

Client ABB SACE S.p.A. BAU ATAP

Address of the Client Via Italia, 50-58
23846 Garbagnate Monastero (LC)
ITALY

Manufacturer ABB SACE S.p.A. BAU ATAP

Tested samples/items n.2 ABB SACE ArTu K Distribution Boards

Tests carried out SEISMIC QUALIFICATION TESTS – Levels: 0,50g and 0,75g

Standards/Specifications

- IEEE Std 693-2005: “IEEE Recommended Practice for Seismic Design of Substations”.
- IEC Publication 60068-2-57, 1989: “Environmental testing. Part 2: Tests method. Test Ff: Vibration – Time history method”.

Tests date from June 15th, 2010 to June 17th, 2010

The results reported in this document relate only to the tested samples/items.

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1 GENERAL DATA

1.1 Customer

ABB SACE S.p.A. BAU ATAP
Via Italia, 50-58
23846 Garbagnate Monastero (LC)
ITALY

1.2 Unit under test

Tests have been performed on:

- Unit 1: ABB SACE ArTu K Distribution Board (photo 3), with electrical components;
- Unit 2: ABB SACE ArTu K Distribution Board with seismic kit (photo 4) without electrical components. During all tests Unit 2 has been charged up with dummy loads, instead electrical components, see photo 4.

Unit 1 and 2 are shown in photos 1 ÷ 4 with the general views of the units. Drawing about ABB SACE ArTu K Distribution Board is reported in photo 5.

1.3 Manufacturer

ABB SACE S.p.A. BAU ATAP

1.4 Reference documents

1.4.1 Contract documents

- CESI offer B0005306 dated 25/02/2010.
- Order ABB SACE S.p.A. BAU ATAP n. 4500574711/RV dated 18/05/2010, CESI prot. B0014511 del 21/05/2010.

1.4.2 Technical documents and standards

- [1] IEEE Std 693-2005: "IEEE Recommended Practice for Seismic Design of Substations".
- [2] IEC Publication 60068-2-57, 1989: "Environmental testing. Part 2: Tests method. Test Ff: Vibration - Time history method".
- [3] IEC Publication 60068-2-6, 1995: "Environmental testing. Part 2: Tests method. Test Fc: Vibration (sinusoidal)".

1.5 Test objective

The purpose of the tests was to demonstrate that the unit behaves in compliance with the requirements stated in technical documents and standards.

1.6 Testing laboratory

CESI - LPS Laboratory
DIVEN Division
via Pastrengo, 9
24068 SERIATE BG
ITALY



RINA



The CESI quality management system for performing laboratory investigations and tests in structural field is conforming with standard UNI EN ISO 9001:2000, as certified in SQS N.24295-01.

CESI LPS laboratory (P610) is qualified for testing railway items by R.I.N.A. (Registro Navale Italiano Div.Ferroviaria).

1.7 Test date

Tests have been performed from the 15th to the 17th of June, 2010.

4 TEST RESULTS

4.1 Resonance frequency search tests

Response curves and transfer functions relevant to the resonance frequency searches are illustrated in the following figures:

		Direction	Control position ⁵	Measuring positions
Unit 1	Tests n. 1, 9, 13	X	Fig. 6	Fig. 7
	Test n. 2, 10, 14	Y	Fig. 9	Fig. 10
	Test n. 3, 11, 15	Z	Fig. 12	Fig. 13
Unit 2	Tests n. 1, 9, 13	X	Fig. 6	Fig. 8
	Test n. 2, 10, 14	Y	Fig. 9	Fig. 11
	Test n. 3, 11, 15	Z	Fig. 12	Fig. 14

4.2 Seismic tests

Response curves during the seismic test are illustrated in the following figures:

		Directions	Control positions	Measuring positions
Unit 1	Test n. 8	X, Y, Z	Figs. 15, 16	Figs. 17 ÷ 19
	Test n. 12	X, Y, Z	Figs. 22, 23	Figs. 24 ÷ 26
Unit 2	Test n. 8	X, Y, Z	Figs. 15, 16	Figs. 20, 21
	Test n. 12	X, Y, Z	Figs. 22, 23	Figs. 27, 28

4.3 Functional checks

At the end of each test the tightening torque of the screws connecting the unit to shaking table have been verified.

Visual inspections have been performed on the Unit 1 and Unit 2:

- Unit 1: no visible damages have been detected on ArTu K Distribution Board after seismic tests at 0,5 g level (test n 8: 0 dB – 100 %).
- Unit 1: damages have been detected on ArTu K Distribution Board after seismic tests at 0,75 g level (test n 12: +3.5 dB – 150 %), as reported in photo 16.
- Unit 2: no visible damages have been detected on ArTu K Distribution

⁵ Spurious motion measured at the distance of: yaw 1879 mm, pitch 1540 mm and roll 1340 mm.