Assembly Notes DKA

Frameless motor kit

1 Target group and intended use

The product and this documentation are directed towards technically trained specialists staff such as developers, application / plant engineers, installers and service staff. Only specialists may install, commission and run the product. Specialist staff are persons who have training and experience in working with motors, their controller and electrostatically sensitive components, are familiar with and understand the content of this document and know the applicable regulations.

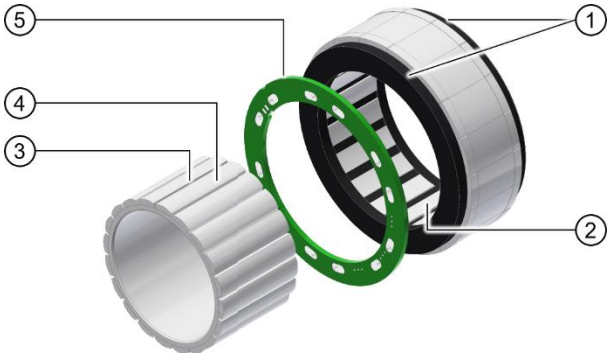
The product is intended for integration in machines/devices in a wide range of industrial applications. Use the product within the limits defined in the technical data and the approved environmental conditions.

Disclaimer

Conversion/modification of the product is prohibited. Nanotec is not liable for damage / malfunction from installation error, failure to observe this document, or improper repair; nor for product integration in the final system. The target group alone is liable for selecting / running / using our products. The general terms & conditions at *www.nanotec.com* apply (*us.nanotec.com* for clients of Nanotec USA).

2 Your product

The products of the *DKA* series are compact BLDC-motor kits in various sizes. They consist of a stator with the motor windings and a rotor with permanent magnets.



The Stator consists of a steel core made of bonded laminations with the copper motor windings (2) and a circuit board (5) with an NTC-thermistor and the connections for the windings on an isolating plastic carrier (1).

The Rotor is a magnetic ring with strong permanent magnets (3, 4).

2.1 DKA variants

DKA***x***xxx	BL**D**C **K**it Generation **A**
DKA**(*)****x***xxx	Stator outer diameter: **25** | **38** | **43** | **50** | **60** | **70** | **85** | **102** | **115** mm
DKA*****X*****xxx	Kit length: **M** | **L**
DKA***x*******xxx	Rated voltage VDC: **024** | **048**
DKA***x*****xxx**	Rated speed rpm **006:** 620 | **014:** 1400 | **020:** 2000 | **029:** 2950 | **035:** 3500 | **036:** 3650 | **045:** 4500 | **050:** 5000 | **080:** 8000 | **100:** 10000

2.2 Technical data

Find all technical data and dimensions in the data sheet of the respective variant on www.nanotec.com.

DKA..	Inner diameter rotor mm	Rated torque Ncm	Rotor length mm	Wiring
25M024100 / 25L024100	11.6	3.2 / 6.3	7 / 11	***U-V-W:*** rd-wh-bk ***NTC1-2:*** ye
38M024080 / 38L048050	18	10 / 23	8.1 / 16.1	***U-V-W:*** ye-rd-bk ***NTC1-2:*** wh
43M048050	25.5	15	9.5	dto.
50M048050 / 50L048035	30	30 / 50	10 / 17	dto.
60M048045	39.2	45	16	dto.
70M048036 / 70L048035	42	55 / 100	12 / 21	dto.
85M048029 / 85L048035	52	120 / 200	15 / 25	dto.
102M048020	63	250	18	dto.
115M048014 / 115L048006	74	390 / 780	26 / 51	dto.

3 Transport and storage

Rotor and stator are delivered sealed in a plastic bag and in separate boxes, to avoid damage during transport and storage. Store all product parts **at -20 to +85 °C and at a maximum air humidity of 85%** in a clean and well-ventilated environment without corrosive gases; the maximum recommended storage time is **12 months.** Unbox the parts just before the assembly.

⚠ WARNING!

Injury or even death: from disruption of implants due to the rotor magnetic field!

- Keep rotor away (≥ 1m) from medical implants (cardiac pacemakers, insulin pump etc.!).
- Duly warn / instruct your staff.

⚠ CAUTION!

Injury: from sharp splinters after magnetic clash!

- Wear safety goggles and gloves.
- Keep the rotor away from other magnetic parts.

⚠ CAUTION!

Bruise: from magnetism between rotor and stator or other magnetic parts!

- Wear sufficiently thick gloves.
- Slide off clung-to-each-other magnets sideways only.
- Duly warn / instruct your staff.

When unboxing:

- Pay attention to ESD protection when handling the electronic on the stator.
- Kep the rotors away from the stators and other magnetic parts to avoid collisions.
- Check all parts for damage and report all dents, broken magnets, loose wires, etc., straight to Nanotec.

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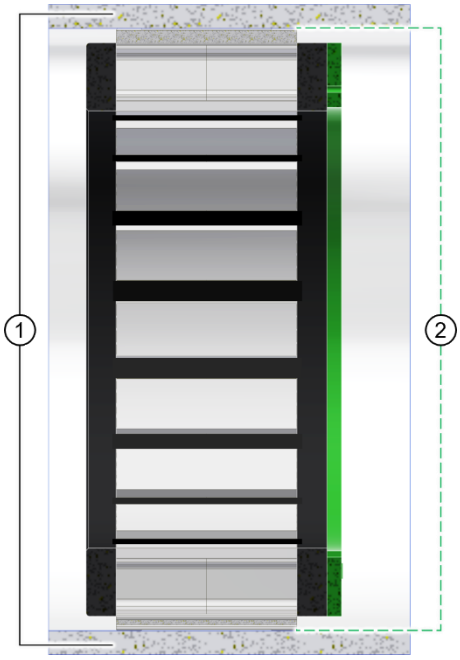
4 Stator assembly

You must fix the stator into a housing, for example by shrink fit or adhesive bonding.

4.1 Shrink fit



CAUTION! Burning from hot surfaces! ▸Wear gloves.

NOTICE: Electronic damage from heat. ▸Install a suitable heat shield / assembly sleeve (2) to protect the PCB. Information on heat dissipation in the motor can be found in the motor data sheet.

The fit tolerances depend on the material and its thermal expansion coefficient (CTE). For aluminum housings (e.g. Al 6000), we advise N8 / h8 fit tolerances.

- Select a housing material with a roughness suitable for shrink fit.
- Pay attention to storage / operating temperatures, to not exceed the tolerances.
- The housing (1) dimensions and thickness must be according to the stator and the motor torque.

4.2 Adhesive bonding

CAUTION! Eye injury and skin irritation from adhesives! ▸Wear safety goggles and gloves. ▸Observe the safety data sheet of the adhesive.

We recommend *H8/js9* fit tolerances (1).

▸ Select the glue (here depicted red) according to the forces between stator and housing and the materials (stator made of silicon steel).

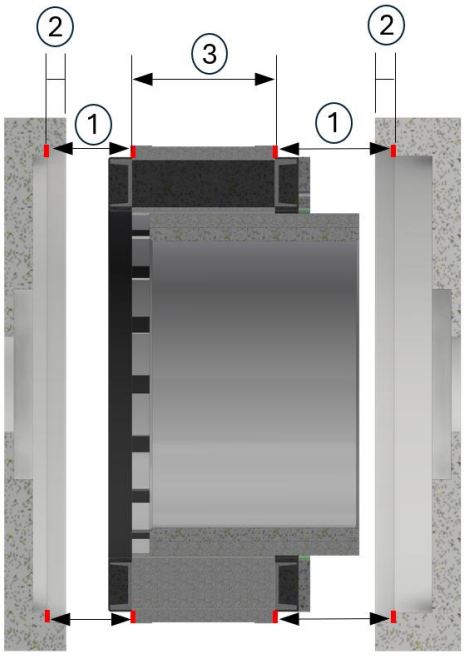
▸ Use glue slots (3) to strengthen the bond.

▸ Adjust the stator to the housing shoulder (2).

▸ Fix the stator axially *und* radially stable, to guarantee a smooth run during operation.

▸ See chapter 7 for further design support

4.3 Fixing by endcaps



▸ In this method you clamp the stator axially between front and rear endcap.

▸ Endcap inner diameter needs to be machined so that highly concentricity is guaranteed.

▸ A transition fit between endcap inner diameter and stator outer diameter according to H8/js9 is recommended.

▸ This method also allows integration of bearings or additional functional elements (eg. Hall sensors) into the endcaps.

▸ Consider through holes for the cables.

▸ (1) Surfaces (red) between which the clamping takes place

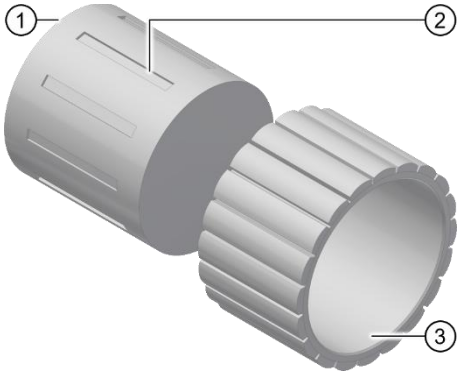
▸ (2) 1/3 stator core length per side

▸ (3) Stator core length

5 Rotor assembly on shaft

Bond the rotor to the shaft, for example by adhesives, press fit or screws. For the shaft we recommend *40Cr-steel* or similar material.

5.1 Adhesive bonding



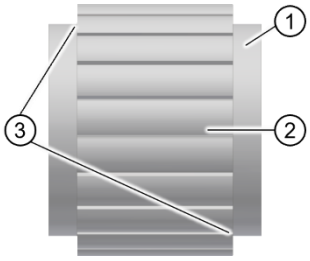
CAUTION! Eye injury and skin irritation from adhesives! ▸Wear safety goggles and gloves. ▸Observe the safety data sheet of the adhesive.

▸ Use glue slots (2) to strengthen the adhesion between shaft (1) and rotor (3).

▸ Adapt the number of slots, glue type and quantity to motor size, torque and materials (rotor made of *40Cr-steel*).

▸ See chapter 7 for further design support

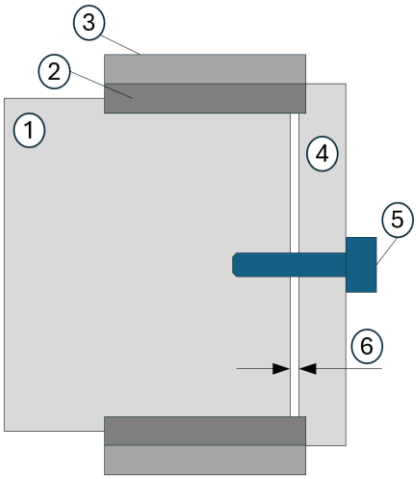
5.2 Press fit



We recommend *H8/p7 fit tolerances* (3).

▸ Select the roughness between rotor (2) and shaft (1) according to operating speed, output torque etc. (rotor made of *40Cr-steel*).

5.3 Screws



▸ Fix the rotor assembly (2, 3) onto the shaft concentrically with a recommended transition fit between shaft (1) outer diameter and rotor inner diameter according to H8/h7.

▸ Install a machined metal cover plate (4) to secure the rotor axially to the shaft.

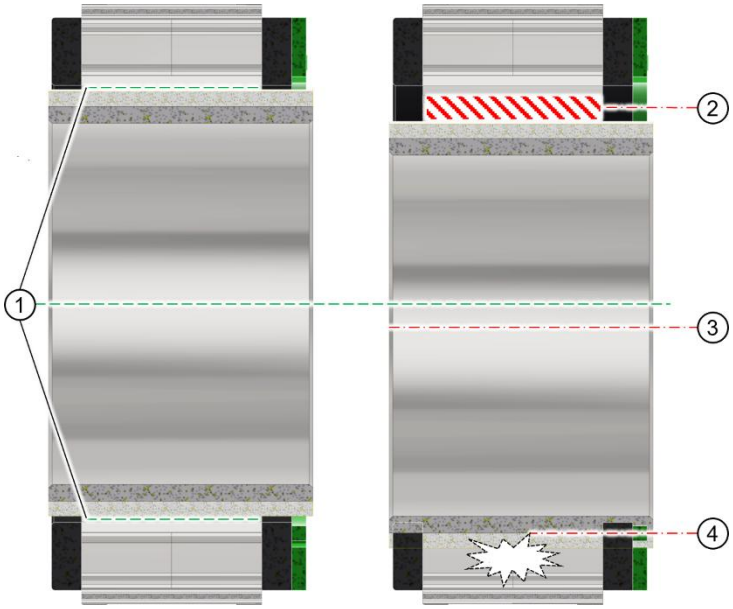
▸ Make sure that the plate only makes contact with the shoulder of the rotor assembly and maintain an air gap (6) between the plate and the shaft.

▸ Place a screw (5) through the plate and secure it into the shaft; size, type and quantity need to be defined based on the used material, overall dimensions and motor torque.

6 Stator / rotor alignment

A precise alignment is essential when inserting the rotor into the stator, to avoid damage and provide for smooth run and maximum torque in the operation.

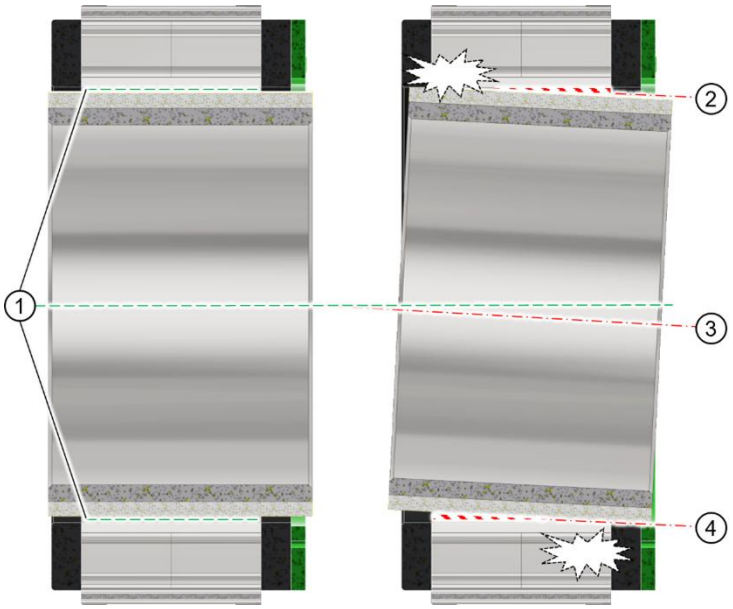
6.1 Radial



▸ With a proper centering tool insert the rotor concentrically (1) into the stator.

▸ The air gap between rotor and stator should not become smaller than half the nominal value on either side (2 to 4).

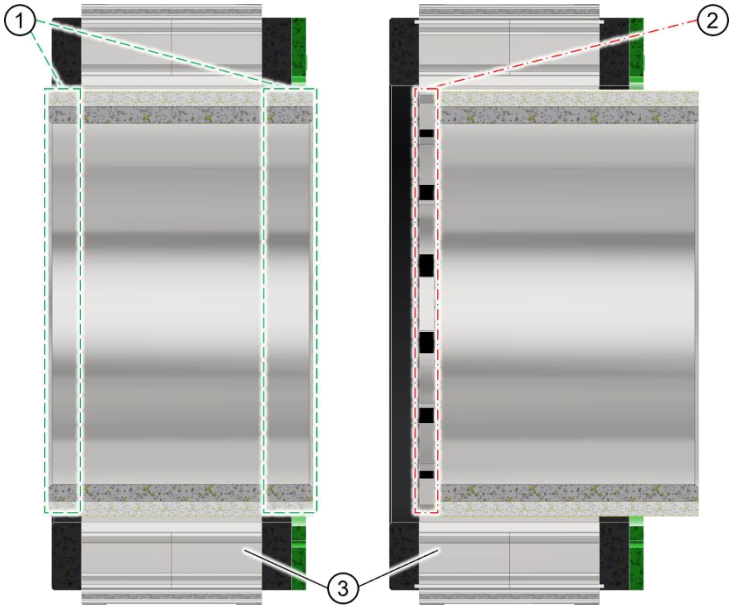
6.2 Angular



▸ With a proper centering tool, insert the rotor concentrically (1) into the stator

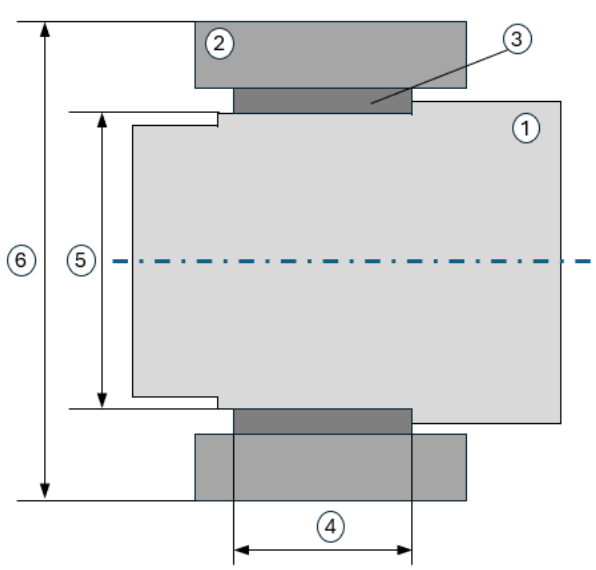
▸ A deviation (3) leads to unstable run and possibly to damages (2, 4).

6.3 Axial



- During the axial alignment, the rotor must protrude (1) on both stator core sides (3).
- An axially offset rotor (2) leads to axial tension in the overall motor and torque losses.

7 Adhesive bonding design support



- (1) shaft
- (2) stator
- (3) rotor
- (4) rotor length
- (5) shaft OD / rotor ID
- (6) stator OD / stator housing ID

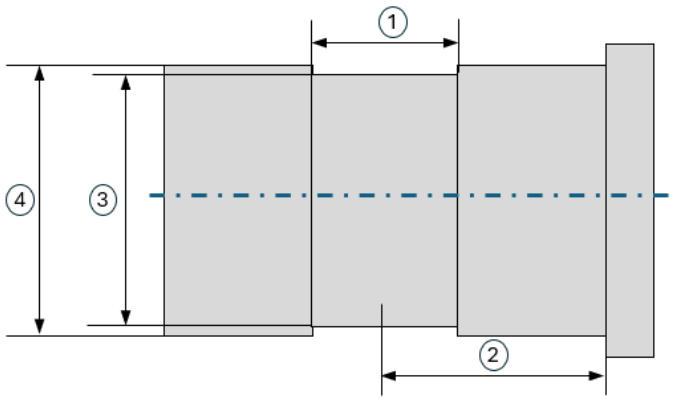
Note: The mating tolerances between the various components should be defined based on the adhesive used and the materials selected by the customer. These guidelines do not replace a thorough and specific analysis tailored to the individual design.

For reliable assembly, we strongly recommend consulting your adhesive supplier for detailed instructions and design recommendations.

Based on our experience—and considering adhesives such as Loctite 603 and Loctite 648—we propose the following dimensions and tolerances for shaft outer diameter (shaft OD) and housing inner diameter (housing ID) for the respective products (see table below, dimensions in [mm]):

	Stator OD		Stator housing ID		Rotor ID		Shaft OD		Rotor length	
Motor code	Dimension	Tolerance	Dimension	Tolerance	Dimension	Tolerance	Dimension	Tolerance	Dimension	Tolerance
25BLF05-24V	25	–0.026 / +0.026	25	+0.03 / +0.05	11,6	0 / +0.027	11,6	–0.005 / –0.018	7	–0.2 / +0.2
25BLF09-24V	25	–0.026 / +0.026	25	+0.03 / +0.05	11,6	0 / +0.027	11,6	–0.005 / –0.018	11	–0.2 / +0.2
38BLF07-24V	38	–0.031 / +0.031	38	+0.03 / +0.06	18	0 / +0.027	18	–0.005 / –0.018	8,1	–0.2 / +0.2
38BLF14-48V	38	–0.031 / +0.031	38	+0.03 / +0.06	25,5	0 / +0.027	25,5	–0.005 / –0.018	16,1	–0.2 / +0.2
43BLF08-48V	43	–0.05 / +0.05	43	+0.04 / +0.06	25,5	0 / +0.03	25,5	–0.005 / –0.018	9,5	–0.2 / +0.2
50BLF08-48V	50	–0.031 / +0.031	50	+0.04 / +0.06	30	0 / +0.033	30	–0.005 / –0.018	10	–0.2 / +0.2
50BLF15-48V	50	–0.031 / +0.031	50	+0.04 / +0.06	30	0 / +0.033	30	–0.005 / –0.018	17	–0.2 / +0.2
60BLF12-48V	60	–0.03 / +0.03	60	+0.04 / +0.06	39,2	0 / +0.039	39,2	–0.005 / –0.018	16	–0.2 / +0.2
70BLF10-48V	69	–0.037 / +0.037	69	+0.04 / +0.06	42	0 / +0.039	42	–0.005 / –0.018	11	–0.2 / +0.2
70BLF19-48V	69	–0.037 / +0.037	69	+0.04 / +0.06	42	0 / +0.039	42	–0.005 / –0.018	21	–0.2 / +0.2
85BLF23-48V	85	–0.043 / +0.043	85	+0.05 / +0.06	52	0 / +0.046	52	–0.005 / –0.018	25	–0.2 / +0.2
85BLF25-48V	85	–0.043 / +0.043	85	+0.05 / +0.06	52	0 / +0.046	52	–0.005 / –0.018	28	–0.2 / +0.2
102BLF14-48V	102	–0.043 / +0.043	102	+0.05 / +0.07	64	0 / +0.046	64	–0.005 / –0.018	18	–0.2 / +0.25
115BLF25-48V	115	–0.043 / +0.043	115	+0.05 / +0.08	74	0 / +0.046	74	–0.005 / –0.018	26	–0.25 / +0.25
115BLF50-48V	115	–0.043 / +0.043	115	+0.05 / +0.08	74	0 / +0.046	74	–0.005 / –0.018	51	–0.25 / +0.25

We also recommend incorporating a slot on the shaft that serves as a reservoir for adhesive. This feature improves the bonding performance. The dimensions of the slot are defined as follows (see illustration below):



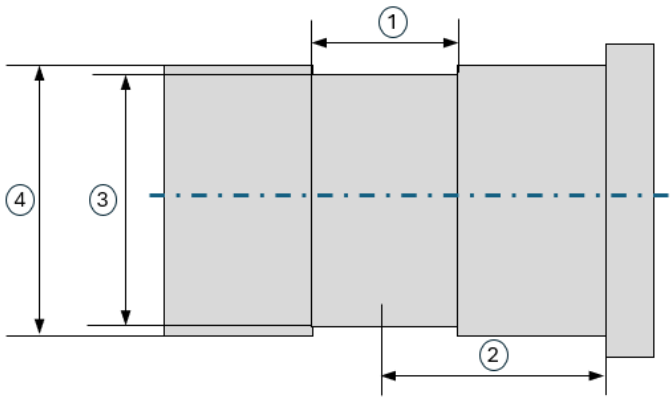
- (1) slot width: The slot's width should follow adhesive design standards. For Loctite 603 and 648, we suggest a slot width equal to one-third of the rotor length.
- (2) slot central position: The location of the slot's center in relation to the rotor positioning reference (in our example, the shaft shoulder). This should be at half the rotor length.
- (3) slot diameter: The inner diameter of the slot, defined by the adhesive specifications. For Loctite 603 and Loctite 648, we recommend starting with a diameter that is 0.06 mm smaller than the shaft's
- (4) shaft OD

The slot dimensions for specific products are as follows:

	Slot central position		Slot width		Slot diameter	
Motor code	Dimension	Tolerance	Dimension	Tolerance	Dimension	Tolerance
25BLF05-24V	3,5	–0.2 / +0.2	2,33	0 / +0.1	11,54	0 / +0.04
25BLF09-24V	5,5	–0.2 / +0.2	3,67	0 / +0.1	11,54	0 / +0.04

38BLF07-24V	4,05	–0.2 / +0.2	2,7	0 / +0.1	17,94	0 / +0.04
38BLF14-48V	8,05	–0.2 / +0.2	5,37	0 / +0.1	17,94	0 / +0.04
43BLF08-48V	4,75	–0.2 / +0.2	3,17	0 / +0.1	25,44	0 / +0.04
50BLF08-48V	5	–0.2 / +0.2	3,33	0 / +0.1	29,94	0 / +0.04
50BLF15-48V	8,5	–0.2 / +0.2	5,67	0 / +0.1	29,94	0 / +0.04
60BLF12-48V	8	–0.2 / +0.2	5,33	0 / +0.1	39,14	0 / +0.04
70BLF10-48V	6	–0.2 / +0.2	4	0 / +0.1	41,94	0 / +0.04
70BLF19-48V	10,5	–0.2 / +0.2	7	0 / +0.1	41,94	0 / +0.04
85BLF13-48V	7,5	–0.2 / +0.2	5	0 / +0.1	51,94	0 / +0.04
85BLF23-48V	12,5	–0.2 / +0.2	8,33	0 / +0.1	51,94	0 / +0.04
102BLF14-48V	9	–0.2 / +0.2	6	0 / +0.1	62,94	0 / +0.04
115BLF25-48V	13	–0.2 / +0.2	8,67	0 / +0.1	73,94	0 / +0.04
115BLF50-48V	25,5	–0.2 / +0.2	17	0 / +0.1	73,94	0 / +0.04

An example of the slot design is given below considering our 38BLF07 solution:



- Stator OD: Ø38 ±0.031 mm, which leads to a stator housing ID of Ø38 +0.04/+0.06 mm.
- Rotor ID: Ø18 0 / +0.027 mm, which leads to a shaft OD of Ø18 –0.005 / –0.018 mm.
- Rotor length: 8.1 ±0.2 mm
- (1) slot width: 8.1 / 3 = 2.7 (0 / +0.1) mm
- (2) slot central position: 8.1 / 2 = 4.05 (±0.2) mm
- (3) slot diameter: Ø18 – (0.02/0.06) = Ø17.94 (0 / +0.04) mm
- (4) shaft OD: Ø18 -0.005/-0.018 mm

8 Imprint

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