VSRT MEMO #006

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To: VSRT Group
From: Alan E.E. Rogers
Subject: Tests of compact fluorescent lamp as microwave sources

In the 1950's and 1960s radio astronomers often used gas discharge tubes mounted inside the receiver waveguide to calibrate the radiometer. In simple terms, the gas discharge results in a plasma of electrons which is optically thick to microwaves. The noise temperature output is equal to the electron temperature which is typically around 10,000 K. The modern energy saving bulb, currently available in the supermarkets is a high intensity discharge (HID) in mercury-vapor. The lamps are all made in China and probably are pretty similar from one brand to another. The most common brand is GE and the discharge tubes are either helical or loop up and down. Wattage ranges from 15 to 30 (equivalent light output to about 50-100 w incandescent). The electronics in the base produces a high starting voltage (most likely around 1 kv) generated from a frequency (derived from a transistor oscillator) in the range of 50 to 90 KHz. The high frequency is used to reduce the 120 Hz flicker. There are two problems associated with the use of these lamps for VSRT tests, demonstrations and experiments:

1] There is often a 50-90 KHz modulation of the microwave output which can be confused with the modulation produced in the detector by interferometric fringes.

2] There is often a variation in the microwave output with a period in the range 10-20 seconds.

Both of these problems appear to be a minimum in the large lamps. The GE Biax electronic 27 W 120 VAC 60 Hz 400 ma FLE27QBX/2/SW gave the best results. I measured a brightness temperature of about 5000 K for this lamp. The tubes appear to be optically thin at 12 GHz so the maximum output occurs when the tubes pointed towards the antenna.

Electricity cost savings*

Kilowatt Hour Rate	6¢	8¢	10¢	12¢
27 watt	$26	$35	$44	$53

27w 100w

- Long Life means less bulb changes
- Flicker-free
- Soft white light

⚠ CAUTION

Risk of electric shock
- For use in dry locations only • Use indoors only • Do not open - no user serviceable parts inside • Not intended for use with emergency exit fixtures or lights, electronic timers, photocells, dimmers, or in totally enclosed recessed fixtures

Lamp may shatter and cause injury if broken
- Remove and install by grasping only plastic portion of the lamp

**Limited Warranty: Based on reasonable household usage, when used in accordance with package and bulb directions, if this bulb does not last for the time period guaranteed (based on 3 hours average usage per day/7 days per week) return bulb, proof of purchase, register receipt and your name and address to General Electric Company, GE Lighting, Nela Park Cleveland, OH 44122. General Electric will replace the bulb. This replacement is the sole remedy available, and LIABILITY FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES IS HEREBY EXPRESSLY EXCLUDED. Some states do not allow exclusion of incidental or consequential damages so the above limitation or exclusion may not apply to you. This warranty gives you specific legal rights and you may also have other rights which vary state to state.

This product complies with Part 18 of the FCC Rules but may cause interference to radios, televisions, wireless telephones, and remote controls. Avoid placing this product near these devices. If interference occurs, move product away from the device or plug either into a different outlet. Do not install this product near maritime safety equipment or other critical navigation or communication equipment operating between 0.45-30MHz.

Use only on 120V 60 hertz circuits.

*Electricity cost savings based on 10¢ per kilowatt hour and avg. life of 6000 hours (avg. initial lumens 1700) compared to eight 100 Watt Soft white bulbs (avg. life 750 hours, avg. initial lumens 1690).

To calculate your energy savings, use your local utility rate with the chart above. Reliable starting to 5°F (-15°C).

For more information on GE energy saving lighting products call toll-free (800) 435-4448 from 8:00am-6:00pm EST.

Manufactured for:
GE Lighting
General Electric Company
Nela Park, Cleveland, OH 44112
www.GELighting.com
Made in China

LISTED 6G49

0 43168 49887 6

PC: 49887
DESC:
FLE27QBX/2/SW/CD
SACG271CN1
Res. #4690609

Long Life Plus

Fits Most Fixtures

27w 100w

Soft White 100

*Energy Saving Bulb**

This bulb save:
$43.80
in energy costs.

Incandescent Soft White Bulb	Long Life
1690 lumens	Light Output 1700 lumens
100 watts	Energy Used 27 watts
750 hours	Life 6000 hours

To save energy costs, find the b… with the light output you ne… then choose the one with t… lowest watts.

Mercury

FLUORESCENT LIGHTS AND MERCURY

Mercury is an essential ingredient for most energy-efficient lamps. Fluorescent lamps and high intensity discharge (HID) lamps are the two most common types of lamps that utilize mercury. Fluorescent lamps provide lighting for most schools, office buildings and stores. HID lamps, which include mercury-vapor, metal halide and high-pressure sodium lamps, are used for street lights, floodlights and industrial lighting. A typical fluorescent lamp is composed of a phosphor-coated glass tube with electrodes located at either end. The tube contains mercury, of which only a very small amount is in vapor form. When a voltage is applied, the electrodes energize the mercury vapor, causing it to emit ultraviolet (UV) energy. The phosphor coating absorbs the UV energy, causing the phosphor to fluoresce and emit visible light. Without the mercury vapor to produce UV energy, there would be no light. A four-foot fluorescent lamp has an average rated life of at least 20,000 hours. To achieve this long life, lamps must contain a specific quantity of mercury. The amount of mercury required is very small, typically measured in milligrams, and varies by lamp type, date of manufacture, manufacturing plant and manufacturer.

Listed below are fact sheets, Web sites, brochures and articles on fluorescent lamps. The links will appear in a new browser window.

General Information on Fluorescent Lamps

Full Title: Disposal of Fluorescent Light Tubes, High Intensity Discharge Lamps and Flourescent Lamp Ballasts
Full Work Author: PRO-ACT
Abstract: Fluorescent light tubes and lamp ballasts, and high intensity discharge (HID) lamps are found throughout our environment in residences, office buildings, commercial and industrial buildings, streets, and parking lots. Their disposal can create waste which are often classified as hazardous. The purpose of this fact sheet is to provide information on the components which make the waste hazardous and on appropriate waste disposal procedures.

Full Title: Mercury in Fluorescent Lamps
Full Work Author: Massachusetts Department of Environmental Protection
Abstract: This Web site covers a very brief synopsis of mercury in fluorescent lamps. It explains why mercury is toxic, what to do with used fluorescent lamps, and links to some of the recycling services of fluorescent lamps in the New England area.

Regulations Affecting Fluorescent Lamps

Full Title: Safe and Environmentally Sound Management of Mercury-Containing Lamps