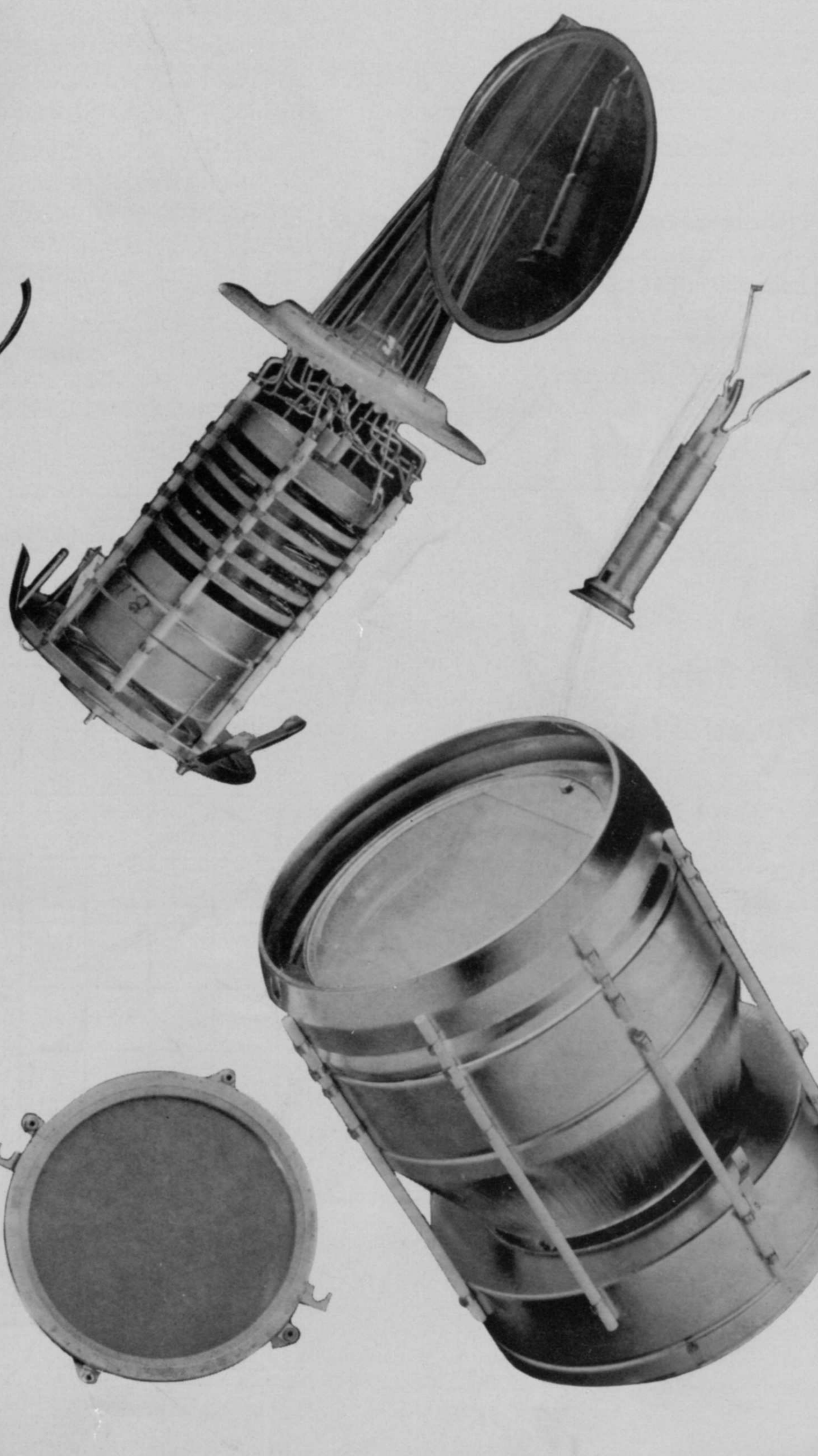
EMI

4½-inch Image Orthicon Television Camera Tubes



Contents

Valve Division, one of the most rapidly expanding divisions of EMI Electronics Ltd., manufactures a wide range of special valves and tubes for equipment used in broadcasting, radar, nuclear and other applications; 4½-inch image orthicon camera tubes are described in detail in this brochure.

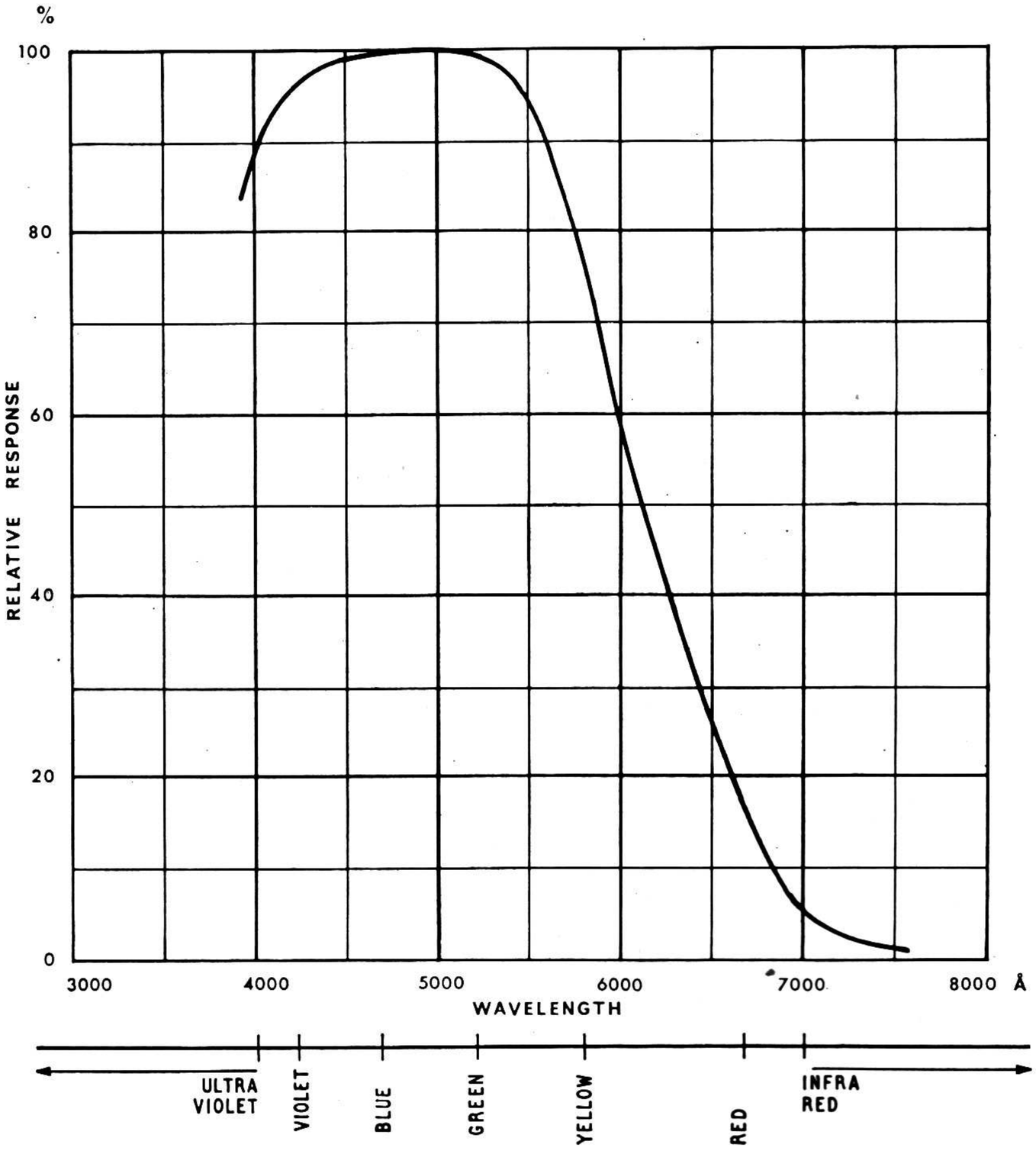
The range of camera tubes includes the 4½-inch image orthicons and 1-inch and ½-inch vidicons; the vidicons include both ultra-violet and infra-red sensitive versions.

Photomultiplier tubes suitable for astronomy, spectrophotometry, scintillation counting, X-ray spectrometry and other applications are produced. Their diameters range from ½ inch to 15 inches. Spectral coverage is from 1,200 Å to 12,000 Å and tube gains of up to 10^9 are available.

The range of klystrons and magnetrons covers wavelengths from 30 cm to 4 mm whilst power output ranges from a few milliwatts to several megawatts. These tubes are extensively used in military and civil radar and communications applications.

Other Valve Division products are high gain multi-stage image intensifiers, barrier grid storage tubes, and the electron stick, a versatile device for teaching the principles of microwave tubes. Specialised components include honeycomb grids, fine meshes, and ceramic metal seals. A small range of photoconductive cells is also produced.

S10 Relative Spectral Response



EMI 4½-inch Image Orthicon Camera Tubes

JEDEC Type 7295 (EMI Type 9564) and

JEDEC Type 7389 (EMI Type 9565)

EMI 4½-inch Image Orthicon Camera Tubes meet the most exacting requirements when used in a standard image orthicon television camera for any broadcast or closed-circuit applications.

JEDEC 7389 (EMI Type 9565), with standard target capacity, is intended for use in controlled studio lighting conditions. JEDEC 7295 (EMI Type 9564), with lower target capacity, is intended for general studio use and remote pick-up applications in poor lighting conditions.

Features

- No free-running microphony
- Minimal shock microphony
- Excellent stable shading characteristics
- Improved subjective signal-to-noise ratio
- Particularly faithful reproduction of facial tones
- Non-burning high-gain first diode
- High sensitivity free from sudden changes

Performance

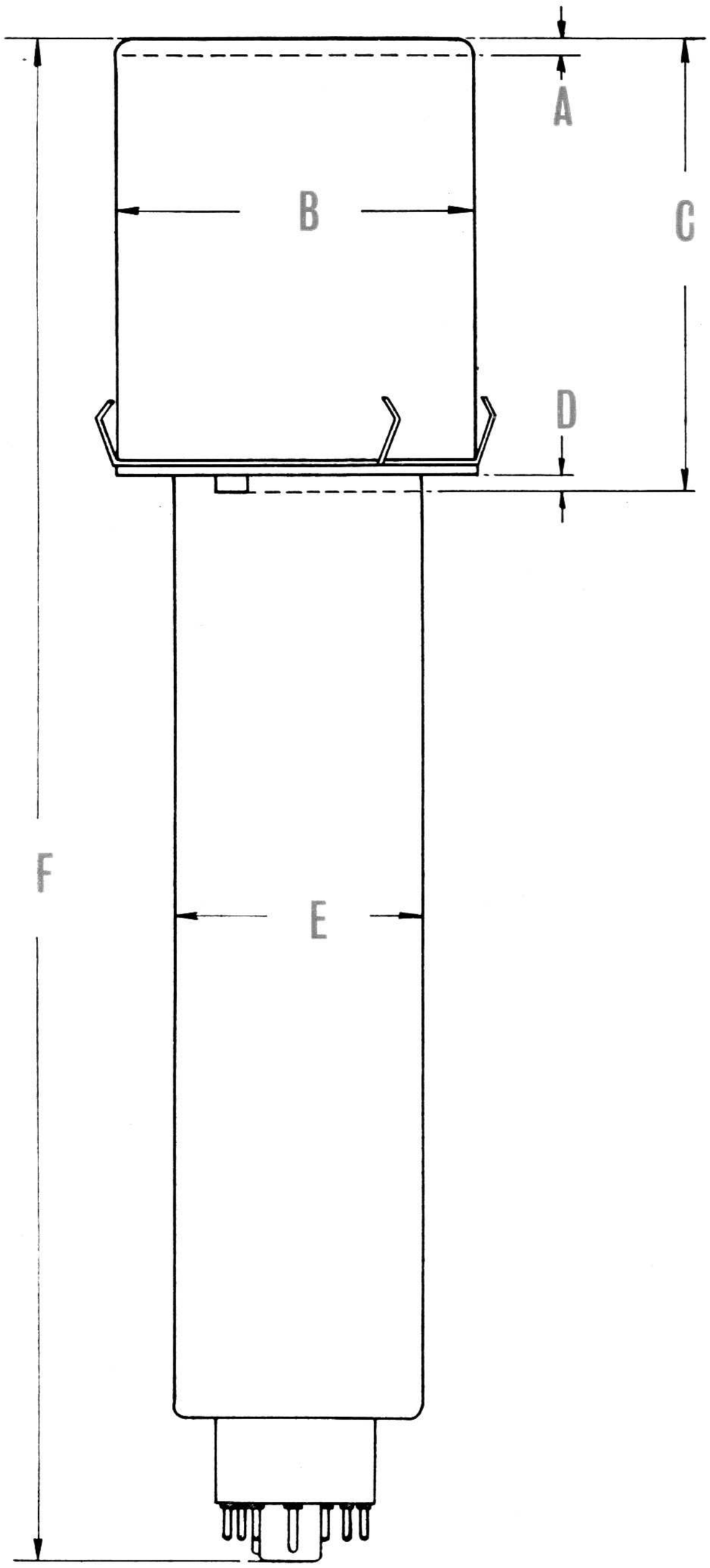
Both the JEDEC Type 7295 and the JEDEC Type 7389 have an excellent signal-to-noise ratio with minimum low frequency noise. Minimum edge and black halo effects and a superior grey scale give pictures of very natural appearance. The low amplitudes of overshoots and halo result in a more faithful reproduction of the picture content, particularly important in the reproduction of facial tones. The depth of modulation at 400 television lines (using a sine wave test pattern) is typically 70%. Both types have a wide range of linear transfer characteristics which provide an improved grey scale. The background shading is stable and maintained at a high standard through-

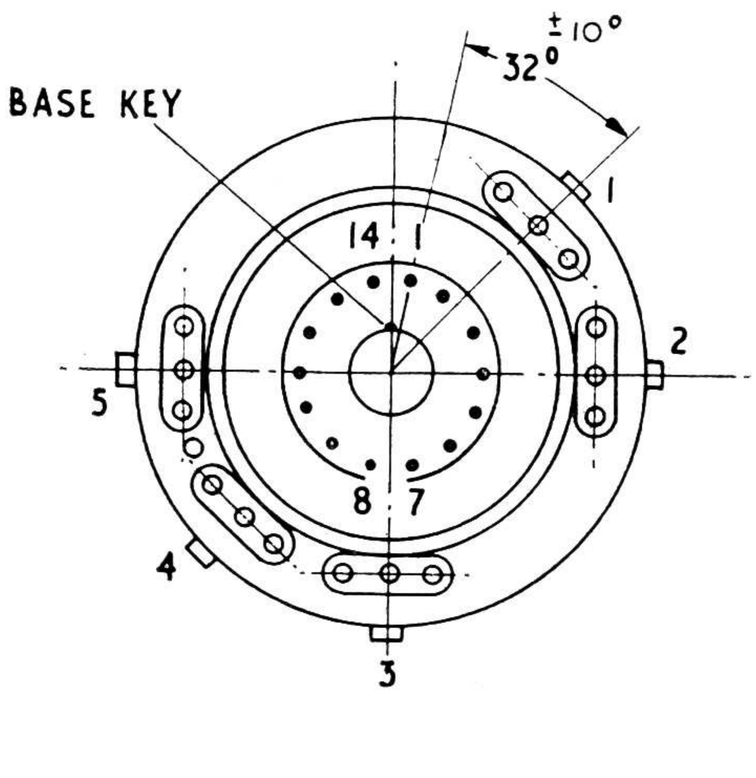
Tubes fitted with EMI "E" type electron conducting targets have the type numbers 9564E and 9565E. These targets do not develop scan burns or memory throughout life and sensitivity does not fall more than ¼ stop.

The data in EMI brochure reference T466/b (V/ORT Issue 2) also applies to type 9564E and 9565E with the exception that the Sticking Specification on page 10 is 10 seconds throughout life.

An outstanding feature is the complete absence of free running microphony. Induced microphony is rapidly damped, and the tubes have very little response to external mechanical excitation. A particular characteristic is the very fine grain non-burning first dynode. In the average tube the first dynode is barely visible in the dark even when the beam is brought to focus on it. However, the gain of the first dynode is such that an excellent signal-to-noise ratio is obtained. The non-burning first dynode and the uniform high quality meshes ensure a picture with minimum shading throughout life.

JEDEC 7295 (EMI Type 9564)





Shoulder base connections

Contact	*Electrode*
1	Field Mesh
2	Photocathode
3	Grid 6
4	Grid 5
5	Target

14 Pin base connections

Pin No.	*Electrode*
1	Heater
2	Grid 4
3	Grid 3
4	Internal Connection–do not use
5	Dynode 2
6	Dynode 4
7	Anode
8	Dynode 5
9	Dynode 3
10	Dynode 1 Grid 2
11	Internal Connection–do not use
12	Grid 1
13	Cathode
14	Heater

Recommended Setting Up Procedure

Notes

A It is important that the tube should **not** be allowed to look at the same scene for more than a minute or two at a time. The camera should be turned to change the position of highlights from time to time or capped up at intervals and whenever a picture is not specifically needed. Particular care is necessary when a diascope is used. If an image is burnt into the target, the tube should be exposed to a uniform white until the image is removed.

B Tube life will benefit if the lens is capped up either electronically or mechanically whenever pictures are not specifically required. It is therefore good practice to develop the habit of capping up whenever possible. A camera should never be left uncapped and static.

C The tube should never be left with the potentials applied and the beam cut off. The method of switching on, described below, with photoemission allowed to stabilise the target to mesh potential before beam is applied, will minimise the possibility of charging the target to field mesh potential and hence minimise the electrostatic attraction between mesh and target. This electrostatic attraction can strain the mesh and may result in a worsening of tube microphony with life. It is **strongly** recommended that this procedure is followed whenever electrode voltages are applied to the tube. In standby, cap mechanically, leaving beam on. When switching off, **uncap mechanically and electrically, switch off tube supplies and cap mechanically.**

Procedure 1 Note whether the tilt indicator shows that the mishandling has occurred. (You may have an insurance claim). Carefully remove the tube from its carrying container and take off the faceplate protector, preserving the protector for further use. Clean tube faceplate with lens tissue.

2 Insert tube into camera yoke. Correct orientation is with the Grid 6 connection at bottom centre. A white arrow is marked on the faceplate in line with this contact to facilitate correct orientation. Plug in face focus coil which should lie in contact with the tube faceplate. Fit socket to the tube 14 pin base.

3 Bring an **uncapped** lens into line with the tube and arrange the camera to view an illuminated blank wall or to be well de-focused on an illuminated portion of the studio.

4 Set BEAM (Grid 1) control for minimum beam. Set scans to overscan position. Switch on tube filament and allow one to two minutes for warm-up. Switch on all tube supplies including image section with electronic cap **not** applied (switch to UNCAP) so that emission from the photocathode can reach the target.

(Check that tube potentials are as recommended if trouble is suspected.)

5 Adjust BEAM control until some signal appears on the picture monitor. Adjust X and Y ALIGNMENT controls to give reasonably uniform white shading. Adjust DYNODE GAIN (multiplier voltage) to ensure that the multiplier is not overloaded.
Some cameras have a fine control of multiplier gain which adjusts the potential between two of the dynodes in addition to a coarse control which adjusts the overall voltage applied to the multiplier chain. Either or both may need to be adjusted.

6 Cap lens electronically or mechanically and allow tube to warm up for 15 to 20 minutes, leaving beam on, to ensure that the gun side of target remains stabilised and that any residual gas is removed by ionisation.

7 When the tube is warm, uncap, adjust OPTICAL, IMAGE AND BEAM focus, using a suitable scene with black and white straight line content. A standard resolution chart is recommended.

8 Adjust HEIGHT, WIDTH and CENTRING controls so that the target ring is just visible in the corners. Find the target cut-off by reducing TARGET voltage until picture highlights are just disappearing, then reset TARGET until it is 2.7V more positive than cut-off (or to the preferred operating voltage for the station). Switch on AUTOMATIC ALIGNMENT (FOCUS ROCK) and adjust X and Y ALIGNMENT for coincidence of straight lines at the centre of the picture and balanced non-coincidence in the corners. Switch off AUTOMATIC ALIGNMENT.

9 Adjust IRIS and BEAM controls until whites are just beginning to crush with further exposure, with sufficient beam fully to discharge the whites. Open the IRIS a half stop. Ensure that the whites are just discharging by BEAM adjustment.

10 Adjust MULTIFOCUS control (Grid 3) for maximum signal and most uniform dark and light shading.

11 Adjust DECELERATOR (Grid 5) for best compromise of capped-up corner shading and geometry of picture.

12 Check test waveform through amplifiers to give peak white signal (normally 0.7 V) for the desired working signal current. Check and adjust DYNODE GAIN for peak white signal when the tube is correctly exposed.

13 Readjust OPTICAL, IMAGE AND BEAM focus (using fine controls where available). It may be found that as BEAM is adjusted through best focus, the signal amplitude will fall slightly. BEAM FOCUS voltage should then be reduced below that at which the signal amplitude is minimum, to give maximum signal without loss of resolution. This will ensure dynode defocus without loss of resolution and most uniform white shading.

14 Repeat operations 7 to 13.

15 From this point on IRIS, LIFT (Pedestal), and possibly GAIN will be the only controls required for normal operation. Local operating practice may specify slightly modified settings of TARGET voltage and IRIS. For example, a 7295 may frequently be operated at 1 to 2 stops over the knee.

	7295 (EMI 9564)	7389 (EMI 9565)	Remarks
Sensitivity			
Scene luminance required to give highlights ½ stop over knee at f/5.6 (405 line system)	25 foot-Lamberts	50 foot-Lamberts	maximum
Target			
Target cut-off voltage	–3V to +5V	–3V to +5V	with respect to cathode
Signal Current			
Signal current	8μA	8μA	minimum for maximum anode voltage of 1,300 V
Signal-to-Noise Ratio			
Peak highlights signal current to r.m.s. noise target 3V above cut-off and band-width 3 Mc/s on 405 line 5 Mc/s on 525 and 625 lines	35 dB	37 dB	minimum
Resolution			
Drop in amplitude response at 400 television lines (per picture height)	8 dB	8 dB	maximum
Microphony			
Duration of observed microphonic signal after mechanical or audible excitation	7 s	7 s	maximum

Sticking

Expose camera to test chart for 30 seconds with the tube correctly set up and then pan to a plain white scene of illumination equal to that of the test chart. The after-image must disappear within the following times :

Working Life of Tube (*hours*)		Time (*seconds*)
From	*To*	
0	50	50
50	100	60
100	150	70
150	200	80
200	250	90
250	300	100
300	350	120
350	500	180

NOTE: These parameters may be varied by prior negotiation