

AUSTRALIAN NATIONAL UNIVERSITY

DEPARTMENT OF NUCLEAR PHYSICS

14UD TANK OPENING REPORT No. 30

Two openings:

27th November to 1st December, 1981

(5 days open. 3 working days.)

and 3rd December.

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

REASON FOR THE FIRST TANK OPENING

A charging chain broke.

PREAMBLE

The 14UD was last closed on October 28th. The machine performed well after closure, apart from the fact that charging current on Chain 1 ran at about 20% lower than for the other two chains. Metering for this chain has given trouble recently (28/3; 29/3; 29/5). Because careful attention had been given to the leads and metering insulator on the charging pulley, we conjectured that the fault could lie in the crossover system in the terminal. Chain 1 was accordingly isolated unless it was needed.

After some long experimental runs at low terminal voltages a run was called for at 14MV and Chain 1 was brought into use. While operating at this voltage there were periods of frequent sparking.

In the evening of Wednesday, 25th November, a farewell dinner was held to honour the retirement of Professor Sir Ernest Titterton, father of not only the 14UD, but also the department's five earlier accelerators. While this prolific patriarch was reminiscing to a distinguished company about past happy days with his linear and cyclic offspring, the youngest sibling became fractious during its second day at 14MV. It let out a prodigious spark and broke its Chain 1. We were unable to fathom which tantrum was first, but at least we can say with confidence that the chain was installed early in January 1979, and had operated for 11,535 hours.

OPERATIONAL TIME.

During the 27 days since the last closure, the 14UD operated for 586 hours. This was 95% of elapsed time, excluding the days for gas transfer.

THE TANK OPENING.

Exploratory tour.

The doors were opened at 5 p.m. on Thursday and we found some chain on the floor at the No. 1 position. There was no strong smell in the tank, but, as has happened before, the smell in the tower was distinctly noticeable when air circulation was started.

Next morning we found the 'up' side of Chain 1 hanging from the terminal to the bottom of the column. The top end was caught up in the terminal, thus preventing half the chain from falling. A number of short lengths lay on random castings with the bulk of the 'down' side in the bottom unit, No. 28. This was the first occasion on record that the chain remained intact in this position, indicating that all subsidiary breakages had occurred on one side only: the side which fell and thrashed about in the castings.

Damage was relatively slight. The nylon insulator of the 'up' inductor had broken and the inductor was lying on the floor of the tank. The contact shimstocks on both pulleys were damaged to the extent that they would all have to be replaced. The rim of the terminal pulley was unaffected, but that of the driving pulley was broken at the edge in a few places. Surprisingly, there was no damage to any stabilizing idlers or spark shields, though the shaft on one idler was worn sufficiently to warrant being changed.

Idlers for the other chains were examined, following the succession of problems related in recent reports. In all cases idlers, tyres, shafts and bearings were in good condition. We would have taken this as a breakthrough had not only a month elapsed since they were all renewed as necessary.

There was no fault in the crossover system in the terminal to substantiate our conjecture about the metering anomaly on Chain 1.

With the exception of one assembly in unit 19 the corona points were all good and there were no further sequences of melted points (27/2; 28/2).

We found evidence of the effect of SF₆ breakdown products. An unusual formation of material was noticed on some post electrodes and on corona assemblies. The material on the electrodes had the appearance of blisters, which popped when touched.

And so to work!

Chains

Both pulleys of Chain 1 were removed and their contact shimstock was renewed. New bearings were put on each pulley. The broken chain was replaced by one made up of 50 new pellets and the remainder from a chain which broke in August 1980 when a removable link pin came out. That chain had operated for 5,000 hours.

Foils

When setting the terminal foils to the blank position prior to closing the Weisser valve, we realized that the internal and external driving magnets were slipping occasionally. This meant that the foil counter could not be

relied on to set the foil string at the blank position. In order to avoid a repeat of the occasion when a foil frame jammed in the valve seat (26/4) the valve was partly closed and opened fully again a few times in order to knock off any frames which were in the way and cause them to fall clear of the valve seats. When the stripper mechanism was withdrawn, two foil frames were seen to have been knocked off and the blank was 20 positions from the appropriate number on the counter.

Points

Two tube points were renewed.

Idlers.

Two shafts were replaced. One, and its bearing, were in bad condition.

Miscellaneous

Buncher. A double-gridded buncher, based on the Argonne National Laboratory design, was installed at the L.E. end of the machine.

Gas dryer. A few months ago, in order to obtain more uniform heating of the alumina, we changed the reactivation conditions by insulating the reactivator and reducing power to the heater. In view of the possible failure to remove breakdown products adequately we reverted to the original configuration. A new reactivation released a great deal more of something or other smellable than we have had recently. The younger author, with better hearing, took this as an indication that the new heating configuration, while perhaps more uniform, was not sufficiently effective. From now on the older, non-uniform technique will be used.

Cleaning.

This was carried out cheerily by our good-hearted students, wielding tac rags.

Button-up.

This was carried out wearily, because one thing and another led to a late closure.

Initial performance.

There was none. Chain 1 broke again in the first few minutes of tests while the SF_6 was still going in. After a few monosyllabic observations the gas direction was reversed. A leaden silence pervaded the place for the best part of an hour and then the hypotheses and conjectures began to be voiced. (One of them turned out to be correct.) The gas was out again by 6.30 p.m. but the doors were not opened until the next morning.

The second opening.

Part of Chain 1 was on the floor; an inductor had been knocked off and the other badly scored. A section of contact shimstock on the pulley of Chain 2 was wrecked.

One end of the chain length on the floor had no pin or broken nylon link and on the column we found the corresponding unbroken link, also with no pin. All alone, on another casting, we found the pin with a screw in only one end. Later we even found the screw.

It was the age-old story of screws in removable links not being loctited. In August 1980 a chain parted because a screw in a removable link came out. It was the same chain, which we had kept as a standby, that had just been put in. On checking we found that screws in all the removable links were fingertight only. Whether these were original links, or new ones from the spares cupboard, is not certain. At the time (21/10) we expressed penitence at failure to take the advice of N.E.C. and loctite all screws in removable links. Though we have done so ever since, regrettably the remaining links in that unfortunate chain may never have been attended to in all the time that it lay resentfully in its box, awaiting a new chance.

After the first of the two recent breakages we telexed N.E.C. and found that a new chain already on order had landed in Sydney that very day. Such fortune as this at first appeared to be does not come often. We took immediate steps to have the chain expedited across the hundred or so air miles to Canberra where customs clearance could be rushed through for it, and we got ready to put it in the machine. Unfortunately the chain had been consigned to Sydney airport, perhaps on the assumption that Canberra is a suburb of Sydney, or has no airport of its own. Airport rules are that clearance must be effected at the nominated airport. The next move was to fly the clearance papers to Sydney but this was countered by the ploy that the chain was part of a containerized shipment which first had to be cleared in its own right, and the papers for that were in Brisbane. We were told, encouragingly, that we were sure to get the chain in about a week: if nothing went wrong, of course.

We then toyed with the idea of buttoning up with only two chains and opening the tank again before Christmas to put in the new chain. Next we reasoned that, since the latest chain failure was not due to the deterioration of its nylon links, which had only operated for 5,000 hours, we had very little to lose by seeing how it performed with loctited screws. We had enough spare links to replace the twenty or so damaged ones. We did this, and put the chain back in.

During the charging tests, which we expected to go as smoothly as they usually do, we were plagued with curious feedback effects which caused Chain 2 to draw current when Chain 3 was run. Eventually we discovered that finely divided aluminium powder from the badly scored inductors of Chain 1 had settled on the inductors of Chain 2 and was responsible for corona and leakage. The inductors were cleaned and the effect disappeared.

Cleaning.

We again blew the column with nitrogen and the same cheery, good-hearted students of two days earlier were forced back into the tank with a new box of tac-rags while the principals retired to the darkroom for a discussion until the cleaning was finished.

Buttonup was about 6.30 p.m. and the tank roughed overnight.

Next morning the tank was gassed up and all appeared well. The column went to 13.2 MV before the first spark and the machine was then used at 11.3 MV

with eerie stability. On the Sunday after the Friday button-up the machine operated at 14 MV, followed by 14.5 MV operation until Monday. Unfortunately we have had no time to condition.

We wish all our readers a very Merry Christmas and a troublefree New Year with their accelerators.

D.C. Weisser

T.A. Brinkley

7th December, 1981.

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