



Cambridge Instruments
& Engg. Co.

EST. 1963 · HOWRAH, INDIA

TEST REPORT FORM

Relay Secondary Injection Test

Phase overcurrent 50/51 · pickup, drop-off, inverse-time operating times and high-set element

01 Job and relay details

Customer / site	Feeder / panel ID	Test date
Relay make and model	Relay serial no.	Auxiliary supply
Test set model, serial no.	Test set calibration due	Tested by

02 Settings from the setting sheet

CT ratio primary (A)	CT secondary (A) ☐ 1 A ☐ 5 A	Pickup Is (A primary)	Time multiplier TMS
Operating characteristic ☐ Standard inverse ☐ Very inverse ☐ Extremely inverse ☐ Long-time inverse ☐ Definite time			
Definite-time delay (s)	High-set I>> (A primary)	High-set time (s)	Relay function tested
Is on the secondary (A) Is × CT sec / CT pri	I>> on the secondary (A) I>> × CT sec / CT pri	Curve constants k = ... α = ...	Tolerances come from the relay datasheet pickup % time % / ms reset ratio I>> % / s

03 Pickup and drop-off

Test	Expected A secondary	Measured A secondary	Error or reset ratio	Result
Pickup				☐ Pass ☐ Fail
Drop-off (reset)				☐ Pass ☐ Fail

04 Operating time on the selected characteristic

Multiple of Is x Is	Inject A sec = x × Is sec	Expected time s, see page 2	Measured time s	Error (meas / exp) - 1	Allowed band ± s	Result
						☐ Pass ☐ Fail
						☐ Pass ☐ Fail
						☐ Pass ☐ Fail
						☐ Pass ☐ Fail
						☐ Pass ☐ Fail
						☐ Pass ☐ Fail

05 High-set element (I>>)

Test	Expected	Measured	Error	Result
High-set pickup (A sec)				☐ Pass ☐ Fail
High-set operating time (s)				☐ Pass ☐ Fail





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Checks, result, sign-off and a plot sheet for expected against measured times

06 Checks

Check	Status
CT ratio and polarity verified against nameplate and drawings	☐ OK ☐ Not OK ☐ N/A
Relay settings read back and match the approved setting sheet	☐ OK ☐ Not OK ☐ N/A
Wiring and terminations checked against the schematic	☐ OK ☐ Not OK ☐ N/A
Trip circuit continuity and trip coil supervision checked	☐ OK ☐ Not OK ☐ N/A
Output contacts operate the circuit breaker (trip test)	☐ OK ☐ Not OK ☐ N/A
Flags, LEDs and event records operate correctly	☐ OK ☐ Not OK ☐ N/A
Insulation resistance of relay circuits measured per instructions	☐ OK ☐ Not OK ☐ N/A
Test connections removed, relay returned to service state	☐ OK ☐ Not OK ☐ N/A

07 Result and sign-off

Overall result

☐ PASS ☐ FAIL ☐ INCOMPLETE

Tolerances taken from

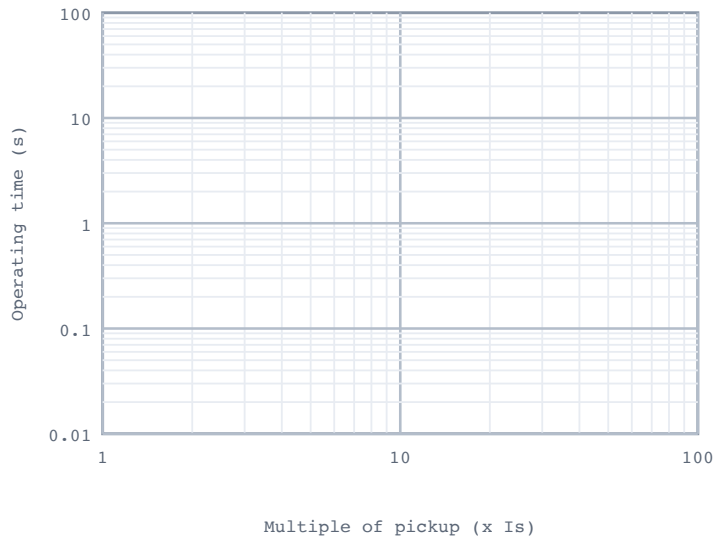
Remarks and recommended action

Signature and date: tester

Signature and date: reviewer

08 Plot sheet

log-log chart: o expected, x measured



- Mark each expected time with a circle and each measured time with a cross at the same multiple. The two should sit close together along the curve.
- A measured point that drifts away at one multiple only suggests a timing or injection error at that point. A whole curve that is shifted suggests a TMS or curve setting that differs from the setting sheet.



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WORKSHEET AND REFERENCE

Expected times and curves

IEC 60255-151 inverse-time characteristics, base times for TMS = 1 and a log-log chart

01 Formula

Inverse-time operating time

$$t = \text{TMS} \times k / ((I / I_s)^{\alpha} - 1)$$

Injection current

$$I \text{ (A sec)} = \text{multiple} \times I_s \text{ (A sec)}$$

Allowed band

larger of (tol % × t) and tol ms

02 Base operating time with TMS = 1

seconds. Multiply by your TMS to get the expected time

Curve	k	α	2 ×	3 ×	5 ×	10 ×	20 ×
Standard inverse	0.14	0.02	10.03	6.302	4.28	2.971	2.267
Very inverse	13.5	1	13.5	6.75	3.375	1.5	0.7105
Extremely inverse	80	2	26.67	10	3.333	0.8081	0.2005
Long-time inverse	120	1	120	60	30	13.33	6.316

Example: Standard inverse, TMS 0.2, injection at 2 × Is: 10.03 × 0.2 = 2.006 s. For definite time the expected time is simply the delay setting. The formula applies for multiples above 1, and many relays limit the characteristic above a maximum multiple (often 20), so stay within the range the manufacturer states.

03 Notes

- Constants are from IEC 60255-151. Check that your relay uses the same characteristic, since manufacturers can define curves differently.
- This form assumes no tolerance. Take pickup, timing, reset and high-set tolerances from the relay datasheet or your test specification and write them in section 02.
- Secondary injection tests the relay and its settings. It does not prove CT ratio, polarity or wiring on its own, which is why those checks are listed. Follow your site permit and safety procedure.

CIE INSTRUMENTS FOR THIS TEST

RTS-5

Single-phase, 0 to 200 A AC, built-in digital timer

RTS-5A

Portable trolley, 0 to 200 A AC, AC or DC voltage output

RTS-33

Three-phase, 0 to 360° phase angle, for distance, directional and differential relays



See the test sets

Scan for CIE relay test sets.
cieinstruments.in/products

