The International Standard: "Reed Switches - Part 1: Generic Specification" (IEC 62246-1 Ed. 2)

Critical Review

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1. Scope

1.1. The IEC 62246-1 Ed. 2 standard Scope section states that it is the generic specification that "applies to all types of reed switches including dry reed switches and heavy-duty reed switches". This formulation leaves a slight bewilderment: if ***all*** types reed switches (that is: dry low voltage, high voltage vacuum, heavy-duty, mercury wetted, plunger-type, membrane-type, etc. [1]) are embraced by this standard why does it find it necessary to focus only on two types (dry and heavy-duty)? The answer can be seen in "Terms and Definitions" section of the standard which gives definitions only of these two types of reed switches: dry and the heavy-duty. From this we see that the IEC 62246-1 standard, in this case, simply misleads users in its assertion that it relates to all reed switch types.

1.2. Further, in the same paragraph it is noted that the standard "applies to reed switches which are operated by applied magnetic field". This is very interesting, what other field, except magnetic, the ***magnetically-operated contact*** (which is the Russian name for reed switch) can scope?

1.3. In Note 2 to this section there is a remark: "for elementary relays with reed switches, this standard is recommended to be used together with the standards IEC 61810-1 and IEC 61811-11". Practically 90% of manufactured reed switches are intended for use in electromagnetic elementary relays. This means that the standard should be coordinated with these over-all standards. As it will be shown below, it does not.

2. Terms and Definitions

2.1. As it was noted above, in the Terms and Definitions section definitions are given only to two types reed switches: dry and heavy-duty and there is not mention at all of reed switches of other types, for example, such as mercury wetted. Why?

2.2. The definition for the term: "reed switch" (p. 3.1.3) is that it is an "assembly containing contact blades, partly or completely made of magnetic material, hermetically sealed in an envelope…" But, first, all these attributes are characterize reed switches of any type, and not just "dry". For example, all of them are found mercury wetted reed switches. Secondly, use of the term "blade" strictly speaking describes only certain contact profiles and does not reflect the complete variety of existing reed switches among which there is also ball and membrane and plunger-type, etc. [1].

In the development process the term "dry" is used to designate reed switches the envelope of which is filled by dry air under atmospheric pressure or special gas (or mixture of gases) under a heightened pressure, and also vacuum reed switches. Thus this term, as defined in the standard, reflects only a minor case: type of the environment filling a reed switch envelope, and is not an essential reed switch attribute, distinguishing it from other type switches. That is, definition of the base term "reed switch" in the standard is replaced by a minor definition that suits only some varieties of reed switches. We ask is it logical to give a definition to various kinds of a reed switches that do not reflect the given base definition of reed switch itself?

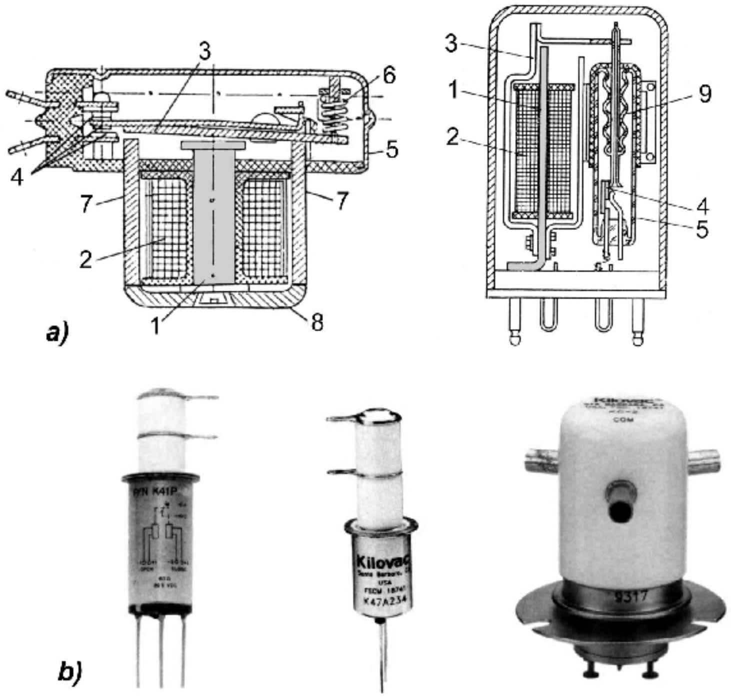

Fig. 1. Design of electromagnetic (***not reed switch***) relays with hermetically sealed contacts placed in gas filed or vacuumized shell (a) and external view not reed switch relays with hermetically sealed contacts (b) manufactures by companies Kilovac, Jennings, Gigavac.
1 – core sticking out of the hermetic shell; 2 – control coli; 3 – stiff ferromagnetic armature; 4 - contact straps; 5 – hermetically sealed shell for contacts; 6 - restoring spring; 7 – parts of the magnetic core sticking put of the hermetic shell; 8 - removable part of the magnetic core; 9 - flexible bellow.

2.3. In the definition of the term: "heavy-duty reed switch" presented in section 3.1.4 it is given that it is a dry reed switch in which increasing switching ability is provided by means of a special design of the contacts. But why should a reed switch with increased switching ability be necessarily "dry"? Why the increasing of the switching ability of the reed switches only possible due to a "heavy-duty" contacts design? Is it that filling its envelope with mercury in the so-called "wetted" reed switches does not allow increasing considerably its switching ability? Unfortunately, the standard only motivates such questions, but does not answer them.

2.4. In the definition of the term "heavy-duty reed switch" a basic mistake is incorporated, in our opinion, consisting in that for such reed switches the design of the magnetic and electric parts are supposed are made as separate parts. As shown in [1] separation of a magnetic and electric circuit is the major attribute distinguishing the usual electromagnetic relay (and not a reed switch relay) in which these circuits are combined. As a matter of fact, already in the term "magnetically controlled switch" (which, by the way, is a Russian term for reed switch) it is certain that just this *electric* contact is controlled by *a magnetic field*. Thus if these circuits are separated, what purpose is served by the magnetic material for the contacts (see the definition in the standard for the term "dry reed switch")? If we push this reasoning to the point of irrationality, it is possible to consider that the usual reed switch contains a ferromagnetic material covered by a special electroconducting coating, in this way electric and magnetic circuits become separated: the electric circuit enclosed in an electroconductive covering and magnetic circuit enclosed in ferromagnetic material. On the other hand, the attribute of the presence of a hermetically sealed envelope on contacts is not the main distinctive reed switch attribute, as the very first element working as reed switch was invented in 1922 by Professor of the Petersburg University V. Kovalenkov (author's certificate USSR N 466) was without an envelope, Fig. 2.

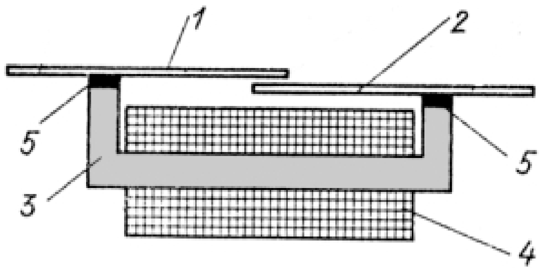

Fig. 2. The first reed switch relay (USSR Author Certificate N 466, 1922)
1 and 2 – contact-elements (springs) made of magnetic material; 3 - external ferromagnetic core; 4 – control winding; 5 - dielectric spacers

And then, in 1936, contact elements were placed in a hermetically sealed envelope by the engineer W. B. Ellwood from "Bell Telephone Laboratories". Since then practically all the types of reed switches manufactured by the industry are supplied with a hermetically sealed envelope. However, today also the contacts of the high-voltage vacuum circuit breakers applied in electric power industry, and contacts of various electromechanical relays are placed in a hermetically sealed envelope, Fig.1, not being reed switches. Therefore the presence of an envelope on contacts is necessary, but is not a basic attribute distinguishing reed switches from other devices.

Thus, IEC 62246-1 does not give precise definition for the very element to which consideration is devoted.

2.5. In the definition of the term: "contact blade", given in the p. 3.4.1, it is given that it is the metal element "providing the functions of either electric or magnetic circuit or both functions combined as in the case of dry and wetted reed switches". We have already pointed out above the abnormality of this approach applied to a reed switch as an element with separate functions of electric and magnetic circuits. The definition as given again includes the separation of the functions to be attributed to all other types of reed switches, except for dry or wetted. Since up to this point in the standard "heavy-duty reed switches" have also been mentioned, the standard implies that the presence of the separation of electric and magnetic circuits is automatically attributed to heavy-duty reed switches. But this is not so in reality. There are many ways for increasing the power of reed switches in which the magnetic circuit and an electric circuit are not separated [1], and the devices in which they are completely separated, Fig. 1. So this definition has very little to do with the general attributes reed switches and refers more to electromagnetic relays with hermetically sealed contacts.

2.6. In Section 3.4.1 of the standard for the first time "wetted reed switches" are mentioned, but definitions of this term are not given.

2.7. In the absence in the standard of a precise definition for reed switch, we shall try to formulate it: "*the reed switch is an electromechanical device intended for switching electric circuits by means the moving or deformation, at least one, of the contact-detail, sensitive to an external* *operating magnetic field and placed in hermetically sealed envelope*"; "*contact-detail" is the internal magnetic sensitive element of the reed switch that is carrying out the switching of an external electric circuit by means of moving or a deformation under the action of the operating magnetic field"*.

2.8. In Section 3.4.8 the "maximum cycling frequency" is defined as the "maximum number of cycles per second at and below which the reed switch still meets the specifications". At the same time, in Section 3.4.20 the "frequency of operation" is defined as "number of cycles per unit of time". What is the "cycling" and how it differs from "operate" is not explained in the standard.

2.9. In Section 3.4.12 the term "maximum contact current" is defined as "maximum allowed switches d.c. or peak current in correlation to given number and frequency of operations and load, under specified conditions".

First, the term "maximum contact current" without additional explanations absolutely not clear as there is also a maximum switched current, and the maximum short-term current carried thought closed contacts, and the maximum long-term current carried thought closed contacts. The term should be specified, in our opinion, as the "maximum switched current".

Secondly, as the limit for switching current and also for the current carried through closed contacts are characterizes ordinarily by their effective values, it is not clear, why for alternating current it is necessary to consider a peak value (as required the standard), instead of the r.m.s. value of the current?

Thirdly, the full cycle of switching process includes make and break operations. As is known, the switching ability of contacts at make and at break (especially on a DC) are essentially different. This has been reflected in the standard, in Sections 3.4.23 and 3.4.24, where such concepts as "limiting making capacity" and "limiting breaking capacity (and, now the r.m.s value for AC for it is underlined) are defined. These concepts are interpreted as the "greatest value of electric current which an output circuit is capable of making (breaking) under specified conditions". This raises a question: in what exactly is the difference between terms the "maximum current" and the "greatest current" used in the standard? The standard does not give the answer to this question. There is no illustrated purpose and scope of the term the "maximum contact current" on the one hand and the terms "limiting making capacity" and "limiting breaking capacity on the other. It is intuitively clear that the term "limiting capacity" means a small number of cycles withstood by contacts at making and at breaking of any super-over-currents specifically stipulated. But, in our opinion, the international standard is not the place for intuitive guesses and fabrications.

Fourthly, what is the purpose for using the term "output circuit" in Sections 3.4.23 and 3.4.24 instead term "contacts" as used in all other sections?

3. Rated Values

3.1. In Section 4.2 one more value is expedient to add: 120 operations per second, as the value implemented by reed switch at feeding the control coil from a source with frequency of 60 Hz to the row of recommended frequencies.

3.2. In Section 4.4 a row of recommended rated values of "open-circuit voltage across contacts" for AC is given as:

0.01; 0.1; 5; 12; 24; 30; 40; 50; 100; 110; 120; 127; 150; 170; 175; 200; 220; 250; 265; 300; 380; 400; 500; 1000; 2000 V (r.m.s),

and for DC:

0.01; 0.03; 0.05; 0.1; 1; 1.5; 4.5; 5; 6; 6.5; 10; 12; 15; 17; 20; 24; 28; 30; 36; 40; 48; 50; 60; 80; 100; 110; 150; 170; 175; 200; 220; 250; 265; 280; 350; 400; 440; 500; 600; 800; 1000; 1200; 1500 V

This section seems very strange. First of all the term “open-circuit voltage across contacts” is not present in the “Terms and Definitions” section. There is a term “maximum contact voltage”. Is this the same or not? Secondly, these voltages rows do not coincide with the rows of the rating voltage values for electromechanical relays (standard IEC 61810-1) in spite of the fact that in Section 1 it is recommended using both of the standards together in the case of reed switch relays (90% of all reed switches applications). Thirdly, there is the strange condition that for DC the voltage row terminates at 1500V, whereas for AC at 2000Vr.m.s. The last value (2000VAC r.m.s.) makes much more serious demands on reed switch insulation than the 1500VDC and is equivalent not less than 2800VDC. So why does the voltage row for DC terminate with 1500V? In mass production there are dry reed switches that withstand voltages 5, 10 and even 15kVDC. Such reed switches are manufactured in large quantities by various firms. What are we to do with these reed switches that are not described in IEC 62246-1? Finally, what is the necessity for a row of values of the voltages differing among themselves from 5 to 7 Volts? For example: 100; 110; 120; 127; 150; 170; 175; 200; 220; 250; 265V. What reed switch manufacturer will develop them separately for 100V, for 110V, for 120V and for 127V? Why isn’t this row given in the form of: 100; 150; 200; 250V and so on? It is enough to analyze the technical specifications of reed switches from various manufacturers to be convinced that actually such just division of the voltages is put into practice. And as for some: 0.01; 0.03; 0.05; 0.1; 1; 1.5; 4.5; 5; 6; 6.5V this is very interesting, where authors of the standard certainly saw reed switches with rated voltages such as these.

It would seem that the person who developed the standard has selected these rows arbitrarily, neither matching them with common sense, nor with existing practice.

3.3. In Section 4.5 a recommended row for rating values of currents is given as:
“1; 1.25; 1.5; 1.6; 2; 2.5; 3; 3.15; 3.5; 4; 5; 6.3; 7; 7.5; 8 A or the decimal multiples or submultiples of these figures in amps: 1, 2 and 5”.

We raise the same question: what is the reason to extract 1.5 and 1.6A separately; 3 and 3.15A, etc.? What is the meaning of 1, 2 and 5 in the end of the row? Why doesn’t this row coincide with a row of rated switching currents, recommended in Sections 4.11: 1; 10; 15; 30; 50; 100mA; 0.3; 0.5; 1; 2; 3; 5A? What is necessity for representing two these rows separately?

3.4. In Section 4.6 there is a recommended row for rated loads, in Volt-Amperes, that is for AC loads. But where are the values, in Watts, for DC loads? Aren’t the reed switches intended for switching a DC load?

3.5. In Section 4.10 there are rows of recommended values for “rated operational voltage”. This yet a third term for designating a voltage on reed switch contacts after “maximum contact voltage” (3.4.14) and “open-circuit voltage across contacts” (4.4). What is the difference between all these terms and why are there no explanations in section “Terms and Definition” for the last two of them? Why does this new voltages row differ from that given earlier in 4.4? Why does this new row of a “rated operational voltage” differ from of same “rated operational voltage” given in Annex E of the standard?

3.6. All the above refers to the term “rated switching current” in Section 4.11 which has not been included in “Terms and Definitions” section, and to values of the current that are not consistent with the values given in Section 4.5.

3.7. In Section 4.12 “rated insulation voltage” (that is a test voltage, according to the definition given in Section 3.4.25) is given in a row of r.m.s. values of the voltages ending with 600V for AC. This is amazing, since above, in Section 4.10, a row of rated operation voltages comes to an end with the value of 1000VAC (r.m.s.), and in Section 4.4 the “open circuit voltage across contacts” ends with the value of 2000VAC (r.m.s.). In this section it says that for the reed switch intended for switching 2000VAC the standard recommends testing at 600VAC?! In what cases and for what are such "tests" necessary? And the boundary value of 1500VDC also is not true, as the test voltage should be always much above the maximum operating voltage. Besides for contacts of the relay (and reed switches are used very widely as contacts of the relay) intended for use in electric power industry there are special standards in which the test voltage is selected as the double operating voltage plus 1000V. In our opinion, this section of the standard demands rewriting.

3.8. Values for the “rated impulse voltage” that are given in Section 4.13 as: 800; 1500; 2500; 3000; 4000 do not encompass constructions actually existing in the market, for miniature and measuring reed switches the voltage 800V is too high a value, and for dry vacuum reed switches with rated voltages 5, 10 and 15 kV, the voltage 4000V is too low a value. This voltage row needs to be corrected.

3.9. The utilization categories presented in Section 4.14 in the form of the table, taken apparently from standard IEC 60947-5-1, also contain rather strange formulations for some classes, in particular for classes AC-12 and DC-12 “control of resistive loads and solid state loads with insulation by opto-coupler”, and also AC-13 “control of solid state loads with transformer isolation” and DC-14 “control of small electromagnetic loads having economy resistor in circuit”. In our opinion, such incorrect and uncertain formulations for load kinds, as “solid state loads with insulation by opto-coupler” or “solid state loads with transformer isolation”, etc. are not acceptable for use in the new international standard on reed switches even if they also have been used earlier in another international standard. In our opinion, classes AC-12, DC-12, AC-13 and DC-14 should be removed from the standard, all the more so since these classes are not used anywhere else in the standard (see tables 5, 6, 7, E1).

3.10. In Section 4.16 a row of recommended values for “limiting continuous current” is given. It is not clear why the recommended row of values for this current does not coincide with other rows of currents given in the standard. In addition in the standard the procedure for testing reed switches on conformity to this parameter is not stipulated. This being the case, what is the purpose for the recommended row for these values?

4. Tests and Measurement Procedures

4.1. In Section 7.7.1 procedure for measurement the contact circuit resistance, based on Kelvin four wire circuit method (measurement voltage drop at presented value of current carried), is given. The measurement is to be made at voltages not exceeding 6V and a current 1A. In our opinion, the specified value of a current (1A) is too high for miniature low-power reed switches and can lead to their faulting. Besides because of overlapping in reed switch magnetic and electric circuits, the current, which is carried through closed contacts, creates a magnetic field aimed at breaking them. In low-power miniature reed switches carrying a current in 1A can lead to an appreciable decrease of contact pressure and, accordingly, to increase in resistance of the closed contacts during measurement process. In our opinion, there must be various values of test currents for reed switches with different switching powers.

4.2. In the testing procedure for dielectric test (Section 7.8.1a) the rapidity with which the value of test voltage is to be increased should be specified.

4.3. In measurement procedures of the operate time and release time (Section 7.10) mention is made about fixing the moments of turn-on and turn-off of a current in the coil of reed switch for the measurements. But in Section 3.3 it is written that the “operate time” and “release time” are terms for times connected with the application and removal of the operating magnetic field on the reed switch. It is very important note that the moment of the turning-on of a current in the coil and the moment when the magnetic field in this coil will reach its rated value is not at all the same moment! They differ by significant value known as the “time constant” of the coil which is commensurable or even exceeds the operate and release times of reed switches. Thus, the test procedure as presented is inapplicable and requires reconstruction in respect to the effect of the coil parameters on the measurement results.

4.4. Section 7.11 refers to “contact sticking” and contains two sub-sections: “thermal sticking” and “magnetostrictive sticking”. For thermal sticking tests the unit under test is kept in a closed condition of contacts for 24 hours at the maximum temperature and for magnetostrictive sticking tests - after 2000 cycles of operation-release then the release value and break time are measured. Changes of these parameters are used as the criterion for an estimation of the extent of reed switch sticking.

It is necessary to note that in the theory of a reed switches there are two principal causes for sticking: the first is the magnetostrictive effect which is a grinding of the contact surfaces after repeated wear and remaining in the closed position under act of molecular forces, and second is electric erosion of contacts at DC switching in which an acute ledge is formed on one of contacts, and a crater on other. The pinching of this ledge in the crater leads to a sticking reed switch. What “thermal sticking” is we do not know and efforts to find any reference presenting this phenomenon in the technical literature have been to no avail. The other matter, magnetomotive force of making (ampere-turns to make), depends to a strong extent on the reed switch temperature owing to changes of the magnetic properties of a ferromagnetic material from which the contact-elements are manufactured, Fig. 2. On the market there are even special, so-called “thermal reed switches”, operating at certain temperatures and used as temperature sensors. On the other hand, it is known, that the turn-on time of reed switches strongly depends on the rate of the current in the control coil, i.e., at the magnetic field level, that is abruptly applied to them, Fig. 3. Therefore, it is abundantly clear that a change of a magnetic condition of the contact-details under the affect of temperature will also change the turn-on time of the reed switch. This change, however, has no relation to reed switches sticking.

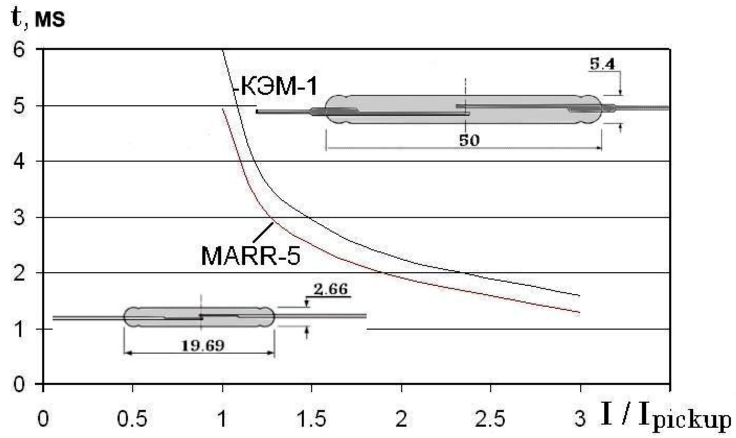

Fig. 3. Experimental curves gained for reed switches of different types and sizes and manufactures by the different companies in the different countries.
I – actual current in the control coil; I_{PICKUP} – pickup (pull-in) current , t – switch-on time

Thus, instead of the analysis of one of the most common reasons for reed switches sticking - electric erosion of contacts, the standard invents some new aspect of reed switch sticking, not known in the technical literature.

4.5. Tests procedures and requirements for vibration, shock and acceleration (Sections 7.19, 7.20 and 7.21) do not specificity reflect of mercury wetted reed switches. But, as the standard comprises all types of reed switches, these sections should be expanded so that they include mercury wetted reed switches as well.

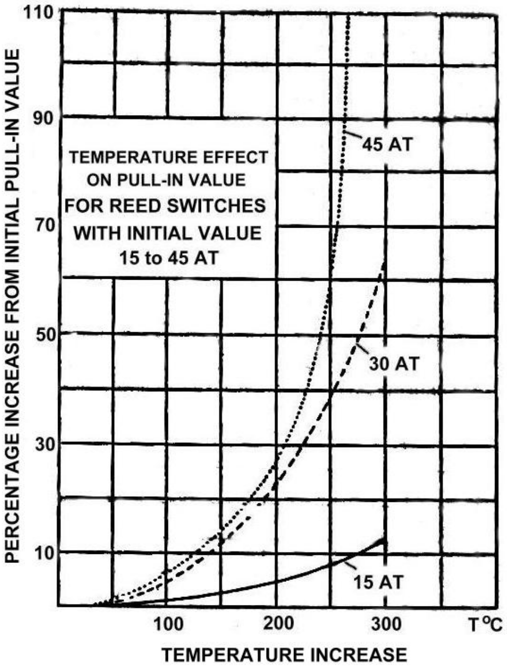

Fig. 4. Impact temperature on pickup current (pull-in value) for reed switches with various initial sensitivity (ampere-turns or AT)

4.6. The electric loads given in Table 2, Section 7.23.4 as the standard conditions for electrical endurance tests refer only to dry reed switches (why?) and also are restricted to resistive loads by values 1 to 100 mA at voltages of 0.03 to 200 VDC and values of 10 mA to 1A at voltages of 0.03 - 230 VAC. And for the combined load (Table 3, Section 7.23.4) the maximum current test does not exceed 100 mA. These values are not connected in any way with the actual parameters of electrical endurance of real reed switches, made by real manufacturers, see Table 1. In addition they are not connected with the values of rated switching currents and rated switching voltages given in Sections 4.10 and 4.11 of the standard. This is certainly puzzling!

Table. 1. Electrical endurance for some types of the reed switches manufactures by company Yaskawa

Voltage and Load	Make		Break		Electrical Endurance (x 1000)			
	Current (A)	Power factor or time constant	Current (A)	Power factor or time constant	Reed Switch Type			
					R24U	R25U	R14U	R15U
~ 110 V resistive	3 2 1	Cos φ = 1.0	3 2 1	Cos φ = 1.0	- 50 300	- 200 500	- 200 1000	200 1000 2000
~ 240 V inductive	10 5 2.5	Cos φ = 0.7	1 0.5 0.25	Cos φ = 0.4	- 300 600	- 1000 2000	500 1000 2000	800 1500 3000
= 115 V inductive	0.5	L/R = 40 ms	0.5	L/R = 40 ms	-	-	1000	1000

4.7. In Section 7.26 “Voltage surge test” (Sub-sections 7.26.3 and 7.26.4) we are given the following recommended values:

- V_{PEAK}: 1000 V, 1200 V, 1500 V
- t_1 = 10 μs
- t_2 = 700 μs or 1000 μs

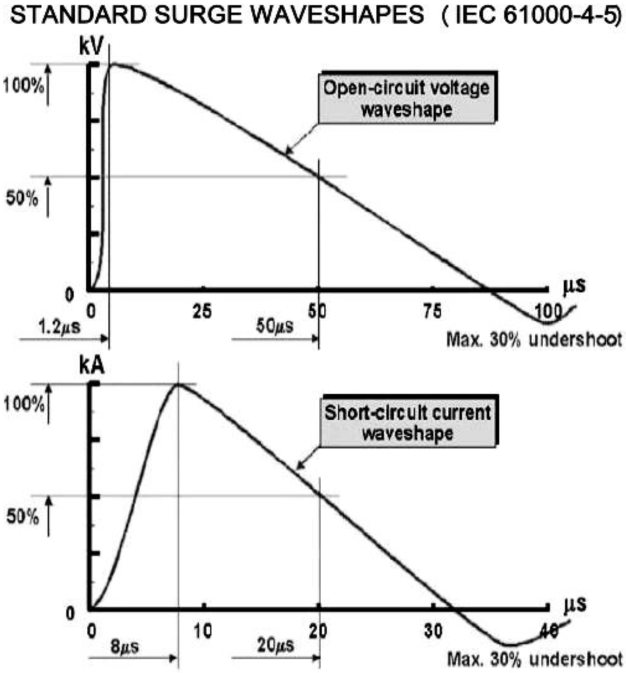

Fig. 5. Standard waveshapes for testing surge immunity (according to IEC 61000-4-5).

Only a specialist in the field of the electro-magnetic compatibility (EMC) may understand what this list means, but by no means the specialist in the field of reed switches.

Why are there no references in these sections to the matching standard: IEC 61000-4-5, which presents, in detail, a technique of conducting of such tests and parameters of test pulses?

Why are there no explanations for t_1 and t_2 as earlier the same designations were applied in the standard to make and break times (see Fig. 2 in Section “Terms and Definitions”)? Why as the parameters of a test pulse (in the given context t_1 and t_2 are the times describing pulse rising edge and pulse decreasing edge of the high-voltage test pulse) are the parameters of the pulse known as “telecommunication pulse”? Are such pulses used for testing the radio-electronic and communication equipment, in contrast to a standard pulse 1.2/50 µs, Fig. 5, used for testing electrotechnical equipment such as the relays, contactors, switches, buttons, etc.? Can the miniature reed switches, for example, ORD213, MITI-3, RI-70, KSK-1A80, HSR-0025 and dozens of other types with breakdown voltages of 100 - 200V, withstand an impulse voltage 1000V? On the other hand, what test using a 1500V impulse voltage will verify vacuum reed switches with rated voltages of 5,000 or 10,000V?

Unfortunately, there are more questions than answers that are absolutely inadmissible for a basic international standard.

4.8. In Section 7.28 “Rated making and breaking capacities” the test procedures and requirements are presented in detail. And also in Section 7.32 “Making current capacity test” and in Section 7.33 “Breaking current capacity test” the same procedures and requirements are presented. Why?

4.9. As the ***procedure*** for the making current capacity test (Section 7.32.2) it is written: “Sub-clause 7.23.5 without breaking applies”. As the ***procedure*** for the breaking capacity test (Section 7.33.2) it is written: “Sub-clause 7.23.5 without making applies”.

However, in Section 7.23.5 the ***requirements*** (not procedure) for failure categories consideration for the ***endurance test*** (not for making or breaking capacity test) are given.

Test procedures and test requirements are not same!

Making (breaking) capacity and electrical endurance are not same! According to Section 3.4.22 “electrical endurance” is a “number of cycles until contact failure, with specified electrical loading of the output circuit and under specified operating conditions”. According to Section 7.32.1 (7.33.1) “the making (breaking) current capacity test evaluates failures caused by the electrical wear of contact surfaces when making (breaking) current”. Are the last definitions sufficiently clear for understanding the difference between ***making (breaking) capacity*** and ***electrical endurance***? In our opinion, the authors of the standard do not understand these differences. There are absences also in all other Sections related to the testing of these two parameters. These Sections simply are exactly copied in the standard. Why? Really, the clear definition for terms "breaking capacity" and "making capacity" is given in the standard IEC 60947-1 Low-voltage switch gear and control gear - Part 1: General rules:

The rated breaking capacity of all equipment is a value of current, stated by the manufacturer, which the equipment can satisfactory break, under specified breaking conditions.
The breaking conditions which shall be specified are:
- the characteristic of the test circuit;
- the power-frequency recovery voltage.
The rated breaking capacity is stated by reference to the rated operational voltage and rated operational current, according to the relevant product standard. An equipment shall be capable of breaking any value of current up to and including its rated breaking capacity.
Note. A switching device may have more than one rated breaking capacity, each corresponding to an operational voltage and a utilization category.

As can be seen, in this definition for breaking capacity (it is analogous also for making capacity) the number of switching cycles is not mentioned all, in contrast to endurance. That is, the switching capacity is the specified current value, and the electrical endurance is a specified number of switching cycles.

And further, what does the note about "without breaking applies" and "without making applies" in the procedures mean for making and breaking current capacity test (Sections 7.32.2 and 7.33.2)? How it is possible to realize this demand practically, if, according to the standard's claim (Section 3.2.13, Fig. 2), the switching process is always accompanied with contact bouncing? In contrast to Fig.2, the figure in Annex G (Making current capacity test sequence) and the figure in Annex H (Breaking current capacity test sequence) do not include contact bouncing. So, which figure is correct?

It is absolutely clear that all these Sections need to be completely rewritten.

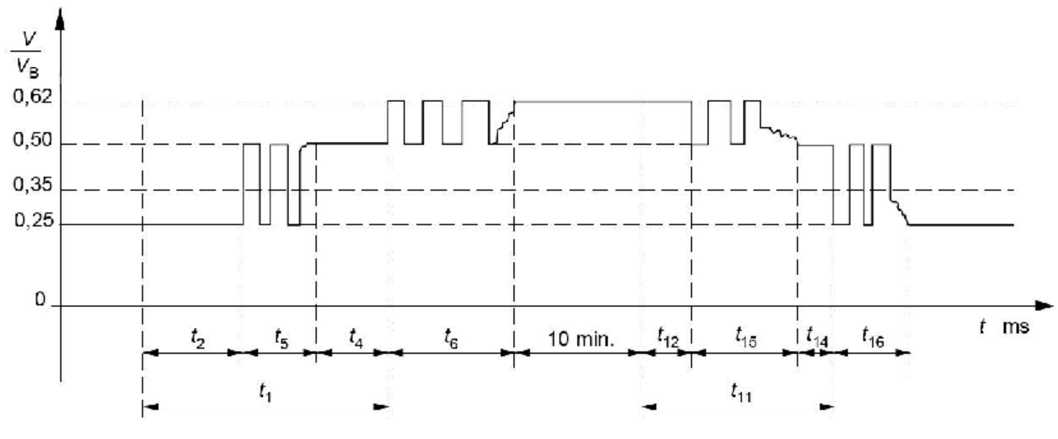

Fig. 6. Oscillograms of switch-on and switch-off processes in the reed switch
t_5; t_6; t_{15}; t_{16} – contact bounce times (Fig. 2 from standard IEC 62246-1 Ed.2)

4.10. For tests on rated conditional short-circuit currents (Section 7.29) in the standard it is stipulated that the item being tested has to be connected in series with a fuse or an automatic protective switch capable of a fast disconnection a short-circuit current. However, the fuses on high currents or automatic circuit breakers are not the calibrated devices that have undergone the latest metrological tests and have matching certificates, on the contrary, the time-current characteristic of such devices is usually rather approximate and has a wide dispersion of parameters. Therefore, in our opinion, they are not suitable for tests for conformity to the standard. At the same time, in the IEC 61000-4-5 standard the technique and parameters of the test pulse intended for test ability to withstand short-circuit currents (see Fig. 5) is presented. The special test equipment is manufactured for these tests by many firms. We do not see any reason to ignore the requirements of the standard IEC 61000-4-5 and to use the “homebrew” methods recommended in the IEC 62246-1 standard.

Conclusion

The second edition of international IEC 62246-1 Ed.2 standard contains many mistakes and inaccuracies, and requires rewriting. IEC 62246-1 Ed.2 is not recommended for use in practical activities. When developing national standards on the basis of this standard, it is necessary to take the deficiencies that we have highlighted into consideration.

Reference

1. Gurevich V. Electric Relays: Principles and Applications. - CRC Press (Taylor and Francis Group), Boca Raton - New York - London, 2005, 704 p.