

# Aqua Fuel Emulsion System List of References



FMC Fiedler Motoren GmbH  
Bismarckplatz 6a  
D- 06385 Aken/Elbe

# Deutz TBD 16V632 am GKS Schweinfurt

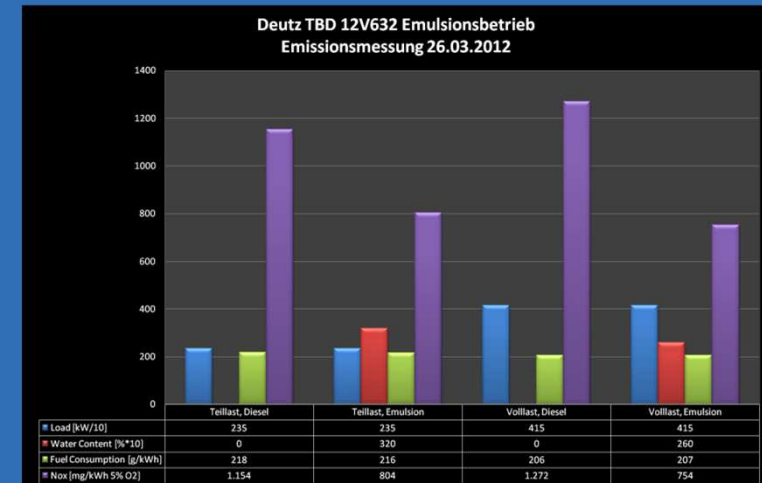
- Engine: Deutz TBD 16V632, 4,2 MW @ 1000rpm
- Operation: Peak Power- and Emergency Genset in waste-to-energy plant
- Aqua Fuel System operating since 1999



Joint project with Deutz AG/Mannheim

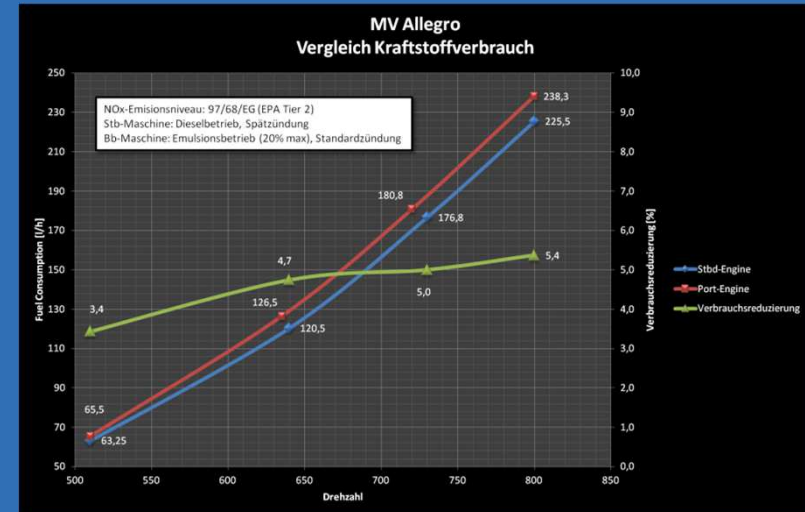
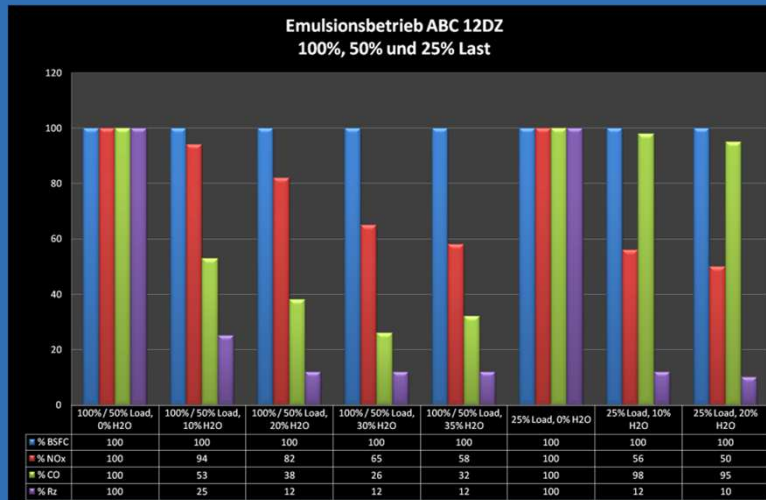
Target: Meet German TA-Luft exhaust gas emission limits using engine internal measures and Fuel-Water Emulsion as an **alternative to SCR-Catalysts**.

The installation is subject to ongoing emission monitoring conducted by the government of **Unterfranken / Germany**.



# ABC DZ-Baureihe, MS Allegro

- Engine: ABC-Diesel DZ-engine family
- Target: Typecertification acc. to 97/68/EG (EPA Tier2)
- Operation: Long time testing onboard MV Allegro
- Aqua Fuel System operating since 1999



Joint project with ABC-Diesel BV, Gent

Target: Meet 97/68/EG (EPA Tier 2) exhaust gas emission limits using FWE as alternative to Standardapplication with retarded Injection.

Type certificate was issued in 2008

The Aqua-Fuel System is running with out manual interception since 2008 based on fuel flowmeter controlled performance maps.



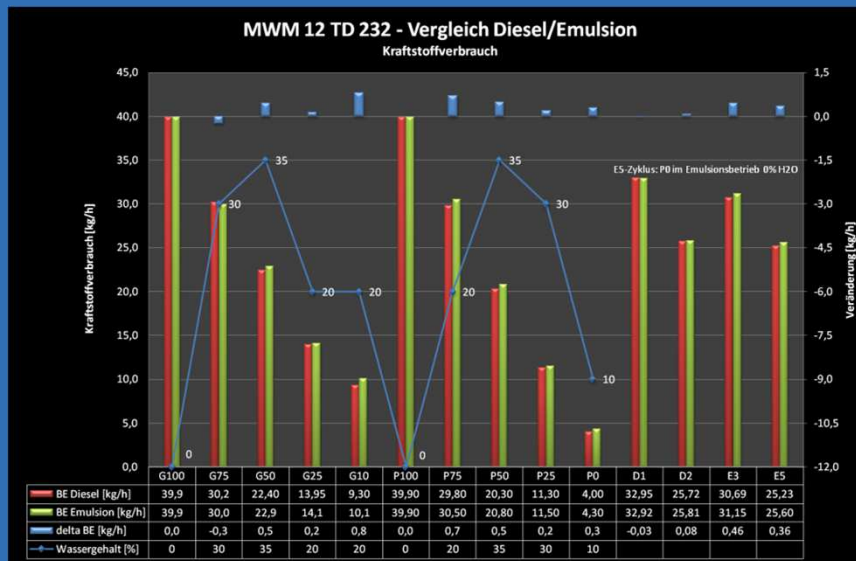
# MWM 12V TD 232 am INMT Flensburg (1)

- Engine: MWM 12V TD 232, 185 kW@1500 Upm , Build date:1968
- Target: Confirmation of effectivity of FWE as a measure for reduction of exhaust gas emission of older engines.

Joint Project with INMT / University of applied sciences Flensburg

## Approach:

1. Evaluation of engine operation field with different water content of the fuel-water emulsion
2. Definition of performance maps for generator and propeller law.
3. Measurement of exhaust gas emissions for test cycles D1, D2, E3, E5.
4. Besides the installation of the Aqua-Fuel mixing chamber into the fuel system the engine and installation stayed unchanged.



Water performance map is limited by:

1. Volumetric delivery of injection system  
=> further improvements possible by increased injection system flow.
2. Increasing CO- und CH-Emissions at low load

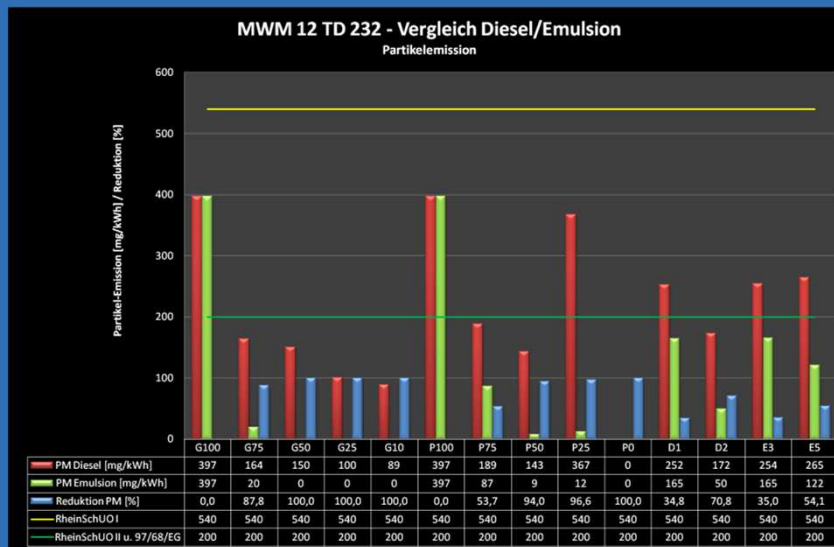
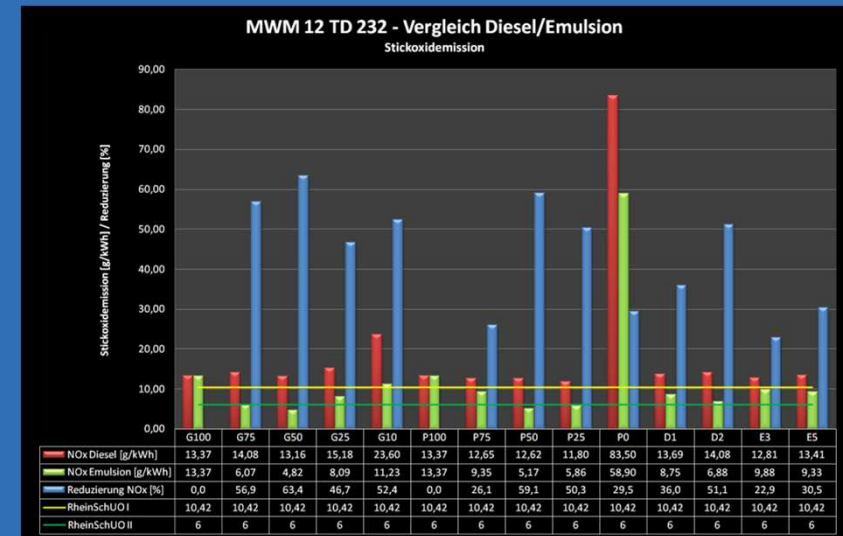
Brake specific fuel consumption:

- Full load: small decrease
- All other points small increase.
- Max. increase in test cycle: +1,6% (E3)

# MWM 12V TD 232 am INMT Flensburg (2)

## NOx-Emissions:

1. Reduction up to 60%
2. Limits of RheinSchUO I are met.
3. Limits of RheinSchUO II achievable with minor modifications to the engine:
  1. Increased fuel injection volume => Increased water flow at high loads
  2. Retarded injection timing, but only in conjunction with increased fuel consumption.



## Particulate Matter Emissions:

1. AVL-SmokeMeter: Calculated from Bosch-No. Acc. (MIRA)
2. Reduction partly below detection limit, even at points with increasing CO- and CH-emissions
3. Limits of RheinSchUO II are achieved.

Emulsionoperation also at low loads to reduce PM-Emission at engine acceleration

# MWM 12V TD 232 am INMT Flensburg (3)

## CO- und CH-Emissions:

1. Partly intense increase at low loads and idle operation
2. Exhaust gas limits are exceeded for low load test cycles (D2, E5)

## Counter measures:

- Abandon Emulsion operation at low loads, or
- Implementation of a Oxidation-Catalyst

Implementation of a Oxidation Catalyst is recommended for full utilisation of the advantages of the emulsion system.

