

# The iQ-motor

Quadratic. Practical. [Intelligent.](#)

|  |                        |    |
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# Same on the outside – better on the inside!

*Typical of ebm-papst: we have taken a standard motor and a principle that for decades has enjoyed success in countless applications and made it more intelligent, energy-efficient and environmentally friendly! Features of the shaded-pole motor (Q-motor) such as outstanding running smoothness, low maintenance and a long service life have made asynchronous motors a standard component in small fans. Our objective was to significantly improve the inner mechanism of the Q-motor by incorporating EC technology – while keeping the exterior design identical. Conventional Q-motors can now be replaced with the new “iQ”-motors if the fans fail or if a more energy-efficient solution is required.*

## **Exchange your old motor for 70 % more efficiency**

During the development of the iQ-motor, our engineers took giant strides towards reducing energy costs and fulfilling environmental protection requirements. By integrating ebm-papst EC technology, new iQ-motor now features far better efficiency and pays for itself quickly due to its significant energy-savings.

The best part of all: from the outside, it is the same old fan. The identical dimensions and mounting options enable simple replacement without changes, structural modifications or any other extra effort. Axial impellers with diameters of 154 to 254 mm can be installed on the new iQ-motor just as before. The same applies to the mounting flange, the wall ring and the guard grille. Therefore, thousands of applications can easily be made more energy-efficient as part of routine maintenance, and may benefit at once from a drastic increase in efficiency, without any development effort.

## **The best equipment – not just in an emergency**

Of course, the enormous increase in energy efficiency is not the only feature we have packed into the intelligent motor. Important electronic features ensure that the iQ-motor works even more “conscientiously” than its simple counterpart. For example, the motor has a closed loop speed control that keeps it at the same speed at all times, regardless of the diameter of the installed blade. With dirt or other interference factors, they do not cause an overload of the motor. The iQ-motor continues working at reduced speed.

## **One design – thousands of applications**

Just one design is compatible with the entire range of impellers, from 154 to 254 mm. This makes logistics easier and keeps your development effort low. Moreover, the smallest size, the iQ 3608, is the most compact version of an EC motor for its field of application in refrigeration. It has an axial installation depth of only 74 mm, thus guaranteeing the necessary little bit of air in very tight installation spaces.

## **Energy-saving and quiet – throughout its long service**

All variants share the low-noise performance and the famous long service life that have made this motor type so popular for so long. A critical role is played by a particularly low-friction bearing system with double ball bearings. Thus the iQ-motor can continue to yield its enormous savings potential for a very, very long time after only a brief amortisation phase. Available options include the IP 54 type of protection and, of course, a standards-compliant TÜV approval.

# iQ-motor

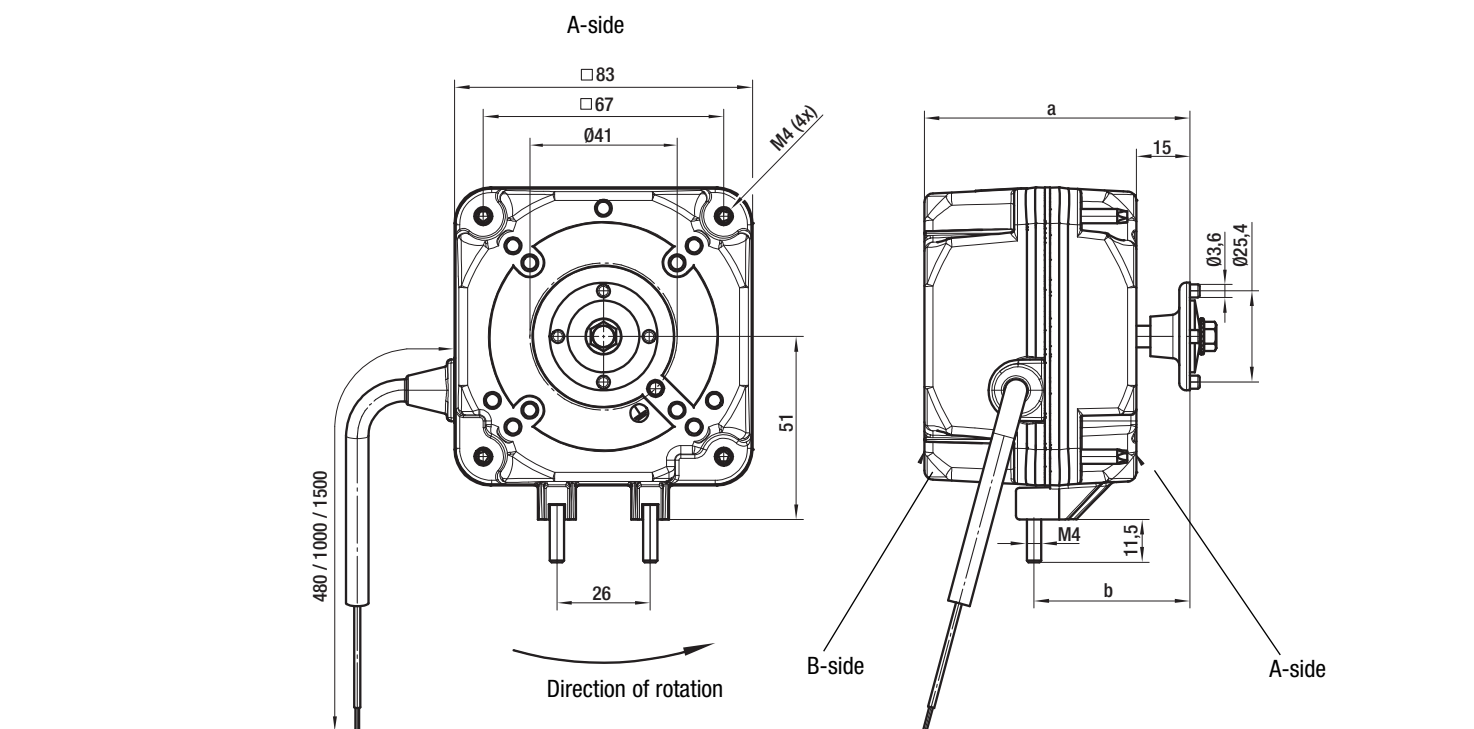


- **Material:**  
Housing: Die-cast aluminium
- **Direction of air flow:** "V" and "A"  
(depending on axial impeller used)
- **Direction of rotation:** Counterclockwise,  
seen on shaft end
- **Type of protection:** IP 42 (only with  
horizontal shaft), optional IP 54 (any shaft  
position)
- **Insulation class:** "H"
- **Mounting position:** Any
- **Mode of operation:** Con. operation (S1)
- **Bearings:** Maintenance-free ball bearings
- **Motor protection:** Via electronics
- **Electrical connection:** Mains cable
- **Protection class:** I
- **Approvals:** TÜV; UL (in progress)
- **Mounting attachment parts:**  
Guard grille and wall ring are attached to  
the projecting thread ends on the A side
- **Axial impeller attachment:**  
A plastic adapter with catching peg and  
M4 screw is used to secure the impeller  
on the motor shaft

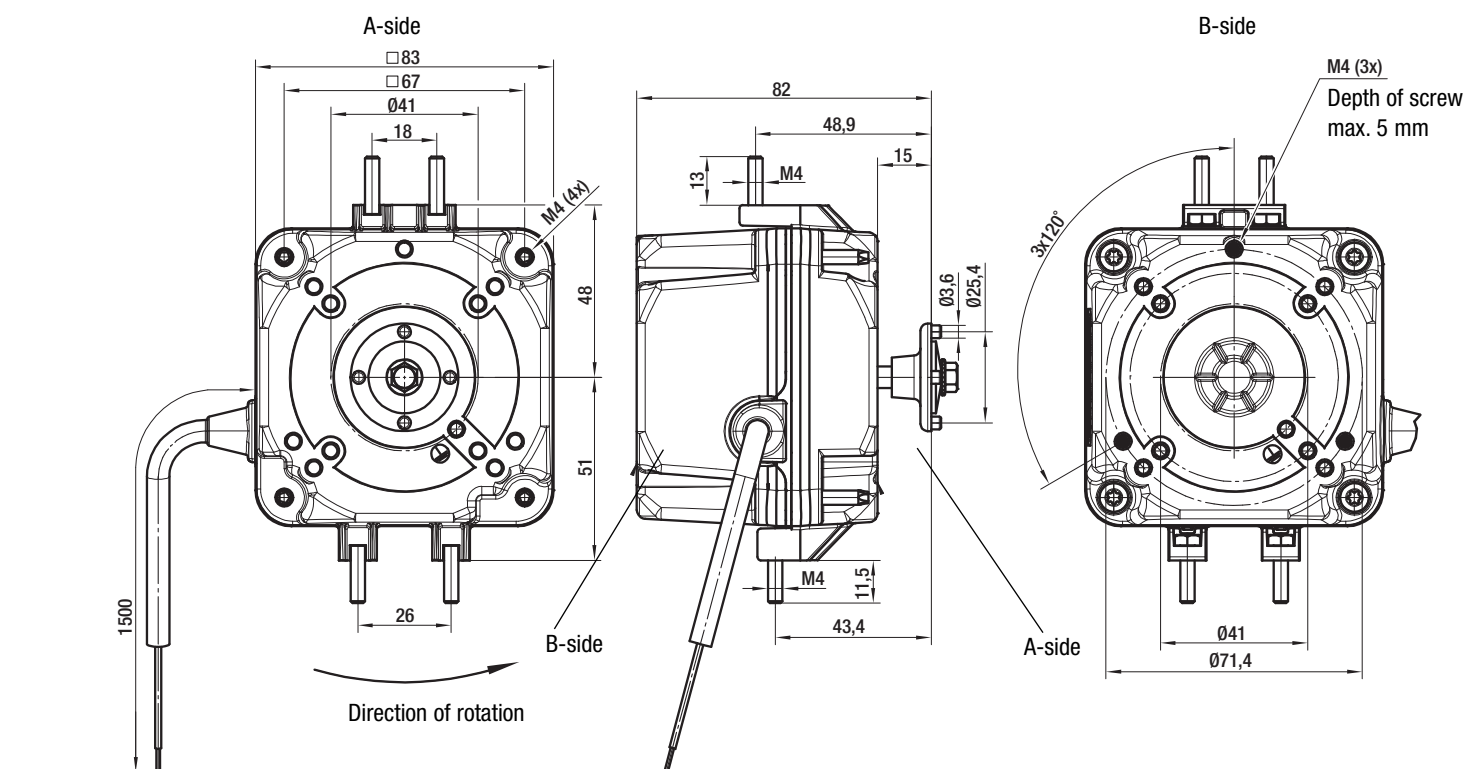
| Nominal data |  | Nominal voltage | Frequency      | Speed/rpm    | Output capacity | Perm. amb. temp.     | Mass | Dimensions |      |
|--------------|--|-----------------|----------------|--------------|-----------------|----------------------|------|------------|------|
| Type         |  | V               | Hz             | rpm          | W               | °C                   | kg   | a          | b    |
| iQ 3608      |  | 220-240<br>115  | 50/60<br>50/60 | 1300<br>1550 | 3<br>3          | -40..+50<br>-40..+50 | 0,5  | 74         | 43,5 |
| iQ 3612      |  | 220-240<br>115  | 50/60<br>50/60 | 1300<br>1550 | 10<br>10        | -40..+50<br>-40..+50 | 0,6  | 82         | 43,5 |
| iQ 3620      |  | 220-240<br>115  | 50/60<br>50/60 | 1300<br>1550 | 20<br>20        | -40..+50<br>-40..+50 | 0,8  | 90         | 51,5 |

subject to alterations

|                                         | Standard design  | Design with 60° angle | Design with 90° angle |
|-----------------------------------------|------------------|-----------------------|-----------------------|
| Number of specimens                     | 10               | 10                    | 10                    |
| Failure load (kN)                       | 78.5 ± 1.5       | 78.5 ± 1.5            | 78.5 ± 1.5            |
| Displacement at failure (mm)            | 1.5 ± 0.2        | 1.5 ± 0.2             | 1.5 ± 0.2             |
| Modulus of elasticity (GPa)             | 15.5 ± 0.5       | 15.5 ± 0.5            | 15.5 ± 0.5            |
| Poisson's ratio                         | 0.25 ± 0.02      | 0.25 ± 0.02           | 0.25 ± 0.02           |
| Tensile strength (MPa)                  | 105 ± 5          | 105 ± 5               | 105 ± 5               |
| Elongation at break (%)                 | 1.5 ± 0.2        | 1.5 ± 0.2             | 1.5 ± 0.2             |
| Yield strength (MPa)                    | 85 ± 5           | 85 ± 5                | 85 ± 5                |
| Reduction of area (%)                   | 15 ± 2           | 15 ± 2                | 15 ± 2                |
| Impact energy (J)                       | 10 ± 2           | 10 ± 2                | 10 ± 2                |
| Charpy transition temperature (°C)      | -10 ± 2          | -10 ± 2               | -10 ± 2               |
| Hardness (HV)                           | 100 ± 5          | 100 ± 5               | 100 ± 5               |
| Surface roughness (Ra)                  | 0.8 ± 0.1        | 0.8 ± 0.1             | 0.8 ± 0.1             |
| Microhardness (HV)                      | 100 ± 5          | 100 ± 5               | 100 ± 5               |
| Fracture surface analysis               | SEM              | SEM                   | SEM                   |
| Fracture mechanism                      | Ductile fracture | Ductile fracture      | Ductile fracture      |
| Fracture surface morphology             | Smooth           | Smooth                | Smooth                |
| Fracture surface texture                | Uniform          | Uniform               | Uniform               |
| Fracture surface porosity               | Low              | Low                   | Low                   |
| Fracture surface oxidation              | None             | None                  | None                  |
| Fracture surface corrosion              | None             | None                  | None                  |
| Fracture surface delamination           | None             | None                  | None                  |
| Fracture surface cracking               | None             | None                  | None                  |
| Fracture surface voiding                | None             | None                  | None                  |
| Fracture surface inclusion              | None             | None                  | None                  |
| Fracture surface segregation            | None             | None                  | None                  |
| Fracture surface second phase           | None             | None                  | None                  |
| Fracture surface grain boundary         | None             | None                  | None                  |
| Fracture surface dislocation            | None             | None                  | None                  |
| Fracture surface slip band              | None             | None                  | None                  |
| Fracture surface shear band             | None             | None                  | None                  |
| Fracture surface necking                | None             | None                  | None                  |
| Fracture surface strain hardening       | None             | None                  | None                  |
| Fracture surface work hardening         | None             | None                  | None                  |
| Fracture surface adiabatic fracture     | None             | None                  | None                  |
| Fracture surface brittle fracture       | None             | None                  | None                  |
| Fracture surface ductile fracture       | None             | None                  | None                  |
| Fracture surface intergranular fracture | None             | None                  | None                  |
| Fracture surface transgranular fracture | None             | None                  | None                  |
| Fracture surface cleavage fracture      | None             | None                  | None                  |
| Fracture surface dimple fracture        | None             | None                  | None                  |
| Fracture surface microvoiding           | None             | None                  | None                  |
| Fracture surface microcracking          | None             | None                  | None                  |
| Fracture surface microsegregation       | None             | None                  | None                  |
| Fracture surface microinclusion         | None             | None                  | None                  |
| Fracture surface microvoid              | None             | None                  | None                  |
| Fracture surface microcrack             | None             | None                  | None                  |
| Fracture surface microvoiding           | None             | None                  | None                  |
| Fracture surface microcracking          | None             | None                  | None                  |
| Fracture surface microsegregation       | None             | None                  | None                  |
| Fracture surface microinclusion         | None             | None                  | None                  |
| Fracture surface microvoid              | None             | None                  | None                  |
| Fracture surface microcrack             | None             | None                  | None                  |
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| Fracture surface microinclusion         | None             | None                  | None                  |
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| Fracture surface microsegregation       | None             | None                  | None                  |
| Fracture surface microinclusion         | None             | None                  | None                  |
| Fracture surface microvoid              | None             | None                  | None                  |
| Fracture surface microcrack             | None             | None                  | None                  |
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| Fracture surface microsegregation       | None             | None                  | None                  |
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| Fracture surface microcrack             | None             | None                  | None                  |
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| Fracture surface microcracking          | None             | None                  | None                  |
| Fracture surface microsegregation       | None             | None                  | None                  |
| Fracture surface microinclusion         | None             | None                  | None                  |
| Fracture surface microvoid              | None             | None                  | None                  |
| Fracture surface microcrack             | None             | None                  | None                  |
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| Fracture surface microsegregation       | None             | None                  | None                  |
| Fracture surface microinclusion         | None             | None                  | None                  |
| Fracture surface microvoid              | None             | None                  | None                  |
| Fracture surface microcrack             | None             | None                  | None                  |
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| Fracture surface microinclusion         | None             | None                  | None                  |
| Fracture surface microvoid              | None             | None                  | None                  |
| Fracture surface microcrack             | None             | None                  | None                  |
| Fracture surface microvoiding           | None             | None                  | None                  |
| Fracture surface microcracking          | None             | None                  | None                  |
| Fracture surface microsegregation       | None             | None                  | None                  |
| Fracture surface microinclusion         | None             | None                  | None                  |
| Fracture surface microvoid              | None             | None                  | None                  |
| Fracture surface microcrack             | None             | None                  | None                  |
| Fracture surface micro                  |                  |                       |                       |



**Multi-function design (only iQ 3612)**



# iQ-motor – combination with axial impellers

## Power input and air flow



- **Power ratings (220 - 240 V design):** Power input and air flow at 230 V / 50 Hz and a constant speed of 1300 min<sup>-1</sup>.

| Motor   | Axial impeller diameter | Axial impeller blade angle | Curves | Max. power input | Power input running at free air | Air flow running at free air at n=1300 rpm |
|---------|-------------------------|----------------------------|--------|------------------|---------------------------------|--------------------------------------------|
| iQ 3608 | mm                      | °                          |        | W                | W                               | m³/h                                       |
|         | 154                     | 22                         | A      | 2,8              | 2,5                             | 150                                        |
|         | 154                     | 28                         |        | 3,2              | 3                               | 190                                        |
|         | 154                     | 34                         |        | 3,7              | 3,5                             | 210                                        |
|         | 172                     | 22                         | B      | 5,3              | 3                               | 240                                        |
|         | 172                     | 28                         |        | 6,7              | 4,1                             | 270                                        |
|         | 172                     | 34                         |        | 7,5              | 5,5                             | 300                                        |
|         | 200                     | 22                         | C      | 7,5              | 5                               | 350                                        |
|         | 200                     | 28                         |        | 7,5              | 6                               | 400                                        |
| iQ 3612 | mm                      | °                          |        | W                | W                               | m³/h                                       |
|         | 200                     | 22                         | D      | 9,5              | 4,4                             | 350                                        |
|         | 200                     | 28                         |        | 11               | 5,3                             | 400                                        |
|         | 200                     | 34                         |        | 15               | 7,8                             | 460                                        |
|         | 230                     | 22                         | E      | 23               | 9,5                             | 520                                        |
|         | 230                     | 28                         |        | 21,5             | 15,5                            | 720                                        |
|         | 230                     | 34                         |        | 23               | 19,5                            | 750                                        |
|         | 254                     | 22                         | F      | 23               | 15                              | 700                                        |
|         | 254 *                   | 28                         |        | 23               | 23                              | 950                                        |
| iQ 3620 | mm                      | °                          |        | W                | W                               | m³/h                                       |
|         | 254                     | 22                         | G      | 26               | 11,8                            | 700                                        |
|         | 254                     | 28                         |        | 30               | 18,3                            | 950                                        |
|         | 254                     | 34                         |        | 31               | 26,8                            | 1000                                       |
|         | 300                     | 22                         | H      | 32               | 27,5                            | 1400                                       |

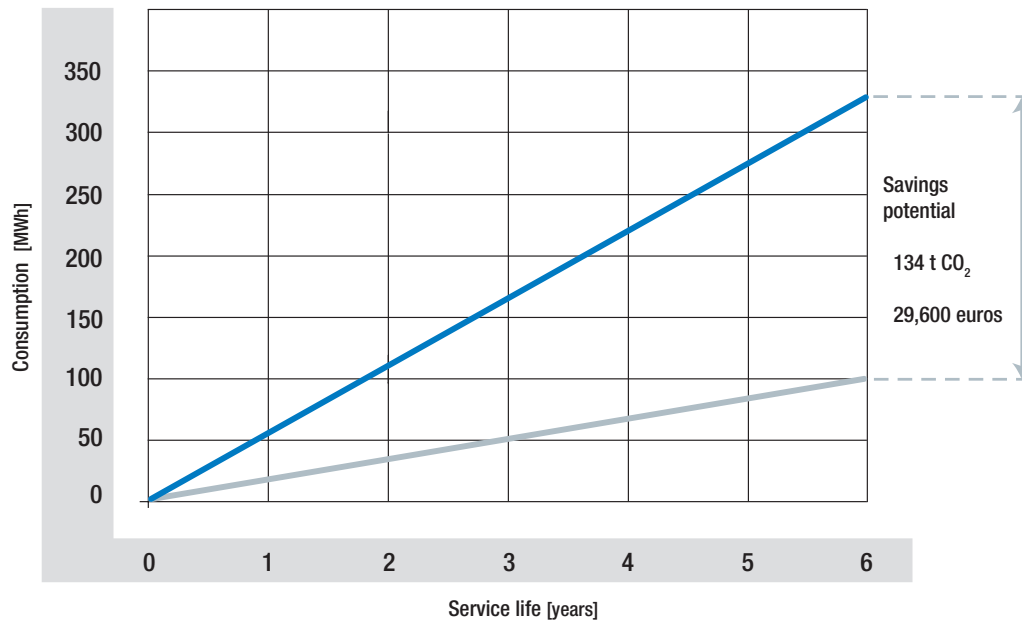
subject to alterations

\* Depending on back pressure, full nominal speed of 1300 min<sup>-1</sup> is not reached to some part. Depending on mounting situation, a speed of approx. 1200 min<sup>-1</sup> (+/- 100 min<sup>-1</sup>) is reached. Due to the intelligent electronics, however, safe (permanent) operation is still guaranteed.

# iQ – Intelligence that pays

## The iQ savings potential in the long term

If you look at the figures for the iQ-motor over a prolonged period, its considerable energy-savings potential becomes especially obvious.



Electricity price: 0.13 euro per kWh

Number of motors: 200

Continuous operation (24 h/365 d)

Axial blades: 200 mm/28° blade angle

CO<sub>2</sub> emissions factor: 0.596 kg per kWh (Federal Environment Agency, Dessau, May 2008)

— iQ 3612  
— AC-shaded-pole motor (comparable)



### All advantages at a glance

- High efficiency of up to 65 %
- Constant speed, even in the event of voltage fluctuations
- High running smoothness due to low-friction bearing system
- Intelligent electronics with n-control, overload and locked-rotor protection
- Conventional AC technology can be replaced easily
- Identical accessories and dimensions to Q-motor
- Long service life due to maintenance-free ball bearings
- One solution replaces multiple sizes of comparable AC motors

### A quick example calculation:

A typical supermarket operates 200 AC fans with 200 mm blades (blade angle 28°) in its refrigeration units. If the shaded-pole motors were to be replaced by iQ motors, the energy consumption would be reduced by 38 megawatt hours. That is an annual saving of more than 4,950 euros\* and a good 22.6 tonnes of CO<sub>2</sub>.



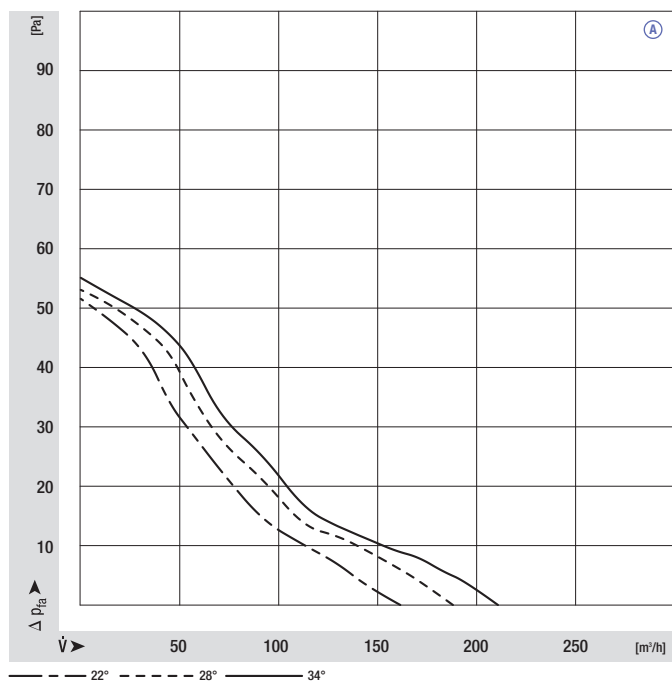
|                                           |                                                          |                                                                 |                                                                     |
|-------------------------------------------|----------------------------------------------------------|-----------------------------------------------------------------|---------------------------------------------------------------------|
| Reduction in power input::<br><b>70 %</b> | Annual reduction in energy consumption:<br><b>38 MWh</b> | Annual reduction in energy costs:<br><b>≈ 4,950 euros total</b> | Annual reduction in emissions:<br><b>22.6 tonnes CO<sub>2</sub></b> |
|-------------------------------------------|----------------------------------------------------------|-----------------------------------------------------------------|---------------------------------------------------------------------|

\*Assumptions: electricity price 0.13 euros per kWh, continuous operation 24 hours a day, 365 days a year

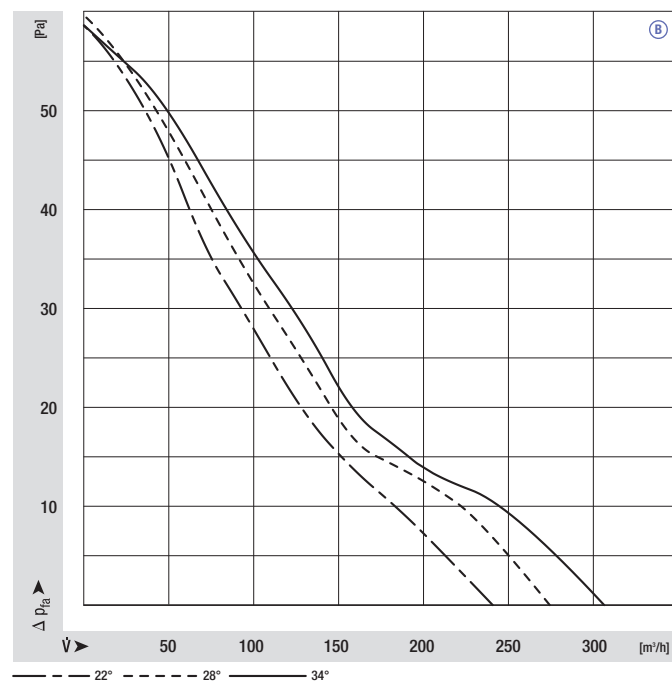
# iQ-motor

Air performance curves (measured in wall ring)

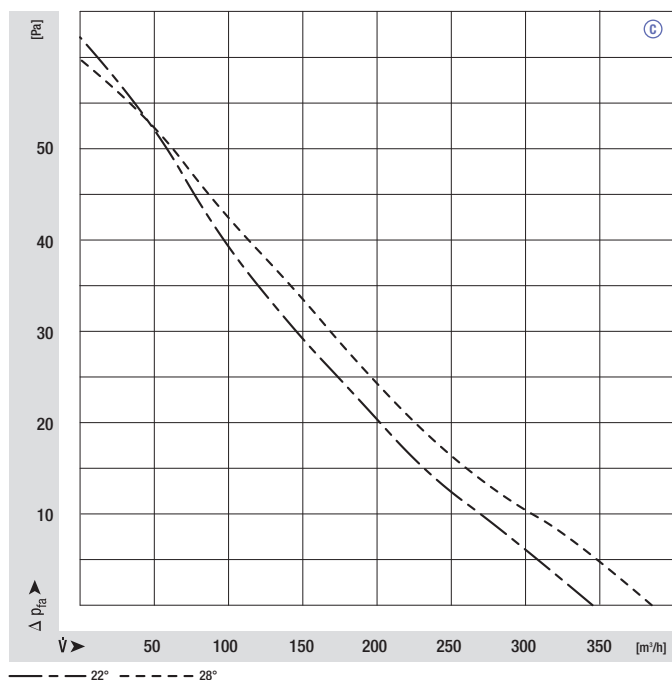
iQ 3608, Ø 154



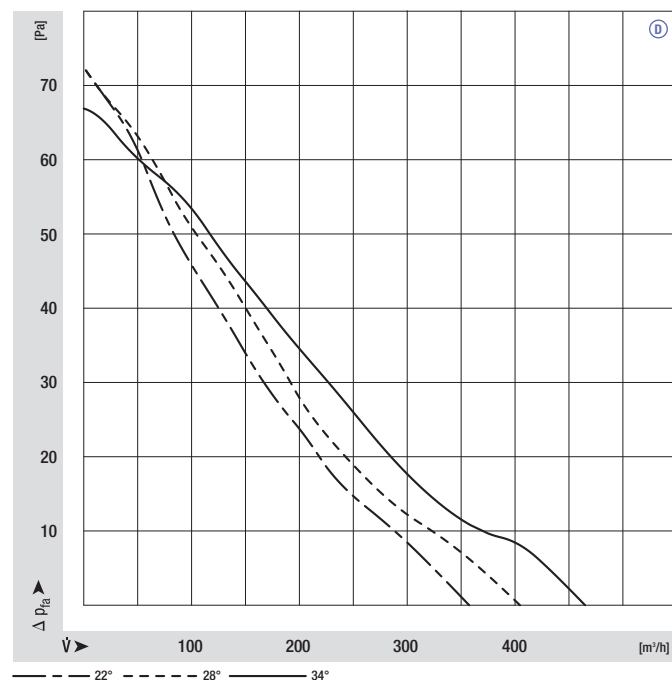
iQ 3608, Ø 172



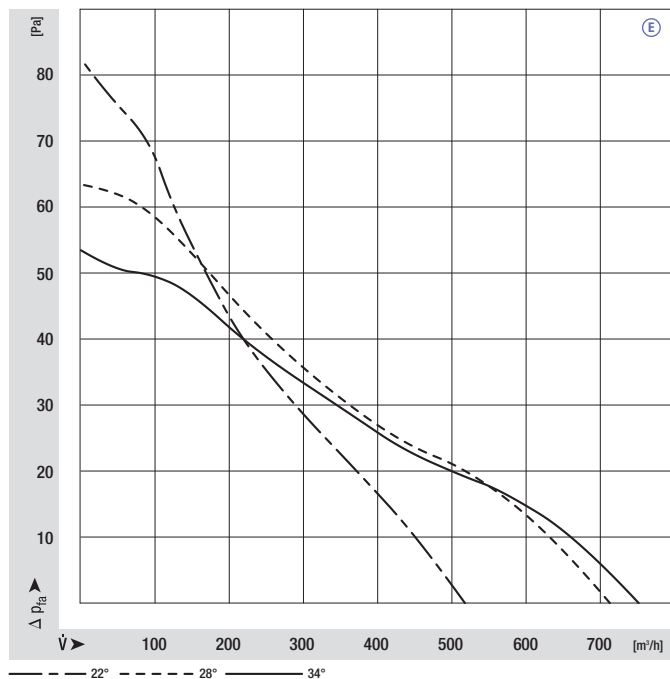
iQ 3608, Ø 200



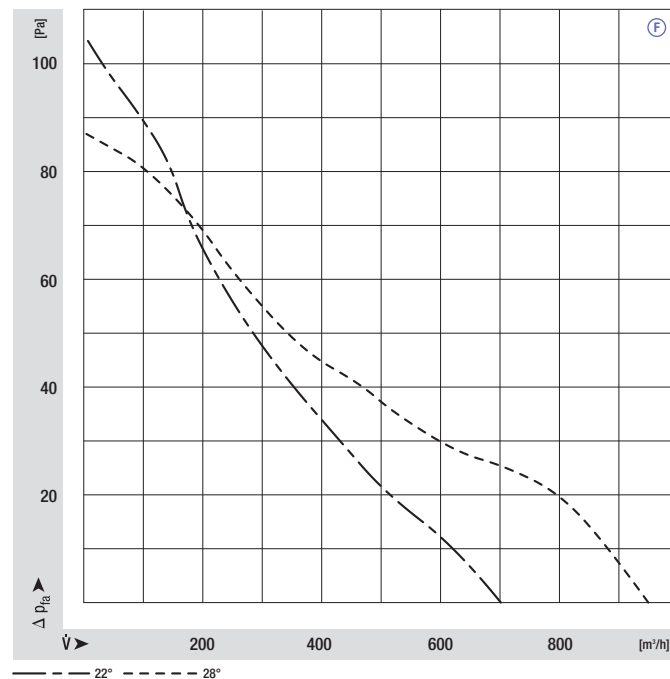
iQ 3612, Ø 200



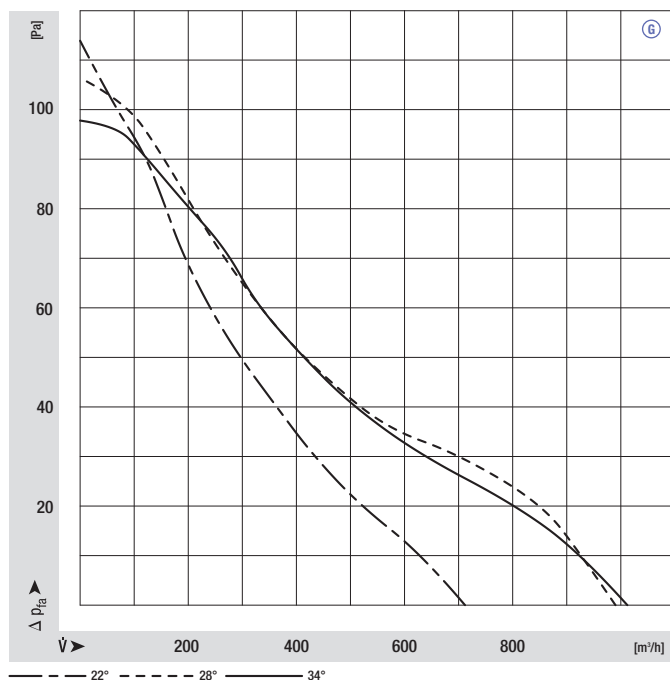
iQ 3612, Ø 230



iQ 3612, Ø 254



iQ 3620, Ø 254



iQ 3620, Ø 300

