PHILIPS

Data handbook

Electronic components and materials

Electron tubes

Part 7b March 1977

Segment indicator tubes

Indicator tubes

Switching diodes

Dry reed contact units

ELECTRON TUBES

Part 7b **March 1977**

RATING SYSTEM

(in accordance with IEC Publication 134)

ABSOLUTE MAXIMUM RATING SYSTEM

Absolute maximum ratings are limiting values of operating and environmental conditions applicable to any electronic device of a specified type as defined by its published data, which should not be exceeded under the worst probable conditions.

These values are chosen by the device manufacturer to provide acceptable serviceability of the device, taking no responsibility for equipment variations, environmental variations, and the effects of changes in operating conditions due to variations in the characteristics of the device under consideration and of all other electronic devices in the equipment.

The equipment manufacturer should design so that, initially and throughout life, no absolute maximum value for the intended service is exceeded with any device under the worst probable operating conditions with respect to supply variation, equipment component variation, equipment control adjustment, load variations, signal variation, environmental conditions, and variations in characteristics of the device under consideration and of all other electronic devices in the equipment.

Some devices are labelled "MAINTENANCE TYPE" or "OBSOLESCENT TYPE"

Maintenance type - Available for equipment maintenance.
No longer recommended for equipment production.

Obsolescent type - Available until present stocks are exhausted.

DATA HANDBOOK SYSTEM

Our Data Handbook System is a comprehensive source of information on electronic components, subassemblies and materials; it is made up of three series of handbooks each comprising several parts.

ELECTRON TUBES	**BLUE**
SEMICONDUCTORS AND INTEGRATED CIRCUITS	**RED**
COMPONENTS AND MATERIALS	**GREEN**

The several parts contain all pertinent data available at the time of publication, and each is revised and reissued periodically.

Where ratings or specifications differ from those published in the preceding edition they are pointed out by arrows. Where application information is given it is advisory and does not form part of the product specification.

If you need confirmation that the published data about any of our products are the latest available, please contact our representative. He is at your service and will be glad to answer your inquiries.

ELECTRON TUBES (BLUE SERIES)

This series consists of the following parts, issued on the dates indicated.

Part 1a	Transmitting tubes for communication Tubes for r.f. heating Types PE05/25 – TBW15/25		December 1975
Part 1b	Transmitting tubes for communication Tubes for r.f. heating Amplifier circuit assemblies		January 1976
Part 2	Microwave products		May 1976
	Communication magnetrons Magnetrons for microwave heating Klystrons Travelling-wave tubes Isolators, Circulators	Diodes Triodes T-R switches Microwave semiconductor devices	
Part 3	Special Quality tubes Miscellaneous devices		January 1975
Part 4	Receiving tubes		March 1975
Part 5a	Cathode-ray tubes		August 1976
Part 5b	Camera tubes Image intensifier tubes		May 1975
Part 6	Products for nuclear technology		January 1977
	Channel electron multipliers Neutron tubes	Geiger-Müller tubes	
Part 7a	Gas-filled tubes		March 1977
	Thyratrons Industrial rectifying tubes	Ignitrons High-voltage rectifying tubes	
Part 7b	Gas-filled tubes		March 1977
	Segment indicator tubes Indicator tubes	Switching diodes Dry reed contact units	
Part 8	TV picture tubes		October 1975
Part 9	Photomultiplier tubes Phototubes (diodes)		June 1976

SEMICONDUCTORS AND INTEGRATED CIRCUITS (RED SERIES)

This series consists of the following parts, issued on the dates indicated.

Part 1a **Rectifier diodes, thyristors, triacs** — **March 1976**

Rectifier diodes
Voltage regulator diodes (> 1,5 W)
Transient suppressor diodes
Rectifier stacks
Thyristors
Triacs

Part 1b **Diodes** — **October 1975**

Small signal germanium diodes
Small signal silicon diodes
Special diodes
Voltage regulator diodes (< 1,5 W)
Voltage reference diodes
Tuner diodes

Part 2 **Low-frequency transistors** — **December 1975**

Part 3 **High-frequency and switching transistors** — **April 1976**

Part 4a **Special semiconductors** — **June 1976**

Transmitting transistors
Microwave devices
Field-effect transistors
Dual transistors
Microminiature devices for thick- and thin-film circuits

Part 4b **Devices for optoelectronics** — **July 1976**

Photosensitive diodes and transistors
Light emitting diodes
Displays
Photocouplers
Infrared sensitive devices
Photoconductive devices

Part 5a **Professional analogue integrated circuits** — **November 1976**

N.B. Consumer circuits will be issued in part 5b

Part 6 **Digital integrated circuits** — **May 1976**

LOCMOS HE family
GZ family

COMPONENTS AND MATERIALS (GREEN SERIES)

This series consists of the following parts, issued on the dates indicated.

Part 1 **Functional units, Input/output devices, Peripheral devices** — November 1975

- High noise immunity logic FZ/30-Series
- Circuit blocks 40-Series and CSA70
- Counter modules 50-Series
- NORbits 60-Series, 61-Series
- Circuit blocks 90-Series
- Input/output devices
- Hybrid integrated circuits
- Peripheral devices

Part 2a **Resistors** — February 1976

- Fixed resistors
- Variable resistors
- Voltage dependent resistors (VDR)
- Light dependent resistors (LDR)
- Negative temperature coefficient thermistors (NTC)
- Positive temperature coefficient thermistors (PTC)
- Test switches

Part 2b **Capacitors** — April 1976

- Electrolytic and solid capacitors
- Paper capacitors and film capacitors
- Ceramic capacitors
- Variable capacitors

Part 3 **Radio, Audio, Television** — January 1977

- FM tuners
- Loudspeakers
- Television tuners and aerial input assemblies
- Components for black and white television
- Components for colour television

Part 4a **Soft ferrites** — October 1976

- Ferrites for radio, audio and television
- Beads and chokes
- Ferroxcube potcores and square cores
- Ferroxcube transformer cores

Part 4b **Piezoelectric ceramics, Permanent magnet materials** — December 1976

Part 5 **Ferrite core memory products** — July 1975

- Ferroxcube memory cores
- Matrix planes and stacks
- Core memory systems

Part 6 **Electric motors and accessories** — September 1975

- Small synchronous motors
- Stepper motors
- Miniature direct current motors

Part 7 **Circuit blocks** — September 1971

- Circuit blocks 100 kHz-Series
- Circuit blocks 1-Series
- Circuit blocks 10-Series
- Circuit blocks for ferrite core memory drive

Part 8 **Variable mains transformers** — July 1975

Part 9 **Piezoelectric quartz devices** — March 1976

Part 10 **Connectors** — November 1975

Segment indicator tubes

DUAL 7-SEGMENT INDICATOR TUBE

suitable for direct drive with 30 V ICs

Long-life segmented dual cold-cathode gas-filled indicator tube in a flat envelope for in-line numeric display applications, such as in digital measuring equipment, clocks, cash registers, weighing machines etc. The tube is suitable for soldering into the circuit. Two or more tubes may be stacked horizontally.

QUICK REFERENCE DATA	
Character height	15 mm
Characters	formed by 7 segments
Number of decades	2
Decimal point	to the lower right of the characters
Decade pitch (also for stacked tubes)	17,78 mm (0,7 in)

MECHANICAL DATA

Mounting position : any

The tube is provided with dual in-line tinned dip-solder pins for insertion in a printed-wiring board. (e = 2,54 mm). It may also be plugged into a socket.

Soldering

The dip-solder pins may be soldered for 5 s in solder of max. 260 °C.

CHARACTERISTICS

Ignition voltage, first ignition, 25 lx	V_{ign}	<	165	V
Ignition delay, first ignition, V_{ba} = 165 V, 25 lx	T_d	<	2	s
Ignition voltage, subsequent ignitions within 10 ms	V_{ign}	<	150	V
Primed ignition voltage	$V_{ign\,pr}$	≤	143	V [1]
Maintaining voltage		see graph		
Extinction voltage	V_{ext}	≥	125	V
Luminous intensity per segment			10	mCd/mA

[1] Primed ignition voltage is the minimum anode to cathode voltage to ensure that the selected numeral (including decimal point) is completed after ignition of one segment.

Data based on pre-production devices.

LIMITING VALUES (Absolute max. rating system)

		segments	dec. points
Cathode current, d.c.	max.	0,7	max. 0,25 mA
	min.	0,25	min. 0,1 mA
Cathode current, mean, T_{av} = max. 25 ms	max.	0,5	max. 0,2 mA
Cathode current, peak	max.	3	max. 1,1 mA
T_{imp} = 0,2 ms	min.	0,35	min. 0,1 mA
Voltage between any two segments and/or decimal points	max.	125	V
Voltage between screen and any other electrode (tube ignited)	max.	125	V
Ambient temperature	max.	100	°C [1]
	min.	-50	°C [2]

RECOMMENDED OPERATING CONDITIONS

If the tube is used within its limiting values and according to the conditions below, a high-quality display is obtained and interdigit discharges are prevented, even with the worst combination of parameters.
For many applications the worst parameter combination will not occur. In those cases the conditions recommended below may be changed which may result in a cheaper drive circuit. These changes should, however, only be made after consulting the tube manufacturer.

Static operation see Fig. 1

Anode supply voltage	V_{ba}	max.	350	V
		min.	165	V

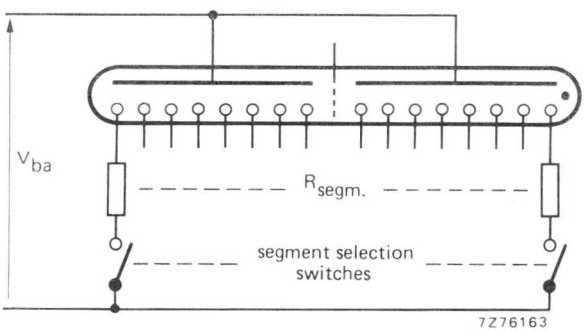


Fig. 1

Notes see page 3.

Dynamic operation see Fig. 2

Anode supply	V_{ba}	max.	185	V
		min.	165	V
Screen supply voltage (R_{screen} = 1 MΩ)	V_{bs}	max.	60	V
		min.	50	V
	$V_{a_{off}}$	max.	125	V
		min.	115	V

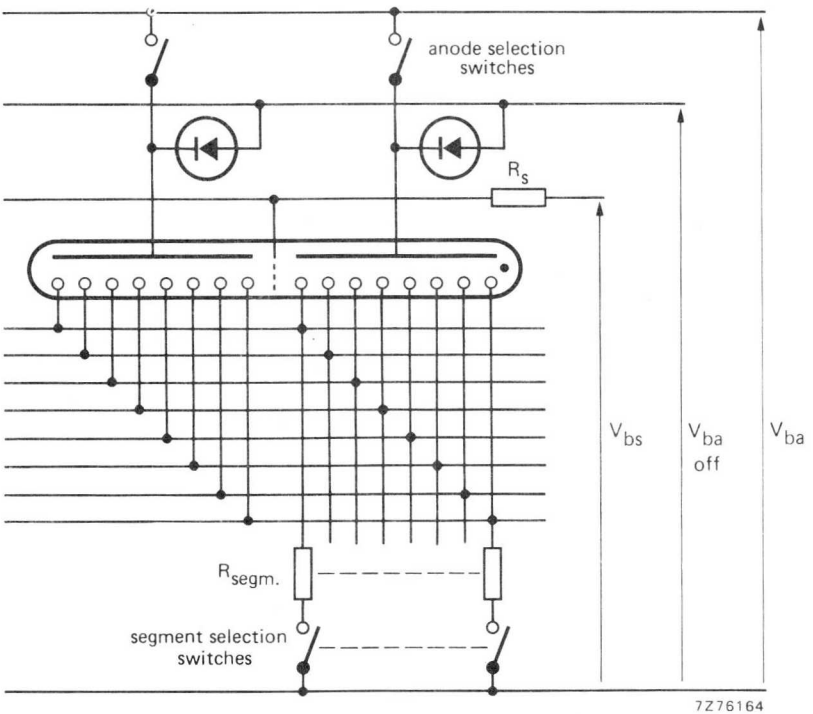


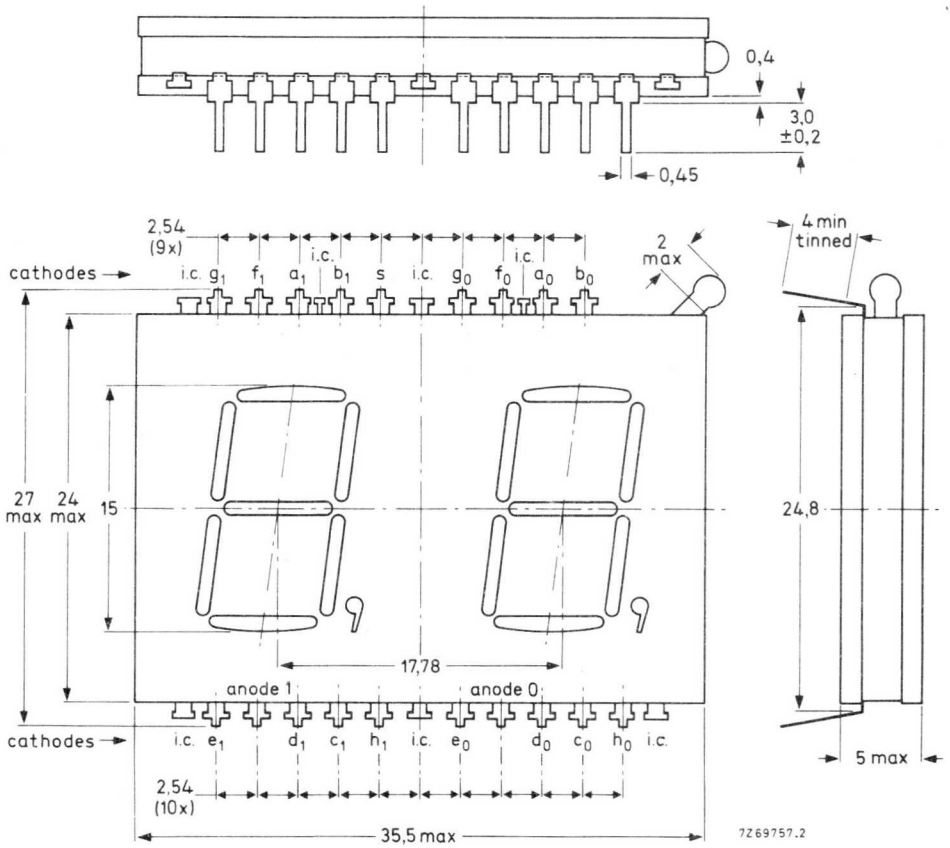
Fig. 2

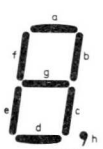
[1]) Bulb temperatures above 70 °C result in changes in colour.

[2]) Bulb temperatures below 10 °C result in a reduced life expectancy and changes in characteristics.

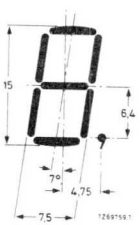
DIMENSIONS AND CONNECTIONS

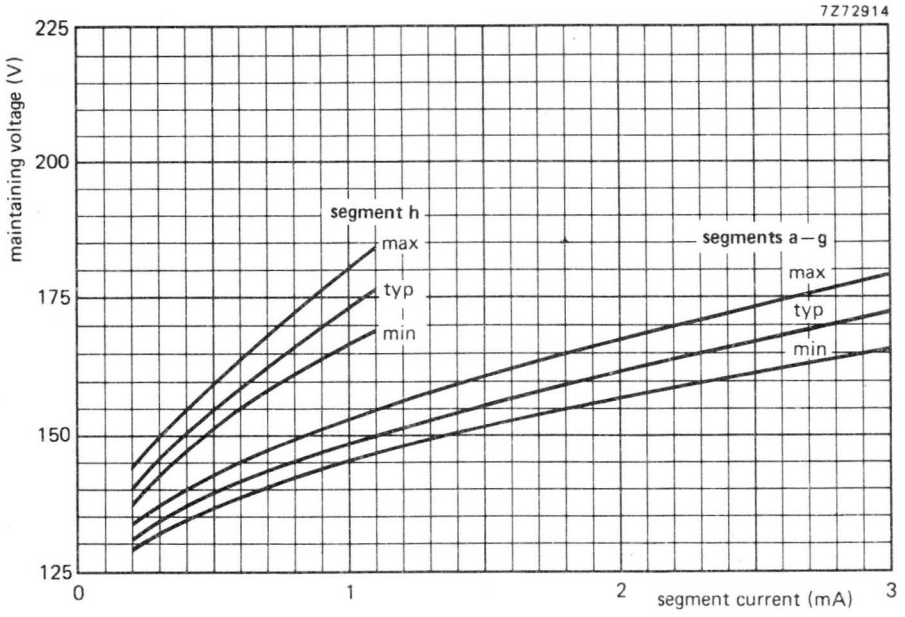
Dimensions in mm



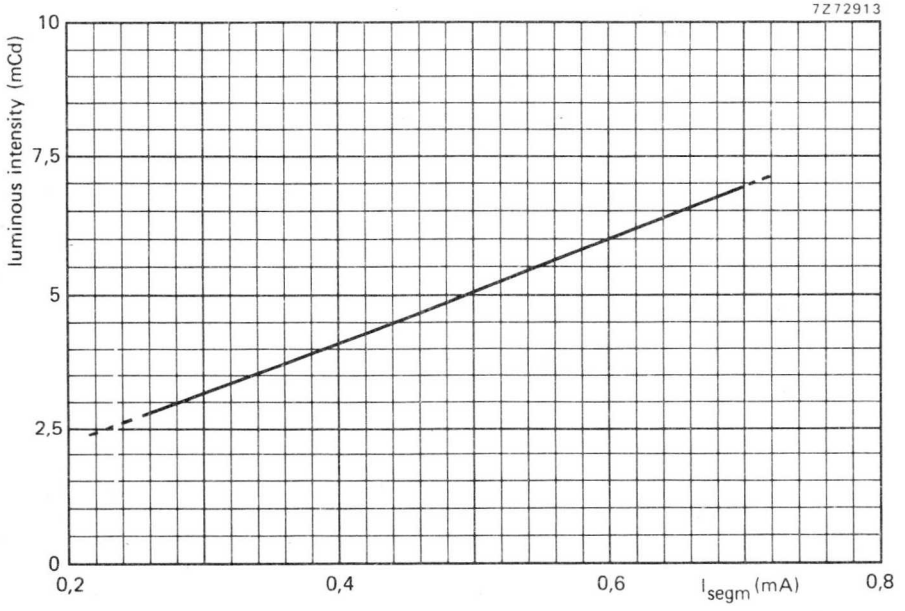


Segment designation

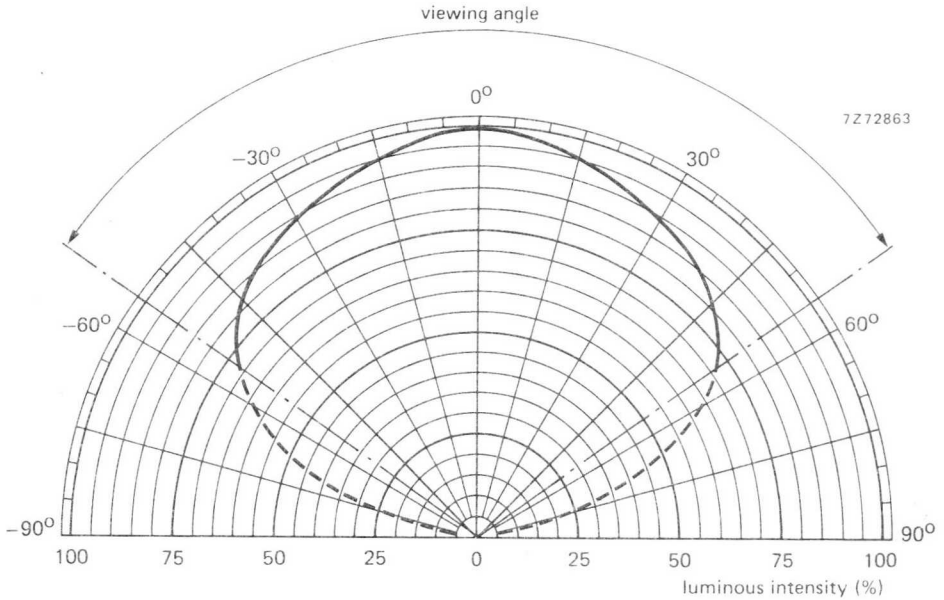




Maintaining voltage as a function of segment current.



Luminous sensitivity as a function of d.c. segment current.



Relative luminous intensity as a function of the direction of viewing.

7-SEGMENT 1,5 DIGIT INDICATOR TUBE

Long-life segmented cold-cathode gas-filled indicator tube in a flat envelope for in-line display applications, such as in digital measuring equipment.
The tube can be stacked with the ZM1550.

QUICK REFERENCE DATA		
Character height		15 mm
Characters	left compartment	+ - 1
	right compartment	formed by 7 segments
Numbers of decades		1,5
Decimal point		to the lower right of the character
Decade pitch (also for stacked tubes)		17.78 mm (0.7 in)

Further information on request.

Indicator tubes

COLD CATHODE INDICATOR TUBES

TERMS AND DEFINITIONS

1. Indicator tube.
An indicator tube is a glow discharge tube designed to give a visual indication of the presence of an electrical signal.

A numerical indicator tube is one in which the indication is given in the form of numerals.

In a point indicator tube the indication is given by the position of the glow.

2. Ignition.

2.1 Ignition voltage (symbol V_{ign})
The ignition voltage is the lowest direct potential, which when applied to a particular anode-cathode gap in the presence of some primary ionisation, will cause a self sustaining discharge to start in that anode-cathode gap.

2.2 Ignition delay.
The ignition delay is the time interval between the application of a direct potential (equal to or exceeding the ignition voltage) to a particular anode-cathode gap and the establishment of a self sustaining discharge in that gap.

The figure quoted applies to a tube which has been inoperative for a time long in comparision with the deionisation time.

3. Maintaining voltage (symbol V_m)
The maintaining voltage is the voltage between an anode and that cathode carrying the main discharge.

4. Extinguishing voltage (symbol V_{ext})
The extinguishing voltage is the voltage between anode and cathode below which the glow discharge extinguishes and is equal to the lowest possible value of the maintaining voltage.

5. "On" cathode.
The "on" cathode is the cathode (numeral) which is required to be displaid and thus carries the main discharge.

6. "Off" cathode.
The "off" cathodes are the cathodes which are not required for display and thus act as probes in the main discharge.

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7. Cathode selecting voltage (symbol V_{kk})
The cathode selecting voltage is the cathode voltage difference which is used for discrimination between the "off" cathodes and the "on" cathode.

8. Anode selecting voltage (symbol V_{aa})
The anode selecting voltage is the anode voltage difference which is used to select the "on" cathode out of a group of cathodes.

9. Anode to cathode bias voltage (bias voltage) (symbol V_{bias})
The anode to cathode bias voltage is the anode to cathode voltage before any cathode has been ignited. This voltage serves to reduce the required selecting voltage.

10. Shield voltage (symbol V_s)
The shield voltage is the voltage difference between the shield electrode and the "on" cathode and is used to prevent the penetration of the discharge from one compartment into another which is separated from the former by said shield.

11. Cathode current (symbol I_k)
The cathode current is the current flowing to the "on" cathode.

11.1 Minimum cathode current for coverage (symbol $I_{k\,min.}$)
The minimum cathode current is the current necessary to ensure full coverage of the "on" cathode by the glow.

11.2 Maximum cathode current (symbol $I_{k\,max.}$)
The maximum cathode current is the current at which the glow is still restricted to the "on" cathode.
If this current is exceeded the glow may spread to connecting leads or other elements.

12. Probe current (symbol I_{kk})
A probe current is the current flowing to or from an electrode which does not form part of the main discharge gap.
(The magnitude and direction of this current will be dependent on the position of this electrode with respect to the main discharge and on the external circuit conditions).

13. Anode current (symbol I_a)
The anode current is the algebraic sum of cathode current and all probe currents.

14. Life expectancy.
End of life is reached when the characteristics of any one numeral surpass the stated limits.

7Z2 5233

SHOCK AND VIBRATION

An indication for the **ruggedness** of the tube is the fact that 95% of the items sampled from normal production pass the shock and vibration tests specified below without perceplible damage.
These tests are carried out on non operating tubes.

Shock: 25 g_{peak}, 1000 shocks in one of the three positions of the tube.

Vibration: 2.5 g_{peak}, 50 Hz, during 32 hours in each of the three positions of the tube.

INDICATOR TUBE

Long-life cold-cathode ten-digit indicator tube for side viewing.

QUICK REFERENCE DATA				
Numeral height		approx.	14	mm
Numerals		0 1 2 3 4 5 6 7 8 9		
Decimal point		to the left of the numerals		
Supply voltage	V_{ba}	min.	170	V
Anode current, average	I_a		2,5	mA
peak	I_{ap}	max.	12	mA

GENERAL

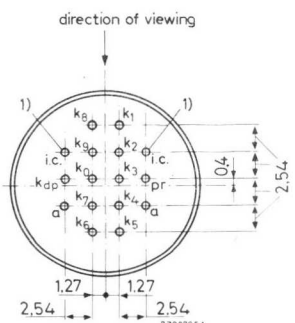
The numerals are 14 mm high and appear on the same base line allowing in-line read out.

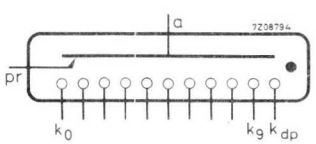
PRINCIPLE OF OPERATION

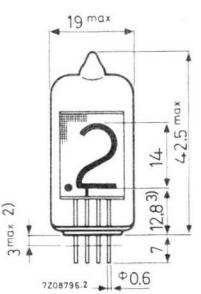
The tube contains ten cathodes in the form of ten numerals and one in the form of a decimal point, a primer, and one common anode. By applying a suitable voltage between the anode and one of the cathodes the corresponding numeral or the decimal point will be covered by a red neon glow.
The primer allows ionization without delay in strobe type or blanking applications.

DIMENSIONS AND CONNECTIONS

Dimensions in mm







1) Length of i.c. pins max. 2,8 mm.
2) Not tinned.
3) Standard deviation 0,13 mm.

The deviations of the axis of the pins with respect to the true geometrical position cover an area of max. 0.3 mm diameter. The pin configuration is compatible with the reference grid for printed wiring according to IEC Publication 97 (0.1 in).

Mounting position: Any

Soldering

The pins may be dip-soldered at a solder temperature of max. 240 °C for maximum 10 seconds up to a point 5 mm from the seals.

Natural frequency

The natural frequencies of the numeral cathodes lie within the range from 300 Hz to 800 Hz.

ACCESSORIES

55701 Printed wiring mounting board (19 x 100 mm) on which the ZM1000 can be soldered; afterwards the combination can be mounted on a vertical printed wiring board carrying, e.g., the drive circuit. Can also be used with the snap-fit tube holder 55703.

55702 Tube socket (for 0.1 in grid). Phenolic. Tinned contacts.

55703 Snap-fit tube holder.

55704 Set of one left-hand and one right-hand end piece to complete the snap-fit indicator tube assembly.

CHARACTERISTICS AND OPERATING CONDITIONS

Ignition voltage	V_{ign}	max. 170	V
Maintaining voltage	V_m	see page 4	
Anode current for coverage	I_a	min. 1.5	mA
(with or without decimal point and $V_{kk} = V_{kk_{min}} - V_{fl}$, see page 5)	I_a	max. 4.5	mA
Cathode selecting voltage	V_{kk}	see page 5	
Cathode resistor, decimal point	R_{dp}	100	kΩ ± 10% [1]
Primer resistor	R_{pr}	10	MΩ ± 10%
Extinction voltage	V_{ext}	min. 118	V

[1] Lower values of this resistor are permitted. The anode current should be increased by the increase of decimal point current resulting from the decrease of this resistor.

Typical operation over full temperature range 0 °C to +70 °C.

D.C. operation see pages 4, 5, 6 and 7.

Pulse operation

Peak currents up to 12 mA can be allowed provided the average current value does not exceed 2.5 mA.
To avoid excessive glow on "off" cathodes, the cathode selecting voltage should exceed 65 V. Minimum pulse duration 100 μs.
For further information consult the manufacturer.

LIFE EXPECTANCY at I_a = 2.5 mA

This tube is manufactured on the same physical principles as other tubes in this category and it is expected that the life will be comparable, viz:

sequentially changing the display from one digit to the others every 1000 h or less			100 000	h
Mean time between failures		min.	200 000	h

LIMITING VALUES (Absolute max. rating system)

Anode voltage necessary for ignition	V_a	min.	170	V
Anode current,				
average during any conduction period	I_a	min.	1.5	mA
average (T_{av} = 20 ms)	I_a	max.	4.5	mA
peak	I_{a_p}	max.	12	mA
Cathode selecting voltage	V_{kk}	see page 5		
Bias voltage between anode and "off" cathodes	V_{bias}	max.	$V_{floating}$	
Ambient temperature	t_{amb}	min.	-50	°C [1]
	t_{amb}	max.	+70	°C

SHOCK AND VIBRATION

An indication for the ruggedness of the tube is the fact that 95% of the items sampled from the normal production line pass the shock and vibration tests specified below without perceptible damage.

Shock: 25 g_{peak}, 1000 shocks in one of the three positions of the tube.

Vibration: 2.5 g_{peak}, 50 Hz, during 32 hours in each of the three positions of the tube.

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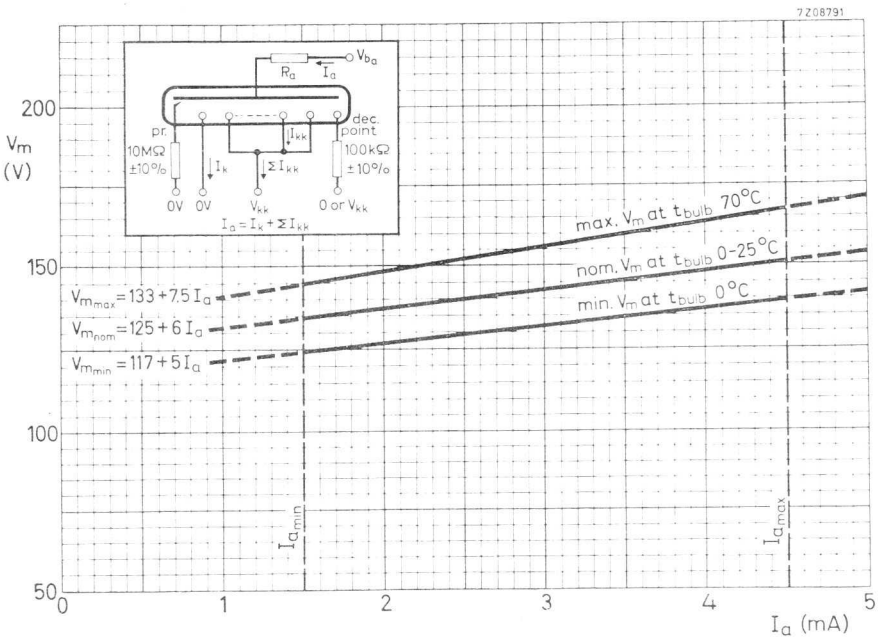
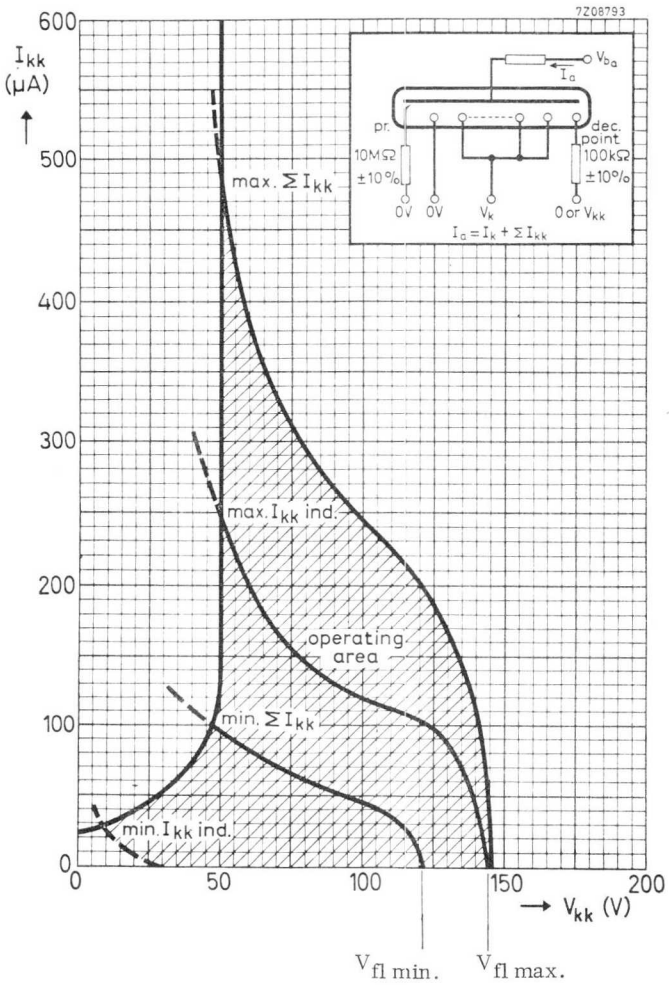
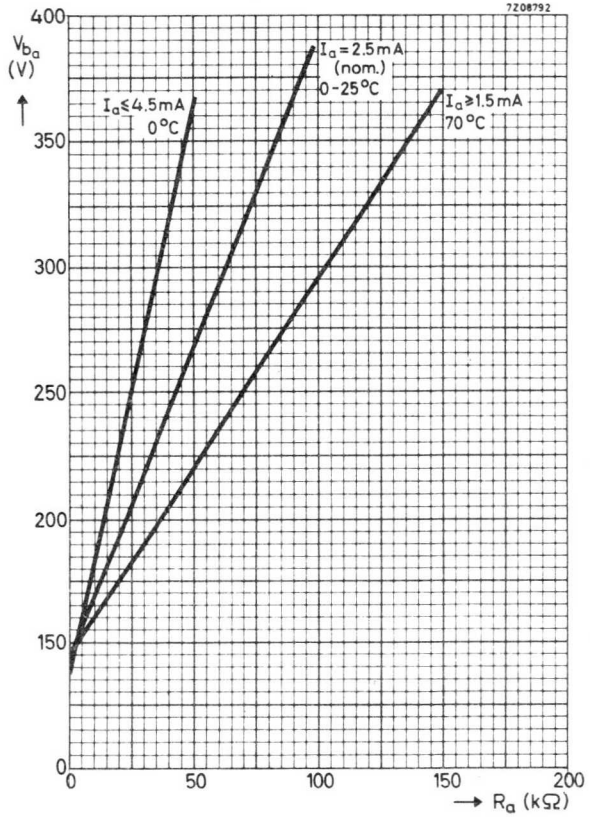
[1]) Bulb temperatures below 10 °C result in a reduced life expectancy and changes in characteristics (see page 4).
For equipment to be used over a wide temperature range, "constant current operation" (high supply voltage with a high anode series resistor) is recommended.


7Z08791
V_m (V)
200
150
100
50
0
1
2
3
4
5
I_a (mA)
$V_{m_{max}} = 133 + 7.5\,I_a$
$V_{m_{nom}} = 125 + 6\,I_a$
$V_{m_{min}} = 117 + 5\,I_a$
max. V_m at t_{bulb} 70°C
nom. V_m at t_{bulb} 0-25°C
min. V_m at t_{bulb} 0°C
$I_{a_{min}}$
$I_{a_{max}}$
V_{b_a}
R_a
I_a
pr
10MΩ ±10%
dec. point
100kΩ ±10%
I_{kk}
I_k
ΣI_{kk}
0V 0V
V_{kk}
0 or V_{kk}
$I_a = I_k + \Sigma I_{kk}$

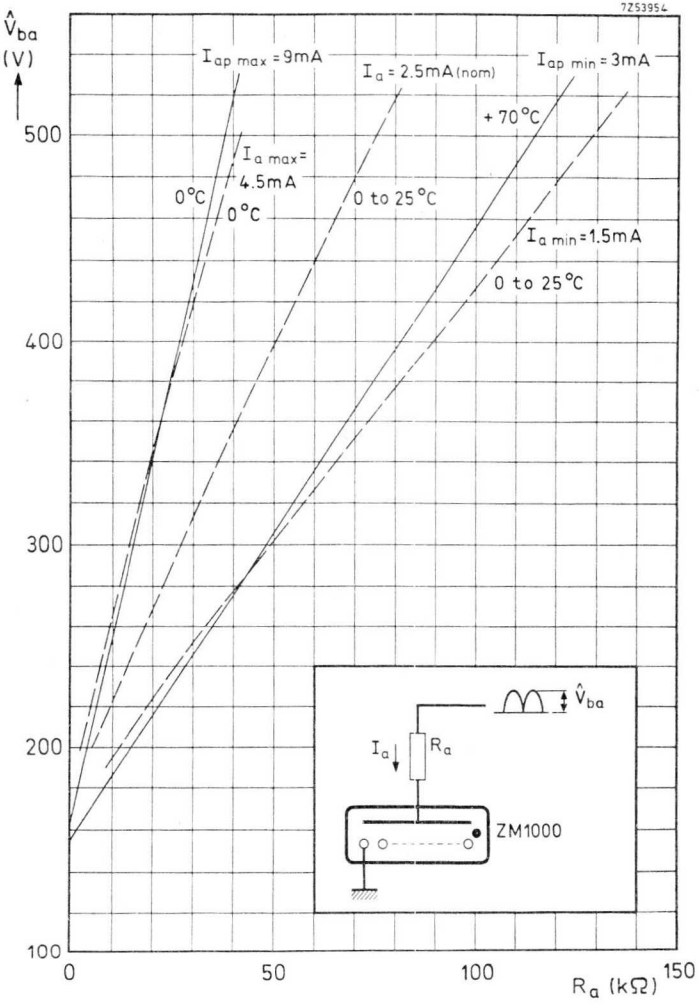


I_{kk} individual and ΣI_{kk} versus cathode selecting voltage V_{kk} at I_a = 2.5 mA.
I_{kk} and ΣI_{kk} are proportional to the anode current within the operating range of I_a and with V_{kk} = 0 V to 100 V.

The curves are valid for instantaneous values and for average values of anode current.



Graph denoting the relationships of D.C. anode supply voltage and required anode resistor to remain within the recommended operating region.


7Z53954
$\hat{V}_{ba}$ (V)
500
400
300
200
100
0
50
100
150
R_a (kΩ)
$I_{ap\ max}$ = 9mA
I_a = 2.5mA (nom)
$I_{ap\ min}$ = 3mA
+ 70 °C
$I_{a\ max}$ = 4.5mA
0 °C
0 °C
0 to 25 °C
$I_{a\ min}$ = 1.5mA
0 to 25 °C
$\hat{V}_{ba}$
I_a
R_a
ZM1000

INDICATOR TUBE

Long-life cold-cathode character indicator tube for side viewing.

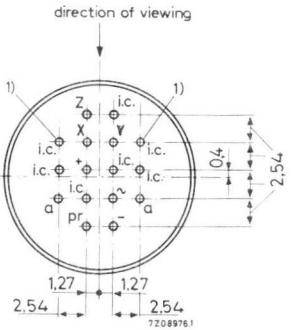
QUICK REFERENCE DATA				
Character height		approx.	10 to 14	mm
Characters	+, −, ~, X, Y, Z			
Supply voltage	V_{ba}	min.	170	V
Anode current	I_a		2,5	mA

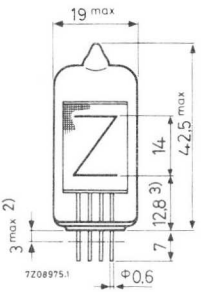
GENERAL

Character indicator tube to be used in conjunction with ZM1000 numerical indicator tube for in-line read-out in e.g. digital instruments or numerical control applications.

DIMENSIONS AND CONNECTIONS

Dimensions in mm





Mounting and Accessories: see ZM1000

CHARACTERISTICS, OPERATING CONDITIONS AND LIMITING VALUES

These are essential the same as of type ZM1000.

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1) Length of these i.c. pins max. 2,8 mm.
2) Not tinned.
3) Standard deviation 0,13 mm.

INDICATOR TUBE

Long-life cold-cathode character indicator tube for side viewing.

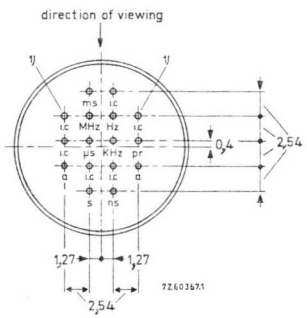
QUICK REFERENCE DATA				
Character height		approx.	9 to 13	mm
Characters		ns, µs, ms, s, Hz, kHz, MHz		
Supply voltage	V_{ba}	min.	170	V
Anode current	I_a		4	mA

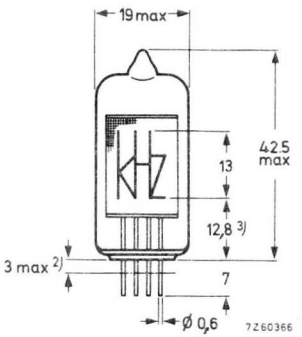
GENERAL

Character indicator tube to be used in conjunction with ZM1000 numerical indicator tube for in-line read-out in e.g. digital instruments such as frequency and time interval measuring apparatus.

DIMENSIONS AND CONNECTIONS

Dimensions in mm





Mounting and Accessories : see ZM1000

1) Length of these i.c. pins max. 2,8 mm.
2) Not tinned.
3) Standard deviation 0,13 mm.

INDICATOR TUBE

Long-life cold-cathode character indicator tube for side-viewing.

QUICK REFERENCE DATA				
Character height		approx.	9 to 14	mm
Characters		⊕ 1 - ~		
Supply voltage	V_{ba}	min.	170	V
Anode current	I_a		2,5	mA

PRINCIPLE OF OPERATION

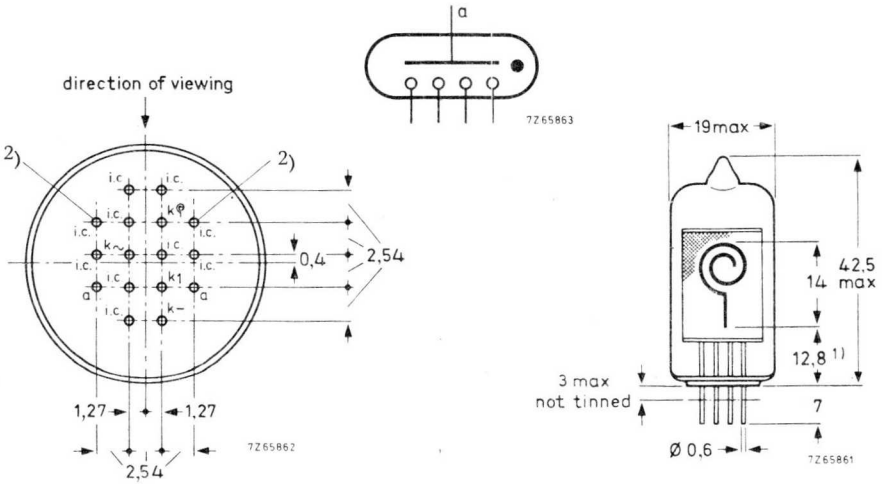
By applying a suitable voltage between the anode and one of the cathodes the corresponding character will be covered by a red neon glow.

CHARACTERISTICS, OPERATING CONDITIONS AND LIMITING VALUES

These are essentially the same as of type ZM1010.

DIMENSIONS AND CONNECTIONS

Dimensions in mm



1) Standard deviation 0,13 mm.
2) Length of i.c. pins max. 2,8 mm.

INDICATOR TUBE

Long-life cold-cathode ten-digit indicator tube for side viewing.
The tube is designed for time-sharing (pulse) applications.

QUICK REFERENCE DATA				
Numeral height		approx.	14	mm
Numerals		0 1 2 3 4 5 6 7 8 9		
Decimal point		to the left of the numerals		
Supply voltage	$V_{ba(pulse)}$	min.	170	V
Anode current, peak	I_{ap}	min.	6	mA
	I_{ap}	max.	20	mA
average	I_a	max.	2,5	mA

GENERAL

The numerals are 14 mm high and appear on the same base line allowing in-line read-out.

PRINCIPLE OF OPERATION

The tube contains ten cathodes in the form of ten numerals and one in the form of a decimal point; a primer, and one common anode. By applying a suitable voltage between the anode and one of the cathodes the corresponding numeral or the decimal point will be covered by a red neon glow.
The primer allows ionization without delay in strobe type or blanking applications.

SHOCK AND VIBRATION

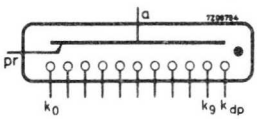
An indication for the ruggedness of the tube is the fact that 95% of the items sampled from the normal production line pass the shock and vibration tests specified below without perceptible damage.

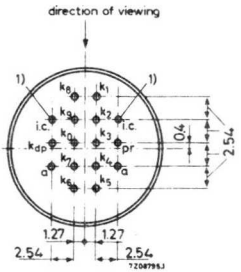
Shock: 25 g_{peak}, 1000 shocks on one of the three positions of the tube.

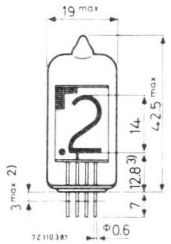
Vibration: 2,5 g_{peak}, 50 Hz, during 32 hours in each of the three positions of the tube.

DIMENSIONS AND CONNECTIONS

Dimensions in mm







The deviation of the axes of the pins with respect to the true geometrical position cover an area of 0.3 mm diameter. The pin configuration is compatible with the reference grid for printed wiring according to IEC Publication 97 (0.1 in).

Mounting position: any

Soldering

The pins may be dip-soldered at a solder temperature of max. 240 °C for maximum 10 seconds up to a point 3 mm from the seals.

Natural frequency

The natural frequencies of the numeral cathodes lie within the range from 300 Hz to 800 Hz.

ACCESSORIES

55702 Tube socket (for 0.1 in grid). Phenolic. Tinned contacts.

55703 Snap-fit tube holder.

55704 Set of one left-hand and one right-hand end piece to complete the snap-fit indicator tube assembly.

1) i.c. pins max. length 2.8 mm
2) Not tinned
3) Standard deviation 0.13 mm

CHARACTERISTICS AND OPERATING CONDITIONS

Ignition voltage	V_{ign}	max.	170	V
Maintaining voltage	V_m	see page 4		
Anode current, average (T_{av} = max. 20 ms)	I_a	max.	2.5	mA
peak	I_{ap}	min.	6	mA
(with or without decimal point)	I_{ap}	max.	20	mA
Pulse duration	T_{imp}	min.	50	μs [1]
Cathode selecting voltage (see also page 4)	V_{kk}	min.	70	V [2]
	V_{kk}	max.	115	V
Cathode resistor, decimal point	R_{dp}		10	kΩ±10% [3]
Primer resistor (anode to primer supply voltage min. 170 V)	R_{pr}		10	MΩ±10%
Extinguishing voltage	V_{ext}	min.	118	V

LIFE EXPECTANCY at I_a = 2 mA

The life expectancy is dependent on the instantaneous and average values of anode current:

sequentially changing the display from one digit to the others every 100 h or less, I_{ap} = 10 mA	100 000	h	
I_{ap} = 20 mA	20 000	h	
Mean time between failures	min. 200 000	h	

LIMITING VALUES (Absolute max. rating system)

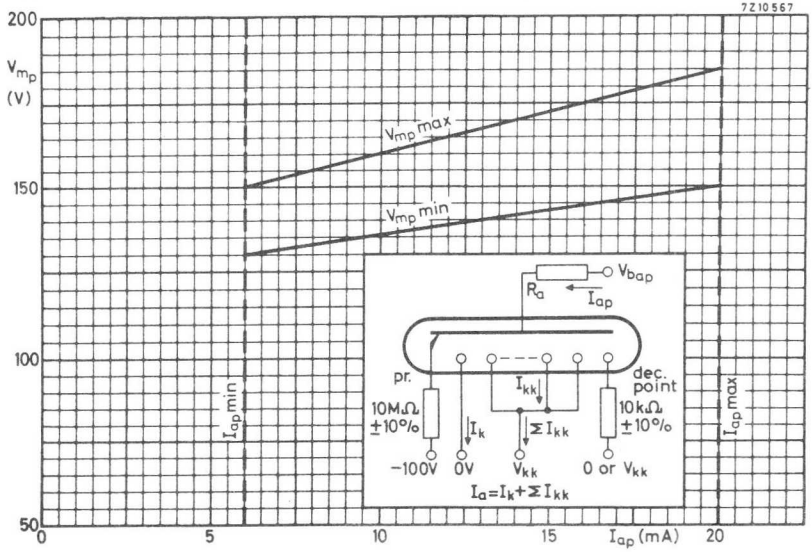
Anode voltage necessary for ignition, pulse	V_{ap}	min.	170	V
Anode current, average (T_{av} = 20 ms)	I_a	max.	2.5	mA
peak	I_{ap}	min.	6	mA
	I_{ap}	max.	20	mA
Pulse duration	T_{imp}	min.	10	μs
Cathode selecting voltage	V_{kk}	min.	70	V
	V_{kk}	max.	115	V
"Off" anode voltage	$V_{a"off"}$	max.	115	V
Ambient temperature	t_{amb}	min.	−50	°C [4]
	t_{amb}	max.	+70	°C

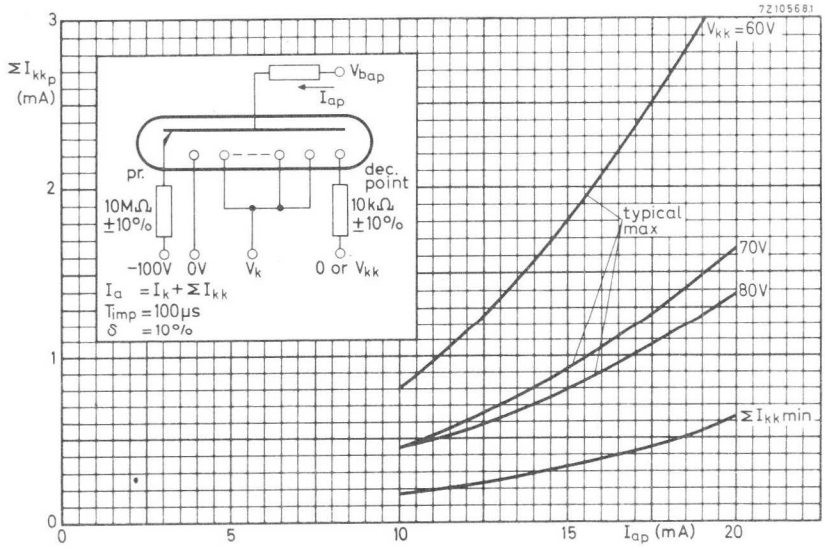
1) Pulse durations down to 10 μs are allowed provided the minimum peak anode current is not less than 10 mA.

2) Lower values of V_{kk} result in increasing background glow impairing readability.

3) The decimal point cathode may not be operated without extra current limiting resistor unless a numeral cathode is operated simultaneously.

4) Bulb temperatures below 10 °C result in a reduced life expectancy and changes in characteristics.
For equipment to be used over a wide temperature range, "constant current operation" is recommended.


7Z10567
200
150
100
50
V_{mp} (V)
V_{mp} max
V_{mp} min
I_{ap} min
I_{ap} max
V_{bap}
R_a
I_{ap}
pr.
dec. point
I_{kk}
10MΩ ±10%
10kΩ ±10%
I_k
ΣI_{kk}
−100V
0V
V_{kk}
0 or V_{kk}
$I_a = I_k + \Sigma I_{kk}$
0
5
10
15
I_{ap} (mA)
20


7Z10568.1
3
2
1
0
ΣI_{kkp} (mA)
V_{kk} = 60V
typical max
70V
80V
ΣI_{kk} min
V_{bap}
I_{ap}
pr.
dec. point
10MΩ ±10%
10kΩ ±10%
−100V
0V
V_k
0 or V_{kk}
$I_a = I_k + \Sigma I_{kk}$
T_{imp} = 100µs
δ = 10%
0
5
10
15
I_{ap} (mA)
20

INDICATOR TUBE

Long-life cold-cathode ten-digit indicator tube for side-viewing.

QUICK REFERENCE DATA				
Numeral height		approx.	14	mm
Numerals		0 1 2 3 4 5 6 7 8 9		
Decimal point		to the left of the numerals		
Supply voltage	V_{ba}	min.	170	V
Anode current	I_a		2,5	mA

GENERAL

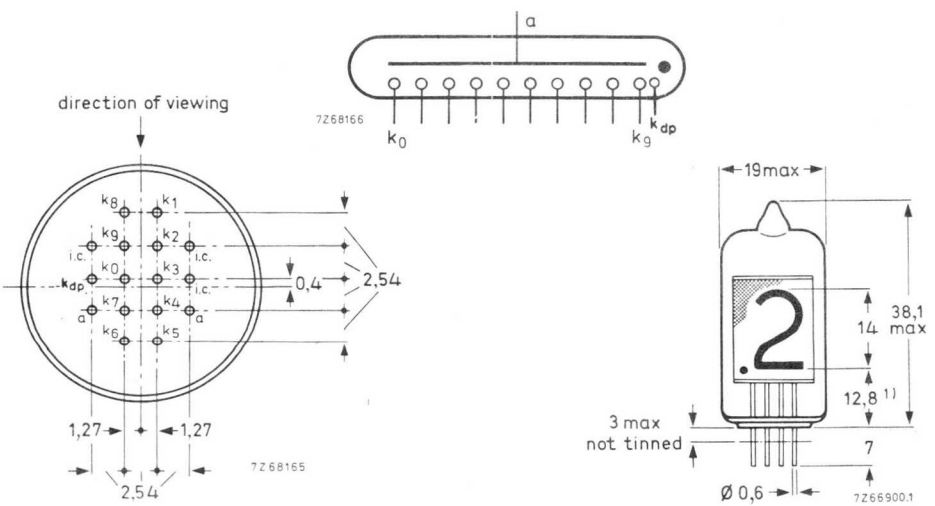
The numerals are 14 mm high and appear on the same base line allowing in-line read out.

PRINCIPLE OF OPERATION

By applying a suitable voltage between the anode and one of the cathodes the corresponding numeral or the decimal point will be covered by a red neon glow.

DIMENSIONS AND CONNECTIONS

Dimensions in mm



1) Standard deviation 0, 13 mm.

The deviations of the axis of the pins with respect to the true geometrical position cover an area of max. 0,3 mm diameter. The pin configuration is compatible with the reference grid for printed wiring according to IEC Publication 97 (0,1 in).

Mounting position: Any

Soldering:

The pins may be dip-soldered at a solder temperature of max. 240 °C for maximum 10 s up to a point 5 mm from the seals.

ACCESSORIES

55701 Printed wiring mounting board (19 x 100 mm) on which the tube can be soldered; afterwards the combination can be mounted on a vertical printed wiring board carrying, e.g., the drive circuit.

55702 Tube socket compatible with IEC reference grid for printed wiring (0,1 in). Phenolic. Tinned pins.

CHARACTERISTICS AND OPERATING CONDITIONS

Ignition voltage	V_{ign}	max.	170	V
Maintaining voltage	V_m	see page	4	
Anode current for coverage	I_a	max.	3,5	mA
		min.	1,5	mA
Cathode selecting voltage	V_{kk}	see page	4	
Extinction voltage	V_{ext}	min.	118	V

LIFE EXPECTANCY at I_a = 2,5 mA

The tube is manufactured on the same physical principles as other tubes in this category and it is expected that the life will be comparable, viz:

Sequentially changing the display from one digit to the others every 1000 h or less		100 000	h
Mean time between failures	min.	200 000	h

LIMITING VALUES (Absolute max. rating system)

Anode voltage necessary for ignition	V_a	min.	170	V
Anode current	I_a	max.	3,5	mA
		min.	1,5	mA
Cathode selecting voltage	V_{kk}	max.	100	V
		min.	60	V
Ambient temperature	t_{amb}	max.	+70	°C
		min.	-50	°C

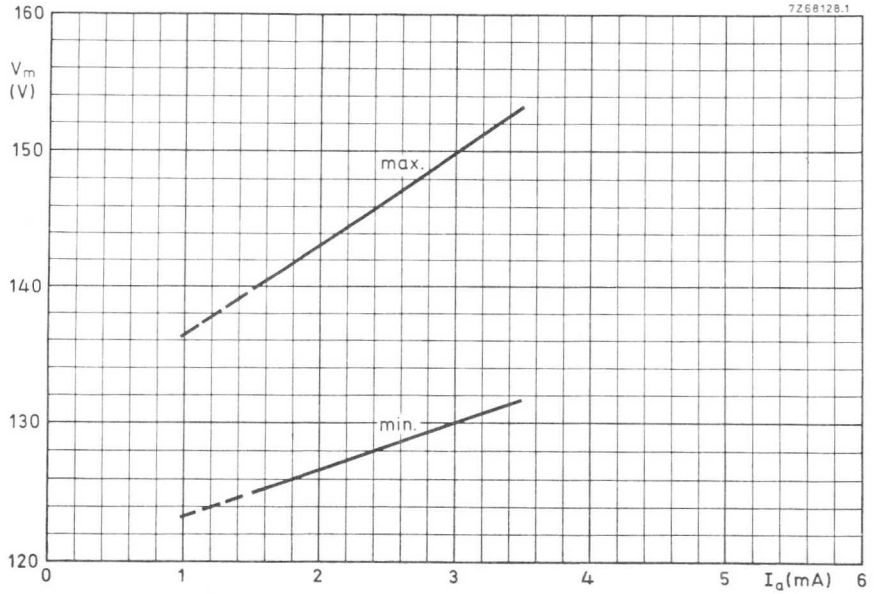
Bulb temperatures below 10 °C result in a reduced life expectancy and changes in characteristics.

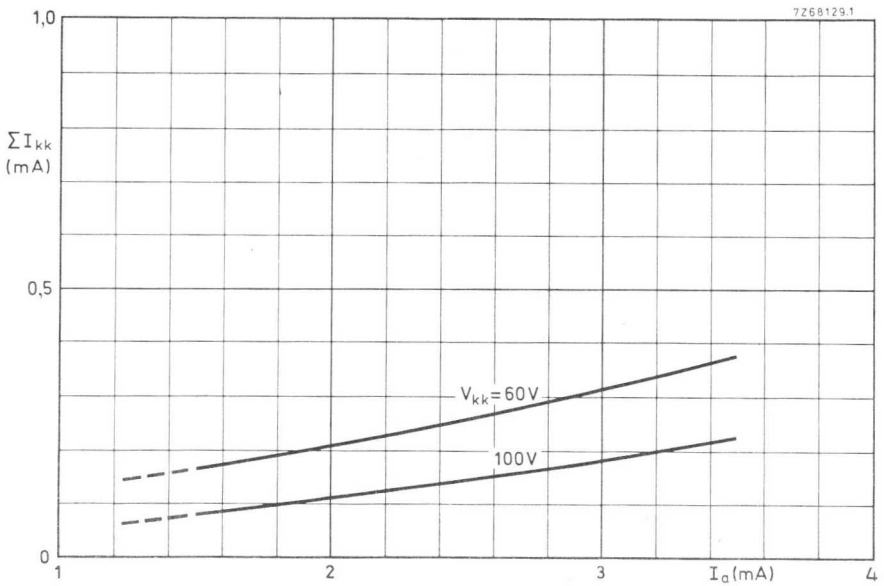
SHOCK AND VIBRATION

An indication for the ruggedness of the tube is the fact that 95% of the items sampled from the normal production line pass the shock and vibration test specified below without perceptible damage.

Shock 25 g_{peak}, 1000 shocks in one of the three positions of the tube.

Vibration 2,5 g_{peak}, 50 Hz, during 32 hours in each of the three positions of the tube.


7Z68128.1
160
V_m (V)
150
140
130
120
max.
min.
0
1
2
3
4
5
I_a(mA)
6


7Z68129.1
1,0
ΣI_{kk} (mA)
0,5
0
V_{kk}=60V
100V
1
2
3
I_a(mA)
4

INDICATOR TUBE

Long-life cold-cathode nine-digit indicator tube for side-viewing.

QUICK REFERENCE DATA				
Numeral height		approx.	14	mm
Numerals		0 1 2 3 4 5 6 7 8		
Supply voltage	V_{ba}	min.	170	V
Anode current	I_a		2,5	mA

GENERAL

The numerals are 14 mm high and appear on the same base line allowing in-line read out.

PRINCIPLE OF OPERATION

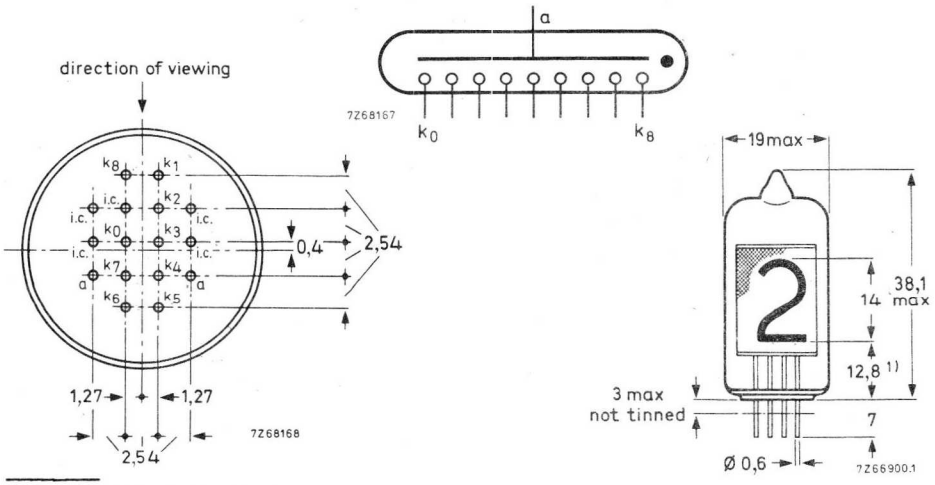
By applying a suitable voltage between the anode and one of the cathodes the corresponding numeral will be covered by a red neon glow.

CHARACTERISTICS, OPERATING CONDITIONS AND LIMITING VALUES

These are essentially the same as of type ZM1010.

DIMENSIONS AND CONNECTIONS

Dimensions in mm



1) Standard deviation 0,13 mm.

INDICATOR TUBE

Long life cold-cathode eight-digit indicator tube for side-viewing.

QUICK REFERENCE DATA				
Numeral height		approx.	14	mm
Numerals		1 2 3 4 5 6 7 8		
Supply voltage	V_{ba}	min.	170	V
Anode current	I_a		2,5	mA

GENERAL

The numerals are 14 mm high and appear on the same base line allowing in-line read out.

PRINCIPLE OF OPERATION

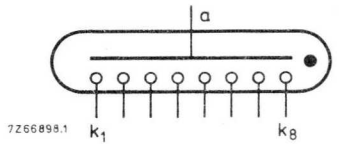
By applying a suitable voltage between the anode and one of the cathodes the corresponding numeral will be covered by a red neon glow.

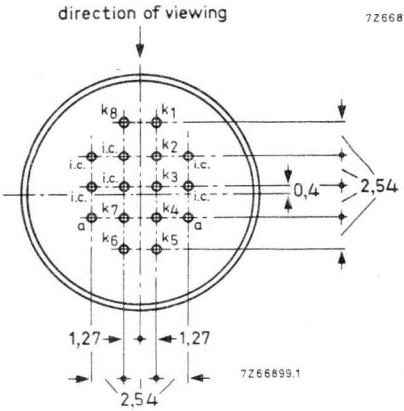
CHARACTERISTICS, OPERATING CONDITIONS AND LIMITING VALUES

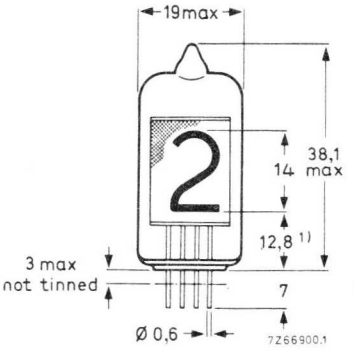
These are essentially the same as of type ZM1010.

DIMENSIONS AND CONNECTIONS

Dimensions in mm







1) Standard deviation 0.13 mm

INDICATOR TUBE

Long-life cold-cathode seven-digit indicator tube for side-viewing.

QUICK REFERENCE DATA				
Numeral height		approx.	14	mm
Numerals		0 1 2 3 4 5 6		
Supply voltage	V_{ba}	min.	170	V
Anode current	I_a		2,5	mA

GENERAL

The numerals are 14 mm high and appear on the same base line allowing in-line read out.

PRINCIPLE OF OPERATION

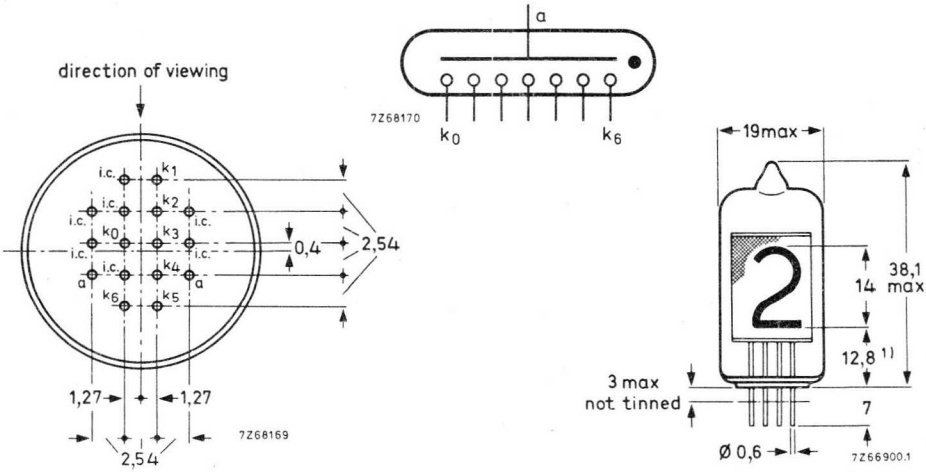
By applying a suitable voltage between the anode and one of the cathodes the corresponding numeral will be covered by a red neon glow.

CHARACTERISTICS, OPERATING CONDITIONS AND LIMITING VALUES

These are essentially the same as of type ZM1010.

DIMENSIONS AND CONNECTIONS

Dimensions in mm



1) Standard deviation 0, 13 mm.

INDICATOR TUBE

Long life cold-cathode six-digit indicator tube for side-viewing

QUICK REFERENCE DATA				
Numeral height		approx.	14	mm
Numerals		1 2 3 4 5 6		
Supply voltage	V_{ba}	min.	170	V
Anode current	I_a		2,5	mA

GENERAL

The numerals are 14 mm high and appear on the same base line allowing in-line read out.

PRINCIPLE OF OPERATION

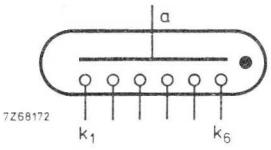
By applying a suitable voltage between the anode and one of the cathodes the corresponding numeral will be covered by a red neon glow.

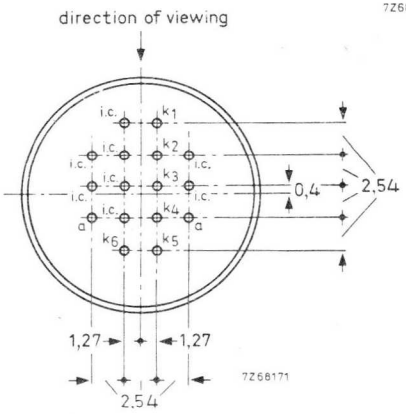
CHARACTERISTICS, OPERATING CONDITIONS AND LIMITING VALUES

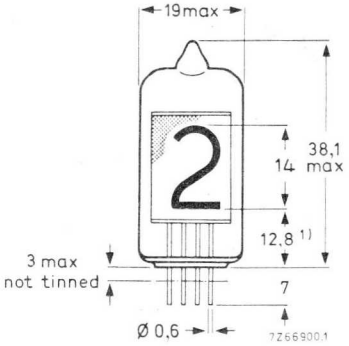
These are essentially the same as of type ZM1010.

DIMENSIONS AND CONNECTIONS

Dimensions in mm







1) Standard deviation 0,13 mm

INDICATOR TUBE

Long-life cold-cathode eight-digit indicator tube for side-viewing.

QUICK REFERENCE DATA				
Numeral height		approx.	14	mm
Numerals		1 2 3 4 5 6 7 8		
Supply voltage	V_{ba}	min.	170	V
Anode current	I_a		2,5	mA

GENERAL

The numerals are 14 mm high and appear on the same base line allowing in-line read out.

PRINCIPLE OF OPERATION

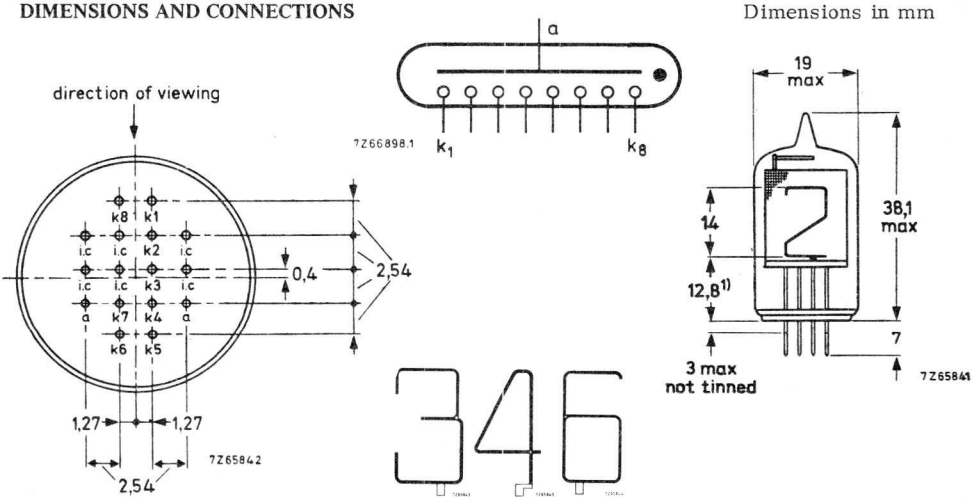
By applying a suitable voltage between the anode and one of the cathodes the corresponding numeral will be covered by a red neon glow.

CHARACTERISTICS, OPERATING CONDITIONS AND LIMITING VALUES

These are essentially the same as of type ZM1010.

DIMENSIONS AND CONNECTIONS

Dimensions in mm



¹) Standard deviation 0,13 mm.

INDICATOR TUBE

Long life cold cathode ten digit numeral indicator tube for top viewing.

QUICK REFERENCE DATA			
Numeral height		15	mm
Numerals	1 2 3 4 5 6 7 8 9 0		
Supply voltage	min.	170	V
Anode current		2	mA

GENERAL

The numerals are 15 mm high and appear on the same base line allowing in-line read out. The ZM1020 is provided with a red contrast filter.
The ZM1020/01 is identical with the ZM1020 but has tinned pins.

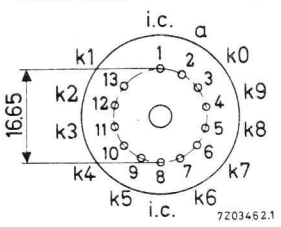
PRINCIPLE OF OPERATION

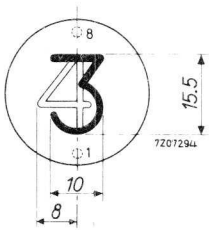
The tube contains ten cathodes in the form of ten figures and one common anode. By applying a suitable voltage between the anode and one of the ten cathodes the corresponding numeral will be covered by a red neon glow.

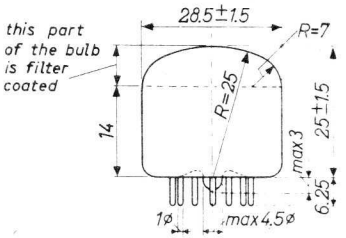
DIMENSIONS AND CONNECTIONS

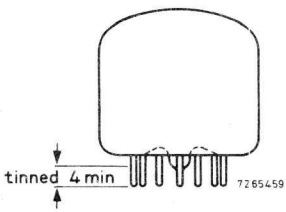
Dimensions in mm

Base: B13B









ZM1020/01

Mounting position: any

The numerals are viewed through the dome of the envelope. The numerals will appear upright (within 1.5°) when the tube is mounted with the line through pins 1 and 8 vertical, pin 8 being uppermost.

Accessories

Socket	type	2422 505 00001 or 2422 505 00002

CHARACTERISTICS AND OPERATING CONDITIONS

(Valid over life and full temperature range)

Ignition voltage	V_{ign}	max. 170 V
Maintaining voltage	V_m	see sheet 4
Anode current for coverage, averaged during any conduction period	I_a	min. 1 mA
Anode current,		
average (T_{av} = max. 20 ms)	I_a	max. 3 mA
peak	I_{ap}	max. 6 mA
Cathode selecting voltage	V_{kk}	see sheet 5
Extinguishing voltage	V_{ext}	min. 118 V

Typical operation [1]

D.C. operation

See sheets 5 and 6

A.C. operation

See sheets 5 and 7

---

[1] Bulb temperatures below 10 °C result in a reduced life expectancy and changes in characteristics (see sheet 4).
In designing equipment to be used over a wide temperature range the use of "constant current operation" (high supply voltage with a high anode series resistor) is recommended.

LIFE EXPECTANCY AND RELIABILITY (at I_a = 2 mA)

Sequentially changing the display from one digit to the others every 1000 h. or less — 100.000 h

The reliability has been assessed in a life test programme totalling 4.5 x 10^6 tube hours. The longest test period was 50.000 hrs on 47 tubes. No failures have been found. The Mean Time between Failures is better than 10^6 hrs which corresponds with a failure rate of less than 0.1 % per 1000 hrs at a confidence level of 95 %.

LIMITING VALUES (Absolute max. rating system)

Anode voltage necessary for ignition	V_a	min. 170	V
Anode current, D.C.	I_a	min. 1	mA
rectified A.C. and pulse	I_{a_p}	min. 2	mA
average (T_{av} = max. 20 ms)	I_a	max. 3	mA
peak	I_{a_p}	max. 10	mA [1]
Cathode selecting voltage	V_{kk}	see lines N and W on sheet 5	
Bias voltage between anode and "off" cathodes (see sheet 5)	V_{bias}	max.	$V_{floating}$
Ambient temperature	t_{amb}	min. −50 max. +70	°C °C

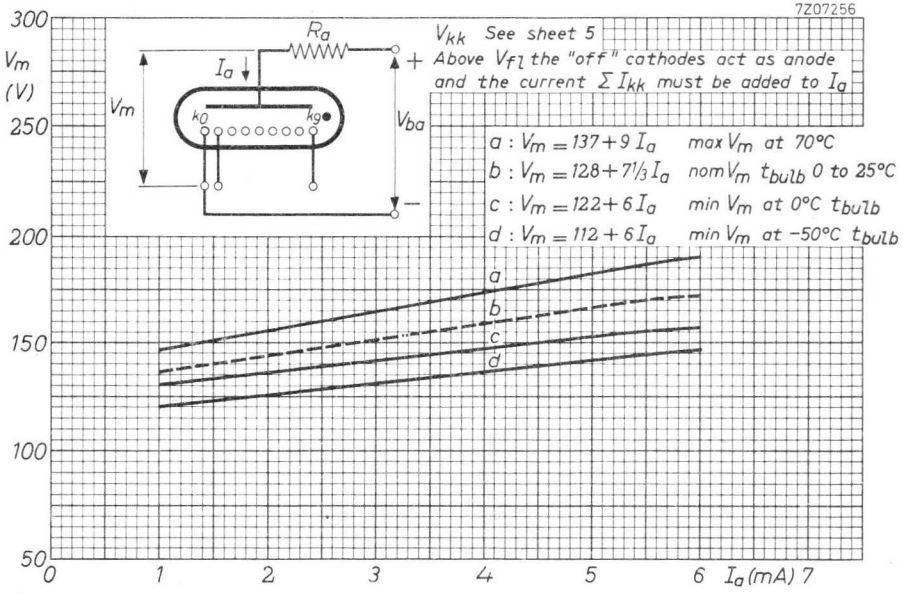
SHOCK AND VIBRATION

An indication for the ruggedness of the tube is the fact that 95% of the items sampled from the normal production line pass the shock and vibration tests specified below without perceptible damage.

Shock: 25 g_{peak}, 1000 shocks in one of the three positions of the tube.

Vibration: 2.5 g_{peak}, 50 Hz, during 32 hours in each of the three positions of the tube.

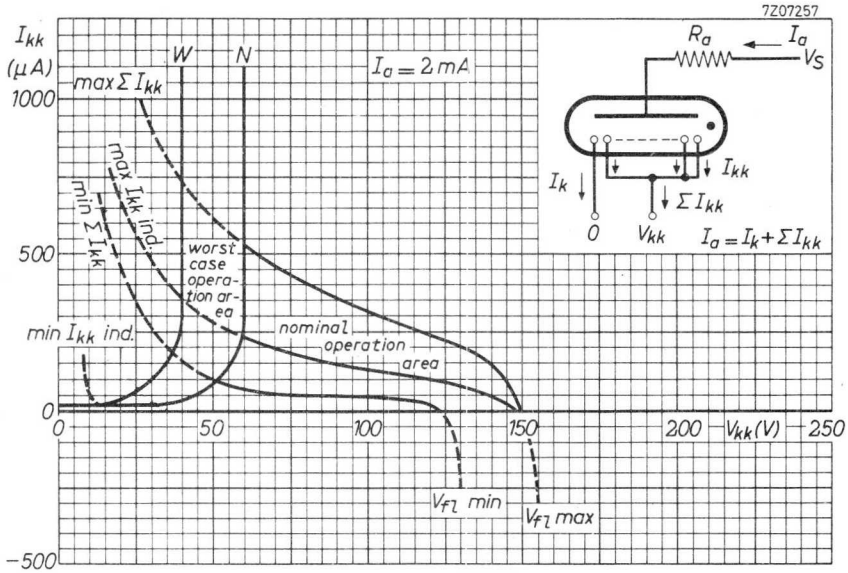
[1]) Above I_a = 6 mA the connecting wires and eyelets may be covered by the glow.


7Z07256
300
Vm
(V)
250
200
150
100
50
0
1
2
3
4
5
6
Ia(mA) 7
Ra
Ia
Vm
k0
kg
Vba
+
−
Vkk See sheet 5
Above Vf1 the "off" cathodes act as anode
and the current Σ Ikk must be added to Ia
a : Vm = 137 + 9 Ia max Vm at 70°C
b : Vm = 128 + 7⅓ Ia nom Vm tbulb 0 to 25°C
c : Vm = 122 + 6 Ia min Vm at 0°C tbulb
d : Vm = 112 + 6 Ia min Vm at −50°C tbulb
a
b
c
d

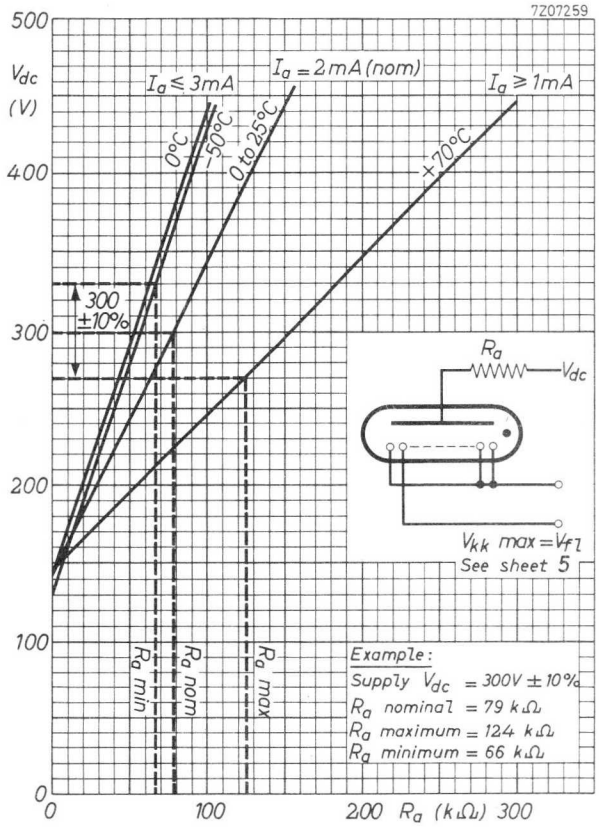
I_{kk} individual and ΣI_{kk} versus cathode selecting voltage V_{kk} at I_a = 2 mA.
I_{kk} and ΣI_{kk} are proportional to anode current in the range V_{kk} = 0 to 100 V.

The range of V_{fl} (I_{kk} = 0) shifts to the right/left at increasing/decreasing anode current (8 V/mA).

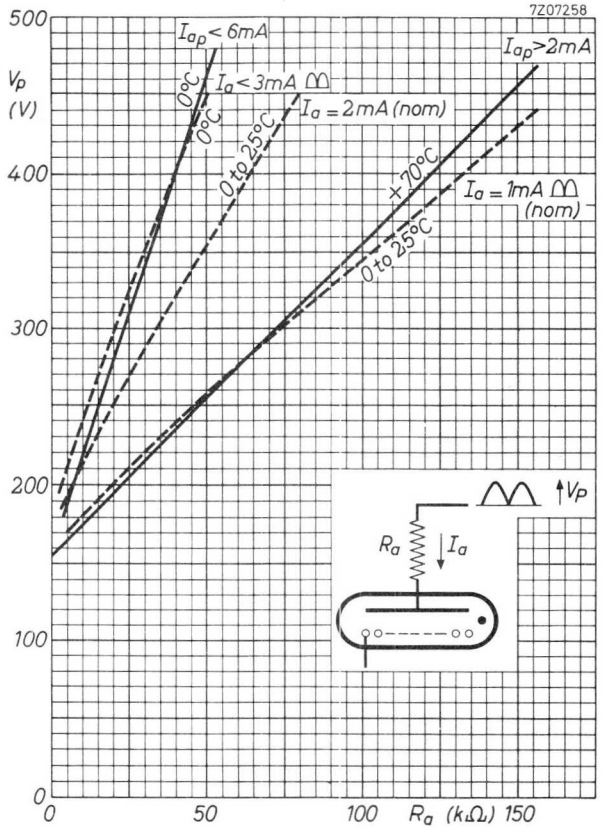
The curves are valid for instantaneous and for average values of anode current.



For low cathode selecting voltages the current I_{kk} to the "off" cathodes will increase and the readability of the "on" cathode will be affected. It is therefore recommended to use a nominal operating point to the right of line N.
Under the worst operating conditions the operating point should never reach the area left of line W.



Graph denoting the relationship of D.C. anode supply voltage and required anode resistor to remain within the recommended operating region.



Graph denoting the relationship of the peak value of full-wave unsmoothed rectified A.C. anode supply voltage and the required anode resistor to remain within the recommended operating area.

INDICATOR TUBE

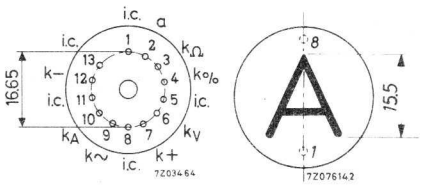
Cold cathode character indicator tube for top viewing.

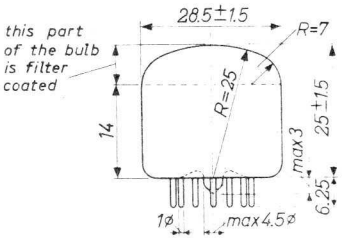
QUICK REFERENCE DATA		
Character height	15	mm
Characters	A, V, Ω, %, , +, -, ~	
Supply voltage	min. 170	V
Anode current	2	mA

DIMENSIONS AND CONNECTIONS

Dimensions in mm

Base: B13B





CHARACTERISTICS, OPERATING CONDITIONS AND LIMITING VALUES

These are essentially the same as those of type ZM1020.

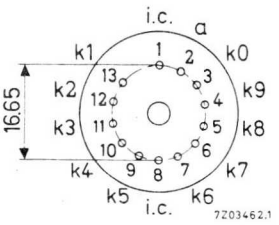
INDICATOR TUBE

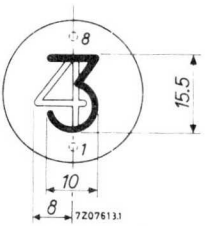
The type ZM1022 is electrically identical with type ZM1020 but has no filter coating.
The use of a separate amber filter (i.e. blue absorbing) is recommended.

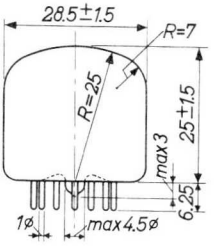
DIMENSIONS AND CONNECTIONS

Dimensions in mm

Base: B13B







INDICATOR TUBE

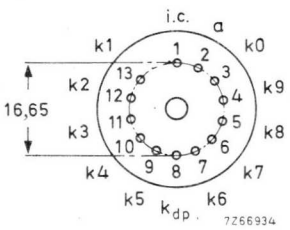
Cold cathode numerical indicator tube for top viewing, electrically identical to type ZM1022 but provided with a decimal point to the left of the numerals.
The use of a separate amber filter (i.e. blue absorbing) is recommended.

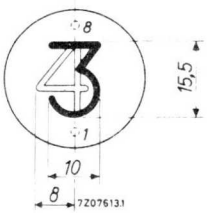
QUICK REFERENCE DATA			
Numeral height		15	mm
Numerals	1 2 3 4 5 6 7 8 9 0		
Decimal point	to the left of the numerals		
Supply voltage	min.	170	V
Anode current, numerals		2	mA
decimal point		0,25	mA

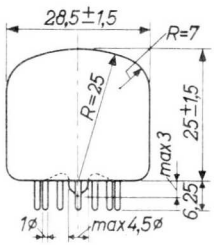
DIMENSIONS AND CONNECTIONS

Dimensions in mm

Base: B13B







CHARACTERISTICS, OPERATING CONDITIONS, AND LIMITING VALUES

For the numerals, are essentially the same as those of type ZM1020.

LIMITING VALUES decimal point (Absolute max. rating system)

Anode current, decimal point	max.	0,5	mA
	min.	0,1	mA

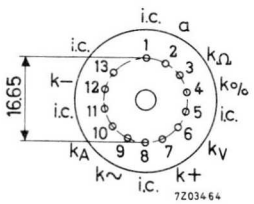
INDICATOR TUBE

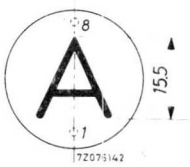
The type ZM1023 is electrically identical with type ZM1021 but has no filter coating. The use of a separate amber filter (i.e. blue absorbing) is recommended.

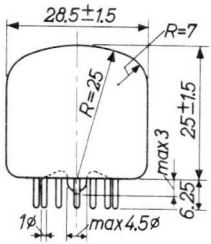
DIMENSIONS AND CONNECTIONS

Dimensions in mm

Base : B13B







INDICATOR TUBE

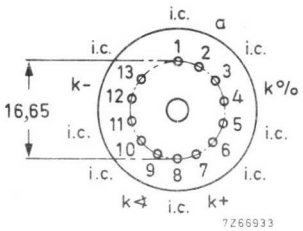
Cold cathode sign indicator tube.
The use of a separate amber filter (i.e. blue absorbing) is recommended.

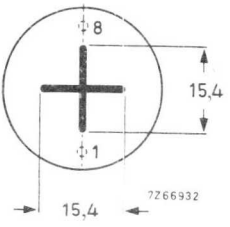
QUICK REFERENCE DATA		
Sign height	15	mm
Signs	∢ % + -	
Supply voltage	min. 170	V
Anode current	2	mA

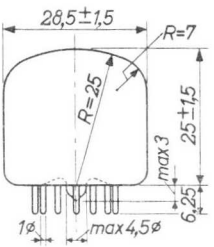
DIMENSIONS AND CONNECTIONS

Dimensions in mm

Base: B13B







CHARACTERISTICS, OPERATING CONDITIONS, AND LIMITING VALUES

These are essentially the same as those of type ZM1020.

INDICATOR TUBE

Cold cathode ten digit numeral indicator tube for side viewing.

QUICK REFERENCE DATA			
Numeral height		30	mm
Numerals	1 2 3 4 5 6 7 8 9 0		
Supply voltage	V_{ba} min.	170	V
Cathode current	I_k	4.5	mA

GENERAL

The numerals are 30 mm high and appear on the same base line allowing in-line read out. The ZM1040 is provided with a red contrast filter.

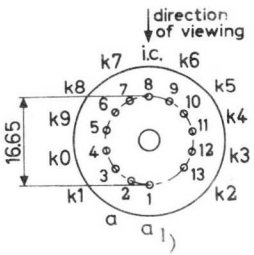
PRINCIPLE OF OPERATION

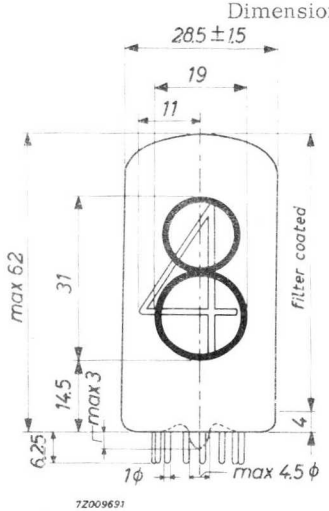
The tube contains ten cathodes in the form of ten figures and one common anode. By applying a suitable voltage between the anode and one of the ten cathodes the corresponding numeral will be covered by a red neon glow.

DIMENSIONS AND CONNECTIONS

Dimensions in mm

Base: B13B





1) Pins 1 and 2 to be interconnected externally.

Mounting position: any

The numerals are viewed through the side of the envelope. The numerals will appear upright (within 1.5°) when the tube is mounted vertically.

Accessories

Socket	type	2422 505 00001 or 2422 505 00002

CHARACTERISTICS AND OPERATING CONDITIONS

Ignition voltage	V_{ign}	max.	170	V
Maintaining voltage	V_m	see sheet 5		
Cathode current for coverage,				
average, during any conduction period	I_k	min.	3	mA
Cathode current,				
average (T_{av} = 20 ms)	I_k	max.	6	mA
peak	I_{k_p}	max.	20	mA
Cathode selecting voltage	V_{kk}	see sheet 6		
Extinguishing voltage	V_{ext}	min.	120	V

Typical operation at temperatures t_{amb} = 10 to 50 °C

D.C. operation with or without V_{kk}

(See fig. 1 and 3 and sheets 5 and 6)

Anode supply voltage	V_{ba}	200	250	300	350	V
Maintaining voltage	V_m	140±10	140±10	140±10	140±10	V
Anode series resistor	R_a	15	27	39	47	kΩ
Cathode selecting voltage	V_{kk}			min.	60	V [1]

A.C. half-wave rectified operation with or without V_{kk}

(See fig. 2 and 4 and sheet 5)

Secondary transformer voltage	V_{tr}	170	220	250	300	V
Anode series resistor	R_a	5.6	12	18	27	kΩ
Cathode selecting voltage	V_{kk}			min.	60	V [1]

[1]) With low cathode selecting voltages the current I_{kk} to the "off" cathodes will increase and the readability of the "on" cathode will be affected. It is therefore recommended to use a voltage V_{kk} in excess off the stated minimum value.

LIFE EXPECTANCY at I_k = 4.5 mA

Sequentially changing the display from one digit to the others every 1000 hours or less			100 000	h

LIMITING VALUES (Absolute max. rating system)

Anode voltage necessary for ignition	V_a	min.	170	V
Cathode current,				
average during any conduction period	I_k	min.	3	mA
average (T_{av} = 20 ms)	I_k	max.	6	mA
peak	I_{k_p}	max.	20	mA
Cathode selection voltage	V_{kk}	min.	60	V
Bias voltage between anode and "off" cathodes	V_{bias}	max.	120	V
Bulb temperature	t_{bulb}	min. max.	0 +70	°C [1] °C

SHOCK AND VIBRATION

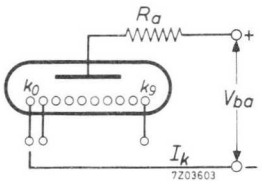
An indication for the ruggedness of the tube is the fact that 95% of the items sampled from the normal production line pass the shock and vibration tests specified below without perceptible damage.

Shock: 25 g_{peak}, 1000 shocks in one of the three positions of the tube.

Vibration: 2.5 g_{peak}, 50 Hz, during 32 hours in each of the three positions of the tube.

[1]) Bulb temperatures below 0 °C result in a reduced life expectancy and changes in characteristics (see sheet 7)
In designing equipment to be used over a wide temperature range the use of "constant current operation" (high supply voltage with a high anode series resistor) is recommended.

Fig.1



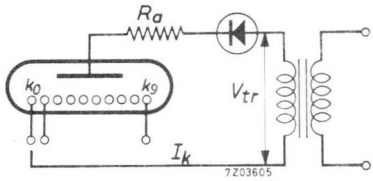


Fig.2

Fig.3

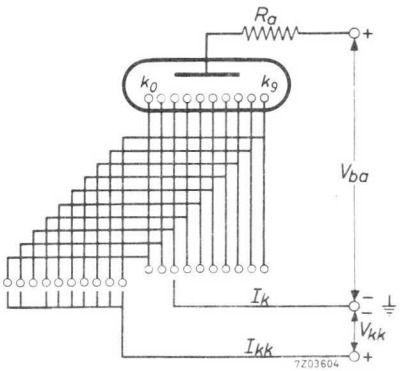
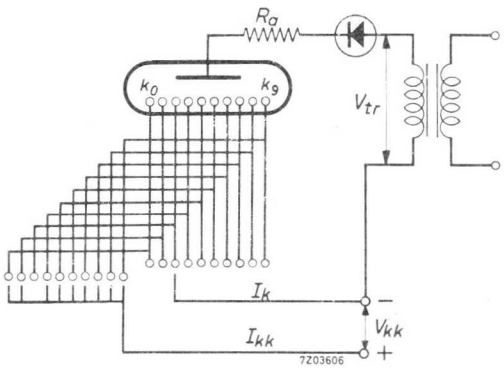
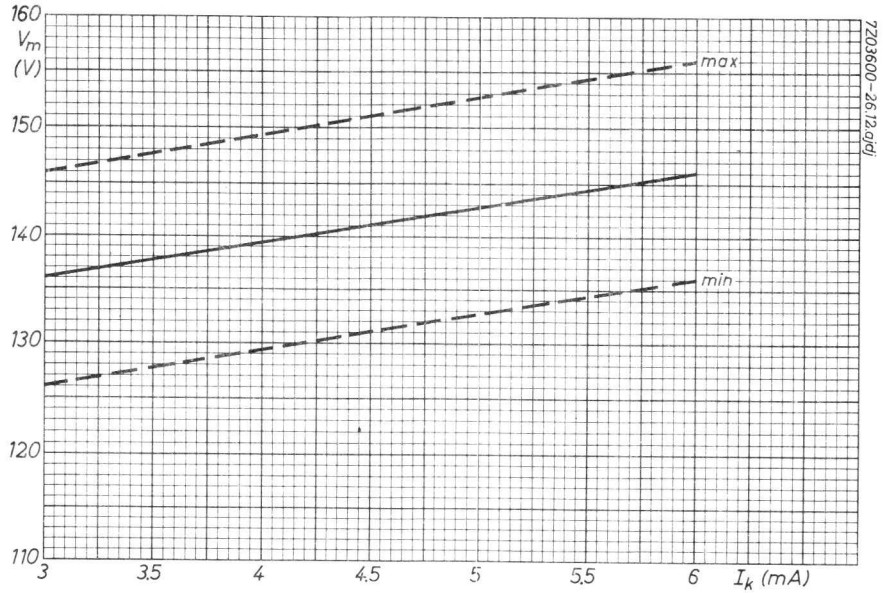
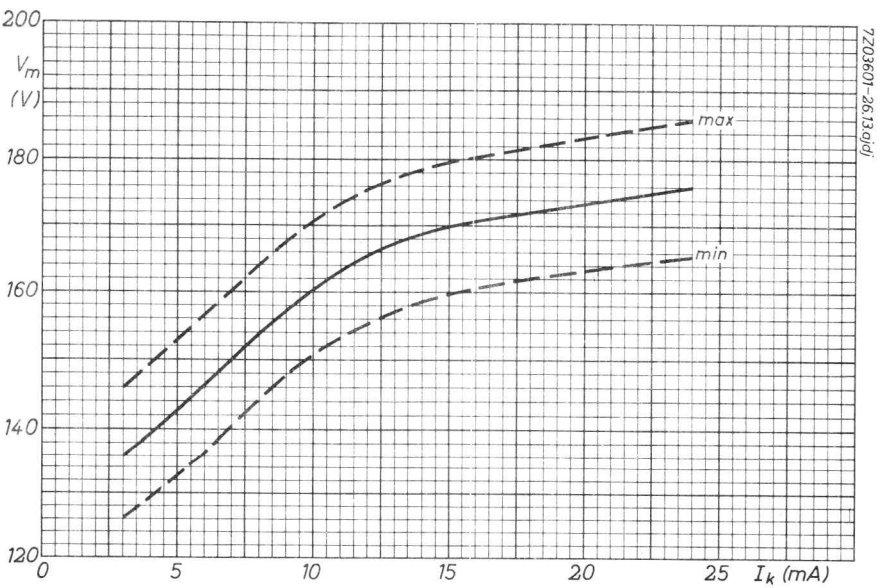
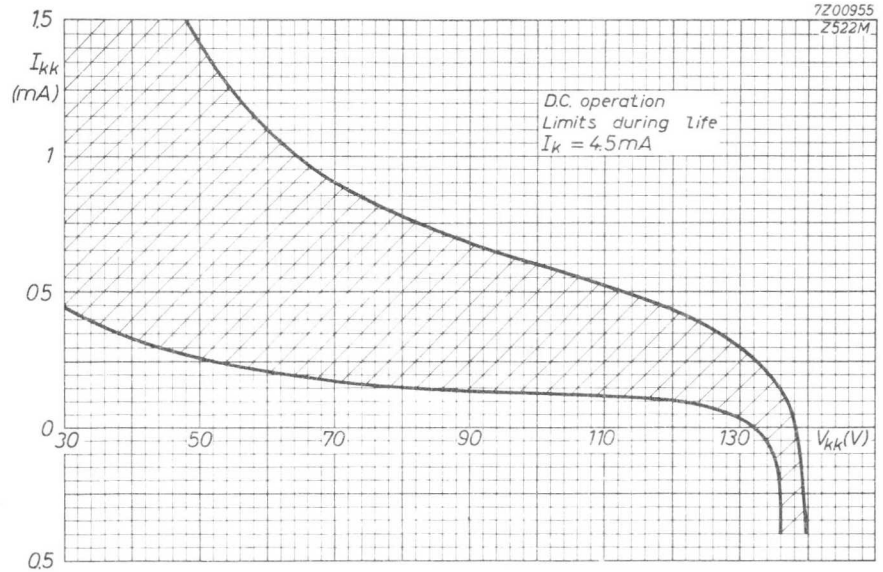


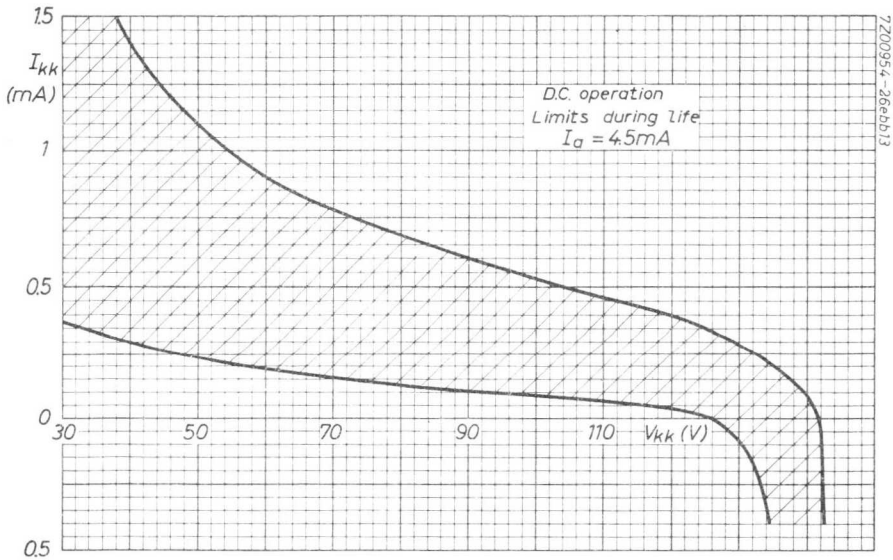
Fig.4

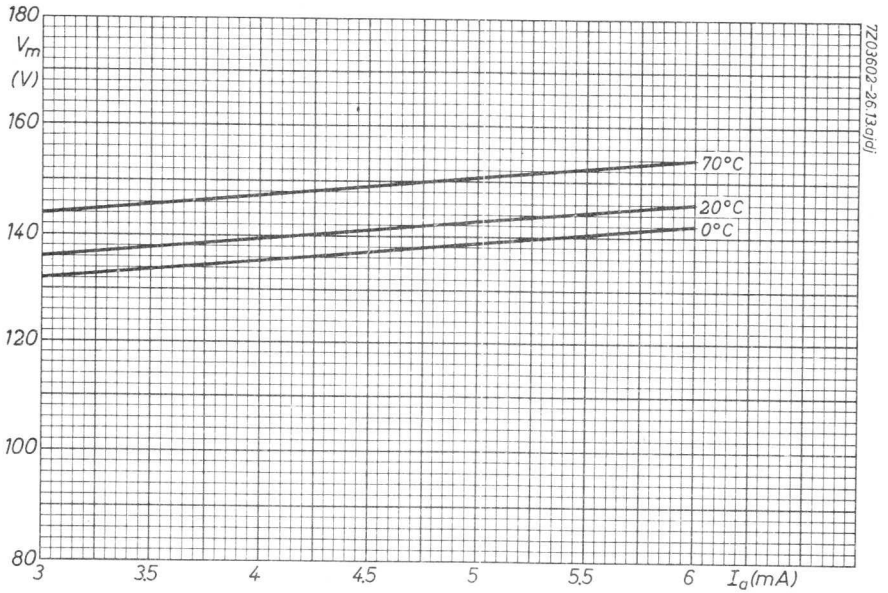



160
V_m
(V)
150
140
130
120
110
3
3.5
4
4.5
5
5.5
6
I_k (mA)
max
min
7203600-26.12.gidj


200
V_m
(V)
180
160
140
120
0
5
10
15
20
25
I_k (mA)
max
min
7203601-26.13.gidj


7Z00955
Z522M
1.5
I_{kk}
(mA)
1
0.5
0
0.5
30
50
70
90
110
130
V_{kk}(V)
D.C. operation
Limits during life
I_k = 4.5mA


7Z00954-26ebb13
1.5
I_{kk}
(mA)
1
0.5
0
0.5
30
50
70
90
110
V_{kk} (V)
D.C. operation
Limits during life
I_a = 4.5mA


180
V_m
(V)
160
140
120
100
80
3
3.5
4
4.5
5
5.5
6
I_a(mA)
70°C
20°C
0°C
7Z03602-26.13ajaj

INDICATOR TUBE

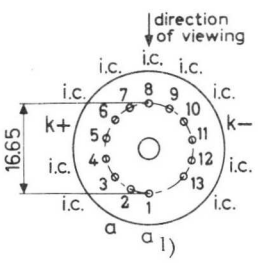
Cold cathode sign indicator tube for side viewing.

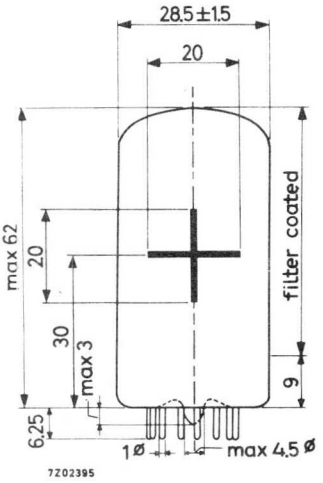
QUICK REFERENCE DATA		
Sign height	20	mm
Signs	+ −	
Supply voltage	170	V
Cathode current	4.5	mA

DIMENSIONS AND CONNECTIONS

Dimensions in mm

Base: B13B





GENERAL

The tube has the same physical dimensions as the ZM1040 numeral indicator tube. The ZM1041 is provided with a red contrast filter.

1) Pins 1 and 2 to be interconnected externally.

CHARACTERISTICS

Ignition voltage	V_{ign}	max. 170	V
Maintaining voltage	V_m	see sheets 3 and 4	
Extinguishing voltage	V_{ext}	min. 120	V
"Off" cathode probe current characteristic		see sheet 4	

PRINCIPLE OF OPERATION

The tube contains two cathodes, in the form of the signs + and −, and a common anode. By applying a suitable voltage between the anode and one of the cathodes the corresponding sign will be covered by a red neon glow.

ACCESSORIES

Socket 2422 505 00001 or 2422 505 00002

MOUNTING POSITION

Any
The signs are vieuwed through the side of the envelope.

LIMITING VALUES (Absolute max. rating system)

Anode voltage necessary for ignition	V_a	min.	170	V
Cathode current,				
average during any conduction period	I_k	min.	3	mA
average (T_{av} = 20 ms)	I_k	max.	6	mA
peak	I_{kp}	max.	20	mA
Impulse duration	T_{imp}	min.	80	µs
Cathode selecting voltage	V_{kk}	min.	60	V
Bias voltage between anode and "off" cathode	V_{bias}	max.	120	V
Bulb temperature	t_{bulb}	max.	+70	°C 1)
		min.	−50	°C

SHOCK AND VIBRATION

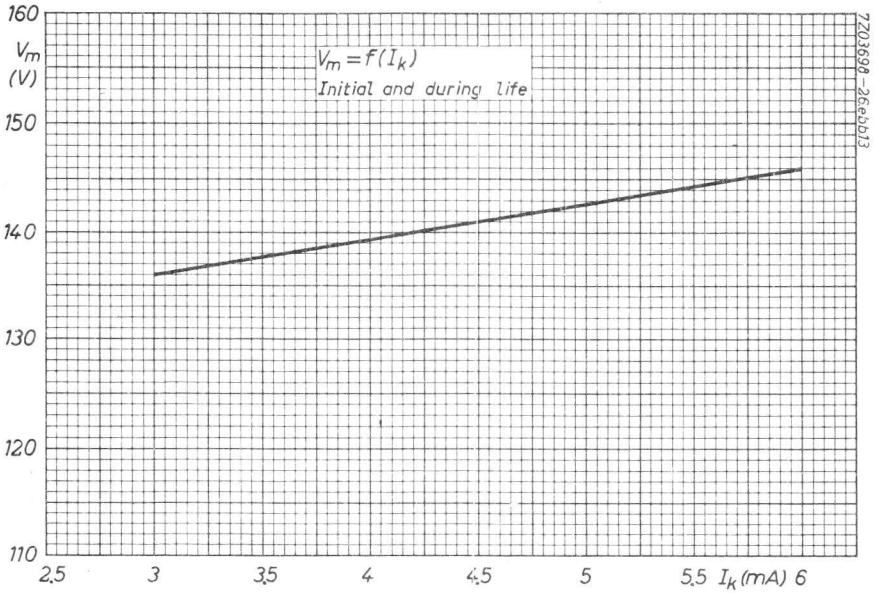
An indication for the ruggedness of the tube is the fact that 95% of the items sampled from the normal production line pass the shock and vibration tests specified below without perceptible damage.

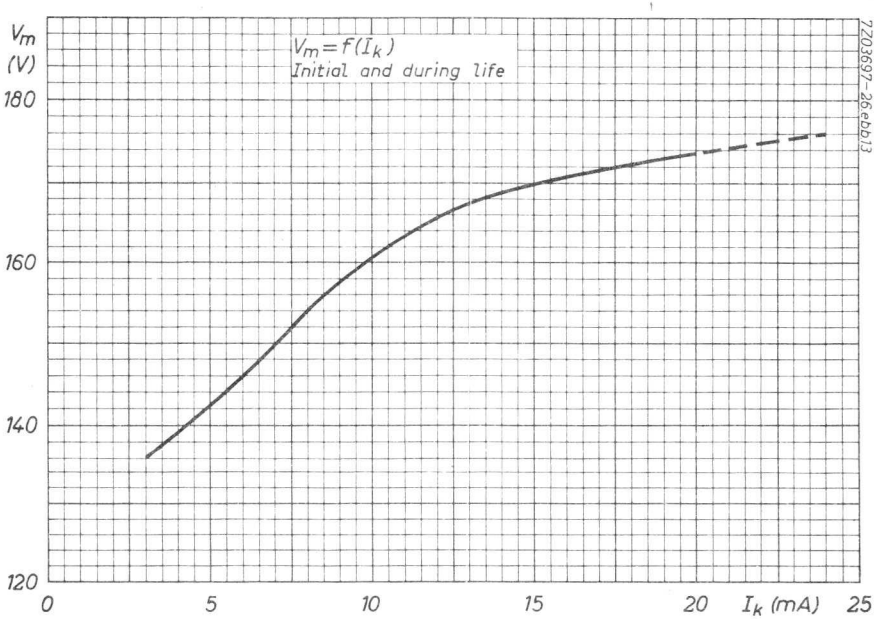
Shock: 25 g_{peak}, 1000 shocks in one of the three positions of the tube.

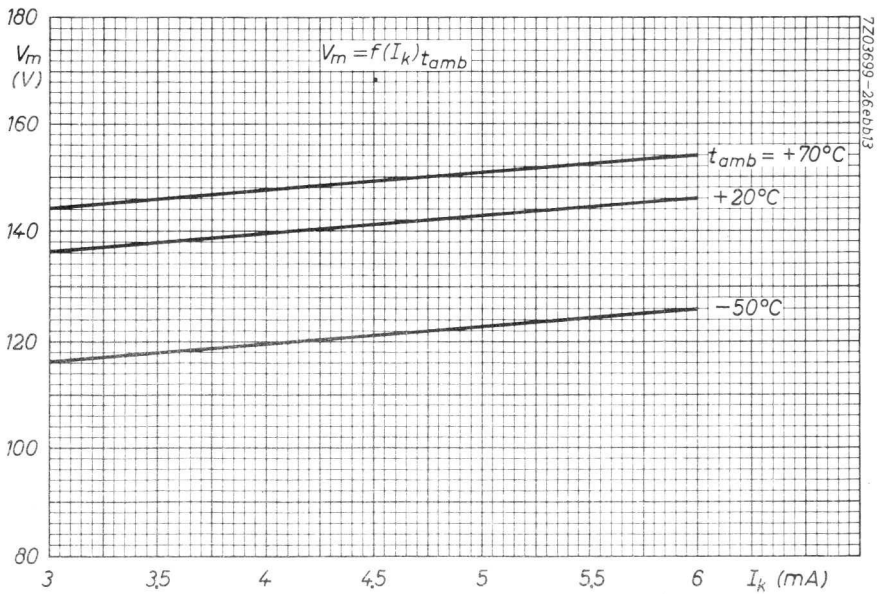
Vibration: 2.5 g_{peak}, 50 Hz, during 32 hours in each of the three positions of the tube.

---

1) Bulb temperatures below 10 °C result in a reduced life expectanxy and changes in characteristics (see sheet 4).
In designing equipment to be used within a wide temperature range the use of "constant current operation" (high supply voltage with a high anode series resistor) is recommended.


160
V_m
(V)
150
140
130
120
110
$V_m = f(I_k)$
Initial and during life
2,5
3
3,5
4
4,5
5
5,5
I_k (mA) 6
7203698-26eb13


V_m
(V)
180
160
140
120
$V_m = f(I_k)$
Initial and during life
0
5
10
15
20
I_k (mA)
25
7203697-26eb13

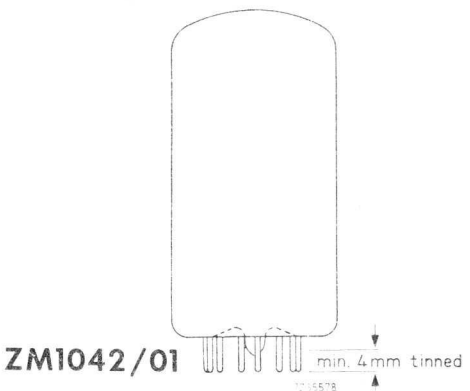

180
V_m
(V)
160
140
120
100
80
$V_m = f(I_k)t_{amb}$
t_{amb} = +70°C
+20°C
−50°C
3
3,5
4
4,5
5
5,5
6
I_k (mA)
7203699-266b13

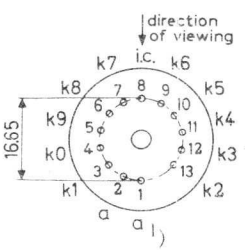
INDICATOR TUBE

Cold cathode ten digit numeral indicator tube for side viewing.
The types ZM1042 and ZM1042/01 are identical with type ZM1040 but have no filter coating.; the ZM1042/01 has tinned pins.
The use of a separate blue absorbing, e.g. circular polarized, amber filter is recommended.

DIMENSIONS AND CONNECTIONS

Dimensions in mm





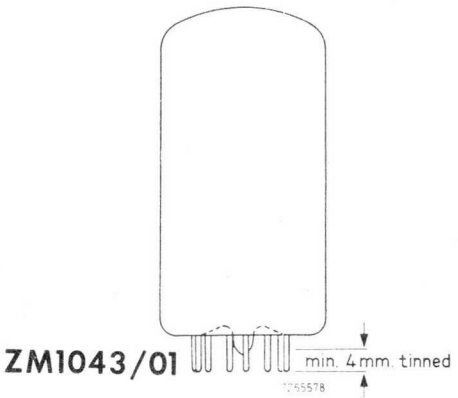
[1]) Pins 1 and 2 to be connected externally.

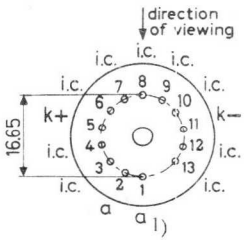
INDICATOR TUBE

Cold cathode sign indicator tube for side viewing.
The types ZM1043 and ZM1043/01 are identical with type ZM1041 but have no filter coating; the ZM1043/01 has tinned pins.
The use of a separate blue absorbing, e.g. circular polarized, amber filter is recommended.

DIMENSIONS AND CONNECTIONS

Dimensions in mm





1) Pins 1 and 2 to be connected externally.

Switching diodes

SWITCHING AND LIGHT DIODE

Cold cathode neon filled subminiature switching and light diode with a large and stable difference between ignition and maintaining voltage intended for low speed switching and counting e.g. in combination with CdS photo sensitive devices. The tube is shock and vibration resistant.

QUICK REFERENCE DATA			
Ignition voltage	V_{ign}	170	V
Maintaining voltage	V_m	109	V
Cathode current	I_k	3.5	mA

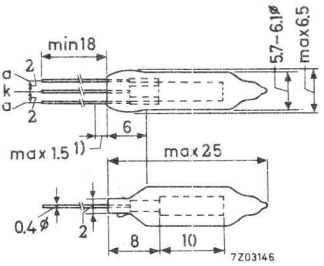
OPERATING PRINCIPLE

The diode contains a rod shaped molybdenum cathode and a concentric gauze anode. By applying a suitable voltage between the electrodes, a glow discharge occurs and its red light is available outside the tube.

DIMENSIONS AND CONNECTIONS

Dimensions in mm

Colour type indication on pinch: red dot.



MOUNTING

The tube may be soldered directly into the circuit but 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 a minimum of 5 mm from the seals at a solder temperature of 240 °C during max. 10 s. Care should be taken not to bend the leads nearer than 1.5 mm from the seals.

1) This part of the leads is not tinned.

CHARACTERISTIC RANGE VALUES FOR EQUIPMENT DESIGN

(Valid over the first 15000 hours operation within the preferred current range and at t_{amb} = room. The electrical characteristics are independent of ambient illumination).

Non conduction

Anode voltage below which ignition will not occur in any tube	$V_{ign\ min}$		163	V
Insulation resistance	r_{isol}	>	300	MΩ

Ignition

Anode voltage to ensure ignition	$V_{ign\ max}$		178	V
Ignition delay	See page A and B			
Typical max. individual variation of ignition voltage during life	ΔV_{ign}	<	5	V
Typical temperature coefficient of ignition voltage, averaged over the range -55 °C to +70 °C	$\frac{\Delta V_{ign}}{\Delta t_{bulb}}$	<	±15	mV/°C

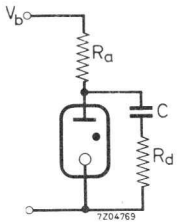
Conduction

Cathode current, average during any conduction period	I_k	>	2.2	mA
average (T_{av} = max. 1 s)	I_k	<	4.5	mA
peak (See "Reliability and life expectancy)	I_{kp}	<	50	mA
Typical rise in bulb temperature	$\frac{\Delta t_{bulb}}{\Delta I_k}$		10	°C/mA
Maintaining voltage	See page A			
Typical max. individual variation of maintaining voltage during life	ΔV_m	<	$^{+2}_{-4}$	V
Typical max. temperature coefficient of maintaining voltage, averaged over the range -55 °C to +70 °C	$\frac{\Delta V_m}{\Delta t_{bulb}}$	<	±15	mV/°C
Light intensity 1)2)	E	>	20	lux/mA
Typical variation of light intensity	ΔE	<	-3	%/1000 h

1)2) See page 3

Extinction

Typical min. RC components to ensure self extinction at V_b = 250 V for different values of current limiting resistance R_d.



R_d	0	1	10	47	100	kΩ
R_a	1	1	1.5	2	3	MΩ
C	5	22	22	22	22	nF

RELIABILITY AND LIFE EXPECTANCY

Reliability has been assessed in a life test programme totalling 5.10^6 tube hours on 400 tubes. The longest test periode being 15000 hours on 100 tubes. A total of 7 failures result in a failure rate of better than 0.15% per 1000 h. This failure rate is not expected to increase over the next period of 15000 h.
Life expectancy: 30000 operating hours within the preferred current range
or
$2.4x10^6$ ignitions discharging a capacitor of max. 16 μF with suitable series impedance to limit the peak current to max. 50 mA.

1) Light intensity measured over an angle of 70° at a distance of 3.6 mm from the tube axis opposite the anode cylinder.

2) Measured with a Standard Weston Cell adopted to eye sensitivity.
Because the light emission of the neon discharge is mainly contained in the red region, the illumination resistance of a CdS cell will be 1.5 to 2 times lower than in case of irradiation by a 2700 °K incandescent light source. The exact conversion factor depends on the type of CdS cell used.

LIMITING VALUES (Absolute max. rating system)

Cathode current, average for continuous conduction	I_k	min.	2.2	mA [1]
average (T_{av} = max. 1 s)	I_k	max.	4.5	mA [1]
peak	I_{kp}	max.	50	mA
Anode voltage, negative peak	$-V_{ap}$	max.	200	V
Bulb temperature	t_{bulb}	min.	-55	°C
		max.	+70	°C
Altitude	h	max.	24	km

SHOCK AND VIBRATION RESISTANCE

These conditions are solely used to assess the mechanical quality of the tube. The tube must not be continuously operated under these conditions.

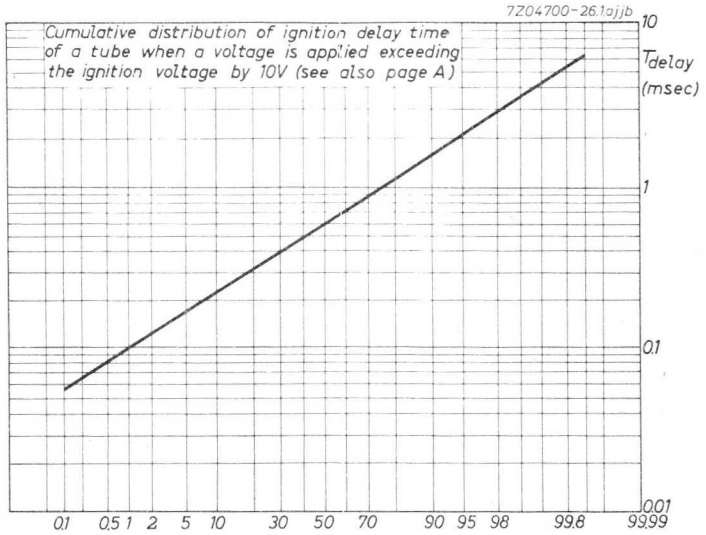
Shock resistance 500 g

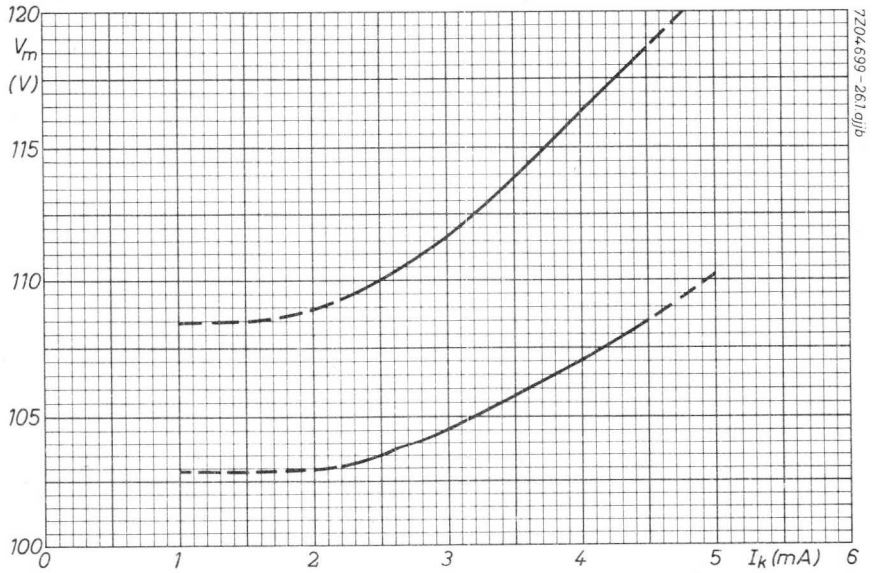
Forces as applied by the NRL impact machine for electronic devices caused by 5 blows of the hammer lifted over an angle of 30° in each of 4 positions of the tube.

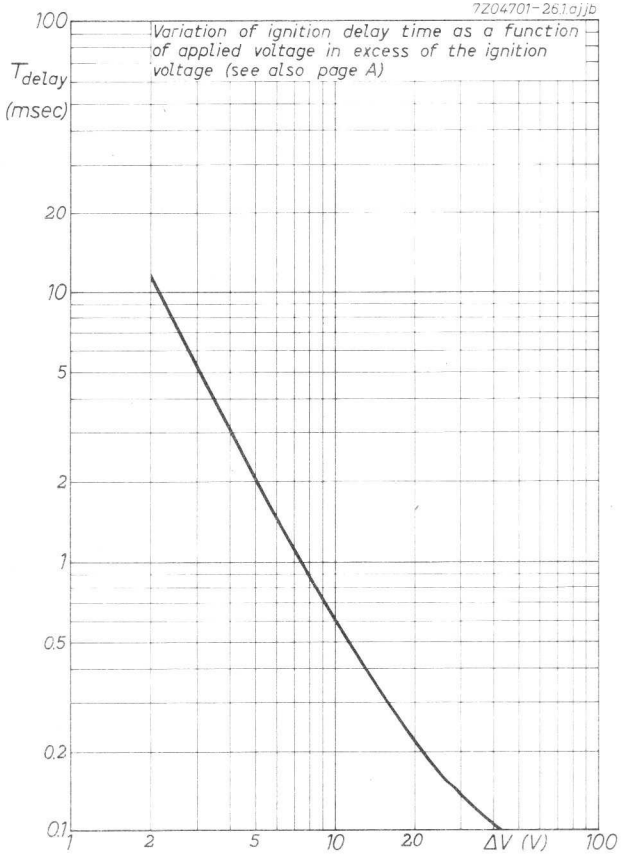
Vibration resistance 2.5 g(peak)

Vibrational forces for a period of 32 hours at a frequency of 50 Hz in each of 3 directions.

[1] Current excursions down to 1 mA and up to 5 mA are permitted under conditions of e.g. extreme supply voltage variations. The excursion times should preferably be as short as possible but never exceed 24 hours.


7Z04700-26.1ajjb
Cumulative distribution of ignition delay time of a tube when a voltage is applied exceeding the ignition voltage by 10V (see also page A)
10
T_{delay} (msec)
1
0.1
0.01
0.1
0.5
1
2
5
10
30
50
70
90
95
98
99.8
99.99


120
V_m (V)
115
110
105
100
0
1
2
3
4
5
I_k (mA)
6
7Z04699-26.1ajjb


7Z04701-26.1ajjb
Variation of ignition delay time as a function of applied voltage in excess of the ignition voltage (see also page A)
T_{delay} (msec)
100
20
10
5
2
1
0.5
0.2
0.1
1
2
5
10
20
ΔV (V)
100

GAS FILLED INDICATOR DIODE

Shock and vibration resistant cold-cathode gas-filled subminiature diode with visible glow-discharge for read-out purposes.
The tube contains two electrodes, a rod shaped molybdenum cathode and a concentric gauze anode.

APPLICATION

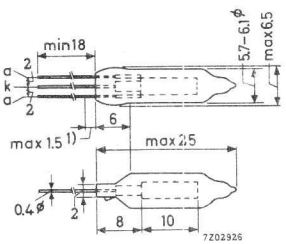
Indicator in low voltage transistor circuits. The diode can be used in combination with CdS photoconductive cells and it can be controlled by voltage signals down to 3 V.

QUICK REFERENCE DATA				
Ignition voltage	V_{ign}	=	90	V
Extinction voltage	V_{ext}	>	83.5	V
Cathode current	I_k	=	1	mA
Light intensity at I_k = 1 mA	E	=	60	lux

MECHANICAL DATA

Dimensions in mm

Type indication on pinch: yellow dot.



MOUNTING

The tube may be soldered directly into the circuit, but heat conducted to the glass-to-metall seals should be kept to a minimum by the use of a thermal shunt.
The leads may be dip-soldered to a minimum of 5 mm from the glass-to-metal seals at a solder temperature of 240 °C during max. 10 seconds.
If the tube is held in its position by the leads only, the connection of both anode leads is recommended.
Care should be taken not to bend the leads nearer than 1.5 mm from the seals.

1) Not tinned

SHOCK AND VIBRATION RESISTANCE

These conditions are solely used to assess the mechanical quality of the tube. The tube must not be continuously operated under these conditions.

Shock resistance 500 g

Forces as applied by the NRL impact machine for electronic devices caused by 5 blows of the hammer lifted over an angle of 30^{o} in each of 4 positions of the tube.

Vibration resistance 2.5 g (peak)

Vibrational forces for a period of 32 hours at a frequency of 50 Hz in each of 3 directions.

CHARACTERISTICS

Valid over 15000 operating hours within the preferred current range and at room temperature unless otherwise stated.
The electrical characteristics are independent of ambient illumination.

Non conduction

Anode voltage below which ignition will not occur in any tube	$V_{ign\,min.}$	=	88	V	
Insulation resistance	r_{isol}	>	300	MΩ	

Ignition

Ignition voltage,					
upper limit	$V_{ign\,max.}$	=	93	V	1)
individual variation during life	ΔV_{ign}	<	2.5	V	
Ignition delay at V_{ba} = 93 V	T_{delay}	≈	0.05	s	2)
Temperature coefficient of ignition voltage	$\frac{\Delta V_{ign}}{\Delta t_{bulb}}$	<	-15	mV/°C	3)
Reignition voltage in case of full wave rectified a.c. supply	V_{reign}	<	101	V	4)
		>	96.5	V	4)

1) The ignition and extinction voltage depression (hysteresis) is max. 0.75 V per mA prior current measured 50 ms after cessation of conduction.
2) Due to the statistical nature of ignition delay values of delay time > 1 s may occasionally occur.
3) Characteristic range value for equipment design.
4) These values apply to 220 V (+10 %, -15 %), 50 Hz to 60 Hz full-wave rectified unsmoothed supply and assume conduction in the course of the preceeding half cycle, so that residual ionization eliminates delay of the following ignition.

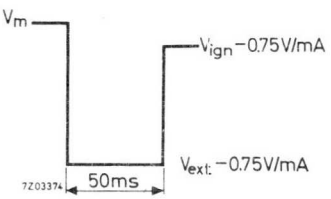
CHARACTERISTICS (continued)

Conduction

Cathode current,					
preferred range	I_k	=	0.4 to 2	mA	5)
peak	I_{kp}	=	3	mA	
Maintaining voltage	V_m	<	86 V + 4.25	V/mA	6)
		>	83 V + 2.5	V/mA	7)
Individual variation during life	ΔV_m	<	1.5	V	
Temperature coefficient of maintaining voltage	$\frac{\Delta V_m}{\Delta t_{bulb}}$	<	-15	mV/°C	3)
Rise in bulb temperature	$\frac{\Delta t_{bulb}}{\Delta I_k}$	=	10	°C/mA	
Light intensity,	E	>	30	lux/mA	8) 9)
individual minimum, measured over an angle of 70° averaged over the full circumference of the tube	E_{av}	>	60	lux/mA	8) 9)

Extinction

Extinction voltage	V_{ext}	>	83.5	V	1)



See note 1) page 2

5) Current excursions during ignition and extinction are not taken into account.
6) Valid within the range 0.1 mA to 3 mA.
7) Valid within the range 0.2 mA to 3 mA. Between 0.05 mA and 0.2 mA $V_{m\,min.} = V_{ext} = 83.5$ V.
8) Light intensity at a distance of 3.6 mm from the tube axis opposite the anode cylinder, measured with a standard Weston cell adopted to eye sensitivity. Because the emission of the neon discharge is mainly contained in the red region the illumination resistance of a CdS cell will be 1.5 to 2 times lower than in case of irradiation by a 2700 °K incandescent light source. The exact conversion factor depends on the type of CdS cell used.
9) At least 90% of the tubes will meet the figure stated.

RELIABILITY AND LIFE EXPECTANCY

The electrical characteristics have been assessed in a life test programme, totalling 3.0×10^6 tube hours with no failures, denoting a failure rate of better than 0.1 % per 1000 hours. The maximum test period was 19000 hours on 22 tubes. This failure rate is not expected to increase over the first 25000 hours of continuous operation within the preferred current range.

LIMITING VALUES (Absolute maximum rating system)

Cathode current, averaging time = 5 s	I_k	= max.	2.5	mA
Cathode current during conduction	I_k	= min.	0.1	mA [1]
Cathode current, peak	I_{kp}	= max.	3	mA
Anode voltage, negative peak	$-V_{ap}$	= max.	70	V
Bulb temperature	t_{bulb}	= min.	-55	°C
		= max.	70 °C + 10	°C/mA
Altitude	h	= max.	24	km

READ-OUT CIRCUIT BISTABLE MULTIVIBRATORS

Principle of operation

The figures 1 and 2 show equivalent circuits for bistable multivibrators, equipped with p-n-p- and n-p-n transistors respectively, to which a read-out circuit has been added. The transistors are replaced by ideal switches, the voltage source V_T represents the available voltage that controls the diodes 2) and R_T is the output resistance as measured at the collector of the cut-off transistor.

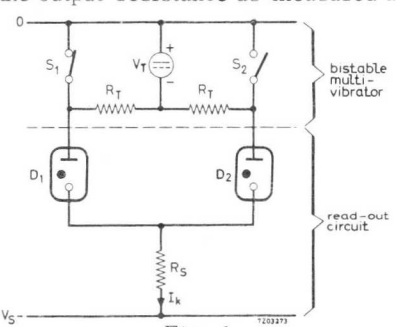


Fig. 1

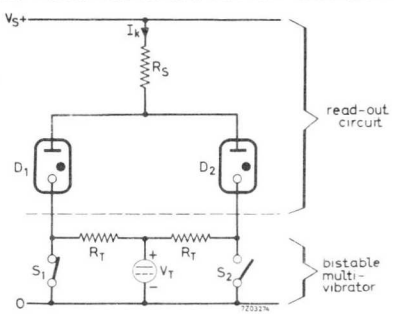


Fig. 2

1) Current excursions down to 50 μA with a duration < 1 s are permitted.

2) $V_T = V_{c.o.} - V_{sat}$ (V) in which

$V_{c.o.}$ = voltage between collector of the cut-off transistor and the common terminal (absolute value).

V_{sat} = voltage across the bottomed transistor (absolute value).

READ-OUT CIRCUIT BISTABLE MULTIVIBRATORS (continued)

Correct read-out is obtained when only the diode corresponding to the bottomed transistor conducts. For this the following conditions must be met: [1])

(I) Ignition of the correct diode, corresponding to the bottomed transistor, when the other diode is conducting.

Thus: $V_{m\,min.} + I_k R_T + V_T > V_{ign\,max.}$,

resulting in $I_k > \frac{10 - V_T}{R_T + 2.5} \quad \frac{(V)}{(k\Omega)}$ for $I_k > 0.2$ mA

(II) Extinction of the diode corresponding to the cut-off transistor, when the correct diode is conducting.

Thus: $V_{m\,max.} - V_T < V_{ext\,min.}$,

resulting in $I_k < \frac{V_T - 2.5}{5} \quad \frac{(V)}{(k\Omega)}$ for $I_k > 0.1$ mA

(III) Non-ignition of the diode corresponding to the cut-off transistor when the correct diode is conducting.

Thus: $V_{m\,max.} - V_T < V_{ign\,min.}$,

resulting in $I_k < \frac{V_T + 2}{5} \quad \frac{(V)}{(k\Omega)}$ for $I_k > 0.1$ mA

These conditions are shown graphically on page A below.

Condensed instructions for designing the read-out circuit. [2])

The following directives are based on the requirement that correct read-out shall be ensured under worst case conditions, after the instant that the bistable circuit has reached its final stationary state. It is irrelevant whether the read-out diodes follow the changes of state of the multivibrator during its dynamic operation or not.

A choice can be made between the following modes of operating the diodes, namely by means of:

(A) a constant direct current

(B) a constant direct current on which a pulse is superimposed prior to reading-out. Three kinds of pulses are possible:
   a) a positive going pulse;
   b) a negative going pulse;
   c) a positive going pulse followed by a negative going one

(C) an unsmoothed current supplied by a full wave rectifier.

[1]) It is assumed that the supply voltage V_s exceeds the ignition voltage of the gas diodes, so that ignition of at least one diode is ensured; the most adverse situation being that only the wrong diode conducts.

[2]) For a detailed analysis of the design procedure please apply to the manufacturer.

READ-OUT CIRCUIT BISTABLE MULTIVIBRATORS (continued)

In fig. 3, schematically representing these waveforms, the required minimum duration of the superimposed pulses is indicated;
t_s denotes the instant at which the bistable circuit reaches its final state.

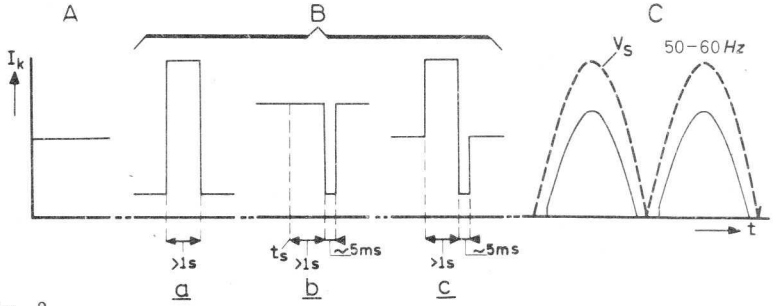


Fig. 3

The conditions to be obeyed by the current I_k are specified in the table below:

Mode of operation		Values of I_k		V_T
		lower limit	upper limit	
(A) constant direct current		(I)	(II)	> 5 V
(B) direct current with superimposed:				
(a) positive going pulses	steady state current	–	(II)	> 4.5 V
	pulse current	(I)	–	
(b) negative going pulses	steady state current	(I)	(III)	> 3 V
	pulse current	–	(II)	
(c) positive and negative going pulses	steady state current	–	(III)	> 3 V
	positive going pulse	(I)	–	
	negative going pulse	–	(II)	
(C) rectified alternating current, peak value of I_k		(I)	(III)	> 4.5 V [1]
This table should be read in conjunction with the specified recommended operating conditions and limiting values.				

1) Since both diodes are extinguished at the end of each half cycle of the supply voltage, condition (II) is not required, and is replaced by the condition that only the correct diode will reignite. The lower limit is thus given by the spread of the reignition voltage (e.i. 4.5 V).

READ-OUT CIRCUIT BISTABLE MULTIVIBRATORS (continued)

The minimum available value of V_T being known, the points of intersection with the curves I, II and III on page 8, and hence the limits of I_k (I_{kI}, I_{kII} and I_{kIII}) can be determined. This having been done, the required values of $V_{S\,min}$ and R_S can be evaluated from the following expressions: [1])

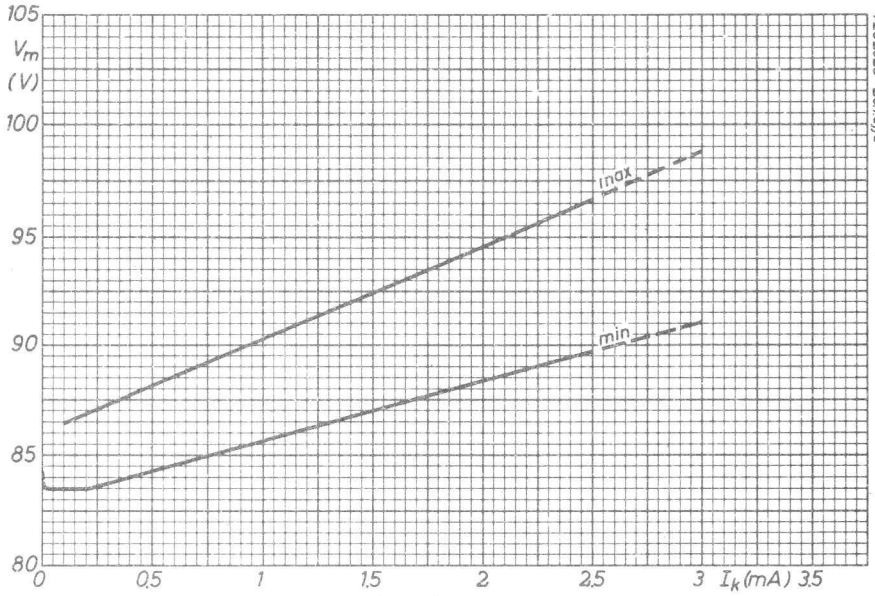
$$\frac{V_{S\,min} - V_{ign\,max}}{R_{S\,max}} = I_{kI} \qquad (1)$$

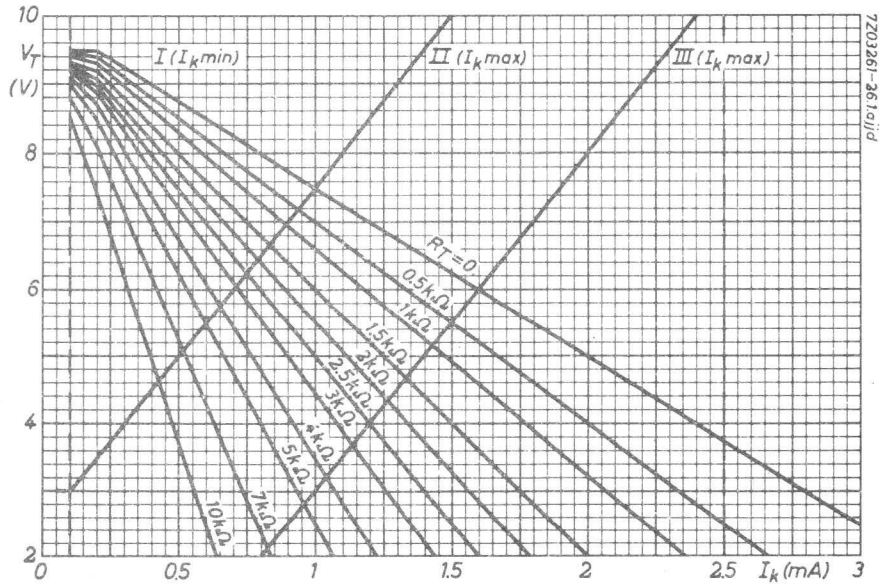
$$\frac{V_{S\,max} - V_{ext\,min} - V_T}{R_{S\,min}} = I_{kII} \qquad (2)$$

$$\frac{V_{S\,max} - V_{ign\,min} - V_T}{R_{S\,min}} = I_{kIII} \qquad (3)$$

In these expressions the suffices min and max denote the worst case limits of the quantities concerned.
For mode of operation (C) the peak value of the supply voltage must be substituted for V_S in the above expressions.

[1]) The use of equivalent circuits for establishing the exact conditions I, II, and III leads to a negligible error in the expressions (1), (2) and (3).


105
V_m
(V)
100
95
90
85
80
0
0.5
1
1.5
2
2.5
3
I_k(mA) 3.5
max
min
7Z02923-26.1ajjd

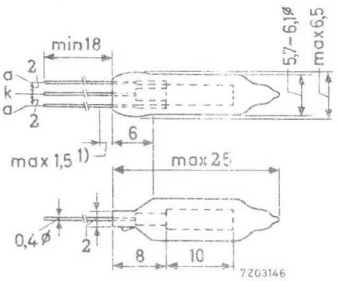

10
V_T
(V)
8
6
4
2
0
0.5
1
1.5
2
2.5
3
I_k(mA)
I ($I_k$min)
II ($I_k$max)
III ($I_k$max)
R_T=0
0.5kΩ
1kΩ
1.5kΩ
2kΩ
2.5kΩ
3kΩ
4kΩ
5kΩ
7kΩ
10kΩ
7Z03261-26.1ajjd

SWITCHING AND LIGHT DIODE

Long-life cold-cathode neon-filled subminiature switching and light diode with a large and stable difference between ignition and maintaining voltage intended for touch control applications e.g. in variable capacitance diode controlled radio or television tuners. The tube is shock and vibration resistant.

QUICK REFERENCE DATA			
Ignition voltage	V_{ign}	172	V
Maintaining voltage	V_m	107	V
Cathode current	I_k	3	mA

DIMENSIONS AND CONNECTIONS Dimensions in mm



MOUNTING

The tube may be soldered directly into the circuit, but heat conducted to the glass to metal seals should be kept to a minimum by using a thermal shunt. The leads may be dip-soldered to a minimum of 5 mm from the seals at a solder temperature of 240 °C during max. 10 s. Care should be taken not to bend the leads closer than 1,5 mm to the seals.

1) This part of the leads is not tinned.

CHARACTERISTICS AND OPERATING CONDITIONS

Valid over life and full temperature range unless otherwise stated.
The electrical characteristics are independent of ambient illumination.

Non conduction				
Anode voltage below which ignition will not occur	$V_{ign_{min.}}$		161	V
Insulation resistance	r_{ins}	>	300	MΩ
Ignition				
Anode voltage to ensure ignition	$V_{ign_{max.}}$		183	V
Ignition delay at V_{ign} + 10 V	T_{delay}	<	50	ms
at V_{ign} + 20 V	T_{delay}	<	20	ms
Typical max. individual variation of ignition voltage during life, within the V_{ign} limits given above	ΔV_{ign}	<	5	V
Conduction				
Cathode current, average during any conduction period	I_k	>	2, 2	mA
average (T_{av} = max. 1 s)	I_k	<	4, 5	mA
Maintaining voltage at I_k = 3 mA	V_m	≥ ≤	103 111	V V
Typical max. individual variation of maintaining voltage during life, within the V_m limits given above	ΔV_m	<	+2 −4	V V
Extinction				
Extinction voltage	V_{ext}	>	100	V

LIMITING VALUES (Absolute max. rating system)

Cathode current, average for				
continuous conduction	I_k	min.	2, 2	mA
average (T_{av} = max. 1 s)	I_k	max.	4, 5	mA
Anode voltage, negative peak	$-V_{a_p}$	max.	200	V
Bulb temperature	t_{bulb}	min.	-55	°C
		max.	+70	°C

SHOCK AND VIBRATION RESISTANCE

These conditions are solely used to assess the mechanical quality of the tube. The tube must not be continuously operated under these conditions.

Shock resistance 500 g

Forces as applied by NRL impact machine for electronic devices caused by 5 blows of the hammer lifted over an angle of 30° in each of 4 positions of the tube.

Vibration resistance 2, 5 $g_{(peak)}$

Vibrational forces for a period of 32 hours at a frequency of 50 Hz in each of 3 directions.

Dry reed contact units

GENERAL

REED CONTACT UNITS

Definitions

Reed contact unit

A reed contact unit is an assembly containing contact blades, some or all of magnetic material, sealed in an envelope.

Must-not-operate value

The must-not-operate value is the stated limit of the magnetic field at which the reed contact unit shall not physically operate.

Must-operate value

The must-operate value is the stated limit of the magnetic field at which the reed contact unit shall physically operate.

Operate time

The operate time is the time between the instant of the application of a specified magnetic field to a specific contact circuit and the instant of the first physical closing (or opening) of this specific contact circuit. The operate time does not include bounce time (unless otherwise indicated).

Bounce

Bounce is a momentary reopening of a contact after initial physical closing, or a momentary reclosing after initial physical opening.

Bounce time

The bounce time is the interval of time between the instant of first physical closing (or opening) and the instant of the final physical closing (or opening) of a specific contact circuit).

Contact circuit

A contact circuit is the whole of the electrically conductive parts of a reed contact unit which are intended to be connected in an external circuit.

Characteristic non-release value

The characteristic non-release value is the stated value of the magnetic field above which the operated reed contact unit fulfills specified qualities, e.g. contact resistance, noise characteristics etc.

Contact circuit resistance (also contact resistance)

The contact circuit resistance is the resistance of the contact circuit under specified conditions of measurement.

Must-not-release value

The must-not-release value is the stated limit of the applied magnetic field at which the operated reed contact unit shall remain physically operated.

Must-release value

The must-release value is the stated limit of the magnetic field at which the operated reed contact unit shall physically release.

Release time

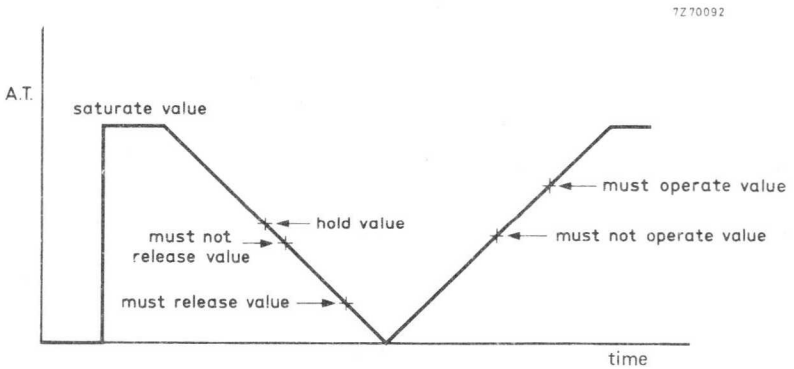
The release time is the time between the instant of the disconnection of a specific magnetic applied field to a specific contact circuit and the instant of the first opening (or closing) of this specific contact circuit. The release time does not include bounce time.

Saturation

The saturation is the magnetic condition, arbitrarily defined, at which the performance of the reed contact unit is unaffected by further increase of the applied magnetic field.

Saturate value

The saturate value is the arbitrarily defined value of the magnetic field at which the reed contact unit reaches saturation.



DRY REED SWITCH

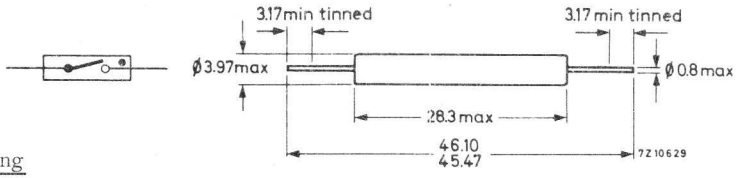
Miniature dry reed switch hermetically sealed in a gas-filled glass capsule. Single-pole, single-throw type, having normally open contacts, and containing two magnetically actuated reeds. The switch is of the double-ended type and may be actuated by means of either an electromagnet or a permanent magnet or combinations of both. The switch is intended for use in telephone equipment and other applications where exceptional reliability is required.

QUICK REFERENCE DATA	
Contact	S.P.S.T. normally open
Switched power	max. 5 W
Switched voltage	max. 65 V
Switched current	max. 100 mA
Failure rate	$< 5 \times 10^{-8}$

MECHANICAL DATA

Dimensions in mm

Contact material	gold
Contact arrangement	normally open
Terminal finish	tinned
Resonant frequency of single reed	approx. 1650 Hz
Net weigth	approx. 0.6 g
Mounting position	any



Mounting

The leads should not be bent nearer than 2 mm to the glass-to-metal seals. Stress on the glass-to-metal seals should be avoided.
The robustness of terminations is tested according to IEC Publication 68-2-21. test Ua (load 2.75 kg), Ub (load 1 kg, 2 bends), and Uc.
Care must be taken to prevent stray magnetic fields from influencing the operating and measuring conditions.

Soldering

The switch may be soldered direct into the circuit but heat conducted to the glass-to-metal seals should be kept to a minimum by the use of a thermal shunt.

Dip-soldering is permitted to a minimum of 4 mm from the seals at a solder temperature of 240 °C during maximum 10 s.

Solderability

Solderability is tested according to IEC Publication 68-2-20, test T, solder globule method.

CHARACTERISTICS

Non-operative

Breakdown voltage	min.	1000	V
Insulation resistance, initial (V = 100 V)	min.	10^5	MΩ
Capacitance without test coil		0.70	pF
Capacitance with earthed test coil		0.35	pF
Non-operative ampere turns	max.	30	A.T. [1]

Operative

Operating ampere turns	max.	58	A.T. [1]
Operating time, including bounce	av.	0.6	ms [1][2]
	max.	1.0	ms [1][2]
Switched current	max.	100	mA

Hold

Hold ampere turns	min.	27	A.T. [1]
Current through closed contacts	max.	1	A
Contact resistance, initial	min.	60	mΩ [1][3]
	max.	150	mΩ [1][3]

Release

Release ampere turns	max.	15	A.T. [1]
Release time	max.	50	μs [1][2]
Switched current	max.	100	mA
Switched power	max.	5	W

[1]) Measured in a standard coil of 5000 turns of 42 SWG single enamelled copper wire on a coil former of 25.4 mm winding length and a core diameter of 8.75 mm.

[2]) Measured with 80 A.T.

[3]) Measured with 40 A.T.

LIMITING VALUES (Absolute max. rating system)

See also "Life expectancy and reliability"

Switched power	max.	5	W
Switched voltage	max.	65	V
Switched current	max.	100	mA
surge (T = max. 100 ns)	max.	1.5	A
Temperature, operating	min.	-55	°C
	max.	+80	°C

LIFE EXPECTANCY AND RELIABILITY

End of life is assumed to be reached when:
a) the contact resistance exceeds 1 Ω for no load conditions or 2.5 Ω for loaded conditions
b) the release time exceeds 2.5 ms (latching or contact sticking)

No load conditions

Life expectancy min. 10^7 operations with a failure rate of less than 5.5×10^{-9} with 90% confidence level.

Loaded conditions

Life expectancy min. 5×10^6 operations with a failure rate of less than 10^{-8} with 90% confidence level.

If inductive loads are to be interrupted, contact protection is recommended (diode or RC network).

Reliability - testing conditions

Capacitive loading resulting in a peak current of 0.8 A $i_1/i_2 = 1.4$, T = 80 ns to 100 ns, see Fig. 1. Nominal switched voltage 50 V, nominal switched current 100 mA.

Under these conditions a life of more than 5×10^6 operations can be reached with a failure rate of less than 8.5×10^{-9}.

Remark

Higher loads may be switched if a reduced life expectancy and reliability are acceptable. The manufacturer should be consulted before doing so.

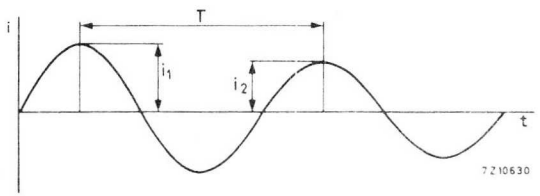


Fig. 1

SHOCK AND VIBRATION

Impact : Acceleration 50 g during 11 ms, due to a force perpendicular to the flat sides of the reeds.
Such an impact will not cause an open contact (no magnetic field present) to close, nor a contact kept closed by an 80 A.T. coil to open.

Vibration: Frequency range 50 Hz to 1500 Hz, acceleration 20 g due to a force perpendicular to the flat side of the reed.
Such a vibration will not cause an open contact (no magnetic field present) to close, nor a contact kept closed by an 80 A.T. coil to open.

DRY REED CONTACT UNIT

Micro dry reed contact unit hermetically sealed in a gas-filled glass capsule. Single-pole, single-throw type, having normally open contacts, and containing two magnetically actuated reeds. The contact unit is of the double-ended type and may be actuated by means of either an electromagnet or a permanent magnet or combinations of both. The device is intended for use in push buttons, relays or in similar devices, in conjunction with semiconductor devices.

QUICK REFERENCE DATA			
Contact	S.P.S.T. normally open		
Switched power	max.	10	W
Switched voltage , d.c.	max.	150	V
a.c. (r.m.s.)	max.	110	V
Switched current , d.c. or a.c. (r.m.s.)	max.	500	mA
Contact resistance (initial)		140	mΩ

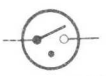
The RI-20 series comprises the types RI-20/3A, RI-20/3B, and RI-20/3C with the following basic magnetic characteristics, measured with the Standard coil.

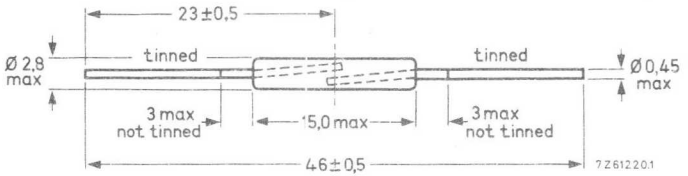
	RI-20/3A	RI-20/3B	RI-20/3C
Operate range (A t)	20 to 32	28 to 52	46 to 70
Release range (A t)	8 to 22	12 to 32	12 to 32

MECHANICAL DATA

Dimensions in mm

Contact arrangement	normally open
Lead finish	tinned
Resonant frequency of single reed	approx. 2900 Hz
Net mass	approx. 0,16 g
Mounting position	any





Mechanical strength

The robustness of terminations is tested according to IEC Publication 68-2-21, test Ua (load 2 kg), Ub (load 0,5 kg, 2 bends), and Uc (3 x 360°).

Mounting

The leads should not be bent nearer than 1 mm to the glass-to-metal seals.
Stress on the seals should be avoided.
Care must be taken to prevent stray magnetic fields from influencing the operating and measuring conditions.

Soldering

The contact unit may be soldered direct into the circuit but heat conducted to the glass-to-metal seals should be kept to a minimum by the use of a thermal shunt.
Dip-soldering is permitted to a minimum of 3 mm from the seals at a solder temperature of 240 °C during maximum 10 s.

Solderability

Solderability is tested according to IEC Publication 68-2-20, test T, solder globule method.

Weldability

The leads are weldable.

The RI-20 SERIES comprises three types: RI-20/3A, RI-20/3B, and RI-20/3C.

CHARACTERISTICS RI-20/3A

Not-operate					
Breakdown voltage	min.		400		V
Insulation resistance, initial	min.		10^3		MΩ
Capacitance, without test coil	max.		0,25		pF
		coil I	coil II	coil III [1]	
Must-not-operate value	max.	20	13	18	At
Operate					
Must-operate value	max.	32	18	26	At
Operate time, including bounce	typ.	0,5 [2]			ms
	max.	1,0 [2]			ms
Bounce time	typ.	0,4 [2]			ms
	max.	0,7 [2]			ms
Contact resistance, initial	typ.	140 [3]			mΩ
	max.	300 [3]			mΩ
Not-release					
Must-not-release value	min.	22	13	18	At
Release					
Must-release value	max.	8	6	8	At
Release time	max.	50 [2]			µs

Notes: see page 3.

CHARACTERISTICS RI-20/3B

Not-operate					
Breakdown voltage	min.		400		V
Insulation resistance	min.		10^3		MΩ
Capacitance, without test coil	max.		0,25		pF
		coil I	coil II	coil III	[1]
Must-not-operate value	max.	28	16	23	At
Operate					
Must-operate value	max.	52	25	40	At
Operate time, including bounce	typ.	0,5 [2]			ms
	max.	1,0 [2]			ms
Bounce time	typ.	0,4 [2]			ms
	max.	0,7 [2]			ms
Contact resistance, initial	typ.	140 [3]			mΩ
	max.	300 [3]			mΩ
Not-release					
Must-not-release value	min.	32	18	26	At
Release					
Must-release value	max.	12	8	11	At
Release time	max.	50 [2]			µs

[1] Coil I : Standard coil.
Coil II : Recommended coil.
Coil III: Miniature coil A according to MIL-S-55433B.

see page 6

[2] Measured with 100 At.

[3] Measured with 70 At , distance between measuring points: 41 mm.
Wire resistance typ. 2,5 mΩ/mm.

CHARACTERISTICS RI-20/3C

Not-operate					
Breakdown voltage	min.		400		V
Insulation resistance, initial	min.		10^3		MΩ
Capacitance, without test coil	max.		0,25		pF
		coil I	coil II	coil III	
Must-not-operate value	max.	46	23	36	At
Operate					
Must-operate value	max.	70	31	53	At
Operate time, including bounce	typ.	0,5 [2]			ms
	max.	1,0 [2]			ms
Bounce time	typ.	0,4 [2]			ms
	max.	0,7 [2]			ms
Contact resistance, initial	typ.	140 [3]			mΩ
	max.	300 [3]			mΩ
Not-release					
Must-not-release value	min.	32	18	26	At
Release					
Must-release value	max.	12	8	11	At
Release time	max.	50 [2]			µs

Notes: see page 3.

LIMITING VALUES (Absolute max. rating system)

Switched power	max.	10	W
Switched voltage , d.c.	max.	150	V
a.c. (r.m.s.)	max.	110	V
Switched current , d.c. or a.c. (r.m.s.)	max.	500	mA
Current through closed contacts, d.c. or a.c. (r.m.s.)	max.	1	A
Temperature, storage and operating	max.	125	°C [1]
	min.	-55	°C

LIFE EXPECTANCY AND RELIABILITY

For life expectancy data end of life is defined as being reached when:
either a) the contact resistance once exceeds 1 Ω for no-load conditions or 10 Ω for loaded conditions, measured 5 ms after energizing coil;
or b) the release time once exceeds 5 ms after de-energizing the coil (latching or contact sticking).

No-load conditions (operating frequency 50 Hz).

Life expectancy min. 10^8 operations with a failure rate of less than 10^{-8} with a confidence level of 90 %.
After each operation a) and b) are tested.

Loaded conditions (Resistive load: 12 V, 2 mA, operating frequency 50 Hz).

Life expectancy min. 10^7 operations with a failure rate of less than 10^{-8} with a confidence level of 90 %.
After each operation points a) and b) are tested.

Note

Switching other loads involves different life expectancy and reliability. Consult us beforehand.

SHOCK AND VIBRATION

Impact: Acceleration 50 g during 11 ms, due to a force perpendicular to the flat sides of the reeds.
Such an impact will not cause an open contact (no magnetic field present) to close, nor a contact kept closed by an 80 At coil to open.

Vibration: Frequency range 50 Hz to 2000 Hz, acceleration 10 g due to a force perpendicular to the flat sides of the reeds.
Such a vibration will not cause an open contact (no magnetic field present) to close, nor a contact kept closed by an 80 At coil to open.

[1] Excursions up to 150 °C may be permissible. Consult us.

COILS

Coil I: Standard coil

5000 turns of 42 SWG single enamelled copper wire on a coil former of 25, 4 mm winding length and a core diameter of 8, 75 mm.

Coil II; Recommended coil

5000 turns of 46 SWG single enamelled copper wire on a coil former of 7, 1 mm winding length, a core diameter of 3, 7 mm and an outer diameter of 8, 3 mm.

Coil III: Miniature coil A according to MIL-S-55433B

10 000 turns of 48 SWG single enamelled copper wire on a coil former of 19, 05 mm winding length and a core diameter of 4, 32 mm.

DRY REED CONTACT UNIT

Micro dry reed contact unit hermetically sealed in a gas-filled capsule. Single-pole, single-throw type, having normally open contacts, and containing two magnetically actuated reeds. The contact unit is of the double-ended type and may be actuated by means of either an electromagnet or a permanent magnet or combinations of both. The device is intended for use in push buttons, relays or in similar devices, in conjunction with semiconductor circuits.

QUICK REFERENCE DATA			
Contact	S.P.S.T. normally open		
Switched power	max.	10	W
Switched voltage, d.c.	max.	150	V
, a.c. (r.m.s.)	max.	110	V
Switched current, d.c. or a.c. (r.m.s.)	max.	500	mA
Contact resistance (initial)		140	mΩ

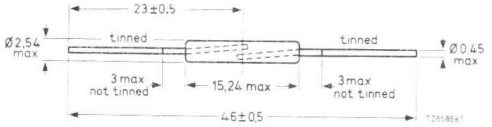
The RI-21 series comprises the types RI-21/3A, RI-21/3B, and RI-21/3C with the following basic magnetic characteristics, measured in the Standard coil.

	RI-21/3A	RI-21/3B	RI-21/3C
Operate range (At)	20 to 32	28 to 52	46 to 70
Release range (At)	8 to 22	12 to 32	12 to 32

MECHANICAL DATA

Contact arrangement	normally open
Lead finish	tinned
Resonant frequency of single reed	approx. 2900 Hz
Net mass	approx. 0,16 g
Mounting position	any

Dimensions in mm



Mechanical strength

The robustness of terminations is tested according to IEC Publication 68-2-21, test Ua (load 1 kg), and Uc (3 x 360 °).

For all further data please refer to the RI-20 SERIES

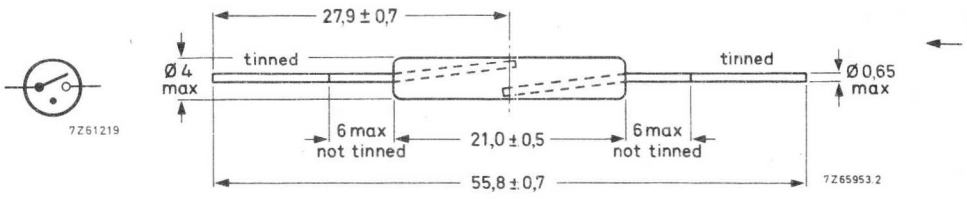
DRY REED CONTACT UNIT

Mini dry reed contact unit hermetically sealed in a gas-filled glass capsule. Single-pole, single-throw type, having normally open contacts, and containing two magnetically actuated reeds. The contact unit is of the double-ended type and may be actuated by means of either an electromagnet or a permanent magnet or combinations of both. The device is intended for use in relays, push buttons or similar devices in conjunction with semiconductor circuits.

QUICK REFERENCE DATA				
Contact	S.P.S.T. normally open			
Switched power	max.		10	W
Switched voltage, d.c.	max.		350	V
a.c. (r.m.s.)	max.		220	V
Switched current	max.		500	mA
Contact resistance, initial	max.		100	mΩ
Basic magnetic characteristics, measured with the Standard coil				
Operate range	30	to	70	At
Release range	9,5	to	21	At

MECHANICAL DATA Dimensions in mm

Contact arrangement	normally open
Lead finish	tinned
Resonant frequency of single reed	approx. 2000 Hz
Net mass	approx. 0,3 g
Mounting position	any



Mechanical strength

The robustness of terminations is tested according to IEC Publication 68-2-21, test Ua (load 3,5 kg), Ub (load 0,5 kg, 2 bends), and Uc (3 x 360°).

Mounting

The leads should not be bent nearer than 2 mm to the glass-to-metal seals. Stress on the seals should be avoided.
Care must be taken to prevent stray magnetic fields from influencing the operating and measuring conditions.

Soldering

The contact unit may be soldered direct into the circuit but heat conducted to the glass-to-metal seals should be kept to a minimum by the use of a thermal shunt.
Dip-soldering is permitted to a minimum of 6 mm from the seals at a solder temperature of 240 °C during maximum 10 s.

Solderability

Solderability is tested according to IEC Publication 68-2-20, test T, solder globule method.

Weldability

The leads are weldable.

CHARACTERISTICS See also "General Reed contact units"

Not-operate

Breakdown voltage	min.	750		V [5]
	min.	1000		V [6]
Insulation resistance, initial	min.	10^3		MΩ
Capacitance, without test coil	max.	1		pF
		coil I	coil II	
Must-not-operate value	max.	30	31	At

Operate

Must-operate value	max.	70	75	At
Operate time, including bounce	typ.	0,6 [2]		ms
	max.	1,0 [2]		ms
Bounce time	typ.	0,3 [2]		ms
	max.	0,5 [2]		ms
Contact resistance, initial	typ.	70 [3]		mΩ
	max.	100 [3]		mΩ

Notes: see page 4.

Not-release

Must-not-release value	min.	21	22	At

Release

Must-release value	max.	9,5	9,5	At
Release time	max.	50 [2]		µs

LIMITING VALUES (Absolute max. rating system)

Switched power	max.	10	W
Switched voltage, d.c.	max.	350	V
a.c. (r.m.s.)		220	V
Switched current, d.c. or a.c. (r.m.s.)	max.	500	mA
Switched current, surge (T = max. 100 ns)	max.	1	A [4]
Current through closed contact, d.c. or a.c. (r.m.s.)	max.	1,5	A
Temperature, storage and operation	max.	125	°C
	min.	-55	°C

LIFE EXPECTANCY AND RELIABILITY

For life expectancy data end of life is defined as being reached when:
either a) the contact resistance exceeds 1 Ω for no load conditions or 5 Ω for loaded conditions, measured 5 ms after energizing coil I to 100 At.
or b) the release time once exceeds 5 ms (latching or contact sticking), after de-energizing coil I to 4 At.

No-load conditions

Operating frequency 50 Hz.
Life expectancy min. 10^8 operations with a failure rate of less than 10^{-8} with a confidence level of 90%.
After each operation a) and b) are tested.

Loaded conditions

Resistive load: 12 V, 100 mA, operating frequency 50 Hz.
Life expectancy min. 10^7 operations with a failure rate of less than 10^{-8} with a confidence level of 90%.
After each operation [a]) and [b]) are tested.

Notes: see page 4.

SHOCK AND VIBRATION

Mechanical shock is tested according to IEC Publication 68-2-27, test Ea (peak acceleration 500 g, half sine-wave).
Such a mechanical shock will not cause an open contact (no magnetic field present) to close, nor a contact kept closed by an 80 At coil to open.

Vibration is tested according to IEC Publication 68-2-6, test Fe, procedure B4 (acceleration 10 g, below cross-over frequency amplitude 0,75 mm, frequency range 10-500 Hz, duration 90 min.). Such a vibration will not cause an open contact (no magnetic field present) to close, nor a contact kept closed by an 80 At coil to open.

COILS

Coil I: Standard coil

5000 turns of 42 SWG single enamelled copper wire on a coil former of 25,4 mm winding length and a core diameter of 8,75 mm.

Coil II: Intermediate coil C according to MIL-S-55433B

10 000 turns of 41 SWG single enamelled copper wire on a coil former of 25,4 mm winding length and a core diameter of 7,62 mm.

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1) Coil I : Standard coil.
Coil II: Intermediate coil C according to MIL-S-55433B.

2) Measured with 100 At.

3) Measured with 32 At, distance between measuring points 41 mm.

4) Surges (e.g. due to stray capacitances of cables) up to 1,5 A are permissible provided these surges decay to values within the limiting values in less than 0,8 µs.
Submicrosecond surges may shorten contact life significantly.

5) Measured after pre-ionization.

6) Measured without pre-ionization.

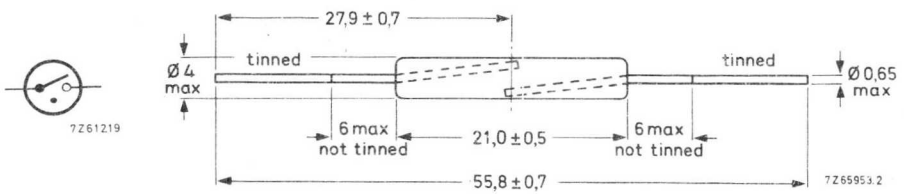
DRY REED CONTACT UNIT

Miniature dry reed contact unit hermetically sealed in a gas-filled glass capsule. Single-pole, single-throw type, having normally open contacts, and containing two magnetically actuated reeds. The contact unit is of the double-ended type and may be actuated by means of either an electromagnet or a permanent magnet or combinations of both. The device is intended for use in telephone exchange relays.

QUICK REFERENCE DATA				
Contact	S.P.S.T. normally open			
Switched power	max.		10	W
Switched voltage	max.		200	V
Switched current	max.		500	mA
Contact resistance (initial)	max.		100	mΩ
Basic magnetic characteristics, measured with the Standard coil				
Operate range	30	to	70	At
Release range	9,5	to	21	At

MECHANICAL DATA Dimensions in mm

Contact arrangement	normally open		
Lead finish	tinned		
Resonant frequency of single reed	approx.	2000	Hz
Net mass	approx.	0,3	g
Mounting position	any		



Mechanical strength

The robustness of terminations is tested according to IEC Publication 68-2-21, test Ua (load 3,5 kg), Ub (load 0,5 kg, 2 bends) and Uc (3 x 360 °).

Mounting

The leads should not be bent nearer than 2 mm to the glass-to-metal seals. Stress on the seals should be avoided.
Care must be taken to prevent stray magnetic fields from influencing the operating and measuring conditions.

Soldering

The contact unit may be soldered direct into the circuit but heat conducted to the glass-to-metal seals should be kept to a minimum by the use of a thermal shunt.
Dip-soldering is permitted to a minimum of 6 mm from the seals at a solder temperature of 240 °C during maximum 10 s.

Solderability

Solderability is tested according to IEC Publication 68-2-20, test T, solder globule method.

Weldability

The leads are weldable.

CHARACTERISTICS

Not-operate					
Breakdown voltage	min.		750		V [5]
	min.		1000		V [6]
Insulation resistance, initial	min.		10^3		MΩ
		coil I	coil II	coil III	
Must-not-operate value	max.	30	21	31	At
Operate					
Must-operate value	max.	70	37	75	At
Operate time, including bounce	max.		1,1 [2]		ms
Bounce time	typ.		0,3 [2]		ms
	max.		0,4 [2]		ms
Hold					
Hold value	min.	32	20,5	33	At
Contact resistance, initial	max.		100 [3]		mΩ
Not-release					
Must-not-release value	min.	21	13	22	At
Release					
Must-release value	max.	9,5	5	9,5	At
Release time	max.		0,1 [2]		ms

Notes: see page 4.

LIMITING VALUES (Absolute max. rating system)

Switched power	max.	10	W
Switched voltage	max.	200	V
Switched current	max.	500	mA [4]
Current through closed contact	max.	1,5	A
Temperature, storage and operating	max.	125	°C
	min.	-55	°C

LIFE EXPECTANCY

For life expectancy data end of life is defined as being reached when within 0,1 x the typical number of operations:

either a) the contact resistance more than once exceeds 1 Ω for no load conditions and 10 Ω for loaded conditions, measured 5 ms after energizing the coil;

or b) the release time more than once exceeds 2 ms after de-energizing the coil (contact sticking).

No load conditions

Typical number of operations: 10^8 Operating frequency 50 Hz.

Loaded conditions

p) Resistance load: 50 V, 100 mA Operating frequency 20 Hz.
Minimum number of operations: 2×10^6

q) Resistive load: 50 V, 50 mA connected to the contacts by means of the following cables:

Surge impedance (Ω)	Cable length (m)
45	20; 100
75	20; 100
140	20; 100

Minimum number of operations: $0,5 \times 10^6$ Operating frequency 20 Hz.

r) Discharge of the following floating cables, previously charged to 50 V:

Surge impedance (Ω)	Cable length (m)
45	1; 10; 100
75	1; 10; 100
140	1; 10; 100

Minimum number of operations: 3×10^6 Operating frequency 20 Hz.

General: After each operation points a) and b) are tested.

Note: Switching other loads involves different life expectancy and reliability. Consult us beforehand.

SHOCK AND VIBRATION

Mechanical shock is tested according to IEC Publication 68-2-27, test Ea (peak acceleration 500 g, half sine-wave).
Such a mechanical shock will not cause an open contact (no magnetic field present) to close, nor a contact kept closed by an 80 At coil II to open.

Vibration is tested according to IEC Publication 68-2-6, test Fc, procedure B4 (acceleration 10 g, below cross-over frequency amplitude 0,75 mm, frequency range 10-500 Hz, duration 90 minutes).
Such a vibration will not cause an open contact by an 80 At coil II to open.

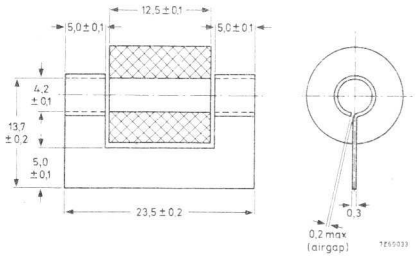
COILS

Coil I: Standard coil

5000 turns of 42 SWG single enamelled copper wire on a coil former of 25,4 mm winding length and a core diameter of 8,75 mm.

Coil II: Recommended coil

2000 turns of 42 SWG single enamelled copper wire on a coil former of 12,5 mm winding length and a core diameter of 4,2 mm with a return circuit of annealed soft iron (80 A/m < H_c < 96 A/m).



Coil III: Intermediate coil C according to MIL-S55433B

10 000 turns of 41 SWG single enamelled copper wire on a coil former of 25,4 mm winding length and a core diameter of 7,62 mm.

---

1) Coil I : Standard coil.
Coil II : Recommended coil.
Coil III: Intermediate coil C according to MIL-S-55433B.

2) Measured with 50 At

3) Measured with 20 At, distance between measuring points: 38 mm.

4) Surges (e.g. due to stray capacitances of cables) up to 1,5 A are permissible provided these surges decay to values within the limiting values in less than 0,8 µs. Submicrosecond surges may shorten contact life significantly.

5) Measured after pre-ionization.

6) Measured without pre-ionization.

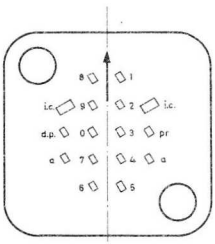
Associated accessories

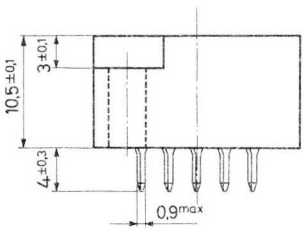
14 PIN TUBE SOCKET

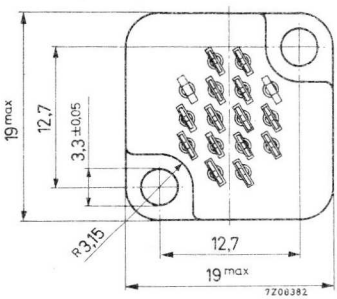
Socket for over-chassis mounting and mounting on a printed-wiring board with reference grid according to IEC publication 97.
The socket is compatible with 14 pin base (e.g. ZM1000).

MECHANICAL DATA

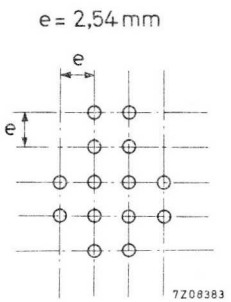
Dimensions in mm







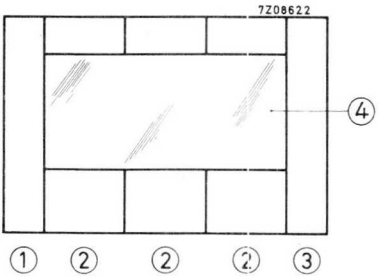
Hole pattern in printed wiring board
(for bottom view of socket)



Material: Phenolic
Contacts: Fork shaped, silver plated

SNAP-FIT INDICATOR-TUBE ASSEMBLY

A snap-fit indicator-tube assembly consists of a left-hand end piece ① , a number of snap-fit tube holders ② , as many as there are indicator tubes to be fitted side by side, a right-hand end piece ③ , and a filter plate ④ , which forms the front panel.
The filter plate is preferably to the blue-light absorbing type made of, for instance, circular-polarized material.

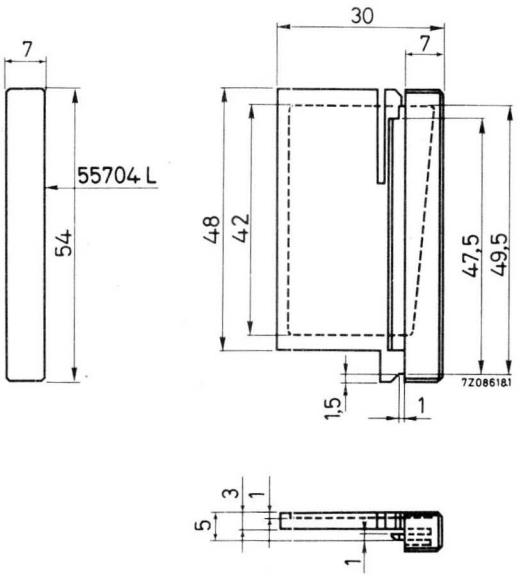


The various items can be fitted easily into a rectangular window cut in the frontplate of a piece of equipment; no tools are needed for mounting and this can take place from the front. A snap-fit indicator-tube assembly can be used with front plates 1,6 ± 0,2 mm thick.

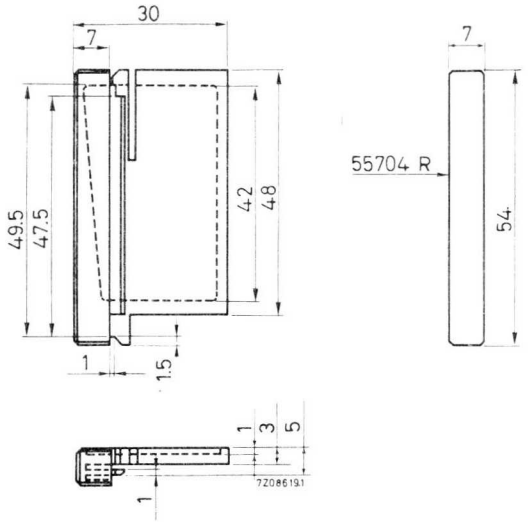
DIMENSIONS in mm

Material: grey plastic.

Left-hand end piece

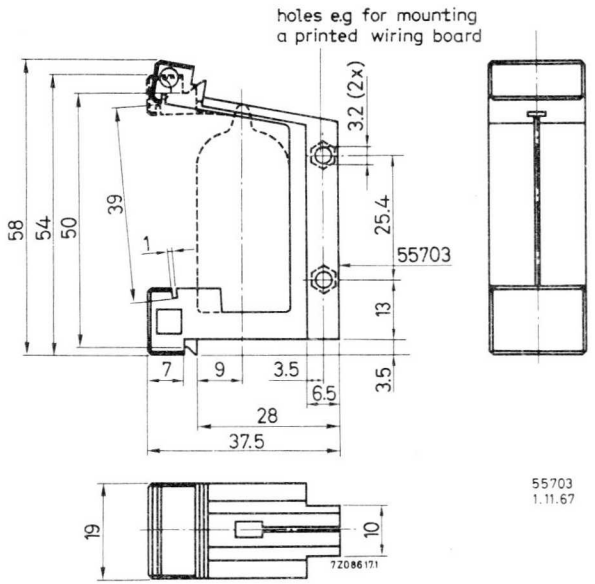


Right-hand end piece

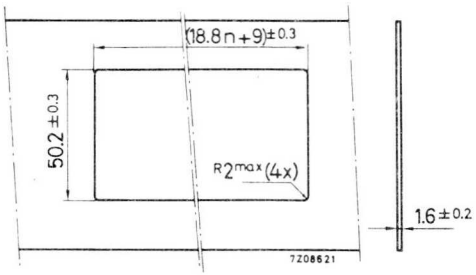


These two items are supplied together under type number 55704

Snap-fit tube holder Type number 55703



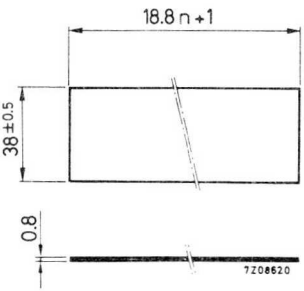
Window to be cut in the front plate



n = number of tube holders type 55703.

plate thickness 1.6 ± 0.2 mm

Filter plate (not included in the delivery)



n = number of tube holders 55703

MOUNTING INSTRUCTIONS

1. Slide one of the end pieces into position in the window cut in the front plate; Figs. 1a and 1b show this for the left-hand end piece.

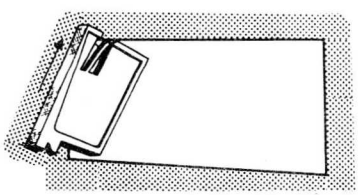


Fig.1a

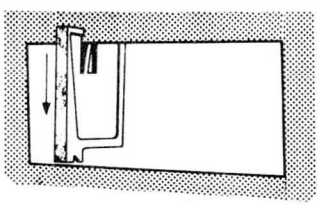


Fig.1b

2. Slide the snap-fit tube holders into position one by one, see Fig.2a and 2b.

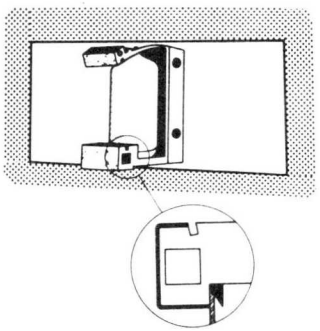


Fig.2a

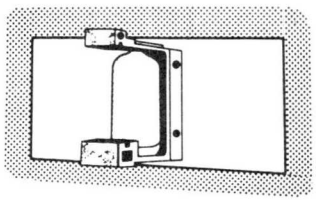


Fig.2b

3. After the last tube holder has been moved to its place, slide the filter plate into the grooves provided for the purpose, see Fig.3. Slide the other end piece into position in the manner explained for the first end piece.

Removal of the various items takes place in the reversed order.

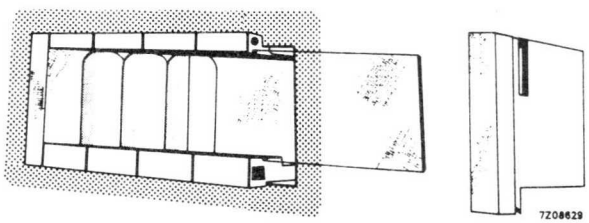


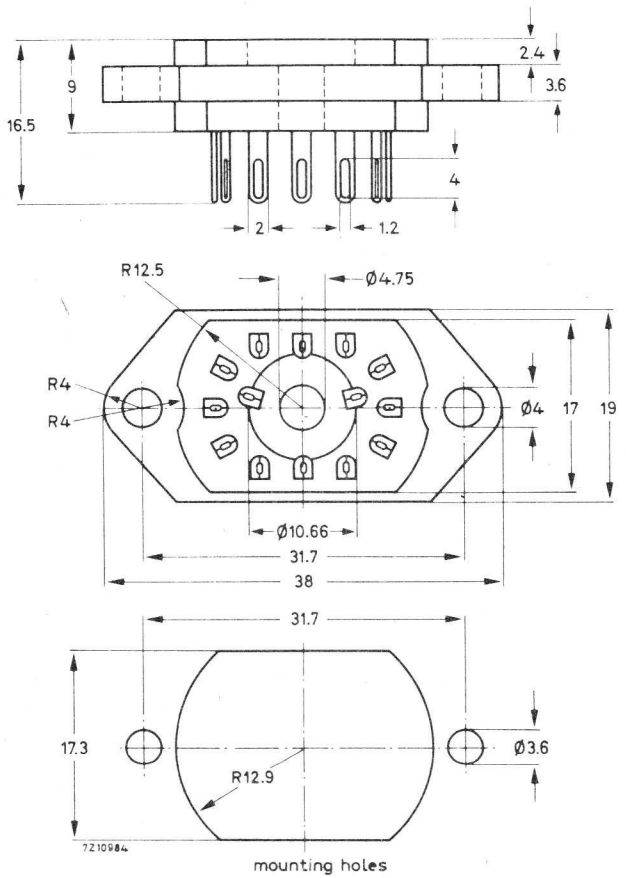
Fig.3

14–PIN TUBE SOCKET

14-pin socket, intended for use with close mounted rectangular envelope indicator tubes.

MECHANICAL DATA

Dimensions in mm

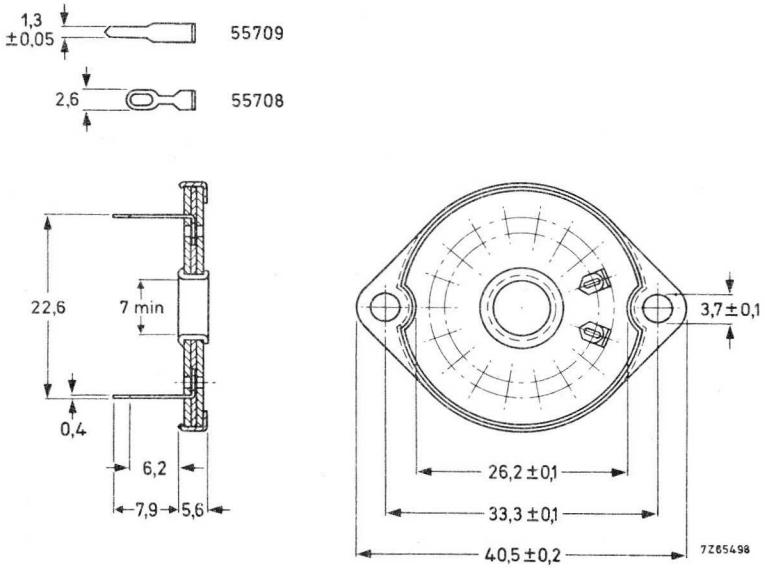


SOCKET FOR 17-PIN BASE

Socket (laminated) with scraping contacts, compatible with 17-pin base as used with "Pandicon"* tubes, e.g. ZM1200.

55708	For chassis mounting. Soldering tags with eyelets.
55709	For printed wiring. Soldering tags on circle.

The contacts are silver plated.



*Registered Trade Mark for multiple indicator tubes.

INDEX OF TYPE NUMBERS

D.R. = Dry reed contact units
S.D. = Switching diodes
I.T. = Indicator tubes
S.I.T. = Segment indicator tubes
Acc. = Accessories

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