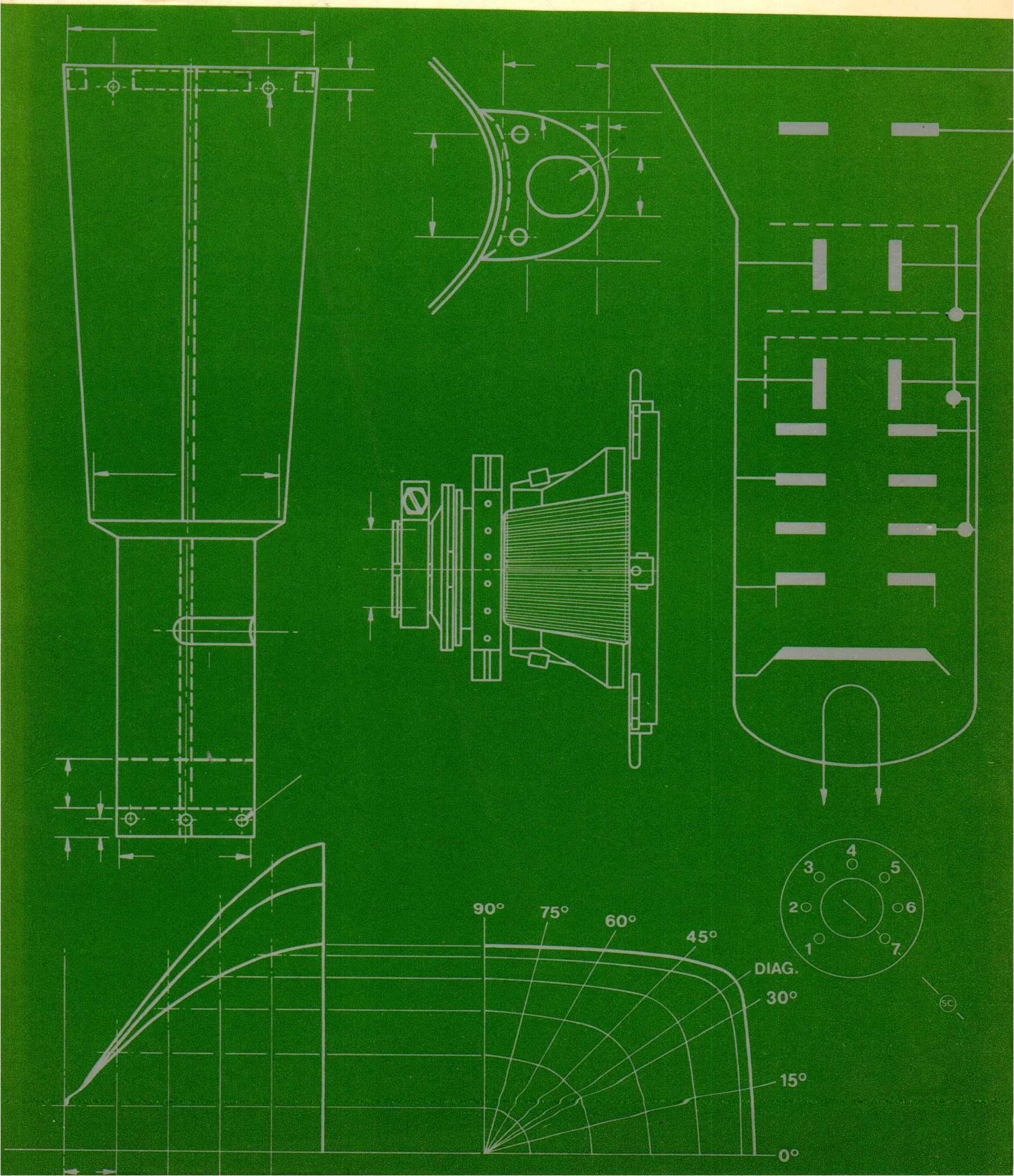
BRIMAR

# Industrial Cathode Ray Tubes

## Volume 2 Data Section Issue 3



# DESIGN DATA HANDBOOK

# INDUSTRIAL CATHODE RAY TUBES

## Volume 2

The facilities and organisation of Thorn Radio Valves and Tubes Limited meet the requirements of the M.O.D. (P.E.) Defence Standard 05-21 and BS.9000.

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BRIMAR

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The third edition of the Brimar Handbook has been published in two volumes.

| | |
|---|---|
| **Volume 1** | **Operational recommendations**<br>**Safety recommendations**<br>**Aspects of Design Reports** |
| **Volume 2** | **Tube Index**<br>**Tube selection tables**<br>**Design data of phosphors**<br>**Design data of accessories**<br>**Design data of tubes** |

Volume 1 is printed in English, French, German, Italian and Spanish.

Volume 2 data sheets are printed in "English" but the "terms" used in the volume are translated and can be found in the general section. The data sheets are filed in alpha-numerical order of tube type numbers.

Extreme care has been taken in the preparation of the data to ensure these volumes are as comprehensive, accurate and up to date as possible at the time of going to press. Before designing tubes into equipment, it is advisable to check with the sales office or authorised agents that availability and data remain unaltered.

## HEALTH AND SAFETY AT WORK ACT 1974

Attention is drawn to the recommendations under this heading in the Safety Recommendations in volume one.

## WARNING

These tubes should be used in accordance with their published ratings, and in conformity with the operational recommendations of the company's data handbook. The company will not entertain claims for loss or damage where this advice has been disregarded.

## APPLICATIONS SERVICE

The Applications Laboratory provide a free advisory service to equipment manufacturers.

**THORN RADIO VALVES AND TUBES LIMITED**
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Mollison Avenue,
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**The following data is additional to that shown in the previous edition.**

## New Tube Data

| | |
|---|---|
| **D10-293..** | 6.8cm x 5.6cm display area, Medium to high bandwidth mesh p.d.a. tube. |
| **D14-270..** | 10cm x 8cm display area, short length, mono-accelerator tube. |
| **D14-280..** | 10cm x 8cm display area, Medium to high bandwidth mesh p.d.a. tube. |
| **D14-310..** | 10cm x 8cm display area, high performance mesh p.d.a. tube. |
| **D18-160..** | 12cm x 10cm display area, Medium to high bandwidth mesh p.d.a. tube. |
| **M8-100..** | 74mm x 24mm display area, low profile screen, ruggedised gun construction data display tube. |
| **M17-152..** | M17-15.. with special minimum blemish screen for diagnostic photography. |
| **M23-111..** | 23cm screen diagonal, 90° deflection angle, 20mm neck data display and monitor tube with anti-reflection face-plate. |
| **M23-112..** | 23cm screen diagonal, 90° deflection angle, 20mm neck data display and monitor tube with Rimguard III implosion protection. |
| **M23-113..** | 23cm screen diagonal, 90° deflection angle, 20mm neck data display and monitor tube with a tinted bonded face-plate and mounting lugs |
| **M24-130..** | 24cm screen diagonal, 90° deflection angle, Mobile or military monitor fully ruggedised construction tube bonded face-plate integral mounting lugs. |
| **M28-133..** | 28cm screen diagonal, 90° deflection angle, data display or monitor tube with a tinted bonded anti-reflection face-plate. |
| **M31-190..** | 31cm screen diagonal, 90° deflection angle, Medical, data display or general purpose monitor tube. Rimguard III protection. Integral mounting lugs. |
| **M31-191..** | Version of M31-190 with a tinted bonded anti-reflection face-plate. 15% screen glass transmission. |
| **M31-192..** | Bonded face-plate version of M31-190.. 50% screen glass transmission. |
| **M31-212..** | 31cm screen diagonal, 90° deflection angle tube specially designed for data display, with tinted bonded anti-reflection face-plate, integral mounting lugs. |
| **M31-213..** | M31-212.. but with clear glass bonded face-plate. |
| **M38-105..** | M38-100.. with a tinted bonded anti-reflection face-plate. 15% screen glass transmission. |
| **M38-106..** | M38-100.. with a tinted bonded anti-reflection face-plate, 30% screen glass transmission. |
| **M38-142..** | 31cm screen diagonal, 110° deflection angle, high voltage focus, high resolution data display tube with Rimguard IV protection and integral mounting lugs. |
| **59-60/90/074** | 38cm screen diagonal, 90° deflection angle fully ruggedised construction tube for mobile or military monitor application. Rimguard III re-enforced envelope and flying lead connections. |

## New Ancillary Data

| | | | |
|---|---|---|---|
| Tube index | | | |
| Phosphor Screens | GX, GY | Socket | B12FPC |
| Graticules | 58, 70, 82, 90, 98 | Scan Coils | TBY2, TBY3, TBY5, TBY7 |

# CONTENTS

# Pro Electron Nomenclature

# Industrial Cathode Ray Tubes

The type nomenclature consists of one letter and number joined by a hyphen to a number and one or two letters.

FIRST LETTER CLASSIFICATION

The first letter indicates the application and/or construction of the tube.

| | |
|---|---|
| A | TV display tube for domestic applications |
| D | Oscilloscope tube, single trace |
| E | Oscilloscope tube, multiple trace |
| F | Radar display tube, direct view |
| L | Display storage tube |
| M | Professional television or display tube (except radar), direct view |
| P | Professional television or display tube, projection |
| Q | Flying-spot scanner |

FIRST NUMBER CLASSIFICATION

The first number indicates the overall diameter or the overall diagonal of the glass envelope (face-plate) in cm.

| | |
|---|---|
| 7 | Represents a 7 cm ( 3 in) face-plate |
| 13 | Represents a 13 cm ( 5 in) face-plate |
| 50 | Represents a 50 cm (20 in) face-plate |

Note: Since the centimetre is smaller than the inch it is possible that more than one first number corresponds to a particular inch size tube, e.g. 47 and 49 have both been allocated for 19 inch tubes.

SECOND NUMBER CLASSIFICATION

The second number is a two or three figure serial number indicating a particular design or development.

FINAL LETTER(S)

The final letter(s) indicates the screen properties.

The first letter denotes the colour of the fluorescence (or phosphorescence in the case of long or very long persistence screens) according to the regions of the Kelly Chart of colour designations for lights, where applicable:

| | |
|---|---|
| A | Reddish-purple, purple, bluish-purple |
| B | Purplish-blue, blue, greenish-blue |
| D | Blue-green |
| G | Bluish-green, green, yellowish-green |
| K | Yellow-green |
| L | Orange, orange-pink |
| R | Reddish-orange, red, pink, purplish-pink, purplish-red, red-purple. |
| W | "Standard White" television display tube phosphor. |
| X | Tri-colour screen |
| Y | Greenish-yellow, yellow, yellowish-orange. |

The second letter is a serial letter to denote other specific differences in screen properties.

SUFFIXES

Internal or external graticules are indicated by a two-figure suffix separated from the final letter by an oblique stroke. Letter suffixes may also be used for Sparkguard bases.

EXAMPLES

| | |
|---|---|
| D13-51GH | Single trace oscilloscope tube with a 13 cm ( 5 in ) face-plate with phosphor type GH. |
| M59-25GM/24 | Professional display tube with a 59 cm ( 23 in ) face-plate and phosphor type GM and having an external co-ordinate graticule, type 24. |

# Translation of Terms

**FRANÇAIS**

## Tubes a Rayons Cathodiques Industriels

## Traduction des Termes

**DEUTSCH**

## Industrielle Elektronenstrahlröhren

## Übersetzung der Fachausdrücke

**ITALIANO**

## Tubi a Raggi Catodici Per Uso Industriale

## Traduzione di Termini

**ESPAÑOL**

## Tubos de Rayos Catódicos Industriales

## Traducción de Términos

Thorn Radio Valves and Tubes Limited

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| ENGLISH | FRANÇAIS | DEUTSCH | ITALIANO | ESPAÑOL |
|---|---|---|---|---|
| Abridged data | caractéristiques résumées | Kurzdaten | Dati abbreviati | Datos Abreviados |
| Aluminised screen | écran aluminisé | Aluminiumhinterlegter Leuchstchirm | Schermo alluminizzato | Pantalla Aluminizada |
| Anti-flicker | anti-scintillement | Flimmerschutz | 'Anti-flicker' | Anti-parpadeo |
| Anti-reflection faceplate | Face avant anti-réflexion | Schirmträger mit Reflexionsschutz | Pannello frontale anti-riflettente | Placa externa antirreflejos |
| Application | application | Anwendung | Applicazione | Aplicación |
| Banded p.d.a. | R.P.A. en bande gammée | Nachbeschleunigung mit Bandelektrode | Post accelerazione anodica a banda | acelerador post-deflexión de banda |
| Beam alignment electrode | électrode d'alignement du faisceau | Zentrierelektrode | Elettrodo de allineamento del fascio | Electrodo de Alineación de Haz |
| Black | Noir | Schwarz | Nero | negro |
| Blue | bleu | Blau | Blu | Azul |
| Bonded face plate | plaque protectrice de verre | Verbundglasscheibe | Pannello frontale 'bonded' | Placa Protectora Incorporada |
| Camera viewfinder | viseur de caméra | Kamerasucher | Mirino per telecamera | Visor de la Cámara |
| Classification | classement | Klassifizierung | Classificazione | Classificación |
| Clear glass | Verre transparent | Durchsichtiges Glas | Vetro lucido | vidrio transparente |
| Closed circuit television | télévision en circuit fermé | Industrielles Fernsehen | Televisione a circuito chiuso | Televisión en Circuito Cerrado |
| Common features | caractéristiques communes | Gemeinsame Merkmale | Caratteristiche comuni | Caracteristicas Comunes |
| Common X deflection | déflection X commune | Normale X-Ablenkung | Deflessione X comune | Desviación X Común |
| Comparables | types comparables | Vergleichbare Typen | Tipi comparabile | Tipos comparables |
| Compass tube | tube pour boussoles | Funkpeilröhre | Tubo per bussola | Tubo Compás |
| Co-ordinate graticule | graticule de coordonnées | Koordinatenraster | Reticolo a coordinate | Reticula de Coordenadas |
| Corners cut | Coins Taillés | Gerundete Ecken | Angoli tagliati | esquinas redondeadas |
| Current types | types courants | Laufende Typen | Tipi correnti | Tipos Corrientes |
| Data Display Tube | Tube de visualisation de données | Datendarstellungsröhre | Tubo presentazione dati | Tubo para presentación de datos |
| Deflection yoke | Collier de déviation | Ablenkjoch | giogo deviator | yugo de desviación |
| Demonstration tube | tube de démonstration | Demonstrationsröhre | Tubi da dimostrazione | Tubo de Demostración |
| Design data sheets | feuilles de caractéristiques | Datenblätter | Pagine dei dati | Hojas de Datos |
| Direction finder | goniomètre | Funkpeiler | Indicatore di direzione | Goniómetro |
| Double gun oscilloscope | oscilloscope à double canon | Zweistrahloszillograph | Oscilloscopio a doppio cannone | Osciloscopio de Cañón Doble |
| Dual phosphor | phosphore double | Dual-Phosphor | Fosforo doppio | Fósforo Doble |
| Edge illumination | Eclairage rasant | Randbeleuchtung | Illuminazione dei contorni | iluminación de bordes |
| Electrostatic deflection | déviation électrostatique | Elektrostatische Ablenkung | Deflessione elettrostatica | Desviación Electrostática |
| Electrostatic focus | concentration électrostatique | Elektrostatische Fokussierung | Focalizzazione elettro-statica | Enfoque Electrostático |
| Equipment manufacturers | fabricants d'équipements | Gerätehersteller | Costruttori di apparec-chiature | Fabricantes de Equipos |
| Equivalents | équivalents | Äquivalente | Equivalenti | Equivalentes |
| External graticule | graticule extérieure | Außenraster | Reticolo esterno | Reticula Externa |
| Features | caractéristiques | Merkmale | Caratteristiche | Caracteristicas |
| Flat face | Face méplate | Flacher Schirm | Faccia piana | cara llana |
| Flashover protection | Protection de contournement | Überschlagschutz | Protezione contro scariche elettriche | protección salto de chispa |
| Flexibility | souplesse | Flexibilität | Flessibilità | Flexibilidad |
| Fluorescent | fluorescent | Fluoreszent | Fluorescente | Fluorescente |
| Flying-spot scanner | balayage à spot mobile | Lichtpunktabtaster | 'Flying spot scanner' | Exploración de Punto Volante |
| General purpose | usage général | Mehrzweck | Impiego generale | De Uso General |
| Graduated scale | échelle graduée | Kalibrierte Skala | Scala graduata | Escala Graduada |
| Graticule | graticule | Raster | Reticolo | Reticula |
| Green | vert | Grün | Verde | Verde |
| Grey | Gris | Grau | Grigio | gris |
| High sensitivity | haute sensibilité | Hohe Empfindlichkeit | Elevata sensibilità | Alta Sensibilidad |
| High voltage focus | Focalisation haute-tension | Hochspannungsbündelung | Focalizzazione ad alta tensione | foco de alta tensión |
| Implosion protection | protection contre les implosions | Implosionsschutz | Protezione contro l'implosione | Protección contra Implosión |
| Industrial applications | utilisations industrielles | Industrielle Anwendungen | Applicazioni industriali | Aplicaciones Industriales |
| Industrial monitor | contrôle industriel | Industrieller Monitor | Monitor per impieghi industriali | Monitor Industrial |
| Instrument tubes | tubes d'instrument | Instrumentenröhren | Tubi per istrumenti | Tubos para instrumentos |
| Integral mounting lugs | pattes de fixation incorporées | Eingearbeitete Befesti-gungsösen | Alette di fissaggio incorporate | Orejetas de Montura Integradas |
| Internal graticule | graticule intérieure | Innenraster | Reticolo interno | Reticula Interna |
| Internal scale | échelle intérieure | Innenskala | Scala interna | Escala Interna |

| ENGLISH | FRANÇAIS | DEUTSCH | ITALIANO | ESPAÑOL |
|---|---|---|---|---|
| **Large display area** | grande surface d'image | Große nutzbare Schirmfläche | Vasta area di rappresentazione | Area de Presentación Amplia |
| **Large screen area** | grande surface d'écran | Große Leuchtschirmfläche | Grande schermo | Area de Pantalla Amplia |
| **Large screen oscilloscope** | oscilloscope à grand écran | Oszillograph mit großem Leuchtschirm | Oscilloscopio a grande schermo | Osciloscopio de Pantalla Amplia |
| **Large spot** | Gros spot | Großer Lichtfleck | Grande macchia luminosa | gran punto |
| **Light injection** | Injection lumineuse | Lichteinstreuung | Iniezione di luce | inyección de luz |
| **Line width** | largeur de ligne | Zeilenbreite | Ampiezza di linea | Anchura de Linea |
| **Long** | long | Lang | Lungo | Largo |
| **Magnetic deflection** | déviation magnétique | Magnetische Ablenkung | Deflessione magnetica | Deflexión Magnética |
| **Magnetic focus** | concentration magnétique | Magnetische Fokussierung | Focalizzazione magnetica | Enfoque Magnético |
| **Magnetic shield** | Ecran magnétique | Magnetische Abschirmung | Schermo magnetico | Blindaje magnético |
| **Maintenance** | entretien | Nachbestückung | Manutenzione | Mantenimiento |
| **Marine radar** | radar marine | Schiffsradar | Radar marino | Radar Marino |
| **Medical application** | Application médicale | Medizinische Anwendung | Applicazione medica | Aplicación medica |
| **Medium** | moyen | Mittel | Medio | Medio |
| **Medium bandwidth** | largeur de bande moyenne | Mittlere Bandbreite | Media larghezza di banda | Anchura de Banda Media |
| **Medium short** | longueur moyenne | Mittel-Kurz | Medio breve | Medio Corto |
| **Mesh P.D.A.** | post-accélération mesh | Maschen-Nachbeschleunigungselektrode | Post accelerazione anodica a griglia | Acel. Post-Desv. Rejilla |
| **Mono-accelerator** | Monoaccélérateur | Mono-Beschleuniger | mono-acceleratore | Mono acelerador |
| **Monoscopes** | monoscopes | Monoskopen | Monoscopi | Monoscopios |
| **Mounting frame** | cadre de montage | Befestigungsrahmen | Telaio di fissaggio | Marco de Montura |
| **Narrow neck** | Col étroit | Enger Hals | Collo stretto | Cuello estrecho |
| **Neck diameter** | diamètre du col | Halsdurchmesser | Diametro del collo | Diámetro de Cuello |
| **Obsolescent** | obsolescent | Auslaufend | In esaurimento | Anticuado |
| **Obsolete** | périmé | Ausgelaufene | Esaurito | Fuera de Uso |
| **Octantal correction** | correction octantale | Achtelkreisige Korrection | Correzione degli ottanti | Corrección Octantal |
| **Orange** | orange | Orange | Arancio | Naranja |
| **Oscilloscope tube** | tube pour oscilloscope | Oszillographenröhre | Tubo per oscilloscopio | Tubo de Osciloscopio |
| **Overall length** | longueur hors tout | Gesamtlänge | Lunghezza totale | Longitud Total |
| **Persistence** | persistance | Nachleuchtdauer | Persistenza | Persistencia |
| **P.D.A. ratio** | rapport de post-accélération | Nachbeschleunigungsverhältnis | Rapporto di post accelerazione anodica | Relación de Acel. Post-Desv. |
| **Phosphorescence** | luminescence | Nachleuchten | Fosforescenza | Fosforescencia |
| **Phosphors** | phosphores | Leuchtschirmarten | Fosfori | Fósforos |
| **Photography** | photographie | Photographie | Fotografia | Fotografia |
| **Post-deflection acceleration** | accélération après déflection | Nachbeschleunigung | Post accelerazione anodica | Aceleración Post-Deflexión |
| **P.P.I. display** | visualisation P.P.I. | P.P.I.-Darstellung | Indicatore di posizione panoramico | Presentación P.P.I. |
| **Purple** | pourpre | Purpur | Porpora | Púrpura |
| **Radar tube** | tube radar | Radarbildröhre | Tubo per radar | Tubo Radar |
| **Rectangular face** | face rectangulaire | Rechteckige Frontfläche | Superficie rettangolare | Cara Rectangular |
| **Reinforced envelope** | enveloppe renforcée | Verstärkter Kolben | Involucro rinforzato | Bulbo Reforzado |
| **Rimband** | bande métallique | Metallstreifenschutz | Striscia metallica | Banda metálica |
| **Rimguard** | coquille métallique | Metallrahmen | Guscio metallico | Protección del Borde |
| **Round face** | écran rond | Runder Schirm | Faccia circolare | Cara circular |
| **Sales classification** | classement | Klassifizierung | Classificazione | Classificación |
| **Scan coil** | Bobine de balayage | Ablenkspule | Bobina per scansione | Bobina de exploración |
| **Screen diameter** | diamètre de l'écran | Leuchtschirmdurchmesser | Diametro dello schermo | Diámetro de Pantalla |
| **Secondary parameters** | paramètres secondaires | Sekundarparameter | Parametri secondari | Parámetros Secundarios |
| **Short length** | longueur réduite | Kurze Baulänge | Corto | Longitud Corta |
| **Short neck** | col court | Kurzer Kolbenhals | Collo corto | Cuello Corto |
| **Short persistence** | courte persistance | Kurz Nachleuchtdauer | Breve Persistenza | Corta Persistencia |
| **Side pins** | sorties latérales | Seitliche Anschlußstifte | Contatti laterali | Patillas Laterales |
| **Single gun** | canon unique | Einstrahlsystem | Cannone singolo | Cañón Sencillo |
| **Small electrostatic tubes** | tubes petits électrostatiques | Kleine elektrostatische Röhren | Tubi piccoli elettrostatici | Tubos electrostáticos pequeños |
| **Socket** | Douille | Fassung | Presa | Zocalo |
| **Sparkguard base** | base anti-flash | Funkenschutzsockel | Base di protezione contro le scariche | Zócalo a Prueba de Arcos |
| **Special quality** | qualité spéciale | Sonderqualität | Qualità speciale | Calidad Especial |
| **Special phosphors** | phosphores spéciaux | Spezial-Phosphor | Fosfori speciali | Fósforos Especiales |
| **Spiral P.D.A.** | post-accélération spirale | Spiralförmige Nachbeschleunigungselektrode | Post accelerazione anodica a spirale | Espiral Acel. Post-Desv. |
| **Standard phosphors** | Phosphores standards | Normalleuchtschirmarten | Fosfori standard | Fósforos standard |
| **Strengthened structure** | structure renforcée | Verstärktekonstruktion | Struttura rinforzata | Estructura reforzada |
| **Studio monitor** | contrôle de studio | Studio-Monitor | Monitor per studio | Monitor de Estudio |

| ENGLISH | FRANÇAIS | DEUTSCH | ITALIANO | ESPAÑOL |
|---|---|---|---|---|
| Television monitor | contrôle de télévision | Fernsehmonitor | Monitor per televisione | Monitor de Televisión |
| Trace | Trace | Spur | Traccia luminosa | Trazado |
| Transistorised | transistorisé | Transistorisiert | Transistorizzato | Transistorizado |
| Transistor scan | balayage par transistor | Transistorabtastung | Scansione a transistor | Barrido por Transistores |
| Twist coil | Bobine de déviation | Koordinatenabgleichspule | Bobina di regolazione coordinate | Bobina de alineación |
| Two phosphor screen | écran à deux phosphores | Dual-Leuchtschirm | Schermo con due fosfori | Pantalla de dos Fósforos |
| Typical operation | conditions typiques d'emploi | Typische Betriebswerte | Funzionamento tipico | Funcionamiento Típico |
| Uniformly graduated | gradué uniformément | Stetige Teilung | Graduato uniformemente | Con Graduación Uniforme |
| Very long | très long | Sehr lang | Molto lungo | Muy Largo |
| Very short | très court | Sehr kurz | Molto breve | Muy Corto |
| Waveform display | visualisation de la forme d'onde | Oszillogramme | Rappresentazione di forme d'onda | Presentación de Formas de Onda |
| White | blanc | Weiß | Bianco | Blanco |
| Wide bandwidth | large bande | Große Bandbreite | Ampia larghezza di banda | Gran Anchura de Banda |
| Yellow | jaune | Gelb | Giallo | Amarillo |
| X-Y plotter | plotter X-Y | Koordinatenschreiber | Tracciatore X-Y | Trazador X-Y |

# Industrial Cathode Ray Tubes

# Index

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# Index

# Industrial Cathode Ray Tubes

SINGLE GUN INSTRUMENT TUBES - CURRENT TYPES

Common features:- Electrostatic deflection and focus, 6.3V heaters

| Type Number | Other Current Phosphors | Description | Face§ Diag. Diam. nom. | Useful Screen Area min. | Overall length max. | TYPICAL OPERATION - voltages to cathode | | | | | | | | Base Type |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | $I_h$ | $V_{a1}$ | $V_{a2}$ focus av | $V_{a3}$ | $V_{a4}$ | $-V_g$† av | $D_x$ | $D_y$ | |
| | | | inch | $cm^2$ | mm | A | kV | V | kV | kV | V | V/cm | V/cm | |
| D3-130GH | | General purpose indicating device | 1 | 2.7* | 103.2 | 0.3 | 1.0 | 96 | 1.0 | 1.0 | 34 | 80 to 120 | 58 to 88 | B13B |
| D7-200GH | GM | Indicators, oscilloscopes, alpha-numerical readout | 3 | 5 x 4 | 180 | 0.3 | 1.0 | 132 | 1.0 | 1.0 | 38 | 21 to 29 | 25 to 35 | B13B |
| D7-201GH | GM | Improved D7-200GH | 3 | 5 x 4 | 190 | 0.12 | 1.2 | 165 | 1.2 | - | 45 | 29 to 37 | 14 to 18 | B13B |
| D9-110GH | | Low profile mono-accelerator | 3.5 | 6.6 x 4 | 264 | 0.12 | 2.0 | 405 | 2.0 | - | 64 | 28 to 34.8 | 12.8 to 16 | B14G |
| D10-210GH | GM | Compact tube, mesh p.d.a. | 4 | 7 x 5 | 230 | 0.075‡ | 0.6 | 160 | 0.54 | 6.0 | 42 | 11.2 to 13.8 | 8 to 10 | B12F |
| D10-230GH | | Flat-faced mono-accelerator | 4 | 8 x 6.4** | 260 | 0.3 | 1.5 | 305 | 1.5 | - | 48 | 21 to 26 | 13 to 16 | B14G |
| D10-240GH | GM | Medium bandwidth, spiral p.d.a. | 4 | 7 x 5 | 260 | 0.12 | 1.0 | 262 | 1.0 | 2.0 | 52 | 21.6 to 26.4 | 8.3 to 10.2 | B12F |
| D10-293GH | | Medium to high bandwidth, mesh p.d.a. | 4 | 6.8 x 5.6 | 300 | 0.12 | 1.0 | 260 | 1.0 | 6 | 39 | 10.5 to 12.8 | 3.8 to 4.8 | B12F |
| D13-47GH | BE, GL GM | Medium bandwidth, spiral p.d.a. | 5 | 10 x 6 | 371 | 0.3 | 1.0 | 287 | 1.0 | 4.0 | 50 | 14.5 to 17.5 | 6.7 to 8.3 | B12F |
| D13-51GH | GM | High bandwidth, mesh p.d.a. | 5 | 10 x 6 | 335 | 0.3 | 1.0 | 90 | 1.0 | 10 | 70 | 11 to 15 | 4.5 to 6.0 | B12F |
| D13-471GH | GM | D13-47GH with low wattage heater | 5 | 10 x 6 | 371 | 0.12 | 1.0 | 287 | 1.0 | 4.0 | 50 | 14.5 to 17.5 | 6.7 to 8.3 | B12F |
| D13-600GH | GM | General purpose short length, spiral p.d.a. | 5 | 10 x 8** | 315 | 0.3 | 1.5 | 400 | 1.5 | 3.0 | 73 | 21 to 27 | 10 to 12.7 | B12F |

Other phosphor screens are available to special order. Both x and y-plates are designed for symmetrical operation.

* Diameter † Cut-off § Round face Rectangular face ‡ $V_h$ = 11V ** Corners cut.

SINGLE GUN INSTRUMENT TUBES - CURRENT TYPES (continued)

Common features:- Electrostatic deflection and focus, 6.3V heaters.

| Type Number | Other Current Phosphors | Description | Face§ Diag. Diam. nom. inch | Useful Screen Area min. $cm^2$ | Overall length max. mm | TYPICAL OPERATION - voltages to cathode | | | | | | | | Base Type |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | $I_h$ A | $V_{a1}$ kV | $V_{a2}$ focus av V | $V_{a3}$ kV | $V_{a4}$ kV | $-V_g$ † av V | $D_x$ V/cm | $D_y$ V/cm | |
| D13-601GH | | D13-600GH with low wattage heater | (5) | 10 x 8* | 315 | 0.12 | 1.5 | 400 | 1.5 | 3.0 | 73 | 21 to 27 | 10 to 12.7 | B12F |
| D13-610GH | GM | General purpose, medium bandwidth, spiral p.d.a. | (5) | 10 x 8* | 371 | 0.3 | 1.0 | 275 | 1.0 | 3.0 | 50 | 12.5 to 15.8 | 6.8 to 8.7 | B12F |
| D13-611GH | GM | General purpose, medium bandwidth, spiral p.d.a. | (5) | 10 x 8* | 371 | 0.3 | 1.0 | 275 | 1.0 | 3.5 | 52 | 14.1 to 16.9 | 7.0 to 8.9 | B12F |
| D13-630GH | | Short length mono-accelerator | (5) | 10 x 8* | 340 | 0.3 | 2.0 | 230 | 2.0 | - | 50 | 19 to 23 | 12 to 15 | B14G |
| D14-150GH | | High bandwidth mesh p.d.a. | [5.5] | 10 x 8 | 386 | 0.3 | 1.2 | 115 | 1.2 | 12 | 70 | 11 to 14.5 | 4.6 to 6.0 | B12F |
| D14-172GH | GL, GM GV | General purpose, short length, spiral p.d.a. | [5.5] | 10 x 8 | 308 | 0.3 | 1.0 | 280 | 1.0 | 2.0 | 50 | 15.7 to 18.7 | 7.4 to 9.7 | B12F |
| D14-173GH | GM, GV | D14-172GH with low wattage heater | [5.5] | 10 x 8 | 308 | 0.12 | 1.0 | 280 | 1.0 | 2.0 | 50 | 15.7 to 18.7 | 7.4 to 9.7 | B12F |
| D14-181GH | GM | Medium bandwidth, spiral p.d.a. | [5.5] | 10 x 8 | 384 | 0.3 | 1.0 | 287 | 1.0 | 4.0 | 50 | 14.1 to 17 | 6.7 to 8.7 | B12F |
| D14-200GH | GM | High bandwidth, mesh p.d.a. | [5.5] | 10 x 8 | 405 | 0.3 | 1.2 | 115 | 1.2 | 12 | 70 | 11 to 14.2 | 4.3 to 5.4 | B12F |
| D14-270GH | | Large screen short length mono-accelerator | [5.5] | 10 x 8 | 333 | 0.3 | 2.0 | 262 | 2.0 | - | 50 | 19 to 23 | 12 to 15 | B14G |
| D14-280GH | | Medium to high bandwidth mesh p.d.a. | [5.5] | 10 x 8 | 395 | 0.3 | 2.0 | 535 | 2.0 | 12 | 80 | 14 to 17.4 | 5.6 to 6.9 | B12F |
| D14-310GH | GM | High performance, mesh p.d.a. | [5.5] | 10 x 8 | 420 | 0.3 | 1.5 | 475 | 1.5 | 12 | 50 | 11 to 14 | 3.4 to 4.3 | B12F |
| D16-100GH | GM | Square face, X-Y plotter, spiral p.d.a. | [6.5] | 10 x 10 | 387 | 0.3 | 1.25 | 350 | 1.25 | 2.5 | 65 | 13.5 to 17 | 13.5 to 17 | B12F |

Other phosphor screens are available to special order. Both x and y-plates are designed for symmetrical operation.

* Corners cut † Cut-off § ◯ Round face ▭ Rectangular face.

SINGLE GUN INSTRUMENT TUBES - CURRENT TYPES (continued)

Common features:- Electrostatic deflection and focus, 6.3V heaters

| Type Number | Other Current Phosphors | Description | Face§ Diag. Dia. nom. inch | Useful Screen Area min. $cm^2$ | Overall length max. mm | TYPICAL OPERATION - voltages to cathode $I_h$ A | $V_{a1}$ kV | $V_{a2}$ focus av V | $V_{a3}$ kV | $V_{a4}$ kV | $-V_g$† av V | $D_x$ V/cm | $D_y$ V/cm | Base Type |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| D16-110GH | | Medium bandwidth, square face, X-Y plotter, spiral p.d.a. | $\boxed{6.5}$ | 10 x 10 | 384 | 0.3 | 1.0 | 287 | 1.0 | 4.0 | 40 | 14.5 to 18.5 | 8.5 to 10.7 | B12F |
| D18-130GH | GM, GV | General purpose, large screen area, spiral p.d.a. | $\boxed{7}$ | 12 x 10 | 310 | 0.3 | 1.5 | 420 | 1.5 | 3.0 | 60 | 23 to 29 | 13 to 16.5 | B12F |
| D18-160GH | | Large screen, mesh p.d.a. | $\boxed{7}$ | 12 x 10 | 450 | 0.3 | 2.0 | 540 | 2.0 | 12 | 60 | 10.5 to 13.5 | 4.1 to 5.5 | B12F |
| D21-102GH | | Large diameter display p.d.a. | 8.5 | 15 x 15* | 420 | 0.3 | 3.0 | 1000 | 3.0 | 6 | 60 | 34.5 to 48 | 28.5 to 40.5 | B12F |

Other phosphor screens are available to special order. Both x and y-plates are designed for symmetrical operation.

* Corners cut † Cut-off §◯ Round face ▭ Rectangular face.

## DOUBLE GUN OSCILLOSCOPE TUBE - CURRENT TYPE

Electrostatic deflection and focus, post deflection acceleration, 6.3V 0.6A heater, B12F base, CT8 side contact.

| Type Number | Description | Face Diam. | Useful Screen Area | Overall Length | Neck Dia. | TYPICAL OPERATION - voltages referred to cathode | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | $V_{a1}$ | $V_{a2}$ focus av. | $V_{a3}$ | $V_{a4}$ | $-V_g$ cut-off av. | P.D.A. Ratio max. | $D_x$ | $D_y$ |
| | | inch | min. $cm^2$ | max. mm | max. mm | kV | V | kV | kV | V | | max. V/cm | max. V/cm |
| SE5/2A/GH CV9337 | High sensitivity, common X deflection, beam alignment electrode. | 5 | 10 x 5 | 380 | 65 | 1.0 | 200 | 1.0 | 4.0 | 60 | 4:1 | 22 | 7.0 |

Other phosphor screens are available to special order.

## FLYING-SPOT SCANNER TUBES - CURRENT TYPES

Common features:- High resolution, small spot size, magnetic deflection, 6.3V 0.3A heaters

| Type | Application and Description | Face Diam | Useful Screen Area | Overall Length | Neck Dia. | TYPICAL OPERATION - voltages referred to cathode | | | | | Base Type |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | $V_{a1}$ | $V_a$ Focus | $V_a$ Final | $-V_g$ cut-off | Max. Spot Dia. at 60% pk. luminance | |
| | | nom. inch | min. $mm^2$ | max. mm | max. mm | V | kV | kV | V | mm at $I_{a3}$ $\mu A$ | |
| Q13-202GS | Electrostatic focus. Document readers or telecine. Precision mounting frame. EHT connection by rubber encapsulated flexible lead. | 5 | 96.5 x 76.2 corners cut† | 580 | 38 | 300 | 3.7 to 5.2 | 15 | 30 to 70 | 0.07 4.5 | B12A |
| Q13-203GT | Smaller spot size version of Q13-202.. | 5 | 89 x 68.6 corners cut† | 580 | 38 | 300 | 3.7 to 5.2 | 15 | 30 to 70 | 0.05 4.5 | B12A |

Other phosphor screens are available to special order. † Diagonal 108 mm min.

RADAR TUBES - CURRENT TYPES

Common features:- Electrostatic focus, magnetic deflection, 6.3V 0.3A heaters, aluminised screens, CT8 side contacts.

| Type Number | Other Current Phosphors | Application and Description | Face Dia. nom. | Overall Length max. | Neck Dia. max. | Defl. Angle nom. | TYPICAL OPERATION Voltages referred to cathode | | | | Base Type |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | $V_{a1}$ | $V_{a2+a4}$ | $V_{a3}$ | $-V_g$ cut-off | |
| | | | inch | mm | mm | ° | V | kV | V | V | |
| F10-100LD | | Small boat radar | 4 | 271 | 38 | 30 | 400 | 5 | 0 to 400 | 40 to 77 | B14G |
| F15-101LD | | Small boat radar | 6 | 242 | 29.4 | 53 | 400 | 9 | 0 to 400 | 40 to 77 | B8H |
| F16-101LD | | Small boat radar | 6 | 370 | 29.4 | 37 | 500 | 14 | 0 to 400 | 27 to 44 | B8H |
| 7ABP33A | | American type for small boat radar | 7 | 342 | 38 | 50 | 300 | 7 | 0 to 250 | 28 to 72 | B12A |
| F21-10LD | GM,LG | General marine radar | 8.5 | 450 | 35.5 | 41 | 600 | 14 | 0 to 400 | 32 to 48 | B8H |
| F21-130LD | | General marine radar | 8.5 | 326 | 29.4 | 60 | 400 | 14 | 0 to 400 | 34 to 78 | B8H |
| F22-10GM | | General marine radar | 9 | 408 | 35.5 | 60 | 300 | 12 | -300 to +300 | 30 to 78 | B12A |
| F22-11LD | | Enlarged spot version of F22-10LD | 9 | 408 | 35.5 | 60 | 300 | 12 | -300 to +300 | 30 to 78 | B12A |
| F31-10GM | LC,LD LG | General marine radar | 12 | 572 | 35.5 | 40 | 600 | 15 | -300 to +300 | 40 to 85 | B8H |
| F31-11LD | LC | Wider scan angle than F31-10LD | 12 | 494 | 35.5 | 50 | 300 | 14 | -300 to +300 | 30 to 70 | B12A |
| F31-12LC | | Narrower cut-off voltage range than F31-10LC | 12 | 572 | 35.5 | 40 | 600 | 16 | -150 to +450 | 44 to 70 | B8H |
| F31-111LC | GR | Enlarged spot version of F31-11LC | 12 | 494 | 35.5 | 50 | 300 | 14 | -300 to +300 | 30 to 70 | B12A |
| F31-112LD | | Extended neck length variant of F31-11LD | 12 | 528 | 35.5 | 50 | 600 | 14 | 0 to 400 | 32 to 48 | B12A |

**The above tubes, in certain cases, can be supplied with phosphor screens other than those listed to special order.**
**Tubes using the B8H base may be fitted with the B8H Sparkguard Base and will then have a suffix after the type number.**

RADAR TUBES - CURRENT TYPES (continued)

Common features:- Electrostatic focus, magnetic deflection, 6.3V 0.3A heaters, aluminised screens, CT8 side contacts.

| Type | Other Current Phosphors | Application and Description | Face Dia. nom. | Overall Length max. | Neck Dia. max. | Defl. Angle nom. | TYPICAL OPERATION Voltages referred to cathode | | | | Base Type |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | $V_{a1}$ | $V_{a2+a4}$ | $V_{a3}$ | $-V_g$ cut-off | |
| | | | inch | mm | mm | ° | V | kV | V | V | |
| F41-12LC | LD | Major radars for ships, ports & airport traffic control. | 16 | 610 | 35.5 | 50 | 300 | 15 | -300 to+300 | 40 to 80 | B12A |
| F41-13LC | | Narrower cut-off voltage range than F41-12.. | 16 | 610 | 35.5 | 50 | 300 | 15 | -300 to+300 | 40 to 64 | B12A |
| F41-14LD | LC | Enlarged spot version of F41-12.. | 16 | 610 | 35.5 | 50 | 300 | 15 | -300 to+300 | 40 to 80 | B12A |
| F41-123LG | LC | Long neck version of F41-12.. | 16 | 650 | 35.5 | 50 | 300 | 15 | -300 to +300 | 40 to 80 | B12A |
| F41-124LG | LG | F41-123.. except positive focus voltage range | 16 | 650 | 35.5 | 50 | 300 | 15 | 0 to+400 | 40 to 80 | B12A |
| F41-141LC | | Enlarged spot version of F41-12.. | 16 | 610 | 35.5 | 50 | 300 | 18 | -300 to +300 | 40 to 80 | B12A |

The above tubes, in certain cases, can be supplied with phosphor screens other than those listed to special order.
Tubes using the B8H base may be fitted with the B8H Sparkguard Base and will then have a suffix after the type number.

DATA DISPLAY AND MONITOR TUBES - CURRENT TYPES

Common features: - Rectangular face-plates, electrostatic focus, magnetic deflection, aluminised screens, CT8 side contacts.

| Type Number | Other Current Phosphors | Application and Description | Face§ Diag. nom. | Overall Length max. | Neck Dia. max. | Defl. Angle | Screen Glass Trans. (Appr.) | TYPICAL OPERATION Voltages referred to cathode | | | | | | Base Type |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Vh | Ih | $V_{a1}$ | $V_a$ final | $V_{a3}$ focus | $-V_g$ cut-off | |
| | | | inch | mm | mm | ° | % | V | mA | V | kV | V | V | |
| M14-100W | GH, GM GV | Medical and camera, viewfinder applications | 5.5 | 184 | 20.7 | 70 | 62 | 11 | 75 | 250 | 10 | 0 to 350 | 35 to 69 | B7G/D |
| M16-100W | | Mobile or military monitor. Fully ruggedised construction Encapsulated flexible leads to base and anode button. | 6 | 233.7 | 27.45 | 70 | Clear | 6.3 | 300 | 400 | 14 | 0 to 400 | 31 to 71 | Flying leads |
| M17-10W | | Small, quality monitor or TV camera viewfinder. | 7 | 236 | 29.4 | 70 | Clear | 11.5 | 150 | 400 | 14 | 0 to 400 | 38 to 78 | B8H |
| M17-12W | | M17-10.. with different heater | 7 | 236 | 29.4 | 70 | Clear | 6.3 | 300 | 400 | 14 | 0 to 400 | 38 to 78 | B8H |
| M17-15W | BE, GR GV | Self-protected version of M17-10.. Bonded face-plate | 7 | 242 | 29.4 | 70 | Clear | 11.5 | 150 | 400 | 14 | 0 to 400 | 38 to 78 | B8H |
| M17-152BE | | M17-15BE with improved screen | 7 | 242 | 29.4 | 70 | Clear | 11.5 | 150 | 400 | 14 | 0 to 400 | 38 to 78 | B8H |
| M19-100W | | Medical, data display or general purpose monitor. | 7.5 | 196 | 20.7 | 90 | 65 | 11 | 75 | 250 | 10 | 0 to 350 | 35 to 69 | B7G/D |
| 59-60/90/037 | | Mobile or military monitor. Fully ruggedised construction | 8.5 | 292 | 27.45 | 70 | Clear | 6.3 | 300 | 400 | 14 | -50 to 400 | 35 to 75 | Flying leads |
| M23-110W | GH | Medical, data display or general purpose monitor. | 9 | 222 | 20.7 | 90 | 50 | 11 | 75 | 250 | 10 | 0 to 350 | 35 to 69 | B7G/D |
| M23-111W | GH | M23-110.. with a tinted bonded anti reflection face-plate. | 9 | 228 | 20.7 | 90 | 30 | 11 | 75 | 250 | 10 | 0 to 350 | 35 to 69 | B7G/D |
| M23-112GH | W | **M23**-110.. with Rimguard III protection | 9 | 222 | 20.7 | 90 | 50 | 11 | 75 | 250 | 10 | 0 to 350 | 35 to 69 | B7G/D |

Other phosphor screens can be supplied to special order. § Rectangular face, Mounting frame, Mounting lugs.
Types using the B8H base may be fitted with the B8H Sparkguard Base and will then have a suffix after the type number.

DATA DISPLAY AND MONITOR TUBES - CURRENT TYPES (continued)

Common features: - Rectangular face-plates, electrostatic focus, magnetic deflection, aluminised screens, CT8 side contacts.

| Type Number | Other Current Phosphors | Application and Description | Face§ Diag. nom. | Overall Length max. | Neck Dia. max. | Defl. Angle | Screen Glass Trans. (Appr.) | TYPICAL OPERATION Voltages referred to cathode | | | | | | Base Type |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | $V_h$ | $I_h$ | $V_{a1}$ | $V_a$ final | $V_{a3}$ focus | $-V_g$ cut-off | |
| | | | inch | mm | mm | ° | % | V | mA | V | kV | V | V | |
| M23-113GV | GH, W | M23-112.. with a tinted bonded anti-reflection face-plate | 9 | 228 | 20.7 | 90 | 30 | 11 | 75 | 250 | 10 | 0 to 350 | 35 to 69 | B7G/D |
| M24-120W | LC, WA | High resolution data display | 9.5 | 260 | 29.4 | 90 | 52 | 6.3 | 300 | 400 | 14 | 0 to 400 | 38 to 82 | B8H |
| M24-121W | | Unprotected version of M24-120.. | 9.5 | 260 | 29.4 | 90 | 52 | 6.3 | 300 | 400 | 14 | 0 to 400 | 38 to 82 | B8H |
| M24-130GJ | | Mobile or military monitor Fully ruggedised construction Bonded **face-plate, integral** mounting lugs. | 9.5 | 280 | 29.4 | 90 | 32 | 6.3 | 300 | 400 | 14 | 0 to 400 | 38 to 82 | Flying leads |
| M28-12W | GM, GP | Medical, data display or general purpose monitor | 11 | 253 | 20.7 | 90 | 58 | 11 | 75 | 250 | 11 | 0 to 350 | 35 to 69 | B7G/D |
| M28-13W | GH, GR GV, LC LG, WA | Self-protected data display tube with Rimguard III for push-through mounting. | 11 | 266 | 29.4 | 90 | 58 | 11.5 | 150 | 400 | 14 | 0 to 400 | 40 to 76 | B8H |
| M28-132GH | | M28-13.. with a tinted bonded anti-reflection face-plate | 11 | 271 | 29.4 | 90 | 35 | 11.5 | 150 | 400 | 14 | 0 to 400 | 40 to 76 | B8H |
| M28-133GH | | M28-13.. with a tinted bonded anti-reflection face-plate | 11 | 271 | 29.4 | 90 | 18 | 11.5 | 150 | 400 | 14 | 0 to 400 | 40 to 76 | B8H |
| M31-120W | | General purpose monitor tube | 12 | 233 | 20.7 | 110 | 50 | 11 | 140 | 250 | 12 | 0 to 350 | 35 to 69 | B7G/D |
| M31-184W | GH | Data display or industrial monitor with Rimguard III protection | 12 | 243 | 29.4 | 110 | 50 | 6.3 | 300 | 400 | 15 | 0 to 400 | 40 to 77 | B8H |
| M31-185GH | | Data display tube with tinted bonded face-plate | 12 | 248.5 | 29.4 | 110 | 15 | 6.3 | 300 | 400 | 12 | 0 to 400 | 40 to 77 | B8H |

Other phosphor screens can be supplied to special order. § Rectangular face Mounting lugs.
Types using the B8H base may be fitted with the B8H Sparkguard Base and will then have a suffix after the type number.

DATA DISPLAY AND MONITOR TUBES - CURRENT TYPES (Continued)

Common Features:- Rectangular face-plates, electrostatic focus, magnetic deflection, aluminised screens, CT8 side contacts

| Type Number | Other Current Phosphors | Application and Description | Face§ Diag. nom. | Overall Length max. | Neck Dia. max. | Defl. Angle | Screen Glass Trans. (Appr.) | TYPICAL OPERATION Voltages referred to cathode | | | | | | Base Type |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | $V_h$ | $I_h$ | $V_{a1}$ | $V_a$ final | $V_{a3}$ focus | $-V_g$ cut-off | |
| | | | inch | mm | mm | ° | % | V | mA | V | kV | V | V | |
| M31-190GH | W | Medical, data display or general purpose monitor Rimguard III Protection integral mounting lugs. | 12 | 277 | 20.7 | 90 | 50 | 11 | 75 | 250 | 12 | 0 to 350 | 35 to 69 | B7G/D |
| M31-191GH | W | M31-192.. with a tinted bonded anti reflection face-plate | 12 | 282 | 20.7 | 90 | 15 | 11 | 75 | 250 | 12 | 0 to 350 | 35 to 69 | B7G/D |
| M31-192GH | W | Bonded face-plate version of of M31-190.. | 12 | 282 | 20.7 | 90 | 50 | 11 | 75 | 250 | 12 | 0 to 350 | 35 to 69 | B7G/D |
| M31-212GH | | Data display tinted bonded anti-reflection face-plate integral mounting lugs | 12 | 282 | 20.7 | 90 | 15 | 11 | 75 | 300 | 12 | 0 to 350 | 40 to 79 | B7G/D |
| M31-213GH | | M31-212.. but with a clear glass bonded face-plate | 12 | 282 | 20.7 | 90 | 50 | 11 | 75 | 300 | 12 | 0 to 350 | 40 to 79 | B7G/D |
| M36-141W | | Studio quality monitor | 14 | 425 | 38 | 70 | 60 | 6.3 | 300 | 300 | 12 | -200 to +200 | 30 to 72 | B12A |
| M38-100W | GH, GJ GR, LC LG, WA | Industrial monitor. Data display. Rimguard III protection. Squared-off screen | 15 | 356 | 29.4 | 90 | 50 | 11.5 | 150 | 400 | 16 | 0 to 400 | 38 to 82 | B8H |
| M38-101GH | LD | M38-100. with longer neck for "position & write" coils | 15 | 378 | 29.4 | 90 | 50 | 11.5 | 150 | 400 | 16 | 0 to 400 | 38 to 82 | B8H |
| M38-102GH | | Bonded face-plate version of M38-100.. | 15 | 383 | 29.4 | 90 | 50 | 11.5 | 150 | 400 | 16 | 0 to 400 | 38 to 82 | B8H |
| M38-103WA | | Version of M38-100WA with modified lugs | 15 | 356 | 29.4 | 90 | 50 | 11.5 | 150 | 400 | 16 | 0 to 400 | 38 to 82 | B8H |

Other phosphor screens can be supplied to special order. § Rectangular face  Mounting lugs.
Types using the B8H base may be fitted with the B8H Sparkguard Base and will then have a * suffix after the type number.

DATA DISPLAY AND MONITOR TUBES - CURRENT TYPES (continued)

Common features: - Rectangular face-plates, electrostatic focus, magnetic deflection, aluminised screens, CT8 side contacts

| Type Number | Other Current Phosphors | Application and Description | Face§ Diag. nom. | Overall Length max. | Neck Dia. max. | Defl. Angle | Screen Glass Trans. (Appr.) | TYPICAL OPERATION Voltages referred to cathode | | | | | | Base Type |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | $V_h$ | $I_h$ | $V_{a1}$ | $V_a$ final | $V_{a3}$ focus | $-V_g$ cut-off | |
| | | | inch | mm | mm | ° | % | V | mA | V | kV | V | V | |
| M38-104GH | | Bonded face-plate version of M38-100GH | 15 | 361 | 29.4 | 90 | 50 | 11.5 | 150 | 400 | 16 | 0 to 400 | 38 to 82 | B8H |
| M38-105GH | | M38-102.. with a tinted bonded anti-reflection face-plate | 15 | 383 | 29.4 | 90 | 15 | 11.5 | 150 | 400 | 16 | 0 to 400 | 38 to 82 | B8H |
| M38-106GH | | M38-102.. with a tinted bonded anti-reflection face-plate | 15 | 383 | 29.4 | 90 | 30 | 11.5 | 150 | 400 | 16 | 0 to 400 | 38 to 82 | B8H |
| M38-113GH | | High resolution "position and write" data display | 15 | 441 | 38 | 90 | 50 | 6.3 | 300 | 400 | 15 | 0 to 400 | 30 to 70 | B12A |
| 59-60/90/074 | | Mobile or military monitor Fully ruggedised construction Rimguard III protection integral mounting lugs | 15 | 372 | 29.4 | 90 | 50 | 6.3 | 300 | 400 | 16 | 0 to 400 | 42 to 86 | Flying leads |
| M38-120W | GH | General purpose monitor tube | 15 | 279.5 | 29.4 | 110 | 50 | 6.3 | 300 | 400 | 16 | 0 to 400 | 40 to 85 | B8H |
| M38-121W | GH | Protected version of M38-120. | 15 | 279.5 | 29.4 | 110 | 50 | 6.3 | 300 | 400 | 16 | 0 to 400 | 40 to 85 | B8H |
| M38-122GH | | Data display. Tinted bonded face-plate | 15 | 284.5 | 29.4 | 110 | 15 | 6.3 | 300 | 400 | 16 | 0 to 400 | 40 to 85 | B8H |
| M38-142W | GH | High voltage focus high resolution data display. Rimguard IV protection integral mounting lugs | 15 | 321 | 29.4 | 110 | 50 | 6.3 | 300 | 450 | 17 | 4000* | 35 to 85 | B8H |

Other phosphor screens can be supplied to special order. § Rectangular face; Mounting lugs. * Va2

Types using the B8H base may be fitted with the B8H Sparkguard Base and will have a suffix after the type number.

DATA DISPLAY AND MONITOR TUBES - CURRENT TYPES (continued)

Common features: - Rectangular face-plates, electrostatic focus, magnetic deflection, aluminised screens, CT8 side contacts

| Type Number | Other Current Phosphors | Application and Description | Face§ Diag. nom. | Overall Length max. | Neck Dia. max. | Defl. Angle | Screen Glass Trans. (Appr.) | TYPICAL OPERATION Voltages referred to cathode | | | | | | Base Type |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | $V_h$ | $I_h$ | $V_{a1}$ | $V_a$ final | $V_{a3}$ focus | $-V_g$ cut-off | |
| | | | inch | mm | mm | ° | % | V | mA | V | kV | V | V | |
| M44-120W | LC | Squared-up screen. Rimguard III push-through protection | 17 | 291 | 29.4 | 110 | 48 | 6.3 | 300 | 400 | 16 | 0 to 400 | 40 to 77 | B8H |
| M50-120W | GH, GR GV, LG WA | Squared-up screen. Rimguard III push-through protection | 20 | 319 | 29.4 | 110 | 45 | 6.3 | 300 | 400 | 16 | 0 to 400 | 40 to 77 | B8H |
| M61-120W | GH, GR | Squared-up screen. Rimguard III push-through protection | 24 | 370 | 29.4 | 110 | 42 | 6.3 | 300 | 400 | 16 | 0 to 400 | 40 to 77 | B8H |

Other phosphor screens can be supplied to special order. § Rectangular face Mounting lugs.

Types using the B8H base may be fitted with the B8H Sparkguard Base and will have a suffix after the type number.

## Magnetic Shields
## Tube Coils

| Tube Type | Magnetic Shield Number MS | Tube Coil Number TW |
|---|---|---|
| D3-130 | 2 | - |
| D7-200 | 3 | 28 |
| D7-201 | 33 | 28 |
| | 34 | |
| D9-110 | 65 | 50 |
| D10-210 | 6 | 24 |
| D10-230 | 41 | - |
| D10-240 | 7 | 33 |
| D10-293 | 83 | 56 |
| D13-33 | 27 | - |
| D13-47 | 23 | 30 |
| D13-51 | 36 | 21 |
| D13-471 | 23 | 30 |
| D13-600 | 47 | - |
| D13-601 | 47 | - |
| D13-610 | 49 | - |
| D13-611 | 50 | - |
| D13-630 | 43 | - |
| D14-150 | 9 | 25 |
| D14-172 | 15 | 20 |
| | | 26 |
| D14-173 | 15 | 20 |
| | | 26 |
| D14-181 | 20 | 23 |
| D14-200 | 11 | 29 |
| D14-270 | 70 | 52 |
| D14-280 | 72 | 29 |
| D14-310 | 1 | 29 |
| D16-100 | 45 | 45 |
| D16-110 | 63 | 45 |
| D18-130 | 61 | 48 |
| D18-160 | 84 | 29 |

## Oscilloscope Tubes

| Tube Type | Magnetic Shield Number MS | Tube Coil Number TW |
|---|---|---|
| D21-10 | 52 | - |
| D21-102 | 52 | - |
| SE4D | 55 | - |
| SE5/2A | 58 | - |
| SE5F | 59 | - |

# Magnetic Shields
# Tube Coils



| Magnetic Shield Number MS | Used on Tube Type number | |
|---|---|---|
| 1 | D14-310 | |
| 2 | D3-130 | |
| 3 | D7-200 | |
| 6 | D10-210 | |
| 7 | D10-240 | |
| 9 | D14-150 | |
| 11 | D14-200 | |
| 15 | D14-172 | D14-173 |
| 20 | D14-181 | |
| 23 | D13-47 | D13-471 |
| 27 | D13-33 | |
| 33 | D7-201 | |
| 34 | D7-201 | |
| 36 | D13-51 | |
| 41 | D10-230 | |
| 43 | D13-630 | |
| 45 | D16-100 | |
| 47 | D13-600 | D13-601 |
| 49 | D13-610 | |
| 50 | D13-611 | |
| 52 | D21-10 | D21-102 |
| 55 | SE4D | |
| 58 | SE5/2A | |
| 59 | SE5F | |
| 61 | D18-130 | |
| 63 | D16-110 | |
| 65 | D9-110 | |
| 70 | D14-270 | |
| 72 | D14-280 | |
| 83 | D10-293 | |
| 84 | D18-160 | |

| Tube Coil Number TW | Used on Tube Type number | |
|---|---|---|
| 20 | D14-172 | D14-173 |
| 21 | D13-51 | |
| 23 | D14-181 | |
| 24 | D10-210 | |
| 25 | D14-150 | |
| 26 | D14-172 | D14-173 |
| 28 | D7-200 | D7-201 |
| 29 | D14-200 | D14-310 |
| | D14-280 | D18-160 |
| 30 | D13-47 | D13-471 |
| 33 | D10-240 | |
| 45 | D16-100 | D16-110 |
| 48 | D18-130 | |
| 50 | D9-110 | |
| 52 | D14-270 | |
| 56 | D10-293 | |

# Scan Coils

# Data Display or Monitor Tubes

CURRENT TYPES

| Tube Type | Scan Coil Number |
|---|---|
| M14-100 | TBY3 |
| M16-100 | * |
| M17-10 | TBY2 |
| M17-12 | TBY2 |
| M17-15 | TBY2 |
| M17-152 | TBY2 |
| M19-100 | TBY3 |
| M21-13 | TBY1 |
| M23-110 | TBY3 |
| M23-111 | TBY3 |
| M23-112 | TBY3 |
| M23-113 | TBY3 |
| M24-120 | TBY1 |
| M24-121 | TBY1 |
| M24-130 | * |
| M28-12 | TBY3 |
| M28-13 | TBY1 |
| M28-132 | TBY1 |
| M28-133 | TBY1 |
| M31-120 | TBY3 |
| M31-184 | TBY1 |
| M31-185 | TBY1 |
| M31-190 | TBY3 |
| M31-191 | TBY3 |
| M31-192 | TBY3 |
| M31-212 | TBY3 |
| M31-213 | TBY3 |
| M36-141 | * |

| Tube Type | Scan Coil Number |
|---|---|
| M38-100 | TBY1 |
| M38-101 | TBY1 |
| M38-102 | TBY1 |
| M38-103 | TBY1 |
| M38-104 | TBY1 |
| M38-105 | TBY1 |
| M38-106 | TBY1 |
| M38-113 | * |
| M38-120 | TBY1 |
| M38-121 | TBY1 |
| M38-122 | TBY1 |
| M38-142 | * |
| M44-120 | TBY1 |
| M50-120 | TBY1 |
| M61-120 | TBY1 |
| 59-60/90/037 | * |
| 59-60/90/074 | * |

* For scan coil information on these tubes contact -
Brimar Equipment Sales Department or Brimar Export Division.

# PHOSPHOR SCREENS

*WA Screen for Colour Television Control Rooms*

The facilities and organisation provided by Thorn Radio Valves and Tubes Limited meet the requirements of the M.O.D. (P.E.) Defence Standard 05-21 and BS 9000.

**HEALTH AND SAFETY AT WORK ACT, 1974**

Attention is drawn to the recommendations under this heading in the Operational Recommendations.

**WARNING**

These tubes should be used in accordance with their published ratings, and in conformity with the Operational Recommendations of the company's data handbook. The company will not entertain claims for loss or damage where this advice has been disregarded.

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**Thorn Radio Valves and Tubes Limited**
Mollison Avenue - Brimsdown - Enfield - Middlesex EN3 7NS

BRIMAR

# Phosphor Screens

# Equivalents & Data Summary

| Corresponding Designations | | | Approximate Persistence Time to 10% | | Kelly Chart Colour | Flicker Threshold* | Typical use |
|---|---|---|---|---|---|---|---|
| New | EIA | Old | Spot | Raster | Fluorescence | Hz | |
| AA | P16 | - | 0.12$\mu$s | | Bluish-purple (UV) | - | Flying-spot scanning |
| BE | P11 | T3† | 40$\mu$s | | Blue | - | Oscillography & photography |
| GE | P24 | T5 | 1.5 $\mu$s | | Green | - | Flying-spot scanning |
| GH | P31 | - | 40 $\mu$s | 0.2 s | Green | 45 | General oscillography & photography |
| GJ | P1 | T1 | 25ms | 30ms | Yellowish-green | 36 | General oscillography & photography |
| GL | P2 | - | 40 $\mu$s | 0.5 s | Yellowish-green | 40 | General oscillography & photography |
| GM | P7 | T6† | 0.5 s § | 7 s § | Purplish-blue ¶ | 38 | Radar & oscillography |
| GP | - | - | 100 $\mu$s | 0.5 s | Green ** | 45 | Data display |
| GR | P39 | - | 150ms | 2 s | Yellowish-green | 30 | Radar & data display |
| GS | - | - | 0.9 $\mu$s | | Yellowish-green | - | Flying-spot scanning |
| GT | - | - | 0.9 $\mu$s | | Bluish-green | - | Flying-spot scanning |
| GV | - | - | | 9 s | Green ¶ | 38 | Radar & oscillography |
| GW | P42 | - | 30 $\mu$s | 0.2 s | Green | 40 | Data display |
| GX | P44 | - | 1.2 ms | | Yellowish-green | 45 | Data display |
| GY | P43 | - | 1.2 ms | | Yellowish-green | 45 | Data display |
| KB | - | T14 | | 1.5 s | Bluish-green ‡ | 38 | Radar & oscillography |
| LA | - | T11 | 25 ms | 50ms | Orange | 36 | Data display |
| LC | P26† | T7 | | 25 s | Orange | 22 | Radar & oscillography |
| LD | P33 | T15 | | 5 s | Orange | 20 | Radar |
| LG | - | T13 | | 4 s | Orange | 18 | Radar & data display |
| W | P4 | T4 | 10 $\mu$s | 10 ms | White | 45 | Monochrome television |
| WA | - | - | 10 $\mu$s | 10 ms | White | 45 | Television monitors |

* Over a range of observers and display arrangements the onset of flickers may vary by at least 5Hz from the above figure.

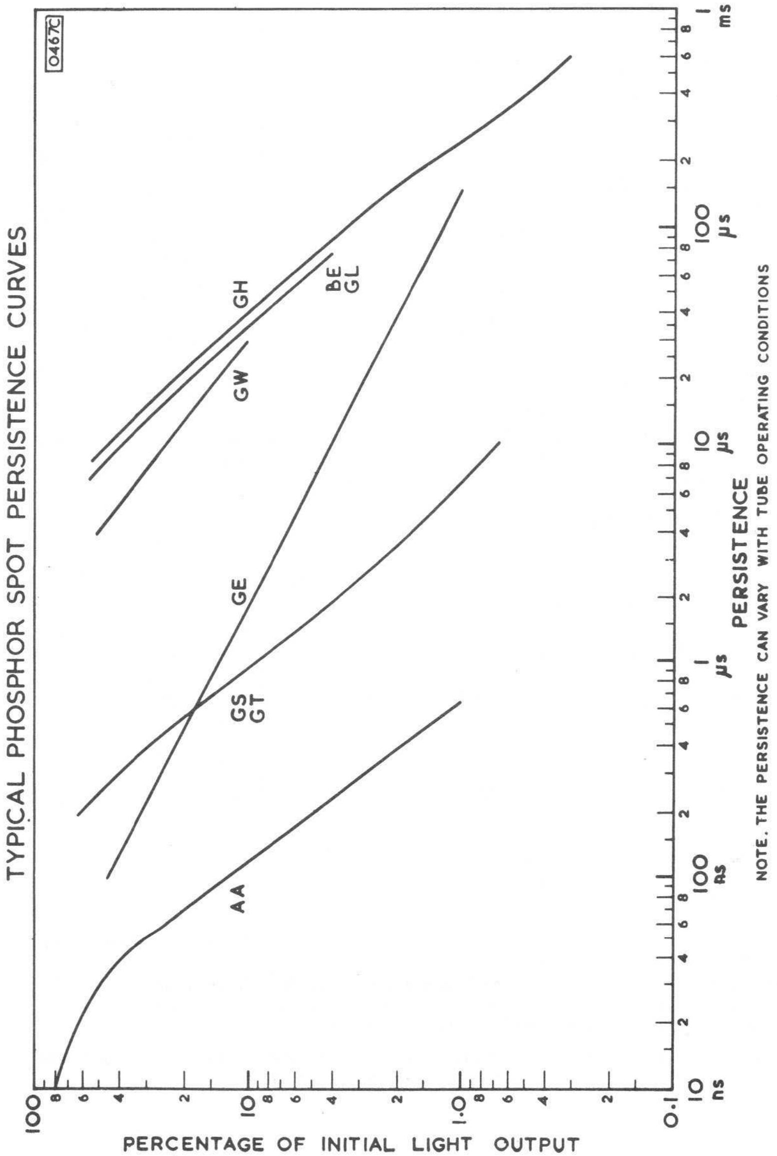
† Approximate. ‡ The phosphorescence is yellow-green.

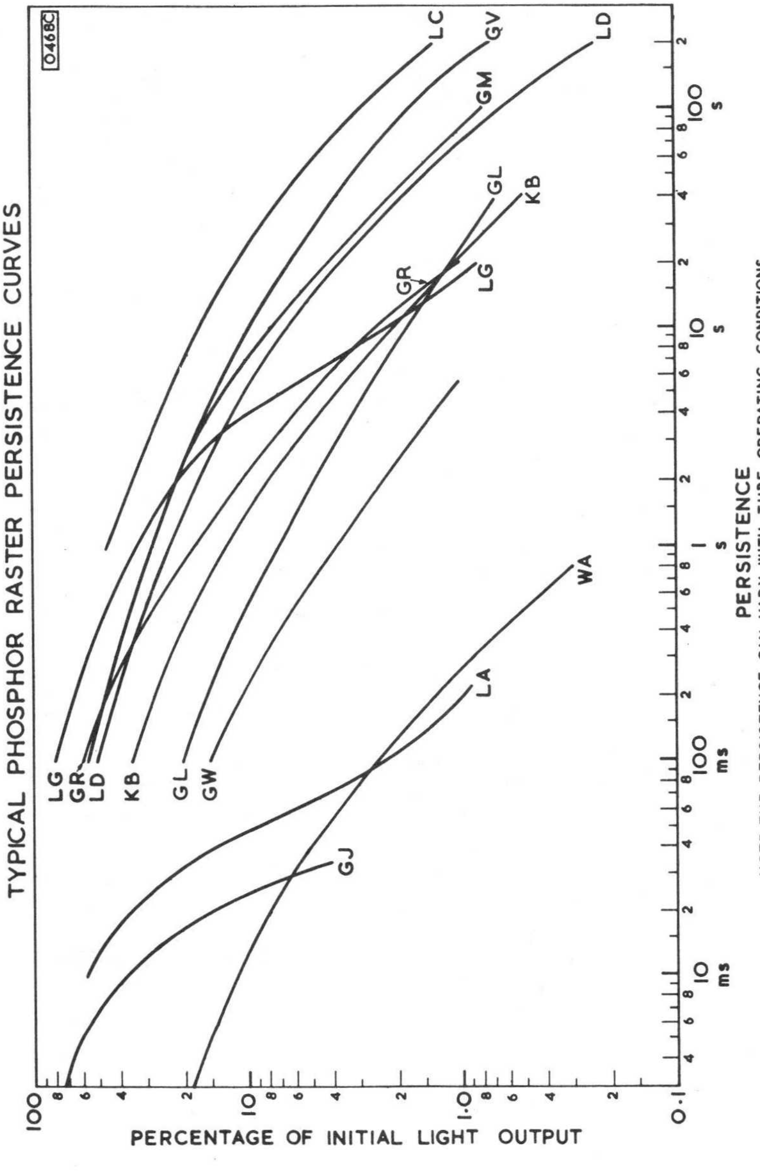
§ Yellowish-green component. ¶ The phosphorescence is yellowish-green.

** The fluorescence at high brightness is bluish-green.

While alternative phosphors can be supplied to special order, most tube types are produced for stock with the particular phosphor most in demand by equipment manufacturers.

PHOSPHOR SCREENS

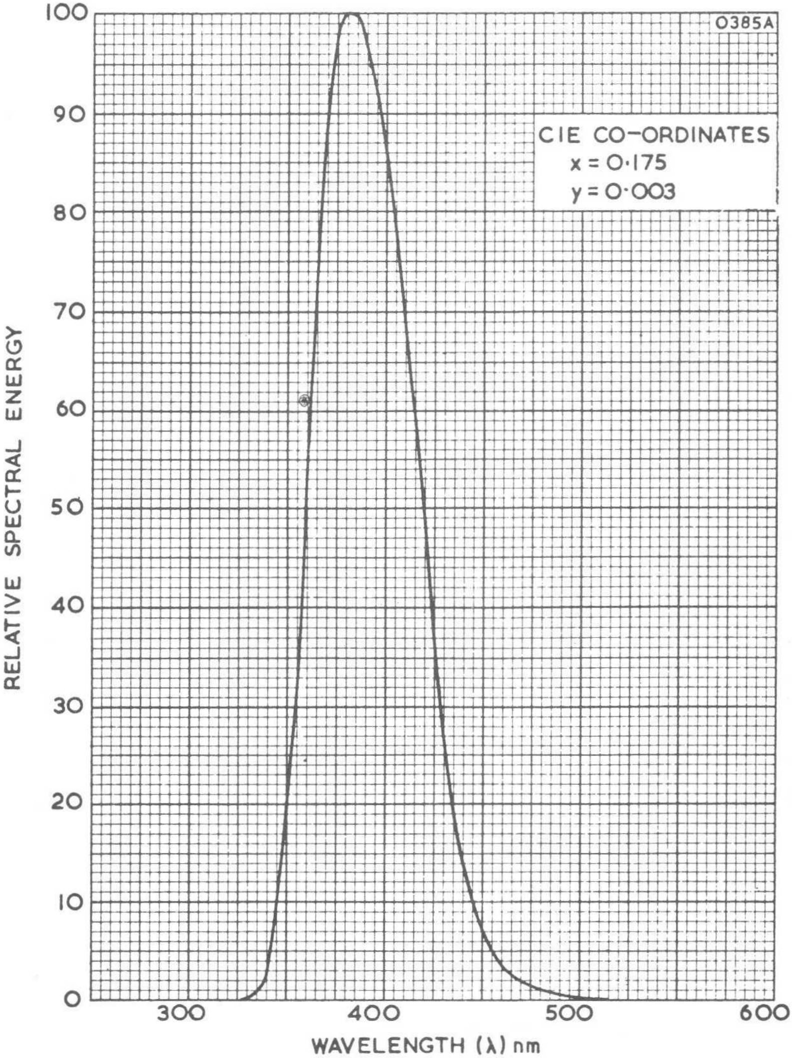

TYPICAL PHOSPHOR SPOT PERSISTENCE CURVES
0467C
GH
BE
GL
GW
GE
GS
GT
AA
100
10
1.0
0.1
PERCENTAGE OF INITIAL LIGHT OUTPUT
10 ns
100 ns
1 µs
10 µs
100 µs
1 ms
PERSISTENCE
NOTE. THE PERSISTENCE CAN VARY WITH TUBE OPERATING CONDITIONS

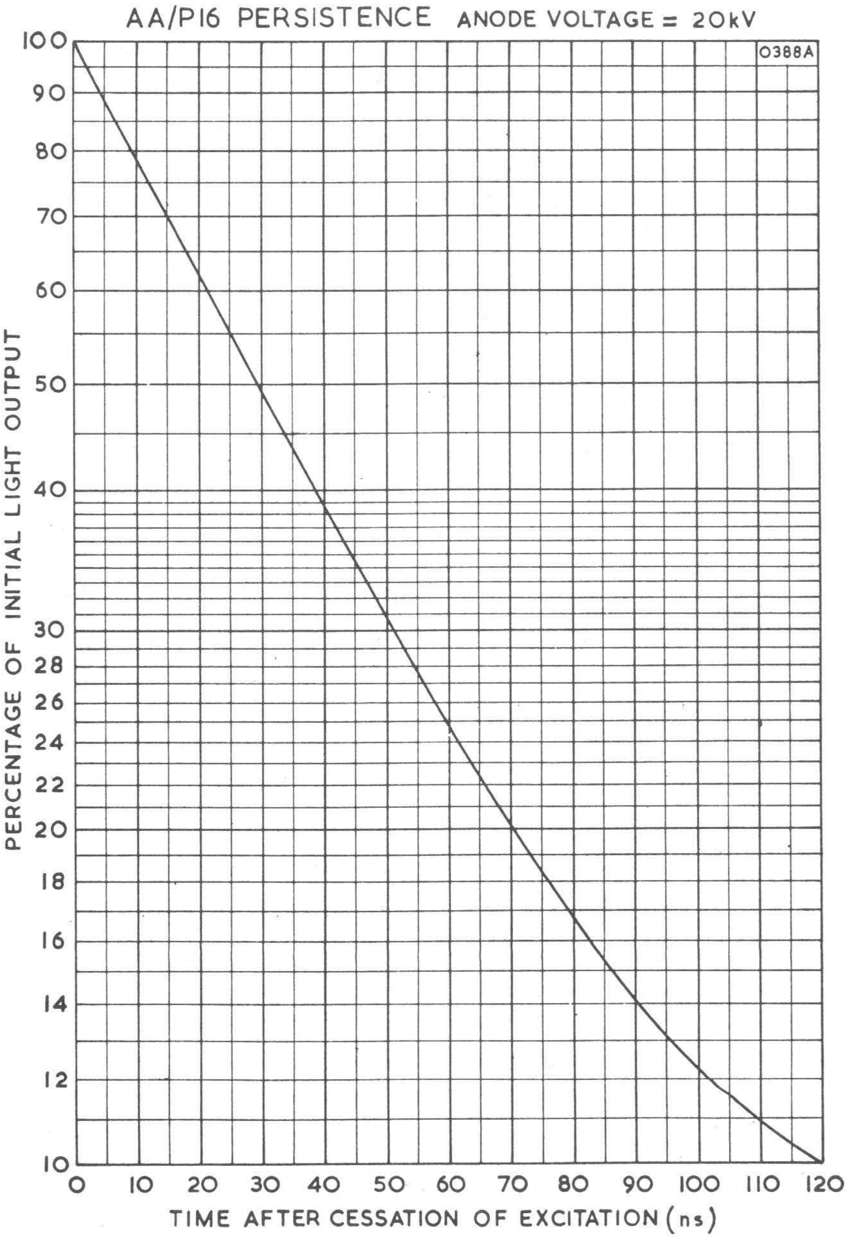



**PHOSPHOR SCREENS**

# Phosphor Screen

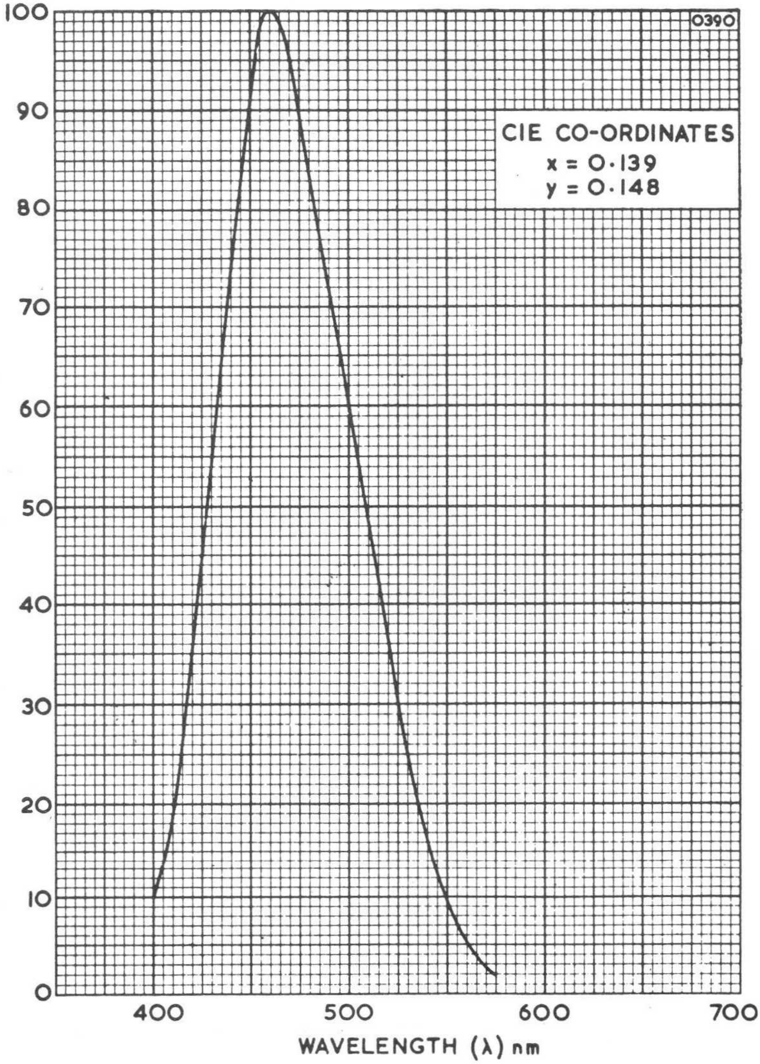
RELATIVE SPECTRAL ENERGY DISTRIBUTION
OF TYPICAL C.R.T. SCREEN TYPE AA/P16

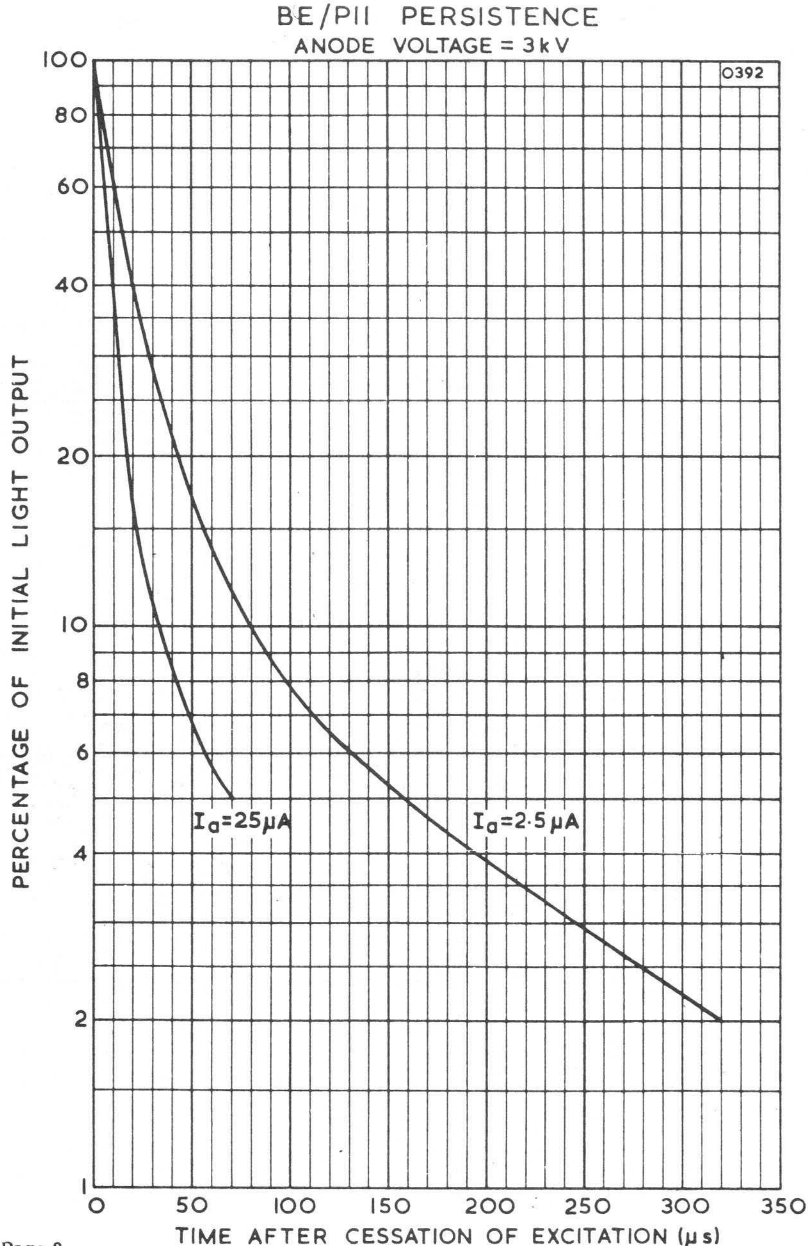



AA/P16 PERSISTENCE ANODE VOLTAGE = 20kV
0388A
PERCENTAGE OF INITIAL LIGHT OUTPUT
100
90
80
70
60
50
40
30
28
26
24
22
20
18
16
14
12
10
0
10
20
30
40
50
60
70
80
90
100
110
120
TIME AFTER CESSATION OF EXCITATION (ns)

# Phosphor Screen

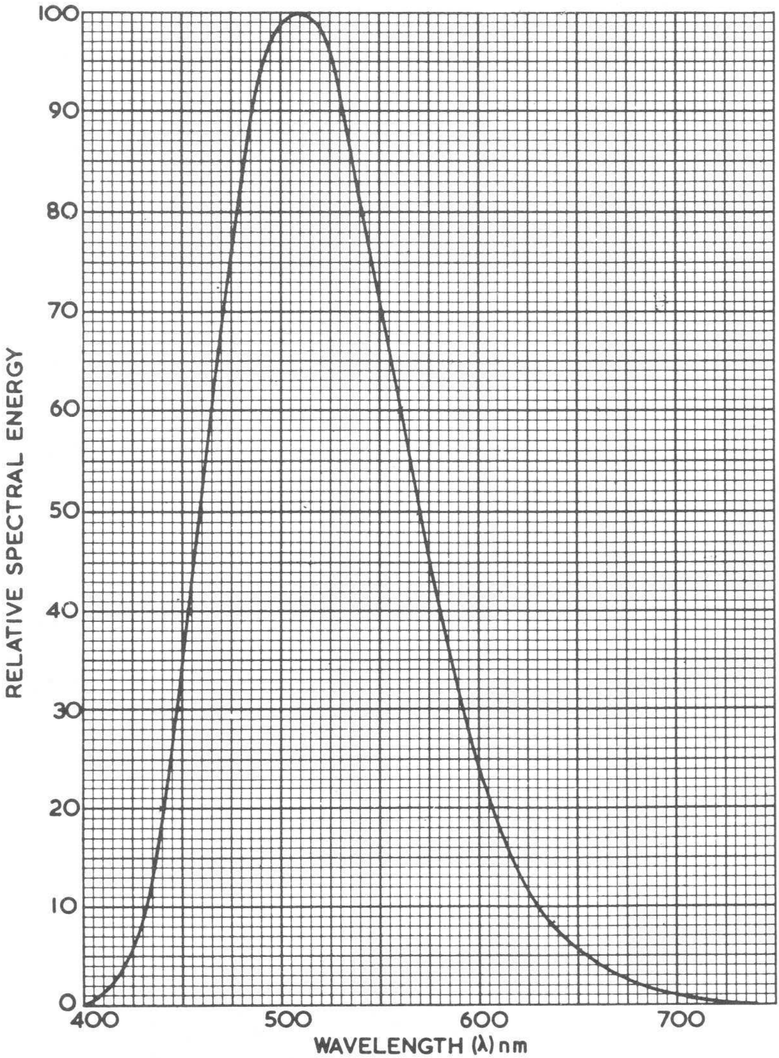
RELATIVE SPECTRAL ENERGY DISTRIBUTION
OF TYPICAL C.R.T. SCREEN TYPE BE/P11




BE/P11 PERSISTENCE
ANODE VOLTAGE = 3 kV
0392
100
80
60
40
20
10
8
6
4
2
1
PERCENTAGE OF INITIAL LIGHT OUTPUT
$I_a$=25µA
$I_a$=2·5µA
0
50
100
150
200
250
300
350
TIME AFTER CESSATION OF EXCITATION (µs)

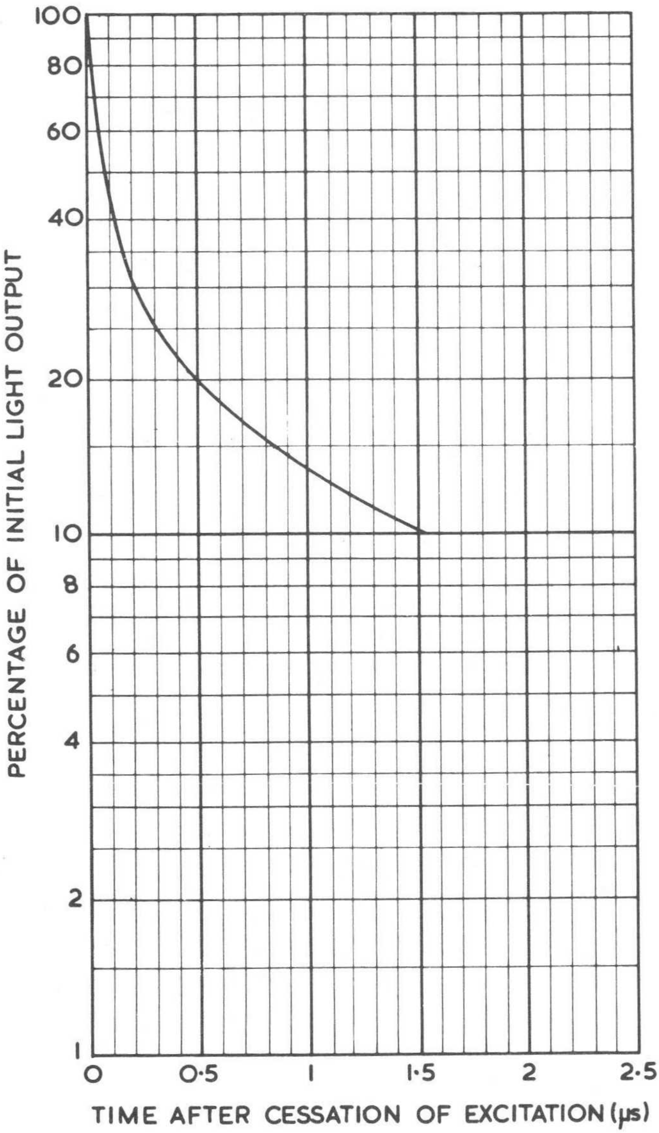
RELATIVE SPECTRAL ENERGY DISTRIBUTION
OF TYPICAL C.R.T. SCREEN TYPE GE/P24/T5

CIE CO-ORDINATES $x = 0{\cdot}245$
$y = 0{\cdot}441$

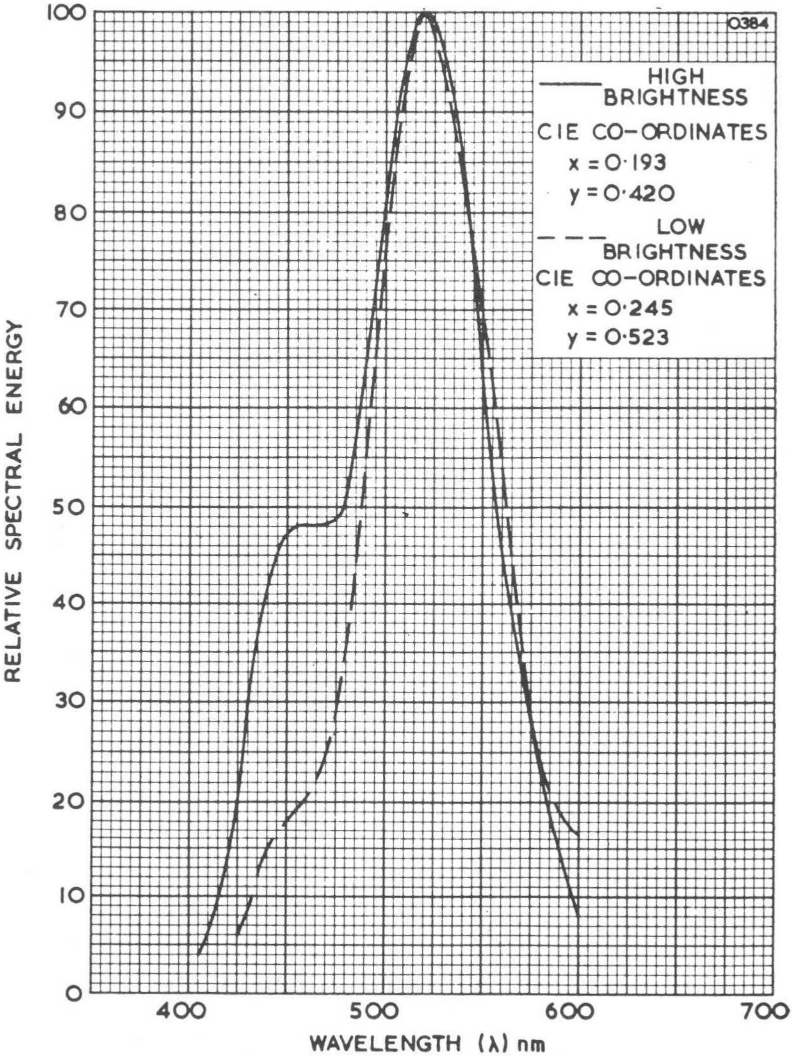


# Phosphor Screen

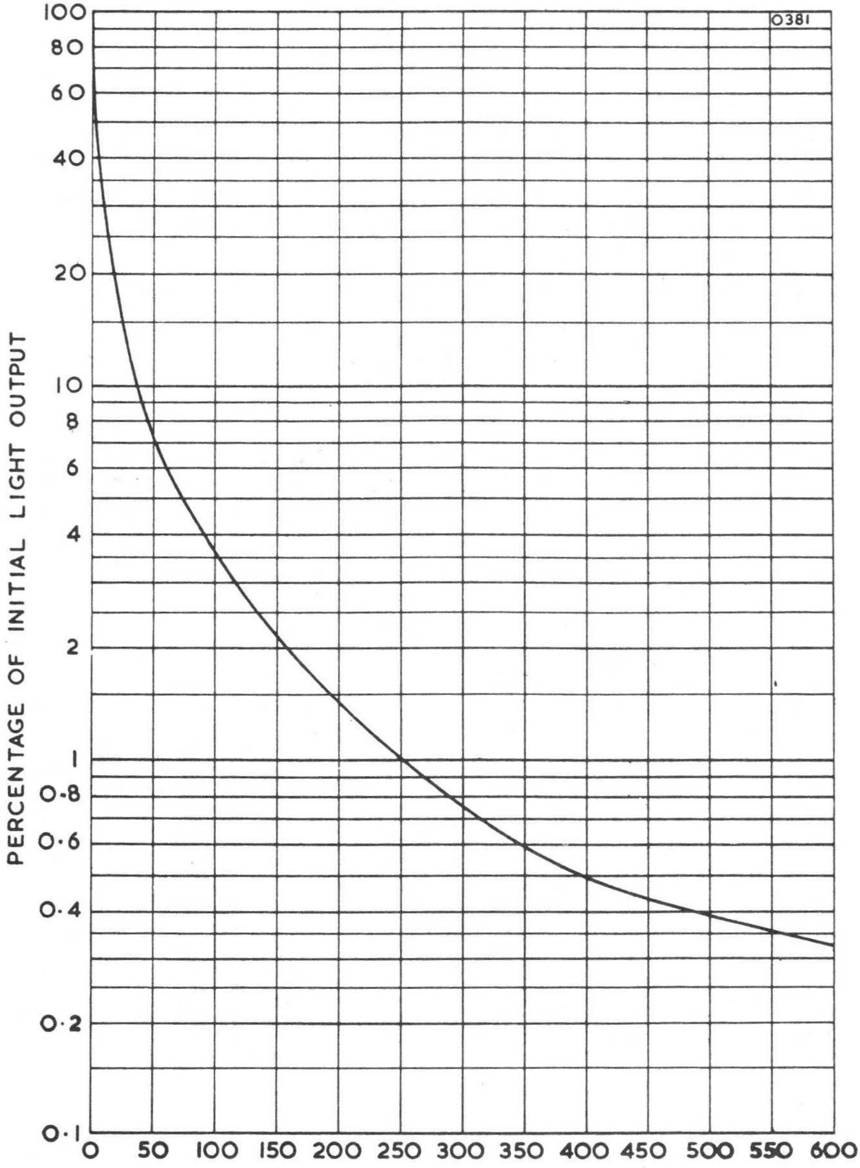
GE/P24/T5 PERSISTENCE



RELATIVE SPECTRAL ENERGY DISTRIBUTION
OF TYPICAL C.R.T. SCREEN TYPE GH/P31



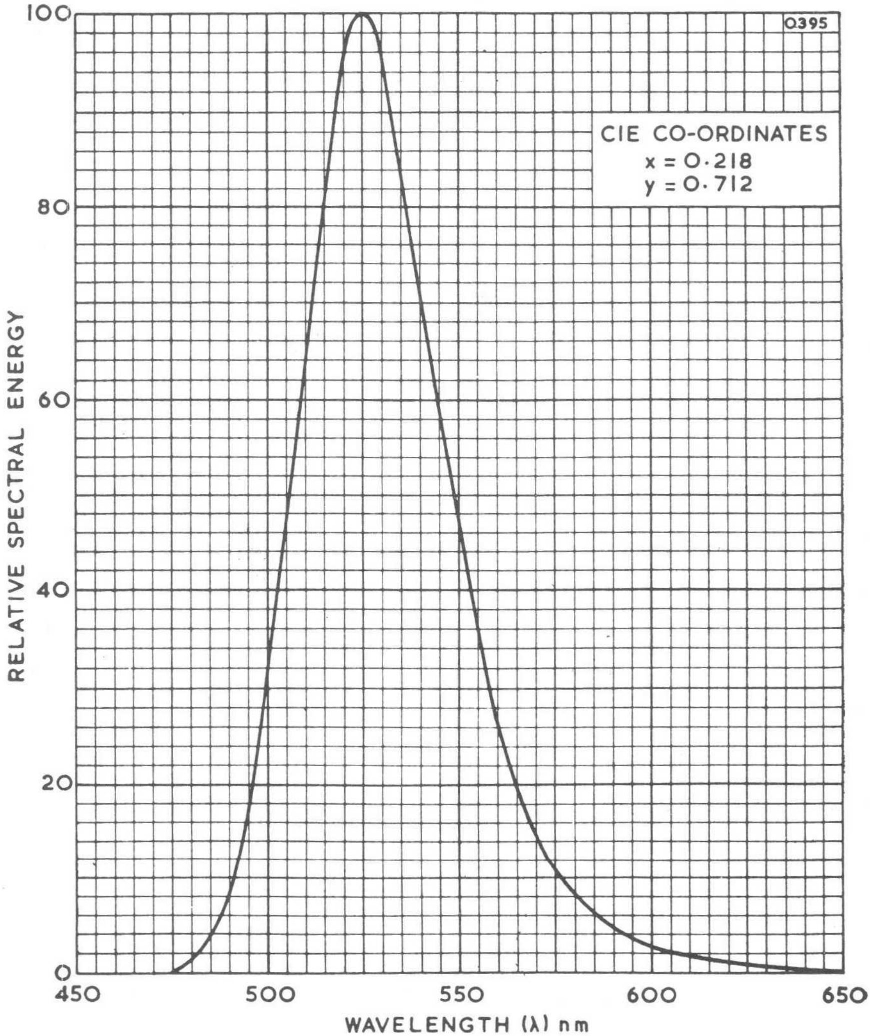
GH/P31 PERSISTENCE

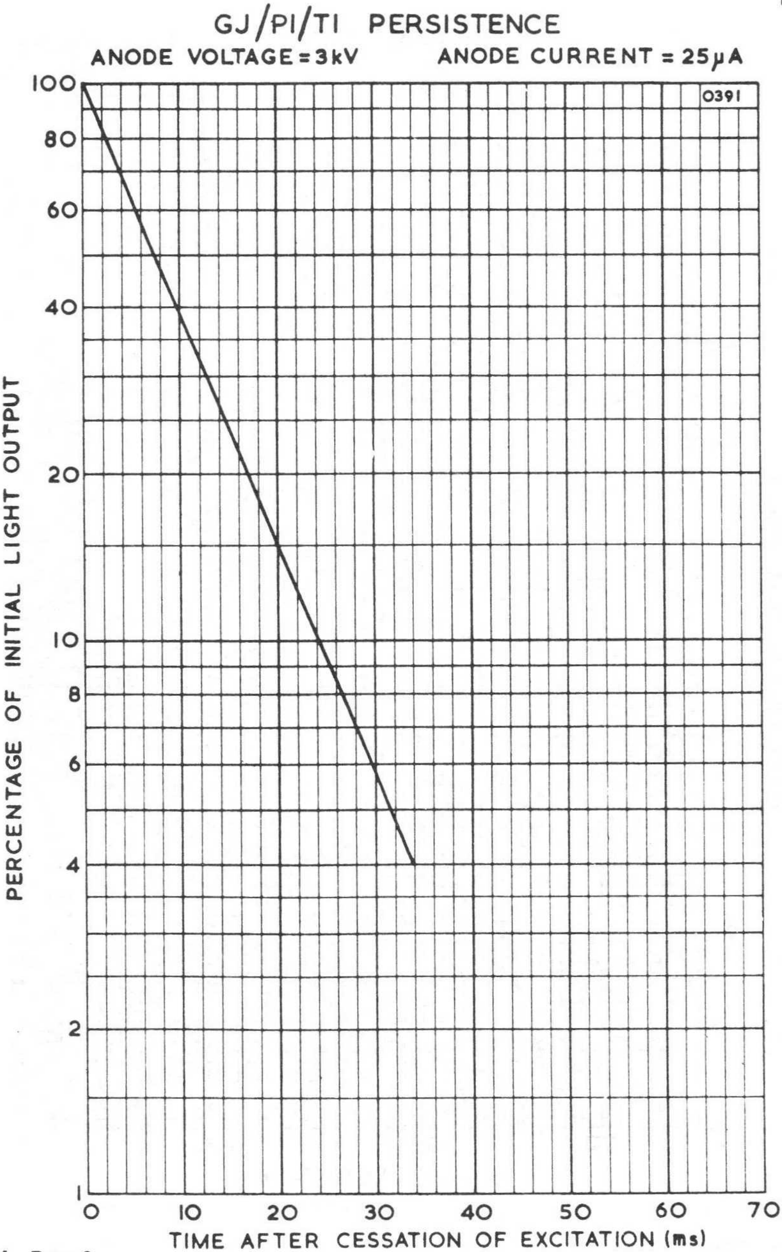



TIME AFTER CESSATION OF EXCITATION (μs)

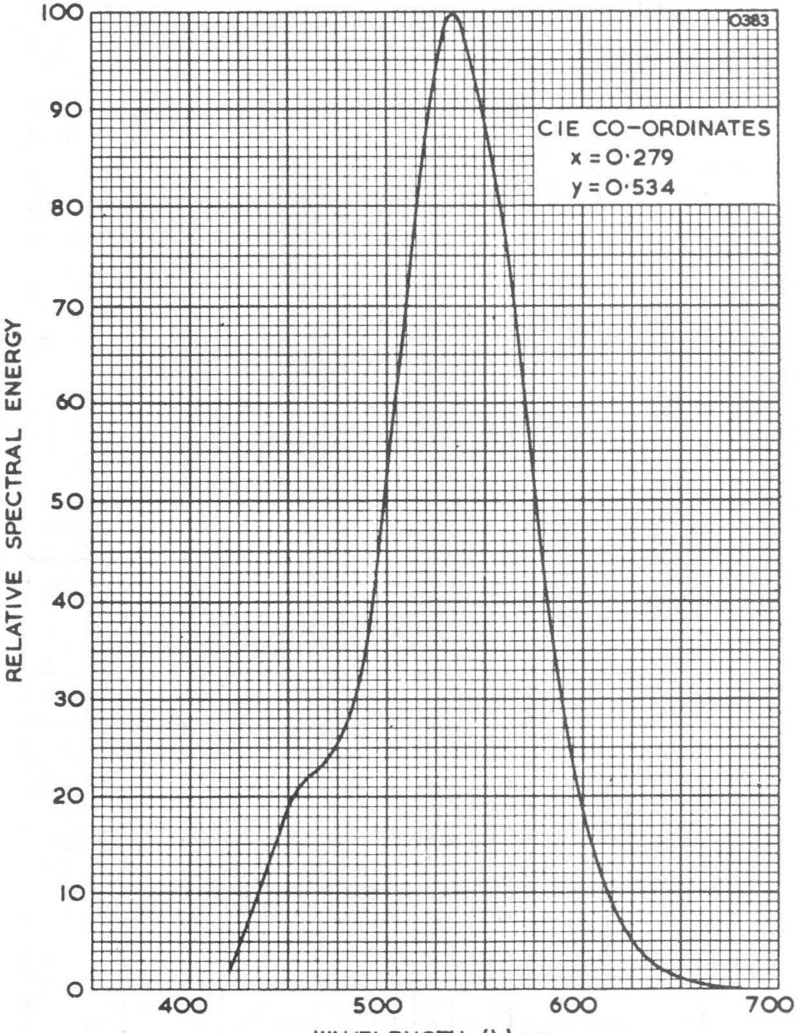
# Phosphor Screen

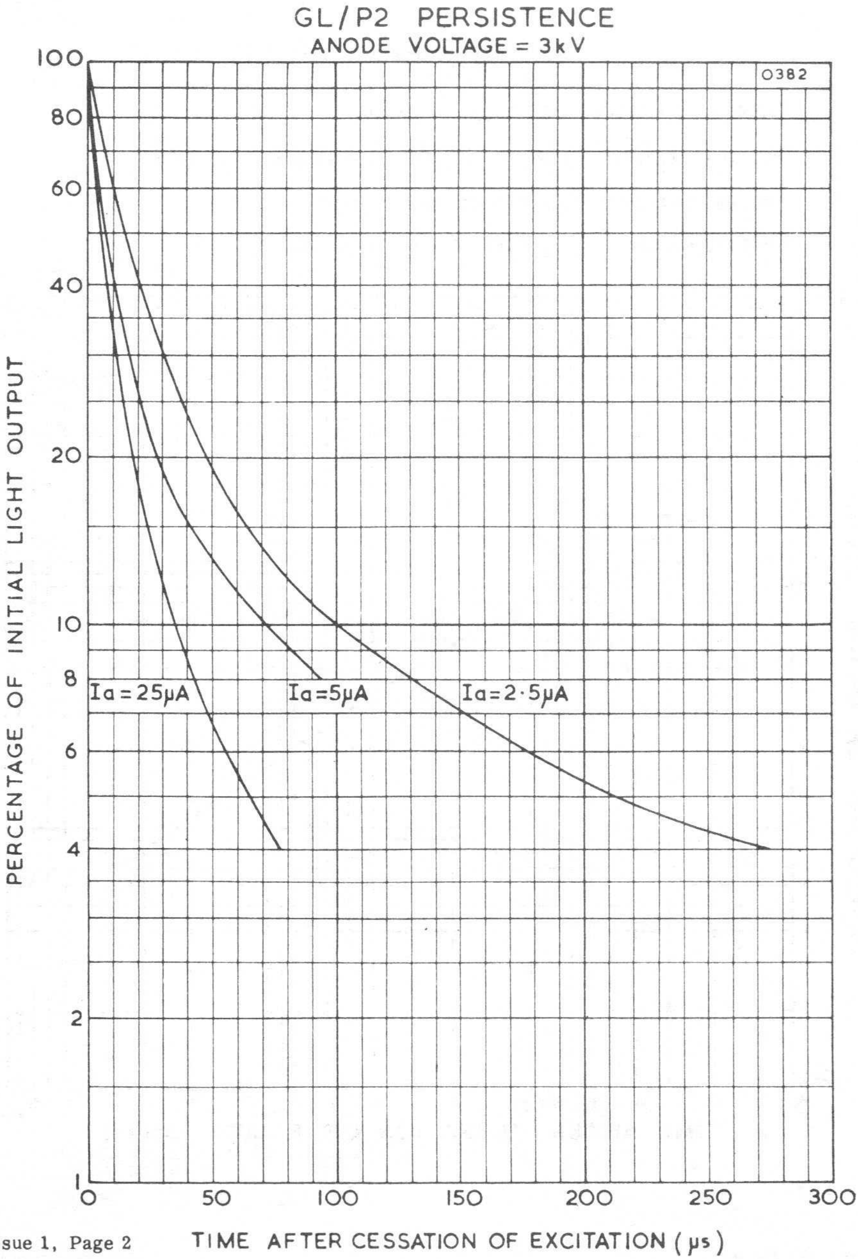
RELATIVE SPECTRAL ENERGY DISTRIBUTION
OF TYPICAL C.R.T. SCREEN TYPE GJ/PI/TI




GJ/PI/TI PERSISTENCE
ANODE VOLTAGE = 3kV
ANODE CURRENT = 25μA
0391
PERCENTAGE OF INITIAL LIGHT OUTPUT
100
80
60
40
20
10
8
6
4
2
1
0
10
20
30
40
50
60
70
TIME AFTER CESSATION OF EXCITATION (ms)

RELATIVE SPECTRAL ENERGY DISTRIBUTION
OF TYPICAL C.R.T. SCREEN TYPE GL/P2




GL / P2 PERSISTENCE
ANODE VOLTAGE = 3 kV
0382
PERCENTAGE OF INITIAL LIGHT OUTPUT
100
80
60
40
20
10
8
6
4
2
1
Ia = 25μA
Ia = 5μA
Ia = 2·5μA
0
50
100
150
200
250
300
TIME AFTER CESSATION OF EXCITATION (μs)

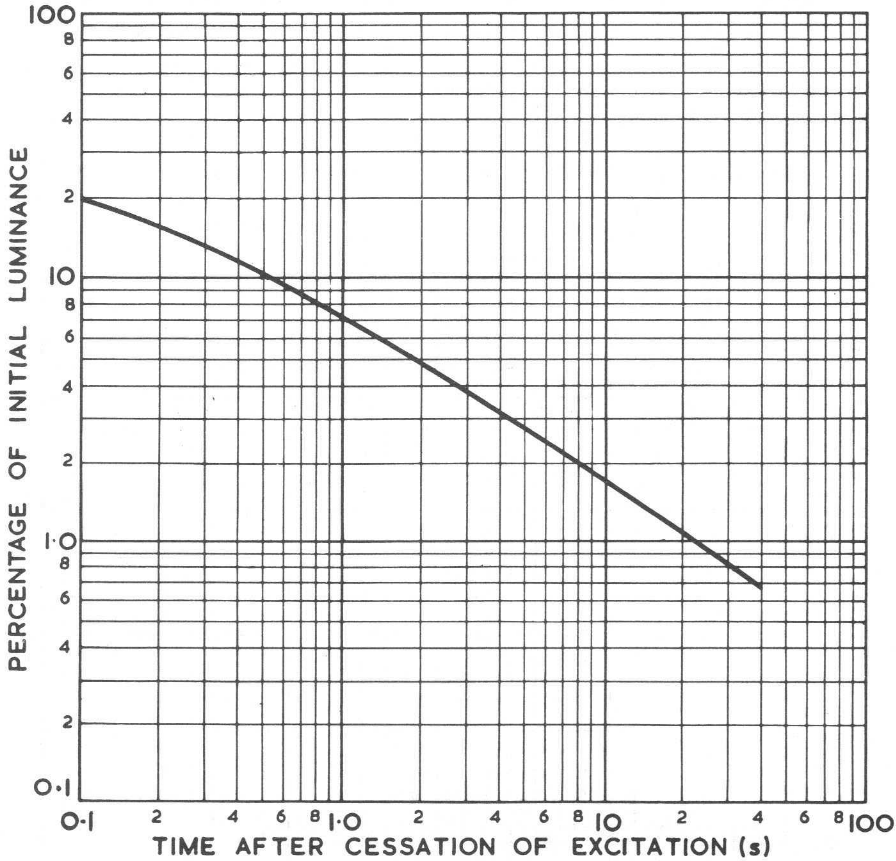
GL/P2 PERSISTENCE

FINAL ANODE VOLTAGE = 15kV

INITIAL LUMINANCE = 1 FOOT LAMBERT (3·43nt)

Excitation: continuous focused raster

Measured on C.R.T. with aluminised screen



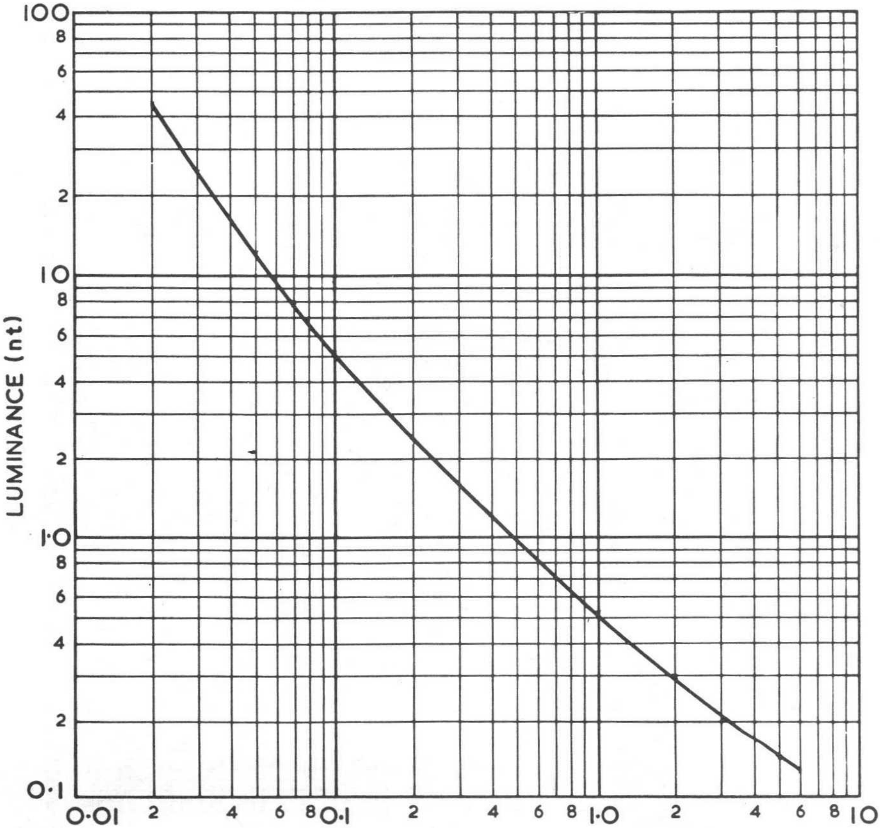
PHOSPHOR SCREENS

## GL/P2 PERSISTENCE

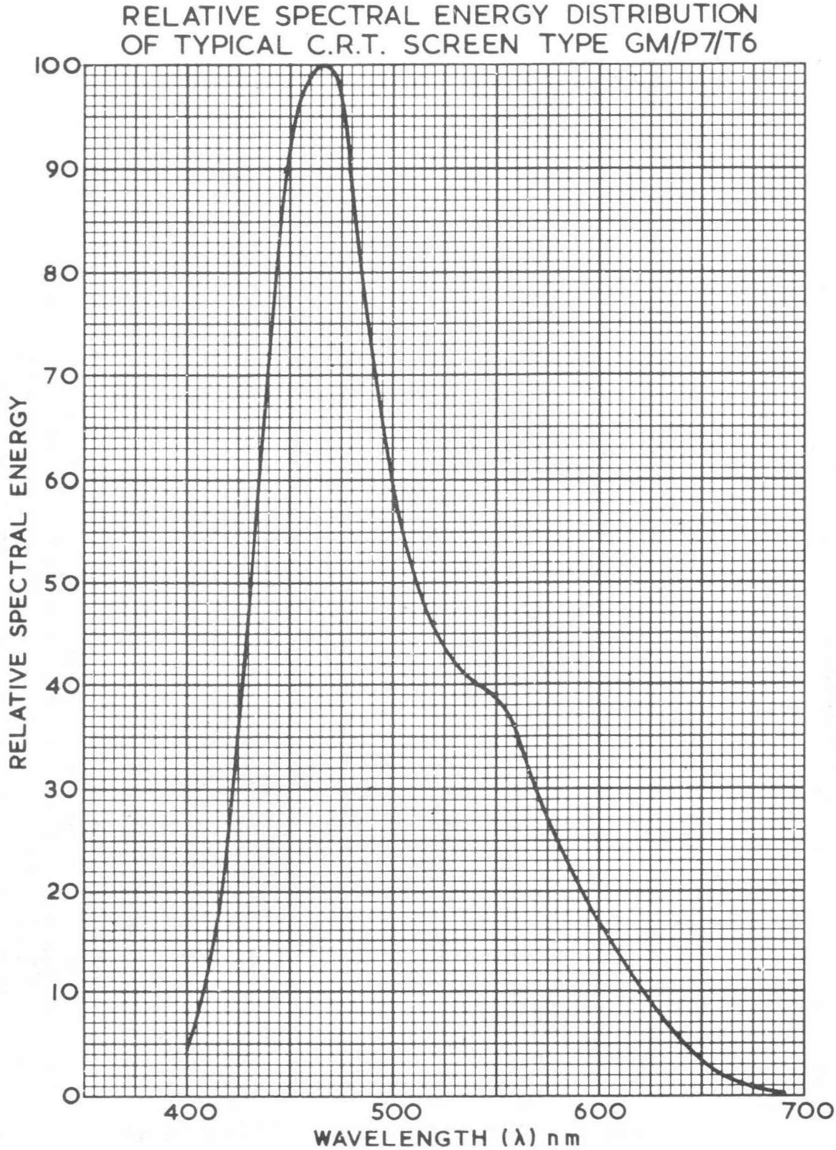
FINAL ANODE VOLTAGE = 15 kV

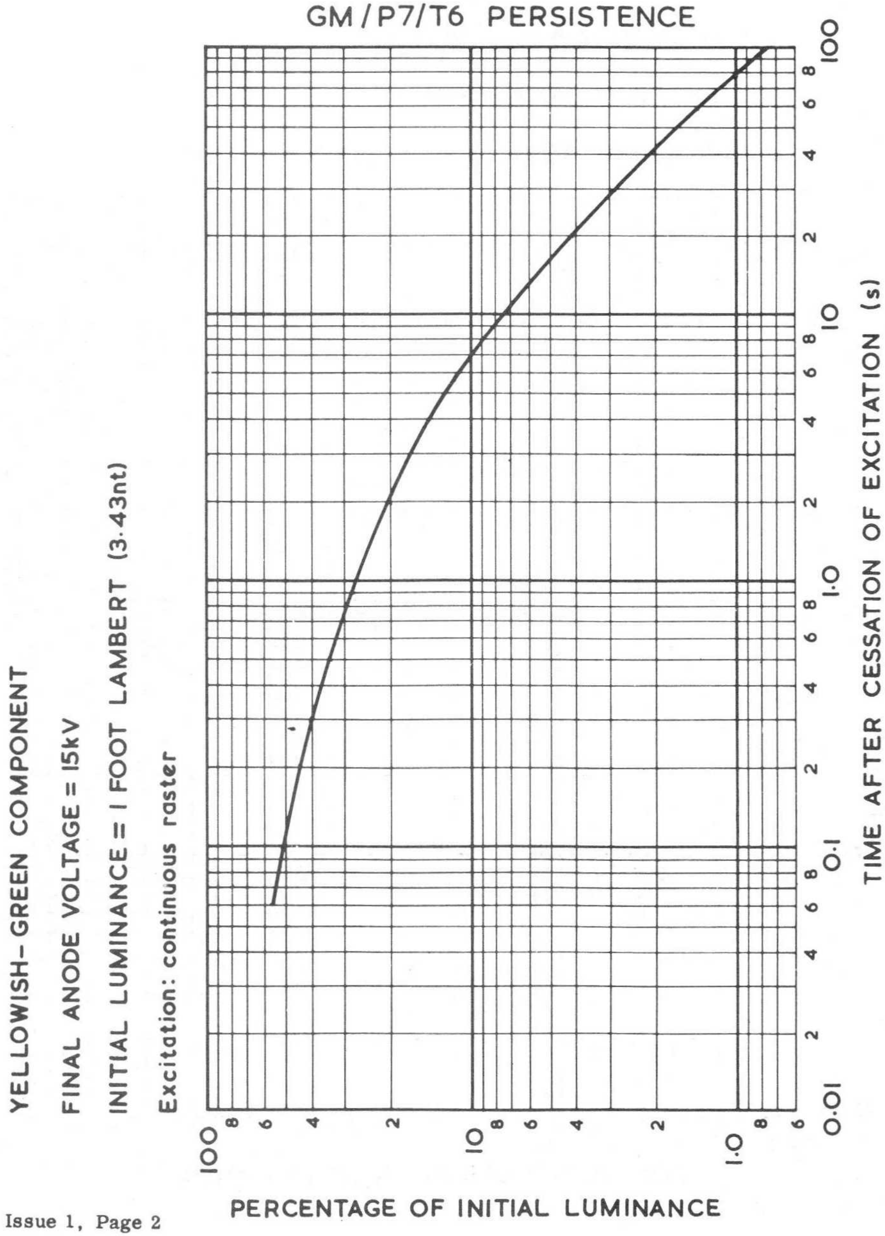
Excitation: single 20ms raster at $1 \mu A/cm^2$

Measured as average luminance of raster on C.R.T. with aluminised screen.



# Phosphor Screen



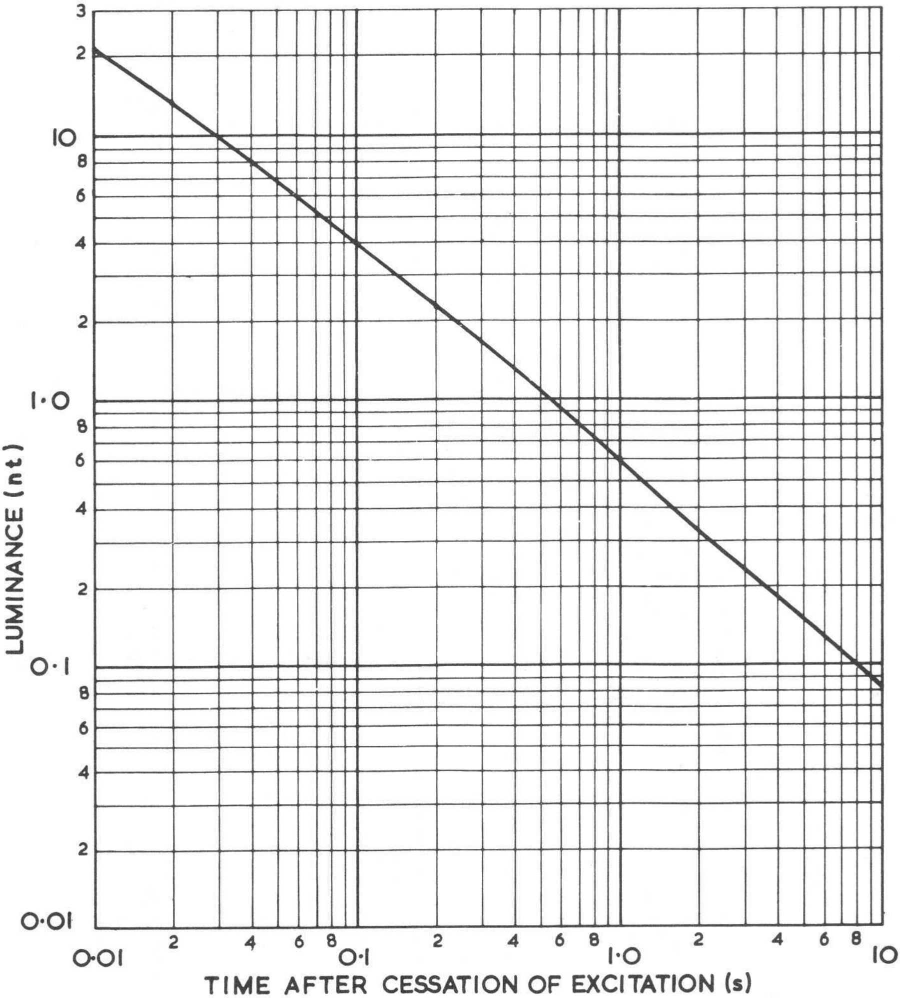

GM / P7/T6 PERSISTENCE
YELLOWISH- GREEN COMPONENT
FINAL ANODE VOLTAGE = 15kV
INITIAL LUMINANCE = 1 FOOT LAMBERT (3.43nt)
Excitation: continuous raster
TIME AFTER CESSATION OF EXCITATION (s)
0.01
0.1
1.0
10
100
PERCENTAGE OF INITIAL LUMINANCE
100
10
1.0

## GM PERSISTENCE

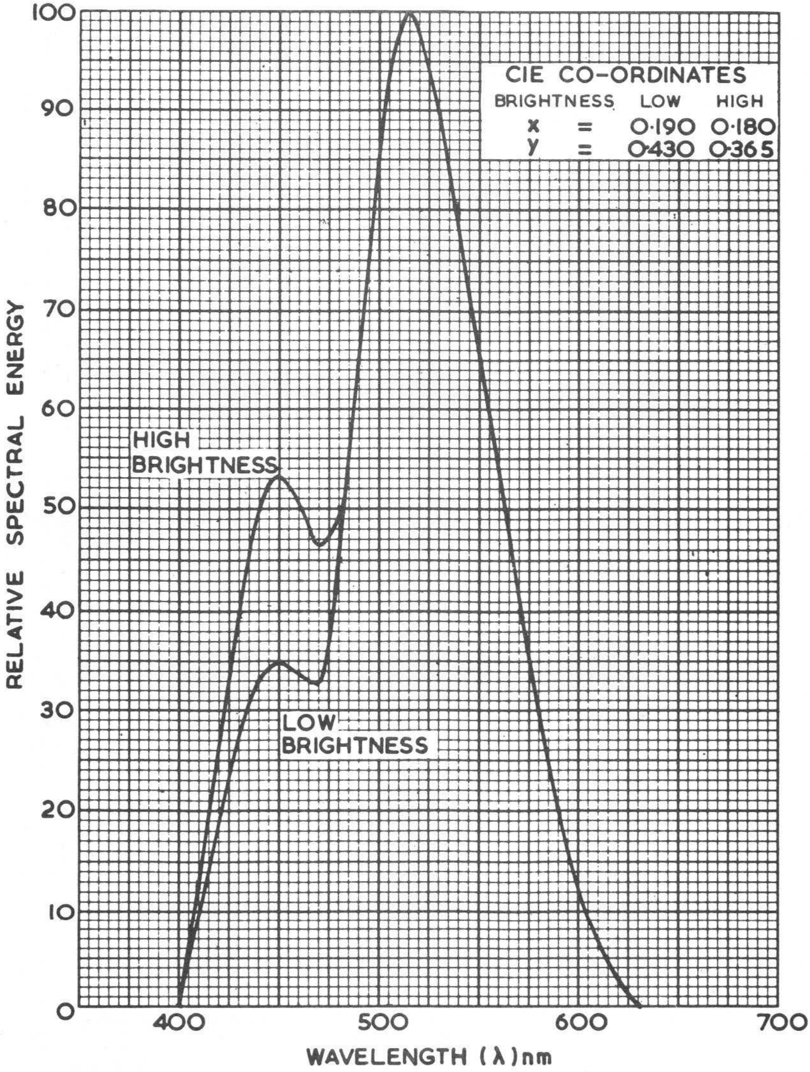
YELLOWISH-GREEN COMPONENT

FINAL ANODE VOLTAGE = 15kV

Excitation: single 20ms raster at 1μA/cm²

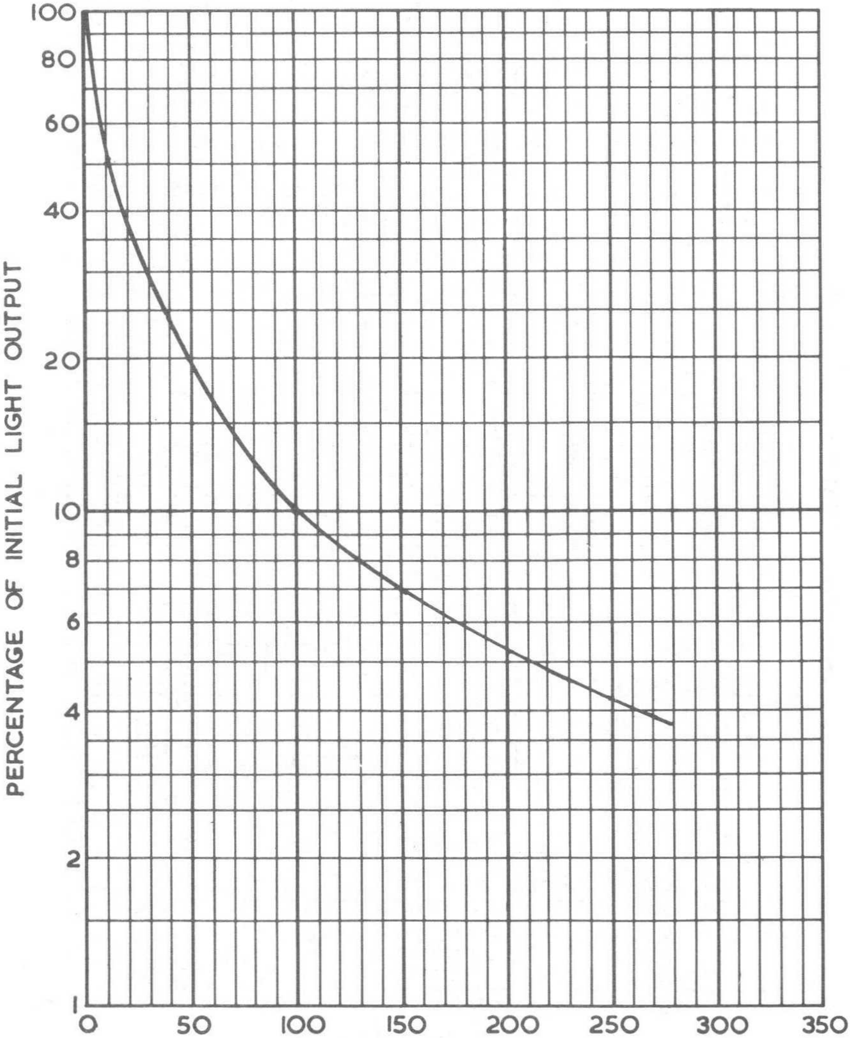


RELATIVE SPECTRAL ENERGY DISTRIBUTION
OF TYPICAL C.R.T. SCREEN TYPE GP



GP PERSISTENCE

ANODE VOLTAGE = 4 kV ANODE CURRENT = 2·5μA




TIME AFTER CESSATION OF EXCITATION (μs)

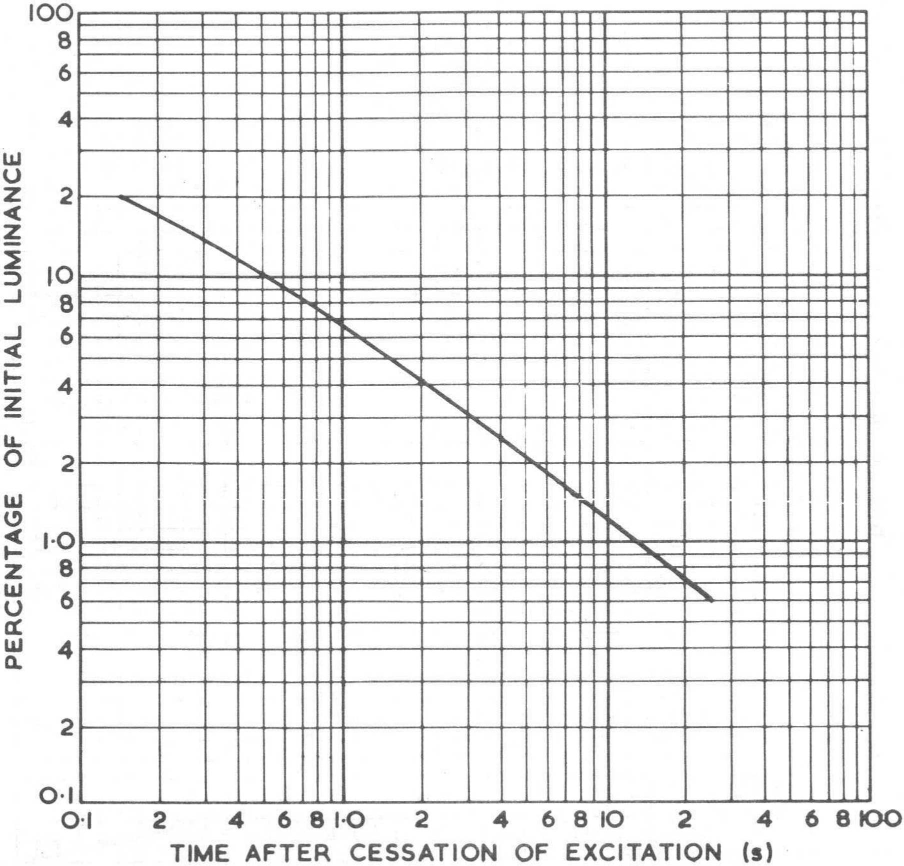
GP PERSISTENCE

FINAL ANODE VOLTAGE 15kV

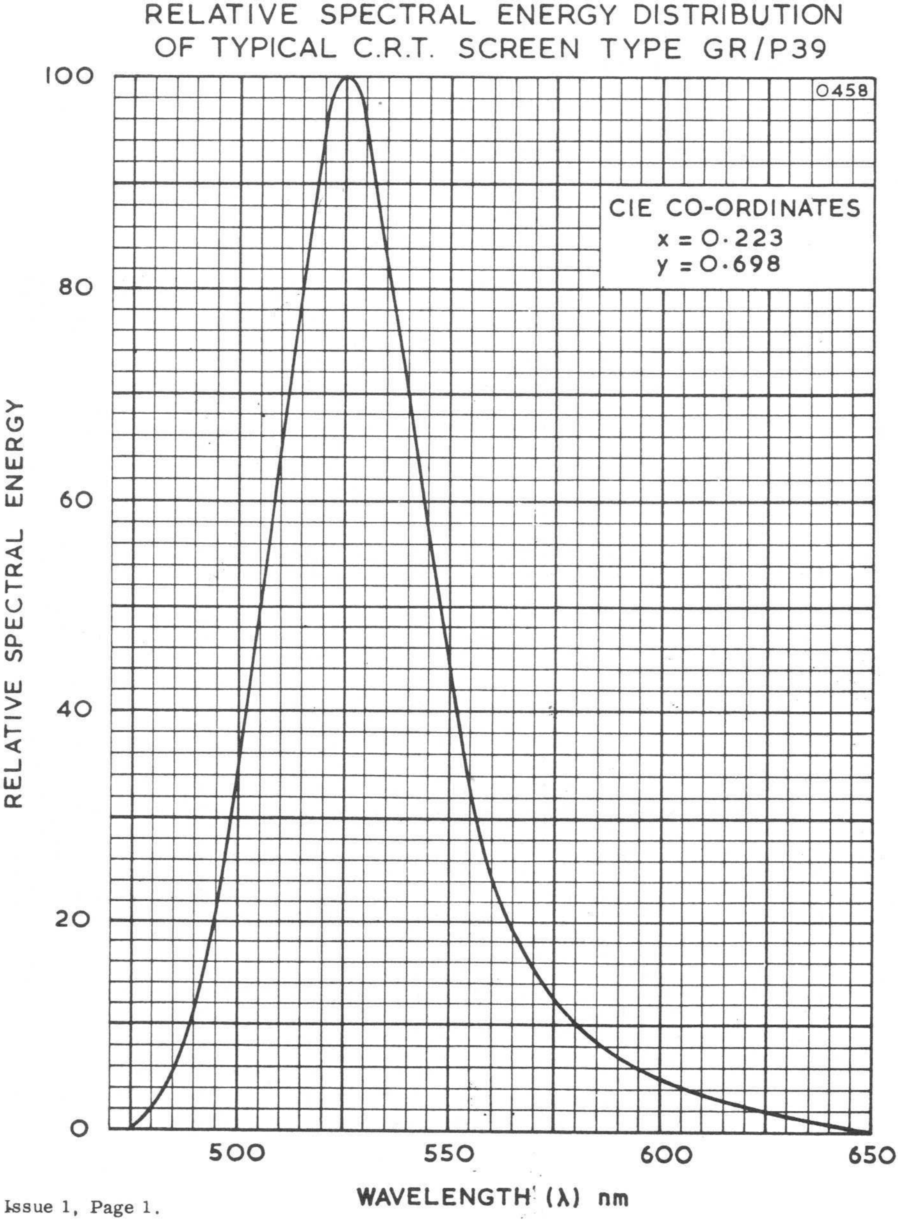
INITIAL LUMINANCE = 1 FOOT LAMBERT (3·43 nt)

Excitation: continuous focused raster

Measured on C.R.T. with aluminised screen



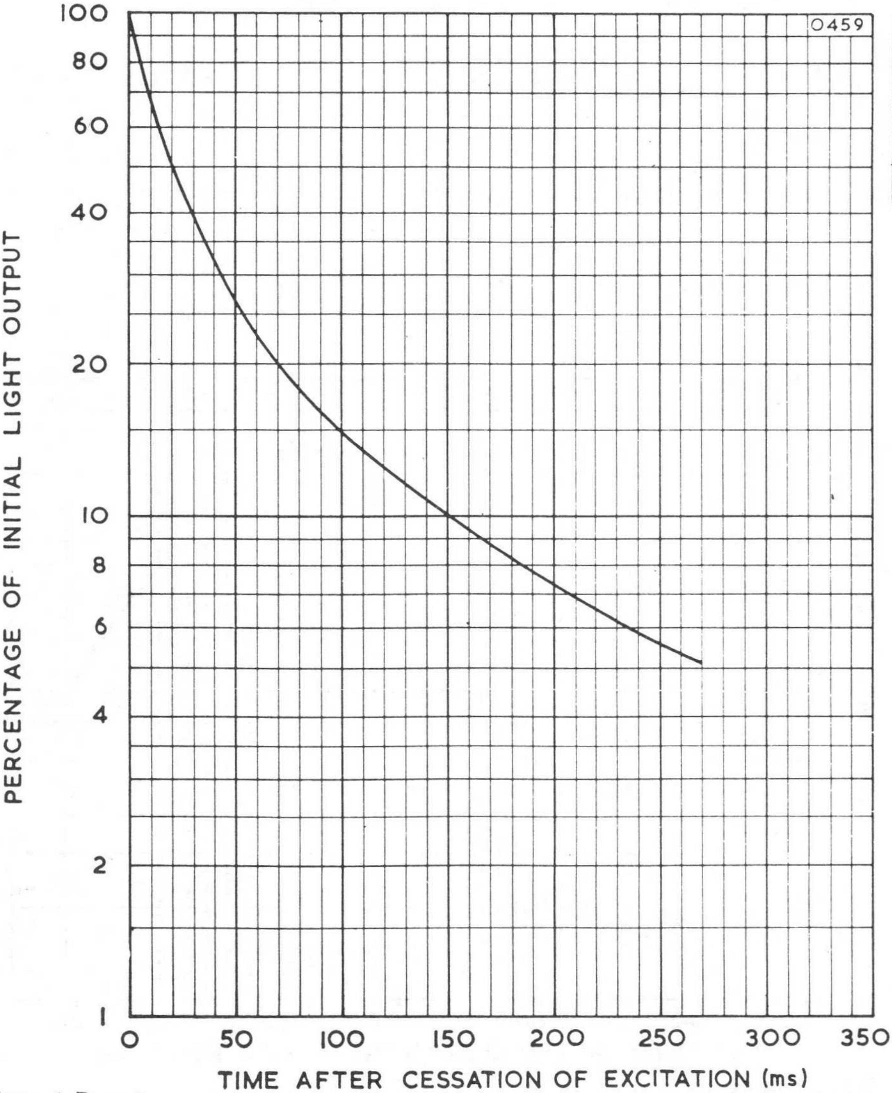
# Phosphor Screen

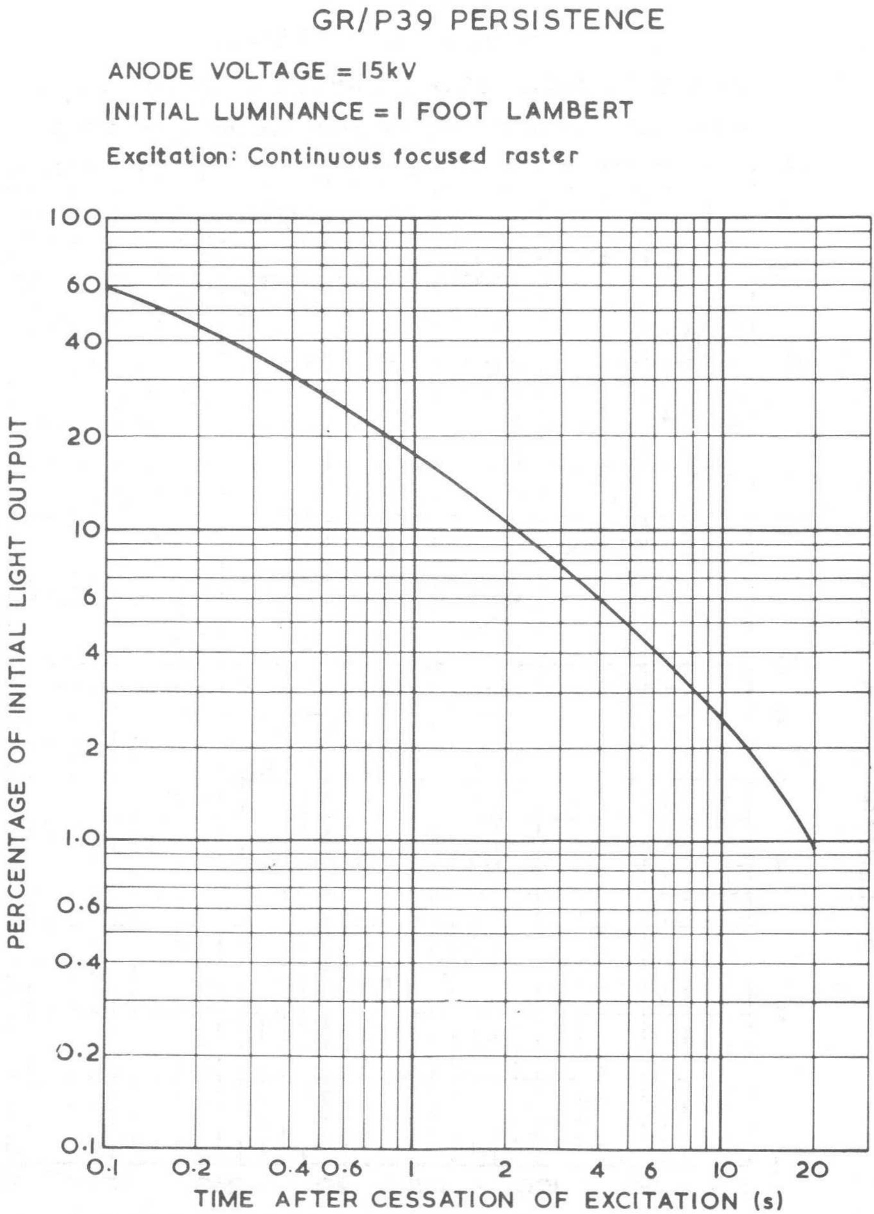


GR/P39 PERSISTENCE

ANODE VOLTAGE = 20kV    ANODE CURRENT = 5μA

Measured after continuous line scan excitation at 16kHz



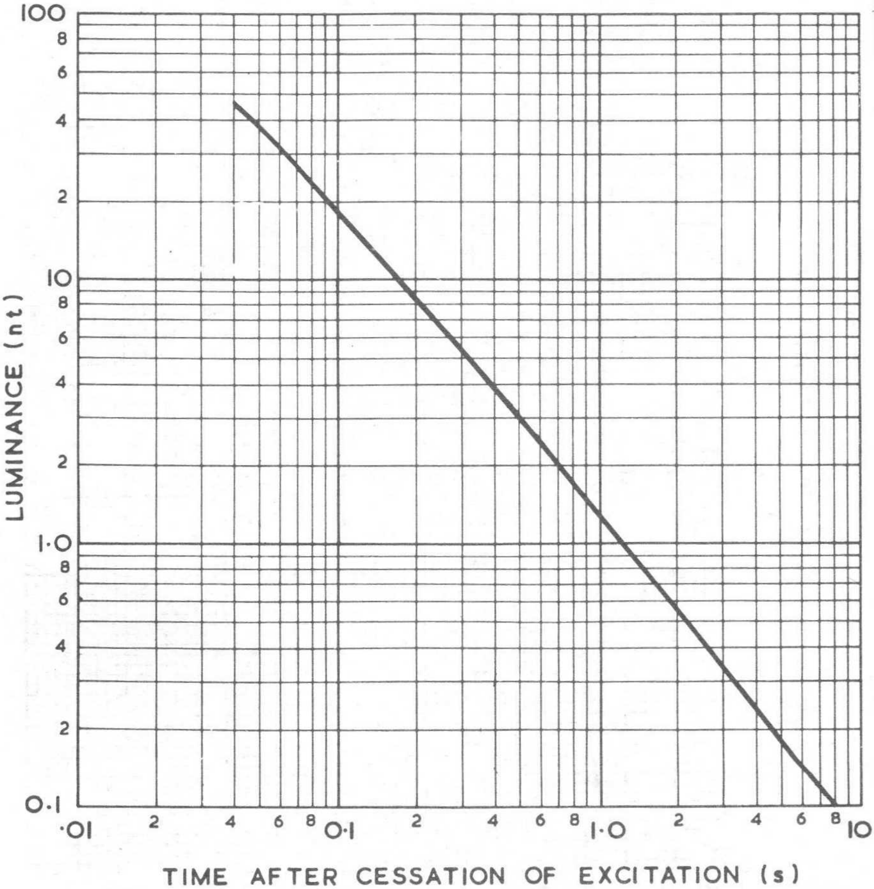

GR/P39 PERSISTENCE
ANODE VOLTAGE = 15kV
INITIAL LUMINANCE = 1 FOOT LAMBERT
Excitation: Continuous focused raster
100
60
40
20
10
6
4
2
1·0
0·6
0·4
0·2
0·1
PERCENTAGE OF INITIAL LIGHT OUTPUT
0·1
0·2
0·4
0·6
1
2
4
6
10
20
TIME AFTER CESSATION OF EXCITATION (s)

GR/P39 PERSISTENCE

FINAL ANODE VOLTAGE = 15 kV

Excitation: single 20ms raster at 1 $\mu$A/cm$^2$

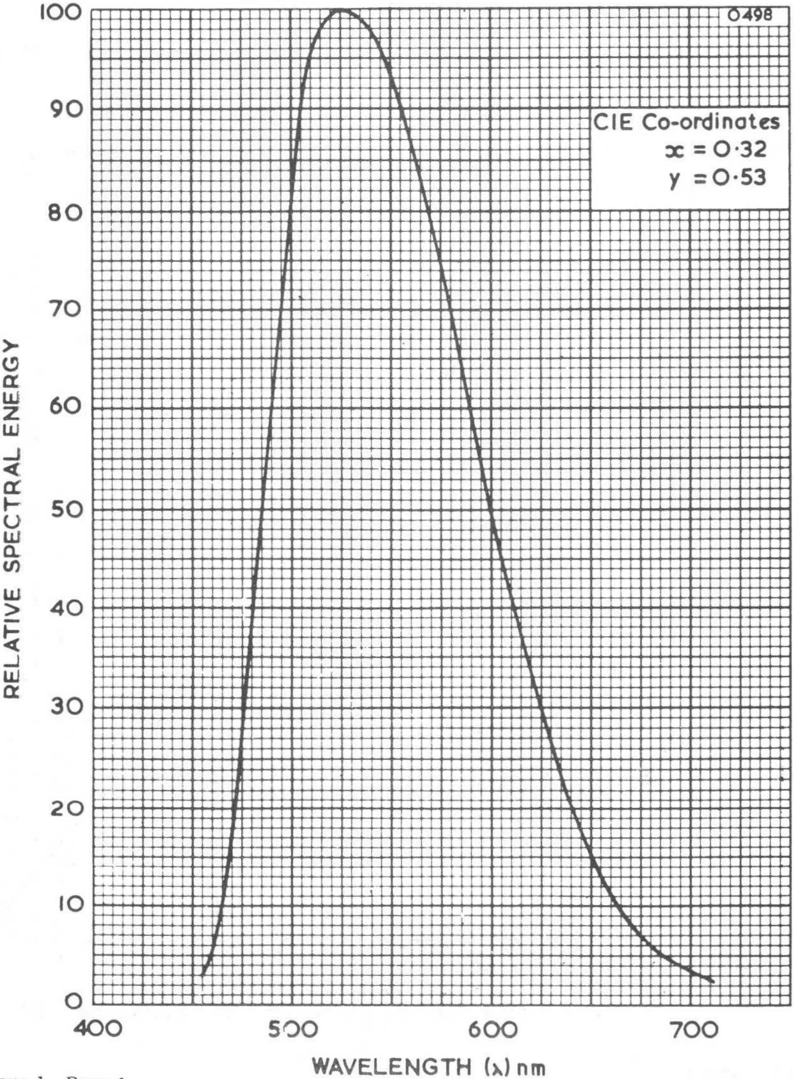
Measured as average luminance of raster on C.R.T. with aluminised screen

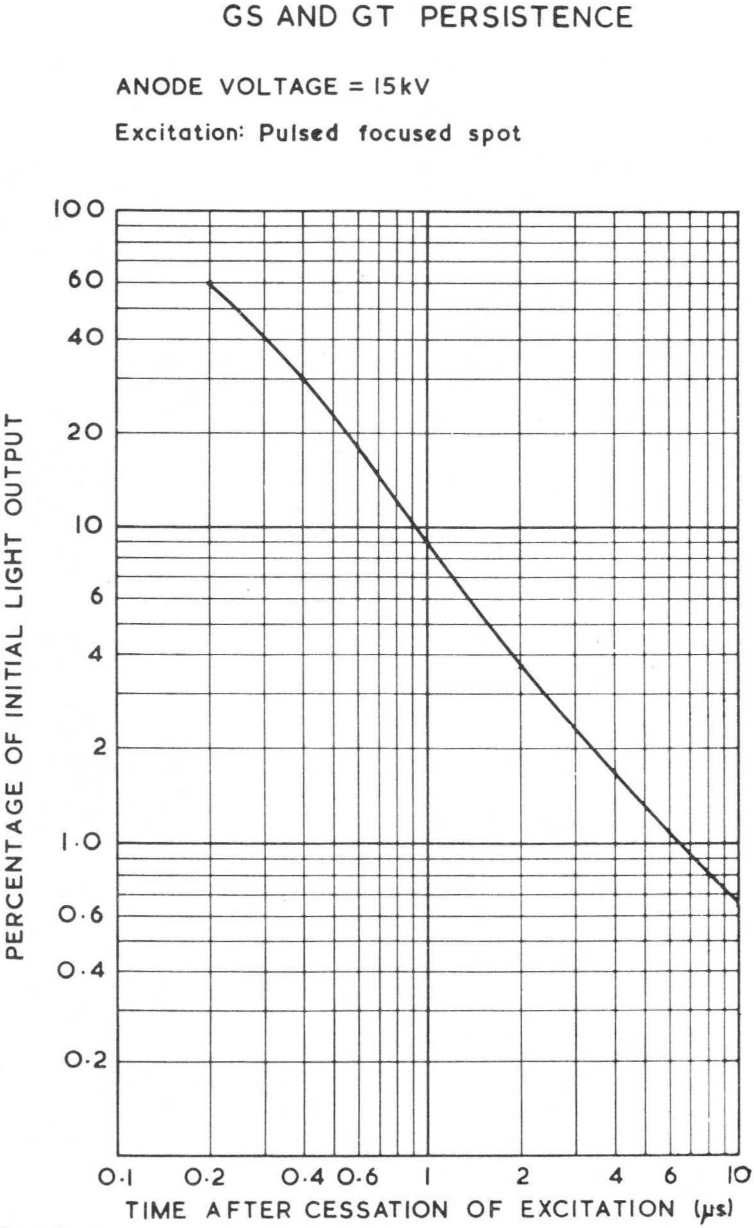


RELATIVE SPECTRAL ENERGY DISTRIBUTION
OF TYPICAL C.R.T. SCREEN TYPE GS

THIS CURVE VARIES WITH CURRENT DENSITY

$V_{a_3} = 15$ kV $I_{a_3} = 4.5\ \mu A$

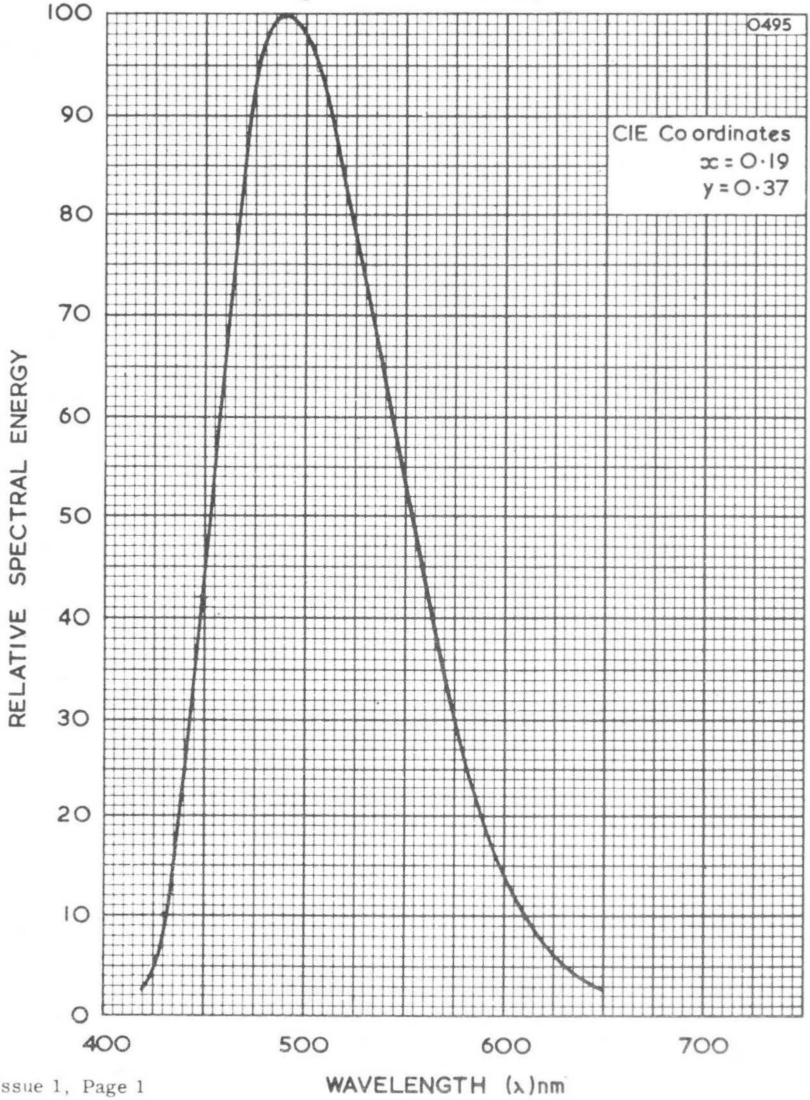



GS AND GT PERSISTENCE
ANODE VOLTAGE = 15kV
Excitation: Pulsed focused spot
100
60
40
20
10
6
4
2
1.0
0.6
0.4
0.2
PERCENTAGE OF INITIAL LIGHT OUTPUT
0.1
0.2
0.4
0.6
1
2
4
6
10
TIME AFTER CESSATION OF EXCITATION (μs)

RELATIVE SPECTRAL ENERGY DISTRIBUTION
OF TYPICAL C.R.T. SCREEN TYPE GT

THIS CURVE VARIES WITH CURRENT DENSITY

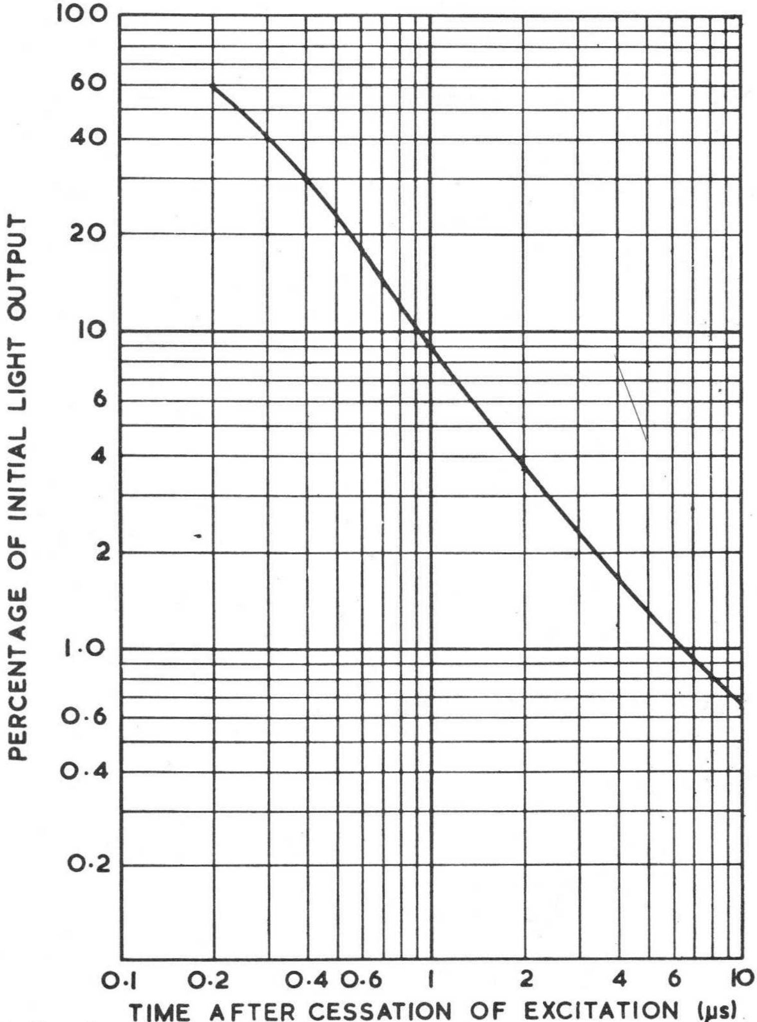
$V_{a_3} = 15\,kV$ $\quad I_{a_3} = 4{\cdot}5\,\mu A$



GS AND GT PERSISTENCE

ANODE VOLTAGE = 15kV

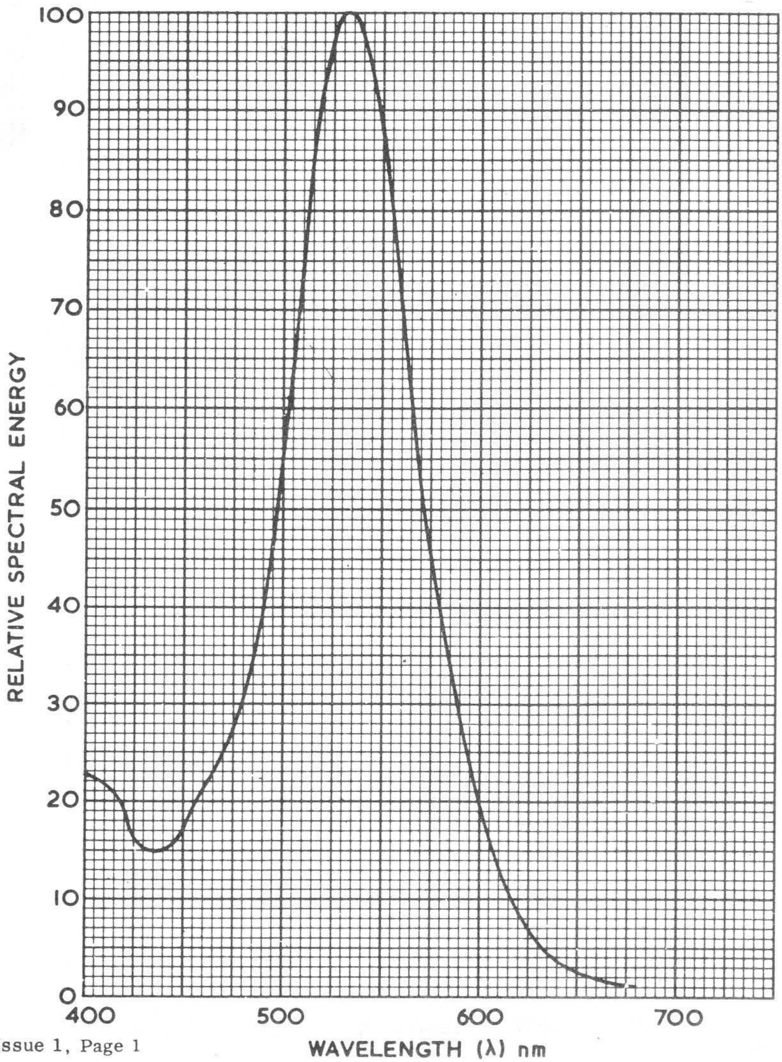
Excitation: Pulsed focused spot

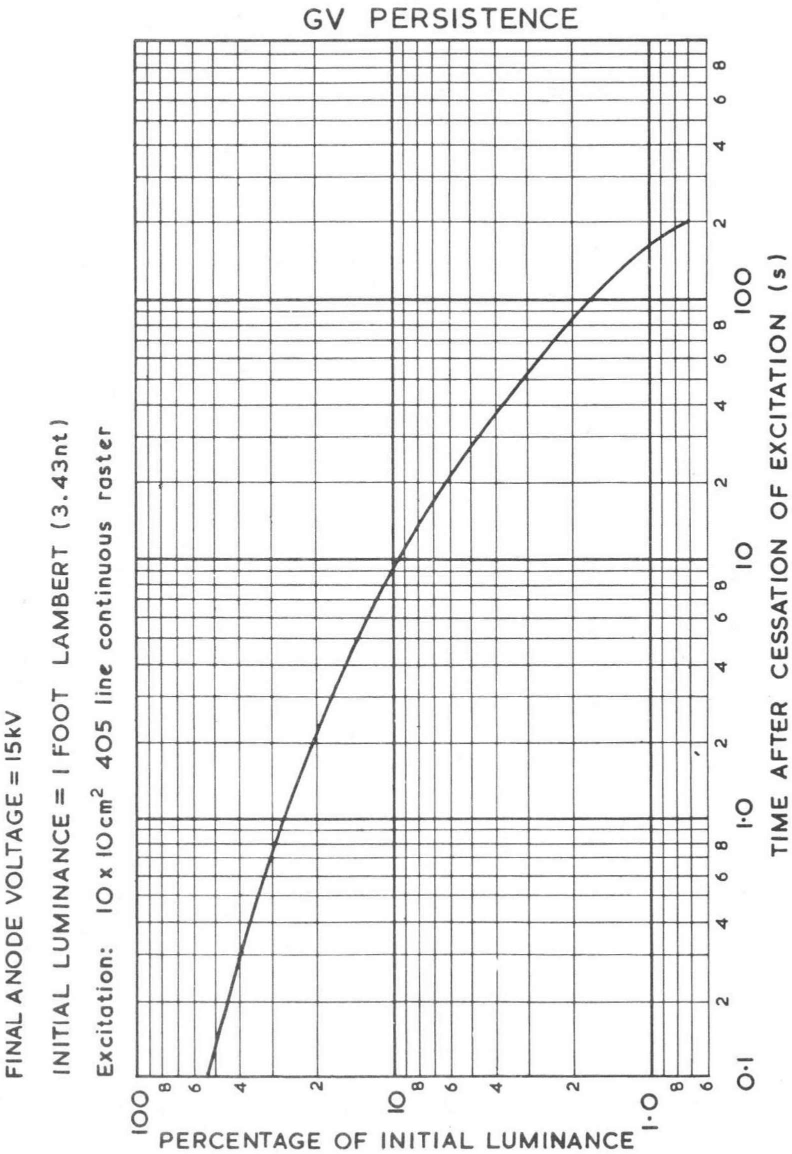


RELATIVE SPECTRAL ENERGY DISTRIBUTION
OF TYPICAL C.R.T. SCREEN TYPE GV

KELLY CHART COLOUR—YELLOWISH-GREEN (Phosphorescence)

SCREEN VOLTAGE = 15kV    CIE CO-ORDINATES x 0.28
y 0.53

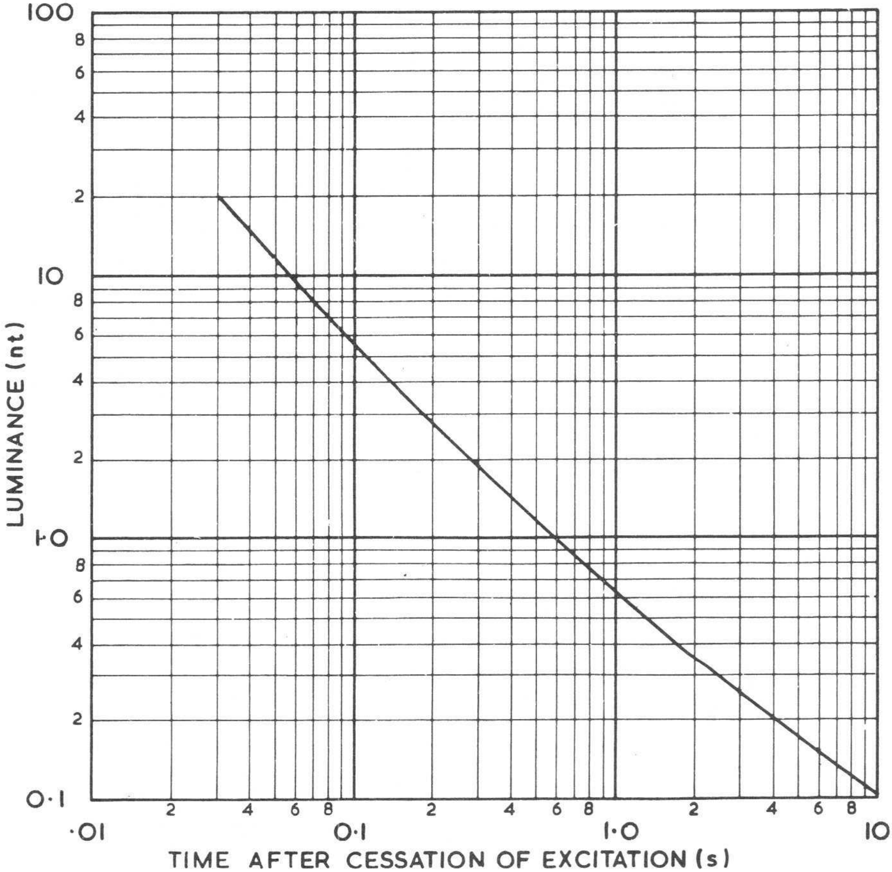



GV PERSISTENCE
FINAL ANODE VOLTAGE = 15kV
INITIAL LUMINANCE = 1 FOOT LAMBERT (3.43nt)
Excitation: 10 x 10cm² 405 line continuous raster
TIME AFTER CESSATION OF EXCITATION (s)
0·1
1·0
10
100
PERCENTAGE OF INITIAL LUMINANCE
100
10
1·0

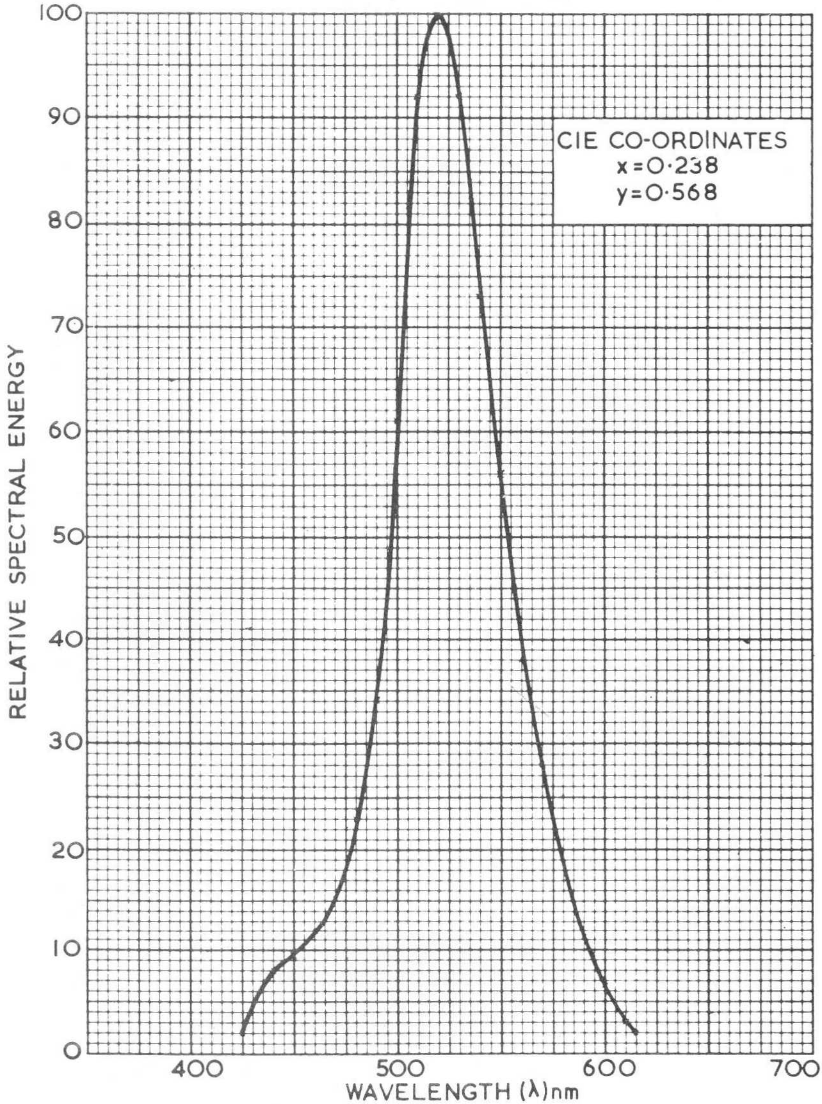
## GV PERSISTENCE

FINAL ANODE VOLTAGE = 15kV

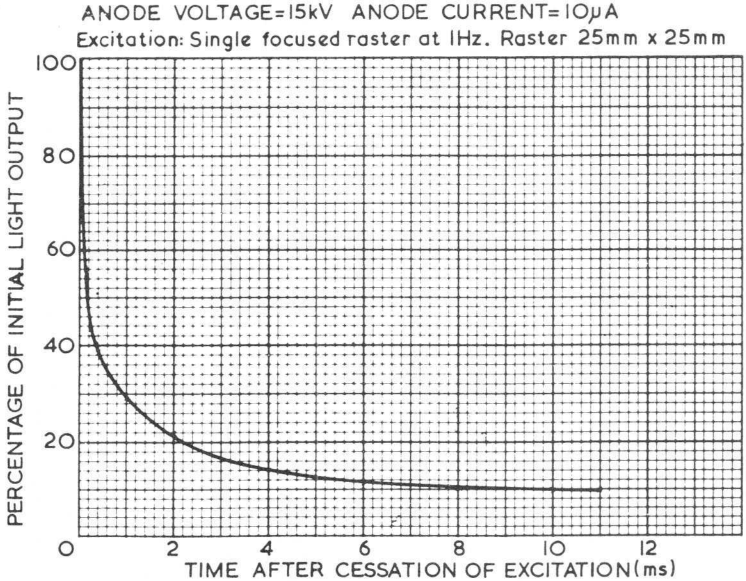
Excitation: single 20 ms raster at 1 μA/cm²

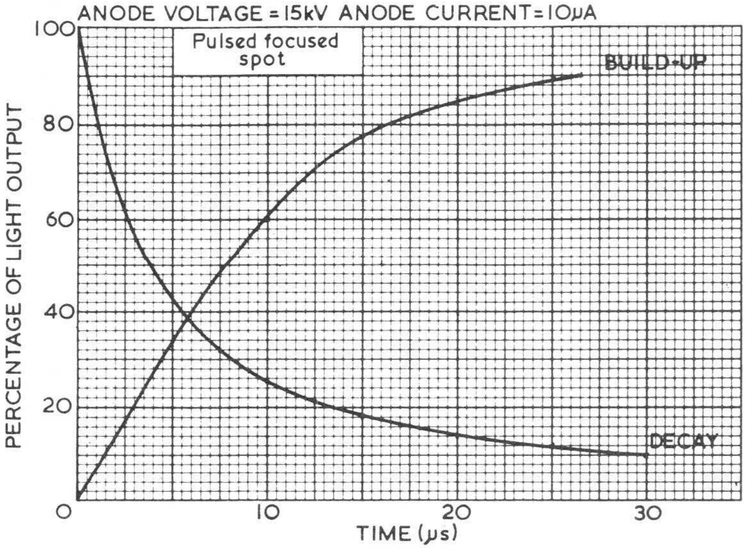


RELATIVE SPECTRAL ENERGY DISTRIBUTION
OF TYPICAL C.R.T. SCREEN TYPE GW/P42
ANODE VOLTAGE = 15kV



GW/P42 PERSISTENCE AND BUILD-UP



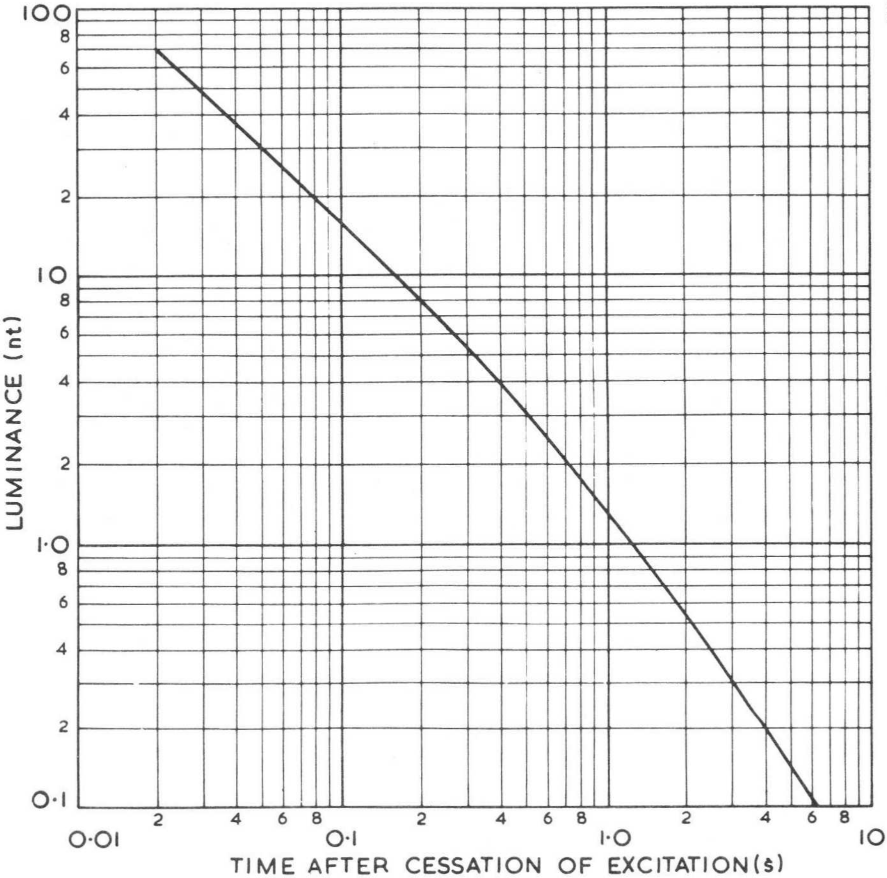
GW/ P42 PERSISTENCE

FINAL ANODE VOLTAGE = 15 kV

Excitation: single 20ms raster at $1 \mu A/cm^2$

Measured as average luminance of raster on C.R.T. with aluminised screen.





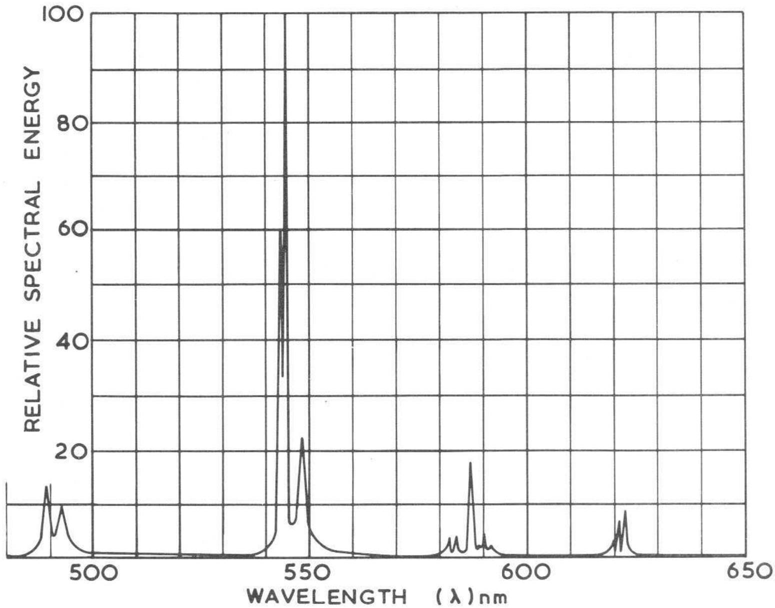
# Phosphor Screen

RELATIVE SPECTRAL ENERGY DISTRIBUTION OF TYPICAL CRT SCREEN TYPE GX / P44

CIE CO-ORDINATES

X = 0·300

Y = 0·596

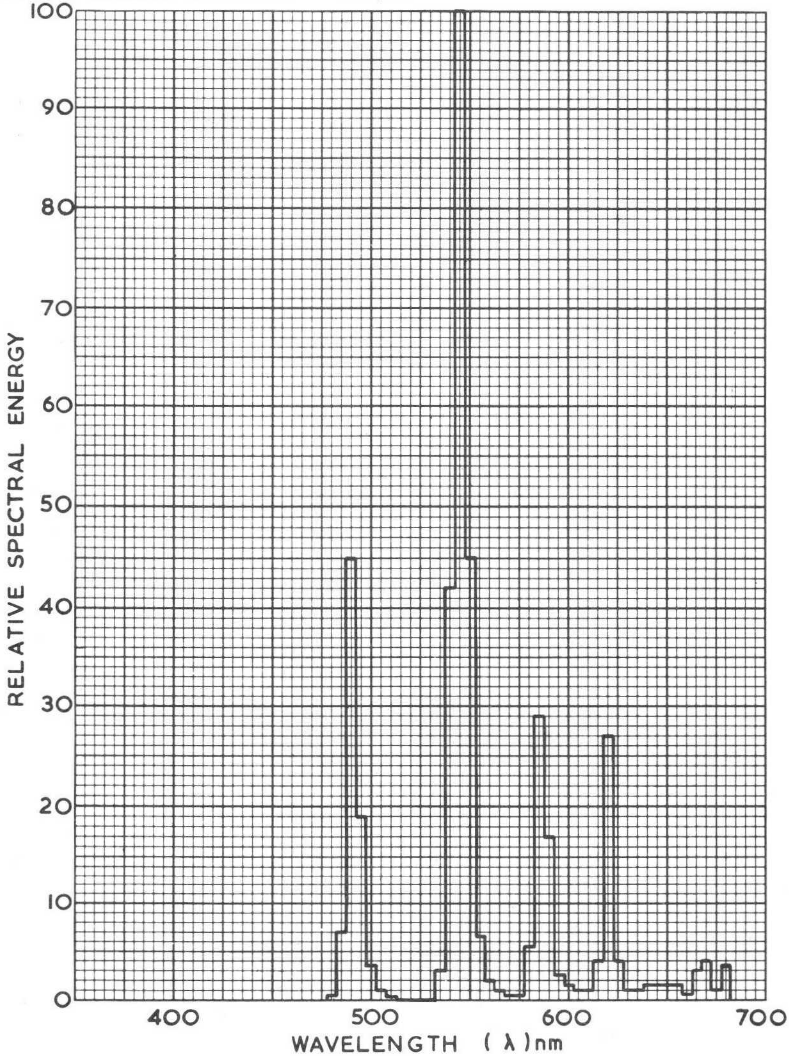


# Phosphor Screen

**GX**
**P44**

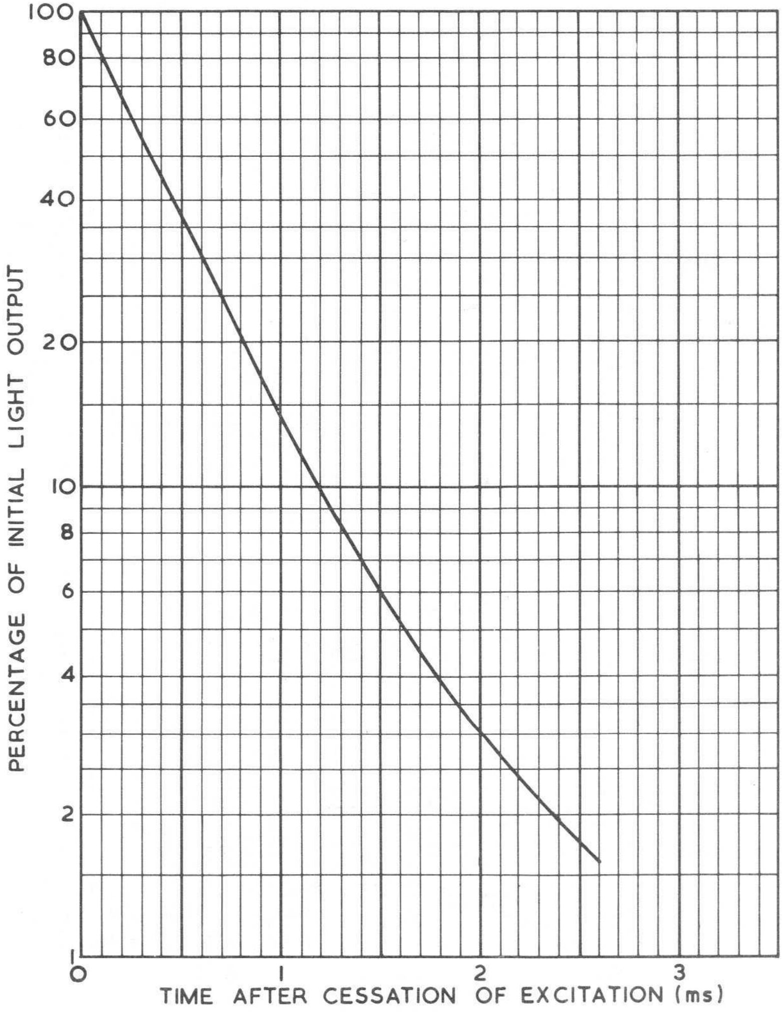
RELATIVE SPECTRAL ENERGY DISTRIBUTION OF TYPICAL CRT SCREEN TYPE GX / P44
MEASURED IN 5nm BANDWIDTHS.

FINAL ANODE VOLTAGE 15 kV
FINAL ANODE CURRENT 20 μA



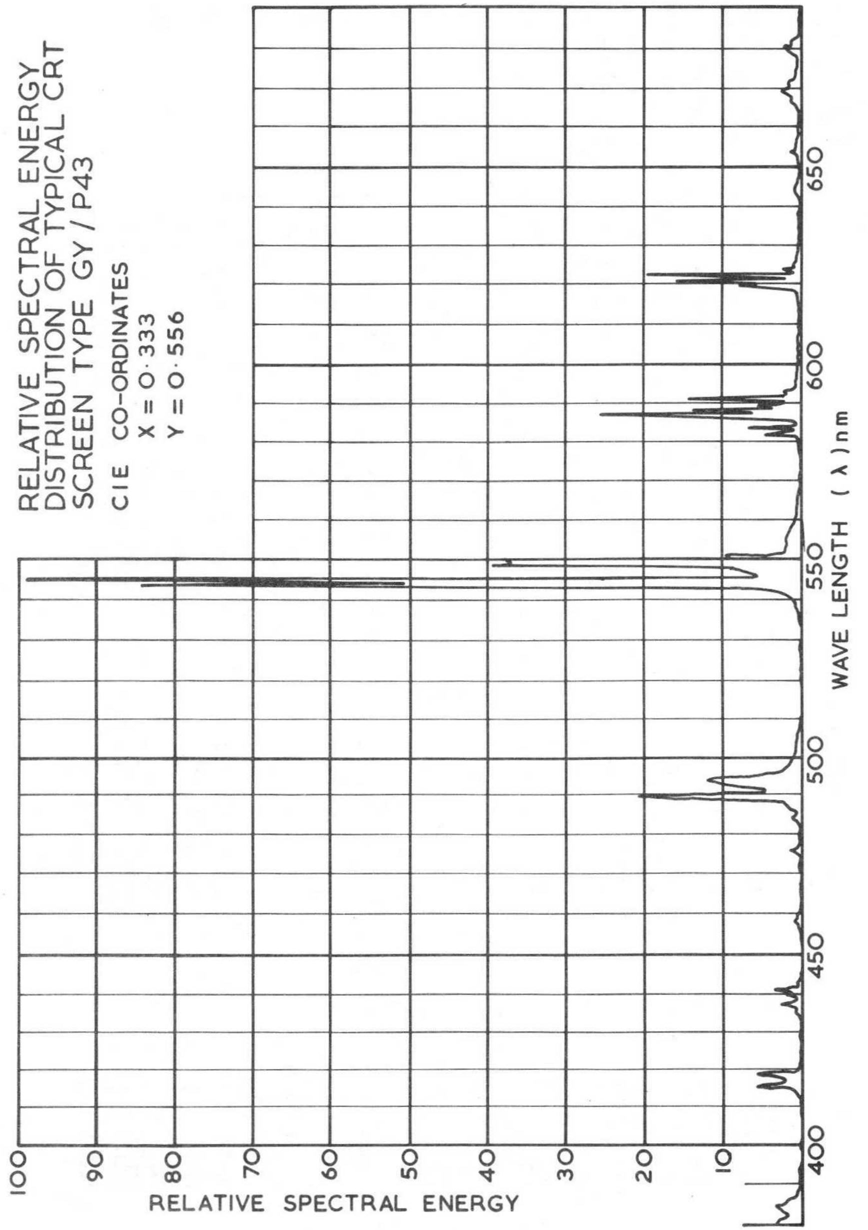

PHOSPHOR SCREENS

GX / P44 PERSISTENCE
FINAL ANODE VOLTAGE = 20 kV
PULSED SPOT



# Phosphor Screen

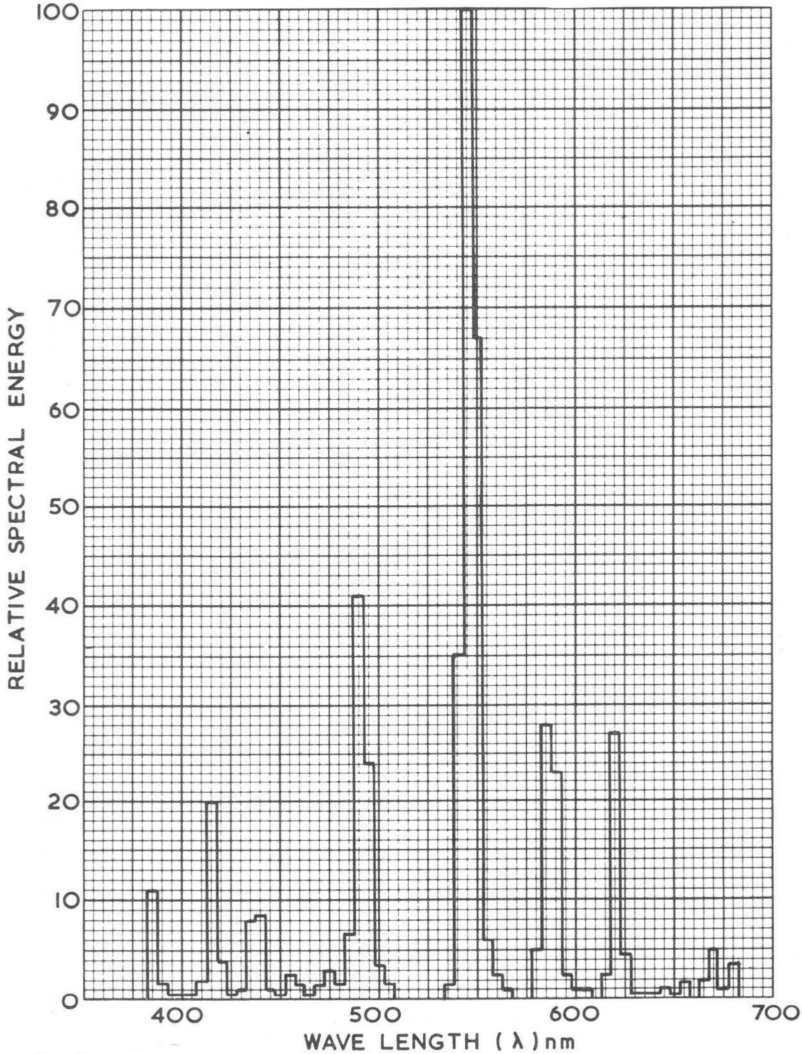
**GY**
**P43**



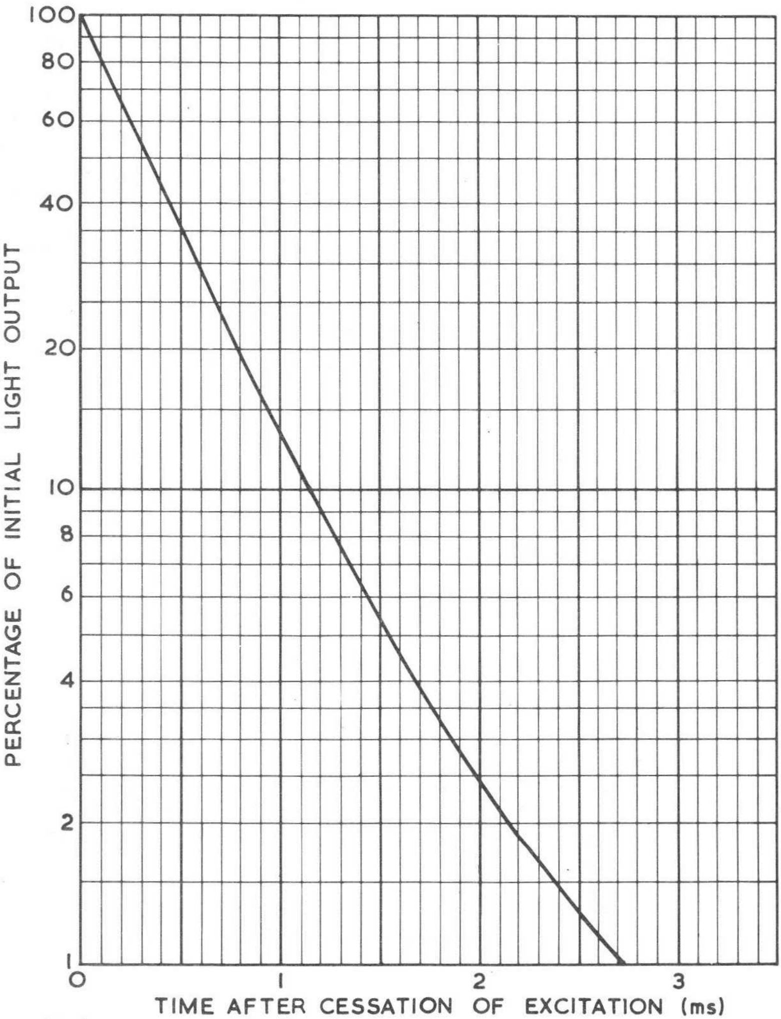

**PHOSPHOR SCREENS**

RELATIVE SPECTRAL ENERGY DISTRIBUTION OF
TYPICAL CRT SCREEN TYPE GY / P43
MEASURED IN 5nm BANDWIDTHS.

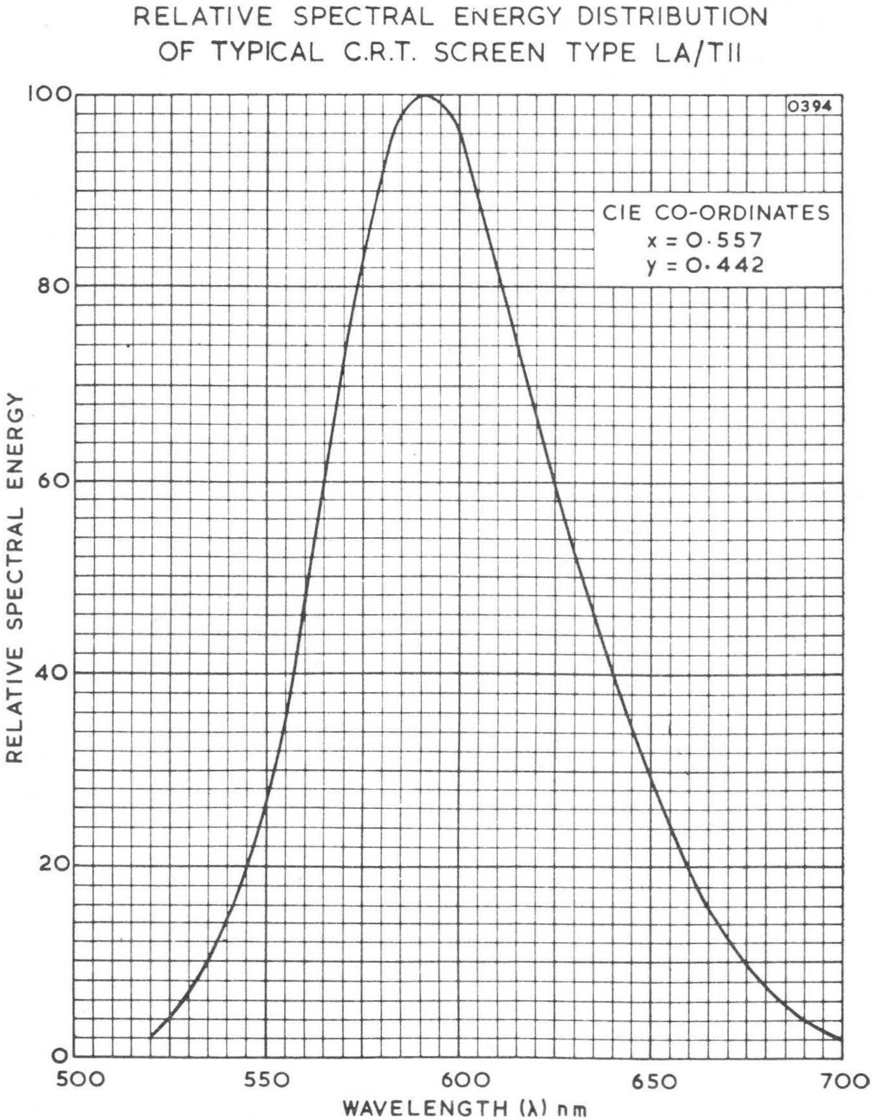
FINAL ANODE VOLTAGE = 15 kV
FINAL ANODE CURRENT = 20 μA

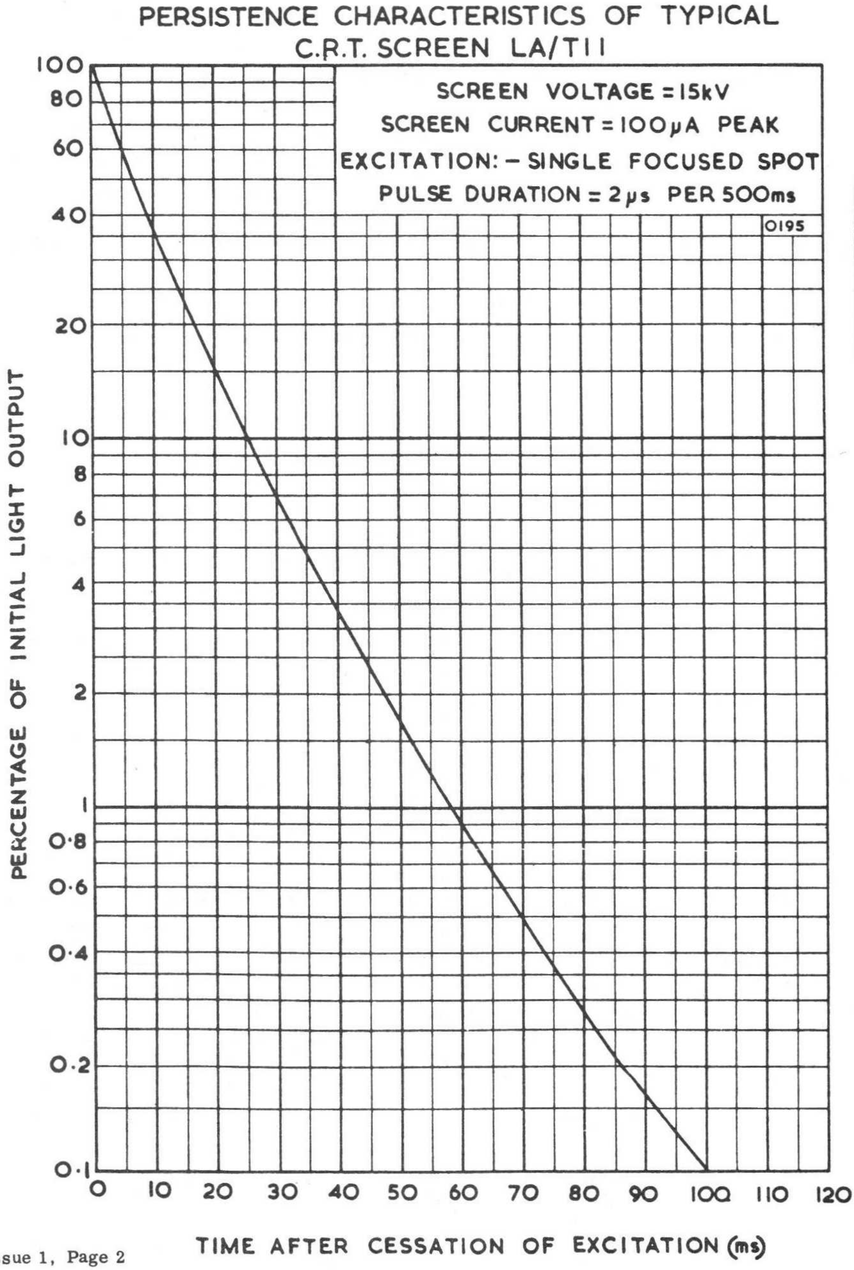


GY/P43 PERSISTENCE
FINAL ANODE VOLTAGE = 20 kV
PULSED SPOT

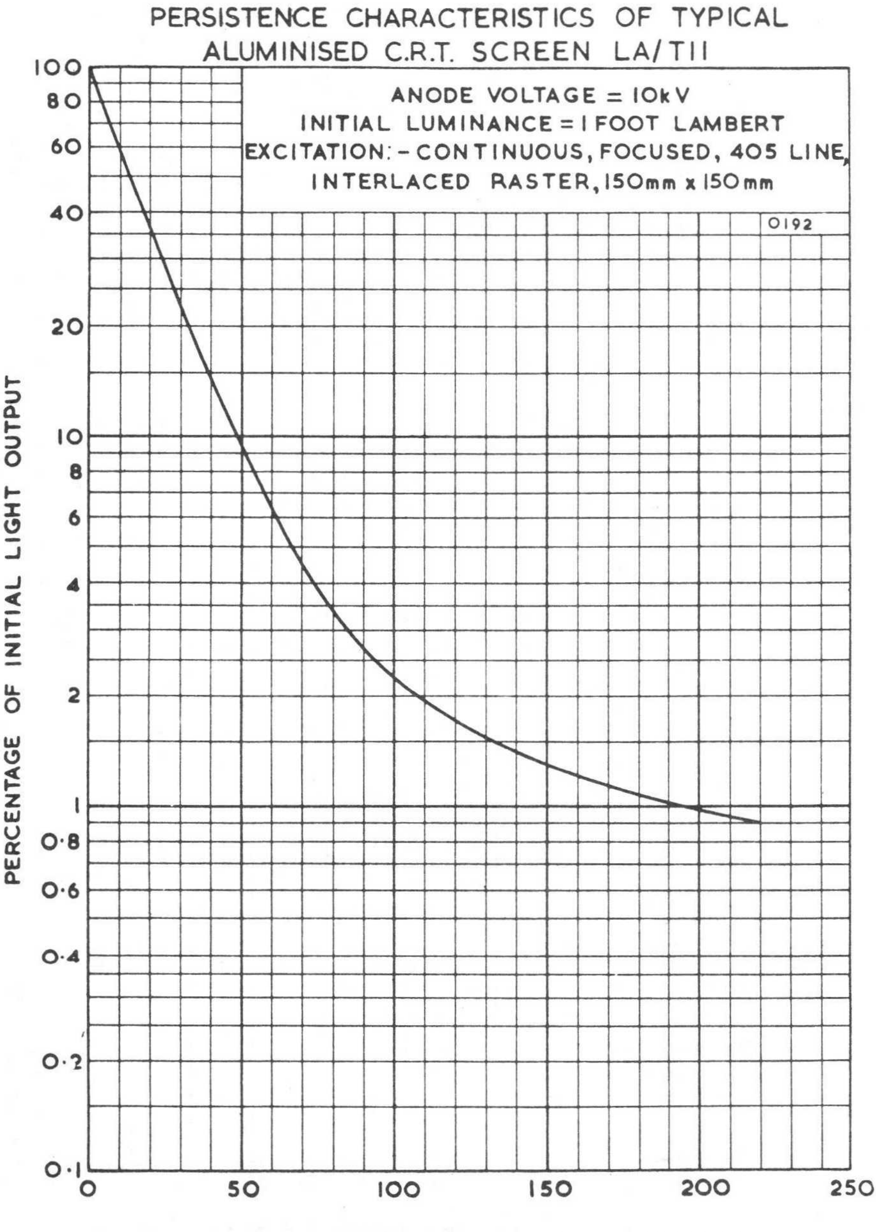


# Phosphor Screen

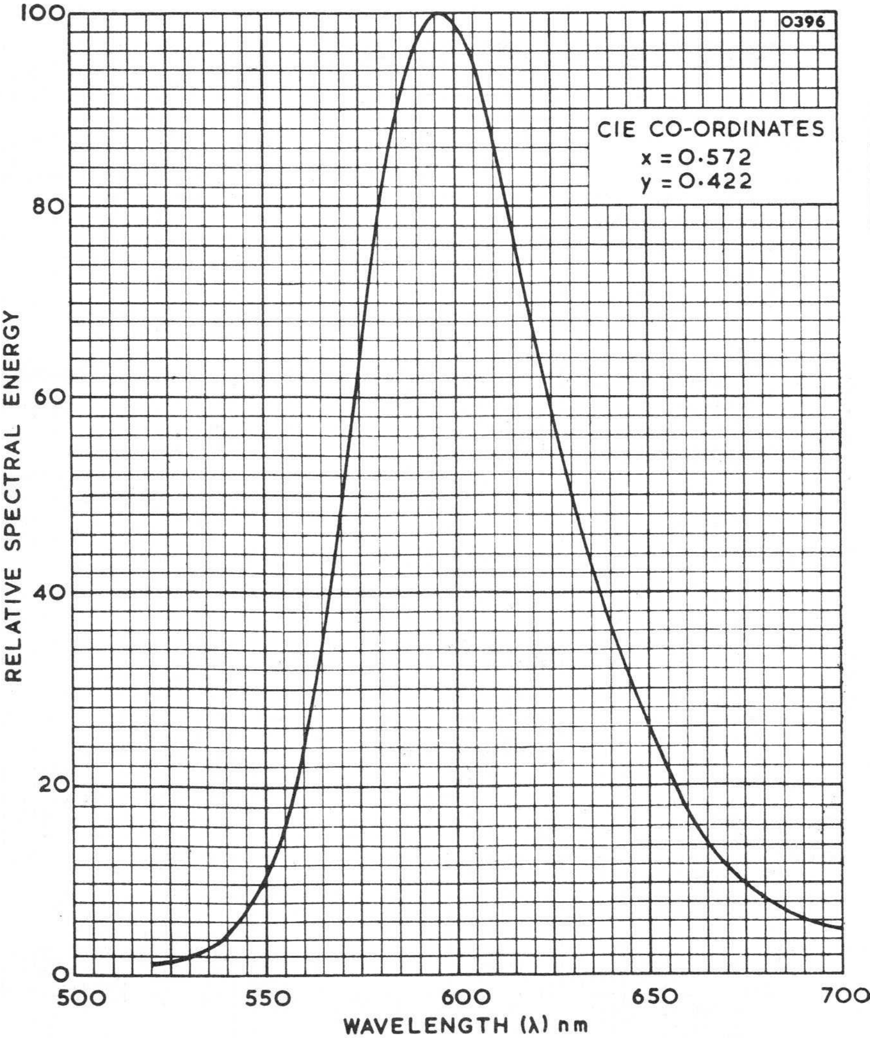



PERSISTENCE CHARACTERISTICS OF TYPICAL
C.R.T. SCREEN LA/T11
SCREEN VOLTAGE = 15kV
SCREEN CURRENT = 100μA PEAK
EXCITATION: – SINGLE FOCUSED SPOT
PULSE DURATION = 2μs PER 500ms
0195
PERCENTAGE OF INITIAL LIGHT OUTPUT
100
80
60
40
20
10
8
6
4
2
1
0·8
0·6
0·4
0·2
0·1
0
10
20
30
40
50
60
70
80
90
100
110
120
TIME AFTER CESSATION OF EXCITATION (ms)

# Phosphor Screen



RELATIVE SPECTRAL ENERGY DISTRIBUTION
OF TYPICAL C.R.T. SCREEN TYPE LC/T7



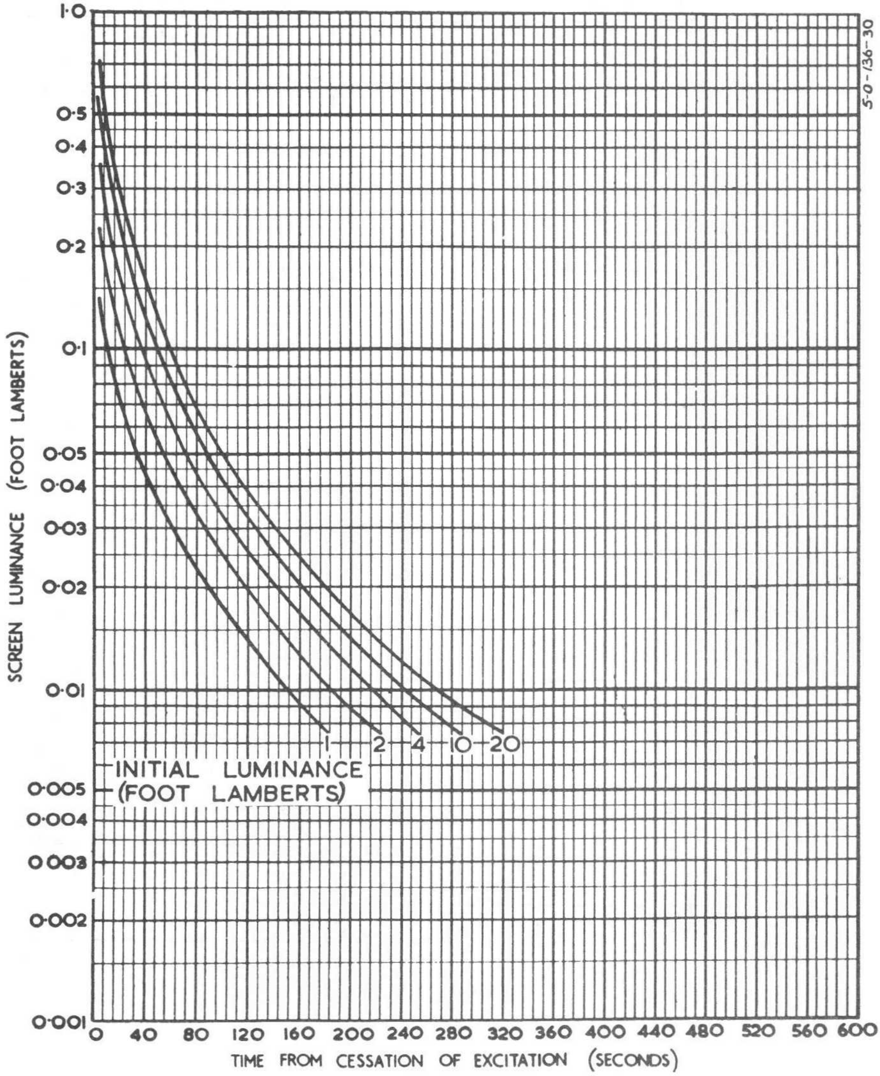
# Phosphor Screen

**PERSISTENCE CHARACTERISTICS** of typical aluminised CRT screen.

**Excitation**—Continuous, focused, 405 line, interlaced raster, 150 mm × 150 mm.

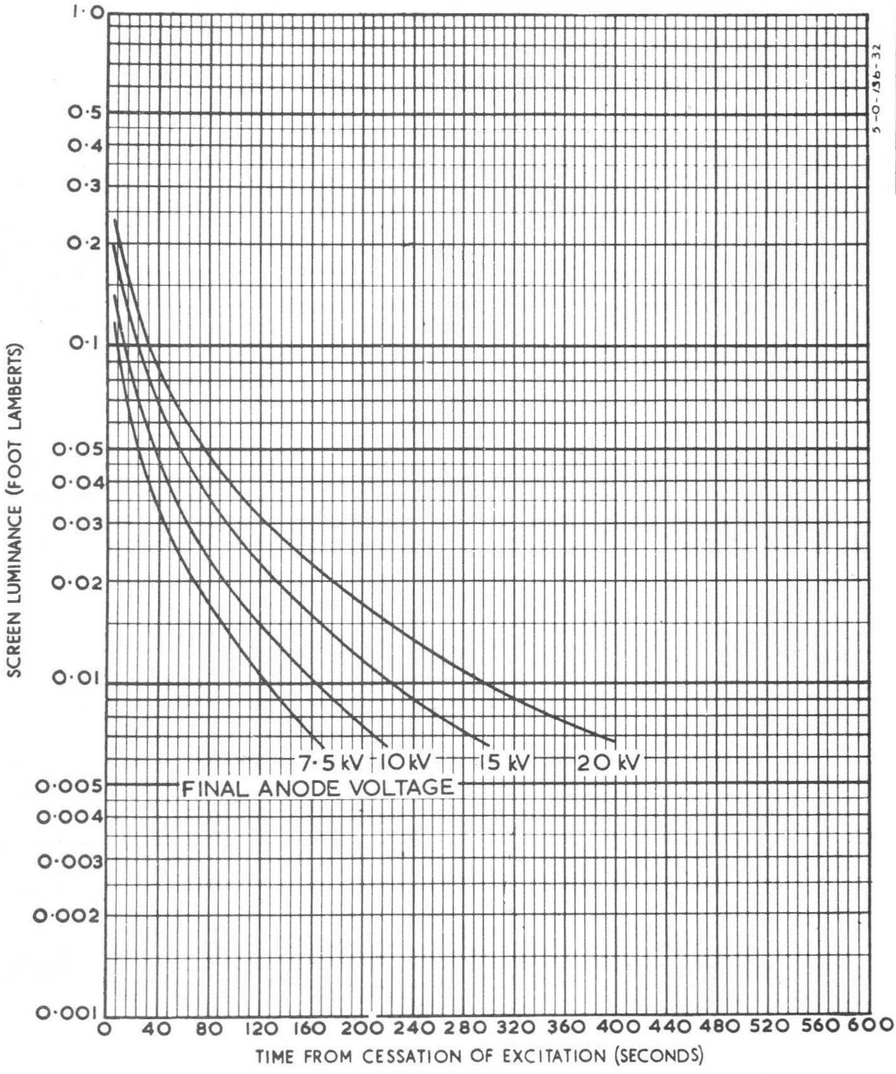
**Final Anode Voltage**—10 kV.

**Note**—This screen is liable to burn if a stationary or slow-moving spot is used even with low values of beam current.



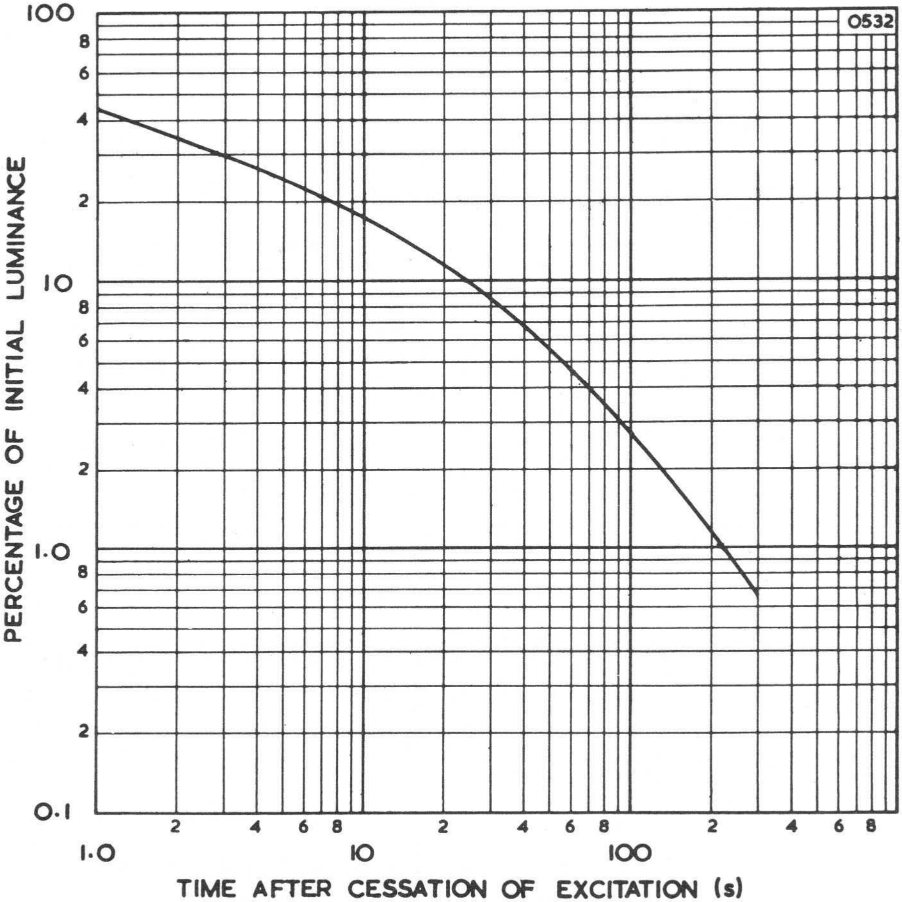
# Phosphor Screen

**PERSISTENCE CHARACTERISTICS** of typical aluminised C.R.T. screen.
**Excitation**—Continuous, focused, 405 line, interlaced raster, 150 mm × 150 mm.
**Initial Luminance**—1 Foot Lambert.
**Note**—This screen is liable to burn if a stationary or slow-moving spot is used even with low values of beam current.



## LC/T7 PERSISTENCE

FINAL ANODE VOLTAGE = 15kV
INITIAL LUMINANCE = 1 FOOT LAMBERT (3·43nt)
Excitation: continuous focused raster
Measured on C.R.T. with aluminised screen

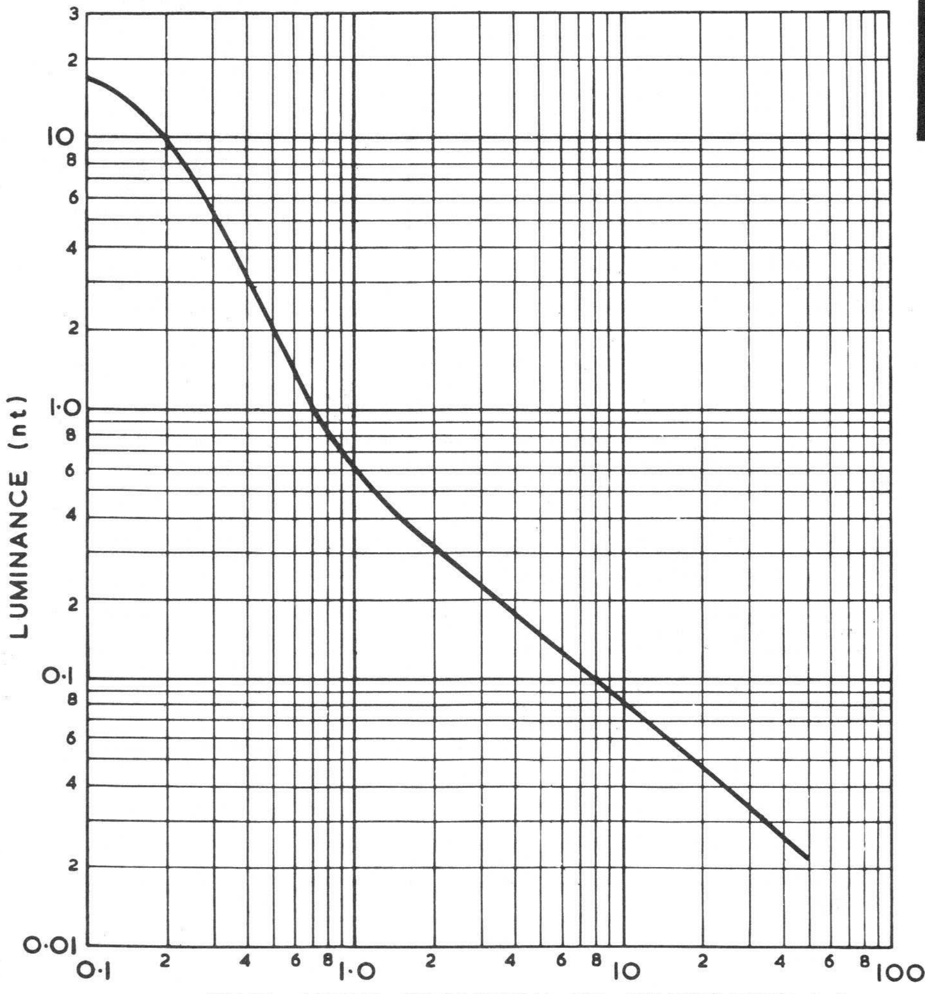


LC/T7 PERSISTENCE

FINAL ANODE VOLTAGE = 15kV

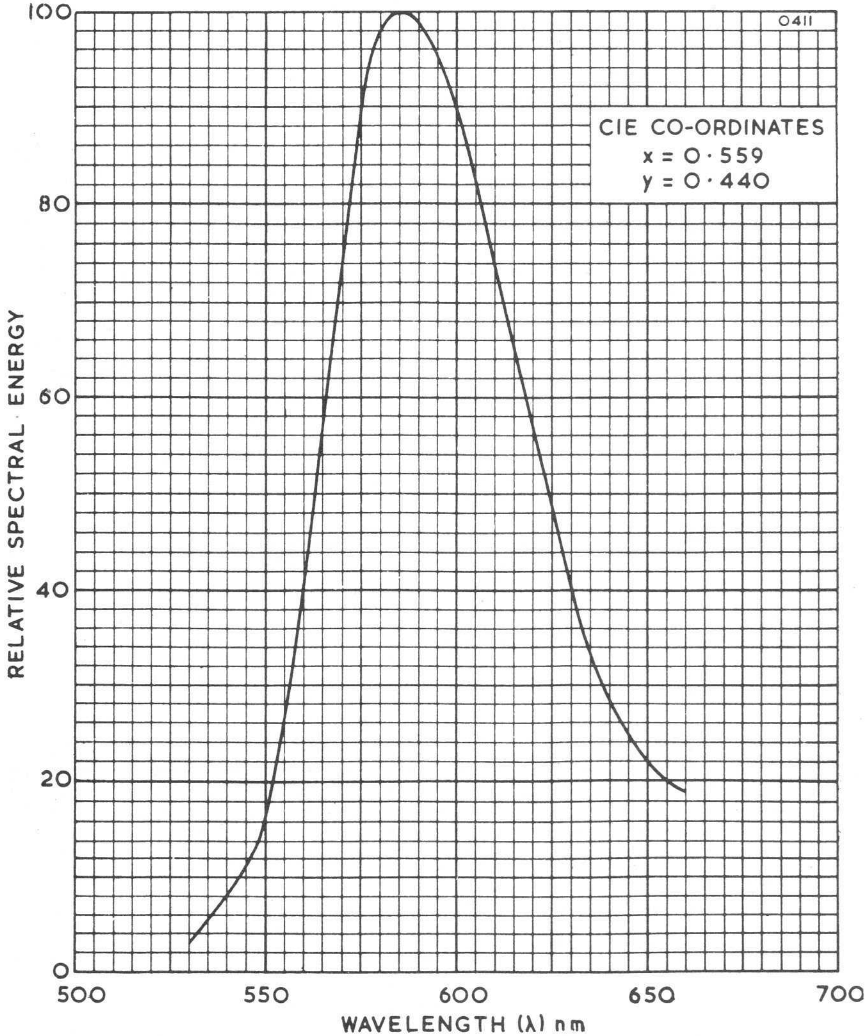
Excitation: single 20 ms raster at 1 μA/cm²

Measured as average luminance of raster on C.R.T. with aluminised screen



# Phosphor Screen

RELATIVE SPECTRAL ENERGY DISTRIBUTION
OF TYPICAL C.R.T. SCREEN TYPE LD/P33/T15

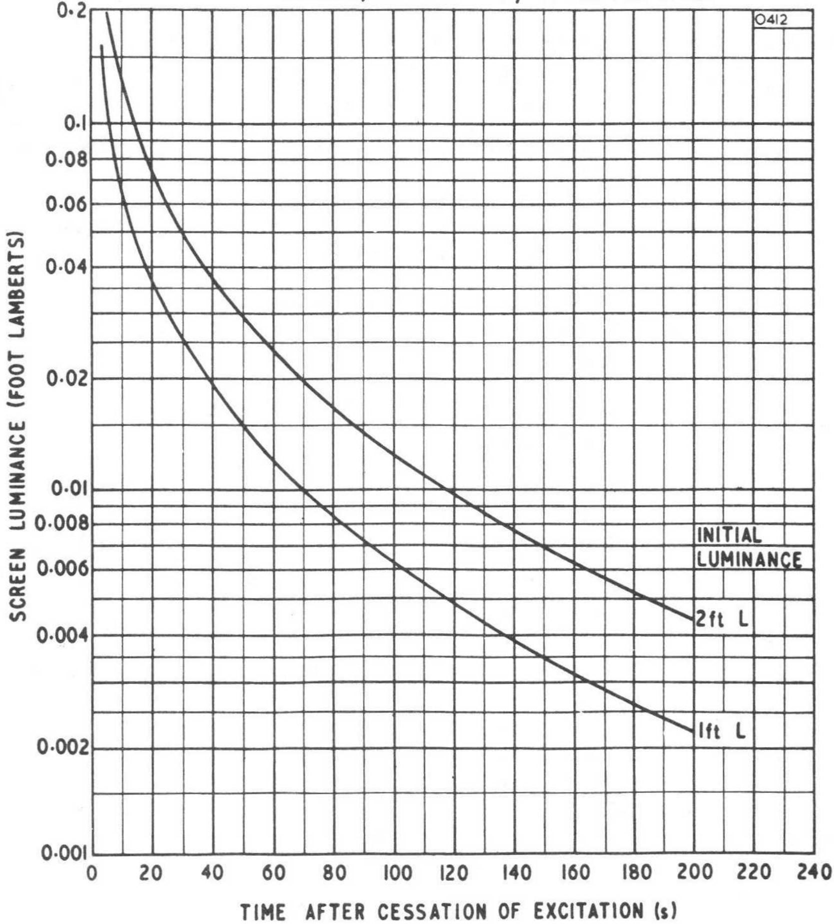


**Note**—This screen is liable to burn if a stationary or slow-moving spot is used even with low valves of beam current.

PERSISTENCE CHARACTERISTICS OF TYPICAL ALUMINISED C.R.T. SCREEN LD/P33/T15

FINAL ANODE VOLTAGE = 15kV

EXCITATION :- CONTINUOUS, UNFOCUSED, 405 LINE, INTERLACED RASTER, 150mm x 150mm, APPLIED FOR 2 MIN



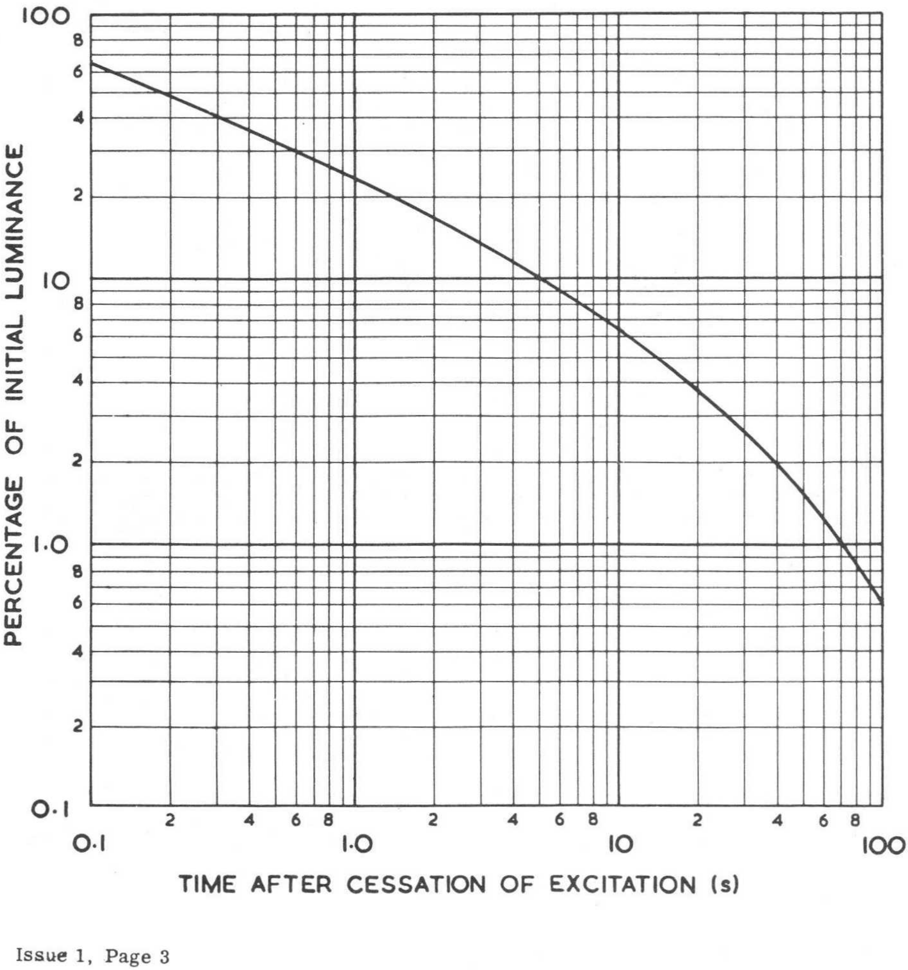
LD/P33/T15 PERSISTENCE

FINAL ANODE VOLTAGE = 15kV

INITIAL LUMINANCE = 1 FOOT LAMBERT (3·43nt)

Excitation: continuous focused raster

Measured on C.R.T. with aluminised screen

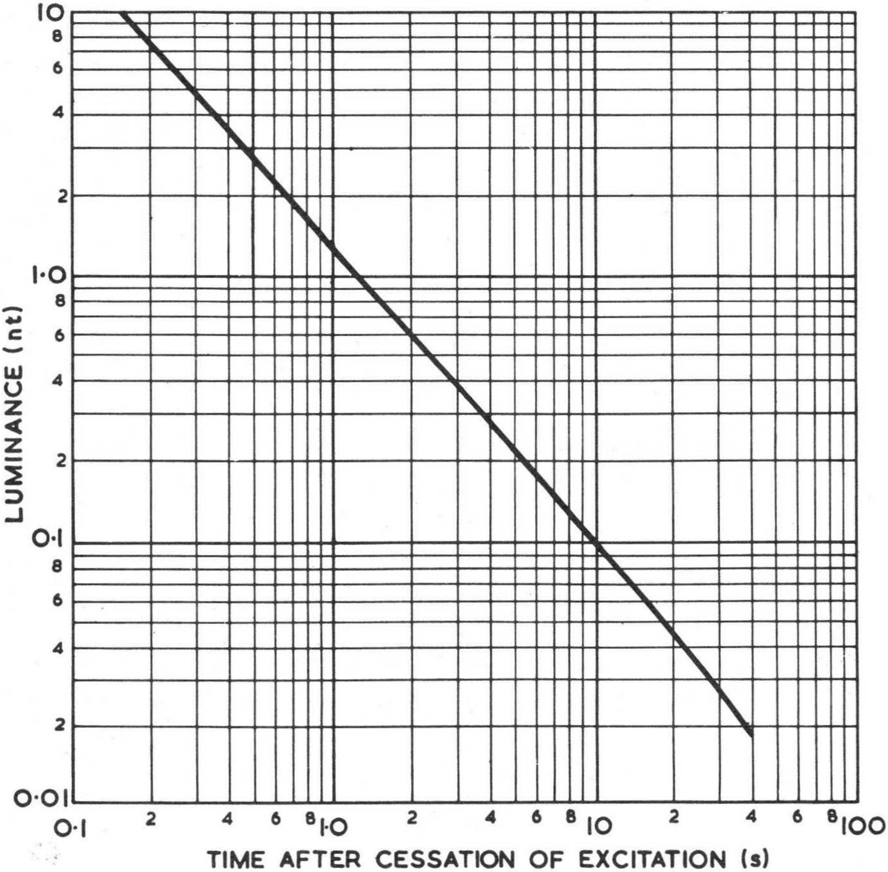


## LD/P33/T15 PERSISTENCE

FINAL ANODE VOLTAGE = 15 kV

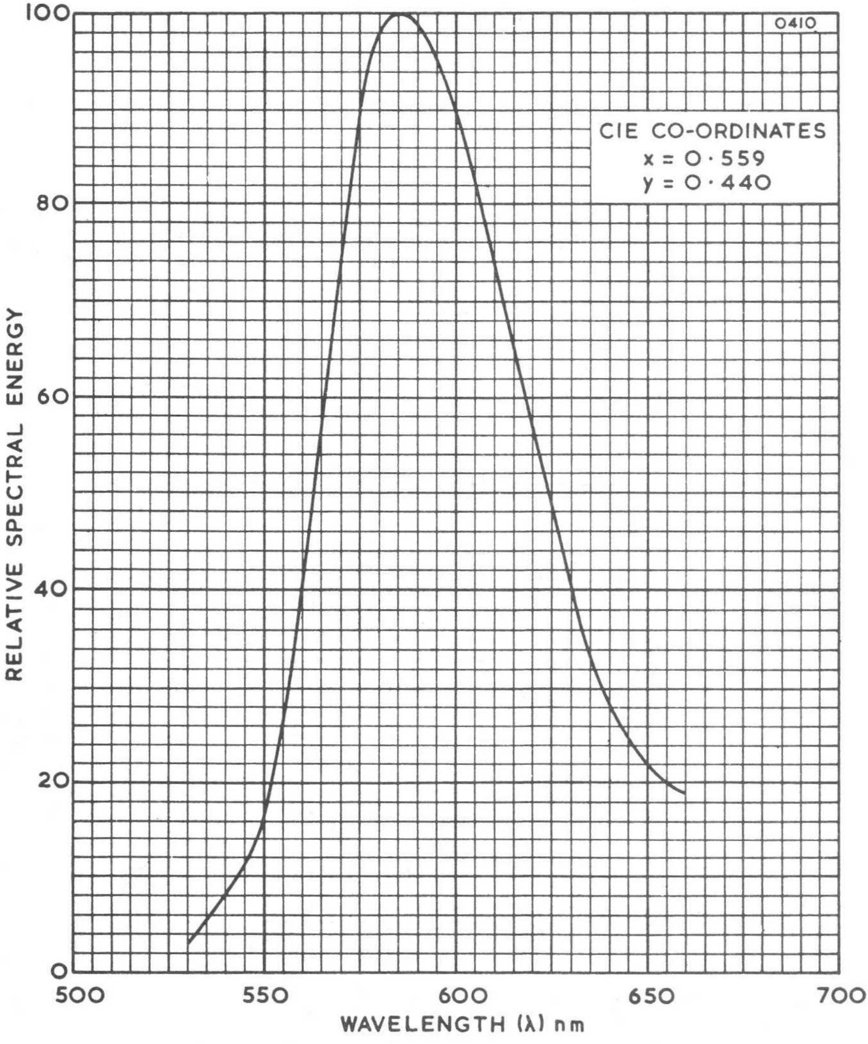
Excitation: single 20ms raster at 1μA/cm²

Measured as average luminance of raster on C.R.T. with aluminised screen.



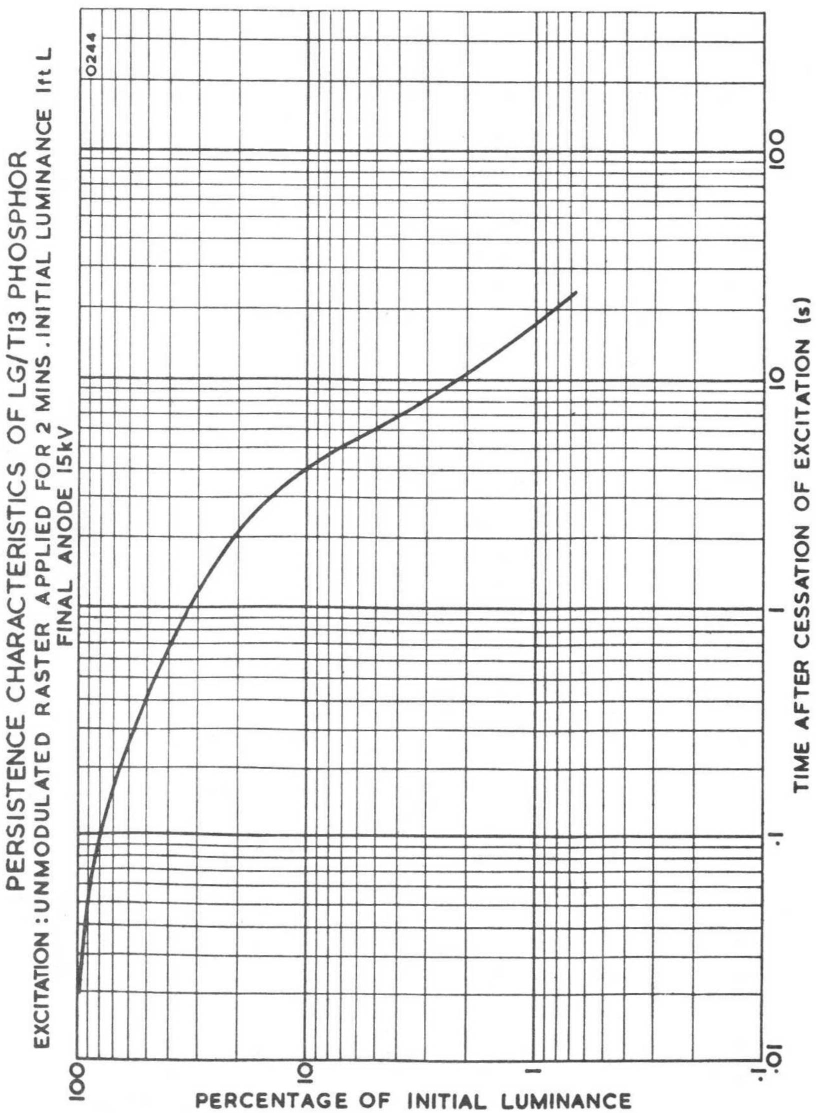
# Phosphor Screen

RELATIVE SPECTRAL ENERGY DISTRIBUTION
OF TYPICAL C.R.T. SCREEN TYPE LG/T13



# Phosphor Screen

**Note**—This screen is liable to burn if a stationary or slow-moving spot is used even with low values of beam current.

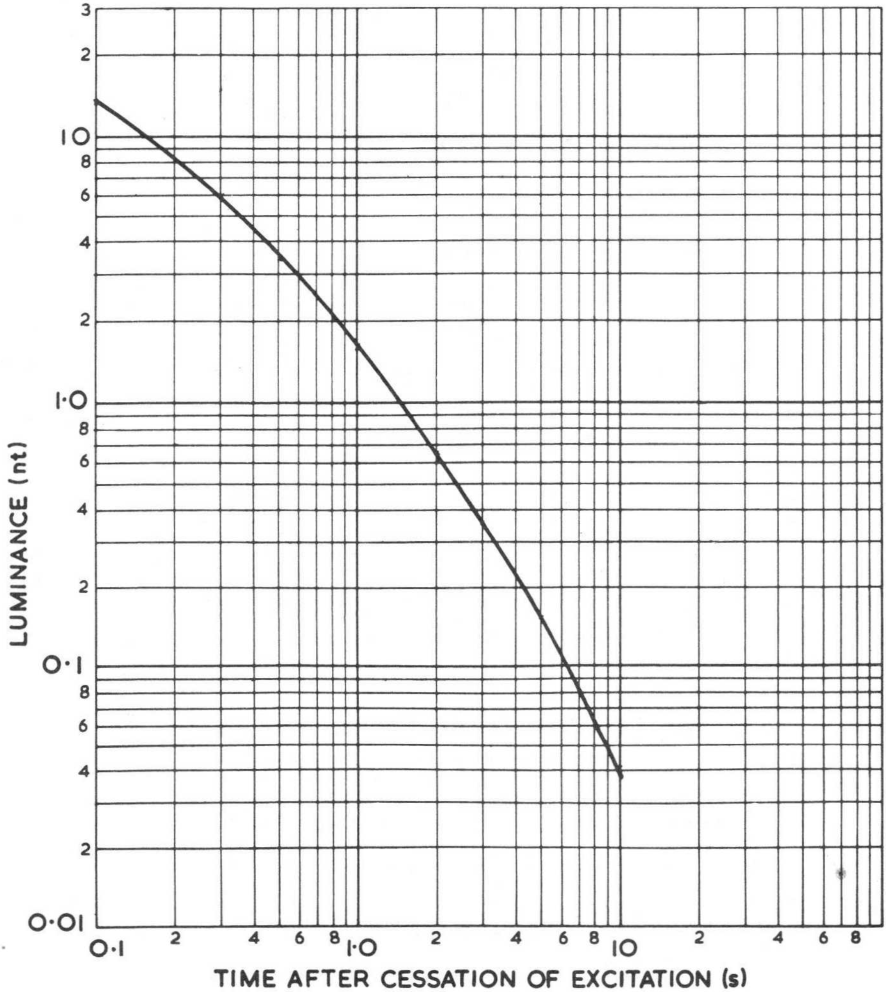


## LG/T13 PERSISTENCE

FINAL ANODE VOLTAGE = 15 kV

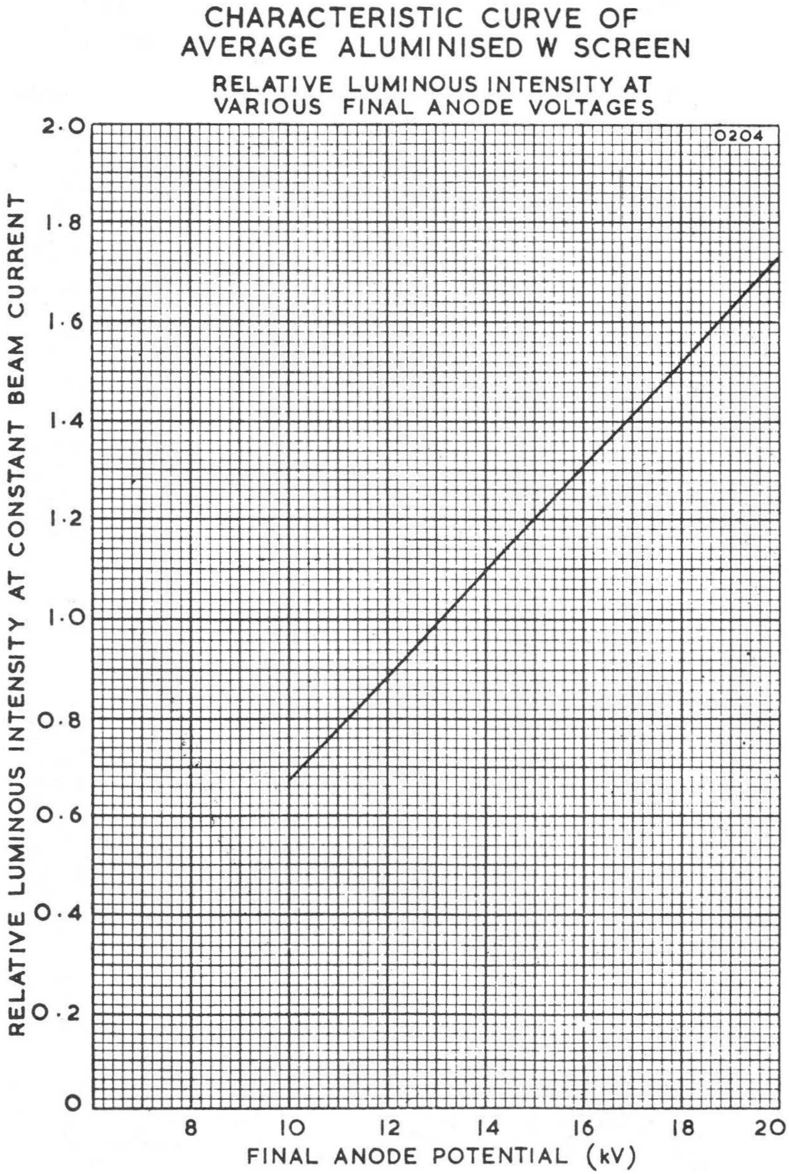
Excitation: single 20ms raster at 1 μA/cm²

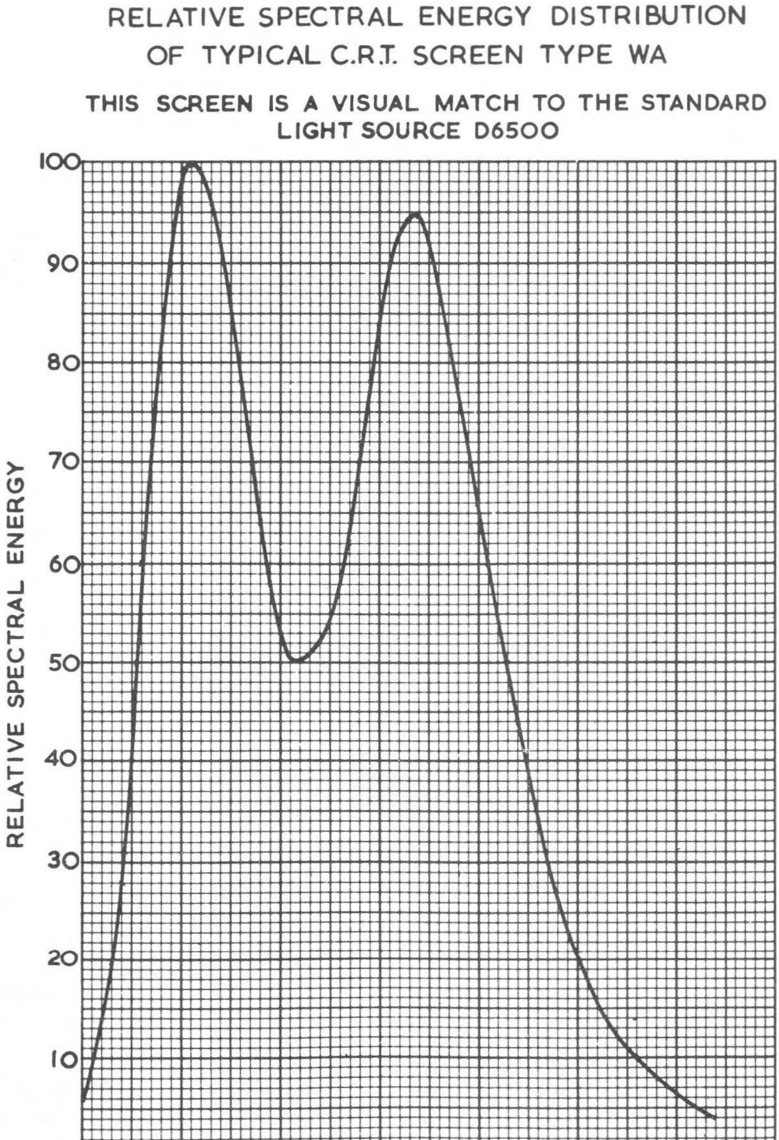
Measured as average luminance of raster on C.R.T. with aluminised screen



# ALUMINISED W SCREEN CHARACTERISTIC

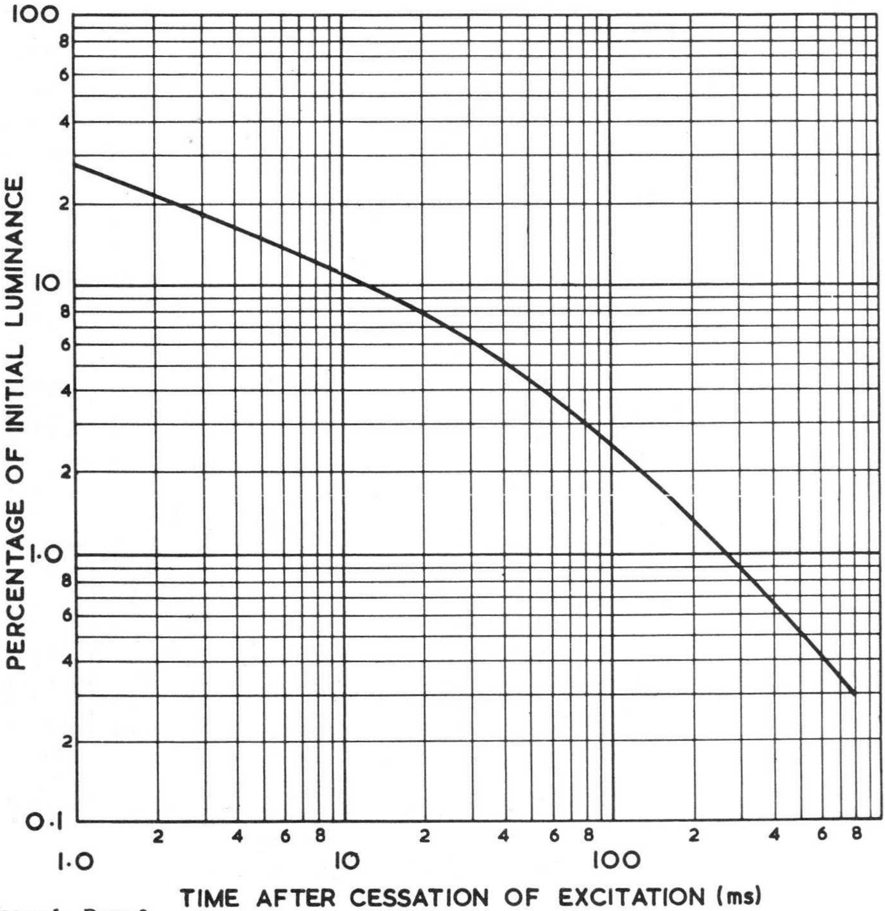





RELATIVE SPECTRAL ENERGY DISTRIBUTION
OF TYPICAL C.R.T. SCREEN TYPE WA
THIS SCREEN IS A VISUAL MATCH TO THE STANDARD
LIGHT SOURCE D6500
RELATIVE SPECTRAL ENERGY
0
10
20
30
40
50
60
70
80
90
100
400
500
600
700
WAVELENGTH (λ) nm

## WA PERSISTENCE

FINAL ANODE VOLTAGE = 15kV
INITIAL LUMINANCE = 1 FOOT LAMBERT (3·43nt)
Excitation: continuous focused raster
Measured as average luminance of raster on C.R.T. with aluminised screen

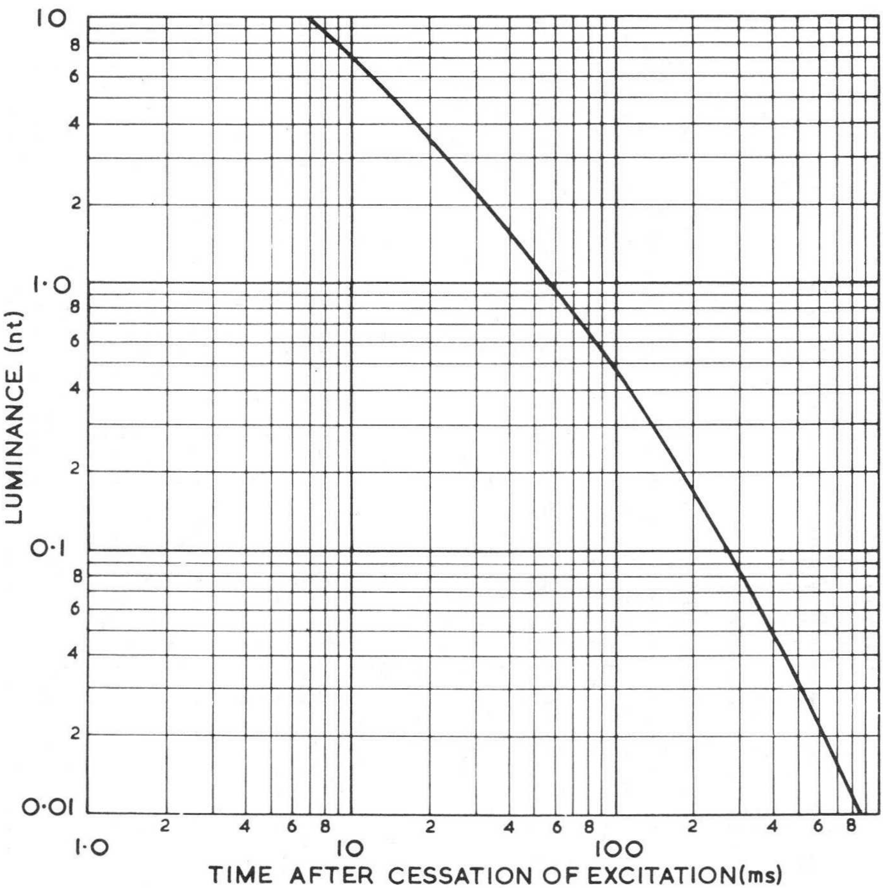


## WA PERSISTENCE

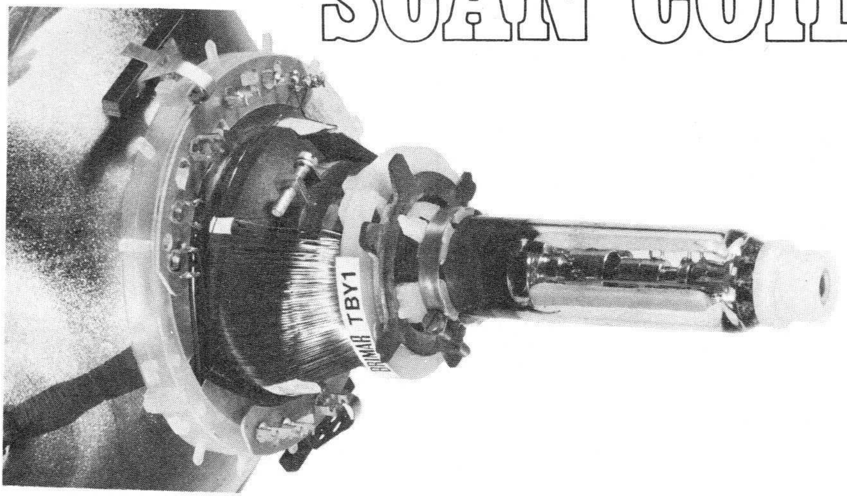
FINAL ANODE VOLTAGE = 15kV

Excitation: single 20ms raster at 1μA/cm²

Measured as average luminance of raster on C.R.T. with aluminised screen.



# GRATICULES GAUGES, BASES CAPS, SOCKETS & SCAN COILS




The facilities and organisation provided by Thorn Radio Valves and Tubes Limited meet the requirements of the M.O.D. (P.E.) Defence Standard 05-21 and BS 9000.

**HEALTH AND SAFETY AT WORK ACT, 1974**

Attention is drawn to the recommendations under this heading in the Operational Recommendations.

**WARNING**

These tubes should be used in accordance with their published ratings, and in conformity with the Operational Recommendations of the company's data handbook. The company will not entertain claims for loss or damage where this advice has been disregarded.

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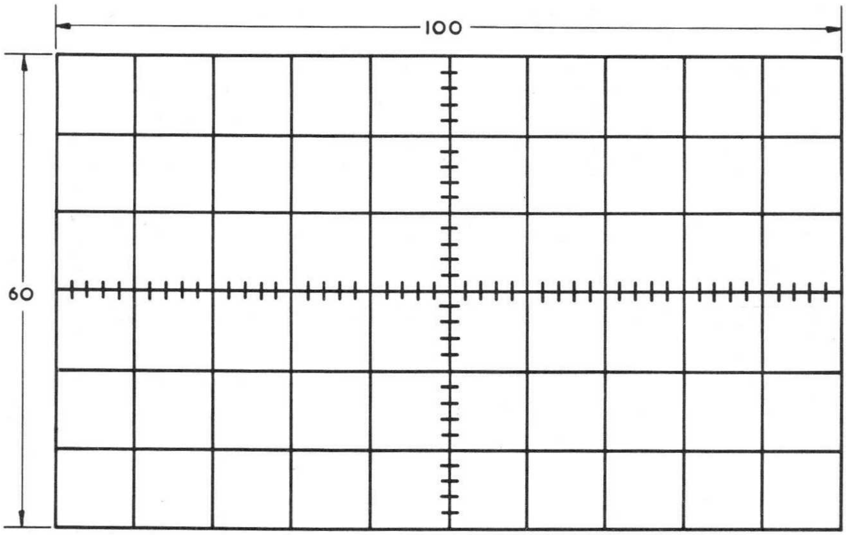
**Thorn Radio Valves and Tubes Limited**

Mollison Avenue - Brimsdown - Enfield - Middlesex EN3 7NS

BRIMAR

# Graticule Type 26

DETAILS OF GRATICULE




All dimensions in mm

Not to be scaled

This dual purpose internal graticule is suitable for direct view or for illumination with an appropriate light guide.

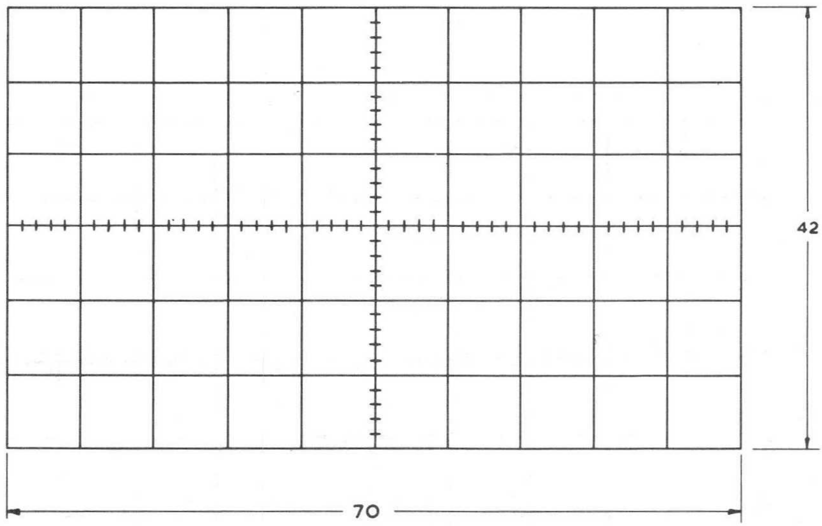
Graticule type 26 normally used on tubes with 13 cm diagonal.

The graticule x and y axes will be on tube face axes ± 2°.

The centre of the graticule will be within 1 mm of the mechanical centre of the face.

GRATICULES GAUGES, BASES & CAPS, SOCKETS SCAN COILS

DETAILS OF GRATICULE




**Dimensions in mm** **Not to be scaled**

This dual purpose internal graticule is suitable for direct view or for illumination with an appropriate light guide.

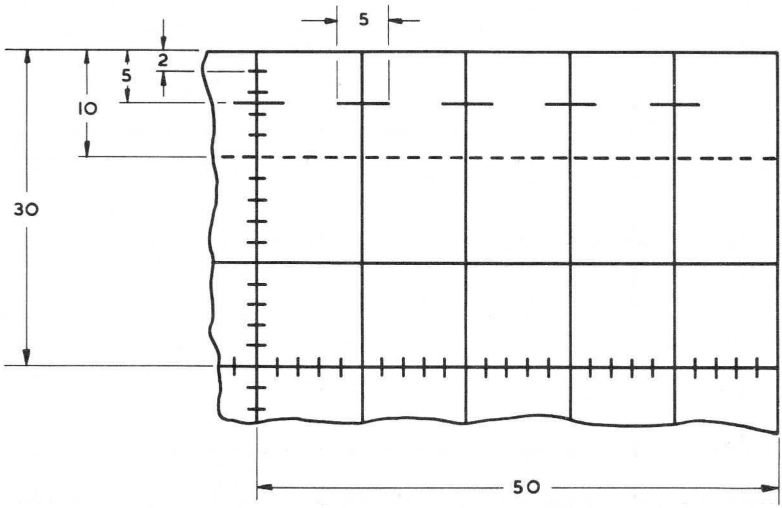
Graticule type 32 normally used on tubes with 10 cm diagonal.

The graticule X and Y axes will be on the tube face axes ± 2°.

The centre of the graticule will be within 1 mm of the mechanical centre of the face.

# Graticule Type 34

DETAIL OF ONE QUADRANT OF GRATICULE




All dimensions in mm

Not to be scaled

This dual purpose internal graticule is suitable for direct view or for illumination with an appropriate light guide.

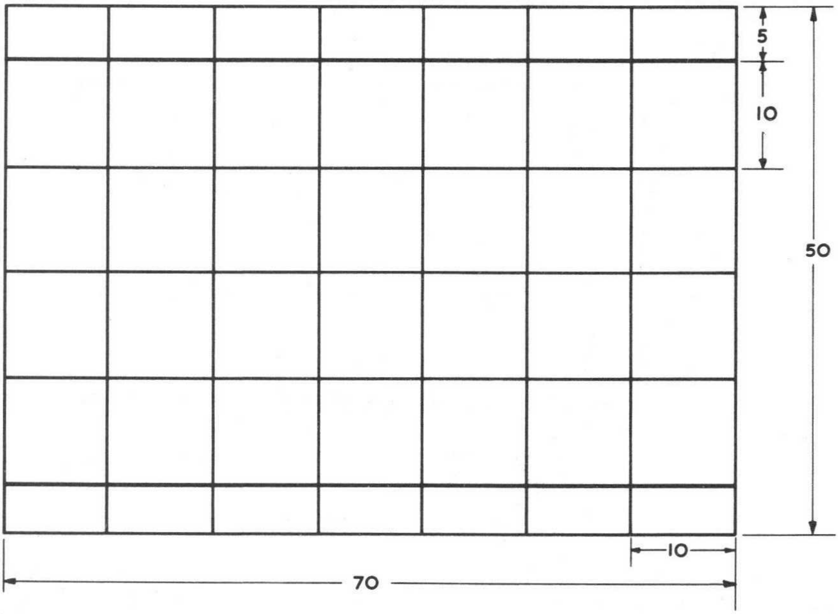
Graticule type 34 normally used on tubes with 13 cm diagonal.

The graticule $x$ and $y$ axes will be on tube face axes $\pm$ 2°.

The centre of the graticule will be within 1 mm of the mechanical centre of the face.

GRATICULES
GAUGES, BASES
& CAPS, SOCKETS
SCAN COILS

DETAILS OF GRATICULE




**All dimensions in mm** **Not to be scaled**

This dual purpose internal graticule is suitable for direct view or for illumination with an appropriate light guide.

Graticule type 42 normally used on tubes with a 10 cm diagonal.

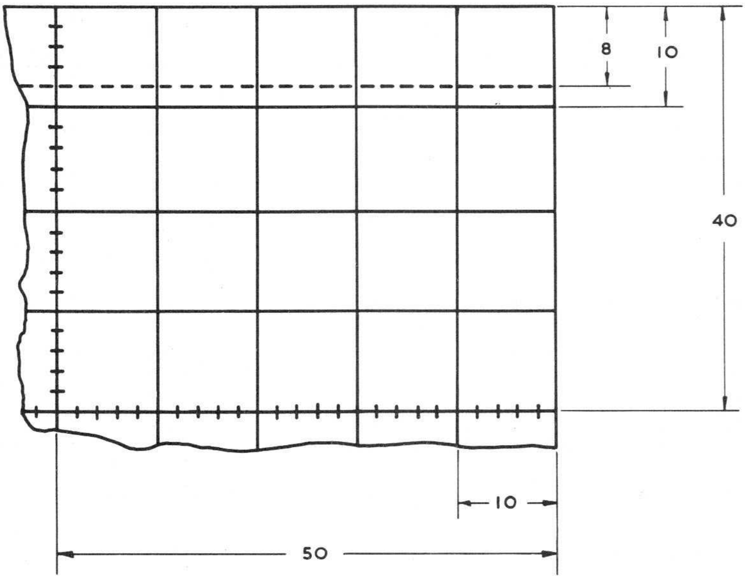
The graticule axes will be on the tube face axes $\pm$ 2°.

The centre of the graticule will be within 1 mm of the mechanical centre of the face.

# Graticule

# Type 50
# Type 51

DETAIL OF ONE QUADRANT OF GRATICULE




All dimensions in mm

Not to be scaled

GRATICULE 50

This dual purpose internal graticule is suitable for direct view or for illumination with an appropriate light guide.

Square with 10 mm side. x and y axes, with markers at 10% and 90%.

Graticule 100 mm x 80 mm normally used on tubes with 14 and 15 cm diagonal.

The graticule x and y axes will be on the tube face axes ± 2°.

The centre of the graticule will be within 1 mm of the mechanical centre of the face.

GRATICULE 51 : Bonded face-plate light guide.

Tubes with graticule designation 51 (e.g. D14-280GH/51) have a 50 graticule together with a bonded face-plate to provide an alternative method of light injection and hence illumination of the graticule.

The bonded face-plate increases the tube overall length.





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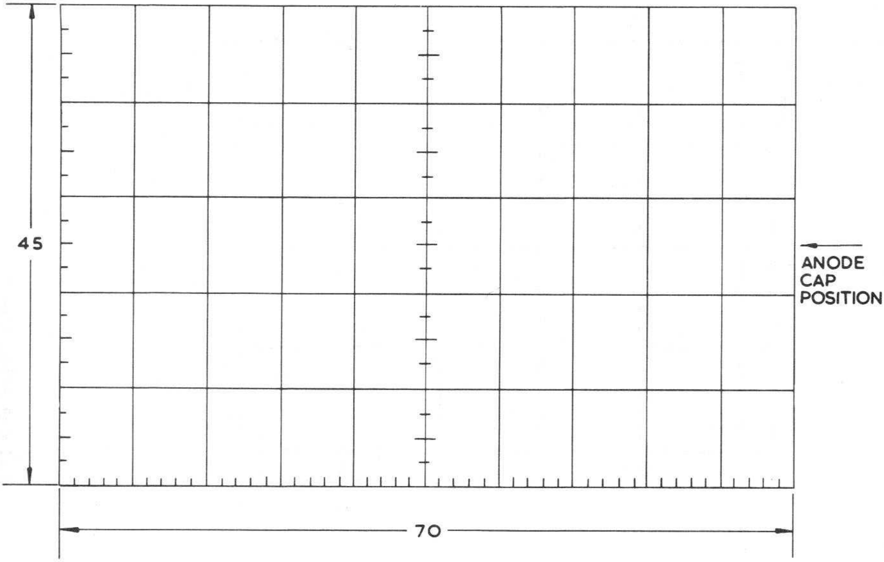
DETAILS OF GRATICULE




All dimensions in mm Not to be scaled

This dual purpose internal graticule is suitable for direct view or for illumination with an appropriate light guide.

Graticule type 58 normally used on tubes with 10 cm diagonal.

The graticule X and Y axes will be on the tube face axes $\pm$ 2°.

The centre of the graticule will be within 1 mm of the mechanical centre of the face.



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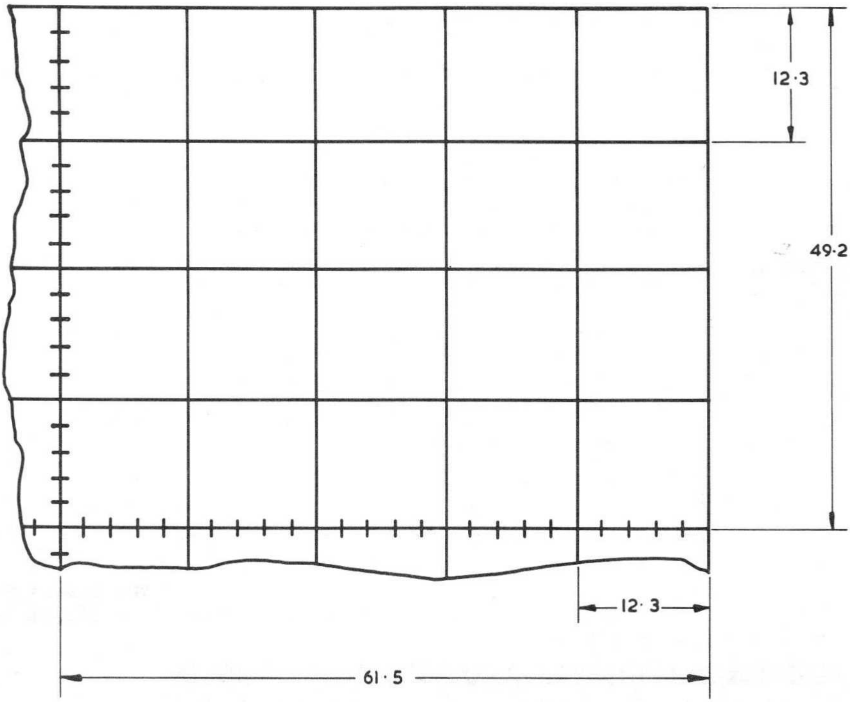
# Graticule

# Type 70

DETAIL OF ONE QUADRANT OF GRATICULE




GRATICULES
GAUGES, BASES
& CAPS, SOCKETS
SCAN COILS

**All dimensions in mm** **Not to be scaled**

This dual purpose internal graticule is suitable for direct view or for illumination with an appropriate light guide.

Squares with 12.3 mm side. x and y axes.

Graticule normally used on tubes with 18 cm diagonal.

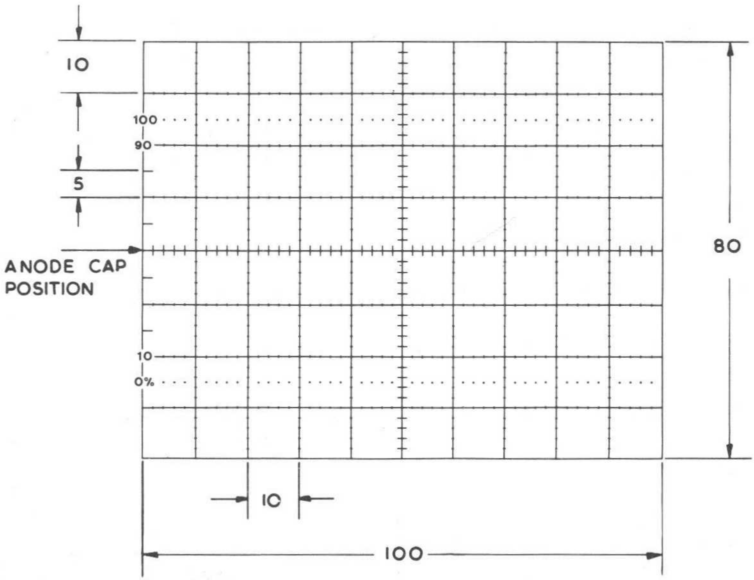
The graticule x and y axes will be on the tube face axes ± 2°.

The centre of the graticule will be within 1 mm of the mechanical centre of the face.

# Type 82
# Type 98

# Graticule

DETAILS OF GRATICULE




**All dimension in mm** **Not to be scaled**

This dual purpose internal graticule is suitable for direct view or for illumination with an appropriate light guide.

[redacted]

The graticule X and Y axes will be on the tube face axes $\pm$ 2°.

The centre of the graticule will be within 1 mm of the mechanical centre of the face.

Type 98

This is the standard graticule suitable for most 14 cm diagonal tube types.

Type 82

This graticule is specially designed for use on certain mesh p.d.a. tubes. for example, D14-280GH/82 and D14-310GH/82.

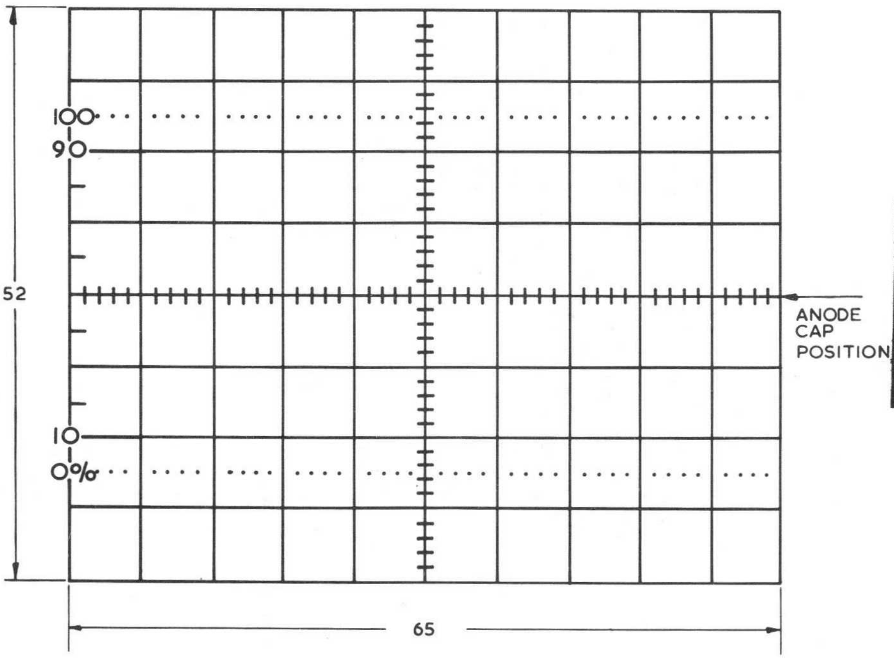


BRIMAR

# Graticule

# Type 90

DETAILS OF GRATICULE




All dimensions in mm

Not to be scaled

GRATICULES GAUGES, BASES & CAPS, SOCKETS SCAN COILS

This dual purpose internal graticule is suitable for direct view or for illumination with an appropriate light guide.

Graticule type 90 normally used on tubes with 10 cm diagonal.

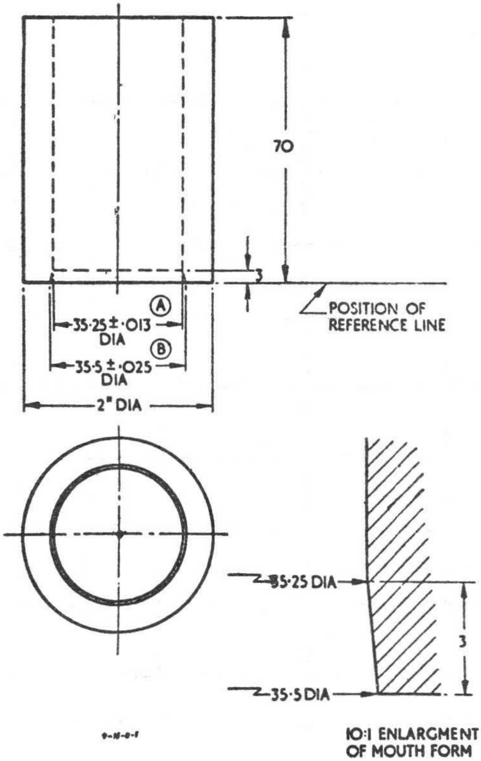
The graticule X and Y axes will be on the tube face axes $\pm$ 2°.

The centre of the graticule will be within 1 mm of the mechanical centre of the face.

Gauge
No. 6

# Reference Line Gauge

For C.R. Tubes having a Nominal Neck Diameter of 34·5 mm




All dimensions in mm unless otherwise stated.

NOTE 1—Deflector Yoke Design

The internal dimensions of the yoke must never be smaller than the maximum internal dimensions of the gauge.

NOTE 2—Tolerances

The tolerances shown are initial manufacturing limits. The figures given below are the maximum allowable limits for wear :

(A) + 0·059 (B) + 0·075

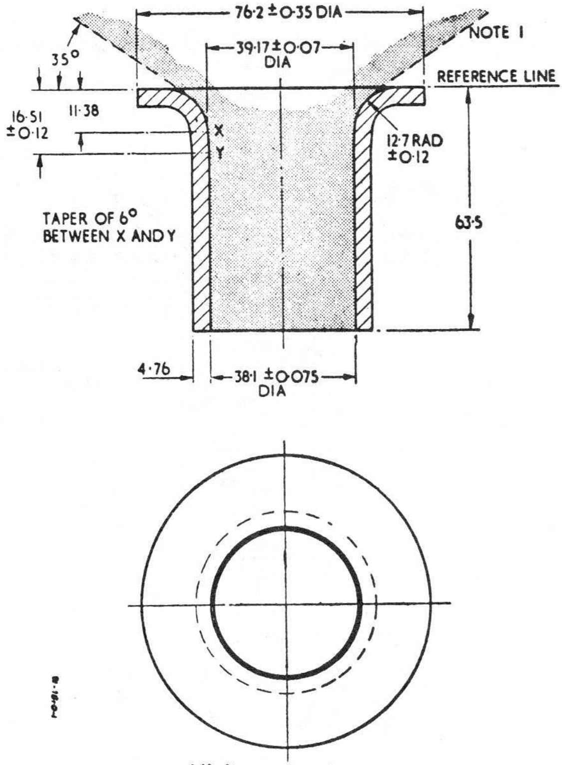


BRIMAR

# Reference Line Gauge

# Gauge No. 12

For C.R. Tubes having a Nominal Neck Diameter of 36·5mm

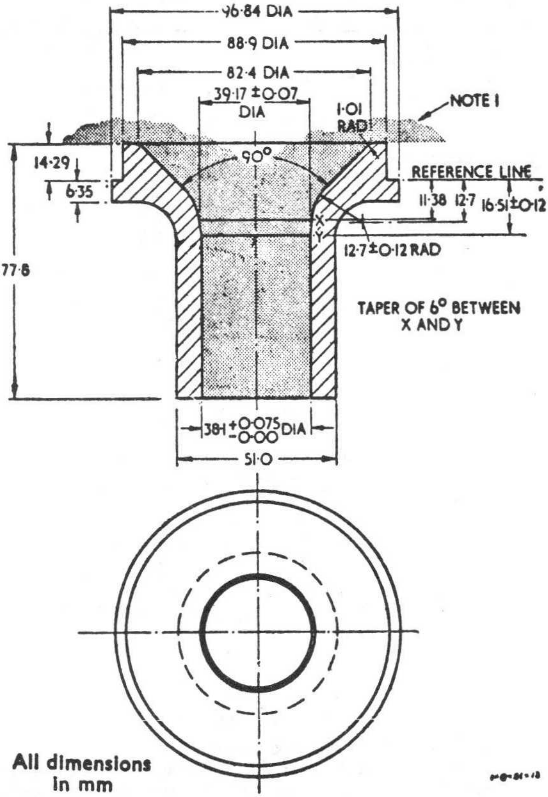



All dimensions in mm

NOTE 1—Deflector Yoke Design

The inner surface of the yoke must not extend into the shaded region and the internal dimensions of the yoke must never be smaller than the maximum internal dimensions of the gauge.

For C.R. Tubes having a Nominal Neck Diameter of 36·5 mm




All dimensions in mm

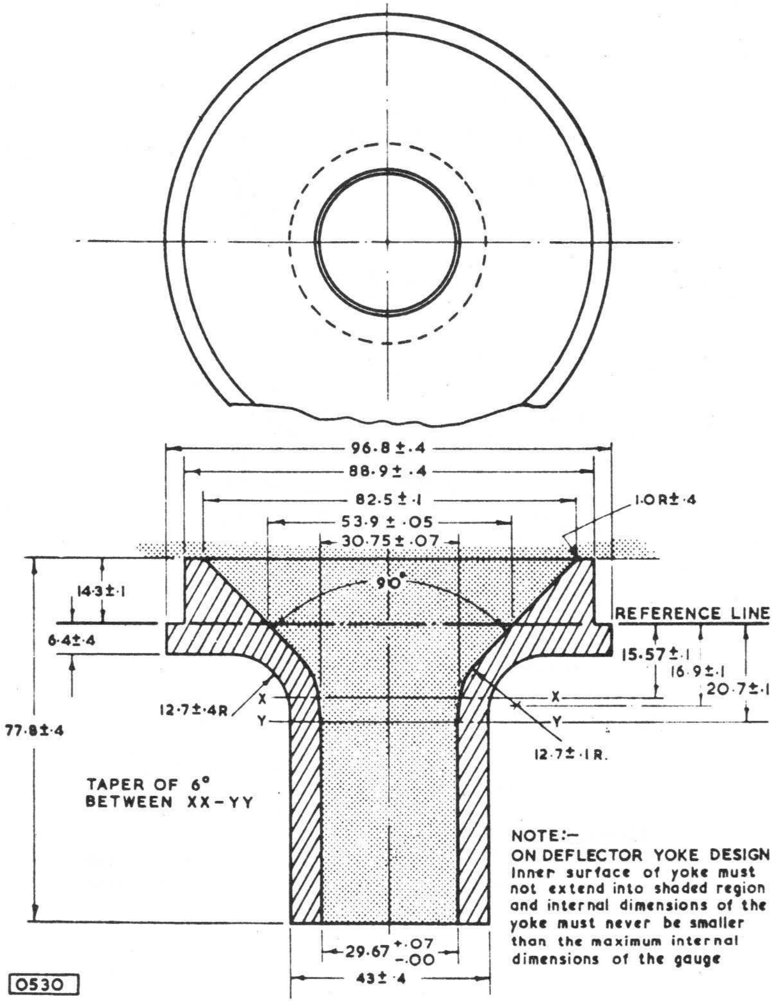
NOTE 1—Deflector Yoke Design

The inner surface of the yoke must not extend into the shaded region and the internal dimensions of the yoke must never be smaller than the maximum internal dimensions of the gauge.

# Reference Line Gauge

# Gauge No. 15

A NECK GAUGE FOR CATHODE RAY TUBES
HAVING A NOMINAL NECK DIAMETER OF 28·5mm
AND DEFLECTION ANGLE (PICTURE DIAGONAL) 90°




NOTE:–
ON DEFLECTOR YOKE DESIGN
Inner surface of yoke must not extend into shaded region and internal dimensions of the yoke must never be smaller than the maximum internal dimensions of the gauge

0530

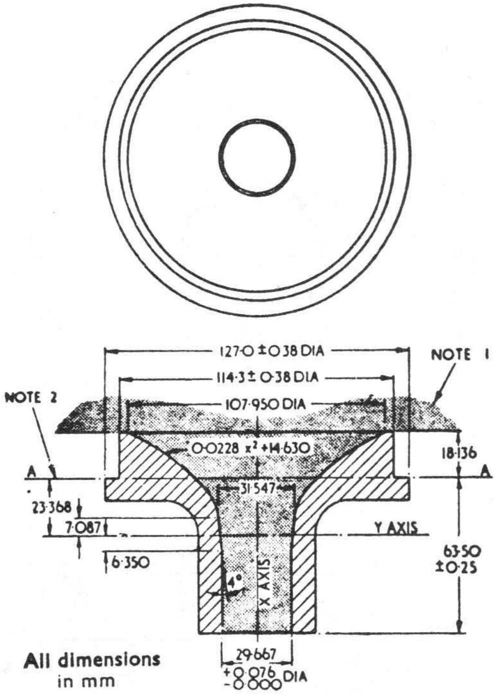
All dimensions in mm

Not to be scaled

# Gauge No. 16

# Reference Line Gauge

For C.R. Tubes having a nominal Neck Diameter of 28.5 mm
Deflection Angle 110° approx. (Picture Diagonal)




**All dimensions**
in mm

NOTE 1.—Deflector Yoke Design.
The inner surface of the yoke must not extend into the shaded region and the internal dimensions of the yoke must never be smaller than the maximum internal dimensions of the gauge.

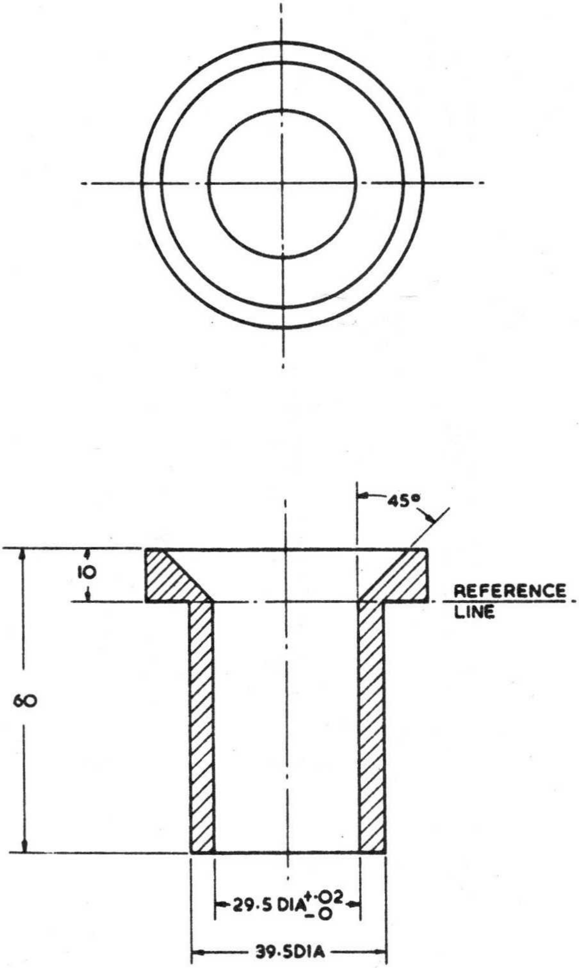
NOTE 2.—Reference Line.
The Reference Line is determined by the plane "A-A" when the gauge is seated against the funnel.

**Thorn Radio Valves and Tubes Limited**

# Reference Line Gauge

# Gauge No. 18

NECK DIAMETER 28·5 NOMINAL




All dimensions in mm

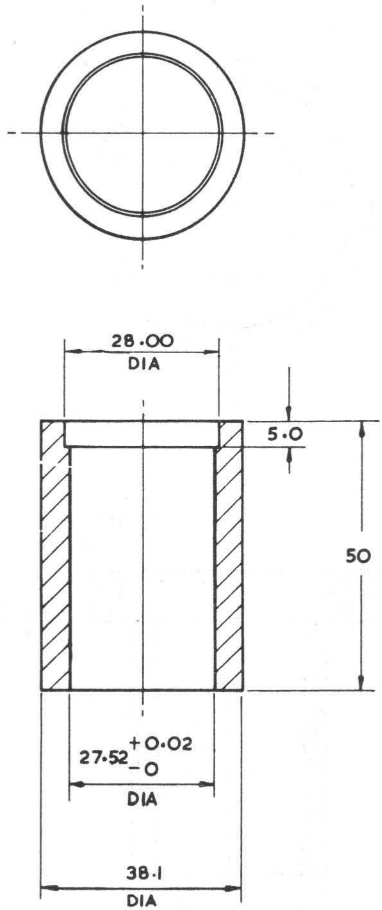
Not to be scaled

GRATICULES GAUGES, BASES & CAPS, SOCKETS SCAN COILS

**Thorn Radio Valves and Tubes Limited**

# Gauge No. 19

# Reference Line Gauge




All dimensions in mm

Not to be scaled

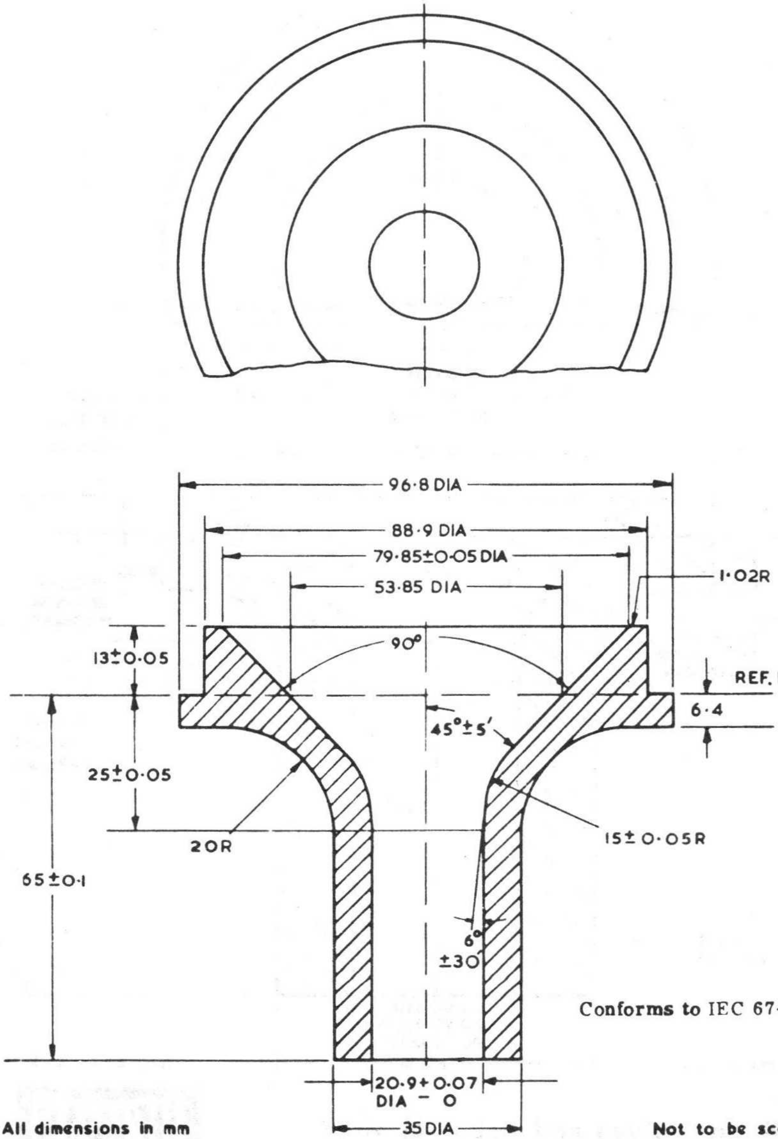
**Thorn Radio Valves and Tubes Limited**

BRIMAR

# Reference Line Gauge

# Gauge No 20

NECK DIAMETER 20 NOMINAL DEFLECTION ANGLE 90°




Conforms to IEC 67-IV-7

All dimensions in mm

Not to be scaled

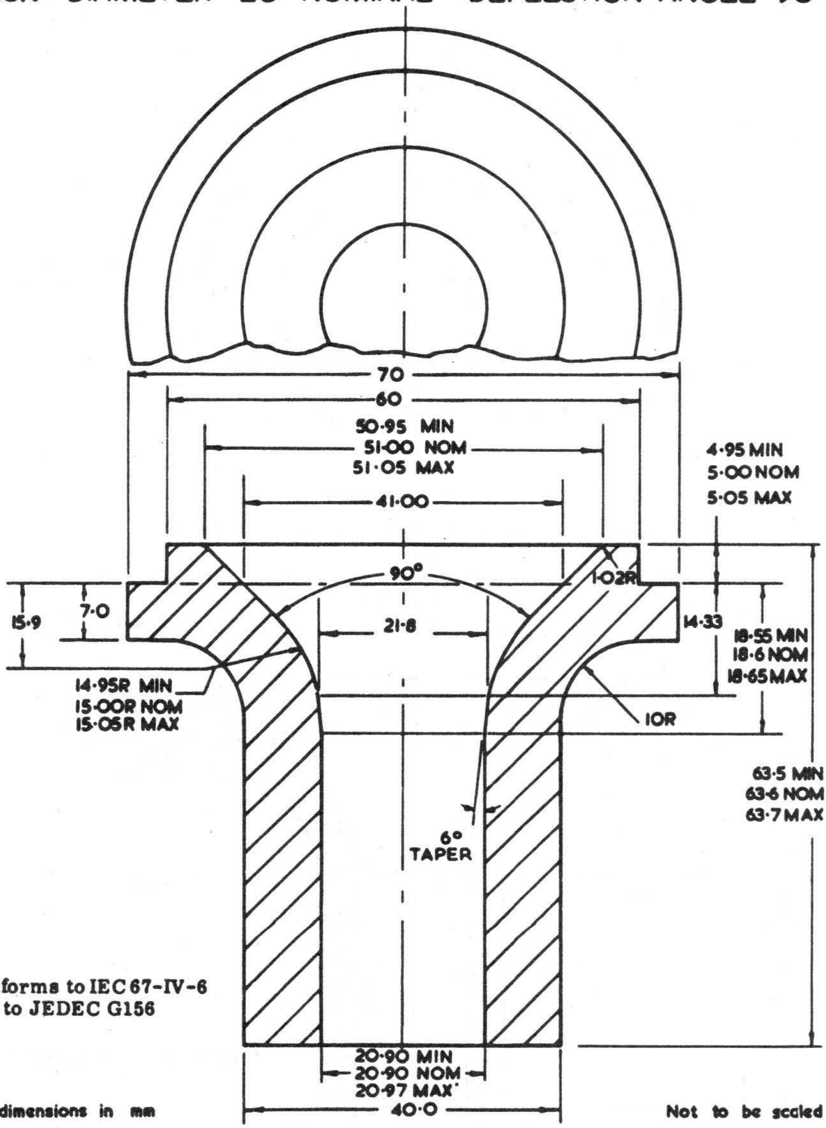


GRATICULES
GAUGES, BASES
& CAPS, SOCKETS
SCAN COILS

**Gauge No 21**

**Reference Line Gauge**

NECK DIAMETER 20 NOMINAL DEFLECTION ANGLE 90°




Conforms to IEC 67-IV-6 and to JEDEC G156

All dimensions in mm

Not to be scaled

**Thorn Radio Valves and Tubes Limited**

Issue 1, Page 1

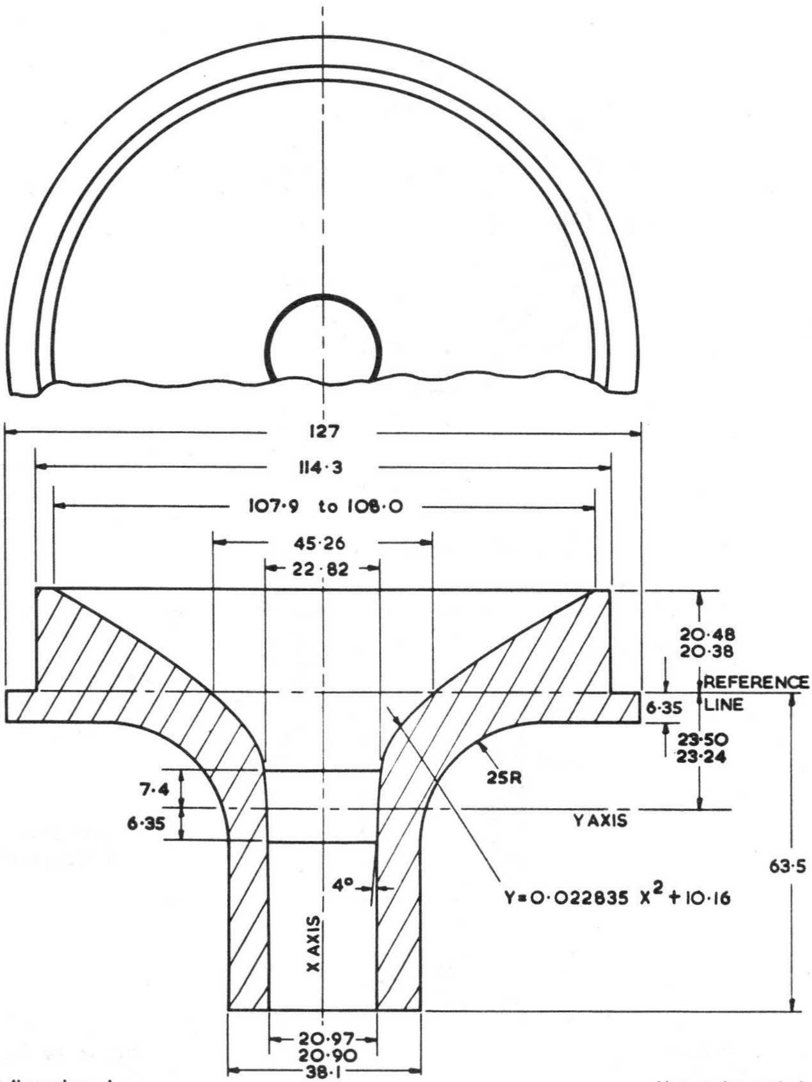
BRIMAR

# Reference Line Gauge

# Gauge No. 22

NECK DIAMETER 20 NOMINAL | DEFLECTION ANGLE 110°






All dimensions in mm

Not to be scaled

**Thorn Radio Valves and Tubes Limited**

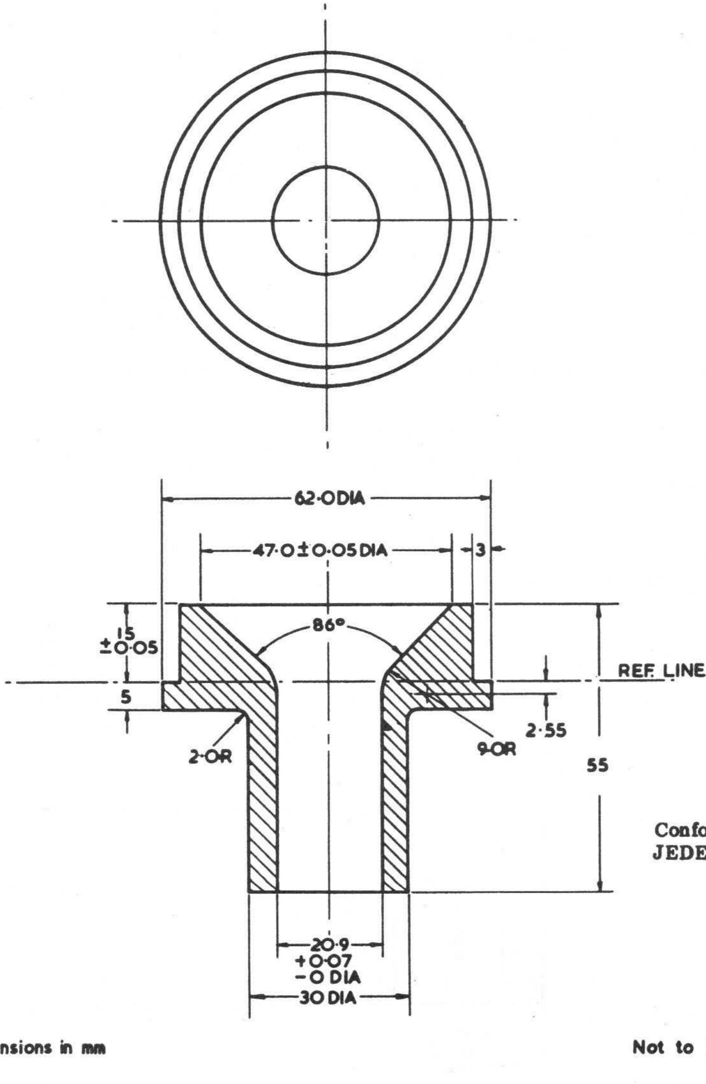
Issue 1, Page 1

BRIMAR

**Gauge No 23**

**Reference Line Gauge**

NECK DIAMETER 20 NOMINAL DEFLECTION ANGLE 70°




Conforms to JEDEC G-154

All dimensions in mm

Not to be scaled

**Thorn Radio Valves and Tubes Limited**

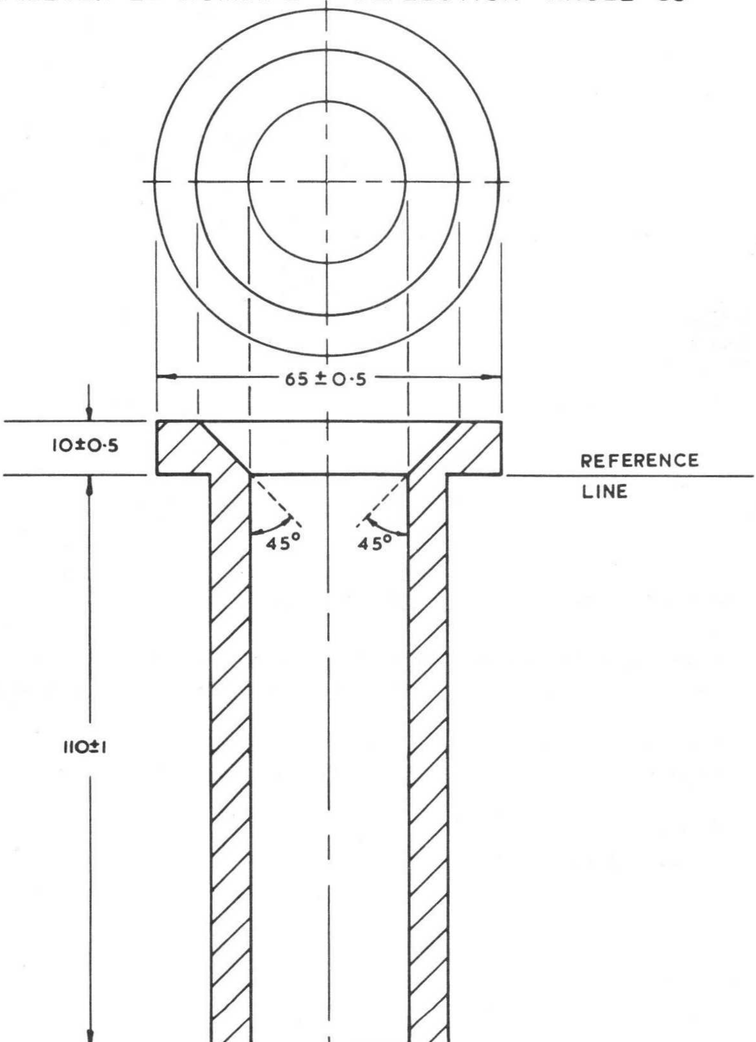


BRIMAR

**Reference Line Gauge**

**Gauge No. 31**

NECK DIAMETER 28 NOMINAL    DEFLECTION ANGLE 53°



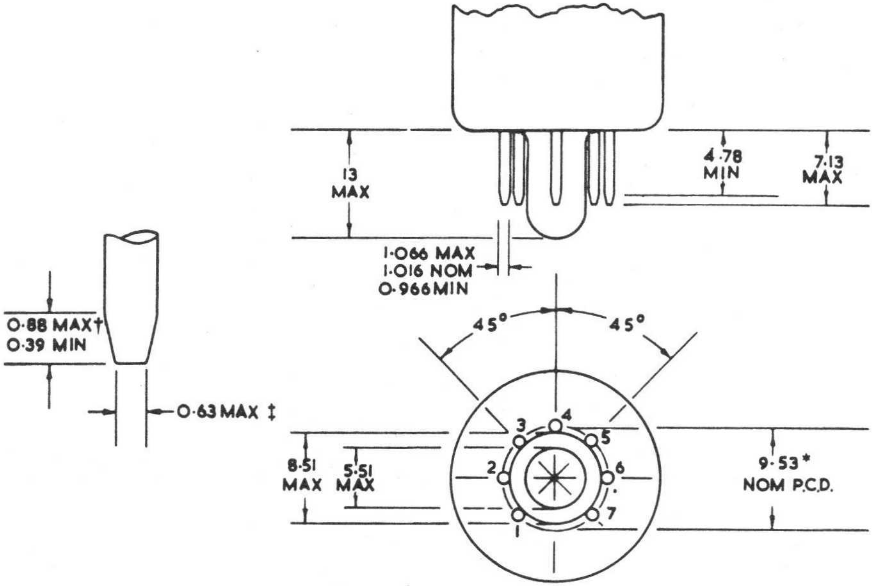

All dimensions in mm

Not to be scaled

GRATICULES GAUGES, BASES & CAPS, SOCKETS SCAN COILS

**Thorn Radio Valves and Tubes Limited**

BRIMAR




All dimensions in mm Third angle projection Not to be scaled

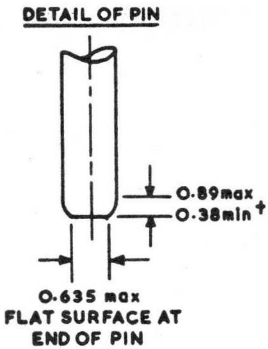
The drawing shows the numbering of the pins as seen from their free ends.

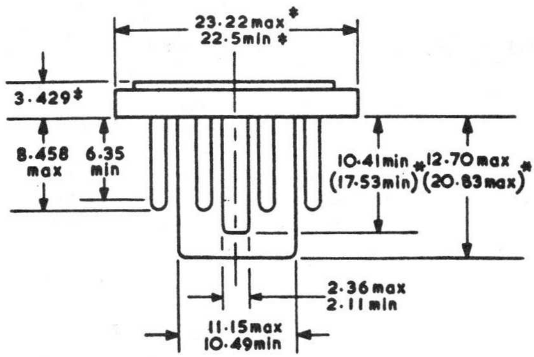
* The dimensions fixing the position of the pins refer to the fixed ends of the pins. The disposition may be checked by the appropriate gauge.

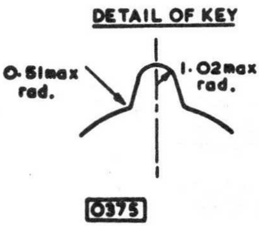
† This dimension may vary within the limits shown around the periphery of any individual pin. The surface of the pin is convex or conical in shape and is not brought to a sharp point.

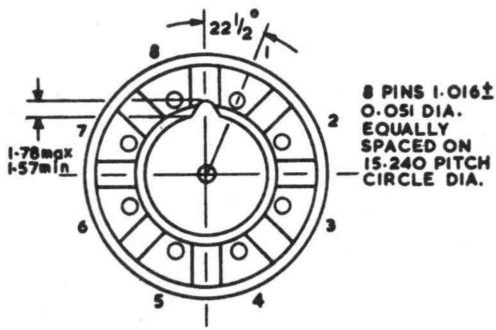
‡ This surface is flat.

Conforms to JEDEC E7-91.




All dimensions in mm. Not to be scaled.

The millimetre dimensions are derived from the original inch dimensions.

The drawing shows the numbering of the pins as seen from their free ends.

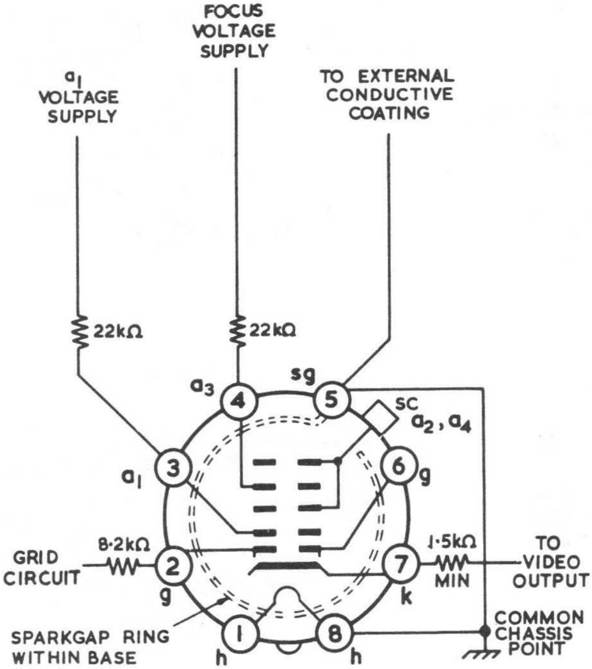
* Dimensions for variant B8H base.

† This dimension may vary within the limits shown around the periphery of any individual pin. This surface of the pin shall be convex or conical in shape and shall not be brought to a sharp point.

‡ These dimensions illustrate current practice and are not regarded as compatibility features.

**Note:**
Base pin positions are held to tolerances such that the base will fit a flat-plate gauge having a thickness of 9·525 mm and eight equally spaced holes of 1·397 ± 0·013 mm diameter located on a 15·240 ± 0·013 mm diameter circle. The gauge is also provided with a centre hole to provide 0·254 mm diametric clearance for the spigot and key. Pin fit in the gauge shall be such that the entire length of pins will, without undue force, enter into and disengage from the gauge.

# B8H SPARKGUARD R C.R.T. BASE CONNECTIONS




ELECTRICAL CONNECTIONS
VIEW FROM FREE END OF BASE PINS

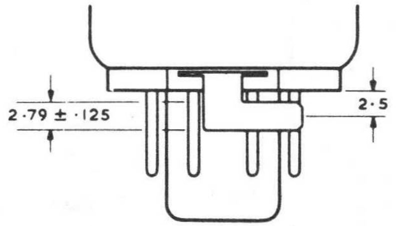
A metal ring within the B8H base, which is taken out to pin 5 (sg), forms a spark gap to all other tube electrodes thus providing flashover protection for all external electrode circuits and components.

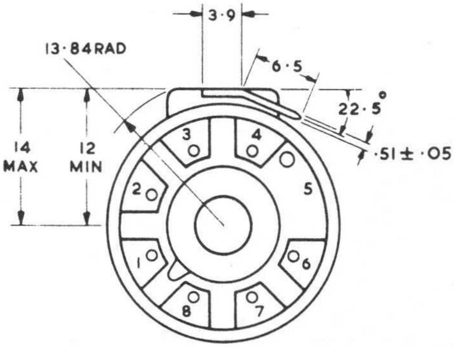
All leads must be as short and direct as possible. The external conductive coating should be connected to pin 5 only, with no other connection to chassis.

The resistors, preferably carbon composition type, in series with the supply leads should be such as to have a minimum surface leakage path between leads of 10 mm.

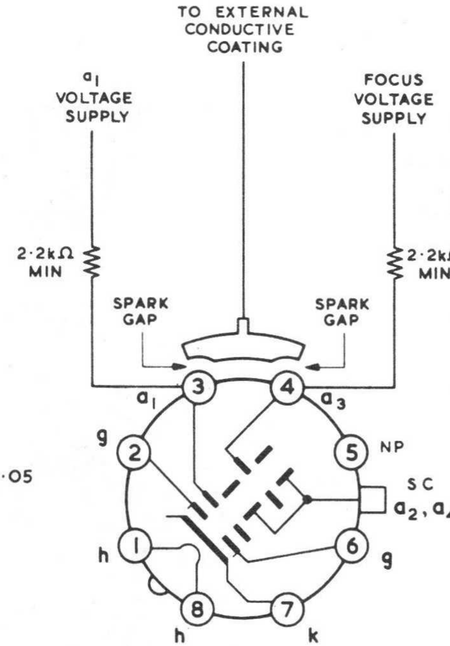
Tube types with the above sparkguard base have a suffix R after the type number and should only be used if the circuit modifications as above are incorporated.

## B8H SPARKGUARD S C.R.T. BASE




VIEW FROM FREE END



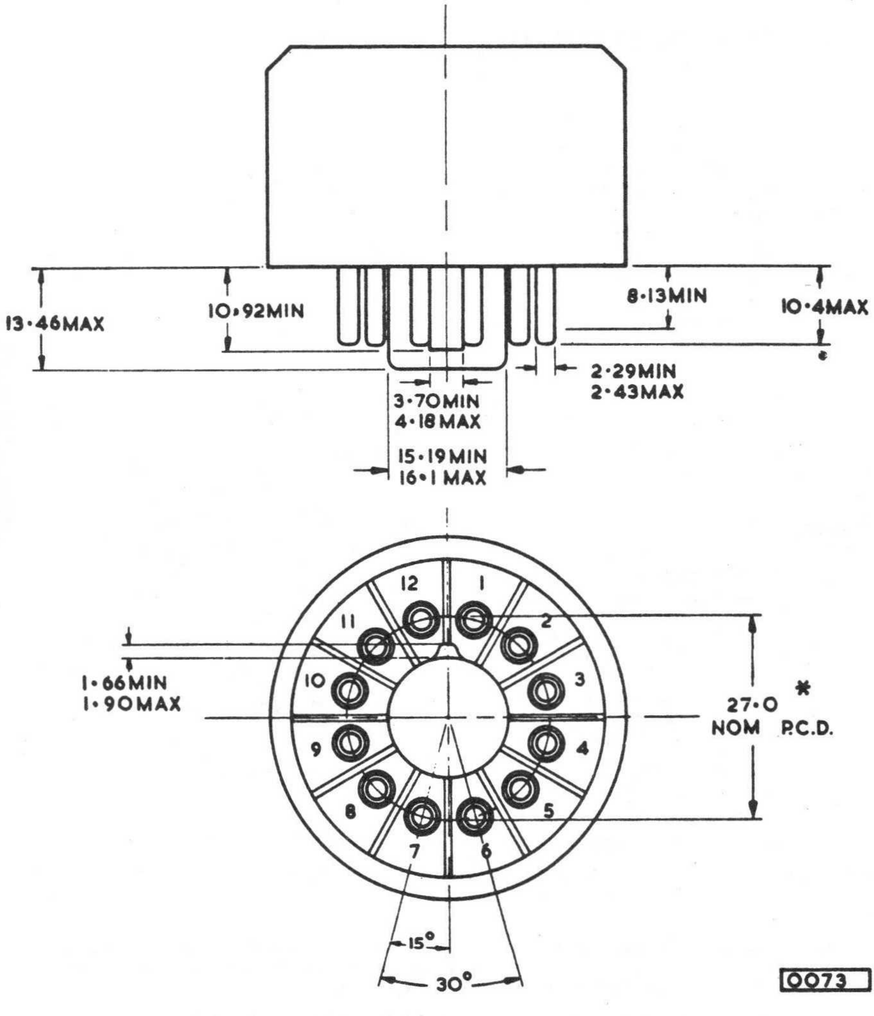

ELECTRICAL CONNECTIONS

A metal plate within the B8H base, which is taken out to a flat, side, earthing tag, forms a spark gap to the first anode and focus electrode. The plastic of Sparkguard S is coloured black.

Tube types fitted with this base have a suffix S after the type number. Sparkguard S tubes can be used in any set without circuit modification, but in sets designed for Sparkguard R protection the side tag must be bonded to pin 5 on the socket.

It is recommended that the earthing tag should be returned to the external conductive coating by the shortest possible route. The resistors of 2.2kΩ placed in series with the supply leads to the first anode and focus electrode should be such as to have a minimum surface leakage path between leads of 10 mm (e.g. at least 1/2 W size).

Connection to the earthing tag should be made by means of a push-on connector so that the connection may be removed whilst the deflector coil and other neck components are being fitted to the tube. An example of a suitable connector is the AMP "110 Series Faston Receptacle "(AMP of Great Britain Ltd., Terminal House, Stanmore, Middlesex).



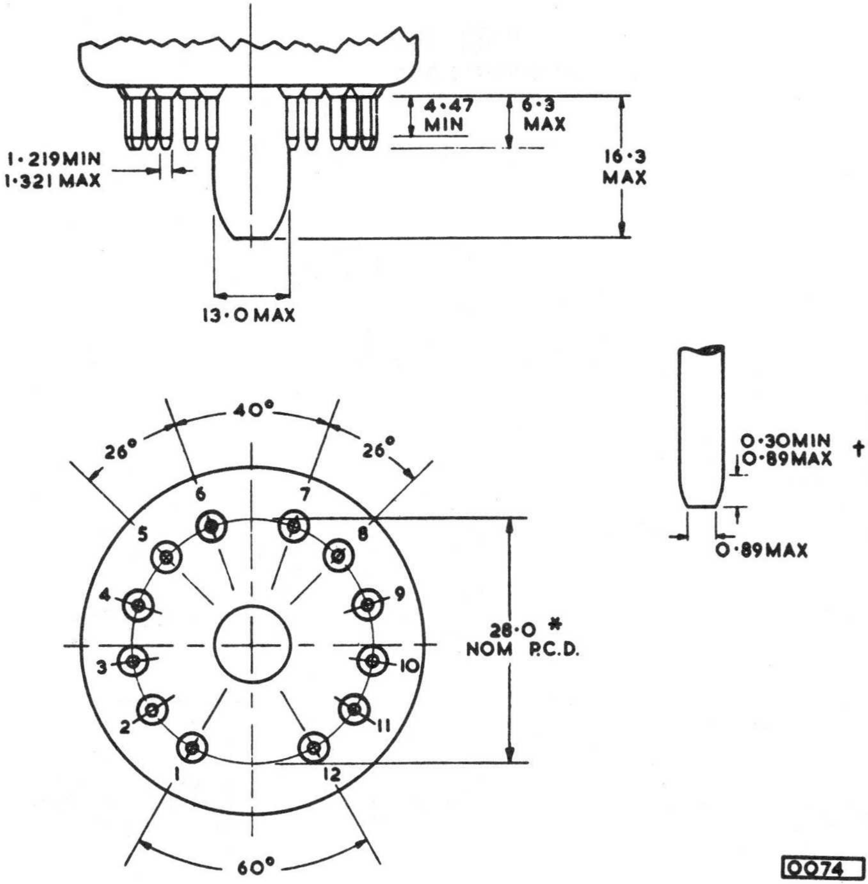

All dimensions in mm.

Not to be scaled.

**Notes**

*The dimensions fixing the positions of the pins refer to the fixed ends of the pins. The pin disposition may be checked only by means of the appropriate gauge.

The drawing shows the numbering of the pins as seen from their free ends.






All dimensions in mm. Not to be scaled.

**Notes**

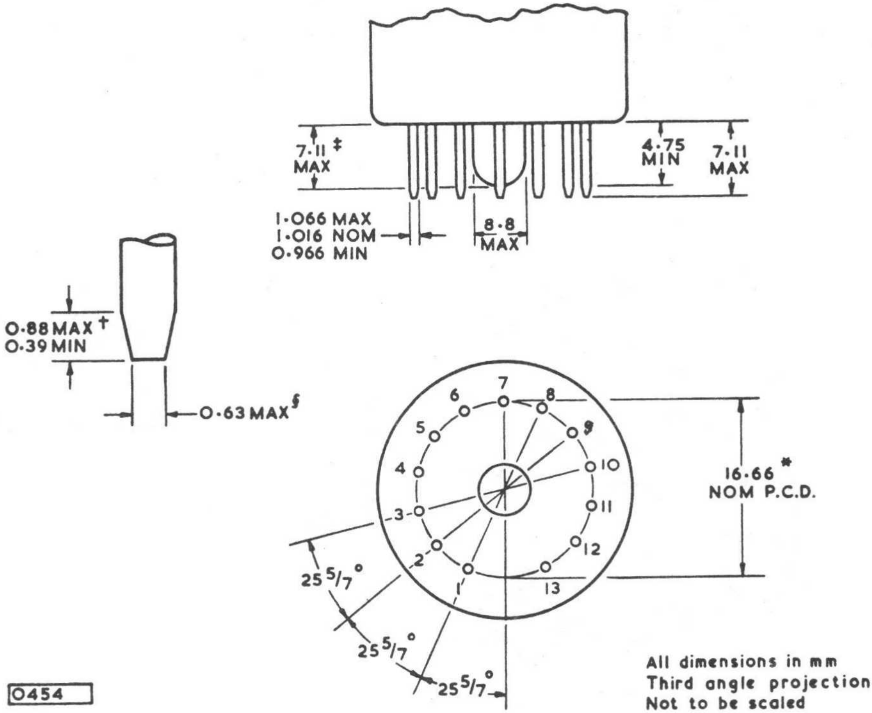
*The dimensions fixing the positions of the pins refer to the fixed ends of the pins. The pin disposition may be checked only by means of the appropriate gauge.

†This surface of the pin shall be convex or conical in shape and shall not be brought to a sharp point.

The drawing shows the numbering of the pins as seen from their free ends.

# B13B BASE

(CONFORMS TO IEC 67-I-37a)




The drawing shows the numbering of the pins as seen from their free ends.

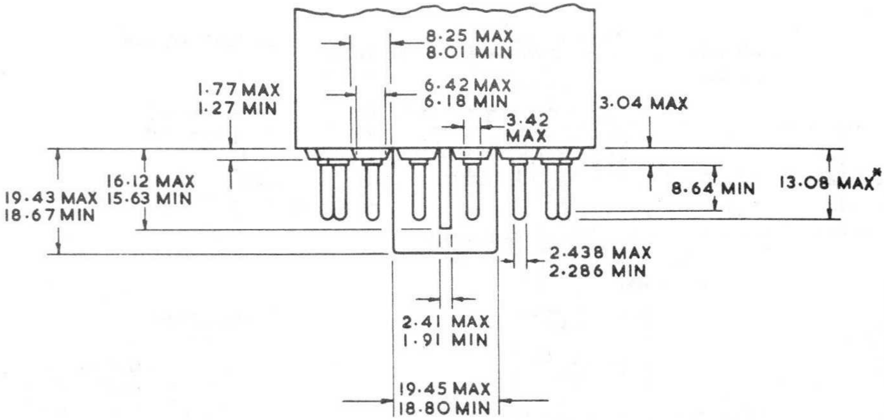
* The dimensions fixing the position of the pins refer to the fixed ends of the pins. The pin disposition may be checked by the appropriate gauge.

† This surface of the pin is convex or conical in shape and is not brought to a sharp point.

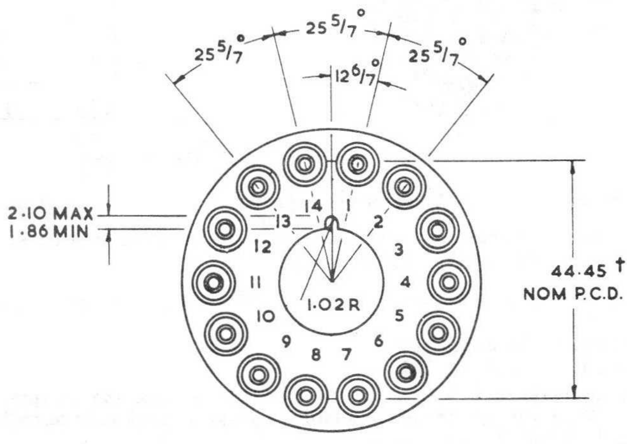
§ This surface is flat.

‡ The tubulation should not project beyond the length of the pins. In some tube types, however, the tubulation does project beyond the length of the pins. Where this happens the maximum length of the tubulation is given on the tube outline drawing.

Conforms to B.S. B14A, I.E.C. 67-1-16a, JEDEC B14-38 and B14-45






All dimensions in mm | Third angle projection | Not to be scaled

The drawing shows the numbering of the pins as seen from their free ends.

* This dimension may be increased by 0.76 mm max. for solder.

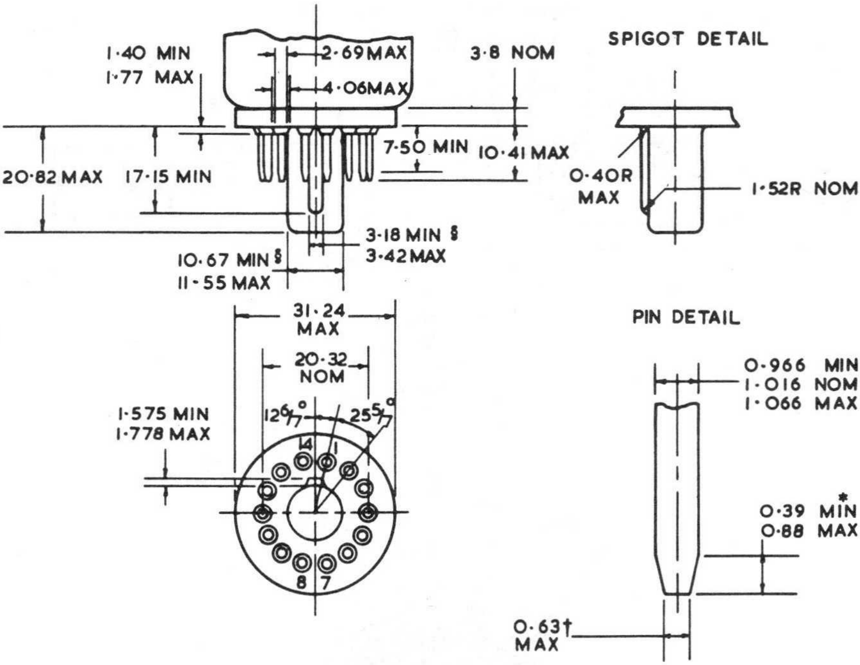
† The dimensions fixing the positions of the pins refer to the fixed ends of the pins. The pin disposition may be checked by the appropriate gauge.

Any projections on the under surface of the base other than those shown, such as a rim or external barriers, shall have a height not exceeding 2.79 mm.

# B14G

# Base

Conforms to I.E.C. 67-I-47a, JEDEC B14-243




All dimensions in mm — Third angle projection — Not to be scaled

The drawing shows the numbering of the pins as seen from their free ends. The pin disposition may be checked by the appropriate gauge.

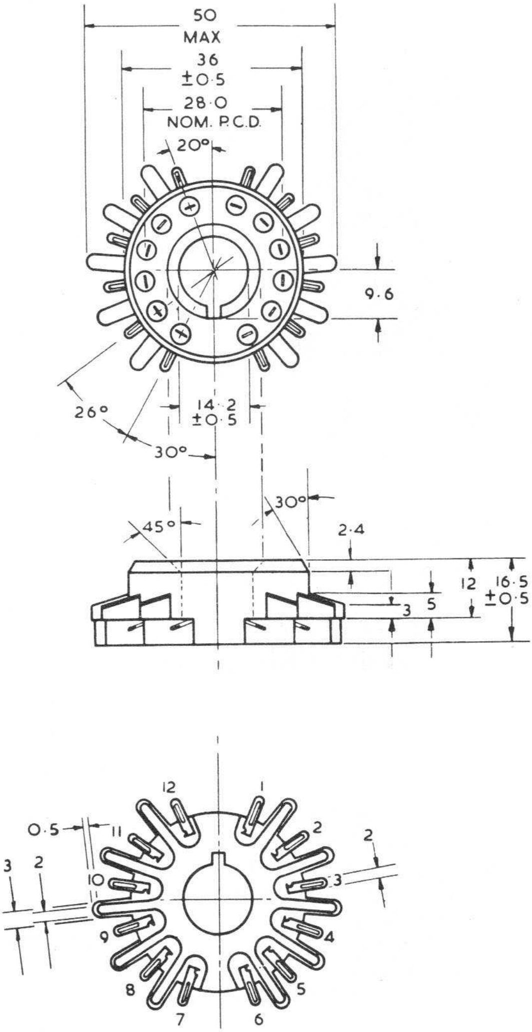
There is a second type with a shorter spigot having the following dimensions.

Type 2: Spigot length = 14.8 mm MAX
Key length = 11.8 mm MIN

* This dimension may vary within the limits shown around the periphery of any individual pin. This surface of the pin shall be convex or conical in shape and shall not be brought to a sharp point.

† This surface shall be flat.

§ The dimensions given include any necessary taper.






All dimensions in mm

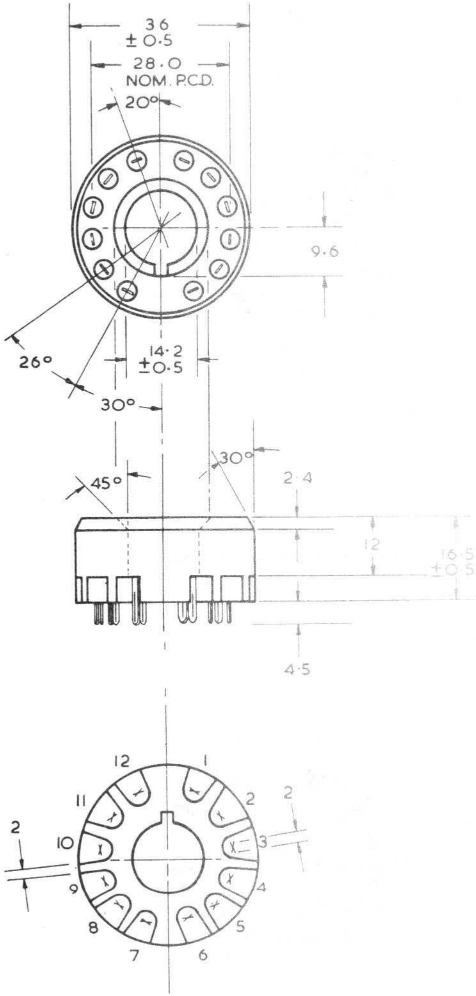
Not to be scaled

**Thorn Radio Valves and Tubes Limited**

BRIMAR

# B12FPC

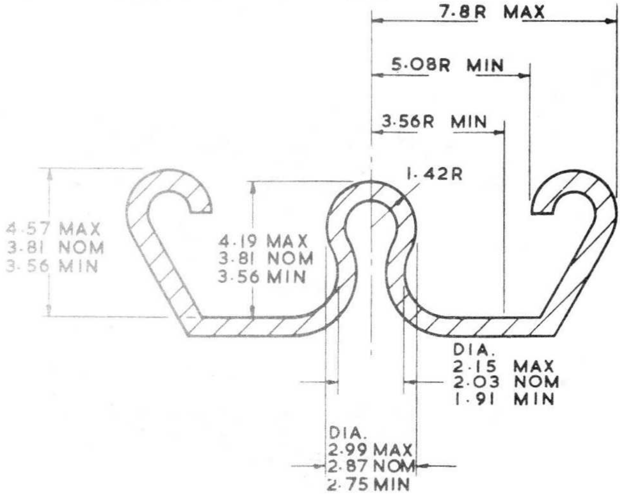
Socket




All dimensions in mm

Not to be scaled

**Thorn Radio Valves and Tubes Limited**






All dimensions in mm

Not to be scaled

Notes

1. This drawing is for illustration only. The shape may be varied provided the specified dimensions are adhered to.
2. When attaching or detaching the connector, the total force required should not exceed 36N (8lbf) applied perpendicular to the plane of the cap rim.
3. Conforms to IEC 67-III-3 and JEDEC J1-22.

## CT7 SEAL TOLERANCES

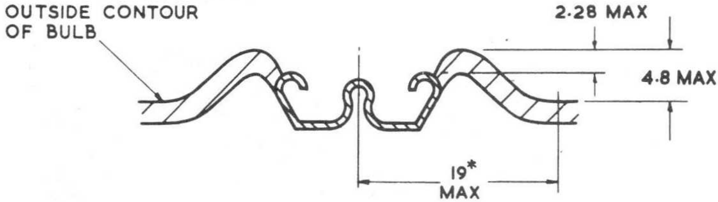



FIGURE 1

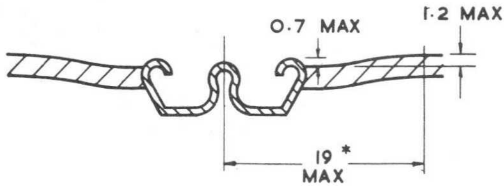



FIGURE 2

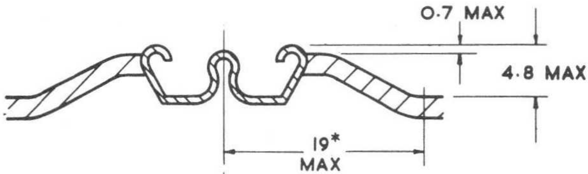



FIGURE 3

**All dimensions in mm** **Not to be scaled**

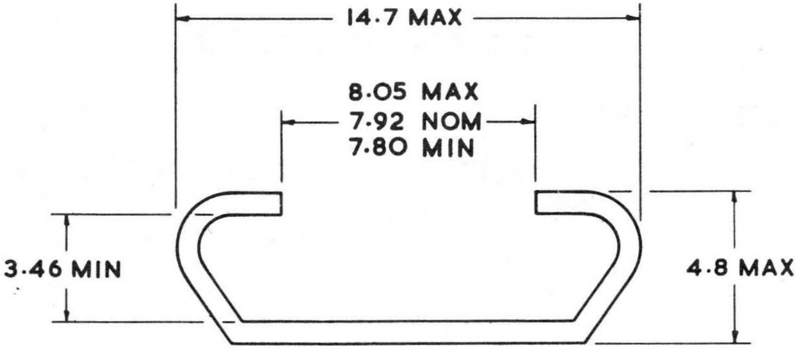
Notes

* Protrusion of glass around cap above bulb contour is limited to area bounded by circle concentric with cap axis and having radius of 19 mm maximum.

The shape of the cap is for illustration purposes only .

Angle between plane of the rim of cap and plane tangent to original contour of bulb at centre of cap will not be more than 10°.

# Cap






All dimensions in mm

Not to be scaled

Notes

1. This drawing is for illustration only. The shape may be varied provided the specified dimensions are adhered to.
2. When attaching or detaching the connector, the total force required should not exceed 35 N (8 lbf) applied perpendicular to the plane of the cap rim.
3. Conforms to IEC 67-III-2 and JEDEC J1-21.

## CT8 SEAL TOLERANCES

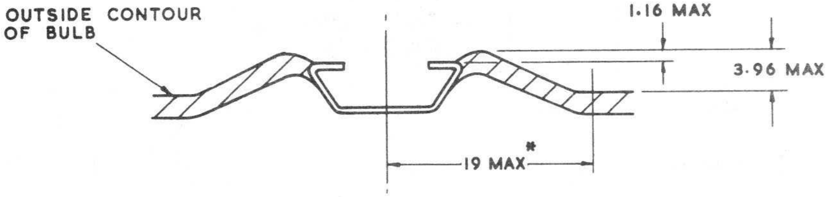



FIGURE 1

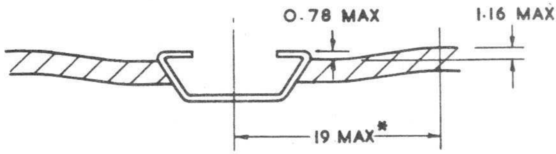



FIGURE 2

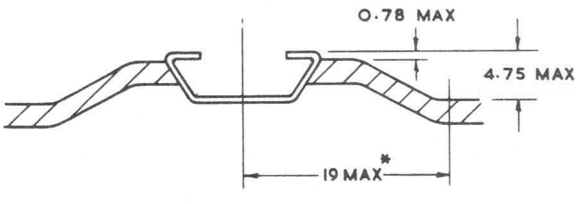



FIGURE 3

**All dimensions in mm** **Not to be scaled**

Notes

* Protrusion of glass around cap above bulb contour is limited to area bounded by circle concentric with cap axis and having radius of 19 mm max.

The shape of the cavity cap is for illustration purposes only.

Angle between plane of the rim of cap and plane tangent to original contour of bulb at centre of cap will not be more than 10°.

# Scan Coils  TBY 1

PRELIMINARY DATA

**GENERAL**

Scan coils designed for 70°, 90° and 110° tubes with 28 mm diameter necks.

A short ferrite ring is used with saddle and toroidal wound coils. Shift rings and a clamp assembly are provided.

TBY1 has two picture shape correction rod magnets mounted on the x axis for adjustment by the user. This type is not suitable for tubes with diagonals smaller than 24 cm.

GRATICULES
GAUGES, BASES
& CAPS, SOCKETS
SCAN COILS

**RATINGS**

| | | |
|---|---|---|
| Maximum voltage between line and field coils (50 Hz) | 2.0 | kV |
| Maximum operating temperature | 100 | °C |

| **ELECTRICAL DATA*** | X Axis | Y Axis | |
|---|---|---|---|
| Type of winding | Saddle | Toroidal | |
| Inductance at 1 kHz (Tolerance ± 5%) | 2.9 | 7.6 | mH |
| Resistance at 20°C (Tolerance ± 6%) | 4.1 | 3.2 | Ω |
| Deflection current, peak to peak, (Tolerance ± 5%) | 1.4 | 0.92 | A |
| for the following deflection | 272 | 205 | mm |
| Rectangularity between x and y traces † | 90° ± 1.0° | | |
| Maximum adjustment of shift ring (dia.) | 60 | | mm |
| Raster distortion § | | | |
| Test raster parallel to sides of rectangle to within | 3.0 | | mm |
| Maximum pincushion distortion LHS | 1.6 | | mm |
| RHS | 3.0 | | mm |
| Maximum barrel distortion LHS | 3.0 | | mm |
| RHS | 1.6 | | mm |
| Maximum pincushion or barrel distortion top or bottom | 3.0 | | mm |

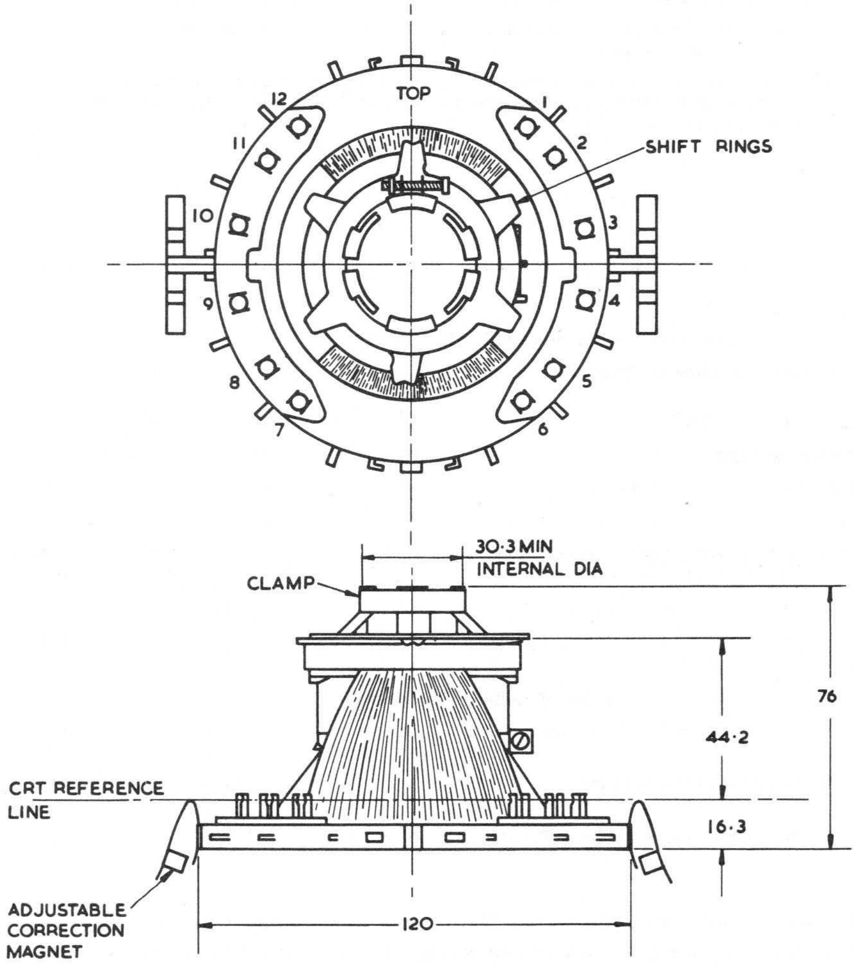
* Applies, where applicable, to an M38-101.. tube operating at 15 kV

† To meet this limit, a coupling coil has occasionally to be fitted to the assembly. This is wired in series with the line coils and adjusted at the factory to limit the coupling factor to less than 0.001.

§ Comparison of a test raster and rectangle of height 90% of the tube minimum screen height and aspect ratio 4:3.

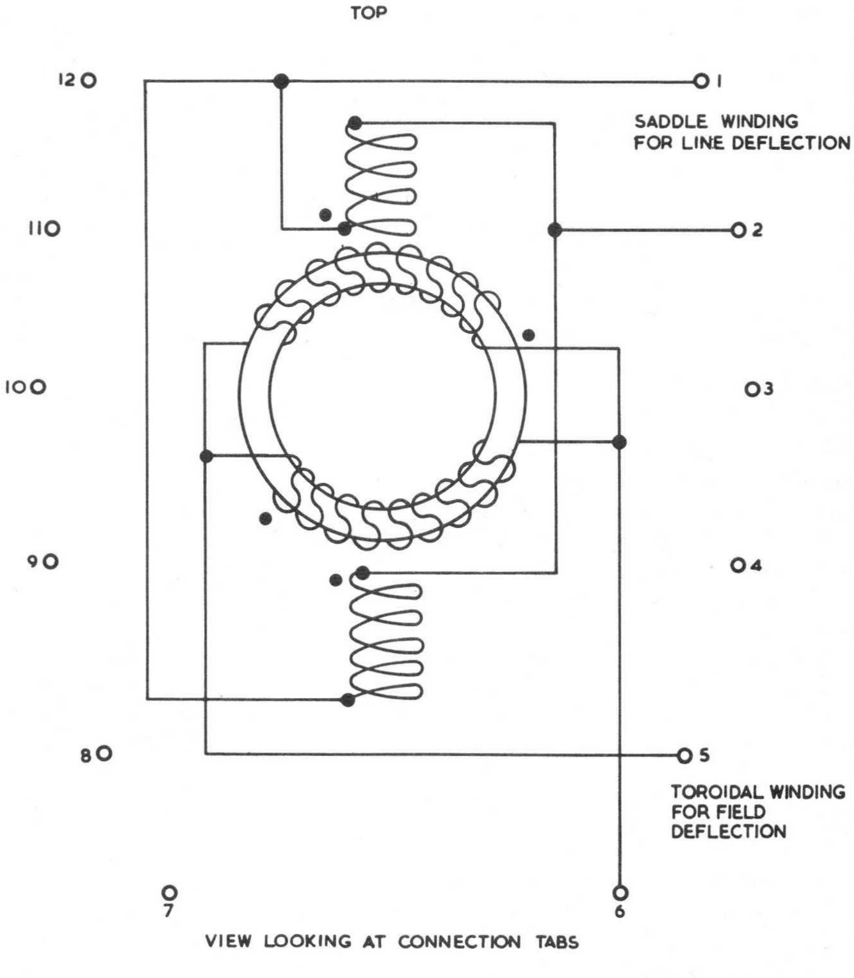


BRIMAR




All dimensions in mm

Not to be scaled


TOP
12
1
SADDLE WINDING
FOR LINE DEFLECTION
11
2
10
3
9
4
8
5
TOROIDAL WINDING
FOR FIELD
DEFLECTION
7
6
VIEW LOOKING AT CONNECTION TABS

PRELIMINARY DATA

**GENERAL**

Scan coils designed for 70° flat faced tubes with 28 mm diameter necks. These coils are particularly suitable for smaller tubes giving adequate clearance of the EHT connector. A short ferrite ring is used with saddle and toroidal wound coils. Shift rings and a clamp assembly are provided.

TBY2 has fixed picture shape correction rod magnets mounted within the plastic moulding.

To reduce raster distortion additional magnets may be placed on the pegs around the periphery of the plastic moulding.

**RATINGS**

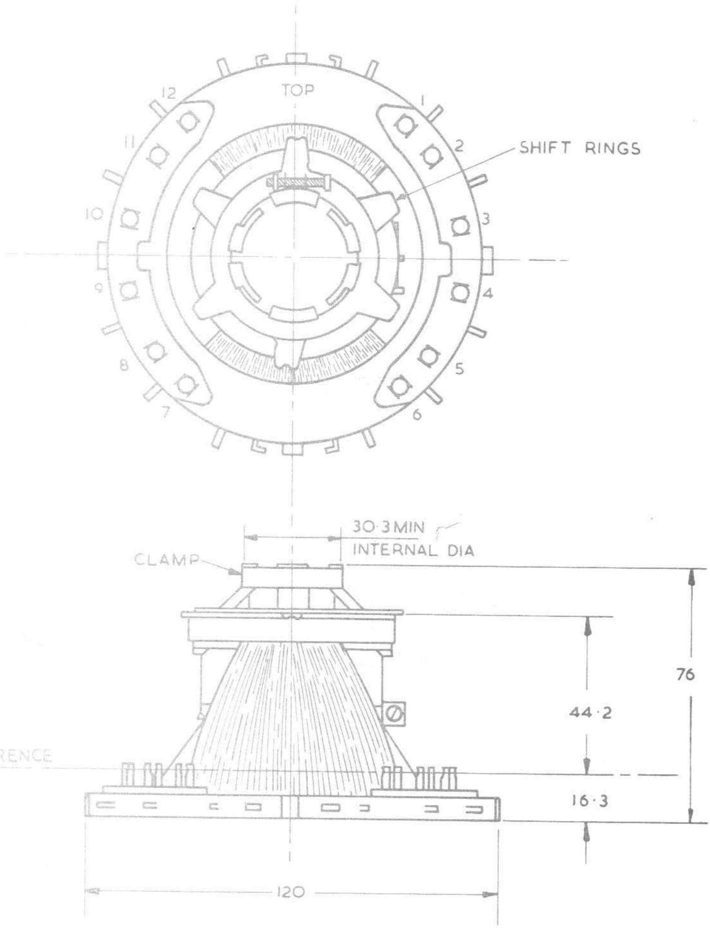
| | | |
|---|---|---|
| Maximum voltage between line and field coils (50 Hz) | 2.0 | kV |
| Maximum operating temperature | 100 | °C |

| **ELECTRICAL DATA*** | X Axis | Y Axis | |
|---|---|---|---|
| Type of winding | Saddle | Toroidal | |
| Inductance at 1 kHz (Tolerance ± 5%) | 2.9 | 7.6 | mH |
| Resistance at 20°C (Tolerance ± 6%) | 4.1 | 3.2 | Ω |
| Deflection current, peak to peak, (Tolerance ± 5%) | 1.35 | 0.87 | A |
| for the following deflection | 127 | 95 | mm |
| Rectangularity between x and y traces † | 90° ± 1.0° | | |
| Maximum adjustment by shift ring (diameter) | 60 | | mm |
| Raster distortion § | | | |
| Test raster parallel to sides of rectangle to within | | | mm |
| Maximum pincushion distortion LHS | | | mm |
| RHS | | | mm |
| Maximum barrel distortion LHS | | | mm |
| RHS | | | mm |
| Maximum pincushion or barrel distortion top or bottom | | | mm |

* Measured, where applicable, on an M17-10.. tube operating at 14kV

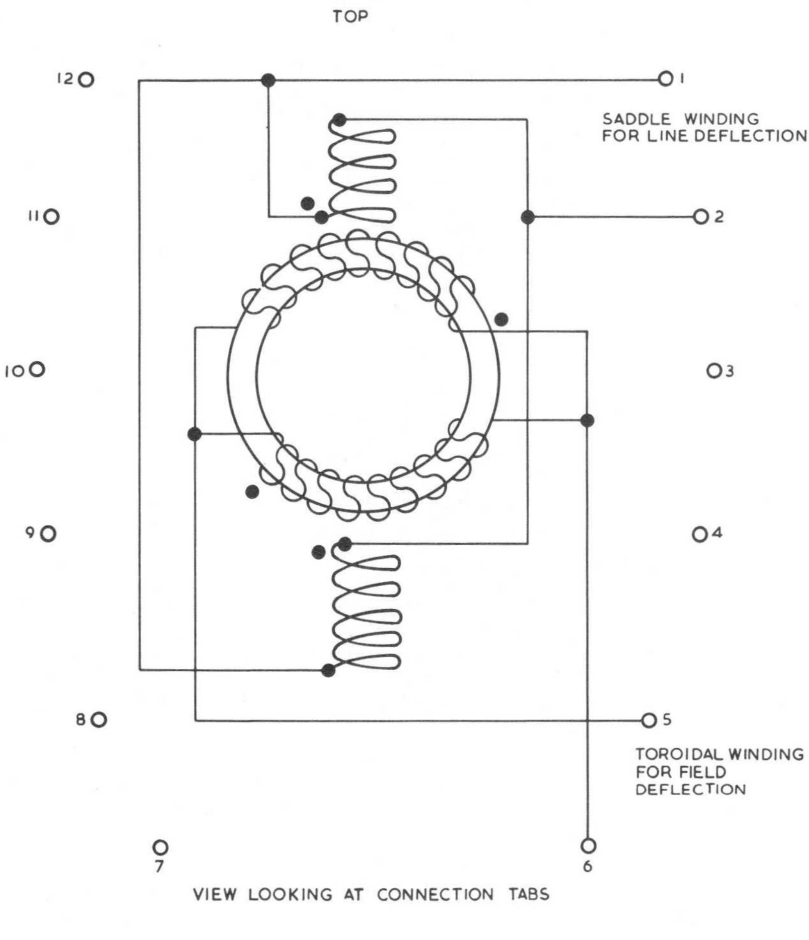
† To meet this limit, a coupling coil has occasionally to be fitted to the assembly. This is wired in series with the line coils and adjusted at the factory to limit the coupling factor to less than 0.001.

§ Comparison of a test raster and rectangle of height 90% of the tube minimum screen height and aspect ratio 4:3.




All dimensions in mm

Not to be scaled




VIEW LOOKING AT CONNECTION TABS

# Deflection Component TBY3

GRATICULES
GAUGES, BASES
& CAPS, SOCKETS
SCAN COILS

**GENERAL** - SCAN COILS

Scan coils can be used for 70°, 90° and 110° tubes with 20 mm diameter necks.

A short ferrite ring is used with saddle wound line and toroidal wound field coils. Shift rings and a neck clamp assembly are provided.

These scan coils are for use in low voltage transistor deflection circuits.

To reduce raster distortion picture shape correction magnets may be placed on the pegs around the periphery of the plastic moulding.

## ELECTRICAL DATA

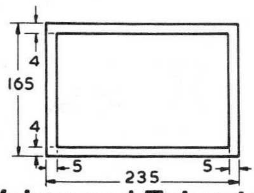
| | Tube Type | Anode Volts (kV) | X Axis | Y Axis | |
|---|---|---|---|---|---|
| Type of winding | | | Saddle | Toroidal | |
| Inductance at 1 kHz (Tol. X ± 5%, Y ± 8%) | | | 0.258 | 30 | mH |
| Resistance at 20°C (Tol. X ± 5%, Y ± 8%) | | | 0.55 | 16.7 | Ω |
| Deflection current, peak to peak, for full screen deflection | | | | | |
| | M14-100 | 10 | 3.6 | 0.36 | A |
| | M19-100 | 10 | 4.0 | 0.42 | A |
| | M23-110 | 10 | 4.1 | 0.42 | A |
| | M28-12 | 12 | 4.5 | 0.45 | A |
| | M31-120 | 11 | 5.1 | 0.53 | A |
| | M31-190 | 12 | 4.5 | 0.44 | A |
| | M38-160 | 13 | 5.5 | 0.56 | A |

Rectangularity between x and y traces $90° \pm 1.0°$

Suitable field and line scanning circuits are shown in TBK3 sheets.

Raster distortion

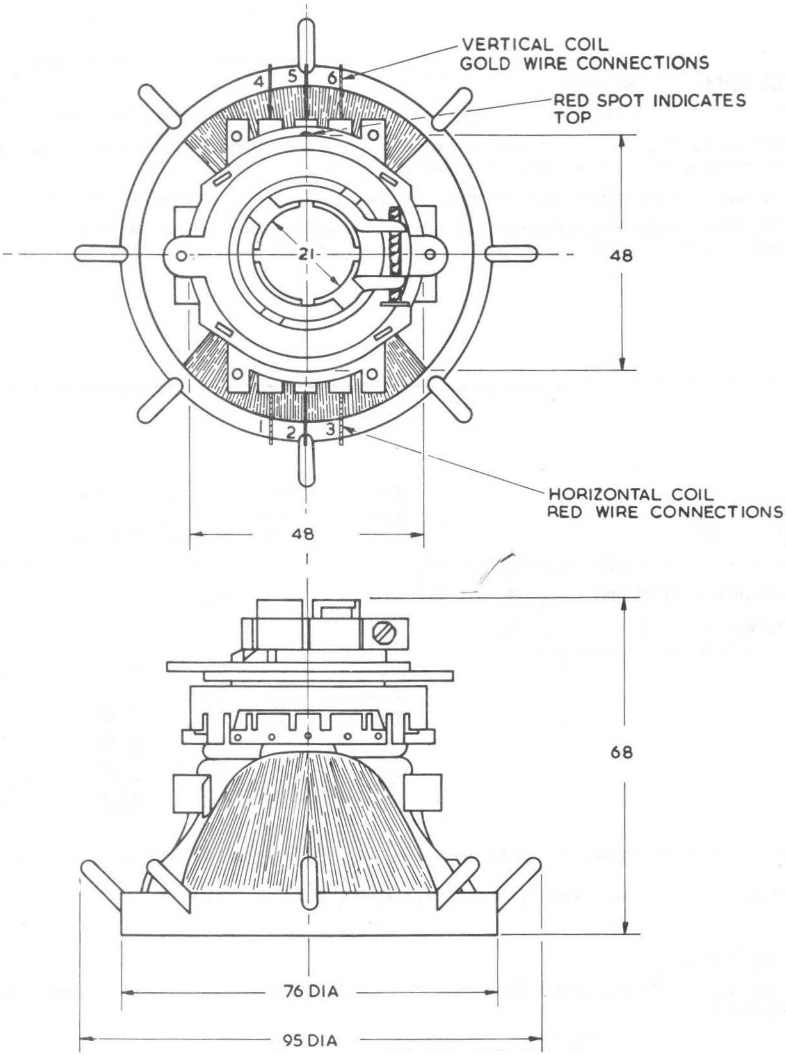
The edges of a test raster for M31-120.. can be contained between two concentric rectangles.




All dimensions in mm

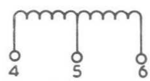
**Thorn Radio Valves and Tubes Limited**

BRIMAR

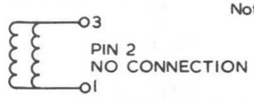



All dimensions in mm

Not to be scaled




VERTICAL COIL




HORIZONTAL COIL

# Deflection Component

# TBY5

**GENERAL** - SCAN COILS

Scan coils can be used for 70°, 90° and 110° tubes with 20 mm diameter necks.

A short ferrite ring is used with saddle wound line and toroidal wound field coils. Shift rings and a neck clamp assembly are provided.

These scan coils are for use in low voltage transistor deflection circuits. The TBY5 is a version of the TBY3 with a low impedance field winding to permit operation with an integrated circuit drive amplifier.

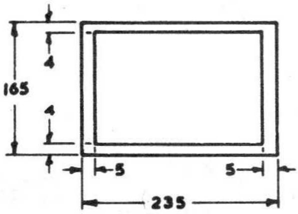
To reduce raster distortion picture shape correction magnets may be placed on the pegs around the periphery of the plastic moulding.

GRATICULES
GAUGES, BASES
& CAPS, SOCKETS
SCAN COILS

| **ELECTRICAL DATA** | Tube Type | Anode Volts (kV) | X Axis | Y Axis | |
|---|---|---|---|---|---|
| Type of winding | | | Saddle | Toroidal | |
| Inductance at 1 kHz (Tol. X ± 5%, Y ± 8%) | | | 0.258 | 7 | mH |
| Typical resistance at 20°C | | | 0.55 | 3.1 | Ω |
| Deflection current, peak to peak, for full screen deflection | M14-100 | 10 | 3.6 | 0.79 | A |
| | M19-100 | 10 | 4.0 | 0.91 | A |
| | M23-110 | 10 | 4.1 | 0.91 | A |
| | M28-12 | 12 | 4.5 | 0.97 | A |
| | M31-120 | 11 | 5.1 | 1.16 | A |
| | M31-190 | 12 | 4.5 | 0.97 | A |
| | M38-160 | 13 | 5.5 | 1.22 | A |
| Rectangularity between x and y traces | | | 90° ± 1.0° | | |

Raster distortion

The edges of a test raster for M31-120.. can be contained between two concentric rectangles.

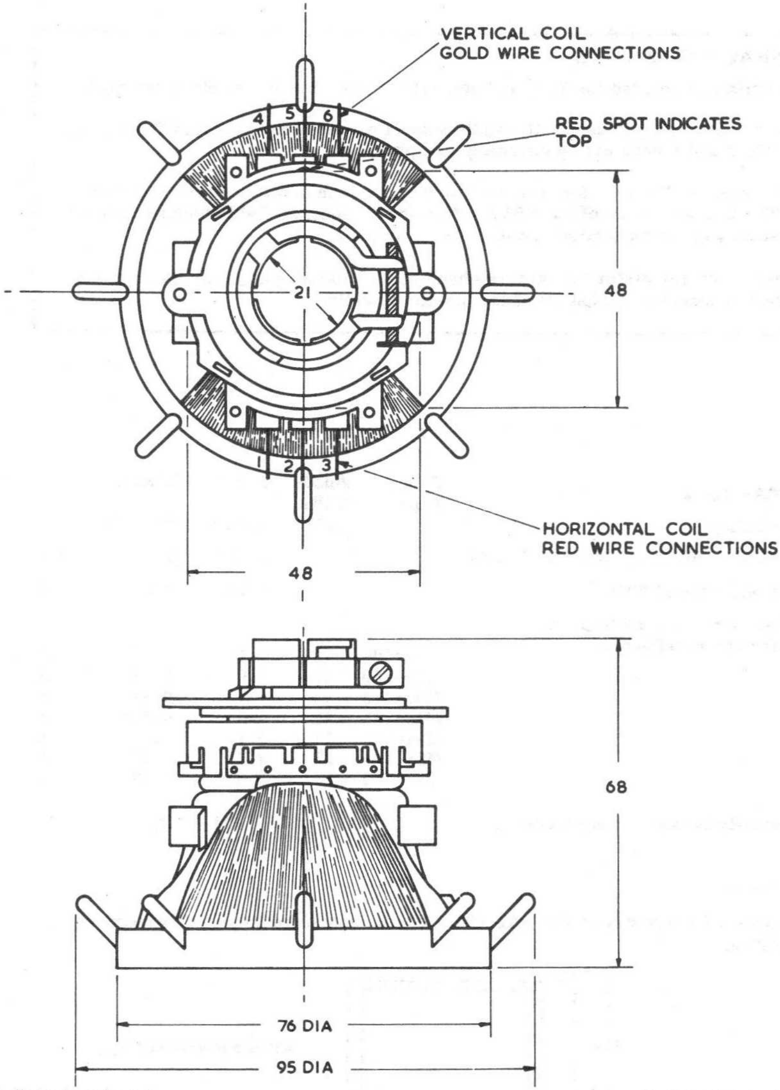



All dimensions in mm

**Thorn Radio Valves and Tubes Limited**

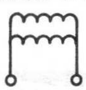


BRIMAR

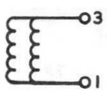



All dimensions in mm

Not to be scaled




VERTICAL COIL




PINS 2 AND 5
NO CONNECTION

HORIZONTAL COIL

# Deflection Component TBY7

PRELIMINARY DATA



**GENERAL** -SCAN COILS

Scan coils can be used for 70°, 90° and 110° tubes with 20 mm diameter necks.

A short ferrite ring is used with saddle wound line and toroidal wound field coils. Shift rings and a neck clamp assembly are provided.

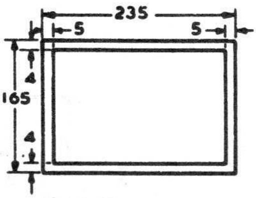
The reduce raster distortion picture shape correction magnets may be placed on the pegs around the periphery of the plastic moulding.

**ELECTRICAL DATA**

| | Tube Type | Anode Volts (kV) | X Axis | Y Axis | |
|---|---|---|---|---|---|
| Type of winding | | | Saddle | Toroidal | |
| Inductance at 1 kHz (Tol. X ± 5%, Y ± 8%) | | | 4.1 | 32 | mH |
| Resistance at 20°C (Tol. X ± 5%, Y ± 8%) | | | 8.8 | 16.0 | Ω |
| Deflection current, peak to peak, for full screen deflection | | | | | |
| | M14-100 | 10 | 0.9 | 0.4 | A |
| | M19-100 | 10 | 1.0 | 0.4 | A |
| | M23-110 | 10 | 1.0 | 0.4 | A |
| | M28-12 | 12 | 1.1 | 0.5 | A |
| | M31-120 | 11 | 1.3 | 0.5 | A |
| | M31-190 | 12 | 1.1 | 0.4 | A |
| | M38-160 | 13 | 1.4 | 0.6 | A |
| Rectangularity between x and y traces | | | 90° ± 1.0° | | |

**Raster distortion**

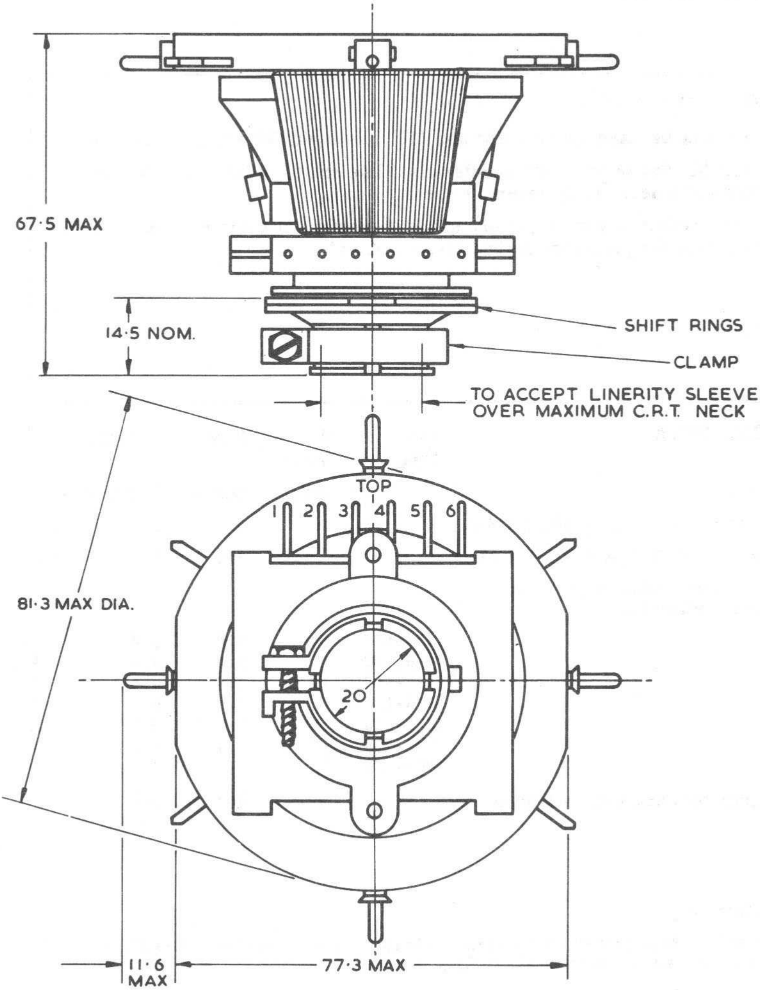
The edges of a test raster for nominal M31-120.. the corrected raster shape can be contained between two concentric rectangles.




All dimensions in mm

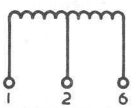
**Thorn Radio Valves and Tubes Limited**

BRIMAR

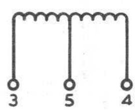



All dimensions in mm

Not to be scaled

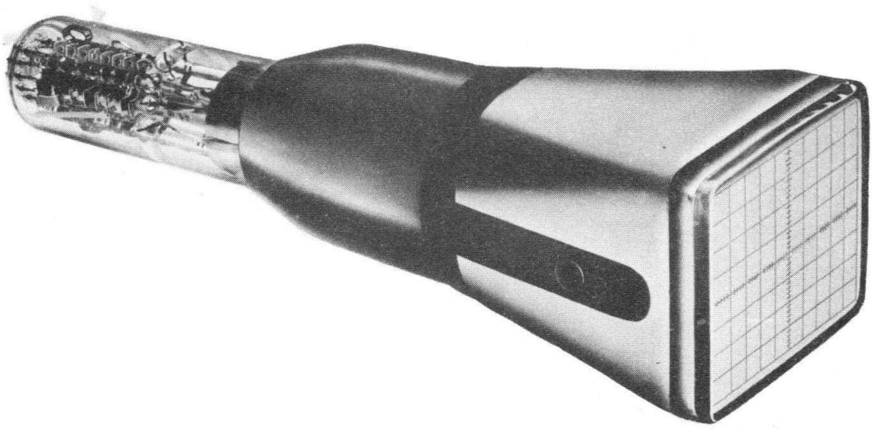



VERTICAL COIL




HORIZONTAL COIL

# OSCILLOSCOPE TUBES



The facilities and organisation provided by Thorn Radio Valves and Tubes Limited meet the requirements of the M.O.D. (P.E.) Defence Standard 05-21 and BS 9000.

**HEALTH AND SAFETY AT WORK ACT, 1974**

Attention is drawn to the recommendations under this heading in the Operational Recommendations.

**WARNING**

These tubes should be used in accordance with their published ratings, and in conformity with the Operational Recommendations of the company's data handbook. The company will not entertain claims for loss or damage where this advice has been disregarded.

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**Thorn Radio Valves and Tubes Limited**
Mollison Avenue · Brimsdown · Enfield · Middlesex EN3 7NS

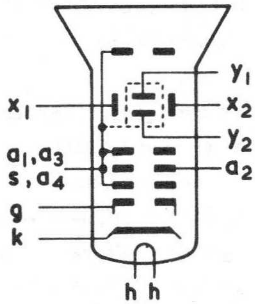
BRIMAR

# Instrument Tube D3-130..

## GENERAL

This 1 inch diameter low voltage instrument tube with electrostatic focus and deflection is for use as a general purpose indicating device.

| | | | |
|---|---|---|---|
| Heater voltage | $V_h$ | 6.3 | V |
| Heater current | $I_h$ | 0.3 | A |




## ABSOLUTE RATINGS

| | | Max | Min | |
|---|---|---|---|---|
| First, third and fourth anode voltage | $V_{a1+a3+a4}$ | 1.5 | | kV |
| Second anode voltage | $V_{a2}$ | 1.2 | - | kV |
| Negative grid voltage | $-V_g$ | 200 | 0 | V |
| Peak x plate to third anode voltage | $v_{x-a3(pk)}$ | 500 | - | V |
| Peak y plate to third anode voltage | $v_{y-a3(pk)}$ | 500 | - | V |
| Grid to cathode resistance | $R_{g-k}$ | 1.5 | - | MΩ |
| Average cathode current | $I_{k(av)}$ | 200 | - | μA |
| Heater to cathode voltage | $V_{h-k}$ | ± 125 | - | V |

All voltages referred to cathode unless otherwise stated.

**TUBE WEIGHT** (approximate) - 43 g

## PHOSPHOR SCREEN

This type is usually supplied with GH phosphor (D3-130GH) giving a green trace of medium short persistence. Other phosphor screens can be made available to special order.

OSCILLOSCOPE TUBES

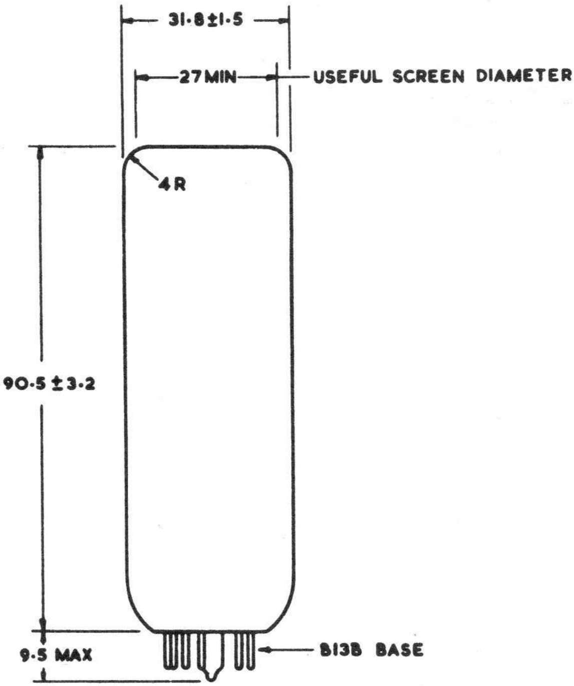
## INTER-ELECTRODE CAPACITANCES

| | | | |
|---|---|---|---|
| Cathode and heater to all | $c_{k,h-all}$ | 2.5 | pF |
| Grid to all | $c_{g-all}$ | 6.5 | pF |
| Grid to $x_1;x_2,y_1,y_2$ plates | $c_{g-x1,x2,y1,y2}$ | 1.9 | pF |
| $x_1$ plate to $x_2$ plate | $c_{x1-x2}$ | 1.1 | pF |
| $y_1$ plate to $y_2$ plate | $c_{y1-y2}$ | 0.4 | pF |
| $x_1$ plate to all, less $x_2$ plate | $c_{x1-all, less\ x2}$ | 3.0 | pF |
| $x_2$ plate to all, less $x_1$ plate | $c_{x2-all, less\ x1}$ | 3.0 | pF |
| $y_1$ plate to all, less $y_2$ plate | $c_{y1-all, less\ y2}$ | 3.0 | pF |
| $y_2$ plate to all, less $y_1$ plate | $c_{y2-all, less\ y1}$ | 2.7 | pF |
| $x_1,x_2$ to $y_1,y_2$ plates | $c_{x1,x2-y1,y2}$ | 0.3 | pF |

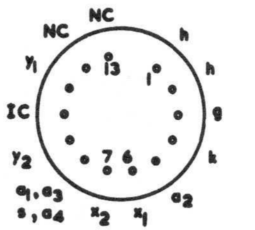
## TYPICAL OPERATION - voltages with respect to cathode

| | | | | |
|---|---|---|---|---|
| First, third and fourth anode voltage | $V_{a1+a3+a4}$ | 500 | 1000 | V |
| Mean deflector plate potential* | | 500 | 1000 | V |
| Second anode voltage for focus | $V_{a2}$ | 24 to 72 | 48 to 144 | V |
| Grid voltage for spot cut-off | $V_g$ | -10 to -24 | -20 to -48 | V |
| x deflection coefficient | $D_x$ | 40 to 60 | 80 to 120 | V/cm |
| y deflection coefficient | $D_y$ | 29 to 44 | 58 to 88 | V/cm |

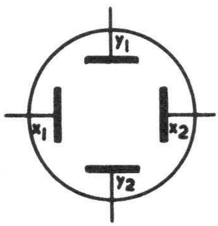
* This tube is designed for symmetrical operation.




OSCILLOSCOPE TUBES




VIEW FROM PINS FREE END
(PINS 6&7 AT BOTTOM)

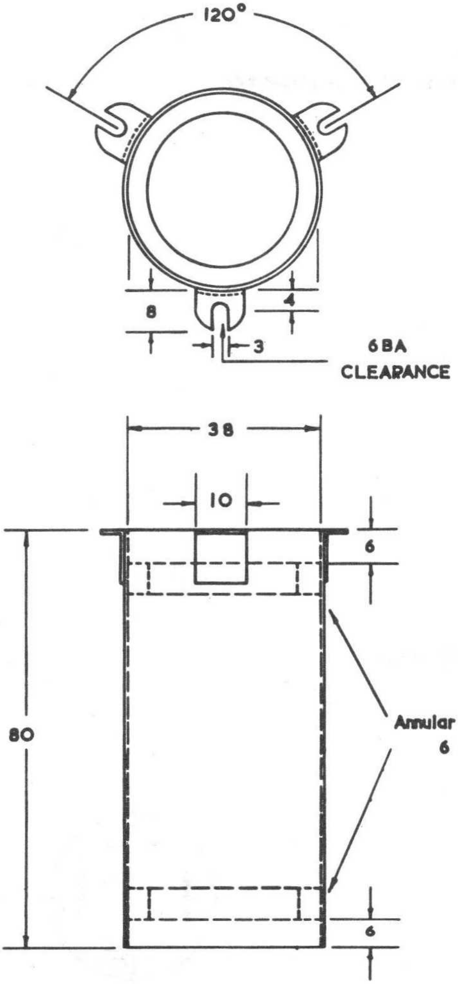



VIEW FROM SCREEN END
(PINS 6 & 7 AT BOTTOM)

All dimensions in mm

Not to be scaled

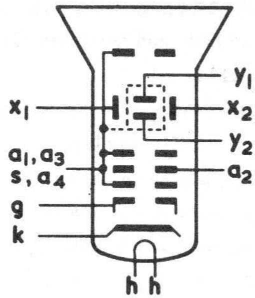
# Magnetic Shield MS2




MATERIAL 0·35 ±0·05 Mumetal
LUGS 0·8±0·05 Mild steel
FINISH Silver hammer outside (except on face of mounting backets)
PADS Soft sponge closed cell neoprene
METAL TOLERANCES ±0·5 Unless otherwise stated
Third angle projection
All dimensions in mm
Not to be scaled

# Oscilloscope Tube

# D7-200..




## GENERAL

This 3 inch diagonal rectangular oscilloscope tube is primarily intended for use in inexpensive oscilloscopes and monitoring devices. The tube has sufficient deflector sensitivity to permit transistor driven deflection.

| | | | |
|---|---|---|---|
| Heater voltage | $V_h$ | 6.3 | V |
| Heater current | $I_h$ | 0.3 | A |

## ABSOLUTE RATINGS

| | | Max | Min | | |
|---|---|---|---|---|---|
| First, third and fourth anode voltage | $V_{a1+a3+a4}$ | 2000 | | V | ← |
| Second anode voltage | $V_{a2}$ | 600 | - | V | |
| Negative grid voltage | $-V_g$ | 200 | 0 | V | |
| Peak x-plate to third anode voltage | $v_{x-a3(pk)}$ | 500 | - | V | |
| Peak y-plate to third anode voltage | $v_{y-a3(pk)}$ | 500 | - | V | |
| x-plate to third anode resistance | $R_{x-a3}$ | 2.0 | - | MΩ | |
| y-plate to third anode resistance | $R_{y-a3}$ | 2.0 | - | MΩ | |
| Grid to cathode resistance | $R_{g-k}$ | 1.5 | - | MΩ | |
| Average cathode current | $I_{k(av)}$ | 200 | - | µA | |
| Heater to cathode voltage | $V_{h-k}$ | ± 125 | - | V | |

All voltages referred to cathode unless otherwise stated.

**TUBE WEIGHT** (approximate) - 100 g

## PHOSPHOR SCREEN

This type is usually supplied with GH phosphor (D7-200GH) giving a green trace of medium short persistence. Other phosphors can be made available to special order. For optimum performance with W phosphor, the tube should be used as near the maximum final anode voltage as possible. ←

OSCILLOSCOPE TUBES

## INTER-ELECTRODE CAPACITANCES

| | | | |
|---|---|---|---|
| Cathode and heater to all | $c_{k,h-all}$ | 3.0 | pF |
| Grid to all | $c_{g-all}$ | 6.5 | pF |
| Grid to $x_1, x_2, y_1, y_2$ plates | $c_{g-x1,x2,y1,y2}$ | 1.0 | pF |
| $x_1$ plate to $x_2$ plate | $c_{x1-x2}$ | 0.5 | pF |
| $y_1$ plate to $y_2$ plate | $c_{y1-y2}$ | 1.3 | pF |
| $x_1$ plate to all, less $x_2$ plate | $c_{x1-all, less\ x2}$ | 3.0 | pF |
| $x_2$ plate to all, less $x_1$ plate | $c_{x2-all, less\ x1}$ | 3.0 | pF |
| $y_1$ plate to all, less $y_2$ plate | $c_{y1-all, less\ y2}$ | 3.0 | pF |
| $y_2$ plate to all, less $y_1$ plate | $c_{y2-all, less\ y1}$ | 3.0 | pF |
| $x_1, x_2$ to $y_1, y_2$ plates | $c_{x1,x2-y1,y2}$ | 0.3 | pF |

## TYPICAL OPERATION - voltages with respect to cathode

| | | | † | |
|---|---|---|---|---|
| First, third and fourth anode voltage | $V_{a1+a3+a4}$ | 1000 | 1800 | V |
| Mean deflector plate potential* | | 1000 | 1800 | V |
| Second anode voltage for focus | $V_{a2}$ | 65 to 200 | 115 to 355 | V |
| Grid voltage for spot cut-off (approx) | $V_g$ | -25 to -50 | -45 to -90 | V |
| x plate deflection coefficient | $D_x$ | 21 to 29 | 37 to 52 | V/cm |
| y plate deflection coefficient | $D_y$ | 25 to 35 | 45 to 63 | V/cm |
| Minimum useful screen area | | 5 by 4 | 5 by 4 | $cm^2$ |
| Line width at centre, measured by shrinking raster, at 25 $\mu$A cathode current | | 0.3 | 0.25 | mm |

* This tube is designed for symmetrical operation.

† Recommended for W phosphor.

## NOTES

Rectangularity of x and y traces 90° ± 3°.

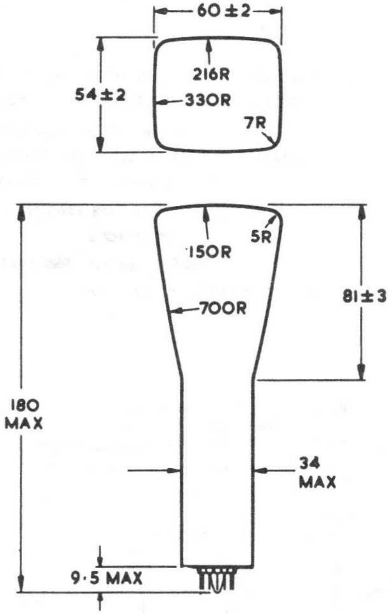
The horizontal trace will be parallel with the axis of the rectangular face-plate to within ± 3°.

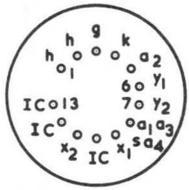
The undeflected focused spot will lie within an 8 mm diameter circle central to the tube face.

Adequate magnetic shielding is required and to avoid screen charging and hand effects it is recommended that the tube is operated with the final anodes at earthy potential.

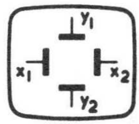
For critical requirements any residual astigmatism may be corrected by adjustment of the final anode to mean x-plate potential within the range ± 30V.

O453A




VIEW FROM PINS FREE END
(PIN 3 AT TOP)



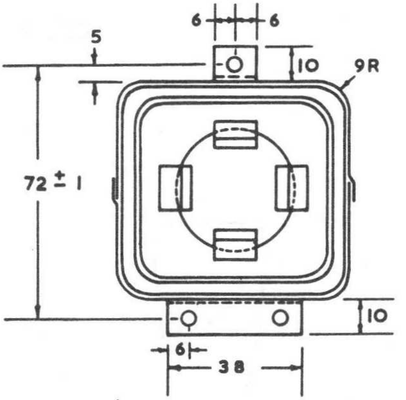

VIEW FROM SCREEN END
(PIN 3 AT TOP)

All dimensions in mm

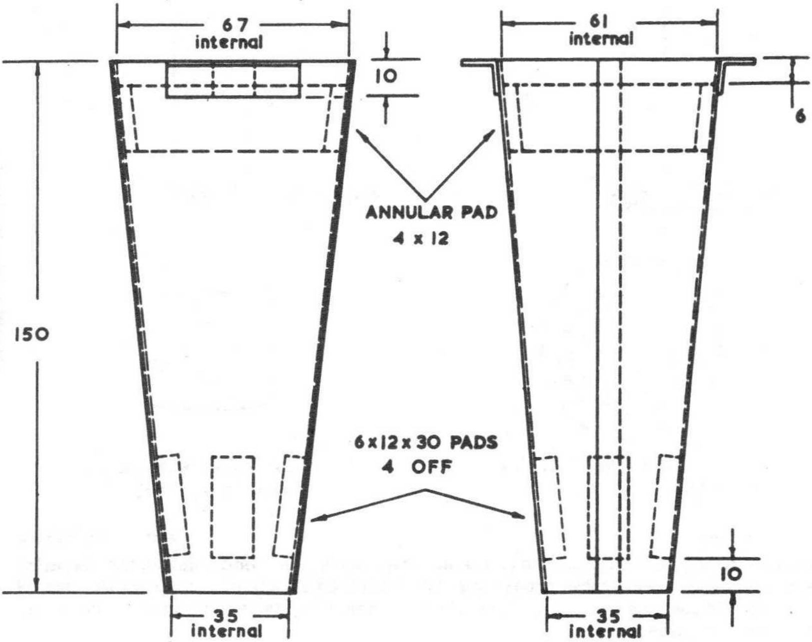
Not to be scaled

It is advisable to support the tube near the screen, and at a second point on the parallel neck near the base. The tube should not be subjected to any stress from the use of clamps and should not be suspended by the base. Connecting leads should not be soldered directly to the tube pins.

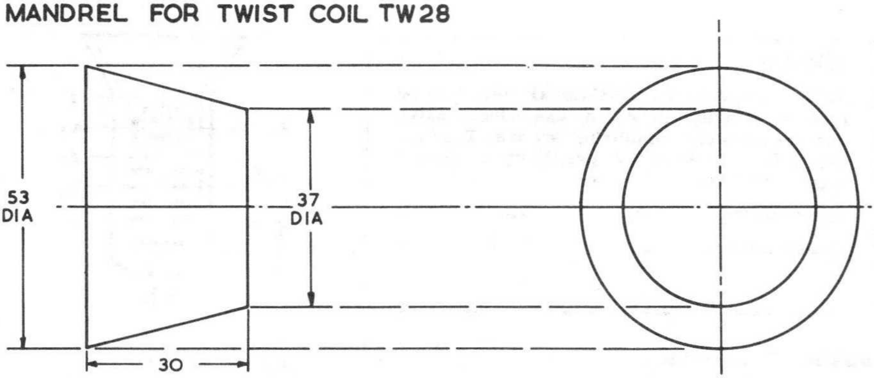
# Magnetic Shield MS3




SHIELD O·4 thick Mumetal
BRACKETS O·8 thick Mumetal drilled 4BA clearance
FINISH Matt black paint (except face of mounting brackets)
TOLERANCES ± O·4 on metalwork dimensions
PADS Soft Sponge Neoprene
All dimensions in mm



## MANDREL FOR TWIST COIL TW28




All dimensions in mm

Not to be scaled

SHIELD

This twist coil is designed to be used in conjunction with magnetic shield MS3 for D7-200..

WINDING

1200 turns of 0.080 mm Lewmex Grade 1 or 2 wire, or approved alternative, layer wound on the adhesive side of adhesive backed crepe paper to give 5 mm margins between the coil and each edge of the mandrel.
Start and finish of winding to be brought out on 450 mm long thin flexible lead wires from the smaller end of winding.
Varnish, if necessary, cover with adhesive backed crepe paper and ensure that the edges of the coil are sealed in place.



ELECTRICAL CHARACTERISTICS

Resistance approximately 600 Ω
Twist coefficient approximately 4mA/degree measured on a typical D7-200..tube with $V_{a1} = 2kV$.

FITTING

The completed twist coil should be pushed hard onto the tube, with the lead out wires at one corner. Secure to tube in two places with suitable adhesive tape.

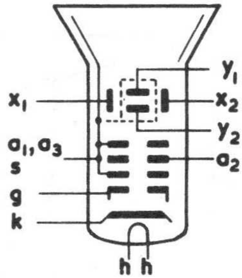
# D7-201..

# Oscilloscope Tube

## GENERAL

This 7 cm diagonal rectangular oscilloscope tube is primarily intended for use in inexpensive oscilloscopes and monitoring devices. The tube has sufficient deflector sensitivity to permit transistor driven deflection.

| | | | |
|---|---|---|---|
| Heater voltage | $V_h$ | 6.3 | V |
| Heater current | $I_h$ | 0.12 | A |




## ABSOLUTE RATINGS

| | | Max | Min | • |
|---|---|---|---|---|
| First and third anode voltage | $V_{a1+a3}$ | 2000 | 700 | V |
| Second anode voltage | $V_{a2}$ | 600 | - | V |
| Negative grid voltage | $-V_g$ | 200 | 1.0 | V |
| Peak x-plate to third anode voltage | $v_{x-a3(pk)}$ | 500 | - | V |
| Peak y-plate to third anode voltage | $v_{y-a3(pk)}$ | 500 | - | V |
| x-plate to third anode resistance | $R_{x-a3}$ | 2.0 | - | MΩ |
| y-plate to third anode resistance | $R_{y-a3}$ | 2.0 | - | MΩ |
| Grid to cathode resistance | $R_{g-k}$ | 1.5 | - | MΩ |
| Average cathode current | $I_{k(av)}$ | 200 | - | μA |
| Heater to cathode voltage | $V_{h-k}$ | ±125 | - | V |

All voltages referred to cathode unless otherwise stated.

**TUBE WEIGHT** (approximate) - 150 g

## PHOSPHOR SCREEN

This type is usually supplied with GH phosphor (D7-201GH) giving a green trace of medium short persistance. Other phosphors can be made available to special order.

This data should be read in conjunction with Brimar Operational and Safety Recommendations for Industrial Cathode Ray Tubes.

### INTER-ELECTRODE CAPACITANCES

| | | | |
|---|---|---|---|
| Cathode and heater to all | $c_{k,h-all}$ | 3.0 | pF |
| Grid to all | $c_{g-all}$ | 7.0 | pF |
| Grid to $x_1, x_2, y_1, y_2$ plates | $c_{g-x1,x2,y1,y2}$ | 1.0 | pF |
| $x_1$ plate to $x_2$ plate | $c_{x1-x2}$ | 1.2 | pF |
| $y_1$ plate to $y_2$ plate | $c_{y1-y2}$ | 1.1 | pF |
| $x_1$ plate to all, less $x_2$ plate | $c_{x1-all, less\ x2}$ | 3.0 | pF |
| $x_2$ plate to all, less $x_1$ plate | $c_{x2-all, less\ x1}$ | 3.0 | pF |
| $y_1$ plate to all, less $y_2$ plate | $c_{y1-all, less\ y2}$ | 3.0 | pF |
| $y_2$ plate to all, less $y_1$ plate | $c_{y2-all, less\ y1}$ | 3.0 | pF |
| $x_1, x_2$ to $y_1, y_2$ plates | $c_{x1,x2-y1,y2}$ | 0.3 | pF |

### TYPICAL OPERATION - voltages with respect to cathode

| | | | | |
|---|---|---|---|---|
| First and third anode voltage | $V_{a1+a3}$ | 1200 | 1800 | V |
| Mean deflector plate potential* | | 1200 | 1800 | V |
| Second anode voltage for focus | $V_{a2}$ | 80 to 250 | 115 to 355 | V |
| Grid voltage for spot cut-off | $V_g$ | -30 to -60 | -45 to -90 | V |
| x plate deflection coefficient | $D_x$ | 29 to 37 | 44 to 56 | V/cm |
| y plate deflection coefficient | $D_y$ | 14 to 18 | 21 to 28 | V/cm |
| Minimum useful screen area | | 5 by 4 | 5 by 4 | $cm^2$ |
| Line width at centre, measured by shrinking raster, at 10 $\mu$A beam current | | 0.24 | 0.20 | mm |
| Grid drive to 10 $\mu$A beam current | | 18 | 17 | V |

### NOTES

The undeflected focused spot will lie within an 8 mm diameter circle central to the tube face.

Raster distortion : the edges of a test raster will fall between two concentric rectangles 5 cm x 4 cm and 4.85 cm x 3.88 cm.

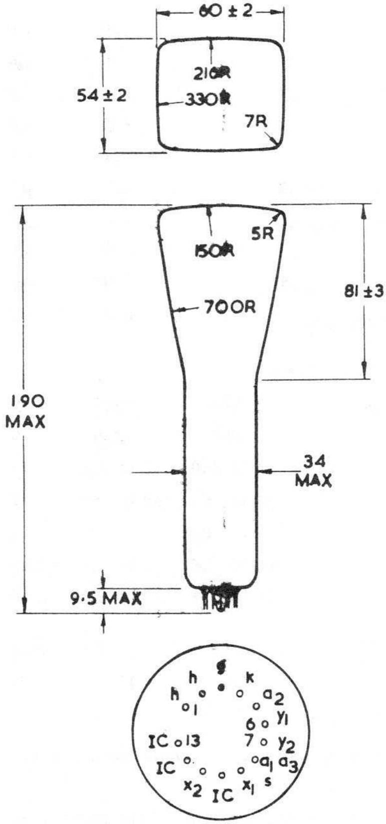
Rectangularity of x and y traces 90° ± 1.5°.

The horizontal trace will be parallel with the major axis of the rectangular face-plate to within ± 3°.

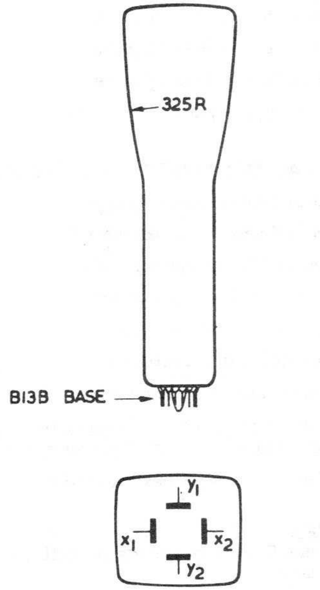
For critical requirements any residual astigmatism may be corrected by adjustment of the final anode to mean x-plate potential within the range ± 30V.

Adequate magnetic shielding is required and to avoid screen charging and hand effects it is recommended that the tube is operated with the final anodes at earthy potential.

* This tube is designed for symmetrical operation.




VIEW FROM PINS FREE END
(PIN 3 AT TOP)




VIEW FROM SCREEN END
(PIN 3 AT TOP)

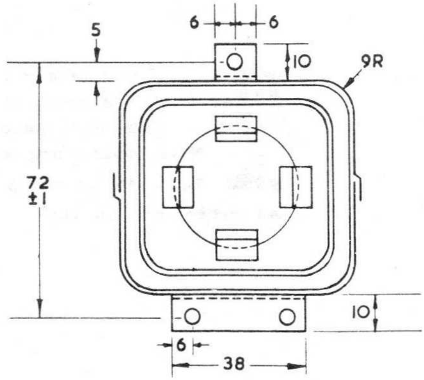
All dimensions in mm                                                    Not to be scaled

It is advisable to support the tube near the screen, and at a second point on the parallel neck near the base. The tube should not be subjected to any stress from the use of clamps and should not be suspended by the base. Connecting leads should not be soldered directly to the tube pins.

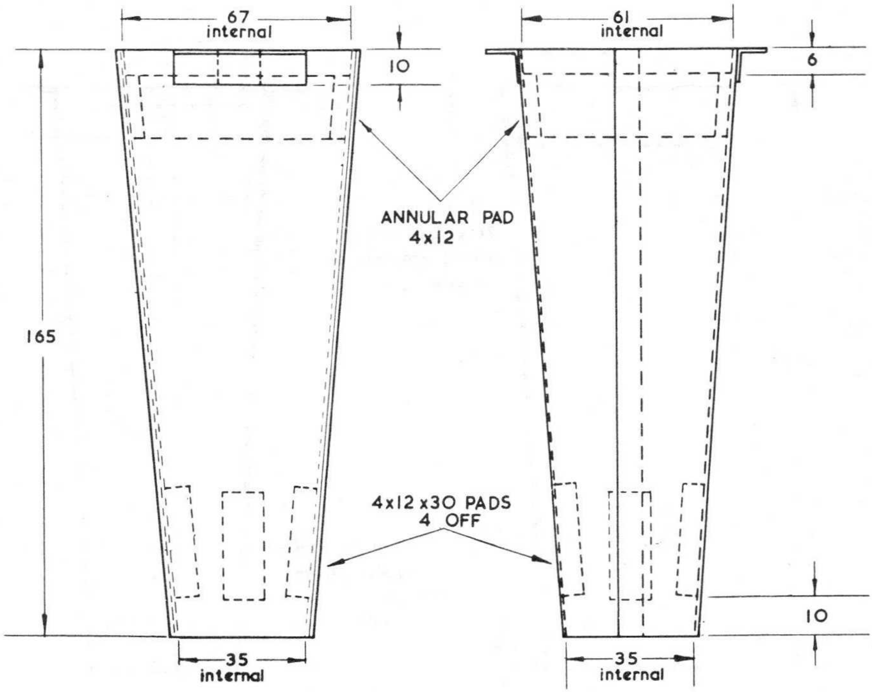
Tolerance on base pin 3 position with respect to minor axis of the rectangular face-plate ± 5°.

# Magnetic Shield MS33

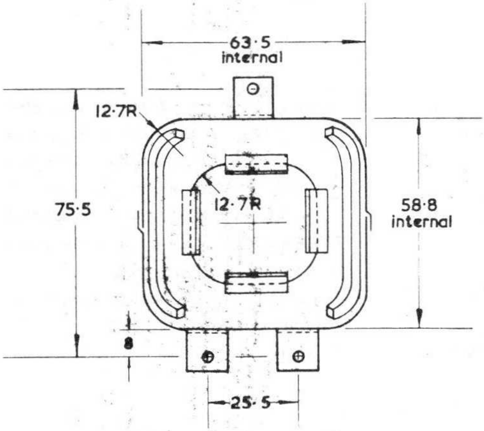





SHIELD  0·4 thick Mumetal
BRACKETS  0·8 thick Mumetal drilled 4BA clearance
FINISH  Matt black paint (except face of mounting brackets)
TOLERANCES ± 0·4 on metalwork dimensions
PADS  Soft Sponge Neoprene
All dimensions in mm



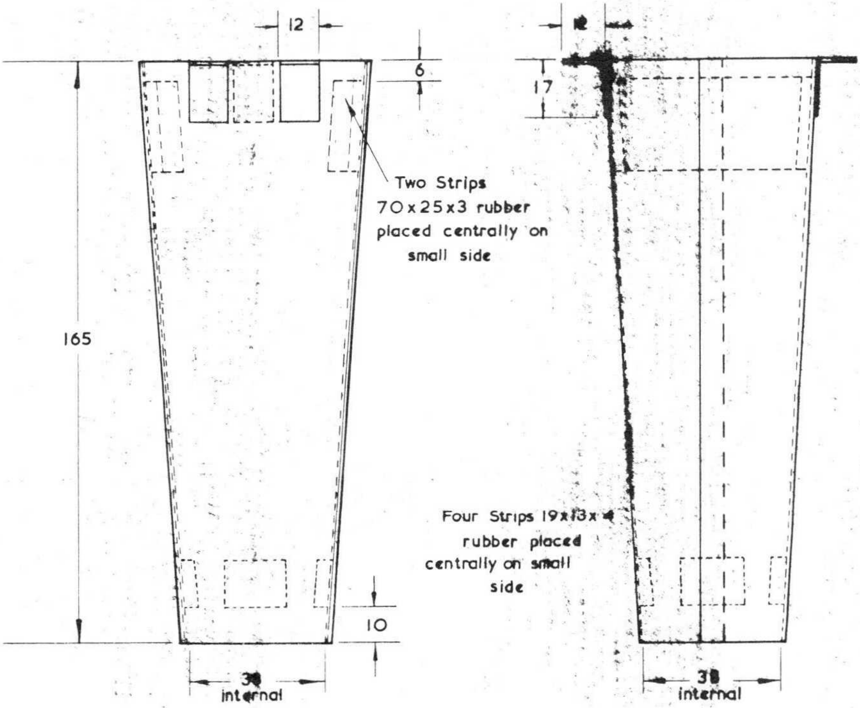
# Magnetic Shield MS34



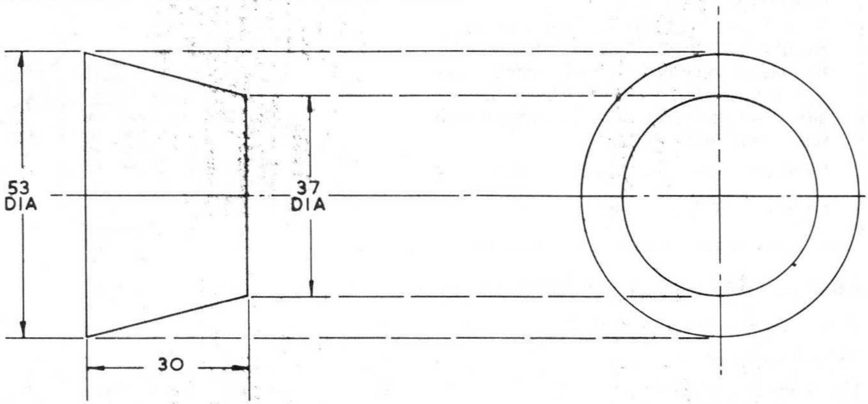

| | |
|---|---|
| SHIELD | 0·4 Mumetal |
| BRACKETS | 1·2 mild steel |
| FINISH | Matt black inside |
| | Silver hammer outside |

METAL TOLERANCES ± 0·5

All dimensions in mm



MANDREL FOR TWIST COIL TW28




All dimensions in mm

Not to be scaled

SHIELD

This twist coil is designed to be used in conjunction with magnetic shield MS33 for D7-201..

WINDING

1200 turns of 0.080 mm Lewmex Grade 1 or 2 wire, or approved alternative, layer wound on the adhesive side of adhesive backed crepe paper to give 5 mm margins between the coil and each edge of the mandrel.
Start and finish of winding to be brought out on 450 mm long thin flexible lead wires from smaller end of winding.
Varnish, if necessary, cover with adhesive backed crepe paper and ensure that the edges of the coil are sealed in place.

ELECTRICAL CHARACTERISTICS

Resistance approximately 600Ω
Twist coefficient approximately 4mA/degree measured on a typical D7-201.. tube with $V_{a1}$ = 2kV.

FITTING

The completed twist coil should be pushed hard onto the tube, with the lead out wires at one corner. Secure to tube in two places with suitable adhesive tape.

OSCILLOSCOPE TUBES

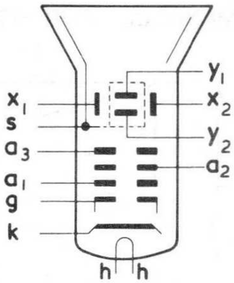
# D9-110..

# Oscilloscope Tube

## GENERAL

This 9 cm diagonal rectangular short oscilloscope tube is primarily intended for use in inexpensive oscilloscopes and monitoring devices. The tube has sufficient deflector sensitivity to permit transistor drive deflection.

| | | | |
|---|---|---|---|
| Heater voltage | $V_h$ | 6.3 | V |
| Heater current | $I_h$ | 0.12 | A |




## ABSOLUTE RATINGS - voltages with respect to cathode

| | | Max | Min | |
|---|---|---|---|---|
| First anode voltage | $V_{a1}$ | 2200 | 800 | V |
| Second anode voltage | $V_{a2}$ | 800 | - | V |
| Third anode voltage | $V_{a3}$ | 2250 | 750 | V |
| Negative grid voltage | $-V_g$ | 200 | 1.0 | V |
| Peak x-plate to third anode voltage | $v_{x-a3(pk)}$ | 500 | - | V |
| Peak y-plate to third anode voltage | $v_{y-a3(pk)}$ | 500 | - | V |
| Heater to cathode voltage | $V_{h-k}$ | ± 125 | | V |
| x-plate to third anode resistance | $R_{x-a3}$ | 2.0 | - | MΩ |
| y-plate to third anode resistance | $R_{y-a3}$ | 2.0 | - | MΩ |
| Grid to cathode resistance | $R_{g-k}$ | 1.5 | - | MΩ |
| Peak cathode current | $i_{k(pk)}$ | 500 | - | μA |

## PHOSPHOR SCREEN

This tube is usually supplied with GH phosphor (D9-110GH) giving a green trace of medium short persistence. Other phosphors can be made available to special order.

This data should be read in conjunction with Brimar Operational and Safety Recommendations for Industrial Cathode Ray Tubes.

## INTER-ELECTRODE CAPACITANCES

| | | | |
|---|---|---|---|
| Grid 1 to all | $c_{g1-all}$ | 5.5 | pF |
| Heater and cathode to all | $c_{h,k-all}$ | 3.8 | pF |
| $x_1$ plate to $x_2$ plate | $c_{x1-x2}$ | 1.2 | pF |
| $y_1$ plate to $y_2$ plate | $c_{y1-y2}$ | 1.4 | pF |
| $x_1$ plate to all, less $x_2$ plate | $c_{x1-all, less\ x2}$ | 4.2 | pF |
| $x_2$ plate to all, less $x_1$ plate | $c_{x2-all, less\ x1}$ | 4.0 | pF |
| $y_1$ plate to all, less $y_2$ plate | $c_{y1-all, less\ y2}$ | 3.4 | pF |
| $y_2$ plate to all, less $y_1$ plate | $c_{y2-all, less\ y1}$ | 3.4 | pF |
| $x_1$, $x_2$ plates to $y_1$, $y_2$ plates | $c_{x1,x2-y1,y2}$ | 0.8 | pF |

## TYPICAL OPERATION - voltages with respect to cathode.

| | | | | |
|---|---|---|---|---|
| Mean deflector plate potential* | | 1500 | 2000 | V |
| Third anode voltage for optimum astigmatism correction | $V_{a3}$ | 1500† | 2000† | V |
| Second anode voltage for optimum focus | $V_{a2}$ | 230 to 380 | 300 to 510 | V |
| First anode voltage | $V_{a1}$ | 1500 | 2000 | V |
| Shield voltage for optimum raster shape | $V_s$ | 1500† | 2000† | V |
| Control grid voltage for cut-off | $V_{g1}$ | -30 to -65 | -40 to -87 | V |
| x deflection coefficient | $D_x$ | 21 to 26 | 28 to 34.8 | V/cm |
| y deflection coefficient | $D_y$ | 9.6 to 12 | 12.8 to 16 | V/cm |
| Minimum useful screen area | | 6.6 x 4.0 | 6.6 x 4.0 | $cm^2$ |
| Grid drive to 10 μA beam current | | 13 | 13 | V |
| Line width at 10 μA beam current<br>Shrinking raster measurement at centre | | 0.31 | 0.27 | mm |

* This tube is designed for symmetrical operation.

† The required voltage will not differ from the quoted value by more than ± 50V.

OSCILLOSCOPE TUBES

## RASTER DISTORTION AND ALIGNMENT

The undeflected spot will fall in a circle of 5 mm radius about the centre of the tube face.

Raster distortion: the edges of a test raster will fall between two concentric rectangles 6.6 cm x 4.0 cm and 6.46 cm x 3.88 cm.

Rectangularity of x and y axes is 90° ± 1°.

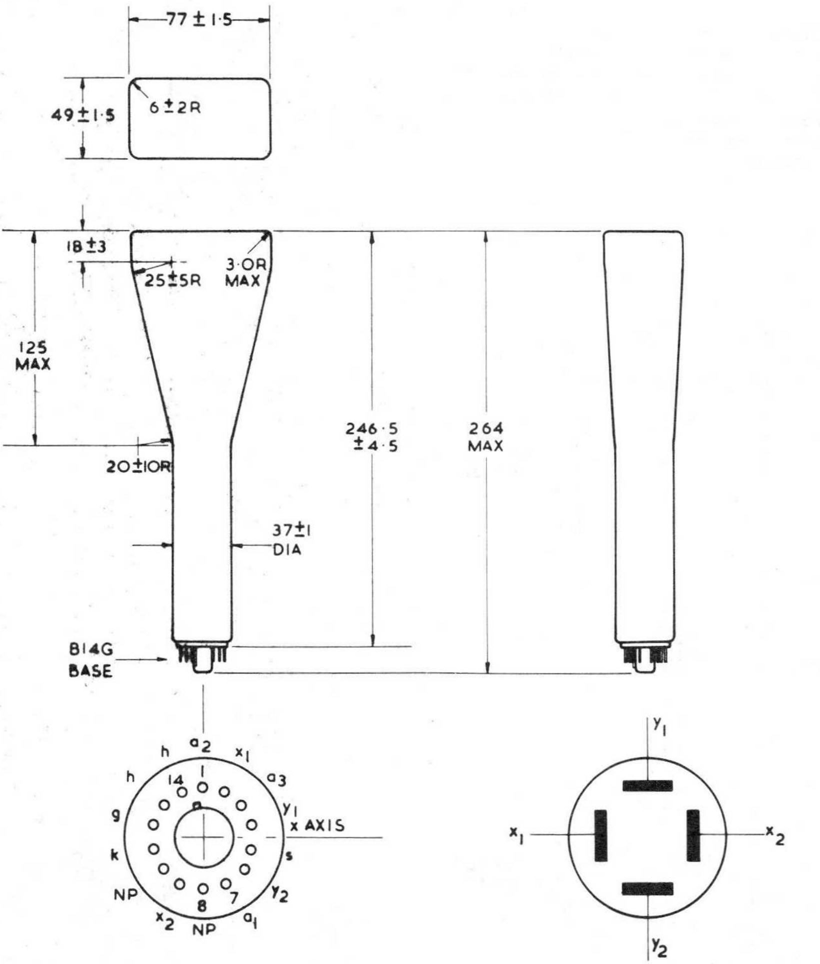
It is preferable that the mean x and y plate potentials are equal otherwise some deterioration in performance will occur. The mean y plate potential should never differ from the mean x plate potential by more than 50V.

## MAGNETIC SHIELDING

Adequate magnetic shielding is required. In addition due attention should be paid to the position of the tube relative to transformers and chokes.

**TUBE WEIGHT** (approximate) 600 g

**MOUNTING POSITION** - unrestricted.




VIEWED FROM PINS FREE END (PIN 1 AT TOP)

VIEWED FROM SCREEN END (PIN 1 AT TOP)

All dimensions in mm

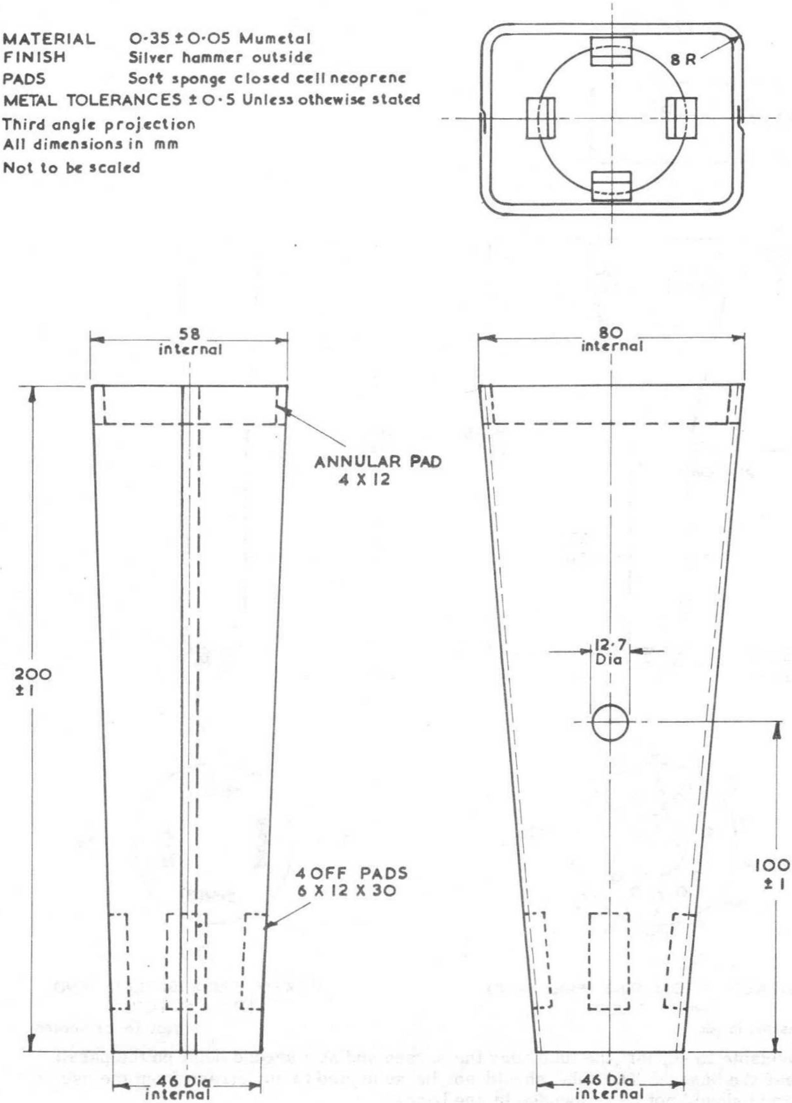
Not to be scaled

It is advisable to support the tube near the screen and at a second point on the parallel neck near the base. The tube should not be subjected to any stress from the use of clamps and should not be suspended by the base.

Tolerance on base pin 1 position with respect to tube y axis ± 5°

# Magnetic Shield MS65

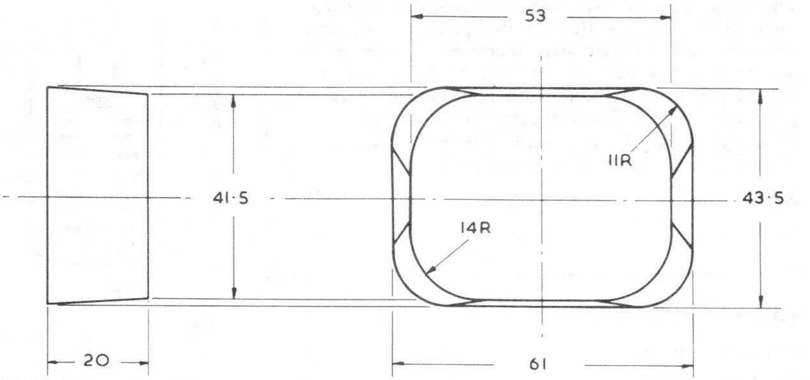
MATERIAL 0·35 ± 0·05 Mumetal
FINISH Silver hammer outside
PADS Soft sponge closed cell neoprene
METAL TOLERANCES ± 0·5 Unless othewise stated
Third angle projection
All dimensions in mm
Not to be scaled






BRIMAR

MANDREL FOR TWIST COIL TW50




MANDREL

Shaped from wood to dimensions given above.

SHIELD

This twist coil is designed to be used in conjunction with magnetic shield MS 65 for D9-110..

WINDING

1000 turns of 0.14 mm Lewmex Grade 1 or 2 wire, or approved alternative, layer wound on the adhesive side of adhesive backed crepe paper to give 5 mm margins between the coil and each edge of the mandrel.
Start and finish of winding to be brought out on 450 mm long thin flexible lead wires from smaller end of winding.
Varnish, if necessary, cover with adhesive backed crepe paper and ensure that the edges of the coil are sealed in place.

ELECTRICAL CHARACTERISTICS

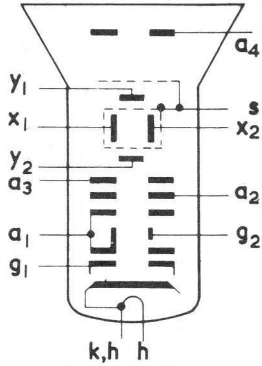
Resistance approx. 210 Ω. Current required for ± 5° twist is ± 20 mA measured on a typical D9-110.. with $V_{a1}$ = 2.0 kV.

FITTING

The completed twist coil should be pushed onto the tube from the base end as far as it will travel and fastened with adhesive tape.

OSCILLOSCOPE TUBES

# D10-210..  Oscilloscope Tube




**GENERAL**

This is a very short 7 x 5 cm$^2$ rectangular tube with high deflection sensitivity designed for general purpose and portable oscilloscopes. The mesh p.d.a. system allows the tube to be transistor driven for medium bandwidth applications without additional electrode voltages. A means of beam blanking at anode potential which avoids d.c. coupling to the grid is incorporated.

| | | | |
|---|---|---|---|
| Heater voltage | $V_h$ | 11 | V |
| Heater current | $I_h$ | 75 | mA |

## ABSOLUTE RATINGS

| | | Max | Min | |
|---|---|---|---|---|
| Fourth anode voltage | $V_{a4}$ | 10 | 5.0 | kV |
| Third anode voltage | $V_{a3}$ | 1.25 | 0.5 | kV |
| Second anode voltage | $V_{a2}$ | 1.0 | 0 | kV |
| First anode voltage | $V_{a1}$ | 1.25 | 0.5 | kV |
| Negative control grid voltage | $-V_{g1}$ | 200 | 1.0 | V |
| Beam blanking voltage | $V_{g2}$ | 2.0 | 0.5 | kV |
| Peak x plate to third anode voltage | $v_{x-a3(pk)}$ | 500 | - | V |
| Peak y plate to third anode voltage | $v_{y-a3(pk)}$ | 500 | - | V |
| x plate to third anode resistance | $R_{x-a3}$ | 5.0 | - | MΩ |
| y plate to third anode resistance | $R_{y-a3}$ | 100 | - | kΩ |
| Control grid to cathode resistance | $R_{g1-k}$ | 1.5 | - | MΩ |
| Second anode current | $I_{a2}$ | 10 | - | μA |
| P.D.A. ratio ($V_{a4}/V_{a3}$) | | 10:1 | - | |

All voltages referred to cathode unless otherwise stated.

## PHOSPHOR SCREEN

This type is usually supplied with GH phosphor (D10-210GH) giving a green trace of medium short persistence. Other phosphors can be made available to special order.

**Thorn Radio Valves and Tubes Limited**

BRIMAR

**INTER-ELECTRODE CAPACITANCES**

| | | | |
|---|---|---|---|
| Grid 1 to all | $c_{g1\text{-all}}$ | 10 | pF |
| Grid 2 to all | $c_{g2\text{-all}}$ | 11 | pF |
| Grid 2 to Grid 1 | $c_{g2\text{-}g1}$ | 0.7 | pF |
| Grid 1 to $x_1$, $x_2$, $y_1$ and $y_2$ plates | $c_{g1\text{-}x1,x2,y1,y2}$ | 1.2 | pF |
| Heater and cathode to all | $c_{h,k\text{-all}}$ | 3.5 | pF |
| $x_1$ plate to $x_2$ plate | $c_{x1\text{-}x2}$ | 1.9 | pF |
| $y_1$ plate to $y_2$ plate | $c_{y1\text{-}y2}$ | 0.9 | pF |
| $x_1$ plate to all, less $x_2$ plate | $c_{x1\text{-all, less }x2}$ | 5.7 | pF |
| $x_2$ plate to all, less $x_1$ plate | $c_{x2\text{-all, less }x1}$ | 5.7 | pF |
| $y_1$ plate to all, less $y_2$ plate | $c_{y1\text{-all, less }y2}$ | 5.4 | pF |
| $y_2$ plate to all, less $y_1$ plate | $c_{y2\text{-all, less }y1}$ | 5.1 | pF |
| $x_1$, $x_2$ plates to $y_1$, $y_2$ plates | $c_{x1,x2\text{ - }y1,y2}$ | 0.4 | pF |

**TYPICAL OPERATION** - voltages with respect to cathode

| | | | | |
|---|---|---|---|---|
| Fourth anode voltage | $V_{a4}$ | 6.0 | 10 | kV |
| Mean deflector plate potential | | 600 | 1000 | V |
| Third anode voltage for optimum astigmatism correction | $V_{a3}$ | 475 to 600 | 875 to 1000 | V |
| Second anode voltage for optimum focus | $V_{a2}$ | 100 to 220 | 160 to 380 | V |
| First anode voltage | $V_{a1}$ | 600 | 1000 | V |
| Shield voltage for optimum raster shape | $V_s$ | 600 to 725 | 1000 to 1125 | V |
| Beam blanking voltage for cut-off | $V_{g2}$ | 550† | 920† | V |
| Control grid voltage for cut-off | $V_{g1}$ | -30 to -55 | -50 to -90 | V |
| x plate deflection coefficient | $D_x$ | 11.2 to 13.8 | 18.6 to 23 | V/cm |
| y plate deflection coefficient | $D_y$ | 8.0 to 10 | 13.4 to 16.6 | V/cm |
| Minimum screen area | | 7 x 5 | 7 x 5 | $cm^2$ |
| Line width at centre (at 5μA beam current) | | 0.65 | 0.6 | mm |
| Line width at edge (at 5μA beam current) | | 1.0 | 0.95 | mm |
| Line width at centre measured by shrinking raster (at 5μA beam current) | | 0.35 | 0.32 | mm |

† The beam is unblanked when $V_{g2} = V_{a1}$. This grid 2 electrode should not be used as a brilliance control.

## RASTER DISTORTION AND ALIGNMENT

The undeflected spot will fall in a circle 5 mm radius from the geometric centre of the tube face.

The total scanned area is 7 cm x 5 cm measured about a point ± 3 mm from the centre of the tube face. The edges of a test raster will fall between two concentric rectangles 7 cm x 5 cm and 6.75 cm x 4.8 cm.

Rectangularity of x and y axes is 90° ± 1°. The horizontal trace will be parallel with the axis of the rectangular face-plate to within ± 5°. A twist coil will be required to effect accurate alignment. This should be mounted inside the magnetic shield and should not extend more than 100 mm from the face. 40 ampere turns will suffice with provision for reversing the current if necessary.

The deflection coefficient (for both x and y plates) at 75% deflection of the useful scan shall not differ by more than 2% from the deflection coefficient over 10% deflection.

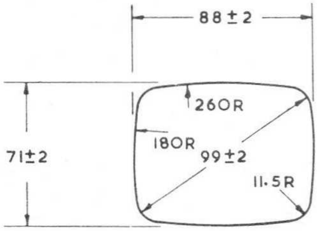
It is preferable that the mean x and y plate potentials are equal otherwise some deterioration in performance will occur. Under no circumstances should the mean y plate potential differ from the mean x plate potential by more than 50 V.

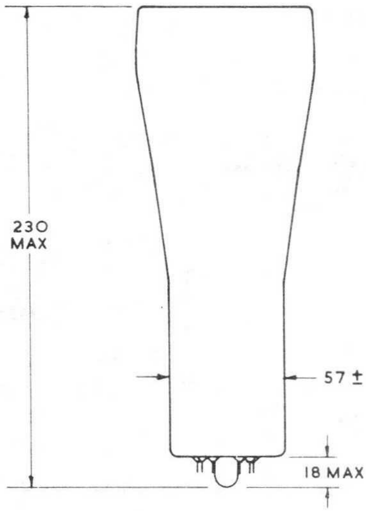
## MAGNETIC SHIELDING

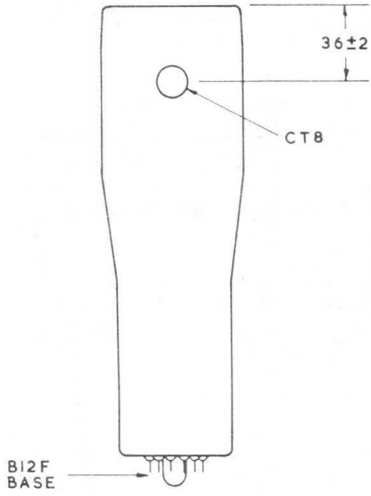
Adequate magnetic shielding is required. In addition due attention should be paid to the position of the tube relative to transformers and chokes.

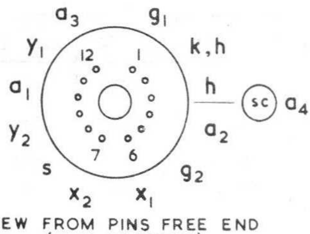
**TUBE WEIGHT** (approximate) - 500 g

**MOUNTING POSITION** - unrestricted

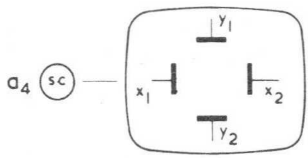



VIEW FROM PINS FREE END
(CT8 AT RIGHT)

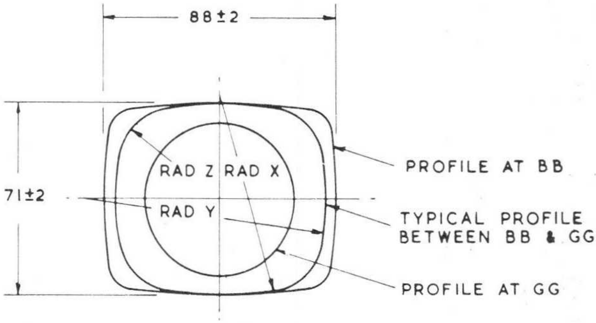


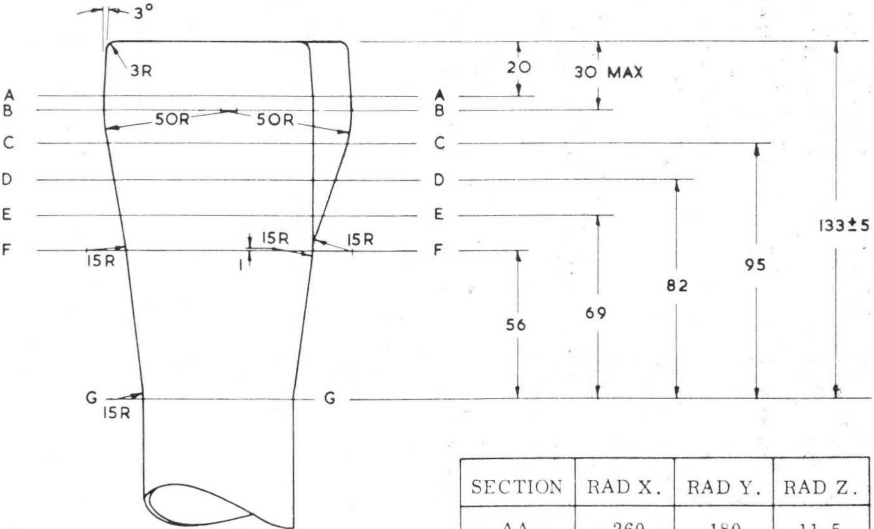

VIEWED FROM SCREEN END
(CT8 AT LEFT)

All dimensions in mm

Not to be scaled

It is advisable to support the tube near the screen, and at a second point on the parallel neck near the base. The tube should not be subjected to any stress from the use of clamps and should not be suspended by the base. Connecting leads should not be soldered directly to the tube pins.



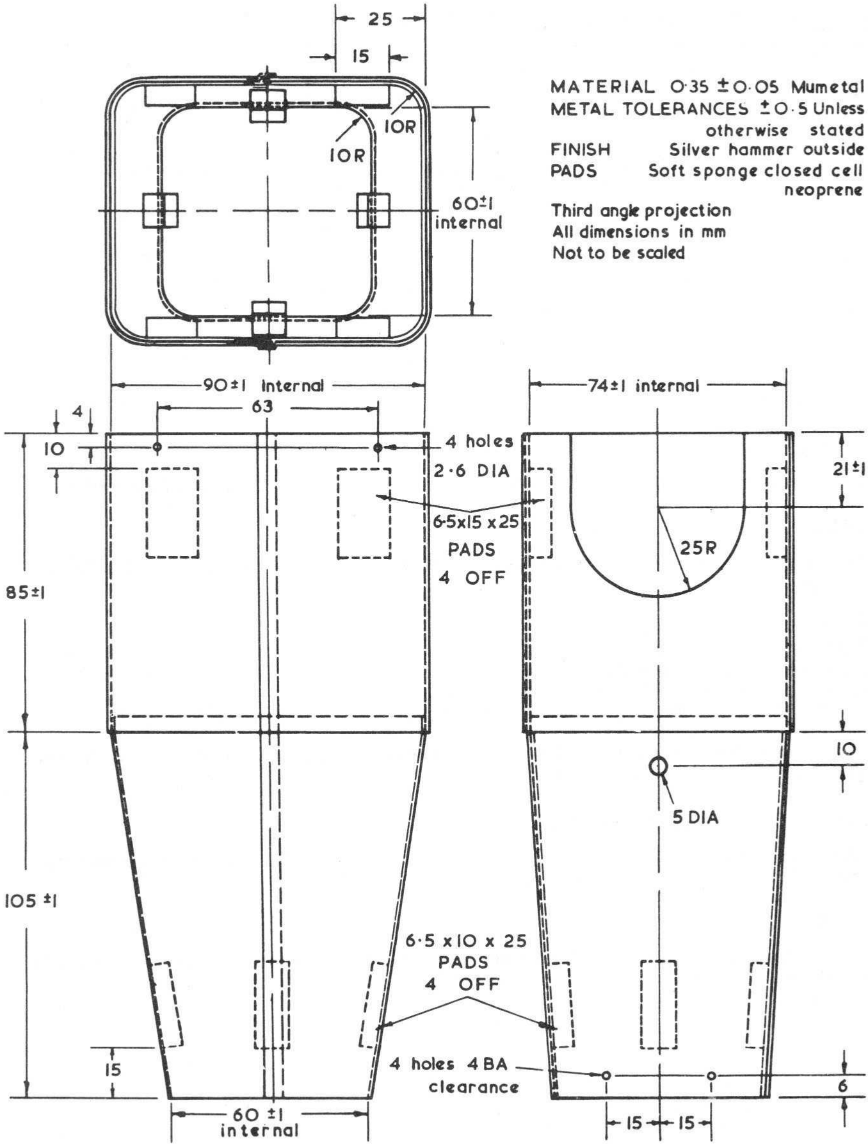




| SECTION | RAD X. | RAD Y. | RAD Z. |
|---|---|---|---|
| AA | 260 | 180 | 11.5 |
| BB | 260 | 180 | 11.5 |
| CC | 220 | 140 | 15.4 |
| DD | 159 | 91 | 22.3 |
| EE | 116 | 55.2 | 30.1 |
| FF | 35.5 | 35.5 | 35.5 |
| GG | 28.5 | 28.5 | 28.5 |

# Magnetic Shield MS6



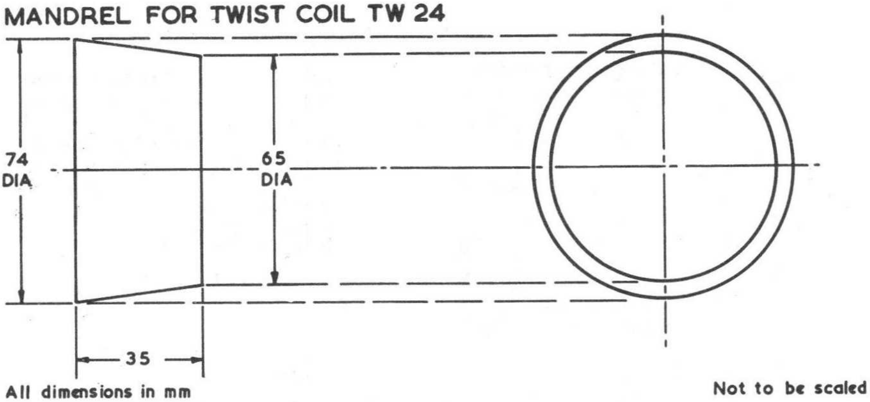
MATERIAL 0·35 ±0·05 Mumetal
METAL TOLERANCES ±0·5 Unless otherwise stated
FINISH Silver hammer outside
PADS Soft sponge closed cell neoprene
Third angle projection
All dimensions in mm
Not to be scaled




OSCILLOSCOPE TUBES



BRIMAR




MANDREL

Shaped from wood in the form of a truncated circular cone, dimensions as above.

SHIELD

This twist coil is designed to be used in conjunction with magnetic shield MS6 for D10-210..

WINDING ←

900 turns of 0.125 mm Lewmex Grade 1 or 2 wire, or approved alternative, layer wound on the adhesive side of adhesive backed crepe paper to give 5 mm margins between the coil and each edge of the mandrel.
Start and finish of winding to be brought out on 450 mm long thin flexible lead wires from smaller end of winding.
Varnish, if necessary, cover with adhesive backed crepe paper and ensure that the edges of the coil are sealed in place.

ELECTRICAL CHARACTERISTICS

Resistance approx. 270 Ω. Twist coefficient approximately 5.5 mA/degree measured on typical D10-210.. with $V_{a4}$ = 10 kV and $V_{a1}$ = 1.0 kV.

FITTING

The completed twist coil should be pushed hard onto the tube with the lead-out wires in the middle of the short side of the tube on the same side as the cavity cap and sealed to the tube with suitable adhesive tape.

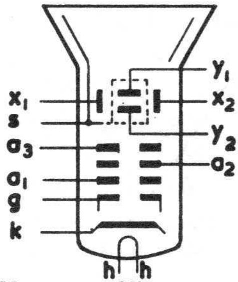
# Oscilloscope Tube

# D10-230..

## GENERAL

This 10 cm diameter short oscilloscope tube is primarily intended for use in inexpensive oscilloscopes and monitoring devices. The tube has sufficient deflector sensitivity to permit transistor driven deflection.

| | | | |
|---|---|---|---|
| Heater voltage | $V_h$ | 6.3 | V |
| Heater current | $I_h$ | 0.3 | A |




## ABSOLUTE RATINGS - voltages with respect to cathode

| | | Max | Min | |
|---|---|---|---|---|
| First anode voltage | $V_{a1}$ | 2200 | 800 | V |
| Second anode voltage | $V_{a2}$ | 800 | - | V |
| Third anode voltage | $V_{a3}$ | 2250 | 750 | V |
| Negative grid voltage | $-V_g$ | 200 | 1.0 | V |
| Peak x plate to third anode voltage | $v_{x-a3(pk)}$ | 500 | - | V |
| Peak y plate to third anode voltage | $v_{y-a3(pk)}$ | 500 | - | V |
| Heater to cathode voltage | $V_{h-k}$ | ± 125 | – | V |
| x plate circuit impedance | $Z_x$ | 100 | - | kΩ |
| y plate circuit impedance | $Z_y$ | 100 | - | kΩ |
| Grid to cathode resistance | $R_{g-k}$ | 1.5 | - | MΩ |
| Peak cathode current | $i_{k(pk)}$ | 500 | - | μA |

## PHOSPHOR SCREEN

This tube is usually supplied with GH phosphor (D10-230GH) giving a green trace of medium short persistance. Other phosphors can be made available to special order.

OSCILLOSCOPE TUBES

This data should be read in conjunction with Operational Recommendations for Industrial Cathode Ray Tubes.

## INTER-ELECTRODE CAPACITANCES

| | | | |
|---|---|---|---|
| Grid to all | $c_{g-all}$ | 8.2 | pF |
| Heater and cathode to all | $c_{h,k-all}$ | 2.3 | pF |
| $x_1$ plate to $x_2$ plate | $c_{x1-x2}$ | 1.7 | pF |
| $y_1$ plate to $y_2$ plate | $c_{y1-y2}$ | 1.3 | pF |
| $x_1$ plate to all, less $x_2$ plate | $c_{x1-all, less\ x2}$ | 5.0 | pF |
| $x_2$ plate to all, less $x_1$ plate | $c_{x2-all, less\ x1}$ | 4.8 | pF |
| $y_1$ plate to all, less $y_2$ plate | $c_{y1-all, less\ y2}$ | 3.6 | pF |
| $y_2$ plate to all, less $y_1$ plate | $c_{y2-all, less\ y1}$ | 3.7 | pF |
| $x_1$, $x_2$ plates to $y_1$, $y_2$ plates | $c_{x1,x2-y1,y2}$ | 0.7 | pF |
| g to $x_1$, $x_2$, $y_1$ and $y_2$ plates | $c_{g-x1,x2,y1,y2}$ | 0.6 | pF |

## TYPICAL OPERATION - voltages with respect to cathode.

| | | | | |
|---|---|---|---|---|
| Mean deflector plate potential* | | 1500 | 2000 | V |
| Third anode voltage for optimum astigmatism correction | $V_{a3}$ | 1500† | 2000† | V |
| Second anode voltage for optimum focus | $V_{a2}$ | 120 to 250 | 160 to 335 | V |
| First anode voltage | $V_{a1}$ | 1500 | 2000 | V |
| Shield voltage for optimum raster shape | $V_s$ | 1500† | 2000† | V |
| Control grid voltage for cut-off | $V_g$ | - 22 to - 52 | - 30 to - 70 | V |
| x deflection coefficient | $D_x$ | 21 to 26 | 28 to 34.8 | V/cm |
| y deflection coefficient | $D_y$ | 13 to 16 | 17.3 to 21.4 | V/cm |
| Minimum useful screen area (Diagonal 9 cm) | | 8.0 x 6.4 | 8.0 x 6.4 | $cm^2$ |
| Grid drive to 10 $\mu$A beam current | | 10 | 11 | V |
| Line width at 10 $\mu$A beam current Shrinking raster measurement at centre | | 0.31 | 0.27 | mm |

* This tube is designed for symmetrical operation.

† The required voltage will not differ from the quoted value by more than ± 30V.

## RASTER DISTORTION AND ALIGNMENT

The undeflected spot will fall in a circle of 5 mm radius about the centre of the tube face.

Raster distortion: the edges of a test raster will fall between two concentric rectangles 7.0 cm x 5.4 cm and 6.84 cm x 5.26 cm.

Rectangularity of x and y axes is $90° \pm 1°$.

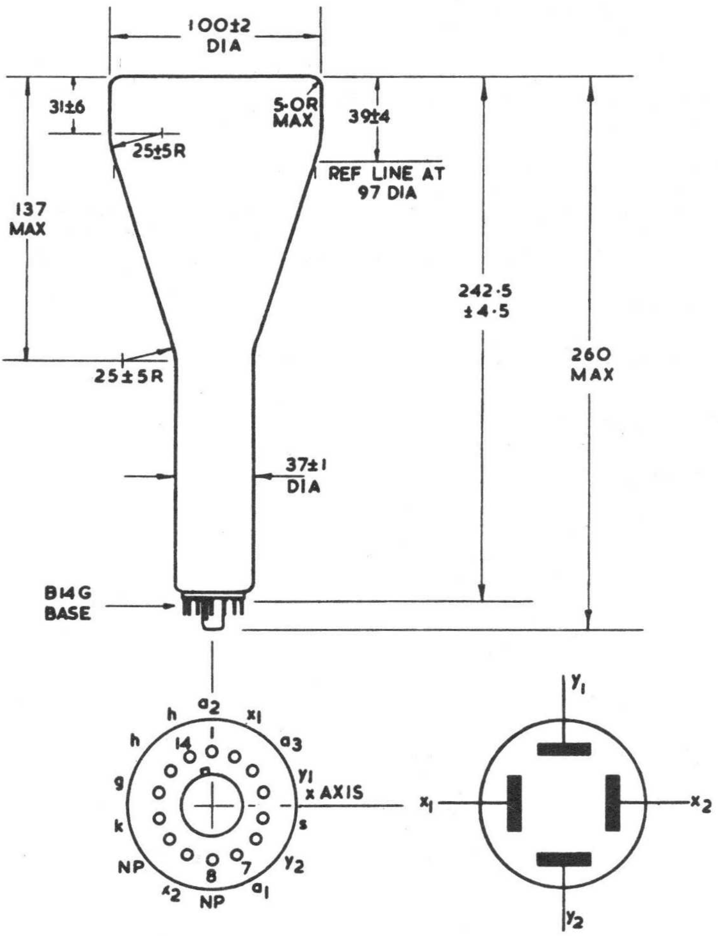
It is preferable that the mean x and y plate potentials are equal otherwise some deterioration in performance will occur. Under any circumstances the mean y plate potential should never differ from the mean x plate potential by more than 50V.

## MAGNETIC SHIELDING

Adequate magnetic shielding is required. In addition due attention should be paid to the position of the tube relative to transformers and chokes.

**TUBE WEIGHT** (approximate) 400 g

**MOUNTING POSITION** - unrestricted.




VIEWED FROM PINS FREE END (PIN 1 AT TOP)

VIEWED FROM SCREEN END (PIN 1 AT TOP)

All dimensions in mm

Not to be scaled

It is advisable to support the tube near the screen and at a second point on the parallel neck near the base. The tube should not be subjected to any stress from the use of clamps and should not be suspended by the base.

Tolerance on base pin 1 position with respect to tube y axis ± 5°

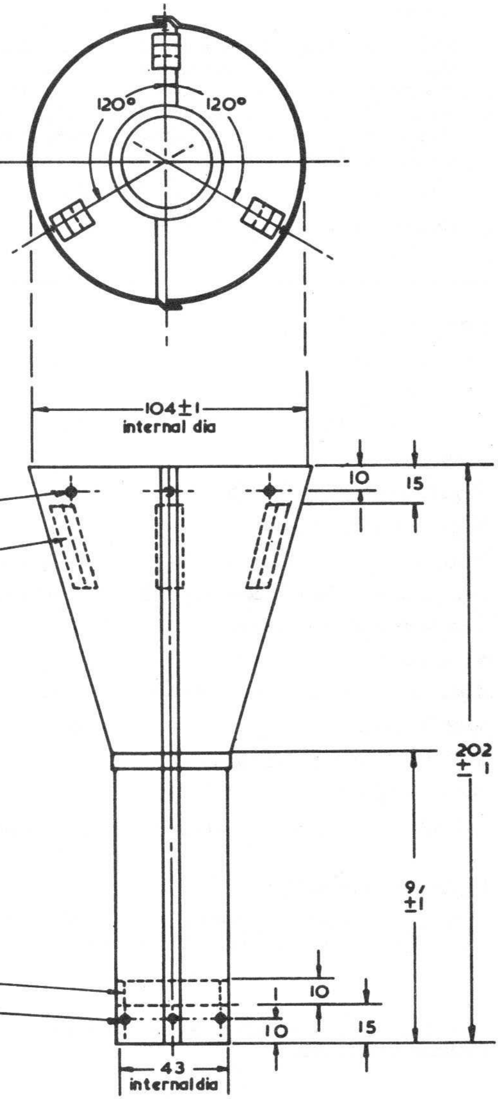
# Magnetic Shield MS41



EXAMPLE OF TYPICAL SHIELD

MATERIAL 0·35±0·05 Mumetal
METAL TOLERANCES ± 0·5
Unless other wise stated
FINISH Silver hammer outside
PADS Soft sponge closed cell neoprene

All dimensions in mm
Not to be scaled

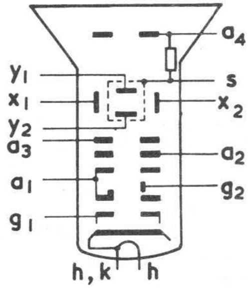


# D10-240..                                                    Oscilloscope Tube

## GENERAL

This 10 cm diagonal rectangular, p.d.a. tube with electrostatic focusing and deflection is designed for medium bandwidth applications and is capable of being deflected by transistor circuits. It incorporates a means of beam blanking at anode potential which avoids d.c. coupling to the grid.

| | | | |
|---|---|---|---|
| Heater Voltage | $V_h$ | 6.3 | V |
| Heater Current | $I_h$ | 0.12 | A |




## ABSOLUTE RATINGS

| | | Max | Min | |
|---|---|---|---|---|
| Fourth anode voltage | $V_{a4}$ | 3.5 | 1.5 | kV |
| Third anode voltage | $V_{a3}$ | 1.75 | 0.75 | kV |
| Second anode voltage | $V_{a2}$ | 1.0 | 0 | kV |
| First anode voltage | $V_{a1}$ | 1.75 | 0.75 | kV |
| Negative control grid voltage | $-V_{g1}$ | 200 | 1.0 | V |
| Beam blanking voltage | $V_{g2}$ | 2.0 | 0.5 | kV |
| Peak x plate to third anode voltage | $v_{x-a3(pk)}$ | 500 | - | V |
| Peak y plate to third anode voltage | $v_{y-a3(pk)}$ | 500 | - | V |
| x plate circuit impedance | $Z_x$ | 100 | - | kΩ |
| y plate circuit impedance | $Z_y$ | 100 | - | kΩ |
| Control grid to cathode resistance | $R_{g1-k}$ | 1.5 | - | MΩ |
| Second anode current | $I_{a2}$ | 10 | - | μA |
| P.D.A. ratio ($V_{a4}/V_{a3}$ nom) | | 2:1 | | |
| Helix resistance | | - | 20 | MΩ |

All voltages referred to cathode unless otherwise stated.

## PHOSPHOR SCREEN

This type is usually supplied with GH phosphor (D10-240GH) giving a green trace of medium short persistence. Other phosphor screens can be made available to special order.

This data should be read in conjunction with Operational Recommendations for Industrial Cathode Ray Tubes.

# Oscilloscope Tube D10-240..

## INTER-ELECTRODE CAPACITANCES

| | | | |
|---|---|---|---|
| Grid to all | $c_{g1\text{-}all}$ | 9.5 | pF |
| Grid 2 to all | $c_{g2\text{-}all}$ | 9.0 | pF |
| Heater and cathode to all | $c_{h,k\text{-}all}$ | 3.5 | pF |
| $x_1$ plate to $x_2$ plate | $c_{x1\text{-}x2}$ | 2.0 | pF |
| $y_1$ plate to $y_2$ plate | $c_{y1\text{-}y2}$ | 1.5 | pF |
| $x_1$ plate to all, less $x_2$ plate | $c_{x1\text{-}all, less\ x2}$ | 6.2 | pF |
| $x_2$ plate to all, less $x_1$ plate | $c_{x2\text{-}all, less\ x1}$ | 5.9 | pF |
| $y_1$ plate to all, less $y_2$ plate | $c_{y1\text{-}all, less\ y2}$ | 4.7 | pF |
| $y_2$ plate to all, less $y_1$ plate | $c_{y2\text{-}all, less\ y1}$ | 4.7 | pF |
| $x_1$, $x_2$ plates to $y_1$, $y_2$ plates | $c_{x1,x2\text{-}y1,y2}$ | 0.6 | pF |
| Grid 1 to $x_1$, $x_2$, $y_1$, $y_2$ plates | $c_{g1\text{-}x1,x2,y1,y2}$ | 1.0 | pF |
| Grid 1 to Grid 2 | $c_{g1\text{-}g2}$ | 0.5 | pF |

## TYPICAL OPERATION - voltages with respect to cathode.

| | | | | |
|---|---|---|---|---|
| Fourth anode voltage | $V_{a4}$ | 2.0 | 3.0 | kV |
| Mean deflector plate potential | | 1000 | 1500 | V |
| Third anode voltage for optimum astigmatism correction | $V_{a3}$ | 1000* | 1500* | V |
| Second anode voltage for optimum focus | $V_{a2}$ | 175 to 350 | 260 to 525 | V |
| First anode voltage | $V_{a1}$ | 1000 | 1500 | V |
| Shield voltage for optimum raster shape | $V_s$ | 1000* | 1500* | V |
| Beam blanking voltage for cut-off | $V_{g2}$ | 935† | 1400† | V |
| Control grid voltage for cut-off | $V_{g1}$ | -35 to -70 | -50 to -100 | V |
| x deflection coefficient | $D_x$ | 21.6 to 26.4 | 32.4 to 39.6 | V/cm |
| y deflection coefficient | $D_y$ | 8.3 to 10.2 | 12.4 to 15.3 | V/cm |
| Minimum screen area | | 7 x 5 | 7 x 5 | $cm^2$ |
| Line width at 10 $\mu$A beam current | | | | |
| Shrinking raster measurement at centre | | 0.27 | 0.20 | mm |
| Shrinking raster measurement at edge | | 0.42 | 0.33 | mm |
| Grid drive for 10 $\mu$A beam current (approx.) | | 25 | 25 | V |

* The required voltage will not differ from the quoted value by more than ± 50V

† The beam is is unblanked when $V_{g2} = V_{a1}$. This grid 2 electrode should not be used as a brilliance control.

OSCILLOSCOPE TUBES

## RASTER DISTORTION AND ALIGNMENT

The following applies for the typical operation conditions.

The undeflected spot will fall in a circle of 5 mm radius about the centre of the tube face.

The edges of a test raster will fall between two concentric rectangles 7cm x 5cm and 6.86cm x 4.88cm. Rectangularity of x and y axes is 90° ± 1°.

The horizontal trace will be parallel with the axis of the rectangular face-plate to within ± 5°. A twist coil will be required to effect accurate alignment. This should be mounted inside the magnetic shield. and should not be less than 50 mm from the face or extend more than 105 mm from the face. The ampere turns required will be equal to $16\sqrt{V_{a4}}$ (where $V_{a4}$ is quoted in kV), with provision for reversing the current if necessary.

The deflection coefficient (for both x and y plates) at 75% deflection of the useful scan shall not differ by more than 2% from the deflection coefficient over 10% deflection.

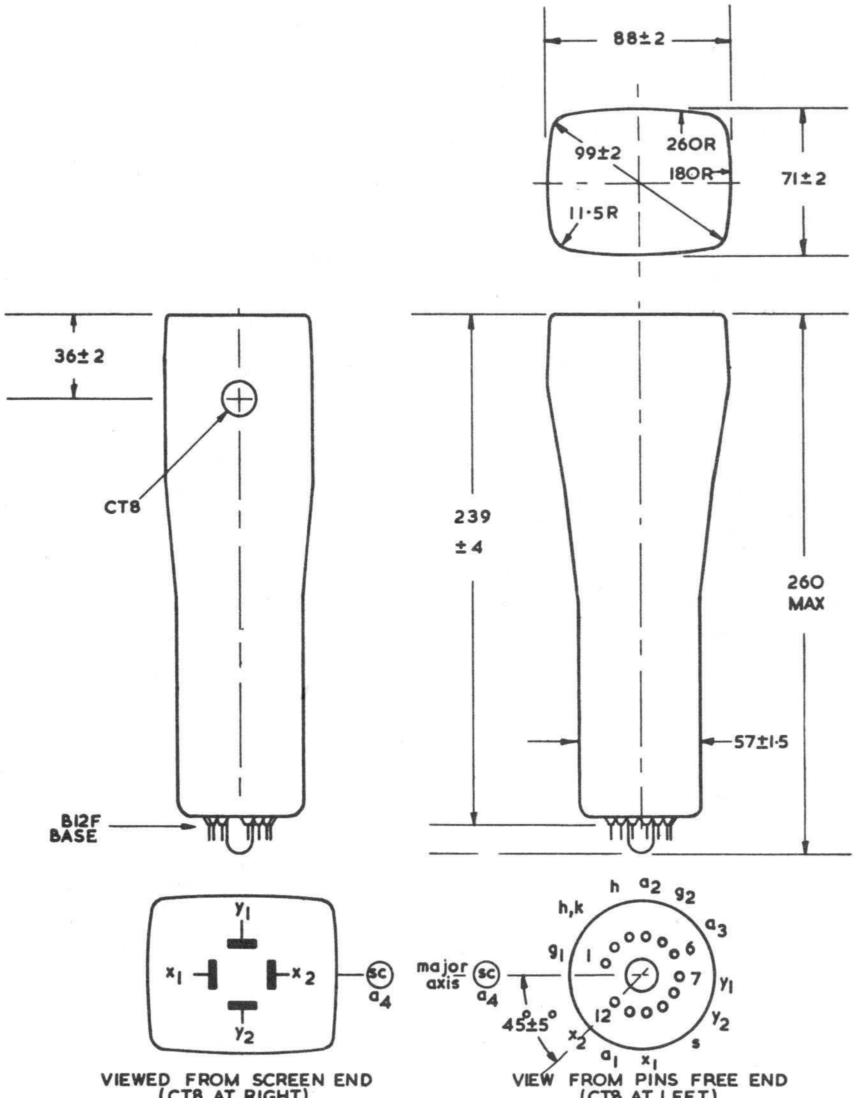
It is preferable that the mean x and y plate potentials are equal otherwise some deterioration in performance will occur. Under any circumstances the mean y plate potential should never differ from the mean x plate potential by more than 50V.

## MAGNETIC SHIELDING

Adequate magnetic shielding is required. In addition due attention should be paid to the position of the tube relative to transformers and chokes.

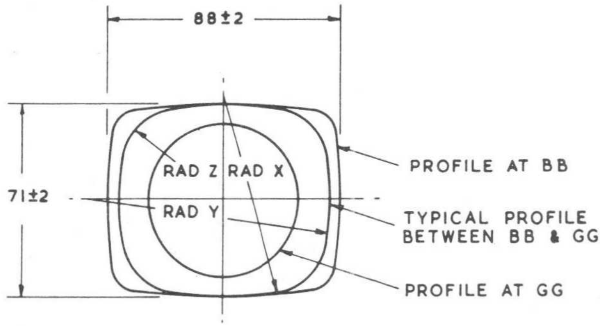
**TUBE WEIGHT** (approximate) - 570g

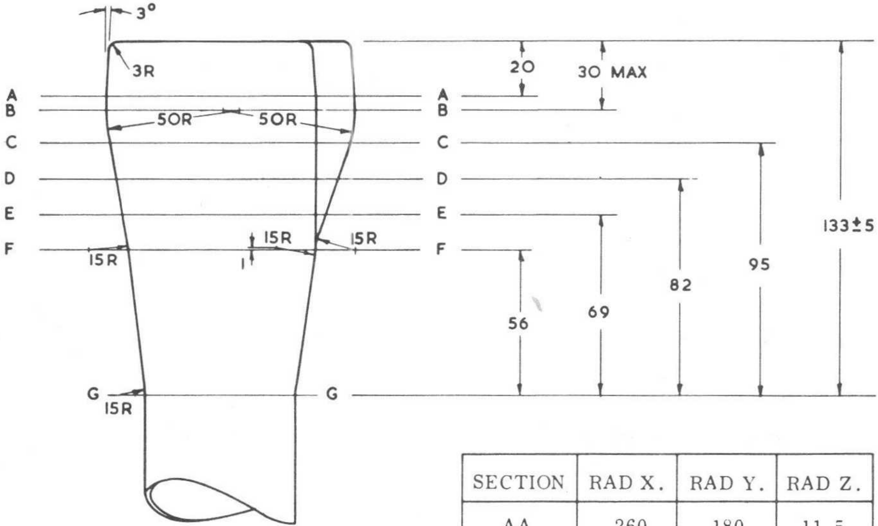
**MOUNTING POSITION** unrestricted.




All dimensions in mm Third angle projection Not to be scaled

It is advisable to support the tube near the screen, and at a second point on the parallel neck near the base. The tube should not be subjected to any stress from the use of clamps and should not be suspended by the base. Connecting leads should not be soldered directly to the tube pins.

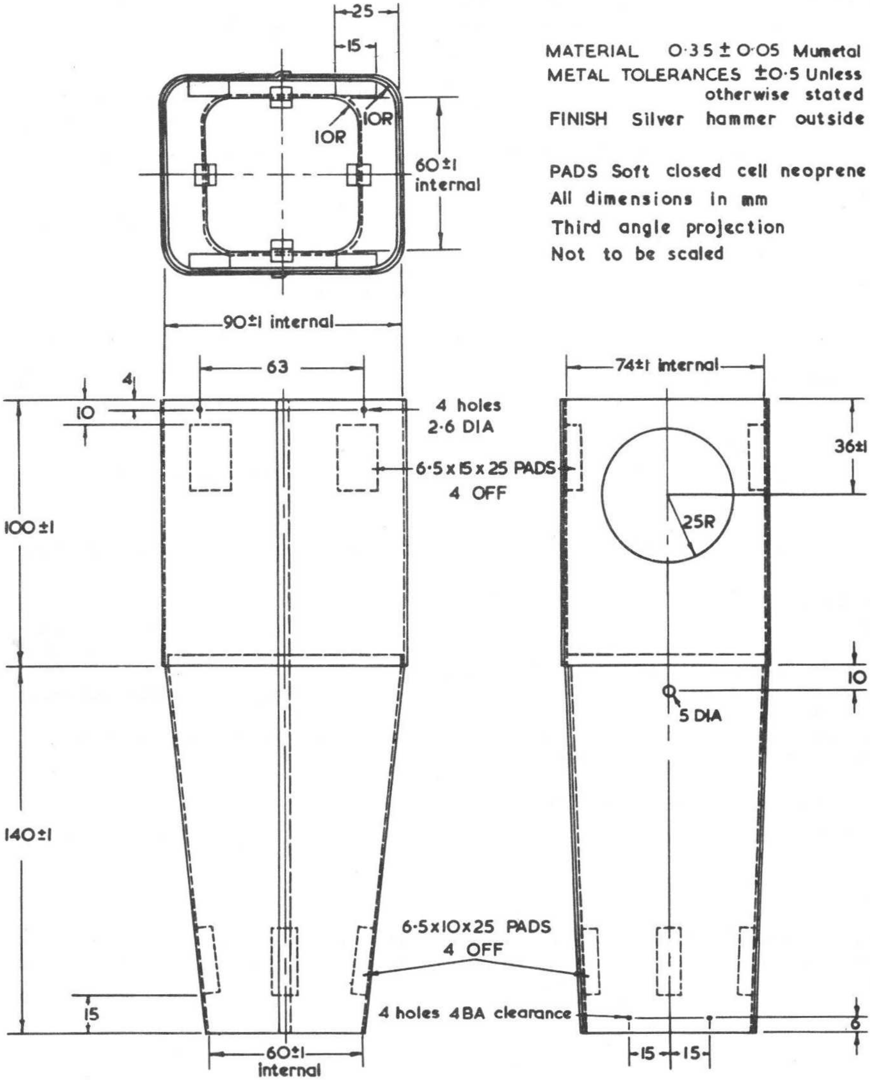



| SECTION | RAD X. | RAD Y. | RAD Z. |
|---|---|---|---|
| AA | 260 | 180 | 11.5 |
| BB | 260 | 180 | 11.5 |
| CC | 220 | 140 | 15.4 |
| DD | 159 | 91 | 22.3 |
| EE | 116 | 55.2 | 30.1 |
| FF | 35.5 | 35.5 | 35.5 |
| GG | 28.5 | 28.5 | 28.5 |

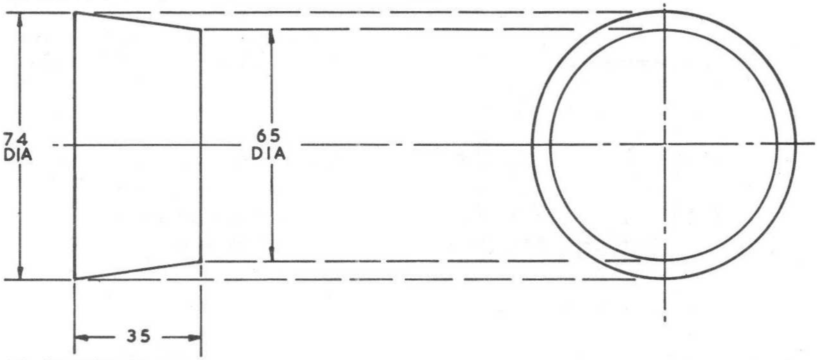
# Magnetic Shield MS7

EXAMPLE OF TYPICAL SHIELD




OSCILLOSCOPE TUBES

MANDREL FOR TWIST COIL TW33




All dimensions in mm

Not to be scaled

MANDREL

Shaped from wood in the form of a truncated circular cone, dimensions as above.

SHIELD

This twist coil is designed to be used in conjunction with magnetic shield MS7 for D10-240..

WINDING ←

900 turns of 0.10 mm Lewmex Grade 1 or 2 wire, or approved alternative, layer wound on the adhesive side of adhesive backed crepe paper to give 5 mm margins between the coil and each edge of the mandrel.
Start and finish of winding to be brought out on 450 mm long thin flexible lead wires from smaller end of winding.
Varnish, if necessary, cover with adhesive backed crepe paper and ensure that the edges of the coil are sealed in place.

ELECTRICAL CHARACTERISTICS

Resistance approx. 420 Ω. Twist coefficient approximately 5.6 mA/degree measured on typical D10-240.. with $V_{a4}$ = 3 kV and $V_{a1}$ = 1.5 kV.

FITTING

The completed twist coil should be pushed hard onto the tube with the lead-out wires in the middle of the short side of the tube on the same side as the cavity cap and sealed to the tube with suitable adhesive tape.

# Oscilloscope Tube

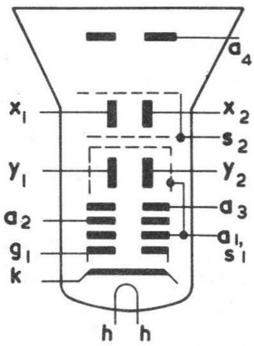
# D10-293..

PRELIMINARY DATA

## GENERAL

This 6.8cm x 5.6cm rectangular aluminised tube with electrostatic focusing and deflection uses a mesh p.d.a. to achieve high deflection sensitivity and high brightness without additional electrode control voltages. The tube is designed for transistor deflection medium to high bandwidth applications.

| | | | |
|---|---|---|---|
| Heater voltage | $V_h$ | 6.3 | V |
| Heater current | $I_h$ | 0.12 | A |




## ABSOLUTE RATINGS

| | | Max. | Min. | |
|---|---|---|---|---|
| Fourth anode voltage | $V_{a4}$ | 10 | 4.0 | kV |
| Third anode voltage | $V_{a3}$ | 2.25 | 0.8 | kV |
| Second anode voltage | $V_{a2}$ | 1.0 | - | kV |
| First anode voltage | $V_{a1}$ | 2.2 | 0.75 | kV |
| Negative control grid voltage | $-V_{g1}$ | 200 | 1.0 | V |
| Peak x plate to third anode voltage | $v_{x-a3(pk)}$ | 500 | - | V |
| Peak y plate to third anode voltage | $v_{y-a3(pk)}$ | 500 | - | V |
| x plate to third anode resistance | $R_{x-a3}$ | 100 | - | kΩ |
| y plate to third anode resistance | $R_{y-a3}$ | 100 | - | kΩ |
| Control grid to cathode resistance | $R_{g1-k}$ | 1.5 | - | MΩ |
| Second anode current | $I_{a2}$ | 10 | - | μA |
| P.D.A. ratio ($V_{a4}/V_{a3}$) | | 7:1 | - | |

OSCILLOSCOPE TUBES

All voltages referred to cathode unless otherwise stated.

## PHOSPHOR SCREEN

This type is usually supplied with GH phosphor (D10-293GH) giving a green trace of medium short persistence. Other phosphor screens can be made available to special order.

This data should be read in conjunction with Operational and Safety Recommendations for Industrial Cathode Ray Tubes.

## INTER-ELECTRODE CAPACITANCES

| | | | |
|---|---|---|---|
| Grid 1 to all | $c_{g1-all}$ | 10 | pF |
| Heater and cathode to all | $c_{h,k-all}$ | 4.5 | pF |
| $x_1$ plate to $x_2$ plate | $c_{x1-x2}$ | 1.0 | pF |
| y1 plate to $y_2$ plate | $c_{y1-y2}$ | 1.5 | pF |
| $x_1$ plate to all, less $x_2$ plate | $c_{x1-all,\ less\ x2}$ | 8.0 | pF |
| $x_2$ plate to all, less $x_1$ plate | $c_{x2-all,\ less\ x1}$ | 8.0 | pF |
| $y_1$ plate to all, less $y_2$ plate | $c_{y1-all,\ less\ y2}$ | 5.0 | pF |
| $y_2$ plate to all, less $y_1$ plate | $c_{y2-all,\ less\ y1}$ | 5.0 | pF |
| $x_1$, $x_2$ plates to $y_1$, $y_2$ plates | $c_{x1,\ x2-y1,y2}$ | 0.8 | pF |
| Grid 1 to $x_1$, $x_2$, $y_1$, $y_2$ plates | $c_{g1-x1,\ x2,\ y1,\ y2}$ | 0.6 | pF |

## TYPICAL OPERATION - Voltages with respect to cathode

| | | | |
|---|---|---|---|
| Fourth anode voltage | $V_{a4}$ | 6.0 | kV |
| Mean deflector plate potential | | 1000 | V |
| Third anode voltage for optimum astigmatism correction | $V_{a3}$ | 970 to 1030 | V |
| Second anode voltage for optimum focus | $V_{a2}$ | 180 to 340 | V |
| First anode and y shield voltage | $V_{a1+s1}$ | 1000 | V |
| Shield 2 voltage for optimum raster shape | $V_{s2}$ | 900 to 1050 | V |
| Control grid voltage for cut-off | $V_{g1}$ | -26 to -52 | V |
| x deflection coefficient | $D_x$ | 10.5 to 12.8 | V/cm |
| y deflection coefficient | $D_y$ | 3.8 to 4.8 | V/cm |
| Line width at 10$\mu$A beam current | | | |
| Shrinking raster measurement at centre | | 0.32 | mm |
| Microscope measurement at centre | | 0.55 | mm |
| Microscope measurement at edge | | 0.8 | mm |
| Grid Drive to 10$\mu$A beam current (approx.) | | 17 | V |

## RASTER DISTORTION AND ALIGNMENT

The following data applies for the typical operation conditions.

The undeflected spot will fall in a circle of 5 mm radius about the centre of the tube face.

Raster distortion: The edges of a test raster will fall between two concentric rectangles 6.8 cm x 5.6 cm and 6.55 cm x 5.4 cm.

Rectangularity of x and y axes is 90° ± 1°. The horizontal trace will be parallel with the axis of the rectangular face-plate to within ± 5°. A twist coil will be required to effect accurate alignment. This should be mounted inside the magnetic shield approximately 80mm from the face and should not extend more than 130 mm from the face. The ampere turns required will be equal to $14\sqrt{V_{a4}}$ (where $V_{a4}$ is quoted in kV) with provision for reversing the current. The sensitivity (for both x and y plates) at 75% deflection of the useful scan will not differ by more than 2% from the sensitivity over 25% deflection.

It is preferable that the mean x and y plate potentials are equal otherwise some deterioration in performance will occur. Under no circumstances should the mean y plate potential differ from the mean x plate potential by more than 50V.

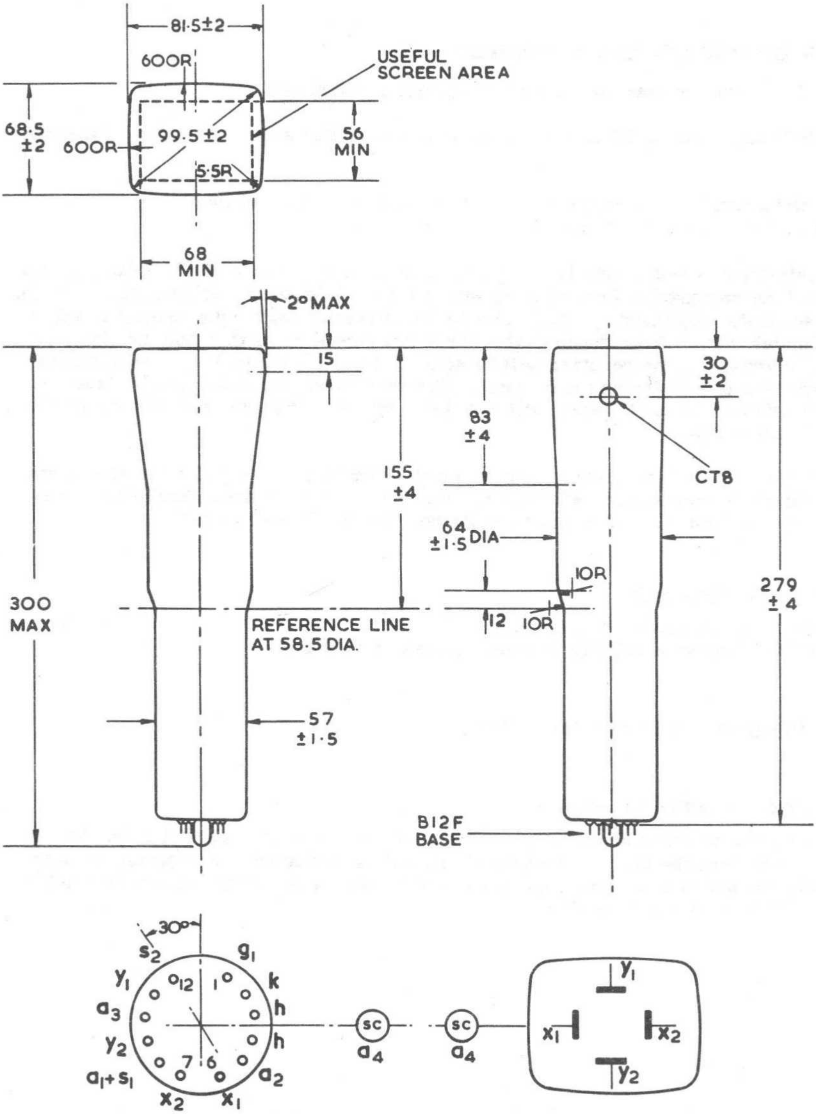
## MAGNETIC SHIELDING

Adequate magnetic shielding is required. In addition due attention should be paid to the position of the tube relative to transformers and chokes.

## TUBE WEIGHT (approximate) - 700 g.

## MOUNTING Position unrestricted

It is advisable to support the tube near the screen, and at a second point on the parallel neck near the base. The tube should not be subjected to any stress from the use of clamps and should not be suspended by the base. Connecting leads should not be soldered directly to the tube pins.




VIEW FROM PINS FREE END (CT8 AT RIGHT)

VIEWED FROM SCREEN END (CT8 AT LEFT)

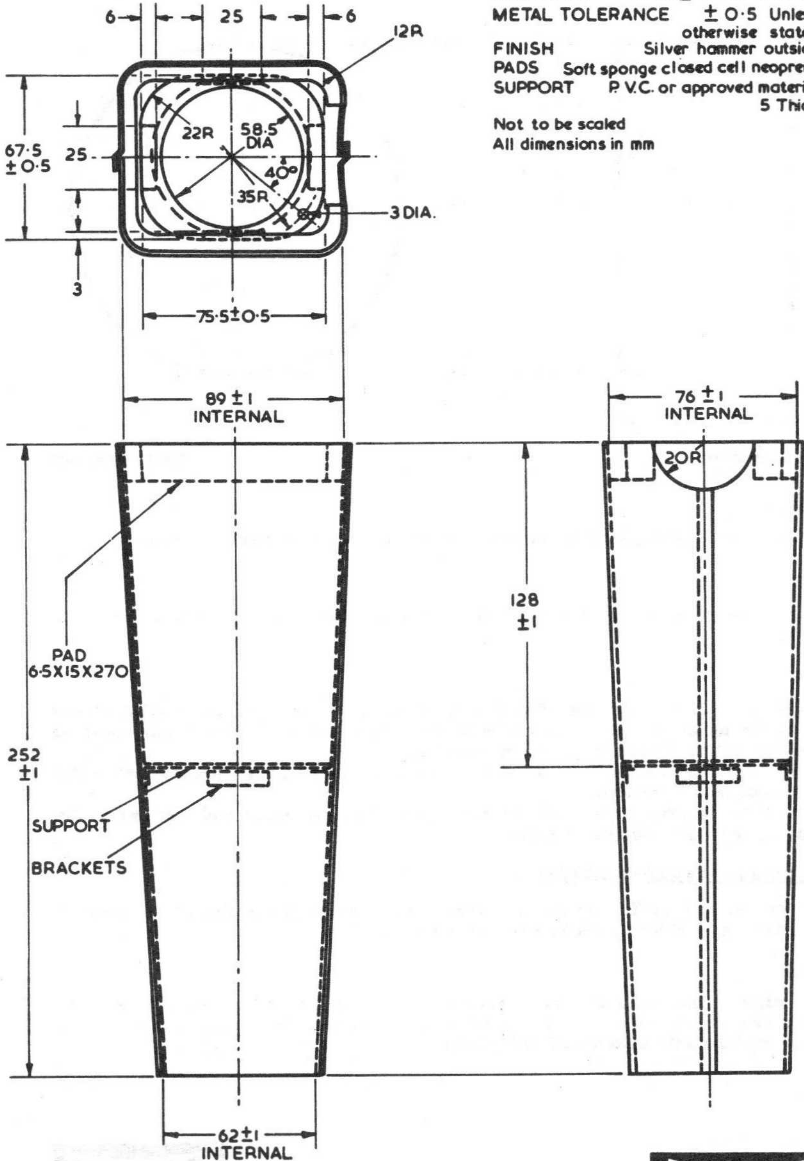
All dimensions in mm

Not to be scaled

# Magnetic Shield MS 83

# D10-293..

EXAMPLE OF TYPICAL SHIELD

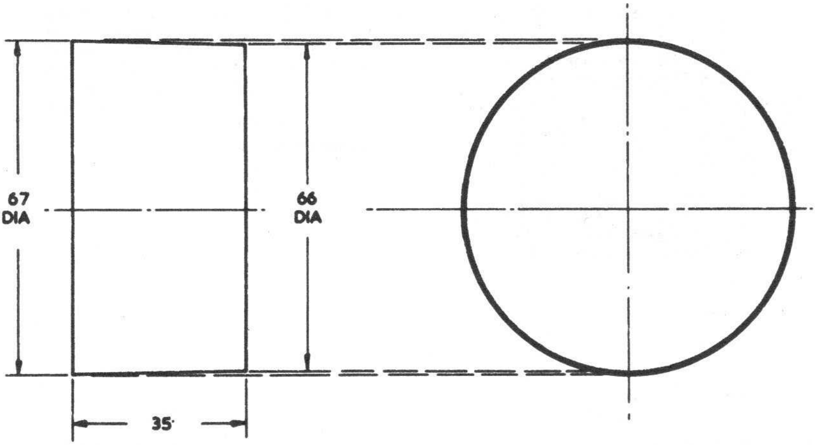



| | |
|---|---|
| MATERIAL | 0·35 ± 0·05 Mumetal |
| METAL TOLERANCE | ± 0·5 Unless otherwise stated |
| FINISH | Silver hammer outside |
| PADS | Soft sponge closed cell neoprene |
| SUPPORT | P.V.C. or approved material 5 Thick |

Not to be scaled
All dimensions in mm

OSCILLOSCOPE TUBES

## MANDREL FOR TWIST COIL TW56




All dimensions in mm

Not to be scaled

### MANDREL

Shaped from wood in the form of a truncated circular cone, dimensions as above.

### SHIELD

This twist coil is designed to be used in conjunction with magnetic shield MS 83 for D10-293..

### WINDING

900 turns of 0.125 mm Lewmex Grade 1 or 2 wire, or approved alternative, layer wound on the adhesive side of adhesive backed crepe paper to give 5 mm margins between the coil and each edge of the mandrel.
Start and finish of winding to be brought out on 450 mm long thin flexible lead wires from smaller end of winding.
Varnish, if necessary, cover with adhesive backed crepe paper and ensure that the edges of the coil are sealed in place.

### ELECTRICAL CHARACTERISTICS

Resistance 260 Ω ± 10 %. Twist coefficient approximately 8 mA/degree measured on typical D10-293.. with $V_{a4}$ = 6 kV and $V_{a1}$ = 1.0 kV.

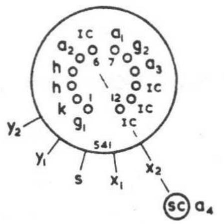
### FITTING

The completed twist coil should be pushed hard onto the tube with the lead-out wires in the middle of the short side of the tube on the same side as the cavity cap and sealed to the tube with suitable adhesive tape.

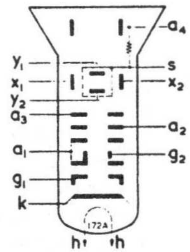
# Oscilloscope Tube

**D13-33GH**

**Maintenance Type**




Base B12F, Cap CT8




## GENERAL

This 5 in. diagonal rectangular tube with electrostatic focusing and deflection is designed for medium bandwidth applications and is capable of being deflected by transistor circuits. It incorporates a means of beam blanking at anode potential which avoids d.c. coupling to the grid. The standard phosphor is GH, but phosphor types GL, GM and BE are also available.

| | | | |
|---|---|---|---|
| Heater Voltage | $V_h$ | 6·3 | V |
| Heater Current | $I_h$ | 0·3 | A |

## ABSOLUTE RATINGS

| | | Max | Min | |
|---|---|---|---|---|
| Fourth Anode Voltage | $V_{a4}$ | 7·0 | 2·5 | kV |
| Third Anode Voltage | $V_{a3}$ | 1·75 | 0·6 | kV |
| Second Anode Voltage | $V_{a2}$ | 1·0 | 0 | kV |
| First Anode Voltage | $V_{a1}$ | 1·75 | 0·6 | kV |
| Negative Control Grid Voltage | $-V_{g1}$ | 200 | 1·0 | V |
| Beam Blanking Voltage | $V_{g2}$ | 2·0 | 0·5 | kV |
| Peak x-plate to Third Anode Voltage | $v_{x\text{-}a3(pk)}$ | 500 | — | V |
| Peak y-plate to Third Anode Voltage | $v_{y\text{-}a3(pk)}$ | 500 | — | V |
| Peak Heater to Cathode Voltage | $v_{h\text{-}k(pk)}$ | 250 | — | V |
| x-plate to Third Anode Resistance | $R_{x\text{-}a3}$ | 5·0 | — | MΩ |
| y-plate to Third Anode Resistance | $R_{y\text{-}a3}$ | 100 | — | kΩ |
| Control Grid to Cathode Resistance | $R_{g1\text{-}k}$ | 1·5 | — | MΩ |
| Second Anode Current | $I_{a2}$ | 10 | — | μA |
| P.D.A. Ratio ($V_{a4}/V_{a3}$) | | 4 : 1 | | |
| Helix Resistance | | — | 50 | MΩ |

All voltages referred to cathode unless otherwise stated.

## INTER-ELECTRODE CAPACITANCES

| | | | |
|---|---|---|---|
| Grid to all | $c_{g\text{-}all}$ | 8·0 | pF |
| Cathode to all | $c_{k\text{-}all}$ | 3·5 | pF |
| $x_1$ plate to $x_2$ plate | $c_{x1\text{-}x2}$ | 1·2 | pF |
| $y_1$ plate to $y_2$ plate | $c_{y1\text{-}y2}$ | 4·5 | pF |
| $x_1$ plate to all less $x_2$ plate | $c_{x1\text{-}all,\ less\ x2}$ | 3·5 | pF |
| $x_2$ plate to all less $x_1$ plate | $c_{x2\text{-}all,\ less\ x1}$ | 3·5 | pF |
| $y_1$ plate to all less $y_2$ plate | $c_{y1\text{-}all,\ less\ y2}$ | 5·0 | pF |
| $y_2$ plate to all less $y_1$ plate | $c_{y2\text{-}all,\ less\ y1}$ | 5·0 | pF |
| Grid 1 and Cathode to $x_1$, $x_2$, $y_1$ and $y_2$ plates | $c_{g1,\ k\text{-}x1,\ x2,\ y1,\ y2}$ | 0·2 | pF |

OSCILLOSCOPE TUBES

**Thorn Radio Valves and Tubes Limited**

BRIMAR

**TYPICAL OPERATION**—Voltages with respect to cathode.

| | | | | | |
|---|---|---|---|---|---|
| Fourth Anode Voltage | $V_{a4}$ | 3·0 | 4·0 | 6·0 | kV |
| Mean Deflector Plate Potential | | 750 | 1000 | 1500 | V |
| Third Anode Voltage for astigmatism correction | $V_{a3}$ | 750* | 1000* | 1500* | V |
| Second Anode Voltage for focus | $V_{a2}$ | 50 to 200 | 75 to 275 | 100 to 400 | V |
| First Anode Voltage | $V_{a1}$ | 750 | 1000 | 1500 | V |
| Interplate shield voltage for optimum raster shape | $V_s$ | 750* | 1000* | 1500* | V |
| Beam Blanking Voltage for cut-off | $V_{g2}$ | 700† | 930† | 1400† | V |
| Control Grid Voltage for cut-off | $V_{g1}$ | −30 to −50 | −40 to −70 | −60 to −105 | V |
| x-plate sensitivity | $S_x$ | 6·15 to 7·85 | 8·2 to 10·5 | 12·3 to 15·75 | V/cm |
| y-plate sensitivity | $S_y$ | 7·8 to 10·1 | 10·5 to 13·5 | 15·75 to 20·3 | V/cm |
| Minimum screen area (x × y) | | 10 × 6 | 10 × 6 | 10 × 6 | cm² |
| Line Width at centre‡ | | 0·5 | 0·45 | 0·4 | mm |
| Line Width at edge‡ | | 0·9 | 0·8 | 0·8 | mm |

* The required voltage will not differ from the quoted value by more than ±50 V.

† The beam is unblanked when $V_{g2} - V_{a1}$. This grid 2 electrode should not be used as a brilliance control.

‡ At 5·0μA beam current.

### Raster Distortion and Alignment

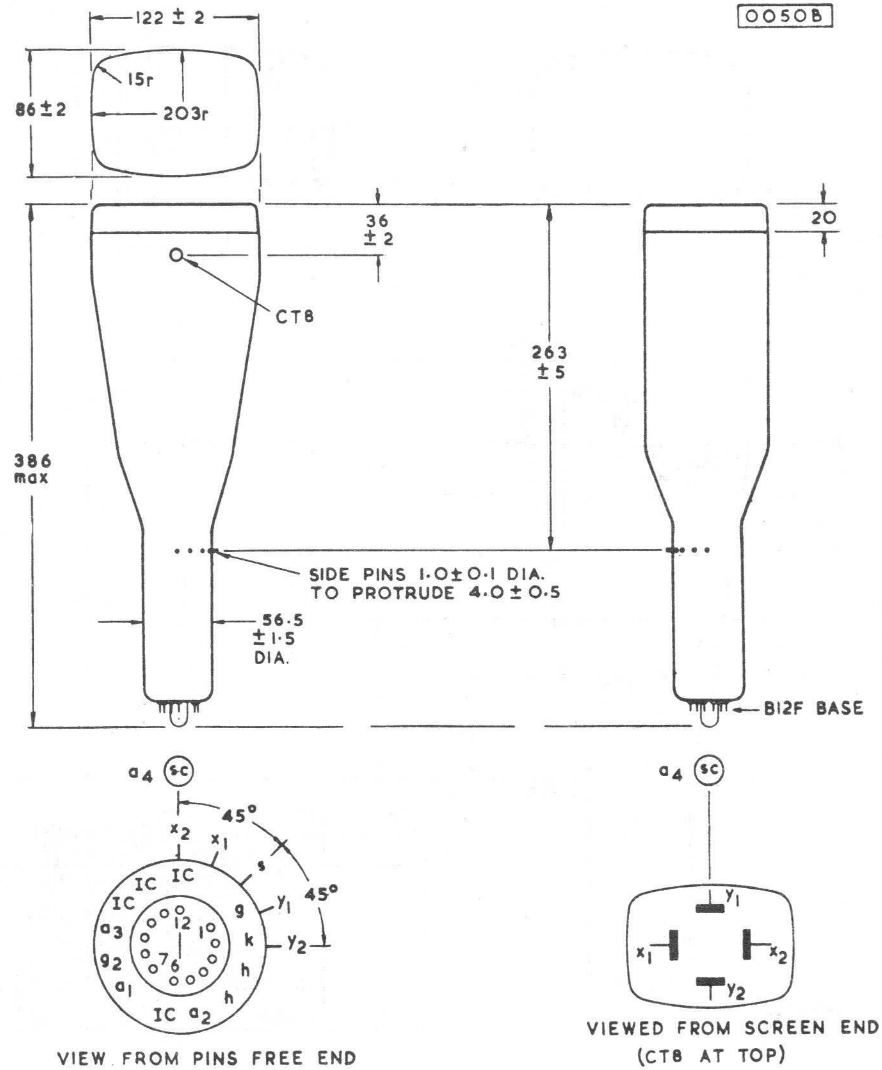
The total scanned area is 10 cm × 6 cm measured from the centre of the tube face. Raster distortion will not be greater than 2%. The edges of a test raster will fall between two concentric rectangles 10 cm × 6 cm and 9·8 cm × 5·8 cm. Rectangularity of x and y axes is 90°±1°.

The horizontal trace will be parallel with the axes of the rectangular face-plate to within ±5°. A twist coil will be required to effect accurate alignment. This should be mounted inside the magnetic shield approximately 90 mm from the face and should not extend more than 175 mm from the face. 34 ampere turns will suffice, with provision for reversing the current if necessary.

### Magnetic Shielding

Adequate magnetic shielding is required. In addition, due attention should be paid to the position of the tube relative to transformers and chokes.

**Approximate Net Tube Weight—0·9 kg (1 lb 15 oz)**



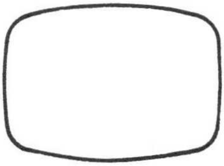


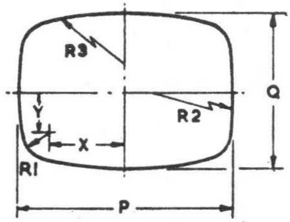

Tolerance on all side pin positions ±5°

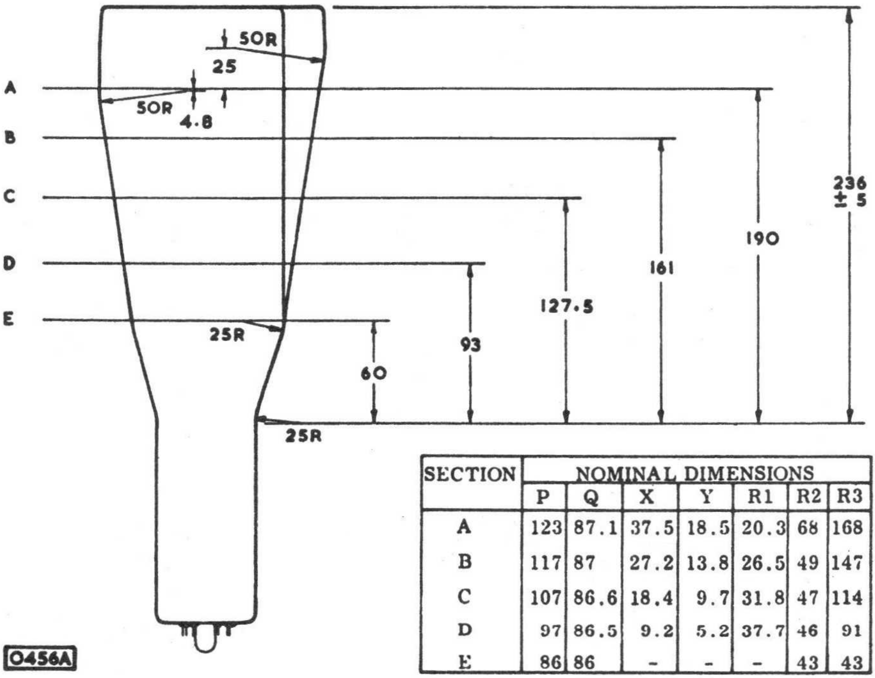
All dimensions in mm. Third angle projection. Not to be scaled.

**Mounting Position**—Unrestricted

It is advisable to support the tube near the screen, and at a second point on the parallel neck near the base. The tube should not be subjected to any stress from the use of clamps and should not be suspended by the base. Connecting leads should not be soldered directly to the tube pins.





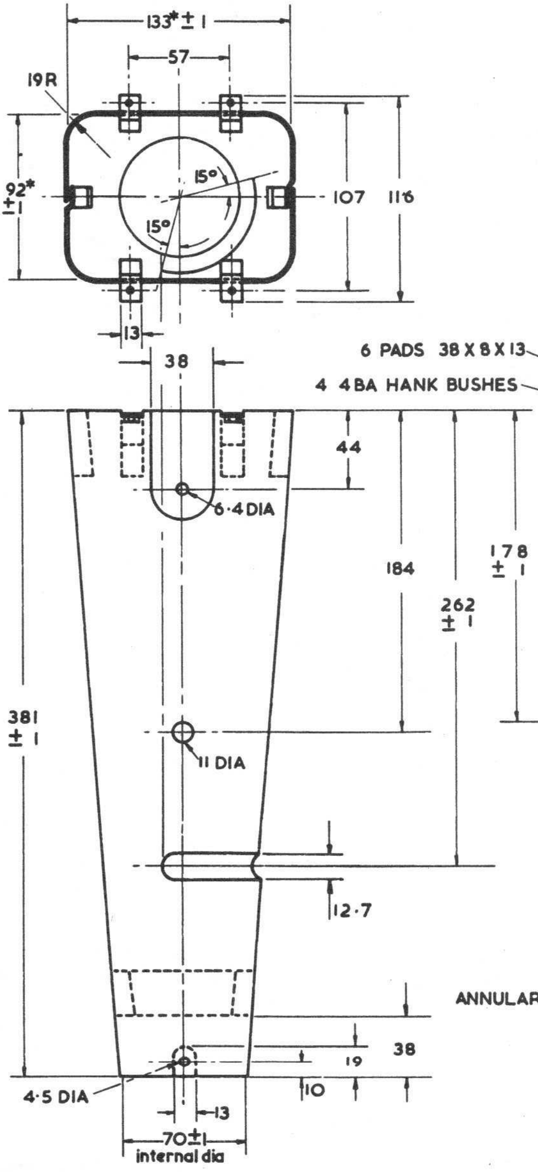




| SECTION | NOMINAL DIMENSIONS | | | | | | |
|---|---|---|---|---|---|---|---|
| | P | Q | X | Y | R1 | R2 | R3 |
| A | 123 | 87.1 | 37.5 | 18.5 | 20.3 | 68 | 168 |
| B | 117 | 87 | 27.2 | 13.8 | 26.5 | 49 | 147 |
| C | 107 | 86.6 | 18.4 | 9.7 | 31.8 | 47 | 114 |
| D | 97 | 86.5 | 9.2 | 5.2 | 37.7 | 46 | 91 |
| E | 86 | 86 | - | - | - | 43 | 43 |

All dimensions in mm. Not to be scaled.

# Magnetic Shield MS27

EXAMPLE OF TYPICAL SHIELD




MATERIAL 0·35±0·05 Mumetal
4 LUGS 0·8±0·05 Mild steel spot welded to shield
METAL TOLERANCES ± 0·5 unless otherwise stated
FINISH Silver hammer outside

PADS Soft sponge closed cell neoprene
3rd angle projection
Not to be scaled
All dimensions in mm
* Internal dimension

OSCILLOSCOPE TUBES

**Thorn Radio Valves and Tubes Limited**

BRIMAR

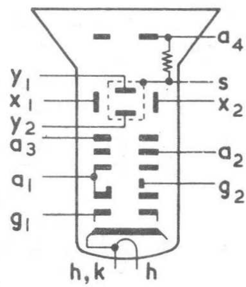
# D13-47..

# Oscilloscope Tube

## GENERAL

This 5 inch diagonal rectangular tube with electrostatic focusing and deflection is designed for medium bandwidth applications and is capable of being deflected by transistor circuits. It incorporates a means of beam blanking at anode potential which avoids d.c. coupling to the grid.

| | | | |
|---|---|---|---|
| Heater Voltage | $V_h$ | 6.3 | V |
| Heater Current | $I_h$ | 0.3 | A |




## ABSOLUTE RATINGS

| | | Max | Min | |
|---|---|---|---|---|
| Fourth anode voltage | $V_{a4}$ | 7.0 | 2.5 | kV |
| Third anode voltage | $V_{a3}$ | 1.75 | 0.6 | kV |
| Second anode voltage | $V_{a2}$ | 1.0 | 0 | kV |
| First anode voltage | $V_{a1}$ | 1.75 | 0.6 | kV |
| Negative control grid voltage | $-V_{g1}$ | 200 | 1.0 | V |
| Beam blanking voltage | $V_{g2}$ | 2.0 | 0.5 | kV |
| Peak x plate to third anode voltage | $v_{x-a3(pk)}$ | 500 | - | V |
| Peak y plate to third anode voltage | $v_{y-a3(pk)}$ | 500 | - | V |
| x plate to third anode resistance | $R_{x-a3}$ | 5.0 | - | MΩ |
| y plate to third anode resistance | $R_{y-a3}$ | 100 | - | kΩ |
| Control grid to cathode resistance | $R_{g1-k}$ | 1.5 | - | MΩ |
| Second anode current | $I_{a2}$ | 10 | - | μA |
| P.D.A. ratio ($V_{a4}/V_{a3}$) | | 4 : 1 | | |
| Helix resistance | | - | 50 | MΩ |

All voltages referred to cathode unless otherwise stated.

## PHOSPHOR SCREEN

This type is usually supplied with GH phosphor (D13-47GH) giving a green trace of medium short persistence. Other phosphor screens can be made available to special order.

## INTER-ELECTRODE CAPACITANCES

| | | | |
|---|---|---|---|
| Grid to all | $c_{g1\text{-}all}$ | 10 | pF |
| Grid 2 to all | $c_{g2\text{-}all}$ | 10 | pF |
| Heater and cathode to all | $c_{h,k\text{-}all}$ | 4.0 | pF |
| $x_1$ plate to $x_2$ plate | $c_{x1\text{-}x2}$ | 2.1 | pF |
| $y_1$ plate to $y_2$ plate | $c_{y1\text{-}y2}$ | 1.6 | pF |
| $x_1$ plate to all, less $x_2$ plate | $c_{x1\text{-}all, less\ x2}$ | 7.0 | pF |
| $x_2$ plate to all, less $x_1$ plate | $c_{x2\text{-}all, less\ x1}$ | 6.7 | pF |
| $y_1$ plate to all, less $y_2$ plate | $c_{y1\text{-}all, less\ y2}$ | 5.0 | pF |
| $y_2$ plate to all, less $y_1$ plate | $c_{y2\text{-}all, less\ y1}$ | 5.0 | pF |
| $x_1$, $x_2$ plates to $y_1$, $y_2$ plates | $c_{x1,x2\text{-}y1,y2}$ | 0.8 | pF |
| Grid 1 to $x_1$, $x_2$, $y_1$, $y_2$ plates | $c_{g1\text{-}x1,x2,y1,y2}$ | 1.3 | pF |
| Grid 1 to Grid 2 | $c_{g1\text{-}g2}$ | 0.6 | pF |

## TYPICAL OPERATION - voltages with respect to cathode.

| | | | | | |
|---|---|---|---|---|---|
| Fourth anode voltage | $V_{a4}$ | 3.0 | 4.0 | 6.0 | kV |
| Mean deflector plate potential | | 750 | 1000 | 1500 | V |
| Third anode voltage for optimum astigmatism correction | $V_{a3}$ | 750* | 1000* | 1500* | V |
| Second anode voltage for optimum focus | $V_{a2}$ | 125 to 300 | 175 to 400 | 260 to 600 | V |
| First anode voltage | $V_{a1}$ | 750 | 1000 | 1500 | V |
| Shield voltage for optimum raster shape | $V_s$ | 750* | 1000* | 1500* | V |
| Beam blanking voltage for cut-off | $V_{g2}$ | 700† | 935† | 1400† | V |
| Control grid voltage for cut-off | $V_{g1}$ | -25 to -50 | -35 to -65 | -50 to -95 | V |
| x deflection coefficient | $D_x$ | 10.5 to 13.2 | 14.5 to 17.5 | 21 to 26.2 | V/cm |
| y deflection coefficient | $D_y$ | 5.0 to 6.2 | 6.7 to 8.3 | 10 to 12.5 | V/cm |
| Minimum screen area | | 10 x 6 | 10 x 6 | 10 x 6 | $cm^2$ |
| Line width at centre | at 5 $\mu$A | 0.5 | 0.45 | 0.4 | mm |
| Line width at edge | beam current | 0.9 | 0.8 | 0.8 | mm |

* The required voltage will not differ from the quoted value by more than ± 50V.

† The beam is unblanked when $V_{g2} = V_{a1}$. This grid 2 electrode should not be used as a brilliance control.

OSCILLOSCOPE TUBES

## RASTER DISTORTION AND ALIGNMENT

The total screen area is 10 cm x 6 cm measured about a point ± 3 mm from the centre of the tube face. The undeflected spot will fall in a circle of 6 mm radius about the centre of the tube face. The edges of a test raster will fall between two concentric rectangles 10 cm x 6 cm and 9.8 cm x 5.85 cm.

Rectangularity of x and y axes is 90° ± 1°. The horizontal trace will be parallel with the axis of the rectangular face-plate to within ± 5°. A twist coil will be required to effect accurate alignment. This should be mounted inside the magnetic shield approximately 90 mm from the face and should not extend more than 175 mm from the face. 24 ampere turns will suffice, with provision for reversing the current if necessary.

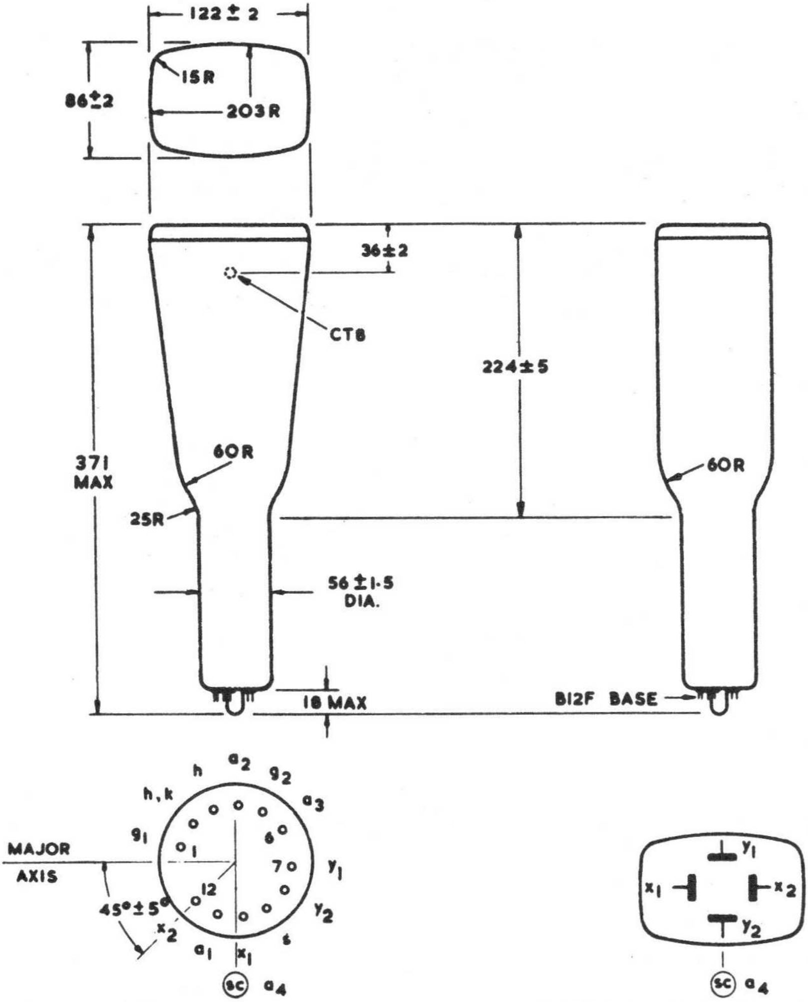
It is preferable that the mean x and y plate potentials are equal otherwise some deterioration in performance will occur. Under any circumstances the mean y plate potential should never differ from the mean x plate potential by more than 50V when the tube is operated at 4 kV.

## MAGNETIC SHIELDING

Adequate magnetic shielding is required. In addition due attention should be paid to the position of the tube relative to transformers and chokes.

**TUBE WEIGHT** (approximate) - 960 g

**MOUNTING POSITION** unrestricted.

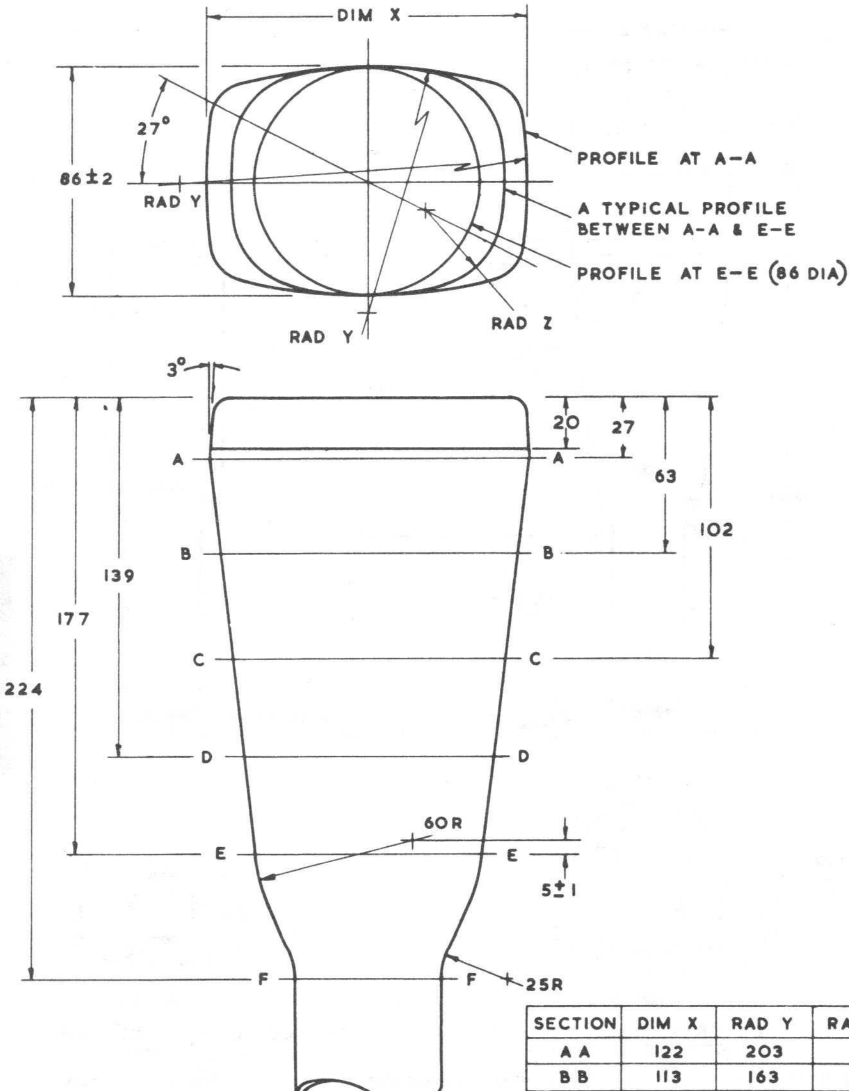



VIEW FROM PINS FREE END (CT8 AT BOTTOM)

VIEWED FROM SCREEN END (CT8 AT BOTTOM)

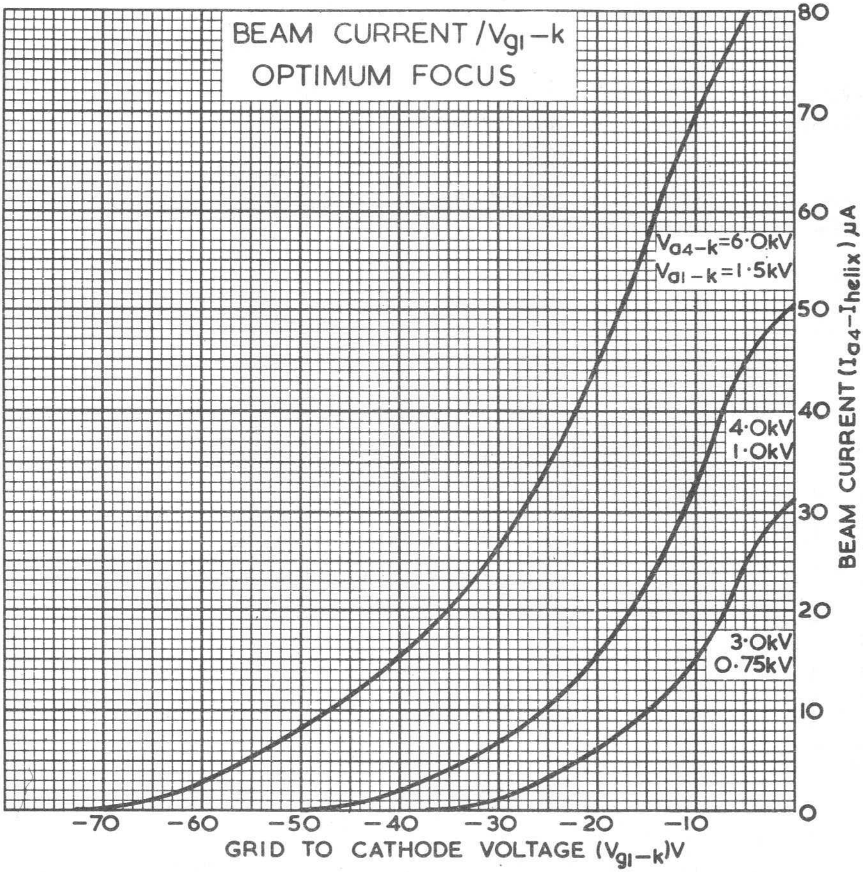
All dimensions in mm — Third angle projection — Not to be scaled

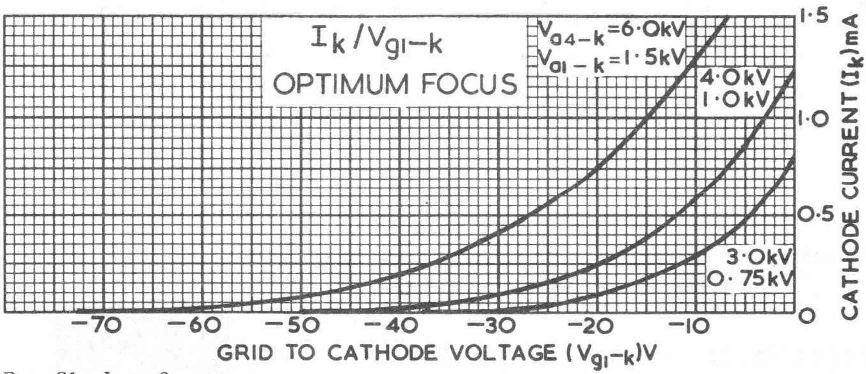
It is advisable to support the tube near the screen, and at a second point on the parallel neck near the base. The tube should not be subjected to any stress from the use of clamps and should not be suspended by the base. Connecting leads should not be soldered directly to the tube pins.




| SECTION | DIM X | RAD Y | RAD Z |
|---|---|---|---|
| A A | 122 | 203 | 15 |
| B B | 113 | 163 | 22 |
| C C | 104 | 123 | 29 |
| D D | 95 | 83 | 36 |
| E E | 86 | 43 | 43 |
| F F | 56 | 28 | 28 |

All dimensions in mm — Third angle projection — Not to be scaled



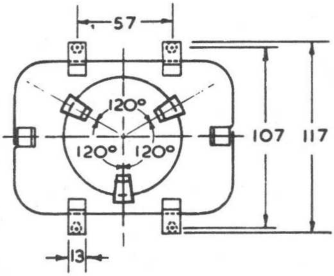



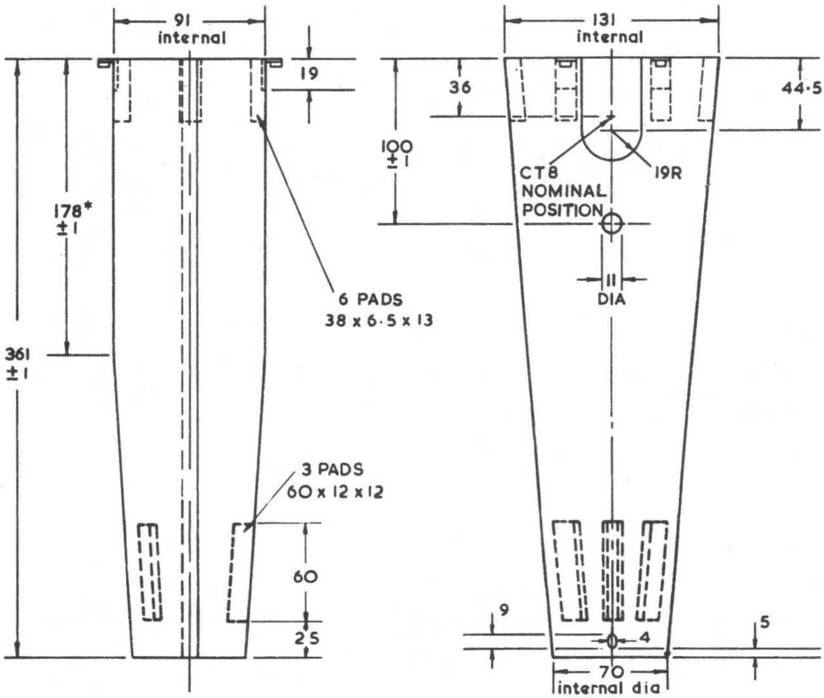

OSCILLOSCOPE TUBES

# Magnetic Shield MS23

MATERIAL 0·35 ±0·05 Mumetal
4 LUGS 0·8 ±0·05 Mild steel spotwelded to shield
Each lug has M4 or 4BA hank bushes fitted
METAL TOLERANCES ± 0·5 Unless otherwise stated
FINISH Silver hammer outside

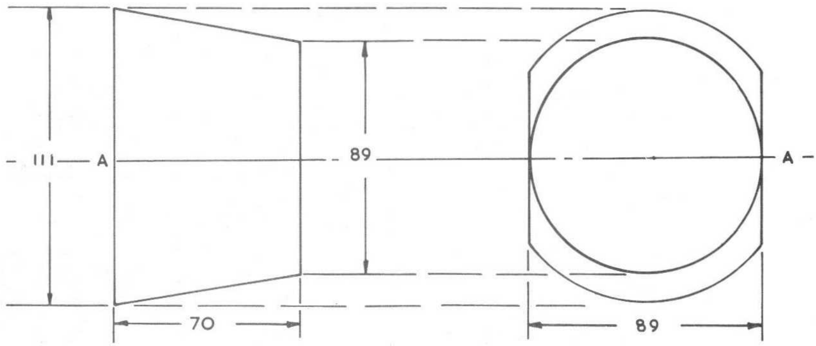
PADS Soft sponge closed cell neoprene
All dimensions in mm
Not to be scaled




* Dimensions at this length are 92 outside x 102 outside with approx. 30R.

## MANDREL FOR TWIST COIL TW 30




All dimensions in mm Not to be scaled

SHIELD

This twist coil is designed to be used in conjunction with magnetic shield MS23 for D13-47..

WINDING

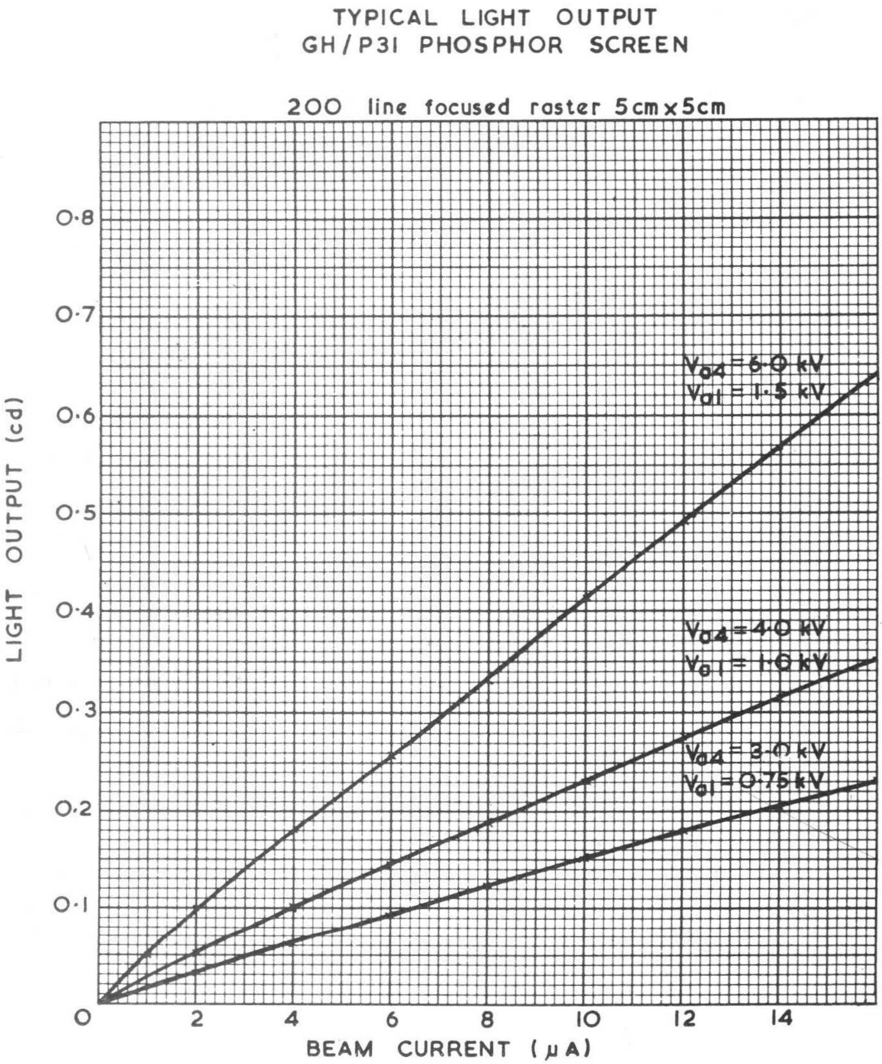
1150 turns of 0.16 mm Lewmex Grade 1 or 2 wire, or approved alternative, layer wound on the adhesive side of adhesive backed crepe paper to give 5 mm margins between the coil and each edge of the mandrel.
Start and finish of winding to be brought out on 450 mm long thin flexible lead wires at position A.
Varnish, if necessary, cover with adhesive backed crepe paper and ensure that the edges of the coil are sealed in place.

ELECTRICAL CHARACTERISTICS

Resistance approx. 300 Ω. Twist coil coefficient approx. 4.5 mA/degree measured on a typical D13-47.. with $V_{a1}$ = 1.5kV $V_{a4-k}$ = 6 kV.

FITTING

The completed twist coil should be pushed hard onto the tube with the lead out wires coming out through the appropriate hole in the shield and secured in two places with suitable adhesive tape.


TYPICAL LIGHT OUTPUT
GH/P31 PHOSPHOR SCREEN
200 line focused raster 5cm x 5cm
LIGHT OUTPUT (cd)
0·8
0·7
0·6
0·5
0·4
0·3
0·2
0·1
0
2
4
6
8
10
12
14
BEAM CURRENT (μA)
Va4 = 6·0 kV
Va1 = 1·5 kV
Va4 = 4·0 kV
Va1 = 1·0 kV
Va4 = 3·0 kV
Va1 = 0·75 kV

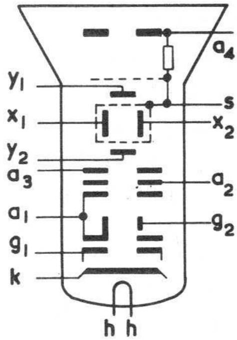
# Oscilloscope Tube

# D13-51..

## GENERAL

This is a short, rectangular, aluminised, all electrostatic tube providing a 10 cm x 6 cm display. High brightness and deflection sensitivity are achieved with a mesh p.d.a. system without additional electrode control voltages. The tube is designed for transistor deflection high bandwidth applications and incorporates a means of beam blanking at anode potential which avoids d.c. coupling to the grid.

| | | | |
|---|---|---|---|
| Heater voltage | $V_h$ | 6.3 | V |
| Heater current | $I_h$ | 0.3 | A |




## ABSOLUTE RATINGS

| | | Max | Min | |
|---|---|---|---|---|
| Fourth anode voltage | $V_{a4}$ | 15.5 | 5.0 | kV |
| Third anode voltage | $V_{a3}$ | 1.75 | 0.6 | kV |
| Second anode voltage | $V_{a2}$ | 1.0 | 0 | kV |
| First anode voltage | $V_{a1}$ | 1.75 | 0.6 | kV |
| Negative control grid voltage | $-V_{g1}$ | 200 | 1.0 | V |
| Beam blanking voltage | $V_{g2}$ | 2.0 | 0.5 | kV |
| Peak heater to cathode voltage | $v_{h-k(pk)}$ | 250 | - | V |
| Peak x-plate to third anode voltage | $v_{x-a3(pk)}$ | 500 | - | V |
| Peak y-plate to third anode voltage | $v_{y-a3(pk)}$ | 500 | - | V |
| x-plate to third anode resistance | $R_{x-a3}$ | 5.0 | - | MΩ |
| y-plate to third anode resistance | $R_{y-a3}$ | 100 | - | kΩ |
| Control grid to cathode resistance | $R_{g1-k}$ | 1.5 | - | MΩ |
| Second anode current | $I_{a2}$ | 10 | - | μA |
| P.D.A. ratio ($V_{a4}/V_{a3}$) | | 11:1 | 5:1 | |
| Helix resistance | | - | 100 | MΩ |

All voltages referred to cathode unless otherwise stated.

## PHOSPHOR SCREEN

This type is usually supplied with GH phosphor (D13-51GH) giving a green trace of medium short persistence. Other phosphor screens can be made available to special order.

**This data should be read in conjunction with Brimar Operational and Safety Recommendations for Industrial Cathode Ray Tubes.**

OSCILLOSCOPE TUBES

# Oscilloscope Tube

## INTER-ELECTRODE CAPACITANCES

| | | | |
|---|---|---|---|
| Grid 1 to all | $c_{g1\text{-all}}$ | 9.5 | pF |
| Grid 2 to all | $c_{g2\text{-all}}$ | 8.9 | pF |
| Heater and cathode to all | $c_{h,k\text{-all}}$ | 4.0 | pF |
| $x_1$ plate to $x_2$ plate | $c_{x1\text{-}x2}$ | 1.8 | pF |
| $y_1$ plate to $y_2$ plate | $c_{y1\text{-}y2}$ | 1.7 | pF |
| $x_1$ plate to all, less $x_2$ plate | $c_{x1\text{-all, less }x2}$ | 4.1 | pF |
| $x_2$ plate to all, less $x_1$ plate | $c_{x2\text{-all, less }x1}$ | 4.1 | pF |
| $y_1$ plate to all, less $y_2$ plate | $c_{y1\text{-all, less }y2}$ | 2.8 | pF |
| $y_2$ plate to all, less $y_1$ plate | $c_{y2\text{-all, less }y1}$ | 2.8 | pF |
| $x_1$, $x_2$ plates to $y_1$, $y_2$ plates | $c_{x1,x2\text{ - }y1,y2}$ | 0.5 | pF |
| Grid 1 to grid 2 | $c_{g1\text{-}g2}$ | 0.6 | pF |
| Grid 1 to $x_1$, $x_2$, $y_1$, $y_2$ plates | $c_{g1\text{-}x1,x2,y1,y2}$ | 0.012 | pF |

## TYPICAL OPERATION - Voltages with respect to cathode

| | | | | | |
|---|---|---|---|---|---|
| Fourth anode voltage | $V_{a4}$ | 7.5 | 10 | 15 | kV |
| Mean deflector plate potential | | 750 | 1000 | 1500 | V |
| Third anode voltage for optimum astigmatism correction | $V_{a3}$ | 750* | 1000* | 1500* | V |
| Second anode voltage for optimum focus | $V_{a2}$ | 20 to 130 | 30 to 150 | 45 to 230 | V |
| First anode voltage | $V_{a1}$ | 750 | 1000 | 1500 | V |
| Shield voltage for optimum raster shape | $V_s$ | 750* | 1000* | 1500* | |
| Beam blanking voltage for cut-off | $V_{g2}$ | 710 to 790† | 955 to 1045† | 1435 to 1565† | V |
| Control grid voltage for cut-off | $V_{g1}$ | -37 to -68 | -50 to -90 | -75 to -135 | V |
| x deflection coefficient | $D_x$ | 8.2 to 11.3 | 11 to 15 | 16.5 to 22.5 | V/cm |
| y deflection coefficient | $D_y$ | 3.4 to 4.5 | 4.5 to 6.0 | 6.8 to 9.0 | V/cm |
| Minimum useful screen area | | 10 x 6 | 10 x 6 | 10 x 6 | $cm^2$ |
| Line width at centre | at 5µA beam current | 0.65 | 0.6 | 0.55 | mm |
| Line width at edge | at 5µA beam current | 1.1 | 1.05 | 1.0 | mm |
| Line width at centre measured by shrinking raster | at 5µA beam current | 0.40 | 0.34 | 0.30 | mm |

* The required voltage will not differ from the quoted value by more than ± 50V.

† The beam is unblanked when $V_{g2} = V_{a1}$. This grid 2 electrode should not be used as a brilliance control.

## RASTER DISTORTION AND ALIGNMENT

The following data applies for the typical operation conditions.

The undeflected spot will fall in a circle of 6 mm radius about the centre of the tube face.

Raster distortion: the edges of a test raster will fall between two concentric rectangles 10 cm x 6 cm and 9.80 cm x 5.85 cm.

Rectangularity of x and y axes is 90° ± 1°. The horizontal trace will be parallel with the axis of the rectangular face-plate to within ± 5°. A twist coil will be required to effect accurate alignment. This should be mounted inside the magnetic shield approximately 90 mm from the face and should not extend more than 150 mm from the face. 45 ampere turns for 10 kV operation or 54 ampere turns for 15 kV operation will suffice, with provision for reversing the current if necessary. The sensitivity (for both x and y plates) at 75% deflection of the useful scan shall not differ by more than 2% from the sensitivity over 10% deflection.

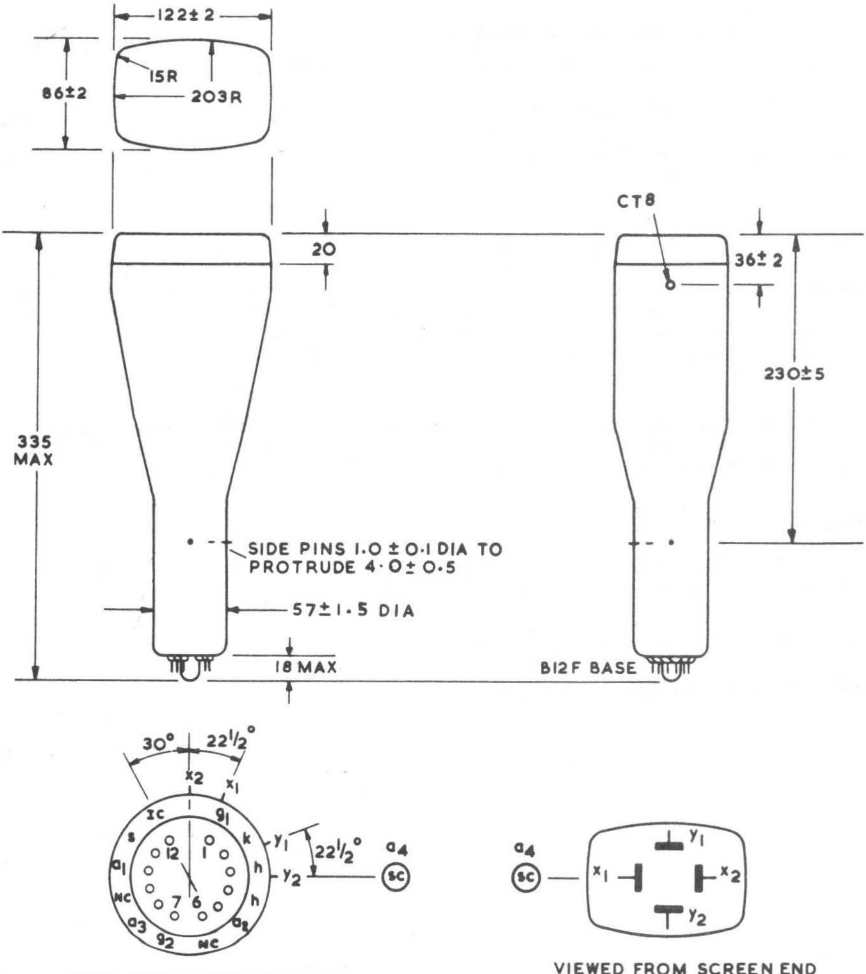
It is preferable that the mean x and y plate potentials are equal otherwise some deterioration in performance will occur. Under no circumstances should the mean y plate potential differ from the mean x plate potential by more than 50V.

## MAGNETIC SHIELDING

Adequate magnetic shielding is required. In addition due attention should be paid to the position of the tube relative to transformers and chokes.

**TUBE WEIGHT** (approximate) - 880 g

**MOUNTING POSITION** - unrestricted



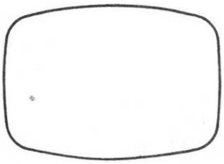

VIEW FROM PINS FREE END
(CT8 AT RIGHT)

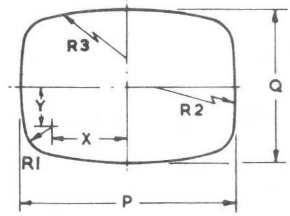
VIEWED FROM SCREEN END
(CT8 AT LEFT)

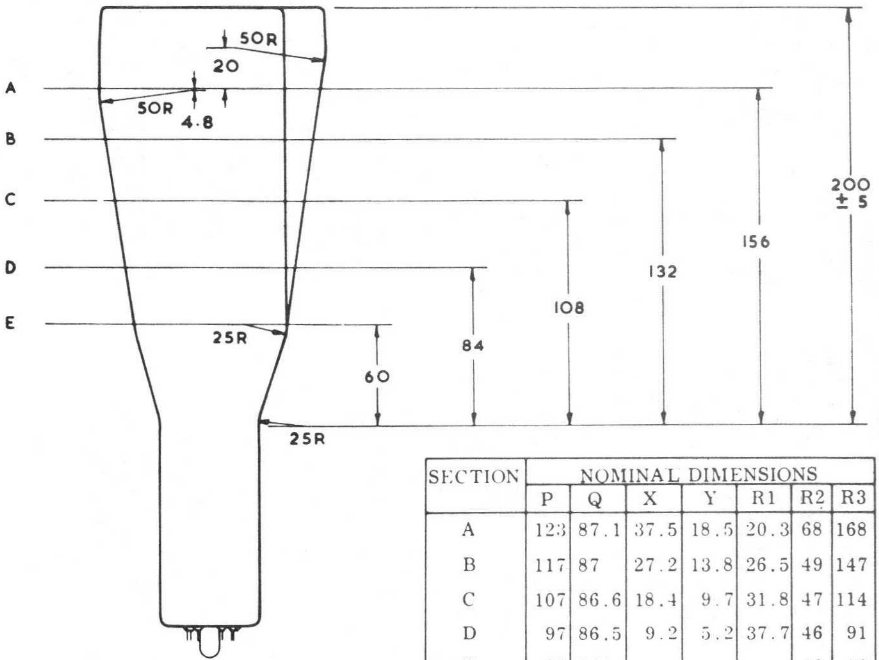
**All dimensions in mm** **Not to be scaled**

It is advisable to support the tube near the screen, and at a second point on the parallel neck near the base. The tube should not be subjected to any stress from the use of clamps and should not be suspended by the base. Connecting leads should not be soldered directly to the tube pins.

Tolerance on all side pin positions ± 5°.



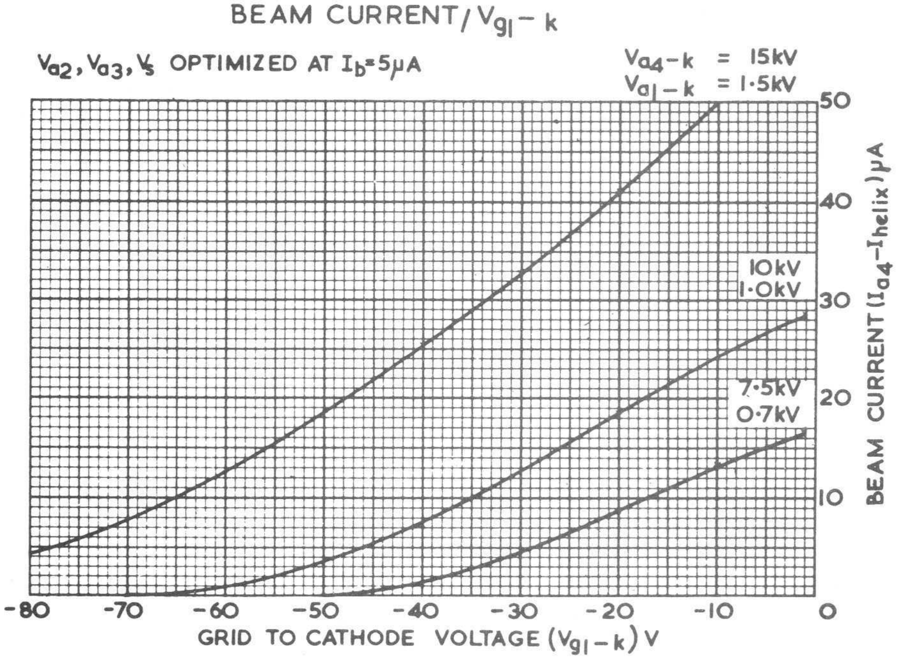


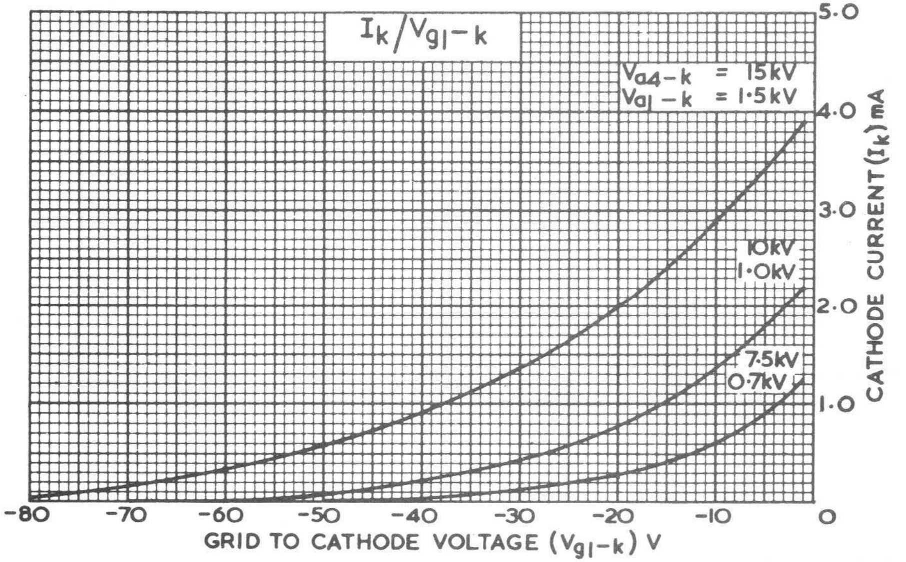




| SECTION | NOMINAL DIMENSIONS | | | | | | |
|---|---|---|---|---|---|---|---|
| | P | Q | X | Y | R1 | R2 | R3 |
| A | 123 | 87.1 | 37.5 | 18.5 | 20.3 | 68 | 168 |
| B | 117 | 87 | 27.2 | 13.8 | 26.5 | 49 | 147 |
| C | 107 | 86.6 | 18.4 | 9.7 | 31.8 | 47 | 114 |
| D | 97 | 86.5 | 9.2 | 5.2 | 37.7 | 46 | 91 |
| E | 86 | 86 | - | - | - | 43 | 43 |

All dimensions in mm

Not to be scaled

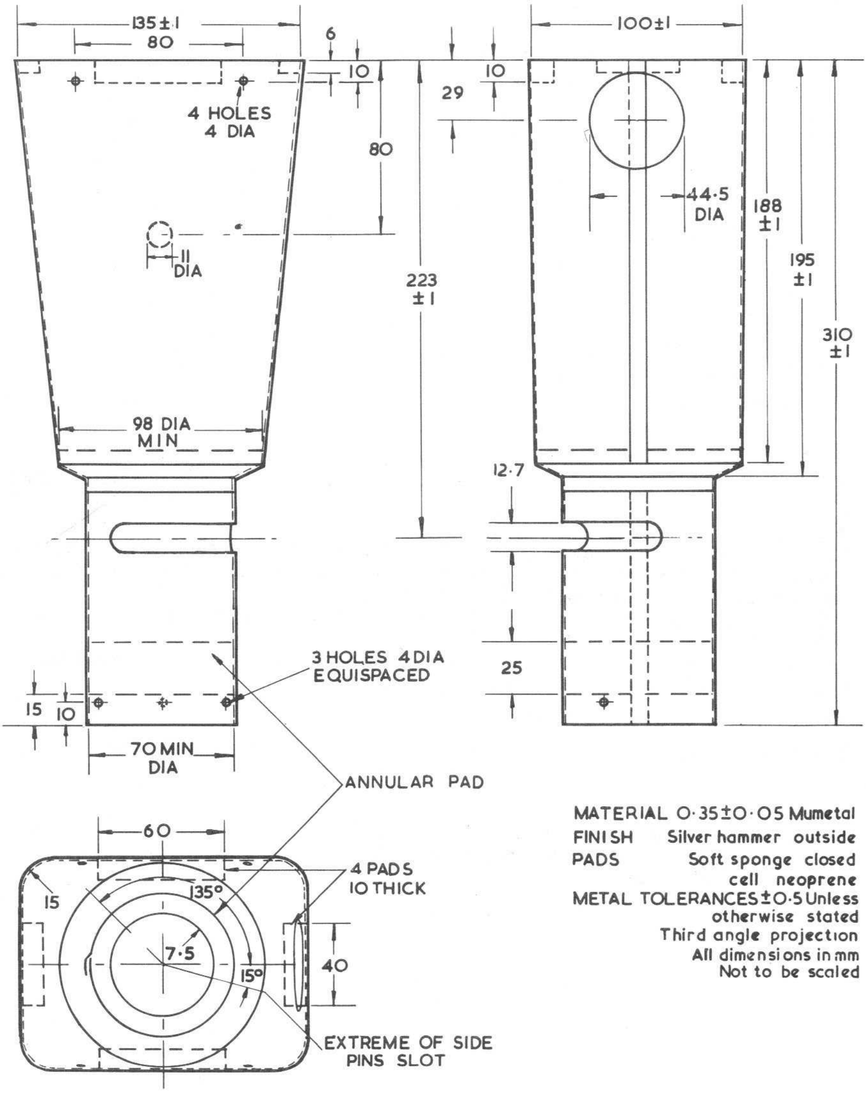

BEAM CURRENT / $V_{g1-k}$
$V_{a2}$, $V_{a3}$, $V_s$ OPTIMIZED AT $I_b$=5μA
$V_{a4-k}$ = 15kV
$V_{a1-k}$ = 1·5kV
10kV
1·0kV
7·5kV
0·7kV
50
40
30
20
10
BEAM CURRENT ($I_{a4}$−$I_{helix}$) μA
-80
-70
-60
-50
-40
-30
-20
-10
0
GRID TO CATHODE VOLTAGE ($V_{g1-k}$) V


$I_k$ / $V_{g1-k}$
$V_{a4-k}$ = 15kV
$V_{a1-k}$ = 1·5kV
10kV
1·0kV
7·5kV
0·7kV
5·0
4·0
3·0
2·0
1·0
CATHODE CURRENT ($I_k$) mA
-80
-70
-60
-50
-40
-30
-20
-10
0
GRID TO CATHODE VOLTAGE ($V_{g1-k}$) V

# Magnetic Shield MS36



EXAMPLE OF TYPICAL SHIELD




MATERIAL 0·35±0·05 Mumetal

FINISH Silver hammer outside

PADS Soft sponge closed cell neoprene

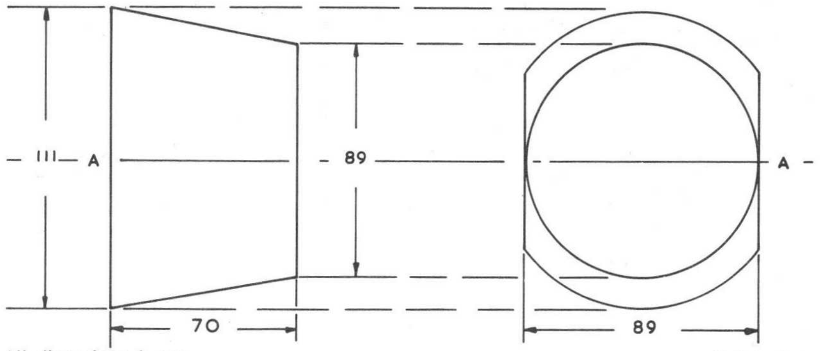
METAL TOLERANCES ±0·5 Unless otherwise stated

Third angle projection

All dimensions in mm

Not to be scaled

MANDREL FOR TWIST COIL TW21




All dimensions in mm

Not to be scaled

SHIELD

This twist coil is designed to be used in conjunction with magnetic shield MS36 for D13-51..

WINDING

1150 turns of 0.2 mm Lewmex Grade 1 or 2 wire, or approved alternative, layer wound on the adhesive side of adhesive backed crepe paper to give 5 mm margins between the coil and each edge of the mandrel.

Start and finish of winding to be brought out on 450 mm long thin flexible lead wires at position A.

Varnish, if necessary, cover with adhesive backed crepe paper and ensure that the edges of the coil are sealed in place.

ELECTRICAL CHARACTERISTICS

Resistance approx. 215 Ω. Twist coil coefficient approx. 7.0 mA/degree.

FITTING

The completed twist coil should be pushed hard onto the tube with the lead out wires coming out through the appropriate hole in the shield and secured in two places with suitable adhesive tape.

# Oscilloscope Tube

# D13-471..

The D13-471.. oscilloscope tube has a 6.3 V 0.12 A heater otherwise it is identical to the D13-47..

## PHOSPHOR SCREEN

This type is usually supplied with GH phosphor (D13-471GH) giving a green trace of medium short persistence. Other phosphor screens can be made available to special order.

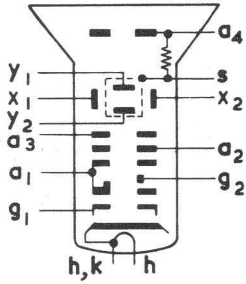
OSCILLOSCOPE TUBES

# D13-600.. Oscilloscope Tube

**GENERAL**

This short 5 inch diameter flat-faced tube with electrostatic focusing and deflection is designed for general purpose applications and is capable of being deflected by transistor circuits. It incorporates a means of beam blanking at anode potential which avoids d.c. coupling to the grid.

| | | | |
|---|---|---|---|
| Heater voltage | $V_h$ | 6.3 | V |
| Heater current | $I_h$ | 0.3 | A |




**ABSOLUTE RATINGS**

| | | Max | Min | |
|---|---|---|---|---|
| Fourth anode voltage | $V_{a4}$ | 4.0 | 1.5 | kV |
| Third anode voltage | $V_{a3}$ | 1.75 | 0.6 | kV |
| Second anode voltage | $V_{a2}$ | 1.0 | 0 | kV |
| First anode voltage | $V_{a1}$ | 1.75 | 0.6 | kV |
| Negative grid voltage | $-V_{g1}$ | 200 | 1.0 | V |
| Beam blanking voltage | $V_{g2}$ | 2.0 | 0.5 | kV |
| Peak x-plate to third anode voltage | $v_{x-a3(pk)}$ | 500 | - | V |
| Peak y-plate to third anode voltage | $v_{y-a3(pk)}$ | 500 | - | V |
| x-plate to third anode resistance | $R_{x-a3}$ | 5.0 | - | MΩ |
| y-plate to third anode resistance | $R_{y-a3}$ | 100 | - | kΩ |
| Control grid to cathode resistance | $R_{g1-k}$ | 1.5 | - | MΩ |
| Second anode current | $I_{a2}$ | 10 | - | μA |
| P.D.A. ratio ($V_{a4}/V_{a3}$) | | 2.2:1 | | |
| Helix resistance | | - | 15 | MΩ |

All voltages referred to cathode unless otherwise stated.

**PHOSPHOR SCREEN**

This type is usually supplied with GH phosphor (D13-600GH) giving a green trace of medium short persistence. Other phosphor screens can be made available to special order.

## INTER-ELECTRODE CAPACITANCES

| | | | |
|---|---|---|---|
| Grid 1 to all | $c_{g1\text{-}all}$ | 9.5 | pF |
| Grid 2 to all | $c_{g2\text{-}all}$ | 10 | pF |
| Heater and cathode to all | $c_{h,k\text{-}all}$ | 3.5 | pF |
| $x_1$ plate to $x_2$ plate | $c_{x1\text{-}x2}$ | 2.2 | pF |
| $y_1$ plate to $y_2$ plate | $c_{y1\text{-}y2}$ | 1.6 | pF |
| $x_1$ plate to all, less $x_2$ plate | $c_{x1\text{-}all, less\ x2}$ | 6.3 | pF |
| $x_2$ plate to all, less $x_1$ plate | $c_{x2\text{-}all, less\ x1}$ | 6.3 | pF |
| $y_1$ plate to all, less $y_2$ plate | $c_{y1\text{-}all, less\ y2}$ | 5.2 | pF |
| $y_2$ plate to all, less $y_1$ plate | $c_{y2\text{-}all, less\ y1}$ | 5.0 | pF |
| $x_1$, $x_2$ plate to $y_1$, $y_2$ plates | $c_{x1,x2\text{-}y1,y2}$ | 0.8 | pF |
| Grid 1 to grid 2 | $c_{g1\text{-}g2}$ | 0.6 | pF |
| Grid 1 to $x_1$, $x_2$, $y_1$, $y_2$ plates | $c_{g1\text{-}x1,x2,y1,y2}$ | 1.4 | pF |

## TYPICAL OPERATION - voltages with respect to cathode.

| | | | | |
|---|---|---|---|---|
| Fourth anode voltage | $V_{a4}$ | 2.0 | 3.0 | kV |
| Mean deflector plate potential | | 1000 | 1500 | V |
| Third anode voltage for optimum astigmatism correction | $V_{a3}$ | 1000* | 1500* | V |
| Second anode voltage for optimum focus | $V_{a2}$ | 200 to 340 | 300 to 500 | V |
| First anode voltage | $V_{a1}$ | 1000 | 1500 | V |
| Shield voltage for optimum raster shape | $V_s$ | 1000* | 1500* | V |
| Beam blanking voltage for cut-off | $V_{g2}$ | 935† | 1405† | V |
| Control grid voltage for cut-off | $V_{g1}$ | -35 to -65 | -50 to -95 | V |
| x-deflection coefficient | $D_x$ | 14 to 18 | 21 to 27 | V/cm |
| y-deflection coefficient | $D_y$ | 6.6 to 8.5 | 10 to 12.7 | V/cm |
| Minimum screen area (corners cut-off) | | 10 x 8 | 10 x 8 | $cm^2$ |
| Line width at centre-using microscope | at 10$\mu$A beam current | 0.55 | 0.5 | mm |
| Line width at edge-using microscope | at 10$\mu$A beam current | 0.85 | 0.82 | mm |
| Line width at centre measured by shrinking raster | at 10$\mu$A beam current | 0.28 | 0.25 | mm |

* The required voltage will not differ from the quoted value by more than ± 75V.

† The beam is unblanked when $V_{g2} = V_{a1}$. This grid 2 electrode should not be used as a brilliance control.

OSCILLOSCOPE TUBES

## RASTER DISTORTION AND ALIGNMENT

The following data applies for the typical operation conditions.

The undeflected spot will fall in a circle of 6 mm radius about the centre of the tube face.

Raster distortion: the edges of a test raster will fall between two concentric rectangles 10 cm x 8 cm and 9.75 cm x 7.8 cm.

Rectangularity of x and y axes is 90° ± 1°.

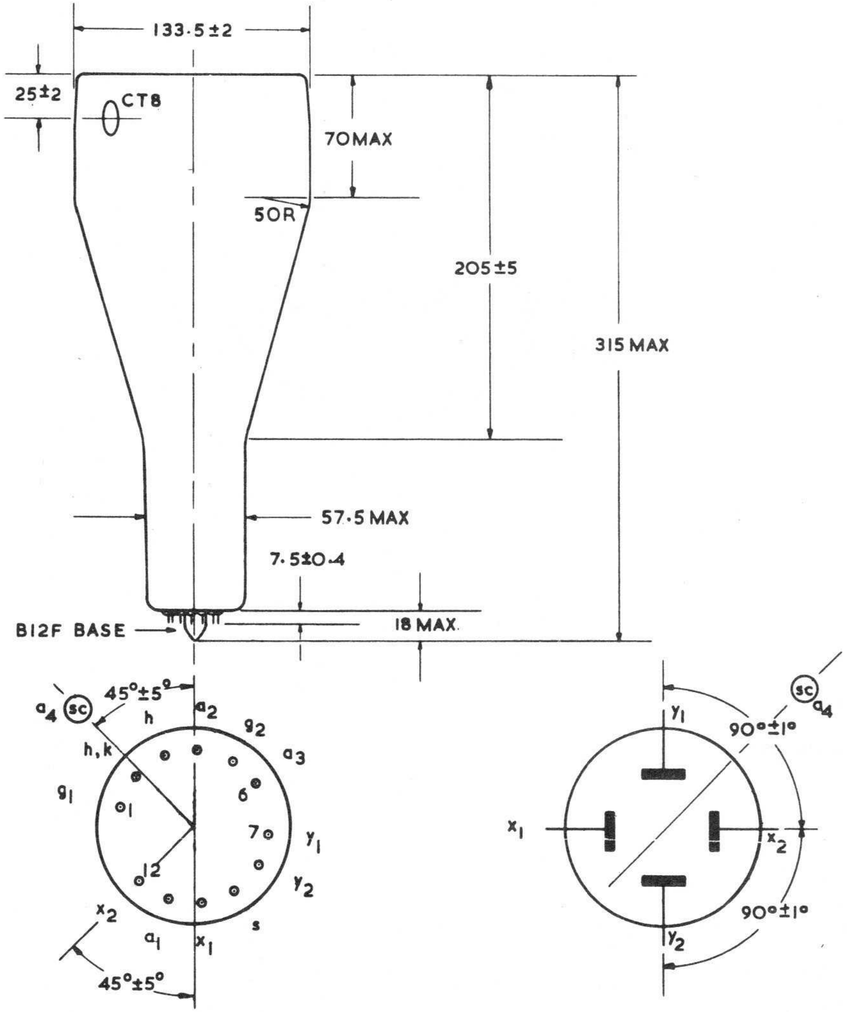
It is preferable that the mean x and y plate potentials are equal otherwise some deterioration in performance will occur. Under no circumstances should the mean y plate potential differ from the mean x plate potential by more than 50V.

## MAGNETIC SHIELDING

Adequate magnetic shielding is required. In addition due attention should be paid to the position of the tube relative to transformers and chokes.

**TUBE WEIGHT** (approximate) 950g

**MOUNTING POSITION** - unrestricted




All dimensions in mm

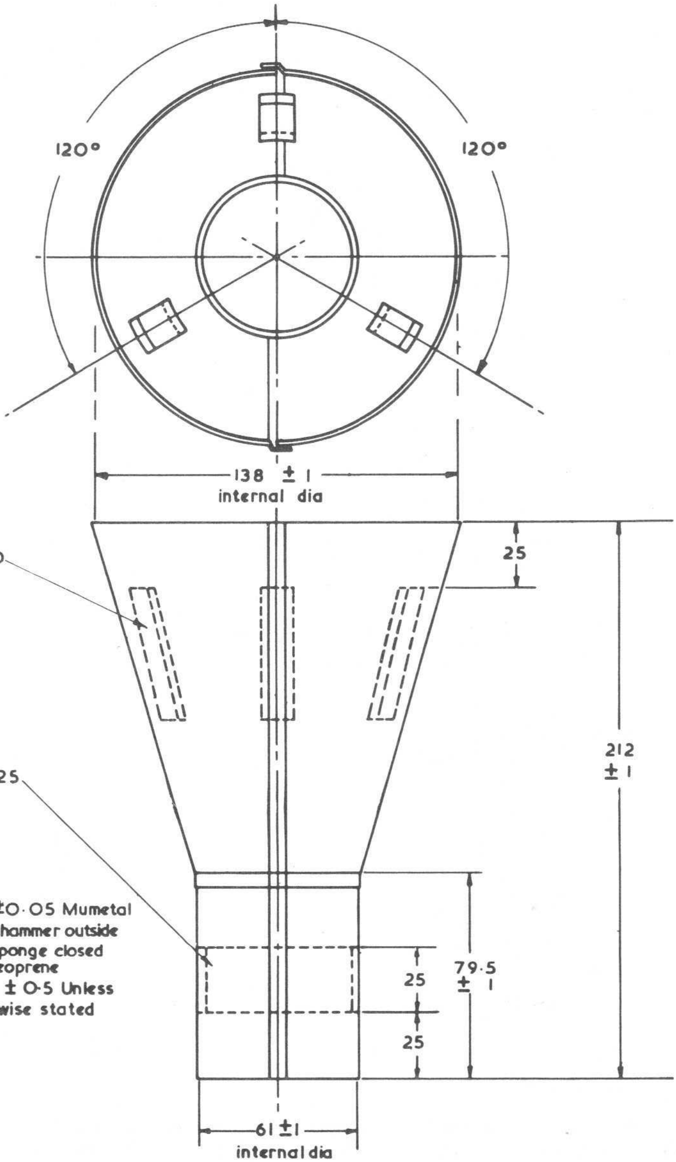
Not to be scaled

It is advisable to support the tube near the screen and at a second point on the parallel neck near the base. The tube should not be subjected to any stress from the use of clamps and should not be suspended by the base.

Connecting leads should not be soldered directly to the tube pins.

# Magnetic Shield MS47

EXAMPLE OF TYPICAL SHIELD




MATERIAL 0·35±0·05 Mumetal
FINISH Silver hammer outside
PADS Soft sponge closed cell neoprene
METAL TOLERANCES ± 0·5 Unless otherwise stated
All dimensions in mm
Not to be scaled



BRIMAR

# Oscilloscope Tube

# D13-601..

The D13-601.. oscilloscope tube has a 6.3 V 0.12 A heater otherwise it is identical to the D13-600..

## PHOSPHOR SCREEN

This type is usually supplied with GH phosphor (D13-601GH) giving a green trace of medium short persistence. Other phosphor screens can be made available to special order.





BRIMAR

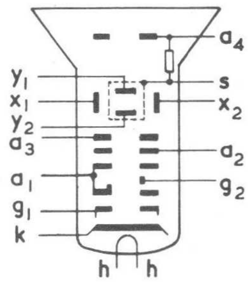
# D13-610..

# Oscilloscope Tube

## GENERAL

This 13 cm diameter round tube with electrostatic focusing and deflection is designed for medium bandwidth applications and is capable of being deflected by transistor circuits. It incorporates a means of beam blanking at anode potential which avoids d.c. coupling to the grid.

| | | | |
|---|---|---|---|
| Heater Voltage | $V_h$ | 6.3 | V |
| Heater Current | $I_h$ | 0.3 | A |




## ABSOLUTE RATINGS

| | | Max | Min | |
|---|---|---|---|---|
| Fourth anode voltage | $V_{a4}$ | 7.0 | 2.5 | kV |
| Third anode voltage | $V_{a3}$ | 1.75 | 0.6 | kV |
| Second anode voltage | $V_{a2}$ | 1.0 | 0 | kV |
| First anode voltage | $V_{a1}$ | 1.75 | 0.6 | kV |
| Negative control grid voltage | $-V_{g1}$ | 200 | 1.0 | V |
| Beam blanking voltage | $V_{g2}$ | 2.0 | 0.5 | kV |
| Peak x plate to third anode voltage | $v_{x-a3(pk)}$ | 500 | - | V |
| Peak y plate to third anode voltage | $v_{y-a3(pk)}$ | 500 | - | V |
| x plate to third anode resistance | $R_{x-a3}$ | 5.0 | - | MΩ |
| y plate to third anode resistance | $R_{y-a3}$ | 100 | - | kΩ |
| Control grid to cathode resistance | $R_{g1-k}$ | 1.5 | - | MΩ |
| Second anode current | $I_{a2}$ | 10 | - | μA |
| P.D.A. ratio ($V_{a4}/V_{a3}$ nom.) | | 4:1 | | |
| Helix resistance | | - | 50 | MΩ |

All voltages referred to cathode unless otherwise stated.

## PHOSPHOR SCREEN

This type is usually supplied with GH phosphor (D13-610GH) giving a green trace of medium short persistence. Other phosphor screens can be made available to special order.

**Thorn Radio Valves and Tubes Limited**

## INTER-ELECTRODE CAPACITANCES

| | | | |
|---|---|---|---|
| Grid to all | $c_{g1\text{-}all}$ | 10 | pF |
| Grid 2 to all | $c_{g2\text{-}all}$ | 9.0 | pF |
| Cathode to all | $c_{k\text{-}all}$ | 3.5 | pF |
| $x_1$ plate to $x_2$ plate | $c_{x1\text{-}x2}$ | 2.8 | pF |
| $y_1$ plate to $y_2$ plate | $c_{y1\text{-}y2}$ | 2.0 | pF |
| $x_1$ plate to all, less $x_2$ plate | $c_{x1\text{-}all,\ less\ x2}$ | 5.7 | pF |
| $x_2$ plate to all, less $x_1$ plate | $c_{x2\text{-}all,\ less\ x1}$ | 5.6 | pF |
| $y_1$ plate to all, less $y_2$ plate | $c_{y1\text{-}all,\ less\ y2}$ | 4.7 | pF |
| $y_2$ plate to all, less $y_1$ plate | $c_{y2\text{-}all,\ less\ y1}$ | 4.5 | pF |
| $x_1$, $x_2$ plates to $y_1$, $y_2$ plates | $c_{x1,x2\text{-}y1,y2}$ | 0.7 | pF |
| Grid 1 to $x_1$, $x_2$ plates | $c_{g1\text{-}x1,x2}$ | 0.5 | pF |
| Grid 1 to $y_1$, $y_2$ plates | $c_{g1\text{-}y1,y2}$ | 0.5 | pF |
| Grid 1 to Grid 2 | $c_{g1\text{-}g2}$ | 0.6 | pF |

## TYPICAL OPERATION - voltages with respect to cathode.

| | | | | | |
|---|---|---|---|---|---|
| Fourth anode voltage | $V_{a4}$ | 3.0 | 4.0 | 4.5 | kV |
| Mean deflector plate potential | | 1.0 | 1.0 | 1.5 | kV |
| Third anode voltage for optimum astigmatism correction | $V_{a3}$ | 1.0* | 1.0* | 1.5* | V |
| Second anode voltage for optimum focus | $V_{a2}$ | 170 to 380 | 175 to 400 | 255 to 570 | V |
| First anode voltage | $V_{a1}$ | 1.0 | 1.0 | 1.5 | kV |
| Shield voltage for optimum raster shape | $V_s$ | 1.0* | 1.0* | 1.5* | kV |
| Beam blanking voltage for cut-off | $V_{g2}$ | 935† | 935† | 1400† | V |
| Control grid voltage for cut-off | $V_{g1}$ | -35 to -65 | -35 to -65 | -50 to -95 | V |
| x deflection coefficient | $D_x$ | 12.5 to 15.8 | 14.5 to 17.5 | 18.8 to 23.7 | V/cm |
| y deflection coefficient | $D_y$ | 6.8 to 8.7 | 7.1 to 8.9 | 10.2 to 13.1 | V/cm |
| Minimum screen area (corners cut-off) | | 10 x 8 | 10 x 6 | 10 x 8 | $cm^2$ |
| Line width at 10$\mu$A beam current: Shrinking raster measurement at centre | | .39 | .36 | .33 | mm |
| Shrinking raster measurement at edge | | .48 | .50 | .44 | mm |

* The required voltage will not differ from the quoted value by more than ± 50V.

† The beam is unblanked when $V_{g2} = V_{a1}$. This grid 2 electrode should not be used as a brilliance control.

## RASTER DISTORTION AND ALIGNMENT

The following data applies for the typical operation conditions.

The undeflected spot will fall in a circle of 8 mm radius about the centre of the tube face.

Raster distortion: the edges of a test raster will fall between two concentric rectangles 10 cm x 8 cm and 9.75 cm x 7.8 cm at a p.d.a. ratio of 3:1.

Rectangularity of x and y axes is 90° ± 1°.

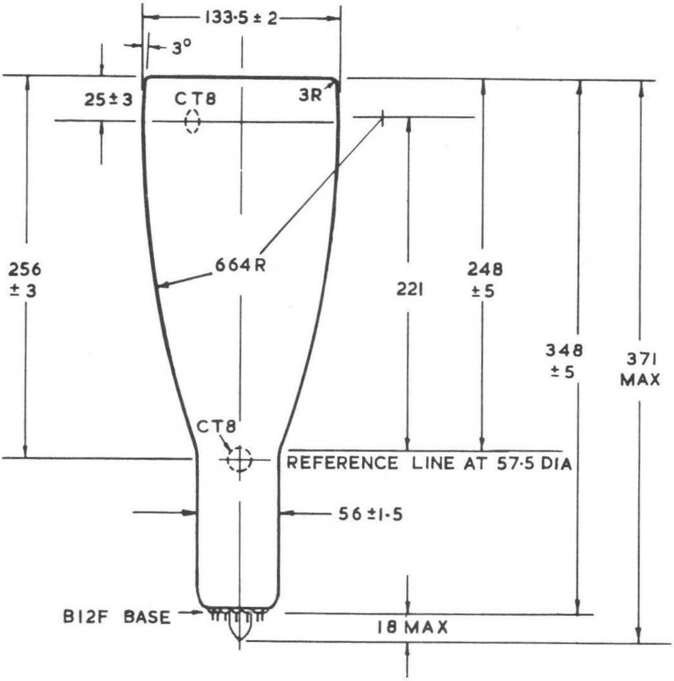
It is preferable that the mean x and y plate potentials are equal otherwise some deterioration in performance will occur. Under no circumstances should the mean y plate potential differ from the mean x plate potential by more than 50V.

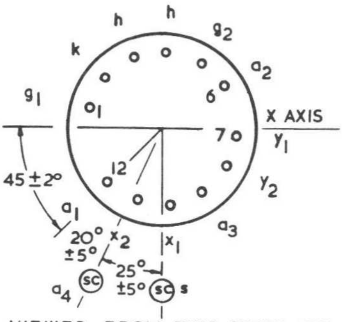
## MAGNETIC SHIELDING

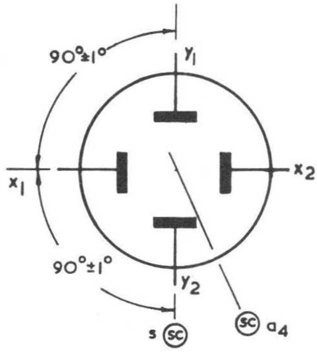
Adequate magnetic shielding is required. In addition due attention should be paid to the position of the tube relative to transformers and chokes.

## TUBE WEIGHT (approximate) 1.2 kg

## MOUNTING POSITION - unrestricted




All dimensions in mm

Not to be scaled

It is advisable to support the tube near the screen and at a second point on the parallel neck near the base. The tube should not be subjected to any stress from the use of clamps and should not be suspended by the base.

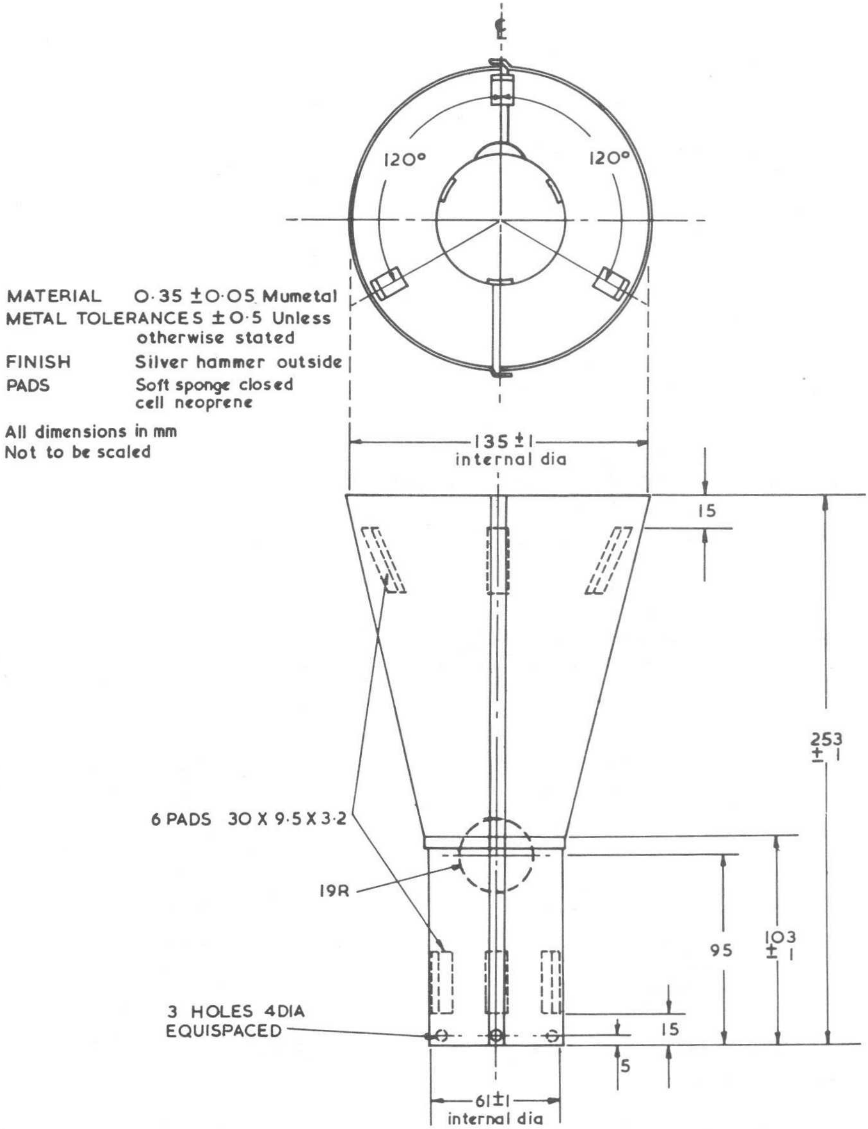
Connecting leads should not be soldered directly to the tube pins.



OSCILLOSCOPE TUBES

# Magnetic Shield MS49

EXAMPLE OF TYPICAL SHIELD






BRIMAR

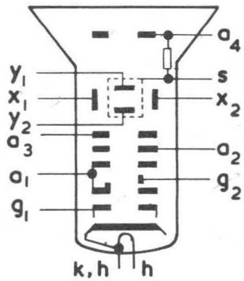
# Oscilloscope Tube

# D13-611..

## GENERAL

This 13 cm diameter round tube with electrostatic focusing and deflection is designed for medium bandwidth applications and is capable of being deflected by transistor circuits. It incorporates a means of beam blanking at anode potential which avoids d.c. coupling to the grid.

| | | | |
|---|---|---|---|
| Heater Voltage | $V_h$ | 6.3 | V |
| Heater Current | $I_h$ | 0.3 | A |




## ABSOLUTE RATINGS

| | | Max | Min | |
|---|---|---|---|---|
| Fourth anode voltage | $V_{a4}$ | 7.0 | 2.5 | kV |
| Third anode voltage | $V_{a3}$ | 1.75 | 0.6 | kV |
| Second anode voltage | $V_{a2}$ | 1.0 | 0 | kV |
| First anode voltage | $V_{a1}$ | 1.75 | 0.6 | kV |
| Negative control grid voltage | $-V_{g1}$ | 200 | 1.0 | V |
| Beam blanking voltage | $V_{g2}$ | 2.0 | 0.5 | kV |
| Peak x plate to third anode voltage | $v_{x-a3(pk)}$ | 500 | - | V |
| Peak y plate to third anode voltage | $v_{y-a3(pk)}$ | 500 | - | V |
| x plate to third anode resistance | $R_{x-a3}$ | 100 | - | kΩ |
| y plate to third anode resistance | $R_{y-a3}$ | 100 | - | kΩ |
| Control grid to cathode resistance | $R_{g1-k}$ | 1.5 | - | MΩ |
| Second anode current | $I_{a2}$ | 10 | - | μA |
| P.D.A. ratio ($V_{a4}/V_{a3}$ nom.) | | 4:1 | | |
| Helix resistance | | - | 50 | MΩ |

All voltages referred to cathode unless otherwise stated.

## PHOSPHOR SCREEN

This type is usually supplied with GH phosphor (D13-611GH) giving a green trace of medium short persistence. Other phosphor screens can be made available to special order.

OSCILLOSCOPE TUBES

**Thorn Radio Valves and Tubes Limited**

BRIMAR

### INTER-ELECTRODE CAPACITANCES

| | | | |
|---|---|---|---|
| Grid 1 to all | $c_{g1\text{-all}}$ | 10 | pF |
| Grid 2 to all | $c_{g2\text{-all}}$ | 9.0 | pF |
| Heater and Cathode to all | $c_{h,k\text{-all}}$ | 4.0 | pF |
| $x_1$ plate to $x_2$ plate | $c_{x1\text{-}x2}$ | 2.0 | pF |
| $y_1$ plate to $y_2$ plate | $c_{y1\text{-}y2}$ | 1.4 | pF |
| $x_1$ plate to all, less $x_2$ plate | $c_{x1\text{-all, less }x2}$ | 6.1 | pF |
| $x_2$ plate to all, less $x_1$ plate | $c_{x2\text{-all, less }x1}$ | 5.8 | pF |
| $y_1$ plate to all, less $y_2$ plate | $c_{y1\text{-all, less }y2}$ | 4.6 | pF |
| $y_2$ plate to all, less $y_1$ plate | $c_{y2\text{-all, less }y1}$ | 4.8 | pF |
| $x_1$, $x_2$ plates to $y_1$, $y_2$ plates | $c_{x1,x2\text{-}y1,y2}$ | 0.6 | pF |
| Grid 1 to $x_1$, $x_2$, $y_1$, $y_2$ plates | $c_{g1\text{-}x1,x2,y1,y2}$ | 1.0 | pF |
| Grid 1 to Grid 2 | $c_{g1\text{-}g2}$ | 0.5 | pF |
| Anode 4 to coating M (approx.) | $c_{a4\text{-}M}$ | 300 | pF |

### TYPICAL OPERATION - voltages with respect to cathode.

| | | | | | |
|---|---|---|---|---|---|
| Fourth anode voltage | $V_{a4}$ | 3.5 | 4.0 | 4.5 | kV |
| Mean deflector plate potential | | 1.0 | 1.0 | 1.5 | kV |
| Third anode voltage for optimum astigmatism correction | $V_{a3}$ | 1.0* | 1.0* | 1.5* | V |
| Second anode voltage for optimum focus | $V_{a2}$ | 170 to 380 | 175 to 400 | 255 to 570 | V |
| First anode voltage | $V_{a1}$ | 1.0 | 1.0 | 1.5 | kV |
| Shield voltage for optimum raster shape | $V_s$ | 1.0* | 1.0* | 1.5* | kV |
| Beam blanking voltage for cut-off | $V_{g2}$ | 935† | 935† | 1400† | V |
| Control grid voltage for cut-off | $V_{g1}$ | -35 to -70 | -35 to -70 | -50 to -105 | V |
| x deflection coefficient | $D_x$ | 14.1 to 16.9 | 14.5 to 17.5 | 18.8 to 23.7 | V/cm |
| y deflection coefficient | $D_y$ | 7.0 to 8.9 | 7.1 to 8.9 | 10.2 to 13.1 | V/cm |
| Minimum screen area (corners cut-off) | | 10 x 8 | 10 x 6 | 10 x 8 | $cm^2$ |
| Line width at 10$\mu$A beam current | | | | | |
| Shrinking raster measurement at centre | | .37 | .36 | .33 | mm |
| Shrinking raster measurement at edge | | .48 | .50 | .44 | mm |

* The required voltage will not differ from the quoted value by more than ± 50V.

† The beam is unblanked when $V_{g2} = V_{a1}$. This grid 2 electrode should not be used as a brilliance control.

## RASTER DISTORTION AND ALIGNMENT

The following data applies for the typical operation conditions.

The undeflected spot will fall in a circle of 7 mm radius about the centre of the tube face.

Raster distortion: the edges of a test raster will fall between two concentric rectangles 10 cm x 8 cm and 9.75 cm and 7.8 cm at a p.d.a. ratio of 3.5 : 1.

Rectangularity of x and y axes is 90° ± 1 .

It is preferable that the mean x and y plate potentials are equal otherwise some deterioration in performance will occur. Under no circumstances should the mean y plate potential differ from the mean x plate potential by more than 50V.

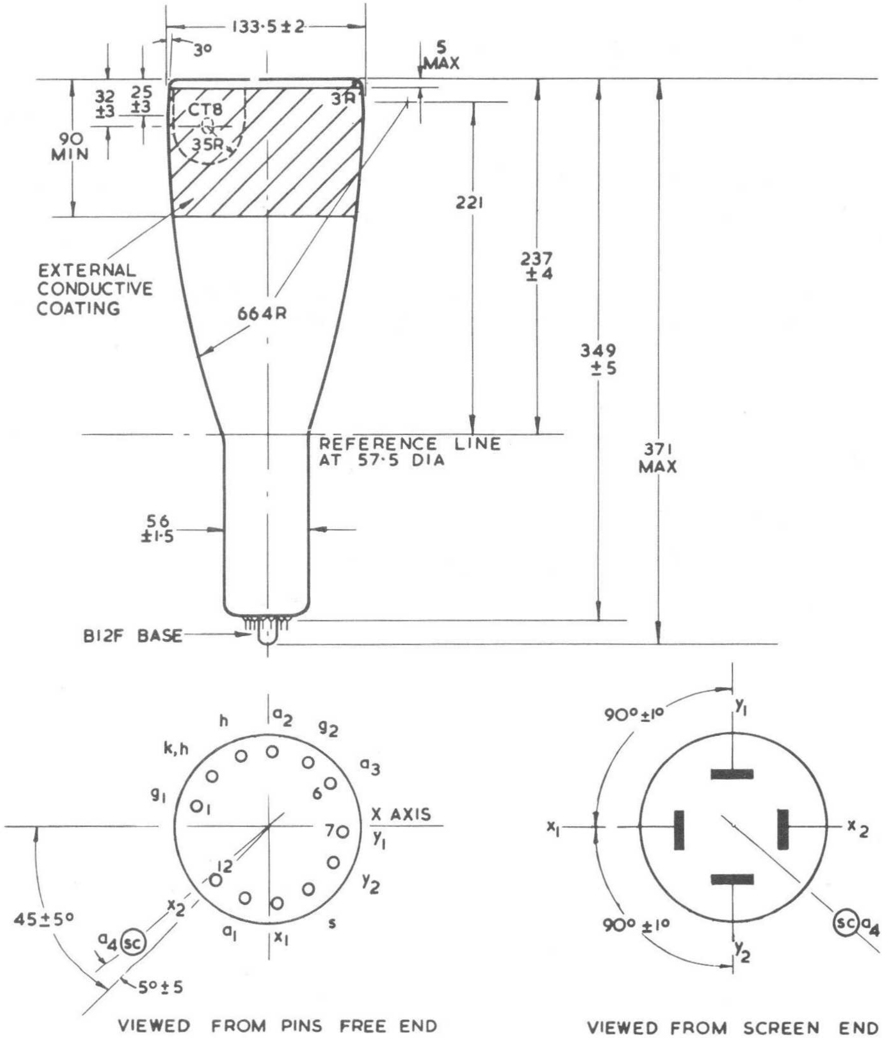
## MAGNETIC SHIELDING

Adequate magnetic shielding is required. In addition due attention should be paid to the position of the tube relative to transformers and chokes.

**TUBE WEIGHT** (approximate) 1.2 kg

**MOUNTING POSITION** - unrestricted

# Oscilloscope Tube




All dimensions in mm

Not to be scaled

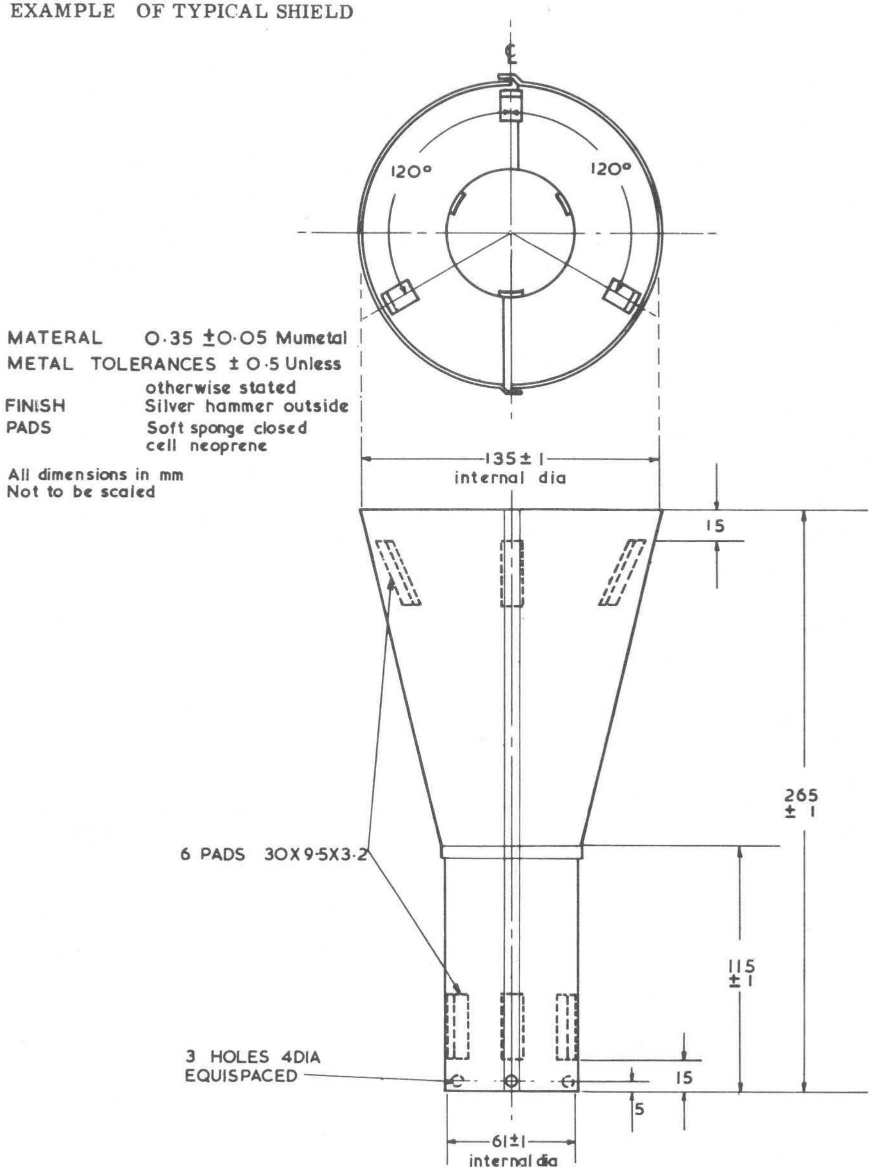
It is advisable to support the tube near the screen and at a second point on the parallel neck near the base. The tube should not be subjected to any stress from the use of clamps and should not be suspended by the base.

Connecting leads should not be soldered directly to the tube pins.

# Magnetic Shield MS 50



EXAMPLE OF TYPICAL SHIELD






**Thorn Radio Valves and Tubes Limited**

BRIMAR

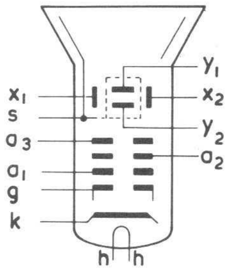
# D13-630..

# Oscilloscope Tube

**GENERAL**

This 13 cm diameter oscilloscope tube is primarily intended for use in inexpensive oscilloscopes and monitoring devices. The tube has sufficient deflector sensitivity to permit transistor driven deflection.

| | | | |
|---|---|---|---|
| Heater voltage | $V_h$ | 6.3 | V |
| Heater current | $I_h$ | 0.3 | A |




**ABSOLUTE RATINGS** - voltages with respect to cathode

| | | Max | Min | |
|---|---|---|---|---|
| First anode voltage | $V_{a1}$ | 2200 | 1250 | V |
| Second anode voltage | $V_{a2}$ | 800 | - | V |
| Third anode voltage | $V_{a3}$ | 2250 | 1200 | V |
| Negative grid voltage | $-V_g$ | 200 | 1.0 | V |
| Peak x-plate to third anode voltage | $v_{x-a3(pk)}$ | 500 | - | V |
| Peak y-plate to third anode voltage | $v_{y-a3(pk)}$ | 500 | - | V |
| Heater to cathode voltage | $V_{h-k}$ | ± 125 | | V |
| x-plate to third anode resistance | $R_{x-a3}$ | 2.0 | - | MΩ |
| y-plate to third anode resistance | $R_{y-a3}$ | 2.0 | - | MΩ |
| Grid to cathode resistance | $R_{g-k}$ | 1.5 | - | MΩ |
| Peak cathode current | $i_{k(pk)}$ | 500 | - | μA |

**PHOSPHOR SCREEN**

This tube is usually supplied with GH phosphor (D13-630GH) giving a green trace of medium short persistence. Other phosphors can be made available to special order.

This data should be read in conjunction with Brimar Operational and Safety Recommendations for Industrial Cathode Ray Tubes.

## INTER - ELECTRODE CAPACITANCES

| | | | |
|---|---|---|---|
| Grid 1 to all | $c_{g1\text{-}all}$ | 8.2 | pF |
| Heater and cathode to all | $c_{h,k\text{-}all}$ | 2.3 | pF |
| $x_1$ plate to $x_2$ plate | $c_{x1\text{-}x2}$ | 1.7 | pF |
| $y_1$ plate to $y_2$ plate | $c_{y1\text{-}y2}$ | 1.3 | pF |
| $x_1$ plate to all, less $x_2$ plate | $c_{x1\text{-}all,\ less\ x2}$ | 5.0 | pF |
| $x_2$ plate to all, less $x_1$ plate | $c_{x2\text{-}all,\ less\ x1}$ | 4.8 | pF |
| $y_1$ plate to all, less $y_2$ plate | $c_{y1\text{-}all,\ less\ y2}$ | 3.6 | pF |
| $y_2$ plate to all, less $y_1$ plate | $c_{y2\text{-}all,\ less\ y1}$ | 3.7 | pF |
| $x_1$, $x_2$ plates to $y_1$, $y_2$ plates | $c_{x1,x2\text{-}y1,y2}$ | 0.7 | pF |

## TYPICAL OPERATION - voltages with respect to cathode

| | | | | |
|---|---|---|---|---|
| Mean deflector plate potential* | | 1500 | 2000 | V |
| Third anode voltage for optimum astigmatism correction | $V_{a3}$ | 1500 † | 2000† | V |
| Second anode voltage for optimum focus | $V_{a2}$ | 125 to 220 | 170 to 290 | V |
| First anode voltage | $V_{a1}$ | 1500 | 2000 | V |
| Shield voltage for optimum raster shape | $V_s$ | 1500 † | 2000† | V |
| Control grid voltage for cut-off | $V_{g1}$ | -22 to -52 | -30 to -70 | V |
| x deflection coefficient | $D_x$ | 14.3 to 17.5 | 19 to 23 | V/cm |
| y deflection coefficient | $D_y$ | 9.0 to 11.3 | 12.0 to 15.0 | V/cm |
| Minimum useful screen area (Diagonal 11.4 cm) | | 10 x 8.0 | 10 x 8.0 | $cm^2$ |
| Grid drive to 10 $\mu$A beam current (approx) | | 10 | 11 | V |
| Line width at 10 $\mu$A beam current Shrinking raster measurement at centre | | 0.40 | 0.35 | mm |

* This tube is designed for symmetrical operation.

† The required voltage will not differ from the quoted value by more than ± 30V.

OSCILLOSCOPE TUBES

## RASTER DISTORTION AND ALIGNMENT

The undeflected spot will fall in a circle of 7 mm radius about the centre of the tube face.

Raster distortion: the edges of a test raster will fall between two concentric rectangles 8.5 cm x 7.0 cm and 8.3 cm x 6.88 cm.

Rectangularity of x and y axes is 90° ± 1°.

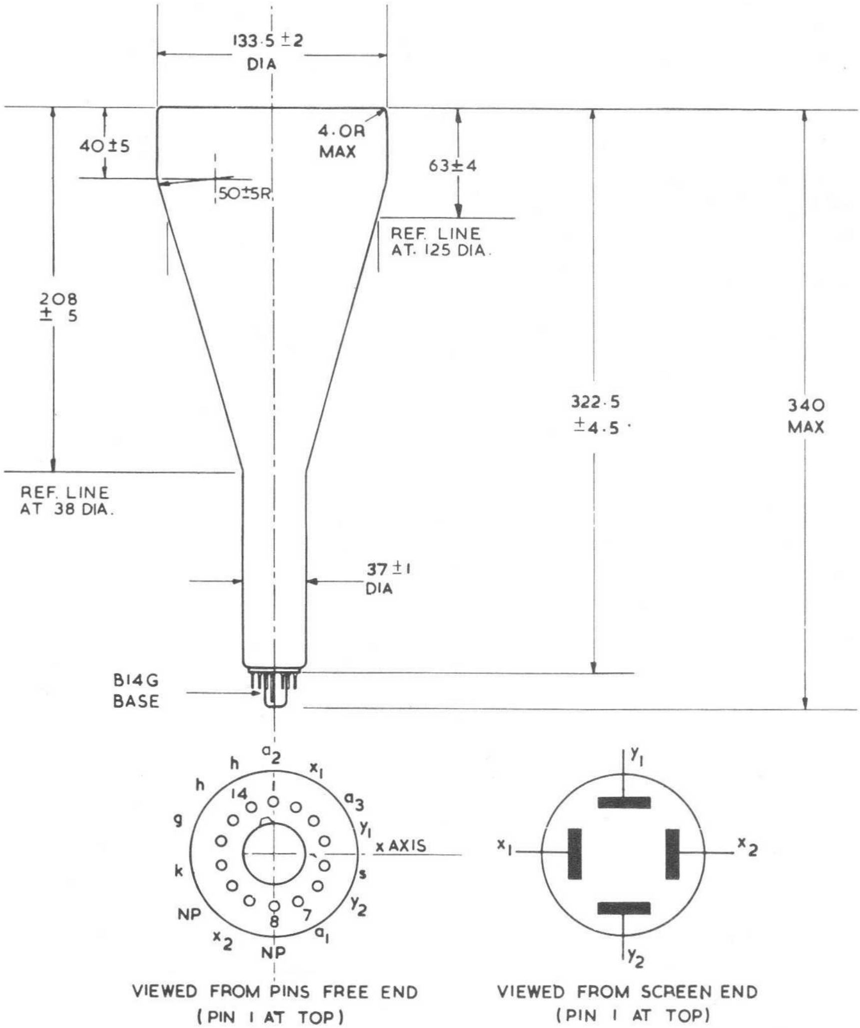
It is preferable that the mean x and y plate potentials are equal otherwise some deterioration in performance will occur. Under no circumstances should the mean y plate potential differ from the mean x plate potential by more than 50V.

## MAGNETIC SHIELDING

Adequate magnetic shielding is required. In addition due attention should be paid to the position of the tube relative to transformers and chokes.

**TUBE WEIGHT** (approximate) 900 g

**MOUNTING POSITION** - unrestricted.



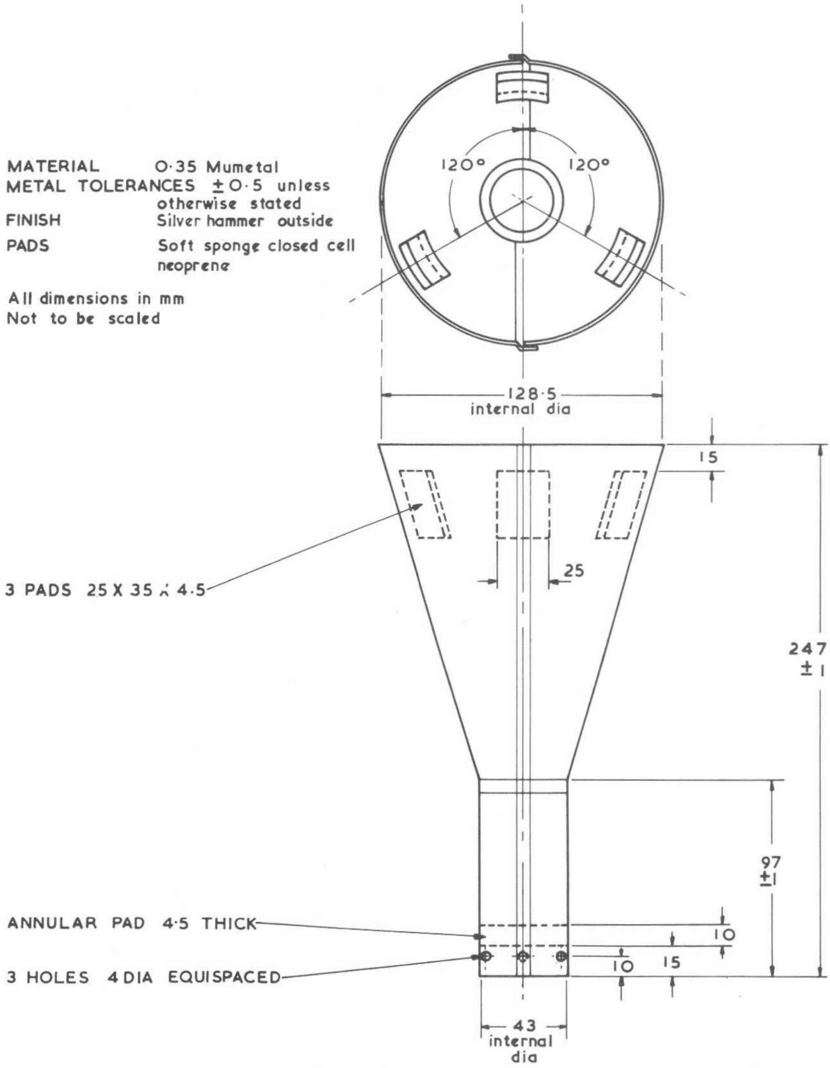

All dimensions in mm. Not to be scaled

It is advisable to support the tube near the screen and at a second point on the parallel neck near the base. The tube should not be subjected to any stress from the use of clamps and should not be suspended by the base.

Tolerance on base pin 1 position with respect to tube y axis ± 5°

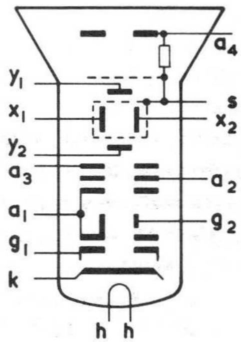
# Magnetic Shield MS43

EXAMPLE OF TYPICAL SHIELD



# Oscilloscope Tube D14-150..

| GENERAL | | |
|---|---|---|
| This 10 cm x 8 cm rectangular aluminised tube with electrostatic focusing and deflection uses a mesh p.d.a. to achieve high deflection sensitivity and very high brightness without additional electrode control voltages. The tube is designed for transistor scan high bandwidth applications, and incorporates a means of beam blanking at anode potential which avoids d.c. coupling to the grid. | | |
| Heater voltage | $V_h$ | 6.3 V |
| Heater current | $I_h$ | 0.3 A |




| ABSOLUTE RATINGS | | Max | Min | |
|---|---|---|---|---|
| Fourth anode voltage | $V_{a4}$ | 16 | 5.0 | kV |
| Third anode voltage | $V_{a3}$ | 1.75 | 0.6 | kV |
| Second anode voltage | $V_{a2}$ | 1.0 | 0 | kV |
| First anode voltage | $V_{a1}$ | 1.75 | 0.6 | kV |
| Negative control grid voltage | $-V_{g1}$ | 200 | 1.0 | V |
| Beam blanking voltage | $V_{g2}$ | 2.0 | 0.5 | kV |
| Peak x-plate to third anode voltage | $v_{x-a3(pk)}$ | 500 | - | V |
| Peak y-plate to third anode voltage | $v_{y-a3(pk)}$ | 500 | - | V |
| x-plate to third anode resistance | $R_{x-a3}$ | 5.0 | - | MΩ |
| y-plate to third anode resistance | $R_{y-a3}$ | 100 | - | kΩ |
| Control grid to cathode resistance | $R_{g1-k}$ | 1.5 | - | MΩ |
| Second anode current | $I_{a2}$ | 10 | - | μA |
| P.D.A. ratio ($V_{a4}/V_{a3}$) | | 11:1 | | |
| Helix resistance | | - | 100 | MΩ |

All voltages referred to cathode unless otherwise stated.

**PHOSPHOR SCREEN**

**This type is usually supplied with GH phosphor (D14-150GH) giving a green trace of medium short persistence. Other phosphor screens can be made available to special order.**

**This data should be read in conjunction with Brimar Operational and Safety Recommendations for Industrial Cathode Ray Tubes.**





BRIMAR

## INTER-ELECTRODE CAPACITANCES

| | | | |
|---|---|---|---|
| Grid 1 to all | $c_{g1-all}$ | 9.5 | pF |
| Grid 2 to all | $c_{g2-all}$ | 8.9 | pF |
| Heater and cathode to all | $c_{h,k-all}$ | 4.0 | pF |
| $x_1$ plate to $x_2$ plate | $c_{x1-x2}$ | 1.9 | pF |
| y1 plate to y2 plate | $c_{y1-y2}$ | 1.7 | pF |
| $x_1$ plate to all, less $x_2$ plate | $c_{x1-all,\ less\ x2}$ | 3.9 | pF |
| $x_2$ plate to all, less $x_1$ plate | $c_{x2-all,\ less\ x1}$ | 3.9 | pF |
| y1 plate to all, less y2 plate | $c_{y1-all,\ less\ y2}$ | 2.8 | pF |
| $y_2$ plate to all, less $y_1$ plate | $c_{y2-all,\ less\ y1}$ | 2.8 | pF |
| Grid 1 to grid 2 | $c_{g1-g2}$ | 0.7 | pF |
| Grid 1 to $x_1$, $x_2$, $y_1$, $y_2$ plates | $c_{g1-x1,x2,y1,y2}$ | 0.012 | pF |
| $x_1$, $x_2$ plates to y1, $y_2$ plates | $c_{x1,x2-y1,y2}$ | 0.5 | pF |

## TYPICAL OPERATION - Voltages with respect to cathode

| | | | | | |
|---|---|---|---|---|---|
| Fourth anode voltage | $V_{a4}$ | 10 | 12 | 15 | kV |
| Mean deflector plate potential | | 1000 | 1200 | 1500 | V |
| Third anode voltage for optimum astigmatism correction | $V_{a3}$ | 1000* | 1200* | 1500* | V |
| Second anode voltage for optimum focus | $V_{a2}$ | 25 to 180 | 30 to 200 | 40 to 250 | V |
| First anode voltage | $V_{a1}$ | 1000 | 1200 | 1500 | V |
| Shield voltage for optimum raster shape | $V_s$ | 970 to 1070 | 1170 to 1270 | 1470 to 1570 | V |
| Beam blanking voltage for cut-off | $V_{g2}$ | 960 to 1040† | 1150 to 1250† | 1435 to 1565† | V |
| Control grid voltage for cut-off | $V_{g1}$ | -40 to -75 | -50 to -90 | -60 to -115 | V |
| x deflection coefficient | $D_x$ | 9.2 to 12.1 | 11 to 14.5 | 13.8 to 18 | V/cm |
| y deflection coefficient | $D_y$ | 3.8 to 5.0 | 4.6 to 6.0 | 5.8 to 7.5 | V/cm |

| | | | | | |
|---|---|---|---|---|---|
| Line width at centre | at 5μA beam current | 0.75 | 0.7 | 0.65 | mm |
| Line width at edge | at 5μA beam current | 1.1 | 1.0 | 0.9 | mm |
| Line width at centre measured by shrinking raster | at 5μA beam current | 0.42 | 0.39 | 0.35 | mm |

* The required voltage will not differ from the quoted value by more than ± 50V.

† The beam is unblanked when $V_{g2} = V_{a1}$. This grid 2 electrode should not be used as a brilliance control.

## RASTER DISTORTION AND ALIGNMENT

The following data applies for the typical operation conditions.

The undeflected spot will fall in a circle of 8 mm radius about the centre of the tube face.

Raster distortion will not be greater than 2%. The edges of a test raster will fall between two concentric rectangles 10 cm x 8 cm and 9.80 cm x 7.84 cm.

Rectangularity of x and y axes is 90° ± 1°. The horizontal trace will be parallel with the axis of the rectangular face-plate to within ± 5°. A twist coil will be required to effect accurate alignment. This should be mounted inside the magnetic shield approximately 70 mm from the face and should not extend more than 175 mm from the face. 45 ampere turns for 10 kV operation or 54 ampere turns for 15 kV operation will suffice, with provision for reversing the current if necessary. The sensitivity (for both x and y plates) at 75% deflection of the useful scan shall not differ by more than 2% from the sensitivity over 10% deflection.

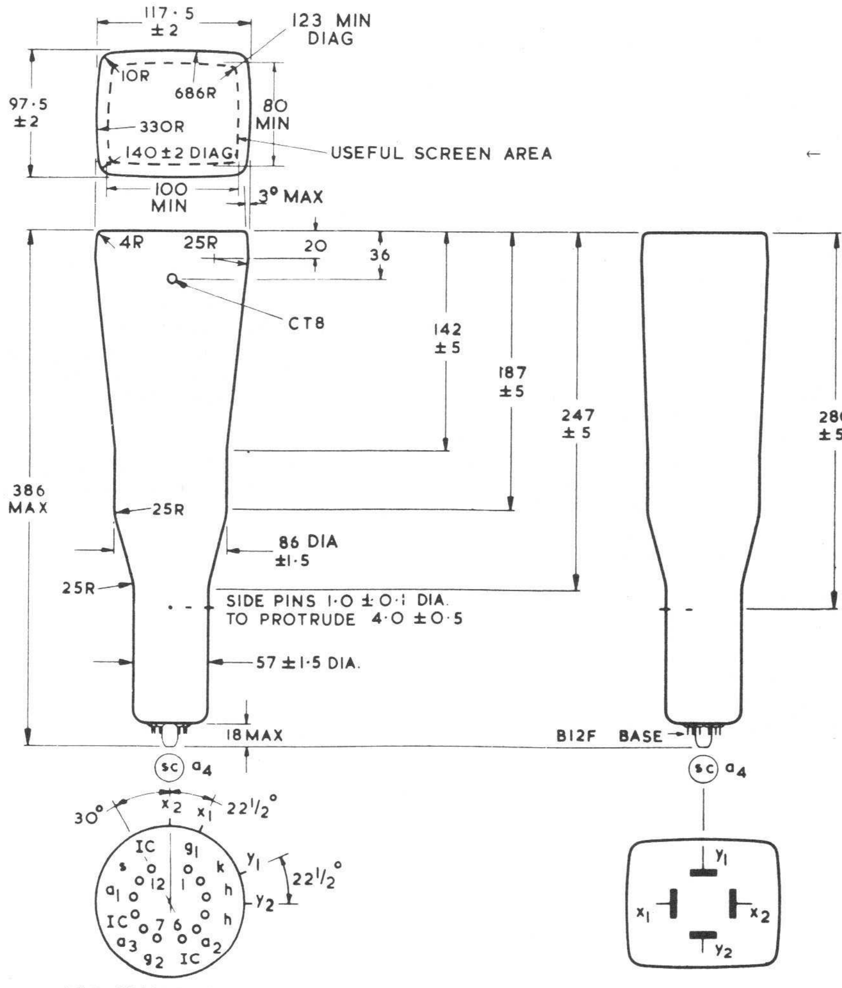
It is preferable that the mean x and y plate potentials are equal otherwise some deterioration in performance will occur. Under no circumstances should the mean y plate potential differ from the mean x plate potential by more than 50V.

## MAGNETIC SHIELDING

Adequate magnetic shielding is required. In addition due attention should be paid to the position of the tube relative to transformers and chokes.

**TUBE WEIGHT** (approximate) - 1.3 kg

**MOUNTING POSITION**- unrestricted



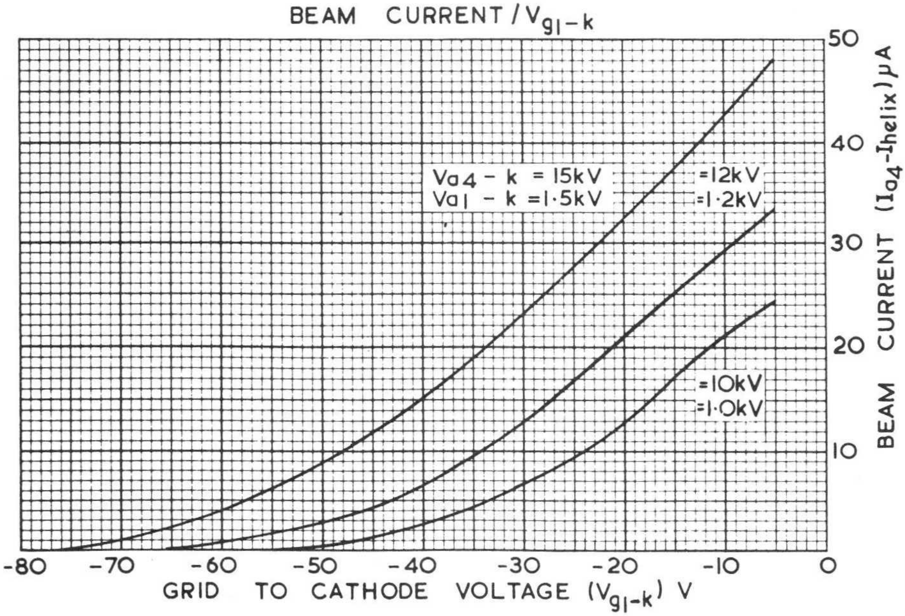

VIEW FROM PINS FREE END
(CT8 AT TOP)

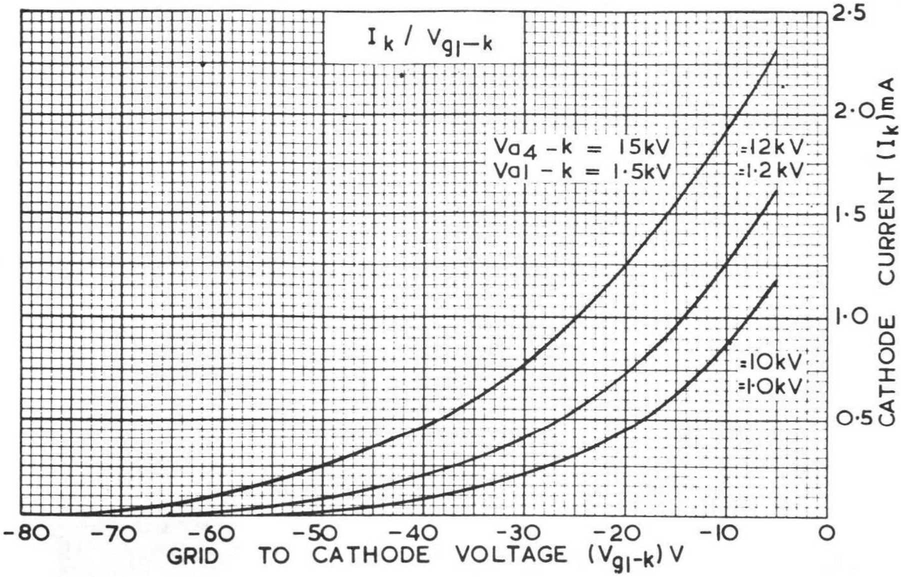
VIEWED FROM SCREEN END
(CT8 AT TOP)

All dimensions in mm Third angle projection Not to be scaled

It is advisable to support the tube near the screen, and at a second point on the parallel neck near the base. The tube should not be subjected to any stress from the use of clamps and should not be suspended by the base. Connecting leads should not be soldered directly to the tube pins.

Tolerance on all side pin positions ± 5°.



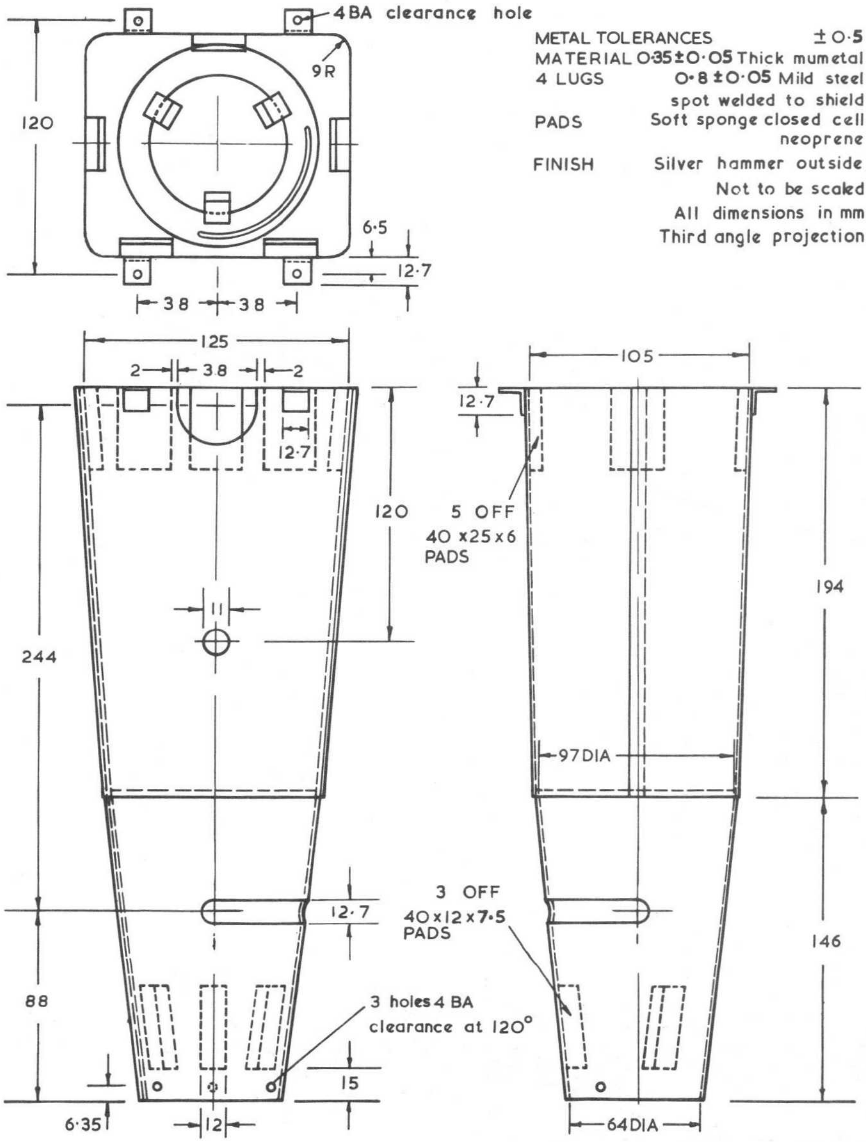



OSCILLOSCOPE TUBES

**D14-150..**

EXAMPLE OF TYPICAL SHIELD

# Magnetic Shield MS9



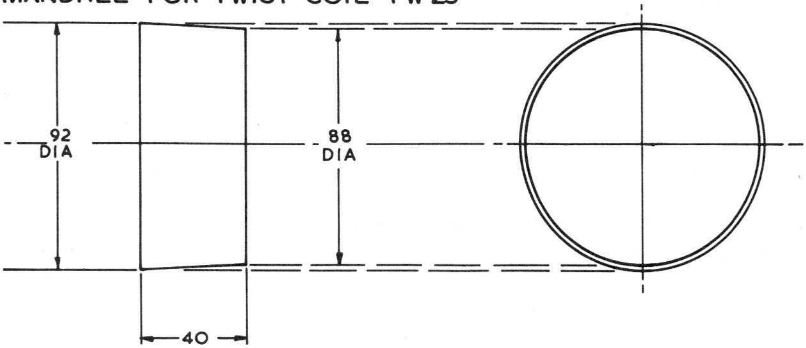

| | |
|---|---|
| METAL TOLERANCES | ± 0·5 |
| MATERIAL | 0·35 ± 0·05 Thick mumetal |
| 4 LUGS | 0·8 ± 0·05 Mild steel spot welded to shield |
| PADS | Soft sponge closed cell neoprene |
| FINISH | Silver hammer outside |

Not to be scaled

All dimensions in mm

Third angle projection

MANDREL FOR TWIST COIL TW 25




All dimensions in mm

Not to be scaled

MANDREL

Shaped from wood in the form of a truncated circular cone, dimensions as above.

SHIELD

This twist coil is designed to be used in conjunction with magnetic shield MS9 for D14-150..

WINDING

1400 turns of 0.20 mm Lewmex Grade 1 or 2 wire, or approved alternative, layer wound on the adhesive side of adhesive backed crepe paper to give 5 mm margins between the coil and each edge of the mandrel.
Start and finish of winding to be brought out on 450 mm long thin flexible lead wires from larger end of winding.
Varnish, if necessary, cover with adhesive backed crepe paper and ensure that the edges of the coil are sealed in place.

ELECTRICAL CHARACTERISTICS

Resistance approx. 230 Ω. Twist coefficient approximately 7 mA/degree measured on typical D14-150.. with $V_{a4}$ = 15 kV and $V_{a1}$ = 1.5 KV.

FITTING

The completed twist coil should be pushed onto the tube and secured to tube in two places with suitable adhesive tape.

OSCILLOSCOPE TUBES

# D14-170..
# D14-171..

## Oscilloscope Tube

OBSOLESCENT TYPES

The D14-170.. is replaced by the D14-172..

The D14-171.. is replaced by the D14-173..

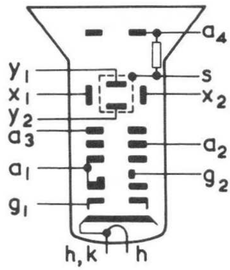
The D14-172.. and the D14-173.. differ from the obsolescent tubes by having a 'squared-up' face-plate with a larger diagonal dimension.

# Oscilloscope Tube D14-172..

**GENERAL**

This short 10 cm x 8 cm rectangular tube with electrostatic focusing and deflection is designed for general purpose applications and is capable of being deflected by transistor circuits. It incorporates a means of beam blanking at anode potential which avoids d.c. coupling to the grid.

| | | | |
|---|---|---|---|
| Heater voltage | $V_h$ | 6.3 | V |
| Heater current | $I_h$ | 0.3 | A |




**ABSOLUTE RATINGS**

| | | Max | Min | |
|---|---|---|---|---|
| Fourth anode voltage | $V_{a4}$ | 4.0 | 1.5 | kV |
| Third anode voltage | $V_{a3}$ | 1.75 | 0.6 | kV |
| Second anode voltage | $V_{a2}$ | 1.0 | 0 | kV |
| First anode voltage | $V_{a1}$ | 1.75 | 0.6 | kV |
| Negative grid voltage | $-V_{g1}$ | 200 | 1.0 | V |
| Beam blanking voltage | $V_{g2}$ | 2.0 | 0.5 | kV |
| Peak x plate to third anode voltage | $v_{x-a3(pk)}$ | 500 | - | V |
| Peak y plate to third anode voltage | $v_{y-a3(pk)}$ | 500 | - | V |
| x plate to third anode resistance | $R_{x-a3}$ | 5.0 | - | MΩ |
| y plate to third anode resistance | $R_{y-a3}$ | 100 | - | kΩ |
| Control grid to cathode resistance | $R_{g1-k}$ | 1.5 | - | MΩ |
| Second anode current | $I_{a2}$ | 10 | - | μA |
| P.D.A. ratio ($V_{a4}/V_{a3}$) | | 2.2:1 | | |
| Helix resistance | | - | 15 | MΩ |

All voltages referred to cathode unless otherwise stated.

**PHOSPHOR SCREEN**

This type is usually supplied with GH phosphor (D14-172GH) giving a green trace of medium short persistence. Other phosphor screens can be made available to special order.

This data should be read in conjunction with Brimar Operational and Safety Recommendations for Industrial Cathode Ray Tubes.

## INTER-ELECTRODE CAPACITANCES

| | | | |
|---|---|---|---|
| Grid 1 to all | $c_{g1\text{-}all}$ | 10 | pF |
| Grid 2 to all | $c_{g2\text{-}all}$ | 10 | pF |
| Heater and cathode to all | $c_{h,k\text{-}all}$ | 4.0 | pF |
| $x_1$ plate to $x_2$ plate | $c_{x1\text{-}x2}$ | 2.1 | pF |
| $y_1$ plate to $y_2$ plate | $c_{y1\text{-}y2}$ | 1.4 | pF |
| $x_1$ plate to all, less $x_2$ plate | $c_{x1\text{-}all, less\ x2}$ | 6.9 | pF |
| $x_2$ plate to all, less $x_1$ plate | $c_{x2\text{-}all, less\ x1}$ | 6.6 | pF |
| $y_1$ plate to all, less $y_2$ plate | $c_{y1\text{-}all, less\ y2}$ | 5.1 | pF |
| $y_2$ plate to all, less $y_1$ plate | $c_{y2\text{-}all, less\ y1}$ | 5.1 | pF |
| $x_1$, $x_2$ plates to $y_1$, $y_2$ plates | $c_{x1,x2\text{-}y1,y2}$ | 0.8 | pF |
| Grid 1 to $x_1$, $x_2$, $y_1$, $y_2$ plates | $c_{g1\text{-}x1,x2,y1,y2}$ | 1.4 | pF |
| Grid 1 to grid 2 | $c_{g1\text{-}g2}$ | 0.7 | pF |

## TYPICAL OPERATION - voltages with respect to cathode.

| | | | | |
|---|---|---|---|---|
| Fourth anode voltage | $V_{a4}$ | 2.0 | 3.0 | kV |
| Mean deflector plate potential | | 1000 | 1500 | V |
| Third anode voltage for optimum astigmatism correction | $V_{a3}$ | 1000* | 1500* | V |
| Second anode voltage for optimum focus | $V_{a2}$ | 180 to 380 | 270 to 570 | V |
| First anode voltage | $V_{a1}$ | 1000 | 1500 | V |
| Shield voltage for optimum raster shape | $V_s$ | 1000* | 1500* | V |
| Beam blanking voltage for cut-off | $V_{g2}$ | 935† | 1405† | V |
| Control grid voltage for cut-off | $V_{g1}$ | -35 to -65 | -50 to -95 | V |
| x deflection coefficient | $D_x$ | 15.7 to 18.7 | 23.5 to 28 | V/cm |
| y deflection coefficient | $D_y$ | 7.4 to 9.7 | 11 to 14.3 | V/cm |

| | | | | |
|---|---|---|---|---|
| Line width at centre-using microscope | at 10µA beam current | 0.55 | 0.49 | mm |
| Line width at edge-using microscope | at 10µA beam current | 0.90 | 0.88 | mm |
| Line width at centre measured by shrinking raster | at 10µA beam current | 0.28 | 0.25 | mm |

* The required voltage will not differ from the quoted value by more than ± 50V.

† The beam is unblanked when $V_{g2} = V_{a1}$. This grid 2 electrode should not be used as a brilliance control.

## RASTER DISTORTION AND ALIGNMENT

The undeflected spot will fall in a circle of 5 mm radius about the centre of the tube face.

Raster distortion: the edges of a test raster will fall between two concentric rectangles 10 cm x 8 cm and 9.75 cm x 7.8 cm.

Rectangularity of x and y axes is 90° ± 1°. The horizontal trace will be parallel with the axis of the rectangular face-plate to within ± 5°. A twist coil will be required to effect accurate alignment. This should be mounted inside the magnetic shield approximately 90 mm from the face and should not extend more than 165 mm from the face. 26 ampere turns will suffice, with provision for reversing the current if necessary.

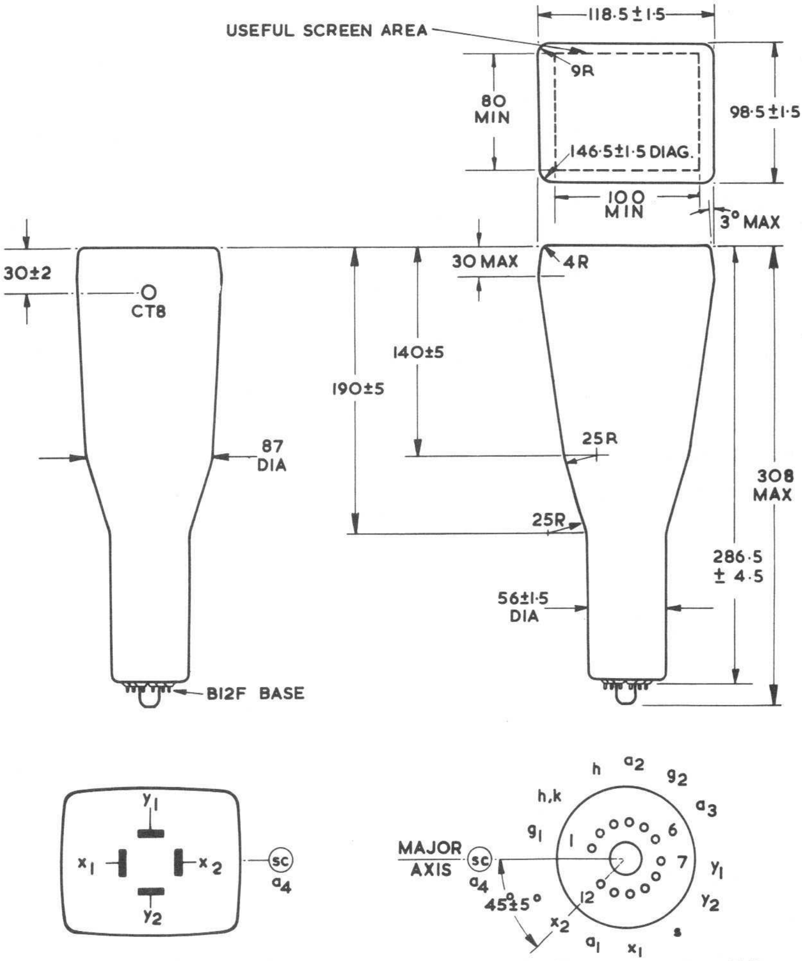
It is preferable that the mean x and y plate potentials are equal otherwise some deterioration in performance will occur. Under any circumstances the mean y plate potential should never differ from the mean x plate potential by more than 50V when the tube is operated at 3 kV.

## MAGNETIC SHIELDING

Adequate magnetic shielding is required. In addition due attention should be paid to the position of the tube relative to transformers and chokes.

**TUBE WEIGHT** (approximate) 1.0 kg

**MOUNTING POSITION** - unrestricted.

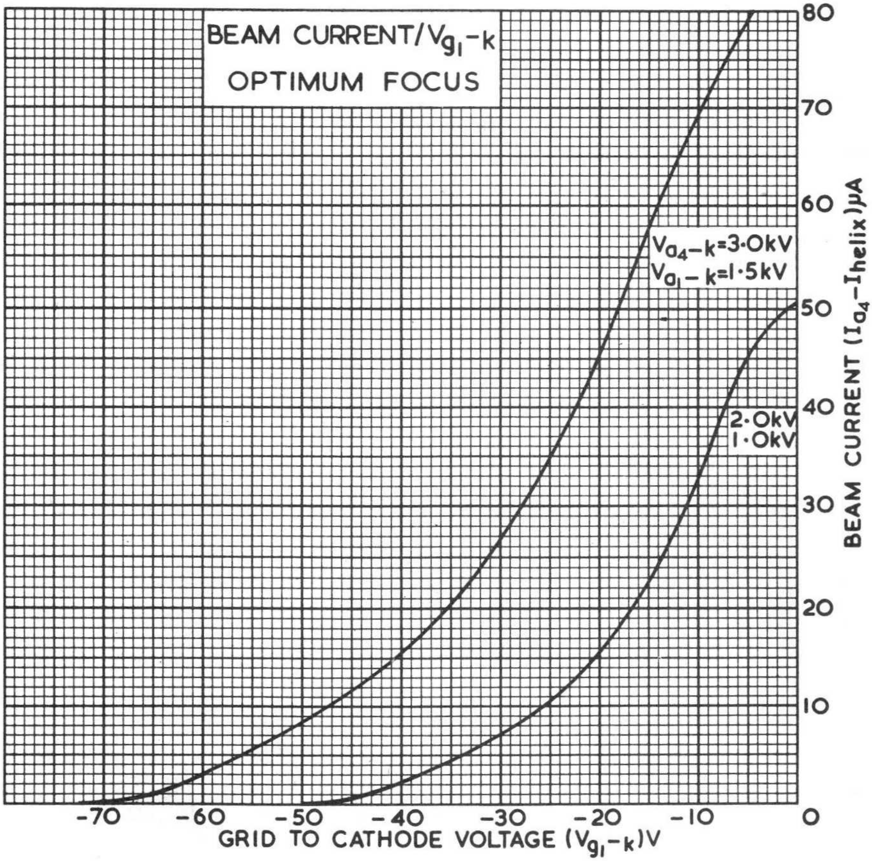


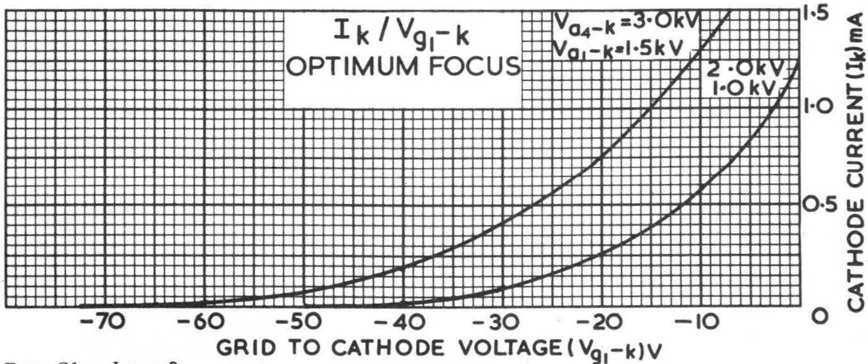

VIEWED FROM SCREEN END (CT8 AT RIGHT)

VIEW FROM PINS FREE END (CT8 AT LEFT)

**All dimensions in mm** **Third angle projection** **Not to be scaled**

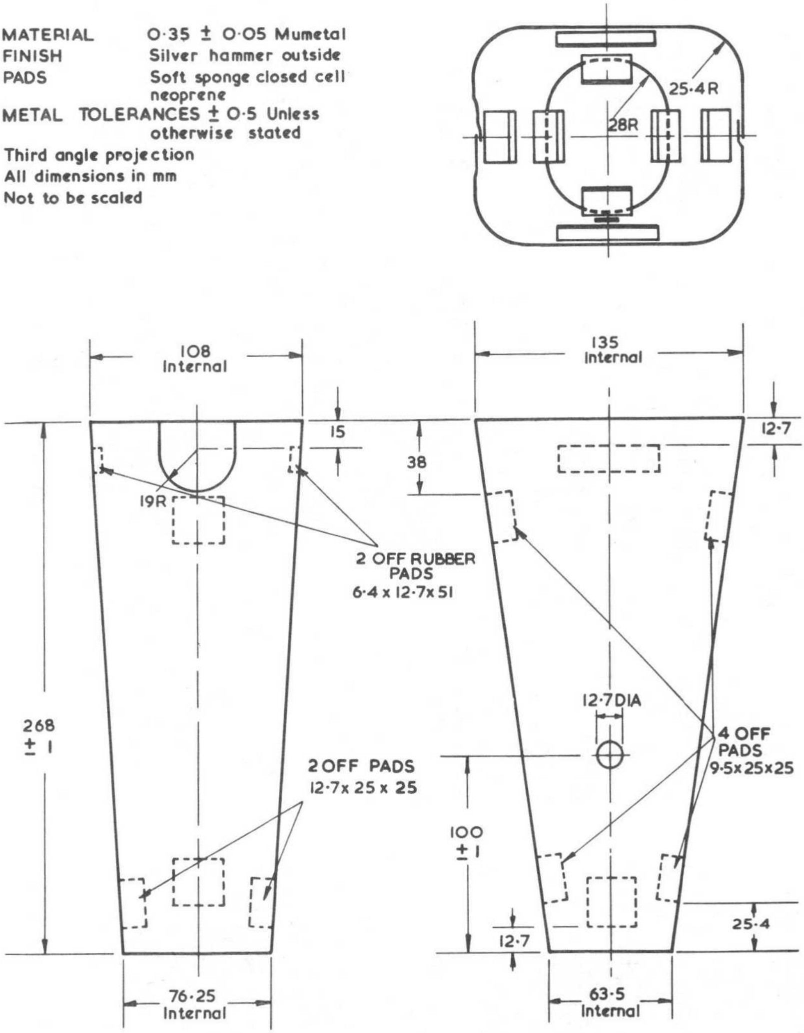
It is advisable to support the tube near the screen, and at a second point on the parallel neck near the base. The tube should not be subjected to any stress from the use of clamps and should not be suspended by the base. Connecting leads should not be soldered directly to the tube pins.


BEAM CURRENT/$V_{g_1-k}$
OPTIMUM FOCUS
$V_{a_4-k}$=3·0kV
$V_{a_1-k}$=1·5kV
2·0kV
1·0kV
BEAM CURRENT ($I_{a_4}-I_{helix}$)μA
GRID TO CATHODE VOLTAGE ($V_{g_1-k}$)V

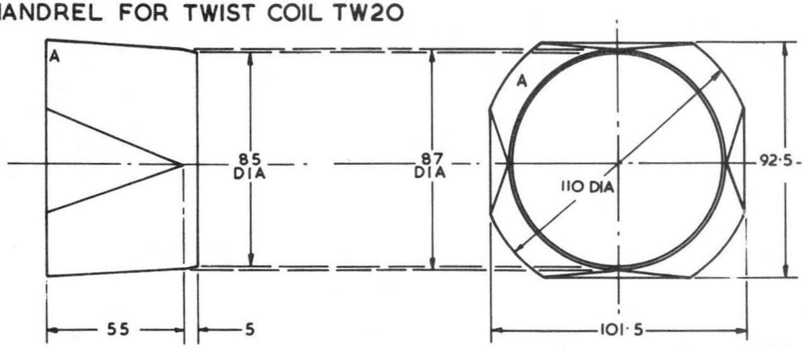

$I_k$ / $V_{g_1-k}$
OPTIMUM FOCUS
$V_{a_4-k}$=3·0kV
$V_{a_1-k}$=1·5kV
2·0kV
1·0kV
CATHODE CURRENT ($I_k$)mA
GRID TO CATHODE VOLTAGE ($V_{g_1-k}$)V

# Magnetic Shield MS15

MATERIAL 0·35 ± 0·05 Mumetal
FINISH Silver hammer outside
PADS Soft sponge closed cell neoprene
METAL TOLERANCES ± 0·5 Unless otherwise stated
Third angle projection
All dimensions in mm
Not to be scaled



MANDREL FOR TWIST COIL TW20




All dimensions in mm

Not to be scaled

MANDREL

Shaped from wood in the form of a shaped truncated circular cone, dimensions as above.

SHIELD

This twist coil is designed to be used in conjunction with magnetic shield MS15 for D14-172..

WINDING

575 turns of 0.28 mm Lewmex Grade 1 or 2 wire, or approved alternative, layer wound on the adhesive side of adhesive backed crepe paper to give 5 mm margins between the coil and each edge of the mandrel.
Start and finish of winding to be brought out on 450 mm long thin flexible lead wires at position A on drawing.

Varnish, if necessary, cover with adhesive backed crepe paper and ensure that the edges of the coil are sealed in place.

ELECTRICAL CHARACTERISTICS

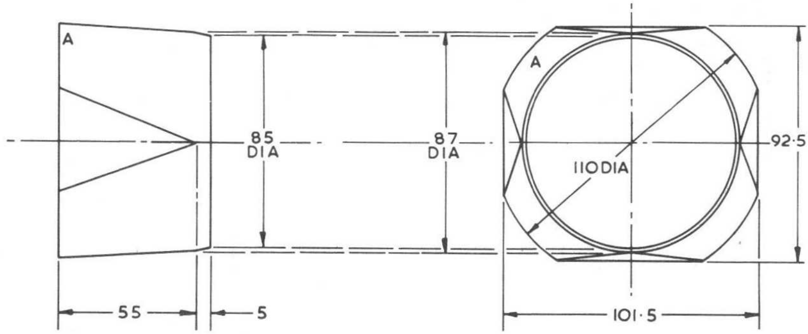
Resistance approx. 50 Ω. Current required for ± 5° twist is ± 42 mA measured on typical D14-172.. with $V_{a4}$ = 3 kV and $V_{a1}$ = 1.5 kV.

FITTING

The completed twist coil should be pushed onto the tube from the base end as far as it will travel and locked in position with adhesive tape.

OSCILLOSCOPE TUBES

## MANDREL FOR TWIST COIL TW26




All dimensions in mm

Not to be scaled

### MANDREL

Shaped from wood in the form of a shaped truncated circular cone, dimensions as above.

### SHIELD

This twist coil is designed to be used in conjunction with magnetic shield MS15 for D14-172..

### WINDING

2500 turns of 0.125 mm Lewmex Grade 1 or 2 wire, or approved alternative, layer wound on the adhesive side of adhesive backed crepe paper to give 5 mm margins between the coil and each edge of the mandrel.
Start and finish of winding to be brought out on 450 mm long thin flexible lead wires from smaller end of winding.
Varnish, if necessary, cover with adhesive backed crepe paper and ensure that the edges of the coil are sealed in place.

### ELECTRICAL CHARACTERISTICS

Resistance approx. 1060 Ω. Current required for $\pm$ 5° twist is $\pm$ 10 mA measured on typical D14-172.. with $V_{a4}$ = 3kV and $V_{a1}$ = 1.5 kV.

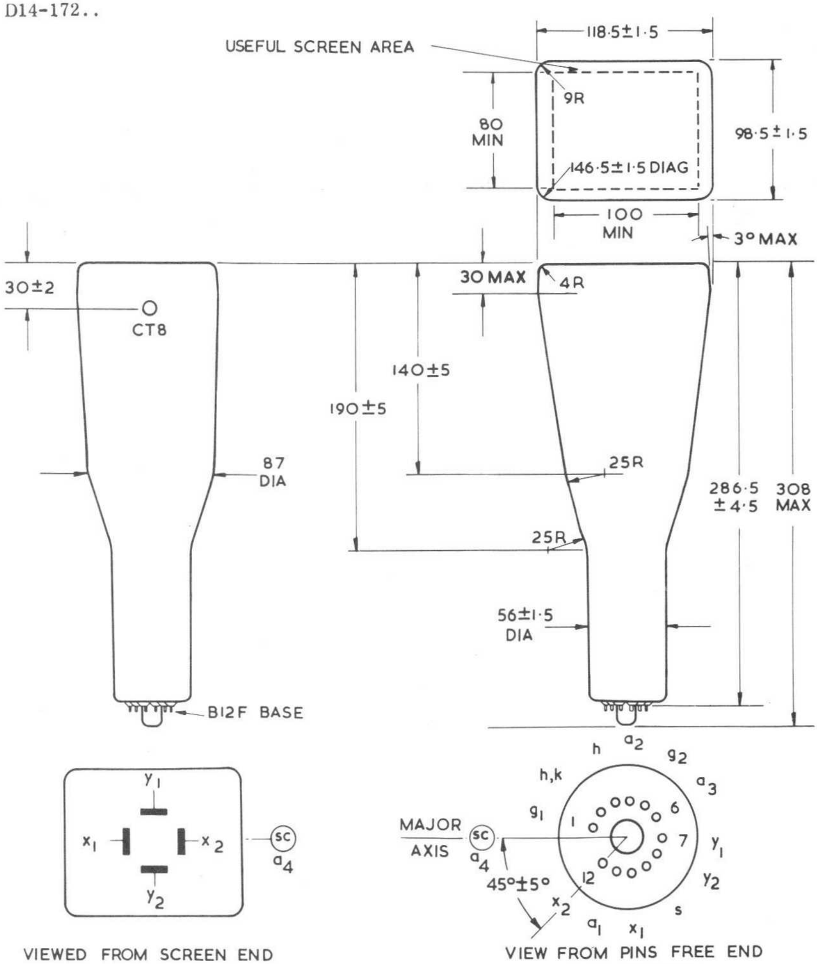
### FITTING

The completed twist coil should be pushed onto the tube from the base end as far as it will travel and locked in position with adhesive tape.

# Oscilloscope Tube

# D14-173..

This D14-173.. tube has a 6.3V, 0.12A heater otherwise it is identical to the D14-172..




VIEWED FROM SCREEN END (CT8 AT RIGHT)

VIEW FROM PINS FREE END (CT8 AT LEFT)

All dimensions in mm Third angle projection Not to be scaled

It is advisable to support the tube near the screen, and at a second point on the parallel neck near the base. The tube should not be subjected to any stress from the use of clamps and should not be suspended by the base. Connecting leads should not be soldered directly to the tube pins.

# D14-180..

# Oscilloscope Tube

MAINTENANCE TYPE

The D14-181.. is the replacement type for the D14-180..

The D14-180.. and D14-181.. differ only in the back cone region with the cylindrical region approximately 10 mm further from the face on the D14-181..

# Oscilloscope Tube

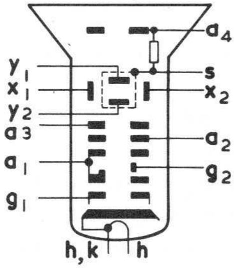
# D14-181..

PRELIMINARY DATA

**GENERAL**

This 10cm x 8cm rectangular tube with electrostatic focusing and deflection is designed for medium bandwidth applications and is capable of being deflected by transistor circuits. It incorporates a means of beam blanking at anode potential which avoids d.c. coupling to the grid.

| | | | |
|---|---|---|---|
| Heater voltage | $V_h$ | 6.3 | V |
| Heater current | $I_h$ | 0.3 | A |




**ABSOLUTE RATINGS**

| | | Max. | Min. | |
|---|---|---|---|---|
| Fourth anode voltage | $V_{a4}$ | 7.0 | 2.5 | kV |
| Third anode voltage | $V_{a3}$ | 1.75 | 0.6 | kV |
| Second anode voltage | $V_{a2}$ | 1.0 | 0 | kV |
| First anode voltage | $V_{a1}$ | 1.75 | 0.6 | kV |
| Negative grid voltage | $-V_{g1}$ | 200 | 1.0 | V |
| Beam blanking voltage | $V_{g2}$ | 2.0 | 0.5 | kV |
| Peak x plate to third anode voltage | $v_{x-a3(pk)}$ | 500 | - | V |
| Peak y plate to third anode voltage | $v_{y-a3(pk)}$ | 500 | - | V |
| x plate to third anode resistance | $R_{x-a3}$ | 5.0 | - | MΩ |
| y plate to third anode resistance | $R_{y-a3}$ | 100 | - | kΩ |
| Control grid to cathode resistance | $R_{g1-k}$ | 1.5 | - | MΩ |
| Second anode current | $I_{a2}$ | 10 | - | μA |
| P.D.A. ratio ($V_{a4}/V_{a3}$) | | 4.3:1 | | |
| Helix resistance | | - | 50 | MΩ |

All voltages referred to cathode unless otherwise stated.

**PHOSPHOR SCREEN**

This type is usually supplied with GH phosphor (D14-181GH) giving a green trace of medium short persistence. Other phosphor screens can be made available to special order.

This data should be read in conjunction with Operational and Safety Recommendations for Industrial Cathode Ray Tubes.

OSCILLOSCOPE TUBES

## INTER-ELECTRODE CAPACITANCES

| | | | |
|---|---|---|---|
| Grid 1 to all | $c_{g1\text{-}all}$ | 10 | pF |
| Grid 2 to all | $c_{g2\text{-}all}$ | 10 | pF |
| Heater and cathode to all | $c_{h,k\text{-}all}$ | 4.0 | pF |
| $x_1$ plate to $x_2$ plate | $c_{x1\text{-}x2}$ | 2.1 | pF |
| $y_1$ plate to $y_2$ plate | $c_{y1\text{-}y2}$ | 1.4 | pF |
| $x_1$ plate to all, less $x_2$ plate | $c_{x1\text{-}all,\ less\ x2}$ | 6.9 | pF |
| $x_2$ plate to all, less $x_1$ plate | $c_{x2\text{-}all,\ less\ x1}$ | 6.6 | pF |
| $y_1$ plate to all, less $y_2$ plate | $c_{y1\text{-}all,\ less\ y2}$ | 5.1 | pF |
| $y_2$ plate to all, less $y_1$ plate | $c_{y2\text{-}all,\ less\ y1}$ | 5.1 | pF |
| $x_1$, $x_2$ plates to $y_1$, $y_2$ plates | $c_{x1,x2\text{-}y1,y2}$ | 0.8 | pF |
| Grid 1 to $x_1$, $x_2$, $y_1$, $y_2$ plates | $c_{g1\text{-}x1,x2,y1,y2}$ | 1.4 | pF |
| Grid 1 to grid 2 | $c_{g1\text{-}g2}$ | 0.7 | pF |

## TYPICAL OPERATION - voltages with respect to cathode

| | | | | | |
|---|---|---|---|---|---|
| Fourth anode voltage | $V_{a4}$ | 3.0 | 4.0 | 6.0 | kV |
| Mean deflector plate potential | | 750 | 1000 | 1500 | V |
| Third anode voltage for optimum astigmatism correction | $V_{a3}$ | 750* | 1000* | 1500* | V |
| Second anode voltage for optimum focus | $V_{a2}$ | 125 to 300 | 175 to 400 | 260 to 600 | V |
| First anode voltage | $V_{a1}$ | 750 | 1000 | 1500 | V |
| Shield voltage for optimum raster shape | $V_s$ | 750* | 1000* | 1500* | V |
| Beam blanking voltage for cut-off | $V_{g2}$ | 700† | 935† | 1400† | V |
| Control grid voltage for cut-off | $V_{g1}$ | -25 to -50 | -35 to -65 | -50 to -95 | V |
| x deflection coefficient | $D_x$ | 10.6 to 12.8 | 14.1 to 17 | 21.2 to 25.5 | V/cm |
| y deflection coefficient | $D_y$ | 5.0 to 6.6 | 6.7 to 8.7 | 10 to 13.1 | V/cm |
| Minimum screen area | | 10 x 8 | 10 x 8 | 10 x 8 | $cm^2$ |
| Line width at centre-using microscope | at 5$\mu$A beam current | 0.52 | 0.47 | 0.42 | mm |
| Line width at edge-using microscope | at 5$\mu$A beam current | 0.94 | 0.89 | 0.84 | mm |
| Line width at centre measured by shrinking raster | at 5$\mu$A beam current | 0.31 | 0.28 | 0.25 | mm |

* The required voltage will not differ from the quoted value by more than ± 50V.

† The beam is unblanked when $V_{g2} = V_{a1}$. This grid 2 electrode should not be used as a brilliance control.

## RASTER DISTORTION AND ALIGNMENT

The following data applies for the typical operation conditions.

The undeflected spot will fall in a circle of 8 mm radius about the centre of the tube face. The edges of a test raster will fall between two concentric rectangles 10 cm x 8 cm and 9.8 cm x 7.8 cm.

Rectangularity of x and y axes is 90° ± 1°. The horizontal trace will be parallel with the axis of the rectangular face-plate to within ± 5°. A twist coil will be required to effect accurate alignment. This should be mounted inside the magnetic shield approximately 90 mm from the face and should not extend more than 195 mm from the face. The ampere turns required will be equal to $12\sqrt{V_{a4}}$ (where $V_{a4}$ is quoted in kV), with provision for reversing the current if necessary.

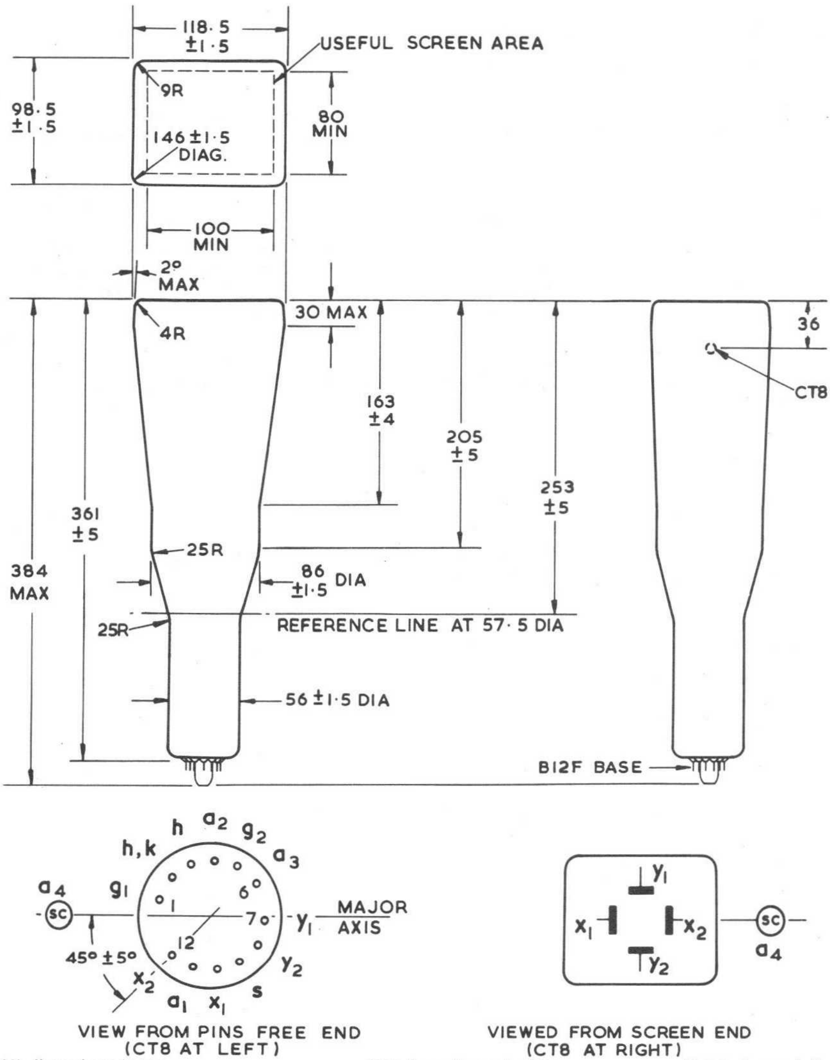
It is preferable that the mean x and y plate potentials are equal otherwise some deterioration in performance will occur. Under no circumstances should the mean y plate potential differ from the mean x plate by more then 50V when the tube is operated at 4kV.

## MAGNETIC SHIELDING

Adequate magnetic shielding is required. In addition due attention should be paid to the position of the tube relative to transformers and chokes.

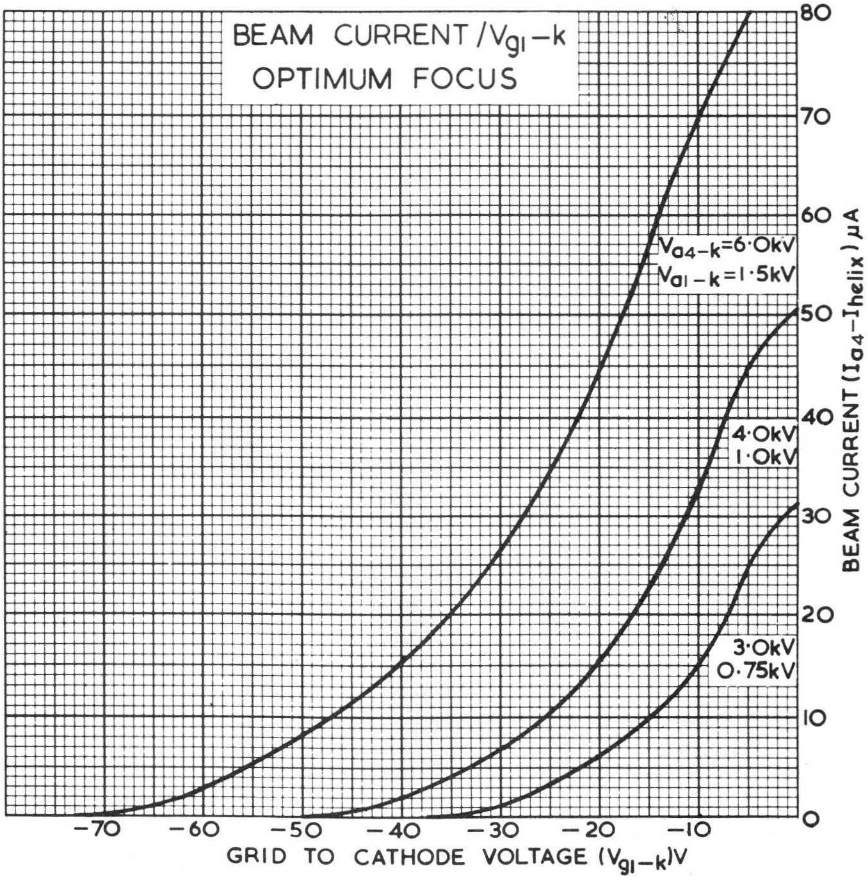
**TUBE WEIGHT** (approximate) 1.1 kg

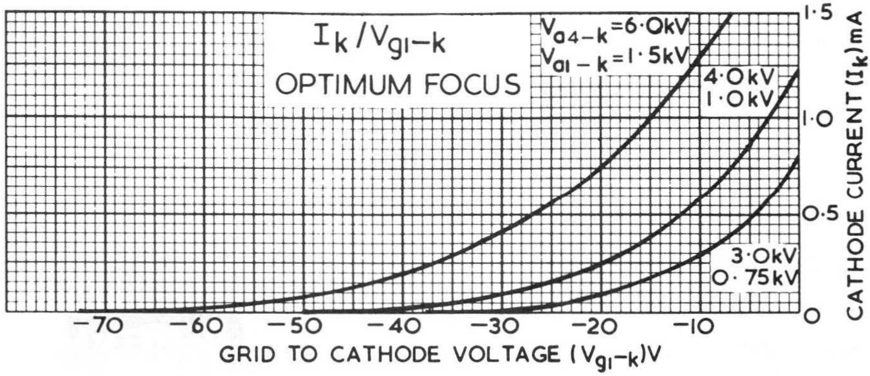
**MOUNTING POSITION** - unrestricted.




All dimensions in mm    Third angle projection    Not to be scaled

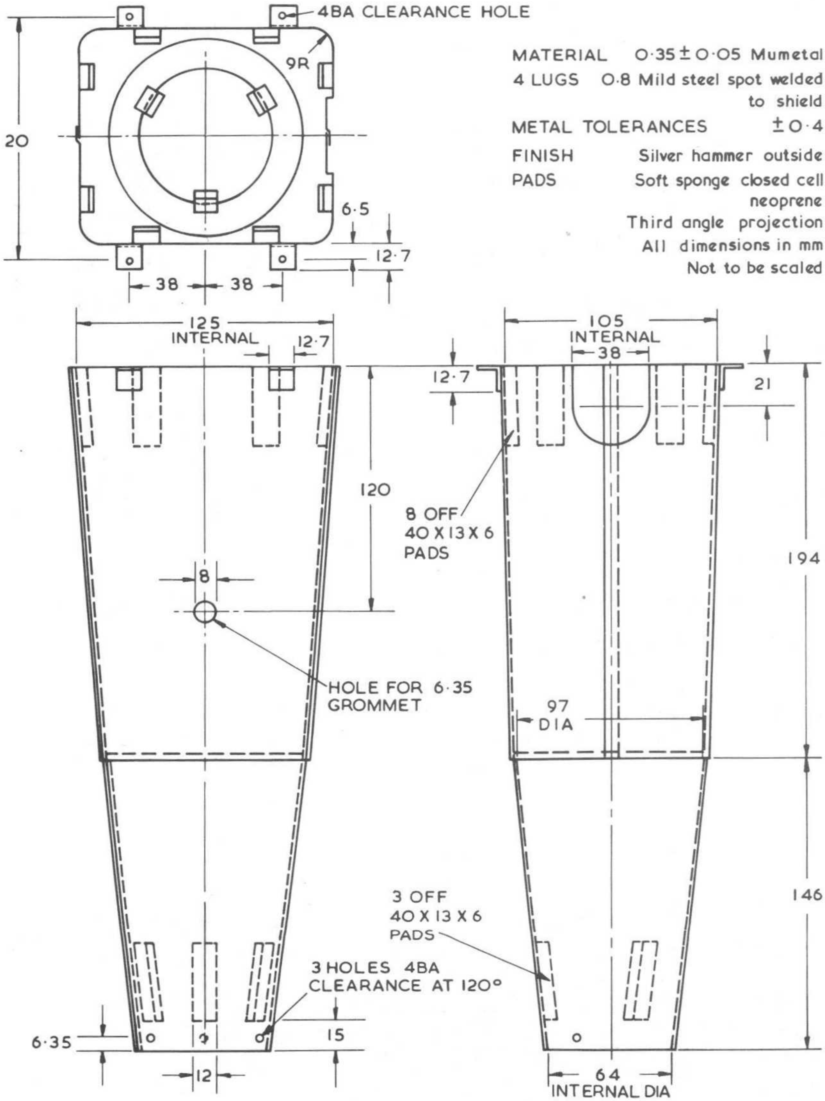
It is advisable to support the tube near the screen and at a second point on the parallel neck near the base. The tube should not be subjected to any stress from the use of clamps and should not be suspended by the base.


BEAM CURRENT / Vg1 – k
OPTIMUM FOCUS
Va4–k = 6·0kV
Va1 – k = 1·5kV
4·0kV
1·0kV
3·0kV
0·75kV
80
70
60
50
40
30
20
10
0
BEAM CURRENT (Ia4 – Ihelix) µA
–70
–60
–50
–40
–30
–20
–10
GRID TO CATHODE VOLTAGE (Vg1–k)V

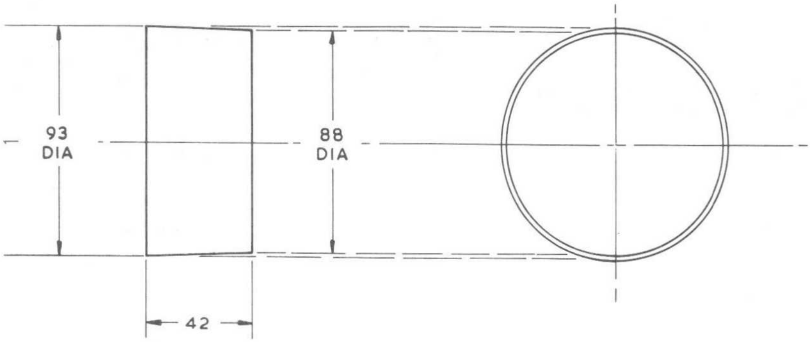

Ik / Vg1–k
OPTIMUM FOCUS
Va4–k = 6·0kV
Va1 – k = 1·5kV
4·0kV
1·0kV
3·0kV
0·75kV
1·5
1·0
0·5
0
CATHODE CURRENT (Ik) mA
–70
–60
–50
–40
–30
–20
–10
GRID TO CATHODE VOLTAGE (Vg1–k)V

# Magnetic Shield MS 20

EXAMPLE OF TYPICAL SHIELD



MANDREL FOR TWIST COIL TW23




All dimensions in mm

Not to be scaled

MANDREL

Shaped from wood in the form of a truncated circular cone, dimensions as above.

SHIELD

This twist coil is designed to be used in conjunction with magnetic shield MS20 for D14-181..

WINDING

1200 turns of 0.16 mm Lewmex Grade 2 wire, or approved alternative, layer wound on the adhesive side of adhesive backed crepe paper to give 5 mm margins between the coil and each edge of the mandrel. Start and finish of winding to be brought out on 450 mm long thin flexible lead wire from larger end of winding.
Varnish, if necessary, cover with adhesive backed crepe paper, and ensure that the edges of the coil are sealed in place.

ELECTRICAL CHARACTERISTICS

Resistance approx. 300Ω. Twist coefficient approximately 5mA/degree measured on typical D14-181.. with $V_{a4}$ = 6 kV and $V_{a1}$ = 1.5 kV.

FITTING

The completed twist coil should be pushed onto the tube from the base end as far as it will travel and locked in position with adhesive tape.

OSCILLOSCOPE TUBES

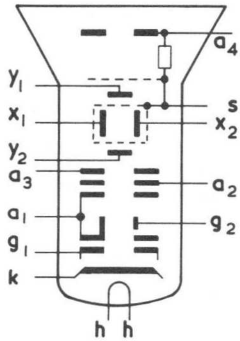
# D14-200..

# Oscilloscope Tube

## GENERAL

This 10 cm x 8 cm rectangular aluminised tube with electrostatic focusing and deflection uses a mesh p.d.a. to achieve high deflection sensitivity and high brightness without additional electrode control voltages. The tube is designed for transistor deflection high bandwidth applications, and incorporates a means of beam blanking at anode potential which avoids d.c. coupling to the grid.

| | | | |
|---|---|---|---|
| Heater voltage | $V_h$ | 6.3 | V |
| Heater current | $I_h$ | 0.3 | A |




## ABSOLUTE RATINGS

| | | Max. | Min. | |
|---|---|---|---|---|
| Fourth anode voltage | $V_{a4}$ | 16 | 5.0 | kV |
| Third anode voltage | $V_{a3}$ | 1.75 | 0.6 | kV |
| Second anode voltage | $V_{a2}$ | 1.0 | 0 | kV |
| First anode voltage | $V_{a1}$ | 1.75 | 0.6 | kV |
| Negative control grid voltage | $-V_{g1}$ | 200 | 1.0 | V |
| Beam blanking voltage | $V_{g2}$ | 2.0 | 0.5 | kV |
| Peak x-plate to third anode voltage | $v_{x-a3(pk)}$ | 500 | - | V |
| Peak y-plate to third anode voltage | $v_{y-a3(pk)}$ | 500 | - | V |
| x-plate to third anode resistance | $R_{x-a3}$ | 5.0 | - | MΩ |
| y-plate to third anode resistance | $R_{y-a3}$ | 100 | - | kΩ |
| Control grid to cathode resistance | $R_{g1-k}$ | 1.5 | - | MΩ |
| Second anode current | $I_{a2}$ | 10 | - | μA |
| P.D.A. ratio ($V_{a4}/V_{a3}$) | | 11:1 | - | |
| Helix resistance | | - | 100 | MΩ |

All voltages referred to cathode unless otherwise stated.

## PHOSPHOR SCREEN

This type is usually supplied with GH phosphor (D14-200GH) giving a green trace of medium short persistence. Other phosphor screens can be made available to special order.

This data should be read in conjunction with Brimar Operational and Safety Recommendations for Industrial Cathode Ray Tubes

## INTER-ELECTRODE CAPACITANCES

| | | | |
|---|---|---|---|
| Grid 1 to all | $c_{g1-all}$ | 9.5 | pF |
| Grid 2 to all | $c_{g2-all}$ | 8.9 | pF |
| Heater and cathode to all | $c_{h,k-all}$ | 4.0 | pF |
| $x_1$ plate to $x_2$ plate | $c_{x1-x2}$ | 1.9 | pF |
| $y_1$ plate to $y_2$ plate | $c_{y1-y2}$ | 1.7 | pF |
| $x_1$ plate to all, less $x_2$ plate | $c_{x1-all,\ less\ x2}$ | 3.9 | pF |
| $x_2$ plate to all, less $x_1$ plate | $c_{x2-all,\ less\ x1}$ | 3.9 | pF |
| $y_1$ plate to all, less $y_2$ plate | $c_{y1-all,\ less\ y2}$ | 2.8 | pF |
| $y_2$ plate to all, less $y_1$ plate | $c_{y2-all,\ less\ y1}$ | 2.8 | pF |
| $x_1$, $x_2$ plates to $y_1$, $y_2$ plates | $c_{x1,x2-y1,y2}$ | 0.5 | pF |
| Grid 1 to grid 2 | $c_{g1-g2}$ | 0.7 | pF |
| Grid 1 to $x_1$, $x_2$, $y_1$, $y_2$ plates | $c_{g1-x1,x2,y1,y2}$ | 0.012 | pF |

## TYPICAL OPERATION Voltages with respect to cathode

| | | | | | |
|---|---|---|---|---|---|
| Fourth anode voltage | $V_{a4}$ | 10 | 12 | 15 | kV |
| Mean deflector plate potential | | 1000 | 1200 | 1500 | V |
| Third anode voltage for optimum astigmatism correction | $V_{a3}$ | 1000* | 1200* | 1500* | V |
| Second anode voltage for optimum focus | $V_{a2}$ | 25 to 180 | 30 to 200 | 40 to 250 | V |
| First anode voltage | $V_{a1}$ | 1000 | 1200 | 1500 | V |
| Shield voltage for optimum raster shape | $V_s$ | 970 to 1070 | 1170 to 1270 | 1470 to 1570 | V |
| Beam blanking voltage for cut-off | $V_{g2}$ | 960 to 1040† | 1150 to 1250† | 1435 to 1565† | V |
| Control grid voltage for cut-off | $V_{g1}$ | -40 to -75 | -50 to -90 | -60 to -115 | V |
| x deflection coefficient | $D_x$ | 9.2 to 11.8 | 11 to 14.2 | 13.8 to 17.7 | V/cm |
| y deflection coefficient | $D_y$ | 3.6 to 4.5 | 4.3 to 5.4 | 5.4 to 6.8 | V/cm |
| Minimum screen area | | 10 x 8 | 10 x 8 | 10 x 8 | $cm^2$ |
| Line width at 5μA beam current | | | | | |
| Shrinking raster measurement at centre | | 0.47 | 0.41 | 0.39 | mm |
| Microscope measurement at centre | | 0.80 | 0.73 | 0.70 | mm |
| Microscope measurement at edge | | 1.0 | 0.98 | 0.96 | mm |

* The required voltage will not differ from the quoted value by more than ± 50V.

† The beam is unblanked when $V_{g2} = V_{a1}$. This grid 2 electrode should not be used as a brilliance control.

OSCILLOSCOPE TUBES

## RASTER DISTORTION AND ALIGNMENT

The following data applies for the typical operation conditions.

The undeflected spot will fall in a circle of 8 mm radius about the centre of the tube face.

Raster distortion will not be greater than 2%. The edges of a test raster will fall between two concentric rectangles 10 cm x 8 cm and 9.80 cm x 7.84 cm.

Rectangularity of x and y axes is 90° ± 1°. The horizontal trace will be parallel with the axis of the rectangular face-plate to within ± 5°. A twist coil will be required to effect accurate alignment. This should be mounted inside the magnetic shield approximately 70 mm from the face and should not extend more than 195 mm from the face. The ampere turns required will be equal to $14\sqrt{V_{a4}}$ (where $V_{a4}$ is quoted in kV), with provision for reversing the current if necessary. The sensitivity (for both x and y plates) at 75% deflection of the useful scan shall not differ by more than 2% from the sensitivity over 10% deflection.

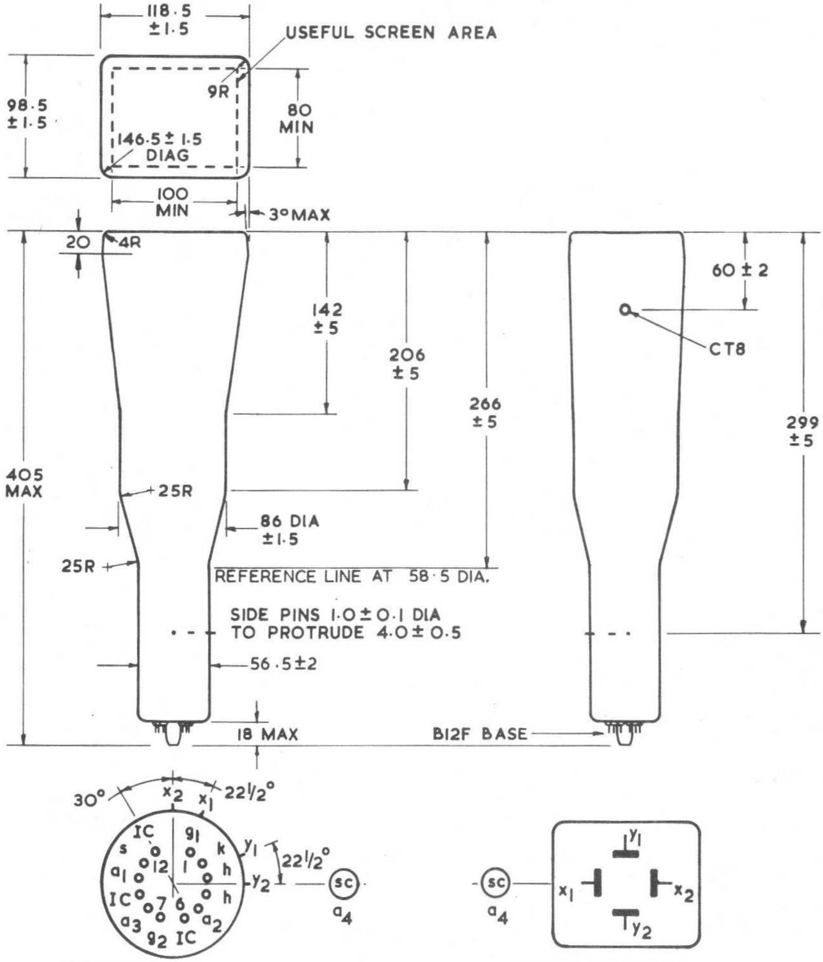
It is preferable that the mean x and y plate potentials are equal otherwise some deterioration in performance will occur. Under no circumstances should the mean y plate potential differ from the mean x plate potential by more than 50V.

## MAGNETIC SHIELDING

Adequate magnetic shielding is required. In addition due attention should be paid to the position of the tube relative to transformers and chokes.

**TUBE WEIGHT** (approximate) - 1.3 kg

**MOUNTING POSITION** - unrestricted



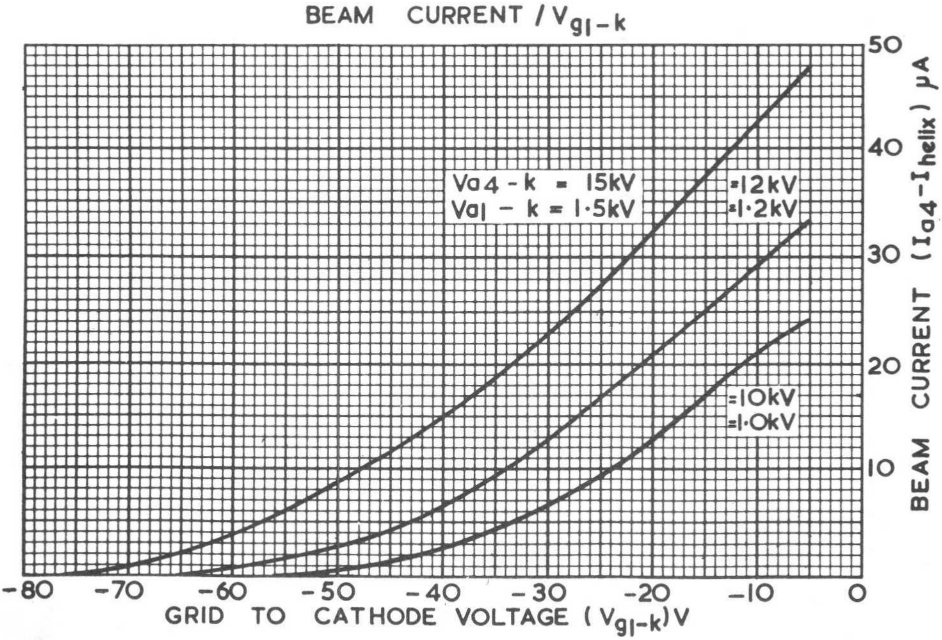

VIEW FROM PINS FREE END
(CT8 AT RIGHT)

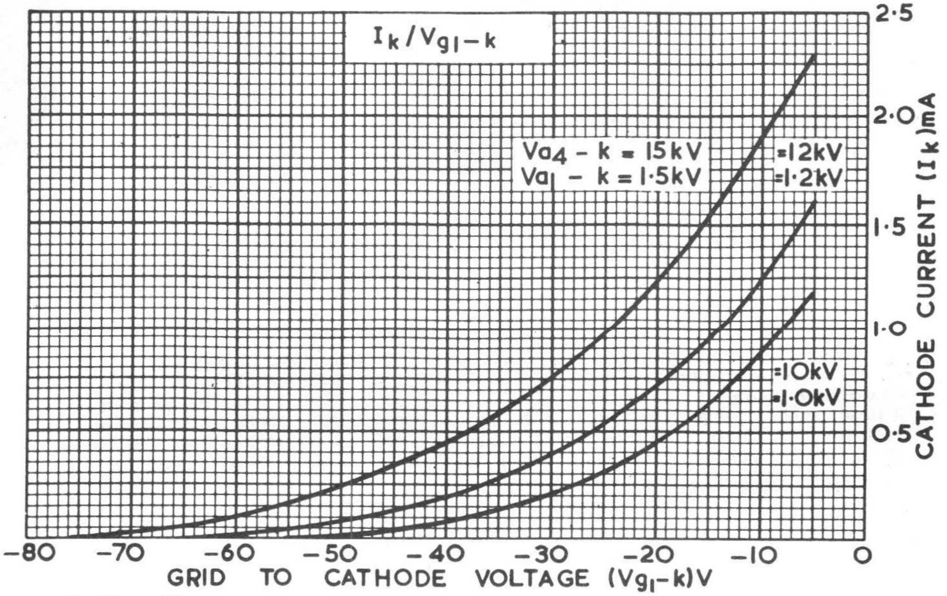
VIEWED FROM SCREEN END
(CT8 AT LEFT)

**All dimensions in mm** **Not to be scaled**

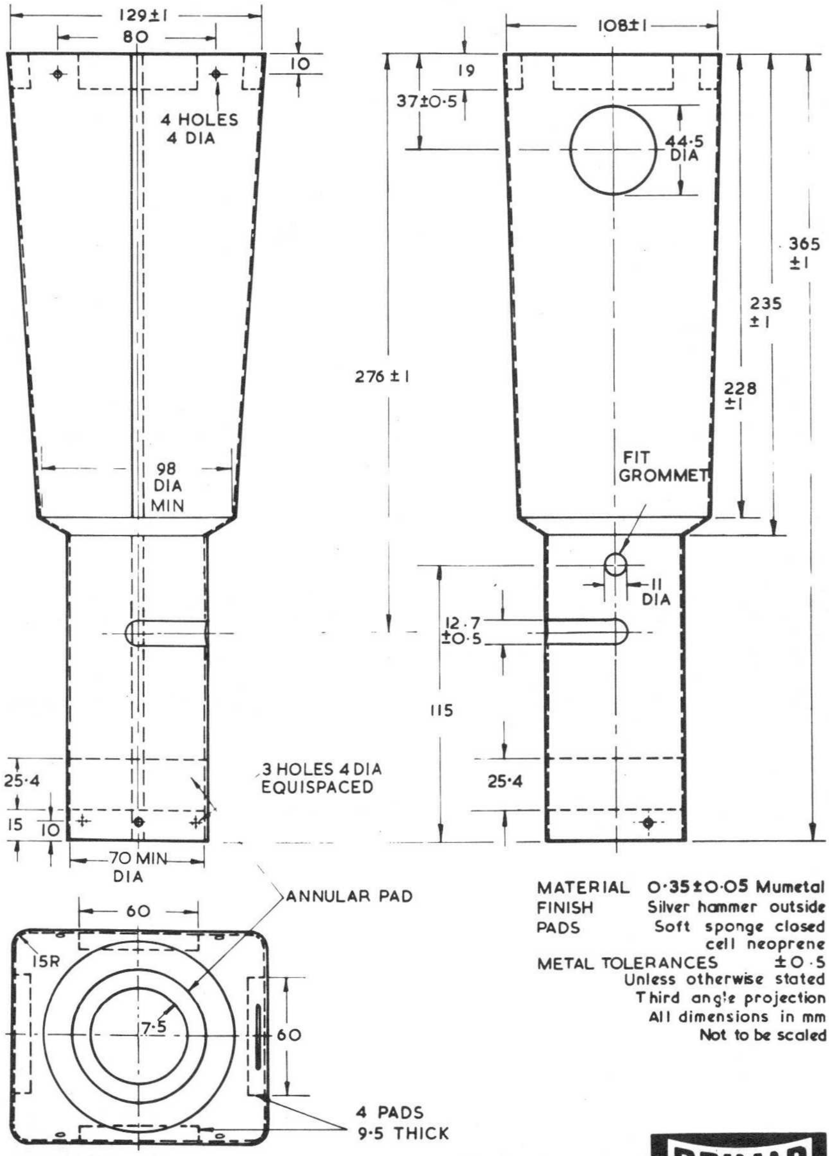
It is advisable to support the tube near the screen, and at a second point on the parallel neck near the base. The tube should not be subjected to any stress from the use of clamps and should not be suspended by the base. Connecting leads should not be soldered directly to the tube pins.

Tolerance on all side pin positions ± 5°.


BEAM CURRENT / $V_{g1-k}$
$V_{a4-k}$ = 15kV
$V_{a1-k}$ = 1·5kV
=12kV
=1·2kV
=10kV
=1·0kV
50
40
30
20
10
BEAM CURRENT ($I_{a4}-I_{helix}$) μA
−80 −70 −60 −50 −40 −30 −20 −10 0
GRID TO CATHODE VOLTAGE ($V_{g1-k}$)V


$I_k / V_{g1-k}$
$V_{a4-k}$ = 15kV
$V_{a1-k}$ = 1·5kV
=12kV
=1·2kV
=10kV
=1·0kV
2·5
2·0
1·5
1·0
0·5
CATHODE CURRENT ($I_k$)mA
−80 −70 −60 −50 −40 −30 −20 −10 0
GRID TO CATHODE VOLTAGE ($V_{g1-k}$)V

EXAMPLE OF TYPICAL SHIELD




| | |
|---|---|
| MATERIAL | 0·35±0·05 Mumetal |
| FINISH | Silver hammer outside |
| PADS | Soft sponge closed cell neoprene |
| METAL TOLERANCES | ±0·5 |

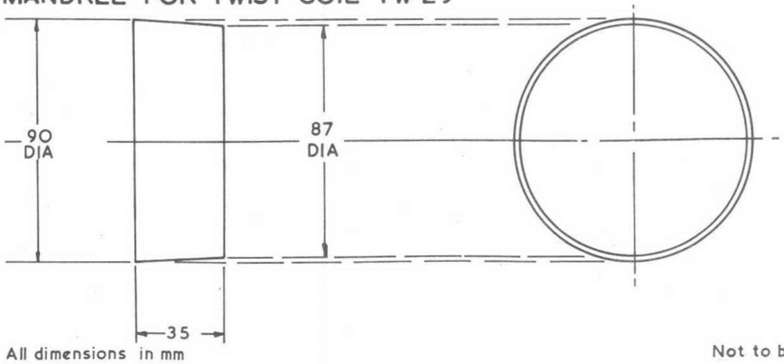
Unless otherwise stated
Third angle projection
All dimensions in mm
Not to be scaled



BRIMAR

OSCILLOSCOPE TUBES

## MANDREL FOR TWIST COIL TW 29




MANDREL

Shaped from wood in the form of a truncated circular cone, dimensions as above.

SHIELD

This twist coil is designed to be used in conjunction with magnetic shield MS11 for D14-200..

WINDING

1600 turns of 0.140 mm Lewmex Grade 1 or 2 wire, or approved alternative, layer wound on the adhesive side of adhesive backed crepe paper to give 5 mm margins between the coil and each edge of the mandrel.
Start and finish of winding to be brought out on 450 mm long thin flexible lead wires from smaller end of winding.
Varnish, if necessary, cover with adhesive backed crepe paper and ensure that the edges of the coil are sealed in place.

ELECTRICAL CHARACTERISTICS

Resistance approx. 550 Ω. Twist coefficient approximately 7 mA/degree measured on typical D14-200.. with $V_{a4}$ = 15 kV and $V_{a1}$ = 1.5 kV.

FITTING

The completed twist coil should be pushed onto the tube and secured to tube in two places with suitable adhesive tape.

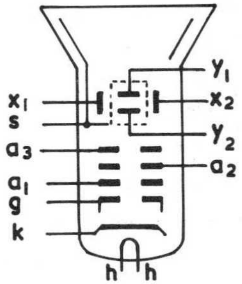
# Oscilloscope Tube

# D14-270..

## GENERAL

This 10cm x 8cm display rectangular oscilloscope tube is primarily intended for use in inexpensive oscilloscopes and monitoring devices. The tube has sufficient deflector sensitivity to permit transistor driven deflection.

| | | | |
|---|---|---|---|
| Heater voltage | $V_h$ | 6.3 | V |
| Heater current | $I_h$ | 0.12 | A |




## ABSOLUTE RATINGS - voltages with respect to cathode

| | | Max. | Min. | |
|---|---|---|---|---|
| First anode voltage | $V_{a1}$ | 2200 | 1250 | V |
| Second anode voltage | $V_{a2}$ | 800 | - | V |
| Third anode voltage | $V_{a3}$ | 2250 | 1200 | V |
| Negative grid voltage | $-V_g$ | 200 | 1.0 | V |
| Peak x-plate to third anode voltage | $v_{x-a3(pk)}$ | 500 | - | V |
| Peak y-plate to third anode voltage | $v_{y-a3(pk)}$ | 500 | - | V |
| Heater to cathode voltage | $V_{h-k}$ | ± 125 | | V |
| x-plate to third anode resistance | $R_{x-a3}$ | 2.0 | - | MΩ |
| y-plate to third anode resistance | $R_{y-a3}$ | 2.0 | - | MΩ |
| Grid to cathode resistance | $R_{g-k}$ | 1.5 | - | MΩ |
| Peak cathode current | $i_{k(pk)}$ | 500 | - | µA |

OSCILLOSCOPE TUBES

## PHOSPHOR SCREEN

This tube is usually supplied with GH phosphor (D14-270GH) giving a green trace of medium short persistence. Other phosphors can be made available to special order.

This data should be read in conjunction with Brimar Operational and Safety Recommendations for Industrial Cathode Ray Tubes.

**Thorn Radio Valves and Tubes Limited**

BRIMAR

## INTER-ELECTRODE CAPACITANCES

| | | | |
|---|---|---|---|
| Grid 1 to all | $c_{g1-all}$ | 8.2 | pF |
| Heater and cathode to all | $c_{h,k-all}$ | 3.8 | pF |
| $x_1$ plate to $x_2$ plate | $c_{x1-x2}$ | 1.7 | pF |
| $y_1$ plate to $y_2$ plate | $c_{y1-y2}$ | 1.3 | pF |
| $x_1$ plate to all, less $x_2$ plate | $c_{x1-all,\ less\ x2}$ | 5.0 | pF |
| $x_2$ plate to all, less $x_1$ plate | $c_{x2-all,\ less\ x1}$ | 4.8 | pF |
| $y_1$ plate to all, less $y_2$ plate | $c_{y1-all,\ less\ y2}$ | 3.6 | pF |
| $y_2$ plate to all, less $y_1$ plate | $c_{y2-all,\ less\ y1}$ | 3.7 | pF |
| $x_1$, $x_2$ plates to $y_1$, $y_2$ plates | $c_{x1,x2-y1,y2}$ | 0.7 | pF |

## TYPICAL OPERATION - voltages with respect to cathode

| | | | | |
|---|---|---|---|---|
| Mean deflector plate potential* | | 1500 | 2000 | V |
| Third anode voltage for optimum astigmatism correction | $V_{a3}$ | 1500† | 2000† | V |
| Second anode voltage for optimum focus | $V_{a2}$ | 125 to 220 | 170 to 290 | V |
| First anode voltage | $V_{a1}$ | 1500 | 2000 | V |
| Shield voltage for optimum raster shape | $V_s$ | 1500† | 2000† | V |
| Control grid voltage for cut-off | $V_{g1}$ | -22 to -52 | -30 to -70 | V |
| x deflection coefficient | $D_x$ | 14.3 to 17.5 | 19 to 23 | V/cm |
| y deflection coefficient | $D_y$ | 9 to 11.3 | 12 to 15 | V/cm |
| Minimum useful screen area | | 10 x 8.0 | 10 x 8.0 | $cm^2$ |
| Grid drive to 10$\mu$A beam current | | 10 | 11 | V |
| Line width at 10$\mu$A beam current Shrinking raster measurement at centre | | 0.4 | 0.35 | mm |

* This tube is designed for symmetrical operation.

† The required voltage will not differ from the quoted value by more than ± 30V.

## RASTER DISTORTION AND ALIGNMENT

The undeflected spot will fall in a circle of 7mm radius about the centre of the tube face.

Raster distortion: the edges of a test raster will fall between two concentric rectangles 8.5 cm x 7.0 cm and 8.3 cm x 6.88 cm.

Rectangularity of x and y axes is 90° $\pm$ 1°.

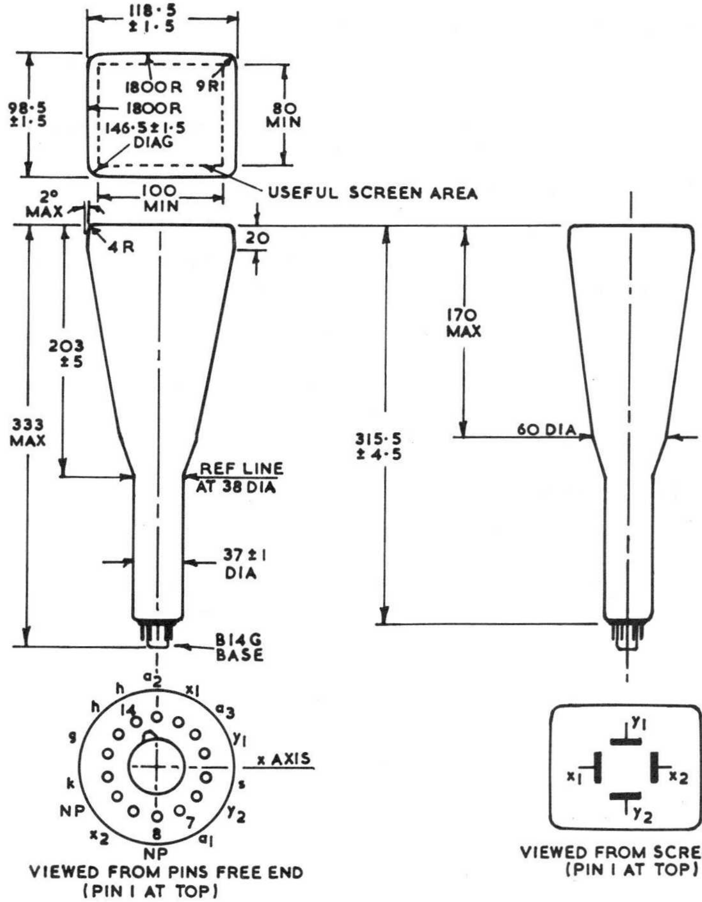
It is preferable that the mean x and y plate potentials are equal otherwise some deterioration in performance will occur. Under no circumstances should the mean y plate potential differ from the mean x plate potential by more than 50V.

## MAGNETIC SHIELDING

Adequate magnetic shielding is required. In addition due attention should be paid to the position of the tube relative to transformers and chokes.

**TUBE WEIGHT** (approximate) 1.2 kg

**MOUNTING POSITION** - unrestricted.




All dimensions in mm

Not to be scaled

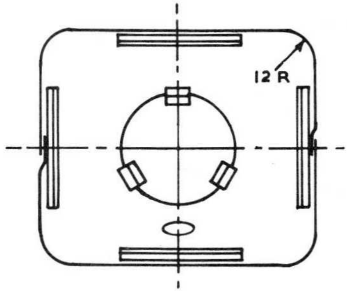
It is advisable to support the tube near the screen and at a second point on the parallel neck near the base. The tube should not be subjected to any stress from the use of clamps and should not be suspended by the base.

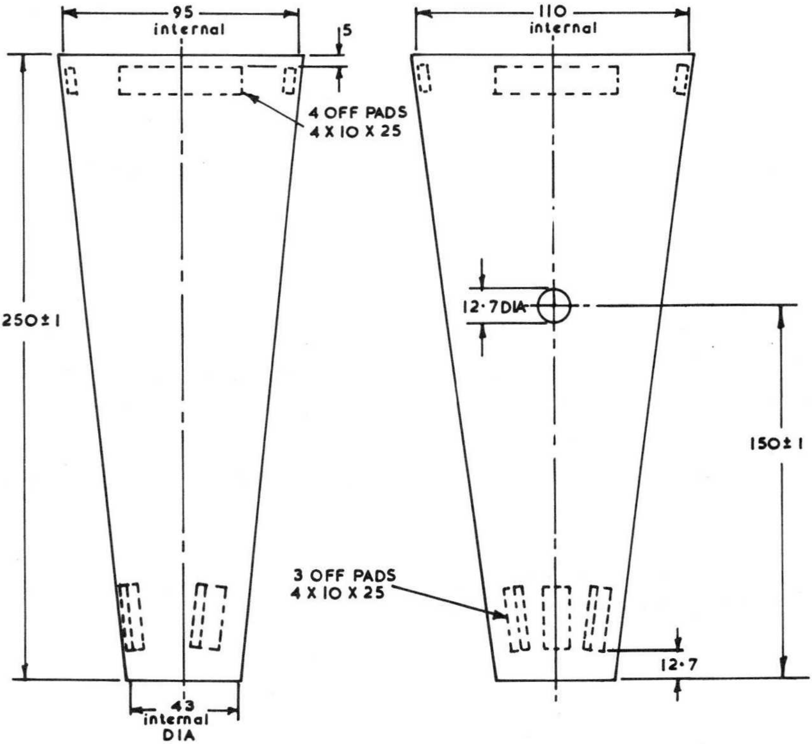
Tolerance on base pin 1 position with respect to tube y axis ± 5°

# Magnetic Shield MS70



MATERIAL 0·35 ± 0·05 Mumetal
FINISH Silver hammer outside
PADS Soft sponge closed cell neoprene
METAL TOLERANCES ± 0·5 Unless othewise stated
Third angle projection
All dimensions in mm
Not to be scaled



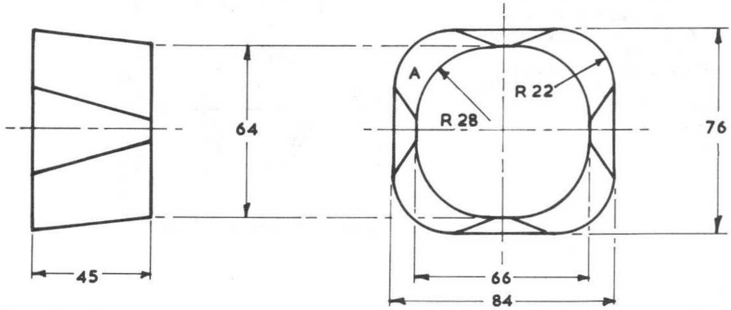




OSCILLOSCOPE TUBES



BRIMAR

## MANDREL FOR TWIST COIL TW52




All dimensions in mm

Not to be scaled

### MANDREL

Shaped from wood in the form of a shaped truncated circular cone, dimensions as above.

### SHIELD

This twist coil is designed to be used in conjunction with magnetic shield MS70 for D14-270..

### WINDING

1000 turns of 0.14 mm Lewmex Grade 1 or 2 wire, or approved alternative, layer wound on the adhesive side of adhesive backed crepe paper to give 5 mm margins between the coil and each edge of the mandrel.
Start and finish of winding to be brought out on 450 mm long thin flexible lead wires at position A on drawing.
Varnish, if necessary, cover with adhesive backed crepe paper and ensure that the edges of the coil are sealed in place.

### ELECTRICAL CHARACTERISTICS

Resistance approx. 300Ω. Current required for ± 5° twist is ± 20 mA measured on typical D14-270.. with $V_{a1}$ = 1.5 kV.

### FITTING

The completed twist coil should be pushed onto the tube from the base end as far as it will travel and locked in position with adhesive tape.

# Oscilloscope Tube

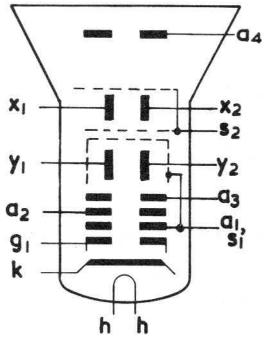
# D14-280..

## PRELIMINARY DATA

### GENERAL

This 10cm x 8cm rectangular aluminised tube with electrostatic focusing and deflection uses a mesh p.d.a. to achieve high deflection sensitivity and high brightness without additional electrode control voltages. The tube is designed for transistor deflection medium to high bandwidth applications.

| | | | |
|---|---|---|---|
| Heater voltage | $V_h$ | 6.3 | V |
| Heater current | $I_h$ | 0.3 | A |




### ABSOLUTE RATINGS

| | | Max | Min | |
|---|---|---|---|---|
| Fourth anode voltage | $V_{a4}$ | 13 | 8.0 | kV |
| Third anode voltage | $V_{a3}$ | 2.2 | 1.2 | kV |
| Second anode voltage | $V_{a2}$ | 1.0 | - | kV |
| First anode voltage | $V_{a1}$ | 2.2 | 1.1 | kV |
| Negative control grid voltage | $-V_{g1}$ | 200 | 1.0 | V |
| Peak x plate to third anode voltage | $v_{x-a3(pk)}$ | 500 | - | V |
| Peak y plate to third anode voltage | $v_{y-a3(pk)}$ | 500 | - | V |
| x plate to third anode resistance | $R_{x-a3}$ | 100 | - | kΩ |
| y plate to third anode resistance | $R_{y-a3}$ | 100 | - | kΩ |
| Control grid to cathode resistance | $R_{g1-k}$ | 1.5 | - | MΩ |
| Second anode current | $I_{a2}$ | 10 | - | μA |
| P.D.A. ratio ($V_{a4}/V_{a3}$) | | 7:1 | - | |

All voltages referred to cathode unless otherwise stated.

### PHOSPHOR SCREEN

This type is usually supplied with GH phosphor (D14-280GH) giving a green trace of medium short persistence. Other phosphor screens can be made available to special order.

This data should be read in conjunction with Brimar Operational and Safety Recommendations for Industrial Cathode Ray Tubes.

## INTER-ELECTRODE CAPACITANCES

| | | | |
|---|---|---|---|
| Grid 1 to all | $c_{g1-all}$ | 9.5 | pF |
| Heater and cathode to all | $c_{h,k-all}$ | 3.5 | pF |
| $x_1$ plate to $x_2$ plate | $c_{x1-x2}$ | 2.0 | pF |
| $y_1$ plate to $y_2$ plate | $c_{y1-y2}$ | 1.5 | pF |
| $x_1$ plate to all, less $x_2$ plate | $c_{x1-all,\ less\ x2}$ | 6.0 | pF |
| $x_2$ plate to all, less $x_1$ plate | $c_{x2-all,\ less\ x1}$ | 6.0 | pF |
| $y_1$ plate to all, less $y_2$ plate | $c_{y1-all,\ less\ y2}$ | 5.0 | pF |
| $y_2$ plate to all, less $y_1$ plate | $c_{y2-all,\ less\ y1}$ | 5.0 | pF |
| $x_1$, $x_2$ plates to $y_1$, $y_2$ plates | $c_{x1,x2-y1,y2}$ | 0.8 | pF |
| Grid 1 to $x_1$, $x_2$, $y_1$, $y_2$ plates | $c_{g1-x1,x2,y1,y2}$ | 0.8 | pF |

## TYPICAL OPERATION - Voltages with respect to cathode

| | | | | |
|---|---|---|---|---|
| Fourth anode voltage | $V_{a4}$ | 10 | 12 | kV |
| Mean deflector plate potential | | 1500 | 2000 | V |
| Third anode voltage for optimum astigmatism correction | $V_{a3}$ | 1470 to 1530 | 1970 to 2030 | V |
| Second anode voltage for optimum focus | $V_{a2}$ | 320 to 480 | 420 650 | V |
| First anode and shield 1 voltage | $V_{a1+s1}$ | 1500 | 2000 | V |
| Shield 2 voltage for optimum raster shape | $V_{s2}$ | 1400 to 1500 | 1900 to 2000 | V |
| Control grid voltage for cut-off | $V_{g1}$ | -40 to -80 | -53 to -106 | V |
| x deflection coefficient | $D_x$ | 10.5 to 13 | 14 to 17.4 | V/cm |
| y deflection coefficient | $D_y$ | 4.2 to 5.2 | 5.6 to 6.9 | V/cm |
| Minimum screen area | | 10 x 8 | 10x8 | $cm^2$ |
| Line width at 10$\mu$A beam current | | | | |
| Shrinking raster measurement at centre | | 0.38 | 0.35 | mm |
| Microscope measurement at centre | | 0.75 | 0.64 | mm |
| Microscope measurement at edge | | 1.0 | 0.9 | mm |
| Grid Drive to 10$\mu$A beam current (approx.) | | 18 | 19 | V |

## RASTER DISTORTION AND ALIGNMENT

The following data applies for the typical operation conditions.

The undeflected spot will fall in a circle of 8 mm radius about the centre of the tube face.

Raster distortion : The edges of a test raster will fall between two concentric rectangles 10 cm x 8 cm and 9.80 cm x 7.84 cm.

Rectangularity of x and y axes is 90° ± 1°. The horizontal trace will be parallel with the axis of the rectangular face-plate to within ± 5°. A twist coil will be required to effect accurate alignment. This should be mounted inside the magnetic shield approximately 130 mm from the face and should not extend more than 195 mm from the face. The ampere turns required will be equal to $14\sqrt{V_{a4}}$ (where $V_{a4}$ is quoted in kV) with provision for reversing the current. The sensitivity (for both x and y plates) at 75% deflection of the useful scan will not differ by more than 2% from the sensitivity over 25% deflection.

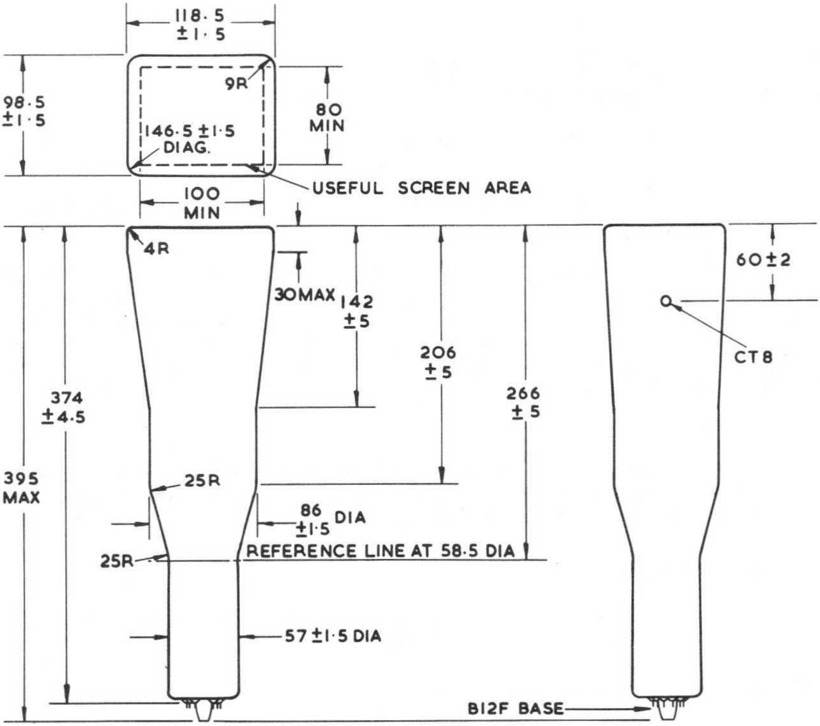
It is preferable that the mean x and y plate potentials are equal otherwise some deterioration in performance will occur. Under no circumstances should the mean y plate potential differ from the mean x plate potential by more than 50V.

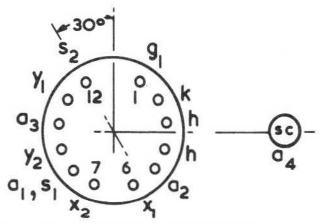
## MAGNETIC SHIELDING

Adequate magnetic shielding is required. In addition due attention should be paid to the position of the tube relative to transformers and chokes.

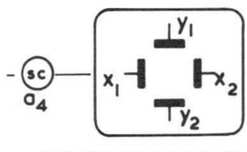
**TUBE WEIGHT** (approximate) - 1.4 kg

**MOUNTING POSITION** - unrestricted




VIEW FROM PINS FREE END
(CT8 AT RIGHT)




VIEWED FROM SCREEN END
(CT8 AT LEFT)

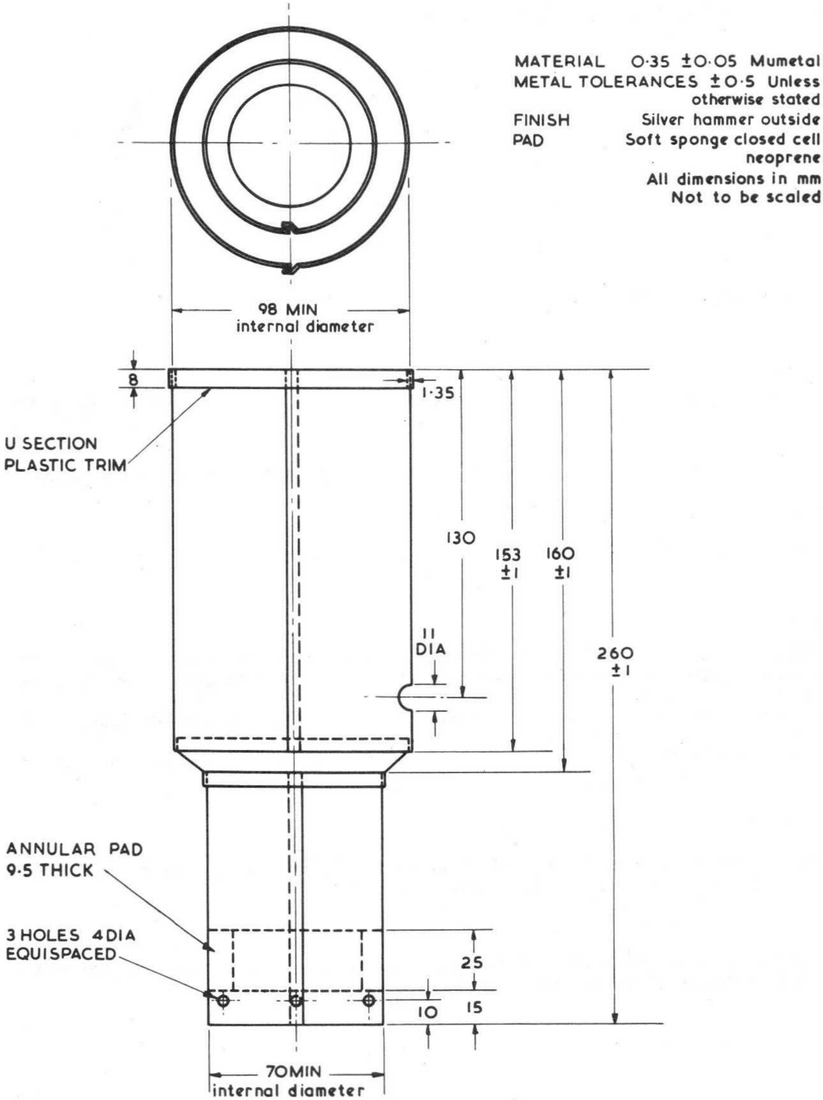
All dimensions in mm

Not to be scaled

It is advisable to support the tube near the screen, and at a second point on the parallel neck near the base. The tube should not be subjected to any stress from the use of clamps and should not be suspended by the base. Connecting leads should not be soldered directly to the tube pins.

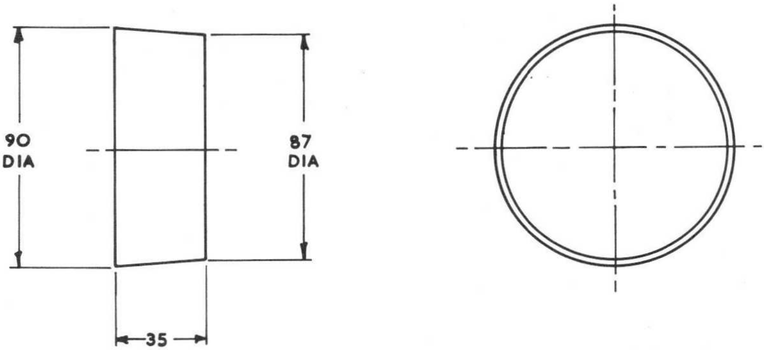
# Magnetic Shield MS72 D14–280..

EXAMPLE OF TYPICAL SHIELD




OSCILLOSCOPE TUBES

## MANDREL FOR TWIST COIL TW29




All dimensions in mm

Not to be scaled

MANDREL

Shaped from wood in the form of a truncated circular cone, dimensions as above.

SHIELD

This twist coil, is designed to be used in conjunction with magnetic shield MS72 for D14-280..

WINDING

1600 turns of 0.140 mm Lewmex Grade 1 or 2 wire, or approved alternative, layer wound on the adhesive side of adhesive backed crepe paper to give 5 mm margins between the coil and each edge of the mandrel.
Start and finish of winding to be brought out on 450 mm long thin flexible lead wires from smaller end of winding.
Varnish, if necessary, cover with adhesive backed crepe paper and ensure that the edges of the coil are sealed in place.

ELECTRICAL CHARACTERISTICS

Resistance approx. 550 Ω. Twist coefficient approximately 6.5 mA/degree measured on typical D14-280.. with $V_{a4}$= 12kV and $V_{a1}$= 2.0 kV.

FITTING

The completed twist coil should be pushed onto the tube and secured to tube in two places with suitable adhesive tape.

# Oscilloscope Tube

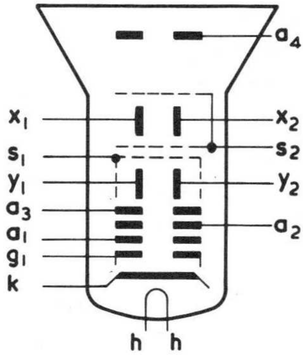
# D14-310..

PRELIMINARY DATA

### GENERAL

This 10cm x 8cm rectangular aluminised tube with electrostatic focusing and deflection uses a mesh p.d.a. to achieve high deflection sensitivity and very high brightness without additional electrode control voltages. The tube is designed for transistor deflection high bandwidth and high writing speed applications.

| | | | |
|---|---|---|---|
| Heater voltage | $V_h$ | 6.3 | V |
| Heater current | $I_h$ | 0.3 | A |




### ABSOLUTE RATINGS

| | | Max | Min | |
|---|---|---|---|---|
| Fourth anode voltage | $V_{a4}$ | 18 | 8.0 | kV |
| Third anode voltage | $V_{a3}$ | 2.25 | 1.0 | kV |
| Second anode voltage | $V_{a2}$ | 1.0 | 0 | kV |
| First anode voltage | $V_{a1}$ | 2.2 | 1.0 | kV |
| Negative control grid voltage | $-V_{g1}$ | 200 | 1.0 | V |
| Peak x plate to third anode voltage | $v_{x-a3(pk)}$ | 500 | - | V |
| Peak y plate to third anode voltage | $v_{y-a3(pk)}$ | 500 | - | V |
| x plate to third anode resistance | $R_{x-a3}$ | 5.0 | - | MΩ |
| y plate to third anode resistance | $R_{y-a3}$ | 100 | - | kΩ |
| Control grid to cathode resistance | $R_{g1-k}$ | 1.5 | - | MΩ |
| Second anode current | $I_{a2}$ | 10 | - | μA |
| P.D.A. ratio ($V_{a4}/V_{a3}$) | | 9:1 | - | |

All voltages referred to cathode unless otherwise stated.

### PHOSPHOR SCREEN

This type is usually supplied with GH phosphor (D14-310GH) giving a green trace of medium short persistence. Other phosphor screens can be made available to special order.

If this tube is operated at voltages in excess of 18 kV, x-ray radiation shielding may be necessary to avoid possible danger of personal injury from prolonged exposure at close range.

OSCILLOSCOPE TUBES

## INTER – ELECTRODE CAPACITANCES

| | | | |
|---|---|---|---|
| Grid 1 to all | $c_{g1\text{-}all}$ | 9.0 | pF |
| Heater and cathode to all | $c_{h,k\text{-}all}$ | 5.0 | pF |
| $x_1$ plate to $x_2$ plate | $c_{x1\text{-}x2}$ | 3.5 | pF |
| $y_1$ plate to $y_2$ plate | $c_{y1\text{-}y2}$ | 1.5 | pF |
| $x_1$ plate to all, less $x_2$ plate | $c_{x1\text{-}all,\ less\ x2}$ | 5.0 | pF |
| $x_2$ plate to all, less $x_1$ plate | $c_{x2\text{-}all,\ less\ x1}$ | 5.0 | pF |
| $y_1$ plate to all, less $y_2$ plate | $c_{y1\text{-}all,\ less\ y2}$ | 3.5 | pF |
| $y_2$ plate to all, less $y_1$ plate | $c_{y2\text{-}all,\ less\ y1}$ | 3.5 | pF |
| $x_1$, $x_2$ plates to $y_1$, $y_2$ plates | $c_{x1,x2\text{-}y1,y2}$ | 0.2 | pF |
| Grid 1 to $x_1$, $x_2$, $y_1$, $y_2$ plates | $c_{g1\text{-}x1,x2,y1,y2}$ | 0.05 | pF |

## TYPICAL OPERATION – Voltages with respect to cathode

| | | | | | |
|---|---|---|---|---|---|
| Fourth anode voltage | $V_{a4}$ | 10 | 12 | 16 | kV |
| Mean deflector plate potential | | 1250 | 1500 | 2000 | V |
| Third anode voltage for optimum astigmatism correction | $V_{a3}$ | 1210 to 1290 | 1460 to 1540 | 1960 to 2040 | V |
| Second anode voltage for optimum focus | $V_{a2}$ | 315 to 450 | 380 to 540 | 505 to 720 | V |
| First anode voltage | $V_{a1}$ | 1250 | 1500 | 2000 | V |
| y shield voltage | $V_{s1}$ | 1250 | 1500 | 2000 | V |
| Shield voltage for optimum raster shape | $V_{s2}$ | 1180 to 1280 | 1420 to 1520 | 1905 to 2005 | V |
| Control grid voltage for cut-off | $V_{g1}$ | -30 to -55 | -35 to -66 | -48 to -88 | V |
| x deflection coefficient | $D_x$ | 9.1 to 11.6 | 11 to 14 | 14.6 to 18.6 | V/cm |
| y deflection coefficient | $D_y$ | 2.8 to 3.6 | 3.4 to 4.3 | 4.5 to 5.8 | V/cm |
| Minimum screen area | | 10 x 8 | 10 x 8 | 10 x 8 | $cm^2$ |
| Line width at 10μA beam current | | | | | |
| Shrinking raster measurement at centre | | 0.34 | 0.31 | 0.28 | mm |
| Microscope measurement at centre | | 0.60 | 0.50 | 0.44 | mm |
| Microscope measurement at edge | | 0.70 | 0.65 | 0.60 | mm |
| Grid Drive to 10μA beam current (approx.) | | 23 | 23.5 | 24 | V |

## RASTER DISTORTION AND ALIGNMENT

The following data applies for the typical operation conditions.

The undeflected spot will fall in a circle of 8 mm radius about the centre of the tube face.

Raster distortion will not be greater than 2%. The edges of a test raster will fall between two concentric rectangles 10 cm x 8 cm and 9.80 cm x 7.84 cm.

Rectangularity of x and y axes is 90° ± 1°. The horizontal trace will be parallel with the axis of the rectangular face-plate to within ± 5°. A twist coil will be required to effect accurate alignment. This should be mounted inside the magnetic shield approximately 90 mm from the face and should not extend more than 200 mm from the face. The ampere turns required will be equal to $14\sqrt{V_{a4}}$ (where $V_{a4}$ is quoted in kV) with provision for reversing the current. The sensitivity (for both x and y plates) at 75% deflection of the useful scan shall not differ by more than 2% from the sensitivity over 10% deflection.

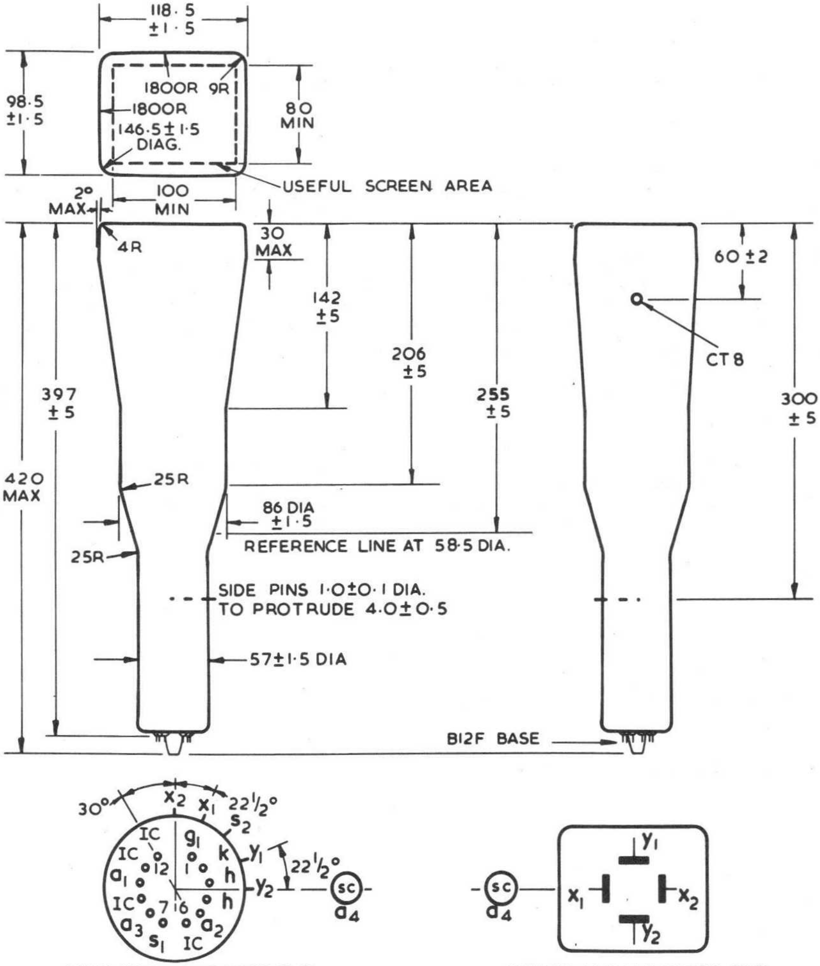
It is preferable that the mean x and y plate potentials are equal otherwise some deterioration in performance will occur. Under no circumstances should the mean y plate potential differ from the mean x plate potential by more than 50V.

## MAGNETIC SHIELDING

Adequate magnetic shielding is required. In addition due attention should be paid to the position of the tube relative to transformers and chokes.

**TUBE WEIGHT** (approximate) - 1.4 kg

**MOUNTING POSITION** - unrestricted




VIEW FROM PINS FREE END
(CT8 AT RIGHT)

VIEWED FROM SCREEN END
(CT8 AT LEFT)

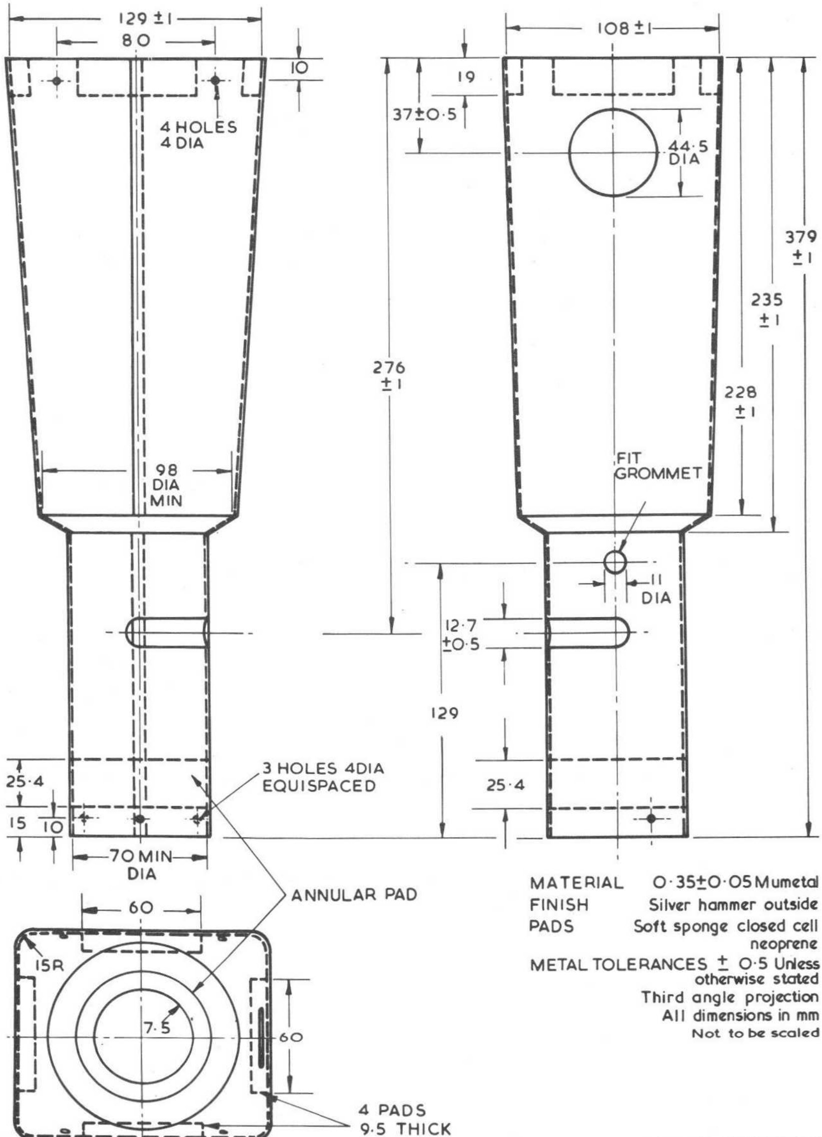
All dimensions in mm

Not to be scaled

It is advisable to support the tube near the screen, and at a second point on the parallel neck near the base. The tube should not be subjected to any stress from the use of clamps and should not be suspended by the base. Connecting leads should not be soldered directly to the tube pins.

Tolerance on all side pin positions ± 5°.

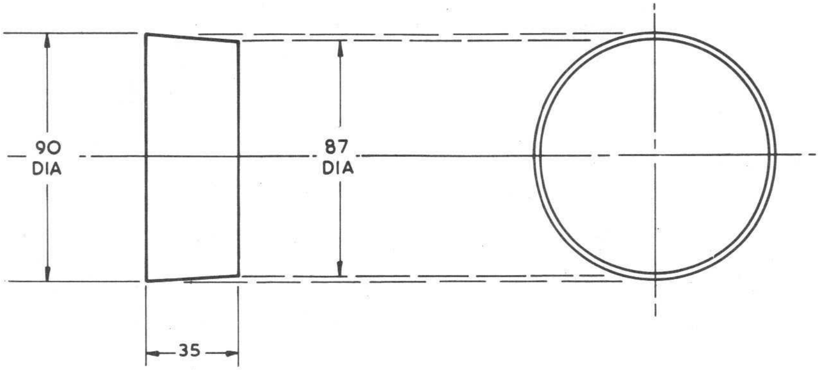
EXAMPLE OF TYPICAL SHIELD




| | |
|---|---|
| MATERIAL | 0·35±0·05 Mumetal |
| FINISH | Silver hammer outside |
| PADS | Soft sponge closed cell neoprene |
| METAL TOLERANCES | ± 0·5 Unless otherwise stated |

Third angle projection
All dimensions in mm
Not to be scaled

MANDREL FOR TWIST COIL TW29




All dimensions in mm

Not to be scaled

MANDREL

Shaped from wood in the form of a truncated circular cone, dimensions as above.

SHIELD

This twist coil is designed to be used in conjunction with magnetic shield MS1 for D14-310..

WINDING

1600 turns of 0.140 mm Lewmex Grade 1 or 2 wire, or approved alternative, layer wound on the adhesive side of adhesive backed crepe paper to give 5 mm margins between the coil and each edge of the mandrel.
Start and finish of winding to be brought out on 450 mm long thin flexible lead wires from smaller end of winding.
Varnish, if necessary, cover with adhesive backed crepe paper and ensure that the edges of the coil are sealed in place.

ELECTRICAL CHARACTERISTICS

Resistance approx. 550 Ω. Twist coefficient approximately 7 mA/degree measured on typical D14-310.. with $V_{a4}$ = 12 kV and $V_{a1}$ = 1.5 kV.

FITTING

The completed twist coil should be pushed onto the tube and secured to tube in two places with suitable adhesive tape.

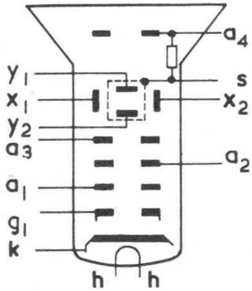
# Oscilloscope Tube

# D16-100..

## GENERAL

This 10 cm x 10 cm square faced tube with electrostatic focusing and deflection is designed for use as an x-y plotter. The tube incorporates spiral post deflection acceleration.

| | | | |
|---|---|---|---|
| Heater voltage | $V_h$ | 6.3 | V |
| Heater current | $I_h$ | 0.3 | A |




## ABSOLUTE RATINGS

| | | Max | Min | |
|---|---|---|---|---|
| Fourth anode voltage | $V_{a4}$ | 6.0 | 1.5 | kV |
| Third anode voltage | $V_{a3}$ | 2.3 | 0.7 | kV |
| Second anode voltage | $V_{a2}$ | 1.0 | 0 | kV |
| First anode voltage | $V_{a1}$ | 2.2 | 0.7 | kV |
| Negative grid voltage | $-V_{g1}$ | 200 | 1.0 | V |
| Peak x plate to third anode voltage | $v_{x-a3(pk)}$ | 500 | - | V |
| Peak y plate to third anode voltage | $v_{y-a3(pk)}$ | 500 | - | V |
| x plate to third anode resistance | $R_{x-a3}$ | 5.0 | - | MΩ |
| y plate to third anode resistance | $R_{y-a3}$ | 100 | - | kΩ |
| Control grid to cathode resistance | $R_{g1-k}$ | 1.5 | - | MΩ |
| Second anode current | $I_{a2}$ | 10 | - | μA |
| P.D.A. ratio ($V_{a4}/V_{a3}$) | | 3.2:1 | | |
| Helix resistance | | - | 50 | MΩ |

All voltages referred to cathode unless otherwise stated.

## PHOSPHOR SCREEN

This type is usually supplied with GH phosphor (D16-100GH) giving a green trace of medium short persistence. Other phosphor screens can be made available to special order.

OSCILLOSCOPE TUBES

**Thorn Radio Valves and Tubes Limited**

BRIMAR

## INTER-ELECTRODE CAPACITANCES

| | | | |
|---|---|---|---|
| Grid 1 to all | $c_{g1\text{-}all}$ | 10.5 | pF |
| Cathode to all | $c_{k\text{-}all}$ | 3.5 | pF |
| $x_1$ plate to $x_2$ plate | $c_{x1\text{-}x2}$ | 2.3 | pF |
| $y_1$ plate to $y_2$ plate | $c_{y1\text{-}y2}$ | 1.0 | pF |
| $x_1$ plate to all, less $x_2$ plate | $c_{x1\text{-}all, less\ x2}$ | 6.2 | pF |
| $x_2$ plate to all, less $x_1$ plate | $c_{x2\text{-}all, less\ x1}$ | 6.4 | pF |
| $y_1$ plate to all, less $y_2$ plate | $c_{y1\text{-}all, less\ y2}$ | 5.4 | pF |
| $y_2$ plate to all, less $y_1$ plate | $c_{y2\text{-}all, less\ y1}$ | 5.2 | pF |
| $x_1$, $x_2$ plates to $y_1$, $y_2$ plates | $c_{x1, x2\text{-}y1, y2}$ | 1.2 | pF |
| Grid 1 to $x_1$, $x_2$ plates | $c_{g1\text{-}x1, x2}$ | 0.8 | pF |
| Grid 1 to $y_1$, $y_2$ plates | $c_{g1\text{-}y1, y2}$ | 0.8 | pF |

**TYPICAL OPERATION** - voltages with respect to cathode.

| | | | | | |
|---|---|---|---|---|---|
| Fourth anode voltage | $V_{a4}$ | 2.5 | 4.0 | 4.5 | kV |
| Mean deflector plate potential | | 1250 | 2000 | 1500 | V |
| Third anode voltage for optimum astigmatism correction | $V_{a3}$ | 1200 to 1300 | 1925 to 2075 | 1425 to 1575 | V |
| Second anode voltage for optimum focus | $V_{a2}$ | 250 to 450 | 400 to 720 | 280 to 580 | V |
| First anode voltage | $V_{a1}$ | 1250 | 2000 | 1500 | V |
| Shield voltage for optimum raster shape | $V_s$ | 1200 to 1300 | 1925 to 2075 | 1425 to 1575 | V |
| Control grid voltage for cut-off | $V_{g1}$ | -45 to -85 | -72 to -135 | -53 to -105 | V |
| x deflection coefficient | $D_x$ | 13.5 to 17 | 21.6 to 27.2 | 18.5 to 23.5 | V/cm |
| y deflection coefficient | $D_y$ | 13.5 to 17 | 21.6 to 27.2 | 18.5 to 23.5 | V/cm |
| Line width at 10 $\mu$A beam current | | | | | |
| Shrinking raster measurement at centre | | 0.50 | 0.31 | 0.32 | mm |
| Shrinking raster measurement at corner | | 0.68 | 0.58 | 0.58 | mm |
| Grid drive for 10 $\mu$A beam current (approx.) | | 28 | 26 | 27 | V |

## RASTER DISTORTION AND ALIGNMENT

The following data applies for the typical operation conditions.

The undeflected spot will fall in a circle of 6 mm radius about the centre of the tube face.

Raster distortion : the edges of a test raster will fall between two concentric squares 10 cm x 10 cm and 9.74 cm x 9.74 cm at a p.d.a. ratio not greater than 2:1.

Rectangularity of x and y axes is 90° ± 1°.

The horizontal trace will be parallel with the axis of the rectangular face-plate to within ±5°. A twist coil will be required to effect accurate alignment. This should be mounted inside the magnetic shield approximately 100 mm from the face and should not extend more than 170 mm from the face. The ampere turns required will be equal to $13\sqrt{V_{a4}}$ (where $V_{a4}$ is quoted in kV) with provision for reversing the current. The sensitivity (for both x and y plates) at 75% deflection of the useful scan will not differ by more than 2% from the sensitivity over 10% deflection.

It is not advisable that the deflector plates be run asymmetrically, or severe raster distortion may result and the focus quality cannot be guaranteed. It is preferable that the tube be operated with mean x and y potentials equal, otherwise the raster distortion and focus quality will suffer and the limits for $V_{a3}$ and $V_s$ will differ from specification.

It is recommended that the maximum p.d.a. ratio is not exceeded as this may reduce scan area.

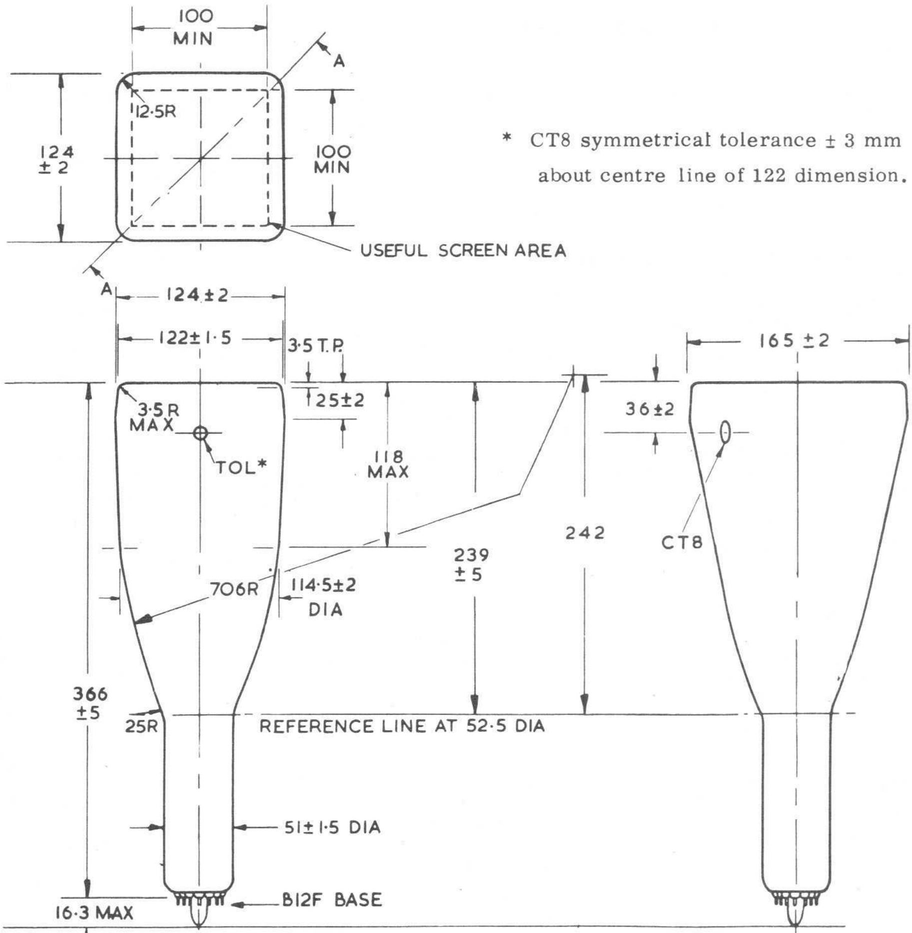
## MAGNETIC SHIELDING

Adequate magnetic shielding is required. In addition due attention should be paid to the position of the tube relative to transformers and chokes.

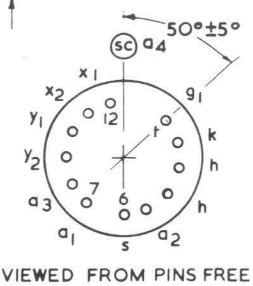
## TUBE WEIGHT (approximate) 1.2 kg

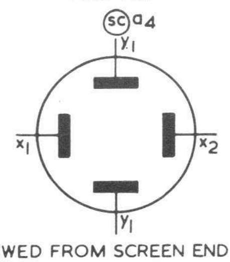
## MOUNTING POSITION - unrestricted

It is advisable to support the tube near the screen and at a second point on the parallel neck near the base. The tube should not be subjected to any stress from the use of clamps and should not be suspended by the base.




* CT8 symmetrical tolerance ± 3 mm about centre line of 122 dimension.




All dimensions in mm

Not to be scaled

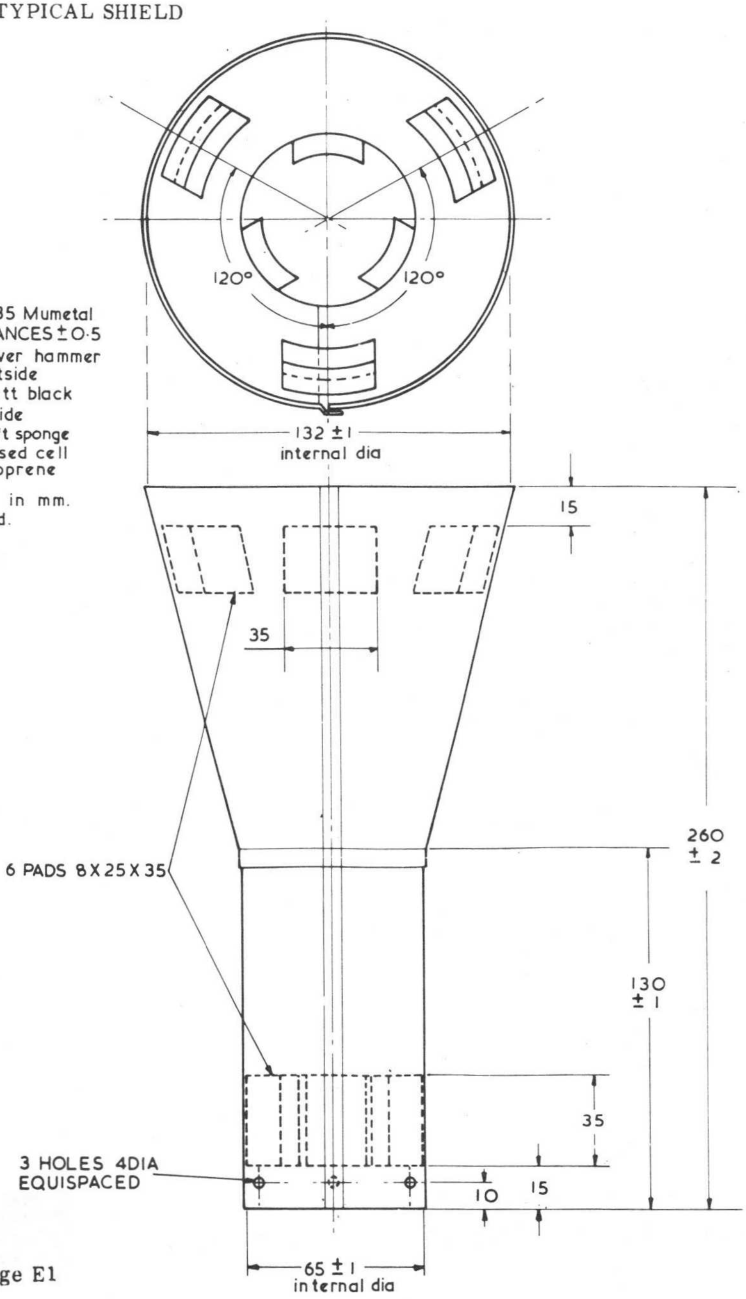
# Magnetic Shield MS45



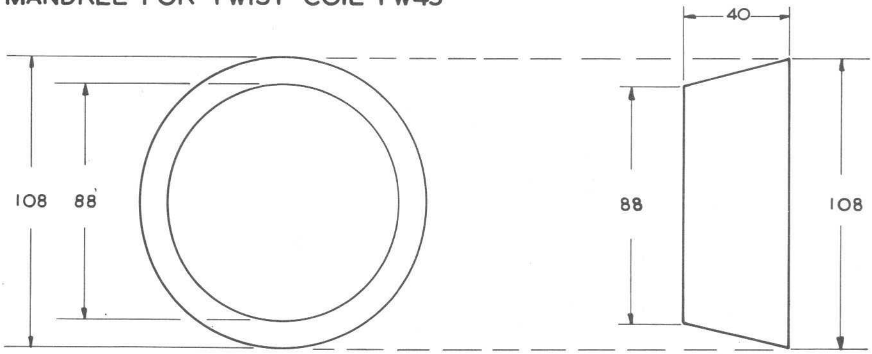
EXAMPLE OF TYPICAL SHIELD

| | |
|---|---|
| MATERIAL | 0·35 Mumetal |
| METAL TOLERANCES | ± 0·5 |
| FINISH | Silver hammer outside<br>Matt black inside |
| PADS | Soft sponge closed cell neoprene |

All dimensions in mm.
Not to be scaled.



## MANDREL FOR TWIST COIL TW45




All dimensions in mm

### SHIELD

This twist coil is designed to be used in conjunction with Magnetic Shield MS45 for D16-100..

### WINDING

1500 turns of 0.140 mm Lewmex Grade 1 or 2 wire, or approved alternative, layer wound on the adhesive side of adhesive backed crepe paper to give 5 mm margins between the coil and each edge of the mandrel.
Start and finish of winding to be brought out on 450 mm long thin flexible lead wires from smaller end of winding.
Varnish, if necessary, cover with adhesive backed crepe paper and ensure that the edges of the coil are sealed in place.

### ELECTRICAL CHARACTERISTICS

Resistance approx. 590 Ω. Twist coefficient approx, 3.4 mA/degree measured on a typical D16-100.. with $V_{a1} = 2.0$ kV and $V_{a4-k} = 4.0$ kV.

### FITTING

The completed twist coil should be pushed hard on to the tube and secured in two places with suitable adhesive tape.

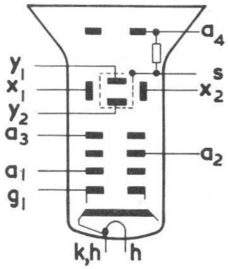
# Oscilloscope Tube

# D16-110..

## GENERAL

This square faced tube with 10 cm x 10 cm display area has spiral p.d.a., electrostatic focusing and deflection. The tube is designed for medium bandwidth applications and is capable of being deflected by transistor circuits.

| | | | |
|---|---|---|---|
| Heater voltage | $V_h$ | 6.3 | V |
| Heater current | $I_h$ | 0.3 | A |




## ABSOLUTE RATINGS

| | | Max | Min | |
|---|---|---|---|---|
| Fourth anode voltage | $V_{a4}$ | 7.0 | 2.5 | kV |
| Third anode voltage | $V_{a3}$ | 1.8 | 0.6 | kV |
| Second anode voltage | $V_{a2}$ | 1.0 | 0 | kV |
| First anode voltage | $V_{a1}$ | 1.8 | 0.6 | kV |
| Negative grid voltage | $-V_{g1}$ | 200 | 1.0 | V |
| Peak x plate to third anode voltage | $v_{x-a3(pk)}$ | 500 | - | V |
| Peak y plate to third anode voltage | $v_{y-a3(pk)}$ | 500 | - | V |
| x plate to third anode resistance | | 100 | - | kΩ |
| y plate to third anode resistance | | 100 | - | kΩ |
| Control grid to cathode resistance | | 1.5 | - | MΩ |
| Second anode current | | 10 | - | μA |
| P.D.A. ratio ($V_{a4}/V_{a3}$) | | 4.5:1 | | |
| Helix resistance | | - | 50 | MΩ |

All voltages referred to cathode unless otherwise stated.

## PHOSPHOR SCREEN

This type is usually supplied with GH phosphor (D16-110GH) giving a green trace of medium short persistence. Other phosphor screens can be made available to special order.

**This data should be read in conjunction with Operational and Safety Recommendations for Industrial Cathode Ray Tubes.**

OSCILLOSCOPE TUBES



BRIMAR

## INTER-ELECTRODE CAPACITANCES

| | | | |
|---|---|---|---|
| Grid 1 to all | $c_{g1\text{-}all}$ | 12 | pF |
| Heater and cathode to all | $c_{h,k\text{-}all}$ | 7.0 | pF |
| $x_1$ plate to $x_2$ plate | $c_{x1\text{-}x2}$ | 2.4 | pF |
| $y_1$ plate to $y_2$ plate | $c_{y1\text{-}y2}$ | 1.5 | pF |
| $x_1$ plate to all, less $x_2$ plate | $c_{x1\text{-}all,\ less\ x2}$ | 6.3 | pF |
| $x_2$ plate to all, less $x_1$ plate | $c_{x2\text{-}all,\ less\ x1}$ | 6.6 | pF |
| $y_1$ plate to all, less $y_2$ plate | $c_{y1\text{-}all,\ less\ y2}$ | 5.0 | pF |
| $y_2$ plate to all, less $y_1$ plate | $c_{y2\text{-}all,\ less\ y1}$ | 5.0 | pF |
| $x_1$, $x_2$ plates to $y_1$, $y_2$ plates | $c_{x1,x2\text{-}y1,y2}$ | 0.7 | pF |
| Grid 1 to $x_1$, $x_2$, $y_1$, $y_2$ plates | $c_{g1\text{-}x1,x2,y1,y2}$ | 1.4 | pF |

## TYPICAL OPERATION - voltages with respect to cathode.

| | | | | |
|---|---|---|---|---|
| Fourth anode voltage | $V_{a4}$ | 4.0 | 6.0 | kV |
| Mean deflector plate potential | | 1000 | 1500 | V |
| Third anode voltage for optimum astigmatism correction | $V_{a3}$ | 1000* | 1500* | V |
| Second anode voltage for optimum focus | $V_{a2}$ | 175 to 400 | 260 to 600 | V |
| First anode voltage | $V_{a1}$ | 1000 | 1500 | V |
| Shield voltage for optimum raster shape | $V_s$ | 1000* | 1500* | V |
| Control grid voltage for cut-off | $V_{g1}$ | -27 to -53 | -40 to -80 | V |
| x deflection coefficient | $D_x$ | 14.5 to 18.5 | 21.8 to 27.8 | V/cm |
| y deflection coéfficient | $D_y$ | 8.5 to 10.7 | 12.8 to 16.1 | V/cm |
| Minimum screen area | | 10 x 10 | 10 x 10 | $cm^2$ |
| Line width at 10 $\mu$A beam current Shrinking raster measurement at centre | | 0.30 | 0.24 | mm |
| Grid drive to 10 $\mu$A beam current | | 17 | 17 | V |

* The required voltage will not differ from the quoted value by more than ± 50V.

## RASTER DISTORTION AND ALIGNMENT

The following data applies for the typical operation conditions.

The undeflected spot will fall in a circle of 6 mm radius about the centre of the tube face.

Raster distortion : the edges of a test raster will fall between two concentric squares 10 cm x 10 cm and 9.7 cm x 9.7 cm.

Rectangularity of x and y axes is 90° $\pm$ 1°.

The horizontal trace will be parallel with the axis of the rectangular face-plate to within $\pm$ 5°. A twist coil will be required to effect accurate alignment. This should be mounted inside the magnetic shield approximately 160 mm from the face and should not extend more than 215 mm from the face. The ampere turns required will be equal to $13\sqrt{V_{a4}}$ (where $V_{a4}$ is quoted in kV) with provision for reversing the current. The sensitivity (for both x and y plates) at 75% deflection of the useful scan will not differ by more than 2% from the sensitivity over 10% deflection.

It is not advisable that the deflector plates be run asymmetrically, or severe raster distortion may result and the focus quality cannot be guaranteed. It is preferable that the tube be operated with mean x and y potentials equal, otherwise the raster distortion and focus quality will suffer and the limits for $V_{a3}$ and $V_s$ will differ from specification.

It is recommended that the maximum p.d.a. ratio is not exceeded as this may reduce scan area.

OSCILLOSCOPE TUBES

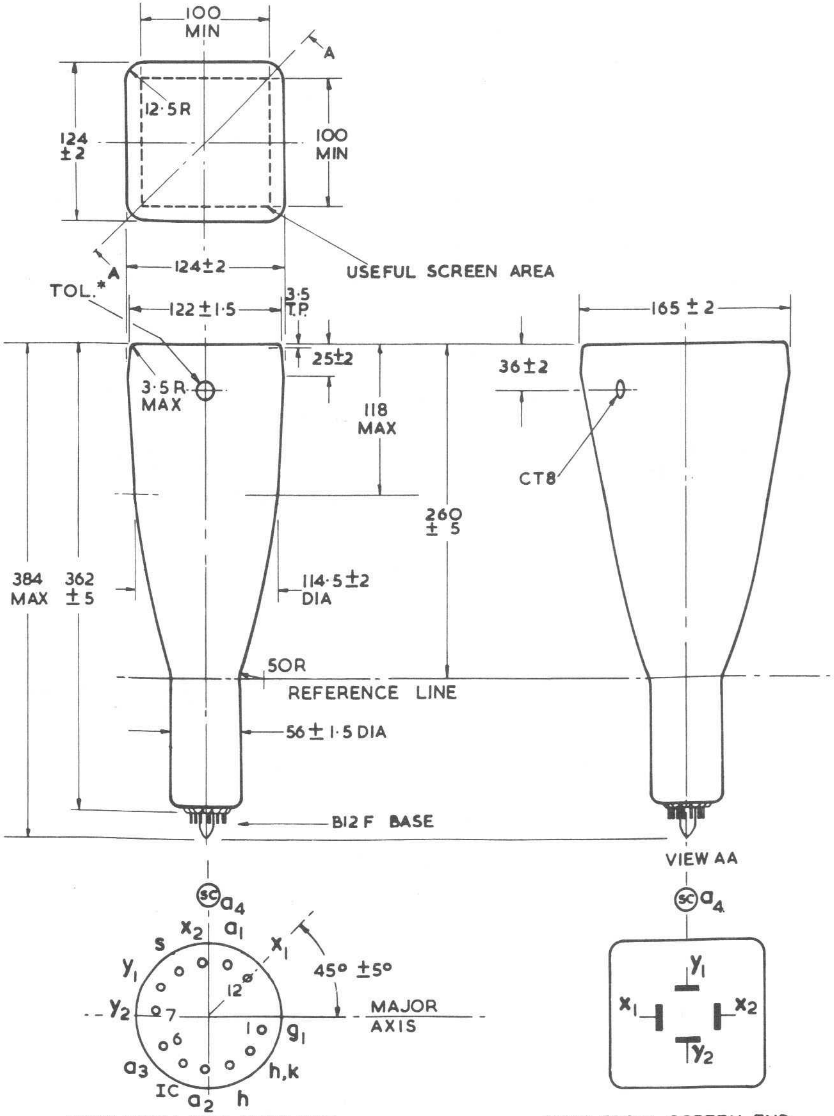
## MAGNETIC SHIELDING

Adequate magnetic shielding is required. In addition due attention should be paid to the position of the tube relative to transformers and chokes.

## TUBE WEIGHT (approximate) 1.2 kg

## MOUNTING POSITION - unrestricted

It is advisable to support the tube near the screen and at a second point on the parallel neck near the base. The tube should not be subjected to any stress from the use of clamps and should not be suspended by the base.




VIEW FROM PINS FREE END (CT8 AT TOP)

VIEW FROM SCREEN END (CT8 AT TOP)

All dimensions in mm

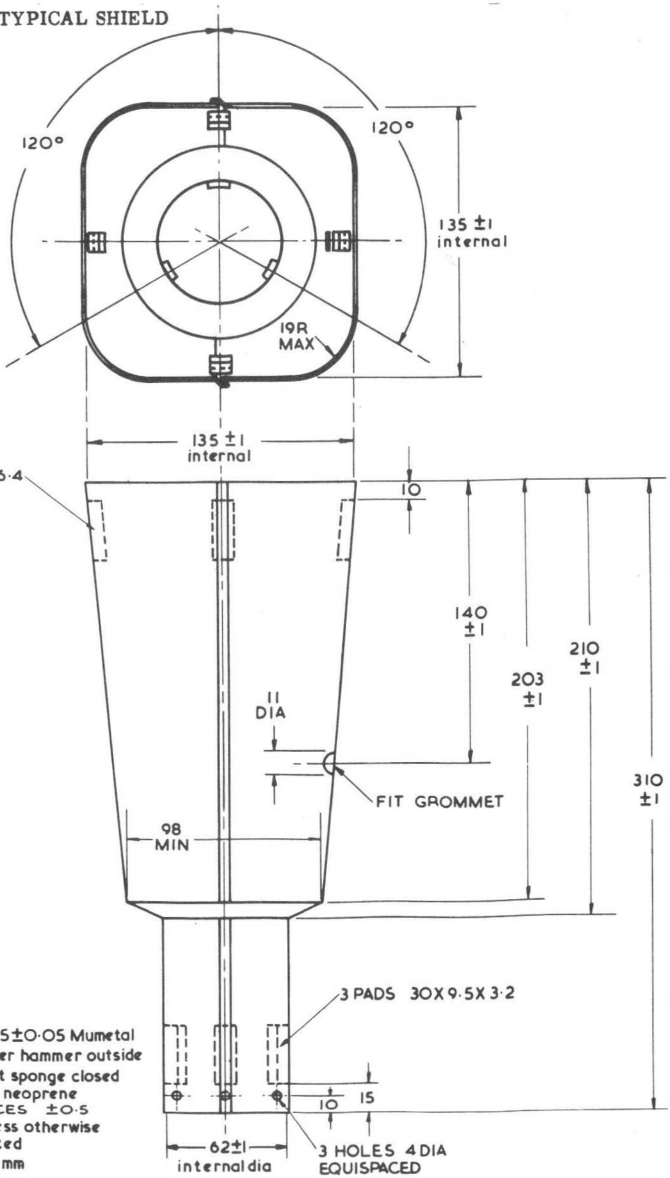
Not to be scaled

* CT8 symmetrical tolerance ± 3 mm about centre line of 122 dimension on CT8 side.

# Magnetic Shield MS63

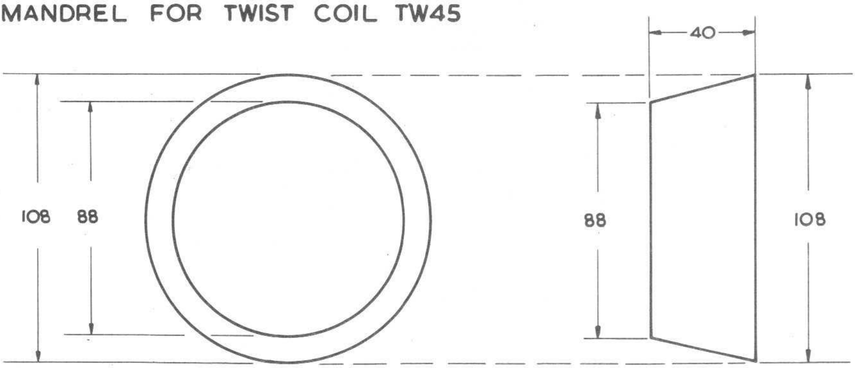


EXAMPLE OF TYPICAL SHIELD




MATERIAL 0·35±0·05 Mumetal
FINISH Silver hammer outside
PADS Soft sponge closed cell neoprene
METAL TOLERANCES ±0·5 Unless otherwise stated
All dimensions in mm
Not to be scaled

## MANDREL FOR TWIST COIL TW45




All dimensions in mm

Not to be scaled

### SHIELD

This twist coil is designed to be used in conjunction with Magnetic Shield MS63 for D16-110..

### WINDING ←

1500 turns of 0.140 mm Lewmex Grade 1 or 2 wire, or approved alternative, layer wound on the adhesive side of adhesive backed crepe paper to give 5 mm margins between the coil and each edge of the mandrel.
Start and finish of winding to be brought out on 450 mm long thin flexible lead wires from smaller end of winding.
Varnish, if necessary, cover with adhesive backed crepe paper and ensure that the edges of the coil are sealed in place.

### ELECTRICAL CHARACTERISTICS

Resistance approx. 590 Ω. Twist coefficient approx. 4.0 mA/degree measured on a typical D16-110.. with $V_{a1} = 1.5$ kV and $V_{a4-k} = 6.0$ kV.

### FITTING ←

The completed twist coil should be pushed hard on to the tube and secured in two places with suitable adhesive tape.

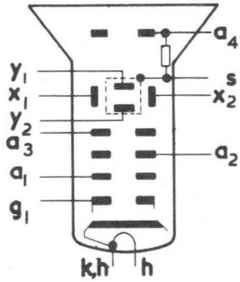
# Oscilloscope Tube

# D18-130..

## GENERAL

This short rectangular tube with 12 cm x 10 cm display area, spiral p.d.a.,electrosatic focusing and deflection is designed for general purpose applications. It is capable of being deflected by transistor circuits.

| | | | |
|---|---|---|---|
| Heater voltage | $V_h$ | 6.3 | V |
| Heater current | $I_h$ | 0.3 | A |




## ABSOLUTE RATINGS

| | | Max | Min | |
|---|---|---|---|---|
| Fourth anode voltage | $V_{a4}$ | 4.0 | 1.5 | kV |
| Third anode voltage | $V_{a3}$ | 1.8 | 0.6 | kV |
| Second anode voltage | $V_{a2}$ | 1.0 | 0 | kV |
| First anode voltage | $V_{a1}$ | 1.8 | 0.6 | kV |
| Negative grid voltage | $-V_{g1}$ | 200 | 1.0 | V |
| Peak x plate to third anode voltage | $v_{x-a3(pk)}$ | 500 | - | V |
| Peak y plate to third anode voltage | $v_{y-a3(pk)}$ | 500 | - | V |
| x plate circuit impedance | $Z_x$ | 100 | - | kΩ |
| y plate circuit impedance | $Z_y$ | 100 | - | kΩ |
| Control grid to cathode resistance | $R_{g1-k}$ | 1.5 | - | MΩ |
| Second anode current | $I_{a2}$ | 10 | - | μA |
| P.D.A. ratio ($V_{a4}/V_{a3}$) | | 2.2:1 | | |
| Helix resistance | | - | 15 | MΩ |

All voltages referred to cathode unless otherwise stated

## PHOSPHOR SCREEN

This type is usually supplied with GH phosphor (D18-130GH) giving a green trace of medium short persistence. Other phosphor screens can be made available to special order.

This data should be read in conjunction with Operational Recommendations for Industrial Cathode Ray Tubes.

## INTER-ELECTRODE CAPACITANCES

| | | | |
|---|---|---|---|
| Grid 1 to all | $c_{g1-all}$ | 10 | pF |
| Heater and cathode to all | $c_{h,k-all}$ | 4.5 | pF |
| $x_1$ plate to $x_2$ plate | $c_{x1-x2}$ | 2.3 | pF |
| $y_1$ plate to $y_2$ plate | $c_{y1-y2}$ | 1.2 | pF |
| $x_1$ plate to all, less $x_2$ plate | $c_{x1-all, less\ x2}$ | 6.3 | pF |
| $x_2$ plate to all, less $x_1$ plate | $c_{x2-all, less\ x1}$ | 5.9 | pF |
| $y_1$ plate to all, less $y_2$ plate | $c_{y1-all, less\ y2}$ | 4.8 | pF |
| $y_2$ plate to all, less $y_1$ plate | $c_{y2-all, less\ y1}$ | 4.9 | pF |
| $x_1$, $x_2$ plates to $y_1$, $y_2$ plates | $c_{x1,x2-y1,y2}$ | 0.6 | pF |
| Grid 1 to $x_1$, $x_2$, $y_1$, $y_2$ plates | $c_{g1-x1,x2,y1,y2}$ | 0.9 | pF |

## TYPICAL OPERATION - voltages with respect to cathode.

| | | | |
|---|---|---|---|
| Fourth anode voltage | $V_{a4}$ | 3.0 | kV |
| Mean deflector plate potential | | 1500 | V |
| Third anode voltage for optimum astigmatism correction | $V_{a3}$ | 1500* | V |
| Second anode voltage for optimum focus | $V_{a2}$ | 270 to 570 | V |
| First anode voltage | $V_{a1}$ | 1500 | V |
| Shield voltage for optimum raster shape | $V_s$ | 1500* | V |
| Minimum useful screen area | | 12 x 10 | $cm^2$ |
| Control grid voltage for cut-off | $V_{g1}$ | -40 to -80 | V |
| x deflection coefficient | $D_x$ | 23 to 29 | V/cm |
| y deflection coefficient | $D_y$ | 13 to 16.5 | V/cm |
| Line width at 10 $\mu$A beam current | | | |
| Shrinking raster measurement at centre | | 0.25 | mm |
| Microscope measurement at centre | | 0.49 | mm |

* The required voltage will not differ from the quoted value by more than ± 50V.

## RASTER DISTORTION AND ALIGNMENT

The undeflected spot will fall in a circle of 7.5 mm radius about the centre of the tube face.

Raster distortion: the edges of a test raster will fall between two concentric rectangles 12 cm x 10 cm and 11.7 cm x 9.75 cm.

Rectangularity of x and y axes is 90° ± 1°. The horizontal trace will be parallel with the axis of the rectangular face-plate to within ± 5°. A twist coil will be required to effect accurate alignment. This should be mounted inside the magnetic shield approximately 80 mm from the face and should not extend more than 130 mm from the face.

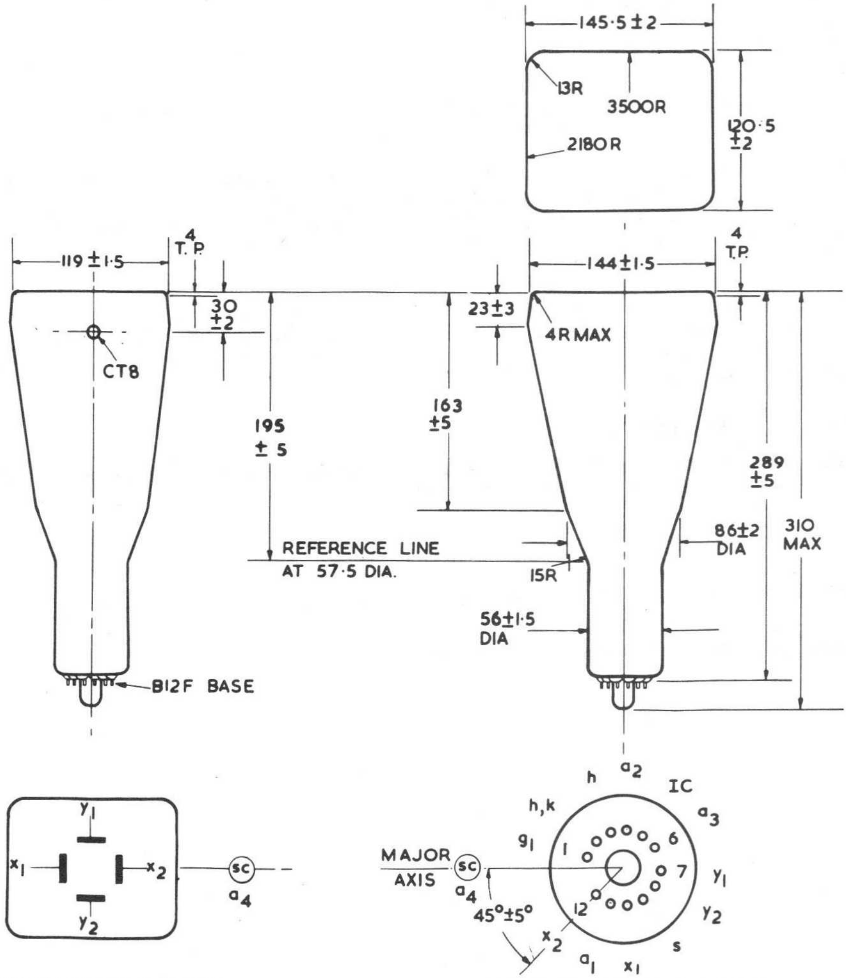
It is preferable that the mean x and y plate potentials are equal otherwise some deterioration in performance will occur. Under any circumstances the mean y plate potential should never differ from the mean x plate potential by more than 50V when the tube is operated at 3 kV.

## MAGNETIC SHIELDING

Adequate magnetic shielding is required. In addition due attention should be paid to the position of the tube relative to transformers and chokes.

**MOUNTING POSITION** - unrestricted.

**TUBE WEIGHT** (approximate) 1.4 kg




VIEW FROM SCREEN END (CT8 AT RIGHT)

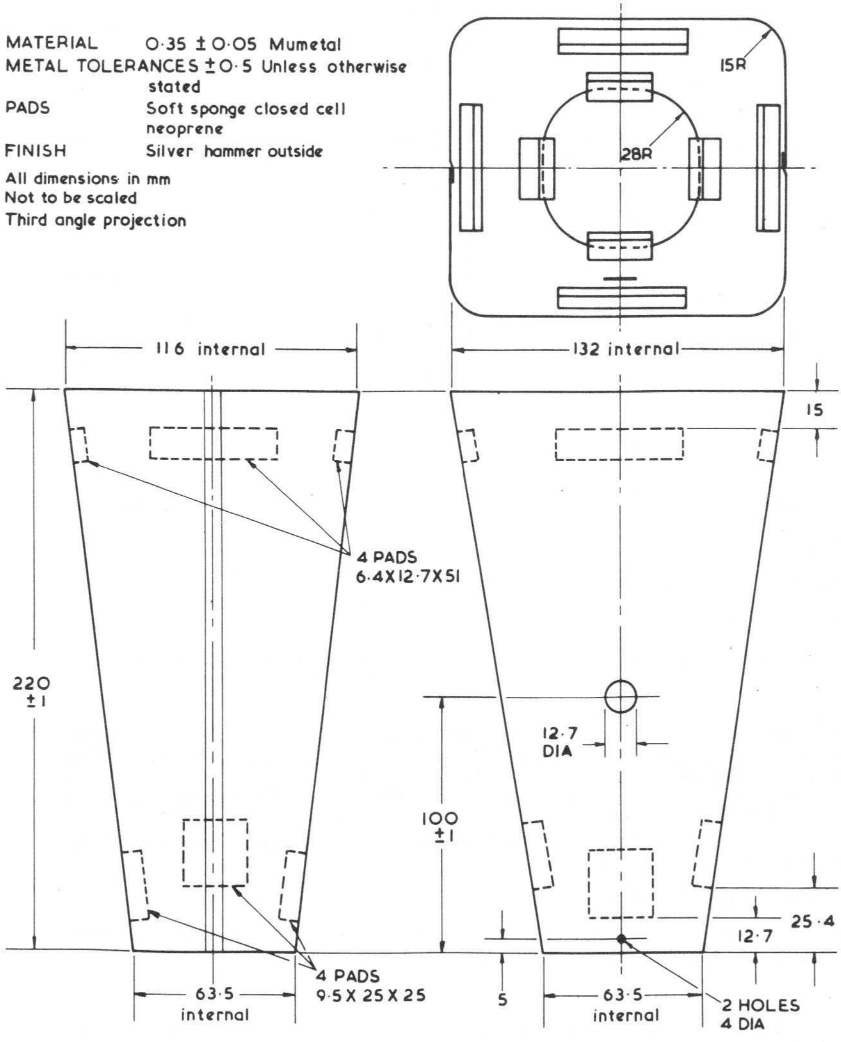
VIEW FROM PINS FREE END (CT8 AT LEFT)

All dimensions in mm. Third angle projection. Not to be scaled

It is advisable to support the tube near the screen, and at a second point on the parallel neck near the base. The tube should not be subjected to any stress from the use of clamps and should not be suspended by the base. Connecting leads should not be soldered directly to the tube pins.

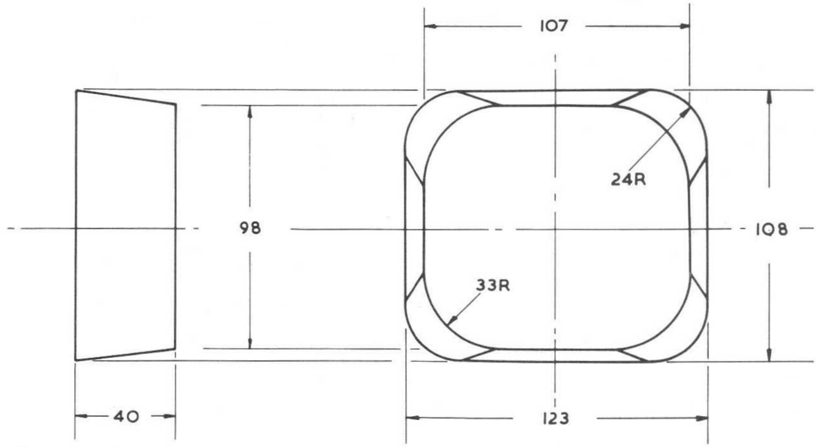
MATERIAL 0·35 ± 0·05 Mumetal
METAL TOLERANCES ± 0·5 Unless otherwise stated
PADS Soft sponge closed cell neoprene
FINISH Silver hammer outside

All dimensions in mm
Not to be scaled
Third angle projection




OSCILLOSCOPE TUBES

## MANDREL FOR TWIST COIL TW48




All dimension in mm                                    Not to be scaled

MANDREL

Shaped from wood to dimensions given above.

SHIELD

This twist coil is designed to be used in conjunction with magnetic shield MS61 for D18-130..

WINDING

2000 turns of 0.14 mm Lewmex Grade 1 or 2 wire, or approved alterative, layer wound on the adhesive side of adhesive backed crepe paper to give 5 mm margins between the coil and each edge of the mandrel.
Start and finish of winding to be brought out on 450 mm long thin flexible lead wires from smaller end of winding.

Varnish, if necessary, cover with adhesive backed crepe paper and ensure that the edges of the coil are sealed in place.

ELECTRICAL CHARACTERISTICS

Resistance approx. 900 Ω. Current required for ± 5° twist is ± 9.5 mA measured on a typical D18-130.. with $V_{a4}$ = 3.0 kV and $V_{a1}$ = 1.5 kV.

FITTING

The completed twist coil should be pushed onto the tube from the base end as far as it will travel and fastened with adhesive tape.

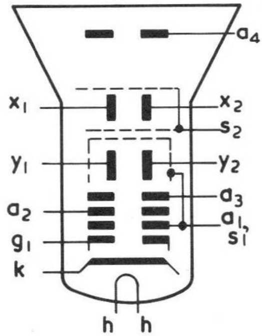
# Oscilloscope Tube D18–160 ..

PRELIMINARY DATA

**GENERAL**

This 12 cm x 10 cm rectangular aluminised tube with electrostatic focusing and deflection uses a mesh p.d.a. to achieve high deflection sensitivity and high brightness without additional electrode control voltages. The tube is designed for transistor deflection medium to high bandwidth applications.

| | | | |
|---|---|---|---|
| Heater voltage | $V_h$ | 6.3 | V |
| Heater current | $I_h$ | 0.3 | A |




| **ABSOLUTE RATINGS** | | Max | Min | |
|---|---|---|---|---|
| Fourth anode voltage | $V_{a4}$ | 13 | 8.0 | kV |
| Third anode voltage | $V_{a3}$ | 2.5 | 1.4 | kV |
| Second anode voltage | $V_{a2}$ | 1.0 | - | kV |
| First anode voltage | $V_{a1}$ | 2.5 | 1.4 | kV |
| Negative control grid voltage | $-V_{g1}$ | 200 | 1.0 | V |
| Peak x plate to third anode voltage | $v_{x-a3(pk)}$ | 500 | - | V |
| Peak y plate to third anode voltage | $v_{y-a3(pk)}$ | 500 | - | V |
| x plate to third anode resistance | $R_{x-a3}$ | 100 | - | kΩ |
| y plate to third anode resistance | $R_{y-a3}$ | 100 | - | kΩ |
| Control grid to cathode resistance | $R_{g1-k}$ | 1.5 | - | MΩ |
| Second anode current | $I_{a2}$ | 10 | - | µA |
| P.D.A. ratio ($V_{a4}/V_{a3}$) | | 7: 1 | - | |

All voltages referred to cathode unless otherwise stated.

**PHOSPHOR SCREEN**

This type is usually supplied with GH phosphor (D18-160GH) giving a green trace of medium short persistence. Other phosphor screens can be made available to special order.

This data should be read in conjunction with Brimar Operational and Safety Recommendations for Industrial Cathode Ray Tubes.

## INTER-ELECTRODE CAPACITANCES

| | | | |
|---|---|---|---|
| Grid 1 to all | $c_{g1\text{-all}}$ | 9.5 | pF |
| Heater and cathode to all | $c_{h,k\text{-all}}$ | 3.5 | pF |
| $x_1$ plate to $x_2$ plate | $c_{x1\text{-}x2}$ | 2.0 | pF |
| $y_1$ plate to $y_2$ plate | $c_{y1\text{-}y2}$ | 1.5 | pF |
| $x_1$ plate to all, less $x_2$ plate | $c_{x1\text{-all, less } x2}$ | 6.0 | pF |
| $x_2$ plate to all, less $x_1$ plate | $c_{x2\text{-all, less } x1}$ | 6.0 | pF |
| $y_1$ plate to all, less $y_2$ plate | $c_{y1\text{-all, less } y2}$ | 5.0 | pF |
| $y_2$ plate to all, less $y_1$ plate | $c_{y2\text{-all, less } y1}$ | 5.0 | pF |
| $x_1$, $x_2$ plates to $y_1$, $y_2$ plates | $c_{x1,x2\text{-}y1,y2}$ | 0.8 | pF |
| Grid 1 to $x_1$, $x_2$, $y_1$, $y_2$ plates | $c_{g1\text{-}x1,x2,y1,y2}$ | 0.8 | pF |

## TYPICAL OPERATION - Voltages with respect to cathode

| | | | |
|---|---|---|---|
| Fourth anode voltage | $V_{a4}$ | 12 | kV |
| Mean deflector plate potential | | 2000 | V |
| Third anode voltage for optimum astigmatism correction | $V_{a3}$ | 1970 to 2030 | V |
| Second anode voltage for optimum focus | $V_{a2}$ | 420 to 660 | V |
| First anode and shield 1 voltage | $V_{a1+s1}$ | 2000 | V |
| Shield 2 voltage for optimum raster shape | $V_{s2}$ | 1950 to 2050 | V |
| Control grid voltage for cut-off | $V_{g1}$ | -40 to -80 | V |
| x deflection coefficient | $D_x$ | 11.0 to 14.2 | V/cm |
| y deflection coefficient | $D_y$ | 4.3 to 5.8 | V/cm |
| Minimum screen area | | 12x10 | $cm^2$ |
| Line width at 10µA beam current | | | |
| Shrinking raster measurement at centre | | 0.35 | mm |
| Microscope measurement at centre | | 0.65 | mm |
| Microscope measurement at edge | | 0.9 | mm |
| Grid Drive to 10µA beam current (approx.) | | 18 | V |

## RASTER DISTORTION AND ALIGNMENT

The following data applies for the typical operation conditions.

The undeflected spot will fall in a circle of 10 mm radius about the centre of the tube face.

Raster distortion: The edges of a test raster will fall between two concentric rectangles 120 mm x 100 mm and 117 mm x 97.5 mm.

Rectangularity of x and y axes is 90° + 1°. The horizontal trace will be parallel with the axis of the rectangular face-plate to within ± 5°. A twist coil will be required to effect accurate alignment. This should be mounted inside the magnetic shield between 200 mm and 250 mm from the face.
The ampere turns required will be equal to $14\sqrt{V_{a4}}$ (where $V_{a4}$ is quoted in kV) with provision for reversing the current. The sensitivity (for both x and y plates) at 75% deflection of the useful scan will not differ by more than 2% from the sensitivity over 25% deflection.

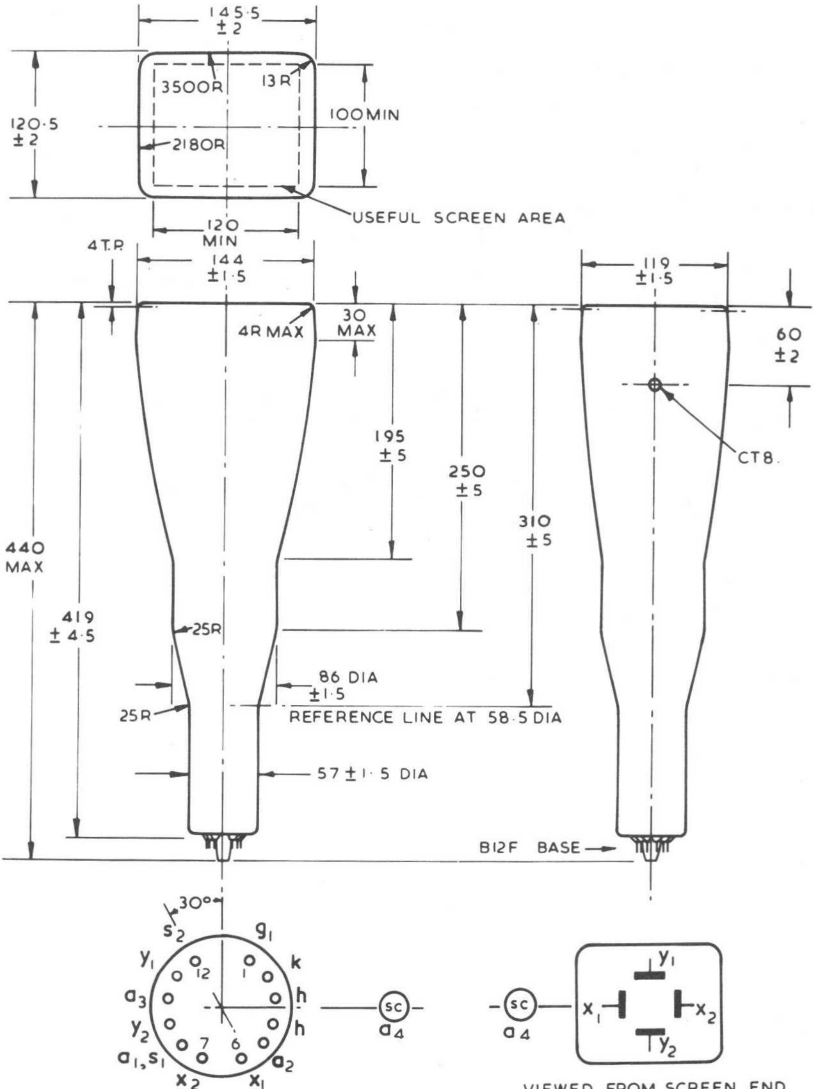
It is preferable that the mean x and y plate potentials are equal otherwise some deterioration in performance will occur. Under no circumstances should the mean y plate potential differ from the mean x plate potential by more than 50V.

## MAGNETIC SHIELDING

Adequate magnetic shielding is required. In addition due attention should be paid to the position of the tube relative to transformers and chokes.

**TUBE WEIGHT** (approximate) - 2.1 kg

**MOUNTING POSITION** - unrestricted




VIEW FROM PINS FREE END
(CT8 AT RIGHT)

VIEWED FROM SCREEN END
(CT8 AT LEFT)

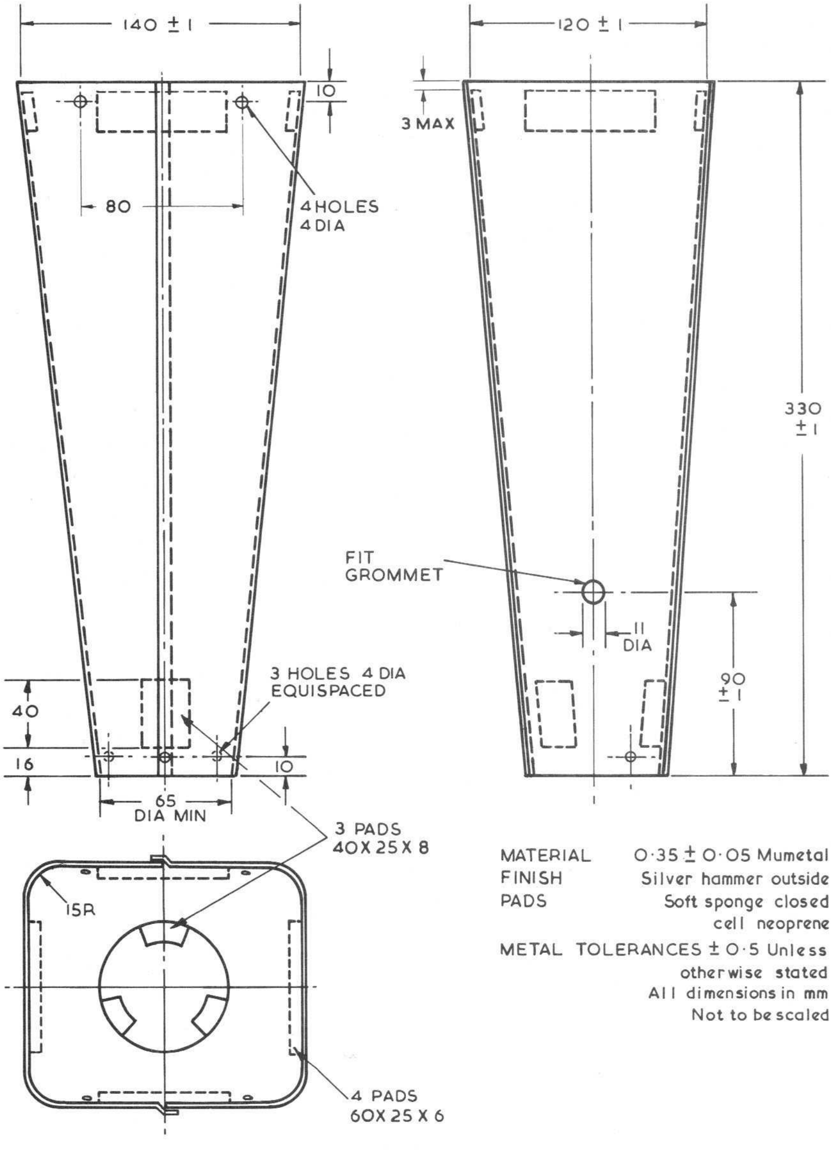
All dimensions in mm

Not to be scaled

It is advisable to support the tube near the screen, and at a second point on the parallel neck near the base. The tube should not be subjected to any stress from the use of clamps and should not be suspended by the base. Connecting leads should not be soldered directly to the tube pins.

# Magnetic Shield MS 84

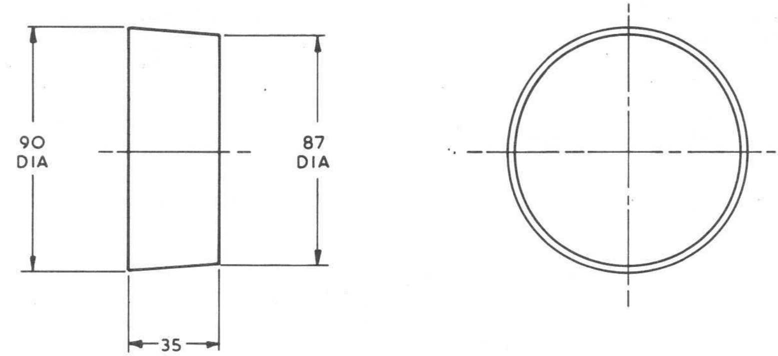





| | |
|---|---|
| MATERIAL | 0·35 ± 0·05 Mumetal |
| FINISH | Silver hammer outside |
| PADS | Soft sponge closed cell neoprene |

METAL TOLERANCES ± 0·5 Unless otherwise stated
All dimensions in mm
Not to be scaled

MANDREL FOR TWIST COIL TW29




All dimensions in mm                                    Not to be scaled

MANDREL

Shaped from wood in the form of a truncated circular cone, dimensions as above.

SHIELD

This twist coil, is designed to be used in conjunction with magnetic shield MS84 for D18-160..

WINDING

1600 turns of 0.140mm Lewmex Grade 1 or 2 wire, or approved alternative, layer wound on the adhesive side of adhesive backed crepe paper to give 5 mm margins between the coil and each edge of the mandrel.
Start and finish of winding to be brought out on 450 mm long thin flexible lead wires from smaller end of winding.
Varnish, if necessary, cover with adhesive backed crepe paper and ensure that the edges of the coil are sealed in place.

ELECTRICAL CHARACTERISTICS

Resistance approx. 550Ω. Twist coefficient approximately 6.5 mA/degree measured on typical D18-160.. with $V_{a4}$ = 12kV and $V_{a1}$ = 2.0 kV.

FITTING

The completed twist coil should be pushed onto the tube and secured to tube in two places with suitable adhesive tape.

# Oscilloscope Tube

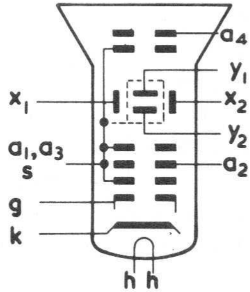
# D21-10..

MAINTENANCE TYPE

**GENERAL**

This 21 cm (8.5 inch) diameter tube with electrostatic focusing and deflection has a large display area and can operate at a p.d.a. ratio of 2:1.

| | | | |
|---|---|---|---|
| Heater voltage | $V_h$ | 6.3 | V |
| Heater current | $I_h$ | 0.3 | A |




**ABSOLUTE RATINGS**

| | | | |
|---|---|---|---|
| Maximum fourth anode voltage | $V_{a4(max)}$ | 6.6 | kV |
| Maximum first and third anode voltage | $V_{a1+a3(max)}$ | 3.3 | kV |
| Maximum second anode voltage | $V_{a2(max)}$ | 2.0 | kV |
| Maximum negative grid voltage | $-V_{g(max)}$ | 220 | V |
| Minimum negative grid voltage | $-V_{g(min)}$ | 1.0 | V |
| Maximum peak x plate to third anode voltage | $v_{x-a3(pk)max}$ | 500 | V |
| Maximum peak y plate to third anode voltage | $v_{y-k(pk)max}$ | 500 | V |
| Maximum peak heater to cathode voltage | $v_{h-k(pk)max}$ | 150 | kΩ |
| Maximum x plate to third anode resistance | $R_{x-a3(max)}$ | 100 | kΩ |
| Maximum y plate to third anode resistance | $R_{y-a3(max)}$ | 100 | kΩ |
| Maximum grid to cathode resistance | $R_{g-k(max)}$ | 1.5 | MΩ |
| Maximum p.d.a. ratio | | 2:1 | |

All voltages referred to cathode unless otherwise stated.

**PHOSPHOR SCREEN**

This type is usually supplied with GH phosphor (D21-10GH) giving a green trace of medium short persistence. Other phosphor screens can be made available to special order.

Type D21-10GH is the commercial version of the CV9315.

## INTER-ELECTRODE CAPACITANCES

| | | | |
|---|---|---|---|
| Grid to all | $c_{g\text{-}all}$ | 8.0 | pF |
| Cathode to all | $c_{k\text{-}all}$ | 10 | pF |
| $x_1$ plate to $x_2$ plate | $c_{x1\text{-}x2}$ | 4.0 | pF |
| $y_1$ plate to $y_2$ plate | $c_{y1\text{-}y2}$ | 2.0 | pF |
| $x_1$ plate to all, less $x_2$ plate | $c_{x1\text{-}all, less\ x2}$ | 8.0 | pF |
| $x_2$ plate to all, less $x_1$ plate | $c_{x2\text{-}all, less\ x1}$ | 8.0 | pF |
| $y_1$ plate to all, less $y_2$ plate | $c_{y1\text{-}all, less\ y2}$ | 6.0 | pF |
| $y_2$ plate to all, less $y_1$ plate | $c_{y2\text{-}all, less\ y1}$ | 6.0 | pF |

## TYPICAL OPERATION - voltages with respect to cathode

| | | | | |
|---|---|---|---|---|
| Fourth anode voltage | $V_{a4}$ | 4.0 | 6.0 | kV |
| First and third anode and shield voltage | $V_{a1+a3+s}$ | 2.0 | 3.0 | kV |
| Second anode voltage | $V_{a2}$ | 540 to 800 | 800 to 1200 | V |
| Grid voltage for cut-off | $V_g$ | -24 to -56 | -36 to -84 | V |
| x deflection coefficient | $D_x$ | 23 to 32 | 34.5 to 48 | V/cm |
| y deflection coefficient | $D_y$ | 19 to 27 | 28.5 to 40.5 | V/cm |
| Minimum screen area | | 15 x 15 | 15 x 15 | $cm^2$ |

## RASTER DISTORTION AND ALIGNMENT

The undeflected spot will fall in a circle of 10 mm radius about the centre of the tube face.

Raster distortion: the edges of a test raster will fall between two concentric rectangles 12.5 cm x 12.5 cm and 12.25 cm x 12.25 cm.

Rectangularity of x and y axes is 90° ± 1°.

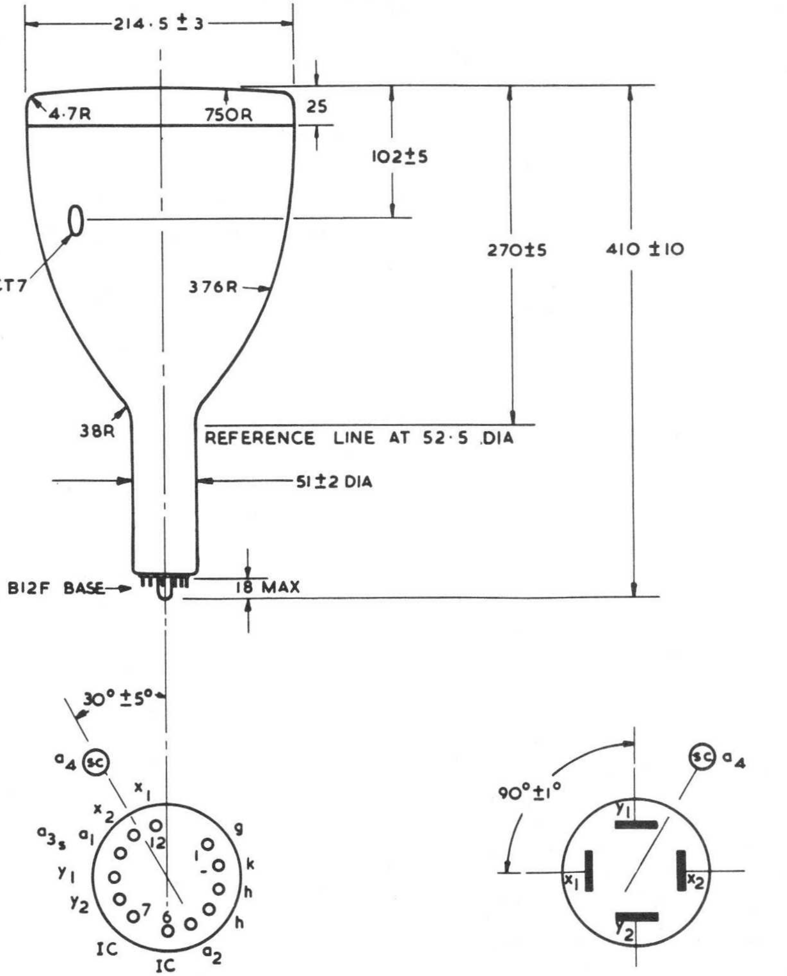
It is preferable that the mean x and y plate potentials are equal otherwise some deterioration in performance will occur. The mean y plate potential should never differ from the mean x plate potential by more than 50V.

## MAGNETIC SHIELDING

Adequate magnetic shielding is required. In addition due attention should be paid to the position of the tube relative to transformers and chokes.

**TUBE WEIGHT** (approximate) 2.4 kg

**MOUNTING POSITION** - unrestricted




VIEW FROM PINS FREE END

VIEWED FROM SCREEN END (PIN 6 AT BOTTOM)

All dimension in mm

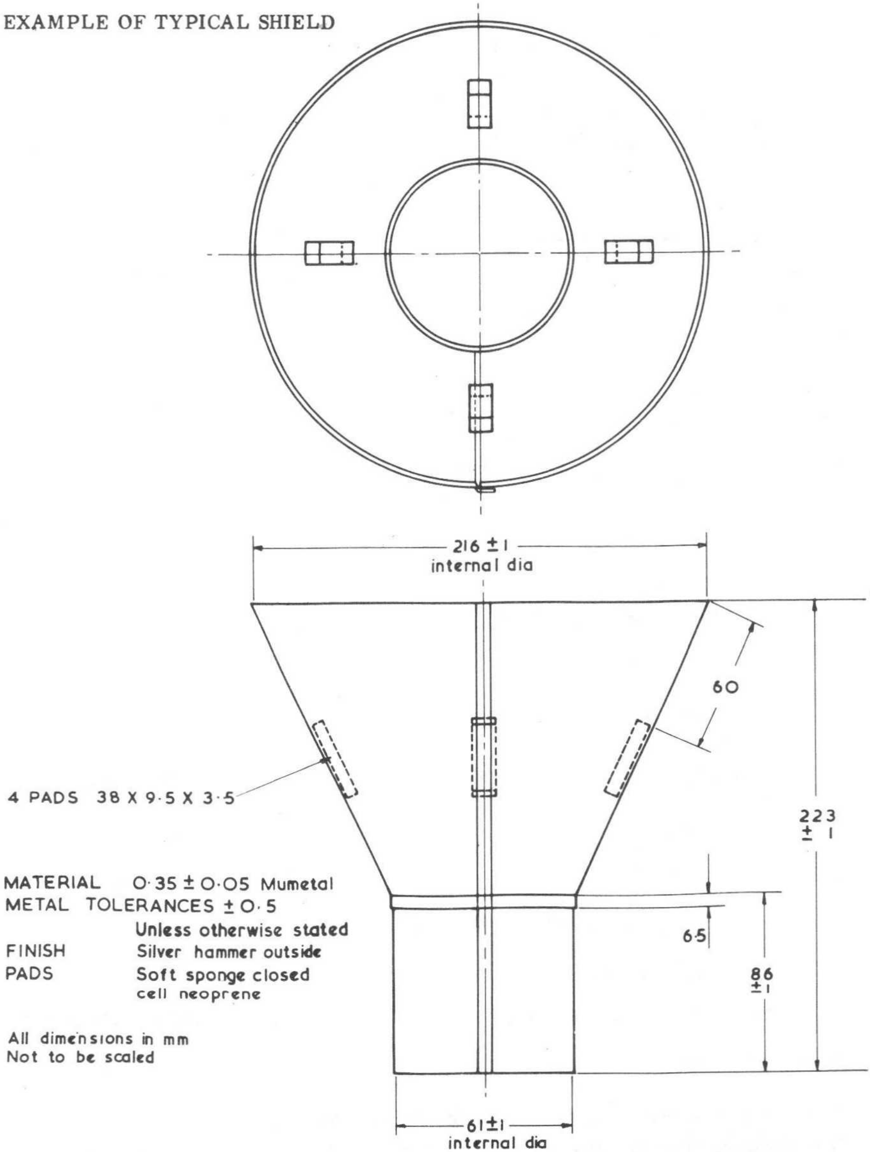
Not to be scaled

Connecting leads should not be soldered directly to tube pins.

It is advisable to support the tube near the screen, and at a second point on the parallel neck near the base. The tube should not be subjected to any stress from the use of clamps and should not be suspended by the base.

# Magnetic Shield MS 52

EXAMPLE OF TYPICAL SHIELD



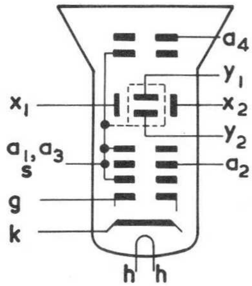
# Oscilloscope Tube

# D21-102..

## GENERAL

This 21 cm (8.5 inch) diameter aluminised tube with electrostatic focusing and deflection has a large display area and can operate at a p.d.a. ratio of 2:1.

| | | | |
|---|---|---|---|
| Heater voltage | $V_h$ | 6.3 | V |
| Heater current | $I_h$ | 0.3 | A |




## ABSOLUTE RATINGS

| | | | |
|---|---|---|---|
| Maximum fourth anode voltage | $V_{a4(max)}$ | 6.6 | kV |
| Maximum first and third anode voltage | $V_{a1+a3(max)}$ | 3.3 | kV |
| Maximum second anode voltage | $V_{a2(max)}$ | 2.0 | kV |
| Maximum negative grid voltage | $-V_{g(max)}$ | 220 | V |
| Minimum negative grid voltage | $-V_{g(min)}$ | 1.0 | V |
| Maximum peak x plate to third anode voltage | $v_{x-a3(pk)max}$ | 500 | V |
| Maximum peak y plate to third anode voltage | $v_{y-k(pk)max}$ | 500 | V |
| Maximum peak heater to cathode voltage | $v_{h-k(pk)max}$ | 150 | V |
| Maximum x plate to third anode resistance | $R_{x-a3(max)}$ | 100 | kΩ |
| Maximum y plate to third anode resistance | $R_{y-a3(max)}$ | 100 | kΩ |
| Maximum grid to cathode resistance | $R_{g-k(max)}$ | 1.5 | MΩ |
| Maximum p.d.a. ratio | | 2:1 | |

All voltages referred to cathode unless otherwise stated.

## PHOSPHOR SCREEN

This type is usually supplied with GH phosphor (D21-102GH) giving a green trace of medium short persistence. Other phosphor screens can be made available to special order.

## INTER - ELECTRODE CAPACITANCES

| | | | |
|---|---|---|---|
| Grid to all | $c_{g-all}$ | 8.0 | pF |
| Cathode to all | $c_{k-all}$ | 10 | pF |
| $x_1$ plate to $x_2$ plate | $c_{x1-x2}$ | 4.0 | pF |
| $y_1$ plate to $y_2$ plate | $c_{y1-y2}$ | 2.0 | pF |
| $x_1$ plate to all, less $x_2$ plate | $c_{x1-all,\ less\ x2}$ | 8.0 | pF |
| $x_2$ plate to all, less $x_1$ plate | $c_{x2-all,\ less\ x1}$ | 8.0 | pF |
| $y_1$ plate to all, less $y_2$ plate | $c_{y1-all,\ less\ y2}$ | 6.0 | pF |
| $y_2$ plate to all, less $y_1$ plate | $c_{y2-all,\ less\ y1}$ | 6.0 | pF |

## TYPICAL OPERATION - voltages with respect to cathode

| | | | |
|---|---|---|---|
| Fourth anode voltage | $V_{a4}$ | 6.0 | kV |
| First and Third anode and shield voltage | $V_{a1+a3+s}$ | 3.0 | kV |
| Second anode voltage | $V_{a2}$ | 800 to 1200 | V |
| Grid voltage for cut-off | $V_g$ | -36 to -84 | V |
| x deflection coefficient | $D_x$ | 34.5 to 48 | V/cm |
| y deflection coefficient | $D_y$ | 28.5 to 40.5 | V/cm |
| Minimum screen area (corners cut) | | 15 x 15 | $cm^2$ |

## RASTER DISTORTION AND ALIGNMENT

The undeflected spot will fall in a circle of 10 mm radius about the centre of the tube face.

Raster distortion: the edges of a test raster will fall between two concentric rectangles 12.5 cm x 12.5 cm and 12.25 cm x 12.25 cm.

Rectangularity of x and y axes is 90° ± 1°.

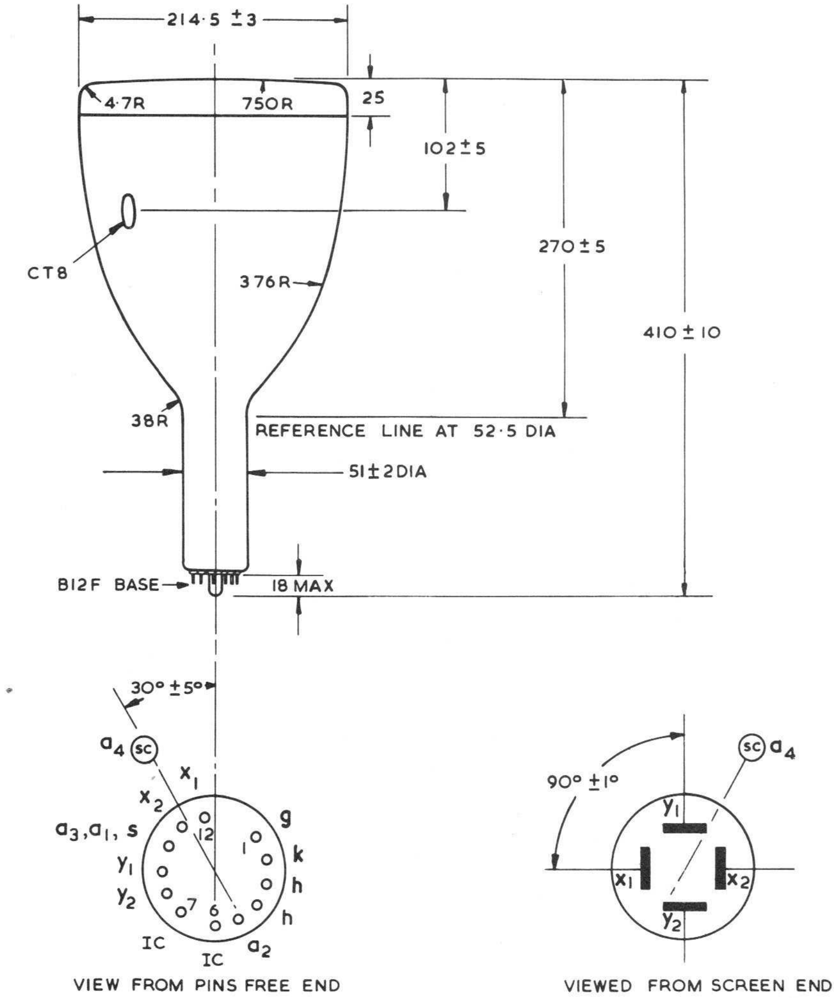
It is preferable that the mean x and y plate potentials are equal otherwise some deterioration in performance will occur. The mean y plate potential should never differ from the mean x plate potential by more than 50V.

## MAGNETIC SHIELDING

Adequate magnetic shielding is required. In addition due attention should be paid to the position of the tube relative to transformers and chokes.

**TUBE WEIGHT** (approximate) 2.4 kg

**MOUNTING POSITION** - unrestricted




All dimensions in mm

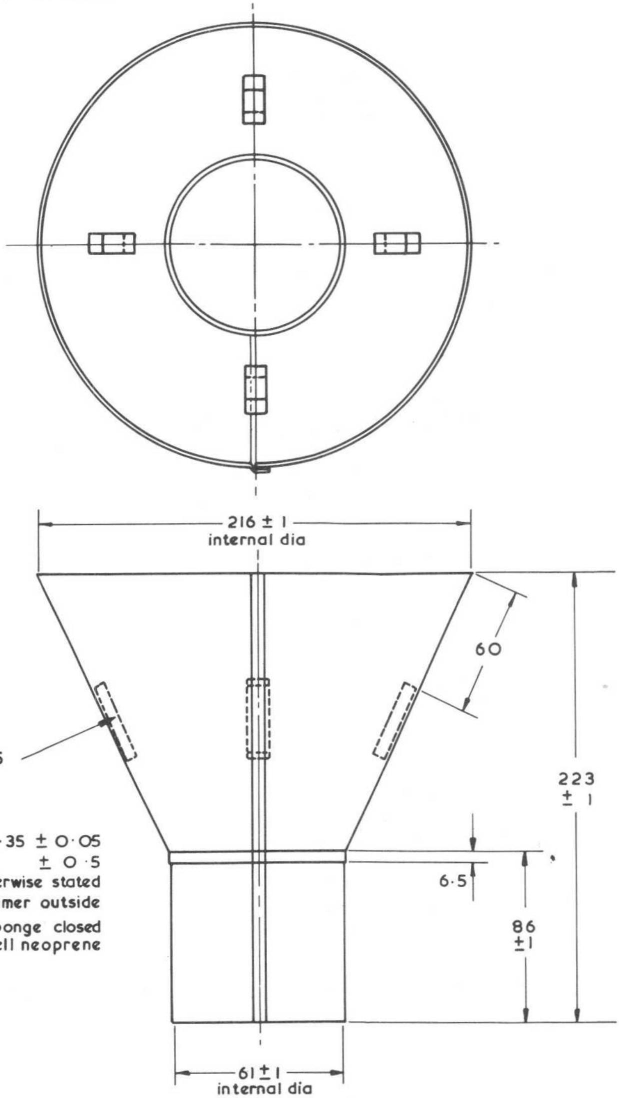
Not to be scaled

Connecting leads should not be soldered directly to tube pins.

It is advisable to support the tube near the screen, and at a second point on the parallel neck near the base. The tube should not be subjected to any stress from the use of clamps and should not be suspended by the base.

# Magnetic Shield MS 52

EXAMPLE OF TYPICAL SHIELD




MATERIAL 0·35 ± 0·05
METAL TOLERANCES ± 0·5
Unless otherwise stated
FINISH Silver hammer outside
PADS Soft sponge closed cell neoprene

All dimensions in mm
Not to be scaled

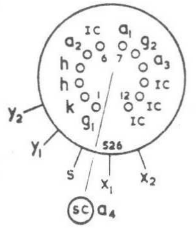


BRIMAR

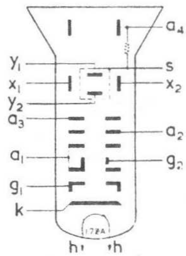
# Oscilloscope Tube

# SE4D

**Maintenance Type**



Base B12F, Cap CT8



## GENERAL

This 4 inch diameter tube incorporates a means of beam blanking at anode potential which avoids d.c. coupling to the grid. The screen is not aluminised. The standard phosphor for this tube is P31, but P7 and P11 can be supplied to special order.

| | | | |
|---|---|---|---|
| Heater Voltage | $V_h$ | 6·3 | V |
| Heater Current | $I_h$ | 0·3 | A |

## ABSOLUTE RATINGS

| | | | |
|---|---|---|---|
| Maximum Fourth Anode Voltage | $V_{a4(max)}$ | 7·0 | kV |
| Minimum Fourth Anode Voltage | $V_{a4(min)}$ | 2·0 | kV |
| Maximum Third Anode Voltage | $V_{a3(max)}$ | 2·0 | kV |
| Maximum Second Anode Voltage | $V_{a2(max)}$ | 500 | V |
| Maximum First Anode Voltage | $V_{a1(max)}$ | 1·7 | kV |
| Maximum Negative Control Grid Voltage | $-V_{g1(max)}$ | 300 | V |
| Minimum Negative Control Grid Voltage | $-V_{g1(min)}$ | 1·0 | V |
| Maximum x plate to Third Anode Voltage | $V_{x\text{-}a3(max)}$ | 500 | V |
| Maximum y plate to Third Anode Voltage | $V_{y\text{-}a3(max)}$ | 500 | V |
| Maximum Peak Heater to Cathode Voltage | $v_{h\text{-}k(pk)max}$ | 250 | V |
| Maximum x plate to Third Anode Resistance | $R_{x\text{-}a3(max)}$ | 5·0 | MΩ |
| Maximum y plate to Third Anode Resistance | $R_{y\text{-}a3(max)}$ | 100 | kΩ |
| Maximum Control Grid to Cathode Resistance | $R_{g1\text{-}k(max)}$ | 1·5 | MΩ |
| Minimum Helix Resistance | | 50 | MΩ |
| Maximum P.D.A. Ratio | | 4:1 | |

All votages referred to cathode unless otherwise stated.

## INTER-ELECTRODE CAPACITANCES

| | | | |
|---|---|---|---|
| Grid 1 to all | $c_{g1\text{-}all}$ | 8·5 | pF |
| Grid 1 to Grid 2 | $c_{g1\text{-}g2}$ | 0·3 | pF |
| Grid 2 to all | $c_{g2\text{-}all}$ | 6·7 | pF |
| Cathode to all | $c_{k\text{-}all}$ | 3·2 | pF |
| $x_1$ plate to $x_2$ plate | $c_{x1\text{-}x2}$ | 1·7 | pF |
| $y_1$ plate to $y_2$ plate | $c_{y1\text{-}y2}$ | 1·3 | pF |
| $x_1$ and $x_2$ plates to $y_1$ and $y_2$ plates | $c_{x1,x2\text{-}y1,y2}$ | 0·5 | pF |
| $x_1$ plate to all, less $x_2$ plate | $c_{x1\text{-}all,\ less\ x2}$ | 3·3 | pF |
| $x_2$ plate to all, less $x_1$ plate | $c_{x2\text{-}all,\ less\ x1}$ | 3·3 | pF |
| $y_1$ plate to all, less $y_2$ plate | $c_{y1\text{-}all,\ less\ y2}$ | 3·2 | pF |
| $y_2$ plate to all, less $y_1$ plate | $c_{y2\text{-}all,\ less\ y1}$ | 3·2 | pF |
| Grid 1 to $x_1$, $x_2$, $y_1$ and $y_2$ plates | $c_{g1\text{-}x1,x2,y1,y2}$ | 0·03 | pF |

The SE4D/P31 is also known as the CV8299.

The SE4D/T14 is also known as the CV8300.

OSCILLOSCOPE TUBES

**Thorn Radio Valves and Tubes Limited**

BRIMAR

**TYPICAL OPERATION**—Voltages with respect to cathode.

| | | | | | |
|---|---|---|---|---|---|
| Fourth Anode Voltage | $V_{a4}$ | 3·0 | 4·0 | 6·0 | kV |
| Mean Deflector Plate Potential | | 750 | 1000 | 1500 | V |
| Third Anode Voltage for astigmatism correction | $V_{a3}$ | 750* | 1000* | 1500* | V |
| Second Anode Voltage for focus | $V_{a2}$ | 60 to 160 | 80 to 200 | 80 to 300 | V |
| First Anode Voltage | $V_{a1}$ | 750 | 1000 | 1500 | V |
| Interplate Shield Voltage for optimum raster shape | $V_s$ | 700 to 800 | 950 to 1050 | 1450 to 1550 | V |
| Control Grid Voltage for visual cut-off | $V_{g1}$ | −27 to −50 | −35 to −65 | −53 to −98 | V |
| Beam Blanking Voltage | $V_{g2}$ | 695† | 930† | 1395† | V |
| Maximum x plate Deflection Coefficient | $D_{x(max)}$ | 19 | 25 | 37·5 | V/cm |
| Maximum y plate Deflection Coefficient | $D_{y(max)}$ | 5·0 | 7·5 | 11·25 | V/cm |
| Maximum Second Anode Current | $I_{a2(max)}$ | 10 | 10 | 10 | μA |
| Maximum Fourth Anode Current | $I_{a4(max)}$ | 75 | 100 | 150 | μA |
| Minimum Screen Area | | 5 x 8 | 5 x 8 | 5 X 8 | cm |
| Line Width | | 0·5 | 0·4 | 0·35 | mm |

* The required voltage will not differ from the quoted value by more than ± 50V.

† The beam is unblanked when $V_{g2} = V_{a1}$. This grid 2 electrode should not be used as a brilliance control.

### Raster Distortion

At the recommended P.D.A. ratios, over the nominally useful screen area, raster distortion will not be greater than 2 per cent. Raster geometry can be adjusted by varying the interplate shield voltage ($V_s$) with respect to the mean deflector plate potential. It is essential to ensure that the correct raster shape has been achieved by this means before adjusting for optimum focus.

Deflection of the spot is proportional to the voltage applied to the deflector plates within ± 2 per cent.

Rectangularity of x and y axes is 90° ± 1°.

### The Deflector System

Both x and y plates are designed for symmetrical operation. Should the tube be required to operate asymmetrically, some degradation of focus and trace geometry will result.

If the mean plate potentials for both x and y plates are the same, the third anode voltage for astigmatism correction will be within ± 50 V of the mean plate potential.

If the x plate mean potential differs considerably from that of the y, greater variation of the third anode voltage ($V_{a3}$) and the interplate shield voltage ($V_s$) will be required, and the x and y sensitivities will decrease.

The y plate mean potential should not be allowed to become greater than that of the x or severe deflection defocusing will result.

The deflection system is designed to intercept part of the beam, so that low impedance deflector plate drive is desirable.

### Magnetic Shielding

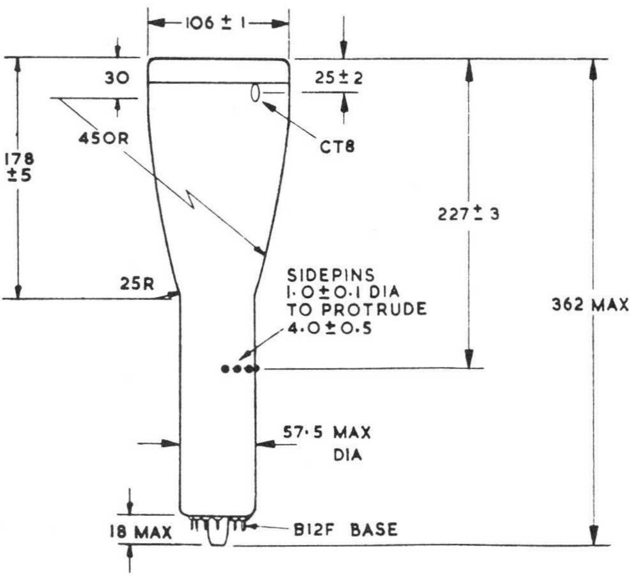
Adequate magnetic shielding is required. In addition due attention should be paid to the position of the tube relative to transformers and chokes.

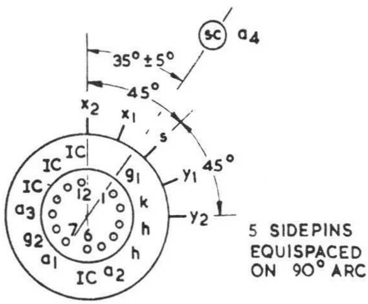
**Net Tube Weight**—0·8 kg (1¾ lb)

# Oscilloscope Tube

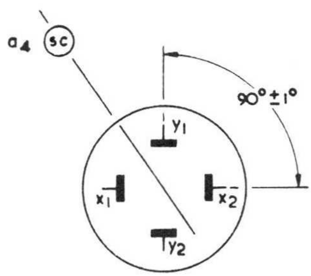
# SE4D

O481




VIEW FROM PINS FREE END




VIEWED FROM SCREEN END
(PIN 6 AT BOTTOM)

All dimensions in mm.

Not to be scaled.

**Mounting Position**—Unrestricted.

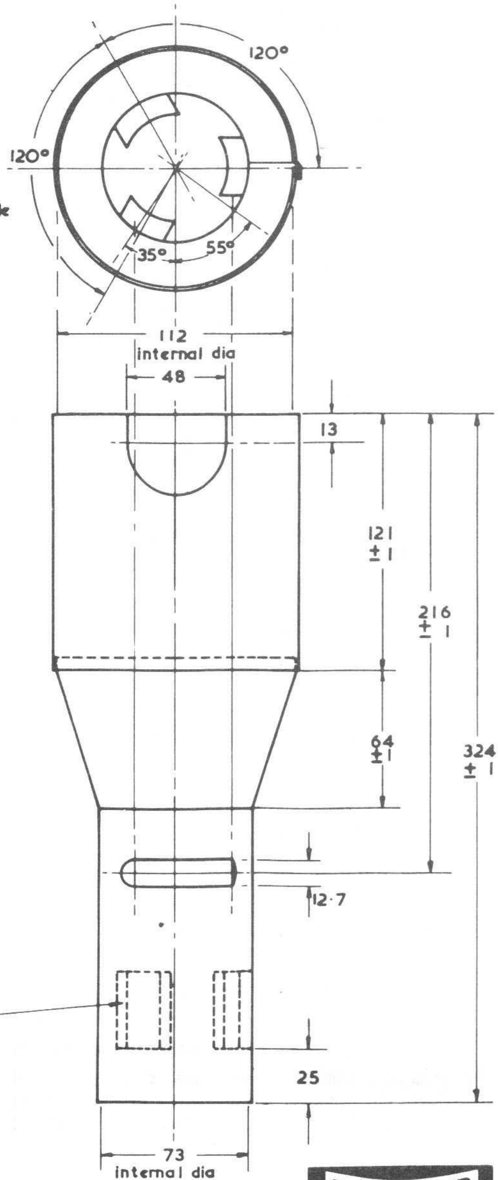
**It is advisable to support the tube near the screen, and at a second point on the parallel neck near the base. The tube should not be subjected to any stress from the use of clamps and should not be suspended by the base. Connecting leads should not be soldered directly to the tube pins.**

**Tolerance on all side pin positions ± 5°.**

EXAMPLE OF TYPICAL SHIELD

| | |
|---|---|
| MATERIAL | 0·35 Mumetal |
| METAL TOLERANCES | ± 0·5 unless otherwise stated |
| FINISH | Silver hammer outside |
| PADS | Soft sponge closed cell neoprene. |

All dimensions in mm
Not to be scaled



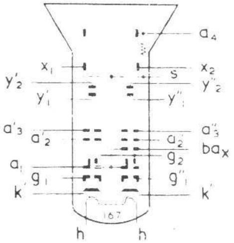

3 PADS 25 X 38 X 10

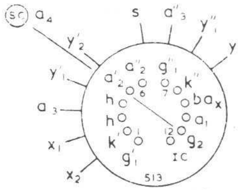


BRIMAR

# Oscilloscope Tube

# SE5/2A





Base B12F, Cap CT8

## GENERAL

This 5 in. diameter screen cathode ray tube has two electron guns, common x plates and a spiral post deflection accelerator. The tube has a common beam alignment electrode and a separate beam blanking electrode on each gun.

The standard phosphor screen is P31(GH), and screen types P2(GL), P7(GM) and P11(BE) are available to special order.

| | | | |
|---|---|---|---|
| Heater Voltage | $V_h$ | 6·3 | V |
| Heater Current | $I_h$ | 0·6 | A |

## ABSOLUTE RATINGS

| | | Max | Min | |
|---|---|---|---|---|
| Fourth Anode Voltage | $V_{a4}$ | 8·0 | 2·5 | kV |
| Third Anode Voltage | $V_{a3}$ | 2·0 | 0·7 | kV |
| Second Anode Voltage | $V_{a2}$ | 1·0 | 0 | kV |
| First Anode Voltage | $V_{a1}$ | 1·7 | 0·7 | kV |
| Negative Control Grid Voltage | $-V_{g1}$ | 200 | 1·0 | V |
| Beam Blanking Voltage | $V_{g2}$ | 1·8 | 0·55 | kV |
| Peak x plate to Third Anode Voltage | $v_{x\text{-}a3(pk)}$ | 500 | – | V |
| Peak y plate to Third Anode Voltage | $v_{y\text{-}a3(pk)}$ | 500 | – | V |
| x plate to Third Anode Resistance | $R_{x\text{-}a3}$ | 5·0 | – | MΩ |
| y plate to Third Anode Resistance | $R_{y\text{-}a3}$ | 100 | – | kΩ |
| Control Grid to Cathode Resistance | $R_{g1\text{-}k}$ | 1·5 | – | MΩ |
| Second Anode Current (each gun) | $i_{a2}$ | 10 | – | μA |
| P.D.A. Ratio ($V_{a4}/V_{a3}$) | | 4·0 | | |
| Post Deflection Helix Resistance | | – | 60 | MΩ |

All voltages referred to cathode unless otherwise stated.

OSCILLOSCOPE TUBES

## INTER-ELECTRODE CAPACITANCES

| | | | |
|---|---|---|---|
| Grid 1 to all | $c_{g1\text{-}all}$ | 7·6* | pF |
| Cathode to all | $c_{k\text{-}all}$ | 5·4* | pF |
| $x_1$ plate to $x_2$ plate | $c_{x1\text{-}x2}$ | 3·05 | pF |
| $y_1$ plate to $y_2$ plate | $c_{y1\text{-}y2}$ | 1·9* | pF |
| $x_1$ plate to all, less $x_2$ plate | $c_{x1\text{-}all,\ less\ x2}$ | 3·8 | pF |
| $x_2$ plate to all, less $x_1$ plate | $c_{x2\text{-}all,\ less\ x1}$ | 3·8 | pF |
| $y'_1$ plate to all, less $y'_2$ plate | $c_{y'1\text{-}all,\ less\ y'2}$ | 3·05 | pF |
| $y'_2$ plate to all, less $y'_1$ plate | $c_{y'2\text{-}all,\ less\ y'1}$ | 4·0 | pF |
| $y''_1$ plate to all, less $y''_2$ plate | $c_{y''1\text{-}all,\ less\ y''2}$ | 4·0 | pF |
| $y''_2$ plate to all, less $y''_1$ plate | $c_{y''2\text{-}all,\ less\ y''1}$ | 3·05 | pF |
| Grid 1 and Cathode to $x_1$, $x_2$, $y_1$ and $y_2$ plates | $c_{g1,k\text{-}x1,x2,\ y1,\ y2}$ | 0·5* | pF |

* Each gun.

**Net Tube Weight (approx) 1·15 kg (2·5 lb)**

**Thorn Radio Valves and Tubes Limited**

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## TYPICAL OPERATION

All voltages referred to cathode unless otherwise stated.

| | | | | | |
|---|---|---|---|---|---|
| Fourth Anode Voltage | $V_{a4}$ | 3·0 | 4·0 | 6·0 | kV |
| Third Anode to Mean y plate Voltage for astigmatism correction | $V_{a3\text{-}y(av)}$ | ±50 | ±50 | ±50 | V |
| Second Anode Voltage for Focus (Range) | $V_{a2}$ | 75 to 250 | 100 to 300 | 150 to 450 | V |
| First Anode Voltage | $V_{a1}$ | 750 | 1000 | 1500 | V |
| Interplate Shield to Mean x plate Voltage for optimum raster shape | $V_{s\text{-}x(av)}$ | ±50 | ±50 | ±50 | V |
| Mean Plate Potentials | | 750 | 1000 | 1500 | V |
| Control Grid Voltage for cut-off | $V_{g1}$ | −35 to −55 | −45 to −75 | −65 to −110 | V |
| Beam Blanking to First Anode Voltage | $V_{g2\text{-}a1}$ | −50* | −70* | −100* | V |
| Beam Alignment to First Anode Voltage for coincidence of vertical traces | $V_{bax\text{-}a1}$ | ±50 | ±50 | ±50 | V |
| Minimum Screen Area (each gun) | | 5 × 10 | 5 × 10 | 5 × 10 | $cm^2$ |
| Minimum Overlap | | 4·0 | 4·0 | 4·0 | cm |
| Minimum x plate Sensitivity | $S_{x(min)}$ | 16·5 | 22 | 33 | V/cm |
| Minimum y plate Sensitivity | $S_{y(min)}$ | 5·5 | 7·0 | 10·5 | V/cm |
| Line Width (Centre) | | 0·6 | 0·5 | 0·5 | mm |
| Line Width (Edge) | | 1·2 | 1·0 | 1·0 | mm |

* The beam is unblanked when $V_{g2} = V_{a1}$. This grid 2 electrode should not be used as a brilliance control.

### Raster Distortion and Alignment

Total scanned area is 6cm (y) × 10cm (x) minimum, measured about a centre ± 3mm from the centre of the tube face.

Angle between axes of deflecting plates is 90° ± 1°.

Angle between axes of two guns is 1° maximum.

The undeflected spots will lie within two rectangles 6 mm × 4 mm, the 6 mm side being vertical, whose centres lie on the vertical centre line of the face, displaced 6 mm above and below the horizontal centre line.

Coincidence of the two vertical traces at the centre of the tube may be achieved by varying the voltage on the beam alignment electrode.

The vertical traces, when deflected in the x direction, will register to one line width. Full deflection registration will be obtained by varying the cathode voltage of one gun with respect to the other. The variation in cathode voltage required will not be greater than ± 1 per cent of $V_{a3}$.

Raster distortion on each raster will not be greater than 2 per cent. The edges of a test raster scanned by one gun will fall between two concentric rectangles 100 mm × 50 mm and 102 mm × 51 mm.

The individual mean y plate potentials should not differ by more than 10V, and the difference between these and the mean x plate potential should be as low as possible. Unless these conditions are met, raster distortion, linearity and sensitivity cannot be guaranteed, and the voltages required for $a_3$ and the interplate shield (s) will differ from those specified.

It is advisable that the y deflector plate drive impedance should be as low as possible, as the y plates intercept part of the beam near the edge of the scan area.

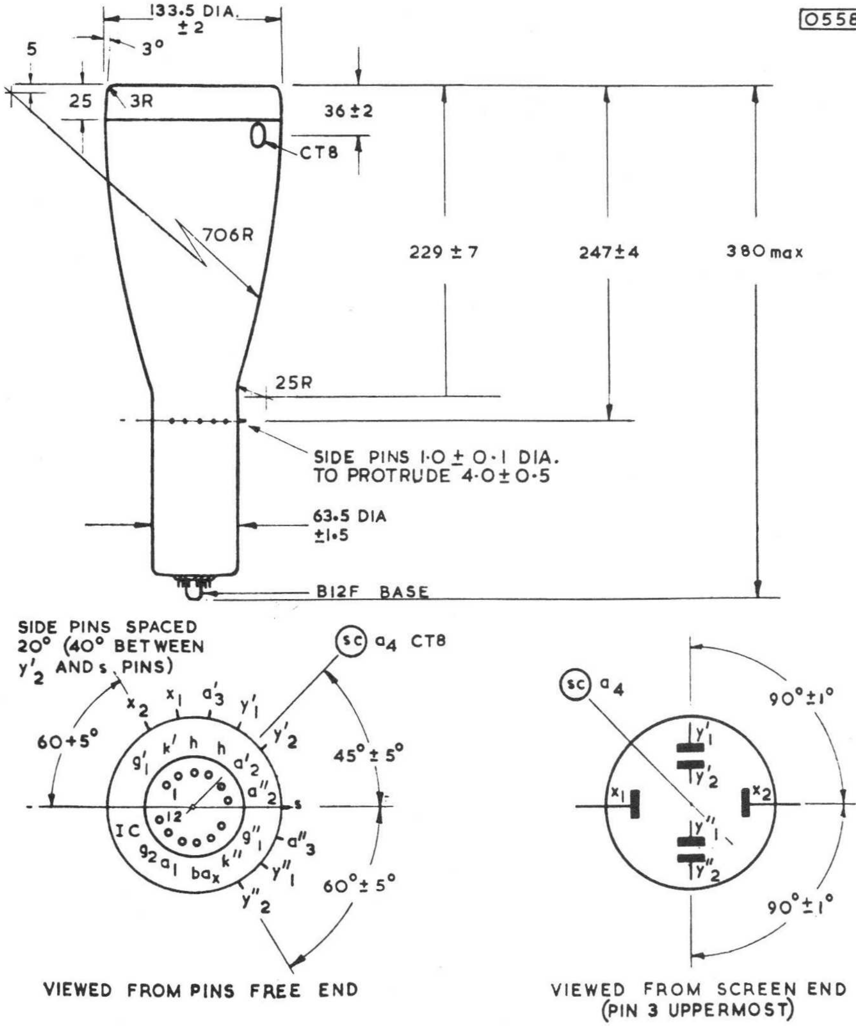
### Magnetic Shielding

Adequate magnetic shielding is required. In addition due attention should be paid to the position of the tube relative to transformers and chokes.

# Oscilloscope Tube

# SE5/2A

O558




All dimensions in mm. Not to be scaled.

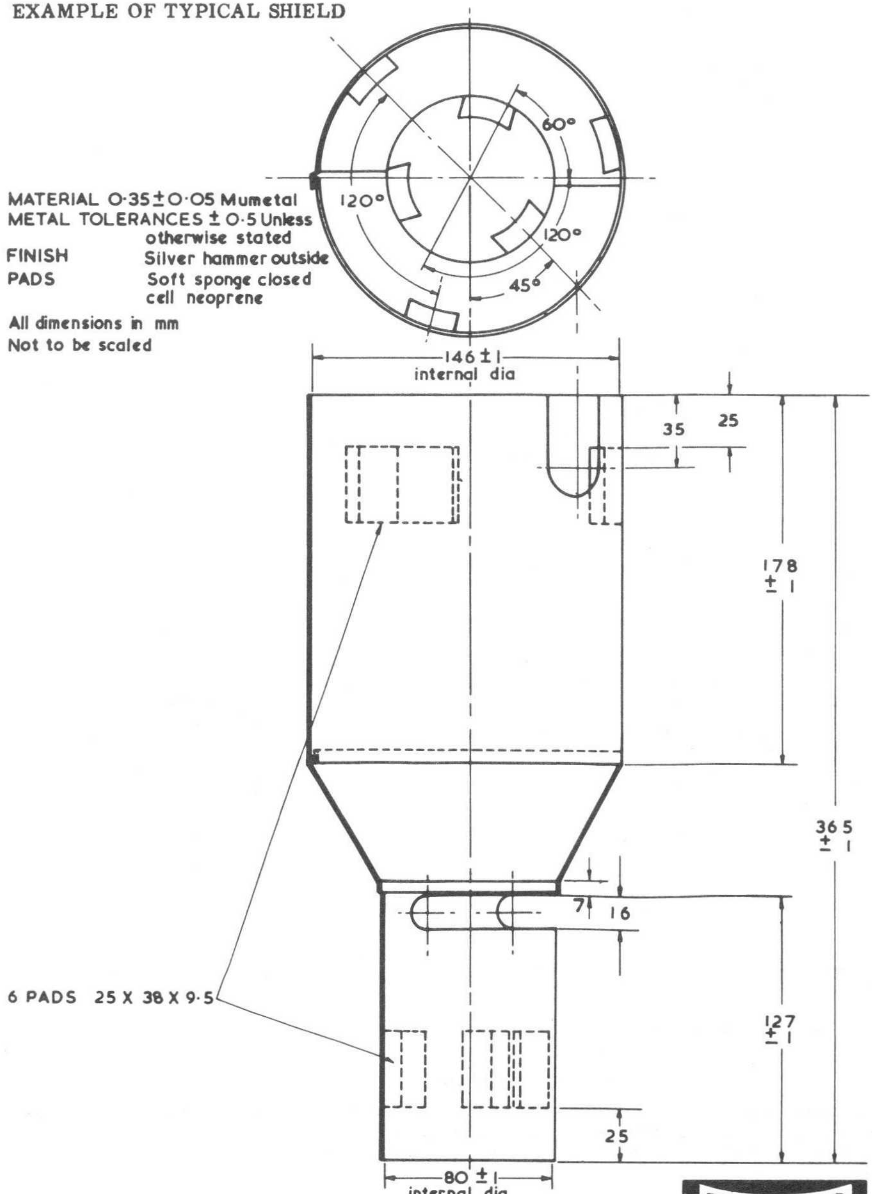
**Mounting Position**—Unrestricted.

**It is advisable to support the tube near the screen, and at a second point on the parallel neck near the base. The tube should not be subjected to any stress from the use of clamps and should not be suspended by the base. Connecting leads should not be soldered directly to the tube pins.**

**Tolerance on all side pin positions ± 5°.**

# Magnetic Shield MS58

EXAMPLE OF TYPICAL SHIELD



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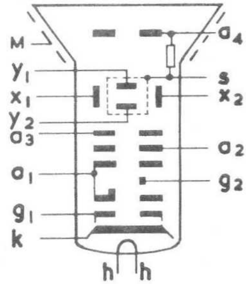
# Oscilloscope Tube SE5F/..

**Maintenance Type**

### GENERAL

This short 13 cm diameter flat-faced tube with electrostatic focusing and deflection is designed for general purpose applications. It has a large screen area coupled with good performance and the added facility of beam blanking at anode potential which avoids d.c. coupling to the grid.

| | | | |
|---|---|---|---|
| Heater voltage | $V_h$ | 6.3 | V |
| Heater current | $I_h$ | 0.3 | A |




### ABSOLUTE RATINGS

| | | Max | Min | |
|---|---|---|---|---|
| Fourth anode voltage | $V_{a4}$ | 5.0 | 1.5 | kV |
| Third anode voltage | $V_{a3}$ | 2.5 | 0.6 | kV |
| Second anode voltage | $V_{a2}$ | 500 | 0 | V |
| First anode voltage | $V_{a1}$ | 2.5 | 0.7 | kV |
| Negative grid voltage | $-V_{g1}$ | 300 | 1.0 | V |
| Beam blanking voltage | $V_{g2}$ | 2.5 | 0.5 | kV |
| Peak x plate to third anode voltage | $v_{x-a3(pk)}$ | 500 | - | V |
| Peak y plate to third anode voltage | $v_{y-a3(pk)}$ | 500 | - | V |
| Peak heater to cathode voltage | $v_{h-k(pk)max}$ | 250 | - | V |
| x plate to third anode resistance | $R_{x-a3}$ | 5.0 | - | MΩ |
| y plate to third anode resistance | $R_{y-a3}$ | 100 | - | kΩ |
| Control grid to cathode resistance | $R_{g1-k}$ | 1.5 | - | MΩ |
| Second anode current | $I_{a2}$ | 10 | - | μA |
| P.D.A. ratio ($V_{a4}/V_{a3}$ nom.) | | 2: 1 | | |
| Helix resistance | | - | 15 | MΩ |

All voltages referred to cathode unless otherwise stated.

### PHOSPHOR SCREEN

This type is usually supplied with GH phosphor (SE5F/GH) giving a green trace of medium short persistence. Other phosphor screens can be made available to special order.



Note : Prior to 1972 this tube was produced without external conductive coating.

## INTER-ELECTRODE CAPACITANCES

| | | | |
|---|---|---|---|
| Grid 1 to all | $c_{g1\text{-}all}$ | 8.0 | pF |
| Grid 2 to all | $c_{g2\text{-}all}$ | 10 | pF |
| Cathode to all | $c_{k\text{-}all}$ | 4.75 | pF |
| $x_1$ plate to $x_2$ plate | $c_{x1\text{-}x2}$ | 2.75 | pF |
| $y_1$ plate to $y_2$ plate | $c_{y1\text{-}y2}$ | 1.5 | pF |
| $x_1$ plate to all, less $x_2$ plate | $c_{x1\text{-}all,\ less\ x2}$ | 6.0 | pF |
| $x_2$ plate to all, less $x_1$ plate | $c_{x2\text{-}all,\ less\ x1}$ | 6.0 | pF |
| $y_1$ plate to all, less $y_2$ plate | $c_{y1\text{-}all,\ less\ y2}$ | 6.5 | pF |
| y2 plate to all, less $y_1$ plate | $c_{y2\text{-}all,\ less\ y1}$ | 6.5 | pF |
| $x_1$, $x_2$ plates to $y_1$, $y_2$ plates | $c_{x1,x2\ \text{-}y1,y2}$ | 1.5 | pF |
| Grid 1 & cathode to $x_1$ & $x_2$ plates | $c_{g1,k\text{-}x1,x2}$ | 0.9 | pF |
| Grid 1 & cathode to $y_1$ & $y_2$ plates | $c_{g1,k\text{-}y1,y2}$ | 0.5 | pF |
| Anode 4 to coating M (approx.) | $c_{a4\text{-}M}$ | 400 | pF |

## TYPICAL OPERATION.- Voltages with respect to cathode

| | | | | | |
|---|---|---|---|---|---|
| Fourth anode voltage | $V_{a4}$ | 2.0 | 3.0 | 4.0 | kV |
| Mean deflector plate potential | | 1000 | 1500 | 2000 | V |
| Third anode voltage for optimum astigmatism correction | $V_{a3}$ | 1000* | 1500* | 2000* | V |
| Second anode voltage for optimum focus | $V_{a2}$ | 50 to 200 | 75 to 250 | 80 to 360 | V |
| First anode voltage | $V_{a1}$ | 1000 | 1500 | 2000 | V |
| Shield voltage for optimum raster shape | $V_s$ | 1000* | 1500* | 2000* | V |
| Beam blanking voltage for cut-off | $V_{g2}$ | 950† | 1430† | 1900† | V |
| Control grid voltage for cut-off | $V_{g1}$ | -30 to -55 | -45 to -80 | -56 to -100 | V |
| x deflection coefficient | $D_x$ | 18.6 to 23.5 | 28 to 35 | 37 to 47 | V/cm |
| y deflection coefficient | $D_y$ | 7.4 to 10 | 11 to 15 | 14.5 to 20 | V/cm |
| Minimum screen area (corners cut-off) | | 8 x 10 | 8 x 10 | 8 x 10 | $cm^2$ |
| Line width at centre at 10 $\mu$A beam current measured by microscope | | 0.6 | 0.5 | 0.4 | mm |

* The required voltage will not differ from the quoted value by more than $\pm$50V.

† The beam is unblanked when $V_{g2} = V_{a1}$. This grid 2 electrode should not be used as a brilliance control.

## RASTER DISTORTION AND ALIGNMENT

The following data applies for the typical operation conditions.

The undeflected spot will fall in a circle of 6 mm radius about the centre of the tube face.

Raster distortion: the edges of a test raster will fall between two concentric rectangles 10 cm x 6 cm and 9.80 cm x 5.88 cm.

Raster geometry can be adjusted by varying the interplate shield voltage ($V_s$) with respect to the mean deflector plate potential. The interplate shield voltage ($V_s$) for optimum raster shape will be within ± 50V of the mean deflector plate potential, though differing from the third anode voltage ($V_{a3}$). It is essential to ensure that the correct raster shape has been achieved by this means before adjusting for optimum focus.

For an 8 cm x 10 cm raster the corners will be cut to 120 mm minimum diameter.

Rectangularity of X and Y axes is 90° ± 1°.

Both X and Y plates are designed for symmetrical operation. Should the tube be required to operate asymmetrically, some degradation of focus and trace geometry will result.

It is preferable that the mean x and y plate potentials are equal otherwise some deterioration in performance will occur. Under no circumstances should the mean y plate potential differ from the mean x plate potential by more than 50V.

The Y plate mean potential should not be allowed to become greater than that of the X or severe deflection defocusing will result.

The deflector system is designed to intercept part of the beam, so that low impedance deflector plate drive is desirable.

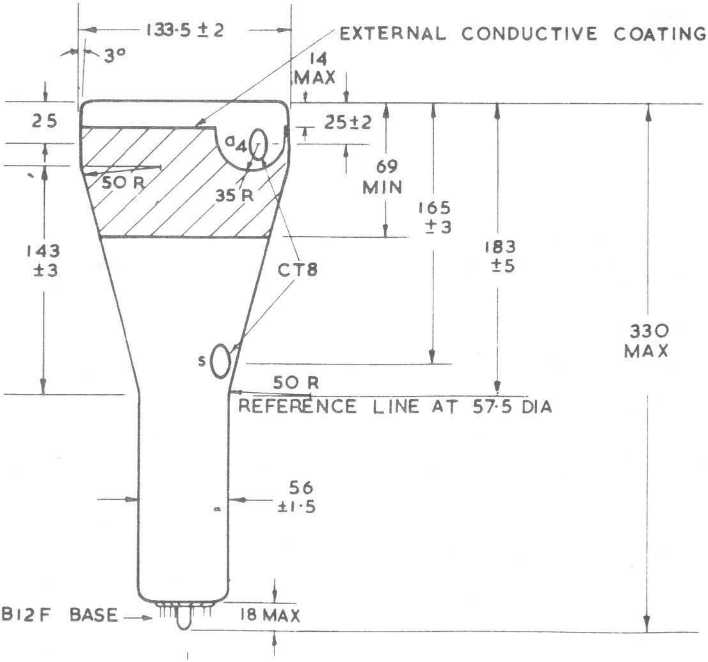
## SHIELDING

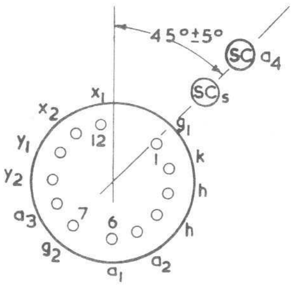
Adequate magnetic shielding is required. In addition due attention should be paid to the position of the tube relative to transformers and chokes.

The primary object of the external conductive coating is as an electrostatic shield and and in use this coating should be earthy.

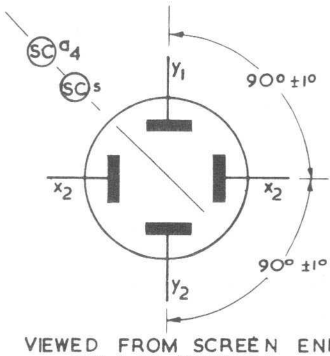
**TUBE WEIGHT** (approximate) 1.0 kg (2.25 lb)

**MOUNTING POSITION** - unrestricted




VIEWED FROM PINS FREE END




VIEWED FROM SCREEN END
PIN 6 AT BOTTOM

All dimensions in mm

Not to be scaled.

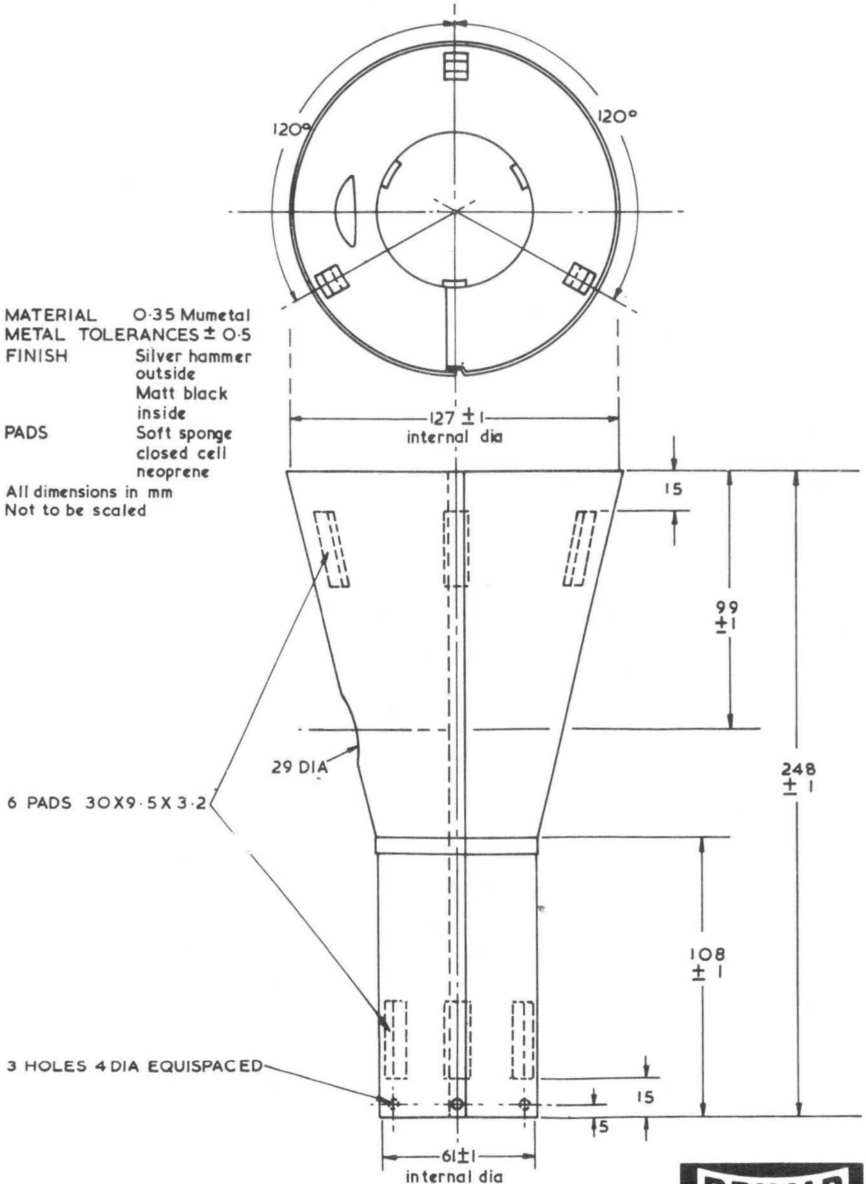
It is advisable to support the tube near the screen and at a second point on the neck near the base. The tube should not be subjected to any stress from the use of clamps and should not be suspended by the base.

Connecting leads should not be soldered directly to the tube pins.

# Magnetic Shield MS 59



EXAMPLE OF TYPICAL SHIELD






**Thorn Radio Valves and Tubes Limited**



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# RADAR TUBES

The facilities and organisation provided by Thorn Radio Valves and Tubes Limited meet the requirements of the M.O.D. (P.E.) Defence Standard 05-21 and BS 9000.

**HEALTH AND SAFETY AT WORK ACT, 1974**

Attention is drawn to the recommendations under this heading in the Operational Recommendations.

**WARNING**

These tubes should be used in accordance with their published ratings, and in conformity with the Operational Recommendations of the company's data handbook. The company will not entertain claims for loss or damage where this advice has been disregarded.

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**Thorn Radio Valves and Tubes Limited**

Mollison Avenue - Brimsdown - Enfield - Middlesex EN3 7NS

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# Radar Tube

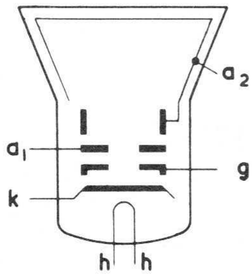
# CV429

Maintenance Type

**GENERAL**

Round flat face 12 inch tube, 50° deflection
Magnetic focus and deflection
Straight tetrode gun, non ion trap
Aluminised screen, orange trace
LC phosphor, very long persistence

| | | | |
|---|---|---|---|
| Heater Voltage | $V_h$ | 6.3 | V |
| Heater Current | $I_h$ | 0.3 | A |




**ABSOLUTE RATINGS** - voltages referred to cathode

| | | | |
|---|---|---|---|
| Maximum second anode voltage | $V_{a2(max)}$ | 15.5 | kV |
| Minimum second anode voltage | $V_{a2(min)}$ | 9.0 | kV |
| Maximum first anode voltage | $V_{a1(max)}$ | 600 | V |
| Minimum first anode voltage | $V_{a1(min)}$ | 250 | V |
| Maximum heater to cathode voltage heater negative (d.c.) | $V_{h-k(max)}$ | 150 | V |
| Maximum beam current | $I_{b(max)}$ | 50 | μA |

**INTER-ELECTRODE CAPACITANCES**

| | | | |
|---|---|---|---|
| Cathode to all | $c_{k-all}$ | <12 | pF |
| Grid to all | $c_{g-all}$ | <12 | pF |

**TYPICAL OPERATION** - grid modulation, voltages referred to cathode

| | | | |
|---|---|---|---|
| Second anode voltage | $V_{a2}$ | 15 | kV |
| First anode voltage | $V_{a1}$ | 300 | V |
| Grid to cathode voltage for cut-off | $V_{g-k}$ | -30 to -90 | V |
| Average peak to peak modulating voltage for modulation up to 50 μA | | 24 | V |
| Maximum deviation of unfocused and undeflected spot from centre of screen | | 15 | mm |
| Maximum unfocused spot diameter for 50 μA beam current | | 15 | mm |
| Maximum line width for 50 μA beam current* | | 0.4 | mm |
| LC screen persistence to 10% (approximate) | | 25 | s |

* Measured on T.V. raster with frame scan expanded.

The LC screen is liable to burn even at low values of beam current if operated with a stationary or slow-moving spot.

RADAR TUBES

**Thorn Radio Valves and Tubes Limited**

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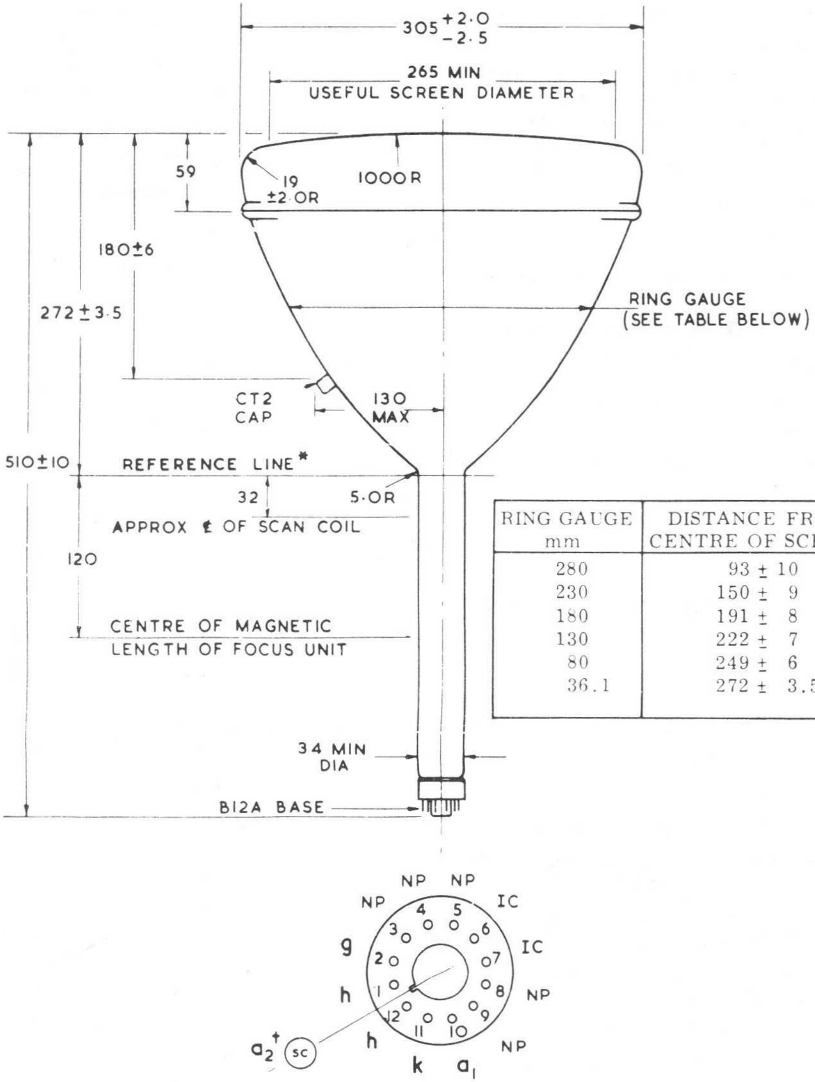



| RING GAUGE mm | DISTANCE FROM CENTRE OF SCREEN |
|---|---|
| 280 | 93 ± 10 |
| 230 | 150 ± 9 |
| 180 | 191 ± 8 |
| 130 | 222 ± 7 |
| 80 | 249 ± 6 |
| 36.1 | 272 ± 3.5 |

All dimensions in mm

Not to be scaled

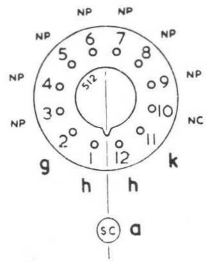
* Reference line is the line where a 36.1 diameter ring gauge 100 mm long will stop against bulb.

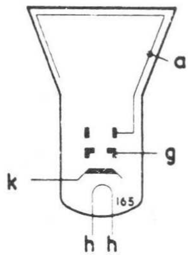
† Anode cap in line with spigot ± 15°.

# Compass Tube

## CV5119

**Maintenance Type**




B12A (5 Pin) Base, CT8 Cap

### GENERAL

Round Flat Face —6 in. Diameter
Internal Compass Scale—Uniformly graduated
T1 Phosphor —Medium Persistence
Treated to reduce Specular Reflection
Aluminised Screen—Green Trace
Magnetic Focus and Deflection
High Brightness Level

| | | | |
|---|---|---|---|
| Heater Voltage | $V_h$ | 6·3 | V |
| Heater Current | $I_h$ | 0·6 | A |

### RATINGS

| | | | |
|---|---|---|---|
| Maximum Anode Voltage | $V_{a(max)}$ | 10* | kV |
| Minimum Anode Voltage | $V_{a(min)}$ | 7·5 | kV |
| Maximum Heater to Cathode Voltage, Heater Negative (d.c.) | $V_{h\text{-}k(max)}$ | 150 | V |

* 10 kV is a design centre rating, the absolute maximum of 12·5 kV must not be exceeded.

### INTER-ELECTRODE CAPACITANCES †

| | | | |
|---|---|---|---|
| Cathode to all | $c_{k\text{-}all}$ | 5·3 | pF |
| Grid to all | $c_{g\text{-}all}$ | 4·7 | pF |

† These capacitances include an AEI wafer type duodecal holder.

### TYPICAL OPERATION—Grid Modulation (Voltages referred to cathode)

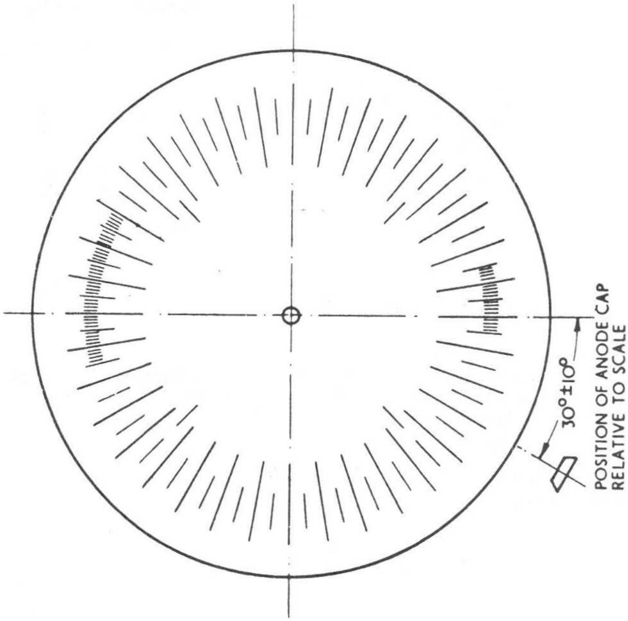
| | | | |
|---|---|---|---|
| Anode Voltage | $V_a$ | 9·5 | kV |
| Grid to Cathode Voltage for cut-off of 140 mm focused line | $V_g$ | −43 to −93 | V |
| Average Peak to Peak Modulating Voltage for modulation up to 150 μA | | 30 | V |
| Maximum Peak to Peak Modulating Voltage for modulation of limit CRT up to 150 μA | | 35 | V |

**Note**

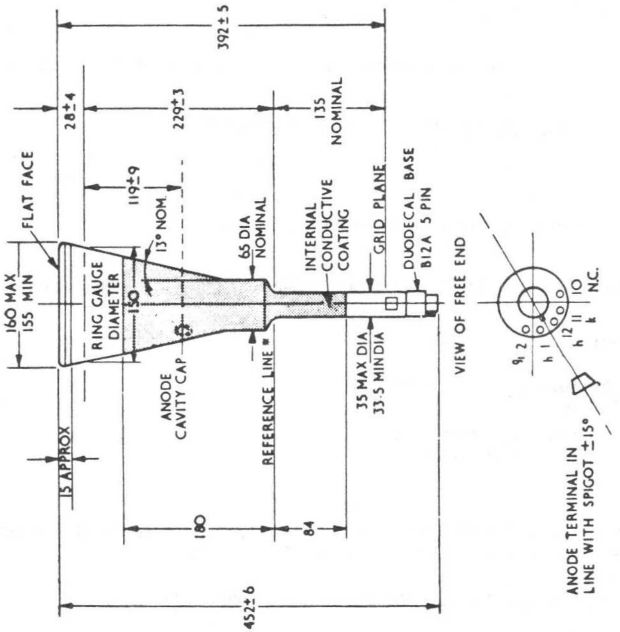
A resistance should be inserted in the anode circuit in order to limit the discharge current to 100 mA max. in the event of a flash-over inside the tube.

**Tube Weight (approx)**—Net 2¼ lb Packed 16¼ lb

RADAR TUBES




This scale is uniformly graduated.



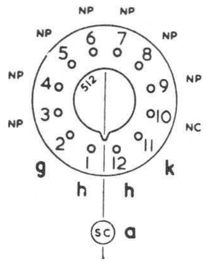

*Determined by Reference Line Gauge No. 6.

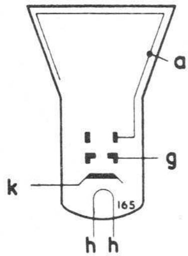
All dimensions in mm.
Not to be scaled.

# Compass Tube

**CV5203**

**Maintenance Type**




B12A (5 Pin) Base, CT8 Cap

## GENERAL

| | |
|---|---|
| Round Flat Face —6 in. Diameter | Treated to reduce Specular Reflection |
| Internal Compass Scale | Graduated with Octantal Correction |
| Aluminised Screen—Green Trace | T1 Phosphor—Medium Persistence |
| Magnetic Focus and Deflection | High Brightness Level |

| | | | |
|---|---|---|---|
| Heater Voltage | $V_h$ | 6·3 | V |
| Heater Current | $I_h$ | 0·6 | A |

## RATINGS

| | | | |
|---|---|---|---|
| Maximum Anode Voltage | $V_{a(max)}$ | 10* | kV |
| Minimum Anode Voltage | $V_{a(min)}$ | 7·5 | kV |
| Maximum Heater to Cathode Voltage, Heater Negative (d.c.) | $V_{h\text{-}k(max)}$ | 150 | V |

* 10 kV is a design centre rating, the absolute maximum of 12·5 kV must not be exceeded.

## INTER-ELECTRODE CAPACITANCES †

| | | | |
|---|---|---|---|
| Cathode to all | $c_{k\text{-}all}$ | 5·3 | pF |
| Grid to all | $c_{g\text{-}all}$ | 4·7 | pF |

† These capacitances include an AEI wafer type duodecal holder.

## TYPICAL OPERATION—Grid Modulation (Voltages referred to cathode)

| | | | |
|---|---|---|---|
| Anode Voltage | $V_a$ | 9·5 | kV |
| Grid to Cathode Voltage for cut-off of 140 mm focused line | $V_g$ | −43 to −93 | V |
| Average Peak to Peak Modulating Voltage for modulation up to 150 µA | | 30 | V |
| Maximum Peak to Peak Modulating Voltage for modulation of limit CRT up to 150 µA | | 35 | V |

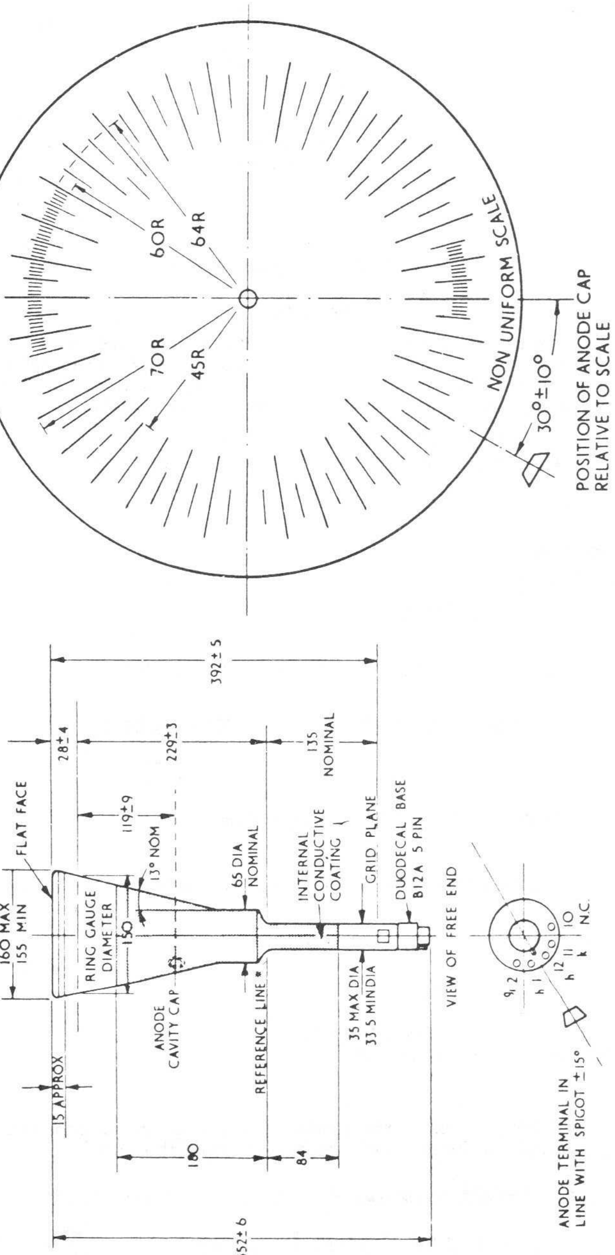
**Note**

A resistance should be inserted in the anode circuit in order to limit the discharge current to 100 mA max. in the event of a flash-over inside the tube.

**Tube Weight (approx)**—Net 2¼ lb Packed 16¼ lb

RADAR TUBES

# Compass Tube




This scale has octantal corrections.

All dimensions in mm
Not to be scaled.

* Determined by Reference Line Gauge No. 6.

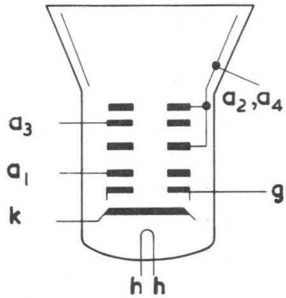
# Radar Tube F10-100..

PRELIMINARY DATA

**GENERAL**

Round face, 10 cm tube, 30° deflection
36.5 mm maximum neck diameter
Electrostatic focus, magnetic deflection
Straight gun
Clear glass

| | | | |
|---|---|---|---|
| Heater voltage | $V_h$ | 6.3 | V |
| Heater current | $I_h$ | 0.3 | A |




**ABSOLUTE RATINGS** (voltages referred to cathode)

| | | | |
|---|---|---|---|
| Maximum second and fourth anode voltage | $V_{a2+a4(max)}$ | 8.0 | kV |
| Minimum second and fourth anode voltage | $V_{a2+a4(min)}$ | 4.0 | kV |
| Maximum third anode voltage | $V_{a3(max)}$ | +1000 to -500 | V |
| Maximum first anode voltage | $V_{a1(max)}$ | 550 | V |
| Maximum heater to cathode voltage, heater negative (d.c.) | $V_{h-k(max)}$ | 250 | V |
| Maximum peak heater to cathode voltage, heater negative (absolute rating) | $v_{h-k(pk)max}$ | 400* | V |
| Maximum impedance, grid to cathode (50 Hz) | $Z_{g-k(max)}$ | 0.5 | MΩ |
| Maximum resistance, grid to cathode | $R_{g-k(max)}$ | 1.5 | MΩ |

All voltages referred to cathode

* During a warming up period not exceeding 45 seconds.

**PHOSPHOR SCREEN**

This type is usually supplied with LD phosphor (F10-100LD) giving an orange trace of very long persistence. Other phosphors can be made available to special order.

RADAR TUBES

## INTER-ELECTRODE CAPACITANCES

| | | | |
|---|---|---|---|
| Cathode to all | $c_{k-all}$ | 3.5 | pF |
| Grid to all | $c_{g-all}$ | 10 | pF |

* Holder capacitance balanced out.

## TYPICAL OPERATION - Grid modulation, voltages referred to cathode.

| | | | |
|---|---|---|---|
| Second and fourth anode voltage | $V_{a2+a4-k}$ | 5.0 | kV |
| First anode voltage | $V_{a1-k}$ | 400 | V |
| Third anode voltage range for focus | $V_{a3-k}$ | 0 to 400 | V |
| Grid to cathode voltage range for cut-off of raster | $V_{g-k}$ | -40 to -77 | V |
| LD screen raster persistence to 10% (approx.) | | 4.0 | s |

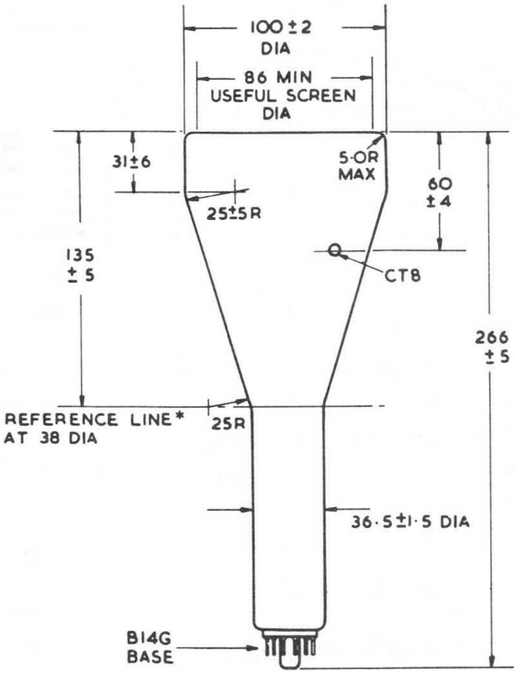
## TYPICAL OPERATION - Cathode modulation, voltages referred to grid

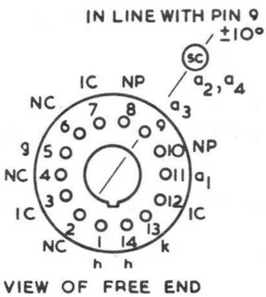
| | | | |
|---|---|---|---|
| Second and fourth anode voltage | $V_{a2+a4-g}$ | 5.0 | kV |
| First anode voltage | $V_{a1-g}$ | 400 | V |
| Third anode voltage range for focus | $V_{a3-g}$ | 0 to 400 | V |
| Cathode to grid voltage range for cut-off of raster | $V_{k-g}$ | 36 to 66 | V |
| LD screen raster persistence to 10% (approx.) | | 4.0 | s |

The LD screen is liable to burn even at low values of beam current if operated with a stationary or slow moving spot.

**TUBE WEIGHT** (approximate) - 400 g

**MOUNTING POSITION** - unrestricted




All dimensions in mm

Not to be scaled

* Gauge 38 mm internal diameter, 50 mm long to slide freely over neck.

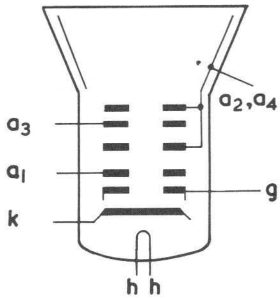
# F15-101..

# Radar Tube

## GENERAL

Round face, 15 cm tube, 53° deflection
29.4 mm maximum neck diameter
Electrostatic focus, magnetic deflection
Straight gun, aluminised screen
Clear glass

| | | | |
|---|---|---|---|
| Heater voltage | $V_h$ | 6.3 | V |
| Heater current | $I_h$ | 0.3 | A |




## ABSOLUTE RATINGS (voltages referred to cathode)

| | | | |
|---|---|---|---|
| Maximum second and fourth anode voltage | $V_{a2+a4(max)}$ | 13.5† | kV |
| Minimum second and fourth anode voltage | $V_{a2+a4(min)}$ | 7.5 | kV |
| Maximum third anode voltage | $V_{a3(max)}$ | +1000 to -500 | V |
| Maximum first anode voltage | $V_{a1(max)}$ | 550 | V |
| Maximum heater to cathode voltage, heater negative (d.c.) | $V_{h-k(max)}$ | 250 | V |
| Maximum peak heater to cathode voltage, heater negative (absolute rating) | $v_{h-k(pk)max}$ | 400§ | V |
| Maximum impedance, grid to cathode (50 Hz) | $Z_{g-k(max)}$ | 0.5 | MΩ |
| Maximum resistance, grid to cathode | $R_{g-k(max)}$ | 1.5 | MΩ |

All voltages referred to cathode

† $I_{a2+a4} = 0$

§ During a warming up period not exceeding 45 seconds.

## PHOSPHOR SCREEN

This type is usually supplied with LD phosphor (F15-101LD) giving an orange trace of very long persistence. Other phosphors can be made available to special order.

This data should be read in conjunction with Operational Recommendations for Industrial Cathode Ray Tubes.

## INTER-ELECTRODE CAPACITANCES

| | | * | † | |
|---|---|---|---|---|
| Cathode to all | $c_{k-all}$ | 3.0 | 3.5 | pF |
| Grid to all | $c_{g-all}$ | 6.5 | 8.0 | pF |

* Holder capacitance balanced out.

† Total capacitances including a typical B8H holder.

## TYPICAL OPERATION - Grid modulation, voltages referred to cathode.

| | | | |
|---|---|---|---|
| Second and fourth anode voltage | $V_{a2+a4-k}$ | 9.0 | kV |
| First anode voltage | $V_{a1-k}$ | 400 | V |
| Third anode voltage range for focus | $V_{a3-k}$ | 0 to 400 | V |
| Average peak to peak picture modulating voltage for 200 $\mu$A cathode current | | 29 | V |
| Grid to cathode voltage range for cut-off of raster | $V_{g-k}$ | -40 to -77 | V |
| LD screen raster persistence to 10% (approx.) | | 4.0 | s |

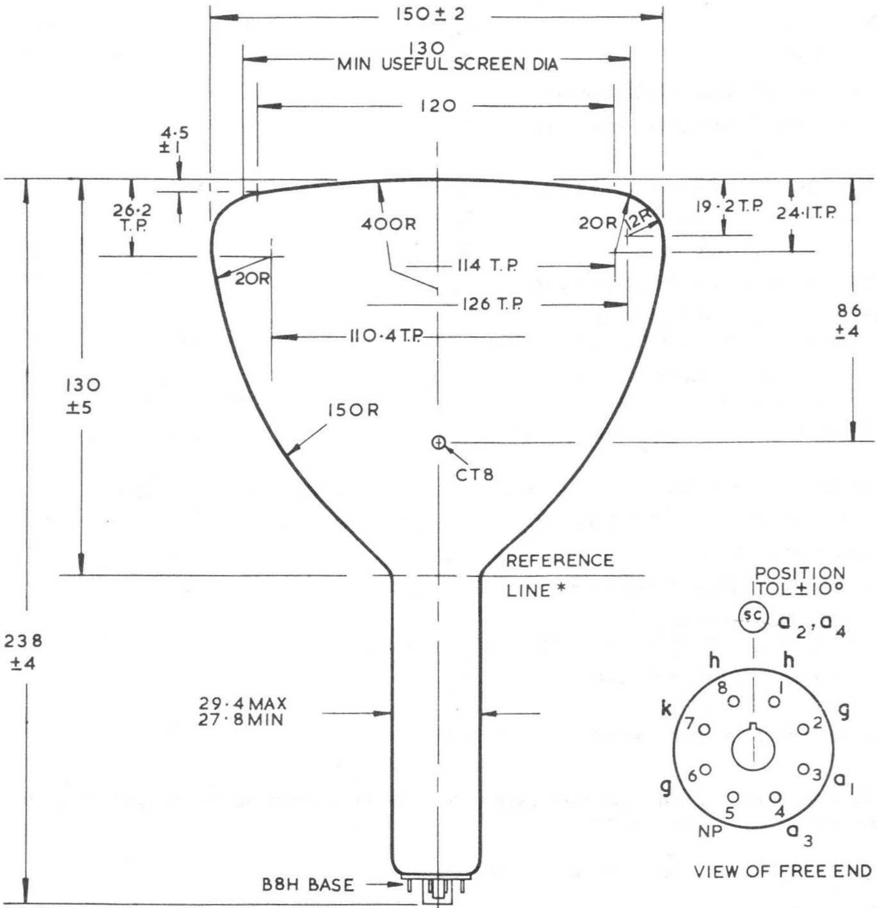
## TYPICAL OPERATION - Cathode modulation, voltages referred to grid

| | | | |
|---|---|---|---|
| Second and fourth anode voltage | $V_{a2+a4-g}$ | 9.0 | kV |
| First anode voltage | $V_{a1-g}$ | 400 | V |
| Third anode voltage range for focus | $V_{a3-g}$ | 0 to 400 | V |
| Average peak to peak picture modulating voltage for 200 $\mu$A cathode current | | 25 | V |
| Cathode to grid voltage range for cut-off of raster | $V_{k-g}$ | 36 to 66 | V |
| LD screen raster persistence to 10% (approx.) | | 4.0 | s |

The LD screen is liable to burn even at low values of beam current if operated with stationary or slow moving spot.

**TUBE WEIGHT** (approximate) - 0.6 kg

**MOUNTING POSITION** - unrestricted




All dimensions in mm

Not to be scaled

A straight line passing centrally through the neck will pass within ± 2 mm of the centre of the screen.

* Determined by reference gauge No. 31

# Radar Tube

# F16–101..

## GENERAL

Round face, 16 cm (6 inch) tube, 37° deflection.

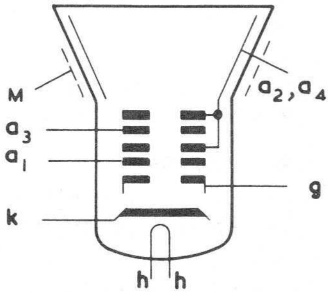
Electrostatic focus, magnetic deflection

Straight gun, aluminised screen

Clear glass, external conductive coating

29.4 mm maximum neck diameter.

| | | | |
|---|---|---|---|
| Heater voltage | $V_h$ | 6.3 | V |
| Heater current | $I_h$ | 0.3 | A |




## ABSOLUTE RATINGS (voltages referred to cathode)

| | | | |
|---|---|---|---|
| Maximum second and fourth anode voltage | $V_{a2+a4(max)}$ | 18 | kV |
| Minimum second and fourth anode voltage | $V_{a2+a4(min)}$ | 10 | kV |
| Maximum third anode voltage range | $V_{a3(max)}$ | +1000 to −500 | V |
| Maximum first anode voltage | $V_{a1(max)}$ | 600 | V |
| Minimum first anode voltage | $V_{a1(min)}$ | 300 | V |
| Maximum negative grid voltage | $-V_{g(max)}$ | 150 | V |
| Maximum positive grid voltage | $V_{g(max)}$ | 0 | V |
| Maximum heater to cathode voltage | $V_{h-k(max)}$ | | |
| heater negative (d.c.) | | 200 | V |
| heater positive (d.c.) | | 125 | V |
| Maximum peak heater to cathode voltage | $v_{h-k(pk)max}$ | | |
| heater negative | | 300 | V |
| heater positive | | 250 | V |
| Maximum third anode current | $I_{a3(max)}$ | ± 15 | μA |
| Maximum first anode current | $I_{a1(max)}$ | ± 15 | μA |
| Maximum heater to cathode resistance | $R_{h-k(max)}$ | 1.0 | MΩ |
| Maximum grid to cathode resistance | $R_{g-k(max)}$ | 1.5 | MΩ |
| Maximum grid to cathode impedance (50 Hz) | $Z_{g-k(max)}$ | 500 | kΩ |
| Maximum cathode to earth impedance (50 Hz) | $Z_{k-e(max)}$ | 100 | kΩ |



## PHOSPHOR SCREEN

This tube is usually supplied with LD phosphor (F16–101LD) giving an orange trace of very long persistence. Other phosphors can be made available to special order.

## INTER-ELECTRODE CAPACITANCES

| | | | |
|---|---|---|---|
| Cathode to all | $c_{k-all}$ | < 6.0 | pF |
| Grid to all | $c_{g-all}$ | < 10 | pF |
| Anodes 2 and 4 to external conductive coating, M (approx.) | $c_{a2+a4-M}$ | 750 | pF |

## TYPICAL OPERATION

| | | | |
|---|---|---|---|
| Second and fourth anode voltage | $V_{a2+a4}$ | 14 | kV |
| Third anode voltage range for focus | $V_{a3}$ | 0 to 400 | V |
| First anode voltage | $V_{a1}$ | 500 | V |
| Grid to cathode voltage for visual extinction of focused spot | $V_{g-k}$* | -27 to -44 | V |
| Cathode to grid voltage for visual extinction of focused spot | $V_{k-g}$* | 25 to 40 | V |
| Average peak to peak modulating voltage for modulation up to 150 μA | | 25 † | V |
| Line width at $I_{a2+a4}$ = 50 μA | | 0.3 | mm |
| LD screen persistence to 10% (approximate) | | 4.0 | s |

The LD screen is liable to burn even at low values of beam current if operated with a stationary or slow-moving spot.

If this tube is operated at voltages in excess of 16 kV, x-ray radiation shielding may be necessary to avoid possible danger of personal injury from prolonged exposure at close range. The normal glass protective viewing window may provide such a safeguard. If the radiation measured in contact with this window does not exceed 0.5 milliröntgens per hour, the window will normally provide adequate protection.

* For grid modulation, all voltages are measured with respect to the cathode. For cathode modulation, all voltages are measured with respect to the grid.

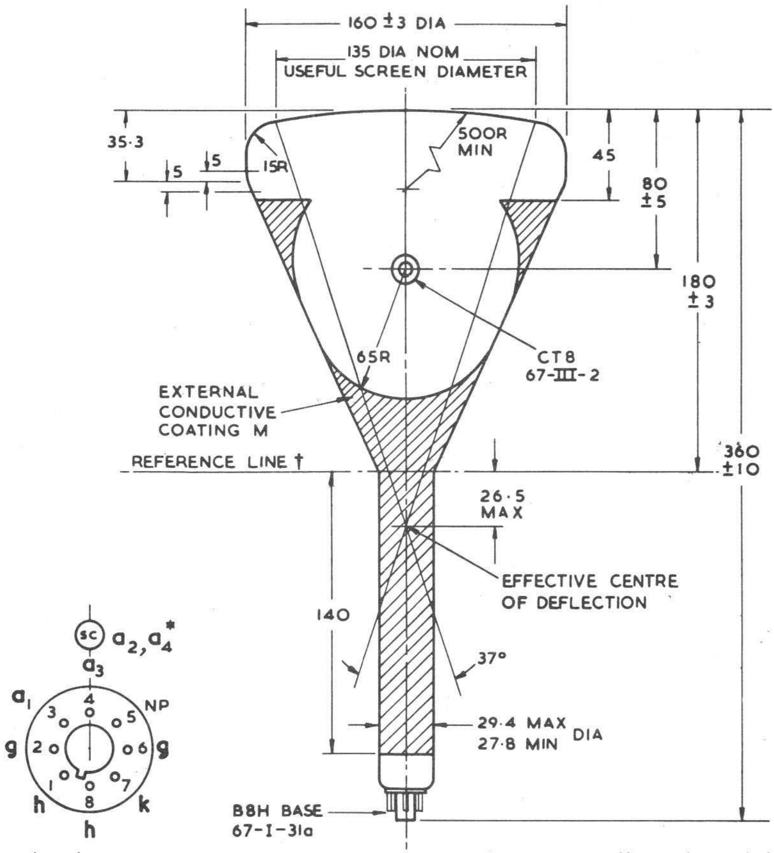
† Grid modulation from spot cut-off.

**TUBE WEIGHT** (approximate) - 1.2 kg (2 lb 10 oz)

**MOUNTING** - unrestricted

The tube should not be supported by the base alone and under no circumstances should the socket be used to support the tube.
The external conductive coating (M) of this tube should be connected to chassis. The capacitance between this coating and final anode may be used to provide smoothing for the e.h.t. supply.
When flashover protection is incorporated the chassis return path of M should be made in a manner appropriate to the protection system employed.

Tubes incorporating a B8H Sparkguard base will have a suffix letter after the type number. For details of the Sparkguard bases see separate sheets.




All dimensions in mm

Not to be scaled

* Anode cap in line with pin 4 ± 10°.

† Determined by Reference Gauge No. 18. (See T.D.S. 5-0-91-18).

There is an annular region of anti-corona coating with an external diameter of 75 mm surrounding the CT8 cap, the tube should not be handled in this region.

The projected neck axis shall pass within 3.5 mm of the geometric centre of the tube face.

The eccentricity of the neck axis with respect to a line perpendicular to the geometric centre of the tube face shall not exceed 3.0 mm at the deflection centre and at a point 100 mm from the reference line.

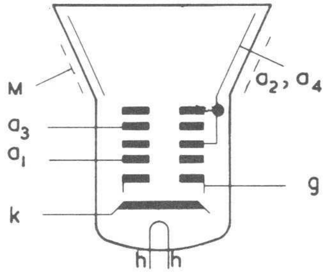
# F21-10..

# Radar Tube

## GENERAL

Round face, 21cm tube, 41° deflection
Electrostatic focus, magnetic deflection
Straight gun, aluminised screen
Clear glass, external conductive coating
35.5 mm maximum neck diameter

| | | | |
|---|---|---|---|
| Heater voltage | $V_h$ | 6.3* | V |
| Heater current | $I_h$ | 0.3 | A |




## ABSOLUTE RATINGS (voltages referred to cathode)

| | | | |
|---|---|---|---|
| Maximum second and fourth anode voltage | $V_{a2+a4(max)}$ | 18 † | kV |
| Minimum second and fourth anode voltage | $V_{a2+a4(min)}$ | 10 | kV |
| Maximum third anode voltage range | $V_{a3}$ | +1000 to -300 | V |
| Maximum first anode voltage | $V_{a1(max)}$ | 800 | V |
| Minimum first anode voltage | $V_{a1(min)}$ | 400 | V |
| Maximum negative grid voltage | $-V_{g(max)}$ | 150 | V |
| Minimum peak negative grid voltage | $-v_{g(min)}$ | 1.0 | V |
| Maximum heater to cathode voltage | $V_{h-k(max)}$ | | |
| heater negative (d.c.) | | 200 | V |
| heater positive (d.c.) | | 125 | V |
| Maximum peak heater to cathode voltage | $v_{h-k(pk)max}$ | | |
| heater negative | | 300 | V |
| heater positive | | 250 | V |
| Maximum first anode current | $I_{a1(max)}$ | ±15 | μA |
| Maximum third anode current | $I_{a3(max)}$ | ±15 | μA |
| Maximum heater to cathode resistance | $R_{h-k(max)}$ | 1.0 | MΩ |
| Maximum grid to cathode resistance | $R_{g-k(max)}$ | 1.5 | MΩ |
| Maximum grid to cathode impedance (50 Hz) | $Z_{g-k(max)}$ | 500 | kΩ |
| Maximum cathode to earth impedance (50 Hz) | $Z_{k-e(max)}$ | 100 | kΩ |

* For series operation the surge heater voltage must not exceed 9.5V r.m.s. when the the supply is switched on. When used in a series heater chain a current limiting device may be necessary in the circuit to ensure that this voltage is not exceeded.

† Adequate precautions should be taken to ensure that the equipment is protected from damage which may be caused by a possible high voltage flashover within the cathode ray tube.

## PHOSPHOR SCREEN

This tube is usually supplied with LD phosphor (F21-10LD) giving an orange trace of very long persistence. Other phosphors can be made available to special order.

## INTER - ELECTRODE CAPACITANCES

| | | | |
|---|---|---|---|
| Cathode to all | $c_{k\text{-}all}$ | < 6.0 | pF |
| Grid to all | $c_{g\text{-}all}$ | < 10 | pF |
| Anodes 2 and 4 to external conductive coating M (approx.) | $c_{a2+a4\text{-}M}$ | 1000 | pF |

## TYPICAL OPERATION

| | | | |
|---|---|---|---|
| Second and fourth anode voltage | $V_{a2+a4}$ | 14 | kV |
| Third anode voltage range for focus | $V_{a3}$ | 0 to 400 | V |
| First anode voltage | $V_{a1}$ | 600 | V |
| Grid to cathode voltage for visual extinction of focused spot | $V_{g\text{-}k}$* | -32 to -48 | V |
| Cathode to grid voltage for visual extinction of focused spot | $V_{k\text{-}g}$* | 30 to 45 | V |
| Average peak to peak modulating voltage for modulation up to 150 $\mu$A | | 25 † | V |
| LD screen persistence to 10% (approximate) | | 4.0 | s |

The LD screen is liable to burn even at low values of beam current if operated with stationary or slow moving spot.

If this tube is operated at voltages in excess of 16 kV, x-ray radiation shielding may be necessary to avoid possible danger of personal injury from prolonged exposure at close range. The normal glass protective viewing window may provide such a safeguard. If the radiation measured in contact with this window does not exceed 0.5 milliröntgens per hour, the window will normally provide adequate protection.

* For grid modulation, all voltages are measured with respect to the cathode. For cathode modulation, all voltages are measured with respect to the grid.

† Grid modulation from spot cut-off.

**TUBE WEIGHT** (approximate) - 2.6 kg (5 lb 10 oz)

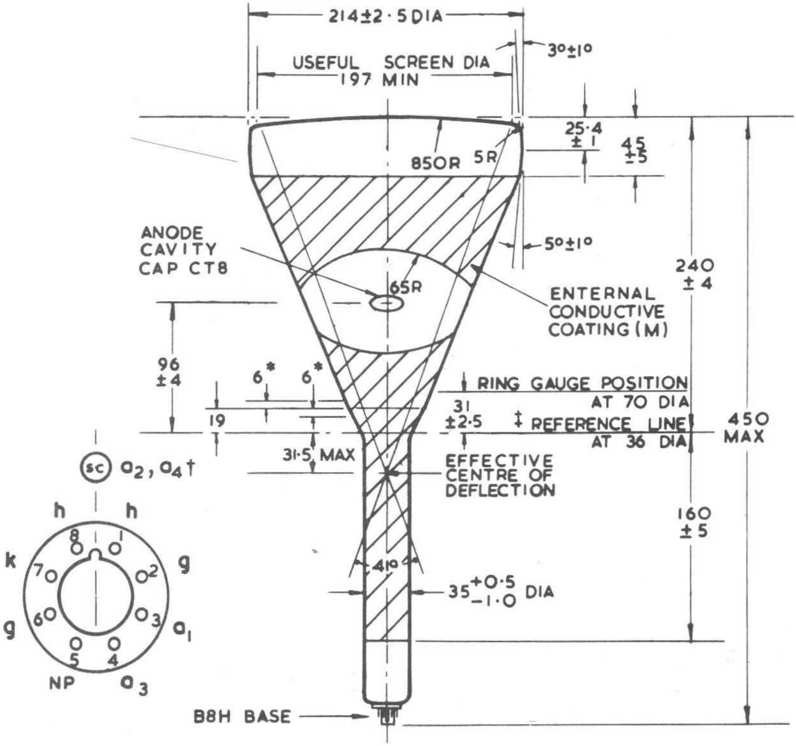
**MOUNTING** - unrestricted

The tube should not be supported by the base alone and under no circumstances should the socket be used to support the tube.

The external conductive coating (M) of this tube should be connected to chassis. The capacitance between this coating and final anode may be used to provide smoothing for the e.h.t. supply.

When flashover protection is incorporated the chassis return path of M should be made in a manner appropriate to the protection system employed.

Tubes incorporating a B8H Sparkguard base will have a suffix letter after the type number. For details of the Sparkguard bases see separate sheets.




All dimensions in mm

Not to be scaled

* Weld is contained within this area (12 mm)

† Anode cap in line with spigot ± 10°.

‡ Gauge 36 mm I/D x 100 mm long to slide freely over neck.

There is an annular region of anti-corona coating with an external diameter of 75 mm surrounding the CT8 cap, the tube should not be handled in this region.

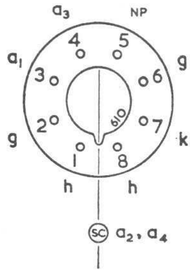
The projected neck axis shall pass within 3.5 mm of the geometric centre of the tube face.

The eccentricity of the neck axis with respect to a line perpendicular to the geometric centre of the tube face shall not exceed 4.0 mm at the deflection centre and 4.5 mm at a point 102 mm from the reference line.

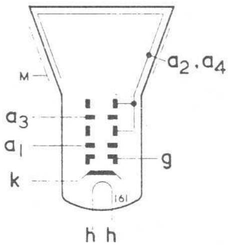
# Radar Tube

# F21-12LC

**Maintenance Type**




B8H Base, CT8 Cap




## GENERAL

| | | | |
|---|---|---|---|
| Round Face | —$8\frac{1}{2}$ in. Diameter | Deflection Angle | —65° Diameter |
| Electrostatic Focus | —Magnetic Deflection | Aluminised Screen | —Orange Trace |
| Straight Gun | —Non Ion Trap | LC Phosphor | —Very Long Persistence |

External Conductive Coating

| | | | |
|---|---|---|---|
| Heater Voltage | $V_h$ | 6·3* | V |
| Heater Current | $I_h$ | 0·3 | A |

## ABSOLUTE RATINGS

| | | | |
|---|---|---|---|
| Maximum Second and Fourth Anode Voltage | $V_{a2,a4(max)}$ | 18† | kV |
| Minimum Second and Fourth Anode Voltage | $V_{a2,a4(min)}$ | 10 | kV |
| Maximum Third Anode Voltage (Range) | $V_{a3(max)}$ | +1000 to −300 | V |
| Maximum First Anode Voltage | $V_{a1(max)}$ | 800 | V |
| Minimum First Anode Voltage | $V_{a1(min)}$ | 400 | V |
| Maximum Heater to Cathode Voltage, | $V_{h\text{-}k(max)}$ | | |
| Heater Negative (d.c.) | | 200 | V |
| Heater Positive (d.c.) | | 125 | V |
| Maximum Peak Heater to Cathode Voltage, | $v_{h\text{-}k(pk)max}$ | | |
| Heater Negative | | 300 | V |
| Heater Positive | | 250 | V |
| Maximum Negative Grid Voltage | $-V_{g(max)}$ | 150 | V |
| Minimum Peak Negative Grid Voltage | $-v_{g(pk)min}$ | 1·0 | V |
| Maximum First Anode Current | $I_{a1(max)}$ | ±15 | μA |
| Maximum Third Anode Current | $I_{a3(max)}$ | ±15 | μA |
| Maximum Heater to Cathode Resistance | $R_{h\text{-}k(max)}$ | 1·0 | MΩ |
| Maximum Grid to Cathode Resistance | $R_{g\text{-}k(max)}$ | 1·5 | MΩ |
| Maximum Grid to Cathode Impedance (f=50 Hz) | $Z_{g\text{-}k(max)}$ | 500 | kΩ |
| Maximum Cathode to Earth Impedance (f=50 Hz) | $Z_{k\text{-}e(max)}$ | 100 | kΩ |

All voltages referred to cathode.

* For series operation the surge heater voltage must not exceed 9·5V R.M.S. when the supply is switched on. When used in a series heater chain a current limiting device may be necessary in the circuit to ensure that this voltage is not exceeded.

† Adequate precautions should be taken to ensure that the associated equipment is protected from damage which may be caused by a possible high voltage flashover within the cathode ray tube.

Tubes incorporating a B8H sparkguard base will have a suffix S after the type number. For details of the sparkguard base see separate sheet.

RADAR TUBES

## INTER-ELECTRODE CAPACITANCES

| | | | |
|---|---|---|---|
| Grid to all | $c_{g\text{-}all}$ | <10 | pF |
| Cathode to all | $c_{k\text{-}all}$ | <6·0 | pF |
| Anode 2 and Anode 4 to External Conductive Coating (approx.) | $c_{a2,a4\text{-}M}$ | 750 | pF |

## TYPICAL OPERATION

| | | | |
|---|---|---|---|
| Second and Fourth Anode Voltage | $V_{a2,a4}$ | 14 | kV |
| Third Anode Voltage for Focus (Range) | $V_{a3}$ | 0 to 400 | V |
| First Anode Voltage | $V_{a1}$ | 600 | V |
| Grid to Cathode Voltage for visual extinction of focused spot | $V_{g\text{-}k}$* | −32 to −48 | V |
| Cathode to Grid Voltage for visual extinction of focused spot | $V_{k\text{-}g}$* | 30 to 45 | V |
| Average Peak to Peak Modulating Voltage for modulation up to 150μA | | 25† | V |
| LC Screen Persistence | | 200‡ | s |

The LC screen is liable to burn even at low values of beam current if operated with stationary or slow-moving spot.

* For grid modulation, all voltages are measured with respect to the cathode. For cathode modulation, all voltages are measured with respect to the grid.

† Grid modulation from spot cut-off.

‡ Persistence is defined as the time taken from the cessation of continuous excitation for the luminance to decay from 1 foot lambert to approximately 1% of that value.

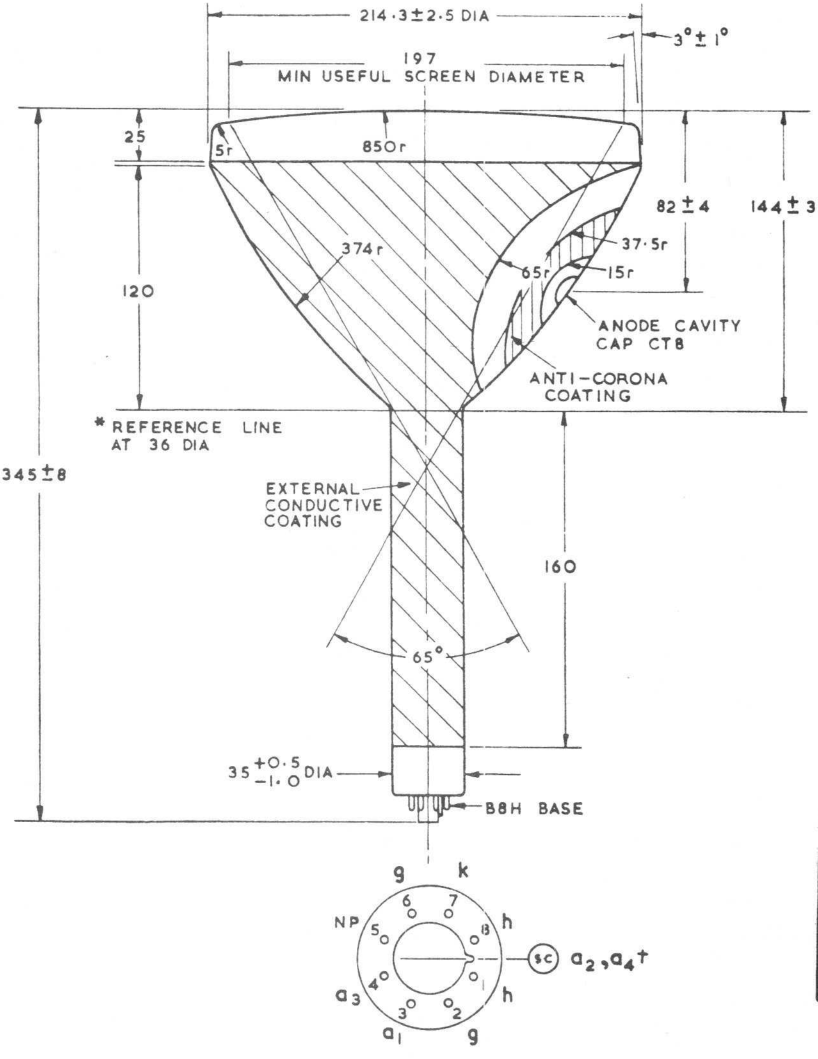
## MOUNTING POSITION : Any

The tube should not be supported by the base alone. Under no circumstances should the socket be used to support the tube.

**Tube Weight (approx.)—Net 1·7 kg (3 lb 12 oz)**

**Note**

If this tube is operated at voltages in excess of 16 kV, x-ray radiation shielding may be necessary to avoid possible danger of personal injury from prolonged exposure at close range. The normal glass protective viewing window may provide such a safeguard. If the radiation measured in contact with this window does not exceed 0·5 milliröntgens per hour, the window will normally provide adequate protection.






All dimensions in mm. Not to be scaled.

**Notes**

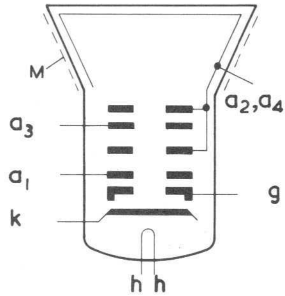
* Gauge 36 mm I/D × 100 mm long to slide freely over neck.

† Anode cap in line with base key, tolerance ± 15°.

The tube should not be handled in the region of the anti-corona coating.

# F21-130..

# Radar Tube




### GENERAL

Round face, 21 cm dia.tube 60° deflection.
Clear glass. Aluminised screen.
Electrostatic focus, magnetic deflection
29.4 mm maximum neck diameter.

| | | | |
|---|---|---|---|
| Heater voltage | $V_h$ | 6.3 | V |
| Heater current | $I_h$ | 0.3 | A |

### ABSOLUTE RATINGS - voltages referred to cathode

| | | | |
|---|---|---|---|
| Maximum second and fourth anode voltage | $V_{a2+a4(max)}$ | 18 | kV |
| Minimum second and fourth anode voltage | $V_{a2+a4(min)}$ | 10 | kV |
| Maximum third anode voltage range | $V_{a3(max)}$ | ± 500 | V |
| Maximum first anode voltage | $V_{a1(max)}$ | 550 | V |
| Maximum negative grid voltage | $-V_{g(max)}$ | 200 | V |
| Maximum peak negative grid voltage | $-v_{g(pk)max}$ | 400 | V |
| Minimum negative grid voltage | $-V_{g(min)}$ | 1.0 | V |
| Maximum heater to cathode voltage heater negative (d.c.) | $V_{h-k(max)}$ | 200 | V |
| Maximum peak heater to cathode voltage heater negative | $v_{h-k(pk)max}$ | 400* | V |
| Maximum impedance, grid to cathode (50 Hz) | $Z_{g-k(max)}$ | 0.5 | MΩ |
| Maximum resistance, grid to cathode | $R_{g-k(max)}$ | 1.5 | MΩ |

* During a warming-up period not exceeding 45 seconds.

### PHOSPHOR SCREEN

This type is usually supplied with LD phosphor (F21-130LD) giving an orange trace of very long persistence. Other phosphor screens can be made available to special order.

Tubes incorporating a B8H Sparkguard base will have a suffix letter after the type number. For details of the Sparkguard bases see separate sheets.

This data should be read in conjunction with Operational Recommendations for Industrial Cathode Ray Tubes.

## INTER-ELECTRODE CAPACITANCES

| | | | |
|---|---|---|---|
| Cathode to all | $c_{k-all}$ | 3.0* | pF |
| Grid to all | $c_{g-all}$ | 6.5* | pF |
| Anodes 2 and 4 to external conductive coating M (approx.) | $c_{a2+a4-M}$ | 800 | pF |

* Holder capacitance balanced out.

## TYPICAL OPERATION - Grid modulation, voltages referred to cathode.

| | | | |
|---|---|---|---|
| Second and fourth anode voltage | $V_{a2+a4}$ | 14 | kV |
| First anode voltage | $V_{a1}$ | 400 | V |
| Third anode voltage range for focus | $V_{a3}$ | 0 to + 400 | V |
| Grid to cathode voltage range for cut-off of spot | $V_g$ | -34 to -78 | V |
| LD screen persistence to 10% (approx.) | | 4.0 | s |

The LD screen is liable to burn even at low values of beam current if operated with a stationary or slow-moving spot.

If this tube is operated at voltages in excess of 16 kV, x-ray radiation shielding may be necessary to avoid possible danger of personal injury from prolonged exposure at close range.

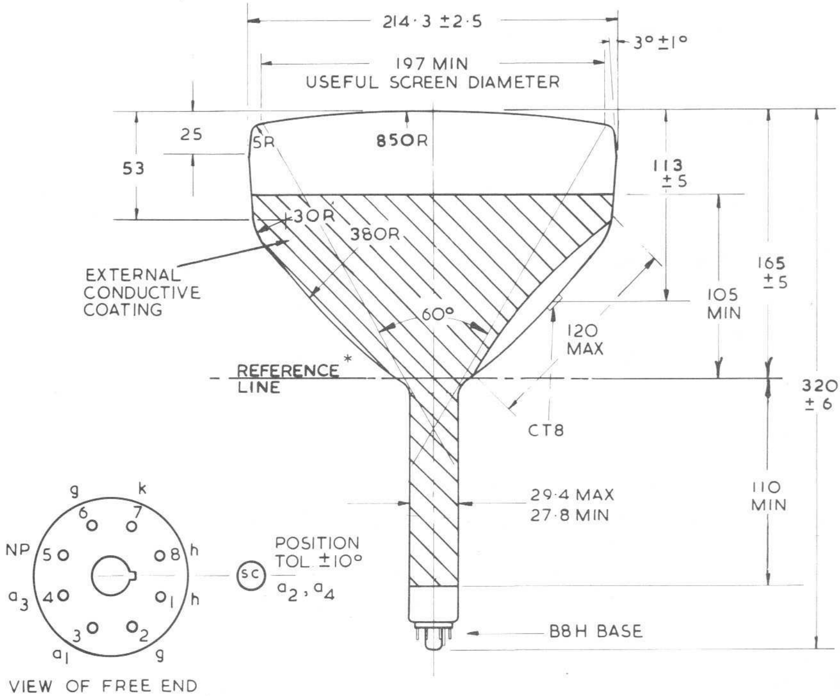
## MOUNTING

The tube can be mounted in any position. The tube socket should not be rigidly mounted but should have flexible leads and be allowed to move freely.

When flashover protection is incorporated the chassis return path of M should be made in a manner appropriate to the protection system employed.

**TUBE WEIGHT** (approximate) - net 3 kg

RADAR TUBES



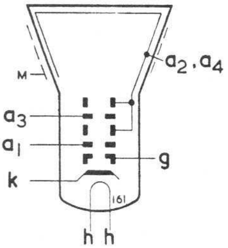

All dimensions in mm

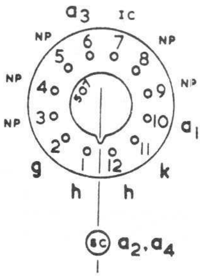
Not to be scaled

There is an annular region of anti-corona coating with an external diameter of 75 mm surrounding the CT8 cap, the tube should not be handled in this region.

* Determined by reference line gauge No. 15 (See T.D.S. No. 5-0-91-15)

# Radar Tube F22-10LD




B12A (7 pin) Base, CT8 Cap

## GENERAL

| | | | |
|---|---|---|---|
| Round Face | —9 in. Diameter | Deflection Angle | —60° Diameter |
| Electrostatic Focus | —Magnetic Deflection | Aluminised Screen | —Orange Trace |
| Straight Gun | —Non Ion Trap | LD Phosphor | —Long Persistence |

External Conductive Coating

| | | |
|---|---|---|
| Heater Voltage | $V_h$ | 6·3 V |
| Heater Current | $I_h$ | 0·3 A |

## RATINGS

| | | | |
|---|---|---|---|
| Maximum Second and Fourth Anode Voltage | $V_{a2,a4(max)}$ | 15* | kV |
| Minimum Second and Fourth Anode Voltage | $V_{a2,a4(min)}$ | 8·0 | kV |
| Maximum Third Anode Voltage | $V_{a3(max)}$ | ±500 | V |
| Maximum First Anode Voltage | $V_{a1(max)}$ | 500 | V |
| Maximum Heater to Cathode Voltage, Heater Negative (d.c.) | $V_{h-k(max)}$ | 200 | V |
| Maximum Peak Heater to Cathode Voltage, Heater Negative | $v_{h-k(pk)max}$ | 400†‡ | V |

* 15kV is a design centre rating, the absolute rating of 16·5 kV must not be exceeded.

† Absolute rating.

‡ During a warming-up period not exceeding 1 minute.

## INTER-ELECTRODE CAPACITANCES

| | | |
|---|---|---|
| Cathode to All | $c_{k-all}$ | 7·0§ pF |
| Grid to All | $c_{g-all}$ | 9·0§ pF |
| Anode 2 and Anode 4 to External Conductive Coating | $c_{a2,a4-M}$ | 750 approx pF |

§ These capacities include a typical duodecal holder.

## TYPICAL OPERATION—Grid Modulation (Voltages referred to cathode)

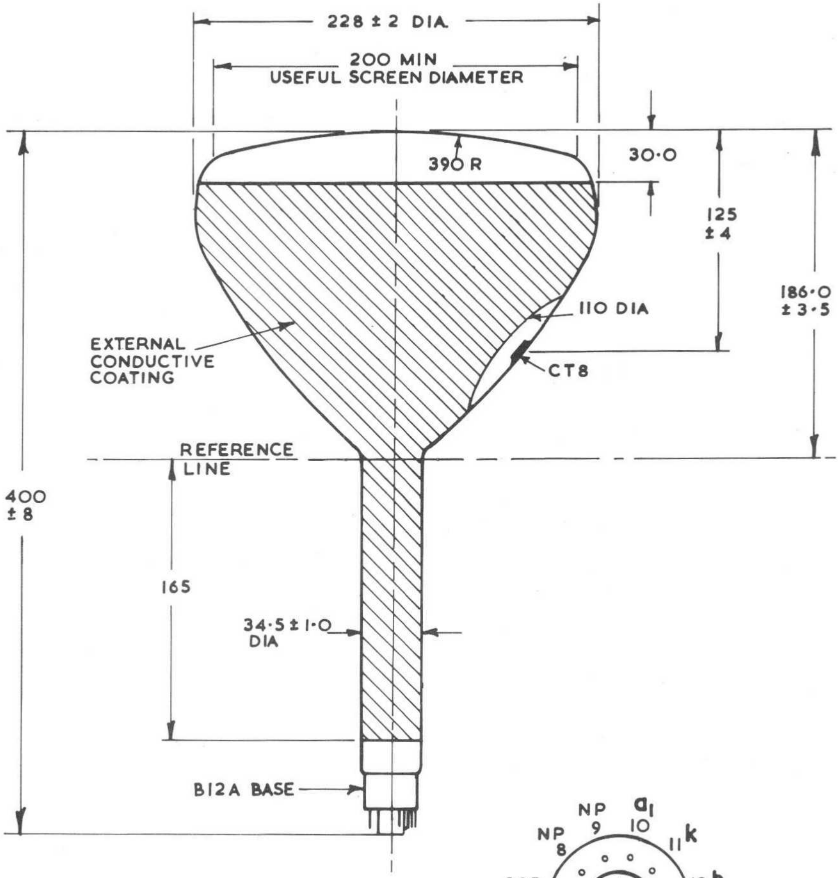
| | | | |
|---|---|---|---|
| Second and Fourth Anode Voltage | $V_{a2,a4}$ | 12 | kV |
| First Anode Voltage | $V_{a1}$ | 300 | V |
| Third Anode Voltage for Focus (Range) | $V_{a3}$ | −300 to +300 | V |
| Grid to Cathode Voltage for Cut-off of Raster | $V_g$ | −30 to −78 | V |
| Average Peak to Peak Modulating Voltage for Modulation up to 150$\mu$A | | 24 | V |
| Line Width ($I_{a2+a4}=50\mu A$) | | 0·4 to 0·6 | mm |
| LD Screen Persistence to 10% (approximate) | | 4·0 | s |

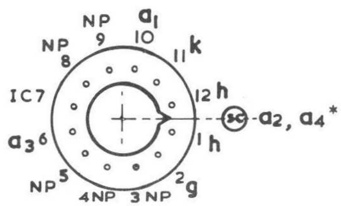
The LD screen is liable to burn even at low values of beam current if operated with stationary or slow-moving spot.

## MOUNTING POSITION—Unrestricted

**Net Tube Weight (approx) 2·7 kg (6 lb)**

RADAR TUBES




All dimensions in mm     Not to be scaled     VIEW OF FREE END

* Anode cap in line with spigot ± 15°

There is an annular region of anti-corona coating with an external diameter of 75 mm surrounding the CT8 cap, the tube should not be handled in this region.

The projected neck axis shall pass within 3.5 mm of the geometric centre of the tube face. Neck eccentricity with respect to the geometric centre of the tube face shall not exceed 4.0 mm at the deflection centre and 4.5 mm at 102 mm from the reference line.

# Radar Tube                                                    F22-11..

**GENERAL**

Round face, 22 cm tube, 60° deflection

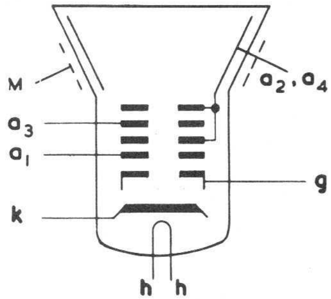
Electrostatic focus, magnetic deflection

Straight gun, non ion trap

External conductive coating

Aluminised screen

| | | | |
|---|---|---|---|
| Heater voltage | $V_h$ | 6.3 | V |
| Heater current | $I_h$ | 0.3 | A |




**ABSOLUTE RATINGS** - Voltages referred to cathode

| | | | |
|---|---|---|---|
| Maximum second and fourth anode voltage | $V_{a2+a4(max)}$ | 16.5 | kV |
| Minimum second and fourth anode voltage | $V_{a2+a4(min)}$ | 8.0 | kV |
| Maximum third anode voltage range | $V_{a3(max)}$ | ± 500 | V |
| Maximum first anode voltage | $V_{a1(max)}$ | 500 | V |
| Maximum heater to cathode voltage heater negative (d.c.) | $V_{h-k(max)}$ | 200 | V |
| Maximum peak heater to cathode voltage heater negative | $v_{h-k(pk)max}$ | 400† | V |

† During a warming-up period not exceeding 1 minute.

**PHOSPHOR SCREEN**

This type is usually supplied with LD phosphor (F22-11LD) giving an orange trace of very long persistence. Other phosphor screens can be made available to special order.

RADAR TUBES

**Thorn Radio Valves and Tubes Limited**

## INTER-ELECTRODE CAPACITANCES

| | | | |
|---|---|---|---|
| Cathode to all | $c_{k-all}$ | 7.0* | pF |
| Grid to all | $c_{g-all}$ | 9.0* | pF |
| Anodes 2 and 4 to external conductive coating, M (approx.) | $c_{a2+a4-M}$ | 750 | pF |

* Including a typical duodecal holder.

## TYPICAL OPERATION - grid modulation (voltages referred to cathode)

| | | | |
|---|---|---|---|
| Second and fourth anode voltage | $V_{a2+a4}$ | 12 | kV |
| Third anode voltage range for focus | $V_{a3}$ | -300 to +300 | V |
| First anode voltage | $V_{a1}$ | 300 | V |
| Grid to cathode voltage for cut-off of raster | $V_{g-k}$ | -30 to -78 | V |
| Average peak to peak modulating voltage for modulation up to 150 $\mu$A | | 24 | V |
| Line width at $I_{a2+a4} = 50\,\mu A$ | | 0.4 to 0.6 | mm |
| LD screen persistence to 10% (approximate) | | 4.0 | s |

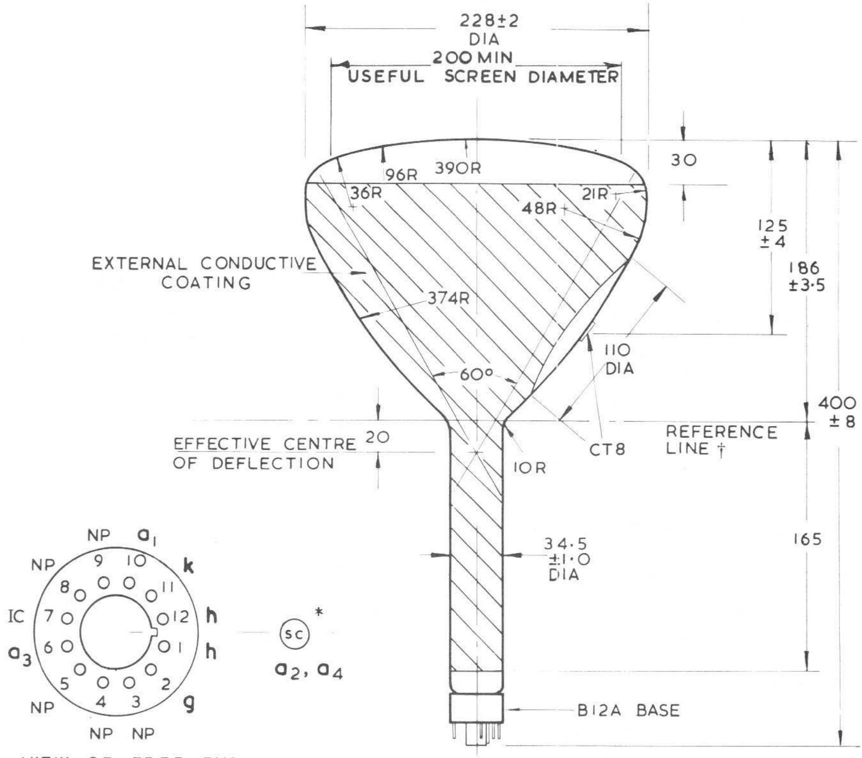
The LD screen is liable to burn even at low values of beam current if operated with a stationary or slow moving spot.

## TUBE WEIGHT (approximate) - 2.7 kg (6 lb)

## MOUNTING POSITION - unrestricted

The external conductive coating (M) of this tube should be connected to chassis. The capacitance between this coating and final anode may be used to provide smoothing for the e.h.t. supply.

When flashover protection is incorporated the chassis return path of the external conductive coating (M) should be made in a manner appropriate to the protection system employed.




VIEW OF FREE END

All dimensions in mm

Not to be scaled

* Anode cap in line with spigot ± 10°.

† Determined by 36.1 diameter ring gauge.

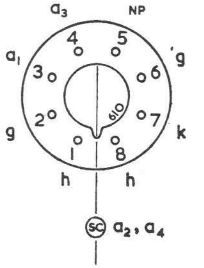
There is an annular region of anti-corona coating with an external diameter of 75 mm surrounding the CT8 cap, the tube should not be handled in this region.

The projected neck axis shall pass within 3.5 mm of the geometric centre of the tube face.

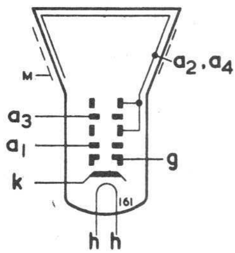
The eccentricity of the neck axis with respect to a line perpendicular to the geometric centre of the tube face shall not exceed 4.0 mm at the deflection centre and 4.5 mm at a point 102 mm from the reference line.

# F31—10LC
# F31—10LD

# Radar Tube




B8H Base, CT8 Cap




## GENERAL

| | | | |
|---|---|---|---|
| Round Face | —12 in. Diameter | Deflection Angle | —40° Diameter |
| Electrostatic Focus | —Magnetic Deflection | Aluminised Screen | —Orange Trace |
| Straight Gun | —Non Ion Trap | LC Phosphor | —Very Long Persistence |
| External Conductive Coating | | LD Phosphor | —Long Persistence |

| | | | |
|---|---|---|---|
| Heater Voltage | $V_h$ | 6·3 | V |
| Heater Current | $I_h$ | 0·3 | A |

## RATINGS.

| | | | |
|---|---|---|---|
| Maximum Second and Fourth Anode Voltage | $V_{a2,a4(max)}$ | 16* | kV |
| Minimum Second and Fourth Anode Voltage | $V_{a2,a4(min)}$ | 12 | kV |
| Maximum Third Anode Voltage Range | $V_{a3(max)}$ | +1000 to −300 | V |
| Maximum First Anode Voltage | $V_{a1(max)}$ | 800 | V |
| Maximum Heater to Cathode Voltage, Heater Negative (d.c.) | $V_{h\text{-}k(max)}$ | 200 | V |
| Maximum Peak Heater to Cathode Voltage, Heater Negative | $v_{h\text{-}k(pk)max}$ | 300†‡ | V |
| Minimum Negative Grid Voltage | $-V_{g(min)}$ | 1·0 | V |
| Maximum Negative Grid Voltage | $-V_{g(max)}$ | 200 | V |
| Maximum Grid to Cathode Resistance | $R_{g\text{-}k(max)}$ | 1·5 | MΩ |

All voltages referred to cathode.

* 16 kV is a design centre rating, the absolute rating of 18·5 kV must not be exceeded.

† Absolute rating.

‡ During a warming-up period not exceeding 1 minute.

## INTER-ELECTRODE CAPACITANCES

| | | | |
|---|---|---|---|
| Grid to all | $c_{g\text{-}all}$ | <10 | pF |
| Cathode to all | $c_{k\text{-}all}$ | < 6·0 | pF |
| Anode 2 and Anode 4 to External Conductive Coating (approx) | $c_{a2,a4\text{-}M}$ | 2500 | pF |

# Radar Tube

# F31—10LC
# F31—10LD

**TYPICAL OPERATION**—Grid Modulation (Voltages referred to Cathode)

| | | | |
|---|---|---|---|
| Second and Fourth Anode Voltage | $V_{a2,a4}$ | 15 | kV |
| First Anode Voltage | $V_{a1}$ | 600 | V |
| Third Anode Voltage for focus (Range) | $V_{a3}$ | −300 to +300 | V |
| Grid to Cathode Voltage for visual extinction of focused spot | $V_g$ | −40 to −85 | V |
| Average Peak to Peak Modulating Voltage for modulation up to 150 $\mu$A | | 25 | V |
| Persistence of LC screen | | 200§ | s |
| Persistence of LD screen | | 100§ | s |

The LC and LD screens are liable to burn even at low values of beam current if operated with stationary or slow moving spot.

If this tube is operated at voltages in excess of 16 kV, x-ray radiation shielding may be necessary to avoid possible danger of personal injury from prolonged exposure at close range. The normal glass protective viewing window may provide such a safeguard. If the radiation measured in contact with this window does not exceed 0·5 milliröntgens per hour, the window will normally provide adequate protection.

§ Persistence is defined as the time taken from the cessation of continuous excitation for the luminance to decay from 1 foot lambert to approximately 1% of that value.

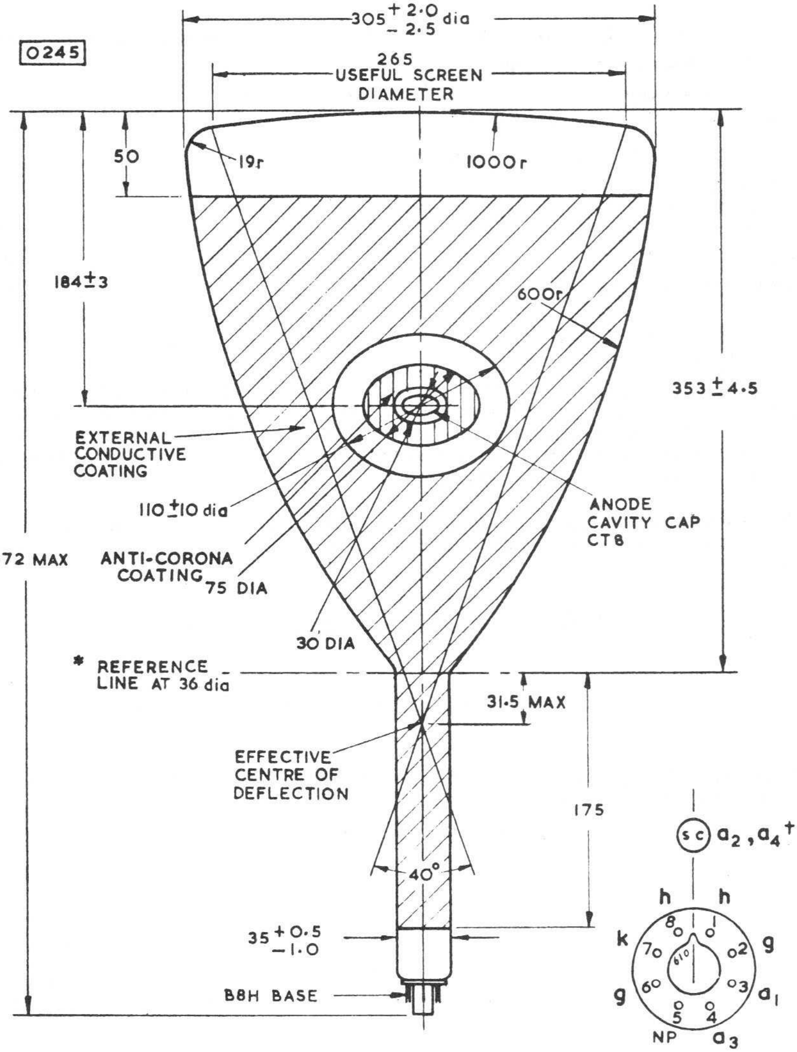
**MOUNTING POSITION**—Unrestricted

**Net Tube Weight (approx)—13 lb 8 oz (6·2 kg)**

Tubes incorporating a B8H sparkguard base will have a suffix S after the type number.
For details of the sparkguard base see separate sheet.

# F31—10LC
# F31—10LD

# Radar Tube




All dimensions in mm. Not to be scaled.

* Gauge 36 mm I/D 100 mm long to slide freely over neck.

† Anode cap in line with base key, tolerance ±15°.

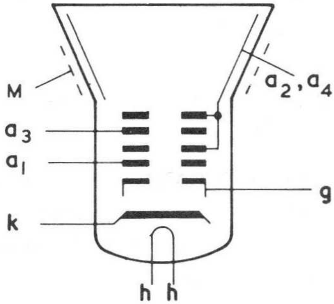
The projected neck axis shall pass within 3·5 mm of the geometric centre of the tube. Neck eccentricity with respect to the geometric centre of the tube face shall not exceed 4·0 mm at the deflection centre and 4·5 mm at 102 mm from the reference line.

The tube should not be handled in the region of the anti-corona coating.

# Radar Tube

# F31-11..

| GENERAL | | | |
|---|---|---|---|
| Round face, 12 inch tube, 50° deflection | | | |
| Electrostatic focus, magnetic deflection | | | |
| Straight gun, non ion trap | | | |
| External conductive coating | | | |
| Aluminised screen | | | |
| Heater voltage | $V_h$ | 6.3 | V |
| Heater current | $I_h$ | 0.3 | A |




**ABSOLUTE RATINGS** (voltages referred to cathode)

| | | | |
|---|---|---|---|
| Maximum second and fourth anode voltage | $V_{a2+a4(max)}$ | 18 | kV |
| Minimum second and fourth anode voltage | $V_{a2+a4(min)}$ | 8.0 | kV |
| Maximum third anode voltage | $V_{a3(max)}$ | ± 500 | V |
| Maximum first anode voltage | $V_{a1(max)}$ | 500 | V |
| Minimum first anode voltage | $V_{a1(min)}$ | 200 | V |
| Maximum negative grid voltage | $-V_{g(max)}$ | 200 | V |
| Minimum negative grid voltage | $-V_{g(min)}$ | 1.0 | V |
| Maximum heater to cathode voltage | $V_{h-k(max)}$ | 150 | V |
| Maximum heater to cathode resistance | $R_{h-k(max)}$ | 100 | kΩ |
| with separate heater transformer | | 1.0 | MΩ |

**PHOSPHOR SCREEN**

This tube is usually supplied with either LC phosphor (F31-11LC) giving an orange trace of very long persistence or LD phosphor (F31-11LD) giving an orange trace of very long persistence. Other phosphors can be made available to special order.

The F31-11LD is also known as the CV5819.

RADAR TUBES

**Thorn Radio Valves and Tubes Limited**

BRIMAR

## INTER-ELECTRODE CAPACITANCES

| | | | |
|---|---|---|---|
| Cathode to all | $c_{k-all}$ | < 8.0 | pF |
| Grid to all | $c_{g-all}$ | < 8.0 | pF |
| Anodes 2 and 4 to external conductive coating, M (approx.) | $c_{a2+a4-M}$ | 1500 | pF |

**TYPICAL OPERATION** - Grid modulation (voltages referred to cathode)

| | | | |
|---|---|---|---|
| Second and fourth anode voltage | $V_{a2+a4}$ | 14 | kV |
| Third anode voltage range for focus | $V_{a3}$ | -300 to +300 | V |
| First anode voltage | $V_{a1}$ | 300 | V |
| Grid to cathode voltage for cut-off | $V_g$ | -30 to -70 | V |

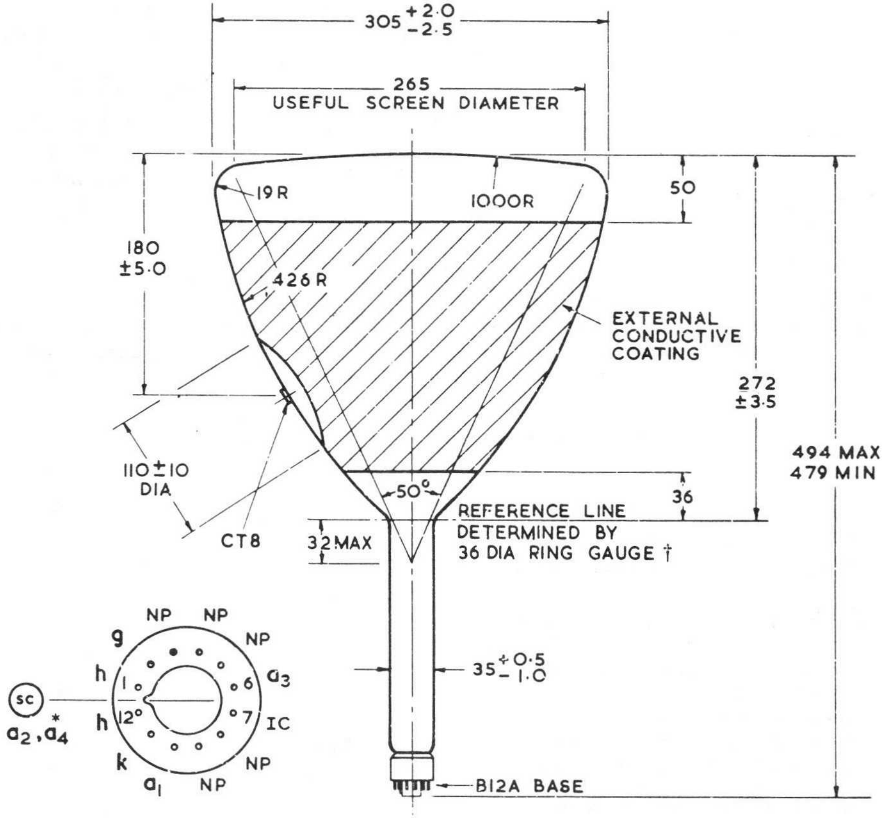
| | | |
|---|---|---|
| LC screen persistence to 10% (approximate) | 25 | s |
| LD screen persistence to 10% (approximate) | 4.0 | s |

The LC and LD screens are liable to burn even at low values of beam current if operated with stationary or slow moving spot.

If this tube is operated at voltages in excess of 16 kV, x-ray radiation shielding may be necessary to avoid possible danger of personal injury from prolonged exposure at close range. The normal glass protective viewing window may provide such a safeguard. If the radiation measured in contact with this window does not exceed 0.5 milli-rontgens per hour, the window will normally provide adequate protection.

**TUBE WEIGHT** (approximate) - 5.4 kg (12 lb)

**MOUNTING POSITION** - unrestricted




All dimensions in mm — Not to be scaled

* Anode cap in line with spigot ± 15°.

† Gauge 36 mm I/D x 100 mm long to slide freely over neck.

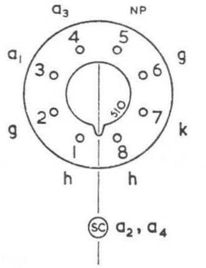
There is an annular region of anti-corona coating with an external diameter of 75 mm surrounding the CT8 cap, the tube should not be handled in this region.

The projected neck axis shall pass within 3.5 mm of the geometric centre of the tube face.

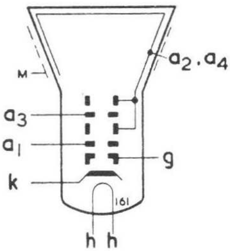
The eccentricity of the neck axis with respect to a line perpendicular to the geometric centre of the tube face shall not exceed 4.0 mm at the deflection centre and 4.5 mm at a point 102 mm from the reference line.

# F31–12..

# Radar Tube




B8H Base, CT8 Cap




## GENERAL

| | | | |
|---|---|---|---|
| Round Face | —12 inch Diameter | Deflection Angle | —40° Diameter |
| Electrostatic Focus | —Magnetic Deflection | Aluminised Screen | —Orange Trace |
| Straight Gun | —Non Ion Trap | LC Phosphor | —Very Long Persistence |

External Conductive Coating

| | | | |
|---|---|---|---|
| Heater Voltage | $V_h$ | 6·3 | V |
| Heater Current | $I_h$ | 0·3 | A |

## RATINGS

| | | | |
|---|---|---|---|
| Maximum Second and Fourth Anode Voltage | $V_{a2,a4(max)}$ | 16* | kV |
| Minimum Second and Fourth Anode Voltage | $V_{a2,a4(min)}$ | 12 | kV |
| Maximum Third Anode Voltage Range | $V_{a3(max)}$ | +1000 to −300 | V |
| Maximum First Anode Voltage | $V_{a1(max)}$ | 800 | V |
| Maximum Heater to Cathode Voltage, Heater Negative (d.c.) | $V_{h\text{-}k(max)}$ | 200 | V |
| Maximum Peak Heater to Cathode Voltage, Heater Negative | $v_{h\text{-}k(pk)max}$ | 300†‡ | V |
| Minimum Negative Grid Voltage | $-V_{g(min)}$ | 1·0 | V |
| Maximum Negative Grid Voltage | $-V_{g(max)}$ | 200 | V |
| Maximum Grid to Cathode Resistance | $R_{g\text{-}k(max)}$ | 1·5 | MΩ |

All voltages referred to cathode.

* 16 kV is a design centre rating, the absolute rating of 18·5 kV must not be exceeded.

† Absolute rating.

‡ During a warming-up period not exceeding 1 minute.

## INTER-ELECTRODE CAPACITANCES

| | | | |
|---|---|---|---|
| Grid to all | $c_{g\text{-}all}$ | <10 | pF |
| Cathode to all | $c_{k\text{-}all}$ | < 6·0 | pF |
| Anode 2 and Anode 4 to External Conductive Coating (approx) | $c_{a2,a4\text{-}M}$ | 2500 | pF |

## PHOSPHOR SCREEN

This type is usually supplied with LC phosphor (F31-12LC) giving an orange trace of very long persistence. Other phosphor screens can be made available to special order.

**TYPICAL OPERATION**—Grid Modulation (Voltages referred to Cathode)

| | | | |
|---|---|---|---|
| Second and Fourth Anode Voltage | $V_{a2,a4}$ | 16 | kV |
| First Anode Voltage | $V_{a1}$ | 600 | V |
| Third Anode Voltage for focus (Range) | $V_{a3}$ | −150 to +450 | V |
| Grid to Cathode Voltage for visual extinction of focused spot | $V_g$ | −44 to −70 | V |
| Average Peak to Peak Modulating Voltage for modulation up to 150 $\mu$A | | 25 | V |
| Persistence of LC screen | | 200§ | s |

The LC screen is liable to burn even at low values of beam current if operated with stationary or slow moving spot.

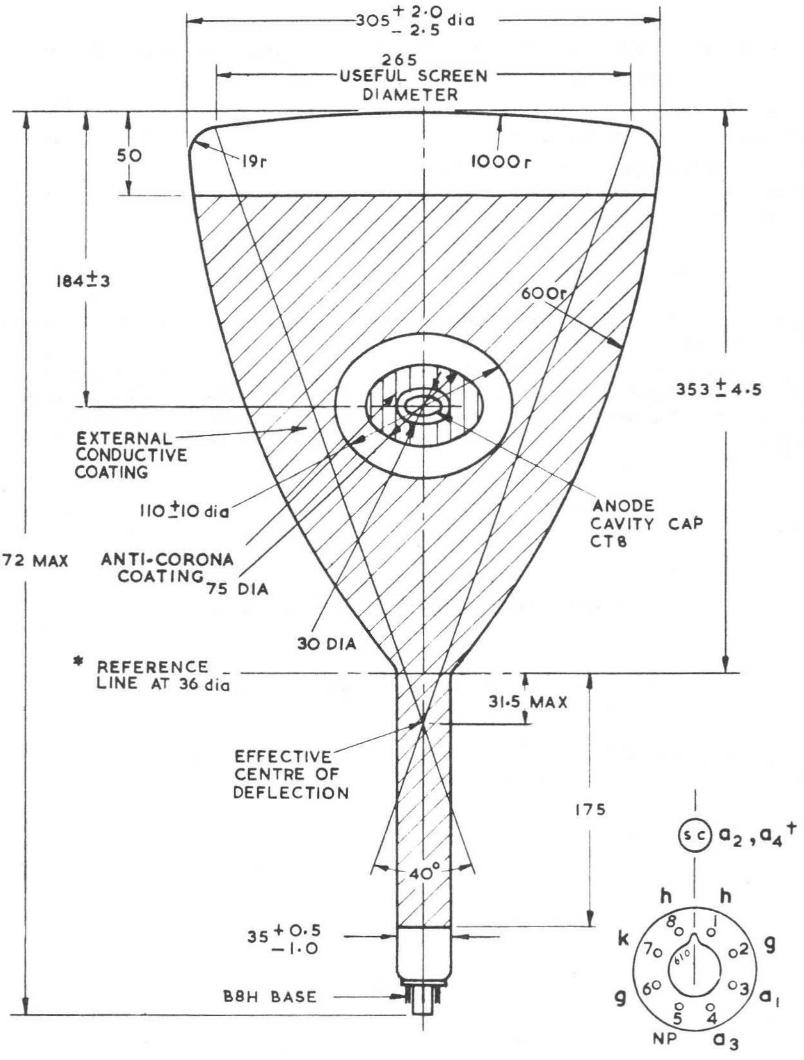
If this tube is operated at voltages in excess of 16 kV, x-ray radiation shielding may be necessary to avoid possible danger of personal injury from prolonged exposure at close range. The normal glass protective viewing window may provide such a safeguard. If the radiation measured in contact with this window does not exceed 0·5 milliröntgens per hour, the window will normally provide adequate protection.

§ Persistence is defined as the time taken from the cessation of continuous excitation for the luminance to decay from 1 foot lambert to approximately 1% of that value.

**MOUNTING POSITION**—Unrestricted

**Net Tube Weight** (approx)—**6·2 kg** (**13 lb 8 oz**)

Tubes incorporating a B8H Sparkguard base will have a suffix after the type number.
For details of the Sparkguard S base see separate sheet.




All dimensions in mm. Not to be scaled.

* Gauge 36 mm I/D 100 mm long to slide freely over neck.

† Anode cap in line with base key, tolerance ±15°.

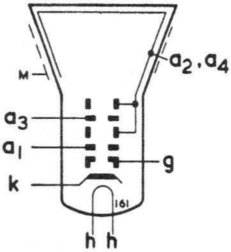
The projected neck axis shall pass within 3·5 mm of the geometric centre of the tube. Neck eccentricity with respect to the geometric centre of the tube face shall not exceed 4·0 mm at the deflection centre and 4·5 mm at 102 mm from the reference line.

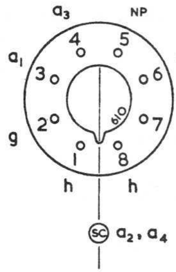
The tube should not be handled in the region of the anti-corona coating.

# Radar Tube

# F31—13LC

Maintenance Type




B8H Base, CT8 Cap

## GENERAL

| | | | |
|---|---|---|---|
| Round Face | —12 in. Diameter | Deflection Angle | —40° Diameter |
| Electrostatic Focus | —Magnetic Deflection | Aluminised Screen | —Orange Trace |
| Straight Gun | —Non Ion Trap | LC Phosphor | —Very Long Persistence |

External Conductive Coating

| | | | |
|---|---|---|---|
| Heater Voltage | $V_h$ | 6·3 | V |
| Heater Current | $I_h$ | 0·3 | A |

## RATINGS

| | | | |
|---|---|---|---|
| Maximum Second and Fourth Anode Voltage | $V_{a2,a4(max)}$ | 16* | kV |
| Minimum Second and Fourth Anode Voltage | $V_{a2,a4(min)}$ | 12 | kV |
| Maximum Third Anode Voltage Range | $V_{a3(max)}$ | +1000 to −300 | V |
| Maximum First Anode Voltage | $V_{a1(max)}$ | 800 | V |
| Maximum Heater to Cathode Voltage, Heater Negative (d.c.) | $V_{h\text{-}k(max)}$ | 200 | V |
| Maximum Peak Heater to Cathode Voltage, Heater Negative | $v_{h\text{-}k(pk)max}$ | 300†‡ | V |
| Minimum Negative Grid Voltage | $-V_{g(min)}$ | 1·0 | V |
| Maximum Negative Grid Voltage | $-V_{g(max)}$ | 200 | V |
| Maximum Grid to Cathode Resistance | $R_{g\text{-}k(max)}$ | 1·5 | MΩ |

All voltages referred to cathode.

* 16 kV is a design centre rating, the absolute rating of 18·5 kV must not be exceeded.

† Absolute rating.

‡ During a warming-up period not exceeding 1 minute.

RADAR TUBES

## INTER-ELECTRODE CAPACITANCES

| | | | |
|---|---|---|---|
| Grid to all | $c_{g\text{-}all}$ | <10 | pF |
| Cathode to all | $c_{k\text{-}all}$ | < 6·0 | pF |
| Anode 2 and Anode 4 to External Conductive Coating (approx) | $c_{a2,a4\text{-}M}$ | 2500 | pF |

**TYPICAL OPERATION**—Grid Modulation (Voltages referred to Cathode)

| | | | |
|---|---|---|---|
| Second and Fourth Anode Voltage | $V_{a2,a4}$ | 15 | kV |
| First Anode Voltage | $V_{a1}$ | 600 | V |
| Third Anode Voltage for focus (Range) | $V_{a3}$ | –300 to +300 | V |
| Grid to Cathode Voltage for visual extinction of focused spot | $V_g$ | –40 to –85 | V |
| Average Peak to Peak Modulating Voltage for modulation up to 150 $\mu$A | | 25 | V |
| Line Width ($I_{a2} + {}_{a4} = 50\mu$A) | | 0·5 to 0·7 | mm |
| Persistence of LC screen | | 200§ | s |

The LC screen is liable to burn even at low values of beam current if operated with stationary or slow moving spot.

If this tube is operated at voltages in excess of 16 kV, x-ray radiation shielding may be necessary to avoid possible danger of personal injury from prolonged exposure at close range. The normal glass protective viewing window may provide such a safeguard. If the radiation measured in contact with this window does not exceed 0·5 milliröntgens per hour, the window will normally provide adequate protection.

§ Persistence is defined as the time taken from the cessation of continuous excitation for the luminance to decay from 1 foot lambert to approximately 1% of that value.

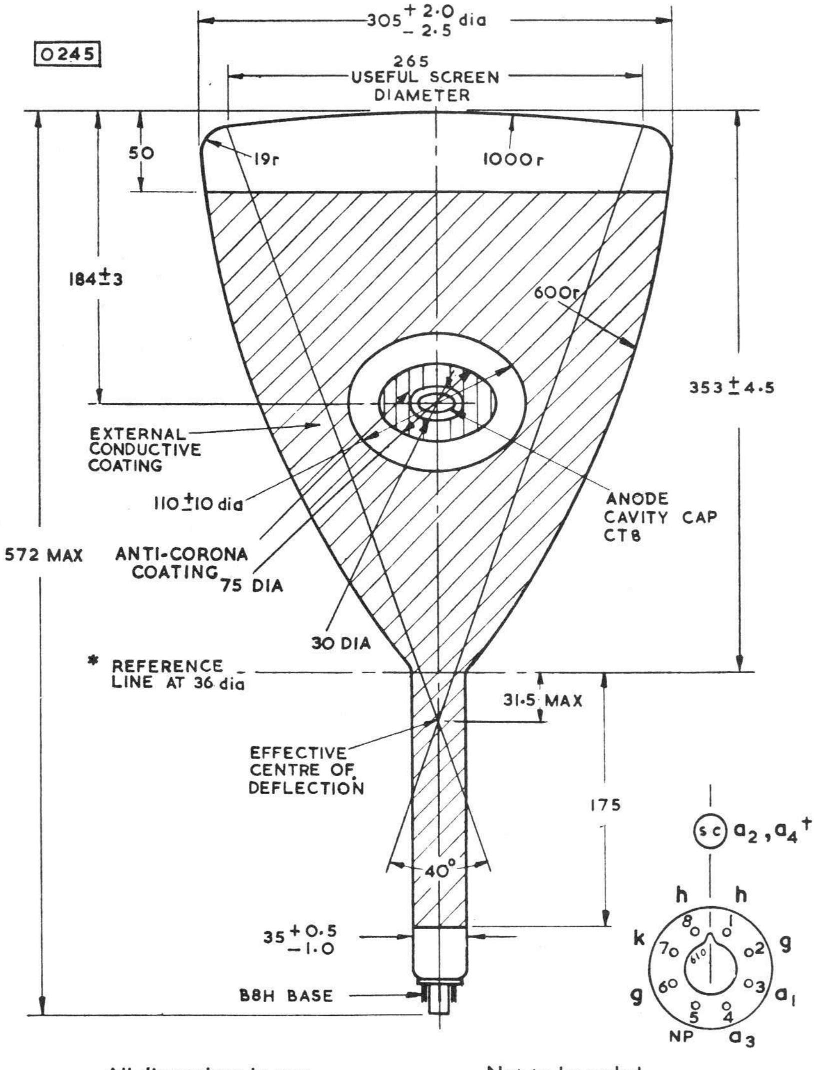
**MOUNTING POSITION**—Unrestricted

**Net Tube Weight (approx)—13 lb 8 oz (6·2 kg)**

Tubes incorporating a B8H sparkguard base will have a suffix S after the type number.
For details of the sparkguard base see separate sheet.

# Radar Tube

# F31—13LC




All dimensions in mm. Not to be scaled.

* Gauge 36 mm I/D 100 mm long to slide freely over neck.

† Anode cap in line with base key, tolerance ±15°.

The projected neck axis shall pass within 3·5 mm of the geometric centre of the tube. Neck eccentricity with respect to the geometric centre of the tube face shall not exceed 4·0 mm at the deflection centre and 4·5 mm at 102 mm from the reference line.

The tube should not be handled in the region of the anti-corona coating.

RADAR TUBES

# F31-14..

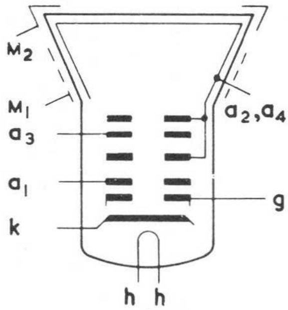
# Radar Tube

**Maintenance Type**

**GENERAL**

Rectangular face, 12 inch, 110° diagonal
Rimband reinforced envelope
29.4mm maximum neck diameter
Electrostatic focus, magnetic deflection
Straight gun, aluminised screen
Grey glass, 50% transmission (approx.)
External conductive coating

| | | | |
|---|---|---|---|
| Heater voltage | $V_h$ | 6.3 | V |
| Heater current | $I_h$ | 0.3* | A |




**DESIGN CENTRE RATINGS**

| | | | |
|---|---|---|---|
| Maximum second and fourth anode voltage | $V_{a2+a4(max)}$ | 13.5† | kV |
| Minimum second and fourth anode voltage | $V_{a2+a4(min)}$ | 10.5 | kV |
| Maximum third anode voltage | $V_{a3(max)}$ | +1000 to -500 | V |
| Maximum first anode voltage | $V_{a1(max)}$ | 550 | V |
| Maximum heater to cathode voltage, heater negative (d.c.) | $V_{h-k(max)}$ | 250 | V |
| Maximum peak heater to cathode voltage, heater negative (absolute rating) | $v_{h-k(pk)max}$ | 400§ | V |
| Maximum impedance, grid to cathode (50 Hz) | $Z_{g-k(max)}$ | 0.5 | MΩ |
| Maximum resistance, grid to cathode | $R_{g-k(max)}$ | 1.5 | MΩ |

All voltages referred to cathode

* In a series heater chain the CRT should always be connected at the chassis end.

† The absolute rating of 16.5 kV must not be exceeded.

§ During a warming up period not exceeding 45 seconds.

**PHOSPHOR SCREEN**

This type is usually supplied with LD phosphor (F31-14LD) giving an orange trace of very long persistence. Other phosphors can be made available to special order .

Tubes incorporating a B8H Sparkguard base will have a suffix letter after the type number. For details of the Sparkguard bases see separate sheets.

**Thorn Radio Valves and Tubes Limited**

## INTER-ELECTRODE CAPACITANCES

| | | * | | † | |
|---|---|---|---|---|---|
| Cathode to all | $c_{k-all}$ | 3.0 | | 3.5 | pF |
| Grid to all | $c_{g-all}$ | 6.5 | | 8.0 | pF |
| Anodes 2 and 4 to coating $M_1$ (approx.) | $c_{a2+a4-M_1}$ | | 450 | | pF |
| Anodes 2 and 4 to band $M_2$ (approx.) | $c_{a2+a4-M_2}$ | | 150 | | pF |

* Holder capacitance balanced out.

† Total capacitances including a typical B8H holder.

## TYPICAL OPERATION - Grid modulation, voltages referred to cathode.

| | | | |
|---|---|---|---|
| Second and fourth anode voltage | $V_{a2+a4-k}$ | 12 | kV |
| First anode voltage | $V_{a1-k}$ | 400 | V |
| Third anode voltage range for focus | $V_{a3-k}$ | 0 to 400 | V |
| Final anode current (peak) | $i_{a2+a4(pk)}$ | 200 | μA |
| Average peak to peak picture modulating voltage | | 29 | V |
| Grid to cathode voltage range for cut-off of raster | $V_{g-k}$ | -40 to -77 | V |
| LD screen persistence to 10% (approx.) | | 4.0 | s |

## TYPICAL OPERATION - Cathode modulation, voltages referred to grid

| | | | |
|---|---|---|---|
| Second and fourth anode voltage | $V_{a2+a4-g}$ | 12 | kV |
| First anode voltage | $V_{a1-g}$ | 400 | V |
| Third anode voltage range for focus | $V_{a3-g}$ | 0 to 400 | V |
| Final anode current (peak) | $i_{a2+a4(pk)}$ | 200 | μA |
| Average peak to peak picture modulating voltage | | 25 | V |
| Cathode to grid voltage range for cut-off of raster | $V_{k-g}$ | 36 to 66 | V |
| LD screen persistence to 10% (approx.) | | 4.0 | s |

The LD screen is liable to burn even at low values of beam current if operated with stationary or slow moving spot.

## PICTURE CENTRING

| | | |
|---|---|---|
| Maximum magnet flux density at centre of neck should not be less than | 15 | Gs |
| Maximum distance of centre of magnetic field from reference line | 53 | mm |

## DEFLECTION ANGLES

Height 80° Width 99° Diagonal 110°

## MOUNTING

This tube is intended for 'push-through' presentation without masking, but if a mask is used it should be flexible enough to take up small variations in fixing and bulb contours.

There is an annular region of anti-corona coating with external diameter of 75 mm surrounding the CT8 cap, the tube should not be handled in this region.

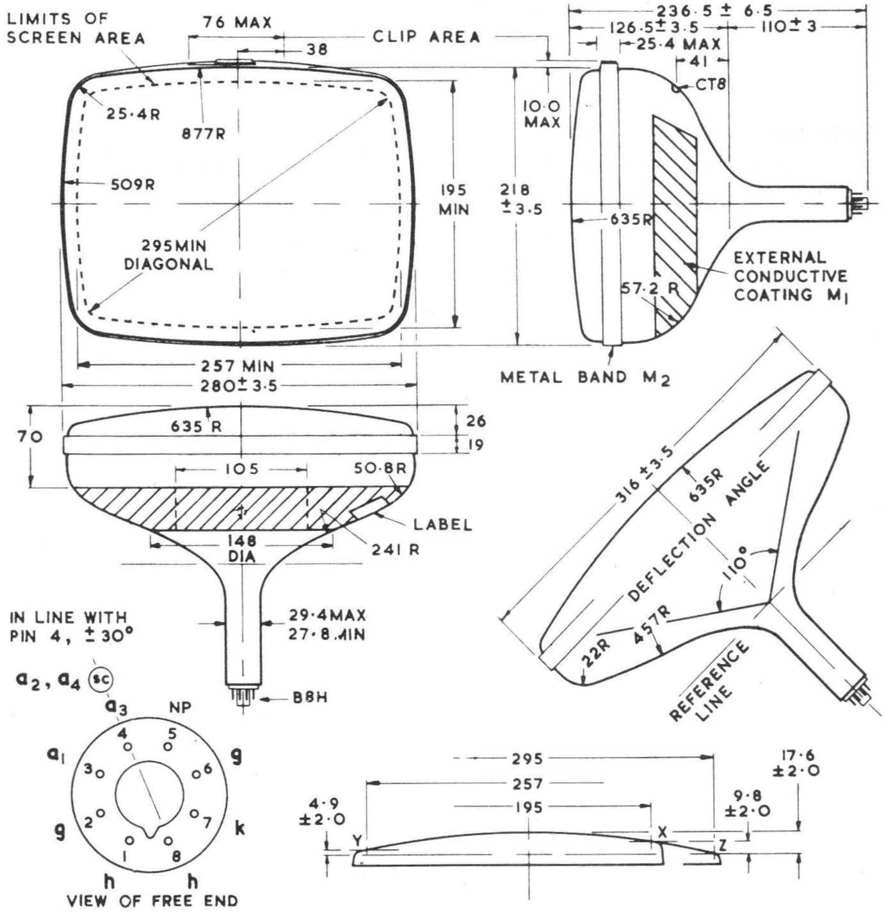
The tube can be mounted in any position. The tube socket should not be rigidly mounted but should have flexible leads and be allowed to move freely. The bottom circumference of the base shell will fall within a circle of 44 mm diameter which is centred on the perpendicular from the centre of the face.

The external conductive coating ($M_1$) of this tube should be connected to chassis. The capacitance between this coating and final anode may be used to provide smoothing for the e.h.t. supply.

The metal rimband ($M_2$) should be connected directly to the chassis in a.c. equipment operating from an isolating transformer, or via a suitable leakage path in a.c. / d.c. equipment, for example 2 MΩ.

When flashover protection is incorporated the chassis return paths of $M_1$ and $M_2$ should be made in a manner appropriate to the protection system employed.

**TUBE WEIGHT** (approximate) - net 2.7 kg (6.0 lb)




All dimensions in mm

Not to be scaled

† Determined by Reference Gauge No.16. (JEDEC No. 126)

# Radar Tube

The F31-111.. is the F31-11.. with increased line width.

## PHOSPHOR SCREEN

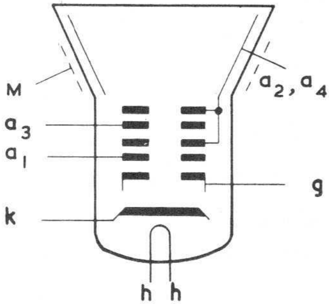
This type is usually supplied with an LC phosphor (F31-111LC) giving an orange trace of very long persistence. Other phosphors can be made available to special order.

# Radar Tube **F31-112..**

## GENERAL

Round face, 12 inch tube, 50° deflection
Electrostatic focus, magnetic deflection
Straight gun, aluminised screen
Clear glass, external conductive coating
35.5 mm maximum neck diameter

| | | | |
|---|---|---|---|
| Heater voltage | $V_h$ | 6.3 | V |
| Heater current | $I_h$ | 0.3 | A |




## ABSOLUTE RATINGS (voltages referred to cathode)

| | | | |
|---|---|---|---|
| Maximum second and fourth anode voltage | $V_{a2+a4(max)}$ | 18 | kV |
| Minimum second and fourth anode voltage | $V_{a2+a4(min)}$ | 10 | kV |
| Maximum third anode voltage | $V_{a3(max)}$ | +1000 to -300 | V |
| Maximum first anode voltage | $V_{a1(max)}$ | 800 | V |
| Minimum first anode voltage | $V_{a1(min)}$ | 400 | V |
| Maximum negative grid voltage | $-V_{g(max)}$ | 150 | V |
| Minimum negative grid voltage | $-V_{g(min)}$ | 1.0 | V |
| Maximum heater to cathode voltage | $V_{h-k(max)}$ | | |
| heater negative (d.c.) | | 200 | V |
| heater positive (d.c.) | | 150 | V |
| Maximum peak heater to cathode voltage | $v_{h-k(pk)max}$ | | |
| heater negative | | 300 | V |
| heater positive | | 250 | V |
| Maximum heater to cathode resistance | $R_{h-k(max)}$ | 1.0 | MΩ |
| Maximum grid to cathode resistance | $R_{g-k(max)}$ | 1.5 | MΩ |
| Maximum grid to cathode impedance (50 Hz) | $Z_{g-k(max)}$ | 500 | kΩ |
| Maximum cathode to earth impedance (50 Hz) | $Z_{k-e(max)}$ | 100 | kΩ |

RADAR TUBES

## PHOSPHOR SCREEN

This tube is usually supplied with LD phosphor (F31-112LD) giving an orange trace of very long persistence. Other phosphors can be made available to special order. .

## NECK LENGTH

This tube has an extended neck length to accomodate an auxiliary high frequency deflector coil.

**Thorn Radio Valves and Tubes Limited**

BRIMAR

## INTER-ELECTRODE CAPACITANCES

| | | | |
|---|---|---|---|
| Cathode to all | $c_{k-all}$ | 3.5 | pF |
| Grid to all | $c_{g-all}$ | 7.5 | pF |
| Anodes 2 and 4 to external conductive coating, M (approx.) | $c_{a2+a4-M}$ | 1500 | pF |

## TYPICAL OPERATION

| | | | |
|---|---|---|---|
| Second and fourth anode voltage | $V_{a2+a4}$ | 14 | kV |
| Third anode voltage range for focus | $V_{a3}$ | 0 to 400 | V |
| First anode voltage | $V_{a1}$ | 600 | V |
| Grid to cathode voltage for visual extinction of focused spot | $V_{g-k}$* | -32 to -48 | V |
| Cathode to grid voltage for visual extinction of focused spot | $V_{k-g}$* | 30 to 45 | V |
| Average peak to peak modulating voltage for modulation up to 150 μA | | 25 † | V |
| LC screen persistence to 10% (approximate) | | 25 | s |
| LD screen persistence to 10% (approximate) | | 4.0 | s |

The LC and LD screens are liable to burn even at low values of beam current if operated with stationary or slow moving spot.

If this tube is operated at voltages in excess of 16 kV, x-ray radiation shielding may be necessary to avoid possible danger of personal injury from prolonged exposure at close range. The normal glass protective viewing window may provide such a safeguard. If the radiation measured in contact with this window does not exceed 0.5 milliröntgens per hour, the window will normally provide adequate protection.

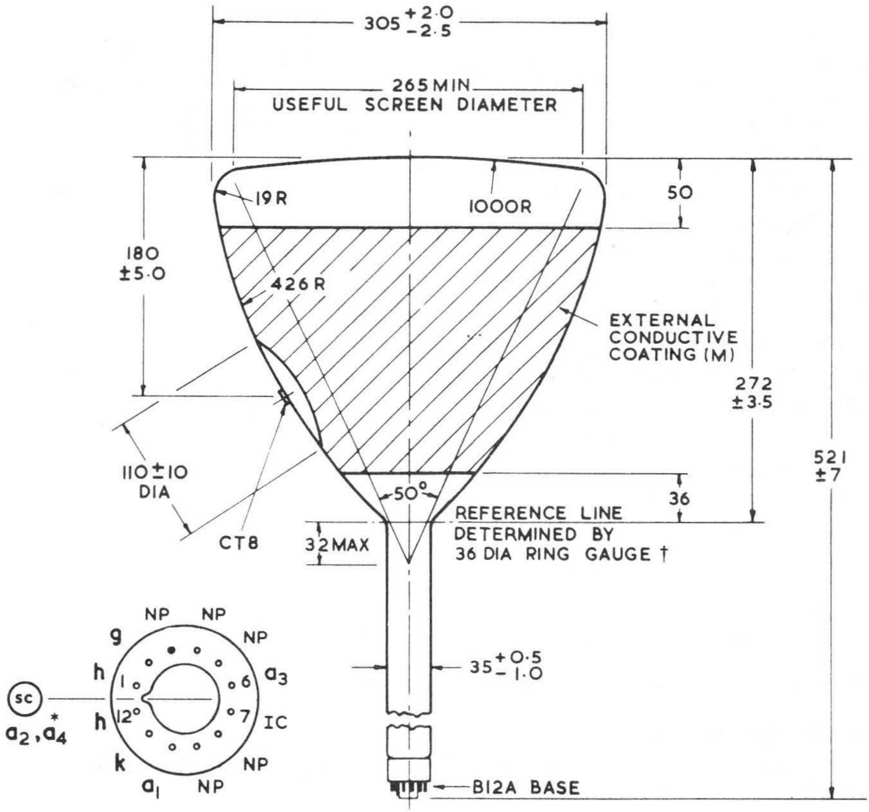
* For grid modulation, all voltages are measured with respect to the cathode. For cathode modulation, all voltages are measured with respect to the grid.

† Grid modulation from spot cut-off.

**TUBE WEIGHT** (approximate) - 5.4 kg (12 lb)

**MOUNTING** - unrestricted

The external conductive coating (M) of this tube should be connected to chassis. The capacitance between this coating and final anode may be used to provide smoothing for the e.h.t. supply.
When flashover protection is incorporated the chassis return path of M should be made in a manner appropriate to the protection system employed.




**All dimensions in mm** **Not to be scaled**

* Anode cap in line with spigot ± 10°.

† Gauge 36 mm I/D x 100 mm long to slide freely over neck.

There is an annular region of anti-corona coating with an external diameter of 75 mm surrounding the CT8 cap, the tube should not be handled in this region.

The projected neck axis shall pass within 3.5 mm of the geometric centre of the tube face.

The eccentricity of the neck axis with respect to a line perpendicular to the geometric centre of the tube face shall not exceed 4.0 mm at the deflection centre and 4.5 mm at a point 102 mm from the reference line.

It is recommended that the deflector coil assembly including "position" and "write" coils should not extend further than 100 mm from the reference line otherwise there may be undesirable interaction with the tube gun.

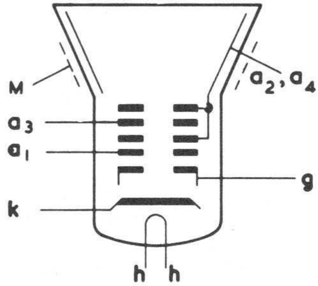
# F41-12 ..

# Radar Tube

**GENERAL**

Round face, 16 inch tube, 50° deflection
Electrostatic focus, magnetic deflection
Straight gun, non ion trap
Clear glass
External conductive coating
Aluminised screen
35.5 mm maximum neck diameter

| | | | |
|---|---|---|---|
| Heater voltage | $V_h$ | 6.3 | V |
| Heater current | $I_h$ | 0.3 | A |




**ABSOLUTE RATINGS** (voltages referred to cathode)

| | | | |
|---|---|---|---|
| Maximum second and fourth anode voltage | $V_{a2+a4(max)}$ | 20 | kV |
| Minimum second and fourth anode voltage | $V_{a2+a4(min)}$ | 10 | kV |
| Maximum third anode voltage | $V_{a3(max)}$ | ± 500 | V |
| Maximum first anode voltage | $V_{a1(max)}$ | 500 | V |
| Maximum negative grid voltage | $-V_{g(max)}$ | 200 | V |
| Minimum negative grid voltage | $-V_{g(min)}$ | 1.0 | V |
| Maximum heater to cathode voltage heater negative (d.c.) | $V_{h-k(max)}$ | 200 | V |
| Maximum peak heater to cathode voltage heater negative | $v_{h-k(pk)max}$ | 400* | V |

* During a warming up period not exceeding one minute.

**PHOSPHOR SCREEN**

This tube is usually supplied with LC phosphor ( F41-12LC) giving an orange trace of very long persistence. Other phosphors can be made available to special order.

This data should be read in conjunction with Operational Recommendations for Industrial Cathode Ray Tubes.

## INTER-ELECTRODE CAPACITANCES

| | | * | † | |
|---|---|---|---|---|
| Cathode to all | $c_{k\text{-}all}$ | 3.5 | 4.5 | pF |
| Grid to all | $c_{g\text{-}all}$ | 7.0 | 7.5 | pF |
| Anodes 2 and 4 to external conductive coating, M | $c_{a2+a4\text{-}M}$ | 1200 | | pF |

* Holder capacitance balanced out.

† Total capacitances including a typical B12A duodecal holder.

## TYPICAL OPERATION - Grid modulation (voltages referred to cathode)

| | | | |
|---|---|---|---|
| Second and fourth anode voltage | $V_{a2+a4}$ | 15 | kV |
| Third anode voltage range for focus | $V_{a3}$ | -300 to +300 | V |
| First anode voltage | $V_{a1}$ | 300 | V |
| Grid to cathode voltage for cut-off of raster | $V_g$ | -40 to -80 | V |
| Average peak to peak modulating voltage for modulation up to 150 $\mu$A | | 24 | V |
| LC screen persistence to 10% (approximate) | | 25 | s |

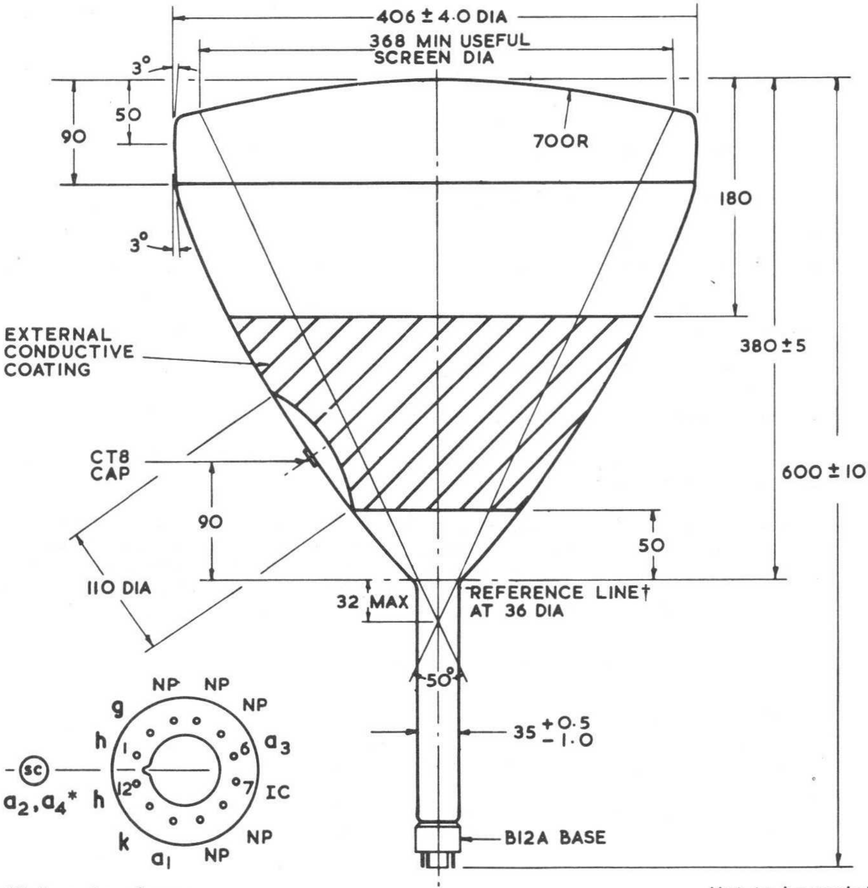
The LC screen is liable to burn even at low values of beam current if operated with a stationary or slow moving spot.

If this tube is operated at voltages in excess of 16 kV, x-ray radiation shielding may be necessary to avoid possible danger of personal injury from prolonged exposure at close range. The normal glass protective viewing window may provide such a safeguard. If the radiation measured in contact with this window does not exceed 0.5 milliröntgens per hour, the window will normally provide adequate protection.

## TUBE WEIGHT (approximate) - 11.8 kg (26 lb)

## MOUNTING POSITION - unrestricted

The external conductive coating (M) of this tube should be connected to chassis. The capacitance between this coating and final anode may be used to provide smoothing for the e.h.t. supply.
When flashover protection is incorporated the chassis return path of M should be made in a manner appropriate to the protection system employed.




All dimensions in mm

Not to be scaled

*. Anode cap in line with spigot ± 10°

† Gauge 36 I/D x 100 long to slide freely over neck.

There is an annular region of anti-corona coating with an external diameter of 75 mm surrounding the CT8 cap, the tube should not be handled in this region.

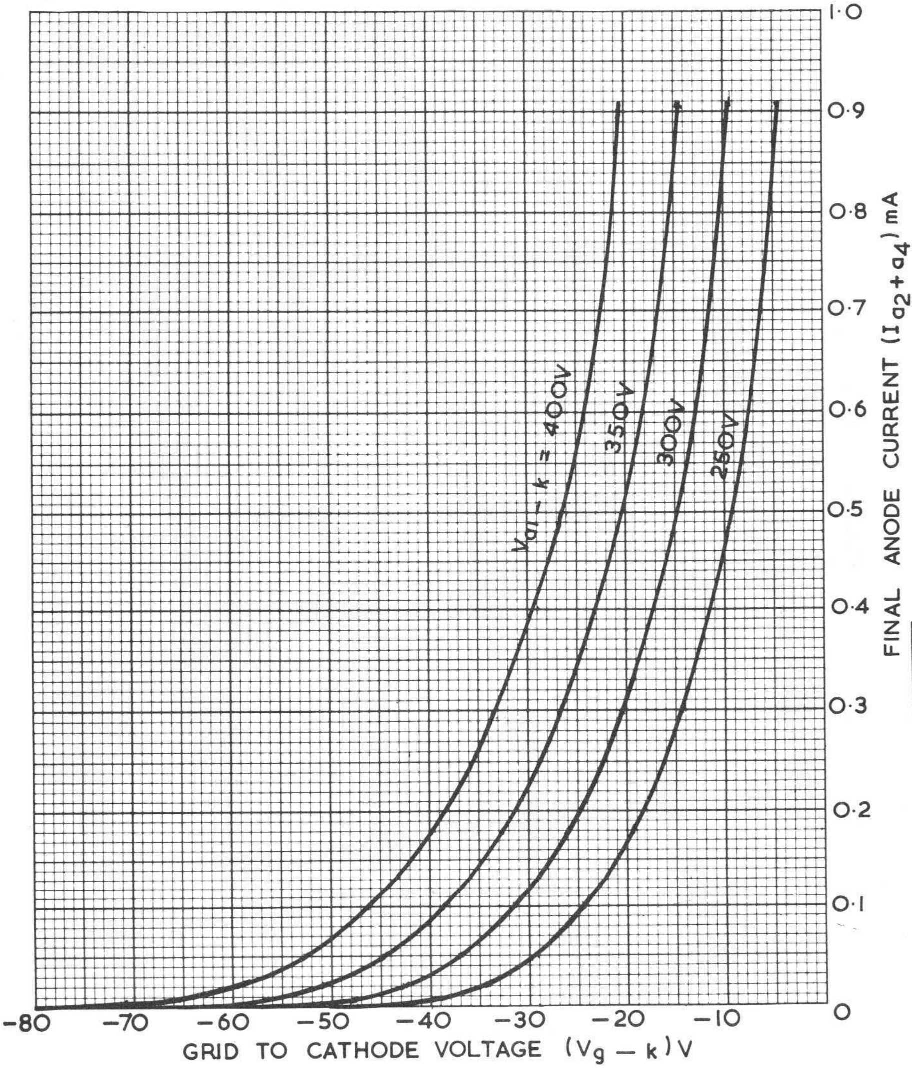
The projected neck axis shall pass within 4.0 mm of the geometric centre of the tube face. The eccentricity of the neck axis with respect to a line perpendicular to the geometric centre of the tube face shall not exceed 4.5 mm at the deflection centre and 5.0 mm at a point 102 mm from the reference line.

## GRID MODULATION $I_{a2+a4} / V_{g-k}$

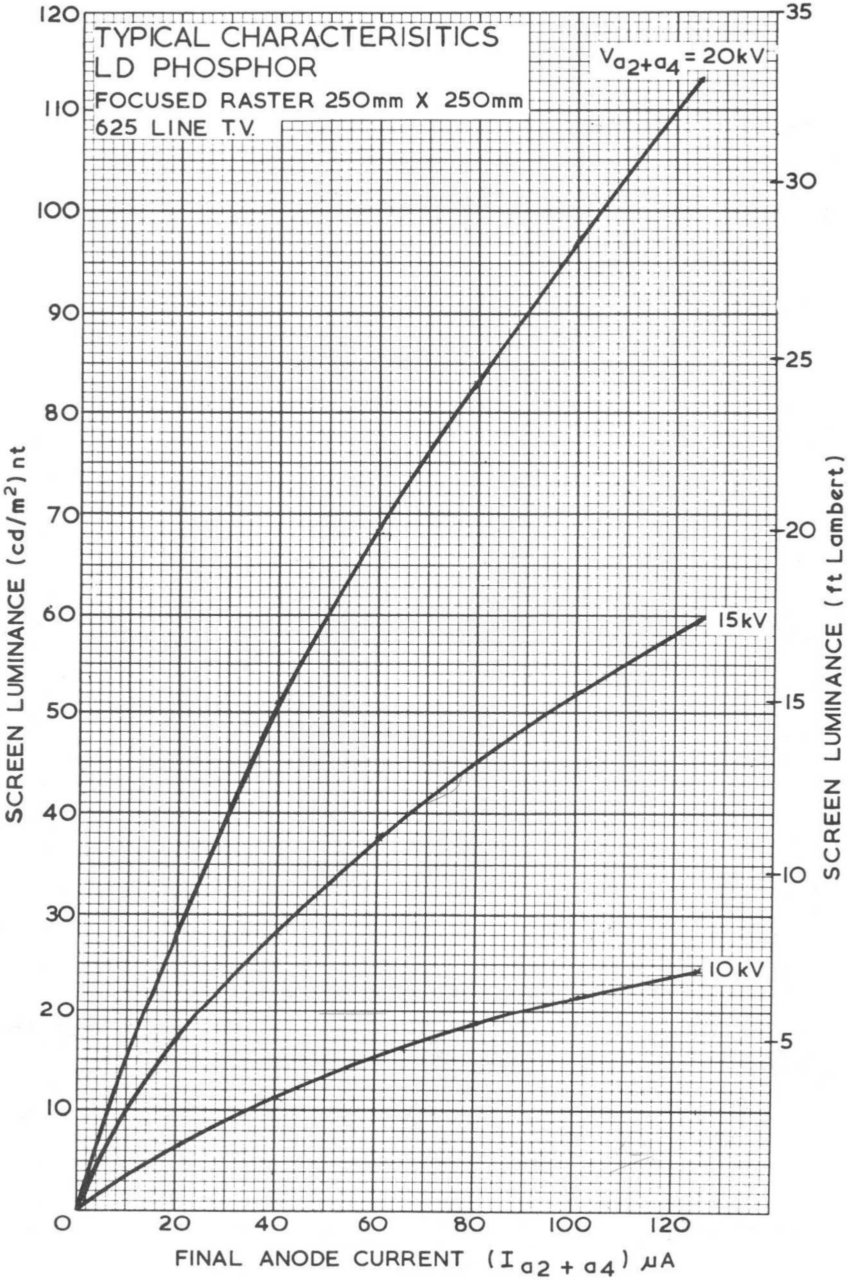
$V_{a2+a4}$ = 10 to 20 kV

FIGURES FOR EXTINCTION OF FOCUSED SPOT

| | | | | |
|---|---|---|---|---|
| $V_{a1-k}$ | 250 | 300 | 350 | 400 |
| $V_{g-k}$ | −50 | −60 | −70 | −80 |




RADAR TUBES


TYPICAL CHARACTERISITICS
LD PHOSPHOR
FOCUSED RASTER 250mm X 250mm
625 LINE T.V.
$V_{a2+a4}$ = 20kV
15kV
10kV
SCREEN LUMINANCE $(cd/m^2)$ nt
SCREEN LUMINANCE (ft Lambert)
FINAL ANODE CURRENT $(I_{a2+a4})$ µA
0
20
40
60
80
100
120
10
30
50
70
90
110
5
15
25
35

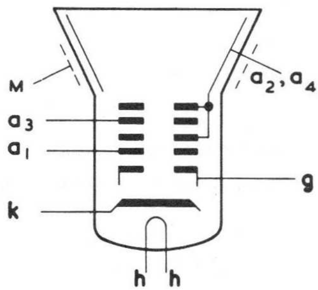
# Radar Tube

# F41–13 ..

**GENERAL**

Round face, 16 inch tube, 50° deflection
Electrostatic focus, magnetic deflection
Straight gun, non ion trap
Clear glass
External conductive coating
Aluminised screen
35.5 mm maximum neck diameter

| | | | |
|---|---|---|---|
| Heater voltage | $V_h$ | 6.3 | V |
| Heater current | $I_h$ | 0.3 | A |




**ABSOLUTE RATINGS** (voltages referred to cathode)

| | | | |
|---|---|---|---|
| Maximum second and fourth anode voltage | $V_{a2+a4(max)}$ | 20 | kV |
| Minimum second and fourth anode voltage | $V_{a2+a4(min)}$ | 10 | kV |
| Maximum third anode voltage | $V_{a3(max)}$ | ± 500 | V |
| Maximum first anode voltage | $V_{a1(max)}$ | 500 | V |
| Maximum negative grid voltage | $-V_{g(max)}$ | 200 | V |
| Minimum negative grid voltage | $-V_{g(min)}$ | 1.0 | V |
| Maximum heater to cathode voltage heater negative (d.c.) | $V_{h-k(max)}$ | 200 | V |
| Maximum peak heater to cathode voltage heater negative | $v_{h-k(pk)max}$ | 400* | V |

* During a warming up period not exceeding one minute.

**PHOSPHOR SCREEN**

This tube is usually supplied with LC phosphor ( F41-13LC ) giving an orange trace of very long persistence. Other phosphors can be made available to special order.

RADAR TUBES

This data should be read in conjunction with Operational Recommendations for Industrial Cathode Ray Tubes.

## INTER-ELECTRODE CAPACITANCES

| | | * | | † | |
|---|---|---|---|---|---|
| Cathode to all | $c_{k-all}$ | 3.5 | | 4.5 | pF |
| Grid to all | $c_{g-all}$ | 7.0 | | 7.5 | pF |
| Anodes 2 and 4 to external conductive coating, M | $c_{a2+a4-M}$ | | 1200 | | pF |

* Holder capacitance balanced out.

† Total capacitances including a typical B12A duodecal holder.

## TYPICAL OPERATION - Grid modulation (voltages referred to cathode)

| | | | |
|---|---|---|---|
| Second and fourth anode voltage | $V_{a2+a4}$ | 15 | kV |
| Third anode voltage range for focus | $V_{a3}$ | -300 to +300 | V |
| First anode voltage | $V_{a1}$ | 300 | V |
| Grid to cathode voltage for cut-off of raster | $V_g$ | -40 to -64 | V |
| Average peak to peak modulating voltage for modulation up to 150 $\mu$A | | 24 | V |
| LC screen persistence to 10% (approximate) | | 25 | s |

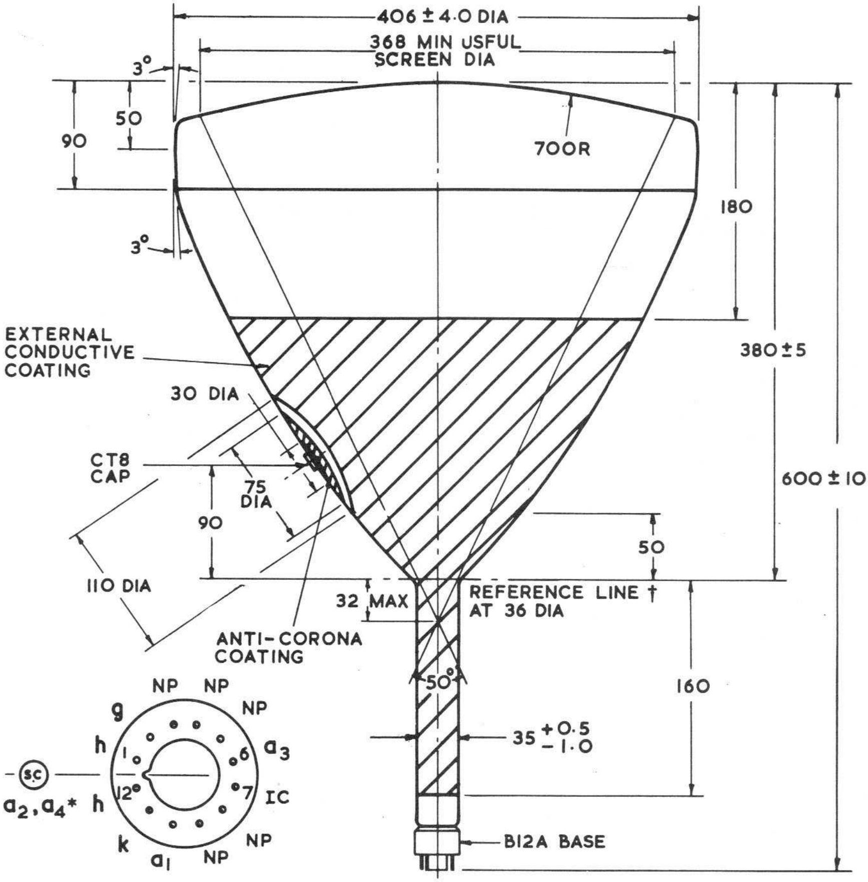
The LC screen is liable to burn even at low values of beam current if operated with a stationary or slow moving spot.

If this tube is operated at voltages in excess of 16 kV, x-ray radiation shielding may be necessary to avoid possible danger of personal injury from prolonged exposure at close range. The normal glass protective viewing window may provide such a safeguard. If the radiation measured in contact with this window does not exceed 0.5 milliröntgens per hour, the window will normally provide adequate protection.

## TUBE WEIGHT (approximate) - 11.8 kg (26 lb)

## MOUNTING POSITION - unrestricted

The external conductive coating (M) of this tube should be connected to chassis. The capacitance between this coating and final anode may be used to provide smoothing for the e.h.t. supply.
When flashover protection is incorporated the chassis return path of M should be made in a manner appropriate to the protection system employed.




All dimensions in mm

Not to be scaled

* Anode cap in line with spigot ± 10°

† Gauge 36 I/D x 100 long to slide freely over neck.

The tube should not be handled in the region of the anti-corona coating.

The projected neck axis shall pass within 4.0 mm of the geometric centre of the tube face. The eccentricity of the neck axis with respect to a line perpendicular to the geometric centre of the tube face shall not exceed 4.5 mm at the deflection centre and 5.0 mm at a point 102 mm from the reference line.

The external conductive coating of this tube should be connected to chassis. The capacitance between this coating and final anode may be used to provide smoothing for the e.h.t. supply.

The F41-14.. is the F41-12.. with an increased line width* of 0.5 to 0.7 mm at $I_{a2+a4} = 50\ \mu A$.

* Microscope measurement.

**TUBE WEIGHT** (approximate) - 11.8 kg (26 lb)

## PHOSPHOR SCREEN

This type is usually supplied with LC phosphor (F41-14LC) giving an orange trace of very long persistence. Other phosphors can be made available to special order.

For all other data please see the F41-12.. data sheets.

# Radar Tube

# F41-120..

OBSOLETE TYPE

The F41-12.. is the replacement type for the F41-120..

The F41-120.. is the F41-12.. with a grey glass face-plate having a light transmission of approximately 52%.

**TUBE WEIGHT** (approximate) - 9.0 kg (20 lb)

**PHOSPHOR SCREEN**

This type is usually supplied with LC phosphor (F41-120LC) giving an orange trace of very long persistence. Other phosphors can be made available to special order.

For all other data please see the F41-12.. data sheets.

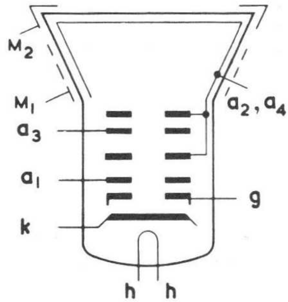
# F41-121.. Radar Tube

**Maintenance Type**

**GENERAL**

Round face, 16 inch tube, 50° deflection
Metal mounting frame
Electrostatic focus, magnetic deflection
Straight gun, non ion trap
External conductive coating
Aluminised screen

| | | | |
|---|---|---|---|
| Heater voltage | $V_h$ | 6.3 | V |
| Heater current | $I_h$ | 0.3 | A |




**ABSOLUTE RATINGS** (voltages referred to cathode)

| | | | |
|---|---|---|---|
| Maximum second and fourth anode voltage | $V_{a2+a4(max)}$ | 20 | kV |
| Minimum second and fourth anode voltage | $V_{a2+a4(min)}$ | 10 | kV |
| Maximum third anode voltage | $V_{a3(max)}$ | ± 500 | V |
| Maximum first anode voltage | $V_{a1(max)}$ | 500 | V |
| Maximum negative grid voltage | $-V_{g(max)}$ | 200 | V |
| Minimum negative grid voltage | $-V_{g(min)}$ | 1.0 | V |
| Maximum heater to cathode voltage heater negative (d.c.) | $V_{h-k(max)}$ | 200 | V |
| Maximum peak heater to cathode voltage heater negative | $v_{h-k(pk)max}$ | 400* | V |

* During a warming up period not exceeding one minute.

**PHOSPHOR SCREEN**

This tube is usually supplied with either LC phosphor (F41-121LC) giving an orange trace of very long persistence or GR phosphor (F41-121GR) giving a yellowish-green trace of very long persistence. Other phosphors can be made available to special order.

## INTER-ELECTRODE CAPACITANCES

| | | * | † | |
|---|---|---|---|---|
| Cathode to all | $c_{k\text{-}all}$ | 3.5 | 4.5 | pF |
| Grid to all | $c_{g\text{-}all}$ | 7.0 | 7.5 | pF |
| Anodes 2 and 4 to external conductive coating, $M_1$ | $c_{a2+a4\text{-}M1}$ | 1200 | | pF |
| Anodes 2 and 4 to mounting frame, $M_2$ | $c_{a2+a4\text{-}M2}$ | 250 | | pF |

* Holder capacitance balanced out.
† Total capacitances including a typical B12A duodecal holder.

**TYPICAL OPERATION** - Grid modulation (voltages referred to cathode)

| | | | |
|---|---|---|---|
| Second and fourth anode voltage | $V_{a2+a4}$ | 15 | kV |
| Third anode voltage range for focus | $V_{a3}$ | -300 to +300 | V |
| First anode voltage | $V_{a1}$ | 300 | V |
| Grid to cathode voltage for cut-off of raster | $V_g$ | -40 to -80 | V |
| Average peak to peak modulating voltage for modulation up to 150 $\mu$A | | 24 | V |
| LC screen persistence to 10% (approximate) | | 25 | s |

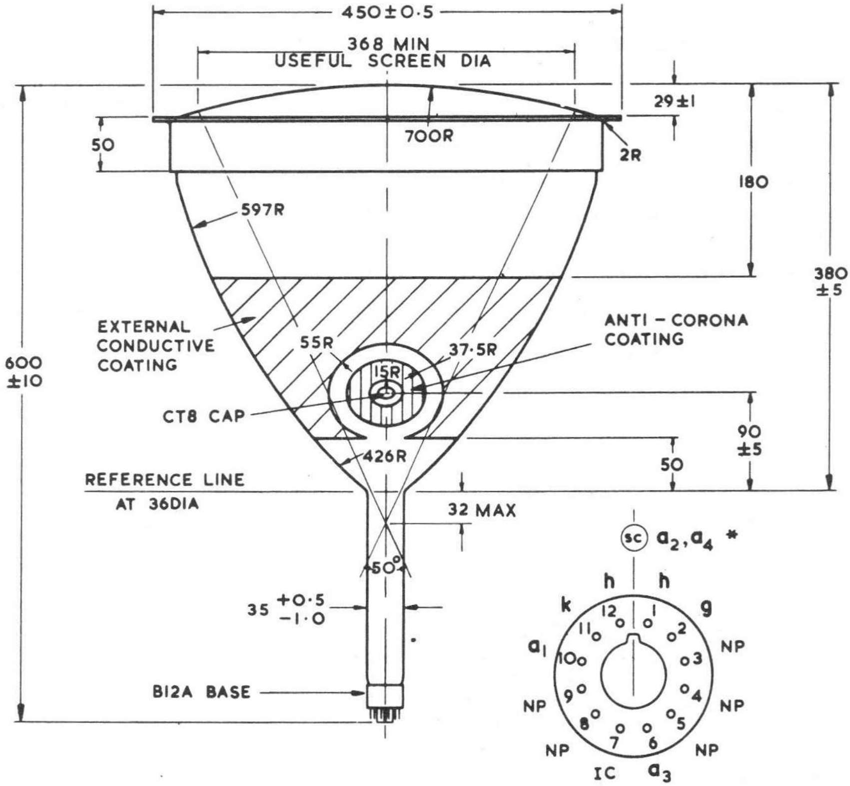
The LC screen is liable to burn even at low values of beam current if operated with stationary or slow moving spot.

If this tube is operated at voltages in excess of 16 kV, x-ray radiation shielding may be necessary to avoid possible danger of personal injury from prolonged exposure at close range. The normal glass protective viewing window may provide such a safeguard. If the radiation measured in contact with this window does not exceed 0.5 milli-rontgens per hour, the window will normally provide adequate protection.

**TUBE WEIGHT** (approximate) - 12 kg

**MOUNTING POSITION** - unrestricted

RADAR TUBES




All dimensions in mm

Not to be scaled

* Anode cap in line with spigot ± 10°.

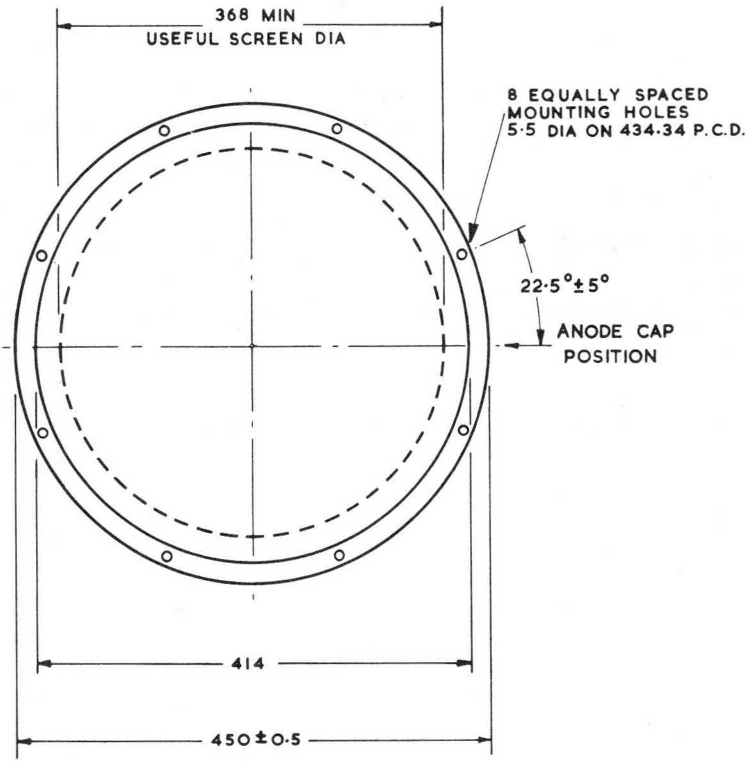
The tube should not be handled in the region of the anti-corona coating .

For details of the mounting frame see following page.

The external conductive coating of this tube should be connected to chassis.
The capacitance between this coating and the final anode may be used to provide smoothing for the e.h.t. supply.

## MOUNTING FRAME

14 SWG (2·03 mm) METAL




All dimensions in mm

Not to be scaled

# F41-122..

OBSOLETE TYPE

## Radar Tube

The F41-123.. is the replacement type for the F41-122..

The F41-122.. is the F41-123.. with a grey glass face-plate having a light transmission of approximately 52%.

**TUBE WEIGHT** (approximate) - 9.0 kg (20 lb)

**PHOSPHOR SCREEN**

This type is usually supplied with LG phosphor (F41-122LG) giving an orange trace of very long persistence. Other phosphors can be made available to special order.

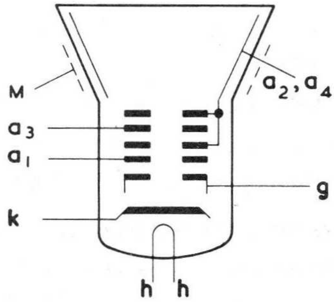
For all other data please see the F41-123.. data sheets.

# Radar Tube F41-123..

## GENERAL

Round face, 16 inch tube, 50° deflection
Electrostatic focus, magnetic deflection
Straight gun, non ion trap
Clear glass
External conductive coating
Aluminised screen
35.5 mm maximum neck diameter

| | | | |
|---|---|---|---|
| Heater voltage | $V_h$ | 6.3 | V |
| Heater current | $I_h$ | 0.3 | A |




## ABSOLUTE RATINGS (voltages referred to cathode)

| | | | |
|---|---|---|---|
| Maximum second and fourth anode voltage | $V_{a2+a4(max)}$ | 20 | kV |
| Minimum second and fourth anode voltage | $V_{a2+a4(min)}$ | 10 | kV |
| Maximum third anode voltage | $V_{a3(max)}$ | ± 500 | V |
| Maximum first anode voltage | $V_{a1(max)}$ | 500 | V |
| Maximum negative grid voltage | $-V_{g(max)}$ | 200 | V |
| Minimum negative grid voltage | $-V_{g(min)}$ | 1.0 | V |
| Maximum heater to cathode voltage heater negative (d.c.) | $V_{h-k(max)}$ | 200 | V |
| Maximum peak heater to cathode voltage heater negative | $v_{h-k(pk)max}$ | 400* | V |

* During a warming up period not exceeding one minute.

## PHOSPHOR SCREEN

This tube is usually supplied with LG phosphor (F41-123LG) giving an orange trace of very long persistence. Other phosphors can be made available to special order.

## NECK LENGTH

This tube has an extended neck length to accommodate an auxiliary high frequency deflector coil.

RADAR TUBES

This data should be read in conjunction with Operational Recommendations for Industrial Cathode Ray Tubes.

## INTER-ELECTRODE CAPACITANCES

| | | * | † | |
|---|---|---|---|---|
| Cathode to all | $c_{k-all}$ | 3.5 | 4.5 | pF |
| Grid to all | $c_{g-all}$ | 7.0 | 7.5 | pF |
| Anodes 2 and 4 to external conductive coating, M | $c_{a2+a4-M}$ | 1200 | | pF |

* Holder capacitance balanced out.

† Total capacitances including a typical B12A duodecal holder.

## TYPICAL OPERATION - Grid modulation (voltages referred to cathode)

| | | | |
|---|---|---|---|
| Second and fourth anode voltage | $V_{a2+a4}$ | 15 | kV |
| Third anode voltage range for focus | $V_{a3}$ | -300 to +300 | V |
| First anode voltage | $V_{a1}$ | 300 | V |
| Grid to cathode voltage for cut-off of raster | $V_g$ | -40 to -80 | V |
| Average peak to peak modulating voltage for modulation up to 150 μA | | 24 | V |
| LG screen persistence to 10% (approximate) | | 4.0 | s |

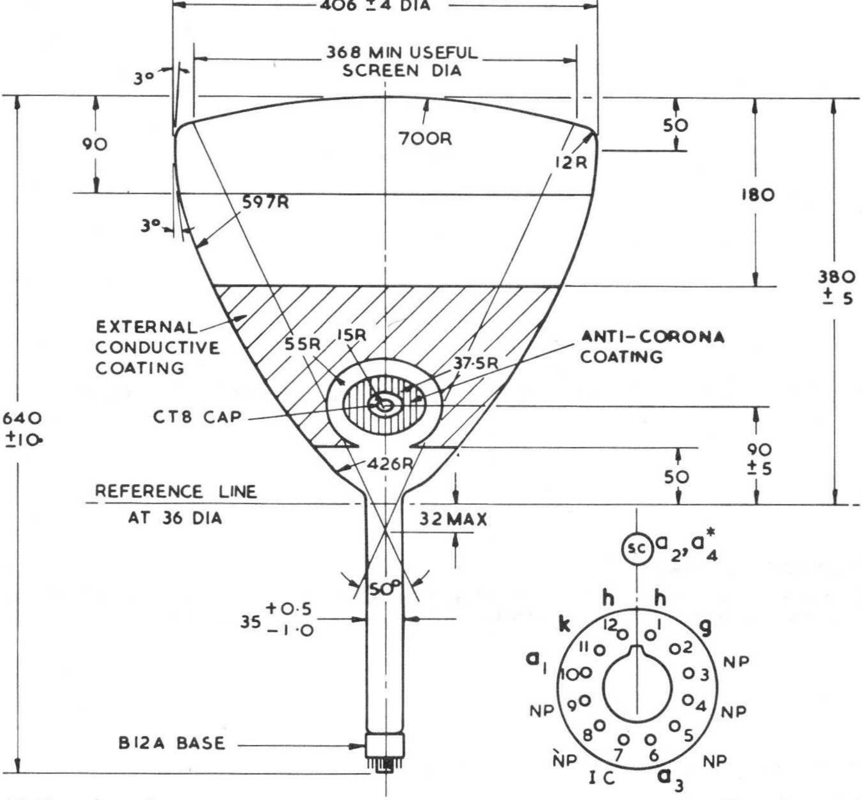
The LG screen is liable to burn even at low values of beam current if operated with a stationary or slow moving spot.

If this tube is operated at voltages in excess of 16 kV, x-ray radiation shielding may be necessary to avoid possible danger of personal injury from prolonged exposure at close range. The normal glass protective viewing window may provide such a safeguard. If the radiation measured in contact with this window does not exceed 0.5 milliröntgens per hour, the window will normally provide adequate protection.

## TUBE WEIGHT (approximate) - 11.8 kg (26 lb)

## MOUNTING POSITION - unrestricted

The external conductive coating (M) of this tube should be connected to chassis. The capacitance between this coating and final anode may be used to provide smoothing for the e.h.t. supply.
When flashover protection is incorporated the chassis return path of M should be made in a manner appropriate to the protection system employed.




All dimensions in mm

Not to be scaled

* Anode cap in line with spigot ± 10°.

The tube should not be handled in the region of the anti-corona coating.

The projected neck axis shall pass within 4.0 mm of the geometric centre of the tube face.

The eccentricity of the neck axis with respect to a line perpendicular to the geometric centre of the tube face shall not exceed 4.5 mm at the deflection centre and 5.0 mm at a point 102 mm from the reference line.

It is recommended that the deflector coil assembly including "position" and "write" coils should not extend further than 95 mm from the reference line otherwise there may be undesirable interaction with the tube gun.

RADAR TUBES

The F 41-124.. is the F41-123.. with a third anode voltage range for focus of 0 to 400 V .

## PHOSPHOR SCREEN

This type is usually supplied with LC phosphor (F41-124LC)giving an orange trace of very long persistence. Other phosphors can be made available to special order.

For all other data please see F41-123.. data sheets.

# Radar Tube

# F41–130..

OBSOLETE TYPE

The F41-13.. is the replacement type for the F41-130..

The F41-130.. is the F41-13.. with a grey glass face-plate having a light transmission of approximately 52%.

**TUBE WEIGHT** (approximate) - 9.0 kg (20 lb)

**PHOSPHOR SCREEN**

This type is usually supplied with LC phosphor (F41-130LC) giving an orange trace of very long persistence. Other phosphors can be made available to special order.

For all other data please see the F41-13.. data sheets.

RADAR TUBES



BRIMAR

# F41-140..

# Radar Tube

OBSOLETE TYPE

The F41-14.. is the replacement type for the F41-140..

The F41-140..is the F41-14..with a grey glass face-plate having a light transmission of approximately 52%.

**TUBE WEIGHT** (approximate) 9.0 kg (20 lb)

**PHOSPHOR SCREEN**

This type is usually supplied with LC phosphor (F41-140LC) giving an orange trace of very long persistence. Other phosphors can be made available to special order.

For other data please see the F41-14.. data sheets.

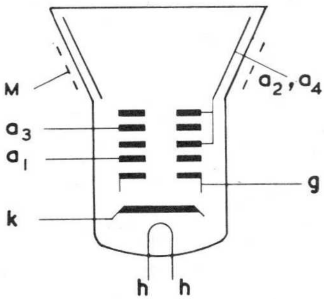
# Radar Tube

# F41-141..

## GENERAL

Round face, 16 inch tube, 50° deflection
Electrostatic focus, magnetic deflection
Straight gun, non ion trap
Clear glass.
External conductive coating
Aluminised screen
35.5 mm maximum neck diameter

| | | | |
|---|---|---|---|
| Heater voltage | $V_h$ | 6.3 | V |
| Heater current | $I_h$ | 0.3 | A |




## ABSOLUTE RATINGS (voltages referred to cathode)

| | | | |
|---|---|---|---|
| Maximum second and fourth anode voltage | $V_{a2+a4(max)}$ | 20 | kV |
| Minimum second and fourth anode voltage | $V_{a2+a4(min)}$ | 10 | kV |
| Maximum third anode voltage | $V_{a3(max)}$ | ± 500 | V |
| Maximum first anode voltage | $V_{a1(max)}$ | 500 | V |
| Maximum negative grid voltage | $-V_{g(max)}$ | 200 | V |
| Minimum negative grid voltage | $-V_{g(min)}$ | 1.0 | V |
| Maximum heater to cathode voltage heater negative (d.c.) | $V_{h-k(max)}$ | 200 | V |
| Maximum peak heater to cathode voltage heater negative | $v_{h-k(pk)max}$ | 400* | V |

* During a warming up period not exceeding one minute.

## PHOSPHOR SCREEN

This tube is usually supplied with LC phosphor (F41-141LC) giving an orange trace of very long persistence. Other phosphors can be made available to special order.

## INTER-ELECTRODE CAPACITANCES

| | | * | † | |
|---|---|---|---|---|
| Cathode to all | $c_{k-all}$ | 3.5 | 4.5 | pF |
| Grid to all | $c_{g-all}$ | 7.0 | 7.5 | pF |
| Anodes 2 and 4 to external conductive coating, M | $c_{a2+a4-M}$ | 1400 | | pF |

* Holder capacitance balanced out.

† Total capacitances including a typical B12A duodecal holder.

## TYPICAL OPERATION - Grid modulation (voltages referred to cathode)

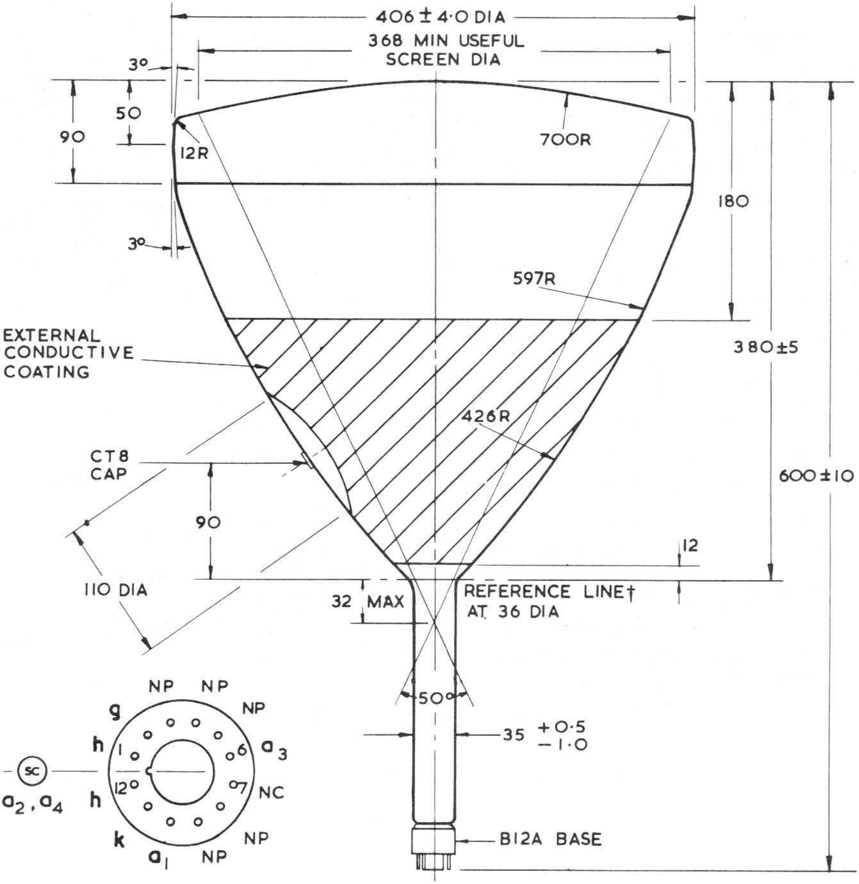
| | | | |
|---|---|---|---|
| Second and fourth anode voltage | $V_{a2+a4}$ | 18 | kV |
| Third anode voltage range for focus | $V_{a3}$ | -300 to +300 | V |
| First anode voltage | $V_{a1}$ | 300 | V |
| Grid to cathode voltage for cut-off of raster | $V_g$ | -40 to -80 | V |
| Average peak to peak modulating voltage for modulation up to 150 $\mu$A | | 24 | V |
| Line width at 50 $\mu$A beam current microscope measurement | | 0.5 to 0.7 | mm |
| LC screen persistence to 10% (approximate) | | 25 | s |

The LC screen is liable to burn even at low values of beam current if operated with stationary or slow moving spot.

If this tube is operated at voltages in excess of 16 kV, x-ray radiation shielding may be necessary to avoid possible danger of personal injury from prolonged exposure at close range. The normal glass protective viewing window may provide such a safeguard. If the radiation measured in contact with this window does not exceed 0.5 milliröntgens per hour, the window will normally provide adequate protection.

**TUBE WEIGHT** (approximate) - 9 kg (20 lb)

**MOUNTING POSITION** - unrestricted




All dimensions in mm

Not to be scaled

* Anode cap in line with spigot ± 15°

† Gauge 36 I/D x 100 long to slide freely over neck.

There is an annular region of anti-corona coating with an external diameter of 75 mm surrounding the CT8 cap, the tube should not be handled in this region.

The projected neck axis shall pass within 4.0 mm of the geometric centre of the tube face. The eccentricity of the neck axis with respect to a line perpendicular to the geometric centre of the tube face shall not exceed 4.5 mm at the deflection centre and 5.0 mm at a point 102 mm from the reference line.

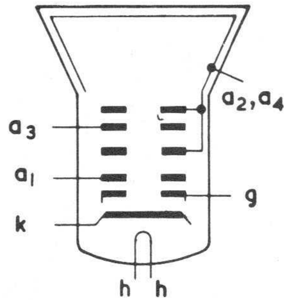
# 7ABP33A

# Radar Tube

## GENERAL

Round face 7 inch tube, 50° deflection
Electrostatic focus, magnetic deflection
Straight gun, non ion trap
Aluminised screen, orange trace
P33(LD)phosphor, very long persistence

| | | | |
|---|---|---|---|
| Heater voltage | $V_h$ | 6.3 | V |
| Heater current | $I_h$ | 0.3 | A |




## ABSOLUTE RATINGS (voltages referred to cathode)

| | | | |
|---|---|---|---|
| Maximum second and fourth anode voltage | $V_{a2+a4(max)}$ | 11 | kV |
| Minimum second and fourth anode voltage | $V_{a2+a4(min)}$ | 6.0 | kV |
| Maximum third anode voltage range | $V_{a3(max)}$ | +1100 to -550 | V |
| Maximum first anode voltage | $V_{a1(max)}$ | 770 | V |
| Maximum negative grid voltage | $-V_{g(max)}$ | 200 | V |
| Maximum positive grid voltage | $V_{g(max)}$ | 0 | V |
| Maximum peak positive grid voltage | $v_{g(pk)max}$ | 0 | V |
| Maximum peak heater to cathode voltage heater negative or positive | $v_{h-k(pk)max}$ | 200 | V |
| Maximum grid to cathode resistance | $R_{g-k(max)}$ | 1.5 | MΩ |

Other phosphors are available to special order.

## INTER-ELECTRODE CAPACITANCES

| | | | |
|---|---|---|---|
| Cathode to all | $c_{k-all}$ | 5.0 | pF |
| Grid to all | $c_{g-all}$ | 6.0 | pF |

## TYPICAL OPERATION - grid modulation (voltages referred to cathode)

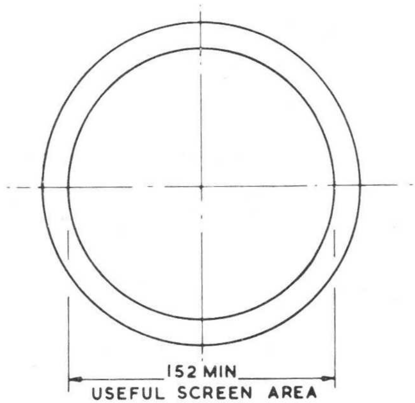
| | | | |
|---|---|---|---|
| Second and fourth anode voltage | $V_{a2+a4}$ | 7.0 | kV |
| Third anode voltage range for focus | $V_{a3}$ | 0 to 250 | V |
| First anode voltage | $V_{a1}$ | 300 | V |
| Grid to cathode voltage for visual extinction of focused spot | $V_{g-k}$ | -28 to -72 | V |
| P33 (LD) screen persistence to 10% (approximate) | | 3.0 | s |

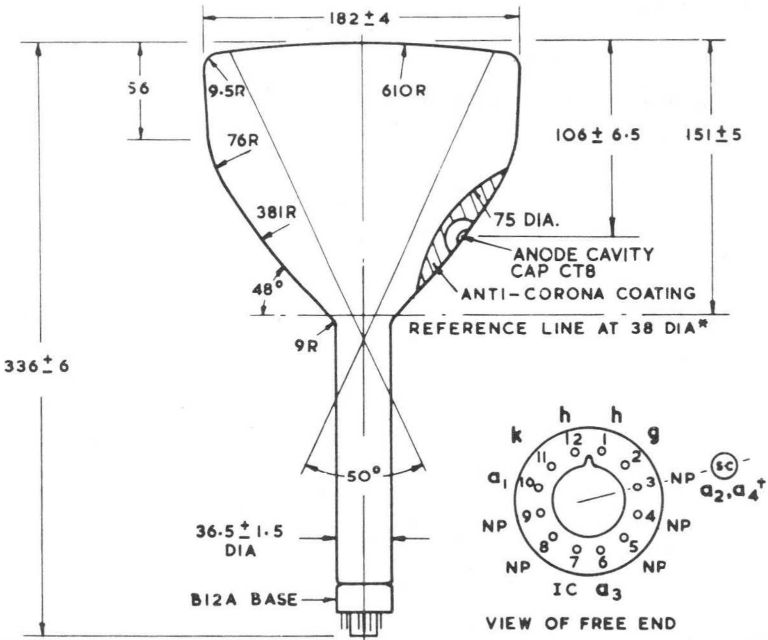
The P33(LD) screen is liable to burn even at low values of beam current if operated with stationary or slow moving spot.

**TUBE WEIGHT** (approximate) - 1.6 kg (3.5 lb)

**MOUNTING POSITION** - unrestricted

RADAR TUBES




All dimensions in mm

Not to be scaled

* Gauge 38 mm I/D 50 mm long to slide freely over neck.

† Anode cap in line with pin 3 ± 10°

The tube should not be handled in the region of the anti-corona coating.

# DATA DISPLAY & MONITOR TUBES

The facilities and organisation provided by Thorn Radio Valves and Tubes Limited meet the requirements of the M.O.D. (P.E.) Defence Standard 05-21 and BS 9000.

**HEALTH AND SAFETY AT WORK ACT, 1974**

Attention is drawn to the recommendations under this heading in the Operational Recommendations.

WARNING

These tubes should be used in accordance with their published ratings, and in conformity with the Operational Recommendations of the company's data handbook. The company will not entertain claims for loss or damage where this advice has been disregarded.

**Thorn Radio Valves and Tubes Limited**

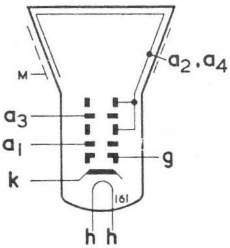
Mollison Avenue - Brimsdown - Enfield - Middlesex EN3 7NS

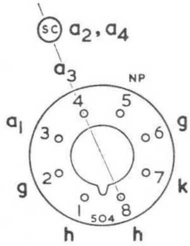
BRIMAR

# Data Display or Monitor Tube

# CV6198

**Maintenance Type**




Base B8H, Cap CT8

## GENERAL

| | | | |
|---|---|---|---|
| Rectangular Face | —$8\frac{1}{2}$ in. Diagonal | Deflection Angle | —90° Diagonal |
| Electrostatic Focus | —Magnetic Deflection | Aluminised Screen | —Orange Trace |
| LG Phosphor | —Very Long Persistence | External Conductive Coating | |

| | | | |
|---|---|---|---|
| Heater Voltage | $V_h$ | 11·5 | V |
| Heater Current | $I_h$ | 0·15 | A |

## RATINGS

| | | | |
|---|---|---|---|
| Maximum Second and Fourth Anode Voltage | $V_{a2,a4(max)}$ | 16* | kV |
| Minimum Second and Fourth Anode Voltage | $V_{a2,a4(min)}$ | 8·0 | kV |
| Maximum Third Anode Voltage | $V_{a3(max)}$ | ±700 | V |
| Maximum First Anode Voltage | $V_{a1(max)}$ | 500 | V |
| Maximum Heater to Cathode Voltage, Heater Negative (d.c.) | $V_{h-k(max)}$ | 200 | V |

*16 kV is a design centre rating, the absolute rating of 18 kV must not be exceeded.
All voltages referred to cathode.

## INTER-ELECTRODE CAPACITANCES

| | | ¶ | § | |
|---|---|---|---|---|
| Grid to all | $c_{g-all}$ | 7·0 | 8·5 | pF |
| Cathode to all | $c_{k-all}$ | 3·0 | 3·5 | pF |
| Anode 2 and Anode 4 to External Conductive Coating (approx) | $c_{a2,a4-M}$ | 400 | | pF |

¶ Inter-electrode capacitance with holder balanced out.

§ Inter-electrode capacitance including a typical B8H holder.

## TYPICAL OPERATION—Grid Modulation (all voltages reterred to cathode)

| | | | |
|---|---|---|---|
| Second and Fourth Anode Voltage | $V_{a2,a4}$ | 14 | kV |
| First Anode Voltage | $V_{a1}$ | 400 | V |
| Third Anode Voltage for Focus (Range) | $V_{a3}$ | 0 to 400 | V |
| Grid to Cathode Voltage for cut-off of Raster | $V_g$ | −30 to −72 | V |
| Average Peak to Peak Modulating Voltage for Modulation up to 150$\mu$A | | 24 | V |
| LG Screen Persistence to 10% (approximate) | | 4·0 | s |

The LG screen is liable to burn even at low values of beam current if operated with a stationary or slow-moving spot.

**Note**

This tube can be supplied with a number of different phosphors as requested.

This tube is fitted with a B8H Sparkguard S base, details of which are given on a separate sheet.

**Net Tube Weight (approx)—1·36 kg (3 lb).**

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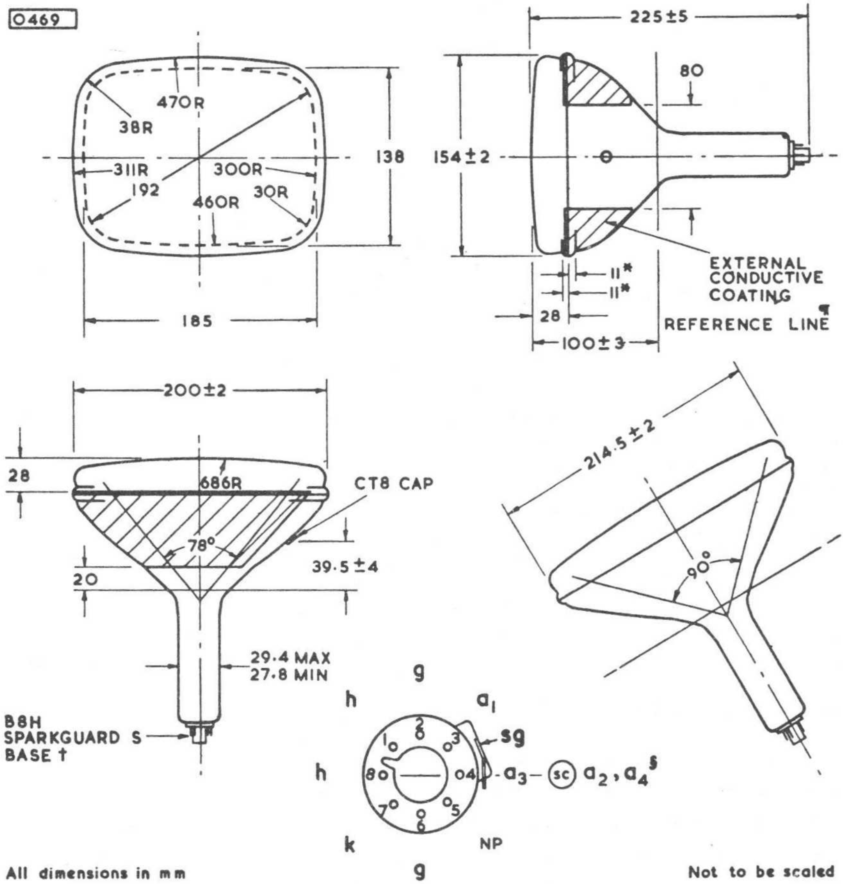



All dimensions in mm

Not to be scaled

There is an annular region of anti-corona coating with an external diameter of 60 mm surrounding the CT8 cap, the tube should not be handled in this region.

* During the face sealing operation the glass in this area (total 22 mm) may be disturbed. As the shape of the contour within this area may be either convex or concave the bulb should not be gripped within this region unless special precautions are taken (such as the use of resilient packing material).

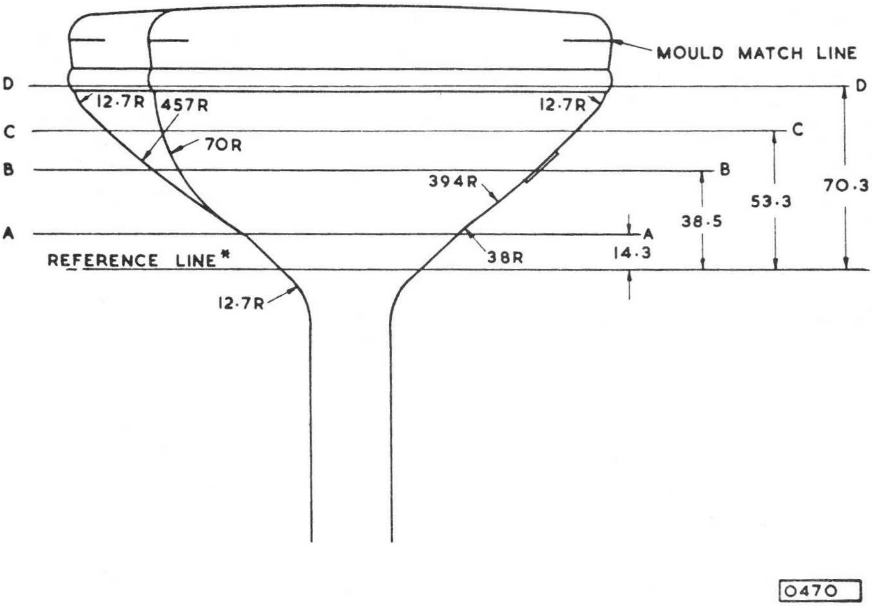
† The socket for the B8H button base should not be rigidly mounted, it should have flexible leads and be allowed to move freely. The design of the socket should be such that the wiring cannot impress lateral strains through the socket contacts on the base.

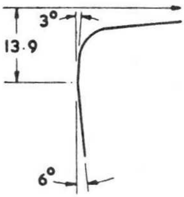
§ Anode cap in line with pin 4 ± 30°.

¶ Determined by Reference Gauge No. 15.

# Data Display or Monitor Tube

**CV6198**




MOULD MATCH DETAIL

| MAXIMUM CONE SIZES AT POINTS A-A, B-B, C-C, D-D | | | |
|---|---|---|---|
| SEC'N | MAJOR AXIS | MINOR AXIS | DIAG'L |
| A-A | 82.4 | 82.4 | 82.4 |
| B-B | 146 | 134 | 153 |
| C-C | 180 | 149 | 193 |
| D-D | 201 | 155 | 216 |

All dimensions in mm

Not to be scaled

* Determined by Reference Line Gauge No. 15.

DATA DISPLAY & MONITOR TUBES

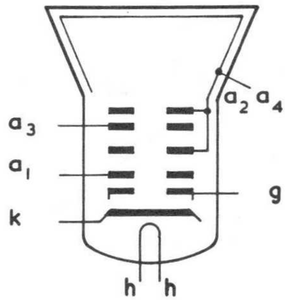
# M8-100.. Data Display or Monitor Tube

PRELIMINARY DATA

## GENERAL

Rectangular face-plate 82 mm x 32 mm
Ruggedised gun construction
Electrostatic focus, magnetic deflection
Flying lead connections to base and anode
Aluminised screen, clear glass
20.7 mm maximum neck diameter.

| | | | |
|---|---|---|---|
| Heater voltage | $V_h$ | 11 | V |
| Heater current | $I_h$ | 75 | mA |




## ABSOLUTE RATINGS - Voltages referred to cathode

| | | | |
|---|---|---|---|
| Maximum second and fourth anode voltage | $V_{a2+a4(max)}$ | 12 | kV |
| Minimum second and fourth anode voltage | $V_{a2+a4(min)}$ | 8 | kV |
| Maximum third anode voltage | $V_{a3(max)}$ | -50 to +500 | V |
| Maximum first anode voltage | $V_{a1(max)}$ | 350 | V |
| Maximum negative grid voltage | $-V_{g(max)}$ | 100 | V |
| Minimum negative grid voltage | $-V_{g(min)}$ | 1* | V |
| Maximum heater to cathode voltage heater negative (d.c.) | $V_{h-k(max)}$ | 110 | V |
| Maximum peak heater to cathode voltage heater negative | $v_{h-k(pk)max}$ | 130 | V |
| Maximum impedance, grid to cathode (50 Hz) | $Z_{g-k(max)}$ | 0.5 | MΩ |
| Maximum resistance, grid to cathode | $R_{g-k(max)}$ | 1.5 | MΩ |

* A 10 kΩ grid series resistor mounted close to the tube base is recommended to limit the peak grid voltage.

## PHOSPHOR SCREEN

This type is usually supplied with GX phosphor ( M8-100GX ). This is a line spectrum phosphor giving a yellowish green fluorescence of medium persistence. Other phosphor screens can be made available to special order.

**TUBE WEIGHT** (approximate) - 180 g

This data should be read in conjunction with Operational Recommendations for Industrial Cathode Ray Tubes.



BRIMAR

## INTER-ELECTRODE CAPACITANCES

| | | | |
|---|---|---|---|
| Cathode to all | $c_{k-all}$ | 4.0* | pF |
| Grid to all | $c_{g-all}$ | 7.0* | pF |

* Lead capacitance balanced out.

## TYPICAL OPERATION - Grid modulation (Voltage referred to cathode)

| | | | |
|---|---|---|---|
| Second and fourth anode voltage | $V_{a2+a4-k}$ | 10 | kV |
| First anode voltage | $V_{a1-k}$ | 250 | V |
| Third anode voltage range for focus | $V_{a3-k}$ | 0 to 350 | V |
| Grid to cathode voltage for cut-off of raster | $V_{g-k}$ | -35 to -69 | V |
| Typical line width at 30μA beam current shrinking raster measurement at tube face centre | | 0.25 | mm |

## TYPICAL OPERATION - Cathode modulation (Voltage referred to grid)

| | | | |
|---|---|---|---|
| Second and fourth anode voltage | $V_{a2+a4-g}$ | 10 | kV |
| First anode voltage | $V_{a1-g}$ | 250 | V |
| Third anode voltage range for focus | $V_{a3-g}$ | 0 to 350 | V |
| Cathode to grid voltage for cut-off of raster | $V_{k-g}$ | 32 to 58 | V |

Characteristic curves as M23-110..

## MOUNTING

The tube can be mounted in any position.

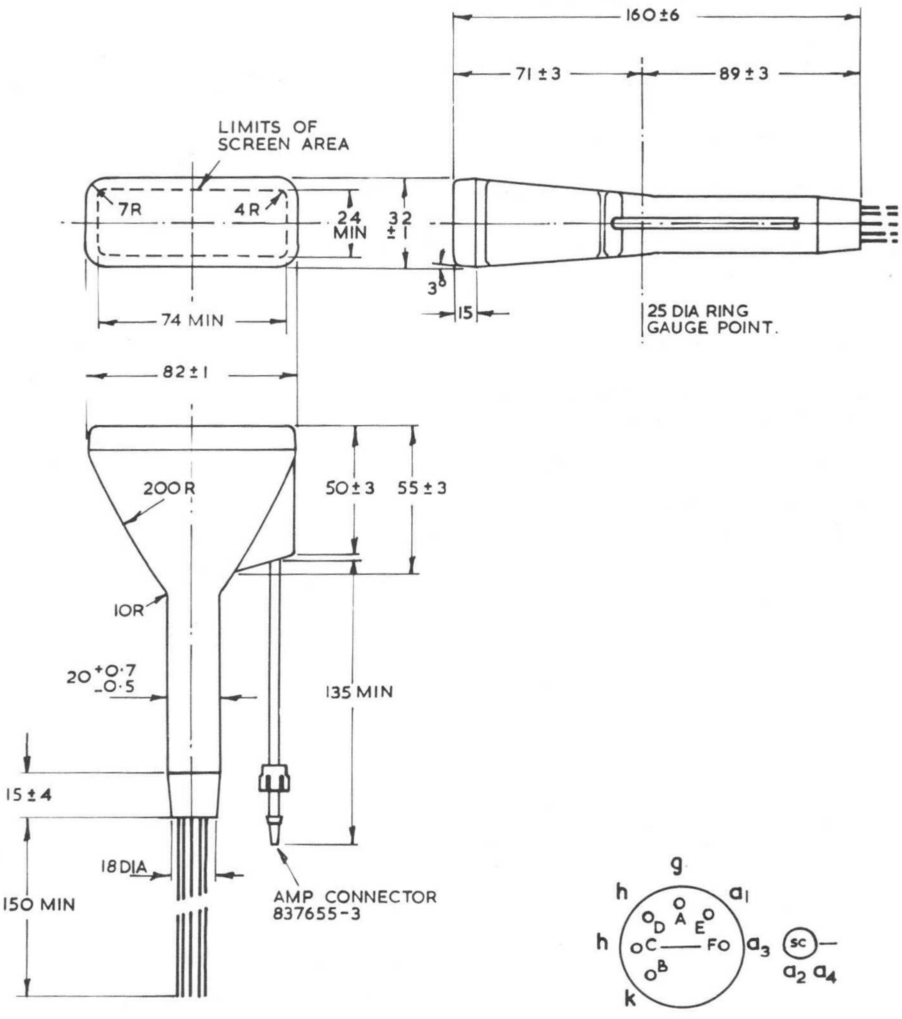
When flashover protection is incorporated the chassis return path should be made in a manner appropriate to the protection system employed.

## ENVIRONMENTAL TESTS CAPABILITIES

| | | |
|---|---|---|
| Temperature range: | Operational | -15°C to + 85°C |
| | Storage | -54°C to + 85°C |
| Vibration endurance | | 5 to 55 Hz 1.5g maximum<br>55 to 2000 Hz 1.0g constant |
| Bump and shock | | 6 bumps, 6g, 11ms, half sine wave, all three axes |
| Tropical environment | | 95% relative humidity<br>cycled 38°C to 50°C. total 48 hrs |
| Altitude: | Operational | 5000m |
| | Non operational | 6000m |

DATA DISPLAY & MONITOR TUBES

# Data Display or Monitor Tube



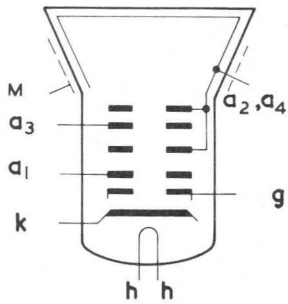

All dimensions in mm

# Data Display or Monitor Tube M14-100..

**GENERAL**

Rectangular face, 14 cm, 70° diagonal
Electrostatic focus, magnetic deflection
Aluminised screen
Grey glass, 62% transmission (approx)
20.7 mm maximum neck diameter
External conductive coating

| | | | |
|---|---|---|---|
| Heater voltage | $V_h$ | 11 | V |
| Heater current | $I_h$ | 75 | mA |




**ABSOLUTE RATINGS** - Voltages referred to cathode

| | | | |
|---|---|---|---|
| Maximum second and fourth anode voltage | $V_{a2+a4(max)}$ | 13.5 | kV |
| Minimum second and fourth anode voltage | $V_{a2+a4(min)}$ | 8 | kV |
| Maximum third anode voltage | $V_{a3(max)}$ | -50 to +500 | V |
| Maximum first anode voltage | $V_{a1(max)}$ | 350 | V |
| Maximum negative grid voltage | $-V_{g(max)}$ | 100 | V |
| Minimum negative grid voltage | $-V_{g(min)}$ | 1* | V |
| Maximum heater to cathode voltage, heater negative (d.c.) | $V_{h-k(max)}$ | 110 | V |
| Maximum peak heater to cathode voltage heater negative | $v_{h-k(pk)max}$ | 130 | V |
| Maximum impedance, grid to cathode (50 Hz) | $Z_{g-k(max)}$ | 0.5 | MΩ |
| Maximum resistance, grid to cathode | $R_{g-k(max)}$ | 1.5 | MΩ |

* A 10 kΩ grid series resistor mounted close to the tube base is recommended to limit the peak grid voltage.

**PHOSPHOR SCREEN**

This type is usually supplied with W phosphor ( M14-100W ) giving a television white trace of medium short persistence. Other phosphor screens can be made available to special order.

**TUBE WEIGHT** (approximate) - 400 g

This data should be read in conjunction with Operational Recommendations for Industrial Cathode Ray Tubes.

DATA DISPLAY & MONITOR TUBES

## INTER-ELECTRODE CAPACITANCES

| | | | |
|---|---|---|---|
| Cathode to all | $c_{k-all}$ | 3.0* | pF |
| Grid to all | $c_{g-all}$ | 4.0* | pF |
| Anodes 2 and 4 to coating M (min.) | $c_{a2+a4-M(min)}$ | 200 | pF |

* Holder capacitance balanced out.

## TYPICAL OPERATION - Grid modulation (Voltage referred to cathode)

| | | | |
|---|---|---|---|
| Second and fourth anode voltage | $V_{a2+a4-k}$ | 10 | kV |
| First anode voltage | $V_{a1-k}$ | 250 | V |
| Third anode voltage range for focus | $V_{a3-k}$ | 0 to 350 | V |
| Average peak to peak picture modulating voltage up to 100 $\mu$A | | 24 | V |
| Grid to cathode voltage for cut-off of raster | $V_{g-k}$ | -35 to -69 | V |

## TYPICAL OPERATION - Cathode modulation (Voltage referred to grid)

| | | | |
|---|---|---|---|
| Second and fourth anode voltage | $V_{a2+a4-g}$ | 10 | kV |
| First anode voltage | $V_{a1-g}$ | 250 | V |
| Third anode voltage range for focus | $V_{a3-g}$ | 0 to 350 | V |
| Average peak to peak picture modulating voltage up to 100 $\mu$A | | 20 | V |
| Cathode to grid voltage for cut-off of raster | $V_{k-g}$ | 32 to 58 | V |

## MOUNTING

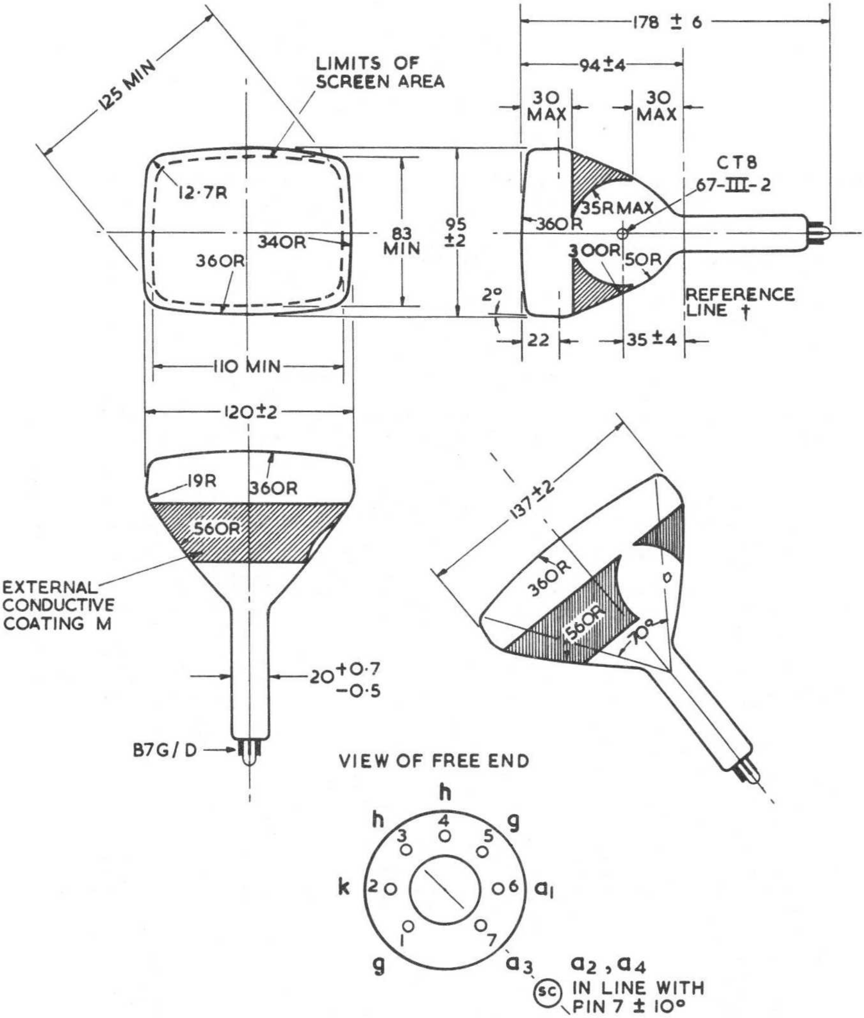
There is an annular region of anti-corona coating surrounding the CT8 cap, the tube should not be handled in this region.

The tube can be mounted in any position. The tube socket should not be rigidly mounted but should have flexible leads and be allowed to move freely.

The external conductive coating of this tube should be connected to chassis. The capacitance between this coating and final anode may be used to provide smoothing for the e.h.t. supply.

When flashover protection is incorporated the chassis return path should be made in a manner appropriate to the protection system employed.

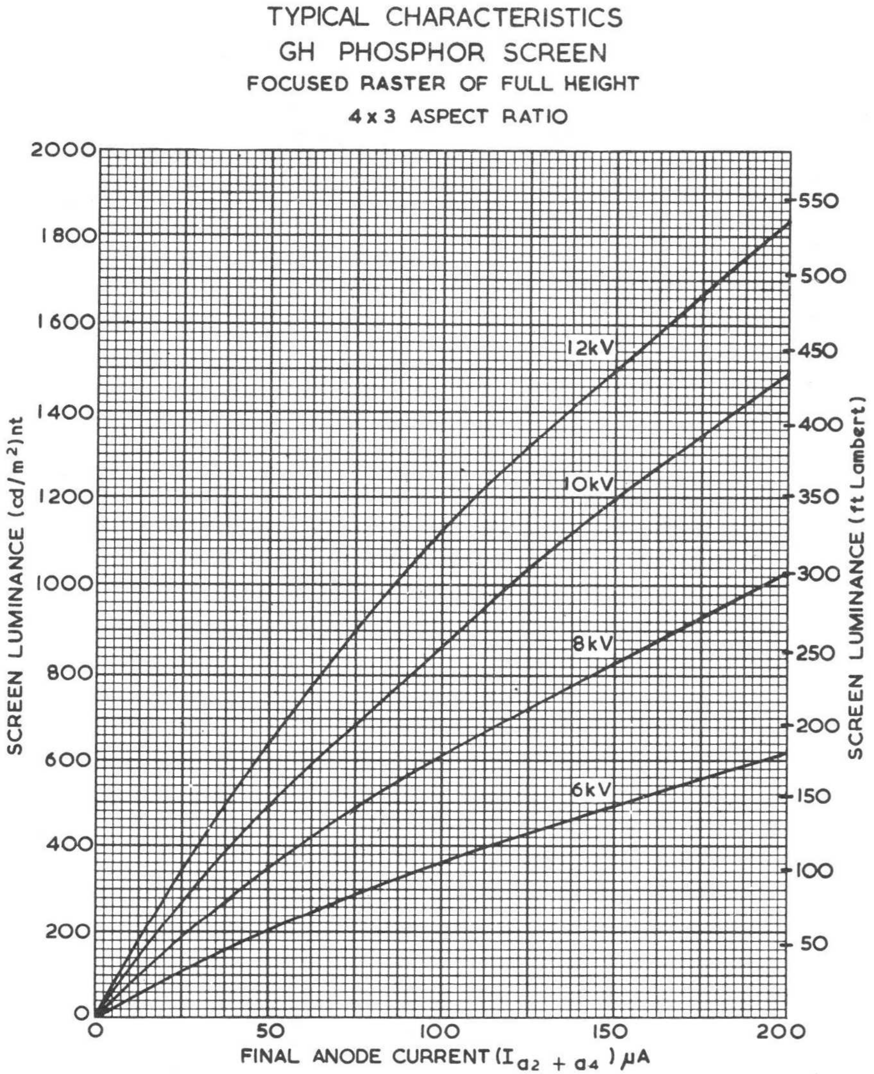
**Characteristic curves as M23-110..**

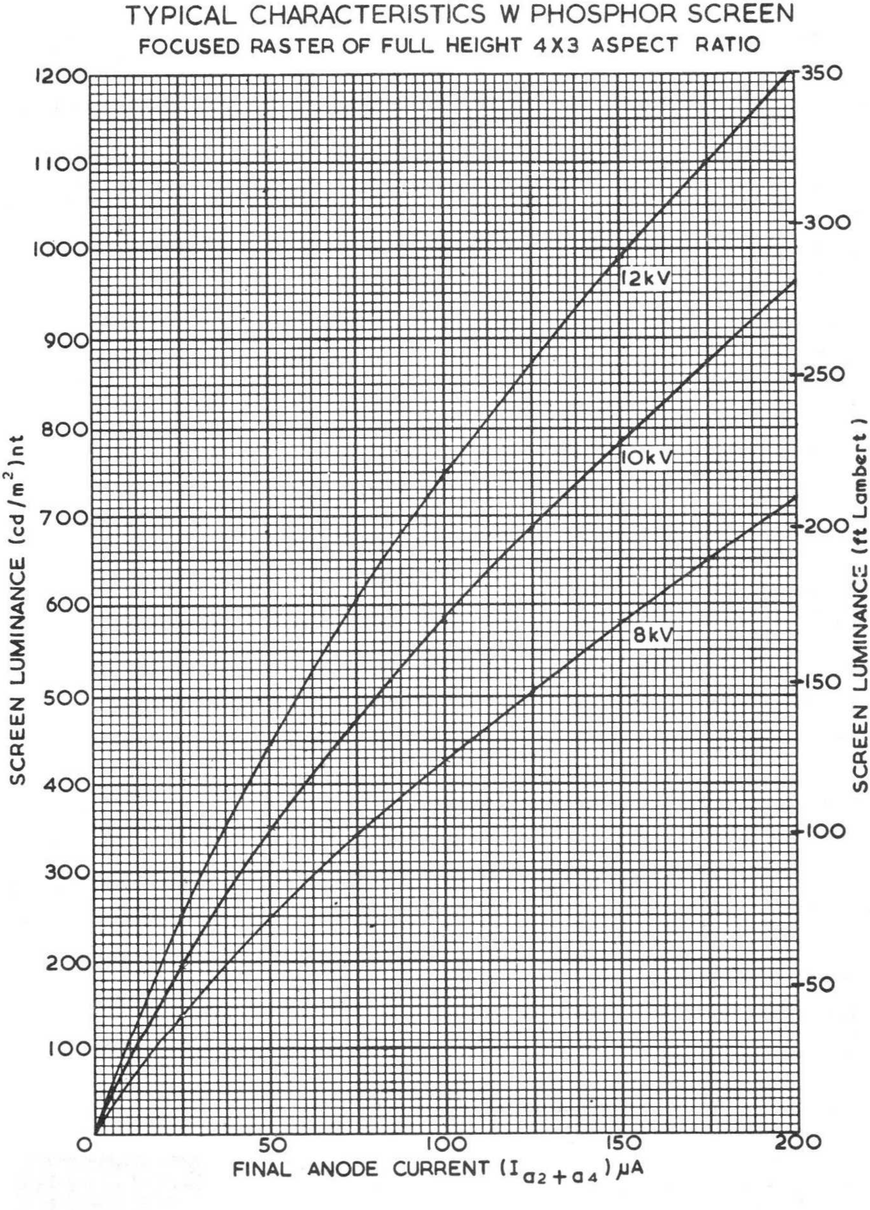



All dimensions in mm

Not to be scaled

† Determined by reference line gauge No. 23


TYPICAL CHARACTERISTICS
GH PHOSPHOR SCREEN
FOCUSED RASTER OF FULL HEIGHT
4 x 3 ASPECT RATIO
SCREEN LUMINANCE (cd/m²)nt
SCREEN LUMINANCE (ft Lambert)
FINAL ANODE CURRENT (Ia2 + a4) μA
12kV
10kV
8kV
6kV
0
200
400
600
800
1000
1200
1400
1600
1800
2000
50
100
150
200
250
300
350
400
450
500
550

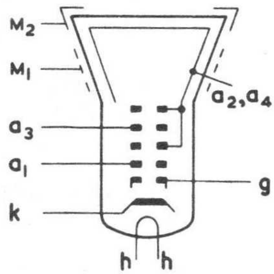

TYPICAL CHARACTERISTICS W PHOSPHOR SCREEN
FOCUSED RASTER OF FULL HEIGHT 4X3 ASPECT RATIO
SCREEN LUMINANCE (cd/m$^2$) nt
SCREEN LUMINANCE (ft Lambert)
FINAL ANODE CURRENT ($I_{a2+a4}$) μA
12kV
10kV
8kV
0
50
100
150
200
100
200
300
400
500
600
700
800
900
1000
1100
1200
50
100
150
200
250
300
350

# M16-100.. Data Display or Monitor Tube

**GENERAL**

Rectangular flat face, 6 inch 70° diagonal tube
Ruggedised construction, metal mounting frame
Electrostatic focus, magnetic deflection
Flying lead connections for base and anode
Aluminised screen, external conductive coating
Clear glass, 27.4 ± 0.05 mm neck diameter.

| | | | |
|---|---|---|---|
| Heater voltage | $V_h$ | 6.3 | V |
| Heater current | $I_h$ | 0.3 | A |




**ABSOLUTE RATINGS** - All voltages referred to cathode

| | | | |
|---|---|---|---|
| Maximum second and fourth anode voltage | $V_{a2+a4(max)}$ | 18 | kV |
| Minimum second and fourth anode voltage | $V_{a2+a4(min)}$ | 12 | kV |
| Maximum third anode voltage | $V_{a3(max)}$ | 1000 | V |
| Maximum negative third anode voltage | $-V_{a3(max)}$ | 500 | V |
| Maximum first anode voltage | $V_{a1(max)}$ | 500 | V |
| Maximum negative grid voltage | $-V_{g(max)}$ | 200 | V |
| Minimum negative grid voltage | $-V_{g(min)}$ | 1.0 | V |
| Maximum heater to cathode voltage heater negative (d.c.) | $V_{h-k(max)}$ | 200 | V |

**TYPICAL OPERATION** - Grid modulation, voltages with respect to cathode

| | | | |
|---|---|---|---|
| Second and fourth anode voltage | $V_{a2+a4}$ | 14 | kV |
| First anode voltage | $V_{a1}$ | 400 | V |
| Third anode voltage range for focus | $V_{a3}$ | 0 to 400 | V |
| Grid to cathode voltage for cut-off of raster | $V_g$ | -31 to -71 | V |

If this tube is operated at voltages in excess of 16 kV, x-ray radiation shielding may be necessary to avoid possible danger of personal injury from prolonged exposure at close range.

**PHOSPHOR SCREEN**

This type is usually supplied with W phosphor (M16-100W) giving a television white trace of medium short persistence. Other phosphor screens can be made available to special order.

Type M16-100W is the commercial version of the CV6244.

**INTER-ELECTRODE CAPACITANCES** - Lead capacitances balanced out

| | | | |
|---|---|---|---|
| Cathode to all | $c_{k\text{-}all}$ | 4.0 | pF |
| Grid to all | $c_{g\text{-}all}$ | 15 | pF |
| Anode 2 and anode 4 to coating $M_1$ (minimum) | $c_{a2+a4\text{-}M1(min)}$ | 350 | pF |
| Anode 2 and anode 4 to frame $M_2$ (minimum) | $c_{a2+a4\text{-}M2(min)}$ | 80 | pF |

**TUBE WEIGHT** (approximate) - 1.0 kg

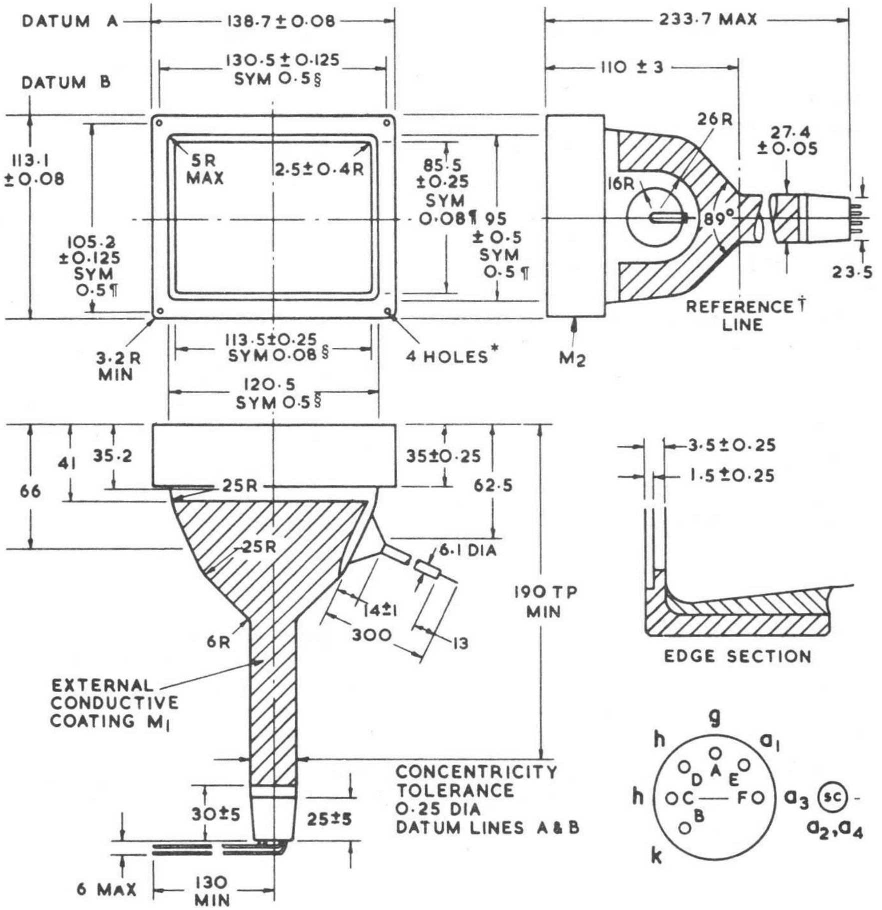
**ENVIRONMENTAL TEST CAPABILITIES**

| | |
|---|---|
| Storage and operational temperature range | -30°C to +55°C |
| Vibration endurance | 10 to 60 Hz displacement ± 0.15 mm<br>60 to 2000 Hz 2 g<br>all three axes for a specified time |
| Centrifuge | 13 g all three axes 2 minutes each |
| Bump and shock | 40 g all three axes for specified number of bumps |
| Tropical environment | 95% relative humidity, cycled 20°C to 40°C, total 10 days |
| Mould growth | To BS2011 Test 2J<br>severity 28 days |
| Salt mist | To BS2011 Test 2K<br>92.5% humidity, 35°C, total 28 days |
| Solar heat | Continuous cycling 30°C to 84°C<br>total 5 days |

**NOTE**

The external conductive coating of this tube should be connected to chassis. The capacitance between this coating and final anode may be used to provide smoothing for the e.h.t. supply.

# M16-100.. Data Display or Monitor Tube




**All dimensions in mm** **Not to be scaled**

Frame finish - black anodised.
Minimum useful screen area 113 x 85

* Tapped 6 - 32UNC x 7.0 deep.

† Determined by Reference Line Gauge No. 19

§ Symmetrical tolerance width Datum A.

¶ Symmetrical tolerance width Datum B.

# Data Display or Monitor Tube — M17-10..

The M17-10.. monitor tube has a 11.5V, 0.15A heater otherwise it is identical to the M17-12..

## PHOSPHOR SCREEN

This type is usually supplied with W phosphor (M17-10W) giving a television white trace of medium short persistence. Other phosphor screens can be made available to special order.

For all other data please see M17-12.. data sheets.

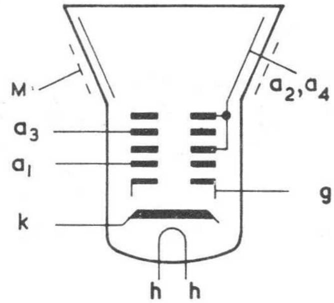
DATA DISPLAY & MONITOR TUBES

# M17-12.. Data Display or Monitor Tube

**GENERAL**

Rectangular face, 7 inch, 70° diagonal
Electrostatic focus, magnetic deflection
Aluminised screen, clear glass
29.4 mm maximum neck diameter
Straight gun, non ion trap
External conductive coating

| | | | |
|---|---|---|---|
| Heater voltage | $V_h$ | 6.3 | V |
| Heater current | $I_h$ | 0.3* | A |




**DESIGN CENTRE RATINGS** - Voltages referred to cathode

| | | | |
|---|---|---|---|
| Maximum second and fourth anode voltage | $V_{a2+a4(max)}$ | 16† | kV |
| Minimum second and fourth anode voltage | $V_{a2+a4(min)}$ | 12 | kV |
| Maximum third anode voltage | $V_{a3(max)}$ | +1000 to -500 | V |
| Maximum first anode voltage | $V_{a1(max)}$ | 500 | V |
| Maximum negative grid voltage | $-V_{g(max)}$ | 200 | V |
| Maximum peak negative grid voltage | $-v_{g(pk)max}$ | 400 | V |
| Minimum negative grid voltage | $-V_{g(min)}$ | 1.0 | V |
| Maximum heater to cathode voltage, heater negative (d.c.) | $V_{h-k(max)}$ | 200 | V |
| Maximum peak heater to cathode voltage, heater negative (absolute rating) | $v_{h-k(pk)max}$ | 400§ | V |
| Maximum impedance, grid to cathode (50 Hz) | $Z_{g-k(max)}$ | 0.5 | MΩ |
| Maximum resistance, grid to cathode | $R_{g-k(max)}$ | 1.5 | MΩ |

* In a series heater chain the CRT should always be connected at the chassis end.

† The absolute rating of 18 kV must not be exceeded.

§ During a warming-up period not exceeding 45 seconds.

**PHOSPHOR SCREEN**

This type is usually supplied with W phosphor (M17-12W) giving a television white trace of medium short persistence. Other phosphor screens can be made available to special order.

Tubes incorporating a B8H Sparkguard base will have a suffix after the type number. For details of the Sparkguard bases see separate sheets.

## INTER - ELECTRODE CAPACITANCES

| | | * | † | |
|---|---|---|---|---|
| Cathode to all | $c_{k-all}$ | 3.0 | 3.5 | pF |
| Grid to all | $c_{g-all}$ | 6.5 | 8.0 | pF |
| Anodes 2 and 4 to coating M (approx.) | $c_{a2+a4-M}$ | 350 | | pF |

* Holder capacitance balanced out. † Total capacitances including typical holder.

## TYPICAL OPERATION - Grid modulation, voltages referred to cathode.

| | | | |
|---|---|---|---|
| Second and fourth anode voltage | $V_{a2+a4-k}$ | 14 | kV |
| First anode voltage | $V_{a1-k}$ | 400 | V |
| Third anode voltage range for focus | $V_{a3-k}$ | 0 to 400 | V |
| Grid to cathode voltage range for cut-off of raster | $V_{g-k}$ | -38 to -78 | V |

## TYPICAL OPERATION - Cathode modulation, voltages referred to grid

| | | | |
|---|---|---|---|
| Second and fourth anode voltage | $V_{a2+a4-g}$ | 14 | kV |
| First anode voltage | $V_{a1-g}$ | 400 | V |
| Third anode voltage range for focus | $V_{a3-g}$ | 0 to 400 | V |
| Cathode to grid voltage range for cut-off of raster | $V_{k-g}$ | 35 to 68 | V |

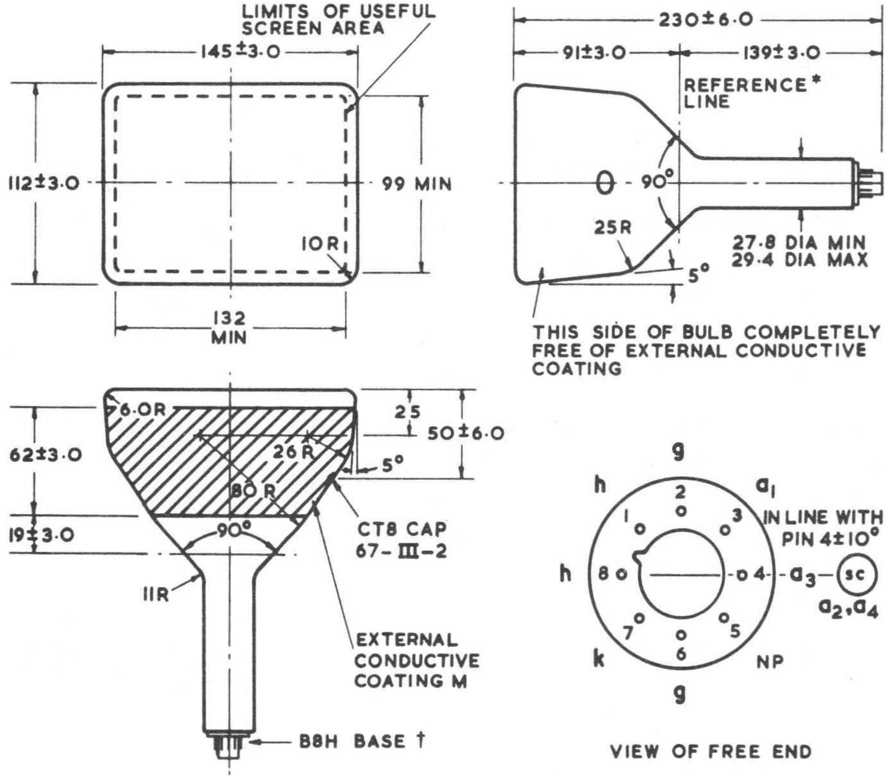
If this tube is operated at voltages in excess of 16 kV x-ray radiation shielding may be necessary to avoid possible danger of personal injury from prolonged exposure at close range.

## MOUNTING

The tube can be mounted in any position.
The external conductive coating (M) of this tube should be connected to chassis. The capacitance between this coating and final anode may be used to provide smoothing for the e.h.t. supply.
When flashover protection is incorporated the chassis return path of the external conductive coating should be made in a manner appropriate to the protection system employed.

**TUBE WEIGHT** (approximate) - net 650g

DATA DISPLAY & MONITOR TUBES

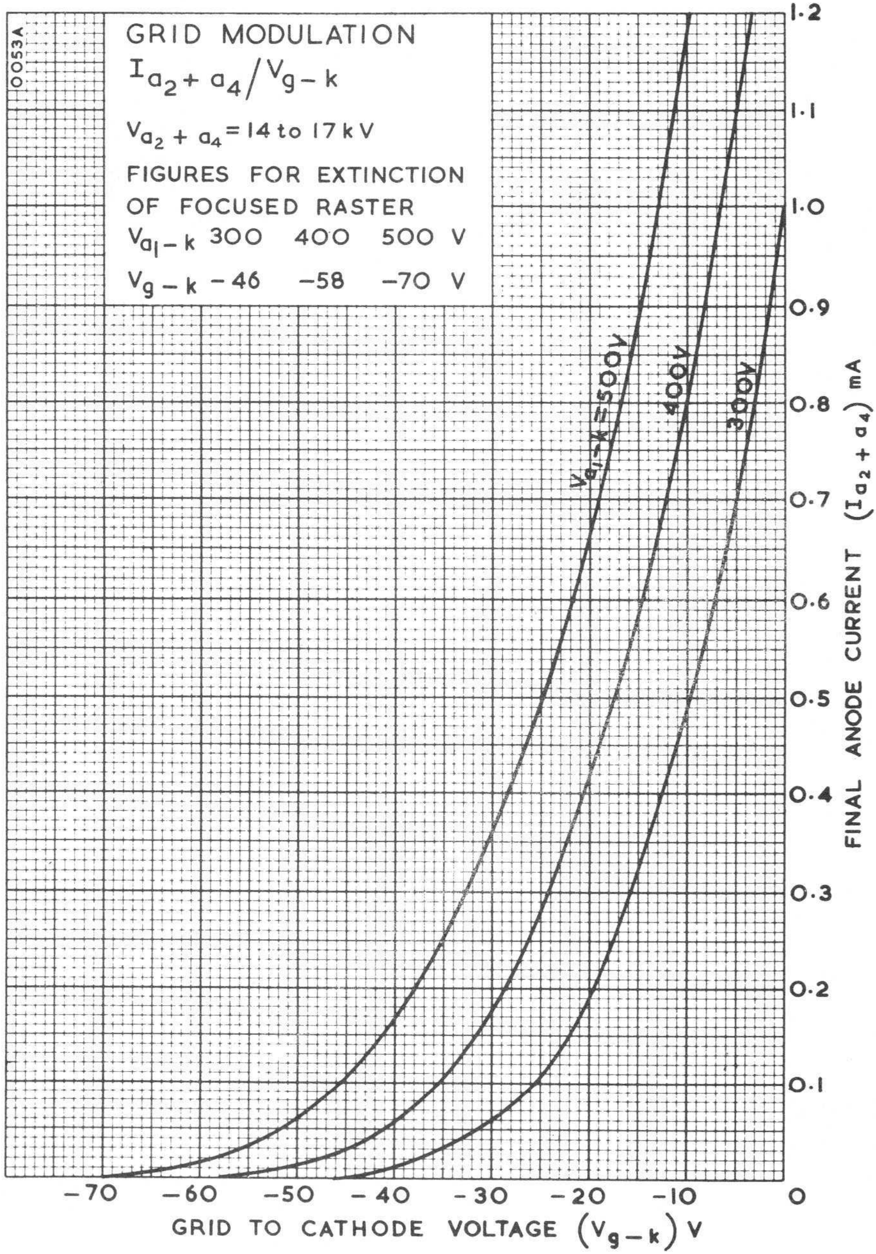


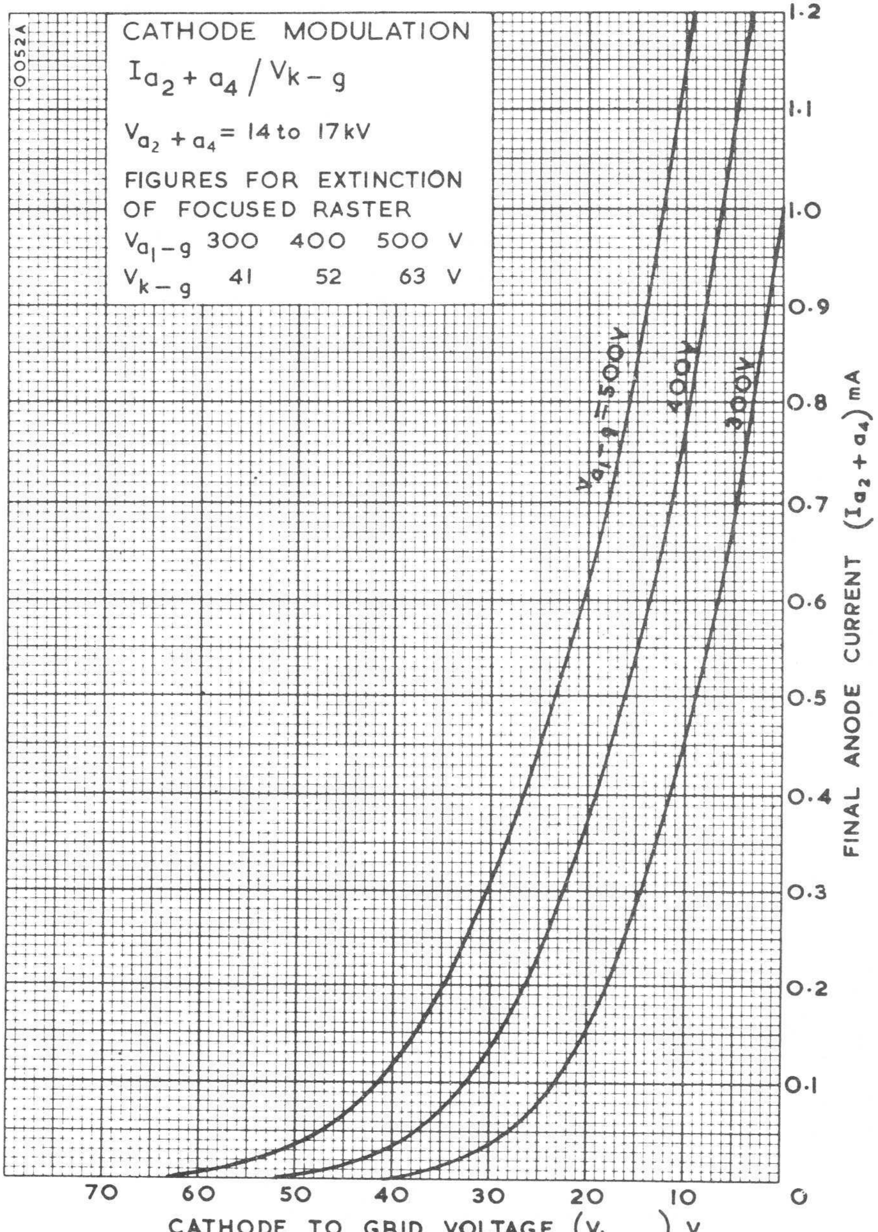

**All dimensions in mm** **Not to be scaled**

**There is an annular region of anti-corona coating with an external diameter of 60 mm surrounding the CT8 cap, the tube should not be handled in this region.**

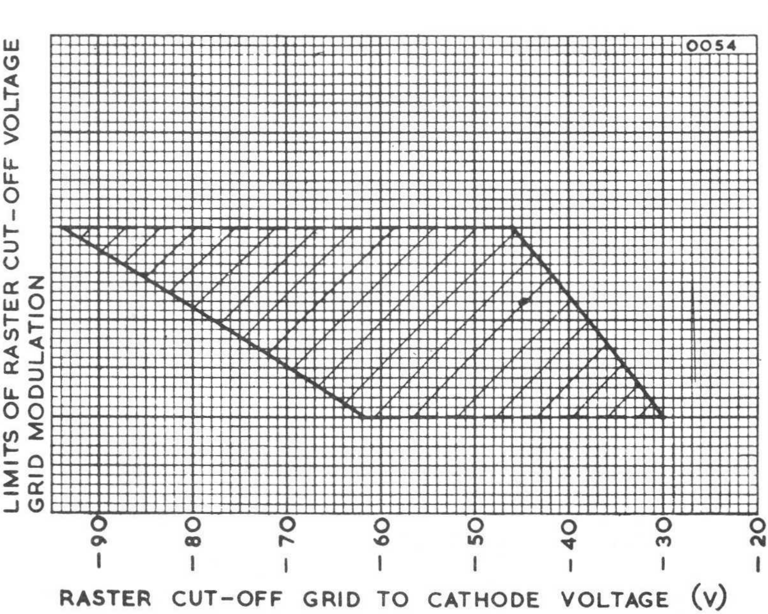
* **Determined by reference line gauge No. 15**

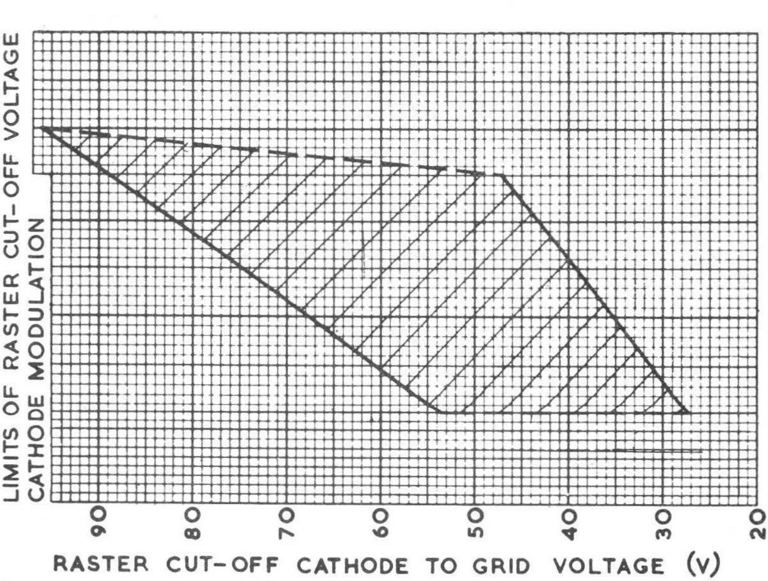
† **The tube socket should not be rigidly mounted, it should have flexible leads and be allowed to move freely.**


0053A
GRID MODULATION
$I_{a_2+a_4}/V_{g-k}$
$V_{a_2+a_4}$ = 14 to 17 kV
FIGURES FOR EXTINCTION
OF FOCUSED RASTER
$V_{a_1-k}$ 300 400 500 V
$V_{g-k}$ −46 −58 −70 V
$V_{a_1-k}$ = 500V
400V
300V
1·2
1·1
1·0
0·9
0·8
0·7
0·6
0·5
0·4
0·3
0·2
0·1
0
FINAL ANODE CURRENT $(I_{a_2+a_4})$ mA
−70 −60 −50 −40 −30 −20 −10 0
GRID TO CATHODE VOLTAGE $(V_{g-k})$ V



0052A
CATHODE MODULATION
$I_{a_2+a_4} / V_{k-g}$
$V_{a_2+a_4}$ = 14 to 17 kV
FIGURES FOR EXTINCTION OF FOCUSED RASTER
$V_{a_1-g}$ 300 400 500 V
$V_{k-g}$ 41 52 63 V
$V_{a_1-g}$ = 500V
400V
300V
1·2
1·1
1·0
0·9
0·8
0·7
0·6
0·5
0·4
0·3
0·2
0·1
0
70
60
50
40
30
20
10
FINAL ANODE CURRENT $(I_{a_2+a_4})$ mA
CATHODE TO GRID VOLTAGE $(V_{k-g})$ V



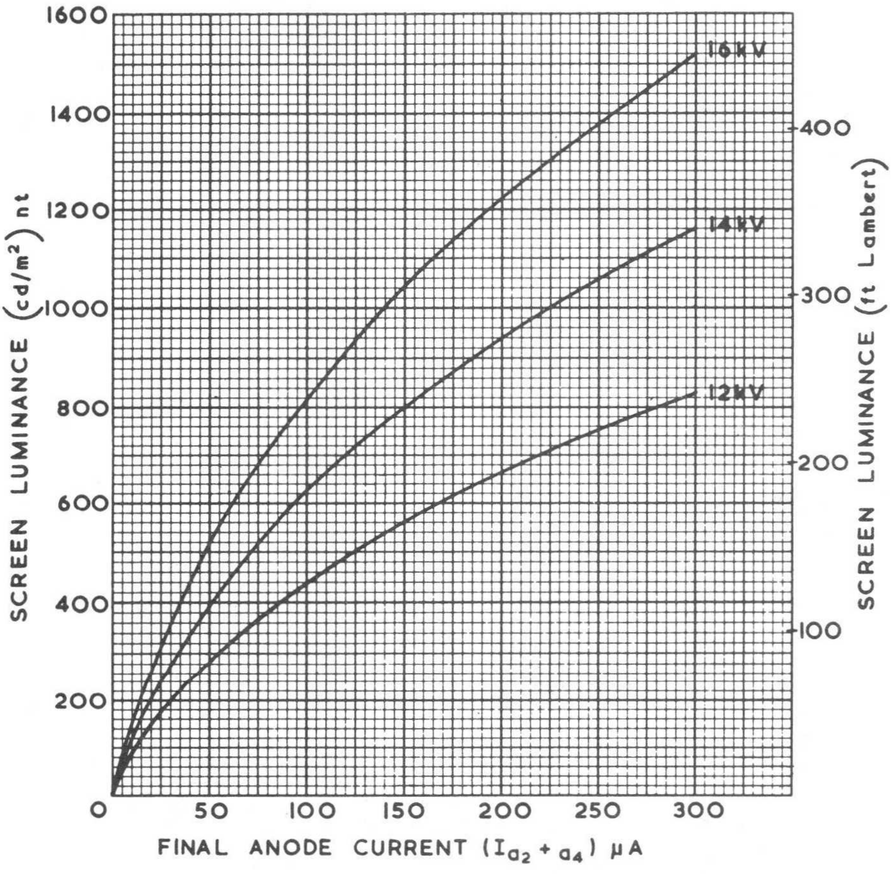




DATA DISPLAY & MONITOR TUBES

TYPICAL CHARACTERISTICS

W PHOSPHOR

FOCUSED RASTER OF FULL HEIGHT
4 x 3 ASPECT RATIO

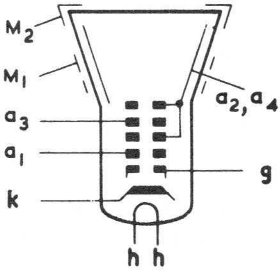


# Data Display or Monitor Tube  M17-15..

**GENERAL**

Rectangular face, 7 inch 70° diagonal
Bonded face-plate with mounting frame
Electrostatic focus, magnetic deflection
Straight gun, aluminised screen
29.4 mm maximum neck diameter
Clear glass, external conductive coating

| | | | |
|---|---|---|---|
| Heater voltage | $V_h$ | 11.5 | V |
| Heater current | $I_h$ | 0.15 | A |




## DESIGN CENTRE RATINGS - Voltages referred to cathode

| | | | |
|---|---|---|---|
| Maximum second and fourth anode voltage | $V_{a2+a4(max)}$ | 16* | kV |
| Minimum second and fourth anode voltage | $V_{a2+a4(min)}$ | 12 | kV |
| Maximum third anode voltage | $V_{a3(max)}$ | +1000 to -500 | V |
| Maximum first anode voltage | $V_{a1(max)}$ | 500 | V |
| Maximum negative grid voltage | $-V_{g(max)}$ | 200 | V |
| Maximum peak negative grid voltage | $-v_{g(pk)max}$ | 400 | V |
| Minimum negative grid voltage | $-V_{g(min)}$ | 1.0 | V |
| Maximum heater to cathode voltage, heater negative (d.c.) | $V_{h-k(max)}$ | 200 | V |
| Maximum peak heater to cathode voltage, heater negative (absolute rating) | $v_{h-k(pk)max}$ | 400† | V |
| Maximum impedance, grid to cathode (50 Hz) | $Z_{g-k(max)}$ | 0.5 | MΩ |
| Maximum resistance, grid to cathode | $R_{g-k(max)}$ | 1.5 | MΩ |

* The absolute rating of 18 kV must not be exceeded.

† During a warming-up period not exceeding 45 seconds.

## PHOSPHOR SCREEN

This type is usually supplied with W phosphor (M17-15W) giving a television white trace of medium short persistence. Other phosphor screens can be made available to special order.

Tubes incorporating a B8H Sparkguard base will have a suffix after the type number. For details of the Sparkguard bases see separate sheets.

## INTER-ELECTRODE CAPACITANCES

| | | * | † | |
|---|---|---|---|---|
| Cathode to all | $c_{k\text{-}all}$ | 3.0 | 3.5 | pF |
| Grid to all | $c_{g\text{-}all}$ | 6.5 | 8.0 | pF |
| Anodes 2 and 4 to coating $M_1$ (approx.) | $c_{a2+a4\text{-}M1}$ | 200 | | pF |
| Anodes 2 and 4 to frame $M_2$ (approx.) | $c_{a2+a4\text{-}M2}$ | 80 | | pF |

* Holder capacitance balanced out. † Total capacitances including typical holder.

## TYPICAL OPERATION - Grid modulation, voltages referred to cathode.

| | | | |
|---|---|---|---|
| Second and fourth anode voltage | $V_{a2+a4\text{-}k}$ | 14 | kV |
| First anode voltage | $V_{a1\text{-}k}$ | 400 | V |
| Third anode voltage range for focus | $V_{a3\text{-}k}$ | 0 to 400 | V |
| Grid to cathode voltage range for cut-off of raster | $V_{g\text{-}k}$ | -38 to -78 | V |

## TYPICAL OPERATION - Cathode modulation, voltages referred to grid

| | | | |
|---|---|---|---|
| Second and fourth anode voltage | $V_{a2+a4\text{-}g}$ | 14 | kV |
| First anode voltage | $V_{a1\text{-}g}$ | 400 | V |
| Third anode voltage range for focus | $V_{a3\text{-}g}$ | 0 to 400 | V |
| Cathode to grid voltage range for cut-off of raster | $V_{k\text{-}g}$ | 35 to 68 | V |

Characteristic curves as M17-12..

Ifthis tube is operated at voltages in excess of 16 kV x-ray radiation shielding may be necessary to avoid possible danger of personal injury from prolonged exposure at close range.

## MOUNTING

The tube can be mounted in any position.

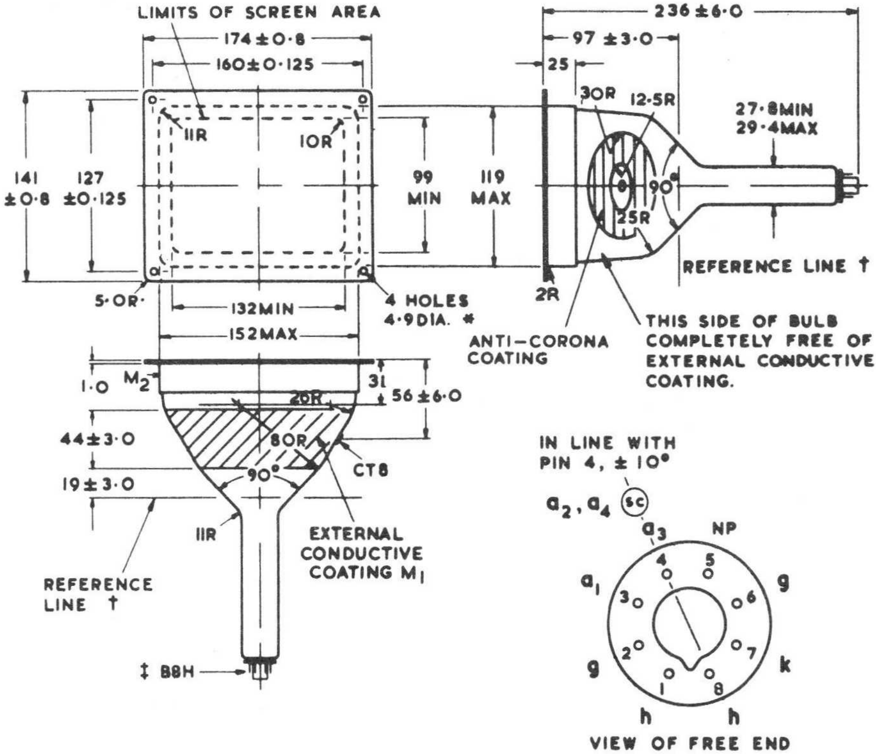
The tube socket should not be rigidly mounted but should have flexible leads and be allowed to move freely.

The external conductive coating ($M_1$) of this tube should be connected to chassis. The capacitance between this coating and final anode may be used to provide smoothing for the e.h.t. supply.

The metal frame ($M_2$) should be connected directly to the chassis in a.c. equipment operating from an isolating transformer, or via a suitable leakage path in a.c./d.c. equipment, for example 2 MΩ.

When flashover protection is incorporated the chassis return paths of $M_1$ and $M_2$ should be made in a manner appropriate to the protection system employed.

**TUBE WEIGHT** (approximate) - net 1.1 kg




All dimensions in mm

Not to be scaled

There is an annular region of anti-corona coating with an external diameter of 60 mm surrounding the CT8 cap, the tube should not be handled in this region.

* It is recommended that 2BA bolts be used for mounting the tube.

† Determined by reference line gauge No. 15

# M17-152BE Data Display or Monitor Tube

The M17-152BE is the M17-15BE with a fine grain and minimal blemish screen for medical applications.

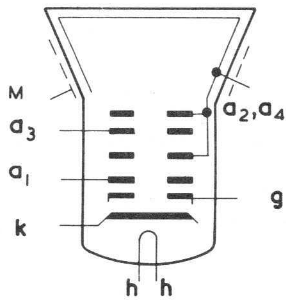
For all other information please see the data sheets for type M17-15..

# Data Display or Monitor Tube M19-100..

## GENERAL

Rectangular face, 19 cm, 90° diagonal
Electrostatic focus, magnetic deflection
Aluminised screen
Grey glass, 65% transmission (approx)
20.7 mm maximum neck diameter
External conductive coating

| | | | |
|---|---|---|---|
| Heater voltage | $V_h$ | 11 | V |
| Heater current | $I_h$ | 75 | mA |




## ABSOLUTE RATINGS - Voltages referred to cathode

| | | | |
|---|---|---|---|
| Maximum second and fourth anode voltage | $V_{a2+a4(max)}$ | 13.5 | kV |
| Minimum second and fourth anode voltage | $V_{a2+a4(min)}$ | 8.0 | kV |
| Maximum third anode voltage | $V_{a3(max)}$ | -50 to +500 | V |
| Maximum first anode voltage | $V_{a1(max)}$ | 350 | V |
| Maximum negative grid voltage | $-V_{g(max)}$ | 100 | V |
| Minimum negative grid voltage | $-V_{g(min)}$ | 1.0* | V |
| Maximum heater to cathode voltage, heater negative (d.c.) | $V_{h-k(max)}$ | 110 | V |
| Maximum peak heater to cathode voltage heater negative | $v_{h-k(pk)max}$ | 130 | V |
| Maximum impedance, grid to cathode (50 Hz) | $Z_{g-k(max)}$ | 0.5 | MΩ |
| Maximum resistance, grid to cathode | $R_{g-k(max)}$ | 1.5 | MΩ |

* A 10 kΩ grid series resistor mounted close to the tube base is recommended to limit the peak grid voltage.

## PHOSPHOR SCREEN

This type is usually supplied with W phosphor (M19-100W) giving a television white trace of medium short persistence. Other phosphor screens can be made available to special order.

**TUBE WEIGHT** (approximate) - 800g

This data should be read in conjunction with Operational Recommendations for Industrial Cathode Ray Tubes.

DATA DISPLAY & MONITOR TUBES

BRIMAR

## INTER-ELECTRODE CAPACITANCES

| | | | |
|---|---|---|---|
| Cathode to all | $c_{k-all}$ | 3.0* | pF |
| Grid to all | $c_{g-all}$ | 4.0* | pF |
| Anodes 2 and 4 to coating M (min.) | $c_{a2+a4-M(min)}$ | | pF |

* Holder capacitance balanced out.

## TYPICAL OPERATION - Grid modulation (Voltage referred to cathode)

| | | | |
|---|---|---|---|
| Second and fourth anode voltage | $V_{a2+a4-k}$ | 10 | kV |
| First anode voltage | $V_{a1-k}$ | 250 | V |
| Third anode voltage range for focus | $V_{a3-k}$ | 0 to 350 | V |
| Average peak to peak picture modulating voltage up to 100 $\mu$A | | 24 | V |
| Grid to cathode voltage for cut-off of raster | $V_{g-k}$ | -35 to -69 | V |

## TYPICAL OPERATION - Cathode modulation (Voltage referred to grid)

| | | | |
|---|---|---|---|
| Second and fourth anode voltage | $V_{a2+a4-g}$ | 10 | kV |
| First anode voltage | $V_{a1-g}$ | 250 | V |
| Third anode voltage range for focus | $V_{a3-g}$ | 0 to 350 | V |
| Average peak to peak picture modulating voltage up to 100 $\mu$A | | 20 | V |
| Cathode to grid voltage for cut-off of raster | $V_{k-g}$ | 32 to 58 | V |

## MOUNTING

There is a region of anti-corona coating surrounding the CT8 cap, the tube should not be handled in this region.

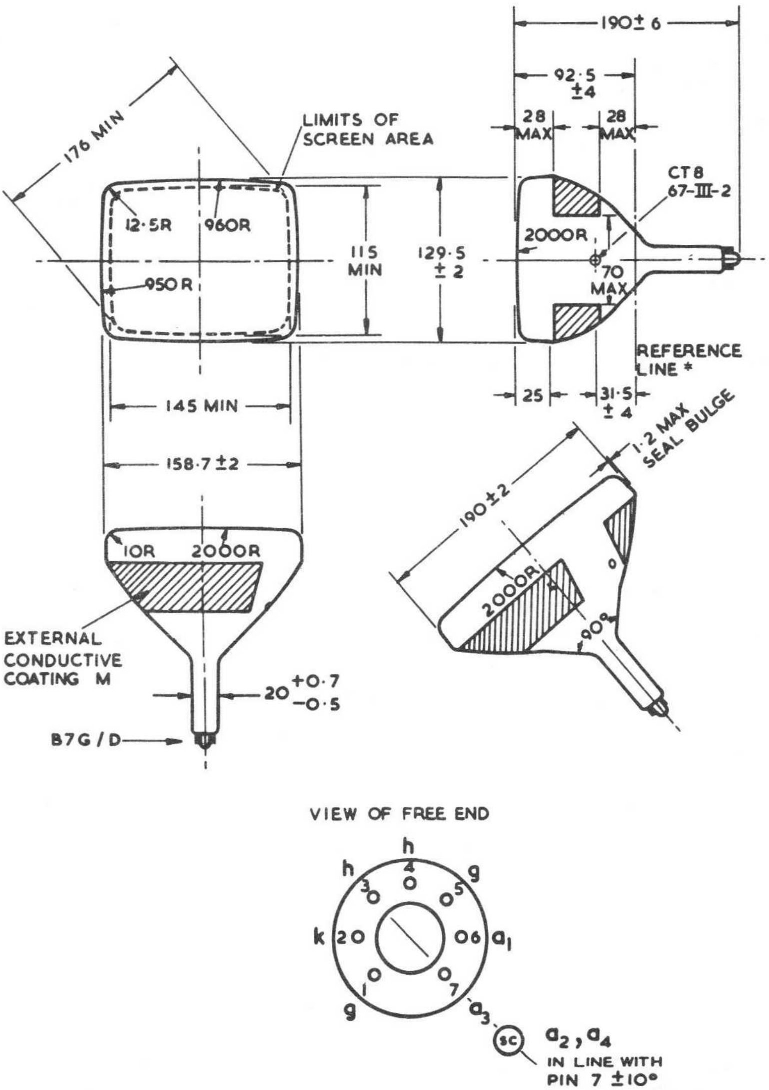
The tube can be mounted in any position. The tube socket should not be rigidly mounted but should have flexible leads and be allowed to move freely.

The external conductive coating of this tube should be connected to chassis. The capacitance between this coating and final anode may be used to provide smoothing for the e.h.t. supply.

When flashover protection is incorporated the chassis return path should be made in a manner appropriate to the protection system employed.

Characteristic curves as M23-110..

# Data Display or Monitor Tube M19–100 ..




All dimensions in mm

Not to be scaled

* Determined by reference line gauge No. 21 (See T.D.S. 5-0-91-21)

DATA DISPLAY & MONITOR TUBES

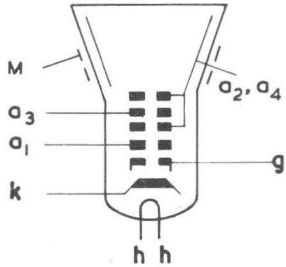
# M21-13.. Data Display or Monitor Tube

MAINTENANCE TYPE

**GENERAL**

Rectangular face, 21 cm 90° diagonal tube
Electrostatic focus, magnetic deflection
Straight gun, aluminised screen
29.4 mm maximum neck diameter
Clear glass, external conductive coating

| | | | |
|---|---|---|---|
| Heater voltage | $V_h$ | 11.5 | V |
| Heater current | $I_h$ | 0.15 | A |




**DESIGN CENTRE RATINGS** - voltages referred to cathode

| | | | |
|---|---|---|---|
| Maximum second and fourth anode voltage | $V_{a2+a4(max)}$ | 16* | kV |
| Minimum second and fourth anode voltage | $V_{a2+a4(min)}$ | 8.0 | kV |
| Maximum third anode voltage | $V_{a3(max)}$ | ± 700 | V |
| Maximum first anode voltage | $V_{a1(max)}$ | 500 | V |
| Maximum negative grid voltage | $-V_{g(max)}$ | 200 | V |
| Minimum negative grid voltage | $-V_{g(min)}$ | 1.0 | V |
| Maximum heater to cathode voltage, heater negative (d.c.) | $V_{h-k(max)}$ | 200 | V |

* 16 kV is a design centre rating, the absolute rating of 18 kV must not be exceeded.

If this tube is operated at voltages in excess of 16 kV, x-ray radiation shielding may be necessary to avoid possible danger of personal injury from prolonged exposure at close range. The normal glass protective viewing window may provide such a safeguard. If the radiation measured in contact with this window does not exceed 0.5 millirontgens per hour, the window will normally provide adequate protection.

**PHOSPHOR SCREEN**

This type is usually supplied with LC phosphor (M21-13LC) giving an orange trace of very long persistence or with W (television white) phosphor. Other phosphor screens can be made to special order.

Tube incorporating a B8H Sparkguard base will have a suffix after the type number. For details of the Sparkguard bases see separate sheets.

This data should be read in conjunction with Operational Recommendations for Industrial Cathode Ray Tubes.

**Thorn Radio Valves and Tubes Limited**

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## INTER-ELECTRODE CAPACITANCES

| | | * | † | |
|---|---|---|---|---|
| Cathode to all | $c_{k-all}$ | 3.0 | 3.5 | pF |
| Grid to all | $c_{g-all}$ | 6.5 | 8.0 | pF |
| Anodes 2 and 4 to coating M (approx.) | $c_{a2+a4-M}$ | 400 | | pF |

* Holder capacitance balanced out.

† Total capacitances including a typical B8H holder.

## TYPICAL OPERATION - Grid modulation, voltages referred to cathode

| | | | |
|---|---|---|---|
| Second and fourth anode voltage | $V_{a2+a4}$ | 12 | kV |
| First anode voltage | $V_{a1}$ | 400 | V |
| Third anode voltage range for focus | $V_{a3}$ | 0 to 400§ | V |
| Grid to cathode voltage range for cut-off of raster | $V_g$ | -30 to -72 | V |
| Average peak to peak modulating voltage final anode current = 150 $\mu$A | | 24 | V |
| LC screen persistence to 10% (approx.) | | 20 | s |

The LC screen is liable to burn even at low values of beam current if operated with a stationary or slow-moving spot.

§ The change of spot size with variation of focus voltage is small and the limit of 0 to 400V is such that an acceptable focus quality is obtained within this range. If it is required to pass through the point of focus a voltage of at least -100V to +500V will be required.

## MOUNTING

The tube can be mounted in any position. The tube socket should not be rigidly mounted but should have flexible leads and be allowed to move freely. The design of the socket should be such that the wiring cannot impress lateral strains through the socket contacts on the base. The bottom circumference of the base shell will fall within a circle of 44 mm diameter which is centred on the perpendicular from the centre of the face.

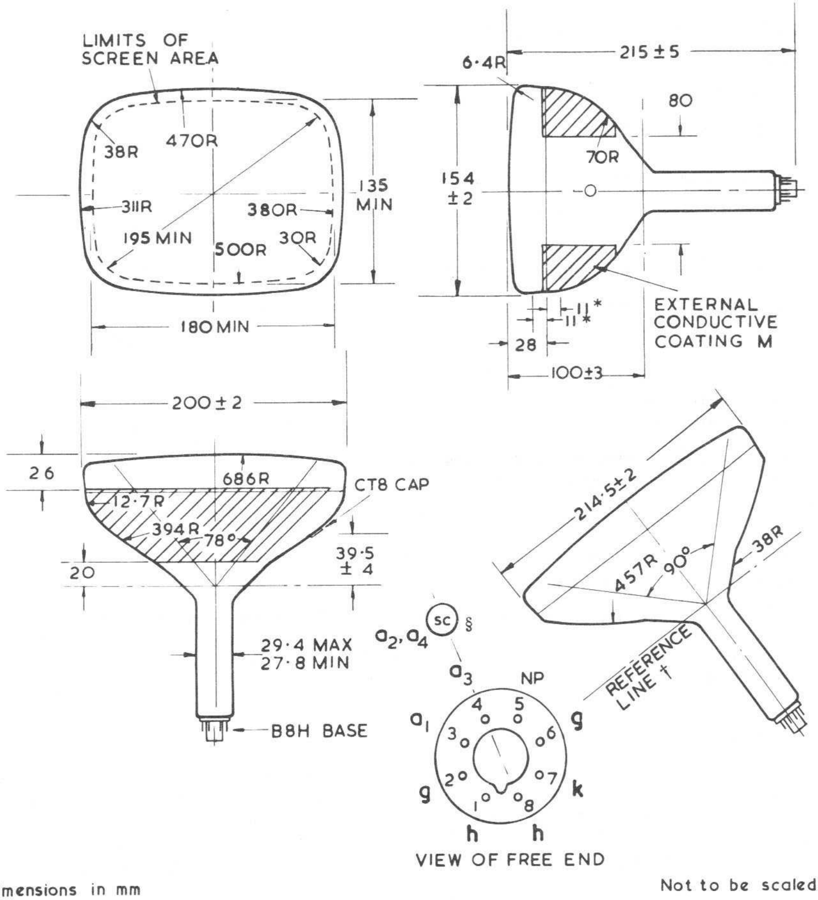
The external conductive coating (M) of this tube should be connected to chassis. The capacitance between this coating and final anode may be used to provide smoothing for the e.h.t. supply.

When flashover protection is incorporated the chassis return path of M should be made in a manner appropriate to the protection system employed.

**TUBE WEIGHT** (approximate) - net 1.3 kg

DATA DISPLAY & MONITOR TUBES

# Data Display or Monitor Tube




All dimensions in mm

Not to be scaled

* During the face sealing operation the glass in this area (total 22 mm) may be disturbed. As the shape of the contour within this area may be either convex or concave the bulb should not be gripped within this region unless special precautions are taken (such as the use of resilient packing material).

† Determined by Reference Gauge No. 15

§ Anode $a_2$, $a_4$ cap in line with pin 4 tolerance ± 10°

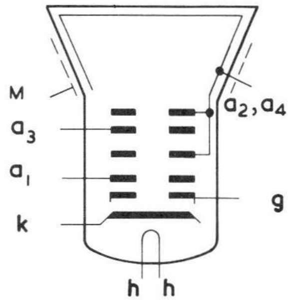
There is an annular region of anti-corona coating with an external diameter of 60 mm surrounding the CT8 cap, the tube should not be handled in this region.

# Data Display or Monitor Tube **M23–110..**

## GENERAL

Rectangular face, 23 cm, 90° diagonal
Electrostatic focus, magnetic deflection
Aluminised screen
Grey glass, 50% transmission (approx)
20.7 mm maximum neck diameter
External conductive coating

| | | | |
|---|---|---|---|
| Heater voltage | $V_h$ | 11 | V |
| Heater current | $I_h$ | 75 | mA |




## ABSOLUTE RATINGS - Voltages referred to cathode

| | | | |
|---|---|---|---|
| Maximum second and fourth anode voltage | $V_{a2+a4(max)}$ | 13.5 | kV |
| Minimum second and fourth anode voltage | $V_{a2+a4(min)}$ | 8.0 | kV |
| Maximum third anode voltage | $V_{a3(max)}$ | -50 to +500 | V |
| Maximum first anode voltage | $V_{a1(max)}$ | 350 | V |
| Maximum negative grid voltage | $-V_{g(max)}$ | 100 | V |
| Minimum negative grid voltage | $-V_{g(min)}$ | 1.0* | V |
| Maximum heater to cathode voltage, heater negative (d.c.) | $V_{h-k(max)}$ | 110 | V |
| Maximum peak heater to cathode voltage heater negative | $v_{h-k(pk)max}$ | 130 | V |
| Maximum impedance, grid to cathode (50 Hz) | $Z_{g-k(max)}$ | 0.5 | MΩ |
| Maximum resistance, grid to cathode | $R_{g-k(max)}$ | 1.5 | MΩ |

* A 10 kΩ grid series resistor mounted close to the tube base is recommended to limit the peak grid voltage.

## PHOSPHOR SCREEN

This type is usually supplied with W phosphor (M23-110W) giving a television white trace of medium short persistence. Other phosphor screens can be made available to special order.

## TUBE WEIGHT (approximate) - 1.4 kg

This data should be read in conjunction with Operational Recommendations for Industrial Cathode Ray Tubes.

DATA DISPLAY & MONITOR TUBES

## INTER-ELECTRODE CAPACITANCES

| | | | |
|---|---|---|---|
| Cathode to all | $c_{k-all}$ | 3.0* | pF |
| Grid to all | $c_{g-all}$ | 4.0* | pF |
| Anodes 2 and 4 to coating M (min.) | $c_{a2+a4-M(min)}$ | 300 | pF |

* Holder capacitance balanced out.

## TYPICAL OPERATION - Grid modulation (Voltage referred to cathode)

| | | | |
|---|---|---|---|
| Second and fourth anode voltage | $V_{a2+a4-k}$ | 10 | kV |
| First anode voltage | $V_{a1-k}$ | 250 | V |
| Third anode voltage range for focus | $V_{a3-k}$ | 0 to 350 | V |
| Average peak to peak picture modulating voltage up to 100 μA | | 21 | V |
| Grid to cathode voltage for cut-off of raster | $V_{g-k}$ | -35 to -69 | V |

## TYPICAL OPERATION - Cathode modulation (Voltage referred to grid)

| | | | |
|---|---|---|---|
| Second and fourth anode voltage | $V_{a2+a4-g}$ | 10 | kV |
| First anode voltage | $V_{a1-g}$ | 250 | V |
| Third anode voltage range for focus | $V_{a3-g}$ | 0 to 350 | V |
| Average peak to peak picture modulating voltage up to 100 μA | | 18 | V |
| Cathode to grid voltage for cut-off of raster | $V_{k-g}$ | 32 to 58 | V |

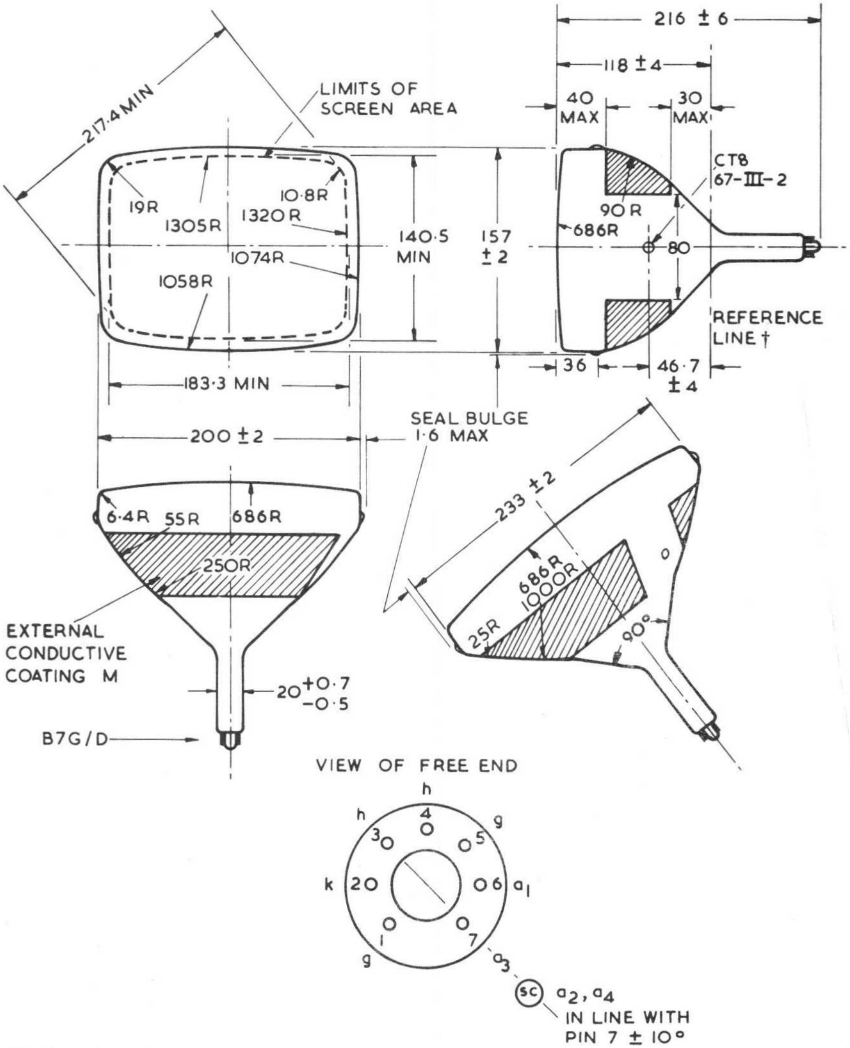
## MOUNTING

There is a region of anti-corona coating surrounding the CT8 cap, the tube should not be handled in this region.

The tube can be mounted in any position. The tube socket should not be rigidly mounted but should have flexible leads and be allowed to move freely.

The external conductive coating of this tube should be connected to chassis. The capacitance between this coating and final anode may be used to provide smoothing for the e.h.t. supply.

When flashover protection is incorporated the chassis return path should be made in a manner appropriate to the protection system employed.

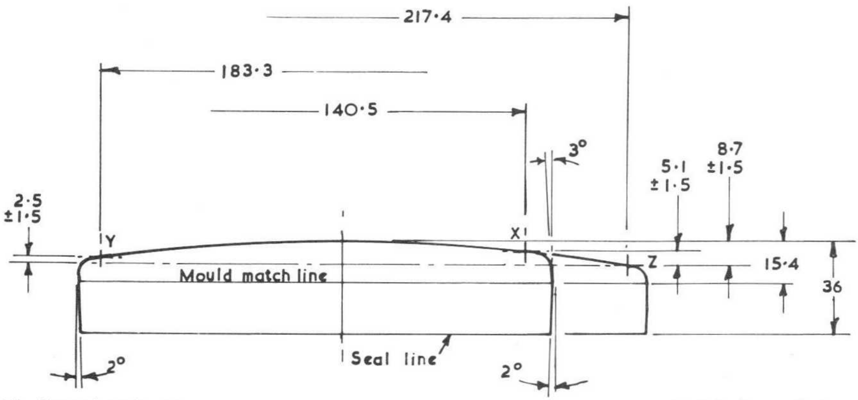



All dimensions in mm

Not to be scaled

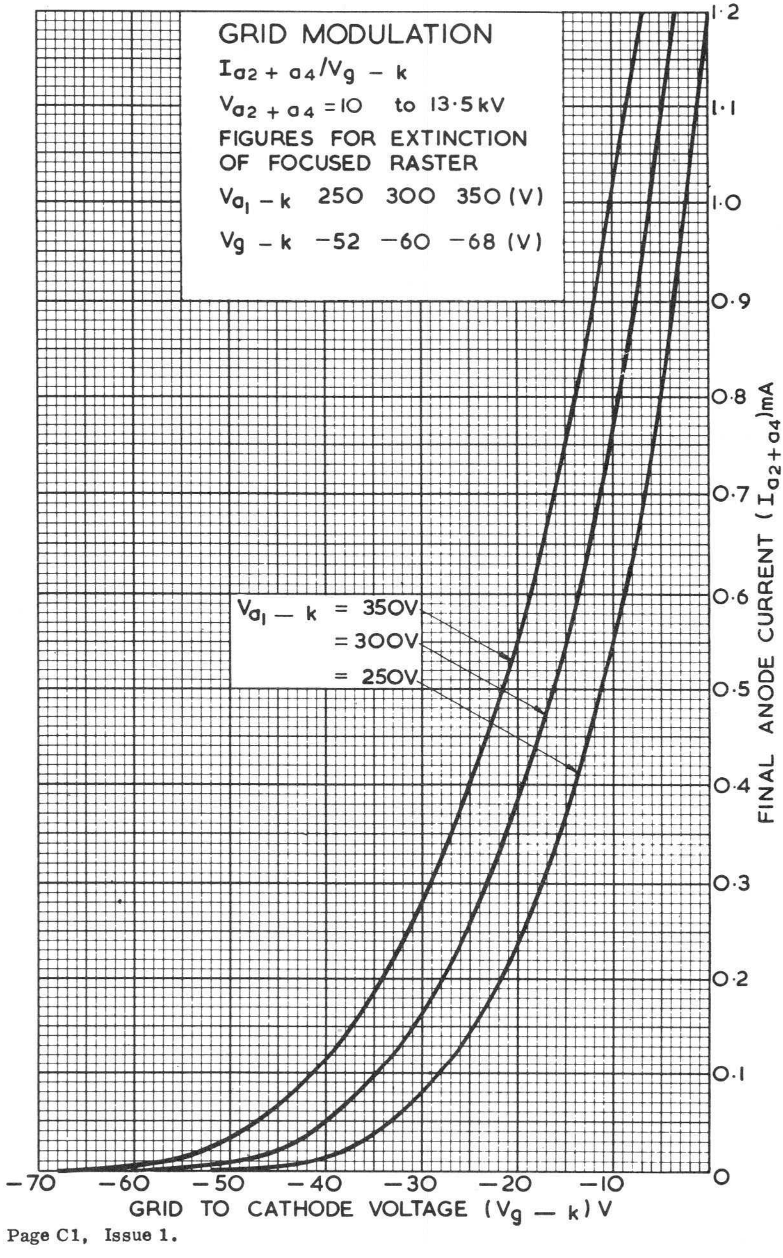
† Determined by reference line gauge No. 21

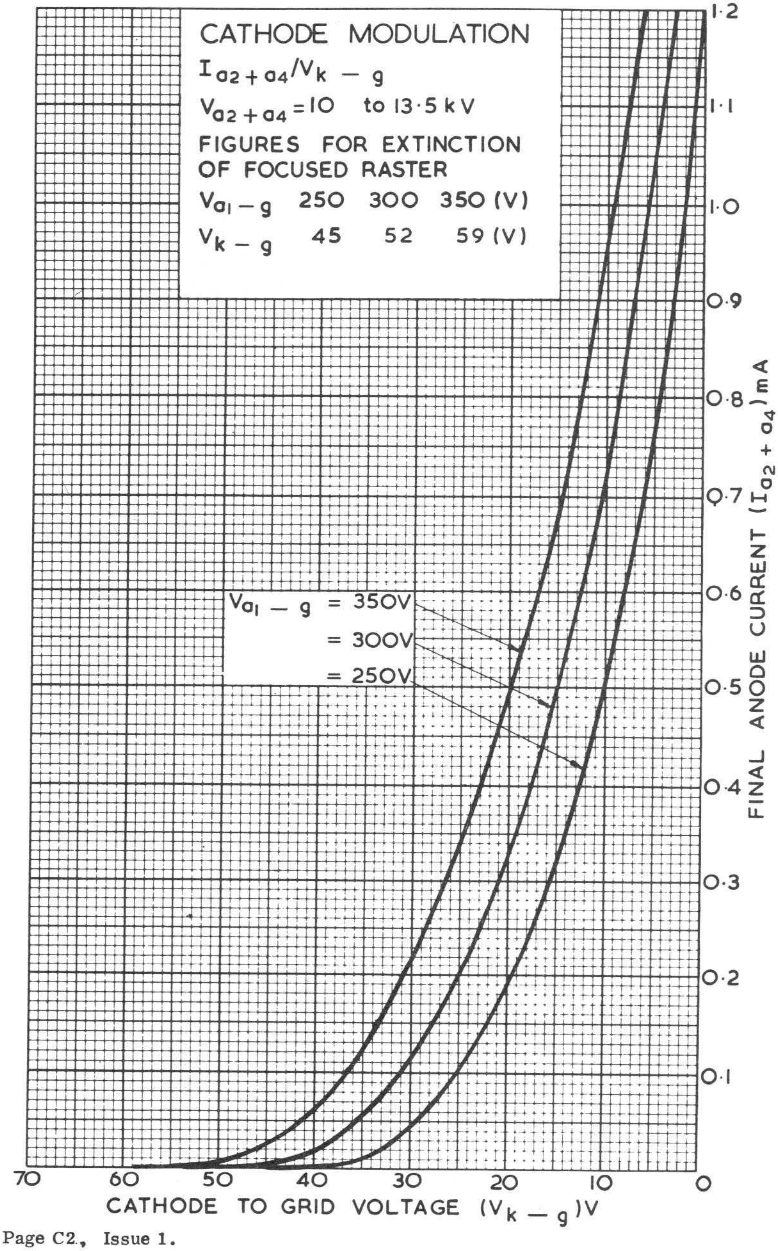
Minimum usefull screen area 242 $cm^2$




All dimensions in mm

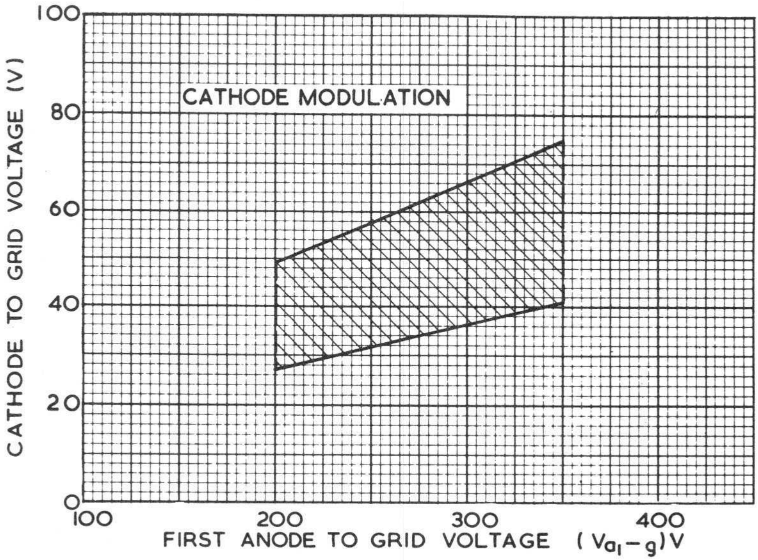
Not to be scaled

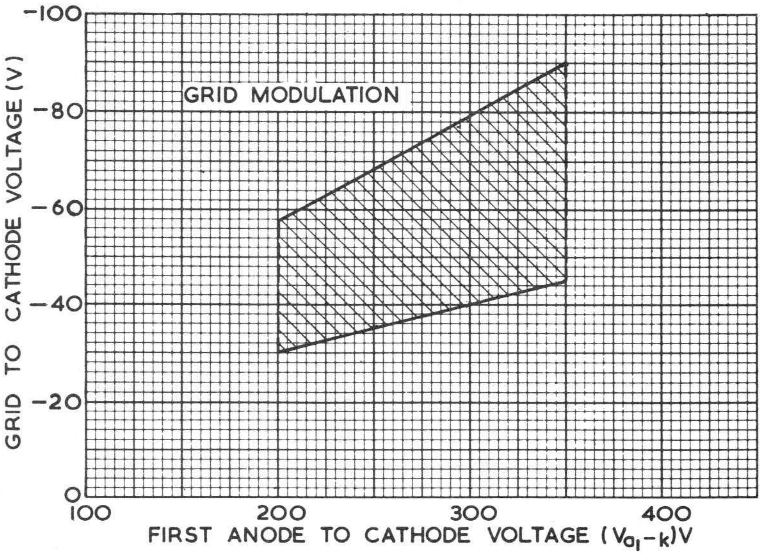

GRID MODULATION
$I_{a2+a4}/V_{g-k}$
$V_{a2+a4}$ = 10 to 13·5 kV
FIGURES FOR EXTINCTION OF FOCUSED RASTER
$V_{a1-k}$ 250 300 350 (V)
$V_{g-k}$ −52 −60 −68 (V)
$V_{a1-k}$ = 350V
= 300V
= 250V
1·2
1·1
1·0
0·9
0·8
0·7
0·6
0·5
0·4
0·3
0·2
0·1
0
FINAL ANODE CURRENT ($I_{a2+a4}$) mA
−70 −60 −50 −40 −30 −20 −10
GRID TO CATHODE VOLTAGE ($V_{g-k}$) V



CATHODE MODULATION
$I_{a2+a4}/V_{k-g}$
$V_{a2+a4}$ = 10 to 13·5 kV
FIGURES FOR EXTINCTION OF FOCUSED RASTER
$V_{a1-g}$ 250 300 350 (V)
$V_{k-g}$ 45 52 59 (V)
$V_{a1-g}$ = 350V
= 300V
= 250V
1·2
1·1
1·0
0·9
0·8
0·7
0·6
0·5
0·4
0·3
0·2
0·1
FINAL ANODE CURRENT $(I_{a2+a4})$ mA
70
60
50
40
30
20
10
0
CATHODE TO GRID VOLTAGE $(V_{k-g})$V

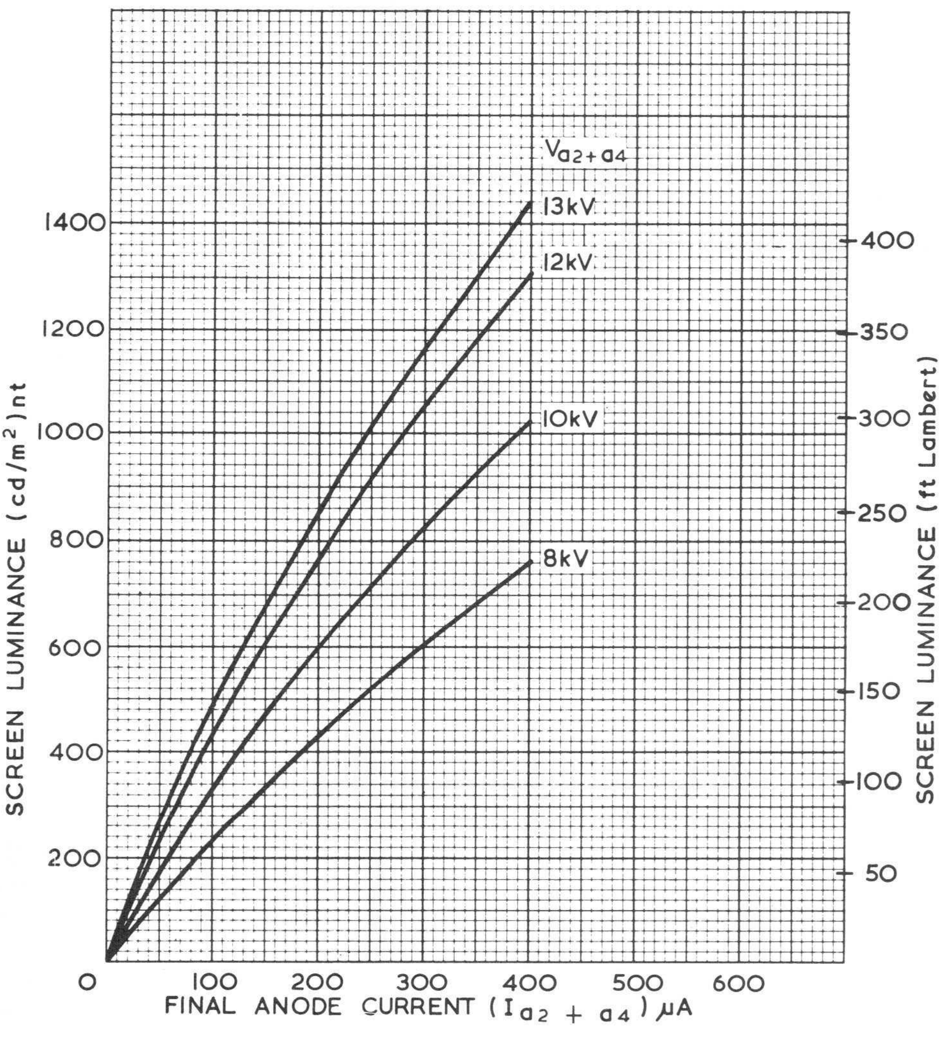
LIMITS OF RASTER CUT-OFF VOLTAGE



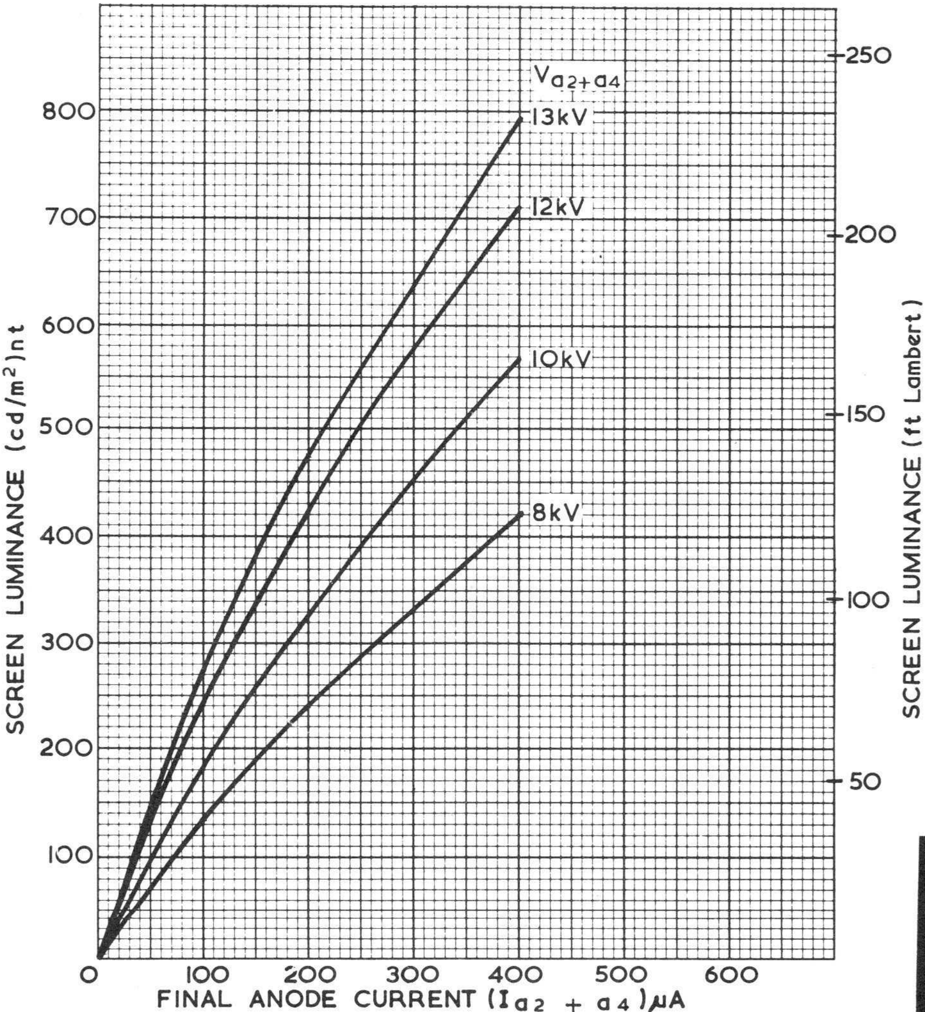
TYPICAL CHARACTERISTICS GH PHOSPHOR SCREEN

FOCUSED RASTER OF FULL HEIGHT 4 X 3 ASPECT RATIO



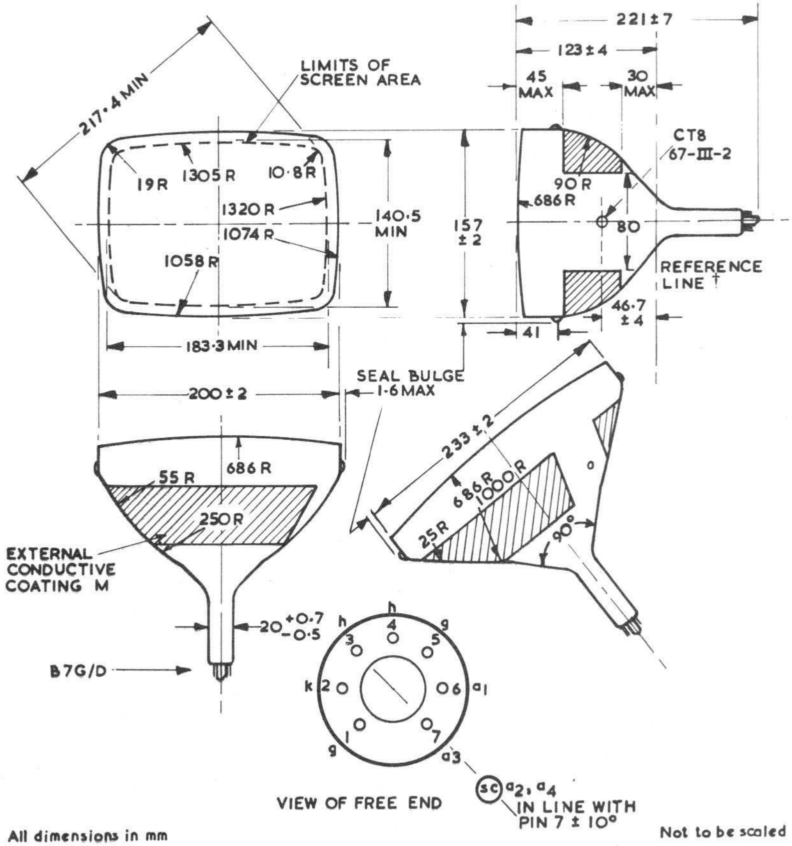
## TYPICAL CHARACTERISTICS W PHOSPHOR SCREEN

FOCUSED RASTER OF FULL HEIGHT 4 X 3 ASPECT RATIO



# M23-111.. Data Display or Monitor Tube

The M23-111.. is the M23-110.. with a tinted bonded face-plate giving a total glass transmission of approximately 30%. The external surface is treated to reduce specular reflection




All dimensions in mm

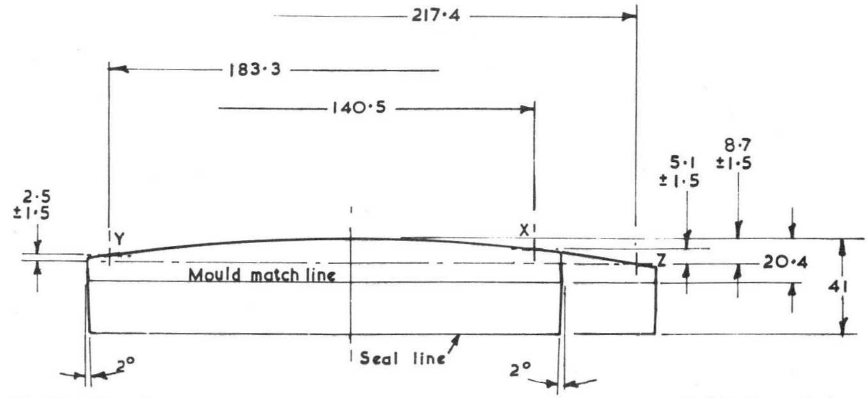
Not to be scaled

† Determined by reference line gauge No. 21

## PHOSPHOR SCREEN

This type is usually supplied with W phosphor ( M23-111W ) giving a television white trace of medium short persistence. Other phosphor screens can be made available to special order.

**TUBE WEIGHT** (approximate) - net 1.7kg




All dimensions in mm

Not to be scaled

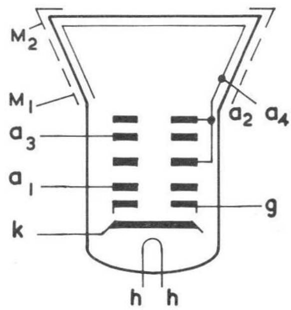
# M23-112.. Data Display or Monitor Tube

PRELIMINARY DATA

**GENERAL**

Rectangular face, 23 cm, 90° diagonal
Rimguard III reinforced envelope *
Integral mounting lugs
Electrostatic focus, magnetic deflection
Aluminised screen
Grey glass, 50% transmission (approx)
20.7 mm maximum neck diameter
External conductive coating

| | | | |
|---|---|---|---|
| Heater voltage | $V_h$ | 11 | V |
| Heater current | $I_h$ | 75 | mA |




**ABSOLUTE RATINGS** - Voltages referred to cathode

| | | | |
|---|---|---|---|
| Maximum second and fourth anode voltage | $V_{a2+a4(max)}$ | 13.5 | kV |
| Minimum second and fourth anode voltage | $V_{a2+a4(min)}$ | 8.0 | kV |
| Maximum third anode voltage | $V_{a3(max)}$ | -50 to +500 | V |
| Maximum first anode voltage | $V_{a1(max)}$ | 350 | V |
| Maximum negative grid voltage | $-V_{g(max)}$ | 100 | V |
| Minimum negative grid voltage | $-V_{g(min)}$ | 1.0 † | V |
| Maximum heater to cathode voltage, heater negative (d.c.) | $V_{h-k(max)}$ | 110 | V |
| Maximum peak heater to cathode voltage heater negative | $v_{h-k(pk)max}$ | 130 | V |
| Maximum impedance, grid to cathode (50Hz) | $Z_{g-k(max)}$ | 0.5 | MΩ |
| Maximum resistance, grid to cathode | $R_{g-k(max)}$ | 1.5 | MΩ |

* This tube meets the requirements for intrinsically safe tubes laid down in the section of I.E.C. Publication 65 dealing with implosion.

† A 10 kΩ grid series resistor mounted close to the tube base is recommended to limit the peak grid voltage.

**PHOSPHOR SCREEN**

This type is usually supplied with GH phosphor (M23-112GH) giving a Green trace of medium short persistence. Other phosphor screens can be made available to special order.

**TUBE WEIGHT** (approximate) - 1.5kg

This data should be read in conjunction with Operational Recommendations for Industrial Cathode Ray Tubes.

**Thorn Radio Valves and Tubes Limited**



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# Data Display or Monitor Tube M23-112..

## INTER-ELECTRODE CAPACITANCES

| | | | |
|---|---|---|---|
| Cathode to all | $c_{k-all}$ | 3.0* | pF |
| Grid to all | $c_{g-all}$ | 4.0* | pF |
| Anodes 2 and 4 to coating $M_1$ (min.) | $c_{a2-a4M_1}$ (min) | 300 | pF |
| Anodes 2 and 4 to metal $M_2$ (approx) | $c_{a2-a4-M_2}$ | 100 | pF |

* Holder capacitance balanced out.

## TYPICAL OPERATION - Grid modulation (Voltage referred to cathode)

| | | | |
|---|---|---|---|
| Second and fourth anode voltage | $V_{a2+a4-k}$ | 10 | kV |
| First anode voltage | $V_{a1-k}$ | 250 | V |
| Third anode voltage range for focus | $V_{a3-k}$ | 0 to 350 | V |
| Average peak to peak picture modulating voltage up to 100 $\mu$A | | 24 | V |
| Grid to cathode voltage for cut-off of raster | $V_{g-k}$ | -35 to -69 | V |

## TYPICAL OPERATION - Cathode modulation (Voltage referred to grid)

| | | | |
|---|---|---|---|
| Second and fourth anode voltage | $V_{a2+a4-g}$ | 10 | kV |
| First anode voltage | $V_{a1-g}$ | 250 | V |
| Third anode voltage range for focus | $V_{a3-g}$ | 0 to 350 | V |
| Average peak to peak picture modulating voltage up to 100 $\mu$A | | 20 | V |
| Cathode to grid voltage for cut-off of raster | $V_{k-g}$ | 32 to 58 | V |

## MOUNTING

Any mask used in the mounting of this tube should be flexible enough to take up small variations in fixing and bulb contours.

The tube can be mounted in any position. The tube socket should not be rigidly mounted but should have flexible leads and be allowed to move freely.

The external conductive coating ($M_1$) of this tube should be connected to chassis. The capacitance between this coating and final anode may be used to provide smoothing for the e.h.t. supply.

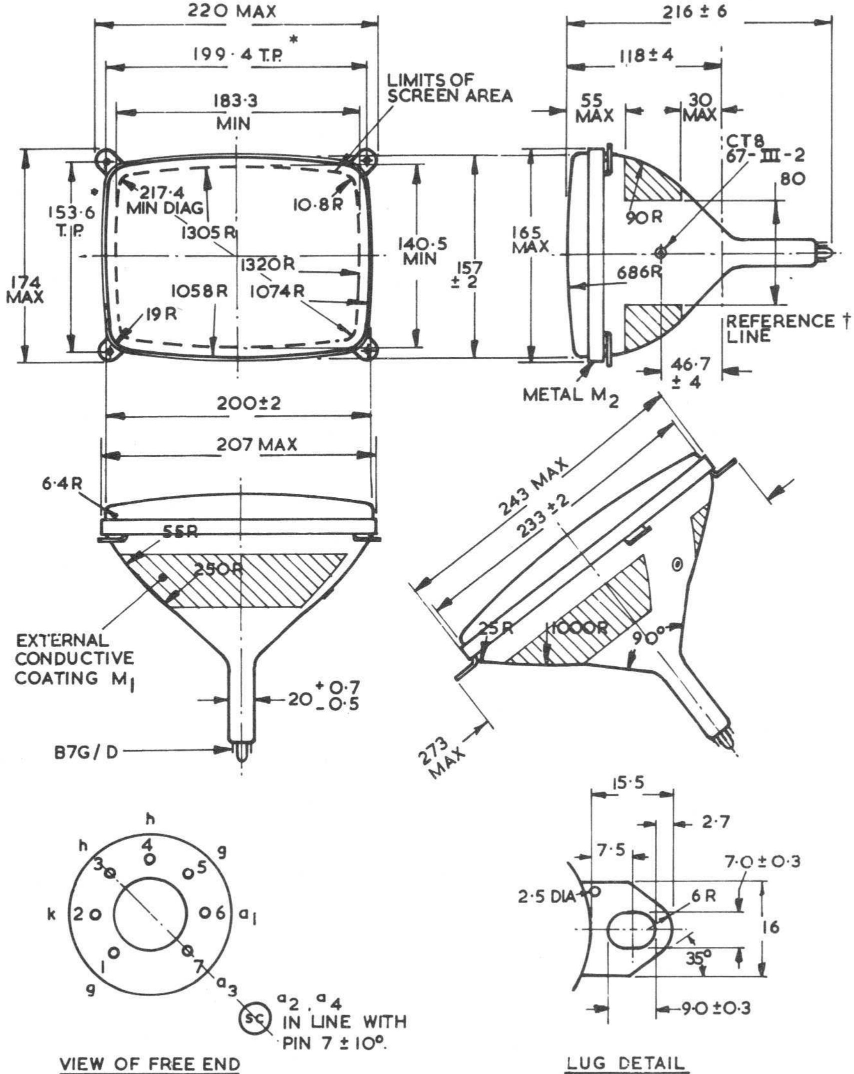
The metal ($M_2$) should be connected to the chassis in an a.c. receiver operating from an isolating transformer, or via a suitable leakage path in an a.c./d.c. receiver, for example 2 MΩ.

When flashover protection is incorporated the chassis return paths of $M_1$ and $M_2$ should be made in a manner appropriate to the protection system employed.

There is a region of anti-corona coating surrounding the CT8 cap. the tube should not be handled in this region.

Characteristic curves as M23-110..

# M23-112.. Data Display or Monitor Tube

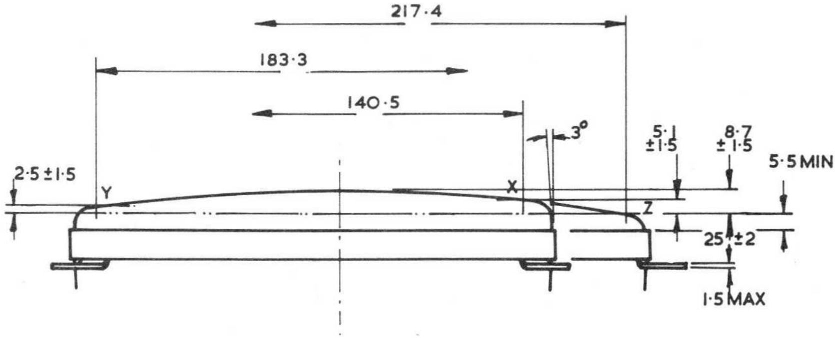



**All Dimensions in mm.** **Not to be scaled.**

Minimum screen area 242 $cm^2$

* The bolts to be used for mounting the tube must lie within circles of 4.0 mm diameter centred on these true positions. One of the four lugs may deviate 2.0 mm maximum from the plane through the other three lugs

† Determined by reference line gauge No. 21.

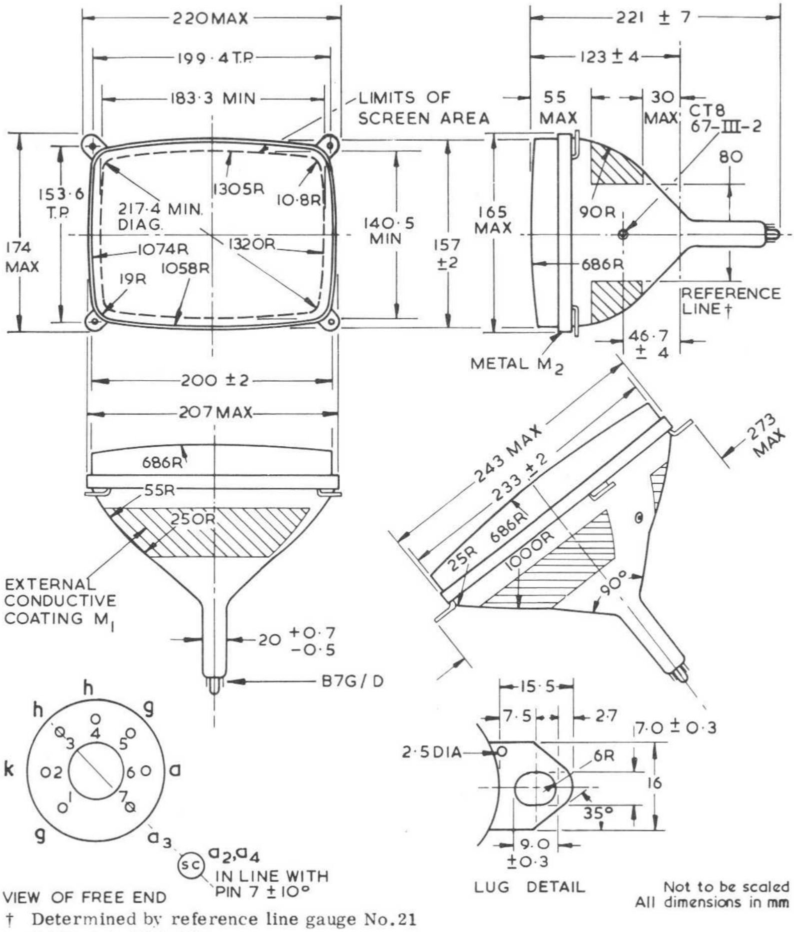



All Dimensions in mm.

Not to be scaled.

# M23-113.. Data Display or Monitor Tube

The M23-113.. is the M23-112.. with a tinted bonded face-plate giving a total glass transmission of approximately 30%. The external surface is treated to reduce specular reflection.




Not to be scaled
All dimensions in mm

† Determined by reference line gauge No.21

**PHOSPHOR SCREEN**

This type is usually supplied with GV phosphor (M23-113GV) giving a green trace of very long persistence. Other phosphor screens can be made available to special order.

**TUBE WEIGHT** (approximate) - net 1.8kg.

**Thorn Radio Valves and Tubes Limited**

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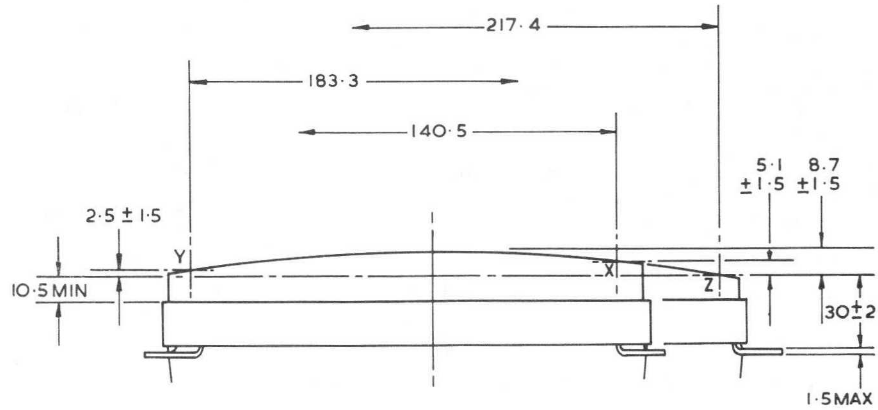



All dimensions in mm

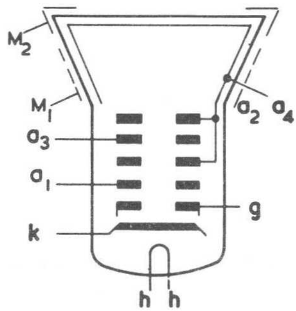
Not to be scaled

# M24-120 .. Data Display or Monitor Tube

**GENERAL**

Rectangular face, 24 cm, 90° diagonal
Rimguard reinforced envelope*
Integral mounting lugs
Electrostatic focus, magnetic deflection
Aluminised screen
Grey glass, 52% transmission (approx.)
29.4 mm maximum neck diameter
External conductive coating

| | | | |
|---|---|---|---|
| Heater voltage | $V_h$ | 6.3 | V |
| Heater current | $I_h$ | 0.3 | A |




**ABSOLUTE RATINGS** - Voltages referred to cathode

| | | | |
|---|---|---|---|
| Maximum second and fourth anode voltage | $V_{a2+a4(max)}$ | 18 | kV |
| Minimum second and fourth anode voltage | $V_{a2+a4(min)}$ | 10 | kV |
| Maximum third anode voltage range | $V_{a3(max)}$ | ± 700 | V |
| Maximum first anode voltage | $V_{a1(max)}$ | 600 | V |
| Minimum first anode voltage | $V_{a1(min)}$ | 200 | V |
| Maximum negative grid voltage | $-V_{g(max)}$ | 200 | V |
| Minimum negative grid voltage | $-V_{g(min)}$ | 1.0† | V |
| Maximum heater to cathode voltage, heater negative (d.c.) | $V_{h-k(max)}$ | 200 | V |
| Maximum peak heater to cathode voltage heater negative | $v_{h-k(pk)max}$ | 250 | V |
| Maximum impedance, grid to cathode (50 Hz) | $Z_{g-k(max)}$ | 0.5 | MΩ |
| Maximum resistance, grid to cathode | $R_{g-k(max)}$ | 1.5 | MΩ |

† A 10 kΩ grid series resistor mounted close to the tube base is recommended to limit the peak grid voltage.

**PHOSPHOR SCREEN**

This type is usually supplied with W phosphor (M24-120W) giving a television white trace of medium short persistence. Other phosphor screens can be made available to special order.

* This tube meets the requirements for intrinsically safe tubes laid down in the section of I.E.C. Publication 65 dealing with implosion.

This data should be read in conjunction with Operational Recommendations for Industrial Cathode Ray Tubes.

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### INTER-ELECTRODE CAPACITANCES

| | | * | † | |
|---|---|---|---|---|
| Cathode to all | $c_{k\text{-all}}$ | 3.0 | 3.5 | pF |
| Grid to all | $c_{g\text{-all}}$ | 6.5 | 7.5 | pF |
| Anodes 2 and 4 to coating $M_1$ (approx.) | $c_{a2+a4\text{-}M1}$ | 400 | | pF |
| Anodes 2 and 4 to metal $M_2$ (approx.) | $c_{a2+a4\text{-}M2}$ | 125 | | pF |

* Holder capacitance balanced out.

† Total capacitances including a typical B8H holder.

### TYPICAL OPERATION - Grid modulation, voltages referred to cathode

| | | | |
|---|---|---|---|
| Second and fourth anode voltage | $V_{a2+a4}$ | 12 to 16 | kV |
| First anode voltage | $V_{a1}$ | 400 | V |
| Third anode voltage range for focus | $V_{a3}$ | 0 to 400 § | V |
| Grid to cathode voltage for cut-off of raster | $V_g$ | -38 to -82 | V |
| Typical line width at 50 $\mu$A (Shrinking raster) | | 0.2 | mm |

§ The change of spot size with variation of focus voltage is small and the limit of 0 to 400 V is such that an acceptable focus quality is obtained within this range. If it is required to pass through the point of focus a voltage range of at least -100V to +500V will be required.

### MOUNTING

If a mask is used with this tube it should be flexible enough to take up small variations in fixing and bulb contours.

There is a region of anti-corona coating surrounding the CT8 cap, the tube should not be handled in this region.

The tube can be mounted in any position. The tube socket should not be rigidly mounted but should have flexible leads and be allowed to move freely.

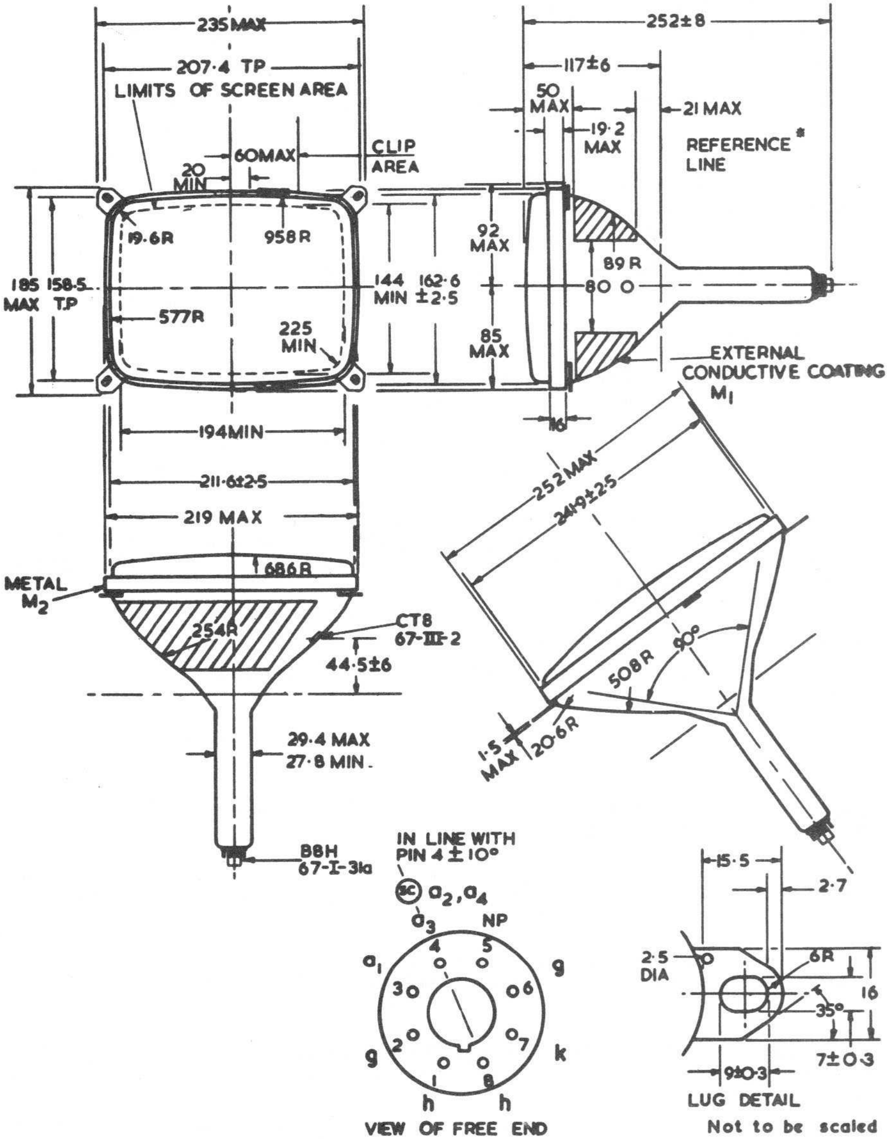
The bolts for mounting the tube must lie within circles of 4 mm diameter centred on these true positions. One of the four lugs may deviate 2 mm maximum from the plane through the other three lugs.

The external conductive coating ($M_1$) of this tube should be connected to chassis. The capacitance between this coating and final anode may be used to provide smoothing for the e.h.t. supply.

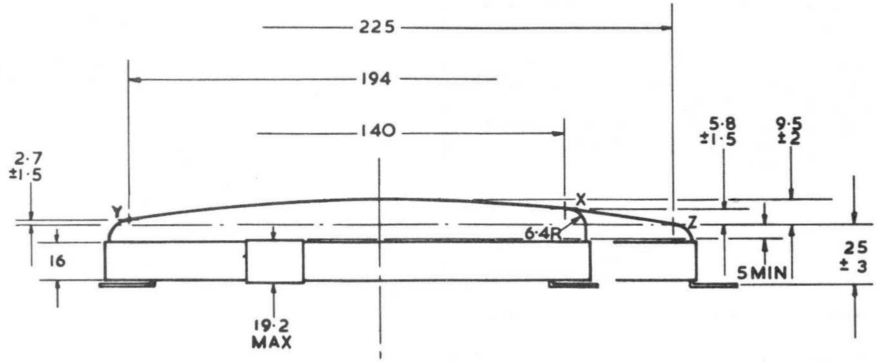
The metal frame ($M_2$) should be connected to the chassis in a.c. equipment operating from an isolating transformer, or via a suitable leakage path in a.c./d.c. equipment, for example 2 M$\Omega$.

When flashover protection is incorporated the chassis return paths of $M_1$ and $M_2$ should be made in a manner appropriate to the protection system employed.

**TUBE WEIGHT** (approximate) 1.8 kg




* Determined by reference line gauge No. 15 (See T.D.S. 5-0-91-15)




All dimensions in mm

Not to be scaled

DATA DISPLAY & MONITOR TUBES

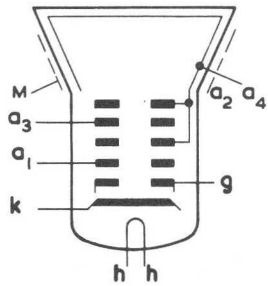
# M24-121..

# Data Display or Monitor Tube

## GENERAL

Rectangular face, 24 cm, 90° diagonal
Electrostatic focus, magnetic deflection
Aluminised screen
Grey glass, 52% transmission (approx.)
29.4 mm maximum neck diameter
External conductive coating

| | | | |
|---|---|---|---|
| Heater voltage | $V_h$ | 6.3 | V |
| Heater current | $I_h$ | 0.3 | A |




## ABSOLUTE RATINGS - Voltages referred to cathode

| | | | |
|---|---|---|---|
| Maximum second and fourth anode voltage | $V_{a2+a4(max)}$ | 18 | kV |
| Minimum second and fourth anode voltage | $V_{a2+a4(min)}$ | 10 | kV |
| Maximum third anode voltage range | $V_{a3(max)}$ | ± 700 | V |
| Maximum first anode voltage | $V_{a1(max)}$ | 600 | V |
| Minimum first anode voltage | $V_{a1(min)}$ | 200 | V |
| Maximum negative grid voltage | $-V_{g(max)}$ | 200 | V |
| Minimum negative grid voltage | $-V_{g(min)}$ | 1.0 † | V |
| Maximum heater to cathode voltage, heater negative (d.c.) | $V_{h-k(max)}$ | 200 | V |
| Maximum peak heater to cathode voltage heater negative | $v_{h-k(pk)max}$ | 250 | V |
| Maximum impedance, grid to cathode (50 Hz) | $Z_{g-k(max)}$ | 0.5 | MΩ |
| Maximum resistance, grid to cathode | $R_{g-k(max)}$ | 1.5 | MΩ |

† A 10 kΩ grid series resistor mounted close to the tube base is recommended to limit the peak grid voltage.

## PHOSPHOR SCREEN

This type is usually supplied with W phosphor (M24-121W) giving a television white trace of medium short persistence. Other phosphor screens can be made available to special order.

This data should be read in conjunction with Operational Recommendations for Industrial Cathode Ray Tubes.

The M24-121.. is the M24-120.. without implosion protection.

# Data Display or Monitor Tube M24-121..

## INTER-ELECTRODE CAPACITANCES

| | | * | † | |
|---|---|---|---|---|
| Cathode to all | $c_{k-all}$ | 3.0 | 3.5 | pF |
| Grid to all | $c_{g-all}$ | 6.5 | 7.5 | pF |
| Anodes 2 and 4 to coating M (approx.) | $c_{a2+a4-M}$ | 400 | | pF |

* Holder capacitance balanced out.

† Total capacitances including a typical B8H holder.

## TYPICAL OPERATION - Grid modulation, voltages referred to cathode

| | | | |
|---|---|---|---|
| Second and fourth anode voltage | $V_{a2+a4}$ | 12 to 16 | kV |
| First anode voltage | $V_{a1}$ | 400 | V |
| Third anode voltage range for focus | $V_{a3}$ | 0 to 400 § | V |
| Grid to cathode voltage for cut-off of raster | $V_g$ | -38 to -82 | V |
| Typical line width at 50 $\mu$A (Shrinking raster) | | 0.2 | mm |

§ The change of spot size with variation of focus voltage is small and the limit of 0 to 400 V is such that an acceptable focus quality is obtained within this range. If it is required to pass through the point of focus a voltage range of at least -100V to +500V will be required.

## MOUNTING

If a mask is used with this tube it should be flexible enough to take up small variations in bulb contours.

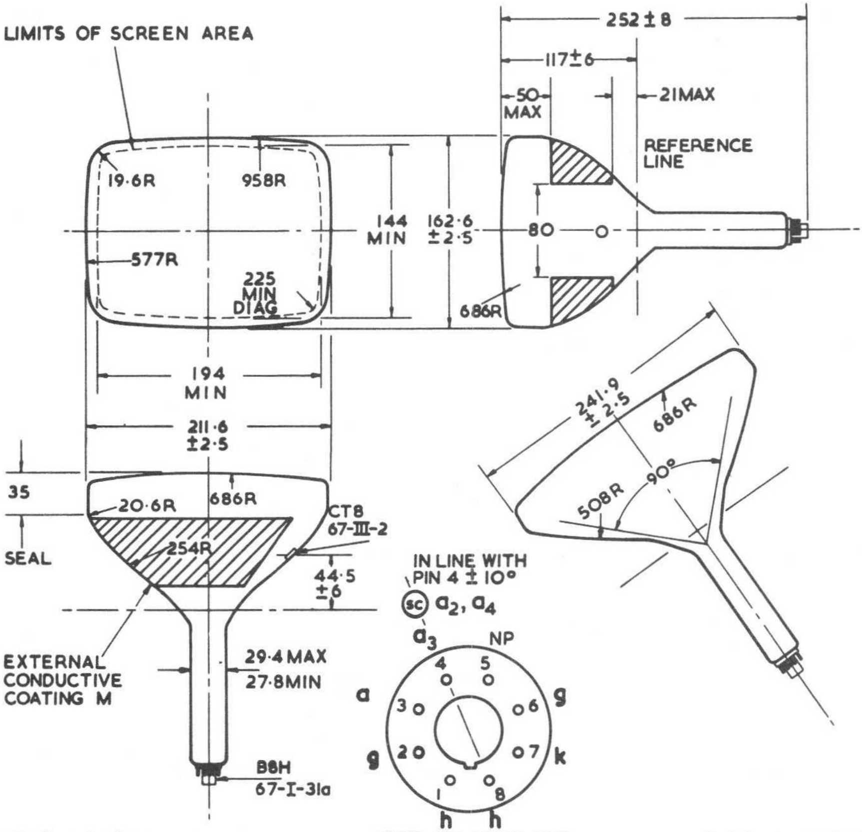
There is a region of anti-corona coating surrounding the CT8 cap, the tube should not be handled in this region.

The tube can be mounted in any position. The tube socket should not be rigidly mounted but should have flexible leads and be allowed to move freely.

The external conductive coating (M) of this tube should be connected to chassis. The capacitance between this coating and final anode may be used to provide smoothing for the e.h.t. supply.

When flashover protection is incorporated the chassis return path should be made in a manner appropriate to the protection system employed.

**TUBE WEIGHT** (approximate) 1.7 kg




All dimension in mm VIEW OF FREE END Not to be scaled

* During the face sealing operation the glass in this area may be disturbed and the shape may be either convex or concave. The bulb should not be gripped within this region unless special precautions are taken, such as, the use of resilient packing material.

† Determined by reference line gauge No. 15.



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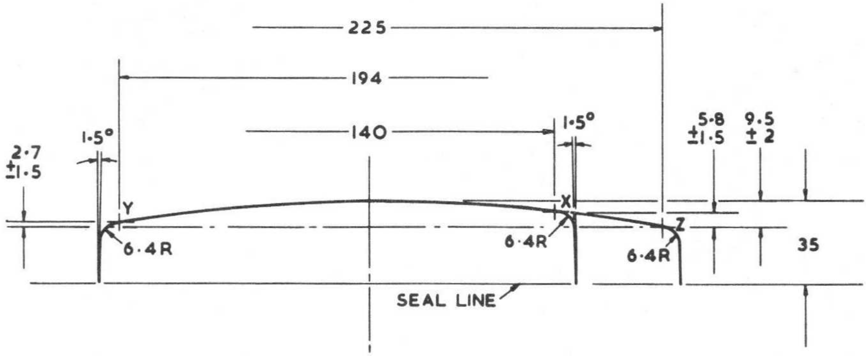
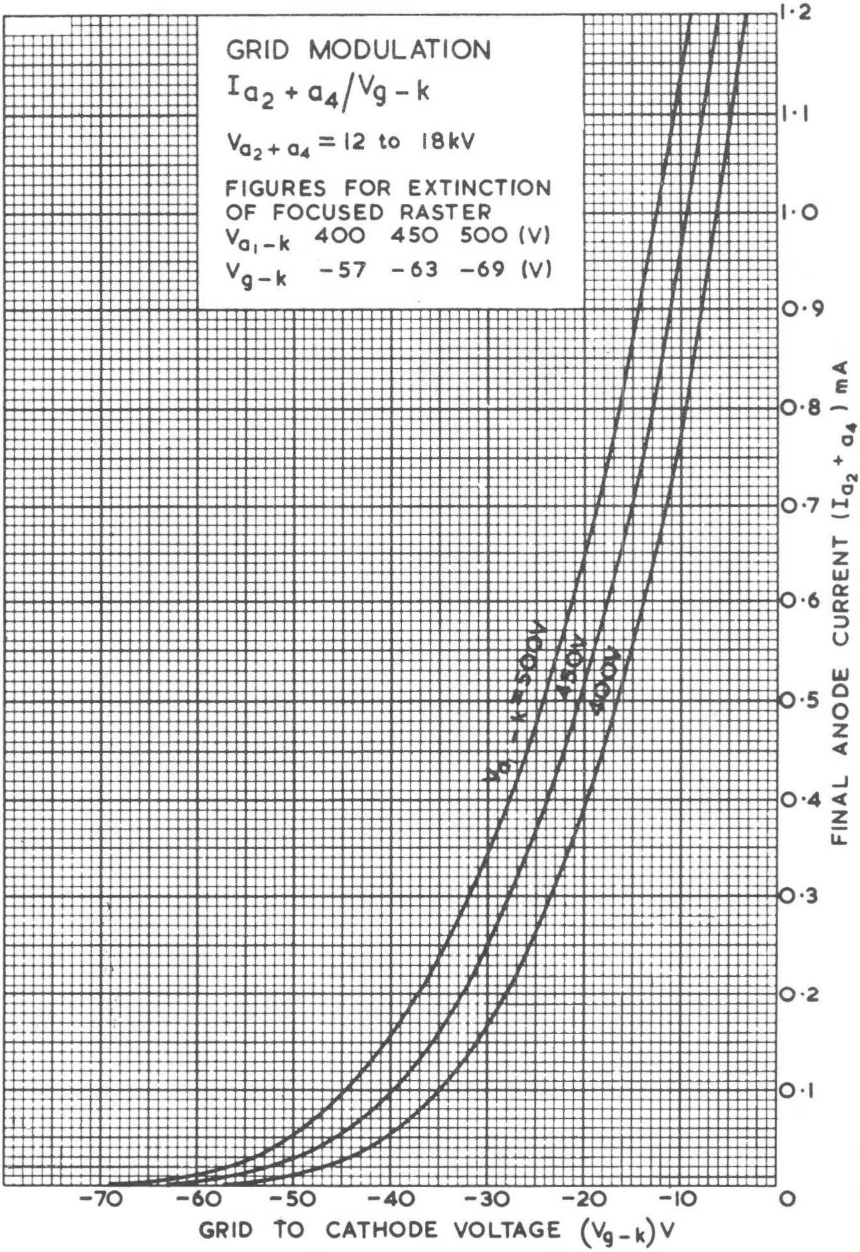
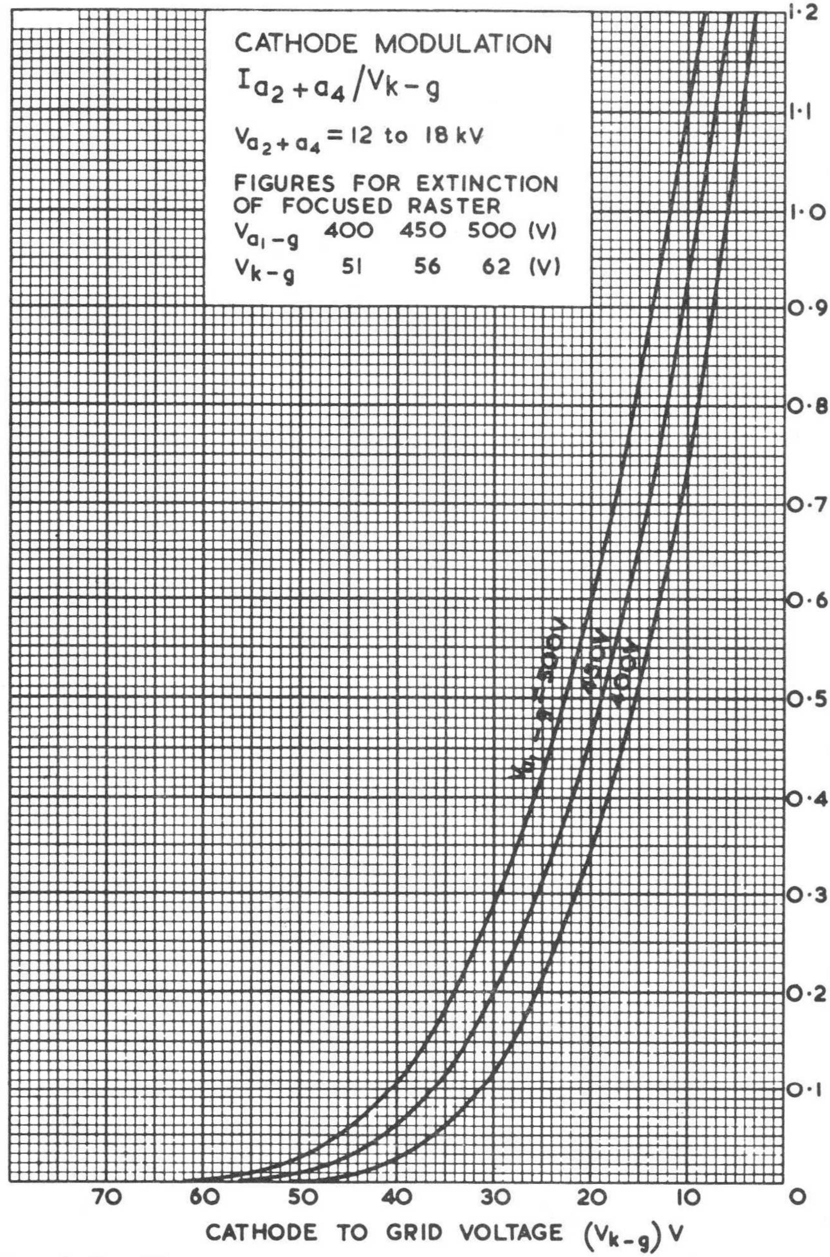


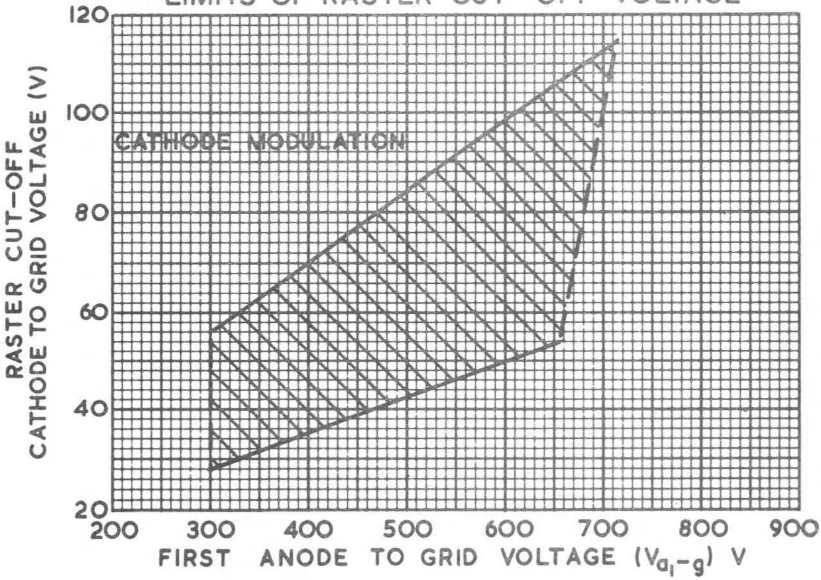

All dimensions in mm

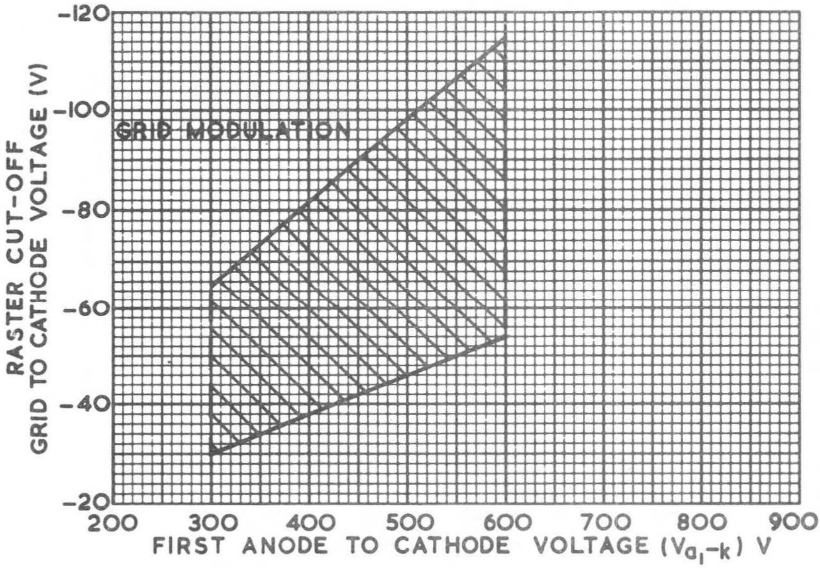
Not to be scaled


GRID MODULATION
$I_{a_2+a_4}/V_{g-k}$
$V_{a_2+a_4}$ = 12 to 18kV
FIGURES FOR EXTINCTION
OF FOCUSED RASTER
$V_{a_1-k}$ 400 450 500 (V)
$V_{g-k}$ −57 −63 −69 (V)
$V_{a_1-k}$ = 500V
450V
400V
1·2
1·1
1·0
0·9
0·8
0·7
0·6
0·5
0·4
0·3
0·2
0·1
0
−70
−60
−50
−40
−30
−20
−10
GRID TO CATHODE VOLTAGE ($V_{g-k}$)V
FINAL ANODE CURRENT ($I_{a_2+a_4}$) mA

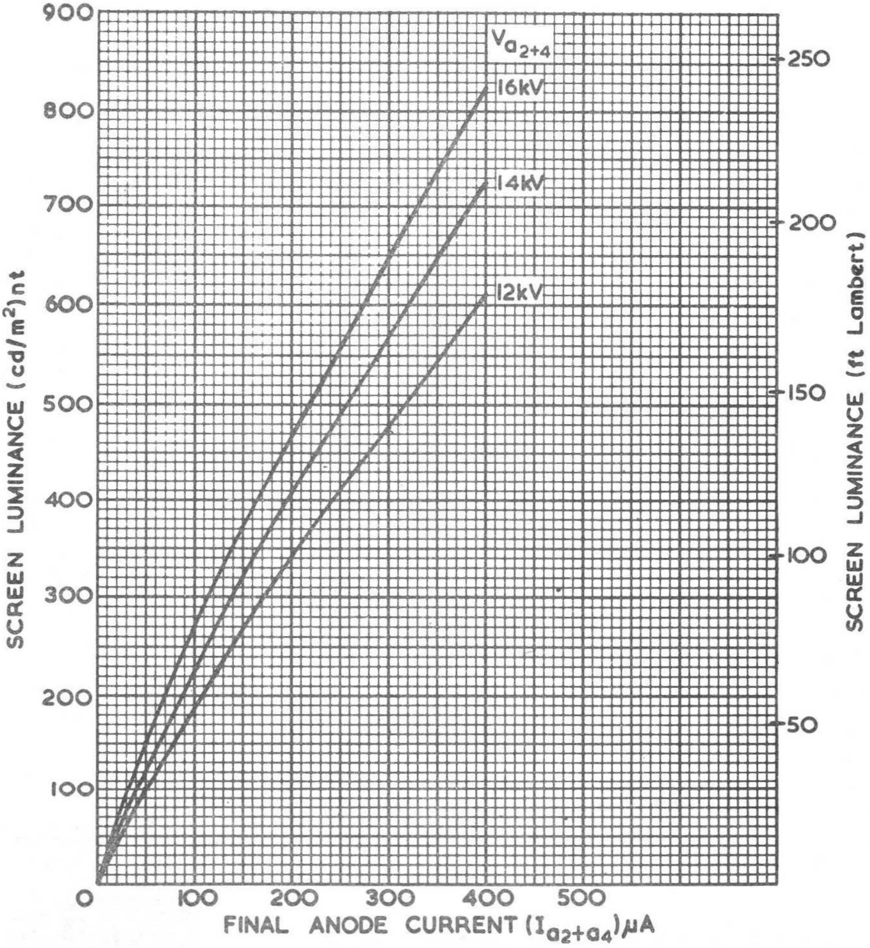

CATHODE MODULATION
$I_{a2+a4}/V_{k-g}$
$V_{a2+a4}$ = 12 to 18 kV
FIGURES FOR EXTINCTION OF FOCUSED RASTER
$V_{a1-g}$ 400 450 500 (V)
$V_{k-g}$ 51 56 62 (V)
$V_{a1-g}$ = 500V
450V
400V
1·2
1·1
1·0
0·9
0·8
0·7
0·6
0·5
0·4
0·3
0·2
0·1
0
70 60 50 40 30 20 10
CATHODE TO GRID VOLTAGE ($V_{k-g}$) V
FINAL ANODE CURRENT ($I_{a2+a4}$) mA

LIMITS OF RASTER CUT-OFF VOLTAGE



TYPICAL CHARACTERISTICS
W PHOSPHOR SCREEN
FOCUSED RASTER OF FULL HEIGHT
4 x 3 ASPECT RATIO



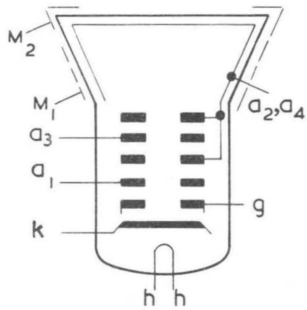
# M24-130.. Data Display or Monitor Tube

PRELIMINARY DATA

## GENERAL

Rectangular face, 24 cm, 90° diagonal
Bonded face-plate treated to reduce specular reflection. Ruggedised gun construction
Rimguard reinforced envelope with mounting lugs
Flying lead connections for base and anode
Electrostatic focus, magnetic deflection
Grey glass, 32% transmission (approx.)
29.4 mm maximum neck diameter
External conductive coating

| | | | |
|---|---|---|---|
| Heater voltage | $V_h$ | 6.3 | V |
| Heater current | $I_h$ | 0.3 | A |




## ABSOLUTE RATINGS - Voltages referred to cathode

| | | | |
|---|---|---|---|
| Maximum second and fourth anode voltage | $V_{a2+a4(max)}$ | 18 | kV |
| Minimum second and fourth anode voltage | $V_{a2+a4(min)}$ | 10 | kV |
| Maximum third anode voltage range | $V_{a3(max)}$ | ± 700 | V |
| Maximum first anode voltage | $V_{a1(max)}$ | 600 | V |
| Minimum first anode voltage | $V_{a1(min)}$ | 200 | V |
| Maximum negative grid voltage | $-V_{g(max)}$ | 200 | V |
| Minimum negative grid voltage | $-V_{g(min)}$ | 1.0† | V |
| Maximum heater to cathode voltage, heater negative (d.c.) | $V_{h-k(max)}$ | 200 | V |
| Maximum peak heater to cathode voltage heater negative | $v_{h-k(pk)max}$ | 250 | V |
| Maximum impedance, grid to cathode (50 Hz) | $Z_{g-k(max)}$ | 0.5 | MΩ |
| Maximum resistance, grid to cathode | $R_{g-k(max)}$ | 1.5 | MΩ |

† A 10 kΩ grid series resistor mounted close to the tube base is recommended to limit the peak grid voltage.

## PHOSPHOR SCREEN

This type is usually supplied with GJ phosphor (M24-130GJ) giving a yellowish-green trace of medium persistence. Other phosphor screens can be made available to special order.

This tube meets the requirements for intrinsically safe tubes laid down in the section of I.E.C. Publication 65 dealing with implosion.

This data should be read in conjunction with Operational Recommendations for Industrial Cathode Ray Tubes.

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## INTER - ELECTRODE CAPACITANCES

| | | * | |
|---|---|---|---|
| Maximum cathode to all | $c_{k\text{-all (max)}}$ | 5.0 | pF |
| Maximum grid to all | $c_{g\text{-all (max)}}$ | 16 | pF |
| Minimum anodes 2 and 4 to coating $M_1$ | $c_{a2+a4\text{-}M1\text{ (min)}}$ | 550 | pF |
| Minimum anodes 2 and 4 to metal $M_2$ | $c_{a2+a4\text{-}M2\text{ (min)}}$ | 100 | pF |

* Flying leads capacitance balanced out.

## TYPICAL OPERATION - Grid modulation, voltages referred to cathode

| | | | |
|---|---|---|---|
| Second and fourth anode voltage | $V_{a2+a4}$ | 12 to 16 | kV |
| First anode voltage | $V_{a1}$ | 400 | V |
| Third anode voltage range for focus | $V_{a3}$ | 0 to 400 § | V |
| Grid to cathode voltage for cut-off of raster | $V_g$ | -38 to -82 | V |
| Typical line width at 50 μA (Shrinking raster) | | 0.2 | mm |

§ The change of spot size with variation of focus voltage is small and the limit of 0 to 400 V is such that an acceptable focus quality is obtained within this range. If it is required to pass through the point of focus a voltage range of at least -100V to +500V will be required.

## MOUNTING

If a mask is used with this tube it should be flexible enough to take up small variations in fixing and bulb contours.

The bolts for mounting the tube must lie within circles of 4 mm diameter centred on the true positions. One of the four lugs may deviate 2 mm maximum from the plane through the other three lugs.

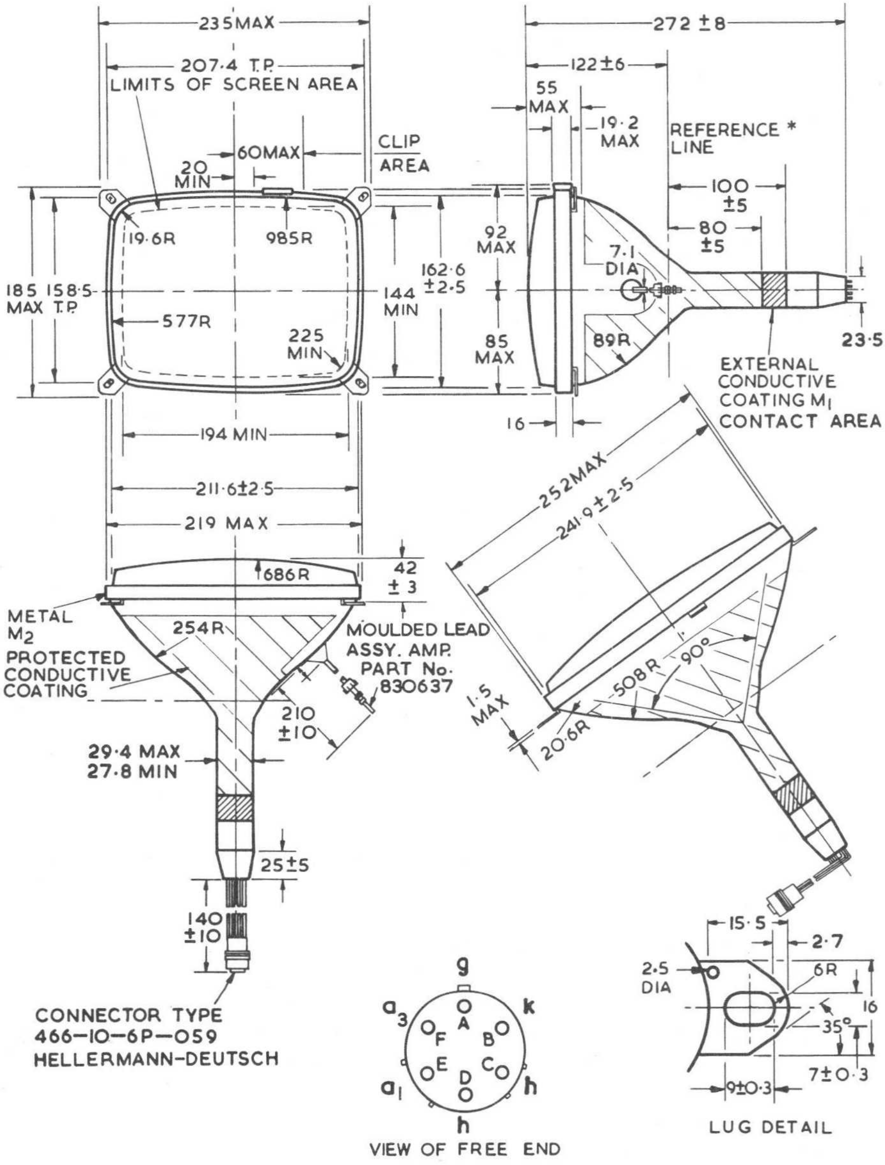
The external conductive coating ($M_1$) of this tube should be connected to chassis. The capacitance between this coating and final anode may be used to provide smoothing for the e.h.t. supply.

The metal frame ($M_2$) should be connected to the chassis in a.c. equipment operating from an isolating transformer, or via a suitable leakage path in a.c./d.c. equipment, for example 2 MΩ.

When flashover protection is incorporated the chassis return paths of M1 and M2 should be made in a manner appropriate to the protection system employed.

**TUBE WEIGHT** (approximate) - 2.2kg

## M24-130.. Data Display or Monitor Tube




All dimension in mm

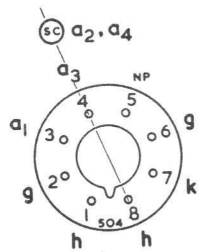
Not to be scaled

* Determined by reference line gauge No. 15

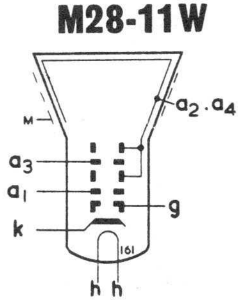
# Monitor Tube

# M28-11W

**Maintenance Type**




Base B8H, Cap CT8




## GENERAL

| | | | |
|---|---|---|---|
| Rectangular Face | —11 in. Diagonal | Deflection Angle | —90° Diagonal |
| Aluminised Screen | —Silver Activated Phosphor | Electrostatic Focus | —Magnetic Deflection |
| Grey Glass | —58% Transmission (approx) | Straight Gun | —Non Ion Trap |

External Conductive Coating

| | | | |
|---|---|---|---|
| Heater Voltage | $V_h$ | 11·5 | V |
| Heater Current | $I_h$ | 0·15 | A |

## DESIGN CENTRE RATINGS

| | | | |
|---|---|---|---|
| Maximum Second and Fourth Anode Voltage | $V_{a2,a4(max)}$ | 18* | kV |
| Minimum Second and Fourth Anode Voltage | $V_{a2,a4(min)}$ | 12 | kV |
| Maximum Third Anode Voltage | $V_{a3(max)}$ | ±700 | V |
| Maximum First Anode Voltage | $V_{a1(max)}$ | 500 | V |
| Maximum Negative Grid Voltage | $-V_{g(max)}$ | 200 | V |
| Minimum Negative Grid Voltage | $-V_{g(min)}$ | 1·0 | V |
| Maximum Heater to Cathode Voltage, Heater Negative (d.c.) | $V_{h\text{-}k(max)}$ | 200 | V |

* 18kV is a design centre rating, the absolute rating of 20kV must not be exceeded.

All voltages referred to cathode.

## INTER-ELECTRODE CAPACITANCES

| | | ¶ | § | |
|---|---|---|---|---|
| Grid to all | $c_{g\text{-}all}$ | 7·0 | 8·5 | pF |
| Cathode to all | $c_{k\text{-}all}$ | 3·0 | 3·5 | pF |
| Anode 2 and Anode 4 to External Conductive Coating (approx) | $c_{a2,a4\text{-}M}$ | 700 | | pF |

¶ Holder capacitance balanced out.

§ Total capacitances including a typical B8H holder.

**TYPICAL OPERATION**—Grid Modulation (all voltages referred to cathode)

| | | | |
|---|---|---|---|
| Second and Fourth Anode Voltage | $V_{a2,a4}$ | 14 | kV |
| First Anode Voltage | $V_{a1}$ | 400 | V |
| Third Anode Voltage for Focus (Range) | $V_{a3}$ | 0 to 400 | V |
| Grid to Cathode Voltage for cut-off of raster | $V_g$ | −40 to −76 | V |
| Average Peak to Peak Modulating Voltage (Final Anode current=200μA) | | 29 | V |

If this tube is operated at voltages in excess of 16 kV, x-ray radiation shielding may be necessary to avoid possible danger of personal injury from prolonged exposure at close range. The normal glass protective viewing window may provide such a safeguard. If the radiation measured in contact with this window does not exceed 0·5 milliröntgens per hour, the window will normally provide adequate protection.

Tubes incorporating a B8H sparkguard base will have a suffix S after the type number. For details of the sparkguard base see separate sheet.

DATA DISPLAY & MONITOR TUBES

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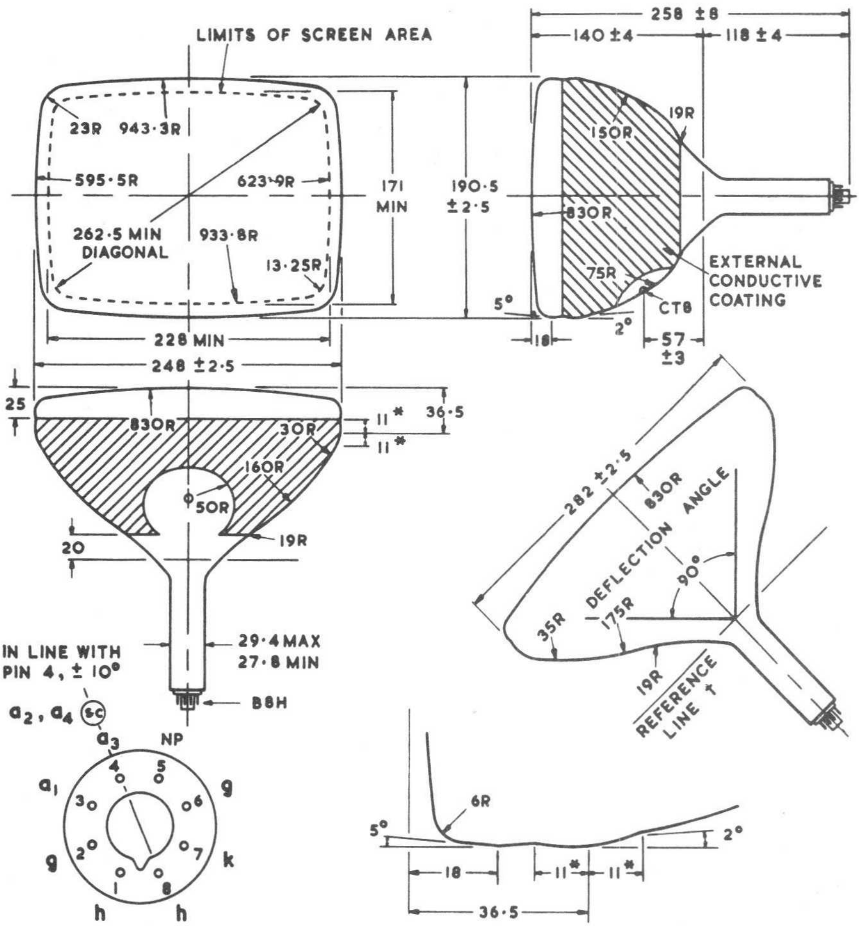



VIEW OF FREE END

All dimensions in mm

Not to be scaled

* During the face sealing operation the glass in this area (total 22mm) may be disturbed. As the shape of the contour within this area may be either convex or concave the bulb should not be gripped within this region unless special precautions are taken (such as the use of resilient packing material).

† Determined by T.D.S. Reference Gauge No. 91-15 (See T.D.S. 5-0-91-15)

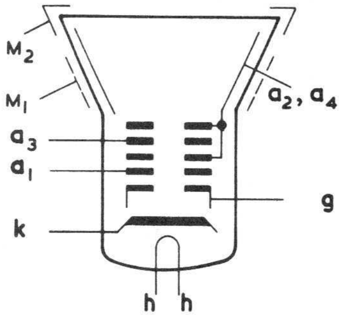
There is an annular region of anti-corona coating with diameters of 25 mm and 60 mm surrounding the CT8 cap, the tube should not be handled in this region. The external conductive coating of this tube should be connected to chassis. The capacitance between this coating and the final anode may be used to provide smoothing for the e.h.t. supply.

# Data Display or Monitor Tube  M28-12..

## GENERAL

Rectangular face, 28 cm, 90° diagonal
Rimguard III reinforced envelope
Integral mounting lugs
Electrostatic focus, magnetic deflection
Aluminised screen.
Grey glass, 58% transmission (approx.)
20 mm neck diameter
External conductive coating

| | | | |
|---|---|---|---|
| Heater voltage | $V_h$ | 11 | V |
| Heater current | $I_h$ | 75 | mA |




## ABSOLUTE RATINGS - Voltages referred to cathode

| | | | |
|---|---|---|---|
| Maximum second and fourth anode voltage | $V_{a2+a4(max)}$ | 14* | kV |
| Minimum second and fourth anode voltage | $V_{a2+a4(min)}$ | 7.5 | kV |
| Maximum third anode voltage | $V_{a3(max)}$ | -50 to + 500 | V |
| Maximum first anode voltage | $V_{a1(max)}$ | 350 | V |
| Maximum negative grid voltage | $-V_{g(max)}$ | 100 | V |
| Maximum peak negative grid voltage | $-v_{g(pk)max}$ | 350† | V |
| Maximum positive grid voltage | $V_g$ | 0§ | V |
| Maximum heater to cathode voltage, heater negative (d.c.) | $V_{h-k(max)}$ | 110 | V |
| Maximum peak heater to cathode voltage, heater negative | $v_{h-k(pk)max}$ | 130 | V |
| Maximum impedance, grid to cathode (50 Hz) | $Z_{g-k(max)}$ | 0.5 | MΩ |
| Maximum resistance, grid to cathode | $R_{g-k(max)}$ | 1.5 | MΩ |

* $I_{a2+a4} = 0$

† Maximum pulse duration 22% of one cycle with a maximum of 1.5 ms.

§ A 10 kΩ grid series resistor mounted close to the tube base is recommended to limit the peak grid voltage.

## PHOSPHOR SCREEN

This type is usually supplied with W phosphor (M28-12W) giving a television white trace of medium short persistence. Other phosphor screens can be made available to special order.

This data should be read in conjunction with Operational Recommendations for Industrial Cathode Ray Tubes.

DATA DISPLAY & MONITOR TUBES

**Thorn Radio Valves and Tubes Limited**

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## INTER-ELECTRODE CAPACITANCES

| | | | |
|---|---|---|---|
| Cathode to all | $c_{k-all}$ | 3.0* | pF |
| Grid to all | $c_{g-all}$ | 4.0* | pF |
| Anodes 2 and 4 to coating $M_1$ (approx.) | $c_{a2+a4-M1}$ | 600 | pF |
| Anodes 2 and 4 to shell $M_2$ (approx.) | $c_{a2+a4-M2}$ | 125 | pF |

* Holder capacitance balanced out.

## TYPICAL OPERATION - Grid modulation (Voltage referred to cathode)

| | | | | |
|---|---|---|---|---|
| Second and fourth anode voltage | $V_{a2+a4-k}$ | 11 | 13 | kV |
| First anode voltage | $V_{a1-k}$ | 250 | 350 | V |
| Third anode voltage range for focus | $V_{a3-k}$ | 0 to 350 | 50 to 400 | V |
| Grid to cathode voltage for cut-off of raster | $V_{g-k}$ | -35 to -69 | -46 to -91 | V |

## TYPICAL OPERATION - Cathode modulation (Voltage referred to grid)

| | | | | |
|---|---|---|---|---|
| Second and fourth anode voltage | $V_{a2+a4-g}$ | 11 | 13 | kV |
| First anode voltage | $V_{a1-g}$ | 250 | 350 | V |
| Third anode voltage range for focus | $V_{a3-g}$ | 0 to 350 | 50 to 400 | V |
| Cathode to grid voltage for cut-off of raster | $V_{k-g}$ | 32 to 58 | 44 to 80 | V |

## MOUNTING

Any mask used in the mounting of this tube should be flexible enough to take up small variations in fixing and faceplate contours.

There is an annular region of anti-corona coating with external diameter of 75 mm surrounding the CT8 cap, the tube should not be handled in this region.

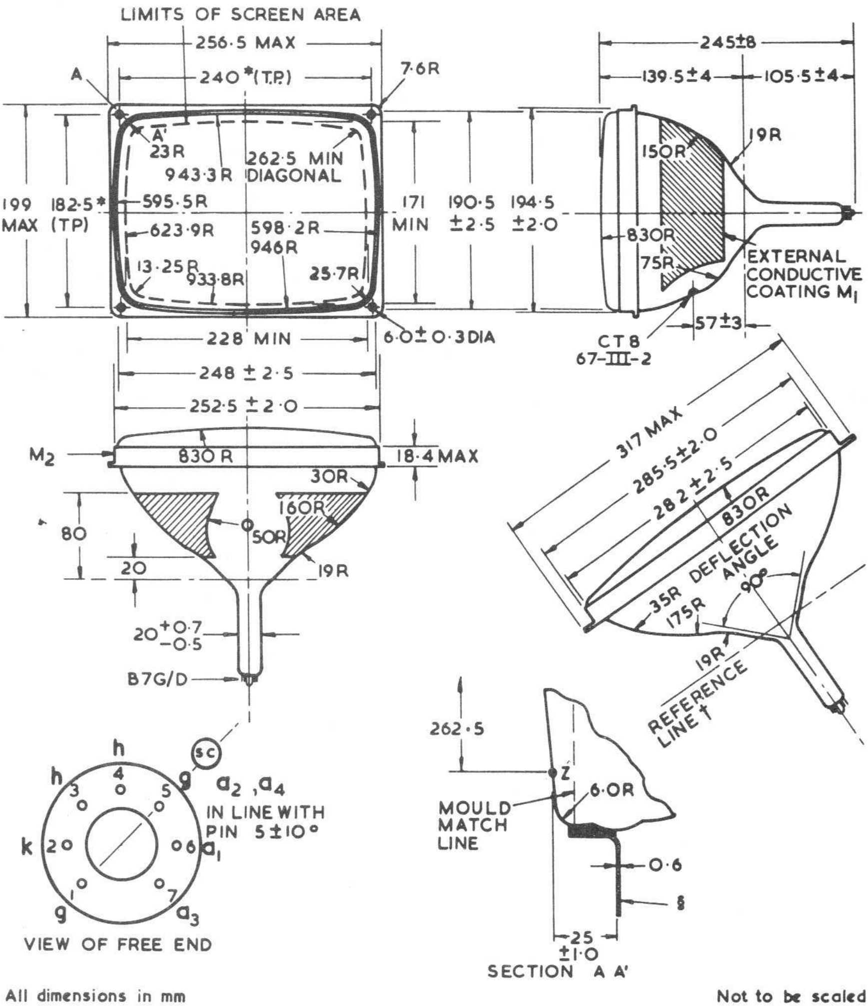
The tube can be mounted in any position. The tube socket should not be rigidly mounted but should have flexible leads and be allowed to move freely.

The external conductive coating ($M_1$) of this tube should be connected to chassis. The capacitance between this coating and final anode may be used to provide smoothing for the e.h.t. supply.

The metal shell ($M_2$) should be connected directly to the chassis in a.c. equipment operating from an isolating transformer, or via a suitable leakage path in a.c./d.c. equipment, for example 2 MΩ.

When flashover protection is incorporated the chassis return paths of $M_1$ and $M_2$ should be made in a manner appropriate to the protection system employed.

**TUBE WEIGHT** ( approximate) - 2.2 kg




All dimensions in mm

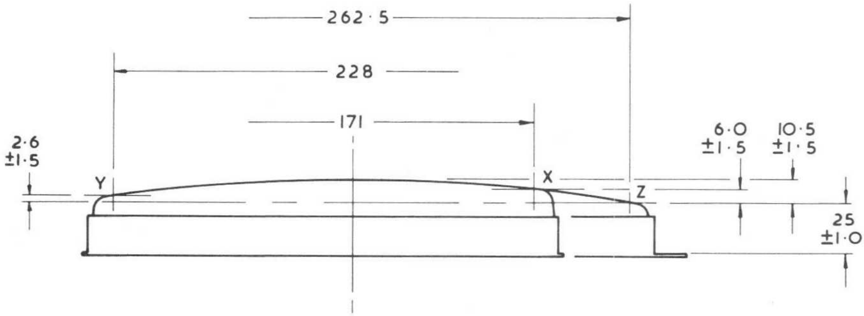
Not to be scaled



* The bolts to be used for mounting the tube must lie within the circles of 5.0 mm diameter centred on these true positions.

† Determined by reference line gauge No. 20 (See T.D.S. No. 5-0-91-20)

§ Maximum departure from flatness of the rim is 1.0 mm.




All dimensions in mm

Not to be scaled

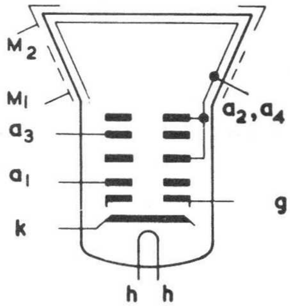
Characteristic curves as M31-190..

# Data Display or Monitor Tube M28-13..

**GENERAL**

Rectangular face, 11 inch, 90° diagonal
Rimguard III reinforced envelope*
Integral mounting lugs
Electrostatic focus, magnetic deflection
Straight gun. Aluminised screen
Grey glass, 58% transmission (approx.)
29.4 mm maximum neck diameter
External conductive coating

| | | | |
|---|---|---|---|
| Heater voltage | $V_h$ | 11.5 | V |
| Heater current | $I_h$ | 0.15 | A |




**DESIGN CENTRE RATINGS** - Voltages referred to cathode

| | | | |
|---|---|---|---|
| Maximum second and fourth anode voltage | $V_{a2+a4(max)}$ | 18 † | kV |
| Minimum second and fourth anode voltage | $V_{a2+a4(min)}$ | 12 | kV |
| Maximum third anode voltage | $V_{a3(max)}$ | ± 700 | V |
| Maximum first anode voltage | $V_{a1(max)}$ | 500 | V |
| Maximum negative grid voltage | $-V_{g(max)}$ | 200 | V |
| Minimum negative grid voltage | $-V_{g(min)}$ | 1.0 | V |
| Maximum heater to cathode voltage, heater negative (d.c.) | $V_{h-k(max)}$ | 200 | V |

† The absolute rating of 20kV must not be exceeded.

If this tube is operated at voltages in excess of 16 kV, x-ray radiation shielding may be necessary to avoid possible danger of personal injury from prolonged exposure at close range.

**PHOSPHOR SCREEN**

This type is usually supplied with W phosphor (M28-13W) giving a television white trace of medium short persistence. Other phosphor screens can be made available to special order.

Tubes incorporating a B8H Sparkguard base will have a suffix after the type number. For details of the Sparkguard bases see separate sheets.

* This tube meets the requirements for intrinsically safe tubes laid down in the section of I.E.C. Publication 65 dealing with implosion.

DATA DISPLAY & MONITOR TUBES

# Data Display or Monitor Tube

## INTER-ELECTRODE CAPACITANCES

| | | * | † | |
|---|---|---|---|---|
| Cathode to all | $c_{k-all}$ | 3.0 | 3.5 | pF |
| Grid to all | $c_{g-all}$ | 7.0 | 8.5 | pF |
| Anodes 2 and 4 to coating $M_1$ (approx.) | $c_{a2+a4-M1}$ | 600 | | pF |
| Anodes 2 and 4 to frame $M_2$ (approx.) | $c_{a2+a4-M2}$ | 125 | | pF |

* Holder capacitance balanced out.

† Total capacitances including a typical B8H holder.

## TYPICAL OPERATION - Grid modulation, voltages referred to cathode

| | | | |
|---|---|---|---|
| Second and fourth anode voltage | $V_{a2+a4}$ | 14 | kV |
| First anode voltage | $V_{a1}$ | 400 | V |
| Third anode voltage range for focus | $V_{a3}$ | 0 to 400 | V |
| Grid to cathode voltage for cut-off of raster | $V_g$ | -40 to -76 | V |
| Average peak to peak modulating voltage for 200 µA final anode current | | 29 | V |
| Typical line width§ at 100 ft-L (343 nt), 155 µA | | 0.3 | mm |

§ Using shrinking raster method.

## MOUNTING

This tube is intended for 'push-through' presentation without masking, but if a mask is used it should be flexible enough to take up small variations in fixing and bulb contours.

There is an annular region of anti-corona coating with external diameter of 60 mm surrounding the CT8 cap, the tube should not be handled in this region.

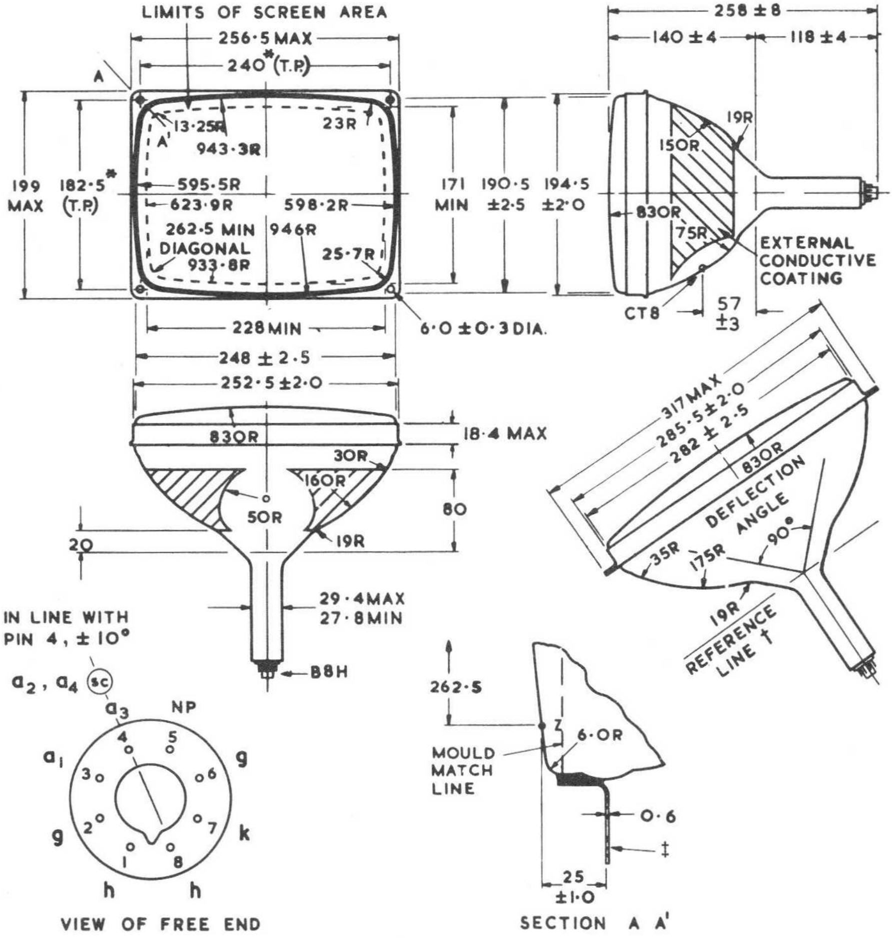
The tube can be mounted in any position. The tube socket should not be rigidly mounted but should have flexible leads and be allowed to move freely.

The external conductive coating ($M_1$) of this tube should be connected to chassis. The capacitance between this coating and final anode may be used to provide smoothing for the e.h.t. supply.

The metal frame ($M_2$) should be connected directly to the chassis in a.c. equipment operating from an isolating transformer, or via a suitable leakage path in a.c./d.c. equipment, for example 2 MΩ.

When flashover protection is incorporated the chassis return paths of $M_1$ and $M_2$ should be made in a manner appropriate to the protection system employed.

**TUBE WEIGHT** (approximate) - net 2.1 kg



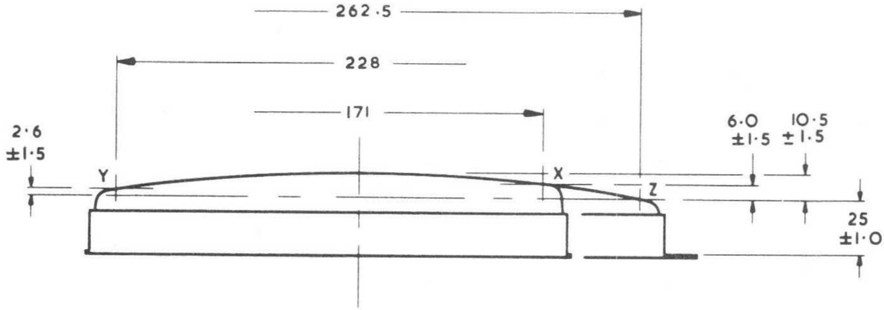

All dimensions in mm

Not to be scaled

* The bolts to be used for mounting the tube must lie within the circles of 5.0 mm diameter centred on these true positions.

† Determined by reference line gauge No. 15 (See T.D.S. No. 5-0-91-15).

‡ Maximum departure from flatness of the rim is 1.0 mm.

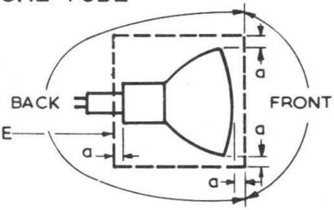


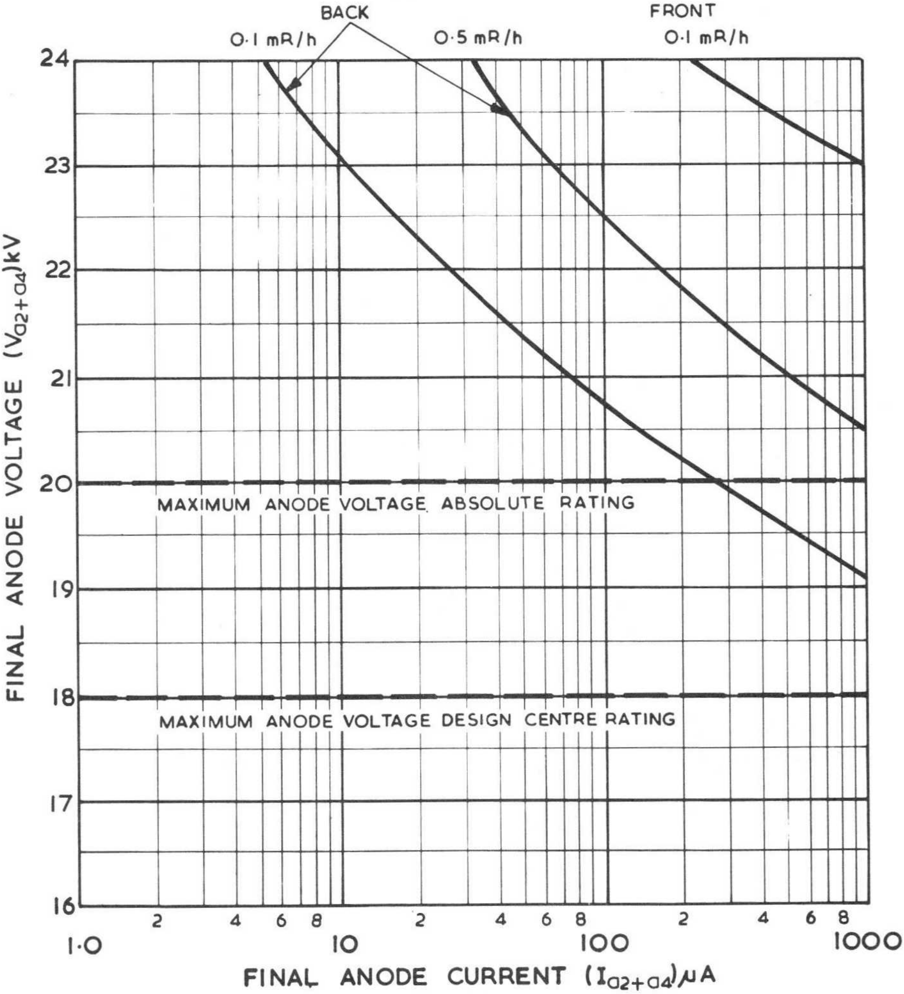

All dimensions in mm

Not to be scaled

## X-RAY ISO-EXPOSURE CURVES OF TYPICAL TUBE

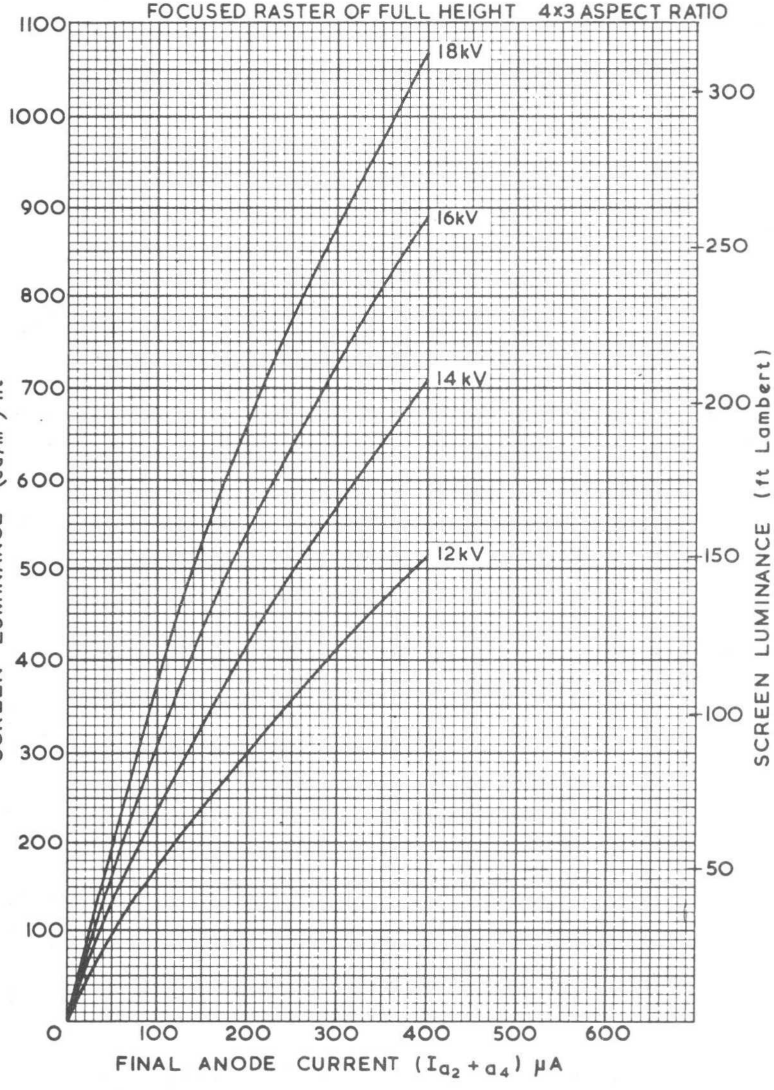
MEASUREMENTS MADE ON LINES OF MAXIMUM RADIATION AT FRONT AND BACK OF TUBE WITH DETECTOR CENTRE 50mm FROM NOTIONAL ENCLOSURE DEFINED BY DIAGRAM




DATA DISPLAY & MONITOR TUBES

TYPICAL CHARACTERISTICS
W PHOSPHOR

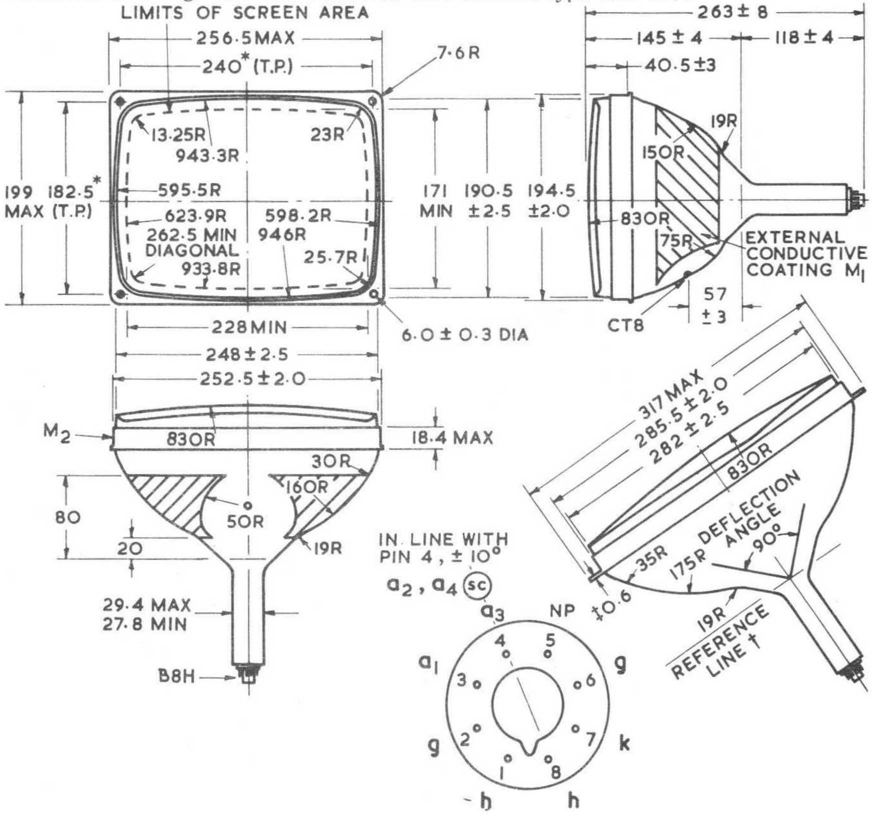


# Data Display or Monitor Tube

**M28-131..**

MAINTENANCE TYPE

The M28-131.. is the M28-13.. with a bonded face-plate treated to reduce specular reflections. For general and electrical data see tube type M28-13..




**All dimensions in mm** VIEW OF FREE END **Not to be scaled**

* The bolts to be used for mounting the tube must lie within the circles of 5.0 mm diameter centred on these true positions.

† Determined by reference line gauge No. 15.

‡ Maximum unflatness of the rim is 1.0 mm.

### PHOSPHOR SCREEN

This type is usually supplied with GR phosphor (M28-131GR) giving a yellowish-green trace of very long persistence. Other phosphor screens can be made available to special order.

**TUBE WEIGHT** (approximate) - 2.5 kg

**Thorn Radio Valves and Tubes Limited**

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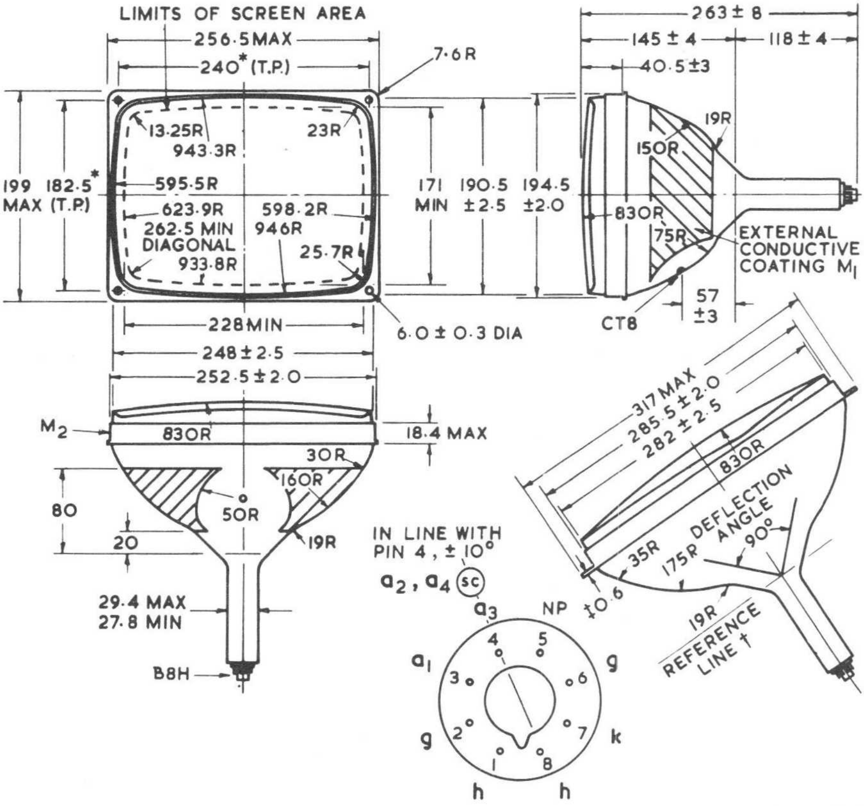
# M28–132..  Data Display or Monitor Tube

The M28-132.. is the M28-13.. with a tinted bonded face-plate treated to reduce specular reflections. The total centre glass transmission is approximately 35%. For other general and electrical data see tube type M28-13..




**All dimensions in mm** VIEW OF FREE END **Not to be scaled**

* The bolts to be used for mounting the tube must lie within the circles of 5.0 mm diameter centred on these true positions.

† Determined by reference line gauge No. 15. (See T.D.S. No. 5-0-91-15)

‡ Maximum unflatness of the rim is 1.0 mm.

## PHOSPHOR SCREEN

This type is usually supplied with GH phosphor (M28-132GH) giving a green trace of medium short persistence. Other phosphor screens can be made available to special order.

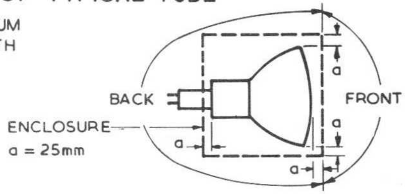
**TUBE WEIGHT** (approximate) 2.5 kg

## Thorn Radio Valves and Tubes Limited

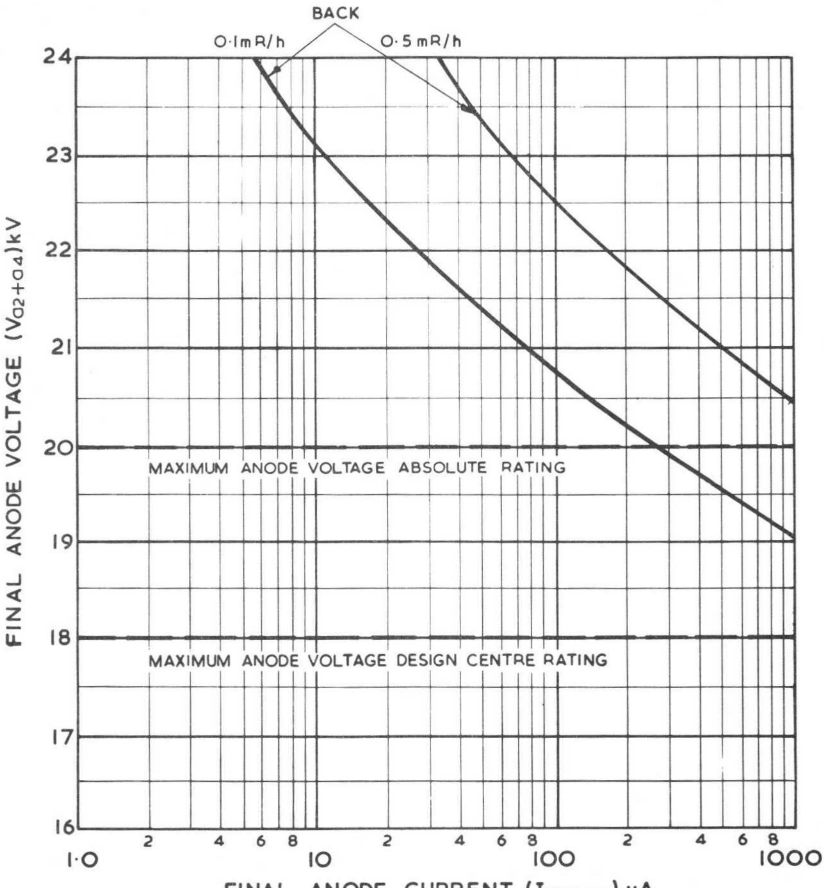
BRIMAR

## X-RAY ISO-EXPOSURE CURVES OF TYPICAL TUBE

MEASUREMENTS MADE ON LINES OF MAXIMUM RADIATION AT FRONT AND BACK OF TUBE WITH DETECTOR CENTRE 50mm FROM NOTIONAL ENCLOSURE DEFINED BY DIAGRAM

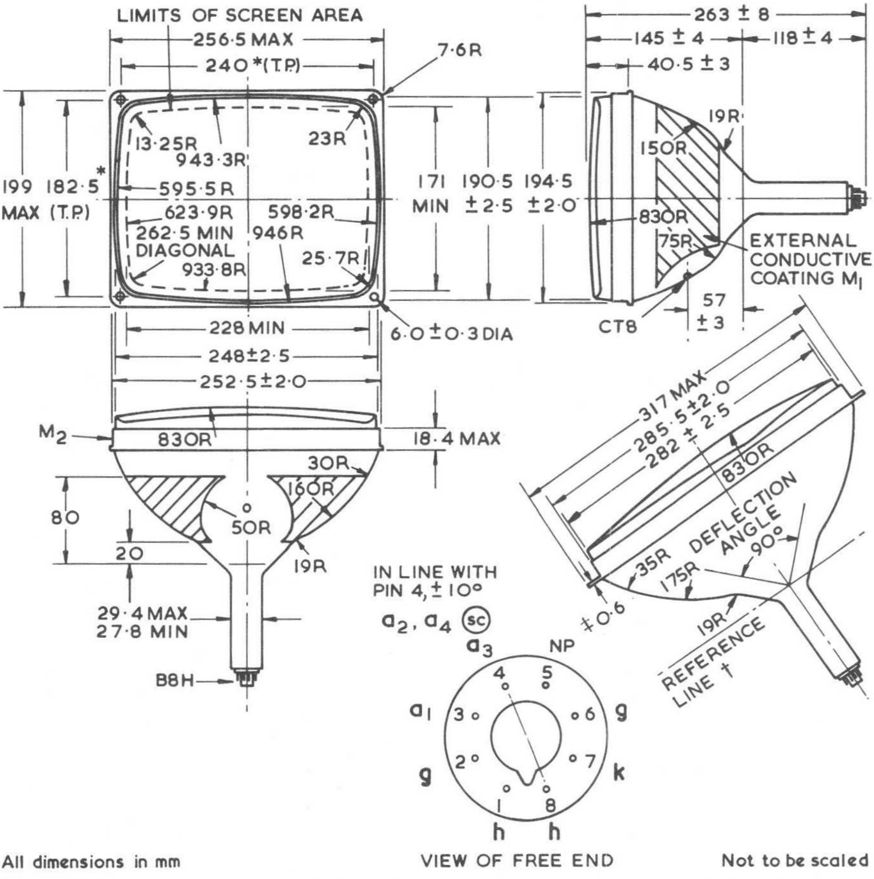



UNDER NO CONDITION REPRESENTED HERE DOES THE RADIATION FROM THE TUBE FRONT EXCEED 0·1 mR/h



# M28-133..    Data Display or Monitor Tube

The M28-133.. is the M28-13.. with a tinted bonded face-plate treated to reduce specular reflections. The total centre glass transmission is approximately 18%. For other general and electrical data see tube type M28-13..




All dimensions in mm    VIEW OF FREE END    Not to be scaled

* The bolts to be used for mounting the tube must lie within the circles of 5.0 mm diameter centred on these true positions.
† Determined by reference line gauge No. 15
‡ Maximum unflatness of the rim is 1.0mm.

## PHOSPHOR SCREEN

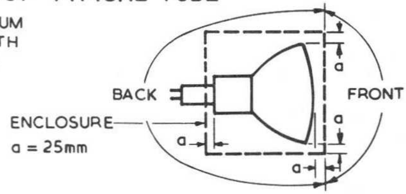
This type is usually supplied with GH phosphor (M28-133GH) giving a green trace of medium short persistence. Other phosphor screens can be made available to special order.

**TUBE WEIGHT** (approximate) 2.5 kg.

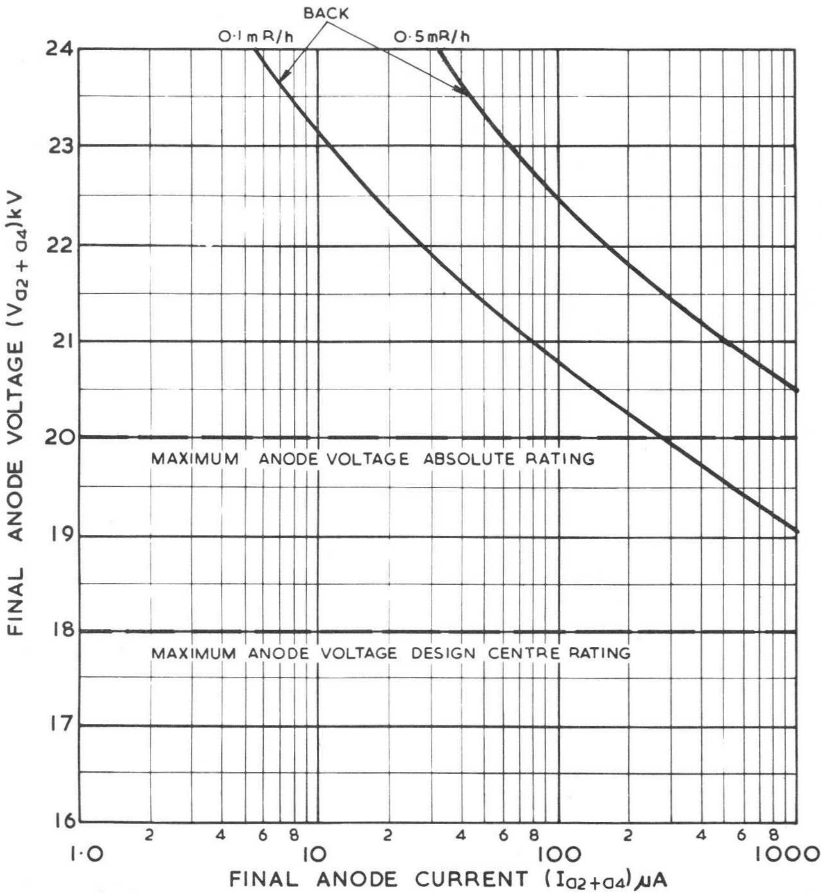
**Thorn Radio Valves and Tubes Limited**

## X-RAY ISO-EXPOSURE CURVES OF TYPICAL TUBE

MEASUREMENTS MADE ON LINES OF MAXIMUM RADIATION AT FRONT AND BACK OF TUBE WITH DETECTOR CENTRE 50mm FROM NOTIONAL ENCLOSURE DEFINED BY DIAGRAM




UNDER NO CONDITION REPRESENTED HERE DOES THE RADIATION FROM THE TUBE FRONT EXCEED 0·1mR/h



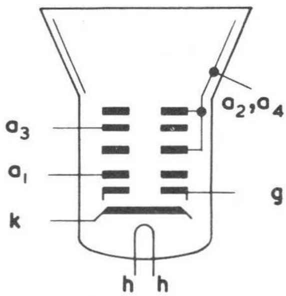
# M31-100.. Data Display or Monitor Tube

Maintenance Type

## GENERAL

Rectangular face, 31 cm, 70° diagonal tube
Bonded faceplate treated to reduce specular reflections. Aluminised screen.
Electrostatic focus, magnetic deflection
38 mm maximum neck diameter
Grey glass, 50% transmission (approx.)
Straight gun, non ion trap

| | | | |
|---|---|---|---|
| Heater voltage | $V_h$ | 6.3 | V |
| Heater current | $I_h$ | 0.3 | A |




## ABSOLUTE RATINGS - Voltages referred to cathode

| | | | |
|---|---|---|---|
| Maximum second and fourth anode voltage | $V_{a2+a4(max)}$ | 18 | kV |
| Minimum second and fourth anode voltage | $V_{a2+a4(min)}$ | 10 | kV |
| Maximum third anode voltage | $V_{a3(max)}$ | + 800 | V |
| Maximum first anode voltage | $V_{a1(max)}$ | 800 | V |
| Maximum negative grid voltage | $-V_{g(max)}$ | 180 | V |
| Maximum positive grid voltage | $V_{g(max)}$ | 0 | V |
| Maximum heater to cathode voltage, heater negative (d.c.) | $V_{h-k(max)}$ | 200 | V |

If this tube is operated at voltages in excess of 18 kV, x-ray radiation shielding may be necessary to avoid possible danger of personal injury from prolonged exposure at close range.

## PHOSPHOR SCREEN

This type is usually supplied with GH phosphor (M31-100GH) giving a green trace of medium short persistence. Other phosphor screens can be made available to special order.

The M31-100GH is also known as the CV6237.

**TYPICAL OPERATION** - Grid modulation, voltages referred to cathode

| | | | |
|---|---|---|---|
| Second and fourth anode voltage | $V_{a2+a4}$ | 12 | kV |
| First anode voltage | $V_{a1}$ | 400 | V |
| Third anode voltage range for focus | $V_{a3}$ | 0 to +400 | V |
| Grid to cathode voltage for cut-off of raster | $V_g$ | -30 to -70 | V |

**INTER-ELECTRODE CAPACITANCES**

| | | * | † | |
|---|---|---|---|---|
| Cathode to all | $c_{k\text{-}all}$ | 3.5 | 4.5 | pF |
| Grid to all | $c_{g\text{-}all}$ | 7.0 | 7.5 | pF |

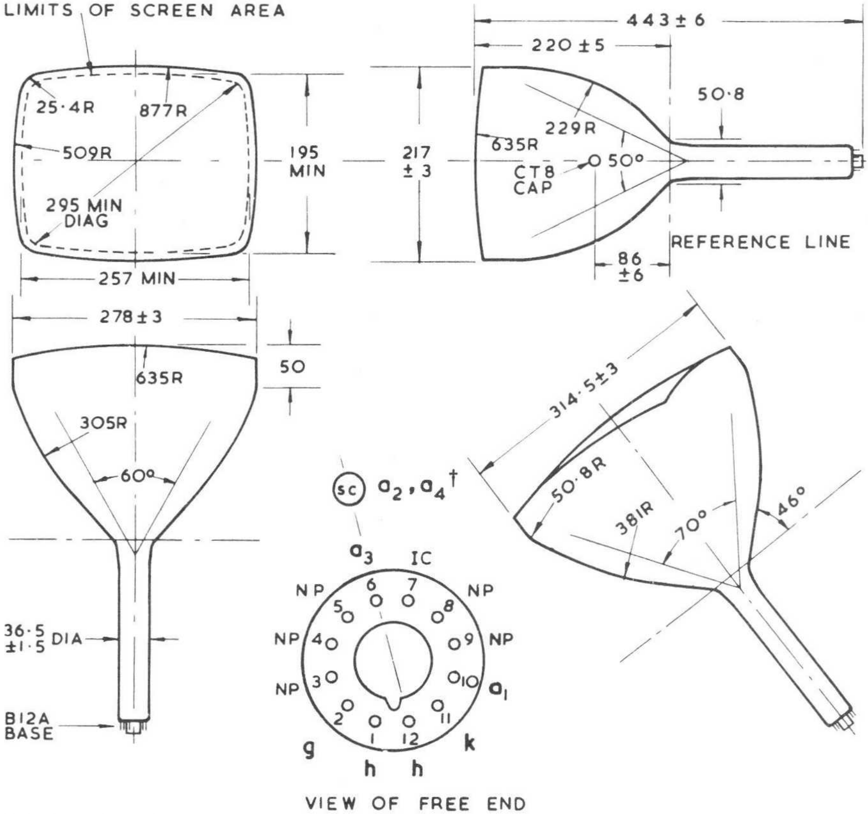
* Holder capacitance balanced out.

† Total capacitance including a typical holder.

**TUBE WEIGHT** (approximate) - 4.4 kg

DATA DISPLAY & MONITOR TUBES

# M31–100..  Data Display or Monitor Tube




All dimensions in mm  Not to be scaled

* Determined by reference line gauge No. 12 (See T.D.S. No. 5-0-91-12)

† Anode $a_2$, $a_4$ cap in line with pin 6, tolerance ± 10°

The socket for the base should not be rigidly mounted, it should have flexible leads and be allowed to move freely.

There is an annular region of anti-corona coating with an external diameter of 75 mm surrounding the CT8 cap, the tube should not be handled in this region.

# Data Display or Monitor Tube M31-101..

Maintenance Type

The M31-101.. is the M31-100.. with an increased neck length to permit the use of an additional high frequency deflector coil ("write" coil) for data display applications.

The neck length of this tube is 264 mm making the overall length 484 ± 6 mm.

## PHOSPHOR SCREEN

This type is usually supplied with GH phosphor (M31-101GH) giving a green trace of medium short persistence. Other phosphor screens can be made available to special order.

For all other data please see M31-100.. data sheets.

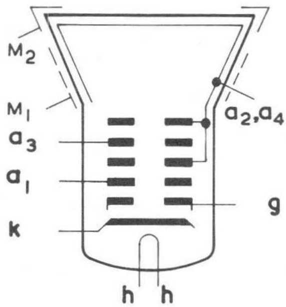
DATA DISPLAY & MONITOR TUBES

# M31–120.. Data Display or Monitor Tube

**GENERAL**

Rectangular face, 31 cm (12 in), 110° diagonal
Rimguard III reinforced envelope**
Integral mounting lugs, 20 mm dia. neck
Electrostatic focus, magnetic deflection
Aluminised screen
Grey glass, 50% transmission (approx.)
Straight gun, non ion trap
External conductive coating

| | | | |
|---|---|---|---|
| Heater voltage | $V_h$ | 11 | V |
| Heater current | $I_h$ | 140 | mA |




**DESIGN CENTRE RATINGS** - Voltages referred to cathode

| | | | |
|---|---|---|---|
| Maximum second and fourth anode voltage | $V_{a2+a4(max)}$ | 13.5† | kV |
| Minimum second and fourth anode voltage | $V_{a2+a4(min)}$ | 10.5* | kV |
| Maximum third anode voltage - range | $V_{a3(max)}$ | -50 to +500 | V |
| Maximum first anode voltage | $V_{a1(max)}$ | 350 | V |
| Maximum negative grid voltage | $-V_{g(max)}$ | 100 | V |
| Maximum peak negative grid voltage | $-v_{g(max)}$ | 350§ | V |
| Maximum positive grid voltage | $V_{g(max)}$ | 0¶ | V |
| Maximum heater to cathode voltage, heater negative (d.c.) | $V_{h-k(max)}$ | 110 | V |
| Maximum peak heater to cathode voltage, heater negative | $v_{h-k(pk)max}$ | 130 | V |
| Maximum impedance, grid to cathode (50 Hz) | $Z_{g-k(max)}$ | 0.5 | MΩ |
| Maximum resistance, grid to cathode | $R_{g-k(max)}$ | 1.5 | MΩ |

All voltages referred to cathode

† The absolute rating of 16.5 kV must not be exceeded.

* Absolute minimum rating is 8.5 kV.

§ Maximum pulse duration 22% of one cycle with a maximum of 1.5 ms.

¶ A 10 kΩ grid series resistor mounted close to the tube base is recommended to limit the peak grid voltage.

** This tube meets the requirements for intrinsically safe tubes laid down in the section of I.E.C. Publication 65 dealing with implosion.

**PHOSPHOR SCREEN**

This type is usually supplied with W phosphor (M31-120W) giving a television white trace of medium short persistence. Other phosphor screens can be made available to special order.

**Thorn Radio Valves and Tubes Limited**



BRIMAR

## INTER-ELECTRODE CAPACITANCES

| | | | |
|---|---|---|---|
| Cathode to all | $c_{k-all}$ | 3.0* | pF |
| Grid to all | $c_{g-all}$ | 4.0* | pF |
| Anodes 2 and 4 to coating $M_{1(min.)}$ | $c_{a2+a4-M1(min.)}$ | 450 | pF |
| Anodes 2 and 4 to shell $M_2$ (approx.) | $c_{a2+a4-M2}$ | 200 | pF |

* Holder capacitance balanced out.

## TYPICAL OPERATION - Grid modulation (Voltages referred to cathode)

| | | | |
|---|---|---|---|
| Second and fourth anode voltage | $V_{a2+a4-k}$ | 12 | kV |
| First anode voltage | $V_{a1-k}$ | 250 | V |
| Third anode voltage range for focus | $V_{a3-k}$ | 0 to 350 | V |
| Final anode current (peak) | $i_{a2+a4(pk)}$ | 250 | µA |
| Average peak to peak picture modulating voltage | | 33 | V |
| Grid to cathode voltage for cut-off of raster | $V_{g-k}$ | -35 to -69 | V |

## TYPICAL OPERATION - Cathode modulation (Voltage referred to grid)

| | | | |
|---|---|---|---|
| Second and fourth anode voltage | $V_{a2+a4-g}$ | 12 | kV |
| First anode voltage | $V_{a1-g}$ | 250 | V |
| Third anode voltage range for focus | $V_{a3-g}$ | 0 to 350 | V |
| Final anode current (peak) | $i_{a2+a4(pk)}$ | 250 | µA |
| Average peak to peak picture modulating voltage | | 26 | V |
| Cathode to grid voltage for cut-off of raster | $V_{k-g}$ | 32 to 58 | V |

This data should be read in conjunction with Operational and Safety Recommendations for Industrial Cathode Ray Tubes.

## PICTURE CENTRING

| | | |
|---|---|---|
| Maximum magnet flux density at centre of neck should not be less than | 15 | Gs |
| Maximum distance of centre of magnetic field from reference line | 44 | mm |

## DEFLECTION ANGLES

| | | |
|---|---|---|
| Height 80° | Width 99° | Diagonal 110° |

## MOUNTING

This tube is intended for 'push-through' presentation without masking, but if a mask is used it should be flexible enough to take up small variations in fixing and bulb contours.

There is an annular region of anti-corona coating with external diameter of 75 mm surrounding the CT8 cap, the tube should not be handled in this region.

The tube can be mounted in any position. The tube socket should not be rigidly mounted but should have flexible leads and be allowed to move freely. The bottom circumference of the base shell will fall within a circle of 44 mm diameter which is centred on the perpendicular from the centre of the face.

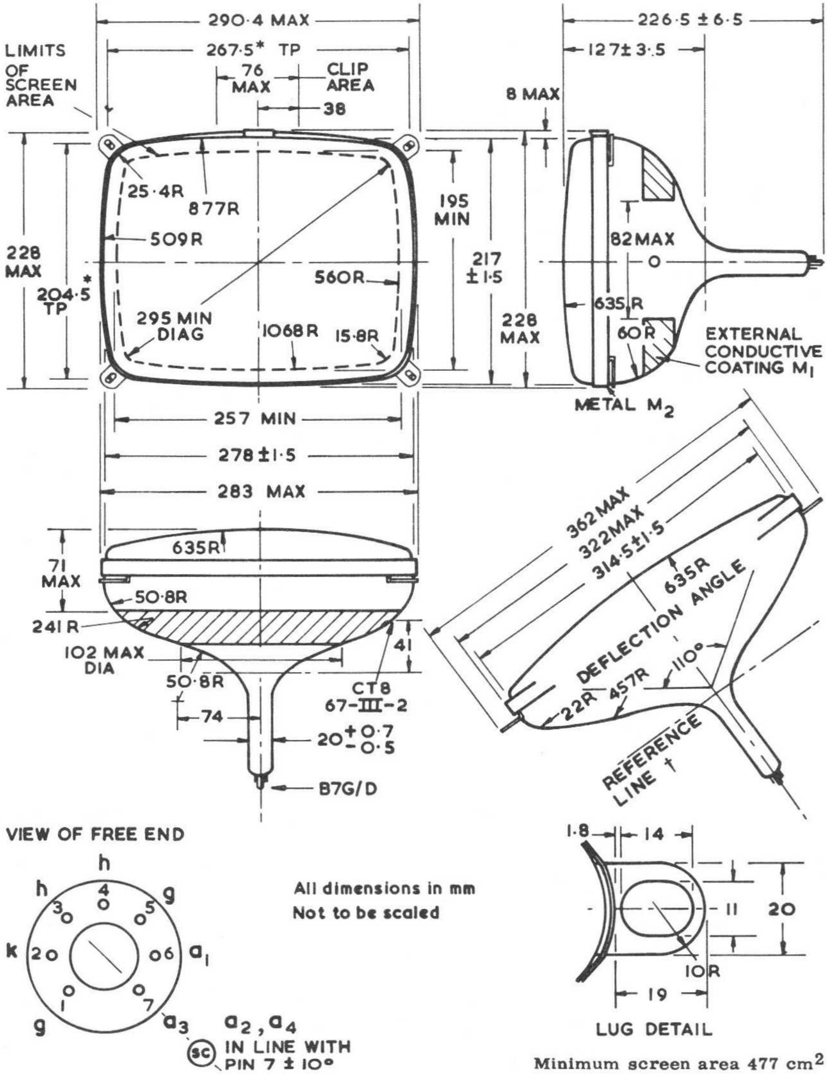
The external conductive coating ($M_1$) of this tube should be connected to chassis. The capacitance between this coating and final anode may be used to provide smoothing for the e.h.t. supply.

The metal shell ($M_2$) should be connected to the chassis in an a.c. receiver operating from an isolating transformer, or via a suitable leakage path in an a.c./d.c. receiver, for example 2 MΩ.

When flashover protection is incorporated the chassis return paths of $M_1$ and $M_2$ should be made in a manner appropriate to the protection system employed.

**TUBE WEIGHT** (approximate) - net 3.0 kg (6.5 lb)

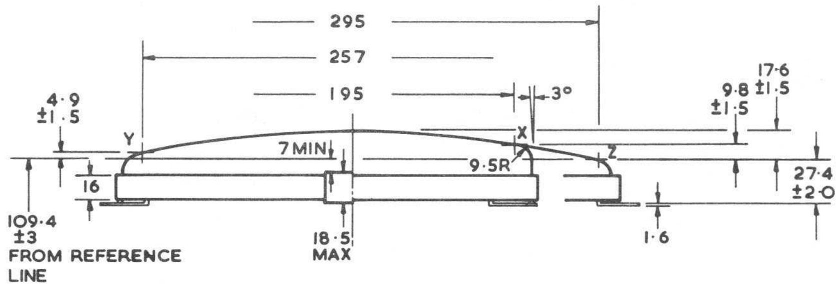
# Data Display or Monitor Tube M31-120..

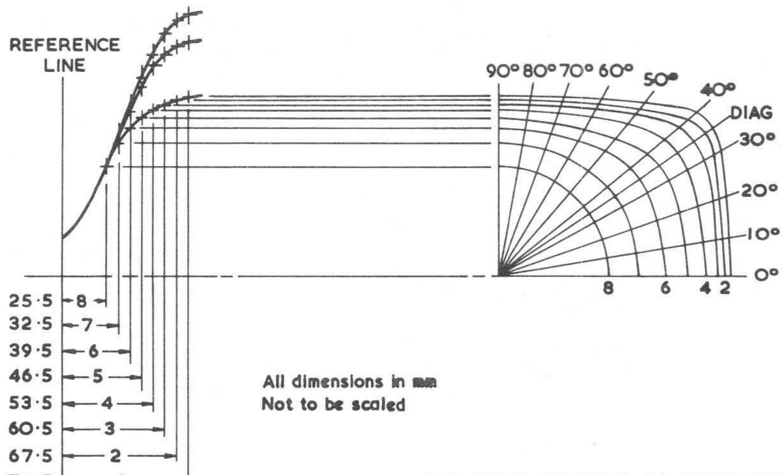



Minimum screen area 477 $cm^2$

* The bolts to be used for mounting the tube must lie within circles of 7.0 mm diameter centred on these true positions. One of the four lugs may deviate 2.0 mm maximum from the plane through the other three lugs.

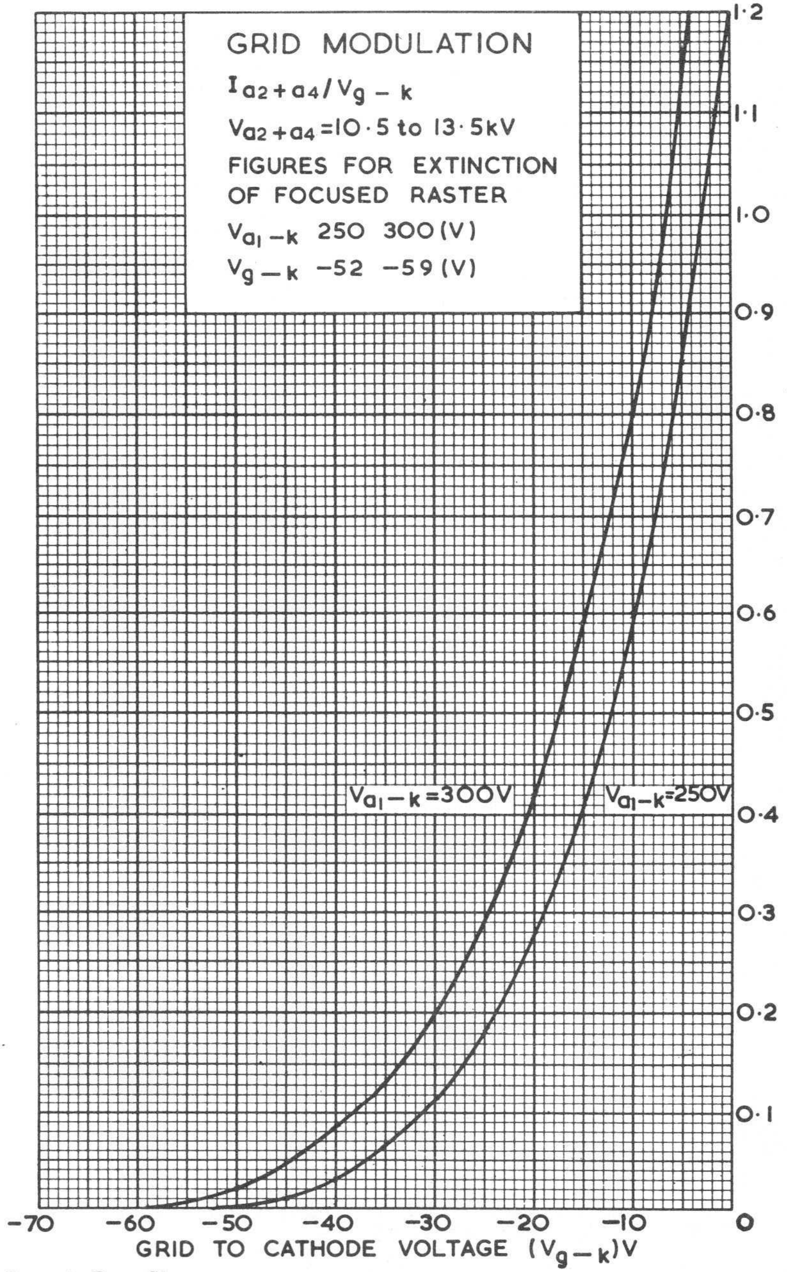
† Determined by reference line gauge No. 22. (See T.D.S. 5-0-91-22)

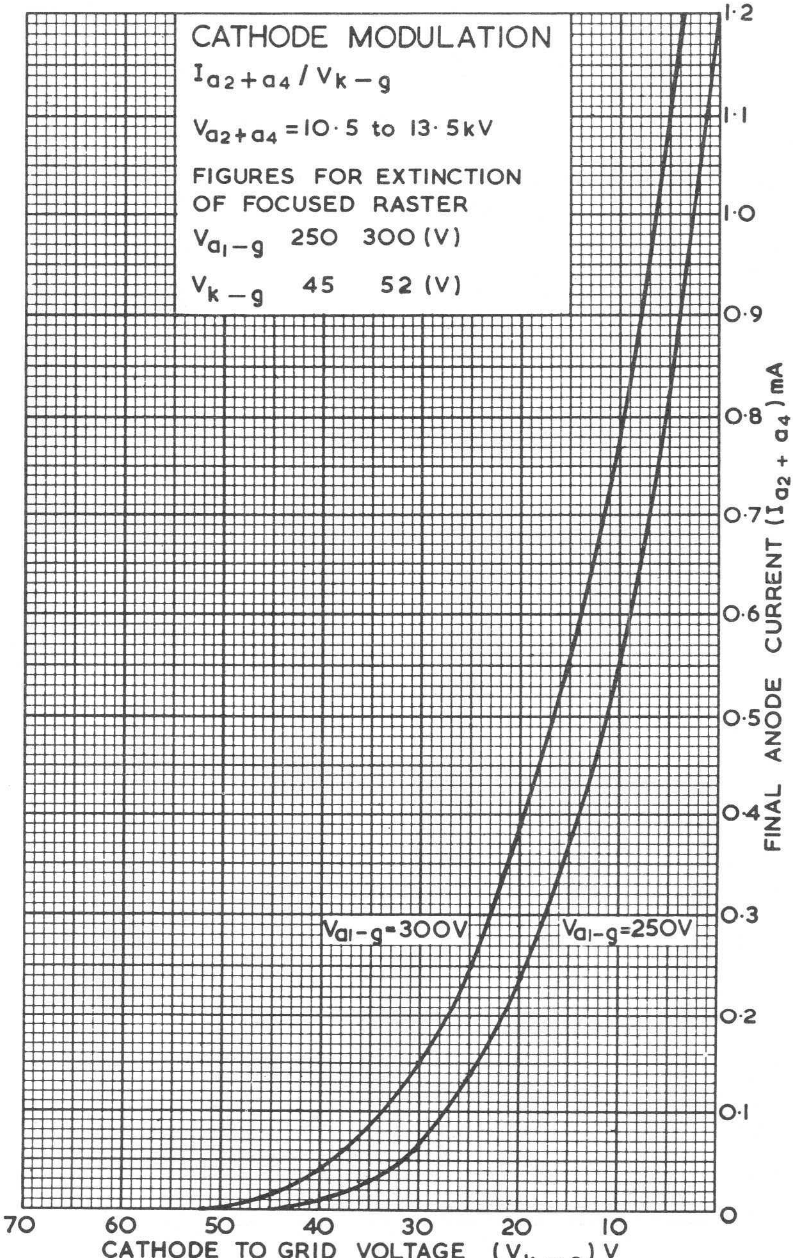


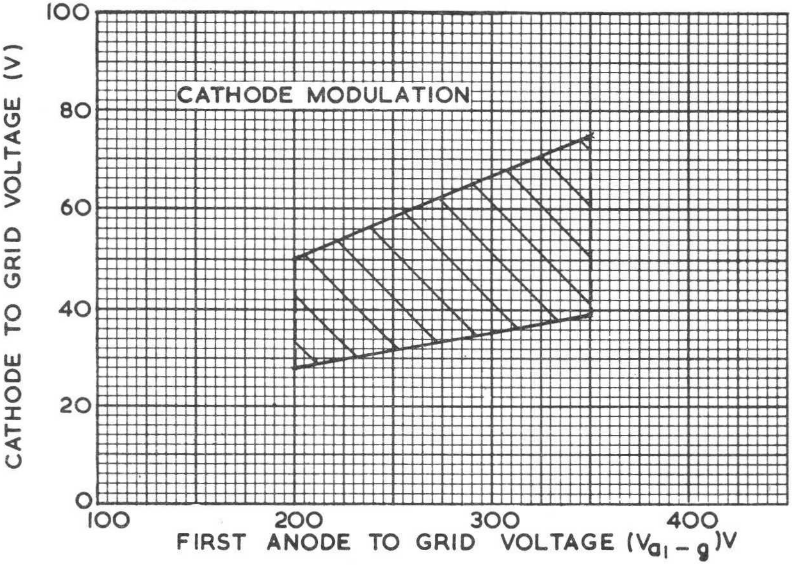

MAXIMUM DIMENSIONS FOR CONE PROFILE CO-ORDINATES

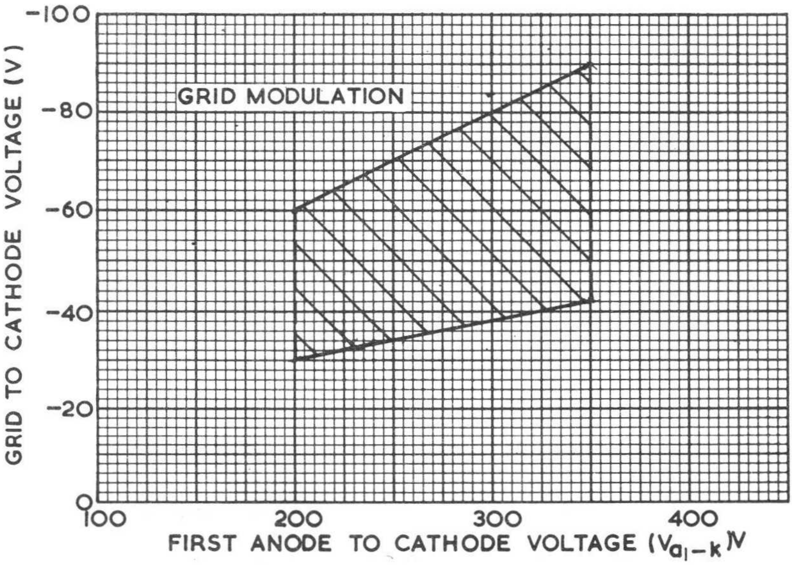
| Reference Plane No. | 0° Major | 10° | 20° | 30° | Diag. | 40° | 50° | 60° | 70° | 80° | 90° Minor |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 140.2 | 141.5 | 146.0 | 154.0 | 157.8 | 154.6 | 136.7 | 123.5 | 115.5 | 111.0 | 109.6 |
| 2 | 137.8 | 139.2 | 143.4 | 151.1 | 154.1 | 151.5 | 134.3 | 121.6 | 113.7 | 109.4 | 108.1 |
| 3 | 133.9 | 134.8 | 137.8 | 143.0 | 145.3 | 143.2 | 129.4 | 118.4 | 111.1 | 107.3 | 106.0 |
| 4 | 127.3 | 127.7 | 129.3 | 132.0 | 133.2 | 132.1 | 122.3 | 113.2 | 107.2 | 103.8 | 102.6 |
| 5 | 116.4 | 116.8 | 117.7 | 119.2 | 120.0 | 119.3 | 112.8 | 105.9 | 101.5 | 98.6 | 98.1 |
| 6 | 103.0 | 103.2 | 103.8 | 104.8 | 105.2 | 104.7 | 101.5 | 97.0 | 94.2 | 92.5 | 91.9 |
| 7 | 87.0 | 87.1 | 87.2 | 87.4 | 87.8 | 87.1 | 85.9 | 84.6 | 83.6 | 83.0 | 82.8 |
| 8 | 68.3 | 68.3 | 68.3 | 68.3 | 68.3 | 68.3 | 68.3 | 68.3 | 68.3 | 68.3 | 68.3 |


GRID MODULATION
$I_{a2+a4}/V_{g-k}$
$V_{a2+a4}$=10·5 to 13·5kV
FIGURES FOR EXTINCTION
OF FOCUSED RASTER
$V_{a1-k}$ 250 300(V)
$V_{g-k}$ −52 −59(V)
$V_{a1-k}$=300V
$V_{a1-k}$=250V
FINAL ANODE CURRENT ($I_{a2+a4}$)mA
1·2
1·1
1·0
0·9
0·8
0·7
0·6
0·5
0·4
0·3
0·2
0·1
0
−70
−60
−50
−40
−30
−20
−10
GRID TO CATHODE VOLTAGE ($V_{g-k}$)V


CATHODE MODULATION
$I_{a2+a4} / V_{k-g}$
$V_{a2+a4} = 10.5$ to $13.5$ kV
FIGURES FOR EXTINCTION OF FOCUSED RASTER
$V_{a1-g}$ 250 300 (V)
$V_{k-g}$ 45 52 (V)
$V_{a1-g}$=300V
$V_{a1-g}$=250V
1·2
1·1
1·0
0·9
0·8
0·7
0·6
0·5
0·4
0·3
0·2
0·1
0
FINAL ANODE CURRENT ($I_{a2+a4}$) mA
70
60
50
40
30
20
10
CATHODE TO GRID VOLTAGE ($V_{k-g}$) V

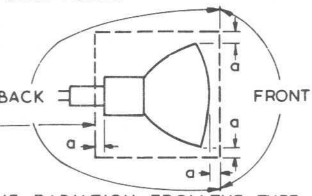
LIMITS OF RASTER CUT-OFF VOLTAGE



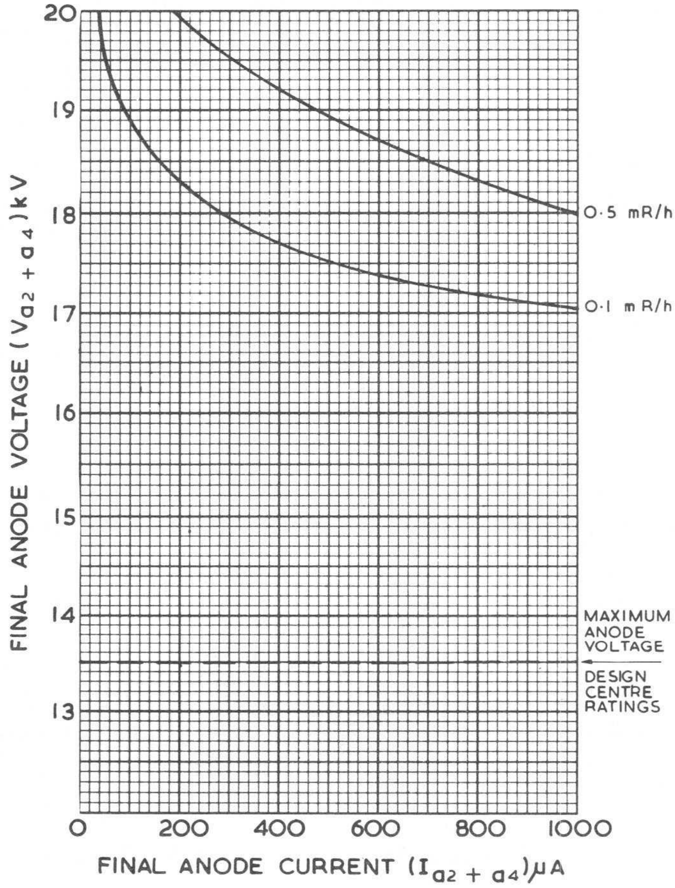
## X-RAY ISO-EXPOSURE CURVES OF TYPICAL TUBE

MEASUREMENTS MADE ON LINES OF MAXIMUM RADIATION AT FRONT AND BACK OF TUBE WITH DETECTOR CENTRE 50mm FROM NOTIONAL ENCLOSURE DEFINED BY DIAGRAM




UNDER NO CONDITION REPRESENTED HERE DOES THE RADIATION FROM THE TUBE FRONT EXCEED 0·1 mR/h

RADIATION FROM BACK OF TUBE



# Data Display or Monitor Tube

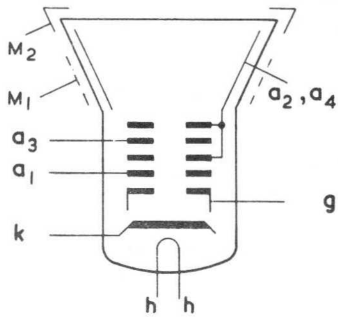
# M31-182..

## Maintenance Type

### GENERAL

Rectangular face, 12 inch, 110° diagonal
Rimguard III reinforced envelope
Integral mounting lugs
Electrostatic focus, magnetic deflection
Aluminised screen. Bonded face-plate
Face treated to reduce reflections
Grey glass, 50% transmission (approx.)
29.4 mm maximum neck diameter
External conductive coating

| | | | |
|---|---|---|---|
| Heater voltage | $V_h$ | 6.3 | V |
| Heater current | $I_h$ | 0.3* | A |




### DESIGN CENTRE RATINGS - Voltages referred to cathode

| | | | |
|---|---|---|---|
| Maximum second and fourth anode voltage | $V_{a2+a4(max)}$ | 13.5† | kV |
| Minimum second and fourth anode voltage | $V_{a2+a4(min)}$ | 10.5 | kV |
| Maximum third anode voltage | $V_{a3(max)}$ | +1000 to -500 | V |
| Maximum first anode voltage | $V_{a1(max)}$ | 550 | V |
| Maximum negative grid voltage | $-V_{g(max)}$ | 150 | V |
| Maximum peak negative grid voltage | $-v_{g(pk)max}$ | 400 | V |
| Maximum positive grid voltage | $V_{g(max)}$ | 0¶ | V |
| Maximum heater to cathode voltage, heater negative (d.c.) | $V_{h-k(max)}$ | 250 | V |
| Maximum peak heater to cathode voltage, heater negative (absolute rating) | $v_{h-k(pk)max}$ | 400§ | V |
| Maximum impedance, grid to cathode (50 Hz) | $Z_{g-k(max)}$ | 0.5 | MΩ |
| Maximum resistance, grid to cathode | $R_{g-k(max)}$ | 1.5 | MΩ |

* In a series heater chain the CRT should always be connected at the chassis end.

† The absolute rating of 16.5 kV must not be exceeded.

¶ A 10 kΩ grid series resistor mounted close to the tube base is recommended to limit the peak grid voltage

§ During a warming-up period not exceeding 45 seconds.

### PHOSPHOR SCREEN

This type is usually supplied with LG phosphor (M31-182LG) giving an orange trace of very long persistence. Other phosphor screens can be made available to special order.

Tubes incorporating a B8H Sparkguard base will have a suffix after the type number. For details of the Sparkguard bases see separate sheets.

DATA DISPLAY & MONITOR TUBES

## INTER-ELECTRODE CAPACITANCES

| | | * | | † | |
|---|---|---|---|---|---|
| Cathode to all | $c_{k\text{-}all}$ | 3.0 | | 3.5 | pF |
| Grid to all | $c_{g\text{-}all}$ | 6.5 | | 8.0 | pF |
| Anodes 2 and 4 to coating $M_1$ (min) | $c_{a2+a4\text{-}M1\,(min)}$ | | 450 | | pF |
| Anodes 2 and 4 to frame $M_2$ (approx.) | $c_{a2+a4\text{-}M2}$ | | 200 | | pF |

* Holder capacitance balanced out.

† Total capacitances including a typical B8H holder.

## TYPICAL OPERATION - Grid modulation, voltages referred to cathode.

| | | | | | |
|---|---|---|---|---|---|
| Second and fourth anode voltage | $V_{a2+a4\text{-}k}$ | | 12 | | kV |
| First anode voltage | $V_{a1\text{-}k}$ | | 400 | | V |
| Third anode voltage range for focus | $V_{a3\text{-}k}$ | | 0 to 400 | | V |
| Final anode current (peak) | $i_{a2+a4(pk)}$ | 200 | | 350 | $\mu$A |
| Average peak to peak picture modulating voltage | | 29 | | 36 | V |
| Grid to cathode voltage range for cut-off of raster | $V_{g\text{-}k}$ | | -40 to -77 | | V |
| LG screen persistence to 10% (approx.) | | | 3.0 | | s |

## TYPICAL OPERATION - Cathode modulation, voltages referred to grid

| | | | | | |
|---|---|---|---|---|---|
| Second and fourth anode voltage | $V_{a2+a4\text{-}g}$ | | 12 | | kV |
| First anode voltage | $V_{a1\text{-}g}$ | | 400 | | V |
| Third anode voltage range for focus | $V_{a3\text{-}g}$ | | 0 to 400 | | V |
| Final anode current (peak) | $i_{a2+a4(pk)}$ | 200 | | 350 | $\mu$A |
| Average peak to peak picture modulating voltage | | 25 | | 31 | V |
| Cathode to grid voltage range for cut-off of raster | $V_{k\text{-}g}$ | | 36 to 66 | | V |
| LG screen persistence to 10% (approx.) | | | 3.0 | | s |

The LG screen is liable to burn even at low values of beam current if operated with stationary or slow moving spot.

This tube meets the requirements for intrinsically safe tubes laid down in the section of I.E.C. Publication 65 dealing with implosion.

## PICTURE CENTRING

| | | |
|---|---|---|
| Maximum magnet flux density at centre of neck should not be less than | 15 | Gs |
| Maximum distance of centre of magnetic field from reference line | 53 | mm |

## DEFLECTION ANGLES

Height 80° Width 99° Diagonal 110°

## MOUNTING

There is an annular region of anti-corona coating with external diameter of 75 mm surrounding the CT8 cap, the tube should not be handled in this region.

The tube can be mounted in any position. The tube socket should not be rigidly mounted but should have flexible leads and be allowed to move freely. The bottom circumference of the base shell will fall within a circle of 44 mm diameter which is centred on the perpendicular from the centre of the face.

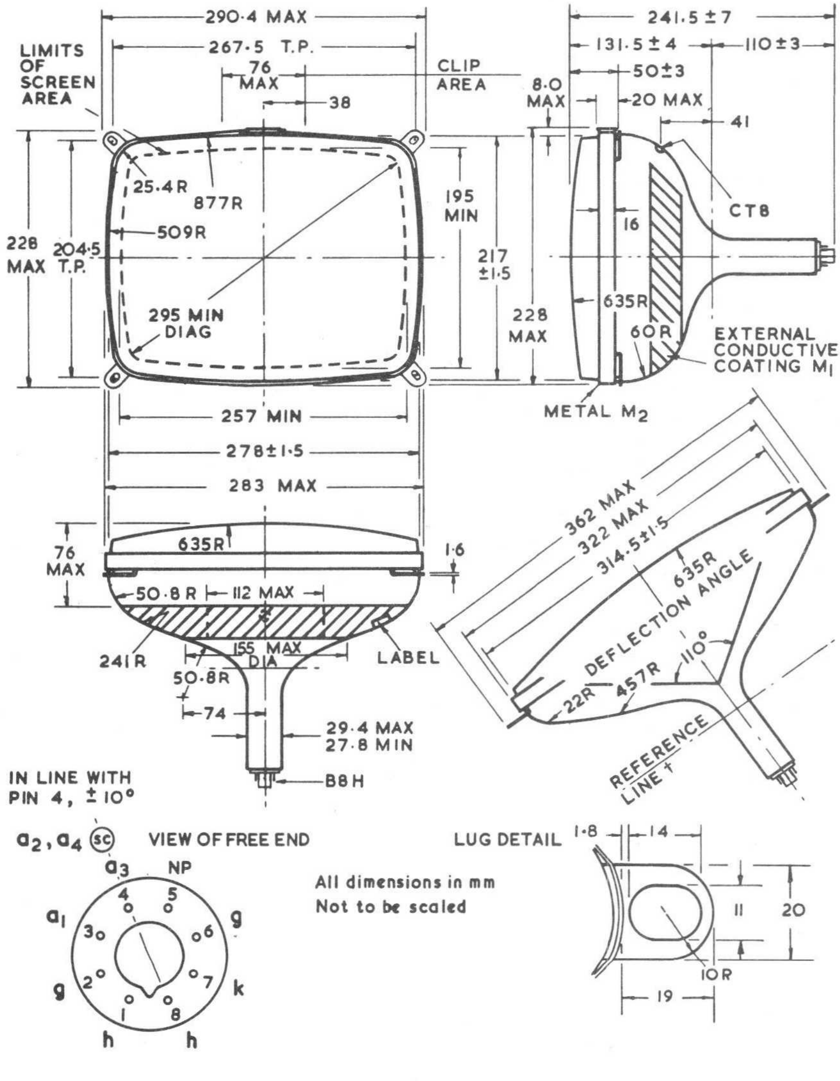
The bolts to be used for mounting must lie within circles of 6.5 mm diameter centred on the true positions of the lug holes. One of the four lugs may deviate 2.0 mm maximum from the plane through the other three lugs.

The external conductive coating ($M_1$) of this tube should be connected to chassis. The capacitance between this coating and final anode may be used to provide smoothing for the e.h.t. supply.

The metal frame ($M_2$) should be connected to the chassis in a.c. equipment operating from an isolating transformer, or via a suitable leakage path in a.c./d.c. equipment, for example 2 MΩ.

When flashover protection is incorporated the chassis return paths of $M_1$ and $M_2$ should be made in a manner appropriate to the protection system employed.

**TUBE WEIGHT** (approximate) - net 3.4 kg (7.5 lb)




† Determined by reference line gauge No. 16. (B.S.RL4 : IEC67-IV-3 : JEDEC126)

Minimum screen area 477 $cm^2$

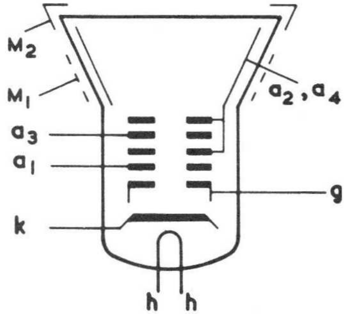
# Monitor Tube

# M31—184..

## GENERAL

Rectangular face, 12 inch, 110° diagonal
Rimguard III reinforced envelope
Integral mounting lugs
Electrostatic focus, magnetic deflection
Aluminised screen
Grey glass, 50% transmission (approx.)
Straight gun, non ion trap
External conductive coating

| | | | |
|---|---|---|---|
| Heater voltage | $V_h$ | 6.3 | V |
| Heater voltage | $I_h$ | 0.3* | A |




## DESIGN CENTRE RATINGS - Voltages referred to cathode

| | | | |
|---|---|---|---|
| Maximum second and fourth anode voltage | $V_{a2+a4(max)}$ | 16† | kV |
| Minimum second and fourth anode voltage | $V_{a2+a4(min)}$ | 10.5 | kV |
| Maximum third anode voltage | $V_{a3(max)}$ | +1000 to -500 | V |
| Maximum first anode voltage | $V_{a1(max)}$ | 550 | V |
| Maximum negative grid voltage | $-V_{g(max)}$ | 150 | V |
| Maximum peak negative grid voltage | $-v_{g(pk)max}$ | 400** | V |
| Maximum positive grid voltage | $V_{g(max)}$ | 0¶ | V |
| Maximum heater to cathode voltage heater negative (d.c.) | $V_{h-k(max)}$ | 250 | V |
| Maximum peak heater to cathode voltage, heater negative (absolute rating) | $v_{h-k(pk)max}$ | 400§ | V |
| Maximum impedance, grid to cathode (50 Hz) | $Z_{g-k(max)}$ | 0.5 | MΩ |
| Maximum resistance, grid to cathode | $R_{g-k(max)}$ | 1.5 | MΩ |

* In a series heater chain the CRT should always be connected at the chassis end.

† The absolute rating of 18 kV must not be exceeded.

¶ A 10 kΩ grid series resistor mounted close to the tube base is recommended to limit the peak grid voltage.

§ During a warming-up period not exceeding 45 seconds.

** Maximum pulse duration 22% of one cycle with a maximum of 1.5 ms.

## PHOSPHOR SCREEN

This type is usually supplied with a W phosphor (M31-184W) giving a television white trace of medium short persistence. Other phosphor screens can be made available to special order.

Tubes incorporating a B8H Sparkguard base will have a suffix after the type number. For details of the Sparkguard bases see separate sheets.

DATA DISPLAY & MONITOR TUBES

## INTER-ELECTRODE CAPACITANCES

| | | * | | † | |
|---|---|---|---|---|---|
| Cathode to all | $c_{k-all}$ | 3.0 | | 3.5 | pF |
| Grid to all | $c_{g-all}$ | 6.5 | | 8.0 | pF |
| Anodes 2 and 4 to coating $M_1$ (min) | $c_{a2+a4-M1(min)}$ | | 450 | | pF |
| Anodes 2 and 4 to shell $M_2$ (approx.) | $c_{a2+a4-M2}$ | | 200 | | pF |

* Holder capacitance balanced out.

† Total capacitances including a typical B8H holder.

## TYPICAL OPERATION Grid modulation (Voltage referred to cathode)

| | | | | | |
|---|---|---|---|---|---|
| Second and fourth anode voltage | $V_{a2+a4-k}$ | | 15 | | kV |
| First anode voltage | $V_{a1-k}$ | | 400 | | V |
| Third anode voltage range for focus | $V_{a3-k}$ | | 0 to 400 | | V |
| Final anode current (peak) | $i_{a2+a4(pk)}$ | 200 | | 350 | μA |
| Average peak to peak picture modulating voltage | | 29 | | 36 | V |
| Grid to cathode voltage for cut-off of raster | $V_{g-k}$ | | -40 to -77 | | V |

## TYPICAL OPERATION Cathode modulation (Voltage referred to grid)

| | | | | | |
|---|---|---|---|---|---|
| Second and fourth anode voltage | $V_{a2+a4-g}$ | | 15 | | kV |
| First anode voltage | $V_{a1-g}$ | | 400 | | V |
| Third anode voltage range for focus | $V_{a3-g}$ | | 0 to 400 | | V |
| Final anode current (peak) | $i_{a2+a4}$ | 200 | | 350 | μA |
| Average peak to peak picture modulating voltage | | 25 | | 31 | V |
| Cathode to grid voltage for cut-off of raster | $V_{k-g}$ | | 36 to 66 | | V |

This tube meets the requirements for intrinsically safe tubes laid down in the section of I.E.C. Publication 65 dealing with implosion.

## PICTURE CENTRING

| | | |
|---|---|---|
| Maximum magnet flux density at centre of neck should not be less than | 15 | Gs |
| Maximum distance of centre of magnetic field from reference line | 53 | mm |

## DEFLECTION ANGLES

Height 80° Width 99° Diagonal 110°

## MOUNTING

This tube is intended for 'push-through' presentation without masking, but if a mask is used it should be flexible enough to take up small variations in fixing and bulb contours .

There is an annular region of anti-corona coating with external diameter of 75 mm surrounding the CT8 cap, the tube should not be handled in this region.

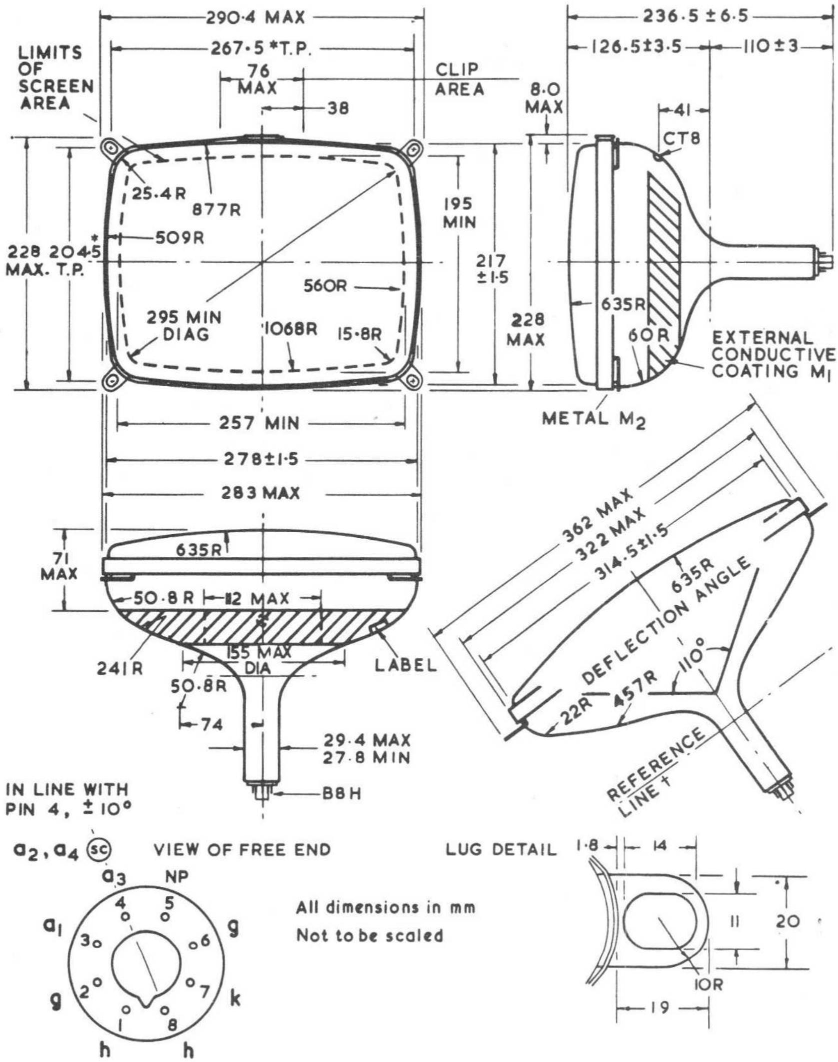
The tube can be mounted in any position. The tube socket should not be rigidly mounted but should have flexible leads and be allowed to move freely. The bottom circumference of the base shell will fall within a circle of 44 mm diameter which is centred on the perpendicular from the centre of the face.

The external conductive coating ($M_1$) of this tube should be connected to chassis. The capacitance between this coating and final anode may be used to provide smoothing for the e.h.t. supply.

The metal rimband ($M_2$) should be connected directly to the chassis in a.c. equipment operating from an isolating transformer, or via a suitable leakage path in a.c. / d.c. equipment, for example 2 MΩ.

When flashover protection is incorporated the chassis return paths of $M_1$ and $M_2$ should be made in a manner appropriate to the protection system employed.

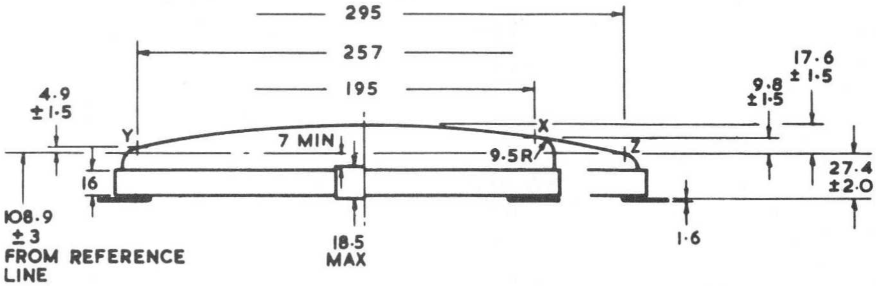
**TUBE WEIGHT** (approximate) - net 3.0 kg (6.5 lb)

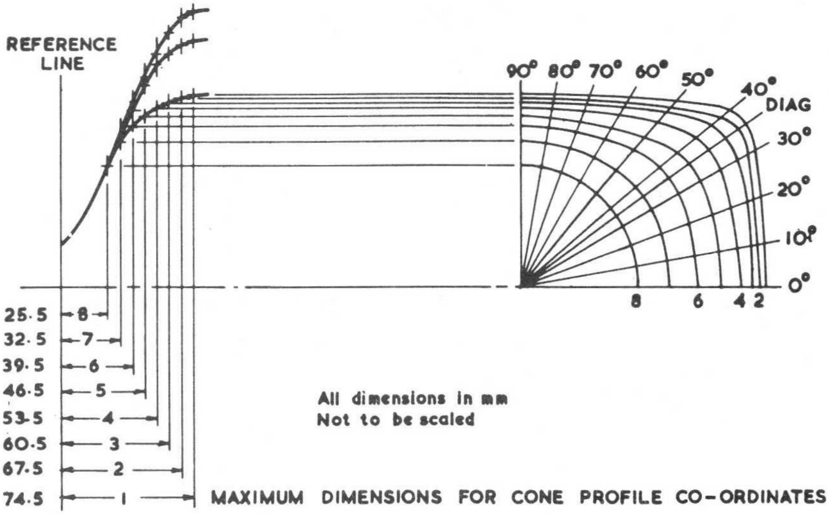



* The bolts to be used for mounting the tube must lie within circles of 6.5 mm diameter centred on these true positions. One of the four lugs may deviate 2.0 mm maximum from the plane through the other three lugs.

† Determined by reference line gauge No.16. (B.S.RL4 : IEC67-IV-3 : JEDEC126)

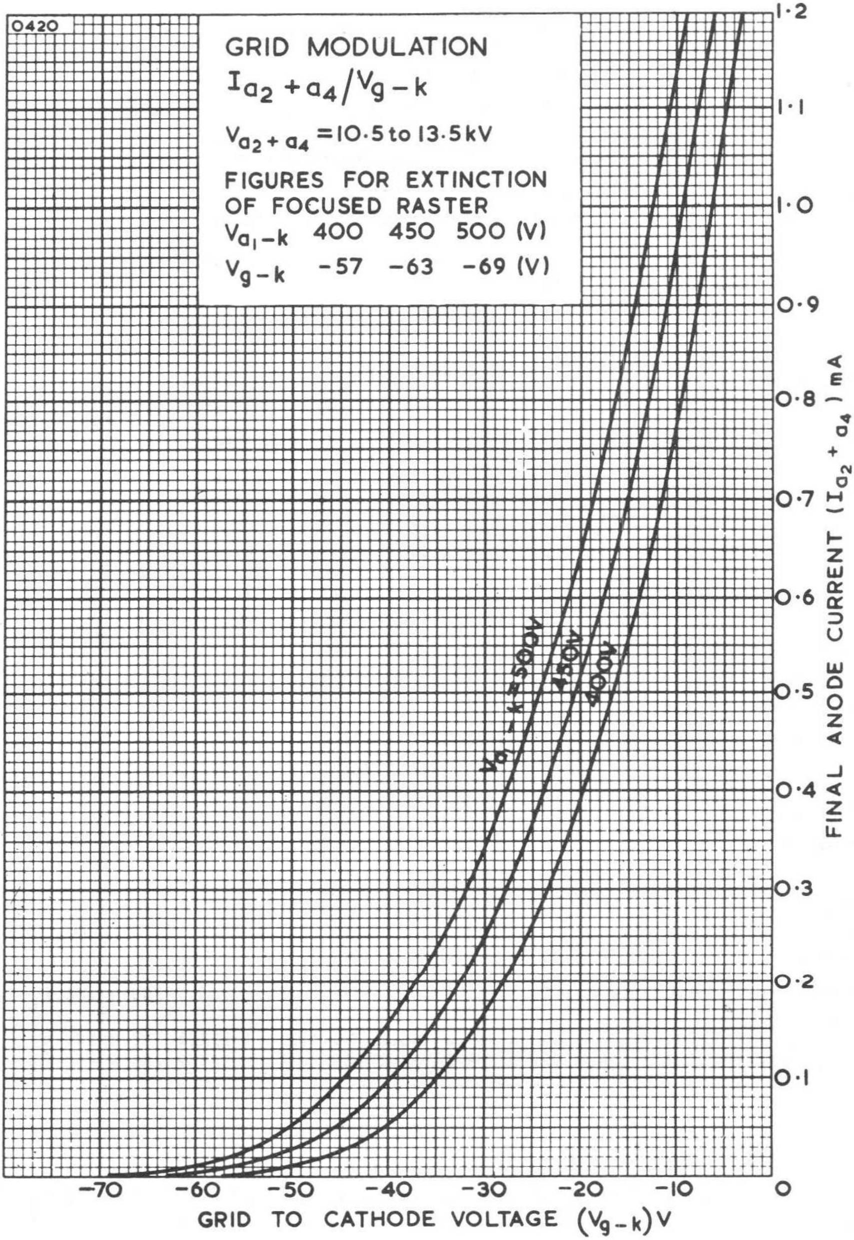
Minimum screen area 477 cm$^2$

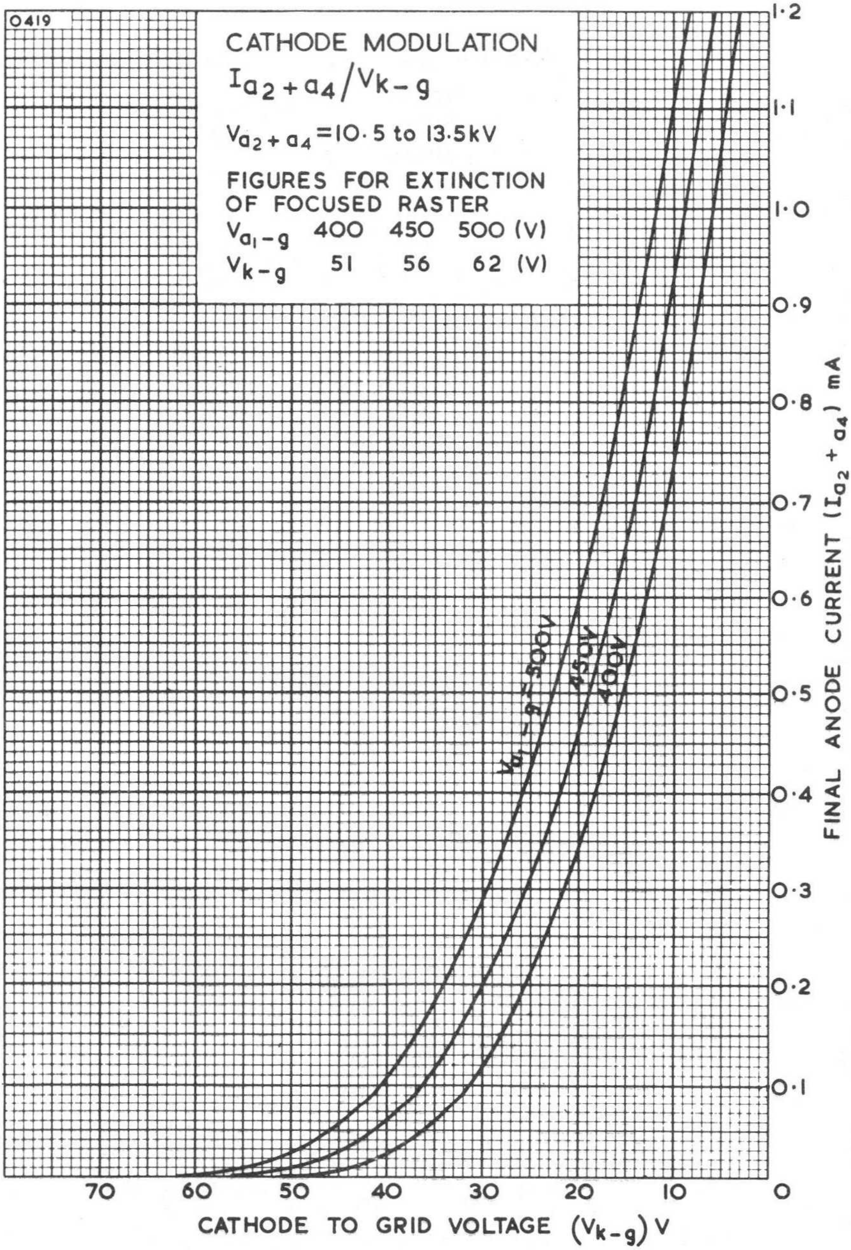


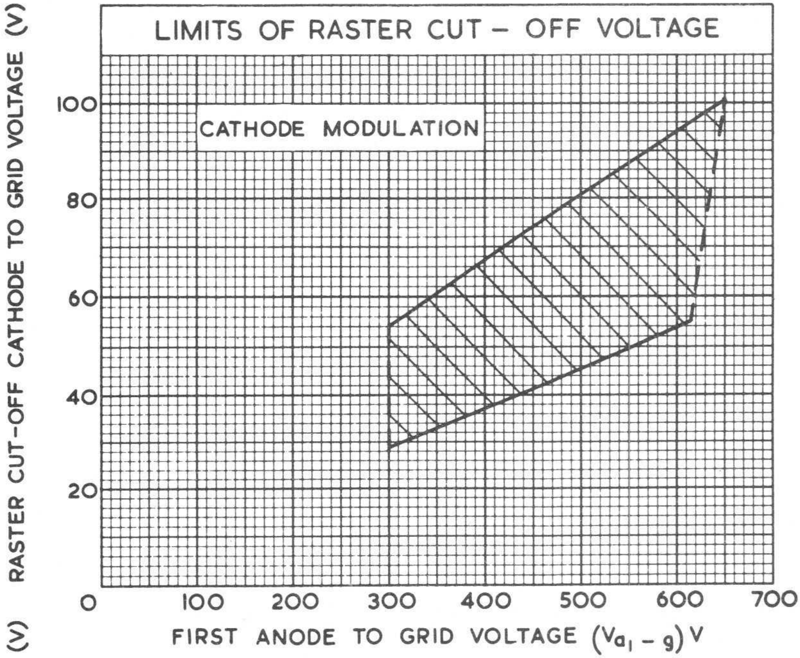

MAXIMUM DIMENSIONS FOR CONE PROFILE CO-ORDINATES

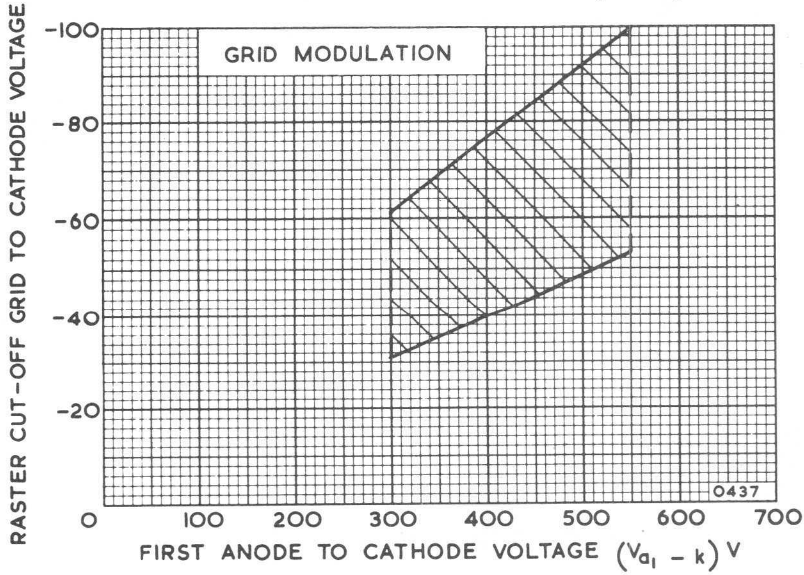
| Reference Plane No. | 0° Major | 10° | 20° | 30° | Diag. | 40° | 50° | 60° | 70° | 80° | 90° Minor |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 140.2 | 141.5 | 146.0 | 154.0 | 157.8 | 154.6 | 136.7 | 123.5 | 115.5 | 111.0 | 109.6 |
| 2 | 137.8 | 139.2 | 143.4 | 151.1 | 154.1 | 151.5 | 134.3 | 121.6 | 113.7 | 109.4 | 108.1 |
| 3 | 133.9 | 134.8 | 137.8 | 143.0 | 145.3 | 143.2 | 129.4 | 118.4 | 111.1 | 107.3 | 106.0 |
| 4 | 127.3 | 127.7 | 129.3 | 132.0 | 133.2 | 132.1 | 122.3 | 113.2 | 107.2 | 103.8 | 102.6 |
| 5 | 116.4 | 116.8 | 117.7 | 119.2 | 120.0 | 119.3 | 112.8 | 105.9 | 101.5 | 98.6 | 98.1 |
| 6 | 103.0 | 103.2 | 103.8 | 104.8 | 105.2 | 104.7 | 101.5 | 97.0 | 94.2 | 92.5 | 91.9 |
| 7 | 87.0 | 87.1 | 87.2 | 87.4 | 87.8 | 87.1 | 85.9 | 84.6 | 83.6 | 83.0 | 82.8 |
| 8 | 68.3 | 68.3 | 68.3 | 68.3 | 68.3 | 68.3 | 68.3 | 68.3 | 68.3 | 68.3 | 68.3 |


0420
GRID MODULATION
$I_{a2+a4}/V_{g-k}$
$V_{a2+a4}$ = 10·5 to 13·5 kV
FIGURES FOR EXTINCTION OF FOCUSED RASTER
$V_{a1-k}$ 400 450 500 (V)
$V_{g-k}$ −57 −63 −69 (V)
$V_{a1-k}$ = 500V
450V
400V
1·2
1·1
1·0
0·9
0·8
0·7
0·6
0·5
0·4
0·3
0·2
0·1
0
FINAL ANODE CURRENT ($I_{a2+a4}$) mA
−70
−60
−50
−40
−30
−20
−10
0
GRID TO CATHODE VOLTAGE ($V_{g-k}$)V



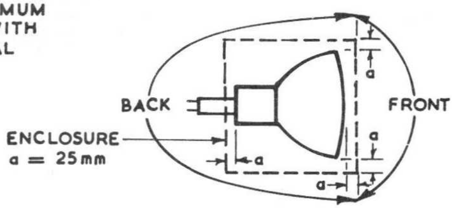

DATA DISPLAY & MONITOR TUBES

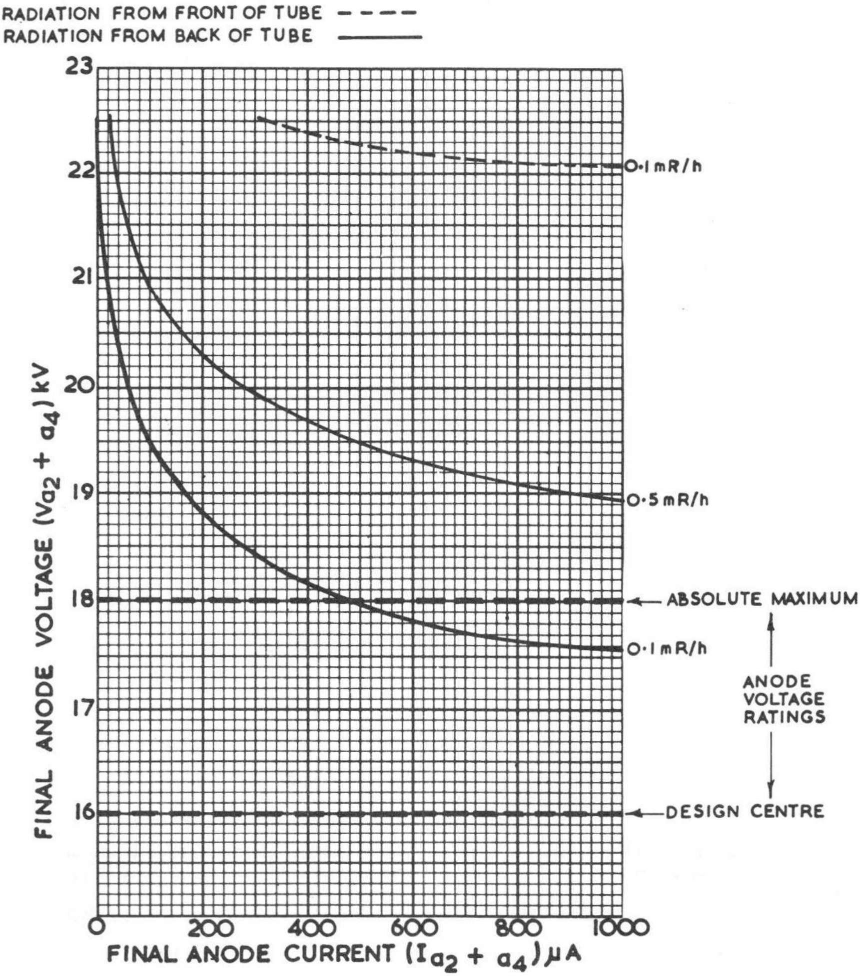

LIMITS OF RASTER CUT – OFF VOLTAGE
CATHODE MODULATION
RASTER CUT-OFF CATHODE TO GRID VOLTAGE (V)
100
80
60
40
20
0
100
200
300
400
500
600
700
FIRST ANODE TO GRID VOLTAGE ($V_{a_1} - g$) V


GRID MODULATION
RASTER CUT-OFF GRID TO CATHODE VOLTAGE (V)
-100
-80
-60
-40
-20
0
100
200
300
400
500
600
700
0437
FIRST ANODE TO CATHODE VOLTAGE ($V_{a_1} - k$) V

## X-RAY ISO-EXPOSURE CURVES OF TYPICAL TUBE

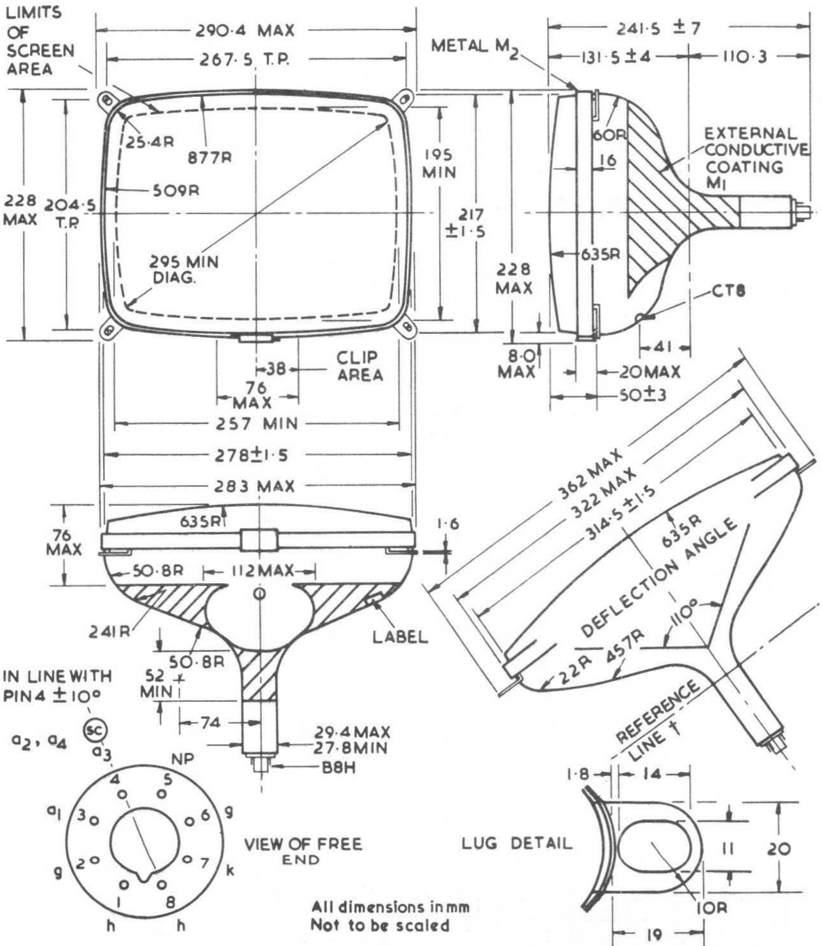
MEASUREMENTS MADE ON LINES OF MAXIMUM RADIATION AT FRONT AND BACK OF TUBE WITH DETECTOR CENTRE 50 mm FROM NOTIONAL ENCLOSURE DEFINED BY DIAGRAM.



# M31-185..    Data Display or Monitor Tube

The M31-185.. is the M31-182.. with a tinted bonded faceplate giving a total glass transmission of approximately 15%. The M31-185.. has external conductive coating dimensions as shown below which also differ from the M31-182..




## PHOSPHOR SCREEN

This type is usually supplied with GH phosphor (M31-185GH) giving a green trace of medium short persistence. Other phosphor screens can be made available to special order.

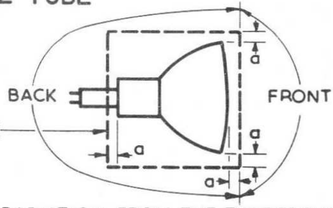
† Determined by reference line gauge No.16. (B.S.RL4: IEC67-IV-3: JEDEC126)
Minimum screen area 477 $cm^2$

**Thorn Radio Valves and Tubes Limited**

BRIMAR

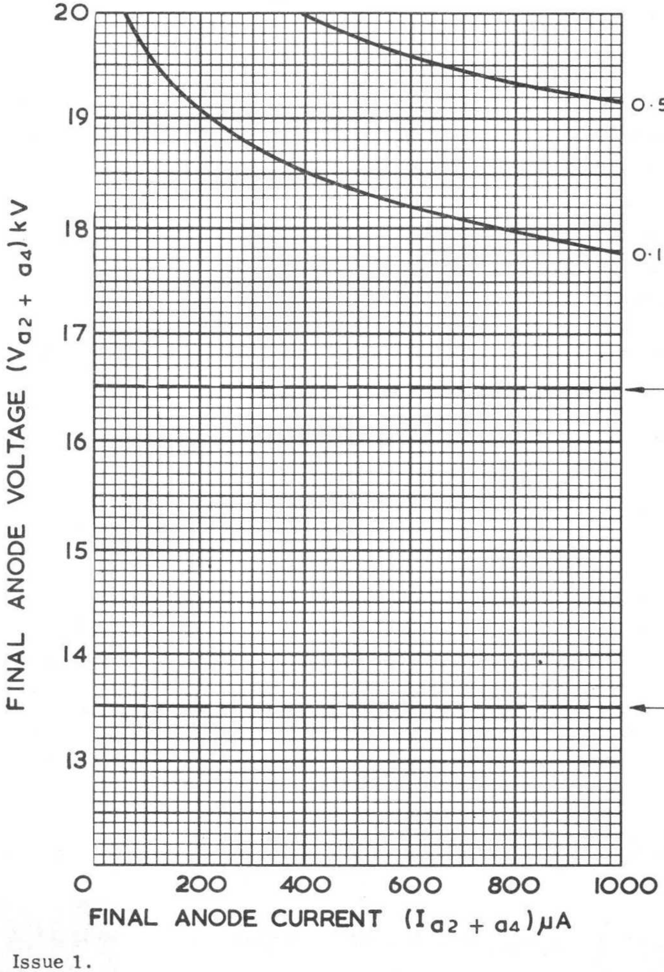
## X-RAY ISO-EXPOSURE CURVES OF TYPICAL TUBE

MEASUREMENTS MADE ON LINES OF MAXIMUM RADIATION AT FRONT AND BACK OF TUBE WITH DETECTOR CENTRE 50mm FROM NOTIONAL ENCLOSURE DEFINED BY DIAGRAM




UNDER NO CONDITION REPRESENTED HERE DOES THE RADIATION FROM THE TUBE FRONT EXCEED 0·1 mR/h

RADIATION FROM BACK OF TUBE



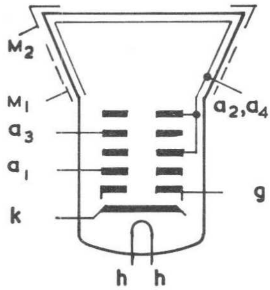

DATA DISPLAY & MONITOR TUBES

# M31-190.. Data Display or Monitor Tube

**GENERAL**

Rectangular face, 31 cm (12in), 90° diagonal
Rimguard III reinforced envelope**
Integral mounting lugs, 20 mm dia. neck
Electrostatic focus, magnetic deflection
Aluminised screen
Grey glass, 50% transmission (approx.)
Straight gun, non ion trap
External conductive coating

| | | | |
|---|---|---|---|
| Heater voltage | $V_h$ | 11 | V |
| Heater current | $I_h$ | 75 | mA |




**DESIGN CENTRE RATINGS** Voltages referred to cathode

| | | | |
|---|---|---|---|
| Maximum second and fourth anode voltage | $V_{a2+a4(max)}$ | 13.5† | kV |
| Minimum second and fourth anode voltage | $V_{a2+a4(min)}$ | 10.5* | kV |
| Maximum third anode voltage - range | $V_{a3(max)}$ | -50 to +500 | V |
| Maximum first anode voltage | $V_{a1(max)}$ | 350 | V |
| Maximum negative grid voltage | $-V_{g(max)}$ | 100 | V |
| Maximum peak negative grid voltage | $-v_{g(max)}$ | 350§ | V |
| Maximum positive grid voltage | $V_{g(max)}$ | 0¶ | V |
| Maximum heater to cathode voltage, heater negative (d.c.) | $V_{h-k(max)}$ | 110 | V |
| Maximum peak heater to cathode voltage, heater negative | $v_{h-k(pk)max}$ | 130 | V |
| Maximum impedance, grid to cathode (50 Hz) | $Z_{g-k(max)}$ | 0.5 | MΩ |
| Maximum resistance, grid to cathode | $R_{g-k(max)}$ | 1.5 | MΩ |

All voltages referred to cathode

† The absolute rating of 16.5kV must not be exceeded.

* Absolute minimum rating is 8.5 kV.

§ Maximum pulse duration 22% of one cycle with a maximum of 1.5 ms.

¶ A 10 kΩ grid series resistor mounted close to the tube base is recommended to limit the peak grid voltage.

** This tube meets the requirements for intrinsically safe tubes laid down in the section of I.E.C. Publication 65 dealing with implosion.

**PHOSPHOR SCREEN**

This type is usually supplied with GH phosphor ( M31-190GH ) giving a green trace of medium short persistence. Other phosphor screens can be made available to special order.

## INTER-ELECTRODE CAPACITANCES

| | | | |
|---|---|---|---|
| Cathode to all | $c_{k-all}$ | 3.0* | pF |
| Grid to all | $c_{g-all}$ | 4.0* | pF |
| Anodes 2 and 4 to coating $M_1$ | $c_{a2+a4-M1}$ | 700 | pF |
| Anodes 2 and 4 to shell $M_2$ (approx.) | $c_{a2+a4-M2}$ | 200 | pF |

* Holder capacitance balanced out.

## TYPICAL OPERATION - Grid modulation (Voltages referred to cathode)

| | | | |
|---|---|---|---|
| Second and fourth anode voltage | $V_{a2+a4-k}$ | 12 | kV |
| First anode voltage | $V_{a1-k}$ | 250 | V |
| Third anode voltage range for focus | $V_{a3-k}$ | 0 to 350 | V |
| Average peak to peak picture modulating voltage up to 250$\mu$A | | 33 | V |
| Grid to cathode voltage for cut-off of raster | $V_{g-k}$ | -35 to -69 | V |

## TYPICAL OPERATION - Cathode modulation (Voltages referred to grid)

| | | | |
|---|---|---|---|
| Second and fourth anode voltage | $V_{a2+a4-g}$ | 12 | kV |
| First anode voltage | $V_{a1-g}$ | 250 | V |
| Third anode voltage range for focus | $V_{a3-g}$ | 0 to 350 | V |
| Average peak to peak picture modulating voltage up to 250$\mu$A | | 26 | V |
| Cathode to grid voltage for cut-off of raster | $V_{k-g}$ | 32 to 58 | V |

This data should be read in conjunction with Operational Recommendations for Industrial Cathode Ray Tubes.

# Data Display or Monitor Tube

## MOUNTING

Any mask used in the mounting of this tube should be flexible enough to take up small variations in fixing and bulb contours.

There is an annular region of anti-corona coating with external diameter of 75 mm surrounding the CT8 cap, the tube should not be handled in this region.

The tube can be mounted in any position. The tube socket should not be rigidly mounted but should have flexible leads and be allowed to move freely. The bottom circumference of the base shell will fall within a circle of 36 mm diameter which is centred on the perpendicular from the centre of the face.

The external conductive coating ($M_1$) of this tube should be connected to chassis. The capacitance between this coating and final anode may be used to provide smoothing for the e.h.t. supply.

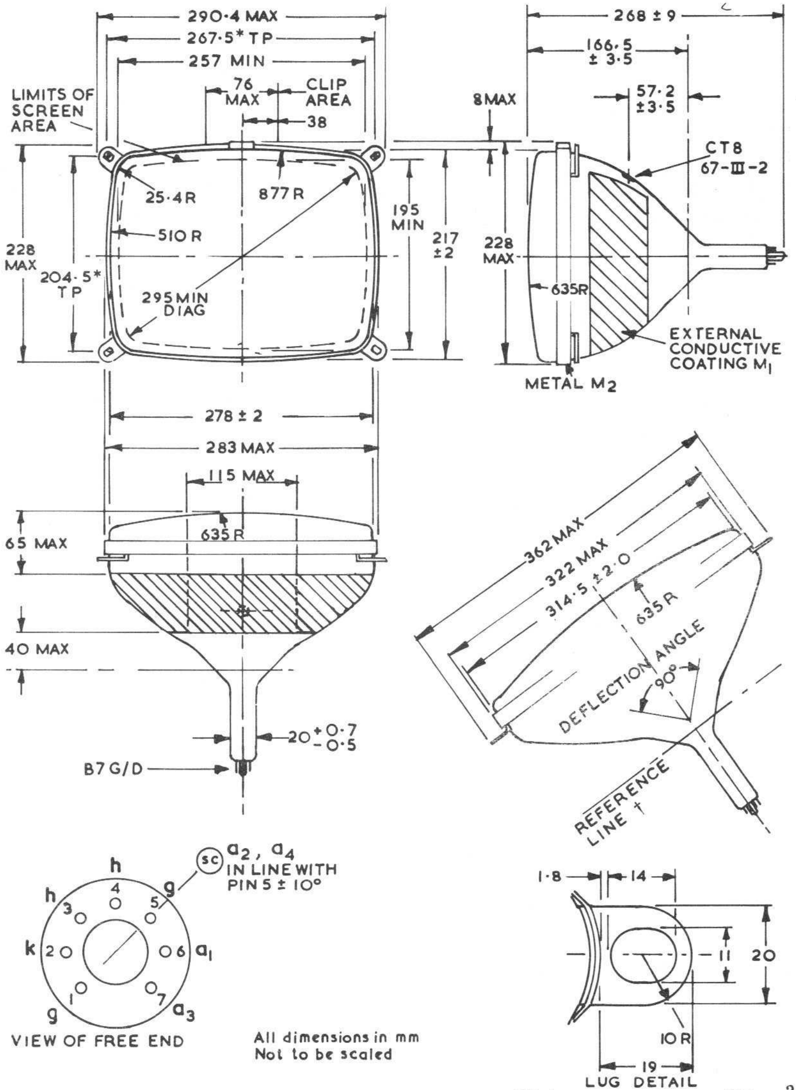
The metal shell ($M_2$) should be connected to the chassis in an a.c. receiver operating from an isolating transformer, or via a suitable leakage path in an a.c./d.c. receiver, for example 2 MΩ.

When flashover protection is incorporated the chassis return paths of $M_1$ and $M_2$ should be made in a manner appropriate to the protection system employed.

**TUBE WEIGHT** (approximate) - net 3.0 kg (6.5lb)

# Data Display or Monitor Tube

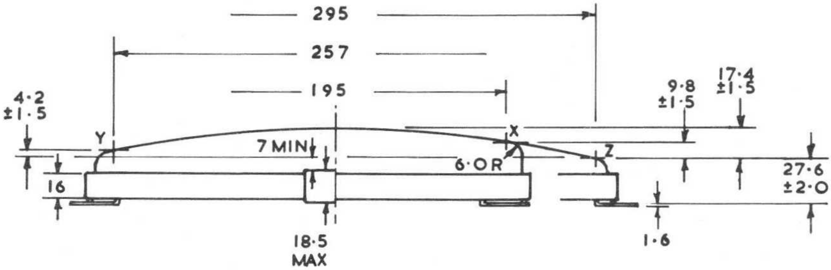
# M31-190..

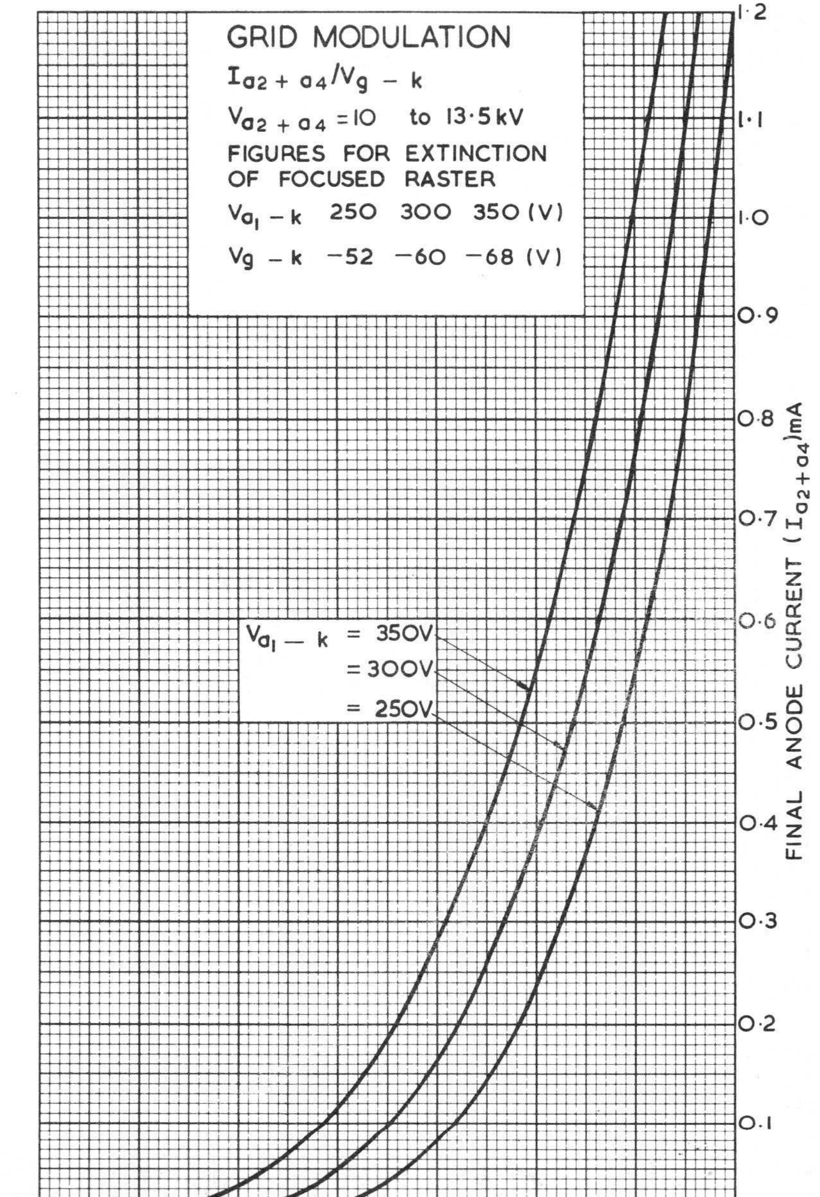


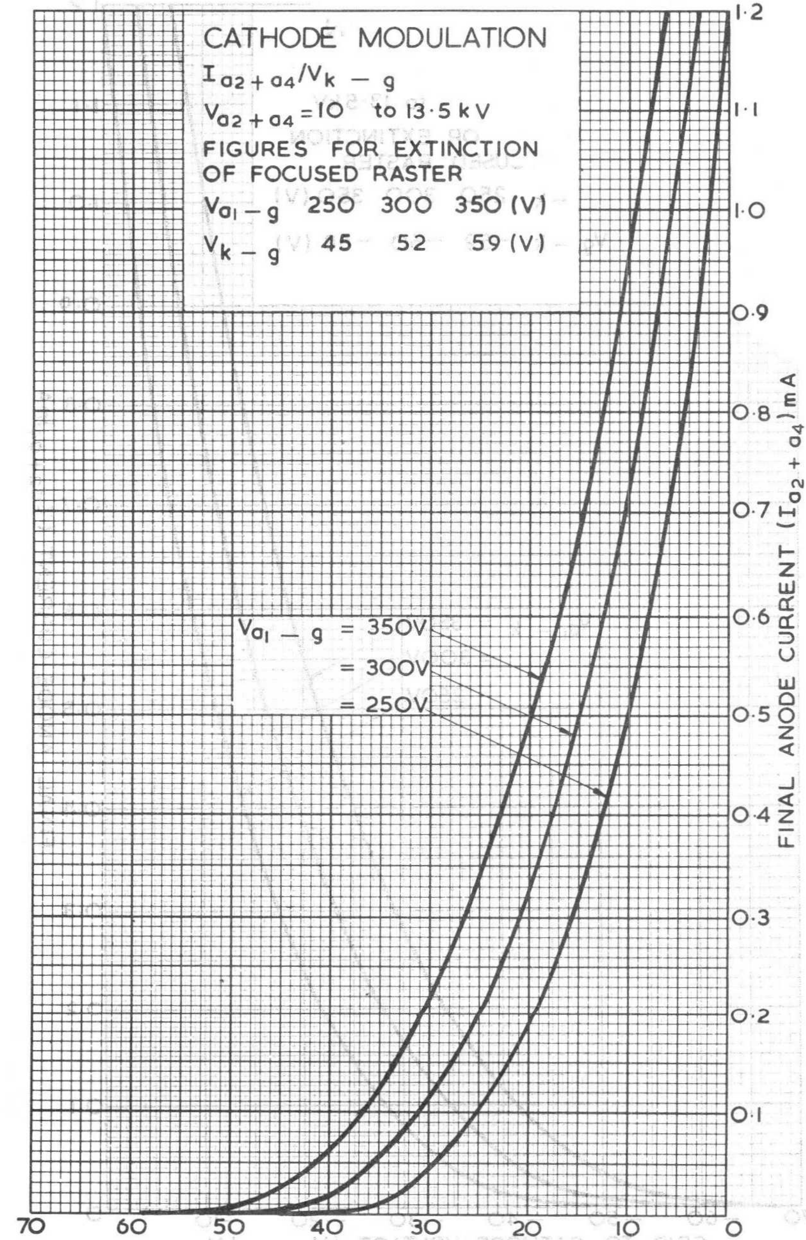

Minimum screen area 477 $cm^2$

* The bolts to be used for mounting the tube must lie within circles of 7.0mm diameter centred on these true positions. One of the four lugs may deviate 2.0 mm maximum from the plane through the other three lugs.

† Determined by reference line gauge No. 20. (See T.D.S. 5-0-91-20)

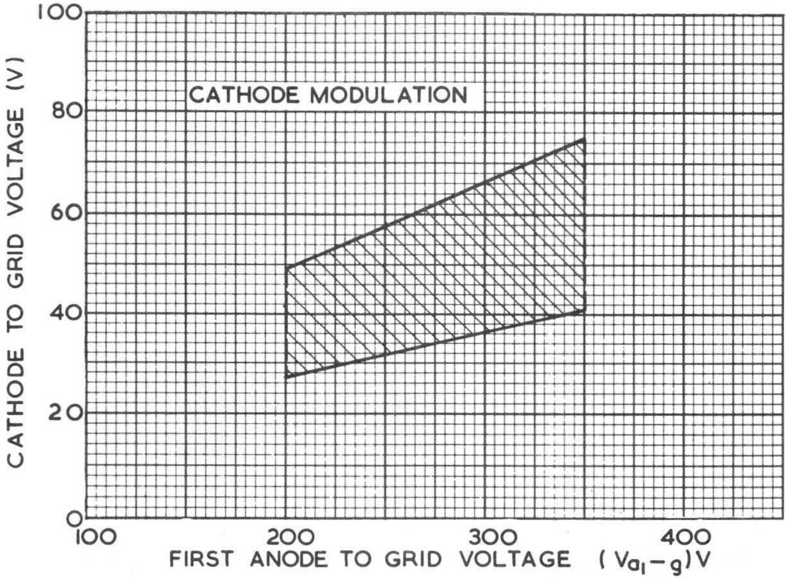

295
257
195
4·2
±1·5
Y
7 MIN
X
6·0R
Z
9·8
±1·5
17·4
±1·5
16
27·6
±2·0
18·5
MAX
1·6

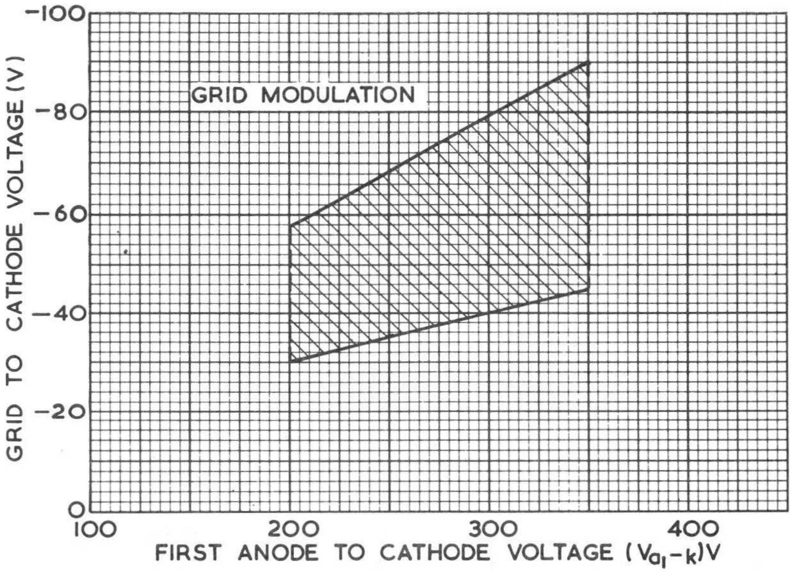

GRID MODULATION
Ia2 + a4/Vg − k
Va2 + a4 = 10 to 13·5 kV
FIGURES FOR EXTINCTION OF FOCUSED RASTER
Va1 − k 250 300 350 (V)
Vg − k −52 −60 −68 (V)
Va1 — k = 350V
= 300V
= 250V
1·2
1·1
1·0
0·9
0·8
0·7
0·6
0·5
0·4
0·3
0·2
0·1
0
−70 −60 −50 −40 −30 −20 −10
GRID TO CATHODE VOLTAGE (Vg — k) V
FINAL ANODE CURRENT (Ia2+a4) mA



CATHODE MODULATION
$I_{a2+a4}/V_{k-g}$
$V_{a2+a4}$ = 10 to 13·5 kV
FIGURES FOR EXTINCTION OF FOCUSED RASTER
$V_{a1-g}$ 250 300 350 (V)
$V_{k-g}$ 45 52 59 (V)
$V_{a1-g}$ = 350V
= 300V
= 250V
1·2
1·1
1·0
0·9
0·8
0·7
0·6
0·5
0·4
0·3
0·2
0·1
0
FINAL ANODE CURRENT ($I_{a2+a4}$) mA
70 60 50 40 30 20 10 0
CATHODE TO GRID VOLTAGE ($V_{k-g}$) V

LIMITS OF RASTER CUT-OFF VOLTAGE

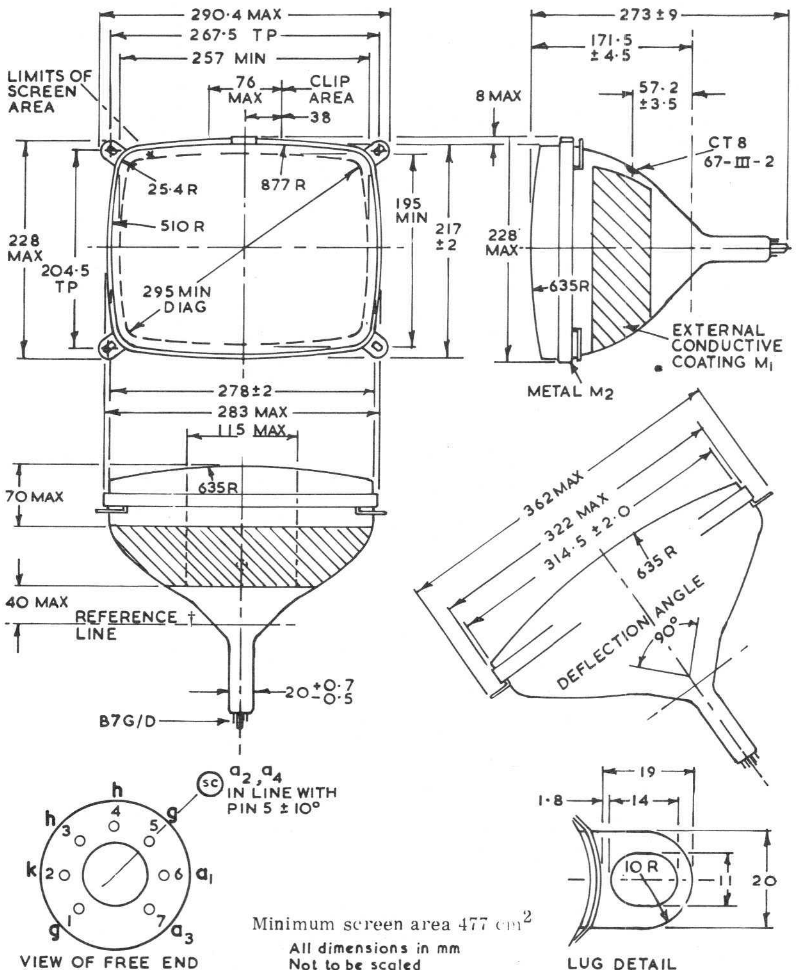


# M31-191..

# Data Display or Monitor Tube

The M31-191.. is the M31-190.. with a tinted bonded face-plate giving a total glass transmission of approximately **15%** and the surface treated to reduce specular reflections.

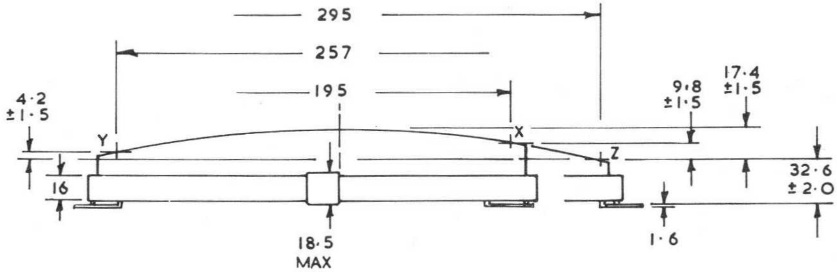



† Determined by reference line gauge No. 20

**PHOSPHOR SCREEN**

This type is usually supplied with GH phosphor ( M31-191GH ) giving a green trace of medium short persistence. Other phosphor screens can be made available to special order.

**TUBE WEIGHT** (approximate) - net 3.6 kg

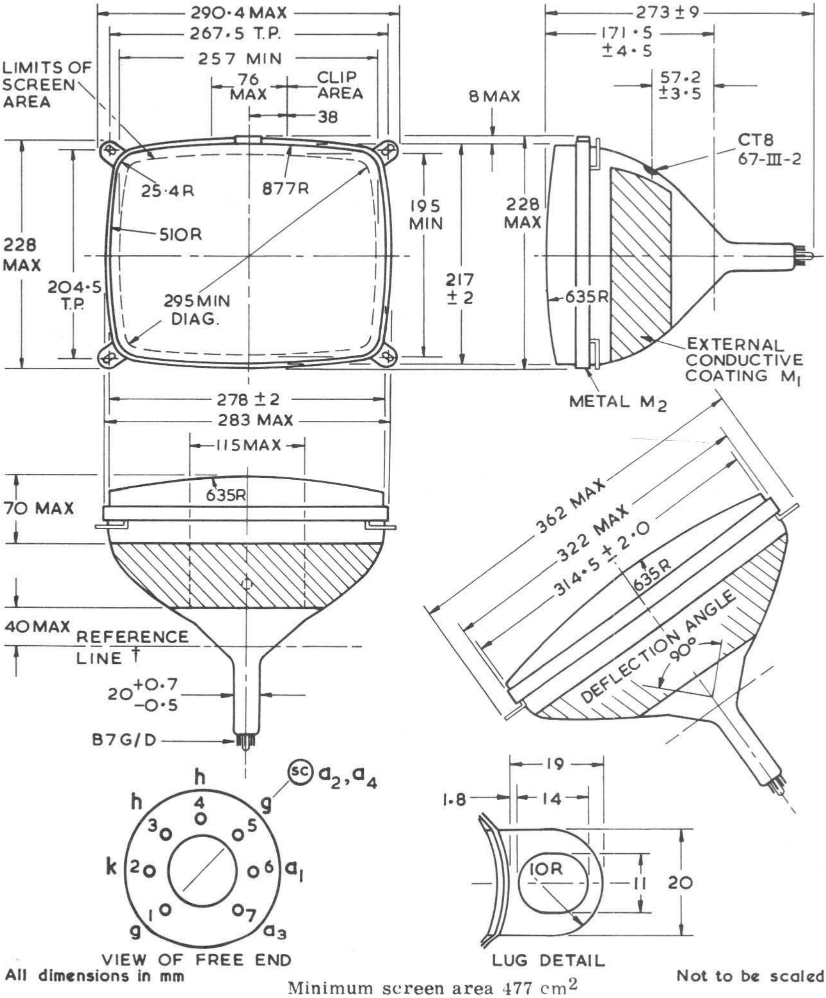



## MOUNTING

The bolts to be used for mounting the tube must lie within circles of 7.0 mm diameter centred on the lug holes true positions. One of the four lugs may deviate 2.0mm maximum from the plane through the other three lugs.

# M31-192.. Data Display or Monitor Tube

The M31-192.. is the M31-190.. with a bonded face-plate giving a total glass transmission of approximately 50%.




All dimensions in mm

Minimum screen area 477 $cm^2$

Not to be scaled

† Determined by reference line gauge No. 20

**PHOSPHOR SCREEN**

This type is usually supplied with W phosphor ( M31-192W ) giving a television white trace of medium short persistence. Other phosphor screens can be made available to special order.

**TUBE WEIGHT** (approximate)-net 3.6 kg

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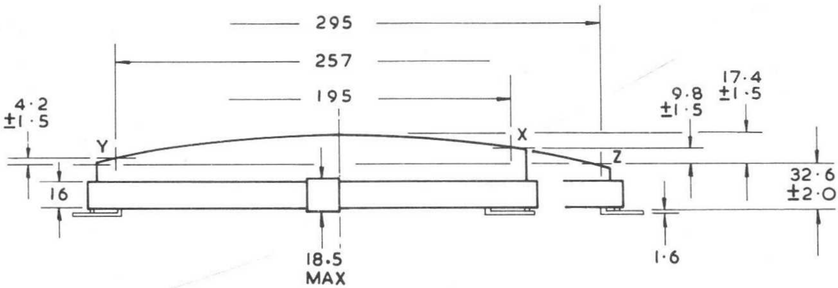



**MOUNTING**

The bolts to be used for mounting the tube must lie within circles of 7.0 mm diameter centred on the lug holes true positions. One of the four lugs may deviate 2.0 mm maximum from the plane through the other three lugs.

DATA DISPLAY & MONITOR TUBES

# M31-212..

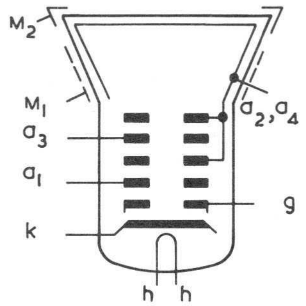
# Data Display Tube

PRELIMINARY DATA

**GENERAL**

Rectangular face, 31cm (12in). 90° diagonal tube specifically designed for high character density data display applications.
Bonded tinted face-plate treated to reduce specular reflection.** Aluminised screen.
Integral mounting lugs, 20 mm dia. neck.
Electrostatic focus, magnetic deflection.
Grey glass, 15% total transmission (approx).
External conductive coating.

| | | | |
|---|---|---|---|
| Heater voltage | $V_h$ | 11 | V |
| Heater current | $I_h$ | 75 | mA |




**DESIGN CENTRE RATINGS** Voltages referred to cathode

| | | | |
|---|---|---|---|
| Maximum second and fourth anode voltage | $V_{a2+a4(max)}$ | 13.5 † | kV |
| Minimum second and fourth anode voltage | $V_{a2+a4(min)}$ | 10.5 * | kV |
| Maximum third anode voltage - range | $V_{a3(max)}$ | -50 to +500 | V |
| Maximum first anode voltage | $V_{a1(max)}$ | 350 | V |
| Maximum negative grid voltage | $-V_{g(max)}$ | 100 | V |
| Maximum peak negative grid voltage | $-v_{g(max)}$ | 350 § | V |
| Maximum positive grid voltage | $V_{g(max)}$ | 0 ¶ | V |
| Maximum heater to cathode voltage heater negative (d.c.) | $V_{h-k(max)}$ | 110 | V |
| Maximum peak heater to cathode voltage heater negative | $v_{h-k(pk)max}$ | 130 | V |
| Maximum impedance, grid to cathode (50Hz) | $Z_{g-k(max)}$ | 0.5 | MΩ |
| Maximum resistance, grid to cathode | $R_{g-k(max)}$ | 1.5 | MΩ |

All voltages referred to cathode

† The absolute rating of 16.5kV must not be exceeded.

* Absolute minimum rating is 8.5kV.

§ Maximum pulse duration 22% of one cycle with a maximum of 1.5 ms.

¶ A 10 kΩ grid series resistor mounted close to the tube base is recommended to limit the peak grid voltage.

** This tube meets the requirements for intrinsically safe tubes laid down in the section of I.E.C. Publication 65 dealing with implosion.

**PHOSPHOR SCREEN**

This type is usually supplied with GH phosphor (M31-212GH) giving a green trace of medium short persistence. Other phosphor screens can be made available to special order.

## Thorn Radio Valves and Tubes Limited



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# Data Display Tube



## INTER-ELECTRODE CAPACITANCES

| | | | |
|---|---|---|---|
| Cathode to all | $c_{k-all}$ | 3.0* | pF |
| Grid to all | $c_{g-all}$ | 4.0* | pF |
| Anodes 2 and 4 to coating $M_1$ | $c_{a2+a4-M1}$ | 700 | pF |
| Anodes 2 and 4 to shell $M_2$ (Approx) | $c_{a2+a4-M2}$ | 200 | pF |

* Holder capacitance balanced out.

## TYPICAL OPERATION - Grid modulation (Voltages referred to cathode)

| | | | |
|---|---|---|---|
| Second and fourth anode voltage | $V_{a2+a4-k}$ | 12 | kV |
| First anode voltage | $V_{a1-k}$ | 300 | V |
| Third anode voltage for best overall focus* | $V_{a3-k}$ | 0 to 350 | V |
| Drive for peak beam current of 200$\mu$A | | 32 | V |
| Grid to cathode voltage for cut-off of raster | $V_{g-k}$ | -40 to -79 | V |

## TYPICAL OPERATION - Cathode modulation (Voltages referred to grid)

| | | | |
|---|---|---|---|
| Second and fourth anode voltage | $V_{a2+a4-g}$ | 12 | kV |
| First anode voltage | $V_{a1-g}$ | 350 | V |
| Third anode voltage for best overall focus* | $V_{a3-g}$ | 0 to 350 | V |
| Drive for peak beam current of 200$\mu$A | | 28 | V |
| Cathode to grid voltage for cut-off of raster | $V_{k-g}$ | 41 to 75 | V |

* RESOLUTION IN DATA DISPLAYS

The spot performance over the screen is sufficiently uniform to permit a focus setting within this range which allows rapid and positive recognition of alpha-numeric characters of density 2000 max. (i.e. character size 2.8 mm x 5 mm minimum) If it is required to pass through the point of focus at any point on the screen a focus range of -50V to 400V with respect to cathode should be provided.

This data should be read in conjunction with Operational and Safety Recommendations for Industrial Cathode Ray Tubes

# Data Display Tube

## MOUNTING

Any mask used in the mounting of this tube should be flexible enough to take up small variations in fixing and bulb contours.

There is an annular region of anti-corona coating with external diameter of 75 mm surrounding the CT8 cap, the tube should not be handled in this region.

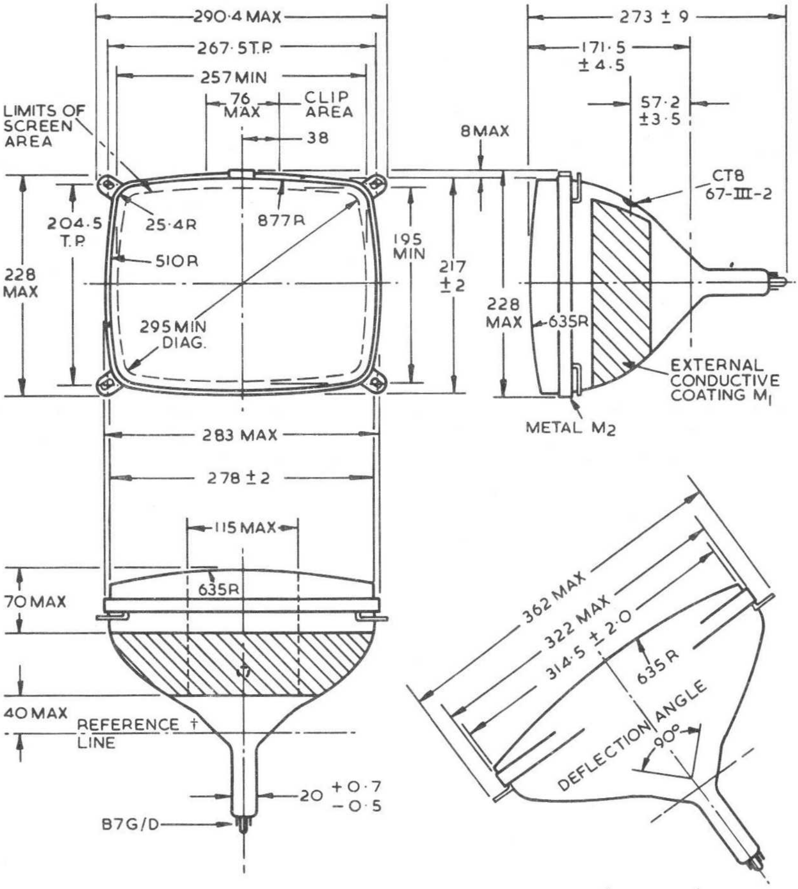
The tube can be mounted in any position. The tube socket should not be rigidly mounted but should have flexible leads and be allowed to move freely. The bottom circumference of the base shell will fall within a circle of 36 mm diameter which is centred on the perpendicular from the centre of the face.

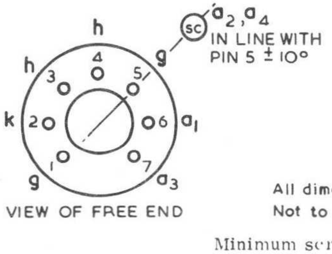
The external conductive coating ($M_1$) of this tube should be connected to chassis. The capacitance between this coating and final anode may be used to provide smoothing for the e.h.t. supply.

The metal shell ($M_2$) should be connected to the chassis in an a.c. receiver operating from an isolating transformer, or via a suitable leakage path in an a.c./d.c. receiver, for example 2 MΩ.

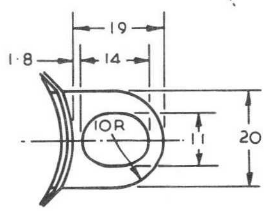
When flashover protection is incorporated the chassis return paths of $M_1$ and $M_2$ should be made in a manner appropriate to the protection system employed.

**TUBE WEIGHT** (approximate) - net 3.6 kg.



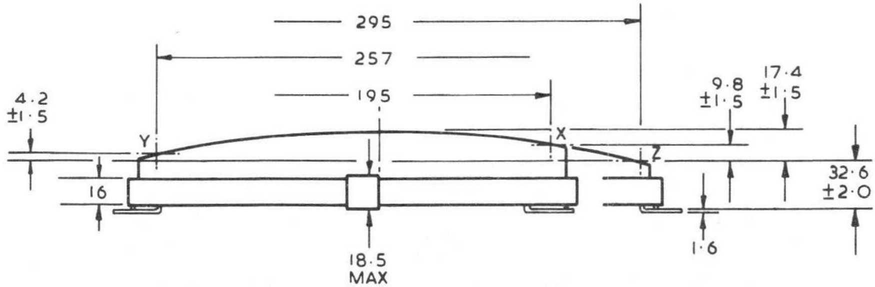




All dimensions in mm
Not to be scaled



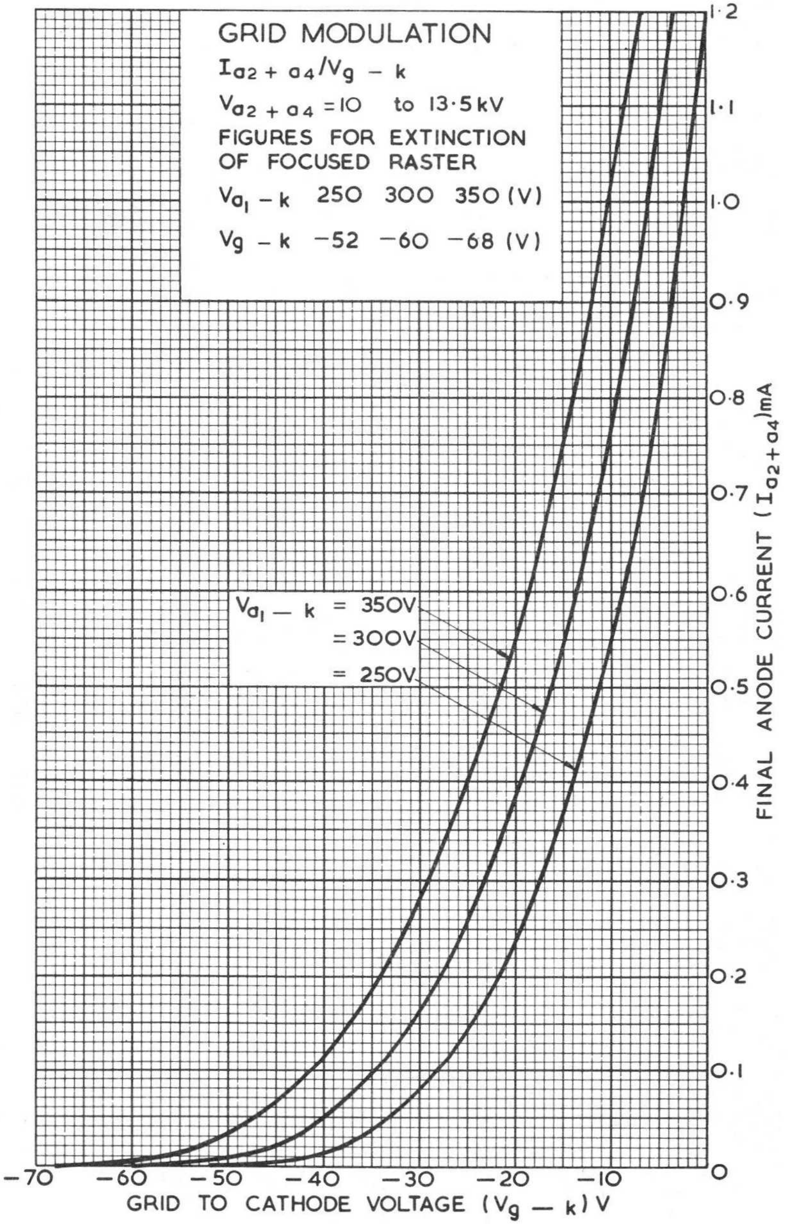

Minimum screen area 477 $cm^2$

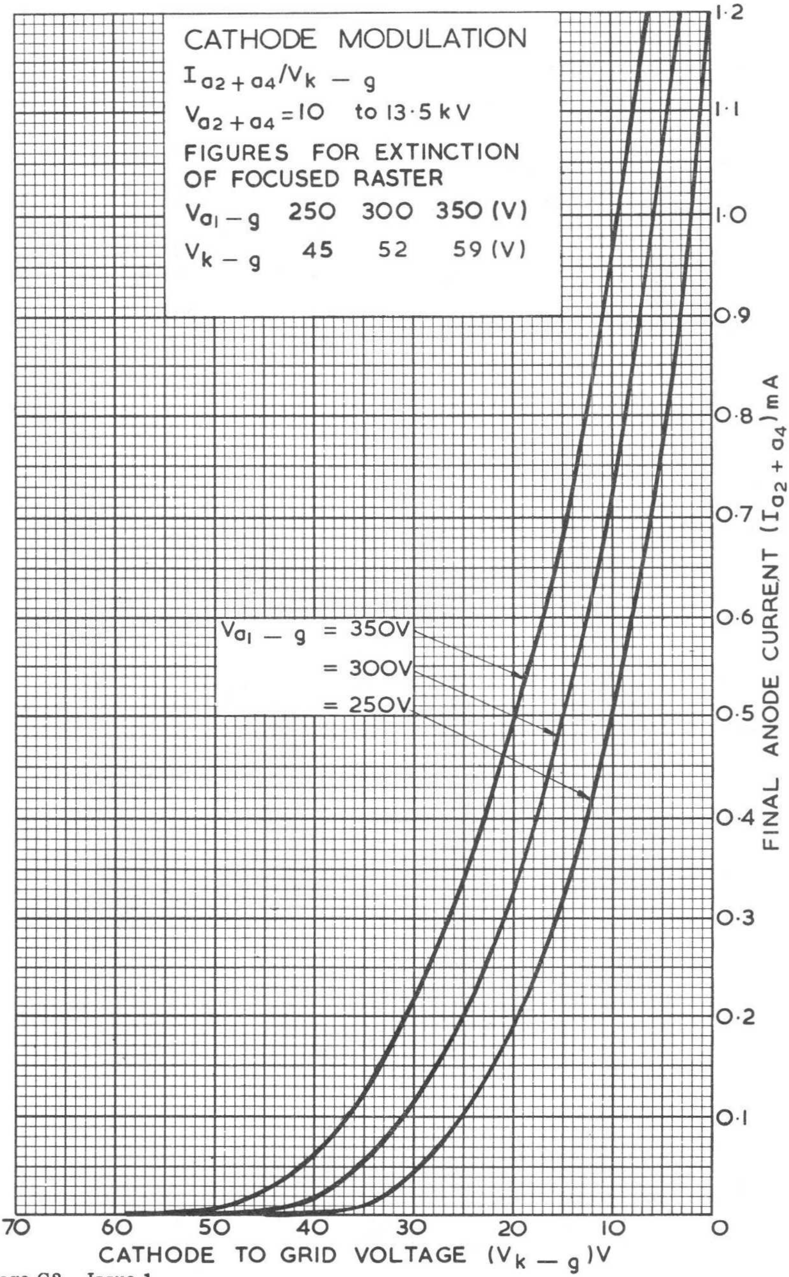
† Determined by reference line gauge No. 20



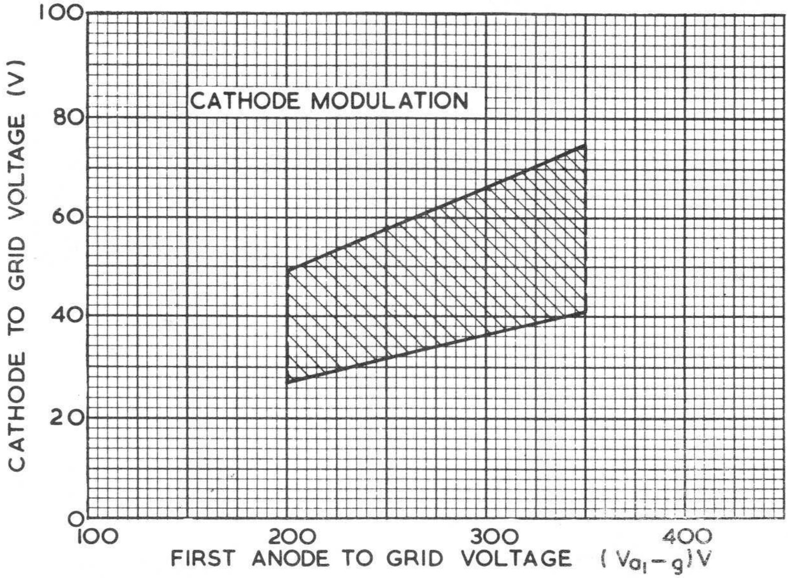

**MOUNTING**

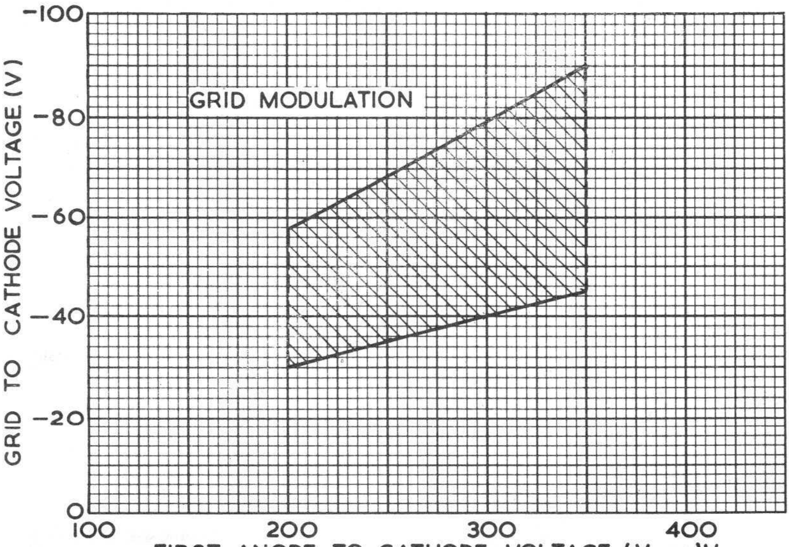
The bolts to be used for mounting the tube must lie within circles of 7.0 mm diameter centred on the lug holes true positions. One of the four lugs may deviate 2.0 mm maximum from the plane through the other three lugs.


GRID MODULATION
Ia2 + a4/Vg − k
Va2 + a4 = 10 to 13·5 kV
FIGURES FOR EXTINCTION OF FOCUSED RASTER
Va1 − k 250 300 350 (V)
Vg − k −52 −60 −68 (V)
Va1 — k = 350V
= 300V
= 250V
1·2
1·1
1·0
0·9
0·8
0·7
0·6
0·5
0·4
0·3
0·2
0·1
0
FINAL ANODE CURRENT (Ia2+a4) mA
−70 −60 −50 −40 −30 −20 −10
GRID TO CATHODE VOLTAGE (Vg — k) V


CATHODE MODULATION
$I_{a2+a4}/V_{k-g}$
$V_{a2+a4}$ = 10 to 13·5 kV
FIGURES FOR EXTINCTION OF FOCUSED RASTER
$V_{a1-g}$ 250 300 350 (V)
$V_{k-g}$ 45 52 59 (V)
$V_{a1-g}$ = 350V
= 300V
= 250V
1·2
1·1
1·0
0·9
0·8
0·7
0·6
0·5
0·4
0·3
0·2
0·1
FINAL ANODE CURRENT ($I_{a2+a4}$) mA
70
60
50
40
30
20
10
0
CATHODE TO GRID VOLTAGE ($V_{k-g}$)V

LIMITS OF RASTER CUT-OFF VOLTAGE



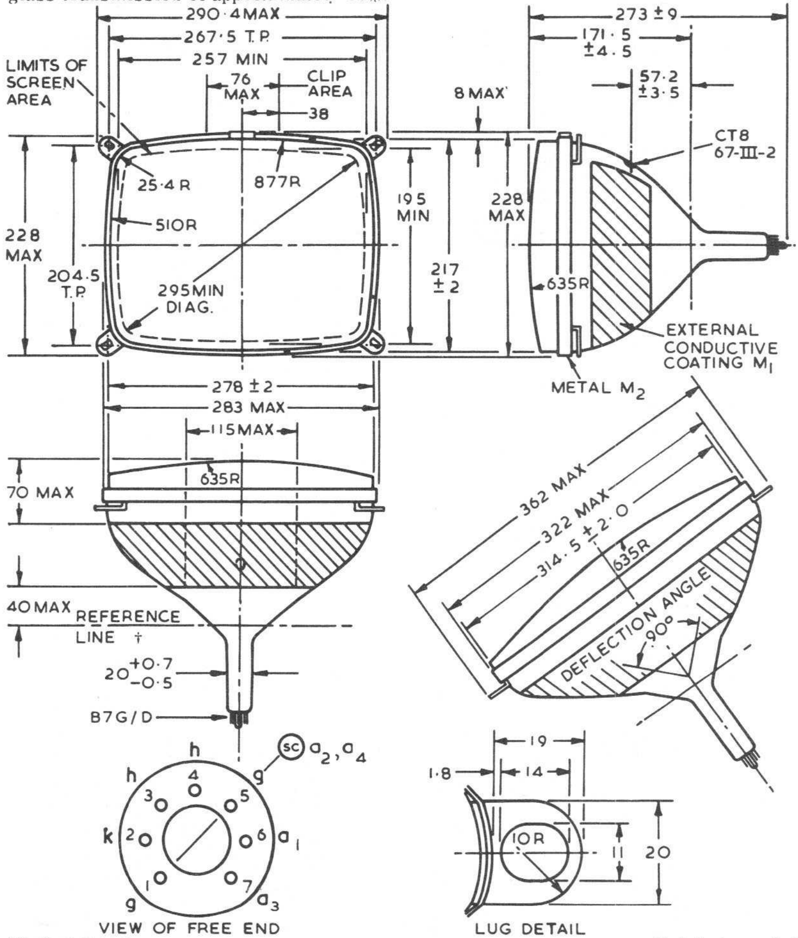






DATA DISPLAY & MONITOR TUBES

# M31-213.. Data Display Tube

The M31-213.. is the M31-212.. with a clear glass bonded face-plate giving a total glass transmission of approximately 50%.




All dimensions in mm — Not to be scaled

† Determined by reference line gauge No. 20. — Minimum screen area 477 $cm^2$

**PHOSPHOR SCREEN**

This type is usually supplied with GH phosphor (M31-213GH) giving a green trace of medium short persistence. Other phosphor screens can be made available to special order.

**TUBE WEIGHT** (approximate) - net 3.6 kg.

## Thorn Radio Valves and Tubes Limited

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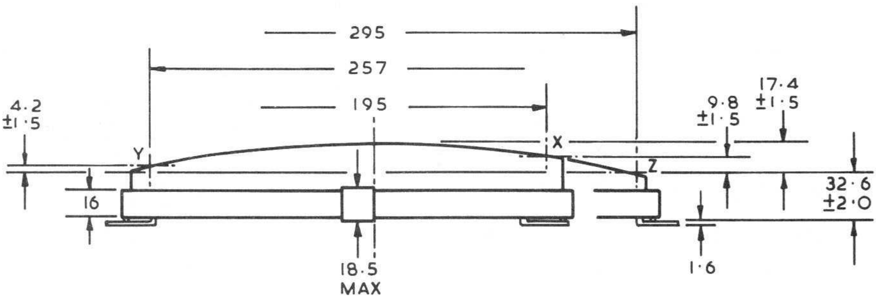



**MOUNTING**

The bolts to be used for mounting the tube must lie within circles of 7.0 mm diameter centred on the lug holes true positions. One of the four lugs may deviate 2.0 mm maximum from the plane through the other three lugs.

# M36-141.. Data Display or Monitor Tube

**GENERAL**

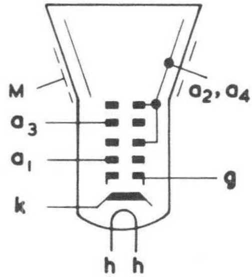
Rectangular face, 36 cm 70° diagonal tube

Grey glass, 60% transmission (approx.)

Electrostatic focus, magnetic deflection

Straight gun, aluminised screen

| | | | |
|---|---|---|---|
| Heater voltage | $V_h$ | 6.3 | V |
| Heater current | $I_h$ | 0.3* | A |




**ABSOLUTE RATINGS** - voltages referred to cathode

| | | | |
|---|---|---|---|
| Maximum second and fourth anode voltage | $V_{a2+a4(max)}$ | 18 | kV |
| Minimum second and fourth anode voltage | $V_{a2+a4(min)}$ | 10 | kV |
| Maximum third anode voltage | $V_{a3(max)}$ | ± 500 | V |
| Maximum first anode voltage | $V_{a1(max)}$ | 500 | V |
| Maximum negative grid voltage | $-V_{g(max)}$ | 200 | V |
| Minimum negative grid voltage | $-V_{g(min)}$ | 1.0 | V |
| Maximum heater to cathode voltage heater negative (d.c.) | $V_{h-k(max)}$ | 180 | V |
| Maximum peak heater to cathode voltage heater negative | $v_{h-k(pk)max}$ | 400† | V |

* In a series heater chain the C.R.T. should always be connected at the chassis end.

† During a warming up period not exceeding one minute.

**PHOSPHOR SCREEN**

This type is usually supplied with W phosphor (M36-141W) giving a television white trace of medium short persistence. Other phosphor screens can be made available to special order.

If this tube is operated at voltages in excess of 18 kV, x-ray radiation shielding may be necessary to avoid possible danger of personal injury from prolonged exposure at close range. The normal glass protective viewing window may provide such a safeguard. If the radiation measured in contact with this window does not exceed 0.5 millirontgens per hour, the window will normally provide adequate protection.

## INTER-ELECTRODE CAPACITANCES

| | | | |
|---|---|---|---|
| Cathode to all | $c_{k-all}$ | 7.0* | pF |
| Grid to all | $c_{g-all}$ | 9.0* | pF |
| Anodes 2 and 4 to external conductive coating, M (approximate) | $c_{a2+a4-M}$ | 1300 | pF |

* Total capacitances including a typical holder.

## TYPICAL OPERATION - Grid modulation, voltages referred to cathode

| | | | |
|---|---|---|---|
| Second and fourth anode voltage | $V_{a2+a4}$ | 12 | kV |
| First anode voltage | $V_{a1}$ | 300 | V |
| Third anode voltage range for focus | $V_{a3}$ | -200 to +200† | V |
| Grid to cathode voltage for cut-off of raster | $V_g$ | -30 to -72 | V |
| Average peak to peak modulating voltage for modulation up to 150 $\mu$A | | 24 | V |

† The change of spot size with variation of focus voltage is small and the limit of ±200V is such that an acceptable focus quality is obtained within this range. If it is required to pass through the point of focus a voltage of at least ±300V will be required.

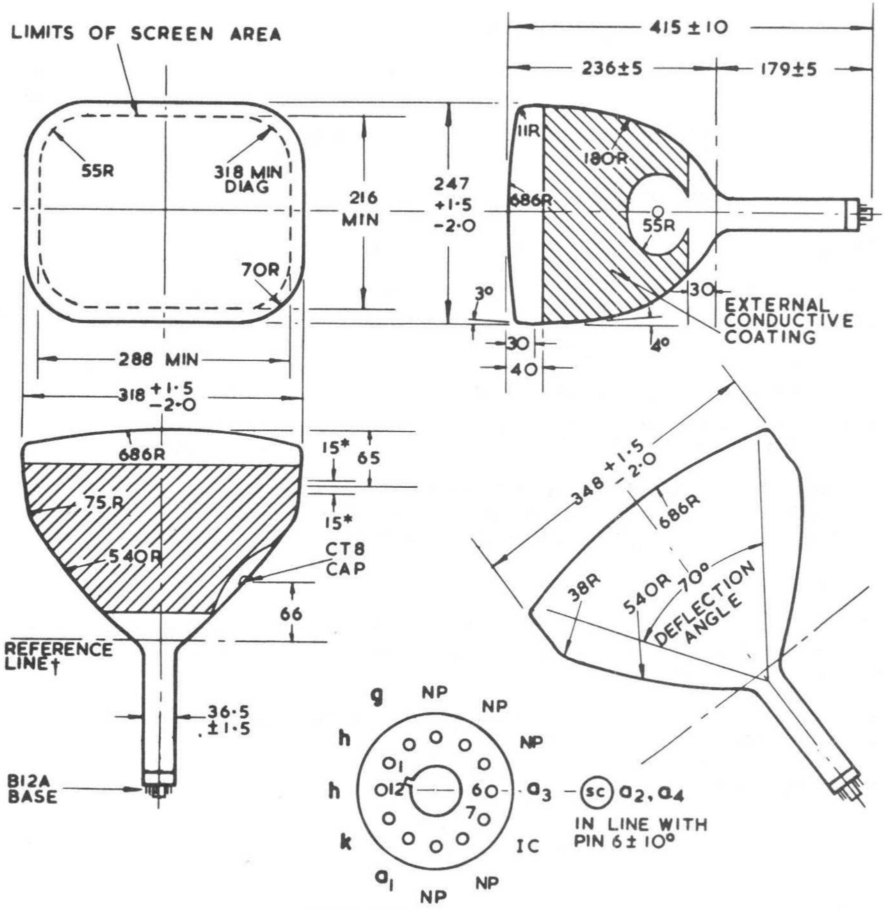
## MOUNTING

The external conductive coating (M) of this tube should be connected to chassis. The capacitance between this coating and final anode may be used to provide smoothing for the e.h.t. supply.

When flashover protection is incorporated the chassis return path of M should be made in a manner appropriate to the protection system employed.

**TUBE WEIGHT** (approximate) - 4.7 kg

DATA DISPLAY & MONITOR TUBES




VIEW FROM PINS FREE END

All dimensions in mm

Not to be scaled

There is an annular region of anti-corona coating with an external diameter of 75 mm surrounding the CT8 cap, the tube should not be handled in this region.

* During the face sealing operation the glass in this area ( Total 30 mm ) may be disturbed. As the shape of the contour within this area may be either convex or concave, the bulb should not be gripped within this region unless special precautions are taken (such as the use of resilient packing material).

† Determined by Reference line gauge No. 12.( See T.D.S. No. 5-0-91-12).

# Data Display or Monitor Tube  M36-142..

## Maintenance Type

**GENERAL**

Rectangular face, 14 inch 70° diagonal

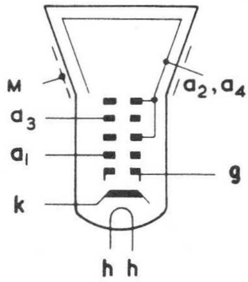
Bonded faceplate protection

Grey glass 60% transmission (approx)

Electrostatic focus, magnetic deflection

Straight gun, aluminised screen

| | | | |
|---|---|---|---|
| Heater voltage | $V_h$ | 6.3 | V |
| Heater current | $I_h$ | 0.3 | A |




**ABSOLUTE RATINGS** - voltages referred to cathode

| | | | |
|---|---|---|---|
| Maximum second and fourth anode voltage | $V_{a2+a4(max)}$ | 18 | kV |
| Minimum second and fourth anode voltage | $V_{a2+a4(min)}$ | 10 | kV |
| Maximum third anode voltage | $V_{a3(max)}$ | ± 500 | V |
| Maximum first anode voltage | $V_{a1(max)}$ | 500 | V |
| Maximum negative grid voltage | $-V_{g(max)}$ | 200 | V |
| Minimum negative grid voltage | $-V_{g(min)}$ | 1.0 | V |
| Maximum heater to cathode voltage heater negative (d.c.) | $V_{h-k(max)}$ | 180 | V |
| Maximum peak heater to cathode voltage heater negative | $v_{h-k(pk)max}$ | 400* | V |

* During a warming up period not exceeding one minute.

**PHOSPHOR SCREEN**

This type is usually supplied with W phosphor (M36-142W) giving a television white trace of medium short persistence. Other phosphor screens can be made available to special order.

If this tube is operated at voltages in excess of 16 kV, x-ray radiation shielding may be necessary to avoid possible danger of personal injury from prolonged exposure at close range.

DATA DISPLAY & MONITOR TUBES

**TYPICAL OPERATION** - Grid modulation, voltages referred to cathode

| | | | |
|---|---|---|---|
| Second and fourth anode voltage | $V_{a2+a4}$ | 14 | kV |
| First anode voltage | $V_{a1}$ | 300 | V |
| Third anode voltage range for focus | $V_{a3}$ | -200 to +200† | V |
| Grid to cathode voltage for cut-off of raster | $V_g$ | -30 to -72 | V |
| Average peak to peak modulating voltage for modulation up to 150 $\mu$A | | 24 | V |

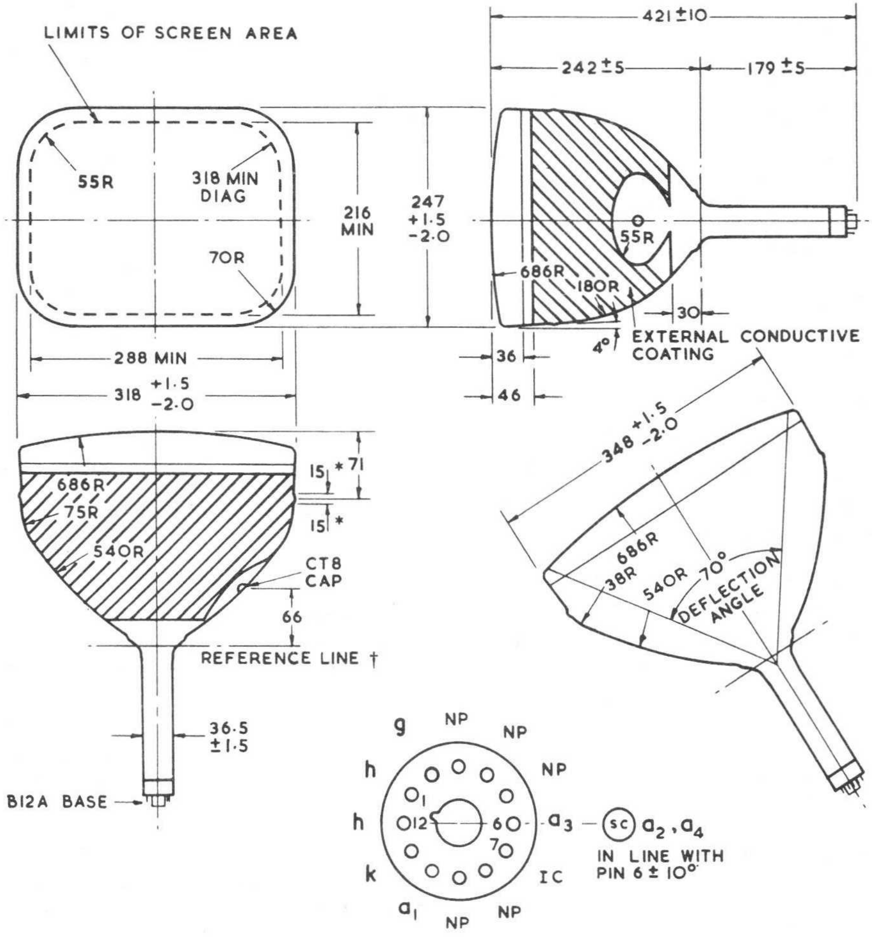
† The change of spot size with variation of focus voltage is small and the limit of ± 200V is such that an acceptable focus quality is obtained within this range. If it is required to pass through the point of focus a voltage of at least ± 300V will be required.

**INTER-ELECTRODE CAPACITANCES**

| | | | |
|---|---|---|---|
| Cathode to all | $c_{k-all}$ | 7.0 | pF |
| Grid to all | $c_{g-all}$ | 9.0 | pF |
| Anodes 2 and 4 to external conductive coating, M (approximate) | $c_{a2+a4-M}$ | 1300 | pF |

**TUBE WEIGHT** (approximate) - 5.4 kg

# Data Display or Monitor Tube **M36-142..**




VIEW FROM PINS FREE END

All dimensions in mm — Not to be scaled

There is an annular region of anti-corona coating with an external diameter of 75 mm surrounding the CT8 cap, the tube should not be handled in this region.

* During the face sealing operation the glass in this area (Total 30 mm) may be disturbed. As the shape of the contour within this area may be either convex or concave, the bulb should not be gripped within this region unless special precautions are taken (such as the use of resilient packing material).

† Determined by Reference line gauge No. 12.

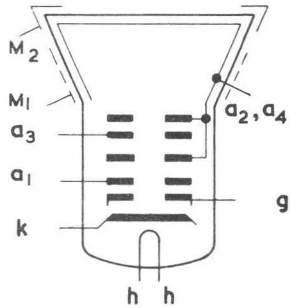
DATA DISPLAY & MONITOR TUBES

# M38-100..  Data Display or Monitor Tube

## GENERAL

Rectangular face, 15 inch, 90° diagonal
Rimguard III reinforced envelope
Integral mounting lugs
Electrostatic focus, magnetic deflection
Straight gun. Aluminised screen
Grey glass, 50% transmission (approx)
29.4 mm maximum neck diameter
External conductive coating

| | | | |
|---|---|---|---|
| Heater voltage | $V_h$ | 11.5 | V |
| Heater current | $I_h$ | 0.15 | A |




**ABSOLUTE RATINGS** - Voltages referred to cathode

| | | | |
|---|---|---|---|
| Maximum second and fourth anode voltage | $V_{a2+a4(max)}$ | 20† | kV |
| Minimum second and fourth anode voltage | $V_{a2+a4(min)}$ | 12 | kV |
| Maximum third anode voltage | $V_{a3(max)}$ | ± 700 | V |
| Maximum first anode voltage | $V_{a1(max)}$ | 600 | V |
| Maximum negative grid voltage | $-V_{g(max)}$ | 200 | V |
| Minimum negative grid voltage | $-V_{g(min)}$ | 1.0 | V |
| Maximum heater to cathode voltage, heater negative (d.c.) | $V_{h-k(max)}$ | 200 | V |

† $I_{a2+a4} = 0$

If this tube is operated at voltages in excess of 16 kV, x-ray radiation shielding may be necessary to avoid possible danger of personal injury from prolonged exposure at close range.

## PHOSPHOR SCREEN

This type is usually supplied with W phosphor (M38-100W) giving a television white trace of medium short persistence. Other phosphor screens can be made available to special order.

Tubes incorporating a B8H Sparkguard base will have a suffix after the type number. For details of the Sparkguard bases see separate sheets.

### INTER-ELECTRODE CAPACITANCES

| | | * | † | |
|---|---|---|---|---|
| Cathode to all | $c_{k-all}$ | 3.0 | 3.5 | pF |
| Grid to all | $c_{g-all}$ | 6.5 | 7.5 | pF |
| Anodes 2 and 4 to coating $M_1$ (approx) | $c_{a2+a4-M1}$ | 700 | | pF |
| Anodes 2 and 4 to frame $M_2$ (approx) | $c_{a2+a4-M2}$ | 250 | | pF |

* Holder capacitance balanced out.

† Total capacitances including a typical B8H holder.

### TYPICAL OPERATION - Grid modulation, voltages referred to cathode

| | | | |
|---|---|---|---|
| Second and fourth anode voltage | $V_{a2+a4}$ | 16 | kV |
| First anode voltage | $V_{a1}$ | 400 | V |
| Third anode voltage range for focus | $V_{a3}$ | 0 to 400 § | V |
| Grid to cathode voltage for cut-off of raster | $V_g$ | -38 to -82 | V |

§ The change of spot size with variation of focus voltage is small and the limit of 0 to 400 V is such that an acceptable focus quality is obtained within this range. If it is required to pass through the point of focus a voltage of at least -100V to +500V will be required.

### MOUNTING

This tube is intended for 'push-through' presentation without masking, but if a mask is used it should be flexible enough to take up small variations in fixing and bulb contours.

There is an annular region of anti-corona coating with external diameter of 75 mm surrounding the CT8 cap, the tube should not be handled in this region.

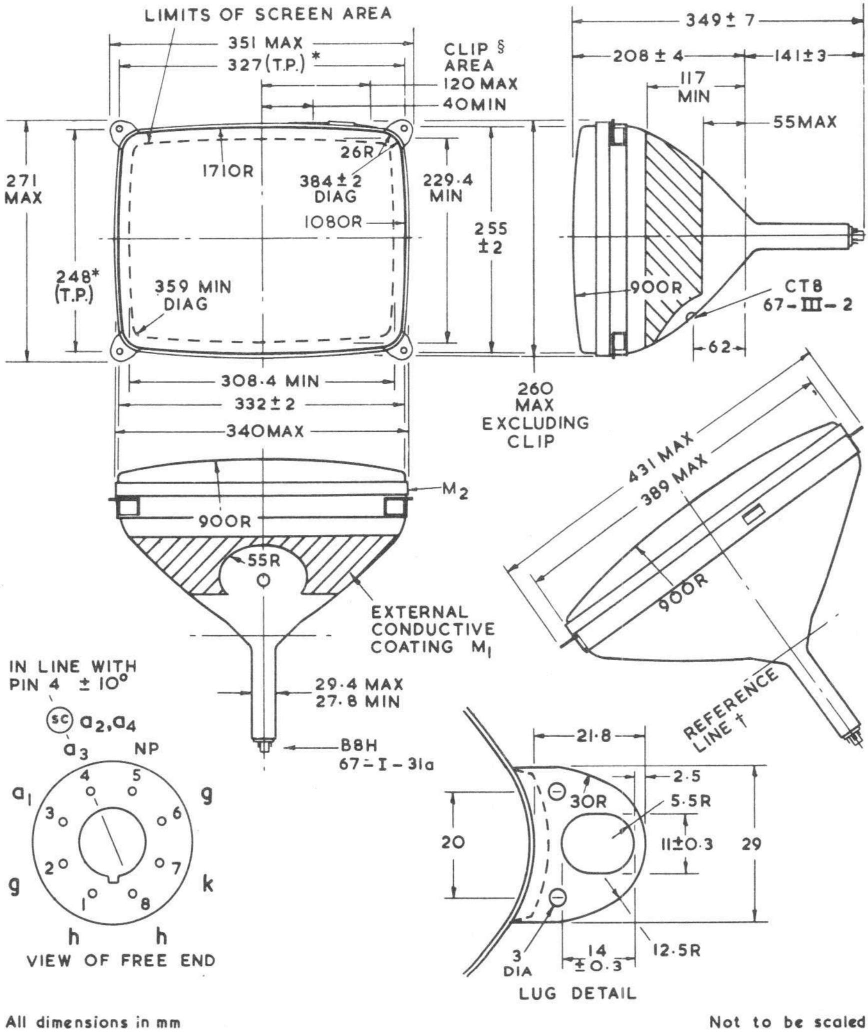
The tube can be mounted in any position. The tube socket should not be rigidly mounted but should have flexible leads and be allowed to move freely.

The external conductive coating ($M_1$) of this tube should be connected to chassis. The capacitance between this coating and final anode may be used to provide smoothing for the e.h.t. supply.

The metal frame ($M_2$) should be connected directly to the chassis in a.c. equipment operating from an isolating transformer, or via a suitable leakage path in a.c./d.c. equipment, for example 2 MΩ.

When flashover protection is incorporated the chassis return paths of $M_1$ and $M_2$ should be made in a manner appropriate to the protection system employed.

**TUBE WEIGHT** (approximate) - net 5.7 kg (12.5 lb)

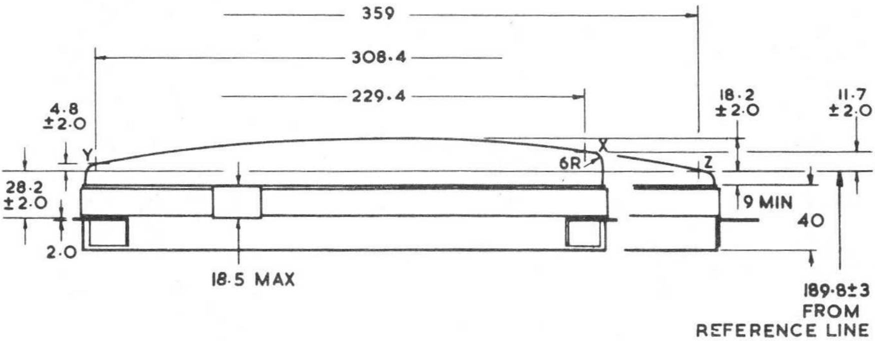


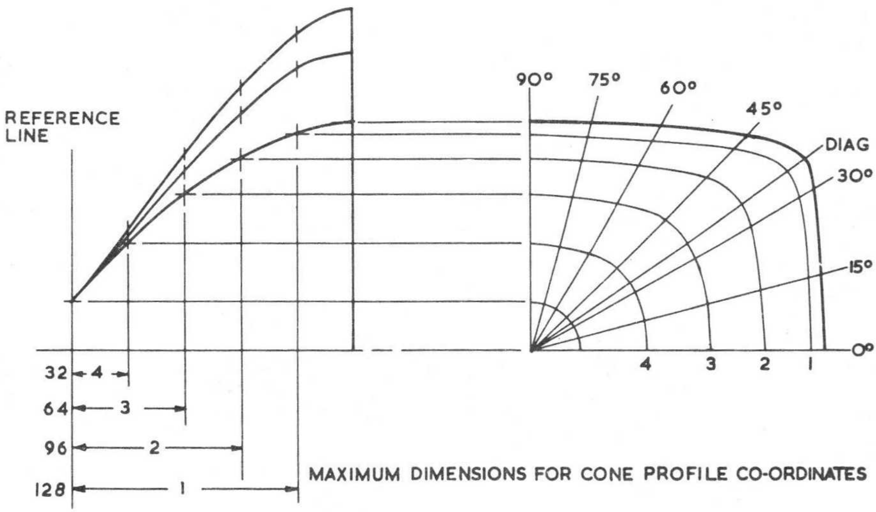

All dimensions in mm Not to be scaled

* The bolts to be used for mounting the tube must lie within the circles of 6.5 mm diameter centred on these true positions. One of the four lugs may deviate 2 mm maximum from the plane through the other three lugs.

† Determined by reference line gauge No. 15.(See T.D.S. No. 5-0-91-15).

§ Total thickness of shell, tension band and clip 8 mm maximum.



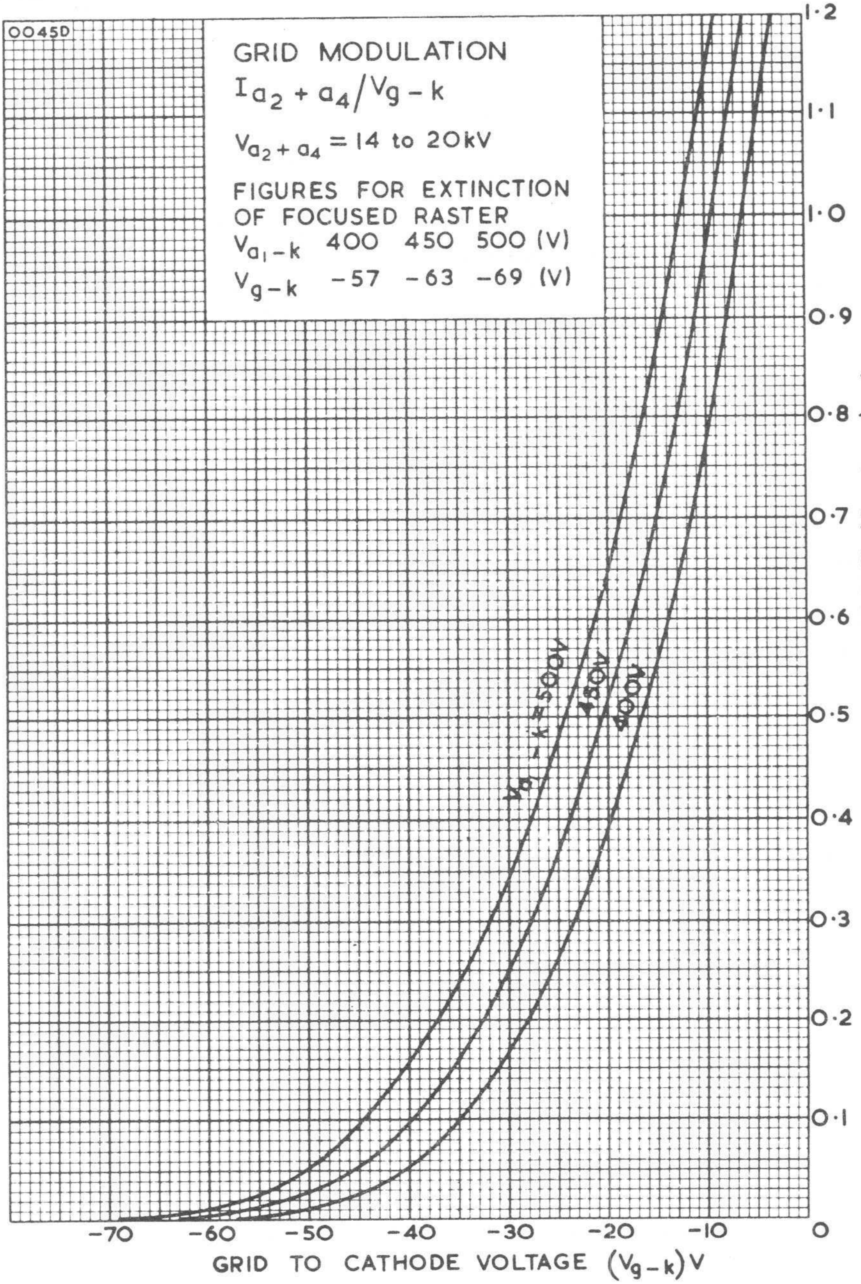



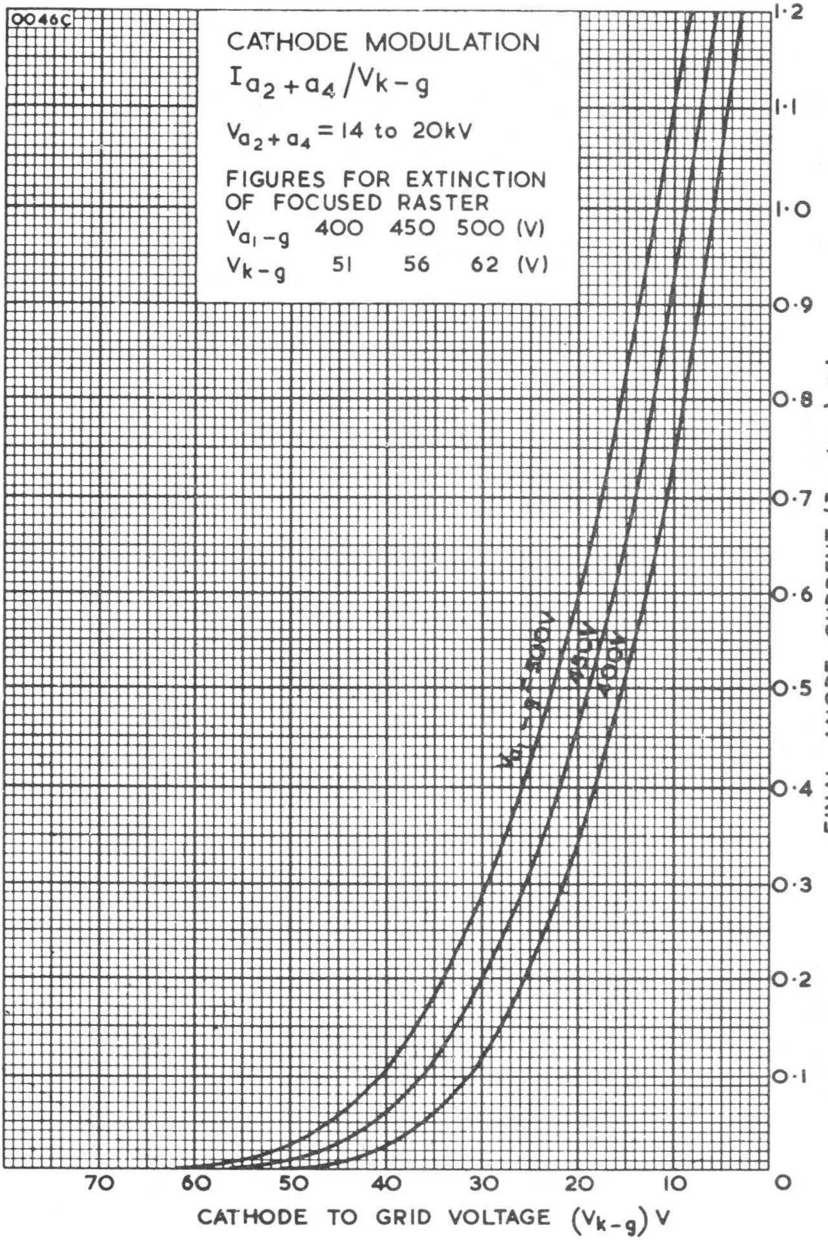

MAXIMUM DIMENSIONS FOR CONE PROFILE CO-ORDINATES

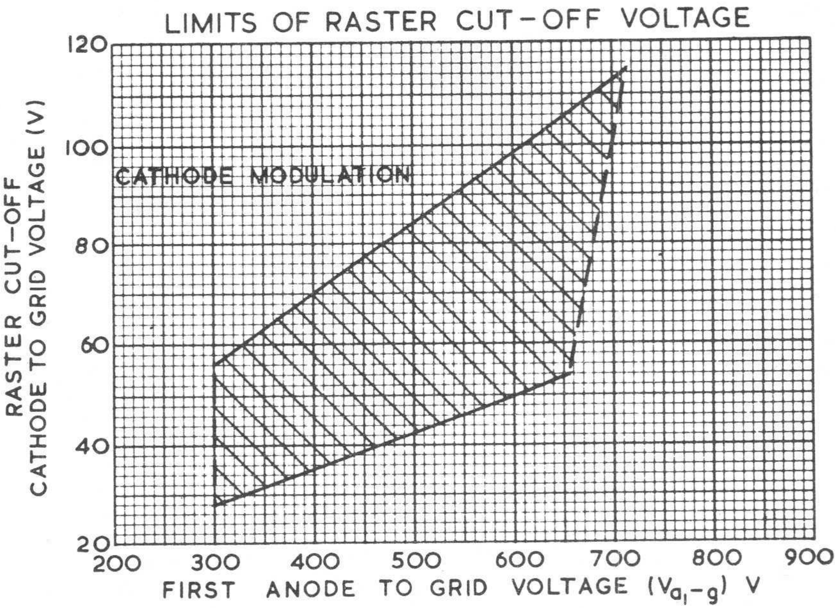
| Reference Plane No. | 0° Major | 15° | 30° | Diag. | 45° | 60° | 75° | 90° Minor |
|---|---|---|---|---|---|---|---|---|
| 1 | 160.7 | 164.9 | 177.6 | 181.6 | 165.9 | 140.5 | 127.9 | 124.0 |
| 2 | 134.0 | 136.6 | 145.5 | 148.0 | 139.3 | 122.0 | 112.6 | 109.7 |
| 3 | 103.0 | 104.8 | 110.3 | 111.3 | 107.9 | 97.7 | 92.0 | 90.5 |
| 4 | 66.8 | 67.4 | 69.3 | 69.4 | 69.0 | 66.0 | 64.0 | 63.5 |

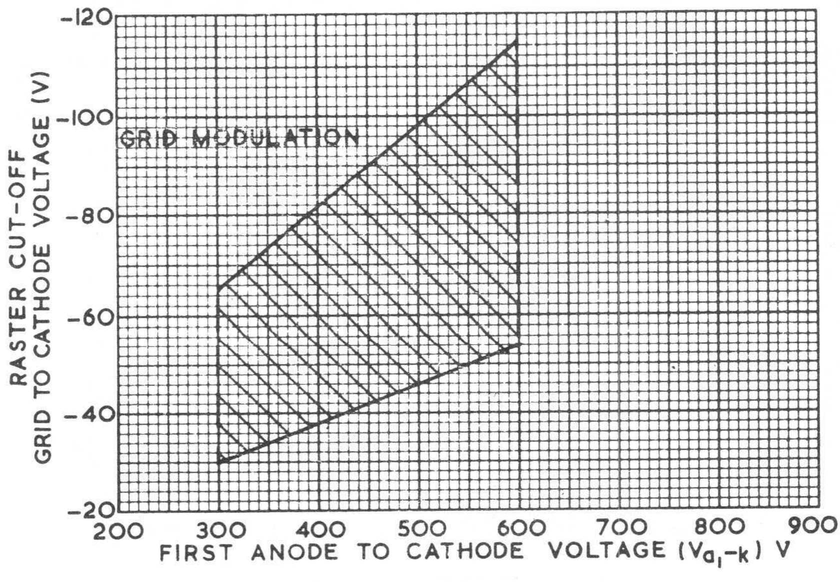
All dimensions in mm

Not to be scaled


0045D
GRID MODULATION
$I_{a2+a4}/V_{g-k}$
$V_{a2+a4}$ = 14 to 20kV
FIGURES FOR EXTINCTION OF FOCUSED RASTER
$V_{a1-k}$ 400 450 500 (V)
$V_{g-k}$ −57 −63 −69 (V)
$V_{a1-k}$ = 500V
450V
400V
1·2
1·1
1·0
0·9
0·8
0·7
0·6
0·5
0·4
0·3
0·2
0·1
0
−70
−60
−50
−40
−30
−20
−10
GRID TO CATHODE VOLTAGE ($V_{g-k}$)V
FINAL ANODE CURRENT ($I_{a2+a4}$) mA

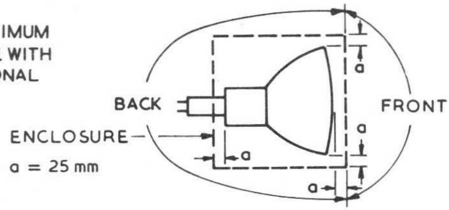

0046C
CATHODE MODULATION
$I_{a2+a4}/V_{k-g}$
$V_{a2+a4}$ = 14 to 20kV
FIGURES FOR EXTINCTION
OF FOCUSED RASTER
$V_{a1-g}$ 400 450 500 (V)
$V_{k-g}$ 51 56 62 (V)
$V_{a1-g}$ = 500V
450V
400V
1·2
1·1
1·0
0·9
0·8
0·7
0·6
0·5
0·4
0·3
0·2
0·1
0
70
60
50
40
30
20
10
0
CATHODE TO GRID VOLTAGE $(V_{k-g})$ V
FINAL ANODE CURRENT $(I_{a2+a4})$ mA

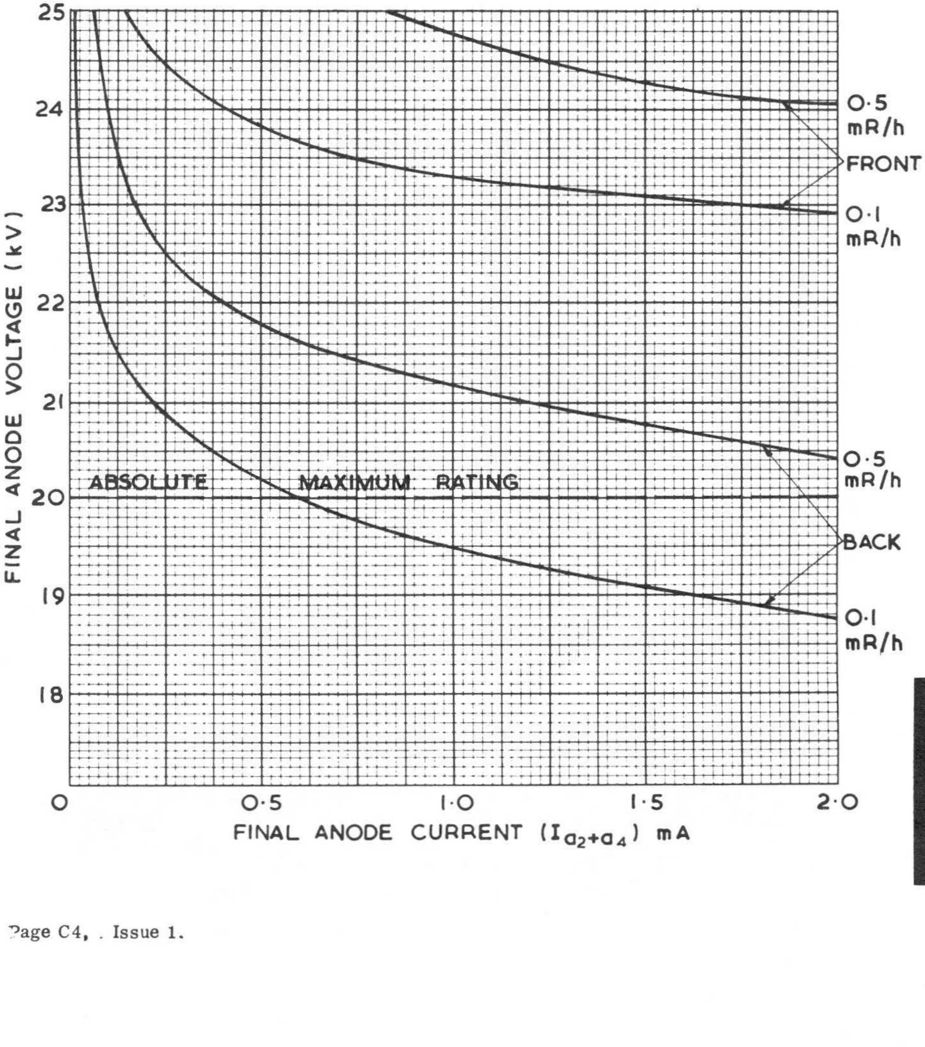

LIMITS OF RASTER CUT-OFF VOLTAGE
CATHODE MODULATION
RASTER CUT-OFF
CATHODE TO GRID VOLTAGE (V)
120
100
80
60
40
20
200
300
400
500
600
700
800
900
FIRST ANODE TO GRID VOLTAGE ($V_{a_1-g}$) V


GRID MODULATION
RASTER CUT-OFF
GRID TO CATHODE VOLTAGE (V)
-120
-100
-80
-60
-40
-20
200
300
400
500
600
700
800
900
FIRST ANODE TO CATHODE VOLTAGE ($V_{a_1-k}$) V

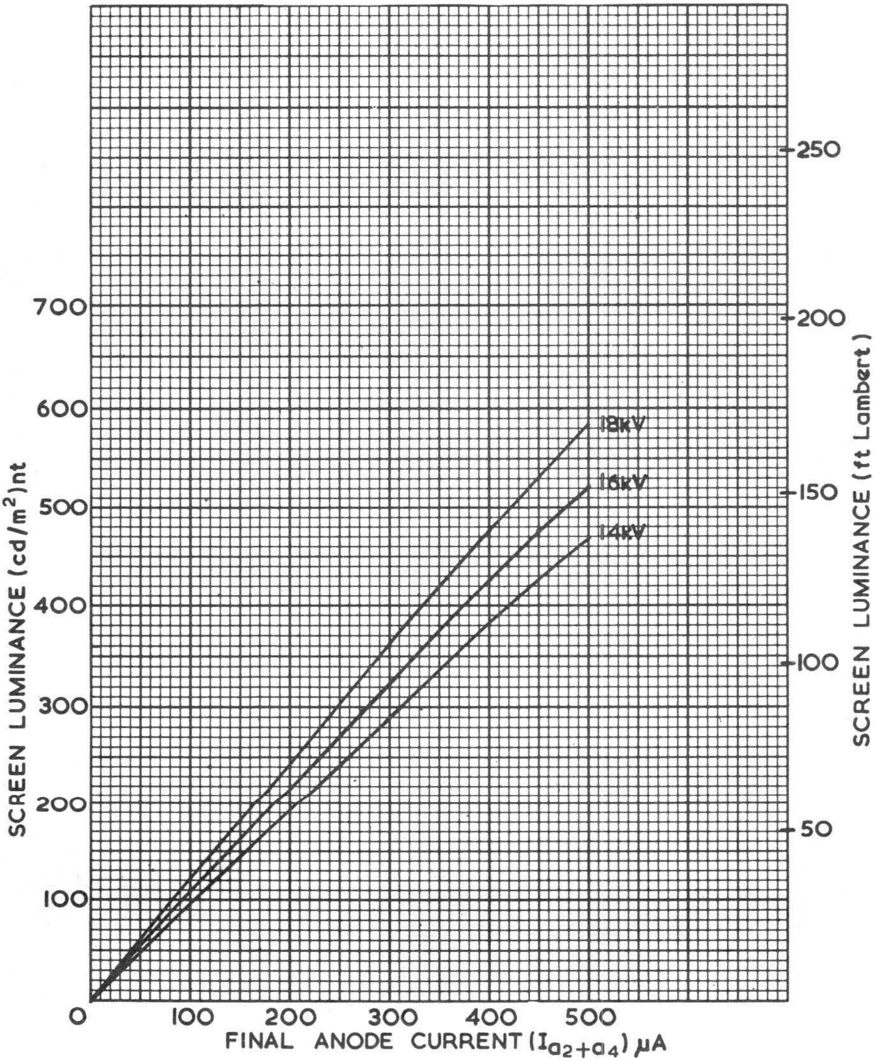
## X-RAY ISO-EXPOSURE CURVES OF TYPICAL TUBE

MEASUREMENTS MADE ON LINES OF MAXIMUM RADIATION AT FRONT AND BACK OF TUBE WITH DETECTOR CENTRE 50mm FROM NOTIONAL ENCLOSURE DEFINED BY DIAGRAM



TYPICAL CHARACTERISTICS
GJ PHOSPHOR SCREEN
FOCUSED RASTER OF FULL HEIGHT
4 x 3 ASPECT RATIO

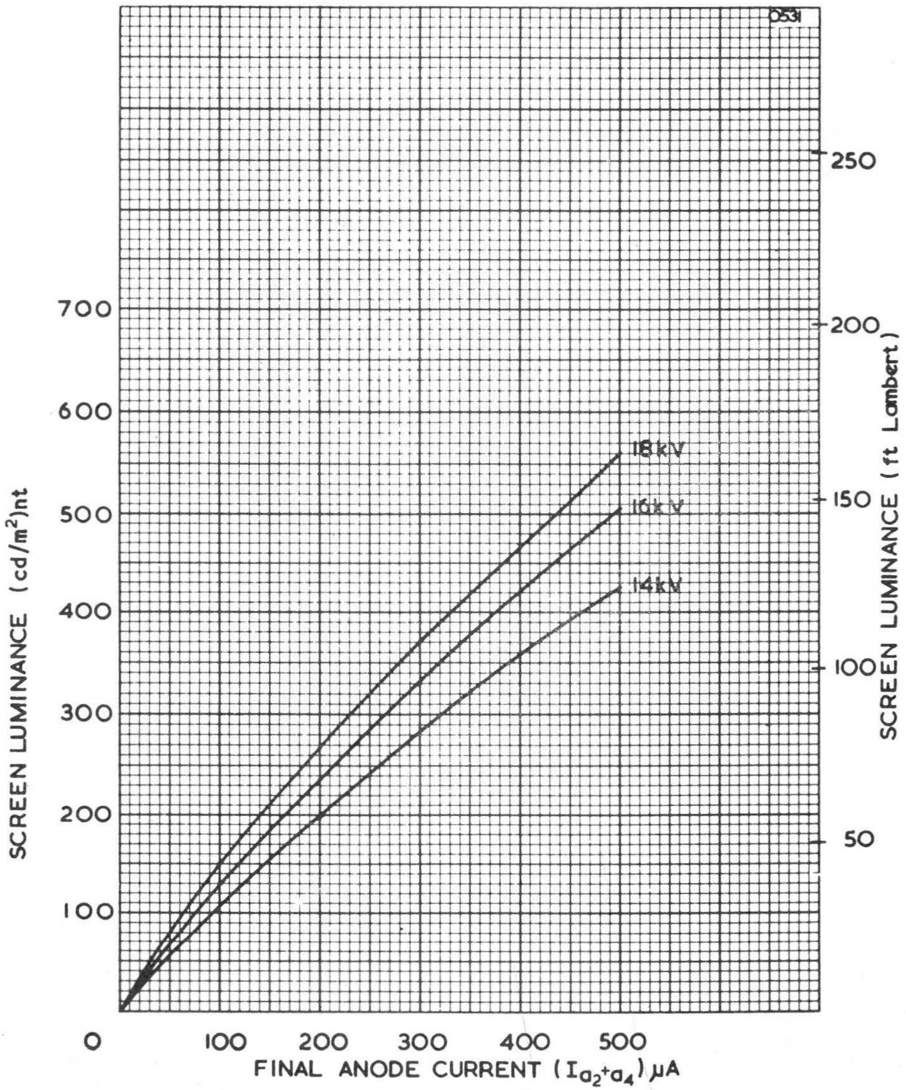


TYPICAL CHARACTERISTICS

W PHOSPHOR SCREEN

FOCUSED RASTER OF FULL HEIGHT

4 x 3 ASPECT RATIO



# M38-101..                Data Display or Monitor Tube

The M38-101.. is the M38-100.. with an increased neck length to permit the use of an additional high frequency deflector coil (''write'' coil) for data display applications.

The neck length of this tube is 163 ± 3 mm making the overall length 371 ± 7 mm

It is recommended that the deflector coil assembly including ''position and write'' coils should not extend further than 60 mm from the reference line otherwise there may be undesirable interaction with the tube gun.

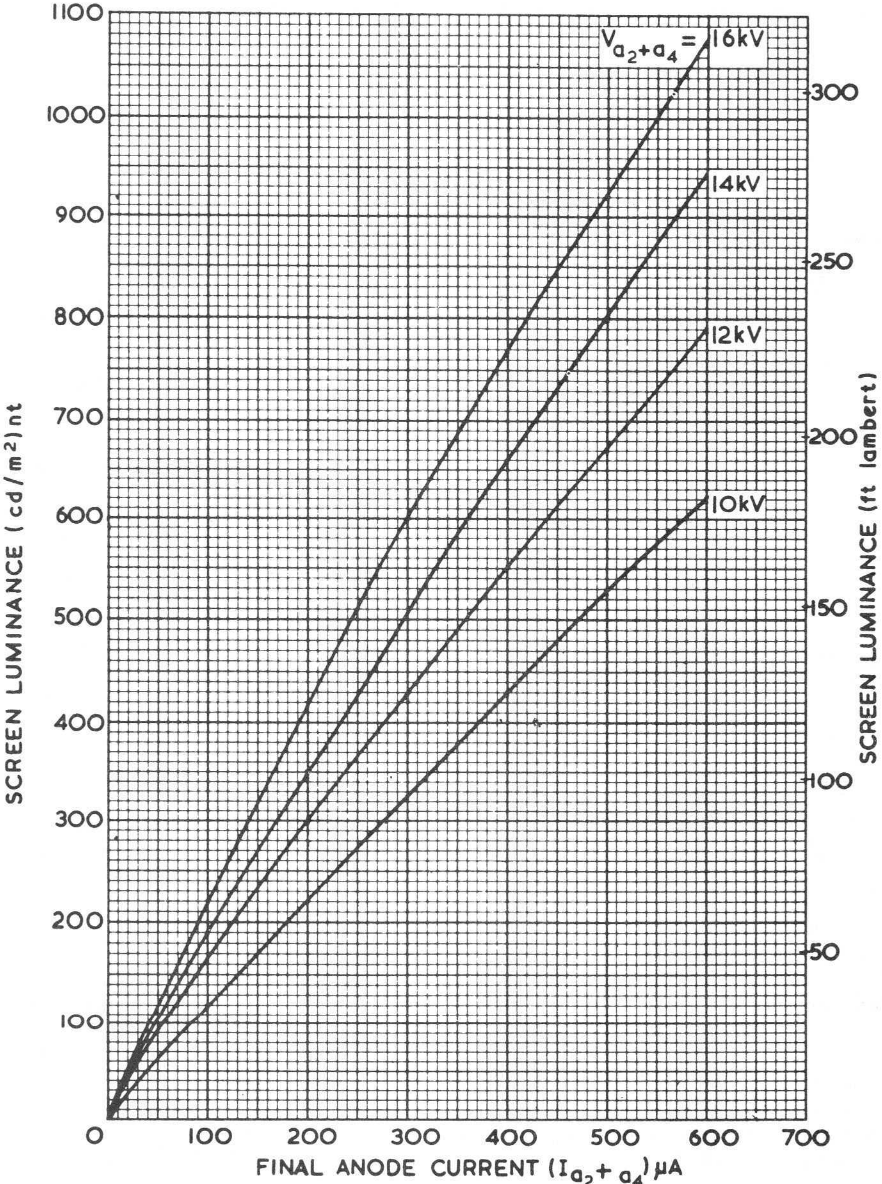
## PHOSPHOR SCREEN

This type is usually supplied with GH phosphor (M38-101GH) giving a green trace of medium short persistence. Other phosphor screens can be made available to special order.

# Data Display or Monitor Tube M38-101 GH

TYPICAL CHARACTERISTICS GH PHOSPHOR SCREEN

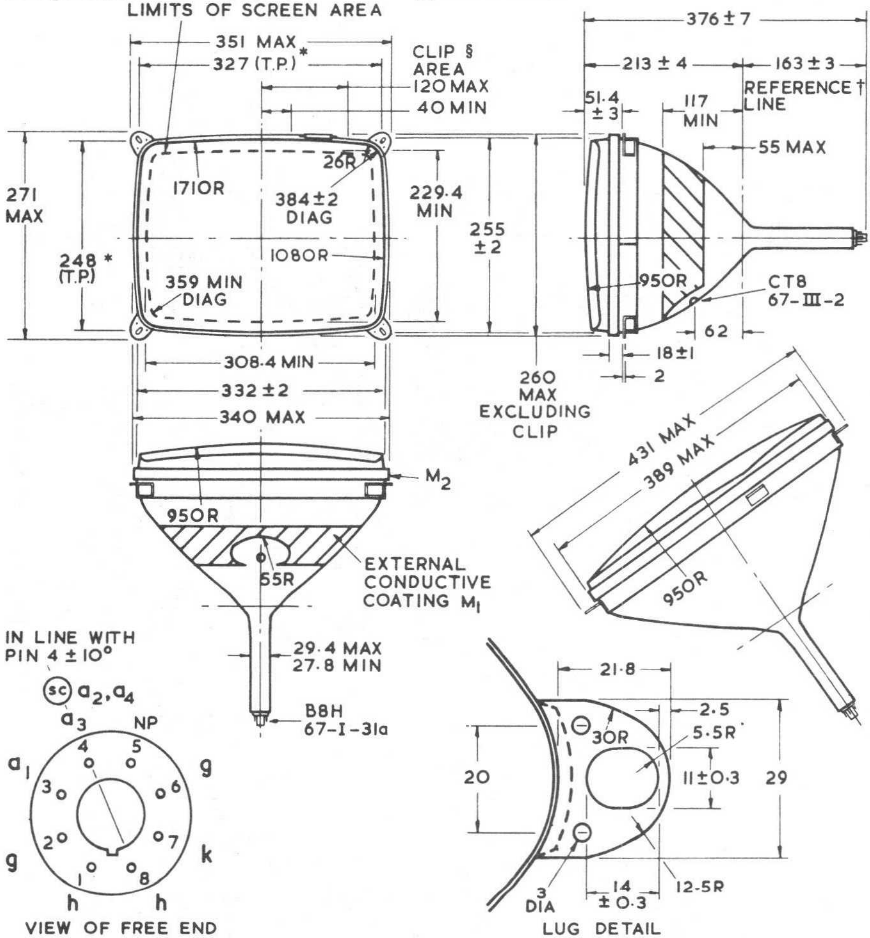
Focused raster of full height 4 x 3 aspect ratio




DATA DISPLAY & MONITOR TUBES

# Data Display or Monitor Tube

The M38-102.. is the M38-101.. with a bonded face-plate to reduce specular reflections. For general and electrical data see tube type M38-100..




**All dimensions in mm** TUBE WEIGHT (approx) - net 6.0 kg **Not to be scaled**

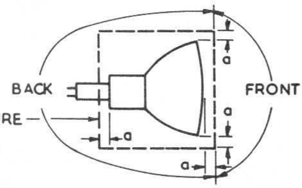
* The bolts to be used for mounting the tube must lie within the circles of 6.5 mm diameter centred on these true positions. One of the four lugs may deviate 2 mm maximum from the plane through the other three lugs.

† Determined by reference line gauge No. 15. (See T.D.S. No. 5-0-91-15).

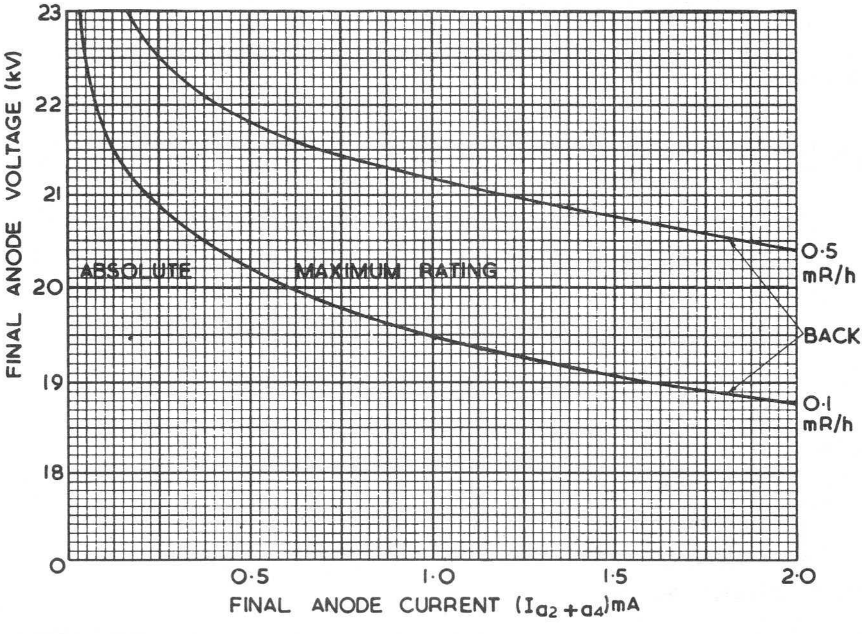
§ Total thickness of frame, tension band and clip 8 mm maximum. The clip will not project in front of the frame dimension.

## X-RAY ISO-EXPOSURE CURVES OF TYPICAL TUBE

MEASUREMENTS MADE ON LINES OF MAXIMUM RADIATION AT FRONT AND BACK OF TUBE WITH DETECTOR CENTRE 50mm FROM NOTIONAL ENCLOSURE DEFINED BY DIAGRAM

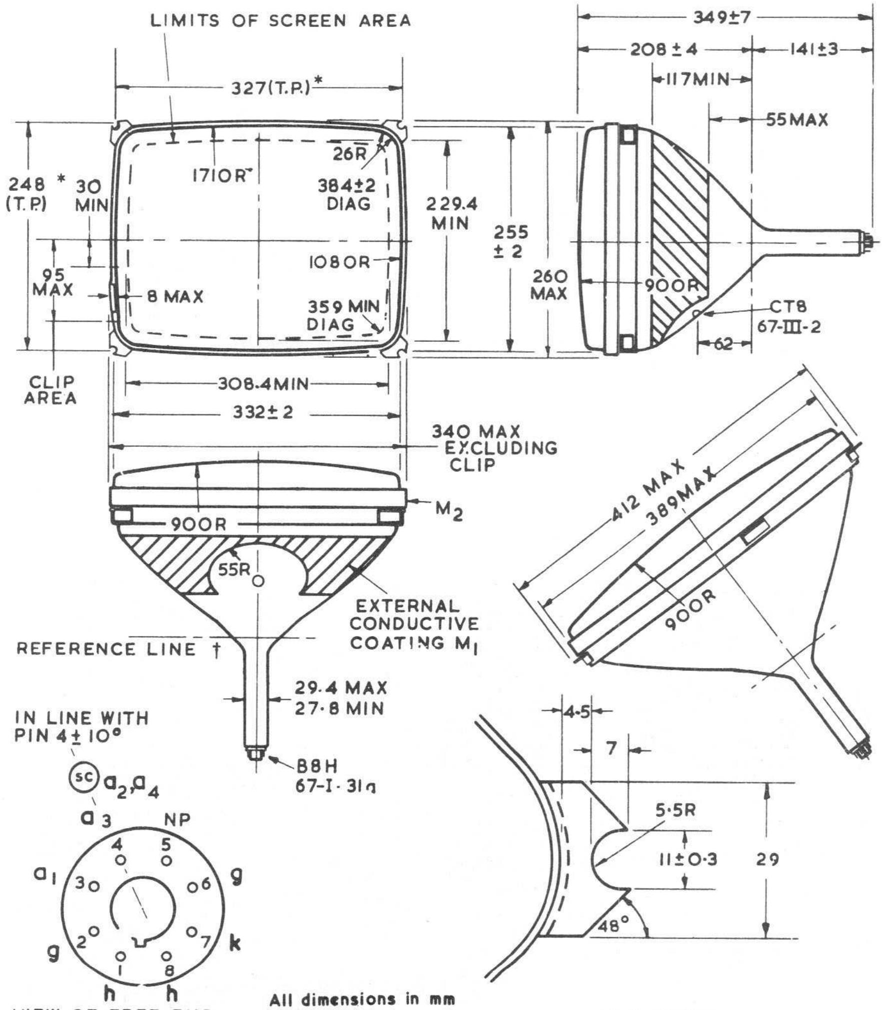



UNDER NO CONDITION REPRESENTED HERE DOES THE RADIATION FROM THE TUBE FRONT EXCEED 0·1 mR/h



# M38-103.. Data Display or Monitor Tube

For general and electrical data on the M38-103.. see tube type M38-100.., the tubes differ only in lug shape and tension band clip position.




VIEW OF FREE END

All dimensions in mm
Not to be scaled

LUG DETAIL

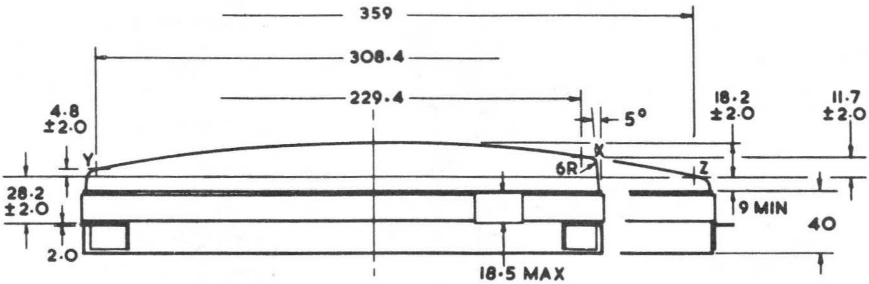
* The bolts to be used for mounting the tube must lie within the circles of 6.5 mm diameter centred on these true positions. One of the four lugs may deviate 2 mm maximum from the plane through the other three lugs.

† Determined by reference line gauge No. 15 (See T.D.S. No. 5-0-91-15).

**TUBE WEIGHT** (approx.) - net 5.3 kg

**Thorn Radio Valves and Tubes Limited**

BRIMAR

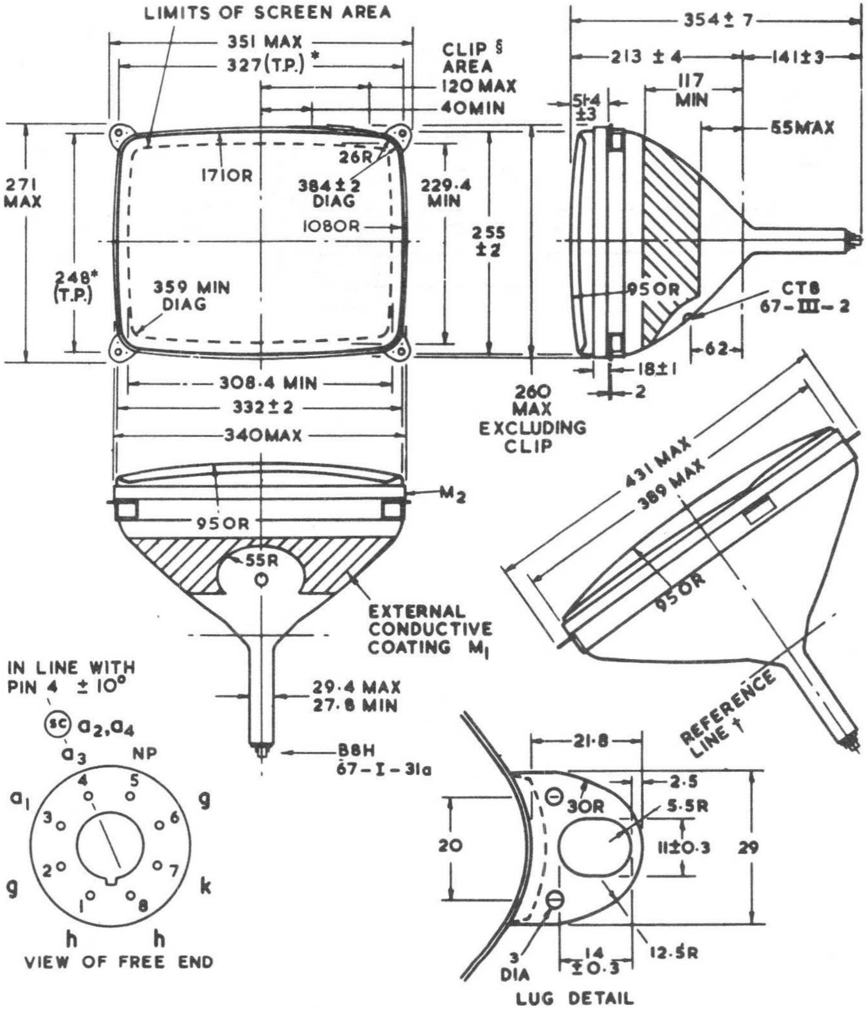



All dimensions in mm

Not to be scaled

# M38–104..    Data Display or Monitor Tube

The M38-104.. is the M38-100.. with a bonded face-plate to reduce specular reflections. For general and electrical data see tube type M38-100..




**All dimensions in mm**    TUBE WEIGHT (approx.) – net 6.0 kg    **Not to be scaled**

* The bolts to be used for mounting the tube must lie within the circles of 6.5 mm diameter centred on these true positions. One of the four lugs may deviate 2 mm maximum from the plane through the other three lugs.

† Determined by reference line gauge No. 15.(See T.D.S. No. 5-0-91-15).

§ Total thickness of frame-tension band and clip 8 mm maximum. The clip will not project in front of the frame dimension.

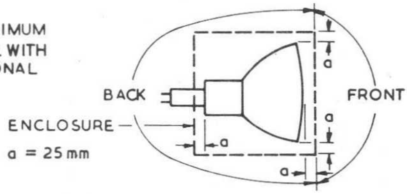
This type is usually supplied with GR phosphor. Other screens available to special order.

**Thorn Radio Valves and Tubes Limited**

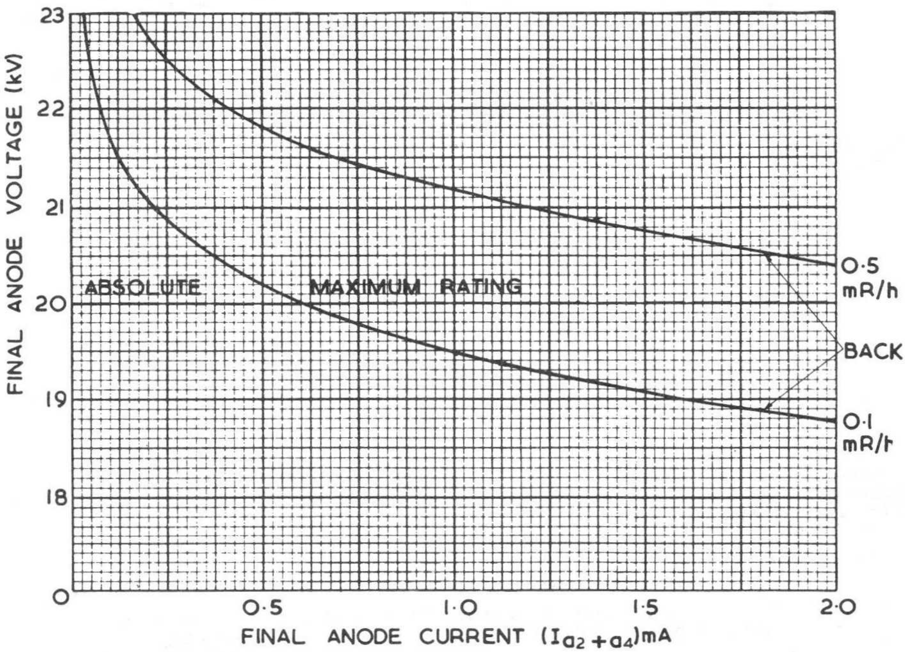
BRIMAR

## X-RAY ISO-EXPOSURE CURVES OF TYPICAL TUBE

MEASUREMENTS MADE ON LINES OF MAXIMUM RADIATION AT FRONT AND BACK OF TUBE WITH DETECTOR CENTRE 50mm FROM NOTIONAL ENCLOSURE DEFINED BY DIAGRAM

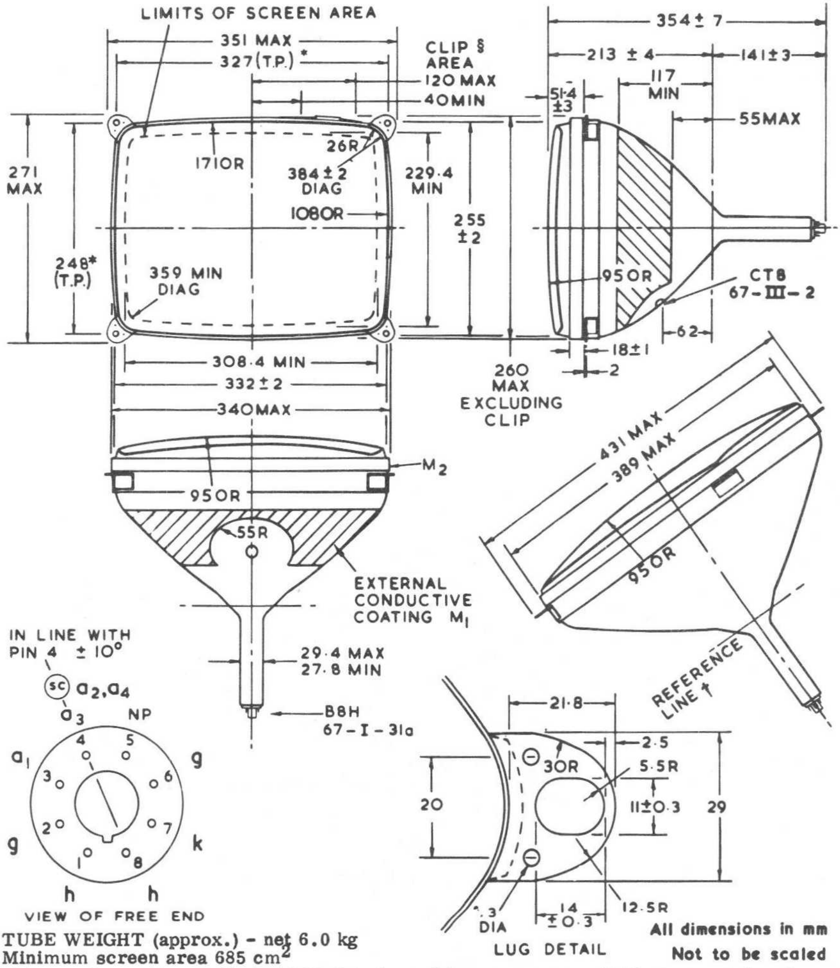



UNDER NO CONDITION REPRESENTED HERE DOES THE RADIATION FROM THE TUBE FRONT EXCEED 0·1 mR/h



# M38-105..                Data Display or Monitor Tube

The M38-105.. is the M38-100.. with a tinted bonded face-plate.
The total centre glass transmission is approximately 15% and the surface is treated to reduce specular reflection. For general and electrical data see tube type M38-100..




**All dimensions in mm**
**Not to be scaled**

TUBE WEIGHT (approx.) - net 6.0 kg
Minimum screen area 685 cm$^2$
This type is usually supplied with W phosphor. Other screens available to special order.
* The bolts to be used for mounting the tube must lie within the circles of 6.5 mm diameter centred on these true positions. One of the four lugs may deviate 2 mm maximum from the plane through the other three lugs.
† Determined by reference line gauge No. 15.

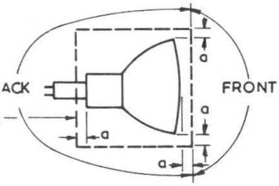
§ Total thickness of frame tension band and clip 8 mm maximum. The clip will not project in front of the frame dimension.

BRIMAR

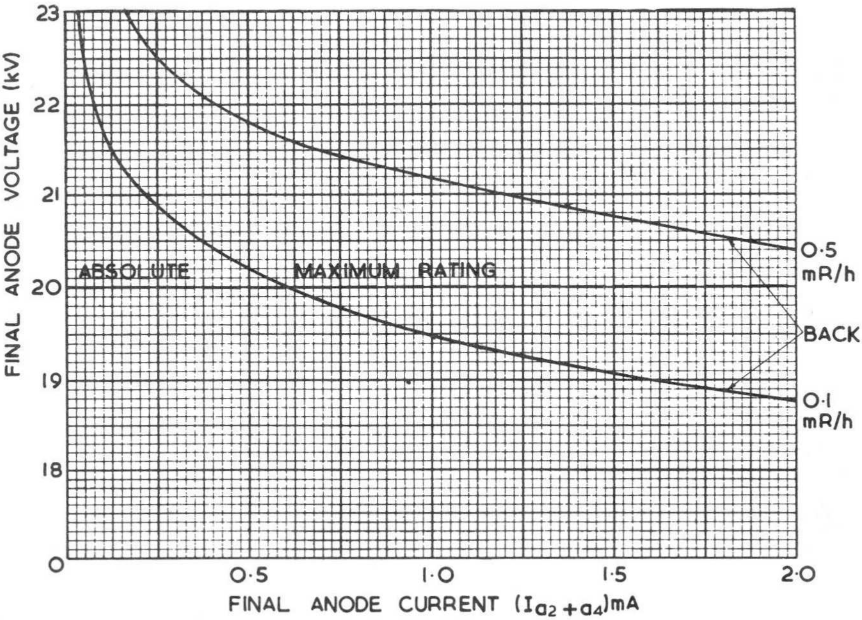
**Thorn Radio Valves and Tubes Limited**

## X-RAY ISO-EXPOSURE CURVES OF TYPICAL TUBE

MEASUREMENTS MADE ON LINES OF MAXIMUM RADIATION AT FRONT AND BACK OF TUBE WITH DETECTOR CENTRE 50mm FROM NOTIONAL ENCLOSURE DEFINED BY DIAGRAM

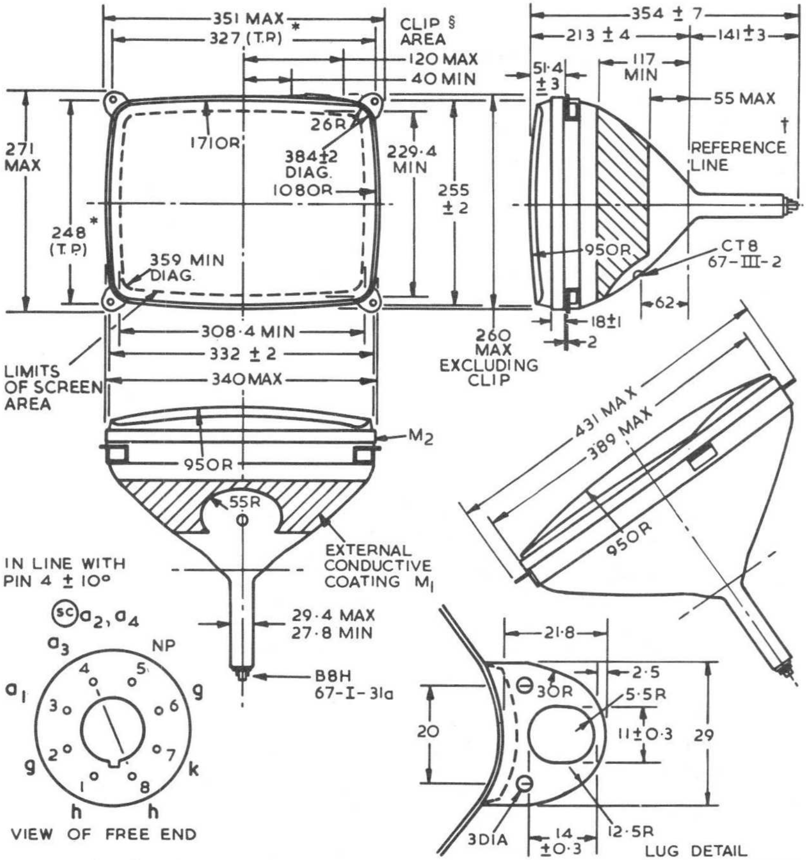



UNDER NO CONDITION REPRESENTED HERE DOES THE RADIATION FROM THE TUBE FRONT EXCEED 0·1 mR/h



# Data Display or Monitor Tube

The M38-106.. is the M38-100.. with a tinted bonded face-plate.
The total centre glass transmission is approximately 30% and the surface is treated to reduce specular reflection. For general and electrical data see tube type M38-100..




All dimensions in mm Not to be scaled

Minimum screen area 685 cm$^2$. TUBE WEIGHT (approx.) - net 6.0 kg.

* The bolts to be used for mounting the tube must lie within the circles of 6.5 mm diameter centred on these true positions. One of the four lugs may deviate 2 mm maximum from the plane through the other three lugs.

† Determined by reference line gauge No. 15.

§ Total thickness of frame tension band and clip 8 mm maximum. The clip will not project in front of the frame dimension.

This type is usually supplied with GH Phosphor. Other screens available to special order.

# Data Display or Monitor Tube

M38-111..

MAINTENANCE TYPE

The M38-111.. is the M38-113.. with a bonded face-plate and with external conductive coating. The overall length is 438 ± 8 mm.

**PHOSPHOR SCREEN**

This type is usually supplied with GH phosphor (M38-111GH) giving a green trace of medium short persistence. Other phosphor screens can be made available to special order.

For all other information please see the data sheets for type M38-113..

DATA DISPLAY & MONITOR TUBES

# Data Display or Monitor Tube

## Maintenance Type

The M38-112.. is the M38-111.. without a bonded faceplate thus making the overall length 433 ± 8 mm and the faceplate radius 900 mm.

### PHOSPHOR SCREEN

This type is usually supplied with GH phosphor (M38-112GH) giving a green trace of medium short persistence. Other phosphor screens can be made available to special order.

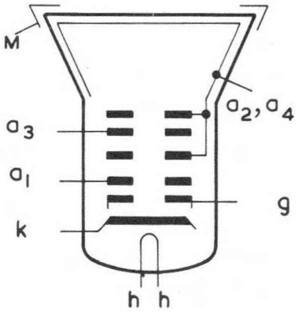
For all other information please see the data sheets for type M38-111..

# Data Display or Monitor Tube M38-113..

## GENERAL

Rectangular face, 15 inch, 90° diagonal tube
Rimguard III reinforced envelope *
Integral mounting lugs
Electrostatic focus, magnetic deflection
Aluminised screen
Grey glass, 50% transmission (approx.)
Straight gun, non ion trap
38 mm maximum neck diameter

| | | | |
|---|---|---|---|
| Heater voltage | $V_h$ | 6.3 | V |
| Heater current | $I_h$ | 0.3 | A |




## ABSOLUTE RATINGS -Voltages referred to cathode

| | | | |
|---|---|---|---|
| Maximum second and fourth anode voltage | $V_{a2+a4(max)}$ | 18 | kV |
| Minimum second and fourth anode voltage | $V_{a2+a4(min)}$ | 12 | kV |
| Maximum third anode voltage | $V_{a3(max)}$ | +1000 | V |
| Maximum first anode voltage | $V_{a1(max)}$ | 800 | V |
| Maximum negative grid voltage | $-V_{g(max)}$ | 200 | V |
| Minimum negative grid voltage | $-V_{g(min)}$ | 1.0 | V |
| Maximum heater to cathode voltage heater negative (d.c.) | $V_{h-k(max)}$ | 200 | V |

If this tube is operated at voltages in excess of 16 kV, x-ray radiation shielding may be necessary to avoid possible danger of personal injury from prolonged exposure at close range.

## PHOSPHOR SCREEN

This type is usually supplied with GH phosphor (M38-113GH) giving a green trace of medium short persistence. Other phosphor screens can be made available to special order.

## NECK LENGTH

This tube has an extended neck length to accommodate an auxiliary high frequency deflector coil.

* This tube meets the requirements for intrinsically safe tube laid down in the section of I.E.C. Publication 65 dealing with implosion.

This data should be read in conjunction with Operational and Safety Recommendations for Industrial Cathode Ray Tubes.

DATA DISPLAY & MONITOR TUBES

**Thorn Radio Valves and Tubes Limited**

BRIMAR

## INTER-ELECTRODE CAPACITANCES

| | | * | † | |
|---|---|---|---|---|
| Cathode to all | $c_{k-all}$ | 3.5 | 4.5 | pF |
| Grid to all | $c_{g-all}$ | 7.0 | 7.5 | pF |
| Anodes 2 and 4 to frame M (approx) | $c_{a2+a4-M}$ | 250 | | pF |

* Holder capacitance balanced out.

† Total capacitance including a typical holder.

## TYPICAL OPERATION

Grid modulation, voltages referred to cathode

| | | | |
|---|---|---|---|
| Second and fourth anode voltage | $V_{a2+a4}$ | 15 | kV |
| First anode voltage | $V_{a1}$ | 400 | V |
| Third anode voltage range for centre focus | $V_{a3}$ | 0 to 400§ | V |
| Grid to cathode voltage for cut-off of raster | $V_g$ | -30 to -70 | V |

§ The change of spot size with variation of focus voltage is small and the limit of 0 to 400 V is such that an acceptable focus quality is obtain within this range. If it is required to pass through the point of focus a voltage of a least -100V to +500V will be required. The voltage for corner focus will be greater than at the face centre by approximately 500 V with a suitably designed deflection yoke.

## MOUNTING

Any mask used in the mounting of this tube should be flexible enough to take up small variations in fixing and faceplate contours.

There is an annular region of anti-corona coating with external diameter of 75 mm surrounding the CT8 cap, the tube should not be handled in this region.

The tube can be mounted in any position. The tube socket should not be rigidly mounted but should have flexible leads and be allowed to move freely.

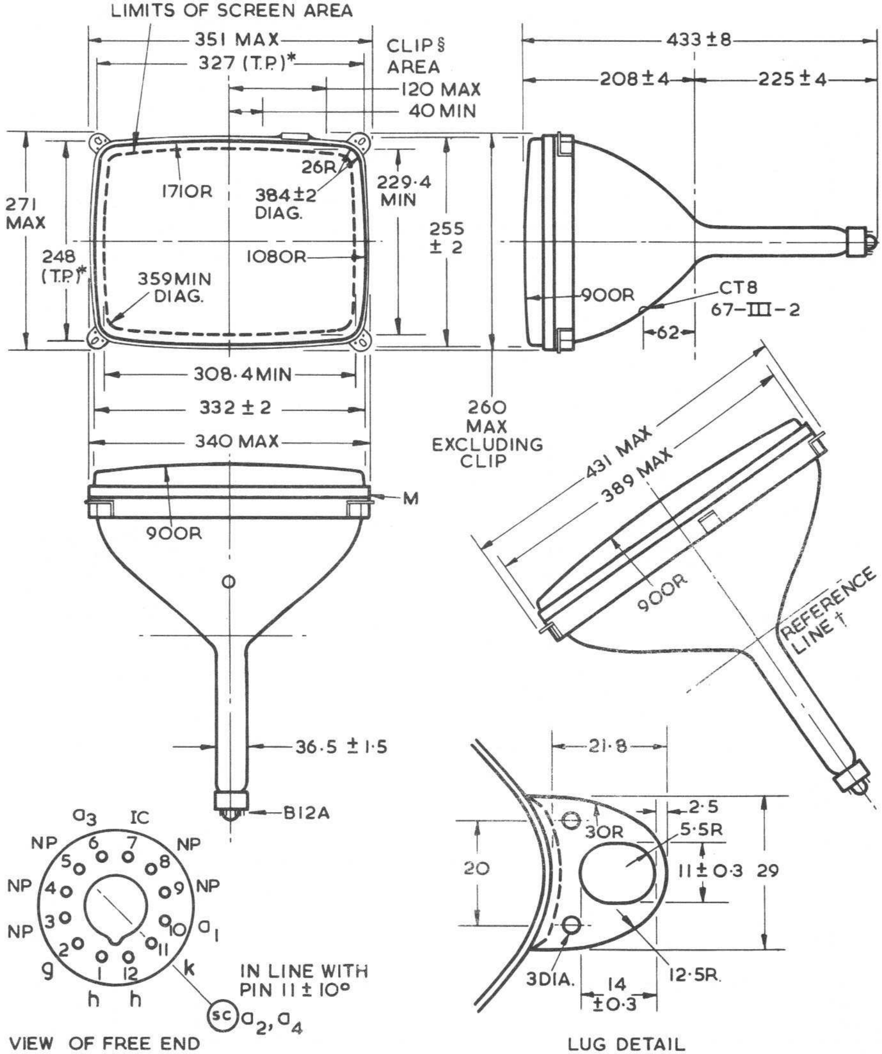
It is recommended that the deflector coil assembly including "position and write" coils should not extend further than 70 mm from the reference line otherwise there may be undesirable interaction with the tube gun.

The metal frame (M) should be connected directly to the chassis in a.c. equipment operating from an isolating transformer, or via a suitable leakage path in non isolated equipment, for example 2 MΩ.

When flashover protection is incorporated the chassis return path of M should be made in a manner appropriate to the protection system employed.

## TUBE WEIGHT

(approximate) - 5.5 kg




All dimensions in mm

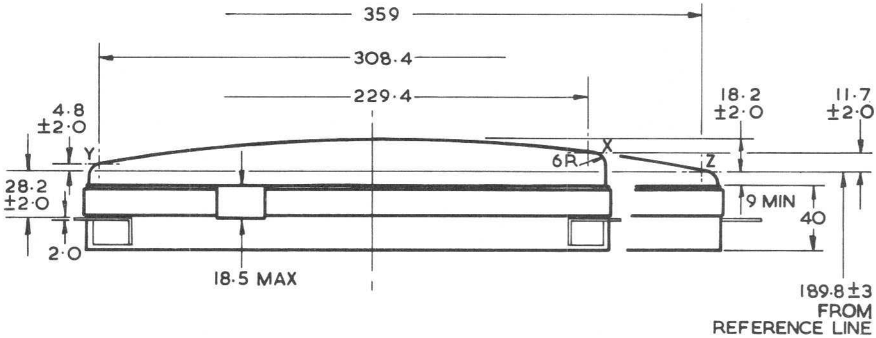
Not to be scaled

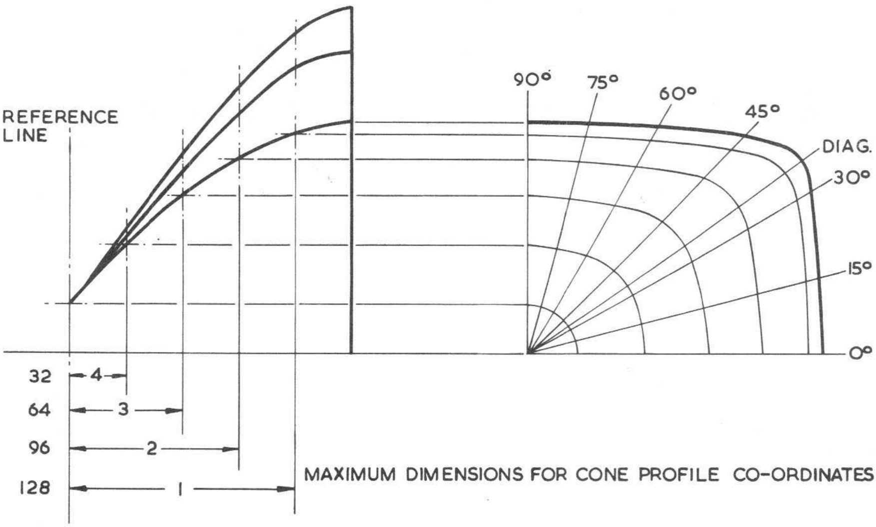
* The bolts to be used for mounting the tube must lie within the circles of 6.5 mm diameter centred on these true positions. One of the four lugs may deviate 2 mm maximum from the plane through the other three lugs.

† Determined by reference line gauge No. 13.

§ Total thickness of frame, tension band and clip 8 mm maximum. The clip will not project in front of the frame dimension.

DATA DISPLAY & MONITOR TUBES




All dimensions in mm

Not to be scaled

| Reference Plane No. | 0° Major | 15° | 30° | Diag. | 45° | 60° | 75° | 90° Minor |
|---|---|---|---|---|---|---|---|---|
| 1 | 160.7 | 164.9 | 177.6 | 181.6 | 165.9 | 140.5 | 127.9 | 124.0 |
| 2 | 134.0 | 136.6 | 145.5 | 148.0 | 139.3 | 122.0 | 112.6 | 109.7 |
| 3 | 103.0 | 104.8 | 110.3 | 111.3 | 107.9 | 97.7 | 92.0 | 90.5 |
| 4 | 66.8 | 67.4 | 69.3 | 69.4 | 69.0 | 66.0 | 64.0 | 63.5 |

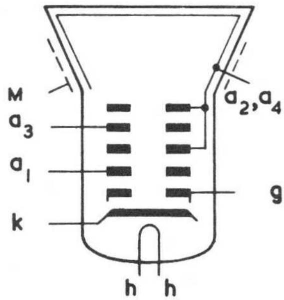
# Data Display or Monitor Tube

# M38-120..

**GENERAL**

Rectangular face, 38 cm, 110° diagonal
Electrostatic focus, magnetic deflection
Straight gun. Aluminised screen
Grey glass, 50% transmission (approx.)
29.4 mm maximum neck diameter
External conductive coating

| | | | |
|---|---|---|---|
| Heater voltage | $V_h$ | 6.3 | V |
| Heater current | $I_h$ | 0.3 | A |




**ABSOLUTE RATINGS** - Voltages referred to cathode

| | | | |
|---|---|---|---|
| Maximum second and fourth anode voltage | $V_{a2+a4(max)}$ | 18 | kV |
| Minimum second and fourth anode voltage | $V_{a2+a4(min)}$ | 13 | kV |
| Maximum third anode voltage range | $V_{a3(max)}$ | +1000 to -500 | V |
| Maximum first anode voltage | $V_{a1(max)}$ | 550 | V |
| Minimum first anode voltage | $V_{a1(min)}$ | 350 | V |
| Maximum negative grid voltage | $-V_{g(max)}$ | 150 | V |
| Minimum negative grid voltage | $-V_{g(min)}$ | 1.0 | V |
| Maximum heater to cathode voltage, | $V_{h-k(max)}$ | | |
| heater negative (d.c.) | | 250 | V |
| heater positive (d.c.) | | 135 | V |
| Maximum peak heater to cathode voltage | $v_{h-k(pk)max}$ | | |
| heater negative | | 300 | V |
| heater positive | | 180 | V |
| Maximum impedance, grid to cathode (50 Hz) | $Z_{g-k(max)}$ | 100 | kΩ |
| Maximum resistance, grid to cathode | $R_{g-k(max)}$ | 1.5 | MΩ |

If this tube is operated at voltages in excess of 16 kV, x-ray radiation shielding may be necessary to avoid possible danger of personal injury from prolonged exposure at close range.

**PHOSPHOR SCREEN**

This type is usually supplied with W phosphor (M38-120W) giving a television white trace of medium short persistence. Other phosphor screens can be made available to special order.

Tubes incorporating a B8H Sparkguard base will have a suffix after the type number. For details of the Sparkguard bases see separate sheets.

DATA DISPLAY & MONITOR TUBES

### INTER-ELECTRODE CAPACITANCES

| | | * | † | |
|---|---|---|---|---|
| Cathode to all | $c_{k\text{-}all}$ | 3.0 | 3.5 | pF |
| Grid to all | $c_{g\text{-}all}$ | 7.0 | 8.5 | pF |
| Anodes 2 and 4 to coating M (approx.) | $c_{a2+a4\text{-}M}$ | 600 | | pF |

* Holder capacitance balanced out.

† Total capacitances including a typical B8H holder.

### TYPICAL OPERATION - Grid modulation, voltages referred to cathode

| | | | |
|---|---|---|---|
| Second and fourth anode | $V_{a2+a4}$ | 16 | kV |
| First anode voltage | $V_{a1}$ | 400 | V |
| Third anode voltage range for focus | $V_{a3}$ | 0 to 400 § | V |
| Grid to cathode voltage for cut-off of raster | $V_g$ | -40 to -85 | V |

This tube will resolve 650 lines measured at a beam current of 100 $\mu$A

§ The change of spot size with variation of focus voltage is small and the limit of 0 to 400 V is such that an acceptable focus quality is obtained within this range. If it is required to pass through the point of focus a voltage of at least -100V to +500V will be required.

### RESOLUTION OPTIMISATION

For optimum overall resolution an external beam steering magnet may be required. Adjustment of the magnet should not be such that a general reduction of brightness or shading of the raster occurs. Typically the flux density at neck centre should be adjustable from 0 to 0.8 mT (0 to 8 gauss).

### MOUNTING

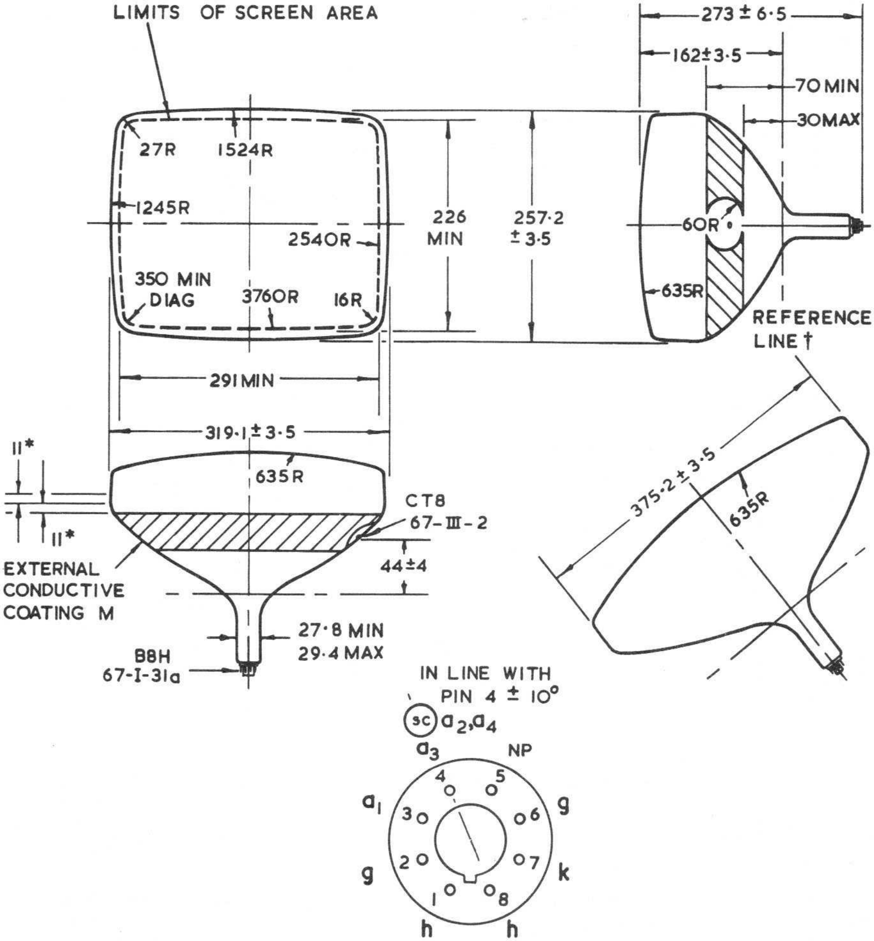
There is an annular region of anti-corona coating with external diameter of 75 mm surrounding the CT8 cap, the tube should not be handled in this region.

The tube can be mounted in any position. The tube socket should not be rigidly mounted but should have flexible leads and be allowed to move freely.

The external conductive coating (M) of this tube should be connected to chassis. The capacitance between this coating and final anode may be used to provide smoothing for the e.h.t. supply.

When flashover protection is incorporated the chassis return path of M should be made in a manner appropriate to the protection system employed.

### TUBE WEIGHT (approximate) - net 4.5 kg




All dimensions in mm

VIEW OF FREE END

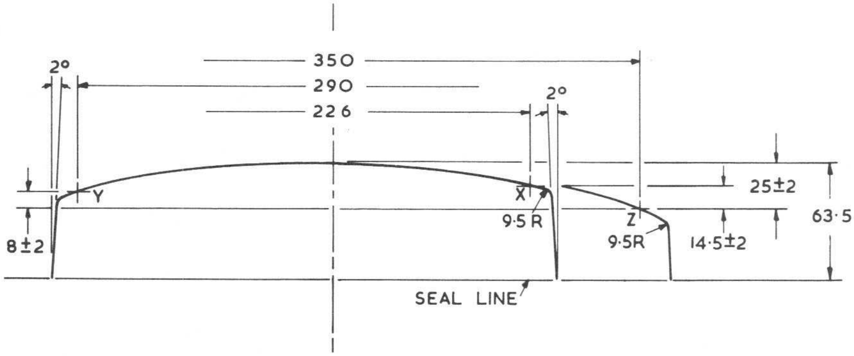
Not to be scaled

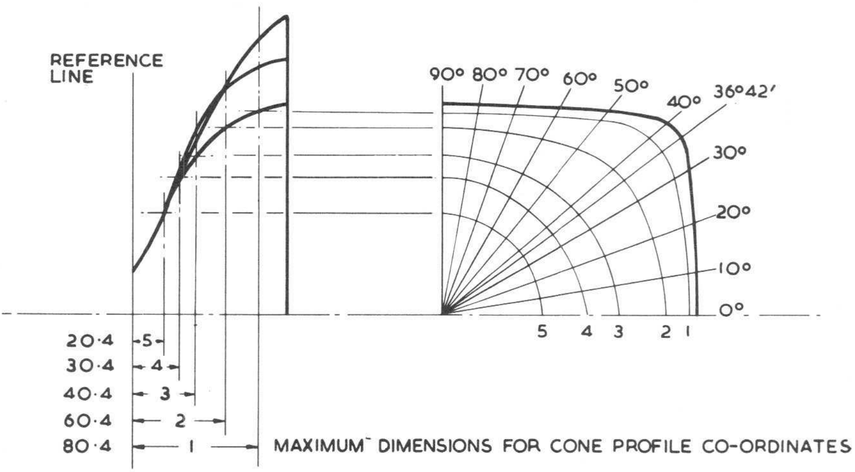
* During the face sealing operation the glass in this area (± 11 mm) may be disturbed and the shape may be either convex or concave. The bulb should not be gripped within this region unless special precautions are taken, such as, the use of resilient packing material.

† Determined by reference line gauge No. 16 (B.S. RL4 : IEC 67-IV-3 : JEDEC 126).

DATA DISPLAY & MONITOR TUBES

# Data Display or Monitor Tube



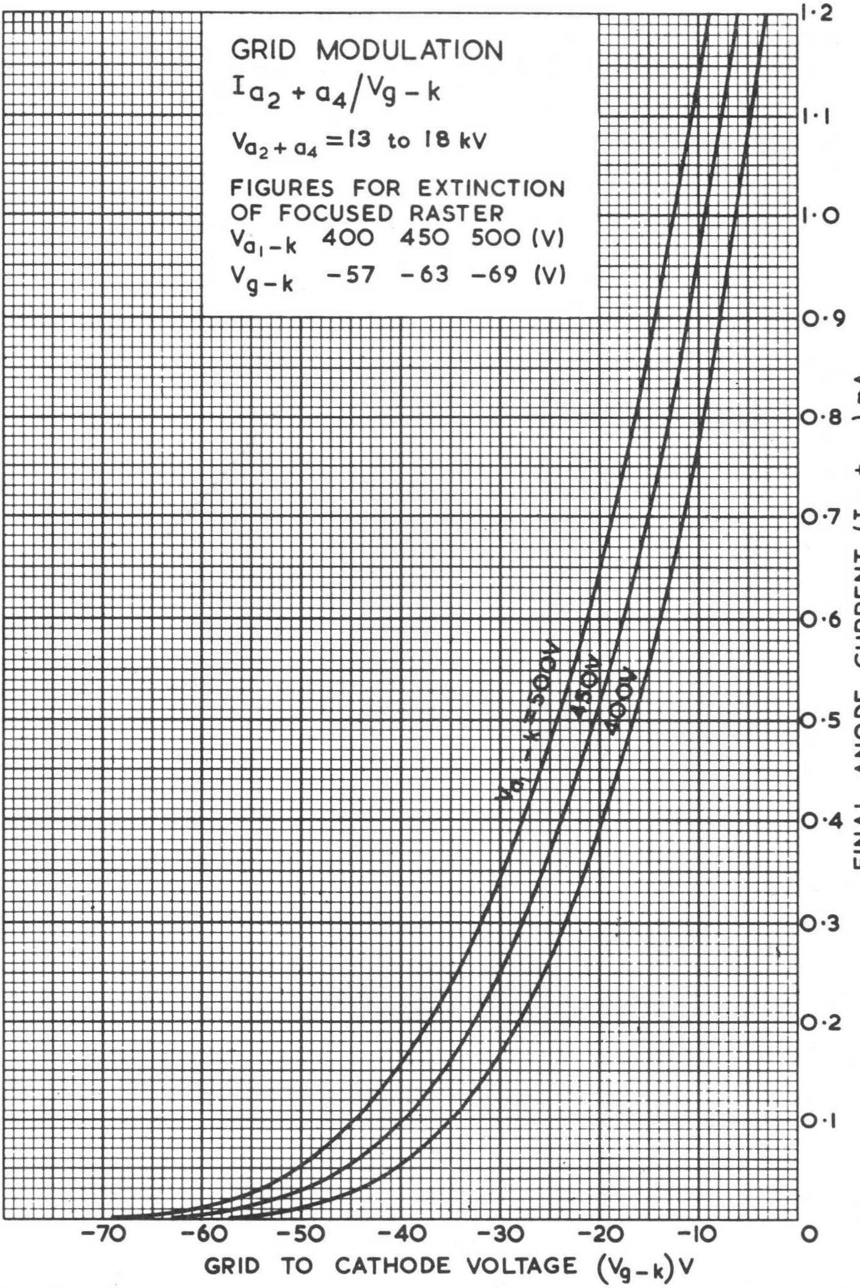



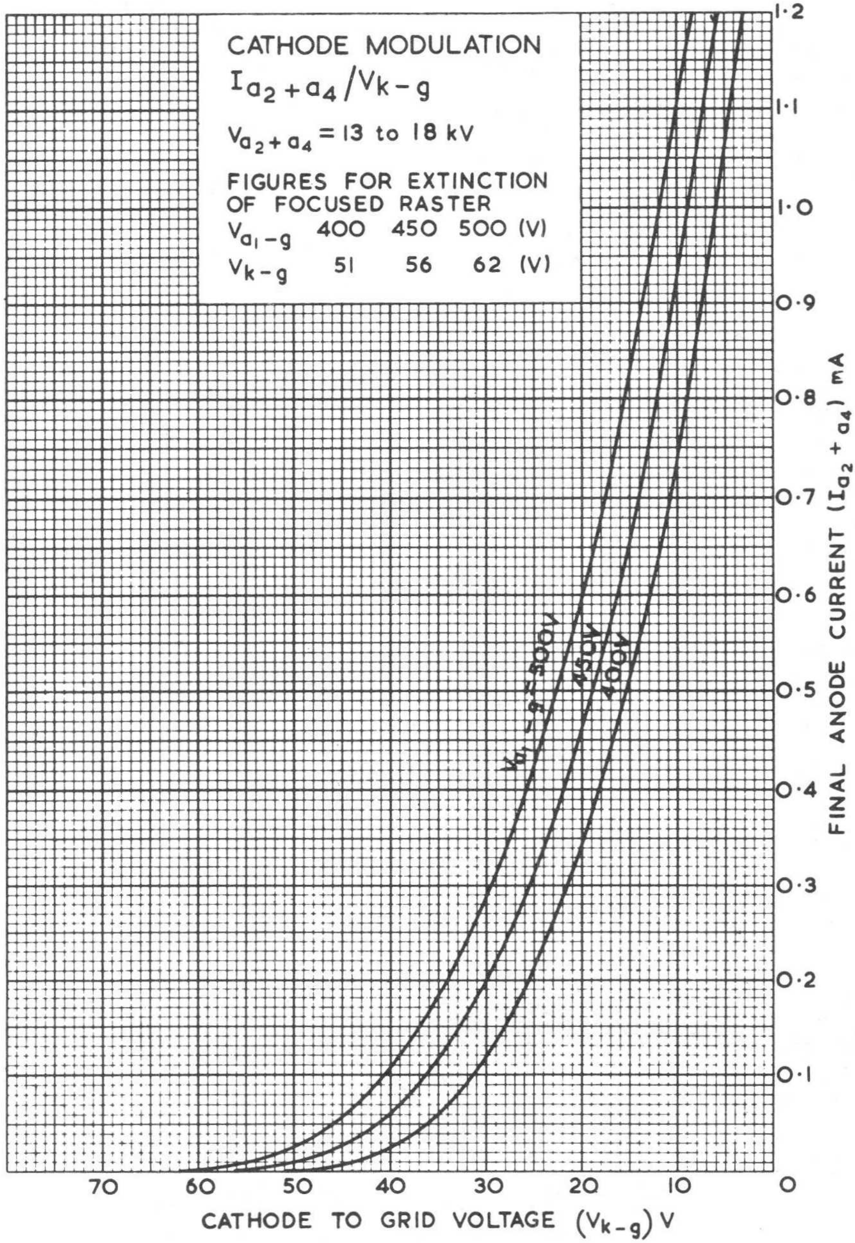

MAXIMUM DIMENSIONS FOR CONE PROFILE CO-ORDINATES

All dimensions in mm

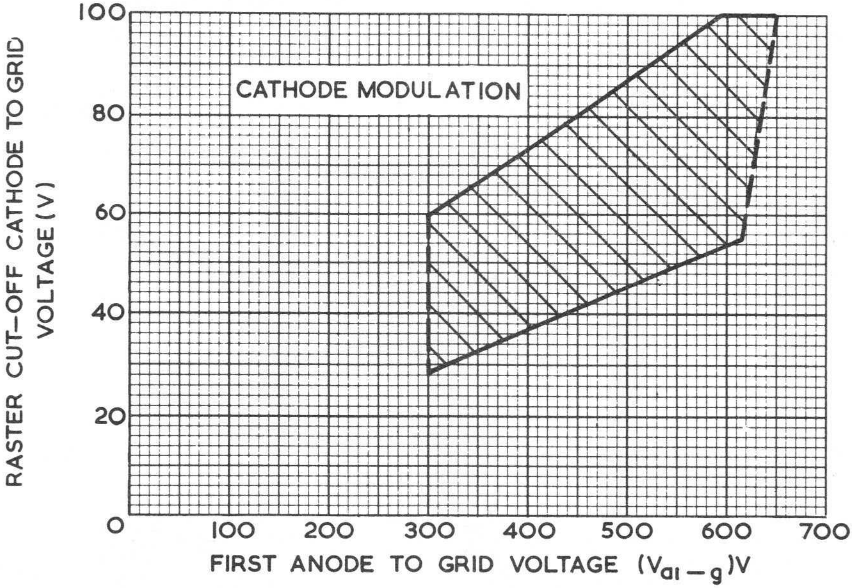
Not to be scaled

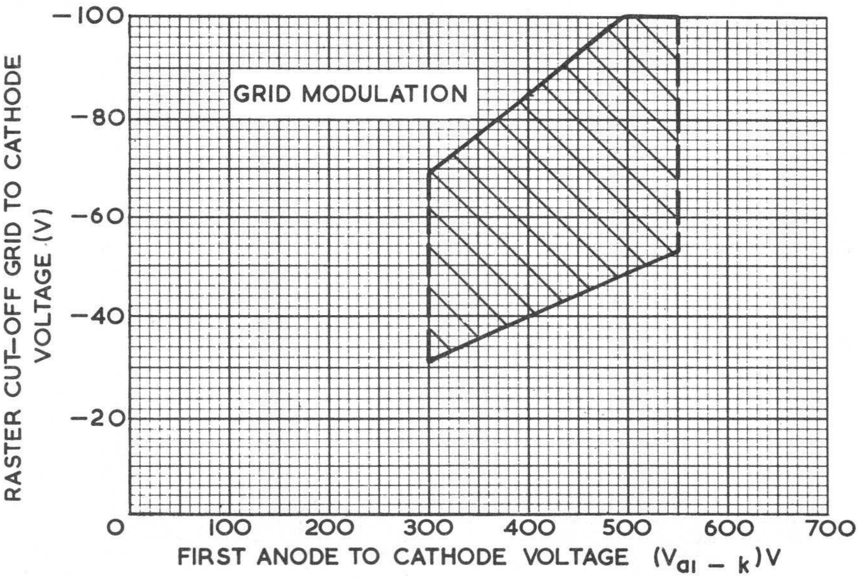
| Reference Plane No. | 0° Major | 10° | 20° | 30° | 36°42' Diag. | 40° | 50° | 60° | 70° | 80° | 90° Minor |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 155 | 157 | 162 | 170 | 173 | 171 | 156 | 141 | 131 | 126 | 124 |
| 2 | 140 | 141 | 143 | 143 | 141 | 140 | 134 | 126 | 119 | 116 | 115 |
| 3 | 112 | 112 | 110 | 108 | 106 | 105 | 104 | 102 | 101 | 99 | 99 |
| 4 | 90 | 89 | 88 | 86 | 86 | 86 | 85 | 85 | 86 | 86 | 85 |
| 5 | 63 | 64 | 63 | 63 | 63 | 63 | 63 | 64 | 64 | 64 | 64 |


GRID MODULATION
Ia2 + a4 / Vg – k
Va2 + a4 = 13 to 18 kV
FIGURES FOR EXTINCTION OF FOCUSED RASTER
Va1–k 400 450 500 (V)
Vg–k –57 –63 –69 (V)
Va1 – k = 500V
450V
400V
FINAL ANODE CURRENT (Ia2 + a4) mA
1·2
1·1
1·0
0·9
0·8
0·7
0·6
0·5
0·4
0·3
0·2
0·1
0
–70
–60
–50
–40
–30
–20
–10
GRID TO CATHODE VOLTAGE (Vg – k) V


CATHODE MODULATION
$I_{a_2+a_4}/V_{k-g}$
$V_{a_2+a_4}$ = 13 to 18 kV
FIGURES FOR EXTINCTION OF FOCUSED RASTER
$V_{a_1-g}$ 400 450 500 (V)
$V_{k-g}$ 51 56 62 (V)
$V_{a_1-g}$ = 500V
450V
400V
1·2
1·1
1·0
0·9
0·8
0·7
0·6
0·5
0·4
0·3
0·2
0·1
0
70
60
50
40
30
20
10
FINAL ANODE CURRENT ($I_{a_2}+a_4$) mA
CATHODE TO GRID VOLTAGE ($V_{k-g}$) V

## LIMITS OF RASTER CUT-OFF VOLTAGE

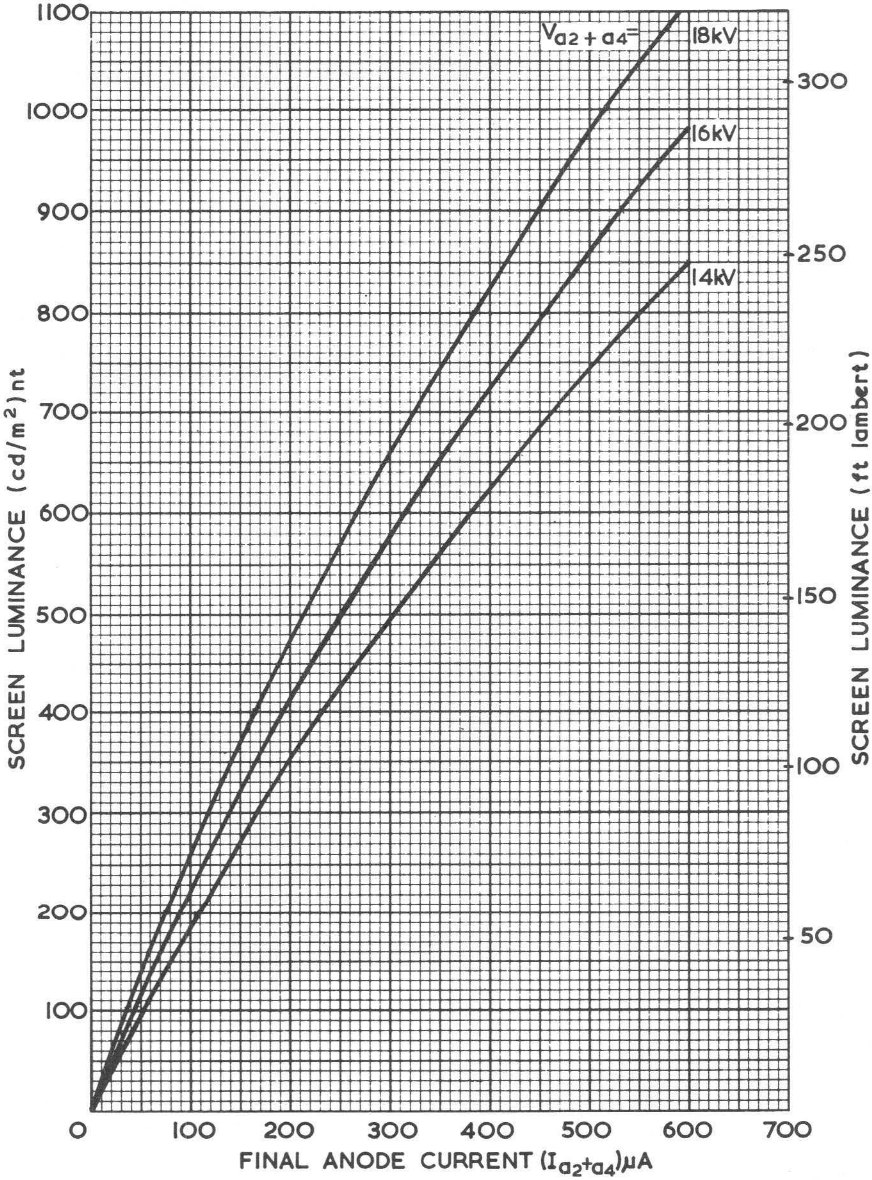


# M38-120 GH Data Display or Monitor Tube

TYPICAL CHARACTERISTICS GH PHOSPHOR SCREEN

Focused raster of full height 4x3 aspect ratio



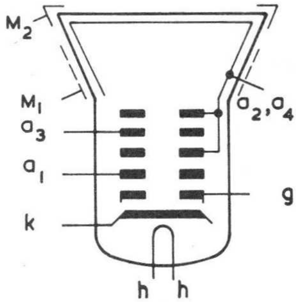
# Data Display or Monitor Tube

# M38-121..

## GENERAL

Rectangular face, 38 cm, 110° diagonal
Rimguard IV reinforced envelope
Integral mounting lugs
Electrostatic focus, magnetic deflection
Straight gun. Aluminised screen
Grey glass, 50% transmission (approx.)
29.4 mm maximum neck diameter
External conductive coating

| | | | |
|---|---|---|---|
| Heater voltage | $V_h$ | 6.3 | V |
| Heater current | $I_h$ | 0.3 | A |




## ABSOLUTE RATINGS - Voltages referred to cathode

| | | | |
|---|---|---|---|
| Maximum second and fourth anode voltage | $V_{a2+a4(max)}$ | 18 | kV |
| Minimum second and fourth anode voltage | $V_{a2+a4(min)}$ | 13 | kV |
| Maximum third anode voltage range | $V_{a3(max)}$ | +1000 to -500 | V |
| Maximum first anode voltage | $V_{a1(max)}$ | 550 | V |
| Minimum first anode voltage | $V_{a1(min)}$ | 350 | V |
| Maximum negative grid voltage | $-V_{g(max)}$ | 150 | V |
| Minimum negative grid voltage | $-V_{g(min)}$ | 1.0 | V |
| Maximum heater to cathode voltage, | $V_{h-k(max)}$ | | |
| heater negative (d.c.) | | 250 | V |
| heater positive (d.c.) | | 135 | V |
| Maximum peak heater to cathode voltage | $v_{h-k(pk)max}$ | | |
| heater negative | | 300 | V |
| heater positive | | 180 | V |
| Maximum impedance, grid to cathode (50 Hz) | $Z_{g-k(max)}$ | 100 | kΩ |
| Maximum resistance, grid to cathode | $R_{g-k(max)}$ | 1.5 | MΩ |

If this tube is operated at voltages in excess of 16 kV, x-ray radiation shielding may be necessary to avoid possible danger of personal injury from prolonged exposure at close range.

## PHOSPHOR SCREEN

This type is usually supplied with W phosphor (M38-121W) giving a television white trace of medium short persistence. Other phosphor screens can be made available to special order.

Tubes incorporating a B8H Sparkguard base will have a suffix after the type number. For details of the Sparkguard bases see separate sheets.
This data should be read in conjunction with Operational Recommendations for Industrial Cathode ray tubes.

DATA DISPLAY & MONITOR TUBES

## INTER-ELECTRODE CAPACITANCES

| | | * | † | |
|---|---|---|---|---|
| Cathode to all | $c_{k-all}$ | 3.0 | 3.5 | pF |
| Grid to all | $c_{g-all}$ | 7.0 | 8.5 | pF |
| Anodes 2 and 4 to coating $M_1$ (approx.) | $c_{a2+a4-M1}$ | 600 | | pF |
| Anodes 2 and 4 to metal $M_2$ (approx.) | $c_{a2+a4-M2}$ | 250 | | pF |

* Holder capacitance balanced out.

† Total capacitances including a typical B8H holder.

## TYPICAL OPERATION - Grid modulation, voltages referred to cathode

| | | | |
|---|---|---|---|
| Second and fourth anode | $V_{a2+a4}$ | 16 | kV |
| First anode voltage | $V_{a1}$ | 400 | V |
| Third anode voltage range for focus | $V_{a3}$ | 0 to 400 § | V |
| Grid to cathode voltage for cut-off of raster | $V_g$ | -40 to -85 | V |

This tube will resolve 650 lines measured at a beam current of 100 $\mu$A

§ The change of spot size with variation of focus voltage is small and the limit of 0 to 400 V is such that an acceptable focus quality is obtained within this range. If it is required to pass through the point of focus a voltage of at least -100V to +500V will be required.

## RESOLUTION OPTIMISATION

For optimum overall resolution an external beam steering magnet may be required. Adjustment of the magnet should not be such that a general reduction of brightness or shading of the raster occurs. Typically the flux density at neck centre should be adjustable from 0 to 0.8 mT (0 to 8 gauss).

## MOUNTING

There is an annular region of anti-corona coating with external diameter of 75 mm surrounding the CT8 cap, the tube should not be handled in this region.

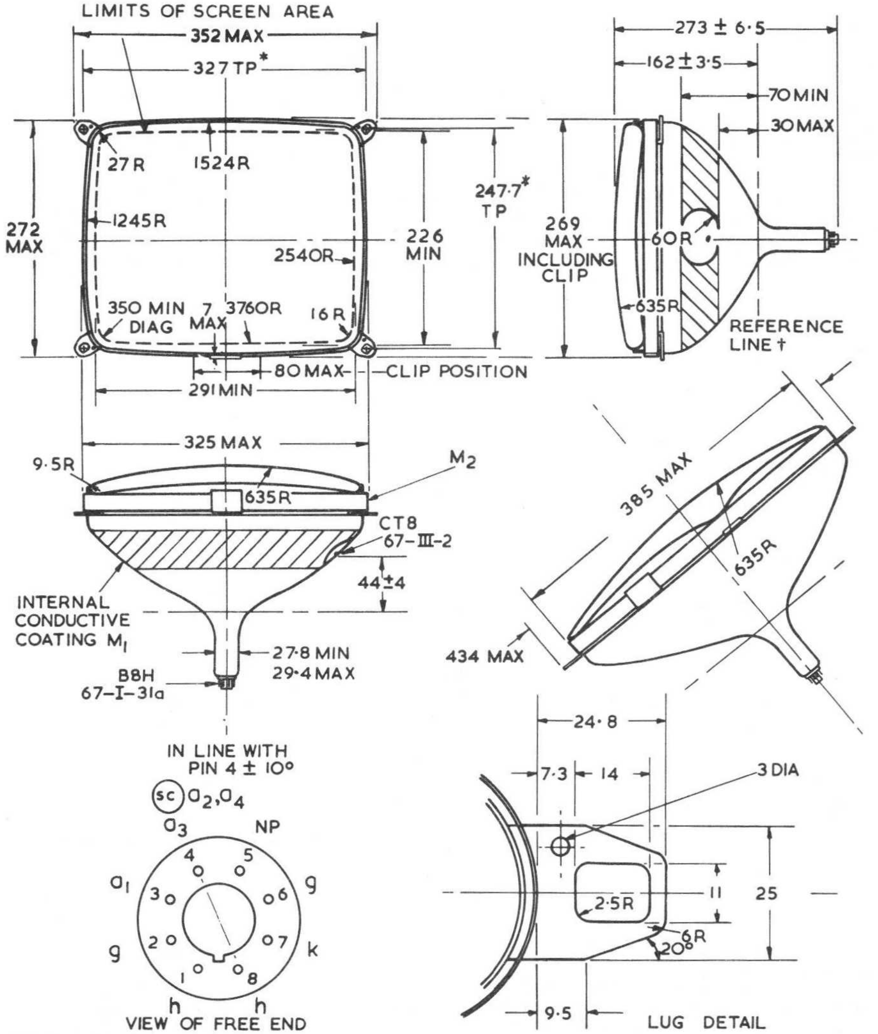
The tube can be mounted in any position. The tube socket should not be rigidly mounted but should have flexible leads and be allowed to move freely.

The external conductive coating ($M_1$) of this tube should be connected to chassis. The capacitance between this coating and final anode may be used to provide smoothing for the e.h.t. supply.

The metal ($M_2$) should be connected to the chassis in a.c. equipment operating from an isolating transformer, or via a suitable leakage path in a.c./d.c. equipment, for example 2 MΩ.

When flashover protection is incorporated the chassis return paths of $M_1$ and $M_2$ should be made in a manner appropriate to the protection system employed.

## TUBE WEIGHT (approximate) - net 4.7 kg



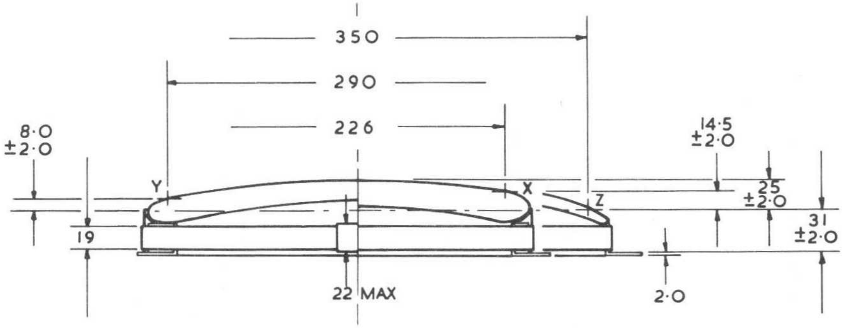

All dimensions in mm

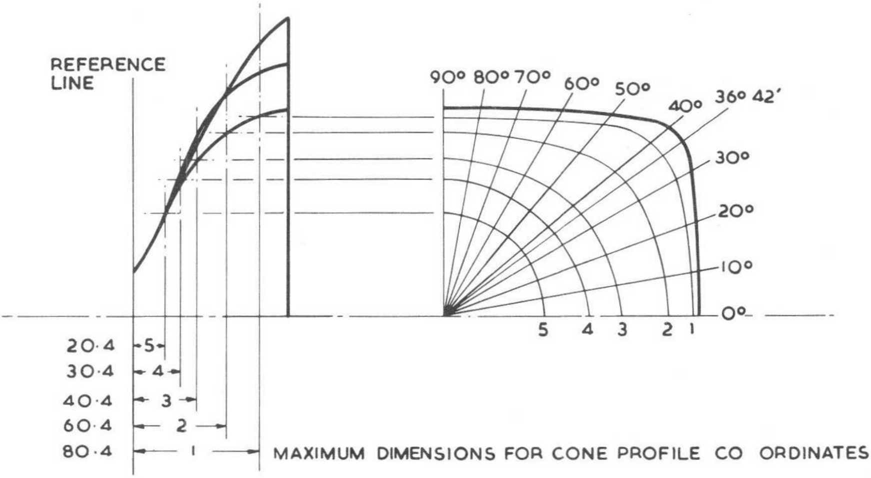
Not to be scaled

* The bolts to be used for mounting the tube must lie within the circles of 7.5mm diameter centred on these true positions. One of the four lugs may deviate 2 mm maximum from the plane through the other three lugs.

† Determined by reference line gauge No. 16 (B.S. RL4 : IEC 67-IV-3 : JEDEC 126).

Minimum useful screen area 646 $cm^2$



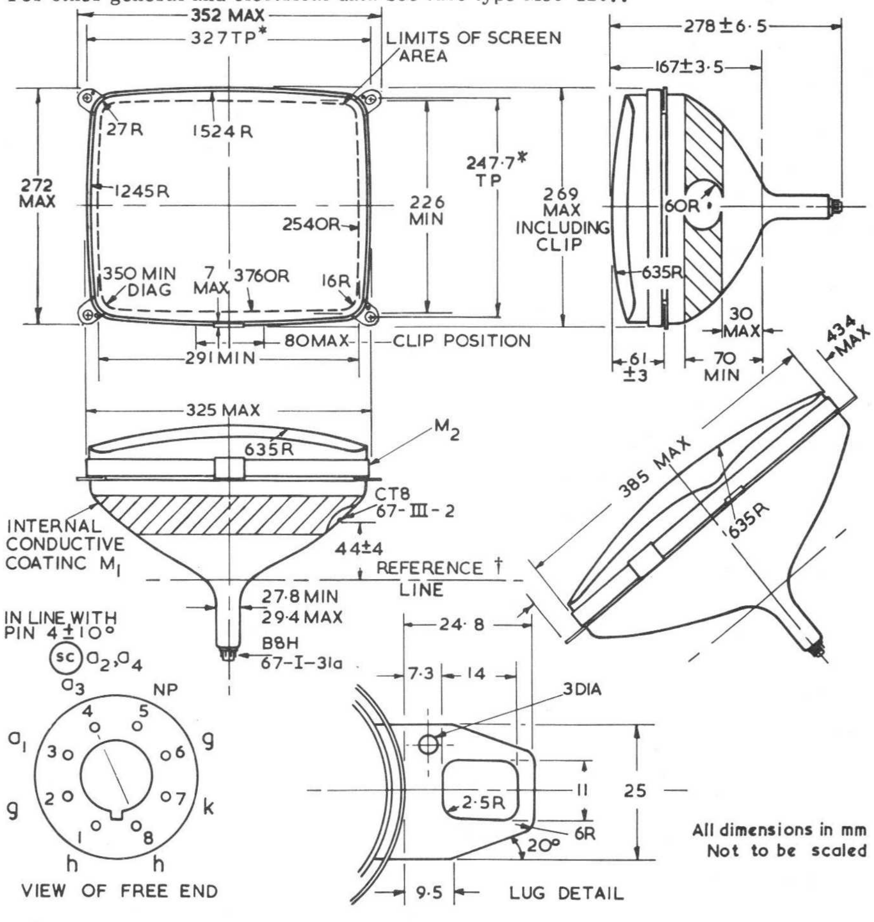

All dimensions in mm

Not to be scaled

| Reference Plane No. | 0° Major | 10° | 20° | 30° | 36°42′ Diag. | 40° | 50° | 60° | 70° | 80° | 90° Minor |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 155 | 157 | 162 | 170 | 173 | 171 | 156 | 141 | 131 | 126 | 124 |
| 2 | 140 | 141 | 143 | 143 | 141 | 140 | 134 | 126 | 119 | 116 | 115 |
| 3 | 112 | 112 | 110 | 108 | 106 | 105 | 104 | 102 | 101 | 99 | 99 |
| 4 | 90 | 89 | 88 | 86 | 86 | 86 | 85 | 85 | 86 | 86 | 85 |
| 5 | 63 | 64 | 63 | 63 | 63 | 63 | 63 | 64 | 64 | 64 | 64 |

# Data Display or Monitor Tube **M38-122..**

The M38-122.. is the M38-120.. with a tinted bonded face-plate, reinforced envelope, and integral mounting lugs. The total centre glass transmission is approximately 15% and the surface is treated to reduce specular reflections.
For other general and electrical data see tube type M38-120..




**TUBE WEIGHT** (approximate) 5.5 kg

* The bolts to be used for mounting the tube must lie within the circles of 7.5 mm diameter centred on these true positions. One of the four lugs may deviate 2 mm maximum from the plane through the other three lugs.

† Determined by reference line gauge No. 16 (B.S. RL4 : IEC 67-IV-3 : JEDEC 126).

Minimum useful screen area 646 $cm^2$

DATA DISPLAY & MONITOR TUBES

**Thorn Radio Valves and Tubes Limited**

BRIMAR

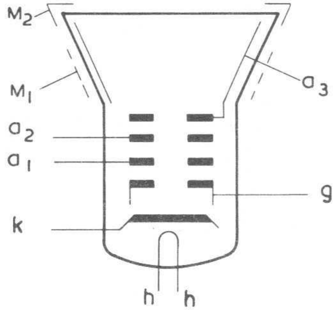
# M38-142.. Data Display or Monitor Tube

PRELIMINARY DATA

**GENERAL**

Rectangular face, 38 cm, 110° diagonal
Rimguard IV reinforced envelope
Integral mounting lugs
High voltage electrostatic focus
Magnetic deflection
Grey glass, 50% transmission (approx.)
Aluminised screen
External conductive coating
29.4 mm maximum neck diameter

| | | | |
|---|---|---|---|
| Heater voltage | $V_h$ | 6.3 | V |
| Heater current | $I_h$ | 0.3 | A |




**ABSOLUTE RATINGS** - Voltages referred to cathode

| | | | |
|---|---|---|---|
| Maximum third anode voltage | $V_{a3(max)}$ | 20* | kV |
| Minimum third anode voltage | $V_{a3(min)}$ | 14 | kV |
| Maximum second anode voltage | $V_{a2(max)}$ | 5.0 | kV |
| Maximum first anode voltage | $V_{a1(max)}$ | 770 | V |
| Maximum negative grid voltage | $-V_{g(max)}$ | 155 | V |
| Minimum negative grid voltage | $V_{g(max)}$ | -1 ¶ | V |
| Maximum heater to cathode voltage, heater negative (d.c.) | $V_{h-k(max)}$ | 250 | V |
| Maximum peak heater to cathode voltage, heater negative | $v_{h-k(pk)max}$ | 400 § | V |
| Maximum impedance, grid to cathode (50 Hz) | $Z_{g-k(max)}$ | 0.5 | MΩ |
| Maximum resistance, grid to cathode | $R_{g-k(max)}$ | 1.5 | MΩ |
| Maximum peak cathode current | $i_{k(pk)max.}$ | 0.5 | mA |

¶ A 10 kΩ grid series resistor mounted close to the tube base is recommended to limit the peak grid voltage.

§ During a warming-up period not exceeding 45 seconds. * $I_{a3} = 0$

**PHOSPHOR SCREEN**

This type is usually supplied with a W phosphor (M38-142W) giving a television white trace of medium short persistence. Other phosphor screens can be made available to special order.

This data should be read in conjunction with Operational and Safety Recommendations for Industrial Cathode ray tubes.

## INTER - ELECTRODE CAPACITANCES

| | | | |
|---|---|---|---|
| Cathode to all (max) | $c_{k-all}$ (max) | 7.0 | pF |
| Grid to all (max) | $c_{g-all}$ (max) | 10 | pF |
| Anode 3 to coating M (approx.) | $c_{a3-M}$ | 600 | pF |

## DEFLECTION ANGLES

Height 76° Width 93° Diagonal 110°

## TYPICAL OPERATION - Grid modulation voltages referred to cathode

| | | | |
|---|---|---|---|
| Third anode voltage | $V_{a3}$ | 17 | kV |
| First anode voltage | $V_{a1}$ | 450 | V |
| Second anode voltage for centre focus(nom) | $V_{a2}$ | 4.0 | kV |
| Grid to cathode voltage for cut-off of raster | $V_g$ | -35 to -85 | V |
| Typical line width at 50 $\mu$A beam current shrinking raster measurements at face centre | | 0.2 | mm |

Note: To obtain best overall performance, a dynamic focus voltage variation of approximately 450V is required between the centre of the screen and any corner.

* In operation the second anode current will vary with beam current. To avoid focus variation the supply impedance should be kept low.

## MOUNTING

There is an annular region of anti-corona coating with external diameter of 75 mm surrounding the CT8 cap, the tube should not be handled in this region.

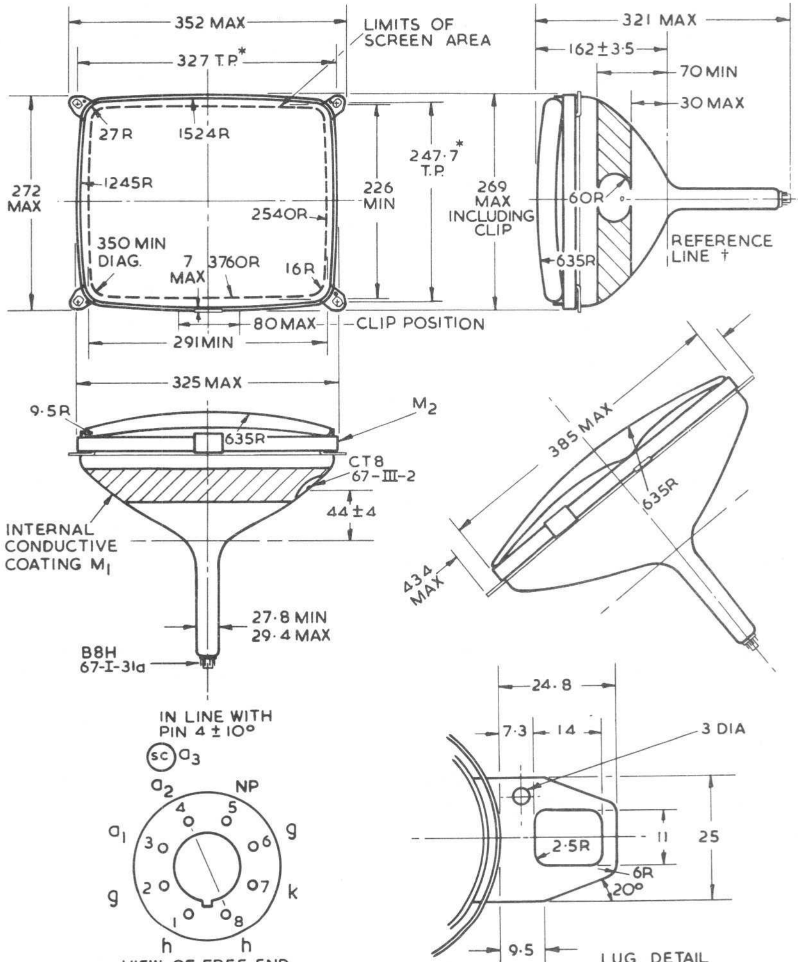
The tube can be mounted in any position. The tube socket should not be rigidly mounted but should have flexible leads and be allowed to move freely.

The external conductive coating ($M_1$) of this tube should be connected to chassis. The capacitance between this coating and final anode may be used to provide smoothing for the e.h.t. supply.

The metal ($M_2$) should be connected to the chassis in a.c. equipment operating from an isolating transformer, or via a suitable leakage path in a.c./d.c. equipment, for example 2 MΩ.

When flashover protection is incorporated the chassis return paths of $M_1$ and $M_2$ should be made in a manner appropriate to the protection system employed.

**TUBE WEIGHT** (approximate) - net 4.7 kg.

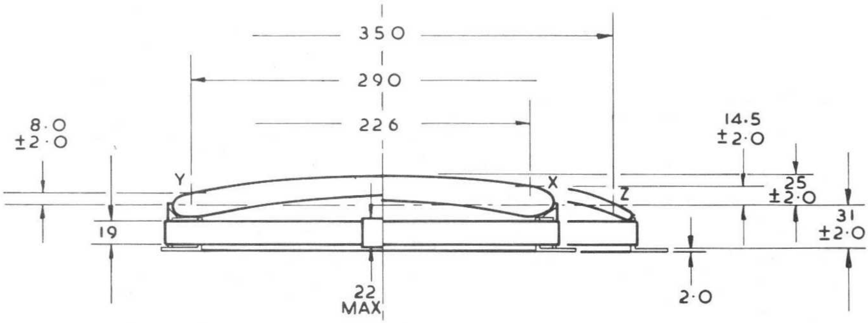


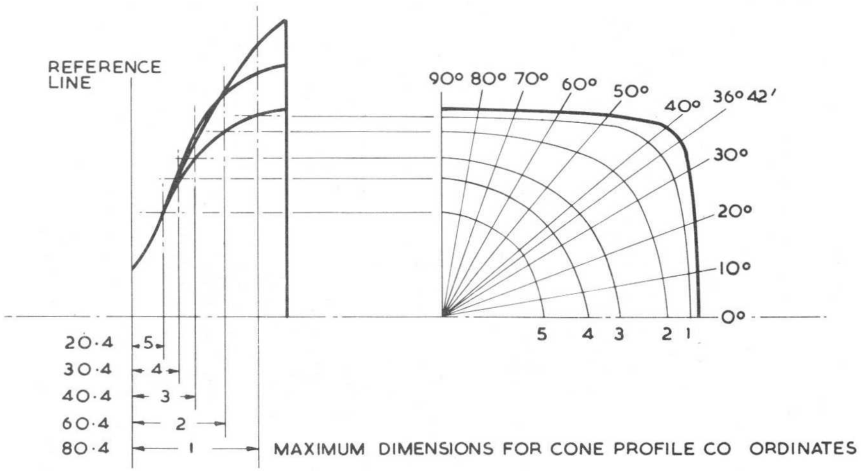

All dimensions in mm

* The bolts to be used for mounting the tube must lie within the circles of 7.5 mm diameter centred on these true positions. One of the four lugs may deviate 2 mm maximum from the plane through the other three lugs.

† Determined by reference line gauge No. 16(B.S. RL4 : IEC 67-IV-3 : JEDEC 126).

Minimum useful screen area 646 $cm^2$




All dimensions in mm

Not to be scaled

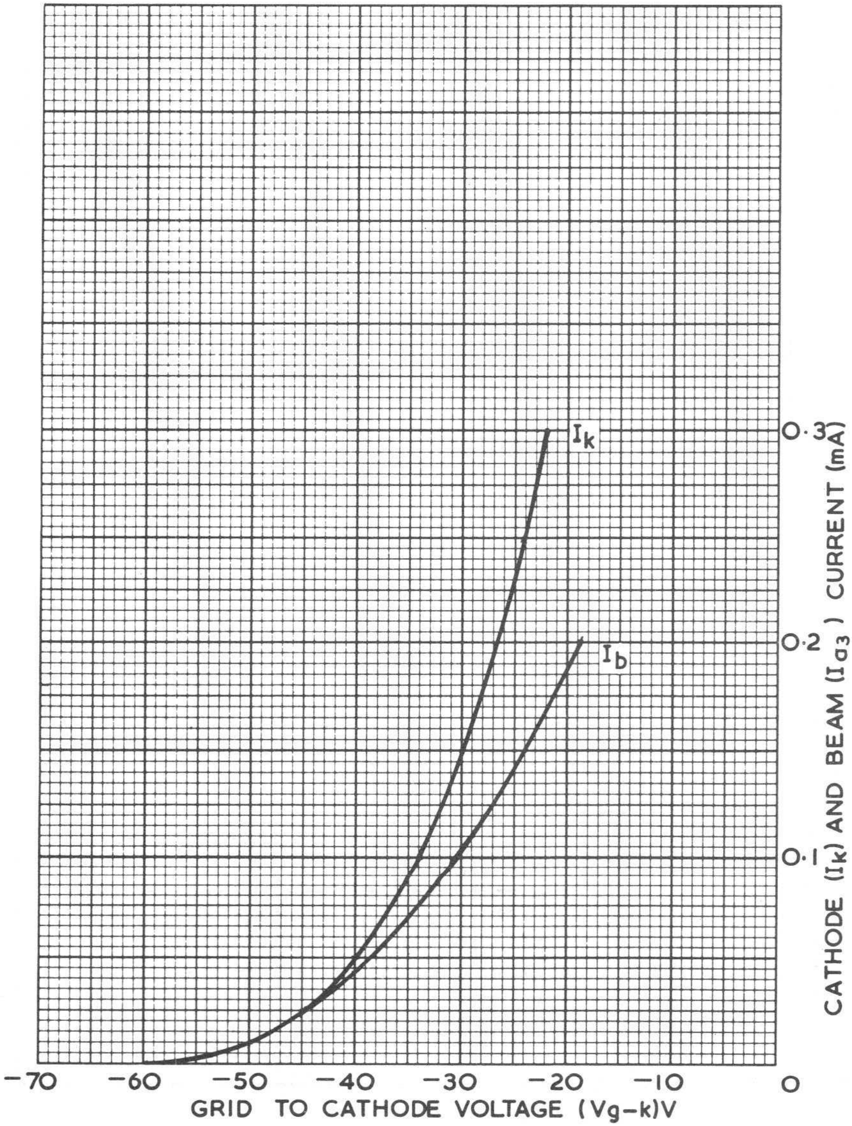
| Reference Plane No. | 0° Major | 10° | 20° | 30° | 36°42′ Diag. | 40° | 50° | 60° | 70° | 80° | 90° Minor |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 155 | 157 | 162 | 170 | 173 | 171 | 156 | 141 | 131 | 126 | 124 |
| 2 | 140 | 141 | 143 | 143 | 141 | 140 | 134 | 126 | 119 | 116 | 115 |
| 3 | 112 | 112 | 110 | 108 | 106 | 105 | 104 | 102 | 101 | 99 | 99 |
| 4 | 90 | 89 | 88 | 86 | 86 | 86 | 85 | 85 | 86 | 86 | 85 |
| 5 | 63 | 64 | 63 | 63 | 63 | 63 | 63 | 64 | 64 | 64 | 64 |

# M38 – 142..  Data Display or Monitor Tube

## GRID MODULATION

$I_k$, $I_{a3}$ / $V_{g-k}$  $V_{a3}$ = 17 kV  $V_{a1}$ = 450V

OPTIMUM FOCUS

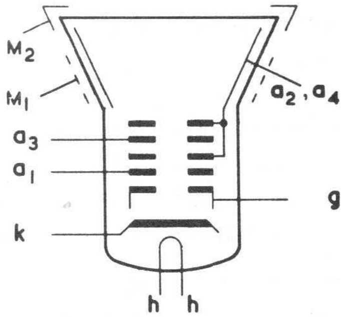


# Data Display or Monitor Tube **M44-120..**

**GENERAL**

Rectangular face, 17 inch, 110° diagonal
Rimguard III reinforced envelope
Integral mounting lugs
Electrostatic focus, magnetic deflection
Aluminised screen
Grey glass, 48% transmission (approx.)
Straight gun, non ion trap
External conductive coating

| | | | |
|---|---|---|---|
| Heater voltage | $V_h$ | 6.3 | V |
| Heater current | $I_h$ | 0.3* | A |




**DESIGN CENTRE RATINGS** - Voltages referred to cathode

| | | | |
|---|---|---|---|
| Maximum second and fourth anode voltage | $V_{a2+a4(max)}$ | 18† | kV |
| Minimum second and fourth anode voltage | $V_{a2+a4(min)}$ | 13 | kV |
| Maximum third anode voltage | $V_{a3(max)}$ | +1000 to -500 | V |
| Maximum first anode voltage | $V_{a1(max)}$ | 700 | V |
| Maximum negative grid voltage | $-V_{g(max)}$ | 150 | V |
| Maximum peak negative grid voltage | $-v_{g(pk)max}$ | 400** | V |
| Maximum positive grid voltage | $V_{g(max)}$ | 0 ¶ | V |
| Maximum heater to cathode voltage, heater negative (d.c.) | $V_{h-k(max)}$ | 250 | V |
| Maximum peak heater to cathode voltage, heater negative (absolute rating) | $v_{h-k(pk)max}$ | 400 § | V |
| Maximum impedance, grid to cathode (50 Hz) | $Z_{g-k(max)}$ | 0.5 | MΩ |
| Maximum resistance, grid to cathode | $R_{g-k(max)}$ | 1.5 | MΩ |

* In a series heater chain the CRT should always be connected at the chassis end.

† $I_{a2+a4} = 0$. ** Maximum pulse duration 22% of one cycle with a max. of 1.5 ms.

¶ A 10 kΩ grid series resistor mounted close to the tube base is recommended to limit the peak grid voltage.

§ During a warming-up period not exceeding 45 seconds.

**PHOSPHOR SCREEN**

This type is usually supplied with either a GR phosphor (M44-120GR) giving a yellowish-green trace of very long persistence or a W (television white) phosphor. Other phosphor screens can be made available to special order.

Tubes incorporating a B8H Sparkguard base will have a suffix after the type number. For details of the Sparkguard bases see separate sheets.

DATA DISPLAY & MONITOR TUBES

**Thorn Radio Valves and Tubes Limited** BRIMAR

### INTER-ELECTRODE CAPACITANCES

| | | * | † | |
|---|---|---|---|---|
| Cathode to all | $c_{k-all}$ | 3.0 | 3.5 | pF |
| Grid to all | $c_{g-all}$ | 7.0 | 8.5 | pF |
| Anodes 2 and 4 to coating $M_1$ (approx.) | $c_{a2+a4-M1}$ | 700 to 1300 | | pF |
| Anodes 2 and 4 to shell $M_2$ (approx.) | $c_{a2+a4-M2}$ | 200 | | pF |

* Holder capacitance balanced out.

† Total capacitances including a typical B8H holder.

### TYPICAL OPERATION - Grid modulation, voltage referred to cathode

| | | | | |
|---|---|---|---|---|
| Second and fourth anode voltage | $V_{a2+a4-k}$ | 16 | 16 | kV |
| First anode voltage ¶ | $V_{a1-k}$ | 400 | 500 | V |
| Third anode voltage range for focus | $V_{a3-k}$ | 0 to 400 | 0 to 400 | V |
| Final anode current (peak) | $i_{a2+a4(pk)}$ | 500 | 500 | μA |
| Average peak to peak picture modulating voltage | | 40.5 | 45 | V |
| Grid to cathode voltage limits for cut-off of raster | $V_{g-k}$ | -40 to -77 | -50 to -93 | V |
| GR screen raster persistence to 10% (approx.) | | 2.0 | | s |

### TYPICAL OPERATION - Cathode modulation, voltage referred to grid

| | | | | |
|---|---|---|---|---|
| Second and fourth anode voltage | $V_{a2+a4-g}$ | 16 | 16 | kV |
| First anode voltage ¶ | $V_{a1-g}$ | 400 | 500 | V |
| Third anode voltage range for focus | $V_{a3-g}$ | 0 to 400 | 0 to 400 | V |
| Final anode current (peak) | $i_{a2+a4(pk)}$ | 500 | 500 | μA |
| Average peak to peak picture modulating voltage | | 35.5 | 39.5 | V |
| Cathode to grid voltage limits for cut-off of raster | $V_{k-g}$ | 36 to 66 | 45 to 80 | V |
| GR screen raster persistence to 10% (approx.) | | 2.0 | | s |

¶ Within this range a higher first anode voltage will provide improved focus performance.

If this tube is operated at voltages in excess of 18 kV, x-ray radiation shielding may be necessary to avoid possible danger of personal injury from prolonged exposure at close range.

**PICTURE CENTRING**

| | | |
|---|---|---|
| Maximum magnet flux density at centre of neck should not be less than | 17 | Gs |
| Maximum distance of centre of magnetic field from reference line | 53 | mm |

**DEFLECTION ANGLES**

Height 83° Width 100° Diagonal 110°

**MOUNTING**

This tube is intended for 'push-through' presentation without masking, but if a mask is used it should be flexible enough to take up small variations in fixing and bulb contours.

There is an annular region of anti-corona coating with external diameter of 100 mm surrounding the CT8 cap, the tube should not be handled in this region.

The tube can be mounted in any position. The tube socket should not be rigidly mounted but should have flexible leads and be allowed to move freely. The bottom circumference of the base shell will fall within a circle of 44 mm diameter which is centred on the perpendicular from the centre of the face.

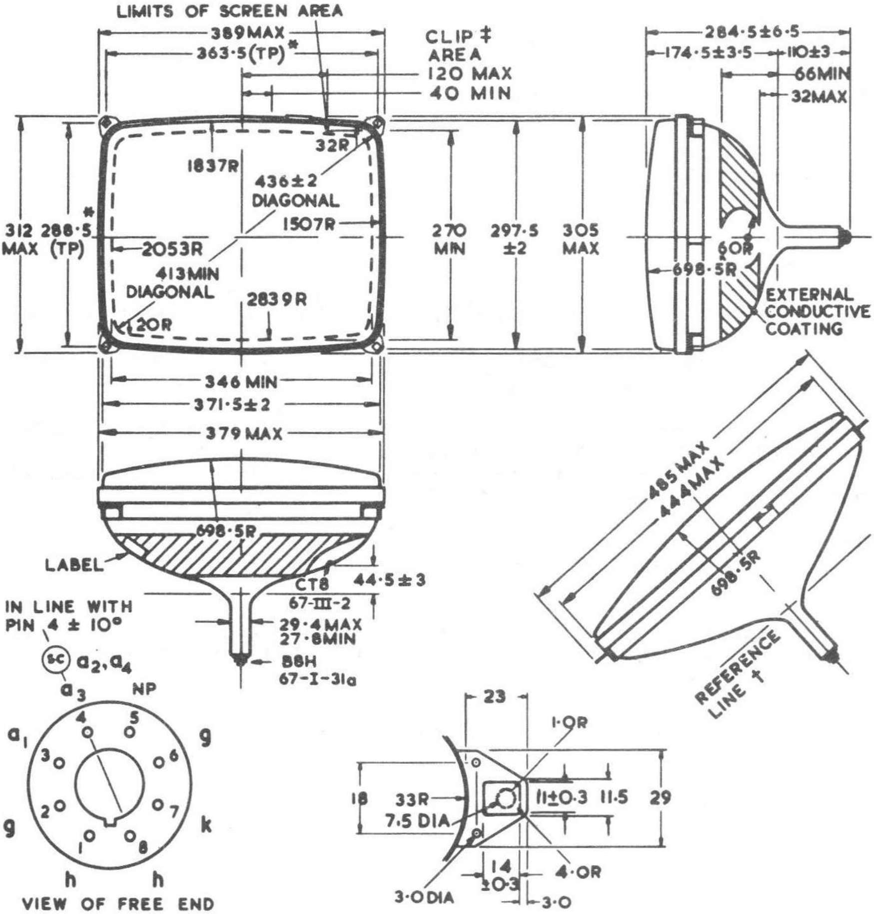
The external conductive coating ($M_1$) of this tube should be connected to chassis. The capacitance between this coating and final anode may be used to provide smoothing for the e.h.t. supply.

The metal frame ($M_2$) should be connected directly to the chassis in an a.c. receiver operating from an isolating transformer, or via a suitable leakage path in an a.c./d.c. receiver, for example 2 MΩ.

**TUBE WEIGHT** (approximate) - net 5.5 kg (12 lb)

Characteristic curves as M50-120..

# Data Display or Monitor Tube



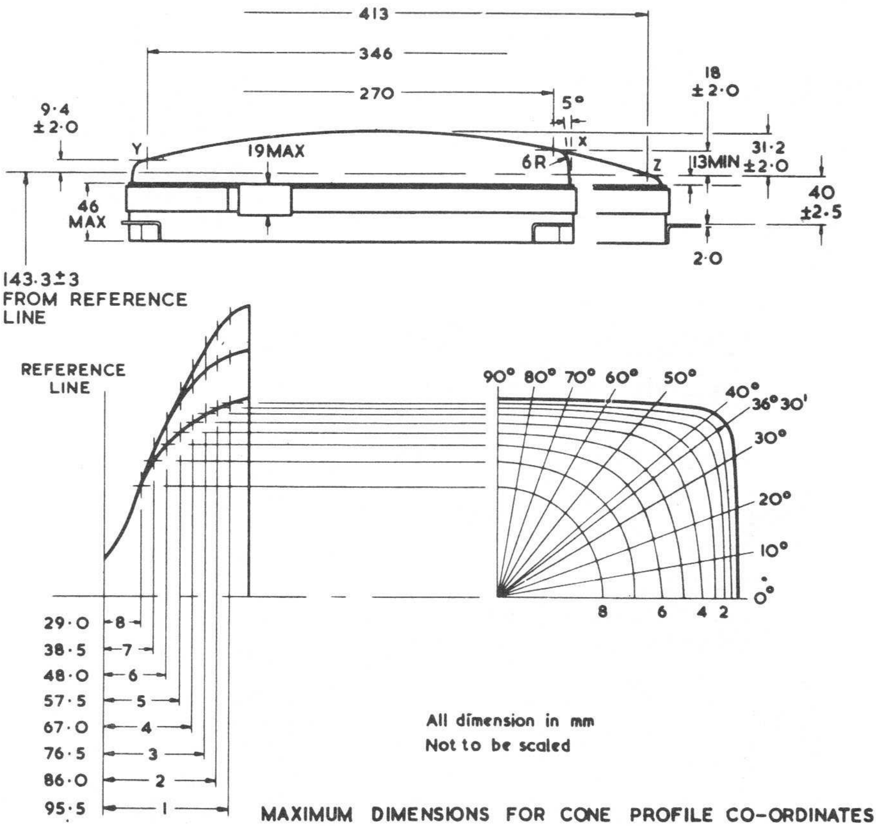

All dimensions in mm

Not to be scaled

* The bolts to be used for mounting the tube must lie within the circles of 7.5 mm. diameter centred on these true positions. One of the four lugs may deviate 2 mm maximum from the plane through the other three lugs.

† Determined by reference line gauge No. 16 (B.S. RL4 : IEC 67-IV-3:JEDEC 126)

‡ Total thickness of shell, tension band and clip 8 mm maximum.

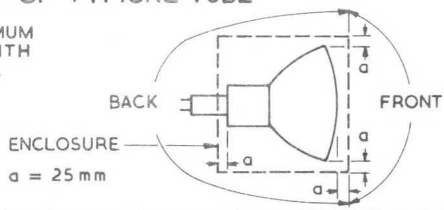



MAXIMUM DIMENSIONS FOR CONE PROFILE CO-ORDINATES

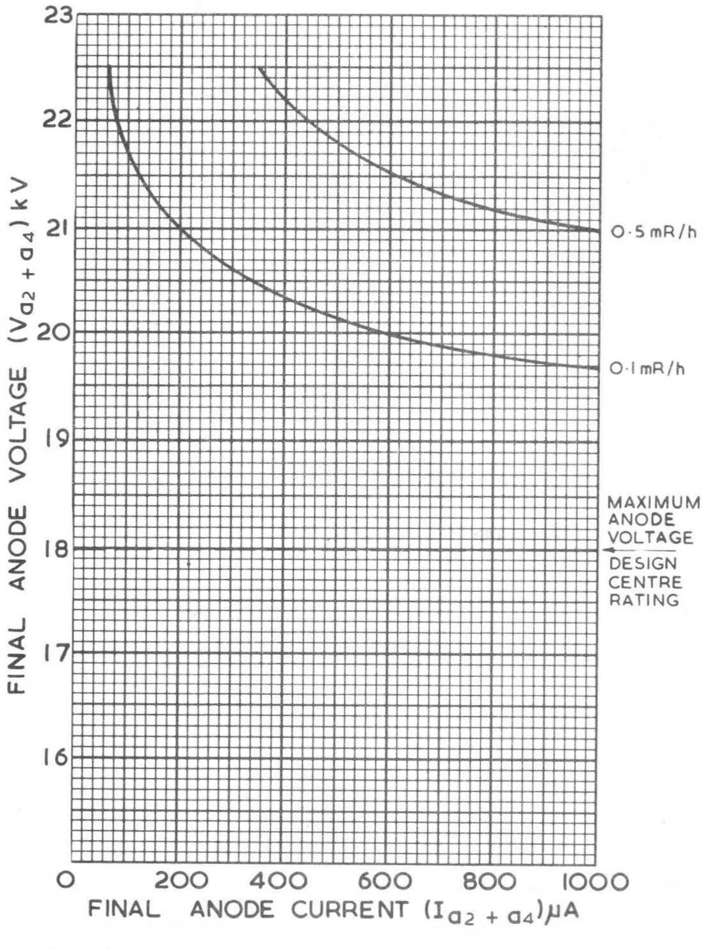
| Reference Plane No. | 0° Major | 10° | 20° | 30° | 36°30' Diag. | 40° | 50° | 60° | 70° | 80° | 90° Minor |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 181.0 | 183.0 | 190.0 | 202.5 | 210.8 | 209.0 | 182.5 | 164.5 | 153.0 | 147.1 | 145.0 |
| 2 | 175.8 | 177.8 | 184.2 | 195.7 | 199.0 | 197.3 | 177.0 | 159.7 | 148.6 | 142.9 | 141.0 |
| 3 | 168.8 | 170.2 | 175.4 | 183.6 | 184.8 | 183.6 | 170.1 | 154.0 | 143.6 | 138.1 | 136.2 |
| 4 | 158.7 | 159.2 | 161.9 | 166.3 | 168.1 | 167.7 | 159.2 | 144.9 | 136.7 | 131.9 | 130.1 |
| 5 | 144.1 | 144.6 | 146.2 | 148.7 | 149.9 | 149.3 | 144.0 | 134.2 | 127.3 | 123.5 | 122.4 |
| 6 | 127.3 | 127.3 | 128.8 | 130.7 | 131.2 | 130.8 | 126.8 | 121.0 | 116.5 | 114.2 | 113.2 |
| 7 | 107.5 | 107.8 | 108.7 | 109.5 | 109.5 | 109.4 | 107.7 | 104.8 | 102.3 | 101.0 | 100.3 |
| 8 | 82.8 | 82.8 | 82.8 | 82.8 | 82.8 | 82.8 | 82.8 | 82.8 | 82.8 | 82.8 | 82.8 |

## X-RAY ISO–EXPOSURE CURVES OF TYPICAL TUBE

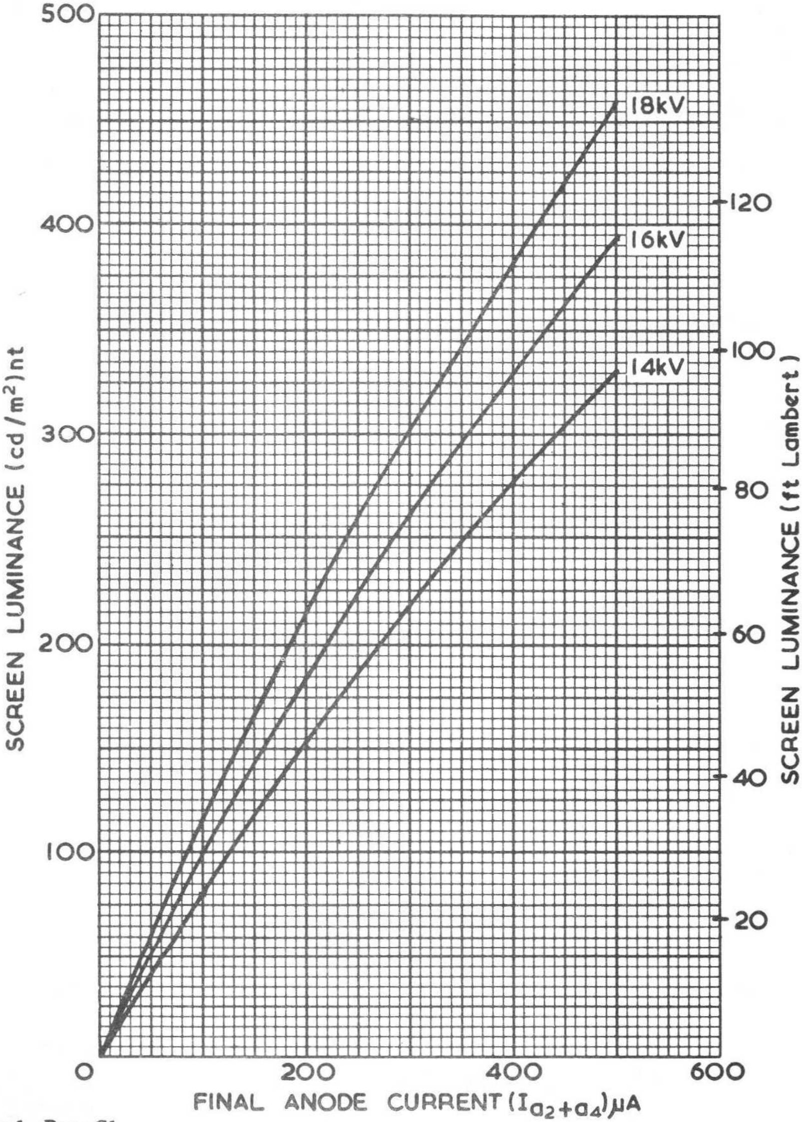
MEASUREMENTS MADE ON LINES OF MAXIMUM RADIATION AT FRONT AND BACK OF TUBE WITH DETECTOR CENTRE 50mm FROM NOTIONAL ENCLOSURE DEFINED BY DIAGRAM.




UNDER NO CONDITION REPRESENTED HERE DOES THE RADIATION FROM THE TUBE FRONT EXCEED 0·1mR/h



TYPICAL CHARACTERISTICS
W PHOSPHOR SCREEN
FOCUSED RASTER OF FULL HEIGHT
4x3 ASPECT RATIO

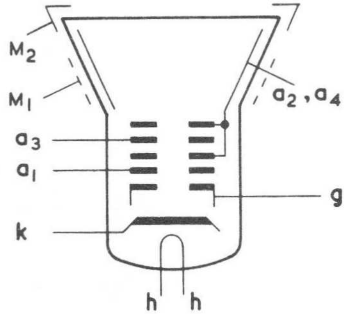


# M50-120..　　Data Display or Monitor Tube

## GENERAL

Rectangular face, 20 inch, 110° diagonal
Rimguard III reinforced envelope
Integral mounting lugs
Electrostatic focus, magnetic deflection
Aluminised screen
Grey glass, 45% transmission (approx.)
Straight gun, non ion trap
External conductive coating

| | | | |
|---|---|---|---|
| Heater voltage | $V_h$ | 6.3 | V |
| Heater current | $I_h$ | 0.3* | A |




## DESIGN CENTRE RATINGS - Voltages referred to cathode

| | | | |
|---|---|---|---|
| Maximum second and fourth anode voltage | $V_{a2+a4(max)}$ | 20† | kV |
| Minimum second and fourth anode voltage | $V_{a2+a4(min)}$ | 13 | kV |
| Maximum third anode voltage | $V_{a3(max)}$ | +1000 to -500 | V |
| Maximum first anode voltage | $V_{a1(max)}$ | 700 | V |
| Maximum negative grid voltage | $-V_{g(max)}$ | 150 | V |
| Maximum peak negative grid voltage | $-v_{g(pk)max}$ | 400** | V |
| Maximum positive grid voltage | $V_{g(max)}$ | 0¶ | V |
| Maximum heater to cathode voltage, heater negative (d.c.) | $V_{h-k(max)}$ | 250 | V |
| Maximum peak heater to cathode voltage, heater negative (absolute rating) | $v_{h-k(pk)max}$ | 400§ | V |
| Maximum impedance, grid to cathode (50 Hz) | $Z_{g-k(max)}$ | 0.5 | MΩ |
| Maximum resistance, grid to cathode | $R_{g-k(max)}$ | 1.5 | MΩ |

* In a series heater chain the CRT should always be connected at the chassis end.

† $I_{a2+a4} = 0$. **Maximum pulse duration 22% of one cycle with a max. of 1.5 ms.

¶ A 10 kΩ grid series resistor mounted close to the tube base is recommended to limit the peak grid voltage.

§ During a warming-up period not exceeding 45 seconds.

## PHOSPHOR SCREEN

This type is usually supplied with either a GR phosphor (M50-120GR) giving a yellowish-green trace of very long persistence or a W (television white) phosphor. Other phosphor screens can be made available to special order.

Tubes incorporating a B8H Sparkguard base will have a suffix after the type number. For details of the Sparkguard bases see separate sheets.

**INTER-ELECTRODE CAPACITANCES**

| | | * | | † | |
|---|---|---|---|---|---|
| Cathode to all | $c_{k\text{-}all}$ | 3.0 | | 3.5 | pF |
| Grid to all | $c_{g\text{-}all}$ | 7.0 | | 8.5 | pF |
| Anodes 2 and 4 to coating $M_1$ (approx.) | $c_{a2+a4\text{-}M1}$ | | 1000 | | pF |
| Anodes 2 and 4 to shell $M_2$ (approx.) | $c_{a2+a4\text{-}M2}$ | | 350 | | pF |

* Holder capacitance balanced out.

† Total capacitances including a typical B8H holder.

**TYPICAL OPERATION** - Grid modulation, voltage referred to cathode

| | | | | | |
|---|---|---|---|---|---|
| Second and fourth anode voltage | $V_{a2+a4\text{-}k}$ | 16 | | 16 | kV |
| First anode voltage ¶ | $V_{a1\text{-}k}$ | 400 | | 500 | V |
| Third anode voltage range for focus | $V_{a3\text{-}k}$ | 0 to 400 | | 0 to 400 | V |
| Final anode current (peak) | $i_{a2+a4(pk)}$ | 500 | | 500 | $\mu$A |
| Average peak to peak picture modulating voltage | | 40.5 | | 45 | V |
| Grid to cathode voltage limits for cut-off of raster | $V_{g\text{-}k}$ | -40 to -77 | | -50 to -93 | V |
| GR screen raster persistence to 10% (approx.) | | | 2.0 | | s |

**TYPICAL OPERATION** - Cathode modulation, voltage referred to grid

| | | | | | |
|---|---|---|---|---|---|
| Second and fourth anode voltage | $V_{a2+a4\text{-}g}$ | 16 | | 16 | kV |
| First anode voltage ¶ | $V_{a1\text{-}g}$ | 400 | | 500 | V |
| Third anode voltage range for focus | $V_{a3\text{-}g}$ | 0 to 400 | | 0 to 400 | V |
| Final anode current (peak) | $i_{a2+a4(pk)}$ | 500 | | 500 | $\mu$A |
| Average peak to peak picture modulating voltage | | 35.5 | | 39.5 | V |
| Cathode to grid voltage limits for cut-off of raster | $V_{k\text{-}g}$ | 36 to 66 | | 45 to 80 | V |
| GR screen raster persistence to 10% (approx.) | | | 2.0 | | s |

¶ Within this range a higher first anode voltage will provide improved focus performance.

If this tube is operated at voltages in excess of 20 kV, x-ray radiation shielding may be necessary to avoid possible danger of personal injury from prolonged exposure at close range.

**PICTURE CENTRING**

| | | |
|---|---|---|
| Maximum magnet flux density at centre of neck should not be less than | 17 | Gs |
| Maximum distance of centre of magnetic field from reference line | 53 | mm |

**DEFLECTION ANGLES**

Height 81° Width 98° Diagonal 110°

**MOUNTING**

This tube is intended for 'push-through' presentation without masking, but if a mask is used it should be flexible enough to take up small variations in fixing and bulb contours.

There is an annular region of anti-corona coating with external diameter of 100 mm surrounding the CT8 cap, the tube should not be handled in this region.

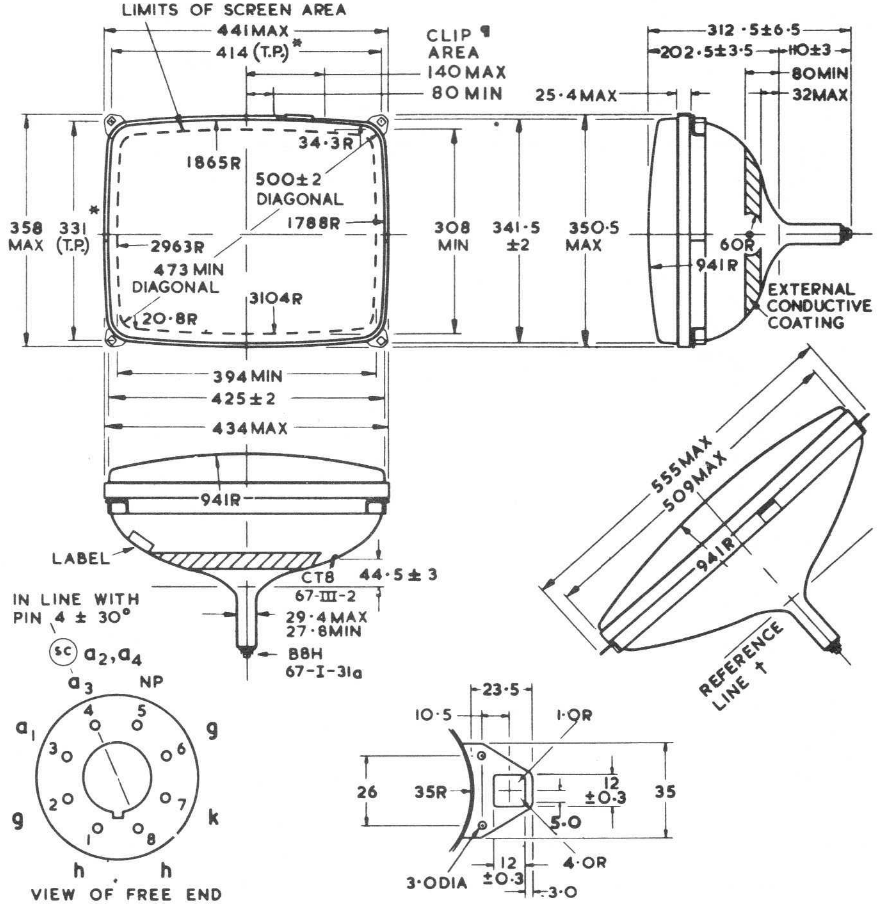
The tube can be mounted in any position. The tube socket should not be rigidly mounted but should have flexible leads and be allowed to move freely. The bottom circumference of the base shell will fall within a circle of 40 mm diameter which is centred on the perpendicular from the centre of the face.

The external conductive coating ($M_1$) of this tube should be connected to chassis. The capacitance between this coating and final anode may be used to provide smoothing for the e.h.t. supply.

The metal frame ($M_2$) should be connected directly to the chassis in an a.c. receiver operating from an isolating transformer, or via a suitable leakage path in an a.c./d.c. receiver, for example 2 MΩ.

**TUBE WEIGHT** (approximate) - net 9.5 kg (21 lb)

# Data Display or Monitor Tube M50-120..




All dimensions in mm

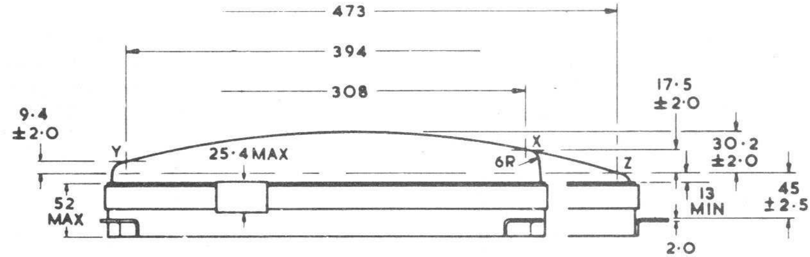
Not to be scaled

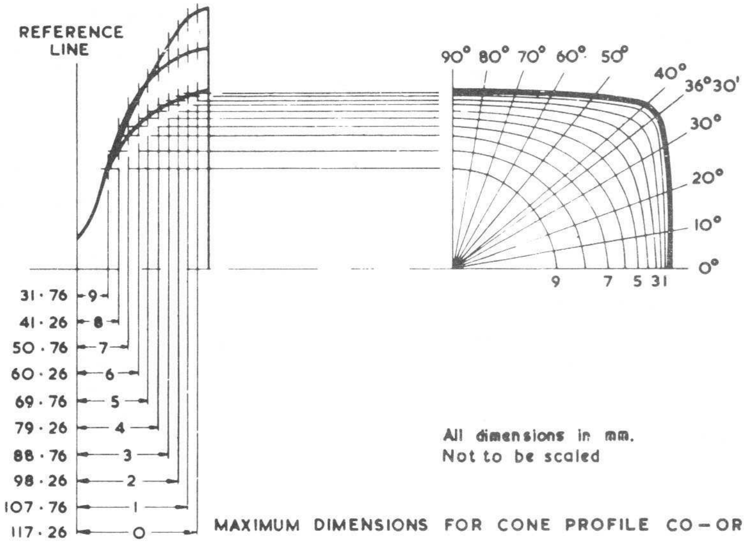
* The bolts to be used for mounting the tube must lie within the circles of 8.0 mm diameter centred on these true positions. One of the four lugs may deviate 2.0 mm maximum from the plane through the other three lugs.

† Determined by reference line gauge No. 16 (B.S.RL4 : IEC 67-IV-3 : JEDEC 126). See T.D.S. 5-0-91-16.

¶ Total thickness of shell, tension band and clip 8.0 mm maximum.

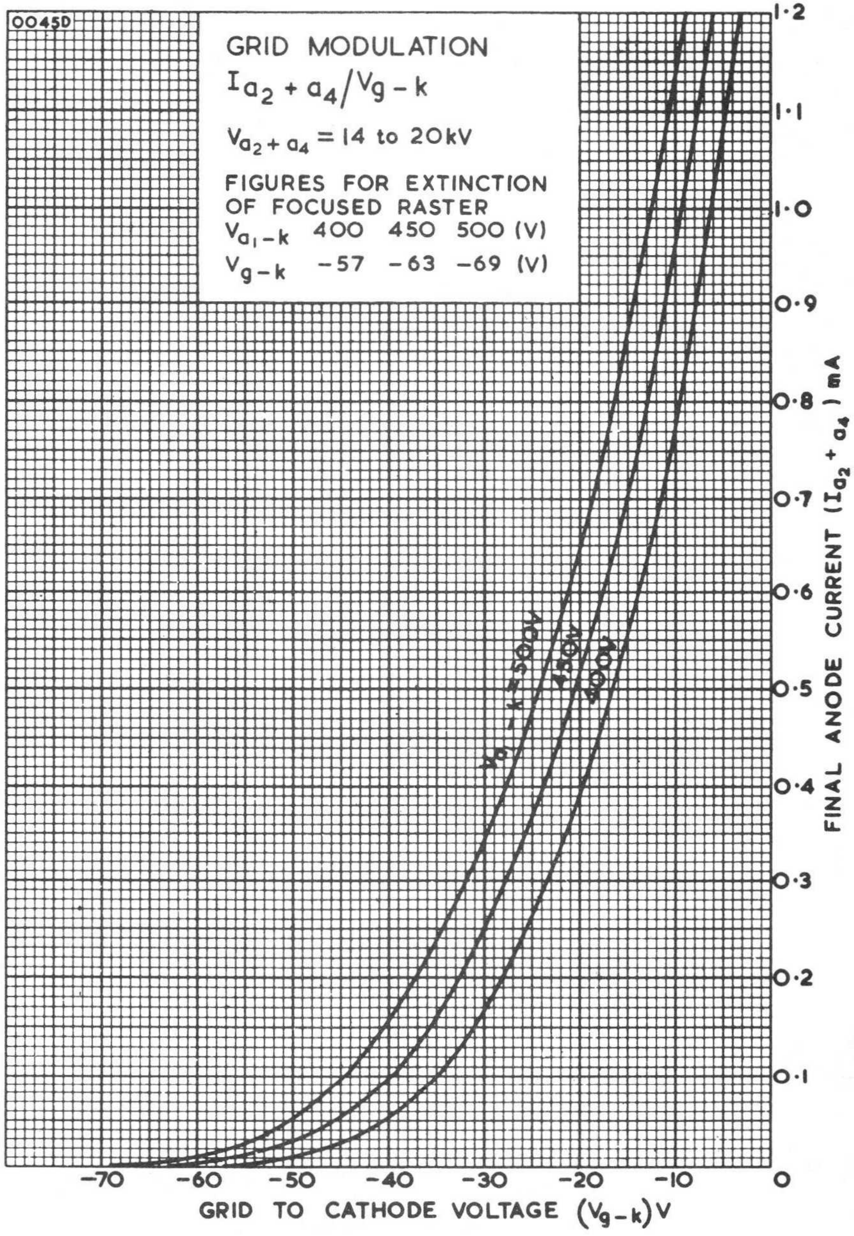
DATA DISPLAY & MONITOR TUBES



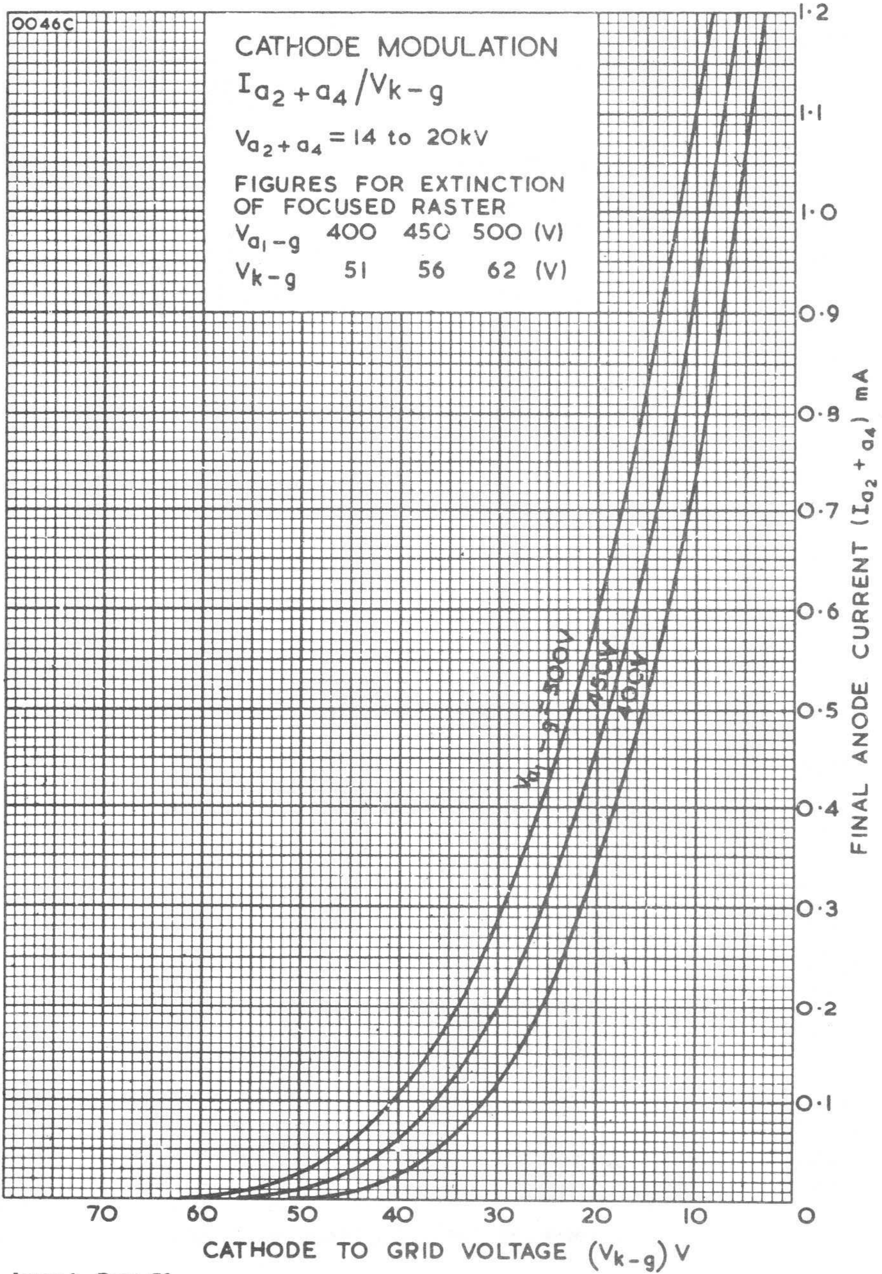



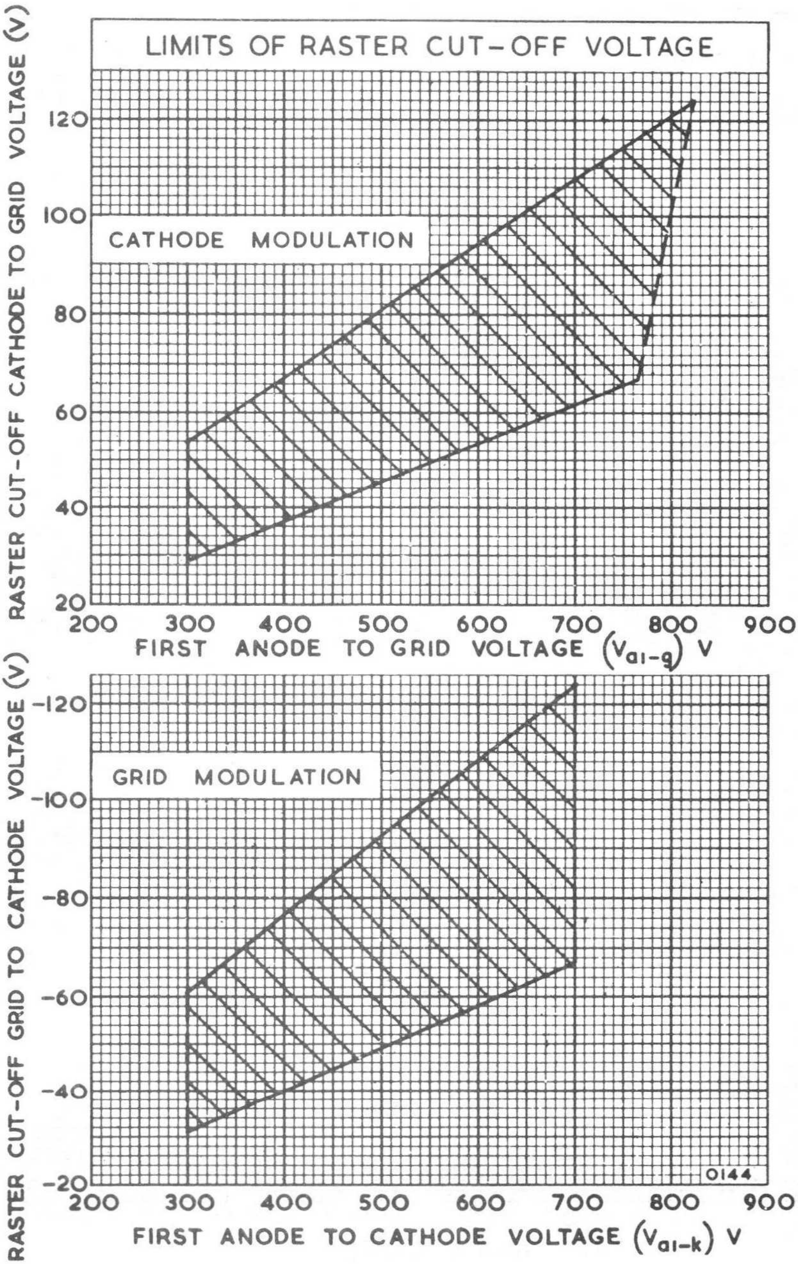

MAXIMUM DIMENSIONS FOR CONE PROFILE CO-ORDINATES

| Reference Plane No. | 0° Major | 10° | 20° | 30° | 36°30' Diag. | 40° | 50° | 60° | 70° | 80° | 90° Minor |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 210.5 | 213.3 | 222.0 | 237.8 | 247.1 | 243.7 | 213.5 | 192.0 | 178.6 | 171.3 | 168.9 |
| 1 | 207.0 | 209.6 | 218.0 | 233.4 | 241.2 | 238.1 | 209.5 | 188.5 | 175.0 | 167.8 | 165.5 |
| 2 | 202.7 | 205.2 | 212.4 | 225.0 | 228.3 | 225.6 | 202.3 | 183.2 | 170.5 | 163.9 | 162.0 |
| 3 | 197.1 | 198.8 | 204.4 | 213.0 | 213.9 | 211.6 | 192.7 | 176.4 | 165.3 | 159.2 | 157.8 |
| 4 | 190.0 | 191.0 | 194.6 | 198.8 | 198.5 | 196.1 | 181.8 | 168.0 | 159.2 | 153.7 | 152.6 |
| 5 | 180.9 | 181.4 | 182.7 | 183.6 | 182.0 | 179.7 | 169.2 | 158.5 | 151.3 | 147.0 | 146.2 |
| 6 | 168.8 | 168.5 | 168.6 | 167.0 | 164.2 | 162.1 | 154.3 | 147.3 | 142.0 | 139.2 | 138.3 |
| 7 | 151.5 | 150.4 | 149.5 | 147.2 | 144.8 | 143.4 | 138.2 | 134.0 | 131.2 | 129.0 | 128.5 |
| 8 | 130.1 | 128.5 | 126.6 | 125.0 | 123.3 | 122.6 | 120.0 | 118.2 | 116.7 | 116.0 | 115.9 |
| 9 | 103.4 | 102.5 | 101.0 | 99.6 | 99.2 | 99.2 | 99.1 | 99.1 | 98.9 | 98.7 | 98.4 |



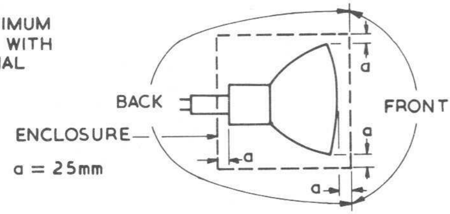

DATA DISPLAY & MONITOR TUBES


0046C
CATHODE MODULATION
$I_{a2+a4}/V_{k-g}$
$V_{a2+a4}$ = 14 to 20kV
FIGURES FOR EXTINCTION OF FOCUSED RASTER
$V_{a1-g}$ 400 450 500 (V)
$V_{k-g}$ 51 56 62 (V)
$V_{a1-g}$ = 500V
450V
400V
FINAL ANODE CURRENT ($I_{a2}+a_4$) mA
1·2 1·1 1·0 0·9 0·8 0·7 0·6 0·5 0·4 0·3 0·2 0·1 0
70 60 50 40 30 20 10 0
CATHODE TO GRID VOLTAGE ($V_{k-g}$) V


LIMITS OF RASTER CUT-OFF VOLTAGE
CATHODE MODULATION
RASTER CUT-OFF CATHODE TO GRID VOLTAGE (V)
120
100
80
60
40
20
200 300 400 500 600 700 800 900
FIRST ANODE TO GRID VOLTAGE ($V_{a1-g}$) V
GRID MODULATION
RASTER CUT-OFF GRID TO CATHODE VOLTAGE (V)
-120
-100
-80
-60
-40
-20
200 300 400 500 600 700 800 900
FIRST ANODE TO CATHODE VOLTAGE ($V_{a1-k}$) V
0144

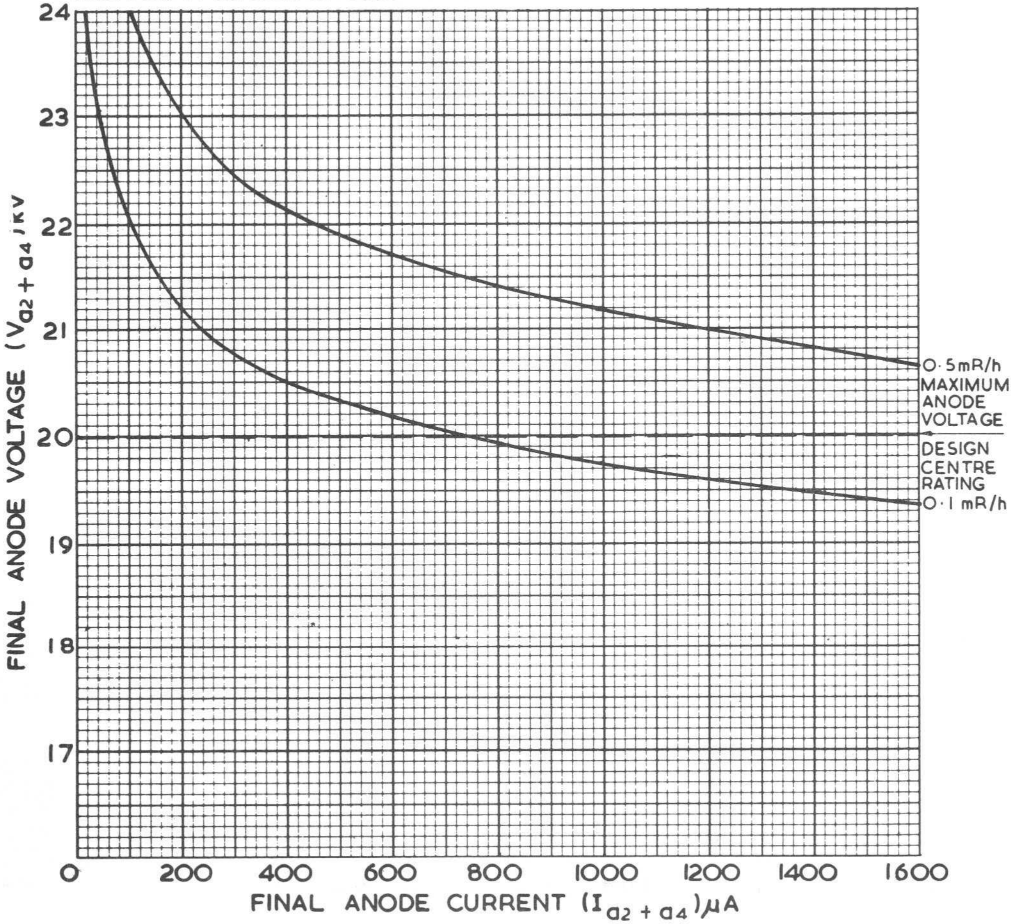
## X-RAY ISO-EXPOSURE CURVES OF TYPICAL TUBE

MEASUREMENTS MADE ON LINES OF MAXIMUM RADIATION AT FRONT AND BACK OF TUBE WITH DETECTOR CENTRE 50mm FROM NOTIONAL ENCLOSURE DEFINED BY DIAGRAM

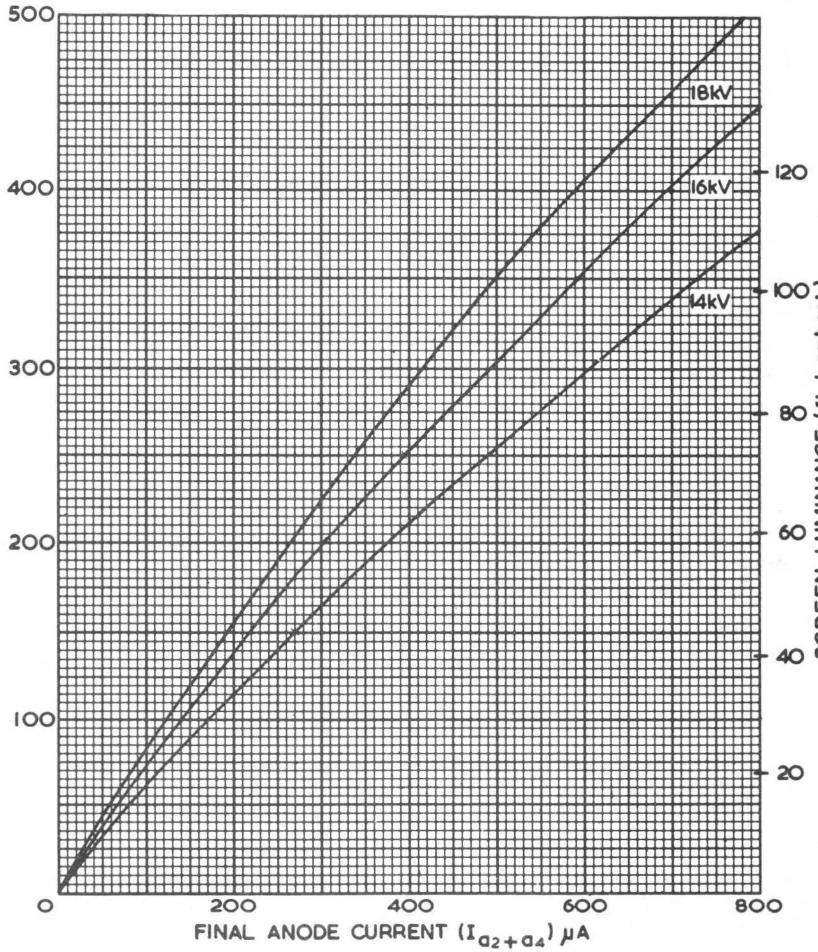



UNDER NO CONDITION REPRESENTED HERE DOES THE RADIATION FROM THE TUBE FRONT EXCEED 0·1 mR/h

RADIATION FROM BACK OF TUBE



TYPICAL CHARACTERISTICS
W PHOSPHOR SCREEN
FOCUSED RASTER OF FULL HEIGHT

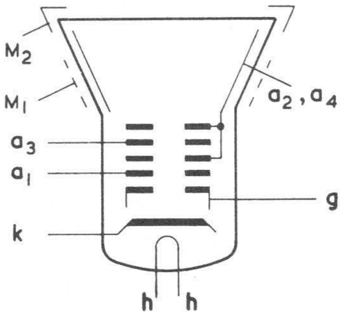


# M61-120.. Data Display or Monitor Tube

**GENERAL**

Rectangular face, 24 inch, 110° diagonal
Rimguard III reinforced envelope
Integral mounting lugs
Electrostatic focus, magnetic deflection
Aluminised screen
Grey glass, 42% transmission (approx.)
Straight gun, non ion trap
External conductive coating

| | | | |
|---|---|---|---|
| Heater voltage | $V_h$ | 6.3 | V |
| Heater current | $I_h$ | 0.3* | A |




**DESIGN CENTRE RATINGS** - Voltages referred to cathode

| | | | |
|---|---|---|---|
| Maximum second and fourth anode voltage | $V_{a2+a4(max)}$ | 20† | kV |
| Minimum second and fourth anode voltage | $V_{a2+a4(min)}$ | 13 | kV |
| Maximum third anode voltage | $V_{a3(max)}$ | +1000 to -500 | V |
| Maximum first anode voltage | $V_{a1(max)}$ | 700 | V |
| Maximum negative grid voltage | $-V_{g(max)}$ | 150 | V |
| Maximum peak negative grid voltage | $-v_{g(pk)max}$ | 400** | V |
| Maximum positive grid voltage | $V_{g(max)}$ | 0¶ | V |
| Maximum heater to cathode voltage, heater negative (d.c.) | $V_{h-k(max)}$ | 250 | V |
| Maximum peak heater to cathode voltage, heater negative (absolute rating) | $v_{h-k(pk)max}$ | 400§ | V |
| Maximum impedance, grid to cathode (50 Hz) | $Z_{g-k(max)}$ | 0.5 | MΩ |
| Maximum resistance, grid to cathode | $R_{g-k(max)}$ | 1.5 | MΩ |

* In a series heater chain the CRT should always be connected at the chassis end.

† $I_{a2+a4} = 0$.   ** Maximum pulse duration 22% of one cycle with a max. of 1.5 ms.

¶ A 10 kΩ grid series resistor mounted close to the tube base is recommended to limit the peak grid voltage.

§ During a warming-up period not exceeding 45 seconds.

**PHOSPHOR SCREEN**

This type is usually supplied with either a GR phosphor (M61-120GR) giving a yellowish-green trace of very long persistence or a W (television white) phosphor. Other phosphor screens can be made available to special order.

Tubes incorporating a B8H Sparkguard base will have a suffix after the type number. For details of the Sparkguard bases see separate sheets.

**Thorn Radio Valves and Tubes Limited**

BRIMAR

# Data Display or Monitor Tube M61-120..

**INTER-ELECTRODE CAPACITANCES**

| | | * | | † | |
|---|---|---|---|---|---|
| Cathode to all | $c_{k-all}$ | 3.0 | | 3.5 | pF |
| Grid to all | $c_{g-all}$ | 7.0 | | 8.5 | pF |
| Anodes 2 and 4 to coating $M_1$ (approx.) | $c_{a2+a4-M1}$ | | 1000 | | pF |
| Anodes 2 and 4 to shell $M_2$ (approx.) | $c_{a2+a4-M2}$ | | 350 | | pF |

* Holder capacitance balanced out.

† Total capacitances including a typical B8H holder.

**TYPICAL OPERATION** - Grid modulation, voltage referred to cathode

| | | | | | |
|---|---|---|---|---|---|
| Second and fourth anode voltage | $V_{a2+a4-k}$ | 16 | | 16 | kV |
| First anode voltage ¶ | $V_{a1-k}$ | 400 | | 500 | V |
| Third anode voltage range for focus | $V_{a3-k}$ | 0 to 400 | | 0 to 400 | V |
| Final anode current (peak) | $i_{a2+a4(pk)}$ | 500 | | 500 | µA |
| Average peak to peak picture modulating voltage | | 40.5 | | 45 | V |
| Grid to cathode voltage limits for cut-off of raster | $V_{g-k}$ | -40 to -77 | | -50 to -93 | V |
| GR screen raster persistence to 10% (approx.) | | | 2.0 | | s |

**TYPICAL OPERATION** - Cathode modulation, voltage referred to grid

| | | | | | |
|---|---|---|---|---|---|
| Second and fourth anode voltage | $V_{a2+a4-g}$ | 16 | | 16 | kV |
| First anode voltage ¶ | $V_{a1-g}$ | 400 | | 500 | V |
| Third anode voltage range for focus | $V_{a3-g}$ | 0 to 400 | | 0 to 400 | V |
| Final anode current (peak) | $i_{a2+a4(pk)}$ | 500 | | 500 | µA |
| Average peak to peak picture modulating voltage | | 35.5 | | 39.5 | V |
| Cathode to grid voltage limits for cut-off of raster | $V_{k-g}$ | 36 to 66 | | 45 to 80 | V |
| GR screen raster persistence to 10% (approx.) | | | 2.0 | | s |

¶ Within this range a higher first anode voltage will provide improved focus performance.

If this tube is operated at voltages in excess of 20 kV, x-ray radiation shielding may be necessary to avoid possible danger of personal injury from prolonged exposure at close range.

DATA DISPLAY & MONITOR TUBES

# Data Display or Monitor Tube

## PICTURE CENTRING

| | | |
|---|---|---|
| Maximum magnet flux density at centre of neck should not be less than | 17 | Gs |
| Maximum distance of centre of magnetic field from reference line | 53 | mm |

## DEFLECTION ANGLES

Height 81° Width 98° Diagonal 110°

## MOUNTING

This tube is intended for 'push-through' presentation without masking, but if a mask is used it should be flexible enough to take up small variations in fixing and bulb contours.

There is an annular region of anti-corona coating with external diameter of 100 mm surrounding the CT8 cap, the tube should not be handled in this region.

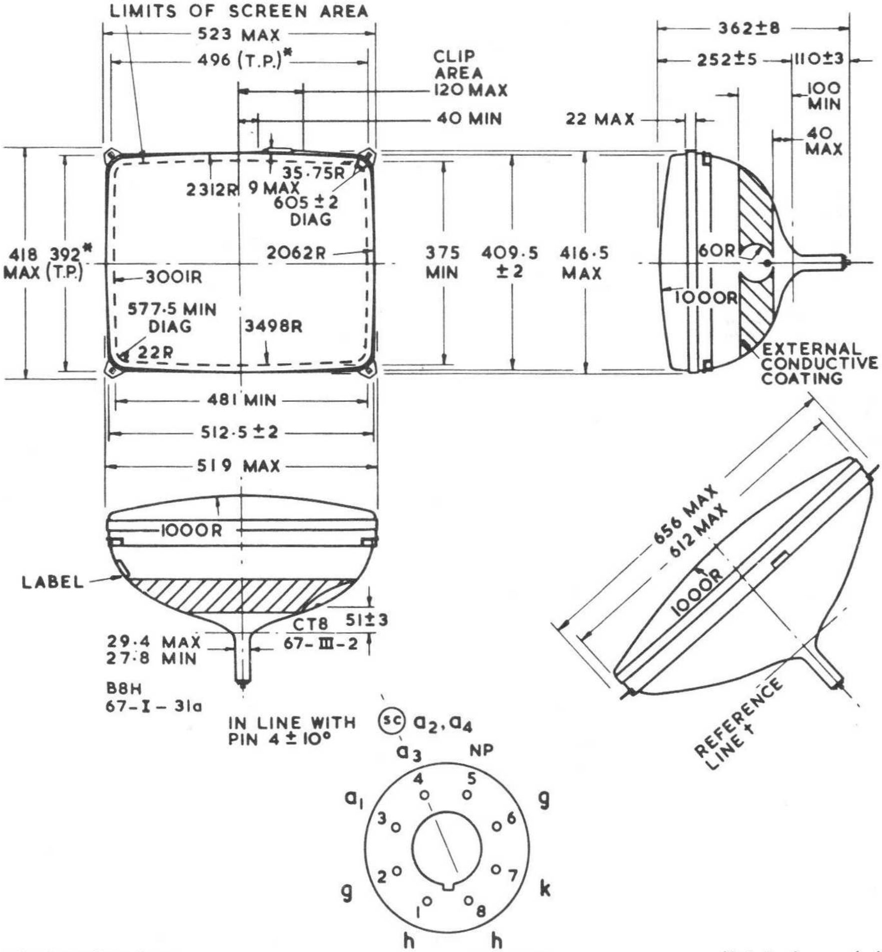
The tube can be mounted in any position. The tube socket should not be rigidly mounted but should have flexible leads and be allowed to move freely. The bottom circumference of the base shell will fall within a circle of 40 mm diameter which is centred on the perpendicular from the centre of the face.

The external conductive coating ($M_1$) of this tube should be connected to chassis. The capacitance between this coating and final anode may be used to provide smoothing for the e.h.t. supply.

The metal frame ($M_2$) should be connected directly to the chassis in an a.c. receiver operating from an isolating transformer, or via a suitable leakage path in an a.c./d.c. receiver, for example 2 MΩ.

**TUBE WEIGHT** (approximate) - net 13.2 kg (29 lb)

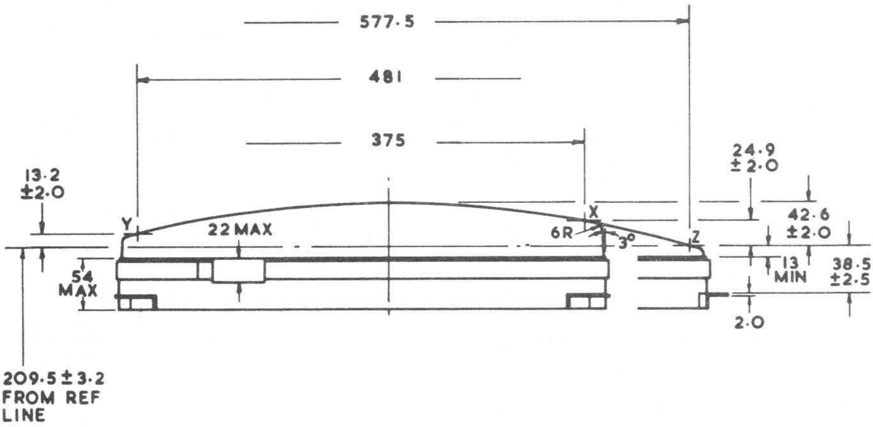
Characteristic curves as M50-120..

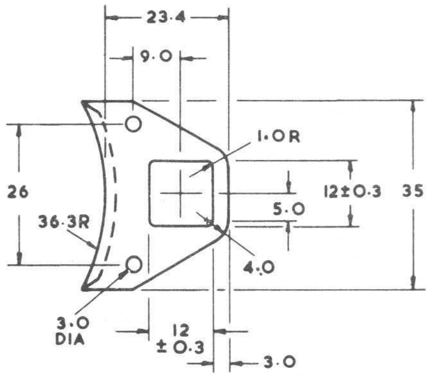



All dimensions in mm    VIEW OF FREE END    Not to be scaled

* The bolts to be used for mounting the tube must lie within the circles of 8.0 mm diameter centred on these true positions. One of the four lugs may deviate 2.0 mm maximum from the plane through the other three lugs.

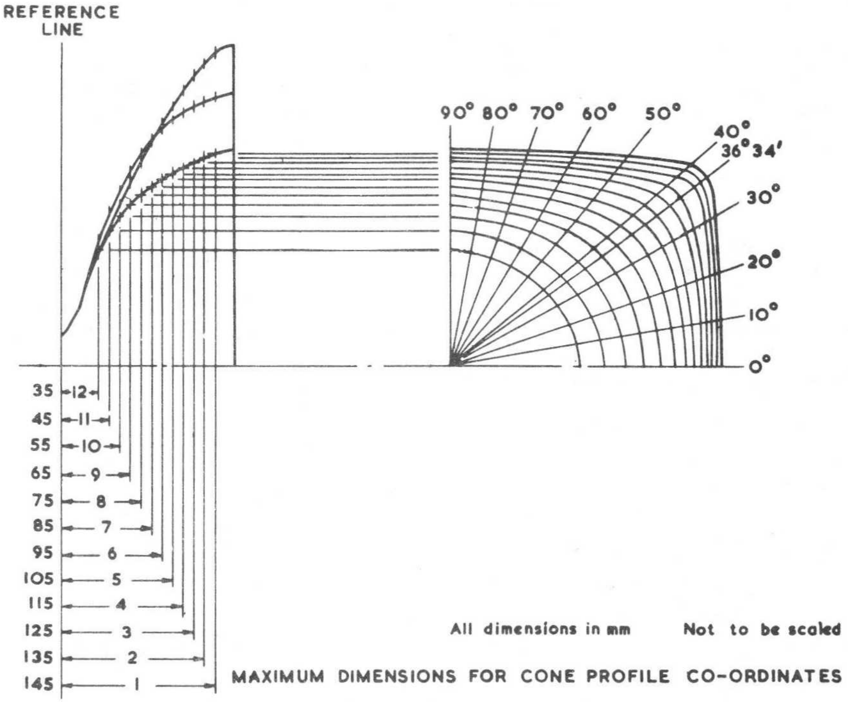
† Determined by reference line gauge No. 16 (B.S.RL4 : IEC 67-IV-3 : JEDEC 126).




All dimensions in mm

Not to be scaled

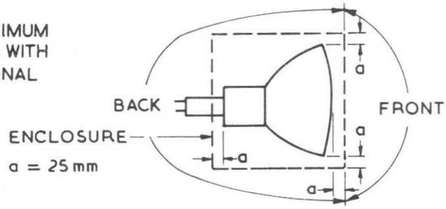



MAXIMUM DIMENSIONS FOR CONE PROFILE CO-ORDINATES

| Reference Plane No. | 0° Major | 10° | 20° | 30° | 36°34' Diag. | 40° | 50° | 60° | 70° | 80° | 90° Minor |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 250.5 | 254.0 | 265.0 | 284.8 | 293.5 | 288.5 | 252.0 | 226.0 | 210.5 | 201.8 | 199.0 |
| 2 | 245.5 | 249.0 | 259.4 | 278.0 | 282.1 | 278.0 | 244.5 | 220.5 | 205.5 | 198.0 | 195.0 |
| 3 | 241.0 | 243.5 | 252.0 | 263.7 | 269.8 | 266.0 | 237.0 | 215.0 | 201.5 | 193.5 | 191.5 |
| 4 | 236.5 | 238.5 | 245.0 | 255.8 | 256.0 | 253.5 | 228.8 | 208.5 | 195.8 | 189.0 | 186.5 |
| 5 | 229.5 | 231.0 | 236.5 | 243.0 | 242.1 | 240.0 | 219.5 | 201.5 | 189.5 | 184.0 | 181.0 |
| 6 | 221.0 | 222.0 | 226.0 | 229.0 | 227.0 | 224.0 | 207.0 | 192.5 | 183.0 | 178.0 | 176.0 |
| 7 | 210.0 | 210.5 | 213.0 | 214.5 | 210.1 | 209.0 | 195.0 | 183.0 | 174.8 | 170.5 | 169.0 |
| 8 | 198.0 | 198.0 | 198.0 | 198.0 | 194.0 | 192.5 | 181.0 | 172.5 | 166.0 | 162.5 | 161.0 |
| 9 | 183.0 | 181.0 | 180.7 | 180.0 | 176.2 | 175.5 | 168.5 | 161.0 | 155.5 | 152.5 | 151.5 |
| 10 | 166.0 | 164.0 | 161.7 | 160.0 | 156.5 | 156.5 | 151.5 | 146.0 | 143.5 | 142.0 | 142.0 |
| 11 | 146.5 | 144.0 | 141.5 | 140.0 | 134.6 | 135.5 | 131.5 | 129.5 | 128.5 | 128.5 | 128.5 |
| 12 | 122.0 | 120.2 | 117.0 | 116.0 | 111.5 | 113.5 | 111.0 | 111.0 | 111.0 | 111.0 | 111.5 |

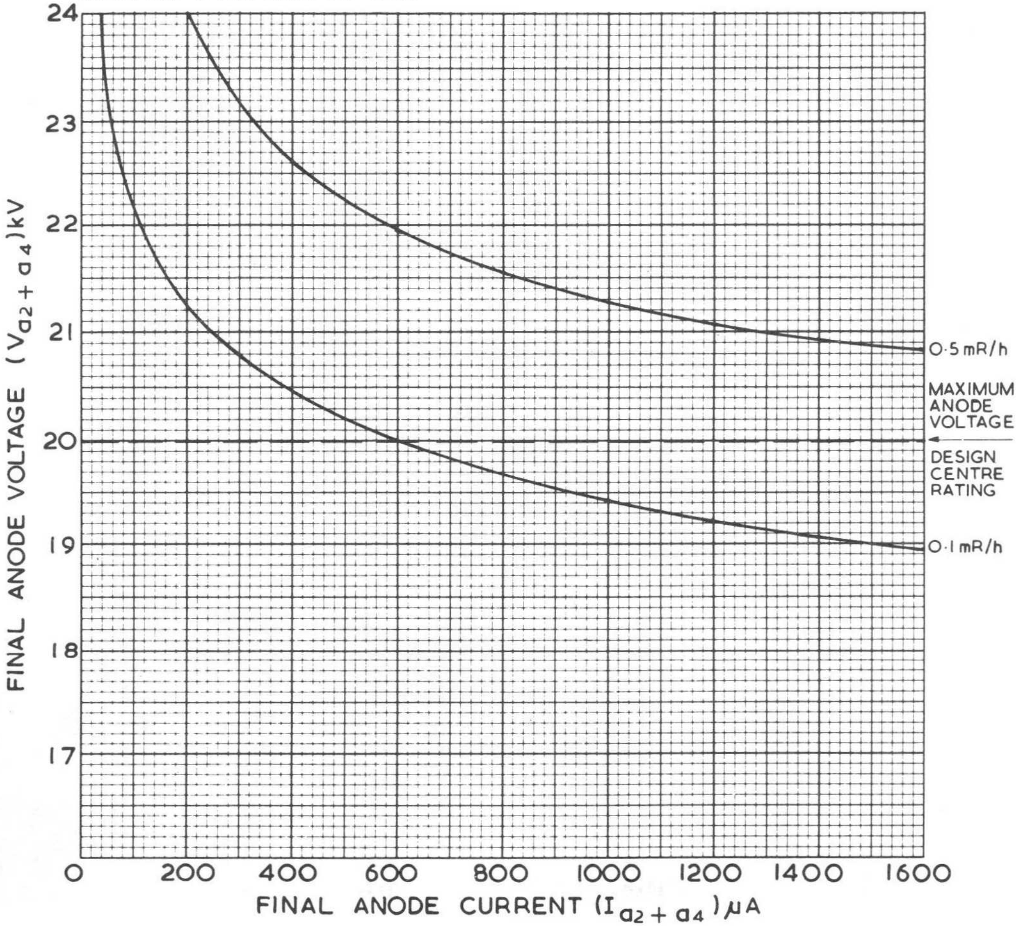
## X-RAY ISO-EXPOSURE CURVES OF TYPICAL TUBE

MEASUREMENTS MADE ON LINES OF MAXIMUM RADIATION AT FRONT AND BACK OF TUBE WITH DETECTOR CENTRE 50mm FROM NOTIONAL ENCLOSURE DEFINED BY DIAGRAM



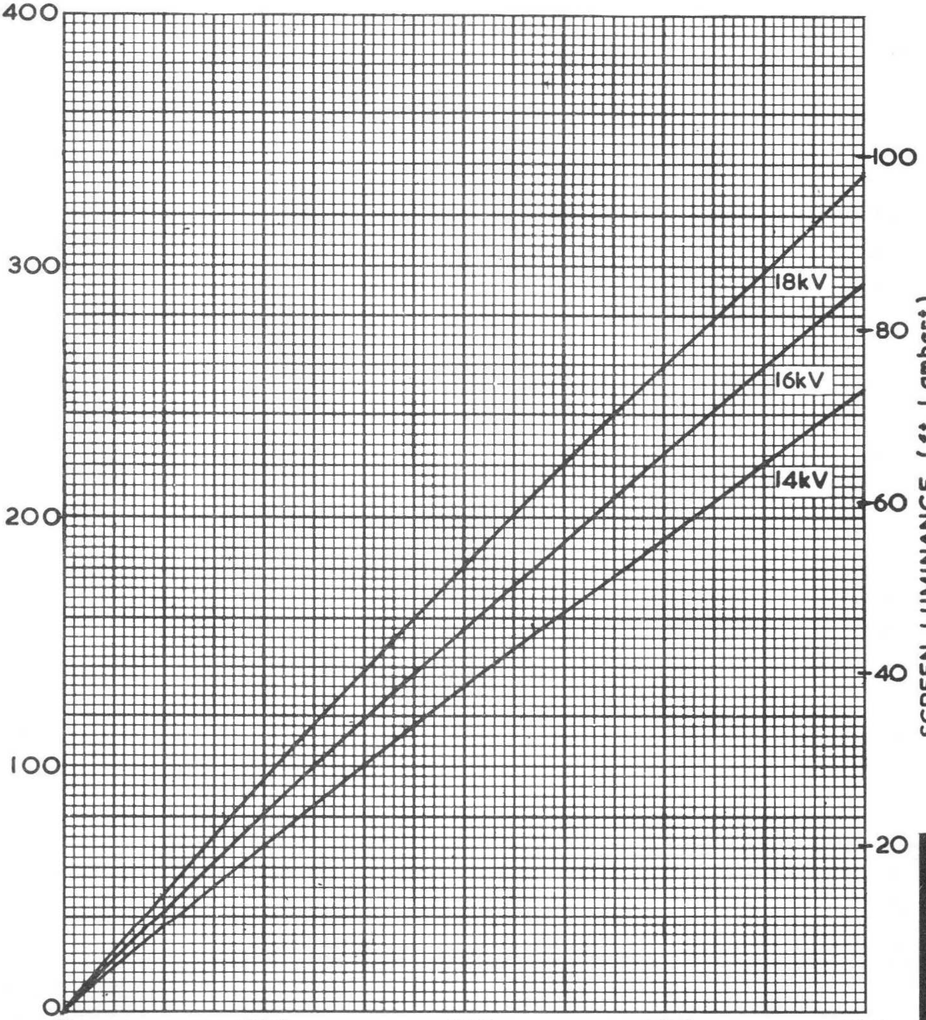

UNDER NO CONDITION REPRESENTED HERE DOES THE RADIATION FROM THE TUBE FRONT EXCEED 0·1 mR/h

RADIATION FROM BACK OF TUBE



# Data Display or Monitor Tube M61–120W

TYPICAL CHARACTERISTICS
W PHOSPHOR SCREEN
FOCUSED RASTER OF FULL HEIGHT
4 x 3 ASPECT RATIO




DATA DISPLAY & MONITOR TUBES

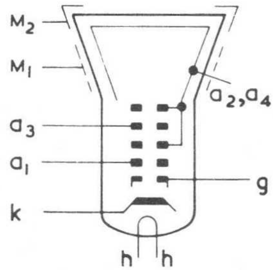
# 59-60/90/037 Data Display or Monitor Tube

## ABRIDGED SPECIFICATION

**GENERAL**

Rectangular flat face, 22 cm 70° diagonal tube
Ruggedised construction, metal mounting frame
Electrostatic focus, magnetic deflection
Flying lead connections for base and anode
Aluminised screen, external conductive coating
Clear glass, 26.95 ± 0.5 mm neck diameter.

| | | | |
|---|---|---|---|
| Heater voltage | $V_h$ | 6.3 | V |
| Heater current | $I_h$ | 0.3 | A |




**ABSOLUTE RATINGS** - All voltages referred to cathode

| | | | |
|---|---|---|---|
| Maximum second and fourth anode voltage | $V_{a2+a4(max)}$ | 20 | kV |
| Maximum third anode voltage | $V_{a3(max)}$ | 800 | V |
| Maximum negative third anode voltage | $-V_{a3(max)}$ | 300 | V |
| Maximum first anode voltage | $V_{a1(max)}$ | 800 | V |
| Maximum negative grid voltage | $-V_{g(max)}$ | 150 | V |
| Minimum negative grid voltage | $-V_{g(min)}$ | 1.0 | V |
| Maximum heater to cathode voltage heater negative (d.c.) | $V_{h-k(max)}$ | 100 | V |

**TYPICAL OPERATION**- Grid modulation, voltages with respect to cathode

| | | | |
|---|---|---|---|
| Second and fourth anode voltage | $V_{a2+a4}$ | 14 | kV |
| First anode voltage | $V_{a1}$ | 400 | V |
| Third anode voltage range for focus | $V_{a3}$ | -50 to 400 | V |
| Grid to cathode voltage for cut-off of raster | $V_g$ | -35 to -75 | V |

If this tube is operated at voltages in excess of 16 kV, x-ray radiation shielding may be necessary to avoid possible danger of personal injury from prolonged exposure at close range.

**PHOSPHOR SCREEN**

This type is usually supplied with W phosphor giving a television white trace of medium short persistence.

**Thorn Radio Valves and Tubes Limited**

BRIMAR

# Data Display or Monitor Tube 59-60/90/037

## INTER-ELECTRODE CAPACITANCES

Lead capacitances balanced out

| | | | |
|---|---|---|---|
| Cathode to all - maximum | $c_{k\text{-}all(max)}$ | 8.0 | pF |
| Grid to all - maximum | $c_{g\text{-}all(max)}$ | 25 | pF |
| Anode 2 and anode 4 to all (minimum) | $c_{a2+a4\text{-}all(min)}$ | 250 | pF |

## TUBE WEIGHT

(maximum) - 3.25 kg

## ENVIRONMENTAL TESTS CAPABILITIES

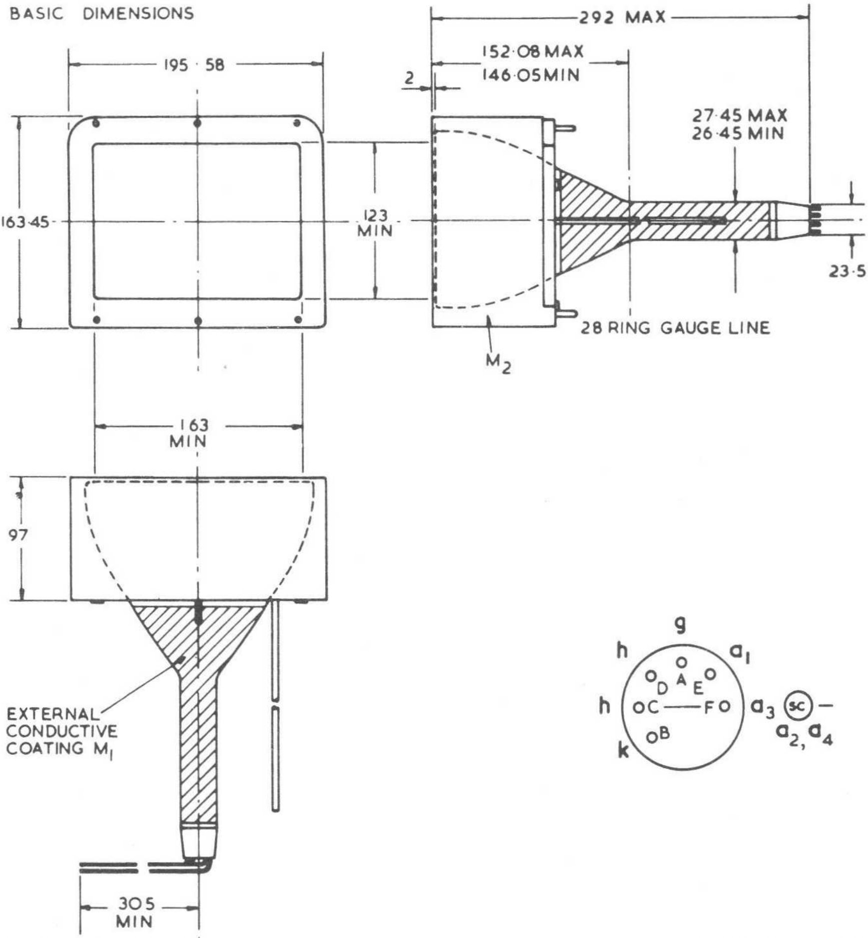
| | |
|---|---|
| Storage and operational temperature range | -30°C to +55°C. |
| Vibration endurance | 10 to 60 Hz displacement ± 0.15 mm<br>60 to 2000 Hz 2g<br>all three axes for a specified time |
| Acceleration | 13 g all three axes 2 minutes each |
| Bump and shock | 40 g all three axes for specified number of bumps |
| Tropical environment | 95% relative humidity.<br>cycled 20°C to 35°C, total 100 hrs. |
| Mould growth | To BS2011 Test 2J<br>severity 28 days |
| Salt mist | To BS2011 Test 2K<br>92.5% humidity, 35°C, total 28 days |
| Solar heat | Continuous cycling 30°C to 84°C<br>total 5 days |

## NOTE

The external conductive coating of this tube should be connected to chassis. The capacitance between this coating and final anode may be used to provide smoothing for the e.h.t. supply

DATA DISPLAY & MONITOR TUBES

BASIC DIMENSIONS




All dimensions in mm

Not to be scaled

Minimum useful screen area 162 x 122.

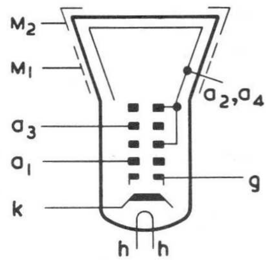
# Data Display or Monitor Tube 59-60/90/074

ABRIDGED SPECIFICATION

**GENERAL**

Rectangular face, 38 cm, 90° diagonal
Ruggedised Construction
Rimguard III reinforced envelope*
Integral mounting lugs
Electrostatic focus, magnetic deflection
Flying lead connections for base and anode
Aluminised screen, external conductive coating
Grey glass, 50% transmission (approx)
29.4 mm maximum neck diameter

| | | | |
|---|---|---|---|
| Heater voltage | $V_h$ | 6.3 | V |
| Heater currant | $I_h$ | 0.3 | A |




**ABSOLUTE RATINGS** - All voltages referred to cathode

| | | | |
|---|---|---|---|
| Maximum second and fourth anode voltage | $V_{a2+a4(max)}$ | 18 | kV |
| Maximum third anode voltage | $V_{a3(max)}$ | 700 | V |
| Maximum negative third anode voltage | $-V_{a3(max)}$ | 700 | V |
| Maximum first anode voltage | $V_{a1(max)}$ | 600 | V |
| Maximum negative grid voltage | $-V_{g(max)}$ | 200 | V |
| Minimum negative grid voltage | $-V_{g(min)}$ | 1.0 | V |
| Maximum heater to cathode voltage heater negative (d.c.) | $V_{h-k(max)}$ | 200 | V |

**TYPICAL OPERATION** -Grid modulation, voltages with respect to cathode

| | | | |
|---|---|---|---|
| Second and fourth anode voltage | $V_{a2+a4}$ | 16 | kV |
| First anode voltage | $V_{a1}$ | 400 | V |
| Third anode voltage range for focus | $V_{a3}$ | 0 to 400 | V |
| Grid to cathode voltage for cut-off of raster | $V_g$ | -42 to -86 | V |

If this tube is operated at voltages in excess of 16 kV, x-ray radiation shielding may be necessary to avoid possible danger of personal injury from prolonged exposure at close range.

* This tube meets the requirements for intrimsically safe tubes laid down in the section of I.E.C. Publication 65 dealing with implosion.

**PHOSPHOR SCREEN**

This type is supplied with W phosphor giving a television white trace of medium short persistence.

This data should be read in conjuction with Brimar Operational and Safety Recommendations for Industrial Cathode Ray Tubes.

Thorn Radio Valves and Tubes Ltd. is an Approved Manufacturer of Cathode Ray Tubes to MOD (PE) Defence Standard 05-21 and BS 9000.

**Thorn Radio Valves and Tubes Limited**

BRIMAR

## INTER-ELECTRODE CAPACITANCES

Lead capacitances balanced out

| | | | |
|---|---|---|---|
| Cathode to all - maximum | $c_{k\text{-all(max)}}$ | 5.0 | pF |
| Grid to all - maximum | $c_{g\text{-all(max)}}$ | 16 | pF |
| Anode 2 and anode 4 to M1 (minimum) | $c_{a2+a4\text{-M1(min)}}$ | 800 | pF |
| Anode 2 and anode 4 to M2 (minimum) | $c_{a2+a4\text{-M2(min)}}$ | 150 | pF |

## TUBE WEIGHT (maximum) - 6kg

## ENVIRONMENTAL TESTS CAPABILITIES

| | |
|---|---|
| Storage temperature range | -55°C to +80°C |
| Operational temperature range | -40°C to +70°C |
| Vibration endurance | 10 to 500 Hz displacement 4g<br>500 to 1000 Hz 0.5 g<br>all three axes for a specified time |
| Acceleration | 10g all three axes 15 seconds each |
| Bump and shock | 30g all three axes for specified number of bumps |
| Damp heat | 92.5% relative humidity, total 40°C 10 days |
| Mould growth | To BS2011 Test 2J severity 28 days |
| Salt mist | To BS2011 Test 2K<br>92.5% humidity, 35°C, total 3 days |

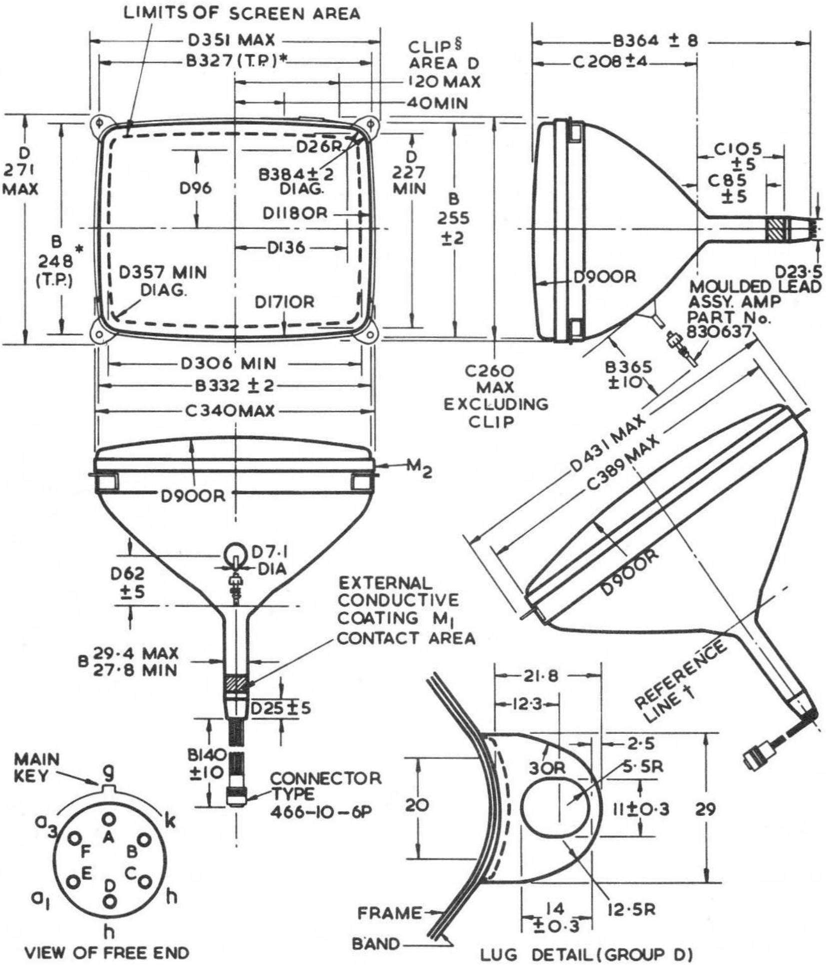
## NOTE

The external conductive coating of this tube should be connected to chassis. The capacitance between this coating and final anode may be used to provide smoothing for the e.h.t. supply.

**When flashover protection is incorporated the chassis return paths of $M_1$ and $M_2$ should be made in a manner appropriate to the protection system employed.**

# Data Display or Monitor Tube    59-60/90/074

INSPECTION DRAWING




All dimensions in mm    Not to be scaled

* The bolts to be used for mounting the tube must lie within the circles of 8.5 mm diameter centred on these true positions. One of the four lugs may deviate 2 mm maximum from the plane through the other three lugs (Group D).

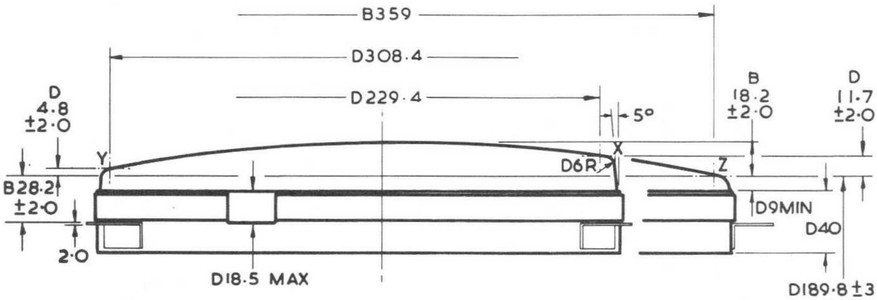
† Determined by reference line gauge

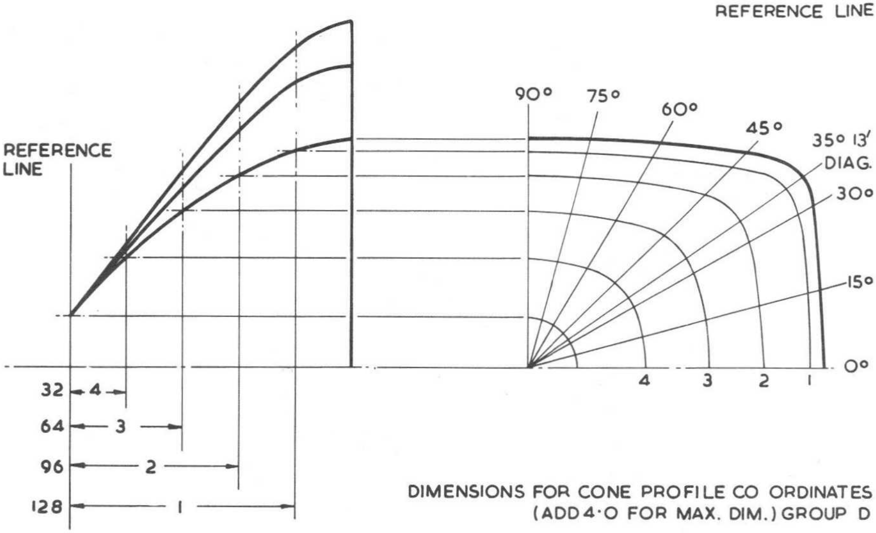
§ Total thickness of shell, tension band and clip 8 mm maximum. (Group D).

Note: Group letters are associated with each dimension.

# 59-60/90/074 Data Display or Monitor Tube

INSPECTION DRAWING (Continued)



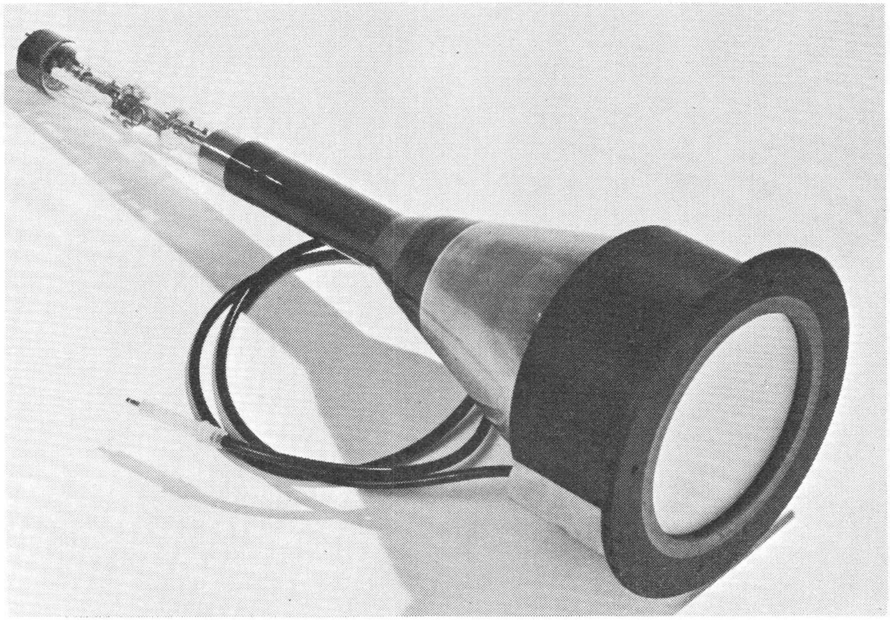

DIMENSIONS FOR CONE PROFILE CO ORDINATES
(ADD 4·0 FOR MAX. DIM.) GROUP D

All dimensions in mm

Not to be scaled

| Reference Plane No. | 0° Major | 15° | 30° | 35° 13' Diag. | 45° | 60° | 75° | 90° Minor |
|---|---|---|---|---|---|---|---|---|
| 1 | 156.7 | 160.9 | 173.6 | 177.6 | 161.9 | 136.5 | 123.9 | 120.0 |
| 2 | 130.0 | 132.6 | 141.5 | 144.0 | 135.3 | 118.0 | 108.6 | 105.7 |
| 3 | 99.0 | 100.8 | 106.3 | 107.3 | 103.9 | 93.7 | 88.0 | 86.5 |
| 4 | 62.8 | 63.4 | 65.3 | 65.4 | 65.0 | 62.0 | 60.0 | 59.5 |

# SPECIAL TUBES



The facilities and organisation provided by Thorn Radio Valves and Tubes Limited meet the requirements of the M.O.D. (P.E.) Defence Standard 05-21 and BS 9000.

**HEALTH AND SAFETY AT WORK ACT, 1974**

Attention is drawn to the recommendations under this heading in the Operational Recommendations.

**WARNING**

These tubes should be used in accordance with their published ratings, and in conformity with the Operational Recommendations of the company's data handbook. The company will not entertain claims for loss or damage where this advice has been disregarded.

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**Thorn Radio Valves and Tubes Limited**

Mollison Avenue - Brimsdown - Enfield - Middlesex EN3 7NS

BRIMAR

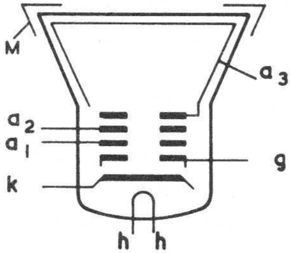
# Flying-spot Scanner Tube

# Q13-202..

## GENERAL

Round flat face 5 inch diameter 25° tube
Mounting flange, potted anode lead
Electrostatic focus, magnetic deflection
Resolution greater than 1200 lines
Aluminised screen

| | | | |
|---|---|---|---|
| Heater voltage | $V_h$ | 6.3 | V |
| Heater current | $I_h$ | 0.3 | A |




## ABSOLUTE RATINGS

| | | | |
|---|---|---|---|
| Maximum third anode voltage | $V_{a3(max)}$ | 16 | kV |
| Minimum third anode voltage | $V_{a3(min)}$ | 12 | kV |
| Maximum second anode voltage range | $V_{a2(max)}$ | 2.5 to 5.5 | kV |
| Maximum first anode voltage | $V_{a1(max)}$ | 500 | V |
| Maximum negative grid voltage | $-V_{g(max)}$ | 150 | V |
| Maximum heater to cathode voltage | $V_{h-k(max)}$ | ± 150 | V |
| Maximum final anode current | $I_{a3(max)}$ | 10 | µA |
| Maximum second anode current | $I_{a2(max)}$ | 600 | µA |
| Maximum resistance grid to cathode | $R_{g-k(max)}$ | 1.5 | MΩ |

Adequate precautions should be taken to ensure that the associated circuitry and the tube are protected from damage which may be caused in the event of a high voltage flash-over within the tube.

## PHOSPHOR SCREEN

This type is usually supplied with GS phosphor (Q13-202GS) giving a yellowish-green trace of very short persistence. Other phosphor screens can be made available to special order.

**Thorn Radio Valves and Tubes Limited**

BRIMAR

### INTER - ELECTRODE CAPACITANCES

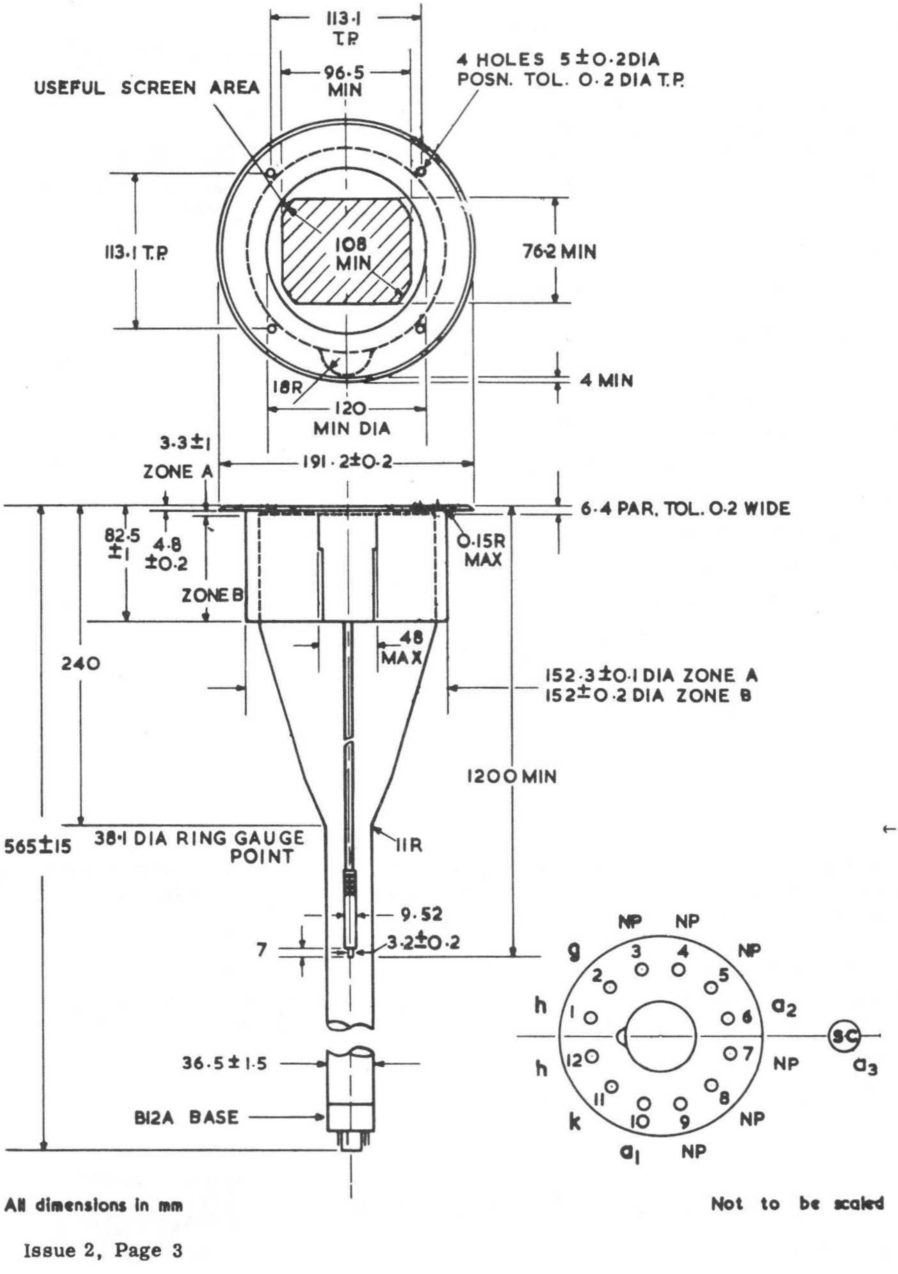
| | | | |
|---|---|---|---|
| Cathode to all | $c_{k\text{-all}}$ | 4.0 | pF |
| Grid to all | $c_{g\text{-all}}$ | 12 | pF |
| Anode 3 to shell M | $c_{a3\text{-M}}$ | 200 | pF |

**TYPICAL OPERATION** voltages with respect to cathode.

| | | | |
|---|---|---|---|
| Third anode voltage | $V_{a3}$ | 15 | kV |
| Second anode voltage range for focus | $V_{a2}$ | 3.7 to 5.2 | kV |
| First anode voltage | $V_{a1}$ | 300 | V |
| Grid to cathode voltage for cut-off ($I_{a3}$ = 0.5 $\mu$A) | $V_g$ | -30 to -70 | V |
| Resolution by shrinking raster ($I_{a3}$ = 4.5 $\mu$A) | | > 1200 | lines |
| Maximum spot diameter at 60% peak luminance ($I_{a3}$ = 4.5 $\mu$A) | | 0.07 | mm |
| Maximum screen noise (peak to peak) | | 30* | % |
| Typical radiant output ($I_{a3}$ = 4.5 $\mu$A) | | 250 | $\mu$W |
| GS screen persistence to 10% (approx.) | | 0.9 | $\mu$s |

* Measured with 0.07mm spot at a writing speed of 25 m/s and with a detector bandwidth of 1.5 MHz.

**TUBE WEIGHT** (approximate) - 2.0 kg




All dimensions in mm

Not to be scaled



SPECIAL TUBES

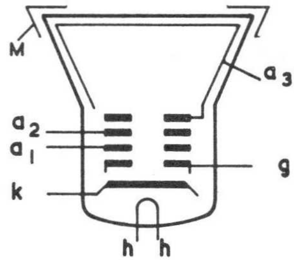
# Q13-203..

# Flying-spot Scanner Tube

**GENERAL**

Round flat face 5 inch diameter 25° tube
Mounting flange, potted anode lead
Electrostatic focus, magnetic deflection
Resolution greater than 1600 lines
Aluminised screen

| | | | |
|---|---|---|---|
| Heater voltage | $V_h$ | 6.3 | V |
| Heater current | $I_h$ | 0.3 | A |




## ABSOLUTE RATINGS

| | | | |
|---|---|---|---|
| Maximum third anode voltage | $V_{a3(max)}$ | 16 | kV |
| Minimum third anode voltage | $V_{a3(min)}$ | 12 | kV |
| Maximum second anode voltage range | $V_{a2(max)}$ | 2.5 to 5.5 | kV |
| Maximum first anode voltage | $V_{a1(max)}$ | 500 | V |
| Maximum negative grid voltage | $-V_{g(max)}$ | 150 | V |
| Maximum heater to cathode voltage | $V_{h-k(max)}$ | ± 150 | V |
| Maximum final anode current | $I_{a3(max)}$ | 10 | µA |
| Maximum second anode current | $I_{a2(max)}$ | 600 | µA |
| Maximum resistance grid to cathode | $R_{g-k(max)}$ | 1.5 | MΩ |

Adequate precautions should be taken to ensure that the associated circuitry and the tube are protected from damage which may be caused in the event of a high voltage flash-over within the tube.

## PHOSPHOR SCREEN

This type is usually supplied with GT phosphor (Q13-203GT) giving a bluish-green trace of very short persistence. Other phosphor screens can be made available to special order.

## INTER-ELECTRODE CAPACITANCES

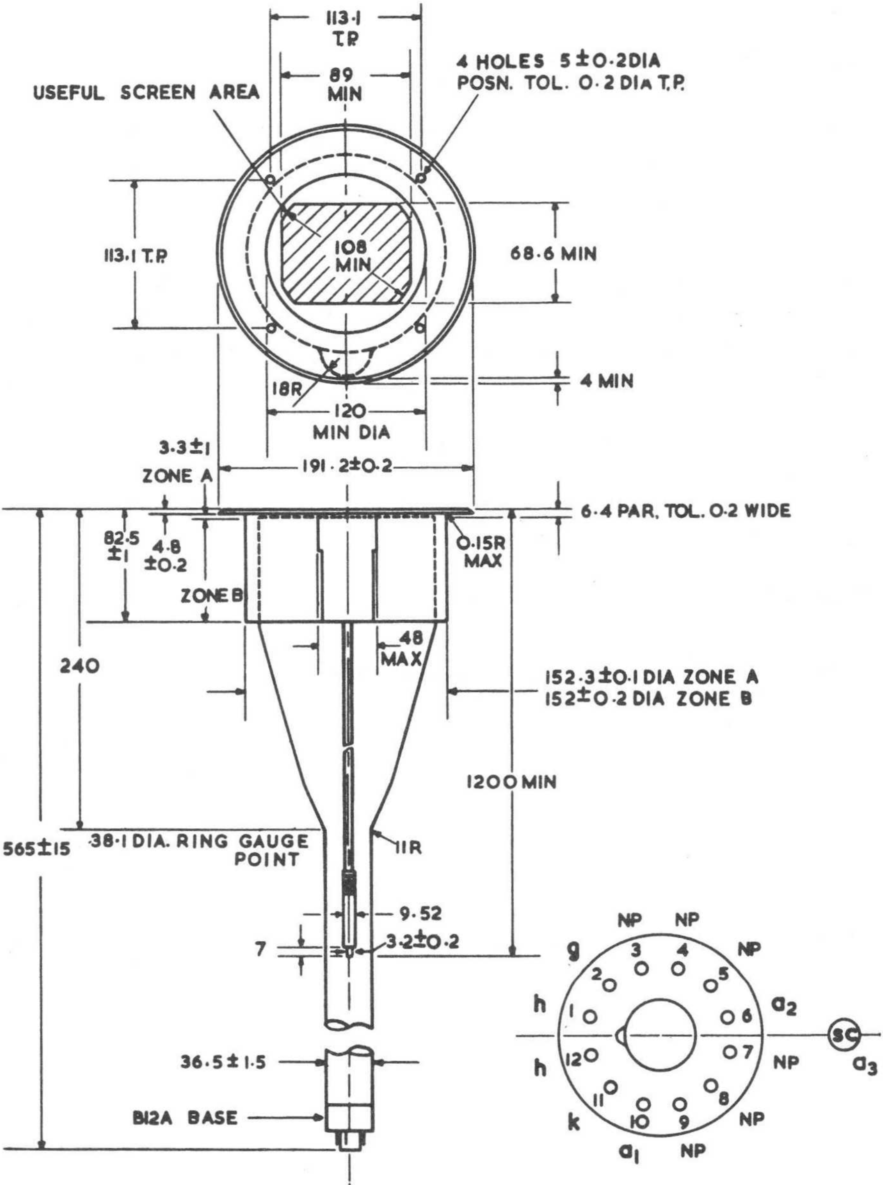
| | | | |
|---|---|---|---|
| Cathode to all | $c_{k-all}$ | 4.0 | pF |
| Grid to all | $c_{g-all}$ | 12 | pF |
| Anode 3 to shell M | $c_{a3-M}$ | 200 | pF |

## TYPICAL OPERATION - voltages with respect to cathode.

| | | | |
|---|---|---|---|
| Third anode voltage | $V_{a3}$ | 15 | kV |
| Second anode voltage range for focus | $V_{a2}$ | 3.7 to 5.2 | kV |
| First anode voltage | $V_{a1}$ | 300 | V |
| Grid to cathode voltage for cut-off ($I_{a3}$ = 0.5 μA) | $V_g$ | -30 to -70 | V |
| Resolution by shrinking raster ($I_{a3}$ = 4.5 μA) | | > 1600 | lines |
| Maximum spot diameter at 60% peak luminance ($I_{a3}$ = 4.5 μA) | | 0.05 | mm |
| Maximum screen noise (peak to peak) | | 45* | % |
| Typical radiant output power ($I_{a3}$ = 4.5 μA) | | 250 | μW |
| GT screen spot persistence to 10% (approx.) | | 0.9 | μs |

**TUBE WEIGHT** (approximate) - 2.0 kg

* Measured with 0.05mm spot at a writing speed of 25 m/s and with a detector bandwidth of 1.5 MHz.



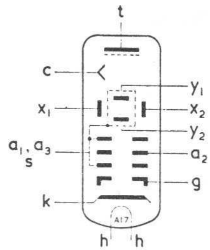

All dimensions in mm

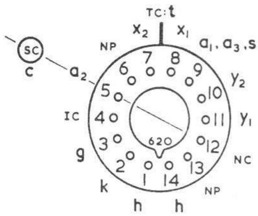
Not to be scaled

# Monoscope Tube

# XR1000

## Maintenance Type




Base B14A, Cap CT7

## GENERAL

This monoscope is used for electrical generation of alpha-numeric characters and symbols. The output signals are generated by scanning the individual characters and symbols which are arranged in an array, typically 8 × 8, on a target. The electron gun has electrostatic focus and deflection.

This device has applications in business and data processing equipment for cathode ray tube display.

| | | | |
|---|---|---|---|
| Heater Voltage | $V_h$ | 6·3 | V |
| Heater Current | $I_h$ | 0·3 | A |

## ABSOLUTE RATINGS

| | | | |
|---|---|---|---|
| Maximum Target Voltage | $V_{t(max)}$ | 2850 | V |
| Maximum Collector Voltage | $V_{c(max)}$ | 2850 | V |
| Maximum First and Third Anode Voltage | $V_{a1+a3(max)}$ | 2850 | V |
| Maximum Second Anode Voltage | $V_{a2(max)}$ | 1100 | V |
| Maximum Collector to Target Voltage | $V_{c\text{-}t(max)}$ | 20 | V |
| Maximum Peak x-plate to Third Anode Voltage | $v_{x\text{-}a3(pk)max}$ | 550 | V |
| Maximum Peak y-plate to Third Anode Voltage | $v_{y\text{-}a3(pk)max}$ | 550 | V |
| Maximum Grid Voltage | | | |
| Negative Value | $-V_{g(max)}$ | 220 | V |
| Positive D.C. and Peak Value | $v_{g(pk)max}$ | 0 | V |
| Maximum Peak Heater to Cathode Voltage | $v_{h\text{-}k(pk)max}$ | ±200 | V |
| Maximum Grid to Cathode Resistance | $R_{g\text{-}k(max)}$ | 1·5 | MΩ |
| Maximum Resistance in any Deflection Electrode circuit* | | 5·0 | MΩ |

All voltages measured with respect to cathode unless otherwise stated.
* It is recommended that the deflecting electrode circuit resistances be approximately equal.

## INTER-ELECTRODE CAPACITANCES

| | | | |
|---|---|---|---|
| Grid to all | $c_{g\text{-}all}$ | 10·6 | pF |
| Cathode to all | $c_{k\text{-}all}$ | 5·1 | pF |
| Collector to all | $c_{c\text{-}all}$ | 5·7 | pF |
| Target to all | $c_{t\text{-}all}$ | 2·3 | pF |
| $x_1$ plate to $x_2$ plate | $c_{x1\text{-}x2}$ | 1·5 | pF |
| $y_1$ plate to $y_2$ plate | $c_{y1\text{-}y2}$ | 2·7 | pF |
| $x_1$ plate to all, less $x_2$ plate | $c_{x1\text{-}all,\ less\ x2}$ | 6·9 | pF |
| $x_2$ plate to all, less $x_1$ plate | $c_{x2\text{-}all\ less\ x1}$ | 6·4 | pF |
| $y_1$ plate to all, less $y_2$ plate | $c_{y1\text{-}all,\ less\ y2}$ | 8·6 | pF |
| $y_2$ plate to all, less $y_1$ plate | $c_{y2\text{-}all,\ less\ y1}$ | 8·3 | pF |

The target used with this tube is indicated by a letter suffix to the type number.

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## TYPICAL OPERATION AND CHARACTERISTICS

| | | | |
|---|---|---|---|
| Target Voltage | $V_t$ | 1200 | V |
| First and Third Anode Voltage | $V_{a1+a3}$ | 1200 | V |
| Mean Deflector Plate Potential | | 1200* | V |
| Minimum Collector to Target Potential | $V_{c\text{-}t(min)}$ | 3·0 | V |
| Second Anode Voltage for Focus | $V_{a2}$ | 150 to 515 | V |
| Grid to Cathode Voltage for beam cut-off | $V_g$ | –25 to –65 | V |
| Deflection voltage per symbol area ($8 \times 8$ array) | | | |
| Vertical direction (nominal) | | 9·0 | V |
| Horizontal direction (nominal) | | 6·5 | V |
| Voltage required for full beam deflection† (nominal) | | | |
| Between centres of lowest and highest rows | | 90 | V |
| Between centres of extreme left and right columns | | 55 | V |
| Target Load Resistance | | 500 | Ω |
| Typical Peak Output Signal | | 5·0 | μA |

* If the mean deflector plate potential differs from the first and third anode voltage the quality of focus will deteriorate.

† Undeflected beam normally at centre of target pattern.

**Notes:** The electron beam should be cut-off when no raster is being scanned otherwise a blemish may be produced by a change in the secondary emission of the target. It is recommended that no character be used in such a way that it has a usage factor greater than ten times the average.

Adequate magnetic shielding is required. In addition due attention should be paid to the position of the tube relative to transformers and chokes.

## PRINCIPLE OF OPERATION

In operation a smaller raster is generated just large enough to scan a single character on the target. The scan circuit also selects and positions the beam on the character to be generated.

As the electron beam lands on the target surface secondary emission electrons are produced and are attracted to the collector which is held at a slightly more positive voltage. The secondary emission from the printed character is lower than from the surrounding target surface where the secondary emission ratio is considerably greater than unity. Hence when the beam lands on the character the target current falls.

The changes of the target current through the load resistance produce the output video voltage signal. By synchronisation of scan and scan position any entire character can be recreated on the final display cathode ray tube. Using suitable circuitry any individual monoscope target character or any sequence of characters can be selected and displayed as required.

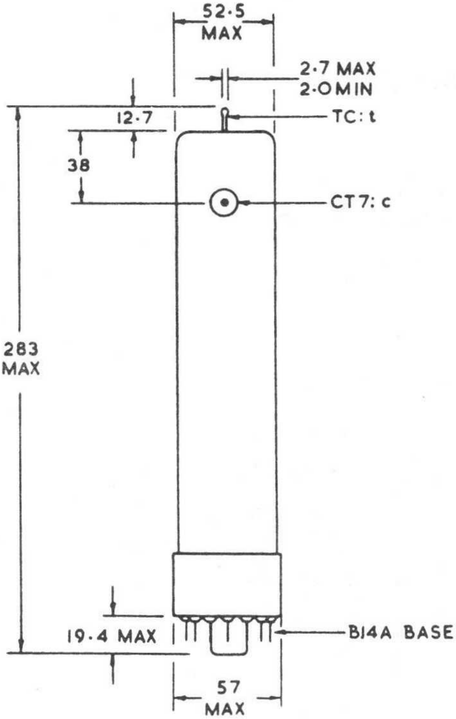
Characters can be " read out " from the monoscope at a rate exceeding 60,000 characters per second, corresponding to the rate required for a display of approximately 1,000 characters refreshed at 50 fields per second, with due allowance made for retrace times in the display. The resolution capability is adequate for a display of this complexity.

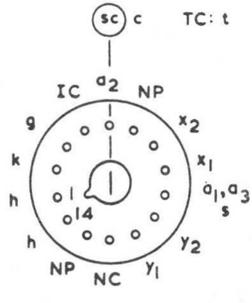
**Approximate Net Tube Weight—380g (0·84 lb.)**

# Monoscope Tube

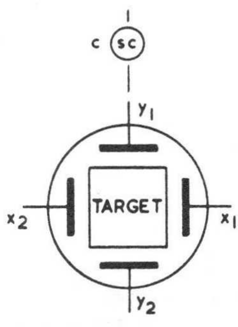
# XR1000

0417




VIEW FROM PINS FREE END
(PIN 5 AT TOP)




VIEWED FROM PINS FREE END
(PIN 5 AT TOP)

All dimensions in mm.

Not to be scaled

**Care should be taken to avoid bending the target pin as this may cause misalignment of the target.**

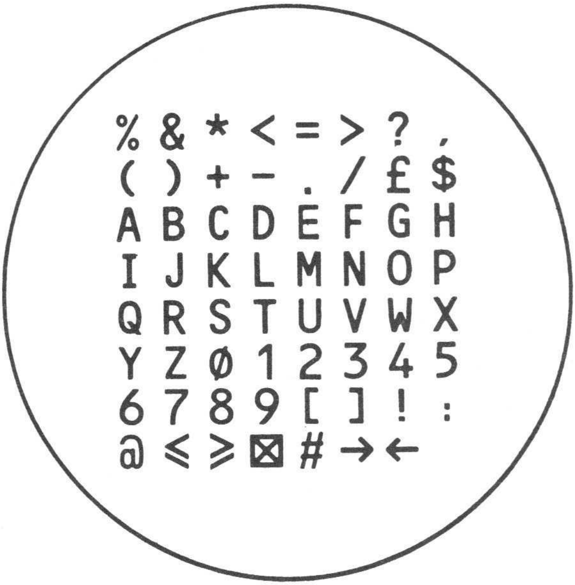
# XR1000A

# Monoscope Tube

**Maintenance Type**

## MONOSCOPE

TARGET "A"
TYPICAL TARGET
USING ECMA FOUNT OCR-B




0446

**Alignment of Traces**

A positive voltage on $y_1$ deflects beam towards top row.
A positive voltage on $x_2$ deflects beam towards left hand column.
Angle between x and y traces $90° \pm 1°$.
Angle between trace and target symbols $\pm 1°$.

See XR1000 data for tube electrical and mechanical details.

# Monoscope Tube

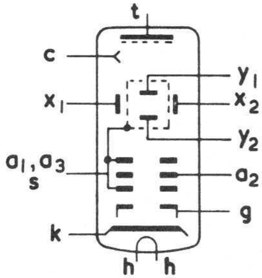
# XR1002

## Maintenance Type

### GENERAL

This monoscope is used for electrical generation of alpha-numeric characters and symbols. The output signals are generated by scanning the individual characters and symbols which are arranged in an array, typically 8 x 8, on a target. The electron gun has electrostatic focus and deflection. This device has applications in business and data processing equipment for cathode ray tube display.

| | | | |
|---|---|---|---|
| Heater Voltage | $V_h$ | 6.3 | V |
| Heater Current | $I_h$ | 0.3 | A |




### ABSOLUTE RATINGS

| | | | |
|---|---|---|---|
| Maximum target voltage | $V_{t(max)}$ | 2850 | V |
| Maximum collector voltage | $V_{c(max)}$ | 2850 | V |
| Maximum collector to target voltage | $V_{c-t(max)}$ | 20 | V |
| Maximum first and third anode voltage | $V_{a1+a3(max)}$ | 2850 | V |
| Maximum second anode voltage | $V_{a2(max)}$ | 1100 | V |
| Maximum peak x plate to third anode voltage | $v_{x-a3(pk)max}$ | 550 | V |
| Maximum peak y plate to third anode voltage | $v_{y-a3(pk)max}$ | 550 | V |
| Maximum grid voltage | | | |
| negative value | $-V_{g(max)}$ | 220 | V |
| positive d.c. and peak value | $v_{g(pk)max}$ | 0 | V |
| Maximum peak heater to cathode voltage | $v_{h-k(pk)max}$ | ± 200 | V |
| Maximum grid to cathode resistance | $R_{g-k(max)}$ | 1.5 | MΩ |
| Maximum resistance in any deflection electrode circuit* | | 5.0 | MΩ |

All voltages measured with respect to cathode unless otherwise stated.

* It is recommended that the deflecting electrode circuit resistances be approximately equal.

The target used with this tube is indicated by a letter suffix to the type number.

## Thorn Radio Valves and Tubes Limited

BRIMAR

### INTER-ELECTRODE CAPACITANCES

| | | | |
|---|---|---|---|
| Grid to all | $c_{g\text{-}all}$ | 10.6 | pF |
| Cathode to all | $c_{k\text{-}all}$ | 5.1 | pF |
| Collector to all | $c_{c\text{-}all}$ | 5.7 | pF |
| Target to all | $c_{t\text{-}all}$ | 2.3 | pF |
| $x_1$ plate to $x_2$ plate | $c_{x1\text{-}x2}$ | 2.7 | pF |
| $y_1$ plate to $y_2$ plate | $c_{y1\text{-}y2}$ | 1.5 | pF |
| $x_1$ plate to all, less $x_2$ plate | $c_{x1\text{-}all,\ less\ x2}$ | 8.6 | pF |
| $x_2$ plate to all, less $x_1$ plate | $c_{x2\text{-}all,\ less\ x1}$ | 8.3 | pF |
| $y_1$ plate to all, less $y_2$ plate | $c_{y1\text{-}all,\ less\ y2}$ | 6.4 | pF |
| $y_2$ plate to all, less $y_1$ plate | $c_{y2\text{-}all,\ less\ y1}$ | 6.9 | pF |

### TYPICAL OPERATION AND CHARACTERISTICS

| | | | |
|---|---|---|---|
| Target voltage | $V_t$ | 1200 | V |
| First and third anode voltage | $V_{a1+a3}$ | 1200 | V |
| Mean deflectorplate voltage | | 1200 † | V |
| Minimum collector to target voltage | $V_{c\text{-}t(min)}$ | 3.0 | V |
| Second anode voltage for focus | $V_{a2}$ | 150 to 515 | V |
| Grid to cathode voltage for beam cut-off | $V_g$ | -25 to -65 | V |
| Deflection voltage per symbol area (8 x 8 array) | | | |
| Vertical direction (nominal) | | 6.5 | V |
| Horizontal direction (nominal) | | 9.0 | V |
| Voltage required for full beam deflection* (nominal) | | | |
| Between centres of lowest and highest rows | | 55 | V |
| Between centres of extreme left and right columns | | 90 | V |
| Target load resistance | | 500 | Ω |
| Typical peak output signal | | 1.5 | μA |

* Undeflected beam normally at centre of target pattern.

† If the mean deflector plate potential differs from the first and third anode voltage the quality of focus will deteriorate.

### CAUTION

The electron beam should be cut-off when no raster is being scanned otherwise a blemish may be produced by a change in the secondary emission of the target. It is recommended that no character be used in such a way that it has a usage factor greater than ten times the average.

### NOTE

Adequate magnetic shielding is required. In addition due attention should be paid to the position of the tube relative to transformers and chokes.

## PRINCIPLE OF OPERATION

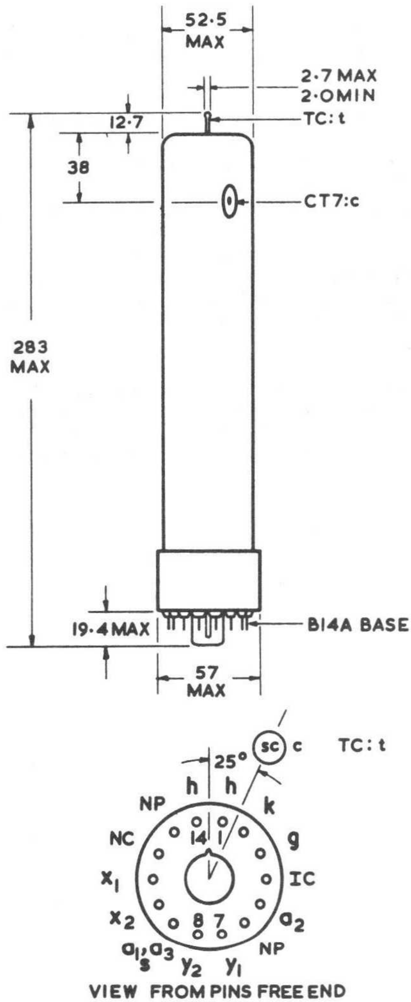
In operation a small raster is generated just large enough to scan a single character on the target. The scan circuit also selects and positions the beam on the character to be generated.

As the electron beam lands on the target surface secondary emission electrons are produced and are attracted to the collector which is held at a slightly more positive voltage. The secondary emission from the printed character is lower than from the surrounding target surface where the secondary emission ratio is considerably greater than unity. Hence when the beam lands on the character the target current falls.

The changes of the target current through the load resistance produce the output video voltage signal. By synchronisation of scan and scan position any entire character can be recreated on the final display cathode ray tube. Using suitable circuitry any individual monoscope target character or any sequence of characters can be selected and displayed as required.

Characters can be "read out" from the monoscope at a rate exceeding 60,000 characters per second, corresponding to the rate required for a display of approximately 1,000 characters refreshed at 50 fields per second, with due allowance made for retrace times in the display. The resolution capability is adequate for a display of this complexity.

**TUBE WEIGHT** (approximate) 380 g (0.84 lb)

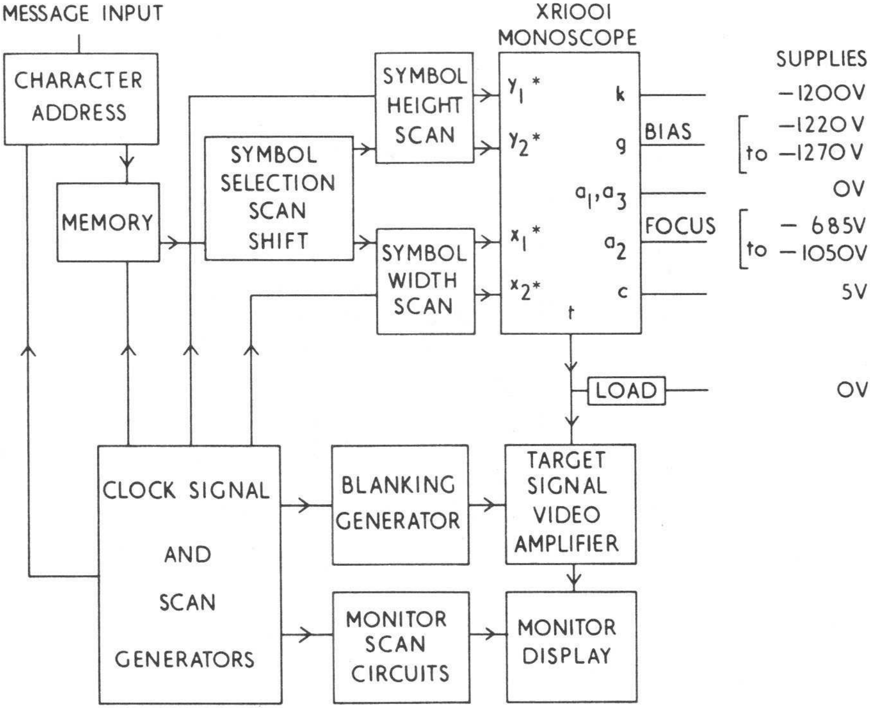



All dimensions in mm

Not to be scaled

**Care should be taken to avoid bending the target pin as this may cause misalignment of the target.**

**OPERATIONAL BLOCK DIAGRAM**

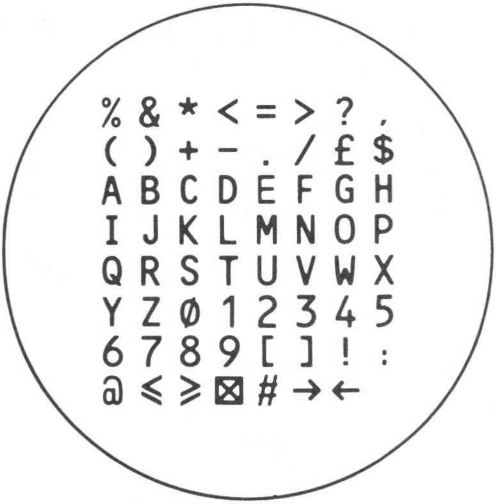



* Zero mean voltage

**XR1002A** **Monoscope Tube**

**Maintenance Type**

TARGET "A"
TYPICAL TARGET
USING ECMA FOUNT OCR-B




<u>Alignment of Traces</u>

A positive voltage on $y_1$ deflects beam towards top row.
A positive voltage on $x_2$ deflects beam towards left hand column.
Angle between x and y traces 90 ± 1 .
Angle between trace and target symbols ± 1 .

See XR1002 data for tube electrical and mechanical details.

**Thorn Radio Valves and Tubes Limited**

# Monoscope Tube

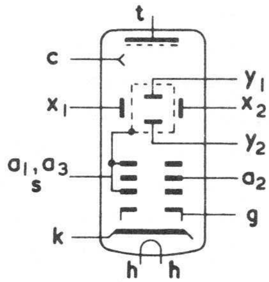
# XR1003

**Maintenance Type**

**GENERAL**

This monoscope is used for electrical generation of alpha-numeric characters and symbols. The output signals are generated by scanning the individual characters and symbols which are arranged in an array, typically 8 x 8, on a target. The electron gun has electrostatic focus and deflection. This device has applications in business and data processing equipment for cathode ray tube display.

| | | | |
|---|---|---|---|
| Heater Voltage | $V_h$ | 6.3 | V |
| Heater Current | $I_h$ | 0.3 | A |




**ABSOLUTE RATINGS**

| | | | |
|---|---|---|---|
| Maximum target voltage | $V_{t(max)}$ | 2850 | V |
| Maximum collector voltage | $V_{c(max)}$ | 2850 | V |
| Maximum collector to target voltage | $V_{c-t(max)}$ | 20 | V |
| Maximum first and third anode voltage | $V_{a1+a3(max)}$ | 2850 | V |
| Maximum second anode voltage | $V_{a2(max)}$ | 1100 | V |
| Maximum peak x plate to third anode voltage | $v_{x-a3(pk)max}$ | 550 | V |
| Maximum peak y plate to third anode voltage | $v_{y-a3(pk)max}$ | 550 | V |
| Maximum grid voltage | | | |
| negative value | $-V_{g(max)}$ | 220 | V |
| positive d.c. and peak value | $v_{g(pk)max}$ | 0 | V |
| Maximum peak heater to cathode voltage | $v_{h-k(pk)max}$ | ± 200 | V |
| Maximum grid to cathode resistance | $R_{g-k(max)}$ | 1.5 | MΩ |
| Maximum resistance in any deflection electrode circuit* | | 5.0 | MΩ |

All voltages measured with respect to cathode unless otherwise stated.

* It is recommended that the deflecting electrode circuit resistances be approximately equal.

The target used with this tube is indicated by a letter suffix to the type number.

## INTER-ELECTRODE CAPACITANCES

| | | | |
|---|---|---|---|
| Grid to all | $c_{g\text{-all}}$ | 9.0 | pF |
| Cathode to all | $c_{k\text{-all}}$ | 3.5 | pF |
| Collector to all | $c_{c\text{-all}}$ | 5.5 | pF |
| Target to all | $c_{t\text{-all}}$ | 2.5 | pF |
| $x_1$ plate to $x_2$ plate | $c_{x1\text{-}x2}$ | 2.3 | pF |
| $y_1$ plate to $y_2$ plate | $c_{y1\text{-}y2}$ | 0.9 | pF |
| $x_1$ plate to all, less $x_2$ plate | $c_{x1\text{-all, less } x2}$ | 7.5 | pF |
| $x_2$ plate to all, less $x_1$ plate | $c_{x2\text{-all, less } x1}$ | 7.5 | pF |
| $y_1$ plate to all, less $y_2$ plate | $c_{y1\text{-all, less } y2}$ | 6.0 | pF |
| $y_2$ plate to all, less $y_1$ plate | $c_{y2\text{-all, less } y1}$ | 6.5 | pF |

## TYPICAL OPERATION AND CHARACTERISTICS

| | | | | |
|---|---|---|---|---|
| Target voltage | $V_t$ | 1200 | | V |
| First and third anode voltage | $V_{a1+a3}$ | 1200 | | V |
| Mean deflector plate voltage | | 1200 † | | V |
| Minimum collector to target voltage | $V_{c\text{-}t(min)}$ | 3.0 | | V |
| Second anode voltage for focus | $V_{a2}$ | 150 to 515 | | V |
| Grid to cathode voltage for beam cut-off | $V_g$ | -25 to -65 | | V |
| Deflection voltage per symbol area for two arrays | | 8 x 8 | 12 x 8 | |
| Vertical direction (nominal) | | 6.5 | 6.5 | V |
| Horizontal direction (nominal) | | 9.0 | 6.0 | V |
| Voltage required for full beam deflection* (nominal) | | | | |
| Between centres of lowest and highest rows | | 55 | 55 | V |
| Between centres of extreme left and right columns | | 90 | 95 | V |
| Target load resistance | | 500 | | Ω |
| Typical peak output signal | | 2.5 | | μA |

* Undeflected beam normally at centre of target pattern.

† If the mean deflector plate potential differs from the first and third anode voltage the quality of focus will deteriorate.

### CAUTION

The electron beam should be cut-off when no raster is being scanned otherwise a blemish may be produced by a change in the secondary emission of the target. It is recommended that no character be used in such a way that it has a usage factor greater than ten times the average.

### NOTE

Adequate magnetic shielding is required. In addition due attention should be paid to the position of the tube relative to transformers and chokes.

## PRINCIPLE OF OPERATION

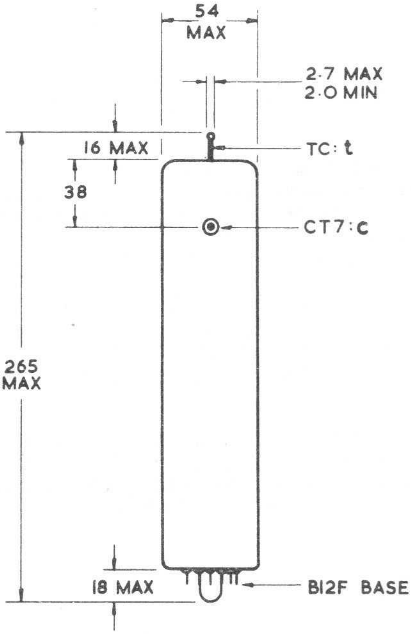
In operation a small raster is generated just large enough to scan a single character on the target. The scan circuit also selects and positions the beam on the character to be generated.

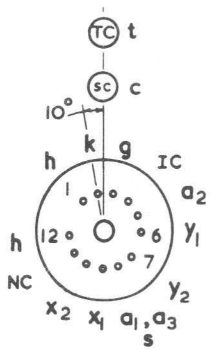
As the electron beam lands on the target surface secondary emission electrons are produced and are attracted to the collector which is held at a slightly more positive voltage. The secondary emission from the printed character is lower than from the surrounding target surface where the secondary emission ratio is considerably greater than unity. Hence when the beam lands on the character the target current falls.

The changes of the target current through the load resistance produce the output video voltage signal. By synchronisation of scan and scan position any entire character can be recreated on the final display cathode ray tube. Using suitable circuitry any individual monoscope target character or any sequence of characters can be selected and displayed as required.

Characters can be "read out" from the monoscope at a rate exceeding 60,000 characters per second, corresponding to the rate required for a display of approximately 1,000 characters refreshed at 50 fields per second, with due allowance made for retrace times in the display. The resolution capability is adequate for a display of this complexity.

**TUBE WEIGHT** (approximate) 330 g (0.73 lb)



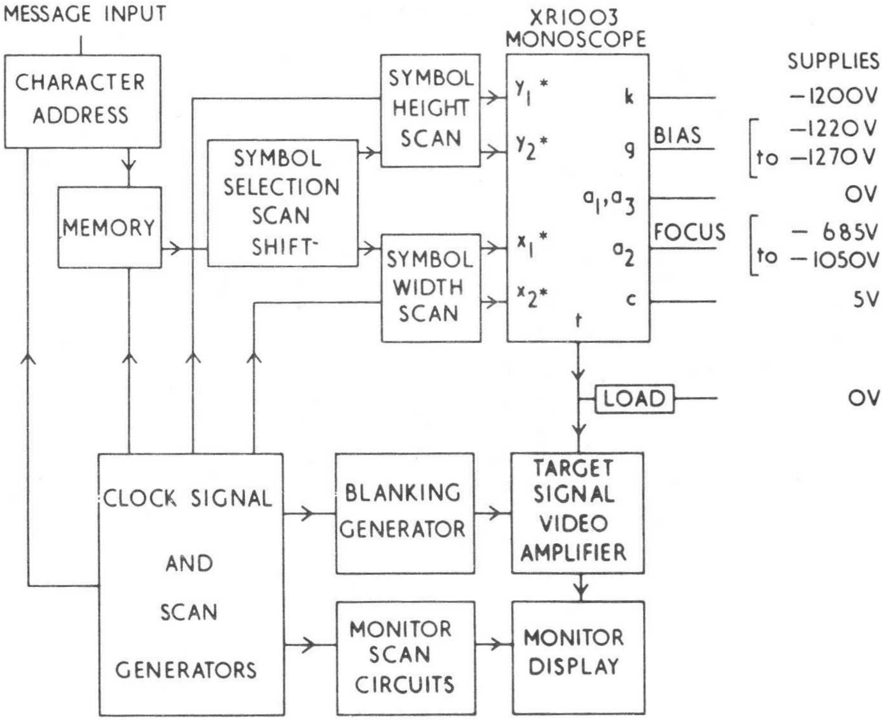

VIEW FROM PINS FREE END

All dimensions in mm

Not to be scaled

Care should be taken to avoid bending the target pin as this may cause misalignment of the target.

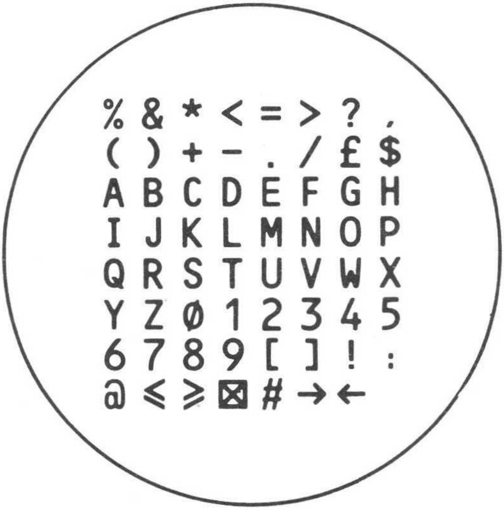
OPERATIONAL BLOCK DIAGRAM




* Zero mean voltage

# Monoscope Tube

TARGET "A"
TYPICAL TARGET
USING ECMA FOUNT OCR-B




<u>Alignment of Traces</u>

A positive voltage on $y_1$ deflects beam towards top row.
A positive voltage on $x_2$ deflects beam towards left hand column.
Angle between x and y traces $90° \pm 1°$
Angle between trace and target symbols $\pm 1°$.

See XR1003 data for tube electrical and mechanical details.

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# NOTES

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