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| Title: Periodic Operation Of Neutron Generators For Extended Operating Life | Date: 05/04/2003 | Page 1 of 1 |
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SUMMARY: This technical bulletin outlines maintenance activities recommended for Thermo Electron sealed tube neutron generators (STNG's) to maximize the storage life of these products.

DISCUSSION: Feedback from customers over the past several decades has shown that the operating life of Thermo Electron neutron generator tubes normally kept in storage, and systems which are used infrequently, is maximized if the generator is operated periodically. One reason for this is that, by periodically heating the getter material, trace amounts of gas that may buildup within the tube over time are fully captured within the getter while still at low concentrations without overwhelming the capability of the getter to perform this secondary task. Sources of gas build-up within the tube include off-gassing of residual light elements from within the tube as well as the ingress of gasses from the environment through the tubes vacuum barrier. Additionally, internal gas pressure within the tube develops from the continuous generation of He-3 within D-T neutron generators as a result of the natural radioactive decay of the tritium loaded in the tube. While the getter material is largely ineffective at sequestering helium, periodic operation of the tube can address this problem by physically implanting the helium-3 atoms into the walls of the ion source and in the target.

The presence of even relatively low concentrations of contaminant gasses within the tube can lead to unstable system operation resulting from molecular scattering of the deuterium-tritium ions as they are accelerated from the ion source to the target. Another problem that occurs as a result of foreign gas within the tube is an excessively high ion source current due to the formation of an intense plasma cloud within the ion source, occurring in the worst cases without the application of any current to the getter. By periodically operating STNG's which are not normally used these problems can be avoided and the storage life of these tubes can be prolonged.

RECOMMENDATIONS: Thermo Electron recommends that all neutron generators be operated at least once a month for at least thirty minutes. For these scheduled maintenance operations the generators do not need to be operated at full power/yield, intermediate operating parameters are sufficient. Suggested operating parameters follow:

| System | Recommended Operating Conditions |
|---|---|
| A-211, P 211, A-211-4B, B 211 | Target Control HV = 400 V Source Control HV = 500 V Rate = 100 PPS |
| A-320, B 320, A-320-3B, B323 | Minimum NOC Beam Current = 50-60 μ A Rate = 1kHz @10% |
| A-325, A-325-LL, P 325 LL, A-320-4P, P 320, PPNG | Target HV = -65 kV Source HV = 3 kV Beam Current = 50 μ A Rate = 1 kHz @ 10% |
| A-711, HY 711, A-920, API 920 | Accelerator HV = 140 kV Beam Current = 2.5mA |

Note: For all STNG's, it is essential that an accelerating voltage be present while operating the ion source. Never operate the ion source without accelerating voltage applied.