AUSTRALIAN NATIONAL UNIVERSITY DEPARTMENT OF NUCLEAR PHYSICS 14UD TANK OPENING REPORT NO 77

Pump Out 24 Feb — Close Doors 28 Feb 92

Reason for Tank Opening

Replace terminal stripper foils.

Preamble

The tank was last open from 8 – 12 July 1991 and has since run 2,500 hours. This is the longest period for the 14UD to be closed and in operation. It reflects an experimental program that was a modest user of terminal stripper foils and a very reliable accelerator. As our readers will know, the Tank Opening Report reliability has been abysmal. Since TOR 72, there have been four tank openings. Reports may some day follow.

This report marks the first tank opening since Bob Turkentine has been reassigned to target making responsibilities, replacing the retired Bert Muggleton. The 14UD regrettably, had to sacrifice its most senior technician and TOR writer because he possessed the most impressive combination of technical and political skills that were required in the target making/techniques area. The training he provided for the rest of the tank crew, Alistair Muirhead and Howard Wallace, as well as the technical achievements and reliability of the 14UD, have made his transfer possible. Alan Cooper, upon returning from FSU on the Technician Exchange Program, will now participate more in 14UD work.

Exploratory Tour

There was a light coating of grey powder on the rings and a modest coffee coloured patch on the terminal opposite the corona triode needles. We were all pleasantly surprised at how little dust was present after so long an operational period.

There were rust coloured patches around some rivet heads on chain number 2. Most spark marks (8) were on unit 15 just below the terminal.

And so to Work

Chains

Chain number 2 was inspected. The "rust" patches on the rivet heads were associated with elongated holes in the pellets. This affected a group of 20 adjacent pellets, as well as a scattering of an additional 75 rivet heads. Nevertheless, we decided to retire this chain after 13,700 hours and 3-1/2 years service. This is a shorter life than achieved by our last chain, 26,000 hours.

All casting idlers were inspected and found to be satisfactory. Five of the six DC idlers in the terminal had wobbly bearings. All DC idler bearings were replaced.

Shafts

All shaft bearings were listened to. After 17K hours for the upper shaft and 22K hours for the lower shaft, since the last bearing change, both shafts sounded beautiful. GVM bearings are also OK.

Terminal Stripper

All foils were replaced. 230 out of the 286 were used.

Post Reconditioning Program

Reconditioned posts were installed in unit 26. We will test the first use of stainless steel flanges. It is expected that the stainless steel will be more resistant to spark erosion at the interface of the cup electrode, than were the aluminium flanges. The electrical/mechanical contact over this interface is now being made with six screws. This is a change from the previous reconditioning technique in which silver loaded epoxy was used for the titanium to aluminium joint. Although this joint has proved to be better than the original pressure only joint, there is some evidence of browning of the epoxy where the ring attachment reduces the epoxy area. See photograph.

Stainless steel flanges are of the early, non-flexing design as shown in the accompanying drawing.

Resistors

The opening of unit 26 allowed a recheck of the stability of the resistance values All tube resistors were measured in place on tube 26/3, the 8 gapper in casting 26, and tube 27/1. Their average value of 299 MΩ is indistinguishable from the nominal values for these resistors. They have been in use for three and a half years during which the machine has run 11,876 hours.

U26 was the site of the test in which the stringers were removed which used to connect the third ring, either side of casting 26, to the flanges on the 8-gap tube. This was to test whether the absence of stringers put extra stress on the tube near the flange. Since the resistances have not changed, we take that as evidence that there is acceptable stress on the tube. The test commenced on 20 Nov 1990, comprising 4,561 hours of operation.

The success of the test now justifies the removal of stringers either side of the 8-gap tube in casting 13. On 25 June 1990, one 575 MΩ, 40kV tangentially mounted resistor replaced each pair of 300 MΩ, 20 kV resistors on the 8-gap tube in this casting. In 6,762 hours of operation, these resistors changed to 574 MΩ. Removing the stringers allows the lower voltage difference across the 8-gap tube to be shared by more column gaps, that is the five column gaps corresponding to each of the adjacent 11-gap tubes.

In future, the removal of stringers adjacent to castings containing 8 gap tubes, will allow the replacement of the 575 MΩ column resistors with the standard 982 MΩ ones. This should increase the voltage holding capability of the column at the cost of greater stress on the tube.

It was noticed during the tube resistor measurements that the resistors measure about 4 MΩ higher when the positive electrode of the 3 volt tester was towards the positive end of the resistor. This asymmetry may be caused by the freezing of electric dipoles in the ceramic core of the resistors when they are exposed to X radiation and voltage.

All the column resistors in U 26 were removed for tests. Thus the information about which end had the positive was lost. The average value of the resistance of the 982 MΩ resistors is now 965 MΩ after 3.5 years comprising 11,876 hours of operation. This 1.6% drop is comparable to the 2% range of resistance specified. It in no way impinges on the operation of the accelerator because the drop is small and similar for the 982 MΩ resistors. 575 MΩ tube resistors in unit 13 were measured to be 569 MΩ, a 1% drop.

All the resistors in the machine were survey checked with 30 kV from stringer to stringer. This tests the parallel set of tube and column resistors. No failed resistors were found.

Conclusion: The resistor system remains stable and reliable.

Clean and Close

All spark marks were recorded as shown on the accompanying table.

Location	No of Spark Marks
U10	2
Casting Cover 11	4
Terminal: Top	1
Mid	0
Bottom	0
U15	8
U16	2
U17	4
CC17	2
U18	1
CC18	1
U19	1
U20	1
U21	1

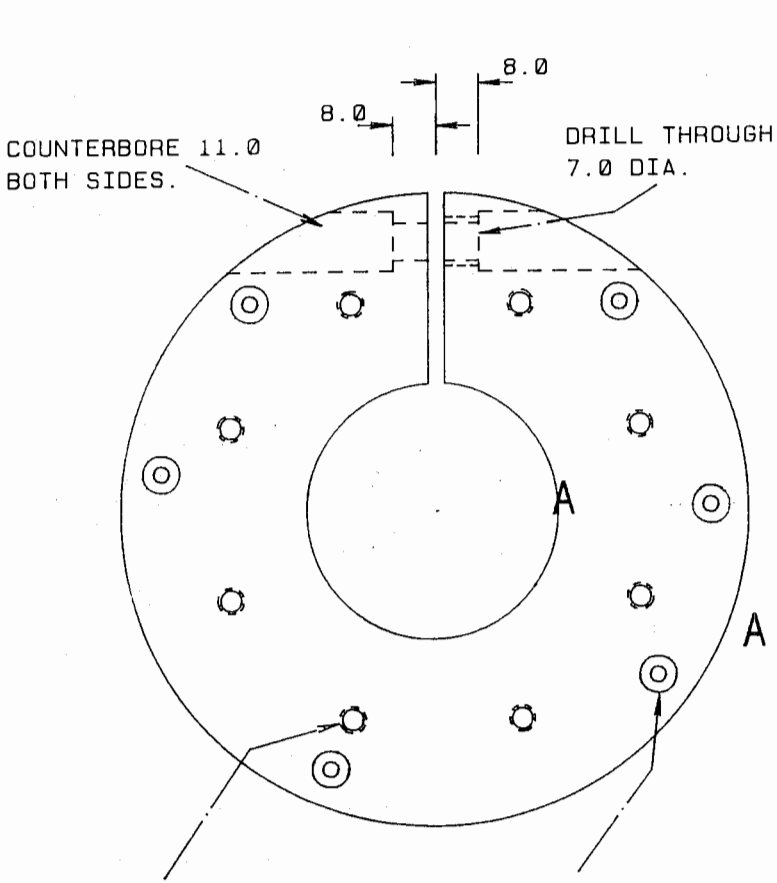
Conclusion: Most tank sparks occurred just below the terminal. This is consistent with these units being subjected to higher gradient when double stripping creates radiation which decreases the voltage at the second stripper. In order to maintain final beam energy, the terminal voltage must rise, increasing the gradient in U15 to U19.

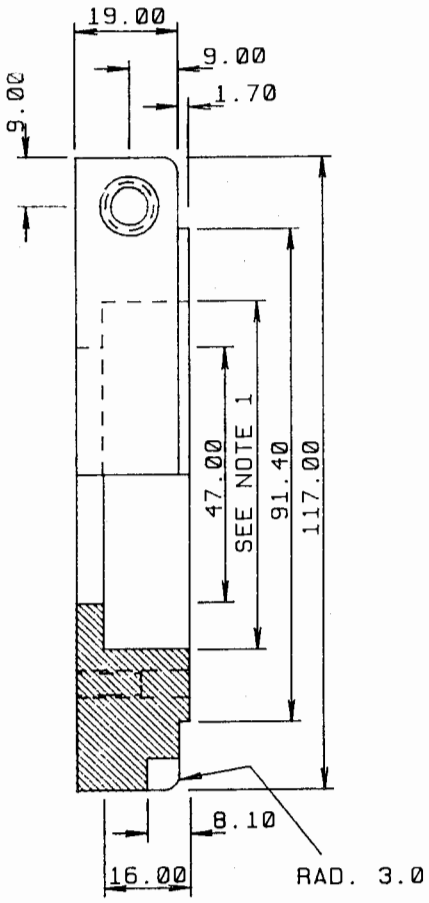
The rings were wiped on the first day in order to pre-clean and make the machine more habitable. The usual blow down and chamois cloth procedure preceded close up.

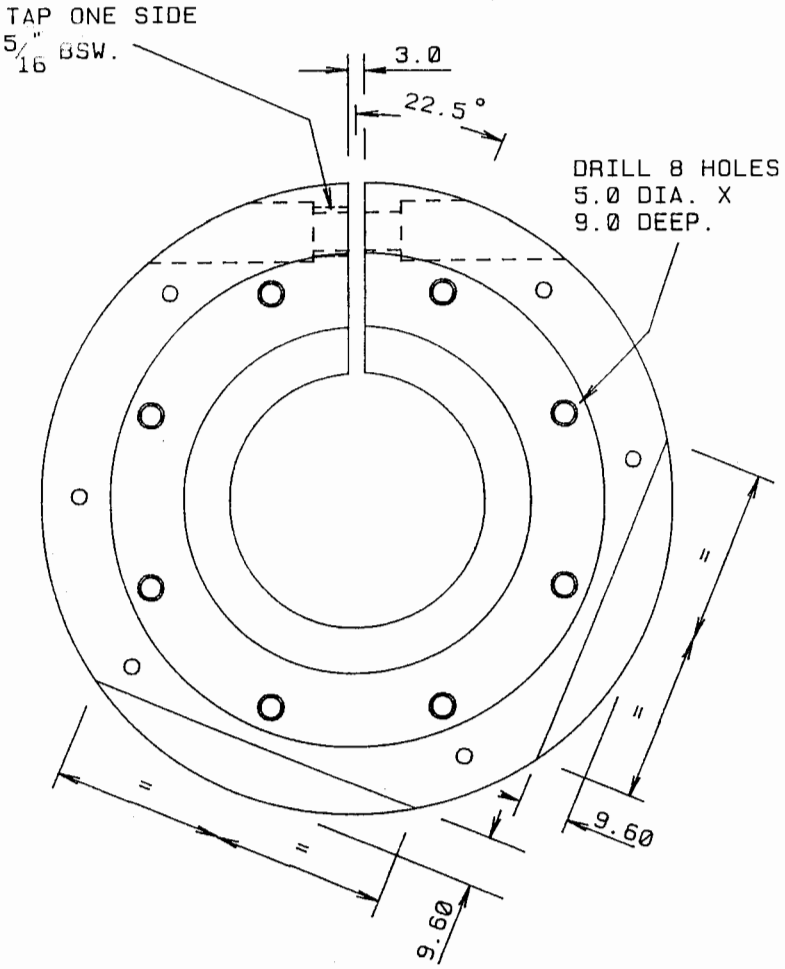
Enclosures:

1. 14UD Log GVM 1992
2. Drawing
3. Photograph

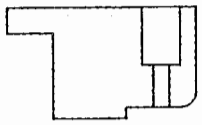
14 UD Log GVM 1992







NOTES:
1. THIS DIMENSION TO BE 2.524 INCH + 0.001" - 0.000".
2. TOLERENCES EXCEPT WHERE NOTED ± 0.05 MM.
3. BREAK ALL SHARP EDGES.



SECTION AT A-A

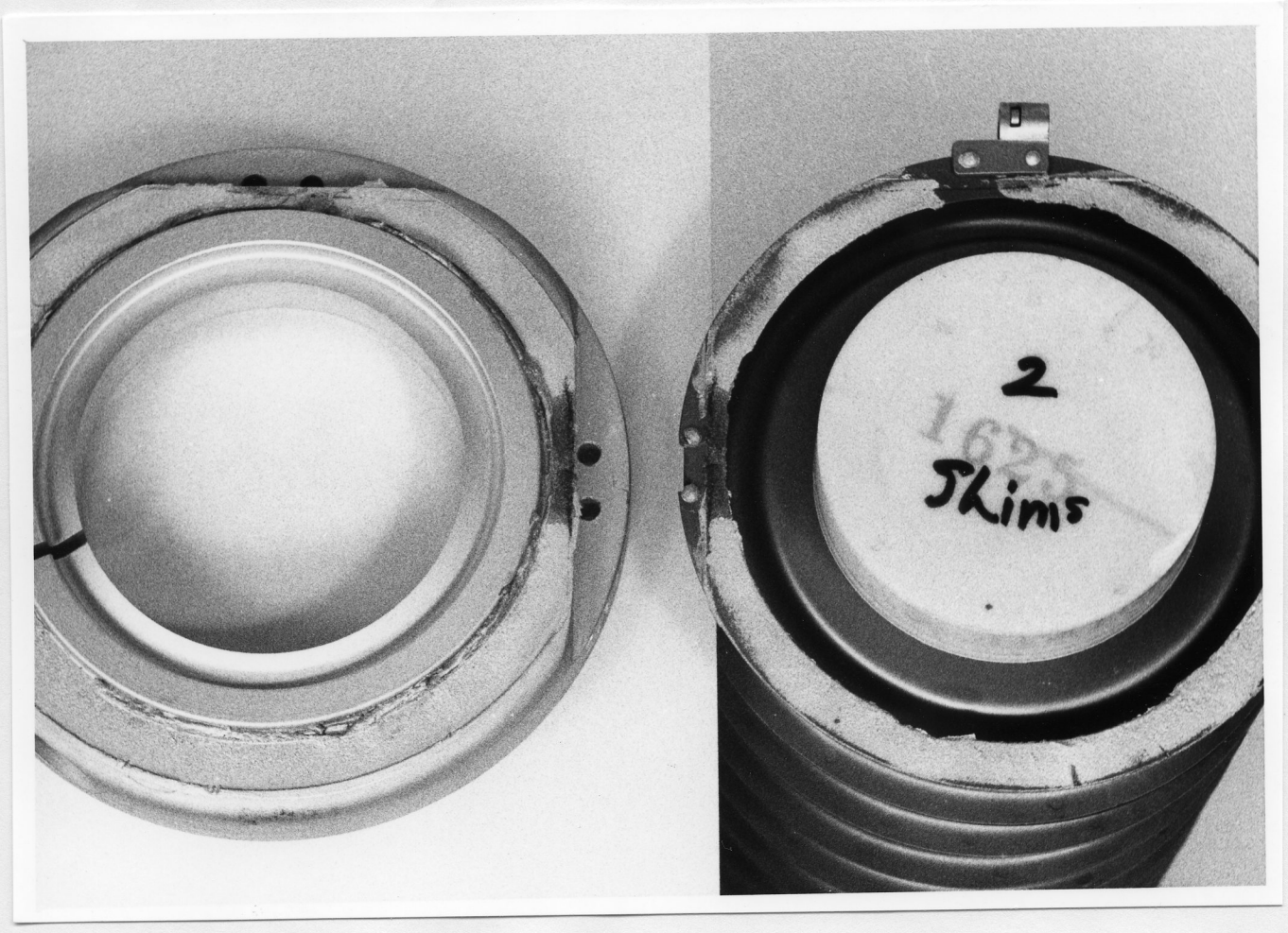
ITEM	DESCRIPTION	REQ.	MATERIAL	REMARKS

NUCLEAR PHYSICS

SCALE	PASSED	DATE
1 : 1		28-8-91

TITLE: 14 UD COLUMN POST END CAP-STAINLESS STEEL

DRAWN	RJB	DRAWING NO.
TRACED		UD655
APP'D		FILE: RJB:003



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