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Heavy Equipment Test System for Hyundai

Hyundai Heavy Industries (HHI), the world's largest shipbuilder with over 25% of the international market, has contracted with ANCO Engineers for the development, engineering, fabrication and installation of a shake table system for dynamic testing and qualification of equipment weighing in excess of 30,000 lbs. Following ANCO's installation of the 14 ft. x 14 ft. table and associated equipment system at HHI facilities in Ulsan, South Korea, Hyundai will utilize the test system primarily to support Hyundai's ship and railroad rolling stock engineering and manufacturing activities.

ANCO's R-020 system, illustrated below, will qualify equipment and validate

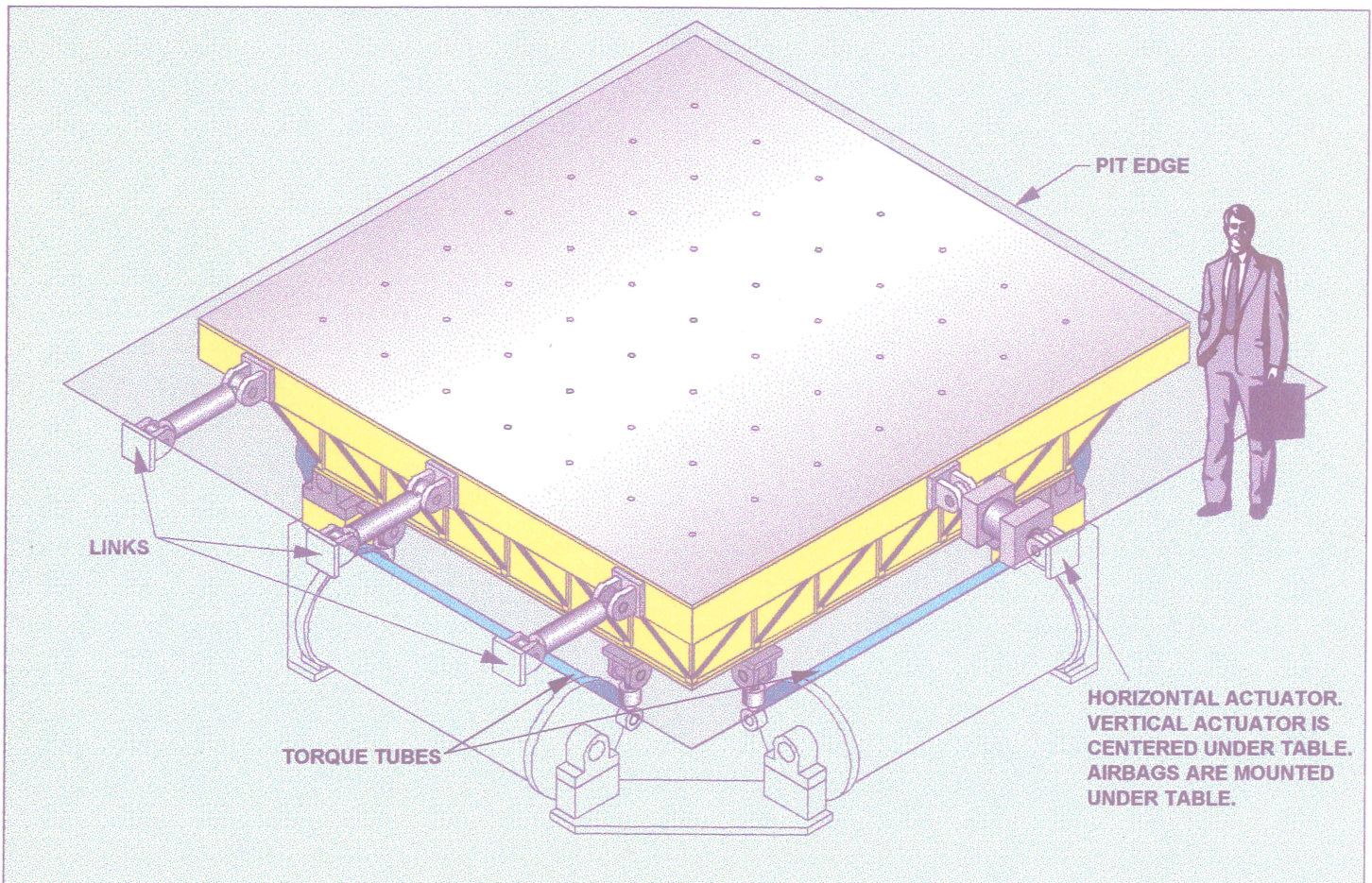
designs for varying sea state conditions. However, the R-020's capabilities are well in excess of those required to meet such naval specifications as MIL-STD-167.

This 'extra' capacity supports the R-020's use for seismic qualification and shock testing of large equipment. With peak accelerations and displacements (with maximum payload) of 4 g's and 6 inch double amplitude, the R-020 is capable of testing to such seismic specifications as IEEE-344 and Bellcore TR-NWT-000063. Even higher motions are achievable with reduced payloads.

High table stiffness and other system properties are achieved using four redundant torque tubes to control table

pitch and roll as well as special joint designs to minimize backlash and 'outer loop' acceleration feedback and control.

The use of torque tubes permits a lower-cost design by enabling the system to be actuated by only two (2) servo-hydraulic actuators, each with very high flowrate servo valves. Each actuator relies upon the 'outer loop' PC-based controller for sine, shock, random, and seismic test control. The ANCO table design, optimized through physical modeling and finite element simulations, relies upon a combined shear and truss concept to help achieve performance goals.



Bellcore Qualification Testing - Cellular Networks

ANCO Engineers provides equipment qualification services to such telecommunications industry leaders as **QUALCOMM, Inc.** ANCO performs **vibration, seismic and rain intrusion testing** of network equipment as stipulated by the **BELLCORE** standards organization. These standards require a rigorous suite of tests to verify that system designs provide for adequate physical protection of housed equipment and that the equipment will function

properly following rather severe earthquake excitation.

For rain intrusion testing, ANCO Engineers has developed a reconfigurable water spray system for subjecting test specimens to the water spray intensity, multiple directions of spray and spray-nozzle-to-test-specimen distances needed to provide the mandated test environment.

For vibration and seismic testing, the ANCO R-5 Triaxial Shake provides

test specimen vibrational inputs simultaneously in each of three independent directions of motion (X,Y,Z). Alternatively, the R-5 can provide uniaxial testing sequentially in each of the X,Y,Z directions. The R-5 is capable of providing seismic qualification testing of specimens weighing more than 4000 lbs and provides input motions well in excess of the peak ground accelerations required by **BELLCORE** for the highest seismic risk regions (UBC Zone 4) of the U.S.A.

Automated Fatigue Test System for Walbro Automotive

Walbro Automotive (Caro, MI) recently selected ANCO Engineers to develop, engineer and fabricate an automated dynamic test system for fatigue testing of automotive fuel tanks developed for installation in Toyota-manufactured automobiles. Walbro required an inexpensive, robust system that simulates severe road conditions and imposes vibratory loading through vehicle rear wheels while supporting the rear half of the test vehicle.

To meet Walbro Automotive's technical requirements and cost constraints, ANCO developed, engineered, fabricated and installed at Walbro's manufacturing facility an eccentric mass vibrator (EMV) system in which multiple variable speed electric drives are used to rotate shafts with offset masses. The force produced by such an exciter is sinusoidal and proportional to the mass eccentricity times the square of the rotational frequency.

This force can be used, for example, to actuate a shake table or perform modal testing.

EMVs are very reliable, compact, and cost effective, producing high force per pound of vibrator or dollar of cost when compared to servo-hydraulic or electro-dynamic test systems. Further, they require no hydraulic systems nor special foundations. By 'ganging' EMV systems into a single test apparatus (mounted to the underside of a flexible beam supporting the test vehicle wheels) and independently driving the multiple eccentric masses via PLC controls, ANCO delivered a superior test system that has proven extremely reliable while providing the following capabilities:

- Programmed frequency sweeps, dwells, and jumps

- Multi-point frequency/amplitude settings, independent of eccentricity setting
- Simultaneous multi-frequency excitation to produce pseudo-random excitation
- Automatic repetitive test profile simulation

This EMV technology has been enhanced and used by ANCO Engineers in the dynamic testing of such diverse structural systems as dams (Aswan, Egypt; Pacoima, CA), offshore oil platforms (North Sea, Gulf of Mexico, Pacific), massive rotating equipment foundations at electric generating plants (Four Corners, NM; Page, AZ), nuclear generating stations (HDR, Germany; San Onofre, CA; Indian Point, NY), and high rise as well as historic buildings (California, Missouri).

ANCO Engineers, Inc.