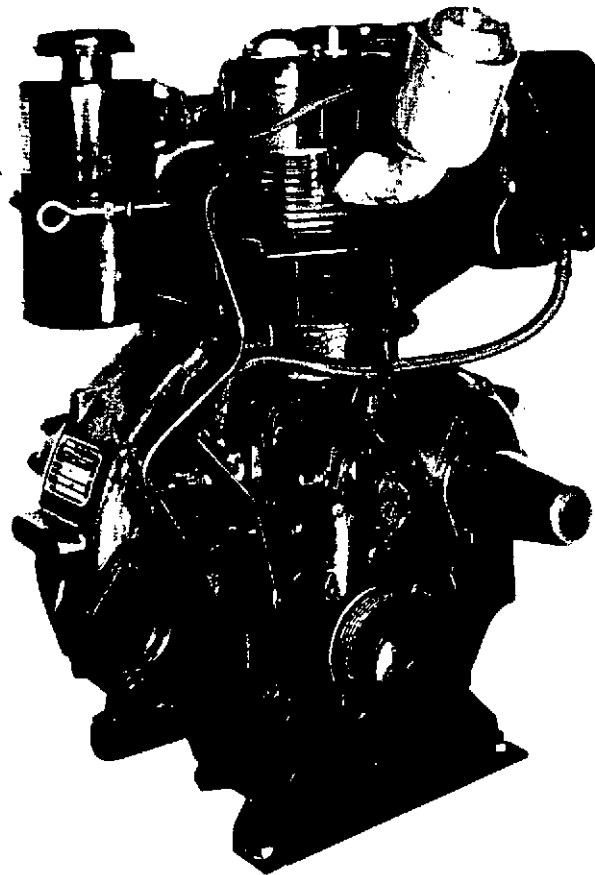


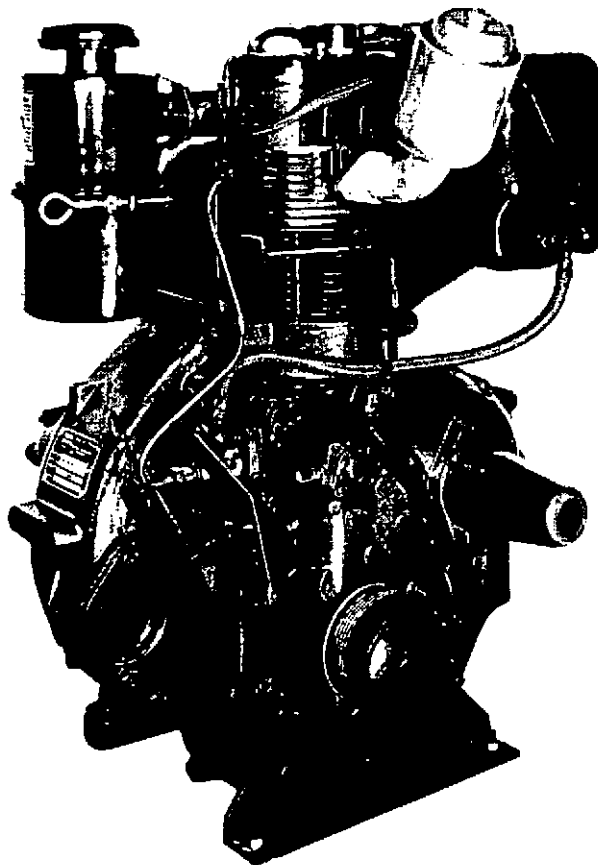


**INSTRUCTIONS FOR
OPERATION, MAINTENANCE
AND TECHNICAL INFORMATION
LKS**



OPERATING INSTRUCTIONS

LKS



MURPHY DIESEL CO.
5317 W. Burnham St.
Milwaukee, Wisconsin 53219

INTRODUCTION

- We recommend you to read this manual carefully and closely follow the operating and maintenance instructions before you start your engine for the first time.

Always use lubricants of reputable brand which comply with our specifications.

- In order to avoid failures of the injection system, make sure that only clean fuel is used.
- Remember that the life of your engine depends on a careful and regular maintenance program.
- In case of failures, please contact us or our distributor. Give all details including engine serial number and specifications number.
- For service parts or warranty information contact your Murphy Diesel Distributor or the factory. Always include your engine serial number, model and specifications number located on the name plate.

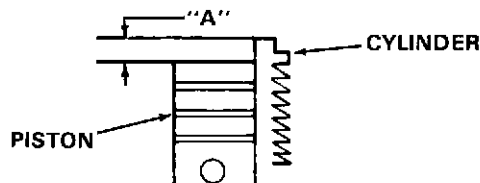
Murphy Diesel Co.
5317 W. Burnham St.
Milwaukee, Wisconsin 53219
414-645-2255

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LKS TECHNICAL SPECIFICATIONS

1. General Description	
Model	LKS
Number of Cylinders	One
Combustion	Direct injection
Combustion cycle	Four stroke
Cooling system	Air cooled
Bore	85 mm.
Stroke	100 mm.
Lubrication	Force-feed-gear (type oil pump)
2. Fuel Injection System	
Injection pump	IESA
Injector	IESA
Commencement of delivery	$27 + 1^\circ$ BTDC
Injection pressure	$180 + 0.5$ kg/cm ²
Injection pump pre-stroke	2.3 - 2.5 mm.
NOTE: 0.1 mm. more pre-stroke gives a point of 1° delay.	
Fuel consumption maximum	200 gr/C.V. hr.
3. Cylinder Head	
Valve clearance — engine cold	0.2 mm.
Valve projection	1.15 - 1.3 mm.
Valve angle	45°
4. Cylinder	
Compression height	A = 0.8 - 1.1 mm.
Adjustable by shims	0.1 mm., 0.2 mm.



Clearance volume	25.3 ± 0.5 cm ³	
5. Crankshaft		
Front main journal diameter	54.9402 mm.	
Rear main journal diameter - std.	60.0024 mm.	
Connecting rod journal diameter - std.	39.9669 mm.	
Repair stage I	39.709 - 39.725 mm.	
Repair stage II	39.459 - 39.475 mm.	
Repair stage III	39.209 - 39.225 mm.	
Repair stage IV	38.959 - 38.975 mm.	
Crankshaft roller bearing ID	$60 - 0.015$ mm.	
Rear bearing spacer ID	$52.5 + 0.2$ mm.	
Backlash - Crankshaft and Camshaft gear	$0.11 - 0.27$ mm.	
Swept volume	567.45 cm ³	
6. Cam Timing		
Intake	OPEN 1° BTDC	CLOSED 36° ABDC
Exhaust	36° BBDC	1° ATDC
Acceptable Tolerance $\pm 3^\circ$		

7. Bearing Clearance

	RADIAL	AXIAL
Crankshaft bearing	0.05 - 0.14 mm.	0.10 - 0.22 mm.
Main cam bearing	0.03 - 0.07 mm.	0.9 - 0.10 mm.
Connecting rod bearing	0.05 - 0.08 mm.	0.30 - 0.50 mm.
Piston pin bushing	0.04 - 0.06 mm.	N/A

8. Lubrication System

Type of oil	AP1 classified CC or CD
Ambient temperatures	below 5° C SAE HD 10
	-5° to + 10° C SAE HD 20
	+10° to + 30° C SAE HD 30
	over + 30° C SAE HD 40
Oil capacity	1.3 liters
Lube oil consumption	1.5 gr/C.V. hr.
Oil pressure - running	3 - 4 kg/cm ²
Oil pressure - minimum idle	0.5 - 0.8 kg/cm ²

9. Torque Data

	MKP
Connecting rod bolts	3 + 0.5
Crankshaft counterweight bolts ...	8.5 + 1
Flywheel bolts	9.0 + 0.5
Cylinder head nuts	5.0 + 0.5
Injection pump pressure pipe	4.0 + 1
Rocker arm bracket bolt	1.0 + 0.5
Cranking nut	20.0 + 1
Cylinder head cover - bolt	1.5 + 0.5
Cylinder head stud in crankcase... ..	3.0 + 1
Crankshaft bearing fastening bolt	1.5 + 0.5
Bearing housing fastening nut	1.5 + 0.5
Lube oil pump fastening bolt	1.5 + 0.5

2. ENGINE DESCRIPTION

2.0. Diesel engine

- LKS is an air cooled four-stroke Diesel engine.
- It works according to the direct injection principle. Most important advantages of this combustion method are:
 - A high specific output
 - Low thermal stress
 - Good cold starting properties
 - Low fuel consumption.
- Originally designed for stationary and moving appliances is also suitable for a large range of vehicles and machinery.
- Consult your Distributor. A lot of accessories such as: electrical starting, clutches pulleys, gear reducers, etc. are available to fit your particular needs.

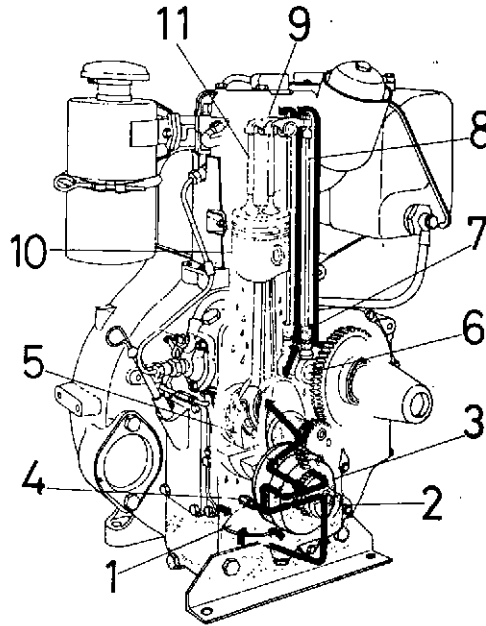
3. LUBE OIL CIRCUIT, COOLING AND COMBUSTION SYSTEMS

3.1. Lube oil circuit

Depending on the particular bearing surface of the moving parts, a force feed or splash lubrication is provided. Lube oil pump aspirates the oil from deepest point of the oilpan and delivers it through a micro-filter to the following bearings:

Main and connecting rod bearings,
Rocker arm bearings,
Camshaft bearings.

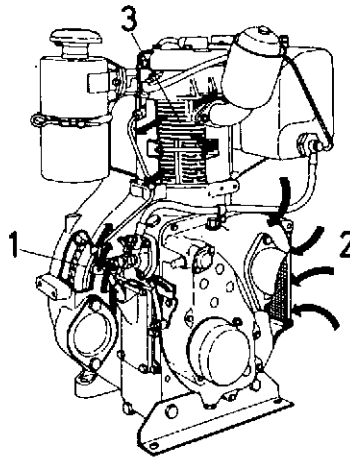
Oil coming out from connecting rod bearings is then splashed to piston and cylinder liner.



- | | |
|-----------------|-----------------|
| 1. Intake | 7. Valve tappet |
| 2. Oil pump | 8. Push rod |
| 3. Oil filter | 9. Rocker arm |
| 4. Safety valve | 10. Piston |
| 5. Crankshaft | 11. Valves |
| 6. Camshaft | |

3.2. Cooling system

Cylinder and cylinder head are cooled by the air from the flywheel acting as a fan.

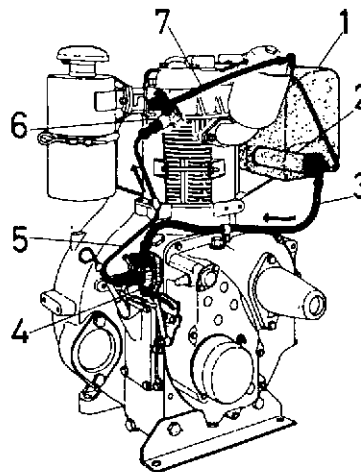


1. Flywheel fan
2. Air inlet
3. Air outlet

3.3. Fuel system

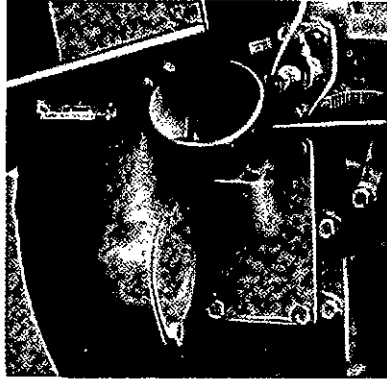
Fuel is taken from the tank through the fuel filter to the injection pump which delivers it under high pressure to the injection valve. Leak off fuel from the injection valve flows back to the tank.

1. Fuel tank
2. Fuel filter
3. Fuel pipe from filter to injection pump
4. Injection pump
5. Fuel delivery pipe
6. Injector
7. Leak off pipe to tank

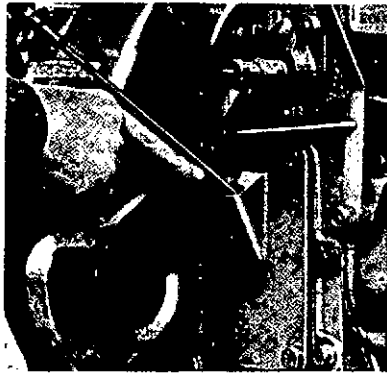


ALWAYS USE REPUTABLE FUEL

4. PREPARATIONS FOR THE FIRST START-UP



Picture 1



Picture 2



Picture 3

4.1. Lube oil filling

a) **Engine.** Unscrew filler plug and fill in with API classified CC or CD oil depending on ambient temperature as follows:

below -5°C : **SAE HD 10**
from -5° to $+10^{\circ}\text{C}$: **SAE HD 20**
from $+10^{\circ}$ to $+30^{\circ}\text{C}$: **SAE HD 30**
over $+30^{\circ}\text{C}$: **SAE HD 40**

To avoid damages by lubricants of inferior quality it is recommended to use only reputable brands and to keep using the brand originally chosen.

Unsuitable oil or delayed oil changes will cause troubles and higher repair costs.

b) **Oil level.** Check oil level in sump (picture 2).

When engine is in horizontal position, oil level should reach upper mark on the dipstick.

NOTE!!

Too high oil level will cause high oil consumption and carbon formations

Too low a level will cause damage to the engine.

c) **Oil bath air filter.** Fill to mark with clean engine oil.

Renew oil if it becomes thick and dark or overcomes upper mark on dipstick.

NEVER operate your engine with the air filter removed as dust will enter the cylinder causing premature failure of the engine.

4.2. Fuel filling

Fuel used is diesel fuel #2, free of any water and impurities to avoid failure regarding injection pumping elements and nozzle.

4.3. Venting the fuel system

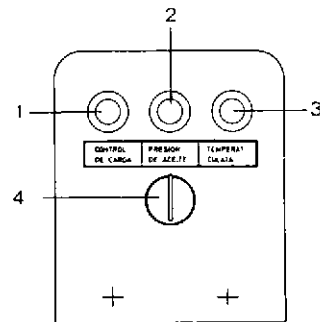
See chapter 7.

5. STARTING THE ENGINE

5.1. Before starting:

Check contents in the fuel tank and oil level in oilpan. Oil level should be at least between upper and lower mark on dipstick. Check oil level in air filter.

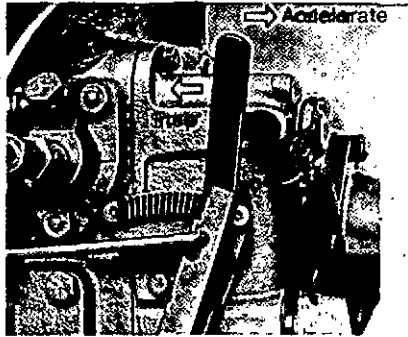
5.2. Electrical starting



- a) Put ignition key into switch (charge indicator bulb comes on).
- b) Set speed adjustment lever (accelerator) to full speed (picture 4).
- c) Push starter button no longer than 20 seconds. To spare the battery, leave intervals of 30 to 60 seconds between attempts.

1. Charge indicator (red bulb).
2. Oil pressure indicator (green bulb).
3. Cylinder head temperature indicator (yellow bulb).
4. Ignition and starting switch.

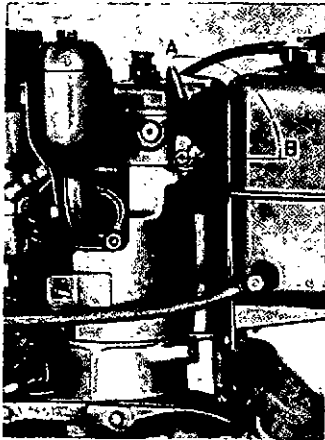
5.2.1. Starting with hand crank



Picture 4



Picture 5



Picture 6

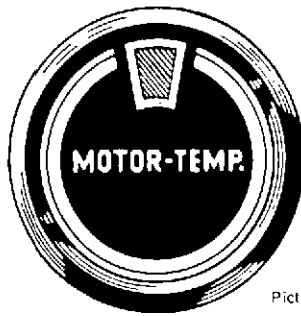
- a) Set governor lever to full speed (picture 4).
- b) Push overload button deeply (picture 5).
- c) Set decompressor lever in position "A" (picture 6).
- d) Start engine by means of the starting cranking handle. At the moment you recognize the distinctive squeak when injecting the fuel, decompression lever should be set in position "B" (picture 6) keeping the cranking handle revolving in order to overcome at least twice the compression strength. Engine should start now. In negative case, repeat again the same operation.

5.3. After start

When engine has started, the oil pressure gauge should immediately indicate a pressure of about 4 Kp/cm². At low idling speed and the engine warm, oil pressure must not drop below 0.5 Kp/cm², otherwise warning green lamp flashes on. Low oil pressure warning light should come on between 0.5 - 0.8 Kp/cm².

5.4. Observations during operation

When engine is running under load, watch the oil pressure gauge and the remote thermometer (delivered upon request). The green field appears in the window as long as temperature is normal. Green and red when engine temperature rises excessively. Cylinder head temperature should not exceed 190° C or 374° F.



Red
or
green
field

Picture 7

When dial is fully red, stop the engine and trace the cause of overheating. If a remote connected alarm to the thermometer sounds, is then the last warning to stop the engine immediately.

NOTE! In case oil pressure drops, or the warning bulb flashes, stop the engine quickly, and determine the cause.

5.5. Stopping the engine

Remove load from engine and run it for a short period at idling speed, to allow it to cool down. Move speed control lever towards «stop» (picture 4) until the engine stops completely.

- Withdraw key from ignition switch.
- NEVER stop the engine with decompressor lever in position «A» (picture 6).
- Before a long period of standstill the engine should be inhibited.

6. ROUTINE MAINTENANCE

We advise you follow this summary of all maintenance work to be carried out regularly.

Daily or every 10 hours of operation.

Check oil level in oilpan (chapter 4.1.b).
Check fuel level in tank.

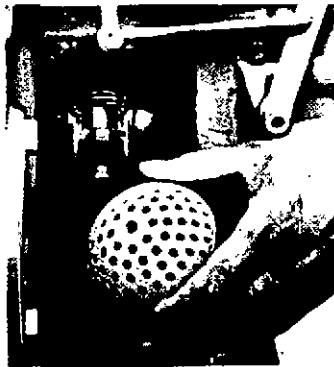
After 30 hours of operation.

First change of oil to be done.

After 70-80 working hours.

Carry out oil change regularly. Remove drain plug from the oil pan and let oil come out. Oil drainage must take place while the engine is still hot. Remove lateral cover (picture 8) and oil filtering sieve from the inset. Clean it by means of a solvent and let it dry before reinstallation. Mount oil filtering sieve, lateral cover and drainage plug. Now fill with oil (chapter 4.1).

Clean the air cleaner with solvent.



Picture 8

Try to avoid inner sediments. Remount the elements of the filter and fill the oil pan with new and clean oil (pict. 3).

USE ONLY ORIGINAL PARTS

Check the battery

(Every 4 weeks at the latest.)

The battery should be clean and dry outside. The electrolyte level should be approx. 10-15 mm above the upper edge of the plates. In a properly maintained battery, density of acid reveals the state of charge. At 20° C acid density should be:

1,285, charged; 1,23-1,21 half charged; 1,14-1,11 discharged.

Wash terminals with hot soda solution. Take care that no soda lye gets into the battery. Rinse with cold water and grease terminals with acid protection grease.

Check tightness of fuel pipes.

After every 250 hours of operation:

Check the clearance of inlet and exhaust valves. In cold engine should be 0,2 mm. (See chapter 7.5)

After every 500 hours of operation.

Check the fuel filter. The filter is maintenance-free as long as fuel can pass through. Decreasing of engine output may be caused by lack of fuel supply. This can be checked by loosening the connection of the delivery pipe at the injection valve while engine running at high speed. Cleaning periods of the filter depend on the amount of dirt in the fuel, therefore no fixed order for cleaning can be indicated. For fuel filter cleaning see chapter 7.3.

Periodically check cylinder head temperature warning lights (ground out sending unit). Cleaning of the air cooling ducts will depend on the environment the engine is operating in.

Check all nuts and fixing bolts. Retighten them if necessary.

After every 2000 hours, check nozzle pressure.

7. Maintenance Guide

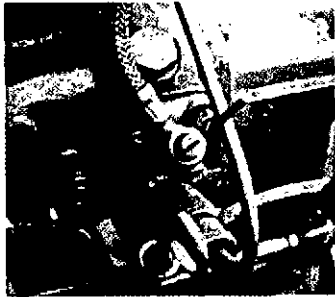
7.1. Venting the fuel system

Venting is necessary:

- a) Before first start-up.
- b) After a long period of standstill.
- c) When pipes have been loosened or removed.
- d) Whenever air is in the system.
- e) When fuel filter has been cleaned or replaced.

7.2. Venting the injection pump

Unscrew vent-screw on the injection pump (picture 9). Set governor lever at maximum speed (picture 4). Place decompressor lever in position "A" (picture 6) and let the engine turn by means of the cranking-handle or starter, until fuel flows bubble-free from the vent screw. Tighten vent-plug again.



Picture 9

7.3. Fuel filter

To clean the fuel filter, unscrew the nut on the filter (picture 10). Dismount the felt insert and wash it and the inner pipe with clean solvent. Verify that the felt insert is in good condition, otherwise replace it. Picture 10 element part number 000.989.02.00.



Picture 10

7.4. Oil filter maintenance

ATTENTION! Renew the disposable filter every 160 working hours, that is after each second oil-change. Dismount the filter by turning counterclockwise. Clean the sealing surface of the filter head carefully with a fluff-free rag. Using your finger, lightly oil the gasket on the bottom of the new disposable filter before tightening. Start the engine and check filter for tightness. Refill with lube oil up to the upper mark on the dipstick. Part number for the oil filter is 9.987.1.740.200.4.

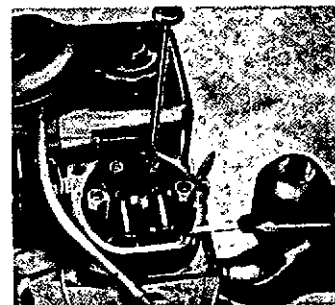


Picture 11

7.5. Adjustment of valve clearance

In cold engine valve clearance must be 0,24 mm.

After each fitting of cylinder head, cylinder head cover, valves or camshaft, clearance is to be re-adjusted. For this purpose use a feeler gauge of 0,2 mm between valve stem and rocker arm, when valve is closed. (Picture 12) Valve clearance adjustment takes place at the end of the compression stroke, this is when both valves are closed.



Picture 12

ALWAYS USE REPUTABLE FUEL

8. TROUBLE SHOOTING

SYMPTOM	CAUSES AND REMEDIES																						
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Engine does not start	x	x	x	x		x	x	x	x	x						x							
Engine stops	x	x	x	x		x	x	x	x														
Engine smokes black						x	x	x	x	x	x	x	x			x							x
Engine blow by insufficient compression									x	x		x				x							
Engine knocks						x	x	x			x	x	x				x	x			x	x	
High consumption of lube oil																x	x						x
Engine output is insufficient						x	x	x	x	x	x						x	x				x	
Engine smokes white		x								x						x	x					x	x
Irregular speed		x				x	x		x														

How to use this list: When engine knocks, see points 5-6-7-10-11-12-17-18-20 and 21.

8.0. Causes and remedies

- | | |
|---|--|
| 1. Fuel filter clogged. | Dismantle fuel filter insert and clean or renew cartridge (Paragraph 7.3) |
| 2. Air in injection pump. | Bleed out air. |
| 3. Water in fuel. | Drain fuel tank and filter and refill with fresh fuel (Paragraph 7.2). |
| 4. Shortage of fuel. | Fill tank with fuel. |
| 5. Excess crank end play | Refit thrust bearings. |
| 6. Injection pump does not work reliably. | Have it checked by an authorized Murphy distributor. |
| 7. Nozzle clogged. | Dismantle injector and clean nozzles. Have it checked by an authorized Murphy distributor. |

- | | |
|--|---|
| 8. Valves leak. | Clean, grind or replace. Check valve rocker arm clearance. |
| 9. Insufficient compression. Engine turns by hand easily. | Grind valves. Check whether all valves are closed. In case cylinder head has been dismantled. Cylinder head studs must be uniformly and crosswise tightened. Adjust clearance between valve stem and rocker properly. |
| 10. Air filter choked. Engine shows signs of overload. | |
| 11. Cylinder head gasket faulty. | Renew cylinder head gasket. |
| 12. Connecting rod bearing, engine cam hot, piston seized. | Examine connecting rod bearing and piston, renew them if necessary. Change oil. |
| 13. Engine is overloaded. | Take off load. Keep constant number of revolutions. |
| 14. Engine over full with oil | Drain off excess oil. |
| 15. Piston rings are sticking. | Dismantle and clean piston. Replace rings. |
| 16. Piston rings are sticking. | Dismantle and clean piston. Replace rings. |
| 17. Fuel unsuitable. | Use suitable brand. |
| 18. Connecting rod bearing loose. | Check bearing clearance. If connecting rod bearings are damaged, renew them. |
| 19. Lubrication fails. Connecting rod bearing runs hot. | Oil level too low. Examine the oil pump and if necessary replace with a new pump. Suction filter clogged. Clean and flush sediments out. |
| 20. Piston has run dry, has seized or cooling fails. | Examine oil level in the crankcase and refill it if necessary. Clean air inlet screen and cooling system. |
| 21. Injection quantity altered. | Have quantity readjusted by a Murphy Diesel Distributor. |
| 22. Button for fuel starting is sticking. | Free push-button, until it comes out by itself after the engine has started. |
| 23. Wet exhaust. | Do not let engine run at low speed without load. |

9.1. Diesel Fuel

Normally the engine works with Diesel fuel, but all other fuels appropriate for diesel engines may be used if in conformity with the below given specifications (DIN 51601):

Requirements			Tested acc. to
Max. content of water	vol. %	0,1	DIN 51777
Density at 15° C	g/ml	0,820-0,860	DIN 51757
Boiling point at 360° C	vol. %	90	DIN 51752
Viscosity at 20° C	c/St.	1,8-10 (1,1-1,85° E)	DIN 51550
Flash point according to Abel-Pensky min.	°C	55	DIN 51755
Possibility of filtering	°C	In summer down to 0 In winter down to 12	DIN 51770
Max. sulphur content	weight %	1,0 -	DIN 51768
Carbon residue acc. to Conradson max.	weight %	0,1	DIN 51551
Reaction to zinc max. loss in weight	mg	4	DIN 51779
Ignition quality (cetane number) min.	CaZ	40	DIN 51773
Percentage of ashes max.	weight %	0,02	DIN 51575

Net calorific value appr. 10.000 Kcal.

Beginning paraffin separation (BPA) by 5° at least below the lowest room resp. outside temperature.

The fuel should not contain solid, insoluble impurities and must be free of mineral acids and alkalis.

9.2. Preservation of stored engines

If there are no particular instructions given for long storage preservation, our engines are preserved for a three months period under normal conditions.

If an engine thus preserved should not yet be put into operation after that time, another preservation is necessary.

Proceed the following way:

1. Fill with rust-preventing anti-corrosion oil of SAE 10 grade up to the lower dipstick mark.
2. Drain fuel system by loosening hollow screws on injection pump or fuel filter. Fill the whole system with rust-preventing oil SAE 10 grade through fuel filter (take inserts out) or through daily tank, if filters are mounted in low position.
3. Crank the engine several times by hand. Vent cylinders by loosening injection valves and put throttle in full load position.
4. Take cylinder head cover off, wipe out and spray with inhibiting oil. Spray valve springs.
5. Spray with inhibiting oil all shining parts, especially injection pump and governor.

If battery is available, procedure shown in point 3) can also be carried out by the electric starter motor.

ATTENTION!! Before starting the engine, check freedom of throttle movement.

Repeat same preservation procedure every 3 months.

Before using the engine, drain anti-corrosion oil from engine and fuel system. If engine is out of operation for more than one year, change anti-corrosion oil.

9.3. Air filter

Impurities and dust in the air cause heavy wear to the engine.

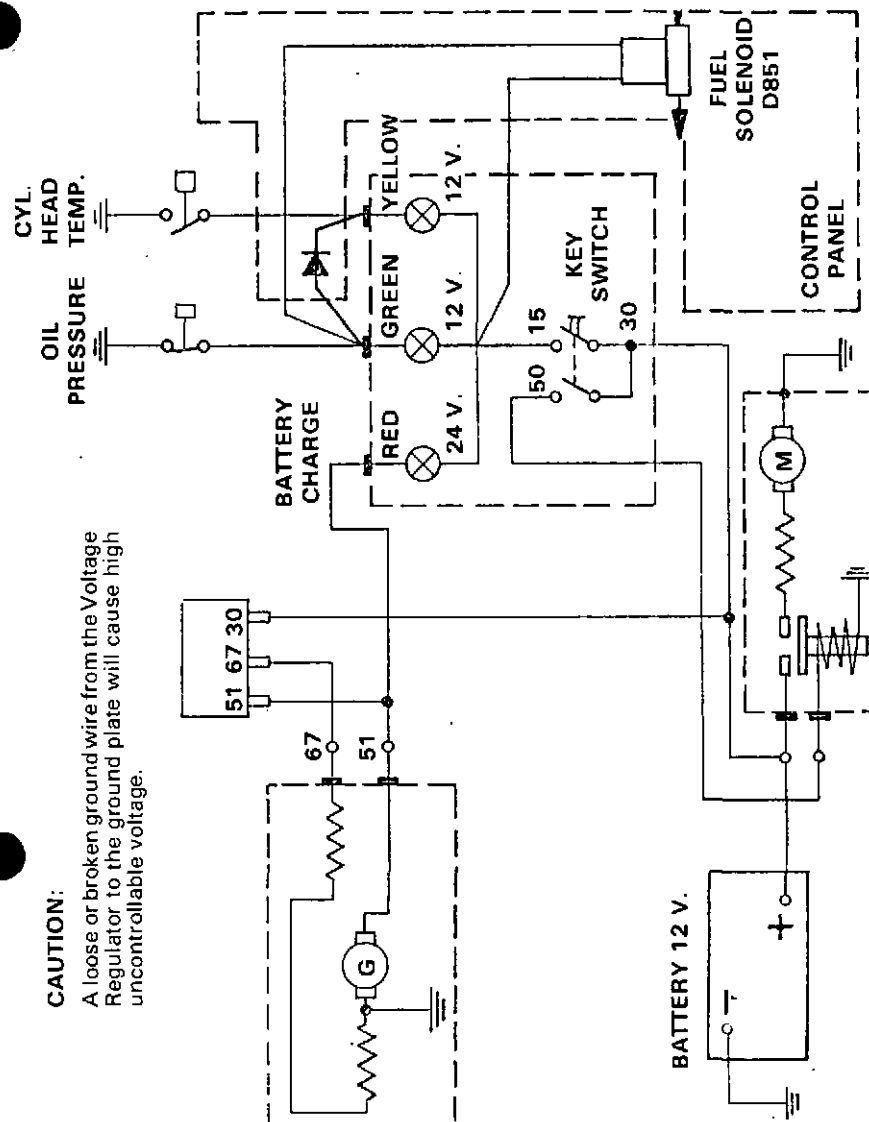
Frequency of sieve cleaning and oil changes depend on where the engine is working. Normally they should be cleaned every 10-125 running hours.

Oil contained in pan should be checked after the engine has been stopped at least 1 and ½ hours or much better just before starting daily work.

BE CAREFUL! In order to avoid accidents do not handle inflammable liquids while you are cleaning the air filter.

Hours of operation								MAINTENANCE SCHEDULE
4000	2000	1000-1250	500	200	100-120	70-80	30-40	
							X	Check oil level when engine is stopped and eventually refill with oil to the upper mark on dipstick. Check fuel level.
							X	First change of oil after 30 hours. Second change of oil after 60 hours.
						X	X	Change oil regularly. For every change of oil, unscrew plug on crankcase.
						X	X	Clean air filter, and fuel filter. See chapt. 9.3 and 7.3
					X			Check the battery.
			X					Verify that in cold engine, valve clearance is 0,24 mm. between rocker-arm and valve. Renew oil filter every 160 hours. Check cell terminals in the battery.
		X						Verify injector, injection pressure 180 + 5 Kg/cm ² . Clean cylinder cooling ribs, cylinder head and flywheel blades. If it works in a dusty atmosphere, clean every 100 hours. Verify thermometer for cylinder head temperature is working. Check all nuts and bolts. Verify tightening.
X								Check the engine.
X								General survey of the engine.

Wiring diagram for D Series engine LKS, D302-1, 302-2 with Femsa generator.



NOTES

Generator V-belt part number 434-23
9.5 x 612.55

V-belt part number 434-17
9.5 x 6.75

Lube oil filter part number
9.987.1.740.200.4

Fuel oil filter element part number
000.989.02.00



MANUFACTURER'S LIMITED WARRANTY
FOR D800, D900, D402, LKS, D202, D302, D225, D226, D229, D327, AND D916 SERIES ENGINES
EFFECTIVE JULY 1, 1981

MWM-Murphy Diesel Company ("MWM-Murphy") extends to the original retail purchaser the following warranty, subject to the following provisions:

(1) MWM-Murphy warrants to the original retail purchaser for the periods set forth below that goods manufactured or supplied by it will be free from defects in workmanship and material, provided such goods are installed, operated, and maintained in accordance with MWM-Murphy's written instructions.

PRODUCT APPLICATION

Engines used for commercial-industrial, agricultural, marine.

Engines sold specifically for stand-by generators.

Engines on equipment used for demonstration or rental.

Repairs or replacement parts.

PERIOD OF WARRANTY

One (1) year from date of delivery to original retail purchaser or 2,000 hours, whichever occurs first.

Two (2) years from date of delivery to original retail purchaser or 2,000 hours, whichever occurs first.

Six (6) months from date of first rental or demonstration or 2,000 hours, whichever occurs first.

Ninety (90) days from date of shipment, excluding labor.

(2) MWM-Murphy agrees to repair or replace at its option, without charge, any part or parts that prove to be defective together with reasonable labor to install these parts, provided failure or defect is not due to items outlined in Section #4 of this warranty. MWM-Murphy shall not be liable for delays arising from defective material or workmanship. Replacement parts provided under the terms of this warranty are warranted for the remainder of the warranty period applicable to the engine in which they are installed as if such parts were original components of that engine. No defect in material or workmanship shall be deemed to exist unless it is so determined by MWM-Murphy upon inspection by MWM-Murphy. Accordingly, MWM-Murphy reserves the right to examine all parts to be repaired or replaced with return transportation charges prepaid to the Milwaukee, Wisconsin plant.

(3) Travel time and mileage (Kilometers) allowance:

- a) Single and two (2) cylinder engines — No travel or mileage except in marine applications where 3b will apply.

All claims for defective products or parts under this warranty must be submitted in writing to MWM-Murphy and will be processed in accordance with MWM-Murphy warranty procedures. No person is authorized to give any other warranty or to assume any additional obligation on MWM-Murphy's behalf unless specific modification is made in writing and signed by a duly authorized officer of MWM-Murphy.

MWM-Murphy reserves the right to improve their product through changes in design or material without being obligated to incorporate such changes on engines of prior manufacture.

- b) Three (3), four (4), six (6) cylinder engines — Travel time up to three and one half (3.5) hours and mileage costs up to one hundred fifty (150) miles (240 Kilometers) roundtrip.

(4) THIS WARRANTY SHALL NOT APPLY TO:

- a) Cost of maintenance, adjustments, installation and start-up.
- b) Failures due to normal wear, accident, misuse, abuse, negligence, improper installation, or improper application.
- c) Products which are altered or modified in a manner not authorized by MWM-Murphy.
- d) Failure of goods caused by defects in the system or application in which the goods are installed.
- e) Telephone, telegraph, teletype, or other communication expenses.
- f) Rental equipment used while warranty repairs are being performed.
- g) Overtime labor requested by purchaser.
- h) Labor, crane rental, or other related expenses to remove or re-install engines in a piece of equipment or boat.
- i) Transporting engine to and from repair shop.
- j) Lube oil, lubricants, anti-freeze, filter elements, hoses, belts and other maintenance items.
- k) Accessories that bear another name (except Femsal); such accessories are in most cases warranted by their respective manufacturers.
- l) An engine operated with other than genuine MWM-Murphy parts.
- m) An engine repaired or altered by anyone other than MWM-Murphy or an authorized MWM-Murphy Distributor or Service Dealer.

(5) MWM-MURPHY SHALL NOT BE LIABLE FOR ANY CONSEQUENTIAL DAMAGES UNDER ANY CIRCUMSTANCES WHATSOEVER, WHETHER BASED ON LOST GOODWILL, LOST RESALE PROFITS, WORK STOPPAGE, IMPAIRMENT OF OTHER GOODS OR OTHERWISE, AND WHETHER ARISING OUT OF BREACH OF ANY EXPRESS OR IMPLIED WARRANTY, BREACH OF CONTRACT, NEGLIGENCE, STRICT LIABILITY IN TORT OR OTHERWISE, EXCEPT ONLY IN THE CASE OF PERSONAL INJURY WHERE AND TO THE EXTENT APPLICABLE LAW REQUIRES THIS EXCLUSION OF CONSEQUENTIAL DAMAGE REMEDIES UNENFORCEABLE.



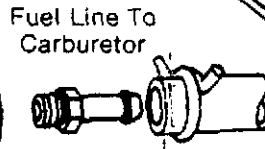
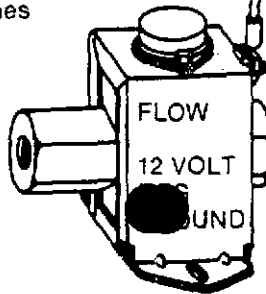
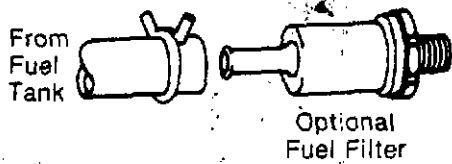
Facet

Facet Enterprises Inc.
Automotive Components Marketing
Elmira, N.Y. 14903

ELECTRIC FUEL PUMP

Installation Instructions

Between the Fuel Tank and the Solid Fuel Line, there should be a Flexible Hose. This is a convenient spot to install the lines for the Fuel Pump.



(P) Contact to the Pump with 16 Ga. Wire

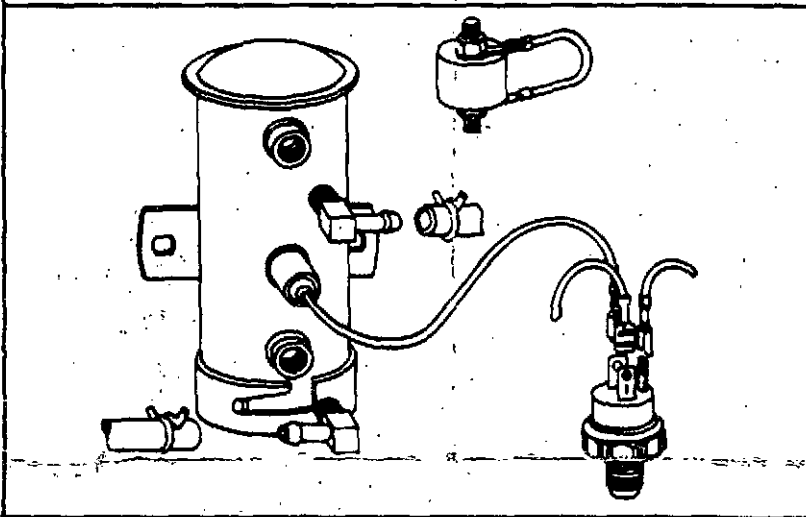
(S) Contact to 12 VCD Controlled by the Starter Relay

(I) Contact to Ignition Switch

Oil Pressure Switch

Optional Rubber Shock Mount (1 of 2) with Ground Strap

Mount to the frame anywhere outside the engine compartment. Refer to "Mounting the Pump" and "Precautions"



PRECAUTIONS

1. To prevent damage to your new fuel pump, install only after checking the proper voltage and polarity. The vehicle's polarity can be determined by checking to see which battery terminal (positive \oplus or negative \ominus) has a heavy lead wire connected from it to the engine block. On U.S. cars, it will be negative.
2. To reduce the possibility of vapor lock, do not mount the fuel pump in the engine compartment, near the exhaust system, or any location that may exceed 140°F (65°C) ambient temperature.
3. To avoid priming problems, do not mount the fuel pump more than 18" (45 cm) above the bottom level of the fuel tank.
4. To ensure a good ground, mount the fuel pump on the vehicle frame, whenever possible. The area of the frame to be used should be thoroughly cleaned to obtain a good electrical connection.
5. Use an oil pressure safety switch which will shut off the fuel pump if your vehicle is involved in an accident that stalls the engine.
6. An in-line filter should be installed before the inlet of the cubical pump, but is not required with the cylindrical pump.
7. The pump may make a tapping or clicking noise during operation. To dampen this noise, use rubber shock mounts when installing the fuel pump. NOTE: When using shock mounts, be sure to use a ground strap to maintain your electrical connection (pump case to vehicle frame.)
8. Carefully read all instructions before proceeding with your installation.

MOUNTING THE PUMP

1. Select a location near existing fuel lines and close to the fuel tank. Use the vehicle frame where possible. If another location is used, be sure you have a good electrical ground and that the pump is not more than 18" (45 cm) above the bottom level of the fuel tank.
2. Using the pump mounting bracket as a template, drill two 7/32" holes for mounting the pump. NOTE: The pump may be mounted in any position; however, it is recommended that the outlet of the pump be at least 30° above horizontal. This will allow any vapor buildup to easily pass through the pump.
3. Thoroughly clean frame surface around drilled holes to remove paint, grease, rust, etc., to ensure a good ground. **THE PUMP CASE MUST BE WELL GROUNDED, OR IT WILL NOT OPERATE.**
4. Firmly secure pump to frame with self-tapping screws.
5. If rubber shock mounts are used, normally not required with solid state pump, a location must be selected that allows you to tighten the 1/4 inch nuts from the back side. On box frames, very often a "U" bracket is required that can be secured to the frame with self-tapping screws, and leave space to tighten the nuts onto the shock mount. Always use the ground strap (wire) to make the electrical connection from one side of the shock mount to the other.
6. The installation of the fuel fittings and filter may be done prior to mounting the pump on the vehicle and should be tightened with approximately 10 ft.-lbs. of torque.
7. Cut fuel line near fuel pump, and use required lengths of flexible hose to connect inlet side of pump to fuel line from tank, and outlet side to fuel line to carburetor. The flexible hose should extend at least 2" over the fuel line. Use hose clamps at end of hose. NOTE: Gas tank should be near empty to avoid excessive spillage after cutting fuel lines. Use a catch basin to collect any fuel that does drain from lines. It is advisable to have the pump mounted on the vehicle with the fittings and fuel hose installed on pump prior to cutting vehicle fuel lines. This will allow for a quick changeover.

ELECTRICAL CONNECTIONS

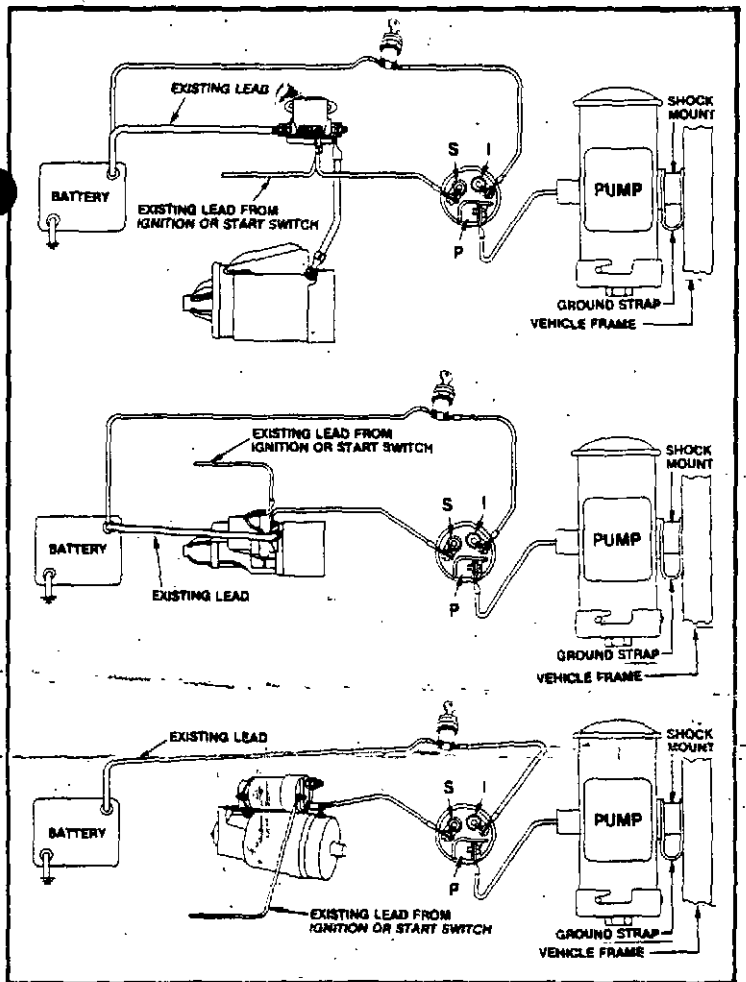
1. Disconnect ground cable from battery. Reconnect cable after oil pressure switch installation is completed.
2. Install switch in an oil gallery opening in the engine where oil pressure can be detected.
3. Using #16 gauge or larger wire and the push on terminals supplied with the switch,
 - a. Connect power lead from fuel pump to common (P) terminal of switch. Do not connect wire to pump case.
 - b. Connect normally open (I) terminal of switch to ignition switch, accessory take-off of fuse block, or some other 12 volt power source controlled by the ignition switch.
 - c. Connect normally closed (S) terminal of switch to starting system as shown in the following typical illustrations.
4. If the electrical terminal on the end of the lead wire from the pump is not needed, just cut it off and strip wire as required

BY-PASSING OR REMOVING OLD FUEL PUMP

1. Disconnect fuel lines from mechanical fuel pump.
2. Using flexible hose, connect the above fuel lines to each other. The by-passed or eliminated mechanical pump should either be removed or have the inlet and outlet hole plugged.
3. On some older model vehicles, a double diaphragm pump was used. One diaphragm pumped gasoline; the other pumped vacuum to aid or operate vacuum windshield wipers. If your vehicle is so equipped, remove only the two fuel lines, and plug the fuel inlet and outlet holes into the mechanical pump. Do not disturb the vacuum lines. It may be easier to connect the inlet and outlet with a piece of rubber hose rather than plug the holes.

FINAL CHECK-OUT

1. Disconnect line from electrical fuel pump, somewhere between the pump and the carburetor, turn on pump (see notice) to prime, and bleed air from the lines. Use a catch basin at the line end. **NOTICE:** With safety switch installed, the pump will not operate unless the engine is being cranked by the starting motor. If carburetor has enough fuel to start the engine, the pump will operate without the starting motor running as long as the engine is running. If pump does not prime in 20 to 30 seconds:
 - a. If pump is not running, check for good ground connection and for good hot wire connections.
 - b. If pump is running but not pumping fuel, check for fuel line kinks or loose suction line connections between the pump and the fuel tank. The outlet line must be open to atmosphere to allow the air in the system to escape so fuel can get into the pump.
2. Start engine and check installation of the following:
 - a. Air or fuel leaks in lines and fittings.
 - b. Kinked or clogged lines.
 - c. Improper or loose electrical connections.
 - d. Carburetor flooding. (Inspect needle valve and seat.)
3. As long as the engine is running, even at slow idle, the electrical fuel pump will be pulsing. Because of the oil pressure safety switch, the fuel pump will remain running a second or two longer after the engine stops.



4. If the electric fuel pump develops a different loud noise during hot operation, vapor lock may be forming. Severe cases of vapor lock will cause the engine to run out of fuel, and the pump will not reprime until it cools down. **Vapor lock normally indicates that the pump is mounted in an area that sees excessive temperatures or that the fuel suction line is positioned where it gets excessively hot. The best installation has the shortest possible suction line and the pump is the coolest spot on the vehicle.**

LIMITED WARRANTY

Facet Enterprises, Inc. warrants this Electric Fuel Pump to the original consumer purchaser against defects in material or workmanship under normal use and service for [redacted] of one (1) year from the date of purchase. In the event of a defect covered by this warranty, the unit should be returned to the dealer from whom it was purchased, with proof of purchase date. Any defective unit will be repaired or, at the dealer's or Facet's option, replaced without charge for either parts or labor. If the dealer is unable or unwilling to cure the defect, Facet should be notified in writing at the address shown below. Facet will then issue instructions as to the proper procedure to follow based on the information supplied in the notice.

ANY IMPLIED WARRANTIES ARE ALSO LIMITED IN DURATION TO THE ONE (1) YEAR PERIOD FROM THE ORIGINAL PURCHASE DATE. FACET ENTERPRISES INC. SHALL NOT BE LIABLE FOR LOSS OF USE OF THIS ELECTRICAL FUEL PUMP OR ANY OTHER INCIDENTAL OR CONSEQUENTIAL DAMAGES.

This warranty does not cover any defect resulting from misuse, abuse, neglect, accident, alteration, improper installation or any other cause not arising out of a defect in materials or workmanship.

This Limited Warranty gives the original purchaser specific legal rights. The purchaser may also have other rights which may vary from state to state. Some states do not allow limitations on how long an implied warranty lasts or the exclusion of limitation of incidental or consequential damages, so the above limitations or exclusions may not be applicable.

FACET ENTERPRISES, INC., Automotive Components Marketing, Elmirā, N.Y. 14903

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