Flying the flag for decades to come

MAURER supplies tuned mass dampers for the 195 m flagpole in Baku, Azerbaijan.

Baku. **Azerbaijan has hoisted the world's largest flag on one of its tallest flagpoles. Located on the shores of the Caspian Sea, it is exposed to extreme winds. The resulting vibrations represented a major challenge. The Azerbaijanis turned to MAURER for a solution. The experts in structural protection supplied and installed precisely tuned mass dampers (TMDs).**

The flagpole in the Azerbaijani capital Baku towers 195 m above the city and carries a flag measuring a massive 35 x 70 m. It consists of ten conical metal segments that are screwed together. When the wind blows, the forces exerted on the mast are enormous. This causes vibrations that can lead to resonance, which in turn can cause major damage ranging from cracks to total collapse. On top of all this, Baku is located in a seismically active area.

Tough requirements

The requirements for the structural protection system were therefore daunting. The project called for a sophisticated system of tuned mass dampers (TMDs). The Azerbaijanis turned to MAURER, as the Munich-based company's dampers were already working reliably in two towering skyscrapers in the city: the Baku Tower and SOCAR Tower.

Tuned mass dampers

In Munich, MAURER designed and produced three TMDs for segment 9. Installed at a height of around 180 m, these dampen all critical vibrations on the flagpole. The dampers were installed on the ground before the segment was mounted up on the mast. This required them to be completely disassembled into small pieces and then fitted one above the other inside the segment.

The three TMDs (image right) are calculated and calibrated to trigger a reaction even in a gentle breeze. Different TMDs are activated depending on the vibrational frequencies and wind strength. If the wind is strong, all three dampers are activated simultaneously.

The functional parameters of the three TMDs differ accordingly. The largest damper mass is 7.1 t, the pendulums measure 144 to 6,414 mm in length, and the frequencies range from 0.65 to 1.32 Hz.

The three tuned mass dampers (TMDs) arranged on top of each other.

Photo: MAURER

The 195 m flagpole in Baku.

Photo: Maneco

The three TMD masses, which resemble three-quarter cylinders, in the plant in Munich.

Photo: MAURER

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The damper masses resemble a three-quarter cylinder. They are each suspended from three pendulum rods secured to the inner wall of the mast. This special shape is necessary so that the maintenance ladder can run up the centre of the mast to the top. The damper masses are each secured horizontally to the wall by four hydraulic dampers. These dampen the movements of the pendulums and stop the masses colliding with the wall.

The TMD masses swing in the opposite direction to the mast. Therefore, if the mast swings to the right, the TMD masses swing to the left at the mast's various natural frequencies, and vice versa. This physical principle of absorption and damping reduces the mast's vibration amplitudes by a factor of two to ten. This prevents fatigue and damage, and will allow the flagpole to remain in service for over 30 years.

Prior to delivery, the tuned mass dampers were assembled at the plant in Munich and successfully inspected by the certification body TÜV SÜD.

The project was managed by ESDESCON LLC, MAURER's representative in Azerbaijan. The mast was erected in mid-2024, before being inaugurated for the national holiday on 9th November.

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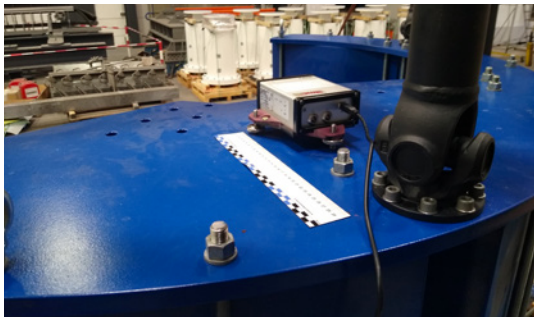
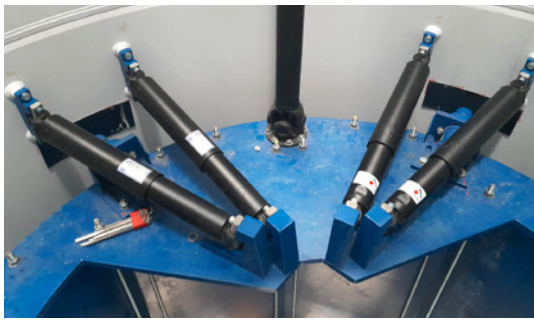


The tuned mass dampers are tested in the Munich plant under the watchful eye of TÜV SÜD inspectors.
Photo: MAURER

The tuned mass dampers were gradually inserted and installed in segment 9 of the flagpole, before the complete segment was mounted on the mast.
Photo: MAURER



Hydraulic dampers fitted inside the flagpole and connected to the blue damper mass, in order to absorb and limit its movements.
Photo: MAURER

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Quick facts about MAURER SE

MAURER SE is a leading specialist in mechanical engineering and steel construction, with over 1,500 employees worldwide. The company is the market leader in structural protection systems (bridge bearings, expansion joints, seismic protection devices, tuned mass dampers and monitoring systems). It also develops and produces vibration isolation solutions for structures and machines, rollercoasters and Ferris wheels, as well as special structures in steel construction.

MAURER has been involved in many spectacular large-scale projects. These include the world's largest bridge bearings in Wazirabad, Pakistan, earthquake-resistant expansion joints for the world's longest suspension bridge, the 1915Çanakkale in Turkey, tuned mass dampers in the Baku Tower and Socar Towers in Azerbaijan, and the unique guided cross-ties with derailing protection on the Champlain railway bridge in Montreal. Complete structural isolation projects range from the Acropolis Museum in Athens to the new airport in Mexico. MAURER has also worked on spectacular amusement rides, such as the Umadum Ferris wheel in Munich, BOLT™ – the first rollercoaster on a cruise ship, and the world's first duelling rollercoaster at the Mirabilandia Park in Ravenna, Italy.

The lowest of the three tuned mass dampers. The mass is the blue three-quarter cylinder. The three pendulum rods can be seen on the right, behind the ladder and at the left edge of the ladder.

Foto: MAURER

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