

Diesel Dual Fuel Technology



- Brief Introduction

About Vensol

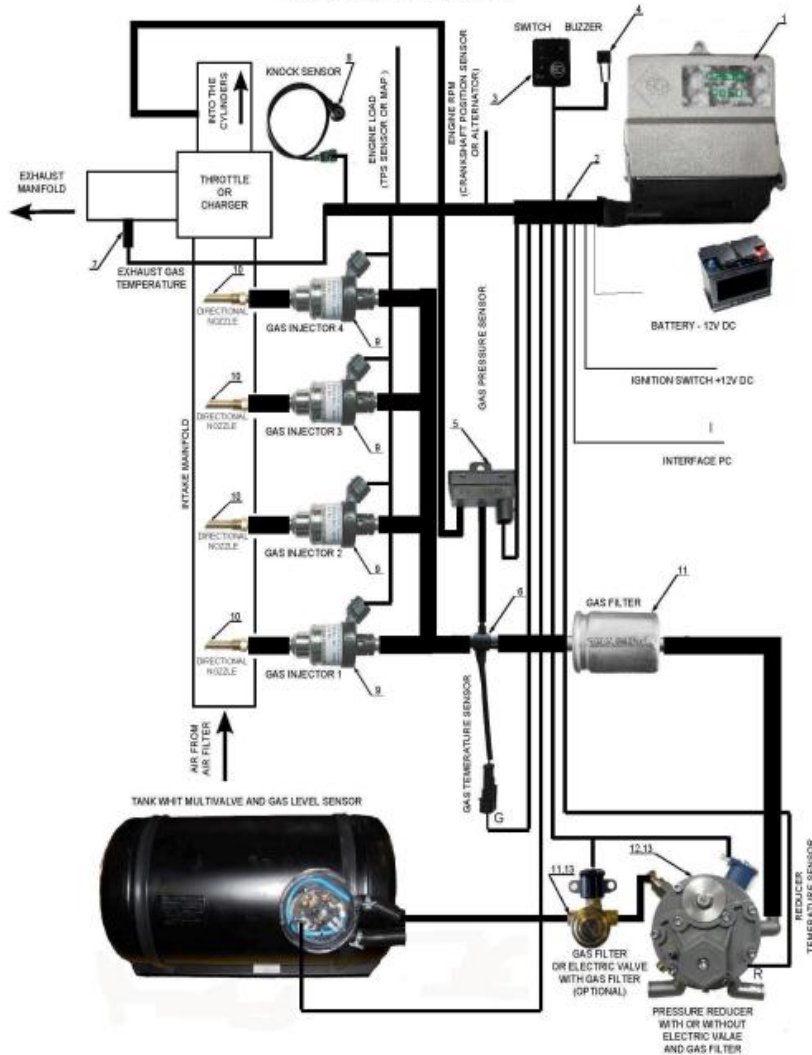
- Entity established to develop and offer viable alternative energy solutions in Pakistan.
- With associates, has spent over 3 – 4 years in R&D and installations of DDF systems on generators and vehicles.
- Vensol currently holds exclusive distributorship rights in Paksitan for certified DDF kits as well as 'Altenergy', a world-leader in SNG (LPG + air mix) systems.



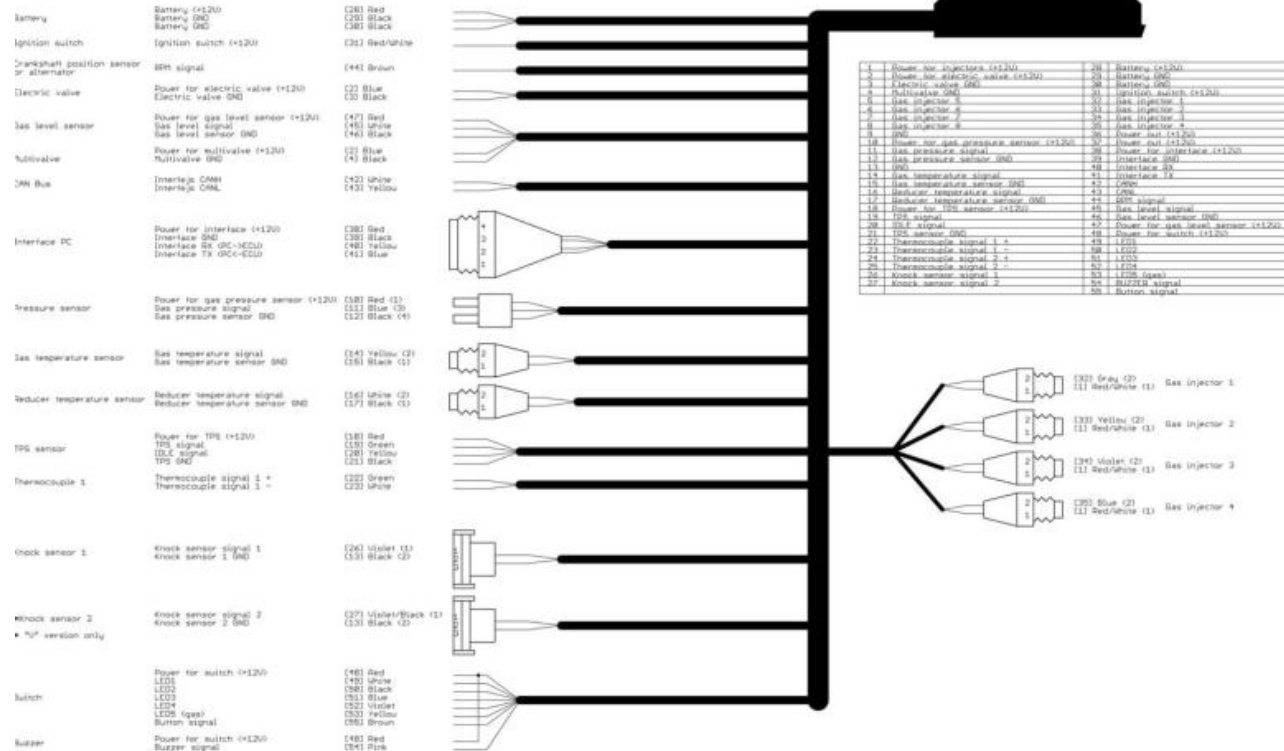
DDF At A Glance

- **Mixed Fuel:** System involves simultaneous injection of Natural Gas or LPG with diesel in compression ignition engines.
- Can be installed on **generators** and **vehicles**.
- Excellent **environmental benefits**.
- Substantial **cost savings**.

DDF SYSTEM SCHEMATICS



DDF Schematics



Key Benefits

- ❖ From 8% up to 15% Savings in Fuel Costs [dependent on market prices].
- ❖ Up to 20% reduction in Nitrogen Oxides (Nox) and 12% reduction in Carbon Dioxide (CO2) Emissions.
- ❖ Has been known to Enhance engine life considerably.
- ❖ Substantial reduction in maintenance costs.

Note: Assumes excellent circumstances. Actuals may vary.

- Installation overview

DDF Installation

- Installation of DDF is completely **non-invasive** (no engine modifications are required).
- Technology **employs the same readings through sensors** that a generator / vehicle operates on (RPM, air pressure, exhaust temperatures, etc.).
- **Successful substitution ratios** (replacing diesel with a near-equivalent quantity of LPG) of **24-33% on generators** and up to **40% on vehicles** have been achieved.

- Installation overview

'Best-Fit' Generators

- Sets that are ECU/ECM type with Electronic Fuels Pump
- Sets with a 'Turbo-Charger'
- Sets of over 200Kva capacity and Load Factors of over 50%
- *[Older designs with no ECU or Turbo-Chargers can also be retro-fitted – the end results though may have a slightly lower diesel replacement percentage]*

- Advantages of DDF

DDF Savings

- While influenced by the prices of Diesel and LPG, historically, the price difference between the two fuels has always been substantial enough to allow considerable annual savings over the original cost of diesel standalone.
- Due to its clean combustion characteristics, there are significant additional savings in costs of engine spare parts and operating expenses such as oil and air filters.
- Due to the reduction in carbon emissions as a result of using DDF technology, organizations may qualify to register and trade carbon credits on the international market.

- Advantages of DDF

Environmental Benefits

- While real time measurements will vary from engine to engine, international tests have all shown the use of DDF has resulted in **substantial greenhouse gas reductions**.
- Significant reduction in Nitrous Oxide (Nox) emissions in the range of 20%. Certain cases have yielded even better results!
- Reduced Carbon Dioxide Emissions (CO₂).
- Considerable reduction in opacity (carbon particulates, the primary contributor of visible 'black' smoke in diesel engines) by over 50%.

Savings at a glance

[Ref Pakistan Market Prices]

Generator Capacity	30 KVA	120 KVA	500 KVA
Diesel Consumption / hr	6 Liters	16 liters	52 liters
Engine Load	80%	60%	50%
Generator use per day	6 hours	6 hours	6 hours
LPG substitution Ratio	30%	30%	30%
Price Diff. between LPG / HSD	PKR 40	PKR 40	PKR 40
Savings per Hour	PKR 72	PKR 192	PKR 702
Savings per day	PKR 432	PKR 1,152	PKR 4,212
Savings per month	PKR 12,960	PKR 34,560	PKR 126,360
Kit Payback Period	Market	Fuels Prices	Dependent



Set Up | Quality & Certification

- All components comply with the International / EU (ECER 67.01) and/or Japanese standards regarded as the most acceptable for LPG kits, worldwide
- LPG cylinders are manufactured in Pakistan by OGRA-licensed plants and conform to international standards. In each country, applicable standards would apply.



DDF INSTALLATIONS

View of some installations



Installation Pictures



Injectors, Vaporizer and Solenoid From Distance



ECU and Harness



Pressure Sensing & Wiring

Installation Pictures (cont.)



Map Sensor



LPG Reticulation Battery



RPM Signal Recording

Thank You



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