

# The Structural Testing Laboratory



**KEMA** Labs



The independent laboratory with the MASTER (MultiAxes Shaking Table for Earthquakes reproduction), one of the few 4000x4000 mm six degree of freedom shaking table in Europe.



The laboratory is accredited according ISO/IEC 17025 for the execution of seismic triaxial multifrequency tests in compliance to IEC60068-2-57 and shock and vibration tests in compliance to IEC60068-2-27, -2-6.

CESI's Structural Testing Laboratory has an extension of approx. 1200 m2 with a maximum height of over 11 m to carry out structural tests on heavy and large-scale components.

The Laboratory has been traditionally active at national and international level in all areas related to structural and dynamic engineering,

- its activity is characterised by:
- ▶ static and dynamic qualification tests on components;
  - ▶ development of experimental and analytical studies concerning fundamental research;
  - ▶ study of specific structures and assistance in the test plan preparation.

The main experimental facilities for laboratory tests include shaking tables, hydraulic actuators and material testing machines. Suitable software is used for control of test performance, data acquisition and processing. The laboratory is furnished of several transducers (acceleration, load cell, displacement, pressure cell, strain gauges) with wide possibility of measurements.



LAB N° 0030L site C  
Signatory of EA, IAF and ILAC  
Mutual Recognition Agreements

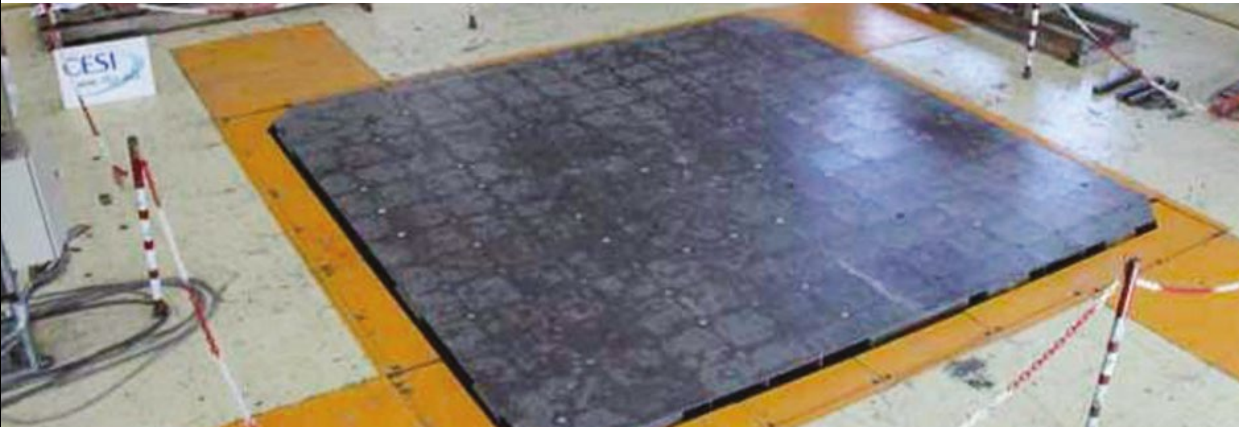
The shaking table MASTER (MultiAxes Shaking Table for Earthquakes Reproduction) is one of the most important installations in Europe for experimental studies in the structural dynamics. Besides the classical support of the earthquake engineering, the performances, dimensions and payload capacities of MASTER allow a wide range of applications both in civil and electromechanical fields. Aerospace, military, electrical transmission, transportation, nuclear equipment and civil construction industries are especially interested in the use of the shaking table.

The table MASTER is operated both for research scopes and for the qualification and inspection of products. It is installed in the context of a Laboratory designed for structural testing and linked with the other engineering units supplying specialised and complementary services (design, numerical computations, engineering expertise).

THE SIX D.O.F TRIAXIAL SHAKING TABLE "MASTER"

| Degree of Freedom 6<br>(simultaneous control of Translation X – Translation Y – Translation Z – Yaw – Pitch – Roll) |                                    |               |
|---|------------------------------------|---------------|
| Table dimensions  | 4 x 4 m (holes M30 at 0.3 x 0.3 m) |               |
| Weight of the movable part  | 110 kN                             |               |
| Frequency range   | sine tests                         | 0 – 120 Hz    |
|   | random tests                       | 0 – 120 Hz    |
| Stroke  | 200 mm (static)                    |               |
| Max velocity (horiz/vert)   | 0.55/0.44 m/s                      |               |
| Max acceleration (bare table)   | horizontal (sine/shock)            | 20/40 m/s²    |
|   | vertical (sine/shock)              | 30/50 m/s²    |
| Yaw rotation  | + 3.80°                            |               |
| Yaw velocity  | 0.37 rad/s                         |               |
| Pitch/Roll rotation   | + 3.80°                            |               |
| Pitch/Roll velocity   | 0.30 rad/s                         |               |
| Max Force (horiz/vert)  | 500/600 kN                         |               |
| Max overturning moment  | 300 kNxm                           |               |
| Max Specimen Dead Weight  | 300 kN                             |               |
| Max compensated Dead Weight   | 300 kN                             |               |
|   | Controlled dofs *                  | Acq. channels |
| Sine  | 1                                  | 32            |
| Random  | 6                                  | 32            |
| Shock   | 6                                  | 32            |
| Seismic   | 6                                  | 32            |

(\*) Translation X – Translation Y – Translation Z – Yaw – Pitch – Roll





### TESTING LABORATORY

|                   |                |            |  |
|-------------------|----------------|------------|--|
| Dimensions        | 56 x 14 m      |            |  |
| Bridge cranes     | 2 (200/100 kN) |            |  |
| Height under hook | 11.35 m        |            |  |
| Oleodynamic plant | flow rate      | 1000 l/min |  |
|                   | rated pressure | 21 MPa     |  |



Specifically designed for HV bushings (seismic or short circuit stresses).



The machine can be assembled also for biaxial loads.



### THE SINGLE AXIS SHAKING TABLE "ARIETE" FOR VIBRATION AND SHOCK TESTS

|                            |            |                               |
|----------------------------|------------|-------------------------------|
| Frequency Range            |            | 0 – 60 Hz                     |
| Max Stroke                 |            | 200 mm                        |
| Max Acceleration           | sinusoidal | 25 m/s²                       |
|                            | shock      | 400 m/s² 7 ms; 120 m/s² 20 ms |
| Max Force                  |            | 160 kN                        |
| Weight of the movable part |            | 50 kN                         |
| Table dimensions           |            | 4 x 2.5 m                     |



Machine designed and realised by ENEA for HDRB tests.

### "SISTEM (SEISMIC ISOLATOR TEST MACHINE)" MACHINE

|                               |                                 |  |  |
|-------------------------------|---------------------------------|--|--|
| Direction of load             | 2 (vert./horiz. simultaneously) |  |  |
| Max. vert. load (compr./tens) | 3 / 0.5 MN                      |  |  |
| Max. horiz. load              | 400 kN                          |  |  |
| Max. displ. (vert./horiz.)    | 90/1000 mm                      |  |  |
| Frequency range               | 0 ÷ 5 Hz                        |  |  |
| Friction coefficient          | 0.003                           |  |  |
| Max specimen dimensions       | h 360 mm Ø 700 mm               |  |  |



### REACTION STRUCTURE EQUIPPED WITH "REACTION WALL"

|                                       |                                    |                      |  |
|---------------------------------------|------------------------------------|----------------------|--|
| Tank dimensions                       | 8 m x 8 m x 4 m                    |                      |  |
| Reaction wall                         | 8 m x 1 m x 8 m                    |                      |  |
| Anchor channels (walls and floor)     | JORDHAL profiles<br>JTA W74/48/5,0 |                      |  |
| Load capacity of the channels         | tension                            | N = 45 kN/250 mm     |  |
|                                       | shear                              | T = 45 kN/250 mm     |  |
| Loading capacity of the reaction wall | moment                             | = 3000 kN at 5300 mm |  |
|                                       | shear                              | = 3000 kN            |  |



### ELECTRO-MECHANICAL EXCITER (SINGLE AXIS SINUSOIDAL FORCE GENERATOR WITH TWO ECCENTRIC ROTATING MASSES OR WITH A SINGLE INERTIAL MASS

| Model                      | 20-20      | 2-50       | V104      |
|----------------------------|------------|------------|-----------|
|                            | mechanical | mechanical | hydraulic |
| Maximum force (kN)         | 200        | 20         | 73.5      |
| Freq. Range (Hz)           | >0–20      | 2–50       | >0–80     |
| Use (Vertical/ Horizontal) | V / H      | V / H      | V         |
| Weight (kN)                | 37.5       | 3.9        | 16.5      |



### ELECTRO-HYDRAULIC ACTUATORS (HIGH VELOCITY/FATIGUE TESTS)

|                        |                   |
|------------------------|-------------------|
| Max force (kN)         | 15-50-100-160-250 |
| Frequency range        | 0 – 150 Hz        |
| Max oil Flow (210 bar) | 340l/min          |



### ELECTRO-HYDRAULIC ACTUATORS (LOW VELOCITY/FATIGUE TESTS)

|                        |   |
|------------------------|---|
| Max force (kN)         | 250 - 280 - 300 - 500 - 1000 - 1500 - 2500 - 6000 |
| Max oil Flow (210 bar) | 340 l/min   |



CESI is a world-leading technical consulting and engineering company in the field of technology and innovation for the electric power sector. Through its Division KEMA Labs, CESI is the world leader for the independent Testing, Inspection and Certification activities in the electricity industry, and is a well-recognized Conformity Assessment Body accredited according to the UNI CEI EN/ISO/IEC 17065:2012,

all the laboratories are accredited according to the UNI CEI EN ISO/IEC 17025:2018 and the inspections services are accredited according to the UNI CEI EN ISO/IEC 17020:2012 for Inspections of Type A. Furthermore, CESI is certified according to ISO 9001, ISO 45001/ OHSAS 18001 and ISO 14001 and is a notified body for IECEx Certification Scheme and ATEX.

## CESI's Business Areas:

- **Testing, Inspection and Certification** services for HV, MV and LV electrical components;
- **Engineering and Consulting** services for power systems and markets, transmission and distribution grids, generation plants, renewable and hydro plants;
- **Environmental Consulting and Structural Engineering** services for Energy, T&D, Industry and Transport sectors;
- Production of **Solar Cells** for Space and Terrestrial (CPV) applications.

# CESI

Shaping a Better Energy Future

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