INSTRUCTION MANUAL

MODEL: 5 BELL JAR

SERIAL NO: SBJ-2641
INDEX

I INTRODUCTION & GENERAL DESCRIPTION

II UTILITY REQUIREMENTS

III SPECIFICATIONS

IV INERT GAS KIT

V POWER SUPPLY

VI EVACUATION KIT

VII FIELD SERVICE

VIII WARRANTY

IX INSTALLATION

X OPERATING INSTRUCTIONS

XI MAINTENANCE AND SERVICE

XII DRAWINGS

XIII OPERATING SPARES
I  INTRODUCTION AND GENERAL DESCRIPTION

The CENTORR 5 BJ Arc Melting Furnace will give years of satisfactory performance when used in those applications where high temperature arc operation is required.

This System consists of:

- Complete Bell Jar Assembly With Lower Cover Flange
- Hearth
- Stinger (Electrode) Assembly
- Hinge and Quick Clamps
- Inert Gas Kit

The entire inside of the vacuum chamber is designed to conform to the best high vacuum practices with particular attention given to surface finishes and choice of construction materials. Rough interior surfaces, inferior materials, internal coolant connections or the like are not found in CENTORR furnaces. A sight port is provided for visual observation of the work area.

Loading is done by opening the hinged bell jar. The bell jar is hinged by means of a double-pin hinge so as to prevent scuffing of o-ring gasket. Clamps are provided for operation to slightly positive pressure.

The stinger (electrode) assembly includes a welded stainless steel bellows and swivel ball joint. Provision is made for purging the inside of the bellows with inert gas to prevent air leakage into the bell jar when the stinger is moved during use.

The unit is ready to operate as soon as connections are made to appropriate power supply and water supply and drain. The furnace is completely assembled and leaked checked prior to shipment.
II UTILITIES

1. Water: 4 GPM @ 70°F @ 50 PSI
2. Inert Gas: 2-10 CFM
3. Electrical: Up to 1000 Amp D.C. welding power supply maximum 30 volts
4. Weight: Approximately 90 lbs.

III SPECIFICATIONS

1. Chamber: All stainless steel, water jacketed, nominal size: 10" I.D. x 12" High
2. Electrode (Stinger): Water-cooled copper, .88" diameter capable of up to 1000 Amps
3. Stinger Tip: 1/4" diameter thoriated Tungsten
4. Arc Starter: 1/4" diameter thoriated Tungsten rod
5. Hearth Plate: 9" diameter copper, water-cooled (Cups are machined into top surface of Hearth to suit customer requirements)
6. Sight Port: Flanged port provided with 1.50" diameter sight window
7. Illumination Port: Flanged port provided with 1.38" diameter window and Centorr light assembly
8. Base Plate: Aluminum base plate with evacuation port and mounting holes
9. Mounting: Unit is designed for counter-top mounting. Provisions must be made for evacuation line and power line through top of counter
IV INERT GAS KIT

For inert gas operation, inlet valves, relief valves and a combination pressure-vacuum gauge are provided. To operated with helium, argon or other inert gas, the chamber can be evacuated by means of the pumping system and then backfilled with the desired inert gas.

V POWER SUPPLY (By Customer)

VI EVACUATION KIT (By Customer)

VII FIELD SERVICE

UNLESS YOU ARE THOROUGHLY FAMILIAR WITH THIS TYPE OF FURNACE, WE STRONGLY RECOMMEND THAT YOU PURCHASE ONE OR TWO DAYS OF FIELD SERVICE TO ASSIST YOU DURING INSTALLATION AND TO HELP TRAIN YOUR FURNACE OPERATOR.

The services of a field service engineer to supervise installation and initial start-up, available at the rate of $450.00 per day plus reasonable travel and living expenses, are not included. The services of the engineer for maintenance and repair are available at the same rate.

VIII WARRANTY

Any defect in workmanship or material which may become apparent under normal use in any product sold by CENTORR will be repaired or replaced provided written notice of such defect is received by CENTORR within one (1) year from date of shipment. Responsibility will be limited to such repair and/or replacement. Expendable items such as electrode tips and hearth cups are not included in this warranty.

OPERATING/MAINTENANCE MANUALS

Two (2) sets are included in basic price of this equipment.
IX  INSTALLATION

1. Remove Arc Furnace from shipping crate. Inspect carefully for damage.

2. Install the stinger as shown in the Chamber & H.Z. Assembly drawing.

3. Place furnace in convenient location and connect the water-cooled power cables from the power supply to the Arc Furnace with the positive lead to the base (work) and the negative lead to the top (stinger). Water feed is the positive lead with the negative lead at the return to the drain at the power supply.

4. Connect a water inlet to the bottom hose barb on the chamber, and a drain at the hose barb on the top of the chamber. Connect water inlet to the base (hearth plate) and a drain to the barb on the stinger. See the water schematic for clarification.

5. Connect a pumping system to the evacuation port in the center of the base. (Blank off the port if no pumping system is used).

6. If possible, evacuate and leak check the system to insure that no leaks have developed during shipping and installation.

7. The system should have a water interlock so that power cannot be applied to the stinger unless an adequate amount of water is flowing through the system.
X OPERATING INSTRUCTIONS

1. Open the furnace by loosening the clamps and lifting the chamber. Place a small amount of titanium and the work to be melted on the hearth and close and fasten the chamber.

2. Purge the furnace with gas for about five minutes at five to ten CFI and turn on water.

3. Purge the stinger. (Do not remove it)

4. Adjust the power as required on the power supply and then turn on the power supply.

5. Push stinger down to strike the arc and melt the titanium to remove additional impurities that may be still inside the work area. Use the sight window shield when the arc is bright to protect operator's eyes.

6. Proceed to melt the sample by striking an arc on the specimen and working around until the material is completely melted and forms a ball. Retract the stinger to break the arc.

7. Turn off power supply. When sample is cool, open the furnace and remove the sample.

XI MAINTENANCE

1. To repair or replace electrode, either open the chamber and push stinger all the way in or pull stinger out of the ball assembly. Loosen the set screw and remove the tungsten set screw.

2. To inspect swivel ball and replace o-rings, remove stinger. Remove bellows assembly. Remove the cap screws that hold the retainer. Remove the retainer and swivel ball. The o-ring in the ball housing should also be inspected periodically.

3. The o-ring in the base plate should be checked for cleanliness each time the chamber is opened.
MODEL NUMBER: 5 Bell Jar

SERIAL NUMBER: 2641

<table>
<thead>
<tr>
<th>A. Chamber &amp; Heat Zone Assembly</th>
<th>Qty</th>
<th>Price Ea.</th>
</tr>
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<tbody>
<tr>
<td>1. Quartz Disc 3&quot; OD x .12 Thk</td>
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<tr>
<td>2. O-Ring 10-149 Viton</td>
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<td>3. O-Ring Viton 10-118</td>
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<td>4. O-Ring Viton 10-212</td>
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<td>5. O-Ring Viton 10-232</td>
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<td>6. O-Ring Viton 10-129</td>
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<td>7. O-Ring Viton 10-378</td>
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<td>8. O-Ring Viton 10-216</td>
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<td>9. O-Ring Viton 10-263</td>
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<td>10. Quad Ring Minnesota #Q4329</td>
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<tr>
<td>Compound 412A</td>
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<td>11. Washer</td>
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<tr>
<td>12. Quartz Disc 1.812 x .12 Thk.</td>
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<td>40.00</td>
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<tr>
<td>13. Striker Button 2% Thoriated Tung. 1/4&quot; Diameter x .62 Lg.</td>
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<tr>
<td>14. Welding Tip Thoriated 2% Tungsten 1/4&quot; Dia. x 3&quot; Lg.</td>
<td>1</td>
<td>42.00</td>
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B. Inert Gas Kit

| B58-0139 | 1 | 20.00 |
| 1. Relief Valve Hoke #6113P2B | | |
| 2. O-Ring Viton 10-111 | 3 | 1.05 |
| 3. Relief Valve Circle seal 559-B-1M-10 | 1 | 30.00 |

ALL PRICES ARE IN U.S. DOLLARS, F.O.B. SUNCOOK, N.H., USA AND ARE SUBJECT TO CHANGE WITHOUT NOTICE. MINIMUM ORDER IS $25.00. TERMS ARE 1% 10 DAYS NET 30 DAYS AFTER RECEIPT OF INVOICE.

EFFECTIVE DATE: October 28, 1987
XII DRAWINGS

General Arrangement .................................................. C01-0447
Chamber & H.Z. Assembly .............................................. D03-0086
Inert Gas Kit .............................................................. B58-0139
CENTORR ARC MELTER

Operating Instructions

n.b. Familiarize yourself with the operating procedure before attempting to melt anything. Failure to do so will result in damage to the melter and probable personal injury. (Inflicted by me if not the arc melter)

Before using, see Paul Munroe or Vic Surprenant

1. Before melting anything make sure the materials to be melted
   a) aren't wildly reactive
   b) That the melting points of all the component materials is less than ~2000°C
   c) That some of the materials don't have boiling points below the melting points of other elements that they are to be melted with.
   d) materials are non-toxic etc.

2. Open the furnace chamber by loosening the clamps and lifting the bell. Place charge in middle of copper hearth, or the recessed region of the copper crucible. Make sure stinger has tungsten electrode in place, ensure the tungsten electrode has a sharp point. If not remove electrode and grind to point. Close lid, fasten clamps.

3. Turn water on at wall switch. There are four water in/outlets mounted on the wall. They will be called, from the left hand side 1, 2, 3, and 4. 1 flows water into the chamber, this fills, and cools, the bell of the chamber and flows out through outlet 4.
2 flows water through the base of the crucible, through the power supply, through the stinger and out through outlet 3.

4. Turn the argon on, adjust the flow rate to \(~10\text{ psi}\). The argon will flow into the chamber, fill the chamber (n.b. Ar is more dense than air) and the excess pressure of argon will flow out through the valve on the right hand side of the chamber. Allow argon to flow through for 5-10 minutes before melting.

5. Turn on power supply at wall switch
Turn on power at left hand side of power supply
Adjust current according to melting point of material, for \(~1300\text{°C}\) for example need \(~375\text{A}\) (on low range). n.b. there are two scales for the power supply, make sure you are on the right one.

6. Gently, lower the stinger toward the charge, when the stinger is just above the melt an arc will strike. As the arc strikes there will be a very bright flash, turn the window shield to protect your eyes. In spite of the reaction which occurs as the arc is struck, do not adjust the position of the stinger. Pulling the stinger up will extinguish the arc, and leave a partially melted lump of the charge stuck on the tungsten electrode. Pushing the stinger further down will drive it into the copper plate.

7. After the initial striking of the arc, you may gently adjust the position of the stinger. Slight height adjustments will change the current. Slight sideways movement of the stinger will allow you to 'work' the molten specimen into a ball.
8. Working the specimen will increase homogeneity. Maintain a melt for ~2 minutes. Slowly retract the stinger, this will break the arc. With the stinger raised, turn the current off.

9. After ~2-5 minutes turn off the argon supply raise clamps and open the bell, do not touch specimen with bare hands until you are sure it is cool.

10. After ~10 minutes, i.e. when the specimen is cool, turn off water supply.

11. Make sure:
   a) Copper plate/crucibles are clean and free from contamination, use fine grit paper to remove oxide
   b) The tungsten electrode is sharp for the next user.

PRM 4/22/90