M-152

MARK IV REDESIGN COMMITTEE;

MINUTES OF MEETING NO. 4

Date: November 5, 1959

In attendance: F. Adams, B. Bunker, A. Crabtree, P. Edwards, D. Goerz, O. Kraus, G. Loew, R. B. Neal, R. Sund, P. Zinder

Discussion of Water Jacket.

Method

A method designed by D. Goerz was discussed. This consists of an outer tube in which a spiral of wire has been located. The accelerator pipe is then inserted on the inside of the wire. The wire acts to cause the water to flow around the tube and also to support the structure at close intervals.

Assembly

Copper wire is wound with a $1\frac{1}{2}$" pitch on a mandrel which is undersize. The mandrel with the copper rod is inserted into the outer jacket. The wire is freed and allowed to expand to the inside of the tube. The mandrel is then removed and the final tube inserted. For a final assembly flanges would be brazed to the structure. A flexible water-tight joint would be provided between the brazed flange and water jacket assembly. The final seal is made with an inert gas weld.

Model

A model of such a section 22" long was shown. The outside diameter of the inner tube was 3 5/8" with a 3/16" copper rod. This was enclosed in a 4" I.D. brass tube. The clearance was about .005. No difficulty in assembly was encountered for this assembly.

An integral heater and water jacket.

A system suggested by D. Goerz consists of replacing the wire with a calrod unit, wound in a similar manner. A computation done by A. Crabtree

showed that only 1.64 kw average were required to raise the temperature of the structure 230° C in 10 hours. It was pointed out that 20 kw rf would be available, hence calrod was sidetracked until further information could be obtained on reliability, tolerance, and cost.

Electric Heater.

Movable electric heaters were considered and are to be investigated for use with the rigid water jacket.

The Vacuum System.

To provide a little background, R. B. Neal explained some of the thought that had gone along with Project M. Since the goal on Project M was for 24 hour operation, this indicated the pump should be located outside the tunnel. The plan that evolved then was to use a large vacuum manifold 16" - 18" diameter, 250 feet long pumped in the center by a single 16" diffusion pump located in the klystron tunnel. It was believed that this plan would not provide the most economical procedure to obtain high vacuum for the accelerator, the next plan was to go back to the small localized pumping on the accelerator itself for each 10-foot section. To these pumps were added a 4-inch vacuum manifold the length of the accelerator so that individual pumps breaking down would have the adjacent pumps on either side to maintain the vacuum. The failure rate of this system having a 4" vacuum manifold plus 1,000 diffusion pumps, has reversed the thinking back to the original system, of the large manifold which would require only 40 of the large 16" diffusion pumps. Also it has been suggested that a large, 16" - 18" diameter, cold-rolled steel tube could be used as the vacuum manifold. The joints could be welded vacuum tight, thus eliminating seals and flanges. The next thought is to extend this idea to Mark IV. In this case we would use one large pump and one large vacuum manifold 12" diameter for the 40' of accelerator trench. This opened the possibility of locating the pump in the trench at one end or outside of the trench.

Following this was a discussion of the various and possible pump locations, such as:

a. Tube Shop
b. At the end of Mark IV trench, on top of the shielding
c. Top of the walkway through Mark IV
d. Where the generator is presently located
e. In the trench proper
f. Outside the building

The 12-inch manifold will be mounted on pedestals above and to the right of the accelerator center line. Therefore the valves would come out of the bottom of the vacuum manifold, using a 90° valve straight into the waveguide rising vertically from the accelerator.

Following this was a discussion of a 3-inch expanding-disk all-metal valve designed by D. Goerz. It was put together this morning and so far sealed Helium tight four times. At the beginning 150-foot pounds of torque was necessary to obtain the seal and on subsequent trials the torque reduced it until we were operating at 100-foot pounds. This valve is adaptable for use as a teflon valve providing a seat at the bellows.

It was decided that at the next meeting we would try to have the sketches for the layout of the accelerator utilizing the single large vacuum manifold of a 12-inch diameter and a small forevac manifold of approximately 2 1/2-inch diameter. Also we would have a decision on the pump location for this large manifold, and some final sketches on flanges and sizes so that we could start our work in the near future on making up some of these components.

Summary of decisions made at this meeting:

1. Use ordinary copper rod in place of calrod for the accelerator support.
2. To use a large (12") welded steel hi-vacuum manifold running the entire length of the trench.
3. A 2 1/2" expanding disc metal valve would be designed with interchangeable teflon seal.

The next meeting is November 12 at 10:30 A.M.