e2v technologies

CX1159 (Service Type CV9080)
Deuterium Thyratron

The data to be read in conjunction with the Hydrogen Thyratron Preamble.

ABRIDGED DATA

Deuterium-filled tetrode thyratron, featuring low jitter and low anode delay time drift. Suitable for use at high pulse repetition rates, in parallel for switching higher powers, or for switching long pulses. A reservoir operating from the cathode heater supply is incorporated.

Peak forward anode voltage	33	kV max
Peak anode current (see page 2)	1000	A max
Average anode current	1.25	A max
Anode heating factor	14×10^9	VApps max
Peak output power	16.5	MW max

GENERAL

Electrical

Cathode (connected internally to mid-point of heater)	oxide coated	
Heater voltage	$6.3 \pm 5\%$	V
Heater current	22	A
Tube heating time (minimum)	5.0	min
Inter-electrode capacitances (approximate):		
anode to grid 2 (grid 1 and cathode not connected)	13	pF
anode to grid 1 (grid 2 and cathode not connected)	7.5	pF
anode to cathode (grid 1 and grid 2 not connected)	26	pF

Mechanical

Overall length	317.5 mm (12.500 inches) max
Overall diameter	84.12 mm (3.312 inches) max
Net weight	0.7 kg (1.5 pounds) approx
Mounting position (see note 1)	any
Base	pin spacing as B5F; metal shell with micalex insert
Base adaptors	see page 5
Top cap (see note 2)	BS448-CT3

CX1159 is also available with a flange base and flying leads as type CX1551.

Cooling . . . . . natural

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PULSE MODULATOR SERVICE MAXIMUM AND MINIMUM RATINGS
(Absolute values)

	Min	Max	
Anode			
Peak forward anode voltage (see note 3)	–	33	kV
Peak inverse anode voltage (see note 4)	–	25	kV
Peak anode current	–	1000	A
Peak anode current (pulse repetition rate limited to 60 pps max)	–	2000	A
Average anode current (see note 5)	–	1.25	A
Rate of rise of anode current (see note 6)	–	5000	A/μs
Anode heating factor	–	14×10^9	VApps
Grid 2			
Unloaded grid 2 drive pulse voltage (see note 7)	200	1000	V
Grid 2 pulse duration	1.0	–	μs
Rate of rise of grid 2 pulse (see note 6)	1.0	–	kV/μs
Grid 2 pulse delay	0.5	3.0	μs
Peak inverse grid 2 voltage	–	450	V
Loaded grid 2 bias voltage	−50	−150	V
Forward impedance of grid 2 drive circuit	50	800	Ω
Grid 1 – DC Primed (See note 8)			
DC grid 1 unloaded priming voltage	75	150	V
DC grid 1 priming current	50	100	mA
Grid 1 – Pulsed			
Unloaded grid 1 drive pulse voltage (see note 7)	300	1000	V
Grid 1 pulse duration	2.0	–	μs
Rate of rise of grid 1 pulse (see note 6)	1.0	–	kV/μs
Peak inverse grid 1 voltage	–	450	V
Loaded grid 1 bias voltage		see note 9	
Peak grid 1 drive current	0.3	1.0	A
Cathode			
Heater voltage	6.3 ± 5%		V
Tube heating time	5.0	–	min
Environmental			
Ambient temperature	−50	+90	°C
Altitude	–	3	km
	–	10 000	ft

CHARACTERISTICS

	Min	Typical	Max	
Critical DC anode voltage for conduction (see note 10)	–	0.5	2.0	kV
Anode delay time (see notes 10 and 11)	–	0.15	0.25	μs
Anode delay time drift (see notes 10, 12 and 13)	–	20	50	ns
Time jitter (see notes 10 and 13)	–	1.0	5.0	ns
Recovery time	see note 14 and curves			
Heater current (at 6.3 V)	18	22	25	A

RATINGS FOR SINGLE-SHOT OR CROWBAR SERVICE
(See note 8)

DC forward anode voltage	30	kV max
Peak anode current	15 000	A max
Product of peak current and pulse duration	0.6	A.s max
Repetition frequency	1 pulse per 10 s	max

NOTES

1. Clamping is only permissible by the base.
2. A large area anode connector, e2v technologies type MA360, is recommended.
3. The maximum permissible peak forward voltage for instantaneous starting is 20 kV and there must be no overshoot.
4. The peak inverse voltage must not exceed 25 kV for the first 25 μs after the anode pulse.
5. For inverter type applications where the peak current does not exceed 50 A, the maximum average anode current may be increased to 2.5 A; e2v technologies should be consulted.
6. This rate of rise refers to that part of the leading edge of the pulse between 25% and 75% of the pulse amplitude.
7. Measured with respect to cathode. In certain cases the maximum drive pulse voltage may be exceeded without damage to the tube; a maximum value of 2.5 kV is then recommended. When grid 1 is pulse driven, the last 0.25 μs of the top of the grid 1 pulse must overlap the corresponding first 0.25 μs of the top of the delayed grid 2 pulse.
8. When DC priming is used on grid 1, a negative bias of 100 to 200 V must be applied to grid 2 to ensure anode voltage hold-off. DC priming is recommended for crowbar service.
9. DC negative bias voltages must not be applied to grid 1. When grid 1 is pulse driven, the potential of grid 1 may vary between −10 and +5 V with respect to cathode potential during the period between the completion of recovery and the commencement of the succeeding grid pulse.
10. Typical figures are obtained on test using conditions of minimum grid drive. Improved performance can be expected by increasing the grid drive.
11. The time interval between the instant at which the rising unloaded grid 2 pulse reaches 25% of its pulse amplitude and the instant when anode conduction takes place.
12. The drift in delay time over a period from 10 seconds to 10 minutes after reaching full voltage.
13. For equipment where jitter and anode delay time drift are not important, the tube may be triggered by applying a single pulse to grid 2 and connecting grid 1 to grid 2 via a 1000 pF capacitor shunted by a 0.1 MΩ resistor. These components are incorporated in adaptor assemblies MA92 and MA179 (see below).
14. The recovery characteristics are controlled on a sampling basis.

ADAPTOR ASSEMBLIES

In addition to standard top cap connectors and base sockets, a number of adaptor assemblies are available from e2v technologies.

MA91

A five-contact socket fitted with flexible leads and terminal tags, and mounted on an insulating base plate. It provides a conversion from base to flange type mounting.

The CX1159 is also available with a flange base with flying leads as type CX1551.

MA92

Similar to MA91 but incorporates an RC network and is designed for use with CX1159 where a single pulse drive and flying lead connections are required.

MA179

A five-contact socket with flexible leads and terminal tags, mounted on an insulating base plate; it is fitted with a base clamp. It incorporates an RC network and is designed for use with CX1159 where a single pulse drive and flying lead connections are required.

Further information is contained in the leaflet 'Accessories for Hydrogen Thyratrons'.

HEALTH AND SAFETY HAZARDS

e2v technologies hydrogen thyratrons are safe to handle and operate, provided that the relevant precautions stated herein are observed. e2v technologies does not accept responsibility for damage or injury resulting from the use of electronic devices it produces. Equipment manufacturers and users must ensure that adequate precautions are taken. Appropriate warning labels and notices must be provided on equipments incorporating e2v technologies devices and in operating manuals.

High Voltage

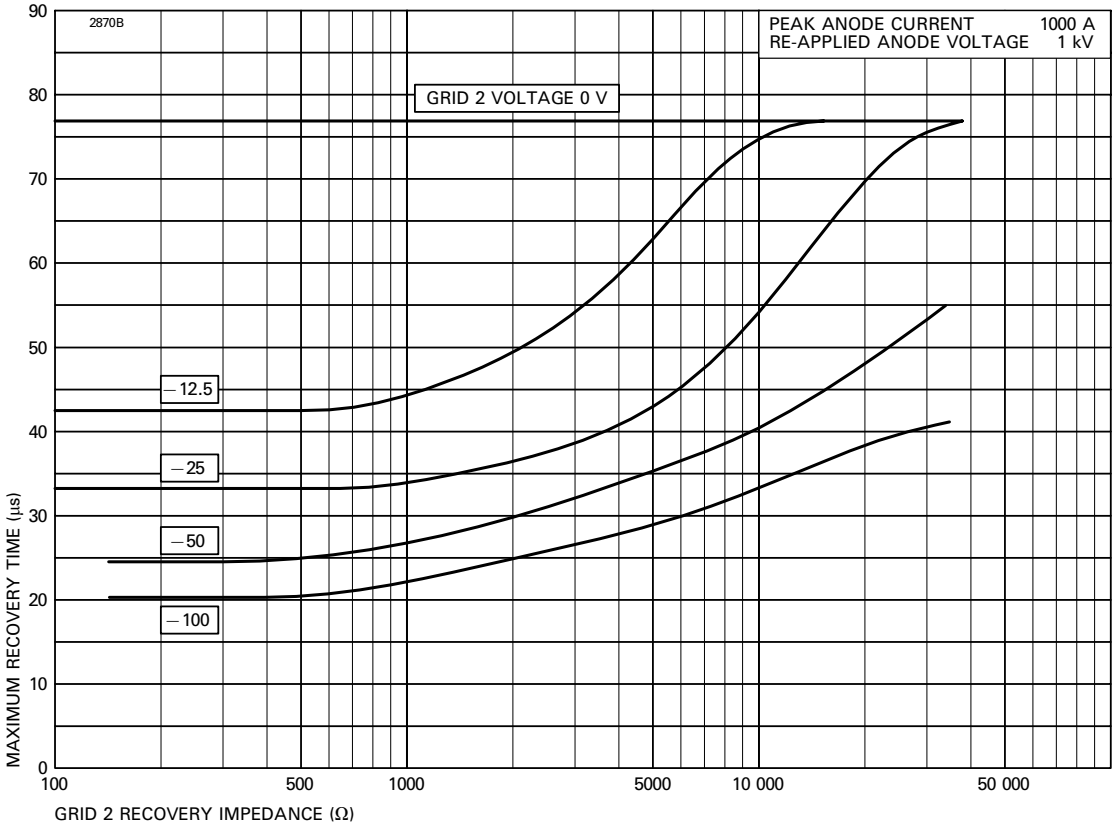
Equipment must be designed so that personnel cannot come into contact with high voltage circuits. All high voltage circuits and terminals must be enclosed and fail-safe interlock switches must be fitted to disconnect the primary power supply and discharge all high voltage capacitors and other stored charges before allowing access. Interlock switches must not be bypassed to allow operation with access doors open.

X-Ray Radiation

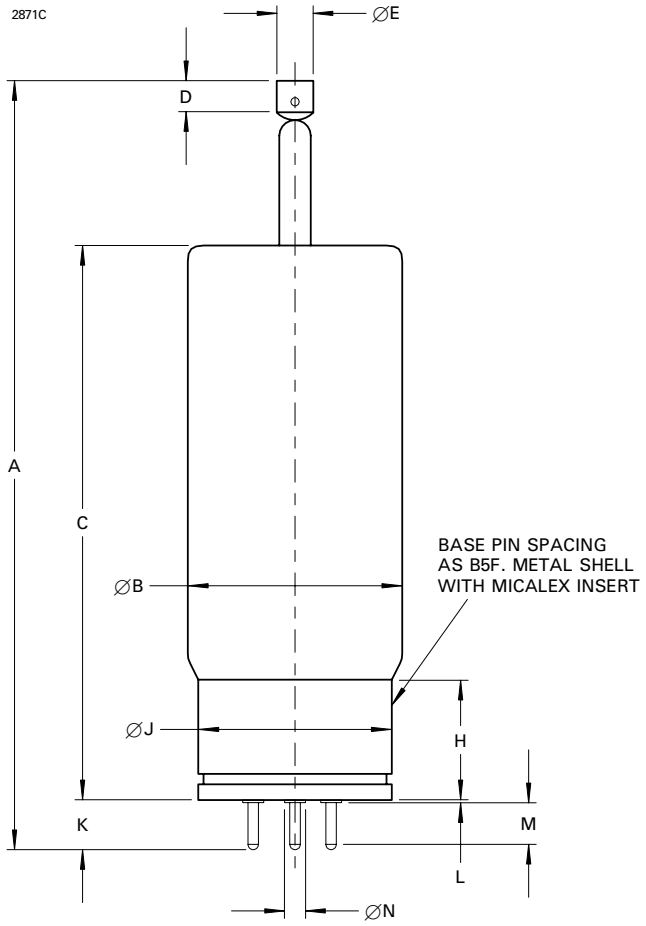
All high voltage devices produce X-rays during operation and may require shielding. The X-ray radiation from hydrogen thyratrons is usually reduced to a safe level by enclosing the equipment or shielding the thyratron with at least 1.6 mm ($^{1}/_{16}$ inch) thick steel panels.

Users and equipment manufacturers must check the radiation level under their maximum operating conditions.

MAXIMUM RECOVERY CHARACTERISTICS

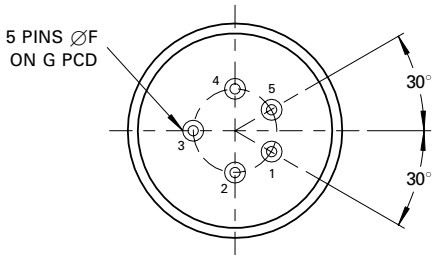


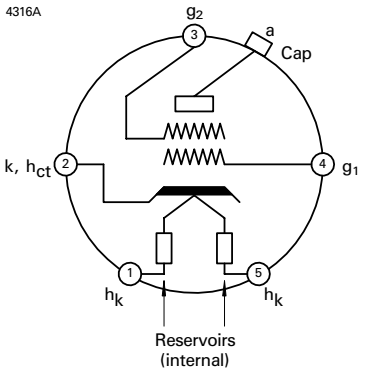
OUTLINE
(All dimensions without limits are nominal)



Ref	Inches	Millimetres
A	12.000 ± 0.500	304.8 ± 12.7
B	3.312 max	84.12 max
C	8.500 ± 0.500	215.9 ± 12.7
D	0.500 min	12.7 min
E	0.566 ± 0.007	14.38 ± 0.18
F	0.187 ± 0.003	4.750 ± 0.076
G	1.250	31.75
H	1.937	49.2
J	3.062 ± 0.062	77.77 ± 1.57
K	0.770 max	19.56 max
L	0.073 max	1.85 max
M	0.575 min	14.6 min
N	0.260 max	6.6 max

Millimetre dimensions have been derived from inches.





Pin	Element
1	Heater
2	Cathode, connected internally to heater mid-point
3	Grid 2
4	Grid 1
5	Heater
Top cap	Anode

