

Novenco axial flow fans

ZerAx - Standard



Product facts

Product

The Novenco® ZerAx® series of axial flow fans uses innovative design to reduce power consumption by improving efficiency. As an extra benefit, which depends on size and solution, it offers to improve the work environment by lowering the sound level.

Application

ZerAx fans are well-suited for both comfort and industrial ventilation.

Range

The ZerAx for duct installation is designated AZN. If fitted with a cone, it can be used with free inlet or outlet.

It spans 9 sizes all with Ø350 hubs and rotor diameters from Ø500 to Ø1250 mm. Larger sizes follow later.

Blade angles lie between 25° and 70° in 5° increments, depending on the desired pressure.

Air flow rates go from 0.1 to 40 m³/s and pressure increases up to 3600 Pa.

Motors

Mounting: Depending on size either enclosed in motor mount or displaced outside through a long hub.

Terminal boxes: Boxes of steel or plastic mounted on fan casing

Dimension standard: IEC-72

Electrical standard: IEC-34

Enclosure: IP-55 or IP-56

Insulation: Class F or H

Balancing: ISO 2373

Structural shape: B14 and B5 for flanges

Efficiency

The ZerAx fan efficiency goes as high as 90%, i.e. without taking the motor into account.

ZerAx fans are capable of running in reverse up to the max. allowable speed for normal direction. In reverse the air flow is reduced to approx. 50% of normal and the pressure to 25%.

Materials

Blades: Aluminium

Hub: Aluminium

Hub cap: Aluminium

Inner hub: Cast steel

Inner tube: AluZink

Fan casing: AluZink for light motors and hot-dip galvanised steel for heavy motors

Guide vanes: Aluminium

Classifications

Flange standard: EUROVENT 1/2

Technical capacity: BS 848-1:2007 and EN ISO 5801:2008

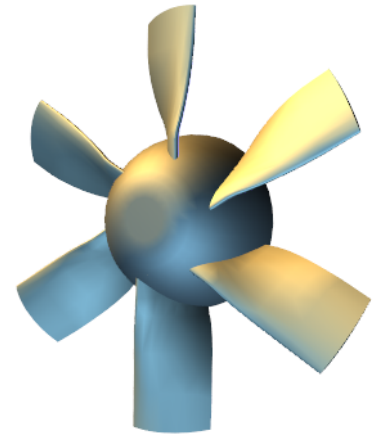
Environment: DS/EN ISO 12944-2, corrosion category C3

Temperature range standard: -20 to 50 °C

Temperature range, max.: -40 to 120 °C

Accessories

- Fan casing extension
- Inlet cone with wire guard
- Outlet wire guard
- Acoustic diffuser type YAD with core
- Short diffuser
- Long diffuser
- Silencer type YAH with or without core
- Feet for horizontal mounting
- Plate for vertical mounting



- Anti-vibration mountings
- Flexible connection
- Counter flange
- Duct spigots
- Roof hood type HAN
- Damper type SBC

Product facts	2
Description	4
Fan sizes	5
Inside the ZerAx	6
Types	8
Dimensions	9
Accessories	10
Calculation examples	16
Quality and service	18

Important

This document is provided 'as is'. Novenco reserves the right to changes without further notice due to continuous product development.

The fan is designed for continuous operation. The following kinds of operation may cause fatigue break in the impeller and endanger people.

- Operation in stall area
- Operation with pulsating counter pressure – called pump mode
- Operation with repeated starting and stopping

If in doubt Novenco should be contacted to assess the suitability of the fan.

Copyright (c) 2009 - 2010, Novenco A/S.
All rights are reserved.

MU 14392 0910

Patents and trademarks

Novenco® is a registered trademark of Novenco A/S.

The ZerAx® trademark and the ZerAx design are registered to Novenco A/S.

The ZerAx manufacturing processes and technologies are patent pending. Pat. no. PA200901117, PA200901118, PA200901119.

Other trademarks appearing in this document are the property of their respective owners.

Quality and environment

Novenco is certified in accordance with ISO 9001 and 14001.

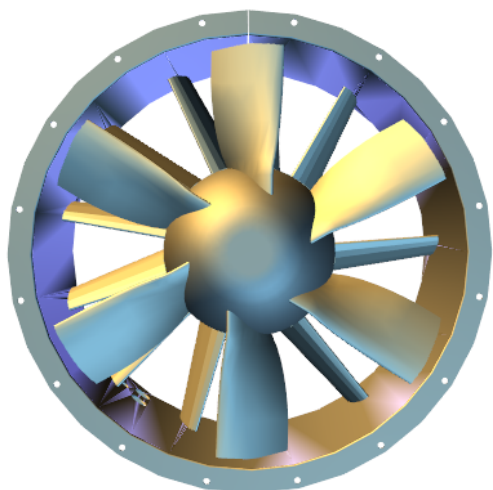


Description

The ZerAx is the future replacement for Novenco's renowned Novax design. A lot has happened since the Novax was first conceived; new technologies have emerged, materials have been refined and last but not least, compliance with environmental legislation has come into focus.

The result, the ZerAx series of axial flow fans, raises the bar for achievable efficiency and lowers the overall power consumption.

As with the previous fan series, the ZerAx is also suited for installation in diverse systems and environments. Built into comfort systems such as residential housing ventilation and carpark ventilation, it offers to keep high levels of performance at minimum costs. Onboard ships and in off-shore facilities, it offers to save barrels of oil and to improve crew conditions by lowering the noise level.



3D model of ZerAx AZN

Design

Central in the ZerAx is the rotor assembled from aluminium cast hub parts and blades. The rotor construction is fitted in an inner tube, which has cast profiled guide vanes mounted on the motor mount.

In the AZN the complete rotor arrangement is installed together with the motor in the fan casing. The AZN is for duct installation and designed to have a minimum blade clearance.

Materials

Key to the performance of the ZerAx is the choice of materials and the characteristics of the surface textures. The focus is on keeping the weight down, i.e. using light

and strong materials. Most parts are of aluminium and optimised to withstand high strains.

To save further on weight the fan casing is shortened and parts are cast and machined with low tolerances.

High efficiency

The fan efficiency is as high as 90%. Motors offered in connection with ZerAx are efficiency class 1 and 2.

The ZerAx fans are capable of running in reverse up to the max. allowable speed for normal direction. In reverse the air flow is reduced to approx. 50% of normal and the pressure to 25%.

Classifications

The ZerAx design has been tested and specifications verified by the largest laboratory in Northern Europe according to the standards EN ISO 5801 and AMCA 210 and BS 848.

Optimum blade angles

Fan performance depends on fan speed and fan blade angle. The blade angle is found with the AirBox program. The data is input to the production and used when manufacturing the fans.

AirBox calculation program

The AirBox program is Novenco's calculation and configuration tool for ZerAx fans. Input to the program are the requirements for air flow and pressure as well as specific characteristics of the operating environment. Further requirements for the fan, motor and accessories are also input and form the basis for calculation of possible solutions.

Novenco AirBox is available on www.novencogroup.com in the download section. It requires registration, checks automatically for updates and is for free.

ZerAx web site

Stay up-to-date on www.zerax.com.

The fans are supplied with 50 or 60 Hz motors as standard, but can also be supplied with special motors. Speed control is either through direct start or through a frequency converter. The maximum speeds appear from the table below.

The ZerAx fans present a serious alternative to centrifugal fans in ventilation and air conditioning systems with varying air flow rate requirements.

The fans are prepared for frequency converter operation with RFI filters according to the product standard EN61800-3, class C2. Using frequency converters removes the limitations caused by net frequencies of 50 or 60 Hz.

The fans can often be designed to operate near optimum

efficiency. At the same time the air quantities can of course be regulated, if needed.

Operational cost and space requirements are low for ZerAx fans, as fan sizes quite often are smaller when comparing to conventional fans with the same air technical specifications.

Hub diameter	Motor sizes	Rotor diameters								
		Ø500	Ø560	Ø630	Ø710	Ø800	Ø900	Ø1000	Ø1120	Ø1250
Ø350	90									
	100									
	112									
	132	3660	3460	3238	3 000	2751	2498	2270	2029	1809
	160									
	180									

Maximum RPMs for frequency regulated ZerAx rotors

Dimensions are in mm.

Inside the ZerAx

Frequency regulated motor (optional)

Motors offered in connection with ZerAx fans can be frequency regulated with external converters.

Short fan casing

The fan casing is of AluZink for strength and kept short to save weight. At the same time the material adds rigidity and minimises critical vibrations.

High efficiency motors

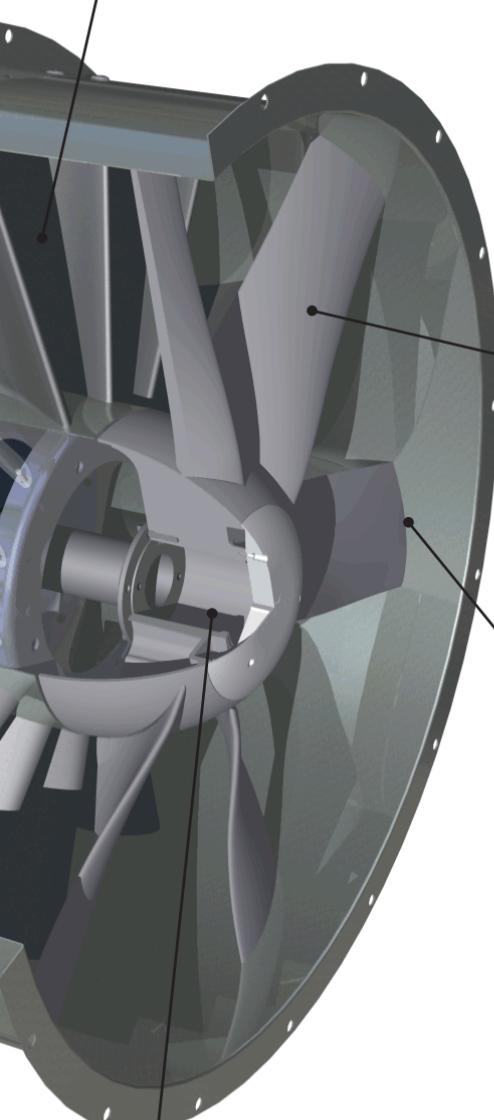
Motors in efficiency class 1 and 2 are available.

About the shown fan

The fan shown here is the AZN 1000-350 for duct installation with a short fan casing.

Extended fan casing (optional)

Depending on the motor position being in- or outside the motor mount, the fan casing can be extended accordingly.



Profiled guide vanes of aluminium

The vanes are cast in aluminium and screwed on the motor mount and to the fan casing.

Unique blade efficiency

The design of the blades brings the efficiency of axial flow fans to the highest level ever.

Innovative hub design

Comparing to the Novax fans, the hub and hub cap are both cast in aluminium. The design is still for optimum performance.

Minimum blade clearance

The rotor blades are milled according to low tolerances. The clearance between the rotor blades and the fan casing is kept to a minimum to optimise performance.

Types

AZN for duct installation

The AZN is the first in the ZerAx series of axial flow fans. The duct version can be fitted with a cone and thereby be used with free inlet or outlet.

The range comprise standard fans in 9 installation sizes with rotor diameters from Ø500 to Ø1250 mm. The hub diameter is Ø350 mm for all sizes.

Air flow rates run from 0.1 to 40 m³/s and pressure increases up to 3600 Pa.

The fan casing is cylindrical with connection flanges at both ends.

The motor mount is aerodynamically designed to optimise air flow.

The motor mount and fan casing are of AluZink or hot-dip galvanised steel.

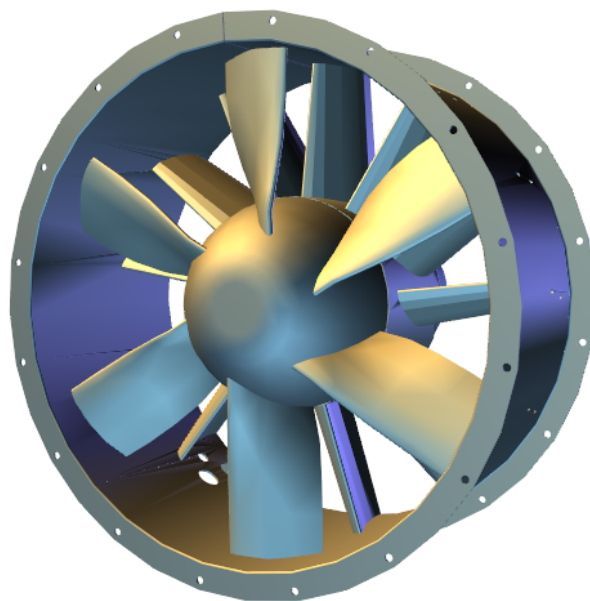
The rotor unit is mounted directly on the spindle of the motor. If the motor cannot fit the motor mount, it is displaced outside the mount and connected to the rotor through a long hub.

The flange pitch diameter, number of holes and hole size are as standard in accordance with EUROVENT 1/2.

The AZN is designed in accordance with Eurovent standards. See arrangement D, motor position B in section "Calculation examples" on page 16.

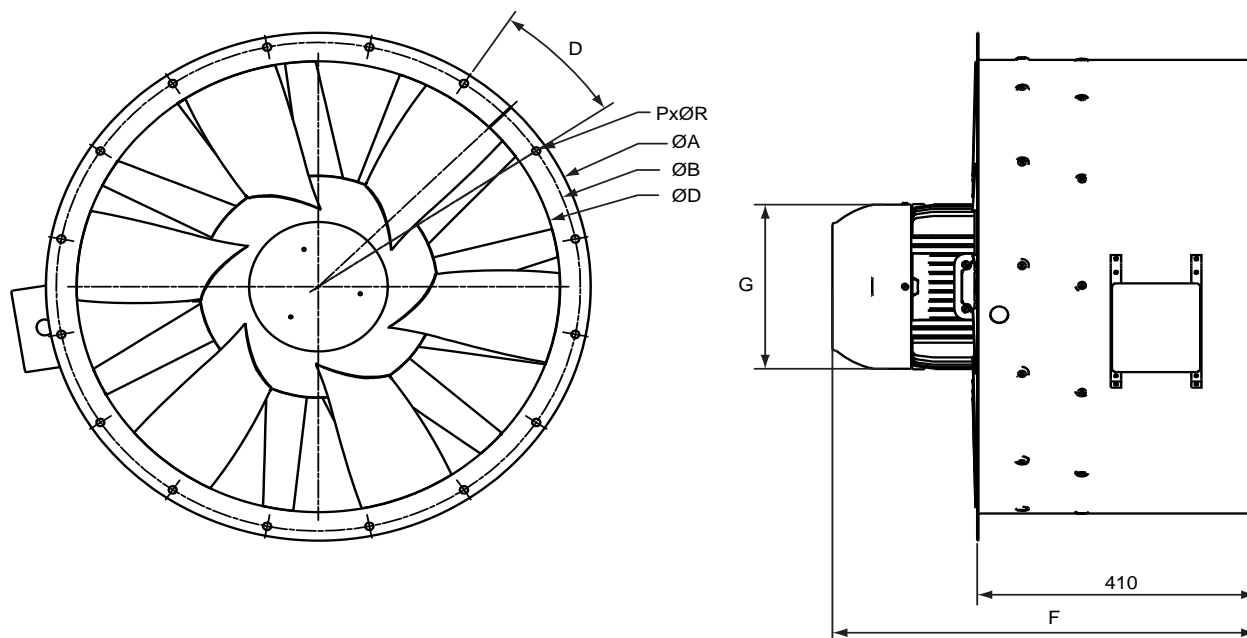
The motor is a flange motor, mounted on the outlet side, and fitted with an electrical cable that passes out through the fan casing to a terminal box for electrical connection.

The direction of air flow for AZN fans is rotor - motor.



3D model of ZerAx AZN

AZN for duct installation



ØA [mm]	ØB [mm]	ØD [mm]	D [mm]	P	ØR [mm]
590	560	500	30	12	12
650	620	560	30	12	12
720	690	630	30	12	12
800	770	710	22.5	16	12
890	860	800	22.5	16	12
995	970	900	22.5	16	15
1095	1070	1000	22.5	16	15
1215	1190	1120	18	20	15
1345	1320	1250	18	20	15

Motor size	F [mm]	G [mm]
90S	452	179
90L	477	
100L	514	199
112M	531	222
132S	585	270
132M	623	
160M	832	312
160L	876	
180M	898	358
180L	936	

Accessories

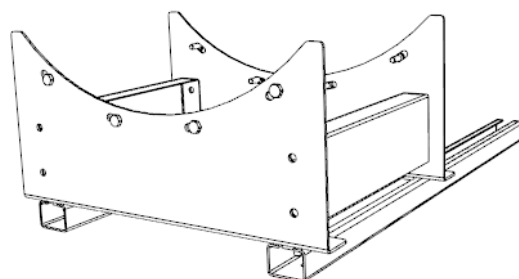
Accessories for any purpose

The ZerAx is offered with a wide choice of accessories. This presents ample opportunities for customising fan solutions for virtually all installation conditions.

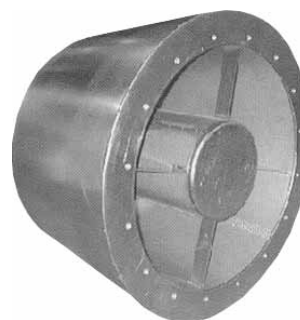
The thickness of the fan casing cannot be changed and varies depending on size and field of application. The material is either 2 or 4 mm sheet steel.

Feature	Fan type AZN
Fan casing extension ¹	•
Inlet cone with wire guard	•
Outlet wire guard	•
Acoustic diffuser type YAD with core	•
Short diffuser	•
Long diffuser	•
Silencer type YAH with or without core	•
Mounting	
Horizontal mounting feet	•
Vertical mounting plate	•
Anti-vibration mountings	•
Connection	
Flexible connection	•
Counter flange	•
Duct spigots	•
External	
Roof hood type HAN	•
Damper type SBC	•

¹ The extension of the fan casing is made of 2 mm AluZink and applies typically to fans where the motors cannot be encased by the fan casing.

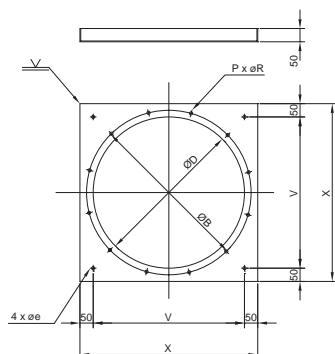


3D model of horizontal mounting feet

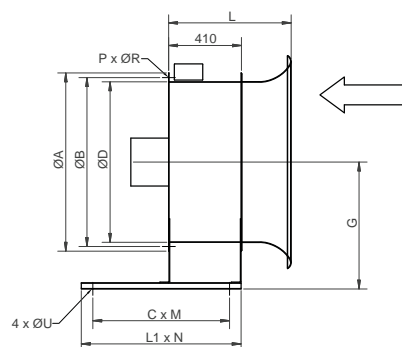


Acoustic diffuser type YAD

Mounting feet and diffusers



Vertical mounting plate

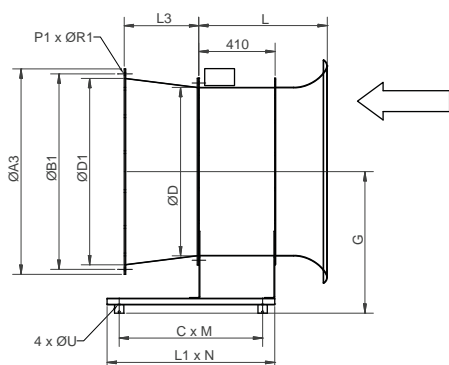


AZN with mounting feet and inlet cone

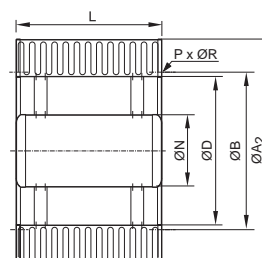
		Installation sizes (rotor diameters)								
		Ø500	Ø560	Ø630	Ø710	Ø800	Ø900	Ø1000	Ø1120	Ø1250
Vertical mounting plate	ØB	770	860	970	770	860	970	1070	970	1070
	ØD	720	810	910	720	810	910	1010	910	1010
	Øe	18	18	18	18	18	18	18	18	18
	P	16	16	16	16	16	16	16	16	16
	øR	12	12	12	12	12	12	12	12	12
	V	720	810	920	720	810	920	1020	920	1020
	X	820	910	1020	820	910	1020	1120	1020	1120
	Weight	10.5	12	19	10.5	12	19	22	19	22
AZN with mounting feet and inlet cone	G	390	440	480	530	580	680	740	800	850
	C ¹	570	570	570	570	570	570	570	570	570
		840	840	840	840	840	840	840	840	840
	M	325	370	400	450	520	590	670	750	810
	L1 ¹	700	700	700	700	700	700	700	700	700
		940	940	940	940	940	940	940	940	940
	N	435	480	530	580	650	720	800	880	980
	L ¹	615	670	675	675	670	690	710	775	780
		410	410	410	410	410	410	410	410	410
ØU	12	12	12	12	12	12	12	12	12	
Weight ¹	165	178	190	201	214	233	249	280	320	
	272	284	296	307	320	339	355	386	426	

¹ Top values are for fans with motor sizes 132 and bottom values are for fans with 180 motors.

Dimensions are in mm. Weights are in kg.



AZN with mounting feet,
inlet cone and diffuser



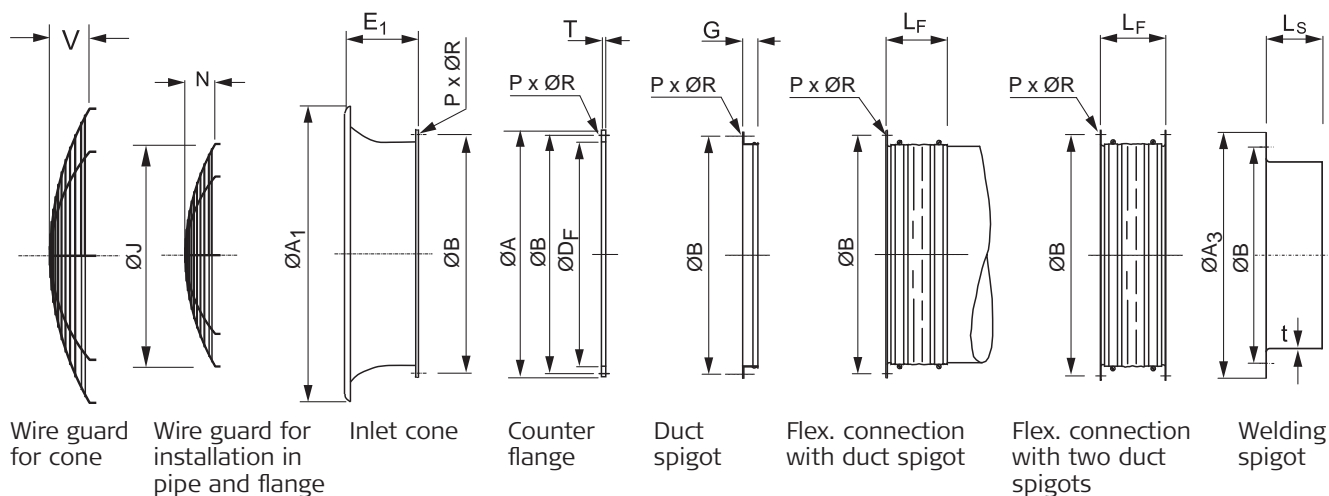
Silencer type YAH

		Installation sizes (rotor diameters)								
		Ø500	Ø560	Ø630	Ø710	Ø800	Ø900	Ø1000	Ø1120	Ø1250
AZN with mounting feet, inlet cone and diffuser	ØD1						1120	1250	1400	1600
	ØA3						1170	1305	1455	1660
	ØB1						970	1070	1190	1320
	L ¹						690 410	710 410	775 410	780 410
	L3						900	1000	1100	1400
	P1						20	20	20	24
	ØR1						15	15	15	19
	L1 ¹						700 940	700 940	700 940	700 940
	N						720	800	880	980
	C ¹						570 840	570 840	570 840	570 840
	M						590	670	750	810
	G						680	740	800	850
	ØU						12	12	12	12
	Weight ¹						266 372	289 395	328 434	377 483
Silencer type YAH	L	500	560	630	710	800	900	1000	1120	1250
	ØN	250	280	315	355	400	450	500	560	578
	ØA ₂	715	775	845	825	1015	1115	1215	1335	1463
	ØR	M10	M10	M10	M10	M10	M12	M12	M12	M12
	Weight without core	19.1	22.8	27.6	33.8	41.3	50.6	61.1	74.5	140
	Weight with core	26.5	32.8	40.8	52.1	69.2	86.8	109.6	134.4	170

¹ Top values are for fans with motor sizes 132 and bottom values are for fans with 180 motors.

Dimensions are in mm. Weights are in kg.

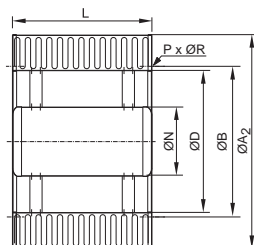
Wire guards, cones and flanges



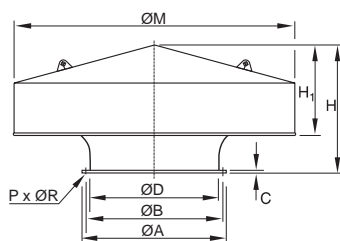
		Installation sizes (rotor diameters)								
		Ø500	Ø560	Ø630	Ø710	Ø800	Ø900	Ø1000	Ø1120	Ø1250
Wire guard	V	55	69	87	111	137	85	106	133	133
	Weight	0.5	0.6	0.8	0.9	1.1	2.5	3.0	3.6	3.6
Wire guard for installation in pipe and flange	N	68	88	55	69	87	111	137	85	106
	ØJ	496	556	626	706	796	896	996	1114	1244
	Weight	0.3	0.3	0.5	0.6	0.8	1.0	1.1	2.5	3.0
Wire guard for installation on flanges	N	88	55	69	87	111	137	85		
	ØJ	556	626	706	796	896	996	1114		
	Weight	0.3	0.5	0.6	0.8	0.9	1.1	2.5		
Inlet cone	E ₁	205	260	265	265	260	280	300	320	320
	ØA ₁	675	760	840	947	1055	1200	1333	1520	1650
	Weight	12.5	17	19	22	26	32	38	45	51
Counter flange	T	4	4	4	4	4	8	8	8	8
	ØD _F	510	570	640	720	810	910	1010	1130	1260
	Weight	2.2	2.4	2.7	3.0	3.4	8.5	9.4	10.2	12.2
Duct spigot	G	55	55	55	55	55	85	85	85	85
	Weight	2.4	2.7	3.1	3.5	3.9	5.9	6.6	7.4	8.5
Flexible connection	L _F	Min. 65 mm - max. 100 mm					Min. 110 mm - max. 175 mm			
	Weight w. 1 spigot	3.0	3.5	3.8	4.3	5.0	7.8	8.9	10.0	11.6
	L _F	Min. 120 mm - max. 145 mm					Min. 210 mm - max. 250 mm			
	Weight w. 2 spigots	5.5	6.2	6.9	7.8	8.8	13.7	15.5	17.4	20.2
Welding spigot	L _s	100	100	120	120	120	120	150	150	150
	t	4	4	6	6	6	6	6	6	6
	ØB	560	620	690	770	860	970	1070	1190	1320
	ØA ₃	590	650	720	800	890	1000	1100	1220	1360
	Weight	6.7	7.5	15.0	16.9	19.0	21.4	29.0	32.4	36.2

Dimensions are in mm. Weights are in kg.
Values for ØA and ØR are in section "Dimensions" on page 9.

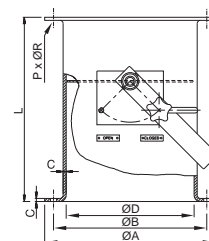
Silencers, hoods and dampers



Silencer type YAH



Hood type HAN



Damper type SBC

		Installation sizes (rotor diameters, ØD)								
		Ø500	Ø560	Ø630	Ø710	Ø800	Ø900	Ø1000	Ø1120	Ø1250
All	ØB	560	620	690	770	860	970	1070	1190	1320
	ØA	590	650	720	800	890	1000	1100	1220	1360
	P	12	12	12	16	16	16	16	20	20
	ØR	12	12	12	12	12	15	15	15	15
Silencers type YAH	L	500	560	630	710	800	900	1000	1120	1250
	ØN	250	280	315	355	400	450	500	560	578
	ØA ₂	715	775	845	925	1015	1115	1215	1335	1463
	ØR	M10	M10	M10	M10	M10	M12	M12	M12	M12
	Weight without core	19.1	22.8	27.6	33.8	41.3	50.6	61.1	74.5	140
	Weight with core	26.5	32.8	40.8	52.1	69.2	86.8	109.6	134.4	170
Hoods type HAN	H	540	641	694	744	811	868	890	1140	1252
	H1	364	405	450	506	569	645	710	800	853
	ØM	1106	1266	1406	1586	1766	2016	2236	2436	2810
	C	3	3	3	3	3	3	3	3	4
	Weight	58	79	97	120	151	206	250	313	625
Dampers type SBC	L	560	620	670	730	810	910	1010	1130	1250
	C	3	3	3	3	3	3	4	4	5
	Weight	32	41.5	49	63	86	107	164	200	274

Dimensions are in mm. Weights are in kg.

Technical data for silencer YAH

YAH - Pressure loss

Without core: Insignificant

With core: $0.2 \times p_{df}$

Two YAH in series: $0.35 \times p_{df}$ (dynamic pressure)

Inlets on AZN use silencers without cones.

Example

YAH-800 with core

Air flow rate, $q_v = 5 \text{ m}^3/\text{s}$

Air speed, inlet = 10 m/s

$p_{df} = 60 \text{ Pa}$

Pressure loss: $0.2 \times 60 \text{ Pa} = 12 \text{ Pa}$

Average values for sound attenuation [dB]

Type	Octave band [Hz]							
	63	125	250	500	1k	2k	4k	8k
Without core	0	1	10	13	11	9	7	7
With core	2	4	10	17	17	15	12	11

Acoustic diffuser type YAD

Acoustic diffusers type YAD with cores are standard products for use in normal installations for comfort and industrial ventilation.

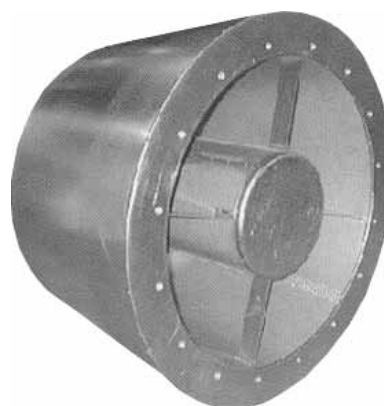
YAD diffusers are available for ZerAx fan sizes Ø560 to Ø900.

Environment

The YAD diffusers are designed for the temperature range: -40 to +120 °C.

The basic version is, in terms of materials, designed to operate in the environmental categories C1, C2 and C3 as formulated in DS/EN ISO 12944.

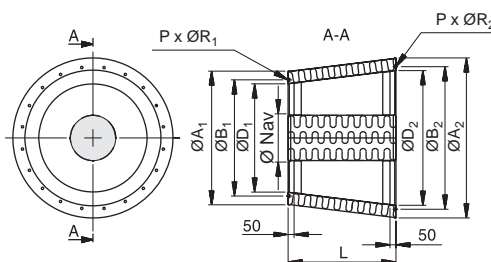
Please note that sound data and attenuation values are based on measurements made with the Novax axial flow fan type ACG.



Acoustic diffuser type YAD

External diameter	Hub diameter	Octave band [Hz]							
		63	125	250	500	1k	2k	4k	8k
560	380	0	2	3	15	19	18	14	8
630		0	2	11	15	15	15	11	6
710		0	1	5	14	16	13	9	6
800		1	3	8	16	15	11	7	6
900		0	1	9	16	15	11	7	5

Dimensions are in mm and attenuation values in dB.



Size	Hub	Fan side				Duct side				L	Weight
		ØA ₁	ØB ₁	ØD ₁	P x ØR ₁	ØA ₂	ØB ₂	ØD ₂	P x ØR ₂		
560	380	776	620	564	12 x M10	926	770	714	16 x M10	560	46.5
630		846	690	634	12 x M10	1011	860	804	16 x M10	630	56
710		926	770	714	16 x M10	1116	960	904	16 x M12	710	73
800		1016	860	804	16 x M10	1216	1070	1004	16 x M12	800	86.5
900		1116	970	904	16 x M12	1336	1190	1124	20 x M12	900	108.5

Dimensions are in mm and weights in kg.

Calculation examples

Basis

The basis for the calculation of solutions are the arrangements C and D shown in the following.

Installing the AZN with free outlet (arr. C) causes loss of the entire velocity energy. However, fitting a diffuser on the outlet side lowers the outlet velocity, whereby some of the dynamic pressure loss is recovered as static pressure. Hence, the energy consumption of the fan is reduced. Novenco diffusers are designed to achieve optimal recovery of the dynamic energy.

a-factor

This is a loss factor, which is used if the AZN is used with free outlet (arrangement C). The a-factor is related to the speed loss (Δp_d) resulting from the difference in air speed between the net inlet area and the total outlet area.

The effect of the a-factor is reduced if a diffuser is mounted on the outlet side.

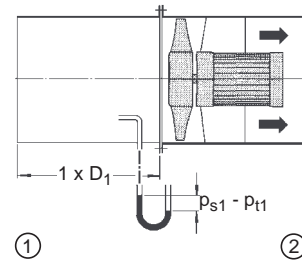
The AirBox program compensates for the a-factor when the fan outlet is to a duct or as free outlet.

Designations	Symbols	Units	Formula
Mass flow	q_m	kg/s	
Air quantity, volume flow	q_v	m ³ /s	$\frac{q_m}{\rho}$
Inlet diameter	D_1	mm	
Outlet diameter	D_2	mm	
Density	ρ	kg/m ³	
Flow area	A	m ²	
Mean speed of plane	c_x	m/s	$\frac{q_v}{A_x}$
Static pressure of plane	p_{sx}	Pa	
Dynamic pressure of plane	p_{dx}	Pa	$0.5 \rho \times c^2$
Total pressure of plane	p_{tx}	Pa	$p_{sx} + p_{dx}$
Total pressure of fan	P_{tF}	Pa	
Dynamic pressure of fan	P_{dF}	Pa	$0.5 \rho \times c_2^2$
Static pressure of fan	P_{sF}	Pa	$P_{tF} - P_{dF}$
System loss	p_t	Pa	
Power consumption	P	kW	
Correction factor	a		

Arr. C – Duct on inlet and free outlet

$$P_{tF} = P_{t2} - P_{t1}$$

$$= P_{s2} + a \times P_{d2} - (P_{s1} + P_{d1})$$

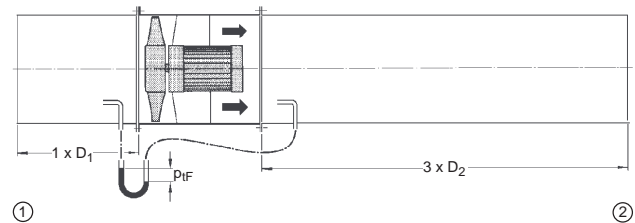


Arr. D – Duct on inlet and outlet

$$P_{tF} = P_{t2} - P_{t1}$$

$$= (P_{s2} - P_{s1}) + (P_{d2} - P_{d1})$$

If $P_{d2} = P_{d1}$; then $P_{tF} = P_{s2} - P_{s1}$



Run up time

The run up time of axial flow fans is found with the following formula.

$$t_s = \frac{0.24 \times n^2 \times (I_m + I_v)}{10^4 \times P \left(\frac{M_s}{M} + \frac{M_k}{M} - \frac{P_v}{P} \right)} \quad \text{where}$$

t_s = Run up time [s]

P = Rated output of motor [kW]

P_v = Required power of fan [kW]

n = Fan speed [RPM]

$\frac{M_s}{M}$ = The ratio between the starting torque of the motor and the nominal torque

$\frac{M_k}{M}$ = The ratio between the maximum torque of the motor and the nominal torque

I_v = Polar moment of inertia for the fan [kgm²]

I_m = Polar moment of inertia for the motor [kgm²]

According to international standards the torque of the motor can vary within the following limits.

M_s : -15% + 25% of the catalogue value

M_k : -10% + 0% of the catalogue value

The above factors may increase the run up time more than calculated.

Finding the total efficiency

The total efficiency tells how effective the complete arrangement is. The efficiency is found with the following formula.

$$\eta_{\text{total}} = \eta_{\text{fan}} \times \eta_{\text{motor}}, \text{ where}$$

η_{total} : Total efficiency

η_{fan} : Fan efficiency

η_{motor} : Motor efficiency

Quality and service



Rest assured

The Novenco ZerAx axial flow fans are produced in accordance with Novenco's well-known quality standards.

The fans are offered with options for technical guidance on installation, test of function and training of personnel.

Warranty

Novenco gives a 12 month base warranty from the time of delivery. The warranty covers material and manufacturing defects. Wear parts are not covered by the warranty.

Units made for marine projects are covered by warranty terms stipulated in the respective contracts.



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.

The headquarters of Novenco is located in Naestved, Denmark.

Novenco, Hi-Pres, XFlow and ZerAx are registered trademarks of Novenco.

Read more about Novenco on the Internet.