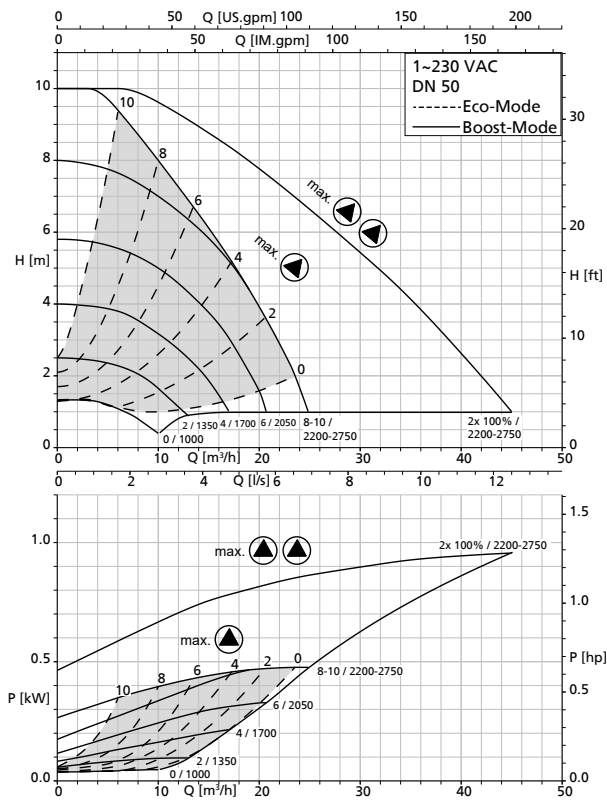
Calio Z 50-80 Open-loop Control, Eco Mode



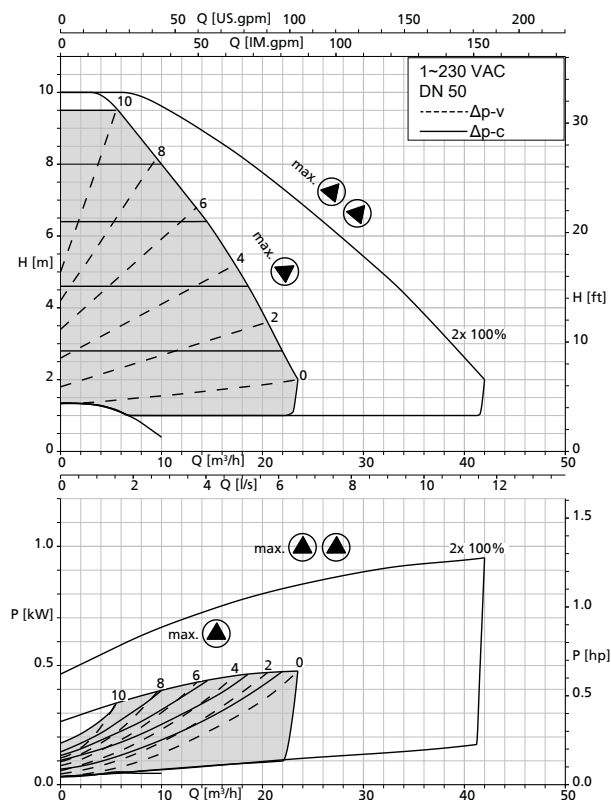
Calio Z 50-80 $\Delta p_v + \Delta p_c$



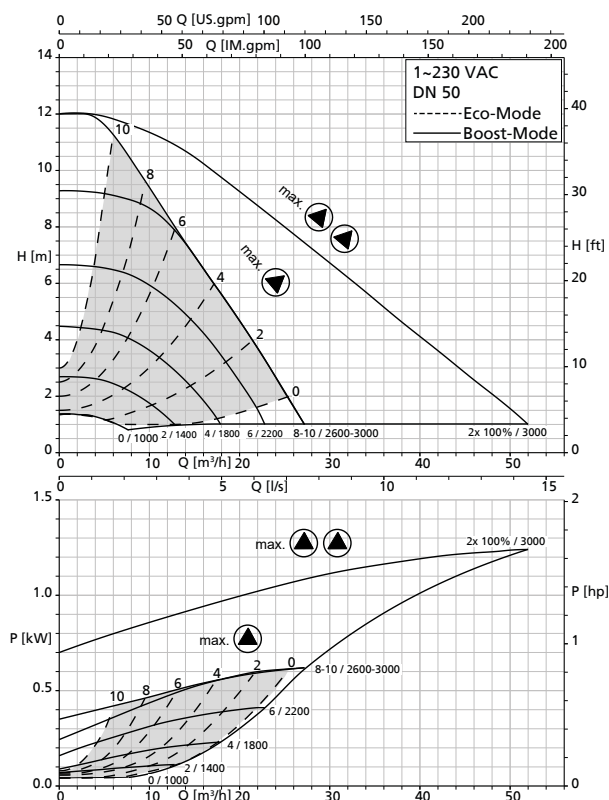
Calio Z 50-100 Open-loop Control, Eco Mode



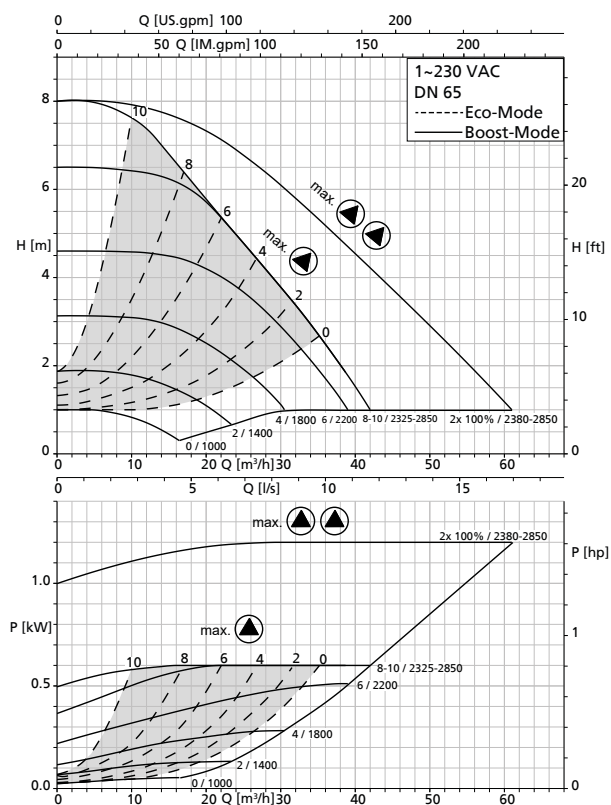
Calio Z 50-100 $\Delta p_v + \Delta p_c$



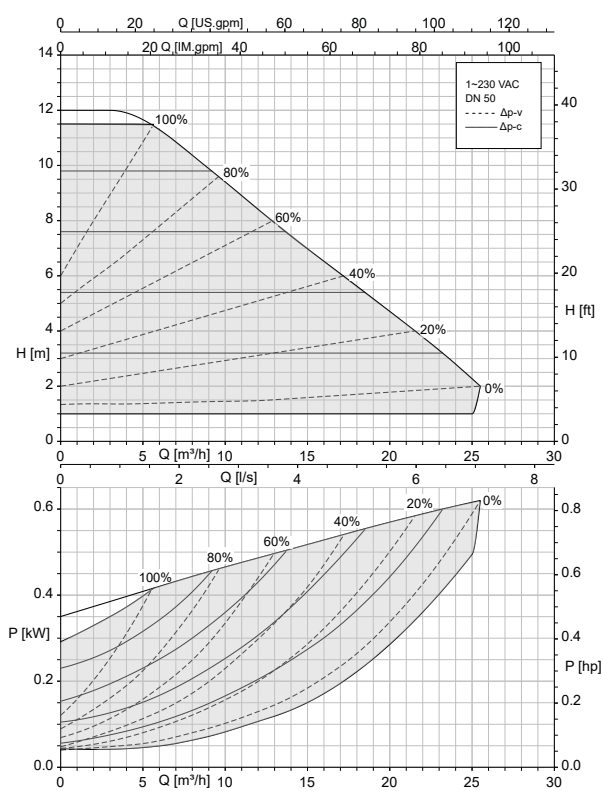
Calio Z 50-120 Open-loop Control, Eco Mode



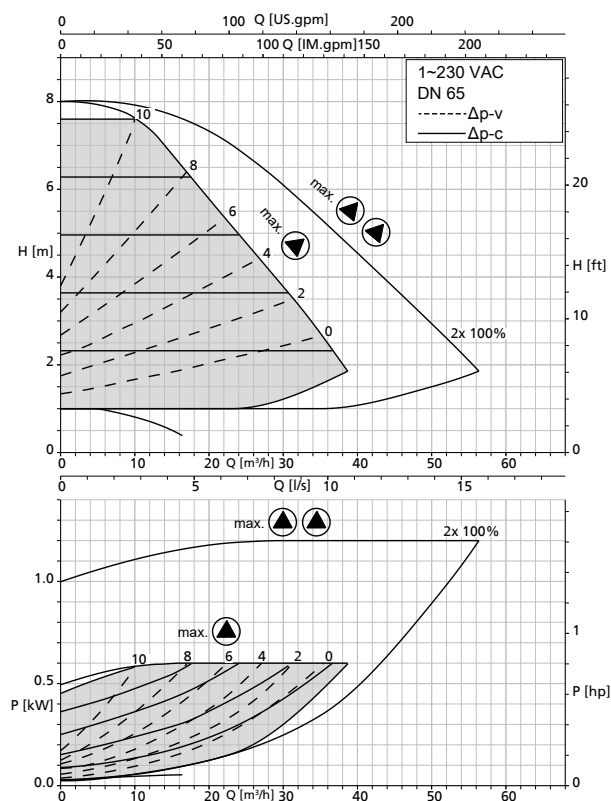
Calio Z 65-80 Open-loop Control, Eco Mode



Calio Z 50-120 $\Delta p_v + \Delta p_c$



Calio Z 65-80 $\Delta p_v + \Delta p_c$



1~230 VAC
DN 65

-----Eco-Mode
———Boost-Mode

H [m]
H [ft]

Q [l/min]
Q [US.gpm]
Q [m³/h]

max.

2 / 1480
0 / 1000
4 / 1960
6 / 2440
8-10 / 2560-3220
2x 100% / 2560-3220

P [kW]

20 Q [m³/h]

max.

2 / 1480
0 / 1000
4 / 1960
6 / 2440
8-10 / 2560-3220
2x 100% / 2560-3220

**1~230 VAC
DN 65**

----- $\Delta p-v$
—— $\Delta p-c$

Top Graph: Head (H) vs. Flow Rate (Q)

- Y-axis:** H [m] (0 to 12), H [ft] (0 to 40)
- X-axis:** Q [US.gpm] (0 to 300), Q [IM.gpm] (0 to 200), $20Q$ [m³/h] (0 to 30)
- Efficiency Islands:** 0, 2, 4, 6, 8, 10
- Pressure Drop Curves:** $\Delta p-v$ (dashed), $\Delta p-c$ (solid)
- Max Flow Points:** Indicated by pump symbols and 'max' labels.
- 2x 100%:** Point at approximately 65 m³/h and 2.5 m head.

Bottom Graph: Power (P) vs. Flow Rate (Q)

- Y-axis:** P [kW] (0.0 to 1.5), P [hp] (0 to 2)
- X-axis:** $20Q$ [m³/h] (0 to 30)
- Efficiency Islands:** 0, 2, 4, 6, 8, 10
- 2x 100%:** Point at approximately 65 m³/h and 2.5 kW power.

Dimensions

Pump set dimensions

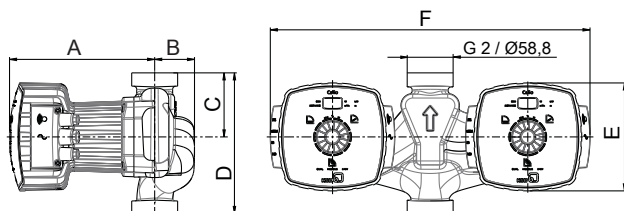


Fig. 4: Screw-ended pump set

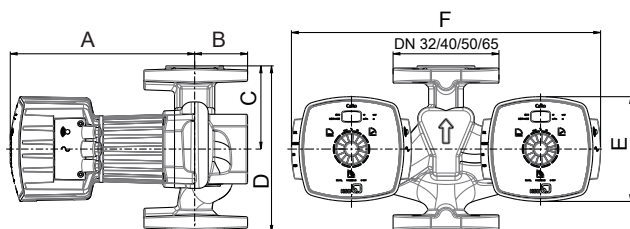


Fig. 5: Flanged pump set

Table 10: Pump set dimensions

Size	Connection			A	B	C	D	E ⁵⁾	F
	R	G	DN	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
30-60	1 1/4	2	-	212	51	82	180	137	418
30-100	1 1/4	2	-	212	51	82	180	137	418
32-80	-	-	32	212	70	110	220	137	418
32-120	-	-	32	232	70	110	220	137	418
40-80	-	-	40	239	75	121	220	137	418
40-100	-	-	40	239	75	121	220	137	418
40-120	-	-	40	396	75	102	250	209	560
40-180	-	-	40	396	75	102	250	209	560
50-80	-	-	50	244	83	126	240	137	418
50-100	-	-	50	390	83	140	280	209	560
50-120	-	-	50	390	83	140	280	209	560
65-80	-	-	65	400	93	180	340	209	560
65-120	-	-	65	400	93	180	340	209	560

Flange dimensions

Table 11: Flange dimensions

Size	PN 6			PN 10, PN 16			Outline drawing
	Ø D	Ø k	n × Ø d ₂	Ø D	Ø k	n × Ø d ₂	
	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	
DN 32	120	90	4 × Ø 14	140	100	4 × Ø 19	
DN 40	130	100	4 × Ø 14	150	110	4 × Ø 19	
DN 50	140	110	4 × Ø 14	165	125	4 × Ø 19	
DN 65	160	130	4 × Ø 14	185	145	4 × Ø 19	

⁵ If the pump is in a horizontal installation position and the vent plug (if applicable) is fitted, dimension E increases by 30 mm.

Installation information

Permissible installation positions

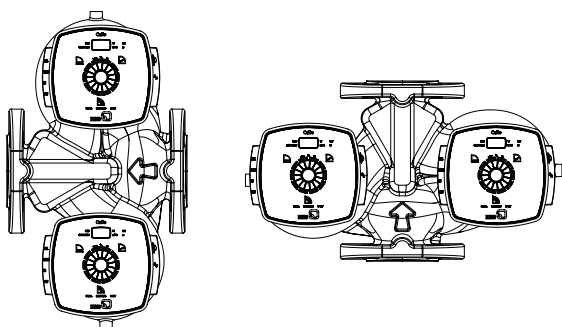


Fig. 6: Permissible installation positions

Scope of supply

Depending on the model, the following items are included in the scope of supply:

- Pump set
- Pre-configured dual connection cable
- Gaskets
- Washers
- Vent plug
- Installation/operating manual

Accessories

Electrical accessories

Table 12: Overview of electrical accessories

	Description	Mat. No.	[kg]
	BACnet MS/TP communication module Suitable for mounting in a control cabinet, for connecting 1 Calio / CalioTherm Pro pump	18041730	0,1

Pipe unions

	Description	Mat. No.	[kg]
	2 pipe unions with G 2 union nut and insert with Rp 1 1/4 internal thread, steel for pumps with G 2 external thread / Rp 1 1/4 pipe connection	19075562	0,2

Spacers (flange)

	Description	Connection Flange	PN	Length [mm]	Mat. No.	[kg]
	Spacer F16	DN 40	6/10/16	30	19075991	2
	Spacer F0	DN 40	6/10/16	70	19075566	2
	Spacer F1	DN 50	6/10/16	10	19075567	2
	Spacer F2	DN 50	6/10/16	20	19075568	2
	Spacer F3	DN 50	6/10/16	50	19075569	2
	Spacer F4	DN 50	6/10/16	60	19075570	2
	Spacer F5	DN 65	6/10/16	10	19075571	2
	Spacer F6	DN 65	6/10/16	25	19075572	2
	Spacer F7	DN 65	6/10/16	30	19075573	2
	Spacer F8	DN 80	6/10/16	10	19075574	2
	Spacer F9	DN 80	6/10/16	15	19075575	2
	Spacer F10	DN 80	6/10/16	20	19075576	2
	Spacer F11	DN 80	6/10/16	25	19075577	2
	Spacer F12	DN 80	6/10/16	30	19075578	2
	Spacer F13	DN 80	6/10/16	40	19075579	2
	Spacer F14	DN 80	6/10/16	50	19075580	2
	Spacer F15	DN 80	6/10/16	80	19075581	2



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