

Operating instructions

Combilabor® CL-I 95 Induction Vacuum Pressure Casting Machine

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This operating instructions apply to:			
Order-No.	Type	Version	Edition
646 00 965	CL-I 95	without closed circuit water cooler without pump CL-P	7/1998

Caution ! High frequency !

Warning for persons with heart pacemakers !

Read operating instructions carefully prior to use !

We cannot accept any guarantee claims or assume liability if the machine is used for other purposes as stated or consequent damage by not following the operating instructions !

Conformation of the manufacturer

We herewith confirm that the Combilabor CL-I 95 is interference screened in accordance with the regulations of VDE 0871 B, paper 163/1984 Vfg 1046.

The machine has been registered with the German Telekom AG. They reserve the right to verify production conforms with the regulations.

Heraeus Kulzer Dental GmbH & Co. KG, Hanau, August 1995



Heraeus Kulzer Dental GmbH & Co. KG, Grüner Weg 11, D-63450 Hanau

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1. Information on safe operation

Explanation of symbols

Symbols	Explanation
	Safety-relevant chapters and sections in the operating instructions have been marked with this symbol !
	Information within the operating instructions on the optimum use of the unit.

General:

Please check the unit for transport damage and, if necessary, report the damage to the forwarder within 24 hours after receiving the unit.

EU-Statement of Conformity

We, the Heraeus Kulzer Dental GmbH & Co. KG, Grüner Weg 11, D-63450 Hanau, herewith declare that the following described machine based on its design and built, as well as the quality introduced into the market by us, complies with the appropriate fundamental safety and health requirements of the EU-guidelines. Through changes on the machine not coordinated with us this declaration loses its validity.

Description of the machine: Induction heated vacuum pressure casting machine CL-I 95

Machine type: A99-0003; 400 V; 50/60 Hz
Machine- no.: 13500 / 95451 ff.

Relevant EU - guidelines: **Machine guideline 89/392/EWG, Appendix II A**
Electromagnetic wholesomeness 89/336/EWG

The unit complies with the safety specifications of:

- DIN VDE 0750 T1 05.82
- DIN VDE 0411 T1 06.86
- DIN 1988 T4 12.88

Furthermore, the laboratory casting unit has been subject to safety-technical tests by the TÜV testing and certification institute. GS and interference protection sign approval exists for this machine, in the tested version.

Operating instructions

With the help of these operating instructions and based on the work to be performed by the operator easily understandable, written instructions have to be prepared and published in the language of the operators concerning the work at and with this machine.

Unit book

We recommend to keep a unit book. All tests, calibrations of the unit as well as all essential works (e.g. repair work, modifications, ...) must be documented in this book.

Safety information

With these laboratory units the safety concerning the protection of persons, the environment and the material to be processed mainly depends on the behaviour of the persons operating the unit.

Prior to operation read the operating instructions carefully, adhere to the information provided in order to avoid errors and damage, in particular damage to the health.

In addition to the information in these operating instructions the respective national laws, regulations and guidelines must be observed for setting up and operating this unit (FRG e.g.: ZH 1 / 119, DIN 12880 Part 1, technical connection requirements of the electrical supply companies etc.).

The unit must not be used for heating up food.

The unit must not be used for works which include the release of combustible gases and vapours which burn with air or which may form a dangerous, explosive mixture.

The unit is not suitable for thermal treatment of dangerous dusts and fibres either.



The metal surface around the casting chamber heats up during continuous operation. Do not touch this surface.

Due to the waste gases resulting from the work, sufficient ventilation must be provided.



Power cable and plug must be checked for damage prior to operation. If any damage exists, the unit must not be connected to the mains.

Works at the electrical equipment of the unit must only be performed by the authorized **Heraeus service** and in the safe condition (voltage cleared).

Only permissible original spare parts must be used. The use of different parts holds unknown risks and must be avoided at any rate.

Proper function and safety of the unit are only guaranteed if the required tests, maintenance and repair works have been performed by the Heraeus service or by personnel which has been authorized by us.

Heraeus Kulzer Dental GmbH & Co. KG will **not accept any liability** for damage to the unit resulting from proper repair which has not been performed by Heraeus service agents or if no original spare parts or accessory parts have been used during the exchange of parts.

2. Use in accordance with specifications

The CL-I 95 induction casting machine is a laboratory unit for casting of precious metal dental alloys and CoCrMo alloys for dental applications with a liquidus temperature up to 1.500°C except for titanium.

Precision castings with alloy quantities of 130 g in the graphite crucible and 100 g in the ceramic crucible are possible.



We recommend the **exclusive** use of original Heraeus Kulzer crucibles which are especially matched for this type of application. The use of other crucibles leads to the exclusion of guarantee claims. Based upon the numerous causes for the occurrence of faulty castings, warranty claims will generally not be excepted.

Normally, the unit is suitable to be set up and operated in the following fields:

Laboratories, e.g. commercial and industrial, schools, universities, hospitals, etc.

The unit has been designed for continuous operation.

Working rules



Personal protective equipment such as hand, face and body protection must be worn; jewelry must be taken off prior to working.



The unit must not be

- used to heat up food.
- used for drying processes or thermal treatment which may lead to release of combustible gases and vapors which burn with air or may form a dangerous, explosible mixture.
- The unit is not suitable for thermal treatment of dangerous dusts fibres either.

3. Description of the unit

Features

- Safe and material appropriate melting and casting under vacuum
- Every type of precious metal alloy and almost all types of non-precious alloys excluding titanium alloys as well as aluminium and beryllium containing alloys (→ health hazard) can be melted and cast.
- Temperature control via electronic power control and time
- Long lifetime of ceramic and graphite crucibles



In order to avoid errors and problems during working we would like to ask you to read these operating instructions as well as the golden booklets

**„Understanding and avoiding Processing Errors“
as well as „The Heraeus Cobalt Chrome System“**

carefully and to store them at a place ready to hand.

4. Scope of delivery / special accessories

Scope of delivery including initial equipment

Number	Designation
1 pce	Pressure reducer/ filter combination with water separator
1 pce	Manometer 63 mm diameter, 0 -10 bar, R 1/4"
1 pce	Double nipple 1/2" - 1/2" outside, screwable
1 pce	Compressed air liner DN 7.2
1 pce	Hose liner 1/2"
1 roll	Teflon tape
7 m	Pressure hose 10 mm diameter
3 m	Pressure hose 13 mm diameter
2 pcs	Universal hose clamp universal norm 12 - 22 mm
4 pcs	Universal hose clamp universal norm 10 - 16 mm
1 pce	Tightener for the mould
6 pcs	Ceramic crucibles, 6 pce NEM-crucibles

- 10 pcs Graphite inserts
- 3 pcs each Casting ring sizes X3, X6, X9
- 1 pce each Cone former sizes X3, X6, X9

Optional accessories

- Vacuum pump CL-P, type 5/6 Order No.: 645 00 223
- Closed circuit water cooler CL-WUK 2 Order No.: 645 00 212

5. Diagrams / operating controls

Diagram 1) Total view

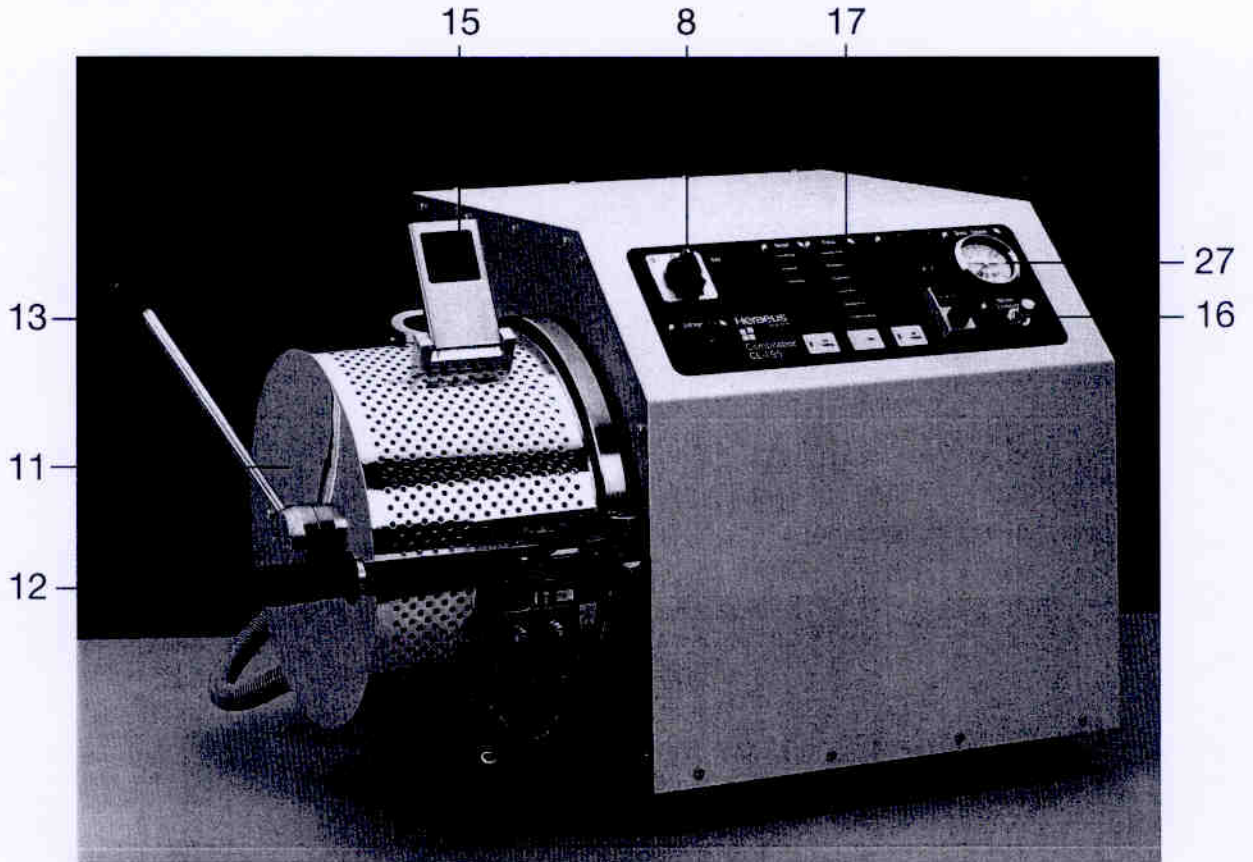


Diagram 2) Front panel with control keys and display

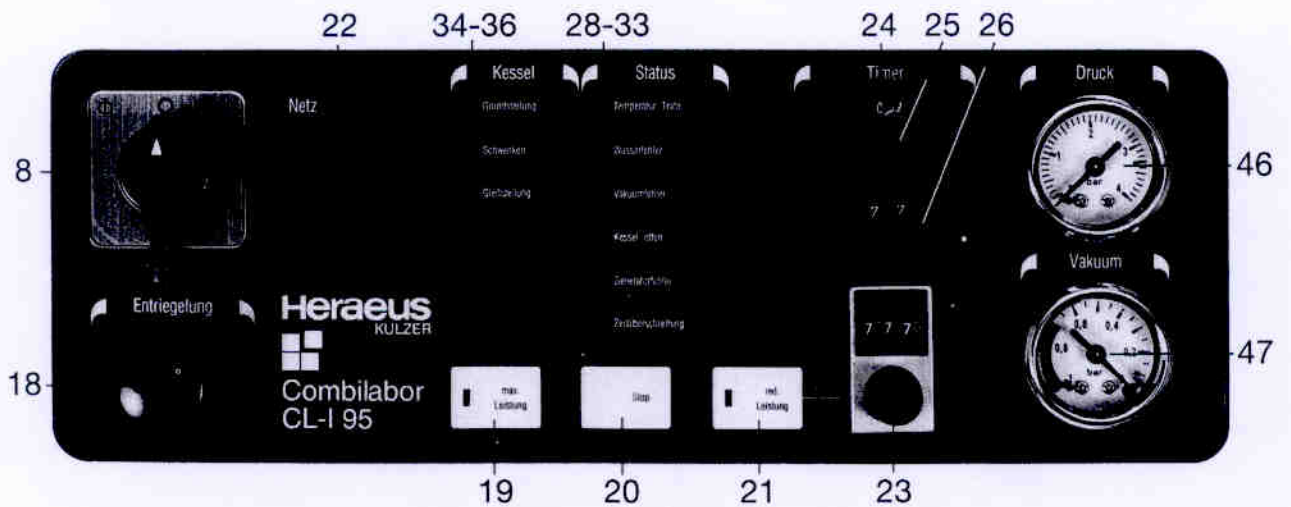


Diagram 3) Partial view right side showing the connections for installation

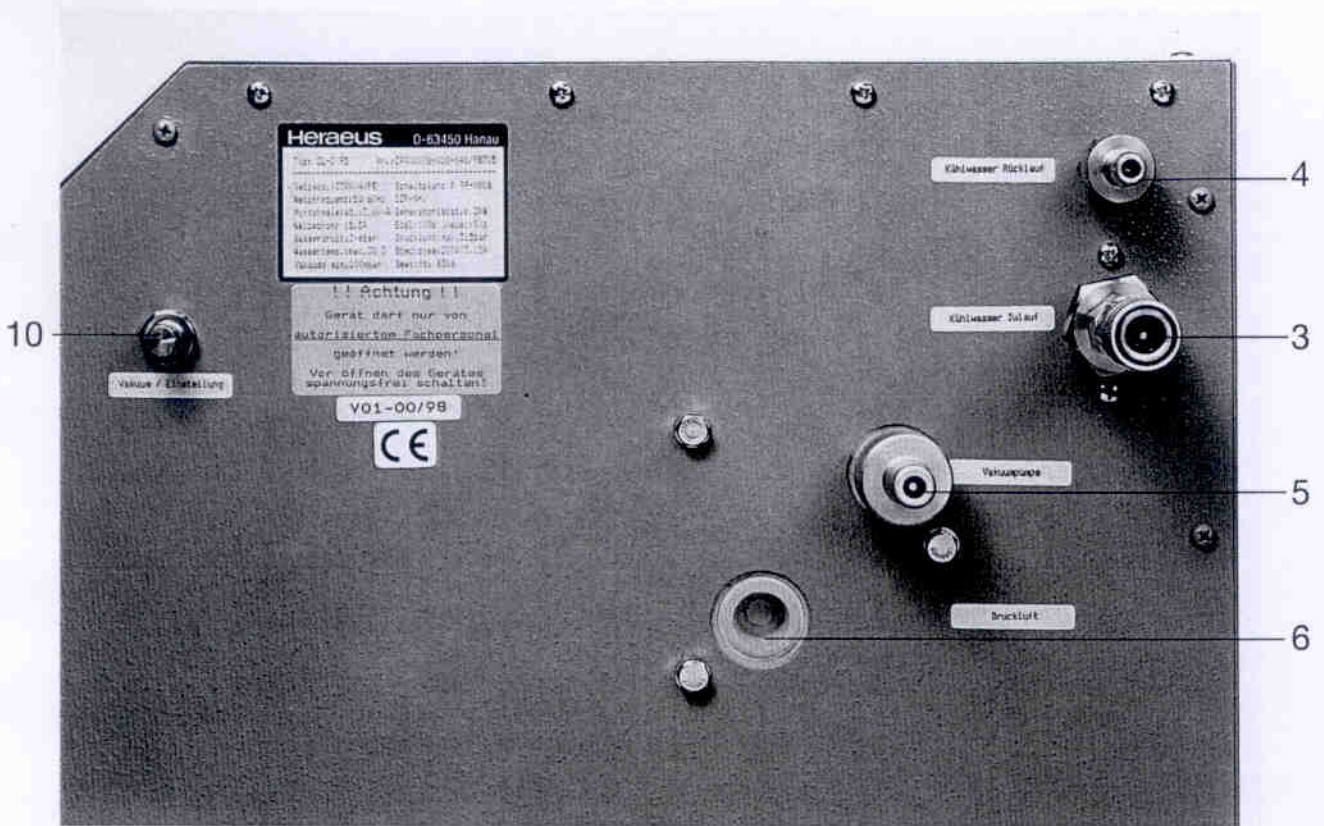
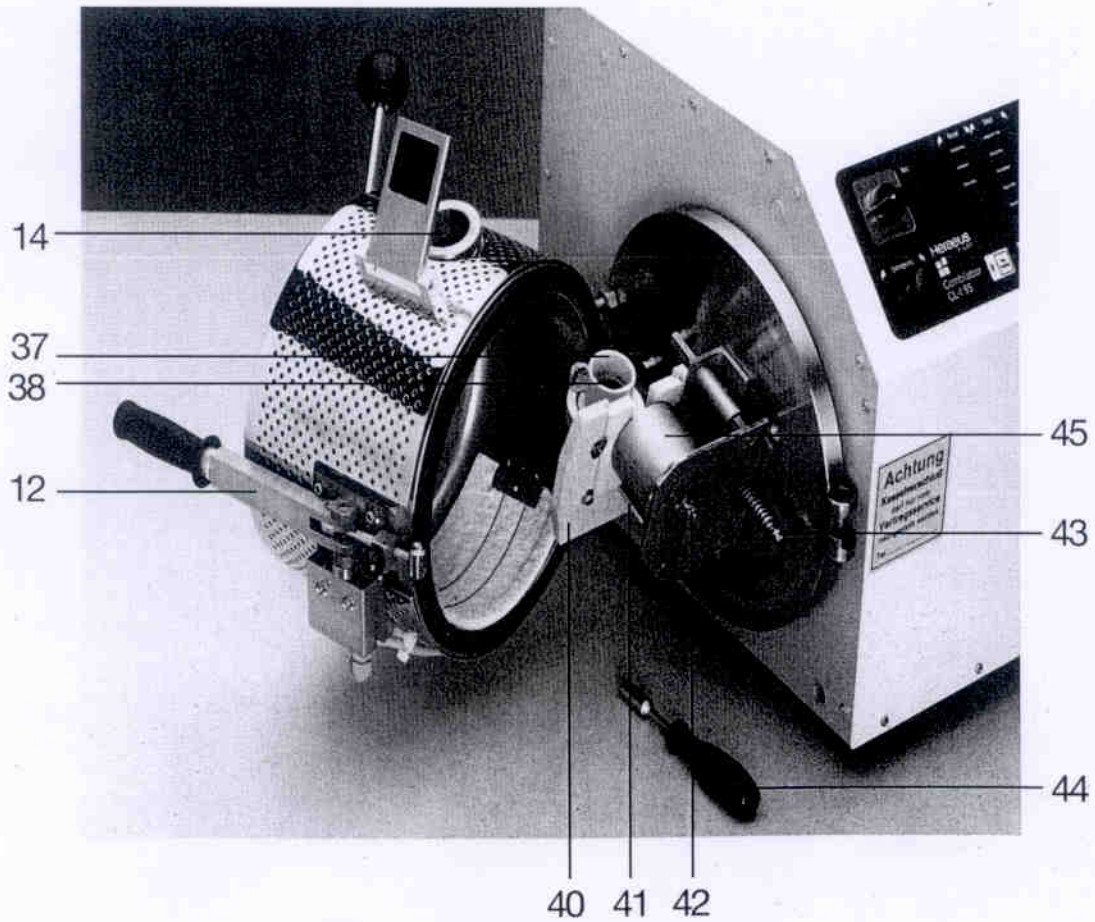


Diagram 4) Partial view open chamber



No. Description

1. 4 screw-in carrying handles. One handle is screwed into chamber locking lever.
3. Cooling water connection, inlet
4. Cooling water connection, outlet
5. Vacuum pump connection
6. Compressed air connection
Socket for vacuum pump (e.g. CL-P, type 5/6 on rear of unit)
8. Mains switch
9. Vacuum pump
10. Adjustable valve - vacuum (from unit no. 98701)
11. Casting chamber
12. Locking lever for casting chamber (with carrying handle)
13. Turning lever
14. Viewing glass casting chamber
15. Protective glass (blue glass)
16. Adjustable valve - vacuum (up to unit no. 98700)
17. Front panel
18. Release knob
19. Melting with maximum power key
20. „Stop“ key
21. Melting with reduced power key
22. Lamp „green“ (= mains on)
23. Potentiometer
24. Timer
25. Display of time
26. Keys for setting time
27. Pressure / vacuum display
28. Lamp „red“ temperature transformer
29. Lamp „red“ water error
30. Lamp „red“ vacuum error
31. Lamp „red“ casting chamber open
32. Lamp „red“ generator error
33. Lamp „red“ time exceeded
34. Lamp „green“ stand by
35. Lamp „green“ turning
36. Lamp „green“ casting position
37. Ceramic crucible
38. Graphite insert
40. Protective plate
41. Mould holder
42. Adjustable screw for size of mould
43. Mould securing screw
44. Mould securing tool
45. Mould
46. Gauge pressure (from unit no. 98701)
47. Gauge vacuum (from unit no. 98701)

6. Location and installation

Transportation

Carefully transport the unit horizontally and do not stack it; avoid shocks ! For dimensions and weight refer to section „Technical data“.

Unpacking

Remove straps. If required, screw in the carrying handles at the corners of the unit.

Set-up

Location: Use a table that will withstand at least 100 kg.

Table area required: Length: 100 cm; Width: 55 cm

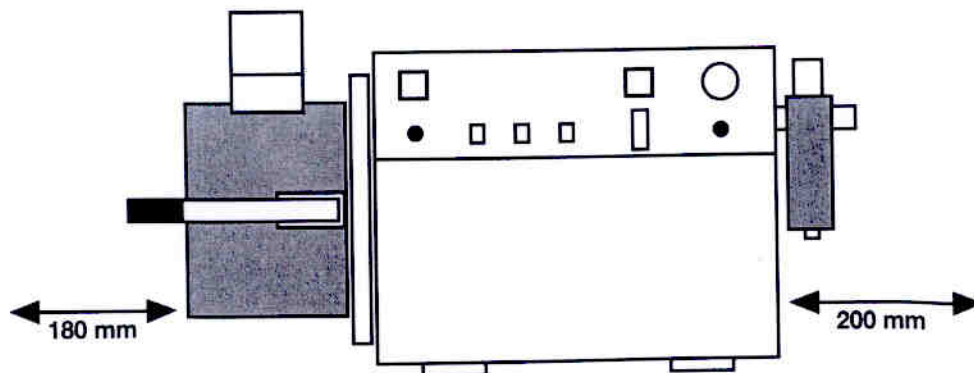
The casting unit must be placed on a solid, non-flammable surface (laboratory desks, racks) so that a horizontal, safe position is ensured. The **surrounding temperature** may amount up to **40°C**. Air inlet and outlet openings in the housing of the unit must not be covered or blocked.

Important notice:

- The rear side of the unit must be least 10 cm from the wall to avoid blocking the air outlet for the built-in fan.
- Do not place flammable material underneath the casting chamber.
- For transport of the unit leave carrying handle (1) under the chamber. Do not lift the chamber ! Chamber will be damaged !
- For operation unscrew the carrying handle (1) on the front left side (underneath the chamber) and screw it into the end of the chamber closing lever (12).
- There must not be any objects within the turning range (horizontal and vertical) of the chamber !
During operation turning movement of the chamber 90° downwards !
- Do not reach with your hands under the chamber !
- Do not lean on the chamber !
- Caution ! Danger of damage and injury !



Minimum distances to adjacent areas or pieces of equipment:



Power supply:

- Mains:** 230 V (AC), 1 P/N/PE, 50/60 Hz, according to VDE requirements and those of your local Electricity Board.
- Mains fuse:** Separate safety fuse, 16 A inert or safety cutout C 16 A.
- Mains connection:** The unit should not be connected via an FI switch. If the FI is required by the local Electricity Board, the 0.5 Ampere type should be used.

Compressed air supply

Note: The compressed air must be dry and clean !

- Line pressure 4 bar min, 8 bar max.
- Line diameter (inside) 10 mm min.
- Connect pressure reducer (10) with enclosed manometer to the housing (6).
- Observe the flow direction of the compressed air (arrow on pressure reducer) !
- Connect the air supply to the pressure reducer/filter combination (10) with a pressure line (min. diameter 13 mm). Secure pressure line using line clips.
- Pull up the adjusting knob of the pressure reducer/filter combination (10) and through turning set the working pressure to 3.0 to 3.3 bar at the pressure reducer.
- If it takes more than 2 seconds for the working pressure to build up miscastings can occur. In this case we recommend an additional compressed air tank CL-DB.

Vacuum pump connection

- Check the oil-level of the vacuum pump (9); fill up if required. Oil quantity for CL-P (type 5 and type 6) is 100 ml.
- Connect the vacuum hose from the pump (9) to the air intake fitting (5).
- Plug into the appropriate socket on the unit (7).
- Switch on mains switch of the vacuum pump.
- Observe the operating instructions of the vacuum pump !

Water connection

Water pressure: 3 bar min., 5 bar max.

Water temperature: 16°C min., 25°C max. The appropriate water temperature, where no condensation water builds up, depends on the room temperature and the relative humidity (also see dewpoint diagram page 29).

Water quality: Water hardness should be less than 15 dH (German standard). If this value is higher, the cooling system must be checked for lime build-up at least once a year (service technician).

Water inlet: Connection from a water tap to the unit via a pressure hose (1/2" min). Secure the pressure hose with hose clips.

Water outlet: The unit must be connected featuring an „open outlet“, i.e. outlet without faucet and not under pressure, not above the water connections at the unit and without tapered diameter. Drain via sink or siphon. The water flow should be visible. The regulations in accordance with DIN VDE 1988 part 4 and DVGW are applicable.

If the water conditions are not as described above for the regular tap water we strongly recommend a closed circuit water cooler (CL-WUK), which is available as a special accessory (see page 7).

Since the unit is equipped with a water solenoid valve, the closed circuit water cooler should be shut off prior to turning off the casting machine.

Room ventilation

The room in which the unit is operated must have sufficient technical ventilation. The unit must not be operated in recesses that can not be ventilated. If several units are to be placed in one room, special ventilation measures may be required (e.g. zone ventilation).

7. Operation

The following pages are to provide basic information and hints which are essential for successful and error-free working. Please observe the order of the working steps. Mostly, casting errors cannot be attributed to the machine. In such cases refer to the golden booklet: „Understanding and avoiding Processing Errors“.

Putting into operation

- 1) Turn on the cooling water prior to switching on the unit. When operating with a closed circuit water cooler, first switch on casting machine and then water cooler.
- 2) Turn on the compressed air supply – check pressure of 3.3 at the pressure reducer
- 3) Mains switch (8) „Ein“ (= on) – amount of 2.5 l/min of water will flow (at 3 bar water pressure).

After switching on the green „Netz (= mains)“ LED is on. The cooling water is checked automatically. If there is no water, the red LED will signal „kein Wasser (no water)“.

The chamber position is indicated by one of the two green LED's „Grundstellung (= stand by)“ and „Gießstellung (= casting)“. The chamber is not in it's designated position if neither of the LED's is illuminated.

The generator of the unit is only ready for service when no red LED is on.

Since the potentiometer has a little bit of play, the setting is possible to the right or to the left limit stop.

(Left limit stop = power minimum; right limit stop = power maximum).

Potentiometer for power setting

Since the potentiometer has a little bit of play, the setting is possible to the right or to the left limit stop. (left limit stop = power minimum; right limit stop = power maximum).

In order to check the valve functions, manual testing can be performed after switching on „Netz“ (= mains).

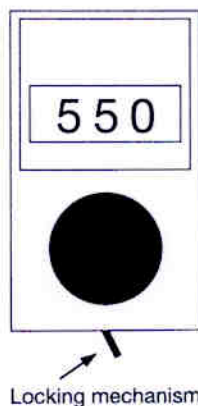
For this purpose the potentiometer can be set to any value.

Attention: The potentiometer is a precision part. Do not try to turn it over it's limit since this may change the scaling and, through that, the power. If it is difficult to turn do not use force, check the locking mechanism of the potentiometer.

Manual testing

After pressing the „red. Leistung“ (= reduced power) key, the vacuum pump starts to evacuate the chamber. If the vacuum can not be achieved, the red LED „Vakuumfehler“ (= vacuum error) comes on; the vacuum can be adjusted with the vacuum adjustment valve on the side of the unit.

The vacuum should be on the manometer in the green area. If the melt spatters the vacuum can be reduced by turning the vacuum adjustment valve counter clockwise. If the chamber is turned manually, compressed air is admitted automatically (check at the manometer). The pressure should be 3.3 bar (red area). After returning to the stand-by position, the chamber is deaerated automatically; the unit is operational (LED „Grundstellung“ = stand-by).



Errors and causes

If a malfunction occurs, the corresponding LED comes on:

Display	Cause and elimination
• Temperatur Trafo – (Temp. transformer)	Leave unit switched on ! Let cool down for 10 minutes. The momentary casting cycle can still be completed.
• Wasserfehler – (Water error)	Check water in- and outlet, if necessary check quantity passing.
• Vakuumfehler – (Vacuum error)	Check the vacuum pump Can also indicate: no compressed air → check compressed air Check the adjustment of the pressure reducer (3.3 bar)
• Kessel offen – (chamber open)	Chamber is not closed; if required, check chamber switch and cable routing outside the chamber.
• Generatorfehler - (Generator error)	Error in the electronics ! Switch off the unit and switch it on again after approx. 10 seconds.
• Zeitüberschreitung – (Time exceeded)	Maximum melting period of 4 minutes has been exceeded. (Buzzer sounds, generator switches off). Set back with „Stop“ (20) key.
• No generator start -	LED „Grundstellung“ (basic position) on?
• Mains switch doesn't - stay „on“	Check mains connection and fuse
• Metal does not melt -	Check potentiometer (left limit stop = no power, right limit stop = max. power). Checked minimum amount for ceramic crucible?
• Potentiometer hard to turn -	Check locking mechanism
• Compressed air escapes - at lip seal	Clean lip seal
• Metal spatlers -	Check ring setting. Original crucible used? Original cone former used? Too much alloy? Turned too fast? Check crucible setting.

For miscasts and technical assistance feel free to call us. Germany: ++ 49 - 6181 - 35 - 5497

Notice:

Please contact the responsible service agent if an error cannot be eliminated. Do not try to repair the unit yourself since this holds unknown risks and is not permissible.

Please ensure that no hot crucible is left in the coil after casting !

After casting, turn off the main water supply !

Please read the for the maintenance relevant service instructions in chapter 10 of these operating instructions.

Putting out of operation

- Remove crucible and mould from the chamber.
- Let the unit cool down for approx. 5 minutes before switching it off (cooling water !)
Then turn off the cooling water supply (cooling water only runs if mains is switched on).
- Switch off the machine. Unplug the unit if it is not to be operated for longer periods.
- When using a water cooling unit, first shut off cooling then casting machine.
- Remove the contamination from the crucible and the chamber.

8. Melting and casting

8.1. General

The following golden booklets with information on casting according to the Heraeus system are available upon request:

- Understanding and Avoiding Processing Errors
- The Heraeus Cobalt Chrome System

Heraeus spruing system:

Information can be found on page 18 of these operating instructions.

8.2. Recommended investments

No graphite-containing investment materials must be used. Due to the graphite content gases can appear and damage to the alloy can result. We recommend to use Heraeus investment materials:

Mainvest	} - plaster-bound, graphite-free
Heravest	} - phosphate-bound, graphite-free

8.3. Premelting

In order to obtain uniform casting conditions, all alloys are premelted. The mould is placed into the casting chamber after premelting the alloy.

Important notice:

The alloy must be observed continuously during premelting. Generally, because of the high light intensity, the melt must only be observed through a blue glass (15). The premelting process must only be interrupted when all the alloy has melted. Alloy loses its shape and forms ball, no edges visible, the opening up of the oxide layer in the graphite insert has no significance. **Exception:** CoCrMo alloys (refer to page 19).

For large amounts (> 50 g) the alloy must be melted in portions. Only after adding the last portion the alloy must be heated up to melt completely. Under these circumstances the melting is possible in as many portions as desired.

8.4. Casting

After premelting, the mould is rapidly placed in the casting chamber (ideally ca. 20 - 40 sec.) and the melting process is started by pressing the „red. Leistung (red. power)“ (graphite) or „max. Leistung (max. power)“ (ceramic) key. After the casting temperature is reached, the casting process is started by manually turning the chamber 90°. The turning should be carried out fast and without jerking.

Important: The interruption between pre- and main melt should not exceed one minute to prevent the melt from cooling down too much. Use every crucible just for one alloy to prevent the mixing up of the alloys. For this the crucibles can be marked with a felt-tip pen. Small metal residue at the crucible sprout can often be traced back to hard hitting the chamber while turning during the casting process. Please ensure the correct positioning of the ceramic crucible. Should there be alloy residue, after cooling it can be easily removed from the sprout and be used in the next casting without sandblasting it again.

Graphite insert

When using graphite inserts, the alloy is heated under continuous observation by the user up to the set point of time. After the set time is reached, the buzzer sounds and the „Schwenken (turning)“ lamp comes on.

If casting is not started immediately, the alloy may be damaged through overheating.

- If graphite inserts lose some of their height or the upper border becomes thin and brittle they must be exchanged → temperature deviation. Minimum weight graphite insert ca. 7 g.
- If a lot of melting powder has accumulated in the graphite insert no melting powder should be added for the next casting.
- Prior to each casting blow out graphite insert (cleanliness)!

Ceramic crucibles

When using ceramic crucibles, the alloy is heated up until the oxide layer splits open or with modelcast- and NEM-alloys until the shadow disappears (refer to picture phase 5, page 19) and, depending on the type of alloy, casting is performed with or without delay time. The machine does not regulate automatically.

The casting parameters of the alloys as well as the delay time value can be taken from the alloy chart (section 9.5.).

- The sprues and the casting buttons must be cut up prior to melting. When filling the crucible make sure that the alloy lays in the crucible as far down as possible to get an optimum and even melting power.
- Note the appropriate placement of the casting cylinders for CoCr according to the melting pictures.

9. Alloys

9.1. Gold casting and high gold content bonding alloys

Processing: Alloy quantities: 5 g to 130 g

Gold casting alloys: Use ceramic crucible with graphite insert and a melting pellet (small) for melting!

Bonding alloys: Use ceramic crucible with graphite insert!
Melt without melting pellet!

In the CL-I 95 the melting powder pellets are used in exactly the reverse order as in the CL-G, G 77, G 94 and G 2002 casting units since the alloys are melted under vacuum which leads to reduced formation of protective gas.

Procedure:

- Mains switch (8) on.
- Check LEDs.
- Open casting chamber (11).
- Place a ceramic crucible (37) with graphite insert (38) into the coil and lock in place with the crucible holder.
- Use the mould securing tool (44) and adjustable screw (42) to set the mould holder (41) to suit the size of the mould.
- Place the alloy into the graphite insert (38).
- Read and set the intensity and the „Schmelzzeit“ (melting time) in accordance with the liquidus temperature of the alloy from the alloy chart (section 9.5.).

Important: Alloy should be small pieces to prevent a partial overheating of the alloy!

- Close the casting chamber (11). Check adjustment of eye-protection-glass (15)!
- Press „max. Leistung“ (max. power) key. Start vacuum pump (9) and generator.
- Adjust the vacuum setting (27) with the adjustable valve (16) to approx. -0.9 bar.
- **Caution:** Observe the melt. Stop premelting after the alloy is completely molten.
- Press „Stop“ key (20).
- Open casting chamber (11).

- Add one small melting powder pellet when melting gold casting alloys.
- Place the mould (45) in the mould holder (41) and secure it with the securing screw (43) and the mould securing tool (44). Don't overtighten!
- Close casting chamber (11).
- Press „red. Leistung“ (red. power) key (21).
- After the preselected melting time has elapsed (optical and acoustic signal) pull up the release knob (18) and turn the casting chamber swiftly and without jolt (compressed air comes in). When turning too hard the alloy may spill !
- Turn the casting chamber back to the initial position after approx. 60 seconds.
- Open the casting chamber, remove the mould and the crucible and close the chamber again.

9.2. Reduced precious metal content and palladium based alloys

Processing: Use ceramic crucible without melting powder pellet.

Alloys quantities: 15 g to 100 g (Minimum quantity of 20 g for reduced precious metal content bonding alloys)

Procedure:

- Mains switch (8) on.
- Check LED's.
- Open casting chamber (11).
- Place a ceramic crucible (37) into the coil (46) and adjust in place with the crucible holder (39).
- Use the mould securing tool (44) and adjustable screw (42) to set the mould holder (41) to suit the size of the mould.
- Place the alloy into the ceramic insert (37).
- Adjust potentiometer setting to „999“ (max. power, **right limit stop**, tolerance in the display from 995 to 999 possible) and enter delay time (6 seconds).

Important: The alloy portions should be as small as possible to prevent a partial overheating of the melt!

- Close the casting chamber (11). Check adjustment of eye-protection-glass (15)!
- Press „max. Leistung“ (max. power) key. Start vacuum pump (9) and generator.
- Adjust the vacuum setting (27) with the adjustable valve (16) to approx. -0.9 bar (middle green area).
- Observe the melt. Press „Stop“ key (20) after the alloy is completely molten and the oxide layer has split open.
- Open casting chamber (11).
- Place the mould (45) in the mould holder (41) and secure it with the securing screw (43) and the mould securing tool (44). Do not overtighten!
- Close casting chamber (11). Check adjustment of eye-protection-glass (15)!
- Press „max. Leistung“ (max. power) key (19).
- After the oxide layer splits open, press „red. Leistung“ (red. power) key. After the 6 seconds delay time (optical and acoustic signal) pull up the release knob and turn the casting chamber.
- After approx. 60 seconds turn the casting chamber back to the initial position .
- Open the casting chamber, remove the mould and the crucible, and close the chamber.

9.3. CoCrMo alloys and non-precious alloys

Processing: Use NEM-ceramic crucible without melting pellets.

Important notice: The NEM-ceramic crucible is only for casting of non-precious alloys and offers a longer lifetime compared with the regular ceramic crucibles. When using NEM-crucibles for precious alloys there is the danger of silicium contamination.

Alloy quantities: 10 g to 60 g

Procedure:

- Premelt and cast are carried out in the ceramic crucible in accordance with section 9.2.
- Proceed in accordance with the enclosed melt characteristics. Observe the horizontal position of the metal cylinders!
- Beryllium-, aluminium- (→ hazardous to the health) and titanium-containing alloys cannot be cast in the CL-I 95.
- Vacuum between -0.7 and -0.8 bar.
- Stop premelt after complete melting or according to other melt characteristics.
- Cast after delay time, after shadow or after opening up of oxide layer.

9.4 Melt characteristics of Hereanium CE, EH, NF and Heraenium NA.

For melt characteristics refer to page 19 and 22.

9.5. Heraeus Kulzer Alloy chart

Pages 20 - 22

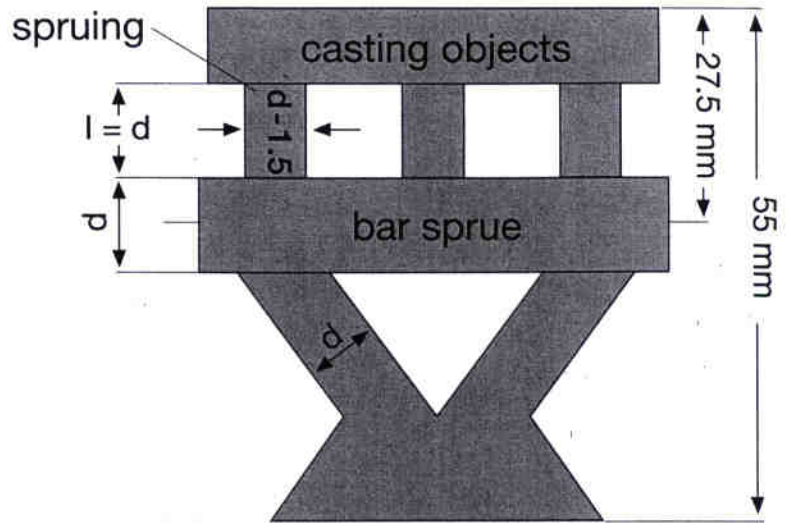


Caution !

- Under no circumstances must the machine be left unattended during the melting process !
- The melt must be observed permanently !
- The eye-protection-glass (15) must be used for every melting process ! Check adjustment !
- Danger of blinding due to high light intensity of the melt !

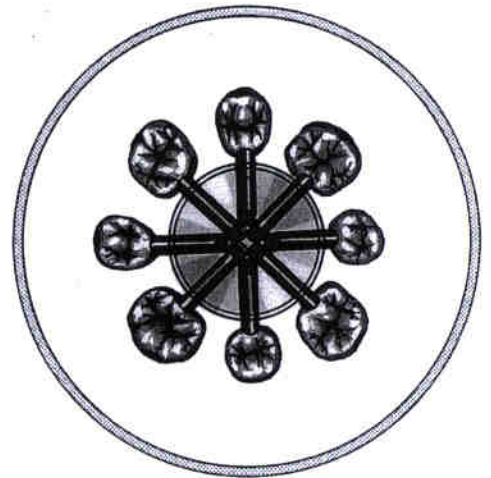
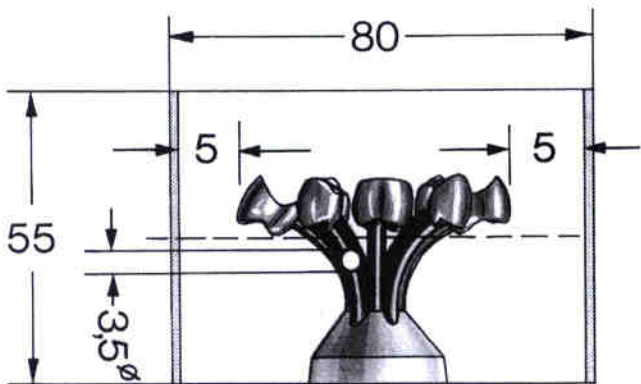
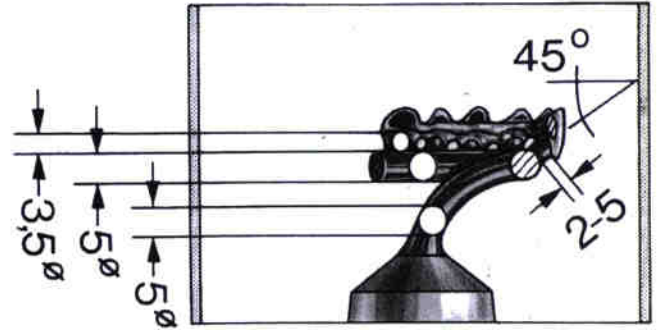
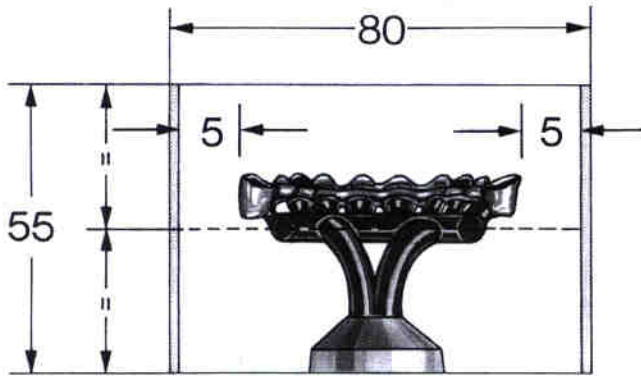
The spruing system

d = diameter of sprue in mm
 d = for bonding alloys 4.5 - 5.0 mm
 d = for gold casting alloys ≥ 3.5 mm
 l = length of sprue



Schematic of casting mould design

Schematic depiction of the casting sprue structuring (bridges).
 (Measurements for precious metal ceramic bonding alloys in mm)



Schematic depiction of the casting sprue structuring (single crowns).
 (Measurements for precious metal ceramic bonding alloys)

9.4. Melt characters of Heraenium CE, Heraenium EH, Heraenium NF and Heraenium NA

Preparations:

- Place ceramic crucibles into coil
- Fill alloy into crucible
- Close chamber

Premelt (Phase 1, 2, 3):

- Push button „max. Leistung (max. power)“
- Adjust vacuum to upper part of green area (250 mbar)
- Observe preheating process of the alloy (phase 1, 2)
- When phase 3 sets in push „Stop“ button

Insert the ceramic mould:

- Open chamber
- Position the casting mould
- Close chamber

Main melt:

- Push button „max. Leistung (max. Power)“
- Observe melting process (phase 4, 5)

• Heraenium CE:

Immediately turn casting chamber after Heraenium CE has reached phase 6 (disappearance of shadow)

• Heraenium EH:

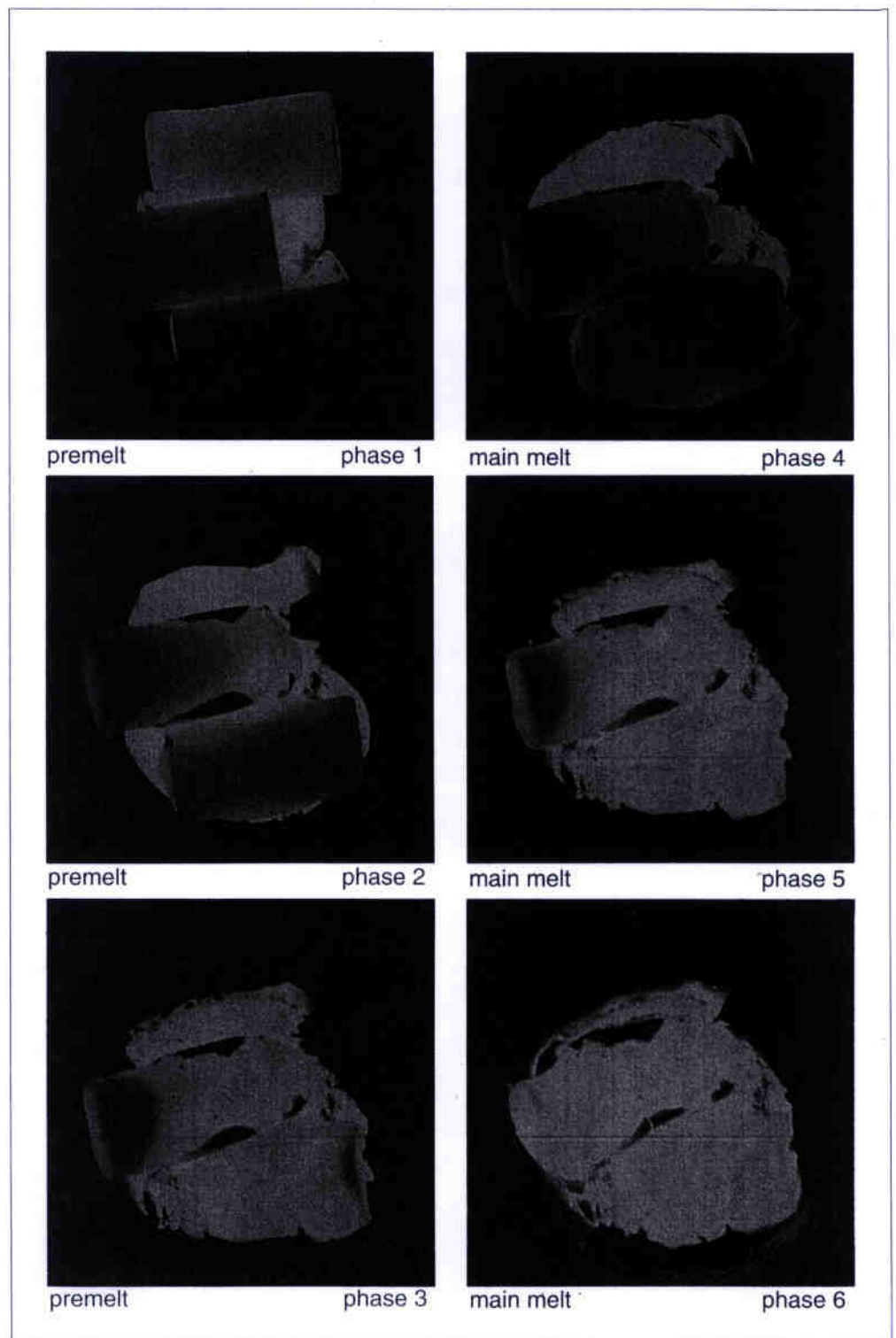
3 Seconds after phase 6 has been reached turn chamber

• Heraenium NF:

6 Seconds after phase 6 has been reached turn chamber

• Heraenium NA:

After oxide layer splits open turn chamber



When setting the potentiometer to 999 clockwise, and setting the timer to required delay time (EH = 3 sec., NF = 6 sec.), the delay time can be counted down with the use of the timer.

After the disappearance of the shadow push button „Red. Leistung“ (Red. Power). After the delay time has been counted down: Turn chamber immediately.

Heraeus alloy chart for CL-I 95

Version 07.98

1.) Gold casting alloys

- Vacuum -0.9 bar
- Graphite insert, one melting powder pellet (small) per main-melt
- Interrupt pre-melt at „max. Leistung (max. Power)“ after the alloy is completely molten „Stop“
- Main-melt with „red. Leistung (red. Power)“ (potentiometer, timer)

Potentiometer adjustment in scale parts

Alloy	Liquidus-temperature	27	29	31	33	35	37	40 g	45 g	50 g	55 g	60 g	65 g	70 g	75 g	80 g
Time in seconds (Timer)		10 g	15 g	20 g	25 g	30 g	35 g	20	22	24	26	28	30	32	34	36
Hera PF	890°C	520	520	520	520	520	520	620	620	620	620	620	620	620	620	620
Hera SG	895°C	525	525	525	525	525	525	625	625	625	625	625	625	625	625	625
Bio Maingold SG	920°C	550	550	550	550	550	550	650	650	650	650	650	650	650	650	650
Hera GG	920°C	550	550	550	550	550	550	650	650	650	650	650	650	650	650	650
Maingold SG	930°C	560	560	560	560	560	560	660	660	660	660	660	660	660	660	660
Bio Maingold IT	930°C	560	560	560	560	560	560	660	660	660	660	660	660	660	660	660
Maingold G	960°C	595	595	595	595	595	595	695	695	695	695	695	695	695	695	695
Maingold GV	970°C	605	605	605	605	605	605	705	705	705	705	705	705	705	705	705
Mainbond A	990°C	630	630	630	630	630	630	740	740	740	740	740	740	740	740	740
Maingold OG	990°C	630	630	630	630	630	630	740	740	740	740	740	740	740	740	740
Alba SG	1000°C	640	640	640	640	640	640	755	755	755	755	755	755	755	755	755
Mainbond EH	1010°C	650	650	650	650	650	650	765	765	765	765	765	765	765	765	765
Bio Maingold I	1035°C	680	680	680	680	680	680	805	805	805	805	805	805	805	805	805
Keramigold PKF	1050°C	695	695	695	695	695	695	820	820	820	820	820	820	820	820	820
Maingold I	1050°C	695	695	695	695	695	695	820	820	820	820	820	820	820	820	820
Maingold W	1060°C	705	705	705	705	705	705	830	830	830	830	830	830	830	830	830
Hera KF	1070°C	720	720	720	720	720	720	840	840	840	840	840	840	840	840	840
Mainbond KF	1070°C	720	720	720	720	720	720	840	840	840	840	840	840	840	840	840

Chart can be continued linear.

Heraeus alloy chart for CL-I 95 Page 2

Version 07.98

2.) High gold content ceramic bonding alloys

- Vacuum -0.9 bar, Graphite insert without melting pellets
- Interrupt pre-melt at „max. Leistung (max. Power)“ after the alloy is completely molten „Stop“
- Main-melt with „red. Leistung (red. Power)“ (**Potentiometer „995 - 999“ max. power limit**)
- Timer setting according to chart

Time in seconds (Timer)

Alloy	Liquidus-temperature	10 g	15 g	20 g	25 g	30 g	35 g	40 g	45 g	50 g	55 g	60 g	65 g	70 g	75 g	80 g
Bio Herador GG	1110°C	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39
Herador GG	1125°C	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
Bio Herador SG / N	1130°C	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
Herador C	1150°C	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41
Alba KF	1165°C	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41
Herador S / SG	1150°C	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41
Herador PF	1160°C	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42
Herador G	1200°C	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44
Herador H	1200°C	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
Herador E	1235°C	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46
Herador NH	1260°C	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48

Chart can be continued linear.

Heraeus alloy chart for CL-I 95 Page 3

Version 07.98

3.) Reduced precious metal content bonding alloys and palladium based alloys

Name of alloy: Albaloy

Albabond / E / EH / U / GF / A / B / C

Herabond N

Heraloy G / U

Herador P

Casting criteria: - palladium-based alloys minimum 15 g

- reduced precious metal content bonding alloys minimum 20 g
- Ceramic crucibles without melting pellets
- Vacuum in the middle of the green area
- Pre- and main-melt with „max. Leistung (max. power)“
- Potentiometer „995 - 999“ (max. power limit)
- interrupt pre-melt after oxide layer splits open
- delay time 6 seconds (timer)
- after opening of oxide layer button „red. Leistung (red. power)“

4.) CoCrMo alloys and non-precious bonding alloys

Name of alloy:	Delay time after shadow:	Casting criteria:
Heraenium CE	0 seconds	- Vacuum between -0.7 and -0.8 bar - pre-melt with „max. Leistung (max. power)“ and interrupt shortly before the shadow disappears („Stop“)
Heraenium EH	3 seconds	- main-melt by individual parameters (Potentiometer „995 - 999“, delay time on timer (start timer with button „red. Leistung (red. power)“
Heraenium NF	6 seconds	- pre-melt until the alloy is completely molten (only Heraenium NF, NA)
Heraenium NA	after opening the oxide layer	

General

Proper function and safe operation of the unit are only ensured if the required tests, maintenance and service work are performed by Heraeus Kulzer service agents or personnel authorized by Heraeus Kulzer.

Service and maintenance work

In case of damage to the unit or personal injury, which resulted from inexpert repair which was performed by unauthorized or untrained personnel, or when parts were used which were not original, Heraeus will not be liable. We recommend a service contract with our service agent.

Note: Prior to maintenance and service work the unit must be switched off and unplugged !

In order to avoid faulty castings and damage to the unit, the following maintenance intervals are recommended. Maintenance work types:

a) daily

- Clean the viewing glass (14) on both sides using a soft cloth.
- Clean the rubber seal of the casting chamber when the unit has cooled down (vacuum cleaner or compressed air).
- In case of moist compressed air: empty the water separator of the pressure reducer through the release valve on the bottom.

b) weekly (or after each 100 castings)

- Remove the lining from the inside of the chamber when the unit has cooled down and clean the inside of the casting chamber, the mould holder and the rubber seal.
- Insert the lining again or replace it.

c) every 6 months (or after each 2500 castings)

- Change the oil in the vacuum pump (9) (see operating instructions for pump).
- Clean the oil mist filter of the pump (9) (see operating instructions for pump).
- Clean the filter of the pressure reducer (10). Disconnect the air hose and unscrew the water separator of the pressure reducer. Clean the filter element with gasoline or similar and blow dry from the inside to the outside. All parts must be dry for assembly. Use warm water and a neutral soap solution to clean all plastic parts.

d) annually (or after each 2500 castings)

Caution: The following service work must only be carried out by authorized service personnel !

- Check the locking device and support of the casting chamber; check welding seams.
- Check water circulation system and flow control instrument.
- Change vacuum and compressed air filter in the unit.
- Check all pressure, vacuum and water hoses.
- Check pressure and vacuum displays and change manometer if required.
- Check generator start at vacuum and calibrate vacuum / pressure switch if required.
- Check power

Important notice: The eyescrew and the closing bolt are important safety relevant parts and must be changed after 5000 castings!

Tests

Works at the electrical equipment of the unit must only be performed by the authorized Heraeus service and in the safe condition (voltage cleared). Only permissible original spare parts must be used.

Maintenance

Permissible spare parts and accessories:

Proper function and safety of the unit are only ensured if the permissible original spare parts listed on the following page are used. The use of other parts includes unknown risks and must be avoided at any rate.

Waste management

For the waste management of spare parts respectively the machine, contact Heraeus Kulzer Germany directly.

Permissible spare parts and accessories

No. in drawing	Order No.	Description
13	645 02 611	Protective glass flap
	645 02 572	Viewing glass for protective glass flap
14	645 02 612	Lining casting chamber
1	645 02 613	Vacuum pressure casting chamber
8	645 02 567	Lip seal for casting chamber CL-IM/IG
10	645 02 614	Mounting for viewing glass
12	645 02 616	Viewing glass, Herasil
11	645 02 617	O-ring DIN 3770 42 x 3.0 – NBR 72
23	645 02 618	Tilted ball bearing
55	645 02 500	Mains filter
42	645 02 627	Flow detector up to max. 2.5 ltr./min.
73	645 02 468	Mains switch complete
62	645 02 635	Earthed socket, white
64	646 01038	Axial blower, 24 V DC, 24 W
90	645 02 640	Carrying handle (Transport handle)
91	645 02 544	Foot for CL-IM/IG/1 95
51	646 01024	Transformer, VDE 0551
40	645 02 563	Vacuum setting valve for CL-IM/IG
1	646 01 028	Foil keyboard
6	645 02 646	Limit switch
50	646 01056	Power control board
53	645 02 648	Push-pull transformer with filter choke, combination
25	646 01035	Generator with coil, complete
19	645 02 566	Ceramic pressure plate
20	645 02 651	Holder for mould
21	646 00 076	Threaded spindle for mould holding mechanism
22	645 02 652	Fraternite insulating plate
5	645 02 653	Limit switch cover
2	645 02 654	Chamber locking mechanism
17	645 02 568	Ceramic insert for generator
30	646 01 006	Valve block
24	646 01 033	Brake cylinder, hydraulic

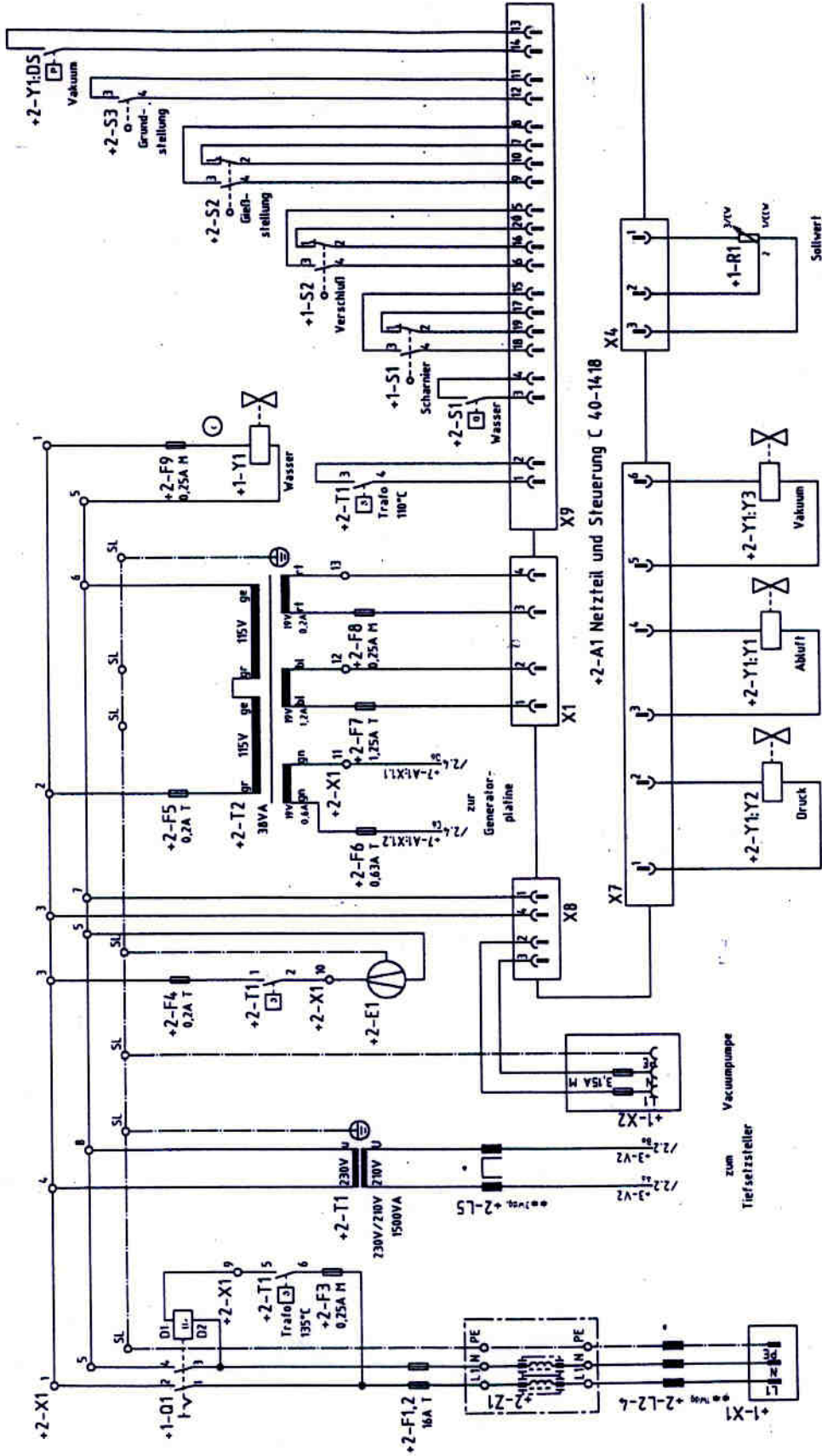
80	646 01 023	Control circuit board
45	646 01 025	Manometer
15	646 01 034	Turning lever
77	646 01 129	Potentiometer
76	646 01 027	Timer
78	646 01 449	Pressure manometer
79	646 01 450	Vacuum manometer

For missing number please inquire directly at Heraeus Kulzer Dental GmbH & Co. KG.

11. Technical data

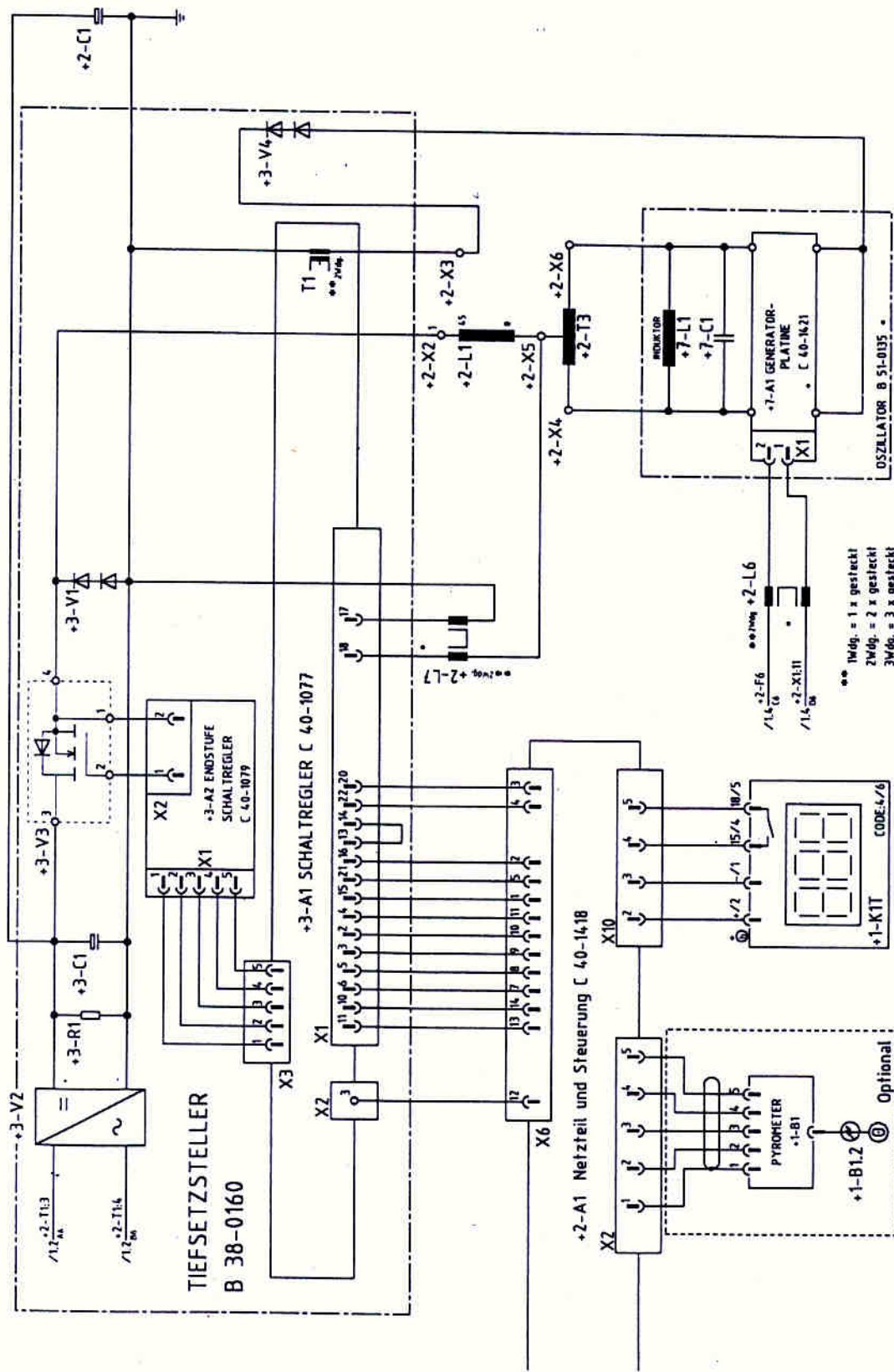
	Value	Unit
Width:	620	mm
Height (with viewing glass)	450	mm
Depth	450	mm
Table area required with casting chamber open	1000 x 550	mm
Power supply	230	V, ~, 1P/N/PE
Power frequency	50/60	Hz
Nominal power rating	3.3	KVA
Generator power rating	2	KW
Water pressure	3-5	bar
Water temperature	16 - 25	°C
Water consumption	ca. 2.5	ltr./min.
Compressed air supply	4-8	bar
Minimum inside hose diameter of compressed air supply	10	mm
Weight	85	kg
Vacuum	< 50	mbar
Noise level	< 58	dB (A)
Protective measure-protection class	1	
International protection	IP 20	

Fuse protection: For the connection to the mains the electro-technical and the technical rules and regulations of the local Electricity Board have to be observed.

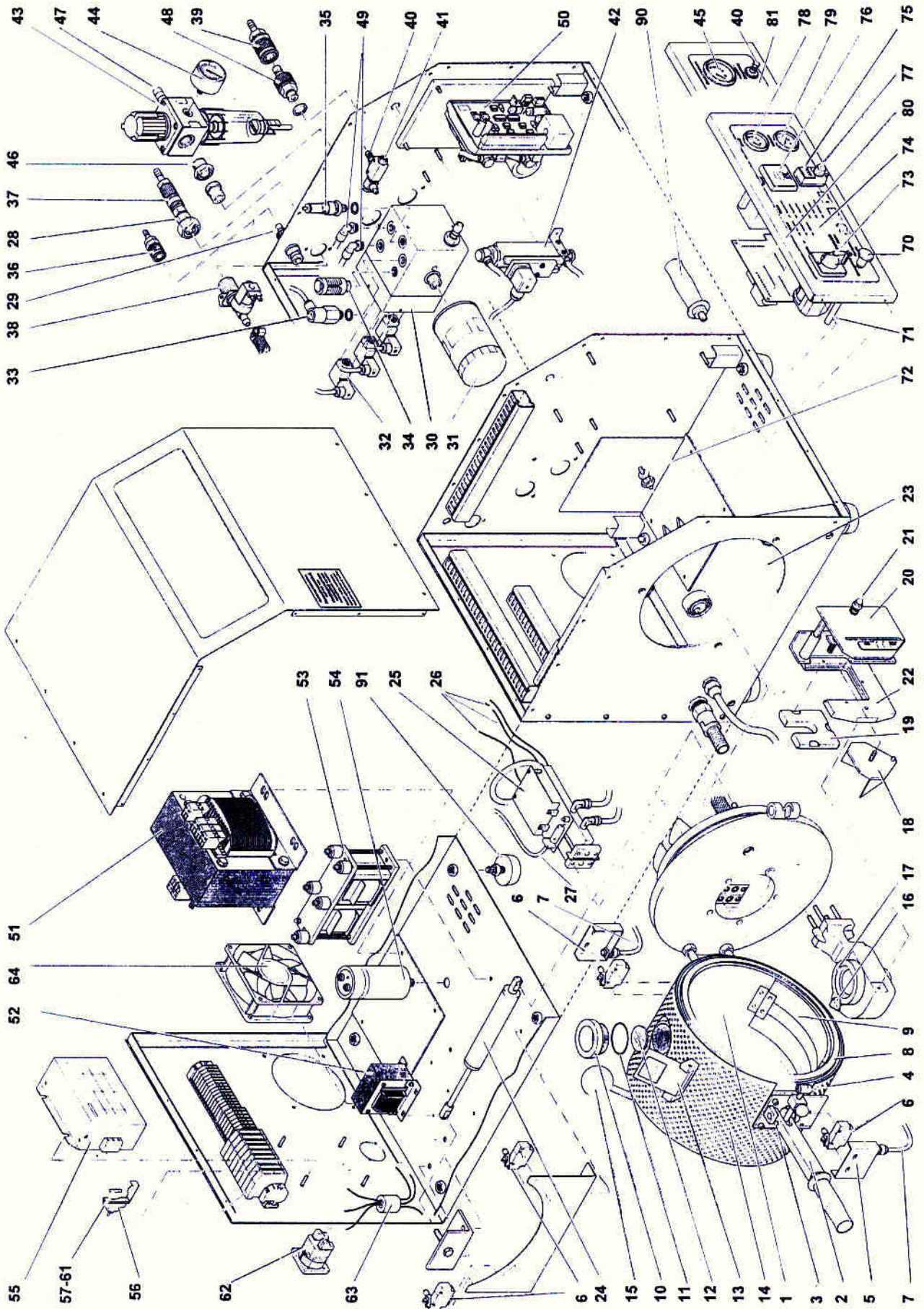


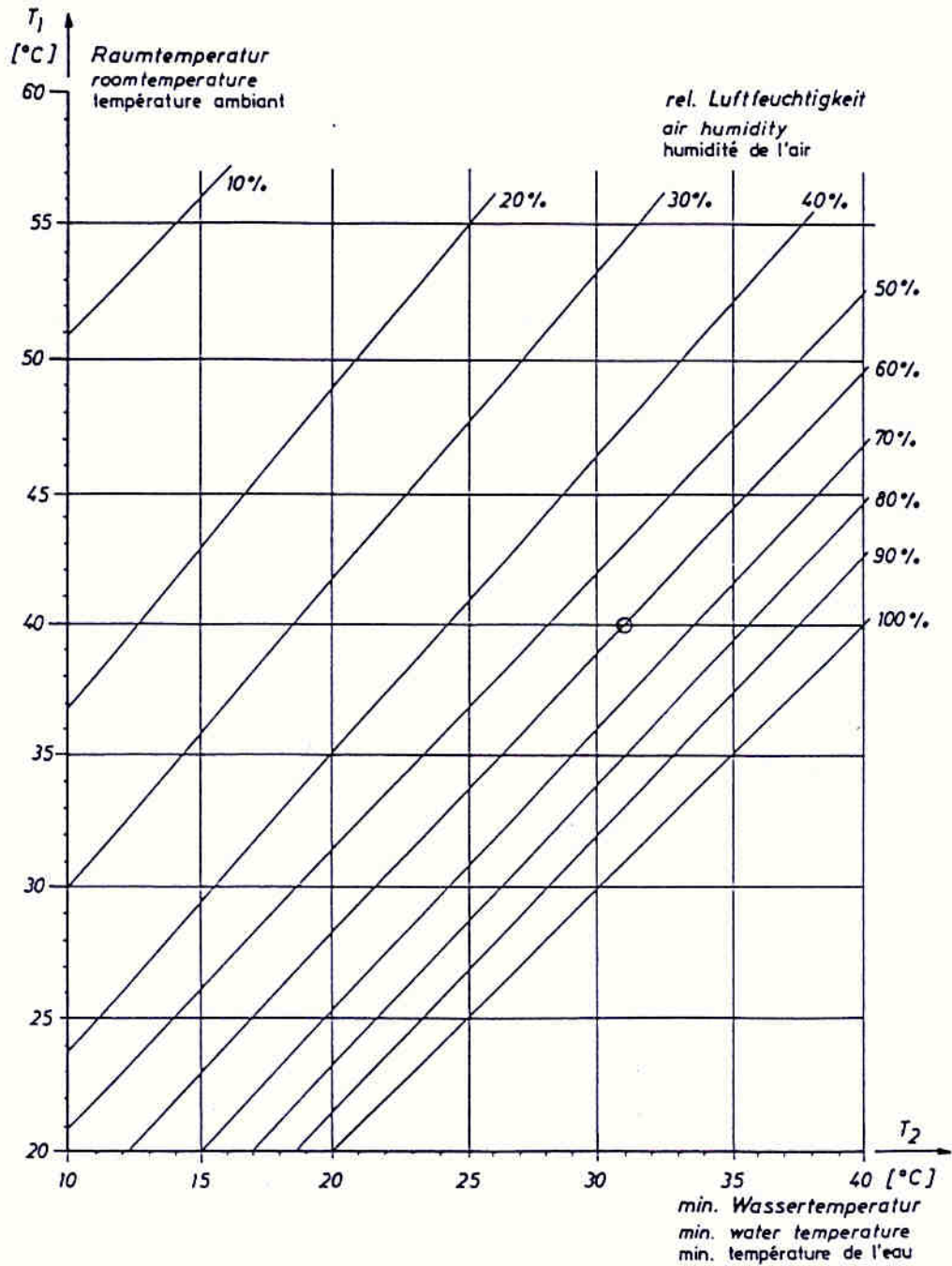
•• Wdg. = 1 x gesteckt
 2Wdg. = 2 x gesteckt
 3Wdg. = 3 x gesteckt

Netzgang
 230V/50Hz/16A



** 1Wdg. = 1 x gesteckt
 2Wdg. = 2 x gesteckt
 3Wdg. = 3 x gesteckt





Minimum water temperature dependent on room temperature and relative humidity at which no condensation occurs.

Example: room temperature 40°C and 60% humidity = minimum water temperature 31°C

Control instructions CL-I 95

Put unit into operation

1. Open water inlet
2. Open compressor air supply
3. Turn on mains switch
4. Check LED's, green LED „basic position“ must be lit
5. Test run possible (manual)
 - push button „red. power“
 - after reaching the vacuum the timer starts
 - turn chamber
 - Compressed air comes in (check 3.3 bar – red marking)
 - turn chamber back

Machine is ready for casting

Put unit out of operation

1. After casting remove crucible
2. After ca. 5 min. turn off unit and water (Faucet or circulating water cooler)

Casting gold

1. Set casting parameters
 - timer according to chart
 - power according to chart depending on alloy and amount
2. Put ceramic crucible with graphite insert
3. Set ring size (X1, X3, X6, X9)
4. Put metal in crucible in small pieces
5. Close chamber
6. Push button „max. power“
7. Check vacuum (ca. -0.9 bar)
8. Watch melt, after alloy is completely molten immediately interrupt premelt („Stop“)
9. Open casting chamber, insert melting powder pellet
10. Insert ring and lock
11. Push button „red. power“
12. After time has elapsed (signal) turn chamber swiftly without jolt
13. After 60 seconds turn chamber back, open chamber and remove ring

Casting high gold-containing bonding alloy

1. Set casting parameters
 - power on potentiometer „999 (max.)“
 - timer according to chart
2. Put ceramic crucible with graphite insert
3. Set ring size (X1, X3, X6, X9)
4. Put metal in crucible in small pieces
5. Close chamber
6. Push button „max. power“
7. Check vacuum (ca. -0.9 bar)
8. Watch melt, after alloy is completely molten immediately interrupt premelt („Stop“)
9. Open casting chamber (no melting powder!)
10. Insert ring and lock
11. Push button „red. power“
12. After time has elapsed (signal) turn chamber swiftly without jolt
13. After 60 seconds turn chamber back, open chamber and remove ring

Casting precious metal reduced bonding alloy

1. Set casting parameters
 - power on potentiometer „999 (max.)“
 - delay time of 6 seconds on timer
2. Put in ceramic crucible
3. Set ring size (X1, X3, X6, X9)
4. Put metal in crucible in small pieces
5. Close chamber
6. Push button „max. power“
7. Check vacuum (ca. -0.9 bar)
8. Watch melt, after opening of oxide layer immediately interrupt premelt („Stop“)
9. Open casting chamber (no melting powder!)
10. Insert ring and adjust
11. Push button „max. power“
12. After opening of oxide layer push button „red. power“
13. After the 6 seconds have elapsed (signal), turn chamber swiftly without jolt
14. After 60 seconds turn chamber back, open chamber and remove ring