



(SE970112)



(SE970124)

Features

- Micro-processor based time-overexcitation relay with continuous settings for operate values and time delays
- Wide setting range, 0,2 to 9,6 V/Hz
- Two measuring stages settable (1-3) \times scale constant U_e independently of each other
- Linear reset of "time counter" with 5 s/% of set value
- Stage 1 is programmable for 5 different inverse time characteristics and definite time delay settable 1-200 min
- Stage 2 is definite time delayed 0,1-20 s
- LED indicators for start and tripping
- Assemblies available with test switch and heavy duty trip circuits

Application

When power transformers are over-excited, the leakage flux increases and this results in heavy hysteresis and eddy-current losses in non-laminated parts of the transformers. If the temperature rise, due to these losses, is excessive, the insulation and core laminations can be damaged and flashovers may occur.

There are many causes of over-excitation:

- Power transformers which are directly connected to a generator can be subject to over-excitation during the start-up or shut-down of the generator.
- Load shedding in systems supplied by overhead lines or cables, can cause excessive voltage rises which result in over-excitation of power transformers connected to these systems. Voltage rise in conjunction with low loads can occur in both generator and distribution stations.

Generally, modern power transformers withstand relatively low over-excitation since the flux density is already high at rated values. To protect transformers against dangerous overheating during over-excitation, the excitation must be kept under strict control.

The RXLK 2H over-excitation relay monitors the magnitude of excitation by measuring the relationship between the voltage and the frequency. When the set operate value is exceeded, an alarm and delayed tripping is obtained. The inverse time tripping is settable with different characteristics in order to suit different types of power transformers.

Application (cont'd)

Inverse time characteristic 1 RATUB

See Fig. 1. This characteristic is similar to the previous ABB type RATUB protection. The curve follows the formula:

$$t(s) = \frac{0,18 \times K}{(X - 1)^2}$$

where K is settable constant 1 to 10.

X is overexcitation acc. to the formula

$$X = \frac{U/f}{(U/f) \text{ set value.}}$$

Inverse characteristic type 2-4

See Fig. 2, Fig. 3 and Fig. 4. Inverse time curve follows the formula according to ANSI-standard.

$$t = e^{-\frac{(X \cdot 100) - K1}{C}} \text{ in minutes}$$

where:

Type	K1	C
Inv 2	108,75 + (k-1) x 2,5	2,449
Inv 3	115 + (k-1) x 2,5	4,8858
Inv 4	113,5 + (k -1) x 2,5	3,04

X = actual U/f divided by set value (V/Hz)

K = a settable constant 1 to 10

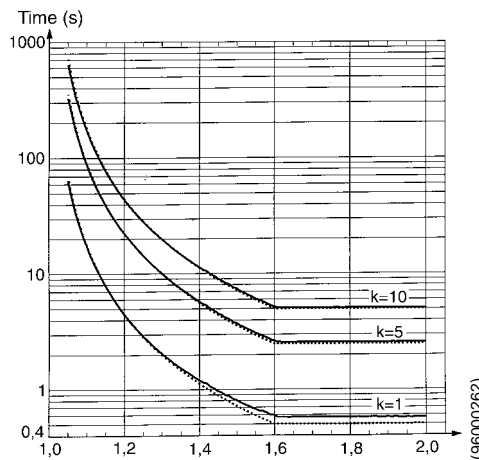


Fig. 1 Inverse characteristic type 1 (RATUB)

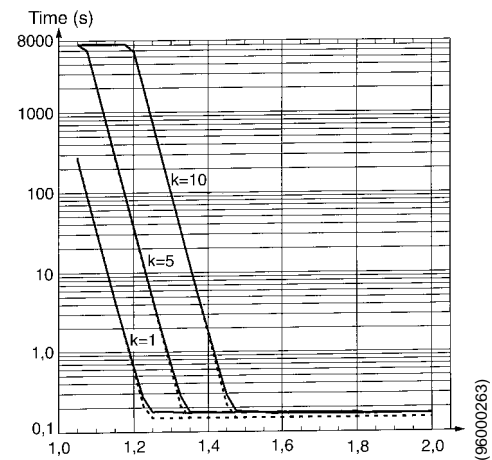


Fig. 2 Inverse characteristic type 2

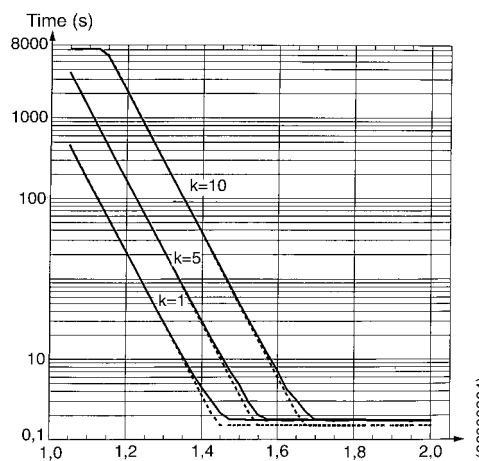


Fig. 3 Inverse characteristic type 3

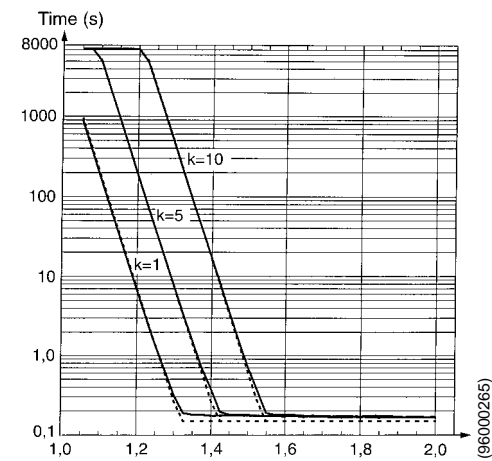
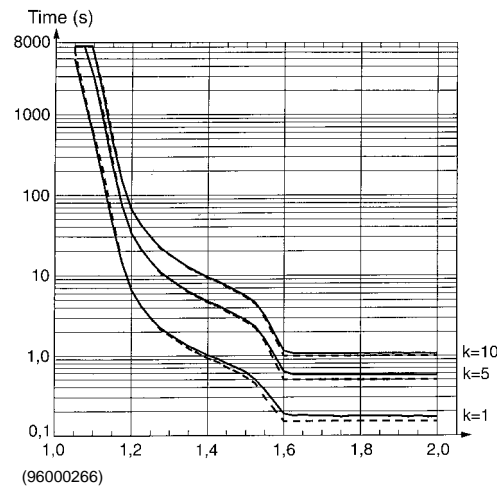


Fig. 4 Inverse characteristic type 4



The inverse curve type 5 is applicable for some ABB power transformers

Fig. 5 Inverse characteristic type 5

Measured curve = Solid line
Theoretical curve = Dotted line

Design

The overfluxing relay assemblies with RXLK 2H are available in variants with different output circuitries.

The RXLK 2H relay requires a separate dc-dc converter for auxiliary supply (± 24 V). One RXTUG converter can supply up to nine relays.

Note:

When the RXLK relay or the dc-dc converter is plugged into or withdrawn from a terminal base, the auxiliary voltage supply must be interrupted. Neither is it allowed to open wiring on plus or minus supply with unit in service.

The time-overexcitation relay, type RXLK 2H, is a static microprocessor based relay. The relay consists mainly of one input voltage transformer, filter circuits, microprocessor, HMI, LEDs for indications of relay in service, start and trip of stage 1 and trip of stage 2, and three output units which provide separate change-over contacts for start of stage 1, trip of stage 1 and trip of

stage 2. The relay is also equipped with one binary input for reset of LEDs. The relay is equipped with a filter for third harmonics suppression.

Start and stage 1 operate values are set on the scale marked V/Hz 1 on the front of the relay. The relay operates when the measured V/Hz-value exceeds the set value.

The start function output is energized immediately after the measured value exceeds the set start level.

For definite-time delayed operation the stage 1 output operates after the set time delay.

For inverse-time operation, the operate time will depend of the time setting (constant k) and by how much the measured V/Hz magnitude exceeds the start level setting.

The V/Hz stage 2 operates independently of stage 1.

Technical data

Table 1: Voltage input

Rated voltage U_r	100/200 V
Scale constant U_e	$(0,2-1,6) \times U_r \times 0,01$ V/Hz (in steps of 0,2)
Setting range V/Hz 1 100 V 200 V V/Hz 2 100 V 200 V	0,2-4,8 V/Hz 0,4-9,6 V/Hz 0,2-4,8 V/Hz 0,4-9,6 V/Hz
Power consumption at $U_r = 100$ V U = lowest U_e U = highest U_e	2 mVA 210 mVA
Overload capacity continuously during 10 s	$3,5 \times U_r$ (Max. 500 V AC for COMBIFLEX) $4,0 \times U_r$ (Max. 500 V AC for COMBIFLEX)

Table 2: Start and trip functions

Volt / Hertz function	Stage V/Hz 1	Stage V/Hz 2
Operating range	5-100 Hz (2-5 and 100-150 Hz with lower accuracy)	
Setting range	$(1-3) \times U_e$ (0,2-9,6 V/Hz)	
Frequency dependence within the range of: 44-66 Hz 4-100 Hz 2-150 Hz	< 1,0% < 4,5% < 17%	
Typical operate time at 50 Hz: (before operation 0,9 x start value) V/Hz = 1,1 x start value V/Hz = 1,3 x start value V/Hz = 1,5 x start value	Start function 50 ms 45 ms 40 ms	Trip function t = 0,1 s 80 ms 70 ms 65 ms
Typical reset time at 50 Hz: (after operation 0,9 x start value) V/Hz = 1,1 x start value V/Hz = 1,5 x start value V/Hz = 2,0 x start value	50 ms 45 ms 40 ms	
Consistency of operate value at: 2 Hz 5 Hz 20 Hz 50 Hz 100 Hz 150 Hz	< 2,0% < 1,5% < 1,0% < 0,5% < 0,5% < 0,5%	
Reset ratio within the range of: 5-100 Hz 2-150 Hz	> 95% > 94%	
Recovery time at 50 Hz	< 70 ms	
Overshoot time at 50 Hz	< 35 ms	
Influence of harmonics: 100 / 120 Hz, 20% 150 / 180 Hz, 20% 250 / 300 Hz, 20%	< 1% < 6% < 3%	

Table 3: Time functions

Time function	Stage V/Hz 1		Stage V/Hz 2
Time delay	Inverse time and Definite time		Definite time
Setting range	5 curves k = 1-10	t = k x 1, 2, 5, 10 or 20 min k = 1-10 (1-200 min)	0,1-20 s
Accuracy at 50 Hz	Curves 1-4 0,5% of X ¹ and 0,5% of the theoretical time and ±100 ms Curve 5 1,0% of X ¹ and 1,0% of the theoretical time and ±100 ms	0,5% of the theoretical time and ±100 ms	0,5% of the theoretical time and ±100 ms
Consistency	< 0,5%	< 0,5%	< 0,5%
Reset mode	Instantaneous or linear recovery		–
Formula for linear recovery	(0,2% / k) / s	(0,2% / t) / s	

1. X = actual U/f divided by set operate value)

Table 4: Auxiliary DC voltage supply

Auxiliary voltage EL for RXTUG 22H Auxiliary voltage for the relay	24-250 V DC, ±20% ±24 V (from RXTUG 22H)
Power consumption at RXTUG 22H input 24-250 V before operation after operation without RXTUG 22H ±24 V before operation after operation	Max. 5,5 W Max. 6,5 W Max. 2,0 W Max. 3,0 W

Table 5: Binary input

Binary input voltage RL	48-60 V and 110-220 V DC, -20% to +10%
Power consumption 48-60 V 110-220 V	Max. 0,3 W Max. 1,5 W

Technical data (cont'd)

Table 6: Output relays

Contacts	3 change-over
Maximum system voltage	250 V AC / DC.
Current carrying capacity continuous during 1 s	5 A 15 A
Making capacity at inductive load with L/R >10 ms during 200 ms during 1 s	30 A 10 A
Breaking capacity AC, max. 250 V, $\cos \varphi > 0,4$ DC, with L/R < 40 ms 48 V 110 V 220 V 250 V	8 A 1 A 0,4 A 0,2 A 0,15 A

Table 7: Electromagnetic disturbance tests

All tests are done together with the DC/DC-converter, RXTUG 22H

Test	Severity	Standard
Surge immunity test	1 and 2 kV, normal service 2 and 4 kV, destructive test	IEC 61000-4-5, class 3 IEC 61000-4-5, class 4
AC injection test	500 V, AC	SS 436 15 03, PL 4
Power frequency field immunity test	1000 A/m	IEC 61000-4-8
1 MHz burst test	2,5 kV	IEC 60255-22-1, class 3
Spark test	4-8 kV	SS 436 15 03, PL 4
Fast transient test	4 kV	IEC 60255-22-4, class 4
Electrostatic discharge test In normal service with cover on	8 kV (contact) 15 kV (air) 8 kV, indirect application	IEC 60255-22-2, class 4 IEC 60255-22-2, class 4 IEC 61000-4-2, class 4
Radiated electromagnetic field test	10 V/m, 26-1000 MHz	IEC 61000-4-3, level 3
Conducted electromagnetic test	10 V, 0,15-80 MHz	IEC 61000-4-6, level 3
Interruptions in auxiliary voltage 110 VDC, no resetting for interruptions	2-200 ms < 40 ms	IEC 60255-11

Table 8: Electromagnetic emission tests

Test	Severity	Standard
Conducted	0,15-30 MHz, class A	EN 50081- 2
Radiated emission	30-1000 MHz, class A	EN 50081- 2

Table 9: Insulation tests

Test	Severity	Standard
Dielectric test Circuit to circuit and circuit to earth Over open contact	2,0 kV AC, 1 min 1,0 kV AC, 1 min	IEC 60255-5
Impulse voltage test	5 kV, 1,2/50 μ s, 0,5 J	IEC 60255-5
Insulation resistance	> 100 M Ω at 500 V DC	IEC 60255-5

Table 10: Mechanical tests

Test	Severity	Standard
Vibration	Response: 2,0 g, 10-150-10 Hz Endurance: 1,0 g, 10-150-10 Hz, 20 sweeps	IEC 60255-21-1, class 2 IEC 60255-21-1, class 1
Shock	Response: 5 g, 11 ms, 3 pulses Withstand: 15 g, 11 ms, 3 pulses	IEC 60255-21-2, class 1
Bump	Withstand: 10 g, 16 ms, 1000 pulses	IEC 60255-21-2, class 1
Seismic	X axis: 3,0 g, 1-35-1 Hz Y axis: 3,0 g, 1-35-1 Hz Z axis: 2,0 g, 1-35-1 Hz	IEC 60255-21-3, class 2, extended (Method A)

Table 11: Temperature range

Storage	-20 °C to +70 °C
Permitted ambient temperature	-5 °C to +55°C

Table 12: Weight and dimensions

Equipment	Weight	Height	Width
RXLK 2H without RXTUG 22H	0,7 kg	4U	6C

Diagrams

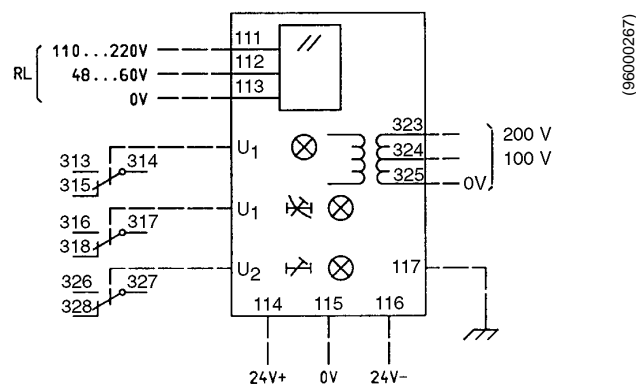


Fig. 6 Terminal diagram RXLK 2H.

Diagrams (cont'd)

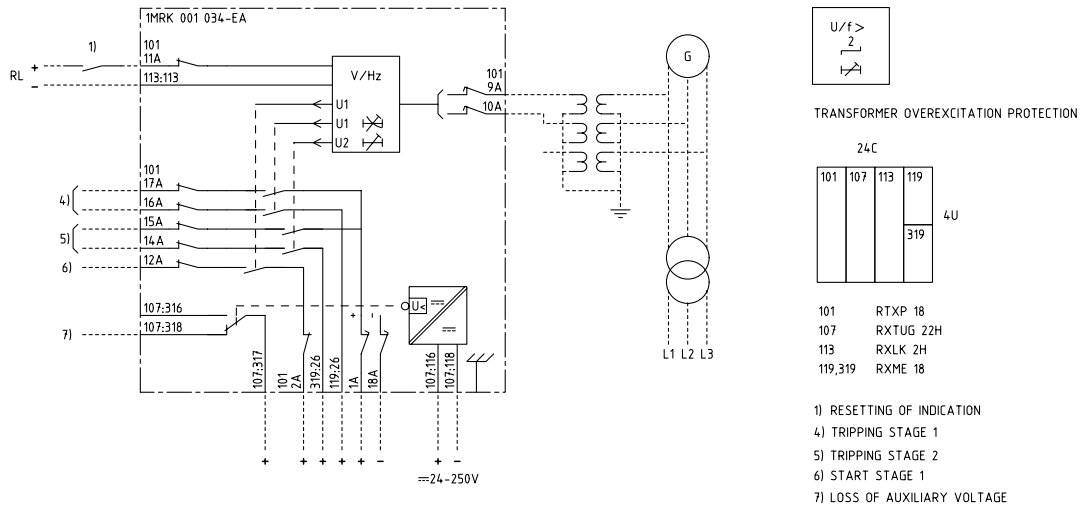


Fig. 7 Terminal diagram 1MRK 001 034-EAA

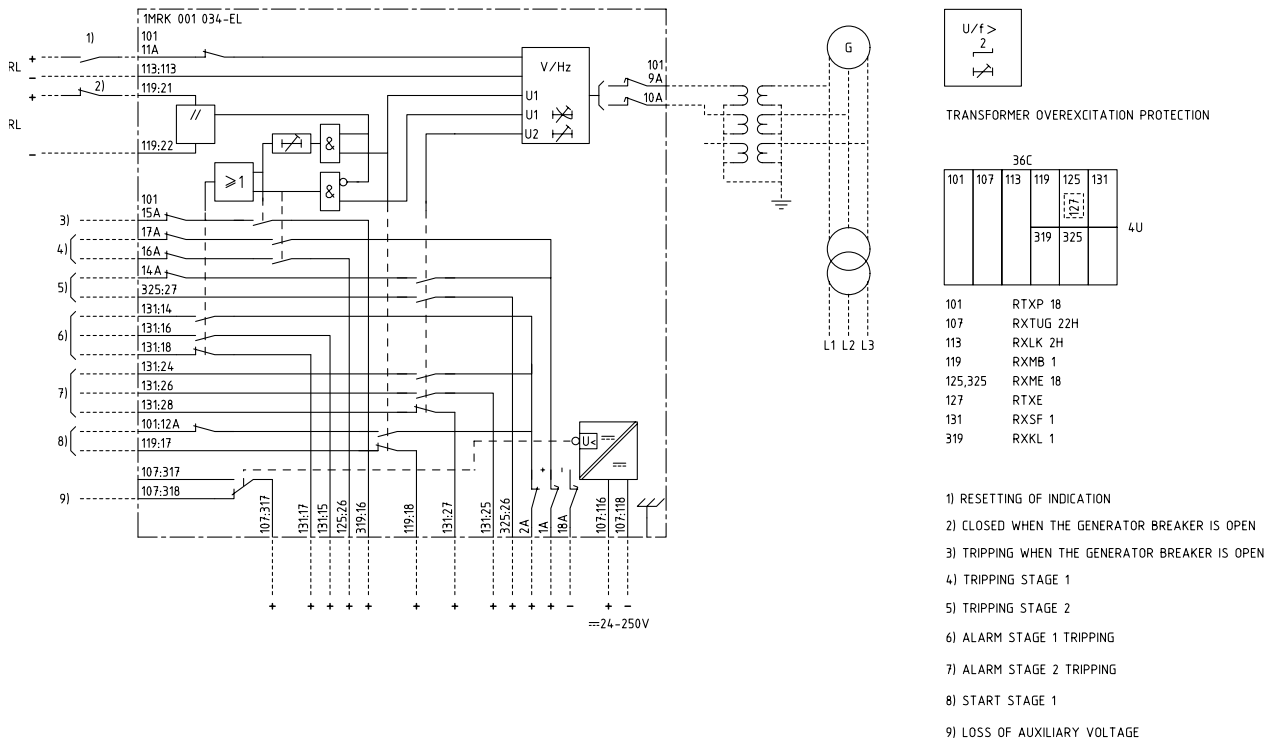


Fig. 8 Terminal diagram 1MRK 001 034-ELA
Similar to RATUB 2

Protection assemblies

RALK

Protection assemblies are built up based upon transformer time-overexcitation relay RXLK 2H. Test device RXP 18 and dc/dc-converter RXTUG 22H can also be included for specific application requirements. Test device RXP 18 is a tool for relay testing.

DC/DC-converter RXTUG 22H can be used either separately for a single protection or to feed also other protections with up to 9 units of the same relay family. With RXTUG 22H all requirements concerning disturbance emission and immunity with this protection assembly will be met.

The assemblies have output contacts as specified for the relay RXLK 2H, which in most cases are fully sufficient. Protections are nor-

mally available with output logic with heavy duty relay RXME 18 (RK 221 825-XX) with indicating flag and can upon request be completed with an output logic of free choice. Output relays are connected to separate auxiliary voltage.

The extremely flexible mounting system COMBIFLEX together with a modern CAD-system enables us to present a unique flexibility for designing assemblies upon the customers requests.

The interface voltage for enable or block impulses can be connected to either 48-60 V dc or 110-220 V dc by connecting the voltage circuit to separate terminals. At delivery all relays are connected for 110-220 V dc.

RALK 1 Single-phase transformer time-overexcitation protection

V/Hz	101 107	101 107	101 107 113	101 107 113 119	101 107 113 119 125 131
[1=>0]					
	101 RXP 18 107 RXLK 2H	101 RXTUG 22H 107 RXLK 2H	101 RXP 18 107 RXTUG 22H 113 RXLK 2H	101 RXP 18 107 RXTUG 22H 113 RXLK 2H 119 RXME 18 319 RXME 18	101 RXP 18 107 RXTUG 22H 113 RXLK 2H 119 RXMB 1 125 RXME 18 131 RXSF 319 RXKL 325 RXME 18
	Order No. Circuit diagram 1MRK 001 033-BA 1MRK 001 034-BA	Order No. Circuit diagram 1MRK 001 033-CA 1MRK 001 034-CA	Order No. Circuit diagram 1MRK 001 033-DA 1MRK 001 034-DA	Order No. Circuit diagram 1MRK 001 033-EA 1MRK 001 034-EA	Order No. Circuit diagram * 1MRK 001 033-EL 1MRK 001 034-EL

* Similar to RATUB 2

Mounting alternatives

All assemblies can be delivered in the following mounting alternatives:

- on apparatus bars
- in equipment frame 60C
- in RHGS
- in RHGX

Ordering

Specify RALK (Protection):

- Quantity
- Ordering number
- Code H, M
- Desired wording on the lower half of the test switch face plate max. 13 lines with 14 characters per line.

Specify RXLK (Loose Relay):

- Quantity
- Ordering number 1MRK 000 843-AA

Auxiliary voltage

For included auxiliary relays

	Code
24 V dc	<input type="checkbox"/> H5
48-55 V dc	<input type="checkbox"/> H6
110-125 V dc	<input type="checkbox"/> H7
220-250 V dc	<input type="checkbox"/> H8

Mounting

Mounting alternatives	Size	Article No.	Code
Apparatus bars			<input type="checkbox"/> M10
Equipment frame without door	4U 19"	1MRK 000 137-GA	<input type="checkbox"/> M11
Equipment frame with door	4U 19"	1MRK 000 137-KA	<input type="checkbox"/> M12
RHGX 4	4U 12C	RK 927 001-AB	<input type="checkbox"/> M71
RHGX 8	4U 24C	RK 927 002-AB	<input type="checkbox"/> M72
RHGX 12	4U 36C	RK 927 003-AB	<input type="checkbox"/> M73
RHGX 20	4U 60C	RK 927 004-AB	<input type="checkbox"/> M74
RHGS 30	6U x 1/1 19" rack	1MRK 000 315-A	<input type="checkbox"/> M81
RHGS 12	6U x 1/2 19" rack	1MRK 000 315-B	<input type="checkbox"/> M82
RHGS 6	6U x 1/4 19" rack	1MRK 000 315-C	<input type="checkbox"/> M83

References

Connection and installation components in COMBIFLEX	1MRK 513 003-BEN
Relay accessories COMBIFLEX	1MRK 513 004-BEN
Test system COMBITEST	1MRK 512 001-BEN
User's Guide RXLK 2H	1MRK 509 008-UEN

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