

AUSTRALIAN NATIONAL UNIVERSITY
DEPARTMENT OF NUCLEAR PHYSICS

14 UD TANK OPENING REPORT # 99

15 to 22 Feb 2005

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REASON FOR TANK OPENING

Total loss of control of all terminal functions.

PUMP OUT 14-0-05

- Pump out tank, open doors and start ventilation system.
- The ventilation system ran overnight.

SUMMARY OF WORK 15-02-05 to 22-02-05, Photos in main body of report.

- 15-02-05
- The initial cruise down the column found the top half of the machine was very clean.
- The LE mid section and the terminal were opened and access covers removed from all boxes containing Group 3 components.
- It was noted that Chains 2 and 3 were very slightly oily to touch but that Chain 1 felt and looked dry.
- Breakdown products again adhered to the up side pick off and lower casting of chain #1 and although very slight, as would be expected with such a short run, it indicated that the problems with “breakdown products” still persisted.
- Testing of the mid section ion pump calibration led to the removal of the Ion Pump Fibre Optic Interface and the DC to DC converter was found to be shorted to ground. This had caused the loss of control of all terminal functions by loading the general purpose DC power supply.
- The chains were run in the dark in a vain attempt to spot any discharges that may lead to finding the source of “breakdown products”.

16-02-05

- All inductor and pick off stand offs were HV tested and no significant anomalies were found.

- Chain #1 terminal inductors were taken out and cleaned anyway.
- During a discussion among all tank personnel it was realised that the powder may not be breakdown products but nylon particulates.
- This was confirmed by the powder did not dissolving in water.
- NEC were contacted with the news and asked their opinion on the new revelation of nylon powder and its likely source.
- It was realised that the chain was wearing away the pulley tyre material.
- The oilers were checked and their performance compared to one another.
- Chain #1 was removed for yet another clean.

17-02-05

- The idlers and petal were cleaned after photos were taken.
- Chain #1 was installed in Chain position #3. The chain was hand oiled and photos were taken prior to a test run.
- Sent sample Chain #1 pellets to NEC and e-mailed photos.
- Chain was run for 1 hour and checked. There were no conclusive signs of particulates.

18-02-05

- Checked Chain #1 at 08.00, 17 hours total, and some dust was accumulating in the oil film on the pellets.
- Checked again at 09.00 and decided that the oiler was dripping and keeping the pulley oilier than it would have normally been. The oiler was removed and the chain restarted but with 8 kV charging volts on.
- It was decided to continue the test over the weekend.
- Chain #3 was washed, while out of the machine, ready for reinstallation next week.

19-02-05

- The amount of particulates was found to be increasing but the chain was still oily so it was decided to run until Monday morning.

21-02-05

- The particulate sludge was now thick on each pellet and found to be extruding across the pellet-to-pellet gap. It was assumed that the oil was still keeping the particulates attached but it could be seen that the slurry was drying out and that flakes were becoming detached. Whilst this test of 80 hours did not produce exactly the same type of powder as in position #1 it did produce a large volume of dried slurry. The test was terminated and NEC sent all photos and commentary.
- Old 56 k-hour Chain #1 was found and cleaned. It was installed in position one and Chain #3 was returned to its rightful home.

- NEC asked for the return of new Chain #1 for testing.
- The petals were reinstalled and all inductors set using the new plastic gauge that NEC recently sent.

THE PENNY DROPS, PLASTIC NOT BREAKDOWN PRODUCTS



Hindsight can be a great leveller and it was hard to believe, once the evidence was understood, that the powder was not correctly diagnosed earlier. Placing some of the powder in water conclusively ruled out “breakdown products” as the power would not

dissolve and it actually floated on the surface even after vigorous stirring. It is probably bound by traces of oil into lumps that break up easily once touched. The conclusion, in light of the worn condition of the pulleys that had run against new chain 1, was that the chain was somehow different to its predecessors. The chain and most other sundry left over pellets were, literally, put under the microscope.

CHAIN OBSERVATIONS

The plated pellet surface was thought to be rougher than some samples of older chain held in storage but then some even older pellets were found to be at least as rough as new chain 1.

Howard noticed a tooling mark on most new chain #1 pellets that was not present on any older examples. It takes the form of a lip and is around the entire circumference at each end of the cylindrical pellet body.

The jury is still out on this feature but it is suspected that the raised lip may be gouging plastic from the tyre surface.

Chain 1 was moved to see if the problem moved with it (see below).

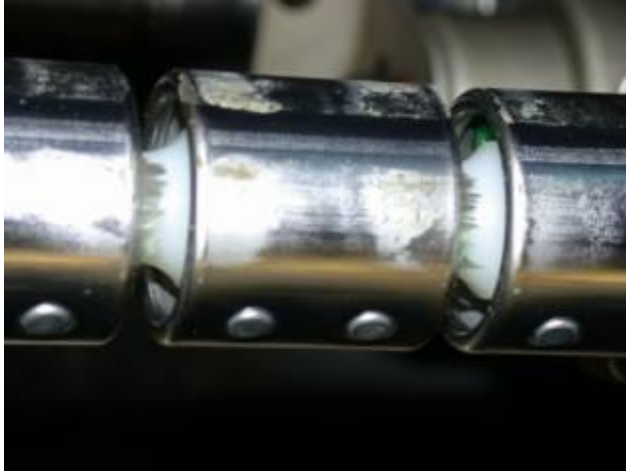
NEC has been sent the chain for testing on their rig.

CHAIN #1 TEST

New chain 1 was run for 80 hours in chain position 3.

Whilst chain 1 in position 3 did not produce the copious amounts of loose white powder that it did in its own location it did produce powder that was trapped in oil and seen, as the hours passed, as a progressively drier slurry. More than enough slurry accumulated on the chain and wheel to confirm the erosion of pulley tyre material.

Chain pulley 3 began the test in typical shiny and oily condition, though, due to the incontinent oiler, the chain was significantly oilier than “normal”. However, after only 80 hours the tyre was scored in the same way that the chain pulleys, upper and lower, had been over the last few openings in the #1 position.



Dry slurry extrudes across pellet gap



Slurry adhering to tyre rim.

LOSS OF TERMINAL EQUIPMENT CONTROL

The cause of this opening was found to be the internal shorting to ground of the DC-to-DC converter in the Ion Pump Fibre Optic Interface.

It was deduced that this part was not really required if we told the Group # ADC to operate in differential mode. The DC-to-DC converter was removed from the circuit board even though we are not sure why it failed. We speculate that it might not like being in 100-psi environment.

MID SECTION ION PUMP READOUT

Just prior to closing the tank, tests found that the pump read out was again faulty. In the previous opening, a fuse was installed to protect the rest of the terminal electronics from failures on the fibre receiver board.

It was found that the 250 mA fuse in the 12v power circuit, of the Ion Pump Fibre Optic Receiver, had blown. While attempting to check for volts on the interface board it was discovered that the 12V plug base had delaminated from the printed circuit.

This was thought to be the reason the fuse had blown and after resoldering the mid section ion pump the readout was sensible and has continued to function since.

INITIAL PERFORMANCE:

The machine first showed conditioning x-rays at 14.62 MV. Old, old Chain #1 seems to operating very well. Because of its history (May 2002, [TOR 92](#)), we removed it for cause in July 2003 ([TOR 94](#)), we will only run it for high voltage experiments to preserve its remaining life.

Long may the tank stay closed.