UPGRADES & ENHANCEMENTS

CAT® DYNAMIC GAS BLENDING™ KIT

CAT 785C MINING TRUCK USING LNG

Overview

785C Mining Trucks can now upgrade to a Dynamic Gas Blending (DGB) solution that uses liquefied natural gas (LNG). Cat® Dynamic Gas Blending allows mining operations to significantly reduce fuel and mine production costs through lower cost LNG, while maintaining diesel-like truck performance in payload, speed, reliability and durability.

As mines around the world are already benefiting, DGB allows the engine to operate on a blend of diesel and LNG fuel, delivering tangible value through:

- Integrated and proven Cat LNG DGB technology
- Safety features including methane detectors
- Substantial reduction in fuel costs, with 60-65% average cycle diesel displacement
- 100% diesel backup operation
- Maintains 100% diesel like performance with original 785C power and transient response

Cat Dynamic Gas Blending Value Summary

Mines can save millions in production costs by replacing diesel with lower cost LNG. Current DGB customers are experiencing 30% lower fuel cost.

- Experienced energy companies supply and equip your mine with LNG fuel and equipment at their expense.
- DGB trucks running at customer sites delivers equal performance, productivity and payload as their diesel truck fleet.
- DGB achieves 85% peak diesel displacement with natural gas and 60-65% on a cycle basis
- Proven Cat DGB engine technology in production since 1995 and utilized in numerous applications with over 10 million operating hours
- Mines can lower emissions using DGB through use of cleaner natural gas.
- DGB is an OEM offering that is designed, serviced, supported and warranted by Caterpillar Inc.
- Cat DGB consolidates parts packaging and simplifies the process for ordering all necessary parts through kit availability.

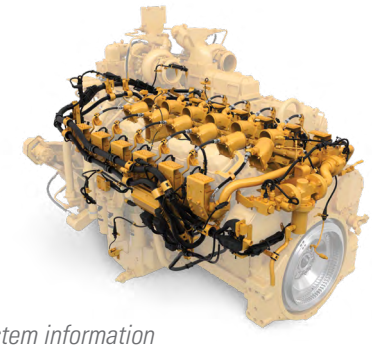
DGB System Information

LNG DELIVERY SYSTEM

- Multi-port gas admission system and in-cylinder pressure sensors to deliver and control gas flow to engine
- On-board vaporizer converts natural gas from liquid to gaseous state
- Integrated gas pressure regulator maintains optimum natural gas pressure
- Individual gas admission valves control combustion in each cylinder
- DGB mining truck can utilize LNG down to a Cat Methane Number (MN) of 80, which nearly all LNG fuels compositions meet.

FUEL TANKS

- Capable of fueling both fuels simultaneously through integrated diesel and LNG tank module assembly
- Designed and certified to CE conformity. LNG Pressure vessel meets SAE J2343/NFPA 52 On Highway certification.
- Rigorously tested and verified under extreme operating conditions, with more than 30,000 field hours accumulated prior to production
- Quick fill LNG fueling capable in 10 minutes
- Designed to operate on a wide range of pressure from 550-1,585 kPag (75-230 psig)
- Designed to be defueled and purged with nitrogen gas to render the tank inert prior to maintenance
- LNG total useable fuel capacity 1,076L (282 gallons)
- Diesel total useable fuel capacity of 608L (160 gallons)



DGB system information continued on back.

LNG

LNG FUEL

- LNG is available in many parts of the world and required infrastructure cost is responsibility of fuel supplier and not the mine.
- LNG suppliers available to provide fuel supply, equipment and resources
- Cat LNG DGB Application and Installation Guide (LBT0003) available for more details on integrating LNG into mine site operations
- LNG is a clear, colorless, non-toxic liquid that forms when natural gas is cooled to a cryogenic temperature of -162ºC (-260ºF) at ambient pressure.
- Natural gas shrinks to 1/600 (less than 1%) of its original volume when liquefied for easier transport and storage.
- LNG rapidly evaporates when exposed to the environment, leaving no residue on water or soil. LNG weighs less than half the weight of a similar volume of water, so it will float if spilled on water.
- LNG tank included in the DGB kit is designed for safe operation in mining environment.
- Caterpillar Gas Engine Rating Pro (GERP) is available for natural gas analysis. Website: cat.com/en_US/articles/solutions/oil-gas/gas_engine_rating_pro.html

Cat DGB FAQ

Q. *Does Cat offer DGB expertise to help with project feasibility, mine integration and economic analysis?*

A. Yes, send email to DGBhelp@cat.com and a Caterpillar DGB expert will be in touch with you shortly.

Q. *Where do I go for more DGB information like brochures and customer testimonials?*

A. Go to cat.com/DGBmining where videos, savings calculators and more information is available.

Q. *When will the kits be available?*

A. Kits are available now for order.

Q. *What is included in the kits?*

A. The kits contain all required piece parts that are needed for the upgrade.

Q. *How do I order?*

A. Contact your dealer for more information.

SAFETY

- Two on-board methane detectors and display panel integrated onto DGB truck for safe operation and 100% diesel backup.
- Existing truck fire suppression system effective with gas
- Established safety training and operating protocols available and effective
- LNG fueling system is self-protecting without operator intervention

ELECTRONICS

- 1 dedicated A5:E4 ECM controls diesel performance
- 2 dedicated A4:E4 ECMs govern gas injection
- 1 dedicated A6:P1 ECM works with In-Cylinder Pressure Sensors (ICPS) to monitor real-time combustion performance

CAB INFORMATION SYSTEM

- Cab-mounted indicator methane detection system status and alarm
- Cab-mounted indicator for LNG tank fuel level sensing

EMISSIONS

- LNG is a clean fuel and offers lower CO2e emissions on a wells to wheels (WTW) basis than diesel.
- Emissions benefits can be realized including NOx reduced up to 30%, PM reduced up to 50%, and CO2 reduced up to 20%.