

Steering Module Test Simulator SMTS

Overview

The Steering Module Test Simulator (SMTS) from MB Dynamics is a non-hydraulic turnkey lab test system, offering accurate, reliable and repeatable in-laboratory simulations of driver, road & vehicle inputs acting on a steering system, and their associated effects on steering system performance and annoying noises. Supports troubleshooting, identification, diagnosis, and resolution of root causes of unwanted noise and other performance issues common to EPS, EPHS, EPAS, MDPS, and HPS steering systems.

Applications

- Quiet enough to detect root causes of airborne and structure-borne noises caused by rack rattle, clatter, reversal clunk, zipper and running noises, in columns, gears, I-shafts, column EPS and rack EPS units
- Achieve objective and subjective NVH metrics and other steering system performance goals over a vehicle's full warranted service life
- Experimentally verify EPS functions

Typical System Components

- Extremely quiet electric/acoustic rack load simulator, with tie rod force simulation to 25 kN and strokes from 20 mm to 250 mm pk-pk
- Acoustically and electrically quiet driver simulators for inputting and controlling steering wheel position, velocity and torque values to columns and I-shafts with 1080 deg/s (180 RPM) max. velocity and 150 Nm instantaneous force
- Onboard hardware and software mitigates EPS motor pole-passing cogging, torque and force fluctuations
- PC-based dynamic controllers with supplied sensors and signal conditioning for angle, displacement, force, acceleration, and torque parameters, as required for multi-axis closed-loop control
- Additional options: gear fixtures, column stands, road load data acquisition (RLDA), NVH test analysis system, for recording and objective evaluations of noise and vibration parameters

MB Dynamics, Inc.

25865 Richmond Road, Cleveland, OH 44146 USA

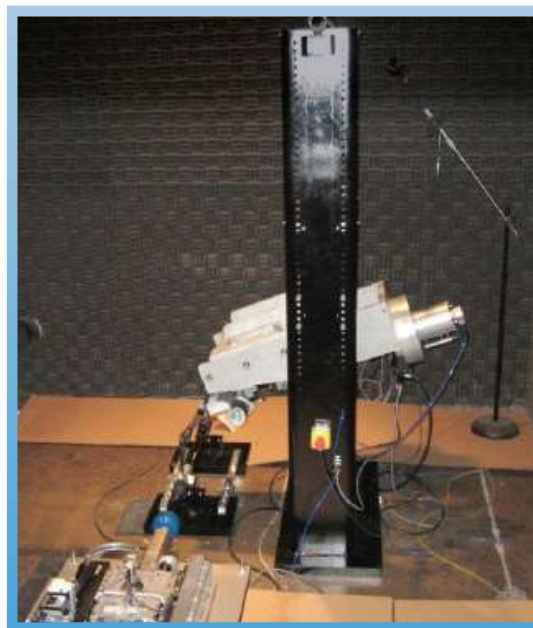
Tel: +1 216 292 5850 · Fax: +1 216 292 5614

For Sales: sales@mbdynamics.com · For Service: service@mbdynamics.com

www.mbdynamics.com

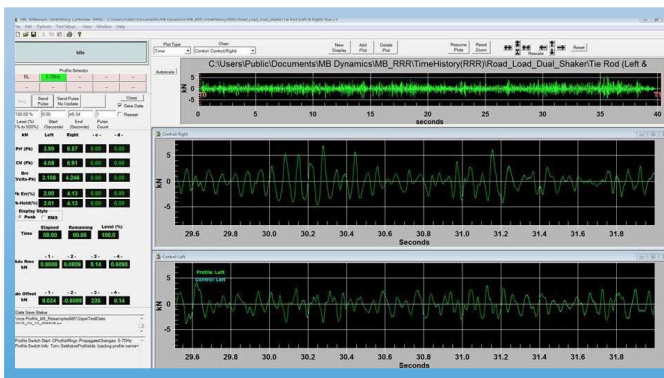
NVH Steering Module Test Simulator

- Helps meet objective and subjective NVH metrics
- Recording and objective evaluations of steering system noise and vibration parameters
- PC-based dynamic controllers, multi-test head, data acquisition & multi-axis closed-loop control
- In-lab & In-vehicle sound & acceleration acquisition
- Driver simulator
 - Input and control steering wheel position, velocity and torque values to columns and I-shafts from 10 Nm to 150 Nm
- EPS steering rack load simulator
 - Excite of one or both tie rods
- Fully electrodynamic and pneumatic system
 - Non-hydraulic; requires no oil for operation
- Linear motor
- Supplied with all necessary sensors & signal conditioning for proper acquisition and evaluation of:
 - Torque, force, angle, acceleration, and displacement data
- Tilt positioner for in-line force application at different tie rod angles
- Separate, movable, gear and height-adjustable column stand
- Full system applications engineering and troubleshooting support from industry experts



PC Data Acquisition and Control

- Full software control over:
 - Running noise
 - Rack and column rattle
 - Reversal clunk
 - Displacement and torque
 - Smooth road shake
 - Road-excited squeak and rattle (S&R)
 - In-vehicle zipper noise



Software Control Over All Applications that Follow

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Driver Simulator

- Quiet, non-cogging, repeatable, non-hydraulic rotary motion for PC-controlled rotational inputs to columns and I-shafts

Supported Test Procedures:

- All in-lab and in-vehicle steering motions from 30 Nm to 150 Nm peak or 10 Nm to 50 Nm continuous



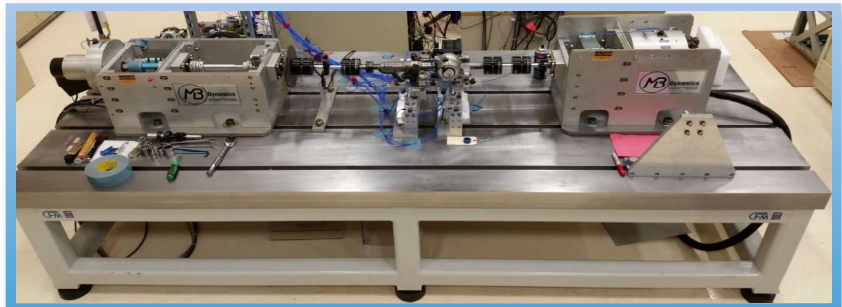
DS10 Driver Simulator Acoustic Performance

Test Condition	dB(A)	Sones N10
Ambient Noise, No Air, No AC, No Enable to motor	20.8	0.34
Background Noise, Air @ 80 PSI, AC ON, ENA ON	22.5	0.50
Trapezoid, 30 RPM, $\pm 500^\circ$, 900 dpss, 1 sec HOLD	22.6	0.50
Trapezoid, 60 RPM, $\pm 500^\circ$, 900 dpss, 1 sec HOLD	22.7	0.54
Trapezoid, 75 RPM, $\pm 500^\circ$, 900 dpss, 1 sec HOLD	23.1	0.62
Trapezoid, 90 RPM, $\pm 500^\circ$, 900 dpss, 1 sec HOLD	23.4	0.62
Sine, 0.25 Hz, $\pm 500^\circ$	25.7	0.82
Triangle, 1000 deg/s, $\pm 450^\circ$ (0.556 Hz)	32.6	2.38
Position Time History, BW, $\pm 510^\circ$, ± 875 deg/s	24.1	0.94
Pos. Time History, Sweep 2, $\pm 510^\circ$, ± 817 deg/s	25.0	1.02
Pos. Time History, Sweep 3, $\pm 510^\circ$, ± 828 deg/s	24.8	1.02
Reversal Clunk, $\pm 40^\circ$, 74 RPM, 2500 dpss	26.1	0.86

Column EPS Test Bench

Supported Test Procedures:

- Rack EPS tests
- Steering shaft torsional rate
- Friction and backdrive torque
- Simultaneous steering shaft displacement and rack load torque
- Column rattle
- Smooth road shake
- Reversal clunk



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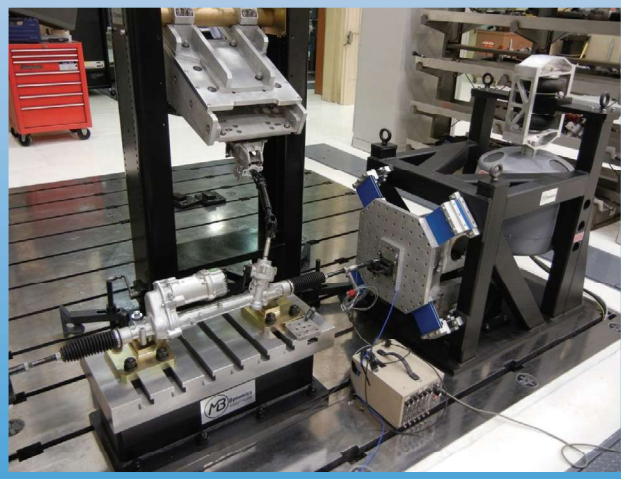
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Steering Gear Rack Rattle and Clatter Evaluations

Supported Test Procedure:

- GMW16216: Steering Gear Rattle Evaluation



Supported Test Procedure:

- Ford Core Engineering Requirements



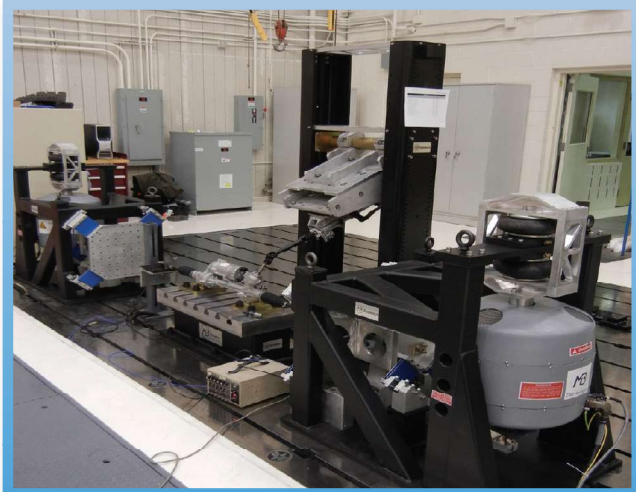
Supported Test Procedure:

- HMC ES56310-00: Steering Rack Rattle Testing



Supported Test Procedure:

- GMW16216: Steering Gear Rattle Evaluation



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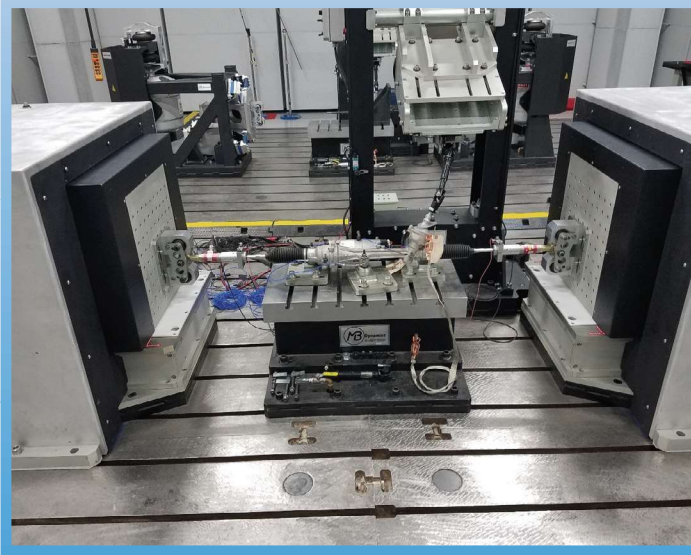
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Running Noise, Zipper Noise, Gear Wear, and Gear Conditioning

Supported Test Procedure:

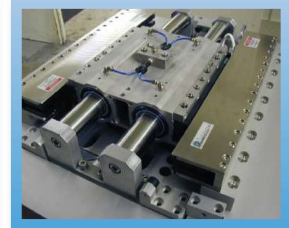
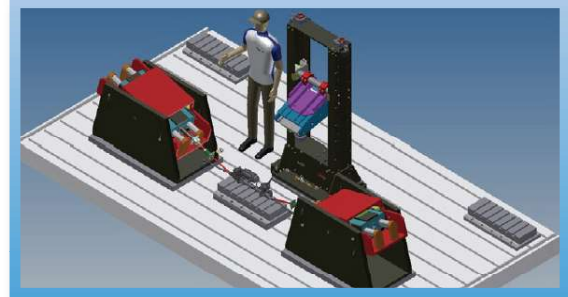
- GMW17112: Electric Power Steering Gear Performance Test



Unified Test Bench for Rack Rattle, Running Noise, Reversal Clunk

Supported Test Procedure:

- All OEM and Supplier Requirements



Transfer Path Analysis and Virtual Acoustic Prototyping

Supported Test Procedures:

- Implementation of In-Situ Blocked Forces for In-Vehicle and In-Lab Implementation

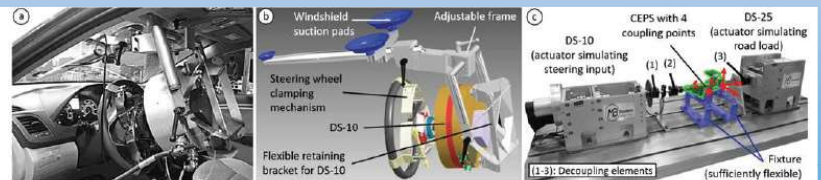


Figure 2: Operational measurements with low-noise Driver Simulators (DS) from MB Dynamics: (a) DS mounted in stationary vehicle via (b) windshield holding fixture to conduct in-vehicle steering noise evaluations; (c) Matched DS pair in horizontal arrangement to provide driver inputs and torsional road loads during CEPS lab tests.

Evaluations of Friction and Stick-slip Performance Characteristics of Inner Tie Rod Ball Joints under Controlled Conditions

Supported Test Procedure:

- Ford Inner Tie Rod Stick-Slip Test, ESAE5C-3280-AA



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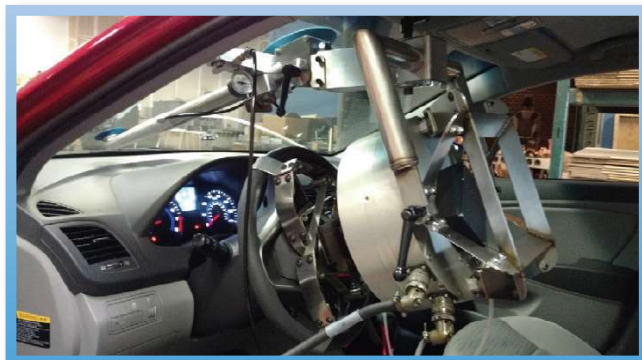
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In-Vehicle Zipper Noise Measurement

Supported Test Procedure:

- GMW14479: Electric Power Steering Zipper Noise Evaluation Procedure for Steering Wheel Inputs in Vehicle



I-Shaft Turning Friction, Hysteresis, Lash, Stick Slip, Torsion Performance, Stick Slip Durability

Supported Test Procedure:

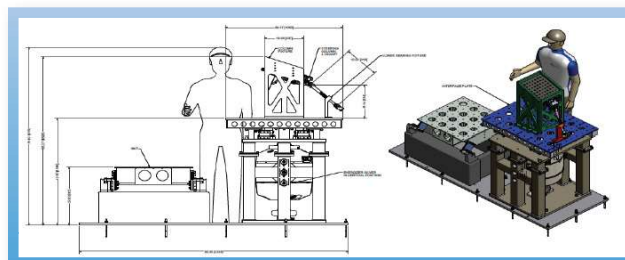
- GMW17444: Intermediate Shaft Rotating Friction Test Procedure
- GMW17422: Intermediate Shaft Stiffness/Hysteresis/Lash Test
- GMW17207: I-Shaft Stick-Slip and Torsion Performance Test
- GMW15599: Steering Column Intermediate Shaft Stick Slip Durability



Column and I-Shaft Vibration Squeak & Rattle, Durability, Rotational Noise, Lower Bearing Squeak

Supported Test Procedures:

- Ford Core Tests:
 - o III.B.1.5
 - o III.B.3.1
 - o III.C.1.6
 - o III.C.1.8
 - o III.C.1.13



MB Dynamics Test Engineering Services:

- 80-year experts in automotive testing
- Test equipment specification assistance
- Test methodology and operating procedure development
- Applications troubleshooting assistance
- Dynamic testing; results interpretation; design and production verifications
- Road load data acquisition and processing
- New test system installation and validation
- Full applications engineering support
- Customer technical support teams in more than a dozen countries
- Field service and on-site training
- Test laboratory support

Contact us today for a free consultation.

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