... the Road in Your Lab
Pioneering Test Systems for Reproducible Road Drive Simulations
Welcome to Haldenwang

Our Headquarters in The Beautiful Allgäu

Our headquarters are located in Haldenwang in the heart of the Allgäu region, approx. 12 km northeast of Kempten in an area of over 50,000 m². For more than 45 years, MAHA has been designing and manufacturing future-oriented automotive equipment to promote a safe and clean environment.

Please feel free to contact us to setup an appointment to see our latest products and information services.

We look forward to your visit!

The Allgäu is the southern region of Germany and one of the most popular tourist areas in the country. It is known especially for its intact and charming nature. Surrounded by mountains, forests, meadows and lakes the area invites you to linger.

The charming nature of this area led the Bavarian King Ludwig II to build its world-famous fairy tale castle ‘Neuschwanstein’ here.

MAHA-AIP
Working where others take their holidays...
MAHA-AIP Automotive Industry Products

Our Headquarters in The Beautiful Allgäu

2008
Moving into the new MAHA AIP research- and development center – Section A.
Prior to delivery to the customer each test system is setup and subjected to a pre-acceptance test and wide variety of quality checks to ensure the functionality and product quality before the test systems are delivered to the customer.

2014
In July 2014, a ground-breaking ceremony was conducted for a new addition – Section B to the existing MAHA-AIP research and development center. The ground floor will include production and the QA area for MAHA-AIP exhaust gas measurement technologies, Test cells for the development of powertrain test benches and test bench automation. The upstairs will include offices for MD, Sales, Project Management, Software Development and the Service Department.
Each MAHA-AIP test system built in Haldenwang is subjected to a detailed function test prior to shipment.

Theoretical and practical training on the equipment takes place in our training department. State of the art manufacturing capabilities provides substantial production depth at our headquarters in Haldenwang.
MAHA-AIP Automotive Industry Products

Our Motto: Technology- and Service Leadership

MAHA-AIP is a division of the MAHA Group offering a premium class of specialty vehicle test systems.

MAHA-AIP designs and manufactures individual test systems for development and manufacturing centers, most vehicle OEM's and their tier suppliers locally and globally.

MAHA-AIP develops and manufactures special testing equipment (reproducible road driving simulation) for cars, trucks, motorcycles, ATV's, tractors, forklift trucks, special vehicles, etc., in the areas of research and development, type approval and quality assurance.

- Emission and fuel consumption measurement
- Acoustic measurement (NVH)
- Endurance testing COP
- Performance measurement (e.g. in a wind tunnel)
- Functional testing (e.g. in climatic and altitude chambers)
- Verification electro-magnetic compliance (EMC)
- Hydraulic road simulation testing (shaker)
- Emission measurement systems
- Test automation
- Robot driver / Throttle actuator
- Vehicle cooling fans
- Drivers aid systems

The AIP comprehensive system solutions are of modular design and easily adaptable to various vehicle types and customer requirements (budget, time frame, laws and regulations, etc.).

A long-term close cooperation with our customers worldwide as well as a high degree of self-motivation for the development of new testing equipment guarantees innovative solutions for a variety of test requirements.

The motivation and creativity of our employees, a modern environmentally friendly production facility and the continuous development of our Products and Services creates a high level of customer satisfaction and trust.

MAHA AIP Milestones

1994
Formation of the AIP (Automotive Industry Projects) profit center to amend the standard MAHA workshop equipment product line with tailor-made vehicle testing solutions for the automotive industry.
Quality certification as per ISO 9001.

1998
Development of the first MAHA-AIP 48” Emission Chassis Dyno 4WD as per EPA standard, using MIM-design and AC-motor technology.
Due to AIP’s innovations in the accuracy of the MAHA electrical 4WD synchronization module/dyno controller, AIP became the state-of-the-art supplier in this field.
As a result, MAHA-AIP became the market leader in manufacturing 48” chassis dynos within just a few years.
Currently, nearly all “premium class” vehicle manufacturers and automotive industry suppliers worldwide rely on the strength of MAHA-AIP.

2000 – 2007
Cooperation Contract between MAHA-AIP and HORIBA in the range of Emission Chassis Dynos.

2004
The EPA (Environmental Protection Agency, Ann Arbor/USA) selected MAHA-AIP as a supplier for their first 48” four-wheel drive chassis dynamometer (reference test regarding new legislation and regulations in range pollutant emissions for cars and delivery vehicles). Due to the outstanding product quality and performance the EPA in 2010 selected four more MAHA-AIP 48” four-wheel drive chassis dynamometer systems.

2005
The former MAHA-AIP profit center changed into an independent legal entity, MAHA AIP GmbH & Co. KG. Nevertheless, the close cooperation with the parent company MAHA workshop equipment (www.maha.de, with more than 1,000 employees) offers a lot of benefits, especially in terms of in-house manufacturing capacity and global service.

2006
CARB (California Air Research Board) selects MAHA-AIP to supply 4WD 48 MDD test stands as the reference test stand for 4WD emission tests.
Certification as per ISO 14001:2004

2007
Since 1999, more than 320 Emission Chassis Dynos 48” have been successfully installed – globally.
Extensive product development activities with high growth in other vehicle test dyno applications, e.g. NVH-, EMC- or vehicle endurance test (mileage accumulation tests).
Opening of MAHA-AIP branch in Shanghai/ Pudong, China.

2008
New product range – emission measuring systems. MAHA-AIP designs and manufactures Solid Particle Counter, CVS, Particle Mass Controller and various other systems.

2009
Cooperative contract between MAHA-AIP and Prime ONE Contracting to provide ‘turn-key’ solutions, sales and service of MAHA-AIP equipment in US, Canada, Mexico and Brazil.

2011
Founding of the company MAHA-PA (MAHA process Automation), based in Karlsruhe, Germany.
Development of the test stand automation MPAS / MTOS software products.

2012
Expansion of product ranges Emission Measurement Systems (N₂O measurement, analysis systems) and high-density wind tunnel balances with 5-band- or 1-band-wheel drive units.
Features a complete exhaust measuring cell with MAHA testing – 48” roller Dynamometers, Emission Measurement Systems and Test automation MPAS – TÜV Nord located in the city of Essen.

2013
The EPA (Environmental Protection Agency, Ann Arbor/USA) selected after a worldwide research MAHA-AIP as a supplier for their first 72” HD 4WD Chassis Dyno for commercial vehicles (Reference test regarding new laws and regulations in the field of emission of trucks, buses, etc.).
Widening the product range with powertrain test facilities and new developments in the areas – mobile emission measurement (PEMS) on LDV, mobile urea measurement in the exhaust AdBlue® for stationary fuel consumption measurement.
Emission Technology

NOx l/km
HC °C

N2O CO2
CO F
Emission Chassis Dynos

CDM – compelling designs for accurate, repeatable measurements.

Emission Chassis Dynos for rear-, front- or all-wheel-driven vehicles and motorcycles, etc. Conforms to the US-spec “EPA RFP C100081 T1” as well as to the requirements of the current European and Japanese Guidelines.

Applications
In research, development centers, car manufacturers and their suppliers (two-wheel- or all-wheel drive).

- Emission tests
  - WLTP
  - FTP 75/SFTP (US06
  - EPA
  - ECE + EUDC
  - Japan 10 ... 15 mode
  - Temperature tests (climate chambers)
  - Fuel consumption
  - Pre-conditioning
  - Quality checks (COP)
  - Mileage accumulation
  - Electric vehicle tests

CDM 48" - Emission Chassis Dyno
2WD / 4WD - LDD / MDD

- 48" (1,219 mm) Roller set with AC motor for LDVs and MDVs
  - Precise, reproducible mass simulation
  - Accuracy exceeds EPA’s requirements
  - Extremely compact design
  - Slim pit dimensions
  - Excellent 4WD synchronization with high dynamic regulation between the front- and rear roller set
    - max. speed diff. = 0.01 mph (0.02 km/h)
    - max. angular deviation roller set FA to RA = 0.2°

- Low wear and low maintenance construction for multiple shift-operation
- Intelligent bearing concept
  - no test stand ‘warm-up’ required
- Modular test stand concept for various applications and budgets
- Fast data availability
  - Simple, intuitive test stand setup and operation
- Interface to standard emission measurement systems
### Emission Chassis Dynos


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* Extract, Stand May 2014
Emission Chassis Dynos

Heavy Duty Dynos

CDM 72” Chassis Dynamometer
2WD / 4WD HDD - Heavy Duty

- 72” (1,828 mm) Roller set with AC motor for measurement of heavy trucks, buses, ...
  (MIM, "inline principle" or multi-motor principle)
- Precise, reproducible mass simulation
- Accuracy exceeds EPA’s requirements
- Extremely compact design
- Narrow pit dimensions
- Excellent 4WD synchronization – high dynamic regulation
- Interface to common emission measurement systems
- Variety of performance classes available

Optional Accessories

- Hydraulic tie-down device
- Automatic centering device
- Automatic lowering of test stand decking plates for tandem axle (dual axle) operation
- Service central pit between rolls, including height-adjustable service platform

DynoServer

Automation Software module, including basic functions (V constant, constant F, road load simulation)
- incl. AK-interface (Ethernet) for connection to a HOST-system
- incl. diagnostic test functions/integrated oscilloscope

Various optional software modules for function extension retrofit.
Emission Chassis Dynos

Dynos for Motorcycles, Scooters, ATV’s

ECMD-21MC Exhaust Dynamometers for Motorcycles / Trikes and ATV’s

- Emission measurement
- Temperature experiments (cold chamber)
- Preconditioning
- Production quality control (COP)
- 75 FTP/SFTP (US06)
- EPA fuel economy tests
- ECE + EUDC
- Japan 10 ... 15 mode
- Mileage accumulation

Features

- Electrical mass simulation
- 200 ... 1,600 lbs (electric)
- Single roller with 400 mm diameter (other roll diameters available upon request)
- AC motor 50 kW or larger
- Wear and maintenance-free design for multi-shift operation
- Fast data availability through simple, user-friendly setup and clear operation
- A modular test concept for a variety of development stages, requirements and budgets

Optional Accessory Packages

- E.g. for the expansion of power, the test speed and e.g. the temperature range (e.g. -30°C ... +45°C)
- Vehicle cooling fans in different versions

Designed for use in Research and Development centers, manufacturing plants of motorcycle OEM’s and their tier suppliers.
Test Stand Accessories

- Vehicle cooling fans (radial/axial)
- Cooling fans for tires, vehicle components, catalysts, etc.
- Drivers aid system
- 2WD/4WD Vehicle restraint systems
- Custom pit decking available
- Automatic driving robot

MAHA Vehicle Cooling Fan Design
40,500-135

The MAHA vehicle cooling fan is used for vehicle engine cooling during a simulated road drive on a chassis dyno or flat belt, in accordance with specified driving cycles (e.g. WLTP cycle conform).

Optional accessories:
- Electric height adjustment
- Electric moving system 'easy-to-move' for easy fan positioning in front of the test vehicle
- Ultrasonic distance sensor
- Optical center alignment sensor
- Extended temperature range
Emission Measuring Systems

Emission Volume Identification

CVS – Constant Volume Sampler
For the certification of vehicles and combustion engines according to the latest emission regulations, such as: UNECE R83, EPA 40 CFR 86, WLTP TRIAS Att 42).

- Most compact CVS system on the market
- Consistently straight exhaust system
- Tandem blowers
- Components networking via EtherCAT
- 3x probe sampling venturi
- Max. flow 30 m³/min

Features
- Most compact CVS system on shared cabinet design, with very easy access for maintenance and service work
- Standard industrial hardware avoids high replacement costs
- Low switching time for 15 flow levels (<250 ms)
- Simultaneous filling, analyzing, rinsing and evacuation ensures maximum efficiency
- High-capacity vacuum pump for high-speed rinse / evacuation of the bag
- Modular expansion (e.g. dilution air treatment, dilution path control)

MAHA Test Cell
For internal development work, customer and staff training, test equipment and exhaust test bench automation tools, which are continuously updated with functional test cells available for use as well.
Emission Measuring Systems

Particle Measurement

SPC Solid Particle Counter
For determining the number concentration of solid exhaust particles in combustion engines.
Sampling is from a full or partial flow dilution system or even directly possible from the raw exhaust gas sample. An optimized sampling system for raw exhaust protects the particle counter from excessive particulate and temperature stress.

Features
- Designed in accordance with European regulations and beyond the specifications of the German Automotive Industry (ECE R83, PMP Group). Certified by AEA Energy & Environment
- Compact design (19" / 6U)
- Ease of service
- Optional TSI or Grimm CPC
- Automated procedures for startup and maintenance
- Aerodynamic raw exhaust diluter (optional)

Example: 19" cabinet design with integrated HFID, SPC and PMC, incl. supply unit.

HFID Heated Flame Ionization Detector
For continuous measurement of THC in the dilution tunnel.
- Heated sampling probe
- Analyzer – quick ‘snap in’ technology
- 19" rack design

PMC Particle Mass Controller
For the gravimetric determination of particulate mass solid exhaust particles from internal combustion engines.
Provides space for the integration of a heated analyzer e.g. for THC measurement of diesel vehicles.

Features
- Design in accordance with worldwide requirements (UNECE R83, EPA 40 CFR 86, TRIAS Att. 42 WLTP).
- Very compact (19" / 6U)
  - on request also available as a separate desktop unit
- Up to 4 filter paths
- Mass Flow – regulated to 80 Nl/min.
- Automatic self-calibration with 2 integrated venturi nozzles

Example: 19" cabinet design with integrated HFID, SPC and PMC, incl. supply unit.
Emission Measuring Systems

Modular Emission Measurement System

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<tr>
<th>Component</th>
<th>Manufacturer/Technology</th>
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<td>CO / CO₂</td>
<td>ABB Uras (NDIR)</td>
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<tr>
<td>O₂</td>
<td>ABB Magnos (PMD)</td>
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<tr>
<td>THC</td>
<td>ABB Fidas (FID)</td>
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<tr>
<td>THC / NMHC</td>
<td>ABB Fidas (Cutter - FID)</td>
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<td>MAHA-AIP CLD or ABB Limas</td>
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<tr>
<td>N₂O</td>
<td>MAHA-AIP QCL</td>
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<tr>
<td>Further</td>
<td>components on request</td>
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</table>

EMS Exhaust Measurement System

Modular exhaust measuring system for determining a limited and non-limited exhaust gas components from diluted and undiluted vehicle exhaust.

In the development of MAHA EMS were the requirements/compliance to global legislation in the foreground (UNECE R83, EPA 40 CFR 86 & 1065 TRIAS Att 42, WLTP).

Application
- on a chassis dynamometer in conjunction with a CVS system for vehicle certification
- on engine test beds
- on a chassis dynamometer in conjunction with a raw exhaust gas sampling system for research and development of catalysts

Features
- Compact cabinet design, easy accessibility for maintenance and service work. The back wall of the cabinet can be placed directly against the wall of the test cell
- Components networking via EtherCAT
- Reduced operating costs
- Standard industrial hardware avoids high cost of spare parts
- Mobile using a pump truck, the unit can be pulled out during operation
- 2 lines in a 19" cabinet (1 + tracer/EGR)
- Components quick-change concept ("snap-in" principle) ensures maximum system availability

“Snap-in” Principle
Plug-in modules with locking mechanism allows quick docking of measurement modules from the front of the system cabinet. The gas connections are separated by undocking while the electrical supply remains wired. Advantage: Servicing of the analyzer modules in the normal operating condition.
Emission Measuring Systems

Reproducible N₂O Measurement

QCL / N₂O Quantum Cascade Laser

Measurement of the nitrous oxide levels in vehicle emissions is becoming increasingly important because N₂O with 298 CO₂ equivalent possesses a very high global warming potential.

Application
Certification of cars and internal combustion engines in accordance with future emissions legislation, e.g.
- EPA 40 CFR 1065
- EPA 40 CFR 1066, WLTP GTR
- Meets the requirements in terms of EURO VI
- Universal application in research, development and quality assurance

Benefits
- Compact stand-alone or 19” rack-mount analyzer module
- High selectivity and sensitivity
  - no cross sensitivity to CO, CO₂, H₂O, NOX, CₓHₓ
- Easy operation and calibration
- Short rise times T₉₀: < 2 sec.
- Low detection limit: < 10 ppb
- No LN₂ cooling required

Measuring Principle
The QCL laser module is designed to emit laser light to measure N₂O in the MIR range. The advantage of using a Quantum Cascade Laser is the extremely narrow band width of the emitted laser light, where a very high selectivity to the desired measurement component can be achieved. When measured over a long path gas-flow cell the coupled laser light is partially absorbed. The absorption rate determined by the analyzer software is a measure of the concentration of the component gas.
Emission Measuring Systems

Portable Emission Measurement System (PEMS)

The compact measurement system allows for mobile exhaust gas measurement during an actual road trip. The device fitted on the test vehicle hardware includes flue gas analyzers, exhaust gas mass flow meter, a weather station a GPS system and the connection to the vehicle network for constituent evaluation. A probe delivers the vehicle exhaust gases from the test box in real-time mode. The component emissions (HC, CO, CO₂, NOₓ [or NO + NO₂], PM) together with the associated engine, vehicle and environmental parameters are then recorded for analysis.

Application Examples
- Measurement and analysis of the exhaust emissions directly from the vehicle, while on an actual road trip
- Fuel consumption measurement
- Analysis for engine development and exhaust after-treatment
- Component testing

DEF or AdBlue® Consumption Meter

Urea CH₄N₂O, or better known as DEF or AdBlue® is added to reduce pollution of exhaust gases and to reduce fuel consumption.

Developed by MAHA-AIP, the compact measuring system is suitable for stationary or mobile use and is used by vehicle manufacturers in research and development for reproducible metering, combined with road trip simulation, test bench or, ‘on-board’ the vehicle during a real road trip.

The measuring principle of the Coriolis sensor does not produce any influence on the dosing by the measuring device.

Application Examples
- Development tool for complete vehicles, engines and drive trains
- Range detection
- Exhaust emission measurement
- Component testing
- Quality inspection

Mobile Vehicle Emission Analysis

Mobile Urea Consumption Measurement
Emission Measuring Systems

Fuel Consumption Measurement

KVM Fuel Consumption Meter

The MAHA-AIP KVM fuel consumption meter has been designed for research and development with the reproducible, continuous and dynamic fuel consumption measurement in conjunction with chassis dynos, engine- and powertrain test benches.

The KVM system operates according to the Coriolis principle which ensures precise, pressure- and temperature-controlled fuel conditioning as a basis for an accurate fuel consumption measurement.

Application Examples

• Development tool for complete vehicles, engines and drive trains
• Development tool for ECU’s, injection systems, etc.
• Range detection
• Quality inspection

Nitric Oxide Measurement

Chemiluminescence Detector CLD

For the reproducible measurement of high concentrations of gaseous nitrogen oxides (NO or NO₂) in the ppb range from vehicle emission.

The compact 19” CLD-measuring system is suitable for integration into the MAHA emission measurement system, as well as in existing systems from other manufacturers.

Application Examples

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• Development tool for ECU, fuel injection systems, etc.
• Quality inspection

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Research and Development
Test Stands for R&D and COP Measurement

Wind- and Climatic-Measurement

CDM 75L Chassis Dynamometer
(4-Motor)

For use in wind tunnels and climatic chambers to measure e.g. vehicle aerodynamics. Different designs available for 2WD and 4WD applications:

- Multi-motor principle, each roll has an individual motor
- Inline-principle
- Motor-in-the-middle design (MIM)
- Special thermal isolated test stand design, water-cooled drives
- Roller dia. 75” (1,905 mm)
- AC-motor per roll, e.g. 300 kW

- Test speed, e.g. 300 km/h
- Temperature range, e.g.: -40°C ... +60°C
- Service aisle with integrated lifting platform to access the underbody of the test vehicle
- The service platform is used as service pit cover when lifted up in test cell floor position
- Special water management design for rain-/snowfall simulation in wind-tunnels
**Test Stands for R&D and COP Measurement**

**Function- and Performance Tests**

**CDM-FRP Function-Performance Test Stands (Multi-Motor Principle)**

Front-, rear- and 4-wheel driven vehicles can be tested under load on the test stand with repeatable road load simulation, force, speed, etc. Each roll is equipped with an individual drive. This modular drive concept is suitable especially for ‘single wheel measurement’ (hybrid vehicles, wheel motors, etc.) and extends the testing capabilities over traditional MIM motor design chassis dynos immensely.

**Reliable Test Results Under All Conditions.**

Various test configurations are available for individual budgets and applications, for example:

- in a wind tunnel
- in a climate chamber
- in EMC chambers with turn table
- for acoustic measurements
- in an altitude chamber

**DynoServer Dynamometer Software**

With optional software modules for various measurement applications, such as:

- **Drivers Aid Software**
- **Single-axle load simulation with synchronized drag roller**
  Simulation of the driving forces of resistance on a roll axis with speed-synchronized, second roll axis
- **DynoPlanner**
  Time-controlled, automatic start of the test bench diagnostic tests, based on custom test sequences
- **Delta velocity/angle control**
  (applicable only with 4WD dynos)
  Vehicle tests with different speeds, different angular position and angular offset position (e.g. NVH tests with shock bars) between front- and rear axle
- **Augmented Braking**
  Vehicle brake assistant. Supports the test driver for following the operating curve
- **US06 Road Load Reduction**
  (analog input) load matching of vehicles with insufficient power for US06
- **Grade Control Modules**
  Simulation of an ascent (uphill/downhill) on the chassis dyno
Test Stands for R&D and COP Measurement

**CDM 48L/M and CDM 62.6 L/M**

**Mileage Accumulation**

Reproducible, automated endurance measurements in a test cell or outdoors for simulating life cycles for a complete vehicle, vehicle components and lubricants, etc.

**Roller Diameter 48” or 62.6”**

- Motor-in-the-middle (MIM) design for compact pit dimensions
- Robust system design, low maintenance
- Easy to access with optional sub-systems:
  - Throttle actuator or automatic driving robot
  - Data collection/data processing systems
  - Vehicle cooling fan
  - Automatic refueling
  - Test speeds up to 350 km/h (option)
- Optional: Various performance packages as well as noise reduction modifications available, e.g. to reduce tire noise

**Example**

Motorcycle adaptation kit for two-wheeled cycle test in conjunction with a 48” or 62.6” chassis dynamometer

- Reduced mechanical base inertia
- Noise absorbing safety barriers and roller coating (optional)
- Vehicle positioning sensors, integrated in the test stand safety loop
Test Stands for R&D and COP Measurement

Electromagnetic Compliance (EMC) Measurement

CDM 37.5L / EMC Chassis Dynamometer

2WD or 4WD roller test stands for light and medium duty vehicles, motorcycles, ATVs for the indoor measurement of electromagnetic compliance of the test vehicle driving on a rolling road.

Reproducible measurement of internal and external EMC effects created through the vehicle to the environment or vice versa.

Roll Diameter 37.5” (953 mm)

- Special MAHA-AIP motor design to avoid emission of electromagnetic disturbance
- Multi-motor-design (individual drive motors for ea. roll) rolls can be controlled individually, e.g. for ABS tests, traction control tests or other vehicle tests
- E.g. 121 HP (90 kW) per motor
- Test speed up to 124 mph (200 km/h) – other configurations upon request
- Option: P-JAMES EMC Drive Robot pneumatic brake-, clutch actuator as well as steering wheel actuator designed for EMC test

Option: turntable, integrated in the test stand decking, to align the test vehicle into different angle positions toward the EM-antenna while driving the vehicle on the rolling road

The MAHA -Chassis Dynamometer design has no “detectable RF-radiation” in the frequency range between 30 kHz ... 3 GHz!

Different diameters available.
Test Stands for R&D and COP Measurement

Noise, Vibration and Harshness (NVH) Measurement

CDM 75L NVH Chassis Dynamometer

For the measurement and analysis of
- exterior noise (pass-by measurement)
- internal noise (comfort measurement)

Roll Diameter 75\" (1,905 mm)

- 4-motor design
- Motor ‘inline’ principle
- Various road surface simulation shells for the simulation of different road surface conditions (e.g. rough asphalt, small cobbled streets, etc.)
- Soundproofed rolls for preventing the ‘bell effect’
- Water-cooled drive motors

- Integrated service center pit with height adjustable service platform
- Special vehicle restraining systems (e.g. wheel hub fixation) available
- Drive motors, rolls and test stand decking are sound-absorbing insulated to reduce the noise to test e.g. 41 dB(A) at 50 km/h
- Test speed to 250 km/h

Optional various performance and climatic packages available.

Service aisle in between the covered rolls allows for easy access underneath the test vehicle to install microphones or other sensors.

Multi-motor principle, each roll is driven individually by a liquid cooled AC motor (single wheel measurement possible).
Flat Track Systems for R&D and COP Measurement

Simulation of Road Drives in the Laboratory

FRDM 20L Flat Track Dynamometer ‘NewtonFinder’

Designed for the study of very small frictional losses in the drive train.

The new testing method ‘Newton Finder’ enables high-precision measurement of the traction forces (Fx-forces). Each Newton, initiated by the vehicle, is measured accurately.

- Exact reproducibility of measurement conditions to reduce fuel consumption and CO₂ emissions
- Verbatim following of driving cycles with cornering, incl. steering operations

Features

- Very compact, ergonomic design
- Highly dynamic built-in drive unit available
- Precise determination of the drag losses in simulated real driving conditions
- Maximum 0.4 mm deviation of the lateral band position during a steering operation
- Optional: 4-belt system with center belt for additional simulation of the road surface under the vehicle between the wheels
Flat Track Systems for R&D and COP Measurement

Acoustics and Vibration Control

FRDM 12L
Pulsed Flat Road Dynamometer

The pulsed flat road dynamometer provides highly dynamic excitation of the individual wheels in the vertical and horizontal direction during a road drive simulation. A robot driver operates the vehicle during an automatic test. The excitation of the vehicle wheels in the vertical direction provides realistic simulation of various road surfaces (i.e. pot holes, gaps, cobblestone streets, bridge joints, etc.). This system allows for either full vehicle or individual vehicle components to be tested.

Application Examples

- Study of the long-term stability/fatigue
- Noise analysis of complete systems and individual vehicle components
- Durability analyzes
- Optimization of spring and damping behavior
Wind Tunnel Balance for Research & Development

Aerodynamic Studies

FRDM 20L
Wind Tunnel Balance with Integrated 4WD Flat Track Dyno

For the development and basic research in the field of aerodynamic research on cars, delivery vans and racing cars in an aero-acoustic wind tunnel.

Test Stand Design (Example)

In order to come as close as possible to the real wind conditions which impact a vehicle during a road trip, those conditions are simulated on a wind tunnel balance with an integrated flat track dyno (‘rolling road’).

The test project shown (example) includes, e.g. a 5-belt system, consisting of a driven belt unit (WDU – wheel drive unit) per wheel and a Center Belt (CB) for the simulation of the road surface under the test vehicle.

The MAHA-AIP-5 belt system allows versatile use for reproducible aerodynamic and aero-acoustic measurement tasks (example: Cd value optimization, component strength test, ...).

For measurements with inclusion of crosswind effects on the test vehicle, the flat track dyno is built into a turntable (e.g. 12 m diameter), which is combined with a high-resolution balance system.

This wind tunnel balance is primarily used for the reproducible determination of the forces introduced by the vehicle in x-y-z direction as well as for the precise measurement of induced roll-, pitch- and yaw moments. In addition, e.g. a sill-stacker cranes (SHE) to the horizontal fixing of the vehicle when turning wheels (wheels are driven by the WDU, vehicle’s engine is not active) is included.

Test Bench Key Data (Example)

- Application for 2WD and 4WD vehicles
- Axle load max.: 2,000 kg
- Test speed max.: 265 km/h
- Wheelbase: min. 1,750 mm ... max. 3,750 mm
- Total weight (including turntable/wind tunnel balance): approximately 80 tons

For optional service accessibility, the center belt can be raised using the integrated lifting equipment.

Further information on request.
Powertrain or engine test rig for analysis of the entire vehicle, the complete vehicle drivetrain or the components.

Depending on the test requirements, the test stand configuration is setup for static- or dynamic tests.

Highly dynamic drives are used to derive torques in the test setup or to obtain them. Optionally, additional stimulations, such as the road surface simulation can be integrated by using hydraulic actuators in the test procedure.

Application Examples

Realistic road driving simulation by tracing predetermined driving cycles or road profiles.

- Evaluation of energy efficiency
- Fuel consumption measurement and CO₂ emissions determination
- Range detection
- Exhaust gas measurement

Testing of the complete drive train in the entire vehicle or as an aggregate setup with bus simulation.

Pulsed Power Train Dyno (Hub dyno combined with hydraulic shaker) for the highly dynamic excitation of the individual wheels in the vertical and horizontal direction during a road drive simulation.
Function
Function-, Performance- and Brake Chassis Dynos

Test Stands for Commercial Vehicles

**FRP 8x8 Function-Performance Roller Test Stand**

The FRP 8x8 has been specially designed for conducting end-of-line quality and final check-out tests on commercial vehicles with 2-, 3- and 4-axles. The system has multifunctional capabilities for conducting a wide variety of test procedures from simple driving tests up to special function tests such as TCS or differential lock functions.

**FRP / BPS Testlane for Tractors**

Specially designed for end-line quality- and check-out tests. Two vehicles can be tested simultaneously on the combination “two-axle function roller test stand and brake roller test stand”.

**BL Brake-Performance-Roller Test Stand for Forklifts**

The BL test stand is a combined brake-performance roller test stand especially designed for model-, quality tests (DVT).

**LPS ST2AC Stationary Function-Performance Test Stand**

For the examination of special vehicles (e.g. harvesters, construction vehicles, aircraft tractors, etc.) in the area of vehicle development.

**FRP 500 / 4x4 Function-Performance Roller Test Stand**

Roller test stand (4-motor units, one per roller pair) e.g. for the drive system development for heavy duty special purpose vehicles.
Test Stand Automation
Test Stand Automation

Hydraulic Road Simulators (Shaker)

Road Simulator

Precise examinations of noise sources, endurance test, component tests, fatigue tests, etc. under dynamic loads is possible.

Quality Benefits

Critical driving ranges can be driven repeatedly, modified and or reinforced without limits using dynamic road simulators. An exact analysis can be presented in detail concerning possible sources of disturbances and influencing variables.

Cost Advantages

Road simulators are used in conjunction with climate chambers and solar systems to achieve a substantial reduction in costs and time when compared to conventional testing involving real road driving under variable climatic conditions.

Application Examples

- Research of endurance stability/signs of fatigue
- Noise analysis of total systems and individual components
- Serviceability analysis
- Optimization of spring and damping properties

Generally

Depending on the application, hydraulic simulation test stands can be one-poster system up to multi-post systems.

- One poster system (shock absorber, component test, etc.)
- Multi-poster system (road simulator, exhaust line test, etc.)
- Multi-poster system (fender test, shaker, movements with 6 degrees of motion)

E-Shaker

- Designed for development, research and quality assurance facilities
- Research into the long-term stability and fatigue of vehicle components or the entire vehicle ("lifecycle test")
- Noise analysis ("squeak & rattle" test)
- Fatigue analysis

Features

- Compact design, low mass
- Low noise, no fans
- Low heat generation
- Special designs available upon request
Test Stand Automation

Integrated Dyno Solution

MPAS Test Bench Automation

The overarching automation software MPAS was developed for single operating test rigs as well as complete test facilities with central data or configuration management requirements.

- MPAS supports all national and international legal requirements for exhaust emission tests (‘light duty’)
- Independent test data management, parameterization
- Analysis, recalculation and test analysis

Efficient
- Customer-optimized process flow
- Drag & Drop parameterization
- Easy operation
- Verifiable processes

Modular
- Manufacturer-independent device integration
- Easy integration of new drivers through add-in
- Open programming

Open Minded
- Non-proprietary standard hardware
- Drivers reference via third party

Flexible
- Operating screens, processes, operating curves, calculations, reports, easily adaptable
- Integration of customer specific databases
Test Stand Automation

Integrated Test Facility Management

e.g. for easy scheduling of the respective test cell occupancy, capacity planning.

MTOS Test Facility Management

Features
- Maximum test availability through plausibility checks during parameterization
- Easy to understand graphical test procedure parameterization
- Consistent documentation of the test sequence
- Rapid migration of individual test benches to complete test facilities (test fields)
- Evaluation Excel-based (without macros)

Drivers-Aid Software Module
- for the reproducible road drive simulations in combination with a chassis dyno
- incl. pre-installed, common driving cycles from Europe, USA, Japan, China
- incl. ‘drive cycle’ Editor function to create customized driving cycles
Driving Robot
The automatic driving robot JAMES was developed with the view to an intelligent and modular system design. This allows extremely short setup/installation times and a simple, menu-driven operation. The application is usually in automated road driving simulations on a chassis dyno or on flat track dyno, requiring a high degree of reproducibility and accuracy.

**Application Examples**
- Emission tests
- Mileage Accumulation tests
- Non-stop trips (24 hours / 7 days)
- Reproducible road drive simulation in NVH-, Altitude- or Climatic Chambers
- Automated driving under adverse or hazardous environmental conditions

**Features**
- Fuel consumption optimized (energy optimized)
- Emission optimized
- Compact, modular design
- Rugged design, low wear and minimal service
- Threaded spindle free driven linear-actuators (pending patent) for a high dynamic control of the pedals and the gear shift assembly
- Weight saving design
- Simple, fast installation (< 8 min.)
- Simple, menu driven setup (“teach-in”)
In July 2014, construction of our new research and development center commenced in Haldenwang. The two-story building extends the existing MAHA-AIP research and development center (since 2008) for more capacity regarding development, testing and production of e.g:

- Emission test equipment
- Powertrain dynos

as well as additional office space for more employees …

**Data**

- Total floor area: 3,700 m²
- Groundbreaking: July 10, 2014
- Start of construction: July 14, 2014
- Planned entry: April 2015
Prime ONE Contracting (POC) is a veteran owned (small-business) company which was founded in 1999. Since the inception of the company the focus has been on our customers and the constantly evolving testing market. This attention has led to continued expansion of our services & products to offer the latest advancements to our customer base.

Constant growth has led to further expansion into foreign markets where POC was recognized by key companies in our industry. MAHA-AIP located in Hadenwang, Germany was one such company that based on our capabilities decided to partner with us in 2008 as their sole solutions provider of test equipment for markets in Canada, USA, Mexico and Brazil. This partnership has allowed both POC & MAHA-AIP to leverage our respective strengths in R&D, engineering and support to offer a diverse portfolio of innovative products & services to those in the testing market.

This combined commitment by both companies has secured key opportunities at the EPA, many of the OEM’s and tier suppliers who recognize our passion and ability to provide solutions which not only solve their testing challenges now but in the foreseeable future as well.

The branch office in Pudong/Shanghai was established in 2007 to cover the MAHA business with automotive industry customers (vehicle manufacturers, TIER suppliers, test facilities like CATARC, CAERI, ...).

MAHA-AIP China Sales, Project Management as well as Service is located in Shanghai to provide reliable and competent customer care.

MAHA-AIP reached nearly 70% market share in China within 5 years for special chassis dynos, such as NVH- and EMC-dynos.

The local head office of MAHA GmbH & Co. KG MAHA Maschinenbau Trading Co. Ltd., located in Beijing since 2001, is mainly responsible for the MAHA product range `workshop equipment` (vehicle lifts, brake test dynos, safety lanes, etc.).
Automotive Industry Products
Test Systems for a Clean and Safe Environment

... the Road in Your Lab

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