

SUBJECT GLASS ANNEALING - With the  
Continuous Glass Lehr

SUPERSEDED DATE

Initially used for annealing cathode-ray bulbs.

## 1. EQUIPMENT

Continuous Glass Lehr (Surface Combustion Corp. Serial No. B-7102)

- (a) Fuel - 520 B.t.u. artificial gas; 1000 cu. ft. per hr. with a continuous load.
- (b) Maximum Temperature Rating - 600°C.
- (c) Burner Equipment - Four radiant tube burners.
- (d) Auxiliary Equipment - Brown controls and Garden City fans.

Description: The Continuous Annealing Lehr utilizes the principle of convection heating. The fuel used as the heating medium is burned under automatically proportioning control in the heating zone of the Lehr. A recirculating fan, atop the Lehr tunnel, exhausts the flue gases from the tunnel and delivers these gases in a continuous supply over the burners. Thus a heated mixture is formed, the resultant temperature of which approximates the desired annealing temperature within the Lehr tunnel. These heated gases are then distributed under accurate control below the conveyor belt. As these gases flow up through the belt and around the bulbs loaded thereon, an equalization of temperature is produced in all parts of the glass thus treated. Part of the heated gases are distributed for controlling the necessary temperature gradient of the glass throughout the critical zone of annealing. This insures the steady and continuous drop in temperature necessary for the annealing cycle.

## 2. OPERATING INSTRUCTIONS

a. Starting Glass Lehr

- (1) The operator should check to make sure all gas valves are closed at the burner.
- (2) Start drive motors and fan motor in the following order:
  - (a) Turn on main disconnect switch on the panel board.
  - (b) Start control instrument.
  - (c) Start Leeds & Northrup conveyor belt speed recorder.
  - (d) Start recirculating fan.
  - (e) Start exhaust fan.
  - (f) Turn on ignition switch and check all four ignition spark plugs at the burner to make sure they have an arc of about 1/8 in. between the burner throat and the spark plug electrode.

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2. OPERATING INSTRUCTIONS (Cont'd)

a. Starting Glass Lehr (Cont'd)

- (3) Check to see that the blast gate valve in use in the exhaust lines are open; these valves should always remain part way open. In case a tube carbons up, open blast gate for that tube, say 1/4 in. more.
- (4) To light the main gas burners:
  - (a) open the hand valve in the gas line marked "Main Gas Valve."
  - (b) Press and hold down start button to safety shut-off valve, and while the button is still down raise the hand lever on the shut-off valve.
  - (c) Release the start button and the shut-off valve should remain open.
  - (d) Open the gas valve located at each burner; the gas should ignite immediately.
- (5) After the burners are lighted:
  - (a) Adjust the blast gate valve in the exhaust line.
  - (b) To adjust the exhaust and set the burners properly, remove the 1/2 in. pipe plugs in the exhaust side of the burner tube.
  - (c) Close the blast gate valve very slowly until the gas flame can be seen at the last turn of the tube.
  - (d) Lock the blast gate valve in place and replace the pipe plugs. Steps (c) and (d) must be taken on all four burners.

Flue gas analysis: Should be maintained between 9-10% CO<sub>2</sub>

b. Maintenance of Glass Lehr

- (1) Temperature control should be checked and balanced weekly.
- (2) Lubricate all motors and bearings in accordance with manufacturers' instructions. Bearings with no instructions should be lubricated every three days of operation.
- (3) Burner instructions:
  - (a) Burner gas pressure must be constant at 6-in. water column on high setting.
  - (b) Burner gas pressure must be constant at 0.5 - in. water column on low setting.

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## 2. OPERATING INSTRUCTIONS (Cont'd)

b. Maintenance of Glass Lehr (Cont'd)

(c) The burners are equipped with water gauges and should read 6-in. water column when in operation.

Note: The gas spuds in these burners are drilled with a letter M drill or 0.295-in. orifice.

c. Shutting Down Glass Lehr

- (1) Close the gas valves at each burner.
- (2) Close the main gas valve.
- (3) Stop the exhaust fan.
- (4) Turn off the ignition switch.
- (5) Stop control instrument.
- (6) CAUTION: The recirculating fan should not be shut down until the Lehr temperature has reached 100°C.
- (7) The conveyor belt should not be stopped until the furnace has reached a temperature of 250°C.

## 3. ANNEALING PROCEDURE

- a. Stand bulb assemblies face plate down on conveyor belt inserting a heat insulating pad between bulb and steel belt.
- b. The bulbs are carried into the Lehr tunnel at a rate of speed (inches per minute) specified on each FB bulb assembly (S.N. 17-1-0).
- c. As the bulb progresses through the tunnel it is first heated to a uniform temperature approximately 20 degrees above the anneal point, allowed to remain at that temperature for an interval of time depending on the thickness of the glass, and gradually permitted to cool to a temperature (strain point) below which no permanent strains are introduced.
- d. Remove bulbs at unload end of furnace. In the event that the operator does not remove the bulbs, the conveyor belt is automatically stopped by a phototube arrangement. Upon removing the bulbs, the belt may again be put in motion by pressing the starter button.

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## 3. ANNEALING PROCEDURE (Cont'd)

## Temperature Guide:

<u>Glass Code No.</u>	<u>Description</u>	<u>Anneal Point °C</u>	<u>Strain Point °C</u>
008	Lime	510	475
012	Potash Soda Lead	433	400
772	Soda Lead Borosilicate	510	484
774	Soda Aluminum Borosilicate	553	510

The above represents types of glass which are presently being used in all kinescope and oscilloscope bulbs.

STANDARDIZING SECTION  
ENGINEERING DEPT.

9-474-14-60

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