2006 Ford LCF (Low Cab Forward) Vehicle Overview

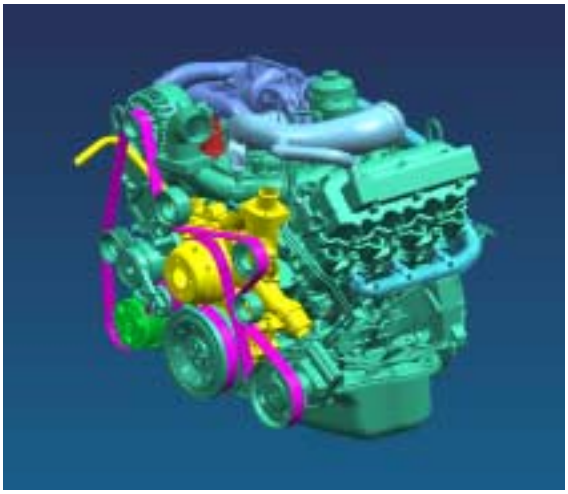
The LCF is an all new platform for Ford Motor Company that will be available in Class 4 & 5. The competition is Isuzu's LCF which currently controls a 75% share of the LCF market. Ford's LCF has Best-in-Class maneuverability with the segment's tightest turning diameter and a segment exclusive V6 diesel with 200hp and 440 lb-ft of torque along with the segment's strongest frame. There are numerous configurations to choose from:

- Four axle-to-frame lengths
- Five cab-to-axle lengths
- Five wheelbases (113", 137", 149", 167", 185")

The tilting front cab to allow ease of powertrain service.

The cab is based on the Mazda J29 Trader Cab sold in Japan with changes to Mazda Trader cab electrical architecture, a modified front frame x-member for cab hinge mounting, revised J29 doors to accommodate new side mirrors, modified cab steps integrated into wheel lip, fixed and interval wiper control with wet arm washer fluid delivery. The driver and passenger high-back seats with integral head restraint along with a center 3rd seat. The standard trim standard package includes vinyl seats, hand crank windows, manual locks, vinyl floor covering, full-length, extra deep overhead storage bin. Options include air conditioning, chrome grille, back up alarm and a trim upgrade package (cloth seats, power windows/locks).

Engine, Transmission & Driveline



Power Stroke Engine – 4.5L Power Stroke ® V6 Turbo Diesel

The Ford LCF's engine is the new 4.5 liter V6 turbo Power Stroke ® with 200 hp and 440 lb-ft torque in front of the Torqshift ™ 5-speed transmission with the overdrive with PTO option. The LCF has a floor-mounted shift control with tow haul activation button. The engine is available with a optional block heater. The ECM, IDM and TCM are located under the same electrical distribution box. The rear axle is a rear single-reduction with 160 wheel ends (same as F550). The standard fuel tank is a 40 gallon (aft of axle & between frame rails –same as the Super Duty aft-axle tank). The optional fuel tank configuration is a single 35 gallon LH or RH mounted tank or dual 35 gallon LH & RH mounted tanks (no aft of axle tank).

New 4.5L Power Stroke Essential Special Service Tools (ESST)

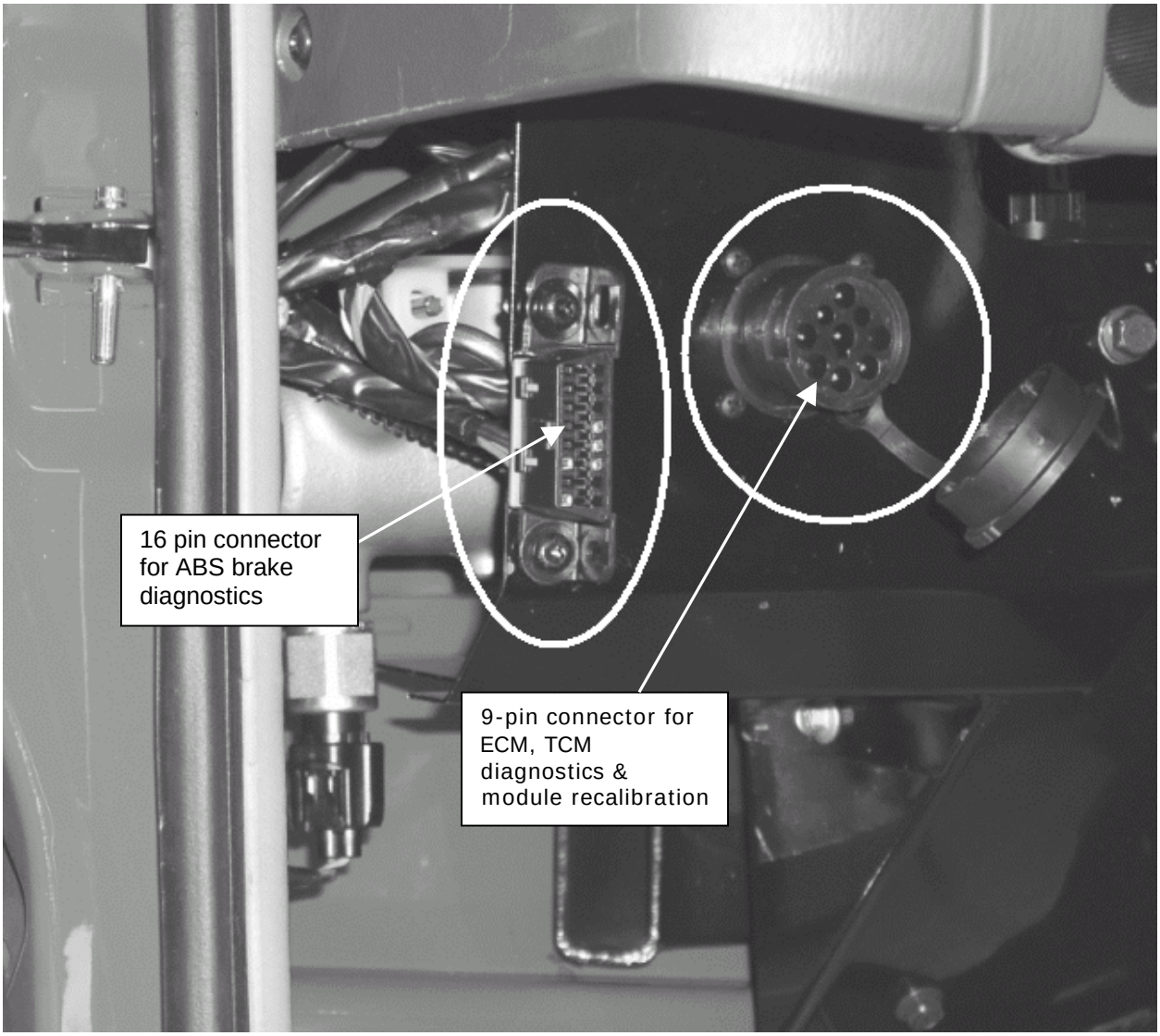
- turbo crossover tube seal removal & installation tool
- cylinder head lifting bracket
- exhaust gas recirculation (EGR) valve puller arm used with existing 6.0L tool set
- front seal installer
- balance shaft, camshaft, crankshaft timing pin
- charge air cooler test plugs
- injection control pressure (ICP) test adapter kit
- fuel pressure inlet restriction test adapter
- fuel pressure test adapter
- oil/fuel pressure test coupling
- high fuel pressure supply tube removal tool
- crankcase pressure test adaptor
- main power relay breakout harness
- exhaust gas recirculation (EGR) valve test breakout harness
- 4.5L engine mass air flow (MAF) sensor test breakout harness

New Engine & Transmission Control Module Diagnostic Cable

For the LCF engine and transmission diagnostics, a new WDS diagnostic cable is required. This cable can also be used to diagnose the F650/750 models. The Rotunda tool number for this is 418-D553A.

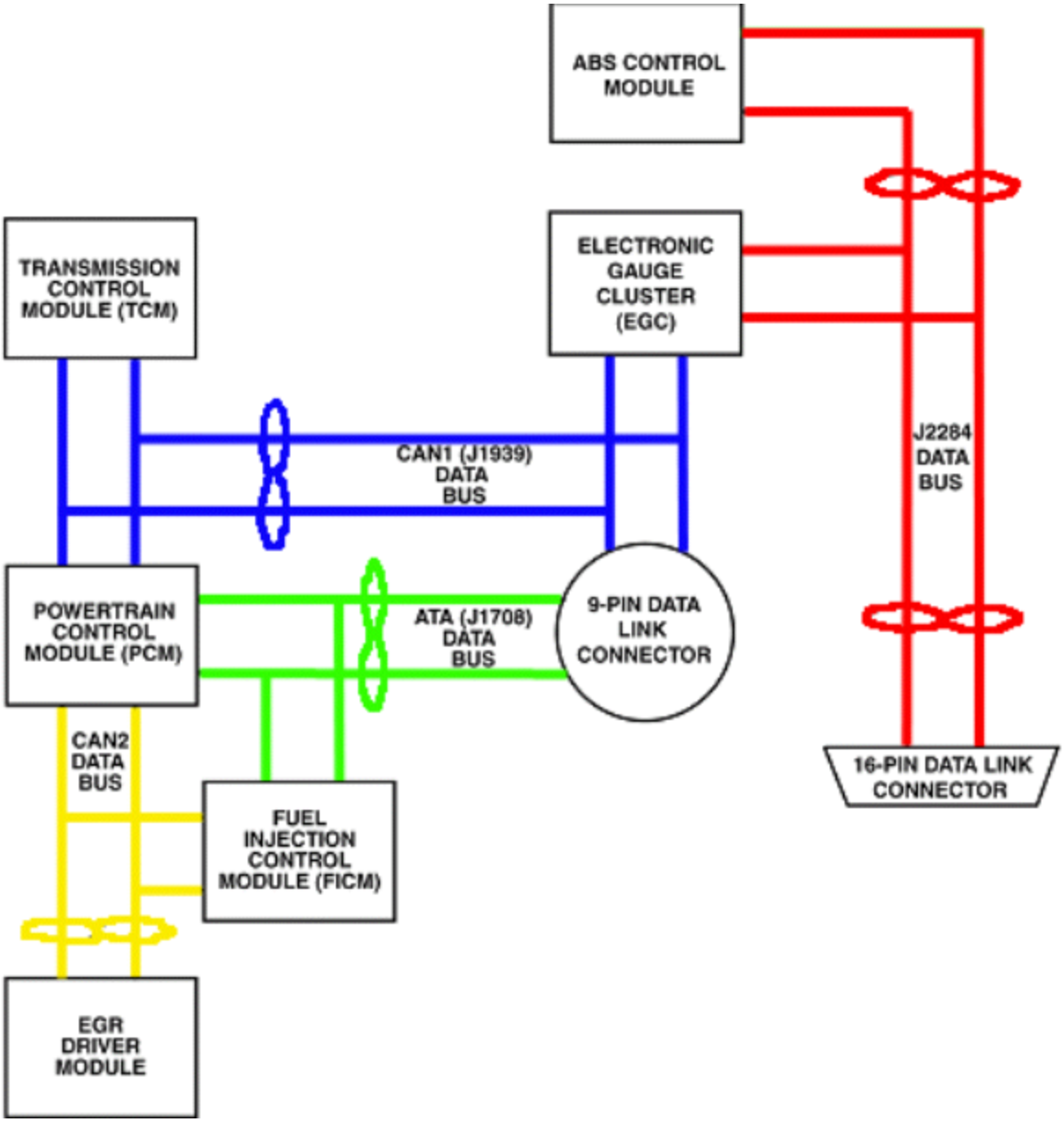
Diagnosing the LCF is similar to diagnosing the F650/750. The Master Diagnostics "MD Truck" software when loaded into the WDS operates with when connected to the 9-pin ATA (Deutsch) connector. The same diesel engine control outputs can be tested on the 4.5L as the 6.0L engine using the WDS/MD truck functions, for example; fuel injectors, glow plugs and turbocharger control valve. The NETS function in MD Truck is also the same, facilitating reprogramming of an PCM/ECM or FICM. As with the F650/750, NETS is used to GET, SEND, RECEIVE and PROGRAM.

Diagnostic Connectors



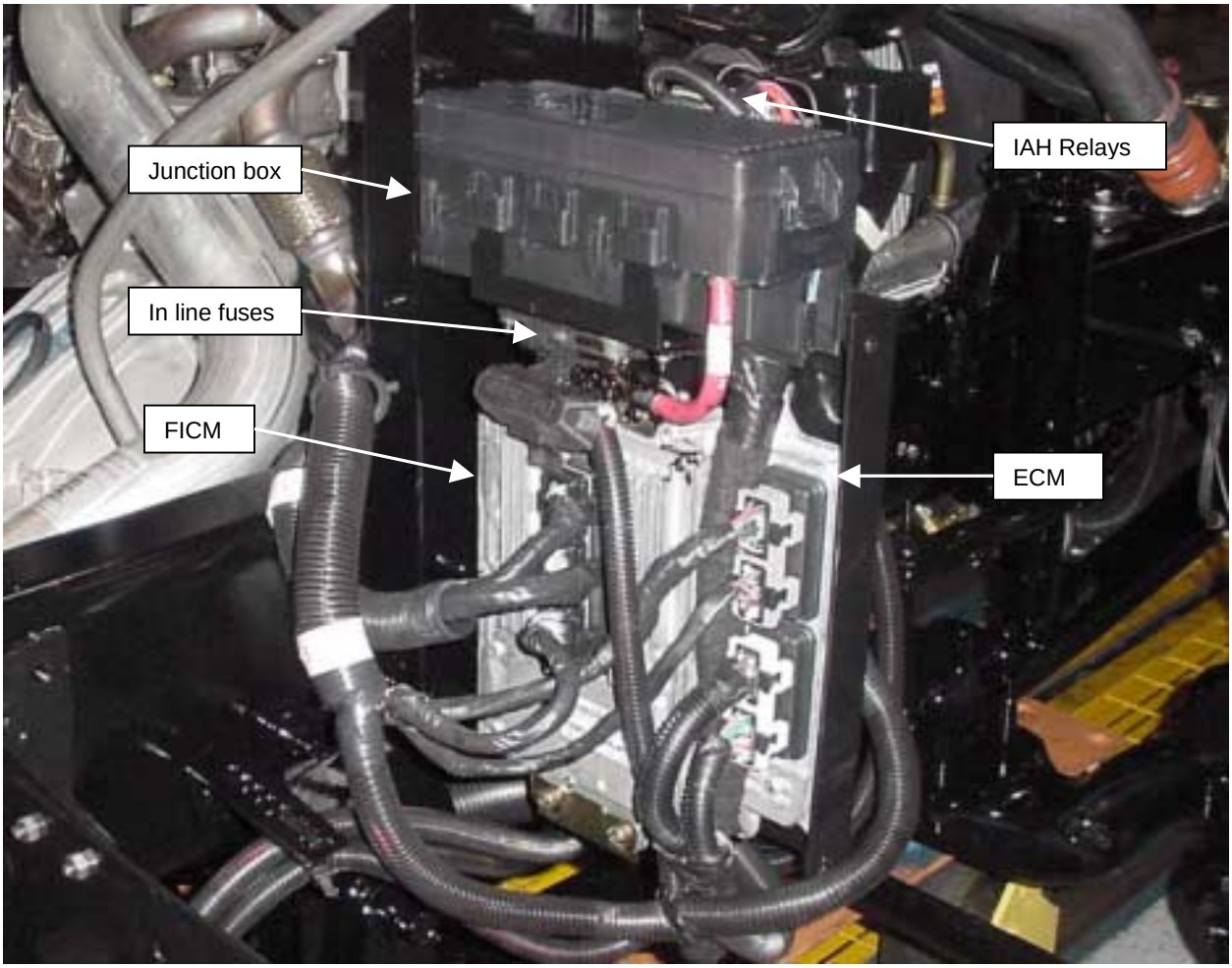
Two diagnostic connectors are used for vehicle diagnostics; the 9-pin connector for ECM, TCM diagnostics and module recalibration. The 16 pin connector is used for ABS brake system diagnostics.

Ford LCF Communication Network



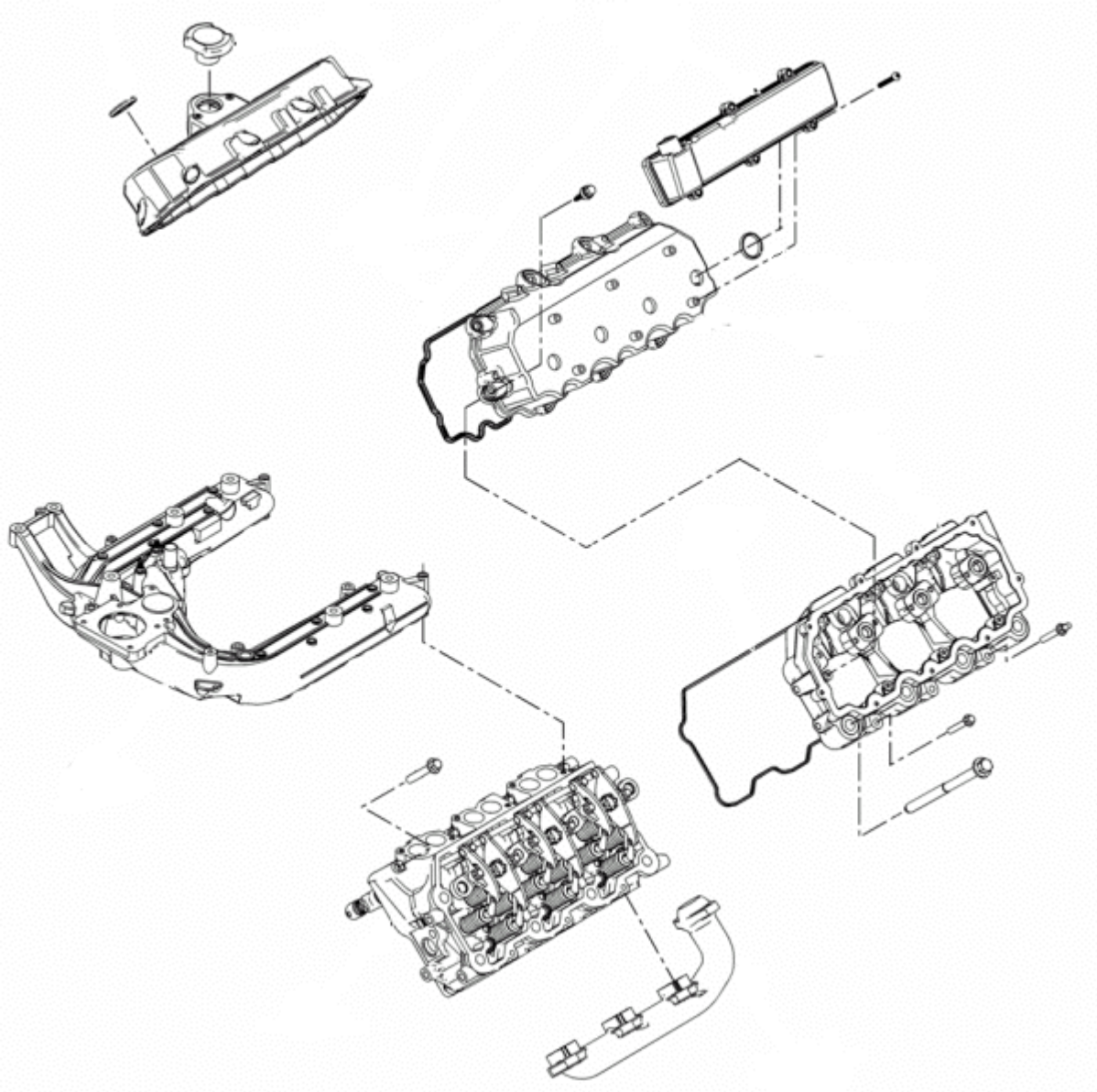
The CAN 1 (J1939) network allows the PCM to communicate with the TCM, instrument panel and the scan tool. The 9-pin connector is located on the J1939 network. The J2284 network allows the ABS to communicate with the instrument cluster and the scan tool. The 16-pin connector is located on the J2284 network. The J1708 network also connects to the 9-pin connector to allow module programming.

Power Distribution Center (PDC)



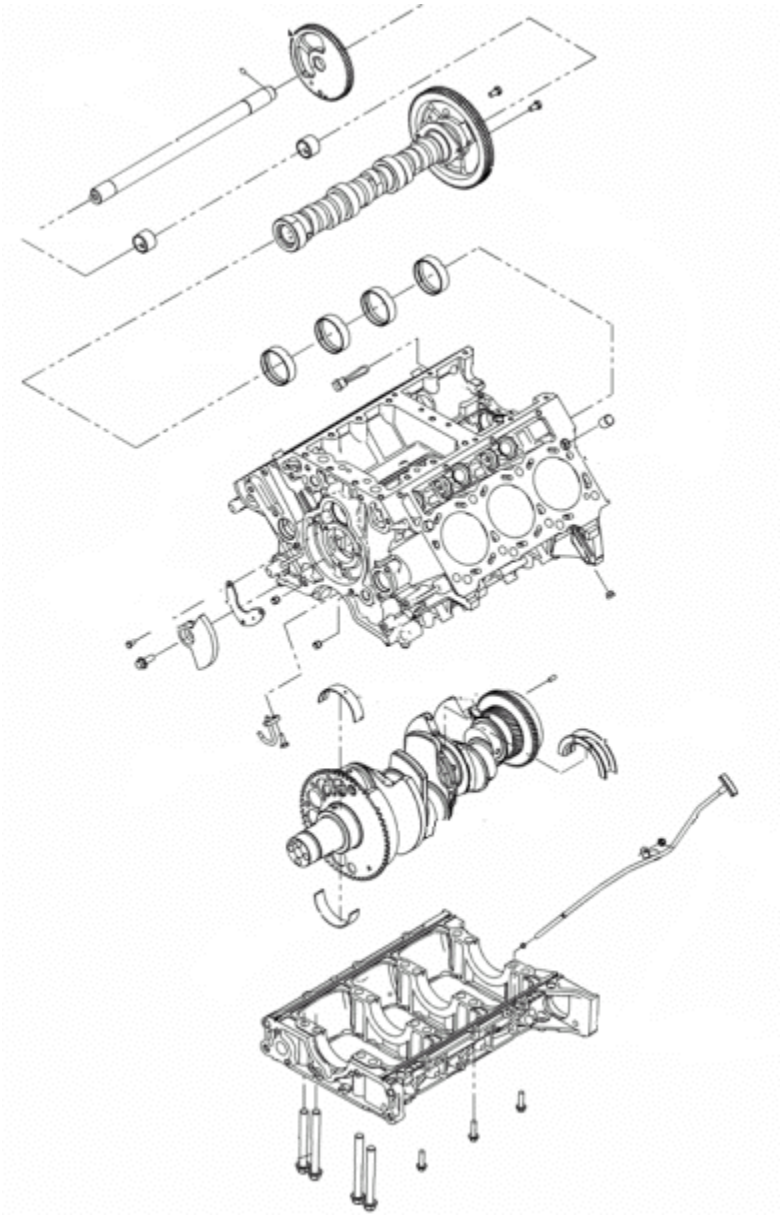
The Power Distribution Center (PDC) is located behind the right side of the cab. The center includes the battery junction box, PCM, FICM, EGR driver module (located on the back side of the PDC), Intake air heater (IAH) relays, Glow plug relay and in-line fuses 1 and 2.

Upper Engine



The cylinder head has four valves per cylinder for improved air flow. Each fuel injector is centrally located between the four valves and directs fuel over the piston bowl for improved performance and reduced emissions. The overhead valve activation includes self adjusting hydraulic roller cam followers, push rods, rocker arms, and dual intake and exhaust valves that open using a valve bridge.

Lower Engine



The crankcase is a two piece design. The lower crankcase housing has integral main bearing caps. Coolant and oil passages are cast and machined in the crankcase and front cover housing.

The crankshaft has four main bearings with fore and aft thrust controlled by a thrust bearing on the third main bearing. The connecting rods are attached to each crankshaft rod journal. Piston pins are free floating and held in place with retaining rings.

The camshaft is supported by four insert bushings pressed into the crankcase. The crankshaft gear drives the camshaft gear.

Camshaft thrust is controlled with the rear surface of the fourth cam journal and the cam gear.

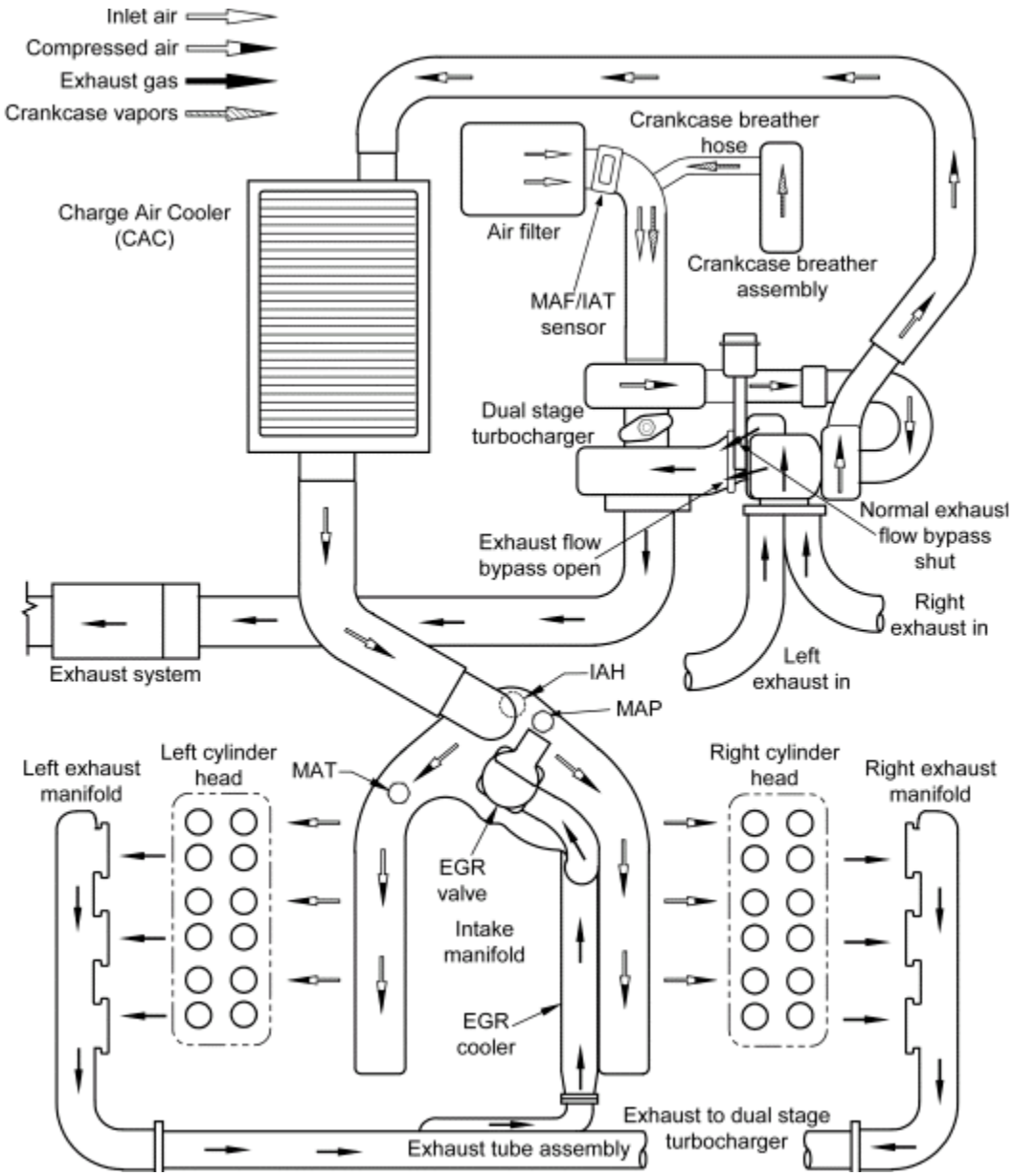
The primary balancer shaft turns inside the camshaft. The balance shaft is driven by the crankshaft flange on the rear of the engine. The primary balancer counterweight is on the front of the balance

shaft held on with the thrust-primary plate. The thrust plate aligns and holds the front end of the balance shaft in the crankcase.

One piece aluminum-alloy pistons are fitted with one keystone ring, one rectangular intermediate compression ring, and a two piece oil control ring. The combustion bowl is located in the piston crown to reduce emissions. All pistons are mated to fractured cap joint connecting rods.

The optional coolant heater raises the temperature of coolant surrounding the cylinders for improved performance during start-up.

Air Management System



The Air Management System includes the following:

- Air filter assembly
- Dual stage turbocharger with pneumatic actuator
- Charge Air Cooler (CAC)
- MAF/IAT sensor
- MAP sensor
- Intake manifold
- Intake valves
- Exhaust Gas Recirculation (EGR) system
- Exhaust valves
- Exhaust manifolds
- Exhaust tube assembly
- Catalytic converter

Air flow within the Air Management System

All inlet air is drawn through the air filter assembly past the MAF/IAT sensor through the air inlet duct. Crankcase vapors are recycled and mixed in the air stream. The air mixture that is drawn to the low pressure compressor is compressed and discharged to the high pressure compressor.

The high pressure compressor compresses the discharge air at a high pressure, temperature, and density before it enters the Charge Air Cooler (CAC). Discharge air flows through CAC. Outside air flows over the CAC tubes and fins to cool the compressed air. Air flows from the CAC through the intake manifold and intake valves to the engine cylinders. During startup, an inlet air heater in the intake manifold warms the inlet air. The inlet air heater relay controls the inlet air heater element. After combustion, hot exhaust gas is forced through the exhaust manifolds to the EGR cooler and the turbocharger.

Some hot exhaust gas is cooled in the EGR cooler and flows through the EGR valve back through the intake manifold to mix with incoming filtered air.

The rest of the hot exhaust gas expands and flows to the turbocharger high pressure turbine, spinning the high pressure turbine wheel. Exhaust continues to flow to the low pressure turbine, spinning the low pressure turbine wheel, then exits from the turbocharger outlet to the engine exhaust pipe. Exhaust flows through the exhaust piping, muffler and catalytic converter and out the exhaust pipe.

Dual-Stage Turbocharger

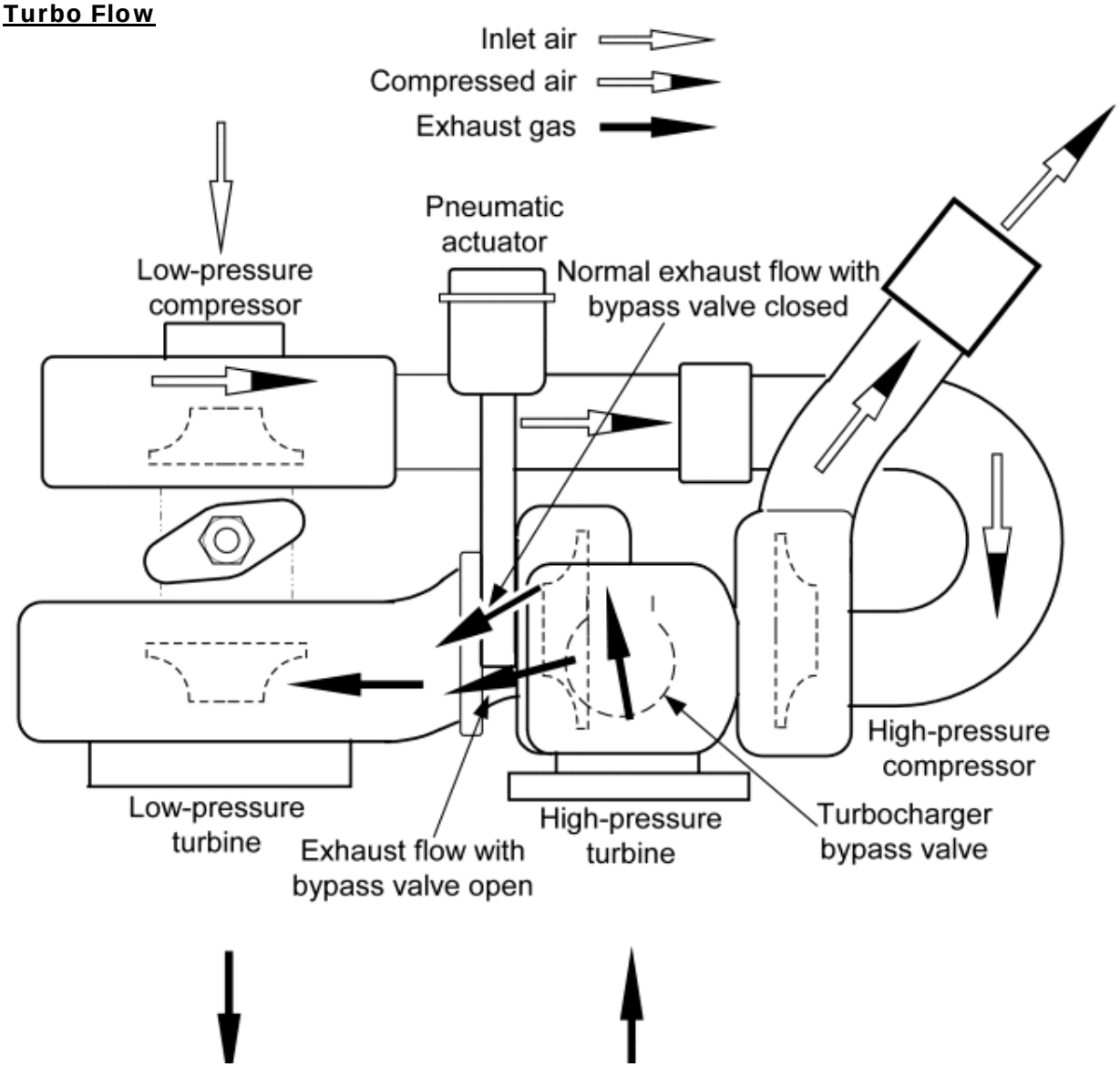
The dual-stage turbocharger used on the Powerstroke V-6 falls under the heading of dual regulated turbocharger. As with all turbocharger systems, the main objective is to increase the power output of the engine by supplying compressed air to the engine.
By compressing the air, the engine is capable of delivering more mass airflow for the same volumetric displacement of the engine. The turbocharger gets its energy from hot exhaust gases produced during the combustion process.

The hot exhaust gases are expanded in the turbine housing of the turbocharger, spinning the turbine wheel and shaft to speeds over 100,000 rpm. The other end of the shaft is connected to a compressor wheel. The compressor wheel spins inside a compressor housing, boosting inlet air pressure up to three times that of ambient conditions.

Dual turbochargers work by having one turbocharger feeding into the second, thus enabling both turbochargers to work in series resulting in increased boost and airflow capacity of the engine. The smaller of the two turbochargers is designated as the high-pressure turbocharger. It is sized to generate boost and airflow for low to medium speeds and loads.

The larger turbocharger is called the low-pressure turbocharger. It is sized to work in tandem with the smaller high-pressure turbocharger to provide boost and airflow needed for sustained high speed, high load conditions. To better understand how the two turbochargers work, it is better to first consider the path of the exhaust gases and then the path of the compressed fresh intake air charge.

Turbo Flow



Exhaust gases flow from the exhaust manifolds and spin up the high-pressure turbine first. After exhaust gases have expanded through the high-pressure turbine, they exit and enter the low-pressure turbine. The low-pressure turbine is driven with energy not consumed by the high-pressure turbine. Exhaust gases finally exit the low-pressure turbine and flow out the exhaust system.

As speed and load conditions increase, engine ambient air and exhaust gas flow increase. The high-pressure turbine eventually reaches a condition at which it can no longer efficiently discharge all of the exhaust flow. A bypass valve is setup to open at this time and divert some of the excess gas flow directly into the low-pressure turbine.

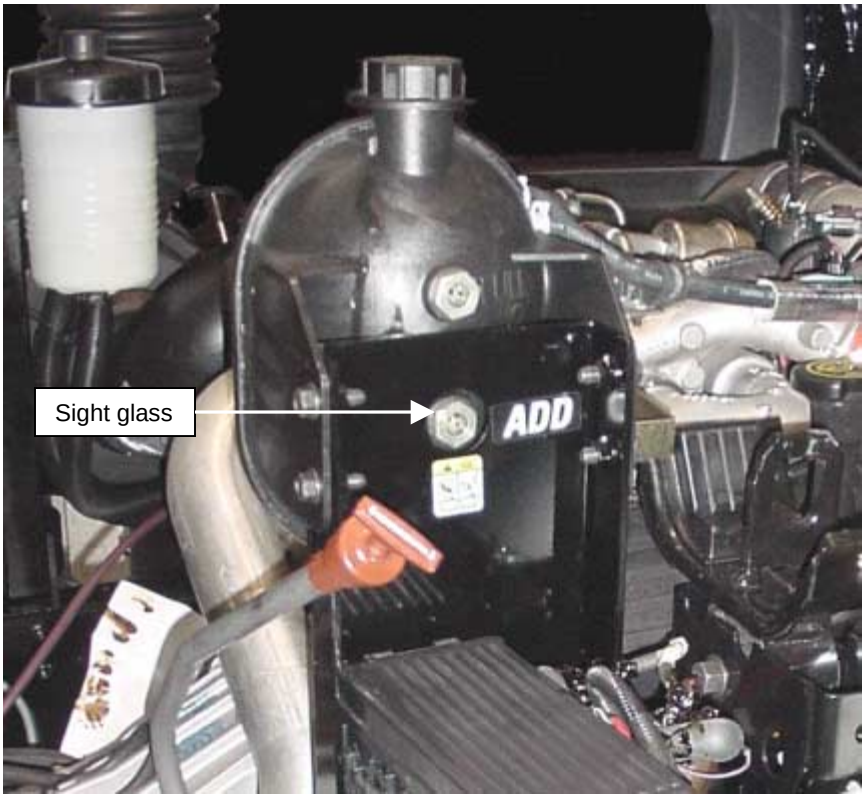
At this point, the low-pressure turbine sees an increase in exhaust energy and begins to take on the job of boosting inlet air pressure to keep pace with increasing engine load demands.

Diverting exhaust flow from the turbine is similar to conventional wastegate turbochargers. The big difference with this configuration is that exhaust gases are diverted around the high-pressure turbine and is channeled into the low-pressure turbine, making use of heat energy that would otherwise be vented to the atmosphere. This Exhaust Gas bypass Control valve (EGC) is a rod actuated diaphragm that is pushed open pneumatically with boost pressure.

Cab-Mounted Intake Air Snorkel & Air Filter Housing

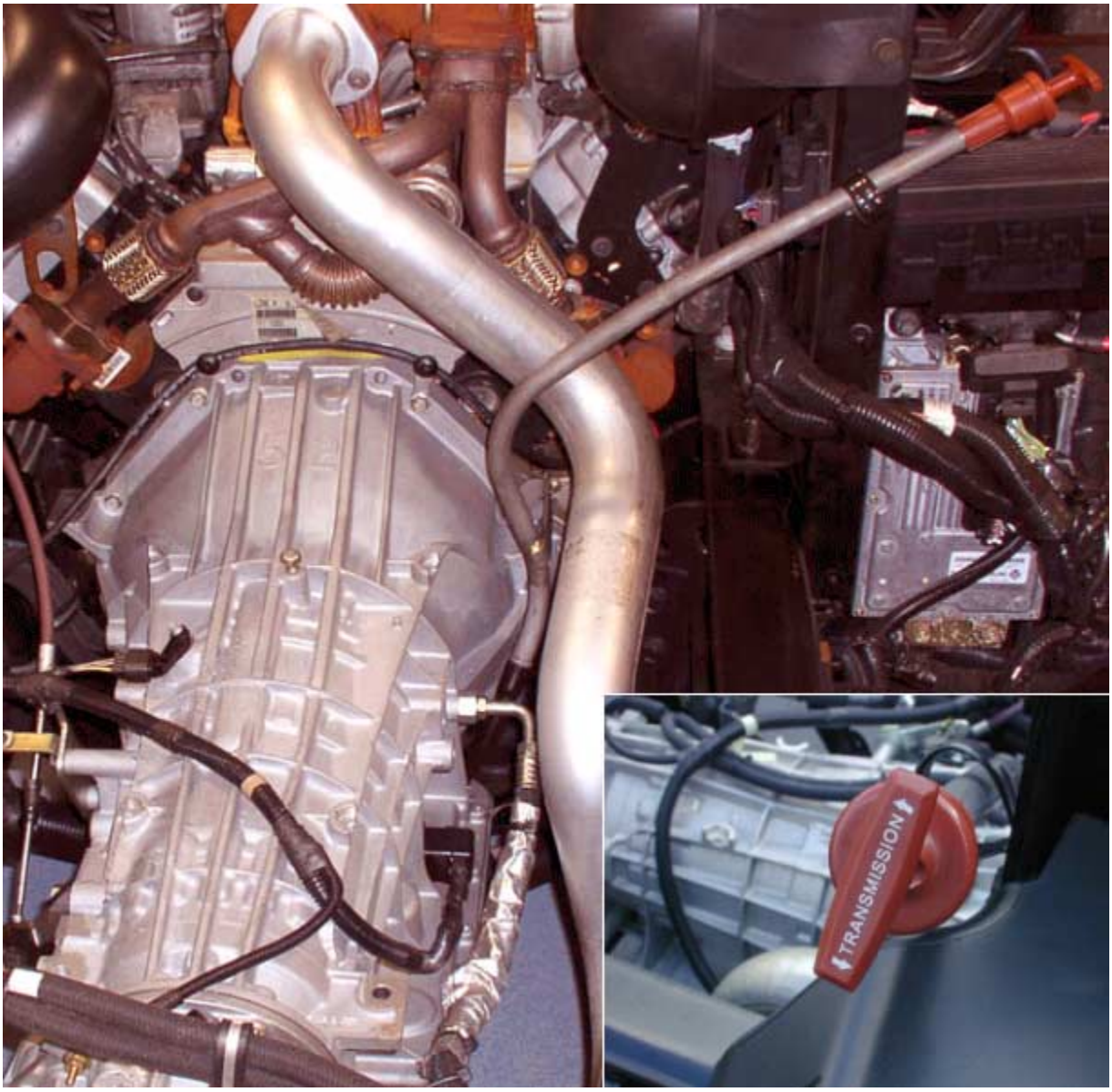
The cab-mounted intake air snorkel that couples with the air filter housing. A 11-inch diameter cylindrical air filter cartridge removes dirt from intake air before it passes to the engine. There is also a filter minder on the housing that alerts the operator when the filter is becoming restricted, however it is no warning light in the instrument cluster. This is strictly a visual indicator on the air filter housing.

Engine Coolant Reservoir



The engine coolant reservoir is located directly behind the cab. The coolant level is checked using the sight glass on the side of the reservoir.

Torqshift Transmission



Mercon SP ATF is only the transmission fluid recommended. The transmission oil dipstick and fill tube are located behind the cab and requires ¼ turn to remove and install.

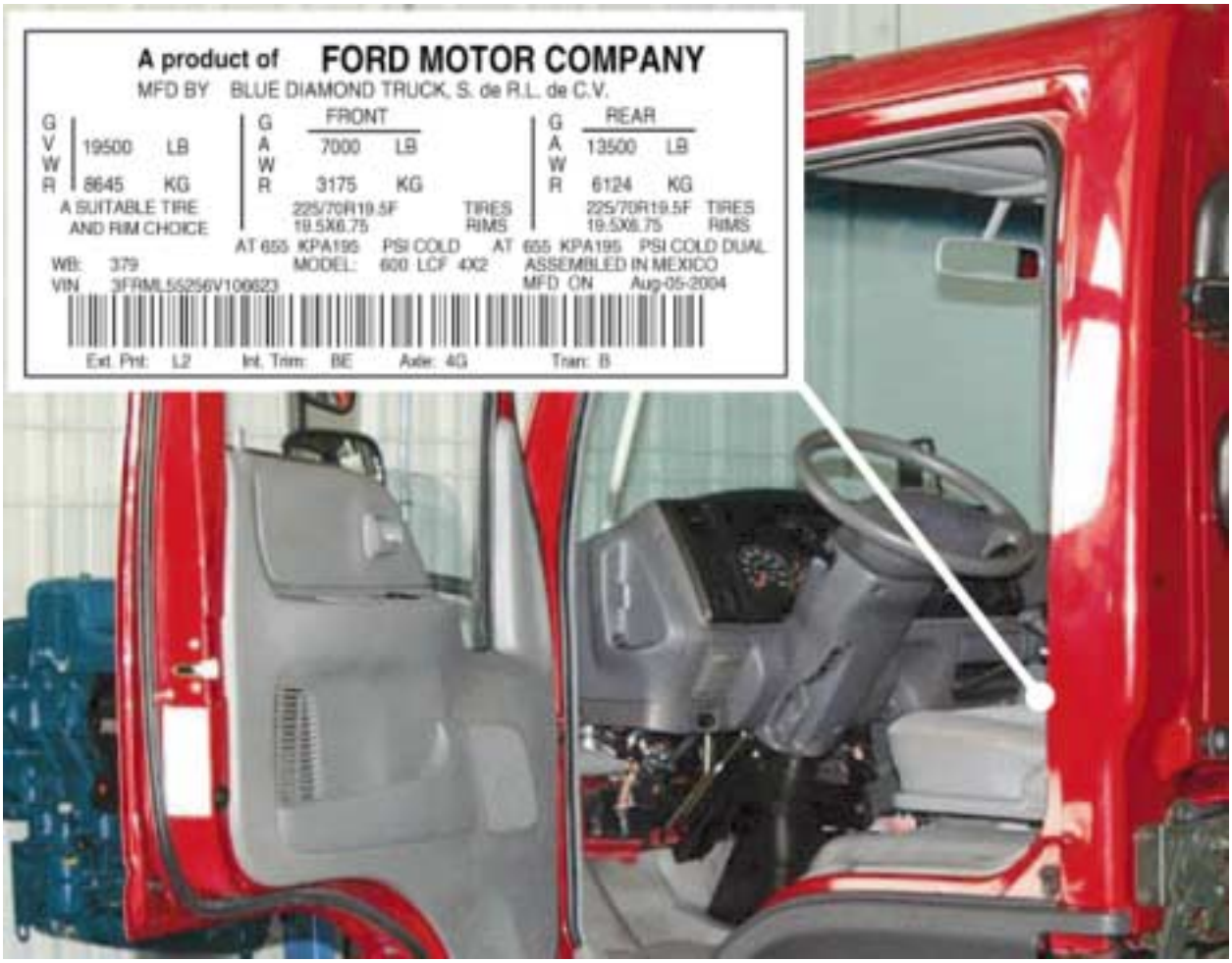
Body/Chassis/Electrical

Five wheelbases are available (see chart below). The suspension has 6,000 lb. front springs and 11,000 lb. rear springs with front and rear stabilizer bars. The chassis/frame is Huck-bolted. The braking system is a hydro boost system with 3-channel ABS (front & rear disc brakes/wheel ends are the same as F550). The ABS system is similar to the 3 channel system used on the F Super Duty. The steering system uses a steering gear that is similar to the F450/550. The front bumper includes two front tow hooks. The wheels are 19.5" steel with optional polished aluminum wheels. An optional trailer tow prep package is also available.

Wheelbases available

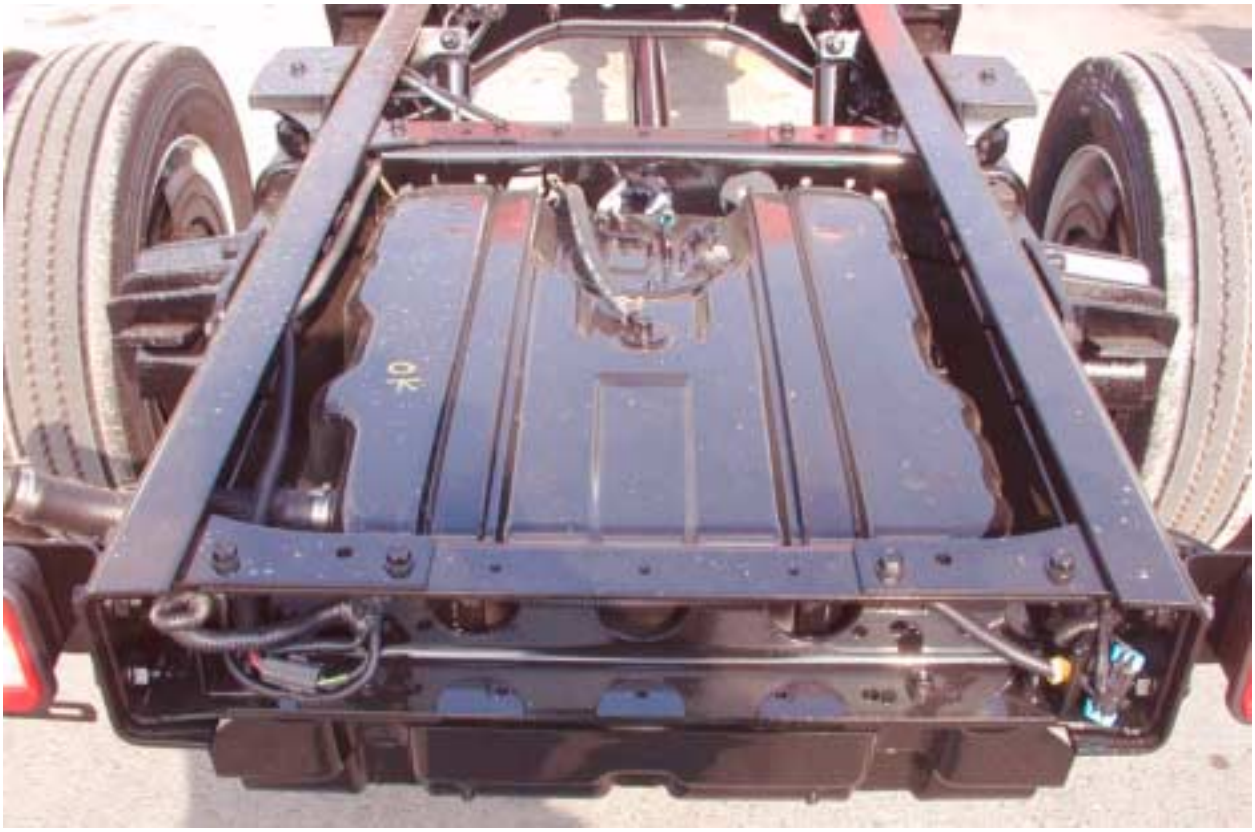
WB (inches)	Useable CA (inches)	AF (inches)
113.0	84	47.5
113.0	84	63.0
137.0	108	47.5
137.0	108	63.0
149.0	120	47.5
149.0	120	75.0
167.0	138	75.0
185.0	185	96.0

Vehicle Identification Label



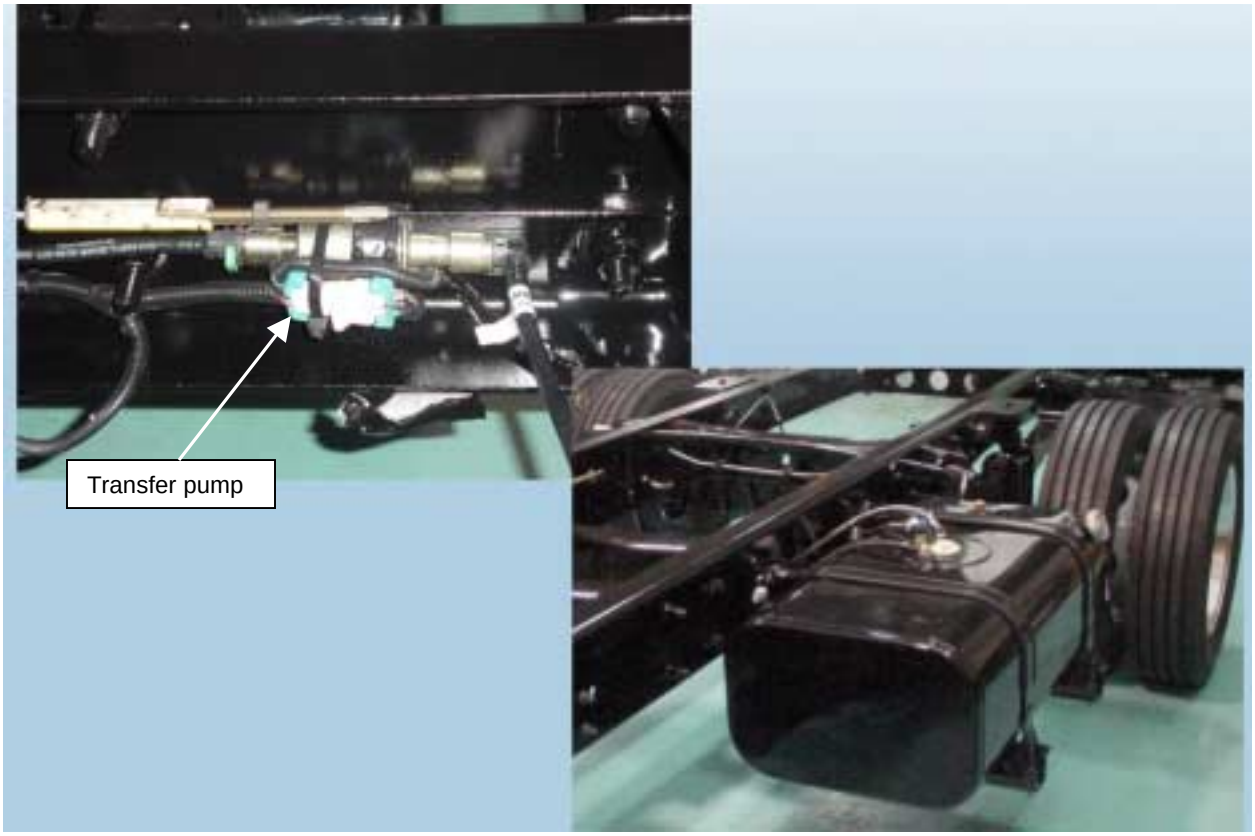
Vehicle Identification Label is located on the driver's side B-pillar

Fuel Tanks



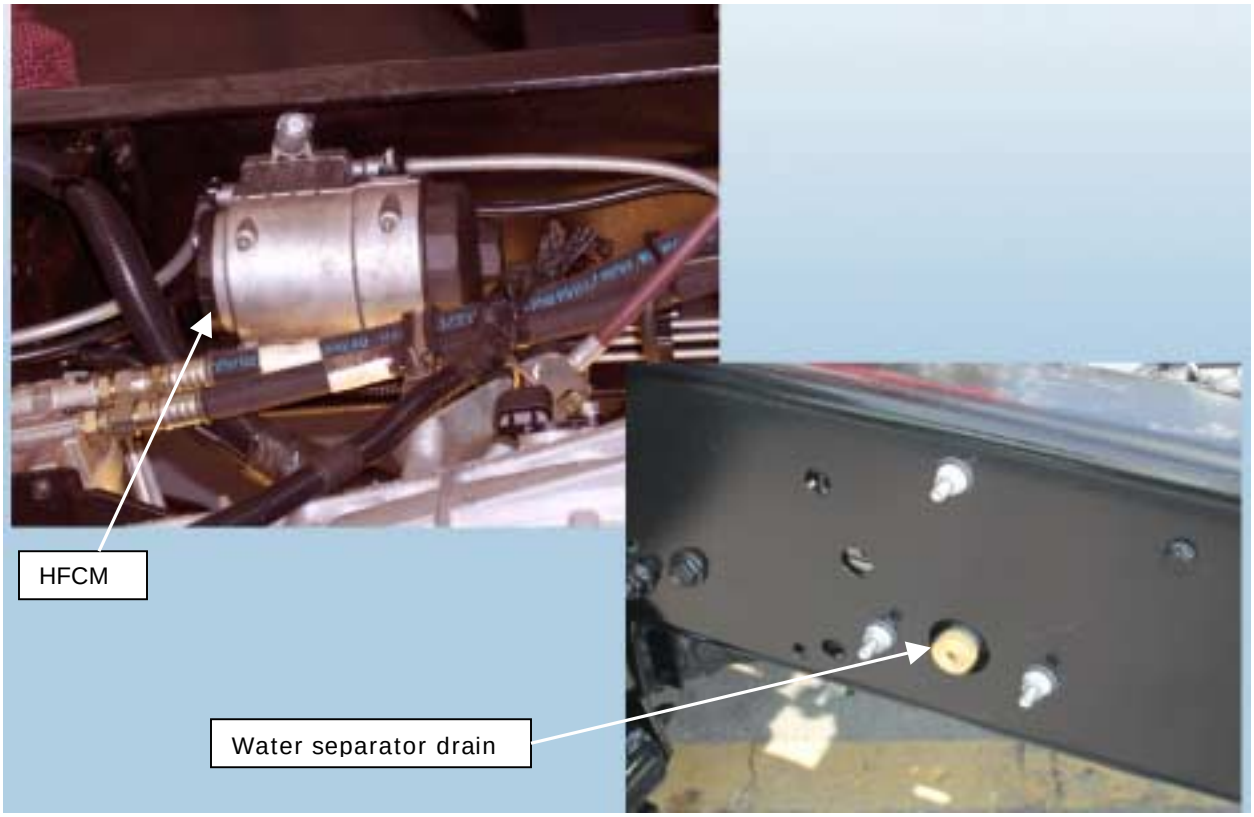
The standard fuel tank is the Between-The-Rails (BTR) 40 gallon tank

Dual Fuel Tanks & Fuel Transfer pump



The dual fuel tanks use a transfer pump to equalize the levels between the two tanks. The saddle tanks are an optional 35 gallon tank.

Horizontal Fuel Conditioning Module (HFCM)

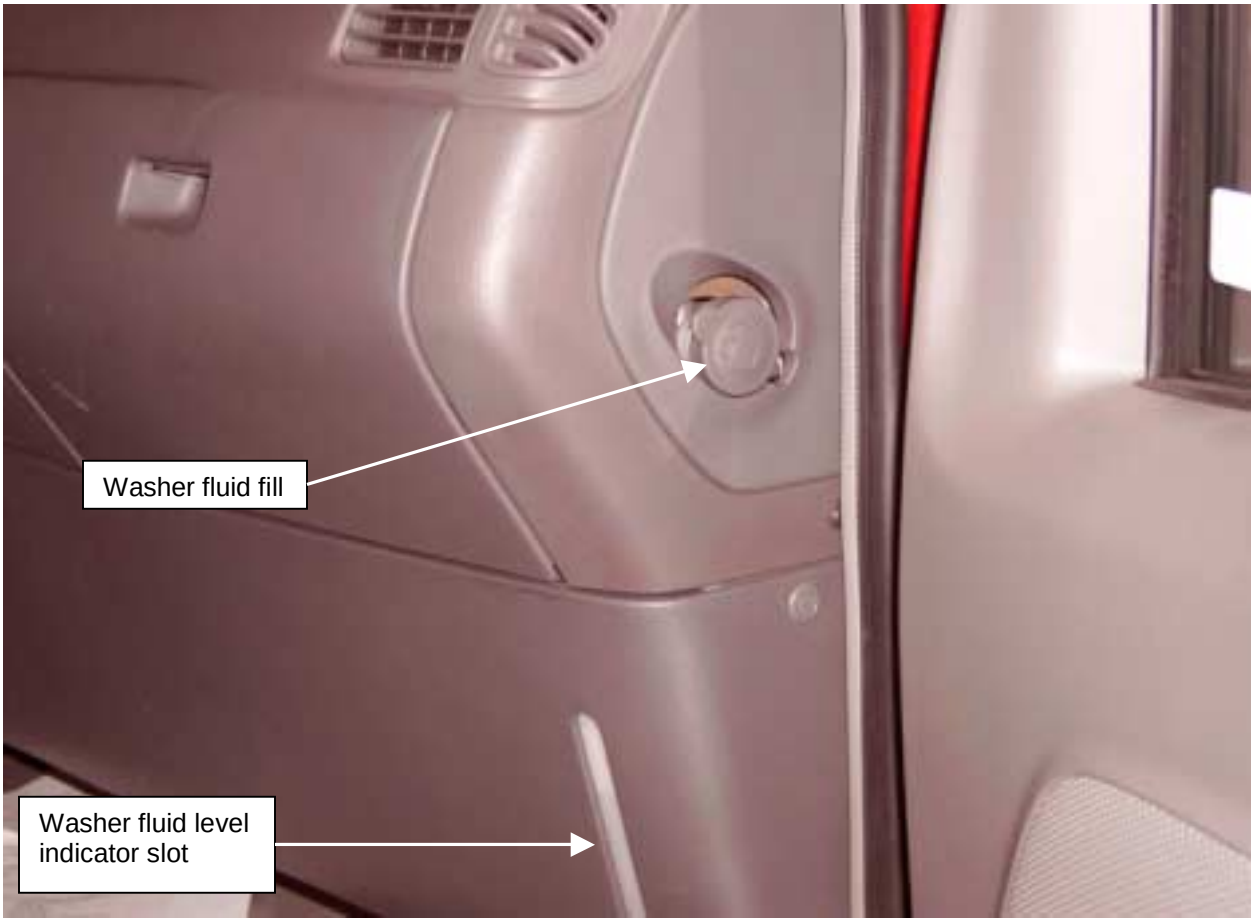


The primary fuel filter is located in the Horizontal Fuel Conditioning Module (HFCM). This module contains a fuel pump, fuel/water separator, fuel filter and fuel heater. There is also a water separator drain knob accessible through a hole in the frame rail. The secondary fuel filter is located on top of the engine.

Power Steering Fluid Reservoir

The power steering fluid reservoir is mounted behind the left side of the cab. Mercon is used for the power steering system. The power steering reservoir filter is available as a service part. Change interval is 5 yrs/75,000 miles.

Washer Fluid Reservoir



Washer fluid filling and level is done from inside the cab on the passenger side. The washer fluid level can be checked in the slot below the filler on the front of the dash panel.

Brake Fluid Reservoir

Brake fluid is filled from inside the cab on the driver's side. The brake fluid level can be checked without cap removal through the transparent reservoir. Use only DOT 3 brake fluid.

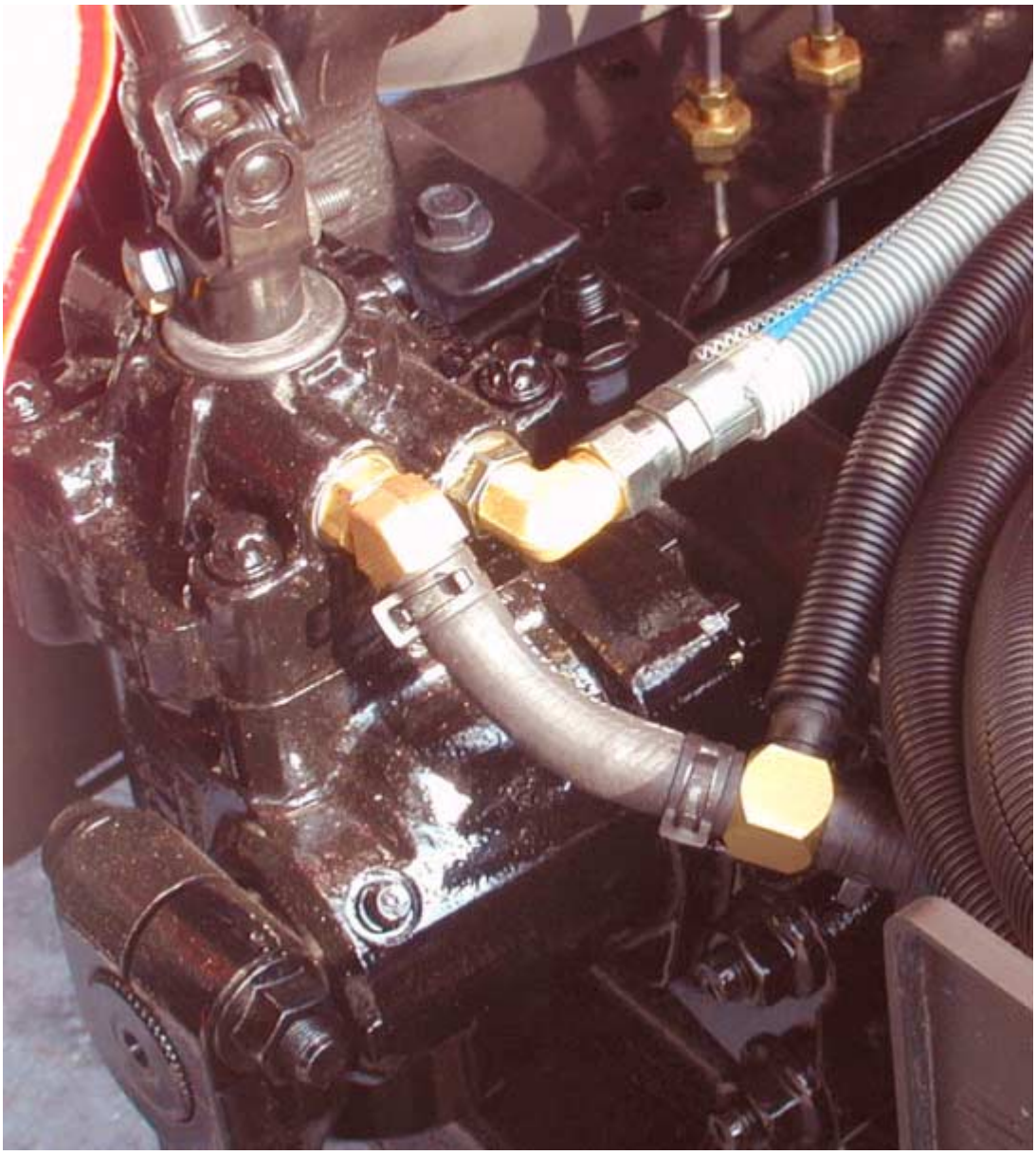
Keyless Entry

Keyless entry is optional and uses this design key fob.

Steering Column

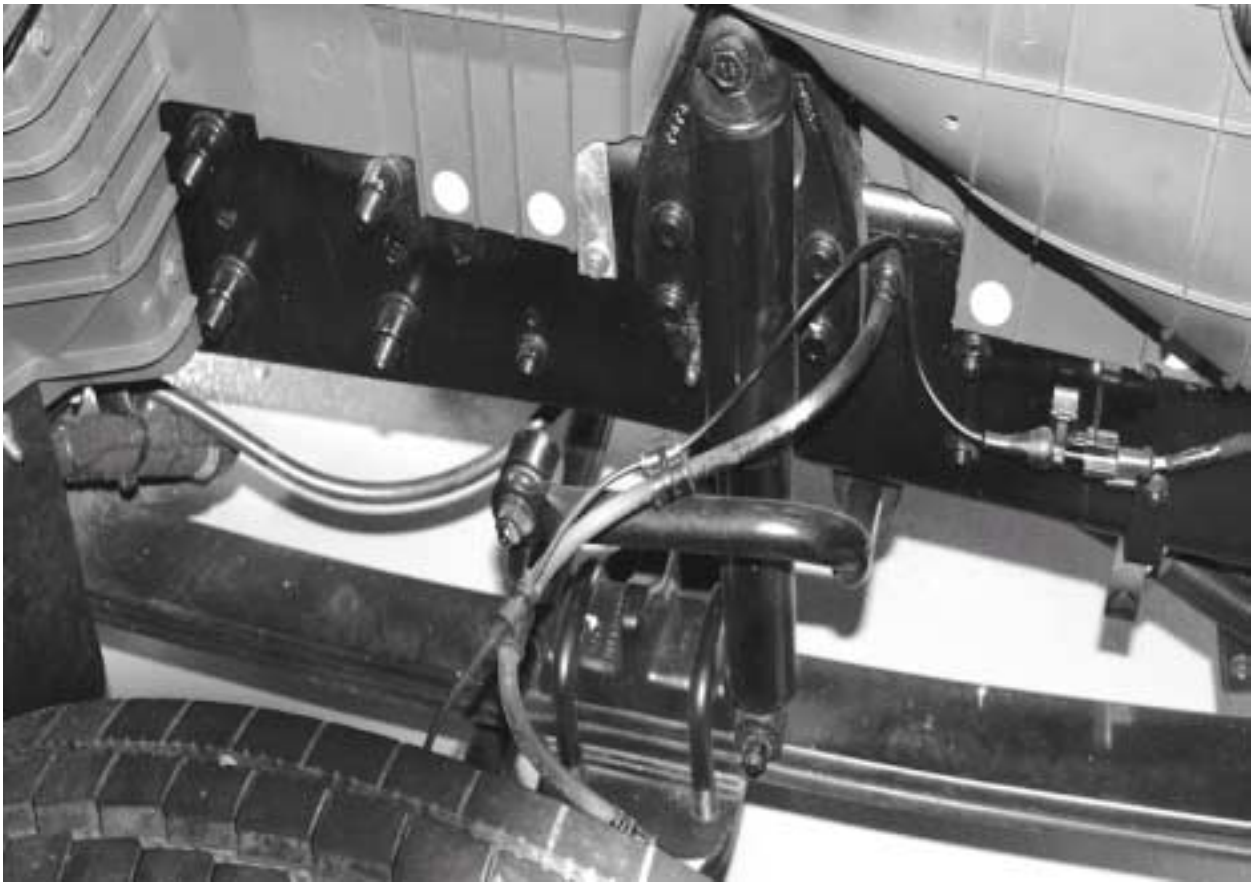
The cruise control switches are located on the dash. The steering column has a tilt and telescope adjustment with the tilt/telescope adjustment lock lever is located on the left side of the steering column.

Steering Gear



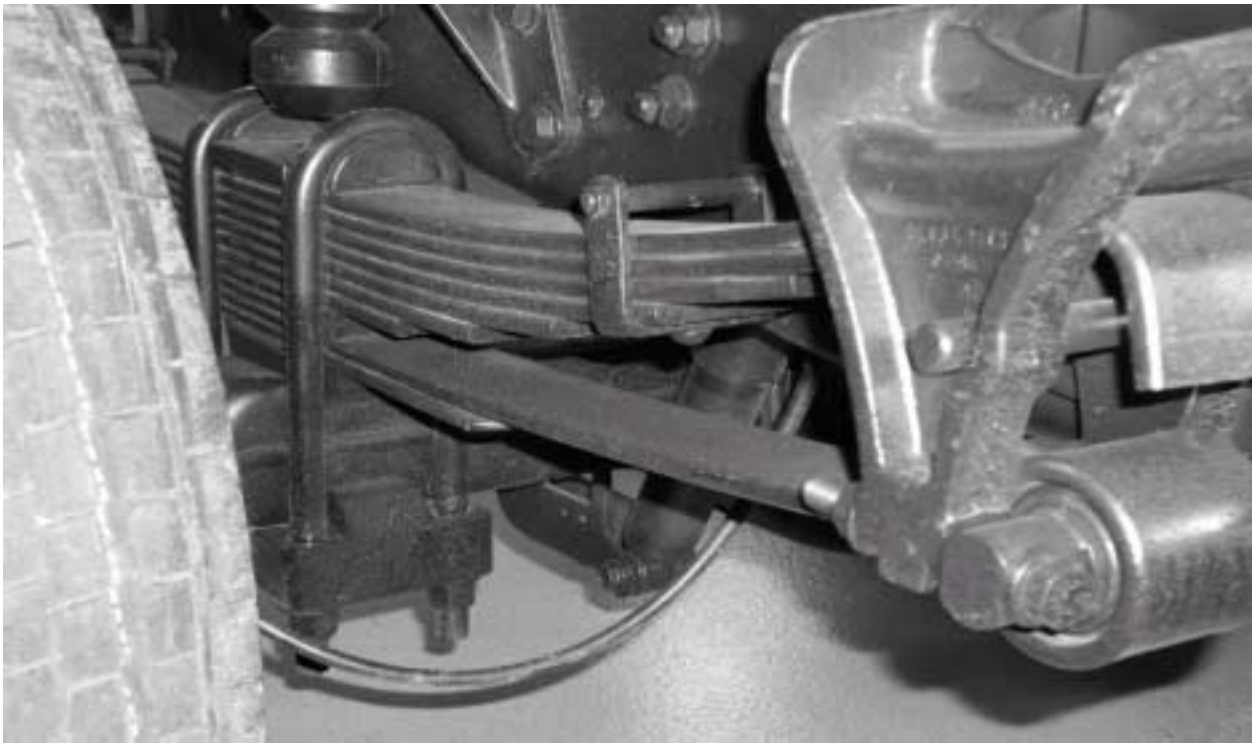
The hydro boost brake system receives pump fluid pressure first, then the steering gear.

Front Suspension



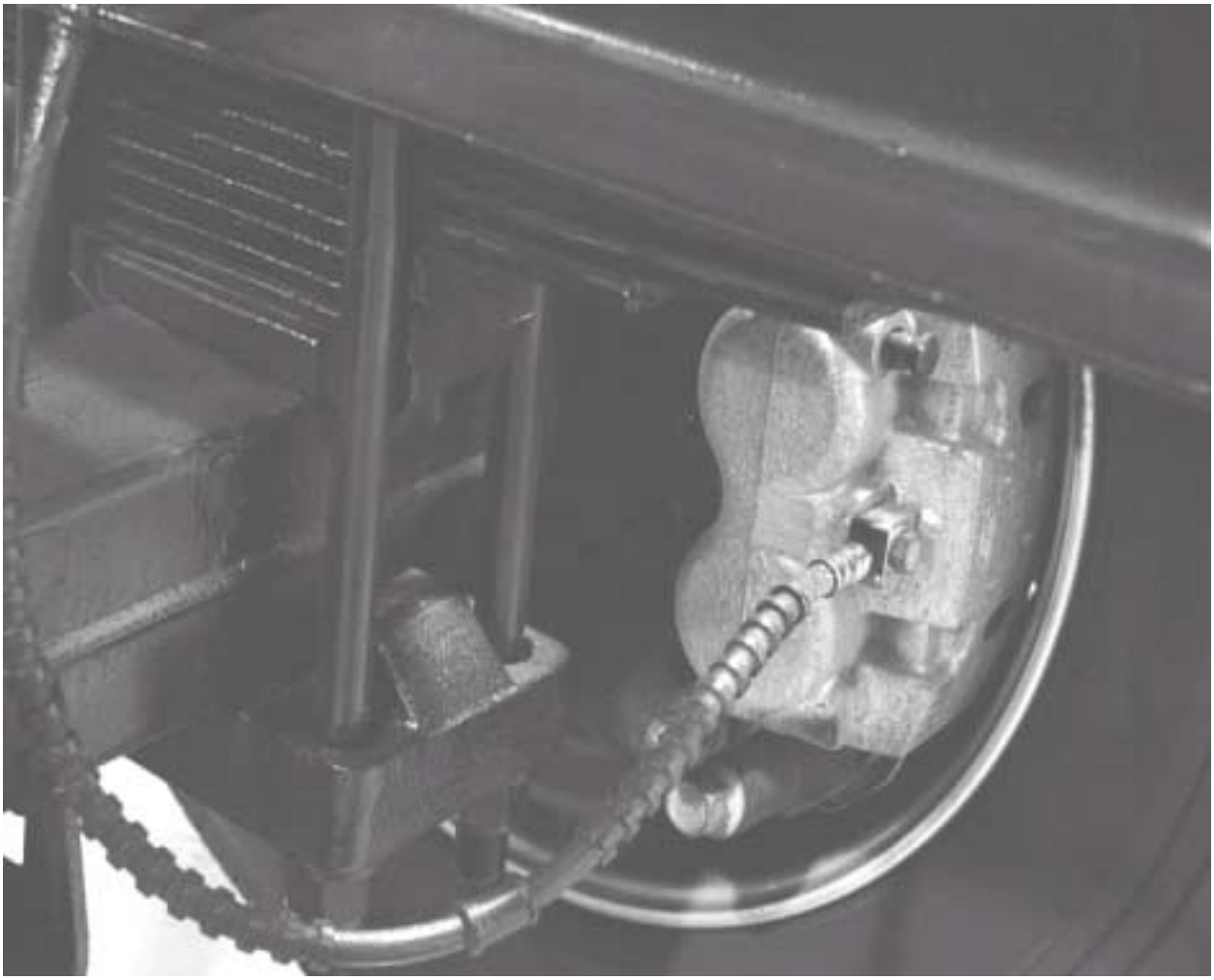
The front suspension is a I-Beam taper-leaf suspension with 6,000 or 7,000 pound capacity and is matched to springs with maintenance free rubber spring pin bushings.

Rear Suspension



A Dana Spicer S110 axle is used on the LCF-series truck. Axle ratings are 11,000 lb GVW and 13,500 lb. GVW. The rear suspension uses a parallel leaf design with rubber overload springs. 4.88 and 5.38 axle ratios are available with either axle rating. The rear axle location in relationship to the end of the frame is determined by the wheelbase of the truck.

Brake System



The brake system uses twin 60 mm caliper pistons. The rear brakes are equipped with standard drum-in-hat parking brakes. The parking brake is adjusted by changing the length of the cable ahead of the axle on the passenger side of the frame.

HVAC System

The LCF HVAC system is a typically system that also includes a pusher fan.

Ford LCF Program Key Dates

Key Date	Activity
September '04	- EFC/EDC was sent to all Ford field, Dealer General Sales and service Managers - Fordstar Broadcast Launch Announcement - Dealer enrollment began - Ford LCF Order bank opened - Pricing was announced
October '04	- Dealer enrollment closed end of October '04
November '04	- Necessary tools ordered through program certification headquarters for enrolled dealers
February '05	- Classroom scheduling began
March '05	- Tool delivery began - Ongoing classroom scheduling
May '05	- Ford LCF shipments begin

LCF Program Required Tools

Submission of your dealer enrollment form to LCF Certification Headquarters automatically initiated the order process for the required tools to service this new vehicle. The list of dealers that enrolled was forwarded to Rotunda following the October 31, 2004 deadline with tool shipments in March 2005. **NOTE:** This automatic tool order with dealer enrollment does not include the new diagnostic cable required for the LCF engine and transmission diagnostics. This cable must be ordered separately by the dealer. The Rotunda tool number for this diagnostic cable is # 418-D553A.

Ford LCF Training Requirements

The table below lists the prerequisites and the Ford LCF course code.

COURSE CODE	COURSE NAME	DELIVERY METHOD	INCLUDED IN DIESEL ENGINE MASTER
34S11W0	Basic Electrical Theory and Operation	WBT	X
34S13M0	Electrical Diagnostic Tools and Testing	CBT	X
34S15W0	Electronic Theory and Operation	WBT	X
34S16M0	Understanding Electronic Systems	CBT	X
34S18W0	Basic Worldwide Diagnostic System (WDS) Tool Operation	WBT	X
34S20W0	Networks and Multiplexing Theory and Operation	WBT	X
34S12W0	Battery Starting and Charging System Theory and Operation	WBT	X
34S25W0	Advanced WDS Tool Theory and Operation	WBT	X
34S14T0	Basic Electrical Diagnosis	Classroom	X
34S19T0	Electronic System Diagnosis	Classroom	X
30N31F0	2005 F-650/750 & 2006 LCF Engine Electronic Controls and Diagnostic Software	FORDSTAR	
30N11T0	LCF NMT	Classroom	

Notes:
Delivery Methods

1. Web-Based Training (WBT) courses are accessed and completed using the Ford-proprietary Professional Technician Society (PTS) website. Dealership management controls technician access to PTS.

2. Computer-Based Training (CBT) consists of a CD that students install and run on a local PC. CBT courses will eventually be replaced by WBT courses.
3. FORDSTAR distance-learning courses are conducted via a satellite system. Live instructors conduct training, and the system features two-way communication with technicians during course delivery.
4. Classroom courses are offered at Ford Regional Training Centers. There are approximately eight Centers equipped to offer Commercial Truck training.

Additional Notes:

- All courses require students to successfully complete a Mastery Exam at the end of the course in order to receive credit for the course.
- Student training records are maintained in the STARS2 database. Student records can be obtained from the STARS2 database in order to determine which courses have been completed, and when those courses were completed.
- Since most Ford Commercial Truck dealerships also sell and service Super Duty vehicles such as F-250 through F-550, many technicians will already have completed the courses required to meet the Diesel Engine Master requirements. If that is the case, only two additional courses (FORDSTAR 30N31F0 and LCF Classroom 30N11T0) will be required in order to attain certification.