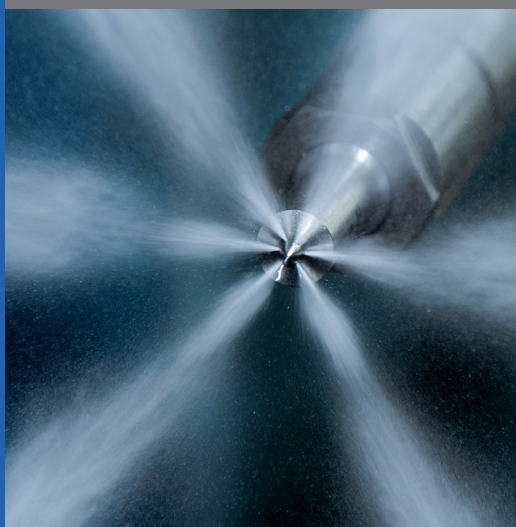


## DUAL FUEL CONVERSION SYSTEMS



# DUAL FUEL CONVERSION FOR HIGH SPEED DIESEL ENGINES

HUEGLI TECH offers an innovative retrofit technology to convert high speed diesel engines to operate reliably and efficiently in dual fuel mode, i.e. typically with 25% diesel fuel and 75% natural gas, or other gaseous fuel.

No internal modifications to the diesel engine are required; the standard compression ratio and pistons etc. are retained.

Note: Our system dynamically controls both fuels simultaneously, allowing better response to load changes than a pure gas engine, whilst maximising cost savings in steady-state conditions.

HUEGLI TECH has developed a comprehensive range of key components, allowing each system to be tailored to meet individual customer requirements.

The system automatically compensates for variations in gas quality and availability and will continue to function as a pure diesel engine if the gas supply is interrupted. This allows for maximum utilisation of the most cost-effective gaseous fuels and tariffs.

This kit is an inexpensive method to get an existing high speed diesel engine running on dual fuel and significantly reducing fuel costs while retaining the full output power and flexibility of the original engine.

The larger the engine and the higher the annual running hours, the shorter the payback period will be.

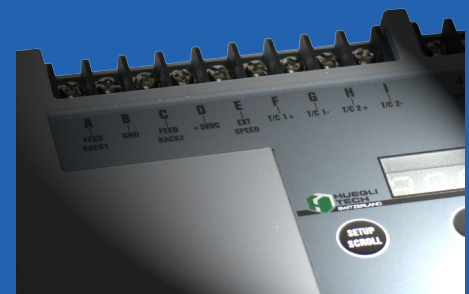
**Return of Investment: Can often be less than 6 Months**

## The Benefits

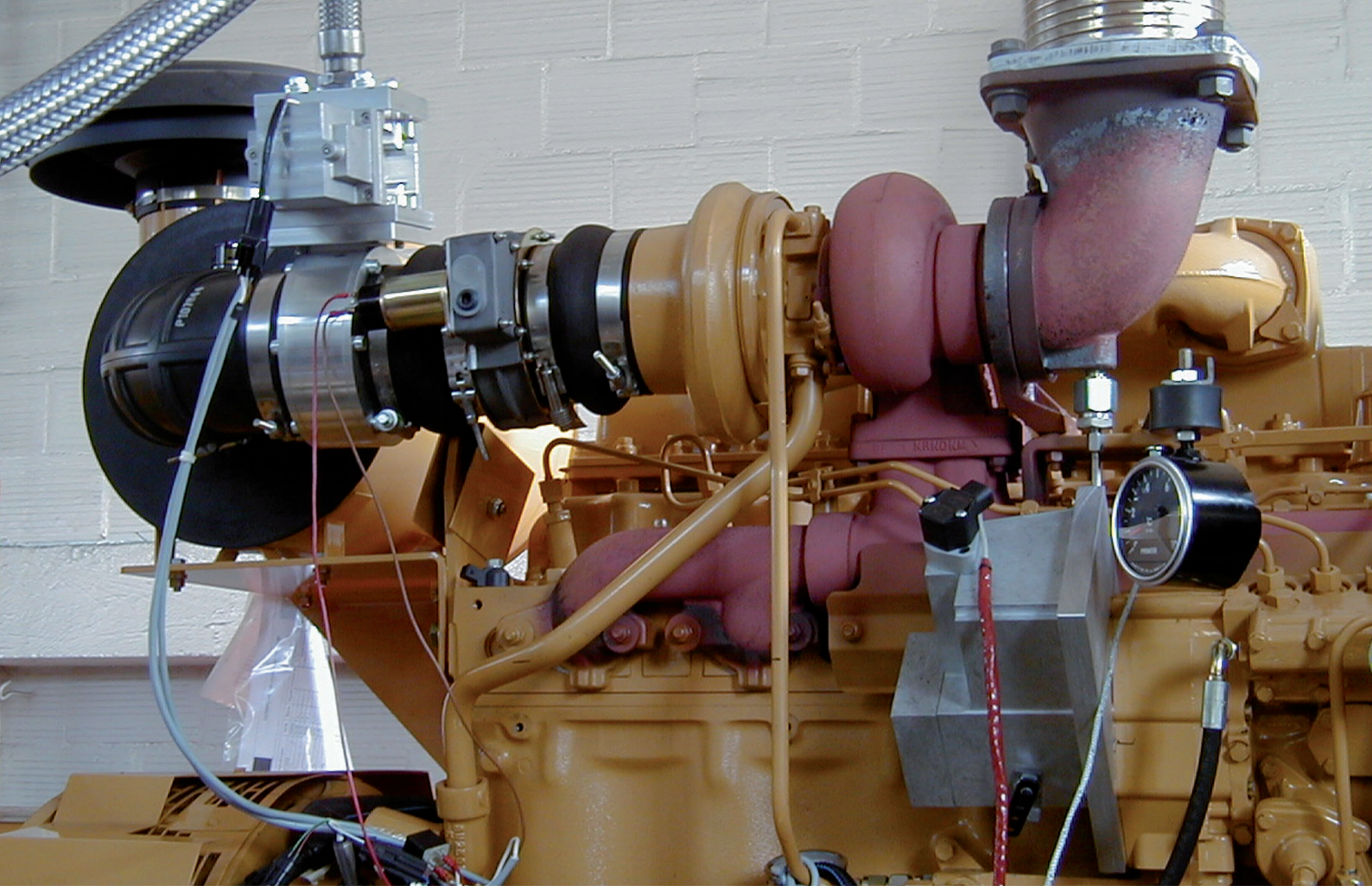
- Save money with cheaper fuel
- Simple conversion is cost effective
- Low pressure gas compatible
- 100% power with diesel or dual fuel
- Fast response time
- Improved dynamic performance
- Running clean gas can extend service intervals

## Virtually unlimited Applications e.g

- Gensets converted to use associated gas at oil wells
- Biogas generators on farms turn waste into electricity
- Biofuel/natural gas CHP applications (where the liquid fuel is cheaper but may be subject to shortages until the supply infrastructure improves)







## TARGET - OPERATING PRINCIPLE

### Target

The development target was to combine simplicity with high tech components to safely operate the engine at an optimised diesel fuel/gas ratio of at least 25%/75%, and to maintain the same power output and response to load changes as the original diesel engine.

### Operating Principle

The HT-SG105 Dual Fuel Module sets the amount of injected diesel fuel via the diesel actuator (with positional feedback sensor) linked to the fuel pump. Simultaneously, the HT-SG100 also regulates the amount of gas into the special air/gas blender by means of a throttle body. The air/gas mixture then passes through the turbo charger, through the inter-cooler and into the engine. The requested engine speed is controlled by the governor, which measures the engine speed at the engine ring gear via a speed sensor. Both, isochronous or droop mode are possible.

### Dynamic Performance

The HT-SG105 and the HT-SG100 control the fast responding electric actuators in such a way to optimise economy in steady state and dynamic performance during load steps.

### Protection and Safety

The system protects the engine against harmful situations. Each cylinder exhaust temperature is monitored individually. If the temperature should exceed the set (safe) limit, the DFC-2000 control reduces the gas portion, and increases the diesel fuel portion.

All combustion engines are susceptible to harmful knocking (Detonation), but gas-fuelled engines, running hotter, are more prone than liquid fuelled ones. We strongly recommend the use of an anti-knocking control system. Multiple knock sensors continually monitor engine vibrations, and the Antiknock Controller uses these inputs to ensure that the engine can be run close to, but still within the knocking threshold.

As an option, and as an additional protection against overspeed, etc, one or two solenoid-operated air intake shutoff valves can be supplied.

**Whilst looking to minimise the conversion costs, no compromise was made regarding quality. All components are of top quality and offer utmost reliability, at an affordable price!**

## Fuel Economy

A Dual Fuel conversion is a perfect investment for power users who are looking to upgrade their current system to alternative fuel technology, without revamping their entire system. As a retrofit technology, the HT-SG105 system provides an economically attractive alternative to buying costly new generators.

With the ability to utilise both fuels, the engine will never be down due to a lack of adequate gas fuel supply. Another distinct advantage of dual fuel is the decreased engine wear that comes with the use of cleaner fuel. Due to a reduction of carbon soot build-up and cleaner lube oil, longer intervals between service maintenance can be expected, sometimes doubled. This means a longer economic life for the engine and a better overall return on your investment.

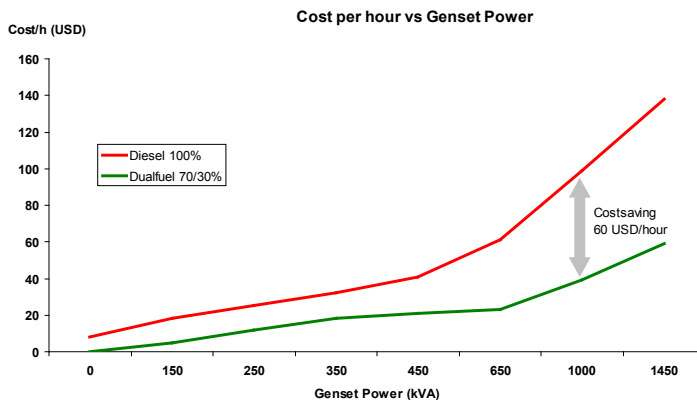
## Savings

To determine approximate cost savings you will need to be aware of your present fuel cost. The fuel replacement percentage and replacement cost with natural gas is in the ratio of approx: 25 / 75, but also can be lower. Be sure to apply any losses of efficiency and always estimate on the safe side.

Ask a HUEGLI TECH representative to help you in determining your projected annual cost savings including fuel and maintenance.

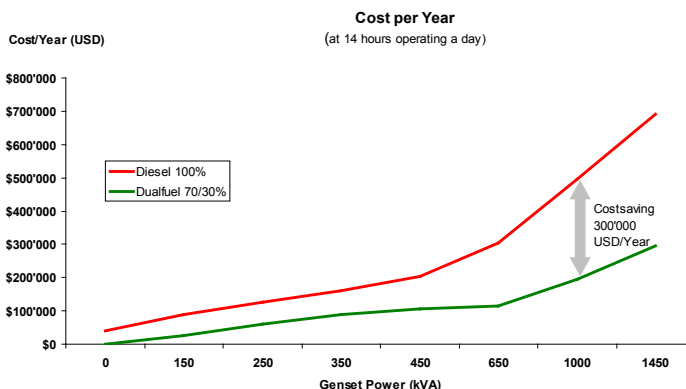
When considering the cost of natural gas, also bear in mind that many suppliers are willing to give better rates if they are able to interrupt your fuel supply. A dual fuel engine, which can continue to run on diesel alone if the gas is interrupted, allows the operator to take full advantage of these tariffs without compromising system availability.

## The Benefits



**! Uninterrupted power supply around the clock save cost for production and investment!**

The below comparison is based on average fuel and gas costs. An automatic calculation table is available in Excel which allows calculating with any fuel cost. Please contact us so we can provide more information to you.

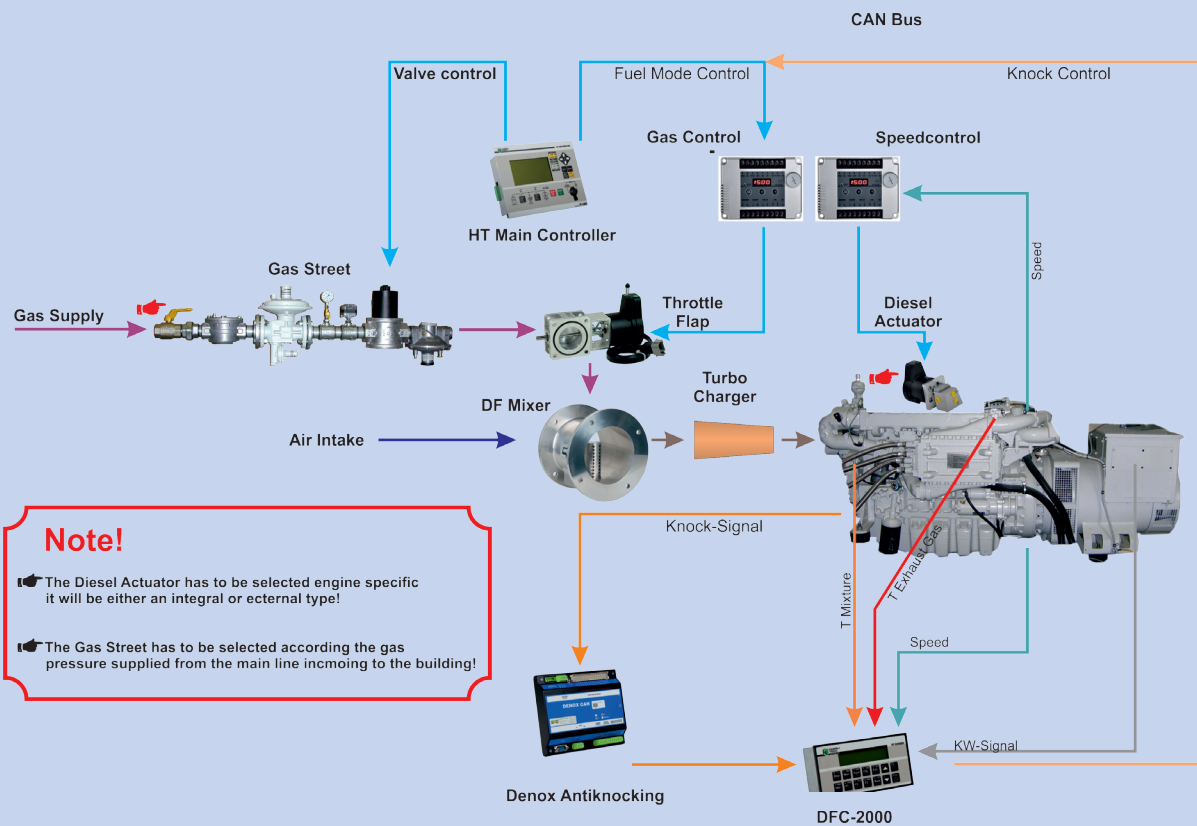






## CONFIGURATION EXAMPLES

### Overview Inline Engine 1 Mixer 1 Turbo

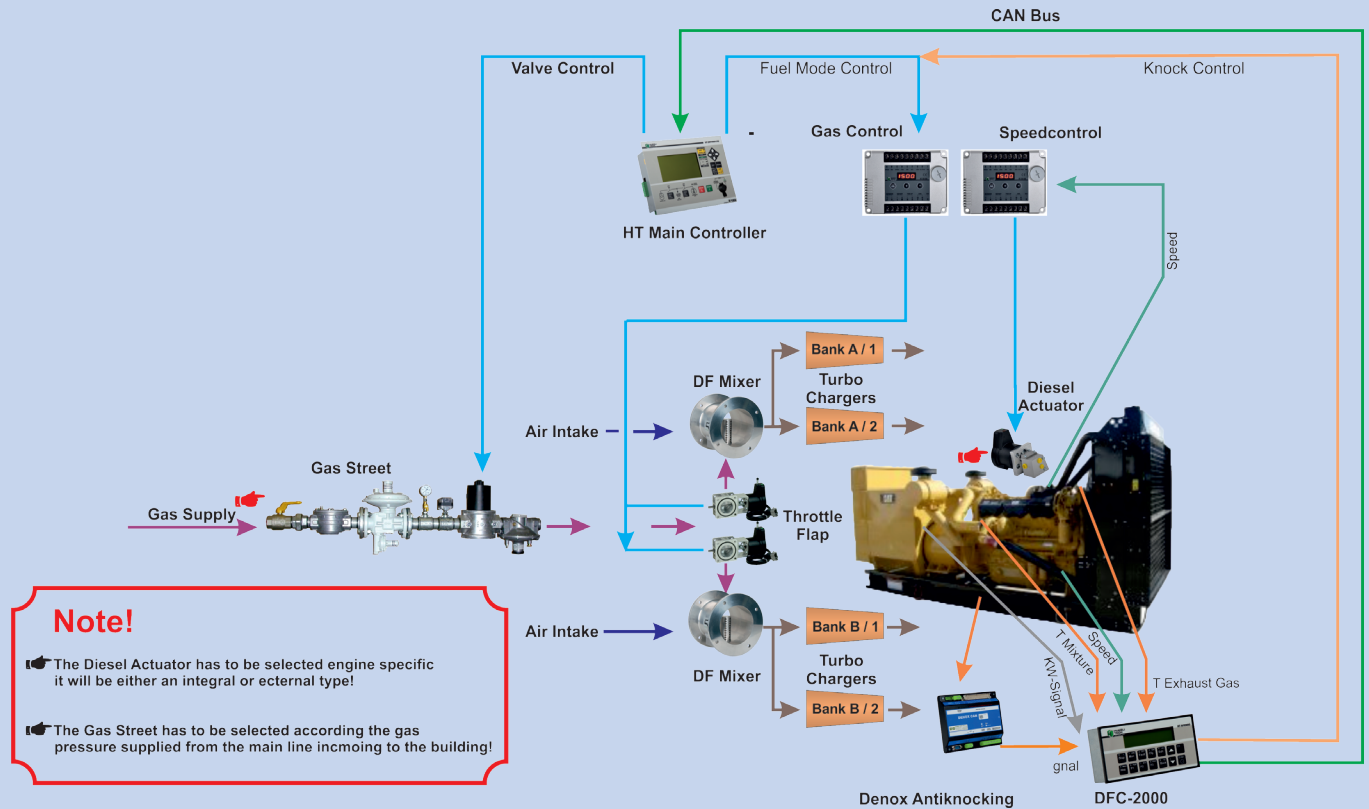


Note:

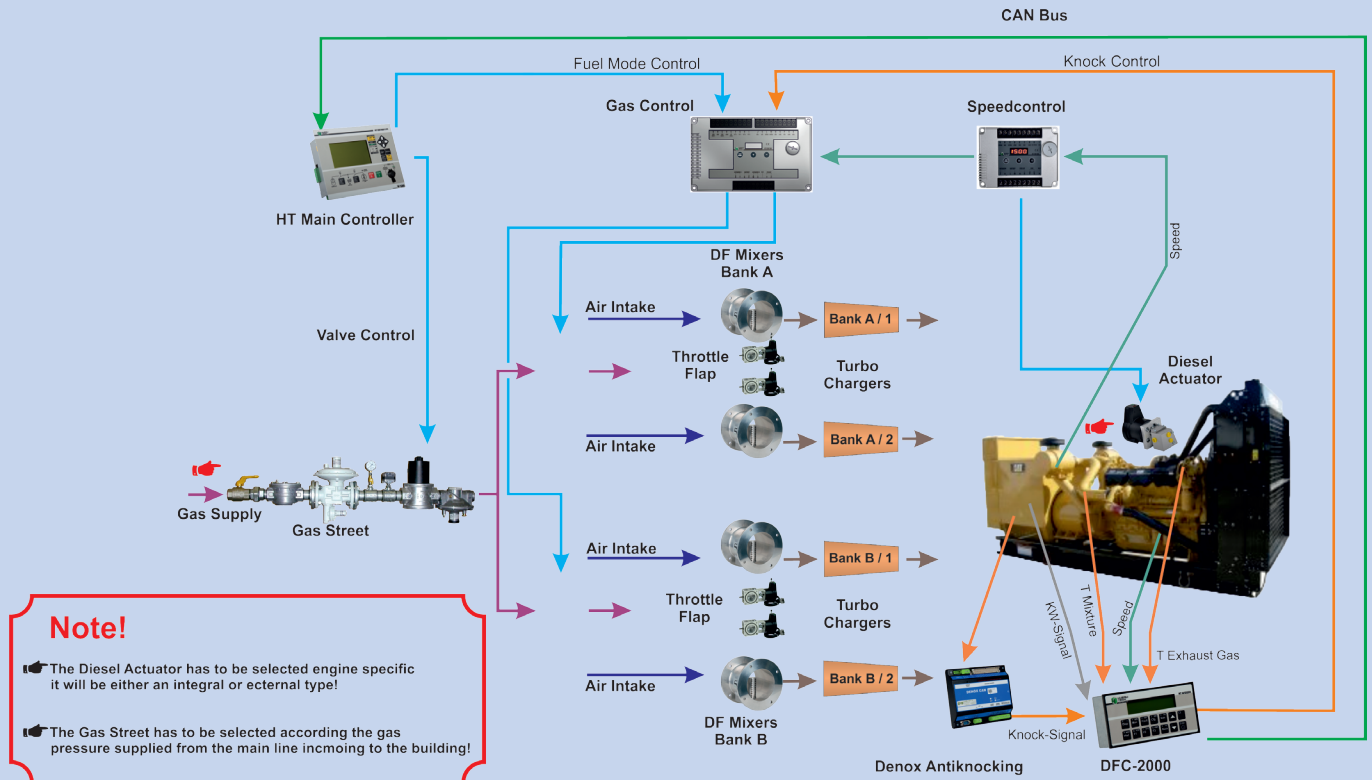
- ☛ The Diesel Actuator has to be selected engine specific it will be either an integral or external type !
- ☛ The Gas Street has to be selected according the gas pressure supplied from the main line incoming to the building !



## Overview V-Engine 2 Mixer 4 Turbo



## Overview V-Engine 4 Mixer 4 Turbo





## THE INDIVIDUAL COMPONENTS

### HT-DST4602



HT-DST4602 AMF and PARALLEL genset controller.

HT-DST4602 is a highly configurable gen-set controller designed to handle a broad range of critical and complex parallel applications, including multiple Mains and CHP systems. It includes an internal load sharing unit that allows simple implementation of Multiple Prime Mover applications. PLC functions (including PID blocks) are available in this unit.

A split version with a separate display and base box is also available.

### DFC-2000



DFC-2000 Temperature Control Module monitors the exhaust temperatures and controls the Y-Flap and signals to the DFM if diesel fuel needs to be increased to cool the combustion chamber.

### Denox antiknocking control



Denox antiknocking control. Each individual cylinder is monitored and protected against knocking.

### HT-SG100



HT-SG100 is an isochronous speed governor tailored to communicate with the HT-SG105 or HT-TPD100.

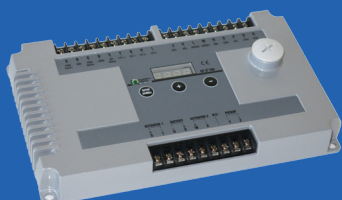
Features such as dual gain, switchable engine configuration, start smoke limitation and overspeed etc. make this governor an ideal choice for dual fuel applications.

### HT-SG105



HT-SG105, Dual Fuel Control module takes control of the Gas actuator independently. The unit is fitted with a load anticipation feature that simultaneously adjusts the supply of the Gas Fuel to reduce load transients to an absolute minimum, often achieving better transient performance than the original diesel engine.

### HT-TPD100



HT-TPD100 is a dual actuator driver with balancing function. This unit can also be used together with diesel engines that have two fuel pumps, such as the Cummins QST 30 or some 8 and 12 cyl. Komatsu engines.



### Y-Flap



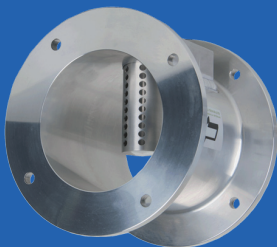
Y-Flap, a unique device that works with the DFC-2000 to control the gas flow to the individual cylinder banks! This provides accurately balanced cylinder bank temperatures.

### ITB Actuator



ITB series actuators are designed for precise efficient metering of gas flow. The actuator is mounted directly to the DF-5 mixer and features a proportional electromagnetically driven throttle plate. Two internal return springs make this a normally-closed fail-safe design.

### DF-5 Air Gas Mixer



DF-5 is a simple but effective air gas mixer designed specifically for dual-fuel systems. It can be adapted to fit a wide range of induction system diameters and the internal gas inlet tube can be optimised on-site.

### Actuator Variouse



Variouse actuators are available for the diesel fuel pump. We also offer integral as external solutions including position feedback.



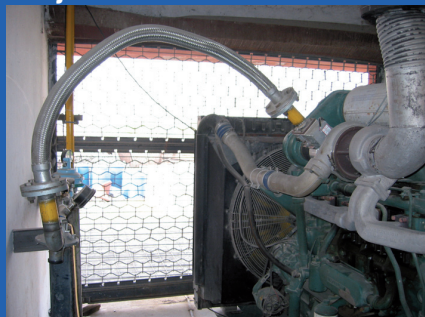
## TYPICAL APPLICATION

### Project: CAT 3306



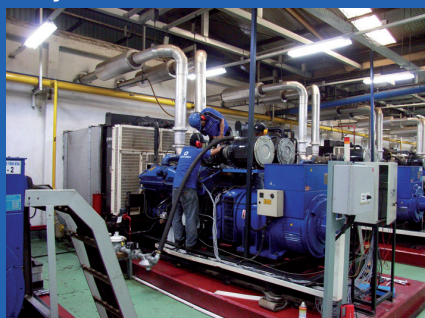
Custom specified conversion on a brand new CAT 3306 with CNG. Fuel ratio: 20% Diesel 80% Gas at 100% load. The engine was converted in our factory in Switzerland. Test conditions: Ambient temperature: 28°C, humidity: 40% relative, resistive load bank.

### Project: Volvo 1613G



Conversion made in Indonesia. Due to Air to Air cooled system it was possible reducing the diesel fuel down to 10% and 90% of natural gas at 100% load. Final adjustment set to 30% diesel 70% gas. Ambient temperature 40°C.

### Project: Cummins KTA 38



Conversion made in Jakarta. Ratio 30% Diesel 70% Gas. Cylinder Temperature balance within 1 to 3 degrees C° via Y-Flap. Ambient temperature 35-38°C high humidity.

### Project: Cummins KTA 50



Conversion made in Pakistan through R.A. Engineering. Fuel Ratio 30% Diesel 70 % Gas at 100% power.

### Project: CAT 3412



Conversion made in USA. Fuel Ratio 30% Diesel 70% Gas.





## SOME REFERENCES

### **Pakistan**

Cummins NTA 855, KTA 19, 38 and 50, all engines operating with 30% Diesel 70 % Gas. Total sets converted, 15 pcs.

### **Germany**

MAN 2840 1 pcs, engine operating with Bio Gas at 18 % Diesel, 82 % Gas.

### **Indonesia**

Volvo TD 710 6 Cylinder, 1 pcs. 30% Diesel 70 % Gas.

### **China**

Jinan 12 Cylinder 190, 1 pcs. Engine is operating with 20 % Diesel 80 % Gas.

### **Egypt**

CAT 3406 1pcs, engine operating at 28% Diesel, 72 % Gas.

### **China**

Jinan 12 Cylinder 190, 10 pcs. Engine is operating with 20 % Diesel 80 % Gas.

### **China**

Jinan 12 Cylinder 3012, 3 pcs. Engine is operating with 20 % Diesel 80 % Gas.

### **China**

Jinan 12 Cylinder 190, 100 pcs. Engine is operating with 20 % Diesel 80 % Gas.

### **China**

Application: Hydraulic Drill sets, world wide first time 3 engines parallel to hydraulic in dual fuel mode.

### **USA**

CAT 3406 and Mitsubishi 6 Cylinder operating at 25% Diesel and 75% Gas.

### **Iran**

KTA-19 operating at 30% Diesel 70% Gas.

### **Indonesia**

KTA-38 operating at 35% Diesel 65% Gas.

### **Korea**

KTA-38 at 35% Diesel 65% Gas, all new HT-TECHNOLOGY

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\*due to pre-existing agreements not all products are available in every country



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### Solution Provider for:

- Gas Management Systems
- Dual Fuel Conversion Systems
- Governing Systems
- Automation Systems
- Engine Protection
- Starting Solutions
- Battery Care
- Oil Treatment and Recycling
- Thermostatic Control Valves

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