

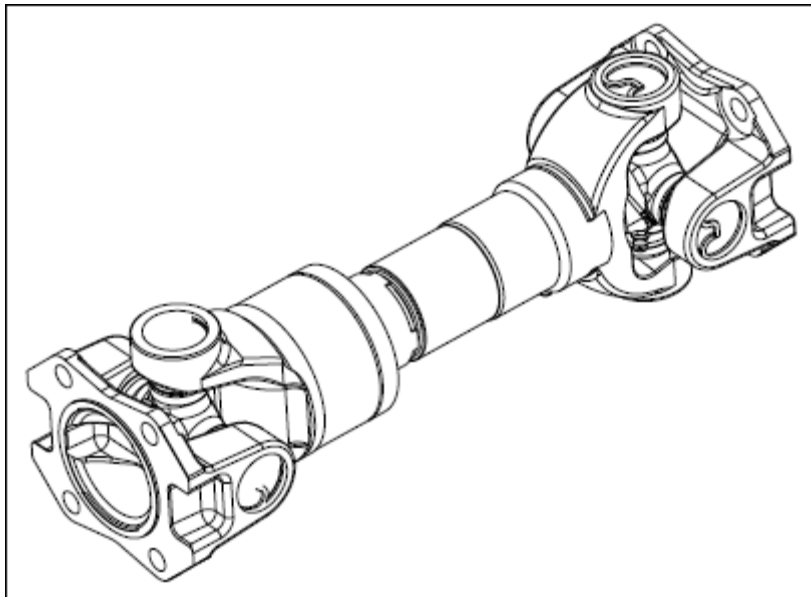


Enriching Lives

Application, Installation & Maintenance Manual

KOEL Driveshaft

FOR FIRE PUMP DRIVE ENGINES



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Foreword

Dear Customer,

We are glad to welcome you to the family of KIRLOSKAR KFP series engine owners. The Connecting Drive shafts are specifically selected for KFP series engines for Fire fighting pump application. These Drive shafts are UL Listed. Kirloskar products are well known for their reliability, simplicity in the maintenance and low running cost. Prompt after sales service through countrywide network of Service Dealers and Distributors is one of the plus point in buying Kirloskar products.

We assure you that all necessary safety precautions and regulations have been observed in design and selection of materials Drive shafts. All the units undergo rigorous tests before being delivered to customer.

This manual deals with Drive shafts Installation, Operations and Maintenance. The performance of the Drive shafts largely depends on its proper maintenance and up keep. So be sure to maintain the Flexible Connecting Shaft properly as per the instructions given in this manual. We recommend that only trained staff should be permitted to perform the operating and maintenance tasks. Always use genuine KIRLOSKAR SPARE PARTS, if at all required. In addition to the publication of this manual, we maintain facilities for training operators and owners in the maintenance of KIRLOSKAR products. You can avail yourself of these facilities by contacting our authorized Service Dealer/Distributor nearest to you.

Continuous improvements and advancement of product design may cause changes in products, which may not include in the publication. Each publication is reviewed and revised as and when required to update and include changes in later editions without notice.

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1. Overall

1.1 Introduction

KOEL Driveshaft manual provides the information of the Application, installation and maintenance of Flexible driveshaft used for diesel engine driven fire pump application. The proper Application, installation and maintenance gives the optimum results in shaft performance and safety.

KOEL recommend that the customer to keep the manuals with every equipment. It is operator responsible for operation and maintenance of the equipment, Operator should read and understand this manual thoroughly before the actual operation.

These Driveshafts should be installed in accordance with the Standard for Installation of Stationary Pumps for Fire Protection, NFPA 20.

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1.2 Service and Maintenance

The proper service and maintenance practices will ensure that the driveshaft continues to meet the requirements. Recommended service intervals must be observed. The service and maintenance work should be carried out carefully. Special care should be taken under abnormally demanding operating conditions.

1.3 Maintenance and Repairs

Shut down the diesel engine driver before carrying out maintenance or repair work. When the work is complete, be sure to install safety devices that may have been removed. Observe all industrial safety regulations when diesel engine drivers are operating in enclosed spaces or underground.

Please contact your distributor for Spare parts enquiry. Use only genuine spare parts.

1.4 Safety Precautions

The operator should read and understand the following safety precautions before the actual operation.



All Safety instructions and the attention of operating personnel should be drawn to these instructions. General safety and accident prevention regulations laid down by law must also be observed.



The rotating shafts can cause major injuries, so keep body parts and any loose wearing away all the times. Follow all safety precautions during installation, maintenance and operation. Use proper guards on rotating parts.



Remove all tools and any other material after completion of installation or maintenance and re-install the removed guards and covers before starting the equipment.

2. Driveshaft Application Guidelines

2.1 Drive Shaft for Centrifugal Pump Driver

The Flexible Connecting Shaft selected for Engine Power Rating and Torque is as below;

Sr. No.	Driver Cylinder	Drive Shaft Part Number
1	4 Cylinder	4H.1441.01.0.PR
2	6 Cylinder	4H.1441.02.0.PR

2.2 Driver Maximum Available Power Chart and Application Calculation

The selection of Flexible Connecting shaft shall be based on the rating of the driver and not the pump. The driver power shall not exceed the maximum available power.

The driveshaft maximum available power table is as below Table 1;

Flexible Connecting Shaft for Centrifugal Pump								
Maximum Power (HP) Rating								
Shaft Part Number	Driver Cylinder	Rated Speed (RPM)						
		1470	1760	2100	2200	2350	2600	3000
4H.1441.01.0.PR	4	100	108	111	117	143	151	145
4H.1441.02.0.PR	6	254	288	336	332	330	225	266

Table 1

Note:

1. The type of driver intended for use of this drive shaft is Diesel engine only.
2. The Maximum operating speed for above drive shafts is 3000 RPM
3. The service factor is applied to the calculated end use application torque. The calculated end use application toques ask adjusted by the service factor (SF), shall not exceed the torque rating of the drive shaft at the applicable speed.

Refer Appendix – A showing how Table 1 values are established.

3. Installation Guidelines

3.1 Driveshaft Installation Procedure

1. The mounting flange surfaces to be cleaned by removing the dirt or contaminants. Examine the mating surfaces for any damage in the machine finish. If the mating surfaces not cleaned properly then it can result in premature driveshaft failure.
2. Do inspection of companion flanges for proper installation.
3. Make the driveshaft compressed position and place into position between mating flanges (Refer Figure 1). Bigger universal joint shaft assemblies are very heavy, so use proper lifting equipment during installation. Align pilot bore boss carefully into/onto companion flange mating diameter, then align bolt holes on driveshaft flange with holes on companion flange. Fix the flange to driveshaft with proper hardware. Now extend the

shaft at slip section until pilot bore boss aligns with companion flange pilot bore boss. the mounting holes to be aligned and fix the flanges.

4. Tighten the fasteners with proper torque
5. All the joints are to be lubricated before start of the equipment. Do Lubrication until lubricant appears at all four bearing cap seals properly.
6. Verify the Horizontal offset and vertical shaft operating angle as per the specification.
7. The drive shaft guard to be installed properly prior to start up the equipment.

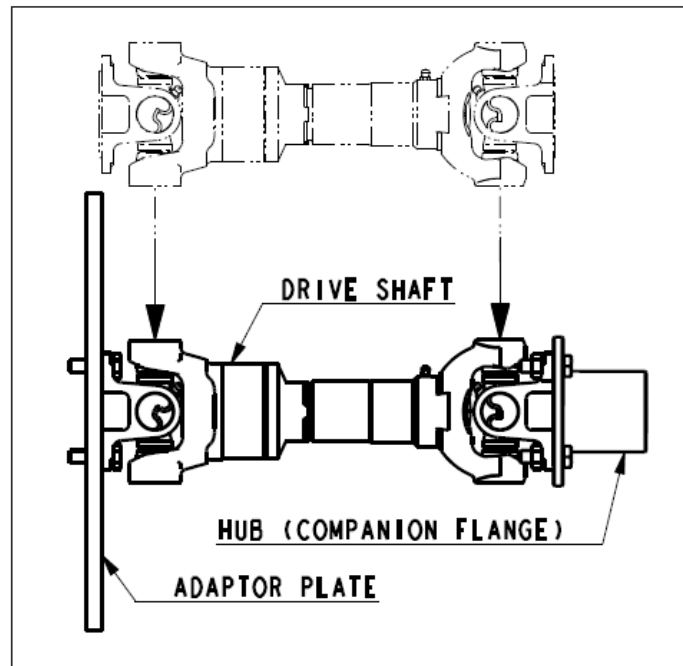


Figure 1

Note:

1. The Drive shaft installation shall be in accordance with Standard for Installation of Stationary Pumps for Fire Protection, NFPA 20.
2. The Maximum and Minimum Installed length of drive shaft is as below
For 4H.1441.01.0.PR : Max. length is 425 mm (16.73 Inch) and Min. length is 361 mm (14.21 Inch)
For 4H.1441.02.0.PR : Max. length is 497 mm (19.57 Inch) and Min. length is 453 mm (17.83 Inch)

The tightening Torque Specification for Companion Flange is as below

Driveshaft Part Number	Bolt Size	Grade (Class)	Torque
4H.1441.01.0.PR	M10 - 1.5	8.8	47 N-m (35 lb – ft)
4H.1441.02.0.PR	M12 - 1.75	8.8	75 N-m (55 lb – ft)

3.2 Drive Shaft Alignment Procedure

The drive shaft alignment procedure is based on a fire pump installation guidelines where the engine crankshaft centerline and the pump centerline is same when viewed from the top and parallel in the front view (Refer Figure 2). For the measurement of misalignment dial indicator or angle meter or vernier caliper will be needed.

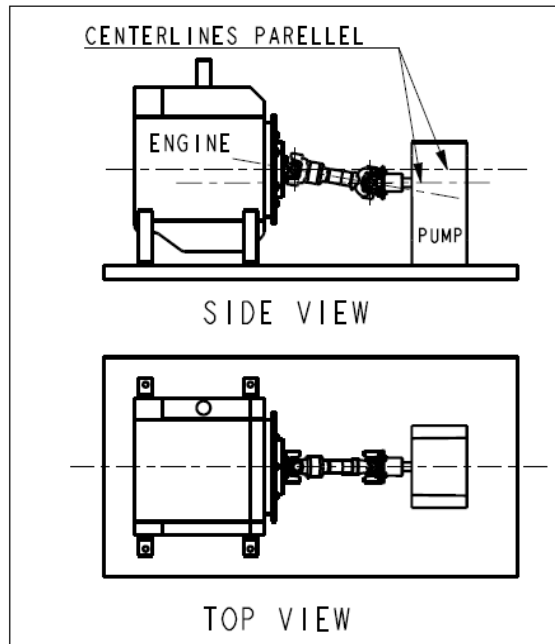


Figure 2

Note:

1. Maximum permitted Vertical angular misalignment is 1 +/-1 Deg and Horizontal(Parallel)) misalignment is 0 +/-1 Deg
2. It is recommended that the torsional analysis need to conduct on the actual fire pump set arrangement but not on only engine

For service and parts inquiries, please contact to:

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Please provide the Driveshaft Serial Number or Engine serial number information.

Visit us on the web at: www.koel.co.in

4. Drive Shaft Lubrication

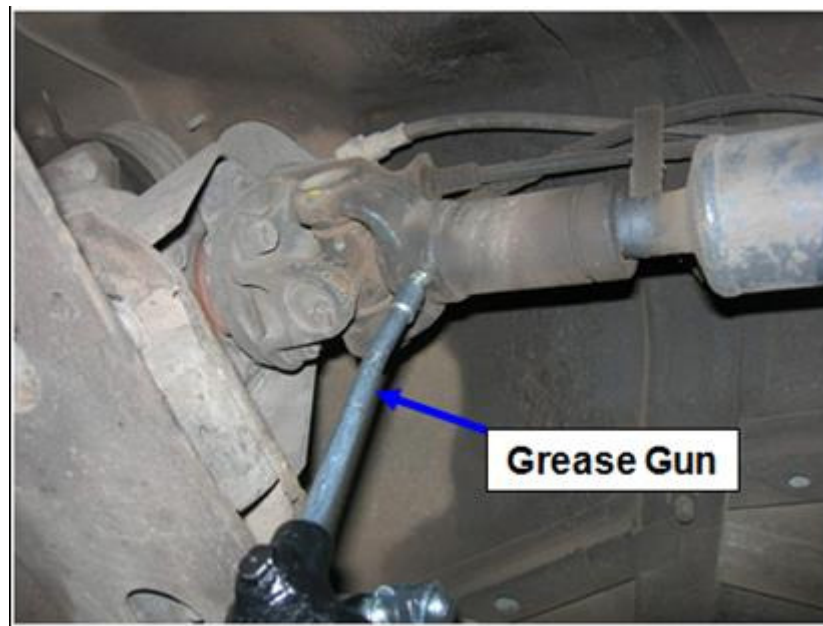
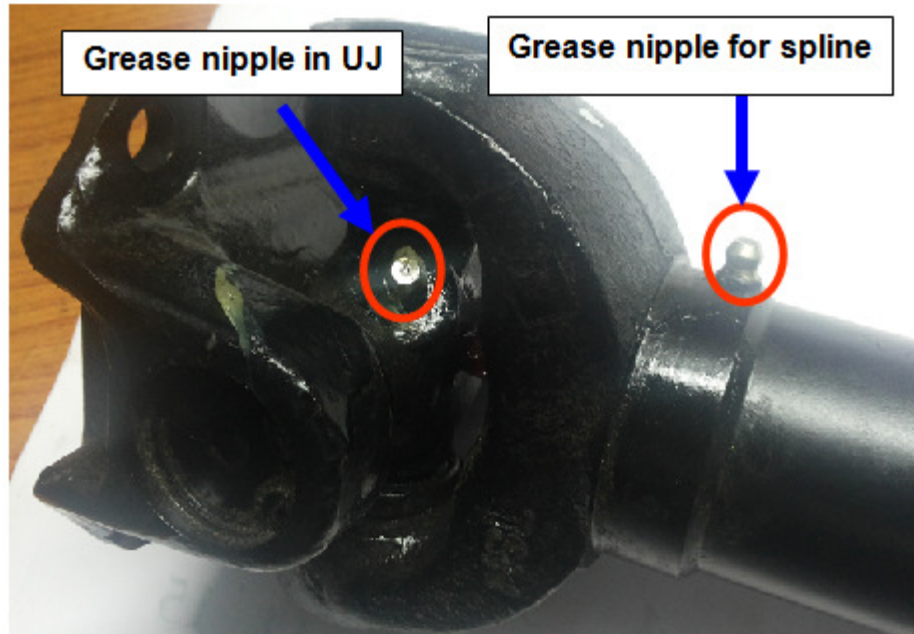
4.1 Lubrication

Every drive shaft needs some sort of lubrication due to rotating motion. Many times, the premature failures of universal joint (UJ kit) and slip spline are due to lack of lubrication or improper lubrication. The proper and regular lubrication practice removes contaminants from the bearings resulting into maximum functional life. It is recommended to use high quality greases with Multi-purpose Extreme Pressure Lithium Complex grease containing corrosion and oxidation inhibitors, E.P. and anti-wear additives.

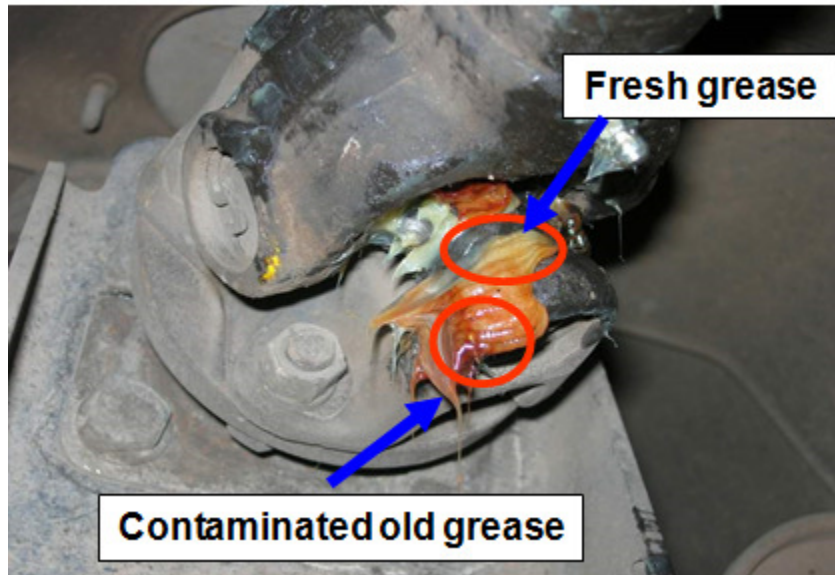
The lubrication intervals may vary depending on the drive shaft application, installation and operating conditions. As Fire pump application is not continuous duty operation, so the lubrication can be done at every 5- 6 months interval for indoor operating conditions and every 60 days open condition operations.

4.2 Lubrication Procedure

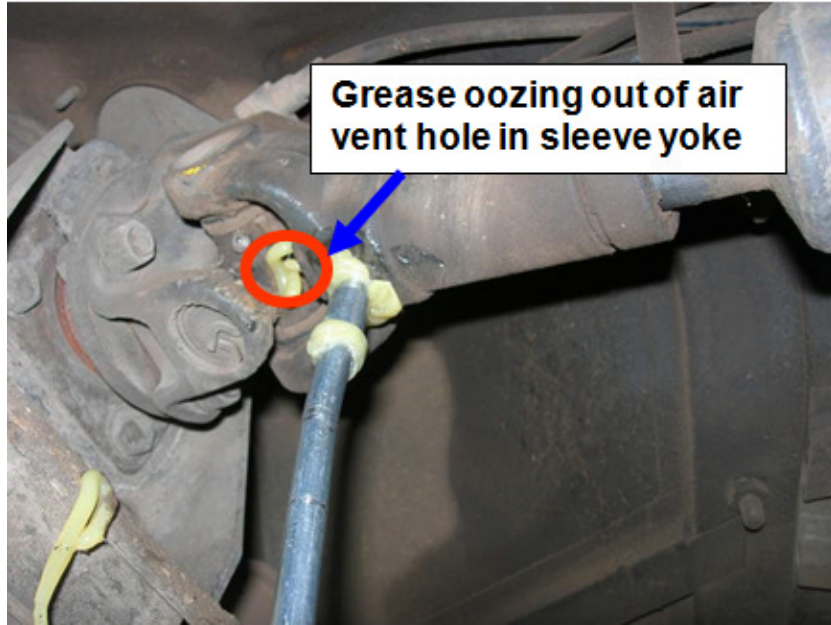
1. Before doing the lubrication, clean the sleeve yoke grease nipple and surrounding area to remove dust, dirt etc. with cloth / water jet.



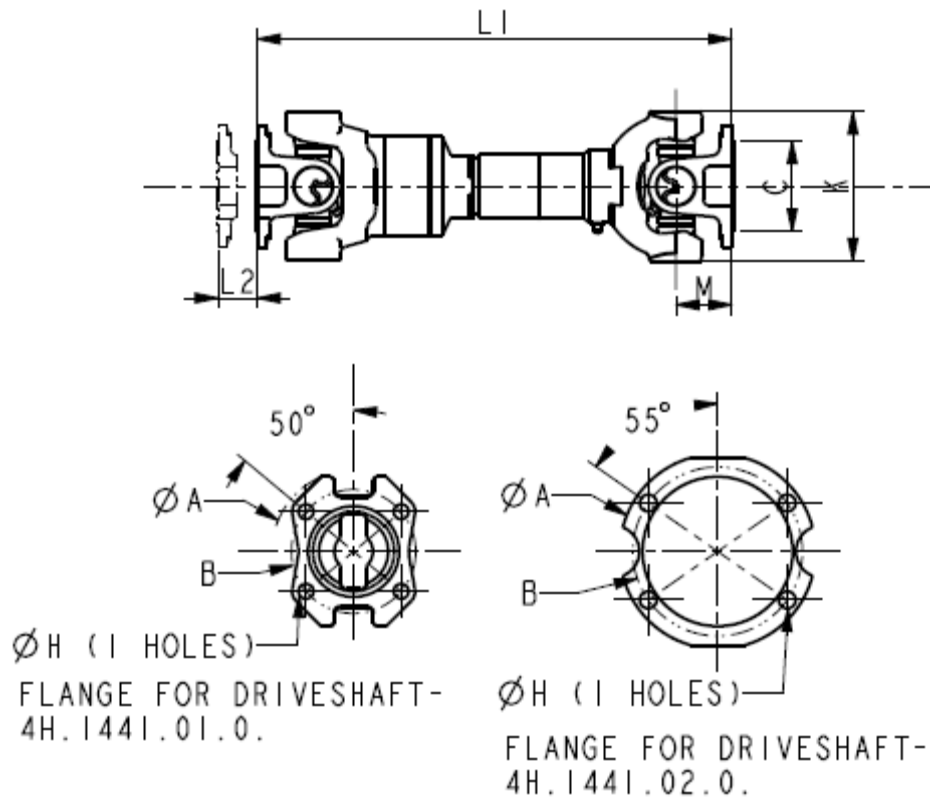
2. Purge all four bearing seals of the universal joint kit through nipple fitting which flushes all contaminants from each bearing assembly and apply grease gun to the grease nipple. Ensure that all four nipples are filled completely shown below.



3. Similarly lubricate the splines through nipple on shaft assembly as shown below. Continue greasing with grease gun till the grease comes out of air vent hole in sleeve yoke plug.



5. Dive Shaft Dimensional Data



Drive Shaft Dimensional Data (Inches)

Sr.No.	Drive shaft model	L1	L2	A	B	C	H	I	M
1	4H.1441.01.0.PR	14.29	2.28	4.77	3.75	2.75	0.45	4	1.69
2	4H.1441.02.0.PR	17.91	1.57	5.91	5.12	4.53	0.51	4	3.78

Note :

1. The drive shafts are designed for minimum B-10 Life of 5000 hours
2. The weight of drive shaft is as below

For 4H.1441.01.0.PR : Weight is 8 kg (17.6 lbs)

For 4H.1441.02.0.PR : Weight is 18 kg (39.6 lbs)

6. Trouble Shooting

Trouble	Cause	Solution
VIBRATIONS	Drive shaft yokes not in phase	Disassemble and re-align yoke.
	Driver or driven components out of balance.	Consult equipment manufacturer.
	Drive shaft exceeding maximum joint acceleration.	Reduce the operating angle and/or speed.
	Drive shaft operating near critical or half critical speed resonance	Consult equipment manufacturer.
	Flange faces not seated.	Remove drive shaft fasteners and check for burrs or dirt. Reassemble the shaft with tightening torque for all fasteners.
	Operating at or near driver or driven equipment natural frequency.	Consult with equipment manufacturer.
	Operating speed is within a torsional vibration mode.	Carry out the torsional analysis. Consult equipment manufacturer for assistance.
	Driver and driven shaft/Companion flange not parallel within 1Degree.	Re-align and re-adjust any of these, Add shims if necessary.
	Dry or brinelled (needle bearing indentations)	Replace defective joints or check lubrication. Review operating parameters.
	Driver and driven shaft run-out	Consult engine manufacturer.
	Excessive radial movement at the slip yoke	Lack of lubrication, overload condition. Consult with equipment manufacturer.
	Companion flange, fastener loose.	Tighten the fastener or Check for vibrations
	Drive system resonance/vibration	Perform vibration analysis. Consult equipment manufacturer.
Pump noise.	Consult pump manufacturer.	
FLANGE LOOSE ON DRIVESHAFT	Companion Flange fasteners or Set screw over keyway not tightened properly.	Reassemble fasteners/set screw properly.
	Weight limitations exceeded for flange bored or shaft diameter undersized.	Use additional set screw or replace flange with interference fit bore.

Appendix - A

Flexible Connecting Shaft for Centrifugal Pump

Maximum Torque (lb-ft) Rating

Shaft Part Number	Driver Cylinder	Engine Rated Speed(RPM)						
		1470	1760	2100	2200	2350	2600	3000
4H.1441.01.0.PR	4	715	645	555	559	639	610	508
4H.1441.02.0.PR	6	1361	1289	1260	1189	1106	682	699

$$\text{Rated Torque} = \frac{\text{Max Torque}}{5252}$$

$$\text{Rated HP} = \frac{\text{Rated Torque} \times \text{RPM}}{\text{Service Factor (SF)}}$$

Service Factor (SF) = 1.5 (Diesel Engine - 6 or more cylinders)

Service Factor (SF) = 2.0 (Diesel Engine - 5 or less cylinders)