PHILIPS

Data handbook

Electronic components and materials

Electron tubes

Book T15 1986

Dry reed switches

DRY REED SWITCHES

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DATA HANDBOOK SYSTEM

Our Data Handbook System comprises more than 60 books with specifications on electronic components, subassemblies and materials. It is made up of four series of handbooks:

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

The contents of each series are listed on pages iv to viii.

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

When ratings or specifications differ from those published in the preceding edition they are indicated with arrows in the page margin. Where application information is given it is advisory and does not form part of the product specification.

Condensed data on the preferred products of Philips Electronic Components and Materials Division is given in our Preferred Type Range catalogue (issued annually).

Information on current Data Handbooks and on how to obtain a subscription for future issues is available from any of the Organizations listed on the back cover.
Product specialists are at your service and enquiries will be answered promptly.

ELECTRON TUBES (BLUE SERIES)

The blue series of data handbooks comprises:

T1 **Tubes for r.f. heating**

T2a **Transmitting tubes for communications, glass types**

T2b **Transmitting tubes for communications, ceramic types**

T3 **Klystrons**

T4 **Magnetrons for microwave heating**

T5 **Cathode-ray tubes**
Instrument tubes, monitor and display tubes, C.R. tubes for special applications

T6 **Geiger-Müller tubes**

T8 **Colour display systems**
Colour TV picture tubes, colour data graphic display tube assemblies, deflection units

T9 **Photo and electron multipliers**

T10 **Plumbicon camera tubes and accessories**

T11 **Microwave semiconductors and components**

T12 **Vidicon and Newvicon camera tubes**

T13 **Image intensifiers and infrared detectors**

T15 **Dry reed switches**

T16 **Monochrome tubes and deflection units**
Black and white TV picture tubes, monochrome data graphic display tubes, deflection units

SEMICONDUCTORS (RED SERIES)

The red series of data handbooks comprises:

S1 **Diodes**
Small-signal silicon diodes, voltage regulator diodes (< 1,5 W), voltage reference diodes, tuner diodes, rectifier diodes

S2a **Power diodes**

S2b **Thyristors and triacs**

S3 **Small-signal transistors**

S4a **Low-frequency power transistors and hybrid modules**

S4b **High-voltage and switching power transistors**

S5 **Field-effect transistors**

S6 **R.F. power transistors and modules**

S7 **Surface mounted semiconductors**

S8 **Devices for optoelectronics**
Photosensitive diodes and transistors, light-emitting diodes, displays, photocouplers, infrared sensitive devices, photoconductive devices.

S9 **Power MOS transistors**

S10 **Wideband transistors and wideband hybrid IC modules**

S11 **Microwave transistors**

S12 **Surface acoustic wave devices**

S13 **Semiconductor sensors**

INTEGRATED CIRCUITS (PURPLE SERIES)

The purple series of data handbooks comprises:

EXISTING SERIES		Superseded by:
IC1	**Bipolar ICs for radio and audio equipment**	IC01N
IC2	**Bipolar ICs for video equipment**	IC02Na and IC02Nb
IC3	**ICs for digital systems in radio, audio and video equipment**	IC01N, IC02Na and IC02Nb
IC4	**Digital integrated circuits** CMOS HE4000B family	
IC5	**Digital integrated circuits – ECL** ECL10 000 (GX family), ECL100 000 (HX family), dedicated designs	IC08N
IC6	**Professional analogue integrated circuits**	
IC7	**Signetics bipolar memories**	
IC8	**Signetics analogue circuits**	IC11N
IC9	**Signetics TTL logic**	IC09N and IC15N
IC10	**Signetics Integrated Fuse Logic (IFL)**	IC13N
IC11	**Microprocessors, microcomputers and peripheral circuitry**	IC14N

NEW SERIES

IC01N	**Radio, audio and associated systems** Bipolar, MOS	(published 1985)
IC02Na	**Video and associated systems** Bipolar, MOS Types MAB8031AH to TDA1524A	(published 1985)
IC02Nb	**Video and associated systems** Bipolar, MOS Types TDA2501 to TEA1002	(published 1985)
IC03N	**Integrated circuits for telephony**	(published 1985)
IC04N	**HE4000B logic family** CMOS	
IC05N	**HE4000B logic family – uncased ICs** CMOS	(published 1984)
IC06N	**High-speed CMOS; PC54/74HC/HCT/HCU** Logic family	(published 1985)
Supplement to IC06N	**High-speed CMOS; PC74HC/HCT/HCU** Logic family	(published 1985)
IC07N	**High-speed CMOS; PC54/74HC/HCT/HCU – uncased ICs** Logic family	
IC08N	**ECL 10K and 100K logic families**	(published 1984)
IC09N	**TTL logic series**	(published 1984)
IC10N	**Memories** MOS, TTL, ECL	
IC11N	**Linear LSI**	(published 1985)
IC12N	**Semi-custom gate arrays & cell libraries** ISL, ECL, CMOS	
IC13N	**Semi-custom** Integrated Fuse Logic	(published 1985)
IC14N	**Microprocessors, microcontrollers & peripherals** Bipolar, MOS	(published 1985)
IC15N	**FAST TTL logic series**	(published 1984)

Note

Books available in the new series are shown with their date of publication.

COMPONENTS AND MATERIALS (GREEN SERIES)

The green series of data handbooks comprises:

C1	**Programmable controller modules** PLC modules, PC20 modules
C2	**Television tuners, coaxial aerial input assemblies, surface acoustic wave filters**
C3	**Loudspeakers**
C4	**Ferroxcube potcores, square cores and cross cores**
C5	**Ferroxcube for power, audio/video and accelerators**
C6	**Synchronous motors and gearboxes**
C7	**Variable capacitors**
C8	**Variable mains transformers**
C9	**Piezoelectric quartz devices**
C10	**Connectors**
C11	**Varistors, thermistors and sensors**
C12	**Potentiometers, encoders and switches**
C13	**Fixed resistors**
C14	**Electrolytic and solid capacitors**
C15	**Ceramic capacitors**
C16	**Permanent magnet materials**
C17	**Stepping motors and associated electronics**
C18	**Direct current motors**
C19	**Piezoelectric ceramics**
C20	**Wire-wound components for TVs and monitors**
C21*	**Assemblies for industrial use** HNIL FZ/30 series, NORbits 60-, 61-, 90-series, input devices
C22	**Film capacitors**

* Will be issued in 1985.

DRY REED SWITCHES

TYPE SELECTION

series		RI-22	RI-23	RI-26	RI-27	RI-45	RI-46	
description	unit	general purpose micro-reed	general purpose micro-reed	high-inrush current micro-reed	general purpose pico-reed	switching mains voltage micro-reed	high power micro-reed	
Operate values	At	8-70	8-70	8-32	10-34	30-65	12-31	27-77
Release values	At	4-32	4-32	4-22	4-19,5	10-25	5-19	9,5-26,5
Contact resistance	mΩ	< 90	< 100	< 100	< 115	< 90	< 90	< 90
Insulation resistance	Ω	$> 10^{12}$	$> 10^{12}$	$> 10^{12}$	$> 10^{12}$	$> 10^{12}$	$> 10^{12}$	$> 10^{12}$
Switched power	W	10	10	15	10	40	30	40
Switched voltage	V	200 d.c. 110 a.c.	200 d.c. 110 a.c.	200 d.c. 110 a.c.	200 d.c. 110 a.c.	250 a.c.	200 d.c. 250 a.c.	200 d.c. 250 a.c.
Switched current	mA	500	500	1000	500	1000	1000	1000
Glass diameter	mm	$< 2,8$	$< 2,54$	$< 2,54$	$< 1,8$	$< 2,8$	$< 2,8$	$< 2,8$
Glass length	mm	$< 15,0$	$< 15,0$	$< 15,0$	$< 13,5$	$< 21,5$	$< 21,5$	$< 21,5$
Total length	mm	$46 \pm 0,5$	$46 \pm 0,5$	$46 \pm 0,5$	$46 \pm 0,5$	$46 \pm 0,5$	$46 \pm 0,5$	$46 \pm 0,5$
Page		9	17	25	31	43	49	

INTRODUCTION

DEFINITIONS (based on IEC 255-9)

A *dry reed switch* is an assembly containing ferromagnetic contact blades, hermetically sealed in a glass envelope and operated by an externally-generated magnetic fields, e.g. that from an actuating coil.

The *must-not-operate value* is the stated limit of the applied magnetic field at which the dry reed switch shall not operate.

The *must-operate value* is the stated limit of the applied magnetic field at which the dry reed switch shall operate (see Fig. 1).

The *operate time* is the time between the instant of application of a magnetic field to a dry reed switch and the instant of the first physical closing of this switch. The operate time does not include bounce time.

The *must-not-release value* is the stated limit of the applied magnetic field at which the operated dry reed switch shall remain physically closed (see Fig. 1).

The *must-release value* is the stated limit of the applied magnetic field at which the closed dry reed switch shall physically release.

The *release time* is the time between the instant of removal of an applied magnetic field to a dry reed switch and the instant of the first physical opening of this switch. The release time does not include bounce time.

Bounce is a momentary opening of a switch after initial closing, or a momentary closing after initial opening.

The *bounce time* is the interval of time between the instant of initial closing (or opening) and the instant of final closing (or opening) of the dry reed switch.

The *dry reed switch contact resistance* is the resistance of the dry reed switch under specified conditions of measurement.

The *saturate value* is the arbitrary defined value of the applied magnetic field at which the dry reed switch is unaffected by further increase of the applied magnetic field (see Fig. 1).

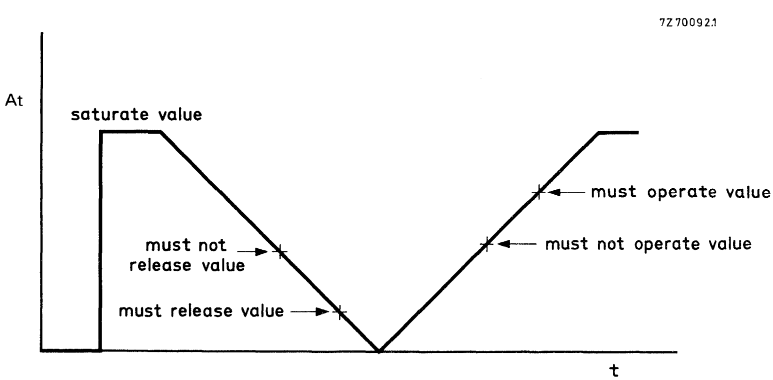


Fig. 1.

CHARACTERISTICS

Operate and release values

Operate and release values are dependent on the measuring coil, the rate of energization (0,1 At/ms), the detection of the operate (closing) and the release (opening) moment, the position of the measuring coil relative to the earth's magnetic field and on the environmental conditions.
If necessary, special operate and release values can be agreed upon between manufacturer and customer.

Operate and release times

The operate and release times are mostly dependent on the de-energization rate. They are proportional to the R/L time of the coil. Operate time is inversely proportional to the ratio of energization to operate value. Release time is proportional to the ratio of energization to release value.

Bounce time

The bounce time is almost independent of the energization, however, a high energization gives a somewhat shorter bounce time. The bounce time is dependent on the current to be switched; above about 100 mA the bounce time is almost zero.

Contact resistance

The contact resistance is dependent on the wire diameter, energization and contact layer. The published contact resistance is measured with an open contact voltage of 20 mV and a current through the closed contacts of 10 mA, using the 4-point method (Kelvin method).

Breakdown voltage

The breakdown voltage depends on the gap between the contact blades, gas pressure, material of the contact layer and the availability of free electrons in the gas. The first three items are set by the design of a particular reed switch. The last one is very dependent on ambient conditions. Therefore minimum values are given in the published data.

Insulation resistance

The insulation resistance is dependent on the condition of the inside of the glass envelope and on the environment, e.g. relative humidity, conducting layers on the outside of the glass envelope.

Life expectancy

The life of a dry reed switch is influenced by the contact layer, the wire diameter, the load, the load circuit parameters and the applied magnetic field. The contact layer and the wire diameter are determined by the manufacturer. Load, load circuit parameters and magnetic field are determined by the user. The load should be within the maximum published values. The load circuit parameters, e.g. wiring capacitance and inductance, should be kept as low as possible and the applied magnetic field must be slightly stronger than necessary for obtaining the maximum most-operate value.

APPLICATION NOTES

Cutting and bending

Ensure that the glass-to-metal seals are not stressed while cutting and bending the leads. Shocks should be avoided. Cutting and bending the leads increases the must-operate value and the must-release value.

Coils

Most of the electrical characteristics are measured using a standard coil. Using another coil may change these characteristics. Also the measuring method e.g. speed, detection, and the position of the coil with respect to the earth's magnetic field may affect the characteristics.

Calculating the magnetic field for a dry reed switch in a coil

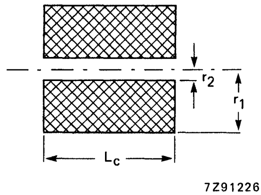


Fig. 4.

The magnetic field at any point x on the central axis of a coil (see Fig. 4) can be calculated by means of:

$$H_x = \frac{N I_c}{2L_c(r_1 - r_2)} \left[(x + L_c) \ \ln \frac{\sqrt{r_1^2 + (x + L_c)^2} + r_1}{\sqrt{r_2^2 + (x + L_c)^2} + r_2} - x \ \ln \frac{\sqrt{r_1^2 + x^2} + r_1}{\sqrt{r_2^2 + x^2} + r_2} \right]$$

The number of windings in the coil is calculated from:

$$N = \frac{4 f_{sp} L_c (r_1 - r_2)}{\pi d^2_{Cu}}$$

Coil resistance is calculated by means of:

$$R_c = \frac{16 f_{sp} \rho L_c (r_1^2 - r_2^2)}{\pi d^4_{Cu}}$$

r_1	outer radius of a coil (mm)
r_2	inner radius of a coil (mm)
L_c	length of a coil (mm)
d_{Cu}	wire diameter of the copper wire used in a coil (μm)
f_{sp}	space factor of a coil
N	number of turns in a coil
R_c	coil resistance (Ω)
I_c	coil current (mA)
ρ	specific resistance of copper (Ωcm)
H_x	magnetic field (At.m^{-1})

Contact protection

The published life-expectancy data are based on resistive loads unless stated otherwise. For inductive, capacitive or lamp loads, inrush current or reverse voltage can affect the life of a reed switch. For a maximum life-time, contact protection is advised.

Inductive loads

To reduce the high reverse voltage produced when a reed switch opens, the following contact protection can be applied.
a) D.C. voltage: a diode parallel to the load or the reed switch, see Fig. 2.

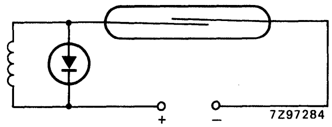


Fig. 2.

b) A.C. voltage: an RC-network parallel to the load or the reed switch, see Fig. 3.

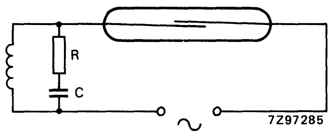


Fig. 3.

$$C = \frac{I^2}{10} \qquad R = \frac{V}{10(1 + 50/V)}$$

C in μF and I in A
R in Ω and V in V

Capacitive loads

To reduce the high inrush current when a reed switch closes, connect a resistor in series with the capacitance or the reed switch.

Lamp loads

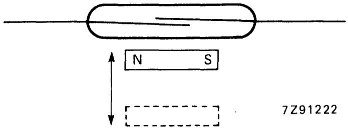
To reduce the high inrush current when a cold incandescent lamp has to be switched by a reed switch (closing only), connect a resistor in series with the lamp or a resistor parallel to the reed switch.

Magnets

Permanent magnets are often used to operate a dry reed switch. There are several methods, e.g.:

- perpendicular movement

closes the switch once per movement



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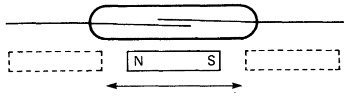
- parallel movement

closes the switch three times per movement



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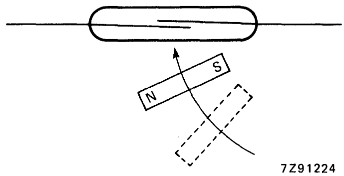
- rotational movement I

closes the switch once per movement



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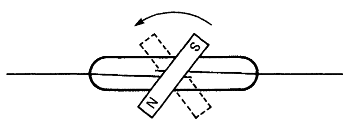
- rotational movement II

closes the switch twice per movement



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Shielding

To shield a dry reed switch from a magnetic field, use can be made of ferromagnetic materials which shunt the magnetic field.

General

Should your specific application require further consultation, please contact us.

QUALITY

Adherence to detail during manufacture and a rigorous quality control procedure ensure our reed switches meet the toughest specifications in the world. It takes many steps to manufacture a reed that meets with our approval, and our quality department is involved at every one. There are no short-cuts when you are building quality into a product.

Samples of finished reed switches are subjected to extensive electrical and mechanical testing according to IEC Publication 68. Testing includes measurement of contact resistance and bounce, sensitivity, breakdown voltage, hermeticity, lead bending, and a variety of vibration, impact and temperature tests, and life testing of samples from every batch.

Extremely low contact resistance, insulation resistance $> 10^{12}\ \Omega$ and long life make our reed switches ideal for use in Automatic Test Equipment such as circuit board testers. Price, ruggedness and ease of operation make our reed switches ideal for use in the car industry, e.g. in level detectors for screen washer and hydraulic fluid reservoirs, and in lamp-failure indicators.

DRY REED SWITCHES

Micro 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 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. 200 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)	typ. 60 mΩ

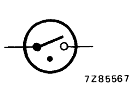
The RI-22 series comprises the types **RI-22AAA, RI-22AA, RI-22/3A, RI-22/3B** and **RI-22/3C** with the following basic magnetic characteristics, measured with the Standard coil.

		RI-22AAA	RI-22AA	RI-22/3A	RI-22/3B	RI-22/3C
Operate range	(At)	8 to 16	14 to 23	18 to 32	28 to 52	46 to 70
Release range	(At)	4 to 14	7,5 to 17,5	8 to 22	12 to 29	16 to 32

MECHANICAL DATA

Contact arrangement	normally open
Lead finish	tinned
Resonant frequency of single reed	approx. 5600 Hz
Net mass	approx. 0,21 g
Mounting position	any

Dimensions in mm



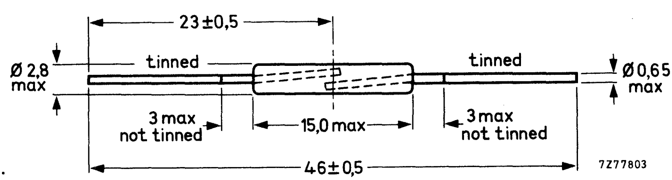


Fig. 1.

Mechanical strength

The robustness of terminations is tested according to IEC publication 68-2-21, test Ua (load 10 N).

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. The switches can also be supplied with cut and bent leads to customer specification.

Resistance to soldering heat

The switch can withstand IEC test 68-2-20 Tb, method 1B: solder bath at 350 ± 10 °C during 3,5 ± 0,5 s.

Solderability

Solderability is tested according to IEC 68-2-20 test Ta, method 3: solder globule 235 °C, ageing 1b: 4 h steam.

Weldability

The leads are weldable.

The RI-22 series comprises five types: RI-22AAA, RI-22AA, RI-22/3A, RI-22/3B and RI-22/3C.

CHARACTERISTICS RI-22AAA

		coil I	coil II	
Not-operate				
Breakdown voltage		see relevant graph		
Insulation resistance, intial	min.	10^6		MΩ (note 1)
Capacitance, without test coil	max.	0,35		pF
Must-not-operate value	max.	8	9	At
Operate				
Must-operate value	max.	16	15	At
Operate time, including bounce	typ.	0,10 (note 2)		ms
	max.	0,25 (note 2)		ms
Bounce time	typ.	0,05 (note 2)		ms
	max.	0,15 (note 2)		ms
Contact resistance, initial	typ.	60 (note 3)		mΩ
	max.	90 (note 3)		mΩ
Not-release				
Must-not-release value	min.	14	12	At
Release				
Must-release value	max.	4	4	At
Release time	max.	30 (note 2)		μs

Notes

1. Measured at a relative humidity of max. 45%.
2. Measured with 100 At.
3. Measured with 25 At, distance between measuring points: 41 mm. Wire resistance typ. 1,0 mΩ/mm.
4. Measured with 30 At, distance between measuring points: 41 mm. Wire resistance typ. 1,0 mΩ/mm.
5. Measured with 40 At, distance between measuring points: 41 mm.Wire resistance typ. 1,0 mΩ/mm.

CHARACTERISTICS RI-22AA

		coil I	coil II	
Not-operate				
Breakdown voltage		see relevant graph		
Insulation resistance, initial	min.	10^6		MΩ (note 1)
Capacitance, without test coil	max.	0,30		pF
Must-not-operate value	max.	14	13,5	At
Operate				
Must-operate value	max.	23	20	At
Operate time, including bounce	typ.	0,25 (note 2)		ms
	max.	0,5 (note 2)		ms
Bounce time	typ.	0,15 (note 2)		ms
	max.	0,3 (note 2)		ms
Contact resistance, initial	typ.	60 (note 3)		mΩ
	max.	90 (note 3)		mΩ
Not-release				
Must-not-release value	min.	17,5	15	At
Release				
Must-release value	max.	7,5	7	At
Release time	max.	30 (note 2)		μs

CHARACTERISTICS RI-22/3A

		coil I	coil II	
Not-operate				
Breakdown voltage		see relevant graph		
Insulation resistance, initial	min.	10^6		MΩ (note 1)
Capacitance, without test coil	max.	0,25		pF
Must-not-operate value	max.	18	16	At
Operate				
Must-operate value	max.	32	27	At
Operate time, including bounce	typ.	0,25 (note 2)		ms
	max.	0,5 (note 2)		ms
Bounce time	typ.	0,15 (note 2)		ms
	max.	0,3 (note 2)		ms
Contact resistance, initial	typ.	60 (note 4)		mΩ
	max.	90 (note 4)		mΩ
Not-release				
Must-not-release value	min.	22	19	At
Release				
Must-release value	max.	8	7	At
Release time	max.	30 (note 2)		μs

CHARACTERISTICS RI-22/3B

		coil I	coil II	
Not operate				
Breakdown voltage		see relevant graph		
Insulation resistance	min.	10^6		MΩ (note 1)
Capacitance, without test coil	max.	0,25		pF
Must-not-operate value	max.	28	23	At
Operate				
Must-operate value	max.	52	42	At
Operate time, including bounce	typ.	0,25 (note 2)		ms
	max.	0,5 (note 2)		ms
Bounce time	typ.	0,15 (note 2)		ms
	max.	0,3 (note 2)		ms
Contact resistance, initial	typ.	60 (note 5)		mΩ
	max.	90 (note 5)		mΩ
Not-release				
Must-not-release value	min.	29	24	At
Release				
Must-release value	max.	12	10	At
Release time	max.	30 (note 2)		μs

CHARACTERISTICS RI-22/3C

		coil I	coil II	
Not-operate				
Breakdown voltage		see relevant graph		
Insulation resistance, initial	min.	10^6		MΩ (note 1)
Capacitance, without test coil	max.	0,25		pF
Must-not-operate value	max.	46	37	At
Operate				
Must-operate value	max.	70	55	At
Operate time, including bounce	typ.	0,25 (note 2)		ms
	max.	0,5 (note 2)		ms
Bounce time	typ.	0,15 (note 2)		ms
	max.	0,3 (note 2)		ms
Contact resistance, initial	typ.	60 (note 5)		mΩ
	max.	90 (note 5)		mΩ
Not-release				
Must-not-release value	min.	32	27	At
Release				
Must-release value	max.	16	13	At
Release time	max.	30 (note 2)		μs

LIMITING VALUES

Absolute maximum rating system

Switched power	max.	10 W
Switched voltage		
d.c.	max.	200 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.	2 A
Temperature, storage and operating	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 either 1 Ω for no-load conditions or 2 Ω for loaded conditions, measured 5 ms after energizing coil; or

(b) the release time exceeds 5 ms after de-energizing the coil (latching or contact sticking).

No-load conditions (operating frequency 50 Hz)

Life expectancy min. 10^8 operatings with a failure rate of less than 10^{-9} 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

Shock

The switches are tested according to IEC Publication 68-2-27, test Ea (peak acceleration 150g, half sine-wave). Such a shock will not cause an open switch (no magnetic field present) to close, nor a switch kept closed by an 80 At coil to open.

Vibration

The switches are tested according to IEC Publication 68-2-6, test Fc (acceleration 10g, below cross-over frequency 57 to 62 Hz, amplitude 0,75 mm, frequency range 10 to 2000 Hz, duration 90 min.). Such a vibration will not cause an open switch (no magnetic field present) to close, nor a switch kept close 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: 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.

* Excursions up to 150 °C may be permissible. Consult us.

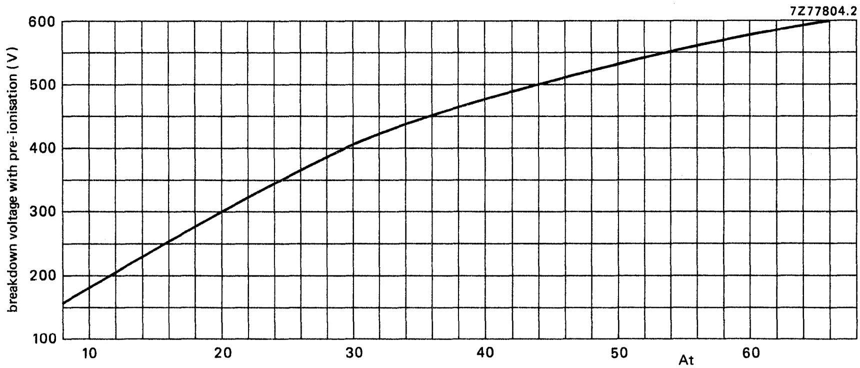


Fig. 2 Breakdown voltage as a function of ampere-turns.

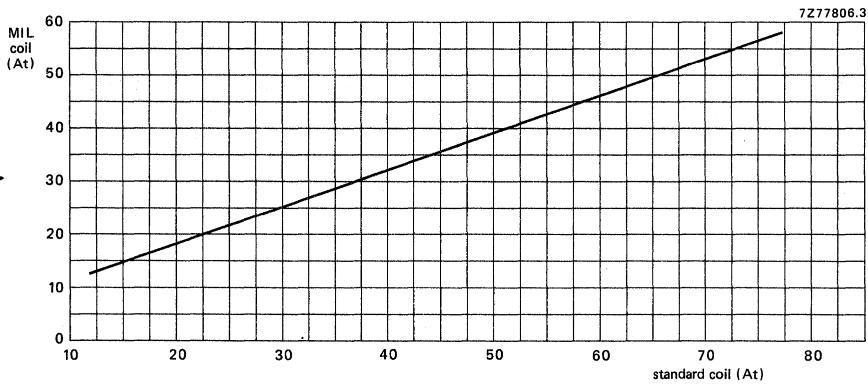


Fig. 3 Correlation of At operate in standard coil and MIL coil.

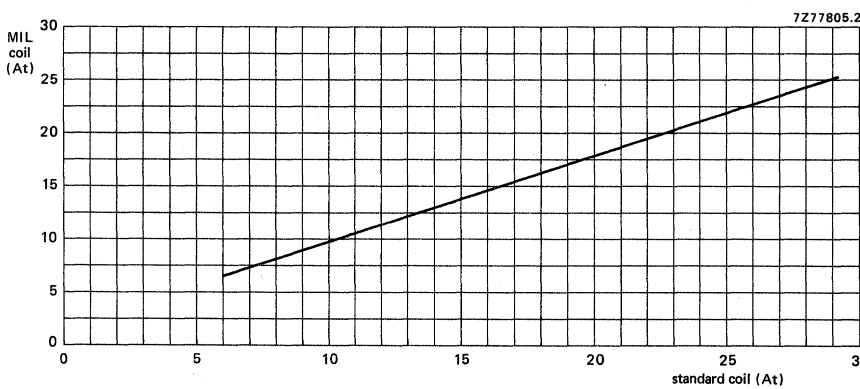


Fig. 4 Correlation of At release in standard coil and MIL coil.

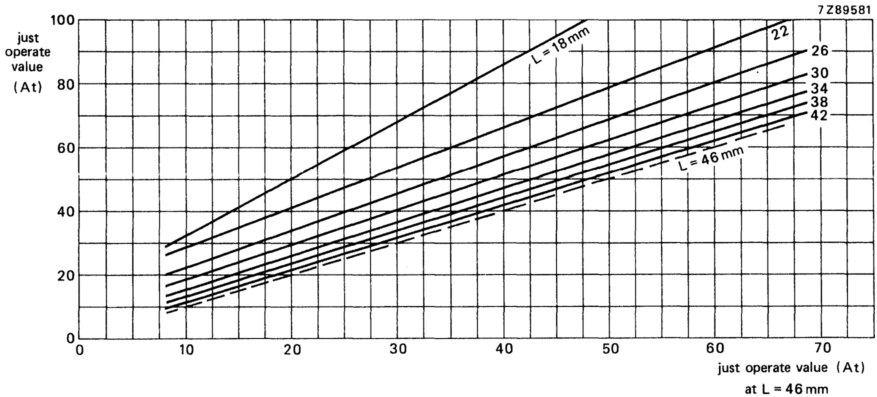


Fig. 5 Just operate values at various overall lengths compared with standard length of 46 mm.

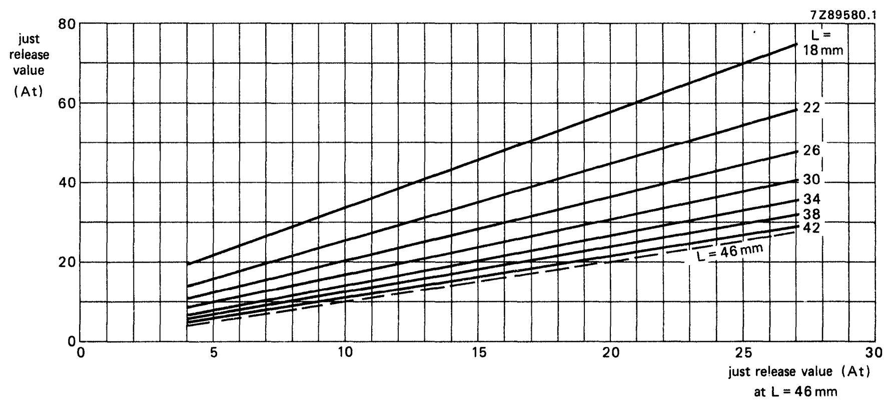


Fig. 6 Just release values at various overall lengths compared with standard length of 46 mm.

DRY REED SWITCHES

Micro 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 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. 200 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)	typ. 70 mΩ

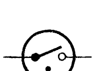
The RI-23 series comprises the types RI-23AAA, RI-23AA, RI-23/3A, RI-23/3B and RI-23/3C with the following basic magnetic characteristics, measured with the Standard coil.

	RI-23AAA	RI-23AA	RI-23/3A	RI-23/3B	RI-23/3C
Operate range (At)	8 to 16	14 to 23	18 to 32	28 to 52	46 to 70
Release range (At)	4 to 14	7,5 to 17,5	8 to 22	12 to 29	16 to 32

MECHANICAL DATA

Contact arrangement	normally open
Lead finish	tinned
Resonant frequency of single reed	approx. 5500 Hz
Net mass	approx. 0,19 g
Mounting position	any

Dimensions in mm



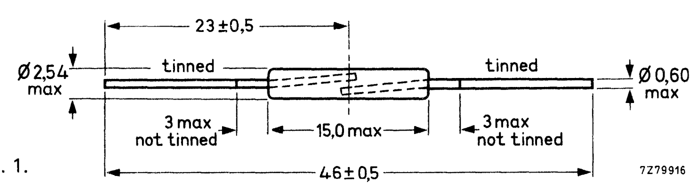


Fig. 1.

Mechanical strength

The robustness of terminations is tested according to IEC publication 68-2-21, test Ua (load 10 N).

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. The switches can also be supplied with cut and bent leads to customer specification.

Resistance to soldering heat

The switch can withstand IEC test 68-2-20 Tb, method 1B: solder bath at 350 ± 10 °C during 3,5 ± 0,5 s.

Solderability

Solderability is tested according to IEC 68-2-20 test Ta, method 3: solder globule 235 °C, ageing 1b: 4 h steam.

Weldability

The leads are weldable.

The RI-23 series comprises four types: RI-23AAA; RI-23AA; RI-23/3A; RI-23/3B and RI-23/3C.

CHARACTERISTICS RI-23AAA

		coil I	coil II	
Not operate				
Breakdown voltage		see relevant graph		
Insulation resistance, initial	min.	10^6		MΩ (note 1)
Capacitance, without test coil	max.	0,30		pF
Must-not-operate value	max.	8	9	At
Operate				
Must-operate value	max.	16	15	At
Operate time, including bounce	typ.	0,10 (note 2)		ms
	max.	0,25 (note 2)		ms
Bounce time	typ.	0,05 (note 2)		ms
	max.	0,15 (note 2)		ms
Contact resistance, initial	typ.	70 (note 3)		mΩ
	max.	100 (note 3)		mΩ
Not-release				
Must-not-release value	min.	14	12	At
Release				
Must-release value	max.	4	4	At
Release time	max.	70 (note 2)		μs

Notes

1. Measured at a relative humidity of max. 45%.
2. Measured with 100 At.
3. Measured with 25 At, distance between measuring points: 41 mm. Wire resistance typ. 1,2 mΩ/mm.
4. Measured with 30 At, distance between measuring points: 41 mm. Wire resistance typ. 1,2 mΩ/mm.
5. Measured with 40 At, distance between measuring points: 41 mm. Wire resistance typ. 1,2 mΩ/mm.

CHARACTERISTICS RI-23AA

		coil I	coil II	
Not-operate				
Breakdown voltage		see relevant graph		
Insulation resistance, initial	min.	10^6		MΩ (note 1)
Capacitance, without test coil	max.	0,30		pF
Must-not-operate value	max.	14	13,5	At
Operate				
Must-operate value	max.	23	20	At
Operate time, including bounce	typ.	0,25 (note 2)		ms
	max.	0,5 (note 2)		ms
Bounce time	typ.	0,15 (note 2)		ms
	max.	0,3 (note 2)		ms
Contact resistance, initial	typ.	70 (note 3)		mΩ
	max.	100 (note 3)		mΩ
Not-release				
Must-not-release value	min.	17,5	15	At
Release				
Must-release value	max.	7,5	7	At
Release time	max.	30 (note 2)		μs

CHARACTERISTICS RI-23/3A

		coil I	coil II	
Not-operate				
Breakdown voltage		see relevant graph		
Insulation resistance, initial	min.	10^6		MΩ (note 1)
Capacitance, without test coil	max.	0,25		pF
Must-not-operate value	max.	18	16	At
Operate				
Must-operate value	max.	32	27	At
Operate time, including bounce	typ.	0,25 (note 2)		ms
	max.	0,5 (note 2)		ms
Bounce time	typ.	0,15 (note 2)		ms
	max.	0,3 (note 2)		ms
Contact resistance, initial	typ.	70 (note 4)		mΩ ←
	max.	100 (note 4)		mΩ
Not-release				
Must-not-release value	min.	22	19	At
Release				
Must-release value	max.	8	7	At ←
Release time	max.	30 (note 2)		μs

CHARACTERISTICS RI-23/3B

		coil I	coil II	
Not-operate				
Breakdown voltage		see relevant graph		
Insulation resistance	min.	10^6		MΩ (note 1)
Capacitance, without test coil	max.	0,25		pF
Must-not-operate value	max.	28	23	At
Operate				
Must-operate value	max.	52	42	At
Operate time, including bounce	typ.	0,25 (note 2)		ms
	max.	0,5 (note 2)		ms
Bounce time	typ.	0,15 (note 2)		ms
	max.	0,3 (note 2)		ms
→ Contact resistance, initial	typ.	70 (note 5)		mΩ
	max.	100 (note 5)		mΩ
Not-release				
Must-not-release value	min.	29	24	At
Release				
Must-release value	max.	12	10	At
Release time	max.	30 (note 2)		μs

CHARACTERISTICS RI-23/3C

		coil I	coil II	
Not-operate				
Breakdown voltage		see relevant graph		
Insulation resistance, initial	min.	10^6		MΩ (note 1)
Capacitance, without test coil	max.	0,25		pF
Must-not-operate value	max.	46	37	At
Operate				
Must-operate value	max.	70	55	At
Operate time, including bounce	typ.	0,25 (note 2)		ms
	max.	0,5 (note 2)		ms
Bounce time	typ.	0,15 (note 2)		ms
	max.	0,3 (note 2)		ms
→ Contact resistance, initial	typ.	70 (note 5)		mΩ
	max.	100 (note 5)		mΩ
Not-release				
Must-not-release value	min.	32	27	At
Release				
Must-release value	max.	16	13	At
Release time	max.	30 (note 2)		μs

LIMITING VALUES

Absolute maximum rating system

Switched power	max.	10 W
Switched voltage		
d.c.	max.	200 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.	2 A
Temperature, storage and operating	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 either 1 Ω for no-load conditions or 2 Ω for loaded conditions, measured 5 ms after energizing coil; or

(b) the release time exceeds 5 ms after de-energizing the coil (latching or contact sticking).

No-load conditions (operating frequency 50 Hz)

Life expectancy min. 10^8 operatings with a failure rate of less than 10^{-9} 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

Shock

The switches are tested according to IEC Publication 68-2-27, test Ea (peak acceleration 150g, half sine-wave). Such a shock will not cause an open switch (no magnetic field present) to close, nor a switch kept closed by an 80 At coil to open.

Vibration

The switches are tested according to IEC Publication 68-2-6, test Fc (acceleration 10g, below cross-over frequency 57 to 62 Hz, amplitude 0,75 mm, frequency range 10 to 2000 Hz, duration 90 min.). Such a vibration will not cause an open switch (no magnetic field present) to close, nor a switch kept close 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: 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.

* Excursions up to 150 °C may be permissible. Consult us.

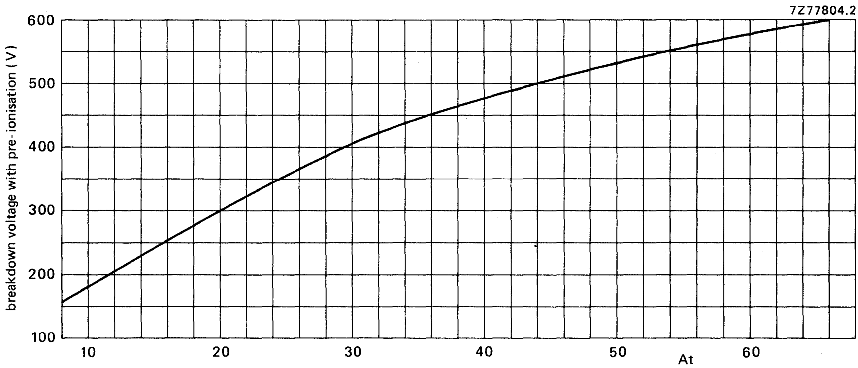


Fig. 2 Breakdown voltage as a function of ampere-turns.

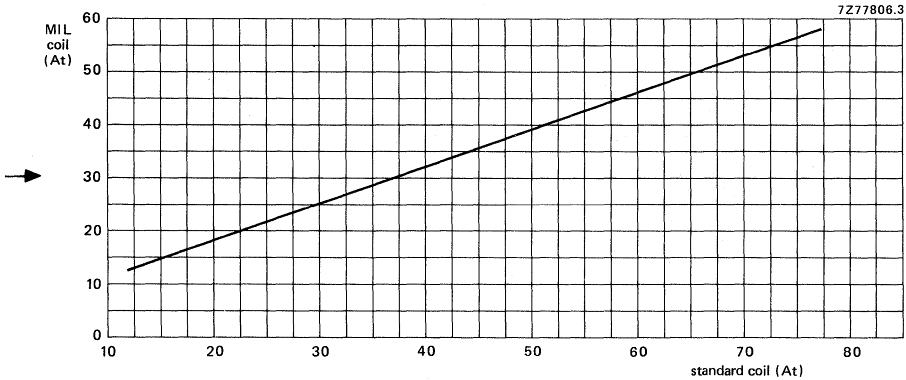


Fig. 3 Correlation of At operate in standard coil and MIL coil.

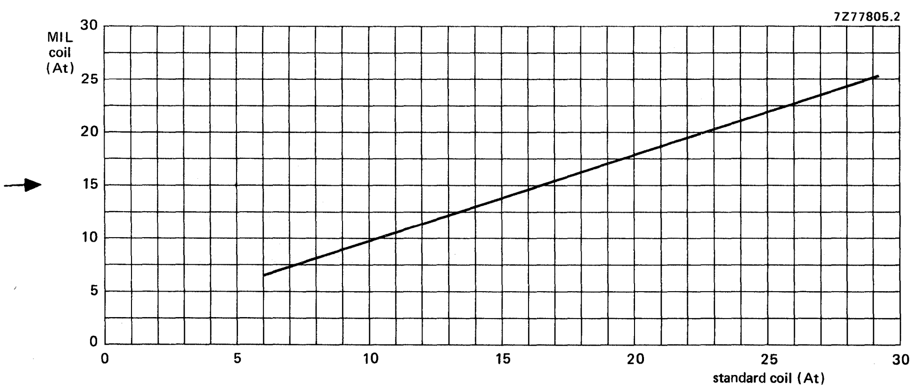


Fig. 4 Correlation of At release in standard coil and MIL coil.

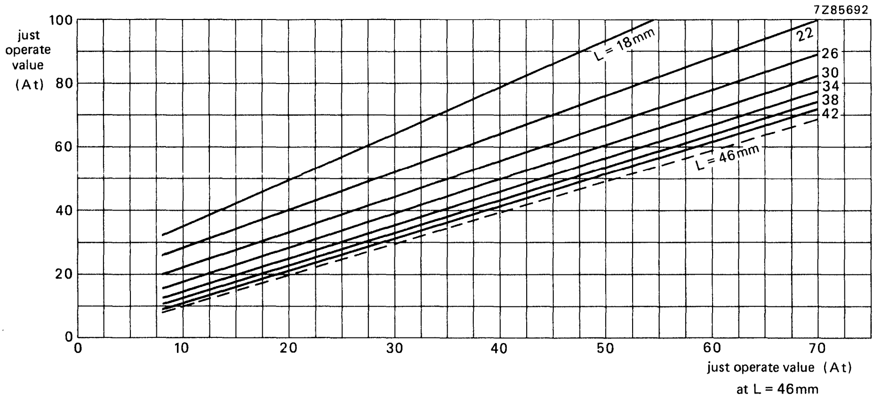


Fig. 5 Just operate values at various overall lengths, compared with standard length of 46 mm.

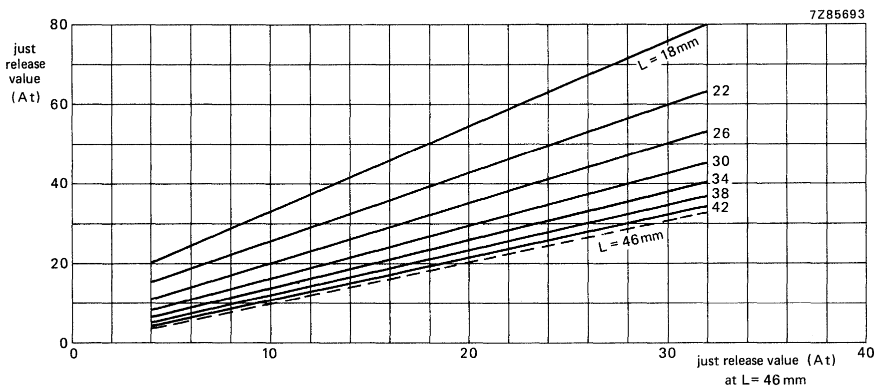


Fig. 6 Just release values at various overall lengths, compared with standard length of 46 mm.

DRY REED SWITCHES

Micro 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 device is intended for use in high inrush current applications in relays or in similar devices, in conjunction with semiconductor devices.

QUICK REFERENCE DATA

Contact		S.P.S.T. normally open
Switched power	max.	15 W
Switched voltage		
d.c.	max.	200 V
a.c. (r.m.s.)	max.	110 V
Switched current, d.c. or a.c. (r.m.s.)	max.	1000 mA
Contact resistance (initial)	typ.	70 mΩ

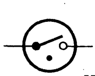
The RI-26 series comprises the types RI-26AAA, RI-26AA and RI-26A with the following basic magnetic characteristics, measured with the Standard coil.

	RI-26AAA	RI-26AA	RI-26A
Operate range (At)	8 to 16	14 to 23	18 to 32
Release range (At)	4 to 14	7,5 to 17,5	8 to 22

MECHANICAL DATA

Contact arrangement	normally open
Lead finish	tinned
Resonant frequency of single reed	approx. 5100 Hz
Net mass	approx. 0,19 g
Mounting position	any

Dimensions in mm



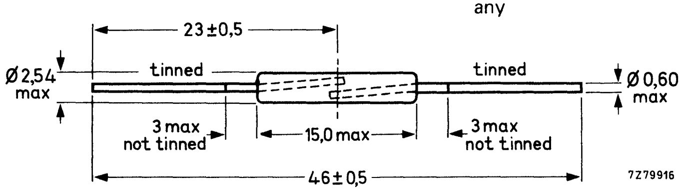


Fig. 1.

Mechanical strength

The robustness of terminations is tested according to IEC publication 68-2-21, test Ua (load 10 N).

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. The switches can also be supplied with cut and bend leads, to customer specification.

Resistance to soldering heat

The switch can withstand IEC test 68-2-20 Tb, method 1B: solder bath at 350 ± 10 °C during 3,5 ± 0,5 s.

Solderability

Solderability is tested according to IEC 68-2-20 test Ta, method 3: solder globule 235 °C, ageing 1b: 4 h steam.

Weldability

The leads are weldable.

The RI-26 series comprises three types: RI-26AAA, RI-26AA and RI-26A.

CHARACTERISTICS RI-26AAA

		coil I	coil II	
Not operate				
Breakdown voltage		see relevant graph		
Insulation resistance, initial	min.	10^6		MΩ (note 1)
Capacitance, without test coil	max.	0,30		pF
Must-not-operate value	max.	8	8	At
Operate				
Must-operate value	max.	16	14,5	At
Operate time, including bounce	typ.	0,25 (note 2)		ms
	max.	0,50 (note 2)		ms
Bounce time	typ.	0,05 (note 2)		ms
	max.	0,15 (note 2)		ms
Contact resistance, initial	typ.	70 (note 3)		mΩ
	max.	100 (note 3)		mΩ
Not-release				
Must-not-release value	min.	14	12,5	At
Release				
Must-release value	max.	4	4,5	At
Release time	max.	70 (note 2)		μs

Notes
1. Measured at a relative humidity of max. 45%.
2. Measured with 20 At.
3. Measured with 25 At, distance between measuring points: 41 mm. Wire resistance typ. 1,2 mΩ/mm.
4. Measured with 30 At, distance between measuring points: 41 mm. Wire resistance typ. 1,2 mΩ/mm.
5. Measured with 29 At.
6. Measured with 40 At.

CHARACTERISTICS RI-26AA

		coil I	coil II	
Not-operate				
Breakdown voltage		see relevant graph		
Insulation resistance, initial	min.	10^6		MΩ (note 1)
Capacitance, without test coil	max.	0,30		pF
Must-not operate value	max.	14	13	At
Operate				
Must-operate value	max.	23	20	At
Operate time, including bounce	typ.	0,25 (note 5)		ms
	max.	0,5 (note 5)		ms
Bounce time	typ.	0,05 (note 5)		ms
	max.	0,15 (note 5)		ms
Contact resistance, initial	typ.	70 (note 3)		mΩ
	max.	100 (note 3)		mΩ
Not-release				
Must-not-release value	min.	17,5	15,5	At
Release				
Must-release value	max.	7,5	7,5	At
Release time	max.	30 (note 5)		μs

CHARACTERISTICS RI-26A

		coil I	coil II	
Not-operate				
Breakdown voltage		see relevant graph		
Insulation resistance, initial	min.	10^6		MΩ (note 1)
Capacitance, without test coil	max.	0,25		pF
Must-not operate value	max.	18	16	At
Operate				
Must-operate value	max.	32	27	At
Operate time, including bounce	typ.	0,25 (note 6)		ms
	max.	0,5 (note 6)		ms
Bounce time	typ.	0,05 (note 6)		ms
	max.	0,15 (note 6)		ms
Contact resistance, initial	typ.	70 (note 4)		mΩ
	max.	100 (note 4)		mΩ
Not-release				
Must-not-release value	min.	22	19	At
Release				
Must-release value	max.	8	7,5	At
Release time	max.	30 (note 6)		μs

LIMITING VALUES

Absolute maximum rating system

Switched power	max.	15 W
Switched voltage		
d.c.	max.	200 V
a.c. (r.m.s.)	max.	110 V
Switched current, d.c. or a.c. (r.m.s.)	max.	1000 mA
Current through closed contacts, d.c. or a.c. (r.m.s.)	max.	1,5 A
Temperature, storage and operating	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 either 1 Ω measured 5 ms after enegizing coil; or
(b) the release time exceeds 5 ms after de-energizing the coil (latching or contact sticking).

No-load conditions (operating frequency 50 Hz)

Life expectancy min. 10^8 operatings with a failure rate of less than 10^{-9} with a confidence level of 90%. After each operation (a) and (b) are tested.

Loaded conditions (capacitive load: 100 V; 0,8 A_p – 0,1 mA; operating frequency 30 Hz

Life expectancy RI-26AAA: min. 10^6; RI-26AA: min. $2x10^6$ and RI-26A: $5x10^6$ operations. 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

Shock

The switches are tested according to IEC Publication 68-2-27, test Ea (peak acceleration 150g, half sine-wave). Such a shock will not cause an open switch (no magnetic field present) to close, nor a switch kept closed by an 80 At coil to open.

Vibration

The switches are tested according to IEC Publication 68-2-6, test Fc (acceleration 10g, below cross-over frequency 57 to 62 Hz, amplitude 0,75 mm, frequency range 10 to 2000 Hz, duration 90 min.). Such a vibration will not cause an open switch (no magnetic field present) to close, nor a switch kept close 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: 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.

* Excursions up to 150 °C may be permissible. Consult us.

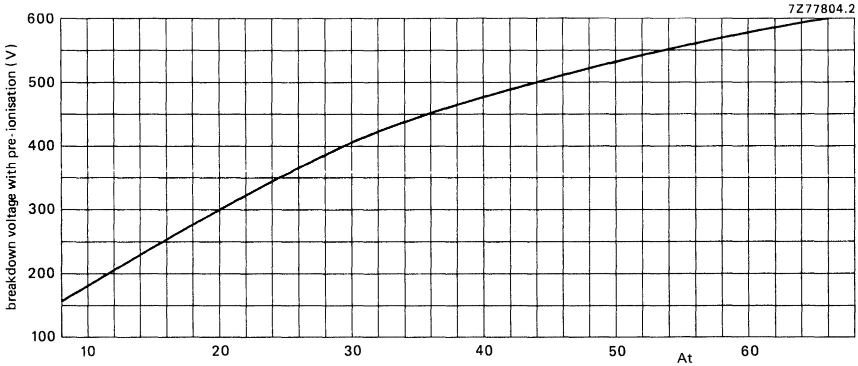


Fig. 2 Minimum breakdown voltage as a function of ampere-turns.

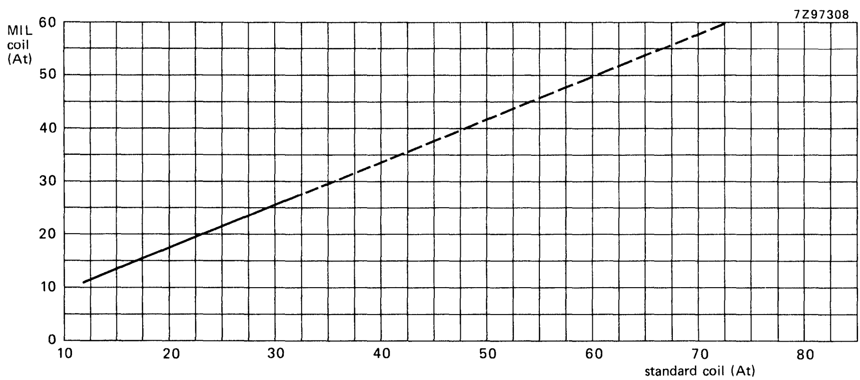


Fig. 3 Correlation of At operate in standard coil and MIL coil.

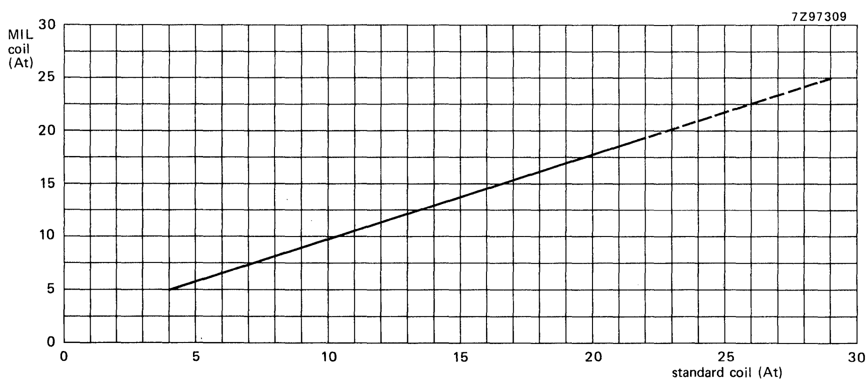


Fig 4 Correlation of At release in standard coil and MIL coil.

DEVELOPMENT DATA

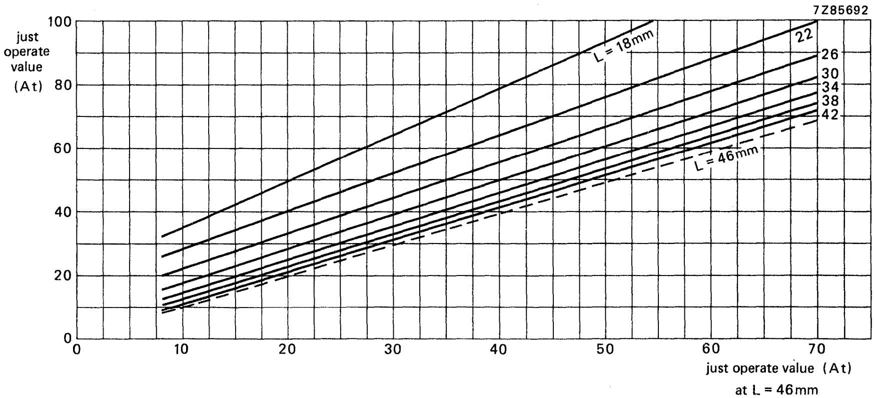


Fig. 5 Just operate values at various overall lengths, compared with standard length of 46 mm.

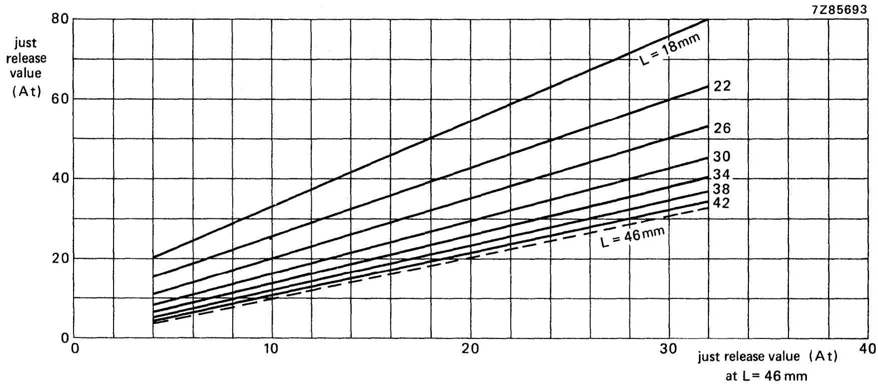


Fig. 6 Just release values at various overall lengths, compared with standard length of 46 mm.

DRY REED SWITCHES

Pico 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 or in similar devices.

QUICK REFERENCE DATA

Contact		S.P.S.T. normally open
Switched power	max.	10 W
Switched voltage		
d.c.	max.	200 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)	typ.	90 mΩ

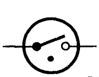
The RI-27 series comprises the types RI-27AA and RI-27A with the following basic magnetic characteristics, measured with the Standard coil.

		RI-27AA	RI-27A
Operate range	(At)	16 to 25	20 to 34
Release range	(At)	5 to 18	7 to 19,5

MECHANICAL DATA

Contact arrangement	normally open
Lead finish	tinned
Resonant frequency of single reed	approx. 6700 Hz
Net mass	approx. 0,1 g
Mounting position	any

Dimensions in mm



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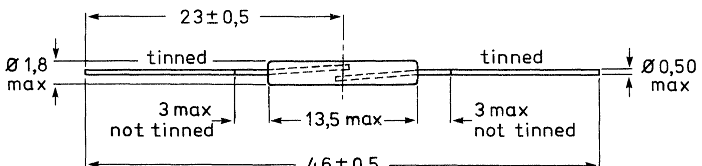


Fig. 1.

Mechanical strength

The robustness of terminations is tested according to IEC publication 68-2-21, test Ua (load 10 N).

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. The switches can also be supplied with leads cut and bent to customer specification.

→ Resistance to soldering heat

The switch can withstand IEC test 68-2-20 Tb, method 1B: solder bath at 350 ± 10 °C during 3,5 ± 0,5 s.

→ Solderability

Solderability is tested according to IEC 68-2-20 test Ta, method 3: solder globule 235 °C, ageing 1b: 4 h steam.

Weldability

The leads are weldable.

The RI-27 series comprises two types: RI-27AA and RI-27A.

CHARACTERISTICS RI-27AA

		coil I	coil II	
Not operate				
Breakdown voltage		see relevant graph		
Insulation resistance, initial	min.	10^6		MΩ (note 1)
→ Capacitance, without test coil	max.	0,30		pF
Must-not-operate value	max.	16	13,5	At
Operate				
Must-operate value	max.	25	21	At
Operate time, including bounce	typ.	0,25 (note 2)		ms
	max.	0,5 (note 2)		ms
Bounce time	typ.	0,05 (note 2)		ms
	max.	0,15 (note 2)		ms
Contact resistance, initial	typ.	90 (note 3)		mΩ
	max.	115 (note 3)		mΩ
Not-release				
→ Must-not-release value	min.	18	15	At
Release				
→ Must-release value	max.	5	4	At
Release time	max.	30 (note 2)		μs

→ Notes

1. Measured at a relative humidity of max. 45%.
2. Measured with 29 At.
3. Measured with 25 At, distance between measuring points: 41 mm. Wire resistance typ. 1,8 mΩ/mm.
4. Measured with 40 At.

CHARACTERISTICS RI-27A

Not-operate				
Breakdown voltage		see relevant graph		
Insulation resistance, initial	min.	10^6		MΩ (note 1)
Capacitance, without test coil	max.	0,25		pF
		coil I	coil II	
Must-not operate value	max.	20	16	At
Operate				
Must-operate value	max.	34	27	At
Operate time, including bounce	typ. max.	0,25 (note 4) 0,5 (note 4)		ms ms
Bounce time	typ. max.	0,05 (note 4) 0,15 (note 4)		ms ms
Contact resistance, initial	typ. max.	90 (note 3) 115 (note 3)		mΩ mΩ
Not release				
Must-not-release value	min.	19,5	16	At
Release				
Must-release value	max.	7	6	At
Release time	max.	30 (note 2)		μs

LIMITING VALUES

Absolute maximum rating system

Switched power	max.	10	W
Switched voltage			
d.c.	max.	200	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.	1,5	A
Temperature, storage and operating	max. min.	125 −55	°C* °C

* Excursions up to 150 °C may be permissible. Consult us.

Notes: see previous page.

LIFE EXPECTANCY AND RELIABILITY

The life expectancy data mentioned below are given at a coil energization of 1,25 x the published must-operate value for each group. Coil energizations above 1,25 x will result in better life performance.

No-load conditions (operating frequency 100 Hz)

Life expectancy min. 2.10^8 operations with a failure rate of less than 10^{-9} with a confidence level of 90%.
End of life criteria: contact resistance $>$ 1 Ω after 2 ms
release time $>$ 2 ms

Loaded conditions

- resistive load: 5 V, 100 mA; operating frequency 125 Hz.

Life expectancy min. 5.10^7 operations with a failure rate of less than $0{,}5.10^{-8}$ with a confidence level of 90%.
End of life criteria: contact resistance $>$ 1 Ω after 2,5 ms
release time $>$ 2,5 ms

- resistive load: 16 V, 10 mA; operating frequency 125 Hz.

Life expectancy min. 2.10^6 operations with a failure rate of less than 10^{-7} with a confidence level of 90%.
End of life criteria: contact resistance $>$ 2 Ω after 2,5 ms
release time $>$ 2,5 ms

- resistive load: 12 V, 4 mA; operating frequency 170 Hz.

Life expectancy average 45.10^6 operations (tested up to 50.10^6 operations).
End of life criteria: contact resistance $>$ 2 Ω after 4 ms
release time $>$ 0,7 ms

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

SHOCK AND VIBRATION

Not yet fixed.

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: 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.

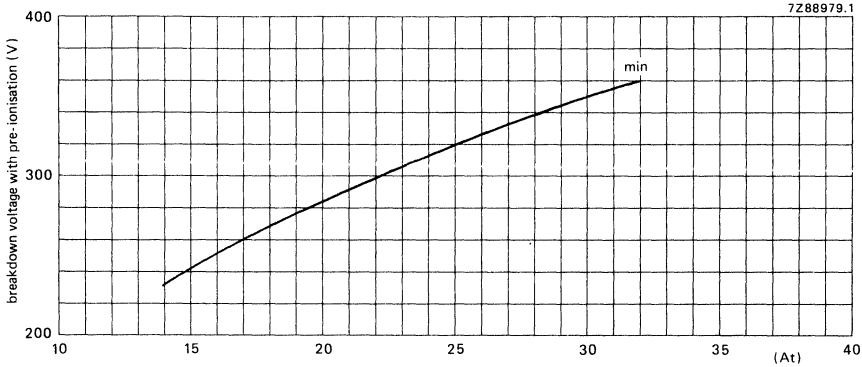


Fig. 2 Breakdown voltage as a function of ampere-turns.

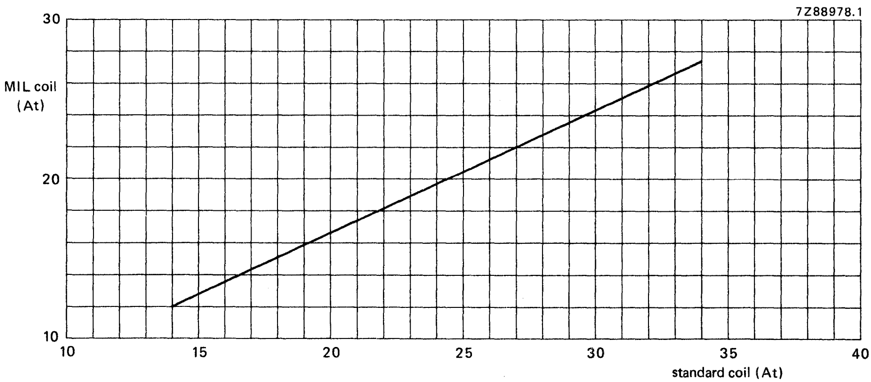


Fig. 3 Correlation of At operate in standard coil and MIL coil.

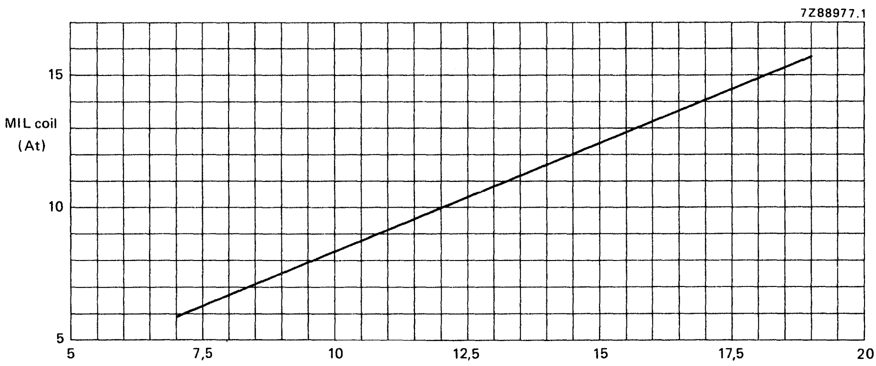


Fig. 4 Correlation of At release in standard coil and MIL coil.

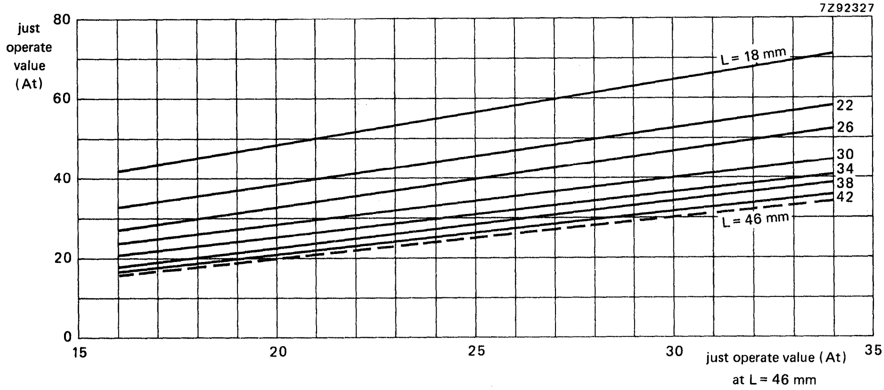


Fig. 5 Just operate values at various lengths, compared with standard length of 46 mm.

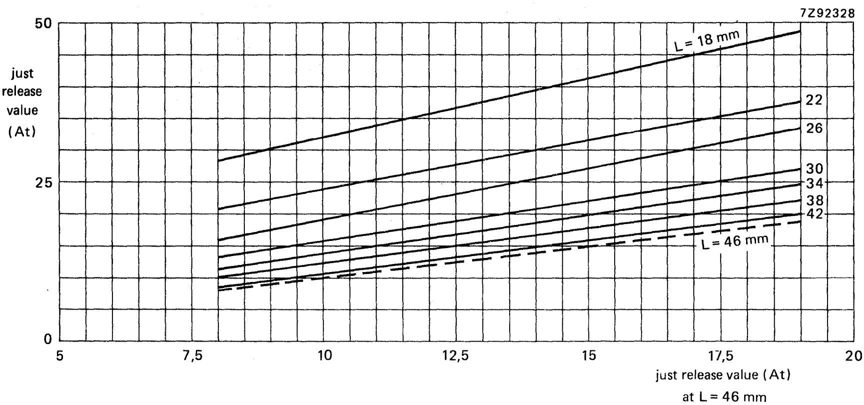


Fig. 6 Just release values at various lengths, compared with standard length of 46 mm.

DRY REED SWITCHES

Pico 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 or in similar devices.

QUICK REFERENCE DATA

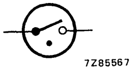
Contact	S.P.S.T. normally open	
Switched power	max.	10 W
Switched voltage		
d.c.	max.	180 V
a.c. (r.m.s.)	max.	110 V
Switched current, d.c. or a.c. (r.m.s.)	max.	500 mA
Contact resistance (initial)	typ.	90 mΩ

Operate range	(At)	10 to 19
Release range	(At)	4 to 16

MECHANICAL DATA

Contact arrangement	normally open
Lead finish	tinned
Resonant frequency of single reed	approx. 6700 Hz
Net mass	approx. 0,1 g
Mounting position	any

Dimensions in mm



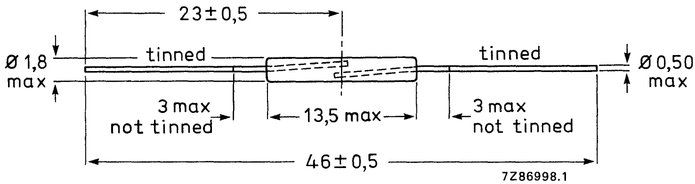


Fig. 1.

Mechanical strength

The robustness of terminations is tested according to IEC publication 68-2-21, test Ua (load 10 N).

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. The switches can also be supplied with leads cut and bent to customer specification.

Resistance to soldering heat

The switch can withstand IEC test 68-2-20 Tb, method 1B: solder bath at 350 ± 10 °C during 3,5 ± 0,5 s.

Solderability

Solderability is tested according to IEC 68-2-20 test Ta, method 3: solder globule 235 °C, ageing 1b: 4 h steam.

Weldability

The leads are weldable.

CHARACTERISTICS RI-27AAA

		coil I	coil II	
Not operate				
Breakdown voltage		see relevant graph		
Insulation resistance, initial	min.	10^6		MΩ (note 1)
Capacitance, without test coil	max.,	0,30		
Must-not-operate value	max.	10	8,5	At
Operate				
Must-operate value	max.	19	16	At
Operating time, including bounce	typ.	0,25 (note 2)		ms
	max.	0,5 (note 2)		ms
Bounce time	typ.	0,05 (note 2)		ms
	max.	0,15 (note 2)		ms
Contact resistance, initial	typ.	90 (note 3)		mΩ
	max.	115 (note 3)		mΩ
Not-release				
Must-not-release value	min.	16	13,5	At
Release				
Must-release value	max.	4	3	At
Release time	max.	30 (note 2)		µs

→ Notes
1. Measured at a relative humidity of max. 45%.
2. Measured with 29 At.
3. Measured with 20 At, distance between measuring points: 41 mm. Wire resistance typ. 1,8 mΩ/mm.

LIMITING VALUES

Absolute maximum rating system

Switched power	max.	10 W
Switched voltage		
d.c.	max.	180 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.	1,5 A
Temperature, storage and operating	max.	125 °C*
	min.	−55 °C

LIFE EXPECTANCY AND RELIABILITY

The life expectancy data mentioned below are given at a coil energization of 1,25 x the published must-operate value for each group. Coil energizations above 1,25 x will result in better life performance.

No-load conditions (operating frequecny 100 Hz)

Life expectancy min. 2.10^8 operations with a failure rate of less than 10^{-9} with a confidence level of 90%.
End of life criteria: contact resistance > 1 Ω after 2 ms
release time > 2 ms

DEVELOPMENT DATA

Loaded conditions

- resistive load: 5 V, 100 mA; operating frequency 125 Hz.

Life expectancy min. 2.10^7 operations with a failure rate of less than 10^{-8} with a confidence level of 90%.
End of life criteria: contact resistance > 1 Ω after 2,5 ms
release time > 2,5 ms

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

SHOCK AND VIBRATION

Not yet fixed.

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: 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.

* Excursions up to 150 °C may be permissible. Consult us.

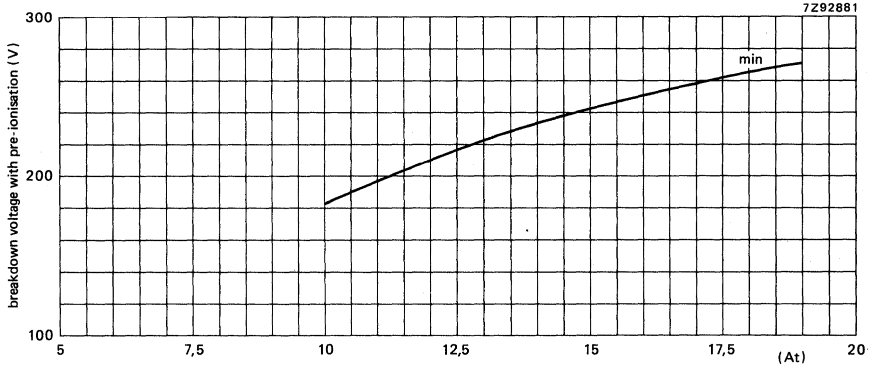


Fig. 2 Breakdown voltage as a function of ampere-turns.

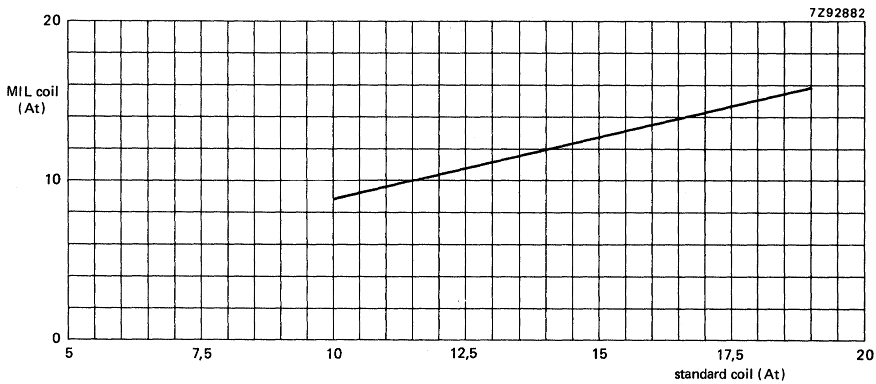


Fig. 3 Correlation of At operate in standard coil and MIL coil.

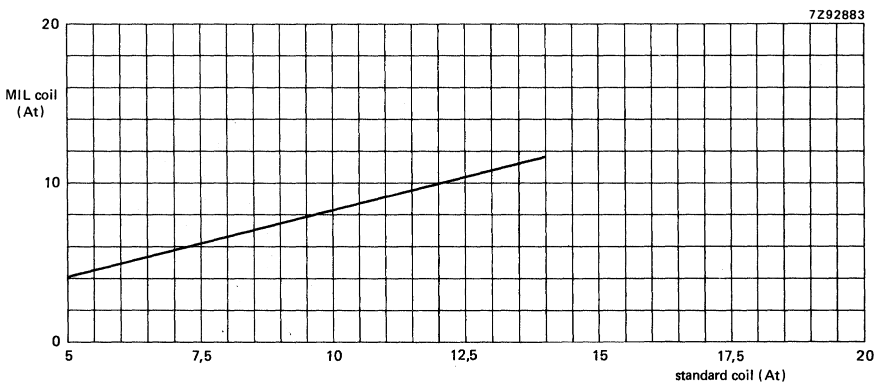


Fig. 4 Correlation of At release in standard coil and MIL coil.

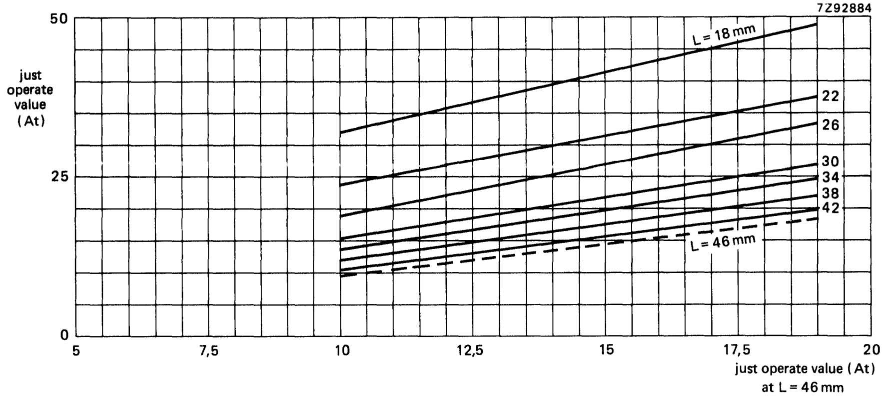


Fig. 5 Just operate values at various lengths, compared with standard length of 46 mm.

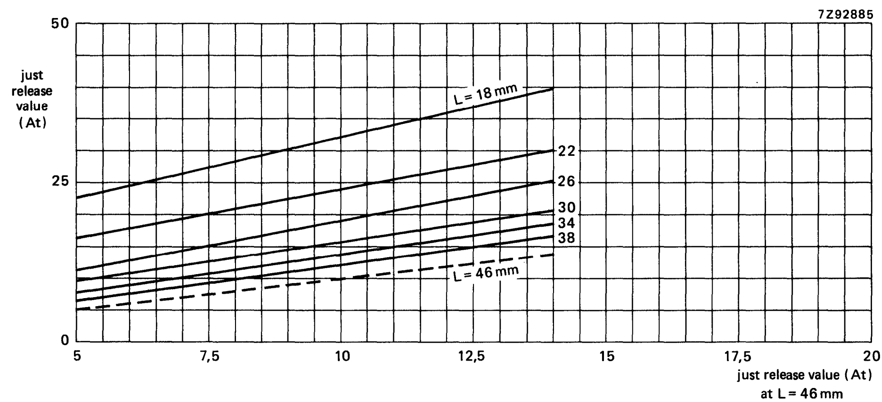


Fig. 6 Just release values at various lengths, compared with standard length of 46 mm.

DRY REED SWITCH

Micro 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 contact 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 device is intended for use in relays for switching main loads.

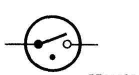
QUICK REFERENCE DATA

Contact	S.P.S.T. normally open		
Switched power	max.	40	W
Switched voltage, a.c. (r.m.s.)	max.	250	V
Switched current, resistive a.c. (r.m.s.)	max.	1	A
Contact resistance (initial)	max.	90	mΩ
Basic magnetic characteristics, measured with the Standard coil			
Operate range		30 to 65	At
Release range		10 to 25	At

MECHANICAL DATA

Contact arrangement	normally open
Lead finish	tinned
Resonant frequency of single reed	approx. 3200 Hz
Net mass	approx. 0,26 g
Mounting position	any

Dimensions in mm



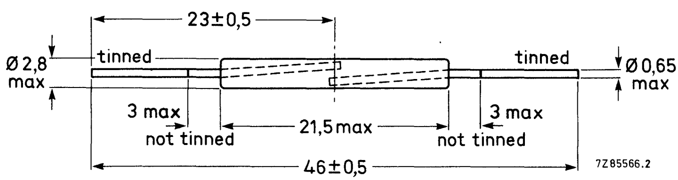


Fig. 1.

Mechanical strength

The robustness of terminations is tested according to IEC publication 68-2-21, test Ua (load 10N).

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. The switches can also be supplied with cut and bent leads to customer specification.

Resistance to soldering heat

The switch can withstand IEC test 68-2-20 Tb, method 1B: solder bath at 350 ± 10 °C during 3,5 ± 0,5 s.

Solderability

Solderability is tested according to IEC 68-2-20 test Ta, method 3: solder globule 235 °C, ageing 1b: 4 h steam.

Weldability

The leads are weldable.

CHARACTERISTICS

Not-operate

Breakdown voltage	min.	750	V
Insulation resistance, initial	min.	10^6	MΩ (note 1)
Capacitance, without test coil	max.	0,20	pF

		coil I	coil II	
Must-not-operate value	max.	30	25	At
Operate				
Must-operate value	max.	65	51	At
Operate time, including bounce	typ.	0,35 (note 2)		ms
	max.	0,5 (note 2)		ms
Bounce time	typ.	0,15 (note 2)		ms
	max.	0,3 (note 2)		ms
Contact resistance, initial	typ.	60 (note 3)		mΩ
	max.	90 (note 3)		mΩ
Not-release				
Must-not-release value	min.	25	22	At
Release				
Must-release value	max.	10	9,5	At
Release time	max.	30 (note 2)		μs

Notes

1. Measured at a relative humidity of max. 45%.
2. Measured with 80 At.
3. Measured with 40 At, distance between measuring points: 41 mm, wire resistance: typ. 1 MΩ/mm.
4. Switching higher currents is possible depending on the signature of the load.

LIMITING VALUES

Absolute maximum rating systems

Switched power	max.	40 W
Switched voltage, a.c. (r.m.s.)	max.	250 V
Switched current, resistive a.c. (r.m.s.)	max.	1 A (note 4)
Current through closed contacts	max.	3,0 A
Temperature, storage and operating	max.	125 °C
	min.	−55 °C

LIFE EXPECTANCY AND RELIABILITY

Inductive loads

A. 220 V a.c. (r.m.s.); L = 3,95 H; R = 662 Ω; operating freq. 2 Hz; min. 10^4 operations. (No sticking allowed.) With a failure rate of max. 2.10^{-5} at 90% confidence level.
B. 220 V a.c. (r.m.s.); L = 5,5 H; R = 2230 Ω; operating freq. 2 Hz; min. 10^5 operations. (No sticking allowed.) With a failure rate of max. 2.10^{-6} at 90% confidence level.
C. 220 V a.c. (r.m.s.); L = 0,28 H; R = 106 Ω; switching on only; operating freq. 0,6 Hz min. 2.10^4 operations. (No sticking allowed.) With a failure rate of max. 2.10^{-5} at 90% confidence level.

Resistive load

A. 250 V a.c. (r.m.s.); R = 1 MΩ; operating freq. 20 Hz; min. 2.10^6 operations. Contact resistance max. 100 Ω and no sticking allowed. With a failure rate of 10^{-7} at 90% confidence level.

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

SHOCK AND VIBRATION

Shock

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

Vibration

The switches are tested according to IEC Publication 68-2-6, test Fc (acceleration 10g, below cross-over frequency 57 to 62 Hz, amplitude 0,75 mm, frequency range 10 to 2000 Hz, duration 90 min.). Such a vibration will not cause an open switch (no magnetic field present) to close, nor a switch kept close 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: 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.

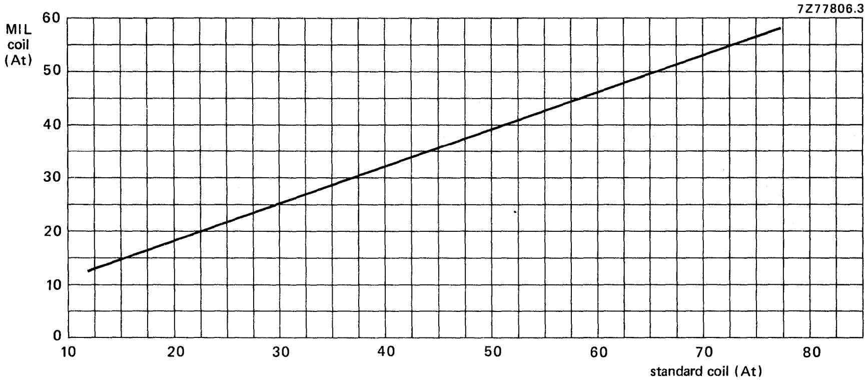


Fig. 2 Correlation at At operate in standard coil and MIL coil.

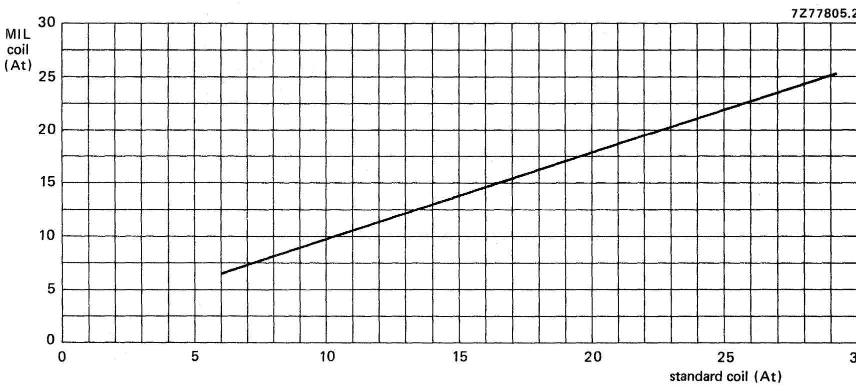


Fig. 3 Correlation of At release in standard coil and MIL coil.

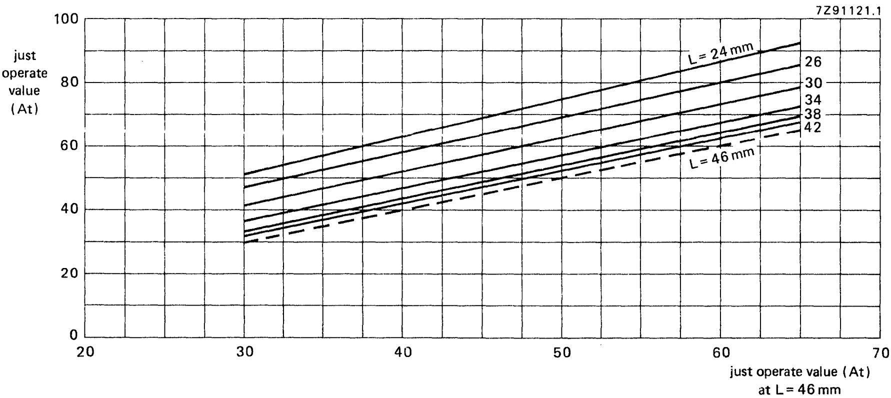


Fig. 4 Just operate values at various overall lenght compared with standard lenght of 46 mm.

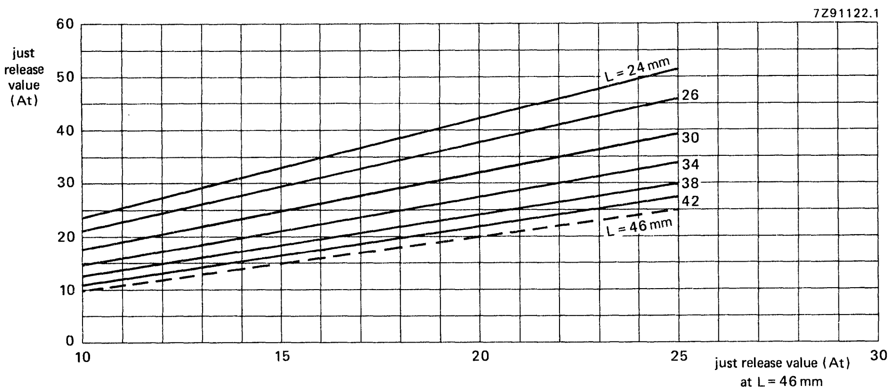


Fig. 5 Just release values at various overall lenght compared with standard lenght of 46 mm.

DRY REED SWITCHES

Micro 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 device is intended for use in relays for switching power loads and high stand-off voltage applications.

QUICK REFERENCE DATA

Contact		S.P.S.T. normally open
Switched power		
types RI-46AA and RI-46A	max.	30 W
types RI-46B and RI-46C	max.	40 W
Switched voltage		
d.c.	max.	200 V
a.c. (r.m.s.)	max.	250 V
Switched current, resistive d.c. or a.c. (r.m.s.)	max.	1 A
Contact resistance (initial)	typ.	60 mΩ

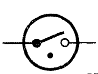
The RI-46 series comprises the types RI-46AA, RI-46A, RI-46B and RI-46C with the following basic magnetic characteristics, measured with the Standard coil.

		RI-46AA	RI-46A	RI-46B	RI-46C
Operate range	(At)	12 to 21	17 to 31	27 to 56	51 to 77
Release range	(At)	5 to 14,5	6,5 to 19	9,5 to 24	14,5 to 26,5

MECHANICAL DATA

Contact arrangement	normally open
Lead finish	tinned
Resonant frequency of single reed	approx. 3200 Hz
Net mass	approx. 0,26 g
Mounting position	any

Dimensions in mm



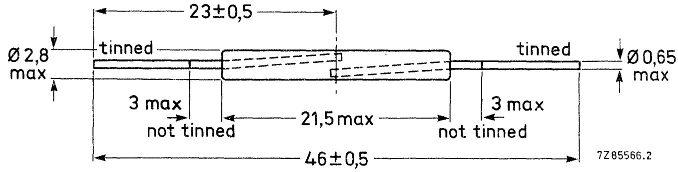


Fig. 1.

Mechanical strength

The robustness of terminations is tested according to IEC publication 68-2-21, test Ua (load 10N).

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. The switches can also be supplied with cut and bent leads to customer specification.

→ **Resistance to soldering heat**

The switch can withstand IEC test 68-2-20 Tb, method 1B: solder bath at 350 ± 10 °C during 3,5 ± 0,5 s.

→ **Solderability**

Solderability is tested according to IEC 68-2-20 test Ta, method 3: solder globule 235 °C, ageing 1b: 4 h steam.

Weldability

The leads are weldable.

The RI-46 series comprises four types: RI-46AA, RI-46A, RI-46B and RI-46C.

CHARACTERISTICS RI-46AA

		coil I	coil II	
Not-operate				
Breakdown voltage		see relevant graph		
Insulation resistance, initial	min.	10^6		MΩ (note 1)
Capacitance, without test coil	max.	0,25		pF
Must-not-operate value	max.	12	13	At
Operate				
Must-operate value	max.	21	19	At
Operate time, including bounce	typ.	0,35 (note 2)		ms
	max.	0,5 (note 2)		ms
Bounce time	typ.	0,15 (note 2)		ms
	max.	0,3 (note 2)		ms
Contact resistance, initial	typ.	60 (note 3)		mΩ
	max.	90 (note 3)		mΩ
Not-release				
Must-not-release value	min.	14,5	13	At
Release				
Must-release value	max.	5	6,5	At
Release time	max.	30 (note 2)		μs

Notes
1. Measured at a relative humidity of max. 45%.
2. Measured with 1,25 times the max. must-operate value per group.
3. Measured with 30 At, distance between measuring points: 41 mm. Wire resistance typ. 1,0 mΩ/mm.
4. Measured with 40 At, distance between measuring points: 41 mm. Wire resistance typ. 1,0 mΩ/mm.

CHARACTERISTICS RI-46A

		coil I	coil II	
Not-operate				
Breakdown voltage		see relevant graph		
Insulation resistance, initial	min.	10^6		MΩ (note 1)
Capacitance, without test coil	max.	0,20		pF
Must-not-operate value	max.	17	16	At
Operate				
Must-operate value	max.	31	26	At
Operate time, including bounce	typ.	0,35 (note 2)		ms
	max.	0,5 (note 2)		ms
Bounce time	typ.	0,15 (note 2)		ms
	max.	0,3 (note 2)		ms
Contact resistance, initial	typ.	60 (note 3)		mΩ
	max.	90 (note 3)		mΩ
Not-release				
Must-not-release value	min.	19	17	At
Release				
Must-release value	max.	6,5	7,5	At
Release time	max.	30 (note 2)		μs

CHARACTERISTICS RI-46B

		coil I	coil II	
Not-operate				
Breakdown voltage		see relevant graph		
Insulation resistance	min.	10^6		MΩ (note 1)
Capacitance, without test coil	max.	0,20		pF
Must-not-operate value	max.	27	23	At
Operate				
Must-operate value	max.	56	44	At
Operate time, including bounce	typ.	0,35 (note 2)		ms
	max.	0,5 (note 2)		ms
Bounce time	typ.	0,15 (note 2)		ms
	max.	0,3 (note 2)		ms
Contact resistance, initial	typ.	60 (note 4)		mΩ
	max.	90 (note 4)		mΩ
Not-release				
Must-not-release value	min.	24	20,5	At
Release				
Must-release value	max.	9,5	9,5	At
Release time	max.	30 (note 2)		μs

CHARACTERISTICS RI-46C

Not-operate

Breakdown voltage		see relevant graph		
Insulation resistance, initial	min.	10^6		MΩ (note 1)
Capacitance, without test coil	max.	0,20		pF
		coil I	coil II	
Must-not-operate value	max.	51	40	At
Operate				
Must-operate value	max.	77	58	At
Operate time, including bounce	typ.	0,35 (note 2)		ms
	max.	0,5 (note 2)		ms
Bounce time	typ.	0,15 (note 2)		ms
	max.	0,3 (note 2)		ms
Contact resistance, initial	typ.	60 (note 4)		mΩ
	max.	90 (note 4)		mΩ
Not-release				
Must-not-release value	min.	26,5	22,5	At
Release				
Must-release value	max.	14,5	13,0	At
Release time	max.	30 (note 2)		μs

LIMITING VALUES

Absolute maximum rating system

Switched power			
types RI-46AA and RI-46A	max.	30	W
types RI-46B and RI-46C	max.	40	W
Switched voltage			
d.c.	max.	200	V
a.c. (r.m.s.)	max.	250	V
Switched current, resistive d.c. or a.c. (r.m.s.)	max.	1	A (note 5)
Current through closed contacts			
type RI-46AA	max.	2,0	A
type RI-46A	max.	2,5	A
type RI-46B	max.	3,0	A
type RI-46C	max.	3,0	A
Temperature, storage and operating	max.	125	°C
	min.	−55	°C

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

Notes
1. Measured at a relative humidity of max. 45%.
2. Measured with 100 At.
3. Measured with 30 At, distance between measuring points: 41 mm. Wire resistance typ. 1,0 mΩ/mm.
4. Measured with 40 At, distance between measuring points: 41 mm; Wire resistance typ. 1,0 mΩ/mm.
5. Switching higher currents is possible depending on the signature of the load.

LIFE EXPECTANCY AND RELIABILITY

The life expectancy data mentioned below are given at a coil energization of 1,5 x the published must-operate value for each group. Coil energization above 1,5 x will result in better life performance.

For life expectancy data end of life is defined as being reached when either:

(a) the contact resistance exceeds either 1 Ω for no-load conditions or 2 Ω for loaded conditions, measured 3 ms after energizing coil; or

(b) the release time exceeds 3 ms after de-energizing the coil (latching or contact sticking).

No-load conditions (operating frequency 100 Hz)

Life expectancy min. 10^7 operations with a failure rate of less than 10^{-9} with a confidence level of 90%. After each operation (a) and (b) are tested.

Loaded conditions (resistive load: 20 V —500 mA, operating frequency 125 Hz

Life expectancy min. 2,5 x 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.
Currents between 50 and 200 mA may result in a reduced life expectancy.

SHOCK AND VIBRATION

Shock

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

Vibration

The switches are tested according to IEC Publication 68-2-6, test Fc (acceleration 10g, below cross-over frequency 57 to 62 Hz, amplitude 0,75 mm, frequency range 10 to 2000 Hz, duration 90 min.). Such a vibration will not cause an open switch (no magnetic field present) to close, nor a switch kept close 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: 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.

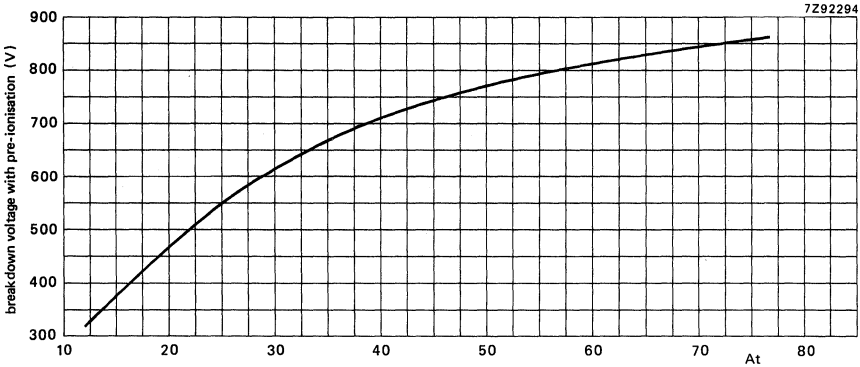


Fig. 2 Minimum breakdown voltage with pre-ionisation as a function of ampere-turns.

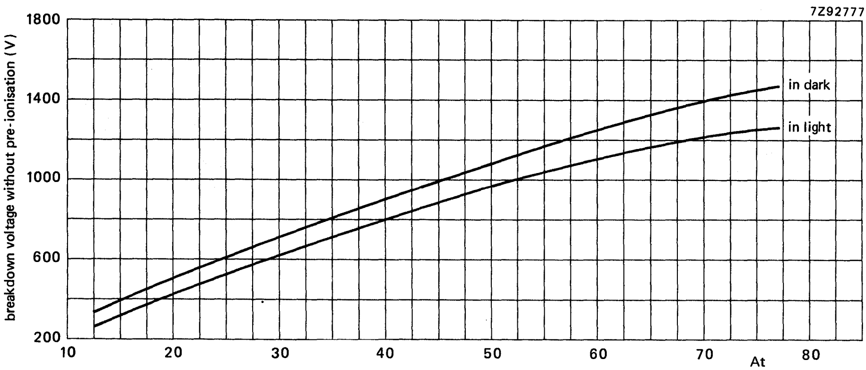


Fig. 3 Minimum breakdown voltage without pre-ionisation as a function of ampere-turns.

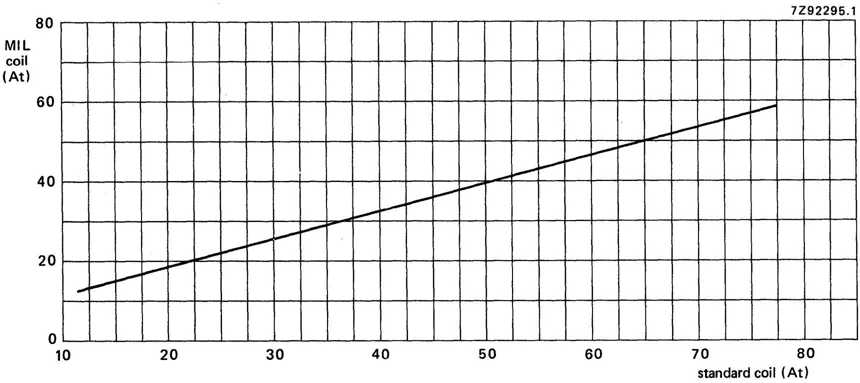


Fig. 4 Correlation of At operate in standard coil and MIL coil.

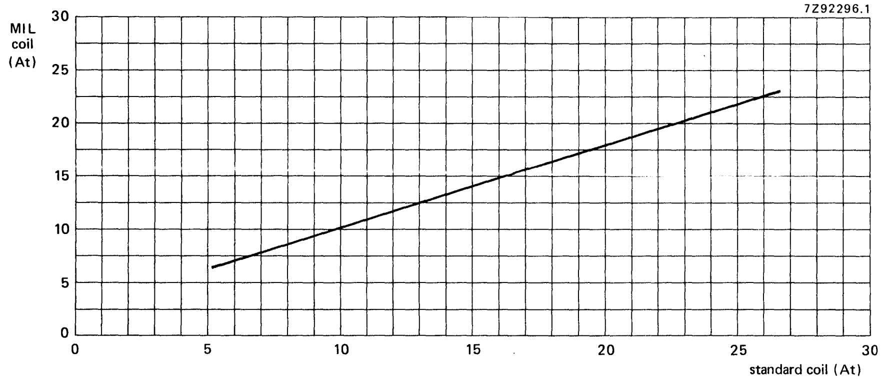


Fig. 5 Correlation of At release in standard coil and MIL coil.

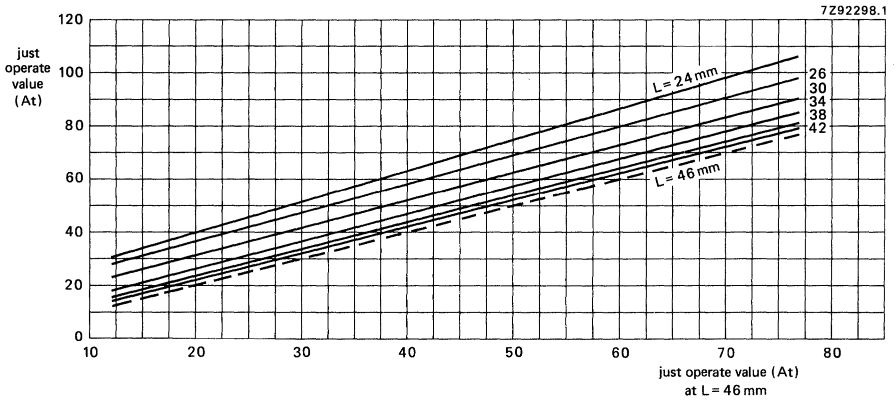


Fig. 6 Just operate values at various overall lenghts compared with standard lenght of 46 mm.

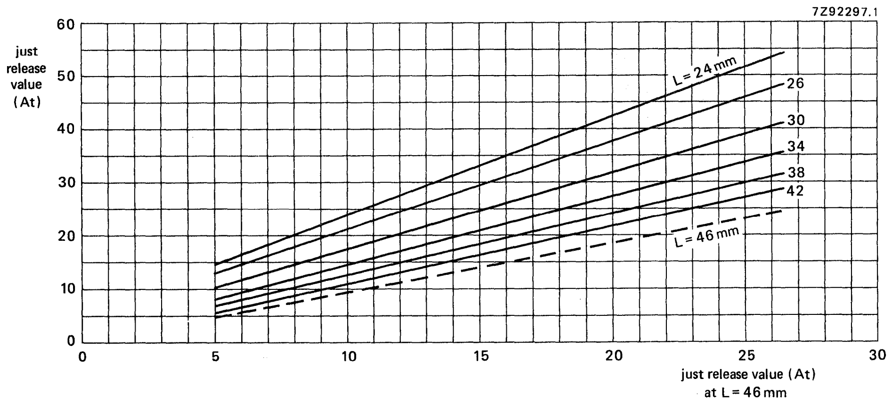


Fig. 7 Just release values at various overall lenghts compared with standard lenght of 46 mm.

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