ELECTROMONTAJ S.A.

68 years in Power Transmission

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ELECTROMONTAJ S.A. is a Romanian joint stock company acting as specialized main contractor for turn-key projects of transmission and distribution of electric power.

Since its establishment in 1949, the main concern of ELECTROMONTAJ S.A. was to continuously increase the quality standards of its activity, to the full satisfaction of its Clients. The volume of works increased steadily and the range of activity grew wider year after year.

Along the 67 years of activity, a huge number of projects have been completed, amounting:

- 70,000 km of 1÷132 kV underground cables;
- 240,000 km of 20÷132 kV overhead lines;
- 11,000 km of 220÷400 kV overhead transmission lines;
- 154 km of 750 kV overhead transmission lines;
- 65,000 substations up to 63 kV;
- 900 substations of 132 kV;
- 70 substations of 220÷400 kV;
- 1 substation of 750 kV.
ELECTROMONTAJ Offer

ELECTROMONTAJ S.A. offers to its customers around the world a complete range of activities in the field of electric power, such as:

Turn-key projects for:
- Substations up to 750 kV;
- Overhead transmission lines up to 750 kV;
- Underground cables up to 400 kV;
- Rural electrification networks;
- Urban public works (lightning, catenaries);
- Low power hydro-plants;
- Wind power plants.

Consulting, engineering, design:
- Technical investigations and studies;
- Technical assistance and supervising.

Manufacture and supply of:
- Hot dip galvanized steel towers for transmission lines;
- Steel structures for substations and industrial projects;
- Clamps and fittings for transmission lines and substations.

Special works:
- Engineering studies and design works;
- Full scale load tests on tower prototypes;
- Soil investigation and survey works;
- Technical assistance and supervision of site works;
Turnover evolution

Annual Turnover (USD)
Exports (USD)
Historical data

- **1949**: ELECTROMONTAJ founded as a Romanian own State company
- **1953**: ELECTROMONTAJ finalize the first OHL Tower production facility
- **1950-1969**: ELECTROMONTAJ finalize the first OHL Tower Testing Station for OHL Towers
- **1971**: ELECTROMONTAJ becomes a private own company
- **1984**: ELECTROMONTAJ finalize the first Tower Testing Station for OHL Towers
- **1986**: ELECTROMONTAJ finalize the new OHTL tower factory with a yearly production of 10,000 tons
- **1989**: ELECTROMONTAJ starts Isaccea Station – 750 kV and the first connection line with Bulgaria and USSR
- **1993**: ELECTROMONTAJ finalize the biggest European TTS (Tower Testing Station) in Bucharest
- **2013**: ELECTROMONTAJ upgrades the OHTL Tower factory production to 20,000 tones
- **2014**: ELECTROMONTAJ takes the decision to expand its operations in Africa and South America
- **2015**: ELECTROMONTAJ finalize the biggest European TTS (Tower Testing Station) in Bucharest

Electromontaj profile 2017
Design Department

We have a team of designers engineers and highly skilled draftsmen in the art of Transmission line design, including mechanical calculation of conductors, tower spotting, sag and tensions calculations according to recognized international standards.

The design activities are performed with up to date international software (PLS_CADD, PLS-TOWER, PROKON, SAP, CYMGrd, Line Constants) and cover the detail design and calculation of structures/towers for transmission lines, transformer stations, addressing the needs of different customers and geographic areas.
Substations: Design, Execution, Commissioning

- Up to 750kV
- Electrical works: installation of equipment, transformers, control panels, protection, telecommunications and SCADA.
- Mechanical works: gantries and support structures
- Civil works: equipment foundations, cable trenches, buildings
Lattice Towers

- Electromontaj S.A. Bucharest is one of the most experienced designer and manufacturer of transmission line towers within the range of 11 kV to 750 kV.

- Electromontaj S.A. Bucharest has full ability to realize the basic and detailed design for the towers in his highly experienced design group, and also to perform full scale load testing in its own Tower Testing Station.

- Towers are manufactured on fully automatic CNC lines, galvanized and packed according to international standards and the requirements of the customer; and delivered at the place requested by the customer as per Incoterms 2000.

- All the products made by Electromontaj OHTL Tower Plant are CE Certified.

- The factory located in Bucharest has a total manufacturing capacity of 20,000 tones/year.
OHTL Emergency Restoration System

Since 2002, Electromontaj S.A. has its own quick fix solution to possible failure of the 110-400 kV OHL networks.

The temporary towers were designed, tested and approved by Electromontaj in 2001, the system offering a substantial advantage to the customer through the rapid restoration of the damaged zone.

Electromontaj S.A. provides everything is necessary for the provisional closure of the circuit in the damaged area and then the reconstruction or repair of the line.

This system has been used many times in Transelectrica networks, Electrica and NEPCO (Jordan).
Tower Plant
Tower Testing

- ELECTROMONTAJ Tower Testing Station, located in Bucharest is suitable to perform design and sample tests for towers: steel lattice type, self-support or anchored types, other tower types.

- The testing station is capable to do design tests for giant and multi circuit towers with 80 meters height, 35x35 m base, 800 t compression load and 730 t tension load.

- The design and sample tests are performed in accordance to IEC Standard 60652:2002 Loading Tests On Overhead Line Structures At Full Scale.
Tower Testing

Activities:
- Possibility to build the prototype and replace damaged parts in the trial.
- Test samples of the materials used.
- Calibrations of pre-trial and post same.
- Use of strain gauges for recording and monitoring efforts in certain bars.
- Graphics for each stress applied to the Tower for each scenario.
- Trial Monitoring by cameras connected to the Internet and video recording.
- Final report with all records and test calibrations.
## Tower Testing Station

<table>
<thead>
<tr>
<th>Technical Data</th>
<th>Ilioara - Testing Station</th>
</tr>
</thead>
<tbody>
<tr>
<td>Universal Foundation Dimensions</td>
<td>35m x 35m</td>
</tr>
<tr>
<td>Maximum Tower Height to be tested</td>
<td>82.3m (90m)</td>
</tr>
<tr>
<td>Maximum Compression/ Uplift per Leg</td>
<td>830t / 700t (1000t)</td>
</tr>
<tr>
<td>Allowable Overturning Moment</td>
<td>50,000 t-m</td>
</tr>
<tr>
<td>Maximum Cross Arm Spread</td>
<td>70m</td>
</tr>
<tr>
<td>Maximum Transverse Wire Load</td>
<td>90t per point (100t)</td>
</tr>
<tr>
<td>Maximum Longitudinal Wire Load</td>
<td>60t per point (75t)</td>
</tr>
<tr>
<td>Maximum Vertical Wire Load</td>
<td>45t per point (50t)</td>
</tr>
<tr>
<td>Load Application System</td>
<td>66 Nos. 5t, 6t and 7.5t capacity Electrically Operated Winches</td>
</tr>
<tr>
<td>Longitudinal Gantry Force (H = 81.7m)</td>
<td>560t (20 points)</td>
</tr>
<tr>
<td>Transversal Gantry Force (H = 82.3m)</td>
<td>720t (26 points)</td>
</tr>
<tr>
<td>Maximum Capacity for Vertical Force</td>
<td>500t (20 points)</td>
</tr>
<tr>
<td>Load Measurement System</td>
<td>Strain Gauge Type Load Cell</td>
</tr>
<tr>
<td>Sample Material Testing and Equipment Calibration</td>
<td>– 60t; – 100t;</td>
</tr>
<tr>
<td>Crane for Tower Erection</td>
<td>COMANSA Tower Crane (82,3m height with 55m boom length and 12t/R = 25m capacity)</td>
</tr>
<tr>
<td>Deflection Measurement</td>
<td>Optical Theodolites</td>
</tr>
<tr>
<td>Load Application</td>
<td>Electrical Winches (made by Pfaff Germany) electronically controlled by variable Frequency Drivers and SCADA.</td>
</tr>
</tbody>
</table>
Foundation works

Electromontaj profile 2017
Vertical Piled Foundation
### ELECTROMONTAJ Experience
#### OHTL Projects Statistics By Kilometers

<table>
<thead>
<tr>
<th>Country</th>
<th>km</th>
<th>Line specification (kV)</th>
<th>Timeline</th>
</tr>
</thead>
<tbody>
<tr>
<td>United Arab Emirates</td>
<td>234</td>
<td>400</td>
<td>2015-Present</td>
</tr>
<tr>
<td></td>
<td>205</td>
<td>220</td>
<td>1999-2012</td>
</tr>
<tr>
<td>Cyprus</td>
<td>44</td>
<td>220</td>
<td>2007</td>
</tr>
<tr>
<td></td>
<td>123</td>
<td>132</td>
<td>1994-2003</td>
</tr>
<tr>
<td>Jordan</td>
<td>120</td>
<td>400</td>
<td>1999-2013</td>
</tr>
<tr>
<td></td>
<td>794</td>
<td>132</td>
<td>2000-2013</td>
</tr>
<tr>
<td>Mexic</td>
<td>20</td>
<td>400</td>
<td>1999</td>
</tr>
<tr>
<td>Qatar</td>
<td>300</td>
<td>220</td>
<td>1998</td>
</tr>
<tr>
<td>Romania</td>
<td>2229</td>
<td>400</td>
<td>1997-Present</td>
</tr>
<tr>
<td>Yemen</td>
<td>1200</td>
<td>220</td>
<td>2003</td>
</tr>
<tr>
<td></td>
<td>300</td>
<td>132</td>
<td>1994-1996</td>
</tr>
</tbody>
</table>
Main Customers

<table>
<thead>
<tr>
<th>Country</th>
<th>Customers</th>
</tr>
</thead>
<tbody>
<tr>
<td>ROMANIA</td>
<td>CN TRANSELECTRICA S.A., EON, ENEL, CEZ</td>
</tr>
<tr>
<td>UAE</td>
<td>TRANSCO, ADWEA</td>
</tr>
<tr>
<td>JORDAN</td>
<td>NEPCO</td>
</tr>
<tr>
<td>CYPRUS</td>
<td>EAC</td>
</tr>
<tr>
<td>YEMEN</td>
<td>Public Electricity Corporation</td>
</tr>
</tbody>
</table>
ELECTROMONTAJ S.A. Bucharest, is acting in the market as a holding composed of subsidiaries with different profiles of activity in compliance with its legal status and as a major share-holder in other companies. Briefly, the group consists of the following:

- **ELECTROMONTAJ S.A.** - with branches in Romania and abroad (UAE, Jordan, Cyprus);
- **CONFIDENT INVEST S.A.** - a company providing services for financial investments;
- **EMFOR MONTAJ S.A.** - makes foundations, drilling and other civil works;
- **IPROEB S.A.** - produces cables, conductors, composite insulators and other electrical equipments.
<table>
<thead>
<tr>
<th>Employees</th>
<th>Total area (m²)</th>
<th>Built area (m²)</th>
<th>Production capacity of insulated cables (km/year)</th>
<th>Annual amount of aluminum processed (tons)</th>
<th>Izolators production capacity (unit / year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>423</td>
<td>101000</td>
<td>50000</td>
<td>16000</td>
<td>4500</td>
<td>22000</td>
</tr>
</tbody>
</table>
The main range of products manufactured

<table>
<thead>
<tr>
<th>Cables and copper or aluminum conductors, polyethylene insulated</th>
<th>Cables and copper or aluminum conductors, PVC insulated</th>
<th>Cables and copper conductors, rubber insulated</th>
</tr>
</thead>
<tbody>
<tr>
<td>AAC, ACSR, AAAC overhead bare conductors</td>
<td>Galvanised steel conductors</td>
<td>Steel wire ropes</td>
</tr>
<tr>
<td>Composite insulators</td>
<td>Insulating materials</td>
<td>Means of automations</td>
</tr>
<tr>
<td>Various electrical equipments, drums and tools</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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Cables and conductors factory
Noninsulated cables

AAC - All Aluminium Conductors
ACSR – Aluminium Conductors Steel Reinforced
ACSS – Aluminium Conductors Steel Supported
AAAC – All Aluminium Conductors Alloy Conductors
AACS – Aluminium Alloy Conductors, Steel Reinforced
Steel Stranded Conductors
Steel wire ropes
Sustain and stretching composite insulators
20 ÷ 400 kV
70 ÷ 210 kN

Composite type support insulators CIS 20
CIS 20, cu cap A, cu cap A*, cu cap rotund R
CIS 20, cu clema C

Housing type composite insulators for electric equipment
Clc 110

Chains of composite insulators with TT fittings
de 20, 110, 220, 400 kV

Chains of composite insulators with BS fittings
de 110, 220, 400 kV