BLOWTECH
we make air move

Double Inlet Centrifugal Fans
(Forward Curved)

BAT Series

www.blowtech.in

Blowtech Air Devices Pvt. Ltd. was founded in 1988 and quickly established itself as a leading manufacturer and exporter of HVAC fans and ventilation products in India. The company has excelled in the design, development and manufacture of the following high quality product line for a wide range of HVAC&R applications:

- Centrifugal and Axial Flow Fans and Impellers
- Inline Duct Fans
- Cabinet Fans
- Commercial Kitchen Ventilation Fans
- Fan Filter Units
- Evaporative Coolers & Scrubbers
- Energy Recovery Ventilators (ERVs)
- Air to Air Plate Type Heat Exchangers

The company's 30,000 sq. ft., state of the art manufacturing facility near New Delhi (India) incorporates the most modern equipment & machines, a skilled workforce & over twenty-two years of rich experience. The production process is supported by a complete in house design and development facility and a full fledged tool room. All tools, jigs, fixtures and special purpose machines (SPMs) are designed and developed in house. All fan components are manufactured exclusively with the aid of precision tools and dies. This ensures inbuilt quality and consistency in fan performance fan after fan, year after year.

Blowtech passed ISO-9001 QMS certification in 2003 and is a member of the Air Movement and Control Association, Inc. (AMCA). Consistent with its objectives of designing for optimum quality and performance, the company has its own Fan Test Laboratory which houses a Multiple Nozzle Test Chamber as per International Standard AMCA 210. The line of products including centrifugal fans, tube axial fans, kitchen exhaust fans, cabinet fans, direct driven fans, fan blades and impellers are tested in this in-house laboratory for performance evaluation and design validation.

Blowtech's 30,000 Sq. Ft. state of the art manufacturing plant near New Delhi (India)

To ensure long life and vibration-free operation, each impeller is first checked for eccentricity and run-out. Only after passing this quality check, the impeller is ready for balancing on computerized dynamic balancing machines. Balancing is done as per balance quality grade G 4.0 of the International Standard ISO 1940.

On the basis of advanced management ideas and perfect quality systems, Blowtech constantly strives to absorb and adopt latest technologies, precisely control the quality in each of its working processes and actively promote its products to keep it at the leading position in the HVAC&R industry in India. Our stakeholders' and affiliate relationship networks ensure that we remain at the forefront of industry knowledge and future technology trends. Our skills, infrastructure and experience are trusted by our customers to optimize performance, minimize costs and increase efficiencies of their products. Our people ensure the success of our company, bringing the best in commercial understanding, technical capabilities and market know-how to bear on our customers' business.

BAT Series

Double Inlet Centrifugal Fans with Forward Curved Wheels

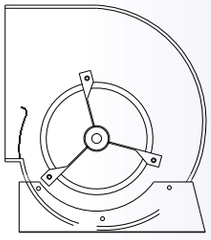
Blowtech Air Devices Pvt. Ltd. certifies that the **BAT Series Fan Models 9x9, 10x10, 12x12, 15x15 & 18x18** shown herein are licensed to bear the AMCA Seal. The ratings shown are based on tests and procedures performed in accordance with AMCA Publication 211 and AMCA Publication 311 and comply with the requirements of the AMCA Certified Ratings Program.

BAT Series - Double Inlet Forward Curved Centrifugal Fans

The BAT Series is made of Double Inlet Double Width (DIDW) Centrifugal Fans with Forward Curved Impellers. These fans are suitable for supply and exhaust applications in commercial and industrial heating, ventilation and air-conditioning (HVAC) systems. Typical applications include evaporative cooling units, air handling units, indoor units of packaged air-conditioners, fresh air supply units, exhaust units and general ventilation and pressurization. The superior design of the Blowtech BAT series fans – optimum blade curvature, width and angle, aerodynamically shaped inlets, matching of the inlets to the wheel and optimum design of cut-off – has resulted in them being one of the most efficient fans. The BAT series is an economic choice for low to medium pressure range applications requiring high air volume and quiet operation.

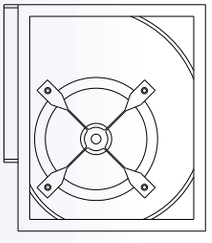
BAT Series fans are available in 9 sizes from wheel diameters of approximately 7" to 18". The Air Volume capacity of BAT fans ranges from 1000 m3/h to 15000 m3/h. The performance of sizes 7x7, 9x7, 12x9 and 15x11 are not licensed by AMCA International.

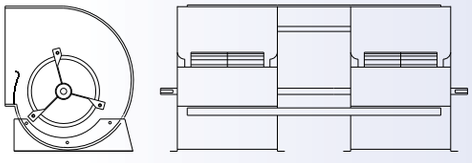
The BAT series is available in type S, R and twin version T2 as shown below.



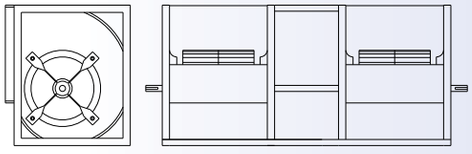
Type S are supplied with mounting feet and can be mounted in 3 different fan orientations. The wheel-shaft assembly is supported in bearings which are mounted to the fan housing using specially designed brackets.

Type R has rectangular side frames made from Galvanized Steel sheets which are bolted to the Fan Housing. This improves rigidity and strength and allows easy mounting of the fan in various orientations. The wheel-shaft assembly is supported in bearings which are mounted to the fan housing using specially designed brackets.





Type T2-S



Type T2-R

BAT Twin (T2) : BAT Series fans are also available in TWIN version where two double inlet fans are mounted on a single common shaft. These fans are ideal for applications where height is a limitation. The following factors need to be applied to obtain the performance of a twin fan from the performance of the corresponding single fan.

Pressure	x	1
Air Volume	x	2
Shaft Power	x	2.15
Speed (RPM)	x	1.05
Sound Level	+	3 dB

Performance of BAT twin fans calculated as shown above is not licenced by AMCA International.

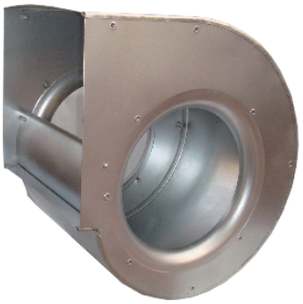
BLOWTECH
we make air move

Fan Construction Specifications

Impeller (Wheel)

The BLOWER WHEEL is made from high quality rust resistant galvanized sheet steel and has forward curved blades.

A large forged steel or die cast aluminium hub with a precisely machined bore and a key way is fitted to the wheel backplate. Use of precision tooling for the punching and assembling of wheel components results in extremely low levels of eccentricity and run out. The wheel is statically and dynamically balanced on computerised dynamic balancing machines to balance quality grade G 4.0 of ISO 1940 and AMCA 204 standard.



Housing

The FAN HOUSING is also made from high quality rust resistant galvanized sheet steel with the housing wrapper fixed to the side plates using electric spot welding for sizes upto 10" and using 'Pittsburg Lock' for sizes from 12" to 18". Side plate profiles are cut on precision machines which results in proper centering of the Impeller – Shaft assembly and precise overall fan dimensions for quiet performance. Aerodynamically shaped inlet venturies form an integral part of the side plates.

Shaft

The FAN SHAFT is manufactured from high quality EN9 carbon steel with keyways at both ends (for pulleys) and at the centre (for wheel hub) and is ground to close tolerance for precision fit.

Bearings

The WHEEL – SHAFT ASSEMBLY is supported at both ends in imported pre-greased permanently sealed ball bearings with an eccentric locking collar.

Each bearing sits inside a moulded rubber housing which in turn is mounted on to the fan housing using a set of 4 specially designed die - formed sheet steel brackets on each side.

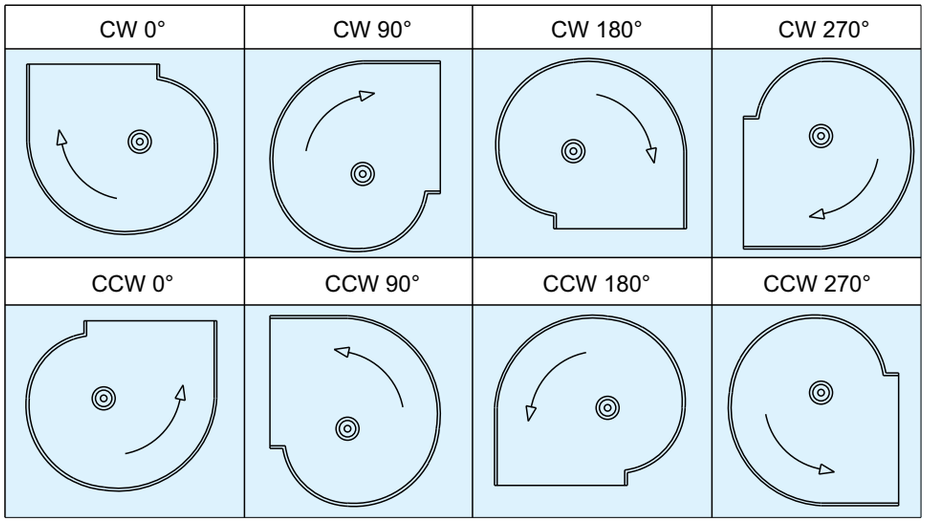
Frames

In type 'R' the frame is manufactured in Galvanized Steel sheets.

Accessories such as Casing Drain Plug, Outlet Flange, Inspection Door and inlet and discharge guards are optional and can be supplied on request.

Fan Rotation and Orientation

Standard fans are supplied with both shaft ends prepared to fit a pulley. They can be used with either Clockwise (CW) or Counter Clockwise (CCW) rotation. All BAT 'R' Series fans can be easily turned to install them in any one of the four orientations 0^{o}, 90^{o}, 180^{o} and 270^{o} as shown below. On BAT 'S' series fans, the mounting feet can be relocated to install the fan in any one of the 4 orientations. The direction of rotation (CW or CCW) is specified by looking at the wheel from the motor end.



Motor Selection

The shaft power (H) lines shown on each performance curve indicates the input power at the fan shaft in kW.

To determine the minimum motor power required to drive the fan, this fan shaft power H has to be multiplied by a safety coefficient which accounts for power losses in belt drives and a reasonable safety margin. The recommended values for the safety coefficient are as under:

Safety Coefficient = **1.20** for H upto 10 kW

= **1.12** for H over 10 kW

The reasonable safety margin mentioned above takes care of any small change in the operating point or fan speed, which may be due to possible minor inaccuracies in calculation of system pressure drop or a pulley ratio slightly different from the design value.

For conversion to horsepower (hp), 1 hp = 0.746 kW.

With motors larger than 7.5 kW (10 hp), the use of a star/delta (Y/Δ) starter is highly recommended.

Fan Pressure under Free Outlet Conditions

The outlet velocity V and velocity pressure Pv shown on each performance curve has been determined under ducted outlet conditions, i.e. with an outlet duct having a cross section area equal to fan outlet area. When operating under "free outlet" conditions (no outlet duct connected), the outlet velocity and the resulting velocity pressure is higher (due to a smaller outlet area produced by the presence of the cut-off baffle). Thus the available static pressure, which is the difference between fan total pressure and fan velocity pressure, will be lower under "free outlet" conditions.

The velocity pressure under free outlet conditions can be reasonably estimated by multiplying the velocity pressure Pv from the performance curves by the following correction factor Kv.

$$Kv = 2.0$$

Fan performance calculated with this correction factor is not licensed by AMCA International.

Interpretation of Fan Sound Power Levels

The sound power levels Lwi(A) shown on the performance charts are at fan inlet for installation type "free inlet ducted outlet" in accordance with AMCA standard 301. The single total A-weighted value has been calculated by summing the measurements over the 8 octave bands using the following A-weighting correction factors:

Octave band mid-frequency (Hz)	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**
A-weighting correction (dB)	**-25.5**	**-15.5**	**-8.5**	**-3**	**0**	**+1**	**+1**	**-1**

Since what humans hear are sound pressure levels (and not power levels), an approximate value of the Sound Pressure Level Lpi(A) can be obtained from the power levels Lwi(A) shown on the curves using the following formulae :

a) **In spherical free field :** $Lpi(A) = Lwi(A) - 20 \cdot \log_{10}(d) - 11$

b) **In room conditions :** $Lpi(A) = Lwi(A) - 20 \cdot \log_{10}(d) - 7$

where d = distance between the fan and the microphone in meters.

It should be noted that the sound power level of a fan, as installed in practice, could be significantly higher than that measured in laboratory conditions, due to a host of factors such as vibrations in the drive motor, stiffness of fan installation, air leakage through the connections, or turbulence produced by guards, diffuser grids or transition pieces. Also the above equations to estimate sound pressure levels must be used with extreme caution. The sound pressure level depends not only on the distance 'd' but also on the acoustic properties of the enclosure in which the fan is installed. The above equations are only valid for theoretical acoustic environments. In real life situations, the actual pressure levels may be significantly different.

Fan Laws

These are laws governing the performance of a fan and are used to convert the performance of a fan from one set of variables viz. size, speed and air density to another. Thus, if the performance of a fan is known for a given size, rpm or air density, its performance for another size, rpm or air density can be computed.

Air Volume : $Q2 = Q1 \times (N2/N1)^1 \times (D2/D1)^3$

Pressure : $P2 = P1 \times (N2/N1)^2 \times (D2/D1)^2 \times (\rho 2/\rho 1)^1$

Absorbed Power : $W2 = W1 \times (N2/N1)^3 \times (D2/D1)^5 \times (\rho 2/\rho 1)^1$

Sound Power : $Lw2 = Lw1 + 55 \log_{10}(N2/N1) + 70 \log_{10}(D2/D1) + 20 \log_{10}(\rho 2/\rho 1)$

Where N = Fan Speed (RPM)

D = Fan Size (Impeller Diameter)

ρ = Air Density

For application of fan laws to size, the fans must be “geometrically similar”. Fans are geometrically similar if

- The number of blades and vanes are the same.
- All angular dimensions are the same.
- All linear dimensions change in proportion to the wheel diameter.

The efficiency of a fan does not change with rpm or air density. However, there is a minor increase in efficiency for larger sizes due to what is known as “size effect”.

Fan laws apply to all types of fans and therefore the fan law equations are a very powerful tool for both fan designers and system engineers. The fan designer can accurately predict the performance of a larger or smaller geometrically similar fan if the performance of a given size fan is known.

Example of BAT Fan Selection using the Performance Charts :

Ideally, for a given duty (flow rate and system pressure drop) a fan should be selected so as to operate near the point of maximum efficiency. This will result in the lowest energy cost to operate the fan and also lead to acceptable noise levels.

The selection process consists of 2 steps:

1. To determine the right size of the fan and
2. To determine the operating parameters e.g speed (RPM), shaft power, outlet velocity, efficiency, velocity pressure and sound power level.

Most designers limit the outlet velocity of a fan within a band usually from 8m/s – 12 m/s. The size of a fan for a given duty can be narrowed down to 2 or 3 sizes to suit this requirement. Once a size is chosen, one can go to the performance chart for this size to determine the operating parameters.

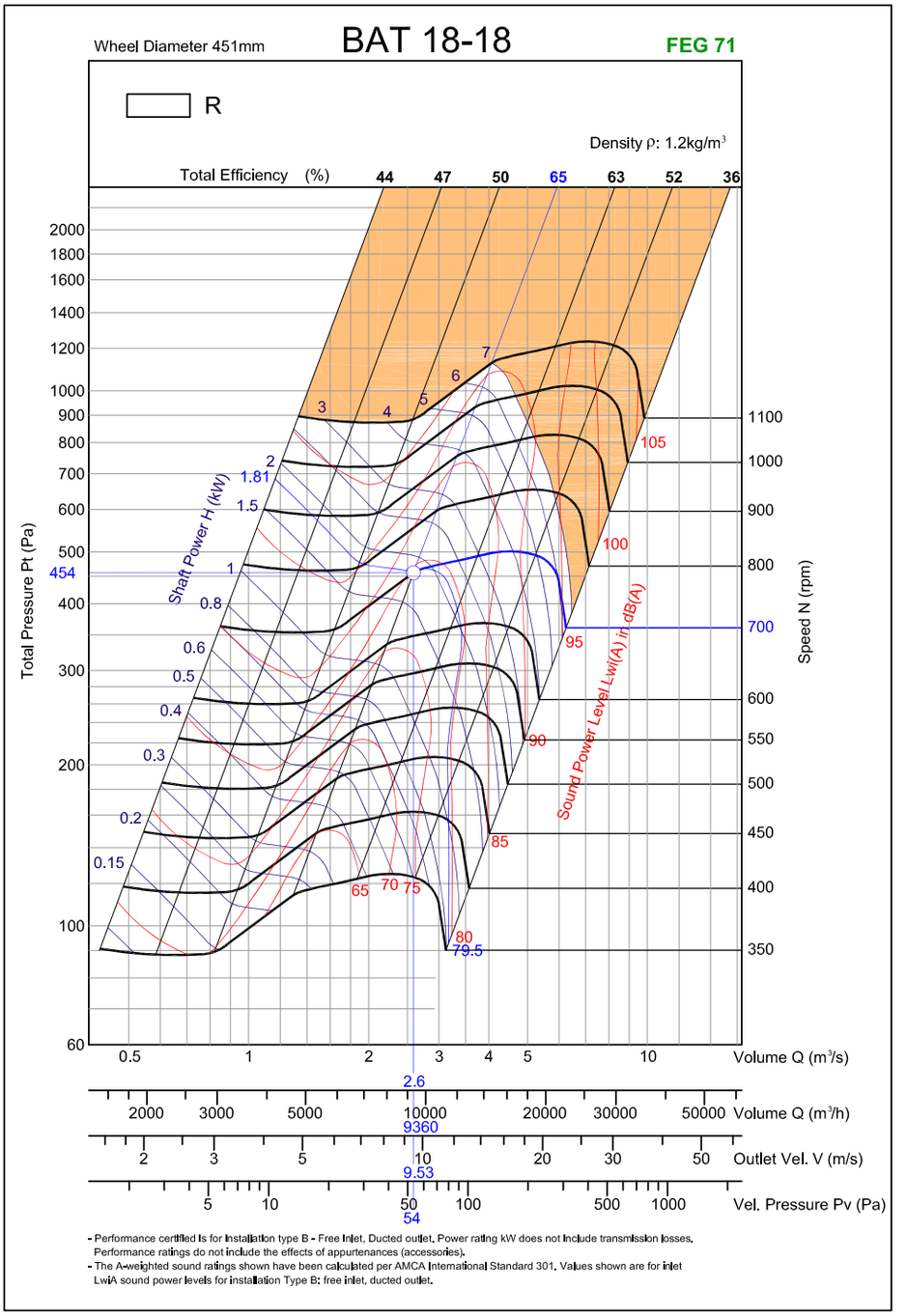
Example

Required:

Volume Flow Rate 'Q'	=	9360 m^3/h
Static Pressure Drop (Ps)	=	400 Pa
Air Density (ρ)	=	1.2 kg/m^3

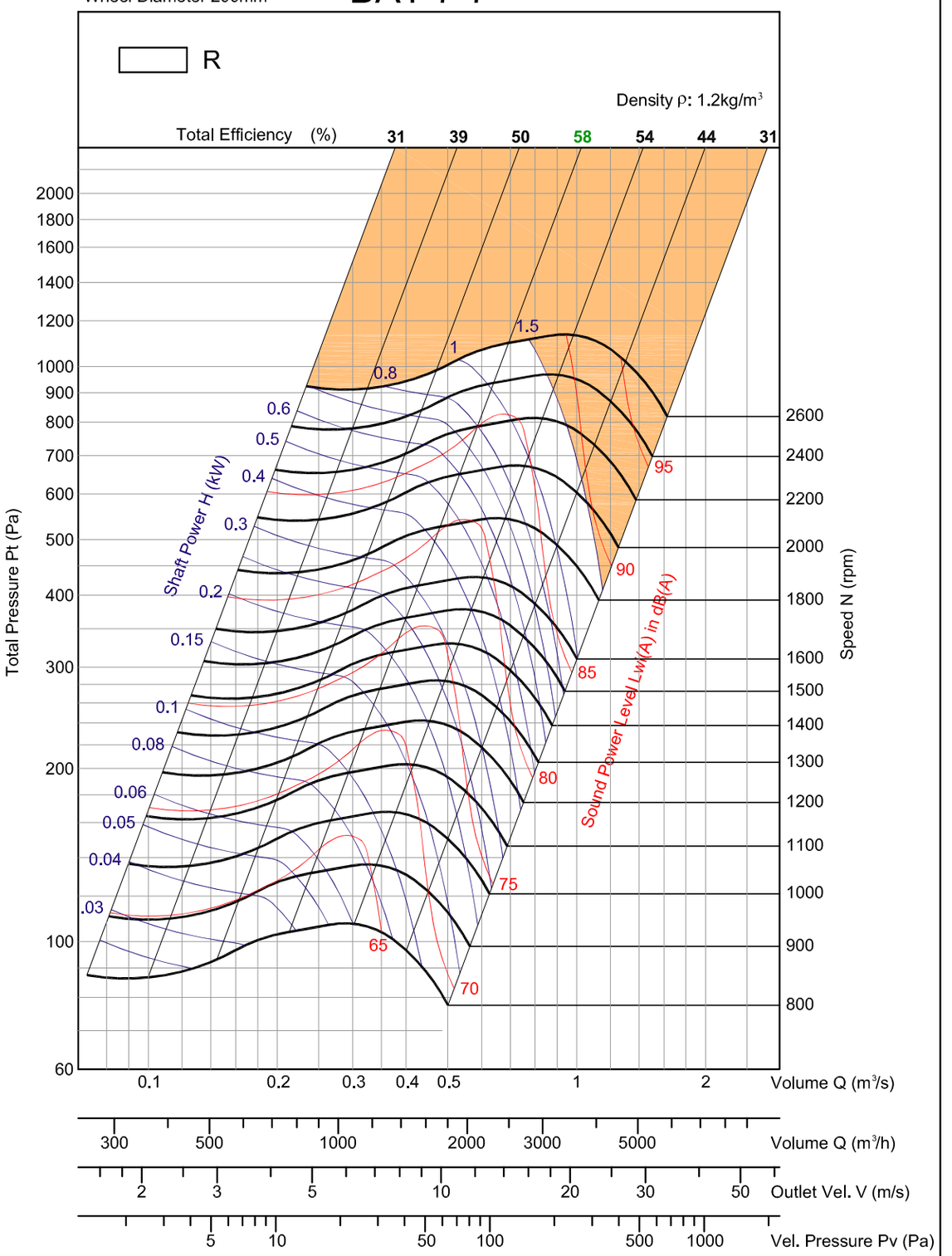
Determine:

Fan Size	=	BAT18x18
Outlet Velocity (V)	=	9.53 m/s
Velocity Pressure (Pv)	=	54 Pa
Total Pressure (Pt)	=	400+54 Pa
	=	454 Pa
Fan Speed (N)	=	700 RPM
Shaft Power (H)	=	1.81 kW
Sound Power Level (Lwi(A))	=	79.5 dB(A)
Total Efficiency (ή)	=	65%



BAT 7-7

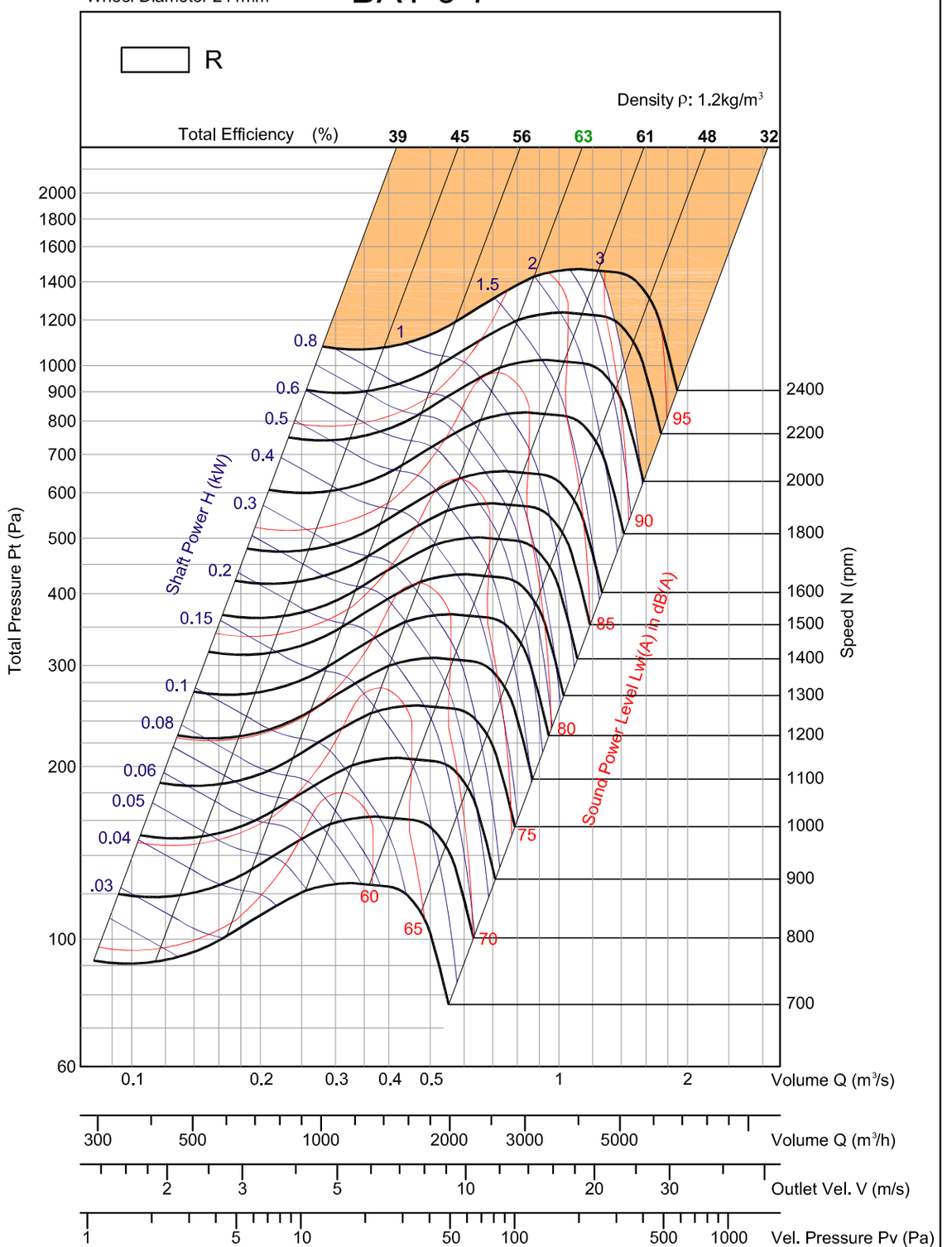
Wheel Diameter 200mm



- Performance certified is for installation type B - Free inlet, Ducted outlet. Power rating kW does not include transmission losses. Performance ratings do not include the effects of appurtenances (accessories).
- The A-weighted sound ratings shown have been calculated per AMCA International Standard 301. Values shown are for inlet LwiA sound power levels for installation Type B: free inlet, ducted outlet.
- MODEL BAT7-7 IS NOT LICENSED TO BEAR THE AMCA CERTIFIED RATINGS SEAL.

BAT 9-7

Wheel Diameter 241mm

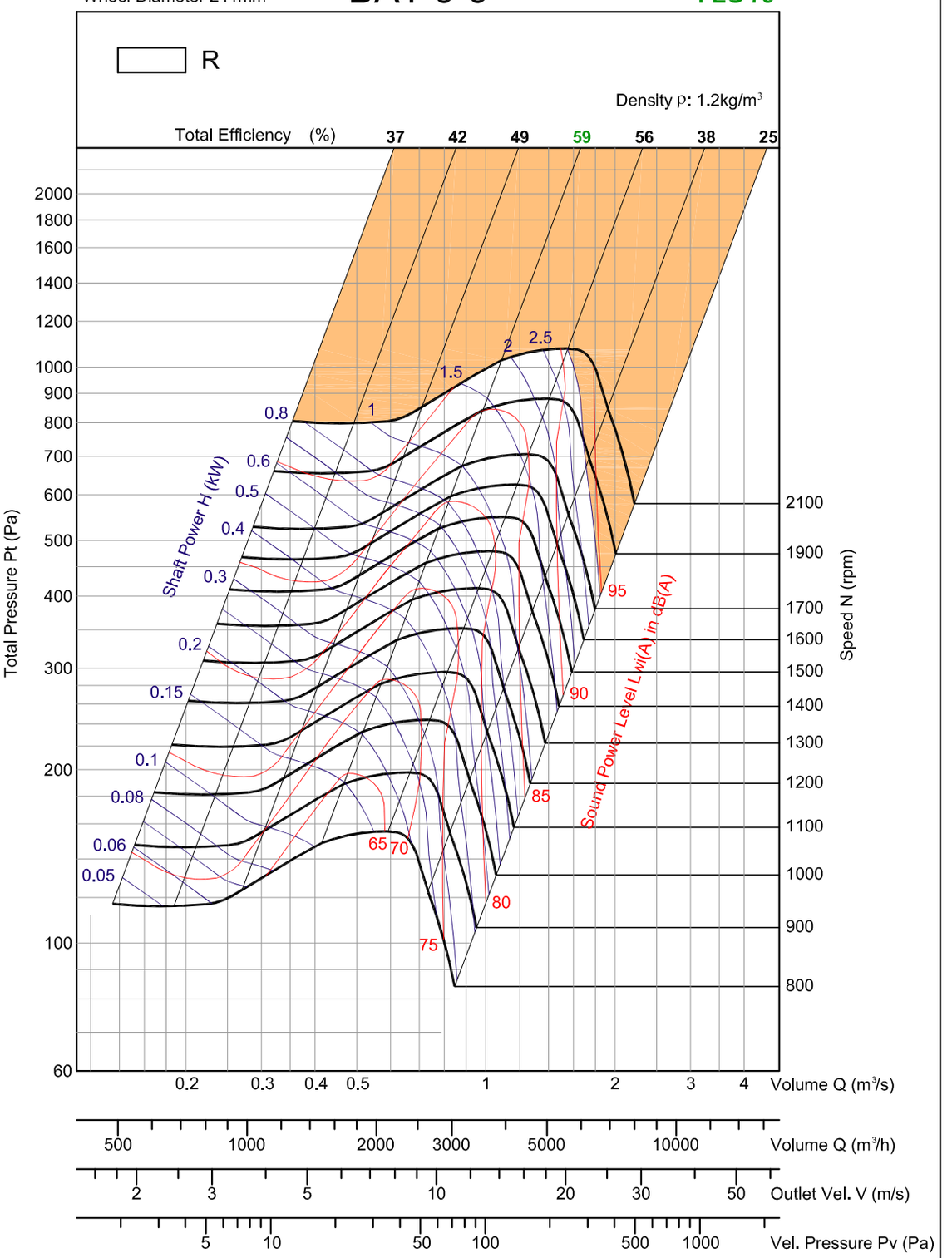


- Performance certified is for installation type B - Free inlet, Ducted outlet. Power rating kW does not include transmission losses. Performance ratings do not include the effects of appurtenances (accessories).
- The A-weighted sound ratings shown have been calculated per AMCA International Standard 301. Values shown are for inlet LwiA sound power levels for installation Type B: free inlet, ducted outlet.
- MODEL BAT9-7 IS NOT LICENSED TO BEAR THE AMCA CERTIFIED RATINGS SEAL.

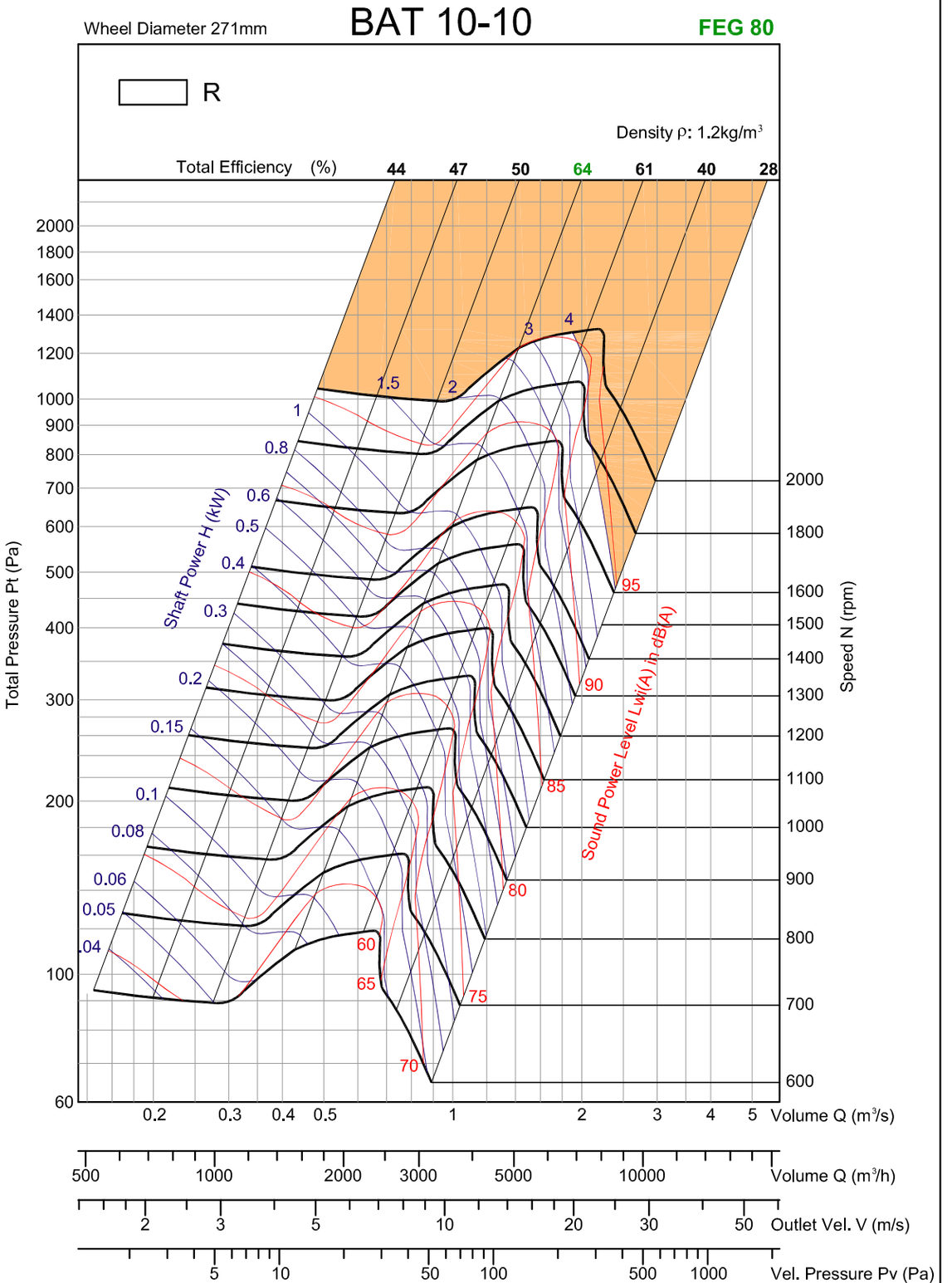
Wheel Diameter 241mm

BAT 9-9

FEG 75



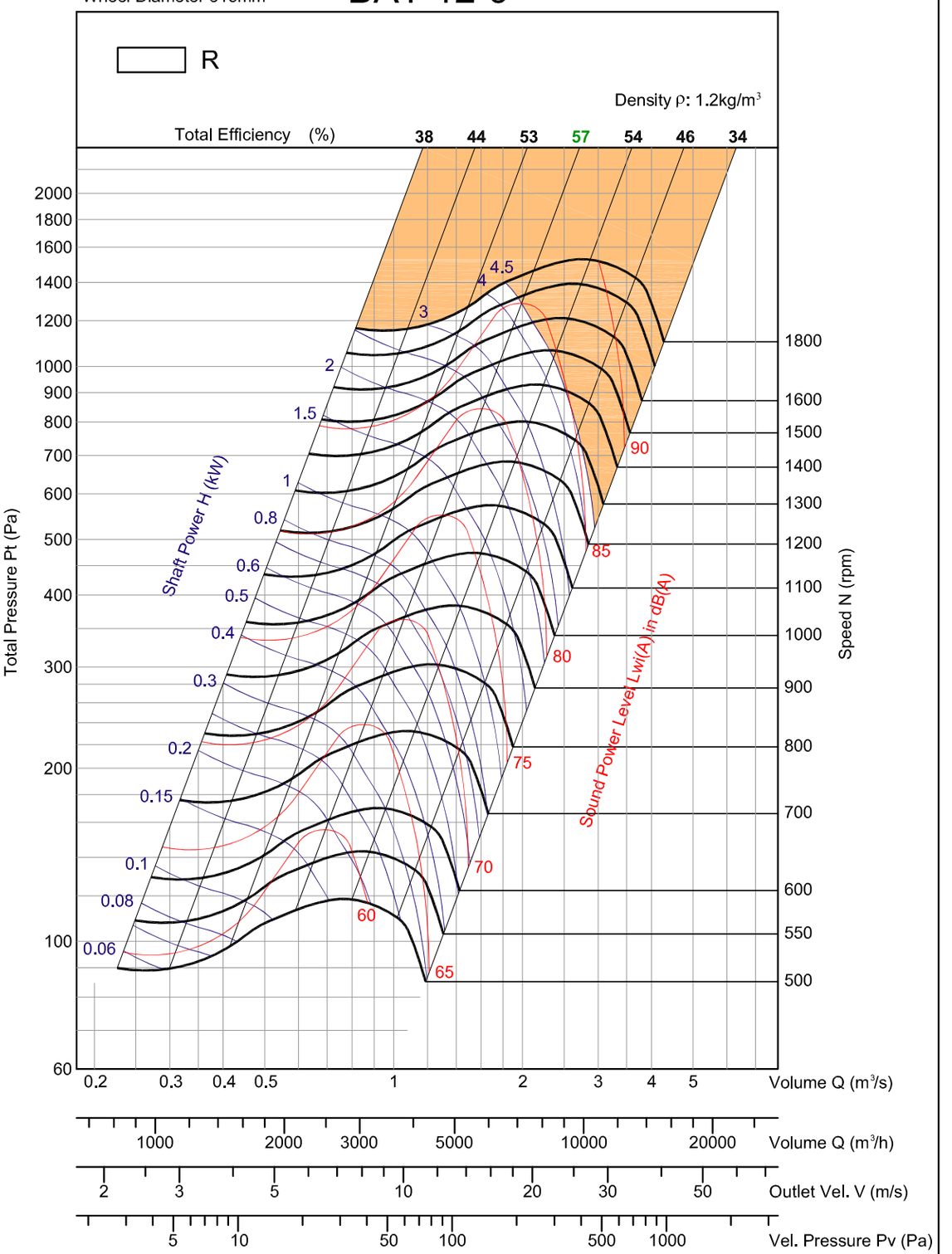
- Performance certified is for installation type B - Free inlet, Ducted outlet. Power rating kW does not include transmission losses. Performance ratings do not include the effects of appurtenances (accessories).
- The A-weighted sound ratings shown have been calculated per AMCA International Standard 301. Values shown are for inlet LwiA sound power levels for installation Type B: free inlet, ducted outlet.



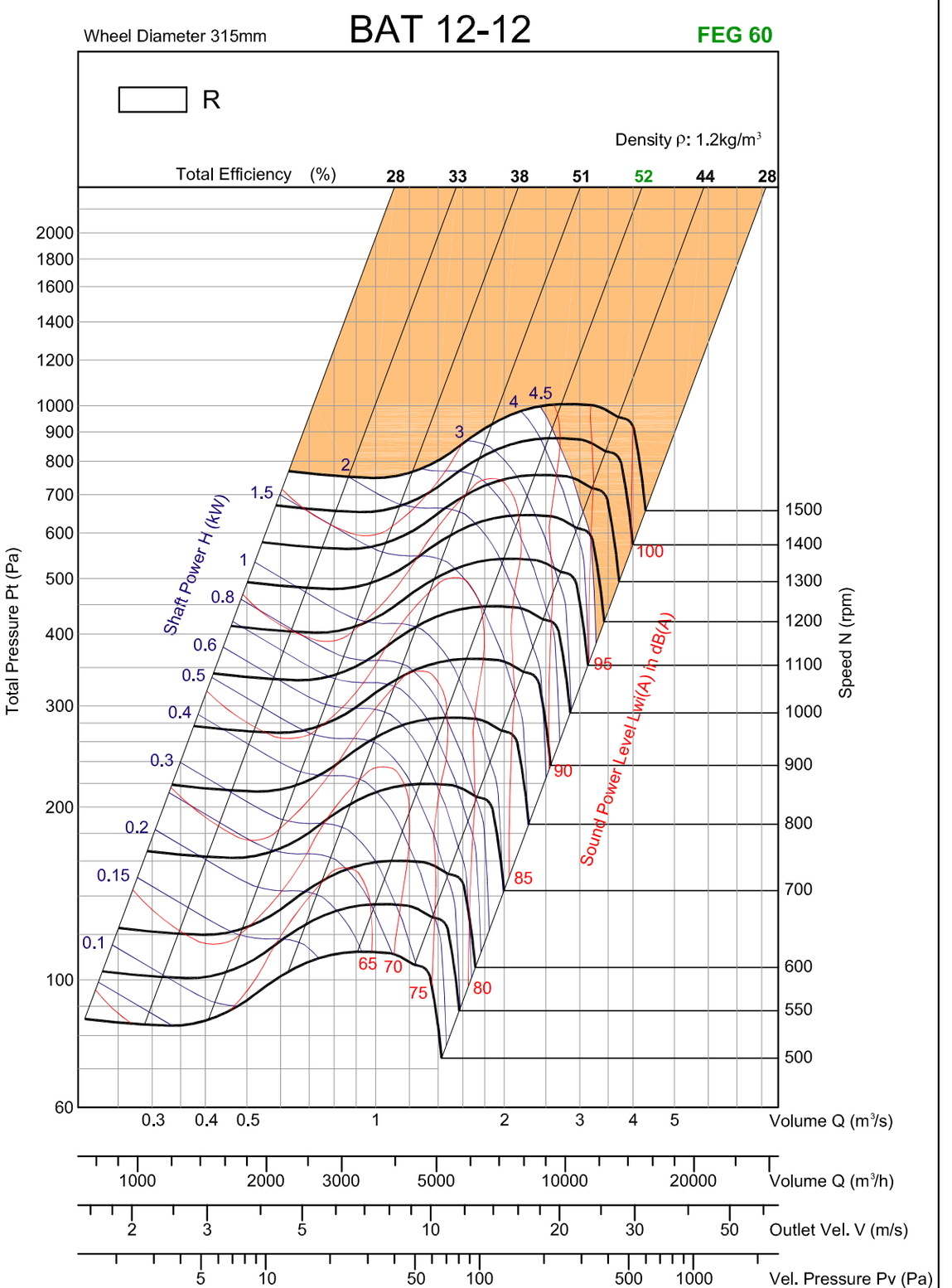
- Performance certified is for installation type B - Free inlet, Ducted outlet. Power rating kW does not include transmission losses. Performance ratings do not include the effects of appurtenances (accessories).
- The A-weighted sound ratings shown have been calculated per AMCA International Standard 301. Values shown are for inlet LwiA sound power levels for installation Type B: free inlet, ducted outlet.

BAT 12-9

Wheel Diameter 315mm



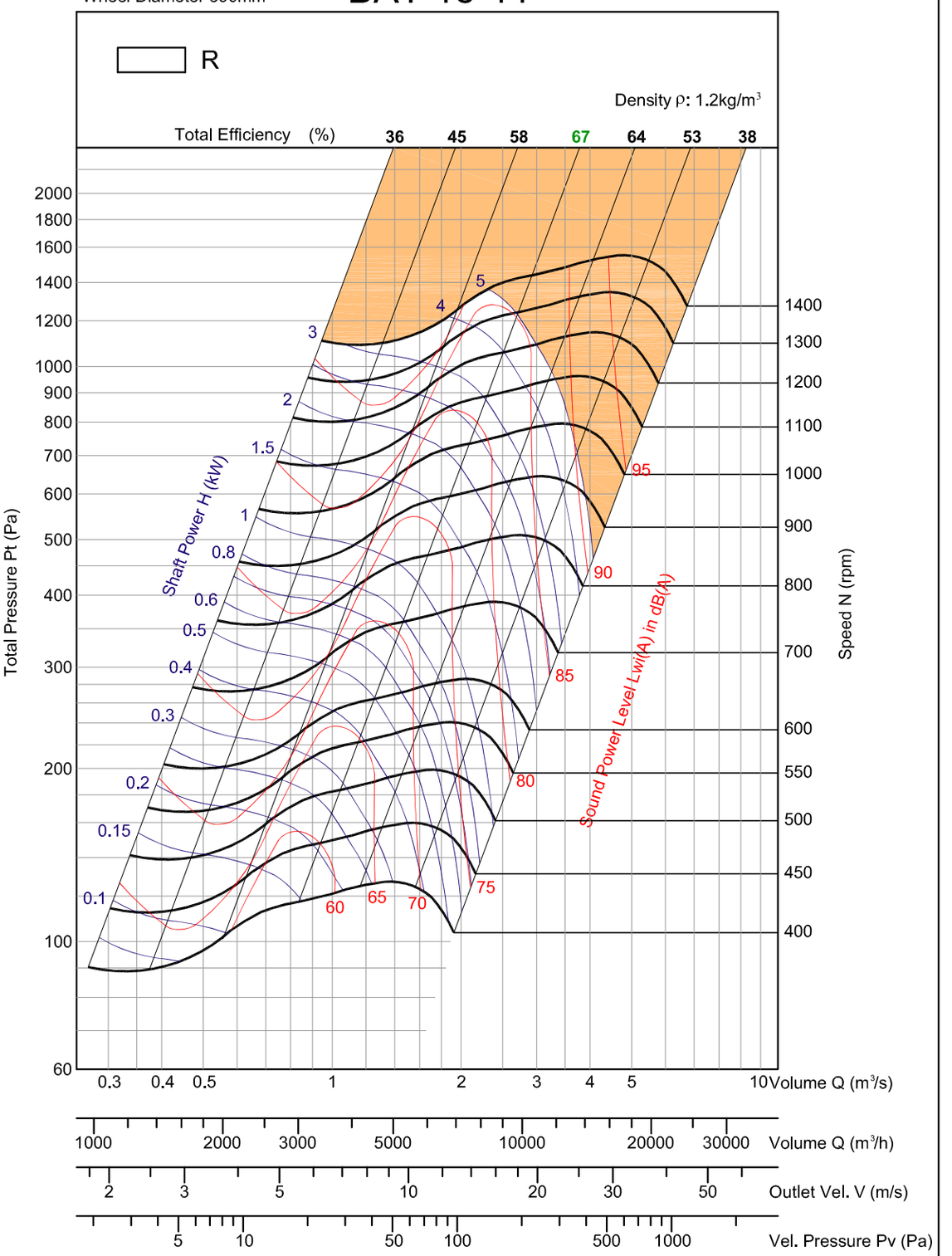
- Performance certified is for installation type B - Free inlet, Ducted outlet. Power rating kW does not include transmission losses. Performance ratings do not include the effects of appurtenances (accessories).
- The A-weighted sound ratings shown have been calculated per AMCA International Standard 301. Values shown are for inlet LwiA sound power levels for installation Type B: free inlet, ducted outlet.
- MODEL BAT12-9 IS NOT LICENSED TO BEAR THE AMCA CERTIFIED RATINGS SEAL.



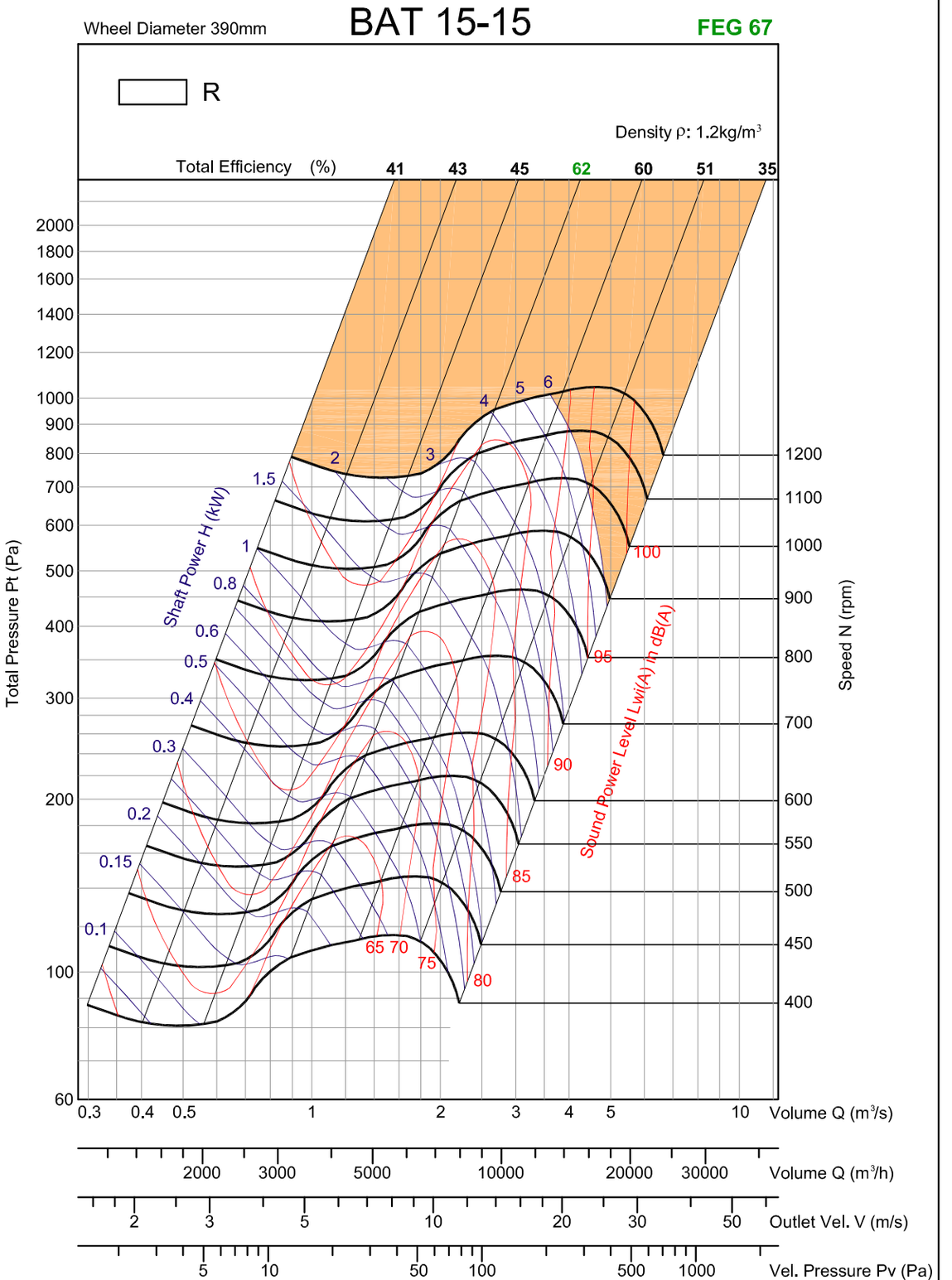
- Performance certified is for installation type B - Free inlet, Ducted outlet. Power rating kW does not include transmission losses. Performance ratings do not include the effects of appurtenances (accessories).
- The A-weighted sound ratings shown have been calculated per AMCA International Standard 301. Values shown are for inlet LwiA sound power levels for installation Type B: free inlet, ducted outlet.

BAT 15-11

Wheel Diameter 390mm



- Performance certified is for installation type B - Free inlet, Ducted outlet. Power rating kW does not include transmission losses. Performance ratings do not include the effects of appurtenances (accessories).
- The A-weighted sound ratings shown have been calculated per AMCA International Standard 301. Values shown are for inlet LwiA sound power levels for installation Type B: free inlet, ducted outlet.
- MODEL BAT15-11 IS NOT LICENSED TO BEAR THE AMCA CERTIFIED RATINGS SEAL.

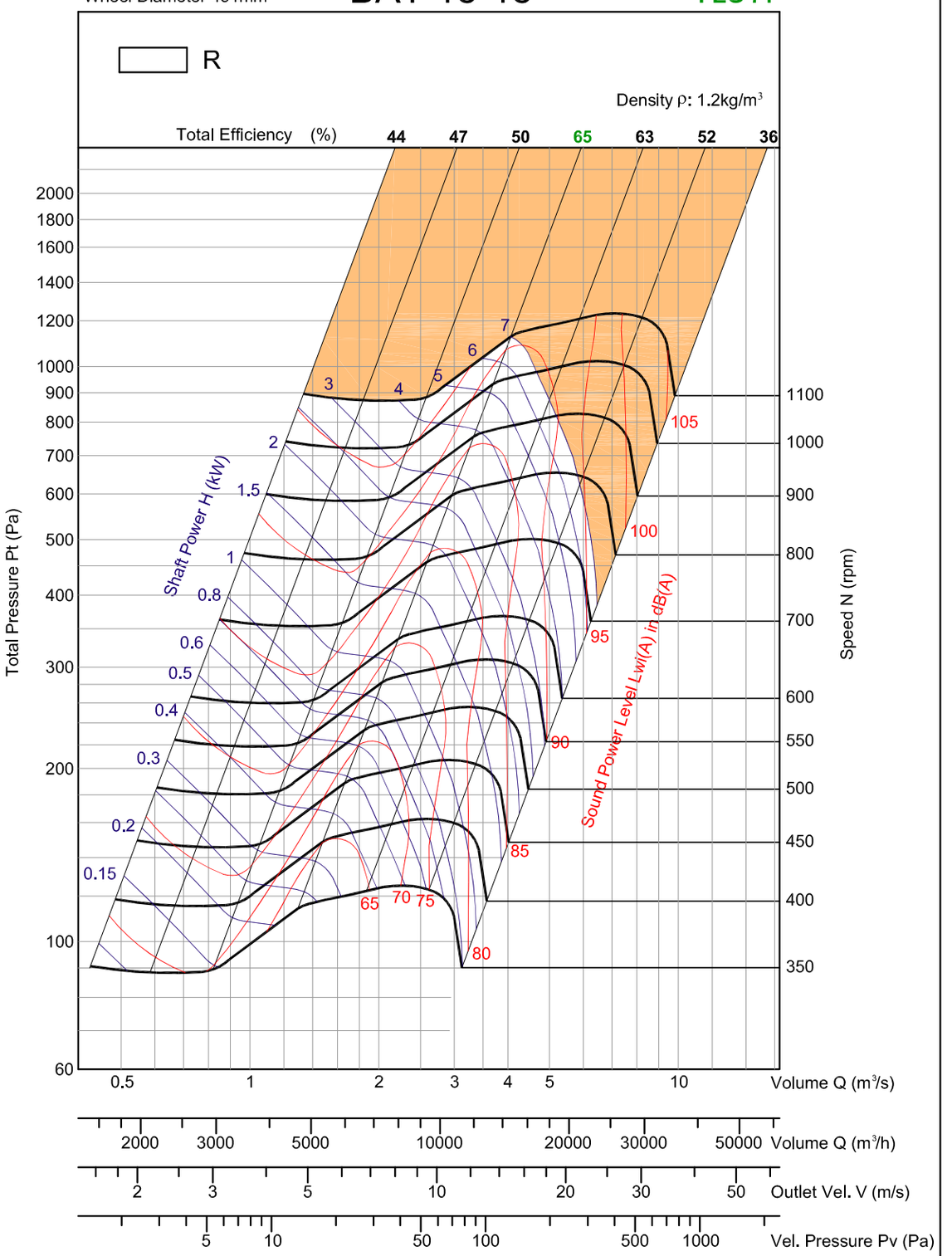


- Performance certified is for installation type B - Free inlet, Ducted outlet. Power rating kW does not include transmission losses. Performance ratings do not include the effects of appurtenances (accessories).
- The A-weighted sound ratings shown have been calculated per AMCA International Standard 301. Values shown are for inlet LwiA sound power levels for installation Type B: free inlet, ducted outlet.

BAT 18-18

Wheel Diameter 451mm

FEG 71

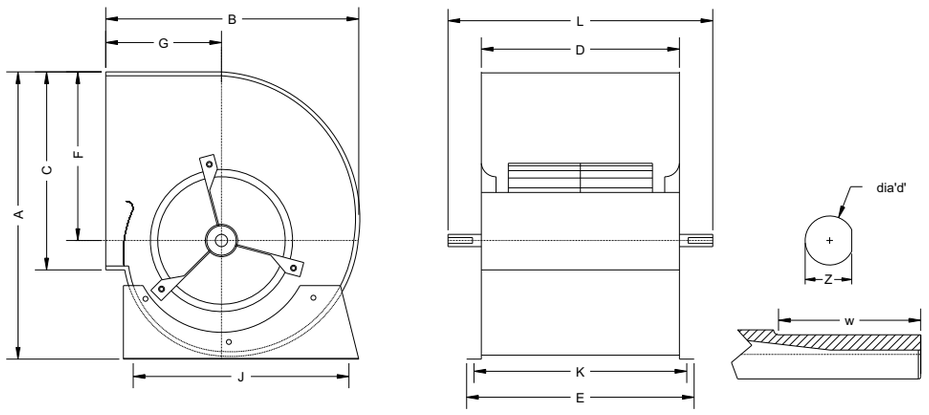


- Performance certified is for installation type B - Free inlet, Ducted outlet. Power rating kW does not include transmission losses. Performance ratings do not include the effects of appurtenances (accessories).
- The A-weighted sound ratings shown have been calculated per AMCA International Standard 301. Values shown are for inlet LwiA sound power levels for installation Type B: free inlet, ducted outlet.

BLOWTECH
we make air move

Dimensions :

BAT 'S'

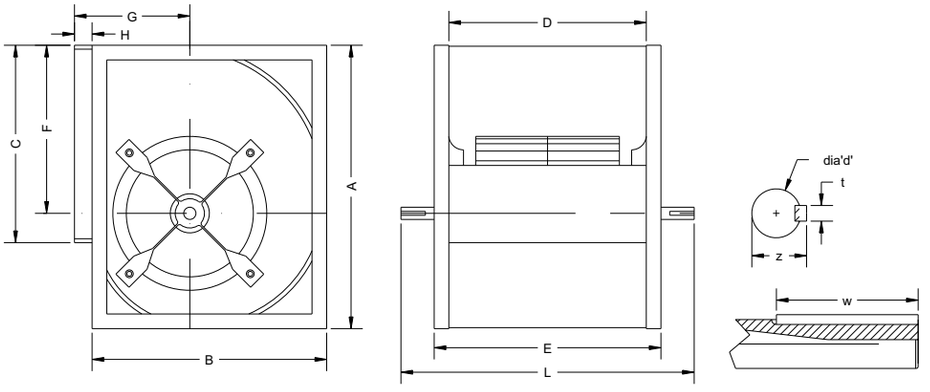


BAT 7x7 - 10x10 'S'

Model	A	B	C	D	E	F	G	J	K	L	d	z	w
7x7	330	316	208	232	282	186	153	225	258	330	20	19	40
9x7	390	380	262	232	282	215	185	300	258	330	20	19	40
9x9	390	380	262	298	342	215	185	300	324	395	20	19	40
10x10	446	425	289	331	381	249	203	340	357	430	20	19	40

All dimensions are in mm.

BAT 'R'



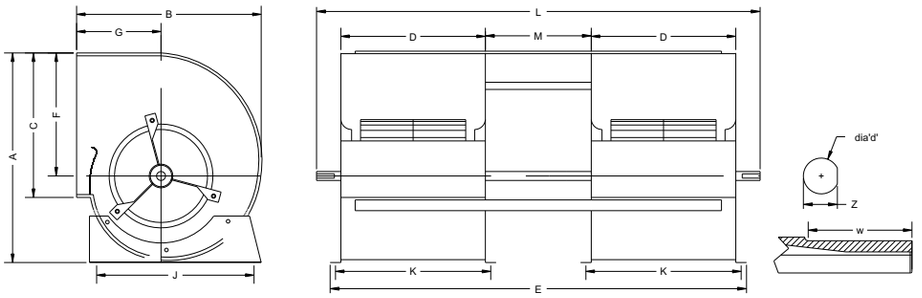
BAT 12x12 - 18x18 'R'

Model	A	B	C	D	E	F	G	H	L	d	t	z	w
12x9	525	455	341	309	369	294	230	38	495	25	8	28	50
12x12	525	455	341	395	455	294	230	38	585	25	8	28	50
15x11	620	538	404	373	453	342	264	36	585	25	8	28	50
15x15	620	538	404	471	551	342	264	36	685	25	8	28	50
18x18	745	650	478	557	637	415	314	36	790	25	8	28	50

All dimensions are in mm.

Dimensions :

BAT 'T2-S'

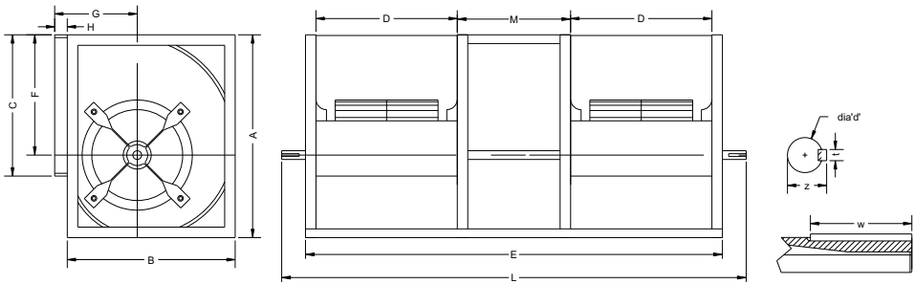


BAT 7x7 - 10x10 'T2-S'

Model	A	B	C	D	E	F	G	J	K	L	M	d	z	w
7x7	330	316	208	232	698	186	153	225	258	808	184	20	19	40
9x7	390	380	262	232	698	215	185	300	258	808	184	20	19	40
9x9	390	380	262	298	890	215	185	300	324	1000	244	20	19	40
10x10	446	425	289	331	976	249	203	340	357	1086	264	20	19	40

All dimensions are in mm.

BAT 'T2-R'



BAT 12x12 - 18x18 'T2-R'

Model	A	B	C	D	E	F	G	H	L	M	d	t	z	w
12x9	525	455	341	309	917	294	230	38	1066	239	25	8	28	50
12x12	525	455	341	395	1169	294	230	38	1320	319	25	8	28	50
15x11	620	538	404	373	1118	342	264	36	1270	292	25	8	28	50
15x15	620	538	404	471	1408	342	264	36	1560	386	25	8	28	50
18x18	745	650	478	557	1651	415	314	36	1805	457	25	8	28	50

All dimensions are in mm.

Notes

Operational Limits - BAT Series

Model			7x7 S	9x7 S	9x9 S	10x10 S	12x9 R	12x12 R	15x11 R	15x15 R	18x18 R
Maximum Fan Speed	rpm	BAT	2600	2400	2100	2000	1800	1500	1400	1200	1100
		BAT T2	2400	2200	1900	1800	1600	1300	1200	1000	900
Maximum Shaft Power	kW	BAT	1.5	3	3	4	4.5	4.5	5	6	7
		BAT T2	2.5	5	5	7	8	8	9	10	12
Maximum Temperature (Minimum -20^{0}C)	^{0}C	BAT	85	85	85	85	85	85	85	85	85
		BAT T2	85	85	85	85	85	85	85	85	85
Fan Weight	kg	BAT	7	7.7	8.7	10.7	19.3	21.5	27.6	30.4	41.8
		BAT T2	15.7	17.4	19.8	23.4	42.5	47	60.7	66.9	94.2

BLOWTECH
we make air move

BLOWTECH AIR DEVICES PVT. LTD.

(An ISO:9001-2008 certified company)

A-15, Sector-65, Noida 201301 INDIA

Ph. : +91-120-4229300 Fax : +91-120-4229309

E-mail : info@blowtech.in web : www.blowtech.in

BAT V1.0 January 2012