



Underwriters Laboratories (UL LLC) Safety Certification (Manufacturing Factory) Report

Model: 5452 (MiniSpin), 5453 (MiniSpin plus)

Device Description: Centrifuge

Applicant: EPPENDORF A G
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22339 HAMBURG GERMANY

Manufacturer: Same as applicant

Manufacturing Facility(ies): EPPENDORF ZENTRIFUGEN GMBH
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Additional Standards: UL 61010-2-020, Third Edition (2016)

Report Types: This report consists of the following report types:

[Yes] US Certification (UL Listing)

[Yes] CAN Certification (cUL Listing)

This report covers the Safety evaluation of the referenced model(s) according to the standard(s) specified above.

This is the Manufacturing Factory report only, which is used as part of the factory FUS inspections.

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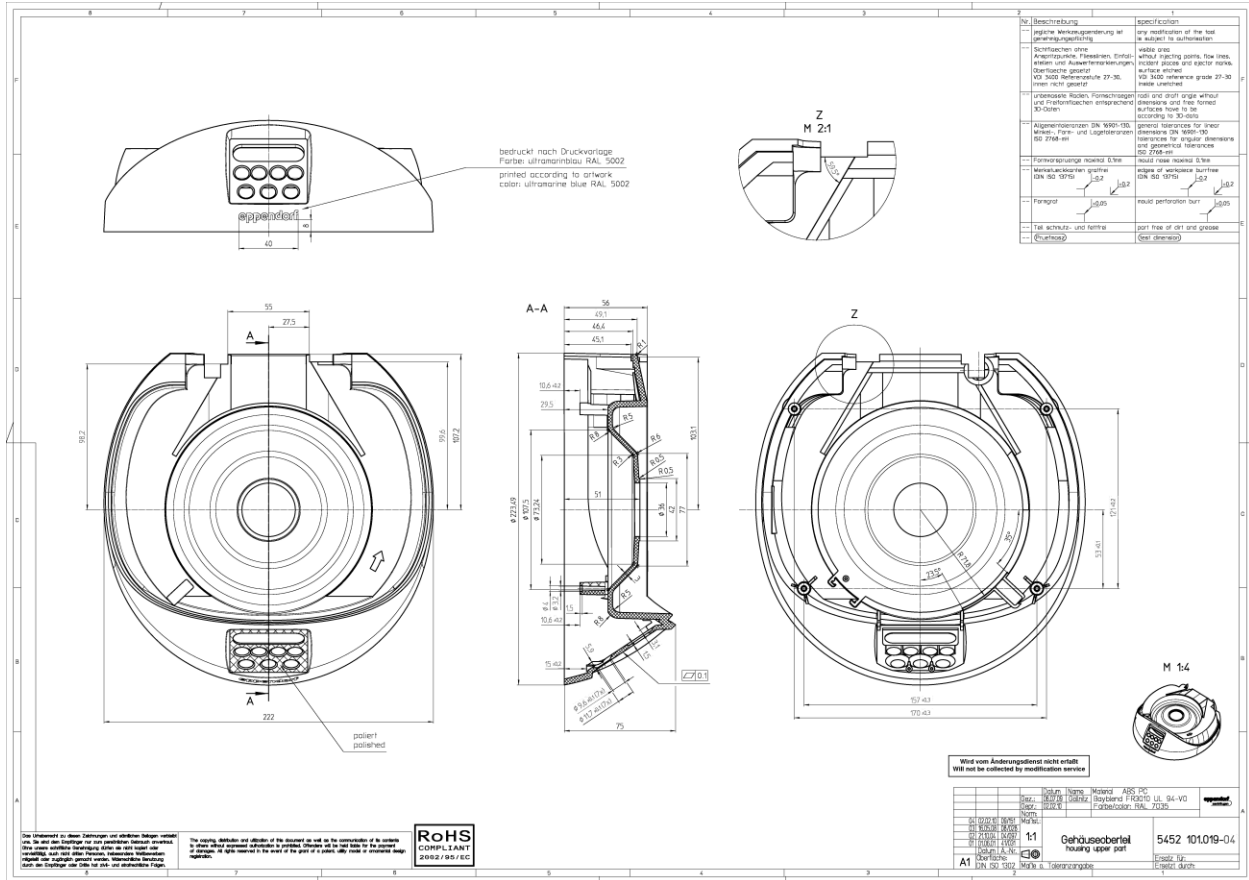
All Enclosures associated with this report are shown below.

Enclosures

<u>Supplement - (ID)</u>	<u>Description</u>
Diagrams - (01)	Housing upper part
Diagrams - (02)	RPM Sensor Holder
Diagrams - (03)	RPM Sensor
Manuals - (002)	OMGLP_MiniSpin_MiniSpinPlus_5452_900_035-04_022021_en_print- Manual
Marking Label - (003)	Marking labels
Miscellaneous - (01)	Alternate Main motor
Miscellaneous - (02)	Construction drawing of Hartu Transformer
Miscellaneous - (03)	Description of interlock circuit
Miscellaneous - (04)	Drawing AMP Quick
Miscellaneous - (05)	Drawing AMPMODU II
Miscellaneous - (06)	Drawing centrifuge foot
Miscellaneous - (07)	Drawing rotor F45-12-11
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Miscellaneous - (09)	Main Motor
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Miscellaneous - (12)	Transformer TR200 - Renco Electronics Inc. S005701
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Photographs - (09)	09. Interlock circuit including switch, hall sensor and
Photographs - (10)	10. Mini Spin Alternate Main Board
Schematics + PWB - (01)	Electrical circuit diagram - alternate Mains PWB - PN_ 5452
Schematics + PWB - (02)	Electrical Circuit Diagram
Schematics + PWB - (03)	Electrical Component Assembly Diagram

Diagrams - (01) Housing upper part

Diagrams - (01) Housing upper part



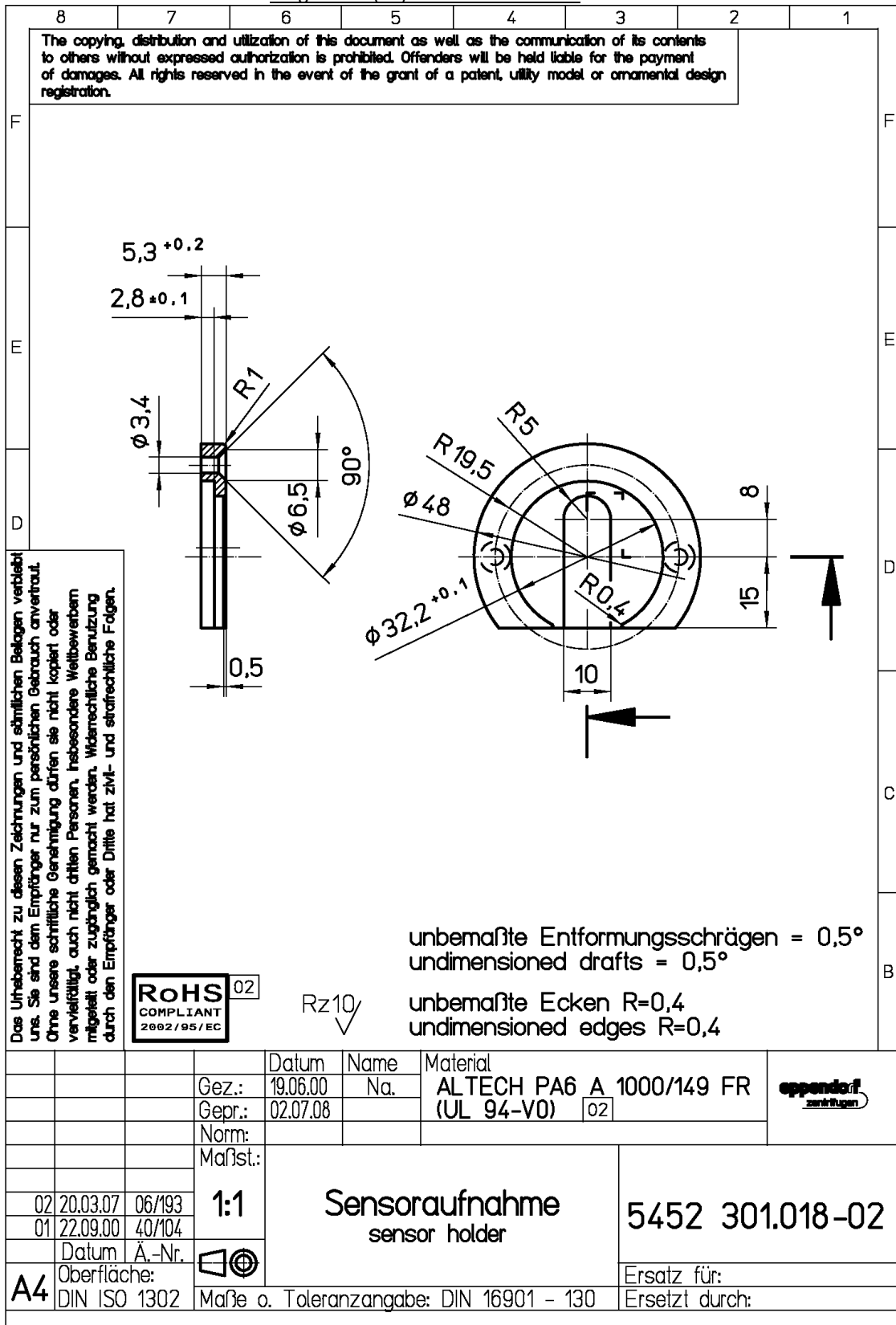
Das Unternehmen ist einem Zulieferer und weiterer Lieferant verantwortlich für die Einhaltung der RoHS-Richtlinie.

The company, supplier and other provider is responsible for compliance with the RoHS Directive in relation to the part of the product.



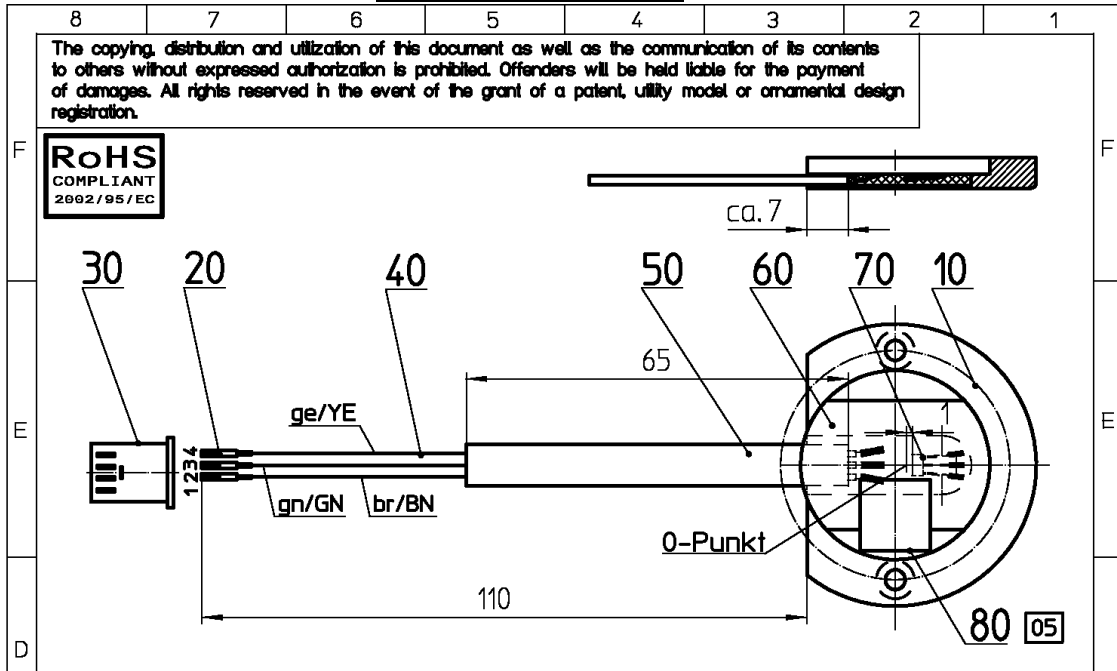
Diagrams - (02) RPM Sensor Holder

Diagrams - (02) RPM Sensor Holder



Diagrams - (03) RPM Sensor

Diagrams - (03) RPM Sensor



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05			
080	Etikett Rückverfolgbarkeit gemäß Arbeitanweisung 5800 915 076-01 Art.-Nr.: 5452 302.006-05 Lieferanten-Nr.: 443 425	label item tracking according to working instruction 5800 915 076-01 part no.: 5452 302.006-05 supplier no.: 443 425	1x
070	Hallsensor HAL 506UA-K Hall sensor HAL 506UA-K		1x Mikronas
060	Leiterplatte, flexibel PCB, flexible		1x
050	Schrumpfschlauch DI 3,2 sw UL shrinking tube DI 3,2 BK UL		65mm
040	Flachbandkabel 3 pos. AWG 26 ribbon cable 3 pos. AWG 26		120mm
030	Buchsengehäuse 280 359-4 socket housing 280 359-4		1x Tyco
020	Buchsenkontakt 280 530-3 socket contact 280 530-3		3x Tyco
010	Sensoraufnahme 5452 301.018-02 sensor attachment 5452 301.018-02		1x
Pos.	Benennung/naming	Stück/Länge pieces/length	Lieferant supplier

		Datum	Name	Material	ependorf zentrifugen
		Gez.:	31.01.07	STU	
		Gepr.:	14.12.09		
05	11.12.09	09/177	Norm:		
04	02.07.07	06/193	Maßst.:		
03	29.03.04	04/010	1:1	Drehzahlsensor kpl. speed sensor complete	5452 302.006-05
02	21.12.00	40/141			
01	22.09.00	40/104			
		Datum				Ä.-Nr.
A4	Oberfläche:		Maße o. Toleranzangabe: DIN ISO 2768-mH		Ersatz für:
	DIN ISO 1302				Ersetzt durch:

Manuals - (002) OMGLP_MiniSpin_MiniSpinPlus_5452_900_035-04_022021_en_print-Manual

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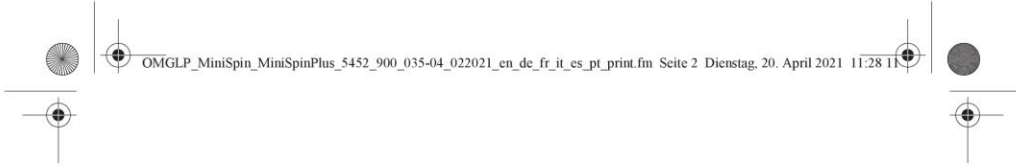
Register your instrument!
www.eppendorf.com/myeppendorf



MiniSpin®/MiniSpin® plus

Original instructions
Originalbetriebsanleitung
Notice originale
Istruzioni originali
Manual original
Manual original

Manuals - (002) OMGLP MiniSpin MiniSpinPlus 5452 900 035-04 022021 en print- Manual



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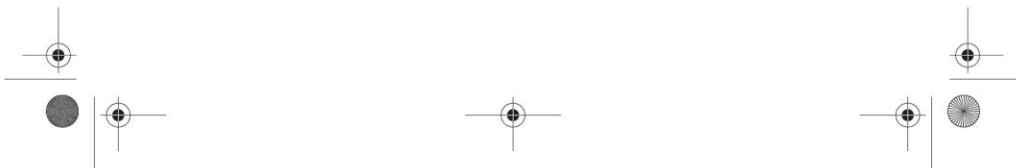
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 MiniSpin®/MiniSpin® plus
 English (EN) **3**

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Operating instructions
 MiniSpin®/MiniSpin® plus
 English (EN) **5**

1 Operating instructions**1.1 Using this manual**

- ▶ Read this operating manual completely before using the device for the first time. Observe the instructions for use of the accessories where applicable.
- ▶ This operating manual is part of the product. Please keep it in a place that is easily accessible.
- ▶ Enclose this operating manual when transferring the device to third parties.
- ▶ The current version of the operating manual for all available languages can be found on our webpage www.eppendorf.com/manuals.

1.2 Danger symbols and danger levels**1.2.1 Danger symbols**

The safety instructions in this manual have the following danger symbols and danger levels:

	Biohazard		Explosive substances
	Electric shock		Risk of crushing
	Hazard point		Material damage

1.2.2 Danger levels

DANGER	Will lead to severe injuries or death.
WARNING	May lead to severe injuries or death.
CAUTION	May lead to light to moderate injuries.
NOTICE	May lead to material damage.

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6 Operating instructions
MiniSpin®/MiniSpin® plus
English (EN)

**1.3 Symbols used**

Depiction	Meaning
1.	Actions in the specified order
2.	
▶	Actions without a specified order
•	List
<i>Text</i>	Display or software texts
i	Additional information

1.4 Abbreviations used

rcf
Relative centrifugal force : g -force in m/s^2

rpm
Revolutions per minute

UV
Ultraviolet radiation



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Safety
MiniSpin®/MiniSpin® plus
English (EN) 7

2 Safety

2.1 Intended use

The MiniSpin/MiniSpin plus is used for the separation of aqueous solutions and suspensions of different densities in approved sample tubes.

The MiniSpin/MiniSpin plus is exclusively intended for use indoors. All country-specific safety requirements for operating electrical equipment in the laboratory must be observed.

2.2 User profile

The device and accessories may only be operated by trained and skilled personnel.

Before using the device, read the operating manual and the instructions for use of the accessories carefully and familiarize yourself with the device's mode of operation.

2.3 Information on product liability

In the following cases, the designated protection of the device may be affected. The liability for any resulting damage or personal injury is then transferred to the owner:

- The device is not used in accordance with the operating manual.
- The device is used outside of its intended use.
- The device is used with accessories or consumables that are not recommended by Eppendorf.
- The device is maintained or repaired by persons not authorized by Eppendorf AG.
- The user makes unauthorized changes to the device.

2.4 Application limits

2.4.1 Declaration concerning the ATEX directive (2014/34/EU)



DANGER! Risk of explosion.

- ▶ Do not operate the device in areas where work with explosive substances is carried out.
- ▶ Do not use this device to process any explosive or highly reactive substances.
- ▶ Do not use this device to process any substances which could generate an explosive atmosphere.

Due to its design and the environmental conditions inside the device, the MiniSpin/MiniSpin plus is not suitable for use in a potentially explosive atmosphere.

The device may only be used in a safe environment, such as in the open environment of a ventilated laboratory or a fume hood. The use of substances that may contribute to a potentially explosive atmosphere is not permitted. The final decision on the risks associated with the use of such substances lies with the user.



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Safety
8 MiniSpin®/MiniSpin® plus
English (EN)



2.5 Warnings for intended use

2.5.1 Personal injury or device damage



WARNING! Risk of electric shock due to damage to the device or the mains/power cord.

- ▶ Only switch on the device if the device and the mains/power cord are undamaged.
- ▶ Only operate devices which have been installed or repaired properly.
- ▶ In the event of danger, disconnect the device from the mains/power supply voltage. Disconnect the mains/power plug from the device or the earth/grounded socket. Use the isolating device intended for this purpose (e.g., the emergency switch in the laboratory).



WARNING! Lethal voltages inside the device.

Touching high-voltage parts can cause an electric shock. Electric shocks cause heart injury and respiratory paralysis.

- ▶ Ensure that the housing is closed and undamaged.
- ▶ Do not remove the housing.
- ▶ Ensure that no liquids can penetrate the device.
Only authorized service staff may open the device.



WARNING! Risk due to incorrect voltage supply.

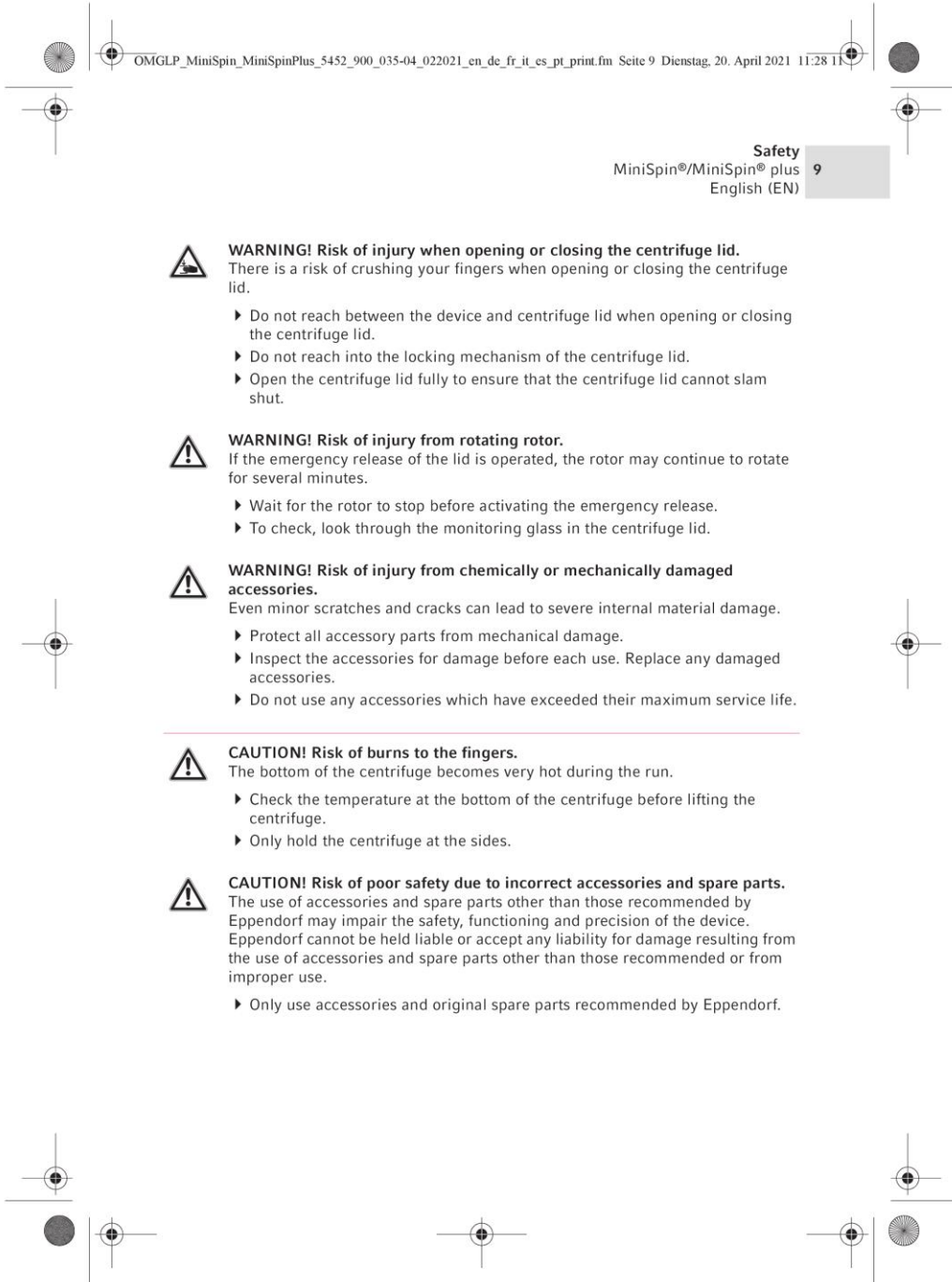
- ▶ Only connect the device to voltage sources which correspond with the electrical requirements on the name plate.
- ▶ Only use earth/grounded sockets with a protective earth (PE) conductor.
- ▶ Only use the mains/power cord supplied.



WARNING! Damage to health due to infectious liquids and pathogenic germs.

- ▶ When handling infectious liquids and pathogenic germs, observe the national regulations, the biosafety level of your laboratory, and the manufacturers' Safety Data Sheets and application notes.
- ▶ Wear your personal protective equipment.
- ▶ For comprehensive regulations about handling germs or biological material of risk group II or higher, please refer to the "Laboratory Biosafety Manual" (source: World Health Organization, Laboratory Biosafety Manual, in the currently valid version).



Manuals - (002) OMGLP MiniSpin MiniSpinPlus 5452 900 035-04 022021 en print- Manual

**NOTICE! Damage to the device due to spilled liquids.**

1. Switch off the device.
2. Disconnect the device from the mains/power supply.
3. Carefully clean the device and the accessories in accordance with the cleaning and disinfection instructions in the operating manual.
4. If a different cleaning and disinfection method is to be used, contact Eppendorf AG to ensure that the intended method will not damage the device.

**NOTICE! Damage to electronic components due to condensation.**

Condensate may form in the device when it has been transported from a cool environment to a warmer environment.

- ▶ After installing the device, wait for at least 3 h. Only then connect the device to the mains/power line.

2.5.2 Incorrect handling of the centrifuge**NOTICE! Damage from knocking against or moving the device during operation.**

If the rotor hits the rotor chamber wall, it will cause considerable damage to the device and rotor.

- ▶ Do not move or knock against the device during operation.

2.5.3 Incorrect handling of the rotors**WARNING! Risk of injury from improperly attached rotors and rotor lids.**

- ▶ Only centrifuge with the rotor and rotor lid firmly tightened.
- ▶ If any unusual noises occur when the centrifuge starts, the rotor or the rotor lid may not be attached properly. Stop the centrifugation immediately.

**CAUTION! Risk of injury due to asymmetric loading of a rotor.**

- ▶ Load rotors symmetrically with identical tubes.
- ▶ Only load adapters with suitable tubes.
- ▶ Always use the same type of tubes (weight, material/density and volume).
- ▶ Use a balance to check that the load is symmetrical by balancing the adapters and tubes that are used.



**CAUTION! Risk of injury from overloaded rotor.**

The centrifuge is designed for the centrifugation of material with a maximum density of 1.2 g/mL at maximum speed and filling volume and/or load.

- ▶ Do not exceed the maximum load of the rotor.

**NOTICE! Damage to rotors from aggressive chemicals.**

Rotors are high-quality assemblies which withstand extreme stresses. This stability can be impaired by aggressive chemicals.

- ▶ Avoid using aggressive chemicals such as strong and weak alkalis, strong acids, solutions with mercury ions, copper ions and other heavy metal ions, halogenated hydrocarbons, concentrated saline solutions and phenol.
- ▶ If it is contaminated by aggressive chemicals, clean the rotor and especially the rotor bores immediately using a neutral cleaning agent.
- ▶ Due to the manufacturing process, color variations may occur on PTFE coated rotors. These color variations do not affect the service life or resistance to chemicals.

2.5.4 Extreme strain on the centrifugation tubes**CAUTION! Risk of injury from overloaded tubes.**

- ▶ Note the loading limits specified by the tube manufacturer.
- ▶ Only use tubes which are approved by the manufacturer for the required *g*-forces (rcf).

**NOTICE! Danger from damaged tubes.**

Damaged tubes must not be used, as this could cause further damage to the device and the accessories and loss of the samples.

- ▶ Visually check all tubes for damage before use.

**NOTICE! Danger due to deformed or brittle material. Autoclaving at excessively high temperatures can lead to plastic tubes, adapters and rotor lids becoming brittle and deformed.**

This could result in damage to the device and the accessories and sample loss.

- ▶ Observe the temperatures specified by the manufacturer when autoclaving tubes.
- ▶ Do not use any deformed or brittle tubes.



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Safety12 MiniSpin®/MiniSpin® plus
English (EN)**NOTICE! Danger from open tube lids.**

Open tube lids may break off during centrifugation and damage both the rotor and the centrifuge.

- ▶ Carefully seal all tube lids before centrifuging.

**NOTICE! Damage to plastic tubes due to organic solvents.**

The density of plastic tubes is reduced when organic solvents (e.g., phenol, chloroform) are used, i.e. the tubes may become damaged.

- ▶ Note the manufacturer's information on the chemical resistance of the tubes.

**NOTICE! Micro test tubes heat up.**

In non-refrigerated centrifuges, the temperature in the rotor chamber, rotor and sample may increase to above 40 °C, depending on the run time, *g*-force (*rcf*)/ speed and ambient temperature.

- ▶ Please note that this will reduce the centrifugation stability of the micro test tubes.
- ▶ Please note the temperature resistance of the samples.

2.6 Safety instructions on the device

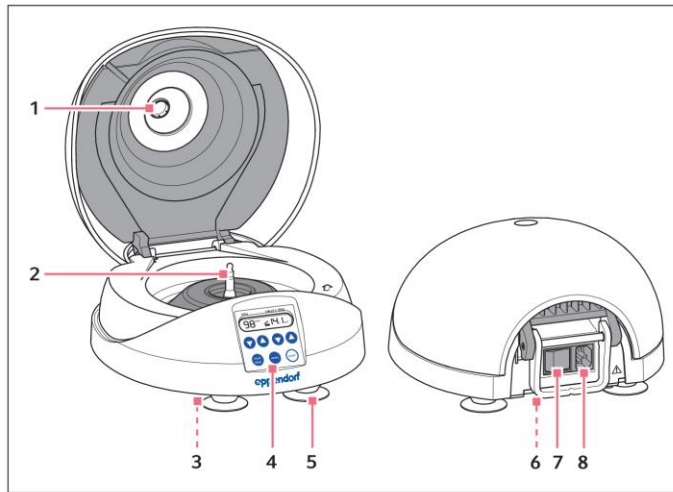
Symbol	Meaning	Location
	NOTICE ▶ Observe the safety instructions in the operating manual.	Rear of the device
	▶ Observe operating manual.	

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Product description
 MiniSpin®/MiniSpin® plus
 English (EN) **13**

3 Product description
3.1 Product overview



- | | |
|----------------------------------------|---------------------------------|
| 1 Monitoring glass | 5 Suction foot |
| 2 Motor shaft | 6 Name plate (bottom of device) |
| 3 Emergency release (bottom of device) | 7 Mains/power switch |
| 4 Control panel | 8 Mains/power cord socket |

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14 Product description
MiniSpin®/MiniSpin® plus
English (EN)

**3.2 Delivery package**

1	CentrifugeMiniSpin
or	CentrifugeMiniSpin plus
1	Rotor F-45-12-11 incl. rotor lid
1	Rotor nut
1	Mains/power cord
1	Operating manual

- i**
- ▶ Check that the delivery is complete.
 - ▶ Check all parts for transport damage.
 - ▶ To safely transport and store the device, retain the transport box and packing material.

3.3 Features

The high-power and user-friendly microcentrifuges MiniSpin and the MiniSpin plus are so small that each workstation can be equipped with a "personal" centrifuge. For the MiniSpin and the MiniSpin plus, 2 rotors are available:

Fixed-angle rotor F-45-12-11

Capacity: 12 tubes

- Micro test tubes 0.2 mL to 2.0 mL
- Microtainers

Fixed-angle rotor F-55-16-5-PCR

Capacity: 16 PCR tubes

- 0.2 mL PCR tubes
- PCR strips



3.4 Name plate

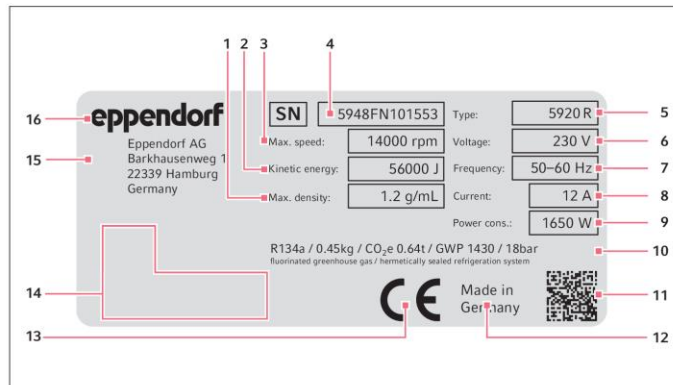


Fig. 3-1: Eppendorf AG device identification (example)






- | | |
|-----------------------------------------------------------|--------------------------------------------------------------------------|
| 1 Maximum density of the material for centrifuging | 9 Maximum rated power |
| 2 Maximum kinetic energy | 10 Information on the refrigerant (refrigerated centrifuges only) |
| 3 Maximum speed | 11 Data matrix code for serial number |
| 4 Serial number | 12 Designation of origin |
| 5 Product name | 13 CE marking |
| 6 Rated voltage | 14 Certification marks and symbols (device-specific) |
| 7 Rated frequency | 15 Address of manufacturer |
| 8 Maximum rated current | 16 Manufacturer |

Manuals - (002) OMGLP MiniSpin MiniSpinPlus 5452 900 035-04 022021 en print- Manual

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Product description
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 English (EN)

Tab. 3-1: Certification marks and symbols (device-specific)

Symbol/ Certification mark	Meaning
	Serial number
	Symbol for waste electrical and electronic equipment (WEEE) according to EU Directive 2012/19/EU, European Community
	UL mark: declaration of conformity, USA
	Conformity mark for electromagnetic compatibility according to the <i>Federal Communications Commission</i> , USA
	China conformity mark – Use of certain hazardous substances in electrical and electronic products (<i>Requirements for Concentration Limits for Certain Hazardous Substances in Electronic Information Products SJ/T 11363-2006</i>), People's Republic of China

4 Installation

4.1 Selecting the location



WARNING! Risk due to incorrect voltage supply.

- ▶ Only connect the device to voltage sources which correspond with the electrical requirements on the name plate.
- ▶ Only use earth/grounded sockets with a protective earth (PE) conductor.
- ▶ Only use the mains/power cord supplied.



NOTICE! If a fault occurs, any objects in the immediate proximity of the device will be damaged.

- ▶ In accordance with the recommendations of EN 61010-2-020, leave a safety clearance of **30 cm** around the device during operation.
- ▶ Please remove all materials and objects from this area.



NOTICE! Risk of damage due to overheating.

- ▶ Do not install the device near heat sources (e.g., heaters, drying cabinets).
- ▶ Do not expose the device to direct sunlight.
- ▶ Ensure unobstructed air circulation. Maintain a clearance of at least 30 cm (11.8 in) around all ventilation gaps.



NOTICE! Radio interference.

For devices with Class A noise emission in accordance with and , the following applies: This device has been developed and tested in accordance with CISPR 11 Class A. The device may cause radio interference in domestic environments and is not intended for use in residential areas. The device cannot ensure adequate protection of radio reception in residential areas and domestic environments.

- ▶ If necessary, take appropriate measure to eliminate the interferences.



Mains/power connection for centrifuges: Operation of the centrifuge is only permitted in building installations that comply with the applicable national regulations and standards. In particular, it must be ensured that there are no impermissible loads on the supply lines and assemblies that are located upstream of the internal protection of the device. This can be ensured by using additional circuit breakers or other suitable fuse elements in the building installation.



The mains/power switch and the disconnecting device of the mains/power line must be easily accessible during operation (e.g., a residual current circuit breaker).

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**Installation**
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Select the location of the device according to the following criteria:

- Mains/power connection in accordance with the name plate
 - Minimum distance to other devices and walls: 30 cm (11.8 in)
 - Resonance free table with horizontal even work surface
 - The surrounding area must be well ventilated.
 - The location is protected against direct sunlight.
- ▶ Do not use this device near strong electromagnetic sources (e.g. unshielded high frequency sources) as they could impede proper functioning of the device.

4.2 Installing the instrument

Prerequisites

- The centrifuge is standing on a suitable lab bench with a smooth surface.
- The suction feet are fixed to the surface.

**WARNING! Risk due to incorrect voltage supply.**

- ▶ Only connect the device to voltage sources which correspond with the electrical requirements on the name plate.
- ▶ Only use earth/grounded sockets with a protective earth (PE) conductor.
- ▶ Only use the mains/power cord supplied.

**NOTICE! Damage to electronic components due to condensation.**

Condensate may form in the device when it has been transported from a cool environment to a warmer environment.

- ▶ After installing the device, wait for at least 3 h. Only then connect the device to the mains/power line.

1. Let the centrifuge warm up to ambient temperature.
2. Connect the centrifuge to the mains and switch it on using the mains/power switch.
 - The display is active.
 - The centrifuge lid opens.



5 Operation

5.1 Operating controls

i All display content will appear when the centrifuge lid is closed.

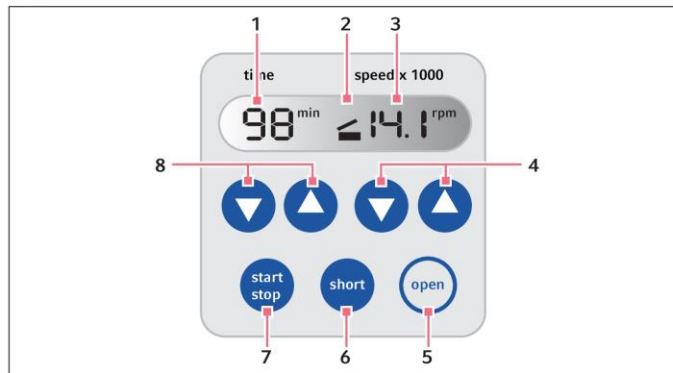


Fig. 5-1: MiniSpin/MiniSpin plus operating controls

- | | |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------|
| <p>1 Centrifugation time</p> | <p>5 open key
Open the centrifuge lid.</p> |
| <p>2 Centrifuge status
■ The centrifuge lid is open.
Top and bottom bar flashing alternately:
centrifugation in progress.</p> | <p>6 short key
Short run centrifugation</p> |
| <p>3 Centrifugation speed
MiniSpin: Rotational speed (rpm)
MiniSpin plus: Rotational speed (rpm) or
<i>g</i>-force (rcf)</p> | <p>7 start/stop key
Start and stop centrifugation.</p> |
| <p>4 speed arrow keys
Set the centrifugation speed.
Touch and hold the arrow key: quick
setting
Toggle rpm/rcf display (MiniSpin plus):
Press both speed arrow keys
simultaneously.</p> | <p>8 time arrow keys
Set the centrifugation time.
Touch and hold the arrow key: quick
setting</p> |

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**5.2 Switching on the centrifuge**

- ▶ Switch the centrifuge on using the mains/power switch at the rear of the device.
 - The lid opens.
 - The display shows the parameters of the last run.

5.3 Inserting and loading the rotor**WARNING! Risk of injury from chemically or mechanically damaged accessories.**

Even minor scratches and cracks can lead to severe internal material damage.

- ▶ Protect all accessory parts from mechanical damage.
- ▶ Inspect the accessories for damage before each use. Replace any damaged accessories.
- ▶ Do not use any accessories which have exceeded their maximum service life.

5.3.1 Inserting the rotor

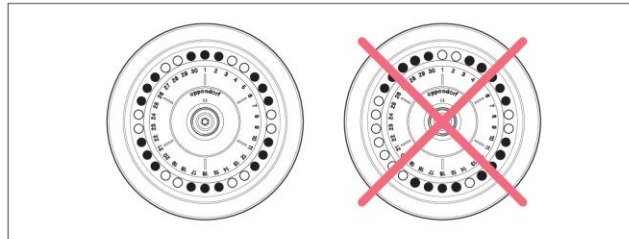
1. Fit the rotor on the motor shaft.
2. Fit the rotor nut on the motor shaft.
3. Rotate the rotor nut **clockwise** and tighten it.

5.3.2 Loading the rotor**CAUTION! Risk of injury due to asymmetric loading of a rotor.**

- ▶ Load rotors symmetrically with identical tubes.
- ▶ Only load adapters with suitable tubes.
- ▶ Always use the same type of tubes (weight, material/density and volume).
- ▶ Use a balance to check that the load is symmetrical by balancing the adapters and tubes that are used.

1. Check maximum load (adapter, vessel, and contents) for each rotor bore.
2. Load rotors and adapters only with the tubes intended for them.
3. To ensure symmetrical loading, insert sets of two tubes in opposite bores.
Tubes located opposite each other must be of the same type and contain the same filling quantity.





5.3.3 Positioning the rotor lid

- ▶ Position the rotor lid on the rotor.
The rotor lid audibly engages.

5.3.4 Removing the rotor

1. Pull up the knob of the rotor lid and remove the rotor lid.
2. Turn the rotor nut **counterclockwise** and remove it.
3. Remove the rotor.

5.4 Centrifuging

**WARNING! Risk of injury from improperly attached rotors and rotor lids.**

- ▶ Only centrifuge with the rotor and rotor lid firmly tightened.
- ▶ If any unusual noises occur when the centrifuge starts, the rotor or the rotor lid may not be attached properly. Stop the centrifugation immediately.



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5.4.1 Closing the centrifuge lid



WARNING! Risk of injury when opening or closing the centrifuge lid.
There is a risk of crushing your fingers when opening or closing the centrifuge lid.

- ▶ Do not reach between the device and centrifuge lid when opening or closing the centrifuge lid.
- ▶ Do not reach into the locking mechanism of the centrifuge lid.
- ▶ Open the centrifuge lid fully to ensure that the centrifuge lid cannot slam shut.

1. Check the correct attachment of the rotor and rotor lid.
2. Press the centrifuge lid down until it is gripped by the lid latch.

5.4.2 Starting centrifugation

Setting the centrifugation parameters

1. Set the centrifugation time with the **time** arrow keys.
2. Set the centrifugation speed with the **speed** arrow keys.

Starting the centrifugation run

3. To start the centrifugation run, press the **start/stop** key.

Display during centrifugation

- The bar in the center of the display flashes alternately at the top and bottom.
- Remaining run time in minutes. The last minute is counted down in seconds.
- Current speed (rpm) or *g*-force (rcf) (MiniSpin plus).



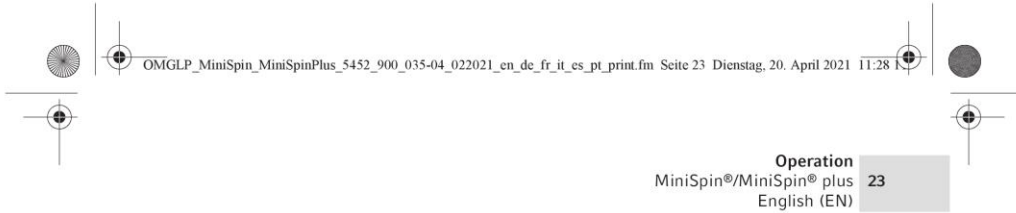
During the run, you can change the centrifugation time and the centrifugation speed. The new parameters are adopted immediately.

5.4.3 Short run centrifugation

- **MiniSpin:** Short run centrifugation at maximum speed (13400 rpm)
- **MiniSpin plus:** The speed of the short run centrifugation can be set.

1. Start short run centrifugation: Keep the **short** key pressed.
 - The bar in the center of the display flashes alternately at the top and bottom.
 - The cycle time is counted up.
2. Stop short run centrifugation: Release the **short** key.
 - During the braking process, the elapsed running time flashes on the display.
 - The centrifuge lid opens automatically.





5.4.3.1 MiniSpin plus: Setting the speed of the short spin centrifugation

Prerequisites

The centrifuge lid is open.

- ▶ Keep the **short** key pressed until the display changes.
 - *14t*: Short run centrifugation at maximum speed (14500 rpm)
 - *1 – 14t*: Short run centrifugation at set speed (rpm) or *g*-force (rcf)
- ▶ For *1 – 14t*, set the speed (rpm) or *g*-force (rcf) with the **speed** arrow key.

5.4.4 MiniSpin plus: Switching the display between speed and *g*-force

- ▶ Press both **speed** ▼ and ▲ arrow keys simultaneously.
The display changes from *rpm* (speed) to *rcf* (*g*-force) and vice versa.

i It is possible to switch the display between speed and *g*-force during a centrifugation run.

For the MiniSpin, you can use the following formula to calculate the *g*-force for the displayed speed according to DIN 58 970:

$$rcf = 1.118 \cdot 10^{-5} \cdot n^2 \cdot r_{\max}$$

n: speed in min⁻¹

*r*_{max}: maximum centrifugation radius in cm

Example: The maximum centrifugation radius of the rotor F-45-12-11 is 6 cm. At a speed of 10200 rpm, a maximum *g*-force of 7000 × *g* is reached.

5.4.5 MiniSpin plus: Centrifuging in continuous operation

Setting continuous run

1. In order to centrifuge without any time limits, use the **time** arrow keys to select the setting *oo* (▼ below 15 s or ▲ above 99 min).
2. Set the speed (rpm) or *g*-force (rcf) with the **speed** arrow keys.
3. To start the centrifugation run, press the **start/stop** key.
 - The bar in the center of the display flashes alternately at the top and bottom.
 - The cycle time is counted up.
 - Current speed (rpm) or *g*-force (rcf).
4. Press the **start/stop** key to end the centrifugation.
 - During the braking process, the elapsed running time flashes on the display.

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6 Maintenance
6.1 Service



WARNING! Risk of fire or electrical shock

- ▶ Have the centrifuge's electrical safety, especially the continuity of the protective connections, checked every 12 months by trained and skilled personnel.

We recommend to have the centrifuge and the associated rotors checked by Technical Service during a service at least every 12 months. Please note the country-specific regulations.

6.2 Preparing cleaning/disinfection

- ▶ Clean all accessible surfaces of the device and the accessories at least weekly and when contaminated.
- ▶ Clean the rotor regularly. This way the rotor is protected and the durability is prolonged.
- ▶ Furthermore, observe the notes on decontamination (see *Decontamination before shipment on p. 27*) when the device is sent to the authorized Technical Service for repairs.

The procedure described in the following chapter applies to the cleaning as well as to the disinfection or decontamination. The table below describes the steps required on top of this:

Cleaning	Disinfecting/decontamination
<ol style="list-style-type: none"> 1. Use a mild cleaning fluid to clean the accessible surfaces of the device and the accessories. 2. Carry out the cleaning as described in the following chapter. 	<ol style="list-style-type: none"> 1. Choose the disinfection method which corresponds to the legal regulations and guidelines in place for your range of application. For example, use alcohol (ethanol, isopropanol) or alcohol-based disinfectants. 2. Carry out the disinfection or decontamination as described in the following chapter. 3. Then clean the device and the accessories.

- i** If you have any further questions regarding the cleaning and disinfection or decontamination or regarding the cleaning fluid to be used, contact the Eppendorf AG Application Support. The contact details are provided on the back of this manual.

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6.3 Cleaning/disinfection**DANGER! Electric shock due to the ingress of liquid.**

- ▶ Switch off the device and disconnect it from the mains/power line before commencing any cleaning or disinfection procedures.
- ▶ Do not allow any liquids to penetrate the inside of the housing.
- ▶ Do not spray clean or spray disinfect the housing.
- ▶ Only reconnect the device to the mains/power line when it is completely dry, both inside and outside.

**NOTICE! Damage from the use of aggressive chemicals.**

- ▶ Do not use any aggressive chemicals on the device or its accessories, such as strong and weak bases, strong acids, acetone, formaldehyde, halogenated hydrocarbons or phenol.
- ▶ If the device has been contaminated by aggressive chemicals, clean it immediately using a mild cleaning agent.

**NOTICE! Corrosion due to aggressive cleaning agents and disinfectants.**

- ▶ Do not use any corrosive cleaning agents, aggressive solvents or abrasive polishes.
- ▶ Do not incubate the accessories in aggressive cleaning agents or disinfectants for longer periods.

**NOTICE! Damage from UV and other high-energy radiation.**

- ▶ Do not use UV, beta or gamma rays or any other high-energy forms of radiation for disinfection.
- ▶ Avoid storage in areas with high UV radiation levels.

**NOTICE! Danger due to deformed or brittle tubes. Autoclaving at excessively high temperatures can lead to plastic vessels becoming brittle and deformed. This could result in damage to the device and the accessories and sample loss.**

- ▶ Observe the temperatures specified by the manufacturer when autoclaving tubes.
- ▶ Do not use any deformed or brittle tubes.

**Autoclaving**

All rotors, rotor lids and adapters can be autoclaved (121 °C, 20 min).





6.3.1 Cleaning and disinfecting the device

i If you have any additional questions on disinfection, decontamination, cleaning and the cleaning agents to be used, please contact Eppendorf AG Application Support. The contact details are provided on the back of this manual.

1. Open the lid. Switch the device off at the mains/power switch. Disconnect the mains/power plug from the voltage supply.
2. Loosen the rotor nut To this purpose, loosen the rotor nut by turning it counterclockwise.
3. Remove the rotor.
4. Clean and disinfect all accessible surfaces on the device including the mains/power cord using a damp cloth and recommended cleaning agents.
5. Clean the motor shaft with a soft, dry, lint-free cloth. Do not grease the motor shaft.
6. Check the motor shaft for damage.
7. Check the device for corrosion and damage.
8. Leave the centrifuge lid open when the device is not being used.
9. Only reconnect the device to the mains/power supply if it is fully dry on the inside and outside.

6.3.2 Cleaning and disinfecting the rotor

1. Inspect the rotor and accessories for damage and corrosion. Do not use damaged rotors or accessories.
2. Clean and disinfect the rotors and accessories with the recommended cleaning agents.
3. Clean and disinfect the rotor bores with a bottle brush.
4. Rinse the rotors and accessories thoroughly with distilled water. Rinse the rotor bores of fixed-angle rotors particularly thoroughly.
i Do not put the rotor into the dishwasher and do not immerse the rotor in liquid as liquid can enter through the openings when doing so.
5. Place the rotors and accessories on a towel to dry. Place fixed-angle rotors with the rotor bores facing down so the bores can also dry.
6. Clean the rotor cone with a soft, dry, lint-free cloth. Do not lubricate the rotor cone.
7. Inspect the rotor cone for damage.
8. Place the dry rotor onto the motor shaft.
9. Tighten the rotor nut by turning it clockwise.
10. Leave the rotor lid open when the rotor is not being used.



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6.4 Decontamination before shipment

If you are shipping the device to the authorized Technical Service for repairs or to your authorized dealer for disposal please note the following:



WARNING! Risk to health from contaminated device.

1. Observe the information in the decontamination certificate. It is available as a PDF document on our webpage (<https://www.eppendorf.com/decontamination>).
2. Decontaminate all the parts to be shipped.
3. Include the fully completed decontamination certificate in the shipment.

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English (EN)**7 Troubleshooting**

If you cannot remedy an error with the recommended measures, please contact your local Eppendorf partner. The contact address can be found on the Internet at www.eppendorf.com.

7.1 General errors

Problem	Cause	Solution
No display.	No mains connection.	<ul style="list-style-type: none"> ▶ Check the mains connection. ▶ Check the mains fuse of the laboratory.
	Power failure.	<ul style="list-style-type: none"> ▶ Check the mains connection. ▶ Check the mains fuse of the laboratory.
The centrifuge lid cannot be opened.	Rotor is still running.	▶ Wait for the rotor to stop.
	Error message with locking time. Locking period still running.	▶ Wait for the locking time to elapse.
The centrifuge cannot be started.	Centrifuge lid is not closed.	▶ Close the centrifuge lid.
Centrifuge shakes when it starts up.	Rotor loaded unsymmetrically.	<ol style="list-style-type: none"> 1. Stop the centrifuge and load the rotor symmetrically. 2. Re-start the centrifuge.

7.2 Error messages

Key lock after error message

- If an error message occurs, the keys remain locked as long as the rotor is moving.
- For some errors, the remaining blocking time and the error message are alternately shown on the display. The blocking time also remains active if the centrifuge is disconnected from the mains/power line.

If an error message appears, proceed as follows:

- ▶ Remedy the fault as described in the "Remedy" column.
- ▶ Wait for the blocking time to elapse or the rotor to stop.
- ▶ To clear the error message from the display, press the **open** key.

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Problem	Cause	Solution
Er 3.1 Er 3.2 Er 3.3 Er 3.4 Er 3.5	Error in speed measuring system.	<ul style="list-style-type: none"> ▶ Tighten rotor. ▶ Wait for the blocking time to elapse. ▶ Press the open key.
Er 6.1 Er 6.2 Er 6.3 Er 6.4	<ul style="list-style-type: none"> • Error in the drive electronics. • The drive is overheated. 	<ul style="list-style-type: none"> ▶ Repeat the run. If the error message appears again: <ol style="list-style-type: none"> 1. Switch off centrifuge and wait for 20 s. 2. Switch on the centrifuge. If the error message appears again: <ul style="list-style-type: none"> ▶ Let the drive cool down for at least 15 min.
Er 10.0 Er 10.1 Er 10.2	Electronics fault.	<ol style="list-style-type: none"> 1. Switch off centrifuge and wait for 20 s. 2. Switch on the centrifuge.
Er 15.1 Er 15.2 Er 16.2 Er 16.3 Er 16.4	Electronics fault.	<ol style="list-style-type: none"> 1. Switch off centrifuge and wait for 20 s. 2. Switch on the centrifuge.
Int	Mains/power failure during a run.	<ul style="list-style-type: none"> ▶ Check the power supply. ▶ Press the open key.
Lid	Centrifuge lid will not lock.	<ul style="list-style-type: none"> ▶ Press the open key. ▶ Try again to close centrifuge lid.
	Centrifuge lid cannot be released.	<ul style="list-style-type: none"> ▶ Switch off centrifuge and wait for 20 s. ▶ Switch on the centrifuge. ▶ Press the open key. If the error occurs again: <ol style="list-style-type: none"> 1. Switch off centrifuge. 2. Activate the emergency lid release.
	Emergency release was actuated during a run.	<ul style="list-style-type: none"> ▶ Wait for the rotor to stop. ▶ Press the open key.

Troubleshooting30 MiniSpin®/MiniSpin® plus
English (EN)**7.3 Emergency release**

If the centrifuge lid cannot be opened during a power failure, you can activate the emergency release manually.

**WARNING! Risk of injury from rotating rotor.**

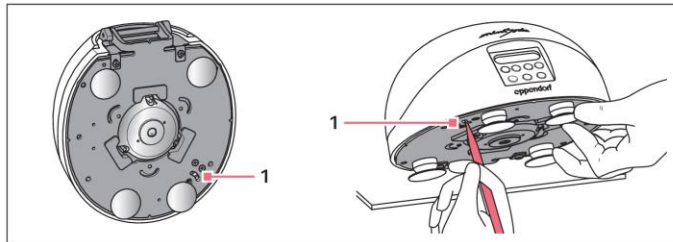
If the emergency release of the lid is operated, the rotor may continue to rotate for several minutes.

- ▶ Wait for the rotor to stop before activating the emergency release.
- ▶ To check, look through the monitoring glass in the centrifuge lid.

**CAUTION! Risk of burns to the fingers.**

The bottom of the centrifuge becomes very hot during the run.

- ▶ Check the temperature at the bottom of the centrifuge before lifting the centrifuge.
- ▶ Only hold the centrifuge at the sides.



1. Pull out the mains/power plug and wait for the rotor to stop.
2. Lift up the centrifuge. Use a ball pen to move the disk behind the opening of the bottom panel clockwise until the centrifuge lid opens.

8 Transport, storage and disposal

8.1 Transport

- ▶ Remove the rotor from the centrifuge before transport.
- ▶ Use the original packaging and the transport securing devices for transport.

	Air temperature	Relative humidity	Atmospheric pressure
General transport	-25 °C – 60 °C	10 % – 75 %	30 kPa – 106 kPa
Air freight	-20 °C – 55 °C	10 % – 75 %	30 kPa – 106 kPa

8.2 Storage

	Air temperature	Relative humidity	Atmospheric pressure
In transport packing	-25 °C – 55 °C	10 % – 75 %	70 kPa – 106 kPa
Without transport packing	-5 °C – 45 °C	10 % – 75 %	70 kPa – 106 kPa

8.3 Disposal

Observe the relevant legal regulations when disposing of the product.

Information on the disposal of electrical and electronic devices in the European Community:

Within the European Community, the disposal of electrical devices is regulated by national regulations based on EU Directive 2012/19/EU pertaining to waste electrical and electronic equipment (WEEE).

According to these regulations, any devices supplied after August 13, 2005, in the business-to-business sphere, to which this product is assigned, may no longer be disposed of in municipal or domestic waste. They are marked with the following symbol to indicate this:



As the disposal regulations may differ from one country to another within the EU, please contact your supplier for more information.

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9 Technical data

9.1 Power supply

	MiniSpin	MiniSpin plus
Mains/power connection	230 V, 50 Hz – 60 Hz 120 V, 50 Hz – 60 Hz 100 V, 50 Hz – 60 Hz	230 V, 50 Hz – 60 Hz 120 V, 50 Hz – 60 Hz 100 V, 50 Hz – 60 Hz
Power consumption	70 W	85 W
Current consumption	0.45 A (230 V) 0.9 A (120 V) 1.0 A (100 V)	0.6 A (230 V) 1.2 A (120 V) 1.3 A (100 V)
Overvoltage category	II	
EMC: Noise emission (radio interference)	230 V – EN 61326-1 / EN 55011 – Class B 120 V – CFR 47 FCC Part 15 – Class B 100 V – EN 61326-1 / EN 55011 – Class B	
EMC: Noise immunity	EN 61326 – 1 – basic electromagnetic environment	
Degree of pollution	2	

9.2 Ambient conditions

Environment	For indoor use only
Ambient temperature	10 °C – 40 °C
Relative humidity	10 % – 75 %, non-condensing
Atmospheric pressure	79,5 kPa – 106 kPa

9.3 Weight/dimensions

	MiniSpin	MiniSpin plus
Dimensions	Width: 225 mm (8.86 in) Depth: 230 mm (9.06 in) Height: 130 mm (5.12 in)	
Weight without rotor	3.7 kg (8.16 lb)	
Rotor weights:		
F-45-12-11	450 g	
F-55-16-5-PCR	210 g	

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9.4 Noise level

The noise level was measured according to (DIN EN ISO 3745) frontally in a sound measuring room with accuracy class 1 at a distance of 1 m from the device and at lab bench height.

	MiniSpin	MiniSpin plus
Noise level	< 49 dB(A)	< 52 dB(A)

9.5 Application parameters

	MiniSpin	MiniSpin plus
Cycle time	15 s – 30 min	<ul style="list-style-type: none"> • 15 s – 99 min • unlimited (oo)
	<ul style="list-style-type: none"> • 15 s – 1 min: can be set in increments of 15 s • from 1 min: can be set in increments of 1 min 	
Rotational speed	800 rpm – 13400 rpm	800 rpm – 14500 rpm
	can be set in increments of 100 rpm Tolerance at maximum rotational speed: 3 %	
Relative centrifugal force	100 × g – 12100 × g	100 × g – 14100 × g
		can be set in increments of 100 × g
Maximum load	12 × 2,0 mL	
Maximum kinetic energy	870J	1020J
Permitted density of the material for centrifuging (at maximum g-force (rcf) and/or speed (rpm) and maximum load)	1.2 g/mL	
Tolerance at maximum rotational speed	13 s	
Deceleration time from maximum rotational speed	12 s	

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English (EN)**9.6 Service life of accessories****CAUTION! Danger due to material fatigue.**

If the service life is exceeded, it cannot be guaranteed that the material of the rotors and the accessories will withstand the stresses during centrifugation.

- ▶ Do not use any accessories which have exceeded their maximum service life.

Eppendorf states the maximum service life of rotors and accessories both in years and in the maximum number of cycles. The decisive factor for the service life is which case occurs first, usually this is the number of years in operation.

Each centrifugation run during which the rotor is accelerated and braked is counted as a cycle, independent of the speed and the duration of the centrifugation run.

All other rotors and rotor lids can be used during the entire service life of the centrifuge if the following conditions are met:

- proper use
- recommended maintenance
- undamaged condition

Accessories	Maximum service life after first initial setup
Rotor lid of polycarbonate (PC), polypropylene (PP) or polyetherimide (PEI)	3 years
Aerosol-tight rotor lids with exchangeable seal (e.g., QuickLock rotor lids)	3 years (replace seals every 50 autoclaving cycles)
Non-aerosol-tight rotor lids	3 years
Adapter	1 year

The date of manufacture is stamped on the rotors and buckets in the format *03/15* or *03/2015* (= March 2015). On the inside of the plastic rotor lids and aerosol-tight caps, the date of manufacture is stamped in the form of a clock ⌚.

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9.7 Rotors

i Eppendorf centrifuges may only be operated with rotors that are intended for use with the corresponding centrifuge.







▶ Only use rotors that are intended for use with the corresponding centrifuge.

9.7.1 Rotor F-45-12-11

Fixed-angle rotor for 12 tubes

	Maximum <i>g</i> -force:	MiniSpin MiniSpin plus	12100 × <i>g</i> 14100 × <i>g</i>
	Maximum speed:	MiniSpin MiniSpin plus	13400 rpm 14500 rpm
	Maximum load (tubes and contents):		12 × 4 g




Rotor F-45-12-11

Tube	Tube Capacity Tubes per adapter/ rotor	Adapter Order no. (international)	Bottom shape Tube diameter	Maximum <i>g</i> -force: Maximum speed: Radius
	PCR tube 0.2 mL 1/30	 5425 715.005	conical Ø 11 mm	MiniSpin MiniSpin plus MiniSpin MiniSpin plus 7830 × <i>g</i> 9170 × <i>g</i> 13400 rpm 14500 rpm 3.9 cm
	Tube 0.4 mL 1/30	 5425 717.008	conical Ø 6 mm	MiniSpin MiniSpin plus MiniSpin MiniSpin plus 12100 × <i>g</i> 14100 × <i>g</i> 13400 rpm 14500 rpm 6.0 cm
	Tube 0.5 mL 1/30	 5425 716.001	conical Ø 6 mm	MiniSpin MiniSpin plus MiniSpin MiniSpin plus 9840 × <i>g</i> 11520 × <i>g</i> 13400 rpm 14500 rpm 4.9 cm

Manuals - (002) OMGLP MiniSpin MiniSpinPlus 5452 900 035-04 022021 en print- Manual

OMGLP_MiniSpin_MiniSpinPlus_5452_900_035-04_022021_en_de_fr_it_es_pt_print.fm Seite 36 Dienstag, 20. April 2021 11:28

Technical data
 36 MiniSpin®/MiniSpin® plus
 English (EN)

Tube	Tube Capacity Tubes per adapter/ rotor	Adapter Order no. (international)	Bottom shape Tube diameter	Maximum <i>g</i> -force:	
				Maximum speed:	Radius
	Microtainers 0.6 mL 1/30	 5425 716.001	open Ø 8 mm	MiniSpin MiniSpin plus MiniSpin MiniSpin plus	12 100 × <i>g</i> 14 100 × <i>g</i> 13 400 rpm 14 500 rpm 6.0 cm
	Tube 1.5 ml/2.0 mL -/30		Ø 11 mm	MiniSpin MiniSpin plus MiniSpin MiniSpin plus	12 100 × <i>g</i> 14 100 × <i>g</i> 13 400 rpm 14 500 rpm 6.0 cm

Manuals - (002) OMGLP MiniSpin MiniSpinPlus 5452 900 035-04 022021 en print- Manual


OMGLP_MiniSpin_MiniSpinPlus_5452_900_035-04_022021_en_de_fr_it_es_pt_print.fm Seite 37 Dienstag, 20. April 2021 11:28



Technical data
 MiniSpin®/MiniSpin® plus
 English (EN)

37

9.7.2 Rotor F-55-16-5-PCR

Fixed-angle rotor for 16 PCR tubes

	Maximum <i>g</i> -force:	MiniSpin MiniSpin plus	9840 × <i>g</i> 11520 × <i>g</i>
	Maximum speed:	MiniSpin MiniSpin plus	13400 rpm 14500 rpm
Rotor F-55-16-5-PCR	Maximum load (tubes and contents):		16 × 0.43 g (2 × 3.5 g)

Tubes	Tube Capacity Tubes per adapter/rotor	Bottom shape Tube diameter	Maximum <i>g</i> -force:	
			Maximum speed:	Centrifugation radius
	0.2 mL -/16	conical Ø 6 mm	MiniSpin MiniSpin plus	9840 × <i>g</i> 11520 × <i>g</i>
	0.2 mL -/2 × 8	conical Ø 6 mm	MiniSpin MiniSpin plus	13400 rpm 14500 rpm 4.9 cm

Manuals - (002) OMGLP MiniSpin MiniSpinPlus 5452 900 035-04 022021 en print- Manual

OMGLP_MiniSpin_MiniSpinPlus_5452_900_035-04_022021_en_de_fr_it_es_pt_print.fm Seite 38 Dienstag, 20. April 2021 11:28

Ordering information
38 MiniSpin®/MiniSpin® plus
 English (EN)

10 Ordering information
10.1 Accessories

Order no. (International)	Order no. (North America)	Description
5452 725.000 5452 720.008	022668501 022668498	Rotor F-45-12-11 angle 45°, 12 places, max. tube diameter 11 mm, incl. rotor lid and rotor nut MiniSpin MiniSpin/MiniSpin plus
5452 702.000	022668510	Rotor lid for rotor F-45-12-11 stainless steel, with rotor nut
5452 727.007	022665821	Rotor F-55-16-5-PCR angle 55°, 16 places, max. tube diameter 5 mm, incl. rotor lid (aluminum) MiniSpin/MiniSpin plus
5452 730.008	022665847	Rotor lid for rotor F-55-16-5-PCR aluminum, with rotor nut
5452 729.000	022668455	Rotor nut for MiniSpin, MiniSpin plus
5425 716.001	022636227	Adapter used in FA-45-48-11, F-45-48-11, FA-45-30-11, F-45-30-11, F-45-48-11, F-45-70-11, FA-45-24-11, FA-45-24-11-Special, FA-45-24-11-HS and FA-45-24-11-Kit for 1 sample tube (0.5 mL, max. Ø 6 mm) or 1 Microtainer (0.6 mL, max. Ø 8 mm), set of 6
5425 717.008	022636243	Adapter used in FA-45-48-11, F-45-48-11, F-45-12-11, FA-45-18-11, FA-45-30-11, F-45-30-11, F-45-24-11, F-45-70-11, FA-45-24-11-HS, FA-45-24-11-Kit and S-24-11-AT for 1 micro test tube (0.4 mL, max. Ø 6 mm), set of 6

Manuals - (002) OMGLP MiniSpin MiniSpinPlus 5452 900 035-04 022021 en print- Manual

OMGLP_MiniSpin_MiniSpinPlus_5452_900_035-04_022021_en_de_fr_it_es_pt_print.fm Seite 39 Dienstag, 20. April 2021 11:28

Ordering information
MiniSpin®/MiniSpin® plus
English (EN)

39

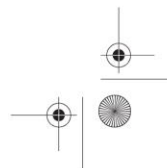
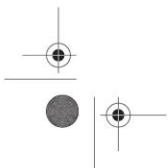
Order no. (International)	Order no. (North America)	Description
5425 715.005	022636260	Adapter used in FA-45-48-11, F-45-48-11, FA-45-30-11, F-45-30-11, F-45-24-11, F-45-70-11, FA-45-24-11, FA-45-24-11-Special, FA-45-24-11-HS and FA-45-24-11-Kit for 1 PCR tube (0.2 mL, max. Ø 6 mm), set of 6

Order no. (International)	Order no. (North America)	Description
0013 563.934	–	Mains/power cord 230 V/50 Hz, Europe
0013 594.490	–	230 V/50 Hz, GB/HK
0013 613.952	–	230 V/50 Hz, CN
0013 592.454	–	230 V/50 Hz, AUS
0013 613.973	–	230 V/50 Hz, ARG
0013 563.942	022377183	120 V USA

Manuals - (002) OMGLP MiniSpin MiniSpinPlus 5452 900 035-04 022021 en print- Manual

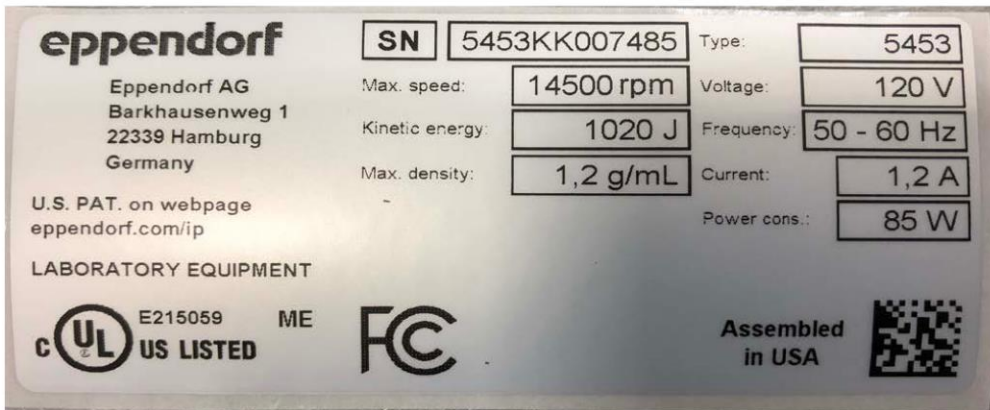
OMGLP_MiniSpin_MiniSpinPlus_5452_900_035-04_022021_en_de_fr_it_es_pt_print.fm Seite 40 Dienstag, 20. April 2021 11:28

Ordering information
40 MiniSpin®/MiniSpin® plus
English (EN)



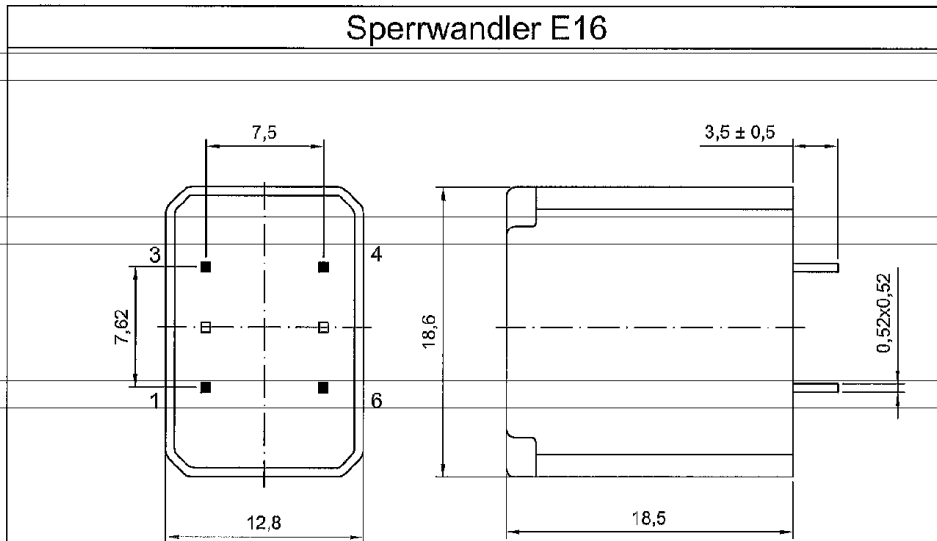
Marking Label - (003) Marking labels

Marking Label - (003) Marking labels




Miscellaneous - (02) Construction drawing of Hartu Transformer

Miscellaneous - (02) Construction drawing of Hartu Transformer



Übersetzungsverhältnis W1 : W2 : 6,35 : 1
 Leerlaufinduktivität $L_{0 W1}$: 4,65 mH ± 25%
 gemessen bei 10 kHz / 50 mV
 Streuinduktivität $L_{s W1}$: ≤ 139 µH
 gemessen bei 20°C / 10 kHz / 50 mV
 Gleichstromwiderstand R_{cu} bei $T_u = 20^\circ\text{C}$ W1 : 3,000 Ω ± 15%
 Gleichstromwiderstand R_{cu} bei $T_u = 20^\circ\text{C}$ W2 : 360 mΩ ± 15%
 Prüfspannung -Wicklung geg. -Wicklung : 1500 V / 50 Hz / 2 s
 Klimakategorie n. DIN IEC 60068 Teil 1 : 40 / 125 / 21
 Isolierklasse B (130°C)

Vollverguss

Stift- oder Drahtlänge "ohne" Zinnspitze, ab Auflagefläche Bauteil gemessen!		Gewicht in kg ca. 0,0086		Anschlußpins u. dazugehöriger LochØ der Prüflinge in mm			
Bauabmessungen = Maximalmaße		Muster Nr.: M 28208		Pins	Art	Maße	LochØ Toleranz
● = Wicklungsanfang		Kunden Nr.:		1,3,4,6	■	0,52x0,52	1,0 +0,1
Erstellt	01-07-09	UD	PM HARTU S.A.R.L.	Ersatz für:		Blatt: 1	
Prüfung	01-07-09	SEV	Rue Annaba - Z.I.	ersetzt durch:		von: 1	
Freigabe	01-07-09	KA	TN - 2013 Den Arous	 Datenblatt 717283-51			
Änd. Zust.			Tel. + 216 71 387802				
Datbl-2-2000	Datum	Zeichen	Fax. + 216 71 387928				

Miscellaneous - (02) Construction drawing of Hartu Transformer



Specification of insulation materials

Type 717283-51

Insulation	Manufacturer	Tradename	Chemical name	File
Bobbin / Coilformer insulation	BASF SE	Ultramid A3X2G5	Polyamide 66	E41871
Case insulation	BASF SE	Ultramid A3X2G5	Polyamide 66	E41871
Polyester tape	CMC Klebtechnik	10260	Polyester	E93622
Drown material	Du Pont Performance Coatings Wevo	Volatex 3110/5131 PU 552FL/300HARDENER PU 403FL/300REHARDENER	Polyurethan casting resin	E72640 E108835
Magnet wire insulation	Schwing&Hasse Heermann	SH Sold V155 SH Sold V180 Heersolit V155 Heersolit V180	Polyurethane	E75926 E174210

i.V. Kammenhuber
Götz-Udo Hartmann GmbH & Co. KG

Miscellaneous - (03) Description of interlock circuit

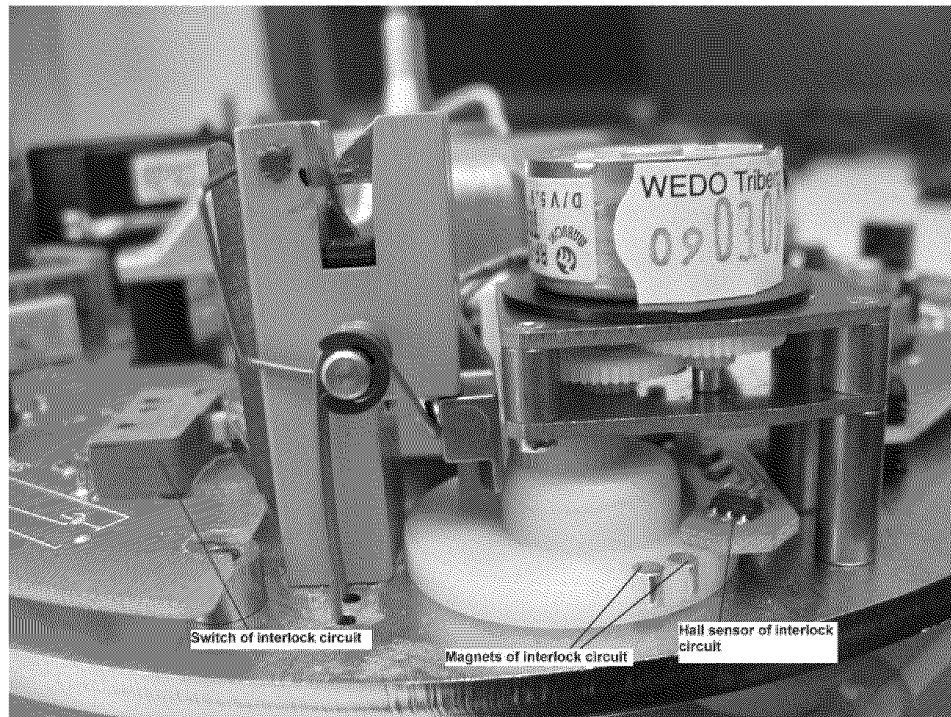
Miscellaneous - (03) Description of interlock circuit

Description of the Interlock Circuit copied from E215059, Volume1, Section 1.

Pictures of switch and hall contact were added for later reference. T.H. 2013-01-16

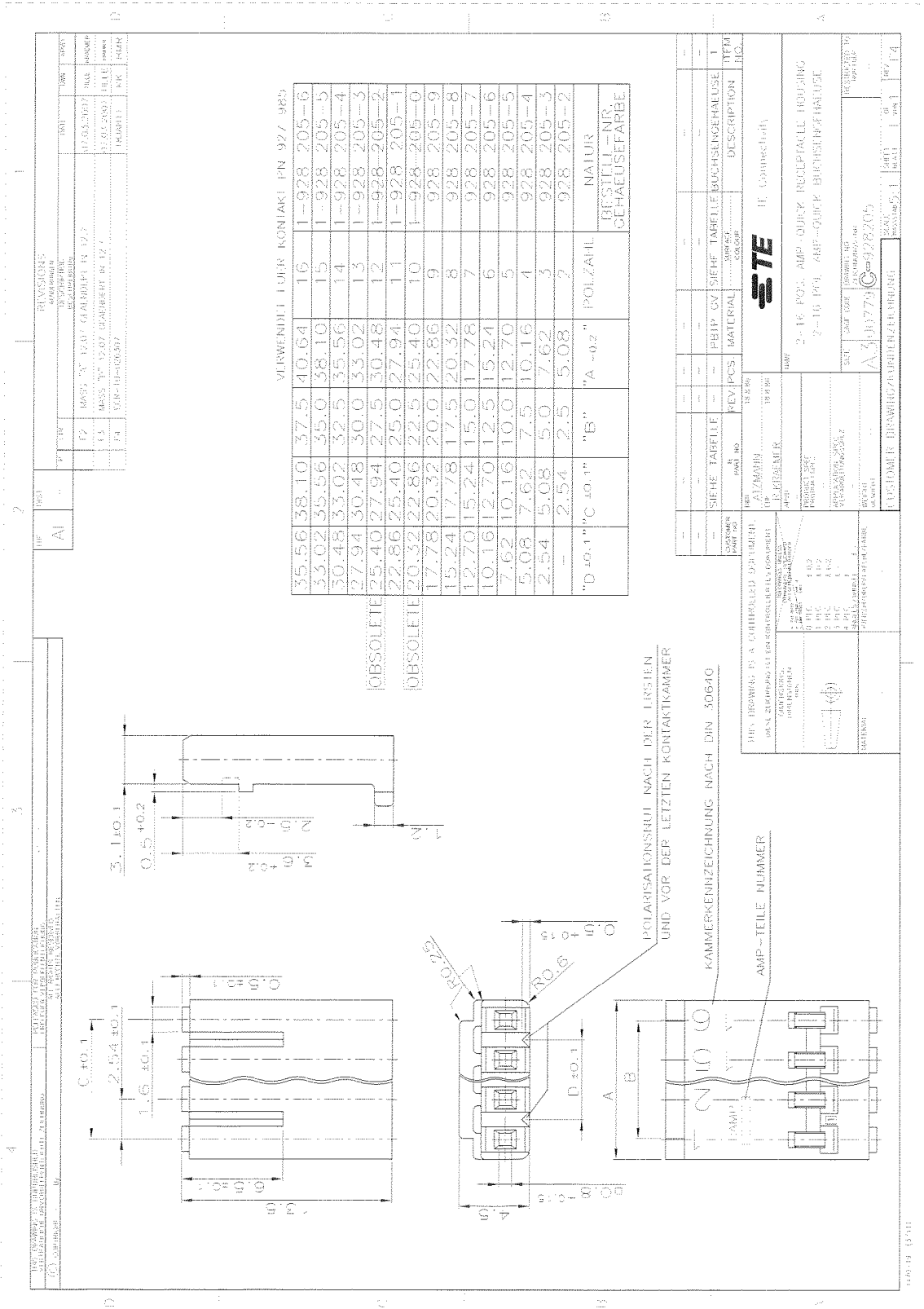
Interlock Assembly - Provided with geared motor (5 V DC), controlling mechanical latch engaged to the lid hook.

A switch signals when the lid is put on and the hook is closed by geared motor automatically. A Hall contact signals when the hook is in latch position. (In addition the hall contact only releases the power conversation equipment in a closed position. The lid opens automatically when the rotor has a standstill. An additional signal was created by the rpm-sensor and make sure that the LID will not open when rotor is still rotating. See page 8 item 24)



Miscellaneous - (04) Drawing AMP Quick

Miscellaneous - (04) Drawing AMP Quick



VIERWENDEL I UBER KONIAKI PN 977 985

REV. NO.	REV. DATE	REV. BY	REV. DESCRIPTION
1	08/25/07	...	...
2	08/25/07	...	...
3	08/25/07	...	...
4	08/25/07	...	...

REV. NO.	REV. DATE	REV. BY	REV. DESCRIPTION
1	08/25/07
2	08/25/07
3	08/25/07
4	08/25/07

REV. NO.	REV. DATE	REV. BY	REV. DESCRIPTION
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2	08/25/07
3	08/25/07
4	08/25/07

REV. NO.	REV. DATE	REV. BY	REV. DESCRIPTION
1	08/25/07
2	08/25/07
3	08/25/07	...	...
4	08/25/07	...	...

11% BELEGUNG IN A-GEHÄUSE (30.1) UND VOR DER LETZTEN KONTAKTKAMMER

KAMMERKENNZEICHNUNG NACH DIN 50640

AMP-TEILE NUMMER

STE II, Connecticut

2-16 POL. AMP-QUICK RECEPTACLE HOUSING

2-16 POL. AMP-QUICK BURSHENGEHÄUSE

REV. NO. 10779 C-028205

DATE 08/25/07

BY ...

DESCRIPTION ...

REVISIONS HISTORY

REV. NO. REV. DATE REV. BY REV. DESCRIPTION

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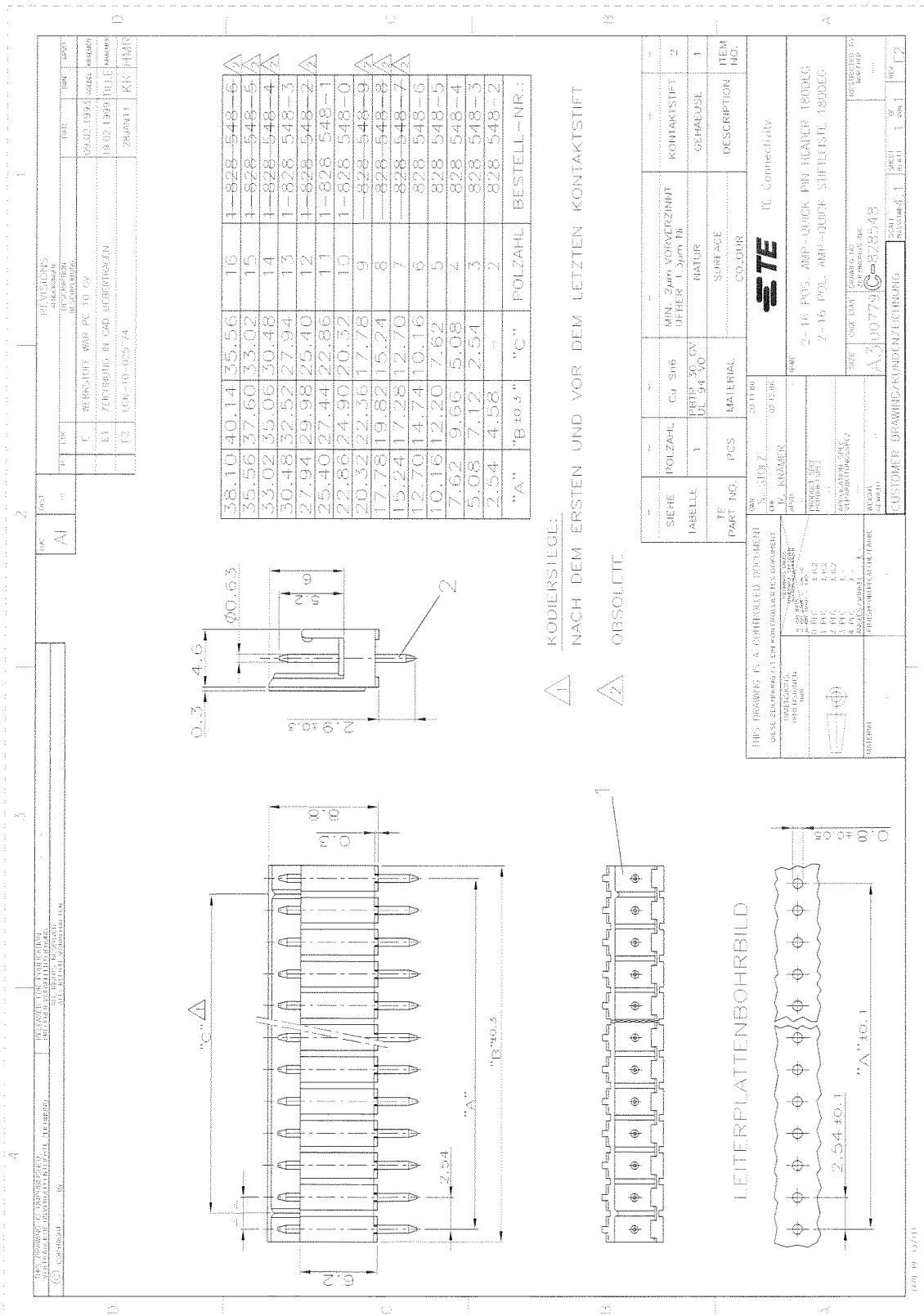
2 08/25/07 ...

3 08/25/07 ...

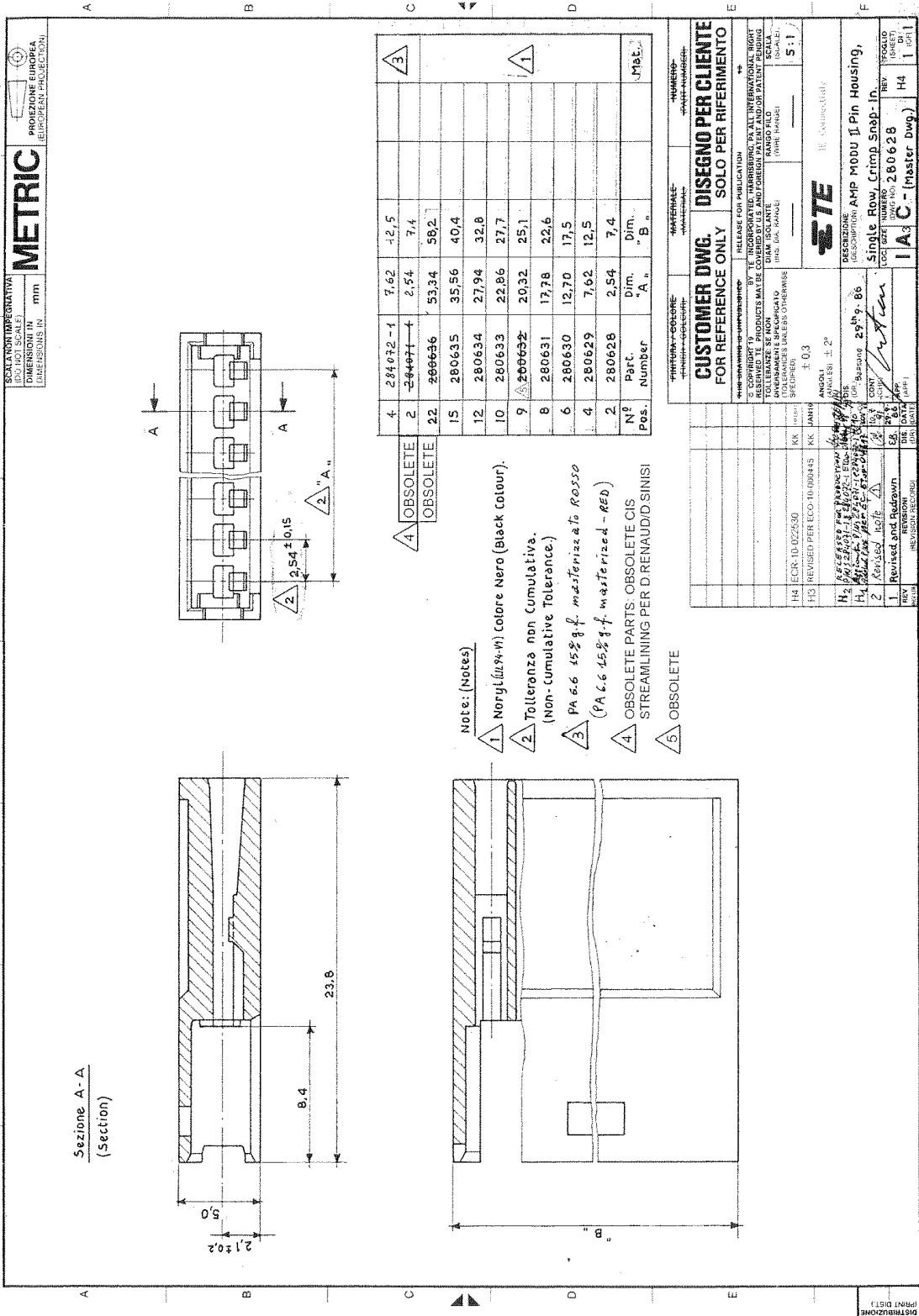
4 08/25/07 ...

440-19 (5/01)

Miscellaneous - (04) Drawing AMP Quick



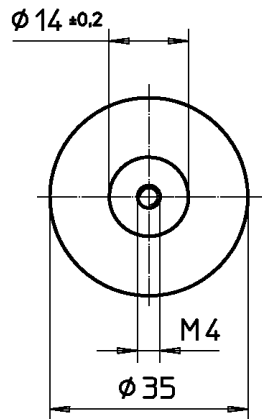
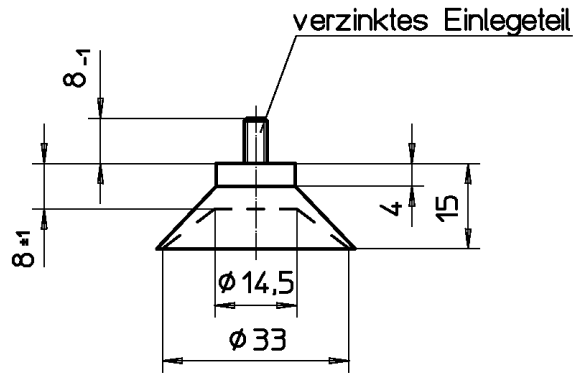
Miscellaneous - (05) Drawing AMPMODU II



Miscellaneous - (06) Drawing centrifuge foot

Miscellaneous - (06) Drawing centrifuge foot

Nur zur Information
For information only



9
8
7
6
5
4
3
2
1
0

Datum	Name	Material	
Gez.: 01.09.94	Sr	PVC	GBE
Gepr.:		farblos, transparent	
Norm:		0000 000.000	
Maßst.:			

1:1

Saugfuß

0013 010.234-01

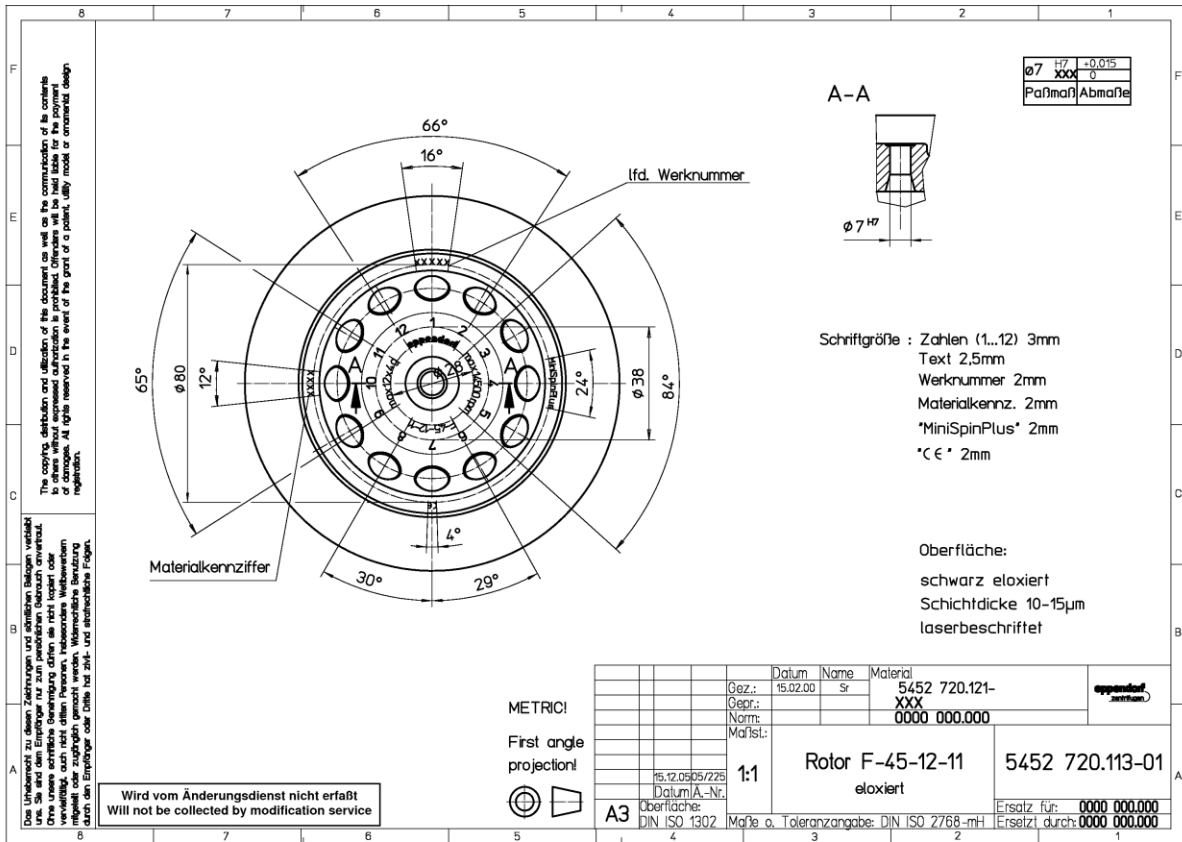
17.06.94 94/868

Datum Ä.-Nr. Maße o. Toleranzangabe: ±0,5

Ersatz für: 0000 000.000
Ersetzt durch: 0000 000.000

Miscellaneous - (07) Drawing rotor F45-12-11

Miscellaneous - (07) Drawing rotor F45-12-11



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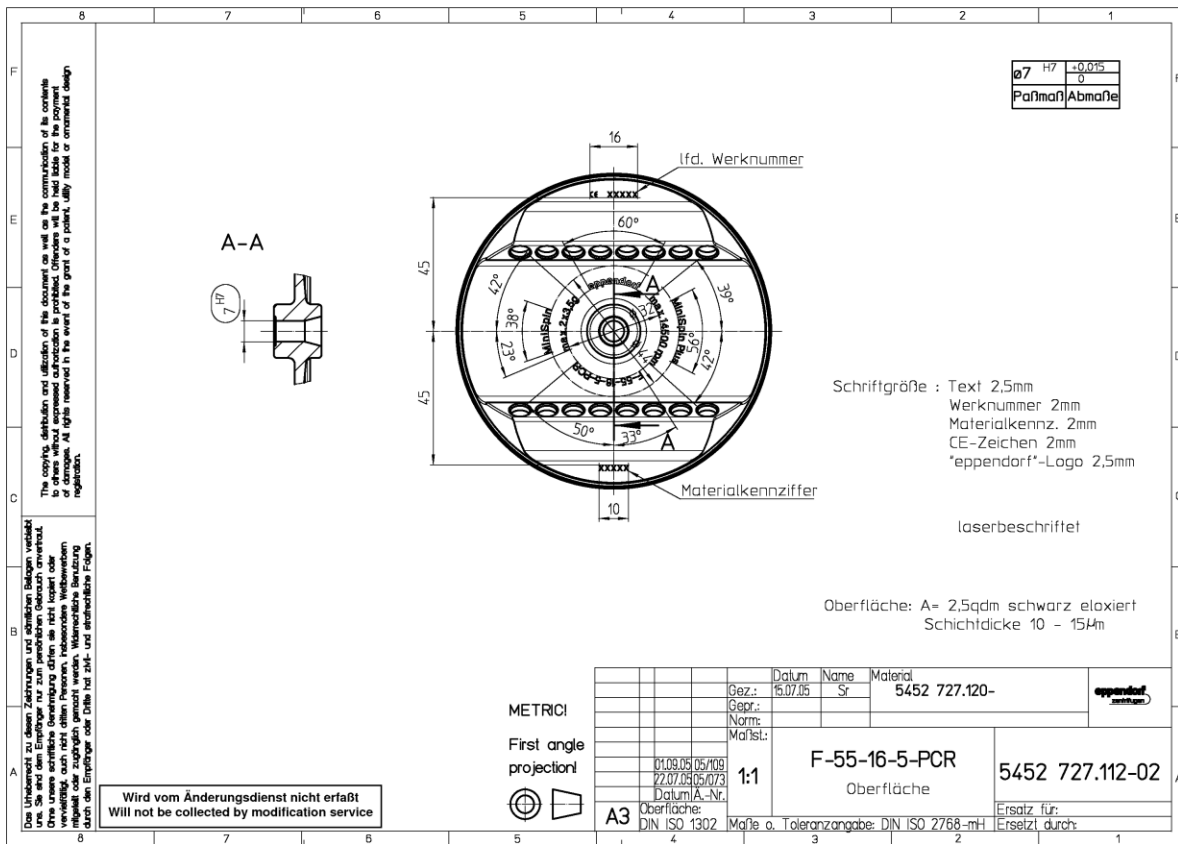
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Will not be collected by modification service

METRIC!
First angle projection



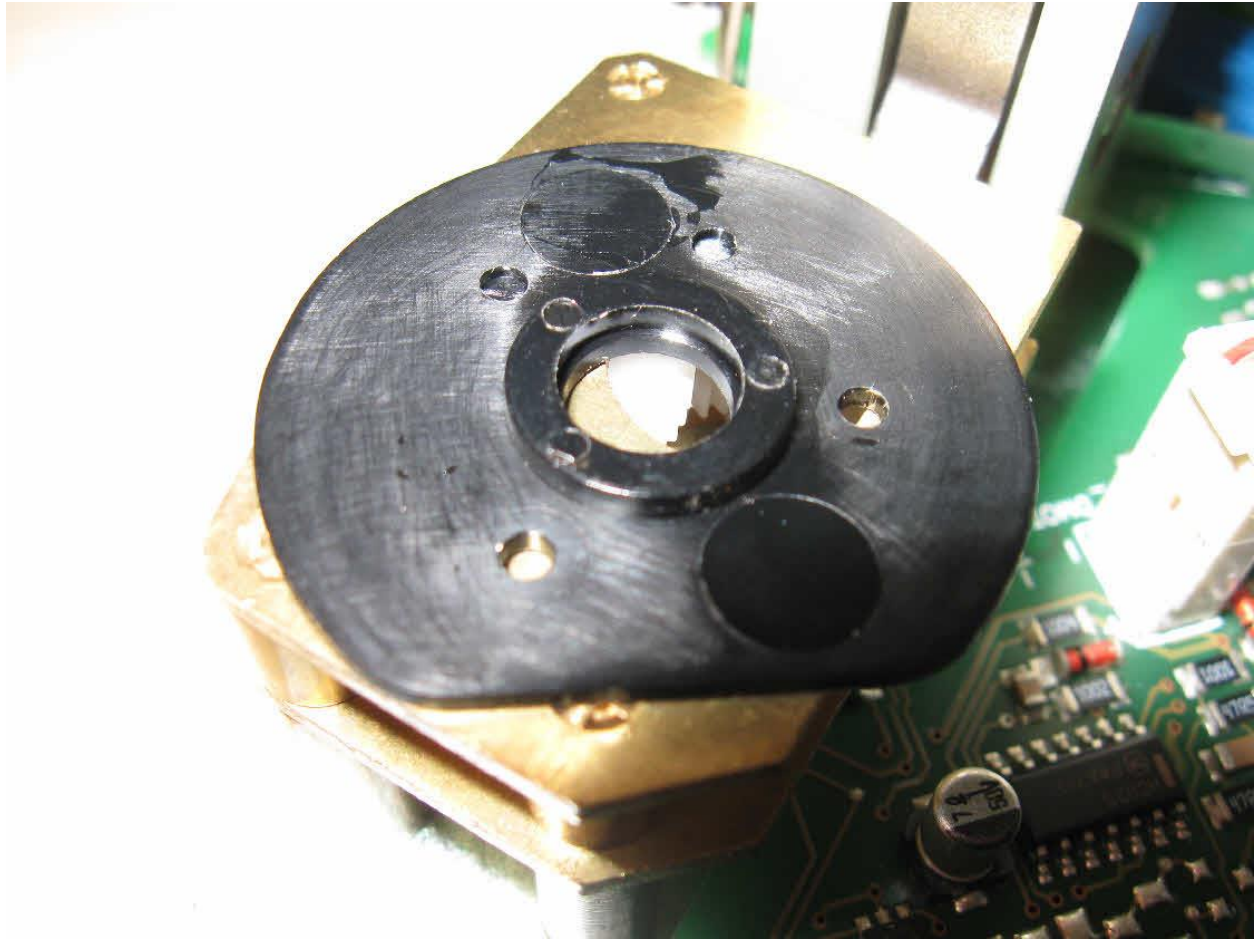
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Miscellaneous - (08) Drawing rotor F55-16-5-PCR



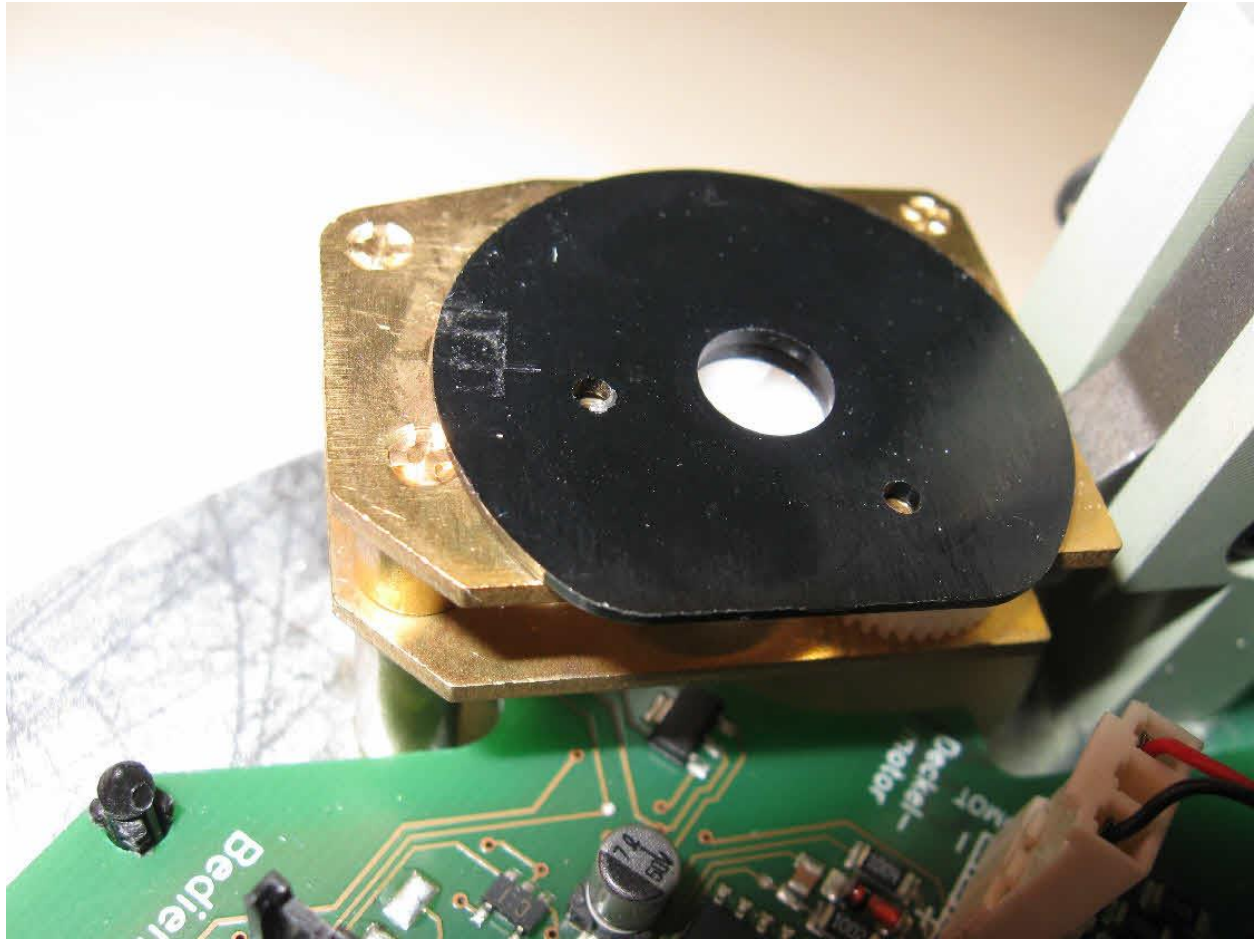
Miscellaneous - (10) Plastic underlay of motor bottom side

Miscellaneous - (10) Plastic underlay of motor bottom side



Miscellaneous - (11) Plastic underlay of motor top side


Miscellaneous - (11) Plastic underlay of motor top side



Miscellaneous - (12) Transformer TR200 - Renco Electronics Inc. S005701

Miscellaneous - (12) Transformer TR200 - Renco Electronics Inc. S005701

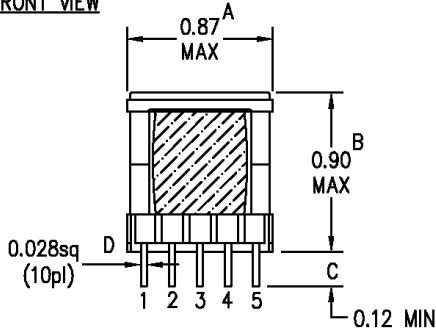
FRM-DOC-15



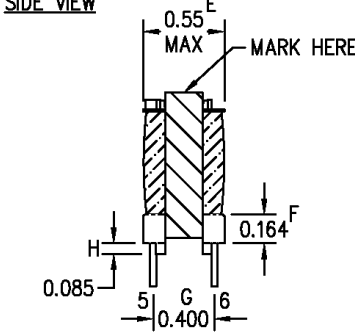
RENCO ELECTRONICS, INC.

595 INTERNATIONAL PL. • ROCKLEDGE, FLORIDA 32955
 ph. (321)637-1000 fax (321)637-1600
 web www.rencousa.com < > email engineering@rencousa.com

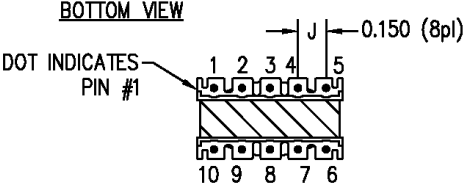
FRONT VIEW



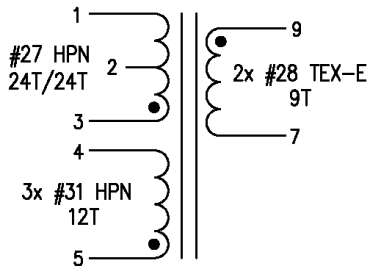
SIDE VIEW



BOTTOM VIEW



SCHEMATIC



ELECTRICAL TEST PARAMETERS:

INDUCTANCE @ 100kHz/0.10VAC
 L(3-1)=370µH ±7%
 RANGE: (395.9µH-395.9µH)

LEAKAGE INDUCTANCE @ 100kHz/0.10VAC
 SHORT PINS: 4,5,7,9
 Le(3-1)=5µH MAX

DC RESISTANCE OHMS (Ω) ±15% @ 25°C
 RDC(3-1)=0.300Ω (9-7)=0.035Ω
 (5-4)=0.075Ω

HIPOT
 APPLY: 3750VAC @ 60Hz FOR 1 SEC
 BTWN PINS 1,4 TO 9
 APPLY: 1500VDC FOR 1 SEC
 BTWN PINS 1 TO 4
 APPLY: 2500VAC @ 60Hz FOR 1 SEC
 BTWN PINS 1,4,9 TO CORE

TECHNICAL SPECIFICATION

	SUPPLIER	PART #	DESCRIPTION	UL FILE #
1	ACME INC	FERRITE, MnZn	CORE	N/A
2	SUMITOMO BAKELITE CO. LTD	PHENOLIC PM-9630	BOBBIN	E41429
3	FURUKAWA	TEX-E	TRIPLE INSULATED WIRE	E206440
4	3M	#1350F-1 TAPE	WINDING TAPE	E17385
5	VARIOUS	NEMA MW-75C	WIRE, HEAVY POLY	VARIOUS
6	DOLPHS	BC-346A	VARNISH	E51047

THIS COMPONENT COMPLIES WITH A UL CLASS B (130°C) INSULATION SYSTEM ADOPTED BY RENCO ELECTRONICS UNDER UL FILE E73291 AND IS DESIGNATED BY R130, TABLE II.

RoHS COMPLIANT: YES NO (REFERENCE: S005701)

- TOLERANCES -	
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES	
.XX=±	.03
.XXX=±	.015
ANGULAR=±	3°
FRACTIONAL=±	1/16"

DWN BY	DATE	CUSTOMER NAME
IAR	06/08/15	EPENDORF ZENTRIFUGEN
ENGR CONTACT	REV	DESCRIPTION
I. RENSING	N/A	FLYBACK TRANSFORMER
SIZE	SCALE=	THIS DOCUMENT IS FOR REFERENCE ONLY
A	NONE	

PAGE
1 of 1

COMPONENT DRAWING

FILE NAME
RL-10388

Photographs - (01) 01. Mini Spin front view

Photographs - (01) 01. Mini Spin front view



Photographs - (02) 02. Mini Spin front view with Lid open

Photographs - (02) 02. Mini Spin front view with Lid open



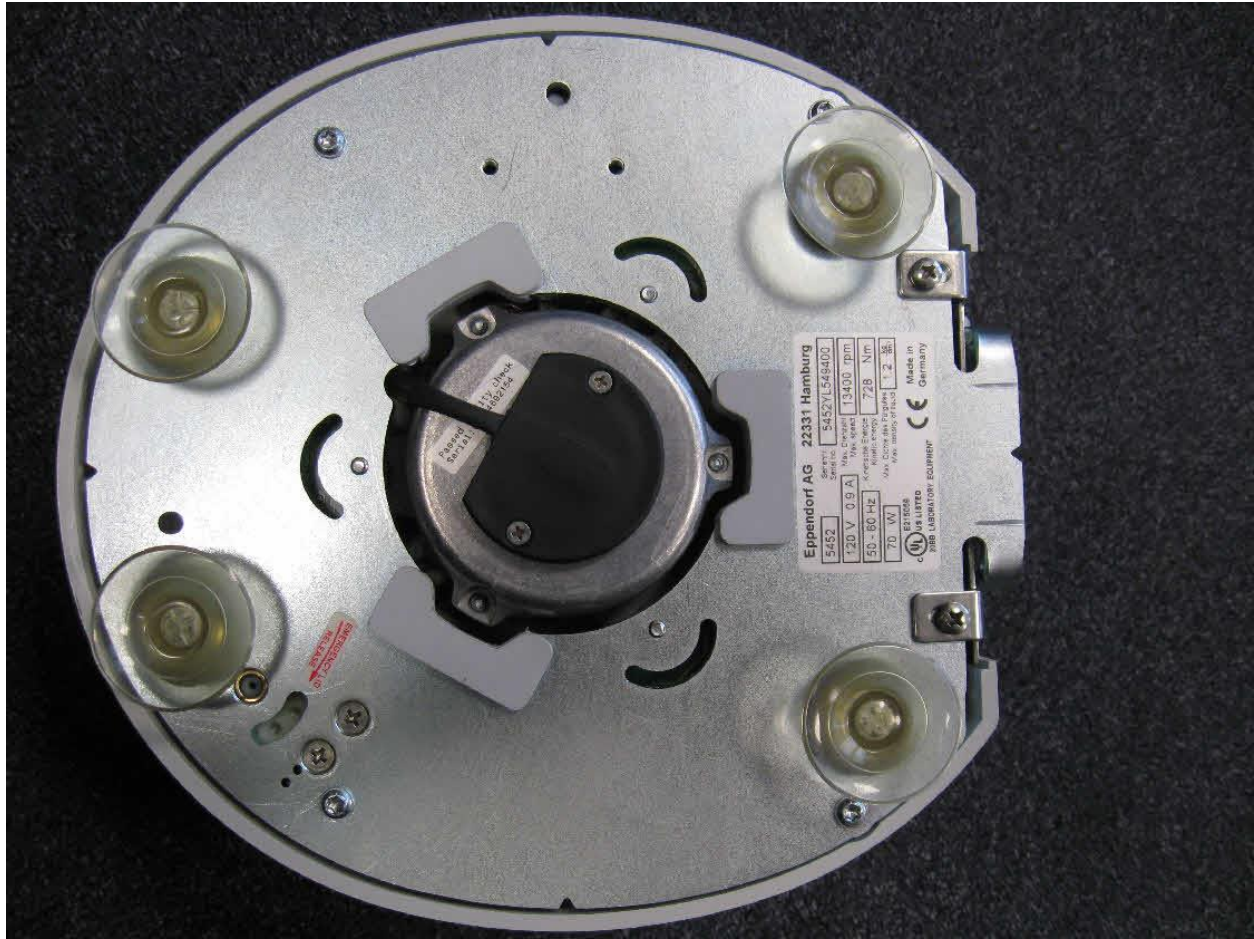
Photographs - (03) 03. Mini Spin rear view

Photographs - (03) 03. Mini Spin rear view



Photographs - (04) 04. Mini Spin bottom view

Photographs - (04) 04. Mini Spin bottom view



Photographs - (05) 05. RMP Sensor on bottom side

Photographs - (05) 05. RMP Sensor on bottom side



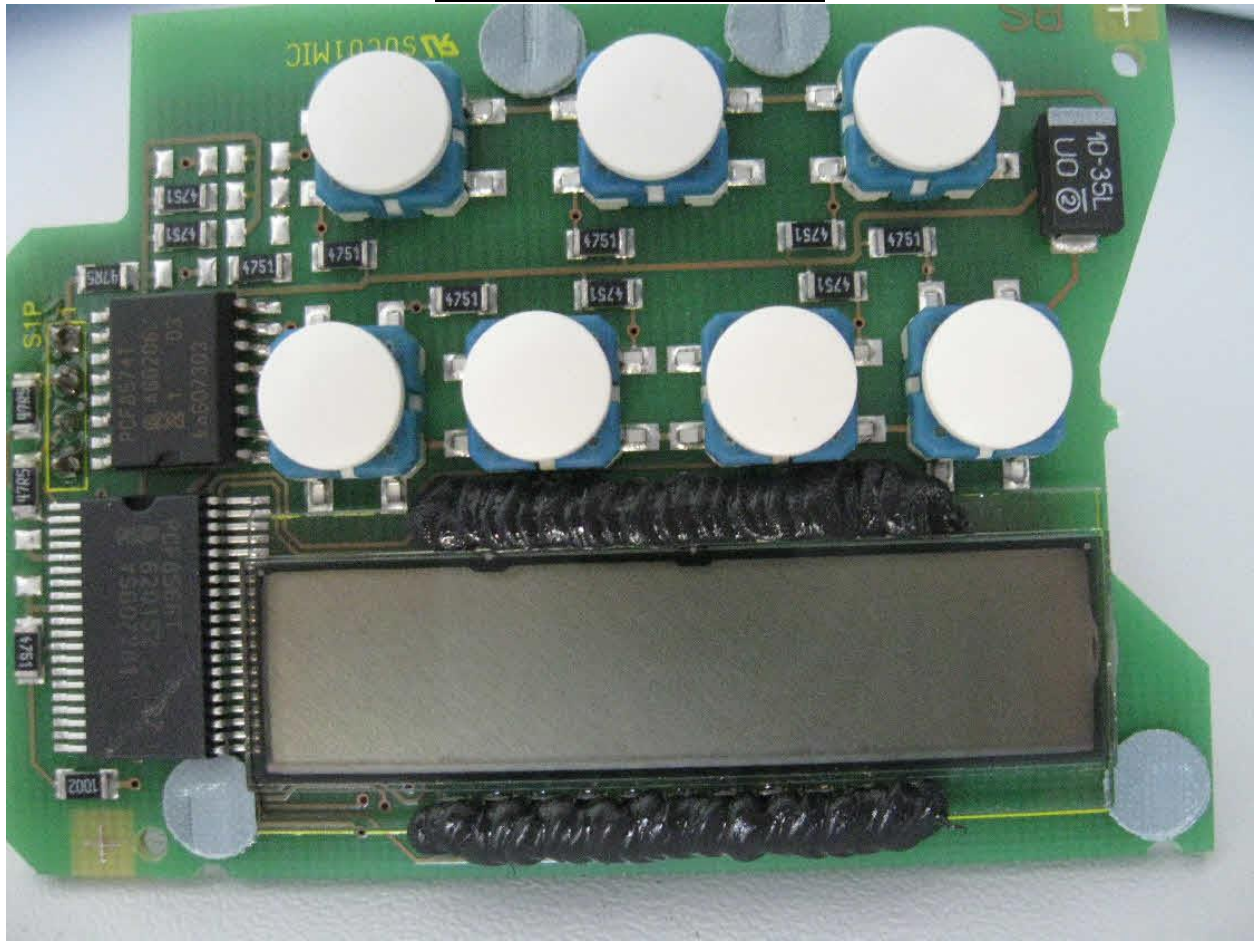
Photographs - (06) 06. Mini Spin Main Board

Photographs - (06) 06. Mini Spin Main Board



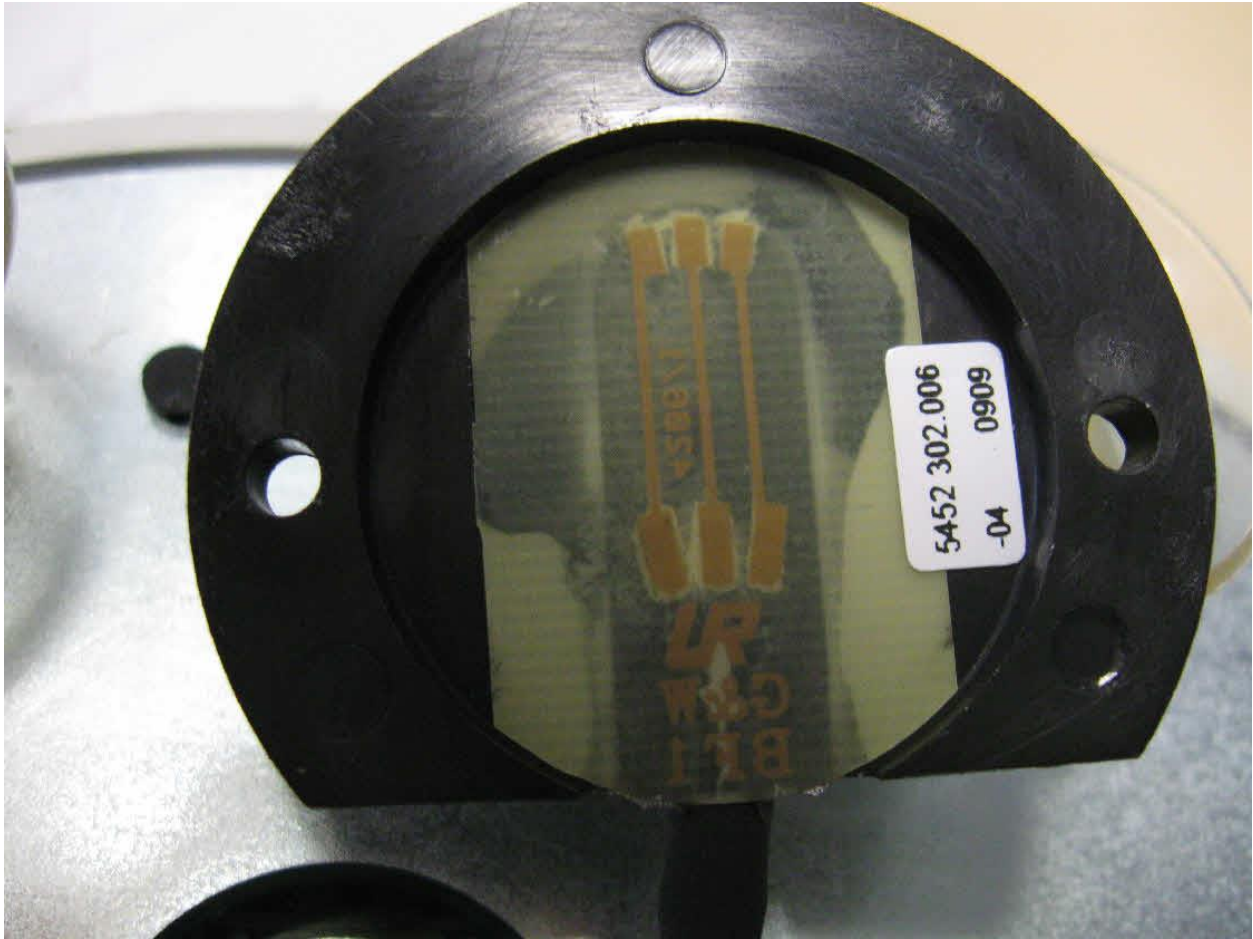
Photographs - (07) 07. Display PWB

Photographs - (07) 07. Display PWB



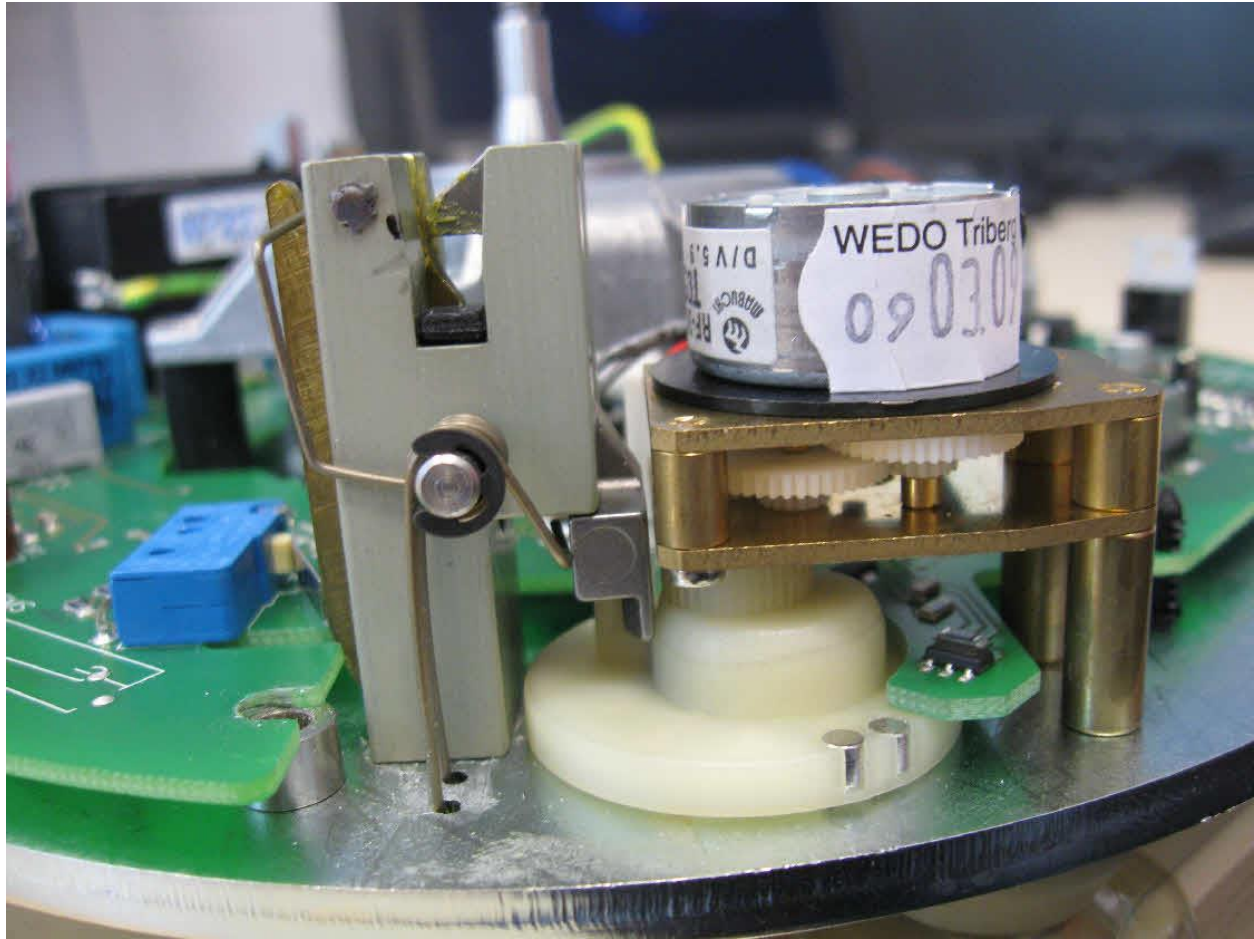
Photographs - (08) 08. PWB of RMP Sensor on bottom side

Photographs - (08) 08. PWB of RMP Sensor on bottom side



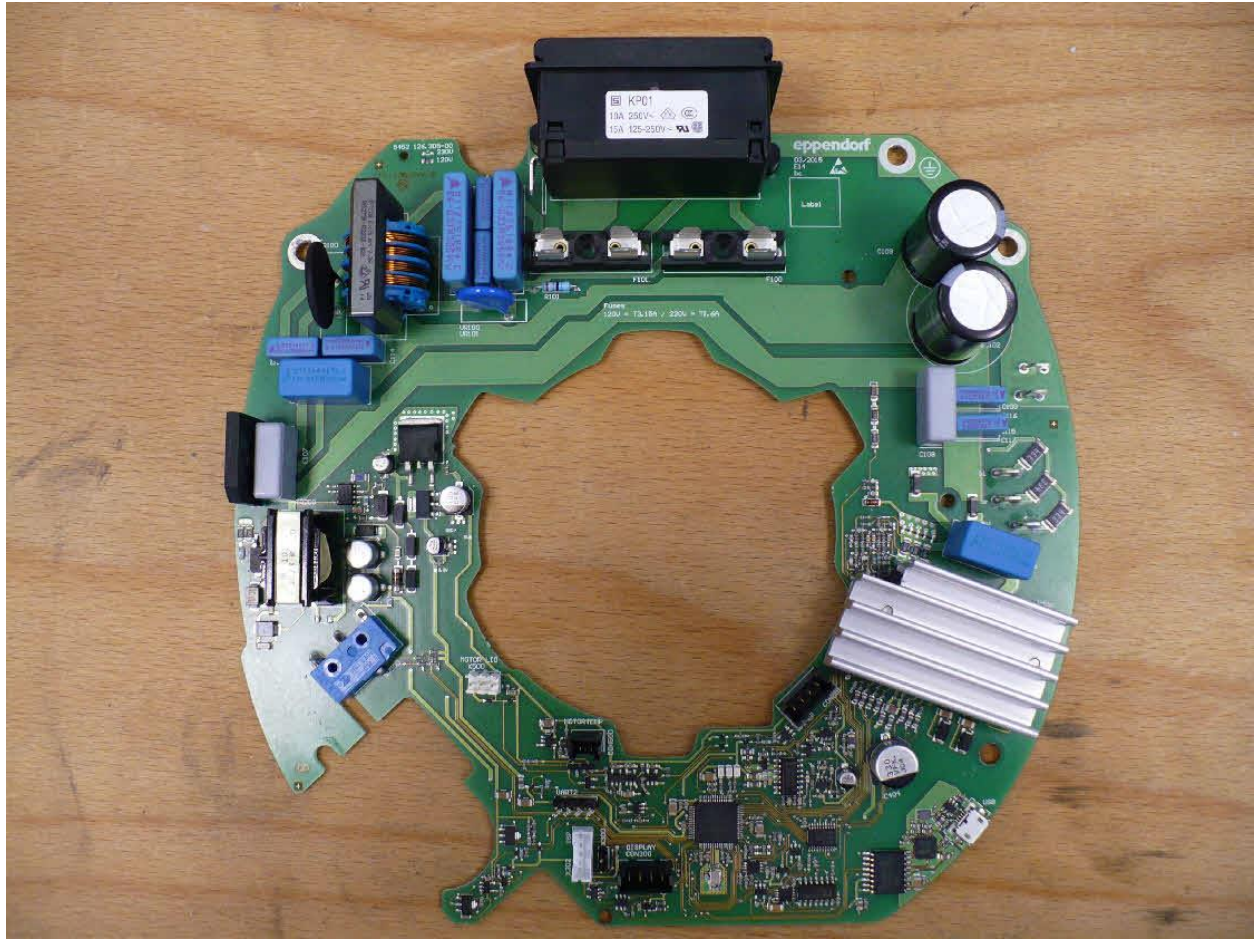
Photographs - (09) 09. Interlock circuit including switch, hall sensor and

Photographs - (09) 09. Interlock circuit including switch, hall sensor and



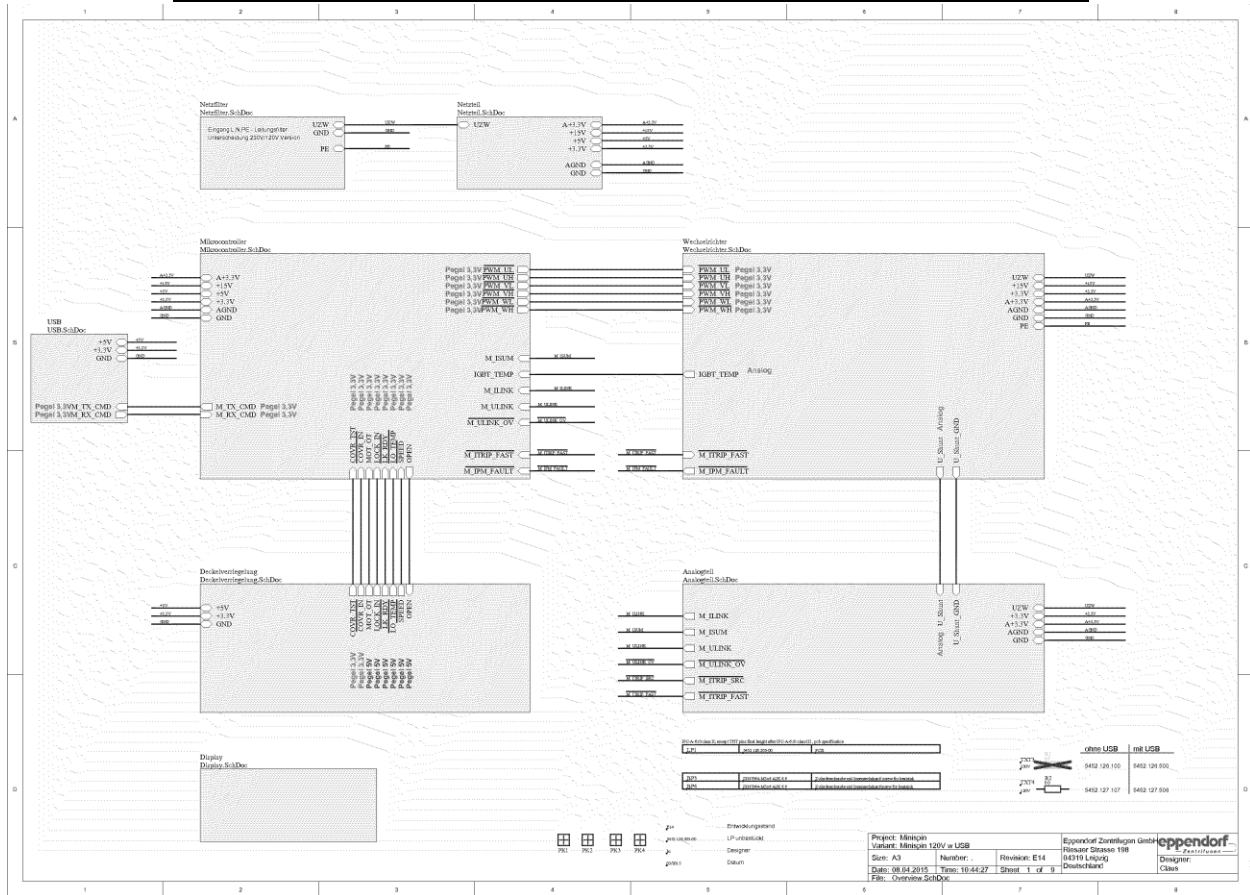
Photographs - (10) 10. Mini Spin Alternate Main Board

Photographs - (10) 10. Mini Spin Alternate Main Board

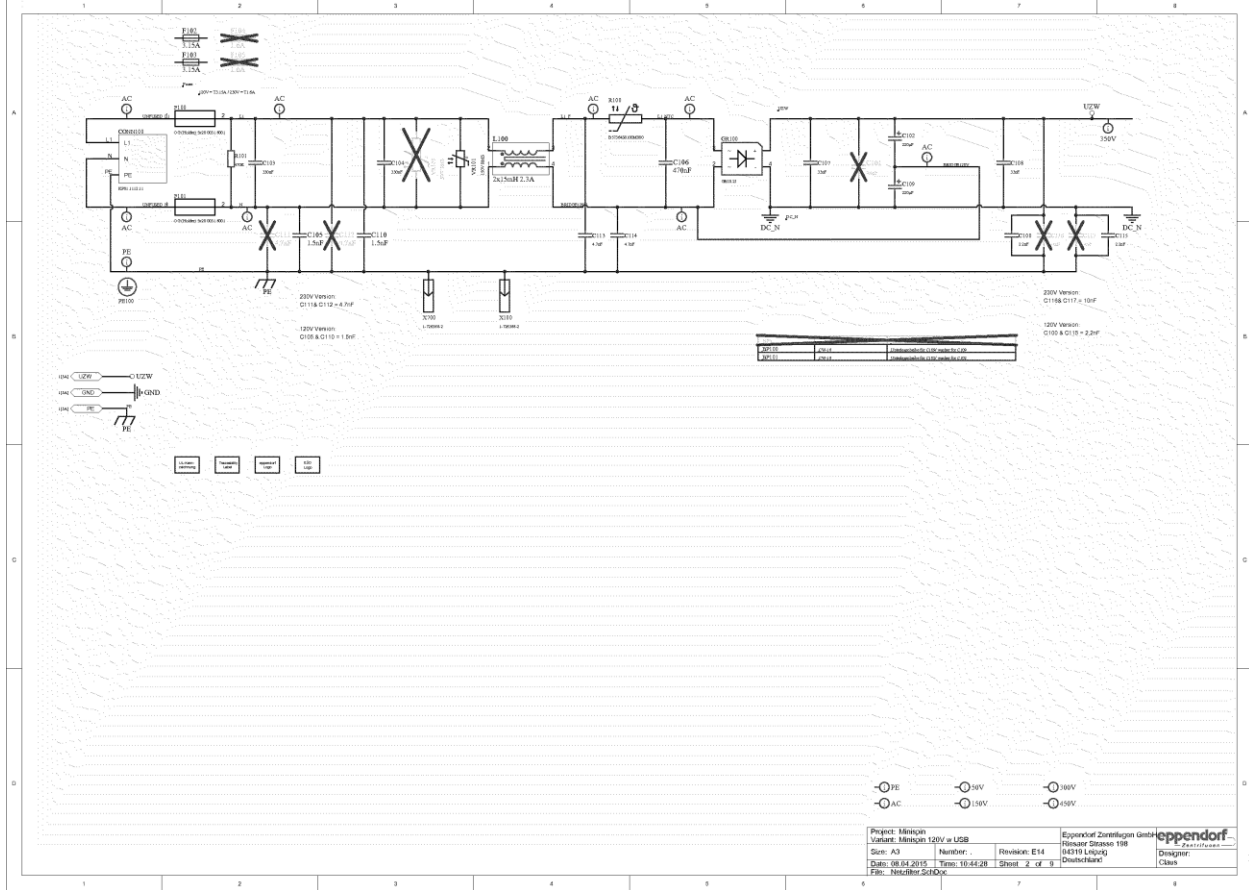


Schematics + PWB - (01) Electrical circuit diagram - alternate Mains PWB - PN_5452

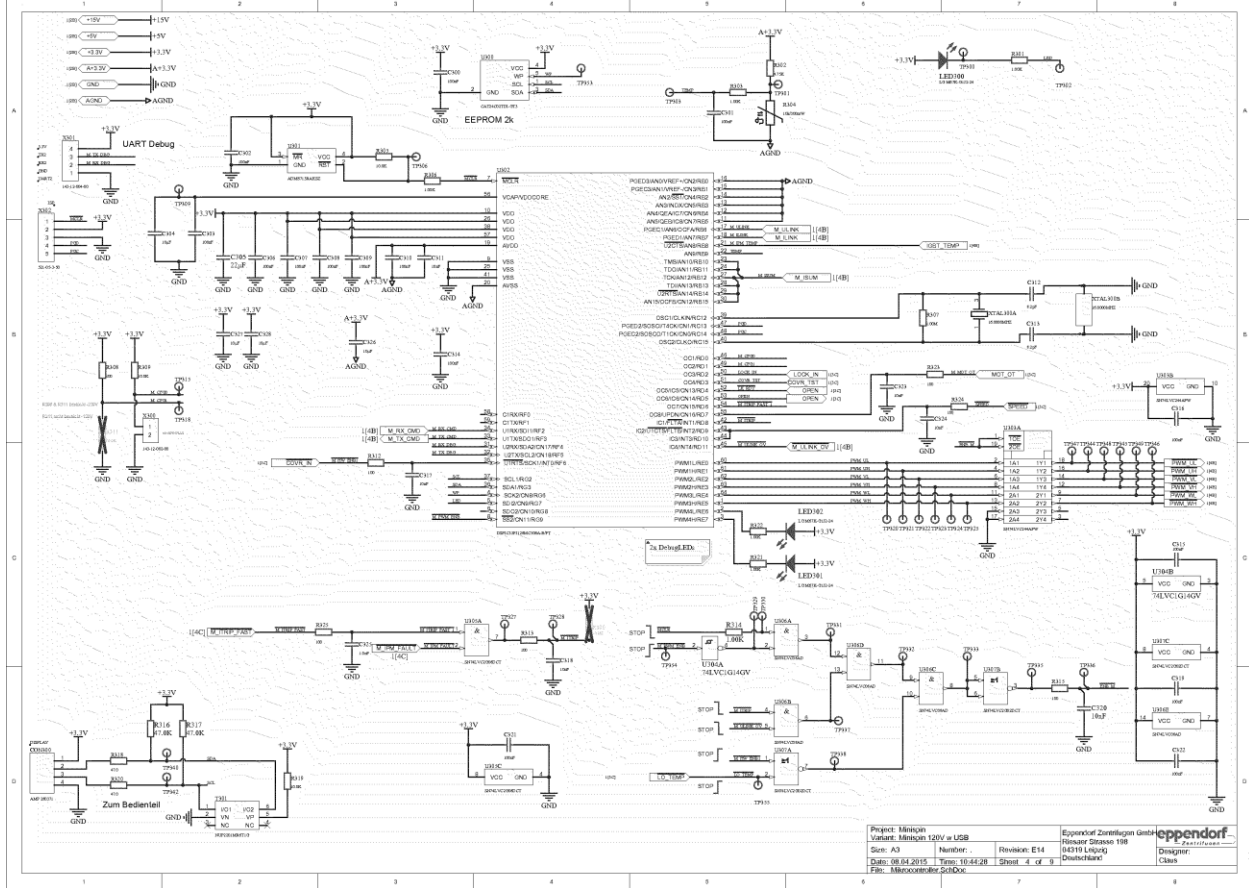
Schematics + PWB - (01) Electrical circuit diagram - alternate Mains PWB - PN_5452



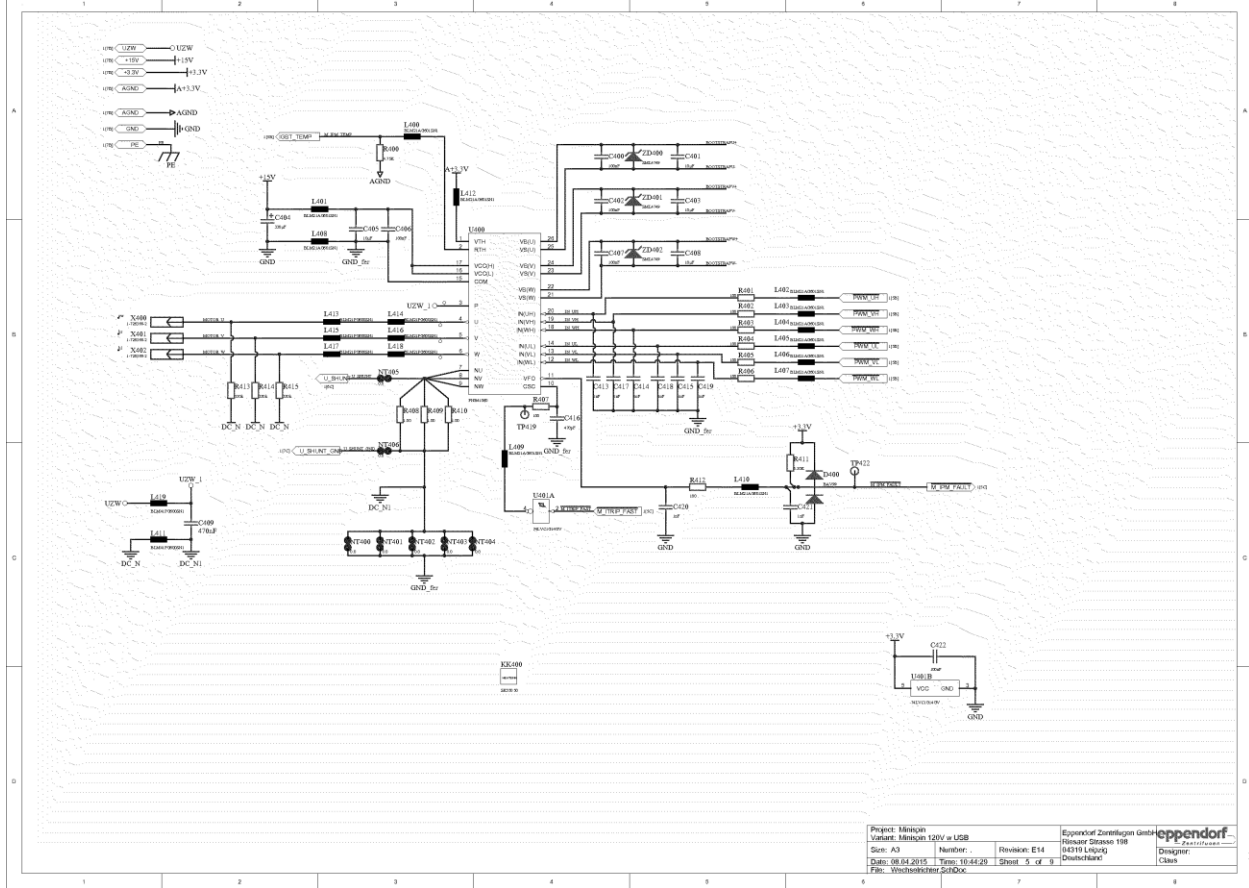
Schematics + PWB - (01) Electrical circuit diagram - alternate Mains PWB - PN 5452



Schematics + PWB - (01) Electrical circuit diagram - alternate Mains PWB - PN 5452

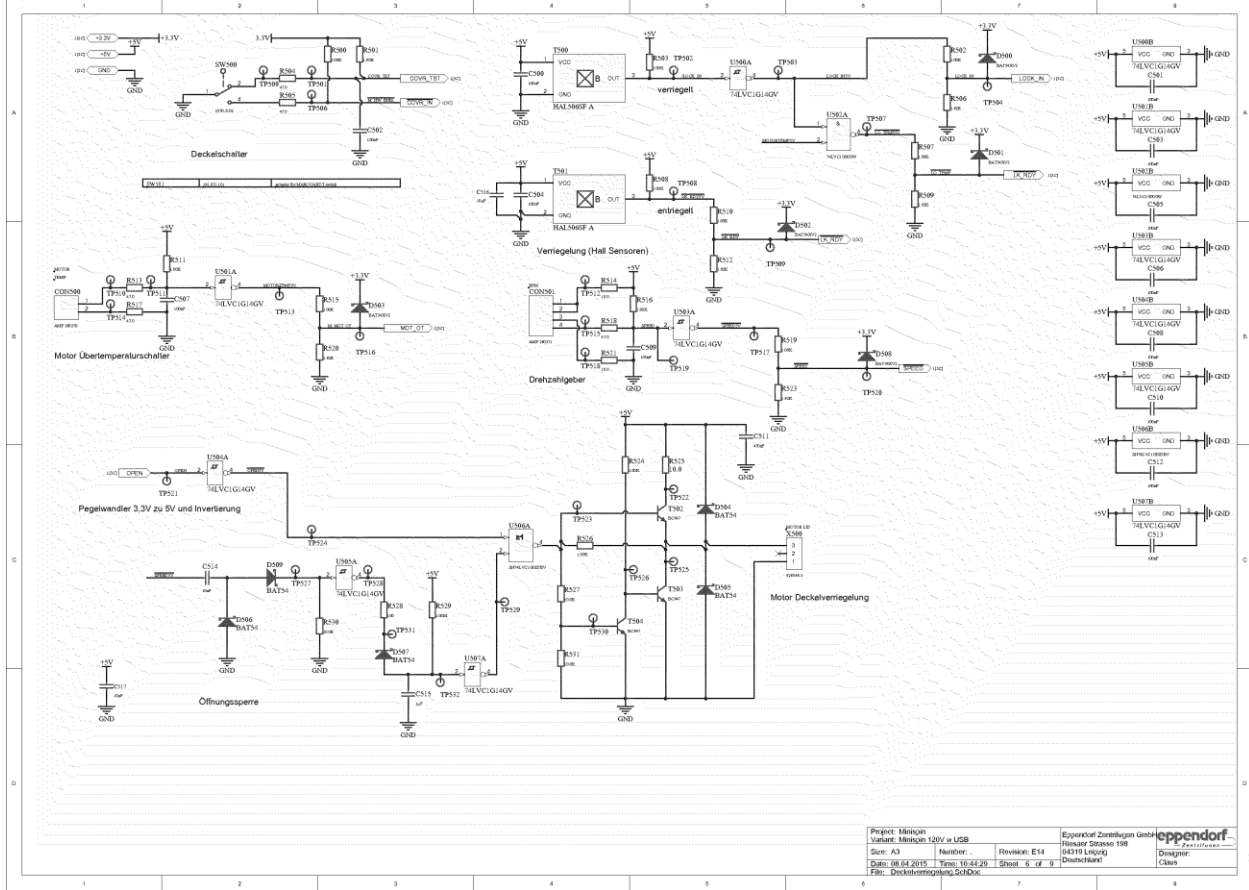


Schematics + PWB - (01) Electrical circuit diagram - alternate Mains PWB - PN 5452



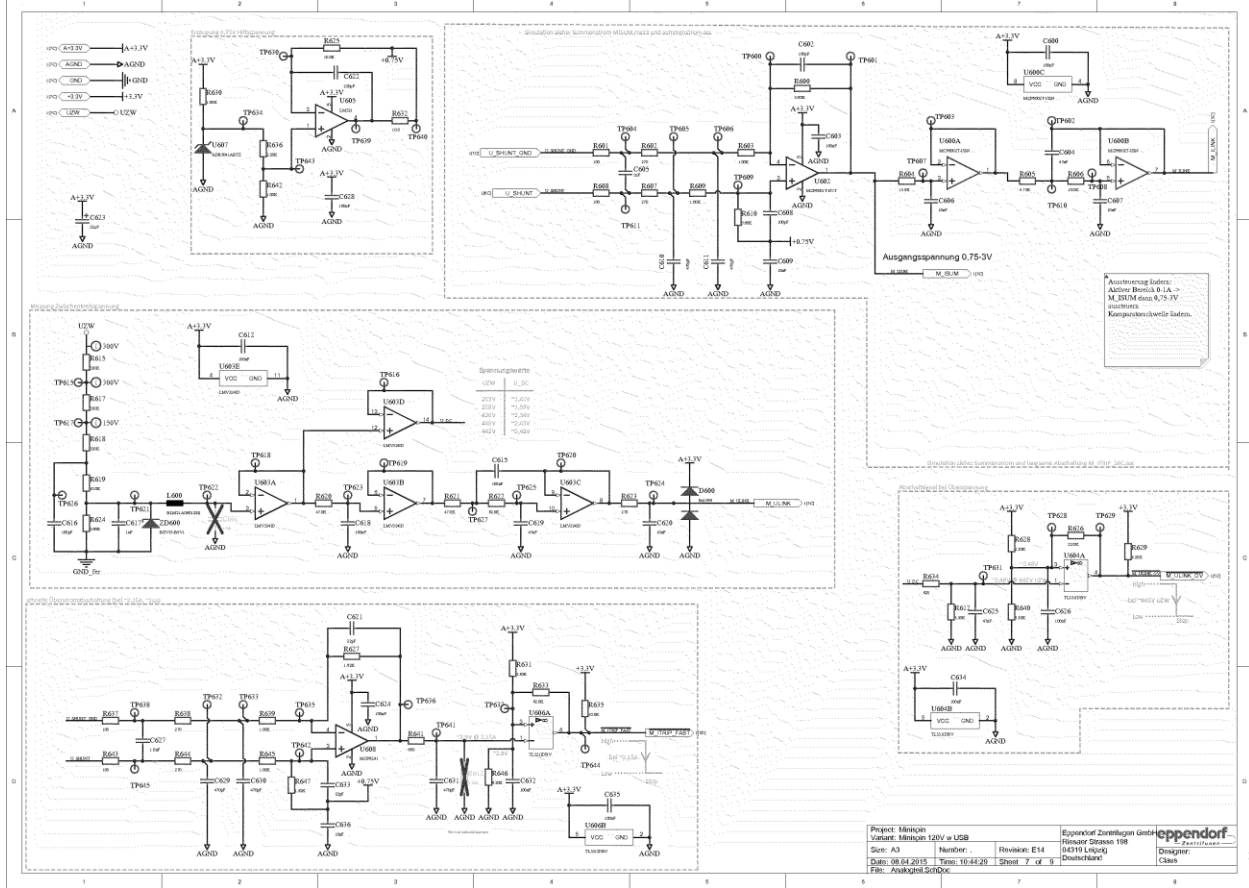
Project: Mischen	Erpenhofer Zentrale GmbH
Variante: Mischen 120V in USB	Steuer Gruppe 118
Size: A3	Number: ..
Date: 08.04.2015	Time: 10:44:20
Page: 5 of 9	Revision: E14
File: Weichschleifer 508Doc	04319 Leipzig
	Deutschland
	Designer:
	Claws

Schematics + PWB - (01) Electrical circuit diagram - alternate Mains PWB - PN 5452

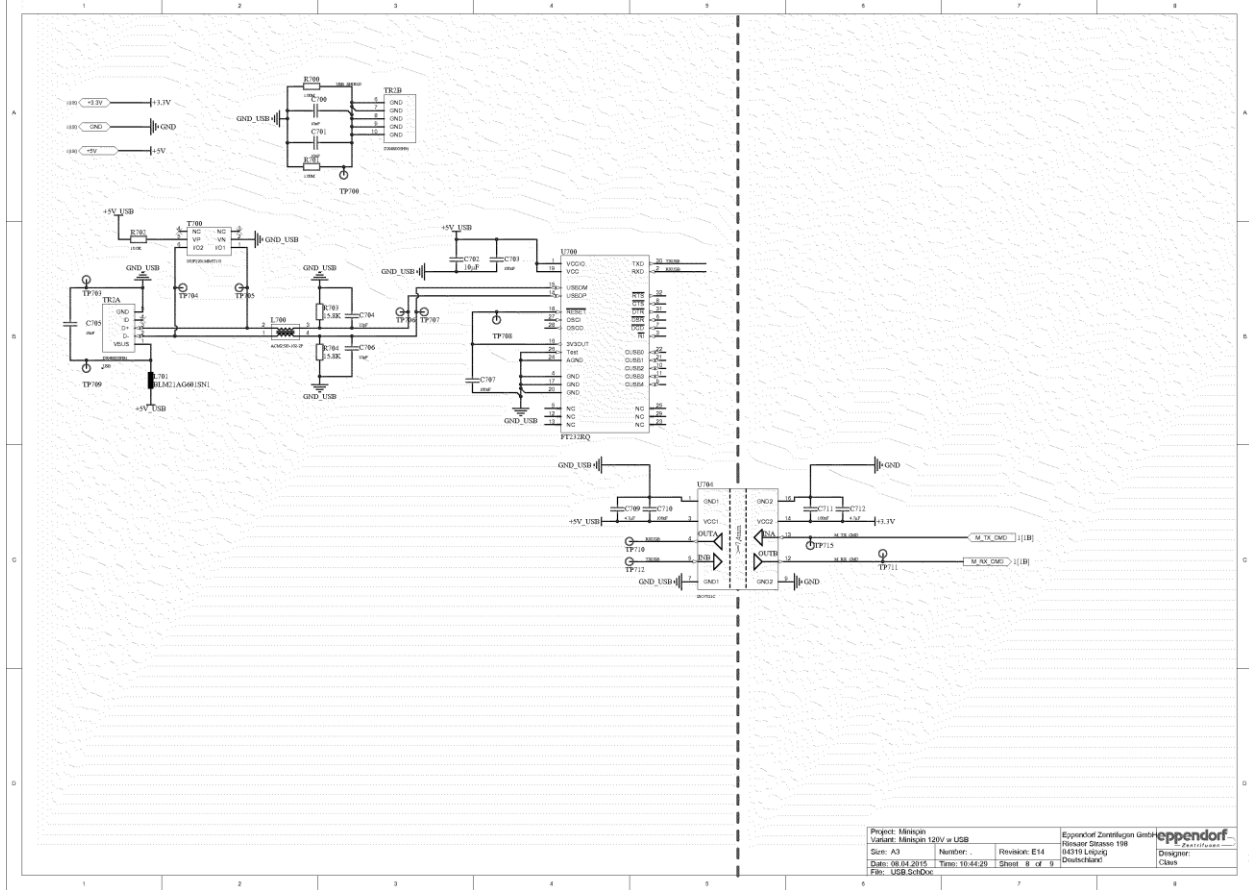


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Variante: Mischgel 120V in USB	Steuer-Station 118
Size: A3	Revision: E14
Number: .	04310 Leipzig
Date: 08.04.2015	Time: 10:42:20
Sheet: 6 of 9	Designer:
File: Deckelverriegelung_S01Doc	Drawn:

Schematics + PWB - (01) Electrical circuit diagram - alternate Mains PWB - PN 5452

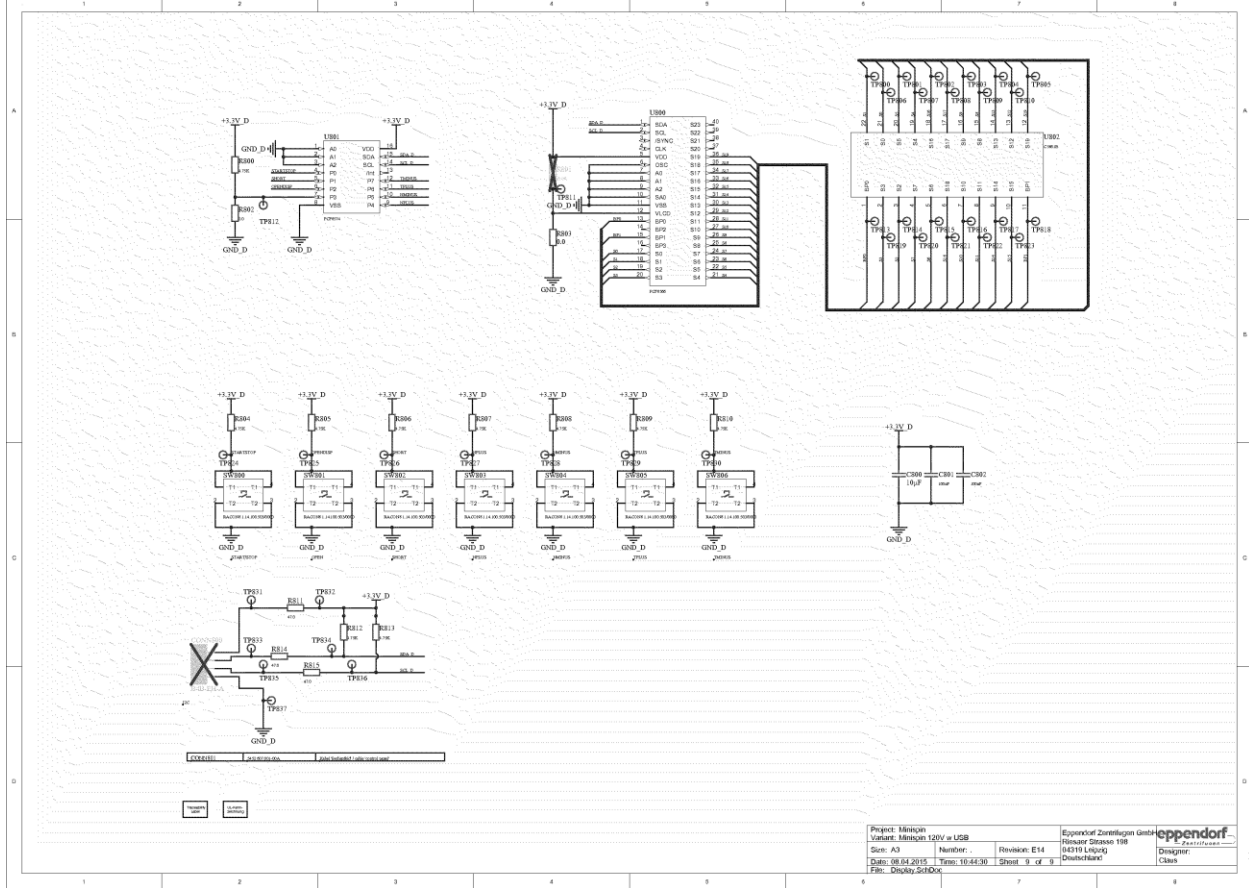


Schematics + PWB - (01) Electrical circuit diagram - alternate Mains PWB - PN 5452



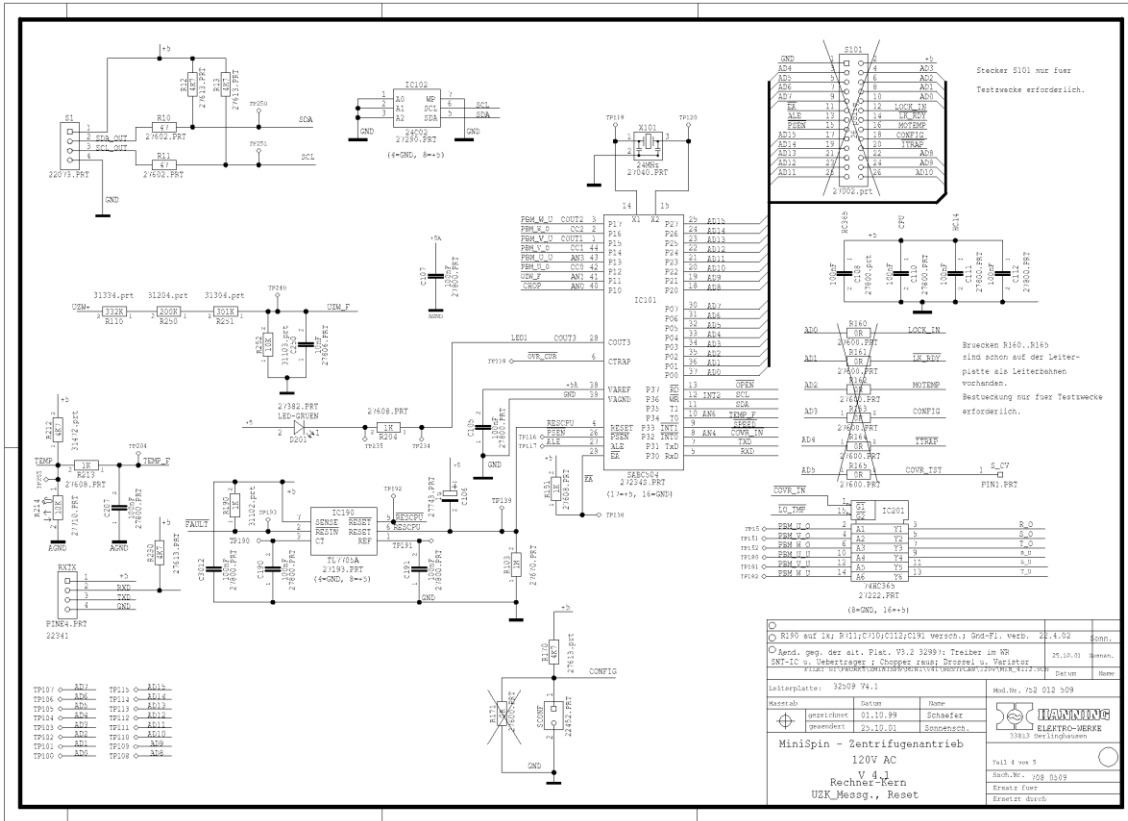
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Variante: Mischel 120V w USB	Steuer Straße 118
Size: A3	04310 Leipzig
Date: 08.04.2015	Deutschland
Time: 10:44:20	Sheet: 8 of 9
File: USB_SchDoc	Designer: Claus

Schematics + PWB - (01) Electrical circuit diagram - alternate Mains PWB - PN 5452

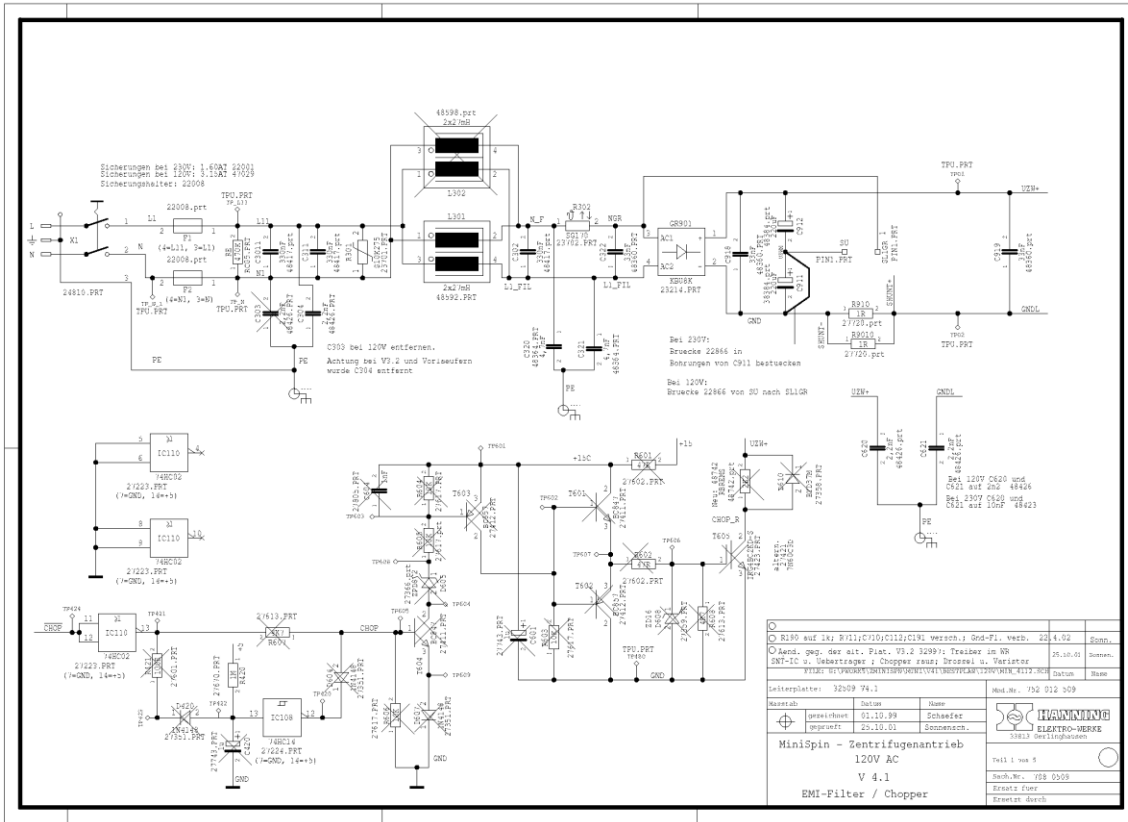


Schematics + PWB - (02) Electrical Circuit Diagram

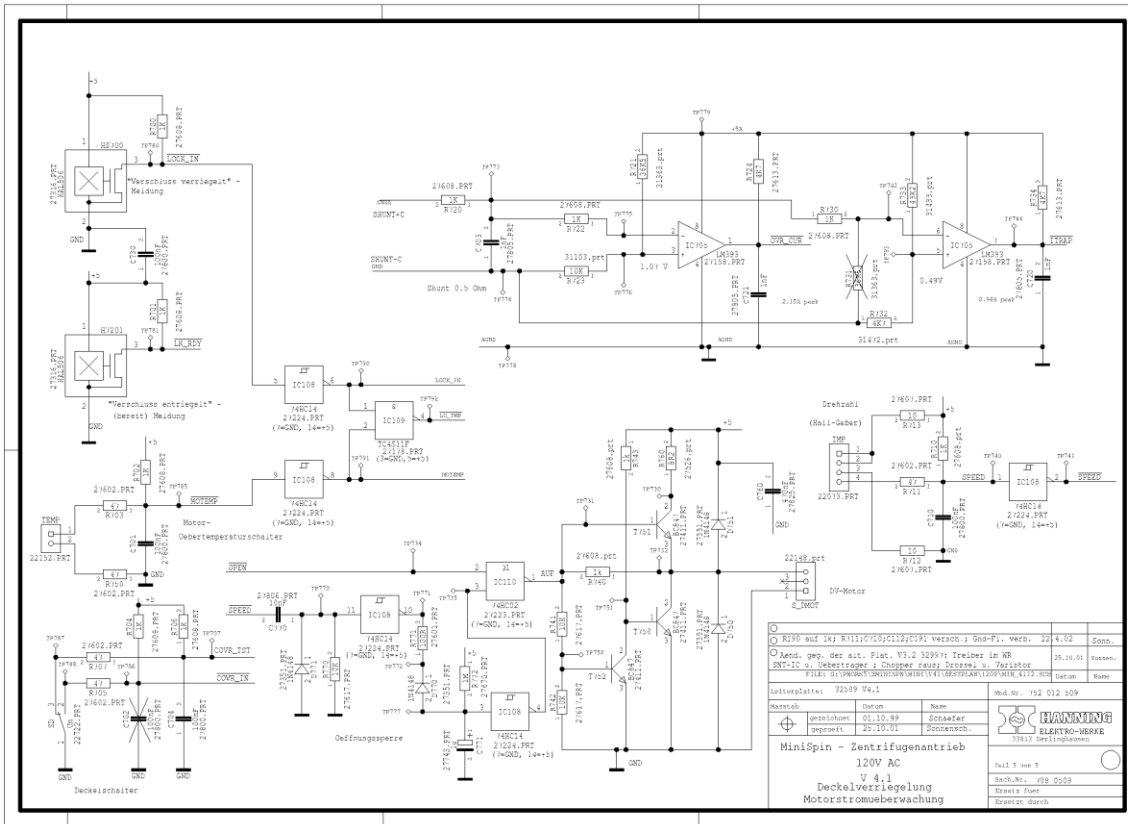
Schematics + PWB - (02) Electrical Circuit Diagram



Schematics + PWB - (02) Electrical Circuit Diagram



Schematics + PWB - (02) Electrical Circuit Diagram



<ul style="list-style-type: none"> ○ R180 auf 1k; R111;C110;C111;C191 wechsch. j Gnd-Fl. wech. 22 4.02 Sonn. ○ Aend. gep. der et. Plat. V3.2 3299/; Treiber im KR ○ SNT-12 u. Übertrager j Chopper rausj Drossel u. Varistor File: C:\pwwork\elektro\projekte\1000\1000_1\A2_C0.M 	<p>Leitungsleiter: 32199 V4.1</p> <p>Mod.Nr.: V02 012 009</p> <table border="1"> <thead> <tr> <th>Monat/Jahr</th> <th>Uhrzeit</th> <th>Name</th> </tr> </thead> <tbody> <tr> <td>gezeichnet</td> <td>01.10.99</td> <td>Schaefer</td> </tr> <tr> <td>geprüft</td> <td>22.10.01</td> <td>Schmiesch.</td> </tr> </tbody> </table> <p> MINNING ELEKTRO-WERKE 73113 Detmold/Baden </p> <p> MiniSpin - Zentrifugenantrieb 120V AC v. 4.1 Deckelverriegelung Motorstromüberwachung </p> <p> Blatt 5 von 5 Zeich.Nr.: 018 0509 Entwurf durch Ersetzt durch </p>	Monat/Jahr	Uhrzeit	Name	gezeichnet	01.10.99	Schaefer	geprüft	22.10.01	Schmiesch.
Monat/Jahr	Uhrzeit	Name								
gezeichnet	01.10.99	Schaefer								
geprüft	22.10.01	Schmiesch.								

-----END OF APPENDIX A-----

APPENDIX C: Follow-Up Service Documentation

Follow-Up Service Procedure

It is important to keep UL Procedures and Test Reports up-to-date as new or revised pages are received. Correct maintenance will decrease the amount of time the UL Representative spends when visiting your facility.

UL LLC offers MyHome @UL, a dedicated website providing secure access to online tools and databases that can help simplify your compliance activities. You can customize your personal MyHome @UL page to include the content needed most, including timely information about certification updates and links to other Web sites you visit regularly. Visit <http://my.home.ul.com/> to sign up today!

PAGES (in content order)	FUNCTION	HOW TO UPDATE
Authorization Page	Displays the Product Category, the type of Follow-Up Service (Type R=Reexamination / Type L=Label), the File Number and the Volume Number associated with each Applicant's, Manufacturer's and Listee's company name and address.	Replace existing page by matching the UL File Number and Volume Number. Discard the older page (refer to "Issued" or "Revised" date).
Addendum to Authorization Page*	Lists the additional names and addresses of manufacturing locations, when multiple locations exist	Replace existing page by matching the UL File Number and Volume Number. Discard the older page (refer to "Issued" or "Revised" date).
Listing Mark Data (LMD), Classification Mark Data (CMD) or Recognized Component Mark Data (RCMD) Pages* #	Used only for products covered under Type R Service. Displays the correct LMD, CMD, or RCMD Mark, the Control Number for Listed and Classified categories and additional information regarding minimum size, application, procurement, and any other optional markings, in addition to the UL Mark.	Replace existing page by matching the UL File Number and Volume Number. Discard the older page (refer to "Issued" or "Revised" date).
Multiple Listing (ML) Correlation Sheet*	Correlates product model numbers between those products made by a Manufacturer for the Basic Applicant and those supplied to another company, the Multiple Listee.	Replace, add or delete page(s) with most current "Issued" or "Revised" date.
Index*	Catalogs the contents of the Procedure by some logical means, i.e. Section Number, Report Reference Number, or Issue Date.	Replace present page by matching the UL File Number, Volume Number, Page Number and most current "Revised" date.
Appendices* # (App.)	Contains instructions for the Manufacturer and UL Representative concerning specific responsibilities and required periodic tests. May also outline tests to be conducted on samples to be forwarded to UL's facilities.	Replace present page by matching the UL File Number, Volume Number, Appendix letter (eg. App. A), Page Number and most current "Revised" date.
	Standardized Appendix Pages are the same for all manufacturers within a particular product category.	Replace present page by matching the Appendix letter (eg. App. A), Page Number and most current "Revised" date.
Follow-Up Inspection Instructions (FUII) Pages*	Contains information similar to that in the Appendices. FUII Pages are issued as part of the Procedure when a UL Standard is used in conjunction with the Procedure, and are the same for all manufacturers within a particular category.	Replace present pages by matching the Page Number and most current "Issued" or "Revised" date.
Section General* # (Sec. Gen.)	Contains description, requirements, identifications and/or specifications that are common to all products covered by the entire volume and supplements the information provided in the Description Section.	Replace present page by matching the UL File Number, Volume Number, Page Number and most current "Revised" date.
Description, or Section (Sec.)*	Contains the specific description of one or more products or systems. This includes written text supplemented by photographs, drawings, etc., as necessary, to define features that affect compliance with the applicable requirements.	Replace present page by matching the UL File Number, Volume Number, Section Number, Page Number and most current "Issued" date.

* The above page(s) may not appear in all UL Follow-Up Service Procedures; UL's Conformity Assessment Services staff determines their inclusion.

These pages are combined in the **Generic Inspection Instructions** for International Style Reports, identified, as example by Vol. X1, X2, etc.

PLEASE NOTIFY YOUR LOCAL UL OFFICE OF ANY CHANGES IN CONTACT NAME, COMPANY NAME OR ADDRESS, SO THIS MATERIAL AND IMPORTANT INFORMATION CONTINUES TO BE DELIVERED TO YOUR FACILITY WITHOUT INTERRUPTION.

UL Authorization Page

UL File Number: E215059
2019-04-16 (Am1), 2021-05-25 (Am2)

Volume: D1

Issue Date: 2017-03-22,

FOLLOW-UP SERVICE PROCEDURE

(TYPE R)

PRODUCT CATEGORY NAME
(OGTK / OGTK7)

Manufacturer: SEE ADDENDUM FOR MANUFACTURING LOCATIONS

Applicant: 561291 (Party Site)
117315-002 EPPENDORF A G
BARKHAUSENWEG 1
22339 HAMBURG GERMANY

Listee/Classified/
Recognized Co.: Same as Applicant (unless specified differently below)
Same as applicant

This Follow-Up Service Procedure authorizes the above Manufacturer(s) to use the marking specified by UL LLC, or any authorized licensee of UL LLC, including the UL Contracting Party, only on products when constructed, tested and found to be in compliance with the requirements of this Follow-Up Service Procedure and in accordance with the terms of the applicable service agreement with UL Contracting Party. The UL Contracting Party for Follow-Up Services is listed on addendum to this Follow-Up Service Procedure ("UL Contracting Party"). UL Contracting Party and UL LLC are referred to jointly herein as "UL."

UL further defines responsibilities, duties and requirements for both Manufacturers and UL representatives in the document titled, "UL Mark Surveillance Requirements" that can be located at the following web-site: <http://www.ul.com/fus>. Manufacturers without Internet access may obtain the current version of this document from their local UL customer service representative or UL field representative. For assistance, or to obtain a paper copy of this document or the Follow-Up Service Terms referenced below, please contact UL's Customer Service at <http://ul.com/aboutul/locations/>, select a location and enter your request, or call the number listed for that location.

The Applicant, the specified Manufacturer(s) and any Listee/Classified/Recognized Company in this Follow-Up Service Procedure must agree to receive Follow-Up Services from UL Contracting Party. If your applicable service agreement is a Global Services Agreement ("GSA"), the Applicant, the specified Manufacturer(s) and any Listee/Classified/Recognized Company will be bound to a Service Agreement for Follow-Up Services upon the earliest by any Subscriber of use of the prescribed UL Mark, acceptance of the factory inspection, or payment of the Follow-Up Service fees which will incorporate such GSA, this Follow-Up Service Procedure and the Follow-Up Service Terms which can be accessed by clicking here: <http://services.ul.com/fus-service-terms>. In all other events, Follow-Up Services will be governed by and incorporate the terms of your applicable service agreement and this Follow-Up Service Procedure.

It is the responsibility of the Listee/Classified/Recognized Company to make sure that only the products meeting the aforementioned requirements bear the authorized Marks of UL LLC, or any authorized licensee of UL LLC.

This Follow-Up Service Procedure contains information for the use of the above Manufacturer(s) and representatives of UL and is not to be used for any other purpose. It is provided to the Manufacturer with the understanding that it will be returned upon request and is not to be copied in whole or in part.

This Follow-Up Service Procedure, and any subsequent revisions, is the property of UL and is not transferable. This Follow-Up Service Procedure contains confidential information for use only by the above named Manufacturer(s) and representatives of UL and is not to be used for any other purpose. It is provided to the Subscribers with the understanding that it is not to be copied, either wholly or in part unless specifically allowed, and that it will be returned to UL, upon request.

Capitalized terms used but not defined herein have the meanings set forth in the GSA and the applicable Service Terms or any other applicable UL service agreement.

UL shall not incur any obligation or liability for any loss, expense or damages, including incidental, consequential or punitive damages arising out of or in connection with the use or reliance upon this Follow-Up Service Procedure to anyone other than the above Manufacturer(s) as provided in the agreement between UL LLC or an authorized licensee of UL LLC, including UL Contracting Party, and the Manufacturer(s).

UL LLC has signed below solely in its capacity as the accredited entity to indicate that this Follow-Up Service Procedure is in compliance with the accreditation requirements.

Bruce A. Mahrenholz
Director
Conformity Assessment Programs (CPO)
UL LLC

Addendum to Authorization Page

LOCATION

Manufacturing Factory(ies)
Information:

EPPENDORF ZENTRIFUGEN GMBH
Portitzer Allee 15
04329 LEIPZIG GERMANY
Party Site: 556111
Subscriber No: 711004-001
Factory ID: None
UL Contracting Party: UL GmbH

EPPENDORF MFG CORP
175 FRESHWATER BLVD
ENFIELD CT 06082-4444 USA
Party Site: 578824
Subscriber No: 100226-333
Factory ID: ME
UL Contracting Party: UL LLC

UL Appendix:**GENERIC INSPECTION INSTRUCTIONS**

Product Category	Product Category CCN
Laboratory Use Electrical Equipment	OGTK

These instructions consist of the following Parts:

Part	Description
AA	Instructions and Responsibilities for UL Representative
AB	Instructions for Follow-Up Tests at UL
AC	Responsibilities and Requirements for Manufacturer
AD	General Terminology
AE	General Product Construction Requirements
AF	UL Certification Marks

PART AA**INSTRUCTIONS AND DUTIES FOR UL REPRESENTATIVE**

AA1.0	UL REPRESENTATIVE'S DUTIES
AA1.1	<p>The UL Representative's duties include, but are not limited to:</p> <ul style="list-style-type: none"> A. Examining the construction of production intended to bear the UL Mark or Marking to determine compliance with the description of the product and any other requirements expressed in this Procedure. B. Where so specified in each Test Report, forwarding samples to UL for Follow-Up tests. C. Where so specified by Part AC, inspecting the test records and facilities of the manufacturer to ensure that: <ul style="list-style-type: none"> 1. The proper number of samples are undergoing the required tests, and 2. The required tests are being performed correctly, and 3. The proper information is being recorded and is up-to-date, and 4. The instruments being used for the tests have been calibrated at the prescribed interval and are in good working order.
AA2.0	PROCEDURE IN CASE OF NONCONFORMANCE
AA2.1	<p>Report to the manufacturer and UL LLC by means of a Variation Notice (VN) if:</p> <ul style="list-style-type: none"> A. Variations in construction are found, or B. The manufacturer's method and/or frequency of testing is not as described, or C. The test records maintained by the manufacturer are not as described, or D. The manufacturer's inspection program is not being performed as described, or E. Nonconforming test results are witnessed during tests conducted specifically for the UL Representative.
AA2.2	<p>Explain to the manufacturer that a VN is a means of communication with the manufacturer and applicant and forms a record of those items where nonconformance to the Procedure has been found.</p>
AA2.3	<p>When a product does not conform with the Procedure, require that the manufacturer:</p> <ul style="list-style-type: none"> A. Remove any markings referencing UL from the product, or obliterate these markings where the marking is imprinted, die-stamped, molded, etc., or B. Suitably modify all products that do not comply with the Procedure, or C. Hold shipment pending further instructions from UL LLC D. Demonstrate that one of the conditions shown below exist and be able to provide any of the referenced information or documentation. Under the following conditions, variations from Procedure described constructions shall be noted on a Variation Notice, however, the manufacturer is not required to remove UL markings, rework the product or hold shipment. <ul style="list-style-type: none"> 1. A part is called out as Listed and the manufacturer or part number is not as described and the alternate part being used is Listed and all other attributes for the part are met. 2. A part is called out as a Recognized Component (R/C) and the manufacturer or part number is not as described and the alternate part being used is Recognized under the described category and all other attributes for the part are met. 3. Internal wiring is identified by UL Style Number and the manufacturer is using (R/C) Appliance Wiring Material (AWM) with Style Numbers not referenced in the Procedure

	description. The manufacturer must be able to provide documentation that the voltage and temperature ratings of the alternate Style Number are equal to or greater than the ratings of the Style Numbers specified in the Procedure. AWM with Style Numbers not specified in the Procedure must be rated VW-1.
AA2.4	It is the manufacturer's responsibility to forward a copy of the Variation Notice to the Applicant.
AA2.5	If the manufacturer or Applicant question the rejection of the product, the material may be held at the point of inspection, typically at the factory, pending an appeal. The manufacturer has the right to appeal a decision with which they disagree. Provide the name of the UL engineer to whom the appeal is to be made. To resolve issues involving variations in construction, the manufacturer and Applicant may also be offered the option of contacting their New Work assignment engineer. Held shipment appeals involving Follow-Up Services issues (e.g. -improper labeling, etc.) should be directed to an appropriate staff member designated by the Reviewing Office for the product category. Should UL grant temporary authorization for the continued use of the UL Mark, such temporary authorization shall only be for the time needed to review and/or process the Procedure revisions, or as otherwise specified to cover a particular lot or production run. The manufacturer shall satisfy the UL Representative that all marks referencing UL are removed from the rejected material. Those marks referencing UL not destroyed during their removal from the product shall be turned over to the UL Representative for destruction.

AA3.0	EXAMINATIONS TO BE WITNESSED BY UL REPRESENTATIVE
AA3.1	Inspection of Printed Wiring Boards and Printed Wiring Board Assemblies
AA3.1.1	The UL Representative shall determine that the printed wiring board is as specified in the Procedure.
AA3.1.2	If the soldering operation is performed at the Original Equipment Manufacturer's factory (OEM) and the soldering temperature and dwell time are given in the Procedure, the temperature and dwell time shall also be checked to determine that they do not exceed the limits specified.
AA3.1.3	The UL Representative shall determine that the printed wiring board is as specified in the Procedure. The UL Representative then shall make a visual inspection of the printed wiring board assemblies for any mechanical damage or evidence of exposure to excessive temperatures that may have occurred during the soldering operation. The base material and the conductors shall be examined for nonconforming features as indicated below: <ul style="list-style-type: none"> A. Conductors, Terminal Pads, and Tabs <ul style="list-style-type: none"> 1. Reduction in cross-section, such as scratches, nicks, pin holes, tearing. 2. Loosening or lifting of printed wiring conductor, pad, or tab from the base material. 3. Sections missing or damaged. 4. Blistering 5. Breaks B. Base Material <ul style="list-style-type: none"> 1. Warping 2. Cracking 3. Charring, blistering, or other heat damage due to solder process 4. Delamination

AA3.1.4	Samples shall be selected at random as shown in Table AA1 in accordance with the size of the incoming lot. The lot is to be rejected in accordance with the fifth column of the table.
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AA3.1.5	With respect to printed wiring boards using Surface Mounted Technology (SMT), if the SMT assembly process is done at temperatures and times below the soldering limits, the UL Representative will accept the boards. If the assembly process is conducted on-site with temperatures/times in excess of soldering limits or if the process is conducted off-site and the temperatures/times cannot be verified, a visual inspection will be conducted by the UL Representative in accordance with the guidelines shown above. If any instructions for SMT components are specified in the Procedure, then these SMT instructions are superseded.
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TABLE AA1
PRINTED WIRING BOARD SAMPLE SELECTION

Size of incoming lot# for each type##	Initial number of samples taken	Number of nonconforming samples requiring additional samples	Additional number of samples to retest lot	Cumulative number of nonconforming samples to reject lot
1 - 500	8	1	13	2
501 – 3200	13	1	20	2
3201 - 35000	20	1	32	2
Above 35000	32	1	50	2

Notes:

A lot is considered to comprise all printed wiring board assemblies of the same type at the manufacturer's factory at the time of the UL Representative's visit, which have not been previously checked by the UL Representative.

A type is considered a printed wiring board assembly meeting all the following:

1. Same vendor who mounts and solders the components.
2. Same board manufacturer and type or catalog number.
3. Same size
4. Same pattern
5. Same components

AA4.0	SAMPLE SELECTION FOR TESTS CONDUCTED AT MANUFACTURER AND UL
AA4.1	Standard Follow-Up Tests for Plastic Enclosures and Parts
AA4.1.1	Each Test Report indicates the plastics enclosures or parts that may require Follow-Up Service testing. The UL Representative shall consult Table AA2 to determine which tests are required.
AA4.1.2	With respect to Table AA2, Access to Molding Operation shall be determined in accordance with the following:
	A. UL is considered to have access to the plastic molding operation if the molding takes place in the end-product assembly location and the operation complies with the requirements below.
	B. The UL Representative shall have free, unannounced, and immediate access to the factory and the storage facility during all business hours of the factory or storage facility. The UL Representative shall also have access to the records required below.
	C. The manufacturer shall mark each enclosure, cartons containing enclosures, or a tag accompanying the enclosure in a manner such that the UL Representative can trace the origin of each enclosure to a specific batch.
	D. The manufacturer shall keep records for each batch of plastic enclosures molded, in accordance with the below requirements.
	E. The records shall be thorough, so that the UL Representative may determine the composition of the enclosure. The records shall be maintained for at least six months from the date of production, and shall be accurate. All of the following items are to be covered:
	1. The records shall indicate the base material. The manufacturer may not blend resins. <i>Exception: The manufacturer may blend resins provided it is specifically stated in the Procedure.</i>
	2. The records shall include the amount of regrind used. Thermoplastic regrind shall not exceed 25 percent by weight. UL does not authorize the use of thermoset regrind. <i>Exception: Thermoplastic regrind may exceed 25 percent provided it is specifically stated in the Procedure and does not exceed the percent stated in the Procedure.</i>
	3. The composition of the enclosures shall not include recycled plastics, color concentrates, flame retardants, or mold release lubricants. <i>Exception: One or more of the elements indicated in 3) may be included, provided the Procedure specifically acknowledges its use.</i>
AA4.1.3	Where testing is required, samples are to be selected no less than once per year in accordance with each Test Report. All samples are to be handled in accordance with the requirements of this section.
AA4.1.4	Enclosure samples shall be chosen in a manner such that each enclosure material in use by the manufacturer is represented by tests no less than once over a two-year period. Enclosure materials that are used infrequently (i.e. less than once in a two year period) shall be selected whenever they are used.

TABLE AA2
FOLLOW-UP TESTING FOR PLASTIC ENCLOSURES AND PARTS

Enclosure plastic	Molding location		
	Recognized Component molder or evaluated component molder other than Recognized ^d	Not evaluated molding	
		UL has access to molding operation ^a	UL does not have access to molding operation ^a
1. Recognized Component plastic	No impact test required	Reserved (no requirement)	Reserved (no requirement)
2. Unlisted Component plastic ^c	Annual Impact test required	Annual Impact test required	Impact test required at twice annually
<p>^aAccess to molding operation means the molding takes place in the end-product assembly location and the manufacturer follows the requirements in Access to Molding Operation in AA3.</p> <p>^bThe manufacturer may elect to perform an impact test in place of the ID Tests. If the manufacturer does not elect to perform the impact test, samples are to be selected for the ID tests. See Instructions for Sample Selection, AA4.</p> <p>^cThe reference to Unlisted component plastic is in regard to a component plastic used in a Listed or Recognized product which is separately investigated in accordance with applicable requirements for the end-use product, and for which no coverage has been requested or established.</p> <p>^dThe reference to evaluated component molder other than Recognized is in regard to a molder of plastic fabricated parts which has been authorized by UL to mold plastic for the end-use product, but for which no Recognition has been established.</p>			

Enclosure plastic	Molding location		
	Recognized Component molder or evaluated component molder other than Recognized ^a	Not evaluated molding	
		UL has access to molding operation ^b	UL does not have access to molding operation ^b
Recognized Component	No tests required	Annual Impact Test at Mfg. OR Annual ID Tests at UL ^{c, d}	Annual Impact and ID Tests at UL
Unlisted Component ^e	Annual Impact Test at Mfg. ^d AND Annual ID and Flame Tests at UL	Annual Impact Test at Mfg. ^d AND Annual ID and Flame Tests at UL	Bi-annual Impact and ID Tests at UL
<p>^a The reference to evaluated component molder other than Recognized is in regard to a molder of plastic fabricated parts which has been authorized by UL to mold plastic for the end-use product, but for which no Recognition has been established.</p> <p>^b Access to molding operation means the molding takes place in the end-product assembly location and the manufacturer follows the requirements in AA4.1.2.</p> <p>^c The manufacturer may elect either an Impact Test or ID Tests. The UL Representative shall act accordingly.</p> <p>^d If the manufacturer does not have the ability to perform the Impact Test in accordance with AA4.1.5, the required test samples are to be forwarded to UL for testing.</p> <p>^e The reference to Unlisted component plastic is in regard to a component plastic used in a Listed or Recognized product which is separately investigated in accordance with applicable requirements for the end-use product, and for which no coverage has been requested or established.</p>			

AA4.1.5	Impact Test at Manufacturer
AA4.1.5.1	Where indicated in Table AA2, the UL Representative shall conduct the Impact Test as part of the product inspection at the manufacturer's facility and shall determine if the manufacturer records the test data in compliance with the requirements of this document <i>Exception: As noted in Table AA2 footnote (d), the Impact Test shall be conducted at UL if the manufacturer does not have the ability to conduct the test.</i>
AA4.1.5.2	Each enclosure sample fabricated with the material specified in the Test Report shall be subjected to a single impact. The impact shall be directed onto the surface most likely to demonstrate a nonconformance when the Basis of Acceptability of AA4.1.5.3 is applied. The impact is to be produced by dropping a steel sphere 2 inches (50.8 mm) in diameter and weighing 1.18 pounds (0.536 kg mass) a height of 50.85 in. (129.2 cm). For surfaces other than the top of an enclosure the steel sphere is to be suspended by a cord and swung as a pendulum, dropping through the 50.85 in. (129.2 cm) vertical distance before striking the surface
AA4.1.5.3	Each sample shall withstand the impact of AA4.1.5.2 without being affected to the extent that: A. Uninsulated, live parts are accessible to contact, or B. The mechanical performance of the product is adversely affected so as to create a risk of injury to persons, or C. A condition is produced that can cause a risk of electric shock.
AA4.1.5.4	To determine compliance with AA4.1.5.3 (A), the UL Representative shall apply the articulate probe to verify that the probe cannot contact an uninsulated, live part. It is the manufacturer's responsibility to order and purchase the probe through UL's Corporate Standards Department, at the Northbrook Office.
AA4.1.5.5	To determine compliance with AA4.1.5.3 (B), the UL Representative shall give consideration to the functioning of safety devices and constructional features (such as thermostats, overload protective devices and strain relief). Cracking or denting of the enclosure shall not result in the exposure of moving parts that could cause a risk of injury to persons.
AA4.1.5.6	To determine compliance with AA4.1.5.3 (C), the product shall be subjected to a Dielectric Voltage-Withstand Test as described in AC2.3 without dielectric breakdown.
AA4.1.5.7	If the Impact Test sample produces any one of the conditions specified in AA4.1.5.3, the test is to be repeated on three previously untested samples from the same lot. The results are considered acceptable if all three samples comply with the requirements. If a nonconformance occurs on any one of the additional samples, then the lot shall be considered rejected.
AA4.1.6	ID and Flammability Tests
AA4.1.6.1	Samples selected in accordance with Table AA2 shall be tagged with all the following information, and the manufacturer shall forward them to the Reviewing Office: A. Material B. Manufacturer C. Model number D. Follow-Up Test(s) required E. Test parameters (if any)
AA4.2	Standard Follow-Up Tests for Plastic Enclosures and Parts (Abnormal Operation, Mold Stress Relief Distortion and HB Flammability)
AA4.2.1	Where specified by a Test Report, samples are to be collected once per year for these tests. All samples shall be tagged with all the following information, and the manufacturer shall forward them to the Reviewing Office: A. Material B. Manufacturer C. Model number

	D. Follow-Up Test(s) required
	E. Test parameters (if any)

PART AB**INSTRUCTIONS FOR FOLLOW-UP TESTS AT UL**

AB1.0	GENERAL
AB1.1	The samples forwarded by the UL Representative shall be subjected to the tests indicated on the sample tags in accordance with any indicated test specifics (e.g. oven temperature).
AB1.2	Unless otherwise notes, all references are to the Generic Inspection Instructions.
AB1.3	Abnormal Operation Test
AB1.3.1	The sample shall be operated under the condition of abnormal operation indicated in the Test Report. During the test, the equipment is to rest on white tissue paper on a softwood surface and operate continuously until the ultimate results have been determined. In most cases, continuous operation for seven hours will be necessary in order to make sure that the ultimate results have been determined.
AB1.3.2	There shall be no ignition of the enclosure material, exposure of live parts, emission of flame or molten metal (except as noted below), nor glowing or flaming of the combustible material upon which the equipment is placed. Warping, shrinkage, expansion or cracking of the thermoplastic material is acceptable. Emission of flame or molten metal that occurs through regular openings provided as a part of the enclosure design and construction (not openings which occur as a result of the performance of this test) are acceptable.

TABLE AB1
TEST PARAMETERS

Test	Method	Basis for Acceptability
Impact	AA4.1.5.2	AA4.1.5.3 – AA4.1.5.7
Identification		
Qualitative Infrared Analysis (IR)	UL 746A	Compare to original spectrum in Test Report
Differential Scanning Calorimetry (DSC)	UL 746A	Compare to original thermogram in Test Report
Thermogravimetry (TGA)	UL 746A	Compare to original thermogram in Test Report
Flammability		
3/4 Inch Flame	UL 746C	UL 746C
5 Inch Flame	UL 746C	UL 746C
Mold Stress-Relief Distortion	UL746C	UL746C
HB Flammability	UL746C	UL746C
Abnormal Operation	AB1.3.1	AB1.3.2

PART AC**RESPONSIBILITIES AND REQUIREMENTS FOR MANUFACTURER**

AC1.0	MANUFACTURER'S RESPONSIBILITIES (INCLUDING BUT NOT LIMITED TO)
AC1.1	<u>Control of UL Mark</u> - Restrict the use of markings that reference UL (either directly or by use of the name, an abbreviation of it, or the UL symbol or Classification Mark, or indirectly by means of agreed-upon markings that are understood to indicate acceptance by UL) to those products that are found by the manufacturer's own inspection to comply with the Procedure description. Such restrictions apply to packaging, brochures or other means of advertising that reference UL. Use of such markings is further limited by the agreements that have been executed by the subscriber and UL. Markings shall be confined to the locations authorized in these Generic Inspection Instructions or in individual Test Reports.
AC1.2	<u>Access to Factory</u> - During hours in which the factory is in operation, provide the UL Representative with free access to any portion of the premises where the product or components thereof are being fabricated, processed, finished or stored, and to the test area assigned for the UL Representative's use. The UL Representative shall be permitted to inspect and subject to prescribed tests, prior to shipment, any product bearing or intended to bear markings referencing UL.
AC1.3	<u>Production-Line Tests</u> - Conduct the tests detailed in Part AC2.0.
AC1.4	<u>Required Records</u> - Maintain records of test performance. The records shall include the model or catalog designation of the product, the date of production, the tests performed, number of units tested, test results and action taken on rejections. Records for test performance shall be retained for six (6) months and shall be readily available for review by the UL Representative. <u>Exception</u> - Records of test results need not be maintained for 100% Production-Line Tests.
AC1.5	<u>Test Equipment and Personnel</u> - Provide, at a convenient location, all required test equipment and facilities and any required personnel for conducting all tests that are to be performed at the factory. These shall be available when needed so that the inspection work can proceed without undue delay.
AC1.6	<u>Test Equipment Calibration</u> - Determine that the test equipment is functioning properly daily, and have it calibrated at least annually, or whenever it has been subject to abuse (such as being dropped or struck with an object) or its accuracy is questionable. The test equipment and instruments shall be calibrated either by the manufacturer or by an outside laboratory. In either case, it shall be calibrated by comparison with a standard that is traceable to the applicable U.S. or foreign National Standard. A letter from the outside laboratory or from an off-site manufacturer's calibration lab stating that their lab standards are directly traceable to their country's National Standard and outlining their traceability pathway is considered adequate proof of traceability. For in-house calibrations, the Standard (weight and gauge blocks, etc.) used shall be calibrated every three years, or whenever the Standard has been subject to some form of abuse that may affect the Standard's fitness for use. The Standard shall be stored to protect it from damage or deterioration per the Standard manufacturer's recommendations. Records of the calibration of the test equipment and Standard(s) shall be maintained until the next required calibration is completed and recorded, and shall be readily available for review by the UL Representative.
AC1.7	<u>Samples for Follow-Up Testing at UL</u> - If Part AA4.0 specifies that samples are required to be forwarded to UL for Follow-Up Testing, the manufacturer shall forward the samples selected by the UL Representative, to the specified UL Testing Laboratory, within five working days of the UL Representative's inspection visit. Packaging and shipment of the samples are the responsibility of the manufacturer.
AC1.8	<u>Substitution of Non-Specified Plastic Materials</u> - Non-specified plastic materials may not be substituted for Procedure described materials unless a minimum flammability rating at a minimum thickness is described. Before a non-specified plastic material can be used, current UL certification documentation must be checked to ensure that the plastic material has a flammability rating as

	<p>specified at the thickness specified. Acceptable UL certification documentation includes: (a) the current edition of the Recognized Component Directory or Supplement; (b) the UL Online Certification Directory (http://www.ul.com/database); a copy of the plastic material company's Recognition Report; or d) a copy of the Recognition Card. The Component Recognition Report or Recognition Card may be used only if it is issued after the latest publication of the Recognized Component Directory.</p> <p>It is the responsibility of the manufacturer to provide the UL Representative with the above documentation.</p> <p>NOTE: The above does not apply to materials for which the specific manufacturer and type designation of the plastic is specified in the individual Test Reports (i.e. Enclosures).</p>
AC1.9	<p><u>Substitution of Non-Specified PWBs</u> – Non-specified printed wiring boards may not be substituted for Procedure described materials unless a minimum flammability rating or maximum operating temperature is described. Before a non-specified printed wiring board can be used, current UL certification documentation must be checked to ensure that the printed wiring board meets the specified flammability rating, operating temperature rating, solder and dwell times, and direct support requirements. Acceptable UL certification documentation includes: (a) the current edition of the Recognized Component Directory or Supplement; (b) the UL Online Certification Directory (http://www.ul.com/database); (c) a copy of the printed wiring board company's Recognition Report; or (d) a copy of the Recognition Card. The Component Recognition Report or Recognition Card may be used only if it is issued after the latest publication of the Recognized Component Directory.</p> <p>It is the responsibility of the manufacturer to provide the UL Representative with the above documentation.</p> <p>NOTE: The above does not apply to materials for which the specific manufacturer and type designation of the plastic is specified in the individual Test Reports (i.e. Enclosures).</p>
AC1.10	<p><u>Articulate Probe</u> - If the need for an articulate probe is identified in AA4.1.5, it is the manufacturer's responsibility to purchase the probe, and make it available for the UL Representative's use. The probe may be ordered through UL's Corporate Standards Department, at the Northbrook Office.</p>

AC2.0	REQUIREMENTS FOR PRODUCTION-LINE TESTS
AC2.1	The following Production-Line Tests shall be conducted on the products covered by this Procedure. During production, the test equipment shall be checked for proper operation at least once during each shift. When the tests are not performed concurrently, it is preferred that the Grounding Continuity Test be performed before either Dielectric Voltage-Withstand Test.
AC2.2	Production-Line Grounding Continuity Test
AC2.2.1	<p><u>General</u> - Except as may be noted under "Exceptions" in each Test Report, the manufacturer shall subject 100 percent of production of all of the following products to a routine Production-Line Grounding Continuity Test as described in section AC2.2.3:</p> <ul style="list-style-type: none"> A. Products that are provided with a grounding type power supply cord, or B. Fixed products that are for permanent connection to the branch circuit. <p>Exception: This test is not required for permanent connection to the branch circuit by fixed wiring if the design does not employ bonding jumpers or grounding wiring to remote units.</p>
AC2.2.2	<u>Test Equipment</u> - Any suitable continuity-indicating device (such as an ohmmeter, a battery and buzzer combination, or the like) may be used to determine compliance with the Grounding Continuity Test requirements.
AC2.2.3	<u>Method</u> - Continuity shall be determined between the grounding conductor of the attachment plug cap, and/or the designated main grounding point, and accessible dead-metal parts of the product, using the test equipment indicated above.
AC2.2.4	<u>Basis for Acceptability</u> - There shall be grounding continuity between the parts specified.
AC2.3	Production-Line Dielectric Voltage-Withstand Test
AC2.3.1	<u>General</u> - Except as may be noted under "Exceptions" in each Test Report, the manufacturer shall subject 100 percent of production of all products to a routine Production-Line Dielectric Voltage-Withstand Test as described in section AC2.3.3.
AC2.3.2	<p><u>Test Equipment</u> - The test equipment shall include a means of indicating the test potential, an audible or visual indicator of electrical breakdown, and either a manually operated reset device to restore the equipment after electrical breakdown or an automatic feature that rejects any unacceptable unit. If an ac test potential is applied, the test equipment shall also include a transformer having an essentially sinusoidal output.</p> <p>If the output of the test-equipment transformer is less than 500 volt-amperes, the equipment shall include a voltmeter in the output circuit to indicate the test potential directly.</p> <p>If the output of the test-equipment transformer is 500 volt-amperes or more, the test potential may be indicated (1) by a voltmeter in the primary circuit or in a tertiary-winding circuit, (2) by a selector switch marked to indicate the test potential, or (3), in the case of equipment having a single test-potential output, by a marking in a readily visible location to indicate the test potential. When marking is used without an indicating voltmeter, the equipment shall include a positive means, such as an indicator lamp, to indicate that the manually operated reset switch has been reset following a dielectric breakdown.</p> <p>Test equipment other than that described above may be used when it can be shown that UL has previously confirmed in writing that the equipment complies with the above requirements and is deemed suitable for use for this test.</p>
AC2.3.3	<p><u>Method</u> - Each product shall withstand without electrical breakdown, as a routine production-line test, the application of an ac potential at a frequency within the range of 40-70 Hz or DC potential between the primary wiring, including connected components, and accessible dead metal parts that are likely to become energized.</p> <p>The test potential shall be in accordance with Table AC1. The manufacturer's test conditions may be higher than those shown in Table AC1 when necessary to comply with other international product safety certifications. The test duration for the a.c. and d.c. tests shall be</p>

	<p>raised to its specified value within 5s and maintained for at least 2s. The test duration for impulse tests are a minimum of three pulses of each polarity at 1s minimum intervals.</p> <p>The product may be in a heated or unheated condition for the test.</p> <p>The test shall be conducted when the product is complete (fully assembled), and it is not intended that the product be unwired, modified, or disassembled for the test, unless otherwise permitted below:</p> <ul style="list-style-type: none">A. A part, such as a snap cover or a friction-fit knob, that would interfere with conducting the test need not be in place.B. The test may be conducted before final assembly if the test parameters represent that for the completed product. <p>During the test, the primary switch is to be in the on position, both sides of the primary circuit of the product are to be connected together and to one terminal of the test equipment, and the second test-equipment terminal is to be connected to accessible dead metal.</p> <p>Electromagnetic interference filter capacitors connected to the primary circuit shall not be disconnected during the test.</p>
AC2.3.4	<p><u>Basis for Acceptability</u> - All products shall withstand the applied potential without an indication of electrical breakdown.</p>

TABLE AC1
DIELECTRIC VOLTAGE-WITHSTAND TEST CONDITIONS

Table F.1 – Test voltages for ROUTINE TESTS of MAINS CIRCUITS

Nominal line- toneutral voltage of MAINS supply	OVERVOLTAGE CATEGORY II			OVERVOLTAGE CATEGORY III			OVERVOLTAGE CATEGORY IV		
	a.c.	d.c.	1,2/50 μ s Impulse	a.c.	d.c.	1,2/50 μ s Impulse	a.c.	d.c.	1,2/50 μ s Impulse
	V	V	V peak	V	V	V peak	V	V	V peak
a.c. r.m.s. or d.c.	V r.m.s.	V	V peak	V r.m.s.	V	V peak	V r.m.s.	V	V peak
≤ 150	840	1 200	1 200	1 400	2 000	2 000	2 200	3 100	3 100
$>150 \leq 300$	1 400	2 000	2 000	2 200	3 100	3 100	3 300	4 700	4 700
$>300 \leq 600$	2 200	3 100	3 100	3 300	4 700	4 700	4 300	6 000	6 000
$>600 \leq 1\ 000$	3 300	4 700	4 700	4 300	6 000	6 000	5 300	7 500	7 500

PART AD

GENERAL TERMINOLOGY

AD1.0	ABBREVIATIONS / DEFINITIONS	
AD1.1	KAM	Known Agency Mark (Refer to Table AE3)
AD1.2	LP	Limited Power- A circuit with maximum available power of 15 or less
AD1.3	PWB	Printed wiring board
AD1.4	PRI	Primary (mains)
AD1.5	SEC	Secondary

AD1.0	ABBREVIATIONS / DEFINITIONS	
AD1.1	IEC	Component provided with a testing agency's mark as indicated in Table II
AD1.2	PRI	Primary circuit (mains)
AD1.3	PWB	Printed wiring board
AD1.4	SEC	Secondary circuit
AD1.5	CN	Component provided with CSA or CUL Marking
AD1.6	LC	Supplied by source limited to the values specified Table 17 (see below)

Table 17 – Limits of maximum available current

Open-circuit output voltage (U or \hat{U})			Maximum available current
V			A
a.c. r.m.s.	d.c.	Peak ^a	a.c. r.m.s. or d.c.
$U \leq 2$	$U \leq 2$	$\hat{U} \leq 2,8$	50
$2 < U \leq 12,5$	$2 < U \leq 12,5$	$2,8 < \hat{U} \leq 17,6$	$100 / U$
$12,5 < U \leq 18,7$	$12,5 < U \leq 18,7$	$17,6 < \hat{U} \leq 26,4$	8
$18,7 < U \leq 30$	$18,7 < U \leq 60$	$26,4 < \hat{U} \leq 42,4$	$150 / U$

^a The peak value (\hat{U}) applies to non-sinusoidal a.c. and to d.c. with ripple exceeding 10 %, and is provided for convenience. The r.m.s. value of the maximum available current shall be determined as that value is related to heating.

PART AE

GENERAL PRODUCT CONSTRUCTION REQUIREMENTS

AE1.0	CONSTRUCTION DETAILS
AE1.1	Unless otherwise described or supplemented in individual Test Reports, the following requirements apply to all equipment included in this Procedure. It is the manufacturer's responsibility to assure the compliance of production with these requirements.
AE1.1.1	<u>Accessories Parts and Accessories</u> - Such items packaged with the product shall be specifically described in a Test Report.
AE1.1.2	<u>Adapters</u> – Three or two wire grounding type adapters shall not be furnished with the product unless specifically authorized by a Test Report.
AE1.1.3	<u>Attachment Plugs</u> - When a Test Report describes the power supply cord as being brazed, welded or both crimped and soldered to the plug, and the production line cannot be reviewed, the UL Representative will be required to cut open a sample of the attachment plug for confirmation.
AE1.1.4	<u>Bonding</u> - Except where specifically noted in a Test Report, bonding of internal dead-metal parts to the enclosure for grounding purposes shall be accomplished by a positive means such as clamping, riveting, bolting or screwed connection. The bonding connection shall reliably penetrate any nonconductive coatings such as paint or vitreous enamel.
AE1.1.5	<u>Casualty Considerations</u> - Except as described, or as necessary for normal operation of the equipment, there shall be no sharp edges, burrs, points, or spikes inside or outside the device that may cause injury during use or during cleaning operations.
AE1.1.6	<u>Connectors</u> - Connectors shall be applied so as to ensure that all bare strands are contained and insulated.
AE1.1.7	<p><u>Grounding</u> - The following guidelines shall be observed:</p> <p>A. <u>Non-Detachable Cord Connected Appliance</u> - The equipment-grounding conductor of the flexible cord:</p> <ol style="list-style-type: none"> 1. Shall be connected to the grounding member of the attachment-plug cap. <p>Note: The grounding member of the attachment-plug shall be fixed in position with respect to the cap.</p> <ol style="list-style-type: none"> 2. Shall be conductively connected to all dead-metal parts of the product that are specified in the description as being connected to the grounding conductor. The grounding-conductor shall be connected by either (1) a screw or other reliable means which serves no other purpose and which is not liable to be removed during any servicing operation, or (2) a threaded grounding stud on which a closed ring connector secured to the ground conductor is the first conductor mounted and secured by a nut and split ring lockwasher. Solder alone shall not be used for securing this conductor. <p>Note: The screw or stud and nut shall: (1) be provided with a means to penetrate nonconductive coatings, such as paint or enamel; (2) be of a corrosion-resistant metal or shall be protected against corrosion; and (3) be marked on or adjacent with a grounding symbol or the IEC417 Grounding Symbol 5019 “⊕”. The installation instructions shall identify the meaning of the symbol.</p>

	<p>B. <u>Detachable Cord Connected Appliance</u> - Polarization shall be maintained through the load fitting of the cord (appliance coupler) and the mating connector (appliance inlet) on the product. The load fitting shall be a three wire ANSI configuration.</p> <p>Exception: The load fitting need not be an ANSI configuration provided it is wired as follows (the description applies when viewing the face of the connector on the product, with the center contact down):</p> <ol style="list-style-type: none"> 1. The right contact shall be connected to the grounded conductor (neutral) of the cord. 2. The center contact shall be connected to the grounding conductor of the cord. <p>C. <u>Permanently-Connected Products</u> - In a permanently connected product (1) all exposed metal parts, and (2) all dead-metal parts within the enclosure, which are specified in the description as being connected (see “Bonding”) to the grounding conductor, shall be conductively connected to:</p> <ol style="list-style-type: none"> 1. The point of the enclosure at which the metal raceway of the power supply circuit will be connected, and 2. The equipment-grounding field-wiring terminal or lead. <p>The equipment-grounding terminal or grounding lead shall be connected to the frame or enclosure by a positive means, such as by a bolted or screwed connection. The grounding connection shall reliably penetrate nonconductive coatings, such as paint or vitreous enamel. The grounding point shall be so located that it is unlikely that the grounding means will be removed during normal servicing.</p> <p>A wire-binding screw intended for the connection of an equipment-grounding conductor shall be identified by the protective earth symbol. The head shall be either hexagonal shaped or slotted, or both. A pressure wire connector intended for connection of an equipment grounding conductor shall be identified by the protective earth symbol “⊕”.</p> <p>The wire-binding screw or pressure wire connector shall be so located that it is unlikely to be removed during normal servicing of the unit.</p> <p>D. <u>Grounding Terminal</u>:- The grounding conductor shall be the first conductor terminated on a grounding terminal and secured by a separate nut. Other grounding conductors may be secured to this terminal if they are secured on top of the first nut by a second nut.</p>
AE1.1.8	<u>Indicators</u> - Indicator lights shall be clearly visible to the equipment operator.
AE1.1.9	<u>Internal Plastic Parts</u> - For each type of plastic material the manufacturer shall review the Recognized Component Directory and Supplement or UL Online Certification Directory (http://www.ul.com/database) in order to insure that the plastic material in question meets all the material characteristics specified (i.e. flammability rating, Relative Thermal Index (RTI), and color) at the thickness specified. Alternatively, a copy of the Plastic Manufacturer’s Component Recognition Report or Recognition Card may be used as a traceability pathway only if these materials were issued after the latest publication of the Recognized Component Directory.
AE1.1.10	<u>Internal Wiring</u> - Conductors shall be routed away or protected from sharp edges and moving parts. Exception: LC that are reliably separated from PRI and SEC circuits need not be Recognized AWM.
AE1.1.11	<u>Lampholder Connections</u> - All screw shells of lampholders shall be connected to the same conductor of the supply circuit.
AE1.1.12	<p><u>Loose Strands</u> - Ends of stranded conductors shall have all strands contained to prevent contacting of, or reduction of spacing to, other live parts and dead metal. This can be accomplished by:</p> <ol style="list-style-type: none"> A. Tinning B. Inserting properly into suitable wire connectors.

	<p>C. Crimped connectors and/or eyelets with the crimp containing all strands</p> <p>D. Solder lugs.</p>
AE1.1.13	<u>Markings</u> - Required information shall be legibly marked on the product, in the manner and minimum height specified.
AE1.1.14	<u>Multiple Voltage</u> - Cord-connected multiple voltage products shall be provided with an attachment plug that is suitable for the voltage for which the product is set.
AE1.1.15	<p><u>Polarity</u> - An appliance intended for permanent connection to the source of supply and having an identified terminal or lead; and an appliance employing a power supply cord with a polarized attachment plug cap (excluding 250 volt, 2-pole and 250 volt, 3-pole, 3-phase), utilizing the components indicated, shall have the components wired as follows:</p> <p>A. <u>Lampholders and Receptacles</u> - The screw shell or identified terminal or lead of a lampholder and the identified terminal or lead of a receptacle, shall be connected to the identified grounded conductor or terminal within the product.</p> <p>B. <u>Switches (Single Pole)</u> - Unless otherwise specified in the Procedure, a manual single pole switch, and an automatic control with a marked "off" position, shall not be connected to the identified grounded conductor.</p>
AE1.1.16	<p><u>Power Supply Cords</u></p> <p>A. <u>Non-Detachable Power Supply Cord</u> – A non-detachable power supply cord as described in each Test Report <u>must</u> be provided and shipped with the unit in <u>all</u> cases. The power supply cord and any alternatives must be described in each Test Report. <u>Each conductor of a non-detachable power supply cord shall have only one color, except the conductor identified by a combination of green and yellow.</u></p> <p>B. <u>Detachable Power Supply Cord</u> – The detachable power supply cord as described in each Test Report may or may not be shipped with the unit. Follow the guidelines in Table AE1 to apply the alternatives under each of the situations described in the notes to Table AE1. Table AE1 also includes alternative detachable power supply cords that may be shipped with units intended for use outside the USA.</p>
AE1.1.17	<p><u>Printed Wiring Boards (PWBs)</u> - PWBs shall show no burning, bubbling or other visible evidence of damage to their conductors or substrate material as a result of the fabrication process.</p> <p>With respect to PWBs using Surface Mounted Technology (SMT), it is acceptable if the SMT assembly process is done at temperatures and times below the soldering limits. If the SMT assembly process is conducted on-site with temperatures/times in excess of soldering limits or if the process is conducted off-site and the temperatures/times cannot be verified, a visual inspection shall be conducted by the UL Representative.</p> <p>The PWBs shall be inspected by the manufacturer for mechanical damage or evidence of exposure to excessive temperatures that may have occurred during the soldering operation. If any nonconforming features (defined below) are found after visual inspection, the manufacturer shall reject the lot (as defined in Table AA1). Otherwise, the use of PWBs may continue without any interruption.</p> <p>The base material and the conductors shall be examined for nonconforming features as indicated below.</p> <p>A. Conductors, Terminal Pads, and Tabs</p> <ol style="list-style-type: none"> 1. Reduction in cross-section, such as scratches, nicks, pin holes, tearing. 2. Loosening or lifting of printed wiring conductor, pad, or tab from the base material. 3. Sections missing or damaged. 4. Blistering

	<ul style="list-style-type: none"> 5. Breaks B. Base Material <ul style="list-style-type: none"> 1. Warping 2. Cracking 3. Charring, blistering, or other heat damage due to solder process 4. Delamination
AE1.1.18	<p><u>Protection of Wiring</u> - All wire and wire insulation in the product shall be protected from damage. This is commonly achieved by securement, segregation, and routing to keep the wire away from parts or assemblies which can damage the wire or insulation. Internal wiring that might make contact with metal parts shall be protected from sharp metal edges. This can be accomplished by rounding or deburring the metal, using a Recognized Component bushing, or through other construction features described in the Test Report.</p> <p>If the wiring is located where it may be in proximity to combustible material, it shall be protected by the method(s) described in the individual Test Report.</p> <p>Conductors shall be examined for evidence of damage. Faulty practices which can cause damage to conductors and/or insulation include:</p> <ul style="list-style-type: none"> A. Improper application of crimped connectors, including but not limited to, use of crimping tool and dies not recommended by the manufacturer of the connector. B. Improper insulation removal. C. Overheating of conductor insulation because of routing or contact with hot surfaces during or after installation. D. Use of wire in which the insulation has been cut, cracked, crushed, abraded, etc. <p>Constructions which may cause damage to conductors and/or insulation include:</p> <ul style="list-style-type: none"> A. Moving parts such as rotating or reciprocating cams, shafts, and the like, as well as removable or sliding covers, hinged doors. B. Sharp edges and corners (including screw threads, burrs, points, stamped metal edges). C. Heat sources (including lamps, heating elements, etc.). D. Assemblies that clamp or squeeze wire insulation, unless described in the Test Report.

AE1.1.19	<p><u>Securement of Parts</u> - Screws or other fastenings used to mount or support small, fragile, insulating parts shall not be tight enough to cause cracking or breaking of these parts. Uninsulated live parts, components which support live parts, and dead metal parts, that are normally intended to remain stationary, shall be prevented from rotating or shifting if movement will result in twisting or stress of internal wiring or connections, or spacings being reduced below that specified in the Test Report. Similar parts that are normally intended to move or rotate shall be prevented from excessive movement if such movement will result in twisting or stress of internal wiring or connections, or spacings being reduced below that specified in the Test Report.</p> <p>A switch, lampholder, attachment plug receptacle, motor attachment plug cap, or other components subject to handling by the user shall be mounted securely and prevented from rotating.</p> <p>Exception: Based on engineering considerations certain constructions of securely mounted push button or plunger type switches, and lampholders of the type in which the lamp cannot be replaced (such as a neon pilot or indicator light in which the lamp is sealed in a non-removable jewel) may be excluded from the above. These constructions are described in the Procedure. However, in no case will nonconforming spacings be allowed.</p> <p>Some means commonly used to prevent rotation are:</p> <ul style="list-style-type: none"> A. Lock washer. B. Matched keying of the component and its mounting. C. Two or more fasteners (screws, rivets, pins, etc.). D. Strap, clip, or pin fitted into an adjacent part. E. Physical barrier (molded boss, side of enclosure, adjacent component, etc.) that bears against the component.
AE1.1.20	<p><u>Solder Connections</u> - All solder connections shall be made mechanically secure before soldering. Some typical examples of mechanical securement are:</p> <ul style="list-style-type: none"> A. Twisting wire around a solder post that has a change in dimension or restriction so unsoldered wire will not slip off post. B. Inserting wire through an opening, and bending over the free end.
AE1.1.21	<p><u>Strain Relief</u> - Strain Relief methods such as tying the supply cord into a knot or tying the ends of the cord with string shall not be used.</p>
AE1.1.22	<p><u>Usage Markings</u> - There shall be no marking in the instruction manual, or on the carton or package that is, or could be construed to be, in conflict with or an extension of the use covered in the Test Report.</p>
AE1.1.23	<p><u>Documentation</u> - Handling of hazardous substances and correct disposal procedure, field-installed devices, explanation of warning symbols.</p>
	<ul style="list-style-type: none"> A. Documentation such as an instruction manual shall be provided with these products. No attachments or accessories are mentioned in the instruction manual unless specifically mentioned in a particular section.
	<ul style="list-style-type: none"> B. For products where attachments are specifically mentioned in a particular section, which are packaged and sold separately, the instruction manual packaged with the basic appliance identifies each separately available attachment by attachment name and model number. In addition, the manual packaged with the attachment indicates by name and model number the basic appliance with which it is to be used.

	<p>C. Documentation shall also include the complete electrical rating of the device as described in the electrical rating section of the Procedure; a description of all input/output connections; assembly, location and mounting requirements; supply connection and earthing requirements, ventilation requirements; identification of operating controls, instructions for cleaning, replacement of consumable materials, interconnecting accessories, indication of suitable accessories, instructions for use, technical specifications, name and address of manufacturer or supplier and as statement of range of environmental conditions as noted below.</p>
	<ul style="list-style-type: none"> - Indoor use or outdoor use;
	<ul style="list-style-type: none"> - Altitude up to 2000 m or above 2000 m if specified by the manufacturer
	<ul style="list-style-type: none"> - Temperature 0 to 40°C, or outside this range if specified by the manufacturer.
	<ul style="list-style-type: none"> - Maximum relative humidity 80 percent for temperatures up to 31°C decreasing linearly to 50 percent relative humidity at 40°C;
	<ul style="list-style-type: none"> - Mains supply voltage fluctuations not to exceed ± 10 percent of the nominal voltage;
	<ul style="list-style-type: none"> - Temporary Overvoltages as stated by the manufacturer;
	<ul style="list-style-type: none"> - Transient overvoltages according to INSTALLATION CATEGORIES (OVERVOLTAGE CATEGORIES) I, II, III and IV. For mains supply the minimum and normal category is II;
	<ul style="list-style-type: none"> - POLLUTION DEGREE 1 2, 3 or 4.

TABLE AE1
DETACHABLE POWER SUPPLY CORD REQUIREMENTS

Detachable Power Supply Cord	
Provided	Not Provided
A or B	(C and D) or (C and E)
A. The power supply cord should be as described in the Test Report.	
B. The detachable power supply cord is either: <ol style="list-style-type: none"> 1. Certified by one of the agencies listed in Table AE3; or 2. Comprised of cordage marked with an agency marking per Table AE3 or marked per Table AE4. The fittings are to be marked with at least one of the agencies listed in Table AE3. Units provided with detachable power supply cords, which are certified by one of the agencies listed in Table AE3 or AE4, shall be considered to be intended for use outside of the USA.	
C. A marking must be provided adjacent to the appliance coupler or at an equivalent location either to inform the user on proper selection of the power supply cord or to see the instruction manual for this information. This marking may be in the form of a tag, nonpermanent label, or product insert that is provided on or packaged with the product so that the marking is visible at the time of installation.	
D. The marking (tag, label, or product insert) or instruction manual must contain complete instructions concerning selection of the power supply cord. It shall include either Option 1, 2, or 3 as follows: <ol style="list-style-type: none"> 1. Reference to a power supply cord must be as a UL Listed detachable power supply cord consisting of the specific configuration of appliance coupler, the cord type, and the electrical rating of the power supply cord as described in each Test Report. Refer to Table AE2 for equivalent cord types. 2. Reference to a power supply cord may be made to a Listed field installed accessory kit containing a suitable Listed power supply cord. Authorization for use of a Listed field installed accessory kit must be included in the individual Test Reports. 3. Reference to a power supply cord may be made to a cord that is not Listed and not intended for use in the United States or Canada. In this case, the manufacturer is to supply the UL Representative with information to verify that the referenced cord is certified or similarly appropriate for use in the destination country. 	
E. The reference to the power supply cord (see Note C) shall include instruction for selection of the proper power supply cord as described in Note B above.	

TABLE AE2
EQUIVALENT CORDS

Basis Cord Type	Equivalent Types
SP-2	SPE-2, SPT-2
SP-3	SPE-3, SPT-3
SV	SVE, SVO, SVOO, SVT, SVTO, SVTOO
SJ	SJE, SJO, SJOO, SJT, SJTO, SJTOO
S	SE, SO, SOO, ST, STO, STOO

TABLE AE3
CERTIFICATION MARKINGS





















Country	Cert. Agency	Mark	Country	Cert. Agency	Mark
Argentina	IRAM		Ireland	NSAI	
Australia	SAA		Italy	IMQ	
Austria	OVE		Japan	JET, JQA	
Belgium	CEBEC		Netherlands	KEMA	
Canada	CSA		Norway	NEMKO	
China	CCC		Spain	AEE	
Denmark	DEMKO		Sweden	SEMKO	
Finland	FEI		Switzerland	SEV	
France	UTE		United Kingdom	ASTA	
Germany	VDE			BSI	





TABLE AE4
HAR FLEXIBLE CORDS
APPROVAL ORGANIZATIONS AND CORDAGE HARMONIZATION MARKING METHODS

Approval Organization	Printed or Embossed Harmonization Marking (May be Located On Jacket or Insulation of Internal Wiring)		Alternative Marking Utilizing Black-Red Yellow Thread (Length of color Section, mm)		
Comite Electrotechnique Belge (CEBEC)	CEBEC	<HAR>	10	30	10
Verband Deutscher Elektrotechniker (VDE) e.V. Prufstelle	<VDE>	<HAR>	30	10	10
Union technique de l'Electricite (UTE)	UTE	<HAR>	30	10	30
Instituto Italiano del Marchio di Qualita (IMQ)	IEMMEQU	<HAR>	10	30	50
British Approvals Service for Electric Cables (BASEC)	BASEC	<HAR>	10	10	30
N.V. KEMA	KEMA-KEUR	<HAR>	10	30	30
SEMKO AB Svenska Elektriska materielkontrollanstalter	SEMKO	<HAR>	10	10	50
Österreichischer Verband für Elektrotechnik (ÖVE)	<ÖVE>	<HAR>	30	10	50
Danmarks Elektriske Materialkontroll (DEMKO)	<DEMKO>	<HAR>	30	10	30
National Standards Authority of Ireland (NSAI)	<NSAI>	<HAR>	30	30	50
Norges Elektriske Materielkontroll (NEMKO)	NEMKO	<HAR>	10	10	70
Asociacion Electrotecnica Y Electronica Espanola (AEE)	<UNED>	<HAR>	30	10	70
Hellenic Organization for Standardization (ELOT)	ELOT	<HAR>	30	30	70
Instituto Portages da Qualidade (IPQ)	np	<HAR>	10	10	90
Schweizerischer Elektro Technischer Verein (SEV)	SEV	<HAR>	10	30	90
Elektriska Inspektoratet	SETI	<HAR>	10	30	90

PART AF
UL CERTIFICATION MARK

<i>Product Category:</i>	Laboratory Use Electrical Equipment
<i>Product Category CCN:</i>	OGTK / OGTK7
<i>Product Identity:</i>	"LABORATORY EQUIPMENT" or the appropriate product name as shown in the individual Listing.

UL Listing Mark

AF1.1	The Test Report covering each product must be consulted to determine which Listing Marks are authorized for use in conjunction with that product.
AF1.1.1	The following Listing Mark is authorized for use on products that are Listed only to the requirements for Canada: 
AF1.1.1	The following Listing Mark is authorized for use on products which are Listed only to the requirements for the United States: 
AF1.1.2	Either of the following Listing Marks is authorized for use on products that are Listed to the requirements of both the United States and Canada:  
AF1.2	The Listing Mark consists of several elements that are placed in close proximity to each other and shall appear on Listed products only.
AF1.2.1	Element 1 - UL Symbol. There is no required minimum height for the UL Symbol, as long as it is legible. The minimum height of the registered trademark symbol ® shall be 3/64 of an inch. When the overall diameter of the UL Symbol is less than 3/8 of an inch, the trademark symbol may be omitted if it is not legible to the naked eye. Information on downloading electronic versions or receiving camera-ready artwork of the UL Symbols may be obtained at www.ul.com .
AF1.2.2	Element 2 - The word "LISTED"
AF1.2.3	Element 3 - A product identity
AF1.2.3.1	<product identity details are provided above this table>
AF1.2.3.2	The product identity may be omitted if the Listing Mark is directly and permanently applied to the product by stamping, molding, ink-stamping, silk screening or similar process. The product identity may appear elsewhere on the product if the other three elements are part of the nameplate that includes the rating or the catalog or model designation.
AF1.2.4	Element 4 - A number represented above by XXXX is to be replaced with the Applicant's or Listee's file number or a control number.
AF1.3	A separable Listing Mark (not part of a nameplate and in the form of decals, stickers or labels) must include all elements.
AF1.4	The manufacturer may reproduce the Listing Mark or obtain it from a UL authorized supplier.

Description**UL TEST REPORT AND PROCEDURE**

Standard:	UL 61010-1, 3rd Edition, May 11, 2012, Revised July 15 2015, CAN/CSA-C22.2 No. 61010-1-12, 3rd Edition, Revision dated July 2015
Certification Type:	Listing
CCN:	OGTK / OGTK7
Complementary CCNs:	OGTK7
Product:	Centrifuge
Model:	5452 (MiniSpin), 5453 (MiniSpin plus)
Rating:	Model 5452: 120Vac, 1.0A, 50-60Hz, 70W Model 5453: 120Vac, 1.2A, 50-60Hz, 85W
Applicant Name and Address:	EPPENDORF A G BARKHAUSENWEG 1 22339 HAMBURG, GERMANY

This is to certify that representative samples of the products covered by this Test Report have been investigated in accordance with the above referenced Standards. The products have been found to comply with the requirements covering the category and the products are judged to be eligible for Follow-Up Service under the indicated Test Procedure. The manufacturer is authorized to use the UL Mark on such products which comply with this Test Report and any other applicable requirements of UL LLC ('UL') in accordance with the Follow-Up Service Agreement. Only those products which properly bear the UL Mark are considered as being covered by UL's Follow-Up Service under the indicated Test Procedure.

The applicant is authorized to reproduce the referenced Test Report provided it is reproduced in its entirety.

UL authorizes the applicant to reproduce the latest pages of the referenced Test Report consisting of the first page of the Specific Technical Criteria through to the end of the Conditions of Acceptability as applicable.

Any information and documentation involving UL Mark services are provided on behalf of UL LLC (UL) or any authorized licensee of UL.

Prepared by: Paweł Wasiak supervised by Grzegorz Kowalski Reviewed by: Lars Grønnegaard (Reviewer)

Supporting Documentation

The following documents located at the beginning of this Procedure supplement the requirements of this Test Report:

- A. Authorization - The Authorization page may include additional Factory Identification Code markings.
- B. Generic Inspection Instructions -
 - i. **Part AC** details important information which may be applicable to products covered by this Procedure. Products described in this Test Report must comply with any applicable items listed unless otherwise stated in the body of this Test Report.
 - ii. **Part AE** details any requirements which may be applicable to all products covered by this Procedure. Products described in this Test Report must comply with any applicable items listed unless otherwise stated in the body of each Test Report.
 - iii. **Part AF** details the requirements for the UL Certification Mark which is not controlled by the technical standard used to investigate these products. Products are permitted to bear only the Certification Mark(s) corresponding to the countries for which it is certified, as indicated in each Test Report.

Product Description

Models 5452 (MiniSpin) and 5453 (MiniSpin plus) are intended exclusively for indoor use and for separating aqueous solutions and suspensions of various densities in approved test tubes. Refer to the Report Modifications page for any modifications made to this report.

Model Differences

Model 5452 is identical to Model 5453 except for speed.
 5452 has a max. speed of 13400 rpm.
 5453 has a max. speed of 14500 rpm.

Additional Information

Only the specified rotor types may be used with each centrifuge.
 Rotor F55-16-5-PCR nmax=14500 rpm Ekin max = 0.302 kJ
 Rotor F45-12-11 nmax=14500 rpm Ekin max = 1.02kJ
 Rotor F45-12-11 used in MCA

All applicable testing was performed under UL report No.E215059-20010403 and E215059-A8.

Technical Considerations

- The product was investigated to the following additional standards: UL 61010-2-020, Third Edition (2016)
- The following additional investigations were conducted: None
- The product was not investigated to the following standards or clauses: None
- The following accessories were investigated for use with the product: See additional Information
- Equipment class: Class I
 Equipment type: Portable
 The product was submitted and tested for use at the maximum recommended ambient temperature (Tmra) of 40°C

Engineering Conditions of Acceptability

For use only in or with complete equipment where the acceptability of the combination is determined by UL LLC. When installed in an end-product, consideration must be given to the following:

- -

TABLE: List of Critical Components

TABLE: List of critical components					
Component/ Part No.	Manufacturer/ Trademark	Type No./model No./	Technical data	Standard No. ¹	Required Mark(s) & Certificates of Conformity
Enclosure	BAYER	FR3010	Rated V-0, min. 3mm thick, overall dimension 222mm diameter by 75mm high. Secured to bottom plate by 4 screws, provided in front with one slot for lid latch, one sector for keypad and the back a sector for cover hinges and power supply on P.W.B	UL94, UL746C	UR - QMFZ2, E41613
Enclosure Lid, Exterior Portion	BAYER	FR3010	Rated V-0, min. 3mm thick, hemispheric, with an opening for monitoring glass, secured to interior side by integrated snap bolts and adhesive	UL94, UL746C	UR - QMFZ2, E41613
Interior side	Interchangeable	Interchangeable	Aluminum alloy casting portion to secure the rotor chamber, provided with two hinges to rear and mounted in front with one hook for lid latch by screws, mounted to the bottom plate by a screwed axle	--	---
Membrane Panel (Keypad foil)	Interchangeable	Interchangeable	Keypad foil, thickness 400um, is mounted by adhesive consists of layers of plastic material	--	---
Bottom Plate	Interchangeable	Interchangeable	Galvanized steel, overall about 210mm diameter, thickness min. 4.75 mm	--	---
Interlock Assembly	Interchangeable	Interchangeable	Provided with geared motor (5V DC), controlling mechanical latch engaged to the lid hook, Refer to test reference 9-03 for additional information	--	---
Plastic underlay of lid motor	Interchangeable	Interchangeable	Plastic material, min. 1mm thick, 30mm in diameter, refer to enclosure 7-09, 7-10	--	---

Grounding	Interchangeable	Interchangeable	All exposed dead-metal parts likely to become energized in the event of a single insulation failure, are electrically connected to the grounding conductor of the power supply circuit. This connection is maintained by power entry module soldered on the PWB ground. P.W.B. is connected and secured by screws, bolts, and lockwashers, supplying reliable metal to metal contact to the bottom plate. In addition there is an earthing blade on power entry module which is connected by crimp contact and a R/C (AVLV2) AWG 16 wire, rated 300V, and screwed with lock washer to the bottom plate.	--	----
Tabs/double crimp connectors for PE connections, motor connections	Interchangeable	Interchangeable	6.3x0.8 or 4.8x0.8 blades, double crimp connectors	UL310	UL - ZMNV or RFWV
Internal wiring (PE connection from inlet to PCB and PCB to motor)	Interchangeable	Interchangeable	Min. AWG 16, 105degC, green/yellow	UL758	UR - AVLV2, CN or AVLV2/8
Internal wiring (PCB to Motor supply, PCB to front display)	Interchangeable	Interchangeable	Min. 300V, 80degC, min. AWG 20	UL758	UR - AVLV2, CN or AVLV2/8
Tubing for wiring to display board and to lid motor	Interchangeable	Interchangeable	Min. 150V, 80degC	ANSI/UL224	UR - YDOW2 or YDPU2
Single Row crimp on-snap in/Pin Housing single row crimp snap-in for (RPM sensor, TEMP sensor, Display)	TYCO	AMP Modu II (Part Nr 280358, 280359 and 280628, 280629)	Made of Black, thermoplastic, rated min. V-1, QMFZ2, refer to enclosure 7-11 for drawing	--	----
Receptacle Housing / Pin Header for Lid motor	TYCO	AMP Quick (Part Nr. 928205-3, 828548-3)	Made of White, thermoplastic, rated min. V-1, QMFZ2, refer to enclosure 7-12 for drawing	--	----
Power Entry Module with switch	SCHURTER	Combifit KP01.1112.11	250V, 10A, max 70degC	C14 acc. to IEC/EN 60320-1, UL 498, CSA C22.2 no. 42	UR - AXUT2, E96454
Fuse (2 provided) F1, F2)	Littelfuse	218	3.15A, 250V	UL248-1	UR - JDYX2

Fuse Holder for F1, F2	Interchangeable	Interchangeable	Min. 4A, min. 250V	ANSI/UL 4248-1	UR - IZLT2
Power Cord	Interchangeable	Type SVT	18AWG, 3 conductor, terminating in molded on cord or a Listed assembled on parallel blade, grounding type attachment plug having a 10A, 125V configuration. Appliance end terminates in molded on cord connector body IEC configuration, rated 6A, min. 125V, min. 75degC	UL817	UR - ELBZ/7
Interlock Switch (on main PWB)	MARQUARDT	Type 1050	250V, 5A(tested for 87.000 cycles)	UL1054	UR - E41971, WOYR2
Main PWB	Interchangeable	Interchangeable	Min. V-1, 105 degC, suitable for soldering time and temperature, mounted on studs 5mm high	UL94, UL746C	UR - ZPMV2
Rectifier (GR901)	Interchangeable	KBU8K	800V, 8 A		UR - QQQX2
Alternate (GR901)	Interchangeable	Interchangeable	Min: 800V, 8 A		UR - QQQX2
Surge;Guard (R302)	KETEMA RODAN/RTI	SG170	Silicone resin material, 8A/4.0R	--	---
Alternate Surge;Guard (R302) Not to be inspected by the UL Inspector	KETEMA RODAN/RTI	SG308	Silicone resin material, 8A/4.0R		---
Varistor line to line (R301)	EPCOS	SIOV S10K275	275V AC	UL1449	UR - VZCA2, E321126
Alternate varistor (R301)	Littelfuse	V275LA10	275V AC	UL1449	UR - VZCA2, E320116
IGBT (T501,T511,T521,T502,T512,T522) Not to be inspected by the UL Inspector	IR	IRG 4BC20KD	600V, 9 A	--	---
Alternate IGBT (T501,T511,T521,T502,T512,T522) Not to be inspected by the UL Inspector	Interchangeable	Interchangeable	600V, 6 A	--	---
Integrated circuit IC 301 Not to be inspected by the UL Inspector	IR	2136J	3 Phase Bridge Driver	--	---
Y-Capacitor (C320, C321)	Xiamen Faratronic	MKP 63 Serie	4.7nF, min.250V, marked Y2	UL1414	UR - FOWX2/8, E186600
Alternate Y-Capacitor (C320, C321)	Interchangeable	Interchangeable	4.7nF, min.250V, marked Y2 or Y1, same dimensions as above	UL1414	UR - FOWX2/8 or FOWX2, CN
Y Capacitor (C620, C621)	Xiamen Faratronic	MKP 63 Serie	2.2nF, 250V, marked Y2	UL1414	UR - FOWX2/8, E186600

Alternate Y Capacitor (C620, C621)	Interchangeable	Interchangeable	2.2nF, min. 250V, marked Y2 or Y1, same dimensions as above	UL1414	UR - FOWX2/8 or FOWX2, CN
X2 Capacitor (C302,C3011,C311)	Epcos	B81130 C1334	330nF, 250V, Marked with "X2"	UL1414	UR - FOWX2, E97863
Alternate X2- Capacitor (C302,C3011,C311)	Interchangeable	Interchangeable	330nF, min. 250V Marked with "X1" or "X2", same dimensions as above	UL1414	UR - FOWX2
X-Capacitor (C918,C919)	Xiamen Faratronic	MKP 62 Serie	33nF, 250V, Marked with "X2"	UL1414	UR - FOWX2
Alternate X Capacitor (C918,C919)	Interchangeable	Interchangeable	33nF, min. 250V, Marked with "X1" or "X2"	UL1414	UR - FOWX2
Capacitor (C911,C912)	EPCOS	B43504	220uF, 450V, 105degC.	--	---
Alternate Capacitor (C911,C912)	Interchangeable	Interchangeable	220uF, 450V, 105degC.	--	---
Choke (48592) (L302)	EPCOS	B 82734 R2172 B30	2x 27mH, 1.7A	UL1283	UR - FOKY2, E70122
Transformer TR1 (48653)	ACAL/LION	Model A3620007	Ferrite core, coils of copper magnet wire wound on nylon bobbin. Leads exit directly with no primary or secondary crossover through integral flanges in bobbin and are mechanically secured and soldered to pins which are molded into bobbin. Bobbin is Recognized Component Plastics (QMFZ2), polyamide manufactured by BASF, Ultramid, rated V0. Transformer varnished or wax impregnated to retard moisture absorption and secured to printed wiring board by soldering. Transformer enclosed in molded enclosure, epoxy casting resin material, filled with epoxy	--	---
Alternate TR1	Vogt	5450115700	Same as above	--	--- Same as above
Alternate TR1	PM Hartu	717283-51	Same as above	--	--- Same as above
--	--	--	--	--	---
Alternate Main PWB (PN: 5452 126.305-xx)	Interchangeable	Interchangeable	Min. V-1, 105 degC, suitable for soldering time and temperature, mounted on studs 5mm high	UL94, UL746C	UR - ZPMV2
Coil L100	Epcos	B82734R	Rated, 2x15mH, 2.3A, 250V AC	UL1283	UR - FOKY2, E70122

Varistor VR101	Epcos	Varistor Series SIOV S14K150	Surge-protective device, Type 4, For use in SPD Type 2 applications, rated 150Vrms	UL 1449	UR - VZCA2, E319264
Resistor R101	Interchangeable	Interchangeable	Rated 470Kohm, 500V, 1W	--	---
Resistor R100	Epcos	S364 series, ordering code B57364S0100M000	Rated 7.5A, R(25) = 10 ohm, max load capacitance 110V/4000uF, 230V/1000uF, class C3	UL1434	UR - XGPU2E69802
Rectifying bridge, GR100	Diotec	GBU12J	Rated 420V, 12A	--	---
Alternate rectifying bridge GR100	Interchangeable	Interchangeable	Rated 420V, 12A	--	---
X capacitors, C103, C104	Epcos	B32923-C3334-M	Marked X2, Rated 330nF, 305Vac	UL 60384-14	UR - FOWX2 E97863
Alternate X capacitors, C103, C104	Interchangeable	Interchangeable	Marked X2, Rated 330nF, 305Vac	UL 60384-14	UR - FOWX2
X capacitors, C106, C409	Epcos	B32922-C3474-M	Marked X2, Rated 470nF, 305Vac	UL 60384-14	UR - FOWX2 E97863
Alternate X capacitors, C106, C409	Interchangeable	Interchangeable	Marked X2, Rated 470nF, 305Vac	UL 60384-14	UR - FOWX2
Y capacitors, C105, C110	Epcos	B32021A3152M	Marked Y2, Rated 1.5nF, 305Vac	UL 60384-14	UR - FOWX2 E97863
Alternate Y capacitors, C105, C110	Interchangeable	Interchangeable	Marked Y2, Rated 1.5nF, 305Vac	UL 60384-14	UR - FOWX2
X capacitors, C107, C108	Vishay	MKP 338 4 (ordering code BFC2 338 44333)	Marked X2, Rated 33nF, 300Vac	UL 1283	UR - FOWX2 E354331
Alternate X capacitors, C107, C108	Interchangeable	Interchangeable	Marked X2, Rated 33nF, min. 300Vac	UL 1283	UR - FOWX2
Y capacitors, C113, C114	Epcos	B32021A3472M	Marked Y2, Rated 1.5nF, 305Vac	UL 60384-14	UR - FOWX2 E97863
Alternate Y capacitors, C113, C114	Interchangeable	Interchangeable	Marked Y2, Rated 1.5nF, min. 305Vac	UL 60384-14	UR - FOWX2
Y capacitors, C100, C115	Epcos	B81122-C1222-M	Marked Y2, Rated 2.2nF, 250Vac	UL 60384-14	UR - FOWX2 E97863
Alternate Y capacitors, C100, C115	Interchangeable	Interchangeable	Marked Y2, Rated 2.2nF, min. 250Vac	UL 60384-14	UR - FOWX2
Electrolytic capacitors, C102, C109	Rubycon	250TXW220MEFC18X30	Rated 220uF, 250Vdc	--	---
Alternate electrolytic capacitors, C102, C109	Interchangeable	Interchangeable	Rated 220uF, min. 250Vdc	--	---
Transformer TR200	Renco Electronics Inc.	S005701	See enclosure 7-13 for construction details.	--	---

MOSFET T200	ST	STD5NM60T4	Rated 650V, 5A, 96W, RdsON < 1 ohm	--	----
Alternate MOSFET T200	Interchangeable	Interchangeable	Rated 650V, 5A, 96W, RdsON < 1 ohm	--	----
SMPS controller IC U200	Texas Instruments	UCC28711	Rated 35Vdc	--	----
Inverter IC, U400	Fairchild Semiconductor	SPM 45 Series, FNB41060	Rated 600V, 10A	UL1577	UR - QQQX2 E209204
-	--	--	--	--	----
Main motor	Hanning Elektro-Werke	C3A071-015P0003-138-0010NE-121	200V, 230Hz, Secured by three screws to bottom plate. Provided with R/C (OBJY2) Class F insulation system, Hanning Elektrowerke, designated Type F96	UL1004	UR - PRGY2, E228048
Alternate main motor	Hanning Elektro-Werke	C3A071-015P0003-138-0010NE-87	200V, 230Hz, Secured by three screws to bottom plate. Provided with R/C (OBJY2) Class F insulation system, Hanning Elektrowerke, designated Type F96	UL1004	UR - PRGY2, E228048
Alternate main motor (Unlisted Component)	Hanning-Elektro-Werke	ZCI4W2-062 or Type ZCI4W2-087 or ZCIW2-121 or ZCI4W2-195	200V, 230Hz, Secured by three screws to bottom plate. Provided with R/C (OBJY2) Class F insulation system, Hanning Elektrowerke, designated Type F96, refer to E215059SP, issued 2001-04-04 for unlisted component report	-	--- OGTK3
--	--	--	--	--	----
Display PWB located in mains circuit	Interchangeable	Interchangeable	Rated in. 105degC, min. V-1	UL94, UL746C	UR - ZPMV2
--	--	--	--	--	----
RPM Sensor mounted on main motor bottom by 2 screws, constructed as follows:	--	--	--	--	----
Leads	Interchangeable	Interchangeable	AWG 26, min. 150V, VW1	--	UR - AVLV2
Electrical Tubing/Sleeving over leads and over wires from main PCB to display	Interchangeable	Interchangeable	Min. 90degC, 300V, VW1	--	UR - XDPU2 or UZFT2
Enclosure of RPM sensor	Albis	PA6 A 1000/149	Overall dimensions diameter 48mm, height 5.3mm, min. thick. 2.5mm, rated min. V0	UL94	UR - QMFZ2, E80168

PCB	Interchangeable	Interchangeable	Rated in. 105C, min. V-1	UL94, UL746C	UR - ZPMV2
Type Label	Herma	PETP Silber SR	-40 to 150C	UL969	UR - PGJI2
Warning Marking (Symbol 14)	Hein	Interchangeable	Min. 60C, suitable for affixed surface	UL969	UR - PGDQ2, MH46678
Feet (4 provided)	J. Meinert GmbH	Made of PVC, transparent, Drawing No. 0013 010.234-01	Refer to drawing 7-08 for details	Accepted by Test	-- --

Supplementary information:

The Test Laboratory has verified the component information.

- 1) Anything specified within brackets "()" is for reference purposes only and can be used to specify the UL Product Category CCN(s)/File Number if the component includes an UL Certification. This can be useful for the UL Follow-Up Service Inspection associated with the UL Mark; however if in brackets, should not be a required element of the UL Inspection.

----- END OF APPENDIX C -----