

AUSTRALIAN NATIONAL UNIVERSITY

DEPARTMENT OF NUCLEAR PHYSICS

14UD TANK OPENING REPORT No. 27

28th to 31st July 1981

(4 days open.)

REFERENCES: Earlier Tank Opening Reports are referred to by the notation (12/4) etc, meaning Report No. 12, page 4.

REASON FOR TANK OPENING

Chain troubles, and inability to hold volts.

PREAMBLE

The 14UD was last closed on June 22nd and, as stated (26/6) performance after button-up was satisfactory.

After about two weeks of troublefree operation some problems began to occur with the charging system. Instability developed when Chain 1 was running. We found that overall stability was better when the chain was turned off.

After a sequence of relatively low voltage runs it was found that the machine would not hold voltages much in excess of 12 MV. Individual units in both columns were shorted, but the location of the problem could not be determined conclusively. After operation below 12.5 MV for a further two weeks a tank opening was scheduled to occur in the middle of the current operating sequence. Shortly after this decision was taken there was an opportunity for further tests with shorting rods. Beyond eliminating the L.E. column entirely we were unable to localize the problem. We reached the conclusion that the trouble related to Chain 2 as well as Chain 1, and was probably due to idlers. (Chain 2 was kept off in addition to Chain 1.) For a while the 14UD was spark free from 13 to 14 MV and then became erratic again. The machine ran well on experiments up to about 13 MV with Chain 3 only.

OPERATIONAL TIME.

During the 35 days since the last closure, the 14UD operated for 707 hours. This was 84% of elapsed time, excluding gas transfer.

THE TANK OPENING

Exploratory tour.

Before the platform was lowered we took a brief look in the bottom of the tank. A few fragments of white material were scattered over the floor and Chain 2 had a great deal of the stuff adhering to its tacky surface. There was a little on the other chains but the impression was that the material had originated at Chain 2 and migrated to the others.

One of the lead blocks used to balance the pivot systems of the charging motors and fallen off the Chain 1 platform due to its steep downward slope caused by chain stretch. We felt that this, if no other evidence appeared, was just sufficient to explain the instabilities which had occurred on this chain.

Once on the platform we found bits of the same material on all the castings of the H.E. column; in the casting recesses, where the stabilizing idlers are located, there was a considerable buildup of the substance, now clearly seen to be rubber ground off the idler tyres.

At the last opening all the idlers were removed and serviced (26/4) and, for the first time, were replaced by two technicians and not checked by either author. In many cases the idlers on all chains were set more tightly than in the past and it was concluded that this was the cause of the trouble. This solution, however, did not explain why only Chain 2 should have reacted so violently, nor why all its four stabilizing positions, at castings 16, 19, 22 and 25, were affected instead of merely at the locations of the tightest settings. In addition, it was only the "up" idlers which were ground up. There were accumulated bits of ground rubber on many of the rings. In one case a 3 mm lump had migrated from near a column post to midway between posts, a distance of 30 cm, leaving a clear track along the ring.

Some corona points were seen to be melted, as in the old days, in units 20 and 21 and would need to be changed. We presume this was a result of the 14 MV sparking caused by the chain idler disintegration. Why the point failures should have occurred in units 19 and 20 predominantly is not obvious. A tenuous excuse is that it might have something to do with the presence of the H.E. stripper. This produces a structural and perhaps R.F. discontinuity which has, in the past, resulted in spark damage to any connecting straps which were not made tight enough.

There was no other evidence of failures. The modification of tightly fitting shafts in the idler bearings seems, at least so far, to be satisfactory.

And so to work!

Idlers.

All the idlers were removed from Chain 2 for servicing. Before continuing with other work we carried out a prodigious preliminary clean-up of the entire H.E. column using a vacuum cleaner, chlorothene and students to remove oil patches with rubber dust stuck to them. In the bottom of the tank the floor

and all chains were cleaned with chlorothene. This exercise was assigned to the older author who is held to be able to exist contentedly in any atmosphere.

The repaired idlers were put back and they, and those at all positions on the other chains, were set less tightly by the two authors themselves.

Foils.

The terminal foil magazine needed to be returned to the correct position for closing the foil isolation valve. The mechanism was operated a hundred or so times to reposition it. Remembering previous occasions, it was assumed that there was but a slender chance of closing the Weisser valve at the blank position; we merely hoped that another foil frame would not jam in the valve (26/4). With some pride we found the return to zero had been exact. After reloading, the foil changer was put back at the first opportunity so that we could keep an eye open for leaks.

Points.

Tube points were replaced in units 19, tube 2, and 20, tube 1, i.e. each tube section above and below the H.E. stripper. The failures were typically one point on the plate of three being melted down to about half its original length.

Tube end points were more frequently the casualties than is consistent with their proportion of the total population.

Chains.

Chain 2 was shortened by two pellets and the other chains by three each.

General examination.

During the chlorothene cleanup in the bottom of the tank, after all the above work was completed, black powdery material on one side of charging pulley No. 2 led to the discovery that the bearing locking ring was loose. There was little doubt that vibrations caused by this defect, and not closely set idlers, were the cause of damage to the idlers on Chain 2. Moreover it explained why the other chains had not suffered accordingly. Nevertheless, all idlers had been rather too tightly set, and resetting was justified.

At this late stage in the tank opening all hope of buttoning up that day was abandoned. The pulley was removed and the shaft found to have a groove about 1 mm deep worn on it. It was machined to a smaller diameter and a sleeve was shrunk on; this, in turn, was machined to appropriate diameter for the bearings.

Had the fault on the pulley been noticed earlier the repair could have been carried out in parallel with work on the idlers. The penalty of not following our own rigid procedure of always examining absolutely everything,

including those things which never go wrong from one year to another, had fallen squarely on the two authors. This vindicated another local maxim: the authors, no matter how grandiose they believe their status to be, must participate in the rotten cleaning jobs, for it is only through this intimate contact with the 14UD that unplanned observations occur. The experts who shortened Chain 2 thought the black powder on the side of the pulley was from a worn carbon brush. They missed the failed bearing clamp and didn't even pass on the erroneous information about the brush.

Cleaning.

When all repairs had been effected, the H.E. column was once more cleaned with alcohol, a nitrogen jet and tacrags. However fastidious we were, we recognized that not all the loose material could be found and removed. We anticipated another thorough cleaning in about a month.

Button-up tests.

All chains were run and some adjustments were made with the movable lead blocks to establish optimum mechanical performance.

Further opening.

In order to change shaft bearings and examine the stabilizing idlers so as to observe the onset of wear as soon as possible, a tank opening was scheduled for 14th. September as a 63rd birthday present for one of the authors (13/3). However, because of continued dirt-induced sparking at 14 MV, this opening has been moved forward to 24th August. The new arrangement is not expected to detract from the festivity mentioned above.

In view of the imminence of the coming opening, this report is being held over to include Report 28, which we hope will be brief.

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18 August, 1981