Water cooled vibration testing systems

64 to 289 kN (15 - 65 klbf) force

V964, V984 and V994 Shakers

DPA-K Amplifiers

Typical system applications

- atmospheric and flight simulation testing
- avionics and military electronics
- structural dynamics
- hazardous materials
- clean room environments
- multi-shaker space applications

A range of vibration testing systems designed to minimise operational costs whilst providing the maximum flexibility to the test engineer. Featuring:-

- Unique closed-loop water cooling system
- Resin bonded, carbon fibre reinforced coil construction
- Long stroke rolling strut armature suspension
- Ruggedised field coil construction
- Pneumatic test load support
- Automatic armature and body position load compensation
- Ultra-compact modular switching amplifiers
- Greater than 90% power efficiency
- 3 times peak to RMS capability
- Distortion less than 0.15% THD
- Complies with European safety regulations
- Proven multi-shaker, multi-axis shaker control

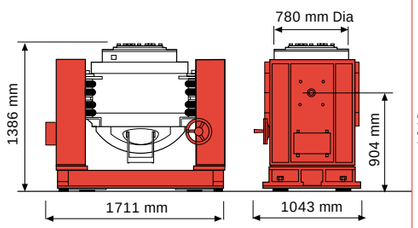
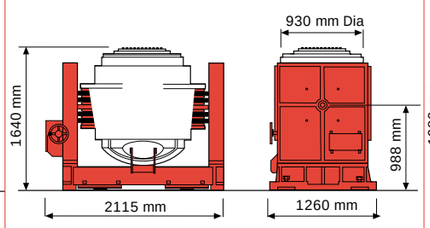
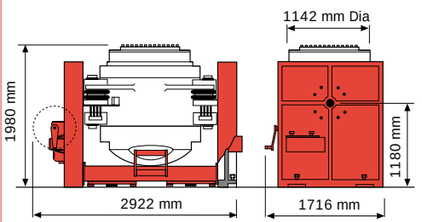
Total system solutions

With the addition of an LDS sine, random and shock controller we can provide total testing solutions. Alternatively our systems are designed to interface with any standard third party controller. Whichever route you choose, you have the assurance that all LDS products are supported by a world-wide sales and service organisation. From application engineering, installation and training through to maintenance, spares and repairs LDS offers a total service approach to keep your system operating efficiently and reliably.

LDS
LING DYNAMIC SYSTEMS

V964, V984, V994

Shaker system
configuration & performance parameters

Model	V964 – DPA-K		V984 – DPA-K		V994 – DPA-K	
						
	Metric	**American**	**Metric**	**American**	**Metric**	**American**
Armature diameter	432 mm	17 in	590.6 mm	23.25 in	760 mm	29.92 in
Peak sine force	89.0 kN	20000 lbf	160 kN	36000 lbf	289 kN	65000 lbf
Random force rms (ISO 5344)	89.0 kN	20000 lbf	160 kN	36000 lbf	267 kN	60000 lbf
Half sine peak bump force	267 kN	60000 lbf	480 kN	108000 lbf	801 kN	180000 lbf
Armature resonance (fn)	2250 Hz	2250 Hz	1700 Hz	1700 Hz	1380 Hz	1380 Hz
Useful frequency range	5-2500 Hz	5-2500 Hz	5-2000 Hz	5-2000 Hz	5-1700 Hz†	5-1700 Hz†
Effective mass of moving element	59 Kg	130 lb	130.2 Kg	287 lb	254.9 Kg	562 lb
Velocity peak sine	2.0 m/s	78.7 in/s	2.0 m/s	78.7 in/s	2.0 m/s	78.7 in/s
Acceleration sine peak	981 m/s^2	100 gn	981 m/s^2	100 gn	735 m/s^2	75 gn
Acceleration random rms	686 m/s^2	70 gn	686 m/s^2	70 gn	588 m/s^2	60 gn
Degauss* **Stray magnetic field:**	<1 mT	<10 gauss	<0.9 mT	<9 gauss	<2 mT	<20 gauss
Total heat dissipation **Shaker:** **Amplifier:** **CUFPS:**	12 kW 13.8 kW 2.8 kW	12 kW 13.8 kW 2.8 kW	14 kW 20.6 kW 3.6 kW	14 kW 20.6 kW 3.6 kW	21 kW 30 kW 4.8 kW	21 kW 30 kW 4.8 kW
LDS amplifier	DPA130/140K	DPA130/140K	DPA195/210K	DPA195/210K	DPA280K	DPA280K
Amplifier rating	130 kVA	130 kVA	195 kVA	195 kVA	280 kVA	280 kVA
Suspension cross-axial stiffness	21000 N/mm	120000 lbf/in	31520 N/mm	180000 lbf/in	71800 N/mm	410000 lbf/in
Suspension axial stiffness	61.3 N/mm	350 lbf/in	87.5 N/mm	500 lbf/in	91.1 N/mm	520 lbf/in
Displacement (continuous) pk-pk	38 mm	1.5 in	38 mm	1.5 in	50.8 mm	2.0 in
Body mass	2820 kg	6217 lb	6275 kg	13830 lb	12970 kg	28590 lb
Displacement pk-pk half sine bump	50.8 mm	2.0 in	50.8 mm	2.0 in	63.5 mm	2.5 in
Body suspension resonance	<2.5 Hz	<2.5 Hz	<2.5 Hz	<2.5 Hz	<2.5 Hz	<2.5 Hz
Internal load support capability	907 kg	2000 lb	2000 kg	4410 lb	5000 kg	11023 lb
Cooling air flow **Amplifier:** **CUFPS:**	3.3 m^3/s 0.66 m^3/s	6990 ft^3/m 1400 ft^3/m	4.95 m^3/s 0.66 m^3/s	10485 ft^3/m 1400 ft^3/m	6.6 m^3/s 0.66 m^3/s	14000 ft^3/m 1400 ft^3/m
Heat rejected to raw water **CUFPS:**	100 kW	100 kW	160 kW	160 kW	211 kW	211 kW
Raw water flow **CUFPS:**	90 l/min	23.8 US G/min	147 l/min	38.8 US G/min	209 l/min	55.2 US G/min
Raw water max. inlet temperature **CUFPS:**	32°C	90°F	32°C	90°F	32°C	90°F
Raw water pressure drop **CUFPS:**	0.44 bar	6.38 lbf/in^2	0.49 bar	7.15 lbf/in^2	0.77 bar	11.2 lbf/in^2
Compressed air supply	6.9 bar	100 lbf/in^2	6.9 bar	100 lbf/in^2	6.9 bar	100 lbf/in^2
Total electrical requirements **Shaker:** **Amplifier:** **CUFPS:**	0.12 kVA 123 kVA 72 kVA	0.12 kVA 123 kVA 72 kVA	0.12 kVA 184 kVA 116 kVA	0.12 kVA 184 kVA 116 kVA	0.12 kVA 245 kVA 170 kVA	0.12 kVA 245 kVA 170 kVA
Working ambient temperature range **Shaker:** **Amplifier:** **CUFPS:**	+4.5°C to 66°C +5°C to 40°C +5°C to 40°C	+40°F to 150°F +41°F to 104°F +41°F to 104°F	+4.5°C to 66°C +5°C to 40°C +5°C to 40°C	+40°F to 150°F +41°F to 104°F +41°F to 104°F	+4.5°C to 66°C +5°C to 40°C +5°C to 40°C	+40°F to 150°F +41°F to 104°F +41°F to 104°F
Acoustic noise at 2m** **Shaker:** **Amplifier:** **CUFPS:**	105 dBA 85 dBA 68 dBA	105 dBA 85 dBA 68 dBA	105 dBA 85 dBA 75 dBA	105 dBA 85 dBA 75 dBA	105 dBA 90 dBA 75 dBA	105 dBA 90 dBA 75 dBA

* Degauss measured 150 mm (6") above armature, full field at normal operating temperature
** Acoustic noise at 2m (measured in enclosed test cell - worst case)
† 2000 Hz at reduced force

Advantages of LDS water cooled systems

A Rolling strut suspension provides up to 51mm (2") displacement for sine operation and 63.5mm (2.5") for transient pulses - no critical wearing parts - simple to operate.

B Testload compensation system - maintains the armature at any pre-selected datum position.

C High performance field coil material technology and encapsulation techniques give long-term durability at vibration and temperature extremes.

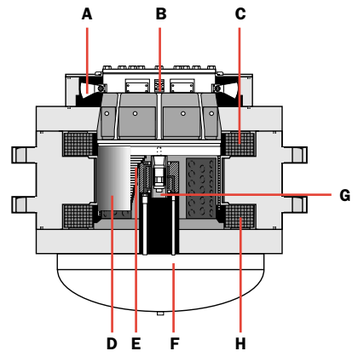
D Water-cooled coil construction gives excellent low frequency performance, requiring smaller amplifiers with reduced running costs.

E Patented armature design - resin bonded, carbon fibre construction ensures long and trouble-free life.

F Hermetically sealed body - provides a static load support up to 5 tonnes. No air demands on the environment, reducing air conditioning costs - ideal for testing hazardous materials working with environmental chambers and clean areas.

G Single hydrostatic bearing has low axial stiffness. Unique self-aligning rubberbush for ease of set-up with slip-tables.

H Sealed water-cooling system - no expensive water losses.

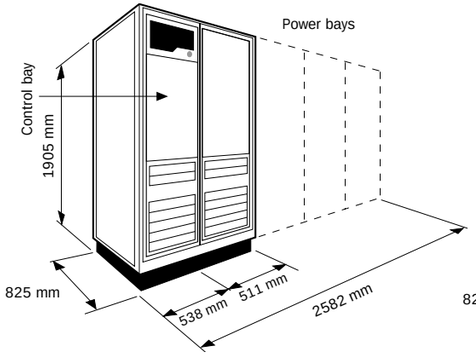


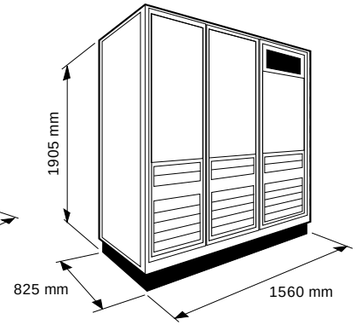
Armature insert patterns

Shaker	V964 Metric	V964 American	V984	V994
Centre inserts	1	1	1	1
200.0 mm	8	-	-	-
203.2 mm	-	8	8	8
400.0 mm	8	-	-	-
406.4 mm	-	8	8	8
558.8 mm	-	-	8	8
711.2 mm	-	-	-	8

DPA-K Amplifiers

Cooling unit/field power supply (CUFPS)





Options

Shaker model		V964	V984	V994
Alternative inserts:	M8	●	-	-
	3/8" UNF	●	-	-
	3/8" UNC	●	-	-
	M10	●	-	-
	M12	-	●	●
	1/2" UNF	-	●	-
	1/2" UNC	-	●	-
Geared rotation handle		●	●	●
Hydraulic rotation		■	■	■
Internal pneumatic load support		●	●	●
Automatic load compensation system		●	●	●
Body position control		○	○	○
Air-glide mobility		○	○	○
Armature alignment toolkit		○	○	○
Thermal barrier		○	○	■
Atmospheric chamber interface, (vacuum)		■	■	■
Combination slip-table (see data sheet 6)		○	○	○
Seismic slip-table		○	○	■
Air isolation trunnion		●	●	●
Solid trunnion		■	●	●
Low gauss kit		■	■	■
Vertical load support platform		■	○	■
Load bearing platform		○	■	■
RFI supression kit		○	○	○

KEY ● standard ○ standard option ■ by special order - not available

DPA-K series power amplifier characteristics

Power range	5 - 280 kVA in 5 kVA increments
Total harmonic distortion	Typically 0.15 % when measured into resistive load
Input impedance	10K ohm nominal
Input sensitivity	1 V rms for 100 V rms output. Differential Input compatible with all standard controllers
Signal to noise ratio	>68 dB
Amplifier efficiency	>90 %
Switching frequency	150 kHz
Modulation range	dc to 10 kHz
Rated output voltage	100 V rms (sine)
Continuous output current	50 A rms (sine and random) per 5 kVA increment
Transient output current	150 A for 100 ms per 5 kVA increment
Full power bandwidth	10 Hz to 5 kHz
Module efficiency	93 %
Protection	Integral protection to prevent the MOSFET output devices working outside their specification limits
Safety	Complies with the Essential Health and Safety Requirements of the Machinery Directive 89/392 EEC and the Low Voltage Directive 73/23/EEC
EMC	EN50081-1 Emissions, EN50082-2 Immunity

Some of the features listed are available as standard, others as options.
Please contact LDS for advice on the optimum specification to meet your system needs.
Specifications are correct at time of going to print. LDS reserves the right to amend specifications without prior notice.

LING DYNAMIC SYSTEMS

World leaders in vibration and environmental test systems

An SPX Company

Ling Dynamic Systems Limited
Heath Works, Baldock Road, Royston,
Hertfordshire SG8 5BQ, England.
Tel (UK) 01763 242424
International + 44 1763 242424
Fax (UK) 01763 249715
International + 44 1763 249715
Email sales@lds-group.com
www.lds-group.com

Ling Dynamic Systems Inc
60 Church Street, Yalesville,
Connecticut 06492, USA.
Tel (203) 265 7966
Toll Free # 1- 800 - GO TO LDS
Fax (203) 284 9399
Email sales@lds-group.com

LDS SARL
Z.I. l'Eglantier - 17, rue des Cerisiers,
CE 1528 Lisses - 91015 Evry Cedex,
France.
Tel (1) 69 11 21 30
Fax (1) 69 11 21 31
Email sales@lds-group.com

Ling Dynamic Systems GmbH
Freisinger Straße 32,
D-85737 Ismaning, Germany.
Tel (+49) 89 96 98 9180
Fax (+49) 89 96 98 9189
Email sales@lds-group.com

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All LDS equipment complies with current European and USA safety and EMC regulations

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