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Signalling relays

Relais de signalisation
Signalrelais

UNION INTERNATIONALE DES CHEMINS DE FER
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1st edition, January 1954	under the title: "Safety Relays - Essential characteristics of the different categories of relay used in safety installations".
2nd edition, January 1965	under the title: "Safety Relays - Essential characteristics of the different categories of direct current relays used in safety installations".
3rd edition, July 1974	under the title: "Signalling relays" including 1 amendment.
4th edition, June 2004	Overhaul of leaflet - Processing with Frame Maker.

The person responsible for this leaflet is named in the UIC Code

Contents

Summary

UIC Leaflet 736 gives a set of generic and specific requirements for signalling relays.

This leaflet introduces a set of recommended requirements for signalling relay characteristics, construction, magnetic system, contacts and insulation. Requirements are coordinated with present international standards on all-or-nothing relays.

Relays with the characteristics described in this leaflet are also known, outside railway signalling technology, as "relays with forcible guided (linked) contacts" (safety relays).

1 - Preliminary remarks

The following information is intended to serve as a basis for the various Railways for their specifications concerning direct current relays of signalling installations.

The characteristics described are valid for relays where the armature (see Glossary - page 9) and the contact system automatically revert to the de-energised position after interruption of the current in the coil.

The Railways will be able to determine the characteristics for relays with bistable behaviour on the basis of this leaflet.

Terms and definitions (see Glossary - page 9) used and applicable to this leaflet are included in the standards listed in the Bibliography - page 10, and in the International Electrotechnical Vocabulary *(IEC 60050)*.

2 - Classification

The characteristics of the various categories of signalling relays (see Glossary - page 9) required to guarantee installation with the degree of reliability and safety desirable for operating purposes, depend on the functions to be fulfilled by the relays and the type of circuit with which they are to be used.

Bearing in mind these characteristics, a distinction may be made between the following types of signalling relays:

Type N (non-proved relays)

Relays themselves fulfilling all the safety conditions without the aid of other relays or without control of operations in the circuit.

Type C (proved relays)

Relays for which the safety conditions are guaranteed by control of operations in the circuit.

3 - Essential characteristics of the relays and their construction

3.1 - Generic requirements for signalling relays

3.1.1 - Forcibly guided (linked) contacts

Signalling relays shall be equipped with forcibly guided (linked) contacts. The forcibly guided (linked) contacts shall be designed in such a way that it is ensured by mechanical means that make and break contacts (see Glossary - page 9) can never be in the closed position simultaneously.

NB: If one of the make contacts is closed, none of the break contacts is closed. If one of the break contacts remains closed, none of the make contacts closes (assuming that nominal power conditions apply – see also point 3.6.2 - page 7).
Operation of forcibly guided (linked) contacts means that if, for example, any given make contact fails to open and the relay is de-energised, none of the break contacts closes. The same principle applies to the failure-to-open of a break contact with energisation of the relay, i.e. in this case, no make contact shall close.

3.1.2 - Forcibly guided (linked) operation

The efficiency of forcibly guided (linked) contact operation shall be maintained as long as the relay operates – even when beyond the specified endurance. This applies both to loaded and unloaded contacts. Forcibly guided (linked) operation shall be maintained even if individual parts of the relay fail. Under such circumstances, it is irrelevant whether this failure is due to wear or breakage.

NB: Use of change-over contacts (see Glossary - page 9) is permitted for signalling relays in safety-relevant circuits (*EN 50205, Point 4.2* is not applicable to signalling relays).

3.1.3 - The choice of material, the shape, arrangement and control of the contacts are left to the discretion of the Railways.

3.1.4 - Relays shall be characterised by a direct link between the armature and the contact members (see Glossary - page 9) which shall be rendered integral (indirect drive, by other contact members for example, is not allowed).

3.2 - Specific requirements

3.2.1 - Relays of type N

3.2.1.1 - These shall be characterised by their non-weldable make contact tips (see Glossary - page 9), through the use of a suitable contact tip material (for example silver-carbon for which there is no risk of welding above a certain percentage of carbon), or by the introduction of special constructional conditions preventing risks of welding of the contact tips (for example fusing, contacts in series).

3.2.1.2 - They shall be further characterised by the reliable opening of the make contacts on falling of the armature under its own weight, together with that of a return spring, when the current is interrupted in the coil.

3.2.1.3 - The relays may also be equipped with return springs. The return springs shall only be used to increase the contact pressure of break contacts and ensure that the required time parameters for the armature to fall are met. They shall not be used for the reliable opening of the make contacts.

3.2.2 - Relays of type C

This type of relay shall be characterised by the fact that the falling of the armature of the relay is proved during operation; for this reason, no special qualities of non-weldability are required for the material that contact tips are made of.

3.3 - Mechanical construction of the signalling relays

3.3.1 - The connecting devices for relays of the plug-in type (or groups of connectable relays) shall be constructed so that it is not possible for any errors in assembly or connection to occur (protection against coding errors).

3.3.2 - Sufficient space shall be left between the moving parts of the relays and the detachable case or cover of the relay (or group of relays), to avoid interfering with its operation.

3.3.3 - When in the normal position, a relay shall still function correctly when subjected to sinusoidal vibrations applied either in the direction of movement of the armature or in the direction of movement of the contacts, in which the oscillations have a frequency of between 5 and 22 Hz and a maximum amplitude of 1 mm, together with a frequency of between 22 and 50 Hz and an acceleration of 2 g. Closed contacts shall not open and open contacts shall not close on their own, whether the relays are energised or not.

If the signalling relays do not comply with these requirements, and if the installations are subject to interference as a result, it is necessary to take special measures, for example spring suspension of the relay, groups of relays or framework.

3.3.4 - Since climatic zones differ, the Railways are left to determine within which limits of temperature the relays should be able to function perfectly, taking into account the hydrometric conditions. As a guide, values of -10°C and +55°C can be taken as the ambient temperature inside the buildings.

3.4 - Magnetic system

The travel of the moving armature shall be limited by means of stops of energised and de-energised positions; these elements shall be made of anti-residual and anti-corrosive material.

During the entire service life prescribed, the air gap, in the energised position of the relay, shall not be less than 0,1 mm, to avoid residual sticking of the armature.

3.4.1 - Regulations for new relays

The choice of material and the construction shall guarantee the following:

- The pick-up current shall not exceed a given value and the drop-away current shall not fall below a given value.
- The factor $K = \frac{\text{drop-away current}}{\text{pick-up current}}$ for all new relays of a given type shall not vary by more than ±15% in relation to that obtained from the quotient of the values fixed for the drop-away current and the pick-up current.

3.4.2 - Functioning during service

During the minimum mechanical service life (10×10^6 movements), the following variations can be accepted in relation to the initial value:

- a maximum increase of 10% in the pick-up current,
- a maximum decrease of 15% of the drop-away current,
- a maximum decrease of 20% of the factor K.

The drop-away current is measured after magnetising of the relays by a current equivalent to 2,5 times the nominal current (see Glossary - page 9). In addition, when a current equivalent to 2,5 times the nominal current energises the relay and the reverse pick-up current is measured, the latter shall not exceed 110% of the direct pick-up current.

3.5 - Dielectric strength

3.5.1 - Overvoltage category III to *IEC 60664-1* (see Bibliography - page 10) shall apply when determining the clearances between the following voltage-carrying, electrically-conducting parts:

- the various windings of a coil,
- the windings of the coil and the other parts of the relay,
- the contacts themselves,
- the contacts and earth.

NB : Overvoltage category III applies to equipment in fixed installations, and for cases where a higher degree of availability of the equipment is expected.

3.5.2 - Railways may decide to choose another overvoltage category keeping as a minimum a test voltage equal to 2 000 V RMS at 50 Hz:

NB : This dielectric strength may, in the case of a supply circuit not connected to earth, also be required for functional combinations (for example groups of relays), i.e. all the output terminals of a combination are tested against earth by applying a voltage of 2 000 V RMS, 50 Hz.

3.5.3 - In the case of a supply circuit not connected to earth, the insulation between the various windings of a coil shall be able to withstand a test voltage of 750 V RMS, 50 Hz, for one minute.

3.5.4 - Unless otherwise explicitly specified by the manufacturer, pollution degree 3 to *IEC 60664-1* shall be assumed for determining the creepage distances between the voltage-carrying, electrically-conducting parts.

NB : Pollution degree 3 designates conductive pollution or dry non-conductive pollution, which can be predicted to become conductive due to condensation.

3.6 - Contacts

3.6.1 - The contacts may comprise:

- single spacing with a single contact tip,
- single spacing with double contact tips (2 contacts tips in series),
- double spacing (2 contacts in series).

Depending on their use, the contact stud tips shall be of silver or silver alloy or a silver-carbon combination. Other material can also be used, provided it fulfils the conditions of use.

3.6.2 - If a break contact remains accidentally closed, none of the make contacts shall close, even when the relay is energised at 1,5 times its nominal supply voltage.

3.6.3 - Adequate construction of the contacts ensures that, when in the closed position and under normal contact pressure (see Glossary - page 9), they shall not become overheated to an inadmissible extent under the effect of the prescribed current intensity. This latter may be fixed by each Railway in relation to the use in service.

3.6.4 - The minimum service life under the prescribed intensity shall be 2×10^6 movements.

3.6.5 - Minimum distance apart of the relay contact elements

The values given below shall not vary by more than 40% during the service life, on the understanding that the distance between two make contact elements is never less than its initial value.

3.6.5.1 - Non-weldable contact tips or contact tips not used in equipment concerned with safety

- 0,5 mm when attraction of the moving armature takes place (see NB - page 8),
- 1,2 mm when attraction of the moving armature ceases.

3.6.5.2 - Single or double contact tips of weldable material used in equipment concerned with safety

- 0,7 mm when attraction of the moving armature takes place (see NB - page 8),
- 1,2 mm when attraction of the moving armature ceases.

3.6.5.3 - Contacts with double spacing of weldable material used in equipment concerned with safety

- 0,5 mm when attraction of the moving armature takes place,

- 0,9 mm when attraction of the moving armature ceases.

NB : distance between the contact tips of the break contacts when the make contacts close; distance between the contact tips of the make contacts when the break contacts close.

3.6.6 - Contact pressure

The compression force of the contacts on completion of the movement of the moveable armature shall not be less than the following:

Relays of type N

0,245 N (25 g) in the case of silver-carbon contact tips.

0,196 N (20 g) in the case of silver-silver contact tips.

Relays of type C

0,147 N (15 g) in the case of silver-silver contact tips.

For contacts with double contact tips, half the contact pressure suffices per contact tip. For double spacing contacts, full pressure is necessary at each contact tip.

Non-activated contact members shall rest on the support blades by pre-stressing.

3.6.7 - Self-cleaning

The minimum contact wipe (see Glossary - page 9) of the contact shall be:

- 0,2 mm for type N,

- 0,1 mm for type C (in the case of double spacing contacts, a smaller contact wipe is considered sufficient).

3.6.8 - Bounce

The following maximum bounce times (see Glossary - page 9) are allowed on closing and opening of the contact:

- 20 ms in the case of type N,

- 10 ms in the case of type C.

Glossary

Armature	Moveable parts of a relay that control contact members.
Bounce time	For a contact that is closing (opening) its circuit, the time interval between the instant when the contact circuit first closes (opens) and the instant when the circuit is finally closed (opened).
Break contact	A contact that is closed when the relay is in its de-energised state and which is open when the relay is in an energised state.
Change-over contact	Combination of two contact circuits with three contact members, one of which is common to the two contact circuits, such that when one of these contact circuits is open, the other is closed.
Contact gap	The gap between the contact tips, under specified conditions, when the contact circuit is open.
Contact member	A conductive part of a contact assembly that is electrically isolated from other such parts when the contact circuit is open.
Contact pressure	The force that two contact tips exert against each other in the closed position under specified conditions.
Contact tip	A conductive part of a contact member designed to co-act with another to close or open the circuit.
Contact wipe	During contact, the relative rubbing movement of contact tips when they have just touched.
Make contact	A contact which is open when the relay is in its de-energised state and closed when the relay is in an energised state.
Nominal current	The current passing through the coil of the relay when the coil is supplied with nominal voltage.
Signalling relays	Direct current relays for signalling installations.

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Warning

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