

MEMCO Inducto-Vac Casting System

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NOTICE

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MEMCO, Inc. reserves the right to make improvements or changes in specification at any time without incurring obligation to install them on units previously sold.

INDUCTO-VAC CASTING SYSTEM PACKING LIST

CUSTOMER _____ MODEL _____ S/N _____

DATE _____ PACKED BY _____ INSPECTED BY _____

STANDARD EQUIPMENT INCLUDED BUT PACKED SEPARATELY:

_____ 5135 RING / 5180 SADDLE, 3"	_____ WATER FILTER & FITTING
_____ 5136 RING / 5181 SADDLE, 4"	_____ (NO RECIRCULATOR)
_____ 5137 RING / 5182 SADDLE, 5"	_____ METAL SCOOP
_____ 5132 SADDLE, 6"	_____ 5192 CASTING TABLE
_____ VACUUM TRAP (FOR PLATFORM)	_____ 5456 INSTRUCTION MANUAL
_____ 5175 VALVE ROD HANGER	_____ 5457 INSTRUCTION TAPE
_____ 5459 CRUCIBLE TONGS	_____ 5463 10-30R RECEPTACLE*
_____ 5455/61 MIRROR & FLASHLIGHT	_____ (*INTERNATIONAL ONLY)

REFRACTORY REPLACEMENT PARTS

INSTALLED:

_____ 5260 TOP PLATE
_____ 5261 BOTTOM PLATE
_____ 5231 SETTER
_____ 5272 VACUUM FILTER
_____ TUBE CLAMP
_____ WATER SEPARATOR DRAIN VALVE

NOT INSTALLED:

_____ 5214 THERMOCOUPLE CABLE
_____ 5268 CASTING LID, DG, EZ LOAD
_____ 5267 CRUCIBLE LID LINER, EZ LOAD
_____ 5269 INSULATING RING, EZ LOAD
_____ VACUUM PUMP (7 OPTION)
_____ 5252 GAS STRAW & STOP

NOTE:

Each machine includes one basic set of refractory parts, indicated by check. Additional spare parts are indicated on separate sheet.

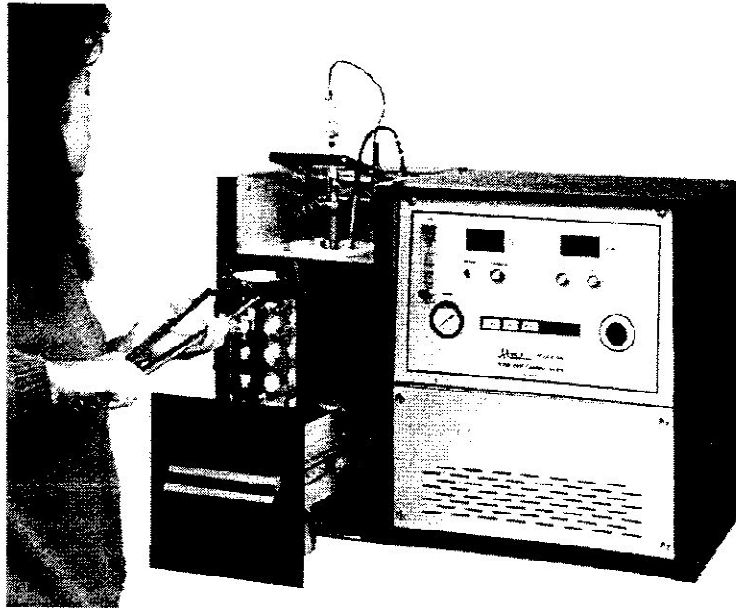
WARRANTY:

No warranties are made on refractory parts. Most refractory materials are very fragile and will be damaged by improper handling. Refer to instruction manual for proper installation.

DAMAGE:

Our terms of sale are FOB our plant. The responsibility for damage in transit is the carrier's whether it be visible or concealed damage. Shipments are equipped with the Shockwatch device to indicate rough handling. Inspect your shipment immediately and insist visible damage be indicated on your freight bill copy. Inspect for concealed damage as soon as possible. We have taken every precaution to insure safe arrival but our responsibility ceased when shipment was turned over to the carrier. Claims for damage must be made by you within 15 days of receipt of delivery.

MEMCO INDUCTO-VAC CASTING SYSTEM



DESCRIPTION

The MEMCO Inducto-Vac combines creative technology to each aspect of the casting process to produce perfect castings every time by precision control of the process variables that affect the casting. This new approach to investment casting is a unique combination of features providing a synergistic effect to the casting process. This system produces dense castings that are free from voids and porosity. These castings have much better definition of contours and detail and far better polishing properties than ordinary centrifugal castings. In addition, this new system is smaller, faster and far safer than ordinary casting machines.

CONTROLS

The completely automatic power control system eliminates manual start up sequences, and other complex adjustments. Solid state digital control logic replaces cumbersome mechanical relays. No complex sequence operation is required. Controls are few, simple and clearly labeled.

Fully automatic temperature regulation system monitors all metals without modification or adjustment. The immersion thermocouple actually measures the metal temperature - not an approximation as with optical pyrometers that see surface trash of unknown emissivity. The thermocouple is contained inside the valve rod thereby keeping it out of the way. The system automatically reaches preset casting temperature and sounds an audible signal to alert the operator to get the flask for casting. This precise temperature control prevents overheated metal causing porosity in the casting. System temperature is easily set and read by the digital readout on the front panel.

SOLID STATE POWER SYSTEM

The innovative power system utilizes recent developments in heavy duty solid state components. The entire power system is solid state, not just the rectifiers. This provides many advantages over common vacuum tube units that are shaken to pieces by a vibrating centrifuge. These advantages include:

- Instant starting with no warm-up or idling losses,
- Quiet operation resulting in less operator fatigue,
- Small size enabling unit to be located conveniently,
- Very high efficiency resulting in lower power consumption, and
- High reliability and long life resulting in fewer service calls.

RECIRCULATOR

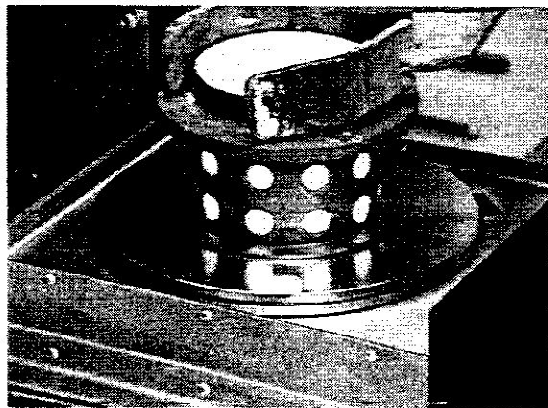
The optional recirculator provides self-contained automatic cooling for all operations. The recirculator should not be used for metals casting above 2200°F or 1200°C.

VACUUM CASTING

Precision vacuum casting provides superior castings free from voids, surface roughness and distortion due to the unidirectional force of a centrifuge. The vacuum exerts a uniform force in all directions ensuring evacuation of all gases and perfect filling. Casting accuracy is further enhanced because the metal flows directly into the flask at the exact set temperature. This short distance to the flask minimizes temperature change and enhances safety. There is no chance of accidents due to a dangerous centrifuge or an exposed high voltage coil. A very high output is achieved in vacuum castings because (1) casting is instantaneous - no waiting on a centrifuge to stop spinning and (2) the crucible is stationary, insulated and not cooled by spinning. Less heating is necessary, melting is faster, and it saves energy.

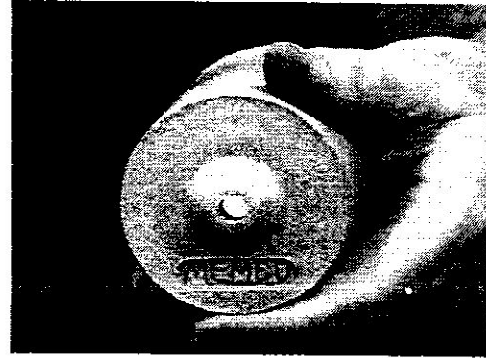
FLASKS

The vacuum chamber accommodates several popular sizes of perforated flasks. Excellent filling of large perforated flasks is achieved without special techniques. The insulated flask chamber stabilizes flask temperature during the critical cooling phase as opposed to violent spinning by a centrifuge. The ability to control both metal temperature entering the flask and the flask temperature is critical to optimum results. Strip and wire ingots can be cast easily using standard molds.



CRUCIBLES

This bottom pour crucible allows all impurities to remain on the top surface of the molten metal and is contained in the button of the casting. The impurities are not slung into the flask first as with a centrifuge. This static pour crucible allows melting and casting under a protective gas blanket without using pressurized seals and cumbersome mechanisms requiring constant maintenance. The crucible can be refilled immediately after emptying to speed production. Since the crucible never cools between successive melts, the new metal is rapidly melted thereby minimizing oxidation and power consumption. Oversize crucibles permit shotting large sprues and buttons. Crucibles are available in both ceramic and graphite. Ceramic crucibles are electrically transparent and allow the penetrating low frequency currents to thoroughly stir the molten metal to provide a homogeneous alloy. The slick surface does not combine with or contaminate any alloy. The indirect heating used with the high conductivity ceramic crucible transmits heat quickly and evenly to prevent burning the metal. The ceramic crucible and valve rod are chemically inert and are not subject to oxidation or erosion. Graphite crucibles are heated directly and, consequently, heat faster. These options may be interchanged quickly. Hot crucibles may be quickly exchanged when casting different metals.



CONSTRUCTION

The Inducto-Vac is designed and manufactured entirely in the USA using the latest technologies. Our Dallas warehouse stocks parts and supplies for same day shipment.

SHOTTING

The shotting feature permits quick conversion from casting to shotting. The stainless steel shot barrel is rolled under the table and the shotting tube is attached. A pump provides turbulent flow to separate the molten metal and prevent it from fusing together. Now, buttons and sprues from previous castings can be quickly shotted under protective gas. Since no alterations are required the machine can quickly convert back to casting.

ALLOYING

A gas lance is used to vigorously clean and mix dissimilar metals in the crucible. Metal can be melted at its optimum temperature to prevent alloy loss.

MEMCO INDUCTO-VAC CASTING SYSTEM

SPECIFICATIONS

CRUCIBLE TYPES

Ceramic - for use with any alloy

Graphite - for brass only.

CERAMIC CRUCIBLE CAPACITY: 13.2 cu in, 218cc.

MOLTEN METAL CAPACITY

Fine Gold: 136 tr oz, 4.27 kg, 2736 dwt. *molten*

Sterling: 75 tr oz, 2.32 kg, 1494 dwt. *molten*

STANDARD FLASK OPTION - Adjustable platform

Saddles furnished for 3", 4", 5" & 6" diameters.

Maximum flask height is 8".

PERFORATED FLASK OPTION - Vacuum Chamber

Adapter rings furnished for 3 3/8", 4", & 5" diameters.

Maximum flask height is 9".

Optional small standard flask adapter.

FLASK VACUUM - 26" Hg (100 mbar) at sea level, 4 cfm standard, other pumps optional.

PROTECTIVE GAS - 1/4" MHB connection.

Flowmeter: 0 - 20 cfh (0 - 10 lpm).

TEMPERATURE CONTROL

Accuracy: 3°C

Resolution: 1°C

TEMPERATURE LIMITS

Medium Temperature - 1250°C

High Temperature - 1700°C

COOLING OPTIONS - 3/8" MHB connections.

Single pass: Requires 1 gpm @ 35 psi (4 lpm @ 2.5 bar).

Recirculating: Power outlet furnished for automatic operation.

External recirculating system available as an option.

POWER SUPPLY OPTION - Furnished with 5' cord and plug (NEMA 10-30P)

Domestic (USA) : 120/208 -240V, 23A, 1Ø, 60Hz

International : 230V, 23A, 1Ø, 50 Hz

DIMENSIONS:

22 1/2 " h x 31 1/2" w x 17 1/4" d

(57 cm h x 80 cm w x 44 cm d) Actual.

28" h x 36" w x 21" d

(71 cm h x 91 cm w x 53 cm d) Crated.

WEIGHT - 181 lbs. net (83 kg) , 275 lbs. crated (125 kg).

MEMCO LIMITED WARRANTY

LIMITED WARRANTY. All products sold are warranted by McFerrin Engineering & Manufacturing Company, Inc., dba MEMCO, against defects in materials or workmanship under normal use for one year after date of purchase from MEMCO, or its authorized dealer, unless otherwise stated in product literature or catalog. Any part which is determined by MEMCO to be defective in material or workmanship and returned to MEMCO'S service location, as MEMCO designates, shipping costs prepaid, will be as the exclusive remedy, repaired or replaced, at MEMCO'S option. This warranty shall be voided by:

1. Unauthorized installation by other than MEMCO trained technicians (applies to all induction equipment),
2. Altering, removing or defacing nameplate,
3. Use of non-MEMCO repair parts and supplies,
4. Misuse, abuse or unauthorized alterations, or
5. Failure to properly maintain equipment as specified in Owner's Manual.

Refractory items are specifically excluded from all warranties.

WARRANTY DISCLAIMED

MEMCO has made a diligent effort to illustrate and describe the products accurately. However, such illustrations and descriptions are for the sole purpose of identification, and do not express or imply a warranty that the products are merchantable, or fit for a particular purpose, or that the product will necessarily conform to the illustrations or descriptions. No warranty or affirmation of fact, express or implied, other than as set forth in the limited warranty statement above is made or authorized by MEMCO.

LIMITATION OF LIABILITY

Any liability for consequential and incidental damages is expressly disclaimed. MEMCO's liability in all events is limited to, and shall not exceed, the purchase price paid.

PROMPT DISPOSITION

MEMCO will make a good faith effort for prompt correction or other adjustment with respect to any product which proves to be defective within the warranty period. Before returning any product, write or call the MEMCO location from which the product was purchased, giving date and number of original invoice and describing defect. Title and risk of loss pass to buyer on delivery to the common carrier. If product was damaged in transit, recipient must file claim with carrier.

PRODUCT SUITABILITY

Many states and localities have codes and regulations governing sales, construction, installation, and/or use of products for certain purposes, which may vary from those in neighboring areas. While MEMCO attempts to assure that its products comply with such codes, it cannot guarantee compliance, and cannot be responsible for how the product is installed or used. Before purchase and use of a product, please review the product application, and national and local codes and regulations, and be sure that the product, installation, and use will comply with them.

NO WARRANTIES TO CONSUMERS

MEMCO makes no warranties to those defined as consumers in the Magnuson-Moss Warranty-Federal Trade Commission Improvement Act.

IMPROVEMENTS

MEMCO, Inc. specifically reserves the right to make improvements in design or changes in specifications at any time without incurring obligation to install them on units previously sold.

Compliance with City of Los Angeles Electrical Code

The City of Los Angeles Municipal Ordinance Sec 93.0402 requires that all electrical equipment installed in the City to be approved. The Ordinance specifically states:

"Sec. 93.0402 -- SALE, INSTALLATION AND USE

No person shall sell, offer for sale, advertise, or display for sale, dispose of by way of gift, loan, rental, lease or premium, or install or use any "equipment" as defined in Article 100 of the NEC, unless such equipment has been approved by the Department.

EXCEPTIONS:

1. Equipment which is not similar to any equipment currently listed by the nationally recognized laboratories approved by the Department, or which is to be custom manufactured or modified for use at a specific address, provided all component parts which are similar to equipment currently listed by any of the above laboratories are approved, and further provided such equipment and its components comply with all provisions of the Code.

2. Equipment listed by an approved laboratory, provided it is installed and used in conformance with this Code."

Memco, Inc. hereby certifies that all equipment manufactured by MEMCO complies fully with Exception 1 of Sec 93.0402. Further, this equipment complies with the National Electrical Code (NEC) when installed according to instructions.

MATERIAL SAFETY DATA SHEET SUMMARY

PRODUCT IDENTIFICATION:

ALL REFRACTORY ITEMS LISTED ON MEMCO PRICE LIST

INGREDIENTS: ONE OR MORE OF THE FOLLOWING: SiO_2 , Al_2O_3 , MgO , C, SiC

PRODUCT HAZARD SUMMARY

HEALTH: ITEMS CONTAINING FIBROUS CERAMICS MAY BE IRRITATING TO THE SKIN, EYES, AND RESPIRATORY TRACT.

CHRONIC HEALTH HAZARD: N/A

CARCINOGENICITY: N/A (NO ASBESTOS USED IN ANY PRODUCT).

FLAMMABILITY: NON COMBUSTIBLE

REACTIVITY: STABLE FOR PRESCRIBED USAGE

DOT HAZARD CLASS: NONE

HANDLING/STORAGE: NO SPECIAL PRECAUTIONS NEEDED FOR PRESCRIBED USAGE.

DISPOSAL: SUBSTANCES ARE NOT LISTED AS HAZARDOUS

NOTICE: The information presented herein is based on data considered to be accurate as of the date of the preparation of this Material Safety Data Sheet. However, no warranty or representation, express or implied, is made as to the accuracy or completeness of the foregoing data and safety information, nor is any authorization given or implied to practice any patented invention without a license. In addition no responsibility can be assumed by vendor for any damage or injury resulting from abnormal use, from any failure to adhere to recommended practices, or from any hazards inherent in the nature of the products.

INSTALLATION INSTRUCTIONS

Congratulations on your selection of the MEMCO Inducto-Vac, the world's finest casting system. We want your installation to provide peak performance, reliability and safety. In order to insure a proper installation, please do not deviate from these instructions as they have been developed to insure optimum performance, economy and safety.

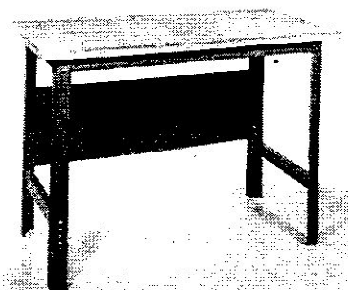
INSPECTION

Inspect for shipping damage immediately. Insist that visible damage be indicated on the freight receipt. Open containers as soon as possible and inspect for concealed damage. Be very careful unpacking as many refractory items are very fragile. In case of damage, notify carrier immediately requesting that an inspection be made.

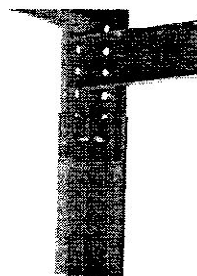
UNCRATING

Remove the steel bands around the crate. Carefully lift cover straight up off base. Remove the four bolts and washers under the base. Save these for mounting machine to the table.

MOUNTING



Assemble the special 4'L x 2'W table shipped with the machine.



Assemble leg extensions for maximum table height.

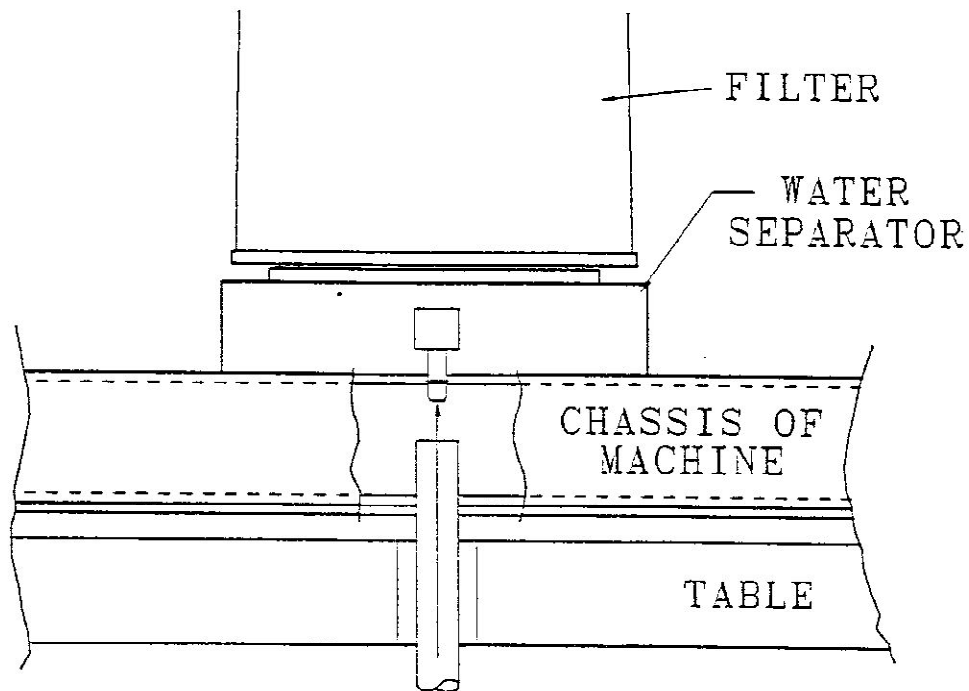
Place machine on table so that the casting chamber is over the large hole in the table. Align mounting holes and bolt machine to table using bolts from the shipping crate. Use only ONE flat washer per bolt.

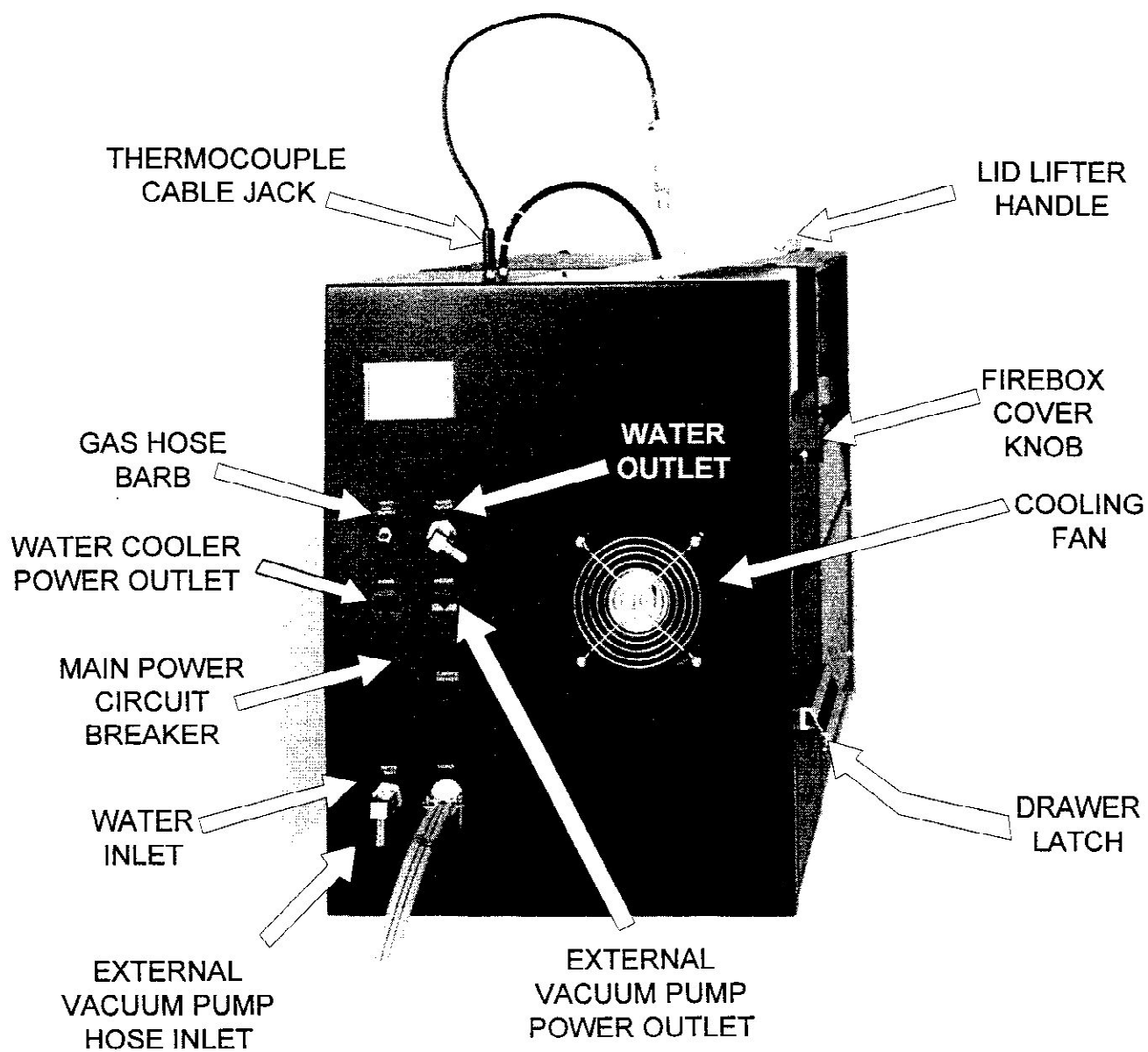
LOCATION

Locate system so that operator may have quick access to flasks from burnout ovens. However, to prevent excessive ambient temperatures, locate a minimum of five feet from electric ovens and ten feet from gas ovens.

WARNING

ATTACH WATER SEPARATOR
DRAIN HOSE BEFORE BOLTING
CASTING MACHINE TO TABLE!

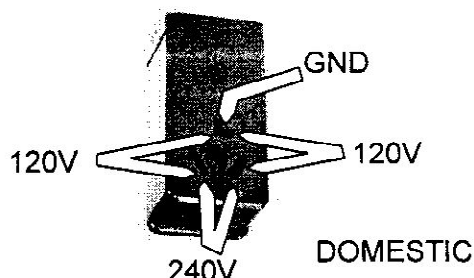




EXTERNAL CONNECTIONS

ELECTRICAL CONNECTION

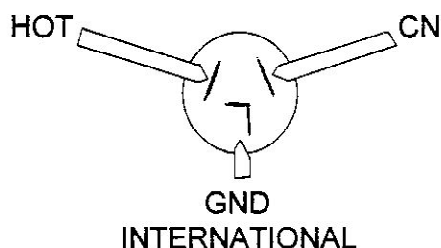
Domestic machines require 120/240V, 23A, 1Ø, 60HZ as indicated by nameplate on left end of the machine. Cord furnished requires a NEMA 10-30R receptacle. This is the standard electrical clothes dryer connection. Install receptacle 5 feet above floor near left end of machine. Circuit should have a two pole 40A breaker. This manner of installation insures compliance with National Electrical Code Art. 250-60. If the local codes require conduit installation, remove rear cover and connect power line to the five position terminal board next to the breaker. The conduit should NEVER be used for a ground connection. A ground wire is ALWAYS required. Use of conduit for grounding is a violation of the national electrical code and may result in shock hazard and equipment damage. Improper electrical hookup voids warranty.



Terminal	Connect
1	Hot Line
2	Hot Line
3	Common Neutral
4	Ground

The ground and common neutral may be separated by removing the jumper between terminals 3 and 4.

International machines require 230V, 23A, 1Ø, 50HZ as indicated by nameplate on left end of machine. Receptacles are furnished for all international machines.



Terminal	Connect
1	230V Hot Line
2	Common Neutral
4	Ground

Do not attempt to convert a machine wired for domestic voltages to international voltages or vice versa. Check the MEMCO nameplate on the left side of the machine for proper identification. Improper wiring could result in serious damage to machine and electrical shock hazard. **IMPORTANT**-Always make sure that the machine is connected to an electrical ground.

This machine incorporates automatic regulation circuitry to maintain constant power levels if the power line voltage is within 8% of nameplate rating.

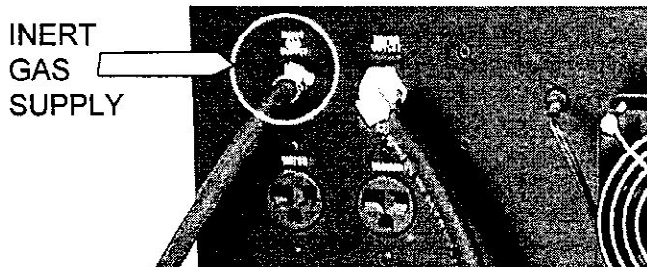
WATER CONNECTIONS

Connect machine to water line and drain with 6 feet each of 3/8 ID reinforced hose to provide adequate movement for maintenance. The drain hose should be high temperature automotive (gasoline) hose. The machine requires 1 gpm of water for cooling at a pressure of 35 psi. Water connections on the left end are 3/8 male hose barb. The inlet is the connection next to the rear of the machine. A water shutoff valve should be located nearby for emergency shutoff and setting water flow rate. The external water valve should remain open for automatic cool down of the machine. The sediment filter should be installed on the inlet water line to prevent debris accumulation in the system.

An electrical outlet located on the left end of the machine is provided to operate a recirculating cooling system, or a pressure booster pump, if required. The recirculator should provide cooled water at less than 120°F (49°C) to the inlet. Only distilled water should be used with a recirculator. Do not allow machine to freeze. Connect recirculator to unit with high temperature hose.

GAS CONNECTION

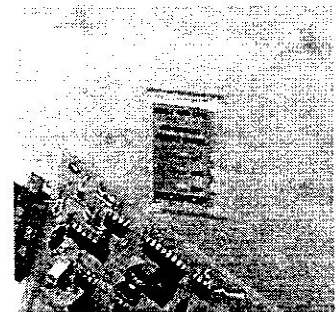
The machine is designed to operate with any of the gases discussed in the section, Operating Instructions - Gas System. A 1/4" male hose barb is provided on the left end for gas connections to the machine. A dual stage regulator (P/N 5411) for the gas cylinder is required. This regulator should have the high pressure gauge range to 4,000 psi and the low pressure gauge range to 30 psi maximum. Do not use a regulator with full scale greater than 30psi. Outlet fitting should be 1/4" male hose barb. *ALSO FOR STEEL (embellishment)*

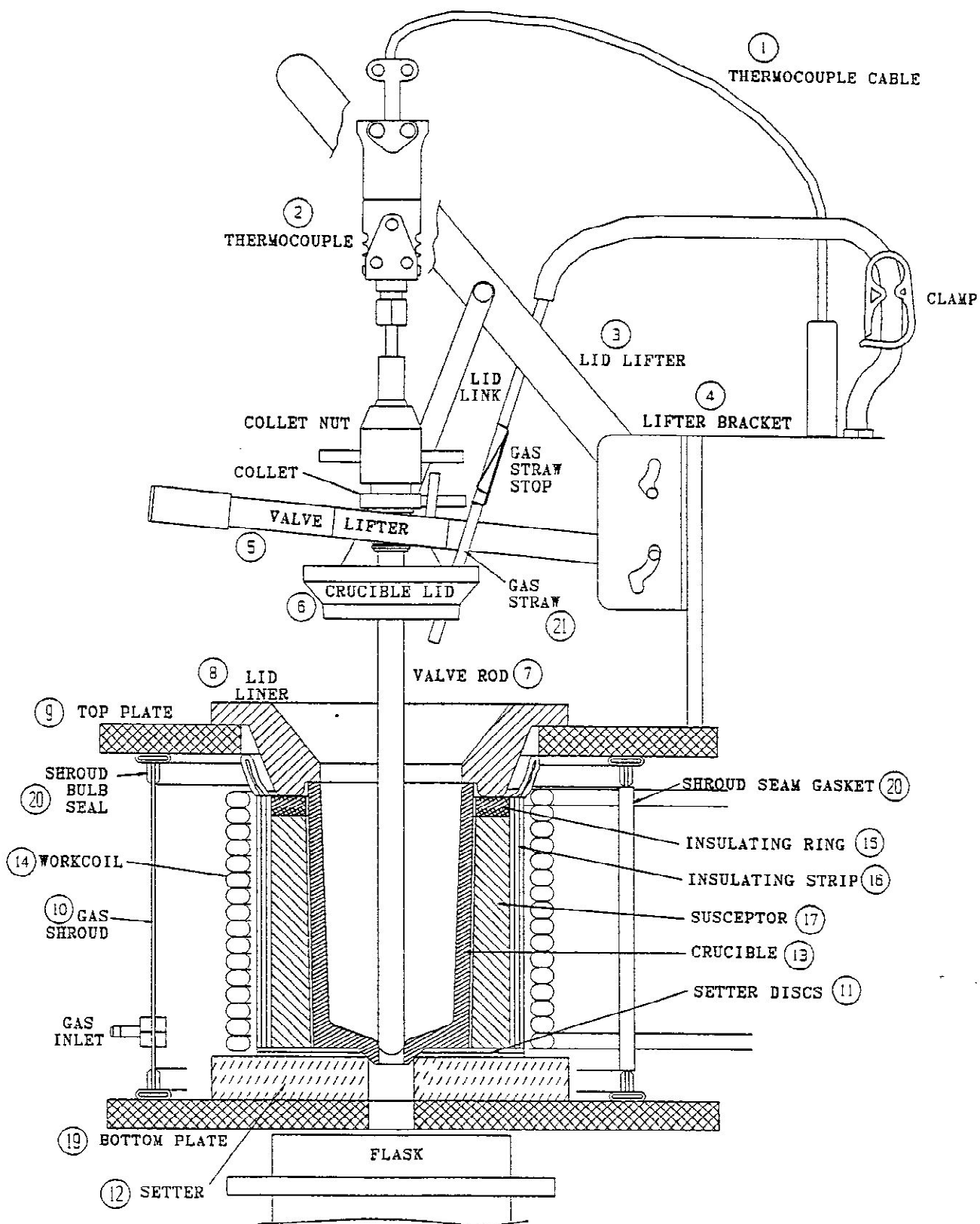


INTERNAL INSPECTION

Open control panel and check that all connectors are secure. Remove the Main Control Board (ELECTRICAL 14) and note the status of the Shockwatch mounted behind it. Replace board. Remove top and rear covers and check interior for loose connections, mountings, etc. Check water system for leaks. Turn breaker on machine off. Turn machine on. Open external water valve and adjust water flow so that OVER TEMP light stays off. Inspect all connections for leaks and tighten clamps if necessary.

Caution - overtightening clamps on cooling blocks will distort the soft copper.





CERAMIC CRUCIBLE ARRANGEMENT

PARTS LIST FOR CERAMIC CRUCIBLE ARRANGEMENT

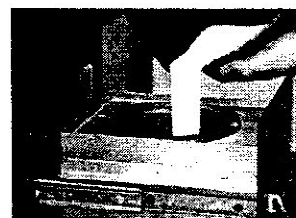
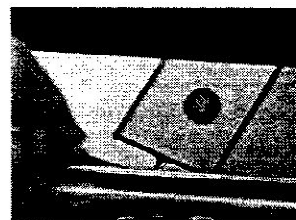
ITEM NO.	PART NO.	DESCRIPTION
1	5214-1	THERMOCOUPLE 15" CABLE FOR 5213, 5219, 7217
	5216-1	THERMOCOUPLE 15" CABLE FOR 5215, 5211
2	5213-1	THERMOCOUPLE 1150°C, 3/16Ø, UNSHLD
	5219-1	THERMOCOUPLE 1150°C, 3/16Ø, SHLD
	5211-1	THERMOCOUPLE 1200°C, 3/16Ø, SHLD
	5215-1	THERMOCOUPLE 1700°C, 1/4Ø, UNSHLD
	7217-1	THERMOCOUPLE 1300°C, 1/4Ø
3	3-5120-1A	LID LIFTER ASSY
4	4-5138-1F	LEFT LIFTER BRACKET, AND
	4-5139-1F	RIGHT LIFTER BRACKET
5	3-5142-1A	VALVE ROD LIFTER ASSY
6	5264-1	LID, ALLOYING OR
	5268-1	CRUCIBLE LID, EZ LOAD
7	5249-1	VALVE ROD 1500°C, 3/16Ø, GRAY OR
	5250-1	VALVE ROD 1600°C, STD, WHT OR
	5251-1	VALVE ROD 1950°C, HT, YEL, 1/4Ø
8	5267-1	CRUCIBLE LID LINER, EZ LOAD
9	5260-1	TOP PLATE
10	3-5118-1B	GAS SHROUD ASSY
11	5235-1	SETTER DISC, HT OR
	5236-1	SETTER DISC, MT
12	5230-1	SETTER, HT OR
	5231-1	SETTER, MT OR
13	5220-1	CERAMIC CRUCIBLE .31Ø (SILVER) OR
	5221-1	CERAMIC CRUCIBLE .40Ø (GOLD) OR
14	3-5154-1B	WORK COIL ASSY
15	5245-1	INSULATING RING, HT OR
	5269-1	INSULATING RING, EZ LOAD
16	5240-1	INSULATING SHEET, HT OR
	5241-1	INSULATING STRIP, MT
17	5225-1	SUSCEPTOR
19	5261-1	BOTTOM PLATE
20	5270-1	SHROUD SEAL SET
21	GAS-STRAW-STOP	GAS STRAW STOP

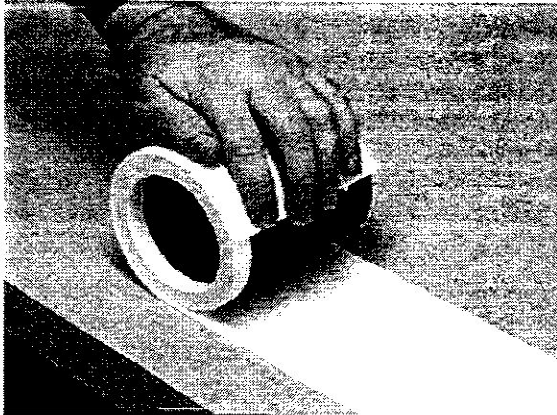
NOTE: ITEMS DESIGNATED HT (HIGH TEMPERATURE) ARE FOR CASTING STAINLESS STEEL.

REFRACTORY INSTALLATION

The machine is shipped with some refractory materials assembled; however, those materials prone to shipping damage are packed separately and require installation. Refer to Ceramic Crucible Arrangement, Installation 6, 7 & 8.

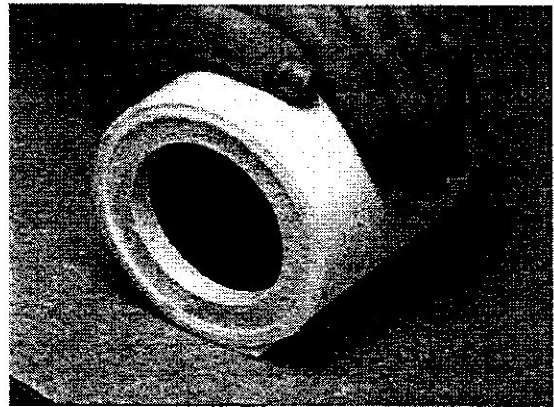
1. For initial installation, unscrew the firebox cover knob and remove the cover and top plate. Inspect the gas shroud to see that the shroud seam gasket is aligned and the belt is secure. Replace top plate and firebox cover.
2. Install two setter discs. Temporarily place crucible on top of setter discs and set lid liner on top of crucible. Lid liner should touch top plate on all sides and seal around top of crucible. Add or remove setter discs to achieve proper height. Remove lid liner and crucible.
3. Place crucible into susceptor to determine top and bottom of susceptor. Remove crucible and place insulation ring on top end of susceptor. Wrap entire insulating strip around crucible and insulating ring for three full layers. Be careful to align strip with top of ring and bottom of susceptor. Carefully place this assembly with ring on top into the work coil. Turn in such direction as to tighten wrapping to ease insertion. Add small insulating strip around top of coil.
4. Use Refractory Preparation Flux, P/N 5265, on the inside of a new crucible exposed to metal, especially around the pour hole. Also dip a new valve rod into the refractory preparation flux. It is only necessary to use this prior to initial use. This will dry quickly.
5. Install the crucible inside the susceptor. Place the lid liner on top of the crucible again checking for sealing on the crucible and top plate. If it doesn't seal on both, make sure it seals around the crucible.
6. Place a thermocouple into valve rod and plug into jack on top of machine. Use a thermocouple having temperature range compatible with metal being cast.
7. All of the parts should align on a common center line dictated by the valve rod. Use an extension mirror and flashlight to check for alignment as viewed under bottom plate. This step is very important. Never attempt refractory alignment from top - always use mirror and flashlight inside casting chamber. Never attempt direct viewing from under machine.
Pour 1/4" of liquid investment into the bottom of the vacuum chamber. When this hardens it will prevent molten metal from welding to the bottom of the chamber.





PLACE INSULATING RING ON TOP END OF SUSCEPTOR. WRAP ENTIRE INSULATING STRIP AROUND SUSCEPTOR AND INSULATING RING FOR THREE FULL LAYERS.

BE SURE TO ALIGN THIS STRIP WITH TOP OF RING AND BOTTOM OF SUSCEPTOR.

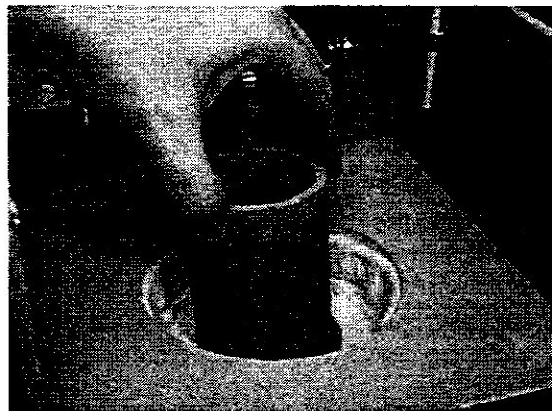


CAREFULLY PLACE THIS ASSEMBLY WITH RING ON TOP INTO THE WORK COIL. TURN IN SUCH DIRECTION AS TO TIGHTEN WRAPPING TO EASE INSERTION.

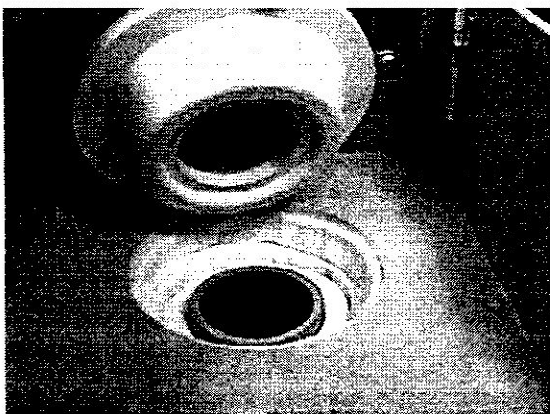
TOP PLATE OMITTED FROM VIEW FOR CLARITY



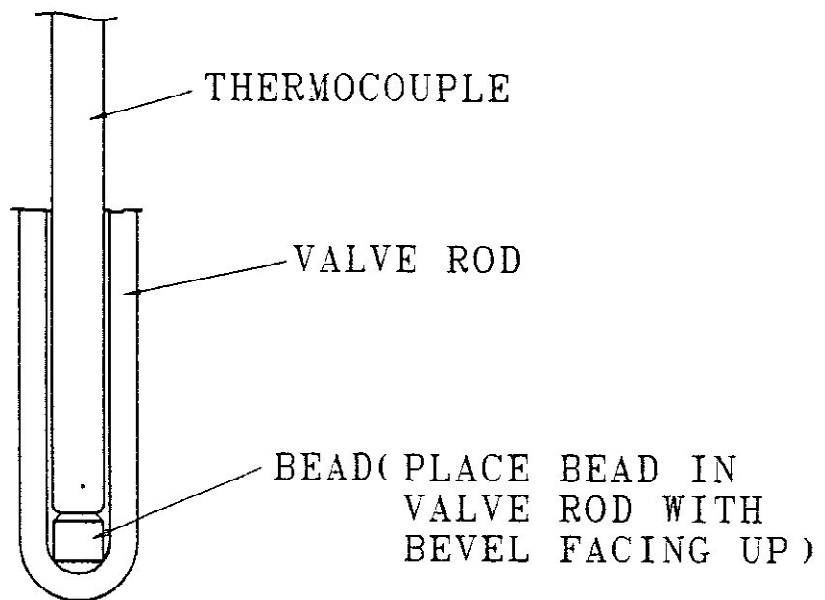
INSTALL INSULATING STRIP



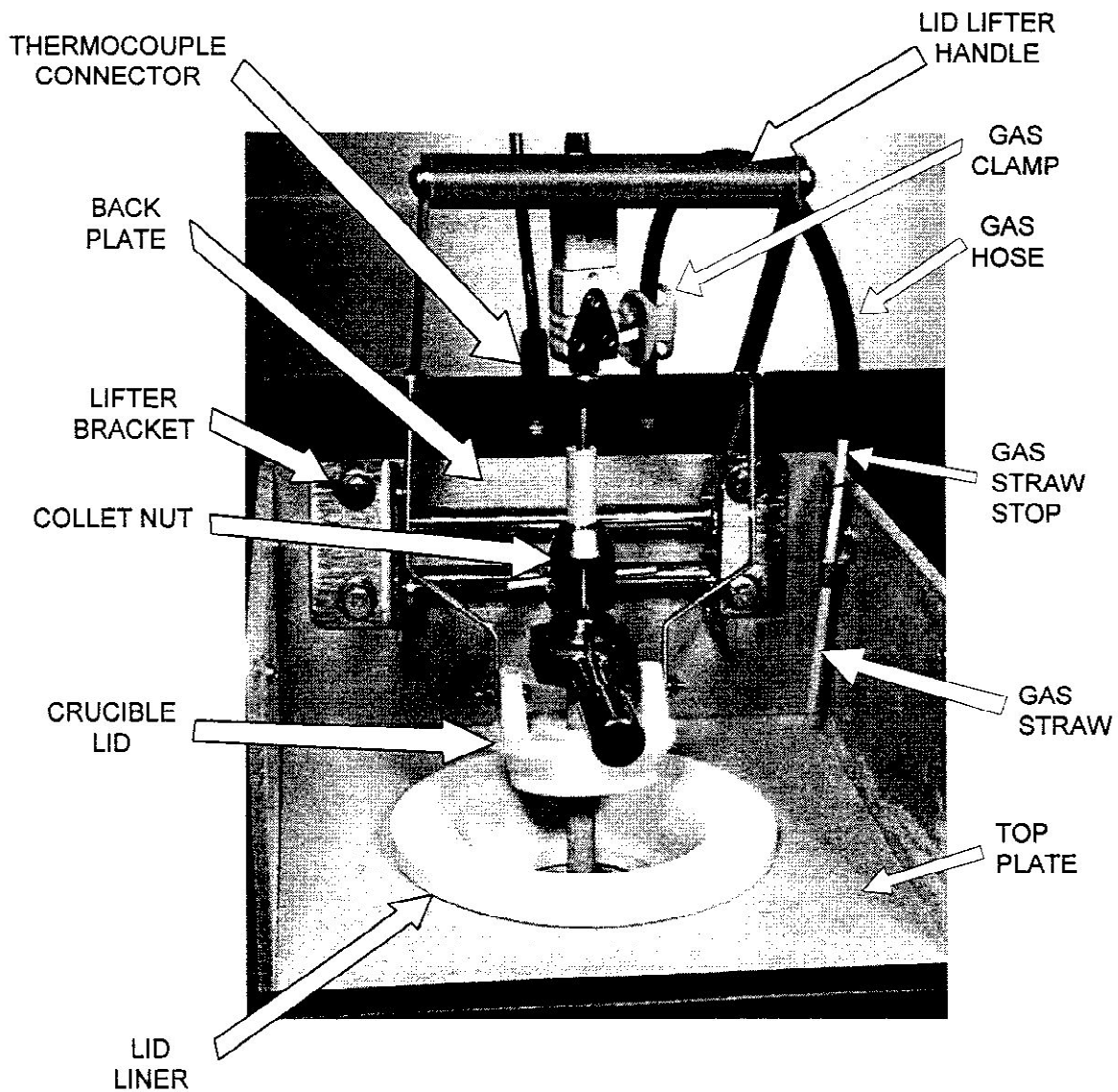
INSTALL CRUCIBLE



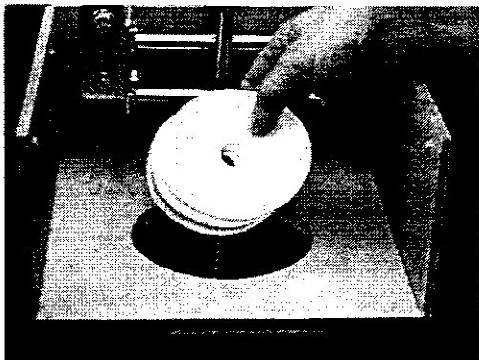
INSTALL LID LINER



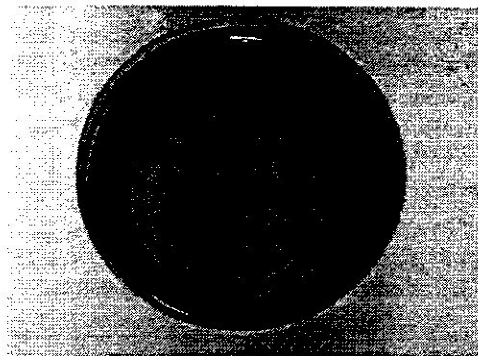
PLACING A CERAMIC BEAD AS SHOWN IN
THE VALVE ROD WILL IMPROVE THE ACCURACY
OF THE THERMOCOUPLE READING.



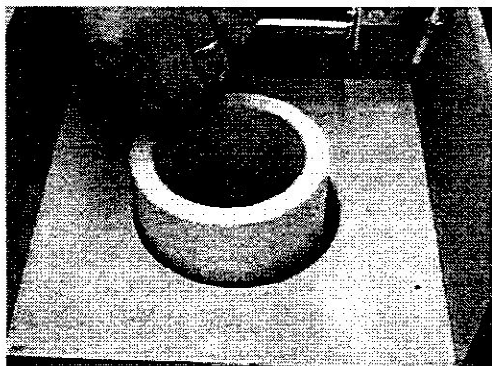
LOADING CHAMBER ARRANGEMENT



INSTALL SETTER DISCS



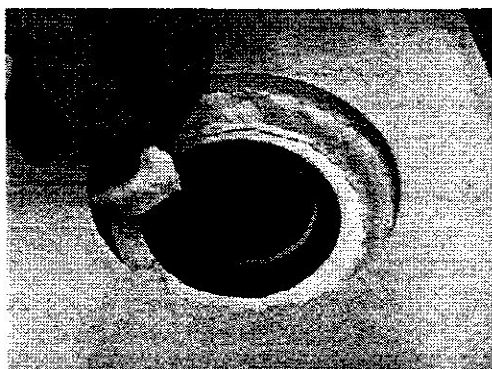
INSTALL SETTER DISCS
ON HOLE IN SETTER



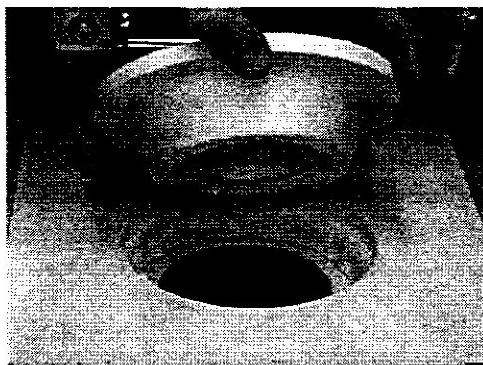
INSTALL INSULATING TUBE



INSTALL GRAPHITE CRUCIBLE

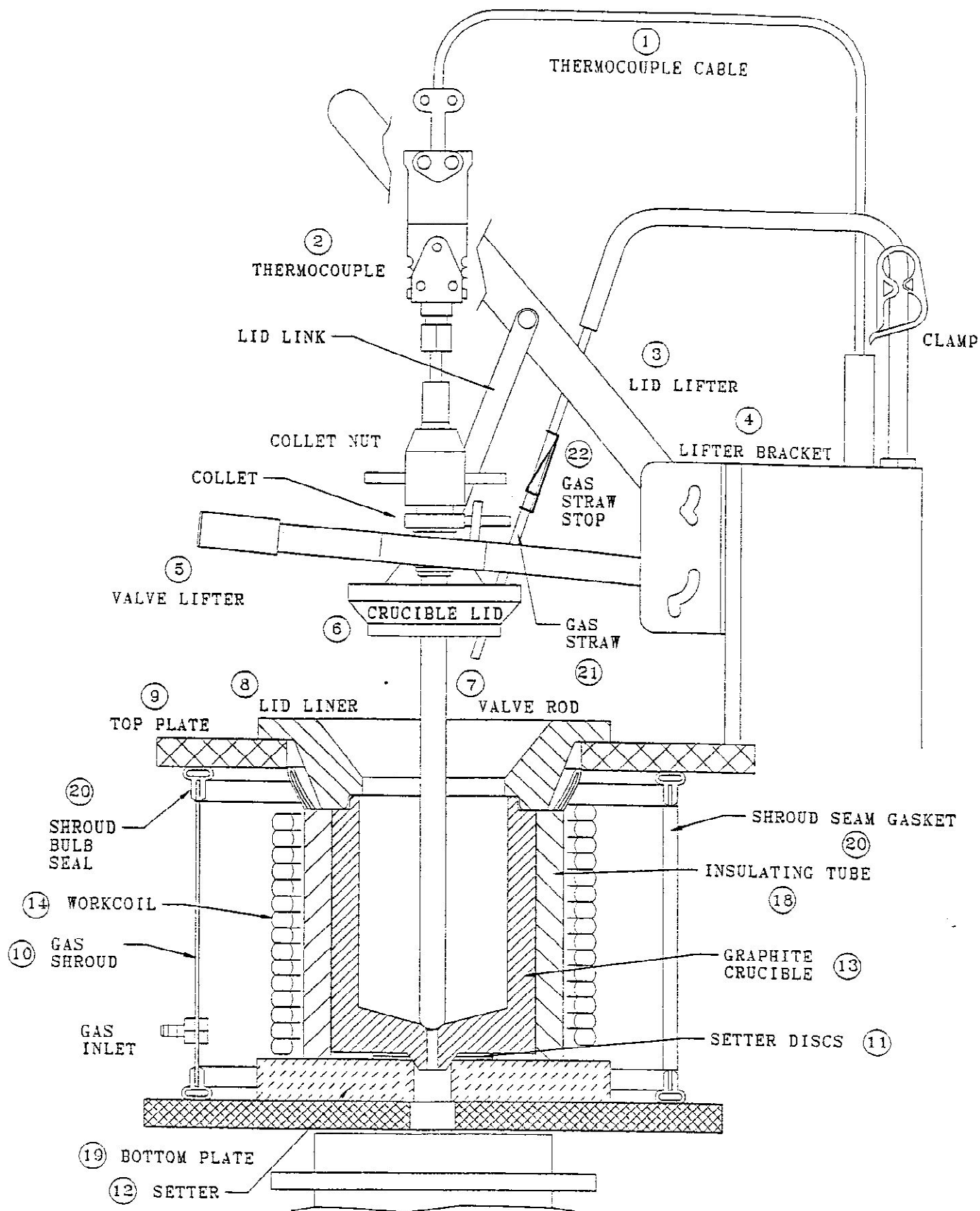


INSTALL WORK COIL
INSULATING STRIP



INSTALL LID LINER

GRAPHITE CRUCIBLE INSTALLATION



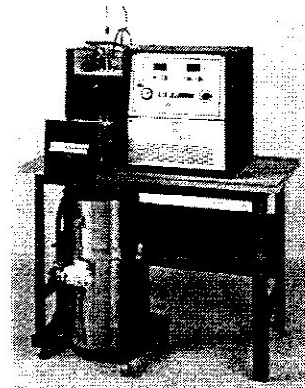
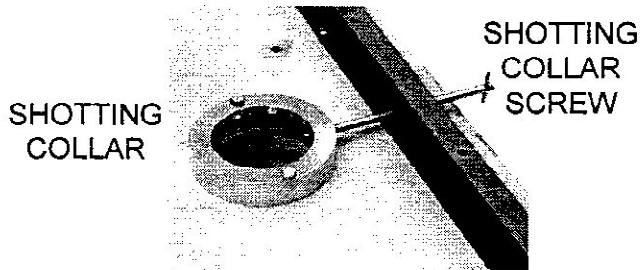
GRAPHITE CRUCIBLE ARRANGEMENT

PARTS LIST FOR GRAPHITE CRUCIBLE ARRANGEMENT

ITEM NO.	PART NO.	DESCRIPTION
1	5214-1	THERMOCOUPLE 15" CABLE-PLUG
2	5213-1	THERMOCOUPLE 1200°C, 3/16Ø, UNSHLD
	5219-1	THERMOCOUPLE 1150°C, 3/16Ø, SHLD
	5211-1	THERMOCOUPLE 1200°C, 3/16Ø, SHLD
3	3-5120-1A	LID LIFTER ASSY
4	4-5138-1F	LEFT LIFTER BRACKET, AND
	4-5139-1F	RIGHT LIFTER BRACKET
5	3-5142-1A	VALVE ROD LIFTER ASSY
6	5264-1	LID, ALLOYING OR
	5268-1	CRUCIBLE LID, EZ LOAD
7	5249-1	VALVE ROD 1500°C, 3/16Ø, GRAY OR
	5250-1	VALVE ROD 1600°C, STD, WHT OR
8	5267-1	CRUCIBLE LID LINER, EZ LOAD
9	5260-1	TOP PLATE
10	3-5118-1B	GAS SHROUD ASSY
11	7208-1	SETTER DISC, MT
12	5232-1	SETTER, LT (GRAPHITE CRUCIBLE)
13	5226-1	GRAPH CRUC .18Ø, 240cc (BRASS) OR
	5227-1	GRAPH CRUC .31Ø, 240cc (BRASS) OR
	5228-1	GRAPH CRUC .18Ø, 420cc (BRASS)
14	3-5154-1B	WORK COIL ASSY
18	5248-1	INSULATING TUBE, LT (GRAPH CRUC)
19	5261-1	BOTTOM PLATE
20	5270-1	SHROUD SEAL SET
21	GAS STRAW	GAS STRAW
22	STOP	GAS STRAW STOP

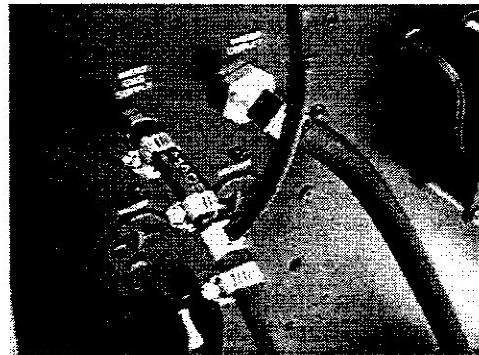
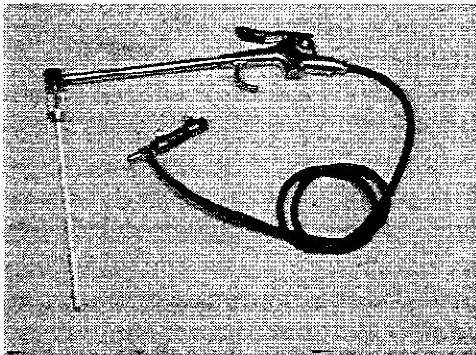
INSTALLATION PROCEDURE - SHOTTING SYSTEM

1. Place shot tube with shot bucket attached into barrel open end up.
2. Fill barrel with water to level indicated by sticker on outside of barrel.
3. Move barrel under machine and push shot tube up through the collar until it is flush against the bottom plate and tighten collar screw finger tight. (Do not over-tighten collar screw.) Position barrel so pump faces operator.



INSTALLATION PROCEDURE - ALLOYING SYSTEM

Your ALLOYING GUN comes fully assembled and ready to install. The hose attached to the gun has a TEE plumbing fitting on the opposite end, with a 2 inch piece of hose and clamps attached. See below.



Turn off gas at tank, loosen hose clamp and disconnect hose at the side of the machine at point marked "INERT GAS SUPPLY". Connect the free end of the 2 inch piece of hose to the side of the machine, and tighten hose clamp (supplied). Now reconnect the hose from the tank to the open plug on the TEE plumbing fitting and tighten hose clamp.

Loosen the collet and insert the 90° cut end of the alloy straw. Push the straw in firmly and tighten the nut. Note the 45° end should point in such direction that the exit gas causes the metal to spin inside the crucible.

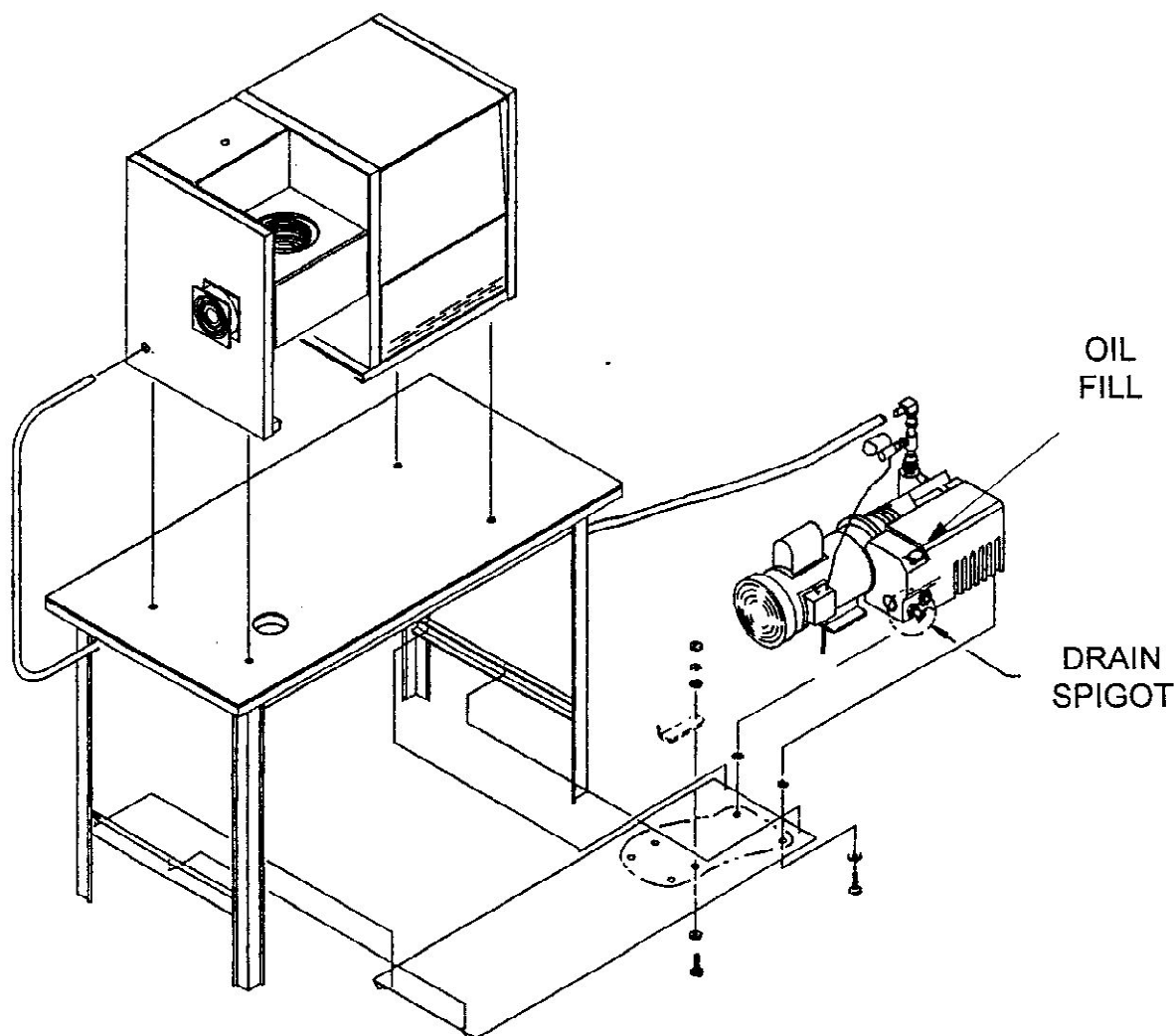
INSTALLATION PROCEDURE - EXTERNAL VACUUM PUMP ON THE INDUCTO-VAC

1. Unplug the power cord to the Inducto-Vac.
2. Remove the rear cover and the vacuum pump panel.
3. Remove the black hole plug below the "WATER INLET" on the left side of the machine. Install the hose grommet into this hole.
4. Disconnect the hose from the internal pump to the oil filter at the oil filter. Do not remove this hose.
5. Disconnect the electrical cable to the internal pump at the rear of the pump motor. Open the cover plate and use needle nose pliers to remove the wires by their flag terminals. Tape each wire terminal separately with electrical tape.
6. Place the external pump on the table brace under the table. The oil drain spigot should face to the front.
7. Route the hose from the external pump through the grommet, through the center wall at the lowest hole, toward the front of the machine and onto the oil filter fitting.
8. Plug the external pump into the outlet on the left side marked "VACUUM".
9. Internal pump may be removed or left in place for spare.
10. Fill external pump with oil. Oil fill hole is the gauge mounted on pump. Place a wrench on the hex head behind the gauge to remove. Fill with oil until the oil is halfway across the sight glass. Replace gauge hand tight.
11. Reconnect Inducto-Vac power cord.

EXTERNAL PUMP OPTION WAS PURCHASED FROM MEMCO

1. Place the external pump on the table brace under the table. The oil drain spigot should face to the front.
2. Uncoil hose from around fan, and route to fitting for vacuum hookup on pump.
3. Plug the external pump into the outlet on the left side panel marked "VACUUM".

Fill external pump with oil. Oil fill hole is the gauge mounted on pump. Place a wrench on the hex head behind the gauge to remove. Fill with oil until the oil is halfway across the sight glass, Replace gauge hand tight.



OPERATING INSTRUCTIONS

The Memco Inducto-vac is significantly different from other casting machines and requires different techniques for successful operation.

WAXING HINTS

1. Always sprue into the heaviest part of the casting.
2. Leave 1" of sprue tree from button to first branch.
3. All branches to be at least 45° angle to the tree.
4. Always place the hard to fill items at the top of the tree.
5. The finished tree should be at least 1/2" inside the walls of the flask.
6. Dip the finished wax tree into the room temperature detergent and water solution. Agitate. Rinse in clean water. Allow to dry. Dip into wetting agent solution. (do not spray or paint on.) Allow to dry 30 minutes before investing.
7. Carefully weight the wax tree to determine metal weight. Allow minimum button as this increases reused metal.

SPRUNG SYSTEM DESIGN

The sprung system is the conduit for liquid metal to enter and fill the rings. Properly designed, a good sprue system will provide the progressive solidification of the metal: First, the ring, then the gate, then the tree, then the button. Since liquid metal shrinks when it solidifies, the ring must be fed more liquid metal during solidification to prevent shrinkage of the ring. The sprue system forces progressive solidification by becoming progressively larger as it goes into the button. This is an extremely important element of good casting.

INVESTMENT PROCEDURE

Vacuum casting requires perforated flasks or specially prepared nonperforated flasks for any flask larger than 3φ x 4H. A standard flask adapter is available to utilize small standard flasks. Rubber sleeves are used to contain the liquid investment in the perforated flask.

INVESTMENT PROCEDURE cont'd

1. Calculate investment and water requirements from table.

Investment and Water Requirements for Various Flasks

Investment - OZ

Water - ML

Diameter	Height of Flask					
	3	3 1/2	4	5 3/4	7	9
2 1/2	11.8 134	13.7 155	15.7 178			
3	17 192	19.8 224	24.5 277			
3 3/8			28.6 324			
4				57.8 655	70.3 798	90.4 1025
5					110 1246	141.3 1602

1 Kilo = 2.2 lbs

182 mL per 1 lb

~~82~~ 182 mL per Kilo
401

Investment, oz. = $.628 \times D^2 \times H$

Water, 1 oz = 11.34 ML (water/powder of 40/100)

2. Weigh investment with accurate scales.
3. Measure water in graduated cylinder. ALWAYS measure water temperature with thermometer. It MUST be between 70°F and 75°F.
4. ALWAYS add the investment powder to the water.
5. ALWAYS use a timer for each step of the procedure. Blend by hand for 30 seconds.
6. Mix with electric mixer 3-1/2 minutes.
7. Vacuum in mixing bowl 1-1/2 minutes. (Periodically check the vacuum in the investment bell jar. It should be able to vigorously boil a glass half full of room temperature water within 60 seconds.) As the investment rises, shake the vacuum table sharply to help release trapped air.
8. Pour investment into the flasks.
9. Vacuum the investment in the flasks for 1-1/2 minutes while shaking the vacuum table.
10. Cap off the flasks with investment to the bottom edge of the flask. Carefully move flasks to setting area and do not disturb while investment is setting. Mark identification numbers on wet investment to identify flask when cast.
11. Let flasks sit for 10 minutes and then carefully remove sleeves. To remove sleeves, place flask on floor with base down between feet. Use feet to hold flange and lift sleeve off. Remove any investment on flange seal surface and sides with wet rag. Remember, any investment on flange will prevent proper vacuum. Investment on flange seal surface will damage gaskets. Excess investment on the outside of the flask will fall into the vacuum chamber.
12. Remove sprue base thirty minutes after investing. Gently load into oven. Load so that flasks to be cast at highest temperature are cast first. Make an oven diagram so that you know exactly where each flask is located without searching. Remember, you do not have time to search when the horn sounds for casting!

BURNOUT PROCEDURE

The temperature range for the burnout is largely governed by the particular investment used. The time required for the burnout is proportional to the size of the flask.

SUGGESTED BURNOUT SCHEDULE

For Satincast or Ultravest

Memco Programmable Temperature Controller

When several flask sizes are in the same burnout oven, the burnout cycle length is based on the largest diameter. The following guide can be used for a conservative estimate for the applications for metal casting temperature below 2200°F (1200°C). If flasks are steam dewaxed, steps 2 and 3 can be eliminated; however, step 4 should be increased by 10%.

Step Durations By Flask Diameter

		Diameter						
Step	Operation	2 1/2	3	3 1/2	4	4 1/2	5	6
1	Delay Start							
2	RU to 300°F	.2	.3	.4	.5	.6	.7	.8
3	Hold 300°F	.6	.8	1.1	1.4	1.7	2.0	2.4
4	RU to 1350°F	2.0	2.7	3.5	4.4	5.4	6.5	7.8
5	Hold 1300°F	1.5	2.0	2.7	3.4	4.2	5.0	6.0
6	RD to Cast	.4	.6	.8	1.0	1.2	1.5	1.8
7	Hold @ First	.3	.4	.5	.6	.8	1.0	1.2
8	RD to Last							

Flask casting temperature- A flask too cold gives incomplete fills, whereas one too hot gives surface roughness and porosity. The FIFI Rule for flask temperature should always be followed-- Fill It and Freeze It! The flask should fill completely and start to freeze immediately. The temperature to accomplish this depends on the metal being cast and the item cross section area. Optimum holding temperature is empirically determined and all tests should be recorded in a notebook for future references.

KERR SPECTRACAST BURNOUT PROCEDURE

Invest flasks according to the instructions packed with the investment. Let the flasks dry for at least one hour between 70°F to 90°F. Stack the flasks into the burnout oven.

This procedure is designed for use with the Memco Model 4406 or 4407 Programmable Temperature Controller. The following program is designed to stop thermal shocks by eliminating steps of rapid rise and overshoot which will crack this phosphate investment.

1. Delay start for x.x hours.
(Hold 32, x.x)
2. Soak at 200°F for two hours.
(Hold 200, 2.0)
3. Ramp up to 500°F in four hours.
(RU 75, 4.0)
4. Ramp up to 1750°F in five hours.
(RU 250, 5.0)
5. Hold 1750°F for two hours.
(Hold 1750, 2.0)
6. Ramp down to 1650°F in one hour for casting.
(RD 100, 1.0)
7. Hold at least 1650°F for x.x hours for casting.
(Hold 1650, x.x)

SELECTION OF CRUCIBLES AND VALVE RODS

The selection of crucible and valve rod depends upon the metal being cast. The following recommendations are made to:

1. Get the best casting possible.
2. Reduce operating costs.

Metal	Crucible	Valve Rod
Pure 24K Gold	5221	5250
10, 14, 18K Golds w/o deoxidizer	5221	5250
10, 14, 18K Golds w/ deoxidizer	5221	5249
Silver and Copper Alloys	5220C	5249
And metal with deoxidizer	5221	5249
Only high zinc brass	5227	5250
High capacity brass	5228	5250
Stainless Steel	5221	5251
Shotting	5222C	5249

COATED CRUCIBLE USAGE

Coated crucibles provide longer life and the cleanest melt possible. Far less slagging of high deox alloys is apparent. There are several precautions necessary for optimum performance.

1. Do not use refractory prep flux, alcohol, or any other chemical on a coated surface.
2. Do not use the crucible above 1250°C.
3. Use forming gas (25%H and 75%N) at 6-10 CFH for the Inducto-Vac.
4. Do not place a cold coated crucible in a hot machine. When more than one coated crucible is going to be needed, preheat the next crucible to avoid thermal shock which can crack the coating.
5. After all casting is finished and the crucible is very hot, gently clean up any buildup off the crucible walls with a quartz rod. It is not necessary to remove the crucible.
6. Do not attempt to remove solidified metal from the crucible because that will tear the coating.
7. Boric acid may be added to the melt in small quantities if needed with a particular alloy. Too much flux will build up on the crucible wall and require cleaning.

If casting less than 250g, reduce power to 2.5KW for uniform heating and maximum crucible life.

GAS SYSTEM

The protective gas system is designed to prevent oxidation of the melt and graphite susceptor. Inadequate gas flow will result in oxidation of the metal, increased slag and shorter susceptor life. The increased slag will reduce the life of the valve rods and crucibles. Obviously, adequate protective gas is very important!

Several gases are available for use with this machine. The operator should determine which type of gas and flow rate meets his particular need.

NITROGEN -Common inert gas. Nitrogen has the same specific gravity as air, hence it does not completely displace the air. Semi-inert atmosphere prevents some oxidation. Cheapest of all gases.

ARGON -Rare inert gas. Argon is much heavier than air; therefore, readily displaces air and prevents additional oxidation. More expensive than nitrogen. Commonly used.

FORMING GAS -Reducing atmosphere. Forming gas will remove oxides already present in recycled metal and prevents new oxide formation completely. Moderate cost. Generally, 25% hydrogen and 75% nitrogen uncertified, industrial quality forming gas is ideally suited for this operation. It is imperative that adequate ventilation is used in the casting room, as an accumulation of hydrogen is potentially explosive. A flow of 10 CFH can remove 2.1 grams of oxygen per minute from the melt.

MEMCO strongly recommends the forming gas for casting all metals. It is the only practical method of removing all traces of oxygen without leaving hydrocarbons to contaminate the metal. The forming gas will produce a small flame above the hot lid around the valve rod hole. This indicates the gas is in the crucible doing its job properly.

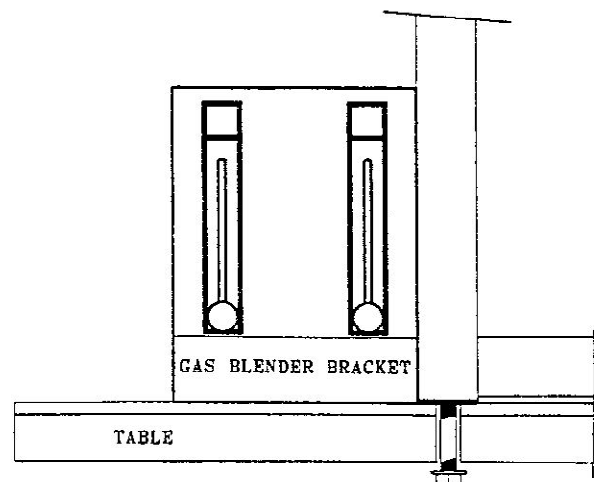
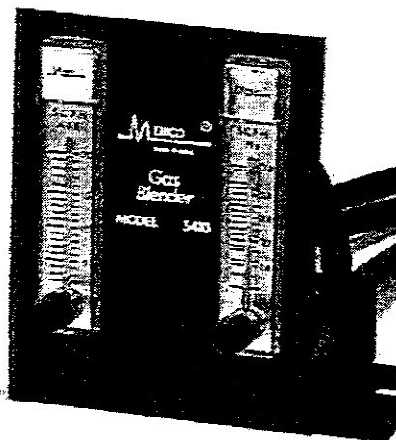
The gas system should be tested periodically. Seat valve rod. Close clamp on gas straw line to crucible. Let gas flow for at least 1-1/2 minutes. Release clamp and permit gas to flow to crucible for 30 seconds. Open lid. Place lighted match into crucible. The match should extinguish immediately, indicating a lack of oxygen in the crucible. If this does not occur, check sealing around the shroud, setter, etc. for gas leaks. Also check lid and lid liner for proper fit.

Pay particular attention to the seal in the rear of the shroud. It is best to check this seal with the top plate on. It can be easily checked by unplugging the machine and removing the rear panel. Using a flashlight, look at the work coil entering and leaving the shroud. If there is a gap, this can be fixed by using a screwdriver to push seal into place.

GAS BLENDER MODEL 5410

This blender is used to blend hydrogen and nitrogen into forming gas in areas where mixed gasses are not available. All MEMCO Casting Machines require forming gas.

1. Mount gas blender at left front corner of the casting machine using the table mounting bolt. Loosen table mounting bolts, insert slot in foot around bolts, and retighten all bolts. See drawing.
2. Attach the regulators to the hydrogen and nitrogen tanks. Note that these regulators have different tank fittings to match the tanks.
3. Attach the gas hoses to the bottom inlets of the corresponding flowmeter. Make **ABSOLUTELY CERTAIN** that the hydrogen hose goes to the hydrogen flowmeter. Disregarding this precaution is very dangerous!
4. Attach blender outlet hose to the gas inlet on the left side of the casting machine. Close blender valves by turning fully clockwise. Open the gas flow valve on the flowmeter on the control panel.
5. Adjust each regulator for 3 PSI. This is important to maintain proper blend. A blend of 25% hydrogen and 75% nitrogen is recommended; however, the exact ratio is not critical. Set hydrogen flowmeter to 2.5 CFH and nitrogen flowmeter to 7.5 CFH.
6. Readjust each regulator for 3 PSI and fine adjust flowmeters as required with gas flowing through flowmeter in control panel.
7. Make the match test before turning the heat on. This is only valid with a cold crucible. When the crucible and lid are hot, a green flame will be seen around the valve rod hole in the lid about 1/2" high.



LOOSEN 2 BOLTS HOLDING MACHINE TO TABLE.
RAISE MACHINE, AND SLIP BLENDER BRACKET
UNDER MACHINE, MATCHING NOTCH IN BRACKET
TO FRONT BOLT IN MACHINE.

CASTING PROCEDURE

1. Arrange to do an entire day's casting in one machine heat cycle (single heat up and cool down) for maximum production efficiency, refractory life, and energy savings. Preferably, group same metals first and then same flask sizes.
2. Turn on gas valve on tank. Set regulator for 3 psi. Make sure external water valve is on. Inspect crucible and valve rod. Do not attempt to clean residue from cold crucible or valve rod - it will break! (Always flux a new non-coated crucible with Refractory Prep Flux, MEMCO P/N 5265.)

Be sure to use ceramic crucible with .31Ø hole for silver and the .40Ø hole for gold.

3. Turn power on. Set temperature by depressing setpoint button and rotating temperature knob. The SET temperature reads negative and the ACTUAL temperature reads positive. The setpoint button switches the display from the thermocouple to the controlled setting.

The temperature should be set approximately 30°C below the casting temperature for adequate time for the operator to install a flask. This, of course, can be varied to suit the operator. The chart below gives approximate casting temperatures for various metals. Add 30°C for alloys containing heavy silicon deoxidizer.

Do not allow the yellow head thermocouple to exceed 1200°C. This will decalibrate the thermocouple.

CASTING ALLOY TABLE

Alloy	Casting Temp °C	Ratio Metal/Wax	Flask Temp °F
Aluminum	720	2.5	450
Brass 85/15	1120	8.5	1110
Ferrium B	1540	7.7	1600
Gold 10KY	977	11.5	960
Gold 10KW	1149	11.0	1130
Gold 14KY	950	13.0	935
Gold 14KW	1066	12.5	1050
Gold 18KY	996	15.5	985
Gold 18KW	1013	14.5	1000
Sterling Silver	980	10.2	990

melt temp 50° - 70° C

melt temp - mostly liquid
but still solid pieces

10+10k button = 20 grams

Brass + Bronze = 15g
18K = 30g

CASTING PROCEDURE cont'd

Notes:

- A. Casting temperature will vary depending upon the particular alloy used. Add 60°C to the melting temperature to start the tests for most alloys. Optimum casting temperature for a particular alloy is empirically determined and all tests should be recorded in a notebook for future reference. Optimum temperature should be posted on the control panel.
- B. The flask temperature will vary depending upon the item's cross-sectional area. Do not compensate for non-fills by raising metal temperature, raise flask temperature.
- C. $^{\circ}\text{C} = (^{\circ}\text{F} - 32) \times 5/9$
 $^{\circ}\text{F} = ^{\circ}\text{C} \times 9/5 + 32$ *1.8*
- 4. Turn HEAT on. Set POWER knob. Maximum power gives rapid melting. Reducing power gives operator more time for preparation. When casting small amounts of metal, turn power down to promote uniform heating. When the actual temperature is below the setpoint, the POWER knob controls the machine power level. When the actual temperature approaches the setpoint, the horn sounds and the machine reduces power automatically. After the actual temperature passes the setpoint, the power automatically goes off. Ceramic crucibles heat slowly when cold, however, they heat rapidly as the temperature increases.
- 5. Release gas hose clamp to lid straw prior to first loading metal and close it when last flask is cast for the day. Set gas flow to 10 CFH. The gas system should be tested daily while cold.

TO TEST GAS SYSTEM, begin by seating the valve rod and clamping off gas flow to gas straw. Let gas flow for at least 1-1/2 minutes. Then release clamp and allow gas to flow into the crucible for approximately 30 seconds. Open lid just enough to place lighted match into crucible. The match should extinguish immediately, indicating a lack of oxygen in the crucible. If this does not occur, check sealing around the shroud, setter, etc. for gas leaks. Inadequate gas flow will result in oxidation of metal, increased slag, and shorter susceptor, crucible, and valve rod life.

THIS IS VERY IMPORTANT!

EYE PROTECTION SHOULD BE WORN WHILE LOADING METAL AS TRAPPED WATER MAY EXPLODE SHOT. DARK BLUE GLASSES SHOULD BE WORN TO BLOCK THE INTENSE INFRARED RAYS FROM THE CRUCIBLE. PROLONGED EXPOSURE TO THE INTENSE INFRARED RAYS WILL DAMAGE EYES.

CASTING PROCEDURES cont'd

Set desired horn volume. Load first charge of metal shot when horn sounds after checking valve rod for proper seating in crucible. The valve rod should be gently rotated 1/4 turn to insure seating. Never press down on valve rod or subject it to stress - it will break. Never rotate valve rod while metal is in crucible.

Note: Do not drop large metal chunks or buttons on the valve rod - it will break! Use shot or small pieces.

The cold metal will drop the temperature quickly and the machine will begin heating again to maintain the setting. Do not watch the metal melt!

Operation with lid up results in slower melting and diminishes the gas cover. The melt may be checked momentarily before casting for fluxing.

The operator should have marked containers of metal corresponding to the flasks in the oven.

Flux may not be necessary or desired with deoxidizing agents in the alloy. Reducing gas is used for melting; therefore, a minimum of flux is required. Use up to 1/2 tsp of casting flux (MEMCO P/N 5266) for all new metal. Frequently, less flux is required. Many prepared fluxes contain carbon which may cause harmful reactions with metal and investment. Others contain borax which can damage ceramic crucibles and valve rods. Excessive flux use will increase slag in crucibles and on valve rods. Excessive flux will also cause flux porosity on casting surfaces. Flux is to be added after melting, at least 30 seconds before casting.

6. Install proper flask adapter ring and gaskets for the flask size to be cast. Make sure that all mating surfaces are clean. The bottom of the perforated flask collar should be very clean for a proper seal. Check vacuum chamber for investment. Be sure to inspect the vacuum filters for any accumulation of investment.
7. When casting temperature is again approached, the horn will sound to alert the operator to get the flasks into the chamber for casting. The machine will automatically shut power down; however, the temperature will continue to climb at a much slower rate.
8. The flask must be inverted and set into the vacuum chamber. Turn vacuum pump on and check to see that there is at least 23" of vacuum. If not, shut pump off and clean flange and gasket. This can usually be done by lifting flask a couple of inches and blowing under flange. If gasket and flange are clean, try turning flask with tongs. When proper vacuum is attained, close drawer. Low vacuum can also be caused by dirty filters in vacuum system.
9. Observe temperature carefully and cast by pulling valve rod up 1/2" for 5 seconds. Carefully release valve rod and gently turn 1/4 turn to insure seating for next melt. The lid should always be down when the valve rod is operated; conversely, the valve rod should always be down when the lid is lifted. The lid and valve rod interact with each other as guides to insure proper alignment.

CASTING PROCEDURE cont'd

10. Raise and lock the lid and check for a complete pour. Make certain valve rod is seated. Reload with metal shot for next melt. Close lid. Open casting drawer and check button in flask. If it has solidified, turn vacuum pump off. Avoid excessive vacuuming time as it only increases moisture in the vacuum system. Remove the flask after the vacuum gauge drops to zero. Write the time in pencil on flask for quenching purposes. This casting cycle is complete.
11. When all casting is completed, close gas hose clamp, switch power off, raise and lock crucible lid. Do not allow valve rod to freeze in bottom of crucible - it will break! Lift valve rod handle and secure to lid handle with hanger. Clean crucible with quartz rod while red hot. Never clean crucible when cold. Turn vacuum pump on for 2 minutes for room air to cool pump. Do not turn off water or unplug machine as it will need water, gas and power to cool down. Leave drawer closed to catch any metal drips.

WARNING: If for any reason electricity is lost to machine, remove everything that is hot, i.e., crucible and susceptor.

ALLOYING PROCEDURE

The alloying procedure is used to produce new metal shot for casting. It is important to maintain the correct temperature for several minutes while the alloying lance is used to thoroughly stir the various components into a homogenous alloy. No manual stirring is necessary.

1. Place the shotting tube/bucket and tank into position as described under "Shotting Procedure"
2. Install valve rod and thermocouple.
3. Set gas regulator for 3 PSI. Readjust front panel flowmeter for 10 CFH.
4. Weigh metals to be alloyed. Total weight should be about 1 KG.
5. Thoroughly mix the shot from each of the metals before loading the crucible. Use shotting crucible, P/N 5222 or 5222C.
6. Load metal. Close lid. Set temperature about 40°C above normal casting temperature for that particular alloy. Turn power to minimum as metal melts. **CAUTION:** Alloying straws are extremely fragile. Insert slowly into crucible to reduce thermal shock.
7. When metal melts, insert alloy straw slowly through hole in lid to bottom of crucible and depress valve for about ten seconds. The gas flow should cause a metal vortex and result in a complete mixing of the metals.

WARNING: KEEP FACE AND HANDS AWAY FROM LID OPENING AS MOLTEN METAL MAY SPATTER THROUGH LID HOLE. WEAR EYE PROTECTION AND GLOVES.

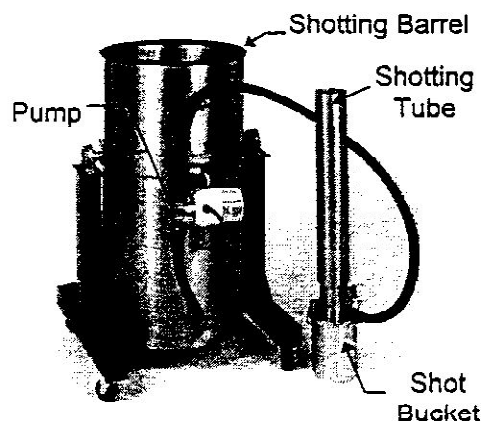
ALLOYING PROCEDURE con't

8. Remove gas straw. Plug pump into water outlet on side of casting machine. Pump should come on and run for ten seconds before proceeding.
9. Slightly raise the valve rod to allow metal to enter the shot barrel very slowly. This helps control shot size.
10. When all alloying is complete, switch HEAT off, raise and lock lid, lift valve rod handle and secure with hanger. Do not allow valve rod to freeze in crucible- it will break! Do not turn water off or unplug machine as it will need water and power to continue cooling. Loosen collar screw and remove shotting tube. Pull barrel out from under table. Remove bucket from end of shotting tube, and position flange end of tube over water drain. Plug pump into the water outlet again. This will drain the barrel. **(Note: DO NOT ALLOW PUMP TO RUN DRY. THIS WILL RUIN PUMP.)**

SHOTTING PROCEDURE

The shotting procedure is used to quickly and easily reduce large spues and buttons to shot size for casting. Maximum production efficiency is attained by accumulating sprues and buttons, cleaning them, and making shot in a continuous run. All metal should be thoroughly cleaned prior to shotting.

1. Place shotting tube/bucket and tank into position as described under Installation Procedure.
2. Remove thermocouple and valve rod. Lock valve rod lifter up.
3. The same crucible used for casting the metal can be used for shotting. Load sprues and buttons.
4. Turn on POWER. Set power knob to maximum. Since the thermocouple is unplugged, the power knob and HEAT switch have complete control. Turn on HEAT. Close lid. Set gas flow at 10 CFH. Plug in pump on barrel.
5. The metal will flow through the hole in the crucible as soon as it is melted. Use cleaning rod to clear hole after each melt. The crucible and shot tube are filled with forming gas to minimize oxidation. Refill crucible with metal as needed.
6. When all shotting is completed, turn HEAT and POWER off. Raise and lock lid up for cooling.



MACHINE PREPARATION TO CAST STAINLESS STEEL

Unless your machine was ordered from MEMCO to cast stainless, modifications need to occur to prevent damage to the machine due to higher casting temperatures.

1. Attach an HT Setter, P/N 5230, to the bottom plate, using the same silicone glue as usual.
2. You must switch the temperature amplifier from K to B.
3. Forming gas is preferred with all nonferrous metals. But, if you are casting high strength stainless or alloy steels, you should use argon.
4. MEMCO would suggest for any high temperature operation that you use the following refractories:

P/N	DESCRIPTION
5206	GASKET SET, PF, HT
5215	THERMOCOUPLE, 1700°C, 1/4Ø, UNSHIELDED
5216	THERMOCOUPLE, 15" CABLE & WHITE PLUG
5221	CRUCIBLE, GRY, .40Ø. 240cc, GOLD
5225	SUSCEPTOR, FOR GRY CRUCIBLE, BLK
5230	SETTER, HT
5235	SETTER DISCS, HT
5240	INSULATING SHEET, HT
5245	INSULATING RING, HT
5251	VALVE ROD, 1950°C, HT, YELLOW, 1/4Ø
5252	GAS STRAW
5267	CRUCIBLE LID LINER, EZ LOAD
5268	CRUCIBLE LID, DG, EZ LOAD

TECHNIQUES FOR CASTING STAINLESS STEEL

There are several special techniques for casting stainless. The investing and burnout are different for stainless.

1. Investing - You need a high temperature investment such as Kerr Platinite. We have learned to use about 10% more water than they recommend. Let the invested flask set overnight and pour the excess water off. Let it set for 2 more hours and then remove the sleeves. Burn out according to the schedule in the owner's manual. You may encounter some difficulties because this investment is very different from Kerr Satincast.
2. At casting temperature, most high temperature investment will shrink and pull away from the flask leaving a gap between the flask wall and the investment. You must seal this gap or you cannot pull good vacuum for proper casting. We use a P/N 5380 Flask Sealing Ring to apply Memco Casting Flux P/N 5266 around the gap and seal this. The ring merely transfers flux to the hot gap without getting any in the sprue hole.
3. Some steels leave large amounts of slag in the crucible. The amount of slag depends entirely on the particular alloy. Our P/N 5910 Stainless Shot leaves very little slag.
4. Let the flask cool to room temperature after casting. Do not immerse into water. Strike the button with a steel hammer to remove the tree from the flask. Bead blasting is the preferred method for cleaning. Follow with usual chemical cleaning.
5. It is MUCH more difficult to invest and divest steel than brass, gold, silver, etc. using Satincast. Do not assume that you are doing something wrong because of the difficulty you encounter.
6. It will normally require about 20 minutes to cast the first flask from cold start. It usually requires about 5 to 7 minutes per flask thereafter. Arrange to cast one flask right after another. You may use a small amount of casting flux.
7. Do not use a recirculator for cooling the Inducto-Vac when casting steel. Recirculators cannot remove the heat as fast as single pass water cooling.
8. Be careful in selecting a place to set the flask for cool down. The high temperature can easily crack concrete floors.
9. Casting temperature for stainless is about 120°C above melting. The size of the part being cast usually determines flask temperature. Normal men's rings are cast from 750°C to 900°C flask temperature. As usual, try to cast with the coldest metal and flask temperatures for best surface finish.

SPECIAL INSTRUCTIONS FOR CASTING PALLADIUM WHITE GOLD

1. Set temperature amplifier for °C, type K.
2. Use MT refractories where noted on price list except for two items:
 - 7217 Thermocouple, 1300°C, 1/4Ø
 - 5251 Valve Rod, 1950°C, 1/4Ø

CASTING PROBLEMS - CAUSES AND REMEDIES

PROBLEMS	CAUSE AND REMEDY
Slag in crucible, poor metal pouring, and incomplete filling and oxidized castings when using a ceramic crucible.	Cover gas. Either wrong gas used or insufficient gas cover. Use forming gas, 75% N & 25% H. Use 10 CFH for golds and 15 CFH for silver. Check shroud for proper sealing, check gas line connections, and check lid liner sealing.
Gas porosity characterized by random small round holes near the surface appearing after polishing.	Investment from reused metal causes gas formation. Thoroughly clean all metal and pickle before reuse.
Microporosity giving same appearance as gas porosity.	Gold picks up carbon from fluxes, graphite rods, graphite crucibles, and incomplete vaporization of wax. The carbon chemically combines with investment in flask to produce gases. Do not use any carbon with gold. Follow proper burnout procedure.
Firescale, burned appearance, spots.	Oxidation of the metal caused by improper gas cover. May also require use of small amount of casting flux (Memco P/N 5266).
Inclusions in castings	Sharp bends in sprues. Inadequate setting time before burnout. Flask heated too fast. Metal contaminated with foreign particles.
Shrinkage porosity characterized by tiny holes throughout	Metal overheated. Improper spruing, see waxing instructions
Gross porosity characterized by very rough surface	Investment breakdown due to improper mixing procedures, contaminated water, or bad investments.
Large holes in casting	Most likely bubbles in wax pattern. The bubble in the wax will burst and fill with investment during vacuuming thereby reproducing a hole in the casting.
Flux porosity characterized by tiny holes facing button and appear after polishing.	Too much flux in melt. Flux may be unnecessary with alloys containing deoxidizer.
Sponge porosity characterized by spongy appearance throughout	Considerable over heating of alloy and burning off zinc

Incomplete filling	Sprued too close to the button. Sprues too small, too few. Sprues not into heaviest part. Incomplete burnout. Flask too cool. Metal too cool. Insufficient metal. Insufficient vacuum. Review waxing, burnout and casting instructions.
Flash on castings	Fins on waxes. Inspect all waxes prior to treeing. Cracked flasks.
Cracked flasks	Flask burned out then allowed to cool before casting. Flask heated too fast. Flask heated beyond maximum recommended for that investment. Flask allowed to dry out before burnout. Flask dropped or mishandled. Flask disturbed while setting. Investing extended beyond work time. Excess water in investment.
Porous castings	Improper spruing. Sprues tapered where they attach. Incomplete burnout. Metal too hot. Too much old metal. Too much flux added. Too little flux added.
Watermarks on the castings	Excess water in investment mix, or water too cold or investing too fast.
Nodules or bubbles on castings	Insufficient vacuum on the investment table. Investment improperly mixed or vacuumed. Wax tree not washed in detergent, not dipped in wetting agent.
Rough surfaced castings	Flash too hot when cast. Roughness on pattern. Improper spruing. Incorrect investment mix. Insufficient setting before burnout, working investment too fast. Flask heated too rapidly, wax trapped in flask. Too much old metal used.
Brittle castings	Metal cast too cold. Too much old metal used. Flask quenched too soon.
Flask blowout	Excess water in investment mix. Investment layer too thin around wax patterns.
Slagging of silver and copper alloys	Some alloys may react with the crucible. Use factory coated crucible and valve rods to eliminate slag.

Slagging of deoxidized alloy.	Deoxidizer produces slag. Coated crucibles reduce this slag.
Metal loss	Overheating karat golds. Oxidation of Si and Cu will carry Au in vapor
Hard spots in sterling	Copper precipitation. Metal stayed molten too long before casting.

NOTES:

CASTING HINTS

1. Getting bad castings? Check the gas system first. See Operating 6. Use at least 10 CFH of forming gas in all applications except stainless steel.
2. Decrease power after melting to allow time for forming gas to clean out all oxides.
3. Pour 1/4" of liquid investment into the bottom of the vacuum chamber. When this hardens, it will prevent molten metal from welding to the bottom of the chamber. Do not attempt casting before the investment is completely dry.
4. In the event of power failure in your building, the cooling water supply will be shut off by the internal electric valve. If power failure occurs during casting, dump any liquid metal into shot tank and quickly remove crucible and susceptor with crucible tongs to avoid overheating the machine.
5. Longer valve rod life...valve rod life will be improved if the operator:
 - always lifts slightly while twisting to seat
 - never presses down on valve rod
 - minimizes flux usage
 - does not change unnecessarily
 - makes certain gas system is operating properly
 - cleans any slag from crucible
 - cleans lid hole regularly
 - avoids loading large chunks of metal on valve rod
 - use valve rod P/N 5249 with hi deox alloys
6. Keep quartz rods next to the machine. (DO NOT use graphite rods as they will contaminate your ceramic crucible) While crucible is still at casting temperature, push quartz rod around the bottom of the crucible. This allows the quartz rod to pick up the trash that builds up due to deoxidizer, investment, dirt, etc. When the first rod has picked up all it will hold, use another. Repeat this process until crucible is clean.
Clean quartz rods by knocking buildup off when cool.
7. Keep large tweezers available for handling sprues and buttons to prevent damage to the valve rod. Tweezers are also used for emergency valve rod operation when valve rod breaks.
8. Some alloying additives may react with crucibles and/or valve rods causing shorter life. Please consult factory for recommendation for your particular needs.

We sincerely appreciate the suggestions made by our customers to improve casting techniques.

REFRACTORY USE ESTIMATION

Generally, the initial order should provide adequate refractory items for at least one month's service plus an emergency spare of each item.

Although most items can be delivered by overnight air freight, it is usually more economical to have sufficient spares to avoid disruption of work.

1. Determine flasks cast per month, FPM (Flasks Per Month)
2. Crucibles = $2/\text{Alloy} + .01 (\text{FPM}) + 2$
3. Gasket sets = $3 + .01 (\text{FPM})$
4. Thermocouples = $2 + .002 (\text{FPM})$
5. Susceptor = $2 + .005 (\text{FPM})$
6. Insulating strip, MT = Susceptor
7. Setter Discs, MT = Susceptors
8. Insulating Ring, MT = Susceptors
9. Valve Rod = $5 + .01 (\text{FPM})$
10. Crucible Lids = 2
11. Crucible Lid Liner = 1
12. Gas Straw = Valve Rods

Later orders can compensate for a different usage pattern.

MEMCO RECOMMENDED REFRACTORIES

The following refractories are recommended for casting gold, silver, and brass. These are to be considered preferred over others on current price list.

PART NUMBER	DESCRIPTION	
5201	Gasket Set, SF, HT	
5207	Gasket Set, PF, MT	
5211	Thermocouple, 1200°C, 3/16Ø	
5213	Thermocouple, 1050°C, 3/16Ø, UNSHLD	
5214	Thermocouple Cable, 15" & YELPLG	
5216	Thermocouple Cable, 15" & WHTPLG	
5219	Thermocouple, 1100°C, 3/16Ø, SHLD	
5220	Crucible, .31Ø, 240cc, Silver	
5220C	Crucible, Coated, .31Ø, 240cc, Silver	
5221	Crucible, Gry, .40Ø, 240cc, Gold	
5221C	Crucible, Coated, Gry, .40Ø, 240cc, Gold	
5225	Susceptor for Above Crucibles	
5231	Setter, MT	
5236	Setter Discs, MT	
5241	Insulating Strip, MT (2 Per Box)	
5249	Valve Rod, 1500°C, HI DEOX, 3/16Ø	
5250	Valve Rod, 1600°C, STD, WHT, 1/4Ø	
5251	Valve Rod, 1950°C, YEL 1/4Ø	
5252	Gas Straw	
5256	Alloy Straw	
5259	Cleaning Rod 3/8Ø x 12	
5264	Alloy Lid, EZ Load	
5265	Refractory Prep Flux, 1 QT	
5266	Casting Flux, 8 Oz	
5267	Crucible Lid Liner, EZ Load	
5268	Crucible Lid, EZ Load	
5269	Insulating Ring, EZ Load	
5270	Shroud Seal Set	
5272	Vacuum Filter, Spin On	
7217	Thermocouple, 1300°C, 1/4Ø	

MAINTENANCE MANUAL

GENERAL

This maintenance manual supercedes all previous editions. Check dates on manual updates. Most refractory parts are very fragile and will be damaged by improper handling. No warranties are made on refractory parts.

TEMPERATURE MEASUREMENT

The complete temperature measurement system consists of the thermocouple inside the valve rod, the connecting cables, the temperature amplifier, and the display. The thermocouple is the only item constantly exposed to extreme heat and, hence, requires normal replacement.

Each type of thermocouple has its maximum temperature indicated on the parts lists. Exceeding this temperature for even a short time will cause the thermocouple to decalibrate irreversibly, requiring replacement.

The control system constantly monitors the thermocouple continuity. If the thermocouple opens, the control system automatically shuts the power off, sounds the horn and displays a higher temperature than the maximum for that type thermocouple. The thermocouple is an expendable item and should be replaced when this occurs. Disconnect the connector and replace.

The tip of the thermocouple is the only point that senses temperature. It is very important to have this tip as close to the metal as possible. This is accomplished by raising the tip slightly with a ceramic bead in a highly conductive valve rod. Therefore, the tip is further away from the crucible hole and closer to the metal. SEE INSTALLATION 11.

The display will often give clues to problems in the temperature system. Unstable readouts are often the result of poor connections. When there are temperature variations of less than 50° with HEAT on or off- clean jack and receptacle on top of the machine, check all connections inside the plastic covers on the thermocouple cable, and check the wires at the temperature amplifier terminals. Extreme variations of several hundred degrees with HEAT on and proper readings with heat off are caused by damage to the work coil. See work coil inspection and replacement ELECTRICAL 13. A large constant error (OVER 50°C) is caused by malfunction of the temperature amplifier. The amplifier may be checked for accuracy as described in the procedure on ELECTRICAL 12.

VALVE ROD REPLACEMENT

Replace the valve rod at the first sign of cracks to prevent damage to the thermocouple inside. The thermocouple will outlast several valve rods if properly protected. The thermocouple should be removed IMMEDIATELY when a valve rod breaks.

VALVE ROD REPLACEMENT cont'd

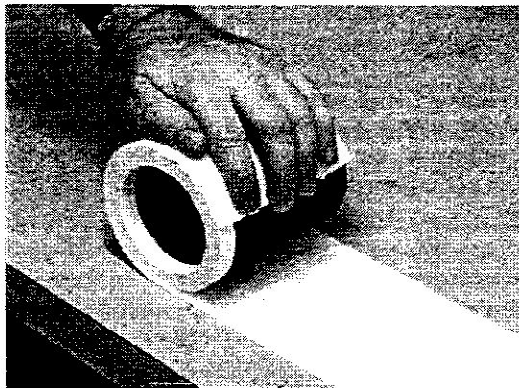
1. Disconnect jack and pull thermocouple out of valve rod.
2. Loosen collet and raise valve rod to clear lid.
3. Push valve lifter all the way back and pull valve rod through collet from bottom.
4. Replace new valve rod in reverse order. Seat valve rod in crucible. Hold valve lifter handle up 10° above horizontal and tighten collect nut with fingers until snug.

SUSCEPTOR

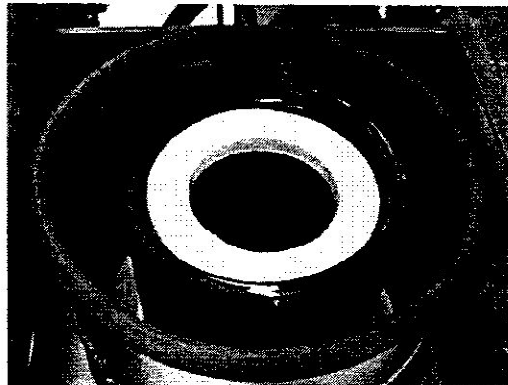
A carbon cylinder, the susceptor, is used around the outside walls of the ceramic crucibles to generate heat. The special design allows the low frequency induction currents to flow through the bottom of the crucible and thoroughly stir the metal. Check the condition of the susceptor when the power on the KW meter cannot reach normal levels. The susceptor is an expendable item and oxidation will cause erosion from the outside wall.

SUSCEPTOR REPLACEMENT - MT INSULATION

1. Remove thermocouple and valve rod.
2. Remove lid liner, insulating ring and crucible.
3. Place your hand inside the susceptor and insulation as a unit. NOTE: Steps 2 & 3 can be performed with crucible tongs if working with a hot unit.
4. Replace the setter discs if necessary. Temporarily place crucible on top of setter discs. Install lid liner. If lid liner rests above top plate, subtract setter discs. If insulating ring does not meet lid liner, add setter discs. Remove crucible and lid liner. Place crucible into susceptor to determine top and bottom of susceptor. Remove crucible and place insulating ring on top end of susceptor. Wrap entire insulating strip around the susceptor and insulating ring for three full layers. Be careful to align strip with top of ring and bottom of susceptor. Carefully place this assembly with ring on top into the work coil. Turn in such direction as to tighten wrapping to ease insertion. Add small insulating strip around top of coil.
5. Replace remaining parts.



WRAP SUSCEPTOR &
INSULATING RING



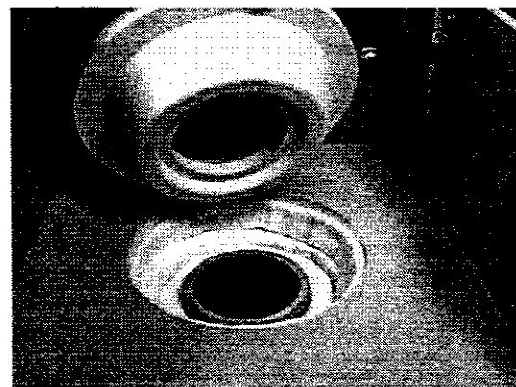
INSTALL SUSCEPTOR



ADD INSULATING STRIP



INSTALL CRUCIBLE



INSTALL LID LINER

SUSCEPTOR REPLACEMENT - HT INSULATION

1. Remove thermocouple and valve rod.
2. Remove lid liner and crucible.
3. Remove fiber ring very carefully. This ring may be broken but it may be reused if handled very carefully.
4. Carefully lift out susceptor and insulation as a unit.
5. If the insulation is not damaged, it can be reused. Make sure there are three full layers at all points.
6. Vacuum all trash and debris from top of setter.

If it is necessary to replace the insulation, install 3 setter discs on top of setter. Cut insulation sheet 4 1/2" wide into strips totaling 42". Starting with shortest strip, wrap 3 full layers around the susceptor and insulating ring. Susceptor is tapered on the inside. Insulating ring fits on the large hole end. Be sure to closely butt the ends together - do not overlap. Hold the susceptor and insulation together and lower into work coil. Turn in such direction as to tighten wrapping to ease insertion. Add insulating strip. Make sure large hole in susceptor is on top. Install ceramic crucible.

GRAPHITE CRUCIBLE and INSULATION REPLACEMENT

Graphite crucible 218cc arrangements have a fiber insulating cylinder that may be replaced if necessary. Do not replace insulating cylinder due to minor cracks.

1. Remove thermocouple and valve rod.
2. Remove lid liner.
3. Remove graphite crucible.
4. Lift the old fiber insulating cylinder out, clean area thoroughly and replace with new cylinder.
5. Replace the graphite crucible if necessary. Graphite crucibles are expendable and oxidation will erode the crucible. Do not reuse a marginal crucible.

NOTE: 420cc graphite crucibles are installed the same as susceptors with MT strip insulation.

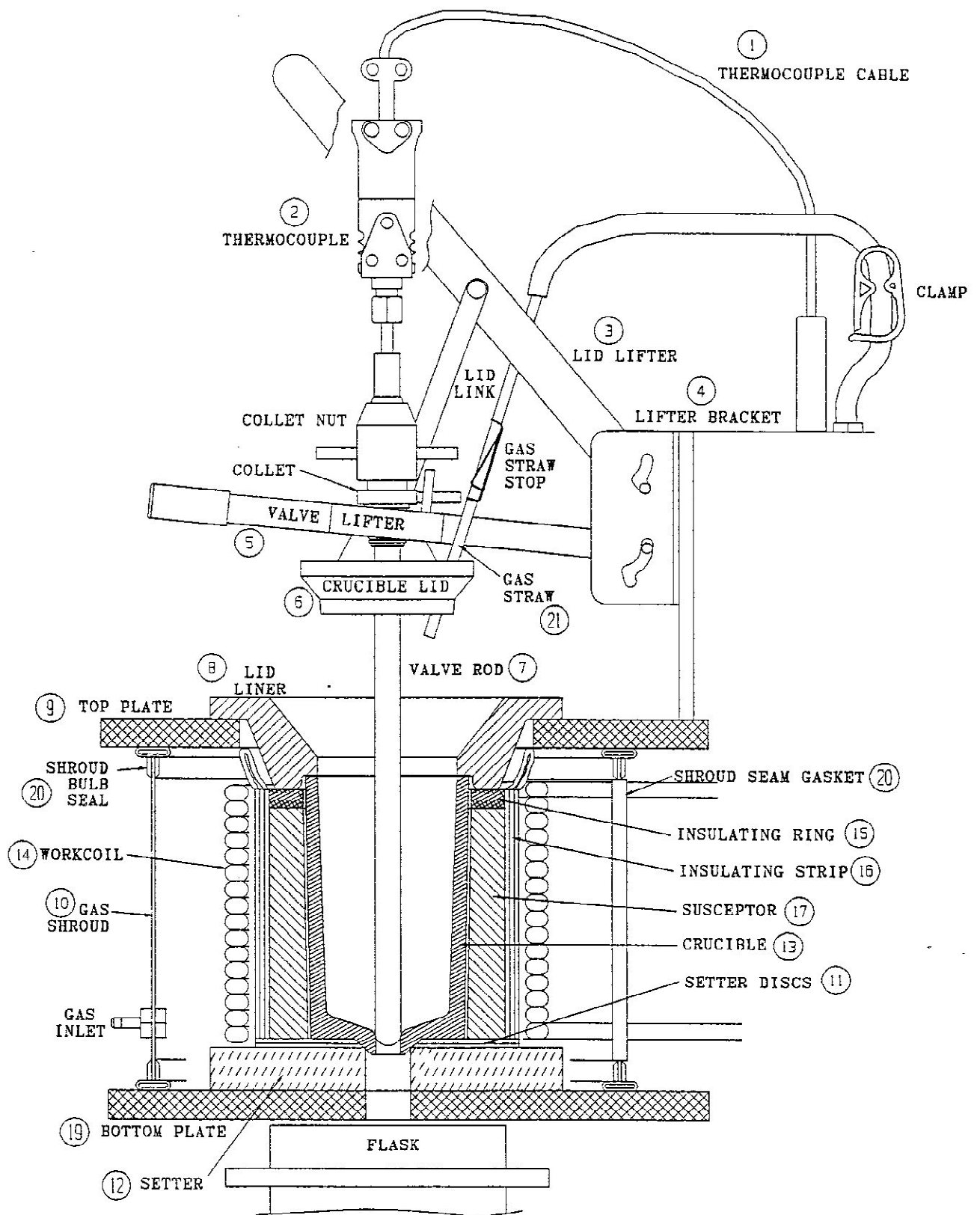
SETTER REPLACEMENT

The 6"Ø disc that the crucible sits on, the setter, requires infrequent replacement. Do not replace due to small hairline cracks. The setter replacement procedure involves the removal and replacement of all refractory items. Check all parts for wear as the disassembly proceeds.

1. Remove the thermocouple and valve rod.
2. Remove lid liner and insulating ring.
3. Remove crucible, susceptor and insulation.
4. Remove the firebox cover.
5. Raise the front of the top plate to a 45° angle and lift out.
6. Remove the gas tubing from the shroud fitting. Unbuckle and remove shroud belt. Gently pull the shroud apart to clear the work coil tubes and lift out.

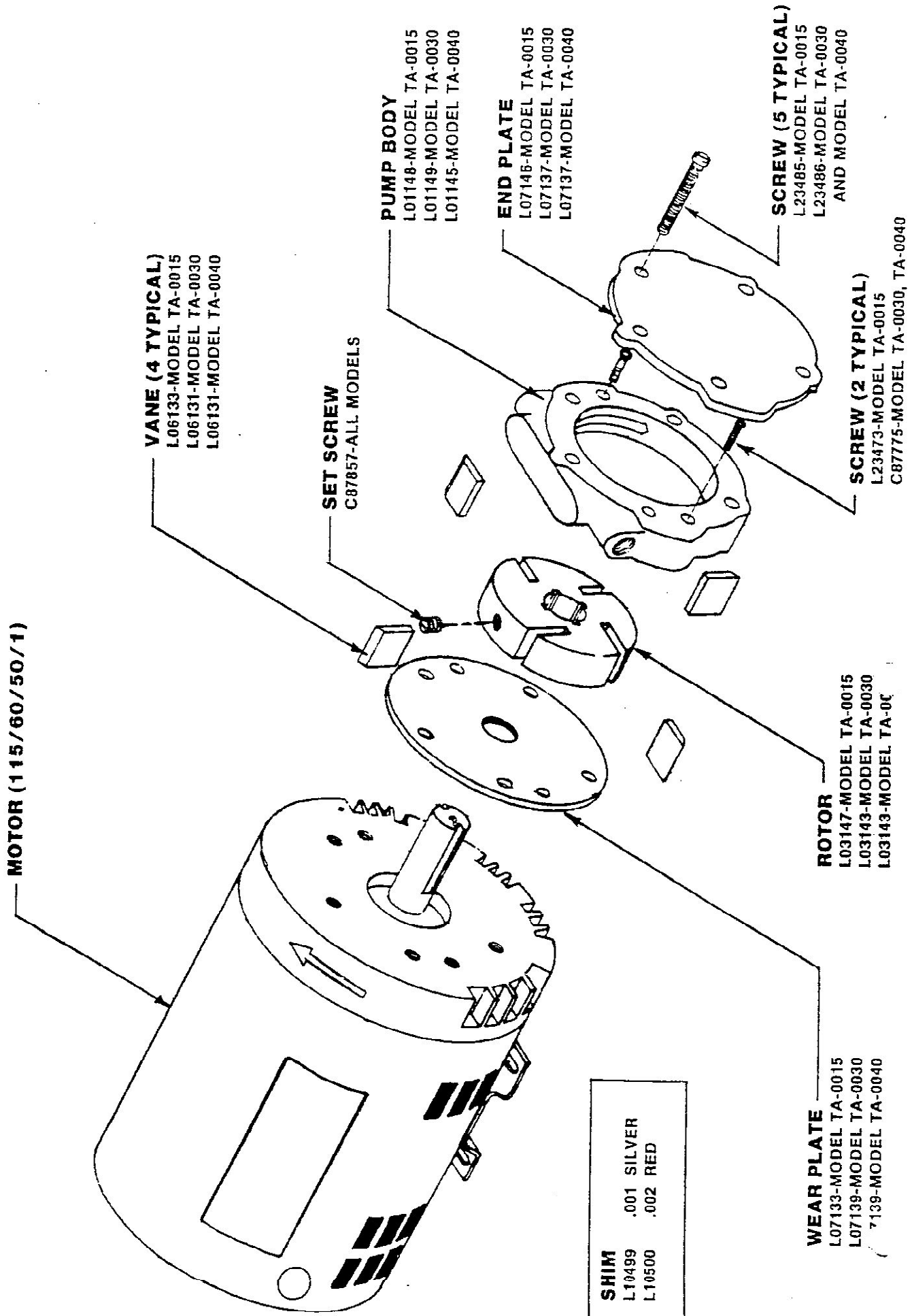
SETTER REPLACEMENT cont'd

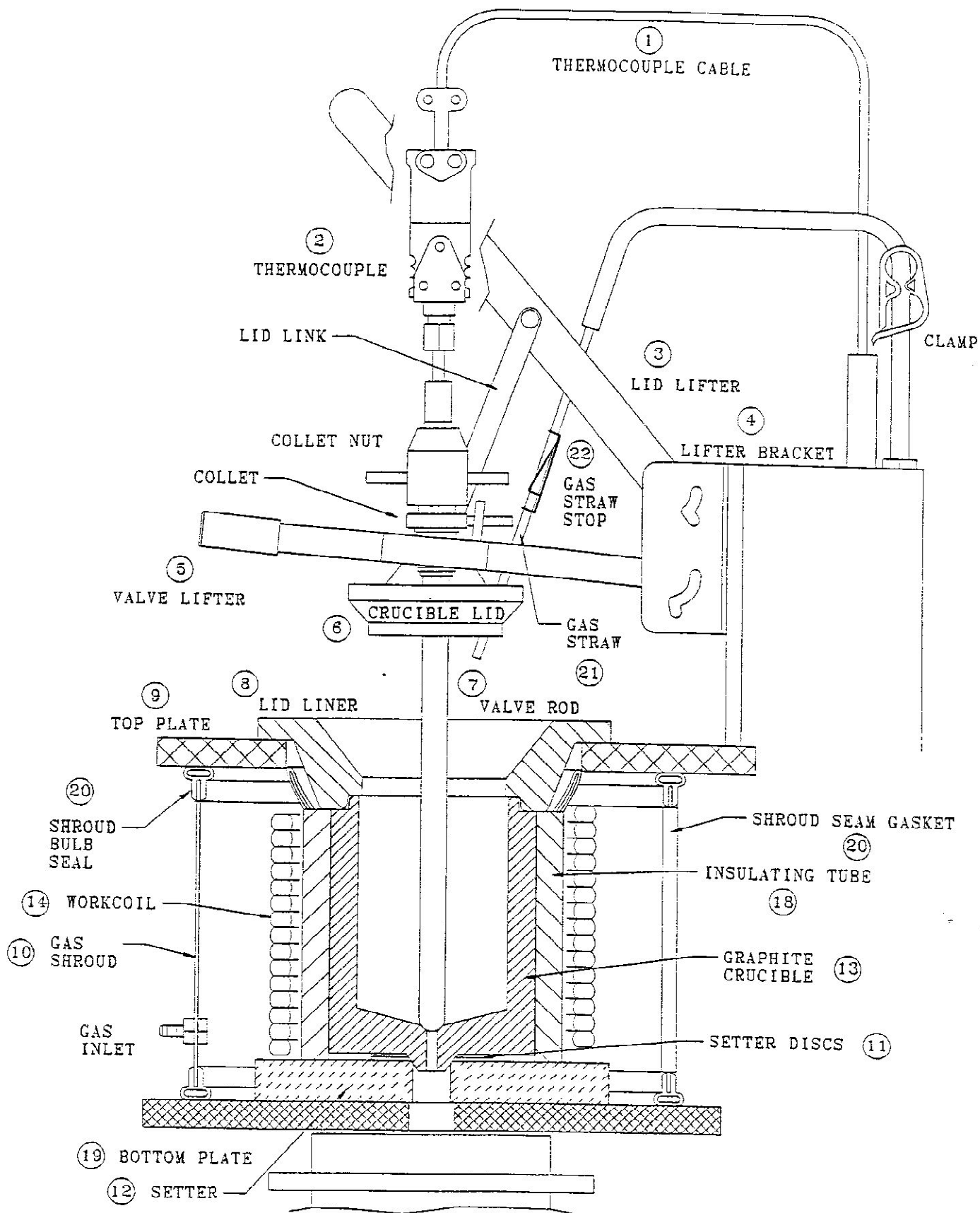
7. Remove the two screws and nuts at the front of the bottom plate. Slide the bottom plate out to the front of machine while holding work coil clear with fingers. Do not scar coating on the work coil.
8. The setter is secured to the bottom plate by a bead of clear silicone caulk. This seal is easily removed with a knife. A new setter and/or bottom plate may now be installed.
9. Align the hole in the setter in the center of the hole in the bottom plate and place a new bead of silicone caulk around the entire outside edge for a gas seal.
10. Replace remaining parts in reverse order.



CERAMIC CRUCIBLE ARRANGEMENT

Rotary Air Pump





GRAPHITE CRUCIBLE ARRANGEMENT

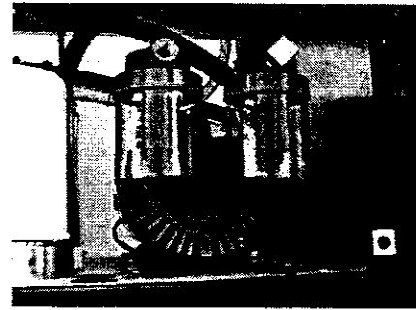
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MAINTENANCE 7

VACUUM SYSTEM

KEEP THE VACUUM CHAMBER CLEAN!



FILTERS

The vacuum system is equipped with two filters to trap investment and trash before reaching the vacuum pump. Vacuum is metered at the vacuum chamber; therefore, a low vacuum reading or a slower climb could indicate clogged filters. Remove the front cover below the control panel to gain access to these filters. The filter mounted on the vacuum pump serves as a back up to the in-line disposable filter. The disposable filter is a spin-on filter, P/N 5270. Periodically remove the oil filter and examine the inside circle of small holes for evidence of any trash or investment. The large center hole is the outlet and will always be clean unless the filter is severely clogged. If in doubt, replace filter. Always replace the filter after a flask blowout. Remember, it is easier and cheaper to keep the filters clean than it is to clean out the dirty pump!

NOTE: The following sections apply only to internal pumps.

50 - 150 HRS

1-3 mths min

FLUSHING

When investment and other trash enters the vacuum pump, the pump will act sluggish. Place finger over inlet in vacuum chamber. Start pump and note vacuum rise on gauge. It should read at least 26" in four seconds. Leave finger on inlet and shut pump off. It should fall back to zero within six seconds. If it does not, replace spin on filter and wash permanent filters. Make sure permanent filters are completely dry. Repeat test. If it remains sluggish, flush pump. Remove the muffler and filter assemblies on the pump. While the pump is RUNNING allow two ounces of safety solvent to enter the intake. Collect the waste in the muffler jar. NOTE: Eye protection is recommended. Flush in well ventilated area. Do not use flammable solvent.

Replace filters and check operation. Repeat the flushing procedure if it does not remedy the problem. If flushing does not eliminate the problem, disassembly will be required.

WD -40

Run for 4 min

DISASSEMBLY

If the motor will not rotate, disassembly is required for cleaning. Unplug power cord. Remove the bolts holding the pump end plate to the body. Now remove the end plate and the four vanes. Remove the housing by removing the 2 Allen screws. The set screw in the side of the rotor can now be loosened and the rotor pulled off the shaft. Clean vanes, rotor and chamber thoroughly with steel wool to remove foreign matter. Do not use a screwdriver on rotor to attempt to turn shaft. All inside surfaces are precisely ground and metal tools will ruin these surfaces. Replace vanes in same direction and reassemble.

A repair kit is available for field replacement of worn vanes. Under normal operation, the vanes should last several thousand hours. If internal cleaning and vane replacement do not remedy the problem, it is usually quickest and least expensive to send the pump in for repair.

LUBRICATION

The vacuum pump inside the machine is an oil-less design. The carbon vanes and grease packed motor bearings require no lubrication. **NEVER PUT OIL INTO THE OIL-LESS VACUUM PUMP.**

HOSES

The vacuum hose is 3/8" automobile gasoline hose. When replacing hose, make sure that new hose is the same length as the old hose. Also, the new hose should have the hose retainer ring next to the center panel exactly like the old hose to insure proper drawer movement.

WATER SEPARATOR

The very hot air surrounding the flask in the vacuum chamber is pulled through the spin-on filter. This filter's metal shell is at room temperature and causes the very hot air to cool rapidly and release it's moisture. If the water builds up in the spin-on filter, it may corrode the mounting base. If large amounts of water accumulate, it will be pulled into the vacuum pump and cause rusting internally. This rust will ruin the pump vanes.

The removal of this rust and replacement of pump vanes are not covered by warranty.

The water separator automatically drains any accumulated water on each cycle of the vacuum pump and prevents damage to the vacuum pump.

At the end of the days casting, the vacuum pump should be run for 2 minutes with an empty chamber to cool down the vacuum system.

WATER SYSTEM

The water cooling system requires at least 1 gpm @ 35 psi (4 lpm @ 2.5 bar) with an inlet temperature less than 120°F (49°C). The OVER TEMP light will be triggered by either low water flow or excessive temperature of the inlet water. Keep cooling water temperature above dew point to avoid condensation inside the machine. This may be accomplished by reducing flow or mixing with warmer water for tempering.

Clean the trash filter on the outside of the machine monthly. This filter prevents trash causing malfunctions of the water flow switch and water valve.

Check the water flow switch operation monthly by shutting off water flow and observing the OVER TEMP light. Clean the switch if the light does not operate. If adequate flow of cool water does not turn off the OVER TEMP light, clean the switch. Before cleaning, unplug power cord. The flow switch may be cleaned without disconnecting the plumbing. It is cleaned by placing paper towels under the switch then unscrewing the slotted end cap, pulling out the spring and plunger and using a small brush inside the barrel. Clean the spring and plunger and reassemble. Refer to MAINTENANCE 15.

Inadequate water flow may be caused by trash in the water valve. Before cleaning, unplug power cord and turn the external water valve off. The electric water valve may be cleaned without disconnecting plumbing. Use a screwdriver blade to pry the cap off the top. Slide the coil assembly up off the shaft. Insert tips of spanner or needle nose pliers into the holes provided on each side of the shaft and unscrew the valve operator. Clean any trash off valve faces reassemble in reverse order. Refer to MAINTENANCE 16.

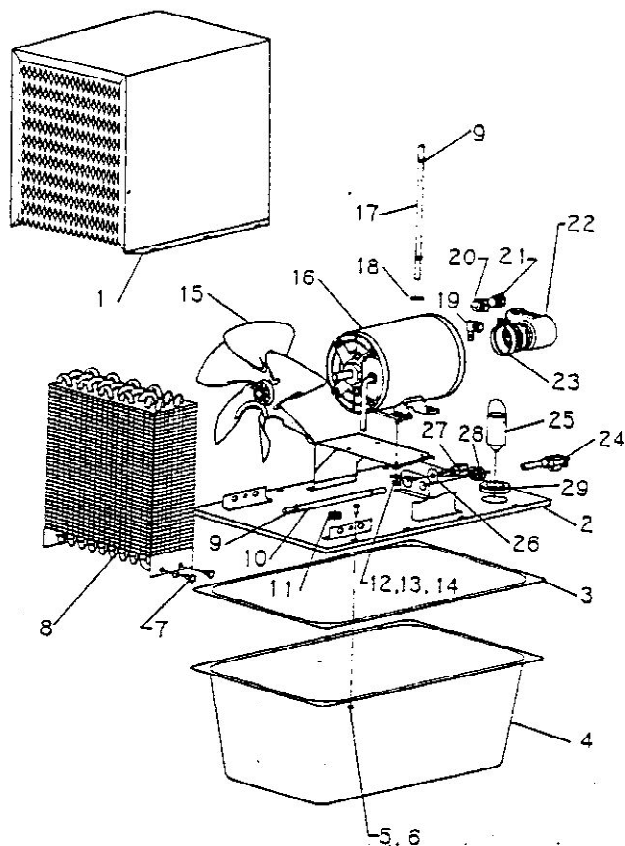
The water system is equipped with three electrolytic targets. Erosion of these targets is normal and necessary to protect other valuable components. Replace all targets when severe corrosion is evident. Do not attempt to circumvent its purpose. Refer to ELECTRICAL 20.

High temperature hoses are used to connect the work coil since it gets quite hot when continuous water flow ceases at machine shutdown. When the water hoses need replacement, replace hose-for-hose with the same type. Do not substitute. Cut to same lengths.

If a recirculating water system is used, periodic maintenance is essential. Lack of proper maintenance is considered abuse and will void warranty. Maintenance intervals should be no longer than 150 hours of machine operation. Any debris should be blown out of radiator. Recirculator cleaning should be performed as described on the separate instructions.

Do not use a recirculating water system if the casting machine is used to cast steel or other high temperature metals. The recirculator does not have the capacity to remove the excess heat generated.

MODEL 6500SS STAINLESS STEEL WATER COOLER



PARTS LIST

ITEM	QUANTITY	PART NO.	DESCRIPTION
1	1	3583	Cover, Cooler
2	1	1590017	Top Weldment
3	1	3574	Gasket Material, 5.5 ft.
4	2	2640002	Tank
5	8	3596	Screw, 10-32x1/2
6	8	1374	Nut, 10-32
7	3	1102	Screw, 1/4-20x1/2
8	1	2230001	Radiator
9	3	272	Clamp, Worm Gear
10	1	3098A	Hose
11	1	3888	Grommet, 3/8 I.D.
12	4	1451	Screw, 1/4-20x1/2
13	4	1456	Nut, 1/4-20
14	8	1452	Washer, flat 1/4
15	1	3525	Fan Blade with Set Screw
16	1	3429	Motor, 115/230V, 50/60HZ, 1PH
17	1	3098B	Hose
18	1	3558	Grommet, 5/8 I.D.
19	1	5523	Elbow 90
20	1	3077	Elbow, 3/8 N.P.T.
21	1	3063	Reducer, 3/8 N.P.T.-1/4 N.P.T.
22	1	5515	Pump
23	1	106	Clamp, Motor to Pump
24	1	1096	Power Cord
25	1	3683	Level Indicator Assembly
26	1	3504	Retainer
27	1	3408	Adaptor, Hose to Pipe
28	1	429	Strain Relief Bushing
29	1	3889	Grommet, 1-1/4 I.D.
NS	1	5557	Replacement Filter Screen (Not Shown)
NS	2	3066	5/8-18 UNC Left Arc Nut (Not Shown)

MECHANICAL SPECIFICATIONS

Dimensions: 21 1/4" long x 13 1/8" wide x 20 3/4" high
 (54.0 cm. x 25.4 cm.)
Net Weight: 56 lbs. (25.7 kg.)
Shipping Weight: 59 lbs. (29.7 kg.)
Pump Capacity: 100 p.s.i. max. 1.5 gpm @ 50 psi/1.8 gpm
 @ 60 p.s.i.

Heat Exchanger: High efficiency, rustproof
Reservoir: 6 gal. capacity stainless steel
Motor Voltage: 115/230V, single phase, 50/60 HZ A.C.
Amperage: 5.4/2.7 (60HZ)
Water Connections: 1/4 NPT female fittings (5/8-18 UNC left
 hand arc nuts supplied.)

MODEL SELECTION CHART

Model	Gal.	Liter	Volts	Amps	HZ	Phase
6500SS	6	22.72	115	5.4	50/60	Single
6502SS			230	2.7		

MEMCO Recirculator Cleaner

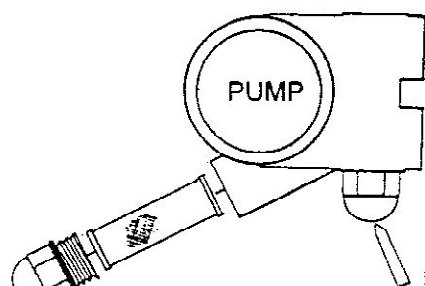
Read all directions first.

This product is to be used every 150 hours to remove deposits that form in the machine and recirculator. The purpose for using this product is to insure proper water flow through the machine.

Directions for use:

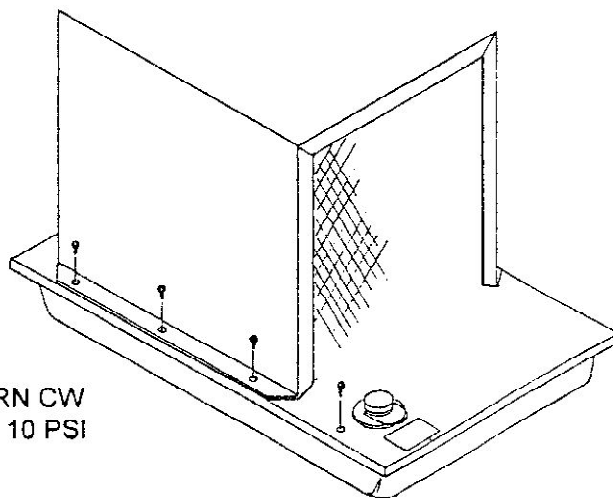
After casting while water is still hot-

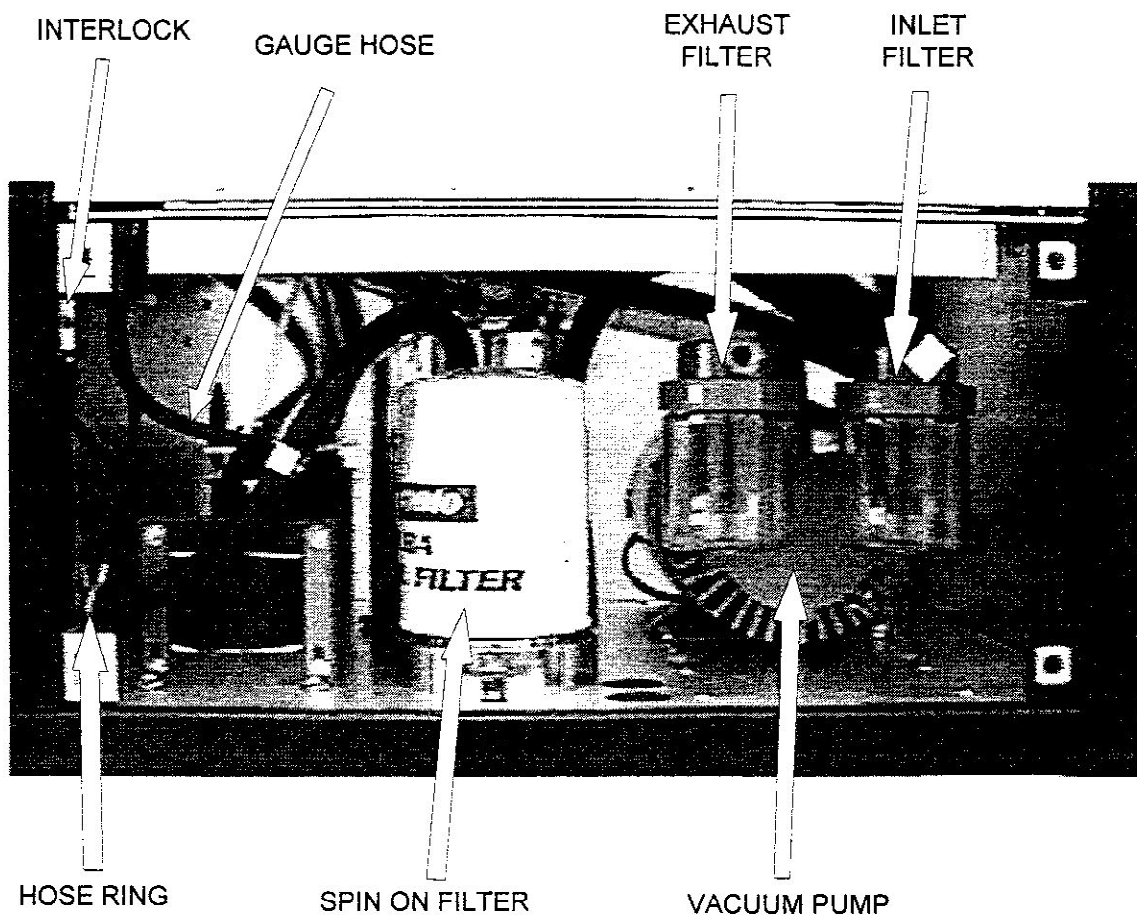
1. Remove hose to fitting on side of machine marked "water inlet" and place into a gallon container.
2. Turn off furnace breaker. Turn on power button and fill gallon container. Turn off power.
3. Reconnect hose to "water inlet" fitting.
4. Mix 1/2 contents of package (MEMCO P/N 5404) with gallon of water and pour back into recirculator.
5. Let hot water flow for about one hour or until crucible temperature is under 250°C by turning power on, and breaker off.
6. Clean filter screen in pump.
7. Drain recirculator and remove pan for cleaning.
8. Refill with distilled water.
9. Turn furnace breaker on.



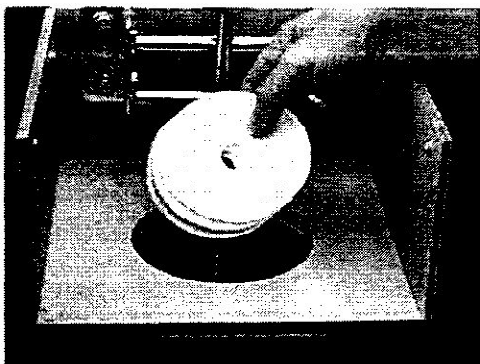
FILTER
SCREEN

PRESS ADJ
UNDER CAP 1/2 TURN CW
RAISES PRESSURE 10 PSI

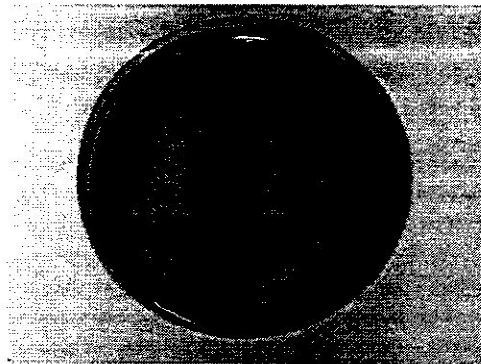




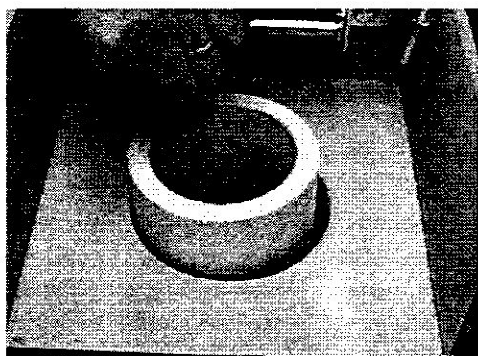
FRONT VIEW VACUUM SYSTEM



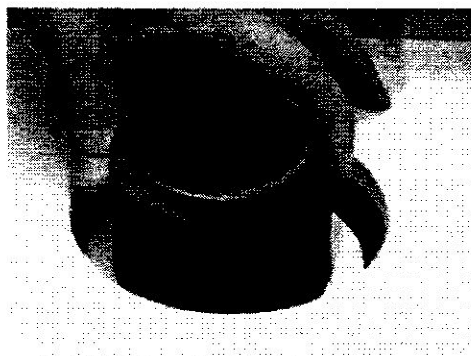
INSTALL SETTER DISCS



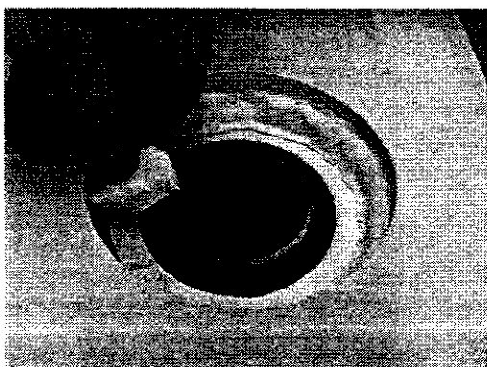
ALIGN SETTER DISCS ON
HOLE IN SETTER



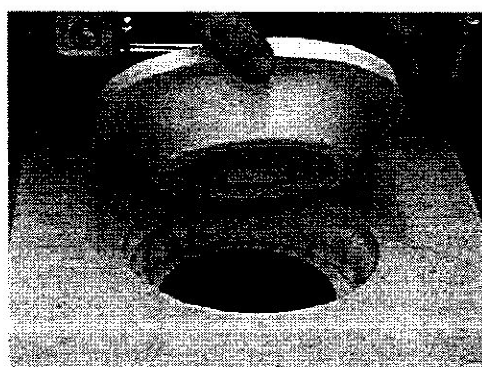
INSTALL INSULATING TUBE



INSTALL GRAPHITE CRUCIBLE

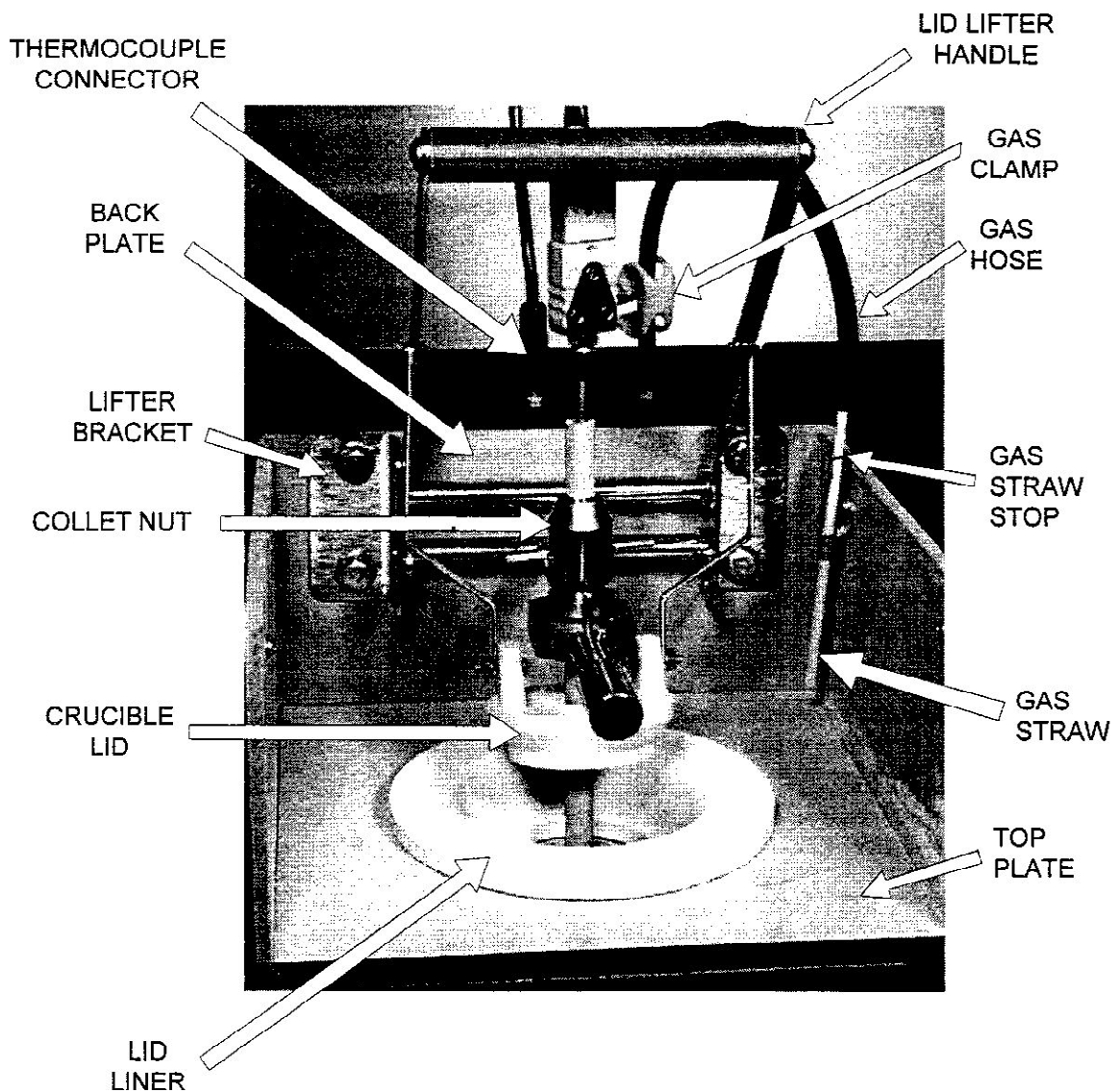


INSTALL WORK COIL INSULATING
STRIP

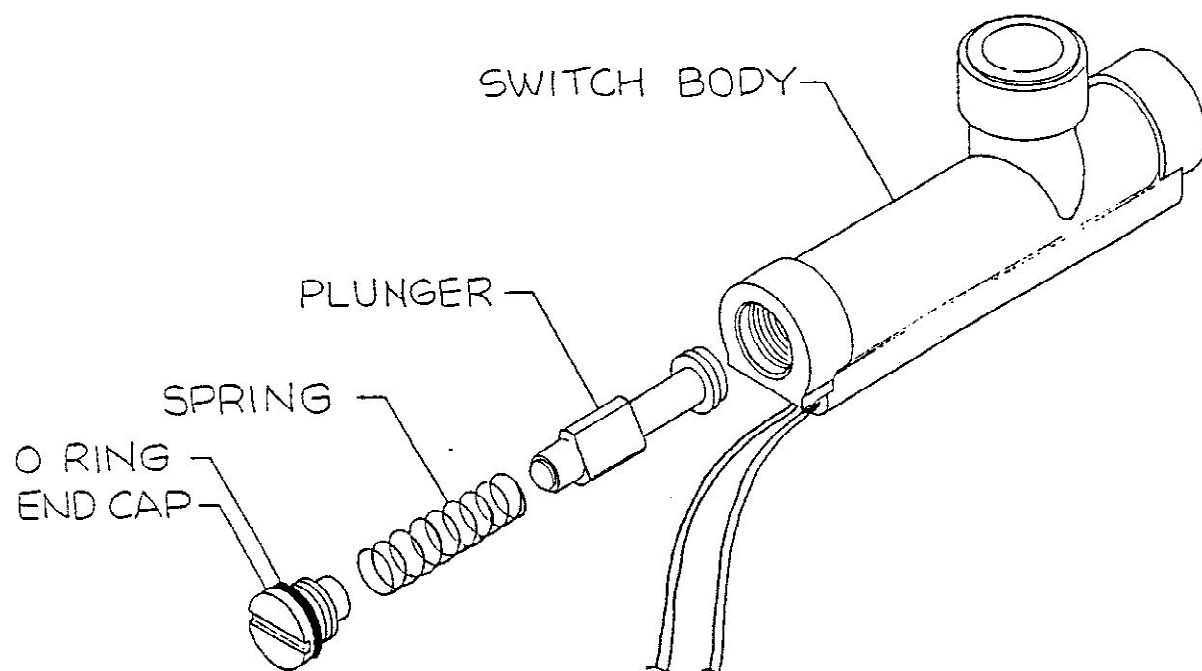


INSTALL LID LINER

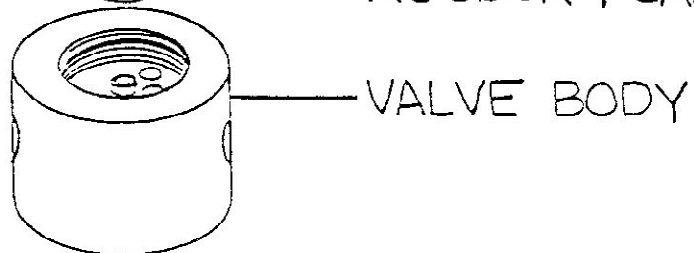
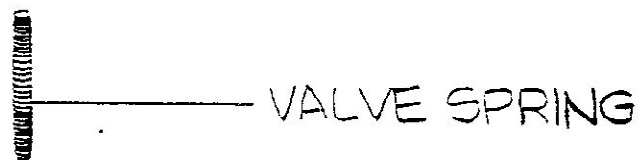
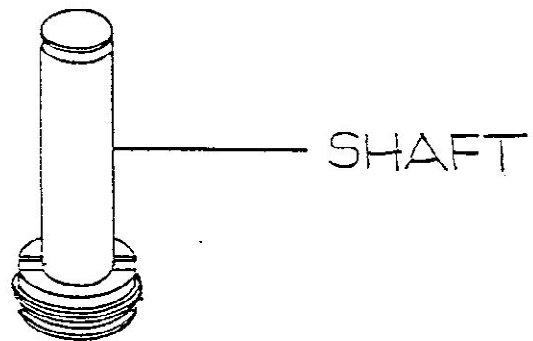
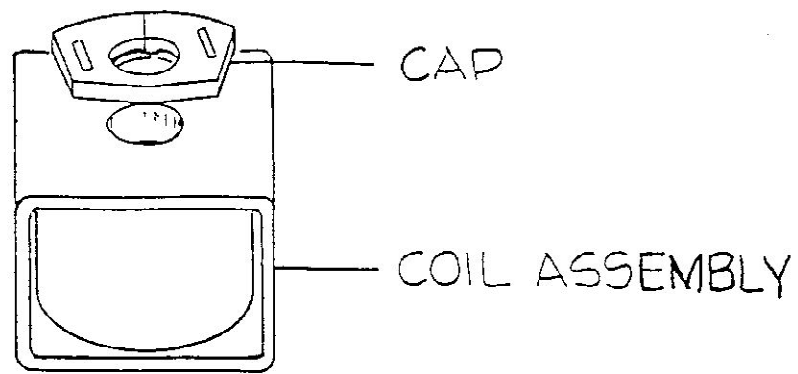
GRAPHITE CRUCIBLE ARRANGEMENT



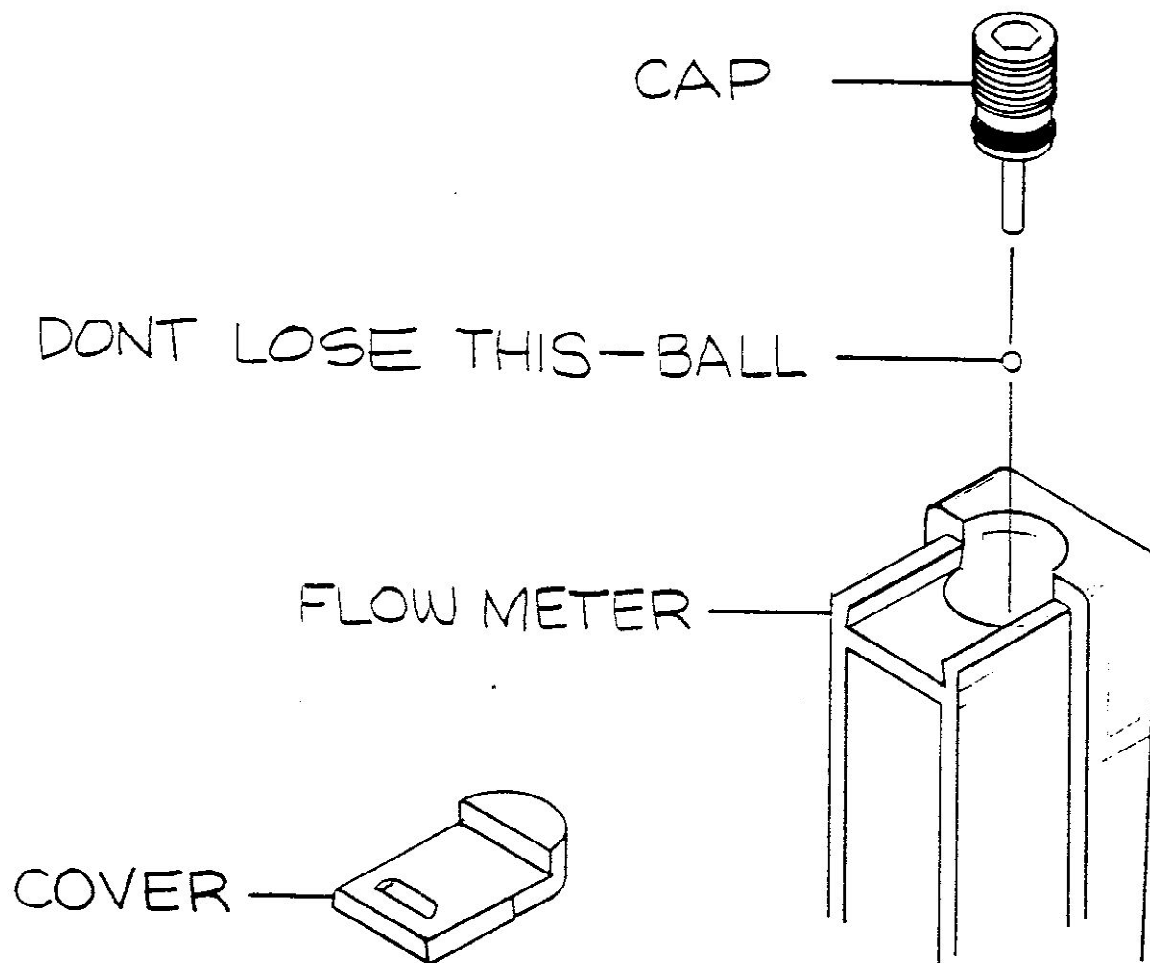
LOADING CHAMBER ARRANGEMENT



FLOW SWITCH ASSEMBLY

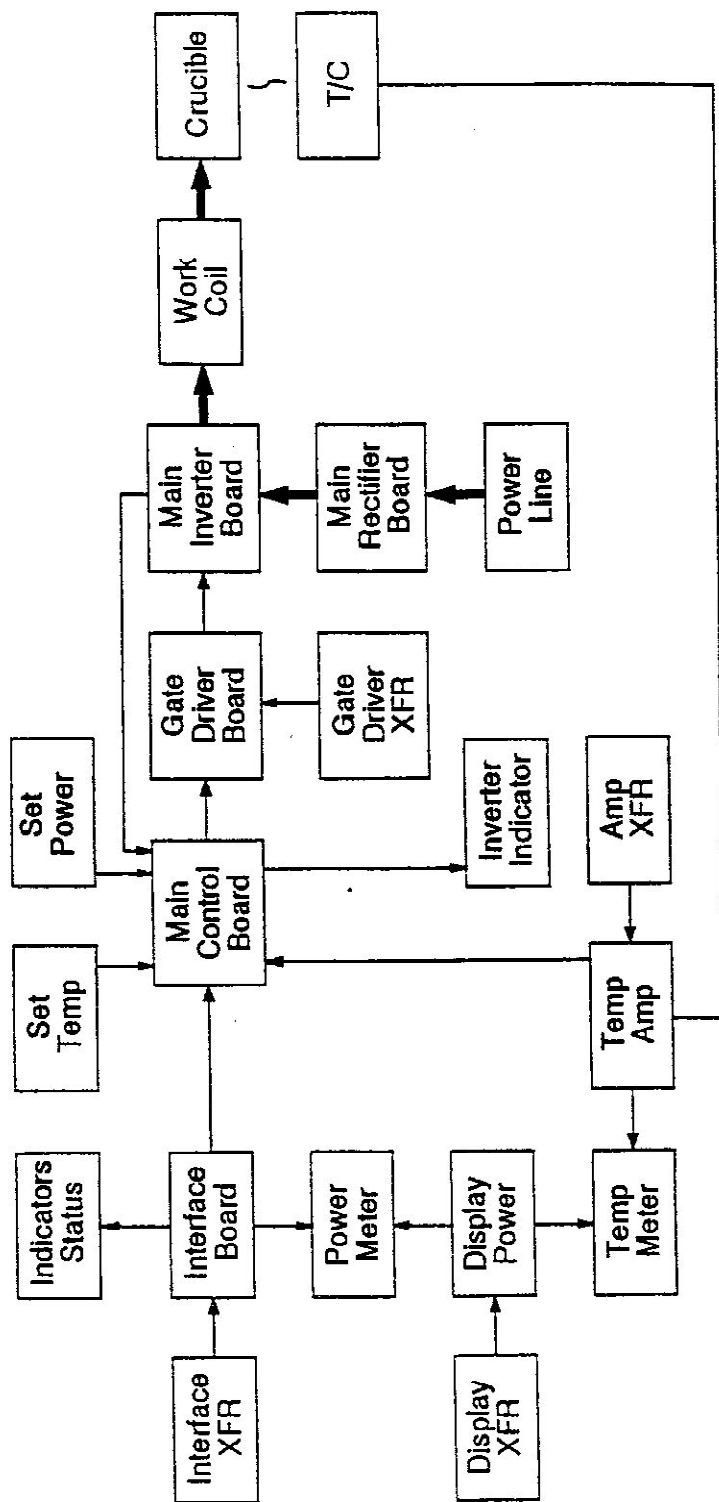


SOLENOID VALVE ASSEMBLY

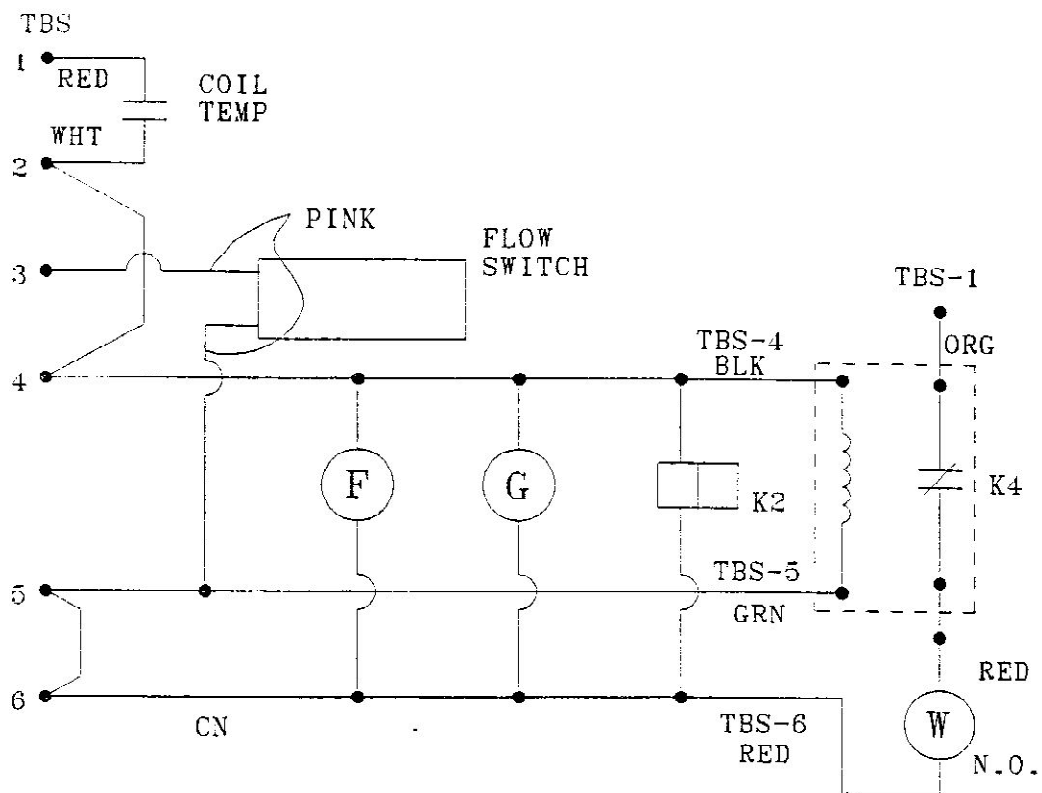


CLEAN INSIDE OF INDICATOR TUBE WITH MOIST Q-TIP.
CLEAN INDICATOR BALL. REASSEMBLE.

GAS FLOWMETER ASSEMBLY



Simplified
Block Diagram
Model 5100
REV. A,B,C



*will not work with
water Rec*

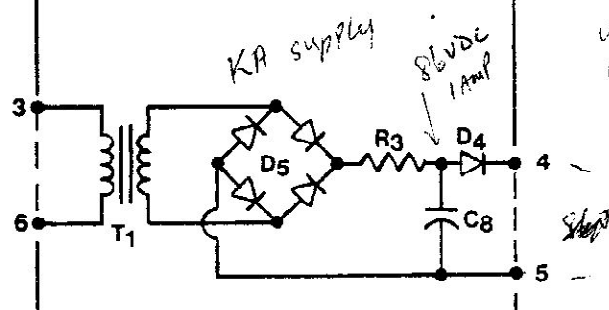
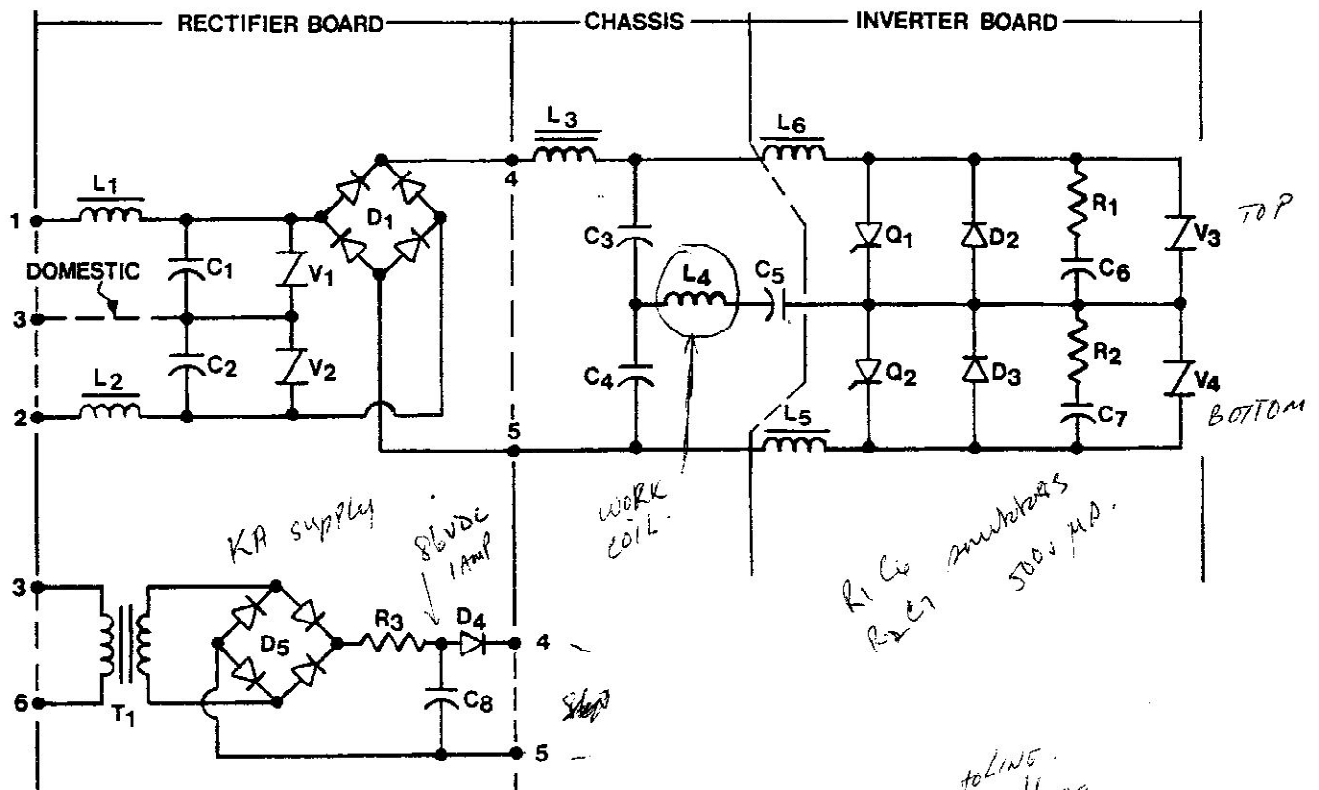
REVERSE LOGIC WATER VALVE
KIT P/N 5465

ring choke

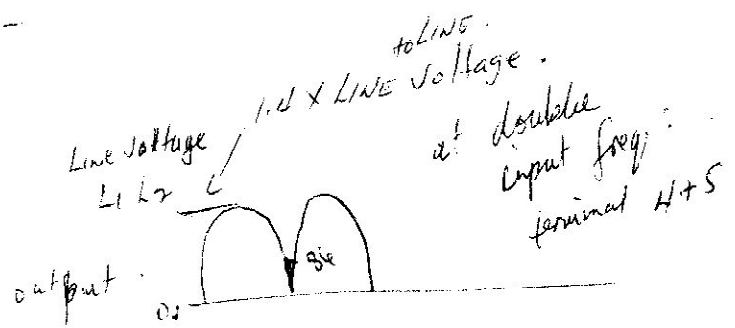
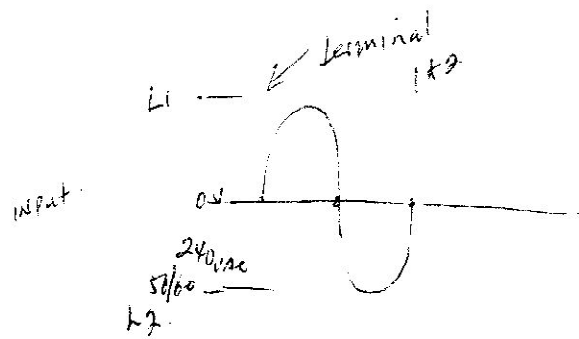
POWER SYSTEM SCHEMATIC

MODEL 5100D

$L4 + C5 = \text{SCL Res Ckt. centre fr } 12000 \text{ Hz}$



R_1, C_6 multibias
 R_2, C_7 500 μ A.



$L5 + L6 = \text{DIT choke}$
 300 Amps.
 250 amp RMBS

ELECTRICAL SYSTEM

PINOUT IDENTIFICATION LISTS

MAIN CONTROL 5142

PIN	DESIGNATOR	PIN	DESIGNATOR
A	Top SCR Control	1	Top Gnd
B	Zero Cross CT (1.5Ω)	2	Zero Cross Gnd
C	Bottom SCR Control	3	Bottom Gnd
D	Start/Stop	4	-12.0 VDC
E	Heat Light	5	Fault Input
F	+12.0 VDC	6	Temp Gnd
H	Power Gnd	7	Overload CT
J	OVER LOAD Light	8	Overload CT (1.5Ω)
K	Actual Temp	9	Max Temp
L	Max Power	10	Set Temp
M	Set Power	11	Horn
N	N/C	12	N/C

INTERFACE 5146

PIN	DESIGNATOR	PIN	DESIGNATOR
A	+12.0 VDC	1	Power - NO
B	Vacuum - NC	2	VACUUM Light
C	N/C	3	POWER Light
D	12 VAC, T3	4	12 VAC, T3
E	OVER TEMP Light	5	Power Gnd
F	-12.0 VDC	6	Flow Switch
H	HEAT - NC	7	+5.0 VDC
J	Contractor	8	T3 Control
K	16 VAC, T4 (2Ω)	9	16 VAC, T4
L	Bottom SCR Cathode	10	Top SCR Anode
M	Fault Output	11	Line CT
N	KW Output	12	Line CT (2.2Ω)

GATE DRIVER 3

PIN	DESIGNATOR	PIN	DESIGNATOR
1	Bottom Gnd	6	24 VAC, T2
2	Bottom control	7	Top Gate
3	Bottom Cathode	8	Top Cathode
4	Bottom Gate	9	Top Control
5	24 VAC, T2 (2Ω)	10	Top Gnd

DISPLAY POWER SUPPLY

PIN	DESIGNATOR	PIN	DESIGNATOR
1	- 5.0 VDC	6	Ground
2	+ 5.0 VDC	7	Ground
3	N/C	8	- 1.000 VDC
4	16 VAC, T6	9	- 6.2 VDC
5	16 VAC, T6	10	- 7.5 MV

DISPLAY T/C

PIN	DESIGNATOR
1	+ 5.0 VDC
2	- 1.000 VDC
3	Input High
4	Input Low
5	- 5.0 VDC
6	Ground

THERMOCOUPLE AMPLIFIER 4404 OR 4405

PIN	DESIGNATOR	PIN	DESIGNATOR
1	- 5.0 VDC	6	16 VAC, T5
2	+ 5.0 VDC	7	16 VAC, T5
3	N/C	8	T/C +
4	Output	9	T/C -
5	Ground	10	T5 CT

Note: Symbols Use
 N/C - Not Connected
 NO - Normally Open
 NC - Normally Closed
 CN - Common Neutral

CONNECTOR IDENTIFICATION LISTS

After S/N 8600

TOP BULKHEAD

BOTTOM BULKHEAD

CHASSIS

CONTROL BOX

CHASSIS

CONTROL BOX

PIN	DESIGNATOR	TO	DESIGNATOR	PIN	DESIGNATOR	TO	DESIGNATOR
1	TBP-5		F1	1	GD3-2		MCB-C
2	TBR-2		F2	2	ZX XFR CTR		MCB-B
3	TBR-6		F2	3	GD3-9		MCB-A
4	TBS-1		POWER-NC	4	GD3-1		MCB-3
5	TBS-2		POWER-NO	5	ZX XFR SHLD		MCB-2
6	VR-1		VACUUM-NO	6	GD3-10		MCB-1
7	CN		CN	7	OVL CT		MCB-7
8		N/C		8	OVL CT		MCB-8
9	KW CT		IFB-11	9	OVL SHLD		MCB-H
10	KW CT		IFB-12	10	TOP ANODE		IFB-10
11		N/C		11	BOTTOM CATHODE		IFB-L
12		N/C		12	INTERLOCKS		IFB-J
13		N/C		13	TBS-3		IFB-6
14		N/C		14		N/C	
15		N/C		15		N/C	

INSIDE CONTROL BOX PIN ARRANGEMENT

13	10	7	4	1
14	11	8	5	2
15	12	9	6	3

TOP CONNECTOR

15	12	9	6	3
14	11	8	5	2
13	10	7	4	1

BOTTOM CONNECTOR

TROUBLESHOOTING PROCEDURES

CAUTION: Only qualified electronic technicians should make the tests and repairs outlined hereafter. Caution should be observed when making operating tests as lethal voltages are present inside the machine. This machine should never be operated without a proper electrical ground connected to the chassis. Disregard for appropriate safety precautions can be dangerous to life and property.

WARNING: Never make any connections with power applied. Disconnect line cord before starting to connect/disconnect terminals, wires, PCB connectors, etc.

CAUTION: Do not change the settings of trimmers on circuit boards or modules. These are factory calibrations and require special equipment to set. Changing settings may cause malfunction or damage.

If several symptoms are present, proceed in the sequence listed below.

1. POWER does not come on -- Machine is disconnected, building breaker open, PCB connector loose, internal fuse blown. See Test #1, ELECTRICAL 9.
2. OVER TEMP -- Low water flow - Gallon jug placed under drain should fill in one minute. Incoming water too hot - Inlet water fitting should be less than 120°F (49°C). See "Water System". Trash in flow switch. See MAINTENANCE 15 & 16.
3. OVER LOAD
 - Momentary power loss - cycle power to restore.
 - Interlock switch open. Make certain all 3 panel interlocks are closed.
 - Loose power connections - Unplug machine and check all power connections and bolts for tightness. Do not overtighten copper bolts - they will strip. Use magnet to determine copper bolts.
 - Work coil damaged - See ELECTRICAL 13. Remove refractories, clean coil and check inside and out. If molten metal has damaged coil, or if coil is black, replace coil.
 - Component failure - See Test #6, Inverter Assembly Tests. Monitor open - see Test #7, Monitor Tests. These are rare. Attempt to cycle power first. Then make test and, if problem is not found, make Test #6.
4. HEAT does not come on -- HEAT switch off, thermocouple is near set temperature, breaker is off, panel interlock switches open, OVER LOAD or OVER TEMP lights on, PCB connector loose, see "Locating Malfunction" section.
5. VACUUM PUMP does not operate -- See Vacuum System" section.
6. PYROMETER reads overrange -- Open thermocouple circuit. Check thermocouple. Thermocouples have a finite life and require periodic replacement. Check jack and wiring.

TROUBLESHOOTING PROCEDURES cont'd

7. TEMPERATURE Readout Unstable --

- Open the plastic covers on the thermocouple and thermocouple cable and check all connections.
- Check all connections on the temperature amplifier.
- Clean jack and receptacle.
- Check display power supply reference for stability.
- Check for metal on setter or setter discs.
- Erratic with heat off - replace temp amp.
- Erratic with heat on - replace work coil.
- Make certain all ground wires are in same connector on terminal 5.

8. KW meter reads low with full power setting.

- Check susceptor for erosion or cracks.
- If using a known good susceptor and power is low, replace work coil. A turn-to-turn short exists. Especially if the hum is higher frequency than normal.

9. BREAKER trips --

- Look for blown varistors. Varistor resistance should be over 20M Ω .
- See power system schematic, ELECTRICAL 3. Troubleshoot by isolating sections as shown. See No. 6 on ELECTRICAL 10, Inverter Assembly Tests.

10. MACHINE buzzes/shocks operator/blows varistor V₁ and V₂ -- Caused by metal on setter touching frame. Clean firebox and replace any damaged refractories.

PANEL LAMP REPLACEMENT

The control panel lamps are rated for very long life; therefore, if the lamp is out, it is probably loose in the socket. Pull lighted button straight out to remove. There is a metal tab in one corner of the lamp housing. Pull it out with a fingernail. This lamp is type 73. Using fingers only, carefully align and press into socket. Snap button back into housing.

LOCATING MALFUNCTION

1. BLOWN FUSE TESTS

Refer to page ELECTRICAL 2. The DC load resistance from indicated point to CN is shown with the source disconnected.

Disconnect power cord. If fuse F1 (5A) is blown, remove fuse and measure resistance from front of holder to CN. With the POWER switch on, normal reading is $34\Omega \pm 10\%$. Turn POWER switch off and measure Ω from the white wire on the power switch (goes to TBS 2) to CN. The normal reading is $65\Omega \pm 10\%$. If the 65Ω reading is significantly lower than this, the problem is fan, gas valve, water valve or wiring. With the POWER switch off, measure the resistance from the yellow wire on the power switch to CN. The normal reading is $60\Omega \pm 10\%$. A low reading indicates a shorted transformer. Note that this does not measure T3. Look at the white covering on the lower (primary) windings. A burnt look should warrant an electrical test. Remove one wire to the primary and measure the primary resistance. Compare this reading to the table in "Transformer Tests". If the secondary also appears burned, check for a shorted load. Clear load shorts before replacing transformer. Make similar checks on the vacuum switch to locate the short.

If fuse F2 (1A) is blown, remove fuse and measure Ω from front of holder to CN. Normal reading is 11Ω (domestic) or 45Ω (international) $\pm 10\%$. If this is very low, this indicates a shorted transformer primary for T1, T2 or wiring. See ELECTRICAL 14 for location. T1 supplies the auxilliary power supply on the MRB (see ELECTRICAL 3). T2 supplies the gate drive board, GD3. Check the appropriate load for shorts.

2. TRANSFORMER OUTPUT TESTS

Turn HEAT off and POWER on. Check the secondary voltage of all transformers in the control box. The voltage should be -0 to +20% of the suffix on the transformer label. If a transformer appears defective, check the coil resistances (in ohms) with the tables below. See ELECTRICAL 19 & 21.

T	VOLTS	PRI Ω	SEC Ω
1	48	22	6
2,3	24	22	2
4,6	16	140	4
5	16	380	11

INTERNATIONAL MODELS

T	VOLTS	PRI Ω	SEC Ω
1	48	90	6
2	24	90	2
7	115	13	6

*Center 2 pins
on CBB for transformer
voltage.*

*Top Bobbin
sec.*

3. MAIN RECTIFIER TESTS

Measure voltages on the Main Rectifier Board (MRB) terminals.

Terminals	Voltage
1-2	240 VAC Line to line
4-5	340 VDC 1.4 x Line to line
3-6	120 VAC Line to neutral

KA = 86 VDC

TBR #5 anode of

D4

NOTE: Voltages shown are domestic 1Ø for illustration.

*3-6 240 line to neutral
on INT.*

4. REGULATED VOLTAGE TESTS

Measure the tests points on the Interface Board (IFB) for +12VDC $\pm 5\%$ and -12VDC $\pm 5\%$. If the voltage is too high, replace regulator of IFB. If voltage is too low and heat sink is hot, turn off power and locate short. Check voltage on display power supply.

5. GATE DRIVER TESTS

Disconnect power cord. Remove and individually tape wires 1,2 and 6 to MRB. On Main Control Board (MCB), place jumpers from GND to FLT IN, GND to MON, OSC to Z. Reconnect power cord. Turn breaker, POWER and HEAT on. If all three gate driver LEDs come on and HEAT lamp comes on, all boards are satisfactory and problem is in inverter assembly. Check all large wire connections and bolts for proper tightness. Do not overtighten copper bolts. If the center LED (power) did not come on, the other two will not either. Check voltage GD3-5&6. Should be nominal 24 VAC.

If proper voltage is present and center LED is off, problem is in the gate driver board (GD3) power supply. If the center LED is on and the other two did not come on, remove jumper from OSC to Z. Have an assistant watch LEDs carefully. It is normal for "T" LED to glow dimly while "B" is dark. Hook jumper to GND on MCB and bounce on "T" point (above Z). The "T" LED on GD3 should flicker on each bounce. Repeat for "B" (below Z) point and "B" LED on GD3. If a distinct flicker was not observed on both "T" and "B" LED's, replace GD3. If distinct flicker was observed, replace MCB.

6. INVERTER ASSEMBLY TESTS

Refer to Power System Schematic, page ELECTRICAL 3. Disconnect machine. Discharge all capacitors. Check rectifiers D1, D4, and D5 on the Main Rectifier Board. (A) Visually inspect V1 and V2. Check capacitors C1, C2 and C8 for shorts. (B) All components on the MRB are field replaceable. (C)

INVERTER ASSEMBLY TESTS cont'd

On the inverter assembly, check Q1 and Q2 for shorts. These should measure greater than $5K\Omega$ across the cooling blocks. SCRs and diodes D2 and D3 should not be replaced in the field. DO NOT ATTEMPT TO DISASSEMBLE INVERTER. Remove and replace the inverter assembly, not the individual components. Connections to the large wires must be tight to avoid overheating. It is important to replace all connections EXACTLY the same as the original.

7. MONITOR TESTS

Disconnect power cord. Remove and individually tape wires 1 and 2 to MRB. On Main Control Board (MCB), place jumpers from GND to FLT IN and GND to MON. Reconnect power cord. Turn power knob to minimum. Turn breaker, POWER and HEAT on. If machine starts and runs, shut off before 10 seconds of running. OPERATION LONGER THAN 10 SECONDS DESTROYS T1!

If machine starts and runs, check wiring and connections on the Interface Board (IFB). Remove IFB connector. Turn breaker off and POWER on. Measure voltages between pins K and 9. This should be 16 to 20 VAC. Turn power off. Check continuity from IFB-M to MCB-5. Make diode test from top inverter outer cooler (-) to IFB-10 (+). Make diode test from bottom inverter outer cooler (+) to IFB-L (-). If all checks out, replace IFB. **Be very careful in handling IFB with machine operating as high voltages are present.**

Back Boff

If machine did not start and run and all previous tests in this section have been made and no problem found, replace MCB.

*SEA
switched
at 12000 RPS*

*17 M per
of full power*

TEMPERATURE AMPLIFIER FIELD CALIBRATION

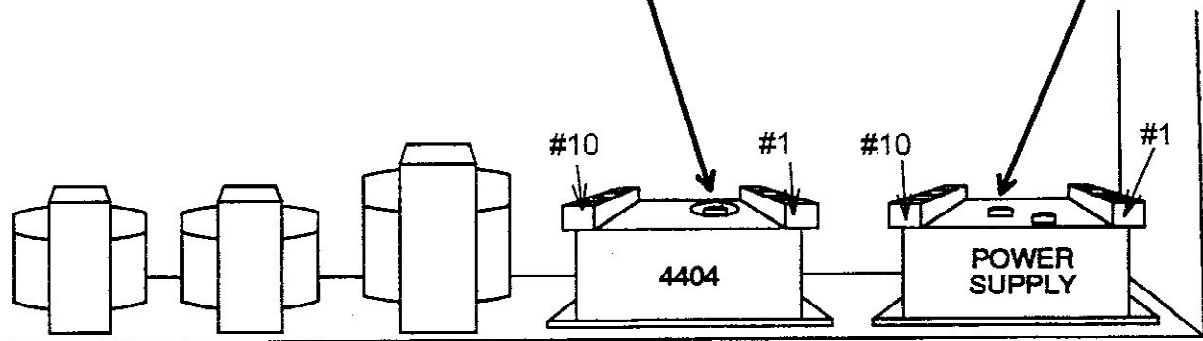
(MODEL 4404)

NOTE: A 4404 IS IDENTIFIED BY THE TWO TOGGLE SWITCHES IN THE
CENTER

A MODEL 4405 DOES NOT REQUIRE FIELD CALIBRATION

TOOLS NEEDED: QUALITY V.O.M., AN ADJUSTABLE 0-50 MVDC SOURCE,
AND A SMALL SLOTTED SCREW DRIVER OR POT
ADJUSTMENT TOOL.

1. Turn machine on and let warm up at least 3 minutes before making adjustments. Place both switches to the left.
2. Plug in the millivolt source in the thermocouple jack.
3. Set the VOM to the 2VDC scale.
4. Place the red lead on terminal #8 of the power supply and the black lead on #7.
5. Adjust the pot closest to #8 of the power supply till the VOM reads exactly -
~ 1.00VDC (minus).
6. Apply a voltage of 40.3 millivolts d.c. between terminals #8 and #9 of the
4404. #8 should be positive.
7. The temperature display meter should read 1 000°C. If not, adjust the pot
nearest terminal #5 (the only one uncovered) on the 4404 until it reads
1000°C.



WORK COIL INSPECTION / REPLACEMENT

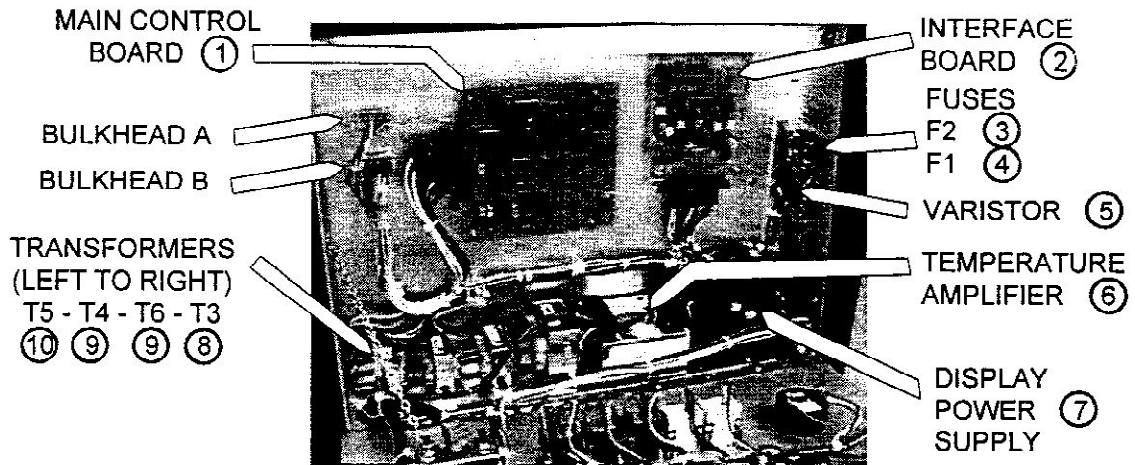
INSPECTION - Remove all refractory materials inside work coil as well as top plate and gas shroud. Clean work coil with damp cloth to permit visual inspection. The coil should have a reddish brown color.

A uniformly black work coil indicates charred insulating varnish and should be replaced. The charred varnish is the result of cooling water being shut off while a hot susceptor remains in the coil. The machine requires cooling water after power down to cool without damage.

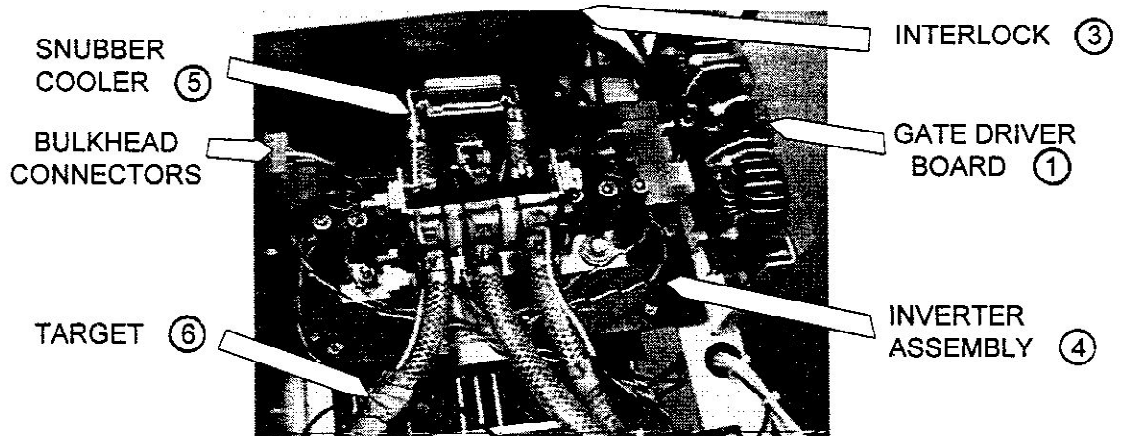
If the coil has a normal reddish brown color and damage is suspected, a turn by turn inspection will be necessary. Gently pry turns of the work coil apart using fingers only. Sharp tools will damage the insulation. Using a flashlight and mirror, carefully inspect the area between the turns for a turn to turn short. If a short is found, a temporary fix can be made by placing a piece of insulating felt between the turns. The coil should be replaced as soon as possible.

REPLACEMENT

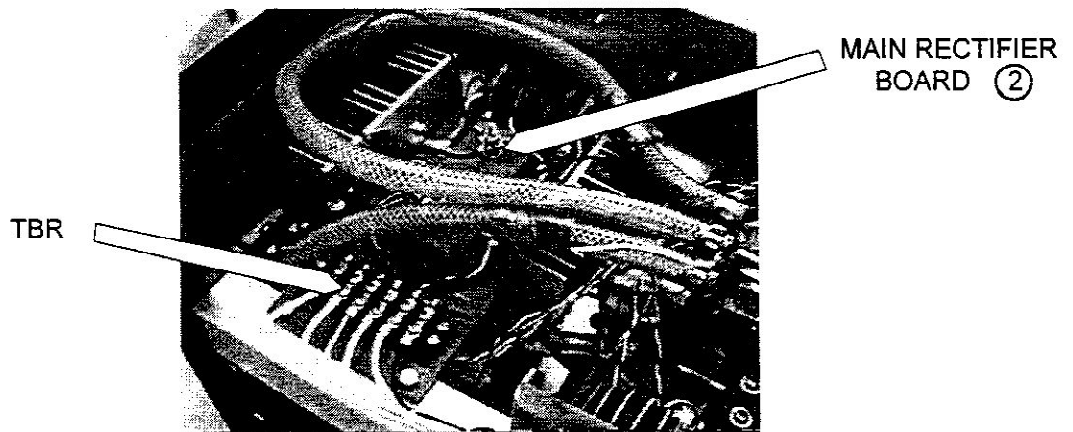
1. Disconnect from power source.
2. Remove firebox cover and top plate.
3. Remove gas shroud.
4. Loosen hose clamps on back of work coil. Place rags under bottom hose on work coil. Remove top hose first. Position cup under bottom hose before removal of hose to catch water trapped in coil.
5. Using two 9/16 open end wrenches, remove and retain 2 hex nuts and lock washers holding work coil to work coil bulkhead. Slip braided cables off of bolts. Remove and retain two bolts and all flat washers. Take note of hardware stack up to reinstall correctly. The large flat washers are used as alignment spacers between bulkhead and work coil mounting terminal. **No hardware of any type should exist between the work coil terminal and the cable assembly.** Disconnect two wires at thermostat. Lift work coil out of machine.
6. Remove thermostat from old work coil and install in same location on new work coil.
7. Replace work coil in machine. Work coil must be centered front to rear on hole in setter. This position may be adjusted and fixed by the number of washers between work coil bulkhead and work coil mounting terminals. Once in position, replace braided cables to their correct positions, followed by split lock washers and hex nuts. **NOTE: WORK COIL TERMINAL MUST DIRECTLY CONTACT CABLE TERMINAL. THERE SHALL BE NO WASHERS BETWEEN THESE TWO CONNECTORS.** Tighten securely.
8. Install hoses and tighten hose clamps. Install thermostat wires.
9. Install gas shroud, making sure there are no leaks at seam gaskets in rear of shroud. Install top plate and firebox cover. Adjust side to side position of work coil after top plate has been installed.
10. Connect machine to power source.



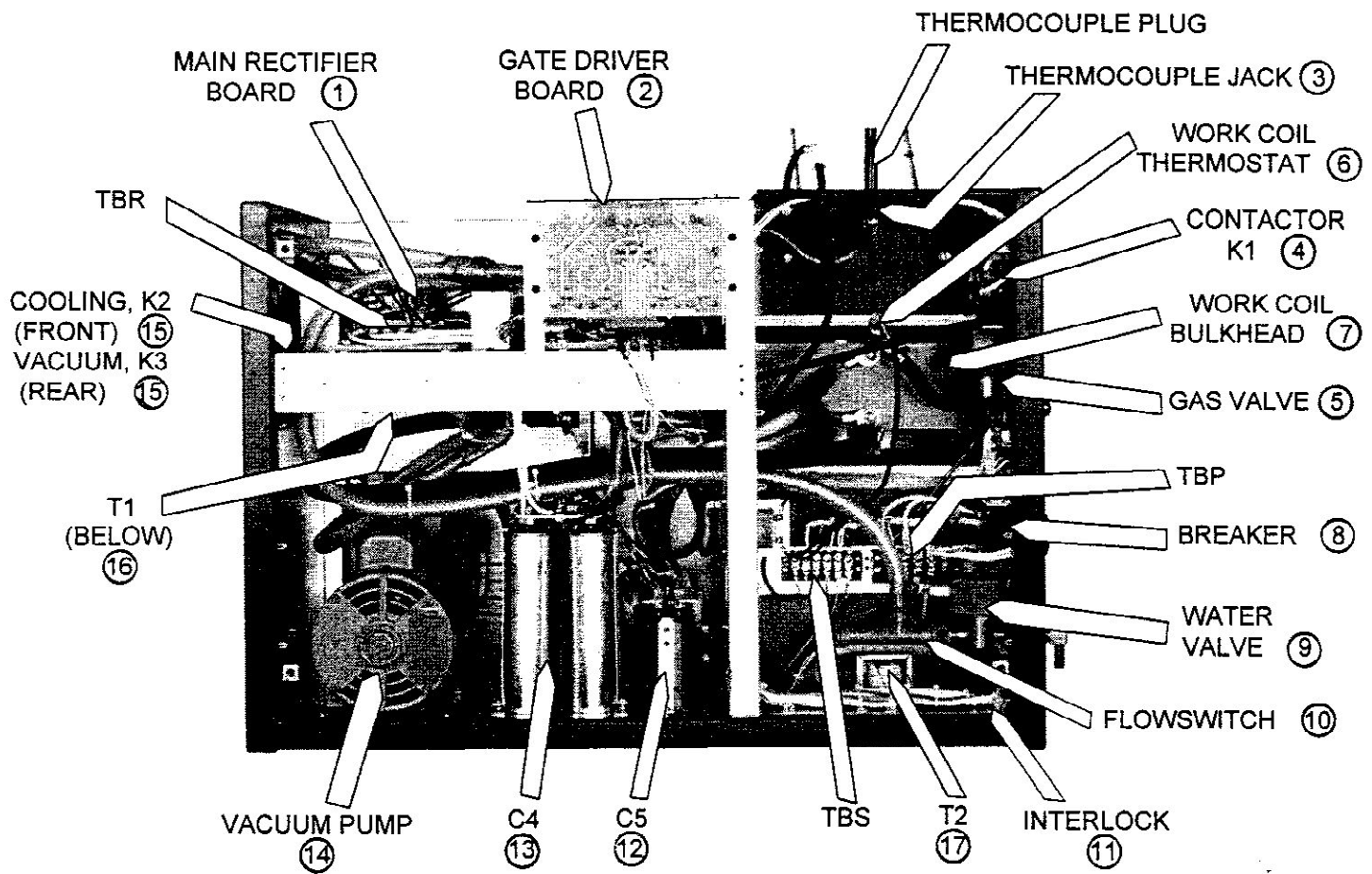
CONTROL BOX MODEL 5100



TOP VIEW INVERTER ASSEMBLY
MODEL 5100



MAIN RECTIFIER ASSEMBLY
MODEL 5100



REAR VIEW MODEL 5100

PARTS LIST FOR CONTROL BOX MODEL 5100

ITEM NO.	PART NO.	DESCRIPTION
1	3-5141-1A	Main Control Board
2	3-5146-1A	Interface Board
3	FUSE-001.00	FUSE, 1A, 250V
4	FUSE-005.00	FUSE, 5A, 250V
5	09-130-LA20	Varistor, 130V
6	3-4404-1A	Temperature Amplifier
6	3-4405-1	Temperature Amplifier
7	3-4300-1A	Display Power Supply
8	TRN-24V-1.2A	Transformer, T3
9	TRN-16V-.4A	Transformer, T4, T6
10	TRN-16V-.2A	Transformer, T5

PARTS LIST FOR TOP VIEW-MODEL 5100

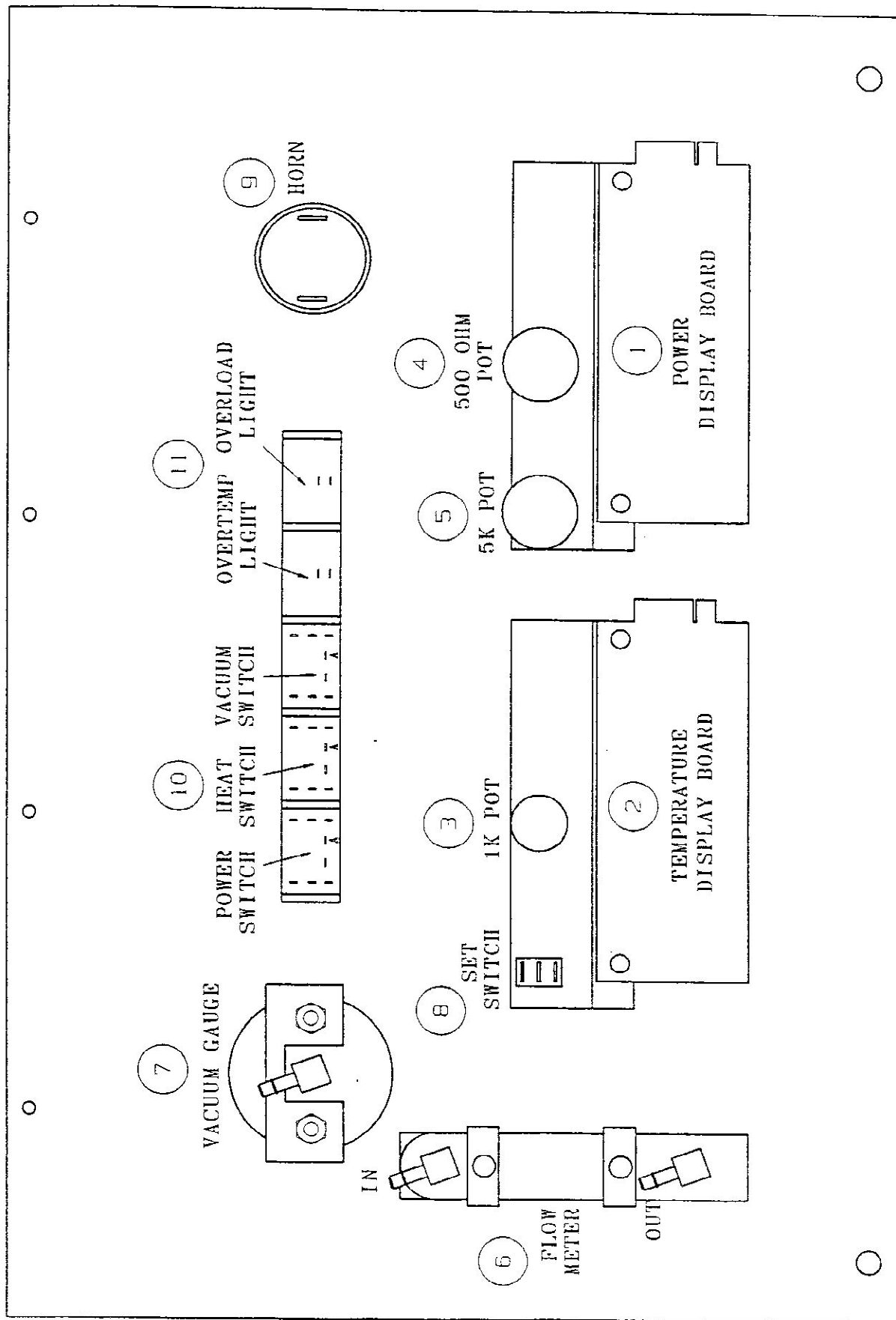
ITEM NO.	PART NO.	DESCRIPTION
1	3-5147-3A	Gate Driver Board
2	3-5106-1A	Main Rectifier Assy
3	SWITCH-INTLK	Switch, Interlock
4	3-5105-1A	Inverter Assy
5	3-5115-1C	Snubber Cooler Assy
6	3-5109-1B	Target Assy

PARTS LIST FOR REAR VIEW-MODEL 5100

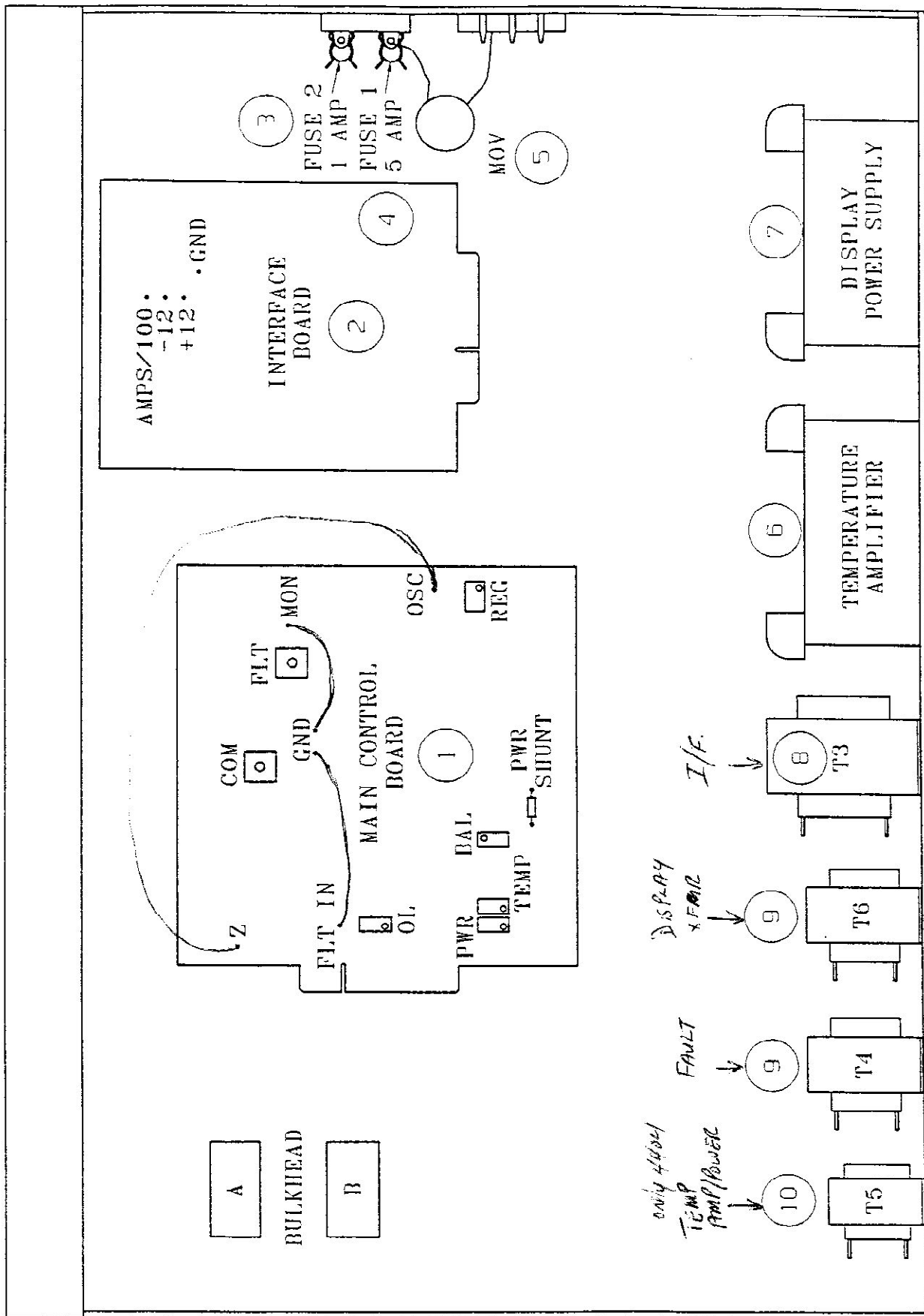
ITEM NO.	PART NO.	DESCRIPTION
1	3-5106-1A	Main Rectifier Board
2	3-5147-3A	Gate Driver Board
3	3-5119-1A	Thermocouple Jack Cable, Internal
4	RELAY-2P-30A	Contact, K1
5	VALVE-NC-2-115	Gas Valve
6	THERMO-140F	Thermostat
7	5-5101-1	Workcoil Bulkhead
8	CB-30A-250V-1	Circuit Breaker
9	VALVE-NC-4-115	Water Valve
10	SWITCH-FLOW	Water Flow Switch
11	SWITCH-INTLK	Interlock
12	3-5143-1A	Comm Cap Assy, C5
13	3-5144-1A	Fil Cap Assy, C3, C4
14	PUMP-VAC-04A1	Vacuum Pump, 4cfm or
14	PUMP-VAC-10A1	Vacuum Pump, 10cfm
15	RELAY-1P-25A	Relay, K2-K3
16	TRN-48V-.6A	Transformer, T1 (Domestic) or
16	TRN-48V-.6A-DP	Transformer, T1 (Foriegn)
17	TRN-24V-1.2A	Transformer, T2 (Domestic) or
17	TRN-24V-1.2A-DP	Transformer, T2 (Foriegn)

PARTS LIST FOR INSIDE VIEW-CONTROL PANEL

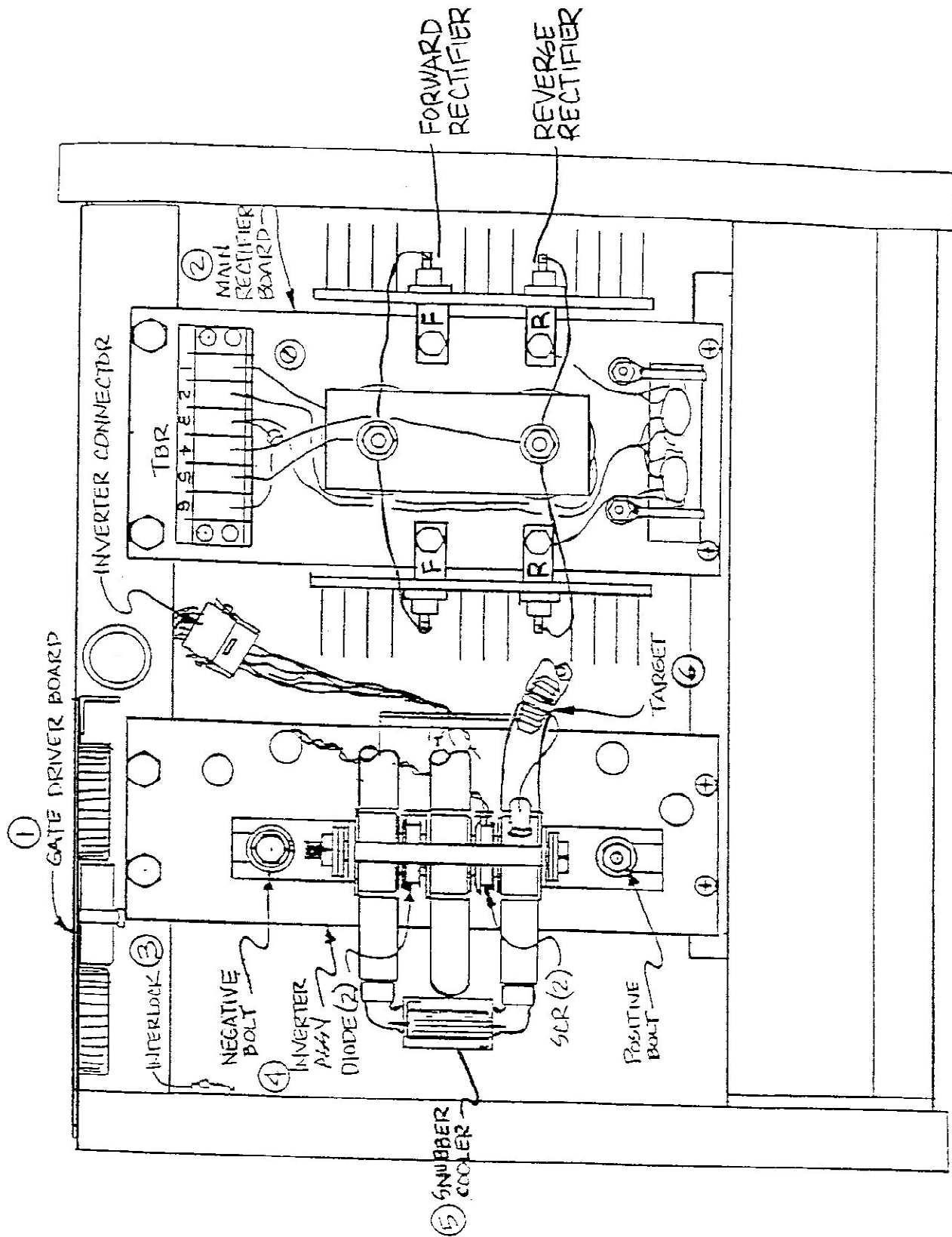
ITEM NO.	PART NO.	DESCRIPTION
1	3-5148-1A	KW Power Display Board
2	3-5148-2A	Temperature Display Board
3	P.5WK001T10	Pot, 1K, .5W, 10 Turn (Temperature)
4	P.5WK0.5T01	Pot, 500 Ω , .5W, 1 Turn (Volume)
5	P.5WK005T01	Pot, 5K, .5W, 1 Turn (Power)
6	FLOWMETER-20CFH	Flowmeter, Panel MT, Scale 5-20, A6
7	GAGE-VAC-30	Vacuum Gauge, 30" HG
8	SWITCH-SPDT-ALT	Switch, SPDT, ALT, PB, Set
9	HORN-PANEL	Control Panel Horn
10	SWITCH-PB-DPDT	Switch, PB, ALT, DPDT, POWER/HEAT/VACUUM
11	INDICATOR-1	Indicator Housing, OVER LOAD/OVER TEMP



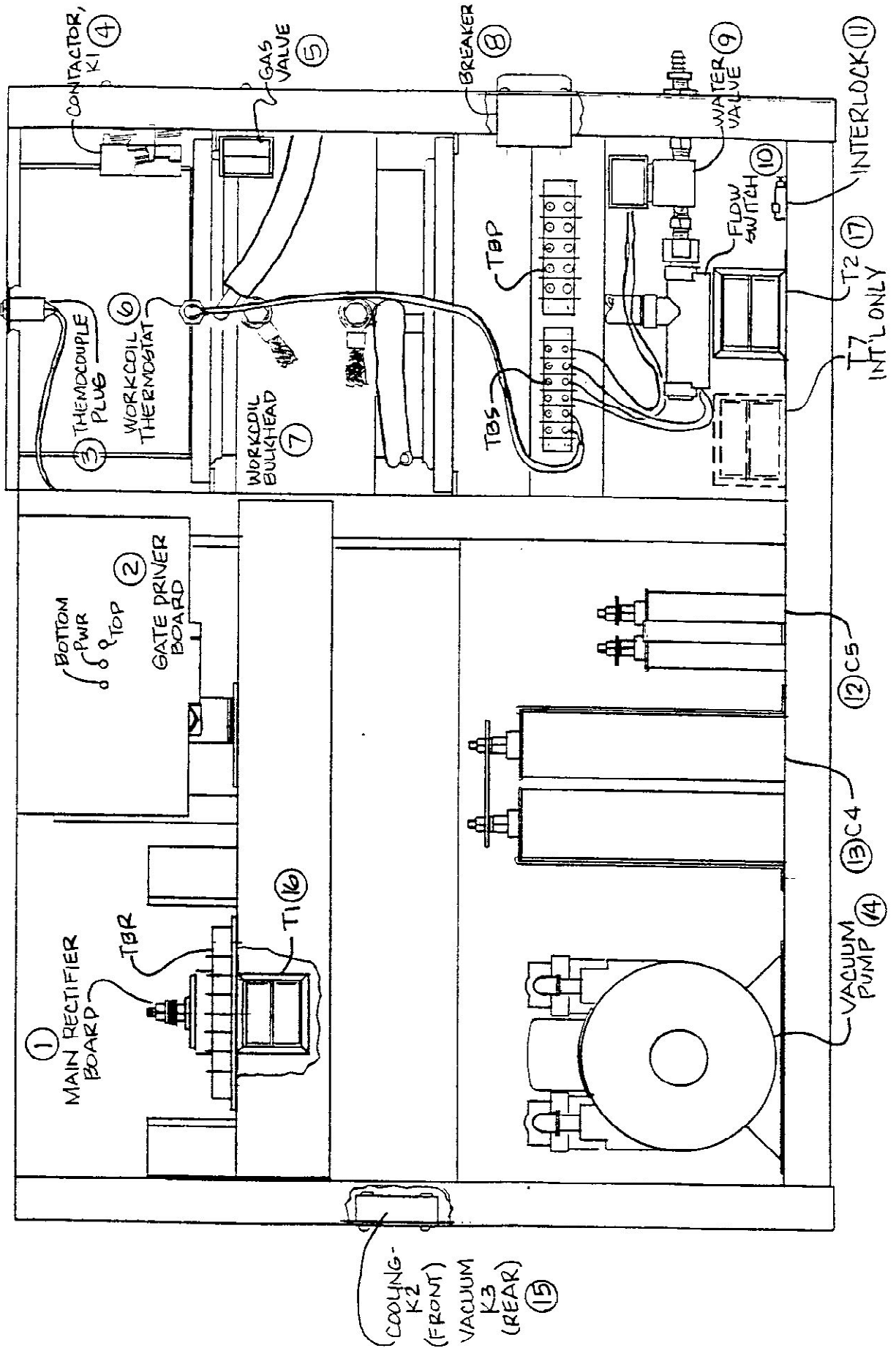
INSIDE VIEW - CONTROL PANEL



INSIDE VIEW - CONTROL BOX
MODEL 5100



TOP VIEW - RECTIFIER AND INVERTER
MODEL 5100



REAR VIEW - MODEL 5100