



“Circolare 220/M3/C2”

**Italian rules for diesel–gas
retrofit systems type-approval**

*Informal ‘Workshop’ on Heavy Duty
Dual-Fuel Retrofits
Brussels – 13/12/2012*

Agenda

1. History and Scope

I. Historical background

II. Scope

2. Approval process

I. Authorities

II. Application field

III. Requirements

IV. Safety

3. Retrofitted vehicle final inspection

I. Authorities

II. Requirements

1- History and Scope

I. Historical background

- ✓ Government authorized experimental diesel–gas retrofits in late 80s, requiring diesel mode and original power-torque characteristics preservation.
- ✓ Results of the experimentation: emissions benefits and engine reliability.

II. Scope

The national regulation applies to:

- ✓ motor vehicles using diesel engines (vehicles => cars, vans, trucks...) – no restriction to any specific category
- ✓ gas retrofit systems fitted on diesel vehicles/engines to let them run on diesel-gas running mode [called: dual-fuel (CNG) or mixed-fuel (LPG), *hereafter DF*] in addition to diesel mode.

2 - Approval process

I. Authorities

- **Authority: Ministry of Transport**
- **Technical services: Ministry of Transport Technical Services (s.c. “Centri Prova Autoveicoli”)**

II. Application field

“Vehicle Family” => the approval certificate covers diesel vehicles when tested vehicle/s compliant with following characteristics:

- ✓ **Total displacement \pm 25%**
- ✓ **Maximum injection pressure \pm 25%**
- ✓ **Fuel system type (DI or IDI)**
- ✓ **Induction system (Naturally aspirated or turbocharged)**
- ✓ **Emission regulation and class (Euro 2, 3..or II, III...earlier series are included)**
- ✓ **“Retrofit system family”**
 - ✓ **components (listed alternatives allowed, if not influencing tests results)**

2 - Approval process

III. Requirements

- ✓ Diesel running mode must be maintained.
- ✓ Engine Performances, defined as running mode (DF/Diesel) ratios:
 - Torque ratio => 0.9 – 1.1 at any speed
 - Rated speed ratio => 0.95 – 1.05
 - Max Power speed ratio => 0.9 – 1.1
- ✓ Emissions: original vehicle ECE/EU emission regulation/directives prescriptions, tested in DF mode on engine test bench, or chassis dynamometer, depending on vehicle category and type. [Emissions (gases, particulates, opacity and smoke values) are measured according to 13-mode, ESC, ELR test and free acceleration, or ECE and EUDC cycle, as applicable].
- ✓ Noise: original vehicle ECE/EU noise regulation/directives prescriptions [commonly free acceleration exhaust noise DF mode Vs Diesel mode reduction is checked].
- ✓ Diesel engine governor: unchanged functionality in DF mode Vs Diesel mode [idle and rated speed governing original function is checked]
- ✓ Low idle: only Diesel mode allowed

2 - Approval process

IV - Safety

- ✓ single components and their installation are approved in accordance with ECE/ONU R67 or R110, and with some additional national provisions.
- ✓ A “system family” is accepted, if formed by approved components alternatives. Alternative components affecting performances or emissions [typically ECU, pressure regulator, gas injector] may be included if installed on tested engine / vehicle [test repetition at any important system update].

3 - Retrofitted vehicle final inspection

Vehicles are converted in authorized workshops by trained personnel.

I. Authorities

- ✓ The inspection and approval process is identical to that for bi-fuel retrofitted vehicles
- ✓ Each retrofitted vehicle is finally inspected and approved by the local departments of the Ministry of Transport

II. Requirements

- ✓ Vehicle inspection: DF retrofit system applicability and components list according to the retrofit system approval and its correct installation in accordance with the relevant provisions.
- ✓ Registration document is updated with DF retrofit system manufacturer name and main data.



Thank you

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