

Novenco Centrifugal Fans

CNA and CNB

September 2007



Product Facts

Product

Single-inlet low-pressure fans with backward-curved blades.

Use

In industrial ventilation systems for uncontaminated, non-corrosive air, max. 70° C, where a low sound level is required. The M-type for corrosive environments.

Range

CNA: 9 installation sizes with impeller diameters from 250 mm to 1000 mm. Air flow rates from 0.2 m³/s to 14 m³/s and pressures up to 1000 Pa.

CNB: 7 installation sizes with impeller diameters from 400 mm to 1000 mm. Air flow rates from 0.8 m³/s to 18 m³/s and pressures up to 1500 Pa.

Construction

Fan housing with rectangular side panels for universal installation. The fan is available in directly coupled and belt-driven versions.

Material and Surface treatment

Housing, CNA/B: Sendzimir galvanised (hot-dip galvanised) sheet steel, unpainted.

Housing, CNA/B-M: Sendzimir galvanised (hot-dip galvanised) sheet steel with epoxy coating.

Impeller, CNA-250 to -630: Spot-welded, galvanised sheet steel, unpainted.

Impeller, CNA-710 to -1000: Welded Corten sheet steel, hot-dip galvanised.

Impeller, CNA-M-250 to -630: Spot-welded, galvanised sheet steel, unpainted.

Impeller, CNA-M-710 to -1000:

Welded Corten sheet steel, hot-dip galvanised.

Impeller, CNB + CNB-M:

Welded Corten sheet steel, hot-dip galvanised.

Inlet funnel, CNA/B:

CNA/B-250 to -630: Galvanised deep-drawn sheet, unpainted.

CNA/B-710 to -1000: Cast aluminium, unpainted.

Corrosion Classification

The products meet the requirements for operation in unheated, low-corrosion environments in accordance with:

DS/EN ISO 12944-2.

Corrosion category: C2.

Technical Classification

Technical capacity in accordance with BS 848:1980 and ISO 5801:1997, installation type D.

Accessories

Installation:

- Flexible connections
- Mating flanges
- Anti-vibration mountings
- Common base frame (fan and motor)

Regulation:

- Infinitely variable regulator (CNA-250 and 315 single-phase directly coupled motor)
- 3-stage regulator (CNA-250 and 315 single-phase directly coupled motor)
- 2-speed motor, 3-phase
- Frequency inverter, 3-phase motors

Protection:

- Guard net (inlet and outlet)
- Inlet funnel of brass

Service:

- Inspection and access doors
- Drain plug

Novenco Centrifugal Fans

CNA and CNB

Description	4
Position Designations	5
Dimensioned Drawings	6
Motor Installation	7
Accessories	8
Dimensioning Curves	9
Sound Conditions	15
Regulation of Air Flow Rate	16

Centrifugal Fans CNA and CNB

Centrifugal fans of type CNA and CNB are light, compact low-pressure fans, designed for universal installation in light industrial plants.

Type CNA is produced in 9 sizes with impeller diameters from 250 mm to 1000 mm, air flow rates from 0.2 m³/s to 14 m³/s and total pressure up to approximately 1000 Pa.

Type CNB is produced in 7 sizes with impeller diameters from 400 mm to 1000 mm and is designed for higher RPMs with air flow rates from 0.8 m³/s to 18 m³/s and total pressures up to 1500 Pa.

Centrifugal fans of type CNA and CNB consist of the following main components:

Fan housing, constructed from two rectangular side panels and a casing.
Inlet funnel, mounted in the fan's front side panel with a boss for duct connection and designed so that the air is conducted without loss to the impeller.

Impeller with wide, backward-curved blades.

Belt Drive

A bearing part with two dustproof and waterproof encapsulated deep groove ball bearings in a flanged bearing housing, mounted on the fan's rear side panel, or two flanged bearings mounted in two covers. The bearing part in CNB-500 to -1000 must be relubricated. Other sizes have lifetime lubrication (see maintenance instructions).

Surface treatment

All fan parts are protected against standard corrosive action.

Accessories

Motor according to specification.

Motor panel for installing motors up to the sizes stated on page 7 on the fan housing's flanges. The motor panel can be adjusted to tighten the belts.

Base frame for installing motors over the sizes stated on page 7 beside the fan.

Sizes -250, -315 and -400 are also available with a directly coupled flanged motor installed on the fan's rear side panel.

Sizes -500 and -630 are also available with a directly coupled base motor installed on a motor bracket.

Belt drive, consisting of pulleys, V-belts and belt guards.

Flexible connections for the inlet boss and outlet flange.

Mating flange for the fan's outlet flange.

Guard net for the inlet opening.

Anti-vibration mountings.

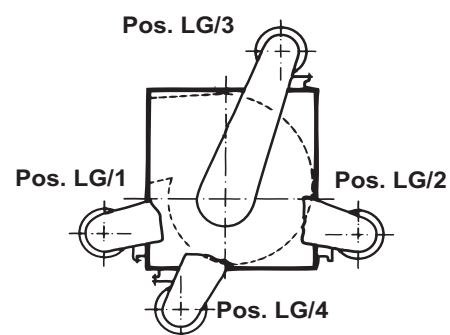
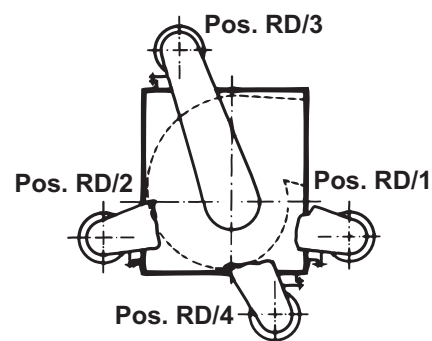
Duct boss for installation on the fan's inlet boss. The inlet flange is also used to connect a flexible connection to the inlet guide vane arrangement.

Inspection hatch placed in the casing of the fan housing.

Drain plug, see page 8.

Positions

Direction of rotation RD or LG.
Motor positions 1, 2, 3 and 4 indicate the position of the motor in relation to the outlet opening.



Position Designations

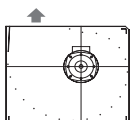
Please note:

Fan positions in connection with installation on a common base frame must be indicated in accordance with EUROVENT.

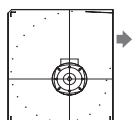
Directly coupled:

motor installed on fan housing

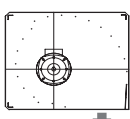
Position: RD 0



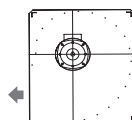
Position: RD 90



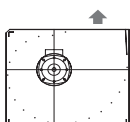
Position: RD 180



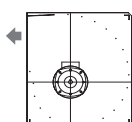
Position: RD 270



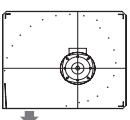
Position: LG 0



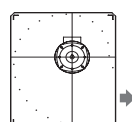
Position: LG 90



Position: LG 180



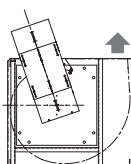
Position: LG 270



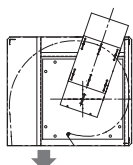
Belt-driven:

low motor bracket for belt drive

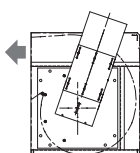
Position: LG/1



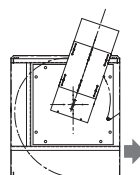
Position: LG/2



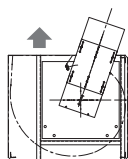
Position: LG/3



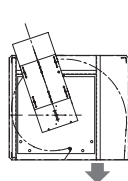
Position: LG/4



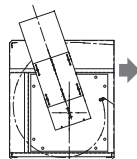
Position: RD/1



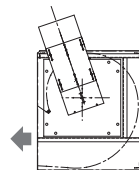
Position: RD/2



Position: RD/3



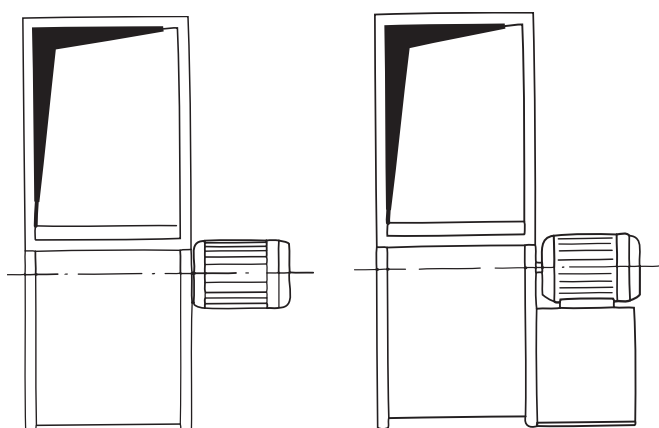
Position: RD/4



Positions in accordance with EUROVENT seen from the motor side

Centrifugal Fans CNA and CNB

Dimensioned Drawings



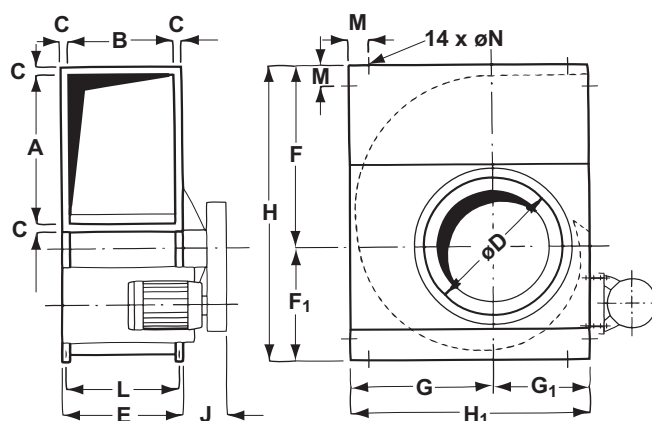
Directly coupled:

CNA-250, -315, -400

CNB-400

CNA-500, -630

CNB-500, -630



With belt drive:

all sizes

Dimensions in mm																Weight*, kg	
CNA CNB	A	B	C	D	E	F	F ₁	G	G ₁	H	H ₁	J	L	M	N	CNA	CNB
-250	250	175	30	250	235	310	250	245	200	560	445	150	207	60	12	22	–
-315	315	220	30	315	280	410	280	345	250	690	595	160	252	100	12	35	–
-400	400	280	30	400	340	485	315	400	300	800	700	145	312	100	12	53	55
-500	500	350	35	500	420	600	400	500	350	1000	850	170	392	125	15	89	98
-630	630	440	35	630	510	758	488	623	440	1246	1063	250	482	125	15	146	161
-710	710	497	40	710	577	870	535	670	465	1405	1135	260	537	62.5	15	238	262
-800	800	560	40	800	640	976	604	754	516	1580	1270	280	600	85	15	304	334
-900	900	630	45	900	720	1098	680	847	573	1778	1420	300	680	110	15	350	385
-1000	1000	700	45	1000	790	1215	750	940	640	1965	1580	360	750	90	15	487	535

*Weight excl. motor and belt drive

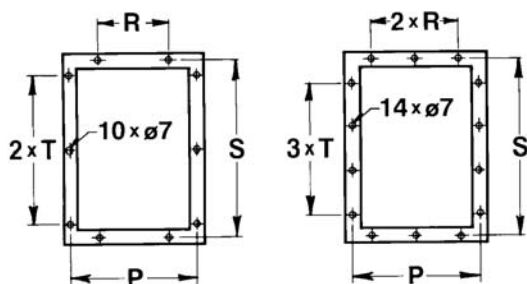
Outlet Flanges

CNA CNB	P	R	S	T
-250	207	85	282	110
-315	252	110	347	142,5
-400	312	140	432	185
-500	386	125	536	155
-630	476	170	666	200
-710	537	150	750	170
-800	600	170	840	175
-900	680	195	950	200
-1000	750	160	1050	180

Mating flanges (4 rails) with the same bolt holes as the outlet flanges are available as accessories.

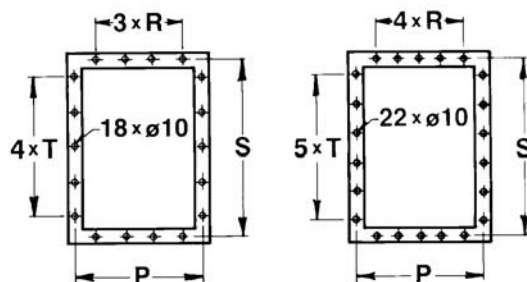
Ducts are made with the same internal dimensions as the fan's outlet opening (A x B).

See dimensioned drawing above.



Size -250, -315, -400

Size -500, -630



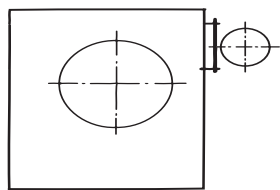
Size -710, -800, -900

Size -1000

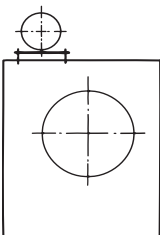
Centrifugal Fans CNA and CNB

Motor installation

The tables show the maximum motor size that can be installed directly on the fan.



Motor on the side
– vertical motor panel



Motor on the top
– horizontal motor panel

Motor Sizes

Directly coupled

Fan size	Motor installation size
CNA-250	71-90
CNA-315	71-100
CNA/B-400	80-100
CNA/B-500	112-132
CNA-630	132
CNB-630	160

250-400 Design B14 small

500-630 Design B3

Belt-driven

CNA CNB	Max. motor	
	Type	Weight
-250	90	20
-315	112	40
-400	112	40
-500	132	70
-630	132	70
-710	132	70
-800	132	70
-900	132	70
-1000	132	70

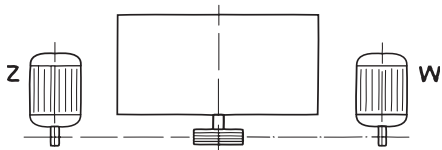
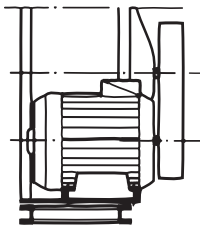
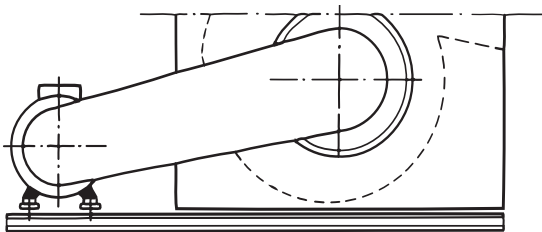
Belt-driven

CNA CNB	Max. motor	
	Type	Weight
-250	90	20
-315	112	40
-400	112	40
-500	132	70
-630	132	70
-710	160	140
-800	160	140
-900	180*	190
-1000	180	190

*CNA max. 160

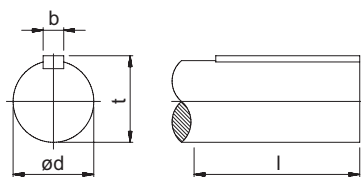
Base Frame for Fan and Motor

Large motors are installed on clamp rails beside the fan. A common base frame for the fan and motor, as shown in the drawings, is available. Please state the desired motor position (pos. W or Z, see below).



Centrifugal Fans CNA and CNB

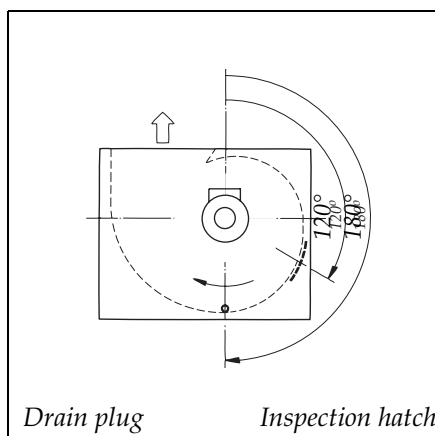
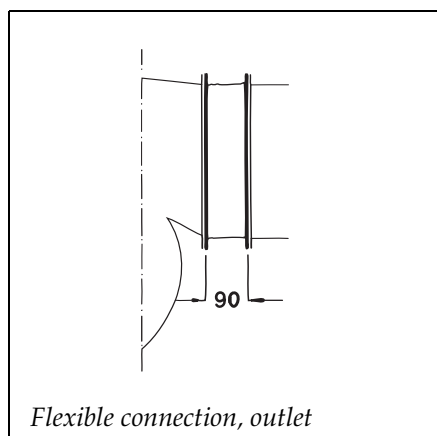
Shaft end for belt drive



CNA	d	l	b	t
-250	24 j6	50	8	27
-315	24 j6	50	8	27
-400	24 j6	50	8	27
-500	28 j6	50	8	31
-630	32k6	60	10	35
-710	35h8	100	10	38
-800	40h8	100	12	43
-900	40h8	100	12	43
-1000	55h8	100	16	59

CNB	d	l	b	t
-400	28 j6	50	8	31
-500	38 k6	90	10	41
-630	48 k6	90	14	51.5
-710	55m6	100	16	59
-800	55m6	100	16	59
-900	60m6	115	18	64
-1000	60m6	115	18	64

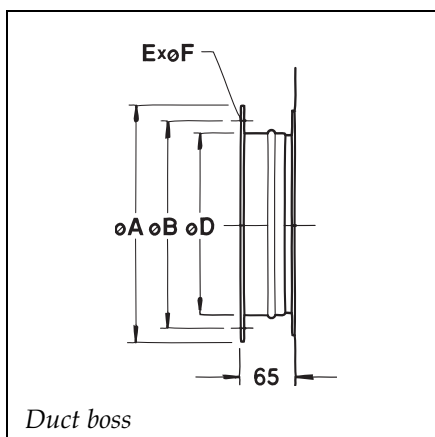
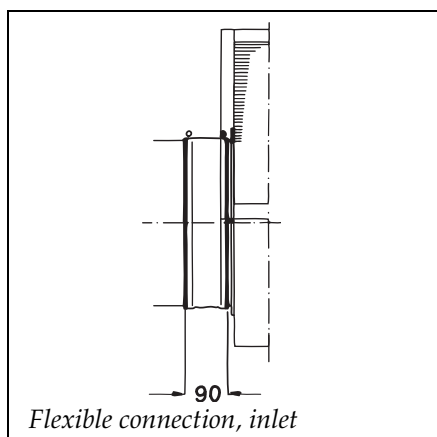
Accessories



Type CNA and CNB are available with inspection hatches in the housing's casing and with drain bosses.

When ordering, please state the location of the inspection hatch and drain boss in relation to the outlet direction.

For example: Inspection hatch pos. RD 120.
Drain plug pos. RD 180.



CNA CNB	A	B	D	E	F
-250	310	280	250	4	10
-315	385	355	315	8	10
-400	480	450	400	8	12
-500	590	560	500	12	12
-630	720	690	630	12	12
-710	790	765	710	10	14
-800	880	850	800	10	14
-900	1000	970	900	16	14
-1000	1080	1050	1000	16	14

Dimensioning

The basis for dimensioning is the air flow rate and the pressure loss in the ventilation system in question = the fan's static pressure, $p_s = p_{s2} - p_{s1}$.

To establish the fan's total pressure p_t , add the air's speed pressure, the dynamic pressure p_d at the outlet and the installation loss at the inlet p_1 and outlet p_2 .

These values are stated in connection with the dimensioning graphs on pages 10 to 14.

All graphs are plotted for arrangement D.

A dimensioning example is shown below.

Choice of Motor

The power consumption in the dimensioning graphs refers to the fan shaft. To cover the loss in the belt drive

and bearing part, etc., the power consumption reading is increased by factor C_1 .

C_1 depends on the fan size:

315-630 : $C_1 = 1.2$

710-1000 : $C_1 = 1.1$

Arrangement D:

(ducts for the inlet and outlet).

Air flow rate $q_v = 1.75 \text{ m}^3/\text{s}$.

Pressure loss = static pressure = $p_s =$

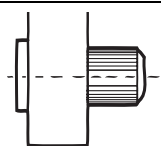
$p_{s2} - p_{s1} = 1300 \text{ Pa}$.

The graph on page 11 shows that type CNB-400 is best suited.

The calculation is as follows:

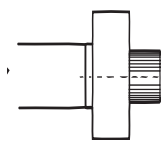
$p_{s2} - p_{s1}$	=	1300 Pa
+ p_d	=	155 Pa
Total pressure	=	1455 Pa

Arrangement A



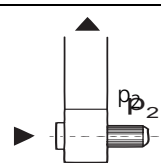
$p_{s2} - p_{s1}$	=	Pa
+ p_1	=	Pa
+ $p_d + p_2$	=	Pa
Total pressure	=	Pa

Arrangement C



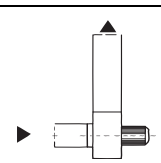
$p_{s2} - p_{s1}$	=	Pa
+ $p_d + p_2$	=	Pa
Total pressure	=	Pa

Arrangement B



$p_{s2} - p_{s1}$	=	Pa
+ p_1	=	Pa
+ p_d	=	Pa
Total pressure	=	Pa

Arrangement D



$p_{s2} - p_{s1}$	=	Pa
+ p_d	=	Pa
Total pressure	=	Pa

The graph also shows the following:

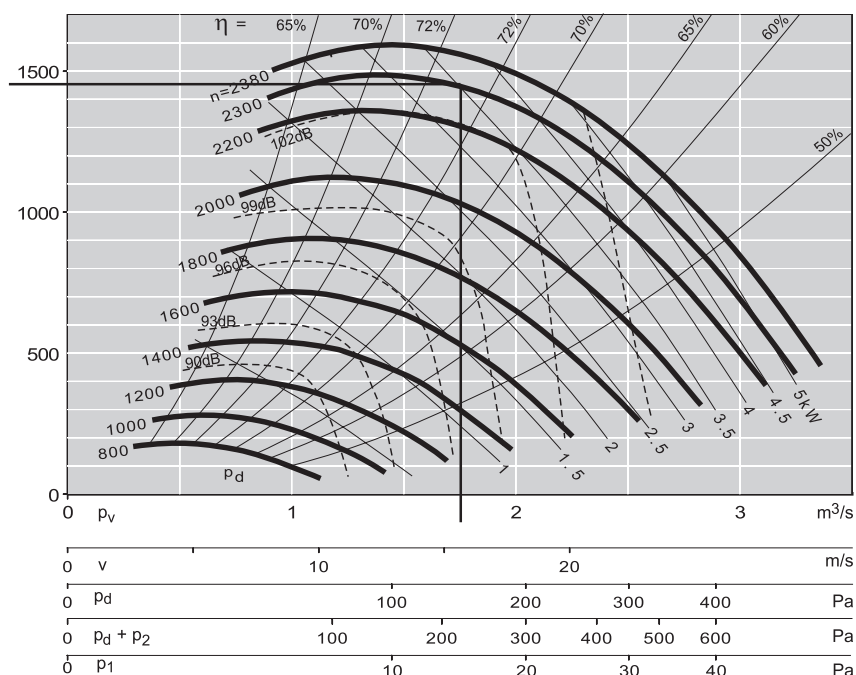
Fan speed of 2300 RPM.

Efficiency of 72 %.

Power demand of 3.5 kW.

Correction $2.3 \times 1.2 = 4.2 \text{ kW}$.

Choice of motor: 5.5 kW.



Centrifugal Fans CNA and CNB

Dimensioning Curves

CNA-250

max. = 3150 RPM (beltdriven)

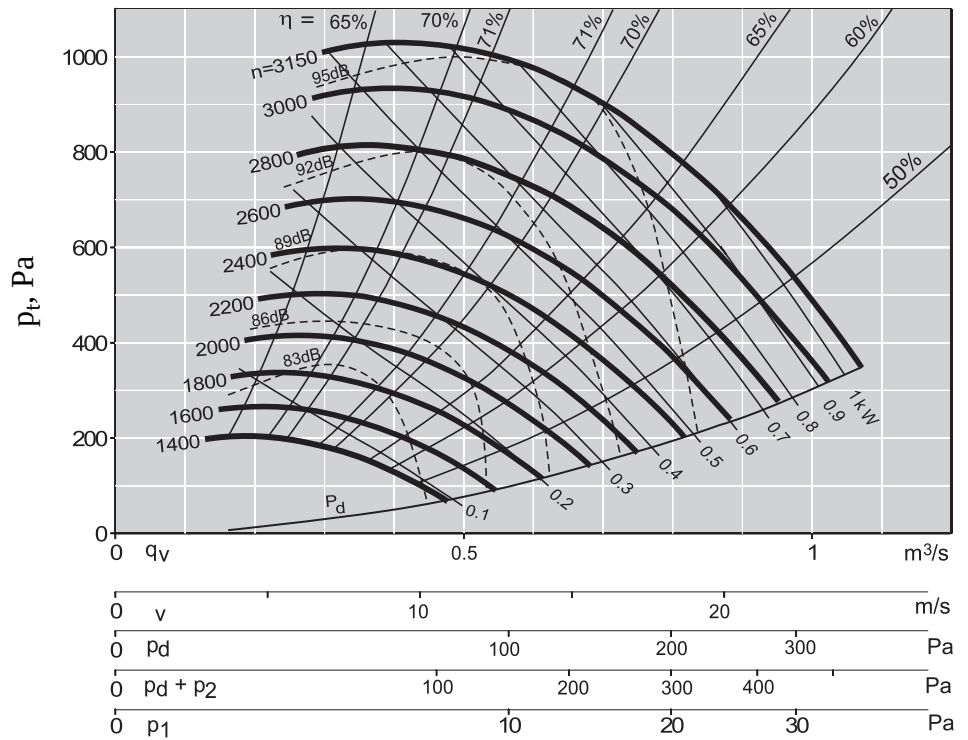
max. = 3600 RPM (direct coupled)

$\rho = 1.20 \text{ kg/m}^3$

$I_V = 0.025 \text{ kgm}^2$

Circumferential speed

$u = 0.013 \times n, \text{ m/s.}$



CNA-315

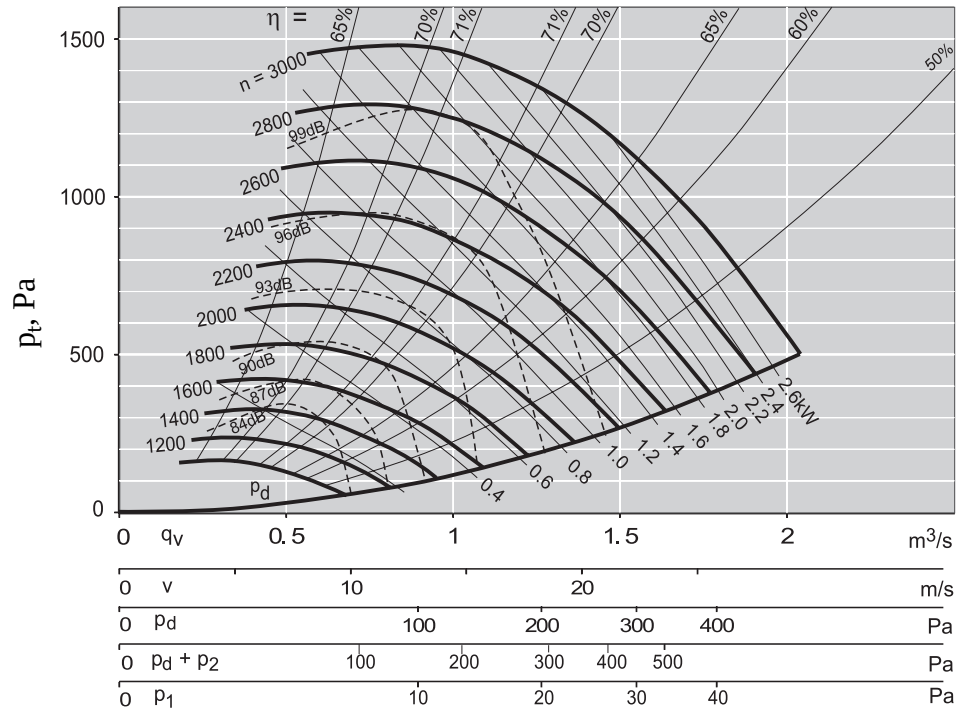
max. = 3000 RPM

$\rho = 1.20 \text{ kg/m}^3$

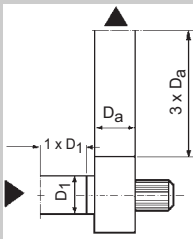
$I_V = 0.05 \text{ kgm}^2$

Circumferential speed

$u = 0.016 \times n, \text{ m/s.}$



Basis for
chart
(Arr. D)



Symbols

p_t = total pressure

p_d = dynamic pressure, outlet

p_1 = connection loss, inlet

p_2 = connection loss, outlet

v = air speed, outlet

q_v = volume flow

n = RPM

η = efficiency in %

kW = power demand, impeller

dB = sound power level, outlet

Centrifugal Fans CNA and CNB

Dimensioning Curves

CNA-400

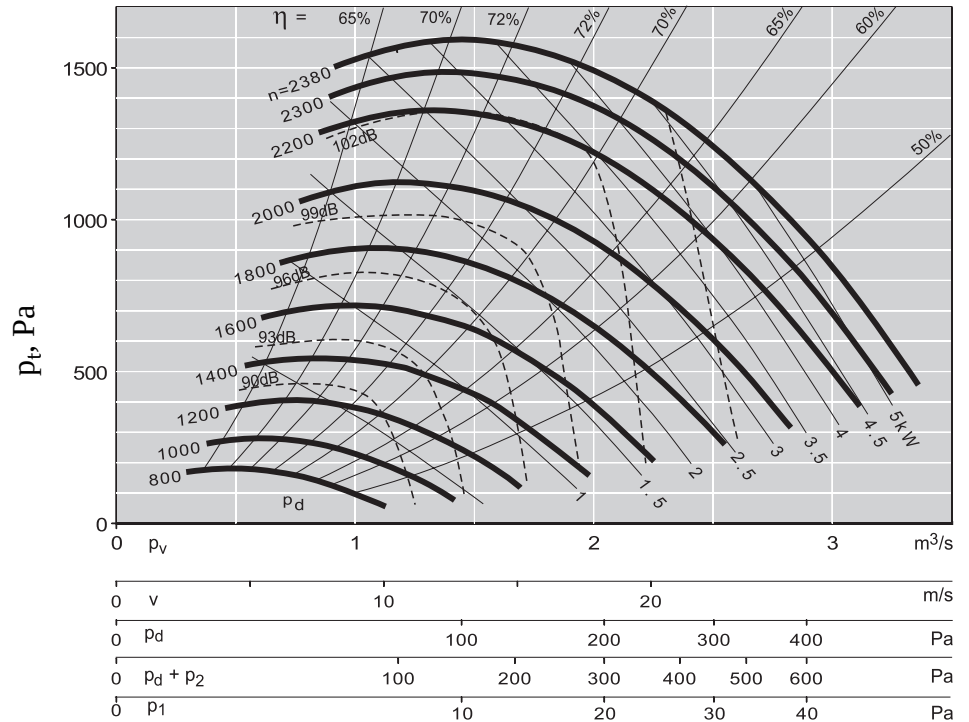
max. = 1950 RPM
 $\rho = 1.20 \text{ kg/m}^3$
 $I_v = 0.175 \text{ kgm}^2$

CNB-400

max. = 2380 RPM
 $\rho = 1.20 \text{ kg/m}^3$
 $I_v = 0.3 \text{ kgm}^2$

Circumferential speed

$u = 0.021 \times n, \text{ m/s.}$



CNA-500

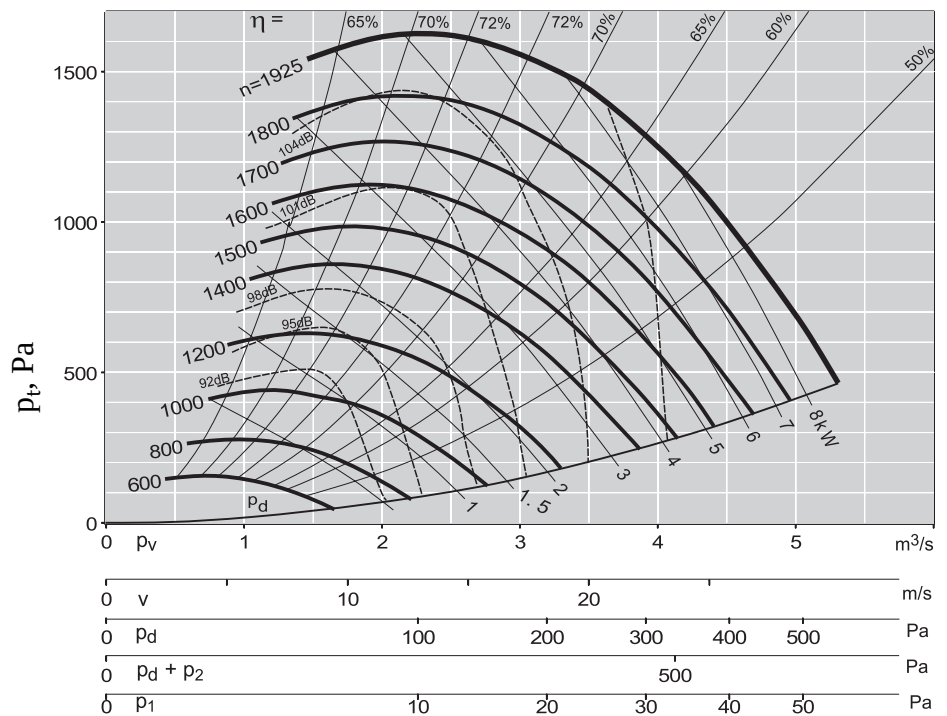
max. = 1575 RPM
 $\rho = 1.20 \text{ kg/m}^3$
 $I_v = 0.55 \text{ kgm}^2$

CNB-500

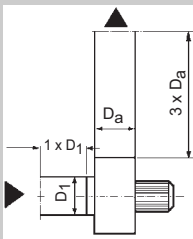
max. = 1925 RPM
 $\rho = 1.20 \text{ kg/m}^3$
 $I_v = 0.75 \text{ kgm}^2$

Circumferential speed

$u = 0.026 \times n, \text{ m/s.}$



Basis for
chart
(Arr. D)



Symbols

p_t = total pressure
 p_d = dynamic pressure, outlet
 p_1 = connection loss, inlet
 p_2 = connection loss, outlet
 v = air speed, outlet

q_v = volume flow
 n = RPM
 η = efficiency in %
 kW = power demand, impeller
 dB = sound power level, outlet

Centrifugal Fans CNA and CNB

Dimensioning Curves

CNA-630

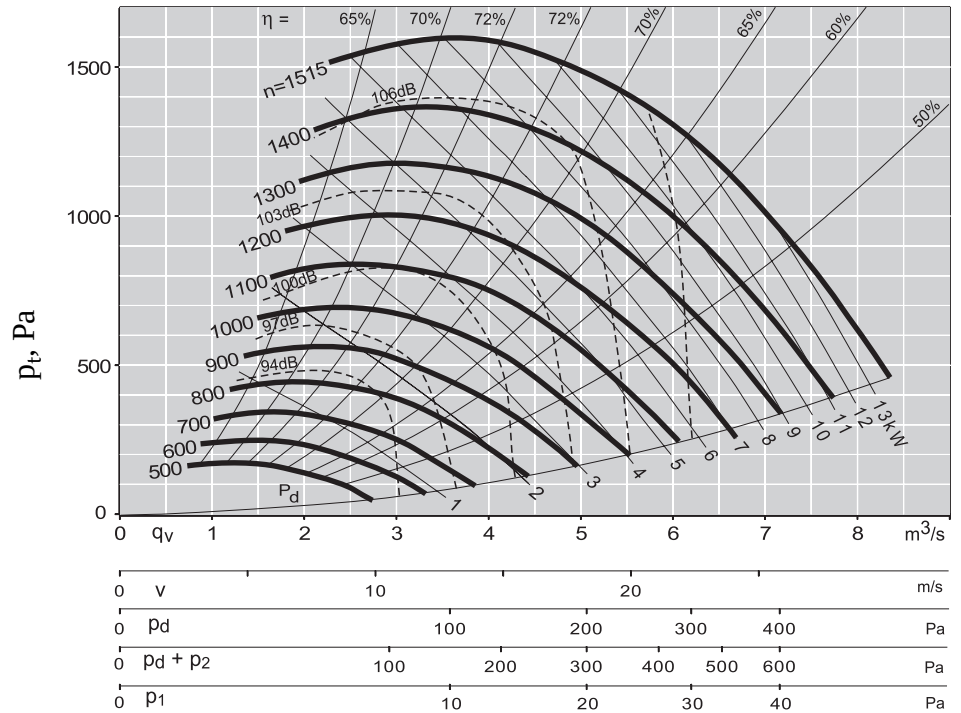
max. = 1240 RPM
 $\rho = 1.20 \text{ kg/m}^3$
 $I_v = 1.35 \text{ kgm}^2$

CNB-630

max. = 1515 RPM
 $\rho = 1.20 \text{ kg/m}^3$
 $I_v = 1.85 \text{ kgm}^2$

Circumferential speed

$u = 0.033 \times n, \text{ m/s.}$



CNA-710

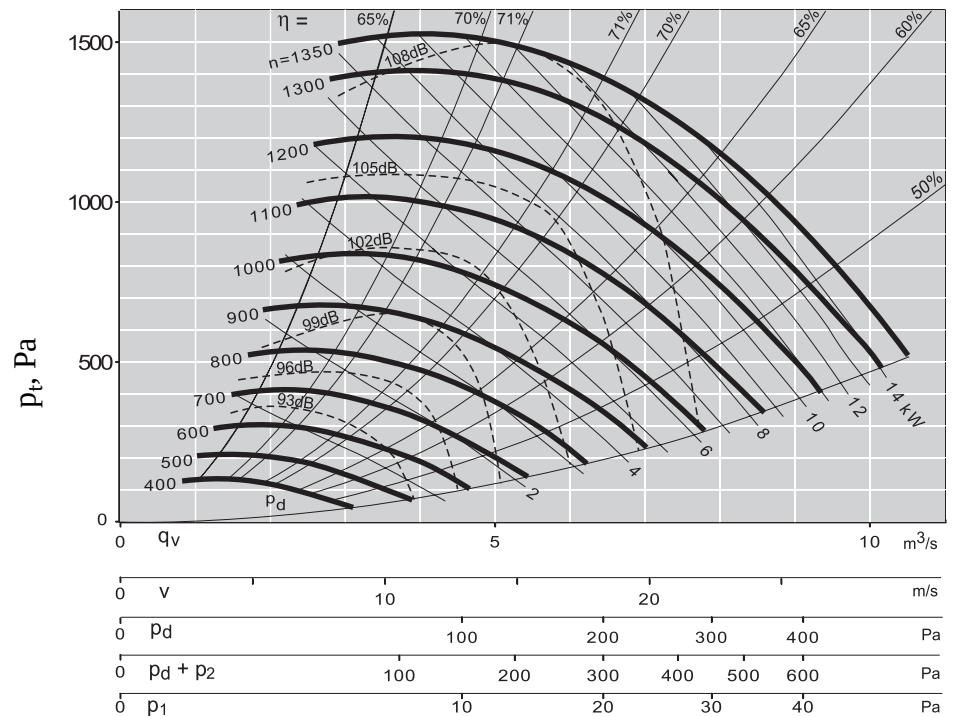
max. = 1105 RPM
 $\rho = 1.20 \text{ kg/m}^3$
 $I_v = 3 \text{ kgm}^2$

CNB-710

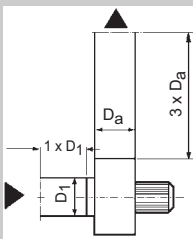
max. = 1350 RPM
 $\rho = 1.20 \text{ kg/m}^3$
 $I_v = 3 \text{ kgm}^2$

Circumferential speed

$u = 0.037 \times n, \text{ m/s.}$



Basis for
chart
(Arr. D)



Symbols

p_t = total pressure
 p_d = dynamic pressure, outlet
 p_1 = connection loss, inlet
 p_2 = connection loss, outlet
 v = air speed, outlet

q_v = volume flow
 n = RPM
 η = efficiency in %
 kW = power demand, impeller
 dB = sound power level, outlet

Centrifugal Fans CNA and CNB

Dimensioning Curves

CNA-800

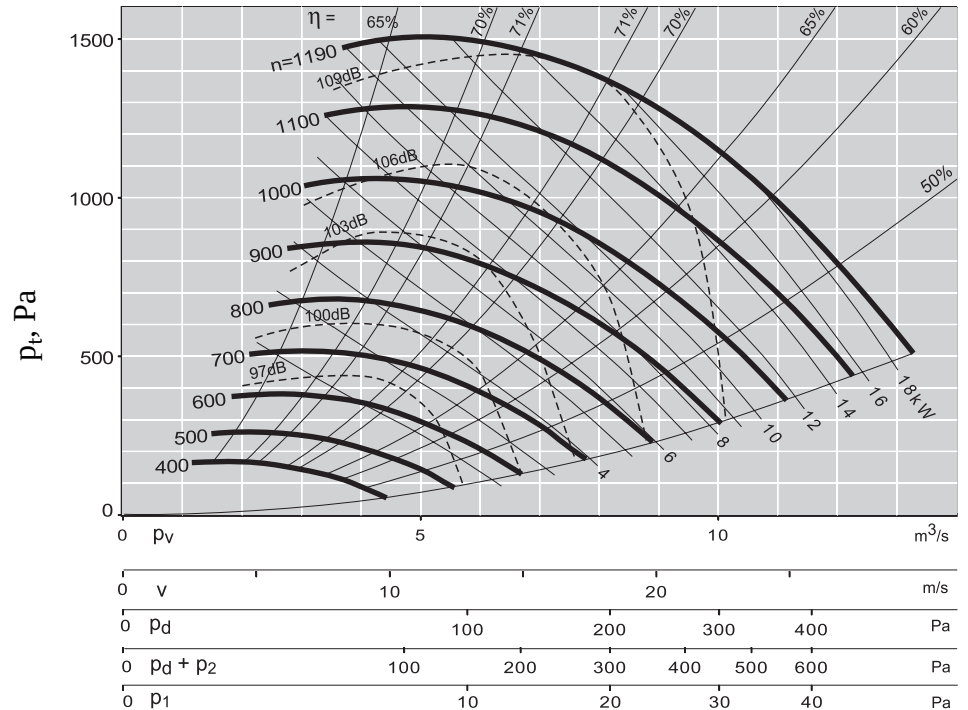
max. = 975 RPM
 $\rho = 1.20 \text{ kg/m}^3$
 $I_v = 5 \text{ kgm}^2$

CNB-800

max. = 1190 RPM
 $\rho = 1.20 \text{ kg/m}^3$
 $I_v = 5 \text{ kgm}^2$

Circumferential speed

$u = 0.042 \times n, \text{ m/s.}$



CNA-900

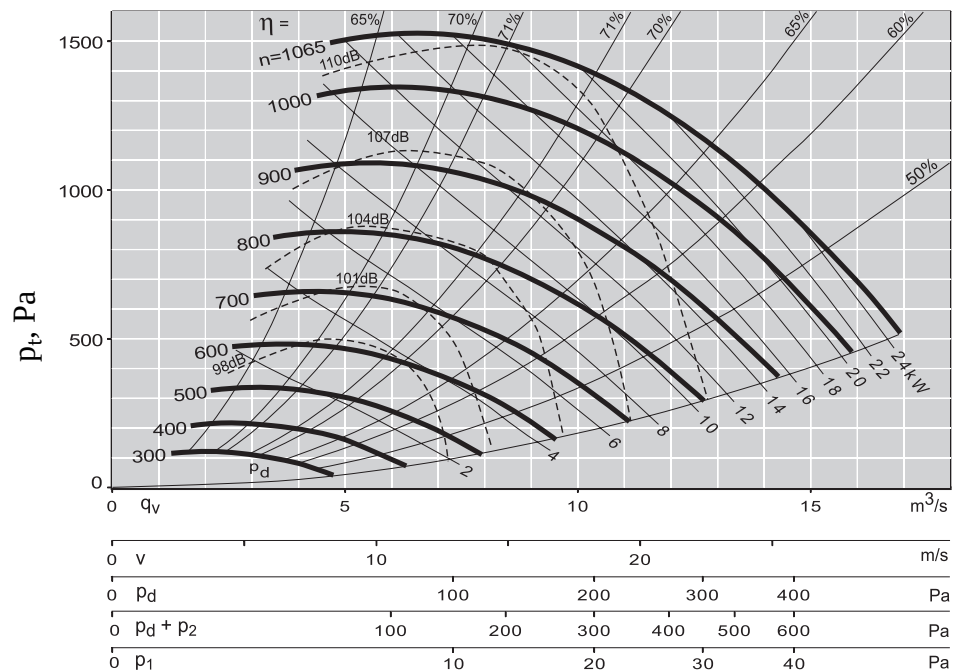
max. = 870 RPM
 $\rho = 1.20 \text{ kg/m}^3$
 $I_v = 7.75 \text{ kgm}^2$

CNB-900

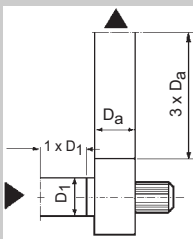
max. = 1065 RPM
 $\rho = 1.20 \text{ kg/m}^3$
 $I_v = 7.75 \text{ kgm}^2$

Circumferential speed

$u = 0.047 \times n, \text{ m/s.}$



Basis for
chart
(Arr. D)



Symbols

p_t = total pressure
 p_d = dynamic pressure, outlet
 p_1 = connection loss, inlet
 p_2 = connection loss, outlet
 v = air speed, outlet

q_v = volume flow
 n = RPM
 η = efficiency in %
 kW = power demand, impeller
 dB = sound power level, outlet

Centrifugal Fans CNA and CNB

Dimensioning Curves

CNA-1000

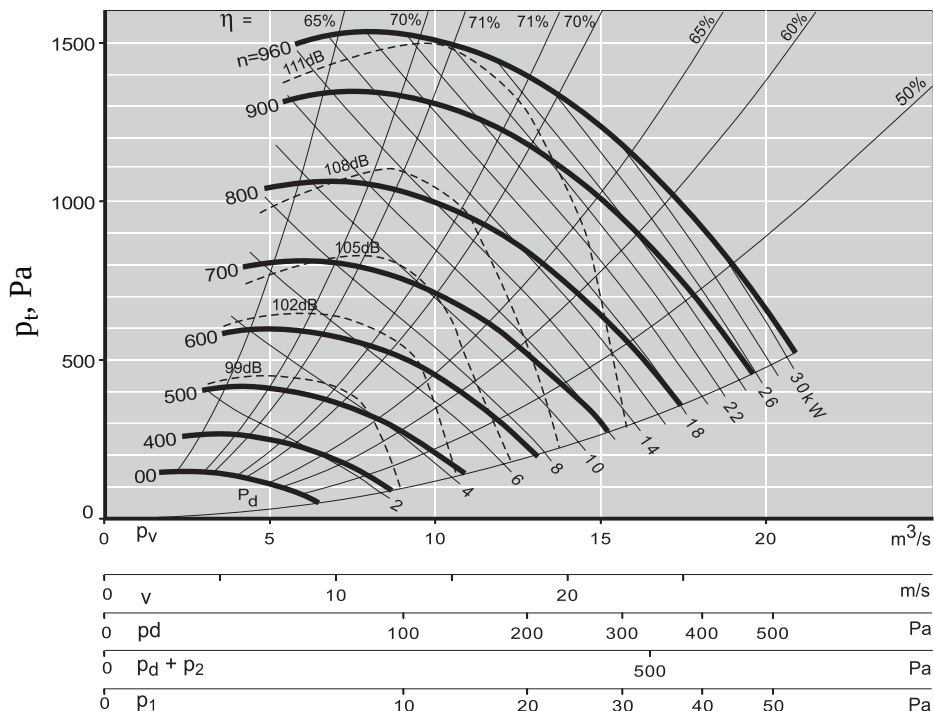
max. = 785 RPM
 $\rho = 1.20 \text{ kg/m}^3$
 $I_v = 14 \text{ kgm}^2$

CNB-1000

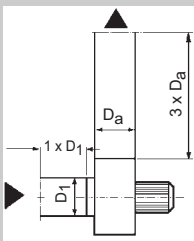
max. = 960 RPM
 $\rho = 1.20 \text{ kg/m}^3$
 $I_v = 14 \text{ kgm}^2$

Circumferential speed

$u = 0.052 \times n, \text{ m/s.}$



Basis for
chart
(Arr. D)



Symbols

p_t = total pressure
 p_d = dynamic pressure, outlet
 p_1 = connection loss, inlet
 p_2 = connection loss, outlet
 v = air speed, outlet

q_v = volume flow
 n = RPM
 η = efficiency in %
 kW = power demand, impeller
 dB = sound power level, outlet

Centrifugal Fans CNA and CNB

Sound Conditions

When a fan is operated, sound is generated. This is partly electrical and mechanical sound in the motor, bearings and other mechanical parts, partly air sound that occurs as the air flows through the fan.

Sound generation is counteracted by the correct design and careful production of all parts of the fan, in particular the inlet funnel and impeller, where air sound is concerned. In this connection, it must be noted that poor installation conditions, for example a sharp duct bend immediately before the inlet opening, may increase sound generation considerably.

The electrical and mechanical sound, and that part of the air sound that passes out through the fan housing, can only be dampened by surrounding the fan with a casing or walls of low-vibration (heavy) materials.

The sound generated in the impeller is distributed through the inlet and outlet openings to the duct system and on to the ventilated rooms.

Calculation of the sound conditions in the duct system and the ventilated rooms, including dimensioning of any silencers in the system, is only possible on the basis of the sound power level in the fan's inlet and outlet openings. In connection with all considerations concerning sound, a sharp distinction must be made between the two terms sound power level and sound pressure level.

The sound power level is an expression of the sound energy emitted through the fan's inlet and outlet openings and forms the basis for any calculation concerning the sound conditions in the connected

duct systems and in the rooms served by the fan.

The sound pressure level (often just called the sound level) is a measure of the sound impression perceived by the ear at a given location in the environment of the fan. It can be measured using a sound meter with a microphone mounted in the location in question.

The sound pressure level depends on the fan's sound power level, the distance from the fan and the silencing properties of the environment. When a fan's sound properties are characterised by stating a sound pressure level, it is therefore necessary also to give a precise description of the conditions under which the sound level stated occurs.

When comparing two fans' sound properties, a sound power level must never be compared with a sound pressure level, and it is only possible to compare two sound pressure levels when the distance from the fan and the silencing in the environment are the same in both cases.

For a correctly constructed fan, the sound power level depends mainly on the air flow rate supplied and the total pressure of the fan.

The sound power level of the individual fans is shown in the graphs on pages 10-14 and is stated in dB with a reference value of 10^{-12} W and applies within the fan's normal working range with a tolerance of ± 5 dB. If the sound power level needs to be divided into octave values, the sound power level in the different octave bands is determined by deducting the correction values in the table below from the total sound power level found.

For CAN and CNB, the correction values depend on the blade frequency

$$z \times \frac{n}{60}, \text{ where}$$

z = number of blades and

n = fan's speed in RPM.

For CNA and CNB, the number of blades is 12.

Correction Values

Octave band, Hz		63	125	250	500	1k	2k	4k	8k
CNA, CNB Blade frequency	90-180 Hz	7	4	7	12	17	22	27	32
	180-360 Hz	11	7	4	7	12	17	22	27
	360-710 Hz	13	11	7	4	7	12	17	22
	710-1400 Hz	15	13	10	6	4	7	12	18

Example: A centrifugal fan type CNA-315 has an output of $0.6 \text{ m}^3/\text{s}$ at 300 Pa and 1400 RPM.
Blade frequency: $12 \times 1400/60 = 280$ Hz.

As the graph on page 10 shows, the total sound power level is 84 dB.

The correction value for 250 Hz is 4 dB.

The sound power level for this octave band is thus:
 $84 \text{ dB} - 4 \text{ dB} = 80 \text{ dB}$

The full octave analysis is shown in the table below.

Octave band, Hz	63	125	250	500	1k	2k	4k	8k
Sound power level, dB	73	77	80	77	72	67	62	57

Regulation of Air Flow Rate

Depending on the operating requirements, the fan's capacity can be regulated in several ways:

- By changing poles between 2 fixed RPMs in the ratio 3: 2 (motor with 2 separate windings) or 2:1 (Dahlander winding motor).
- By frequency regulation.
- By a combination of the above.

Changing Poles

In connection with time-related variations in the air flow rate demand (for example, night-time and daytime operation), it is recommended that the fan be fitted with a change-pole motor. When the fan is changed to a different RPM, the fan's efficiency is unchanged. The change can be controlled by a timer.

If other operating points are required than can be achieved by changing poles, other regulation methods must be used.

Frequency Regulation

The fan's efficiency remains virtually unchanged throughout the regulation range and no sound is generated during the regulation.



Novenco develops and manufactures ventilation and fire fighting systems that are marketed and distributed world-wide through subsidiaries and agents.

The company was founded in Denmark 1947 and has become one of the world-leading suppliers.

Novenco symbolises quality and environmentally friendly products. The company is certified according to ISO 9001 and ISO 14001.

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