



Sigma 8KS

Sigma 8KBS

from serial no. 143558



Refrigerated Centrifuge

Service Manual

Read the manual thoroughly prior to starting work!

In case of inquiries, please state the following numbers:

Order number:

Serial number:

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1 General information

1.1 Copyright

The copyright concerning the service manual remains with Sigma Laborzentrifugen GmbH.

The service manual is solely intended for authorised service personnel. It includes instructions and information that may not be

- duplicated,
- distributed, or
- communicated in any other way

neither in full nor in parts.

Non-compliance may be prosecuted under criminal law.

1.2 Standards and regulations

In the European Community:

The applicable standards and regulations can be found in the declaration of conformity that is included in the operating manual.

In addition, in Germany:

Sigma Laborzentrifugen GmbH performs the inspection and maintenance of devices that are used in Germany following the BGR 500 rule (chapter 2.11) of the German employers' liability insurance association (Berufsgenossenschaft).

In addition, the centrifuges are also tested in accordance with the "DGUV Vorschrift 3" regulation (electrical systems and equipment) of the German employer's liability insurance association (Berufsgenossenschaft).

1.3 Safety

1.3.1 Safety instructions



NOTE

The safety instructions in the operating manual must be followed at all times.

The operating manual of the centrifuge includes extensive safety measures. As a basic rule, these safety measures also apply to the service personnel. Not all of the measures of precaution that the operator must take can be adhered to during service work (e.g. functional test with an open lid). For these cases, special notes are given in this service manual.

1 General information

1.3.2 Explanation of the symbols and notes

This service manual uses the following names and symbols to indicate hazards:



DANGER

This symbol stands for a **direct** hazard to the life and health of persons. Non-observance of these symbols **causes** serious health problems up to life-endangering injuries.



DANGER

This symbol stands for a **direct** hazard to the life and health of persons due to electrical voltage. Non-observance of these symbols **causes** serious health problems up to life-endangering injuries.



WARNING

This symbol stands for a **potential** hazard to the life and health of persons. Non-observance of these symbols **can** cause serious health problems up to life-endangering injuries.



CAUTION

This symbol indicates a potentially hazardous situation. Non-observance of these notes can cause minor injuries or damage to property.



NOTE

This symbol indicates important information.



NOTE

This symbol indicates electrostatic-sensitive devices (ESD).

2 Technical data

Manufacturer	SIGMA Laborzentrifugen GmbH An der Unteren Söse 50 37520 Osterode (Germany)	
Type:	8KS	8KBS
<u>Connection requirements</u>		
Electr. connection:	see name plate	see name plate
Protection class:	I	I
IP code:	20	20
Connected load (kVA):	7.5	7.5
Power consumption (kW):	6.5	6.5
Max. current consumption (A):	11.5 (at 3x400V / 50 Hz)	11.5 (at 3x400V / 50 Hz)
Input fuse (AT):	16.0	16.0
<u>Performance data</u>		
Max. speed (rpm):	10,500	5,100
Max. capacity (ml):	12,000	12,000
Max. gravitational field (x g):	20,954	8,578
Max. kin. energy (Nm):	275,321	275,321
<u>Other parameters</u>		
Time range:	10 sec to 99 h 59 min 59 sec, short run, continuous run	10 sec to 99 h 59 min 59 sec short run, continuous run
Temperature range:	-20 to +40°C	-20 to +40°C
Storage locations:	60	60
<u>Physical data</u>		
Height (mm):	980	980
Height with open lid (mm):	1,690	1,690
Width (mm):	810	810
Depth (mm):	910	910
Weight (kg):	420	420
Noise level (dB(A)):	< 73 (at maximum speed)	< 73 (at maximum speed)
<u>Special equipment:</u>		
<u>Water cooling system</u>		
Tap connections (inch):	2 x ¾	2 x ¾
Inlet pressure (bar):	1.5 to 5.0	1.5 to 5.0
Min. flow rate (l/min):	5 (at maximum power)	5 (at maximum power)
Max. temperature at water inlet (°C):	20	20

2.1 Ambient conditions

- The figures are valid for an ambient temperature of +23°C ± 2°C and a nominal voltage ± 10 %. The minimum temperature is < +4°C and depends on the rotor type, speed, and ambient temperature.



NOTE

At a nominal voltage of 100V or 200V, a tolerance of +10% / -5% applies.

- For indoor use only.
- Allowable ambient temperature +5°C to +35°C.
- Max. relative humidity of air 80% up to 31°C with a linear decrease to 67% relative humidity of air at 35°C.
- Maximum altitude 2,000 m above sea level.

3 Maintenance and service

3 Maintenance and service

The information provided in this section applies to all types of centrifuges.

3.1 Weekly maintenance and service

In order to maintain the warranty, the centrifuges must be cleaned and serviced regularly by the operator.



NOTE

The operator must be informed of the section “Maintenance and service” in the operating manual of the respective centrifuge.

3.2 Annual maintenance and service

The service manual includes a maintenance checklist for those parts of the centrifuge that need to be maintained. If desired, this checklist can be copied (see the next page).

In Germany, Sigma Laborzentrifugen GmbH offers their customers to conclude maintenance contracts.

As a result, the service personnel are obliged to maintain the centrifuges so that they comply with the applicable safety rules.



NOTE

We recommend testing the centrifuge in accordance with BGR 500, chapter 2.11.

3.3 Examination of the dismantled centrifuge

The centrifuge must be dismantled to such an extent that it is possible to assess whether all of the safety relevant components, and in particular the components of the drive system and its suspension, are in perfect working order.



GEFAHR


After repairs, changes, and in the event of repeat tests, a test of the electrical safety is required (in accordance with DIN EN 61010-1). This test must be carried out by an authorised electrician.

The specified test in accordance with DIN EN 61010-1 must be performed for centrifuges made by Sigma. The test is considered as passed if the specified limits are complied with.

A measurement in accordance with VDE 0701-0702 leads to higher values, which is due to a different measurement method. If the limit values are also complied with in this case, the test is also considered as passed. If the limit values are exceeded, a test in accordance with DIN EN 61010-1 is mandatory.

3.4 Form: maintenance checklist

Maintenance checklist for laboratory centrifuges



Model:	Nominal voltage:	Location:	<input type="checkbox"/> Examination of running centrifuge
Serial no.:	Year of construction:	Registration no.:	<input type="checkbox"/> Examination of dismantled centrifuge
Rotors / buckets:			<input type="checkbox"/> Regular examination

Batch no.:

Housing, basic unit

Name plate

Arrow indicating the direction of rotation

Housing / frame / mechanical fastening

Rotor chamber

Housing cover (lid, hinges, dampers)

Lid seals (check for cracks and porosity)

Lid lock, emergency lid release system
For motorised lid locks: Check whether the drive belt is dry and clean, and re-tension it if necessary. Check all moving parts to see whether they move easily, and grease them if necessary.

Drive

Bearings (quiet running)

Drive axle (true running)

Collet chuck/collet chuck screw

Vibration dampers/drive suspension
Check the oil film of motor suspension elements (GI-metals) and add silicon oil, if necessary. Replace porous motor suspension elements. Check oil vibration damper for leakage and sufficient oil content. Replace, if necessary (replacement is not included in lump sum maintenance). Last exchange at _____

Bellows/rubber gaiter (check for cracks and porosity, replace, if necessary)

Imbalance system mech. opt.

Grey wedge, light barrier (check for scratches)

Check imbalance system

Test rotor: _____

Cut off-imbalance: _____ g Max. imbalance: _____ g

Refrigeration system nonexistent air water

Compressor (visual insp./quiet running/rubber buffers)

Condenser (check for contamination)

Heat exchanger fan

Temperature test run

Rotors and buckets

Rotors: Check the rotors for material fatigue (cracks/corrosion). Swing-out rotors need to be checked as to whether all of their parts move easily. Clean the suspension and grease it, if necessary.

Buckets (check for cracks and corrosion)

Rotor inserts, adapters

Rotor lid and lid screw

Seals

Electrical components

Switches

Cables, cable connections, mains power connection protection through the insulation of all active parts

Control lights, LEDs

Read out the ERROR list and deleting (depending on the control unit)

Fan (of power board/compressor/drive)

Control unit Zent E L S

Check the offset values

Cycles _____ Runtime (h) _____ Software version _____

Temp. off. _____ Imb. off. _____ L_p _____ R_e _____

Electrical test according to German DGUV Vorschrift 3, DIN 61010-1

Measuring device: SECUTEST PRO

Power adapter (at 380/400 Volt)

Current consumption _____ A Voltage _____ V

Protective conductor resistance, device with power line _____ Ω
Limit: < 0,3 Ω

Protective conductor resistance, power line _____ Ω
Limit: < 0,2 Ω

Protective conductor resistance, device _____ Ω
Limit: < 0,1 Ω

Leakage current < 3,5 mA _____ mA

Insulating resistance > 1 MΩ _____ MΩ

Test run

Inspection sticker Next test date: _____

Comments, found/eliminated deficiencies:

Service life exceeded: Rotor Bucket

Objection to further operation according to BGR 500 sec. 2.11

according to DGUV Vorschrift 3

No objection to further operation concerning any/the other points

Inspector: _____ Place, date / signature _____

Form maintenance checklist Sigma Version 11/2010, Rev. 1.3 of 23/09/2016 • sb
Translation of the original document

3 Maintenance and service

3.5 List of tools

The following list includes all of the tools and auxiliary devices that should be available when maintaining a centrifuge. The list covers the tools for all types of centrifuges.



- 1 Philipps screwdrivers in several sizes (in Germany: size 1 to 3)
- 2 Flat-head screwdrivers in several sizes (in Germany: width of shaft 1.2 mm to 8 mm)

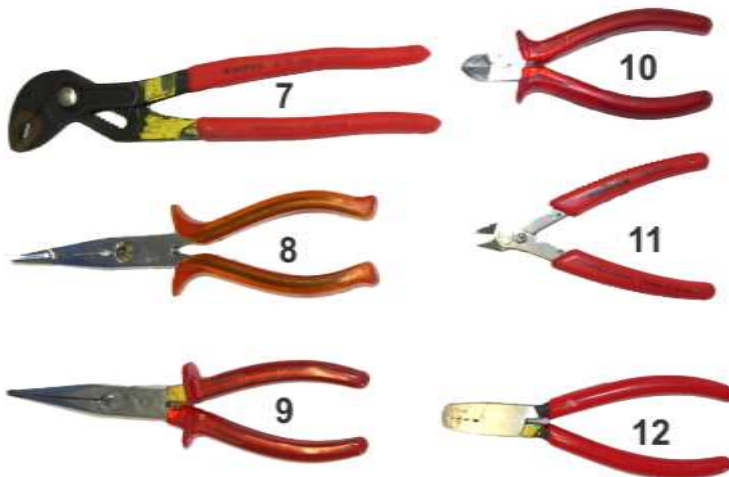


- 3 Hexagon socket keys in several sizes (size 1.5 to 10)



- 4 Combination spanners in several sizes (5.5 mm, 7 mm, 8 mm, 10 mm, 13 mm, 17 mm, 19 mm)
- 5 Adjustable spanner (up to 25 mm)
- 6 Ratchet spanner, 6/7 mm (to loosen the fastening screws of the front panel)

3 Maintenance and service



- 7 Multiple slip-joint gripping pliers
- 8 Needle-nose pliers, offset
- 9 Needle-nose pliers, straight
- 10 Side cutting pliers
- 11 Electronics side cutting pliers
- 12 Pliers for wire end sleeves



- 13 Crimper
- 14 Ejector

→ Special tools for Tyco-AMP® connectors



- 15 Mirror
- 16 Pocket lamp
- 17 Multimeter for measuring voltage, electric current and resistance
- 18 Cutter
- 19 6 mm stainless steel tube (to loosen the circuit boards from the receptacles)

3 Maintenance and service



- 20 Ratchet set
- 21 Bit set (with hexagon head, Philipps-head and flat-head)



21



22

- 22 Cable ties
- 23 Square spanner (standard accessory in centrifuges with motorised lid lock)



23



24

- 24 Grease for load bearing bolts (Sigma part no. 70284)



25

- 25 Insulating tape

26



- 26 Extractor to remove the collet chuck from the motor shaft

(Modification of the jaws is required)
Sigma part no. 25460

3 Maintenance and service

27 Pin wrench



28 Temperature measuring device



29 Flexible socket spanners
(7mm, 8 mm, 10 mm)



30 Soldering iron
31 Unsoldering pump
32 Unsoldering braid



3 Maintenance and service



33 Calliper gauge



34 Permanent magnet



35 Special tool for the cooling system with adapters (ratchets) and extension



36 Refrigerant hoses 7/16",
3 pieces



37 Pipe cutter



38 Manual stop valve



39 Pressure gauge set

3.6 Documentation in the event of damage

In the event of damage, it is essential to produce a photographic documentation.



NOTE

The documentation **must unconditionally be made before dismantling or cleaning** the centrifuge!

3.7 Return of defective parts

Although we exercise great care during the production of our products, it may be necessary to return a unit or accessory to the manufacturer. In order to ensure the quick and economical processing of returns of centrifuges, spare parts, or accessories, we require complete and extensive information concerning the process. Please fill in the following forms completely, sign them, enclose them with the return package, and send them together with the product to:

Sigma Laborzentrifugen GmbH
An der Unteren Söse 50
37520 Osterode (Germany)

3 Maintenance and service

1. Declaration of decontamination

As a certified company and due to the legal regulations for the protection of our employees and of the environment, we are obliged to certify the harmlessness of all incoming goods. For this purpose, we require a declaration of decontamination.

- The form must be filled in completely and signed by authorised and specialised personnel only.
- Affix the original form in a clearly visible manner to the outside of the packaging.



We will return the part/unit if no declaration of decontamination is provided!

2. Form for the return of defective parts

This form is for the product-related data. They facilitate the assignment, and they enable the quick processing of the return. If several parts are returned together in one packaging, please enclose a separate problem description for every defective part.

- A detailed problem description is necessary in order to perform the repair quickly and economically.



If the form does not include a description of the malfunction, neither a refund nor a credit note can be issued. In this case, we reserve the right to return the part/unit to you at your expense.

- Upon request, we will prepare and submit to you a cost estimate prior to performing the repair. Please confirm such cost estimate within 14 days. If the cost estimate has still not been confirmed after 4 weeks, we will return the defective part/unit. Please note that you must bear the incurred costs.



The defective part/unit must be packaged in a transport-safe manner. Please use the original packaging for the unit, if at all possible. If the product is dispatched to us in unsuitable packaging, you will be charged the cost for returning it to you in new packaging.

The forms can be downloaded online from
www.sigma-zentrifugen.de → [Service] → [Overhaul and repair].

3.8 Defective accessories

The photos on the following pages show accessories that were damaged as a result of improper use.

We recommend printing and laminating the pages, and presenting them to the end user.



Round bucket 13350:

The adapter had been left in the bucket.

Result: The bottom of the bucket broke off after only 3,000 cycles and approximately 6 years.

3 Maintenance and service



Angle rotor 12154: Corrosion inside the rotor holes; the tubes had been left in the holes.

Result: Rotor break on the outside



Double rectangular bucket 13420: The anodised coating was removed because the bucket was cleaned in a dishwasher

Result: Cracking in areas that are subject to stress



Carrier for microtitre plates 13218: End of the service life: cracking at the short end of the bucket

4 Error messages

4.1 Error list Spincontrol

This error list is valid for all SIGMA centrifuges with a "Spincontrol" control unit:

- Spincontrol basic (1-14 ab SW-Version 009, 1-14K, 1-16, 1-16K, 2-7)
- Spincontrol easy (2-6, 2-6E)
- Spincontrol universal (Zent4/P)
- Spincontrol comfort (Zent3S)
- Spincontrol professional (Zent5)
- Spincontrol L (Zent6)
- Spincontrol S (Zent7)

4 Error messages

Spincontrol error list



Code	Error type	Description	Remedy [contact]
0	Undefined	-	-
1	Critical	Software in undefined state	- [Sigma Development]
2	Critical	Hardware error CPU	- [Sigma Development]
3	Critical	ROM error (incorrect checksum)	- [Sigma Development]
4	Critical	RAM error	- [Sigma Development]
5	Critical	Software error	- [Sigma Development]
6	Critical	Software error	- [Sigma Development]
7	Log	Software error or manual reset	-
8	Critical	Software error	- [Sigma Development]
9	Critical	Software error	- [Sigma Development]
10	Critical	Speed indicator signal disturbed	- Check the speed sensor and cable. - Check the internal earth (ground) cables. [Sigma Service]
11	Critical	No speed sensor signal	- Check the speed sensor in the sensor mode. - Check the cable. [Sigma Service]
12	Critical	No speed indicator monoflop signal	- Check the "MF speed indicator" signal in the sensor mode. - Check the cable. [Sigma Service]
13	Non-critical	Overspeed	- Compare the maximum rotor speed (rpm) with the preset value. - Check the speed sensor in the sensor mode. [Sigma Service]

Document: Spincontrol error list
 Created by Daniel Hanke on 25/09/2007

Last amendment on 25.02.16

Approved:

Spincontrol error list


<i>Code</i>	<i>Error type</i>	<i>Description</i>	<i>Remedy [contact]</i>
14	Critical	Speed curve too steep	- Check the speed sensor and cable. - Check the connection between the control board and power board. [Sigma Service]
15	Critical	PWM error	- [Sigma Development]
16	Critical	Inverter configuration error	- [Sigma Development]
17	Critical	No rotor code monoflop signal	- Check the "MF rotor" signal in the sensor mode. - Check the rotor code cable. [Sigma Service]
18	Critical	-	-
19	Critical	Inverter short circuit	- Perform a visual inspection of the power board. - If the power board does not show any signs of damage, check the "inverter ready" signal in the sensor mode. - If the signal is not active when the lid is closed, replace the power board. [Sigma Service]
20	Critical	Speed monitor failure	- Contact Sigma. [Sigma Development]
21	Critical	Different CB/PB speed values	- Check the connection between the control board and power board. [Sigma Service]

4 Error messages

Spincontrol error list



Code	Error type	Description	Remedy [contact]
22	Critical	Inverter failure	<ul style="list-style-type: none"> - If the power board does not show any signs of damage, check the "inverter ready" signal in the sensor mode. - If the signal is not active when the lid is closed, replace the power board. <p>[Sigma Service]</p>
23	Critical	Inverter overtemperature	<ul style="list-style-type: none"> - Is the ambient temperature in the specified range? - Let the machine cool. - If the error occurs again even though the operation is within the specification, contact the service department. <p>[Sigma Service]</p>
24	Critical	Inverter overcurrent	<ul style="list-style-type: none"> - Replace the power board. <p>[Sigma Service]</p>
25	Non-critical	Defective inverter temperature sensor	<ul style="list-style-type: none"> - Replace the power board. <p>[Sigma Service]</p>
26	Critical	Overvoltage in DC link	<ul style="list-style-type: none"> - Mains voltage too high. - Brake resistor defective. - Check the lid hook detection reed relay on the 1.5 kW and 2 kW power board. <p>[Sigma Service]</p>

Spincontrol error list


Code	Error type	Description	Remedy [contact]
27	Warning	Undervoltage in DC link	- Mains voltage too low. - Lid lock DC link switch defective. - Tripping during acceleration: Check the connection impedance, connecting cables, and power outlet. [Sigma Service]
28	Critical	Brake resistor overtemperature	- Ambient temperature too high. - Rotor overloaded. [Sigma Service]
29	Critical	Motor overtemperature	- Ambient temperature too high. - Rotor overloaded. [Sigma Service]
30	Critical	-	-
31	Critical	-	-
32	Critical	-	-
33	Non-critical	Warning: Different type and version data in the firmware and EEPROM	- Normal during the first start after a firmware update. - If the error occurs although the firmware has not been changed, replace the corresponding circuit board. [Sigma Service]
34	Non-critical	EEPROM not responding	- Replace the corresponding circuit board. [Sigma Service]
35	Non-critical	No space left on EEPROM	- Delete the EEPROM and reconfigure the imbalance and temperature setting. [Sigma Service]

4 Error messages

Spincontrol error list



Code	Error type	Description	Remedy [contact]
36	Non-critical	Invalid EEPROM data	- Mains power off/on. - If the error continues to occur, delete the EEPROM. [Sigma Service]
37	Warning	EEPROM - incorrect checksum	- Acknowledge the warning so that the EEPROM will be overwritten with the default value. [Sigma Service]
38	Warning	EEPROM - incorrect address	- Contact the Sigma development department. [Sigma Development]
39	Critical	-	-
40	Non-critical	Temperature control failure	- Is the ambient temperature in the specified range? - Check the temperature sensor and refrigeration unit (or heating valve). [Sigma Service]
41	Non-critical	Overtemperature in the rotor chamber	- Is the ambient temperature in the specified range? - Check the temperature sensor and refrigeration unit. [Sigma Service]
42	Non-critical	Refrigeration unit overpressure	- Check the refrigeration unit. [Sigma Service]
43	Non-critical	Temperature value out of range	- Check the temperature sensor and cable. [Sigma Service]

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Spincontrol error list


<i>Code</i>	<i>Error type</i>	<i>Description</i>	<i>Remedy [contact]</i>
44	Non-critical	Temperature out of the preselected warning range	- Heat accumulation [Sigma Service]
45	Non-critical	Set temperature cannot be reached	- Heat accumulation - Preselected temperature too low/high. - Reduce the speed. [Sigma Service]
46	Non-critical	Imbalance	- Eliminate the imbalance. [Sigma Service]
47	Non-critical	Defective imbalance sensor	- Check the speed sensor in the sensor mode. - Check the cable. - Check the position of the grey wedge in between the light barrier [Sigma Service]
48	Critical	-	-
49	Critical	-	-
50	Warning	Lid could not be locked	- Check the lid lock microswitch (sensor mode). [Sigma Service]
51	Non-critical	Lid could not be opened	- Check the lid lock microswitch (sensor mode). - Check the lid control relay. - Replace the power board. [Sigma Service]

4 Error messages

Spincontrol error list



Code	Error type	Description	Remedy [contact]
52	Non-critical	Lid open during operation	The lid has opened during the operation: - Check the relay and transistor of the lid lock. The lid has not been opened: - Check the lid lock microswitch (sensor mode). [Sigma Service]
53	Non-critical	Defective lid lock microswitch	- Check the lid lock microswitch (sensor mode). - Check whether the individual lid lock components move freely. [Sigma Service]
54	Non-critical	Defective lid lock Hall sensor	- Check the Hall sensor of the lid lock (sensor mode). - Check whether the individual lid lock components move freely. [Sigma Service]
55	Non-critical	Defective lid lock transistor	- Replace the power board. [Sigma Service]
56	Non-critical	Defective lid release transistor	- Replace the power board. [Sigma Service]
57	Warning	Lid lock overcurrent	- Check whether the individual lid lock components move freely. [Sigma Service]
58	Critical	-	-
59	Non-critical	General lid lock error	[Sigma Service]

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Approved:

Spincontrol error list


Code	Error type	Description	Remedy [contact]
60	Warning	Centrifuge run interrupted due to power failure	- Mains power failure? - Check the internal connections. [Sigma Service]
61	Non-critical	Stop after power-on	- Let the centrifuge stop. Open the lid. - Mains power failure? - Check the internal connections. [Sigma Service]
62	Warning	Start not possible (e.g. delayed start)	The start could not be performed. Possible causes: - The lid contact/microswitch is defective or the lid is not completely locked. - The maximum number of cycles for the selected rotor has been reached. - In the case of the robot option, the rotor must not be locked.
63	Critical	-	-
64	Critical	-	-
65	Critical	-	-
66	Critical	-	-
67	Critical	-	-
68	Critical	-	-
69	Critical	-	-
70	Critical	CB <-> PB communication interrupted	- Check the connection between the control unit and power board. [Sigma Service]

4 Error messages

Spincontrol error list



Code	Error type	Description	Remedy [contact]
71	Critical	PB not responding	- Check the connection between the control unit and power board. - Incompatible software versions. [Sigma Service]
72	Critical	Incorrect PB version	- Install a suitable power board and firmware. [Sigma Service]
73	Critical	Incorrect PB type	- Install a suitable power board and firmware. [Sigma Service]
74	Critical	-	-
75	Critical	-	-
76	Critical	-	-
77	Critical	-	-
78	Critical	-	-
79	Critical	-	-
80	Non-critical	Incorrect rotor selected	- Select a suitable rotor. - Check the coding magnets on the rotor. [Sigma Service]
81	Non-critical	Rotor code not recognised	- Check the rotor for defective/missing coding magnets. - Check the rotor code sensor in the service mode. [Sigma Service]

Spincontrol error list


Code	Error type	Description	Remedy [contact]
82	Non-critical	Rotor not in the rotor list	If the rotor is included in the rotor list: - Check the rotor for defective/missing coding magnets. - Check the rotor code sensor in the service mode. [Sigma Service]
83	Warning	User interaction: select rotor	- Select a suitable rotor from the list. [Sigma Service]
84	Warning	User interaction: maximum number of cycles for the rotor has been reached	- Purchase a new rotor. Dispose of the old rotor. - Have the cycle counter reset by the Sigma service department.
85	Warning	User interaction: set the maximum speed for the rotor	Select the speed.
86	Critical	-	-
87	Critical	-	-
88	Critical	-	-
89	Critical	-	-
90	Critical	Robot option: overcurrent (e.g. sliding lid)	- Check the sliding lid and rotor locking system for smooth operation. If necessary, lubricate the seal of the sliding lid (with silicone grease or Sigma anti-corrosion oil 70104). - Sliding lid/rotor locking system motor defective. [Sigma Service]
91	Critical	Robot option: communication error	Check the communication cable that leads to the robot circuit board. [Sigma Service]

4 Error messages

Spincontrol error list



Code	Error type	Description	Remedy [contact]
92	Warning	Robot option: rotor cannot be positioned	Select a rotor that can be positioned. [Sigma Service]
93	Non-critical	Robot option: positioning failure	Check the rotor locking system (motor; has the mechanical system been greased?; Bowden cable) [Sigma Service]
94	Critical	Unichiller option: connection to external refrigeration unit interrupted	- Check the connection to the unichiller. [Sigma Service]
95	Critical	Robot with bucket lifting device option: the bucket cannot be moved to the final position	- Check the bucket lifting device (motor, switch, mechanical blocking, etc.) [Sigma Service]
96	Warning	Inert gas option: centrifuge not inertised	- Do not start the centrifuge until it is completely filled with inert gas. [Sigma Service]
97	Critical	Inert gas option: Inert gas sensor failure	- Check the inert gas sensor cable. [Sigma Service]
98	Critical	Water cooling option: insufficient water flow!	- Check the water flow rate. - Check the cable to the flow meter. [Sigma Service]
99	Log	General, temporary errors	-
221	Critical	Inverter error: auxiliary voltage 15V (H15V) not available	Replace the power board (if reproducible) [Sigma Service]

Spincontrol error list

Code	Error type	Description	Remedy [contact]
222	Critical	Inverter error: isolated amplifier (ADuM4190) may be defective	Replace the power board (if reproducible) [Sigma Service]
261	Critical	Current and/or DC link voltage cannot be measured properly	Replace the power board (if reproducible) [Sigma Service]

5 Main components

5 Main components

5.1 Housing panels

Removal of the housing panels

In order to be able to access the electronic and mechanical components as well as the two refrigeration units of this model, the front door must be opened (and, in case of a lack of space, removed) and the upper or lower part of the back panel must be removed.



DANGER

Prior to performing any work, disconnect the mains power plug and secure it so that it cannot be reconnected by mistake (e.g. by way of a warning sign)!



NOTE

Be careful when working on electronic components. Suitable ESD protection measures must be taken!

Opening the front door

- Turn the screws for opening the door on the right-hand side clockwise by $\frac{1}{4}$ turn by way of a square spanner (AF 8).

- 1 Screws for opening the door



Fig. 1: Position of the screws for opening the front door

Removing the front door

- Secure the front door so that it cannot fall down, e.g. by way of a wooden block or with the assistance of a second person.
- Remove the hinge pins. To do so, drive the hinge pins out from below with the aid of the pin punch.

2 Door hinges

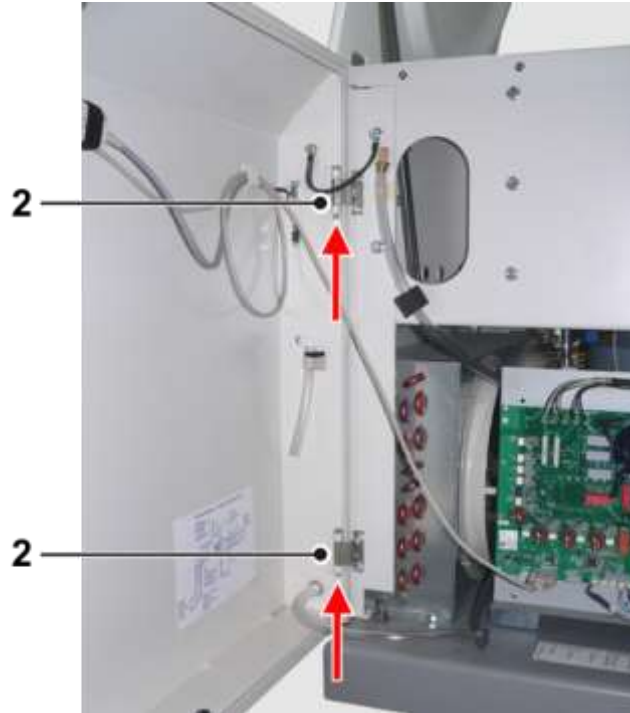


Fig. 2: Position of the door hinges

Removing the back panel

- Loosen the 20 fastening screws in order to remove the upper part of the back panel (see the following picture).

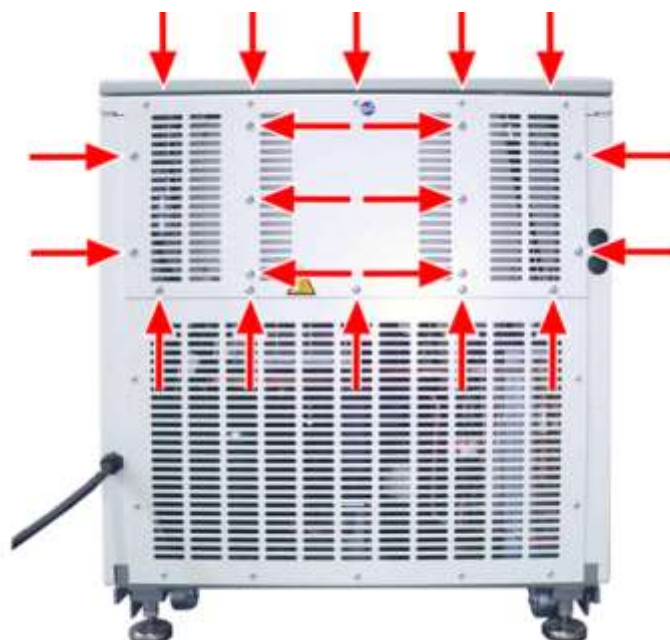


Fig. 3: Fastening screws of the upper back panel

5 Main components

- Loosen the 14 fastening screws in order to remove the lower part of the back panel (see the following picture).

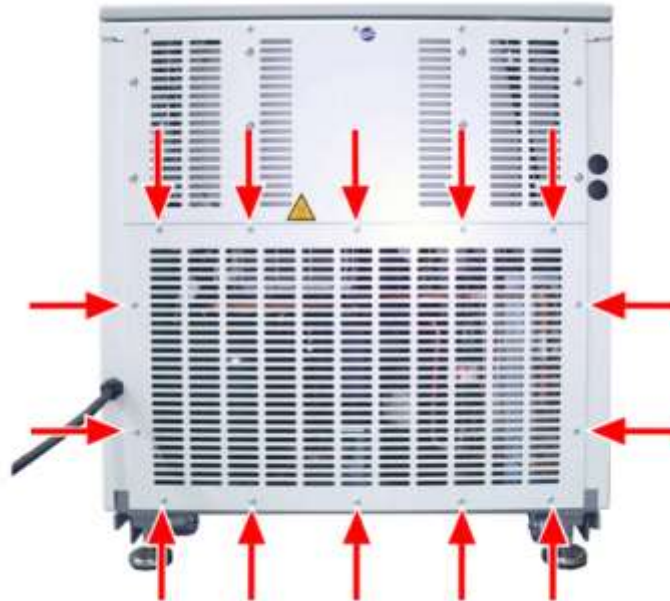


Fig. 4: Fastening screws of the lower back panel



The side panels cannot be removed, since they are part of the load-bearing structure.

5.2 Lid

5.2.1 Replacement of the lid

The lid is fastened on the left-hand side of the centrifuge with four hinges.



The lid weighs approximately 50 kg!

Removal

- Open the lid and remove the rotor.

**DANGER**

Prior to performing any work, disconnect the mains power plug and secure it so that it cannot be reconnected by mistake (e.g. by way of a warning sign)!

- Push the observation window out of the lid towards the outside.
- Pull the round sling through the opening in the lid.
- Attach the round sling to a lifting device (e.g. a crane) and move the lifting device up so that the lid is secured.
- Disconnect the gas struts from their holders (see chapter 5.2.4 - "Gas struts").
- Loosen the hinge screws of the lid (see the following picture).

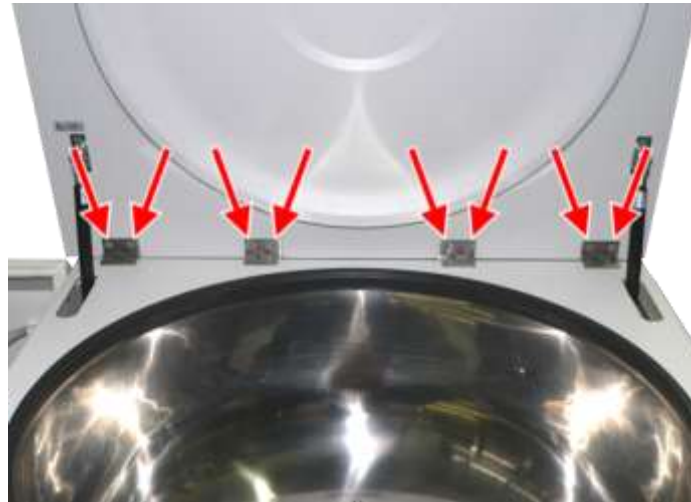


Fig. 5: Position of the hinge screws of the lid

- Deposit the lid away from the centrifuge and remove the round sling.

5 Main components

Installation

- Loosen the hinge screws of the centrifuge (do not remove them).



Fig. 6: Position of the hinge screws of the centrifuge

- Push the observation window out of the lid towards the outside.
- Pull the round sling through the opening in the lid.
- Lift the lid up and bring it to the correct position at the centrifuge.
- Fasten the hinges to the lid.
- Align the lid and tighten all of the hinge screws.
- Fasten the gas struts (see chapter 5.2.4 - "Gas struts").

5.2.2 Lid lock

Removal of the motorised lid lock

- Open the lid and remove the rotor.



DANGER

Prior to performing any work, disconnect the mains power plug and secure it so that it cannot be reconnected by mistake (e.g. by way of a warning sign)!



NOTE

Be careful when working on electronic components. Suitable ESD protection measures must be taken!

- Open the front door and remove the upper part of the back panel (see chapter 5.1 - "Housing panels").
- Disconnect the connection between the locks and power board.
- Loosen the two fastening screws of the lid lock on top of the housing (see the following picture). Hold the lock in place and completely remove the screws.

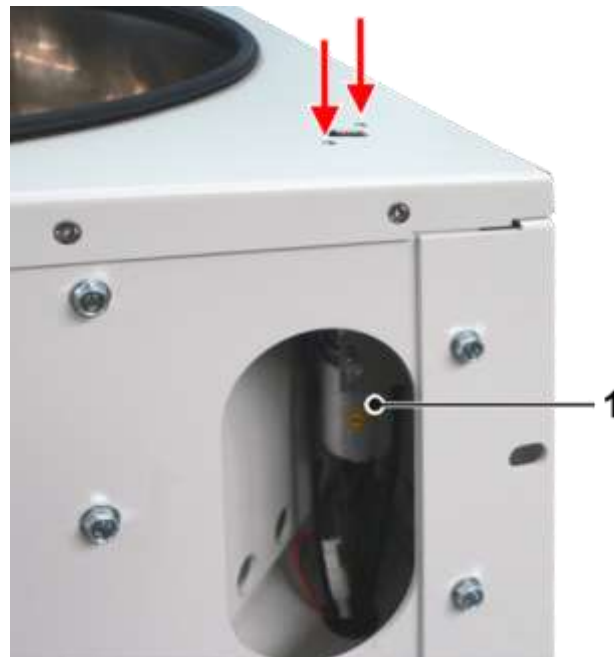


Fig. 7: Position of the screws of the lid lock at the front

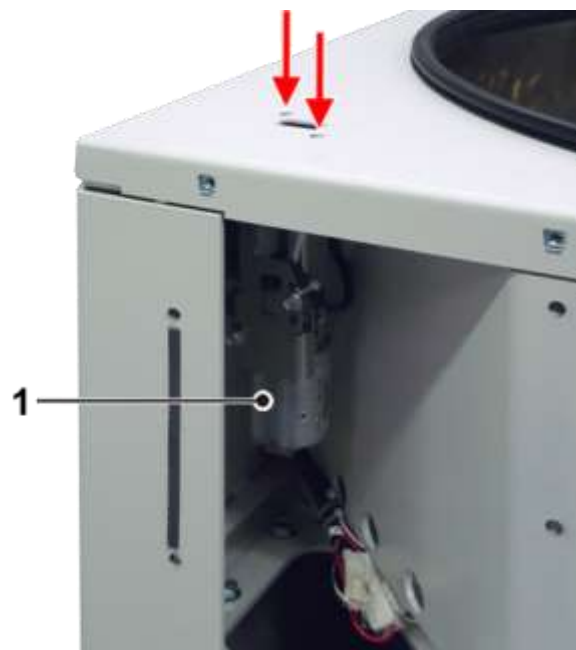


Fig. 8: Position of the screws of the lid lock at the back

- Take the lock out downwards.

Perform the installation in reverse order.

Final steps

- Thoroughly grease all of the moving parts of the lock as well as the lid hooks in order to prevent increased wear and sluggishness.

5 Main components

5.2.3 Lid gasket

The lid gasket is a ring that is attached to the upper surface of the centrifuge.

Replacement of the lid gasket

- Open the lid.
- Remove the old gasket.
- Attach the new gasket evenly with both hands. Ensure that the seam is located opposite the lid and that the gasket has uniform contact over the entire circumference without bulging.

1 Lid gasket



Fig. 9: Position of the seam of the lid gasket

5.2.4 Gas struts

Removal of the gas struts

- Open the lid and remove the rotor.



DANGER

Prior to performing any work, disconnect the mains power plug and secure it so that it cannot be reconnected by mistake (e.g. by way of a warning sign)!

- Open the front door and remove the upper back panel (see chapter 5.1 - "Housing panels").
- Open the lid completely and ask a second person to hold it in this position.



NOTE

Replace the gas struts one after the other in order to avoid the complete release of the lid!

5 Main components

- 1 Holder on the lid
- 2 E-clip (retaining ring)
- 3 Washer
- 4 Pin
- 5 Upper connecting piece for connection to the gas strut

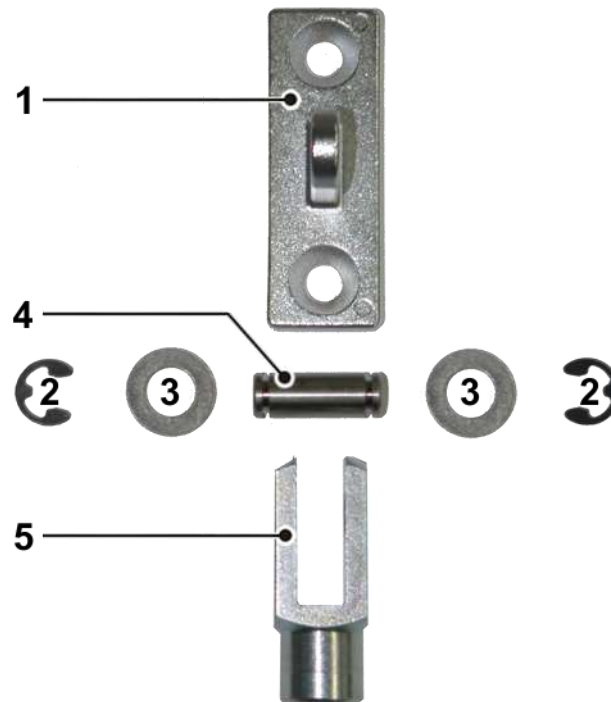


Fig. 10: Components of the gas strut holder

- Remove the e-clip (retaining ring) from the groove of the pin.
- Remove the pin from the holder. If necessary, use a pin punch or similar tool to drive the pin out.

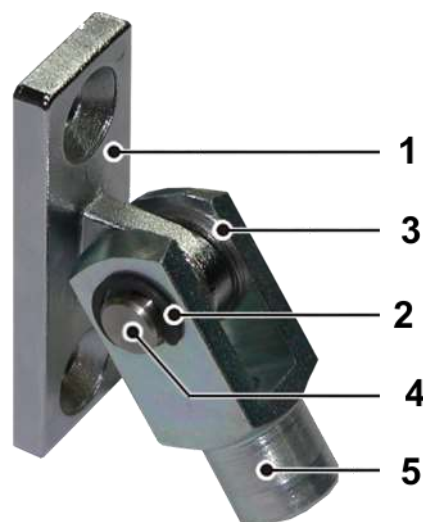


Fig. 11: Gas strut holder, assembled

- Remove the gas strut from the lower threaded fitting by turning it anti-clockwise.

5 Main components

- 6 Gas strut
- 7 Lower connecting piece for connection to the gas strut

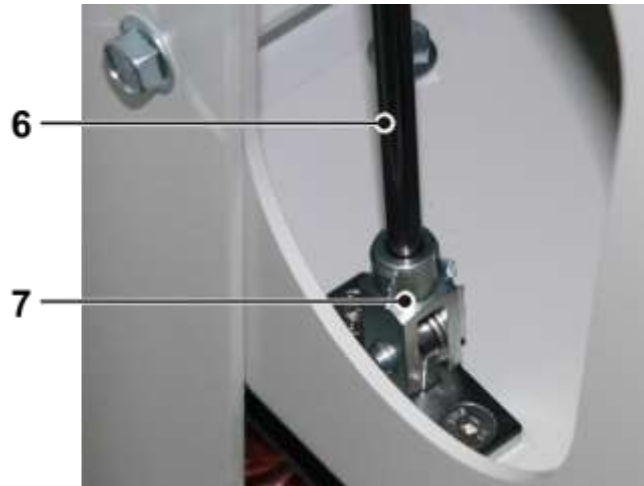


Fig. 12: Lower fitting of the gas strut

Perform the installation in reverse order.

5.3 Drive

5.3.1 Motor suspension

The motor suspension consists of vibration dampers and a motor cover. The material of these components has a limited service life.



WARNING

The motor suspension is safety-relevant, which is why it must be checked annually and replaced immediately if any deficiencies are found (e.g. visible structural changes).

We recommend replacing the vibration dampers and motor cover after 3 years, for safety reasons.

5.3.1.1 Vibration dampers

The motor is supported in an upright position by three vertical metal-rubber-elements that are screwed onto the motor base.

1 Vibration dampers

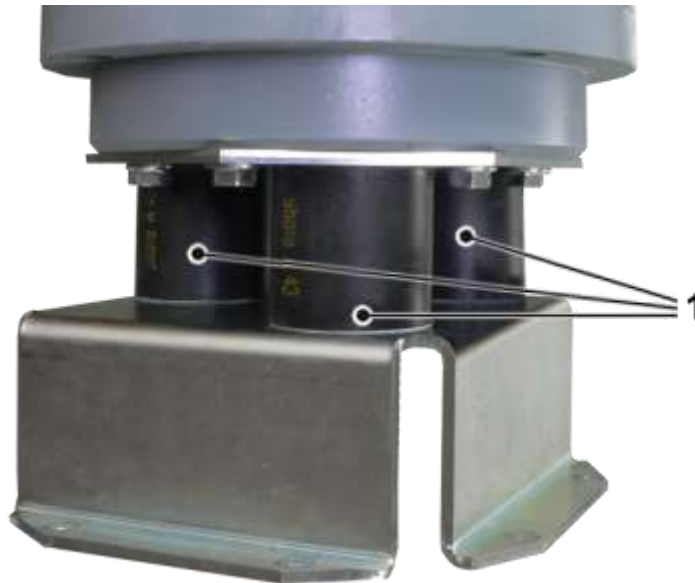


Fig. 13: Vibration dampers, installed

Replacement of the vibration dampers

see chapter 5.3.2 - "Replacement of the motor"

5.3.1.2 Motor cover

The motor cover seals the rotor chamber off against the motor. It is installed in the corresponding opening in the bottom of the rotor chamber and bolted to the motor via a cover collar.

The rotor identification system is mounted on the cover collar (see chapter 7 - "Sensor system, service mode").

Replacement of the motor cover

- Open the lid and remove the rotor.



DANGER

Prior to performing any work, disconnect the mains power plug and secure it so that it cannot be reconnected by mistake (e.g. by way of a warning sign)!

5 Main components

- Loosen the four screws of the cone fastener and remove the cone fastener.

- 1 Cone fastener
- 2 Cone
- 3 Cover collar

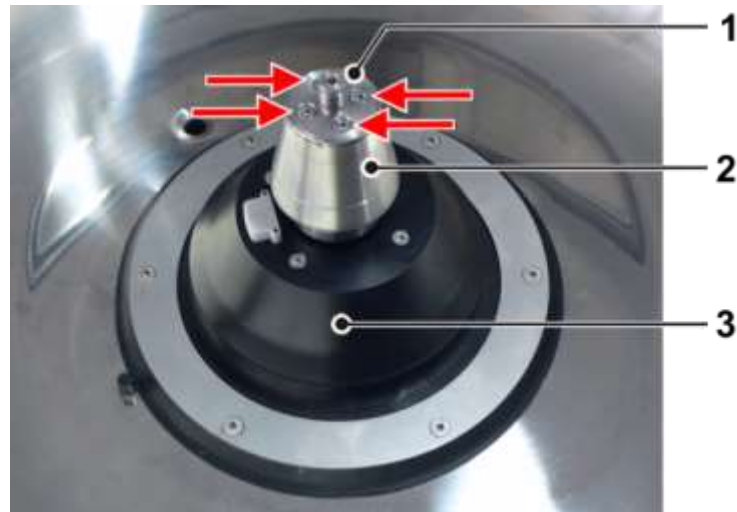


Fig. 14: Position of the screws of the cone fastener

- Loosen the screw in the middle of the cone (do not remove the screw). While doing so, immobilise the cone with the tool for loosening the lid screws (part no. 17985).

- 4 Tool for loosening the lid screws (part no. 17985)



Fig. 15: Loosening the screw of the cone

5 Main components

- Insert the extractor tool into the gap between the cone and the cover collar and disconnect the cone from the motor shaft by turning the shaft with a suitable tool (e.g. with an open-ended spanner).

5 Extractor tool



Fig. 16: Position of the screws of the cover collar (partly hidden)

- Remove the extractor tool and then remove the screw of the cone and the cone itself.
- Loosen the four screws of the cover collar. Lift the cover collar carefully off and deposit it in the rotor chamber.
- If necessary, mark the connections between the rotor identification system and the power board and disconnect them.
- Loosen the six screws of the clamping collar. Then, turn the clamping collar to disconnect it from the rubber and remove it.

6 Cable of the rotor identification system
7 Clamping collar
8 Motor cover

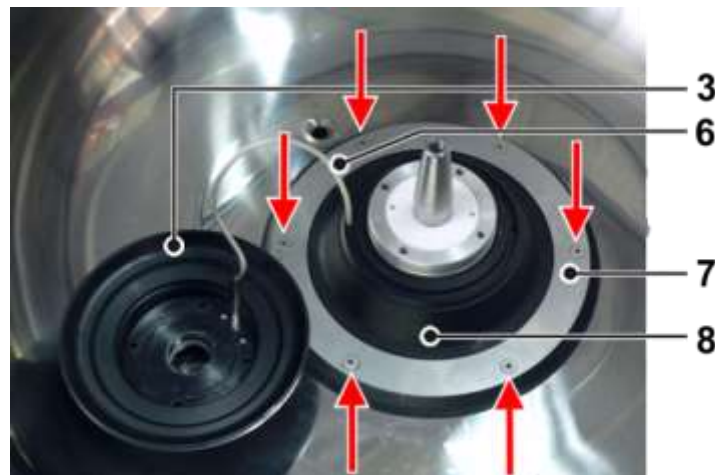


Fig. 17: Position of the screws of the cover flange

- Lift the motor cover off, disconnect the connector of the cable of the rotor identification system and pull the cable out carefully.

Perform the installation in reverse order.

- In order to insert the cable of the rotor identification system (without a connector) through the opening in the motor cover, the opening must be expanded by way of a suitable tool (e.g. with needle-nosed pliers).

5 Main components

5.3.2 Replacement of the motor

Removal of the drive unit

- Open the lid and remove the rotor.



DANGER

Prior to performing any work, disconnect the mains power plug and secure it so that it cannot be reconnected by mistake (e.g. by way of a warning sign)!



NOTE

Be careful when working on electronic components. Suitable ESD protection measures must be taken!

- Open the front door and remove the lower part of the back panel (see chapter 5.1 - "Housing panels").
- If necessary, mark the connections X30, X31 and X32 for the rotor identification system, speed encoder and imbalance sensor and disconnect them from the power board.
- Disconnect the earthing cable from the drive unit.

1 Earthing cable

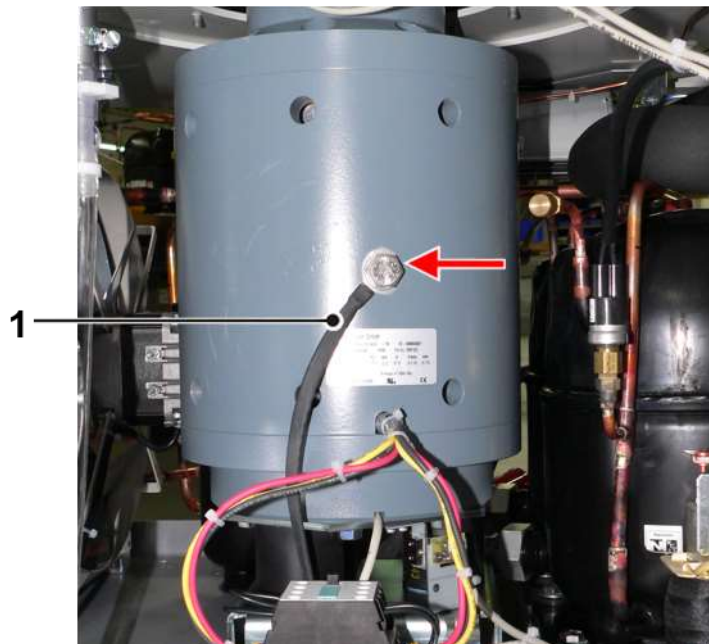


Fig. 18: Position of the fastening screw of the earthing cable at the drive unit

- Note down the respective positions of the electrical connections (the six lower screws of the black-red-yellow cable bundles; see the following picture).



NOTE

The order of the colours on the right and left is not identical!

- Disconnect the electrical connections from the circuit breaker.

2 Circuit breaker

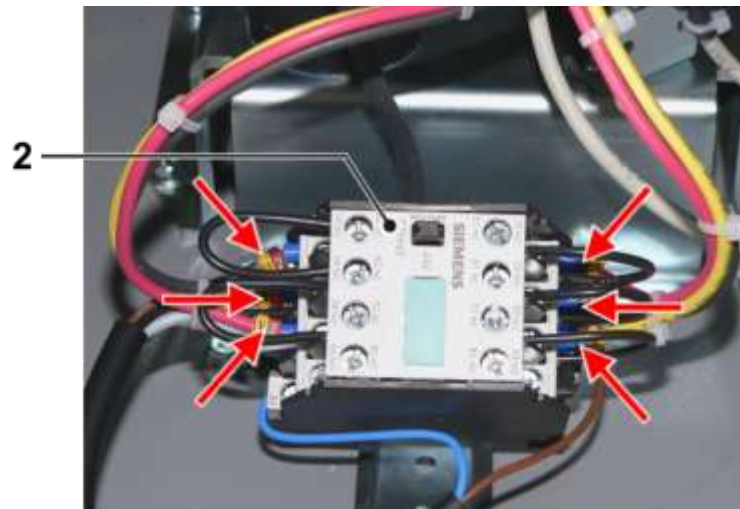


Fig. 19: Disconnecting the electrical connections from the circuit breaker

- Remove the motor cover (see chapter 5.3.1.2 - "Motor cover").
- Loosen the eight screws of the motor base.

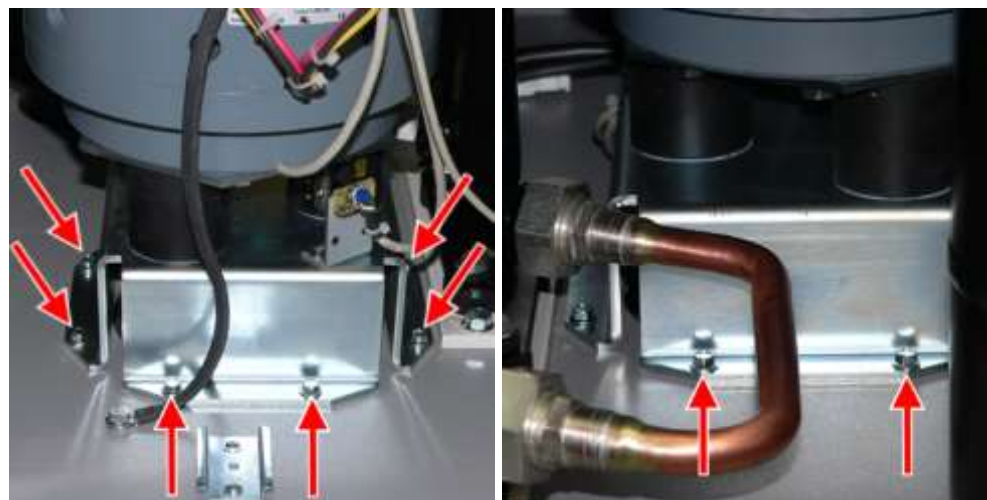


Fig. 20: Screws of the motor base, view from the front (left) and from the back (right)

5 Main components

- Install an eye bolt (M10 thread) on the motor and fasten a round sling to the eye.

3 Eye bolt with round sling



Fig. 21: Drive unit with an eye bolt and round sling

- Lift the drive out by way of a lifting device. Ensure that the connecting cables are not kinked when they pass through the opening in the bottom of the rotor chamber.
- Set the drive unit down on a worktop and secure it in place so that it cannot roll away.

Replacement of the vibration dampers



When loosening the connecting screws between the base and the vibration dampers, the motor base must be secured by way of a flat bar or similar in order to prevent the grey wedge from bending and, thereby, from being damaged.

5 Main components

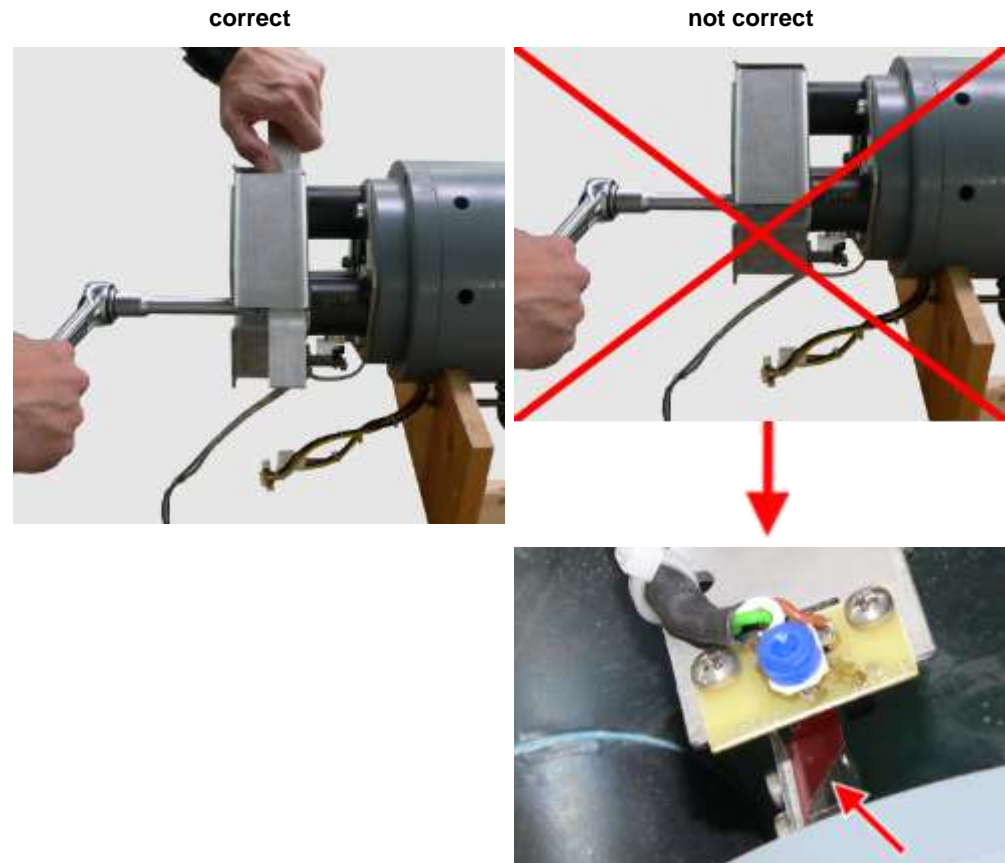


Fig. 22: Loosening the connecting screws between the motor base and vibration dampers

- Remove the three connecting screws between the motor base and the vibration dampers. While doing so, secure the base with a flat bar or similar as described hereinabove.
- Remove the motor base.
- Mark the position of the imbalance sensor on the motor so that the imbalance sensor can be installed in the correct position when the drive unit is reassembled.
- Loosen the six fastening screws of the support plate on the motor and remove the support plate together with the vibration dampers.
- Loosen the screws of the vibration dampers and remove the vibration dampers together with the friction disc. The friction discs will be reused.
- Fasten new vibration dampers together with a friction disc to the support plate and tighten the screws with a torque of 35 Nm.
- Fasten the support plate to the motor and tighten the screws with a torque of 40 Nm.
- Install the motor base and tighten the screws with a torque of 40 Nm.

The assembly of the drive unit is in reverse order compared to the disassembly.

5 Main components

Final steps

After the motor has been replaced, apply some marine grease (part no. 984760) to the upper bearing.

- Remove the bearing with a suitable tool, e.g. with a small hexagon socket key, and then apply the grease.

4 Upper bearing

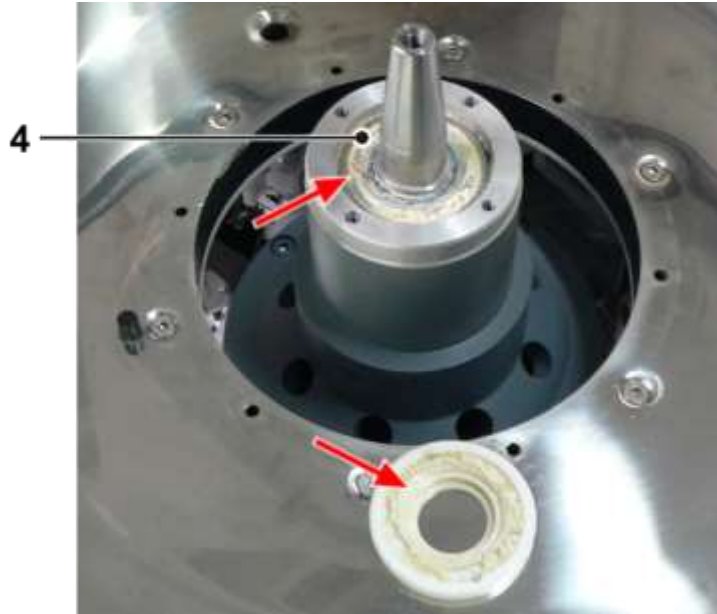


Fig. 23: Application of marine grease to the upper bearing

- Following the installation of the new drive unit, the imbalance sensor must be tested and adjusted (see chapter 7.1.4 - "Optical imbalance sensor").

5.4 Circuit breakers

The centrifuge is equipped with three automatic circuit breakers that are located on the right-hand side of the power board.

1 Automatic circuit breakers



Fig. 24: Automatic circuit breakers

5.5 Refrigeration system

5.5.1 Work on the refrigeration system



Work on the refrigeration system must only be performed by trained refrigeration engineers who can prove their special expertise in accordance with the German ordinance on climate protection against changes caused by chemicals (ChemKlimaschutzV).

If no trained refrigeration engineer is available, please contact the service department of Sigma Laborzentrifugen GmbH.

As a certified company in accordance with section 6, paragraph 1 and 2, of the ordinance on climate protection against changes caused by chemicals (ChemKlimaschutzV) and in combination with section 3, paragraph 1, of the EC regulation 842/2006 concerning certain fluorinated greenhouse gases), and section 4, paragraph 2, of the EC regulation 303/2008 on the certification of personnel, we are authorised to perform leak tests, recovery of refrigerants, installation work, repair work and maintenance work on all types and sizes (power rating) of refrigeration units, air-conditioning systems, and heat pumps, including their circuits.

5.5.2 Compressor

The centrifuge is equipped with two hermetically sealed, maintenance-free compressors that are coupled to one another. Inspections of the compressors are limited to occasional cleaning of the surface and a check of the elastic rubber elements.

1 Compressor

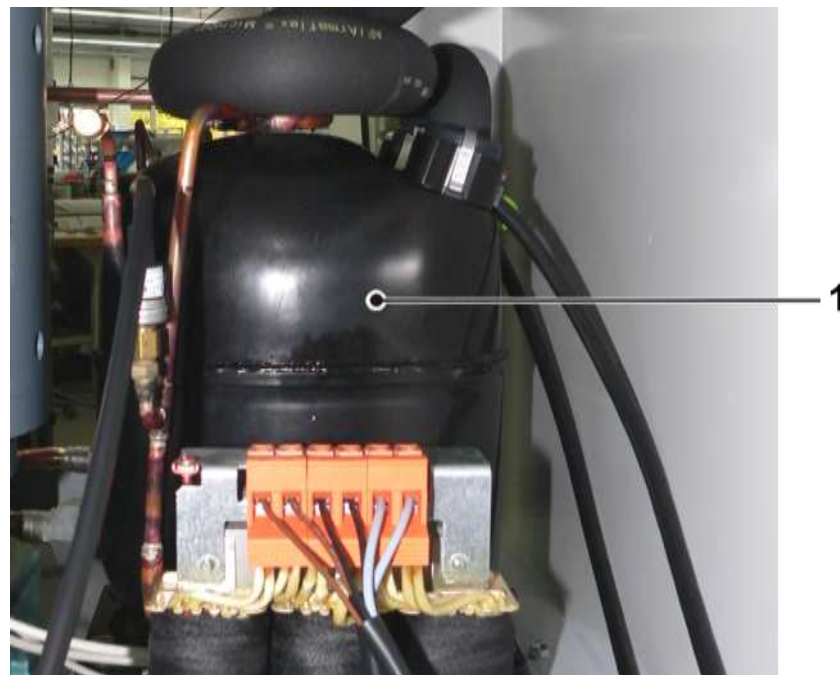


Fig. 25: Compressor, view from the front

5 Main components

2 Rubber elements



Fig. 26: Compressor, view from the back

5.5.3 Condenser

The condenser consists of a coiled tube inside a lamellar structure. A fan is installed behind the condenser drawing in cool ambient air through the lamellae of the condenser.

Dust and dirt obstruct the flow of air and, thereby, the cooling effect. Dust on the condenser pipes and lamellae reduces the heat exchange and thus the performance of the refrigeration unit. The lamellae may become bent following mechanical impact, which in turn impairs the air flow.

- Remove any dust and dirt (e.g. with a vacuum cleaner).
- Straighten and realign the lamellae with a lamella comb.

5.5.4 Fans

Removal of the front fan:

- Open the front door of the centrifuge (see chapter 5.1 - "Housing panels") and swing the power board to the side.
- If necessary, mark the connections to the power board and disconnect them.
- Loosen the four fastening screws of the fan.

1 Fan

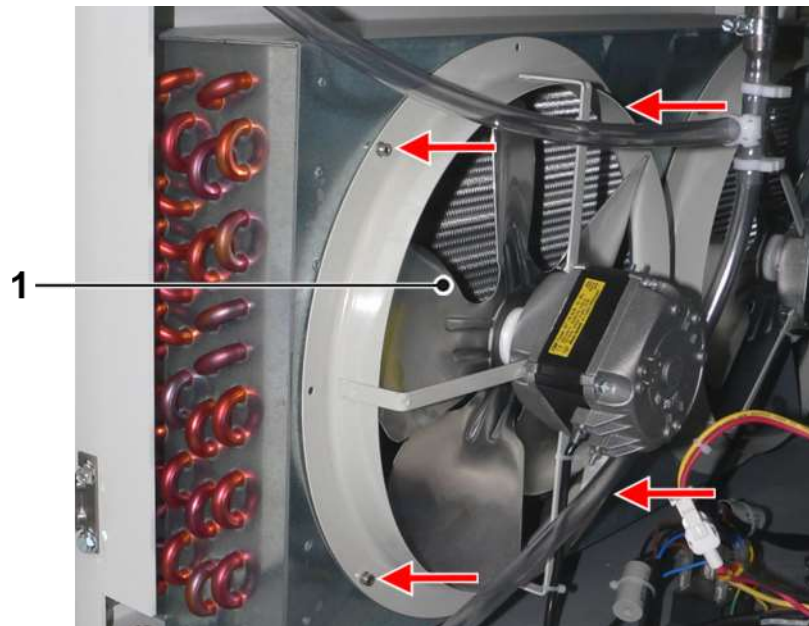


Fig. 27: Position of the fastening screws of the fan (partly hidden)

- Remove the fan towards the front.

Perform the installation in reverse order.

Removal of the back fan:

- Remove the lower back panel (see chapter 5.1 - "Housing panels").
- If necessary, mark the connections to the power board and disconnect them.
- Loosen the four fastening screws of the fan.
- Remove the fan towards the front.

Perform the installation in reverse order.

5 Main components

5.5.5 Expansion device

For this centrifuge type, an expansion valve is used as an expansion device.

1 Expansion valve



Fig. 28: Expansion device

5.5.6 Evaporator

The evaporator consists of a copper tube that is closely wound around the rotor chamber and soldered to the chamber for better heat conductance. The evaporator is thermally shielded against the ambient air by means of an insulation layer. Therefore, only the heat that is generated in the chamber is removed.

If the evaporator is defective, it cannot be repaired. In this case, the entire rotor chamber must be replaced.

5.5.7 Refrigerant



The required refrigerant type and quantity are stated on the label behind the front door (see the following illustration, item 1).

The refrigeration circuit is a closed system. Every intervention means losing a small refrigerant quantity. This is why the refrigeration circuit should only be opened and a pressure gauge connected if all other potential sources of errors (e.g. temperature sensor, temperature offset) have been excluded beforehand. In addition, the centrifuges are filled by weight so that the conclusiveness of a pressure measurement is limited.

- 1 Label with information concerning the refrigerant



Fig. 29: Information concerning the filling quantity and type of refrigerant

5 Main components

5.5.8 Draining the water circuit of water-cooled centrifuges

Prior to transporting the centrifuge, the water circuit must be drained in order to avoid damage, e.g. due to freezing.

- Switch the centrifuge off by actuating the mains power switch.



DANGER

Prior to performing any work, disconnect the mains power plug and secure it so that it cannot be reconnected by mistake (e.g. by way of a warning sign)!



NOTE

Be careful when working on electronic components. Suitable ESD protection measures must be taken!

- Disconnect the connecting hose from the cooling water supply connector and install a hose nozzle with a piece of hose of approximately 50 cm in its place.
- Open the front door with the supplied square spanner (ref. no. 930 114).
- Loosen the screw on the left lower side of the power module. The power module can then be swung out of the way to the right.



Fig. 30: Position of the screw for loosening the power module

The solenoid valves of the water circuit must be opened. To this end, an external power supply must be connected.



DANGER

Following the connection to the external power supply, the corresponding local mains voltage is applied!

- Disconnect the connectors 17 (solenoid valve branch) and 20 and connect them to the external power supply.

5 Main components

- 1 Connector 20
- 2 Connector 17 (solenoid valve)

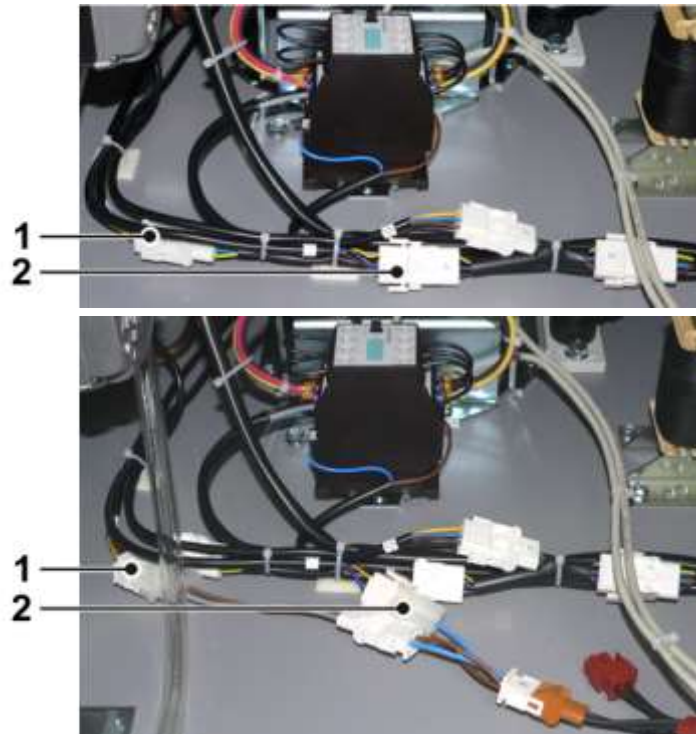


Fig. 31: Connectors of the solenoid valves, original set-up (top) and with the external power supply

- Open both solenoid valves.
- Connect the compressed air gun to the piece of hose that is connected to the cooling water supply connector and purge the water from the system by way of the compressed air.



Fig. 32: Purging the cooling water from the system with compressed air

- Disconnect the connecting hose from the cooling water return flow connector and place a suitable collecting vessel (with a cloth, if necessary) underneath. Clean the pipes once again with compressed air in order to purge all of the water from the system.
- Disconnect the hose from the cooling water supply connector.
- Disconnect the external power supply and reconnect the original connectors 17 and 20.

The centrifuge can now be transported or stored.

6 Electrical system

6 Electrical system



After repairs, changes, and in the event of repeat tests, a test of the electrical safety is required (in accordance with DIN EN 61010-1). This test must be carried out by an authorised electrician.

The specified test in accordance with DIN EN 61010-1 must be performed for centrifuges made by Sigma. The test is considered as passed if the specified limits are complied with.

A measurement in accordance with VDE 0701-0702 leads to higher values, which is due to a different measurement method. If the limit values are also complied with in this case, the test is also considered as passed. If the limit values are exceeded, a test in accordance with DIN EN 61010-1 is mandatory.

6.1 Processor board

The processor board is located behind the display in the front door.

Replacing the processor board



Prior to performing any work, disconnect the mains power plug and secure it so that it cannot be reconnected by mistake (e.g. by way of a warning sign)!



NOTE

Be careful when working on electronic components. Suitable ESD protection measures must be taken!

- Open the front door (see chapter 5.1 - "Housing panels").
- Loosen the four screws of the board and remove the board.
- Mark the connectors and disconnect them.

- 1 X7/X9 display terminal
- 2 X8 reserve
- 3 X3 serial interface
- 4 X1 power board connector
- 5 X2 programming connector
- 6 X4 incremental encoder
- 7 X6 display data cable
- 8 X5 USB port (reserve)

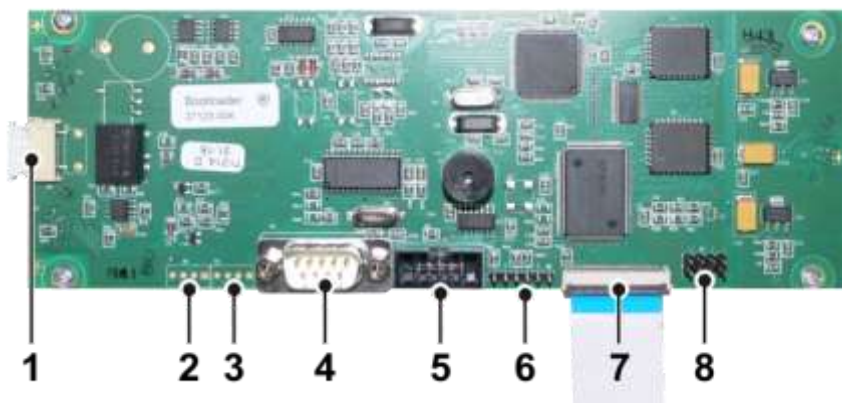


Fig. 33: Zent7 processor board connector assignment

Perform the installation in reverse order.

6.2 Power board

The power board with a heat sink is connected to a mounting plate.

Replacing the power board



DANGER

Prior to performing any work, disconnect the mains power plug and secure it so that it cannot be reconnected by mistake (e.g. by way of a warning sign)!



NOTE

Be careful when working on electronic components. Suitable ESD protection measures must be taken!

- Open the front door (see chapter 5.1 - "Housing panels").
- Loosen the eight nuts and two screws (heat sink) of the power board and remove the unit.

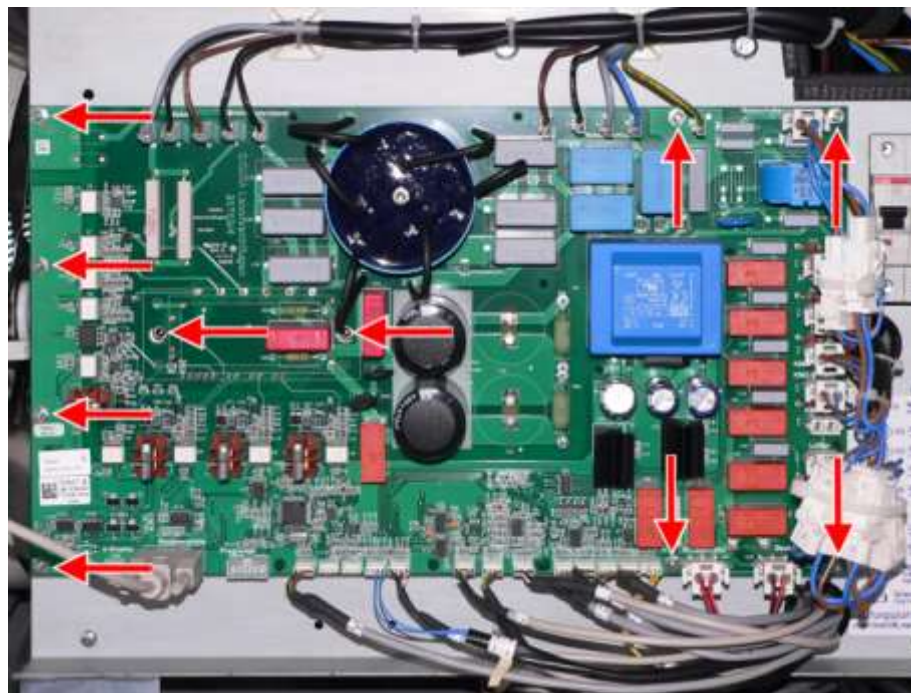


Fig. 34: Position of the nuts and screws of the power board.

- If necessary, mark the connectors and disconnect them.

Perform the installation in reverse order.

7 Sensor system, service mode

Connector assignment

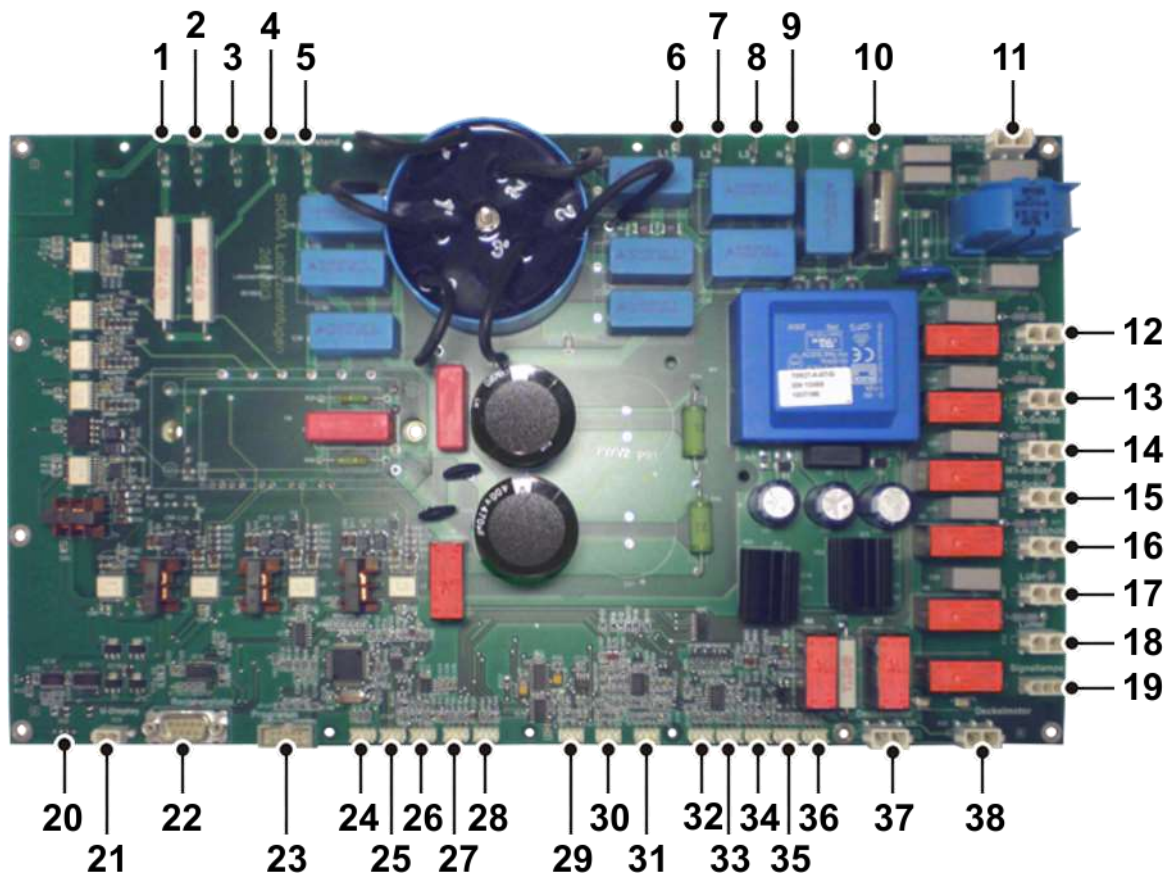


Fig. 35: 4.0 kW power board

1 X10 motor choke 1W1	14 X14 supply voltage, refrigeration unit contactor Q4	27 X26 refrigeration unit overpressure switch
2 X9 motor choke 1V1	15 X15 supply voltage, refrigeration unit contactor Q3	28 X27 chamber temperature sensor
3 X11 motor choke 1U1	16 X16 reserve	29 X30 rotor code encoder
4 X8 braking chopper	17 X17 power board electronics fan	30 X31 speed encoder
5 X7 braking chopper	18 X18 brake fan	31 X32 imbalance sensor
6 X6 L1	19 X21 signal output 24 V DC (lamp or buzzer)	32 X33 lid lock, front, lid hook
7 X5 L2	20 X22 external operation (option)	33 X34 lid lock, front, microswitch
8 X4 L3	21 X28 display	34 X35 lid lock, back, lid hook
9 X3 N	22 X20 processor board connector (see below)	35 X36 lid lock, back, microswitch
10 X2 PE	23 X35 programming connector	36 X37 chamber overtemperature
11 X1 mains power switch	24 X19 brake fan overtemperature	37 X38 lid motor, back
12 X12 supply voltage, DC link contactor Q1	25 X24 serial bus (option)	38 X38 lid motor, front
13 X13 supply voltage, star-delta contactor Q2	26 X25 reserve	

Output to the processor board

X20/1 = speed	X20/4 = Rotor identification	X20/7 = GND (earth)
X20/2 = TRANS3	X20/5 = GND (earth)	X20/8 = VDC
X20/3 = RESEV3	X20/6 = +5 V DC	X20/9 = lid release

7 Sensor system, service mode

7.1 Sensor system

7.1.1.1 Rotor chamber

The bottom of the rotor chamber of the refrigerated centrifuge is equipped with a temperature sensor. For the measurement, an NTC resistor ($R_T=10\text{ k}\Omega$) is used. This type of resistor changes its resistance as a function of the temperature (see the table). The NTC resistor is encased in a plastic sleeve.

1 Temperature sensor



Fig. 36: Temperature sensor in the rotor chamber

The table shows the reference resistance values with which the correctness of the temperature indication can be verified by way of a resistance meter.

T (°C)	R_T (Ω)	T (°C)	R_T (Ω)	T (°C)	R_T (Ω)
-20	94143	1	30452	6	23828
-15	71172	2	28976	7	22708
-10	54308	3	27580	8	21648
-5	41505	4	26260	9	20643
0	32014	5	25011	10	19691
11	18788	16	14923	21	11928
12	17932	17	14236	22	11409
13	17120	18	13636	23	10915
14	16350	19	13040	24	10446
15	15618	20	12474	25	$R_{25}=10000$
26	9577.7	31	7748.5	36	6307.0
27	9175.6	32	7432.4	37	6057.0
28	8792.6	33	7131.0	38	5818.1
29	8427.7	34	6843.4	39	5590.0
30	8080.0	35	6569.0	40	5372.0

Fig. 37: Table with reference resistance values

7 Sensor system, service mode

A broken cable or short-circuit in the sensor will be indicated by way of ERROR 43.



NOTE

In the event of a malfunction, the complete sensor must be replaced since the NTC resistor is encased in a plastic sleeve. In addition, the wiring of the resistor must be checked.

Replacing the temperature sensor

- Disconnect the connection between the temperature sensor and power board.
- Pull the defective temperature sensor out with a pair of pliers.
- Insert the new temperature sensor into the opening and secure it in place by way of some silicone rubber (e.g. Elastosil E43 by Wacker).

7.1.1.2 Safety thermostat (only refrigerated centrifuges)

In order to provide additional protection against dangerous excess temperature (e.g. in the event of failure of the entire electronic temperature monitoring system), the cooling coil is equipped with a safety thermostat. It is a bimetallic switch that is foam-fastened in the insulating layer between the armoured chamber and rotor chamber.

The temperature switch cannot be replaced. If it is damaged, please contact the support of Sigma Laborzentrifugen GmbH and enquire as to whether it can be repaired.

7.1.1.3 Pressure switch (Pressostat)

As of January 2007, a pressure switch (Pressostat) has been integrated in the pressure line of the refrigeration unit.

The pressure switch cannot be replaced. If it is damaged, please contact the support of Sigma Laborzentrifugen GmbH and enquire as to whether it can be repaired.

7.1.2 Rotor identification system

The rotor identification is ensured by a Hall sensor that is mounted on the motor cover inside the rotor chamber. A four-pole cable runs along the motor downwards to the processor board.

The rotor is equipped with several small bar magnets in front of the Hall sensor. These bar magnets with alternating polarity are arranged with a spacing of 0.8 to 2 mm between them. A minimum of 2 and a maximum of 12 magnets are arranged in a circle which is divided into segments of 30°. There is always an even number of magnets. The position within the segments of the circle and the number of magnets form the rotor code.

Replacing the Hall sensor of the rotor identification system



DANGER

Prior to performing any work, disconnect the mains power plug and secure it so that it cannot be reconnected by mistake (e.g. by way of a warning sign)!



NOTE

Be careful when working on electronic components. Suitable ESD protection measures must be taken!

- Remove the motor cover (see chapter 5.3.1.2 - "Motor cover").
- Lift the motor cover off, disconnect the connector of the cable of the rotor identification system and pull the cable out carefully.
- Loosen two fastening screws under the cover plate.
- If this has not been done before, mark the connection between the rotor identification system and power board and disconnect it.
- Replace the Hall sensor.

1 Hall sensor of the rotor identification system



Fig. 38: Rotor identification system in the rotor chamber

Perform the installation in reverse order.

- After the installation, secure the Hall sensor in place with some silicone rubber (e.g. Elastosil E43 by Wacker) and let the silicone rubber dry. Comply with the specified drying time!

7 Sensor system, service mode

7.1.3 Speed encoder

A magnet wheel with pole pairs rotates in front of the sensor at a distance of $1 \text{ mm} \pm 0.5 \text{ mm}$.

The plastic housing with the Hall sensor is mounted on a small circuit board that is located below the motor. This unit cannot be repaired, only replaced. The connection leads to the power board.

Replacement of the speed encoder



DANGER

Prior to performing any work, disconnect the mains power plug and secure it so that it cannot be reconnected by mistake (e.g. by way of a warning sign)!



NOTE

Be careful when working on electronic components. Suitable ESD protection measures must be taken!

- Remove the drive unit of the centrifuge (see chapter 5.3.2 - "Replacement of the motor").
- Remove the four screws of the circuit board (see the following illustration) and remove the speed encoder circuit board.

1 Circuit board of the speed encoder

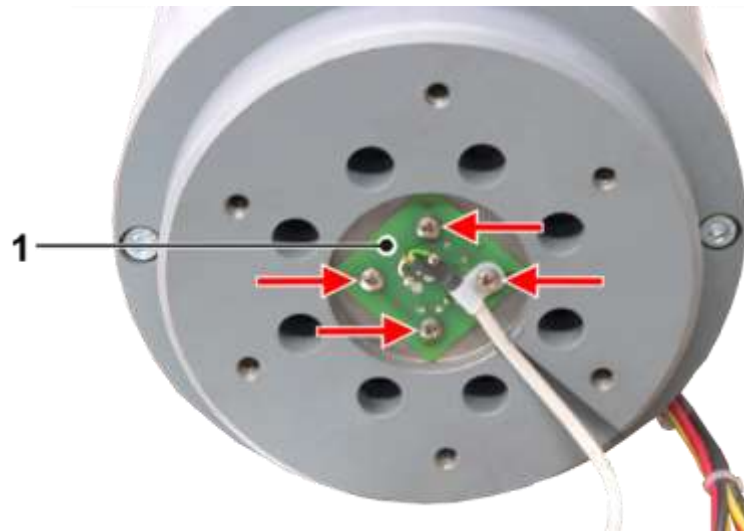


Fig. 39: Position of the fastening screws of the speed encoder circuit board

Perform the installation in reverse order.

7.1.3.1 Checking the speed

The speed is checked with a stroboscope through the window in the lid of the centrifuge.

- Start the centrifuge.
- Position the stroboscope on the window of the lid and perform the measurement.

7.1.4 Optical imbalance sensor

The centrifuge is equipped with an imbalance sensor in the form of a grey wedge that moves to and fro within a light barrier in the event of an imbalance.

Replacing the light barrier



DANGER

Prior to performing any work, disconnect the mains power plug and secure it so that it cannot be reconnected by mistake (e.g. by way of a warning sign)!



NOTE

Be careful when working on electronic components. Suitable ESD protection measures must be taken!

- If necessary, mark the connections to the power board and disconnect them.
- Loosen the fastening screws (see the following picture, item 1) of the light barrier (item 2) and replace the light barrier.
- Reconnect the supply lines.

- 1 Fastening screws of the light barrier
- 2 Light barrier
- 3 Fastening screws of the grey wedge

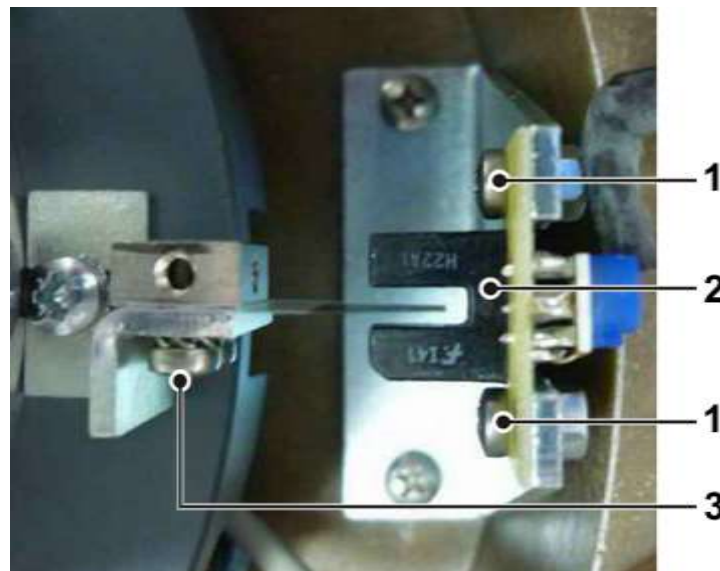


Fig. 40: Optical imbalance sensor

7 Sensor system, service mode

Replacing the grey wedge

- Loosen the fastening screws (see the picture above, item 3) and pull out the grey wedge film.
- Push the new grey wedge film under the clamping block and tighten the fastening screws. Ensure that the grey wedge is aligned in such a way that the upper edge of the clamping block is located between the second and third mark of the grey wedge (see the next picture, item A).

- 1 Clamping block
- 2 Grey wedge film

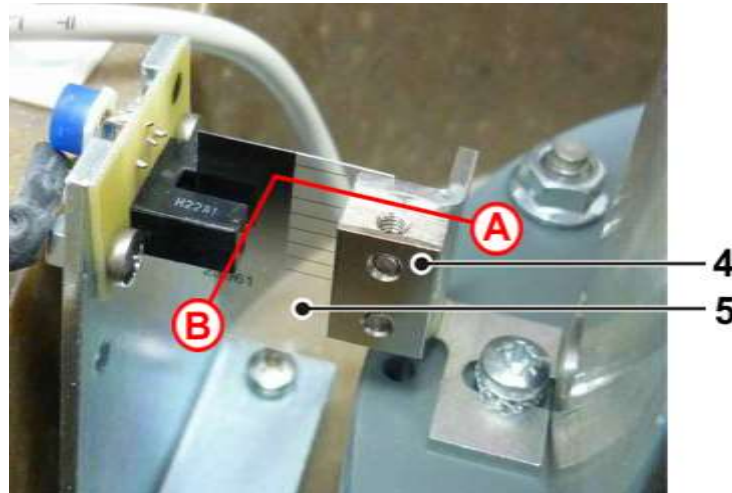


Fig. 41: Alignment of the grey wedge

- If the grey wedge does not have any marks, the centreline of the light barrier (see the picture above, B) must be positioned at the 50% grey value.
In order to determine this line, place the grey wedge on a white sheet of paper so that the colouring becomes visible. Then, mark the beginning and end of the grey area (see the next picture, C and D) on the paper. The middle between the two marks is the line of the 50% grey value (E).

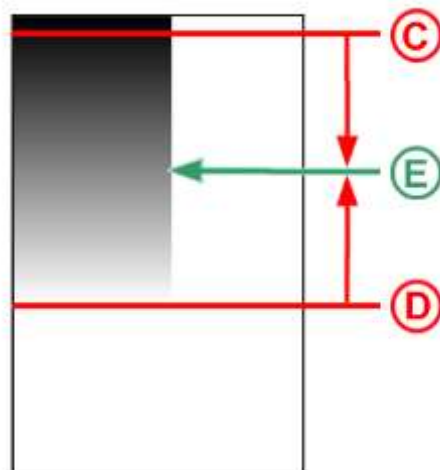


Fig. 42: Determination of the 50% grey line.

- Adjust the imbalance sensor (see below).

Adjusting the imbalance sensor

- Activate the service mode (see chapter 7.2 - "Service mod Zent7 (Spincontrol S)").

Adjustment

- Install the rotor in line with the specifications (see chapter 9.2 - "Table of values for the imbalance adjustment"). Experience has shown that the value should be in the range of 300 to 400.

**NOTE**

The higher the imbalance value is, the more sensitive the response will be of the imbalance system!

In the case of deviations:

- Align the grey wedge centrally between the forks of the light barrier. The potentiometer of the grey wedge circuit board is in its centre position (the adjustment notch is in the vertical position; the flat area points upwards).



Fig. 43: Grey wedge circuit board

- Change the value by turning the potentiometer. Experience has shown that an adjustment by ± 75 is sufficient.

**CAUTION**

The static imbalance must be adjusted in such a manner that the value does not exceed 650 even when the rotor is removed. In the event of a higher value, error 47 ("Defective imbalance sensor") will be issued!

7 Sensor system, service mode

7.2 Service mod Zent7 (Spincontrol S)

In the service mode, various pieces of information can be called up, and settings can be changed.

i
NOTE

The design of the Zent7 control system has been changed over time (see the following pictures). Due to new functions, the tabs with text had to be changed to symbols. However, the procedures that need to be performed are identical for both variants. In the following chapters, only one variant will be described.



Fig. 44: Control panel of the Zent7 control system, old variant



Fig. 45: Control panel of the Zent7 control system, new variant

i
NOTE

In order to be able to work correctly with the instructions of the following chapters, the software version must be determined (see chapter 7.2.1 - "Indication of the software version").

7.2.1 Indication of the software version

- Turn the function knob to select the "Setup" tab or "⚙️" symbol and activate it by pressing the function knob.
- Select the menu item "Info" and activate it by pressing the function knob. The number of the software version is listed in line 4.

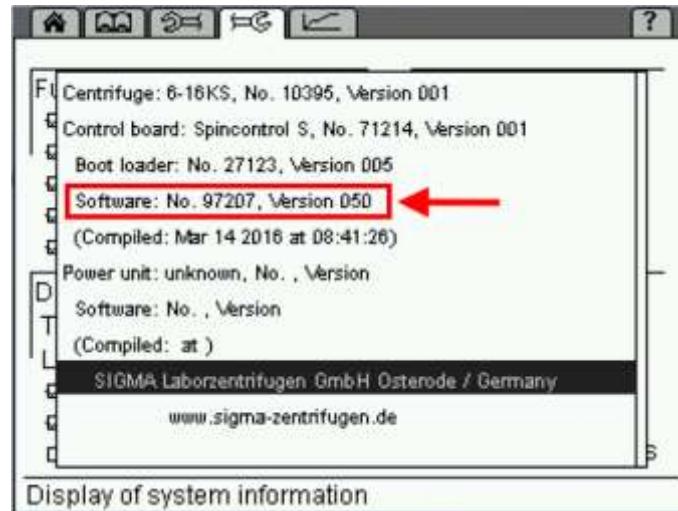


Fig. 46: Menu item "Info" in the "Setup" menu

7.2.2 Activating the service mode

- Press and hold the stop button during the input.
- Turn the function knob 1 notch to the left.
- From this position, turn the function knob 2 notches to the right.
- From this position, turn the function knob 5 notches to the left.

If the code for the activation of the service mode is not available, please contact the support of Sigma Laborzentrifugen GmbH.



The service mode can be activated from any menu.

7 Sensor system, service mode

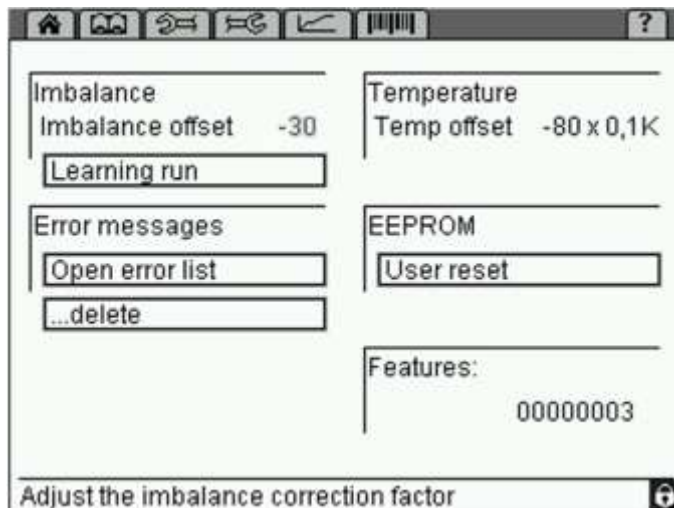


Fig. 47: Service mode, Zent7 (Spincontrol S)

Exiting the service mode

- Select any tab by turning the function knob.
- Press the function knob to exit the service mode.

7.2.3 Determining the imbalance correction value by way of an imbalance programming run

This menu enables the specification of an imbalance correction value (imbalance offset) in order to decrease or increase the imbalance sensitivity. A positive value decreases the imbalance sensitivity and a negative value increases it.



CAUTION

The correction value applies to all of the rotors of the centrifuge type in question!

The following table shows the conversion of the correction values into the resulting correction factors by way of the formula $1/(1+x)$ for negative values and $1+(x/10)$ for positive values:

Correction value	Correction factor
-30	$1/(1+3.0) = 0.25$
-20	$1/(1+2.0) = 0.33$
-10	$1/(1+1.0) = 0.5$
0	$1+0.0 = 1.0$
10	$1+1.0 = 2.0$
20	$1+2.0 = 3.0$
30	$1+3.0 = 4.0$

Determination of the correction value by way of a programming run

The centrifuge must have warmed up prior to starting the programming run. This is necessary in order prevent false tripping of the imbalance sensor (warm rubber elements lead to oscillations with higher amplitudes)!

- Load the weight for the programming run into the rotor .
- Close the lid.
- Select the service mode .
- Select the field "Learning run" by turning the function knob and press the function knob. A dialogue window opens.
- Select the field "OK" by turning the function knob and press the function knob. A dialogue window opens.
- Press the function knob.
The following will be performed **automatically**:
 - selection of the maximum speed,
 - selection of the maximum acceleration,
 - setting of the temperature to 40°C,
 - selection of a sufficient runtime ("Infinite run") so that the rotor can accelerate up to maximum speed.



Following a software update, the imbalance evaluation system must be tested and it may be necessary to readjust the imbalance factor by way of another programming run.

- Correct the imbalance value and perform a new programming run.
Since the input sensitivity of the dynamic imbalance depends on a range of different factors (see above), we cannot provide any absolute static imbalance setting. Experience has shown that values in the range of 300 to 400 work best. If the message "Imbalance learning run failed! Increase/decrease static imbalance!" is displayed, steps of ± 75 usually provide the desired result.



Avoid any type of vibration during the acceleration phase of the programming run. If in doubt, repeat the programming run.

After the successful completion of the programming run, the new imbalance correction value will be set automatically.

7 Sensor system, service mode

7.2.4 Input of the temperature sensor offset

If there are strong deviations between the temperature that is indicated and the measured sample temperature, a general temperature sensor offset (resolution 1/10 K) can be entered.

- Select the service mode (see chapter 7.2 - "Service mod Zent7 (Spincontrol S)").
- Select the "Temp offset" value by turning the function knob. Press the function knob in order to activate the modification mode (the value flashes).
- Adjust the offset value by turning the function knob.

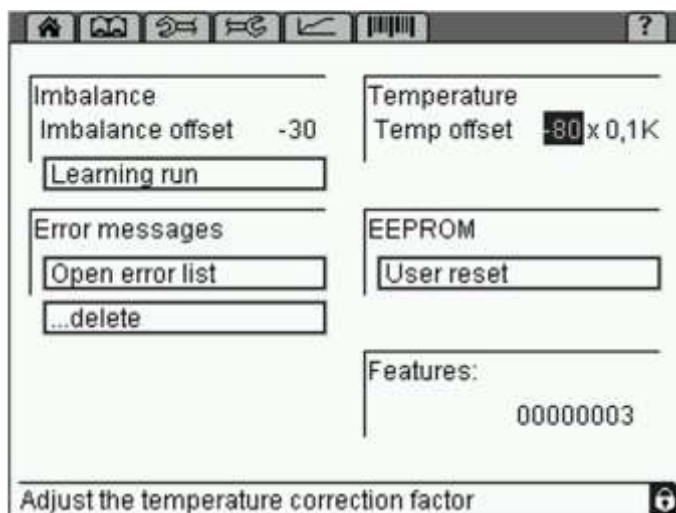


Fig. 48: Indication of the temperature sensor offset

- Press the function knob to save the offset value and to exit the input mode.

7.2.5 Deleting the EEPROM

Data that are to be preserved when the centrifuge is switched off are stored in a non-volatile memory (serial EEPROM).

Deleting user data from the EEPROM

This menu item is used to delete the user data (stored programs, contrast, configuration settings and user-defined curves). The service data (rotor and bucket cycles, temperature offset and imbalance correction value) are preserved.

- Select the service mode (see chapter 7.2 - "Service mod Zent7 (Spincontrol S)")
- In the field "EEPROM", select the "User reset" button and press the function knob. A dialogue window opens.

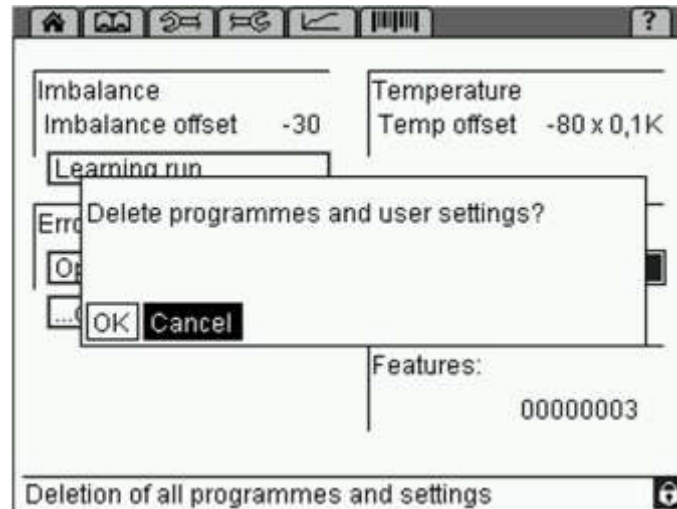


Fig. 49: Deleting the entire EEPROM

- Turn the function knob to select "OK" and press the function knob to confirm. The system will repeatedly ask for confirmation. The EEPROM has now been deleted.

7.2.6 Displaying/deleting the error list

The menu item "Error messages" provides an overview of all of the errors that are stored in the EEPROM.

- Select the service mode (see chapter 7.2 - "Service mod Zent7 (Spincontrol S)")
- Select the field "Open error list" by turning the function knob and press the function knob. The error list will be displayed.



NOTE

Errors that are issued by the power board are marked with an "L" before the error code. Errors that are issued by the processor board are marked with an "R".

- Select the button "...delete" to delete the error list.

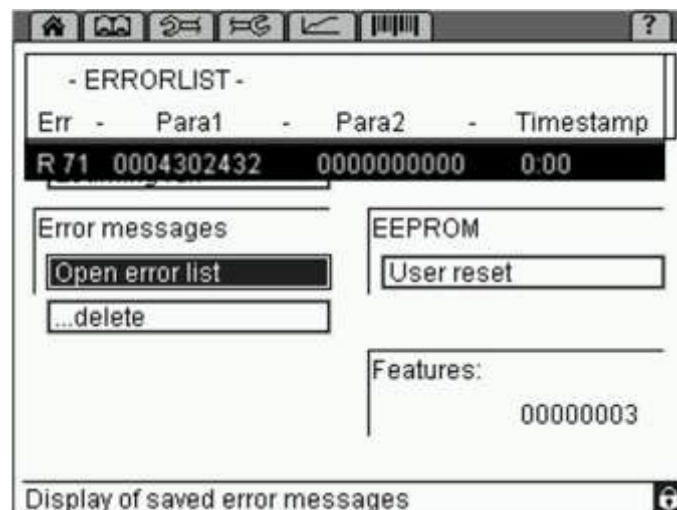


Fig. 50: Indication of the error list

7 Sensor system, service mode

7.2.7 Deleting the rotor or bucket cycles

When the maximum number of cycles of a rotor or bucket is exceeded, the control system will issue a corresponding warning whenever the centrifuge is started.

After the replacement of the accessories, the warning can be deactivated by deleting the rotor or bucket cycles.

Determining the current cycle code

When ordering a new rotor, the current cycle code of the centrifuge must be stated. The enquiry is performed via code 1342:

- Switch the centrifuge on. The centrifuge must be at a standstill.
- Enter the code 1342:
 - Press and hold the stop button while entering the code.
 - Turn the function knob **1** notch to the left.
 - Turn the function knob **3** notches to the right.
 - Turn the function knob **4** notches to the left.
 - Turn the function knob **2** notches to the right.
 - Release the stop button.

The current cycle code is displayed in a dialogue window:

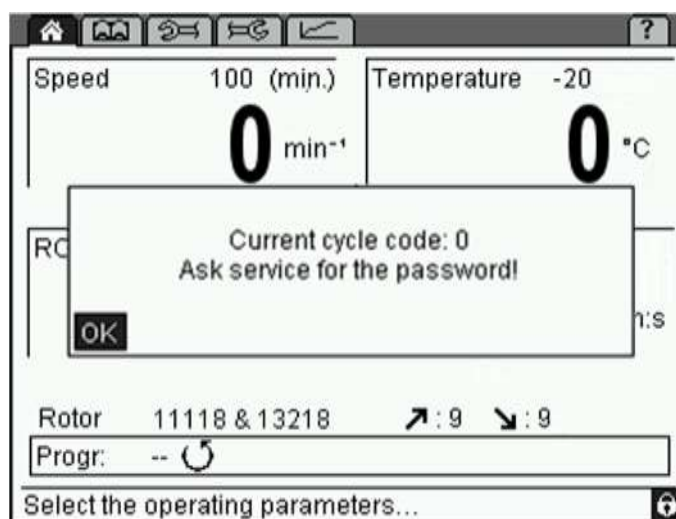


Fig. 51: Indication of the current cycle code (here: 0)

When new accessories are supplied, a password consisting of four numbers is created for every product. This password is required for deleting the rotor or bucket cycles.

Deleting the rotor or bucket cycles

- Select the rotor or bucket whose cycles need to be deleted.

i
NOTE

The cycles of a rotor and those of a bucket cannot be deleted simultaneously. They must be deleted one at a time. If a rotor and bucket have reached their maximum number of cycles at the same time, the cycle deletion process must be performed twice, once for the rotor cycles and once for the bucket cycles.

- Enter the password (as described under "Determining the current cycle; Entering code 1342").

Following the input of the password, a dialogue window will be displayed.

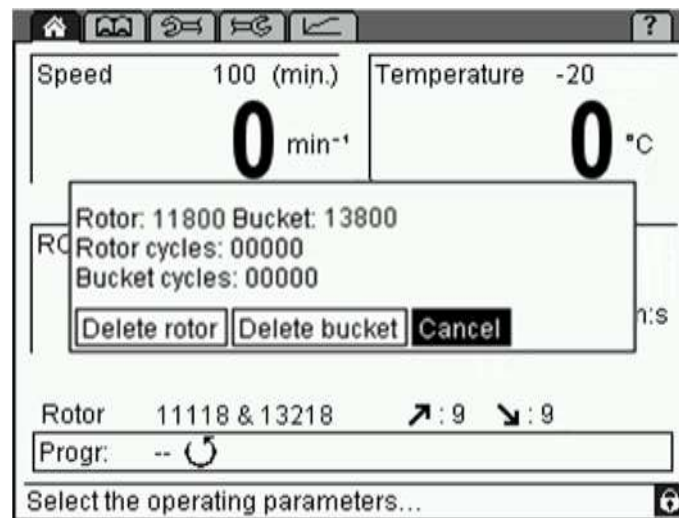


Fig. 52: Dialogue window for deleting the rotor or bucket cycles

Pressing the "Delete rotor" button will delete the rotor cycles, while pressing the "Delete bucket" button will reset the bucket cycles. If a rotor without a bucket is selected, the field "Delete bucket" is greyed out and cannot be selected.

- Select "Delete rotor" or "Delete bucket".

The rotor or bucket cycles will be deleted. Another dialogue window with a confirmation will be displayed:

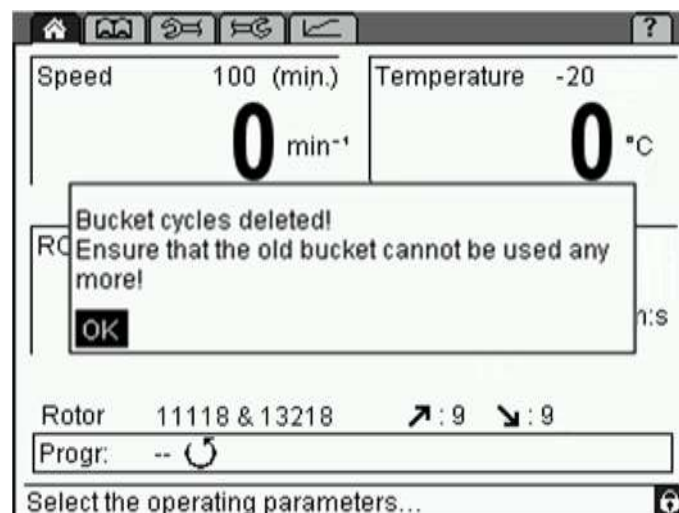


Fig. 53: Confirmation that the rotor or bucket cycles (here: bucket) have been deleted

7 Sensor system, service mode

- If necessary, repeat the process with the next password for another accessory.
- For a better overview, the used cycle codes can be entered into a record (see chapter 9.3 - "Protokol of deleted cycles of rotors and buckets").

7.2.8 Cycle mode

In the cycle mode, the normal operation of the centrifuge can be simulated by the user in order to determine whether the centrifuge operates correctly. The centrifuge run is repeated several times with the set values until the cycle mode is stopped.

Activating the cycle mode

- Set all of the desired parameters for the cycle mode by turning the function knob. Press the function knob in order to confirm the settings.
- Switch the centrifuge off.
- Press the start button and switch the centrifuge back on.

After the set period of standstill has elapsed, the start button starts to flash and the standstill time is counted down.

During the run of the centrifuge, the stop button flashes.

The run can be started or stopped prematurely without causing the deactivation of the cycle mode.

Deactivating the cycle mode

- Switch the centrifuge off and on again in order to exit the cycle mode.

7.2.9 Sensor mode

In the sensor mode, 17 sensor values are displayed in two categories:

1. Digital signals: 0/1
2. Analogue signals that have been converted into a digital format: 0 (0 V) - 1023 (5 V)

In the event of malfunctions, they enable immediate diagnostics and, thereby, the quick elimination of the cause of the error. Values can neither be entered nor changed.

Activating the sensor mode

- In the "Setup" menu or under the symbol "⚙️", select the "Sensor" function.
- Activate the sensor mode by pressing the function knob.

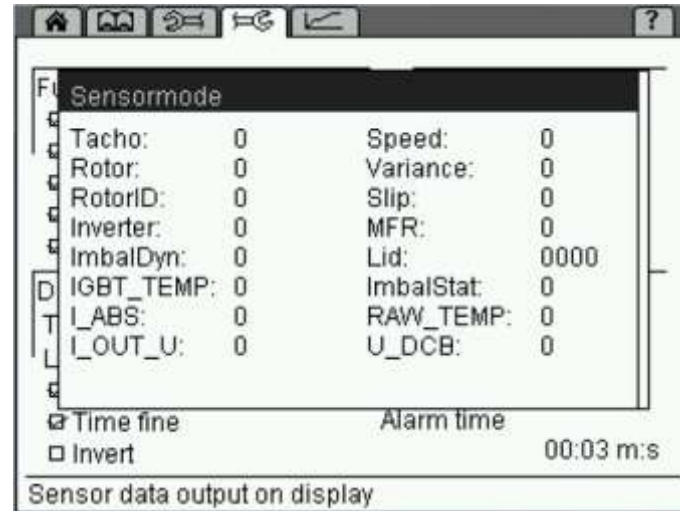


Fig. 54: Zent7 sensor mode (depending on the version)

7.2.9.1 Sensor mode input signals

Tacho	(digital) Speed encoder Alternates between 0 and 1 when the rotor rotates (6x0 and 6x1/revolution)
Rotor	(digital) Rotor code Alternates between 0 and 1 when the rotor rotates The frequency of alternation between 0 and 1 depends on the number of rotor magnets.
RotorID	(digital) Rotor code identified by the power board
Inverter	(digital) Inverter ready 1: ready 0: not ready
ImbalDyn	(analogue) At rest, the value should be > 1000. In the event of an imbalance error, shake the rotor slightly. The value must drop briefly to a value < 1000 and then return to > 1000 when the rotor is at rest.
IGBT_TEMP	(digital) IGBT temperature in digits. At a value above 990 (approx. 104°C), the error "Overtemperature IGBT" will be issued. Under normal operation conditions at an ambient temperature of 20°C, the value should not be greater than 650.

7 Sensor system, service mode

I_ABS	
I_OUT_U	Current in the U phase in digits (for the Sigma development department only)
Speed	Unfiltered speed
Variance	Variance of the measured speed value over an averaging period
Slip	Motor slip ($n_{\text{rotating field}} - n_{\text{shaft}}$)
MFR	(digital) (Monoflop) signal 1: The rotor rotates. 0: The rotor is at rest. After the 1→0 edge of the speed encoder, the MFR signal changes from 0 to 1. After approx. 1 second, the signal level drops to 0 again.
Lid	(digital) Lid switch [hook1 detected, hook2 detected, lock1 locked, lock2 locked]
ImbalStat	(analogue) Analogue imbalance system
RAW_TEMP	Unfiltered sensor value of the chamber temperature (e.g. $200 \pm 20^{\circ}\text{C}$ [$1/10^{\circ}\text{C}$])
U_DCB	DC link voltage in digits. The maximum and minimum values depend on the power board.



NOTE

The purpose of the service mode is to provide the user with a means for checking the sensor system of the centrifuge. To this end, the signals must be changed, e.g. open/close lid → the signal changes as follows: 1-0-1-0...

In order to check the imbalance sensor, rotor code sensor, speed sensor and monoflop sensor, the rotor must be rotated by hand. If the sensor is OK, the display changes as follows: 0-1-0-1...

8 Updates

8.1 Retrofitting to be carried out if technical problems have occurred

8.1.1 Part no. 80770 – impact protector retrofit kit

This document concerns the following units:

Sigma 8K, 8KS, 8KB, 8KBS

Problem:

Damage to the function knob of the control unit

Cause:

The function knob protrudes from the housing

Measures:

Installation of an impact protector on the control panel

Scope of supply:

- 1 impact protector
- 2 EJOT PT screws 40x8
- drilling instructions incl. a drilling template
- installation instructions

Necessary tools:

- centre punch (see the illustration)



- 2 drill bits (Ø 2 mm and Ø 4.5 mm)
- Torx screwdriver T 20

Installation of the impact protector

- Switch the centrifuge off by actuating the mains power switch.



DANGER

Prior to performing any work, disconnect the mains power plug and secure it so that it cannot be reconnected by mistake (e.g. by way of a warning sign)!



NOTE

Be careful when working on electronic components. Suitable ESD protection measures must be taken!

- Open the front door and inspect the area of the drill holes. Remove any data cables that may be in the way.

8 Updates

1 Area of the drill holes

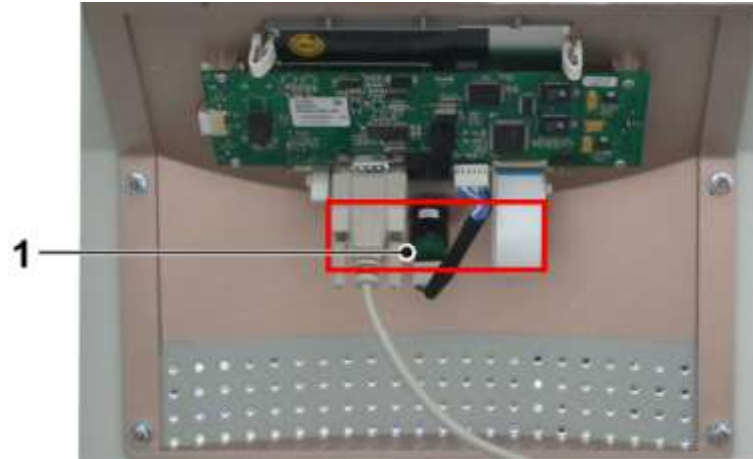


Fig. 55: Front panel with data cables and the control board

- Close the front door.
- Attach the drilling template and secure it in place as per the instructions.

2 Drilling template



Fig. 56: Front panel with the drilling template

- Punch-mark the indicated points with a centre punch in order to provide guidance for the drill.
- Remove the drilling template and predrill small holes in the punch-marked positions by way of the small drill bit (\varnothing 2 mm).
- Widen the holes by way of the bigger drill bit (\varnothing 4.5 mm).
- Install the impact protector with the aid of the supplied screws.

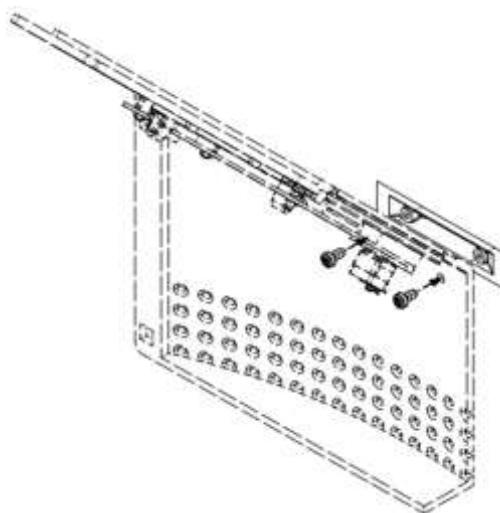


Fig. 57: Installation of the impact protector (schematic representation)

The installation of the impact protector is now complete.

8 Updates

8.1.2 Replacing the handles of the plastic inserts 13865 and 13866

This information is a supplement to the operating manual of the centrifuge and should only be used in combination with the latter.



Please observe the general information provided in chapter 1 of the operating manual of your centrifuge.



This ancillary equipment is solely intended for use in an 8KS/8KBS laboratory centrifuge.

Scope of supply

1 replacement handle

Part no. 27199

4 snap rivets

Part no. 492267

Removal of the defective handle

- 1 Handle
- 2 Rivet
- 3 Container

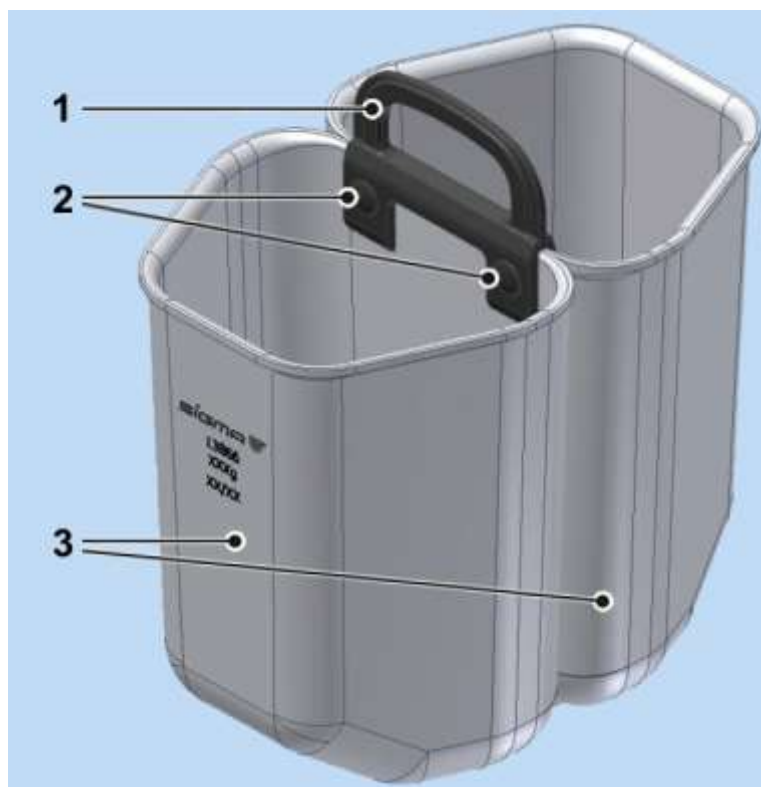


Fig. 58: Layout of a plastic insert (here: 13866)

In order to remove the defective handle, the rivets must be removed first:

- Position the plastic insert on an anti-slip base so that it cannot slip. It must be secured in place in the lower area of the plastic insert and from the outside. Alternatively, the container can also be held tight against the body and secured in place with one arm.

**CAUTION**

Do not damage the plastic insert when securing it in place!

Variant 1

- Use a pointed tool (e.g. a small screwdriver) and move it to and fro in order to position the tip of the tool between the rivet and handle.



Fig. 59: Positioning the tool between the rivet and handle

**DANGER**

There is a risk of injury if the tool slips off!

- Once the rivet has come off slightly, push the tool further in and continue to move it to and fro until the rivet can be removed completely.



Fig. 60: Pushing the tool further in behind the loosened rivet

8 Updates

Variant 2

- Position a sharp knife at the edge of the rivet so that the head of the rivet can be cut off.



Fig. 61: Cutting the rivet head off



There is a risk of injury if the knife slips off!

Both variants

- Remove the rivet on the opposite side by pushing the tool through the new opening.



Fig. 62: Pushing the opposite rivet out

- Remove the other rivets in the same way.
- Pull the handle upwards in order to remove it.



Drilling the rivets out is not permissible, since this may damage the plastic insert!

Installation of the replacement handle

- Check the containers for signs of damage. Damaged containers must not be used anymore.
- Position the two containers against one another so that the holes are aligned one over the other.
- Push the replacement handle over the marked sections of the containers until the handle locks in place.

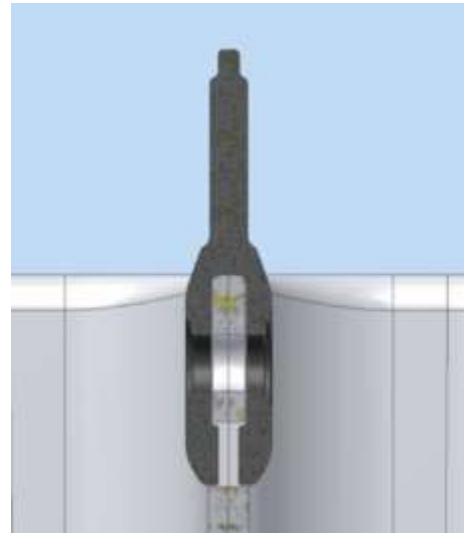


Fig. 63: Positioning of the replacement handle Fig. 64: Replacement handle locked in place

- Press the rivets from both sides into the holes of the handle with a suitable tool (e.g. tongue-and-groove pliers) until the rivet heads lie flat against the handle.

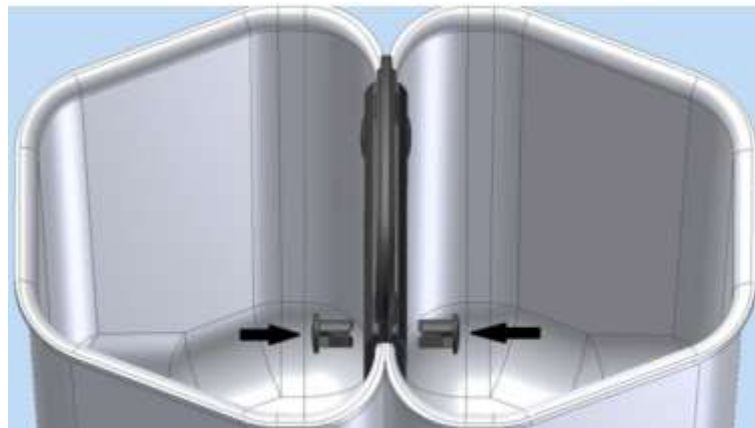


Fig. 65: Pressing the rivets into the holes

i
NOTE

Only use plastic inserts with a complete set of rivets that have been pressed in correctly.

i
NOTE

The use of adhesives is not permissible!

8 Updates

8.1.3 Replacing the rotor cover of a rotor of the type 11805

This concerns:	Rotor 11805 with a windshield as of the year of manufacture 2015
Problem:	The replacement of the rotor cover is rather difficult, since the rotor cover and windshield must form a complete unit.
Cause:	Permissible manufacturing tolerances



Only specialised personnel are authorised to replace the rotor cover.

Measures:

- Determine the following dimensions based on the drawing.
 - Dimension A
(diameter of the windshield):
631 mm -1.6 mm
 - Dimension B
(distance between the upper edge of the rotor and the upper edge of the windshield):
21.9 mm \pm 1.9 mm

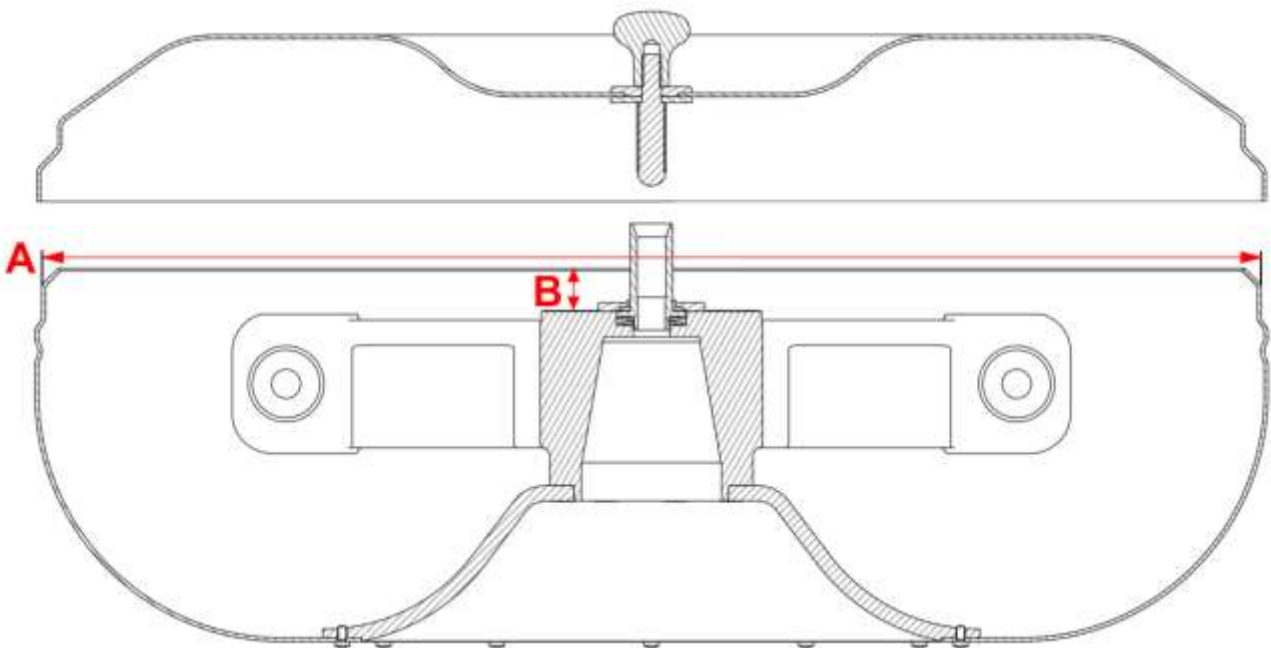


Fig. 66: Dimensions for the replacement of the rotor cover

Evaluation:

1. The dimensions are within the specified tolerance range. The replacement of the rotor cover is possible provided that the measured values are provided to Sigma Laborzentrifugen GmbH.
2. The values are out of the specified tolerance range. The cover cannot be replaced on site. Instead, the rotor and windshield must be sent to Sigma Laborzentrifugen GmbH so that the cover and rotor can be matched to one another.

Final steps:

- Position the replacement cover on top of the rotor with the windshield and check whether it fits correctly. The cover should be firmly seated on the windshield.
- Perform a test run. There should be no excessive noise during the test run.

8 Updates

8.2 Software updates

8.2.1 Software compatibility of the power and processor boards

Our power and processor boards come supplied with installed software. In order to ensure the software compatibility of both boards, the lists of the various centrifuge types, available in the download area, provide an overview of the compatible software versions.

Intersections that are marked with "OK" in the table indicate a documented compatibility of the software versions. Potential compatibilities of combinations that are not listed are unknown at present and will be added once they are known.

In order to ensure the future software compatibility of the circuit boards that are supplied,

- the software version of the board that is used at present and
- the serial number of the centrifuge

must be stated when ordering new power or processor boards.

The software version is stated on the label of the circuit boards (see the illustration below).



Fig. 67: Example of a processor board (version 044)



Fig. 68: Example of a power board (version 039)

If this information is not provided, the circuit boards will be supplied with the most recent software. In the event of incompatible software versions, an upgrade or downgrade in accordance with the software compatibility list is possible.

8.2.1.1 Sigma update kit USB for Spincontrol (ref. no. 71273)

Requirements

The following is required for the upgrade or downgrade in accordance with the software compatibility list:

- Sigma update kit USB for Spincontrol (ref. no. 71273), including:
 - 1 update kit switch housing with a sliding switch and pilot LED (see the following illustration, item 1)
 - 1 connecting cable, 10-pole type (item 2)
 - 1 USB cable (item 3)
 - 1 data CD with the software program and driver
- 1 Sigma software file (.mfx) for the centrifuge that needs to be programmed (available from support.lab@sigma-zentrifugen.de)
- 1 PC with Windows 7 or higher and a CD drive

- 1 Update kit switch housing
- 2 Connecting cable, 10-pole type
- 3 USB cable



Fig. 69: Scope of supply of the Sigma update kit USB for Spincontrol, ref. no. 71273

Preparations

Driver installation

In order to use the Sigma update kit, the "W&T driver" is required. If this driver is not installed on the PC, it must be installed as follows:



The driver will not be installed automatically by the system. It must be installed manually.

- Insert the data CD into the CD drive and copy the data into any directory of the PC (here: C:\Sigma).
- Connect the update kit switch housing to the USB port of the PC by way of the USB cable.

8 Updates

- Open the Device Manager in the Control Panel.

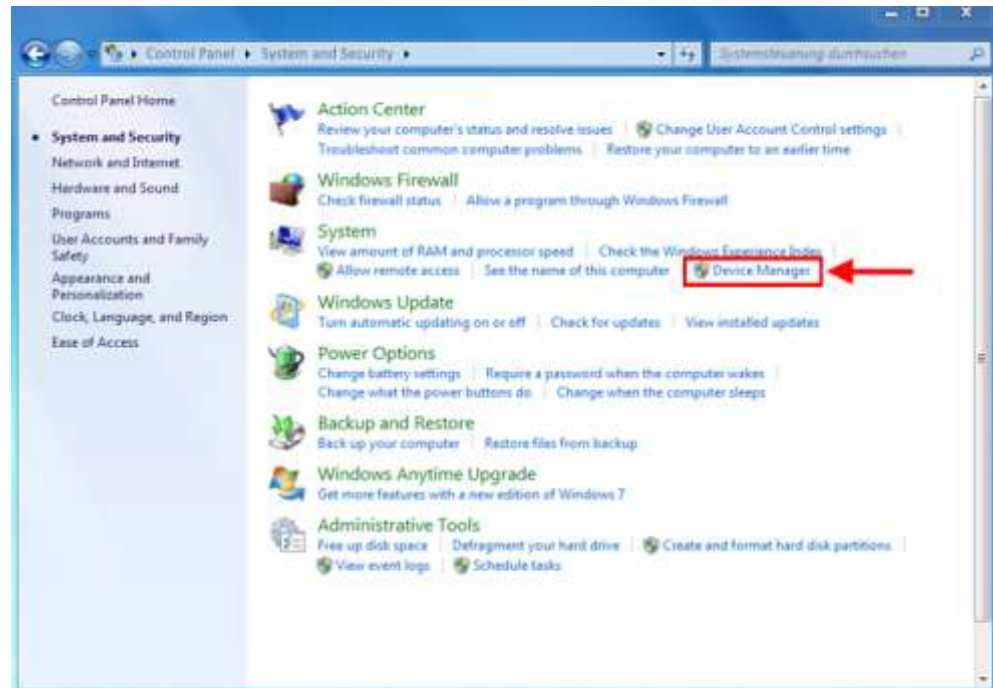


Fig. 70: Opening the Device Manager

The device FT232R USB UART is marked as not installed (see the following illustration).

- Right-click "Update Driver Software".

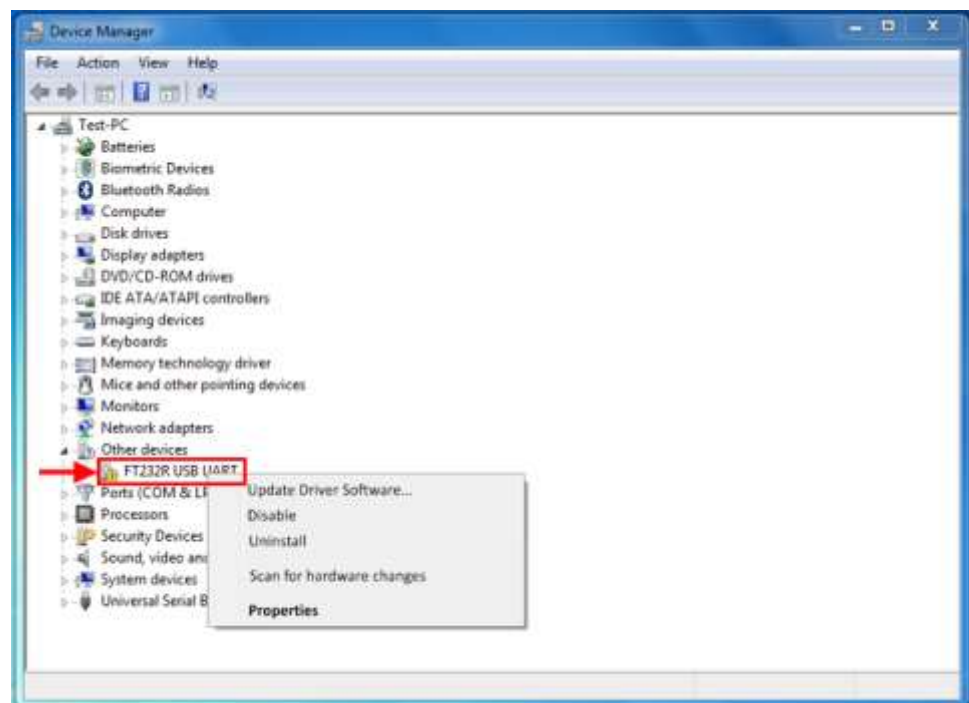


Fig. 71: Driver software update

- Select the installation path under "Browse my computer for driver software".

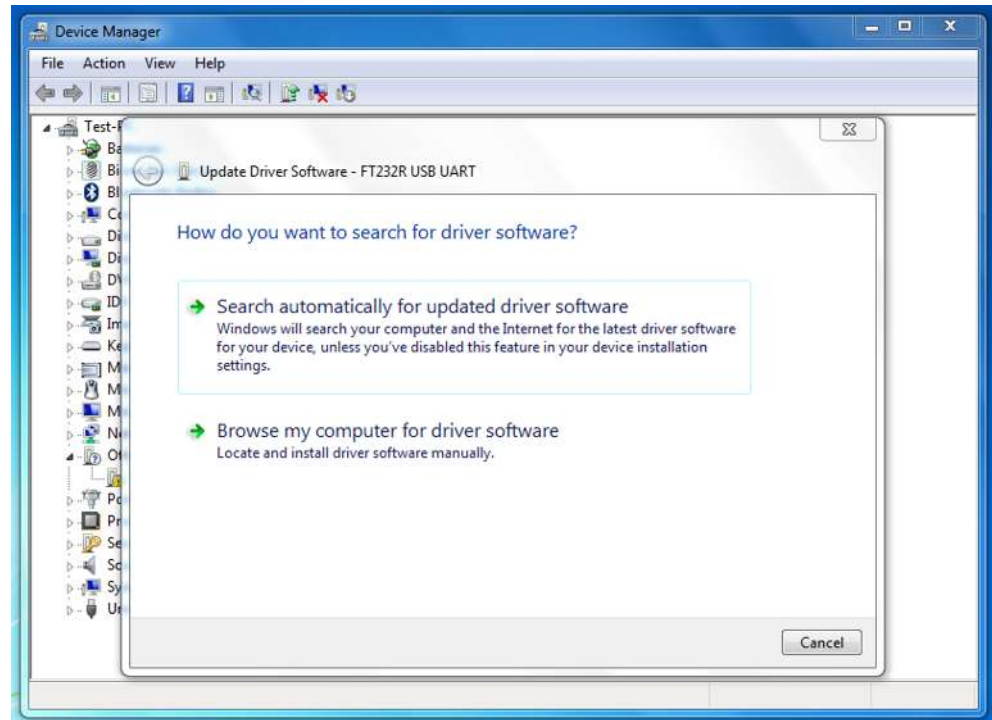


Fig. 72: Installation path for the driver

- Select the directory into which the driver software has been stored.

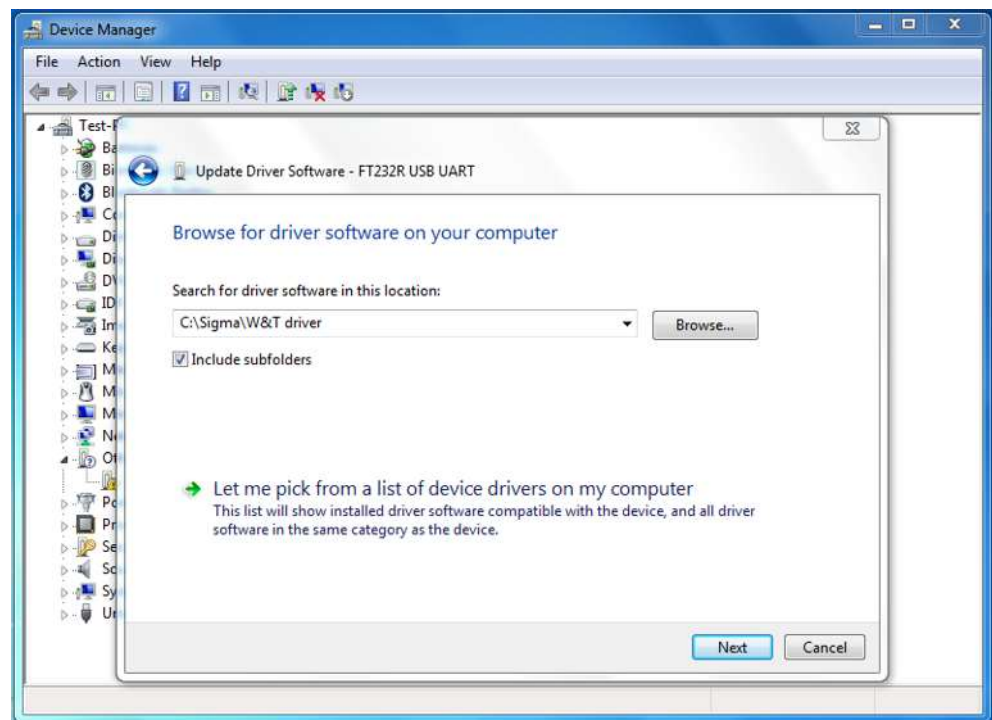


Fig. 73: Driver software directory

The driver will be installed. After the successful installation, a corresponding message will be displayed.

In the Device Manager, the device should now be listed as a USB Serial Port (here: COM3, see the following illustration). If the system fails to recognise the device, repeat the installation.

8 Updates

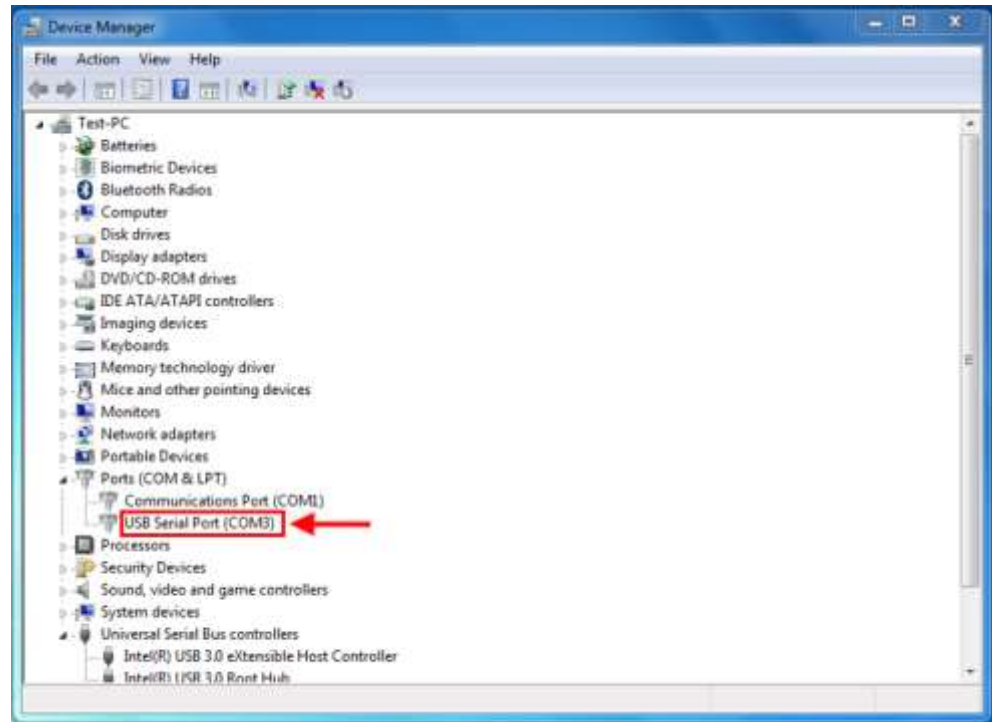


Fig. 74: The device has been recognised as a USB Serial Port (COM3)

Software program installation

The original directory (here "C:\Sigma") includes a compressed directory "SigmaUpdatekit" (item 2) in the folder "Sigma Updatekit" (see the following illustration, item 1).

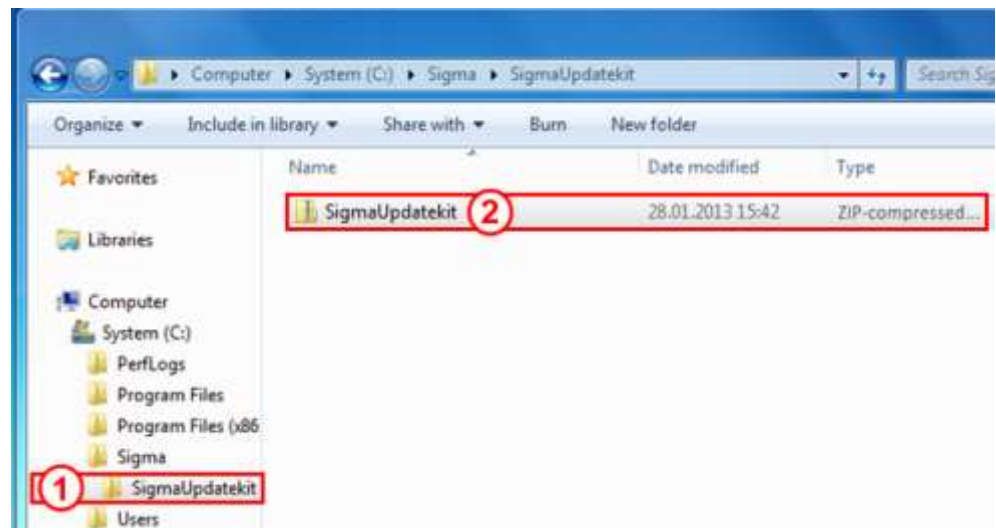


Fig. 75: Compressed directory of the software program

- Unpack the file with a suitable program and save it in the same directory.

The installation of the software program is complete.

Saving the firmware

The software file (.mhx) with the firmware is provided by the service department of Sigma Laborzentrifugen GmbH via e-mail.

- Copy the file into any directory on the PC, ideally into the same directory as the software program (here: C:\Sigma).

Power board software update



Ensure that the centrifuge is disconnected from the power supply prior to connecting the components and prior to actuating the update kit switch. Unplug the mains power plug of the centrifuge before the next steps!

- Connect the update kit switch housing to the power board of the centrifuge via a 10-pole cable.
- Push the sliding switch to "Update".
- Start the program by way of the "flash.exe" file (see the following illustration, item 3).

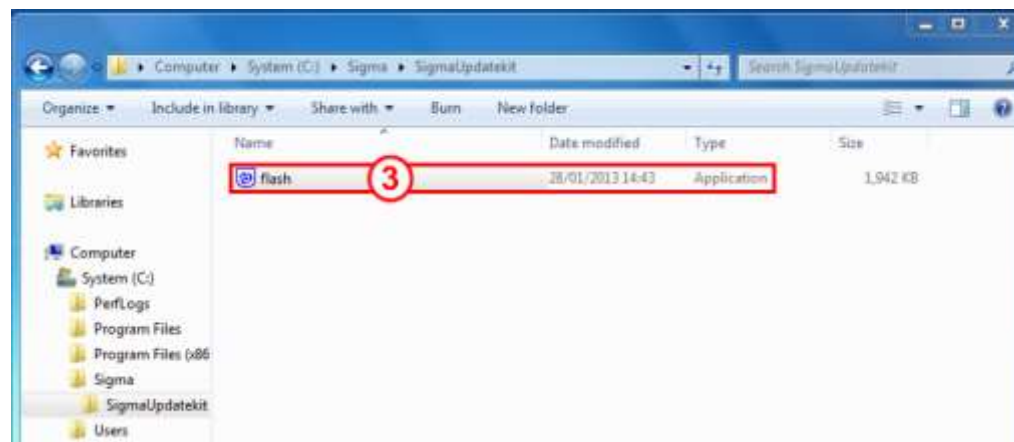


Fig. 76: Starting the program for the software update

The dialogue window "Sigma Updatekit" will be displayed.



Fig. 77: Dialogue window "Sigma Updatekit"

- Under "Target Centrifuge System" (see the illustration above, item. 4) select TYPE 2 and under "Crystal Frequency" (item. 5) select 4 MHz.
- Select the required firmware by way of the "Open" button (item 6).
- Select the correct COM port via the button "Set Environment" (item 7).
- Click "Full Operation" (item. 8).

8 Updates

- Switch the centrifuge on. There will be another enquiry.
- Confirm the enquiry with "OK".

The software will then be updated.

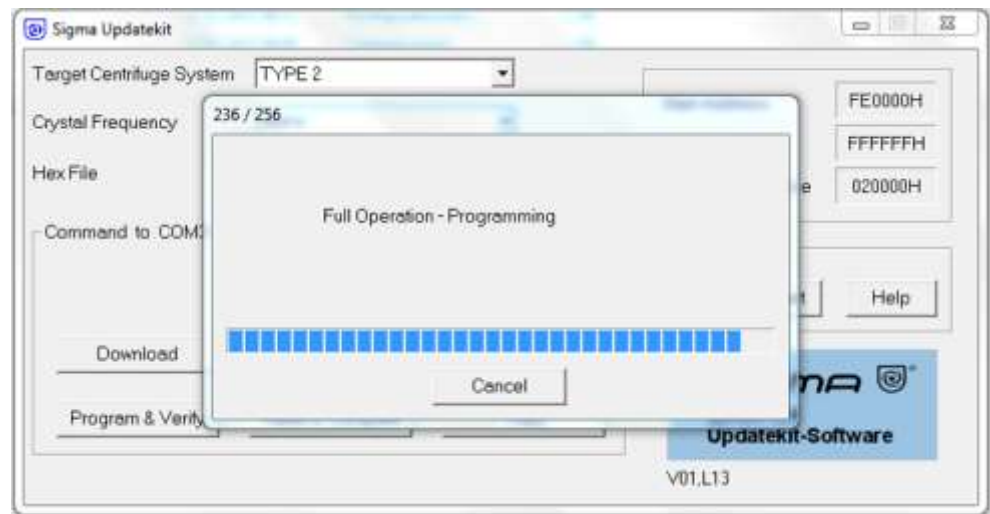


Fig. 78: Software update

After the successful update, a corresponding message will be displayed.

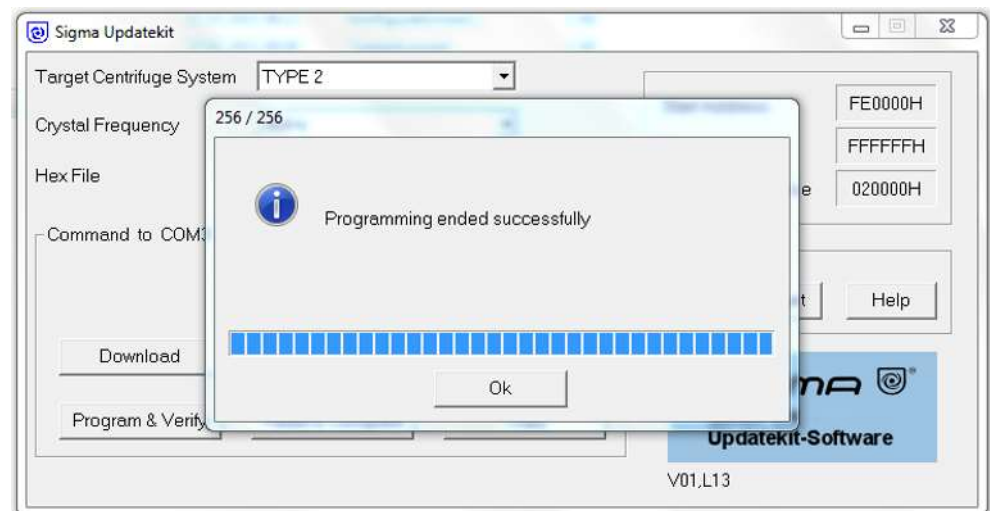


Fig. 79: Message after the successful update

The success of the update process can be verified by viewing the software version (it varies depending on the control variant).

- The software version of the power board that is displayed must correspond to the updated software version.

Processor board software update

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NOTE

Only the software of processor boards of the control systems Zent4P, Zent3S, and Zent6 can be updated with the Sigma update kit 71273!

!
CAUTION

Ensure that the centrifuge is disconnected from the power supply prior to connecting the components and prior to actuating the update kit switch. Unplug the mains power plug of the centrifuge before the next steps!

- Connect the update kit switch housing to the processor board of the centrifuge via a 10-pole cable.
- Push the sliding switch to "Update".
- Start the program by way of the "flash.exe" file (see the following illustration, item 3).

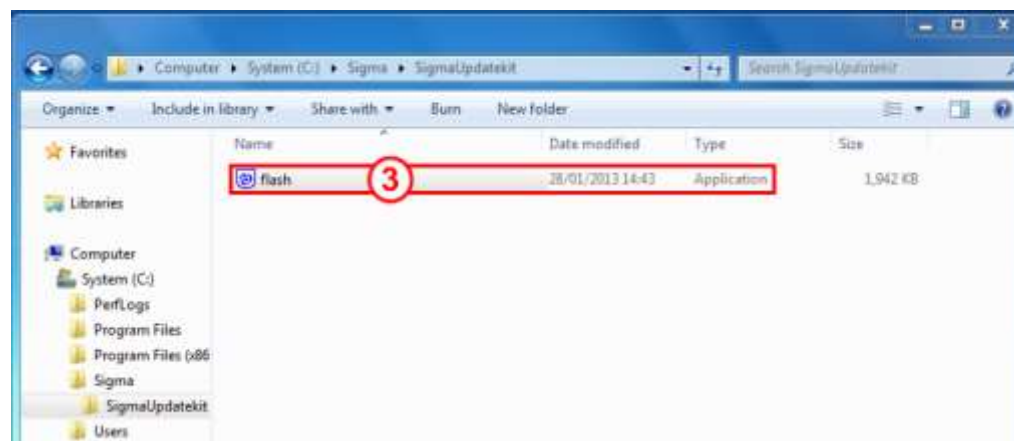


Fig. 80: Starting the program for the software update

The dialogue window "Sigma Updatekit" will be displayed.

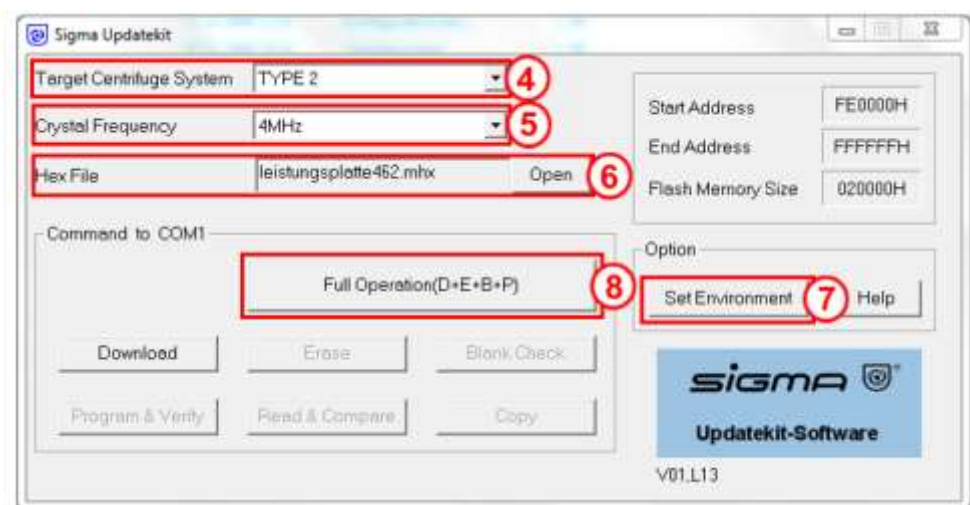


Fig. 81: Dialogue window "Sigma Updatekit"

8 Updates

- Under "Target Centrifuge System" (see the illustration above, item 4), the correct type must be selected based on the control system that is used:
 - For Zent4P and Zent6, select "Type2".
 - For Zent3S, select "Type3".
- Under "Crystal Frequency" (item 5), select 4 MHz.
- Select the required firmware by way of the "Open" button (item 6).
- Select the correct COM port via the button "Set Environment" (item 7).
- Click "Full Operation" (item. 8).
- Switch the centrifuge on. There will be another enquiry.
- Confirm the enquiry with "OK".

The software will then be updated.

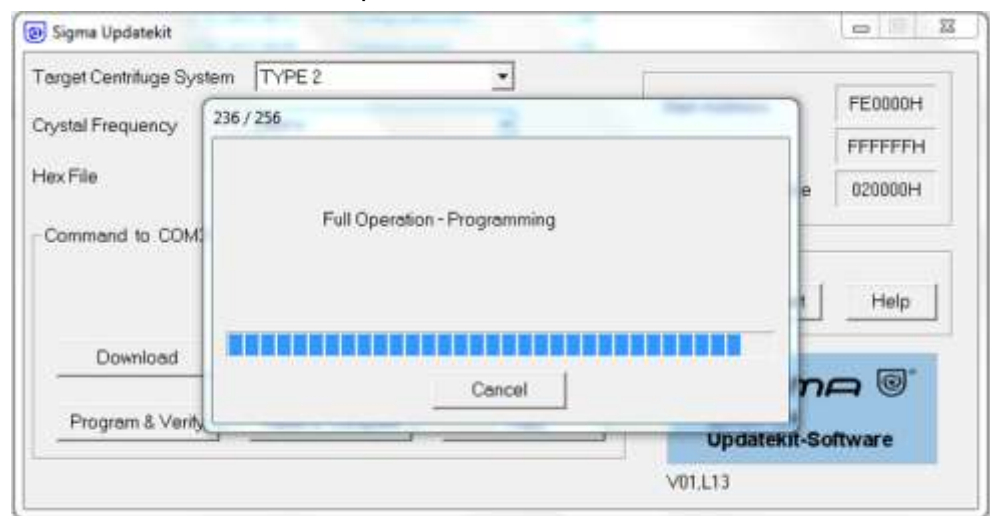


Fig. 82: Software update

After the successful update, a corresponding message will be displayed.

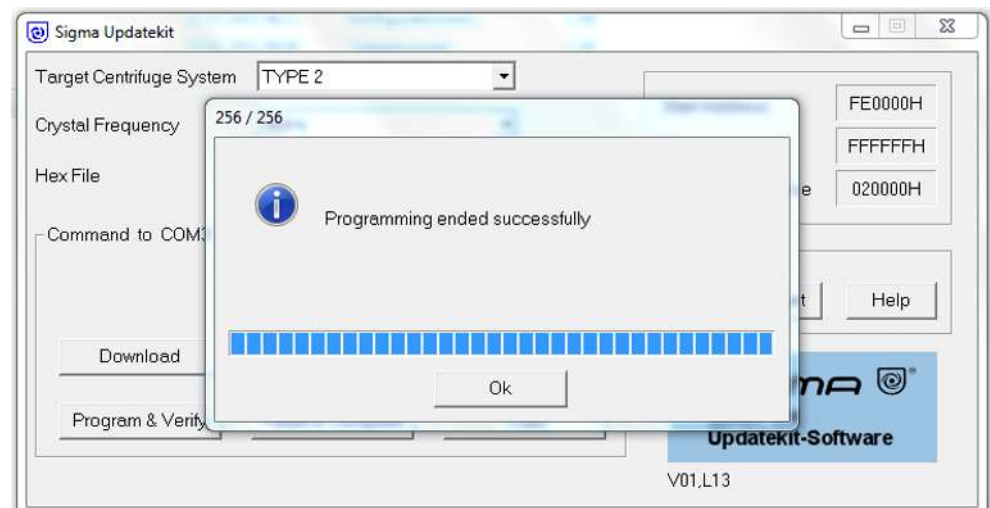


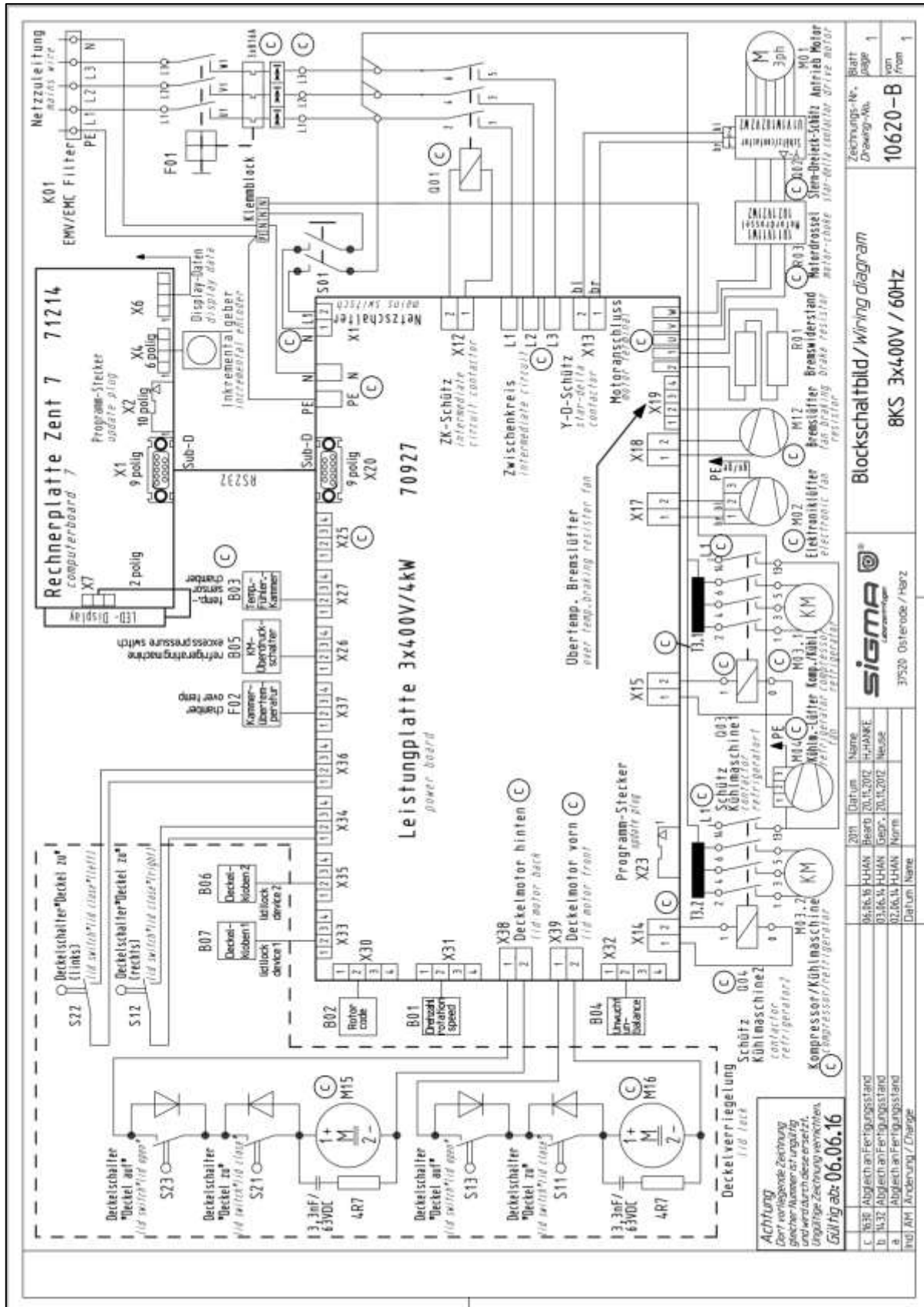
Fig. 83: Message after the successful update

The success of the update process can be verified by viewing the software version (it varies depending on the control variant).

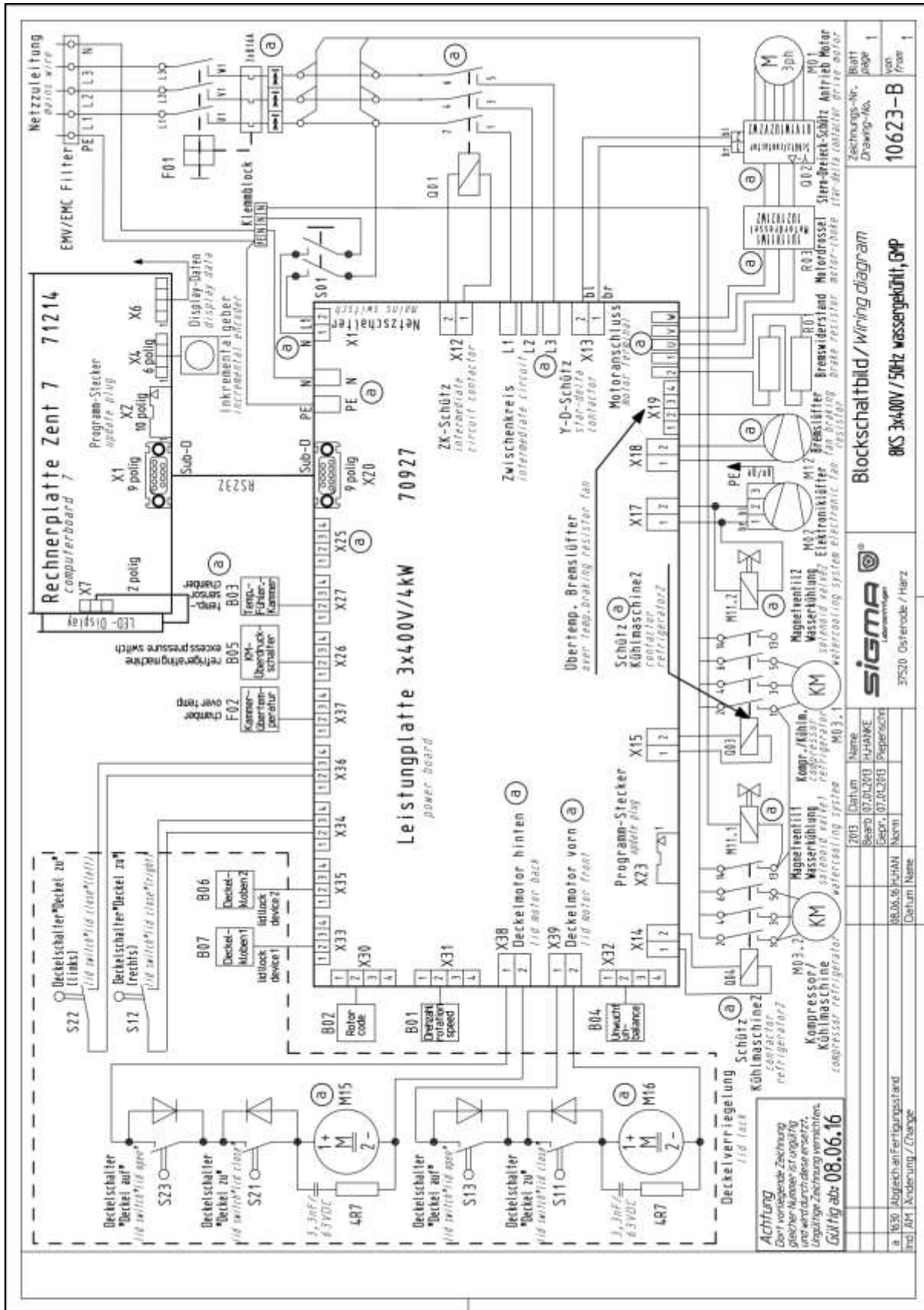
- The software version of the processor board that is displayed must correspond to the updated software version.

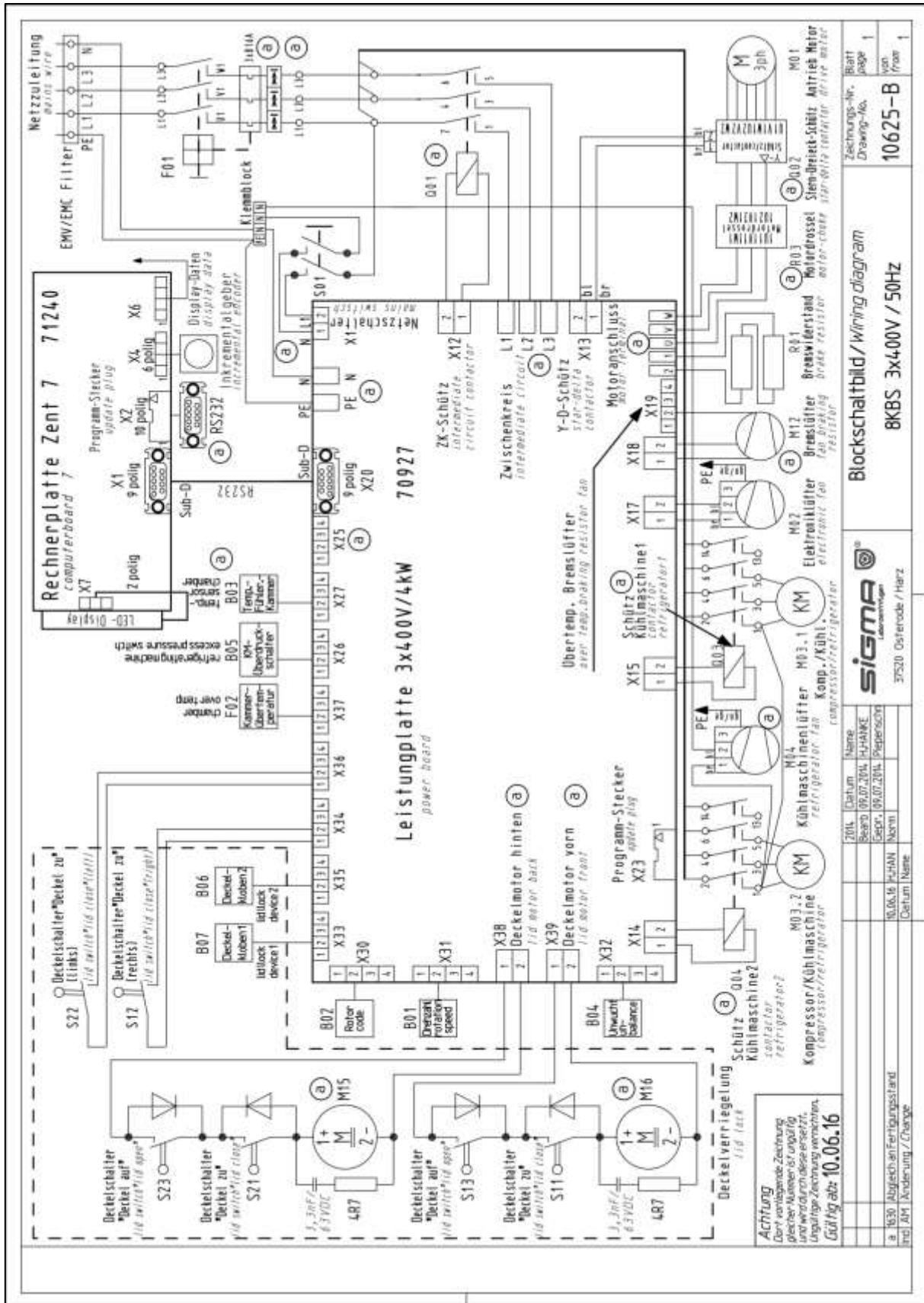
9 Appendix

9.1 Block diagrams 8KS, 8KBS



9 Appendix





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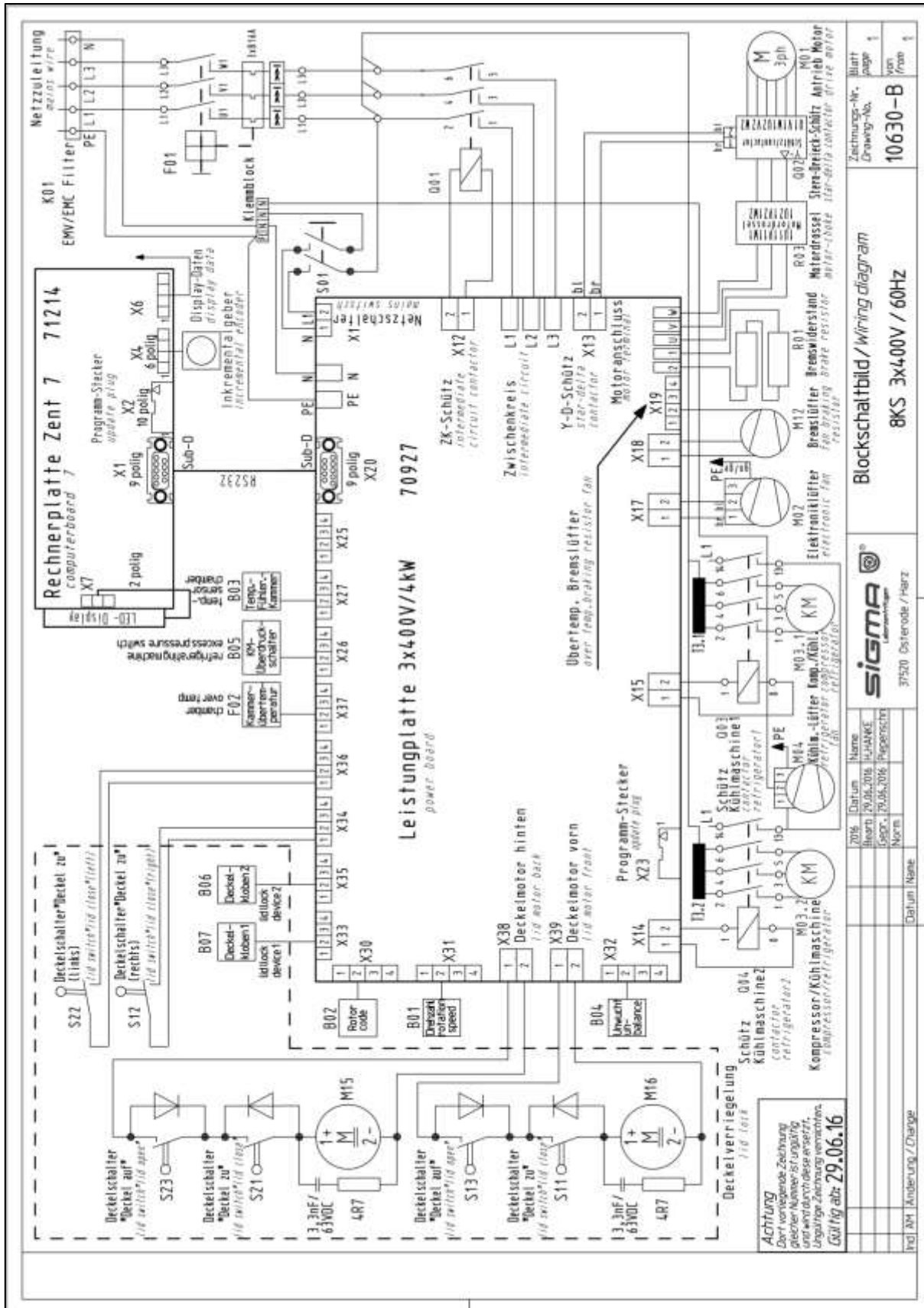
Blattschaltbild / Wiring diagram
8KBS 3x400V / 50Hz



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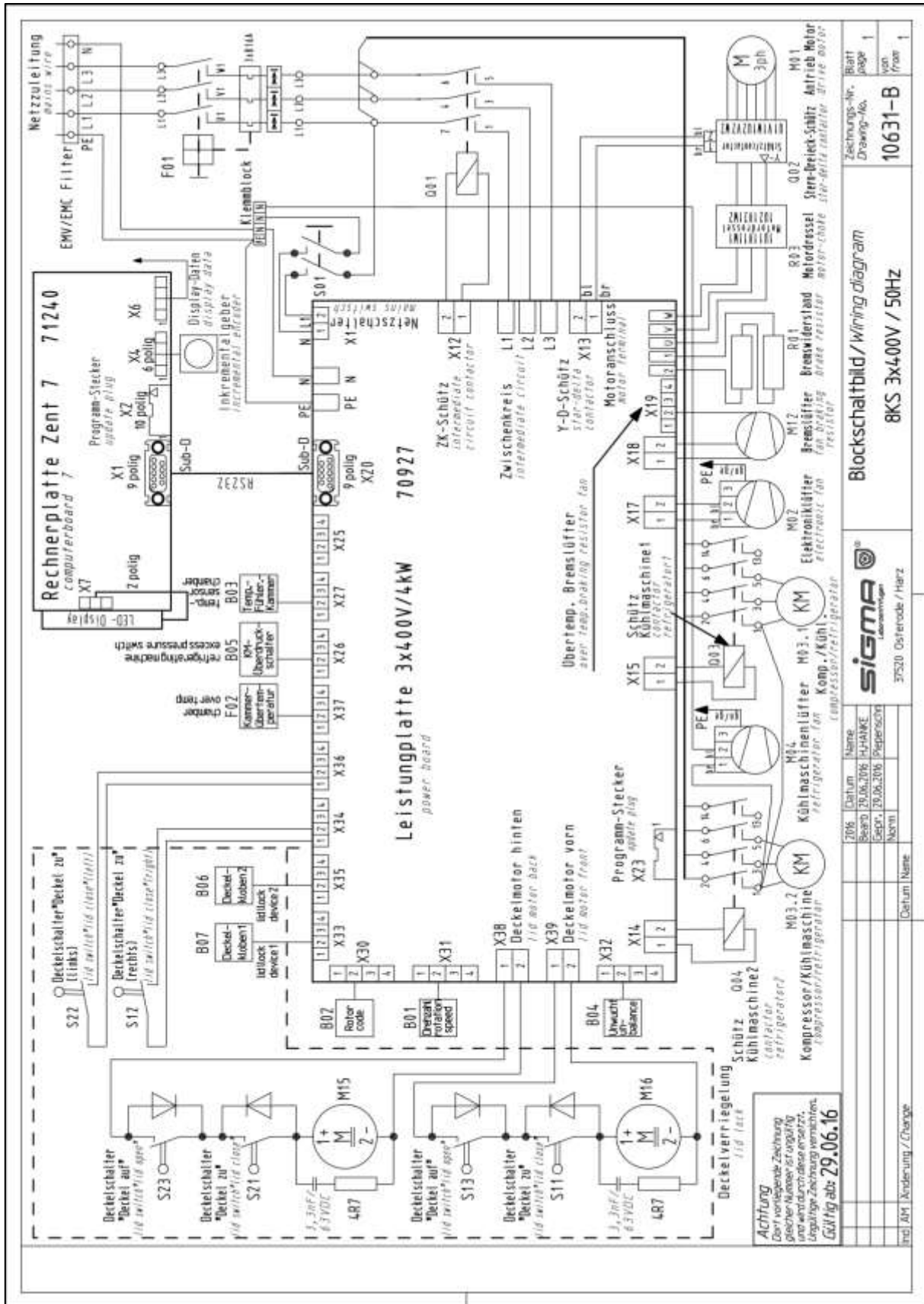
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2016.05.02.2016	Peperesch
2016.05.02.2016	Norm

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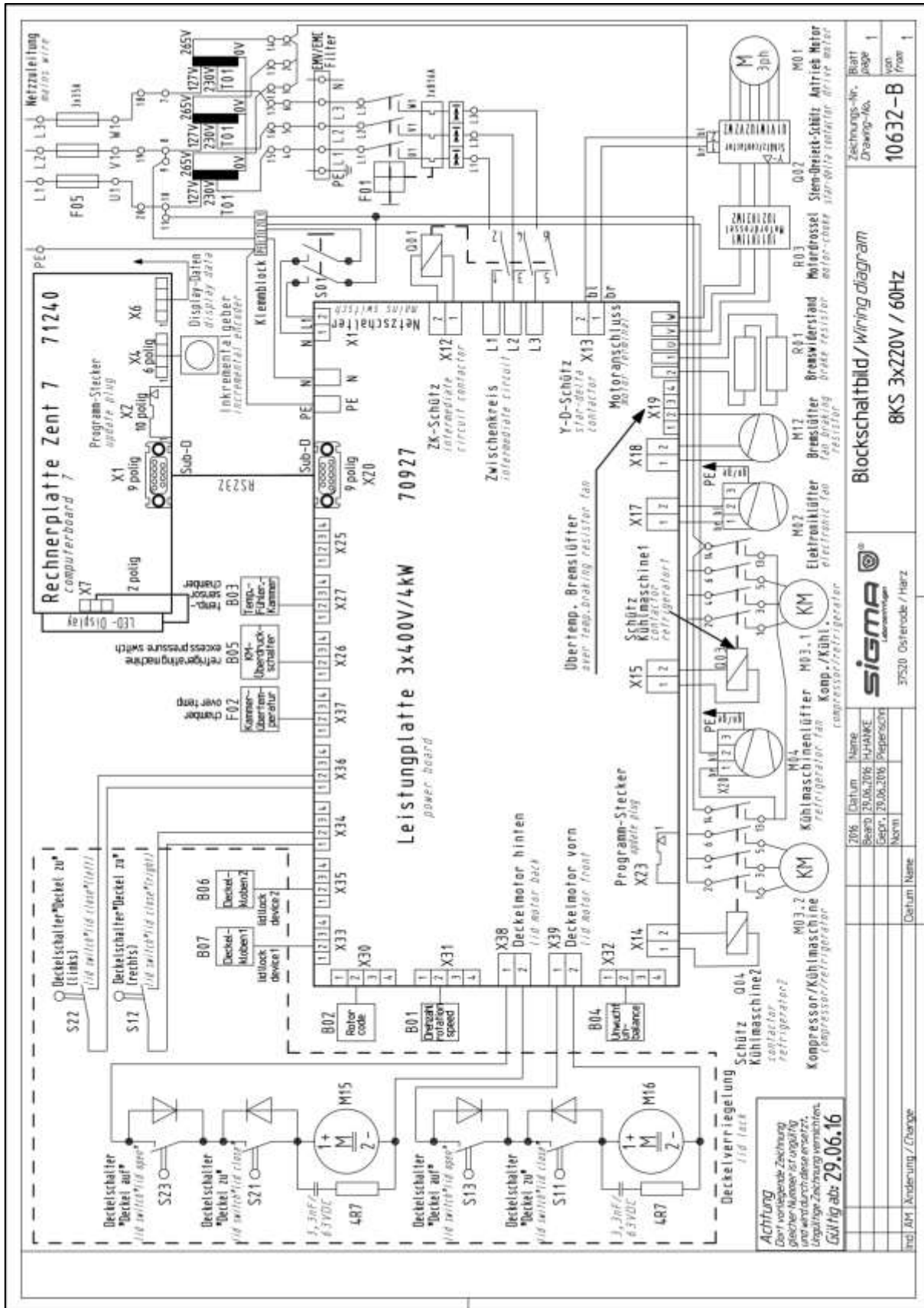


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von from	
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Änderung / Change	
37520	Osterode / Herz
sigma Laborautomation	

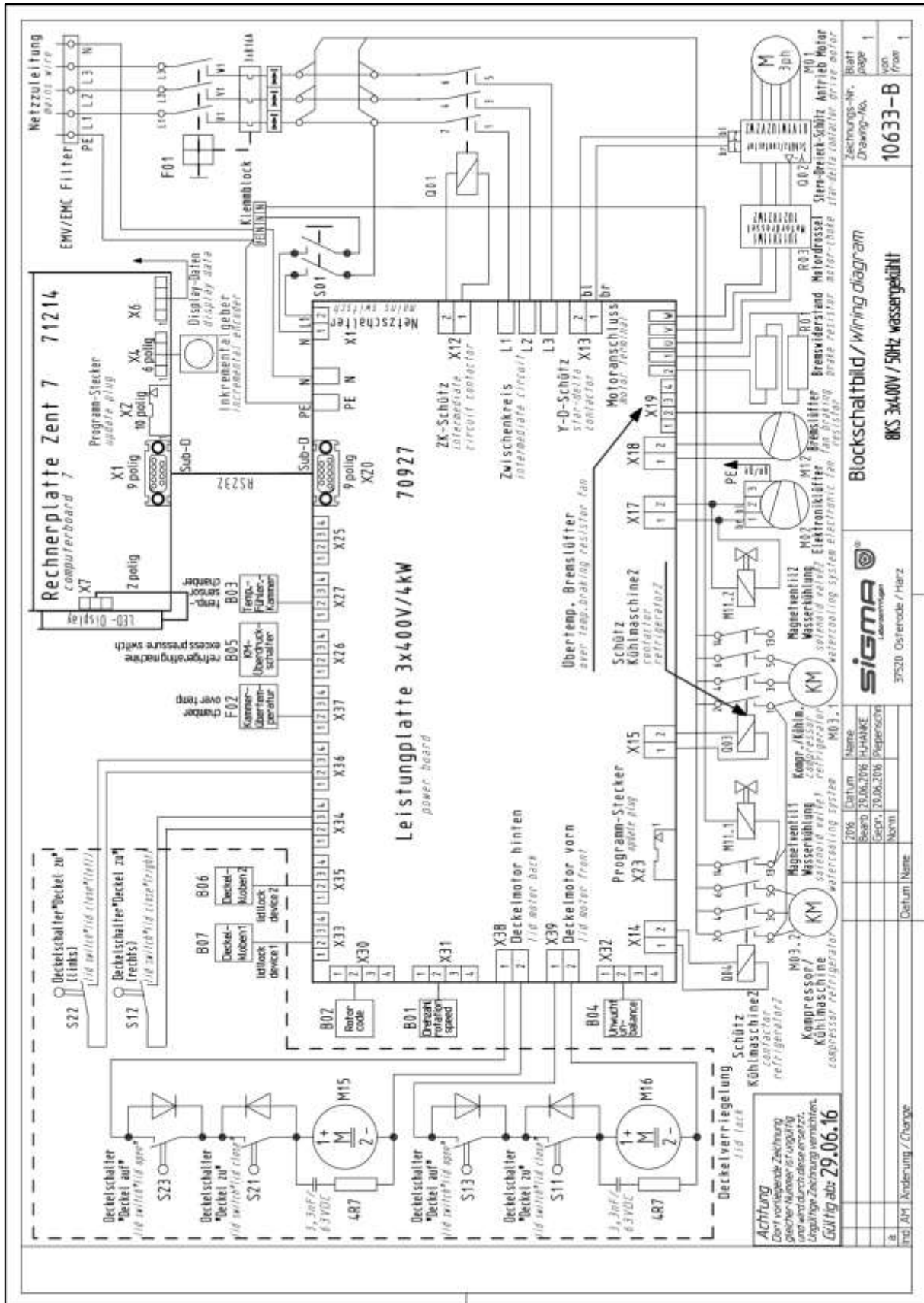
9 Appendix

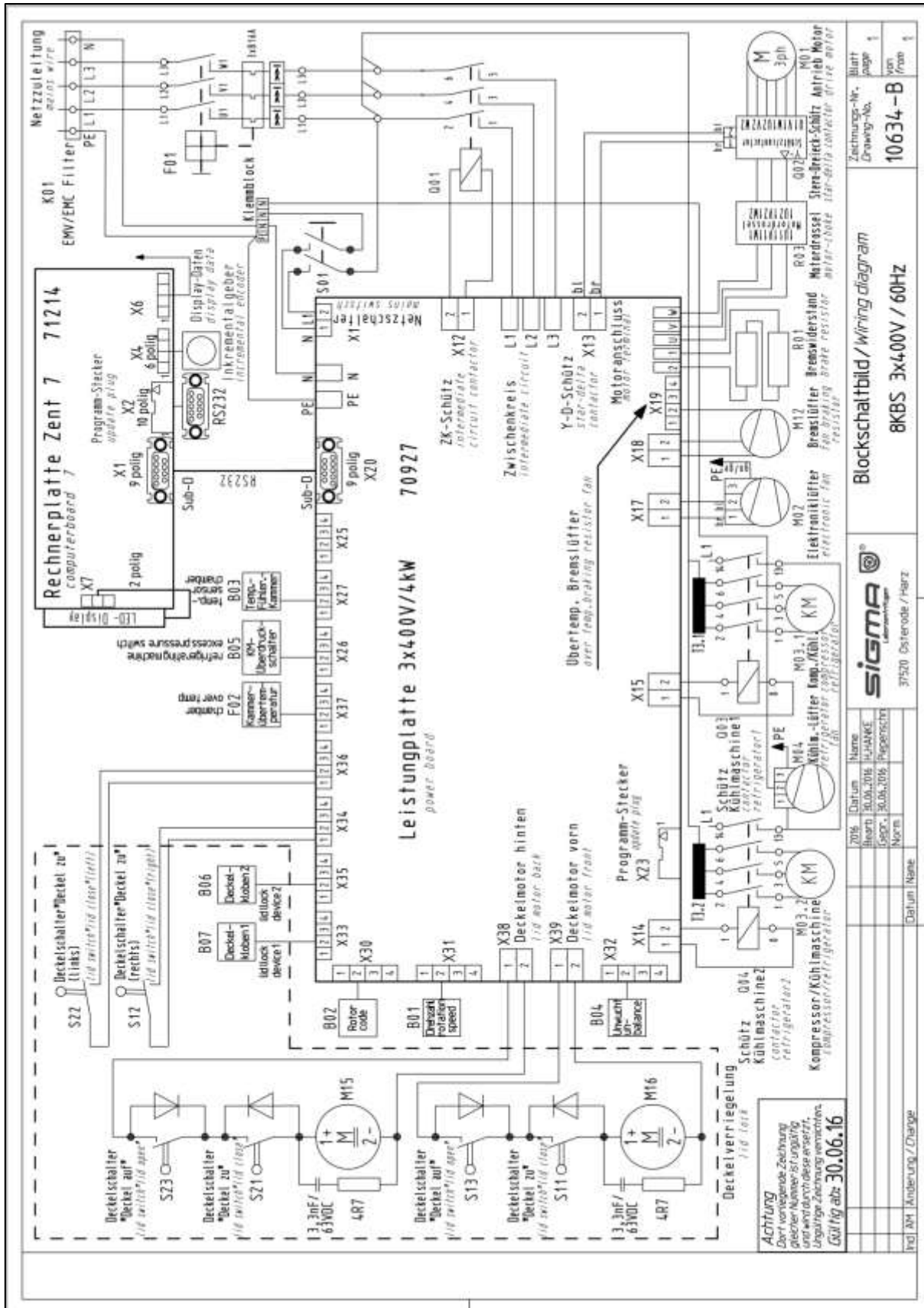


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8KS 3x400V / 50Hz			
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Datum Date		29.06.2016	
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Änderung Change			



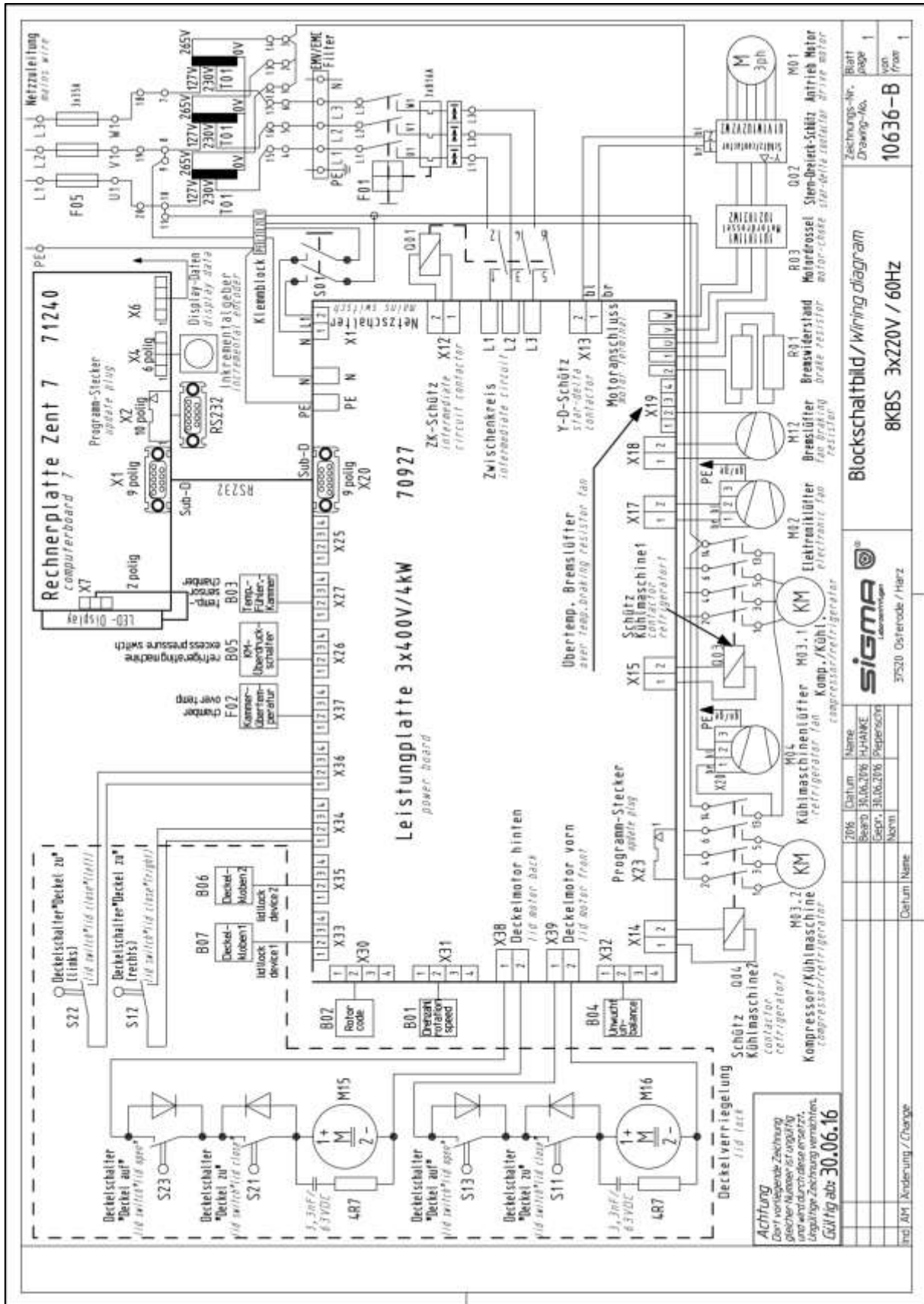
9 Appendix





Blattschaltbild / Wiring diagram	
8KBS 3x400V / 60Hz	
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Gepr. / 30.06.2016 / J.S.HANKE	
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30.06.2016	30.06.2016	Pepernsch
	Norm	

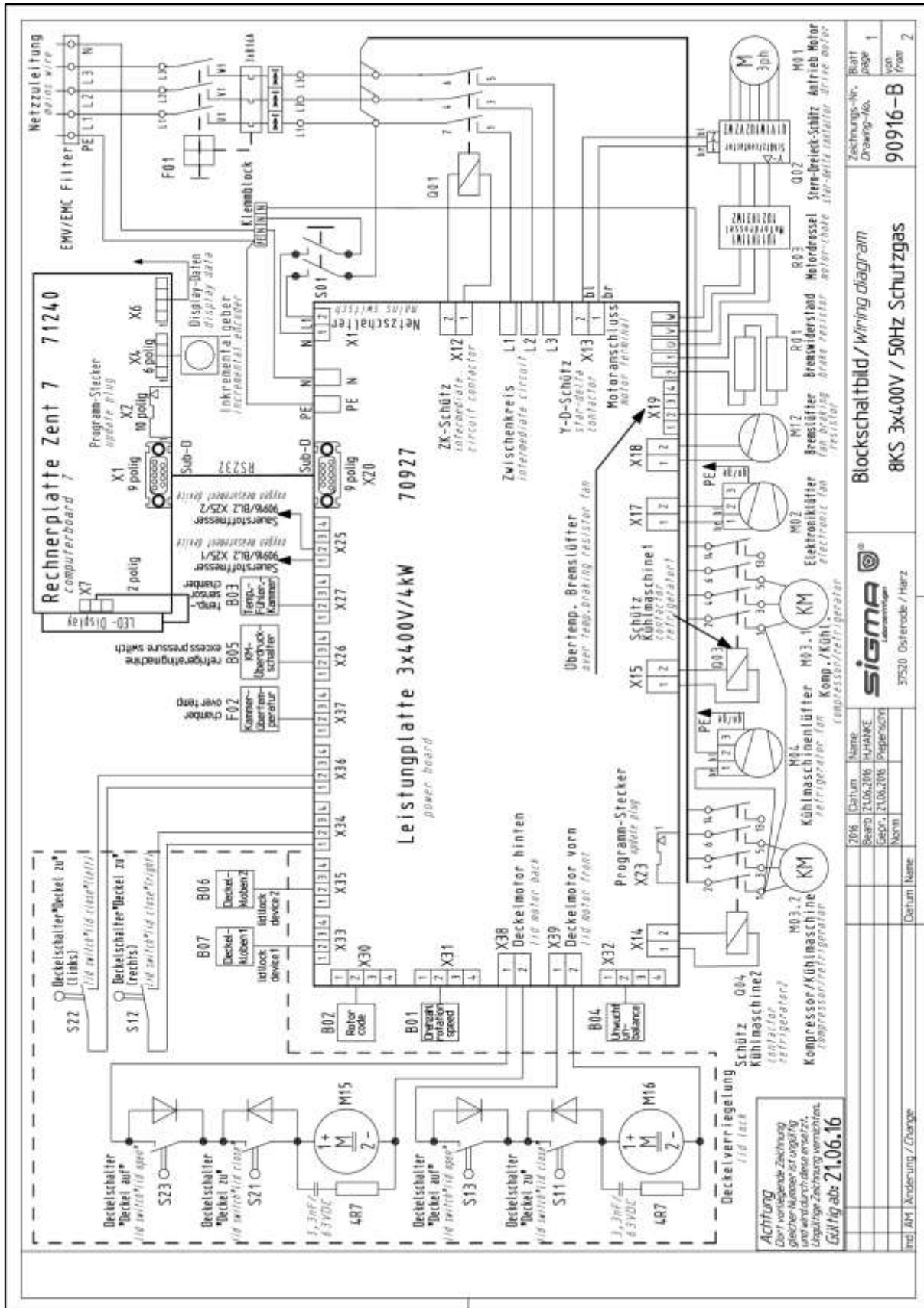
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37520 Osterode / Harz

Blockschaltbild / Wiring diagram
8KBS 3x220V / 60Hz

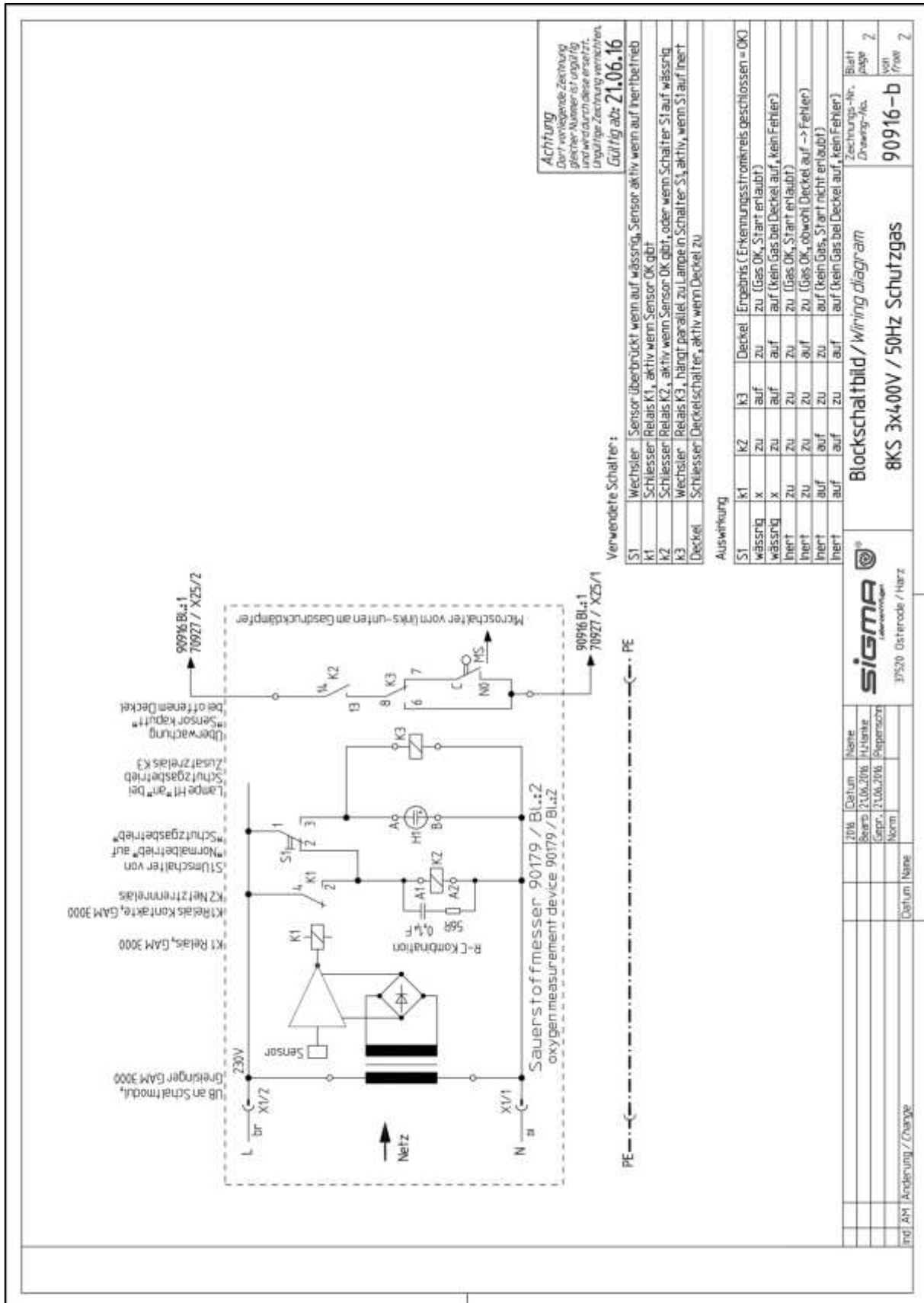
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Drawing-No.
10636-B

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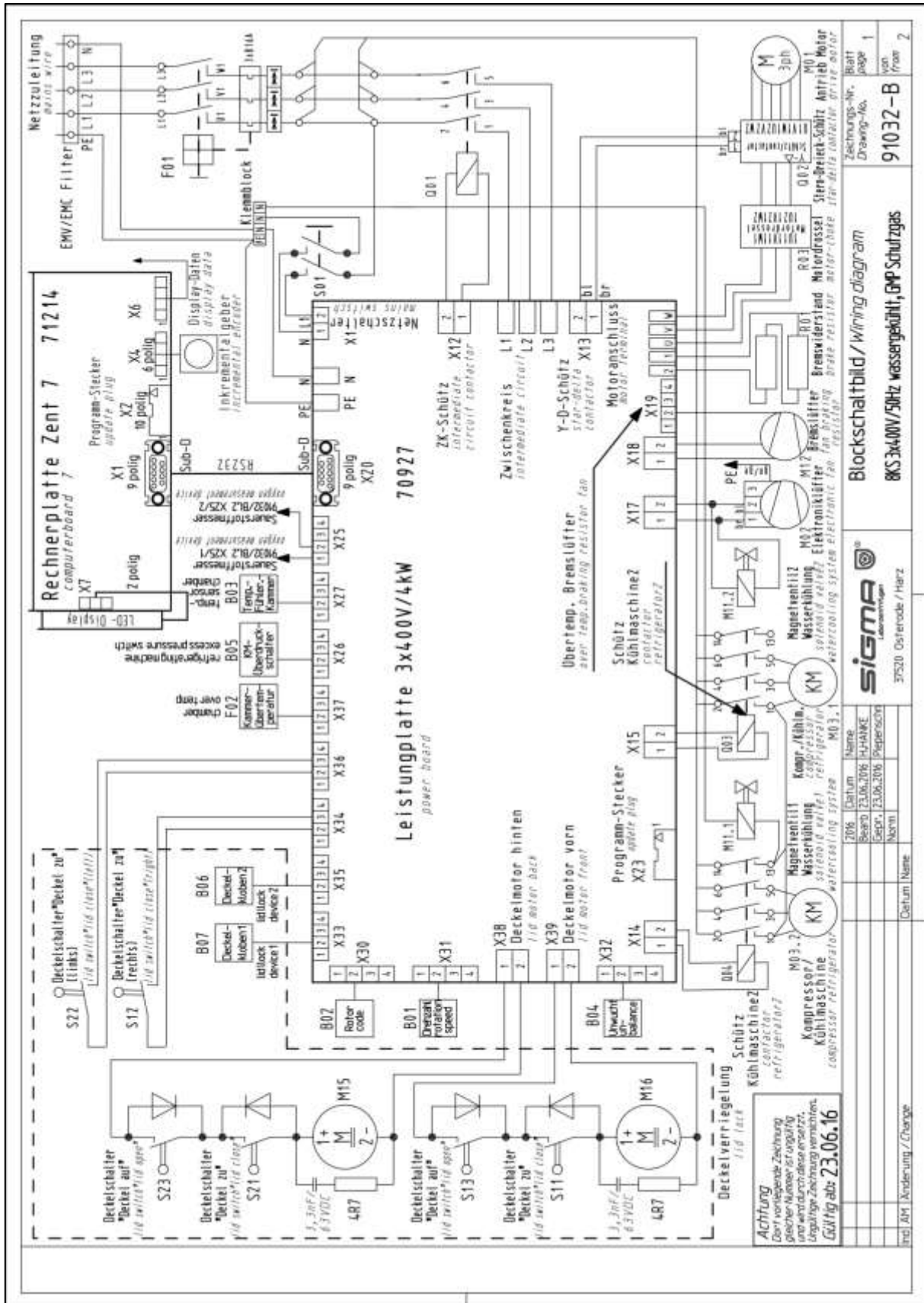


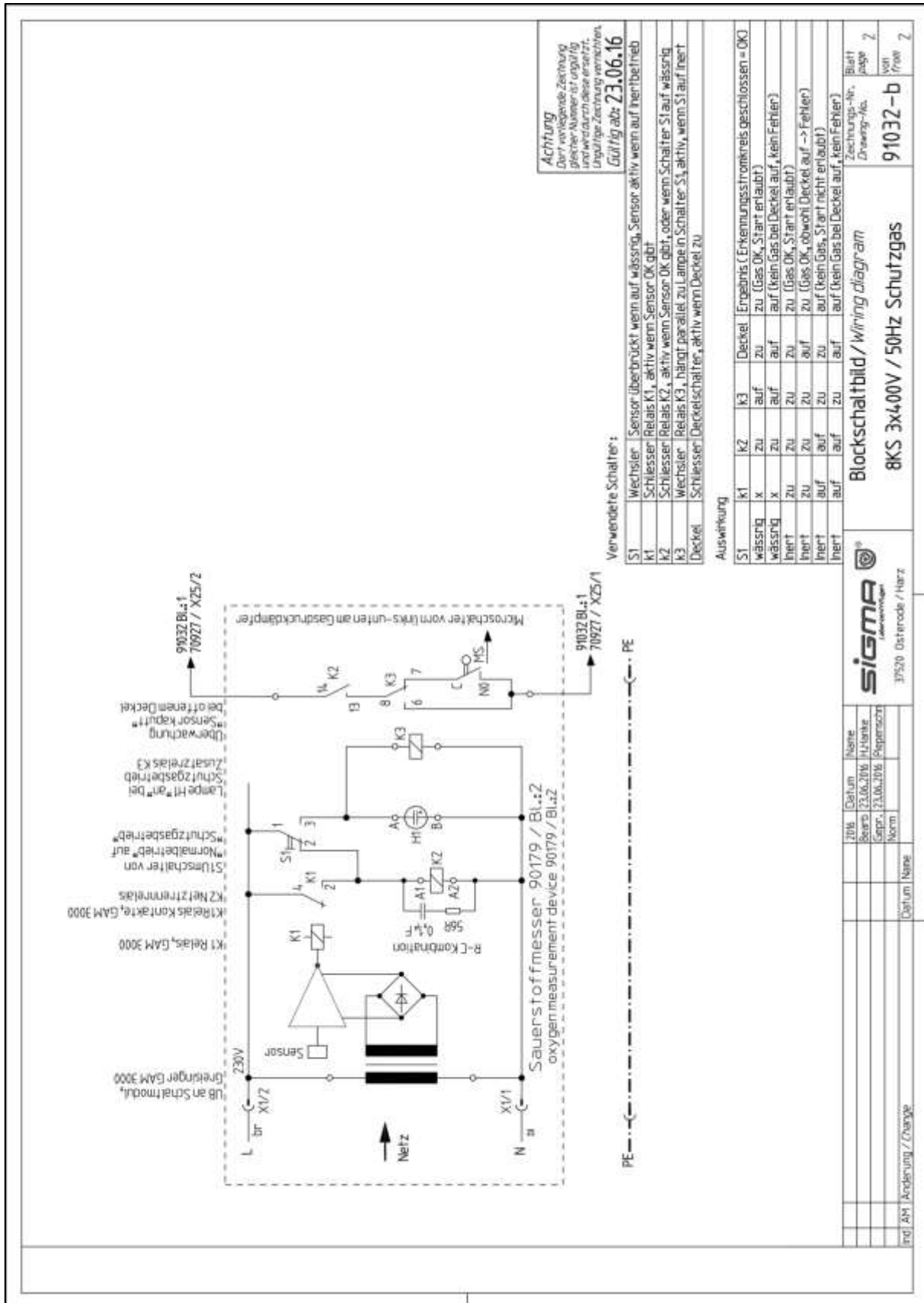
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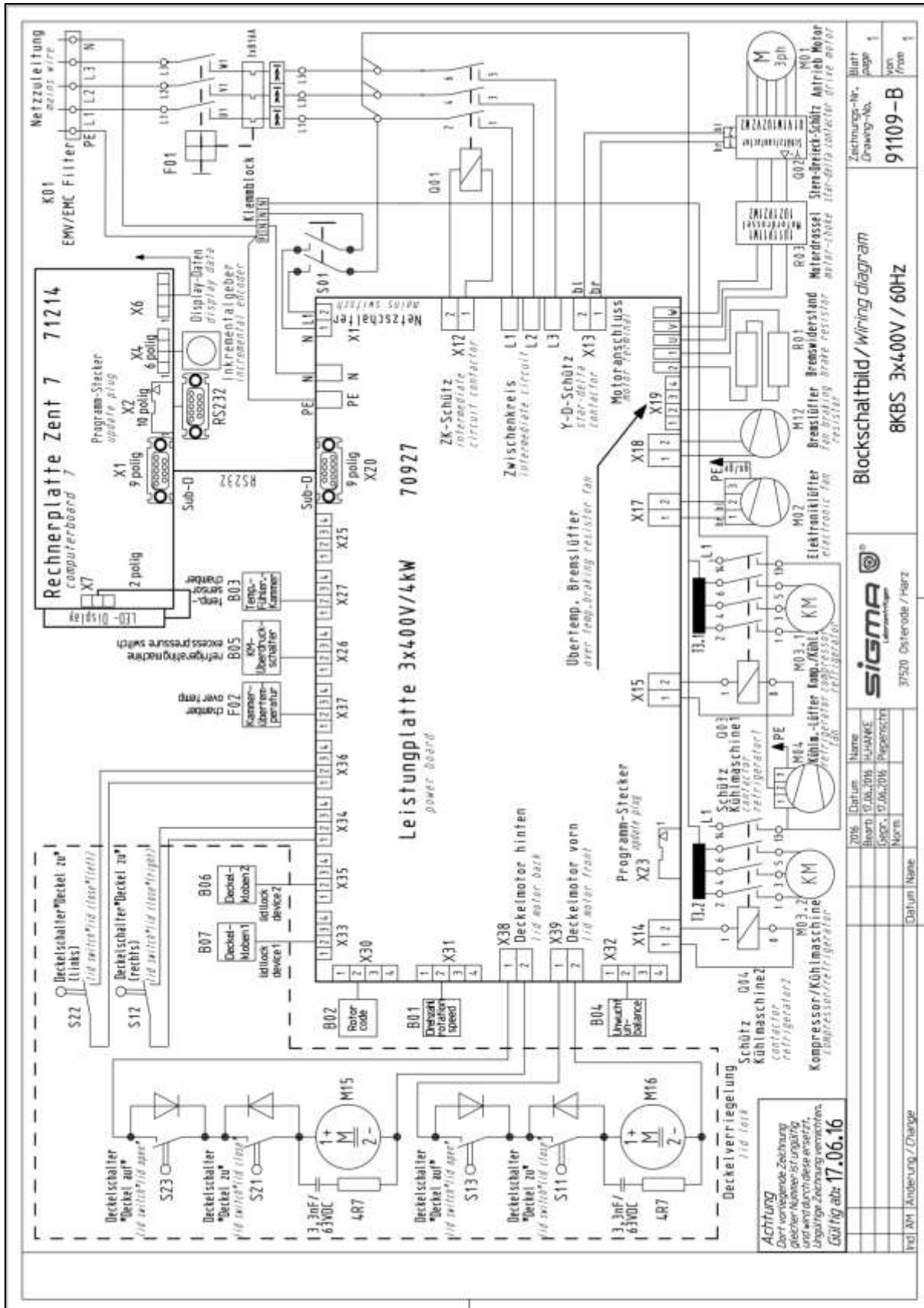
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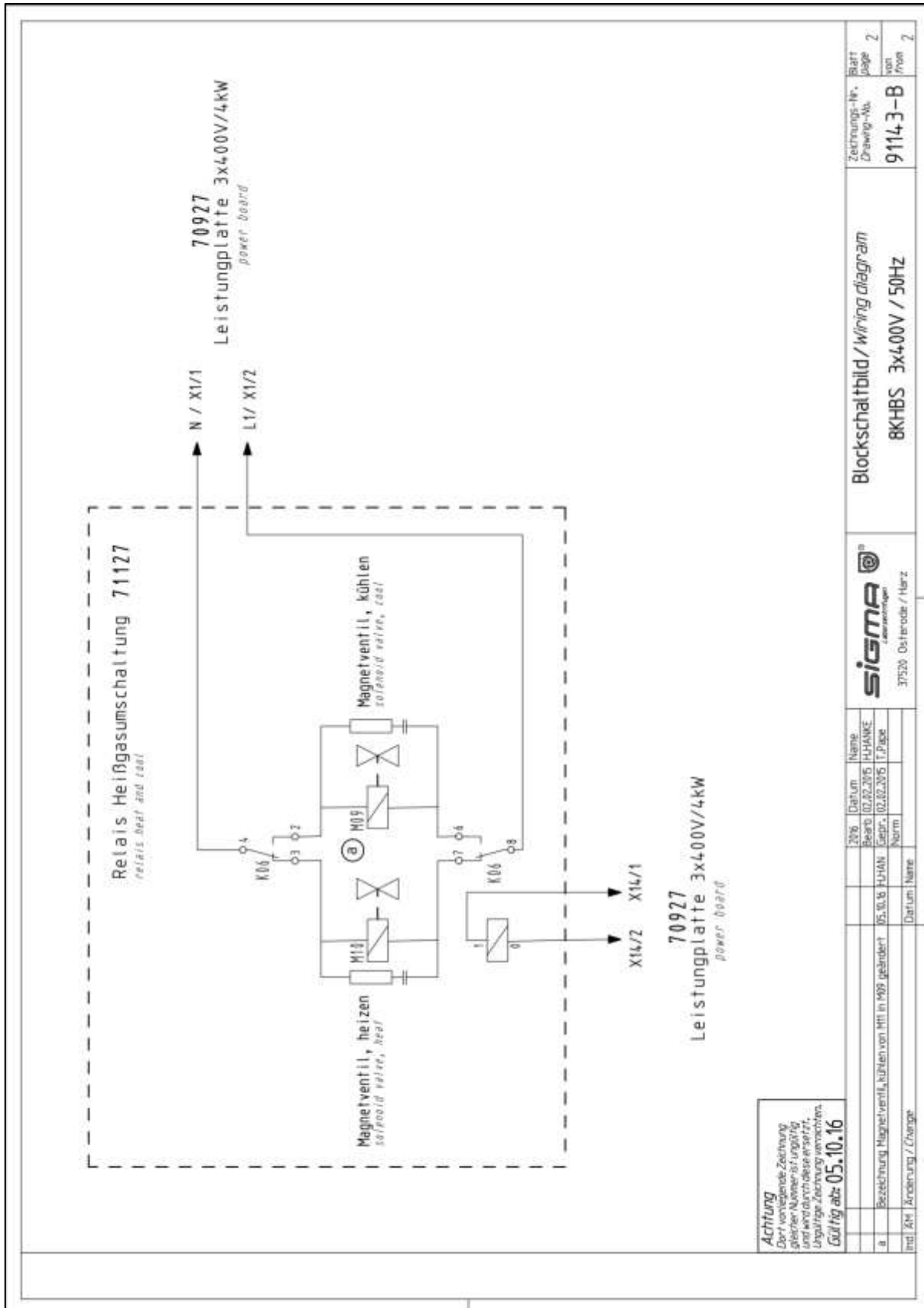
9 Appendix



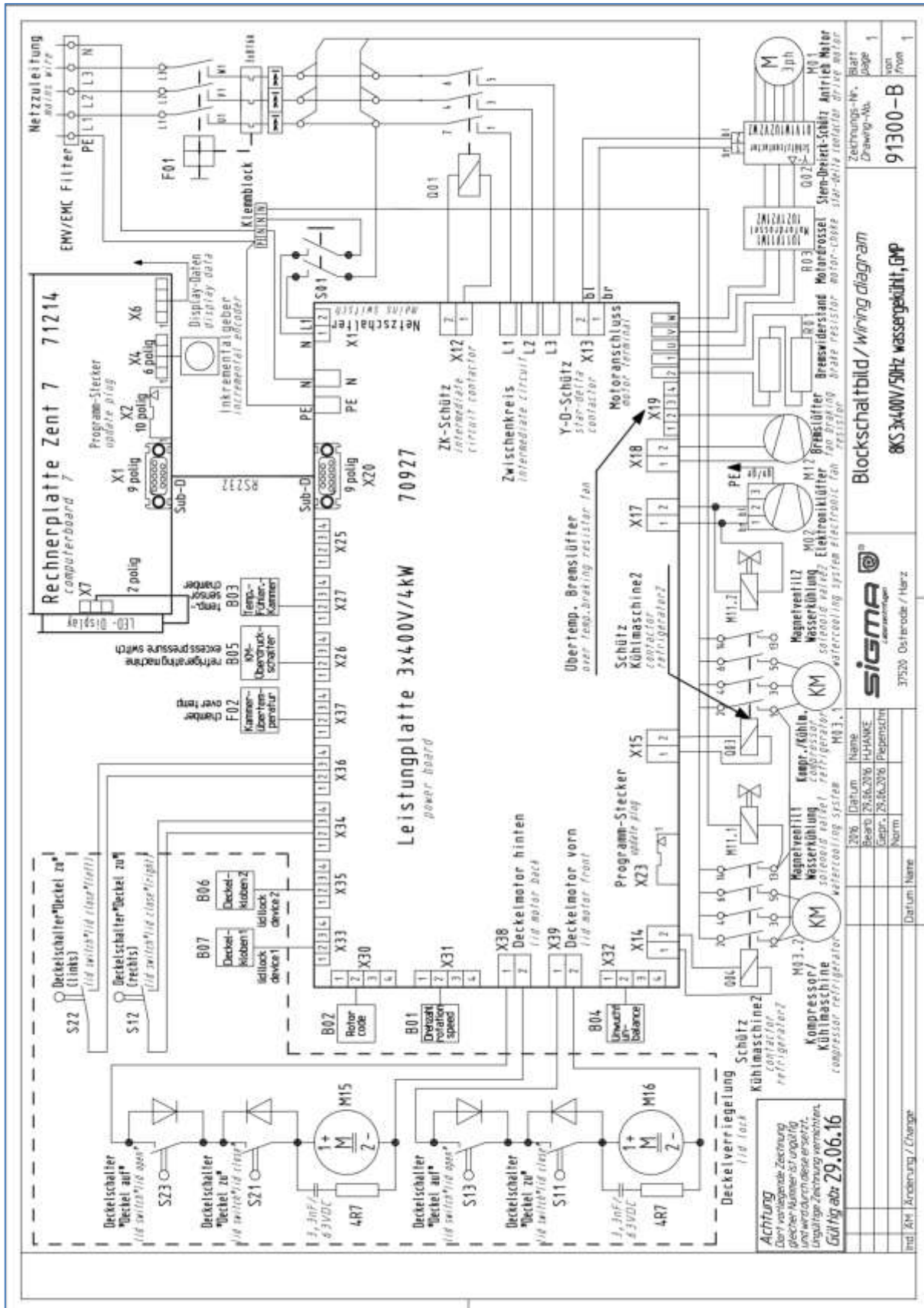




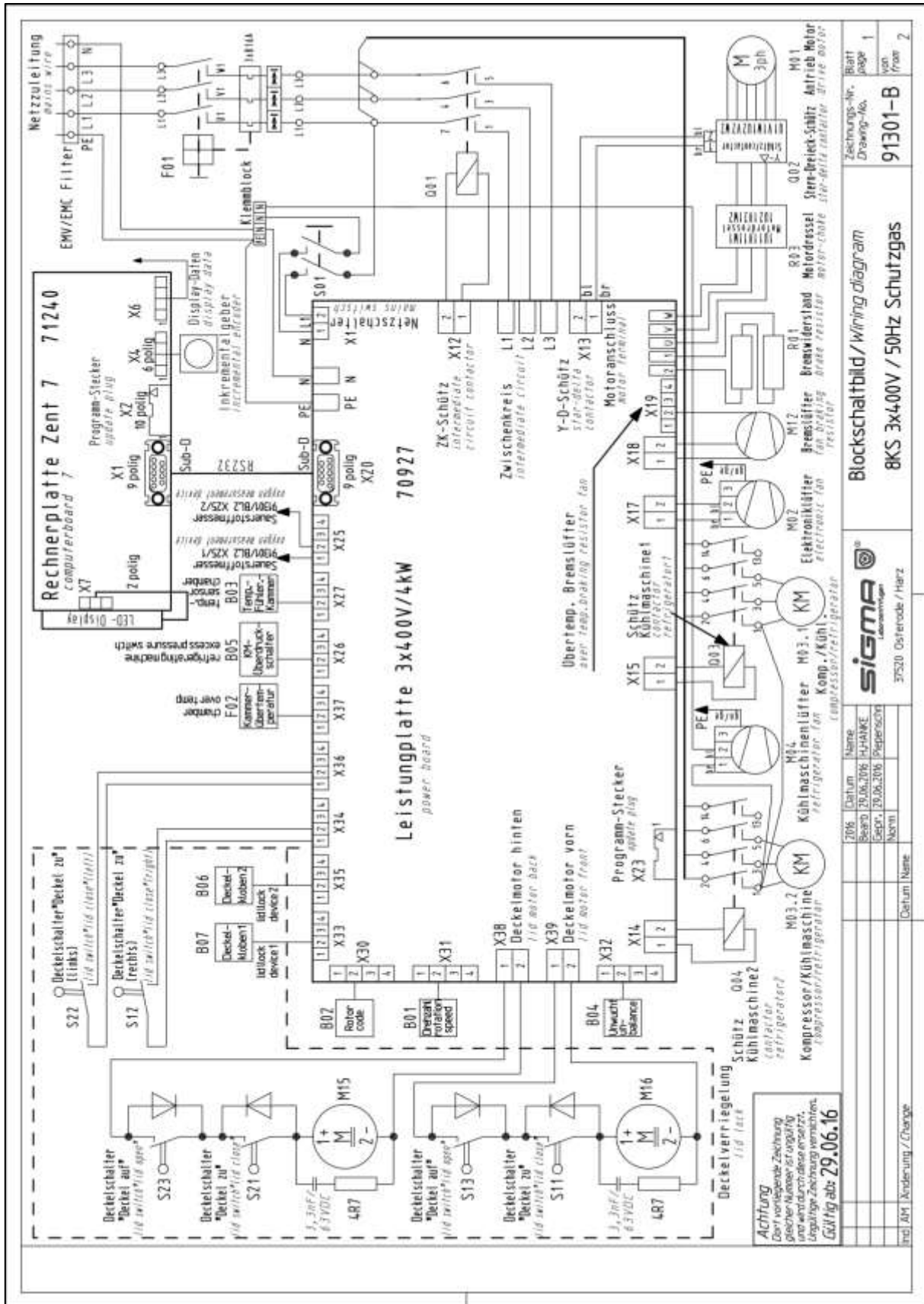
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Name / Name		H. HANKE	
Norm / Norm		GGP-17.06.2016 - Papperstein	
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Ind. / M. / Änderung / Change			



Blattschaltbild / Wiring diagram		Zrechnungs-Nr. Drawing-Ab.	Blatt page
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05.10.16	H.HANKE	T.P. Jace	
Norm			
Datum	Name		
Ind.	Änderung / Change		



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Geprüft		S.BERG	
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9.2 Table of values for the imbalance adjustment

The data concerning the maximum imbalance at critical speed and the cut-off imbalance in the following table depend on the rotor type and mass.

Centrifuge tubes filled with water (1 ml \approx 1 g) can be used for the imbalance simulation.

The imbalance programming run must be performed with special weights in the case of rotors for special purposes.

Centrifuge type	Angle rotor	Swing-out rotor	n-max	Max. permissible imbalance in g (± 1.5 g)	Cut-off imbalance in g (± 1.5 g)	Parameter setting run (programming run) in g	Temperature run rotor / speed
1K15	12024		15,300	2.5 \pm 0.5 g	5 \pm 1 g		12024 / 15,300
1-15K 1-15PK	12024		14,000	3	9		12024 / 14,000
2-5 Imbalance 2-6 2-6E		11030	2,100	6	9		
2-7		11071 + 13299	2,100	6,2	9		
2-15		11192	4,500	Function test			
2-15 Zent		11192	4,500	6	9		
2-16 2-16P		11192	15,000	6	9		
2K15	12141		15,300	6	9		12141 / 15,300
2K15 Zent		11192	5,000	5	8		12141 / 15,300
2-16K 2-16KC 2-16PK		11192	15,300	5	8		12141 / 15,300
3-10		11133	4,500	8	10		
3K10		11133	4,800	8	10		
3-15 3K15 3K18		11133	5,000 5,500 5,500	8	10		11133 / 5,300
3-16 3-16P 3-18		11180 + 13180	4,200	10	20		11180 + 13180
3-16K 3-16PK		11180 + 13180	4,500	10	20		11180 + 13180 / 4,500
3-18K		11180 + 13180	1,700	10	20		11180 + 13180 / 4,700
3-12	12111	11133	14,500 5,000	6 8	8 10		
3K12	12111	11133	15,300 5,500	6 8	8 10		

9 Appendix

Centrifuge type	Angle rotor	Swing-out rotor	n-max	Max. permissible imbalance in g (± 1.5 g)	Cut-off imbalance in g (± 1.5 g)	Parameter setting run (programming run) in g	Temperature run rotor / speed
3K30 3-30K	12156 12110	11134	16,500 30,000 10,000	6	10	8	12126 / 16,500
3K30C	12156	11390	16,500 5,000	7 3	10 5	8 4	12156 / 16,500
4-5L		11660 + 13450 od. 13460	4,700	20	30		
4-10	12165	11140	12,000 5,000	6 6	10 12		
4K10	12165	11140	13,000 5,000	6 6	10 12		
4-15 4-16		11150 + 13125	4,500	12	18	14	11150 + 13215 / 4,500
4-15C* 4-16 Zent5 (Prof.)		11150 + 13125	4,500	12	18	14	11150 + 13215 / 4,500
		09100 + 09366	6,000	17	35		
4K15 4-16K		11150 + 13215	5,100	12	18	14	11150 + 13215 / 4,500
4K15C* 4-16K Zent5 (Prof.)		11150 + 13125	5,100	12	18	14	11150 + 13215 / 5,100
6-10	12500	11162	8,000 4,000	10 10	25 25		
6K10	12500	11162	9,600 4,500	10 10	25 25		
6-15 6-16		11150 + 13125	4,500	10	25	16	11150 + 13420 / 4,200
6K15 6-16K		11150 + 13125	5,100	10	25	16	11150 + 13420 / 4,700
8K10		11800 + 13810	5,130	50-60	80-100	70	5,130
8K		11805 + 13850	5,100	50-60	80-100	70	5,100

*Imbalance values only in conjunction with rotor 09100!

Subject to technical changes.

9.3 Protokol of deleted cycles of rotors and buckets



Protocol of deleted cycles of rotors and buckets

Centrifuge type	Serial number	Customer

Rotor no.	Bucket no.	Cycle reading	Cycle code	Password	Date of deletion
			0	XXXX	
			1		
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9 Appendix

9.4 Table of the service life of rotors and accessories

Rotors and accessories with a different service life



If no other data concerning the service life are engraved on the rotor or accessory, rotors and buckets must be checked by the manufacturer after 10 years. After 50,000 cycles, rotors must be scrapped for safety reasons.

Rotor / bucket	Cycles	Service life ("Exp.Date")	Autoclaving	Suitable for centrifuge	Remarks
9100	15,000			4-15C, 4K15C, 4-16, 4-16S, 4-16K, 4-16KS, 6-15, 6K15, 6-16, 6-16K	without engraving, only "spincontrol professional" and "spincontrol S"
11026		7 years		1-14, 1-14K	
12033		5 years		1-16 Edition, 1-16K Edition	
12082		7 years		1-14, 1-14K	
12083		7 years		1-14, 1-14K	
12084		7 years		1-14, 1-14K	
12085		7 years		1-14, 1-14K	
12092		5 years	20x	1-14, 1-14K	
12093		5 years	20x	1-14, 1-14K	
12094		5 years	20x	1-14, 1-14K	
12096		5 years	20x	1-14, 1-14K	
12097		5 years	20x	1-14, 1-14K	
12101		5 years	20x	1-15, 1-15K, 1-15P, 1-15PK	
12124		5 years	20x	1-15, 1-15K, 1-15P, 1-15PK	
12126		5 years	20x	1-15, 1-15K, 1-15P, 1-15PK	
12134		5 years	20x	1-16, 1-16K	
12135		5 years	20x	1-16, 1-16K	
12137		5 years	20x	1-16, 1-16K	
12500		7 years		6-15, 6K15, 6-16, 6-16K	
12600		7 years		6-16S, 6-16KS	
13218	20,000			4-16, 4-16S, 4-16K, 4-16KS, 6-16, 6-16S, 6-16K, 6-16KS	
13296		5 years	10x	2-6, 2-6E, 2-7	
13299		5 years	10x	2-6, 2-6E, 2-7, 2-16P, 2-16KL, 2-16KHL	
13635	25,000			6-16, 6-16K, 6-16S, 6-16KS	
13650	20,000			4-5L, 4-16S, 4-16KS, 4-16KHS, 6-16S, 6-16HS, 6-16KS, 6-16KHS	
13845	20,000			8K, 8KS	
13850	10,000			8K, 8KS, 8KBS	
13860	35,000			8K, 8KS, 8KBS	
13864	1,000			8K, 8KS	without engraving
13865	1,000			8K, 8KS	without engraving
13866	1,000			8K, 8KS	without engraving

9 Appendix

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