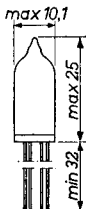
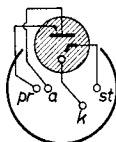


Cold cathode TRIGGER TUBE with positive starter voltage and equipped with priming electrode  
 TUBE DÉCLENCHEUR à cathode froide avec tension du déclencheur positive et équipé d'une électrode auxiliaire (primer)  
 RELAISRÖHRE mit kalter Katode, mit positiver Starterspannung und ausgeführt mit einer Hilfselektrode (Primer)

Application: D.C. counting and switching circuits  
 Obtainable counting speed 3-5 kc/s  
 Application: Des circuits de comptage et de commutation C.C.  
 Vitesse de comptage réalisable 3-5 kHz  
 Anwendung : Gleichstromzähl- und Schaltkreisen  
 Erhältliche Zählgeschwindigkeit 3-5 kHz

Dimensions in mm  
 Dimensions en mm  
 Abmessungen in mm



Typical characteristics  
 Caractéristiques types  
 Kenndaten

$V_{st\ ign}$ ( $V_a = 250\ V$ )	= 137-153 V <sup>1</sup> )
Individual voltage shift of $V_{st\ ign}$ during life	
Changement individuel de $V_{st\ ign}$ pendant la vie	= max. $\pm 5\ V$
Individuelle Verschiebung von $V_{st\ ign}$ während der Lebensdauer	
$V_{st}$ ( $I_{st} = 50\ \mu A$ )	= 105 V
$V_a$ ( $I_a = 3\ mA$ )	= 113-121 V <sup>1</sup> )
$V_a\ ign$	= min. 325 V
$V_{pr-a\ ign}$	= max. 210 V
$V_{pr-a}$ (burning voltage)	
$V_{pr-a}$ (tension de régime)	= 175 V
$V_{pr-a}$ (Brennspannung)	
$I_{st\ transf}$ ( $V_a\ ign = 250\ V$ )	= max. 20 $\mu A$

<sup>1</sup>) These limits are valid during life  
 Ces limites sont valables pendant la durée de vie du tube  
 Diese Grenzen gelten für die gesamte Lebensdauer

Cold cathode TRIGGER TUBE with positive starter voltage and equipped with priming cathode. chiefly intended for use in D.C. supplied circuits

TUBE DÉCLENCHÉUR à cathode froide avec tension de déclenchement positive et équipé d'une cathode auxiliaire (primer). Le tube est destiné tout d'abord à l'utilisation dans circuits alimentés par C.C.

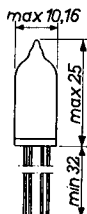
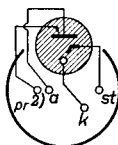
RELAISRÖHRE mit kalter Katode, positiver Starterspannung und ausgeführt mit einer Hilfskatode (Primer), zunächst bestimmt zur Verwendung in Gleichstromkreisen

Application: In counting and switching circuits and in timers. Obtainable counting speed: 2-5 kc/s <sup>1)</sup>

Application: Dans circuits de comptage et de commutation et dans interrupteurs horaires. Vitesse de comptage réalisable: 2-5 kHz <sup>1)</sup>

Anwendung: In Zähl- und Schaltkreisen und in Zeitschaltern. Erhältliche Zählggeschwindigkeit: 2-5 kHz <sup>1)</sup>

Dimensions in mm  
Dimensions en mm  
Abmessungen in mm



Base, culot. Sockel: SUBMINIATURE

Directly soldered connections to the leads of this tube must be at least 5 mm from the seals and any bending of the leads must be at least 2 mm from the seals

Ne pas faire de soudures à moins de 5 mm et ne pas plier les fils de sortie à moins de 2 mm de l'embase

Lötanschlüsse an den Drahtausführungen müssen mindestens 5 mm, etwaige Biegestellen mindestens 2 mm von den Glasdurchführungen entfernt sein

Typical characteristics <sup>3)</sup>  
Caractéristiques types <sup>3)</sup>  
Kenndaten

$V_{stign}$ ( $V_a = 250 \text{ V} \dots$ )	=	137 - 153 V <sup>4)</sup>
$I_{st \text{ transf}}$ ( $V_a = 250 \text{ V} \dots$ )	= max.	30 $\mu\text{A}$
$V_{st}$ ( $I_{st} = 0 - 200 \mu\text{A}$ )	=	5)
$V_a$ ( $I_a = 3 \text{ mA}$ )	=	113 - 121 V
$V_a \text{ ign}^6)$	= min.	360 V
		325 V
$V_{pr-a \text{ ign}}$	= max.	200 V
$V_{pr-a}$ ( $I_{pr} = 3 \mu\text{A}^7)$	=	155 V

<sup>1)2)3)4)5)6)7)</sup> See page 2; voir page 3; siehe Seite 4

Subminiature cold cathode TRIGGER TUBE with priming cathode to eliminate breakdown delay. The tube has one starter, which is controlled by a positive potential. A red neon glow is emitted during conduction.

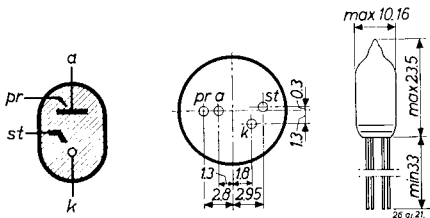
## APPLICATION

Counters, scalars, etc. up to 5 kc/s  
 Logic circuit element in connection with photo-electric devices.  
 Pulse generators, pulse shapers, pulse amplifiers.  
 General relay services.  
 Timers.

## QUICK REFERENCE DATA

Anode supply voltage	$V_{ba}$	=	250 V
Starter breakdown voltage	$V_{st\ ign}$	=	145 V
Starter transfer requirements			
capacitance	$C_{st}$	=	100 pF
current	$I_{st}$	=	11 $\mu$ A
Average cathode current	$I_k$	=	max. 5 mA
Anode to cathode maintaining voltage	$V_{am}$	=	116 V

## Dimensions in mm



Tinned leads 0.43 mm diameter

Limiting values (ABSOLUTE LIMITS)  
Caractéristiques limites (LIMITES ABSOLUES)  
Grenzdaten (ABSOLUTE WERTE)

$V_{ba}$	= max.	310 V
$I_k$	= max.	3 mA <sup>2)</sup>
$I_{kp}$	= max.	12 mA <sup>3)</sup>
$I_{pr}$	= min.	1 $\mu$ A
	= max.	10 $\mu$ A

#### Remarks

- During operation manual touching should be avoided
- The tube gives a bright red glow when ignited
- The working of the tube is independent on lighting conditions

#### Observations

- On devra éviter de toucher le tube avec la main en cours de fonctionnement
- Lorsque le tube est allumé, il donne une lueur rouge brillante
- Le tube fonctionne dans l'obscurité totale. Son fonctionnement est indépendant des conditions d'éclairage

#### Bemerkungen

- Berührung mit den Fingern während des Betriebes ist zu vermeiden
- Die Röhre zeigt nach Zündung ein hellrotes Glimmlicht
- Die Röhre arbeitet in völliger Dunkelheit. Die Funktion der Röhre ist unabhängig von den Beleuchtungsumständen

<sup>2)</sup>  $T_{av} = 1 \text{ sec.}$

<sup>3)</sup> Higher peak currents may be tolerated in special cases  
Dans certains cas particuliers, des valeurs plus élevées sont admissibles  
In Sonderfälle sind höhere Werte zulässig

Limiting values (absolute limits)  
 Caractéristiques limites (limites absolues)  
 Grenzdaten (Absolutwerte)

V <sub>ba</sub>	= max. 310 V	<sup>3)</sup>
I <sub>k</sub> (T <sub>av</sub> ≤ 1 sec)	= max. 4 mA	<sup>8)</sup>
I <sub>kp</sub>	= max. 16 mA	<sup>9)</sup>

Page 2 in English; page 3 en Français; Seite 4 auf deutsch

### Remarks

- The starter and primer circuit elements should be mounted close to the tube
- In capacitivetrigger circuits the capacitance should have a value between 50 pF and 1000 pF. The required capacitance value is inversely proportional to the anode voltage. The value of the starter series resistor with priming discharge ignited must not exceed 20 MΩ. Higher resistor values may be tolerated in special cases
- If a tube is ignited by means of pulses of short duration the total starter voltage (bias + pulse) must exceed 153 V. A typical value with a 100 pF coupling capacitor is 175 V
- With ignited tube the negative starter current should not exceed 100 μA. When the tube is extinguished negative starter current should be avoided
- During operation touching with conductive elements should be avoided
- The operation of the tube is independent of lighting conditions. The tube shows a bright red glow when ignited

<sup>1)</sup> Dependent on the tolerances of the components and the stability of the supply voltage

<sup>2)</sup> Priming cathode, giving a short ignition delay time

<sup>3)</sup> Measured with priming discharge ignited and also valid during life

<sup>4)</sup> The individual ignition voltage drift during life is generally less than 3 V

<sup>5)</sup> See curve on page B

<sup>6)</sup> Starter connected to cathode

<sup>7)</sup> Recommended priming cathode resistor 18 MΩ

<sup>8)</sup> The recommended cathode current range with continuous operation is 2-4 mA

<sup>9)</sup> Higher peak currents may be tolerated in special cases

**MOUNTING**

Directly soldered connections to the leads must be at least 5 mm from the seals and any bending of the leads must be at least 2 mm from the seals.

When soldering into the circuit the heat conducted to the glass-to-metal seals should be kept to a minimum by the use of a thermal shunt.

The leads may be dip soldered to min. 5 mm from the seals at a solder temperature of 240°C during max. 10 sec.

The starter and priming cathode circuit resistors and capacitors should be mounted close to the tube.

Touching the envelope by live components should be avoided. It is recommended to maintain a distance of at least some mm between components and any part of the envelope.

The tube may strike spontaneously when mounted in an electric field, the probability of striking being dependent on the field strength (direction and magnitude) and its rate of change. If necessary an electrostatic shield connected to the cathode can be mounted around the tube.

- 1) The value quoted relates to a tube which has been non-conducting during an appreciable time. The average value for the voltage breakdown depression is 4 V/mA. Normal values for  $V_{a\text{ign}}$  will be restored within 30 sec. after conduction.
- 2) Almost independent of the anode supply voltage between  $V_{ba} = 200\text{ V}$  and 300 V. See also page C
- 3) Almost independent of the cathode current
- 4) When establishing the electrical characteristics of a large number of tubes, it will be found that for each characteristic at least 95 % of the tubes investigated will meet the figures quoted.
- 5) To determine the starter current in a particular application (sign and magnitude) a load-line for  $R_{st}$  can be drawn on the  $I_{st}/V_{st}$  characteristic. See example page A for  $R_{st} = 1\text{ M}\Omega$  and  $V_{bst} = -100\text{ V}$ .

## Observations

- a. Les éléments de montage de l'électrode d'amorçage et de l'électrode auxiliaire doivent être montés près du tube
- b. Dans circuits déclencheurs capacitifs la capacité aura une valeur entre 50 pF et 1000 pF. La valeur de capacité requise est inversement proportionnelle à la tension anodique. La valeur de la résistance série de l'électrode d'amorçage en décharge amorcée de l'électrode auxiliaire doit rester en deçà de 20 MΩ. En certains cas particuliers des valeurs de résistance plus élevées sont tolérables
- c. Si un tube est amorcé par moyen d'impulsions de courte durée, la tension totale de l'électrode d'amorçage (tension de polarisation + tension d'impulsion) doit dépasser 153 V. Une valeur type avec un condensateur de couplage de 100 pF est de 175 V
- d. Quand le tube est amorcé le courant négatif de l'électrode d'amorçage doit rester en deçà de 100 μA. Quand le tube est étouffé il faut éviter un courant négatif de l'électrode d'amorçage
- e. On devra éviter de toucher le tube avec des objets conductifs en cours de fonctionnement
- f. Le fonctionnement du tube est indépendant des conditions d'éclairage. Quand le tube est amorcé une lueur rouge brillante se produit

- 1) Dépendant des tolérances des éléments de montage et de la stabilité de la tension d'alimentation
- 2) Cathode auxiliaire (primer) donnant un court temps de retard de l'amorçage
- 3) Mesurées en décharge amorcée de la cathode auxiliaire et aussi valables pendant la durée de vie du tube
- 4) La déviation individuelle de la tension d'amorçage pendant la vie est généralement moins de 3 V
- 5) Voir la courbe sur page B
- 6) L'électrode d'amorçage reliée à la cathode
- 7) La valeur recommandée pour la résistance série de la cathode auxiliaire est de 18 MΩ
- 8) La gamme recommandée du courant cathodique en service continu est de 2-4 mA
- 9) En certains cas particuliers des courants de crête plus élevés sont tolérables

→ **A. CHARACTERISTICS FOR D.C. IGNITION** (with continuous priming discharge)

**A.1 Limits applicable to all tubes** (initial values)

Anode to cathode breakdown voltage at $V_{st} = 0$ V	$V_{a\ ign} = \text{min.}$	340 V <sup>1)</sup>
Anode to primer breakdown voltage	$V_{pr\ ign} = \text{max.}$	200 V
Starter to cathode breakdown voltage at $V_{ba} = 250$ V	$V_{st\ ign} =$	137 to 153 V <sup>2)</sup>
Anode to cathode maintaining voltage	$V_{am} =$	111 to 121 V <sup>3)</sup>

**A.2 Typical limits** <sup>4)</sup> (initial values)

D.C. starter current for anode breakdown at $V_{ba}=250$ V (See also page B)	$I_{st} =$	3 to 25 $\mu$ A
Starter to cathode maintaining voltage at $I_{st} = 30$ $\mu$ A and $I_a = 0$ mA (See also page A)	$V_{stm} =$	105 to 125 V
Temperature coefficient of starter to cathode breakdown voltage averaged over the range $t_{bulb} = -55$ to $+100$ °C	$\frac{\Delta V_{st\ ign}}{\Delta t_{bulb}} = \text{max.}$	-25 mV/°C

**A.3 Typical life performance** <sup>4)</sup>

(Valid up to 20 000 hours with alternating stand-by and operating periods, within a cathode current range of 2 to 5 mA and with zero or positive starter current. See also page A and note <sup>5)</sup> for calculating the starter current)

Drift in starter to cathode breakdown voltage at $V_{ba} = 250$ V	$\Delta V_{st\ ign} = \text{max.}$	5 V
Anode to cathode maintaining voltage	$V_{am} = \text{max.}$	122 V
Anode to primer maintaining voltage at $I_{pr} = 3$ $\mu$ A. (See also page E)	$V_{prm} =$	140 to 180 V
Starter to cathode maintaining voltage at $I_{pr} = 30$ $\mu$ A, $I_a = 0$ mA	$V_{stm} = \text{max.}$	128 V
D.C. starter current for anode breakdown at $V_{ba}=250$ V	$I_{st} = \text{max.}$	30 $\mu$ A

<sup>1)</sup><sup>2)</sup><sup>3)</sup><sup>4)</sup><sup>5)</sup> See page 2



**Bemerkungen**

- a. Die Schalt-elemente des Starter- und Hilfselektrodenkreises müssen in der Nähe der Röhre montiert werden
- b. In kapazitiven Starterkreisen soll die Kapazität einen Wert zwischen 50 pF und 1000 pF haben. Der benötigte Kapazitätswert ist umgekehrt proportional zu der Anodenspannung. Der Wert des Starter-Serienwiderstandes bei entzündeter Hilfselektrodenentladung muss niedriger als 20 M $\Omega$  sein. In Sonderfällen sind höhere Widerstandswerte zulässig
- c. Wenn die Röhre mittels kurzdaueriger Impulse entzündet wird muss die gesamte Starterspannung (Vorspannung + Impulsspannung) höher als 153 V sein. Ein Kennwert bei einem Kopplungskondensator von 100 pF ist 175 V
- d. Bei entzündeter Röhre muss der negative Starterstrom niedriger als 100  $\mu$ A sein. Bei nicht-entzündeter Röhre ist negativer Starterstrom zu vermeiden
- e. Berührung mit leitfähigen Körpern während des Betriebs ist zu vermeiden
- f. Die Wirkung der Röhre ist unabhängig von den Beleuchtungs-umständen. Nach Entzündung zeigt die Röhre ein hellrotes Glimmlicht

<sup>1</sup>) Abhängig von den Toleranzen der Schaltungsteile und von der Stabilität der Speisespannung

<sup>2</sup>) Hilfskatode (Primer) zur Erzielung einer kurzen Zündverzögerungszeit

<sup>3</sup>) Gemessen bei entzündeter Hilfskatodenentladung und auch gültig für die gesamte Lebensdauer

<sup>4</sup>) Der individuelle Verlauf der Zündspannung während der Lebensdauer ist im allgemeinen weniger als 3 V

<sup>5</sup>) Siehe Kennlinie auf Seite B

<sup>6</sup>) Zündelektrode mit der Katode verbunden

<sup>7</sup>) Der empfohlene Wert für den Hilfskatodenserienwiderstand ist 18 M $\Omega$

<sup>8</sup>) Der empfohlene Katodenstrombereich bei Dauerbetrieb ist 2-4 mA

<sup>9</sup>) In Sonderfällen sind höhere Spitzenströme zulässig

→ B. CHARACTERISTICS FOR PULSED IGNITION (with continuous priming discharge)

B.1 Limits applicable to all tubes (initial values)

Anode to cathode breakdown voltage at  $V_{st} = 0$  V  $V_{a \text{ ign}} = \text{min. } 340 \text{ V } ^1)$

Anode to primer breakdown voltage  $V_{pr \text{ ign}} = \text{max. } 200 \text{ V}$

Sum of bias and pulse voltages to ensure ignition at  $V_{ba} = 250$  V and  $T_{imp} = 20 \mu\text{sec}$   
(See also page D)  $V_{st \text{ ignp}} = \text{max. } 172 \text{ V}$

Anode to cathode maintaining voltage  $V_{am} = 111-121 \text{ V } ^6)$

B.2 Typical limits <sup>4)</sup> (initial values)

Temperature coefficient of starter to cathode breakdown voltage averaged over the range  $t_{bulb} = -55$  to  $+100$  °C  $\frac{\Delta V_{st \text{ ign}}}{\Delta t_{bulb}} = \text{max. } -25 \text{ mV/}^\circ\text{C}$

Anode breakdown delay time = max.  $5 \mu\text{sec} ^7)$

Anode recovery time = max.  $170 \mu\text{sec} ^8)$

B.3 Typical life performance <sup>4)</sup>

(Valid up to 50 000 hours at stand-by or continuous operation within the limiting values)

Sum of bias and pulse voltages to ensure ignition  $V_{st \text{ ignp}} = \text{see page D}$

Anode to cathode maintaining voltage  $V_{am} = \text{max. } 122 \text{ V } ^6)$

<sup>1)4)</sup> See page 2

<sup>6)</sup> Almost independent of cathode current. Within a time interval of max.  $100 \mu\text{sec}$  after breakdown an abnormal low maintaining voltage may occur. Possible oscillations are excluded.

<sup>7)</sup> The anode breakdown delay time is given under the following conditions: Starter overvoltage =  $50 \text{ V}$ ,  $R_{st} = 1.2 \text{ M}\Omega$ ,  $C_{st} = 100 \text{ pF}$ ,  $V_{ba} = 200$  to  $300 \text{ V}$

<sup>8)</sup> The anode recovery time is the time required after interruption of the anode current for the starter to regain control. The value is primarily a function of the anode current, as the extinguishing pulse amplitude as well as its duration both depend on the anode supply voltage. The figure quoted is the value of the time constant  $RC$  determining the rate of rise of the anode voltage

→ LIMITING VALUES (Absolute limits)

Anode supply voltage with continuous priming discharge		
with D.C. ignition	$V_{ba}$	= max. 340 V <sup>1)</sup> = min. 200 V
with pulsed ignition	$V_{ba}$	= max. 310 V = min. 200 V
Peak cathode current (See also page F)	$I_{kp}$	= max. 200 mA = min. 2 mA
Average cathode current (See also page F)	$I_k$	= max. 5 mA <sup>2)</sup> = min. 2 mA
Positive starter current		
peak value	$I_{stp}$	= max. 100 mA
average value	$I_{st}$	= max. 5 mA <sup>2)</sup>
Negative starter current		
with D.C. ignition	$-I_{st}$	= max. 10 $\mu$ A
with pulsed ignition, anode to cathode gap conducting	$-I_{st}$	= max. 150 $\mu$ A
with pulsed ignition, anode to cathode gap extinguished	$-I_{st}$	= max. 0 $\mu$ A
Negative starter pulse voltage		
at $V_{ba} = 300$ V	$-V_{stp}$	= max. 30 V
at $V_{ba} = 200$ V	$-V_{stp}$	= max. 50 V
Anode to primer voltage	$V_{a-pr}$	= min. 200 V
Primer current	$I_{pr}$	= max. 12 $\mu$ A = min. 1 $\mu$ A
Envelope temperature	$t_{bulb}$	= max. 100 °C = min. -55 °C

<sup>1)</sup> The tube may be used with the primer disconnected provided the priming current is delivered by the starter. In this case  $V_{ba} = \text{min. } 180$  V

<sup>2)</sup> Averaging time  $T_{av} = \text{max. } 5$  sec or = max. 1 cycle, whichever is the shortest

MAXIMUM CIRCUIT VALUES (Absolute limits)

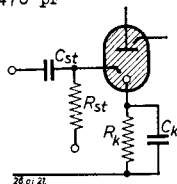
Starter series resistor	$R_{st}$	= max.	20 M $\Omega$
Starter to cathode capacitor	$C_{st-k}$	= max.	2000 pF <sup>1)</sup>
Starter coupling capacitor	$C_{st}$	= max.	2000 pF <sup>1)</sup>
		= min.	20 pF
Capacitor which may be charged or discharged through the anode to cathode gap	C	= max.	0.01 $\mu$ F <sup>1)</sup>

TYPICAL COMPONENT VALUES FOR SELF-QUENCHING PULSE FORMING CIRCUITS

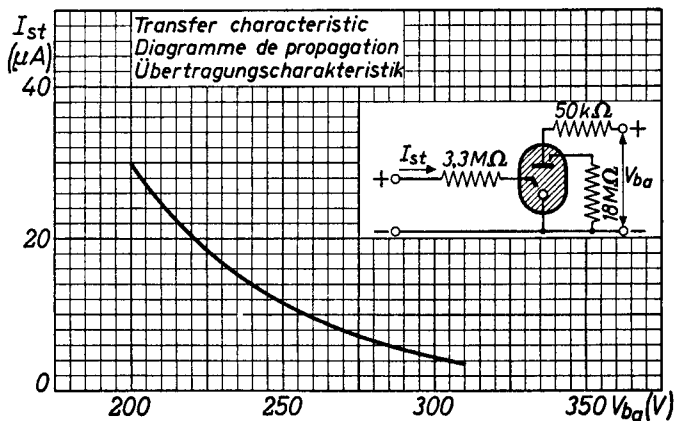
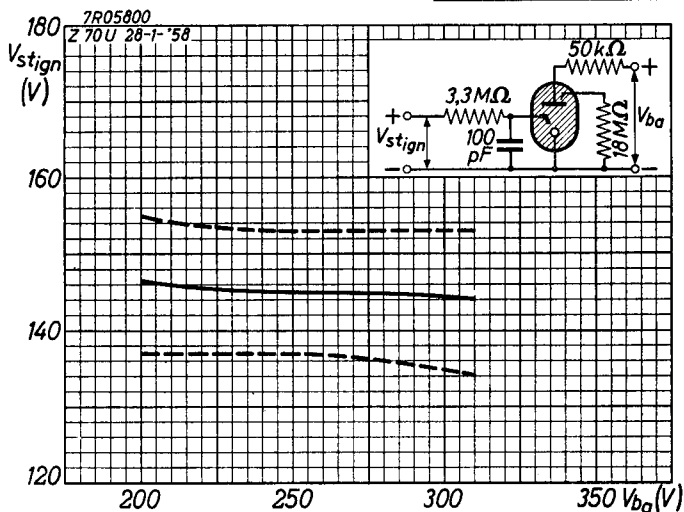
The minimum time constant of a self-quenching circuit is 250  $\mu$ sec. The time constant is the product of the parallel resistance of  $R_{st}$  and  $R_k$  and  $C_k$

Typical values for  $R_k$  and  $C_k$  at  $R_{st} = 1.2$  M $\Omega$  are:

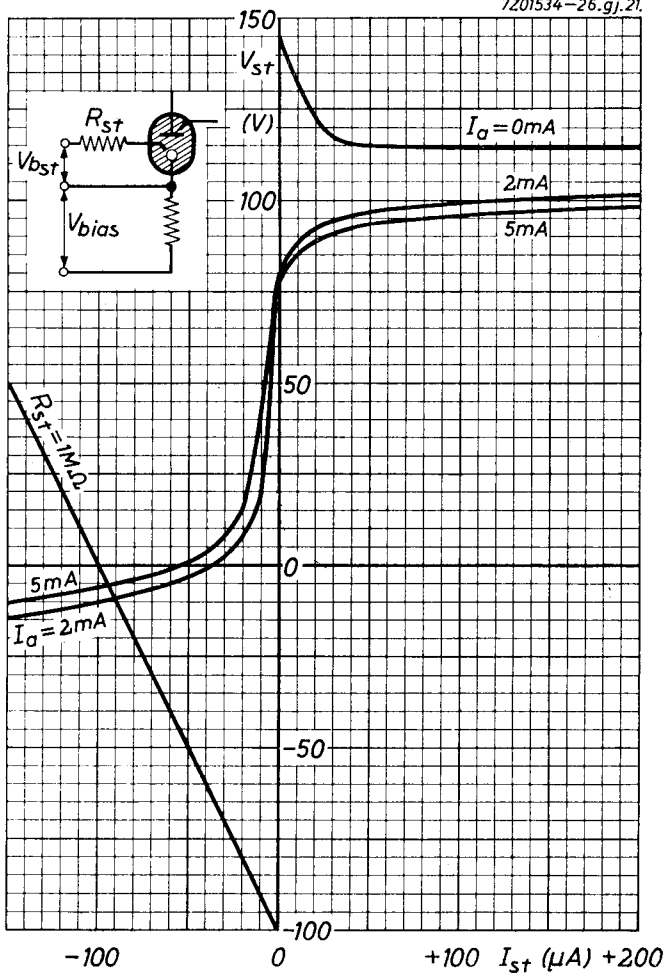
$R_k$	= 1.8	1.2 M $\Omega$
$C_k$	= 330	470 pF



<sup>1)</sup> Higher values of these capacitors are permitted with the use of a resistor in series to limit the peak current to the max. permissible value.

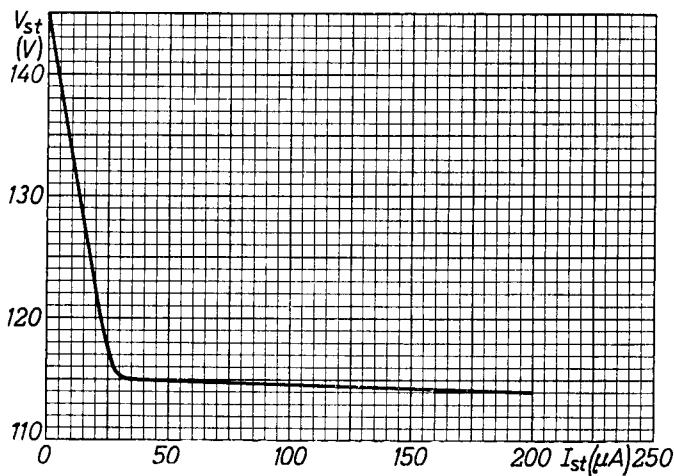
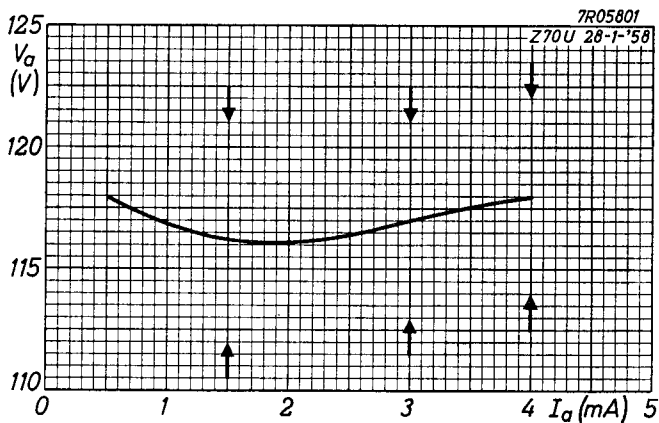


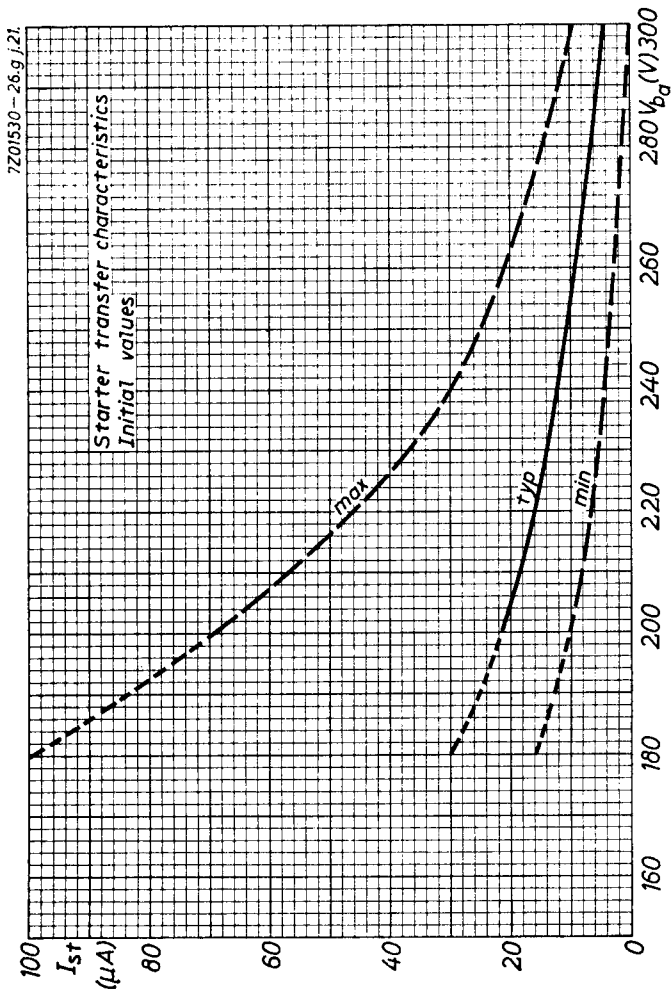
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# Z70U

# PHILIPS



**Z70U****PHILIPS**

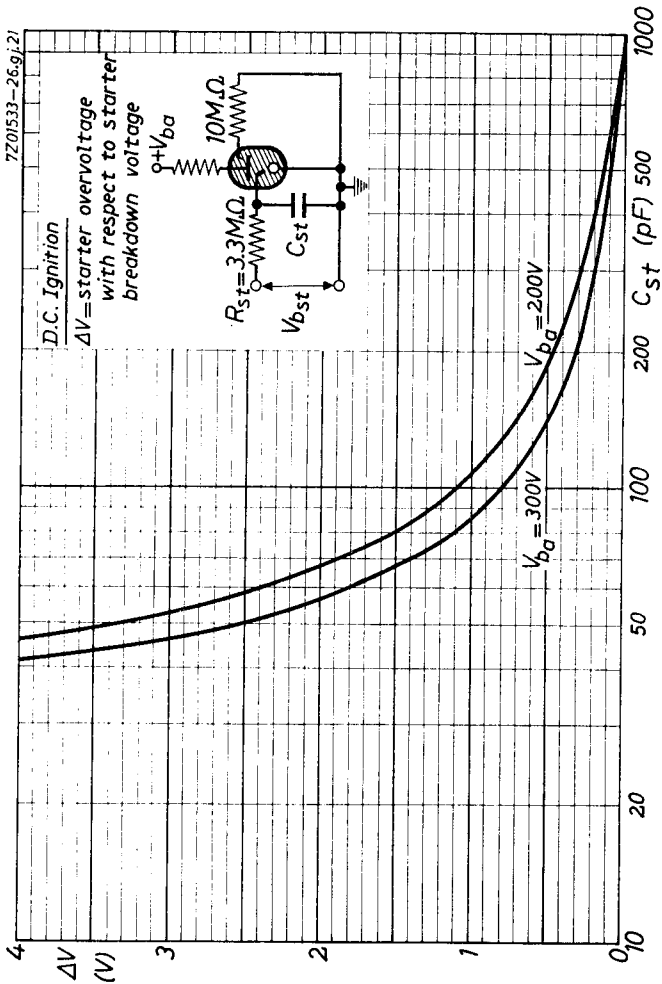
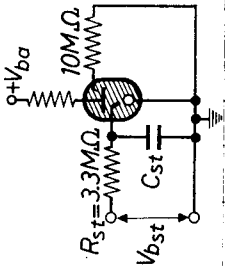
B



7Z01533-26.gj.21

D.C. Ignition

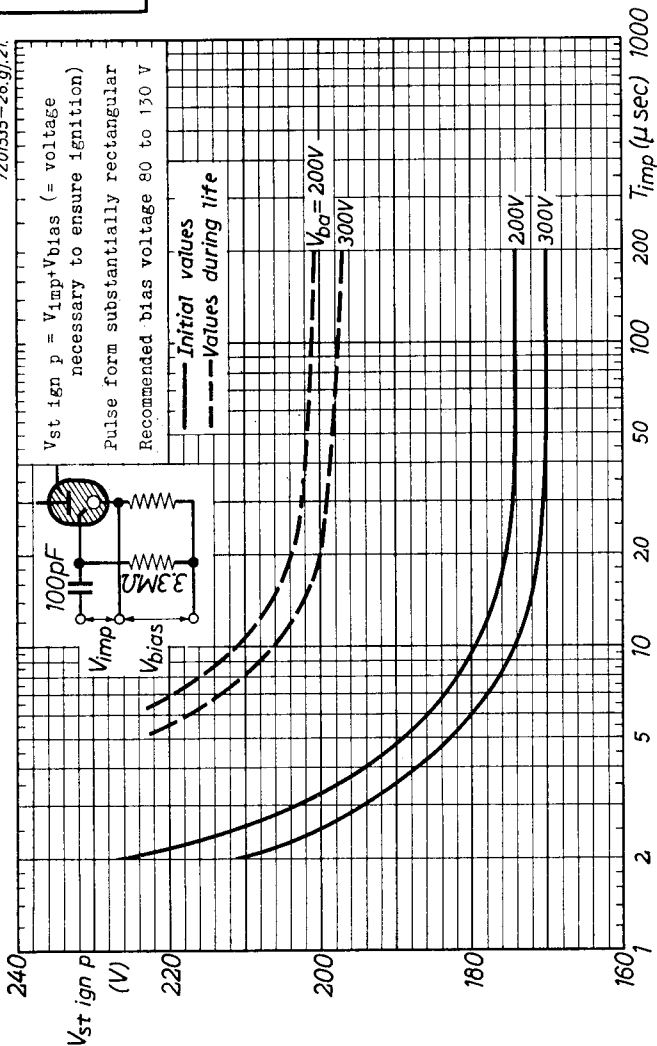
$\Delta V$  = starter overvoltage  
with respect to starter  
breakdown voltage



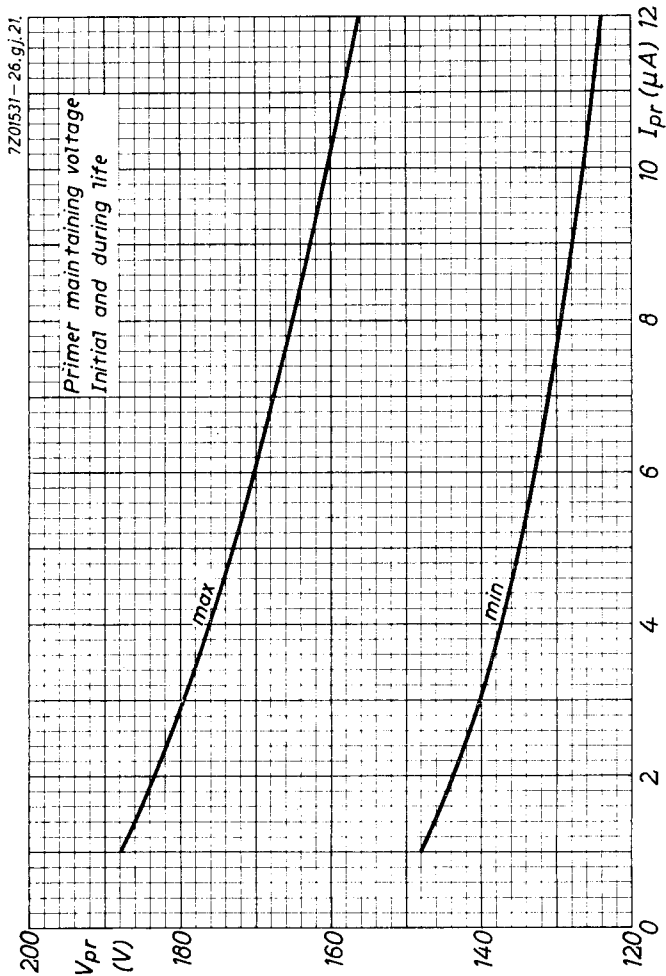
# Z70U

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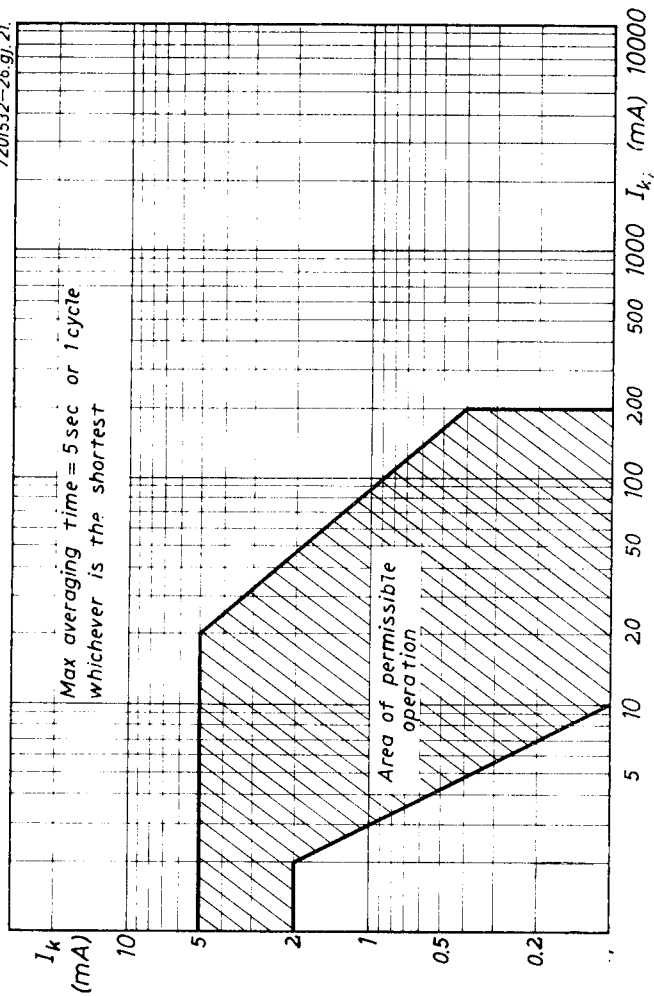


D



**Z70U****PHILIPS**

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F

**PHILIPS**

*Electronic  
Tube*

**HANDBOOK**

<b>page</b>	<b>Z70U sheet</b>	<b>date</b>
1	1	1957.07.07
2	1	1958.02.02
3	1	1963.03.03
4	2	1957.07.07
5	2	1958.02.02
6	2	1963.03.03
7	3	1958.02.02
8	3	1963.03.03
9	4	1958.02.02
10	4	1963.03.03
11	5	1963.03.03
12	6	1963.03.03
13	A	1958.02.02
14	A	1963.03.03
15	B	1958.02.02
16	B	1963.03.03
17	C	1963.03.03
18	D	1963.03.03
19	E	1963.03.03

20  
21, 22

F  
FP

1963.03.03  
1999.12.16