APS 420 ELECTRO-SEIS®

Long stroke shaker with linear ball bearings

Applications

- seismic simulation for components
- test and calibration for seismic instruments
- geological services, science, physics and seismic applications

Selected data

- force rating: 900 N (202 lbf)
- frequency range: 0 Hz…200 Hz
- displacement: 150 mm (6 in)
- armature weight: 3.8 kg (8.4 lbs)

Features

- can be used to generate sine wave, swept sine wave, random or impulse force waveforms, fully adjustable at source
- test set-up flexibility with fixed body, free body and free armature modes of operation
- optimized to deliver power to resonant load with minimum shaker weight and drive power
- adjustable zero position of armature

Specification

The APS 420 ELECTRO-SEIS® vibration exciter has been optimized for driving structures at their natural resonance frequencies. It is an electrodynamic force generator, the output of which is directly proportional to the instantaneous value of the current applied to it, independent of frequency and payload response. It can deliver random or transient as well as sinusoidal waveforms of force to the load. The armature has been designed for minimum mass loading of the drive point. The ample armature displacement allows driving antinodes of large structures at low frequencies and permits rated force at low frequencies when operating in a free body mode.

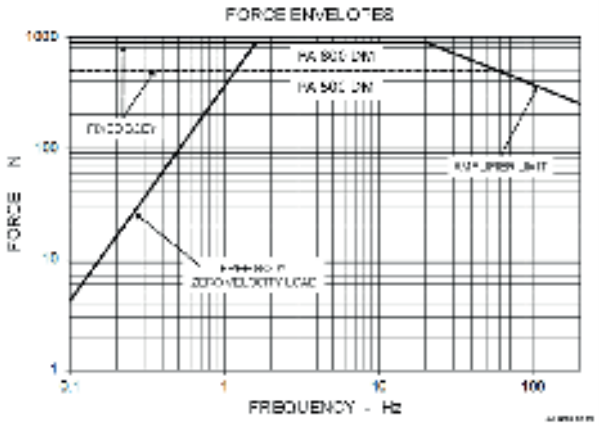
The product employs permanent magnets and is configured such that the armature coil remains in a uniform magnetic field over the entire displacement range, assuring force linearity. The enclosed, self-cooled construction provides safety and minimum maintenance. Attachment of the armature to the drive point is accomplished by a simple thrust rod like the APS 8610 modal stinger. An amplifier, such as the PA 800 DM power amplifier, is required to provide armature drive power.

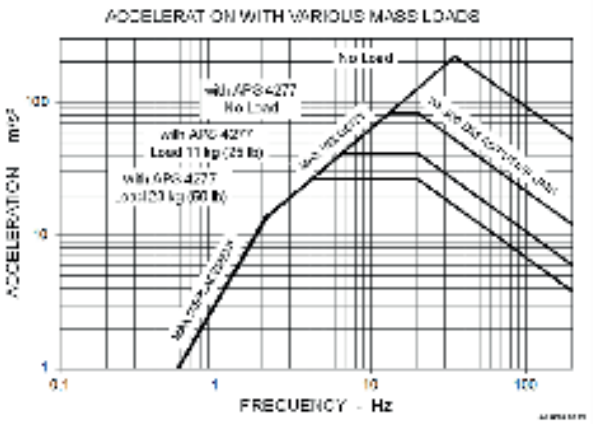
Technical data

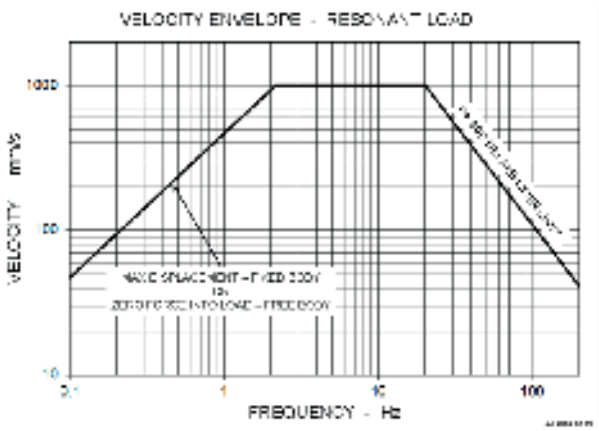
Force rating (sine peak)	900 N (202 lbf)
Frequency range	DC…200 Hz
Displacement (peak - peak)	150 mm (6 in)
Velocity (sine peak)	1 000 mm/s (39 in/s)
Direction of excitation	horizontal or vertical
Moving table (weight)	3.6 kg (8 lbs)
Overhung load at armature attachment point, max.	9 kg (20 lbs)
Payload, max.	23 kg (51 lbs)
DC coil resistance	1.1 Ω
Dimensions L × W × H	591 mm x 360 mm x 280 mm (23.3 in x 14.2 in x 11.0 in)
Weight (net weight)	140 kg (309 lbs)
Temperature range (in operation)	+5 °C…+40 °C (+41 °F…+104 °F)

Performance

The primary purpose of the APS 42 ELECTROSEIS® vibration exciter is to determine the dynamic characteristics of mechanical structures. At resonance, a large amount of energy is contained in the structure, and the shaker must accommodate the resulting motion. However, it needs only supply the real mechanical power dissipated by damping mechanisms within the structure. If a drive point on a structure in resonance is vibrating with a velocity of 1 000 mm/s (39 in/s) peak and a force of 900 N (202 lbf) peak is required to sustain the vibration level, then the shaker will be delivering approximately 450 W RMS to the structure. Such a load on the shaker is termed a matched resonant load, and it is purely resistive since the force is in a phase with the velocity. If the resonant load input is other than 900 N × 1 000 mm/s, the full 450 W of mechanical power cannot be delivered to the structure, the system being either force or velocity limited. If the resulting maximum response level is not great enough, the user may have the option of moving the shaker to a drive point having an impedance closer to the matched value, or adding more shakers to the array driving the structure. Within the limitations of maximum force and velocity, the actual power delivered to a structure is a function of the input mechanical impedance at the drive point. In typical modal testing, this input impedance varies widely in magnitude and phase angle. At different frequencies, the input impedance of the drive point may appear predominately spring-like, mass-like, or resistive. Since the object of the tests is to establish resonant modes, at which the input mechanical impedance of all drive points are resistive, the shaker's maximum performance capability is most meaningful stated in terms of the force and velocity that can be obtained when driving a matched resistive load. Therefore, performance is given in the form of graphs which present the envelopes of maximum force and velocity delivered to a resonant structure as functions of the resonance frequency of the structure. Another application is the excitation for sensor calibration. Acceleration envelopes of the APS 420 ELECTRO-SEIS® vibration exciter with various payloads are shown in the graph below for the 900 N force rating.



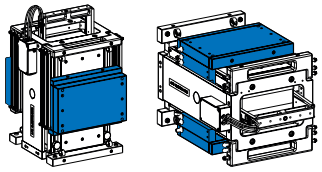




Accessories

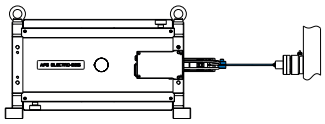
reaction mass

APS 4212



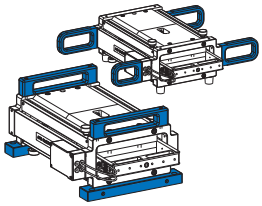
modal stinger kit

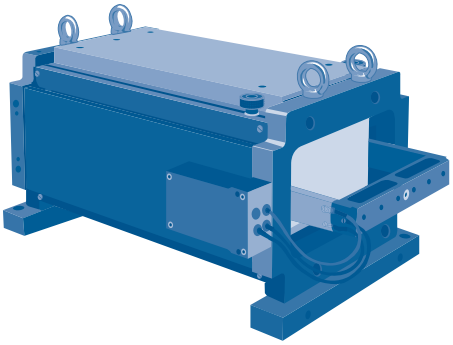
APS 8610



handles

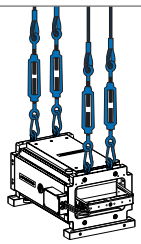
APS 4221





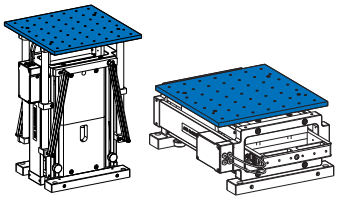
steel cable kit

APS 8612



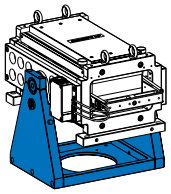
auxiliary table kits

APS 4252, APS 4277, APS 4278



trunnion base

APS 4222



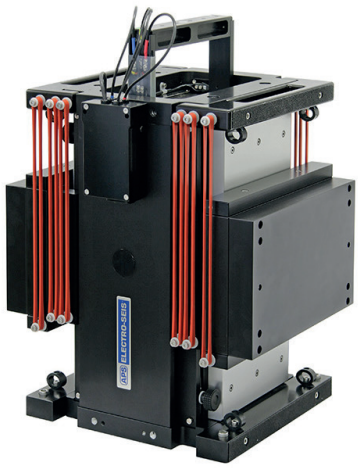
Further accessories	
Power amplifier	PA 800 DM
System interconnect cable	APS 0082-6E
Center position controller for vibration exciters	CPC
Overtravel switch	APS 8543
Overtemperature switch	APS 8544
Additional accessories	on request

Modes of operation

Free armature mode

In this mode, the armature provides the reaction mass for force delivered to the DUT via the vibration exciter body. Auxiliary reaction mass may be added to the armature to decrease the low frequency limit for rated force operation.

The APS 420 and APS 4212 reaction mass may be used in a vertical or horizontal free armature mode with rated force down to less than 4 Hz. Feet and carrying handles are provided for ease in placement of the vibration exciter on horizontal test surfaces.

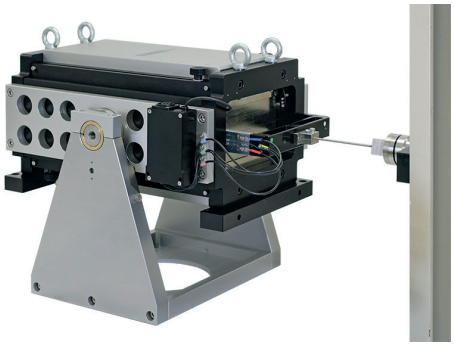


APS 420 with APS 4212 reaction mass assembly

Fixed body mode

By providing a rigid attachment between the body and ground, the full relative velocity and displacement capability is available for payload motion. Maximum rated force can be delivered down to 0.01 Hz and 70 % maximum to 0 Hz.

When choosing the best vibration exciter location for tests, the APS 4222 trunnion base allows the vibration exciter to be set up in any axis from vertical to horizontal.



APS 420 with APS 4222 trunnion base and APS 8610 modal stinger

Free body mode

In this mode, the body provides the reaction mass. Load and body motion are accommodated within the total relative velocity and displacement. Because of the high cross-axis stiffness provided by the armature linear guidance system, the vibration exciter may be supported above ground level by means of suspension lines (APS 8612 steel cable kit) attached to the body. This provides a convenient mounting for introducing force parallel to a horizontal mounting surface. Examples of such surfaces include floors, roofs, platforms, cabinets, bridges and tanks.

Shaker table mode

Auxiliary table kits are available which, when installed on the basic vibration exciter, enable the shaker to provide long stroke excitation to components or model structures mounted on the table.

APS 420 with APS 4252 auxiliary table kit – horizontal

The APS 4252 auxiliary table kit provides horizontal motion, the APS 4277 auxiliary table kit provides vertical motion and the APS 4278 auxiliary table kit provides either the vertical or horizontal motion configuration.