



exergy

ENGINEERING

Solutions for Diesel Fuel Systems

- Component Design
- Layout/Packaging
- Reverse Engineering
- Field Service Strategies
- Reman Operations
- Consulting
- 0-km & Field Quality
- Testing & Test Equipment
- Supplier Development
- Competitive Analysis
- System Application
- Teardown Inspections

exergy

ENGINEERING

Background

- Formed following closure of Robert Bosch Fuel Systems R&D department in Kentwood, Michigan.
- Extensive experience with all types of modern electronic diesel fuel systems.
 - Unit Injectors, Unit Pumps, Conventional Common Rail & Pressure Amplified Common Rail
- Workforce includes:
 - Project Managers
 - Design Engineers
 - Product Engineers
 - Test Engineers
 - Engineering Technicians
- Average associate has 12+ years of diesel fuel system development and production support experience.
- Have a network of 15+ equally experienced people beyond current workforce.



Background

- Associates have gone from concept to production with:
 - Detroit Diesel
 - Daimler Chrysler
 - Scania
 - Volvo
 - Iveco
 - EMD
 - Mack
 - DAF
 - Deutz
 - Liebherr
 - MTU
 - Nissan Diesel
- Associates were responsible for all areas of development: concept, design, test, durability, instrumentation, test equipment and customer interface.
- Development was conducted with a variety of ECMs.
- Experience with manufacturing plants around the world.
- Secured confidentiality between several competing customers.
- Many associates are also very knowledgeable engine builders.



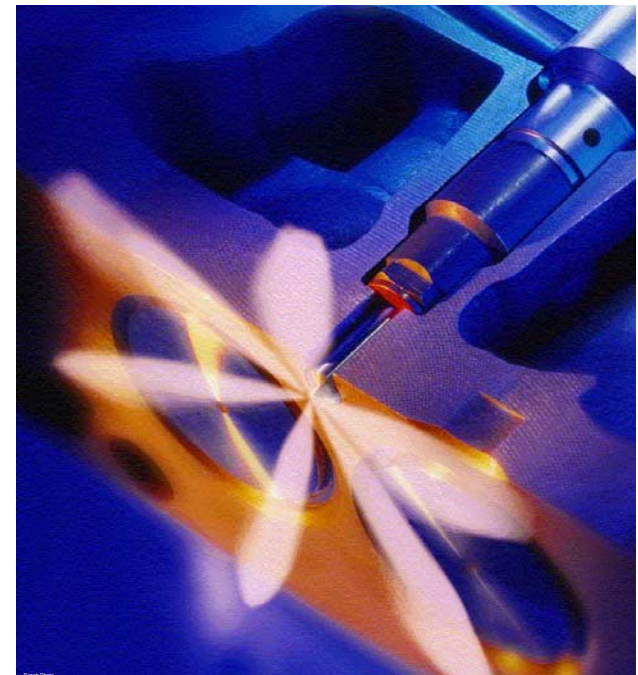
Design Services

- Fuel system, components & assemblies
- Fuel system packaging
- Fuel system instrumentation
- Reverse engineering of competitors products
- Simulation
 - Hydraulic
 - Structural
- Exterior engine components/packaging
- Remanufacturing processes/strategies
- Field service strategies/components/tools
- Project Management
- Supplier Development
- Diesel Fuel System Consulting



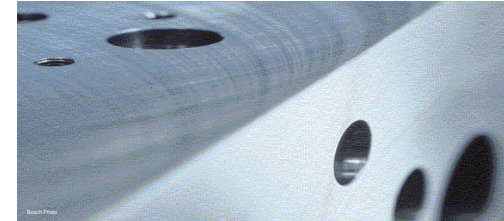
Test Services

- Fuel system and component:
 - Performance/reliability – Any aspect
 - Noise levels
 - Accelerated life
- Pressure pulsation – high & low
- Teardown inspections
- Abrasive wear
- Oil dilution analysis
- Cavitation
- Alternative/Blended fuels
- Competitor Analysis
- Debris Sensitivity



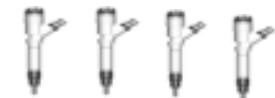
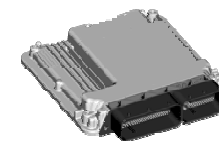
Fuel System Test Equipment

- Motored engine reliability rigs
- Motored engine fuel system performance rigs
 - Cavitation
 - Rate tube systems – single and multi-cylinder
- High pressure pulsation
- Field service
- Custom built to order



Fuel System Application

- Fuel system components
 - All hardware and sensors
- ECM's
- Engine management software
- Fuel system application training/support

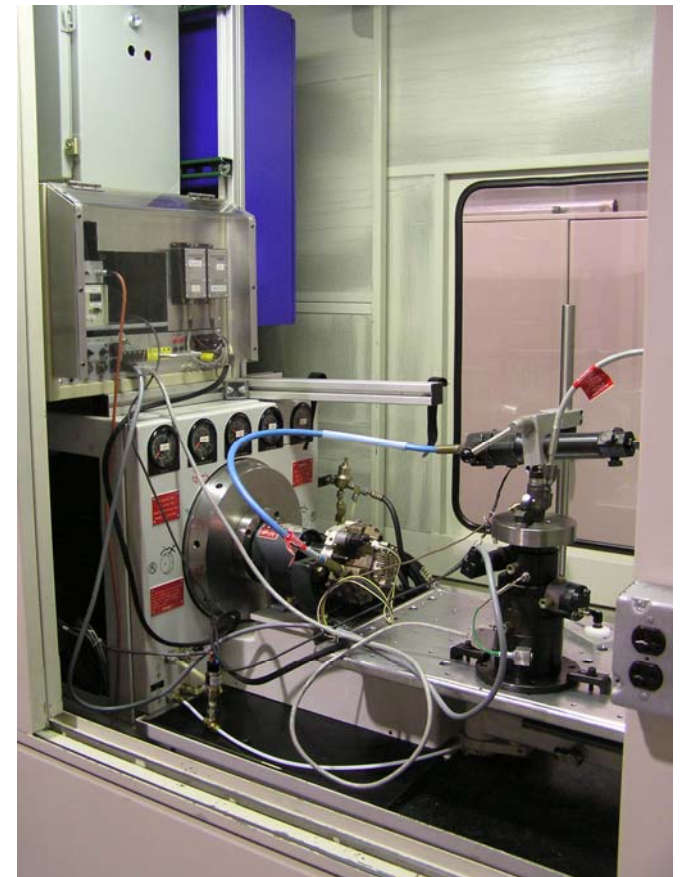


exergy

ENGINEERING

Exergy Test Lab Equipment

- Bosch 818W Test Bench
 - Drive Power: 20 hp
 - Max. Fuel Temp: 60 deg C
 - 25+ Data Acquisition Channels
 - EMI2 Measurement System

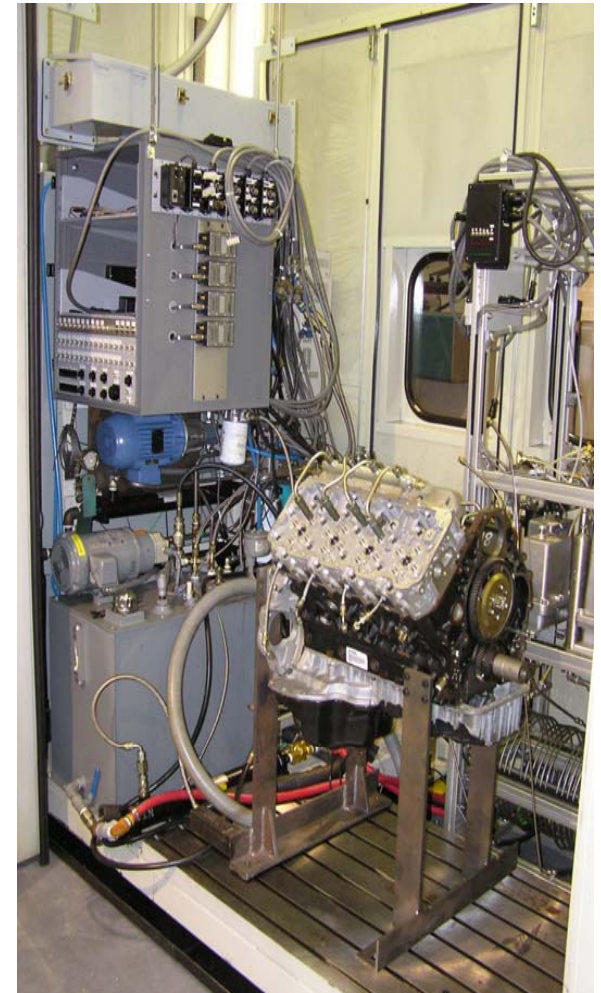


exergy

ENGINEERING

Exergy Test Lab Equipment

- Motored Engine Fuel System Performance Rig
 - Cavitation Probe Testing
 - Multi-cylinder Rate Tube System
 - Reproduces nearly all engine influences
 - Drive Power: 60 hp
 - Max. Fuel Temp: 80 deg C
 - Max. Oil Temp: 100 deg C



Exergy Test Lab Equipment

- Motored Engine Fuel System Durability Rig
 - Reproduces nearly all engine influences
 - Accepts engine sizes up to 14L in-line
 - Can also be configured to run common rail systems without engine (shown below).
 - Drive Power: 40 hp



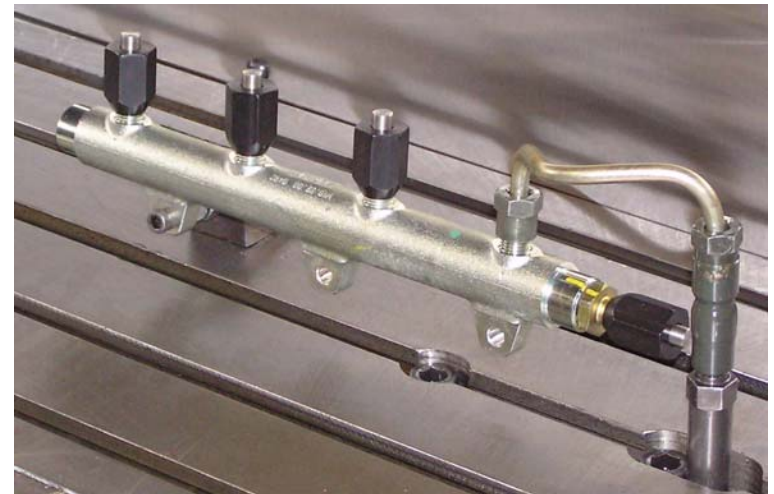
Exergy Test Lab Equipment

- Flow Bench
 - Tests restriction through: Valves, Hole Intersections, Nozzles and Orifices
 - Drive Power: 15 hp
 - Max. Fuel Temp: 80 deg C
 - Max. Flow: 1200 l/hr
 - Max. Pressure: 200 bar



Exergy Test Lab Equipment

- High Pressure Pulsation Rig
 - Validates the pressure rating of fuel system components.
 - Maximum Pressure: 5000 bar
 - Minimum Pressure: ≈ 3 bar
 - Max. Volume at Rated Pressure: 10 cc
 - Operating Frequency: 17 Hz
 - Power Consumption: ≈ 20 hp
 - Floor Space: ≈ 50 ft²



Exergy Test Lab Equipment

- General Lab Information
 - Space: $\approx 4,500$ ft²
 - In addition to test equipment:
 - Injector Teardown/Inspection Area
 - Vehicle Service Bay



exergy

ENGINEERING

Contact

Exergy Engineering LLC

4349 40th Street SE

Grand Rapids, Mi. 49512

Phone: (616) 977-3766

Cell: (616) 260-1434

Fax: (616) 977-3767

E-mail: sales@exergyengineering.com

exergy

ENGINEERING