GENERAL OPERATIONAL RECOMMENDATIONS

GENERAL

Mullard electronic flash tubes have been designed to cover a wide range of uses in industry, in research on the study of high-speed phenomena, and in commercial photography. The tubes are characterised by a high luminous efficiency, ease of triggering and short flash duration. They are capable of producing several thousand flashes without deterioration in the quality and intensity of the light output. The spectrum of the emitted light approximates closely to that of daylight and they may thus be used in colour photography (see curves following the general operational recommendations).

The time delay between application of the trigger pulse and production of the light flash is less than 50 microseconds, and since the duration of the flash itself is usually much less than 1 millisecond, a flash tube is capable of "freezing" movement for photographic purposes.

OPERATION OF FLASH TUBES

Connections

For reliable operation it is recommended that the anode be maintained at earth potential, the cathode being alive. The trigger electrode should be tied to the anode via the trigger transformer. Failure to do this may result in spontaneous breakdown.

Energy of Discharge

The energy dissipated in the tube must not exceed the maximum value given in the data sheet. If it is intended to use the tube at the maximum rated energy discharge, a high grade voltmeter should be used to measure the voltage across the discharge capacitor ; it is not sufficient to rely upon the nominal output rating of the transformer employed, since the energy is proportional to the square of the voltage ($E=\frac{1}{2}CV^2$). The time between flashes must not be less than the minimum value given in the data sheet for each tube. Failure to observe these points will reduce the life of the tube.

The effective resistance of a flash tube during discharge is very low. The leads connecting the discharge capacitor to the anode and cathode should therefore be as short and as thick as possible to ensure maximum delivery of energy to the tube.

Trigger Voltage

The trigger voltage specified in the data sheet is the peak pulse voltage obtained from a damped oscillatory transient and must be such that it is positive with respect to the other electrodes over the first half cycle of its waveform, otherwise satisfactory operation of the tube may not be ensured. A practical method of obtaining this voltage is to discharge a 0.5μF capacitor through the primary of a transformer, the secondary of which is connected between trigger and anode. A typical trigger voltage waveform is shown in the accompanying curve. The faster the initial voltage rise, the smaller will be the delay time between the onset of the trigger voltage and the start of the flash.

GENERAL OPERATIONAL RECOMMENDATIONS

Triggers for Linear Tubes

The type of trigger recommended for linear tubes is a helix of bare wire stretched along the tube from anode to cathode. The pitch of the turns is not critical—a figure of 3.5 to 5 cm is suggested. For reliable operation at the recommended trigger voltage it is necessary that the first turn should start not more than 2 cm from the cathode. Values of trigger voltage given in the data sheets are based on measurements using a trigger of this type.

Covered or enamelled wire should not be used, as permanent glass discoloration may result.

Ventilation

In no circumstances should the hole in the base of the tube be completely enclosed, as the expansion of air due to the heat developed within the dome of the tube may then fracture the envelope.

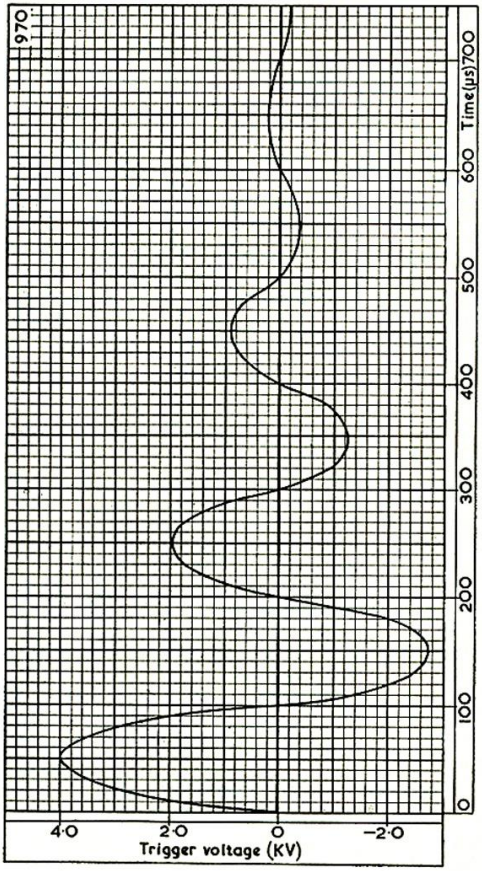
High Voltage Precautions

It is essential that the tube base be kept clean so as to prevent surface leakage between the pins. Soldering should be neat and sharp points avoided to prevent sparking in air.

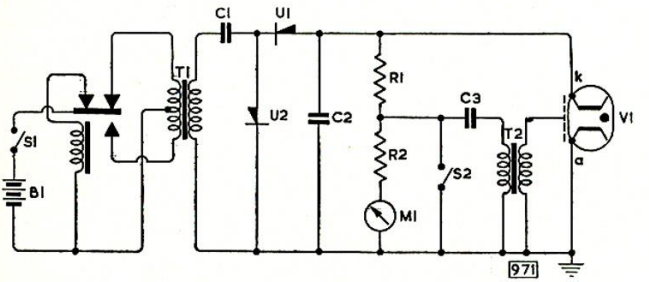
WARNING

IN VIEW OF THE HIGH VOLTAGES AND CAPACITANCES USED IN FLASH EQUIPMENT, CARE MUST BE TAKEN TO ENSURE THAT ALL PARTS WHICH ARE LIKELY TO BE HANDLED ARE ADEQUATELY INSULATED AND PROTECTED.

Flash equipment manufacturers are urged to affix warning labels on each unit pointing out that because of the dangers involved, only experienced servicemen should repair faulty equipment.



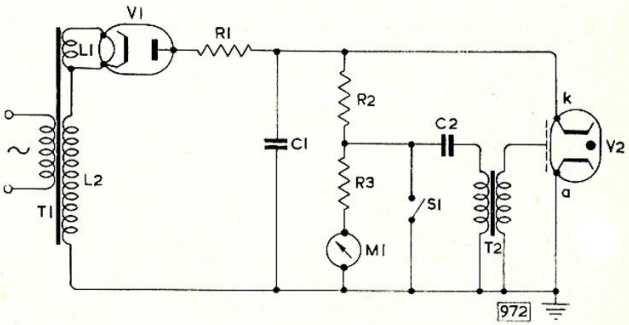
TYPICAL TRIGGER VOLTAGE WAVEFORM



BASIC CIRCUIT FOR BATTERY-OPERATED FLASH TUBE EQUIPMENT

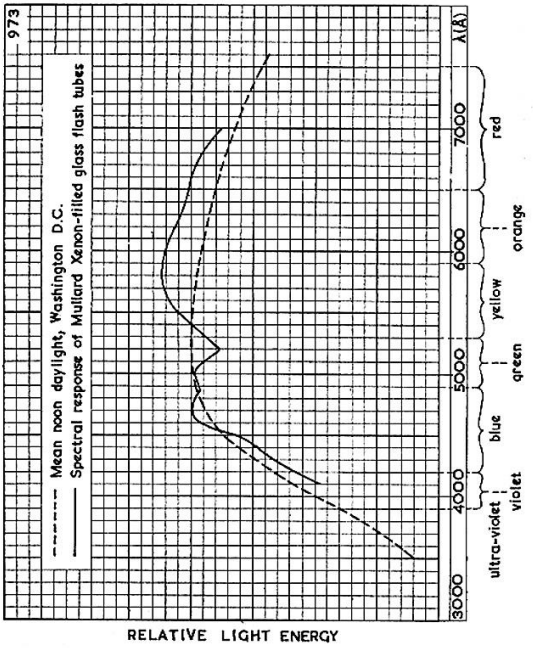
R1	10M Ω
R2	680k Ω
C1	0.05μF (1,000V working)
C2	See Flash Tube Data
C3	1.0μF (500V working)
V1	Flash Tube
M1	Micro-ammeter. 500μA full-scale deflection
*T1	Power transformer
T2	Trigger transformer
*B1	Accumulator or dry batteries
S1	Charging switch
S2	Firing switch
U1, U2	Metal rectifiers. Open circuit input voltage 900V r.m.s. Mean output current 8mA.

*Values should be chosen to provide the required voltage across C2.



BASIC CIRCUIT FOR MAINS-OPERATED FLASH TUBE EQUIPMENT

R1	45 kΩ
R2	10 MΩ
R3	680 kΩ
C1	See Flash Tube Data
C2	1.0μF (500V working)
V1	HVR2
V2	Flash Tube
M1	Micro-ammeter. 500μA full-scale deflection
T1	Mains Transformer { L1=4.0V, 0.8A; L2=Value chosen to provide required voltage across C1
T2	Trigger Transformer
S1	Firing Switch



LIGHT ENERGY DISTRIBUTION CURVE FOR XENON-FILLED GLASS TUBES