

MOTION SYSTEMS

INNOVATION, EXPERTISE,
AND GLOBAL SUPPORT FOR
SIMULATION SOLUTIONS



Rev D, November 2018

MOTION BASES FOR A WIDE VARIETY OF
PAYLOAD AND STROKE APPLICATIONS



LATEST SOLUTIONS FROM A WORLD LEADER IN ELECTRIC MOTION SYSTEMS

Unsurpassed innovation and technological expertise combined with close customer collaboration make Moog a leader in the design and development of 6-Degree of Freedom (DOF) motion platforms.

With 40 years of high fidelity performance associated with legacy systems, we have become synonymous with electric technology since designing the first 4,500 kg (10,000 lb) electric platform in 1994. In fact, Moog motion systems provide the highest level of performance available in the industry.

Around the world, our motion platforms for payloads ranging from 1,000 kg to 16,000 kg (2,200 to 36,000 lb) help customers provide highly realistic motion cues in simulators for trucks, armored vehicles, tanks, trains, and fixed wing and rotary wing aircraft.

Working closely with customers to provide solutions that are precisely matched to their unique requirements, our design teams offer a wealth of technical knowledge and real-world experience for all 6-DOF and special systems.

Our turnkey approach encompasses complete systems including motion bases, generic- or application-specific software, training, replacement parts, repair, and assistance in tuning, installation and system acceptance.

Advantages:

- High performance motion cueing and tuning algorithms provide high fidelity and the smallest turn around bump available
- High reliability with digital control loops that do not drift or deteriorate for greater fidelity
- High degree of modularity for greater flexibility in system design for easy integration with control loading, vibration tables and G-seats
- Cost-effective design and operation
- Redundant mechanical and software safety architecture provides virtually the safest system on the market
- Built-in test features that record performance parameters
- Integrated features such as return to home upon critical failure mode
- Easy to install, use and maintain
- Simple troubleshooting via Moog Simulation Software including a new GUI and deterministic error codes
- Extensive product support and service facilities in Europe, Americas and Asia/Pacific

HELPING YOU MEET TODAY'S SIMULATION CHALLENGES

Around the world, our forward-thinking engineers help customers design and implement motion platform solutions that set new standards in performance, fidelity and versatility. Through close collaboration and a willingness to tailor our approach to meet your unique needs, Moog gives you the leadership edge.

Higher levels of fidelity with the latest technology

Increased reliance on simulator-based pilot training drives the need for constant innovation in training systems. Our second generation level B, C or D certified all-electric solutions are designed to offer an unprecedented level of fidelity to match the motion cues to the sophisticated visuals and the reliability needed to ensure more availability. Our systems are delivered with Moog Simulation Software, a single real-time interface for system installation, maintenance, tuning and troubleshooting.

Adding flexibility to training systems

Our integrated systems can accommodate payloads from low to high and can meet the training needs of customers including business jets, commercial aircraft, helicopters and new categories like Very Light Jets (VLJs). Common software and hardware interfaces across all our subsystems mean easier and faster installation, commissioning and user training. Our experience means we can help you reduce development time and ensure that the subsystems we recommend have the best performance/size ratio to meet your exact requirements.

EMC compliance

Moog motion systems are compliant with the Electromagnetic Compatibility (EMC) directive, which aims to ensure that electromagnetic interference does not affect the performance of products and systems.

Tapping into worldwide support

The surging demand for pilot training in developing countries means OEMs and training centers require a partner with global reach and experience. Over the years, we've installed more than 1,300 simulators working in tandem with some of the world's most recognized organizations. In addition, our operations in 25 countries worldwide mean that a team of trained engineers is there to support you wherever you are.

Finding the right solution

Our deep knowledge of motion platforms ensures you have resources and the proven solutions you require to meet your specific challenges. Incorporating advances in motion control, Moog is there for you with ideas, expertise and ongoing support. With many legacy systems currently in the field, we can upgrade your equipment from analog to digital without needing to replace it.

SPECIAL SYSTEMS

Special systems can be designed to precisely match your unique application requirements. Our wide array of technologies and design expertise mean systems can be customized to meet your specific performance needs in a number of DOF (2, 3, 4, 5, 7 and 8) and platform characteristics.



Turret Test System



8-DOF system with tilt table



7-DOF system with lateral rail



5-DOF



Extra Light Payload Seat Shaker



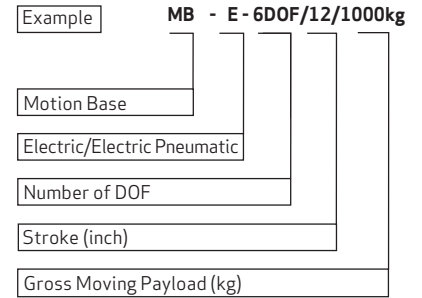
2-DOF

SPECIFICATIONS

Specifications below show minimum capabilities based on software limiting. Additional performance is readily available.

Model	MB-E-6DOF/12/1000KG	MB-E-6DOF/12/1500KG
DOF max. excursion		
Surge (single) (max.)	-0.24 m/ +0.27 m -9.5 in/ +10.8 in -0.24 m/ +0.28 m -9.6 in/ +10.9 in	
Sway (single) (max.)	± 0.23 m ± 9.2 in ± 0.24 m ± 9.3 in	
Heave (single) (max.)	± 0.19 m ± 7.5 in ± 0.19 m ± 7.6 in	
Roll (single max.)	± 19.6 ° ± 20.0 °	
Pitch (single max.)	-19.0 °/ +19.8 ° -19.3 °/ +20.1 °	
Yaw (single max.)	± 23.3 ° ± 23.7 °	
DOF max. velocity		
Surge	± 0.51 m/s ± 20.0 in/s	
Sway	± 0.51 m/s ± 20.0 in/s	
Heave	± 0.30 m/s ± 12.0 in/s	
Roll	± 30.0 °/s	
Pitch	± 30.0 °/s	
Yaw	± 40.0 °/s	
DOF max. acceleration		
Surge	± 5.9 m/s ² ± 0.60 g	
Sway	± 5.9 m/s ² ± 0.6 g	
Heave	-4.9 m/s ² , 6.9 m/s ² -0.5 g, +0.7 g	
Roll	± 500 °/s ²	
Pitch	± 500 °/s ²	
Yaw	± 500 °/s ²	
Gross moving load (GML) up to	1,158 kg 2,554 lb	1,558 kg 3,436 lb
GML moment of inertia about X-axis	650 kg.m ² 479 slug.ft ²	881 kg.m ² 650 slug.ft ²
GML moment of inertia about Y-axis	650 kg.m ² 479 slug.ft ²	881 kg.m ² 650 slug.ft ²
GML moment of inertia about Z-axis	400 kg.m ² 295 slug.ft ²	598 kg.m ² 441 slug.ft ²
GML CoG above moving platform centroid	≤ 0.61 m ≤ 24.0 in	
Top of platform	0.71 m 28.0 in	
Ground frame diameter	Approximately 2.0 m 40.0 in	
Actuator stroke	0.3 m 12.0 in	
Power requirements	208-240 VAC, 3-F - 30.0 A 380-414 VAC, 3-F - 30.0 A 440-480 VAC, 3-F - 20.0 A	380-414 VAC, 3-F - 30.0 A 440-480 VAC, 3-F - 20.0 A
Average power consumption	208-240 VAC, 4.0 kW 380-414 VAC, 5.5 kW 440-480 VAC, 6.0 kW	380-414 VAC, 7.5 kW 440-480 VAC, 9.0 kW
Peak power consumption	208-240 VAC, 12.0 kW 380-414 VAC, 14.5 kW 440-480 VAC, 15.0 kW	380-414 VAC, 7.5 kW 440-480 VAC, 20.0 kW
Electronics & Software	Motion control computer, control cabinet, motion software, Ethernet UDP maintenance and diagnostics software (integral to motion computer, accessed through separate Ethernet UDP)	
Typical simulation application	Low cost vehicle training, R&D, small aircraft, trains & marine training	

MODEL NUMBER EXPLANATION



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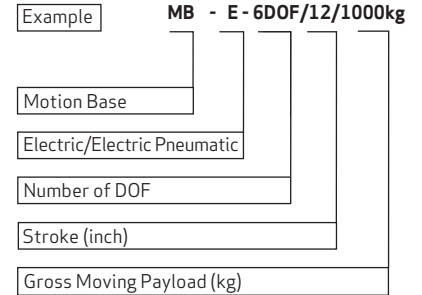


SPECIFICATIONS

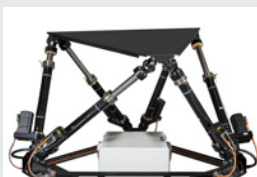
Specifications below show minimum capabilities based on software limiting. Additional performance is readily available.

Model	MB-E-6DOF/26/1800KG	MB-EP-6DOF/26/3000KG
DOF max. excursion		
Surge (single) (max.)	-0.48 m / +0.60 m -18.8 in / +23.6 in -0.64 m / +0.63 m -25.1 in / +24.8 in	-0.48 m / +0.60 m -18.8 in / +23.6 in -0.64 m / +0.63 m -25.1 in / +24.8 in
Sway (single) (max.)	-0.50 m / +0.50 m -19.6 in / +19.6 in -0.66 m / +0.66 m -25.9 in / +25.9 in	±0.50 m ±19.6 in ±0.66 m ±25.9 in
Heave (single) (max.)	-0.41 m / 0.41 m -16.1 in / +16.1 in -0.41 m / 0.41 m -16.1 in / +16.1 in	±0.41 m ±16.1 in ±0.41 m ±16.1 in
Roll (single max.)	-23.8° / +23.8° -29.2° / +29.2°	±23.8° ±29.2°
Pitch (single max.)	-23.7° / +26.0° -28.2° / +32.9°	-23.7° / +26.0° -28.2° / +32.9°
Yaw (single max.)	-25.4° / +25.4° -28.7° / +28.7°	±25.4° ±28.7°
DOF max. velocity		
Surge	0.80 m/s 31.4 in/s	0.80 m/s 31.4 in/s
Sway	0.80 m/s 31.4 in/s	0.80 m/s 31.4 in/s
Heave	0.60 m/s 23.6 in/s	0.60 m/s 23.6 in/s
Roll	± 35.0 °/s	± 35.0 °/s
Pitch	± 35.0 °/s	± 35.0 °/s
Yaw	± 40.0 °/s	± 40.0 °/s
DOF max. acceleration		
Surge	7 m/s ² 0.7 g	6.3 m/s ² 0.63 g
Sway	7 m/s ² 0.7 g	6.3 m/s ² 0.63 g
Heave	10.0 m/s ² 1.0 g	9.0 m/s ² 0.90 g
Roll	250 °/s ²	± 200 °/s ²
Pitch	250 °/s ²	± 200 °/s ²
Yaw	500 °/s ²	± 400 °/s ²
Gross moving load (GML) up to	1,800 kg 3,968 lb	3,000 kg.m ² 6,600 lb
GML moment of inertia about X-axis	2,000 kg.m ² 1,475 slug.ft ²	5,000 kg.m ² 3,688 slug.ft ²
GML moment of inertia about Y-axis	2,000 kg.m ² 1,475 slug.ft ²	5,000 kg.m ² 3,688 slug.ft ²
GML moment of inertia about Z-axis	2,000 kg.m ² 1,475 slug.ft ²	5,000 kg.m ² 3,688 slug.ft ²
GML CoG above moving platform centroid	≤ 1.00 m ≤ 40.0 in	≤ 100 mm ≤ 3.9 in
Top of platform	1.22 m 48.0 in	1.22 m 48.0 in
Ground frame diameter	Approximately 3.1 m 122 in	Approximately 3.1 m 122 in
Actuator stroke	0.6 m 24.0 in	0.6 m 24.0 in
Power requirements	400 VAC, 3-F - 50/60 Hz	400 VAC, 3-F - 50/60 Hz
Average power consumption	10 kVA	10 kVA
Peak power consumption	22 kVA	22 kVA
Electronics & Software	Motion control computer, motion software, Ethernet UDP, reflective memory, SCRAM net host interface	Motion control computer, motion software, Ethernet UDP, reflective memory, SCRAM net host interface
Typical simulation application	Rail vehicles, low cost car, truck and tank driving	Rail vehicles, low cost car, truck and tank driving

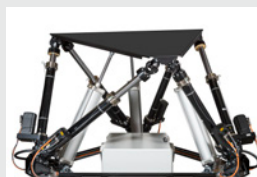
MODEL NUMBER EXPLANATION



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MB-E-6DOF/26/1800KG



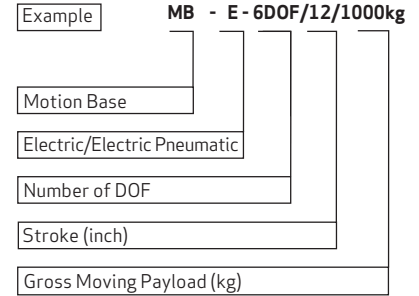
MB-EP-6DOF/26/3000KG

SPECIFICATIONS

Specifications below show minimum capabilities based on software limiting. Additional performance is readily available.

Model	MB-E-6DOF/40/8000KG	MB-E-6DOF/60/14000KG
DOF max. excursion		
Surge (single) (max.)	-0.75 m / +0.89 m -29.5 in / +35.4 in -0.83m/+0.99m -32.8 in / 39.1 in	-1.07 m / +1.30 m -42.4 in / +51.7 in ± 1.32 m ± 51.8 in
Sway (single) (max.)	± 0.74 m ± 29.2 in ± 0.82 m ± 32.5 in	± 1.08 m ± 42.7 in ± 1.20 m ± 47.2 in
Heave (single) (max.)	± 0.64 m ± 25.1 in ± 0.70 m ± 27.4 in	± 0.87 m ± 34.3 in ± 0.97 m ± 38.4 in
Roll (single max.)	± 23.3 ° ± 25.4 °	± 26.2 ° ± 28.9 °
Pitch (single max.)	-21.3 ° / +22.9 ° -23.3 ° / +25.2 °	-24.1 ° / +26.5 ° -27.0 ° / +29.9 °
Yaw (single max.)	± 26.5 ° ± 27.4 °	± 33.0 ° ± 36.9 °
DOF max. velocity		
Surge	± 0.71 m/s ± 28.0 in/s	± 1.00 m/s ± 39.4 in/s
Sway	± 0.71 m/s ± 28.0 in/s	± 1.00 m/s ± 39.4 in/s
Heave	± 0.61 m/s ± 24.0 in/s	± 0.80 m/s ± 31.5 in/s
Roll	± 20.0 °/s	± 22.0 °/s
Pitch	± 20.0 °/s	± 21.0 °/s
Yaw	± 20.0 °/s	± 25.0 °/s
DOF max. acceleration		
Surge	5.9 m/s ² 0.60 g	± 7.0 m/s ² ± 0.71 g
Sway	5.9 m/s ² 0.60 g	± 7.0 m/s ² ± 0.71 g
Heave	7.9 m/s ² 0.81 g	± 9.0 m/s ² ± 0.91 g
Roll	± 100 °/s ²	± 150 °/s ²
Pitch	± 100 °/s ²	± 150 °/s ²
Yaw	± 100 °/s ²	± 150 °/s ²
Gross moving load (GML) up to	8,992 kg 19,836 lb	14,000 kg 30,865 lb
GML moment of inertia about X-axis	56,944 kg.m ² 42,000 slug.ft ²	50,000 kg.m ² 37,000 slug.ft ²
GML moment of inertia about Y-axis	56,944 kg.m ² 42,000 slug.ft ²	50,000 kg.m ² 37,000 slug.ft ²
GML moment of inertia about Z-axis	56,944 kg.m ² 42,000 slug.ft ²	50,000 kg.m ² 37,000 slug.ft ²
GML CoG above moving platform centroid	≤ 1.52 m ≤ 60.0 in	≤ 1.80 m ≤ 70.0 in
Top of platform	1.89 m 74.3 in	2.40 m 94.5 in
Ground frame diameter	5.99 m 236 in	Approximately 7.0 m 275.6 in
Actuator stroke	1.07 m 42.0 in	1.5 m 60.0 in
Power requirements	400 -600 VAC, 3 ph, 50/60 Hz	400 VAC, 3-F - 50/60 Hz
Average power consumption	10 kVA	20 kVA
Peak power consumption	50 kVA	70 kVA
Electronics & Software	Motion control cabinet, computer, software, maintenance & diagnostic web interface, Ethernet UDP API.	Motion Control Computer, Motion Software, SCRAM Net host interface, maintenance and diagnostics laptop, Ethernet UDP, reflective memory
Typical simulation application	FAA & EASA level B flight simulation, car, truck and tank simulation	FAA & EASA level C/D full flight simulation, car, truck and tank simulation

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MB-E-6DOF/40/8000KG



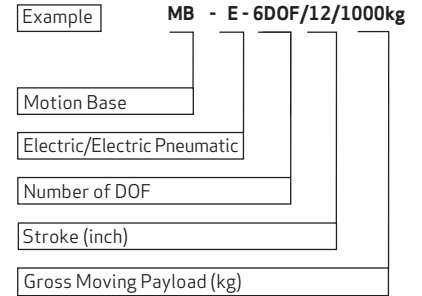
MB-P-6DOF/60/14000KG

SPECIFICATIONS

Specifications below show minimum capabilities based on software limiting.
Additional performance is readily available.

Model	MB-E-6DOF/63/14000KG	MB-E-6DOF/60/16000KG
DOF max. excursion		
Surge (single) (max.)	-1.14 m/+1.38 m -45.0 in/+54.5 in -1.26/+1.51 m -49.5/+59.55 in	-1.03 m/+1.23 m -40.6 in/+48.3 in -1.14/+1.40 m -45.0/+55.1 in
Sway (single) (max.)	± 1.45 m ± 45.2 in ± 1.26 m ± 49.7 in	± 1.07 m ± 42.0 in ± 1.18 m ± 46.6 in
Heave (single) (max.)	± 0.90 m ± 35.5 in ± 1.00 m ± 39.4 in	± 0.92 m ± 36.2 in ± 1.03 m ± 40.4 in
Roll (single max.)	± 27.2 ° ± 29.8 °	± 23.7 ° ± 25.9 °
Pitch (single max.)	-25.0 °/+27.3 ° -27.8 °/+30.7 °	-21.8 °/+24.8 ° -24.3 °/+28.0 °
Yaw (single max.)	± 35.2 ° ± 39.2 °	± 28.8 ° ± 32.2 °
DOF max. velocity		
Surge	± 0.711 m/s ± 28.0 in/s	± 0.711 m/s ± 28.0 in/s
Sway	± 0.711 m/s ± 28.0 in/s	± 0.711 m/s ± 28.0 in/s
Heave	± 0.610 m/s ± 24.0 in/s	± 0.610 m/s ± 24.0 in/s
Roll	± 20.0 °/s	± 20.0 °/s
Pitch	± 20.0 °/s	± 20.0 °/s
Yaw	± 20.0 °/s	± 20.0 °/s
DOF max. acceleration		
Surge	5.89 m/s ² 231.89 in/s ²	5.89 m/s ² 231.89 in/s ²
Sway	5.89 m/s ² 231.89 in/s ²	5.89 m/s ² 231.89 in/s ²
Heave	7.85 m/s ² 309.06 in/s ²	7.85 m/s ² 309.06 in/s ²
Roll	± 100 °/s ²	± 100 °/s ²
Pitch	± 100 °/s ²	± 100 °/s ²
Yaw	± 100 °/s ²	± 100 °/s ²
Gross moving load (GML) up to	14,000 kg 30,865 lb	17,237 kg 38,000 lb
GML moment of inertia about X-axis	67,790 kg.m ² 50,000 slug.ft ²	84,072 kg.m ² 62,000 slug.ft ²
GML moment of inertia about Y-axis	81,348 kg.m ² 60,000 slug.ft ²	90,839 kg.m ² 67,000 slug.ft ²
GML moment of inertia about Z-axis	40,674 kg.m ² 30,000 slug.ft ²	94,920 kg.m ² 70,000 slug.ft ²
GML CoG above moving platform centroid	< 1.651 m < 65.0 in	< 1.35 m < 53.0 in
Top of platform	2.25 m 92.34 in	2.06 m 81.06 in
Ground frame diameter	6.71 m 264 in	6.88 m 271 in
Actuator stroke	1.59 m 62.5 in	1.52 m 60.0 in
Power requirements	400 -600 VAC, 3 ph, 50/60 Hz	400 -600 VAC, 3 ph, 50/60 Hz
Average power consumption	20 kVA	25 kVA
Peak power consumption	70 kVA	80 kVA
Electronics & Software	Motion control cabinet, computer, software, maintenance & diagnostic web interface, Ethernet UDP API.	Motion control cabinet, computer, software, maintenance & diagnostic web interface, Ethernet UDP API.
Typical simulation application	FAA & EASA level C/D full flight simulation, car, truck and tank simulation	FAA & EASA level C/D full flight simulation, car, truck and tank simulation

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MB-E-6DOF/63/14000KG



MB-E-6DOF/60/16000KG

TAKE A CLOSER LOOK

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Motion Systems
TJW/PDF/Rev. D, November 2018, Id. CDL32593-en