INLINE EXHAST, ILEM

Introduction:

The machine consists of an endless conveyor, a tunnel type recirculating hot air oven, exhaust cars and auxiliary equipment for processing requirements.

The purpose of the machine is to bake-out, exhaust, and process color picture tubes.

The conveyor consists of a closed, elongated loop track supported 40" from the floor by pedestals spaced on 5' centers. At one end of the closed loop is the conveyor drive unit fitted with a variable speed drive to provide from 54 to 90 tubes per hour output

The conveyor chain is made up of 4" pitch chain and support block assemblies each block being fitted with support rollers which ride on the closed loop track and a bearing pin. Each block is on 28" centers and two blocks are required to support a side-hung exhaust car. Supported by the pedestals is a water trough with associated piping to provide water-pick facilities for each exhaust car and sections of process rail to provide power take-off for the exhaust car tube process components.

The oven in the form of a "U" is made up of 26 straight sections each 10' long, two turn sections to close the "U" loop and one vestibule section, 3½' long. All 28 sections are fitted with roof mounted plenum chambers and blowers. Each plenum chamber has facilities for the mounting of calrod type heater panels. The first 25 oven sections are fitted with heater banks of different ratings and the remaining three sections are used as cooling zones.

Each 10' section is constructed of a channel and angle iron framework to which is attached a sheet metal skin for supporting 6" of insulation on top and sides and 4" on the bottom. Stainless steel sheets protect the insulation on the inner walls. In the bottom of the oven a 6" wide longitudinal slot provides for passage of the exhaust car tube support structure.

Even distribution of the recirculated air is acheived by two longitudinal air ducts mounted adjacent to the side wall of the oven, each duct having a multiplicity of slots fitted with deflector valves. Both ducts are joined at the top at one end to a central supply duct fed by the fan outlet. Return air is channelled between the back of the air ducts and the inside walls of the oven to the plenum chamber and is pulled by the blowers over the heated electrical elements to be returned as heated air to the

longitudinal ducts. Dampers are provided in both side returns and the roof. In addition an exhaust bleed-off duct is provided on each oven section and this duct is connected to a central system. In this manner make-up air is added through the bottom slot thereby creating a negative pressure at the slot. The cross sectional area of free space is 30" high by 35" wide.

The contactors controlling the blower motor and heaters in each oven section are mounted on individual panels attached to the section framework.

The control circuits for the contactors, in addition to temperature monitoring and controls, are housed in a main control panel located at the inload area of the machine. In addition, a process control panel incorporating equipment to cycle control the automatic glass tip-off process and filament activation process is located adjacent to the main control panel. Fifty-eight (58') feet of RF buss and 12 RF generators are located adjacent to the process section of the track. The RF buss is split into 28 sections, each section under the control of an RF generator. The 12 generators are capable of handling a production rate of 75 tubes per hour.

At the load/unload end of the machines provisions are made for automatically raising, holding and lowering the cage assembly on the exhaust car. In addition, a car unloading unit is located at the entrance end of the oven.

The exhaust car comprising an angle iron frame-work housing the vacuum pumping components is side hung from the conveyor by means of an angle bracket mounted at the top side of the car frame with the side thrust being taken by a tandem trolley at the bottom of the frame. The vacuum system consists of a 5CFM mechanical vacuum pump and a combination 60 liter/sec. oil diffusion pump and compression head. Provision is made to float or fix the diffusion pump from the underside of the car top.

The car top serves as a mounting for counter-weighted tube support system, a tube cage enclosure, RF coil housing support and tubulation/tip-off heater housing. A turbine pump mounted on the car base provides water cooling for the diffusion pump and RF coil

Contacts are provided on the sides of the car to pick up RF, filament and tip-off heater power. Power for the oil diffusion pump, mechanical pump and water pump is from a plug and socket connection to a trolley feed rail system mounted adjacent to the conveyor track.

Operational Data (for 90° rectangular and 70° round)

1. ILEM operational performance is determined on a clear bulb assembly which is unfritted (i.e. through use of thermocouple data obtained by running bulb assembly through the exhaust machine.)

2. Dampers and controllers are adjusted by Engineering to maintain proper air flow, temperature, and exhaust parameters.

3. Compression head torque is accomplished by hand. An alternate is to use torque wrench set at 80+ 10 inch-pounds.

4. Continuity of filaments at load end of machine must read .6 A maximum.

5. Constant current supplies are used in filament activation with attached recorder to determine misses and/or bad carts, etc.

6. Controller settings are determined by curve parameters required, such as peak temperature zone, peak temperature, etc,. Dampers are adjusted for minimum gradients across the bulb during exhaust.

7. Controllers may be used on "ON/OFF" type or adjusted to pulse using cycle rate adjustment.

8. Temperature for RF and filament activation are arrived at by the use of mounts with .005" T/C wire attached to cathodes. These are sealed into dummy necks with T/C wires frit-sealed through holes in the neck. (Activation tests are then run on ILEMs to determine "fine tune set-up" for both schedules.)

9. Sparkers used on the tube neck only at unload end of exhuast to determine air tubes (M&S only).

10. Engineering provides necessary oven controller settings, RF and filament activation schedules and tipping schedule.

11. Conveyor speed is timed by Engineering and sets speed to provide proper exhaust parameters.

12. Cooling water provided to units at 55° ± 5°F. from heat exchangers. (Md. -- 55° ± 5°F using demineralized water).

13. All temperature references made in this specification refer to the #1 T/C located in center of faceplate on a clear uncoated bulb.

Typical Inline Specs. (Lancaster)

Inline #	1
SN	--
Model #	L2702 BM-1
No. Oven Sections	28
KW/Zone	30 to 90
Cart # Series	7001-7155
# Carts	140
Oven Starts/Cart Position	82
Oven Ends/Cart Position	59
Backer Pump Type	1402P (Welch)
Backer Pump Motor	$\frac{1}{2}$ HP
Backer Pump Oil (Type)	Texaco Canopis D
Backer Pump Oil (Cap)	2 quarts
Diffusion Pump Type	MCF 60-018A mod.
Diffusion Pump Heater	350 Watts
Difffusion Pump Oil (Type)	DC 704 (silicone)
Diffusion Pump Oil (Cap.)	125 ml.
Diffusion Pump Cooling (Method) (No Boiler Cooling)	H_2O
Cooling Water to Trough	$55^oF \pm 5^o$

Typical RF and Filament Schedules

General

One coil on ferrite ring placed on top of coil mounted on vertical axis is used to heat the cathode grid assembly, the #2 grid and the lower part of the #3 grid.

Each exciter is designed to provide self-regulation of the RF current circulating in the tank circuit (coils) The range of self-regulation is ± 20% and provides compensation for line voltage variations as well as individual cart variables such as wipers, connectors, etc.

Peak Cathode Temperatures:

a. 90° Types

RF - 640° ± 25°C
Filament Heating - 960° ± 40°C

b. PI Types

RF - Middle Cathode - 640° ± 40°C
Outside Cathode - 660o ± 40°C
Filament Heating - 1010° ± 40°C

RF Scheduled (units in amperes)

Plant	Oven Position									
	10	11	12	13	14	15	16	17	18	19
Lancaster	--	7	7	7	9	9	12	12	12	12
Marion	7	7	9	9	9	12	12	12	12	--

Filament Lighting and Bulb Temperature

Filament lighting in position #23, for 90°, 110°, and PI set filament "OFF" timer to obtain: 45 seconds. The filament activation current will be set within a range of 0.86 to 1.10 within ± 0.02 A. Bulb Temperature (CFP) start of RF - 375°C max.

Bulb temperature (CFP) start of IF - 285°C max.

Typical Oven Schedules:

90° PI	Tubes/hr.	Min. Pack Temp. °C(CFP)	Time Over 375 °C(CFP)	Temp. at T.O. °C(CFP)
15V, 17V, 19V	30	400	12 min.	210
15V, 17V, 19V	45	400	12 min.	210
15V, 17V, 19V	60	400	12 min.	210
15V, 17V, 19V	65	400	12 min.	210
15V, 17V, 19V	72	400	10 min.	210

90° PI	Time from IF Start to T.O. start Minutes	Unload Temp. of Bulb °C (CFP) Max.
15V, 17V, 19V	18	100
15V, 17V, 19V	12	100
15V, 17V, 19V	9	100
15V, 17V, 19V	7.5	100
15V, 17V, 19V	7.5	100

Typical Oven Schedule (cont.'d)

For Scranton

Oven Zone	Heater (KW)	Fan Speed (RPM)	Contr. Setting °C
Air Curtain	None	1975	None
1	60	920	130
2	60	920	160
3	66	920	230
4	72	920	270
5	84	920	305
6	84	760	340
7	90	760	350
8	90	760	400
9	90	760	430
10	90	760	450
11	90	760	445
12	90	902	380
13	60	670	375
14	60	670	345
15	54	670	335
16	54	920	320
17	48	920	270
18	48	920	260
19	48	920	240
20	42	920	230
21	42	920	215
22	36	920	185
23	36	920	170
24	36	920	140
25	30	1003	130
26	None	1003	OFF
27	None	1003	OFF
28	None	1003	OFF
Exhaust Fan #1	None	2330	None
#2	None	2330	None
#3	None	2330	None

The above settings are relative settings which meet the design characteristics of the fan and drive motors. The actual fan speed is reasonably close to the given speeds. The controller settings are to be used as guidelines only.

Typical Oven Schedule (cont.'d)

Damper Settings in Ovens (ALL Plants Except Md.)

Zone	Top Recirc. Damper	Side Recirc. Damper
1-5	100% Open (50% - S)	100% Open
6-12	100% Open (50% - S)	100% Open
13-28	100% Open (50% - S)	100% Open

Damper Setting on Blower

Zone	Damper
All	Vary for Constant Flow on Both Sides

Exhaust Fans from Oven Sections

Uses three exhaust fans with 5 HP motor and dampers on each zone. Set Dampers as Follows:

Zone	Damper Setting
All	Vary to eliminate excessive sting-out in each zone while still maintaining zone temperature.

Safety Controls in Oven

1. Each zone is provided with Hi-Lo controls. The Hi control measures the temperature on the exit side of the blower, the Lo on the inlet side of the blower. Should the temperature of the air exceed the Hi set point, the heaters are turned off and an alarm sounds on main panel board.

If the temperature drops below the Lo set point, an alarm also sounds. On main board next to controller, the Hi alarm will light a red light and Lo alarm will light a green light showing area affected.

2. Also in each oven zone, an air flow switch is provided. Should the fan stop, the air flow switch will shut off the heating element and sound an alarm and light the red light at the proper oven zone on the main control board.

3. Two recorders are also provided to maintain control checks on air temperature and these should be checked frequently.

Heater Controllers:

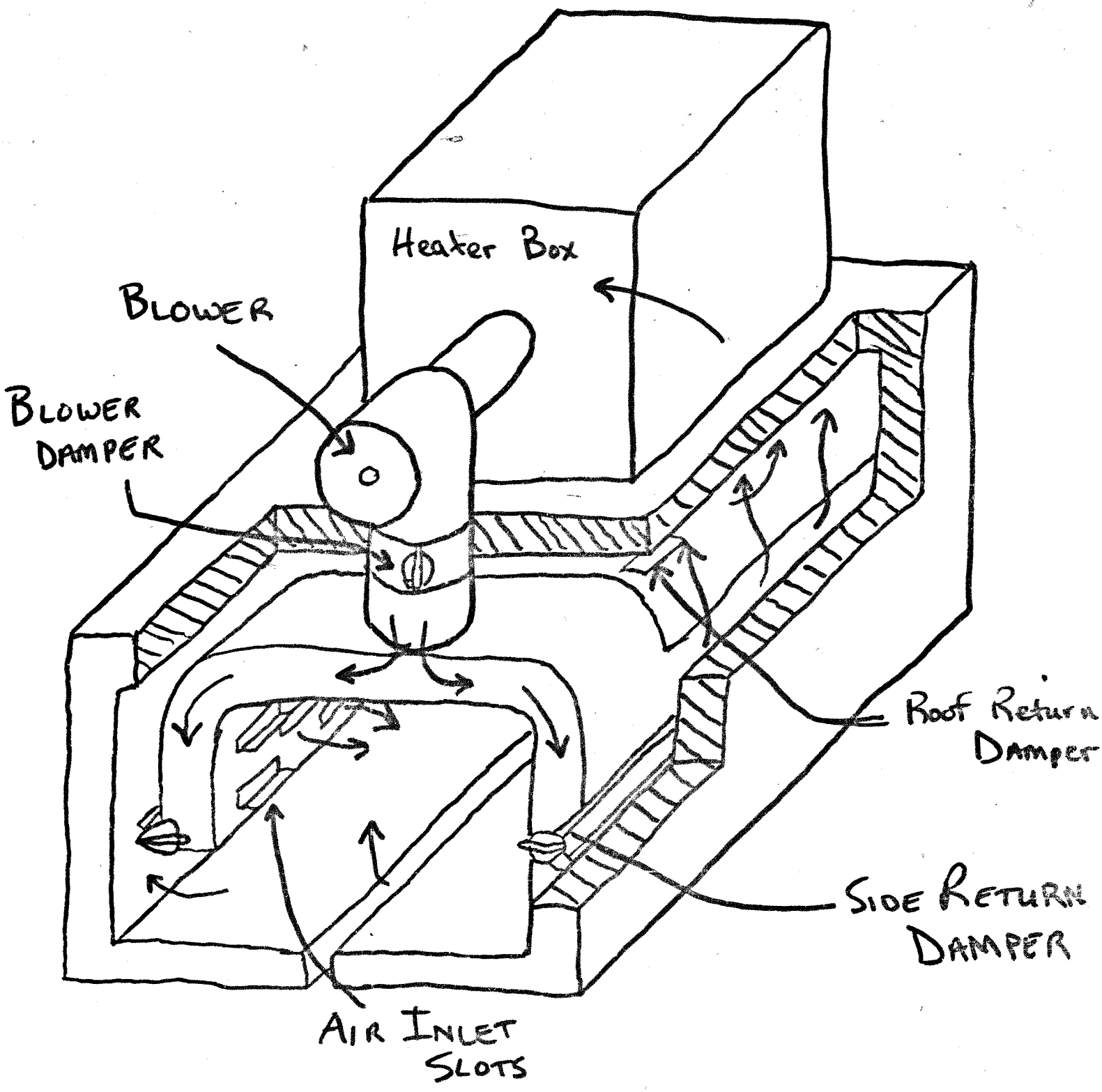
1. Each oven section is controlled by one controller.

   a. No heaters or controllers are in air curtain section.
   b No heaters are in oven zones 26, 27, and 28.
   c. There is no air curtain section at exit end of machine.

2. Controlled zones are as follows:

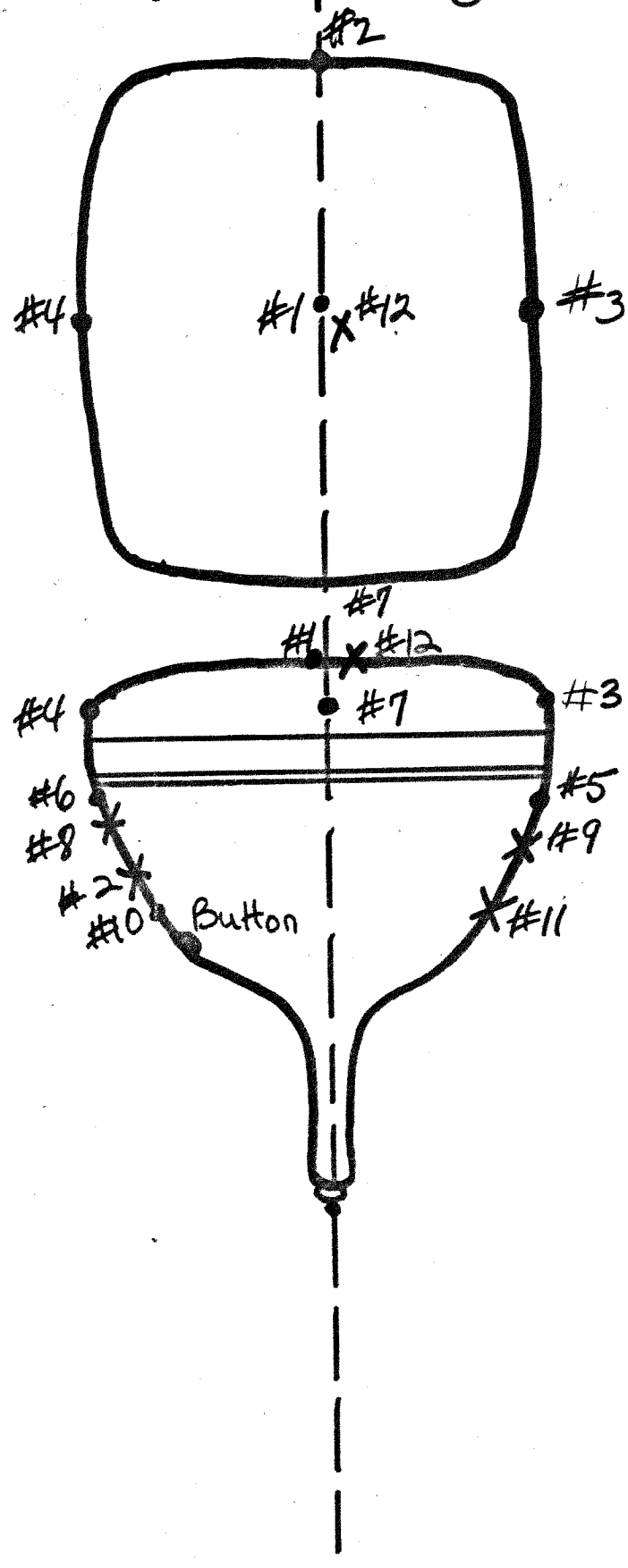
   a. Zones 1 - 25 have controllers, fans and heaters.
   b. Zones 26 - 28 have controllers, fans, no heaters.
   c. Air Curtain - Entrance - have no controllers, has a fan but no heaters.

Damper Arrangement and Air Flow Paths



TC Location for Determining Thermal Curves

For Marion
70°, 90°



Direction of Travel

• glass contact TC
X air TC

Typical Exhaust Cart Maintenance Check

A. Pump Room Procedure

1. Perform the following preservice check and record information:

   a. Date serviced
   b. Quaniity of oil in diffusion pump
   c. Water flow, ml./min.

2. Remove oil diffusion pump and clean as follows:

   a. Remove jet assembly and wash with trichloroethylene.
   b. Wash out pump with trichloroethylene and acetone.
   c. Clean jet assembly with a wire brush.
   d. (All except b) Bake in oven at 150°F for a minimum of 2 hours. Use heat gun or units with leaded coils.
   e. Refill with 125 ml. of new suitable diffusion pump oil, (DC704).

3. Drain backer pump and flush with new oil. Refill with suitable new vacuum pump oil, Texaco Canopus D, operate and test vacuum using McLeod gauge. This vacuum should read 5.0 microns or better within 5 minutes.

4. Clean sweep from the backer to oil diffusion pump.

5. Inspect rubber tubing in vacuum system, and replace if necessary.

6. Install clean oil diffusion pump using an "O" ring gasket at the flange and clean out plug.

7. Install new vacuum switch if required.

8. Check water pump suction tubing and replace if necessary.

9. Clean filter screens in water system.

10. Check water flow through system and note flow of 140ml. per minute.

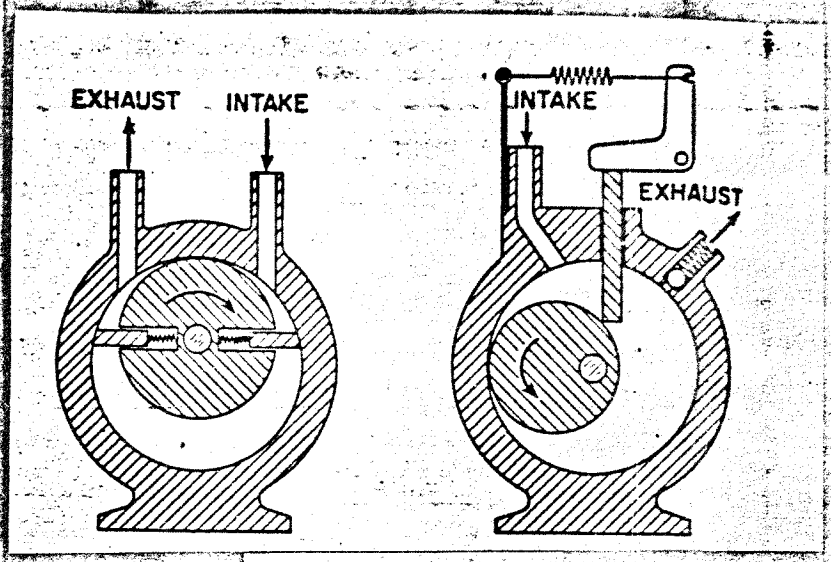
11. Carts are equipped with Barkdale vacuum switch, check as follows:

   a Using a Hoke .125" needle valve brazed to a copper tubulation, pump down as usual.
   b. Open valve approximately 1/8 to 1/4 turn until backer pump labors.
   c. Adjust screw on top of Barkdale for sensitivity until pump shuts off.

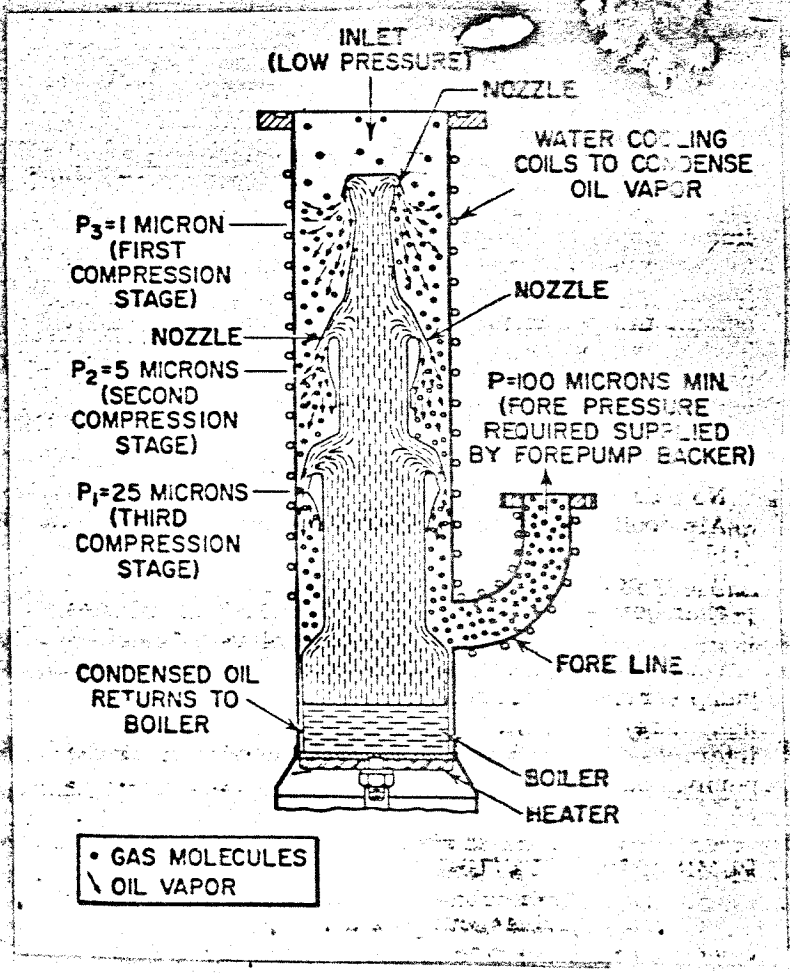
12. Test vacuum system using Type 1949 ionization gauge. System should come down to 0.5 micro amp. (5×10^{-6} mm of Hg) or better in one hour.

13 Record following part service information on cart service ticket.

a. Backer reading
b. Ionization reading
c. Quantity of oil put in diffusion pump
d. Water flow
e. Water pump suction in tubing check
f. Screen cleaning check
g. Serviced by
h. Comments regarding cause and/or problems



MECHANICAL PUMP



OIL-DIFFUSION PUMP