ZERTIFIKAT ◆ CERTIFICATE ◆ 認証証書 ◆ СЕРТИФИКАТ ◆ CERTIFICADO ◆ CERTIFICAT

Industrie Service

Herewith it is confirmed to the company

Comefri SpA

in

I-33010 Magnano in Riviera (UD)

based on the positive results of the completed test at the

Design Software
„Aeolus 4 1.0.x.x.“
„OEM DLL package v10#“

that the software is suitable to configure fans of the model ranges

„TZAF FF... size 315 … 630“
„NTHZ... size 315 … 630“
„NPA... size 250 … 630“
„NPL... size 200 … 800“

bar shaft fan

and the calculation accuracy of B0
under consideration of annex 1 to 5

according to the RLT-RICHTLINIE Zertifizierung:2017-11
and is granted the right to label these with the following
TÜV SÜD Certification Mark.

This certificate is valid until 2024-06-30

Certificate Registration Number: 17/14/21 (Revision 03)

Certification Body for Products
Refrigeration and Air-Conditioning
Munich, 2022-06-15

This certificate is only valid in conjunction with the following annex (5 pages)

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List of the certified impeller types TZAF FF, NTHZ, NPA and NPL				
	TZAF FF-a-b-	**NTHZ-a-b-**	**NPA-a-b-[1)2)]**	**NPL-a-b-[1)2)]**
Fan size -a-	Additional type code –b-			
200				S4,S4GAL,S4NS
225				S4,S4GAL,S4NS
250			S4,S4GAL,S4NS	S4,S4GAL,S4NS
280			S4,S4GAL,S4NS	S4,S4GAL,S4NS
315	B,R,T1,T2,T2L	B,R,T1,T2,T2L	S4,S4GAL,S4NS	S4,S4GAL,S4NS
355	B,R,T1,T2,T2L	B,R,T1,T2,T2L	S4,S4GAL,S4NS	S4,S4GAL,S4NS
400	B,R,T1,T2,T2L	B,R,T1,T2,T2L	S4,S4GAL,S4NS	S4,S4GAL,S4NS
450	B,R,T1,T2,T2L	B,R,T1,T2,T2L	S4,S4GAL,S4NS	S4,S4GAL,S4NS
500	B,R,T1,T2,T2L	B,R,T1,T2,T2L	S4,S4GAL,S4NS	S4,S4GAL,S4NS
560	B,R,T1,T2,T2L	B,R,T1,T2,T2L	S4,S4GAL,S4NS	S4,S4GAL,S4NS
630	B,R,T1,T2,T2L	B,R,T1,T2,T2L	S4,S4GAL,S4NS	S4,S4GAL,S4NS
710	-	-	-	S4,S4GAL,S4NS
800	-	-	-	S4,S4GAL,S4NS

key:
[1)] also provided as loose „wheel and inlet-cone“
[2)] made of steel or aluminium

Remark:

The specified calculation accuracy is only valid for the stated and recommended operating range of the respective fan. Outside the recommended application range, the calculation accuracy can be less.

The recommended operating range is in the map range with fan speeds between 20% to 100% of the maximum speed. The recommended efficiencies are declared with Eta> = 0.9 x Etaopt (left of the optimum) and Eta> = 0.8 x Etaopt (right of the optimum) of the respective air performance curve or, partial load air performance curve.

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The following specific values of the software were verified

TZAF FF, NTHZ, NPA and NPL			
Definition according to the standard DIN EN ISO 5801	**Definition used in „Aeolus“**	**symbol**	**unit**
volume flow rate	Volume	q_v	[m³/s]
fan static pressure	fan static	p_{fs}	[Pa]
rotational speed of the impeller	fan RPM	N	[1/min]
fan shaft power	Fan power	P_a	[kW]
static fan shaft efficiency	eta static	η_{as}	[%]

Table of calculation accuracy

Value	Deviations of the classes		
	B0	B1	B2
Volume flow	± 1 %	± 2.5 %	± 5 %
Pressure increase	± 1 %	± 2.5 %	± 5 %
Power input	+ 2 %	+ 3 %	+ 8 %
Efficiency	- 1 %	- 2 %	- 5 %

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Regarding to the RLT-RICHTLINIE Zertifizierung:2017-11, the correction values listed below must be included into the air handling unit design software.

Installation losses of the fans

As the verification of the installation losses **wasn't** part of the certification of the fan design software, the following standard correction values have to be applied.

a) Installation losses of the fan types NPA and NPL

Suction situation:

Normal suction (at $a < 0.5 \times d_{nenn}$)	=> not permissible
Normal suction (at $a \geq 0.5 \times d_{nenn}$)	=> no correction
Suction protection	=> $k_1 = 0.5 \times p_{dyn}$

Blow out situation:

$a \geq 0.6 \times d_{nenn}$	=> $k_2 = 0.1 \times p_{dyn}$
$a \geq 0.2 \times d_{nenn}$	=> $k_2 = \left(-6.8\left(\frac{a}{d_{nenn}}\right)^3 + 16.9\left(\frac{a}{d_{nenn}}\right)^2 - 13.9\left(\frac{a}{d_{nenn}}\right) + 3.82\right) \cdot p_{dyn}$
$a < 0.2 \times d_{nenn}$	=> not permissible

Installation losses = $(k_1 + k_2) \times p_{dyn}$

b) Installation losses of the fan types TZAF FF and NTHZ

Suction situation:

$a \geq 0.5 \times d_{nenn}$	=> $k_3 = 0.5 \times p_{dyn}$
$a \geq 0.4 \times d_{nenn}$	=> $k_3 = 0.6 \times p_{dyn}$
$a \geq 0.3 \times d_{nenn}$	=> $k_3 = 0.8 \times p_{dyn}$
$a \geq 0.2 \times d_{nenn}$	=> $k_3 = 1.2 \times p_{dyn}$
$a < 0.2 \times d_{nenn}$	=> not permissible

Suction protection	=> $k_4 = 0.3 \times p_{dyn}$
Belt protection 3 side closed	=> $k_5 = 0.4 \times p_{dyn}$
Belt protection 4 side closed	=> $k_5 = 0.6 \times p_{dyn}$

Blow out situation:

Blow out in chamber with baffle plate	=> $k_6 = 1.0 \times p_{dyn}$
Blow out in chamber	=> $k_6 = 0.5 \times p_{dyn}$
Blow out in channel	=> $k_6 = 0.0 \times p_{dyn}$

Installation losses = $(k_3 + k_4 + k_5 + k_6) \times p_{dyn}$

With:

a	Distance to the closest installed part/wall in [mm]
d_{nenn}	Diameter of the wheel in [mm]
k	Correction value
p_{dyn}	Dynamic pressure increase in fan [Pa]

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Installation losses of fan Walls of the fan types NPA and NPL

As the verification of the installation losses of fan walls **wasn't** part of the certification of the fan design software, the following standard correction values have to be applied.

Suction situation:

$a < 0.5 \times d_{nenn}$	=> not permissible
$a \geq 0.5 \times d_{nenn}$	=> no effect
Suction protection	=> $k_1 = 0.5 \times p_{dyn}$

Blow out situation:

$a \geq 0.6 \times d_{nenn}$	=> $k_2 = 0.1 \times \Delta p_{dyn}$
$a \geq 0.2 \times d_{nenn}$	=> $k_2 = \left(-6.8\left(\frac{a}{d_{nenn}}\right)^3 + 16.9\left(\frac{a}{d_{nenn}}\right)^2 - 13.9\left(\frac{a}{d_{nenn}}\right) + 3.82\right) \cdot p_{dyn}$
$a < 0.2 \times d_{nenn}$	=> not permissible

Installation losses = $(k_1 + k_2) \times _{dyn}$

With:

a	Distance to the closest installed part/wall in [mm]
d_{nenn}	Diameter of the wheel in [mm]
k	Correction value
p_{dyn}	Dynamic pressure increase in fan [Pa]

Efficiency of the control equipment of the fans type NPA, NPL, TZAF FF and NTHZ [f_R]:

The measurements carried out to certify the design software of the fan models listed in annex 1 includes **not** the efficiency of the control device. For fan models listed in annex 1 the correction factor of the control device shall be applied to **f_R=0,97**.

Efficiency for the motor drive of the fans type TZAF FF and NTHZ [f_A]:

The measurements carried out to certify the design software of the fan models listed in annex 1 includes **not** the Efficiency for the motor drive.For fan models listed in annex 1 the correction factor of the motor efficiency f_A shall be calculated as shown below.

Flat belts:

For shaft power ≥ 44 kW with	$f_A = 0.99$
For shaft power < 44 kW with	$f_A = -0.00002 \times (SP)^2 + 0.0022 \times (SP) + 0.93$

V belts:

For shaft power ≥ 60 kW with	$f_A = 0.97$
For shaft power 18 > (SP) < 60 kW with	$f_A = 0.0006 \times (SP) + 0.936$
For shaft power ≤ 18 kW with	$f_A = 0.04 \times \ln (SP) + 0.83$

With:
(SP) Shaft power without unit

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Nominal motor efficiency for fans - type NPA, NPL, TZAF FF and NTHZ [f_M]:
The measurements carried out to certify the design software of the fan models listed in annex 1 were carried out on bar shaft fan. For fan models listed in annex 1 the correction factor of the nominal efficiency shall be applied to **f_M=0,98**.

Part load efficiency for fans - type NPA, NPL, TZAF FF and NTHZ [f_{TL}]:
The measurements carried out to certify the design software of the fan models listed in annex 1 were carried out on bar shaft fan. For fan models listed in annex 1 the correction factor of the part load efficiency f_{TL} shall be calculated as shown below.

Part load efficiency of asynchronous machines:
The efficiency in the part load area is calculated with the following correction factors:
In the complete load range (LR) in % with $f_{TL} = -0.00004 \times (LR)^2 + 0.008 \times (LR) + 0.6$

Part load efficiency of synchronous machines:
The efficiency in the part load area is calculated with the following correction factors:
In the load range (LR) < 50% with $f_{TL} = 0.056 \times \ln (LR) + 0.78$
In the load range ≥ 50% with $f_{TL} = 1.00$

Accuracy class for fans - type NPA, NPL, TZAF FF and NTHZ [f_G]:
Due to the accuracy class specified by the manufacturer, the correction class shall be applied to **f_G=1.00**.

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