TECHNICAL BULLETIN

Industriepark West 46 B-9100 Sint-Niklaas Tel. +32 3 766 60 20 Fax +32 3 778 16 56 mail@wynns.be

Direct Injection Power 3 – Intake air cleaner & tank treatment For direct injection petrol engines

- Instantly cleans intake air system and inlet valves
- Assures good starting properties
- Restores stable idle and acceleration
- Provides optimal power, torque
- Lowers fuel consumption and exhaust emissions

1. INTRODUCTION

a) Why direct injection petrol engines?

Direct injection petrol engines were introduced to obtain:

- Reduced fuel consumption
- Increase engine torque and power, resulting in smoother driving and higher performance
- Reduce exhaust emissions to meet the severe EURO4/EURO5 specifications

b) What is the difference between a classic petrol injection and direct injection petrol?

With a ***classic petrol injection engine***, air is aspirated by the piston through the intake manifold and inlet valves. Fuel is injected in this air stream in the inlet manifold, before entering the combustion chamber. Fuel and air are mixed.
The mixture passes the inlet valve and enters the combustion chamber. This mixture is compressed. At the end of the compression a spark plug will create ignition of this mixture, resulting in combustion.
The injectors operate under a pressure of 3.5 bars


Photo: Bosch

With a ***direct petrol injection engine***, air is aspirated by the piston through the intake manifold and inlet valves.
The air passes the inlet valve and enters the combustion chamber. The air is compressed. At the end of the compression fuel is directly injected in the combustion chamber.
Fuel and air are mixed in a very short period in the combustion chamber. The special shape of the piston head helps to improve this mixing. The spark plug will create ignition of this mixture, resulting in combustion.
The injectors operate under a pressure of 30 to 100 bars.

2. MANUFACTURERS

The DISI engines or Direct Injection Spark Ignited engines for cars driving with petrol fuel have been introduced by:

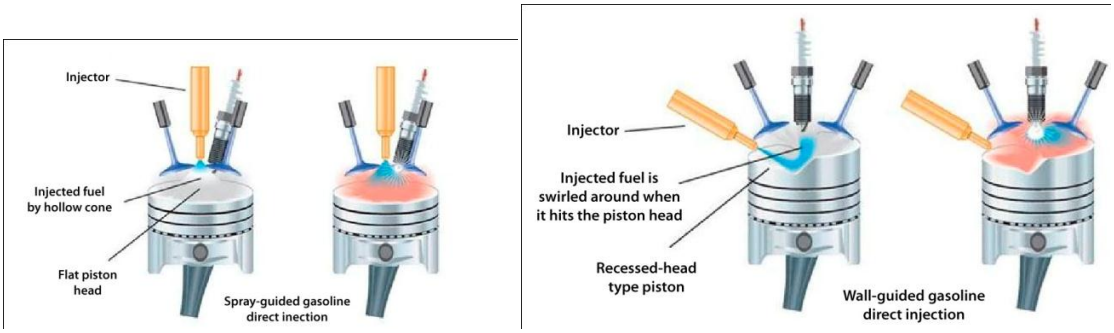
VW / Audi / Seat / Skoda FSI®	since 2002	VW Lupo FSI®	since 2000
Mitsubishi GDI®	since 1997	Nissan	since 1998
Toyota SIDI	since 1998	BMW	2002/2003
DaimlerChrysler CGI®	since 2002	Alfa Romeo (Fiat)	2002/2003
Renault IDE	since 1999		

And following car manufacturers are in an experimental phase, prior to introduction:

Opel (GM)	GM
Ford Deutschland	PSA (Peugeot / Citroen)
Porsche	

3. PROBLEMS

To provide a good mixing of air and fuel in the very short available period, 2 systems of injection have been introduced



Mixture ratios vary from the normal λ-value of 1 (mixture fuel/air, 14.7/1) up to very lean mixtures of 50/1. This extreme lean, stratified combustion makes the system more sensitive to fouling of the inlet valves and injectors.

Most systems are combined with EGR (Exhaust Gas Recirculation) technique, to reduce NOx emissions. Together with the PCV (Positive Crankcase Ventilation), up to 30% of the exhaust gases are recycled towards the inlet system. This leads to increased inlet valve deposits.

Higher compression ratio is used to improve the combustion and ignition quality. This can lead to risk of damage due to carbon deposits or liquid precipitation in the combustion chamber.

Due to a short available period for injection, mixing and ignition, the cleanliness of the injectors is much more important than with the classic petrol injection system.

Dirt build up on inlet valves and in combustion chamber will result in a less efficient mixing of air and fuel. This leads to reduced combustion.
Multi hole, high pressure injectors are more sensitive for deregulation.

For the driver this results in:

- Severe starting problems
- Lack in acceleration
- Loss of power
- Increased fuel consumption
- Higher exhaust emissions

4. SOLUTION

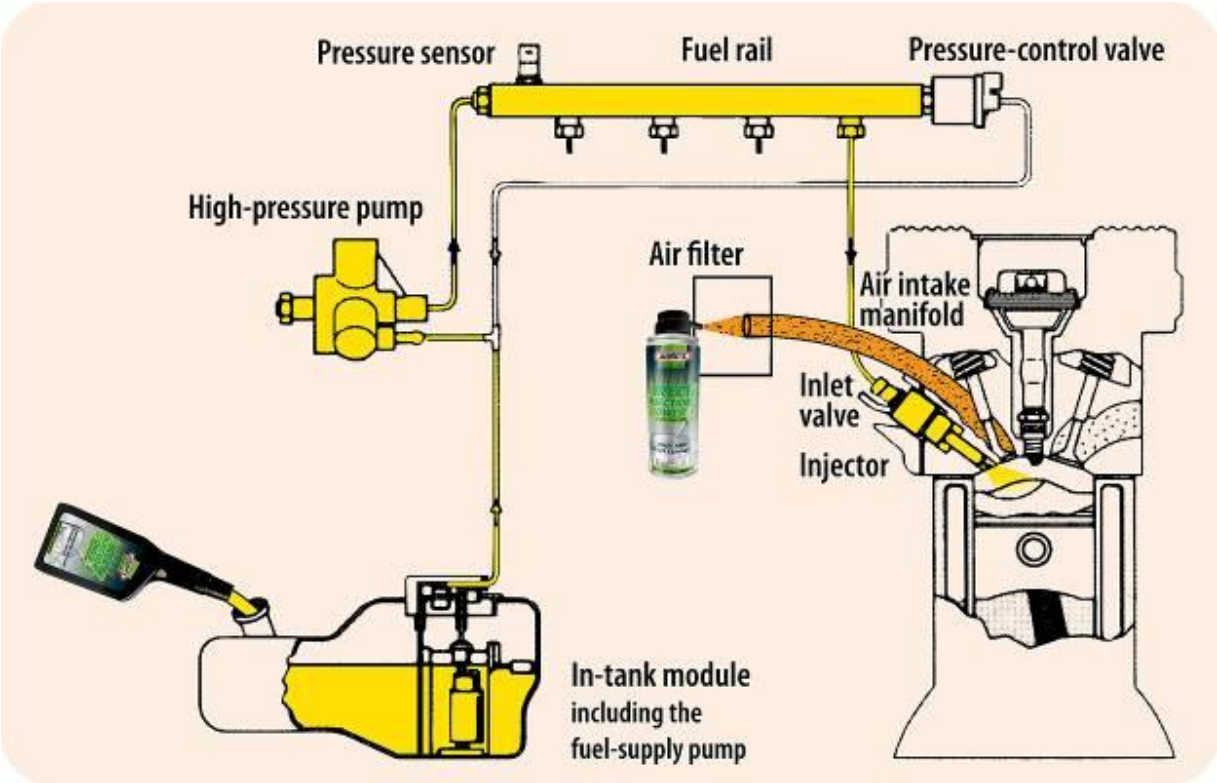
The perfect engine cleaning is a two-fold process for DISI engines:

- **DIP3 – Aerosol Curative treatment**

>> The DIP3 aerosol (marked orange in the schedule) cleans the ñdry partòof the engine: the air intake manifold and the inlet valves

- **DIP3 – Liquid Preventive use of after-treatment**

>> The DIP3 Liquid Treatment (marked yellow in the schedule) cleans the fuel system, the ñwet partòof the engine.



>> *DIP3-Liquid*

Wynn's DIP3 is a chemical treatment for petrol engines with direct injection fuel systems, which cleans the fuel system and reduces friction inside the engine.

Recommended for all petrol engines with direct injection systems, as well new as used.

PREVENTIVE USE OR AFTER-TREATMENT

Properties

- Cleans the injectors and restores and maintains ideal injector spray pattern;
- Keeps clean inlet valves and EGR system and improves acceleration;
- Reduces the formation of deposits in the combustion chamber;
- Restores or maintains the engine performances and provides a regular idle;
- Eliminates and avoids starting problems;
- Reduces CO and HC emissions;
- Reduces internal friction between engine parts (cylinder head), leading to a reduction in fuel consumption;
- Does not harm catalytic converters.

Directions

- Add to the petrol tank. One bottle of 500 ml treats 50 litres of petrol;
- Repeat the treatment every 10.000 km;

Usage

- Every 10 000 km or together with spray usage for after treatment

>> *DIP3 Aerosol – Inlet and Valve Cleaner*

Wynn's DIP3 is an aerosol, developed for cleaning the intake air system of direct injection petrol engines.

Wynn's DIP3 is recommended to be used at each service interval, to maintain cleanliness of the intake air manifold, inlet valves and EGR valve of direct injection petrol engines.

CURATIVE USE OR ACTIVE TREATMENT

Properties

- Strong solvents provide immediate and strong cleaning of intake air system, and inlet valves;
- Strong power jet spray to support cleaning action;
- Dissolves gum, lacquer and deposits;
- Easy to use, cleaning is executed in 5 minutes;
- No dismantling of components necessary;
- Restores or maintains the engine performances;
- Eliminates and avoids starting problems;
- Improves acceleration properties.

Directions

1. Start the engine and let it warm up. Remove the air filter;
2. Let engine run at 2000 rpm;
3. With warm engine, spray the product into the air intake manifold. Spray with intervals;
4. Rpm will drop during pulverisation;
5. After each pulverisation, wait until original set rpm is regained;
6. If necessary accelerate to avoid engine stalling because of enrichment of the mixture;
7. Continue until the 250 ml of product in the aerosol are consumed;
8. Let the engine run at idle during a few minutes;
9. Accelerate the engine approximately 5 to 10 times, during this period. Do not exceed 3000 rpm;
10. Stop the engine, after it has ran again for at least 1 minute. Put filter back in place.

Usage

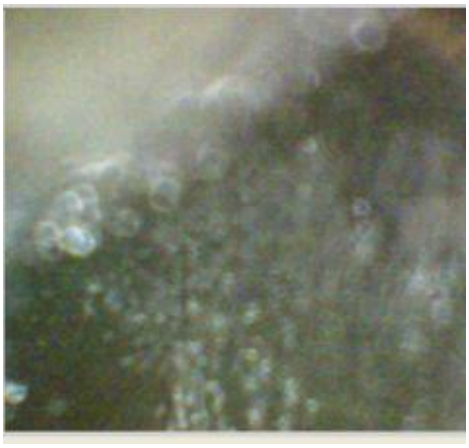
- Every maintenance (15 000 km)

Note: For direct and strong cleaning of the fuel system of direct injection petrol engines, the **Wynn's FuelServe** with **Injection System Purge** liquid can also be used.
Due to the fuel system technology, this will only clean injectors and combustion chamber.

5. TEST RESULTS

Clean up test at Mitsubishi.

a) Mitsubishi Carisma 1,8 GDI motor 82 000 km
Complaint: severe driving and starting problems
Problem disappeared after one cleaning with DIP3 Intake air cleaner
Inlet valves checked with WynnCam
Check with endoscope after 2 weeks: valves were still clean



Before treatment

After treatment

b) Mitsubishi Space wagon 2.0 GDI motor 112 000 km
Complaint: severe driving and starting problems
Instable idle (750rpm), especially at warm engine
Knocking sound at acceleration
Difficult running when air-condition was activated
Treatment carried out with DIP3 Intake air cleaner

After treatment
Stable idle (800-850rpm), also at warm engine
No more knocking sound at acceleration
Running remain stable when air-condition was activated

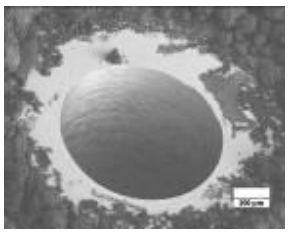
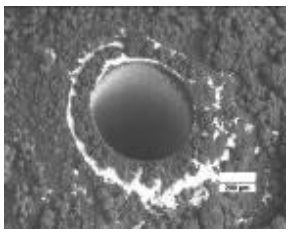
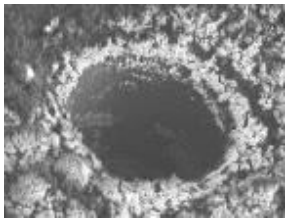
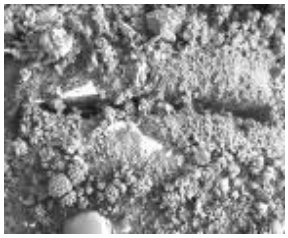
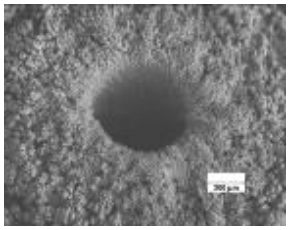
Motor testing

Tests have been carried out on 3 test engines with the tank treatment DIP3 Direct Injection Power 3.
The treatment was checked on the injector cleaning properties and compared with standard fuel and competitive products.

Test engine 1
Mitsubishi Carisma GDI®
1.8 litre 4 cylinder
Road test cycle:
7500 km
1/3 city traffic,
1/3 country road, 1/3 motorway

Test engine 2
2.0 litre 4 cylinder (Daimler)
Bench test cycle:
100 hours
CEC F-05-A-93
conditions (M102E- cycle)

Test engine 3
1.4 litre 4 cylinder (VW)
Bench test cycle:
100 hours
CEC F-05-A-93 conditions (M102E- cycle)

Results:	Engine 1	Engine 2	Engine 3
Wynn's DIP3 Direct Injection Power 3.			
Competitor 1			
Competitor 2 2