



Vacuum Group Procedure VA-008.18.1.30  
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Revision 01

**\*\*IMPORTANT\*\***

PRIOR TO THE PERFORMANCE OF ANY WORK WITHIN THE SCOPE OF THIS PROCEDURE, IT IS THE RESPONSIBILITY OF THE SUPERVISOR TO ENSURE THAT ***WORK PLANNING*** HAS BEEN REVIEWED FOR THE PROTECTION OF WORKERS, EQUIPMENT, AND THE ENVIRONMENT.

**1. PURPOSE:**

1.1 To provide an effective procedure for AGS vacuum technicians to safely operate the cathode firing oven.

**2. RESPONSIBILITIES:**

2.1 The AGS vacuum supervisor shall be responsible for the implementation of this procedure.

**3. DISCUSSION:**

3.1 This procedure is written so that trained AGS vacuum technicians will be able to bake out, while under a vacuum, ion pump parts in a safe & efficient manner. This procedure is divided into 4 sections:

A) Hoist; B) Gate Valve; C) Heaters D) Venting.

**4. PRECAUTIONS:**

4.1 Do not attempt to raise the hoist while under vacuum.

4.2 Verify that the pieces to be baked do not extend beyond the shelf.

**5. PREREQUISITES:**

5.1 The technician will have been trained in this procedure.

5.2 Electrical Safety 15.17.00.04

5.3 Activation Worker Training (BNL OH&S Guide 3.5.0)

5.4 Fluke Meter or equal, capable of reading ohms

5.5 Affected Persons Training 15.12.00.01

**6. OPERATIONAL PROCEDURE:**

6.1 OPERATION:

6.1.1 Hoist

6.1.1.1 Insure that vent valve is open before raising hoist or prepare to re-install boot gasket.

6.1.1.2 Attempting to raise hoist with chamber under vacuum will result in unknown consequences.

6.1.1.3 Some scuffing of nickel shielding is to be expected when raising hoist.

6.1.1.4 Do not allow pieces to extend beyond shelf.

6.1.1.5 After lowering hoist check for heater shorts; Unplug system to isolate ground from neutral line.

6.1.1.6 Probe ammeter from bottom-right terminal on heater contactor K2 to ground. Resistance should be megohms or more.

6.1.2 Gate valve:

6.1.2.1 Do not open gate valve with pressure differential. Observe vacuum gauge reading. Pump down or vent pumping station as required before opening valve.

6.1.2.2 Interlocks

- a) A seven minute interlock bypass timer allows pump down time for turbo rpm and vac pressure interlocks to clear. Timer starts with valve open command. Timer resets with valve close command.
- b) Turbo interlock relay d1 is activated by TCP 270 pump station electronics when turbine is >80% of full speed. Relay is located near clock on pump station and has built in indicator lamp
- c) Vacuum pressure interlock relay K3 will close valve if pirani gauge pressure rises greater than set point.

6.1.2.3 Switch (SI) momentary toggle. Hold in open position until valve is fully open. Valve solenoid is latched open by open indicator switch. If valve will not latch open, reset seven minute timer by momentarily switching valve closed. Start pumping station promptly after opening gate valve.

6.1.3 Heaters:

6.1.3.1 Momentary push buttons on right side of control panel activate variac contactor K2 if interlocks are satisfied.

6.1.3.2 Interlocks:

- a) Vacuum pressure relay K3 allows heater operation when pressure is less than set point.
- b) Water pressure switch insures that cooling system is operating before heaters can be turned on. Located on hoist stand.
- c) Variac interlock micro switch is actuated when variac is turned to zero volts to allow heater turn on.
- d) Observe ammeter when using variac. Do not exceed 30 amps. Heater current will decrease with temperature. Turn up variac slowly to maintain full scale reading on ammeter.

6.1.4 Venting::

6.1.4.1 After chamber cools down connect dry nitrogen supply to vent valve.

6.1.4.2 Insure that gate valve is closed. Vent slowly to avoid dislocating nickel shielding. Pressurizing chamber may dislodge boot gasket.

7. REFERENCES:

6.1 NONE

8. ATTACHMENTS

6.2

## ATTACHMENT

### I. GENERAL

Belljar type vacuum system with turbo molecular pumping station. 65 x 24 inch aluminum base allows transport with pallet jack or fork lift.

Three layers of nickel shielding insulate oven chamber system can maintain temperature of 600 degrees centigrade with only 1800 watts. (70 volts x 25 amps)

Four wire mesh shelves permanently mounted are 11 inches in diameter and five inches high surrounded by a single molybdenum heater ribbon. Typical operating parameters are  $1 \times 10^{-6}$  torr @ 600 degrees C. 208 3 phase 30 amp service required. 80 PSI pneumatic pressure. Manual vent valve located on 2 3/4 inch conflat base plate feedthru at rear of system.

### II. EQUIPMENT DESCRIPTION

- A. Hoist - No operator's manual available. 110 VAC reversible motor. Upper limit switch has limited range of adjustment.
  - A.1 Observe headroom.
  - A.2 Lower limit switch is adjusted so that hoist mast slides out of yoke 3/8 inch thereby resting entire weight of bell jar on base plate.
  - A.3 Hoist is interlocked by vacuum gauge set point relay K3 terminals six and five interrupt relay power (24 VAC) to hoist motor control box when vac pressure is below set point.
  
- B. Vacuum gauge
  - B.1 Granville Phillips convectron gauge with process control option. A pirani type sensor mounted on 2 3/4 inch conflat flange is located on base plate feedthru. Control unit mounted in control panel has internal pressure set point relay which activates relay K3 when pressure is below set point. See manual for details.
  - B.2 Balzers cold cathode gauge on 2 3/4 conflat flange located near vent valve at rear of system. operating pressure depends on cleanliness of pieces being baked and chamber temperature.
  
- C. Temperature indicator - Omega thermocouple displays chamber temperature in degrees centigrade. Two type K thermocouples are provided; one is mounted to shelf support and the other is free standing. Feedthru connector is located on 2 3/4 inch conflat next to pirani gauge. Typical operating temperature 600 degrees C. See manual.
  
- D. Pump station 208 volt single phase.
  - D.1 Balzers horizontal turbo pump model TPU 270. See manual.
  - D.2 Control unit TCP 270 includes clock and interlock relay which are activated when turbine is greater than 80% of rated speed. See manual.
  - D.3 An exhaust filter has been added model ONF 025. May require periodic maintenance. See manual.
  - D.4 Leak test and isolation valves are located between turbo and mechanical pumps.
  - D.5 Mechanical pump DUO 012A See manual.

- E. Cooling system.
  - E.1 Heat exchanger CP-4 cools bell jar water jacket. 208 volts single phase. Five amp fuses are internal. A water pressure interlock switch has been added to outlet side of unit. See manual.
  - E.2 Feedthru cooling fan runs continuous. Failure may damage feedthru.
  - E.3 Variac fan activated by heater contactor K2.
  - E.4 4) Two turbo fans are wired in series to turbo control.
  
- F. Variac.
  - F.1 208 VAC primary activated by relay contactor K2. Max secondary output rated 30 amps continuous. Max output voltage in this application is 75 volts @ 700 degrees C
  - F.2 Modifications;
    - a) Cooling fan
    - b) Communicator stop to prevent over driving heater.
    - c) Interlock micro switch is depressed when communicator is turned to zero output and is required to latch contactor K2.
  
- G. Variac.
  - G.1 Requires 80PSI regulated filtered and lubricated.
  - G.2 Sealing O ring faces pump.
  - G.3 Interlocks;
    - a) Vacuum pressure interlock relay K3 terminals 11 and 9 prevent valve from remaining open when pressure is less than set point.
    - b) Turbo rpm interlock relay d1 terminals one and three prevent valve from remainin9 open if turbine slows for any reason.
    - c) A time delay relay 1S activated when gate valve is opened. Normally closed terminals one and four bypass valve interlocks for seven minutes to allow vac gauge K3 and turbo rpm d1 to close.
    - d) Gate valve remains closed after power interruption.

### **III. OPERATION**

- H. Hoist
  - H.1 Insure that vent valve is open before raising hoist or prepare to re-install boot gasket.
  - H.2 Attempting to raise hoist with chamber under vacuum will result unknown consequences.
  - H.3 Some scuffing of nickel shielding is to be expected when raising hoist.
  - H.4 Do not allow pieces to extend beyond edge of shelf.
  - H.5 After lowering hoist check for heater shorts; Unplug system to isolate ground from neutral line. Probe ammeter from bottom-right terminal on heater contactor K2 to ground. Resistance should be megohms or more.
  
- I. Gate Valve
  - I.1 Do not open valve with pressure differential. Observe vacuum gauge reading. Pump down or vent pumping station as required before opening valve.
  - I.2 Interlocks -
    - a) A seven minute interlock bypass timer allows pump down time for turbo rpm

and vac pressure interlocks to clear. Timer starts with valve open command. Timer resets with valve close command.

- b) Turbo interlock relay d1 is activated by TCP 270 pump station electronics when turbine is >80% of full speed. Relay is located near clock on pump station and has built in indicator lamp.
  - c) Vacuum pressure interlock relay K3 will close valve if pirani gauge pressure rises greater than set point.
- I.3 Switch (S1) momentary toggle. Hold in open position until valve is fully open. Valve solenoid is latched open by open indicator switch. If valve will not latch open, reset seven minute timer by momentarily switching valve closed. Start pumping station promptly after opening gate valve.

#### J. Heaters

J.1 Momentary pushbuttons on right side of control panel activate

J.2 Variac contactor K2 if interlocks are satisfied.

J.3 Interlocks

a) Vacuum pressure relay K3 allows heater operation when

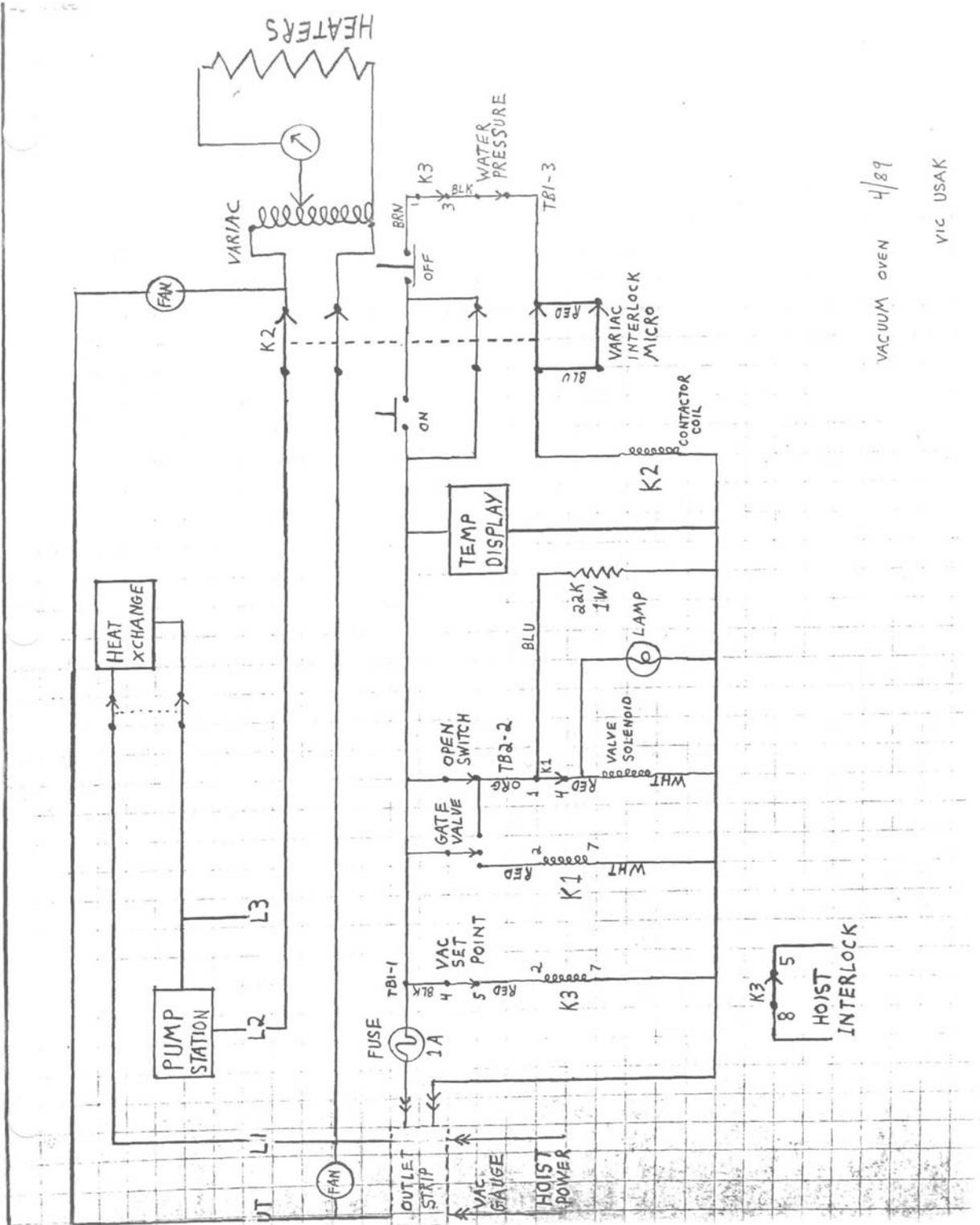
b) pressure is less than set point.

c) Water pressure switch insures that cooling system is operating before heaters can be turned on. Located on hoist stand.

d) Variac interlock micro switch is actuated when variac is turned to zero volts to allow heater turn on.

J.4 Observe ammeter when using variac. Do not exceed 30 amps. Heater current will decrease with temperature. Turn up variac slowly to maintain full scale reading on ammeter.

K. Venting - After chamber cools down connect dry nitrogen supply to vent valve. Insure that gate valve is closed. Vent slowly to avoid dislocating nickel shielding. Pressurizing chamber may dislodge boot gasket.



VACUUM OVEN 4/89  
VIC USAK