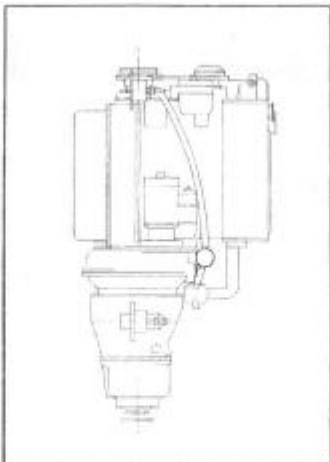


**Operating
Instructions for the
PISCES 27, 40 and 60**



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Foreword

We would like to thank you for specifying the Pisces Engine and congratulate you for buying the finest marine auxiliary on the market today. The Pisces is the product of years of both engineering and practical experience in the marine engine field.

This book of operating instructions contains information pertaining to the operation and maintenance of the Pisces as well as a complete technical description and trouble-shooting section for your reference.

We cannot overstate the importance of maintaining your Pisces Engine exactly as outlined herein. With proper care you can expect to receive years of trouble-free operation and economy that only a Pisces Engine can deliver.

In the event you have further questions or require spare or replacement parts, please contact your nearest PISCES Service Dealer.

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Engine Identification Number

When ordering spare or replacement parts, it is important you give the dealer both the engine model number as well as the serial number. These numbers are stamped into the fly-wheel housing on the engine's port side.

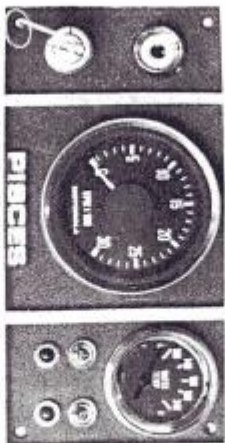


Fig. E Standard Instrument Panel

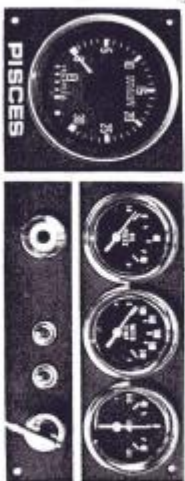


Fig. F Deluxe Instrument Panel

Operation

Before Starting:

1. Check the level of engine oil with the oil dipstick. Be sure the oil level is within the MAX level and MIN mark. Also check viscosity and for contamination of oil sampled. See Fig. 1.
2. Check the oil level in reverse gear. See Fig. 2.
3. Check fuel level in tanks making sure to carry enough fuel for safe cruising. Use only Number Two (#2) Amber Diesel Fuel. Open the fuel shut-off valve (if so equipped) to the engine.
4. Check the level of coolant and if necessary, add to bring the level up to the face of the overflow bypass. Note: Removing the filler cap from a hot heat exchanger will cause dangerous hot steam to blow out. To prevent this, slowly turn the filler cap to the left with a cloth to release the internal pressure. The cooling system is designed for the use of permanent antifreeze at all times.
5. Turn on master switch and pump out any water that may have accumulated in bilge. Avoid pumping oil or fuel overboard.
6. Make sure all safety equipment is in order: fire extinguisher, life vests, anchor, etc.
7. Place shift lever in neutral position.



Fig. 1



Fig. 2

To Start Engine:

1. "Off" Position

The key can be removed from the switch only in the OFF position.

2. Preheating

With the key, turn the switch all the way to the left to operate the glow plugs. See Fig. 3. The state of preheating can be checked against the CONTROL RESISTOR. About 30 seconds is required for the control resistor to get red hot when the glow plug circuit is functioning normally. When the key is released, the switch automatically returns to OFF position.

3. Starting

When the glow plugs are heated, crank the engine by turning the switch all the way to the right with the throttle wide open. Do not operate the starter motor continuously for more than 10 seconds.

4. Operation

As soon as the engine is started, release the key so that it returns automatically to ON position. Reduce engine speed to an idle. Note: Do not turn ignition switch to OFF position while engine is running.

Points To Be Checked After Starting Engine:

Do not abruptly change the engine speed immediately after starting, but hold the engine running at fast idle until normal operating temperature has been reached. Scan the instruments and/or indicator lights and check for abnormal



Fig. 3

engine vibration, noise and color of exhaust.

1. Oil Pressure

If your instrument panel is equipped with oil pressure gauge, it should read between 25-50 P.S.I. while the engine is idling. If the oil pressure falls to reach this range when the engine speed is increased, or if the indication is erratic while the engine is operated at low speeds, bring the engine to a stop immediately and check the oil level. Also, check around the engine for signs of oil leakage. For engines equipped with indicator lights, the oil pressure is normal if the light goes out when the engine is started.

2. Cooling Water Temperature

The cooling water temperature is normal if the temperature gauge indicator falls between 160-190° F., (71-88° C). The engine fails to provide maximum performance if the water temperature is higher or lower than mentioned above. Overcooling of the engine will result in an unnecessary increase in the fuel consumption. If the engine shows signs of overheating or overcooling, check the thermostat for failure. It should begin to open at 175° F., (80° C). Also see "Trouble Shooting."

3. State of Charging

The function of the alternator may be regarded as normal if the ammeter pointer swings toward "+" or if the charge indicator light (on models so equipped) goes out when the engine speed is increased. When batteries become fully charged, voltage regulator will cause alternator output to cut back, thus showing no charge on ammeter.



Fig. 5

To Stop Engine:

To bring the engine to a stop, always lower engine speed to an idle, place shift lever in neutral position, and pull the engine stop cable handle all the way out. This will shut off the air supply thereby causing the engine to stall. The engine cannot be brought to a stop by merely turning the switch to the OFF position. Make sure to turn the switch to the OFF position **after** stopping the engine. Do not run the engine with the ignition switch in the OFF position.

Treatment of New Engine:

In the early life of an engine, the bearing surfaces of certain moving parts are wearing in. Damage to these parts may result if the protective oil films are destroyed. To prevent problems, carefully observe the following:

1. Avoid overloading and continuous high speed operation.
2. Keep the engine running at fast idle until normal operating temperature is reached. Do not race a cold engine.
3. Follow the periodic inspection and service chart in this book.

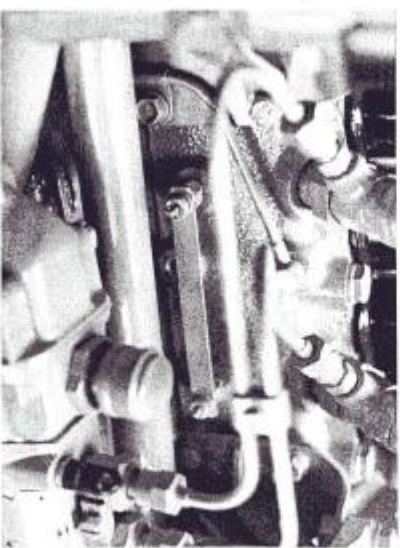


Fig. 6

Starting Precautions

To Be Observed In Cold Weather:

1. Freezing of Cooling Water

The use of antifreeze solution eliminates the problem of coolant freezing.

2. Over-Cooling of Engine

Over-cooling of the engine will cause the thermal efficiency of the engine to deteriorate considerably. If the engine should fail to reach the normal temperature (intermediate range of the temperature gauge) after continuous operation, the thermostat should be checked.

3. Battery Care

The capacity of the battery tends to decline with lower temperatures, so to prevent possible trouble resulting from an undercharged battery, periodic charging is recommended. This can be done with shore power and battery charger but it is more beneficial to both battery and engine to run engine at regular intervals for periods of from $\frac{1}{2}$ to one hour.

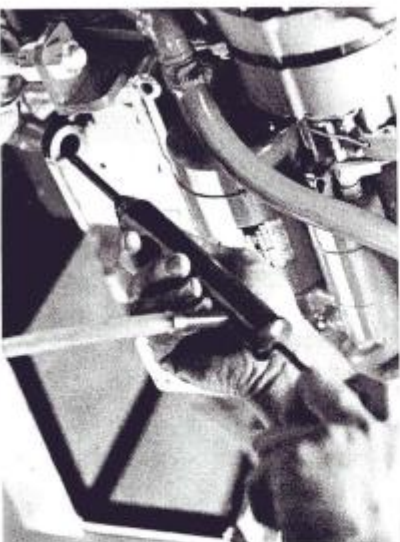


Fig. 7

Winterizing Engine — Short Duration:

In areas where the ambient air temperature falls below the freezing point, it is extremely important to make sure the cooling system contains the recommended quantity of permanent type antifreeze (see technical data). Also, it will be necessary to drain raw water from engine by removing the zinc plug from the heat exchanger (see Fig. 5) and pulling the hoses off the inlet and outlet side of the raw water pump. Residual water in pump can be removed by adding a few drops of oil in the outlet tube and rotating pump pulley counter-clockwise.

Winterizing Engine — Long Duration:

When the engine is to remain idle for periods greater than two months, the following procedure should be followed to avoid problems:

1. Follow short duration winterizing procedure outlined above.
2. Remove glow plugs from cylinder block and squirt engine oil directly into cylinders. See Fig. 6. Rotate engine two full turns by hand, then replace glow plugs.

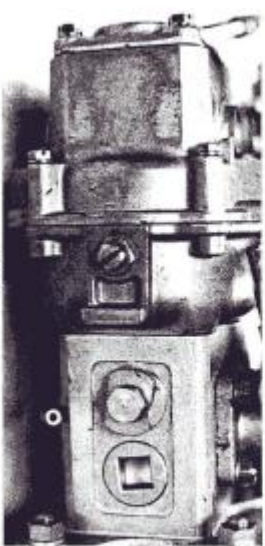


Fig. 6B

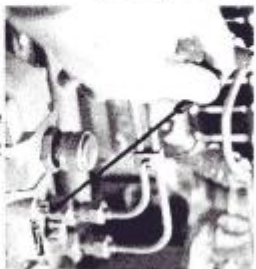


Fig. 8A

3. Remove valve cover and lubricate rocker arms, valve springs and valve stems. Place cover back in position.
4. Remove drain plug (or open water drain cock on models so equipped) from exhaust riser to drain raw water.
5. Remove the batteries and store in warm place.

Engine Maintenance

The Pisces Marine Engine was designed with trouble-free operation and longevity in mind. To obtain the best possible performance from your engine, it is strongly recommended that maintenance schedules be followed closely. For best results, you should keep an accurate log of engine hours, or preferably, install an engine hour meter to eliminate "guessing" at maintenance schedules.

Lubricating System:

1. Engine Oil Type
Engine lubricant should be a heavy duty, high detergent Series Three (3) motor oil meeting or exceeding API Service Classification CD or should be recommended for Service DS. Motor oil should be of 30 wt. viscosity by S.A.E. Standards in areas where air temperature is below 80° F. (26.7° C). S.A.E. 40 is recommended for added protection when air temperature exceeds 80° F. Your engine can best be protected by using the below recommended lubricants or their equivalent:

RECOMMENDED LUBRICANTS

BRAND	NAME
Model	DeWitt 1300
Shell	Remula
Standard	RPW DeWitt 300
Texaco	RPW DeWitt 400
Union	URSA LA 3
	Guardol Series 3
	TSX



Fig. 9

2. Replacement of Engine Oil

Replace the engine oil after the initial 25 hours of operation and thereafter at 100 hour intervals or at least once per season, whichever comes first. Drain the engine crankcase and remove the oil filter while the engine is still warm. Pump oil from dipstick tube by means of a hand operated suction pump. See Fig. 7.

3. Install replacement filter after applying thin film of oil to rubber seal. After seal makes contact, tighten one-third to one-half turn. DO NOT OVERTIGHTEN.

4. Fill the engine crankcase to the specified level. Start engine and while holding the engine speed at an idle, check for oil leaks. Recheck the oil level after running the engine about ten (10) minutes and add oil if level does not fall within indicated marks on dipstick.

5. The Injection Pump

The injection pump oil should be drained and refilled at 300 hour intervals or at least once per season, whichever comes first. Drain the cam chamber through the oil drain plughole (see Fig. 8B) on the lower part of the injection pump and refill through the oil dipstick hole with engine oil (see Fig. 8A).

6. Mechanical Governor

The oil dipstick is located on the rear part of the governor chamber. See Fig. 9. Every 300 hours or at least once per season, whichever comes first, drain the oil through the drain plughole on the lower part of the governor chamber and refill through the oil dipstick hole with engine oil.



Fig. 10

Cooling System:

1. Drive Belt, Raw Water Pump

When correctly adjusted, the raw water pump belt should give a lateral deflection of about $\frac{1}{4}$ " (5MM) when a good pressure is applied between the water pump pulley and crankshaft pulley. To adjust belt tension, loosen the bolt on the water pump bracket and pivot as required. See Fig. 10. While adjusting belt tension, also check for fraying and damage.

2. Drive Belt, Alternator

When correctly adjusted, the alternator belt should have a deflection of $\frac{1}{4}$ " (5MM) when a good pressure is applied between the water pump pulley and the alternator pulley. To adjust tension, loosen bolt on alternator tension arm as well as the pivot bolt at the alternator base, and pry the alternator outboard while re-tightening bolt through tension arm. Note: Do not pry against pulley or fan because they will bend!

3. Replacement of Cooling Fluid

To drain the cooling system, proceed as follows:

- Remove the filler cap on expansion tank.
- Remove drain plug or open draincock on models so equipped, on lower port side of cylinder block. See Fig. 11.
- Remove the two drain plugs from the exhaust manifold. See Fig. 12.
- Remove $\frac{1}{8}$ " drain plug from heat exchanger allowing coolant to escape, then replace plug.
- Remove zinc anode from end cover of the exhaust manifold, and replace. See Fig. 13.
- Refill system.

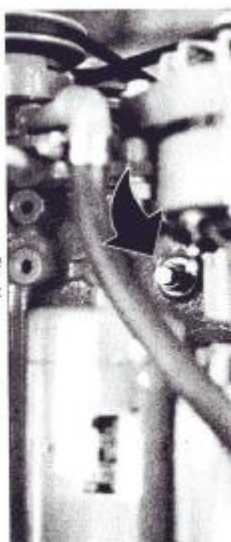


Fig. 11

4. Flushing of Cooling System

Use only a neutralized cleanser, rinsing with a generous amount of water to remove all traces of cooling system cleaners before refilling. The use of alkaline base cleansers or acids is not recommended since they may be harmful to the cooling system. If the cooling system is drained and refilled, the coolant level may drop slightly when the engine is run. To insure that the system is filled to the specified level, operate the engine for a few minutes and bring it to a stop. Check the coolant level and add, if necessary.

5. Zinc Anodes

Zinc anode plugs in heat exchanger and exhaust manifold should be replaced at 100 hour intervals or every six months. Zincs are screwed in the brass plugs screwed into the heat exchanger and end cap of exhaust manifold.

Engine Model	27	40	60
System Capacity	5 Qts. 4.7 Liters	7 Qts. 6.6 Liters	8 Qts. 7.6 Liters
Antifreeze Required	2.5 Qts. 2.3 Liters	3.5 Qts. 3.3 Liters	4.0 Qts. 3.8 Liters

6. Water Pump Impeller

Every 300 hours check the cooling water pump impeller for wear or damage. Replace when necessary.

7. Replacement of Raw Water Pump Impeller

To replace the raw water pump impeller proceed as follows:

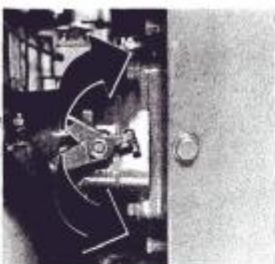


Fig. 12

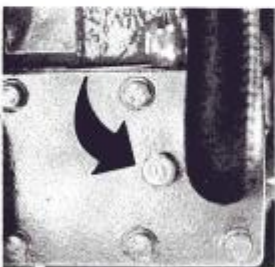


Fig. 13

- Remove drive belt by unscrewing tensioner bolt on water pump. See Fig. 10 (shown earlier).
- Remove the pump mounting bolt and remove pump assembly.
- Remove the 6 screws securing cover plate and remove plate.

d. Remove impeller with the aid of two screw drivers. See Fig. 14.

e. Apply a light film of waterproof grease to new impeller and insert in pump housing.

f. Replace cover plate using a new gasket and a light application of sealer.

g. Reinstall pump.

h. Retighten belt.

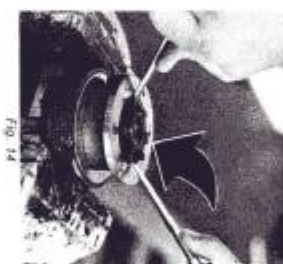


Fig. 14

Air Breather:

The air breather is a ventilation device through which the internal part of the engine is vented. See Fig. 15. The filter element in the breather is to filter the air taken into the engine. A dirty air breather will decrease performance and shorten engine life. At 300 hour intervals, remove the air breather, clean the filter element with solvent, soak in clean engine oil and reinstall.



Fig. 15

Fuel System:

1. Fuel Filter

The fuel injection pump consists principally of delicate parts which are precision finished. Foreign matter carried in the fuel will cause damage to the plungers and in extreme cases, can lead to seizure. To prevent such troubles, the fuel filter must be replaced regularly. At 100 hour intervals or at least twice per season:

a. Drain the filter completely by removing the drain plug on the lower part of the filter body. See Fig. 16.

b. Replace the filter element by removing center bolt and dropping filter can. Every 1,200 hours clean the strainer fitted into the banjo bolt on the inlet side of the fuel feed pump. See Figs. 17 & 18.

2. Additional Filter

It is strongly recommended that an additional filter of the fuel filter/water separator type be installed in line with the standard fuel filter. See Fig. 19. This unit will act not only as a primary fuel filter but also serves to separate any water particles from the fuel. The fuel filter/water separator element should be replaced at the same time engine fuel filters are changed.

3. Air Bleeding

If the engine has stalled due to lack of fuel, or if the fuel filter is drained for installation of a new element, the fuel system must be bled of air in the following manner:

a. Loosen the forward air bleed screw on fuel injection pump. See Fig. 20.

b. Turn hand primer counterclockwise until plunger pulls free. See Fig. 21.

c. Pump plunger to pressurize fuel injection pump and

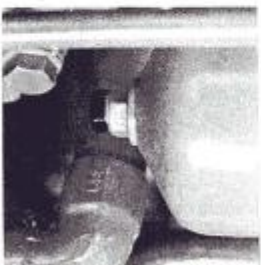


Fig. 16



Fig. 17

1. Screw hand primer plunger back into running position.

4. Fuel Injection Nozzles

Every 300 hours, have a trained service technician check the nozzle injection pressure and spray pattern and make the necessary adjustments. See Fig. 22. If the nozzle pressure or spray pattern is incorrect, the engine will run rough and smoke excessively. To adjust the injection pressure, check the injector with a nozzle tester and add or remove the adjusting shims to or from the nozzle holder as necessary. The standard injection pressure is 1,706 P.S.I. (120 kg/cm²).



Fig. 18

bleed air through the bleeder screw.

d. Close front screw and open rear bleed screw (on models 40 and 60 only), continuing to pump until the system is free of air. Retighten screw.

e. Loosen bleed screw on top of fuel filter and pump plunger until air ceases to blow from line. Then retighten.

5. Adjustment of Injection Timing

The standard injection timing is as listed in the technical data section. The adjustment of the injection timing is not normally required.

6. Injection Pump

The parts of the injection pump that require precise adjustments are protected by lead seals. If the injection pump requires an adjustment, do not disturb the factory setting of the parts and refer the matter to the nearest PISCES Service Dealer.

Electrical System:

1. Electrolyte Level Check

Repeated discharging and recharging of the battery results in a lowering of the electrolyte level. It is therefore advisable to make a periodic check on the level of the electrolyte and replenish as needed.

2. Specific Gravity Check

If engine fails to crank, check the specific gravity of the electrolyte with a hydrometer to determine the state of charge of the battery. It is important to keep the battery fully charged, particularly in winter. With the battery fully charged, the specific gravity should be as high as 1.260 when checked at 68° F. (20° C).

3. Battery Connections

Check for loose battery connections and tighten the terminals if necessary.

4. Cleaning of Battery

Clean the terminals, posts and external part of the battery with water, and if necessary, baking soda to remove corrosion. Apply a thin coat of grease to the battery posts and terminals to prevent corrosion.

5. Glow Plugs

The glow plugs, when the ignition switch is in the proper position, preheat the combustion chambers, increasing temperature in cylinder for easy starting. The glow plugs are connected



Fig. 19

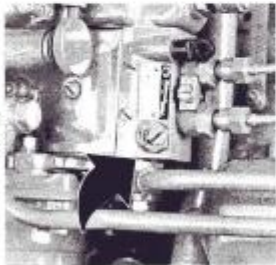


Fig. 20

in series with the control resistance. In the event a glow plug has burned out, the control resistance will not glow red. If the control resistance turns red immediately, it indicates a shorted out glow plug, or a bad wire from switch to glow plug. If either condition exists, disconnect plugs and check with ohmmeter. Proper resistance is 1.8 ohms each.

6. Alternator

- Make sure that the negative terminal (—) of the battery is grounded.
- Do not operate the engine with the output terminal disconnected.
- Do not ground output terminal.
- Do not ground regulator terminal of the alternator.

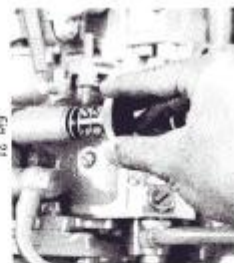


Fig. 21

e. Do not turn off the master battery switch while engine is running.

Engine Components:

1. Cylinder Head Bolts

After the initial 25 hours of operation, check and re-torque the cylinder head bolts. Thereafter the cylinder head bolts should not have to

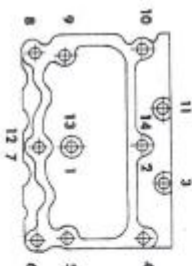


Fig. 23 Cyl. Head Torque Sequence
Proce. 2)

be retorqued.

2. Procedure

With a torque wrench tighten all the cylinder head bolts evenly to 58 ft./lbs. (8 m.-kg). Torque in the sequence specified. See Figs. 23, 24 & 25. The valve clearance should be checked and adjusted whenever the cylinder head bolts are retorqued.

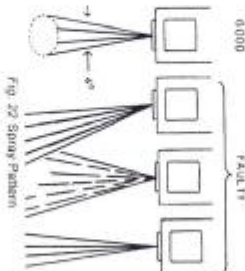


Fig. 22 Spring Pattern

3. Valve Clearance Adjustment

If the valve lifters are making an excessive amount of noise, or if the engine is running rough, it may be necessary to adjust the valve clearance. Also, as mentioned earlier, valve clearance should be checked after cylinder head bolts have been retorqued. Adjustment is made on a cold engine and clearance should be set at .018 (.45) for both intake and exhaust valves.

4. Method of Valve Adjustment — 2 Cylinder

- Hand crank the engine stopping when the timing pointer is aligned with the top dead center mark on the crankshaft damper. See Fig. 26. If valve springs on the No. 1 cylinder are depressed, rotate crankshaft one full turn to put the No. 1 cylinder in the TDC position on the compression stroke. Without cranking engine, adjust the clearance of the intake and exhaust valves of the No. 1 cylinder and the intake valve of the No. 2 cylinder.
- Turn the crankshaft one full turn so that the piston of the No. 2 cylinder is at the bottom dead center on the intake stroke, and adjust the exhaust valve clearance of the No. 2 cylinder.

5. Method of Valve Adjustment — 3 Cylinder

- Hand crank engine stopping when the timing pointer is aligned with the top dead center mark on the crankshaft damper. If the valve springs on the No. 1 cylinder are depressed, rotate crankshaft one full turn to put No. 1 cylinder in the TDC position on the compression stroke.

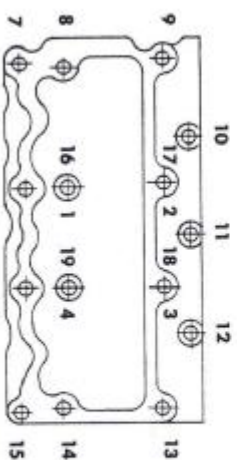


Fig. 24 Cyl. Head Torque Sequence
Pictas 40

- Without cranking engine, adjust the clearance of the intake and exhaust valves of the No. 1 cylinder, intake valve of the No. 2 cylinder and exhaust valve of the No. 3 cylinder.
- Rotate crankshaft one full turn to place the No. 1 cylinder at the bottom dead center on the exhaust stroke.
- Adjust clearance of the exhaust valve on the No. 2 cylinder and intake valve of the No. 3 cylinder.

6. Method of Valve Adjustment — 4 Cylinder

- Hand crank engine stopping when the timing pointer is aligned with the top dead center mark on the crankshaft damper. If the valve springs on the No. 1 cylinder are depressed, rotate crankshaft one full turn to put No. 1 cylinder in the TDC position on the compression stroke.
- Without cranking engine, adjust the clearance of the intake and exhaust valves of the No. 1 cylinder, intake valve of the No. 2 cylinder and exhaust valve clearance of the No. 3 cylinder.
- Rotate crankshaft one full turn to place the No. 4 cylinder at TDC on the compression stroke.
- Adjust clearance of the intake and exhaust valves of the No. 4 cylinder, exhaust valve of the No. 2 cylinder and intake valve of the No. 3 cylinder.

Reverse Gear, Borg Warner 70C

The Borg Warner 70C Velvet Drive utilizes a multiple clutch pack assembly to eliminate bands that require periodic adjustment. Helical cut gear teeth and a planetary assembly are just a few of the features that contribute to its smooth operation.

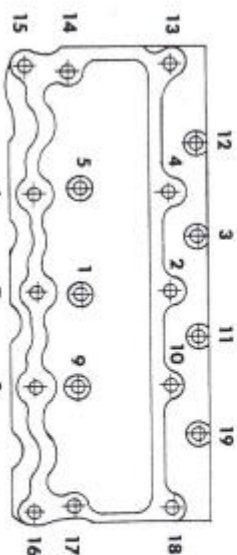


Fig. 25 Cyl. Head Torque Sequence
Pictas 60

Instructions:

Place transmission control selector in neutral before starting the engine. Shifts from any selector position to any other selector position may be made in any order. Make shift at lowest feasible engine speed and, except in an emergency, at engine speeds less than 1000 RPM.

The fluid level should be maintained at the full mark on the dipstick. Check fluid level immediately after stopping the engine. See Fig. 2 (shown earlier). Drain oil once per season or every 100 hours (when changing engine oil) and refill with automatic transmission fluid type "A" or Dextron. Engine oil (SEA 30 wt., service D.S.) may be used if the engine speed is not to exceed 3,000 RPM. Oil additives are not recommended. Although the 70C is a hydraulically operated unit, it is not necessary to lock the propeller shaft. Propeller can be allowed to freewheel while sailing.

Reverse Gear, ZF BW6M 30:

The ZF Model BW6M 30 is a marine reduction/reverse gear which operates by means of a servo cone clutch. It was designed with sailboats in mind. While sailing, it is unnecessary to disengage or lock prop shaft because "trailing" propeller will in no way damage the transmission.

Operation:

The change over from forward to reverse gear should be made only after engine RPM drops to an idle. With this in mind, it is recommended a throttle-shift control quadrant of the "Single Lever Control" type be used. See Fig. 30.

Maintenance:

The ZF reverse gear has a separate oil reservoir from that of the engine. SAE 90 viscosity gear oil is required. Total oil capacity is .85 pints (.4 liters) and should be changed at 100 hour intervals (when changing engine oil) after the initial oil change at 25 hours.

CYLINDER NO.	1	2
VALVE ARRANGEMENT	E I	I E
NO. 1 CYL. AT T.D.C.	0 0	0
NO. 2 CYL. AT B.D.C.		0

Fig. 27

Pisces 27

CYLINDER NO.	1	2	3
VALVE ARRANGEMENT	I E	E I	I E
NO. 1 CYL. AT T.D.C.	0 0	0	0
NO. 1 CYL. AT B.D.C.		0	0

Fig. 28

Pisces 40

CYLINDER NO.	1	2	3	4
VALVE ARRANGEMENT	E I	I E	E I	I E
NO. 1 CYL. AT T.D.C.	0 0	0	0	
NO. 4 CYL. AT T.D.C.		0	0	0 0

Fig. 29

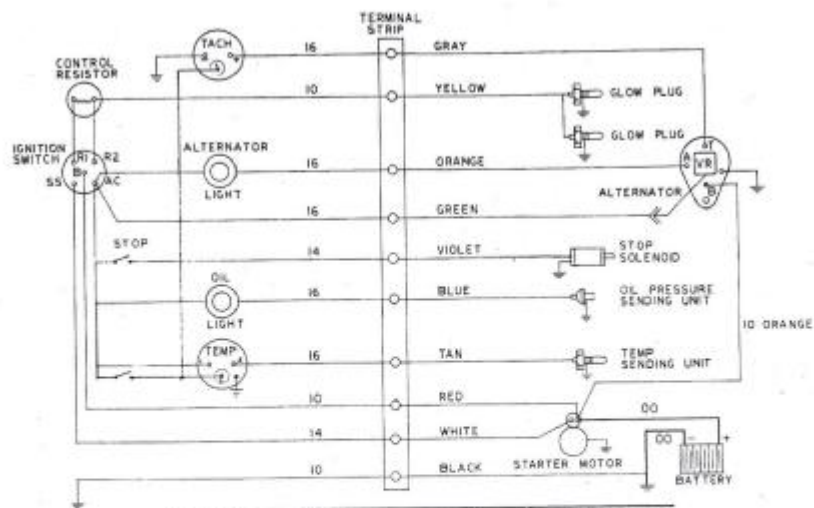
Pisces 60



Fig. 29

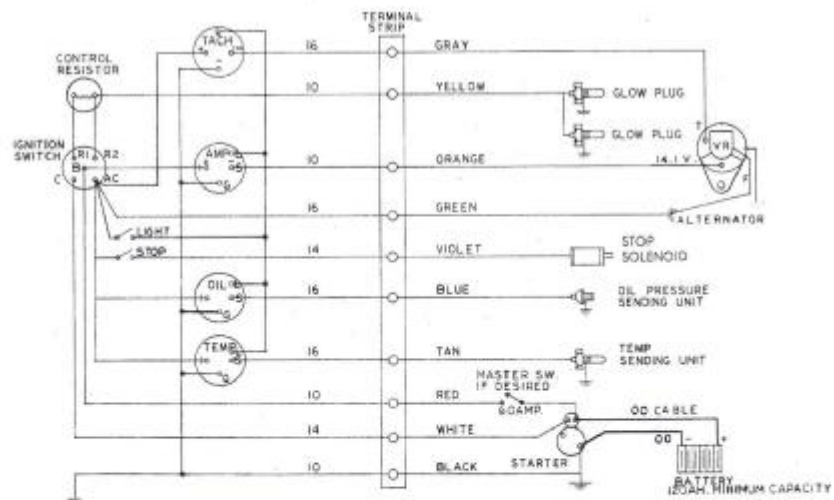


Fig. 30 Single Lever Control



Wiring Diagram, Standard Panel

Fig. 31



Wiring Diagram, Deluxe Panel

Fig. 32

Technical Data

Engine Model	27	40	60
Engine Type	Fresh Water Cooled, 4 Cycle, Overhead Valve		
Output			
Horsepower (SAE) @ RPM	27 @ 2800	40 @ 2800	60 @ 3000
Maximum Torque, ft/lb (m-kg) @ 2000 RPM	51.6 (7.0)	76 (10.5)	98.3 (13.6)
Number of Cylinders	2	3	4
Displacement, Cubic Inches (C.C.)	72.3 (1184)	108.5 (1777)	144.5 (2368)
Bore x Stroke, Inches (mm)	3.30 x 4.02 (86 x 102)		
Compression Ratio	20:1		
Idle Speed, RPM	700		
Engine Rotation, Front of Engine	Clockwise		
Engine Wet Weight incl. ZF Reverse Gear Box, (kg)	477	591	805
Engine Dimensions, LxWxH Inches	ZF—30.2x20.6x25.3 34.7x20.6x25.3 N/A BW—38.2x20.6x25.3 42.6x20.6x25.3 46.6x20.6x25.3		
Maximum Engine Inclination	15°		
Fuel System			
Fuel Injection Timing @ 1000 RPM	18°	18°	14°
Firing Order	1-2	1-3-2	1-3-4-2
Fuel Injection Pump, Type	NP-PES-2A 650	NP-PES-3A 658	NP-PES-4A 658
Fuel Injection Nozzle Type	NP-ONOSD211		
Opening Pressure P.S.I. (kg/cm ²)	1706 (120)		

Technical Data

Engine Model	27	40	60
Fuel Requirements	#2, Ambient Diesel Fuel		
Governor			
Type	Mechanical		
Setting RPM	2800	2800	3000
Cooling System			
Type	Thermosatically Controlled Fresh Water Cooling		
Capacity, Quarts (Liters)	5 (4.7)	7 (6.6)	8 (7.6)
Thermostat			
Begins To Open, °F (°C)	176° (80°)		
Is Fully Open, °F (°C)	190° (88°)		
Antifreeze			
Type	Permanent		
Required Amount, Quarts (Liters)	2.5 (2.4)	3.5 (3.3)	4.0 (3.8)
Pump, Raw Water			
Type	3½" Neoprene Impeller		
Capacity, Gals./Min. (Liters)	8.5 (32) @ 2800 RPM		
Pump, Fresh Water			
Type, Centrifugal	6 Blade		
Capacity, Gals./Min. (Liters)	16 (60) @ 2800 RPM		
Lubrication System			
Capacity, Including Filter, Qts (Liters)	3.5 (3.3)	5.0 (4.8)	5.8 (5.5)
Quality (Diesel Service)	Series 3 API Spec CD		
Viscosity			
Above 80°F (28°C)	SAE 40		
Below 80°F (26.7°C)	SAE 30		
Pressure, Warm Engine, PSI (kg/cm ²)	25-50 (1.75-3.51)		
Idle	40-60 (2.81-4.21)		
Full Speed			

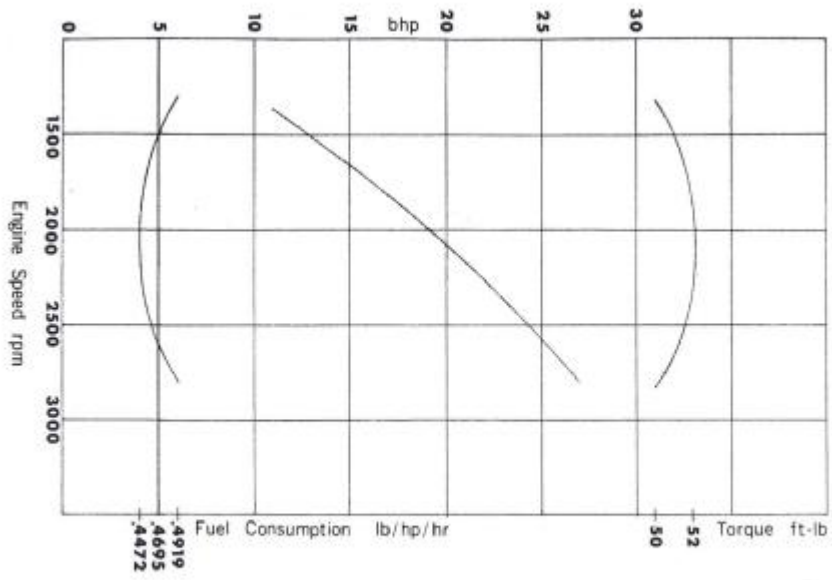
Technical Data

Engine Model	27	40	60
Valve Train			
Valve Clearance, Cold, Inches (mm) Intake and Exhaust		.018 (0.45)	
Electrical System			
Type (Negative Ground)		12V D. C.	
Battery, Recommended Rating, min. AH		120	
Alternator (Standard)			
Type — Motorola		MR 12 N 450 D	
Output, Amps (w)		35 (500)	
Alternator (Optional)			
Type — Motorola		MR 12 N 600 D	
Output, Amps (w)		55 (785)	
Starter Motor			
Type	NIKKO MM 2		Hilachi S19-05
Output H.P. (w)	1.6 (1200)	2.4 (1800)	3.0 (2200)
Tightening Torques ft/lbs (in-kil)			
Cylinder Head Bolts		58 (4)	
Rocker Shaft Bolts		21-22 (2.9-3.1)	
Connecting Rod Bolts		56-59 (7.8-8.7)	
Main Bearing Cap Bolts		115-130 (16-18)	
Injector Sleeve		54 (7.5)	
Flywheel Bolts		56-59 (7.8-8.2)	
Crankcase Bolts		15 (2.1)	
Oil Pan Bolts		6 (.8)	

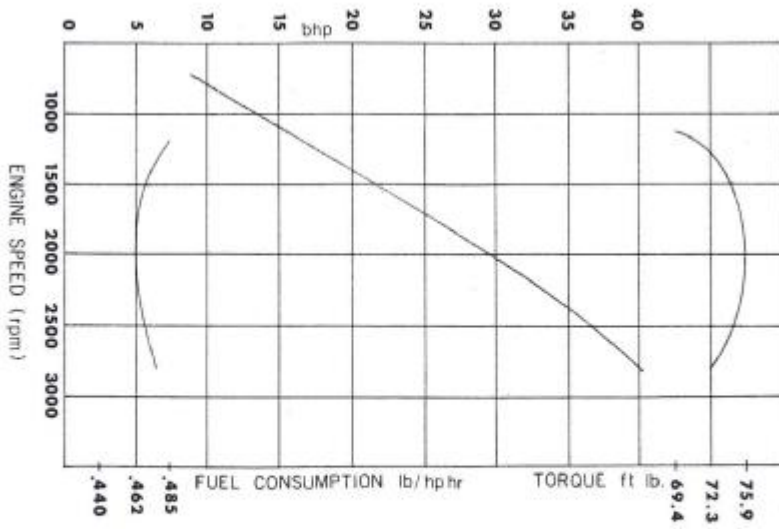
Technical Data

Engine Model	27	40	60
Crank Shaft Nut		100 (19)	
Reverse Gear			
Type, ZF			
Ratio, Forward	2.0:1	2.0:1	N/A
Ratio, Reverse	1.76:1	1.76:1	N/A
Fluid, Type API	SAE 90	SAE 90	N/A
Capacity, Pints (Liters)	.85 (.4)	.85 (.4)	N/A
Type, Borg Warner			
Model 70 C			
AS3-70 CR Ratio, Forward & Reverse		2.10:1	
AS14-70 CR Ratio, Forward & Reverse		2.57:1	
AS15-70 CR Ratio, Forward & Reverse		2.91:1	
AS7-70 CR Ratio, Forward & Reverse		1.8:1	
Fluid Capacity, Qts. (Liters)			
Level		2.5 (2.4)	
15° Inclination		2.7 (2.6)	
Type		ATF or 30 W. OS	

PISCES 27



PISCES 40

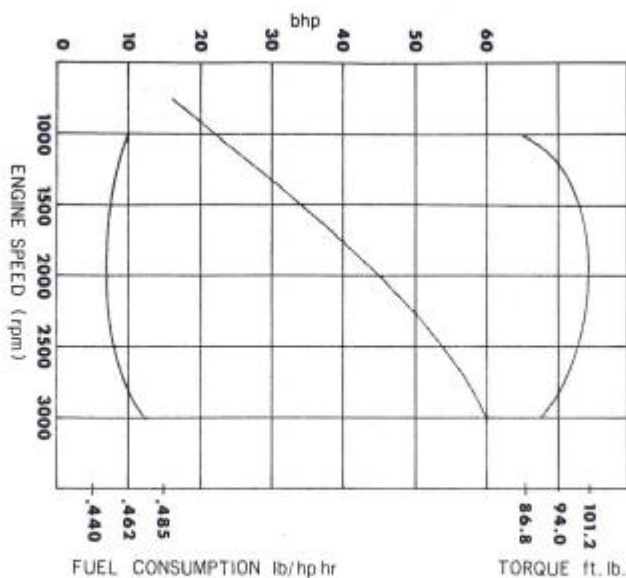


Periodic Inspection Maintenance Table

Operation	Adjustment Standard	Daily	After Initial 25 Hours	100 Hours	300 Hours	450 Hours
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Check for leakage of oil, water & fuel	0					
Check and retorque cylinder head bolts	ft./lbs. (m.kg) 56 (8.0)	0				
Check condition of engine mounts		0				
Adjust valve clearance	intake & exhaust cold .018 (.45mm)	0	0	0		
Clean air breather		0				
Check drive belt tension	deflection $\frac{1}{4}$ " (5mm)	0	0	0		
Check coolant level	0					
Flush cooling system and replace coolant	permanent antifreeze	0				
Check water pump impeller & replace gasket		0				
Check heat exchanger for blockage		0				
Replace cooling hoses and drive belts		0				
Replace zinc anodes		0				
Lubricate control linkage		0				

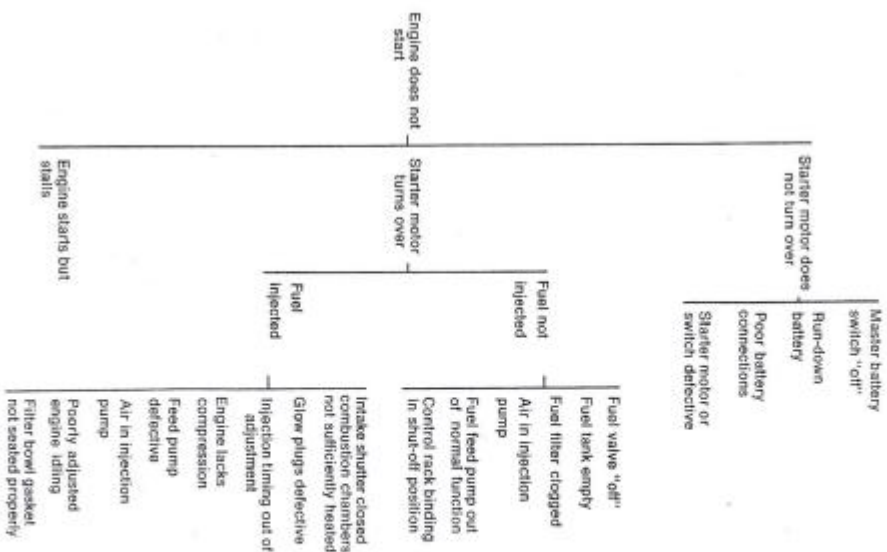
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Periodic Inspection Maintenance Table

Operation	Adjustment Standard	Daily	After			
			Initial	100	300	600
			Hours	Hours	Hours	Hours
Check Engine Oil Level		0				
Check Oil Level in Injection Pump		0				
Check Oil Level in Governor		0				
Check trans. fluid level-ZF, BW		0				
Change engine oil and Filter	SAE 30 or 40 wt. service DS		0	0		
Change oil in Injection pump and governor	engine oil			0		
Change trans. fluid ZF	SAE 90 wt.	0	0			
Change trans. fluid BW	ATF or engine oil			0		
Check injection nozzle press. and spray pattern	1706 p.s.i. (120 kg/cm ²)			0		
Replace fuel filter elements		0	0			
Service the fuel strainer in the intake port of feed pump				0		
Check electrolyte level in battery	0					
Check specific gravity of battery electrolyte	sp. gr. 1.260			0		

Trouble-Shooting



Engine runs rough	Engine idles rough	Cracked high pressure pipes	Excess marine growth on hull and propeller	Propeller size incorrect	Injection timing incorrect	Poor spray pattern					
		Nozzles defective									
		Throttle valve shaft excessively worn									
	Idling speed too high	Compression pressure unequal between cylinders		Engine lacks power	Trouble in injection pump and/or fuel system	Sufficient fuel not reaching injection pump	Level of fuel in fuel tank too low	Air in injection pump			
		Throttle valve out of adjustment									
		Throttle out of adjustment									
	Engine speed varies	Weak governor spring		Governor out of adjustment	Weak governor spring	Intake silencer clogged	Valve clearance incorrect	Nozzle holders loose in mount			
		Insufficient supply of fuel							Air in fuel	Clogged fuel filter	leaky over-flow valve
		Amount of fuel injected through nozzles unequal between cylinders									
	Engine operation unsmooth at high speeds	Weak governor spring		Valve clearance incorrect	Engine overloads	Trouble in cooling system	Drive belt slipping	Water pump impeller shaft seals, or cover plate worn out			
Weak valve springs											

Installation Inspection

To Be Performed By Boat Manufacturer or Installer

1. ✓ Check engine mounting to see that all bolts are secure and that flex mounts are properly positioned.
2. ✓ Check engine to propeller shaft alignment.
3. ✓ Check to see that fuel lines are properly routed and connected.
4. ✓ Check lubrication: engine oil, transmission fluid, injection pump oil, mechanical governor oil.
5. ✓ Check to see coolant is up to proper level.
6. ✓ Check electrolyte level in batteries.
7. ✓ Make sure fuel tanks are properly vented.
8. ✓ Check the throttle and shift controls for smooth operation.
9. ✓ Check alternator and drive belt tension.
10. ✓ Start engine and run at fast idle for 10 minutes checking to see that all gauges read correctly and all warning lights, on models so equipped, are out.
11. ✓ Check engine for leakage of oil, fuel or water.
12. ✓ Instruct the customer on the operation of his engine making sure he receives a copy of the operator's handbook.

25 Hour Inspection

To Be Performed At Owner-Operator's Expense By Qualified Service Facility

1. ✓ Change engine oil and replace filter.
2. ✓ Change transmission fluid, Z F only.
3. ✓ Check oil level in injection pump and add as required.
4. ✓ Check oil level in governor.
5. ✓ Check oil level in Borg Warner transmission and add, as required.
6. ✓ Replace fuel filter element(s).
7. ✓ Check electrolyte level in battery and add as required.
8. ✓ Check for leakage of oil, water or fuel.
9. ✓ Retorque cylinder head bolts.
10. ✓ Adjust valve clearance.
11. ✓ Check alternator and water pump drive belt tension.
12. ✓ Check coolant level, add as required.
13. ✓ Check condition of zinc plug, replace if necessary.
14. ✓ Lubricate control linkage.
15. ✓ Start engine and run at fast idle for 10 minutes checking to see that all gauges read correctly and warning lights, on models so equipped, are out.

Pisces Warranty Agreement

Providing there has been no unreasonable use of the Pisces Marine Diesel Engine, Fiskar . . . Inc. shall repair any defect in parts or workmanship for six (6) months from the date it was first sold to you by Fiskar . . . Inc. or any of its authorized dealers. Fiskar . . . Inc. maintains various repair facilities. Please contact:

FSKAR . . . INC.
759 West 16th Street
Costa Mesa, Calif. 92627

To validate this warranty all we ask is that you properly install the engine, return owner's registration card, and have a Fiskar . . . Inc. dealer perform the first 25 hour inspection. This agreement is in lieu of all express or implied warranties.

PISCES Marine Diesels Engine Registration Card

MODEL, ENGINE _____ NAME, owner/operator _____

SERIAL NO. ENGINE _____ BOAT, BRAND _____

MODEL, Reverse Gear _____ BOAT, MODEL _____

SERIAL NO., Reverse Gear _____ DATE OF MANUFACTURE _____

DATE OF SALE _____ SIGNATURE, Customer _____

NAME, Selling Dealer _____

ADDRESS _____

CITY, STATE & ZIP _____