

**14 UD TANK OPENING REPORT # 94**  
**28 July to 2 August 2003**  
**DEPARTMENT OF NUCLEAR PHYSICS**  
**AUSTRALIAN NATIONAL UNIVERSITY**

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**REASON FOR TANK OPENING**

Last opened November 02, Approximately 7 months running.  
Chain #1 pin to pellet wear. A new chain was in stock, ready for installation.

Planned maintenance and other items were

- Inspection
- Install refurbished column posts if ready.
- Investigate electrical instability of Chain #1.
- Repair faulty LE column metering.
- Investigate failed metering illumination of LE mid-section
- Investigate calibration of the terminal 20 l/sec ion pump
- Check chain oilers.
- Replenish terminal stripper foils

Tank Crew:

Justin Heighway, Alistair Muirhead, Howard Wallace  
Alan Cooper was on Pensioner Leave.

Visitors.

Glyn Whitworth OH & S, with a Com Care representative from lift (elevator) group toured the machine as a familiarisation exercise.

**PUMP OUT 28-07-03**

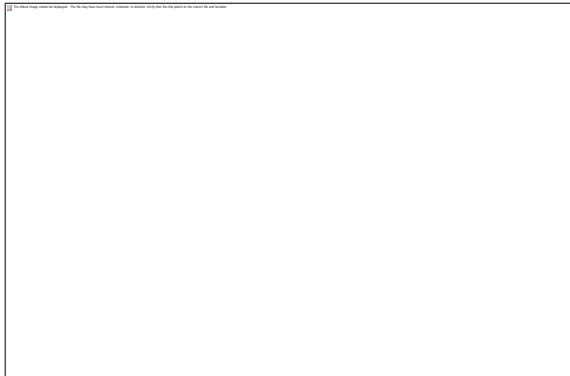
**SUMMARY OF WORK**

- 30 kV POST ELECTRODE GAP TESTS  
10kV tester used because 30 kV unit has gone missing.
- ROTATING SHAFT BEARINGS – pairs of bearings replaced in  
LE Casting 9, 10  
HE Casting 17, 20, 21, 22, 23, 24, 25, 26.  
Rubber coupling in bearing assembly from Casting 24 was cracked and replaced.
- LE mid-section - 5kV Del encapsulated ion pump supply cooked and blew fuse.

- The LE column-metering problem – tank stretch tipped spark gap onto ground.
- Installed foil changer with full compliment of foils
- Loose wiring
  - +ve high voltage chain charging
  - Stringers loose:
    - Unit 9, Tube #3, post end.
    - Unit 2, Tube 1, Top flange.
    - Post A in the Unit 19 dead section which, houses the High Energy Stripper, had a loose screw connection at the top of the shorting loop.

### **RESISTOR LEAD DAMAGE**

Unit 15, Tube 4, Gap 1 had a burnt banana plug and socket.

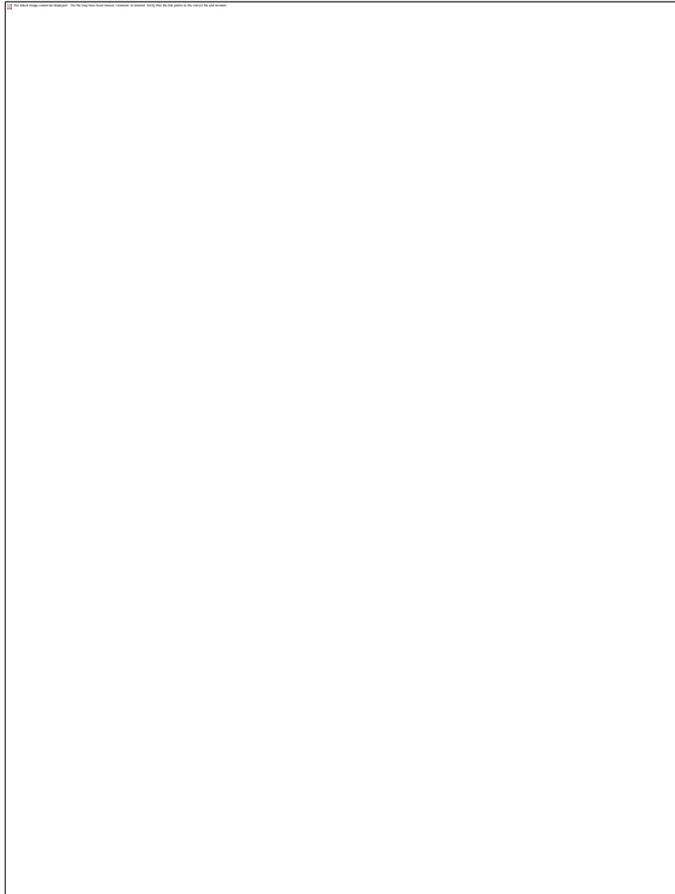


### **TERMINAL ION PUMP CALIBRATION**

Terminal 20 l/sec ion pump is using a 3 kV supply left over from the 2 l/s pump it replaced. It should be a 5kV supply since the calibration not valid at 3 kV nor is the pumping speed at specification. We have ordered a new 5 kV Glassman supply.

### **REDUNDANT CONTROL RODS**

The fibre optics now control all of the terminal functions, so almost all the old control rods are redundant and were removed. The remaining two control rods will also be redundant when we replace the LE sublimator with a 60 l/sec ion pump in the near future.



### **METERING**

The column current metering wiring is supported off ground by spark gap cups supported by double-sided adhesive foam pads. As the tank is pressurised and the tank stretches, the wire is pulled so that the cup tipped and touched ground. The double-sided foam pad was replaced by a glob of Silastic, which was cured while holding the cup off ground.

### **POST REFURBISHMENT**

Didn't happen because of late delivery of flanges from the workshop.  
See content by Cooper below.

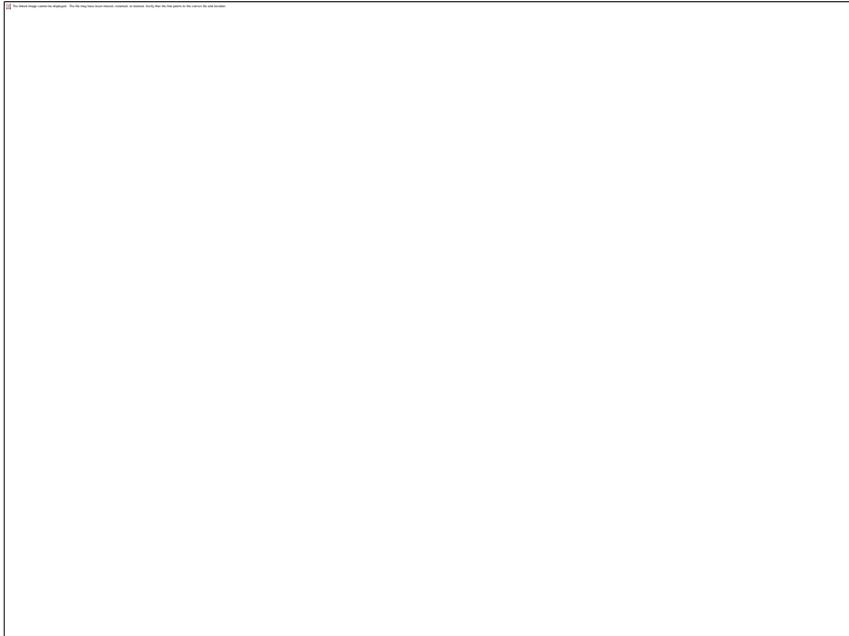
### **CHAINS**

- The chains were run with volts on the first day to establish their condition and to look for the instability on Chain #1 at high current. Since the instability on Chain #1 (Old chain) which only showed up  $> 75 \mu\text{A}$ , it was not evident during test up to  $28 \mu\text{A}$  .
- The chain oiler nozzle on Chain 1 was not centred on the wheel and was rectified.
- Chains #2 and Chain #3 exhibited damage from the contact shims.

Flipping the chains over will present the unworn surface of the chains to the shim stock. That should give us another 61,000 hours of life!!

Ho Ho!

## Typical damage of Chains #2 and #3



- Two pellets were removed from Chains #2 and #3 as they had stretched further with use. Does this signal abnormal stretching/wear?

### **CHAIN #1**

There was an historic problem with Chain 1. In May 1990, a section of 50 links were removed (TOR#72) due to lip-to-lip spark damage. Cracks parallel to the axis of the nylon links in the 50-pellet section were also noted at that time.

In TOR #92 (May 02) we noted that pins exhibited “rust” at the holes in the pellets and there was elongation of the holes. Cracks parallel to the axis were also noted and mistakenly thought to be unprecedented.

Chain #1 has served for over 56K hours which would be even more impressive if the other two chains, with no pin wear, had not run for > 61,000 hours.

A New chain was purchased (28 Nov 2002) to replace Chain #1.

The new Chain #1 was run overnight to get rid of the initial stretch. Three pellets were then removed.

Chain #1 terminal and lower (drive) wheel bearings dated 1989 and 1993 were replaced, as was the rubber coupling to the motor.

### **COLUMN POST REFURBISHMENT** (Section by A. Cooper)

It was intended that a set of four refurbished posts be fitted during this opening. The decision to postpone the job was made soon after the discovery of a post with excessive ceramic to end cap clearance.

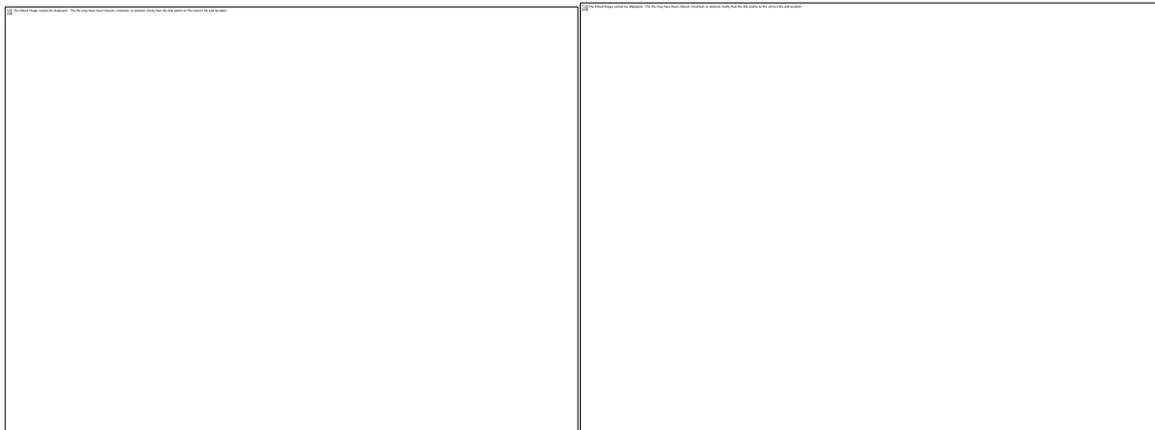
Approx 5 years ago it was noticed that some post end caps did not make complete annular contact with the end ceramic face. Since then all posts have been checked after pressing using a feeler gauge. Posts that have had up to 0.001" gap over less than 90 deg of annulus have been accepted but, surprisingly??, most annuli have no gap using a 0.001" feeler. ANU Posts refurbished before this discovery may have gaps and are in service anyway.

The post in question now had a gap up to 0.003" for 180 degrees of the annulus. The gap was due to the ceramic face being irregular. Half of the end Surface was found to taper off from zero at the centre to 0.003" at the edge. This left only a semicircle available to form a load bearing contact.

Five years ago it was surmised that, since the castings load the posts accurately along their axis and that the ceramic had sufficient compressive capacity in reserve, that the >270 deg of contact would take the axial force with no problems. This thinking led to the acceptance of the 0.001" gap over less the 90 deg.

The decision was taken to machine the ceramic end square in order to improve contact with the metal end cap.

The post was set up in the Thiel mill, as shown in the photos below, and a cupped diamond wheel used to machine the end.



Ink was used to indicate the progressive clean up cut by cut.

The set up was achieved using an end cap aligned to the post axis but not seated on the ceramic. Once the end cap was clocked to the cutter arbor axis it was carefully removed to expose the ceramic.

The machining was achieved taking 0.001" cuts until the entire surface was cleaned up. The end cap was refitted in the usual manner using the press. The feeler gauge test confirmed

that this operation had been entirely successful and the post was then recommitted to the refurbishment program in the school workshop.

A. Cooper carried out design of the procedure concept and the machining in the Nuclear Physics Dept workshop.

### **CLEAN AND CLOSE**

Opened all of the HE units and cleaned the accumulated oil and particulates.

Clean test and close Thursday 8-08-03

### **INITIAL PERFORMANCE**

- Gas in by 14:00, 9-08-03 and experiment started immediately.
- Moisture tested at 15 ppm so drier was NOT reactivated.
- 6 sparks recorded whilst achieving 14.5 –14.8MV in a few hours, more sparks than usual.
- Chain #1 appeared to need oiling when the machine was initially being run as severe negative self-charge was evident. Further investigation revealed that the problem was not a lack of oil but a partial short to ground (6 Ohms). We speculate that the oiler emptied its full load of oil onto the wheel when the SF6 bottle was opened during gas up. This washed some dirt onto the chain wheel insulators, causing the short. The oiler emptied due to a leaky solenoid valve that allowed SF6 pressure to displace the oil.
- LE metering is now working fine.
- The charging efficiency of Chain 1 is equivalent to the others as measured by the terminal volts achieved as a function of charging voltage.