AUSTRALIAN NATIONAL UNIVERSITY

DEPARTMENT OF NUCLEAR PHYSICS

14 UD TANK OPENING REPORT # 88

15th to 18th FEBRUARY 2000

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REASON FOR TANK OPENING

The machine had performed well since last opening in early September 99 (TOR 87). Thirty six idlers that had been ordered as a result of all the idler problems covered in (TOR 86) arrived too late for the urgent opening of September but were available this time.

The Gas Stripper fine valve had been difficult to regulate accurately so a modification to the 12 volt valve motor control was designed, as far as possible, prior to opening the machine. The installation would require some in tank design as well and it was planned to try and get this modification operational and tested during this opening.

Even though the foil inventory was only partially depleted, the foilchanger was to be restocked.

Four column posts were supposed to be ready for this opening but one fractured during machining so it was decided to wait till next opening.

The modifications performed on wiring for Charging Motor 2 during (TOR 87) were planned for Charging Motors 1 and 3.

PUMP OUT 14-2-00
Pump out tank, open doors and start ventilation system.

SUMMARY OF WORK
15 to 18-2-00

The initial cruise down the column found the machine clean and in good order. There were approximately six spark marks "all" below the terminal around units 15 to 17. The HV test found no problems and the column was wiped down. There were a few idler particles lying around the HE castings but it was thought that these were left over from last opening as no idlers were found to be disintergrating this opening.

The idlers in Unit 16 were replaced with new ones. This was done prior to opening the terminal as the terminal spinnings cover unit 16.

The terminal was opened and the Gas Stripper control box opened. The motor control was tested to note "run on" of the fine valve shaft. David Anderson, Alistair Muirhead and the younger author devised a plan for the fitting of the new controller board. The board was fitted and tested before going on to other scheduled tasks.

16-2-00
The foil changer was removed and then all idlers were checked so that the new ones replaced the worst of the old idlers. All the hard idlers are now out of the machine and about four of the softest old idlers have been kept as spares.

The shafts were run and no problems were found.

The terminal was inspected with particular care given to the chains.
Casting covers were refitted, except where covered by the terminal spinnings, and the column was blown down with high pressure nitrogen to Unit10.

17-2-00
George McEwan, our school electrician, upgraded Charging Motors 1 and 3 to the same level of spark protection that Charging Motor 2 received last opening.(TOR 87).

The foil changer was refitted and tested. Then the terminal was closed and the remaining casting covers fitted. It was noted that the Triode needles were in good condition.

During the blow down of the remainder of the terminal, it was noticed that there were four tank spark marks grouped within an area about 300mm square (~ one square foot). Opposite these, the remnants of many failed idlers were found attached to the tank wall. The particulates were confined to the HE end and mainly opposite charging chain 3 where the majority of idler failures had occurred. The tank wall was cleaned by 7 jolly swagmen using RBS and water.

Charging and HE metering tests were carried out. The HV test led to the discovery of a loose stringer and a couple of resistor lead problems. The LE metering was checked just prior to exiting the tank.

GAS STRIPPER FINE VALVE
The fine valve has been troublesome since day one. Right after installation, initial performance was descibed as erratic (TOR 81). The valve was changed out, (TOR 82)

using the original old gas stripper valve as the replacement, back in November 97. The valve was sent back to Granville Phillips for tests but they found nothing wrong with it. Since then operators have persisted with less than fine control.

The lack of control left operators with the feeling that the minimum step of operation was too long. It was thought, also, that a significant amount of motor overun exacerbated the problem. The minimum angular displacement was found to be approximately 30 deg of which only 5 deg was run on.

The 12 volt DC actuation motor turns the Granville Philips valve shaft through a 900:1 gearbox. The motor needed to be slowed down in order to reduce both the number of turns per step and the overun. In order to preserve motor torque, pulse control, at the full 12 volts, was chosen. A board was bought and tested on a similar motor prior to the opening. It was judged that the new board would fit into the shielded box mounted on the inner face of the valve box lid. All connections into the valve box were made via a filtered D connector. During the opening, the board was fitted after measuring the minimum angular displacement of the valve shaft for each step. The new contoller was set at 1/2 RPM and the new angular displacement, per step, was found to be approximately 5 deg total with undetectable run on.

Subsequent testing of the gas stripper canal pressures, during operation of the valve, showed that the valve was much more controllable in the range of 0.2 to 10 mtorr measured at the center of the stripper canal. The RF shielded box was then closed.

CHAIN IDLERS

Thirty six new idlers were in stock and, after 4 each had been sent to ANSTO and Melbourne University to replace those kindly loaned for last opening, 28 were available for this opening. These were fitted in place of the tyres judged to be hardest, ie most suseptable to failure. Unit 16 is usually inaccessable due to the bottom terminal electrode being parked there to allow access to the terminal. It was decided to fit 18, a full compliment of new idlers, to unit 16 on the basis that they should require changing further in the future than the servicable older ones. The older ones liberated from unit 16, that were deemed servicable, were refitted to other locations. When all the reshuffling was completed there were 4 viable soft tyred old wheels kept as spares. All others were discarded. It was felt that the machine should be free of idler problems for quite some time, however, idler condition will be closely monitored during future openings.

During the blowing down of the column with high pressure nitrogen, part of our usual preparation for tank closure, it was noticed that four of the tank spark marks were grouped close together. Inspection of the tank wall adjacent to these marks revealed the resting place of much of the plastic material liberated during disintergration of idler wheels. Particulates ranging from dust up to 6mm across were found adhered to the wall. The impression was that the larger of these had been accelerated to the tank wall while hot enough to adhere to the painted surface. The smaller and dust size particles were too small to note whether melting, electrostatic attraction or a combination of these effects left them trapped on the wall. As may be have been expected, the quarter of the tank

circumference adjacent to chain 3, where the worst of the idler problems had occurred, had the majority of particulates. The entire tank wall was wiped clean using RBS detergent and synthetic chamois. This task took seven people approximately 45 minutes and ensured that the opening ran into the fourth day.

It will be a relief to be able to devote some time to other aspects of machine maintainance because, in the recent past, tank personel had developed various nervous twiches whenever chain idlers were mentioned.

CHARGING CHAIN MOTORS 1 and 3

A power lead failure of chain motor two was the main reason that the tank was opened in September 99 and the resultant repair and modification, to improve spark damage resistance, was covered in TOR 87.

During this opening George McEwan, our school electrician, ably assisted by Alistair Muirhead, brought chain motors 1 and 3 up to the same spark protection specification. The decision not to replace 4 column posts allowed time for this motor protection work. It was fortunate and appreciated that George was able to give time to this task at such short notice.

FOIL CHANGER

The foilchanger was restocked with our usual inventory of repeated groups of foils comprised of; 5 Laser Ablated, 14 ANU, 1 Space.

RESISTOR LEADS

During the HV test, though not because of any voltage problem, just good observation, a couple of resistor leads were found to be in need of replacement.

The lowest gap of the 8 gap tube in unit 13 had a blackened nut to lead connection. The nut and lead were replaced. In unit 14, tube 1, Gap 11 had a slightly spark damaged lead that was replaced also. A loose stringer connection was discovered and tightened while in unit 13.

COLUMN POSTS

The column post reconditioning program was resurrected in January in the hope that four posts would be ready for this opening, however one post fractured at the last gap. The fracture occurred at the ceramic side of the aluminium to titanium bond. The occurrence of a fractured bond, a few days before the opening, suggested it would be prudent to revise the process before committing any more refurbished posts to the column. In any case it is usual practice here to fit a set of four posts at a time and only three were available.

An investigation of the handling and machining of the fractured post led to a better understanding of the process, particulary the clamping of the post into the machining fixture.

The last operation in finishing a post is the machining of the end caps square and to length. The posts have always been clamped, at each end cap, into a fixture that operates similarly to a pair of vee blocks. The two clamps apply modest force to the top end cap circumference thus forcing each cap downward into the vee shaped fixtures at each end.

The fracture was discovered after the final machining operation was completed. It was only when the clamps were unfastened and the post came out of the fixture in two pieces that the machinist became aware that the fracture had occured.

The end caps have holes and a slot that cause the facing cut to be intermittant. During the investigation, it was noticed that the end cap surface at the fractured end of the post, the last end machined, had a slight chatter pattern on the trailing side of the holes and the slot. This end face was the only one, of the four posts, to have such a chatter pattern. This fact suggested that the post fractured just prior to or during the early stages of the final light cut.

It was known that the end caps assume the plane of the last ceramic when pressed into place and locked. This is one of the reasons that the end caps require machining to square the ends, the other reason being to finish the posts at the required length. During the investigation it was realised that the side surfaces, being at 90 deg to the ends, do not align with vee blocks and that when clamped to vee blocks a bending moment is set up in the post. It was found that, while clamped, the post did not deflect at the centre of its length but, none the less, a level of stress would be imposed within the post.

In absence of a single conclusive reason for the failure it was assumed that a combination of clamping stress combined with the machining of an intermittant cut may have caused the break.

It was decided that the machining fixture would be modified to eliminate clamping stress. Furthermore, although great care was always excercised in the handling and machining of all posts in the past, the level of caution and observation will be raised even more when the program is resumed in the near future.

ITEMS REQUIRED FOR NEXT OPENING
Spare resister leads. 3/16" ball driver. Dental mirror. New o-rings for the platform cable feed throughs. Glue for the platform cable seal o-rings.

INITIAL PERFORMANCE
The machine was run at relatively low voltages initially but has since attained 14 Mv. There have been no tank sparks recorded in the log and performance has been excellent as of 9-03-00.