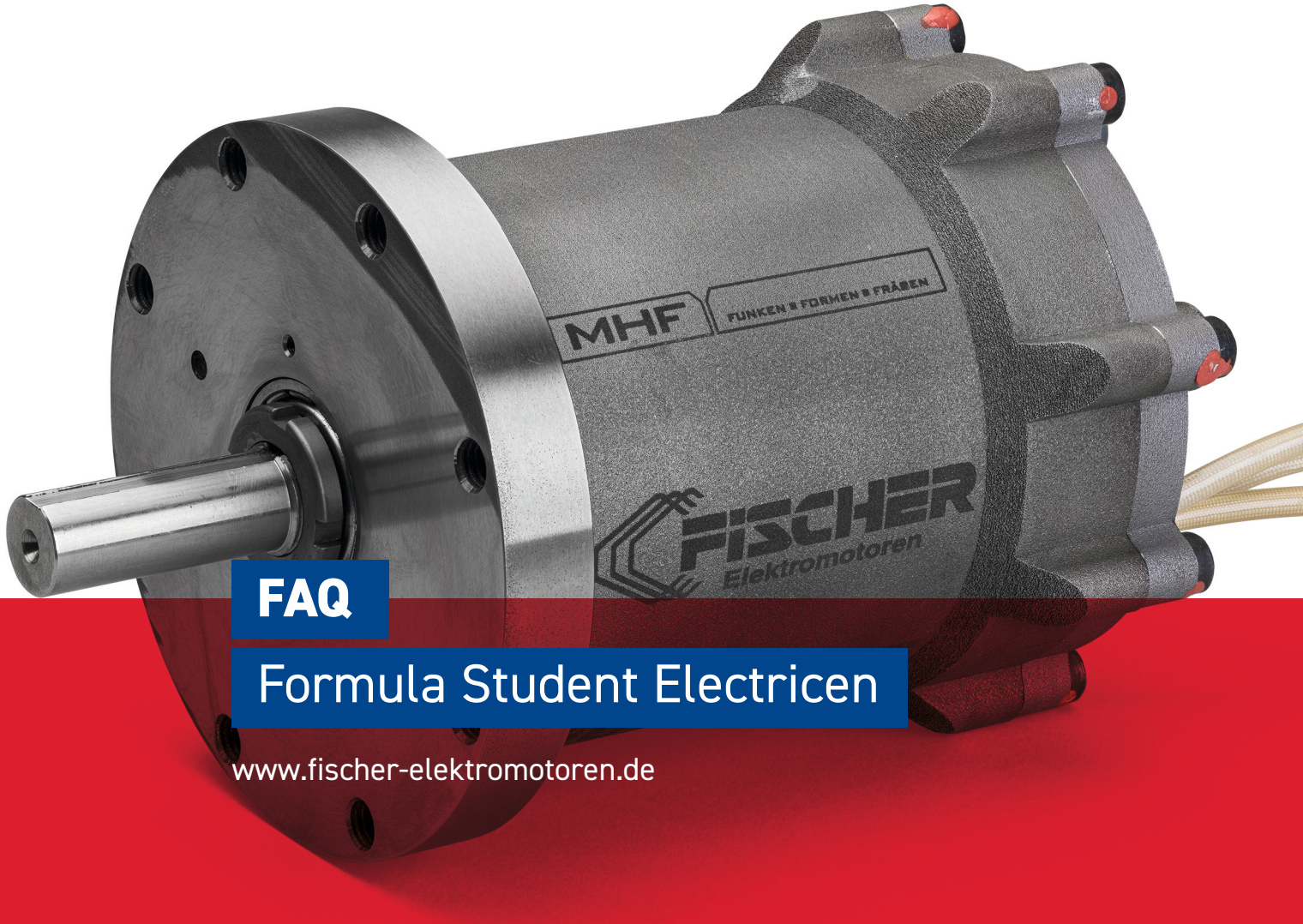
FISCHER E-RACING



FAQ

Formula Student Electricen

www.fischer-elektromotoren.de

01 What is the minimum thickness and required stiffness for a 3D-printed motor housing?

From our experience we can say that the most teams use a minimum wall thickness of 2 mm.

02 Is it possible to reduce the outer diameter of the housing?

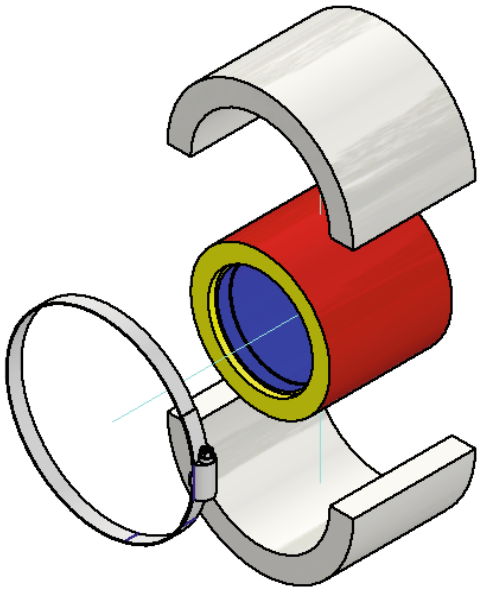
If you want to reduce the outer diameter you either have to machine it afterwards or provide us a set of half shells, with an outer diameter of at least Ø120 mm, since we need the thermal mass of the housing to insert our Stator into your housing.

03 Can we also use a removable jacket to increase the thermal mass?

We do not recommend using a removable jacket, since the housing can get stuck in the manufacturing process. Instead to half shells are perfect.

04 What are the ‘half shells’ mentioned in your drawing?

If your outer diameter is smaller than Ø120 mm, we need additional thermal mass so to shrink the stator into the housing. The half shells are a pipe cut in half with an inner diameter close to the outer diameter of your housing, fixated with screws or a hose clamp.



05 **Is it possible to add threaded holes on the yellow surface of the housing?**

Yes.

06 **Should the cooling structure of the housing cover the whole stator?**

You can get away only cooling the active length of the stator (70 mm dimension), if you have a good cooling structure and also cover up the rest of the length with a material, which has a high thermal conductivity.

07 **Should the cooling jacket be outside of the Ø120 mm diameter?**

No, you can design the cooling jacket into the volume between the red and blue surface and machine it in advance.

08 **Can the housing be hollow through manufacturing using 3D-Printing?**

Yes, in this case we also need half shells. Since the thermal mass of a 3D printed structure is usually too low for us to shrink in the stator.

09 **Is it possible that the outer shape of the housing is not a cylinder?**

The outer design of the housing can have any shape.

10 **Following rule T7.3.2 (2025), there should be a scatter shield of 2mm steel or 3mm Aluminium. Considering this is the minimum outer diameter of the housing 88.8/90.8 mm?**

Around the rotor is the stator which isn't a rotating part and has a thickness of 16,65 mm+thickness of your housing, which would cover the rotor. So, I don't think this rule applies here.

11 **What is the definition of casting residues?**

Because of the capillary effect the potting can rise up on this ledge. It can be removed using a knife or a scraper.

12 **How should the cutout for the connector on the bearing shield look like?**

Either you cut out a C-Shape to fit in connection box or you can have holes for the wires to pass though.

13 Does the rotor shaft have to be secured axially?

The axial shift of the rotor should be as small as possible.

14 Do you have any recommendations on bearing size?

Standard deep grove ball bearing which can handle the required speed should work.

15 Do you have recommended bearing arrangements?

Since the bearing arrangement depends on the load case, which is heavily influenced by your design, we can`t give a certain arrangement. From our side a Standard Locating/non-locating bearing arrangement is enough.

16 As a seal between the motor and the transmission is it sufficient enough to use sealed bearings?

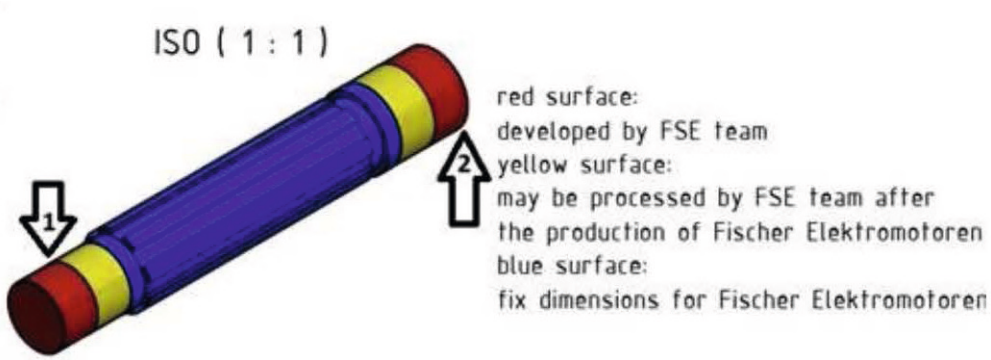
Standard sealed bearings e.g.6207-2RS can't handle the speed.

17 Can the rotor shaft be designed with a trough hole?

Yes, it can be a hollow shaft design.

18 We understand that the region marked with arrow '1' will be on the output side and have spline (red surface) and a bearing (yellow surface)?

Yes, that is correct. Both yellow surfaces are for bearings and the region marked with '2' is for your encoder system.



19 Is it possible to mount the rotor back-to-front with respect to the assembly drawing you sent?

Yes, that is no problem.

20 Is it ok if we send the shaft with an additional component press-fitted in one end?

Yes, that is no problem.

21 How are the balancing discs fixed to the shaft?

They are fixed by an interference fit and glue.

22 Is the balancing done on your side?

We balance the rotor inhouse to a balancing grade of G1.

23 Can we design our own connection box?

Yes, but you will have to mount it yourself and order the standard version with copper wire.

24 What size are the cables coming out of the resin?

For each of the 3 phases (U, V, W), there are 4 copper wires with a diameter of 0,65 mm.

25 Will the Motor be assembled on your site?

No, the assembly that takes part on our side is, shrinking the stator into your housing, casting the windings, shrinking the rotor and balance weights on to your shaft and balancing the rotor assembly.

26 Is there anyway we can mark the position of the stator on our housing and ill you mount it according to our markings?

You can mark where the power connection should be and we will do our best to insert it in that position. We don't have a positioning tool because every team has a different housing, so we do it by sight. The holes for the connection box or the wires should be designed accordingly. Additionally you can send us a working instruction for the positioning if the connection box or wires.

28 What kind of Magnets do you use?

We use NdFeB magnets with a temperature class SH.

29 Do you have a standard motor we can order?

No, we just have a motor kit consisting of a stator and rotor.

30 What are the main precautions we should take when designing the rest of the motor?

What we have seen is that cooling is usually the limiting factor so I would make sure that the cooling system is solid.

31 Can we get a detailed CAD model of the Motor?

Sorry, but we do not give out detailed models, only the models which are included in the ZIP folder.

32 Is there any material that you recommend using for the housing and motor shaft?

We suggest using aluminum for the housing and titanium for the shaft, but a lot of other materials can be used. The only requirements that we have is that the shaft is non magnetic and the expansion coefficient of the housing is close to the one of aluminium.

33 What is the thermal isolation class of your motor?

The winding is ISO Class H.

34 Is there a temperature sensor?

Yes, the motor has a PT1000 build in.

35 Is it possible to add more temperature sensors?

It is not possible to add more or different sensos, as the stator is a production finished standard in stock.

36 Where is the temperature sensor positioned in the motor?

The PT1000 is placed inside the winding head.

37 **Do you have data on the temperature difference/thermal resistance between the position of the temperature sensor and the outside diameter of the stator?**

We don't have concrete data on this, since the values would be different for every team.

38 **How long can peak torque be used?**

Until the thermal limit is reached, which in most cases is only seconds.

39 **Can we go higher than 130°C?**

We have only tested the motor to a temperature of 130°C. Anything higher will be on your on risk. The stator itself is rated for up to 180°C. But there are things that can happen at higher temperatures. For example, Magnets lose their magnetic force at a certain temperature and also the magnet is easier demagnetized by another opposing field (stator field) the hotter the magnet is. Since we can't messure the rotor temperature during the operation, it is hard to evaluate when this demagnetization happens. So, we can say that up to a winding temperature of 130°C we can guarantee that the rotor will stay undamaged.

40 **The peak curve of the data sheet indicates a maximum of 61 Arms of current. Is this value calculated, simulated or tested? Can the value be tested though non-destructive testing?**

All the values are simulated since the true value heavily depends on your cooling system. If you want to test it you can rise the current while checking that the winding temperature stays below 130°C

41 **The 'Stator Iron Losses' and 'Rotor Losses' curves are valid for nominal, S6 and/or peak operation? Could you explain how these were obtained?**

The losses are for nominal with a phase angel of 0°deg_el up to 13250 rpm. From this point the phase angle is shifted in steps to reach the points above 13250 rpm. For each step the losses were calculated.

42 **Is it possible to run the motor at higher speeds than 20000 rpm?**

The maximum speed is determined by the mechanical design and the temp erature of the rotor due to frequency losses in the rotor material and magnets.

43 Does the motor withstand oil splashes?

Splashes are no problem, but the motor should not be filled with oil by design.

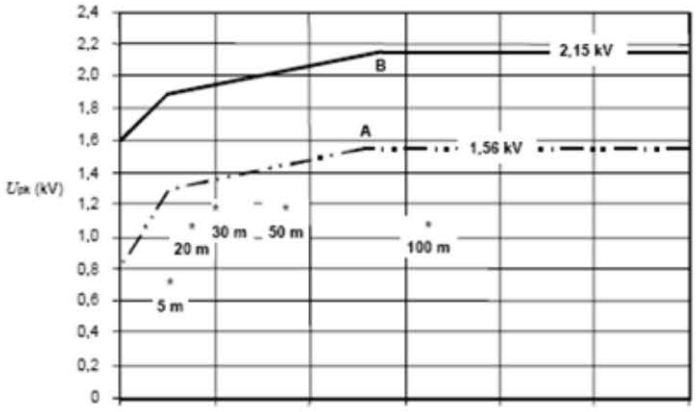
44 While assembling the motor, we had problems with the magnetic forces do you have any suggestions on how to join the rotor with the stator?

There are a lot of ways to assemble a motor. A simple solution would be to use a lathe or a mill as a guide. Put the rotor in the chuck and the housing either in a jaw chuck of a lathe or fixate it on the table of the mill and then use the axis of the lathe/mill to join the parts.

45 Do you recommend any Inverter and Encoder?

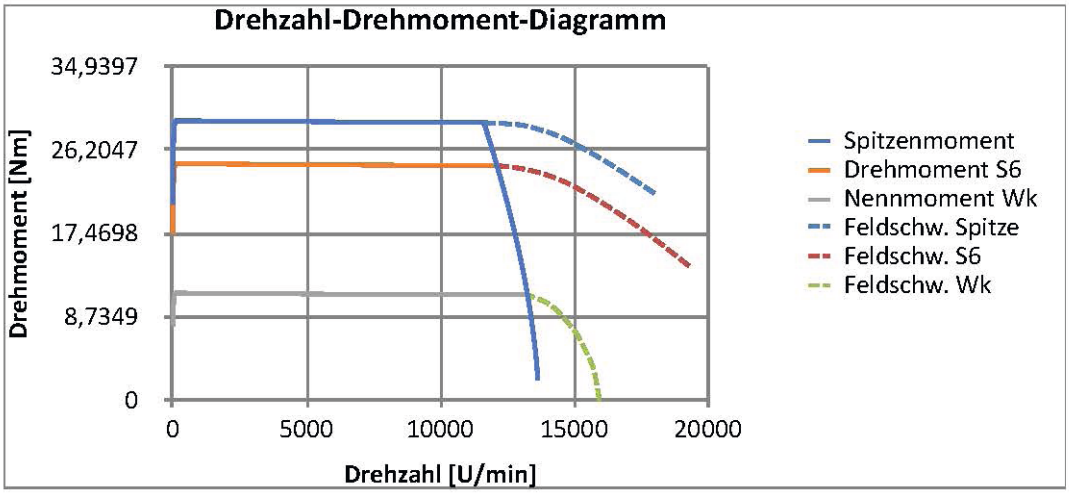
No, there are a lot of solutions which will work and we want to let the teams make their own research.

46 We want to use a SiC Controller is there a limit for dU/dt?



47 What is the difference between idle speed and the max speed with field weakening. Is the idle speed the max speed without field weakening?

The idle speed is the speed the motor reaches with no load on it.
The max field weakening speed is a theoretical speed limit we put on the data sheet. This value comes out of empirical values from different FSE-teams also in terms of the structural strength of their design.



In theory the motor can reach every point below the 3 solid lines without fieldweakening and underneath the three dashed line with fieldweakening.
The maximum speed you can reach without fieldweakening is coupled to the load you want to put on. At nominal torque you can reach the nominal speed without field weakening. On S6 duty as well of peak we put the data with fieldweakening on the data sheet because there is a point where you have a increased torque with usage of the reluctance moment.

48 Do you have a Formula Student package that utilises direct drive external rotor motors?

There are too many disadvantages when using a direct drive motor, that it wouldn't be competitive.

49 Do you have any recommendations for positive locking the fasteners that hold the flanges?

The mechanical design is part of the teams. In our experience using the correct torque spec and a threadlocker is usually enough.

50 Can we send you our design so you can check it over?

Yes, of course. You can send any questions regarding your design to this E-Mail: FSE@fischer-elektromotoren.de.

51 What is your delivery time?

Our delivery time is usually between 12 to 16 weeks. To meet the delivery time, it is mportant that you provide your parts 6 to 8 weeks before the delivery is due.

52 What happens when our provision of parts is late?

In that case the delivery time will shift according to the delay.

53 When do we get the proforma-invoice?

As soon as we get received your order

54 Which payment methods are accepted?

The payment is made in advance.

55 Can I make changes to my order at a later date?

If you have to make changes to your order, please inform us immediately and we will check your changes and change the order accordingly.

56 Where do we transfer the invoiced amount?

You can transfer the amount to one of the following bank accounts:

Postbank:
IBAN: DE22 6601 0075 0121 2897 54
BIC: PBNKDEFFXXX

Sparkasse:
IBAN: DE09 6745 0048 0003 0344 85
BIC: SOLADES1MOS

Volksbank:
BAN: DE52 6739 0000 0057 4332 05
BIC: GENODE61WTH

57 How can I place my order?

You can submit your order to us in writing e.g. E-Mail.

58 Can we shorten the delivery time?

Our delivery time is determined by the production process. In exeptional cases it can be shortened but this requires an individual consultation.

59 What do I need to consider before I provide the products?

Please make sure that the delivery note includes following:
- Your order number (if available)
- Our order number, offer number or order confirmation number
- The amount of provided parts

60 What is the address where we can deliver our parts to?

Fischer Elektromotoren GmbH
Rittwiese 25
74842 Billigheim
Germany

61 Do you also ship to third countries?

Yes, we also deliver to third countries.

62 When will we receive the official invoice?

You will receive the official invoice after the delivery of the orders parts.

Fischer Elektromotoren GmbH
Schützenstr. 19
74842 Billigheim

Telefon: +49 (0) 6265 9222-0
Telefax: +49 (0) 6265 9222-22

vertrieb@fischer-elektromotoren.de
www.fischer-elektromotoren.de