MUSTANG DYNAMOMETER

Emission Testing Solutions

Corporate Headquarters
2300 Pinnacle Parkway, Twinsburg, Ohio 44087 USA
Ph: (330) 963-5400 • Fax: (330) 425-3310
E-mail: sales@mustangdyne.com
Web: http://www.mustangdyne.com

Driving Excellence further

Mustang Dynamometer - Corporate Profile

- *Founded in 1975*
- *ISO 9001-2000 Certified*
- *Leading Manufacturer of Test Equipment, Technology, and Services*
- *Leading Unit Supplier of Vehicle Inspection Systems worldwide*
- *Over 20,000 Emissions Testing Dynamometers Supplied*
- *Credited with numerous patents*
- *A medium sized US company with a "large company" approach to product quality and superiority*

Products & Services

Products

- Production Line Testing Systems
- Tow Dynamometers
- Chassis Dynamometers
- Engine Dynamometers
- Transmission Dynamometers
- Torque Converter
- Axle Dynamometers
- Powertrain Testing Systems
- Electric Motor Test Systems (Hybrids)
- Gearbox, Belt, Driveline Test Systems
- End-of-Line Test Systems
- Durability Test Systems
- EMC/RFI Test Cell Dynes
- NVH & Emissions Dynamometers
- Turnkey Test Cell Installations
- Vehicle Safety & Emissions Inspection Systems
- Custom Engineered Test Systems
- Dynamometer Controllers & Software
- Fuel Delivery and Conditioning Systems

Services

- On-site System Installation, Start-up, Training, and Maintenance Services
- Engineering Consulting Services
  - Facility Planning
  - Testing Consultation
  - Equipment Design
  - Emissions
- Program Management

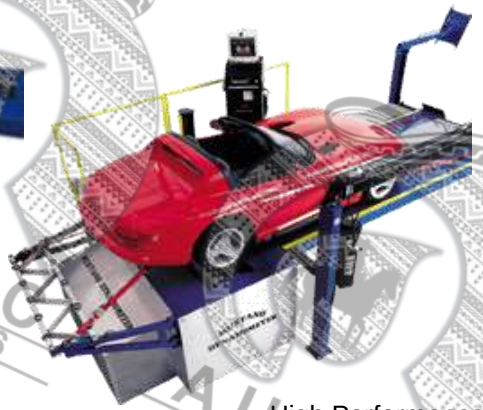
Dynamometer Products Capabilities

- Mustang has delivered over 20,000 emission testing dynamometers.
- 150+ Dynamometer Systems Per Week

Chassis Dynamometer Products

- Extensive product development has resulted in a broad range of off-the-shelf products.
- Systems controls for electric inertia simulation, Independent Wheel Control, patented Virtual Inertia™ and independent wheel noise road simulation.
- Chassis Dynamometer Applications
  - **Passenger Car / Light Truck**
  - **Truck/Bus**
  - **Motorcycle/ATV**
  - **Track/Snowmobile**

Track Dynamometers



High Performance Dynamometers

Multi-Axle Truck Dynamometers

AWD Dynamometers

Motorcycle Dynamometers

NVH Snowmobile Dynamometer

MUSTANG DYNAMOMETER

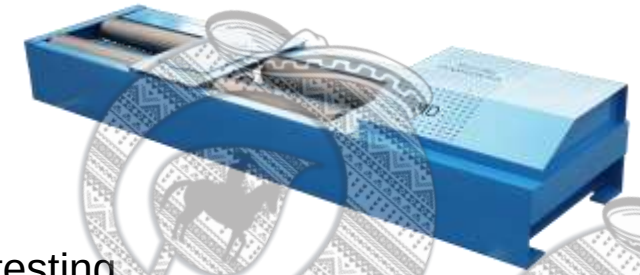
ASM Testing Summary

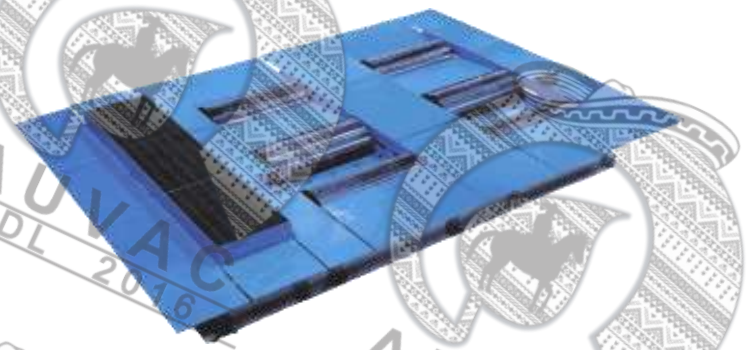
- Steady State Test (50% load @ 15 mph, 25% load at 25 mph, or both)
- Dynamometer Loading Based on Simulated Acceleration
- Short Test Cycle (30 to 180 seconds)
- The Least Expensive Loaded Mode Test Equipment
- Lowest Loaded Mode Maintenance & Consumable Costs
- Extremely Easy to Operate and Calibrate
- A Small Portion of the Vehicle's Exhaust is Collected & Analyzed
- Measures % and PPM (parts per million) of HC, CO_2, CO, NO, and O_2

MUSTANG DYNAMOMETER

ASM Dynamometer Summary

- Power Absorption Unit (PAU) to provide loading
- Inertia weight (2,000 lb. base inertia)
- Motor for automatic warm-up and calibration
- Rolls, mechanically linked to allow bi-directional testing
- Load cell to accurately measure torque
- Speed encoder to accurately measure speed
- Lift system to allow vehicle ingress and egress
- Extremely Easy to Operate and Calibrate
- New generation can do performance testing in addition to emissions





ASM Analyzer Summary

- Hydrocarbon (HC) measurement via non-dispersive infrared.
- Carbon dioxide (CO2) measurement via non-dispersive infrared.
- Carbon monoxide (CO) measurement via non-dispersive infrared.
- Nitric oxide (NO) measurement (consumable)
- Oxygen (O2) measurement (consumable)
- Extremely easy to operate and calibrate
- For gasoline only

MUSTANG DYNAMOMETER

MD-100-M 2WD (MD-ASM-97-HP) Chassis Dynamometer

Horsepower:	300 hp peak absorption
Loading:	Air cooled eddy current power absorber (Model MDK - 70)
Rolls:	Precision machined & dynamically balanced Belted for bi-directional capability 8.575" (218mm) diameter balanced rolls 35" (889mm) face length 30" (762mm) inner track width 100" (2,540mm) outer track width 17.1" (434mm) roll spacing
Maximum Speed:	100 mph
Frame:	Heavy-duty structural steel frame Heavy-duty restraint kit included Height: 15"
Lift:	Between roll lift with integrated roll lock
Air Requirements:	80-100 PSI, dry, regulated, oil free
Power Requirements:	115 VAC single phase, 60 Hz, 15 Amps (computer) 230 VAC single phase, 60 Hz, 30 Amps (dynamometer)
Axle Weight:	7,720 lbs. (3,500 kg) maximum
Drive-over Capacity:	12,000 lbs. (5,544 kg) maximum
Shipping Weight:	3,250 lbs.
Motor:	5 hp calibration motor
Inertia:	2,000 lbs base mechanical inertia

MUSTANG DYNAMOMETER

STATE OF CALIFORNIA
BUREAU OF AUTOMOTIVE REPAIR

PROVISIONAL COMPONENT APPROVAL
ASM Dynamometer

Mustang Dynamometer is granted a *Provisional Component Approval* for the ASM Dynamometer, Model MD-ASM-97-CA-HP based on tests conducted in compliance with the provisions of Health and Safety Code Section 44036 and upon documentation and representations made by Mustang and/or their representatives. *Provisional Component Approval* means that the component has met the performance requirements allowing it to be considered for use in a BAR-97 EIS system. This approval is subject to, but not limited to the conditions listed below.

DESCRIPTION: ASM Dynamometer Model MD-ASM-97-CA-HP meeting requirements of the BAR-97 Emissions Inspection System Specifications, dated May 1996, with updates through November 1997.

CONDITIONS OF CERTIFICATION:

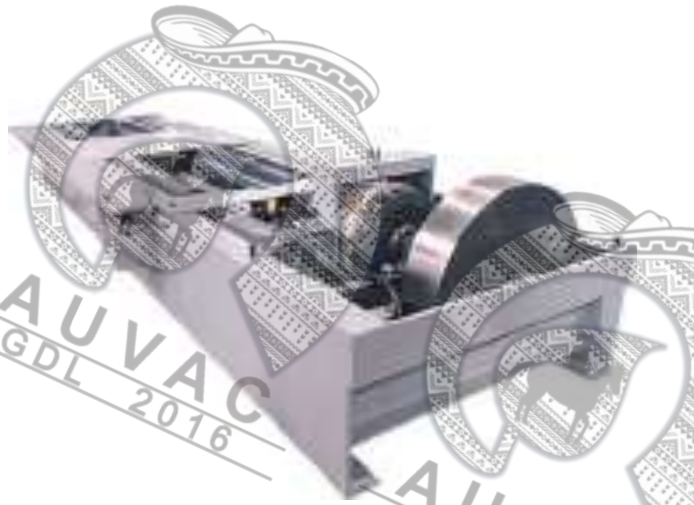
1. If any problems or discrepancies are discovered subsequent to the granting of this certificate, Mustang shall cooperate to resolve the problems to the satisfaction of the Bureau and in a time frame acceptable to the Bureau. At the discretion of the Bureau, this approval, Mustang must submit its changes along with appropriate documentation to the bureau prior to the release/sale of the updated equipment.
2. The following items must be completed by the EIS system integrator:
   - The dynamometer must be on system and load tested before final approval.
   - System propeller name must be shown on the dynamometer ID plate(s) by the system provider.

Failure to comply with the conditions listed above may result in decertification of future sales for a period of 30 days or more. Serious uncorrected problems could result in decertification.

APPROVAL DATE: July 15, 1998

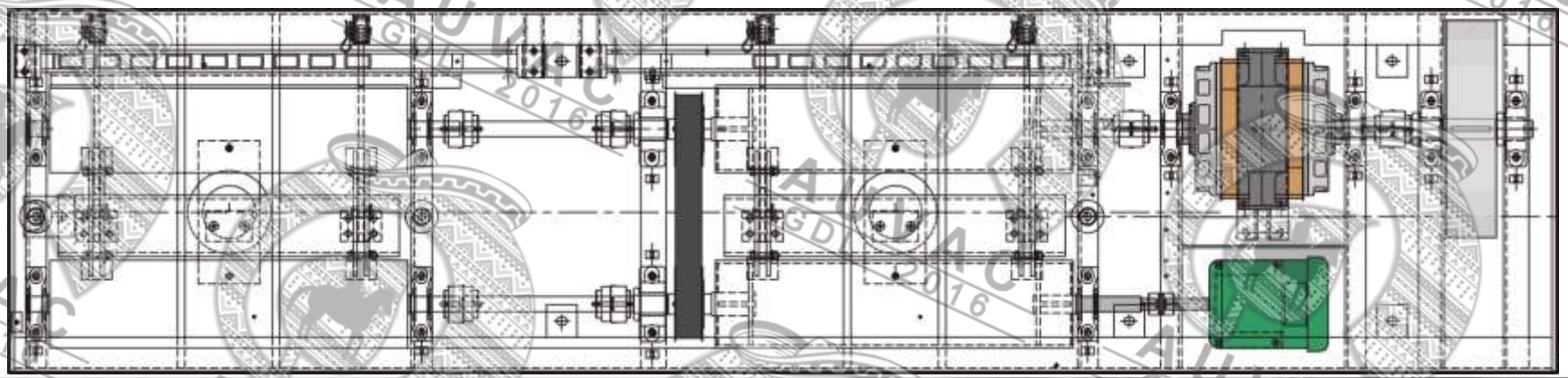
Chief of Test Only Check Program

TOTAL P.01



MUSTANG DYNAMOMETER

MD-100-M ASM Chassis Dynamometer



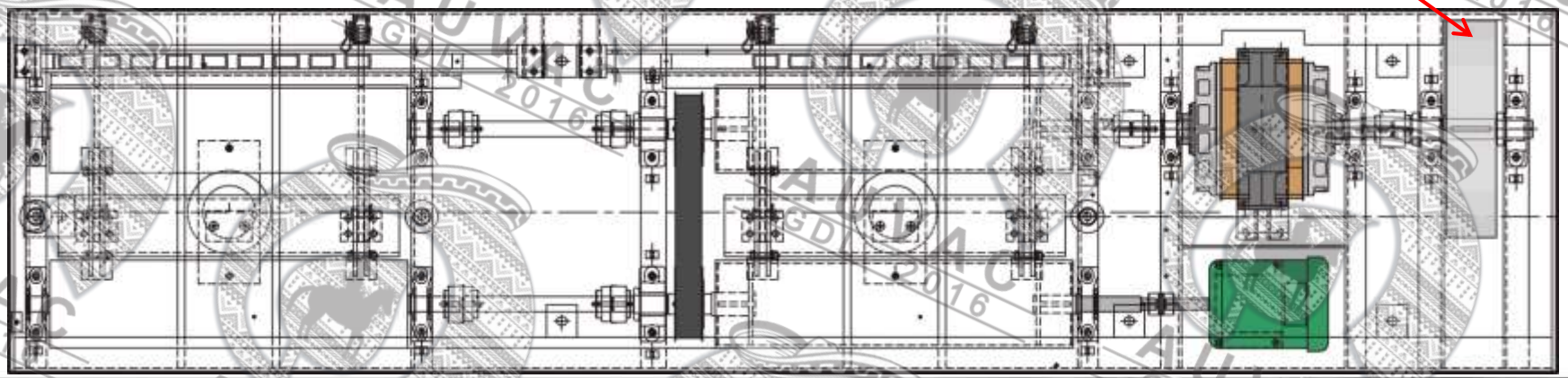
MD-100-M ASM Chassis Dynamometer

Inertia Weight

(Peso Inercial)

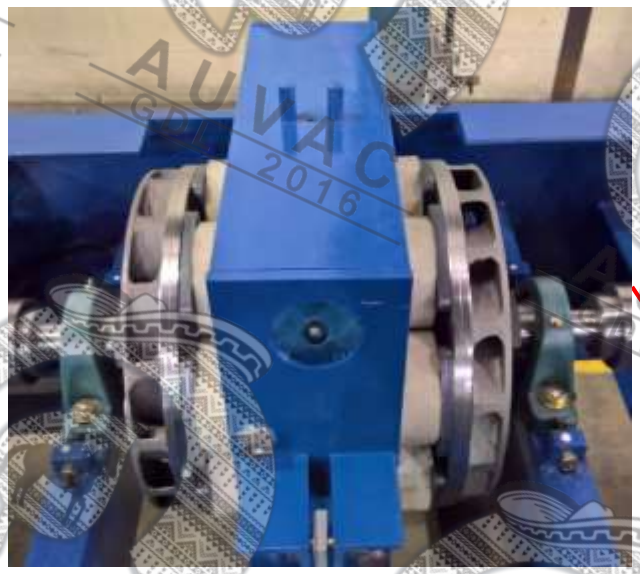
2,000 lbs. Inertia

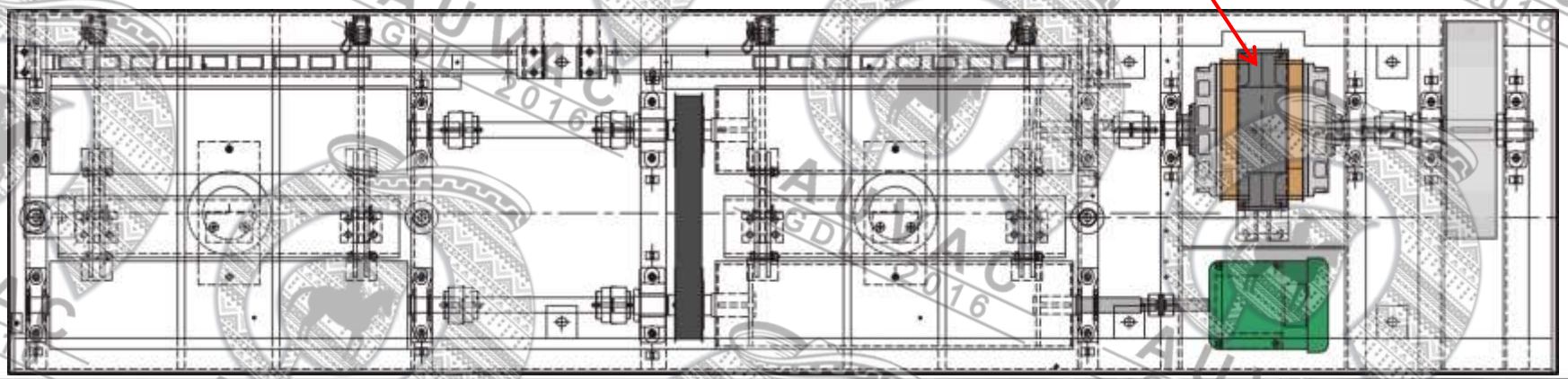
(907 kg Inercial)



MD-100-M ASM Chassis Dynamometer

Power Absorber
(Unidad de Absorción de Potencia)





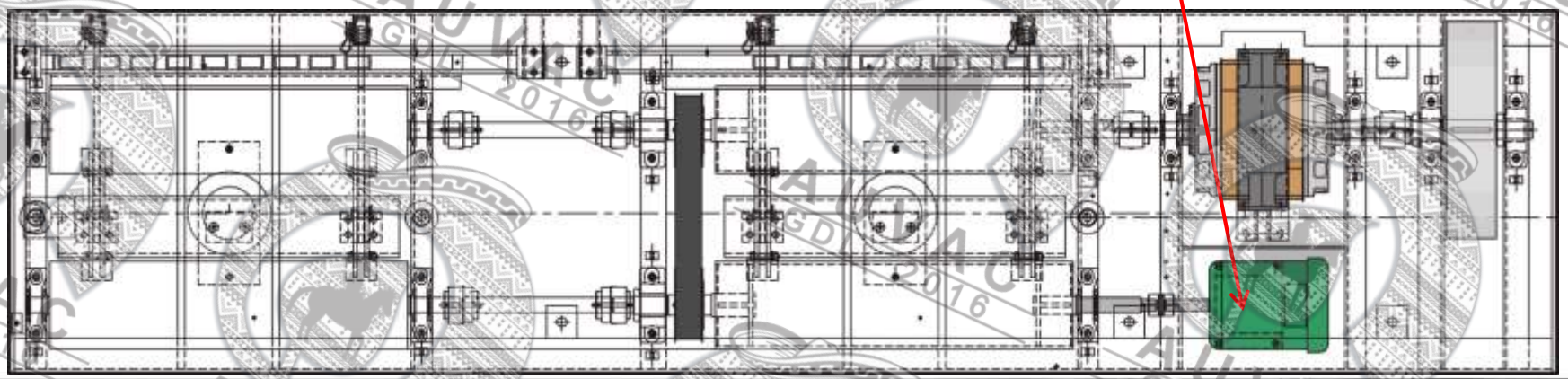
MD-100-M ASM Chassis Dynamometer

Calibration Motor

(Motor de Calibración)

5 HP

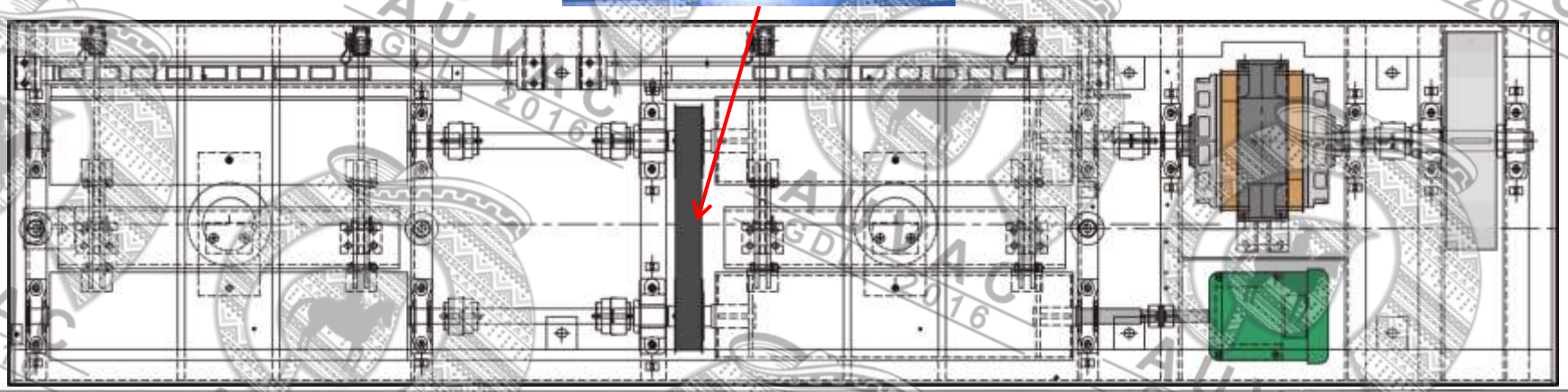
(3.7 kW)



MD-100-M ASM Chassis Dynamometer

Belt

(Banda o Correa)

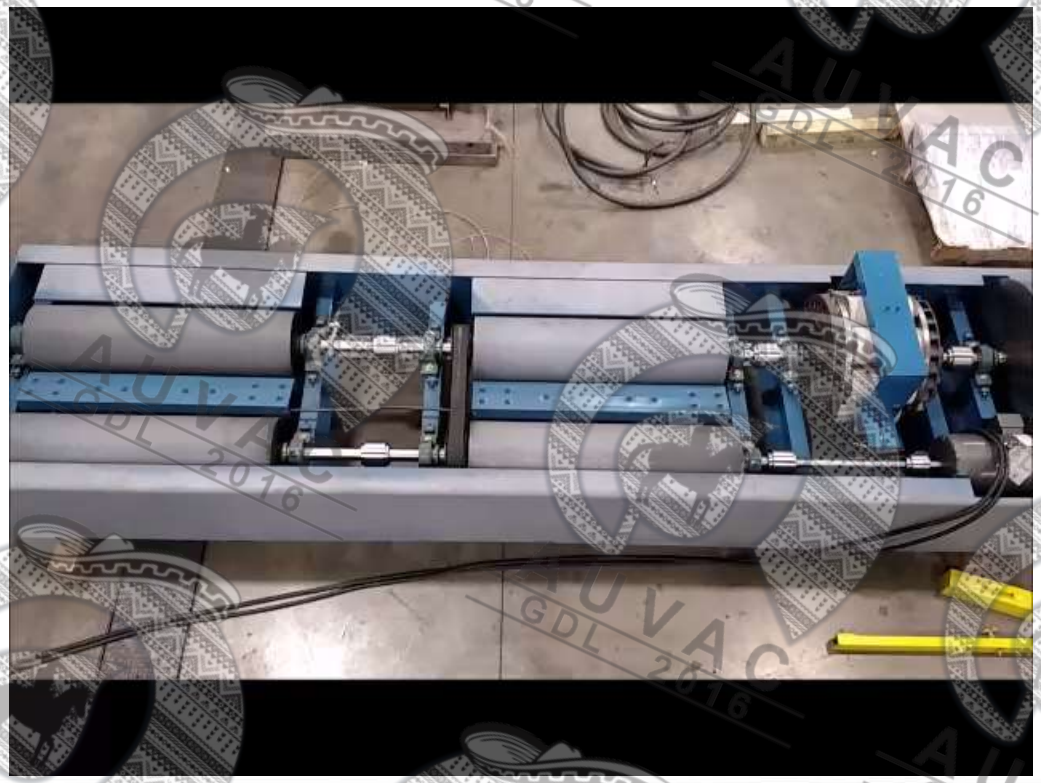


ASM Dynamometer Static Calibration (daily)

- Calibrate the load cell with OEM certified weights and calibration arm

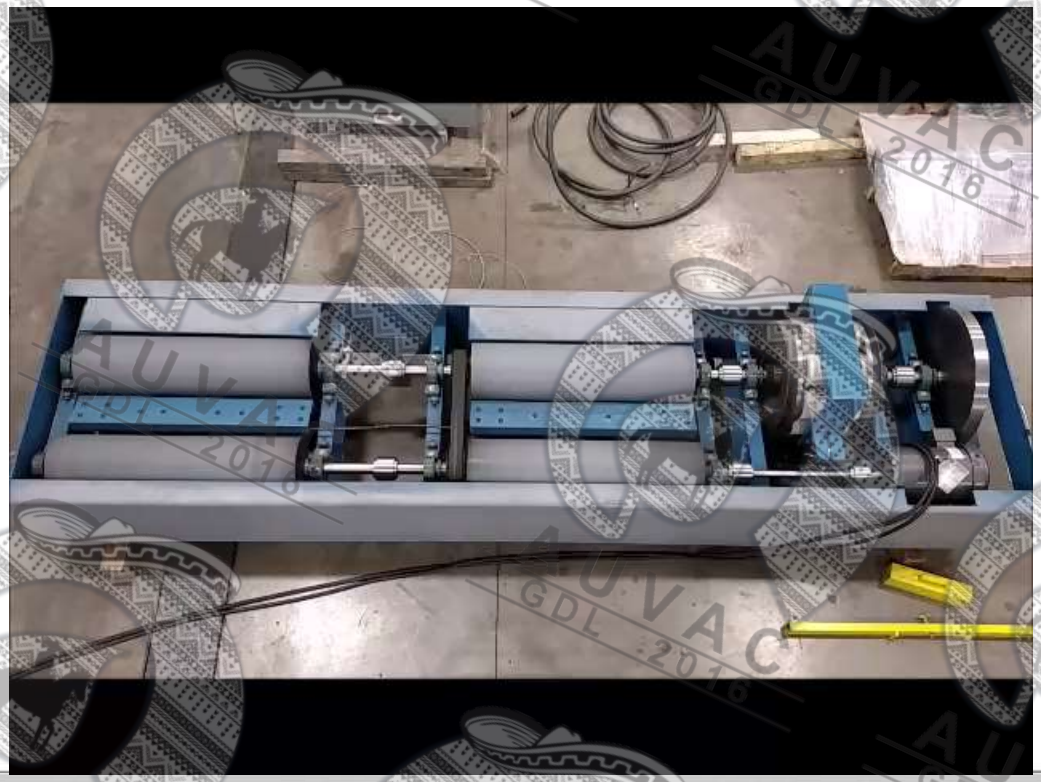
ASM Dynamometer Dynamic Calibration (30 days)

- Calibrate the load cell with OEM certified weights and calibration arm
- Perform dynamometer warmup (recommended 45 mph for 15 minutes)



ASM Dynamometer Dynamic Calibration (30 days)

- Calibrate the load cell with OEM certified weights and calibration arm
- Perform dynamometer warmup (recommended 45 mph for 15 minutes)
- Perform coastdowns per BAR/EPA specifications to verify dynamometer calibration



ASM Dynamometer Inertia Verification (Mustang Factory QA)

- Calibrate the load cell with OEM certified weights and calibration arm
- Perform dynamometer warmup (recommended 45 mph for 15 minutes)
- Determine dynamometer parasitic loss curve by running dynamometer at various constant speed setpoints and measuring system losses
- Perform a series of dynamometer coastdowns with varying loads to determine inertia (equivalent weight) using the published BAR/EPA formulas
- Perform coastdowns per BAR/EPA specifications to verify dynamometer calibration and inertia verifications

Intertia Test Status	Passed
Dyno Inertia (LBS)	2039.487
Parasitics Test Status	Passed
Parasitics (HP/MPH^1) A	2.60949
Parasitics (HP/MPH^1) B	0.13944
Parasitics (HP/MPH^1) C	0.00031
Coastdown Test Status	Passed
Hi Window Target (Seconds)	5.511
High WIndow Actual (Seconds)	5.435
Percent Error	-1.37%
Lo Window Target (Seconds)	4.732
Lo Window Actual (Seconds)	4.676
Percent Error	-1.19%

MD-ASM-150-M (MD-AWD-100-M) Chassis Dynamometer

Horsepower:	300 hp peak absorption
Loading:	Air-cooled eddy current power absorber (model MDK-70)
Motor:	15 hp calibration motor
Rolls/Wheelbase:	Precision machined & dynamically balanced knurled finish rollers Belted for bi-directional capability 8.575" (218mm) diameter balanced rolls 35" face length 18" inner track width 88" outer track width 96" - 122" standard wheelbase accommodation
Transmission:	Heavy-duty, industrial-fiber belt drive with mechanical disconnect
Air Clutch:	Automatic air clutch to disengage the front roll set from rear
Frame:	Heavy-duty structural steel frame Height: 12"
Roll Decelerator:	Allows vehicle deceleration without use of vehicle brakes Eddy Current PAU used to decelerate rollers
Air Requirements:	80 PSI, dry, regulated, oil free
Power Requirements:	115 VAC, single phase, 50/60 Hz, 15 amps (computer) 230 VAC, single phase, 50/60 Hz, 30 amps (dynamometer) 230 VAC, three phase, 50/60 Hz, 30 amps (motor drive)
Axle Weight:	7,720 lbs (3,500 kg) maximum 1 axle
Shipping Weight:	9,000 lbs (4,090 kg) (dynamometer weight only)

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MD-150-M ASM Chassis Dynamometer

MUSTANG DYNAMOMETER

Diesel Lugdown Test

Diesel Smoke Opacity System

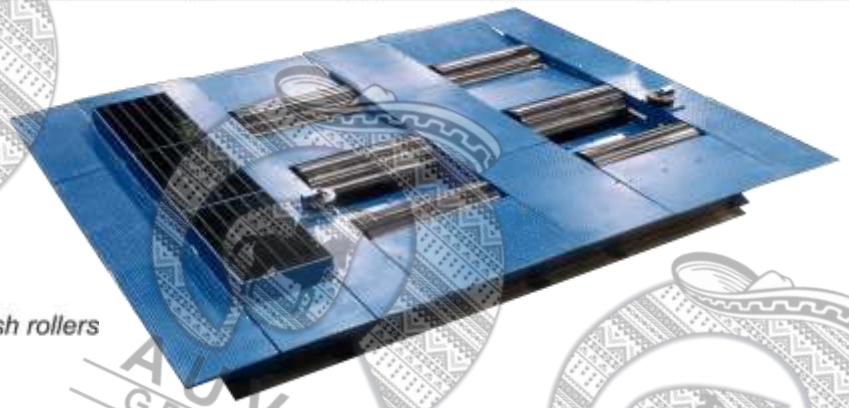
MD-1000-M Dynamometer

MUSTANG DYNAMOMETER

MD-250-M 2WD HD Chassis Dynamometer

Horsepower:	800 hp peak absorption
Loading:	Air cooled eddy current power absorber (Model MDK - 250)
Rolls:	Precision machined & dynamically balanced Belted for bi-directional capability 10.7" (272mm) diameter balanced rolls 40" (1,016mm) face length 28" (711mm) inner track width 108" (2,743mm) outer track width 19.6" (498mm) roll spacing
Maximum Speed:	100 mph
Frame:	Heavy-duty structural steel frame Height: 18"
Lift:	Between roll lift with integrated roll lock
Air Requirements:	80-100 PSI, dry, regulated, oil free
Power Requirements:	115 VAC single phase, 50/60 Hz, 15 amps (computer) 230 VAC single phase, 50/60 Hz, 40 amps (dynamometer) 230 VAC three phase, 50/60 Hz, 20 amps (motor drive)
Axle Weight:	28,660 lbs (13,000kg) maximum
Shipping Weight:	4,500 lbs
Motor:	7.5 hp calibration motor

MD-1000-M Chassis Dynamometer



Horsepower:	1,200 hp peak absorption
Loading:	Air-cooled eddy current power absorber
Motor:	15 hp calibration motor
Rolls/Wheelbase:	Precision machined & dynamically balanced knurled finish rollers Belted for bi-directional capability 17.8" (452 mm) diameter balanced rolls 38" (965 mm) face length 32" (812 mm) inner track width 108" (2,743 mm) outer track width 46" - 60" (1,168 - 1,524 mm) Tandem axle wheelbase
Roll Decelerator:	Allows vehicle deceleration without use of vehicle brakes Eddy Current PAU used to decelerate rollers
Air Requirements:	80 PSI, dry, regulated, oil free
Power Requirements:	115 VAC, single phase, 50/60 Hz, 15 amps (computer) 230 VAC, three phase, 50/60 Hz, 60 amps (dynamometer) 230 VAC, three phase, 50/60 Hz, 30 amps (motor drive)
Axle Weight:	28,660 lbs (13,000 kg) maximum
Shipping Weight:	15,000 lbs (6,804 kg) (dynamometer weight only)

3DATX iPEMS

- MAE has partnered with 3DATX Corporation in the distribution of the parSYNC® and parSYNC® PLUS iPEMS (integrated PEMS) systems.
- The 3DATX parSYNC® device utilizes a miniaturized multi-chamber, and replaceable “Sensor Cartridge” (patents pending) design to obtain second-by-second PM/PN data from diesel engines – in either a dedicated , “pass/fail” lane-testing configuration, or a field unit PEMS/PAMS approach.
- The parSYNC® PLUS has the addition of the new NOx/CO2 GasMOD™ Sensor Cartridge expanding the testing capabilities on-road for Light and Heavy Duty Diesel.

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