TIRA Schwingtechnik
Vibration Test Systems

TIRA Vibration Test Systems

Selection Guide (Imperial units)

TIRA Vibration Test Systems – Vibration Testing Equipment

System overview (with imperial units)

TIRA GmbH supplies measuring and testing systems for industry and research worldwide. At the Thuringia business location, we develop and manufacture modern plant engineering including application-specific software for testing the properties of materials and recording and eliminating undesirable vibrations.

Our product- and delivery range:

· Electrodynamic vibration test systems, 2 lbf - 67,442 lbf
· Modal systems from 22 - 3,372 lbf
· Long stroke systems from from 899 lbf - 3,372 lbf, max. stroke 3.94 inch
· Calibration shaker systems 22 lbf - 180 lbf
· Inertial shaker systems 28 lbf - 146 lbf
· Induction ring shaker systems 31,500 lbf
· Elektrodynamic 3D vibration test systems
· Multishaker - Push/Pull- and Push/Push systems
· Slip tables, linear/hydrostatically guided
· Head expanders/special-purpose fixtures
· Analog/digital amplifiers
· Vibration control systems for sine/random/shock/mixed mode
· Servomotor powered vibration test systems

General formula for calculating the force vector of vibration systems:

Force (N) = mass (kg) x acceleration (m/s²)

*Mass = moving element + device under test + fixture,

where applicable: slip table + driver bar + thermobarrier

A variety of applications, all from one source.

The corporate structure of the **TIRA** Group with its product line of vibration testing technology, its own mechanical machining centre and the specialized departments of Material Testing Technology and Balancing Technology opens up the greatest possible flexibility and high manufacturing depth. More than 50 years of tradition, experience and the latest research in our sector form a solid base for first-class technology and reliable performance.

We offer tailor-made and standardized system solutions from one source. We also provide competent support to our customers, from concept and development, via construction, assembly, up to commissioning and support.

TIRA machines have proven themselves worldwide in industry, universities and institutes. Selected sales and service companies in more than 60 countries around the world represent the name and know-how of TIRA GmbH in order to advise and support users and prospective customers all over the world with regard to products.

TIRA booth at the trade show Productronica in Munich

Vibration test systems from 2 lbf to 90 lbf

Our products are subject to strict quality control in accordance with the requirements of CE, RoHS and national and international standards. The same care is given to the maintenance and modernisation of our traditional TIRA test and measurement technology, which has been proven over many years. In close cooperation with our customers, we maintain the progress, efficiency and quality of TIRA products and invest in the future of this potential. Our quality management has been certified according to DIN ISO 9001 since 1995 and according to DIN EN ISO 9001:2015 since February 2018.

TIRA permanent-magnet shakers are used as portable and stationary systems for the simulation of environmental influences. Typical applications are **structural analysis** and **testing of smaller assemblies**. The robust construction of the shakers guarantees a long service life. TIRA shakers are characterized by **high lateral stiffness**. TIRA has met the requirements of the industry for **lightweight construction** of the shakers. New rare earth magnets have been added to the usual Alnico magnets. This has resulted in a **reduction in mass** from 79.4 to 26.4 lb, which guarantees **easy handling** of the shakers especially **in mobile use**. These shakers have proven their worth in applications such as environmental laboratories and universities as well as in industrial production lines for component testing and calibration. These complete system offers allow users to test according to national and international standards such as DIN, ISO, BS, MIL, IEC and ASTM.

Shakers 2 lbf to 90 lbf

System	TV 50009	TV 50018	TV 51110
Shaker	**S 50009**	**S 50018**	**S 51110**
Amplifier	**BAA 120**	**BAA 120**	**BAA 120**
Rated peak force $Sine_{pk}$ / $Random_{RMS}$	2/- lbf	4/- lbf	22/15 lbf
Frequency range	2 - 20,000 Hz	2 - 20,000 Hz	2 - 7,000 Hz
Max. displacement (pk-pk)	0.12 in.	0.20 in.	0.51 in.
Max. velocity	59 in/s	59 in/s	59 in/s
Max. acceleration Sine/Random	60/- g	65/- g	45/30 g
Suspension stiffness	22.8 lbf/in	25.1 lbf/in	45.7 lbf/in
Effective moving mass ±5%	0.033 lb	0.062 lb	0.51 lb
Main resonance frequency	>13,000 Hz	>13,000 Hz	>6,500 Hz
Total shaker mass (without trunnion)	4.9 (3.7) lb	11.0 (8.2) lb	26.4 lb
Coupling/Armature diameter	M4	M4	2.36 in.
Max. power consumption at 120 V	50 VA	50 VA	80 VA

System	TV 51120	TV 52110	TV 52120	TV 51140
Shaker	**S 51120**	**S 52110**	**S 52120**	**S 51140**
Amplifier	**BAA 500**	**BAA 120**	**BAA 500**	**BAA 1000**
Blower	**TB 0080**	**–**	**TB 0080**	**TB 0140**
Rated peak force $Sine_{pk}$ / $Random_{RMS}$	44/31 lbf	22/11 lbf	44/22 lbf	90/70 lbf
Frequency range	2 - 7,000 Hz	2 - 7,000 Hz	2 - 7,000 Hz	2 - 6,500 Hz
Max. displacement (pk-pk)	0.51 in.	0.6 in.	0.6 in.	0.78 in.
Max. velocity	59 in/s	59 in/s	59 in/s	59 in/s
Max. acceleration Sine/Random	89/62 g	50/25 g	100/50 g	100/50 g
Suspension stiffness	45.7 lbf/in	74.8 lbf/in	74.8 lbf/in	28.6 lbf/in
Effective moving mass ±5%	0.51 lb	0.55 lb	0.55 lb	0.88 lb
Main resonance frequency	>6,500 Hz	>5,700 Hz	>5,700 Hz	>5,500 Hz
Total shaker mass	26.4 lb	79.4 lb	79.4 lb	39.7 lb
Armature diameter	2.36 in.	2.36 in.	2.36 in.	2.36 in.
Max. power consumption at 120 V Amplifier/Blower	350/460 VA	80/- VA	350/460 VA	2.7/1.4 kVA

General data - For detailed technical information see product data sheets with metric units (Download at https://www.tira-gmbh.de/en/datasheets)

Subject to change without notice. Errors and omissions excepted.

TIRA Vibration Test Systems

Vibration test systems from 225 lbf to 607 lbf

- Automatic centering of the armature
- LS-shakers with up to 1.77 inch displacement and electronic zero-point regulation with adjustable stiffness
- Optional degauss kit to reduce stray magnetic field
- Multiple safety devices
- Coarse filter unit
- Squeak&Rattle Option (Low noise operation without blower)

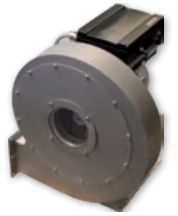
TIRA Energy Management System

TIRA EMS

The TIRA Energy Management System enables for all vibration test systems with a force of 607 lbf (and higher) two possible energy saving options:

- operation with temperature-controlled cooling unit
- operation with temperature-controlled cooling unit and variable field power (+optional low degaussing kit)

Advantages: Reduction of costs, noise emission and environmental influences



System	TV 5220-120	TV 5220/LS-120	TV 54216-130	TV 50350-120	TV 50350/LS-120
Shaker	S 5220-120	S 5220/LS-120	S 54216-130	S 50350-120	S 50350/LS-120
Amplifier	BAA 1000-E	BAA 1000-ET	BAA 1000-E	A 1 02 11 021 SV	A 1 02 11 021 T SV
Blower	TB 0140	TB 0140	TB 0140	TB 0310	TB 0310
Rated peak force $Sine_{pk}$ / $Random_{RMS}$ / $Shock_{pk}$	225/146/337 lbf	225/146/337 lbf	360/225/450 lbf	607/450/1,236 lbf	607/450/1,191 lbf
Frequency range	2 - 6,500 Hz	2 - 6,500 Hz	2 - 3,500 Hz	2 - 4,500 Hz	2 - 4,500 Hz
Max. displacement (pk-pk)	1.0 in.	1.77 in.	1.0 in.	1.0 in.	1.77 in.
Max. velocity Sine/Random/Shock	59/59/79 in/s	59/59/79 in/s	59/59/79 in/s	59/59/98 in/s	59/59/98 in/s
Max. acceleration Sine/Random/Shock	60/35/90 g	60/35/90 g	60/40/80 g	100/70/180 g	95/73/160 g
Suspension stiffness	125.6 lbf/in	Electr. adjustable	125.6 lbf/in	125.6 lbf/in	Electr. adjustable
Effective moving mass ±5%	3.9 lb	3.9 lb	5.7 lb	5.9 lb	6.4 lb
Max. specimen mass	44.1 lb	44.1 lb	44.1 lb	264.6 lb	55.1 lb
Main resonance frequency	>4,800 Hz	>4,600 Hz	>3,000 Hz	>3,800 Hz	>3,700 Hz
Total shaker mass	269.0 lb	269.0 lb	414.5 lb	617.3 lb	617.3 lb
Stray magnetic field without/with degauss kit	<8.5/<1.5 mT	<8.5/<1 mT	<8.5/- mT	<8.5/<1.4 mT	<8.5/<1.4 mT
Armature diameter	4.72 in.	4.72 in.	5.12 in.	4.72 in.	4.72 in.
Max. power consumption at 120/480 V incl. blower	5.1 kVA	5.2 kVA	5.2 kVA	17 kVA	17 kVA
Interlocks	Temperature, overtravel, airflow, overcurrent, compressed air	Temperature, overtravel, airflow, overcurrent	Temperature, overtravel, airflow, overcurrent, compressed air	Temperature, overtravel, airflow, overcurrent, compressed air	Temperature, overtravel, airflow, overcurrent

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Vibration test systems from 899 lbf to 1,798 lbf

TIRA EMS
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- Clamping table ø7.09 inch with 21 threaded inserts or ø13.39 inch with 25 threaded inserts
- Long-time operation
- Minimum maintenance effort
- High cross-axial stiffness
- Supported by rugged frame with combined rubber/air isolators
- Automatic centering of the armature
- Fully automatic pneumatic load compensation for heavy test loads
- 2 inch displacement
- Standard degauss kit to reduce stray magnetic field
- Optional low degauss kit to reduce stray magnetic field to <0.8 mT
- Multiple safety devices
- Coarse filter unit
- Squeak&Rattle Option (Low noise operation without blower)
- Wheels&Rails Option (Shaker is maneuverable on rails)

Shaker S 55240/LS-340

System	TV 55240/LS-180	TV 55240/LS-340	TV 56280/LS-180	TV 56280/LS-340
Shaker	S 55240/LS-180	S 55240/LS-340	S 56280/LS-180	S 56280/LS-340
Amplifier	A 1 02 11 021 SV	A 1 02 11 021 SV	A 1 02 11 021 SV	A 1 02 11 021 SV
Blower	TB 0310	TB 0310	TB 9 FUK	TB 9 FUK
Rated peak force $Sine_{pk}$ / $Random_{RMS}$ / $Shock_{pk}$	899/787/2,698 lbf	899/809/2,698 lbf	1,798/1,619/5,395 lbf	1,798/1,619/5,395 lbf
Frequency range	2 - 3,000 Hz	2 - 3,000 Hz	2 - 3,000 Hz	2 - 3,000 Hz
Max. displacement (pk-pk)	2.0 in.	2.0 in.	2.0 in.	2.0 in.
Max. velocity Sine/Random/Shock	79/79/94 in/s	79/79/94 in/s	79/79/138 in/s	79/79/138 in/s
Max. acceleration Sine/Random/Shock	60/50/150 g	50/45/130 g	93/72/186 g	88/65/200 g
Suspension stiffness	285.5 lbf/in	285.5 lbf/in	285.5 lbf/in	285.5 lbf/in
Effective moving mass ±5%	14.9 lb	18.3 lb	17.9 lb	21.2 lb
Max. payload	551.2 lb	551.2 lb	551.2 lb	551.2 lb
Main resonance frequency	>3,000 Hz	>2,700 Hz	>2,900 Hz	>2,500 Hz
Total shaker mass	1,543.2 lb	1,719.6 lb	1,686.5 lb	1,719.6 lb
Stray magnetic field Std./Low degaussing	<1.5/<0.8 mT	<1.5/<0.8 mT	<1.5/<0.8 mT	<1.5/<0.8 mT
Armature diameter	7.09 in.	13.39 in.	7.09 in.	13.39 in.
Max. power consumption at 480 V incl. blower	17 kVA	17 kVA	17 kVA	17 kVA
Interlocks	Temperature, overtravel, airflow, overcurrent, compressed air	Temperature, overtravel, airflow, overcurrent, compressed air	Temperature, overtravel, airflow, overcurrent, compressed air	Temperature, overtravel, airflow, overcurrent, compressed air

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Vibration test systems from 2,473 lbf to 3,372 lbf

- Long-time operation
- Minimum maintenance effort
- High cross-axial stiffness
- Supported by rugged frame with vibration isolators
- Fully automatic pneumatic load compensation for heavy test loads
- Coarse filter unit
- 2 inch displacement
- Standard degauss kit to reduce stray magnetic field
- Optional low degauss kit to reduce stray magnetic field to <0.8 mT
- Wheels&Rails Option (Shaker is maneuverable on rails)
- Squeak&Rattle Option (Low noise operation without blower)

TIRA EMS

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Shaker S 57315/LS-340

System	TV 51010/LS-230	TV 51010/LS-340	TV 57315/LS-230	TV 57315/LS-340
Shaker	**S 51010/LS-230**	**S 51010/LS-340**	**S 57315/LS-230**	**S 57315/LS-340**
Amplifier	**A 1 02 11 021 SV**	**A 1 02 11 021 SV**	**A 3 01 11 042**	**A 3 01 11 042**
Blower	**TB 120 FUK**	**TB 120 FUK**	**TB 120 FUK**	**TB 120 FUK**
Rated peak force $Sine_{pk}$ / $Random_{RMS}$ / $Shock_{pk}$	2,473/2,473/7,419 lbf	2,473/2,473/7,419 lbf	3,372/2,923/10,116 lbf	3,372/2,923/10,116 lbf
Frequency range	2 - 3,000 Hz	2 - 3,000 Hz	2 - 3,000 Hz	2 - 3,000 Hz
Max. displacement (pk-pk)	2.0 in.	2.0 in.	2.0 in.	2.0 in.
Max. velocity Sine/Random/Shock	79/79/118 in/s	79/79/118 in/s	79/79/138 in/s	79/79/138 in/s
Max. acceleration Sine/Random/Shock	85/65/220 g	85/70/200 g	115/80/230 g	110/80/200 g
Suspension stiffness	428.3 lbf/in	428.3 lbf/in	428.3 lbf/in	428.3 lbf/in
Effective moving mass ±5%	28.6 lb	30.9 lb	28.6 lb	29.8 lb
Max. payload	551.2 lb	551.2 lb	551.2 lb	551.2 lb
Main resonance frequency	>2,300 Hz	>2,400 Hz	>2,300 Hz	>2,400 Hz
Total shaker mass	2,425 lb	2,425 lb	2,425 lb	2,425 lb
Stray magnetic field Std./Low degaussing	<1.5/<0.8 mT	<1.5/<0.8 mT	<1.5/<0.8 mT	<1.5/<0.8 mT
Armature diameter	9.06 in.	13.39 in.	9.06 in.	13.39 in.
Max. power consumption at 480 V incl. blower	17 kVA	17 kVA	31 kVA	31 kVA
Interlocks	Temperature, overtravel, airflow, overcurrent, compressed air	Temperature, overtravel, airflow, overcurrent, compressed air	Temperature, overtravel, airflow, overcurrent, compressed air	Temperature, overtravel, airflow, overcurrent, compressed air

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Vibration test system 4,946 lbf

TIRA EMS

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- Long-time operation
- Minimum maintenance effort
- High cross-axial stiffness
- Supported by rugged frame with vibration isolators
- Automatic centering of the AIT-System and the armature
- Fully automatic pneumatic load compensation for heavy test loads
- AIT-System fixable to use the full displacement also at low frequencies and heavy loads
- Coarse filter unit
- Available as RIT or AIT trunnion system*
- 3 inch displacement (Shock)
- Energy-saving mode (Field power reduction)
- Standard degauss kit to reduce stray magnetic field
- Wheels&Rails Option (Shaker is maneuverable on rails)
- Airglide option (Shaker is maneuverable on air cushions)

Shaker S 59322/AIT-340

System	TV 59322/*-340	TV 59322/*-440
Shaker	S 59322/*-340	S 59322/*-440
Amplifier	A 3 09 11 042	A 3 09 11 042
Blower	TB 7/FUK/11	TB 7/FUK/11
Rated peak force $Sine_{pk}$ / $Random_{RMS}$ / $Shock_{pk}$	4,946/3,485/14,837 lbf	4,946/3,485/14,837 lbf
Frequency range	5 - 3,000 Hz	5 - 3,000 Hz
Max. displacement (pk-pk) Sine/Random/Shock	2.5/2.5/3.0 in.	2.5/2.5/3.0 in.
Max. velocity Sine/Random/Shock	79/79/138 in/s	79/79/138 in/s
Max. acceleration Sine/Random/Shock	80/55/200 g	80/55/200 g
Suspension stiffness	856.5 lbf/in	856.5 lbf/in
Effective moving mass	57.3 lb	62.8 lb
Max. payload	661.4 lb	661.4 lb
Main resonance frequency	>2,250 Hz	>2,250 Hz
Total shaker mass *RIT / AIT	3,858/4,409 lb	3,858/4,409 lb
Stray magnetic field	<1.5 mT	<1.5 mT
Armature diameter	13.4 in.	17.3 in.
Max. power consumption at 480 V Amplifier/Blower	29/17.5 kVA	29/17.5 kVA
Interlocks	Temperature, overtravel, airflow, overcurrent, compressed air	Temperature, overtravel, airflow, overcurrent, compressed air

General data - For detailed technical information see product data sheets with metric units
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The transmission of vibrations to the installation site can be reduced by means of a corresponding trunnion mount ("**RIT**"=**R**igid **I**solated **T**runnion). The frame is equipped with vibration isolators as standard.

The TIRA AIT-System ("**AIT**" =**A**ir **I**solated **T**runnion) is a vibration isolation system integrated in the frame for vertical and horizontal guidance of the shaker. At low frequencies, it ensures optimal vibration isolation and precise guidance of the shaker body in the excitation direction.

Low **B**ase "**LB**" vibration shakers for vertical test operation can be equipped with vibration damping elements or with rail systems for mobility. TIRA shakers, amplifiers and vibration control systems form a complete test system that allows users to verify the quality of their products in accordance with national standards (such as DIN, ISO, BS, MIL, IEC, ASTM).

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Vibration test systems from 6,070 lbf to 7,868 lbf

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- Energy-saving mode (Field power reduction)
- Optional Dual Bearing-System for enhancement of cross axial stiffness and reduction of wear
- Airglide option (Shaker is maneuverable on air cushions)
- Multiple safety devices
- Clamping table ø13.4 inch, ø17.3 inch or ø25.2 inch
- Long-time operation
- Minimum maintenance effort
- High cross-axial stiffness
- Supported by rugged frame with vibration isolators
- Automatic centering of the AIT-System and the armature
- AIT-System fixable to use the full displacement also at low frequencies and heavy loads
- Fully automatic pneumatic load compensation for heavy test loads
- Air-cooling blower with optional fan speed control
- Available as RIT, AIT or LB trunnion system*
- Displacement of up to 3 inch (option for 17.3 inch CT)
- Standard degauss kit to reduce stray magnetic field
- Optional low degauss kit to reduce stray magnetic field to <0.8 mT

Shaker S 59335/AIT-440

System	TV 59327/*-340	TV 59327/*-440	TV 59327/*-640	TV 59335/*-340	TV 59335/*-440	TV 59335/*-640
Shaker	S 59327/*-340	S 59327/*-440	S 59327/*-640	S 59335/*-340	S 59335/*-440	S 59335/*-640
Amplifier	A 3 08 11 042	A 3 08 11 042	A 3 08 11 042	A 3 08 11 063	A 3 08 11 063	A 3 08 11 063
Blower	TB 7/FUK/11	TB 7/FUK/11	TB 7/FUK/11	TB 7/FUK/11	TB 7/FUK/11	TB 7/FUK/11
Rated peak force $Sine_{pk}$ / $Random_{RMS}$ / $Shock_{pk}$	6,070/6,070/17,985 lbf	6,070/6,070/17,985 lbf	6,070/6,070/17,985 lbf	7,868/7,194/23,605 lbf	7,868/7,194/23,605 lbf	7,868/7,194/23,605 lbf
Frequency range	5 - 3,000 Hz	5 - 3,000 Hz	5 - 2,000 Hz	5 - 3,000 Hz	5 - 3,000 Hz	5 - 2,000 Hz
Max. displacement (pk-pk) Sine/Random/Shock	2.0/2.0/2.0 in.	2.0/2.0/2.0 in.	2.0/2.0/2.0 in.	2.0/2.0/2.0 in.	2.0/2.0/2.0 in.	2.0/2.0/2.0 in.
Max. velocity Sine/Random/Shock	79/71/118 in/s	79/71/118 in/s	79/71/118 in/s	79/71/118 in/s	79/71/118 in/s	79/71/118 in/s
Max. acceleration Sine/Random/Shock	84/65/167 g	79/50/158 g	66/50/131 g	100/88/220 g	100/67/207 g	70/63/160 g
Suspension stiffness	856.5 lbf/in	856.5 lbf/in	856.5 lbf/in	856.5 lbf/in	856.5 lbf/in	856.5 lbf/in
Effective moving mass	63.9 lb	83.8 lb	89.3 lb	63.9 lb	83.8 lb	89.3 lb
Max. payload	1,345 lb	1,345 lb	1,345 lb	1,345 lb	1,345 lb	1,345 lb
Main resonance frequency	>2,400 Hz	>2,400 Hz	>1,900 Hz	>2,400 Hz	>2,400 Hz	2,000 Hz
Total shaker mass *RIT/AIT/LB	5,181/5,952/4,960 lb	5,181/5,952/4,960 lb	5,181/5,952/4,960 lb	5,181/5,952/4,960 lb	5,181/5,952/4,960 lb	5,181/5,952/4,960 lb
Stray magnetic field Std./Low degaussing	<1.5/<0.8 mT	<1.5/<0.8 mT	<2/<1 mT	<1.5/<0.8 mT	<1.5/<0.8 mT	<2/<1 mT
Armature diameter	13.4 in.	17.3 in.	25.2 in.	13.4 in.	17.3 in.	25.2 in.
Max. power consumption at 480 V Amplifier/Blower	30/17.5 kVA	30/17.5 kVA	30/17.5 kVA	32/17.5 kVA	32/17.5 kVA	32/17.5 kVA
Interlocks	Temperature, overtravel, airflow, overcurrent, compressed air	Temperature, overtravel, airflow, overcurrent, compressed air	Temperature, overtravel, airflow, overcurrent, compressed air	Temperature, overtravel, airflow, overcurrent, compressed air	Temperature, overtravel, airflow, overcurrent, compressed air	Temperature, overtravel, airflow, overcurrent, compressed air

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Vibration test systems from 11,128 lbf to 15,737 lbf

TIRA EMS
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- Clamping table ø18.9 inch
- Other clamping table sizes on request
- Long-time operation
- Minimum maintenance effort
- High cross-axial stiffness
- Supported by rugged frame with vibration isolators
- Automatic centering of the AIT-System and the armature
- AIT-System fixable to use the full displacement also at low frequencies and heavy loads
- Fully automatic pneumatic load compensation for heavy test loads
- Air-cooling blower with optional fan speed control
- Up to 3 inch displacement
- Degauss kit to reduce stray magnetic field
- Energy-saving mode (Field power reduction)
- Dual Bearing-System for enhancement of cross axial stiffness and reduction of wear
- Airglide option (Shaker is maneuverable on air cushions)
- Multiple safety devices

Shaker S 59370/AIT-480

System	TV 59349/AIT-480	TV 59356/AIT-480	TV 59370/AIT-480
Shaker	S 59349/AIT-480	S 59356/AIT-480	S 59370/AIT-480
Amplifier	A 6 26 11 105	A 6 26 11 126	A 6 26 11 147
Blower	TB 7/FUK/20	TB 7/FUK/20	TB HR160
Rated peak force $Sine_{pk}$ / $Random_{RMS}$ / $Shock_{pk}$	11,128/10,791/33,384 lbf	12,589/12,589/35,969 lbf	15,737/15,062/47,210 lbf
Frequency range	5 - 2,500 Hz	5 - 2,500 Hz	5 - 2,500 Hz
Max. displacement (pk-pk) Sine/Random/Shock	2.5/2.5/3.0 in.	2.5/2.5/3.0 in.	2.5/2.5/3.0 in.
Max. velocity Sine/Random/Shock	79/79/138 in/s	79/79/138 in/s	79/79/138 in/s
Max. acceleration Sine/Random/Shock	91/75/224 g	100/80/350 g	100/80/350 g
Suspension stiffness	1,427.5 lbf/in	1,427.5 lbf/in	1,427.5 lbf/in
Effective moving mass	121.3 lb	121.3 lb	154.3 lb
Max. payload	2,006 lb	2,006 lb	2,006 lb
Main resonance frequency	>2,100 Hz	>2,100 Hz	>2,100 Hz
Total shaker mass	10,582 lb	10,582 lb	10,582 lb
Stray magnetic field	1.5 mT	1.5 mT	1.5 mT
Armature diameter	18.9 in.	18.9 in.	18.9 in.
Max. power consumption at 480 V Amplifier/Blower	56/27 kVA	66/27 kVA	82/30 kVA
Interlocks	Temperature, overtravel, airflow, overcurrent, compressed air	Temperature, overtravel, airflow, overcurrent, compressed air	Temperature, overtravel, airflow, overcurrent, compressed air

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TIRA Vibration Test Systems

Water-cooled vibration test systems from 16,636 lbf to 28,101 lbf

TIRA EMS
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Water-cooled **TIRA** shakers are guided hydrostatically and cooled by a closed water circuit. The external cooling unit also supplies the lubricant for the hydrostatic bearings, which enables frictionless positioning of the vibration armature. Water-cooled shakers have the advantage of generating high forces for testing heavy loads with high accelerations. Specimen masses up to 2,006 lb are possible. A fully automatic pneumatic load compensation system enables the nominal vibration displacement to be reached even at high specimen masses.

- Displacement up to 3 inch
- Shaker water circuit with overpressure
- Degauss kit to reduce stray magnetic field
- Dual Bearing-System for enhancement of cross axial stiffness and reduction of wear
- Automatic permanent conductance monitoring of the cooling water
- Automatic centering of the AIT-System and the armature
- AIT-System fixable to use the full displacement also at low frequencies
- Energy saving mode (Field power reduction)

Shaker S 59412/AIT-480

System	TV 59374/AIT-480	TV 59389/AIT-480	TV 59410/AIT-480	TV 59412/AIT-480
Shaker	S 59412/AIT-480	S 59412/AIT-480	S 59412/AIT-480	S 59412/AIT-480
Amplifier	A 6 00 11 210	A 6 00 11 252	A 6 00 11 273	A 6 00 11 315
Cooling Unit	C 59412	C 59412	C 59412	C 59412
Rated peak force $Sine_{pk}$ / $Random_{RMS}$ / $Shock_{pk}$	16,636/16,636/49,908 lbf	20,008/20,008/60,024 lbf	22,481/20,008/67,443 lbf	28,101/24,729/84,303 lbf
Frequency range	5 - 2,500 Hz	5 - 2,500 Hz	5 - 2,500 Hz	5 - 2,500 Hz
Max. displacement (pk-pk) Sine/Random/Shock	2.5/2.5/3.0 in.	2.5/2.5/3.0 in.	2.5/2.5/3.0 in.	2.5/2.5/3.0 in.
Max. velocity Sine/Random/Shock	79/79/157 in/s	79/79/157 in/s	79/79/157 in/s	79/79/157 in/s
Max. acceleration Sine/Random/Shock	99/90/300 g	100/90/300 g	100/90/300 g	100/90/300 g
Suspension stiffness	1,427.5 lbf/in	1,427.5 lbf/in	1,427.5 lbf/in	1,427.5 lbf/in
Effective moving mass	167.6 lb	167.6 lb	167.6 lb	167.6 lb
Max. payload	2,006 lb	2,006 lb	2,006 lb	2,006 lb
Main resonance frequency	>2,100 Hz	>2,100 Hz	>2,100 Hz	>2,100 Hz
Total shaker mass	11,684 lb	11,684 lb	11,684 lb	11,684 lb
Stray magnetic field	<1.5 mT	<1.5 mT	<1.5 mT	<1.5 mT
Armature diameter	18.9 in.	18.9 in.	18.9 in.	18.9 in.
Max. power consumption at 480 V Amplifier incl. cooling unit / Field power unit	60/40 kVA	70/40 kVA	95/40 kVA	135/40 kVA
Interlocks	Temperature, overtravel, overcurrent, compressed air, water flow rate, conductance	Temperature, overtravel, overcurrent, compressed air, water flow rate, conductance	Temperature, overtravel, overcurrent, compressed air, water flow rate, conductance	Temperature, overtravel, overcurrent, compressed air, water flow rate, conductance

General data - For detailed technical information see product data sheets with metric units (Download at https://www.tira-gmbh.de/en/datasheets)

Subject to change without notice. Errors and omissions excepted.

Water-cooled vibration test systems from 29,225 lbf to 67,443 lbf

TIRA EMS
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- Displacement up to 3 inch
- Shaker water circuit with overpressure
- Degauss kit to reduce stray magnetic field
- Dual Bearing-System for enhancement of cross axial stiffness and reduction of wear
- Payloads of up to 5,512 lb
- Automatic permanent conductance monitoring of the cooling water
- Automatic centering of the AIT-System and the armature
- AIT-System fixable to use the full displacement also at low frequencies
- Energy saving mode (Field power reduction)

Shaker S 59420/AIT-590

System	TV 59413/AIT-590	TV 59416/AIT-590	TV 59420/AIT-590	TV 59430/AIT-840
Shaker	S 59420/AIT-590	S 59420/AIT-590	S 59420/AIT-590	S 59430/AIT-840
Amplifier	A 6 00 11 336	A 6 00 11 378	A 6 00 11 462	A 6 00 11 483
Cooling Unit	C 59430	C 59430	C 59430	C 59430
Rated peak force $Sine_{pk}$ / $Random_{RMS}$ / $Shock_{pk}$	29,225/29,225/87,675 lbf	37,768/37,768/113,304 lbf	44,962/37,768/134,885 lbf	67,443/60,698/202,328 lbf
Frequency range	5 - 2,000 Hz	5 - 2,000 Hz	5 - 2,000 Hz	5 - 2,000 Hz
Max. displacement (pk-pk) Sine/Random/Shock	2.5/2.5/3.0 in.	2.5/2.5/3.0 in.	2.5/2.5/3.0 in.	2.5/2.5/3.0 in.
Max. velocity Sine/Random/Shock	79/79/138 in/s	79/79/138 in/s	79/79/138 in/s	79/79/138 in/s
Max. acceleration Sine/Random/Shock	100/75/300 g	100/75/300 g	100/75/300 g	70/70/250 g
Suspension stiffness	1,427.5 lbf/in	1,427.5 lbf/in	1,427.5 lbf/in	2,569.6 lbf/in
Effective moving mass	275.6 lb	275.6 lb	275.6 lb	606.3 lb
Max. payload	2,866 lb	2,866 lb	2,866 lb	5,512 lb
Main resonance frequency	1,700 Hz	1,700 Hz	1,700 Hz	1,500 Hz
Total shaker mass	18,629 lb	18,629 lb	18,629 lb	40,786 lb
Stray magnetic field	<1.5 mT	<1.5 mT	<1.5 mT	<5 mT
Armature diameter	23.2 in.	23.2 in.	23.2 in.	33.1 in.
Max. power consumption at 480 V Amplifier incl. cooling unit / Field power unit	220/98 kVA	244/98 kVA	285/98 kVA	370/110 kVA
Interlocks	Temperature, overtravel, overcurrent, compressed air, water flow rate, conductance	Temperature, overtravel, overcurrent, compressed air, water flow rate, conductance	Temperature, overtravel, overcurrent, compressed air, water flow rate, conductance	Temperature, overtravel, overcurrent, compressed air, water flow rate, conductance

General data - For detailed technical information see product data sheets with metric units (Download at https://www.tira-gmbh.de/en/datasheets)

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TIRA Vibration Test Systems

Induction ring vibration test systems 31,500 lb

See page 4

Induction ring shakers operate with an all-metal moving coil with a single winding, in which an alternating voltage is induced by surrounding static coils, thus setting the moving coil in motion. Cooling is provided by a combined water/air cooler.The external cooling unit also provides the lubricant for the hydrostatic bearings, which enable friction-free mounting of the vibration armature.

Advantages of induction ring shakers:

- No power connection to the vibration armature necessary -> Less failure susceptibility
- High mechanical strength of the moving coil -> Greatly reduced maintenance requirements
- High acceleration values
- High resonance frequency of the vibrating armature

Shaker S 69440/AIT-480

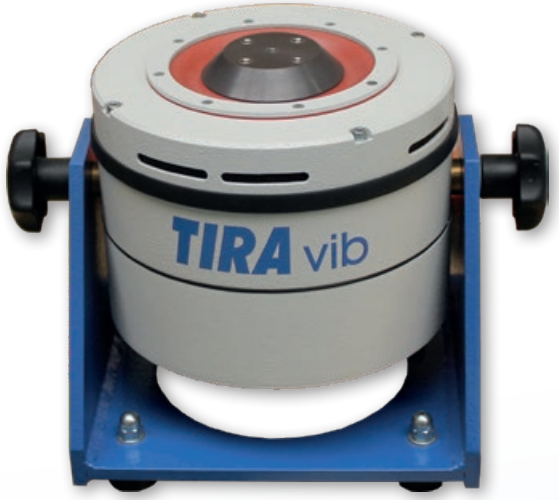
System	TV 69440/AIT-480-IRS-210	TV 69440/AIT-480-IRS-315	TV 69440/AIT-480-IRS-402
Shaker	S 69440/AIT-480	S 69440/AIT-480	S 69440/AIT-480
Amplifier	A 6 00 11 210	A 6 00 11 315	A 6 00 11 402
Cooling Unit water/air	C 59412 / TB 7/FUK/20	C 59412 / TB 7/FUK/20	C 59412 / TB 7/FUK/20
Rated peak force $Sine_{pk}$ / $Random_{RMS}$ / $Shock_{pk}$	31,500/29,225/94,420 lbf	31,500/29,225/94,420 lbf	31,500/29,225/94,420 lbf
Frequency range	5 - 3,000 Hz	5 - 3,000 Hz	5 - 3,000 Hz
Max. displacement (pk-pk) Sine/Random/Shock	2.5/2.5/3.0 in.	2.5/2.5/3.0 in.	2.5/2.5/3.0 in.
Max. velocity Sine/Random/Shock	79/79/157 in/s	79/79/157 in/s	79/79/157 in/s
Max. acceleration Sine/Random	200/180 g	200/180 g	200/180 g
Max. acceleration Shock (at payload)	3 ms: 300 g (77.2 lb) 6 ms: 100 g (507.1 lb) 11 ms: 100 g (176.4 lb)	3 ms: 300 g (132.3 lb) 6 ms: 100 g (529.1 lb) 11 ms: 100 g (661.4 lb)	3 ms: 300 g (209.4 lb) 6 ms: 100 g (529.1 lb) 11 ms: 100 g (771.6 lb)
Suspension stiffness	565 lbf/in	565 lbf/in	565 lbf/in
Effective moving mass	116.8 lb	116.8 lb	116.8 lb
Max. payload	1,345 lb	1,345 lb	1,345 lb
Main resonance frequency	2,400 Hz	2,400 Hz	2,400 Hz
Total shaker mass	11,684 lb	11,684 lb	11,684 lb
Stray magnetic field	<1,5 mT	<1,5 mT	<1,5 mT
Armature diameter	18.9 in.	18.9 in.	18.9 in.
Max. power consumption at 480 V Amplifier incl. cooling unit / Field power unit	60/40 kVA	285/40 kVA	370/40 kVA
Interlocks	Temperature, overtravel, overcurrent, cooling air, compressed air, water flow rate, conductance	Temperature, overtravel, overcurrent, cooling air, compressed air, water flow rate, conductance	Temperature, overtravel, overcurrent, cooling air, compressed air, water flow rate, conductance

General data - For detailed technical information see product data sheets with metric units (Download at https://www.tira-gmbh.de/en/datasheets)

Subject to change without notice. Errors and omissions excepted.

Calibration shakers from 22 lbf to 180 lbf

Measurements for determining vibration transmission and vibration analysis are increasingly being carried out in all areas of industry, aviation, the automotive industry and power plants.
In order to be able to carry out such tests, a large number of measuring sensors are necessary.The sensors must be checked and calibrated for accuracy at defined time intervals. Since most transducers have a high measuring range and wide frequency ranges, special shakers are required to calibrate the transducers.
TIRA has taken up this challenge and developed a shaker that meets these requirements. This newly developed shaker consists of a **ceramic vibration system** and a special guide system. This newly developed vibration system is characterized by its very high, usable frequency range up to 25 kHz and is ideally suited for professional calibration with the appropriate measuring equipment. Note: The calibration shakers are not designed for continuous operation at maximum power.
The "AC" calibration shaker additionally has a special air bearing which offers the advantage of friction and wear-free operation and also dampens interference vibrations.



Calibration shaker S 51140-C

System	TV 51110-C	TV 51110-AC	TV 51120-C	TV 51140-C	TV 5220-C
Shaker	S 51110-C	S 51110-AC	S 51120-C	S 51140-C	S 5220-C
Amplifier	BAA 120	BAA 500-T	BAA 500	BAA 1000	BAA 1000-ET
Blower	-	-	TB 0080	TB 0140	TB 0140
Rated peak force $Sine_{pk}$ / $Random_{RMS}$	22/11 lbf	22/11 lbf	45/22 lbf	90/45 lbf	180/90 lbf
Frequency range	10 - 25,000 Hz	1 - 20,000 Hz	10 - 25,000 Hz	10 - 20,000 Hz	1 - 20,000 Hz
Max. displacement (pk-pk)	0.2 in.	1.0 in.	0.2 in.	0.2 in.	1.0 in.
Max. velocity	47 in/s	47 in/s	47 in/s	47 in/s	59 in/s
Max. acceleration Sine/Random	25/12 g	17/8 g	51/25 g	68/34 g	60/30 g
Effective moving mass ±5%	0.88 lb	1.17 lb	0.88 lb	1.10 lb	2.98 lb
Main resonance frequency	>25,000 Hz	>19,000 Hz	>25,000 Hz	>19,000 Hz	>13,000 Hz
Total shaker mass	72.8 lb	39.7 lb	92.6 lb	46.3 lb	242.5 lb
Armature diameter	2.1 in.	1.97 in.	2.1 in.	2.1 in.	5.1 in.
Compressed air		87 psi (app. 2.5 l/min)			
Max. power consumption at 120 V Amplifier/Bl.	80/- VA	350/- VA	350/460 VA	2.7/1.4 kVA	2.7/2.5 kVA

General data - For detailed technical information see product data sheets with metric units (Download at https://www.tira-gmbh.de/en/datasheets)

Subject to change without notice. Errors and omissions excepted.

TIRA Vibration Test Systems – Modal systems

Modal systems from 22 lbf to 607 lbf

TIRA provides a series of modal exciters from 22 lbf to 607 lbf specifically for the requirements of **modal and structural analysis**.

Up to 90 lbf, the modal exciters are excited by permanent magnets, whereby the exciters, which are manufactured especially with rare-earth magnets, convince by their **lightweight construction** in mobile use. The construction of the modal exciters is characterized by **high lateral stiffness**. Modal exciters from 225 lbf upwards provide a vibration displacement of up to 1.8 inch. This is made possible by a TMC control. The **electronic zero point control TMC** enables an exact coupling of the modal exciter to the test object. The axial stiffness is also electronically adjustable.

All modal exciters are equipped with a trunnion as standard. A variety of coupling options are offered.

The modal exciter systems TV 51120-MNC and TV 51130-MSC are a special development of TIRA to **increase mobility.** The 45 lbf shaker does not require any additional cooling unit and the 79 lbf shaker has an integrated air cooling system, which eliminates the need for an additional external cooling unit.

Modal shaker S 51120-M

Modal shaker S 51130-MSC

System	TV 51110-M	TV 51120-M	TV 51120-MNC	TV 51130-MSC
Shaker	S 51110-M	S 51120-M	S 51120-MNC	S 51130-MSC
Amplifier	BAA 120	BAA 500	BAA 500	BAA 500-MSC
Blower	–	TB 0080	–	internal
Rated peak force $Sine_{pk}$ / $Random_{RMS}$	22/16 lbf	45/31 lbf	45/22 lbf	79/45 lbf
Frequency range	DC - 5,000 Hz	DC - 5,000 Hz	DC - 3,000 Hz	DC - 4,000 Hz
Max. displacement (pk-pk)	0.51 in.	0.51 in.	0.35 in.	0.39 in.
Max. velocity	59 in/s	59 in/s	51 in/s	51 in/s
Suspension stiffness	45.7 lbf/in	45.7 lbf/in	400 lbf/in	400 lbf/in
Effective moving mass ±5%	0.51 lb	0.51 lb	1.1 lb	1.2 lb
Main resonance frequency (free-swinging)	>2,680 Hz	>2,680 Hz	>4,000 Hz	>2,700 Hz
Total shaker mass	26.5 lb	26.5 lb	39.7 lb	59.5 lb
Coupling (Thread ø)	M6	M6	M8	M8
Max. power consumption at 120 V Amplifier/Blower	80/- VA	350/460 VA	350/- VA	900 VA (incl. blower)

System	TV 51140-M	TV 5220-M	TV 50350-M
Shaker	S 51140-M	S 5220-M	S 50350-M
Amplifier	BAA 1000	BAA 1000-ET	A 1 02 11 021 T SV
Blower	TB 0140	TB 0140	TB 0310
Rated peak force $Sine_{pk}$ / $Random_{RMS}$	90/70 lbf	225/146 lbf	607/450 lbf
Frequency range	DC - 5,000 Hz	1 - 5,000 Hz	1 - 3,000 Hz
Max. displacement (pk-pk)	0.79 in.	1.77 in.	1.77 in.
Max. velocity	59 in/s	59 in/s	59 in/s
Suspension stiffness	28.6 lbf/in	Electr. adjustable	Electr. adjustable
Effective moving mass ±5%	0.9 lb	3.2 lb	5.1 lb
Main resonance frequency (free-swinging)	>2,450 Hz	>4,000 Hz	>3,000 Hz
Total shaker mass	39.7 lb	269.0 lb	617.3 lb
Coupling (Thread ø)	M6	M8	M8
Max. power consumption at 120/480 V Amplifier/Blower (+FPS)	2.7/1.4 kVA	2.7/2.5 kVA	17 kVA (total)

General data - For detailed technical information see product data sheets with metric units (Download at https://www.tira-gmbh.de/en/datasheets)

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Modal systems from 22 lbf to 3,372 lbf

TIRA offers a new range of special modal exciters for **mobile use**. The MOSP models feature a **large vibration displacement** of up to 1 inch. The low mass by using rare-earth magnets, the through hole in the center of the armature for **using piano-wire stingers** besides push/pull stingers and for accomplishing a variable adjustment of the distance to the test structure, are additional features of this series.

TIRA offers a series of modal exciters from 899 lbf to 3,372 lbf especially for modal excitation of **large structures** or structures with **high mass**.
The construction of these modal exciters is characterized by **high lateral stiffness**. They provide a vibration displacement of up to 3.94 inch (pk-pk), which is achieved by the use of a TMC control.
The **electronic zero point control TMC** enables an exact coupling of the modal exciter to the test object. The axial stiffness can be easily adjusted.

System	TV 51110-MOSP	TV 51120-MOSP	TV 51140-MOSP
Shaker	S 51110-MOSP	S 51120-MOSP	S 51140-MOSP
Amplifier	BAA 120	BAA 500	BAA 1000
Blower	–	TB 0080	TB 0140
Rated peak force $Sine_{pk}$ / $Random_{RMS}$	22/15 lbf	45/31 lbf	90/63 lbf
Frequency range	DC - 5,000 Hz	DC - 5,000 Hz	DC - 5,000 Hz
Max. displacement (pk-pk)	1.0 in.	1.0 in.	1.0 in.
Max. velocity	59 in/s	59 in/s	59 in/s
Suspension stiffness	22.8 lbf/in	22.8 lbf/in	22.8 lbf/in
Effective moving mass ±5%	0.51 lb	0.51 lb	0.88 lb
Main resonance frequency (free-swinging)	>6,000 Hz	>6,000 Hz	4,000 Hz
Total shaker mass	46.3 lb	46.3 lb	46.3 lb
Coupling (Thread ø)	M6	M6	M6
Max. power consumption at 120 V Amplifier/Blower	80/- VA	350/460 VA	2.7/1.4 kVA

Modal shaker S 51110-MOSP

Modal shaker S 55240-M/LSS

System	TV 55240-M/LSS	TV 56280-M/LSS	TV 57315-M/LSS
Shaker	S 55240-M/LSS	S 56280-M/LSS	S 57315-M/LSS
Amplifier	A 1 02 11 021 T SV	A 1 02 11 021 T SV	A 3 01 11 063 T
Blower	TB 0310	TB 9 FUK	TB 120 FUK
Rated peak force $Sine_{pk}$ / $Random_{RMS}$	899/764 lbf	1,798/1,349 lbf	3,372/2,473 lbf
Frequency range	1 - 2,000 Hz	1 - 2,000 Hz	1 - 2,000 Hz
Max. displacement (pk-pk)	3.94 in.	3.94 in.	3.94 in.
Max. velocity	79 in/s	79 in/s	79 in/s
Effective moving mass ±5%	24.3 lb	26.5 lb	39.7 lb
Main resonance frequency (free-swinging)	>2,500 Hz	>2,500 Hz	>2,500 Hz
Total shaker mass	1,764 lb	1,874 lb	2,646 lb
Coupling (Thread ø)	M10	M10	M10
Max. power consumption at 480 V incl. blower	17 kVA	17 kVA	31 kVA

General data - For detailed technical information see product data sheets with metric units
(Download at https://www.tira-gmbh.de/en/datasheets)

Subject to change without notice. Errors and omissions excepted.

Inertial systems from 28 lbf to 146 lbf

TIRA manufactures a range of inertial exciters (IN) from 28 lbf to 146 lbf. The inertial exciters (IN) are screwed directly to the structure and can be coupled at any angle to the structure.

These inertial exciters (IN) are characterized by **high lateral stiffness**. The permanent magnet driven inertial exciters are equipped with a special spring system which provides an optimal guidance. This allows the exciter to work on the structure with its full body mass with no problems.

A maintenance-free fan guarantees the cooling of the vibration exciter. The cooling air is suctioned through a coarse filter system. TIRA's inertial exciters (IN) are used in industry, aerospace, civil engineering and the shipbuilding industry, as they are a favourable and effective method for transferring dynamic forces into large structures.

Inertial shaker S 51140-IN

System		TV 51112-IN	TV 51125-IN
Shaker		S 51112-IN	S 51125-IN
Amplifier		BAA 120	BAA 500
Blower		–	TB 0080
Rated peak force	$Sine_{pk}$ / $Random_{RMS}$	28/16 lbf	56/34 lbf
Frequency range		2 - 2,000 Hz	2 - 2,000 Hz
Max. displacement (pk-pk)		0.4 in.	0.4 in.
Max. velocity		59 in/s	59 in/s
Max. acceleration	Sine/Random	0.98/0.54 g	2/1.2 g
Suspension stiffness		114.2 lbf/in	114.2 lbf/in
Effective moving mass ±5%		0.8 lb	0.8 lb
Total shaker mass		28.7 lb	28.7 lb
Coupling (Thread ø)		M12	M12
Max. power consumption at 120 V Amplifier/Blower		100/- VA	400/460 VA

System		TV 51140-IN	TV 51165-IN
Shaker		S 51140-IN	S 51165-IN
Amplifier		BAA 1000	BAA 1000
Blower		TB 0140	TB 0140
Rated peak force	$Sine_{pk}$ / $Random_{RMS}$	90/70 lbf	146/95 lbf
Frequency range		2 - 2,000 Hz	2 - 2,000 Hz
Max. displacement (pk-pk)		0.4 in.	0.4 in.
Max. velocity		59 in/s	59 in/s
Max. acceleration	Sine/Random	2.8/2 g	2.6/1.7 g
Suspension stiffness		319.8 lbf/in	559.6 lbf/in
Effective moving mass ±5%		1.4 lb	2.1 lb
Total shaker mass		35.3 lb	57.3 lb
Coupling (Thread ø)		M12	M12
Max. power consumption at 120 V Amplifier/Blower		2.7/1.4 kVA	2.7/1.4 kVA

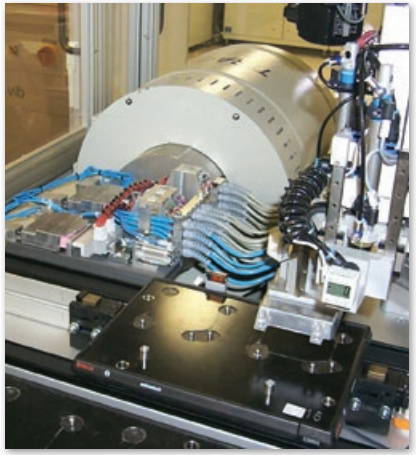
General data - For detailed technical information see product data sheets with metric units (Download at https://www.tira-gmbh.de/en/datasheets)

Subject to change without notice. Errors and omissions excepted.

Long stroke shaker with 3.94 inches displacement (pk-pk)

As a result of growing safety requirements, the industry is increasingly developing sensors and components that have to be tested under extreme stress conditions.The test parameters reach higher and higher accelerations combined with long shock duration - these tests are no longer possible with conventional standard systems with a vibration displacement of 2 inches.

TIRA has responded to the requirements of the industry for testing systems that can simulate extreme shocks by developing a series of long stroke exciters with 3.94 inch vibration displacement (pk-pk). In addition to their use in the laboratory for testing development tasks, these shakers have also proved their worth in the integration into complete production lines.



System	TV 55240/LSS-250	TV 56280/LSS-250	TV 57315/LSS-300
Shaker	S 55240/LSS-250	S 56280/LSS-250	S 57315/LSS-300
Amplifier	A 1 02 11 021 T SV	A 1 02 11 021 T SV	A 3 01 11 063 T
Blower	TB 0310	TB 9 FUK	TB 120 FUK
Rated peak force $Sine_{pk}$ / $Random_{RMS}$ / $Shock_{pk}$	899/764/2,248 lbf	1,798/1,349/4,496 lbf	3,372/2,473/8,430 lbf
Frequency range	1 - 2,000 Hz	1 - 2,000 Hz	1 - 2,000 Hz
Max. displacement (pk-pk)	3.94 in.	3.94 in.	3.94 in.
Max. velocity Sine/Random/Shock	79/79/177 in/s	79/79/177 in/s	79/79/177 in/s
Max. acceleration Sine/Random/Shock	37/30/74 g	60/45/136 g	60/50/210 g
Max. payload	110 lb	110 lb	176 lb
Effective moving mass ±5%	26.5 lb	28.7 lb	37.5 lb
Main resonance frequency	>2,000 Hz	>2,000 Hz	>1,700 Hz
Total shaker mass	1,764 lb	1,874 lb	2,646 lb
Stray magnetic field	n/a	n/a	<6 mT
Armature diameter	9.8 in.	9.8 in.	11.8 in.
Max. power consumption at 480 V incl. blower	17 kVA	17 kVA	31 kVA

General data - For detailed technical information see product data sheets with metric units (Download at https://www.tira-gmbh.de/en/datasheets)

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TIRA Vibration Test Systems – Slip Tables

TIRA Slip Tables

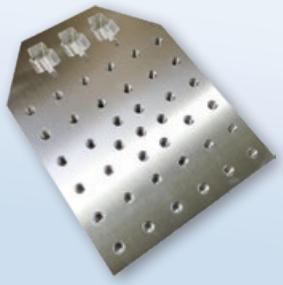
OUR CONCEPT

The clear and functional design ofTIRA slip tables enables **user-friendly handling and trouble-free testing.** Swiveling the shaker does not limit the possibility of conventional vibration tests on the vibration armature. Rigid welded structures as a basis increase the reaction mass of our systems. Undesirable vibrations on the surrounding area are damped. Linear guides guarantee the lateral stiffness of the slip plate and minimize lateral vibrations in asymmetrical test arrangements.

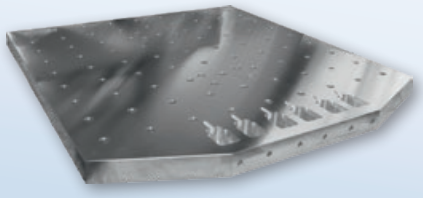
TIRA's Monobase slip tables are available in different versions:

Index XS:	for vibration systems:	TV 5220,TV 54216
Index S:	for vibration systems:	TV 50350
Index SM:	for vibration systems:	TV 55240
Index M:	for vibration systems:	TV 56280
Index L:	for vibration systems:	TV 51010,TV 57315
Index XL:	for vibration systems:	TV 59322,TV 59327,TV 59335
Index XXL:	for vibration systems:	TV 59349 -TV 59412,TV 69440
Index XXXL:	for vibration systems:	TV 59413,TV 59416,TV 59420
Index LX:	for vibration systems:	TV 59430

In vibration technology, testing tasks arise from applications in research, development and quality assurance. As the masses and dimensions of the test specimens increase, the testing tasks can no longer be performed on the armatures of electrodynamic shakers.

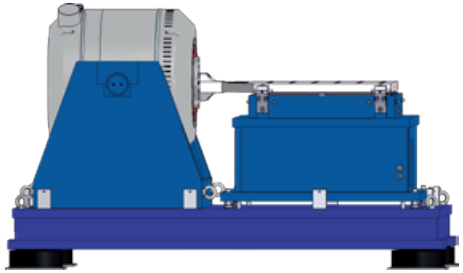


Slip plate 12”



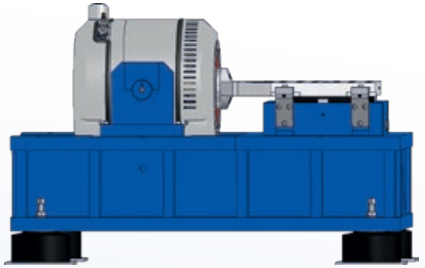
Slip plate 48”

SLIP TABLE MINIBASE



TIRA MINIBASE slip table: shaker in the original frame and slip table module mounted together on a base plate.
Available on request.

SLIP TABLE MONOBASE



TIRA MONOBASE slip table: shaker and slip plate are integrated in a common frame.

Tailor-made manufacturing is our success. We offer customer-specific solutions which can be adapted to all special requirements. TIRA slip tables can be optionally adapted to all existing vibration and climate test systems. By the use of high-quality materials and reliable components, our products ensure long-term use at low operating costs.

Subject to change without notice. Errors and omissions excepted.

TIRA Slip Tables

TESTING UNDER STRESS

Modern systems and installations have to prove themselves in all areas under their operating conditions such as temperature changes, vibrations and high humidity. From the conceptual design stage to the final inspection of electrical, electronic or mechanical products, **combined vibration-climate testing systems** simulate environmental influences on the test object. Weak points can be detected early and optimized cost-effectively. Expensive downtimes and damage are avoided by the correct design of functionally relevant components. These multi-test systems are important elements of quality assurance in the production process.

DRIVER BARS

TIRA driver bars provide the **link between shaker and slip plate**. They are FEM designed and made of magnesium. Depending on size, they are single pieces or welded together. Their geometric design enables perfect force transmission while minimizing the moving mass. Driver bars are available for vibration generators with different armature diameters from 4.72 inch to 33.1 inch.

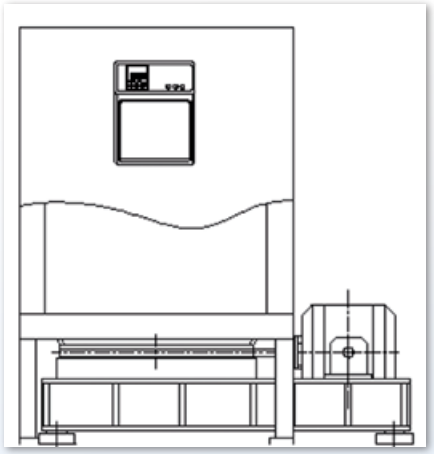
Driver bars		
Slip table version	**Armature diameter**	**~Mass**
XS	4.72 in.	2.2 lb
S	4.72 in.	3.3 lb
SM	7.09 in.	6.6 lb
	13.4 in.	14.3 lb
M	7.09 in.	6.6 lb
	13.4 in.	14.3 lb
L	9.06 in.	7.7 lb
	13.4 in.	13.2 lb
XL	13.4 in.	17.6 lb
	17.3 in.	19.8 lb
	25.2 in.	22.0 lb
XXL	13.4 in.	33.1 lb
	18.9 in.	35.3 lb
	25.4 in.	44.1 lb
XXXL	23.2 in.	108.0 lb
LX	33.1 in.	211.6 lb

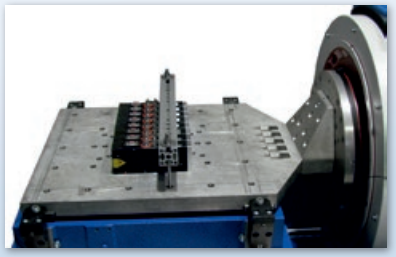
VIBRATION ISOLATION, SAFE INSTALLATION

Air spring elements allow the use of the slip tables without expensive foundations. Due to the low natural frequency of the isolators (3 - 5 Hz) a wide test spectrum can be applied.

TEST OBJECT FIXING

Test objects must be excited in their final position for practice-oriented simulation. TIRA supplies individual clamping devices for each application.





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TIRA Vibration Test Systems – Slip Tables

Oil-film slip tables

Shaker S 51010/LS-340
with slip table TGT MO 20 L

Increasing requirements in vibration testing demand additional slip table systems, which also allow testing of large and heavy specimens in horizontal mounting positions. The monobase design ensures fast and precise alignment and coupling of the shaker to the slip table. The slip tables are available as standard with slip table plates up to 78 inch x 78 inch. Different and larger tables are manufactured according to customer requirements. The oil film slip tables consist of a precision ground and lapped natural granite base plate on which a magnesium plate slides onto an oil film. 4 linear guides ensure the lateral guidance of the slip plate and minimize lateral vibrations. The possibility of horizontal and vertical excitation allows tests in mounting position. Vibration isolators are mounted on the bottom of the frame as a standard feature to prevent vibration effects on the building.

· Up to 3.94 inch of displacement possible
· Integrated oil pan

Designation	Moving plate working area	Slip plate mass (±5%)	Slip plate thickness	Max. specimen mass	Dimension ~ L*W*H	Max. pitch moment	Max. roll moment	Max. yaw moment
TGT MO 12 XS	12*12 in.	18.7 lb	1.57 in.	220 lb	37.4*23.6*21.7 in.	4,868 lbf in	4,868 lbf in	2,213 lbf in
TGT MO 12 S					45.3*29.5*29.5 in.			
TGT MO 12 SM					59.1*41.3*35.4 in.			
TGT MO 12 M					59.1*41.3*35.4 in.			
TGT MO 18 XS	18*18 in.	39.7 lb	1.57 in.	661 lb	49.2*25.6*21.7 in.	14,161 lbf in	14,161 lbf in	2,213 lbf in
TGT MO 18 S					53.1*37.4*29.5 in.			
TGT MO 18 SM					63.0*41.3*35.4 in.			
TGT MO 18 M					66.9*43.3*35.4 in.			
TGT MO 18 L					63.0*47.2*37.4 in.			
TGT MO 20 XS	20*20 in.	48.5 lb	1.57 in.	882 lb	53.1*27.6*21.7 in.	21,242 lbf in	21,242 lbf in	2,213 lbf in
TGT MO 20 S					53.1*33.5*29.5 in.			
TGT MO 20 SM					65.0*43.3*35.4 in.			
TGT MO 20 M					65.0*43.3*35.4 in.			
TGT MO 20 L					66.9*47.2*37.4 in.			
TGT MO 20 XL					80.7*53.1*47.2 in.			
TGT MO 24 S	24*24 in.	68.3 lb	1.57 in.	1,213 lb	59.1*37.4*29.5 in.	34,341 lbf in	34,341 lbf in	2,213 lbf in
TGT MO 24 SM					70.9*43.3*35.4 in.			
TGT MO 24 M					70.9*43.3*35.4 in.			
TGT MO 24 L					70.9*49.2*37.4 in.			
TGT MO 24 XL					84.6*63.0*49.2 in.			
TGT MO 30 M	30*30 in.	103.6 lb	1.57 in.	2,205 lb	76.8*43.3*35.4 in.	67,266 lbf in	67,266 lbf in	2,213 lbf in
TGT MO 30 L					76.8*43.3*37.4 in.			
TGT MO 30 XL					98.4*55.1*49.2 in.			
TGT MO 36 L	36*36 in.	177.5 lb	1.97 in.	3,858 lb	80.7*49.2*39.4 in.	112,139 lbf in	112,139 lbf in	2,213 lbf in
TGT MO 36 XL					90.6*63.0*49.2 in.			
TGT MO 36 XXL					106.3*78.7*63.0 in.			
TGT MO 39 L	39*39 in.	220.5 lb	1.97 in.	4,850 lb	84.6*68.9*39.4 in.	147,807 lbf in	147,807 lbf in	2,213 lbf in
TGT MO 39 XL					96.5*65.0*49.2 in.			
TGT MO 39 XXL					110.2*78.7*63.0 in.			
TGT MO 48 L	48*48 in.	313.1 lb	1.97 in.	5,291 lb	86.6*70.9*39.4 in.	172,589 lbf in	172,589 lbf in	2,213 lbf in
TGT MO 48 XL					106.3*63.0*49.2 in.			
TGT MO 48 XXL					118.1*76.8*59.1 in.			
TGT MO 60 L	60*60 in.	535.7 lb	1.97 in.	7,716 lb	112.2*70.9*39.4 in.	226,579 lbf in	226,579 lbf in	2,213 lbf in
TGT MO 60 XL					120.1*70.9*47.2 in.			
TGT MO 60 XXL					124.0*66.9*55.1 in.			
TGT MO 70 L	70*70 in.	665.8 lb	1.97 in.	8,818 lb	124.0*82.7*39.4 in.	265,522 lbf in	265,522 lbf in	2,213 lbf in
TGT MO 70 XL					128.0*82.7*47.2 in.			
TGT MO 70 XXL					135.8*78.7*55.1 in.			
TGT MO 78 XL	78*78 in.	859.8 lb	1.97 in.	9,921 lb	139.8*90.6*55.1 in.	300,925 lbf in	300,925 lbf in	2,213 lbf in
TGT MO 78 XXL					143.7*90.6*55.1 in.			

Effective frequency range 0 - 2,000 Hz / please inquire for larger slip plates/other sizes

Subject to change without notice. Errors and omissions excepted.

Hydrostatically guided slip tables

Oil-film slip tables with hydrostatic guidance from TIRA give you a compact system for a variety of vibration tests, including those of large and heavy specimens which generate high yaw, roll and pitch moments due to their high centers of gravity above the slip plate. These tables use high-pressure bearings with a separate hydraulic supply unit.

The monobase design enables rapid conversion from horizontal to vertical testing and the accurate alignment of vibration generators relative to slip tables. Magnesium slip plates are available in different sizes, up to a working area of max. 78 x 78 inch. Other (and larger) sizes can be produced on request.
Oil-film slip tables consist of a precision ground and lapped natural granite block with a magnesium plate sliding on an oil film.

Hydrostatic slide bearings make it possible to restrain the high yaw, roll and pitch moments as they appear with heavy test items or very large loads which may have a high centre of gravity. Hydrostatically guided slip tables are used to test specimens in a horizontal direction. Vibration isolators are provided on the underside of the frame as a standard feature to prevent vibration transfer to the building.

- Enclosed oil aggregate with return flow pump
- Integrated oil pan
- 3.94 inch displacement possible

Shaker S 57315/LS-340 with slip table TGT MOH 30 L

Designation	Moving plate working area	Number of bearings	Slip plate mass (±5%)	Slip plate thickness	Max. specimen mass	Dimension L*W*H	Max. pitch moment	Max. roll moment	Max. yaw moment
TGT MOH 24 SM	24*24 in.	2	105.8 lb	1.97 in.	1,213 lb	70.9*43.3*35.4 in.	234,544 lbf in	221,268 lbf in	197,371 lbf in
TGT MOH 24 M						70.9*43.3*35.4 in.			
TGT MOH 24 L						70.9*49.2*37.4 in.			
TGT MOH 24 XL						84.6*63.0*49.2 in.			
TGT MOH 30 M	30*30 in.	2	158.7 lb	1.97 in.	2,205 lb	76.8*43.3*35.4 in.	284,994 lbf in	300,925 lbf in	218,613 lbf in
TGT MOH 30 L						76.8*43.3*37.4 in.			
TGT MOH 30 XL						88.6*65.0*49.2 in.			
TGT MOH 36 L	36*36 in.	2	211.6 lb	1.97 in.	3,858 lb	80.7*49.2*39.4 in.	423,950 lbf in	404,478 lbf in	307,120 lbf in
TGT MOH 36 XL						90.6*63.0*49.2 in.			
TGT MOH 36 XXL						106.3*78.7*63.0 in.			
TGT MOH 39 L	39*39 in.	2	231.5 lb	1.97 in.	4,850 lb	84.6*68.9*39.4 in.	588,574 lbf in	529,274 lbf in	395,628 lbf in
TGT MOH 39 XL						96.5*65.0*49.2 in.			
TGT MOH 39 XXL						110.2*78.7*63.0 in.			
TGT MOH 48 L	48*48 in.	2	374.8 lb	1.97 in.	13,228 lb	86.6*70.9*39.4 in.	808,957 lbf in	727,530 lbf in	495,641 lbf in
TGT MOH 48 XL						106.3*63.0*49.2 in.			
TGT MOH 48 XXL						118.1*66.9*59.1 in.			
TGT MOH 60 L	60*60 in.	3	555.6 lb	1.97 in.	17,637 lb	112.2*70.9*39.4 in.	1,478,072 lbf in	1,265,654 lbf in	881,533 lbf in
TGT MOH 60 XL						120.1*70.9*47.2 in.			
TGT MOH 60 XXL						124.0*66.9*55.1 in.			
TGT MOH 70 L	70*70 in.	5	727.5 lb	1.97 in.	22,046 lb	124.0*82.7*39.4 in.	2,301,190 lbf in	1,902,907 lbf in	1,106,341 lbf in
TGT MOH 70 XL						128.0*82.7*47.2 in.			
TGT MOH 70 XXL						135.8*78.7*55.1 in.			
TGT MOH 78 XL	78*78 in.	5	1,025.1 lb	1.97 in.	26,455 lb	139.8*90.6*55.1 in.	2,832,234 lbf in	2,407,399 lbf in	1,610,833 lbf in
TGT MOH 78 XXL						143.7*90.6*55.1 in.			

Effective frequency range 0 - 2,000 Hz / please inquire for larger slip plates/other sizes

Subject to change without notice. Errors and omissions excepted.

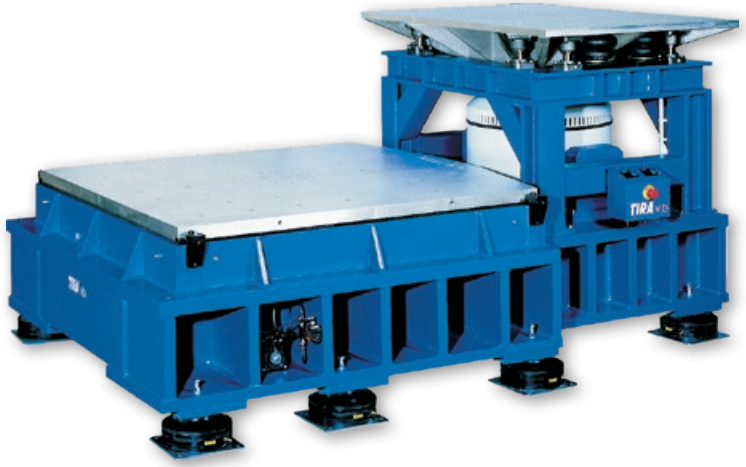
Load-bearing platforms (guided head expanders)

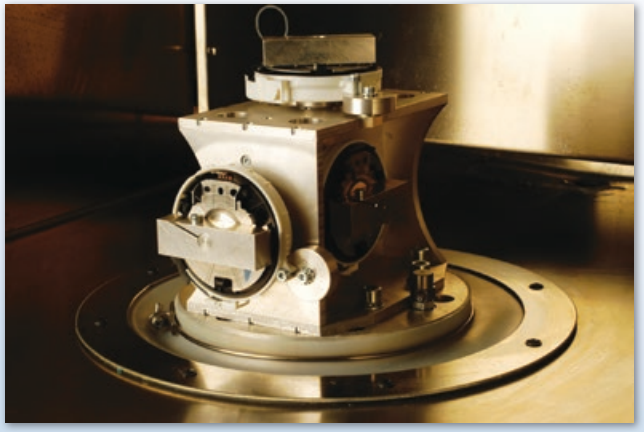
FEM-designed head expanders

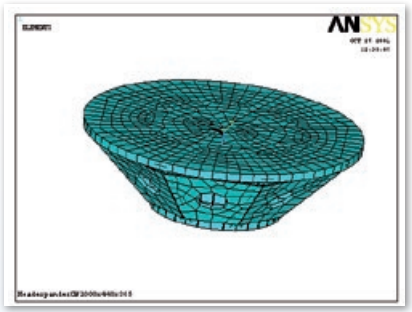
TIRA offers a wide range of head expanders, L and T-type fixtures, cubes and special support systems. The latest software for FEM calculation and analysis is used so that customers get specifically designed fixture assemblies with optimized and predicted dynamic performance to produce the best result.

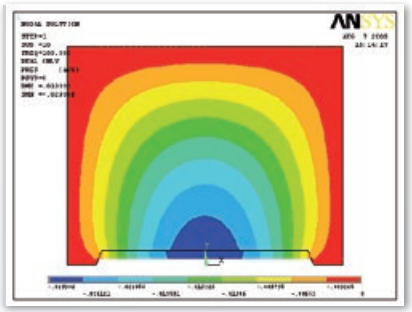
Fixtures are often main items of application conditions in industrial testing where specimens are tested to high standards of precision. This means that the fixture has to be optimized for both the specimen and the test parameters. Many customers, however, can not do these sophisticated calculations to produce a suitable fixture. **TIRA** has met this challenge and will develop, calculate and manufacture any type of special-purpose fixtures for your application, with the emphasis on minimizing its mass and optimize its dynamic performance.

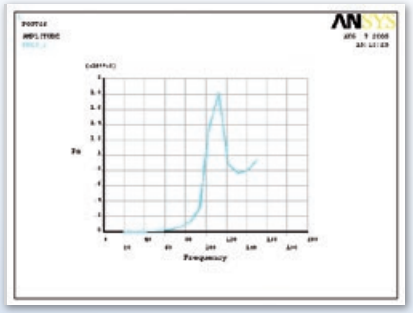
Monobase systems with a horizontal slip table and vertically guided load-bearing platform make it possible to test extremely large and heavy loads in direction of x, y and z axis. Specially-designed slip tables and load-bearing platforms are available with a working area of max. 78 x 78 inch. Slip plate and load-bearing platform are accurately aligned in a common base frame. Conversion from horizontal to vertical operation is easy and takes a minimum of time.

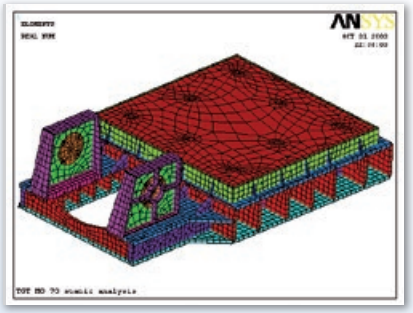












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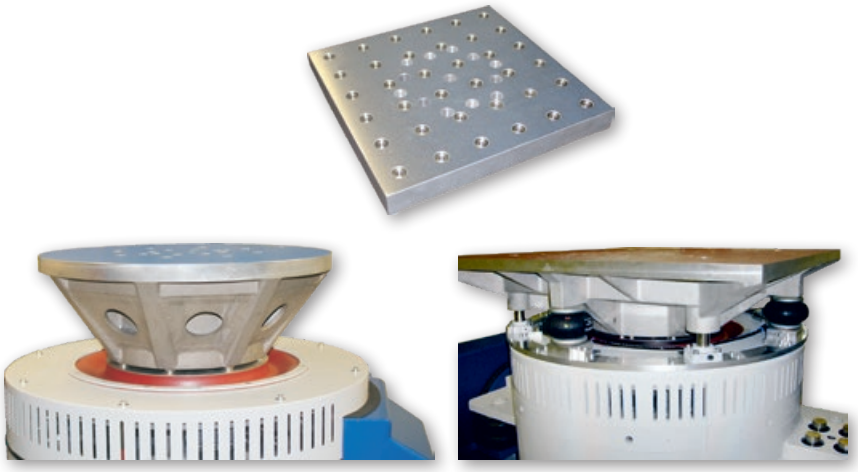
Head Expanders



TIRA head expanders are manufactured from magnesium and provide an expansion of the armature table. The unique design of the head expanders and 3 channel control strategies allow tests up to a frequency of 2,000 Hz (depends on resonance frequency). Head expanders especially provided with 'vibrodamp' can be subjected to test frequencies above 1,000 Hz. This damping process reduces amplification of upper frequency resonances.

If a test object needs eccentric clamping or generates high transverse moments, Tira also offers guided head expanders.

Apart from the range of standard head expanders **TIRA** also offers customized fixtures for round, square or rectangular working areas.

CIRCULAR VERSION				
Diameter	**Type**	**Armature diameter**	**Height**	**Mass ~**
10 in.	THR 25-120	4.7 in.	3.1 in.	8.2 lb
	THR 25-180	7.1 in.	3.1 in.	9.5 lb
12 in.	THR 30-180	7.1 in.	3.1 in.	12.3 lb
	THR 30-230	9.1 in.	3.1 in.	14.8 lb
16 in.	THR 40-180	7.1 in.	4.7 in.	23.8 lb
	THR 40-230	9.1 in.	4.7 in.	26.5 lb
20 in.	THR 50-180	7.1 in.	5.9 in.	45.2 lb
	THR 50-230	9.1 in.	5.9 in.	48.5 lb
	THR 50-340	13.4 in.	5.9 in.	53.8 lb
24 in.	THR 60-180	7.1 in.	8.3 in.	63.9 lb
	THR 60-230	9.1 in.	7.5 in.	68.3 lb
	THR 60-340	13.4 in.	7.1 in.	78.3 lb
31 in.	THR 80-340	13.4 in.	8.3 in.	112.4 lb
	THR 80-440	17.3 in.	7.9 in.	136.7 lb
	THR 80-640	25.2 in.	5.1 in.	103.6 lb
39 in.	THR 100-440	17.3 in.	13.4 in.	269.0 lb
	THR 100-590	23.2 in.	12.0 in.	275.6 lb
	THR 100-640	25.2 in.	7.3 in.	200.6 lb
48 in.	THR 120-440	17.3 in.	13.2 in.	379.2 lb
	THR 120-590	23.2 in.	13.8 in.	405.6 lb
	THR 120-840	33.1 in.	11.0 in.	372.6 lb
60 in.	THR 150-590	23.2 in.	11.2 in.	621.7 lb
	THR 150-840	33.1 in.	10.8 in.	617.3 lb

Vibrodamp version on request

SQUARE VERSION				
Size	**Type**	**Armature diameter**	**Height**	**Mass ~**
12 x 12 in.	THS 30-120	4.7 in.	3.9 in.	16.1 lb
	THS 30-180	7.1 in.	4.1 in.	18.1 lb
16 x 16 in.	THS 40-180	7.1 in.	3.9 in.	30.9 lb
	THS 40-230	9.1 in.	3.9 in.	32.0 lb
20 x 20 in.	THS 50-180	7.1 in.	4.9 in.	49.6 lb
	THS 50-230	9.1 in.	5.9 in.	60.6 lb
	THS 50-340	13.4 in.	7.1 in.	75.0 lb
24 x 24 in.	THS 60-180	7.1 in.	7.1 in.	79.4 lb
	THS 60-230	9.1 in.	7.1 in.	87.1 lb
	THS 60-340	13.4 in.	7.1 in.	104.7 lb
	THS 60-440	17.3 in.	7.1 in.	108.0 lb
31 x 31 in.	THS 80-340	13.4 in.	9.8 in.	196.2 lb
	THS 80-440	17.3 in.	9.8 in.	220.5 lb
	THS 80-640	25.2 in.	4.7 in.	145.5 lb
39 x 39 in.	THS 100-440	17.3 in.	9.1 in.	284.4 lb
	THS 100-590	23.2 in.	6.9 in.	341.7 lb
	THS 100-640	25.2 in.	6.9 in.	297.6 lb
48 x 48 in.	THS 120-440	17.3 in.	11.6 in.	429.9 lb
	THS 120-590	23.2 in.	13.4 in.	562.2 lb
	THS 120-840	33.1 in.	13.6 in.	568.8 lb
60 x 60 in.	THS 150-440	17.3 in.	15.0 in.	630.5 lb
	THS 150-590	23.2 in.	13.4 in.	760.6 lb
	THS 150-840	33.1 in.	15.0 in.	848.8 lb

Vibrodamp version on request

Subject to change without notice. Errors and omissions excepted.

TIRA Vibration Test Systems – Temperature/Climatic Test Systems

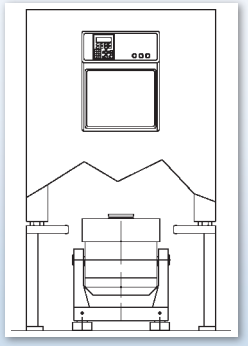
TIRA Shakers and Vibration Test Chambers

Quality, reliability and safety of products require utmost care from the concept to the end-user. To meet this pretentious requirement, one nowadays investigates the interactions between objects and their direct or indirect environment by means of environmental testing systems. Based upon such experience, products are developed with reference to specific applications as well as high quality and reliability. Utilizing combined temperature and vibration testing techniques our customers can detect material and workmanship defects at an early stage to minimize warranty costs.

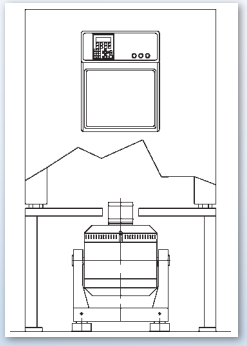
In practical use, the products are exposed to various environmental influences at the same time such as e.g. temperature, humidity, vibrations and transport loads.

TIRA offers individual fixtures, consisting of steel rings, fitting membranes and clamping ring, for the combination of our vibration exciters with climatic chambers of different manufacturers and allows a smooth process of the testing programs in vertical, horizontal and triaxial direction.

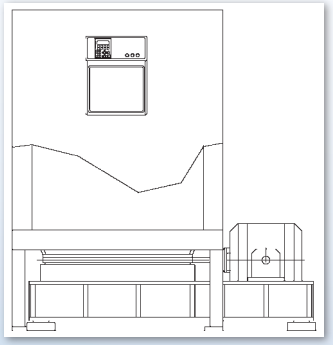
For the operation of our vibration exciters (6,070 to 15,737 lbf) with low pressure chambers TIRA's product range includes a special low pressure unit with a diameter of 13.4 inch.



Integration of vibration generator into climatic chamber



Head extender



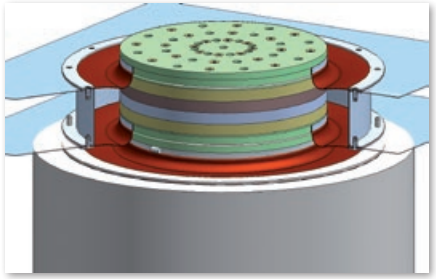
Integration of slip table into climatic chamber

Subject to change without notice. Errors and omissions excepted.

Chamber leadthroughs

TIRA chamber leadthroughs

TIRA has developed a new leadthrough for the operation of shakers with climatic chambers. This leadthrough allows in comparison to the previous systems with headextender and massive thermobarrier plate a significant better isolation at high temperature differences.
This way an operation of sensitive climate with higher dew points is better possible.



Therefore more constant temperature conditions for the test material are present. The condensation of humidity out of the testing air is reduced considerably. At cooling operation of the chamber the shaker inside is better protected against condensation.
The new model offers in addition to the significantly enhanced isolation attributes also a mass advantage of about 30%.

Thermobarriers (TBR, Circular version)

Diameter	Height	Mass
2.4 in.	0.8 in.	0.2 lb
3.1 in.	0.8 in.	0.4 lb
4.7 in.	0.8 in.	1.1 lb
7.1 in.	0.8 in.	2.2 lb
9.1 in.	0.8 in.	3.5 lb
9.8 in.	0.8 in.	4.4 lb
11.8 in.	0.8 in.	6.6 lb
13.4 in.	0.8 in.	7.7 lb
15.7 in.	0.8 in.	11.0 lb
17.3 in.	0.8 in.	12.8 lb
19.7 in.	0.8 in.	17.6 lb
23.2 in.	0.8 in.	23.1 lb
23.6 in.	0.8 in.	25.3 lb
25.2 in.	0.8 in.	27.1 lb
33.1 in.	1.2 in.	69.4 lb

Other sizes on request

Climatic chamber leadthroughs (THX)

Armature diameter	Height (Standard)	for chamber floor thickness (Standard)	Mass*
4.7 in.	3.9-7.9 (6.3) in.	1.6-5.5 (3.9) in.	5.5 lb
7.1 in.	3.9-7.9 (6.3) in.	1.6-5.5 (3.9) in.	12.3 lb
9.1 in.	3.9-7.9 (6.3) in.	1.6-5.5 (3.9) in.	17.2 lb
13.4 in.	3.9-7.9 (6.3) in.	1.6-5.5 (3.9) in.	38.6 lb
17.3 in.	3.9-7.9 (6.3) in.	1.6-5.5 (3.9) in.	55.1 lb
23.2 in.	3.9-7.9 (6.3) in.	1.6-5.5 (3.9) in.	114.6 lb
25.2 in.	3.9-7.9 (6.3) in.	1.6-5.5 (3.9) in.	130.1 lb
33.1 in.	3.9-7.9 (6.3) in.	1.6-5.5 (3.9) in.	235.9 lb

Temperature range -40 °C to 160 °C (-40 °F to 320 °F)
* Mass at standard height of 6.3 inch

Thermobarriers (TBS, Square version)

Size	Height	Mass
12 x 12 in.	0.8 in.	7.9 lb
18 x 18 in.	0.8 in.	14.1 lb
20 x 20 in.	0.8 in.	22.0 lb
24 x 24 in.	0.8 in.	31.7 lb
30 x 30 in.	0.8 in.	56.4 lb
36 x 36 in.	0.8 in.	71.4 lb
39 x 39 in.	0.8 in.	88.2 lb
48 x 48 in.	0.8 in.	127.0 lb
60 x 60 in.	0.8 in.	198.4 lb
70 x 70 in.	0.8 in.	285.7 lb
78 x 78 in.	0.8 in.	352.7 lb

Subject to change without notice. Errors and omissions excepted.

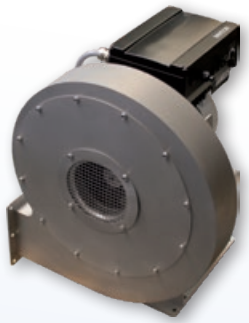
TIRA Vibration Test Systems

Blowers/Noise reduction

Blowers are used for cooling the shakers. TIRA mainly offers side channel blowers that provide an above-average cooling performance in comparison with axial blowers. In addition to this, silencers for damping the blow-off noise are offered.

An aerated sound-absorbing chamber is offered for installing the cooling blower in closed rooms. The low-maintenance blower can also be installed outdoors.

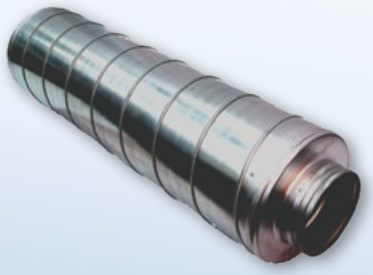
The newly developed Air-Water-Heat exchanger WWT is used for cooling down the exhaust air of the vibration test system to room temperature. This allows the operation inside rooms without problems. The heat exchanger is additionally designed as a noise protection casing and therefore offers highly efficient silencing performance.



Blower TB 9 FUK

Air-Water-Heat exchanger WWT

Acoustic Enclosure TB 7/FUK-AE



Silencer TB 7/FUK-SI

Blower (free blowing)		Engine				Dimensions	Air hose		Mass	Sound-pressure
Designation	Volume flow	Performance	Phases	Voltage	Frequency	W/H/D	Diameter	Length		
TB 0080	47.1 cfm	370 W	1	120/230 V	50/60 Hz	9.7/9.7/10.1 in.	1.57 in.	118 in.	22.0 lb	53 dB(A)
TB 0140	82.4 cfm	1.1 kW	1	120/230 V	50/60 Hz	11.2/11.9/11.5 in.	1.97 in.	118 in.	35.3 lb	63 dB(A)
TB 0310	185.4 cfm	4.0 kW	3	480 V	50/60 Hz	15.0/15.1/17.0 in.	2.36 in.	197 in.	92.6 lb	69 dB(A)
TB 9 FUK	635.7 cfm	4.0 kW	3	480 V	50/60 Hz	19.9/23.5/18.3 in.	5.51 in.	197 in.	132.3 lb	99 dB(A)
TB 120 FUK	882.9 cfm	5.5 kW	3	480 V	50/60 Hz	19.2/25.1/19.2 in.	5.51 in.	197 in.	134.5 lb	102 dB(A)
TB 7/FUK/11	1,130.1 cfm	11 kW	3	480 V	50/60 Hz	24.6/30.1/23.7 in.	5.91 in.	197 in.	249.1 lb	102 dB(A)
TB 7/FUK/20	3,425.5 cfm	11 kW	3	480 V	50/60 Hz	24.6/30.0/23.7 in.	6.89 in.	197 in.	288.8 lb	105 dB(A)
TB HR160	3,884.6 cfm	25 kW	3	480 V	50/60 Hz	26.5/29.9/28.7 in.	6.89 in.	197 in.	215.0 lb	105 dB(A)

Blower	Acoustic Enclosure				Silencer			
Designation	Designation	Dimension (LxWxH)	Mass	Noise Reduction*	Designation	Dimension(LxD)	Mass	Noise Reduction*
TB 0080	TB 0080-AE	33.9x25.6x29.9 in.	99 lb	15-23 dB(A)	TB 0080-SI	12.2x2.6 in.	0.4 lb	5 dB(A)
TB 0140	TB 0140-AE	33.9x25.6x29.9 in.	99 lb	15-23 dB(A)	TB 0140-SI	12.1x3.2 in.	0.4 lb	8 dB(A)
TB 0310	TB 0310-AE	33.9x25.6x29.9 in.	121 lb	15-23 dB(A)	TB 0310-SI	12.1x3.2 in.	1.3 lb	6 dB(A)
TB 9 FUK	TB 9-AE	57.9x49.2x54.8 in.	227 lb	5-23 dB(A)	TB 9-SI	39.8x5.9 in.	2.6 lb	3-6 dB(A)
TB 120 FUK	TB 120-AE	57.9x49.2x54.8 in.	227 lb	5-23 dB(A)	TB 120-SI	43.3x6.3 in.	2.6 lb	3-6 dB(A)
TB 7/FUK	TB 7/FUK-AE	57.9x49.2x54.8 in.	227 lb	5-23 dB(A)	TB 7/FUK-SI	44.1x11.0 in.	20.3 lb	9-15 dB(A)
variable	WWT	47.2x59.1x81.9 in.	1,764 lb	30 dB(A)				

*Depending on frequency

Subject to change without notice. Errors and omissions excepted.

Water Cooling Units

The cooling units include the complete primary circuit of shaker cooling system for the TIRA water-cooled shakers and the hydraulics of the shaker's hydrostatic bearings.

The units are designed as compact mobile devices. Primary circuit is based on deionised water. The extraction of the heat is carried out by a customer-provided secondary-process water circuit. Pressure gauges and flow indicators are available at many positions.

The front and side walls are designed with swing doors to ensure a good accessibility to all built-in components. The connections to the shaker are accomplished by hoses with self-sealing couplings that are free from leakage. A TFT touchscreen displays information on conductivity, pressure, flow rates and the temperature curve over time of the sensors installed in the cooling unit and shaker.

Cooling Unit	C 59412	C 59430
Process water:		
Supply temperature	41-59 °F	
Volumeflow at max. supply temperature	5.9 cfm	8.8 cfm
Supply pressure – static	≤ 116 psi	
Return - Dynamic differential pressure	≥ 43.5 psi	
Dissipated heat flow	110 kW	220 kW
ph-value	7 ±1	
Dirt particle size	< 984 µin	
Water hardness - overall	< 1.4 mmol/l (< 140 ppm)	
Water hardness - carbonate	< 0.9 mmol/l (< 90 ppm)	
Process water connection - Thread	G 1 1/2"	
Total mass ~	660 lb	1,100 lb
Dimensions W x H x D	31.5 x 86.6 x 35.4 in.	31.5x 86.6 x 43.3 in.

The water cooling units have the following benefits compared to other known systems:

- The primary circuit is designed as closed system, which guarantees no evaporation loss of the water and no pollution of the circuit.
- The closed system operates at a higher pressure level. This way the usual interferences of the measuring signal by cavitation are eliminated.
- The flow rate of the splitted lines of the primary circuit to moving coil, field coil and short-circuit rings is monitored.
- The primary circuit features besides the conductance monitoring an integrated demineralization cartridge, which keeps the conductance low within the bypass flow for a long operation period.
- The units control the process water flow. This way the water consumption can be reduced at low process water temperatures and during part load operation.

If needed, an additional fine filter unit for heavier polluted process water is optionally available.

Subject to change without notice. Errors and omissions excepted.

TIRA Vibration Test Systems

Power Amplifiers up to 1,200 VA

TIRA offers a new series of amplifiers with **a rated sinusoidal power** output up to **1,200 VA**. The modules control all permanent magnetic shakers as well as shakers in connection with an internal field excitation up to 225 lbf.
These amplifiers, equipped with highly-advanced MOSFET transistors, can be run in the **current or the voltage mode**, as desired. The amplifiers are user-friendly because of their backgroundlit multifunctional display.
A safety management system monitors functions such as temperature, overcurrent and overtravel.
A **high signal-to-noise ratio and a low distortion factor** are outstanding features. **Selectable ranges of operating voltage** and current range limiting are preconditions for the fact that **TIRA** amplifiers can be readily adapted to other shakers from other manufacturers.

Optionally, the amplifiers are designed for connecting the electronic zero-adjustment unit "Tira Middle Control" (TMC), which makes even with small longstroke-shakers a load compensation for achieving the nominal displacement possible.

Analog power amplifier BAA 1000-ET with Field Power Supply (FPS) and electronic zero-adjustment (TMC)

Amplifer	BAA 120	BAA 500	BAA 1000	BAA 1000-E	BAA 1000-ET
Output power RMS	120 VA	500 VA	1,200 VA	1,200 VA	1,200 VA
Frequency range	DC- 20,000 Hz	DC- 20,000 Hz	DC - 20,000 Hz	DC - 20,000 Hz	2 - 20,000 Hz
Voltage-/Current mode	yes/yes	yes/yes	yes/yes	yes/yes	yes/no
Voltage RMS, max.	22 V	45 V	72 V	72 V	72 V
Current RMS, max.	5.5 A	11.2 A	18 A	18 A	18 A
Signal input voltage PK	< 7.07 V	< 7.07 V	< 7.07 V	< 7.07 V	< 7.07 V
Distortion	< 0.05 %	< 0.1 %	< 0.1 %	< 0.1 %	< 0.1 %
Signal to noise ratio	> 100 dB	> 110 dB	> 90 dB	> 90 dB	> 90 dB
Field supply	no	no	no	yes (external)	yes (external+TMC)
Field voltage, max.	–	–	–	70 V	70 V
Field current, max.	–	–	–	3.2 A	3.2 A
Total mass	19.8 lb	39.7 lb	77.2 lb	125.7 lb	134.5 lb
Size (WxHxD)	17.3 x 3.5 x 11.4 in.	17.3 x 3.5 x 11.4 in.	19.0 x 5.7 x 23.0 in.	19.0 x 11.5 x 23.0 in.	19.0 x 14.6 x 23.0 in.
Interlocks	Overload,Temperature, Clipping	Overload,Temperature, Clipping	Overload,Temperature, Clipping	Overload,Temperature, Clipping	Overload,Temperature, Clipping

Subject to change without notice. Errors and omissions excepted.

Power Amplifiers 15 kVA

The Gradient Amplifier from **TIRA** is a single axis pulse width modulated amplifier. The Amplifier's exceptionally low output noise, extremely high bandwidth and excellent stability make it ideally suited for demanding power amplifier tasks found in laboratory and medical applications. Utilizing advanced hybrid digital and analog control architecture, the **TIRA** Power Amplifiers provide a host of powerful features.

On the **LCD-touch screen display** the module status with current indication and the error diagnostics are shown. A safety monitoring unit protects the amplifier from short circuit and from a possible destruction of the modules.
Error indication and system parameters in plain text increase the availability thanks to a faster diagnostics. The high clock frequency of up to 102 kHz allows test frequencies of up to **5,000 Hz** without any decrease in output power. The cascading of the modules allows an **amplifier design up to 240 kVA** at low floor space requirements. The output voltage of the modules can be modified so that **TIRA** amplifiers can be adapted to almost all shakers existing on the market.

A 1 02 11 021 SV

A 6 00 11 210

Amplifier	A 1 02 11 021 SV	A 1 02 11 021 T SV
Sine output power, max. $_{RMS}$	15 kVA	15 kVA
Frequency range	DC - 5,000 Hz	DC - 5,000 Hz
Voltage, max. $_{RMS}$	212 V	212 V
Current, max. $_{RMS}$, max.	40-100 A	40-100 A
Signal input voltage $_{PK}$	±10 V	±10 V
Distortion	< 0.2 %	< 0.2 %
Signal to noise ratio	> 80 dB	> 80 dB
Field supply	internal	internal
Field voltage*	140-280 V	140-280 V
Field current*	6-8 A	6-8 V
Total mass	727.5 lb	727.5 lb
Size (W x H x D)	23.6 x 68.5 x 31.5 in.	23.6 x 68.5 x 31.5 in.
Interlocks	Overcurrent, Temperature, Displacement, Cooling air, Compressed air, Phase monitoring	Overcurrent, Temperature, Displacement, Cooling air, Phase monitoring

* variable according to customer specification

Subject to change without notice. Errors and omissions excepted.

TIRA Vibration Test Systems

Power Amplifiers 22.5 to 150 kVA

Amplifier	A 3 01 11 042	A 3 09 11 042	A 3 08 11 042	A 3 08 11 063	A 6 26 11 105	A 6 26 11 126
Sine output power $_{RMS}$	22.5 kVA	22.5 kVA	25 kVA	37.5 kVA	60 kVA	75 kVA
Frequency range	DC - 5,000 Hz	DC - 5,000 Hz	DC - 5,000 Hz	DC - 5,000 Hz	DC - 5,000 Hz	DC - 5,000 Hz
Voltage $_{RMS}$, max.	212 V	212 V	212 V	212 V	212 V	212 V
Current $_{RMS}$, max.	200 A	200 A	200 A	300 A	500 A	600 A
Signal input voltage $_{PK}$	±10 V	±10 V	±10 V	±10 V	±10 V	±10 V
Distortion	< 0.2 %	< 0.2 %	< 0.2 %	< 0.2 %	< 0.2 %	< 0.2 %
Signal to noise ratio	> 80 dB	> 80 dB	> 80 dB	> 80 dB	> 80 dB	> 80 dB
Field supply	internal	internal	internal	internal	internal	internal
Field voltage*	140 V	140 V	105 V	105 V	250 V	250 V
Field current*	8 A	62 A	75 A	75 A	103 A	103 A
Total mass	992 lb	992 lb	992 lb	1,411 lb	2,315 lb	2,425 lb
Dimensions (WxHxD)	23.6 x 86.6 x 31.5 in.	23.6 x 86.6 x 31.5 in.	23.6 x 86.6 x 31.5 in.	23.6 x 86.6 x 31.5 in.	70.9 x 86.6 x 35.4 in.	70.9 x 86.6 x 35.4 in.
Interlocks (extract)	Overcurrent, Temperature, Displacement, Air supply	Overcurrent, Temperature, Displacement, Air supply	Overcurrent, Temperature, Displacement, Air supply	Overcurrent, Temperature, Displacement, Air supply	Overcurrent, Temperature, Displacement, Air supply	Overcurrent, Temperature, Displacement, Air supply

Amplifier	A 6 26 11 147	A 6 00 11 210	A 6 00 11 252	A 6 00 11 273	A 6 00 11 315
Sine output power $_{RMS}$	90 kVA	120 kVA	135 kVA	150 kVA	150 kVA
Frequency range	DC - 5,000 Hz	DC - 5,000 Hz	DC - 5,000 Hz	DC - 5,000 Hz	DC - 5,000 Hz
Voltage $_{RMS}$, max.	212 V	212 V	212 V	212 V	212 V
Current $_{RMS}$, max.	700 A	1,000 A	1,200 A	1,300 A	1,500 A
Signal input voltage $_{PK}$	±10 V	±10 V	±10 V	±10 V	±10 V
Distortion	< 0.2 %	< 0.2 %	< 0.2 %	< 0.2 %	< 0.2 %
Signal to noise ratio	> 80 dB	> 80 dB	> 80 dB	> 80 dB	> 80 dB
Field supply	internal	external	external	external	external
Field voltage*	250 V	132 V	132 V	132 V	132 V
Field current*	103 A	270 A	270 A	270 A	270 A
Total mass Amplifier/Field power unit	2,535/- lb	2,976/1,102 lb	3,086/1,102 lb	3,968/1,102 lb	4,189/1,102 lb
Dim. Amplifier/Field unit (WxHxD)	70.9x86.6x35.4 / - in.	70.9x86.6x35.4 / 23.6x68.5x33.5 in.	70.9x86.6x35.4 / 23.6x68.5x33.5 in.	94.5x86.6x35.4 / 23.6x68.5x33.5 in.	94.5x86.6x35.4 / 23.6x68.5x33.5 in.
Interlocks (extract)	Overcurrent, Temperature, Displacement, Air supply	Overcurrent, Temperature, Displacement, Conductance	Overcurrent, Temperature, Displacement, Conductance	Overcurrent, Temperature, Displacement, Conductance	Overcurrent, Temperature, Displacement, Conductance

* variable according to customer specification

Subject to change without notice. Errors and omissions excepted.

Power Amplifiers 165 to 240 kVA / TIRA Remote Display

Features:
- Flexible by modular design
- Integrated mains switch and line filter
- Multiple switchable field levels (for energy-saving)
- 4 sigma peak current

Amplifier	A 6 00 11 336	A 6 00 11 378	A 6 00 11 462	A 6 00 11 483
Sine output power RMS	165 kVA	195 kVA	225 kVA	240 kVA
Frequency range	DC - 5,000 Hz	DC - 5,000 Hz	DC - 5,000 Hz	DC - 5,000 Hz
Voltage RMS, max.	212 V	212 V	212 V	212 V
Current RMS, max.	1,600 A	1,800 A	2,200 A	2,300 A
Signal input voltage PK	±10 V	±10 V	±10 V	±10 V
Distortion	< 0.2 %	< 0.2 %	< 0.2 %	< 0.2 %
Signal to noise ratio	> 80 dB	> 80 dB	> 80 dB	> 80 dB
Field supply	external	external	external	external
Field voltage*	240 V	240 V	240 V	290 V
Field current*	355 A	355 A	355 A	320 A
Total mass Amplifier / Field power unit	5,401 / 2,502 lb	5,512 / 2,502 lb	5,732 / 2,502 lb	5,952 / 2,502 lb
Dimensions Amplifier / Field power unit (WxHxD)	94.5 x 86.6 x 35.4 / 47.2 x 68.5 x 33.5 in.	94.5 x 86.6 x 35.4 / 47.2 x 68.5 x 33.5 in.	126.0 x 86.6 x 35.4 / 47.2 x 68.5 x 33.5 in.	126.0 x 86.6 x 35.4 / 47.2 x 68.5 x 33.5 in.
Interlocks	Overcurrent, Temperature, Displacement, Flow rate, Conductance, Phase monitoring, Compressed air, Emergency power-off switch	Overcurrent, Temperature, Displacement, Flow rate, Conductance, Phase monitoring, Compressed air, Emergency power-off switch	Overcurrent, Temperature, Displacement, Flow rate, Conductance, Phase monitoring, Compressed air, Emergency power-off switch	Overcurrent, Temperature, Displacement, Flow rate, Conductance, Phase monitoring, Compressed air, Emergency power-off switch

* variable according to customer specification

TIRA Remote Display

The TIRA Remote Display consists of a freely placeable housing with 9 inch touch display for remote operation of a vibration test system. All information and operating options of the amplifier display are transmitted.

Features:
- Robust metal housing WxHxD 13.0 x 10.7 x 8.2 in.
- up to 328 ft cable length
- 9 inch TFT widescreen display with LED backlighting
- shows all information of the system, e.g.: status of components, voltage and current of voice coil and field, time history of all temperatures, actual position of the moving armature and error history
- Emergency stop push-button

Subject to change without notice. Errors and omissions excepted.

Vibration Control Systems and Vibration Accelerometers

Variable control hardware and vibration control software

The computer-aided vibration control system meets all requirements for an advanced shaker control. It combines a highly-developed and powerful DSP hardware with a personal computer that is simple to operate. The system covers the entire test range with the modes of operation random, sine, shock and mixed-mode and offers a simple operation with an graphic user environment. Within the control system the PC carries out the test preparation, the indication of the test data and the very flexible report generation.

TIRA offers vibration control systems of various manufacturers with 4 to 32 simultaneous input channels, extensive signal analysing programs incl. Sine-, Transient-, and Modal analysis, acoustic analysis, signal generator. The vibration control systems offer a wide range of options for integration with conditioning cabinets and other test equipment. They allow monitoring and complete control of the test over network and even over internet.

The respective vibration control software finds in the hardware platforms an ideal completion for comprehensive vibration tests. The controller achieves excellent measuring accuracy and an impressive realtime performance by using state of the art technology. The hardware platforms support the extensive functionality of the software, which includes simple sine or random tests over complex tests with random signal excitation, that is overlayed with a multiple sine signal, up to a load simulation in time intervals. Of course all tests are accomplished according to the respective standards ISO, DIN, MIL, ASTM and IEC.

Piezo-electric vibration accelerometers

Part of a complete vibration test system is besides the shaker and control system also a vibration accelerometer. These accelerometers are mostly of piezo-ceramic type. They are used as standard accelerometers for electrodynamic shakers due to their excellent linearity at wide dynamic range and large frequency range. TIRA offers a wide variety for all types of application.

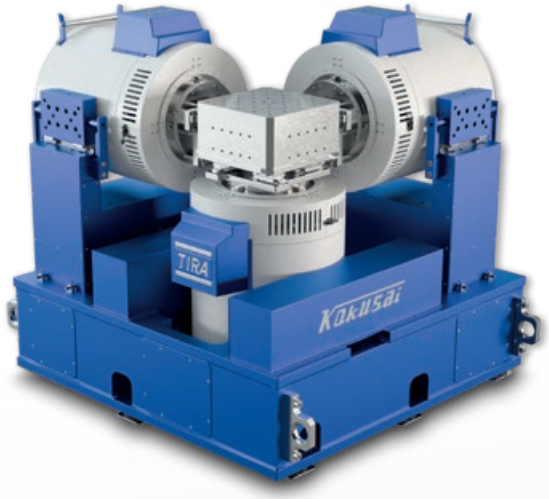
Subject to change without notice. Errors and omissions excepted.

TIRA Vibration Test Systems in Cooperation with Kokusai

Kokusai / TIRA 3D-Shaker-System

REPRODUCING THE REAL ENVIRONMENT

3DED
TIRA X KOKUSAI



Due to the requirements of the automotive industry for a 3-axis simultaneous testing machine, which can cover a wide frequency range up to 2,000 Hz, Kokusai developed a 3-axis testing machine with the aim of meeting the specifications according to MIL standard suitable for the automotive and aviation industries.

As a manufacturer of vibration testing systems, TIRA GmbH produces and supplies the necessary components such as shakers, amplifiers and cooling units in a joint project and also implements the necessary control hardware and software.

Features:

- Energy-saving mode (Field power reduction)
- Multiple safety devices
- Long-time operation
- High cross-axial stiffness
- Air-cooling blower with optional fan speed control

Model		EDS-27M0-3	EDS-35M0-3	EDS-49M0-3	EDS-55M0-3	EDS-70M0-3
Maximum force	Sine	6,070 lbf	7,868 lbf	11,128 lbf	12,364 lbf	15,737 lbf
Frequency range		5 - 2,000 Hz	5 - 2,000 Hz	5 - 2,000 Hz	5 - 2,000 Hz	5 - 2,000 Hz
Maximum acceleration	Sine	12 g	16 g	21 g	24 g	27 g
Maximum displacement (pk-pk)		1.97 in.	1.97 in.	1.97 in.	1.97 in.	1.97 in.
Dimensions of vibration table		19.7 x 19.7 in.	19.7 x 19.7 in.	19.7 x 19.7 in.	19.7 x 19.7 in.	19.7 x 19.7 in.

A wide range of models and configurations are available, contact us today for your personal quote.

Subject to change without notice. Errors and omissions excepted.

TIRA Vibration Test Systems in Cooperation with Kokusai

3-Axis/4-poster Automobile Loaded Vibration Tester

Our servomotor-driven vibration testing systems cover a wide range of table sizes and excitation forces. These are extremely versatile and can be adapted to almost any application in the low to medium frequency range up to 500 Hz, depending on size.

Due to the similar frequency range, customers often have to weigh servo motor systems against hydraulic solutions. A direct comparison illustrates many advantages of servo motor technology.

- More precision through position-based control
- Less maintenance
- No idling or warm-up time
- Lower energy consumption
- Clean and silent operation

ELECTRIC SERVO-MOTOR

Technical Data	Values
Maximum frequency	100 Hz (vertical and horizontal)
Maximum acceleration	10 to 25 g
Maximum displacement	±1.97 in.
Excitation direction	Vertical excitation (Z) Horizontal excitation (X,Y)
Maximum payload	2,205 lb (single wheel)
Types of excitation	Sine, Random, Shock, Road simulation
Options	Wheelbase moving device (ST: 39.4 inch/Standard) Tread width moving device (ST: 15.7 inch/Standard)

On customer request:
We offer single/2D/3D-system for 4-poster-applications

Subject to change without notice. Errors and omissions excepted.

TIRA Vibration Test Systems in Cooperation with Kokusai

Large Size of 3-Axis Simultaneous Vibration Tester

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- More precision through position-based control
- Less maintenance
- No idling or warm-up time
- Lower energy consumption
- Clean and silent operation

Suitable for testing railway equipment and -parts

ELECTRIC SERVO-MOTOR

Technical Data	Values
Maximum force	20,233 lbf (X/Y-Axis) 26,977 lbf (Z-Axis)
Excitation frequency	200 Hz
Maximum acceleration	1.5 g
Dimensions of vibration table	118.1 x 98.4 in. (2 units) Total: 236.2 x 98.4 in.
Maximum payload	8,818 lb
Types of excitation	Sine, Random, Earthquake simulation

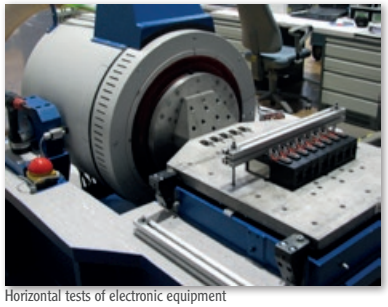
This system is suitable for the railway industry. Versions for the automotive industry are also available on request.

Subject to change without notice. Errors and omissions excepted.

Customer applications:


Modal examinations


Chassis tests in the automotive industry
First publication in ATZworldwide 1-2013, pp. 18 - 21


Horizontal tests of electronic equipment


Integration in production lines

Additional range of products by TIRA GmbH:

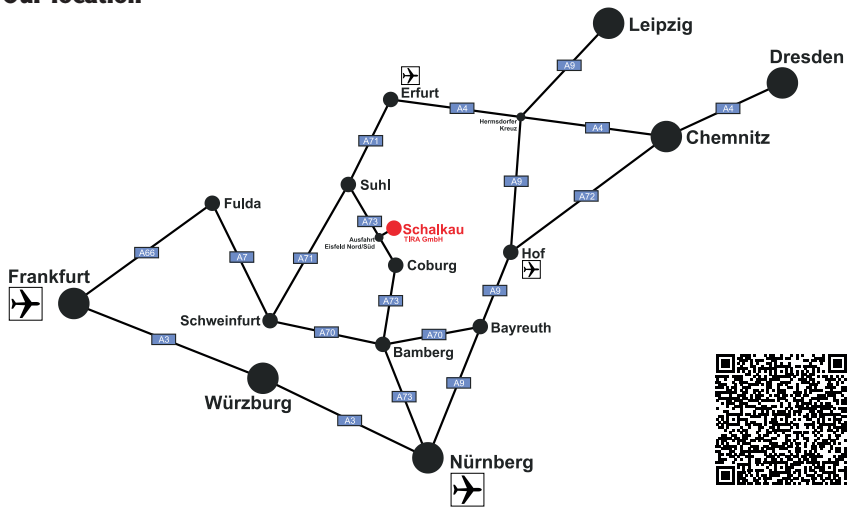
Extract of the production- and delivery program of our other product groups:

TIRA Balancing Technology
- Hard-bearing and soft-bearing balancing machines
- Machines for small-, medium-, and large-batch production with unbalance compensating units

TIRA Material Testing
- Tensile-/compression-/bending machines with spindle drive
- Universal testing machines

TIRA Mechanical Engineering
- Components and sub-assemblies for plant construction, technology, machine- and machine-tool building, Jig-and-fixture and mold construction
- Welded structures and components for tank construction and machinery

Our location



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