Copper Tungsten Furnace Operating Instructions

Scope: Over view, Layout, Operating Instructions and Trouble Shooting for BTU Furnace.

Sections: 1.0 Furnace Overview

2.0 Equipment Layout

3.0 Operating Instructions

4.0 Troubling Shooting

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1.0 Overview

1.1 Furnace is a BTU International Molly Element Pusher Furnace Model: BTU MR64-345E48S

1.2 **Power:** 480 VAC, 3 phase, 70 Amps

1.3 **Gases:** Hydrogen, Nitrogen and Natural Gas,

1.4 **Water:** D I Water And Process Cooling Water

1.5 **Main Elements:** 6 Molly Elements in 3 Zones

1.6 **Controls:**

1.6.1 **Main Elements:** Barbara Coleman Model Q15 Controllers and Halmar Models SCR'S

1.6.2 **Pusher:** 1/3 Hp Bodine DC motor with a Bronco Model xxx Dive, Controlled by SECO DS9000 Digital Controller. Pushing Sequence is controlled GE Series one PLC.

1.6.3 **Alarm Systems:** are Monitored by GE 28pt Micro PLC Displayed on Maple model 460C OIT. Alarm alerts, Visual is a Yellow strobe and audio is a Federal horn.

1.6.4 **Thermocouples:** Furnace 6 each dual Type "C" (W-5-25). Saturator is one Type "E".

1.6.5 **Under-Temp and Over-Temp:** are monitored by Bruce Multi-T/C Unit and controlled by 2 Each Honeywell Dial-A-Trolls.

1.6.6 **Gas Control System:** is a Bruce Gas Control System. Flame Curtains are Controlled by Honeywell Igniter Systems.

1.6.7 **Saturator Temperature**: is controlled By Omega CN9000 On/Off Controller . Saturator has restive heating Elements.

1.6.8 **Furnace Cooling:** is done by Plant Process Water With City Water back-up. The Process Water is monitored for flow and temperature, a failure of either will cause back-up City Water to flow.

1.6.9 **Back up power for Gas System:** is a 24 VDC Battery System, which comes in upon Power Failure.

2.0.0 Equipment Layout

2.1.0 Entrance Section

2.1.1 **End Plate** (west end), has the Pusher Controls located on the white panel. There is also a receptacle which the top is used for speed checking and the lower is for 110 VAC power. The T/C test jacks are not used.

2.1.2 **Center Section** houses the Series 1 PLC for speed control located on the west end. Zone 3 Transformer is located in the center. At the east end is the pusher drive motor, clutch and gear assembly.

2.1.3 **Front Side** is where the Entrance Section attaches to Furnace body is located the Hydrogen and Nitrogen gases flow control panel. The front flame curtain gas controls are located here, also. The flame curtain failure reset is located just to the left of the gas control panel.

2.1.4 **Back Side** is where the entrance section attaches to the furnace body is located the Hydrogen and Nitrogen on/off valves. Emergency gas hook up provisions are located here.

2.1.5. **Top Section** has the pusher and guiding track on it

2.1.6 **Entrance Flame Curtain** is located at the entrance muffle of the furnace. It has an spark Igniter and flame Detector located on the back side of the curtain.

2.3.0 Furnace Section

2.3.1. This section contains the high heat section and main gas chamber and must be *Air Tight.*

2.3.2 There are three access plates on top of the Furnace allowing access to fire chamber. These plates are sealed to the furnace using silicone gaskets. These gaskets must be cooled using process cooling water.

2.3.3. On top of this section are six [6] type “W 25” thermocouples, two [2] each per zone. One is used for control and monitoring and the second is for over temp. In the center of this section is the main Nitrogen Purge unit.

2.3.4. Under the firing chamber are located zones 1 and 2 transformers. The wet hydrogen injection ports are located in the bottom of the firing chamber.

2.3.5. On the south side top is located the six stud assembly which attaches to the molly elements. This stud assembly is air tight and special procedures are required for attaching these units.

2.3.6. The three Halmar SCR’S are located on the south side bottom of firing chamber. In the center there is a Nitrogen injection port.

2.4.0. **Exit section**

2.4.1. **The Exit Cooling Muffle** is attached to the firing chamber exit. The unit is cooled by process water.

2.4.2. **The Saturator** is located on the north side of exit section were it attaches to the firing chamber. Next to the saturator are the process water flow monitors.

2.4.3. **Below the cooling muffle** and unloading track are the main electric’s of the furnace. On the north side there is located the main contactor, unit control relays, Lambda 24 Volt power supply, 480 Volts furnace fuses and control power transformers. On the south side is the Micro alarm

computer, trickle charger, over temp systems, control power fuses (480,120 VAC and 24 VDC) and vacuum pump.

2.4.4. **The Dew Point Meter** is located on the south front of the exit section next to firing chamber.

2.4.5. **The Temperature Control Panel** is located above Dew Point Meter in separate box. This controls the Furnace temperature, speed, displays alarms and monitors the cooling water.

2.4.6. **The Furnace control panel** is located at the south front of the exit section. This controls the Saturator, Wet Air System, Flame Curtain System, Vacuum Pump, Furnace Control (480 volt system) and Over and Under temp control. The amp meters for furnace zones are located on this panel also.

2.5.0. Other

2.5.1. **Emergency City Water System** is tied into the furnace above the process water monitoring controls on the north side of the furnace.

2.5.2. **Backup batteries** are located in separate cabinet underneath the exit end rollers.

3.0.0. Operating instructions

3.2.0. **Flame Curtains**

3.2.1 There are flame curtains located at each end of firing chamber. They consist of the gas assembly, flame sensor and flame failure assembly.

3.2.2. Turn the Keyed Switch marked Pilot, located on the Furnace Control Panel to the *on* position. The light marked *Pilots On* will illuminate. This will turn on the pilots flame. When flame is detected it will turn on main flame curtain. Then the Green Flame Curtain Safe Light will illuminate. This switch will also start the exhaust fan for the curtain exhaust. The Blue Exhaust light on temperature panel will light.

3.2.3. If there is a pilot flame failure the Red System Failure Light will illuminate (If Cover Gas is On a failure will drop out cover gas and the Purge Light will illuminate.). The OIT (Operator Interface Terminal) will display what end failed. The Flame Failure Lockout control must be reset. They are located on the south side of the Furnace near each Flame Curtain. Press the White Reset Tube on the unit, there should be a click and the system should start. If the system does not, reset, wait several minutes and retry. Press Red System Failure to reset.

3.2.4. If Cover Gas is in use, press Red System Failure button to reset system. Then press Start Cover Gas button to restart Cover Gas.

3.3.0 Main Furnace

3.3.1. Non-Explosive Gas

Non-Explosive Purge is required when starting up furnace. First push White Control Power Switch, Control Power Light will light up. Open Number 6 Flow Meter (nitrogen) to 2/3 flow. The Yellow Purge Light will light.
A minimum purge of 4 hours is needed.

After furnace has been purged and started - adjust all Nitrogen Flow Meters for process applications.

3.3.2 Heating Furnace.

Before starting furnace make sure that the Q15 Controller has been programmed (See programming section) and set Over-Temp to the desired temperature.

Press the Heater On/Off Button to the on position. This will turn on the Main Heater Contactor when Heater Reset is pushed. In case of an Emergency pressing the OFF BUTTON will kill power to the heating elements but not to the rest of the Furnace.

The **Red Heater Reset** will light.
On each of the Q15 Controllers Press the Run/Hold-Reset Button for five [5] seconds (making sure that the Run Light is off).

Press the Manual button on the Controller. The Yellow Manual LED will light. The Yellow Display should read *~ 0.0 * (This is % output). If not Press the Down Arrow until it reads * 0.0*. The Controller is now in Manual Mode with Zero % Output.

Press the Heater Reset button on the Furnace Control Panel. If the Over-Temp is set right the Yellow Heaters will light and the Heater Contactor will energize.

To run the Furnace *manually* , With controller in the Manual Mode use the Up and Down Arrows to control the % output. Do not Exceed 20 Degrees per out rate of rise.

To run the Furnace in the Auto mode Press the *Auto/Manual* indicator - the Manual LED will go out. Press the Run/Hold/Reset button and the Green Run LED will light. The Lower Display will show the number “1” for the first Segment, and the Set point. The Furnace is now running in Auto.

If the necessary to run in other Segment press the SP Select/Advance button for about four [4] Seconds (Or until the segment number changes). Repeat this procedure until the desired segment is reached.

To put the program on Hold press the Run/Hold/Reset once, Hold LED will light. To resume - press it again and the Run LED will come on and the program will continue.

To abort the program press the Run/Hold/Reset button for about five [5] seconds or until the Run LED goes out. The program is now stopped.

To change the Setpoint of a segment - while the system is running - will require stopping the program.

First: Press the Run/Hold/Reset button for about five [5] Seconds or until the Run LED goes out.
The program is now stopped.

Second: press the Setup Button once, the Display will Show “Setup”.

Third: Press the Setup Button three [3] more times until “Prog” is displayed.

Fourth: Press the Auto-Tune/Function Button five[5] times until “SS 1” is displayed.(this is the first segment). Pressing the Auto-Tune/Function Button six [6] more time’s will scroll down to the next Segment (SS 2) and so on.

Fifth: When the desired segment is reached it will become necessary to change both Setpoint (SP X) and Step Time (tn X) for each segment. Scroll once to “SS X” and use the arrows to change the set point. Scroll 2 more times to “tn X” and use arrows to change time. When finished, scroll to next segment. Note when changing the last or soak segment it is also necessary to change the segment prior to this segment also.

Sixth: When finished, press the Display button to exit the Program Mode.

Seventh: To run the furnace press the Run/Hold/Reset Button and the Green Run LED will light. The Lower Display will Show the number “1” for the first Segment, and the Set point. The Furnace is now running in Auto. If the necessary to run in other Segment press the SP Select/Advance button for about four [4] Seconds (Or until the segment number changes). Repeat this procedure until the desired segment is reached.

3.3.3. Explosive (Process Cover Gas)

Shut off all hydrogen flow Meters

Cover Gas is applied to the Furnace after 760 degrees C. The Under-Temp Controller prohibits Cover Gas being applied bellow 760 degrees C. After the temperature reaches 760 degrees press the Red System Failure switch. The Red Light will go out and Cover Gas System will be enabled. If the light stays on check to see if Hydrogen Valve is on, the Flame Curtains are on and that the Temperature is above 760 degrees C.

When the System Failure Light is out press the Start Button on the Cover Gas Control section of Furnace Control panel. The Cover Gas On light will come on. Then adjust Hydrogen Flow Meters to the proper flow.

3.3.4. Saturator

When the Furnace reaches 1200 degrees C the Saturator can be turned. Press the *Saturator On* button. This starts the Saturator System. The System is auto filling for water. Press the Heat Button. This starts the Saturator Heater. The Yellow Heat On light will be on. The temperature is controlled by the Omega Controller located on the Temperature Panel.

3.3.5. Changing Speed

1) To change speed, first determine what speed is needed.
2) If the speed already has a known constant, enter the constant into the DS 9000 Controller.
3) If the speed does not have constant then take constant for *one inch per minute* and multiply it by the new speed needed. This will give a starting point for new speed.

4) Press Speed (F3) on the OIT, this will display the Speed Screen. Check Speed Alarm Setpoint and see if it is the same as the speed desired.

5) If not - press the Off (F6)Key on the OIT for several seconds until the Change Speed Screen appears.
6) Press Clear Key - then enter new alarm value. The decimal is fixed - for value of one or greater, two numbers are required E.g. 11 for 1.1.

7) Then press the Enter Key

8) Press the F6 Key until the Speed Screen appears.
The Alarm Set Point now has been set.

9) Start the pusher in Auto and running Forward.
Observe the speed on the Speed Screen.

10) Wait one minute after the unit is moving to allow the unit to get an accurate reading before changing speed.

11) Use the Up and Down Arrows to change constant value until desired speed is reached.

12) Wait one minute again then check speed .

13) Repeat process until desired speed is reached.
It may take several steps to reach desired speed.

14) If the Speed Alarm goes off during this process just press Horn (F8) Key .

15) After speed is reached then record constant for future use.

16) If alarm had gone off now push Alarm Reset (F7) Key .

3.3.6. Pusher

Manual Mode

1) Turn Red Selector Switch to the On Position.

2) Press the Red Hand Button, The Button light will light. Pressing of the Hand Button again will shut off the Hand Mode. Pressing of the Green Auto Button will stop the Hand Mode.

4) By pressing either Green Forward or Reverse buttons will move the pusher in that direction. Releasing the button will stop the pusher.

Auto Mode

1) Turn Red Selector Switch to the On Position. This will also turn on DS 9000 Controller on the Temperature Panel.
2) Press the Green Auto Button, The Button light will light. Pressing of the Auto button again will shut off the Auto Mode. Pressing of the Red Hand Button will stop the Auto Mode.
3) By pressing either Green Forward or Reverse Buttons will start the pusher running in that direction automatically. The light will flash in the direction that it's running in automatically.

4) To stop running in the Auto Mode either press the Auto or Hand Buttons

3.3.7. ALARMS

1) If the system detects an Alarm it will sound a Horn and a Yellow Light will flash above the control panel.

2) To silence the Horn press the Blue Horn Key (F8) on the OIT (Operator Interface Terminal). The alarm area will be displayed on the Screen of the OIT.

3) Press the Help Key (F9) and instructions on what to look for will be displayed - if available. Use the Page Up (F11) and Page Down (F12) Keys to go through the help screen's.

4) When problem is corrected then press the Alarm Reset Key (F7) to clear the alarm, this will stop the Yellow Flashing Light.

5) If another alarm is detected the Horn will sound again even if the first alarm has not been reset.

The Alarms are

1) **Over Temperature**: Furnace is too hot.
2) **Under Temperature:** Furnace is below Safe Hydrogen Temperature.
3) **Low Hydrogen**: Hydrogen pressure is too low.
4) **Low Nitrogen**: Nitrogen pressure is too low.
5) **Entrance Flame Curtain Failure**: No Pilot flame at Entrance Curtain.
6) **Exit Flame Curtain Failure**: No pilot flame at Exit Curtain.
7) **Saturator Under Fill**: Saturator low on water.
8) **Saturator Over Fill**: Water level to high.
10) **Zone One Temperature Deviation**: Zone 1 has a high/low deviation.
11) **Zone Two Temperature Deviation**: Zone 2 has a high/low deviation.

12) **Zone Three Temperature Deviation**: Zone 3 has a high/low deviation.
13) **Pusher Alarm**: Pusher not pushing at set point.
14) **Pusher Retracting Alarm**: Pusher not retracting.