



Common Rail

Your local Delphi Distributor:

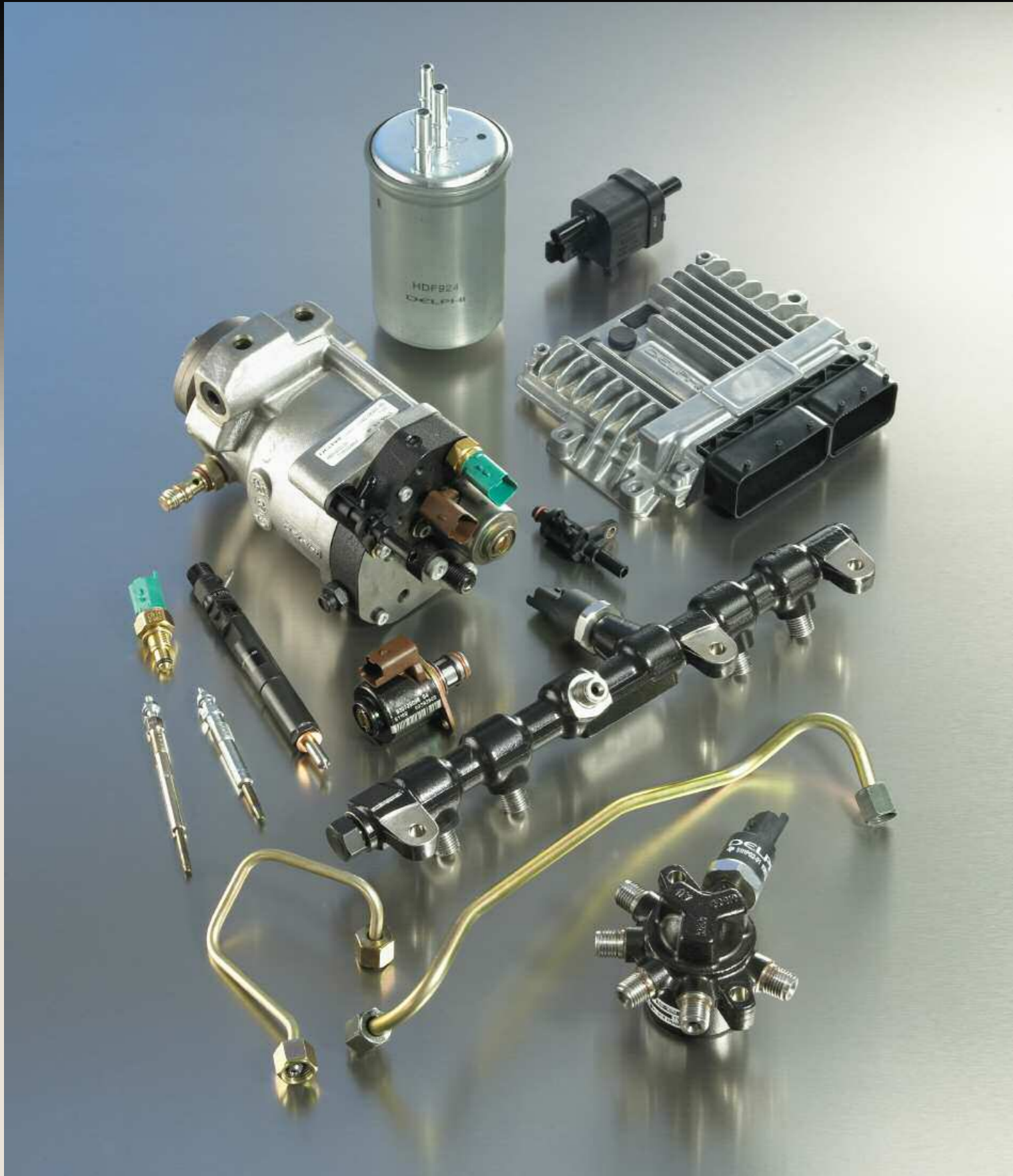


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DDSX451 (EN)



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Introduction to Common Rail

Common Rail is a fundamental change in diesel technology and it is happening now.

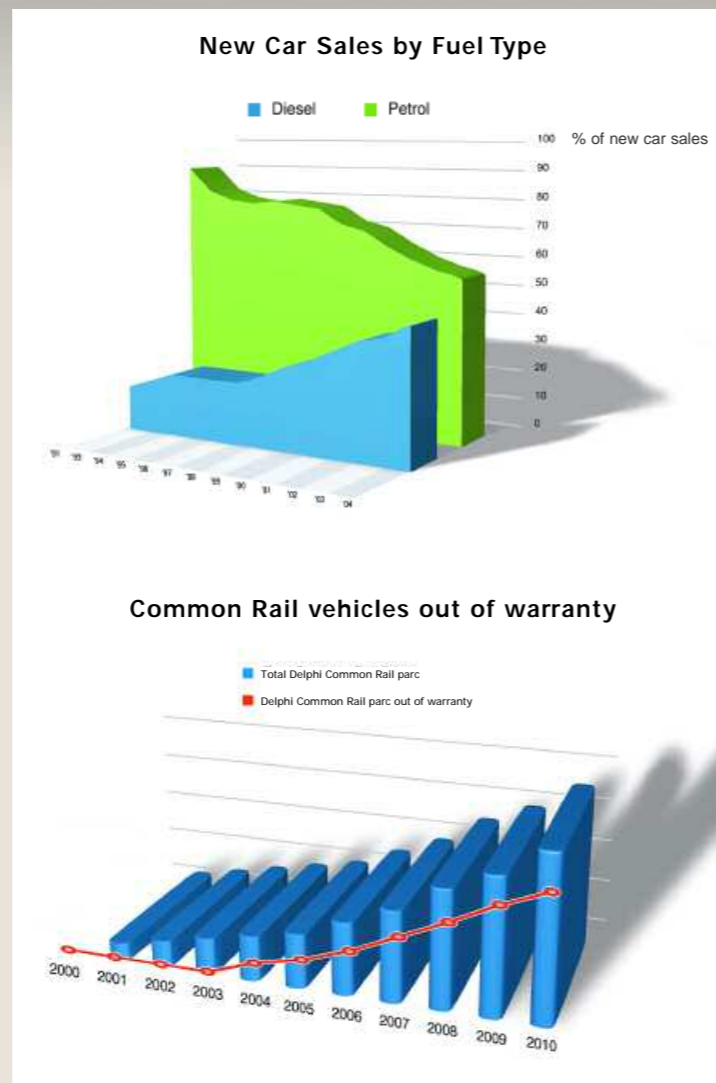
The modern direct-injection engine is a pre-requisite for new diesel-powered passenger vehicles across Europe. It is the only technology to address all planned European emissions legislation, whilst enhancing reliability, performance and fuel economy.

The number of diesel cars we see on our roads is constantly growing. In Europe alone, this growth is predicted to continue at an average rate of 10% per annum, with Common Rail systems growing by 35% per year.

Delphi's Common Rail

Delphi Diesel Systems has been involved in Common Rail technology from the beginning. Some of the very first systems were pioneered by Delphi with systems fitted to, among others, Ford, Jaguar, Renault, Peugeot-Citroen, Mercedes-Benz, Nissan, SsangYong, Kia and Hyundai applications. The number of vehicle manufacturers fitting Delphi's Common Rail systems continues to grow, with new contracts regularly being announced.

Delphi Diesel is committed to supporting vehicle manufacturers and the automotive aftermarket in harnessing this growing market, with total Delphi Diesel Common Rail parc expected to reach 14 million vehicles by 2011.



“Common Rail is the automotive technology of the future”

Euro Standard	Year of Introduction	Particulates FM g/km	Oxides of Nitrogen NOX, g/km
I	1992	0.14	0.97
II (DI)	1996	0.1	0.9
II (IDI)	1996	0.08	0.7
III	2000	0.05	0.5
IV	2005	0.025	0.25
V	2008	0.005	0.2

Emissions

With European emissions regulations for new light duty vehicles (cars and light commercial vehicles) getting tighter and tighter, it is imperative that the Common Rail system meets these requirements.

European emissions standards are evolving regularly and Delphi has always reacted accordingly to ensure that its Common Rail systems meet the latest requirements, and are in a position to be at the forefront of emission-controlled technology.

The current European emissions standard is Euro IV, with Euro V coming soon. The accompanying table shows movement through the European standards.

The Future

From the current environmental and market trends, it is easy to see why Common Rail technology is going to play a major part in the business of everyone involved in diesel vehicles.

Delphi has made a substantial investment in preparing its authorised distributors to deal with the new technology, both in new Common Rail product technology and in diagnostics, equipment and training. With increasing numbers of vehicles equipped with Delphi components coming out of warranty, this spells exciting opportunities in the future.

“Delphi is at the forefront of emissions-controlled technology”



The Delphi Common Rail System

A Common Rail engine is designed to supply constant fuel pressure to electronically controlled injectors, meaning the fuel supply is not dependant upon engine speed.

The system is made up of a number of components, with each performing a role that is vital to the overall running of the system. The high pressures (up to 2000 bar) inherent in Common Rail systems mean that any fault must be diagnosed and the faulty component replaced immediately. Failure to do so can result in prolonged damage to the system and engine.

The accompanying diagram depicts the layout of the Common Rail system and the placement of many of the components within it.

HIGH PRESSURE PIPE

Transports fuel at high pressure between pump and rail, rail and injectors, resistant to pressure changes and totally sealed from the outside world.



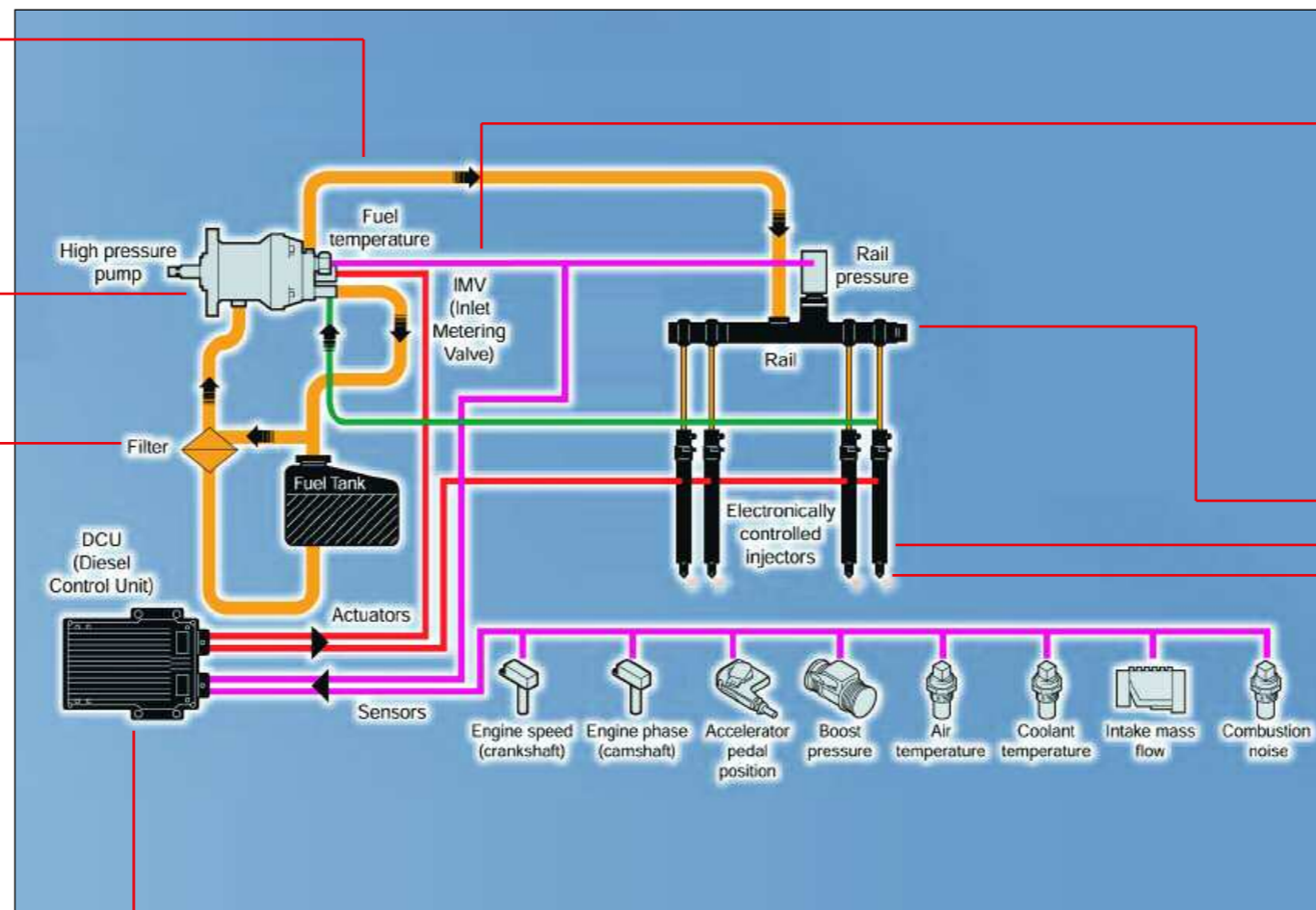
HIGH PRESSURE PUMP

The pump generates the high pressure. This then accumulates in the injection rail and is redistributed to the injectors via the HP pipe.



FILTER

Due to high injection pressures and small nozzle size of the Common Rail system, the cleanliness of the fuel is of even greater importance. The fuel filter traps particles down to as little as 2 microns.



DCU

The DCU is the 'brains'. It controls the functions of the Common Rail system, such as flow and advance and is used in diagnosis to determine faults within the system.



GLOW PLUG

Glow Plugs are critical to the smooth, efficient starting of diesel engines. They ensure sound cold engine performance and emissions control.



IMV

The IMV is used to control the pressure in the rail by regulating the amount of fuel sent to the pumping components of the high pressure pump.



RAIL

The rail is a high pressure accumulator. The HP sensor on the rail is used to transmit the pressure value in the rail to the DCU. This value is used to calculate the flow and injection advance.



INJECTORS

The injector is a vital component within the system, regulating the exact amount of fuel delivered into the combustion chamber. The precise opening and closing of the injectors is electronically controlled by electrovalves that are installed in each nozzle holder body.





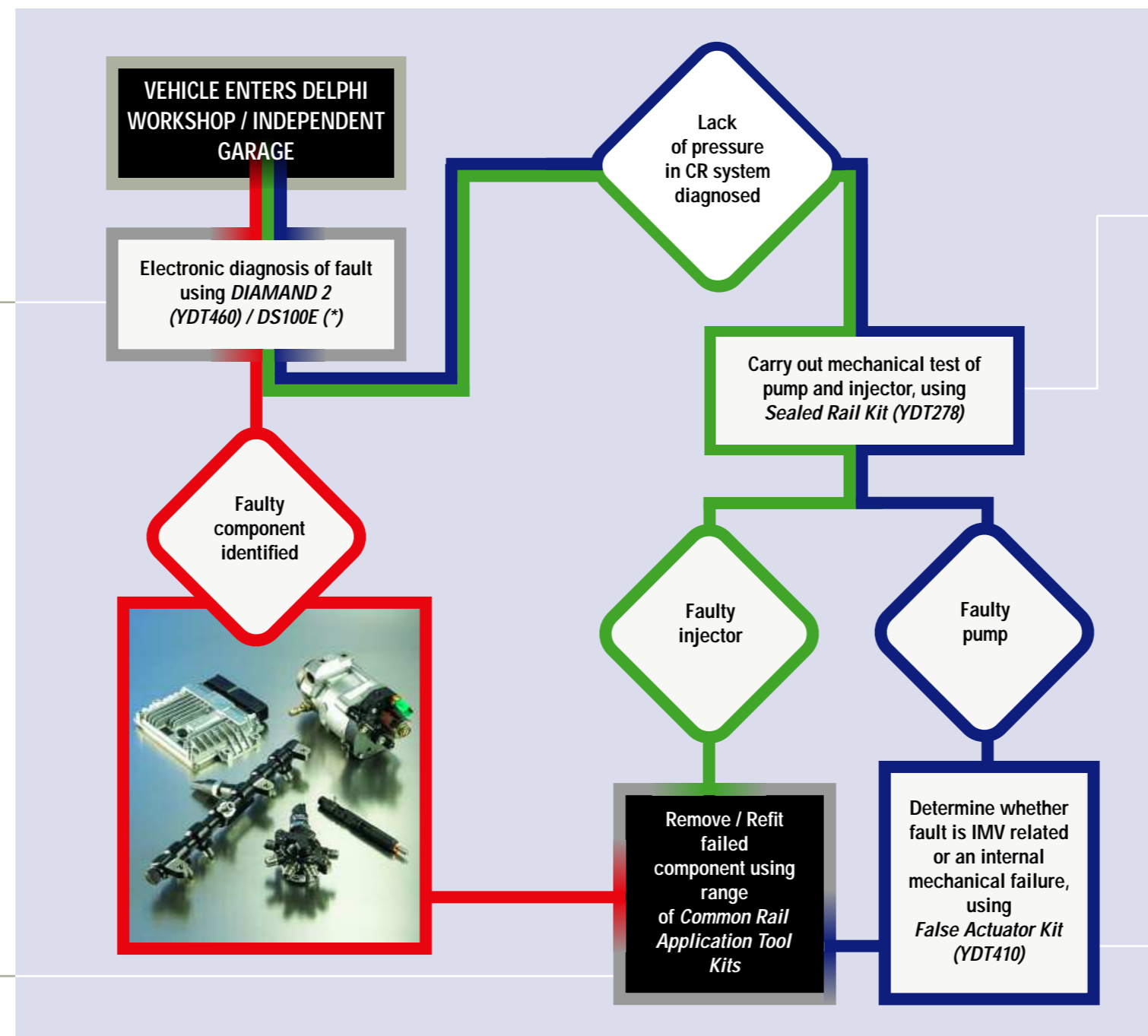
Diagnostic and Test Equipment

The introduction of Common Rail diesel injection systems has brought with it new requirements for diagnostics and vehicle servicing. As an OE Common Rail manufacturer, Delphi has met these challenges head-on by providing a dedicated range of diagnostics and tooling.

Delphi's suite of diagnostic tools ensures that technicians have the ability to interrogate the vehicle's electronic and mechanical systems in order to identify the faulty component. Delphi also provides a range of tools to ensure that the faulty component can be quickly removed from the vehicle and a replacement unit fitted.



Generic Tool Kit	YDT200
Renault K9 Kit	YDT201
Ford Lynx Kit	YDT202
Ford Puma Kit	YDT209
Kia / Hyundai Kit	YDT230
PSA DV4 Kit	YDT250
Ssangyong Kit	YDT381
PSA DW10B	YDT474



DS100E



*Please note that all Delphi CR applications are exclusive to DIAMAND 2 for the first 2 years after vehicle launch. DIAMAND 2 is available only to authorised Delphi Diagnostic Centres with the required clean room facilities.



Common Rail Pumps

The demand for reduced emissions and improved performance means that diesel fuel injection has come a long way since the rotary pump product of yesteryear. The Common Rail system has now put the new generation of diesel engines on a par with petrol engines.

A Common Rail engine is designed to supply constant fuel pressure to electronically controlled injectors through a shared fuel reservoir. This means that the fuel supply is not dependant on engine speed.

At the heart of the Common Rail system is the fuel pump. This is a vital component which generates the high pressure within the system. The pump receives the fuel from the tank via the filter, and then passes it under pressure to the rail, via a pipe.

Delphi Common Rail pumps are fitted to a number of OE applications including Ford, SsangYong, Mercedes-Benz, PSA and Renault.

“The pump is the heart of the Common Rail system”



Common Rail Injectors

The objective of the Common Rail injection system is to be able to control the advance, injection duration and pressure individually, in a way that manages the combustion perfectly – cylinder by cylinder – depending on the working conditions of the engine.

The Common Rail injector is a vital component within the system, regulating the exact amount of fuel that is delivered into the combustion chamber. The precise opening and

closing of the injectors is electronically controlled by electrovalves that are installed in each nozzle holder body.

Delphi Common Rail injectors are fitted to a number of the most popular vehicles of the world's largest vehicle manufacturers, including Renault, Ford and Kia.



Common Rail Filters

Due to the high injection pressures involved in a Common Rail system, the cleanliness of fuel is critical. One of the most important system components is the fuel filter which acts as the engine's first line of defence.

Effective filtration and diesel fuel conditioning are essential to protect the Common Rail fuel injection equipment from water and particle contamination. As little as 2 microns of dirt can completely wear out a fuel pump.

Delphi Diesel is at the forefront of Common Rail filter technology. Our latest range of highly sophisticated fuel filters has been

developed to remove particles down to the level of 2 microns. The range has been designed with enhanced features, ensuring customer demands for long life and improved performance continue to be met.

Delphi Diesel Common Rail filters are manufactured to stringent standards as imposed by the world's leading vehicle manufacturers.

To maximise optimum performance it is important to change the filter at the recommended VM service interval.

"Diesel filtration is the first line of defence"



Common Rail Glow Plugs

Glow Plugs are critical to the smooth, efficient starting of diesel engines. They ensure sound cold engine performance and emissions control.

High quality performance is vital in achieving the required starting temperatures quickly, without compromising the plug's durability.

The Delphi Diesel glow plug range is continually updated to keep it inline with market changes and customer requirements.

Our latest technology ceramic glow plugs offer improved durability and a lightweight design, with enhanced features allowing more efficient combustion.

The complete Delphi Diesel glow plug programme covers 98% of the European vehicle parc.



Filters and Glow plugs – Applications

Manufacturer Model	Engine	Engine code	BHP	Cyl	Date range	Emissions standard	Filter	Glow Plug
NISSAN CONT'D								
Micra	1.5 dCi	K9K272	65	4	10/03 →	Euro III	HDF907	HDS342
Micra	1.5 dCi	K9K272	82	4	10/03 →	Euro III	HDF907	HDS342
Note	1.5 dCi	K9K274	70	4	03/06 →	Euro IV	HDF944	-
Note	1.5 dCi	K9K276	85	4	03/06 →	Euro IV	HDF944	-
Primastar	1.9 dCi	F9Q-760	82	4	09/02 →	Euro III	HDF920	HDS342
Primastar	1.9 dCi	F9Q-760	100	4	09/02 →	Euro III	HDF920	HDS342
X-Trail	2.2 dCi	-	114	4	07/01 →	-	HDF523	-
X-Trail	2.2 dCi	-	136	4	12/03 →	-	HDF523	-
PEUGEOT								
206	1.6 HDi	DV6TED4	110	4	05/04 →	Euro IV	HDF939	HDS399
206	1.6 HDi FAP	-	109	4	05/04 →	-	HDF939	-
206 CC	1.6 HDi FAP	-	109	4	04/05 →	-	HDF939	-
307	1.6 HDi	DV6TED4	110	4	02/04 →	Euro IV	HDF939	HDS399
307	1.6 HDi FAP	-	109	4	02/04 →	-	HDF939	-
407	1.6 HDi	DV6TED4	110	4	05/04 →	Euro IV	HDF939	HDS399
407	1.6 HDi FAP	-	109	4	05/04 →	-	HDF939	-
407	2.7 HDi	-	204	6	10/05 →	-	HDF546	-
607	2.7 HDi	-	204	6	12/05 →	-	HDF546	HDS404
RENAULT								
Clio II	1.5 dCi	K9K710	55	4	06/01 - 12/04	Euro III	HDF907	HDS342
Clio II	1.5 dCi	K9K710	55	4	01/05 - 05/05	Euro III	HDF941	HDS342
Clio II	1.5 dCi	K9K700	65	4	06/01 - 12/04	Euro III	HDF907	HDS342
Clio II	1.5 dCi	K9K700	65	4	12/01 - 12/04	Euro III	HDF913(1)	HDS342
Clio II	1.5 dCi	K9K700	65	4	01/05 - 05/05	Euro III	HDF941	HDS342
Clio II	1.5 dCi	K9K700	65	4	01/05 - 05/05	Euro III	HDF938(1)	HDS342
Clio II	1.5 dCi	K9K700	65	4	01/05 - 05/05	Euro III	HDF946(1)	HDS342
Clio II	1.5 dCi	K9K704	65	4	06/01 - 12/04	Euro III	HDF907	HDS342
Clio II	1.5 dCi	K9K704	65	4	12/01 - 12/04	Euro III	HDF913(1)	HDS342
Clio II	1.5 dCi	K9K704	65	4	01/05 - 05/05	Euro III	HDF941	HDS342
Clio II	1.5 dCi	K9K704	65	4	01/05 - 05/05	Euro III	HDF938(1)	HDS342
Clio II	1.5 dCi	K9K704	65	4	01/05 - 05/05	Euro III	HDF946(1)	HDS342
Clio II	1.5 dCi	K9K702	82	4	06/01 - 12/04	Euro III	HDF907	HDS342
Clio II	1.5 dCi	K9K702	82	4	01/05 - 05/05	Euro III	HDF941	HDS342
Clio II	1.5 dCi	K9K712	100	4	01/04 - 12/04	Euro III	HDF907	HDS342
Clio II	1.5 dCi	K9K712	100	4	01/05 - 12/05	Euro III	HDF941	HDS342
Clio III	1.5 dCi	K9K768	68	4	06/05 →	Euro IV	HDF944	-
Clio III	1.5 dCi	K9K766	86	4	06/05 →	Euro IV	HDF944	-
Clio III	1.5 dCi	K9K	103	4	06/05 →	Euro IV	HDF944	-
Clio III	1.5 dCi	K9K764	106	4	06/05 →	Euro IV	HDF944	-
Grand Scenic II	1.5 dCi	-	100	4	01/04-12/04	Euro III	HDF915	HDS342
Grand Scenic II	1.5 dCi	-	100	4	01/05 →	Euro III	HDF943	HDS342
Kangoo II	1.5 dCi	K9K710	55	4	07/03-12/04	Euro III	HDF907	HDS342
Kangoo II	1.5 dCi	K9K710	55	4	01/05 →	Euro III	HDF941	HDS342
Kangoo II	1.5 dCi	K9K700	65	4	12/01 - 12/04	Euro III	HDF907	HDS342
Kangoo II	1.5 dCi	K9K700	65	4	12/01 - 12/04	Euro III	HDF913(1)	HDS342
Kangoo II	1.5 dCi	K9K700	65	4	01/05 - 05/05	Euro III	HDF941	HDS342
Kangoo II	1.5 dCi	K9K700	65	4	01/05 - 05/05	Euro III	HDF938(1)	HDS342
Kangoo II	1.5 dCi	K9K700	65	4	01/05 - 05/05	Euro III	HDF946(1)	HDS342
Kangoo II	1.5 dCi	K9K704	65	4	12/01 - 12/04	Euro III	HDF907	HDS342
Kangoo II	1.5 dCi	K9K704	65	4	12/01 - 12/04	Euro III	HDF913(1)	HDS342
Kangoo II	1.5 dCi	K9K704	65	4	01/05 - 05/05	Euro III	HDF941	HDS342
Kangoo II	1.5 dCi	K9K704	65	4	01/05 - 05/05	Euro III	HDF938(1)	HDS342
Kangoo II	1.5 dCi	K9K704	65	4	01/05 - 05/05	Euro III	HDF946(1)	HDS342
Kangoo II	1.5 dCi	K9K702	82	4	07/02 - 12/04	Euro III	HDF907	HDS342
Kangoo II	1.5 dCi	K9K702	82	4	01/05 →	Euro III	HDF941	HDS342
Kangoo II	1.5 dCi	K9K	68	4	06/05 →	Euro IV	HDF941	-
Kangoo II	1.5 dCi	K9K	84	4	06/05 →	Euro IV	HDF941	-
Master	2.2 dCi	G9T722	90	4	09/00 →	Euro III	HDF920	HDS396
Megane II	1.5 dCi	K9K722	82	4	11/02 - 12/04	Euro III	HDF915	HDS342
Megane II	1.5 dCi	K9K722	82	4	11/02 - 12/04	Euro III	HDF917(1)	HDS342
Megane II	1.5 dCi	K9K722	82	4	01/05 →	Euro III	HDF943	HDS342

Manufacturer Model	Engine	Engine code	BHP	Cyl	Date range	Emissions standard	Filter	Glow Plug
RENAULT CONT'D								
Megane II	1.5 dCi	K9K722	82	4	01/05 →	Euro III	HDF937(1)	HDS342
Megane II	1.5 dCi	K9K722	82	4	01/05 →	Euro III	HDF942(1)	HDS342
Megane II	1.5 dCi	K9K722	86	4	05/05 →	Euro IV	HDF943	HDS342
Megane II	1.5 dCi	K9K722	86	4	05/05 →	Euro IV	HDF937(1)	HDS342
Megane II	1.5 dCi	K9K724	86	4	-	Euro IV	-	HDS342
Megane II	1.5 dCi	K9K728	101	4	10/03 - 12/04	Euro III	-	HDS342
Megane II	1.5 dCi	K9K729	100	4	2003 →	Euro III	-	HDS342
Modus	1.5 dCi	-	65	4	10/04 →	Euro III	HDF944	HDS342
Modus	1.5 dCi	-	65	4	10/04 →	Euro III	HDF945(1)	HDS342
Modus	1.5 dCi	-	80	4	10/04 →	Euro III	HDF944	HDS342
Modus	1.5 dCi	-	80	4	10/04 →	Euro III	HDF945(1)	HDS342
Scenic II	1.5 dCi	-	82	4	01/02 - 12/04	Euro III	HDF915	HDS342
Scenic II	1.5 dCi	-	82	4	01/02 - 12/04	Euro III	HDF917(1)	HDS342
Scenic II	1.5 dCi	-	86	4	2005 →	Euro III	HDF943	HDS342
Scenic II	1.5 dCi	-	86	4	2005 →	Euro III	HDF937(1)	HDS342
Scenic II	1.5 dCi	-	86	4	2005 →	Euro III	HDF942(1)	HDS342
Scenic II	1.5 dCi	-	101	4	01/02 - 12/04	Euro III	HDF915	HDS342
Scenic II	1.5 dCi	-	106	4	2005 →	Euro III	HDF943	HDS342
Thalia	1.5 dCi	-	65	4	12/01 - 12/04	Euro III	HDF907	HDS342
Thalia	1.5 dCi	-	65	4	12/01 - 12/04	Euro III	HDF913(1)	HDS342
Thalia	1.5 dCi	-	65	4	2005 →	Euro III	HDF941	HDS342
Thalia	1.5 dCi	-	65	4	2005 →	Euro III	HDF938(1)	HDS342
Thalia	1.5 dCi	-	65	4	2005 →	Euro III	HDF946(1)	HDS342
Trafic	1.9 DCi	F9Q762	82	4	01/01 →	Euro III	HDF920	HDS342
Trafic	1.9 DCi	F9Q760	101	4	01/01 →	Euro III	HDF920	HDS342
SSANGYONG								
Kyron	2.7 Xdi	D27DT	165	5	2006 →	Euro III	HDF924	-
Rexton	2.7 Xdi	D27DT	165	5	08/03 →	Euro III	HDF924	HDS377
Rexton	2.7 Xdi	D27DT	165	5	08/03 →	Euro III	HDF925	HDS377
SUZUKI								
Jimny	1.5 DDiS	K9K262	65	4	01/04 →	Euro III	HDF907	-
Jimny	1.5 DDiS	K9K262	65	4	01/04 →	Euro III	HDF913(1)	-
TATA								
Indica	1.4 D	DICOR	69	4	08/06 →	Euro IV	HDF924	-
Indigo	1.4 D	DICOR	69	4	08/06 →	Euro IV	HDF924	-
Marina	1.4 D	DICOR	69	4	08/06 →	Euro IV	HDF924	-
Safari	3.0 D	BS2 DICOR	115	4	01/05 →	Euro III	HDF924	-
VAUXHALL								
Monovan	2.2 Dti	G9T-720	90	4	09/00 →	Euro III	HDF920	HDS396
Vivaro	1.9 Dti	-	-	4	-	Euro III	HDF920	HDS342
VOLVO								
S40	1.6 D	DV6TED4	110	4	11/04 →	Euro IV	HDF939	HDS399

(1) WITH WATER SENSOR FOR EXPORT

Filter application detail is available in Delphi's Filter Elements catalogue (DDCX100B)



Common Rail HP Pipes

“Always fit a new pipe when one is removed”

The Common Rail High Pressure (HP) pipe is made up of a formed pipe with sealing interfaces at both ends with fastening screws or nuts.

The pipe assembly transports fuel at high pressure between pump, rail and injectors, remaining completely sealed and resistant to pressure changes.

The assembly provides a minimum pressure loss against all internal and external influences, such as temperature, corrosion, and engine fluids. It is designed to retain its functional characteristics throughout its working life.

Despite its apparent strength, Delphi strongly recommends that a new pipe assembly is fitted as a result of any system intervention that requires the removal of a pipe. An example of this is the Delphi Sealed Rail kit (YDT278), which requires the pump to rail HP pipe to be removed.

When a pipe is fitted, the end deforms to create a tight seal. Upon removal, the pipe end retains this deformed shape and if refitted, it cannot be guaranteed that the seal will be maintained – a potentially dangerous situation considering the high pressures inherent in Common Rail systems. Fitting a new pipe assembly also ensures the essential high levels of system cleanliness.

The Sealed Rail kit is an All-Makes tool, and recognising the need to offer our customers a complete solution, Delphi has developed a range of Common Rail HP pipes providing application coverage for Bosch, Siemens and Denso Common Rail systems.

Delphi pipes are fitted to a number of OE applications, including SsangYong, Ford and Kia. Delphi will continue to develop the total range in order to offer our customers the largest possible vehicle coverage of HP pipes.



Other Common Rail Products

“Common Rail technology will play a major part in the business of everyone involved in diesel”

Inlet Metering Valve (IMV)

The inlet metering valve, (IMV) is used to control the pressure in the rail. The IMV receives a signal from the DCU which regulates the amount of fuel delivered to the high pressure chamber in the pump, thereby providing rail pressure control.

Temperature Sensor

The fuel temperature sensor is mounted to the pump. Its role is to monitor the fuel temperature inside the pump and make the data available to the DCU, thereby preventing excessive fuel temperatures.

Venturi

The venturi is designed to optimise injector performance. It is fitted to the fuel low pressure outlet of the pump and provides a negative pressure to the injector back leakage circuit.

Protection Caps Kit

The protection caps kit enables inlet and outlet connections to be plugged when there is a system intervention. For example, when removing an injector pipe, the caps will be used to close off the rail, injector and pipe to assist in ensuring absolute cleanliness is maintained at all times.

DCU

The DCU is the 'brains'. It controls the functions of the Common Rail system, such as flow and advance, and is used in diagnosis to determine faults within the system.

Other Filter Components

There is a wide range of other filter components helping to ensure the Common Rail system works smoothly. These include fuel heaters and brackets.



Notes

Lined area for notes

A Diesel Additive that actually works!

From the people who actually know.

To ensure that your customer's fuel injection system delivers the performance they expect we have developed Delphi Diesel +, a range of fuel system conditioners. Incorporating Texaco fuel technology, these conditioners enhance the fuel's ability to clean, protect and restore, thereby improving engine performance and reducing emissions.

For more information call Delphi Diesel on 01926 472 900, email at dds.enquiries@delphi.com or visit www.dieselaftermarket.delphi.com



Engine Management

Diesel

Diagnostics

Technical Support

Service

Incorporating Texaco Fuel Technology 