

INDEPENDENT POWER TRANSMISSION OPERATOR S.A.

TRANSMISSION NEW PROJECTS DEPARTMENT

**TRANSMISSION LINES EQUIPMENT ELECTRICAL DESIGN
AND CABLES ENGINEERING SECTION**

SPECIFICATION TR-18

**STOCKBRIDGE TYPE VIBRATION DAMPERS FOR OVERHEAD T.L.
PHASE CONDUCTORS AND SHIELD WIRES**

**Revision February 2013
ATHENS - GREECE**



**INDEPENDENT POWER TRANSMISSION OPERATOR S.A.
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Specification TR - 18

1. GENERAL

1.1 Object of the technical specification

This technical specification applies to Stockbridge type Vibration dampers for overhead transmission lines with nominal voltage of 66 KV, 150 KV and 400 KV (phase to phase).

The object of this technical specification is to define the requirements, the design and manufacture criteria for good behaviour of the dampers, when are in service.

The specification also covers requirements for inspection, acceptance and packaging of the dampers.

1.2 Transmission Line elements

The vibration dampers consist part of a damping system whose effect depends on the characteristics and the installation of the conductors, as well as, the characteristics and the installation of the dampers.

1.3 Phase conductors

ADMIE SA uses Stockbridge type vibration dampers on single conductors for 66 KV and 150 KV lines and on twin bundled conductors for 400 KV lines.

The twin bundled conductors are horizontal with 400 mm conductor spacing.

The phases in single circuit lines are normally placed in horizontal plane and those of double circuit lines are placed in vertical plane.

The normal ruling span lengths are 350 m and 500 m.

The initial conductor tensions at 0° C are normally the following:

- 24% UTS for ACSR diam. 18.31 mm LINNET
- 21% UTS for ACSR diam. 25.15 mm GROSBEAK
- 22% UTS for ACSR diam. 30.42 mm CARDINAL

ADMIE SA uses armor rods installed on conductors in the suspension clamps.

ADMIE SA uses armor rods installed on conductors in the suspension clamps. The basic characteristics (diameter of each rod, length L of each set, Number of rods/set) of installed armor rods, for every phase conductor, are the following:

- | | | |
|------------------|--------------|--------------------------|
| - ACSR LINNET: | max. Ø 5.2mm | min. L=1800mm12rods/set |
| - ACSR GROSBEAK: | max. Ø 7.9mm | min. L=2200mm11rods/set |
| - ACSR CARDINAL: | max. Ø 7.9mm | min. L=2500mm13rods/set. |

The distance between the suspension clamp center and armor rods ends may differ in case the suspension clamp is moved on the armor rods when is necessary to bring the insulator string to vertical position.

The technical data of phase conductors are specified in the attached Annex A.

1.3.1 Shield wires

ADMIE SA uses shield wires which composed of seven zinc coated class A concentric-lay stranded steel wires. For 400 KV lines the shield wire diameter is 12.60 mm and for 150 KV lines the shield wire diameter is 9.53 mm.

The normal ruling span lengths are 350 m and 500 m.

The initial shield wires tensions at 0° C are normally the following:

- 17% UTS for 9.53 mm conductor diameter and span length of 350 mm
- 14% UTS for 9.53 mm conductor diameter and span length of 500 mm



- 15% UTS for 12.60 mm conductor diameter and span length of 350 mm
- 13% UTS for 12.60 mm conductor diameter and span length of 500 mm

The shield wires are attached to the suspension clamps without armor rods.
The technical data of shield wires are specified in the attached Annex B.

2. DESIGN

Each Stockbridge type vibration damper shall be in accordance with the requirements of paragraph 4 of IEC Standard 61897.

Also Stockbridge type vibration damper shall be designed so as to:

- Be free from appearance defects such as cracks, burrs, notches, and distortions, defective machining of the surfaces, bubbles and castings defects in general.
- Absorb the vibrations of the conductors. The manufacturer must prove the efficiency of the offered damper.
- Have smooth surface with rounded edges so that Corona and development of RIV will be limited. The design of the Stockbridge damper shall be such as to avoid local corona formation and significant radio interference.
- Also, the heads of bolts, for the same reasons, shall have rounded edges.
- Perform satisfactorily under the environmental factors, including conductor temperature variations, ultra-violet radiation, ozone and atmospheric pollutants applicable to the site.
- Be inherently resistant to atmospheric corrosion or be suitably protected against corrosion, such as can occur in transport, storage and in service. Also the vibration damper shall not damage or cause corrosion to the conductor or individual strands when installed or during service.

Stockbridge type vibration dampers for phase and shield wire conductors shall be installed in places exposed to dangerous vibrations. The dampers shall be designed to absorb the vibrations of the conductors. Also manufacturer shall provide ADMIE SA with the assembly or installation instructions of vibration dampers as long as necessary.

2.1 Vibration damper for phase conductors:

ADMIE SA uses three damper sizes, based on conductor diameter.

ADMIE SA has standardized the location of the dampers on the conductors to the following distances from the center of the suspension clamp:

- 1.10 m for ACSR diam. 18.31 mm LINNET
- 1.43 m for ACSR diam. 25.15 mm GROSBEAK
- 1.60 m for ACSR diam. 30.42 mm CARDINAL

This standardization has been made in order to have only one damper installation instruction, independent of damper manufacturer.

2.2 Vibration damper for shield wire conductors.

ADMIE SA has standardized the location of the dampers on the shield wires to 0.80m from the center of the suspension clamp.

This standardization has been made in order to have only one damper installation instruction, independent of damper manufacturer.

3. MATERIALS - MANUFACTURE

3.1 Materials

Materials choice and surface treatments shall be made in such a way that the dampers shall be resistance to atmospheric corrosion during the whole service life.

- Dampers clamps for phases conductors shall be manufactured from aluminum alloy, which shall contain not more than 0.1 % Cu.
- Dampers clamps for shield wire conductors shall be manufactured from steel.

The materials of washers and spring washers shall not cause galvanic corrosion with adjacent parts.



The non-stainless steel and iron component parts of the dampers shall be hot dip galvanized according to ASTM A-153 or others ISO or EN standards latest editions.

The dampers shall not contain non-metallic materials.

3.2 Manufacture

The dampers shall fulfil the requirements of the manufacturing drawings.

The dampers shall be manufactured in accordance with the internationally adopted techniques and practice.

There will be no quality differences between samples of the same damper

The dampers shall be free of appearance defects such as cracks, burrs, notches, defective machining of the surfaces, bubbles and casting defects in general.

The surface shall be smooth with rounded edges so that Corona and development of RIV will be limited. Also, the heads of bolts, for the same reasons, shall have rounded edges.

The inside surfaces of the clamp body and clamp cap shall be smooth and free of projections, grit or other materials which would cause conductor damage.

The bolts and the nuts shall have metric threads. The bolts shall have such lengths that, when clamping the dampers on the conductor, they outside the nuts threads in order to eliminate water collection.

The threads depths of the blind holes shall be enough to ensure full tightening of the bolts without bottoming.

The bolts and nuts shall be turned freely with the fingers over the entire thread length.

The threads of the steel bolts shall be covered with Vaseline or anti-corrosion grease in order to avoid corrosion in the threads of the aluminium alloy component parts.

The dampers shall have drainage holes unless they are designed to exclude water collection.

Welding will not be accepted.

4. **MARKING**

Each damper shall be marked for easy and permanent differentiation.

The symbols (letters and numbers of at least 5 mm height) shall be cast or die stamped and shall refer to the following markings:

- Manufacturer or trade mark
- Manufacturer's type designation
- Tightening torque followed by Nm unit
- Conductor diameter range of the damper clamp
- Year of manufacture

5. **TESTS**

5.1 Type Tests

Type tests will be carried out according to par 6.1 of IEC 61897 as follow:

5.1.1 Visual examination according to clause 7.1



- 5.1.2 Verification of dimensions, materials and mass according to clause 7.2
- 5.1.3 Corrosion protection tests according to clause 7.3
- 5.1.4 Clamp slip test according to clause 7.5
- 5.1.5 Breakaway bolt test ¹⁾ according to clause 7.6
- 5.1.6 Clamp bolt tightening test according to clause 7.7
- 5.1.7 Attachment of weights to messenger cable test according to clause 7.8
- 5.1.8 Attachment of clamp to messenger cable test according to clause 7.9
- 5.1.9 Damper performance tests according to clause 7.11 Variant B-Laboratory test
- 5.1.10 Fatigue test according to clause 7.12 - Swept frequency method.
- 5.1.11 Corona and radio interference voltage (RIV) tests ¹⁾ according to clause 14 of IEC 61284.
The Stockbridge damper attached to the conductor (equipped with armor rods) shall show no visible corona and positive corona plume at a voltage 30% higher than the nominal phase voltage (phase to ground). Also, shall have a radio noise level not higher than 50 db above 1 microvolt across 300 ohms at 1 MHZ measured at a voltage 20% higher than the nominal phase voltage.

¹⁾ Not applicable for earth wire dampers

Type test shall be performed before industrialization in case the manufacturer supplies for the first time the respective damper and in case making any change in damper design.

The purchaser reserves the right to request the repentance of the type tests any time.

Negative test results will be not accepted.

5.2 **Sample Tests - Acceptance Tests**

The following tests shall be performed at the delivery inspection according to IEC 61897, par. 6.2 & 6.4 and the corresponding clauses:

- Visual examination (for all lots of dampers)
- Verification of dimensions, materials and mass
- Corrosion protection tests
- Breakaway bolt test ¹⁾
- Clamp bolt tightening test
- Attachment of weight to messenger cable
- Attachment of clamp to messenger cable test

¹⁾ Not applicable to earth wire dampers

The sample tests shall be performed on random selected dampers from the lots presented for acceptance.

The purchaser reserves the right to select the dampers.

The test results shall conform to the manufacturer's documentation which was the basis for the type approval, according to Section 7.

6. **PACKING**

The dampers shall be packed in strong wooden cases in such a manner as to protect them from damage in transit, handling and outdoor storage.

Each case shall have a maximum gross weight up to 150 kg and shall be equipped with handle facilities.

Each case shall be plainly and indelibly marked with distinctive markings, indicating the following:

- Manufacturer's name
- Code number of the damper
- Conductor diameter range for the damper clamp



- Gross weight
- Quantity (number of dampers)
- Order number

7. TECHNICAL DATA OF THE OFFER

The manufacturer must submit to the purchaser the following documents in duplicate for each damper size:

- 7.1 An assembly drawing, in full scale, showing the damper in at least two views. On the drawing shall be given :
- Code number stated by the manufacturer
 - Main dimensions
 - Conductor diameter range for the damper clamp
 - Width across flats of bolts and nut
 - Tightening torque in Nm
 - All markings on the damper
 - Damper mass
 - Tolerances
- 7.2 Quality of the materials, surface treatment and surface layers for each component part of the damper.
- 7.3 Description of the manufacturing process.
- 7.4 A detailed schedule of the routine production tests that are carried out during the different stages of production.
- 7.5 Type test reports concerning the tests of Section 5.1 for each damper size.
- 7.6 Manufacturer shall certify that he accepts the tests requirements (Sections 5)
- 7.7 Manufacturer shall certify that he has manufactured and sold the offered items for a period of at least five years.
- 7.8 A list of at least five previous purchasers of the same dampers.
- 7.9 Confirmation of the Installation Guidelines for Stockbridge type vibration dampers that referred to Annex C.
- 7.10 Documents or test reports submitted by TELEFAX will be rejected.
- 7.11 The offer failing any of the above data shall not be technically accepted.



ANNEX A

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ANNEX A

TECHNICAL DATA

PHASE CONDUCTORS DATA

Equivalent Code Name	<u>LINNET</u>	<u>GROSBEAK</u>	<u>CARDINAL</u>
Cooper equivalent	107.48 mm ²	199.4 mm ²	296 mm ²
Overall diameter	18.31 mm	25.15 mm	30.42 mm
Aluminum strands	26 x 2.9 mm	26 x 3.95 mm	54 x 3.38 mm
Steel strands	7 x 2.26 mm	7 x 3.08 mm	7 x 3.38 mm
Nominal weight	700 kg/km	1300 kg/km	1840 kg/km
Minimum breaking strength	6050 kg	10315 kg	15550 kg
Standard reel length	3000 m	3000 m	2600 m



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ANNEX B

TECHNICAL DATA

SHIELD WIRES DATA

	Shield Wire for T.L. 150 kV		Shield Wire for T.L. 400 kV	
	Nominal	Tolerances	Nominal	Tolerances
Overall diameter		9.53 mm		12.60 mm
Stranding	7 x 3.17 mm	± 0,1mm	7 x 4.19 mm	± 0.1mm
Minimum breaking strength		6.500 kg		12.000 kg
Minimum elongation strength		4%		4%
Standard reel length	3000 m	± 5%	2.600 m	± 5%
Net weight	440 kg/km	± 2%	770 kg/km	± 2%



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ANNEX C

INSTALLATION GUIDELINES FOR STOCKBRIDGE TYPE VIBRATION DAMPERS

NUMBER OF DAMPERS PER SPAN LENGTH	SPAN LENGTH (S.L.) (at each side of the tower)	
	SINGLE PHASE CONDUCTORS & SHIELD WIRES	BUNDLE CONDUCTORS (TWIN, TRIPLE)
1	S.L. < 370	S.L. < 420
2	370 < S.L. < 550	420 < S.L. < 600
3	550 < S.L.	600 < S.L.

CONDUCTOR'S TYPE	DAMPERS' DISTANCE FROM SPAN'S EDGE		
	1 ST DAMPER	2 ND DAMPER	3 RD DAMPER
LINNET	1.10	2.20	3.30
GROSBEAK	1.43	2.90	4.30
CARDINAL	1.60	3.20	4.80
SHIELD WIRE Ø9.53 mm	0.80	1.60	2.40
SHIELD WIRE Ø12.60 mm	0.80	1.60	2.40