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 8 - 300
 9 - 700
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MAY 31 1956

300 AREA
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May 9, 1950

TO: J. F. Heberer
Maintenance Division

FROM: N. T. Hildreth

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REPORT FOR WEEK ENDING 4-28-50
VACUUM PROBLEM 234-5 BLDG.

This report contains notes and comments on the factors affecting plant processes of units 25 and 26.

Tripod

Wilbur Davis outlined the function of the three position tripod that is being built. This tripod may eliminate the effect of coating not being thick enough at the area covered by the tips. Rotation of the object is accomplished by raising one tripod, rotating slightly, and then returning to the original position. A test of the completed tripod will show whether or not an extra guide will be needed to insure complete positive rotation. This tripod seems to be a worthwhile improvement but not the final answer.

Elimination of the gear box was also outlined by Wilbur Davis. Pin shearing would be eliminated. If needed, the addition of a small gear at the edge of the six inch wheel raising the tripod, will act as a vernier and give smoother action in manipulating the tripods. Stops can be added for exact positioning.

Thermocouple

Instruments are reworking the thermocouples and entrant seals to the vacuum system. The asbestos insulation is being replaced by steatite insulating beads. It was shown by experiment that the asbestos takes two hours longer to pump down than the steatite. The thermocouple is continuous through the side of the chamber. This is accomplished by using hollow Stupakoff insulators through which the wire is soldered.

Further tests are being run on the outgassing of gasket and insulating material.

The use of the standard amphenol thermocouple connectors will bring the thermocouple wire directly to the junction box in the Brown Recorder; thus eliminating extra potentials produced by extra soldered joints.

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Personnel are to be kept informed of the results of the tests and any results of the tests under applicable Federal laws.

Design of Additional Unit

In order to accomodate the installation of additional units in 25 and 26, some time was spent in going over possible arrangement of MC500 or MC300 diffusion pumps and rearrangement of mechanical vacuum pumps. Raising the Tacco work units would eliminate a great many of the supports, and at the same time give us more room for servicing equipment. By turning the 6" valve on its side, it would allow us to move the diffusion pump back of the unit and at the same time give us additional space below the base plate in which any material dropping through the screen would accumulate and not effect the operation of the 6" valve.

Installation of a cold trap between the six inch valve and the diffusion pump would help keep down the back diffusion of pump oil and trap out process gas; thus keeping the oil clean.

Solenoid pneumatically operated valves could be installed in places where conditions make it desirable. Excessive wear can be caused by tightening the valve too much. With the solenoid or air operated valve, there is a maximum pressure available to seat the valve. Cases of twisting off a valve stem would not occur.

Elimination of the Wilson seal by replacement with a bellows seems desirable. Recently, however, there has been little trouble, apparently, with this type of seal.

Putting a surge tank between the fore pump and diffusion pump will give smoother operation and serve as an oil trap.

However, it was decided to wait until H. D. Middel and T. K. Andrews return from Schenectady before making further plans on rearranging equipment.

Pump Oils

It was noted that the diffusion pumps were not operating under the same conditions. The pump on Unit 25 was wrapped in asbestos and had a heater current of 3.2 amperes. The pump on Unit 26 was not covered with asbestos and was operating satisfactorily at 2.8 amperes. Since both pumps use the 702 diffusion pump oil, it would seem likely that they should be operating at the same settings--the conditions being equal. It is common knowledge that after a period of time under operating conditions the diffusion pump oils, or the diffusion pump itself becomes contaminated in such a way that the pumps are no longer operable. This condition comes about by gradual deterioration of the oil from normal operation or from the interaction of the material that is passed through these pumps. This necessitates intermittent cleaning and reassembly in order for process operations to proceed.

In order to eliminate some of the material from being passed through the pumps, it would seem that flushing the system with dry nitrogen each time before opening the 6" valve after a process operation has been made would scavenge the gas from the walls of the vessel. The cooling water on the 6" valve could be turned off. In normal operation the water is left on during the coating and when the

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system is opened to atmospheric pressure. In both cases, condensation of material could take place upon the walls, thus increasing the pumping down time of the system once it is thrown open to the diffusion pump.

Absorption of carbon monoxide on the walls of the vessel may also contribute to long term outgassing. The problem of obtaining a satisfactory vacuum, apparently resolves itself into two items: (1) that of maintaining a satisfactory vacuum in a clean system, and (2) that of finding out what happens when the system is contaminated with process material. The latter item could be studied using a separate unit. The effect of carbon tetrachloride on the oil during the process is not known.

It was noted in several cases that in changing oil a vacuum had been left on the diffusion pump. This is apparently due to not venting the system enough, or not opening the 6" valve to the diffusion pump so that oil may be drained out. Consequently, when the drain plug is removed air surges through the oil, thus scattering it throughout the diffusion pump.

An oil changing procedure would consist of the following: (1) Turn off the diffusion pump heater at least one hour before changing oil. (2) Shut down the fore pump (3) Vent the diffusion pump through a separate valve or through the existing Pirani Gauge connection. (4) Remove the drain plug and drain the oil. (5) Add oil through a separate port on the discharge side of the pump after screwing in the drain plug.

The elimination or reduction of oil vapors above the six inch valve may help our overall vacuum problem.

General

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It would seem that the average amount of operational errors should be maintained at a minimum. If the procedure calls for evacuating overnight on high vacuum at the end of a process, it would seem better to do this rather than evacuate on the fore pump only. Likewise, if one unit is filled with 2 inches of gas, the other unit should also contain 2 inches of gas instead of 4. Once the correct diffusion pump heater current is established, the setting should be maintained.

Improvements in the overall procedure would appear to increase production. A speed up of the outgassing cycle by the application of heat would shorten the total evacuation time. However, since we are limited here by an established procedure, there is probably not much change that we can make for the time being.

The amount of gas able to circulate effectively about a limited space in the bell jar would seem to be hampered by the reaction, the flat plates forming the tripod, and the narrow space between the tripod and the bell jar. This situation might be helped by making a spider network for the tripod instead of the plates and by providing a larger volume above the base plate and above the tripod. Convection and diffusion processes would have a better chance of functioning.

At the beginning of the first cycle there is a rapid rise in the temperature well above the control point. The temperature gradually returns to the control point and the process proceeds.

Since the process is somewhat dependent upon the absolute temperature, it would seem advisable to try to measure the absolute temperature or at least maintain a constant temperature gradient between the thermocouple and the temperature we wish to measure. The change in thermocouple contact with the first process cycle may be responsible for the rapid rise in temperature. The temperature rise can also be caused by letting the gas in too fast. By contact with the thermocouple directly, we could get a more accurate measure of the temperature. The cold outgassing temperature of Unit 26 has been lower than Unit 25, however, I am told the temperature may vary on any one unit.

Intermittent adjustments appear to be made to the Iacco unit during the process. It would seem that if the adjustments are set and the process factors are constant, that no further changes are necessary during the time cycle. Some variation in time cycle is indicated on the recorder charts.

The explanation has been expressed that whiskers formed in the process are due to dirt or lint particles. Such whiskers may contribute to the failure of an individual unit. Paper towels are being used to wipe out the bell jar. Cheese cloth will also leave lint, but not as much as a paper towel. The use of lint free cloth or paper may help solve this problem. Replacement of the asbestos on the thermocouples with steatite will help get down the source of dirt. Gas let into the system too fast also causes dirt. The pressure in Unit 25 builds up very rapidly while in unit 26 the response is very slow. Both systems should respond alike from the view point of the operator.

The new design of the tripod tips appears beneficial. Now the operator does not have as much trouble removing the old tips or installing new ones. In changing from the old style tips to the new ones, the operators had a great deal of trouble in centering and positioning the fingers. Final positioning was accomplished by using a wrench and pliers to bend the fingers. In order to eliminate this trouble it would seem that a jig should be provided for spacing the fingers or the tripod constructed so that no further adjustments are necessary if possible.

A tripod tip will pass the catch screen into the 6" valve when the operator was changing tips. This can be avoided by making a complete covering for the opening in the base plate or by providing a pressure fit between the wire basket and the walls of the base plate.

Further changes in the tripod design might be desirable. Limiting the adjustable height of the tripod fingers to about $\frac{1}{4}$ " would allow only one position for the work coil. At present the operator adjusts the coil to an estimated height for best operation. Also cutting down on the overall height of the tripod might help the problem of gas circulation and coating.

The addition of handles to the bell jar flange would help the operator in removing the jar.

Machine parts or bolts going into the vacuum system should be degreased before being used.

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Wing nuts might be used instead of hex nuts on process cans thus saving manipulation time for the operator.

The cooling water for the VMF-260 diffusion pumps has been running at about 40 to 60 gallons per hour. This is a high rate of flow. The pump was operated in the shop with a water flow as low as 5 gallons per hour. In order to relieve congestion under the unit, the rotometers could be moved. A light or buzzer would then be used to indicate water flow or no water flow.

Additional dial gages are on order so that low pressures may be read more easily. These gages are supplemental to the present gages. A Wallace and Tiernan gage to cover our entire pressure range would save reading, space and connection requirements of an extra gage.

Unit 17

The use of an additional light was suggested in order to give more illumination to the working area.

Unit 19

It was noted that the minimum pressure obtainable was about 200 Microns with the present pump. For more satisfactory service, it appears reasonable to install a pump that will pull a vacuum in the region of twenty microns. The desired operating pressure of 200 microns or less can be more easily obtained and major leaks more readily detected. The present Conco-20 pump should pull down to a few microns of pressure.

WTH:mc

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