



TECHNICAL DATA

**2KDW60LA
2KDW60LF
60KW VISION
40KW VISION/SOUND
UHF-TV KLYSTRODE
AMPLIFIERS**

The EIMAC 2KDW60LA Klystrode® and 2KDW60LF Klystrode tubes are a new development providing exceptionally high average conversion efficiency in UHF Television service. The Klystrode combines the features of a klystron and a tetrode, having a magnetically focused electron beam, an output cavity and a collector. The electron beam is bunched by an rf cavity-driven grid. The Klystrode can therefore be operated as a Class B linear amplifier.

The Klystrode input beam power varies with modulation depth. Because input power follows the modulation waveform precisely, the Klystrode operates in TV visual service with very low average beam current thus saving beam power which would otherwise be wasted as heat in the collector.

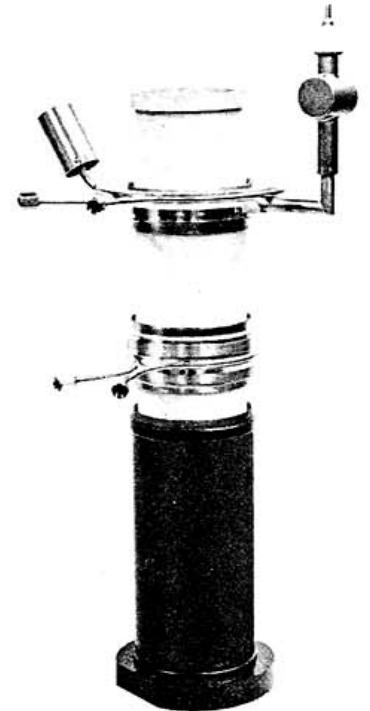
These new Klystrodes may be operated efficiently at 60 kw peak sync power output in visual service. At this power level the ratio of peak-of-sync power output to average beam power input (figure of merit) can exceed 120%.

Two tubes and circuit assemblies: 2KDW60LA w/CV5000 470-600 MHz
cover the UHF-TV band 2KDW60LF w/CV5001 600-806 MHz.

The Klystrode also operates as an FM aural power amplifier. It may be operated in the FM mode at 10% to 20% of the peak sync power of a companion visual Klystrode with a common beam power supply.

These klystrode tubes may also be operated in combined sound and vision service at 40 kw peak sync with pre-correction. This internal diplexing mode of operation results in an extremely simple, compact and economical transmitter design.

A new feature of these tubes is a great reduction in magnet focusing power requirements to less than 200 watts.



GENERAL CHARACTERISTICS ¹

ELECTRICAL

Cathode: Dispenser Type

Heater Voltage	10 to 12 Vdc
Heater Current (nominal)	10 Adc
Maximum Cold Start Heater Current	20 Adc
Heater Warmup Time (minimum)	300 Sec

Magnet - Part of Circuit Assembly:

Voltage (maximum)	7 Vdc
Current (maximum)	28 Adc

MECHANICAL

Cooling:

Body, Collector,	Water
Input and Output Circuit	Forced Air

Input rf Connector Type N

Output rf Connector 4-1/16 In. EIA Standard

Dimensions (2KDW60LA in Hardware):

Length	69.2 In; 175.9 cm
Width	28.0 In; 71.1 cm
Depth	27.0 In; 68.6 cm

Dimensions (2KDW60LF in Hardware):

Length	67.2 In; 170.8 cm
Width	28.0 In; 71.1 cm
Depth	27.0 In; 68.6 cm

Weight (Tube Only) 45 lb; 20 kg

Weight (CV5000 or CV5001 circuit assembly with tube installed) 90 lb; 41 kg

1. Characteristics and typical operating conditions are tentative. These figures may change without notice as the result of additional information. Varian EIMAC should be consulted before using this information for final equipment design. Klystrode® is a registered trademark of Varian Associates.



2KDW60LA, 2KDW60LF

VISUAL SERVICE - 2KDW60LA Klystrode Measured Performance at 500 MHz, -0.5 dB bandwidth 6-MHz
2KDW60LF Klystrode Measured Performance at 783 MHz, -0.5 dB bandwidth 8 MHz

Table with 2 columns: Parameter and Value/Unit. Parameters include Beam Voltage (32 kVdc), Beam Current (3.6 a), rf Power Output (64 kw), Conversion Efficiency (55.0%), etc.

Figure of Merit = Peak Sync Power Out / Average Picture Power Input = 120% including sync & blanking pulses

The currents shown above are instantaneous values measured in repetitive pulse operation with constant pulse width, amplitude and pulse repetition rate, and with zero current between pulses.

AURAL SERVICE - 2KDW60LF and 2KDW60LA Klystrode Performance

Table with 4 columns: Parameter, Value 1, Value 2, Value 3, Unit. Parameters include FM CW rf Power Output (13, 6.4, 6.4 kW), Beam Voltage (32, 32, 16 kVdc), etc.

Note: Beam current is set by the rf drive level which is adjusted for the required power output. The beam voltage may be the same as that used on the associated visual klystron.

APPLICATION

MECHANICAL

CIRCUIT ASSEMBLIES - Included are a magnetic frame, magnet coil, input cavity, double-tuned output cavity and input and output rf couplers.

- CV5000 for 2KDW60LA 470-600 MHz
CV5000A (CH 14-16)
CV5001 for 2KDW60LF 600-806 MHz

VACUUM PUMP - The tube is supplied with a two-liter ion pump and its associated permanent magnet. The primary function of this device is to allow monitoring of the condition of tube vacuum.

COOLING - The tube and circuit assembly are water and forced air cooled. Air is required for cooling

the input circuit of the tube. For power output over about 6 kW, air is blown through the output cavity and load coupler. Approximately 60 cfm at 1/4 inch of water pressure is required.

BODY WATER COOLING - There are two body water circuits, one for the anode and the other for the tail pipe. Each requires a minimum flow of 1.5 gpm at a pressure drop of approximately 25 psi.

COLLECTOR WATER COOLING - Typical minimum flow rate is 25 gpm. Pressure drop at this flow rate is approximately 25 psi. Maximum inlet water temperature is 50°C.

INPUT CAVITY COOLING - Forced-air cooling is required, with a minimum flow of 7 cfm at sea level, at an inlet temperature of 35°C maximum, at a pressure drop of approximately 1.5 inch of water.

ELECTRICAL

HIGH VOLTAGE - Normal operating voltages used with this tube are deadly. Equipment must be designed properly and operating precautions must be followed. Design equipment so that no one can come in contact with high voltages.



RADIO-FREQUENCY RADIATION - Exposure to strong rf fields should be avoided, especially at frequencies above 300 MHz, where energy absorption by the human body is significant. The human eye is particularly sensitive. Prolonged exposure to rf radiation should be limited to 10 milliwatts per square centimeter (Occupational Safety & Health Administration (OSHA) standard). **CARDIAC PACEMAKERS MAY BE AFFECTED.**

X-RADIATION HAZARD - High-vacuum tubes operating at voltages higher than 15 kilovolts produce progressively more dangerous X-ray radiation as the voltage is increased. This tube, operating at its rated voltages and currents, is a potential X-ray source. X-ray shielding may be required on all sides of tubes operating at these voltages to provide adequate protection throughout the life of the tube. If there is any question as to the need for or the adequacy of shielding, an expert in this field should be consulted.

HEATER VOLTAGE - Voltage should be adjustable over the range from 10 to 14 volts dc and measured with an accurate meter. Ripple should not exceed plus/minus five percent. During turn-on current should be limited to 20 amperes. Alternately, a step-start system may be used. The heater connection must be negative, with the cathode positive.

CATHODE/GRID BIAS - A regulated power supply should be used to provide grid bias. The supply should be adjustable over a range of 10 to 70 volts. The supply should be swamped with a 100 ohm bleeder resistor. Alternately, regulated cathode bias may be applied. A conveniently packaged device to provide adjustable and regulated cathode bias is available from EIMAC.

MAGNET POWER SUPPLY REGULATION - Performance of

the Klystrode is quite insensitive to magnet current, and thus magnet power supply regulation need be no better than plus and minus ten percent. Ripple may be plus or minus ten percent.

RF ARC DETECTOR - An rf arc detector is provided as part of the CV5000, CV5000A and CV5001 circuit assemblies for protection of the output cavity. The arc detector is built into the output cavity. The sensor is a cadmium sulfide photo resistor which changes resistance with light level. With no light, resistance is greater than 50K ohms. With an arc or when the test lamp is energized the resistance drops to less than 5K ohms. When this happens rf drive power and the beam voltage must be removed, but the crowbar need not fire. A test lamp is located near the arc detector to simulate an arc for test purposes. The test lamp is also built into the output cavity. It is sealed into the assembly housing with the photo detector. It may be energized at 28 volts and 1.5 milliamperes.

BEAM POWER SUPPLY - For FM sound the Klystrode may be operated from the same power supply as the visual klystron. Beam current may be adjusted to the value necessary for the required power output by changing the rf drive power.

TUBE PROTECTION - In the event of an internal tube arc, or an arc in the input cavity, a "crowbar" device must be used to instantly remove high voltage from the Klystrode. EIMAC Application Bulletin #17 titled FAULT PROTECTION (available on request) contains considerable detail on the subject. A crowbar assembly is available from EIMAC.

FOR MORE INFORMATION - Write to: Varian EIMAC, Attn: Klystrode Marketing Manager, 301 Industrial Way, San Carlos, CA 94070, USA.

OPERATING HAZARDS

PROPER USE AND SAFE OPERATING PRACTICES WITH RESPECT TO POWER TUBES ARE THE RESPONSIBILITY OF EQUIPMENT MANUFACTURERS AND USERS OF SUCH TUBES. ALL PERSONS WHO WORK WITH OR ARE EXPOSED TO POWER TUBES OR EQUIPMENT WHICH UTILIZES SUCH TUBES MUST TAKE PRECAUTIONS TO PROTECT THEMSELVES AGAINST POSSIBLE SERIOUS BODILY INJURY. DO NOT BE CARELESS AROUND SUCH PRODUCTS.

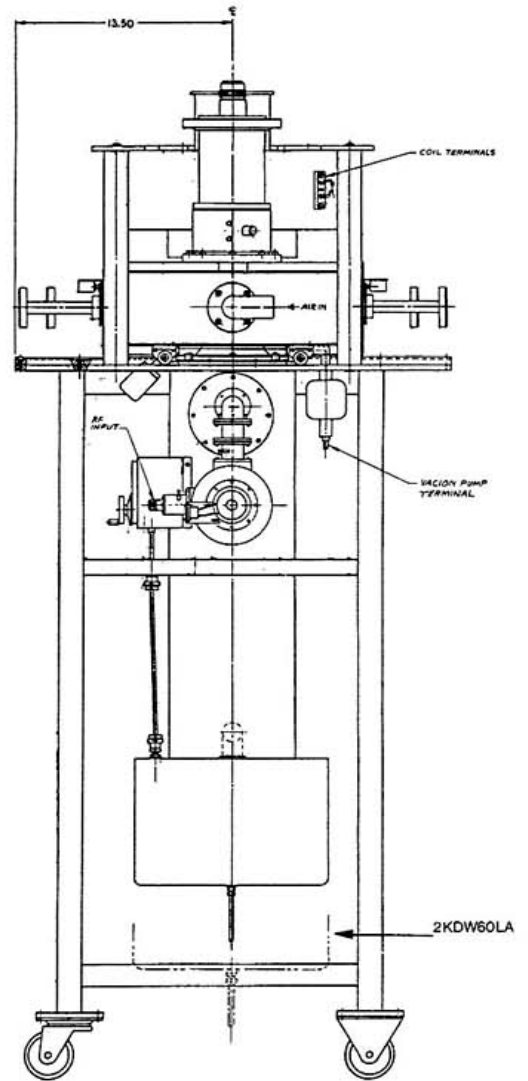
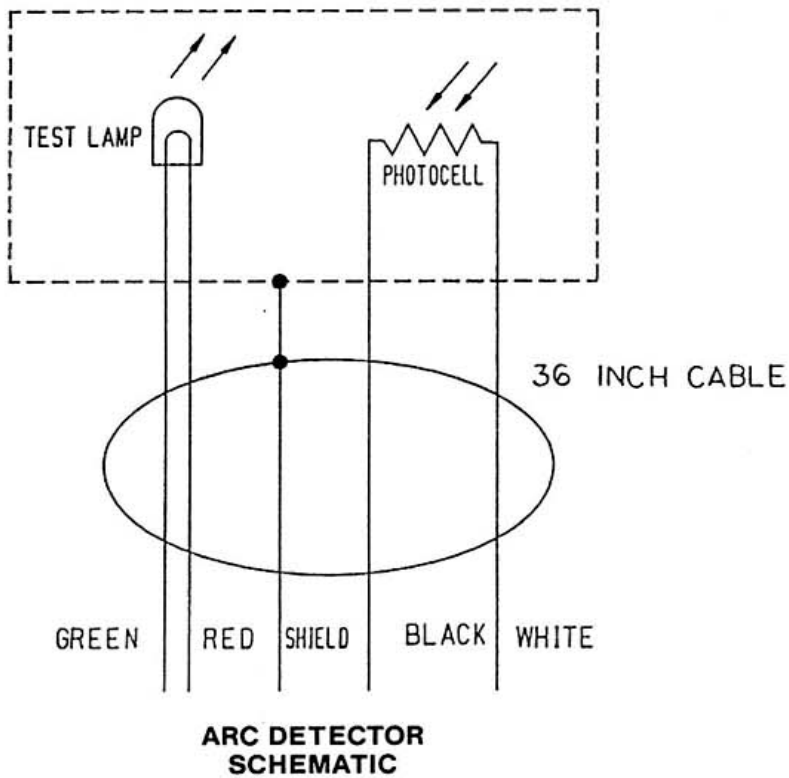
The operation of this tube may involve the following hazards, any one of which, in the absence of safe operating practices and precautions, could result in serious harm to personnel:

- | | |
|---|---|
| <p>a. HOT WATER - Water used to cool tubes may reach scalding temperatures. Touching or rupture of the cooling system can cause serious burns.</p> | <p>and can cause serious bodily and eye injuries. CARDIAC PACEMAKERS MAY BE AFFECTED.</p> |
| <p>b. LOW-VOLTAGE HIGH-CURRENT CIRCUITS - Personal jewelry, such as rings, should not be worn when working with filament contacts or connectors as a short circuit can produce very high current and melting, resulting in severe burns.</p> | <p>d. HIGH VOLTAGE - Normal operating voltages can be deadly. Remember that HIGH VOLTAGE CAN KILL.</p> |
| <p>c. RF RADIATION - Exposure to strong rf fields should be avoided, even at relatively low frequencies. The dangers of rf radiation are more severe at UHF and microwave frequencies</p> | <p>e. X-RAY RADIATION - High-voltage tubes can produce dangerous and possibly fatal X-Rays. If shielding is provided equipment should never be operated without all such shielding in place.</p> |
| | <p>f. HOT SURFACES - Surfaces of tubes can reach temperatures of several hundred °C and cause serious burns if touched for several minutes after all power is removed.</p> |

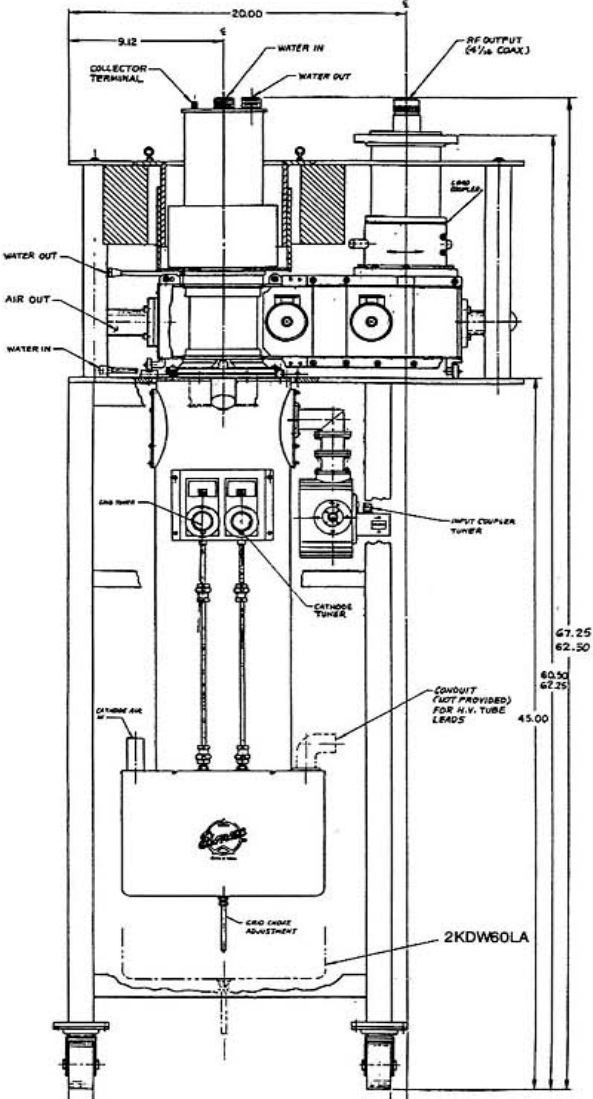
Please review the detailed operating hazards sheet enclosed with each tube, or request a copy from: Varian EIMAC, Power Grid Application Engineering, 301 Industrial Way, San Carlos CA 94070.



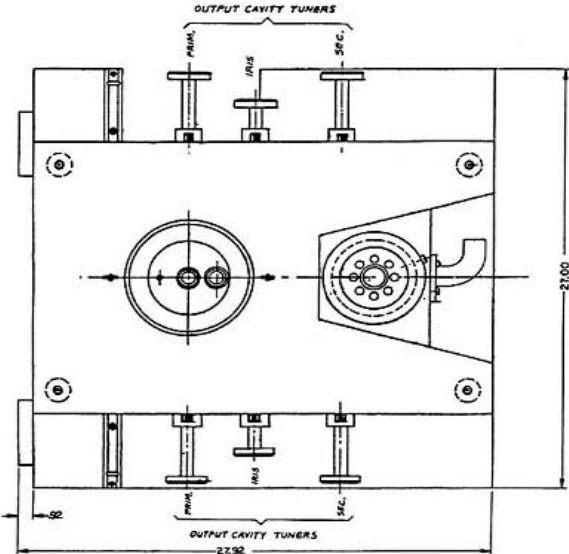
2KDW60LA, 2KDW60LF



**2KDW60LA in CV5000
Circuit Assembly**



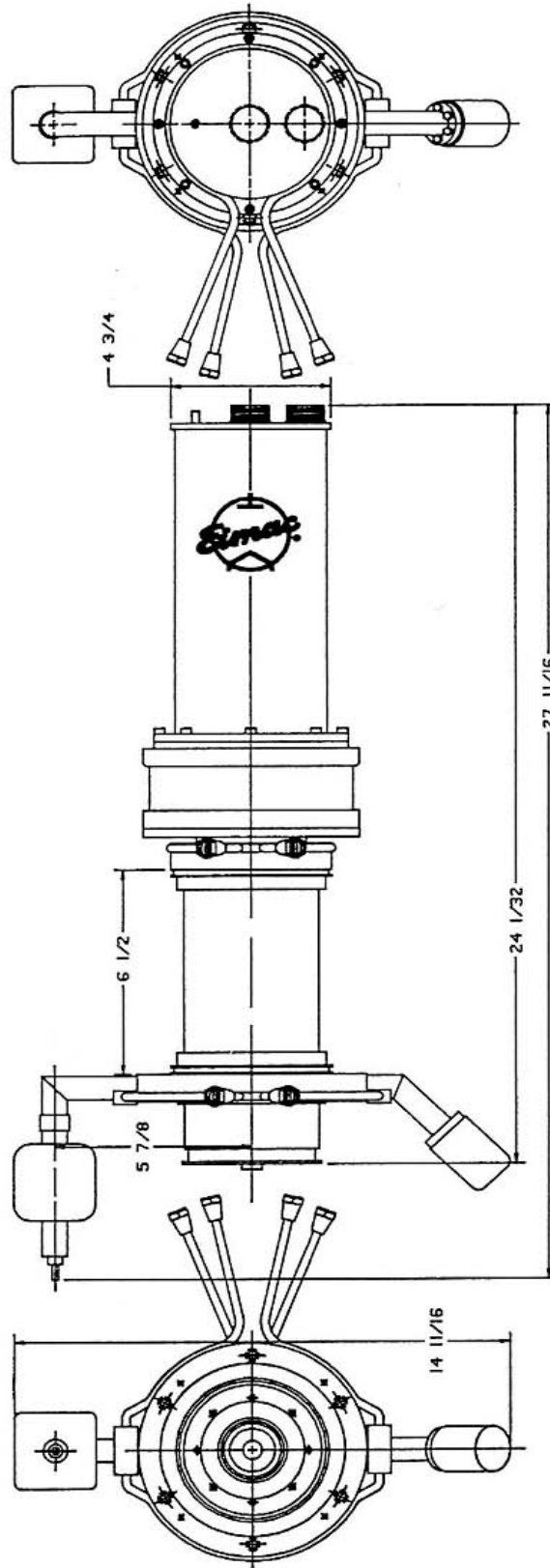
2KDW60LA in CV5000 Circuit Assembly

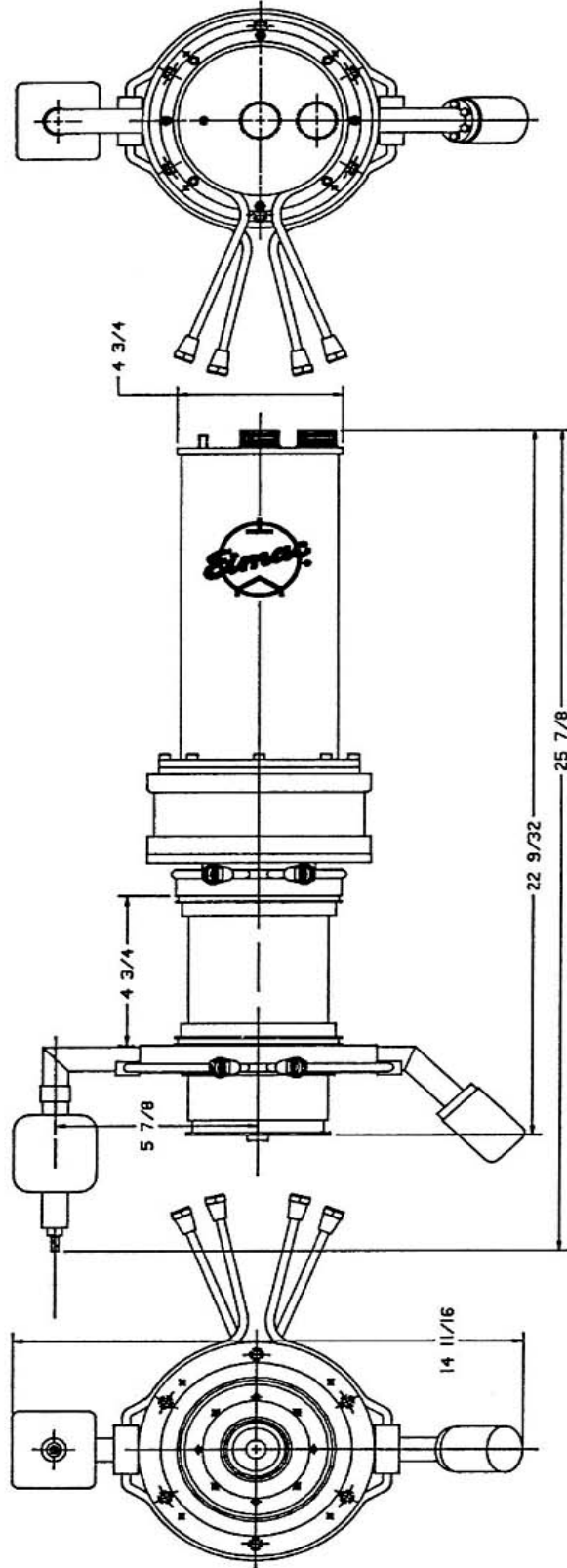




2KDW60LA, 2KDW60LF

2KDW60LA





2KDW60LF