Indutherm VC 480V
Full Automatic Casting Machine

Product Manual

revision			
date	**chapter**	**reason**	**responsible**
06.02.17	all	Edition 2017	DV, KS, RK
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This manual has been prepared in good faith by us. Nevertheless, should you find any mistakes or ambiguities, please let us know. Furthermore, we are grateful for comments and suggestions.

Contents

1 General information

1.1 Scope of delivery and responsibilities

The vacuum pressure casting machine VC480V is delivered complete. Please check delivery immediately after receiving the shipment if there is something missing or possible transport damages. Please tell the faults the shipping agency and your dealer.

1.2 Liability, warranty and guarantee

The company INDUTHERM ErwärmungsanlagenGmbH take liability, warranty and guarantee according to the legal regulations.

The vacuum pressure casting machine is built to be state-of-the-art and in compliance with the accepted safety regulations. Nevertheless, can improper installation and non intended using lead to danger and damages.

INDUTHERM ErwärmungsanlagenGmbH don't take liability for damage caused by untrained personnel operating the machine.

For damages because of demonstrably misusing of machine or because of abnormal behaviour no liability will be taken by INDUTHERM ErwärmungsanlagenGmbH!

INDUTHERM ErwärmungsanlagenGmbH don't take liability for damages caused by faulty protection of power supply and/or wrong connecting the supplies (protective gas, water, compressed air).

There is no guarantee for consumables by INDUTHERM Erwärmungsanlagen GmbH.

Company INDUTHERM ErwärmungsanlagenGmbH can not and will not take responsibility for all consequential damages caused by above mentioned circumstances.

This operating manual is of the technical state at printing date. All rights reserved regarding technical changings and different equipment.

Damages caused by disregard, wrong interpretation and non-compliance with specifications in this manual will lead to expiration of guarantee for this system.

1.3 Responsibility of operating company

The operator has to meet with national accident preventing regulations and technical regulations.

Operating company is allowed to let operate machine by trained and trustworthy personnel only.

Operating company has to make sure the system is supervised by personnel which is trained at this device.

Operating manual must be kept right next to the system.

Operating company has to ensure operating personnel has **read and understood** the manual before they are going to use the machine.

Operating company has to ensure unauthorized person has no access to the system.

Maintenance actions may only be done by authorized personnel or by service technicians from Indutherm.

1.4 EC-conformity

Declaration of European Community conformity is attached to this manual.

1.5 Observation of the product

The management will provide you with a secure machine at state-of-the-art.
Please let us know immediately if there are:

- failures at safety measurement devices,
- failures during production,
- modified parameter settings,
- difficulties in using the system,
- accidents or near accidents and
- remarks for improvement of the manual.

2 Safety

2.1 Intended use

Operational safety of the vacuum pressure casting machine is only guaranteed at intended use.

The casting machine serves exclusively for melting, pouring and vacuum casting of commercially available precious metals and of copper- or aluminium-alloys. The specified temperature ranges must be complied with.

Every other use of the overall plant or parts is considered as not intended.

Unauthorized modifications of the plant are prohibited because of reasons for safety! CE declaration of conformity expires with modification.

Intended use includes reading, knowing and obeying the operating instructions. That also contains observing of servicing and maintenance regulations.

Set up, operation and maintenance is only allowed to be carried out by trained qualified personal that has read and understood all documents.

The plant may affiliate only to the specified media. Supply voltage and input respectively output pressure have to be observed to the given device labelling accordingly.

The machine has been developed for use in enclosed spaces and for the above mentioned application.

Only original INDUTHERM consumables and spare parts are admitted for operation.

It is not allowed to change or vary the system in any way. Technical changes need explicit written approval of INDUTHERM Erwärmungsanlagen GmbH.

The casting machine must not be placed in areas with explosive atmospheres.

Predictable abuse:

- Warming of human body parts on hot surfaces.
- Heating and casting of others then the mentioned metals.

2.2 Demands on staff, duty for utmost care

Work on and with the machine is allowed to be accomplished by reliable, trained and instructed staff only. Responsibilities for the separate sections have to be regulated clearly which include operation, preparation, service and repair.

Only authorized personnel may act at the system.

The machine may never be operated by personnel under influence of reflex diminishing medicine or people not able to work because of illness or disorder.

Running of the system has to be always supervised by trained staff.

Personnel which have to be trained und introduced to this job or within in the course of vocational training may work only under permanent observation of a person experienced with the machine.

Work on the electrical equipment is only allowed for workers skilled in the field of electricity.

The instruction manual has to be freely disposable at the location of the system. The employees have to know the storage place.

Every person working at the system has to read and apply the instruction manual especially the safety advices. The personnel have to read and understand the chapters referring to safety aspects for the particularly components of the machine. Please read before beginning the work.

Please control the personnel for paying attention to all facts of safety and danger prevention.

2.3 Protective measures

This operator’s guide contains all important advices to operate the system secure.

Basic prerequisite for safe dealing and trouble-free running of this system is the knowledge of fundamental safety advices and industrial safety rules.

In commercial facilities you have to regard the accident prevention regulations of the professional association for electrical systems and tools.

When operating the system escape gases / vapours. These are consumable parts dependent applications you use and the molten material. The plant operator must provide a suitable on site and the current standards and laws appropriate exhaust system.

The internal regulations of industrial safety are to be observed.

2.3.1 Concept of safety

Objective is the safety:

- of the staff against injuries;
- of the system against damage or standstill and
- of the environment against endangering.

The list of actions taken:

- deployment of protective equipment like covers and main-switch with emergency stop function,
- safety switch that is used to ensure that the plant can be operated
- only with the swiveled vacuum pressure casting tank;
- water-cooled inductor housing,
- duty of wearing personal protective equipment (PPE),
- affix safety markings on the installation,
- create safety advice in the manual.

2.3.2 Protective gear

Protective gear (PPE) includes:

- heat-resistant clothes,
- heat-resistant, closed shoes,
- heat-resistant protective gauntlets protecting artery and
- face guard.

Caution!

Wear always for every process step the right protective gear.

2.3.3 Safety equipment

The safety of the machine is only guaranteed if all safety equipment is proper installed and working proper. Don’t use the system without the safety equipment!
Disassembling safety equipment is only allowed with locked main-switch. Install every part of the safety equipment after repair. Perfect function has to be checked.

Caution!

Safety equipment protect from unintentional access of the staff to danger spots. They prevent possible injuries. Never manipulate the safety devices!

2.3.4 Main switch with emergency stop function

It is allowed to start the machine or operation only with proper emergency stop function.

Caution!

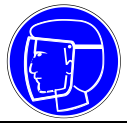
With the emergency stop function you can stop the machine in critical moments of health hazard. You help to diminish potential consequences of injury.

> Don't manipulate the emergency stop equipment.

> Don't obstruct the way to the emergency stop equipment.

2.3.5 Safety markings on the unit

A necessary condition for safe dealing with and undisturbed running of the machine is the knowledge of safety instructions and industrial safety regulations.
On the front of the machine casing the following safety markings are attached.

safety marking	meaning	safety marking	meaning
	warning of dangerous electrical voltages		wear heat resistant safety clothing
	warning on hot surfaces		wear heat resistant protective gauntlet gloves protecting artery
	forbidden for persons with pacemaker		wear face guard
	Warning of hand injuries.		wear protective shoes

Advice

Keep the safety markings always clean. Replace the markings if they aren't recognizable. Observe the warnings and commands. Don't expose yourself careless to dangerous situations.

2.4 Safety marking

The following signal words are used in this document which are associated with safety markings for presentation of possible dangerous situations.

Danger!
Death, serious body injury or substantial property damage **will result** if proper precautions are not taken.

Warning!
Death, serious injury or substantial property damage **can result**, if proper precautions are not taken.

Careful!
Minor personal injury can result if proper precautions are not taken.

Attention!
Property damage can result, if proper precautions are not taken.

Information/advice
Here you get information and advices to carry out the following activities effective and safe.

2.5 Safety advices

Check always the condition of the system before you switch on the system. Examine the supply pipes and insulations if there are leaks and damages. Operate the system only if it is in proper and faultless shape.

Operate the system never:
- if there are malfunctions,
- if it is showing damage or
- after heavy transportation stress.

The system has to be constantly controlled when running to be able to recognize and avoid dangerous situations. The system may not run if it is unsupervised.
Do never change, remove or close the safety valves inside the machine.

Danger!

Danger to life because of strong electromagnetical fields (induction). For persons with pacemaker it is not allowed to approach or to be near to the machine.

Danger!
Danger to life are caused also by the fact that very hot and liquid metals solidify in cold liquids. In this case may arise physical and chemical reactions that have to be previously analysed by the user. During this it can emerge physical and chemical reaction, which is to be evaluated by the operator. For example, can with aluminium happen an explosion of hydrogen gas during hydrolysis.

Warning!

Risk of burning on hot surfaces and hot metal (until ~ 1500 °C). Wear always personal protective equipment when you work with the machine.

Utmost caution during using graphite crucibles and graphite moulds. The heat of these parts is only visible when the temperatures are over 500 °C.

Warning!

Maintenance and servicing of the machine only when the system is disconnected from the mains supply (Pull out mains plug).

Advice!

Don’t disconnect mains plug, while machine is running or in standby. Switch off for pulling out or putting in mains plug.

Danger!

Risk of burns. If metal is melted without the supply of protective gas, can cause a flash fire or explosion when opening the bell.
Melt at temperatures above 500 °C always with protective gas. Use as a protective gas exclusively argon or nitrogen.

Danger!

Danger because of touching parts conducting voltage.

Work on the electrical equipment is only allowed for authorized qualified staff.

Access to the electrical distribution box is only allowed for authorized qualified staff with tool.

Work on the electrical equipment is only allowed when the system is disconnected from power supply (pull out power plug).

- The capacitors can retain their charge even after deactivation of the system.
- Keep the housing of the vacuum pressure casting machine closed continually.
- No work must be carried out on parts conducting high voltage.
- Remove loose connections.
- Replace immediately damaged scorched or slightly burned cables. Perform work only when mains plug is pulled out.
- Cables may not wedge in or rather squeezed. Cables have to be laid in a way that they not become a tripping hazard or can be not damaged.

Danger!

Threat of health injury by escape of medias from damaged hoses. Danger of system damages.

- Remove loose connections. Replace damaged hoses immediately. Perform work only when mains plug is pulled out.
- Hoses may not wedge in or rather squeezed. Hoses have to be laid in a way that they not become a tripping hazard or can be not damaged.

Danger!

- Burning risk by leaking hot metal at protective gas/compressed air failure.
- When protective gas failure of the sealing rod can no longer close properly. Through a check valve, the pressure is maintained in the lock cylinder.
- Press after a protective gas/compressed air failure, no pneumatic units (e.g.: cylinder).

Warning!

Risk of burns:

burns because of squirting liquid metal,

burns at hot surfaces (important here: like new insulations).

Warning!

Danger of explosion.

Dripping liquid metal can’t be excluded.

The floor beneath the system must be made of non-flammable material. As well there must not be stored inflammable materials within a radius of 5 metres.

Attention!

At crucible temperatures over 100 °C the cooling water supply must be switched on. If it is not turned on, the inductor will be destroyed. If cooling water supply fails, the heating system immediately is turned off. Inspect the system for damage before putting back into operation again.

Warning!

Burning hazard because of leaking molten metal.
The system must not be operated without a sealing rod for security reasons.
The tip of the sealing rod must stay in the centre of the pouring hole even when sealing-rod is open.
With built-in and closed sealing rod the according cylinder must have a gap to the lower end stop or the pouring hole is no longer proper sealed.

Danger!

Lethal injuries happen because of false transport by forklift truck.

- Pay attention of the right attachment of the means of transporta tion, otherwise the system can fall from forklift truck. The system must be lifted from the side only, because the centre of gravity is located in front and towards the upper third of the machine.
- With too small dimensioned or forks adjusted too narrowly there is danger for the system to fall from the means of transportation.
- Wear appropriate personal protective equipment (PPE).
- Move the system only by skilled personnel qualified for transpor- tation jobs.

For damages resulting from non-compliance of regulations in transit there is no assertion possible for warranty claims.

Warning!

Health risk because of lifting heavy weight.

Lift and transport the granulating tank only by two persons. Don’t try to transport the tank by yourself. There is danger of permanently healthy damages because of physical overload.

Warning!

Risk of injury.

Make pressure leading system parts depressurized before you carry out servicing.

Warning!

Risk of slip on the floor around the installation in case someone had spilled lubricant or solvent.
Clean the floor from dirt immediately! Dispose cleaning tissues in the particular collecting boxes.

Caution!

Observe regulations for the mains supply written from the responsible electric power supply company, the association VDE and the local electric power station. Inappropriate connecting can lead to injuries and damages of the machine.

Caution!

Danger for health because of inhalation of fibre particles.

- Store crucible shield and insulation in dustproof package.
- Remove the material just before installation.
- Don’t shatter crucible shield and insulation.
- Pack the materials immediately after removal dustproof and dispose the materials in this packaging

2.6 Residual risks

risk characterisation	risk reduction
Health risk for persons with cardiac pacemaker who approach the running system.	Instruct people.
Burn injury on hot surfaces or hot molten metal.	Teach people. Wear personal protective equipment.
Danger of explosion because of dripping of liquid metal in a water filled steel tub during melting of aluminium or aluminium-alloys.	Fill the tub with sand.
Jet flame or explosion when opening the lid of the melting chamber in case of melting without protective gas.	Always melt with protective gas at temperatures above 500 °C.
Tilting and toppling of the system due to improper transportation.	Consider shipping instructions.

2.7 Behaviour in an emergency

The personnel working at the facility must be trained about the behaviour in an emergency.

All persons who are working with the machine must be informed of the possibility of rapid standstill of the plant.

3 Technical data

	VC480V
crucible volume (1)	170 cm^3 ≈ 2.5 kg/Au
flasks	Max. Ø 130 mm (5“) * 260 mm (10“) height Standard: Ø 125, 100, 90, 80, 70 mm
highest working temperature (2)	Max. 1400 °C with type S thermocouple (only with high-temperature insulations)
power	8 kW
mains	3 x , 50 or 60 Hz 3 x 208 V, 50 or 60 Hz (option)
fuse protection	16 A 25-32 A (230 V)
short circuit current	max 5.0 kA
thermocouple	Type K (NiCr-Ni; max. 1200 °C) or Type N (NiCrSi-NiSi; max. 1300 °C) or Type S (PtRh-Pt; max. 1500 °C)
cooling water supply	2 x Ø 8 mm, fittings with 1/4“ thread 2.5 - 5 bar, min. 130 l/h, max. 6 °dH
water output	Pressureless
cooling water input temperature	15 - 25 °C / 59 – 77 °F
ambient temperature	10 - 35 °C / 50 – 95 °F
relative humidity	20 - 80 %
compressed air supply	1 x Ø 6 mm, fitting with 1/4“ thread 8 bar, without oil
protective gas supply	1 x Ø 6 mm, fitting with 1/4“ thread 8 bar, pure N_2 or pure Ar
vacuum	1x Ø 13 mm, fitting with 1/4“ thread, 0 - 20 mbar absolute, min. 21 m^3/h
overpressure in the induction chamber	max. 1,5 bar
Weight in kg	ca. 120
dimensions in mm (Wide x Depth x Height)	500 x 760 x 1450
Options	• granulation tank • sinter unit • S-crucible
Noise emission	75 dB (A)

(1) These are standard values which can be optionally changed.
(2) in a special configuration

4 Description of the system

4.1 Components of the system

The system consists of several modules assembled in one housing.

Inside the housing there are:

- mains cable and mains filter,
- microprocessor controlled induction generator F-type,
- middle-frequency transformer,
- oscillating circuit capacities,
- pneumatic (magnet-) valves,
- pressure regulator for pressure of the sealing rod cylinder and
- pressure regulator for protective gas.

The front plate contains:

- front panel for control of the granulating process.

To the melting system belongs:

- inductor housing, water cooled with inductor, crucible, insulations, sealing rod unit, thermocouple,
- bell hinged, water-cooled and
- vacuum chamber, watercooled;
- flask lift,
- vacuum chamber lift,
- vibration unit,
- granulating tank (option) and
- sinter unit (option).

4.2 Schematic representation

Figure 1: overall view

pos.	designation	Function
1	bell with window	Closing the inductor housing.
2	inductor housing (crucible chamber)	In the inductor housing are: • Induction coil • crucible • insulation
3	vacuum chamber	With water cooling inlet and outlet.
4	flask lift	Enables lifting of tank.
5	lift for vacuum chamber	Enables lifting of vacuum chamber.
6	front panel	Control the process of the system.
7	Bell lock	With pressure build up in the vacuum chamber this rod will secure the handle against unintentional opening.
8	Mains switch with emergency stop function	Switch on and off the vacuum pressure casting machine. Immediate interrupt of power in emergency.

4.3 Backside connections

Figure 2: backside of the vacuum pressure casting machine

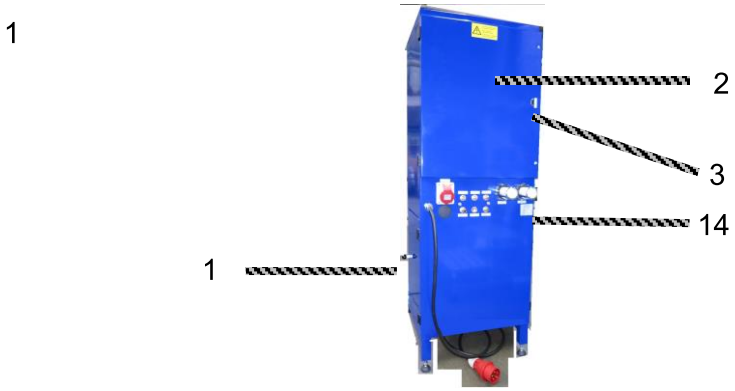
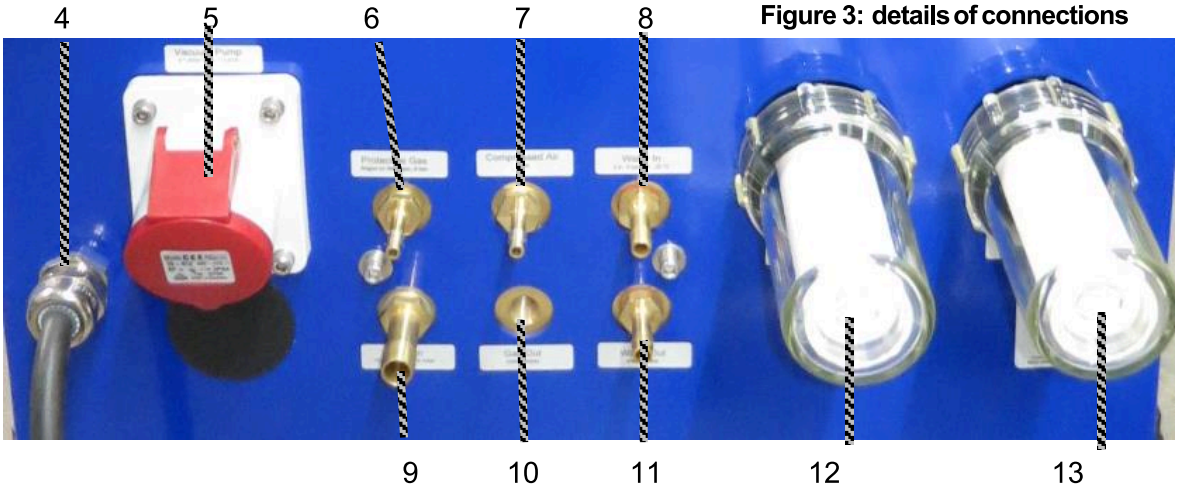


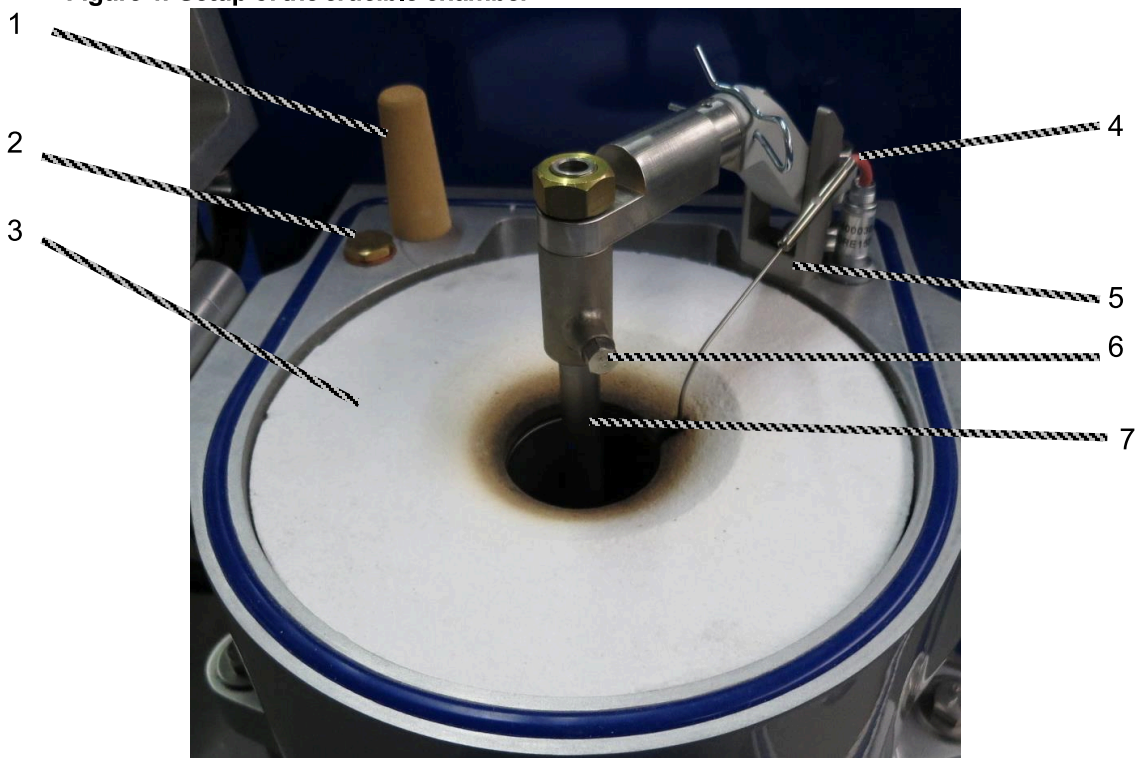
Figure 3: details of connections



1	Side door	Storage area for manual.
2	Back door	Service access (only for experts for open with tool)
3	Serial Interface/RS232	Connection for PC over Indutherm-RS232-cable (socket actual attached to internal modem).
4	Power supply	Power supply of the vacuum pressure casting machine.
5	Vacuum pump	Socket for plug from vacuum pump.
6	Protective gas	Protective gas supply input.
7	Compressed air	Compressed air supply input.
8	Water Input	Cooling water supply input.
9	Vacuum	For the hose from the external vacuum pump.
10	Gas out	Depressurization.
11	Water Output	Cooling water outlet.
12	Filter flask	Filter for vacuum in the flask chamber.
13	Filter crucible	Filter for vacuum in crucible area.

4.4 Setup of the crucible chamber

Figure 4: Setup of the crucible chamber

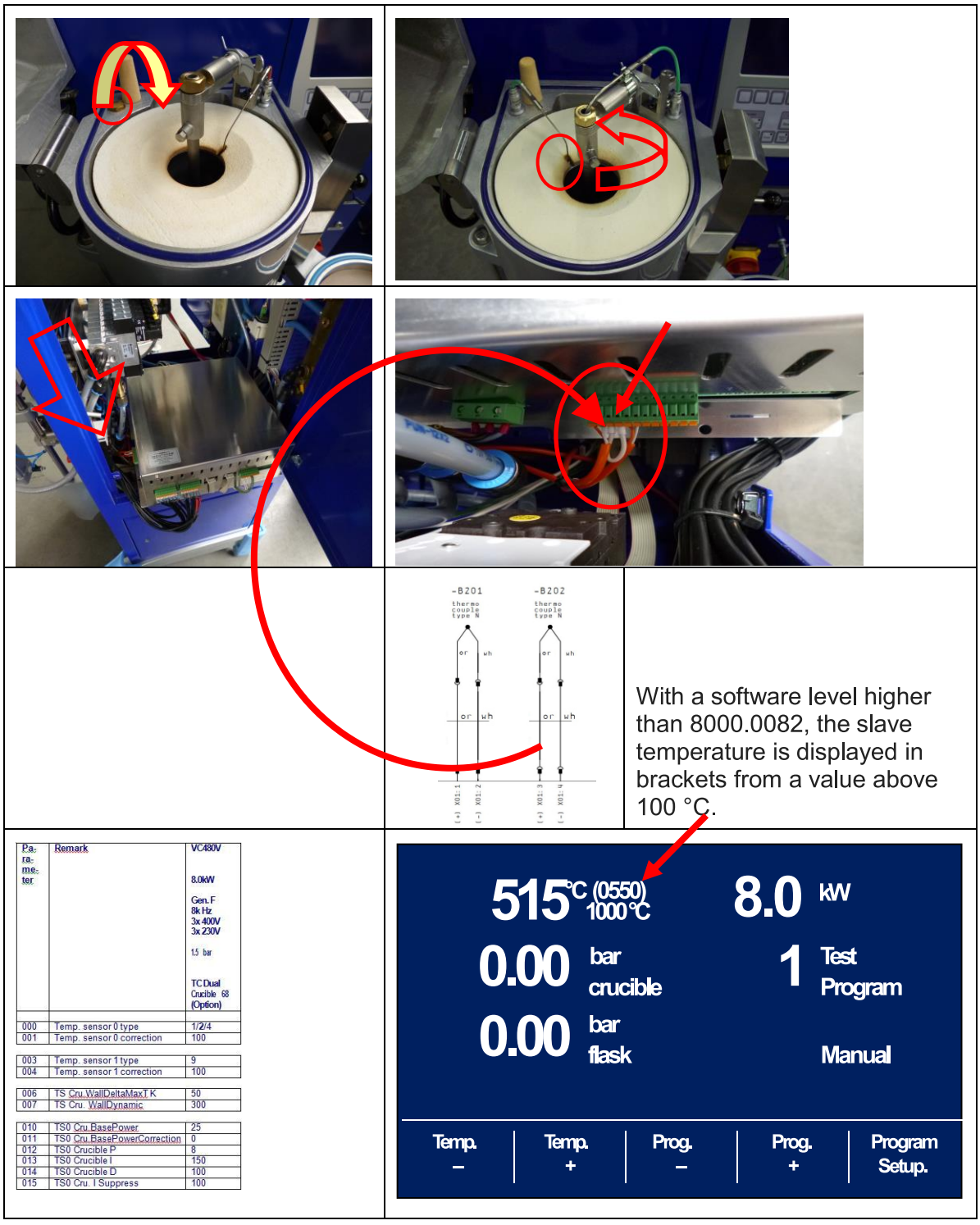


position	designation	Function
1	metal filter C038	Brass filter for cleaning atmosphere in inductor chamber.
2	thermocouple socket (option)	Thermocouple connector for wall measurement if you work with centre measurement additional (option).
3	filling cone	Top insulation and help for filling crucible.
4	thermocouple wall	Thermocouple for the crucible wall measurement.
5	Guiding	Guiding for the sealing rod holder and secures against twisting.
6	Lockabale screw	Place for put on the socket wrench, if you twist in the sealing rod in the crucible hole for good closing.
7	sealing rod	For closing the crucible bottom hole.

4.5 Special options

4.5.1 Centre-and wall measurement (Dual measurement)

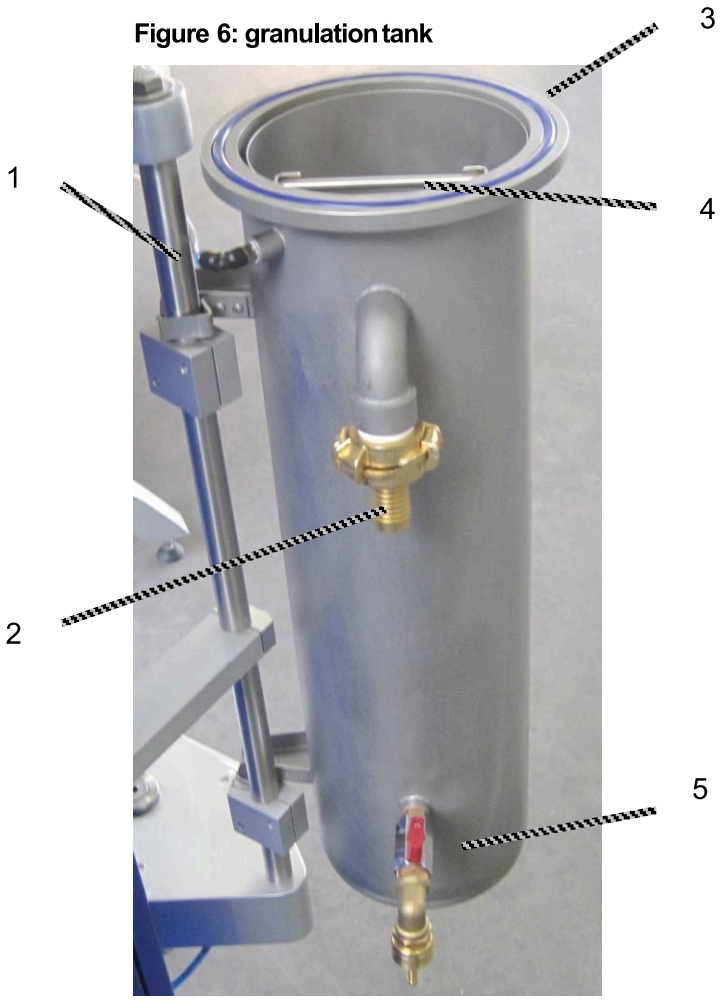
Figure 5: option – dual measurement



Parameter	Remark	VC480V
		8.0kW
		Gen. F 8k Hz 3x 400V 3x 230V
		1.5 bar
		TC Dual Crucible 68 (Option)
000	Temp. sensor 0 type	1/2/4
001	Temp. sensor 0 correction	100
003	Temp. sensor 1 type	9
004	Temp. sensor 1 correction	100
006	TS Cru.WallDeltaMaxT K	50
007	TS Cru. WallDynamic	300
010	TS0 Cru.BasePower	25
011	TS0 Cru.BasePowerCorrection	0
012	TS0 Crucible P	8
013	TS0 Crucible I	150
014	TS0 Crucible D	100
015	TS0 Cru. I Suppress	100

4.5.2 Granulation tank

Figure 6: granulation tank



position	designation	function
1	protective gas entry	Here you can supply additional protective gas.
2	water outlet	Usual water outlet.
3	O-Ring	For sealing of the barrel without a gap.
4	Inside barrel with lever	Removable inside barrel with fast emptying function.
5	fresh water input	Control the fresh water input.

5 Transport

Danger!

Lethal injuries with wrong transport by fork lift truck.

- Take care of the right position using transport device to avoid tilting of the system.
  Pick up the system only from the side, because centre of gravity is in the upper front third.
- If the fork is too small or too narrow adjusted there is a danger of system tip over from the mean of transportation.
- Please wear appropriate personal protective equipment (PPE).
- Let do transportation only by trained personnel.

There is no guarantee for damages because of failure to comply transport regulations.

> Transport the system always with fork lift truck or pallet truck.

> Please protect the induction coil against damages with sturdy foam material.

> Transport the system upright. If the machine is transported in another position, the system will be damaged.

> Take up the system from the side.

Figure 7: lifting the weight

6 Mounting and commissioning

6.1 Safety advices for mounting

Danger!

Only experts may work at the electrical equipment.

Danger!

Observe the mains supply to requirements of the local electricity supply company, the VDE and the local electricity company. Close the system always via the 5-pin power plug to the power supply. Improper connection can result in injury and damage to the system.

Attention!

Check before connecting the system, whether the existing mains voltage corresponds with the operating voltage of the system. If the voltages do not match, the system can be damaged.

6.2 Mounting process

Place the system in a clean, dry place horizontally on. The ground must be firm and level. To the machine the following work area must be kept free: left and right of the door 1.5 m and behind the system 0.5 m. Before installation at least 1.5 m of free workspace.

Cooling air may not exceed 35 °C (95 °F) and should be free of contaminations.

Establish supply connections according to information in chapter 3 “technical data”:

- current,
- compressed air
- protective gas,
- cooling water and
- vacuum.

Examine supply lines and connections on damages.

Only after the correct connection of all supply and connecting systems, the system may be put into operation.

6.3 Apply supply connections

6.3.1 Power supply

The electrical connection may only be performed by a specialist. Note the information specified on the nameplate rated voltage or frequency.

The 3-phase power supply may differ max. +/- 10% from the rated voltage.

The system is supplied with a 16 A CEE plug. The system may only be connected via this 5-pin power plug to the power supply. The on-site to install socket must be equipped with appropriate fuses (slow).

The system consists of an increased leakage current due to the built-in EMC filter.

On site must be provided by a loop impedance measurement of the detection of the switch-off of the overcurrent protective device.

6.3.2 Cooling water

Cooling water supply is connected to the machine by 2 hoses with inside diameter of 8 mm.

Water pressure must be 2.5 bar at minimum and don't exceed 5 bar. Water outlet has to be pressureless.

Input water temperature should be between 15 °C (59 °F) and 25 °C (77 °F).

Lime concentration may not exceed of maximum 6 German hardness degrees. The water should be free of pollutions.

Warning: The cooling water is continuously running through the VC480V even in case the mains switch is off.

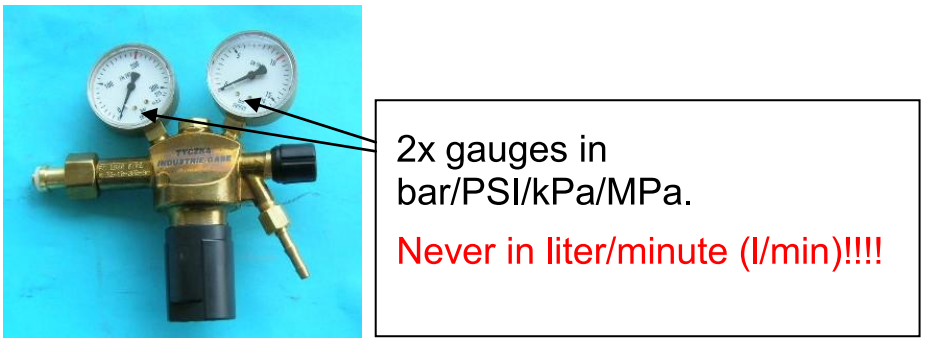
6.3.3 Compressed air

The compressed air must be provided by a service unit with an oil separator and a pressure of 8 bar. The use of lubricated compressed air is not recommended. Please use an air hose with an inner diameter of 6 mm for the connection.

6.3.4 Protective gas

The protective gas only nitrogen or argon may be used with a purity status of at least 99.9 %. The supply is effected via a compressed air hose having an inner diameter of 6 mm. The inlet pressure must not exceed 8 bar. Gas consumption is about 1 - 3 l / min. Please use only a constant pressure regulator.

Figure 8: constant pressure regulator



6.3.5 Vacuum

Here, a vacuum pump with a suction capacity of at least 21 m³ / h and a final pressure of 2 mbar should be connected. The connection must be via a special vacuum tube with a cross section inside of 13 mm carried out (article no. 40200010).
Oil level and air filter should be checked weekly.
The first oil change should be carried out after 100 operating hours. Later we recommend regular oil changes (depending on the work process) all 500 - 2000 operating hours, but at least twice a year. You need special vacuum pump oil (item number 15000910).

The oil filter and the exhaust filter should be replaced at every second oil change.

For detailed information, please also refer to the operating manual in maintenance of the vacuum pump.

6.3.6 Gas outlet

Exit to the pressure reduction. This output must be kept clear at all times.

6.3.7 Vacuumpump (mains socket 16A)

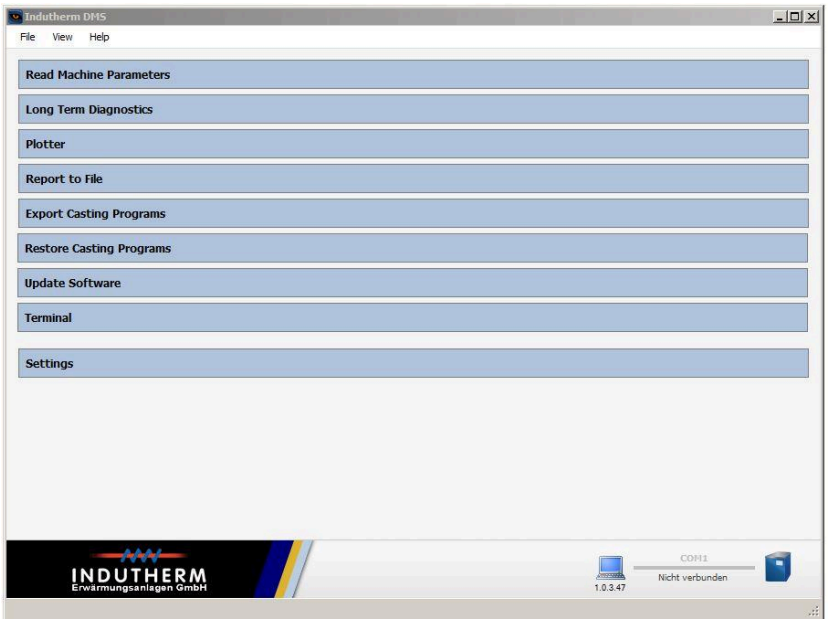
This socket is only intended for connection of a 3-phase vacuum pump (400 V AC) with a maximum output of 1.5 kVA. Internally there are backup fuses for this output. During commissioning the correct direction of the vacuum pump must be checked, otherwise the pump will be destroyed.

6.3.8 RS232

At this plug our serial cable can be connected (article no. 50500060). For the use an internal cable at the generator must be switched with the actual attached modem cable.

Here, the machine can be connected to a PC. Use the data management software provides by Indutherm to read system data and casting programs. It can also record casting logs electronically.

Figure 9: data management software menu



7 Operation

7.1 Safety advices for operation

Caution!
Examine all consumables, insulations and hoses before switching on. Check for damages and cleanliness, especially crucible and insulations. Operate the system only when it's free of damages.

Warning!
Risk of burning on hot surfaces and hot metal (until ~ 1500 °C). Wear always personal protective equipment when you work with the machine.
Utmost caution during using graphite crucibles and graphite moulds. The heat of these parts is only visible when the temperatures are over 500 °C.

Danger!
Risk of burns. The surface of the bell can be very hot, depending on the working temperature.

Danger!
Danger of crushing / shearing by swivelling the vacuum chamber.
The vacuum chamber must be pivoted with the hands at middle height of the chamber surface.

Figure 10: Hand centered

Danger!
Danger of crushing / shearing by moving the flask holder.
By raising or lowering the flask holder injuries can happen.

Danger!
Risk of burns. If metal is melted without the supply of protective gas, can cause a flash fire or explosion when opening the bell.
Melt at temperatures above 500 °C always with protective gas. Use as a protective gas exclusively argon or nitrogen.

Attention!

At crucible temperatures over 100 °C the cooling water supply must be switched on. If it is not turned on, the inductor will be destroyed. If cooling water supply fails, the heating system immediately is turned off. Inspect the system for damage before putting back into operation again.

7.2 Changing casting parts

7.2.1 Removal

> Open the bell-lid. Take out thermocouple.

> Lift sealing rod with button “sealing rod” and remove it.

> Remove “old crucible” and possible insulations.

7.2.2 Mounting

> Install “new” crucible and possibly “new” insulations.

> Put in sealing rod and close it with button “sealing rod” at front panel.

> Put in thermocouple.

> Twist sealing rod a few times to left and right (rub surfaces), so that the crucible is reliably closed.

> Close bell-lid.

7.3 Front panel

7.3.1 LCD screen after mains switch on

Figure 11: main screen

upper area = Actual state of machine

lower area = options

Display in the upper area:	
25 °C	Actual crucible temperature of wall measurement.
0010 °C	Set temperature.
0.00 bar Crucible	Actual pressure in crucible area -1.00 to 1.50 bar.
-1.00 bar Flask	Actual pressure in the vacuum chamber (-1.00 to 0.00 bar).
0.0 kW	Actual heating power in kW
28 Program	Actual program.
InduTest	Program name (InduTest).

Display in the lower area:	
Temp -	Lowering set temperature also during program.
Temp +	Increasing set temperature also during program.
Program -	Program no. 27 will be selected.
Program +	Program no. 29 will be selected.
Program Setup	Allows the jump to the parameter level of the program 28.

7.3.2 Program change page 1

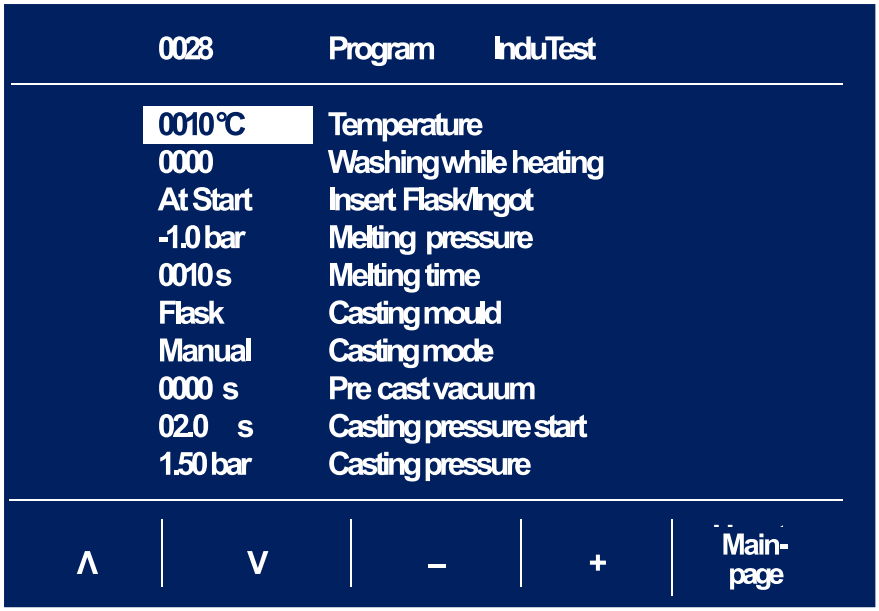


Figure 12: Program parameter page 1

upper area = Parameter

lower area = options

Display in upper area:			
0028	Program	'0' to '99'	Actual selected program to modify.
0010 °C	Temperature	'10' to '1300' °C	Set temperature inside crucible (depends on type of thermocouple).
0000	Washing while heating	'0' to '5'	Number of washing cycles during the heating process (evacuation to full vacuum, then backfill with protective gas).
At Start	Insert Flask/Ingot	'At Start' 'Bef.cast'	The mould will be placed in the mould chamber before the washing cycles and heating process; the mould would be inserted at a later moment during the heating process.
-1.0 bar	Melting pressure	'-1.00' to '0.00' bar	Set value for the gas pressure in the crucible chamber during the melting process.
0010 s	Melting time	'5' to '600' s	Set time for holding set temperature.
Flask Fl	Casting mould	'Flask' 'Flask Fl' 'Flask HSC' 'Ingot' 'Gran'	flask without flange – two chamber system with differential pressure. Flask with flange (differential pressure) under development One chamber system with always similar pressure in both chambers; should be selected if the mould does not allow for a sufficiently good seal between the two chambers, which is frequently the case for ingot moulds. Program basic settings for granulating.
Manual	Casting mode	'Manual' 'Automatic':	The pouring step must be confirmed manually by the operator by pressing the 'Start' button. The pouring step is initiated automatically after the pouring temperature is reached.

0000 s	Pre cast vacuum	‘0’ to ‘20’ s	Set value for a quick evacuation time step in the crucible chamber right before initiation of the pouring step; this removes gas from the interior of the mould/flask but avoids extended melting time under vacuum.
02.0 s	Casting pressure start	‘0.0’ to ‘20.0’ s	Set value for the exact timing at which an overpressure is applied in the crucible chamber towards the end of the pouring step.
1.00 bar	Casting pressure	‘-1.00’ to ‘1.50’	Set value of overpressure in the crucible chamber.

On the bottom level is shown:	
Arrow key up	Move to the set value one position higher (here not possible).
Arrow key down	Move to the set value one position lower (here: to Washing while heating).
-	Lower the set value (here not possible).
+	Rise the set value (here: 0011).
Main page	Return to the main display.

7.3.3 Program change page 2

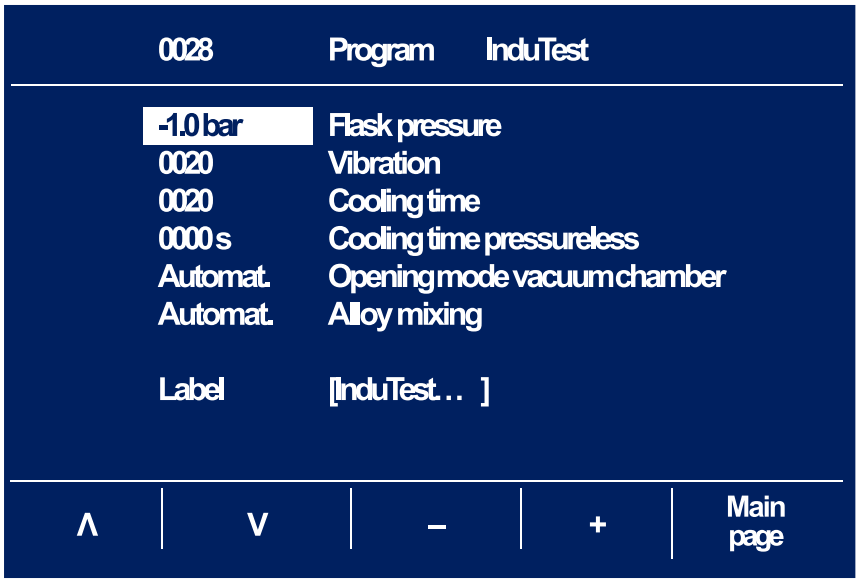


Figure 13: Program parameter page2

upper area= parameter

lower area = options

Display in the upper area:			
-1.0 bar	Flask pressure	'-1.0' to '0.0'	Set value for the gas pressure in the flask chamber during the pouring step; it is created after that the two chambers have been sealed each others by moving the vacuum chamber and flask upward into the position for pouring.
0010 s	Vibration	'0' to '60'	Set value for the mould vibration time.
0020 s	Cooling time	'5' to '600'	Set value for the time during which the chamber remains under pressure.
0000 s	Cooling time pressureless	'0' to '600' s	Set value for time during which the chamber remains closed without pressure.
Automat.	Opening mode vacuum chamber	'Manual'	Swivelling out of the vacuum chamber has to be confirmed from the caster with pressing 'Start' button.
		'Automat'	Swivelling out of the vacuum-chamber starts automatically after program is finished.
High	Alloy mixing	Automat	Movement of liquid (default settings)
		High	Strong movement of liquid.
		Medium	Medium movement.
		Low	Low movement.
Label	[InduTest]	'a-z, A-Z, 0-9'	Opportunity to give a name to the actual program using the +/- keys (alphabet capital and small letters, numbers, symbols) and arrow keys (next character spacing).

7.3.4 Predefined casting programs

Figure 14: pre-setcasting programs

VC480V						
Material		**Bronze**	**Yellow gold 14 kt (with zinc)**	**Yellow gold 18 kt**	**Alumini-um**	**Brass**
Crucible		Graphite	Graphite	Graphite	Graphite	Graphite
Program no.		**10**	**11**	**12**	**13**	**14**
Temperature	°C	1150	1060	1080	740	1080
Washing while heating		0001	0001	0001	0000	0001
Insert Flask/Ingot		At Start	At Start	At Start	At Start	At Start
Melting pressure	bar	-1.00	0.00	-1.00	-1.00	0.00
Melting time	sec.	0090	0090	0090	0120	0090
Casting mould		Flask	Flask	Flask	Flask	Flask
Casting mode		Manual	Manual	Manual	Manual	Manual
Pre cast vacuum	sec.	0000	0010	0000	0000	0000
Casting pressure start	sec	00.8	00.8	00.8	00.8	00.8
Casting pressure	bar	0.00	0.00	0.00	0.00	0.00
Flask pressure	bar	-1.00	-1.00	-1.00	-1.00	-1.00
Vibration	sec.	0060	0020	0020	0060	0060
Cooling time	sec.	0150	0150	0150	0300	0150
Cooling time pressureless	sec.	0000	0000	0000	0000	0000
Opening mode vacuum chamber		Automat.	Automat.	Automat.	Automat.	Automat.
Alloy mixing		Automat.	Automat.	Automat.	Automat.	Automat.
Label		Bronze	YG 585	YG 750	Aluminium	Brass

VC480V							
Material		**Silber 925 In-got**	**Silber 925 heavy**	**Silber 925 middle**	**Silber 925 light**	**Granu late**	**Test**
Crucible		Graphite	Graphite	Graphite	Graphite	Graphite	Graphite
Program no.		**15**	**16**	**17**	**18**	**20**	**28**
Temperature	°C	0950	0980	1000	1020	1150	0010
Washing while heating		0000	0001	0001	0000	0001	0000
Insert Flask/Ingot		At Start	At Start	At Start	At Start	Bef.cast	Bef.cast
Melting pressure	bar	-0.90	0.00	-0.50	-0.90	1.00	-1.00
Melting time	sec.	0180	0120	0090	0090	0180	0010
Casting mould		Ingot	Flask	Flask	Flask	Granul.	Flask Fl
Casting mode		Manual	Manual	Manual	Manual	Manual	Manual
Pre cast vacuum	sec.	0000	0000	0000	0000	0000	0000
Casting pr. start	sec	00.0	02.0	01.2	00.8	00.0	02.0
Casting pressure	bar	0.00	0.50	1.00	1.50	0.50	0.50
Flask pressure	bar	0.00	-1.00	-1.00	-1.00	0.00	-1.00
Vibration	sec.	0060	0060	0045	0030	0000	0010
Cooling time	sec.	0300	0300	0300	0300	0010	0020
C. t. pressureless	sec.	0000	0000	0000	0000	0000	0000
Opening mode VC		Automat.	Automat.	Automat.	Automat.	Automat.	Automat.
Alloy mixing		Automat.	Automat.	Automat.	Automat.	Automat.	Automat.
Label		Ag925 Ingot	Ag925 heavy	Ag925 medium	Ag925 light	Granu-late	InduTest

7.4 System parameter

If you start from the main page and you press ‘Program Setup’ for five seconds you get access to the system parameter level.

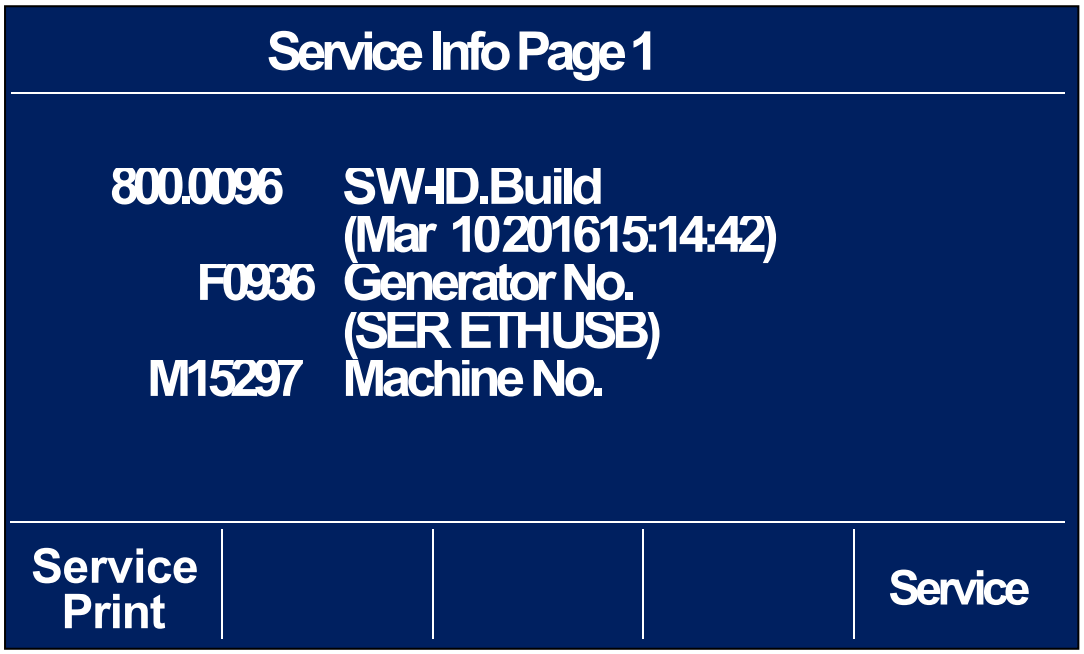
Figure 15: System parameter

Display-functions:		
000:	00002	Selected parameter: 000 Value of parameter is 2, which means here thermocouple type N is activated.
V		With pressing ‘arrow down’ you get to previous parameter (no lower then 000).
Λ		With pressing ‘arrow up’ you get to next parameter 001.
-		With pressing ‘-’ you decrease the value to 1.
+		With pressing ‚+‘ you increase the value to 3.
Service		With pressing the button near to this word you see information of ‚Service Info Page 1‘ with several serial numbers.

7.4.1 State Level

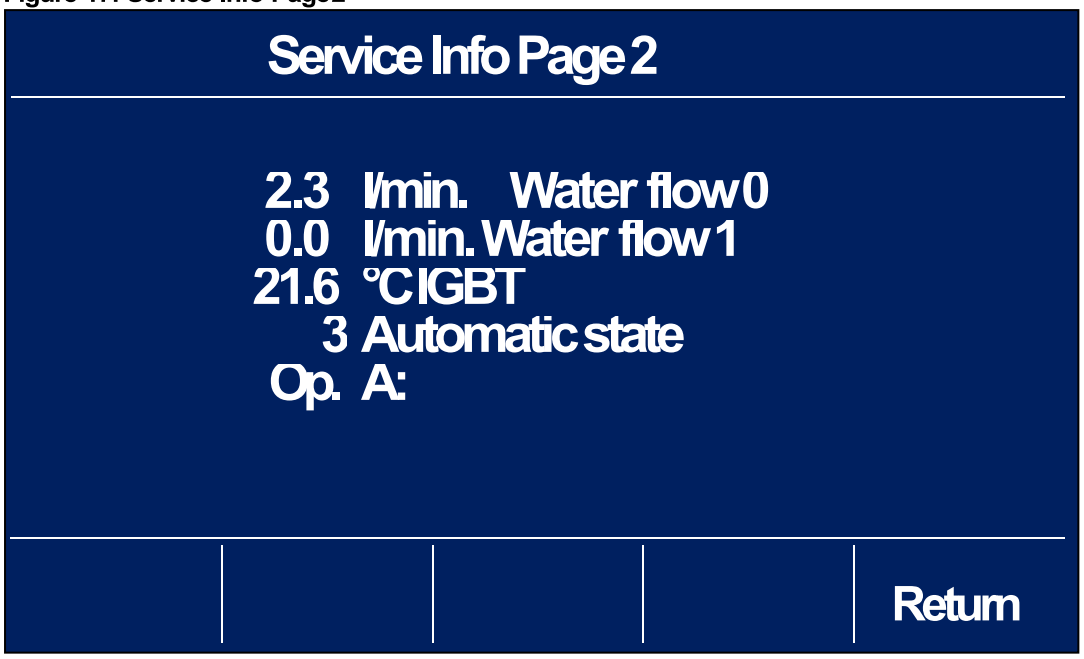
By pressing the ‘Service’-button once, you see the software ID, generator number and machine number.

Figure 16: Service-Info-Page1



Pressing ‘Service’ second time display switches to the second service info page amongst other with important information on the cooling water flow, generator temperature, machine state and signal strength of inbuilt modem.

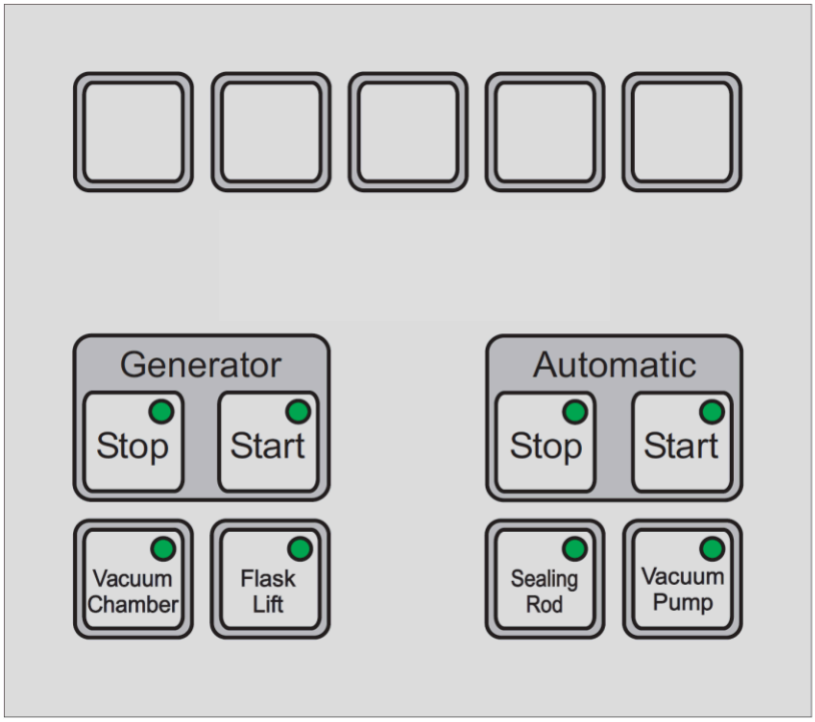
Figure 17: Service-Info-Page2



After pressing ‘Return’ switch display back to main page.

7.5 VC480V Front panel below display

Figure 18: Front panel below display



Manual control:	
Generator Start	By this button you can start heating from generator. Switched on generator regulate for the set temperature (see above 'temperature').
Generator Stop	Stops heating (if not operating in program).
Vacuum Chamber	Opens the vacuum chamber. Chamber will be closed automatically when it is swivelled completely under the crucible chamber. During granulating process lifting and lowering of the granulating tank.
Flask Lift	Lift and sink of flask lift. This function is only possible with closed vacuum chamber. With open chamber lifting and sinking is performed automatically.
Sealing Rod	With pressing this button the sealing rod opens or close, which let flow liquid material in the flask or granulation tank when it is requested. With software 800.0104 and higher (please see Service Page 1) safety function is installed, which controls swivelled in vacuum chamber. With pressing the button for 3 seconds you can disable warning W077, if you want to open the sealing rod for cleaning empty hot crucible.
Vacuum Pump	Switching on and off the vacuum pump, when the pump is connected to the backside socket from the machine.

Automatic Start	With this button the selected casting program starts and its parameter will be executed from the memory. Starts pausing program (LED is blinking).
Automatic Stop	Pausing an automatic program if pressed once and stops the program if you press it twice.

7.6 Protective Gas flow

Protective gas supply for pressure regulation in the crucible occurs automatically. For safety reasons: there is continuous flow of protective gas at temperatures over 500 °C, because there is danger of blow up.

7.7 Casting

Before starting check chambers, crucible and crucible shield for dirt, residues or possible damage. It is recommended to use a **vacuumcleaner** for the entire inductor housing and mould chamber. The sinter filter (left side of the sealing rod) should be twisted out and cleaned with compressed air.

With using of compressed air wear a dust proof mask and must not blow in the room.

Program selection:

11 pre-defined program with recommended parameters are stored for standard VC series and processing of conventional metals (e.g. silver). Program-places are 10-18, 20 and 28. Program 28 =one test program from INDUTHERM for system check without heating power.

A suggestion for a general casting process:

1. Open cooling water, compressed air and protective gas supply.
2. Switch on vacuum casting machine and vacuum pump, for optimum performance always keep the vacuum pump running for at least 30 min to heat up (The vacuum pump attached to the casting machine switch on by itself in program with selected washing or low vacuum).
3. Adjust or select the wished program.
4. Twist (turn) the sealing rod slightly in the crucible hole and fill in the material.
5. Start the program process (Key ‘Automatic Start’).
6. Wait for command ‘Set in flask’. Confirm it with pressing key ‚Automatic Start’. Swivel out vacuumchamber. Put in flask. Close vacuum chamber.
7. Wait for command ‘casting’. With a look through the window check the melted alloy. Confirm command with button ‘Automatic Start’ when LED is flashing in the key (this step is only necessary at manual casting mode).
8. Wait in the end for flashing key ‘Automatic Start’. Press it (this step is only necessary

at manual casting mode). Then swivel out vacuum chamber and take out flask.

A new casting cycle can start beginning with step 3.

Vibration device

The machine VC480V is equipped with a vibration device, which is below of the traverse of the vacuumchamber.

Vibration starts 1 second after opening of sealing rod in the automatic program mode, if there is a vibration time bigger then 0 programmed.

Note:

At our webpage www.INDUTHERM.de you'll find a training video of VC450 and VC650V. This should give you an idea how to use your VC480V.

Suggestion for a simple casting process (sufficient for many applications):

Program parameter to adjust:

Temperature:	ca. 100 °C over melting temperature of the alloy (Consider the recommendation of the alloy manufacturer).
Melting pressure:	+0.00
Melting time:	030
Casting pressure:	+0.60
Casting pressure start:	001
Cooling time:	180
Casting mode:	Automat.

1. Open cooling water, compressed air and protective gas supply.
2. Switch on vacuum casting machine and vacuum pump (connected vacuum pump switch on by itself within program).
3. Adjust program with above mentioned parameters.
4. Twist (turn) the sealing rod slightly in the crucible hole and fill in the material.
5. Start the program process (Key 'Automatic Start').
6. Wait until the material is melted completely.
7. Wait for command 'Set in Flask'. Confirm it with pressing key 'Automatic Start'. Swivel out vacuum chamber. Insert flask. Close vacuum chamber (Remark: Casting occurs with this program about 15 seconds after closing

vacuum chamber. Important: Close vacuum chamber definitely after alloy is fully liquid).

8. Wait for the automatic opening of the vacuum chamber. Swivel out vacuum chamber and take out flask.

A new casting cycle can start, beginning with step 3!

Recommendation INDUTHERM:

Before you do your first castings with your material let run the test program 28 at room temperature with cold flask.

7.8 Possible causes for dissatisfying casting results

Dissatisfying casting results can have various causes and, depending on the material, can have various effects. The following "check list" is to help find the different causes:

1. Casting temperature is too low/too high.
2. Flask temperature is too low/too high.
3. Configuration of flask is disadvantageous ("branches" too thin or too close to the top).
4. Flask is not totally heated up (at least 2 hours on end temperature).
5. Flask was slaked too early/too late.
6. Contamination in the alloy (for example "bad copper").
7. Material was not pre-alloyed/granulated.
8. Investment for flask was bad/old.
9. Eventually not enough protective gas or the gas had water inclusions.
10. Wrong crucible position (different crucible temperatures), because of worn bottom insulation.
11. Not enough vacuum inside the vacuum chamber (at least - 0.9 bar for good casting).
12. Vacuum was turned on too late/turned off too early.
13. Contamination in the investment because of wax residues (steam out flasks).
14. Graphite contamination (use ceramic insert or crucible of better graphite quality).

Please note that INDUTHERM cannot be held responsible for dissatisfying casting results.

7.9 Flask structure

Figure 19: sectional view of flask

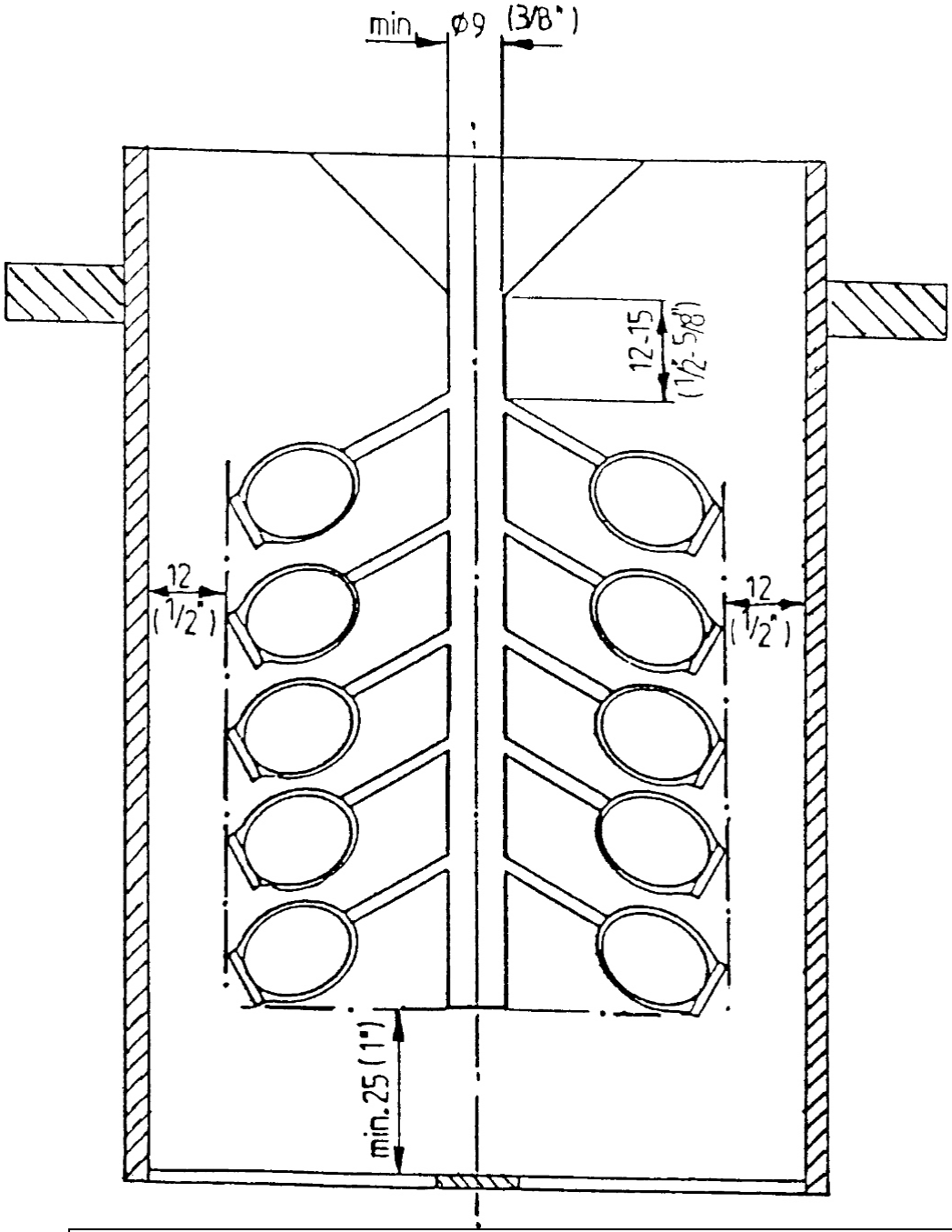


Figure 20: flask without flange and holes

Note:

The principle of the machine is based on the high gas flow through the machine. Please use only flasks with holes on the side.

7.10 Granulating

Before starting check crucible, sealing rod and crucible insulation for dirt residues/possible damages. It is recommended to use a **vacuum cleaner** for the entire inductor. The metal filter (left of the sealing rod) should be taken out and cleaned with compressed air. Use a dustproof mask and blow not in the room!

A crucible with a hole of a 2-mm-diameter is recommended.

Advice!

To produce granules of different diameters, it is sufficient to change screw-fit in the crucible bottom.

Figure 21: granulating crucible

For granulating you have to adjust in *Casting Mould' the value 'Grain'.

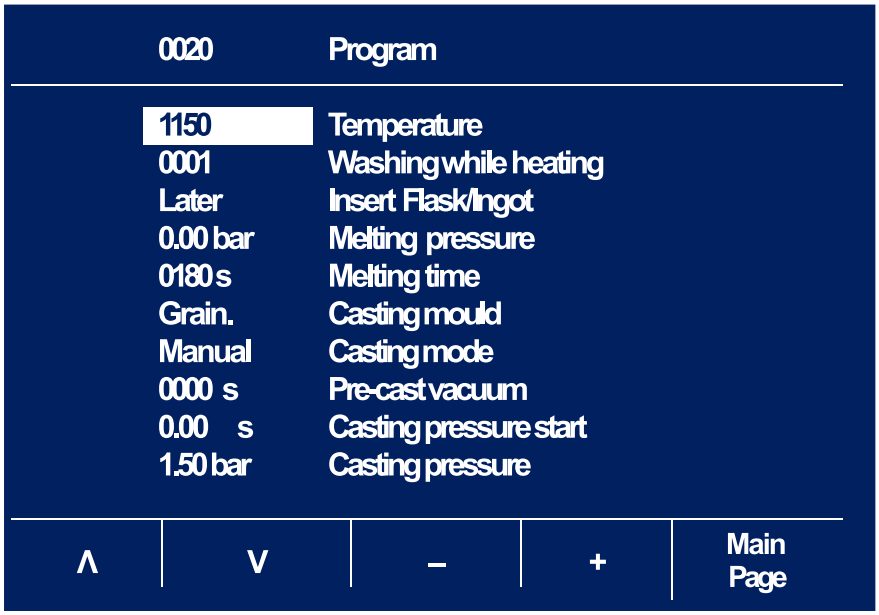


Figure 22: Program parameter granulating

Upper area = parameter

Lower area = Options

Before you start please adjust your parameter. You can choose par example pre set program 20.

Temperature:right adjustment depends from the alloy (about 100 – 200 °C over melting point).

Washing while heating: please set it on 0001, if you melt alloys with zinc (combined with melting pressure of 0.00 bar). Adjust it at 0000, if melt under vacuum alloys without zinc content and melting pressure of -1.00 bar.

Melting pressure: from '0.00' to '-1.00 bar', depending of the alloy.

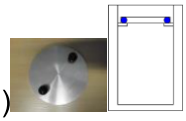
Melting time: depends of the metal quality.

Turbo Pressure Maximum: '0.50' to '1.00 bar', is a kind of turbo pressure function, to blow material residues through the pouring hole after granulating.

Suggestion for a granulating process:

1. Switch on cooling water, compressed air and protective gas supply.
2. Fill the granulating tank with water until overflow.
3. Switch on VC480V at the mains switch.
4. Close the flask chamber avec the appropriate flask chamber-adapter (1).

Figure 23: adapter for flask chamber

(1) 

5. Please press ‘Generator-Start’ in left area of front panel.
   Protective gas will be applied automatically at temperatures over 500 °C.
6. If the set temperature is achieved, twist the sealing rod thoroughly in the crucible bottom hole (rotating movement) and fill in the material.
   Please press key “Automatic Start” at the right side of front panel.
7. Follow commands in the display like ‘Swivel in grain tank’.

   If the flask chamber is opening, then please swivel it completely out.

   Swivel grain tank completely under crucible chamber.

   Press blinking button ‘Automatic Start’ again.

   Now you see new buttons under the front panel like for instance ‘sealing rod’ and ‘Grain pressure’.

   When the alloy is liquid, please regulate the water flow through the nozzles in the grain tank in such a way the water is moving, but not squirting.
8. Depending of the alloy, the metal should maintain the temperature for a few minutes or mixed with a stirring rod.
9. Open the sealing rod with pressing the button ‘sealing rod’.
10. When the crucible is not completely empty, remove residues by pressing button ‘Turbo pressure’ = ‘graining pressure’.

If you want to continue with the same alloy, start with step 4 again.

11. Press the button ‘Generator Stop’, for stopping heating.
12. Swivel grain tank on the left side and take out insert.

Figure 24: granulating insert

Take out insert.


Pour out the water.


Take out material.

7.11 Error diagnosis

There two types of disturbances.

- Error and
- warnings.

If there is an error, the heating will be stopped and there is shown an error code in display.

With light disturbances there is only a warning in display.

7.12 Troubleshooting

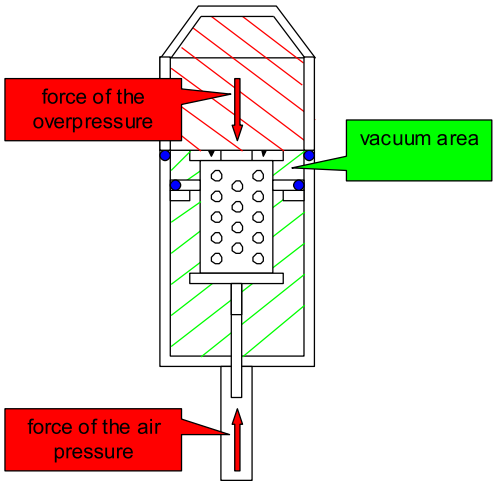
The machine may be opened only by an expert.

Disturbance	Reason
Machine can't be switched on.	• Mains voltage missing.
Heating don't work.	• Cooling water supply not switched on („E010)". • Compressed air supply not switched on („E011"). • Protective gas supply not switched on („E013"). • Thermocouple not put in or faulty („0FbE"). • Generator overheated (too hot, „E021"). • Another error („Exxx").
Temperature indication not right.	• Wrong thermocouple adjusted, see annexe. • Thermocouple faulty („E041"). Because of this the generator can switch off!
Low generator output	• Set value of temperature regulator too low.
Bad pressure build up/release („E081")	• Bad flask sealings. • Dirty flange of flask. • With vacuum (vacuum supply faulty).
Bad vacuum at flask („E082")	• Bad flask sealing. • Dirty flange of flask. • Vacuum supply faulty. • Filter of vacuum pump is dirty.

If you have additional error messages Exxx, Then please see last pages of software documentation in annexe.

7.13 Diagram casting flasks without flange

Figure 25: Flasks without flange

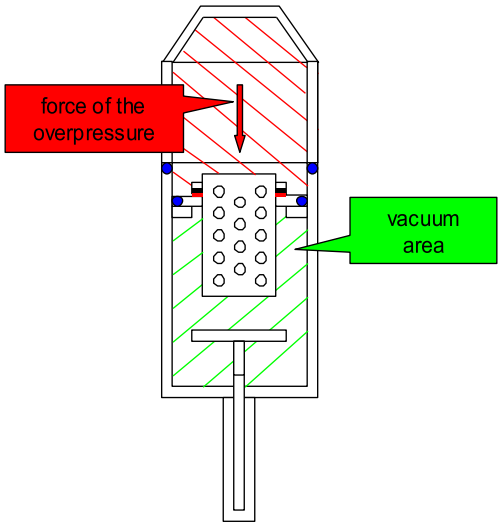


Possible reasons of losing vacuum:

1.) O-Ring of vacuum chamber is not OK.
2.) Flask top surface is not flat enough.
3.) Silicon ring is missing or faulty.
4.) Flask cylinder is not in 'up' position.
5.) By using overpressure on the crucible area you need 8 bars air pressure. With 6 bars pressure the flask will move down and the vacuum will be lost.
6.) Flask has cracks.
7.) 'Flask' isn't selected in Program Set-up.

7.14 Diagram casting flasks with flange

Figure 26: Flasks with flange



Possible reasons of losing vacuum.

1.) Flask flange is not flat enough.
2.) Silicon ring is missing or faulty.
3.) Flask has cracks.
4.) 'Flask Fl' is not selected in program setup.

7.15 Service

If you need technical support from company INDUTHERM, we'd like to have **followinginformation**of your machine at first contact:

- Service No. M17999 F below mains switch or
- Serial number M17999 from identification plate at machine back-side.

8 Maintenance

8.1 Safety advices for repair and maintenance

For reliable use and highest work accuracy use is regular maintenance and service of your system a prerequisite. The necessary working steps are summarized in this chapter and have to carry out in time.

Warning!

Perform maintenance and repair work on the system only if the system has been disconnected from the power supply (pull the plug).

Danger!

Danger of death from touching electrical parts.

Work on electrical equipment may only be performed by authorized personnel.

Access to the electrical installation room is allowed only for authorized personnel with a tool.

Work on the electrical equipment may only be carried out when the system has been disconnected from the power supply (pull the plug).

- The capacitors may still be charged even after turning off the system.
- The cabinet of the vacuum pressure casting machine must be kept close always.
- No work carried out on energized parts.
- Eliminate loose connections.
  Replace damaged, scorched or burned cables immediately. Perform work only when the mains plug is out.
- Cables must not be clamped or pinched. Cables must be routed so that they do not form a tripping hazard or be damaged.

Danger!

Risk of health problems due to exposure to medium from damaged hoses. Risk of damage to the system.

- Eliminate loose connections. Replace damaged hoses immediately. Maintain only when the mains plug is out.
- Hoses must not be clamped or pinched. Hoses must be routed so that they do not form a tripping hazard or be damaged.

Warning!

Risk of injury.
Make pressurized plant parts at zero pressure before work is carried out there.

Warning!

Slipping on the floor in the area around the plant, if lubricants or solvents were spilled.
Clean the floor with dirt immediately! Discard the cleaning cloths in the collecting means made available.

Caution!

Health hazard due to inhalation of fibre particles.

- Store the crucible shield and insulation in a dustproof package.
- Remove the material immediately before installation.
- Don’t shatter crucible shield and isolation.
- Pack the materials immediately dustproof after removal and dispose of these materials in this packaging.

8.2 Maintenance schedule

Follow the maintenance schedule to obtain the functionality of the system.

Daily (before casting)

Warning!

Burning hazard because of leaking molten metal.

The system must not be operated without a sealing rod for security reasons.

The tip of the sealing rod must stay in the pouring opening even when sealing rod is open.

Whit built-in and closed sealing rod the sealing rod-cylinder must not be on the lower end position, otherwise the sealing of the pouring hole is no longer guaranteed.

Check in case of an error necessarily the extent of sealing rod, graphite ball, crucible and the crucible bottom insulation.

- Remove thermocouple, crucible and insulating materials. Clean inductor housing carefully with a vacuum cleaner. Before installing check components and replace if necessary.
- Clean the metal filter on the left of the sealing rod.

Figure 27: Filter crucible chamber

With using of compressed air wear a dust proof mask and must not blow in the room.

- Check and replace white filter for vacuum if necessary.

Weekly

- Apply on the thread of the sealing rod high-temperature grease.
- Check oil level at vacuum pump. Renew oil if necessary. Recommended oil quality HD30/SAE30 (about 0.5 litre).

Every 4 months

- Check the vacuum filter and the oil separator filter of the vacuum pump. Check oil level. Check/clean air filter. Renew it.

Figure 28: air filter of vacuum pump

Every year

- If you use tap water for cooling water-system, then pump about 25% citric acid solution for about an hour through the system. Afterwards the system should be thoroughly flushed with clean water and checked for possible leaks. This cleaning-supply cycle is highly dependent on the hardness and cleanliness of the cooling water.
- Tighten all electrical connections, especially the high current connections.
- Retighten all screws of the water cooling, compressed air and protective gas supply.
- Renew oil separator filter of vacuum pump.

Figure 29: Oil separator filter of vacuum pump

Every 4 years

- Repeat electrical test of the device.

  The intervals of 4 years relate to a trouble-free operation of the electrical equipment. After an exchange of components (repair or extension) are in
  EN60204-1: 2006 + A1: 2009
  defined tests to be performed.

Note:

The operator is in accordance with the Industrial Safety Regulation (BetrSichV) in Germany or pursuant to Directive 2009/104 / EC * in the EU required to define the cycle for the safety inspection of mechanical and electrical equipment.

8.3 Repair

The system must be repaired only by authorized personnel. Never try to repair the system yourself. Incorrect repairs can lead to health problems or damage to the equipment.

*Directive 2009/104/EG

of the European Parliament and of the Council of 16 September 2009 concerning minimum safety and health protection for the use of work equipment by workers at work (second individual Directive within the meaning of Article 16 paragraph 1 of Directive 89/391 / EEC).

9 Dismantling and cleaning up

Warning!

Permanent skin damages after touching lubricant or solvent of every description (long term effects).

- Avoid touching lubricants, solvents and coolants.
- Wash the sprinkled skin parts thoroughly.
- Wear protective gauntlets when using lubricants, solvents and coolants.

Attention!

Disposal possibly inserted lubricants and harmful cleaning agents is strictly regulated by the Environmental Protection Act and its regulations.

- Deliver spent lubricants from at the hazardous waste collection point.
- Spilled lubricants, immediately sprinkle with binder and disposed of after binding as hazardous.
- Meet catch precautionary, spilled feed materials (sealed bottom, catch basins, collecting tarpaulins).

> Separate the system off the mains supply and other supply connections.

> Depressurize all system parts which can be under pressure.

> Dispose the system with the help of an appropriate lifting gear.

> Clean the parts of the system.

> Follow legal regulations at handling and cleaning up of old system parts.

> Bring metal pieces to the recycling.

10 Annexe

10.1 List of figures

10.2 CE-Declaration of conformity

Manufacturer:	INDUTHERM Erwärmungsanlagen GmbH Brettener Str. 32, 75045 Walzbachtal
Product type:	Vacuum-pressure-casting-machine
Machine type:	VC400, VC450(V), VC480(V)
Serial number:	10081 or higher
Authorized to sign:	Peter Hofmann

We herewith declare that the machine named above corresponds to the essential safety and health requirements of the following EC directives because of its design and construction in the version which we have placed on the market.

Legal normative basis

Directive 2014/35/EUProtectiontargets as per MRL.-Annex I Chap. 1.5.1
EN 60204-1:2006+A1:2009 Security of machines Electrical equipment of machines Part 1 General requirements
EN 61010-1:2010(inextracts) Safety requirements for electrical equipment for measurement, control and laboratory use Part 1: General requirements

Directive 2006/42/EConmachinery in extracts
EN ISO 12100:2010 Safety of machinery General principles for design Risk assessment and risk reduction
EN 349:1993+A1:2008 Safety of machinery Minimum gaps to avoid crushing of parts of the human body
EN ISO 13849-1:2015 Safety of machinery Safety-related parts of control systems Part 1: General principles of design
EN ISO 13849-2:2008 Safety of machinery Safety-related parts of control systems Part 2: Validation

EN ISO 13850:2006 Safety of machinery Emergency stop function – Principles of design
EN ISO 13857:2008 Safety of machinery Safety distances to prevent hazard zones being reached by upper and lower limbs
EN ISO 14120:2015 Safety of machinery Guards – General requirements for the design and construction of fixed and moveable guards
EN 1037:1995+A1:2008 Safety of machinery Prevention of unexpected start-up
EN ISO 11201:2010 Acoustics Noise emitted by machinery and equipment – Determination of emission sound pressure levels at a work station and at other specified positions in an essentially free field over a reflecting plane with negligible environmental corrections.

Directive 2014/30/EUonElectromagnetic Compatibility
EN 61000-6-2:2005 Electromagnetic compatibility (EMC) Part 6-2: Generic standards - Immunity for industrial environments
EN 61000-6-4:2007+A1:2011 Electromagnetic compatibility (EMC) Part 6-4: Generic standards - Emission standard for industrial environments

The declaration of conformity relates only to the machine in the state in which it was placed on the market; Parts and / or retrospective interventions carried out subsequently by the end user remain unaffected.

The test protocols are stored at INDUTHERM Erwärmungsanlagen GmbH for 10 years.

city/date/signatory: Walzbachtal/2017-10-16/PeterHofmann, chairman

10.3 Test result chart

	1	2	3	4	5	6
Material						
Quantity						
Type of cast pieces						
Casting problem						
Crucible-temperature						
Casting mode (standard, vacuum, over-pressure)						
Flask-size (casting mould)						
Flask temperature						
Investment						
Particularities						
Result						
Test date						

10.4 Connection diagrams

10.4.1 Connection diagram machine with 3x 400V

Figure 30: connection diagram – power part 3x400V

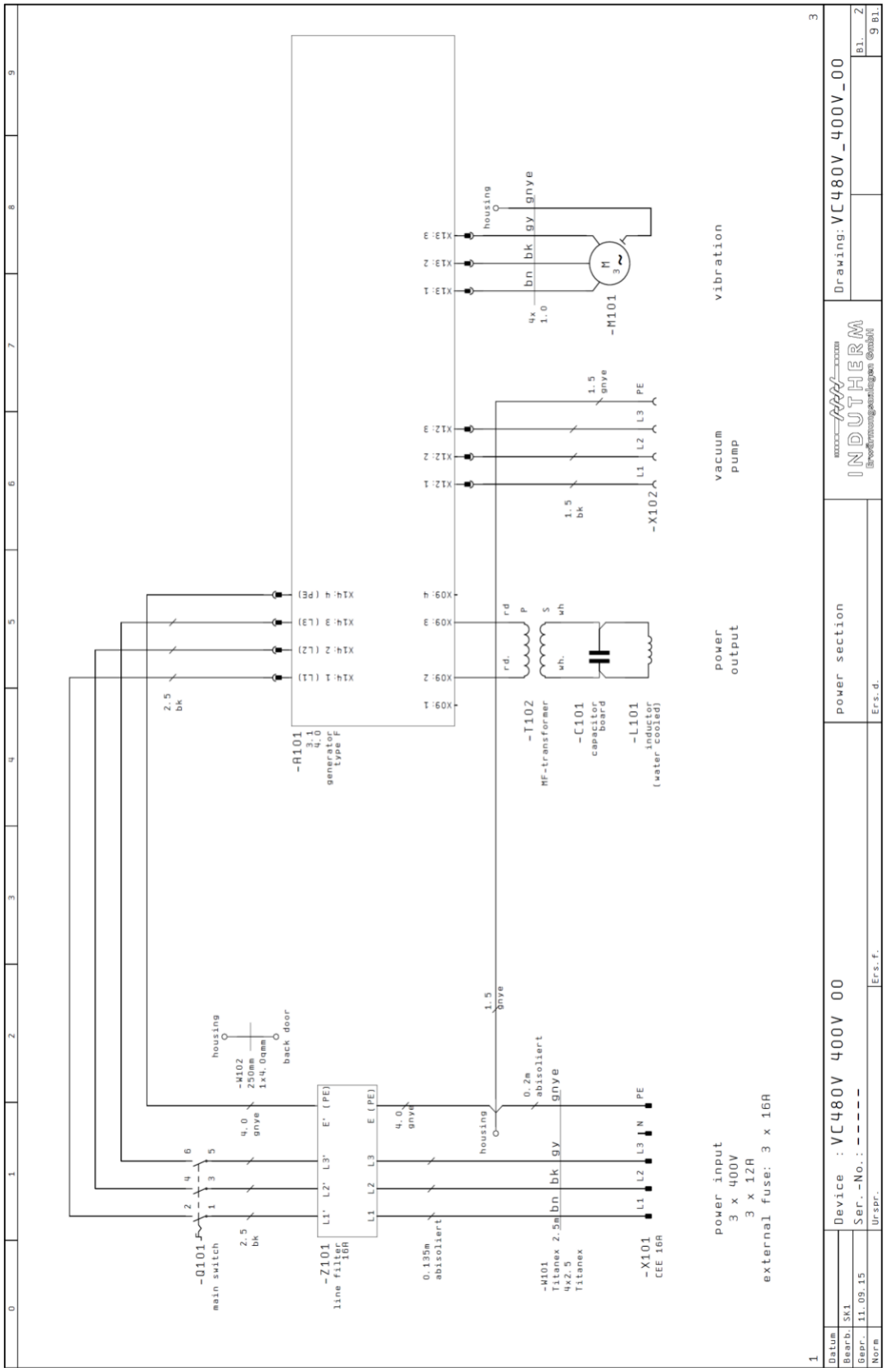


Figure 31: connection diagram– control

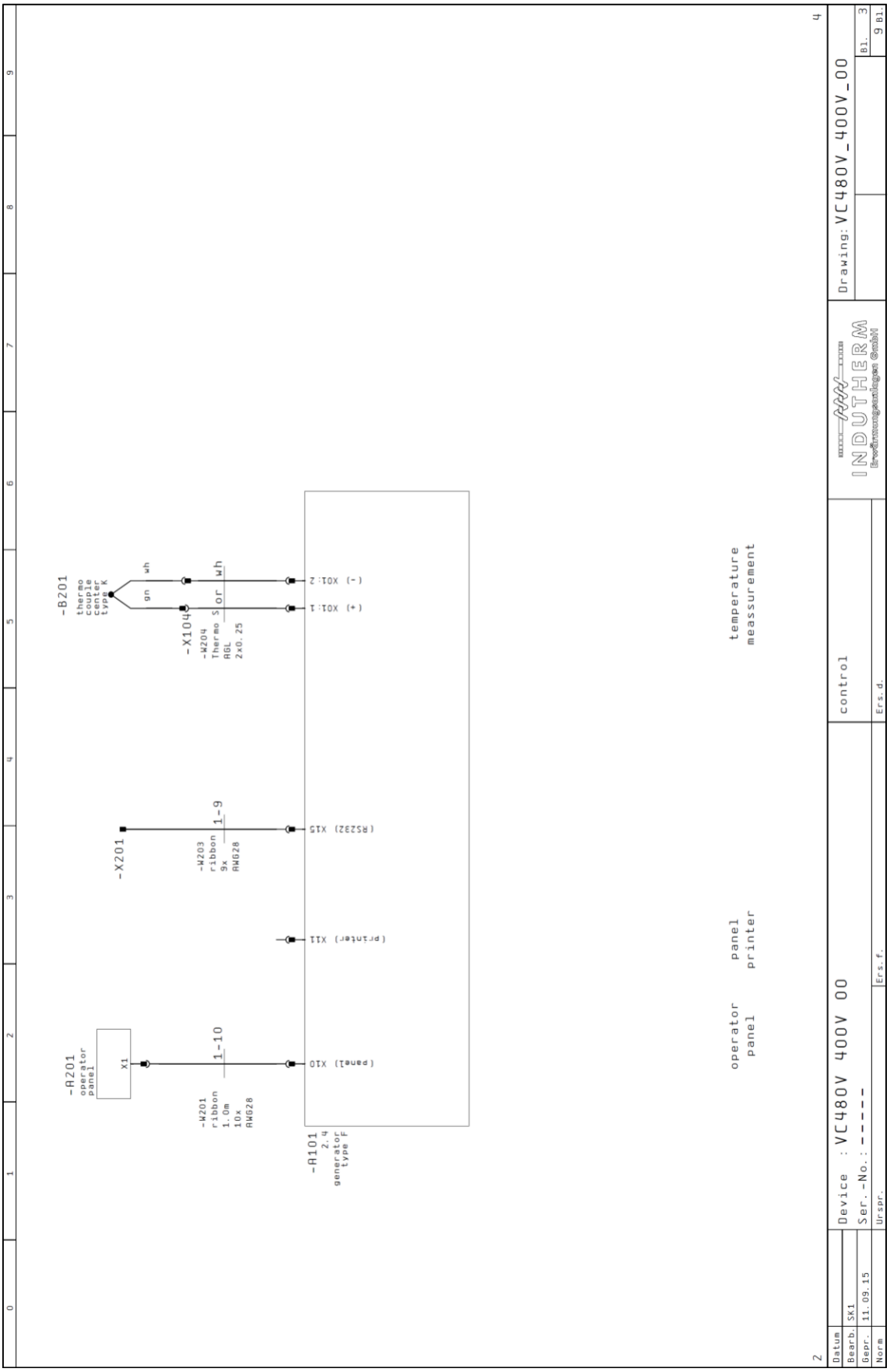
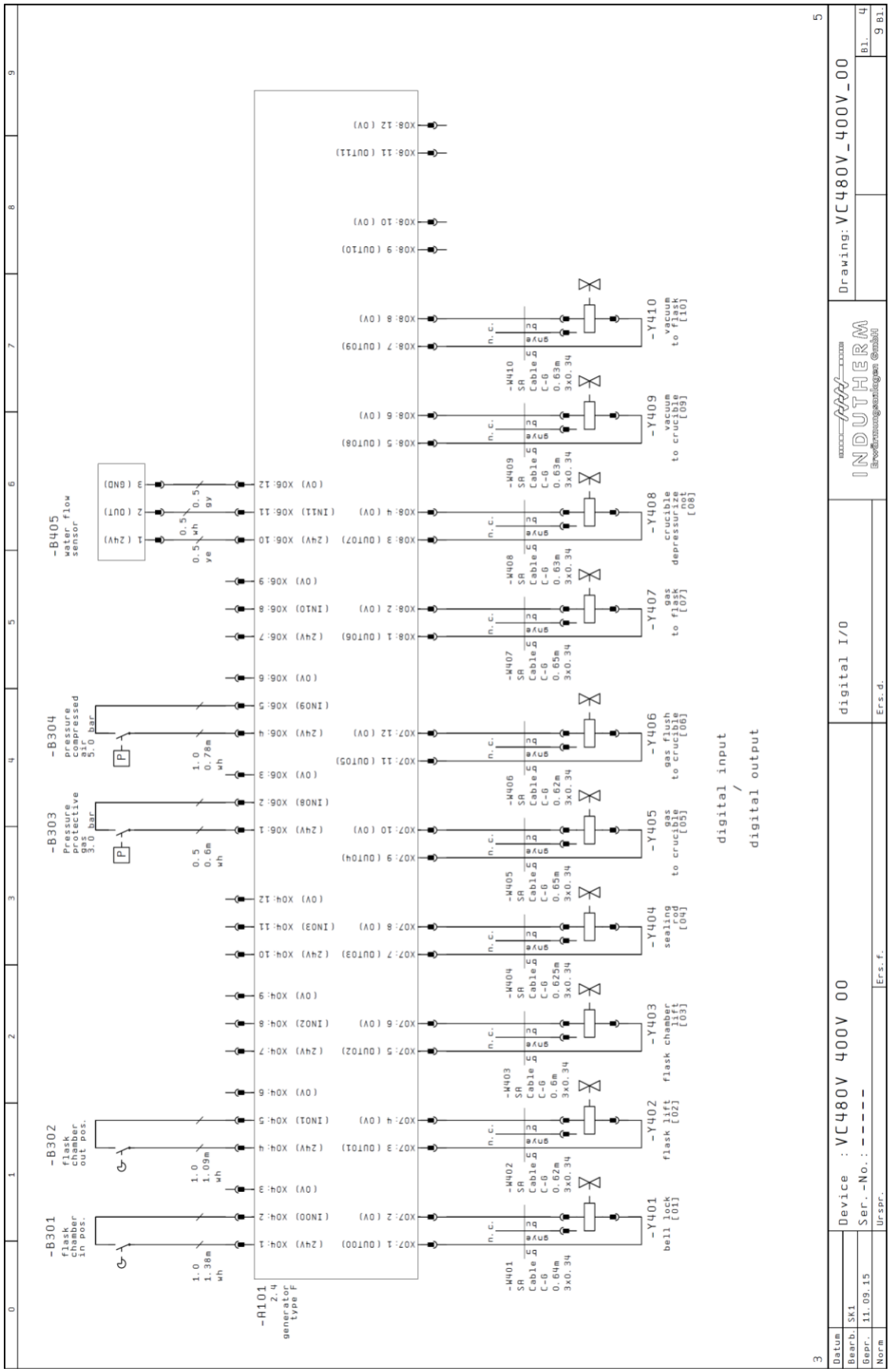
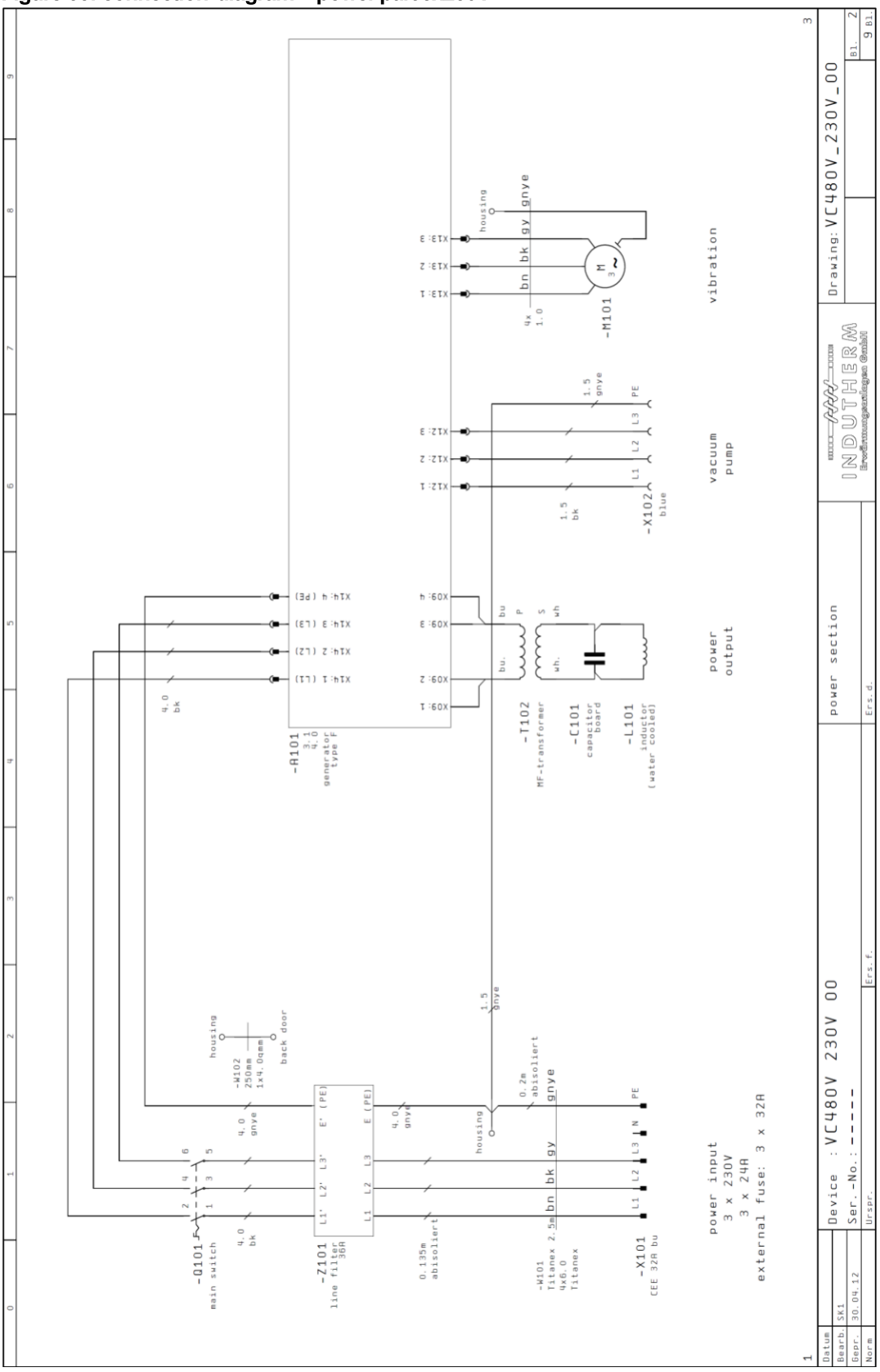


Figure 32: connection diagram – temperature sensor, digital I/O



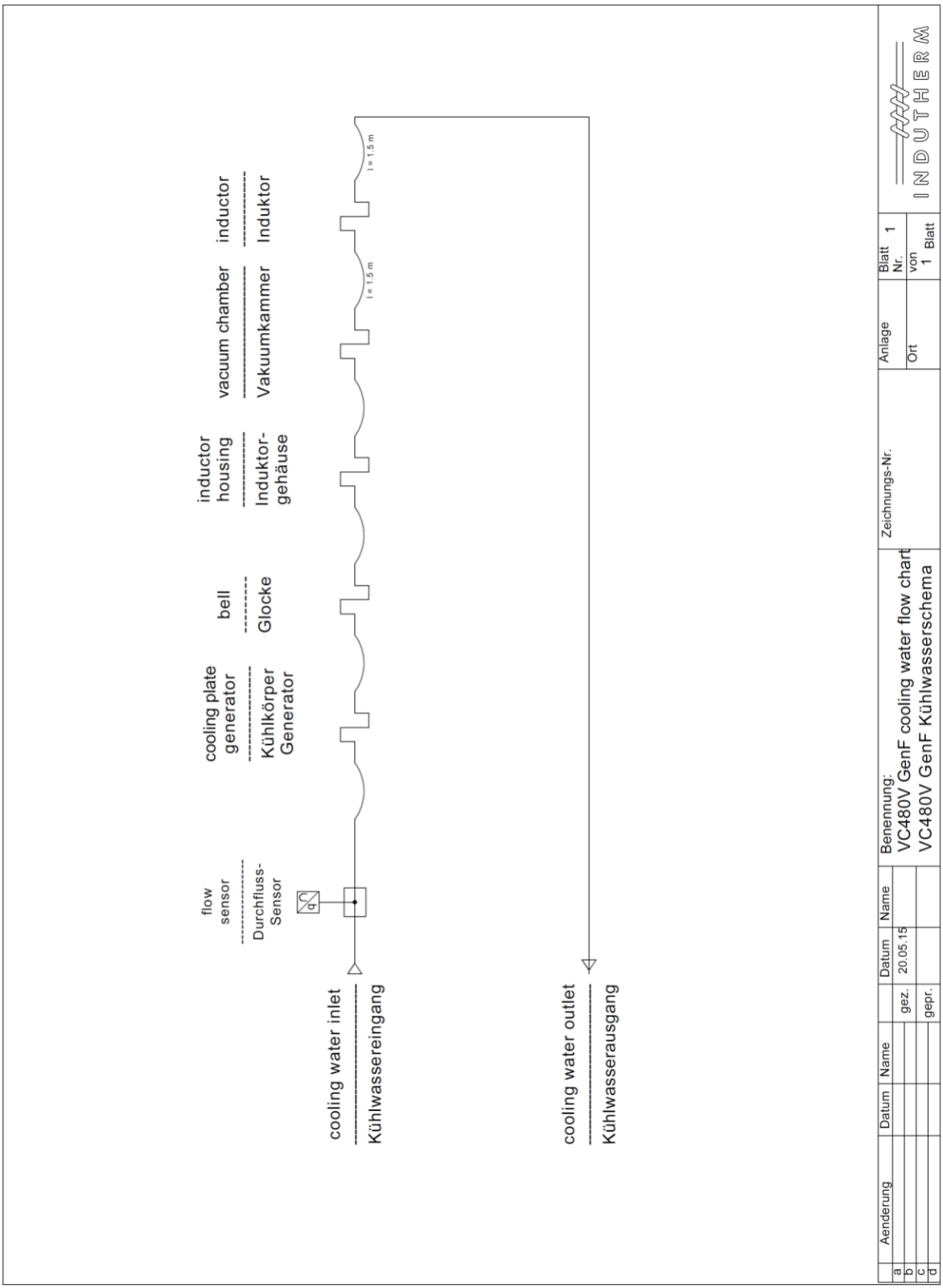
10.4.2 Connection diagram machine with 3x 230V

Figure 33: connection diagram – power part 3x230V



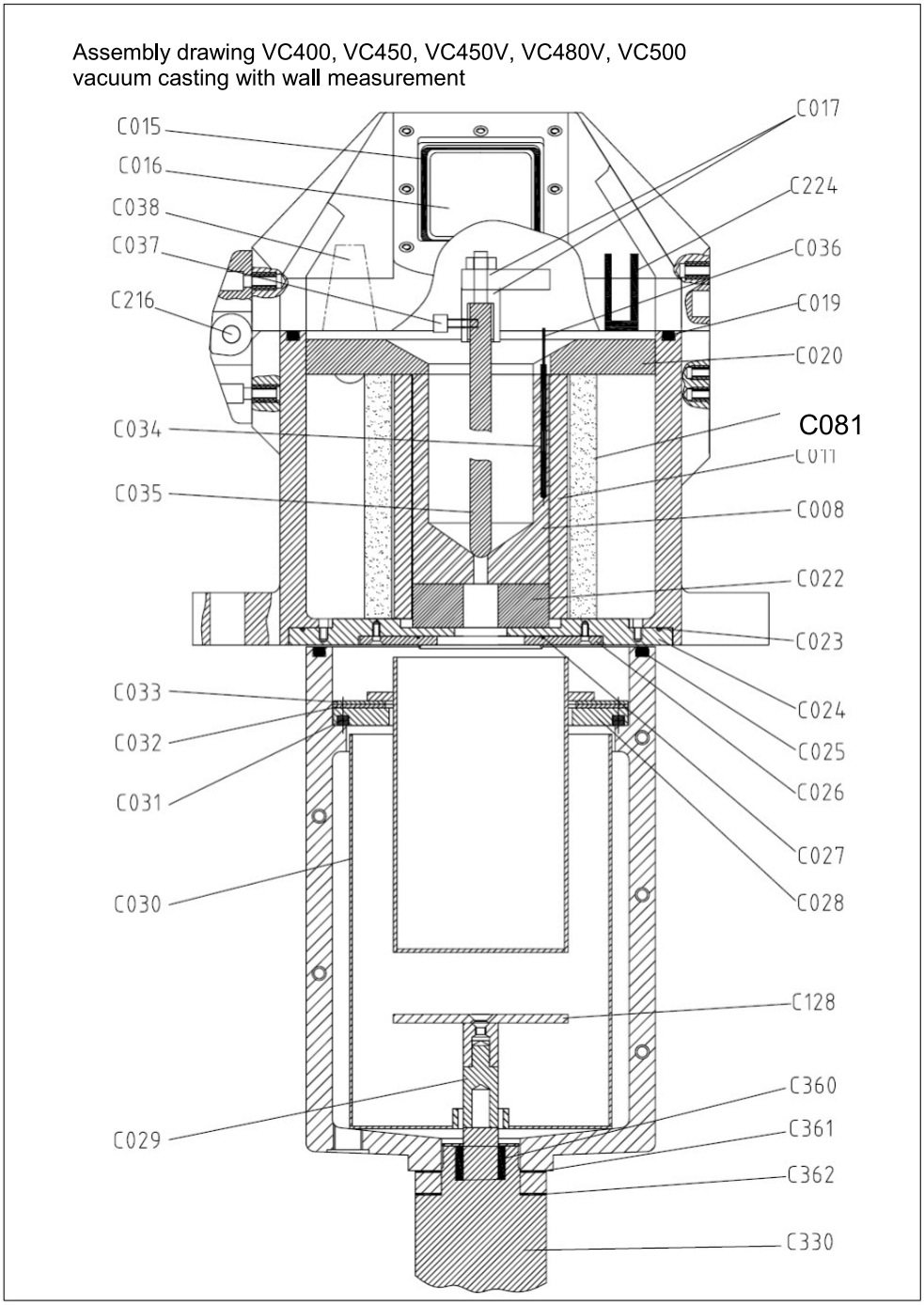
10.5 Water cooling circuit

Figure 34: water cooling circuit



10.6 Assembly drawing VC480V

Figure 35: Assembly drawing with wall measurement



Attention:

The numbers like C008 are placeholder for the position in the machine. The article number to order this piece is 8 digits and listed in your machine specific order list G17999_00.pdf.

10.7 Consumable and spare parts list

INDUTHERM is now using only machine specific spare parts list, which contain all the information for your machine.

At following page, the spare parts list for this machine will start.

The item number of the consumables list is composed by following parts:

- G (for starter kit/basic equipment)
- The next five digits are the machine service number.
- The following combination of letters describe the application (please further below.
- The last two digits are the actual state, starting with '_00'.

One example: G17999_VC_00. This is the consumables list of machine no. 17999, equipped as vacuum pressure casting machine with delivery index '00'.

At request we can send you the actual consumables list in PDF-format. Is there a consumable part or replacement piece replaced by an advanced or better one, changes the index number in the end of item no. in ascending order, in this case to G17999_VC_01? This list replaces the previous edition with index ‚_00'. This should lead to the situation you have always access at the actual consumable and replacement parts of your machine.

Is your machine equipped with options like sinter or granulating, there are for this options specific consumables and spare parts list:

G17999_VC_00	Every part for vacuum casting
G17999_SI_00	Every part for sintering
G17999_GR_00	Every part for granulating
G17999_PA_00	Every part for steel and palladium casting

For ordering of replacement and consumable parts please contact Romanoff at 631-842-2400 or email sales@romanoff.com