TEST REPORT

ANSI 50/51 · ANSI 50N/51N · ANSI 81 · ANSI 67N · ANSI 27/59 · ANSI 46

Date: **28/nov/2026**
Time: **1:20:24 p. m.**

INSTALLATION DATA

Name:	**SUBESTACIÓN DEMO**
Address:	**CIUDAD, PAÍS**
Substation:	**S/E Ejemplo**
Cell/Cubicle:	**Celda 10-1**

PROTECTIVE DEVICE DATA

Name:	**PROT CELDA 10-1**
Type:	**DIGITAL**
Brand:	**SIEMENS**
Model:	**7SJ62**
Serial:	**BM0000000**

TEST DEVICE DATA

Brand:	**MEGGER**
Model:	**FREJA300**
Serial:	**0000000**

RELAY SETTINGS DATA

ANSI 51

Ip:	**1.50** A [180.0 A prim]
TD:	**0.50** Seg
Norma:	**ANSI**
Curva:	

SIEMENS ANSI – EXTREMADAMENTE INVERSA

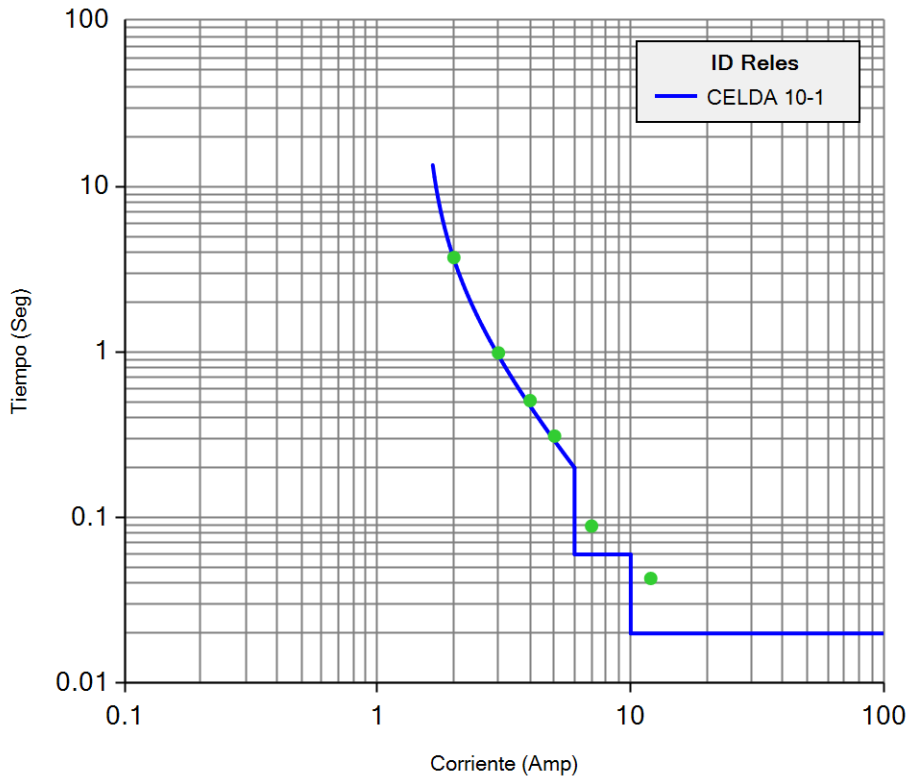
$$T = \left[\frac{5.64}{(I/Ip)^2 - 1} + 0.02434\right] \times TD$$

ANSI 50

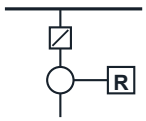
I>:	**6.00** A [720.0 A prim]
TI>:	**0.06** Seg
I>>:	**10.00** A [1200.0 A prim]
TI>>:	**0.02** Seg

TIME–CURRENT CURVE

Log–log scale



CONNECTION



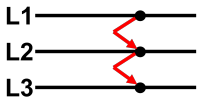
CT —

TEST DATA

Test Date:
22/11/26

Test Time:
10:07 a. m.

FAULT TYPE



THREE-PHASE (A-B-C)

TEST RESULTS

OVERALL RESULT: PASSED · 6 of 6 points within tolerance

Points	I fail (A)	T Trip (S)	T Theor. (S)	Tol. ± (ms)	Diff. ms (%)	Prim Amp	Status
1	2.00	3.720	3.638	363.8	+82.0 (+2.3 %)	—	Pass
2	3.00	0.988	0.952	95.2	+36.3 (+3.8 %)	—	Pass
3	4.00	0.509	0.474	47.4	+35.0 (+7.4 %)	—	Pass
4	5.00	0.311	0.291	40	+19.6 (+6.7 %)	—	Pass
5	7.00	0.089	0.060	60	+29.3 (+48.9 %)	—	Pass
6	12.00	0.043	0.020	60	+22.5 (+112.7 %)	—	Pass

NOTES

.- INDICACION DE DISPAROS ...OK
.- APERTURA INTERRUPTOR...OK

EVIDENCE 1



ANSI 50/51 Overcurrent · fault A-B

RELAY SETTINGS DATA

ANSI 51

Ip: **1.50** A [180.0 A prim]
TD: **0.50** Seg
Norma: **ANSI**
Curva:

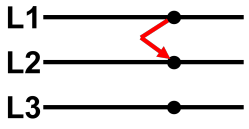
SIEMENS ANSI – EXTREMADAMENTE INVERSA

$$T = \left[\frac{5.64}{(I/Ip)^2 - 1} + 0.02434\right] \times TD$$

ANSI 50

I>: **6.00** A [720.0 A prim]
TI>: **0.06** Seg
I>>: **10.00** A [1200.0 A prim]
TI>>: **0.02** Seg

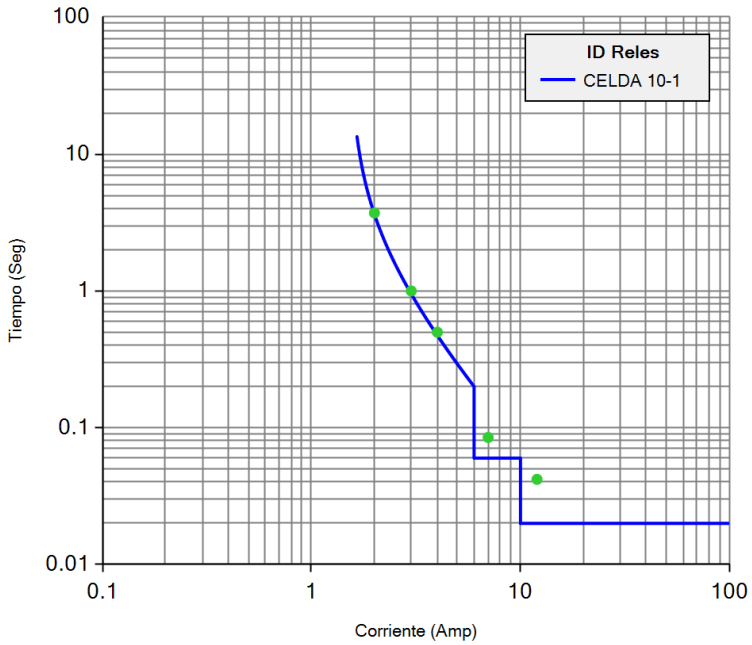
FAULT TYPE



TWO-PHASE (A-B)

TIME–CURRENT CURVE

Time on log scale



PARAMETERS		TEST DATA		TOLERANCE	
T max	**10 s**	Test Date:	**22/11/26**	Zone 51 (inverse)	**± 10 % + 40 ms**
Pre-fault	**0 s**	Test Time:	**10:23 a. m.**	Zone 50 (instantaneous)	**± 30 % + 60 ms**
Trip BI	**1**				

TEST RESULTS · ANSI 50/51

OVERALL RESULT: PASSED · 5 of 5 valid points

Points	Fault I (A sec)	T Trip (S)	T Theor. (S)	Tol. ± (ms)	Diff. ms (%)	Stage	Status
1	2.00	3.721	3.638	363.8	+83.4 (+2.3 %)	51	Pass
2	3.00	1.000	0.952	95.2	+48.2 (+5.1 %)	51	Pass
3	4.00	0.500	0.474	47.4	+26.0 (+5.5 %)	51	Pass
4	7.00	0.085	0.060	60	+25.1 (+41.8 %)	50	Pass
5	12.00	0.042	0.020	60	+21.5 (+107.7 %)	50	Pass

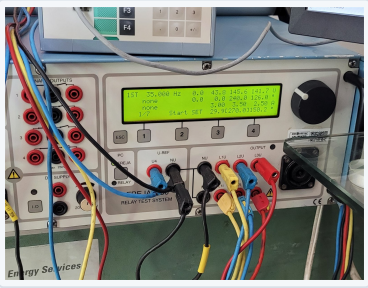
NOTES

DISPAROS ...OK

EVIDENCE 1



EVIDENCE 2



ANSI 50/51 Overcurrent · fault B-C

RELAY SETTINGS DATA

ANSI 51

Ip: **1.50** A [180.0 A prim]
TD: **0.50** Seg
Norma: **ANSI**
Curva:

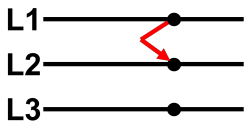
SIEMENS ANSI – EXTREMADAMENTE INVERSA

$$T = \left[\frac{5.64}{(I/Ip)^2 - 1} + 0.02434\right] \times TD$$

ANSI 50

I>: **6.00** A [720.0 A prim]
TI>: **0.06** Seg
I>>: **10.00** A [1200.0 A prim]
TI>>: **0.02** Seg

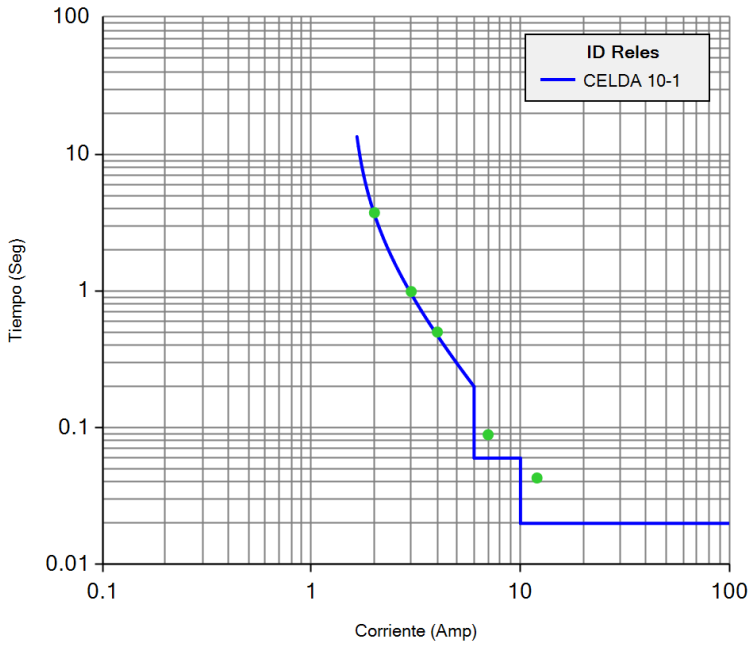
FAULT TYPE



TWO-PHASE (B-C)

TIME–CURRENT CURVE

Time on log scale



PARAMETERS		TEST DATA		TOLERANCE	
T max	**10 s**	Test Date:	**22/11/26**	Zone 51 (inverse)	**± 10 % + 40 ms**
Pre-fault	**0 s**	Test Time:	**10:24 a. m.**	Zone 50 (instantaneous)	**± 30 % + 60 ms**
Trip BI	**1**				

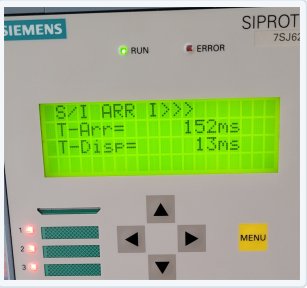
TEST RESULTS · ANSI 50/51

OVERALL RESULT: PASSED · 5 of 5 valid points

Points	Fault I (A sec)	T Trip (S)	T Theor. (S)	Tol. ± (ms)	Diff. ms (%)	Stage	Status
1	2.00	3.733	3.638	363.8	+94.6 (+2.6 %)	51	Pass
2	3.00	0.990	0.952	95.2	+38.0 (+4.0 %)	51	Pass
3	4.00	0.501	0.474	47.4	+26.9 (+5.7 %)	51	Pass
4	7.00	0.089	0.060	60	+28.7 (+47.8 %)	50	Pass
5	12.00	0.043	0.020	60	+23.1 (+115.7 %)	50	Pass

NOTES

EVIDENCE 1



ANSI 50/51 Overcurrent · fault C-A

RELAY SETTINGS DATA

ANSI 51

Ip: **1.50** A [180.0 A prim]
TD: **0.50** Seg
Norma: **ANSI**
Curva:

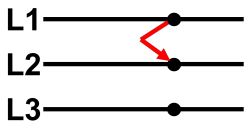
SIEMENS ANSI – EXTREMADAMENTE INVERSA

$$T = \left[\frac{5.64}{(I/Ip)^2 - 1} + 0.02434\right] \times TD$$

ANSI 50

I>: **6.00** A [720.0 A prim]
TI>: **0.06** Seg
I>>: **10.00** A [1200.0 A prim]
TI>>: **0.02** Seg

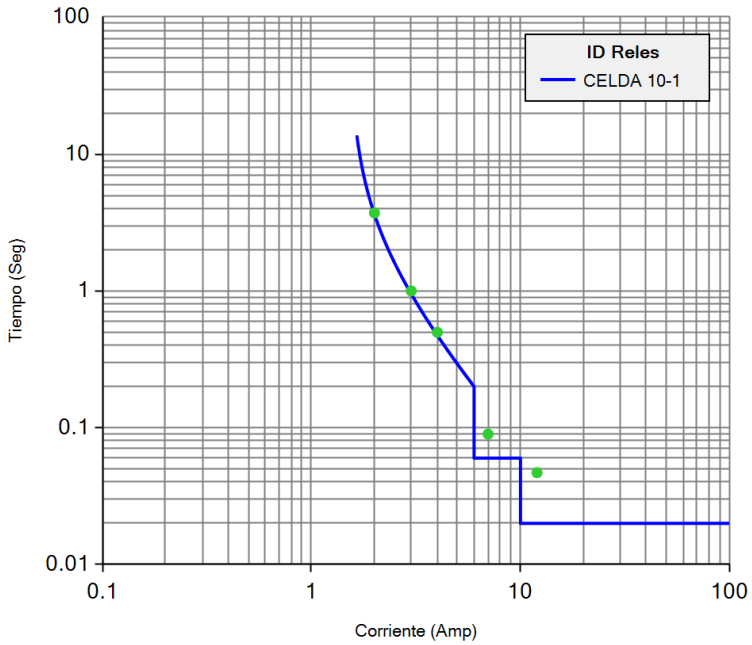
FAULT TYPE



TWO-PHASE (C-A)

TIME–CURRENT CURVE

Time on log scale



PARAMETERS		TEST DATA		TOLERANCE	
T max	**10 s**	Test Date:	**22/11/26**	Zone 51 (inverse)	**± 10 % + 40 ms**
Pre-fault	**0 s**	Test Time:	**10:28 a. m.**	Zone 50 (instantaneous)	**± 30 % + 60 ms**
Trip BI	**1**				

TEST RESULTS · ANSI 50/51

OVERALL RESULT: PASSED · 5 of 5 valid points

Points	Fault I (A sec)	T Trip (S)	T Theor. (S)	Tol. ± (ms)	Diff. ms (%)	Stage	Status
1	2.00	3.722	3.638	363.8	+84.0 (+2.3 %)	51	Pass
2	3.00	1.001	0.952	95.2	+48.8 (+5.1 %)	51	Pass
3	4.00	0.499	0.474	47.4	+25.8 (+5.5 %)	51	Pass
4	7.00	0.090	0.060	60	+29.6 (+49.4 %)	50	Pass
5	12.00	0.047	0.020	60	+26.9 (+134.5 %)	50	Pass

NOTES

EVIDENCE 1



ANSI 50N/51N Overcurrent · fault A-N

RELAY SETTINGS DATA

ANSI 51N

IEp: **0.60** A [72.0 A prim]
TD: **0.20** Seg
Norma: **IEC**
Curva:

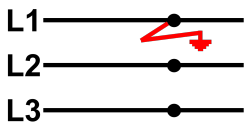
IEC– NORMAL INVERSE

$$T = \frac{0.14}{(I/Ip)^{0.02} - 1} \; x \; TD$$

ANSI 50N

IE>: **3.00** A [360.0 A prim]
TIE>: **0.04** Seg

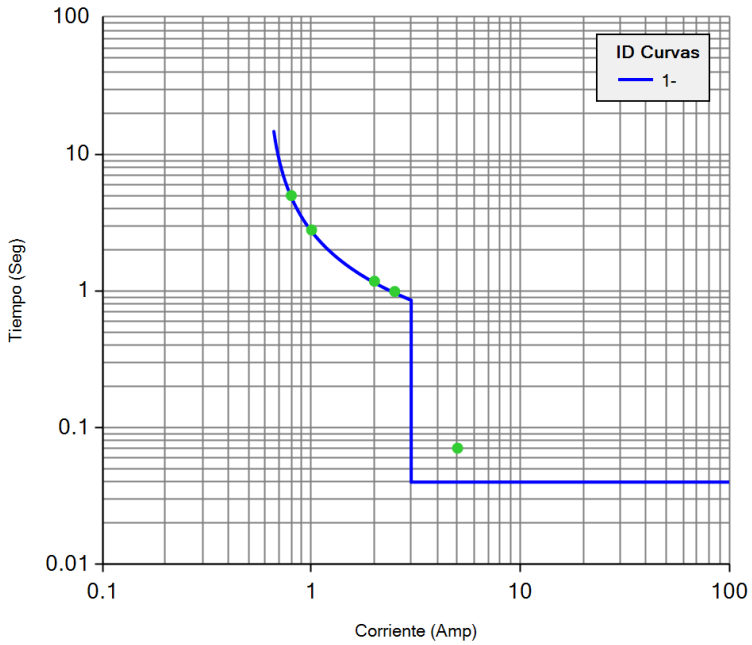
FAULT TYPE



GROUND (A-N)

TIME–CURRENT CURVE

Time on log scale



PARAMETERS		TEST DATA	TOLERANCE
T max	**10 s**	Test Date: **22/11/26**	Zone 51 (inverse) **± 10 % + 40 ms**
Pre-fault	**0 s**	Test Time: **8:43 p. m.**	Zone 50 (instantaneous) **± 30 % + 60 ms**
Trip BI	**1**		

TEST RESULTS · ANSI 50N/51N

OVERALL RESULT: PASSED · 5 of 5 valid points

Points	Fault I (A sec)	T Trip (S)	T Theor. (S)	Tol. ± (ms)	Diff. ms (%)	Stage	Status
1	0.80	4.986	4.853	485.3	+133.8 (+2.8 %)	51	Pass
2	1.00	2.793	2.727	272.7	+66.5 (+2.4 %)	51	Pass
3	2.00	1.179	1.149	114.9	+29.8 (+2.6 %)	51	Pass
4	2.50	0.991	0.967	96.7	+24.2 (+2.5 %)	51	Pass
5	5.00	0.071	0.040	60	+31.3 (+78.3 %)	50	Pass

NOTES

ANSI 50N/51N Overcurrent · fault B-N

RELAY SETTINGS DATA

ANSI 51N

IEp: **0.60** A [72.0 A prim]
TD: **0.20** Seg
Norma: **IEC**
Curva:

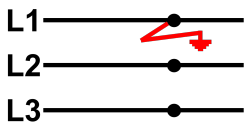
IEC– NORMAL INVERSE

$$T = \frac{0.14}{(I/Ip)^{0.02} - 1} \; x \; TD$$

ANSI 50N

IE>: **3.00** A [360.0 A prim]
TIE>: **0.04** Seg

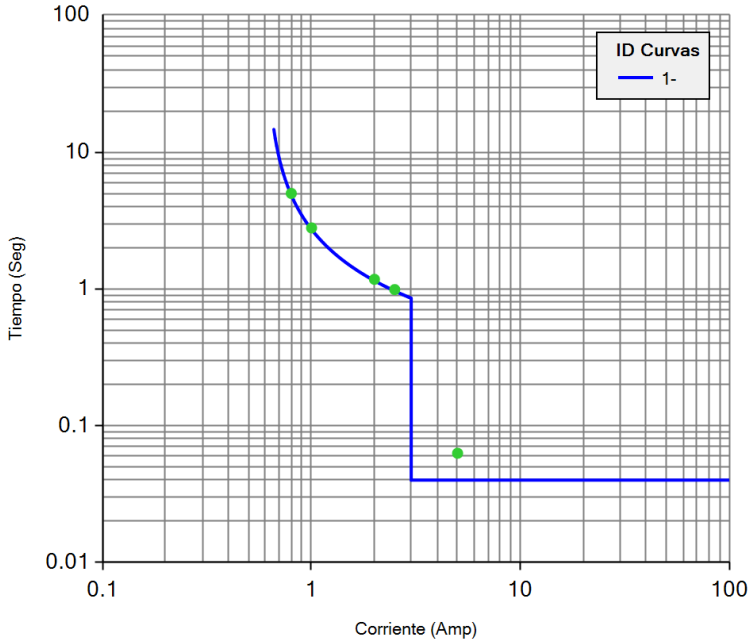
FAULT TYPE



GROUND (B-N)

TIME–CURRENT CURVE

Time on log scale



PARAMETERS		TEST DATA	TOLERANCE
T max	**10 s**	Test Date: **22/11/26**	Zone 51 (inverse) **± 10 % + 40 ms**
Pre-fault	**0 s**	Test Time: **8:44 p. m.**	Zone 50 (instantaneous) **± 30 % + 60 ms**
Trip BI	**1**		

TEST RESULTS · ANSI 50N/51N

OVERALL RESULT: PASSED · 5 of 5 valid points

Points	Fault I (A sec)	T Trip (S)	T Theor. (S)	Tol. ± (ms)	Diff. ms (%)	Stage	Status
1	0.80	4.996	4.853	485.3	+143.3 (+3.0 %)	51	Pass
2	1.00	2.794	2.727	272.7	+67.0 (+2.5 %)	51	Pass
3	2.00	1.177	1.149	114.9	+28.3 (+2.5 %)	51	Pass
4	2.50	0.990	0.967	96.7	+22.4 (+2.3 %)	51	Pass
5	5.00	0.063	0.040	60	+23.0 (+57.5 %)	50	Pass

NOTES

ANSI 50N/51N Overcurrent · fault C-N

RELAY SETTINGS DATA

ANSI 51N

IEp: **0.60** A [72.0 A prim]
TD: **0.20** Seg
Norma: **IEC**
Curva:

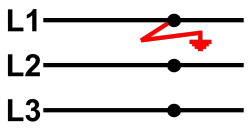
IEC– NORMAL INVERSE

$$T = \frac{0.14}{(I/Ip)^{0.02} - 1} \; x \; TD$$

ANSI 50N

IE>: **3.00** A [360.0 A prim]
TIE>: **0.04** Seg

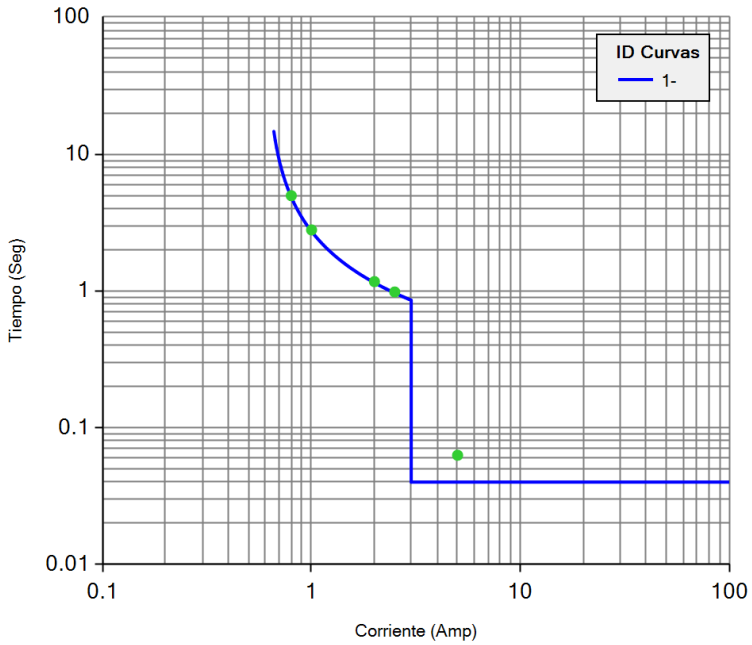
FAULT TYPE



GROUND (C-N)

TIME–CURRENT CURVE

Time on log scale



PARAMETERS		TEST DATA	TOLERANCE
T max	**10 s**	Test Date: **22/11/26**	Zone 51 (inverse) **± 10 % + 40 ms**
Pre-fault	**0 s**	Test Time: **8:44 p. m.**	Zone 50 (instantaneous) **± 30 % + 60 ms**
Trip BI	**1**		

TEST RESULTS · ANSI 50N/51N

OVERALL RESULT: PASSED · 5 of 5 valid points

Points	Fault I (A sec)	T Trip (S)	T Theor. (S)	Tol. ± (ms)	Diff. ms (%)	Stage	Status
1	0.80	4.972	4.853	485.3	+119.6 (+2.5 %)	51	Pass
2	1.00	2.794	2.727	272.7	+67.1 (+2.5 %)	51	Pass
3	2.00	1.171	1.149	114.9	+22.4 (+1.9 %)	51	Pass
4	2.50	0.984	0.967	96.7	+16.9 (+1.8 %)	51	Pass
5	5.00	0.063	0.040	60	+22.7 (+56.7 %)	50	Pass

NOTES

ANSI 81 Frequency

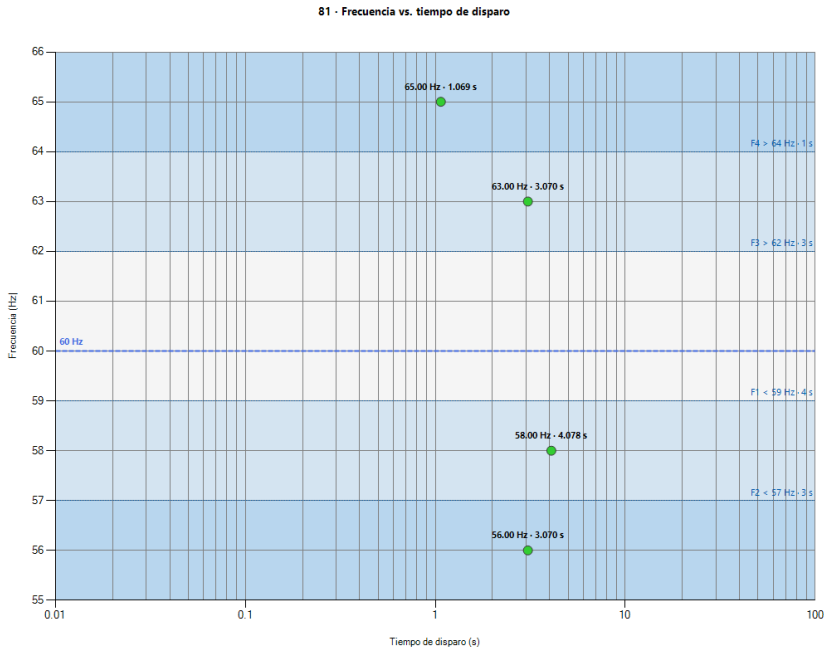
RELAY SETTINGS DATA

ANSI 81

Stage	Acts	Setting	Delay
F1	f <	**59.000** Hz	**4.00** Seg
F2	f <	**57.000** Hz	**3.00** Seg
F3	f >	**62.000** Hz	**3.00** Seg
F4	f >	**64.000** Hz	**1.00** Seg

FREQUENCY–TRIP TIME

Time on log scale



PARAMETERS

Vn	**110 V LL**
Vn primary	**13800 V LL**
Pre-fault	**2 s**
T max	**10 s**
Trip BI	**1**

TEST DATA

Test Date:
22/11/26

Test Time:
11:00 a. m.

TOLERANCE

Time
± 3 % + 50 ms

Setting band
± 0.005 Hz

TEST RESULTS · ANSI 81

OVERALL RESULT: PASSED · 4 of 4 valid points

Points	Injected f (Hz)	T Trip (S)	T Theor. (S)	Tol. ± (ms)	Diff. ms (%)	Stage	Status
1	**58.000**	**4.078**	4.000	170	+78.5 (+2.0 %)	F1	Pass
2	**56.000**	**3.070**	3.000	140	+69.6 (+2.3 %)	F2	Pass
3	**63.000**	**3.070**	3.000	140	+70.5 (+2.3 %)	F3	Pass
4	**65.000**	**1.069**	1.000	80	+68.7 (+6.9 %)	F4	Pass

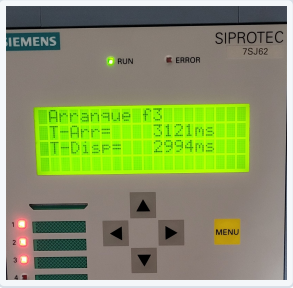
NOTES

DISPAROS...OK

EVIDENCE 1



EVIDENCE 2



ANSI 67N Sensitive earth-fault directional overcurrent — operating zone

1. RELAY SETTINGS · ANSI 67N

Date	**22/11/26**	Time	**3:27 p. m.**	Direction	**Forward**
3V0 via	**U_ref**	Method	**sin φ**	Angle	**-90 °**
Zone width	**176 °**	Alpha1 / Alpha2	**2 / 2 °**	Pickup 3I0	**0.1 A**
3V0>	**10 V**	Dir. release	**0.008 A**	Test 3I0	**0.5 A**
Test 3V0	**20 V**	Tolerance	**± 5 °**	Step	**15 °**
Resolution	**0.5 °**	t per point	**2 s**		

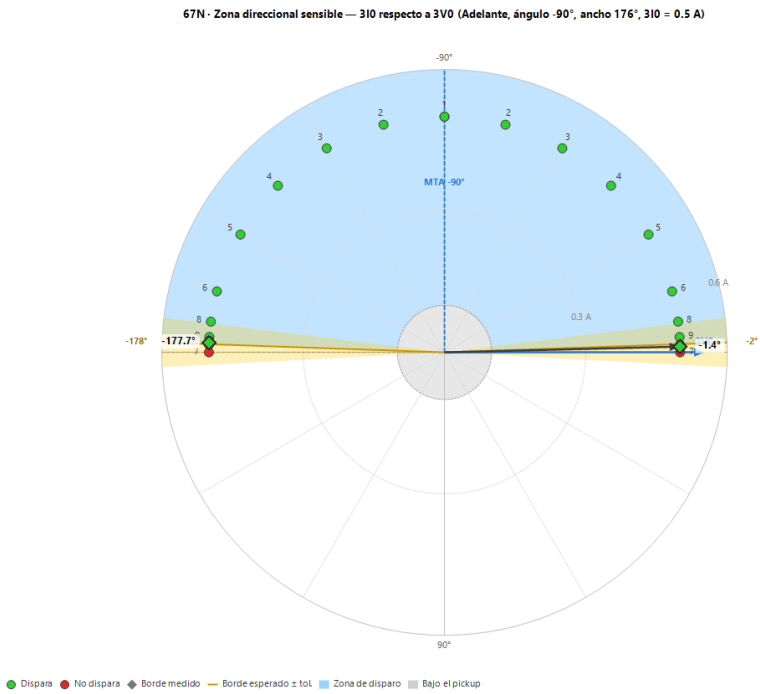
2. RESULTS · DIRECTIONAL ZONE

OVERALL RESULT: PASSED · 4 of 4 valid results

Test	Setting	Measured	Diff.	Tol. ±	Status
Edge − (lag minimum)	-178.0 °	**-177.66 °**	+0.3 °	± 5 °	Pass
Edge + (lag maximum)	-2.0 °	**-1.41 °**	+0.6 °	± 5 °	Pass
Zone width	+176.0 °	**+176.25 °**	+0.3 °	± 10 °	Pass
Centre (angle)	-90.0 °	**-89.53 °**	+0.5 °	± 5 °	Pass

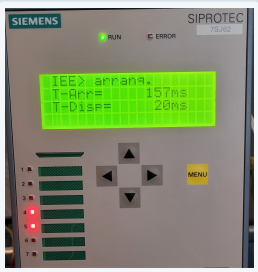
Angles: lag of 3I0 against 3V0 (includes the relay correction angle). Pass if |measured − expected| ≤ tolerance (the width allows twice).

3. POLAR CHART OF THE TRIP ZONE



NOTES

EVIDENCE 1



ANSI 67N Sensitive earth-fault directional overcurrent — pickup

1. RELAY SETTINGS · ANSI 67N

Date	**22/11/26**	Time	**3:30 p. m.**	Direction	**Forward**
Start	**3V0 and 3I0**	Angle	**-90 °**	Pickup 3I0	**0.1 A**
3V0>	**10 V**	3V0 via	**U_ref**	Test 3I0	**0.5 A**
Test 3V0	**20 V**	Tolerance	**± 5 %**	Step	**10 %**
Resolution	**2 %**	t per point	**2 s**		

2. RESULTS · PICKUP

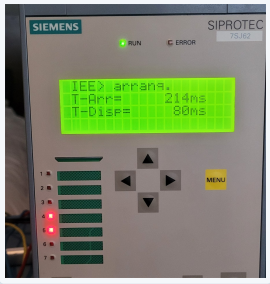
OVERALL RESULT: PASSED · 3 of 3 valid results

Test	Setting	Measured	Diff.	Tol. ±	Status
3I0> · pickup	0.100 A	**0.102 A**	+1.6 %	± 5 %	Pass
3V0> · threshold	10.00 V	**9.88 V**	-1.3 %	± 5 %	Pass
Start 3V0 and 3I0	3V0 y 3I0	**3V0 y 3I0**	—	—	Pass

Pickup: lowest tripping value, lowering each magnitude with the other above its value. Pass if |measured − expected| / expected ≤ tolerance.

NOTES

EVIDENCE 1



ANSI 27/59 Voltage

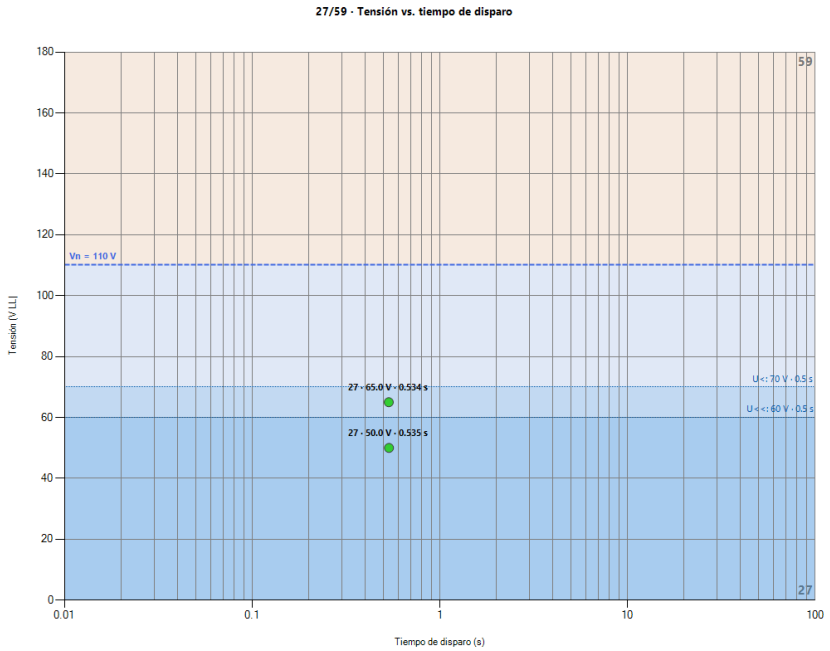
RELAY SETTINGS DATA

ANSI 27/59

Stage	Acts	Setting	Delay
U<	V <	**70.0** V LL	**0.50** Seg
U<<	V <	**60.0** V LL	**0.50** Seg

VOLTAGE–TRIP TIME

Time on log scale



PARAMETERS

Vn	**110 V LL**
Vn primary	**13800 V LL**
Pre-fault	**3 s**
Pre-fault I	**1 A**
Fault T	**5 s**
Trip BI	**1**

TEST DATA

Test Date:
22/11/26

Test Time:
6:14 p. m.

TOLERANCE

Time
± 10 % + 50 ms

Setting band
± 0.05 V LL

TEST RESULTS · ANSI 27/59

OVERALL RESULT: PASSED · 2 of 2 valid points

Points	Injected V (V LL)	T Trip (S)	T Theor. (S)	Tol. ± (ms)	Diff. ms (%)	Stage	Status
1	**65.000** (8.155 kV)	**0.534**	0.500	100	+33.7 (+6.7 %)	U<	Pass
2	**50.000** (6.273 kV)	**0.535**	0.500	100	+34.8 (+7.0 %)	U<	Pass

In parentheses: primary value of the injected voltage (line-to-line).

NOTES

ANSI 46 Negative-sequence overcurrent — pickup and operating time

1. RELAY SETTINGS · ANSI 46

Date	**22/11/26**	Time	**7:51 p. m.**	Injection	**Pure negative sequence**
I2>	**1.5 A**	T I2>	**1.5 s**	BI I2>	**1**
I2>>	**2.5 A**	T I2>>	**1 s**	BI I2>>	**1**
Pickup tolerance	**± 5 %**	Time tolerance	**± 5 %**	Min. tolerance	**± 30 ms**
Pickup multiple	**1.1 ×**	Step	**10 %**	Resolution	**2 %**
t per point	**3 s**				

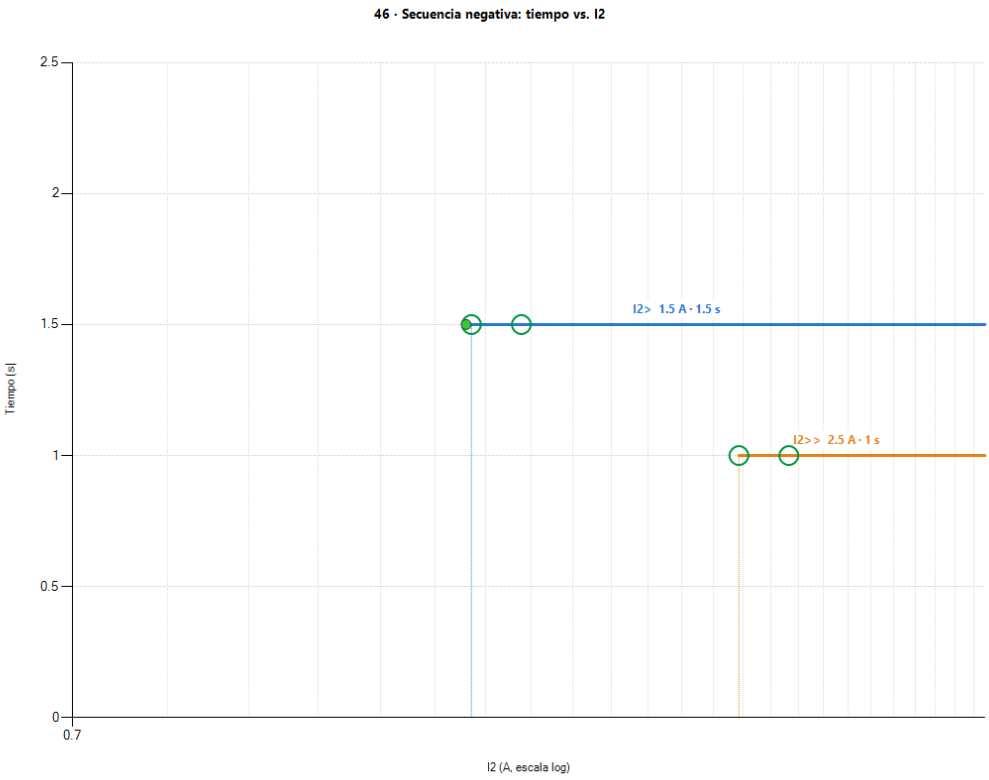
2. RESULTS · PICKUP AND OPERATING TIME

OVERALL RESULT: PASSED · 1 of 1 valid results

Test	Setting	Measured	Diff.	Tol. ±	Status
I2> · pickup	1.500 A	**1.485 A**	-1.0 %	± 5 %	**Pass**

Pickup: lowest I2 that trips (pass if within the % tolerance). Time: injection start to trip contact (pass if within the larger of % and min. ms tolerance).

3. TIME vs. I2 CHART



NOTES

disparo ok

EVIDENCE 1



MADE BY	REVIEWED BY	APPROVED BY
AAAAAAA	**BBBBBBB**	**CCCCCCCC**