

4 Assembly of e+a synchronous rotors

4.1 Function mode

e+a synchronous rotors have a conical rotor bore, into which the conical shaft is forced with pressure. The further the shaft is pushed into the rotor bore, the more the rotor is stretched. This results in the fit (or the interference fit) between rotor and shaft, as well as the necessary pre-loading of the rotor bandage. e+a prescribes the push-in distance (along which the rotor is pushed onto the shaft), and this must be adhered to! On one end there are several threaded holes near the circumference for balancing. One hole has a fine thread and is bored through to the inside of the rotor sleeve. This fine thread is for the oil feed connection. The pressure oil method reduces the force required to push the rotor onto the cone in the axial direction. This process is also suitable for disassembly of the rotor, leaving shaft and rotor intact.

4.2 Safety precautions for the assembly process

Pressurised liquids are dangerous, and can result in serious injuries. Therefore, the following safety precautions must be observed:

- The pressure oil method must only be carried out by qualified, skilled staff.
- Carefully check that the pump and all accessories are fully functional before use.
- Do not allow rotor or shaft to move apart in the axial direction. If the rotor can come away while under oil pressure, there is a risk of it removing itself with force from its fit. Therefore, always secure rotor and shaft when under oil pressure! (Do not reduce pre-loading of the press, when oil pressure is built up between rotor and shaft!)
- Do not remove the protective foil of the bandage during the pushing-on process!
- Always wear goggles, gloves and sealed protective clothing.



Further precautions:



Persons with active implants, e.g. heart pacemakers or ferromagnetic implants must keep away from synchronous rotors!



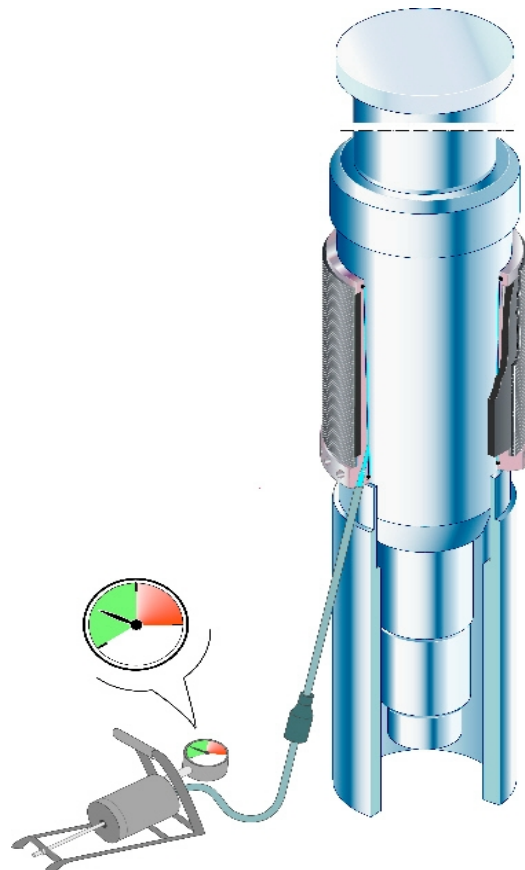
Synchronous rotors contain very powerful magnets! Ferromagnetic items, such as tools, grinding dust, cuttings, as well as tools made of ferromagnetic materials, are attracted. There is a risk of trapping fingers, resulting in injuries!



The rotor bandage must not be damaged under any circumstances. The white protective foil must not be removed during the rotor assembly. Other machine parts and measuring tools made of steel must be kept at a distance of at least 50cm, to avoid magnetisation and attraction.

4.3 Step-by-step assembly of e+a synchronous rotors

1. Clean rotor fit of shaft and conical rotor bore.
2. Install both O-rings (supplied) in the rotor-bore slots intended for this. Observe the different O-ring diameters.
3. Put rotor vertically in the press, with balancing holes/oil connection on the bottom. Place the rotor on a suitable auxiliary sleeve, which supports the rotor in the axial direction (see image). The rotor must only touch the auxiliary sleeve on its front side.
Caution: Since the rotor fit is conical, the shaft below the rotor becomes larger as it is pressed on. For this reason, the inner diameter of the auxiliary sleeve must be large enough not to touch the shaft once it has reached its final rotor position.
4. Introduce the shaft into the rotor. During this process, press lightly with 50-100 kg under the press, so that the rotor sits firmly on the shaft, without being stretched. This is the starting point of the push-in distance.
5. Connect oil supply (see image) (M4x0.5: e.g. SKF No. 234063 / 234064); recommended oil viscosity: 300mm²/s at 20°C.
6. Build up half of the permissible pressure using the oil pump. Fix the press to avoid the shaft moving out of the rotor. **Maximum admissible oil pressure is prescribed by e+a, and must never be exceeded during the entire assembly process!**
7. Push the shaft **continuously** and **slowly** into the rotor. Do not interrupt the pressing process and end it only when the shaft has been pressed into the rotor by the full push-in distance. During the pressing-in process the oil pressure increases! Therefore, continuously check the oil pressure and adjust as necessary!
8. Once the shaft has been pressed into the rotor by the push-in distance, as prescribed by e+a (the rotor has reached its final position), first release the oil pressure. Subsequently the press must be released. This procedure prevents the shaft from sliding back.
9. Finally, disconnect the oil supply. The rotor must then rest for 24 hours so that mechanical stresses, caused by the press fit in the rotor and shaft, are distributed evenly.



5 Assembly of e+a synchronous stators

The stator, with a finished outer diameter, is built into a cooling housing.
It is the user's responsibility to choose an appropriate build-in method.

5.1 Thermal joining

Thermal joining through shrinking is a suitable joining process. Stator and cooling housing are joined to form one firm unit.

Precautions:



During the thermal joining process, the temperature of the windings and isolation must not exceed 155°C!



Danger of hot surfaces during the thermal joining process.

Heatproof gloves, goggles and sealed protective clothing must be worn.



5.2 Step-by-step assembly of stators by thermal joining

The user is responsible for the details regarding the work process.

1. Clean assemblies.
2. Warm cooling housing.
3. Push the stator into the cooling housing with the aid of a lifting device, proceed without delay.
4. Let the shrunk cooling housing cool.

6 Motor spindle assembly

Stator with spindle housing and shaft with rotor core are assembled to form a complete motor spindle.

Precautions:



Danger of crushing: Caution when joining stator and rotor! Keep hands away from the area where stator and rotor can touch!



The bandage of the synchronous rotors must not be damaged under no circumstances!
The white protective foil must not be removed until just before assembly!
Before assembly of the spindle, check that there is no damage to the bandage.

Use lifting equipment to centrally introduce the spindle shaft into the spindle!

The synchronous rotor must not knock against the stator or other spindle parts!

6.1 Electrical danger

Electrical connection of the synchronous built-in motor must be carried out according to the e+a documentation.

All electrical tasks must be carried out by electrical experts, and while the power is switched off.

Safety precautions for working on electrical plants:

- Shut off power!
- Secure against switching power on again!
- Check that there is actually no power!
- Earth and short-circuit!
- Cover up neighbouring parts that are under power!

Observe main circuit as well as existing additional and auxiliary circuits!



The power leads of a turning synchronous motor have a charge of more than 1kV. Do not touch the terminals or leads!

6.2 High voltage test

Once the motor is finished, the customer must carry out a high voltage test according to VDE 0530, as outlined in the e+a documentation.

6.3 Power connections

The power leads must be connected as described in the e+a documentation.

When extending original power leads, appropriate conductor cross sections must be inserted in compliance with the voltage used.

The terminals and leads must be designed for the maximum power present!

The spindle must be earthed by a device in accordance with usual standards.

6.4 Temperature sensors

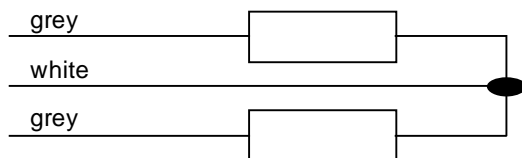
Depending on the version, various temperature sensors are built in. Information on the types of sensors, as well as the colours of the power leads can be found in the e+a documentation.

Correct polarity/connection must be observed with regard to the following sensors:

Polarity of temperature sensor type KTY:



Internal connection of temperature sensor type NTC P1H104T:



7 Operation

Only operate synchronous built-in motors with a frequency inverter! Never connect synchronous built-in motors directly to a 3-phase line!

Ignoring this may result in destruction of the frequency inverter or the motor!



The power leads of a turning synchronous motor have a charge of more than 1kV. Do not touch the terminals or leads!

When the line voltage is above 800V, safety precautions must be observed in order to protect the frequency inverter. Further information on this can be found in e+a settings, as well as in the operation manual for the frequency inverter.

Commissioning must be carried out according to the operation manual for the frequency inverter!

The settings for synchronous built-in motors are supplied by e+a.

In terms of quality control, the voltage constant and the angle between the back EMF and the zero mark of the encoder (rotor position) should be measured and logged. The e+a RPS (Rotor Positioning System) is excellent for this.

<http://www.eunda.ch>

Further safety precautions for commissioning of the motor must be determined by the user.