

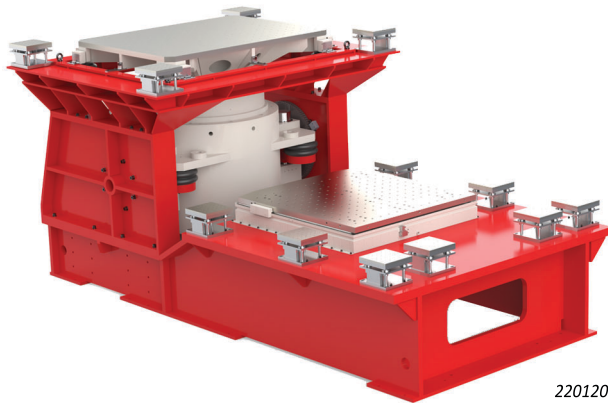
LDS® Vibration Test Solutions

LDS V9940 Shaker

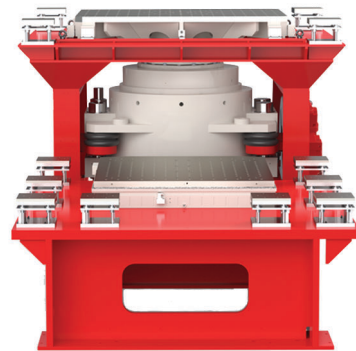
for Electrical Vehicle Battery & Assembly Testing

The largest and most powerful shaker in the LDS® range, V9940 is a water-cooled electrodynamic shaker that has been optimised for considerable half-sine shock performance and reduced moving masses via pedestal bearing assemblies. It is ideal for shock and high-performance vibration tests of extra-large payloads up to 5000 kg (11,000 lb), such as electrical vehicle (EV) battery packs, e-axes and e-powertrains, and has a peak sine force rating of 300 kN (67,443 lbf)*.

V9940 combo-mounted with head expander and HBT1500 expansion slip table with pedestal bearings



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Features

- Adherence to the following standards:
 - UNECE R100/UN 38.3: 50 g/30 g, 6 ms and 11 ms
 - ISO 12405: 25 g 15 ms
- Optimised table designs to suit battery test solutions
- Minimised moving masses to maximise payload mass
- Payloads up to 3 m as standard (other sizes available upon request)
- Full project management support for turnkey EV testing solutions
- Compatibility with climatic chambers with options for thermal management

Shaker Parameters

Performance *

Armature Diameter	760 mm (29.92 in)
Sine Force (peak)*	300 kN (67440 lbf)
Random Force (rms)†	266.9 kN (60024 lbf)
Max. ½-sine Shock Force (peak)‡	800 kN (179847 lbf)‡
Armature Resonance (fn)	1325 Hz
Usable Frequency Range∞	5 – 2000 Hz
Effective Moving Mass	254.9 kg (562 lb)
Velocity (sine peak)††	2.0 m/s (78.7 in/s)
Acceleration (sine peak)*	100 g (980 m/s²)
Acceleration (random rms)	60 g (558 m/s²)
Shock Velocity (peak)	4.0 m/s (157.5 in/s)
Displacement (peak – peak) – continuous	50.8 mm (2.0 in)
Displacement (transient) – shock operation	63.5 mm (2.5 in)
Required Amplifier	DPA320K or DPA384K

Characteristics

Suspension Axial Stiffness	91 N/mm (519.6 lb/in)
Suspension Rotational Stiffness	10700 kN m²/rad (733183 lbf ft²/rad)
Suspension Cross-axial Stiffness	71.8 kN/mm (409989 lb/in)
Internal Load Support Capacity	5000 kg (11023 lb)
Shake Body Mass	12970 kg (28590 lb)
Stray Magnetic Field**	2.0 mT, 20 gauss
Low Gauss Option	0.3 mT, 3 gauss

* Force and velocity ratings depend on the amplifier and matching transformer. Max sine force and acceleration levels limited to 1 sweep per hour.

† Random and shock ratings assume a payload approximately twice the mass of the armature; shock pulse 2 ms. For advice on specific test requirements, contact HBK.

‡ Possible with 50 g, 6 ms and 30 g, 6 ms standard tests

∞ Force will be reduced above 1700 Hz and for heavy payloads depending on the dynamics of payload response

** Theoretical maximum, measured 150 mm above table, full field, at normal operating temperature

†† Sine force limited to 260 kN at max. velocity with DPA384K amplifier

Environmental Data

	V9940 SHAKER	DPA-K AMPLIFIER 320 kVA	DPA-K AMPLIFIER 384 kVA	COOLING UNIT & FPS
Working Ambient Temperature (°C)	4.5 to 66	5 to 40	5 to 40	5 to 40
Heat Dissipation (rejected to air)	12 kW	33.7 kW	38.5 kW	4.79 kW
Acoustic Noise at 2 m	105 dBA	91 dBA	92 dBA	89 dBA
Cooling Air Flow	–	7.6 m ³ /s	9.1 m ³ /s	0.66 m ³ /s
Raw Water Flow Rate	–	–	–	191 L/min
Raw Water Max. Inlet Temperature (°C)	–	–	–	32
Raw Water Max. Outlet Temperature (°C)	–	–	–	45
Compressed Air Supply	6.9 bar/100 psi	–	–	–
Max. Required Input	–	340 kVA	425 kVA	170 kVA
Height (mm)	*	1905	2080	1905
Width (mm)	*	2583	2583	1500
Depth (mm)	*	825	825	825

* Dependent on configuration.

V9940 Armature Inserts

Raised insert options available, stainless steel M12, or ½" UNC

- 1 insert at centre of armature
- 8 inserts on 203.2 mm (8 in) PCD
- 8 inserts on 406.4 mm (16 in) PCD
- 8 inserts on 558.8 mm (22 in) PCD
- 8 inserts on 711.2 mm (28 in) PCD

PCD = pitch circle diameter

System Components

DPA-K Amplifier

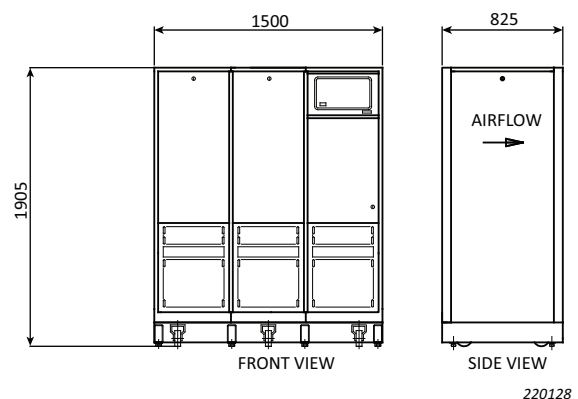
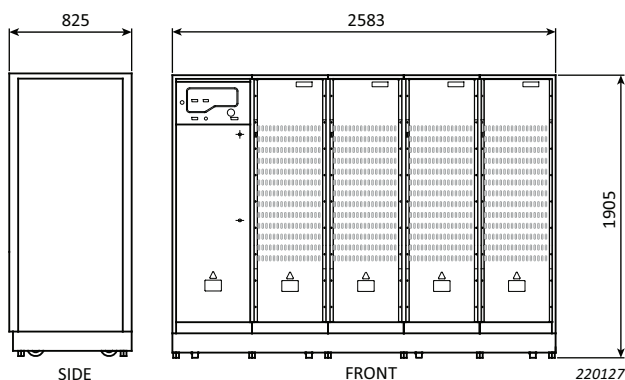
The amplifiers are specifically designed to supply LDS V9940 high-force shakers with the signal they require to perform at optimal levels. Featuring a class D rating, they deliver maximum power with minimal energy waste and lower running costs.

- Power output range from 320 to 384 kVA
- Configurable interlocks for comprehensive system monitoring and safe shutdown
- Low distortion, wide bandwidth (20 Hz to 3 kHz at –3 dB and signal-to-noise ratio better than –68 dB)
- DPA320K mass: 3100 kg (6837 lb);
DPA384K mass: 3250 kg (7167 lb)
- For DPA384K, height is increased to 2080 mm

Cooling Unit and Field Power Supply

The cooling unit/field power supply is a multipurpose assembly providing the following functions required by specific ranges of vibration test system:

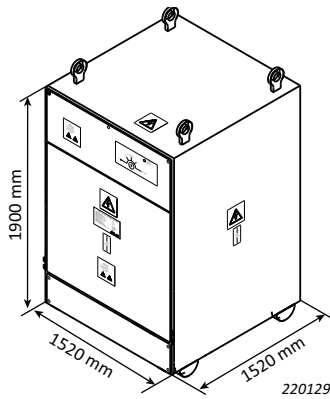
- A demineralised water supply used to cool the shaker's field and armature coils
- A hydraulic oil supply, cooled, to operate the shaker's hydrostatic guide bearing
- The field power supply for the shaker's field coils
- Mass: 1222 kg (2695 lb)



Matching Transformer

A matching transformer is an auto-wound transformer with output taps suiting the voltage and current requirements of a particular vibration testing system.

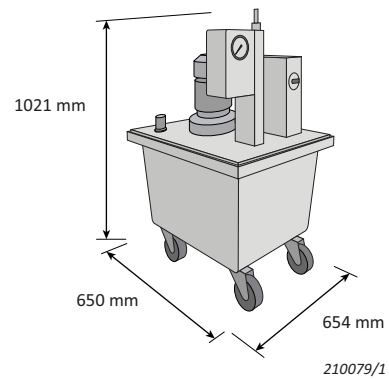
- Mass: 2400 kg (5293 lb)



Slip Table Hydraulic Unit

HBT slip tables use a stand-alone high-pressure hydraulic pump for the bearings, which is in addition to the shaker hydraulic unit and is always required.

- Mass: (empty) 75 kg (165 lb)

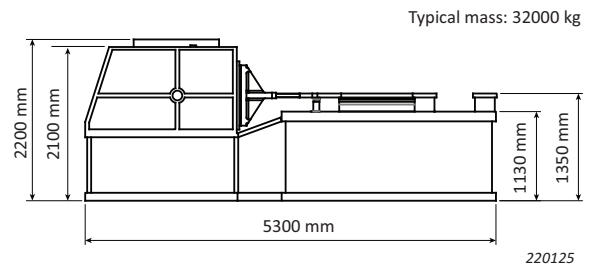
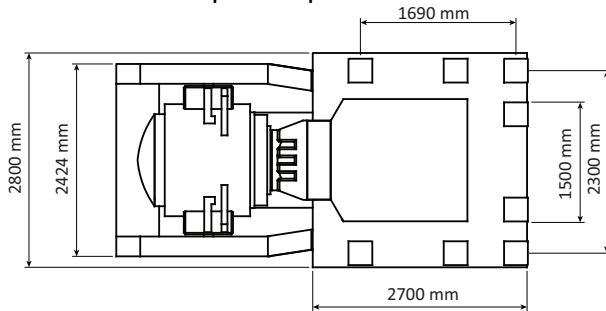


Slip Table, Head Expanders and Pedestal Bearing Layouts

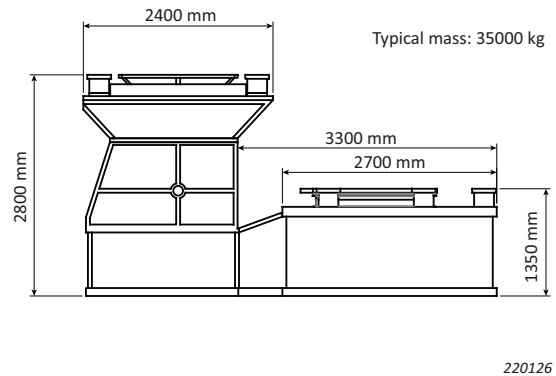
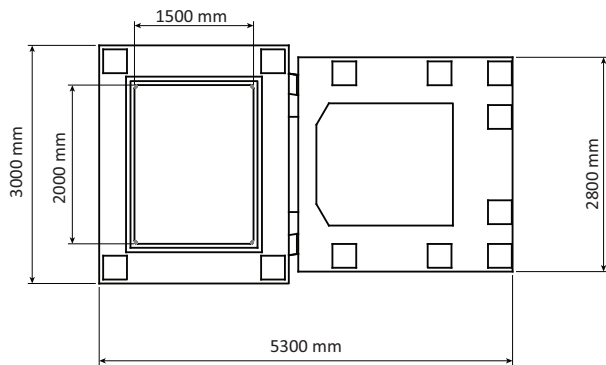
A combo with an HBT1500 or HBT2000 expansion slip table and a 1.5 m by 2.0 m head expander is recommended. The base has been specifically designed to accommodate a 1.5 to 2.0 m slip plate, with additional space for pedestal bearings to suit the

specific battery requirements. This increases performance of the system by reducing moving masses, resulting in higher resonance and improved dynamics.

V9940 Combo with HBT 1500 Expansion Slip Table



V9940 Combo with HBT1500 Expansion Slip Table and 1500 × 2000 mm Head Expander

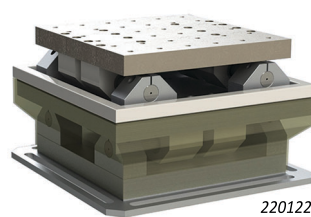


Pedestal Bearings

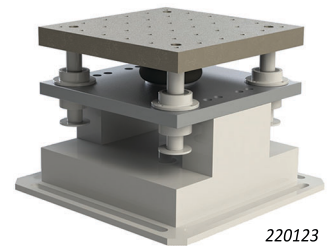
To enable full testing of large, heavy EV batteries, HBK employs the use of pedestal bearings to support the test load. Instead of a full size slip plate to accommodate large footprint EV batteries, pedestal bearings can be positioned around the perimeter of the slip table with a smaller slip plate giving a lighter moving mass.

The pedestal bearings have a 300 × 300 mm mounting surface and consist of paired journal guide bearings, which provide guided displacement in the excitation axis and allow for thermal expansion in the cross axis. The bearing housings are lined with a PTFE-based material and slide along guide shafts.

Horizontal Pedestal Bearing



Vertical Pedestal Bearing



Integration with Climatic Chambers

HBK offers shaker+climatic chamber options, specific to your requirements.

The V9940 shaker has been designed for safe integration with climatic chambers. The shaker system is hermetically sealed to ensure long life performance.

HBK is able to provide the following options for thermal management:

- Spray/mist
- Humidity
- Flooding

Communication with climatic chambers and with higher-level automation system is possible with programmed digital input signals from the controller.

Fig. 1 Typical walk-in chamber for shakers



Safety Information

Complies with the following EU directives:

- Machinery: 2006/42/EC
- Low Voltage: 2014/35/EU
- EMC: 2014/30/EU
- Designed in accordance with EN 61010-1:2010

Complies with the following UK directives:

- Supply of Machinery (Safety) Regulations 2008
- Electrical Equipment (Safety) Regulations 2016
- Electromagnetic Compatibility Regulations 2016
- Designed in accordance with BS EN 61010-1:2010

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