

# Operating instructions

## Plug Fans

Direct driven with asynchronous or PM synchronous motor

(Translation of the Original)

EN

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## BA-CFD\_RLM 9.7 – 03/2017

		<b>RLM E3</b> <b>RLM 53</b>
		<b>RLM 55</b>
		<b>RLM E6</b> <b>RLM G6</b> <b>RLM 56</b>

**NICOTRA** || **Gebhardt**

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## Revision Index

Revision	Date
BA-CFD-RLM 8.6 – 08/2011	08/2011
BA-CFD-RLM 8.7 – 03/2012	03/2012
BA-CFD-RLM 8.8 – 05/2012	05/2012
BA-CFD-RLM 8.9 – 01/2013	01/2013
BA-CFD-RLM 9.1 – 02/2013	02/2013
BA-CFD-RLM 9.2 – 04/2014	04/2014
BA-CFD-RLM 9.3 – 06/2014	06/2014
BA-CFD-RLM 9.4 – 09/2014	09/2014
BA-CFD-RLM 9.5 – 11/2015	11/2015
BA-CFD-RLM 9.6 – 04/2016	04/2016
BA-CFD-RLM 9.7 – 03/2017	07/2017

## 1. Important Information

These Fans are of state of the art design and comply with the requirements for health and safety of the EU Machinery Directive.

Nicotra Gebhardt Fans offer a high level of operational safety and a high standard of quality which is guaranteed through a certified Quality Assurance System (EN ISO 9001).

All fans leave the factory after being subjected to testing and are provided with a test seal.

All fans however can be dangerous,

- if they are not installed, operated and maintained by trained personnel
- if they are not used for approved applications.

This can endanger the life and limbs of personnel, provoke material damage to buildings and equipment and influence the use of the product.



### Attention!

**These Operating Instructions must be read and observed by all personnel engaged on works involving fans!**

### The Operating Instructions

- describe the approved applications for the fans and protect against misuse.
- contain safety notes which must be closely observed.
- warn of dangers which can exist even with correct applications.
- give important information on safety and the economic use of the fan while ensuring the full benefits of the product are available.
- are to be complemented with the trade and national Standards, Regulations and Directives.

**Nicotra Gebhardt accepts no responsibility for damage or breakdowns which can be traced back to non-observance of the Operating Instructions.**

The manufacturer's guarantee does not apply following unauthorised and unacceptable conversions and alterations to the fan.

**There is no responsibility accepted for resultant damages!**

## 2. Safety Notes



**CAUTION**

**This danger symbol identifies all safety and danger information concerning danger to life and limbs of personnel.**

**This draws attention to all information at all points in the Operating Instructions which must be particularly well observed in order to ensure the correct procedures for the work as well as helping to prevent damage and the destruction of the fan.**

## 3. Technical description

### 3.1 Product description RLM



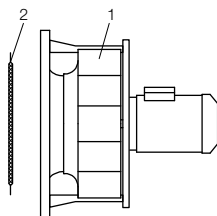
The fans are intended for incorporation into equipment and do not have their own contact protection fitted as standard. The appropriate protective measures are to be taken in accordance with DIN EN ISO 13857

The centrifugal fans RLM, optimised for use without scroll. Direct drive with mounted standard motor construction B3/B5 or a permanent magnet excited synchronous motor (PM motor). The centrifugal impeller with backward-curved blades is attached directly to the motor shaft. Certain fans in the RLM range have an integrated frequency inverter.

#### RLM E6 / G6 / E3 / 56 / 53 / 55

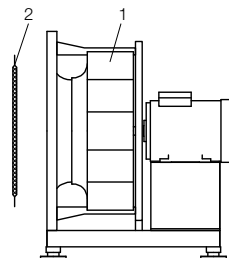
Motor impeller with inlet cone (E3/53), motor block and base frame (E6/G6/55/56), installed and adjusted at the factory.

#### RLM E3 / 53

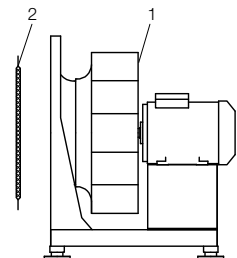


1. Fan

#### RLM 55



#### RLM E6 / G6 / 56



#### Important accessories

2. Inlet guard

### 3.2 Technical Data

Technical data and the permissible limits are to be taken from the type plate, the technical datasheets or the appropriate technical catalogue and must be adhered to.

### 3.3 Authorised use

The fans are intended for the transport of dust-free air and other non-aggressive gases or vapours.

Permissible media temperatures:

Range	RLM
Temperature	-20°C to +40°C

#### CAUTION

Maximum ambient temperature at the drive motor: +40°C.

Ambient temperature with the Danfoss FCP-106 mounted frequency inverter:  
-10 °C to +40 °C



Any installation deviating from the above shall be considered unauthorised. Nicotra Gebhardt will not be responsible for any injury to personnel and/or material damage resulting from any deviations from the above!

Should any control equipment utilising electronic components be employed (e.g. frequency inverter), the recommendations of the manufacturer are to be observed concerning the avoidance of electromagnetic radiation (EMC) (through suitable earthing, cable lengths, cable screening, etc.).

### 3.4 Improper use

**An improper installation would be e.g. the transporting of :**

- media with unacceptable high or low temperatures
- aggressive media.
- very dusty media.

**unauthorised operation**

- No operation above the indicated rpm (see type plate, data sheet)!
- No operation at rpm ranges with increased vibration (resonance)!
- No operation at rpm ranges out of permitted fan curve area (unstability of flow pattern)!
- No operation if fan becomes polluted!

The results are: Bearings damage, corrosion damage, loss of balance, vibration, deformation, abrasion damage.

**CAUTION** Prevent dynamic stress on the impeller, avoid frequent load changes!



**Danger points:**

**There can be injury to personnel and material damage through impeller breakage, shaft breakage, fatigue failure, fire from spark creation.**

## 4. Transport

### 4.1 Transport damage

Deliveries are to be immediately checked in the presence of the carrier as being intact and complete.

**CAUTION** Fans must be carefully transported!

Improper transport as e.g. unyielding, tilted positioning can lead to:

- **impeller becoming jammed.**
- **shaft becoming deformed.**
- **bearing damage.**
- **frequency inverter becoming damaged.**

### 4.2 Transport safety

- The transport material is to be selected according to the weight and packaging of the fan (type plate, data sheet)
- Ensure that loading is done in accordance with the instructions
- Four-point lifting is to be provided when transporting by crane (2 slings)

The attachment points on the fans are:

- Base frame

The following are not attachment points:

- Inlet cone
- Impeller
- Motor
- Frequency inverter

### 4.3 Intermediate storage

For intermediate storage of the fans the following points must be observed:

- The fan is to be stored in its transport packaging or this can be added to in accordance with external influences.
- The place of storage must be dry and dust free. the humidity has to be < 70 %.
- Max. Permissible storage temperature: -20°C to +40°C.

## 5. Installation

### 5.1 Safety notes



- Mounting may only be carried out by trained personnel in accordance with these Operating Instructions and with regard to the regulations in force.
- Safety devices that have been removed for mounting work must be replaced immediately afterwards, and before the electrical connection is made.
- The fans must be mounted such that secure fixing is guaranteed at all times during operation.
- Fans must be fixed to base frames.

#### **CAUTION**

Shoring up the weight at other points leads to fan damage and is dangerous.

### 5.2 Installation site

- The installation site must be suitable for each fan with regard to type, composition, ambient temperature and ambient medium (points 3.3, 3.4 and 3.5 are to be observed).
- The supporting construction must be level and have sufficient bearing strength

### 5.3 Installing / Fixing

The fan or base frame must be fixed without stresses to the supporting structure.

#### **CAUTION**

Stresses can lead to bearing damage and fatigue failures! They also affect the functioning of the fan.

- No forces should be transferred from other parts of the plant.
- Use flexible connecting supports for duct connection.
- Ensure even spring of the vibration dampers.

## 5.4 Electrical connections

### 5.4.1 Safety notes



- The electrical installation of the fans and components may only be carried out by trained personnel in observance of these Operating Instructions and the regulations in force.
- The following Standards and guidelines are to be observed:
  - IEC 60364-1 / DIN VDE 0100 ; DIN EN 60204-1
  - site regulations of the Electricity Supply Companies
- Equipment in accordance with EN 60204-1 is to be installed as protection during unexpected events (e.g. an isolation switch for inspections).



#### Caution electrical hazard!

#### Electrical potential at intermediate circuit of Driver and power connections if the permanentmagnet motor rotates!

- do not work at the fan if the impeller/motor is not locked
- lock fan impeller by proper means

### 5.4.2 Connection to the grid

Connect the fan to the grid according to the enclosed connection diagram or the enclosed operating instructions (of the drive). For the updated circuit diagrams, please see online under [www.nicotra-gebhardt.com](http://www.nicotra-gebhardt.com).

#### **CAUTION**

- **PM motors without integrated electronics may only be connected to a frequency inverter suitable for that purpose.**
- **It is not permitted to operate more than one of the permanent magnet motors with one frequency inverter**
- Only use screened motor cables.
- The motor cable screen must be attached to both sides.

### 5.4.3 Motor protection

- Please check the maintenance instructions of the motor manufacturer
- Motors are to be protected against overload in accordance with EN 60204-1.
- Standard motor protection switches are to be provided and set to the nominal motor current. A higher setting is not permitted!
- Care must be taken to ensure for explosion protected motors that motor protection devices are utilised which correspond with the te time given on the motor type plate.
- Motors with built-in thermistors or similar must be protected through a thermistor or similar operated release device.

#### **CAUTION**

**Fuses or circuit breakers do not provide sufficient motor protection. Damage due to insufficient motor protection invalidates the manufacturer's guarantee.**

### 5.4.4 Motor starting

Motors with a nominal rating of 4kW can generally be direct started.

Motors with a nominal rating >4kW are usually star-delta or soft started. For frequency inverter operation the start-up ramp must be selected so that the current rating of the motor is not exceeded.

**In all cases the power limitations provided by the existing power supply company**

**must be taken into account.**

In the event that plant conditions necessitate a direct start the suitability of the fan design is to be confirmed with Nicotra Gebhardt. Fans with high inertia impellers can take over 6 seconds to reach top running speed. In these cases heavy duty motor protection relays or bimetal relays must be provided.

The motors are designed for S1 continual operation. With more than three starts per hour the suitability of the motor is to be confirmed by Nicotra Gebhardt.

**CAUTION** PM motors without integrated electronics must be operated at inverters suitable for that purpose! (e.g. Danfoss VLT HVAC Drive FC-100, see Chapter 6.6).

## 6. Commissioning

### 6.1 Before commissioning the following checks must be carried out:



- It is to be checked whether all mechanical and electrical safety devices have been fitted and connected.
- Protection devices have to be fitted in accordance with DIN EN ISO 13857!
- The ducts and the fan must be checked for foreign bodies (tools, small components, building debris, etc.)
- The idle running of the impeller must be checked by hand.
- The power setting, voltage and frequency for the mains connections must be checked against the fan or motor type plate.
- Connected control devices must be checked for functioning.
- Check the parameter settings at the frequency inverters for the PM motors (see 6.6).
- Inspection openings (if they exist) must be closed.



The fan may only be commissioned if all the safety devices have been fitted and if it is ensured that the impeller has been safeguarded according to DIN EN ISO 13857!



The suitability of protection devices and their fixtures to the fan have to be evaluated within the complete security concept of the installation.



When operating with a frequency inverter the system of fan-motor-inverter can generate increased vibrations within certain frequencies or fan rpm-areas.

**Operation in such an area must absolutely be avoided!**

When putting the fan into operation this type of eventually occurring resonance rpm have to be determined and to be blinded out. Matching frequency inverters have to be set and operated according to the instructions given by their manufacturer. Non observance of these instructions may cause a destruction of the fan!



**CAUTION** The compliance with EMC-directive has to be valuated for the complete installation with regard to the application.  
It is customer responsibility!

## 6.2 Test run

The fan should be switched on briefly to check that the direction of rotation of the impeller agrees with that indicated by the arrow. In the event of the motor running in the wrong direction the poles are to be changed over while observing the electrical safety instructions.

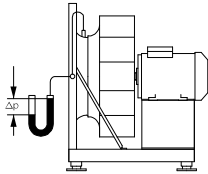
## 6.3 Checking the current consumption

**CAUTION** On reaching the operating speed of the fan immediately measure the current consumption and compare it with the nominal current on the motor or fan type plate. In the event of a substantial overcurrent switch off immediately.

## 6.4 Check for quiet running

**CAUTION** Check on the quiet running of the fan. There should be no unusual rocking or vibration. Check for untypical bearing noises.

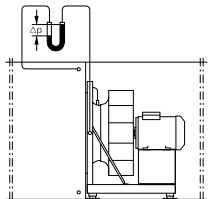
## 6.5 Flow measuring device



The fans are equipped with a flow measuring device as standard. With the flow measuring device it is possible to measure/monitor the flow easily after the fan is installed.

$$q_V = K \times \sqrt{\frac{2}{\rho} \times \Delta p_{Dü}}$$

$q_V$	volume flow	$m^3/h$
$K$	calibration factor	$m^2s/h$
$\rho$	density of media	$kg/m^3$
$\Delta p_{Dü}$	pressure difference at cone	Pa



When fans are built in a plenum, it is required to measure the differential pressure between the static pressure in the plenum on the suction side and the pressure at the inlet cone.

To ensure that the static pressure to be measured at the inlet nozzle is not distorted by dynamic velocities, it is recommended to attach a ring of points on the wall as shown in the following diagram.

When using a differential pressure sensor, the signal can be used for control purpose.

The K- factor is determined by comparative measurement on a standard test ring with non disturbed air flow at suction.

RLM E6- / G6- / E3-	calibration factor K10	RLM 56- / 53- / 55-	calibration factor K10
–	–	<b>2020</b>	58 m <sup>2</sup> s
–	–	<b>2222</b>	67 m <sup>2</sup> s
<b>2225 (G6)</b>	73 m <sup>2</sup> s	<b>2525</b>	77 m <sup>2</sup> s
<b>2528</b>	79 m <sup>2</sup> s	<b>2528</b>	73 m <sup>2</sup> s
<b>2831</b>	94 m <sup>2</sup> s	<b>2831</b>	90 m <sup>2</sup> s
<b>3135</b>	106 m <sup>2</sup> s	<b>3135</b>	105 m <sup>2</sup> s
<b>3540</b>	128 m <sup>2</sup> s	<b>3540</b>	120 m <sup>2</sup> s
<b>4045</b>	155 m <sup>2</sup> s	<b>4045</b>	150 m <sup>2</sup> s
<b>4550</b>	190 m <sup>2</sup> s	<b>4550</b>	190 m <sup>2</sup> s
<b>5056</b>	242 m <sup>2</sup> s	<b>5056</b>	240 m <sup>2</sup> s
<b>5663</b>	310 m <sup>2</sup> s	<b>5663</b>	300 m <sup>2</sup> s
<b>6371</b>	385 m <sup>2</sup> s	<b>6371</b>	385 m <sup>2</sup> s
<b>7180</b>	490 m <sup>2</sup> s/h	<b>7180</b>	485 m <sup>2</sup> s
<b>8090</b>	628 m <sup>2</sup> s/h	<b>8090</b>	620 m <sup>2</sup> s
<b>9010</b>	794 m <sup>2</sup> s/h	<b>9010</b>	790 m <sup>2</sup> s
<b>1011</b>	1017 m <sup>2</sup> s/h	<b>1011</b>	1000 m <sup>2</sup> s
–	–	<b>1112</b>	1260 m <sup>2</sup> s
–	–	<b>1214</b>	1540 m <sup>2</sup> s

## 6.6 Commissioning fans with frequency inverters

### 6.6.1 Instructions for fans with PM motors on external frequency inverters

We recommend inverters from the FC-100 range by Danfoss GmbH for operating fans with PM motors without integrated electronics.

In order to operate PM motors without position encoders, the rotors are brought into a defined starting position when starting up. Only then will the motor actually power up.

**Note** Certain parameters are required for commissioning. Incorrect parameters can lead to problems in particular when starting the devices. It is not permitted to operate more than one of the permanent magnet motors with one frequency inverter.

Updated parameter lists can be found at [www.nicotra-gebhardt.com](http://www.nicotra-gebhardt.com)

### 6.6.2 Commissioning fans with integrated Danfoss FCP-106 frequency inverters

RLM fans with mounted Danfoss FCP-106 frequency inverters are pre-parameterized for activation via the analog 0-10V input (terminals 52 (A IN) and 55 (COM A IN)). The enclosed product handbook describes the commissioning of the inverter in detail under “Quick Menu”.

The start is released by connecting terminals 12 ((+24V OUT) and 18 (DIG IN).

If no other protection devices are to be connected to terminals 12 (+24V OUT) and 27 (DIG IN), these terminals must be bypassed.

If terminals 50 (+10V OUT) and 53 (A IN) are bypassed, the fan will run at its maximum speed.

If required, a hardware reset can be carried out by temporarily bypassing terminals 12 (+24V OUT) and 19 (DIG IN).

Documentation on the FCP-106 frequency inverters can be found at

[www.vlt-drives.danfoss.de/dokumentation/technische-literatur-\(datenbank\)/](http://www.vlt-drives.danfoss.de/dokumentation/technische-literatur-(datenbank)/)

**6.6.3 Fans with integrated NI-DV inverters**

Please see the separate operating instructions or download them at [www.nicotra-gebhardt.com](http://www.nicotra-gebhardt.com)

**7. Upkeep / Maintenance****7.1 Safety notes**

Before working on the fan it is imperative to ensure:

- All poles of the drives and motors are disconnected from the grid!
- The impeller has come to rest!
- The surface temperature has been checked to prevent burning!
- There is no possibility of an uncontrolled running of the fan during the maintenance work (e.g. through an isolating switch)!



**Caution: electric shock!**

**There is electrical voltage in the intermediate circuit of the control electronics and the grid connections when the permanent magnet motor turns!**

- Do not do any work on the fan while the impeller/motor is rotating freely
- Lock the impeller by suitable means

- 
- Any debris or dangerous materials which have arrived in the fan with the transported medium must be removed using a suitable method.

Fan operation may resume after the safety checks of Section 6 “Commissioning / Safety checks” have been carried out.

Only limited work may be carried out while in the operating condition and in observance of the safety and accident prevention regulations: e.g. measurement of vibration.



**Non-observance of these points endangers life and limb for the maintenance personnel.**

**CAUTION**

**If the state of the fan does not allow adapted action for repair it has to be put out of order immediately and to be replaced if required!**

**7.2 Inspection Intervals**

After having passed the period during which the grease keeps its lubrication capacity (30.000 h for standard applications) an bearing exchange may be required. During periods of longer lasting stand stills the fan may be operated shortly in regular intervals. This is to prevent the bearings from mechanical load and the avoid ingress of humidity. If fans have been hold on stock for a longer period the bearings of fan and motor have to be checked prior to installation.

Motors are equipped with permanently lubricated or regreasable bearings, depending on the manufacturer, size and type of motor. Grease leakage cannot be excluded for motors with regreasable bearings, even after the initial filling at the factory. However, this does not have a negative effect on the life of the bearings; regreasing intervals must be adhered to.



**Ensure that the motor manufacturer's maintenance specifications as well as information provided by the manufacturer for the switches and control units as well as the frequency inverter are observed.**

In order to assure a safe operation we recommend to make checks of the fans in regular intervals by specialised service personnel or by a specialised company and to document the result of these checks.

The type, magnitude, and interval period as well as all works which may be necessary in addition depend on the use and the surrounding conditions of the fan and have to be determined case by case.

**The recommendations for checks and maintenance acc. to VDMA 24186-1 may be found at the internet site: [www.nicotra-gebhardt.com](http://www.nicotra-gebhardt.com).**

**CAUTION** No high pressure cleaners (steam rod cleaners) are to be used!

#### **7.2.1** **Vibrations**

The fan has to be checked regularly whether vibrations may occur. The maximum vibration speed in radial direction must not exceed 4.5 mm/s to be monitored at the bearing or bearing housing of the fan or motor. For fans of an impeller diameter up to 315 mm a vibration speed of up to 7.1 mm/s is acceptable. When exceeding the permitted vibration values, it is mandatory to rebalance the entire rotating unit in accordance with DIN ISO 1940-1.

#### **7.2.2** **Dismantling of the impeller**

After dismantling and reinstalling an impeller, the fan must be checked for mechanical vibrations. It may be necessary to rebalance.

### **7.3 Inlet and discharge connections**

Flexible sleeving (compensators) between the fan and plant parts are to be checked at regular intervals.

**CAUTION** Unsealed sleeving leads to breakdowns and danger from escaping transported medium and must be replaced.

### **7.4 Spare parts**

Only original spare parts in accordance with the Spare Parts List are to be used.

**CAUTION** Nicotra Gebhardt accepts no responsibility for damages resulting from the use of other parts!

## 8. Faults

Deviations from normal operating conditions always lead to functional breakdowns and should be looked for immediately by maintenance personnel.



**Longer lasting faults can result in the destruction of the fan and give rise to damage in plant parts and injuries to personnel!**

In the event that the maintenance personnel cannot eliminate the fault, please make contact with our mobile customer service.

## 9. Disposal/Recycling

The protection of the environment and the conservation of resources are important issues for Nicotra Gebhardt GmbH. For this reason, environmentally friendly design and technical safety as well as health protection were already respected in the development of our fans. Always observe the applicable country-specific legal regulations with regard to the disposal of products or waste occurring in the various phases of the life cycle. The corresponding disposal standards must also be considered.

In the following section you will find recommendations for environmentally friendly disposal of the machine and its components.

### 9.1 Disassembly

Disassembly of the product must be performed or supervised by qualified personnel with the appropriate technical knowledge. The dismantling must be prepared as follows:

- Disconnect the machine from the mains all and remove all cables.
- If necessary, remove all liquids, such as oil and remove this according to the local requirements.
- Transport the machine to a suitable location for disassembly.



**The machine is made up of heavy parts. These can fall during dismantling. Serious injury and property damage may result. Secure machine parts against falling before dismantling them.**

### 9.2 Dispose of components

The machine consists mainly of metals. These are generally considered fully recyclable. Separate the components for recycling into the following categories:

- Steel and iron, Aluminium, Non-ferrous metal, Insulating materials, Cables and wires, Electronic scrap, e.g. circuit boards.

Dispose of electronic components employing the proper procedures for electronic scrap.

## 10. Service

We offer to all our partners the following services:

- |  |  |
|--|--|
| <ul style="list-style-type: none"> <li>• <b>Mobile Customer Service</b></li> <li>• <b>Spare Parts Service</b></li> </ul> | <p>Telephone +49 (0)7942 101 384<br/>         Fax +49 (0)7942 101 385<br/>         E-Mail <a href="mailto:service@nicotra-gebhardt.com">service@nicotra-gebhardt.com</a><br/> <a href="http://www.nicotra-gebhardt.com">www.nicotra-gebhardt.com</a></p> |
|--|--|

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## EC-Declaration of Conformity

We hereby declare that the product named below, based on the efficiency grade of the respective fan type and the measurement and efficiency category specified in the technical documentation, complies with the ecodesign requirements set by Commission Regulation (EU) No 327/2011, according to Annex I, Section 2.

Designation:	<b>Centrifugal fan with backward curved blades (without scroll)</b>
Fan type:	<b>RLM E3, E6, G6, 53, 55, 56</b>
Serial no:	See type plate
Year of manufacturing:	See type plate
Relevant EC Directives:	<b>EC-Directive for the setting of ecodesign requirements for energy-related products (2009/125/EC)</b>

Waldenburg, 01th March, 2017



Head of Production  
i.V. T. Ehrhardt



Research & Development Director  
i.V. Dr. J. Anschütz

**NICOTRA||Gebhardt**  
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## EC-Declaration of incorporation

The manufacturer: **Nicotra Gebhardt GmbH**  
Gebhardtstrasse 19-25, 74638 Waldenburg, Germany

herewith declares, that the following product:

Product designation: Plug Fan with direct drive

Type nomination: **RLM**

Serial n°: see type plate

Year of manufacturing: see type plate

qualifies as a partly-completed machine, according to Article 2, clause “g” and does comply to the following basic requirements of the Machine Directive (2006/42/EC): Annex I, Article 1.1.2; 1.3.7

The uncompleted machine may be put into operation only if it has been stated, that the machine, into which the uncompleted machine has to be incorporated, does comply with the requirement of the machine directive (2006/42/EC).

The following harmonised standards <sup>1)</sup> have been applied:

**DIN EN ISO 12100**: Safety of machines – General design principles

**DIN EN ISO 13857**: Safety of machinery - Safety distances to prevent hazard zones being reached by upper and lower limbs

Applied, national standards and technical specifications <sup>2)</sup> particularly:

**VDMA 24167**: Fans – Safety requirements

The manufacturer is committing himselfe to make the special documents of partly-completed machine available to any state authority if required.

Waldenburg, 01th March, 2017

Representativ for the documentation: Michael Hampel



i.V. T. Ehrhardt  
Head of Production



i.V. Dr. J. Anschütz  
Research & Development Director

1) The complete listing of applied standards and technical specifications see manufacturer's documentation

2) As far as harmonised standards are not existing

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