AUSTRALIAN NATIONAL UNIVERTY

DEPARTMENT OF NUCLEAR PHYSICS

14 UD TANK OPENING REPORT # 82

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REASON FOR TANK OPENING

The tasks for this opening were:
1. Fix the sparking problem in Unit 21.
2. To replace the Granville Phillips control valve in the gas stripper.
3. To investigate further the source of vibration in the lower terminal alternator.
4. To repair as many of the previously identified SF6 leaks in the tank and the gas handling system as time would allow.

PUMP OUT 24-11-97

Pump out tank, open doors and start ventilation system.

SUMMARY OF WORK

25-11-97

The usual tour revealed that the machine was quite clean and that there were no obvious problems, even in Unit 21 where, on the 3rd of November, sparking had made it unserviceable.

And so to work.

The HV test found tube resistor 2/1, tube 3, in Unit 21, to be open and this was promptly replaced. The machine did not require the usual pre-work clean with RBS and water. The spark mark survey found very few spark marks. The terminal was opened and the valve box was removed. The lower terminal alternator rotor was removed leaving the stator and housing in position to preserve alignment, which as it turned out, was wrong, anyway.

26-11-97

Outside the machine the valve box and the alternator were being worked on in parallel with inspection and cleaning of the chains, pulleys and inductors inside the machine. The LE end, down to the open terminal electrodes, was blown down with nitrogen, in preparation for closure, as no work was required in this section.

27-11-97

The valve box was refitted and tested for operation using computer control. The terminal was closed and the remainder of the column blown down. During the blow down a damaged resistor lead, which was sharply bent and spark marked, was found and replaced in Unit 14, Tube 1, Gap 1. Then the usual four person wipe down with RBS and water, HV test of the column and, finally, charging and metering tests were performed. The machine was closed, even though a platform cable bolt hole stripped while being tightened, and was pumping by 6.00 PM.

OPEN RESISTOR IN UNIT 21

The open resistor was easily found, during the HV test, as it discharged between the resistor end electrode and the shield. Past records show that the audio on the HV tester had whistled during previous tests in this region. Closer attention will need to paid to these early symptoms in future.

The conductive track that is formed on the surface of the resistor during manufacture is sometimes slightly flawed. In these cases close inspection will reveal chipped edges at the ends of the conductive track where the grinding wheel enters and exits the conductive surface. These chips reduce the cross sectional area of the conductive track and can lead to local overheating and subsequent failure, as was the case this time. This is an anticipated mode of failure for such resistors, however, even though the 14UD service records and the resistor morgue were searched back to 1989 another failure of this type was not recorded.

GRANVILLE PHILLIPS FINE CONTROL VALVE

The fine valve, the DC actuation motor, potentiometer, relays and solonoid valve are housed within their own copper and nickel plated steel box that is itself housed inside one of the larger RF shielded boxes. The original gas stripper used a fine valve of the same type used in the new gas stripper. The old one was liberated from the terminal during the installation of the new gas stripper and was therefore available as a replacement. The box was taken outside for electrical modifications and to fit the old fine valve in place of the seemingly problematical newer one. It was soon discovered that, whilst the valves interchanged with the drive unit, the plumbing was totally different. The decision was quickly made that the box plumbing would be modified to accommodate the old fine valve and that task was completed promptly. It turned out to be a neater installation than the first one. During the leak chasing operation it was discovered that the older fine valve actually behaved as advertised. It was realised that the operational problems with the gas supply were due to an unknown fault in the newer valve. The faulty valve will be returned to Granville Phillips for diagnosis under warranty.

LOWER TERMINAL ALTERNATOR

The alternator rotor was carefully checked between centers in a lathe and was found to be straight. The rotor was then checked for static balance using a set of grinding wheel beams. Although this method is not the ultimate test of balance it was probably adequate for the modest 1500 RPM at which the rotor operates. Further investigation of the alternator installation revealed a misalignment of the housing with respect to the drive coupling beneath. In order to check this more accurately a dummy shaft was made and, once installed, made the required 1.2 mm adjustment an easy matter. The amplitude and direction of the alternator vibrations were measured and were found to be vertical 30 microns, horizontal 60 microns, at 25 Hz (1500 RPM). Having a number to work to allowed further improvement to be quantified.

The rubber coupling had been a source of vibration in the past (TOR 80) and once again came under close scrutiny. The coupling between the terminal alternator and the casting alternator beneath is not of the standard type (Browning "ever-flex" CFR5H). It has a fabricated shaft and flange assembly that was used to adapt a non standard rubber coupling. The non standard coupling had been made and fitted during a breakdown long ago and at a time when the lab held no spares of the standard type. That fact was news to the younger author and a dim memory to others present at the time. The bearing cavity in the casting alternator top plate was worn approximately 0.010" oversize so this was replaced and the coupling reconnected. The fabricated shaft flange assembly still appeared to run out slightly but the shaft was run and the vibrations measured again. The vertical amplitude was now 9 microns and the horizontal amplitude 35 microns and, as would be expected, the terminal felt much steadier to touch. Because it was known that the machine would be open again in March 98, if all went well, the pre-existing level of vibration was grudgingly accepted and the fact that the vibration was reduced by over 40% was seen as a bonus. In comparison the upper alternator was found to have a reading of, vertical 8 microns, horizontal 9 microns.

Browning couplings are now in stock and the original parts to fit these will be found or manufactured by the next opening so the terminal ought to once again pass the old glass of water trick.

PLATFORM CABLE SEALS

The service platform cable seal plate threaded holes are just about worn out. The bolts were replaced and the holes re-tapped (TOR 80) earlier this year when problems were first seen during the loosening of the bolts at that time. The cable plate, that now has only three bolts, was not found to be leaking when tested after gas up. However, a new system for compressing the cable seal o-ring will be designed and built before the next opening.

SF6 LEAKS

1. The o-ring on the corona triode flange was replaced after the surfaces were polished. The small leak persisted, probably due to insufficient o-ring compression. The situation will be revisited next opening.
2. A blank off flange under the tank was found to have a failed gasket. The surfaces were cleaned and the joint remade using Loctite 515 master gasket and that fixed the leak.
3. The top flange on the tank gives a reading on the Halogen leak detector but the exact source has so far eluded detection. More work required here.
4. The SF6 cylinder manifold valve on level 3 was leaking through and was replaced.
5. The actuator manifold at level 2 had given a slight response, on the leak chaser, around two swagelock fittings. These were re-tightened and one leak was stopped and the other reduced.

INITIAL PERFORMANCE

The lower terminal ion pump failed to start, probably due to a fuse or some other power supply problem.

The machine ran up to 13 MV without problems. At the time of writing it had sparked at 13.38 MV and then at 13.01 MV, then it returned to operation at 14.7 MV.

The gas stripper functioned well when used briefly during an experiment.