Magnetron Failure Analysis

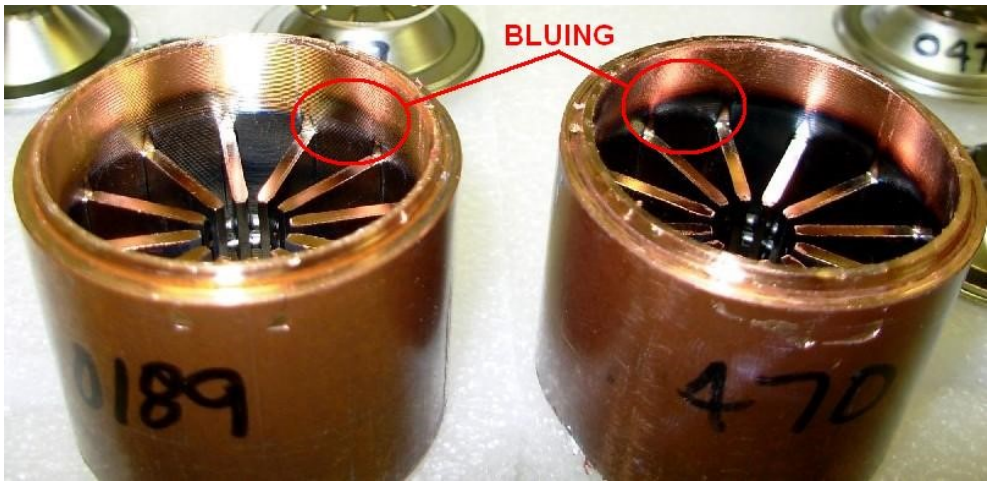
jfGerling MICROWAVE APPLICATIONS CONSULTING

MAGNETRON LIFE EXPECTANCY

Industrial CW magnetrons generally have a life expectancy of approximately 5000 hours under normal operating conditions, although life-times as long as 20K hours have been observed for certain magnetrons under carefully controlled ideal operating conditions. Factors that influence magnetron life include magnetron type, reflected power (VSWR), filament voltage, operating temperature and anode current. As the operating environment is established primarily by the equipment with which magnetrons are used, equipment design must adhere to specifications provided by the magnetron manufacturer. In addition, equipment maintenance must ensure that the specifications are met throughout the life of the magnetron.

PREMATURE FAILURE

Premature magnetron failure can be due to any of several different causes, the most common of which are high reflected power and incorrect filament voltage. In many cases the cause of failure can be determined by inspection of the equipment, revealing discrepancies in operating conditions that are readily corrected to restore the nominal magnetron life expectancy.



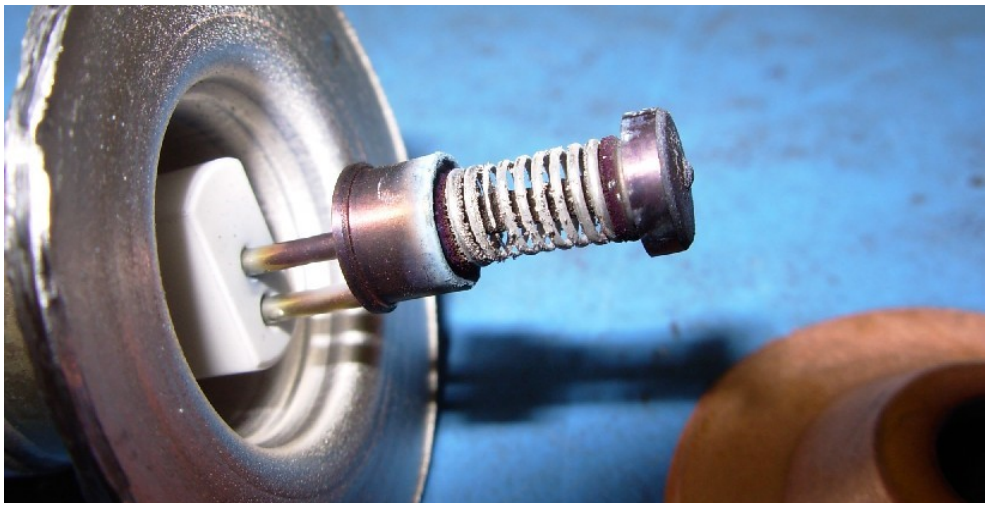
Indication of differences in filament temperature during operation.

FAILURE ANALYSIS

The cause of premature failure is also indicated as visual evidence on the magnetron itself which is revealed by careful examination of its internal and external features. JFG/MAC offers a service to analyze inoperative industrial CW magnetrons to determine the most likely cause of failure. This service includes external and internal examination of the magnetron as well as a review of equipment with which the magnetron is used. Observations, conclusions and recommendations for preventive and/or corrective action to improve magnetron life are provided in a detailed report. Recommendations may include improvements to equipment as well as maintenance procedures. This service is available as a separate activity or part of a more comprehensive equipment review and improvement program.

DATA COLLECTION

A thorough analysis requires as much knowledge of the equipment and actual operating environment as can be collected. The attached **Magnetron Information Sheet** can be used to provide most of the information needed. Please feel free to contact JFG/MAC for assistance with filling in the form.



Visual evidence of sudden loss of vacuum during magnetron operation.

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Magnetron Information Sheet

Client (Company)_____ PO Number_____

Contact_____ Phone or Email_____

Magnetron Data

Manufacturer_____

Model_____

Serial No. (if available)_____

Cooling method ___Air ___Water

Operating hours_____

Microwave Generator Data

Manufacturer_____

Model_____

Output Power_____

System Configuration

Anode supply ___Switch mode ___Linear ___Voltage doubler ___Unknown

Output waveform ___Low ripple ___High ripple ___Pulsed ___Unknown

Filament voltage ___Controlled ___Fixed ___Continuous on ___Turns on with HV

2-port Isolator (circulator/dummy load) ___Yes ___No ___Unknown

Reflected power monitoring ___Yes ___No ___Unknown

Load impedance tuning ___Yes ___No ___Unknown

Cooling interlock device ___Yes ___No ___Unknown

Operating mode ___Continuous ___Intermittent duty (_____seconds on/_____seconds off)

Description of load_____

Comments_____

Symptoms of Failure

Initial failure ___Upon initial start-up ___During normal operation ___Upon turning on HV

Indication ___No output ___Low output ___Output cycling ___Other_____

Alarm code ___None ___Over-voltage ___Over-current ___Other_____

Other observations_____

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