



THOMSON-CSF

DIVISION TUBES ELECTRONIQUES

DATA TEV 3316

TH 8408A

December 1978 - Page 1/5

TH 8408A E22 H7 HIGH-BRIGHTNESS CATHODE-RAY TUBE FOR HEAD-UP DISPLAYS

- Optically flat circular face of 90 % transmittance
- Faceplate diameter : 77 mm
- E22 monochromatic screen
- Magnetic deflection; 52° deflection angle
- High voltage electrostatic focus
- Very rugged construction to meet the most demanding requirements of military aircraft



The TH 8408A E22 H7 is a circular face, monochrome cathode-ray tube having an optically flat faceplate of 65-mm useful diameter. It employs magnetic deflection and high-voltage electrostatic focus. Featuring high brightness and high resolution, this compact CRT is especially designed and fabricated for cockpit head-up displays (HUD) on military tactical aircraft.

The E22 screen is aluminized to enhance picture brightness.

The TH 8408A E 22 H7 is supplied in an appropriate hard housing, incorporating the deflection and geometrical correction yokes. This housing also ensures the magnetic shielding and the mechanical fastening and positioning of the tube. An encapsulated VHV cable, an encapsulated base with flying leads and HV cable are also provided.

The precise tolerances maintained on all critical dimensions allow tube-for-tube replacement without optical system realignment.

The TH 8408A E22 H7 is manufactured to meet the environmental, reliability and maintainability requirements of aircraft cockpit displays. (See the "Environmental Specifications" on page 3).

GENERAL CHARACTERISTICS

Mechanical

Overall length, max.	182.6 mm
Outer diameter, max.	112,2 mm
Minimum useful diameter	65 mm
VHV cable (g4)	AMP-LGH. 1L-832692
HV cable (g3)	AMP-LGH. 1/2L-840706
Weight, approximate	1.5 kg
Operating position.	Any

Electrical

Cathode.	Unipotential, indirectly heated, oxide-coated
Heating :	
– voltage.	6.3 V
– current at 6.3 V.	0.27 to 0.4 A
Preheating time.	30 s
Interelectrode capacitances (without leads) :	
– cathode to other electrodes, max.	8 pF
– g1 to other electrodes, max.	10 pF
– g3 to other electrodes, max.	10 pF
Focusing method.	High-voltage electrostatic
Deflection method.	Electromagnetic
Deflection angle	52°

Optical

Faceplate :	
– transmittance	90 %
– refraction index	1.507
– constringency*	82.3
– thickness	4 ± 0.1 mm
Screen.	Aluminized
– phosphor	E22
– fluorescence and phosphorescence.	Yellowish-green
– persistence at 10 %, max.	4 ms
– λ at spectral peak	540 to 555 nm
– 80 % of total luminance.	530 to 570 nm

* The constringency (dispersion coefficient) is defined as the ratio $\frac{n_d - 1}{n_F - n_C}$ where :

n_d = refraction index relative to helium yellow line	(λ = 587.6 nm)
n_F = refraction index relative to hydrogen blue-green line	(λ = 486.1 nm)
n_C = refraction index relative to hydrogen red line	(λ = 653.3 nm)

OPERATING CONDITIONS

(All potentials are referred to the cathode)

Maximum Ratings (absolute values)

	Min.	Max.	Units
Grid g4 (main accelerating) voltage.	9	20	kV
Grid g3 (focusing) voltage.	0	5	kV
Grid g2 (first accelerating) voltage.	—	1000	V
Grid g1 (control) voltage.	– 150	0	V
Peak heater-to-cathode voltage.	– 40	+ 40	V
Heater voltage.	5.7	6.9	V

Typical Operation

Grid g4 voltage	16 kV
Grid g3 voltage	2500 ± 500 V
Grid g2 voltage	720 V
Cathode voltage	0 V
Cathode current	50 μA
Heater voltage.	6.3 V

Electrooptical Performance

Grid g1 voltage (for cutoff)	− 80 to − 40 V
Modulation (for $I_K = 100 \mu A$), max.	35 V
Peak trace luminance (Note 1)	15 000 cd/m ²
Linewidth (Notes 1 and 2) typ.	0.1 mm
Off-center spot position (Note 3), max.	4 mm
Deflection current (± 32.5 mm deflection) (Note 4), typ.	± 2.4 A
Recovery time at 1 %, typ.	3 μs

NOTES

- 1 — Measurement made with a single horizontal line at 0.125 mm/ μs scanning rate and 50 Hz refresh rate.
- 2 — Linewidth measured at screen center, at half-energy points, for 15000 cd/m² peak trace luminance.
- 3 — Distance of the focused and undeflected spot from screen center.
- 4 — Deflection - yoke characteristics : self-inductance : 143 μH (vertical) - 136 μH (horizontal) — resistance : 0.7 Ω

ENVIRONMENTAL SPECIFICATIONS

The TH 8408A E 22 H7 is designed to withstand the following environmental tests without mechanical damage or electrical failure.

Sweep-Frequency Vibration (sine-wave)

10 to 58 Hz	: 3 mm peak-to-peak amplitude
58 to 2000 Hz	: 20 G
12 cycles are performed for each of the 3 axes	
Total duration	: 12 hours
With voltages applied	

Random Vibration

First Sequence

50 to 100 Hz : + 6 dB	}	15 minutes for each of the 3 axes
100 to 1000 Hz : 0.3 G ² /Hz		
1000 to 2000 Hz : − 6 dB		

Second Sequence

		Z axis	X and Y axes	
● Frequencies (variation rate 1 dB/3.2 Hz)		10 to 30 Hz	+ 3 dB	+ 6 dB
		30 to 100 Hz	0.3 G ² /Hz	0.2 G ² /Hz
		100 to 150 Hz	0.001 G ² /Hz	0.2 G ² /Hz
		150 to 400 Hz	0.001 G ² /Hz	0.2 G ² /Hz
		400 to 450 Hz	0.9 G ² /Hz	0.2 G ² /Hz
		450 to 500 Hz	0.9 G ² /Hz	0.9 G ² /Hz
		500 to 1000 Hz	0.9 G ² /Hz	0.2 G ² /Hz
		1000 to 2000 Hz	0.001 G ² /Hz	− 9 dB
● Duration		6 mn 15 s	6 mn 15 s	

Tests performed with voltages applied to the tube.

Shock

A total of 18 shocks along X and Z axes
With no voltage applied

Constant Acceleration

Acceleration of 20 G is applied to a non-operating tube along Z and X axes.

Barometric Pressure, Reduced

190 mbar during 2 hours
With voltages applied

Low Temperature

Minimum temperature of -40°C during 8 hours (voltages are applied after 1 hour).

High Temperature

+ 95 °C during 7 hours (no voltage applied)	}	(operating tube)
+ 90 °C during 1/2 hour		
+ 70 °C during 1 hour		
+ 55 °C during 1 hour		

Quick Temperature-Variation

From -40°C to $+95^{\circ}\text{C}$ with a variation rate of $3^{\circ}\text{C}/\text{mn}$.
Duration : 3 hours.
With no voltages applied.

Humidity

Relative humidity : 95 %
Temperature : $+55^{\circ}\text{C}$.
2 cycles are performed with voltages applied.

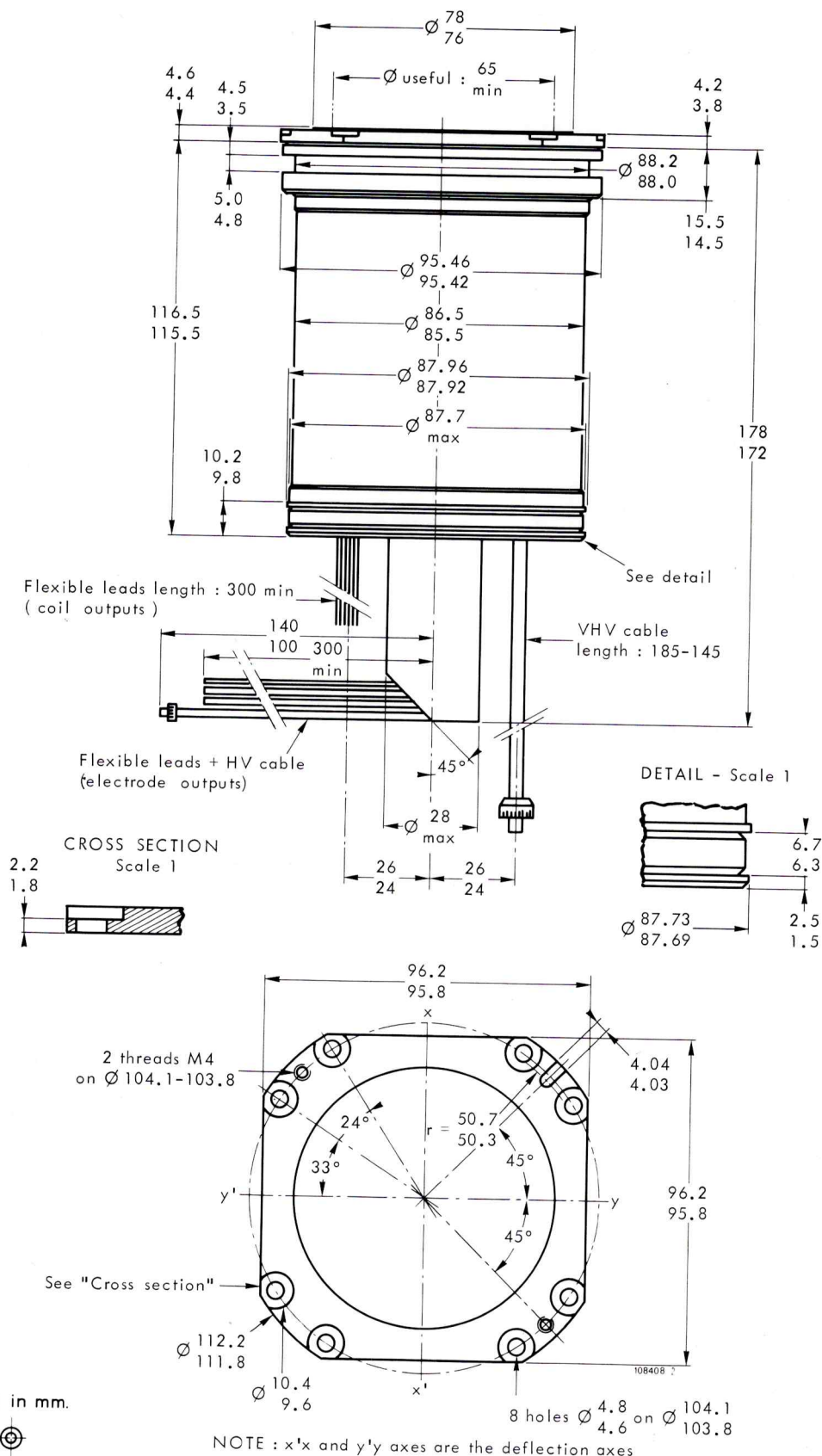
Salt Spray

Duration : 48 hours.
No voltages applied.

Moisture

Duration : 28 days.
No voltages applied.

OUTLINE DRAWING





THOMSON-CSF

DIVISION TUBES ELECTRONIQUES