

EVO MT Systems

EVO-MT[®] 7930 LNG Conversion for Mine Haul Trucks

The EVO-MT[®] System enables operators of Caterpillar 793 mine haul trucks to substantially reduce operational costs and improve sustainability by substituting diesel fuel with lower cost, cleaner natural gas. The EVO-MT[®] System is comprised of patented and proprietary technologies that allow the engine to operate with up to 70% gas and the balance diesel fuel. Trucks converted to natural gas plus diesel, NG+D[®] operation, exhibit diesel-like performance in such critical areas as power, response and efficiency.



Engine Conversion

The EVO-MT[®] System allows for the in-field conversion of the haul truck engine to NG+D[®] operation. The conversion process utilizes components that are installed externally of the engine and no changes or modifications to the cylinders, pistons, fuel injectors or cylinder heads are required. Retaining the OEM diesel fuel system in its entirety, the engine maintains the capability to operate solely on diesel fuel when required. The System interfaces with the engine cooling circuit in order to supply high temperature coolant to a heat exchanger / vaporizer for efficient conversion of the LNG from a liquid to a vapor state. Once the LNG is converted to a vapor phase, it is supplied to the engine's air-intake system at a point upstream of the turbo-compressor inlets using low restriction air-gas mixing technology. Installation is performed using conventional shop tools and equipment.

Protection and Control

The EVO-MT[®] System includes a powerful Electronic Control Unit (ECU) that monitors critical engine, chassis and system data and uses this information to dynamically control the operating fuel mode of the engine. The ECU also provides sophisticated engine protection and monitoring functionality with pre-alarm, alarm and system shutoff logic that allows the engine to be switched from NG+D[®] mode to diesel-only operation seamlessly and automatically. These protective systems and control algorithms ensure continued engine reliability and uptime when operating on LNG. The ECU monitors critical engine parameters including exhaust gas temperature, manifold air temperature, manifold air pressure, engine knock, engine coolant temperature and engine speed. Each ECU data channel is sampled 50 times per second (50 Hz) ensuring rapid detection and correction of anomalies.

Graphical User Interface

The GUI allows for quick and simple access to both real time and logged system data using a proprietary graphical user interface (GUI) program. The GUI program is PC compatible and technical personnel can access System data using a convenient USB interface located in the operator cab. In addition to accessing System data, the GUI program is utilized during setup and commissioning of the haul truck for creation or loading of fuel mapping algorithms as well as for programming various System control, pre-alarm and alarm setpoints.

On-Board LNG Storage

LNG is safely and securely stored onboard the mine haul truck using a fully-integrated chassis mounted Fuel Storage System (FSM). The FSM includes double walled, vacuum insulated cryogenic tanks, LNG vaporizer, cryogenic safety controls, high and low pressure gas regulators and sensors. The FSM is a fully-engineered, pre-fabricated assembly that significantly minimizes the required installation down-time of the truck. FSM's are shipped to the mine site completely assembled and tested and can be installed using overhead shop cranes or mobile lifting systems. The FSM is designed for specific haul truck configurations and/or duty cycles and provides sufficient LNG storage capacity for a 12 hour refueling cycle under normal operation.

LNG Refueling

The LNG is filled via a remote refueling receptacle that is located according to customer requirements. LNG refueling is performed using a pressurized, quick-disconnect coupling that allows for the safe and rapid refueling of the FSM. LNG refueling can be done in parallel with diesel refueling using either permanent, semi-permanent or mobile cryogenic fuel transfer systems.

EVO-MT[®] 7930 | Specifications



Integrated LNG Fuel Storage Module

- 405 U.S. Gallon (1,533 liter) Water volume
- Approximately 360 U.S. Gallon (1362 liter) LNG Capacity
- 50 – 150 PSI Operating Pressure
- 230 PSI Max Allowable Working Pressure
- Hydraulic Tilt System
- Engine Access Unobstructed
- Vibration Isolation
- LNG tanks designed, constructed and tested to DOT4L or SAE J2343, NFPA 52, and other applicable standards.
- Double-Walled and Vacuum-Insulated Cryogenic Tanks
- 7-10 Day Hold Time
- CSA Approved Gas Train
- Cryogenic Shut-Off Solenoid Valves
- Remote Fill LNG Port @ 50-100 GPM fill rate
- Remote Venting System
- Single Stage LNG Vaporizer

Gas Train

- CSA Certified or CRN High Pressure Regulator
- CSA Certified Low Pressure Regulator ANSI Z21.18
- CSA Certified Dual Solenoid Valve ANSI Z21.21

Gas Distribution System

- Fire Shielded Eaton FC3000 Hoses
- 8" or 10" Air / Gas Mixers
- Mass Air Flow Sensor
- Fast Acting Throttle Bodies

Electronic Control Unit (ECU)

- 32-bit Microcontroller with USB and CAN Communications
- J1939 Compatible
- Programmable Fuel Mapping
- Remote Graphic User Interface
- Monitors >25 Sensors 50X per Second
- Four Channel Throttle-Body Control Output
- 24V Input Power, Load Dump Overvoltage > 100V, Under-Voltage Lockout < 18V, Reverse polarity and Double Battery Voltage Protected

ECU Environmental Ratings

- *Ambient Operating Temperature:* -40°C to +105°C
- *Storage Temperature:* -40°C to +125°C
- *EMC/EMI:* EN61000-6-2/-4
ISO 10605
ISO 11452-2,4
CISPR 25
- *Humidity:* MIL-STD-810D, 507.2
- *Chemical Resistance:* SAE J1455, 4.4.3
- *Shock:* 40 Gs
- *Vibration:* Random: 0.3G²/Hz, 10-2000 Hz
- *Thermal Shock:* SAE J1455, 4.1.3.2
- *Ingress Protection:* IP56 Per IEC 60529
SAE J1455

Engine Safety

- Flame Detection
- Air-Gas Mixture Inflammable Outside Combustion Chamber
- High Exhaust / Turbo Temperature
- High Boost Pressure / Temperature
- Engine Over-Speed Protection
- 16 Channel Knock Detection

Operator Safety

- In-Cab Combustible Gas Detection
- In-Cab System E-Stop (Optional)
- External System E-Stop (Optional)
- Automatic Gas Shutdown in Rollover
- Automatic Gas Shutdown on Truck Over-Speed
- Automatic Reversion to Diesel Operation
- Driver Site-Line to RH Mirror Unobstructed
- Secondary Egress Door Still Functional

System Weight

- Fully Filled with LNG ~ 5500 pounds

Trucks / Engines Supported

- B Model
- C Model
- D Model
- 3516B
- 3516B HD