Arkiv

ASEA

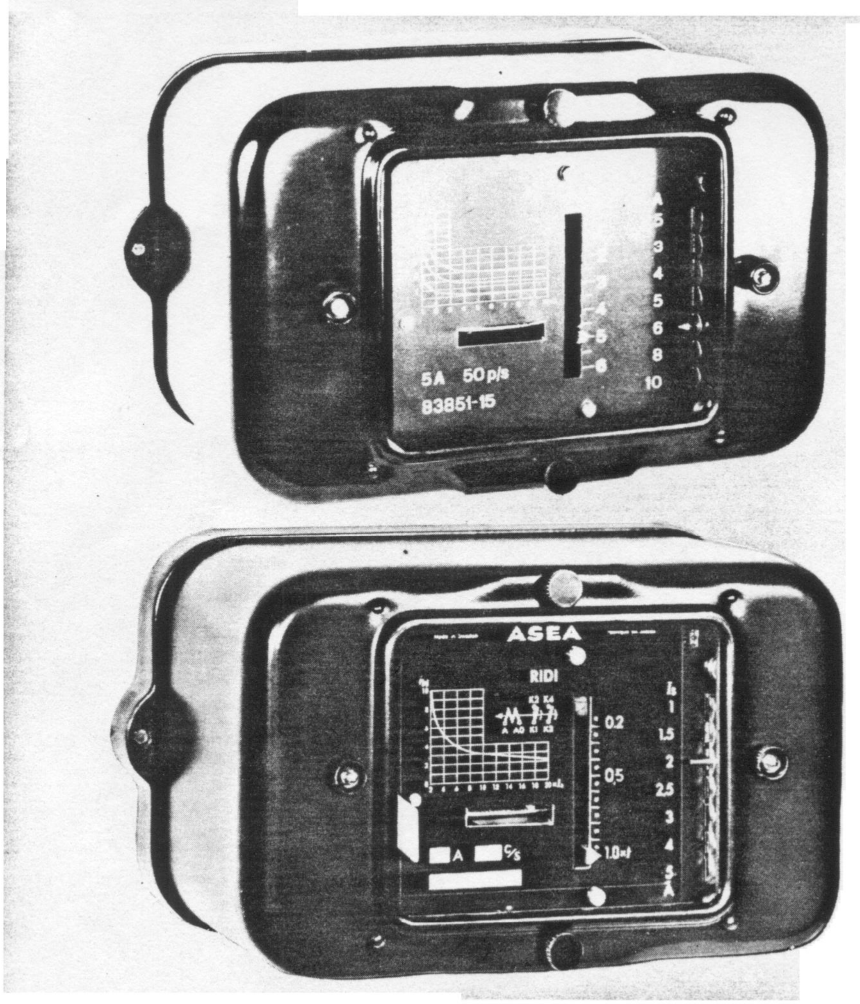
Catalogue RK 47-1E
Edition 2 October 1972 File R, Part 2

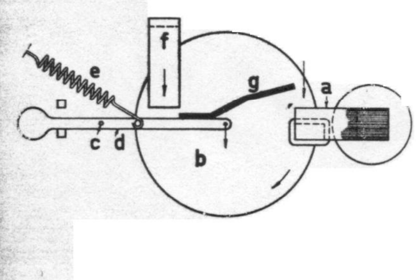
Time-lag overcurrent relays with inverse characteristic
type RI, RIS, RIDI and RIDSI

- Operating time decreasing as the current increases, but practically constant time at very high currents.
- Shape of time/current characteristic not affected by current setting.
- No "creep" since the time-lag mechanism is not actuated until the current reaches the set value.
- Instantaneous resetting if the current drops below 85 % of the current setting before the contacts have closed.
- Instantaneous resetting even when contacts have closed. Total resetting time is short, making it possible to use the relay for rapid auto-reclosing.
- Adjustable instantaneous operation for heavy currents; this function can be disconnected.
- Operating current and operating time practically independent of current waveform.
- Overshoot not more than 35 ms.
- The operating current and operating time can be adjusted when the relay is in service, and independently of one another.
- Indicators for start and tripping.

Contents

Relay type RI and RIDI (40832, 64305)





Time-lag over-current relays

Type RI and RIS with normal inverse-time characteristic
Type RIDI and RIDSI with time/current characteristic complying with British Standard 142:1966

The IDMTL-relays of types RIDI and RIDSI are variants of RI and RIS with a steeper inverse characteristic complying with BS 142; this means that, for an increase in current, the operating time decreases more sharply and over a wider range. This characteristic occasionally permits selective setting with shorter tripping times for large short-circuit currents than those obtained when a normal RI relay is used.

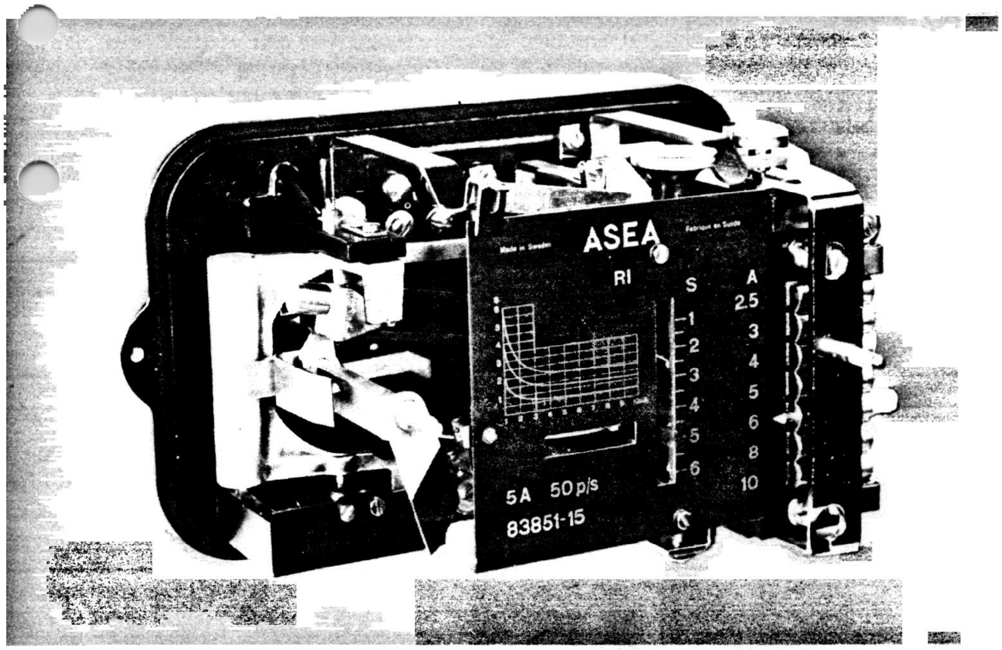


Fig. 1
Type RI, cover removed
(40833)

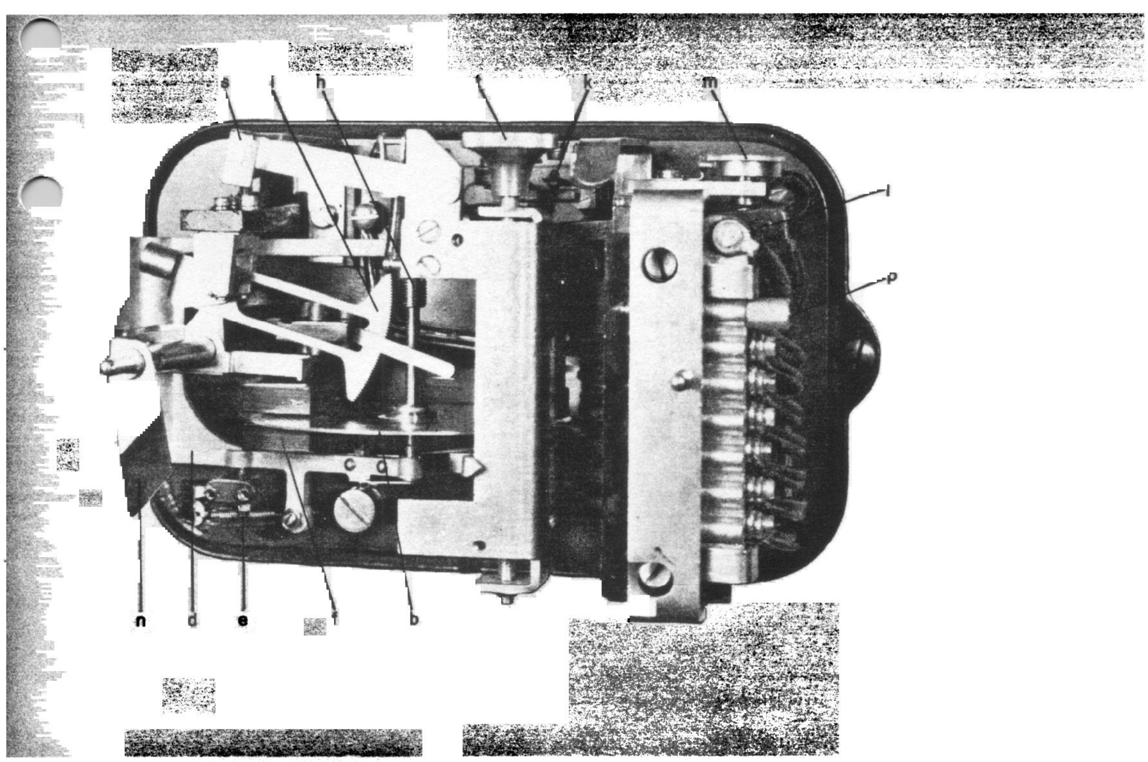


Fig. 2
Type RI, cover and rating plate removed
(29812)

Versions

There are two kinds of time-lag overcurrent relays for use as short-circuit protection for machines, transformers and lines: firstly, relays with inverse time characteristic, types RI, RIS, RIDI and RIDSI and secondly relays with independent time characteristic, type RIDA. This catalogue lists the types mentioned first and RIDA is described in Catalogue RK 47-2 E. For protection against thermal overload the ASEA accurate thermal over-current relay type RVAA can be recommended: see Catalogue RK 48-1 E.

Relays RI and RIS differ from one another in that RI has shading rings in the pole faces of the magnet whereas RIS has an auxiliary winding which is normally open and which must be closed before the relay can operate with a time-lag. RIS is generally used in directional over-current protections where a contact on a directional relay actuates the RIS relay by short-circuiting the auxiliary winding. RIDI and RIDSI which have a time/current characteristic complying with British Standard 142:1966, have practically the same design and mode of operation as RI and RIS. The difference between RIDSI and RIDI is that, like RIS, RIDSI has an auxiliary winding instead of shading rings. It is used in directional protections in the same way as RIS.

The description for type RI given below also applies to RIS, RIDI and RIDSI unless otherwise stated.

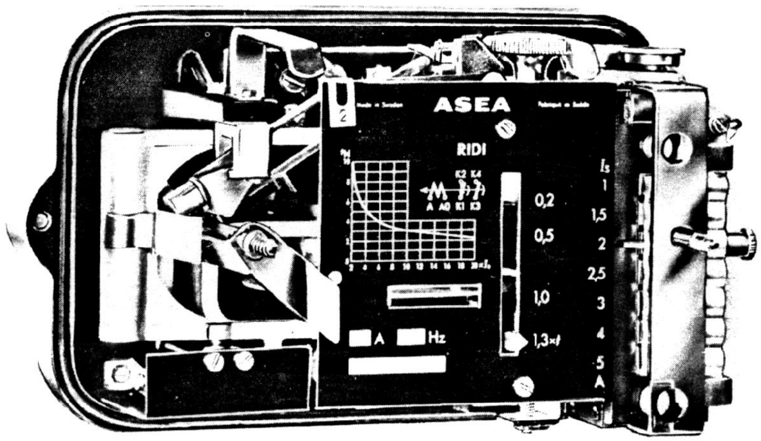


Fig. 3
Relay type RIDI with cover removed (63374)

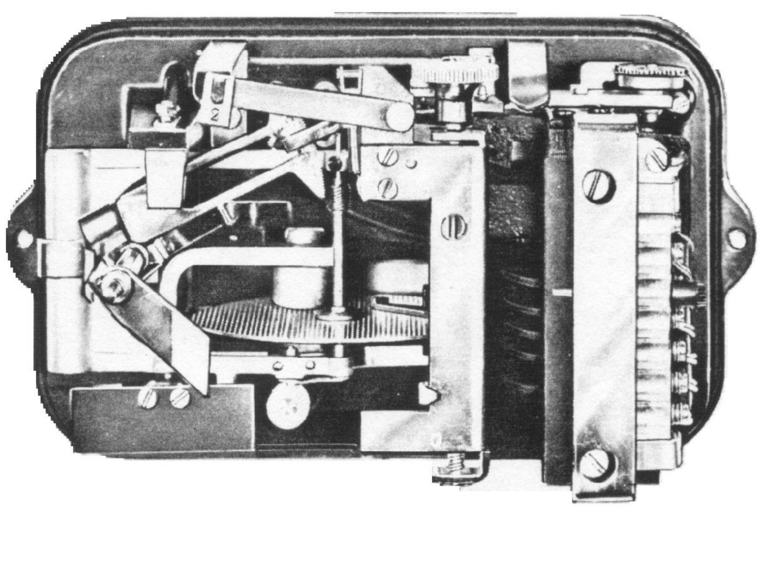


Fig. 4
Relay type RIDI, cover and rating plate removed (63375)

Design and mode of operation

The description of design and mode of operation given below also applies to RIS and RIDSI, except that the shading rings are replaced on these two types by the auxiliary windings which must be short-circuited before the induction disc will rotate.

The driving element of an RI relay comprises an electromagnet a with shading rings on the pole pieces and an induction disc b (see the diagram, Fig. 5).

When the relay coil is energised, the disc begins to rotate, provided that the current through the coil amounts to about 20 per cent of the set value. The stirrup-shaped frame d, in which the spindle carrying the disc is pivoted, is itself free to turn round its pivot c. When the current reaches the set value, the torque exerted by the electromagnet and the retarding pull of the permanent magnet f will suffice to swing the frame forwards. When the disc is carried forwards in this manner, a worm, h in Fig. 2, engages the toothed segment j. After a certain period the toothed segment actuates the armature l which picks up with a snap action and actuates the relay contacts. The design and mode of operation of the RIDI relays is the same, except that the brake magnet f is stronger and thus applies a more powerful braking force to induction disc b.

Current setting

The relay is set to different operating currents by inserting the wander-plug p, in Fig. 3, in the wander-plug bridge socket. This bridge is connected to different tappings on the relay coil and when the plug is withdrawn altogether, the relay is set to its highest current value. It is thus possible to alter the setting while the relay is in service, without any risk of interrupting the secondary winding of the current transformer to which the relay is connected.

Time-lag setting

The operating time is adjusted by means of a setting screw, t in Fig. 2, located above the time scale. This setting screw determines the initial position of the toothed segment.

Instantaneous operation

The relay can be set to operate instantaneously at a large current by means of the graduated setting screw, m in Fig. 2. This screw adjusts the air-gap of the armature.
The setting screw is graduated to give instantaneous operation at 4, 6 and 8 times the current setting. If instantaneous operation is not required, this screw is set to ∞.
See also Figs. 6 and 7 which show in detail the design of the device for instantaneous operation.

Contacts

The relays normally have two make and one break contacts (K1–K2 and K3–K4), the design of which is shown in Fig. 9. The contact K1–K2 can easily be changed from a make to a break contact by altering the fixed contact member K2. It is a simple matter to replace the contacts.

Indicator devices

The standard indicating device (design C, symbol 1 and 2) is provided with one yellow and one red flag. The yellow flag, 1 in Fig. 8, becomes visible as soon as the worm engages the toothed segment. The red flag, 2 in Fig. 8, becomes visible when the armature picks up. The red flag is reset by means of a knob placed above the window and the yellow flag is reset by another knob below the window. The relay may be fitted with a further red indicator flag which becomes visible only as result of time-lag operation (design D). This flag is reset with the same knob as the first red indicator flag.
There is also a design known as CK, symbol 3 and 4, which, like type C, is fitted with one yellow flag and one red flag: in this design the red flag has a manually resetting signalling contact.
The numbering of the flags and the way they indicate is shown in the table on page 16.

Locking device

There is a locking device to protect the relay during transport. A red flag indicates when the relay is locked (see A in Fig. 10). The flag can be seen in the lower left-hand corner of the window in the cover. When the relay has been mounted the cover is removed and the flag is turned 45° clockwise; the cover is replaced and the relay is then ready for service.

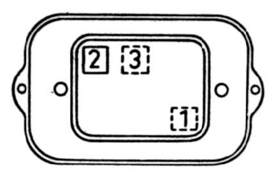


Fig. 8. Positioning of the flags

The red flags 2 and 3 are reset by the same knob, positioned above the window in the case.
The yellow flag 1 is reset by a knob positioned under the window in the case.

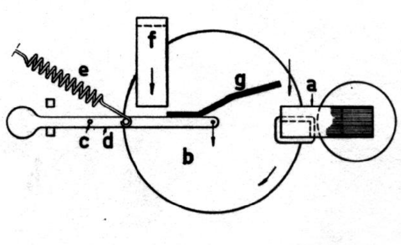


Fig. 5. Schematic drawing of the driving element for RI. (1225 164)

a. Electromagnet
b. Induction disc
c. Pivot
d. Frame
e. Spring
f. Permanent magnet
g. Armature, which keeps the worm engaged in the toothed segment

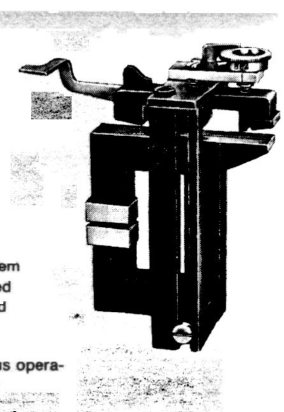


Fig. 6. Magnet system with balanced armature and setting screw for instantaneous operation. (43141)

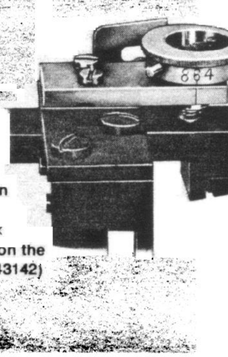


Fig. 7. Setting to obtain instantaneous operation at 6 × the current set on the current scale. (43142)

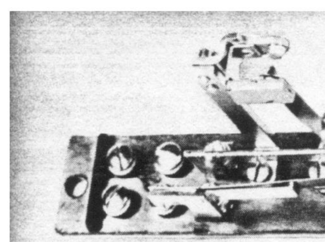


Fig. 9. Contacts for time-lag over-current relays type RI... The contacts are mounted on a terminal block of insulating material. (41841)

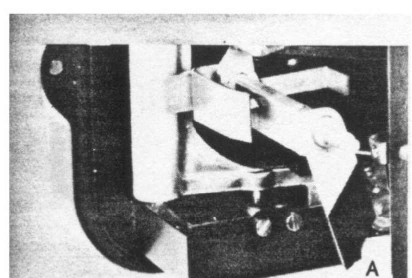


Fig. 10. A red flag A indicates when the relay is blocked. (40833)

Case and mounting

The relay is intended for panel mounting and has the terminals at the rear. It can also be fitted with front terminals at the lower edge of the base; see page 16.

The relay has a base of black-enamelled aluminium alloy and a dust-tight black-enamelled aluminium cover with a window. The dimensions of the relay and of the flush-mounting frame are given in the drawings on page 19. Fixing bolts for a panel up to 5 mm thick are supplied with the relay, but longer bolts are available; see Catalogue RK 90E. Terminal extension bolts are also available; see Catalogue RK 93 E.

Maintenance and testing

With normal conditions of service no maintenance is required apart from the lubrication of the bearings every year or two. If the atmosphere contains corrosive gases or dust or if it has a high relative humidity the relays should naturally be inspected more frequently.

It is important that the relays should not be exposed to dirt or abnormal quantities of dust. The covers should always be kept on and not be removed unnecessarily.
The relays need not be dismantled in order to lubricate the bearings. The lower bearing of the induction disc can be easily removed without using any tools, and this also makes the upper bearing more readily accessible. At the same time, the bearings carrying the swinging arm of the induction disc should also be lubricated. This is most conveniently done when the relay has its base-plate horizontal, but it can also be carried out with the relay in place if the bearing bushes are unscrewed and a drop of oil applied to them. The ASEA lubricating oil for relays listed in Catalogue RK 90 E should always be used.
The bearing should be lubricated when a relay is to be taken into service for the first time or after it has been out of service over a longer period.
The fact that the induction disc rotates, provides direct indication that the relay is operating, but for reasons of safety both the operating current and operating time should be checked as a matter of routine at least twice a year. These tests should be conducted without dismantling the relay. The simplest way of doing this is to use a relay testing switch type OBB as shown in Fig. 11, by means of which the relay can be disconnected from its supply and tripping circuits and connected up instead to test terminals on the relay panel. The relay can also be connected via a relay testing block type RTNP as described in Catalogue RK 93 E. Another useful aid for these tests is the relay testing set TURE, Fig. 12, with which currents, voltages and times may be conveniently measured. Type TURE is described in Catalogue RK 91–2 E.
By comparing the records of test results made at different times, any variation in operating values will indicate when an overhaul might be necessary. It should be noted that the lowest current at which the disc rotates can increase considerably above 20 % of the set current which applies for a newly adjusted relay, without the operating values being affected.
Relays of types RI and RIS are adjusted after manufacture so that the operating times are correct at the current of 3 × the set current. The tests should therefore also be made at this current and preferably at the one of the highest time-lag settings.
RIDI and RIDSI relays should be tested at the scale constant 1.0 and at 2 or 10 × the set current; for these values the operating time on the curve should be 10 and 3 seconds respectively. If any contacts have been subjected to overload so that the surfaces are pitted, they should be dressed with a diamond file or an extremely fine file. Emery cloth or similar products are unsuitable for dressing relay contacts as insulating grains of abrasive may remain on the contact surfaces and cause failures.

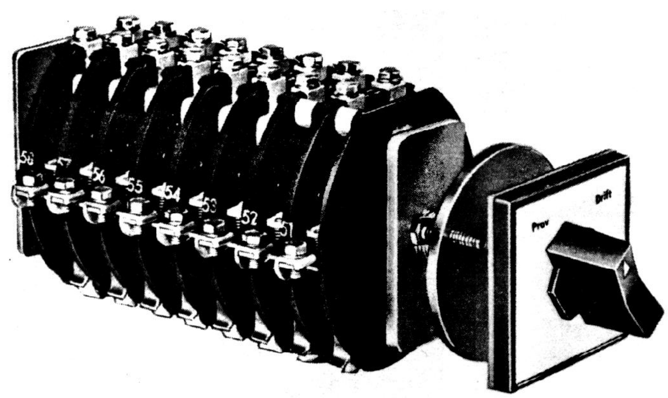


Fig. 11. Relay testing switch type OBB. (76303)

Fig. 12. Relay testing set type TURE. (62164)

Technical data

Operating and resetting values

The induction disc will begin to rotate at about 20% of the current set on the current scale, but the disc does not start to swing over and operate the relay until the current through the relay coil is 100 ±2% of the set current in RI and RIS relays and 100–105% in RIDI and RIDSI relays. If the current through the relay coil is interrupted before the contacts have changed position, or falls below 85% of the set value, the components of the relay reset instantaneously to their initial positions. Once the armature has picked up and actuated the contacts it will reset when the current has fallen to around 55% of the set value. RIS and RIDSI relays reset immediately if the auxiliary winding is opened before the contacts have changed position; with the auxiliary windings short-circuited, the same resetting conditions as for RI and RIDI will apply, i.e. 85 and 55% respectively.

Instantaneous operation

The relay is calibrated for instantaneous operation at 4, 6 or 8 times the current setting with the wander-plug bridge in the rated current position. With other current settings the instantaneous operating current differs from the theoretical value by an amount shown in Fig. 13. The **mean value** (e.g. for 10 trippings) of the operating current for each relay lies within the shaded area. It is also necessary owing to the dispersion, which means that an individual operating value may deviate by as much as ±10% from the mean value. The operating time for instantaneous operation is shown in Fig. 14. If the relay is to be used for series tripping in an installation where very large short-circuit currents can occur, the relay contacts may be damaged due to overloading when the instantaneous operation device is set to ∞. This setting should not be used in such cases. It should be noted in addition that the RIS and RIDSI relays also operate instantaneously if the auxiliary winding is open. The graduation given is for an open auxiliary winding and the operating values are about 25% higher when the winding is short-circuited.

Power consumption and overload capacity

The relays have a high over-current factor. At the **operating current** the power consumption is the same for all current set-

Fig. 13. Curves showing the instantaneous operating current at different current settings

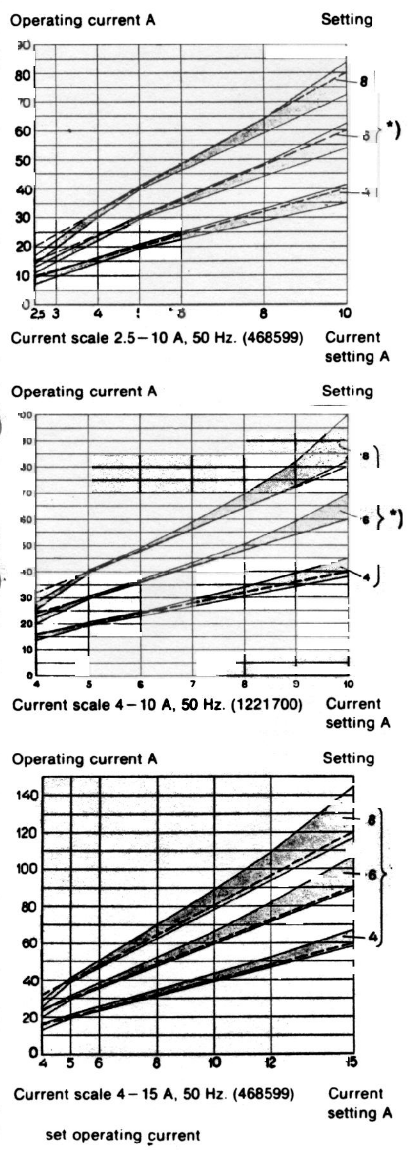


Fig. 14. Operating time at instantaneous operation. (Tko 15002)

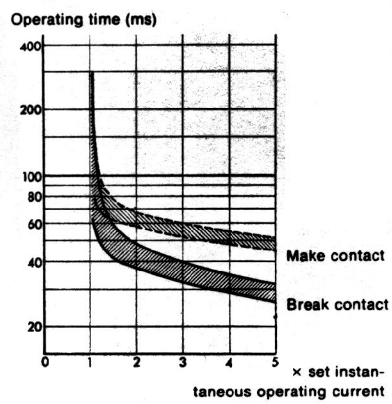
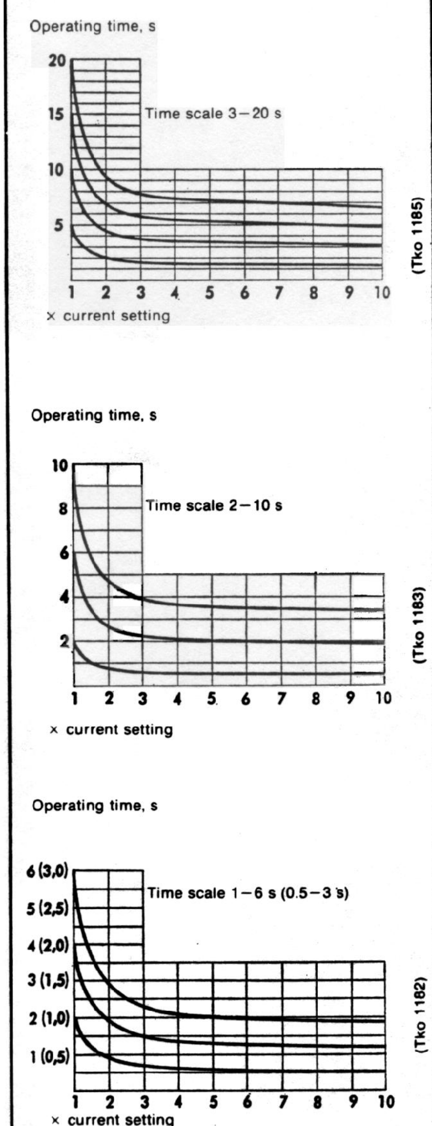


Fig. 15. Typical time-lag curves for RI and RIS



tings. Data for these are given in the tables on pages 10–15. A method for calculating the power consumption for other current is given on page 9.

Time-lag curves for RI and RIS

The time scales of the RI and RIS relays are graduated in a nominal operating time corresponding approximately to a time at a current equal to that on the scale.
If the current to the relay coil exceeds the set value, the operating time diminishes and the relay switches after a delay whose length depends on the magnitude of the current. Should this current exceed the set value by more than about 6 times, the operating time will have an almost constant value, i.e. it will be independent of the current. This **short-circuit time-lag** is usually in the region of one third of the set time-lag. It is a desirable feature in time-lag over-current relays required to operate with selective time-lag settings.

Fig. 15 shows time-lag curves for all time scales of the RI and RIS relays. These curves, which are also reproduced on the rating plates of the relays, give a concise picture of the relationship between the operating time and the over-current for a number of different time-lag settings. However, when selecting the time-lags for the various relays in an over-current protection, it is preferable to refer to the curves shown in Figs. 16–19.
Each of these curves shows the relationship between the set time and the operating time for a given value of overcurrent. The operating time corresponding to intermediate values of the over-current may be obtained by interpolation. The operating times given in the curves refer to operation for over-currents which increase instantaneously from a base value at about half the set current. The magnitude of the base current has, however, a negligible influence on the operating time. If, for example, the base values is just below the set current, the operating time will be about 0.02 seconds shorter than those given in the curves.

The graduation and setting errors of the time scale together with the dispersion in the operating time are to be found in the table below. The errors apply at over-currents exceeding twice the set current. In a case of small over-currents where the time-lag curve is steeper, the same accuracy cannot be counted upon, but in practice this is not of great importance in short-circuit protections. The time-scales available are shown in the ordering tables on pages 10–13.

Fig. 16. Operating times for RI and RIS with time scales 0.5–3 s. 50 Hz and 0.5–2.5 s. 60 Hz. (1223 208)

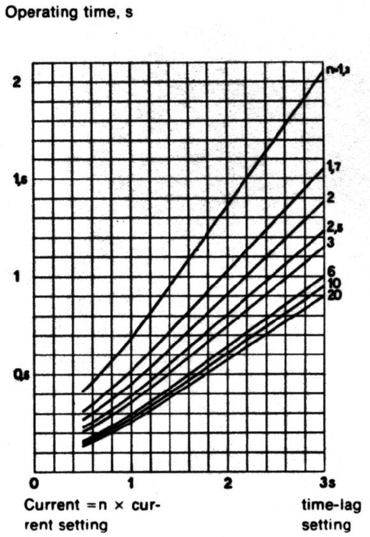


Fig. 17. Operating times for RI and RIS with time scales 1–6 s. 50 Hz and 1–5 s. 60 Hz. (1223 208)

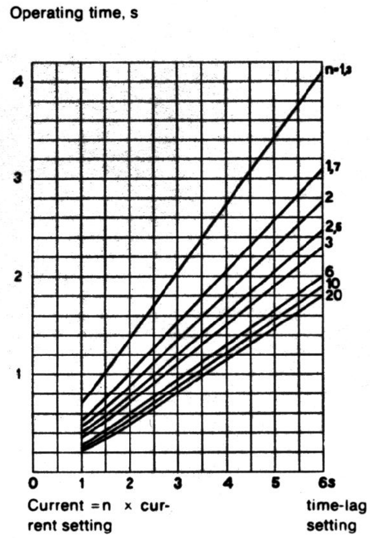


Fig. 18. Operating times for RI and RIS with time scales 2–10 s. 50 Hz and 2–8 s. 60 Hz. (1223 794)

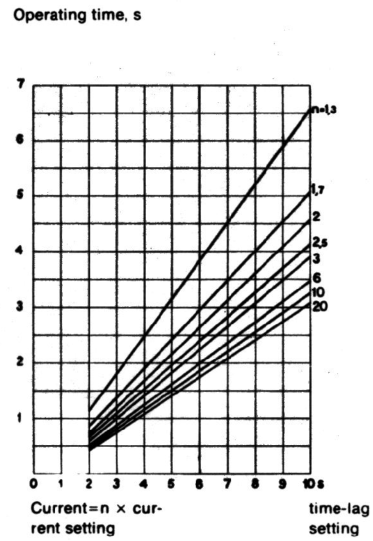
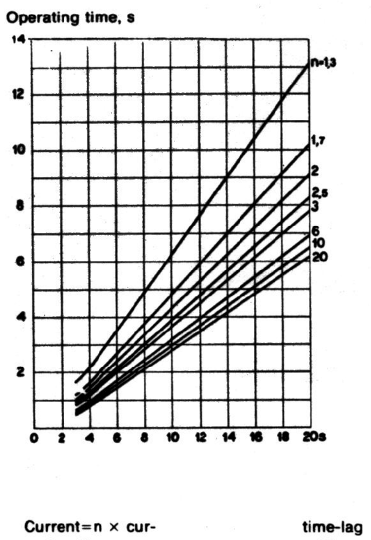


Fig. 19. Operating times for RI and RIS with time scales 3–20 s. 50 Hz and 3–16 s. 60 Hz. (1223 794)



Accuracy of the time-lag curves of RI and RIS

Time-scale s			Current			
			2–4 × set current		4–20 × set current	
50 Hz	60 Hz	Time-lag setting		Dispersion in operating time ms ±		Dispersion in operating time ms ±
0.5–3	0.5–2.5	lowest	70	50	40	20
		highest	120	90	60	30
1–6	1–5	lowest	80	50	60	30
		highest	150	90	120	60
2–10	2–8			80	80	40
				120	160	80
3–20	3–16		180	130	100	50
			400	250	300	150