






## FOUR STROKE OUTBOARD PETROL ENGINE HOMOLOGATION FILE

<b>International Homologation File Number:</b>		<b>00500B</b>
<b>Homologation Valid from</b>	<b>2019</b>	<b>Expiry: 2029 Dec 31</b>
<b>Valid for the following classes:</b>	<b>CIRCUIT: F4, F4s, Endurance S3 OFFSHORE: 3J</b>	
<b>Manufacturer:</b>	<b>Mercury Marine</b>	
<b>Engine Model:</b>	<b>Mercury 60 EFI / 60 APX (4-stroke) (Low Emission)</b>	
<b>Number Manufactured:</b>	<b>1000+</b>	
At the date:	October 2017	
<b>Certified by the National Authority of:</b>		
At the date:		
<b>UIM Homologation Group Inspector</b>	<b>Mikael Lundblad</b>	
At the date:	2019 March 23	
<b>UIM Certification Approval:</b>		
At the date:		
<b>Running Production Changes</b>		
<b>Change Detail</b>	Combustion chamber height +piston Cam shaft profile + ECM info	Page No. 7, 19 Page No. 21,24f
Date Approved for Use	2019 April 13	Approved by 
<b>Change Detail</b>	New ECM calibration + New Graphics + Sparkplug model	Page No. 24, 27, 22
Date Approved for Use	2024 March 19	Approved by 

## PICTURES

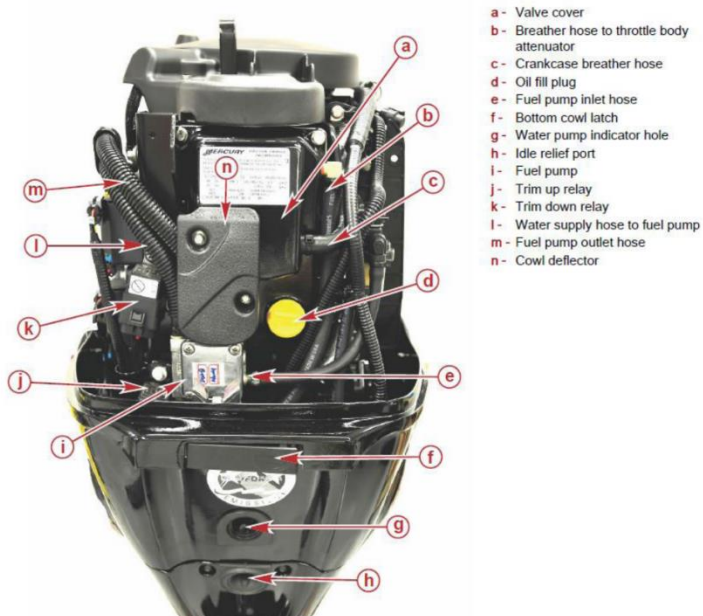
Photo of the complete engine, port side.



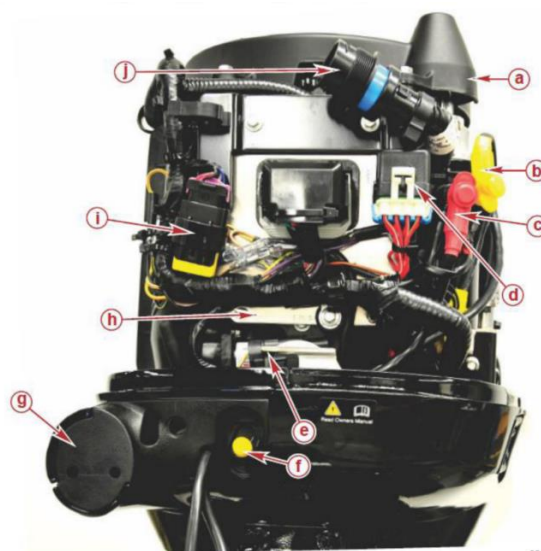
Photo of the complete engine, 45° from the rear at the starboard side.



Rear view of powerhead.

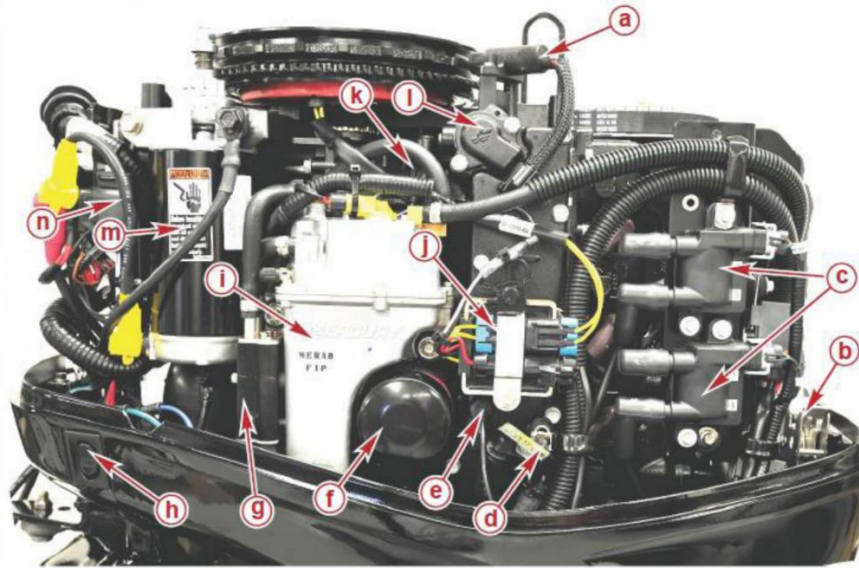


Top view of powerhead.



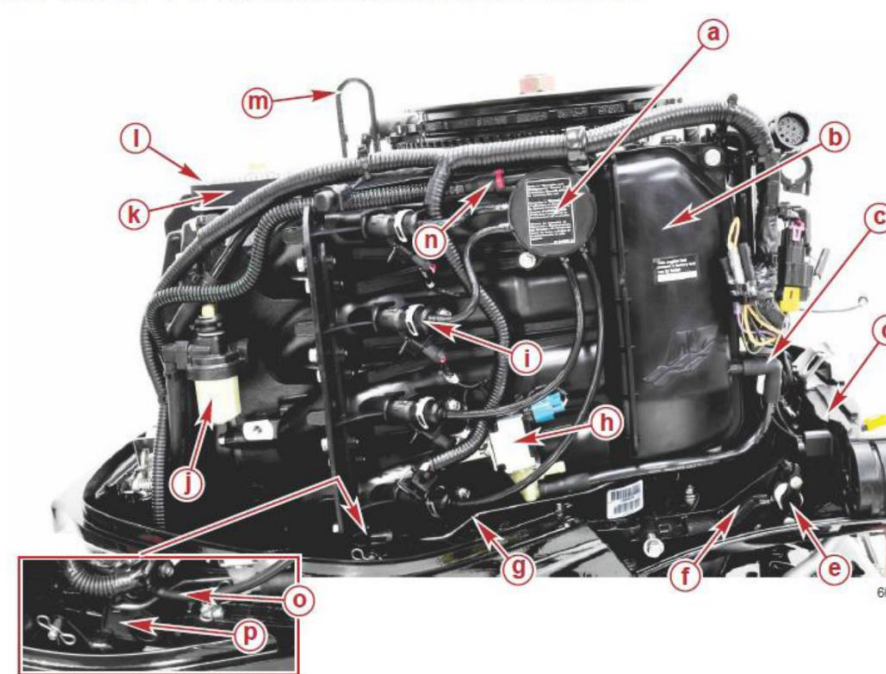
- a - Flywheel cover
- b - Starter lead
- c - Positive (+) 12 volt battery connection
- d - Fuses (2 - 25 amp, 1 - 20 amp, 1 - 15 amp)
- e - Main power
- f - Fuel connection
- g - Rigging grommet
- h - ECM
- i - Diagnostic connector/SmartCraft termination resistor
- j - 14-pin remote control and engine harness connection

Photo of powerhead 45°  
from the rear at the port side.



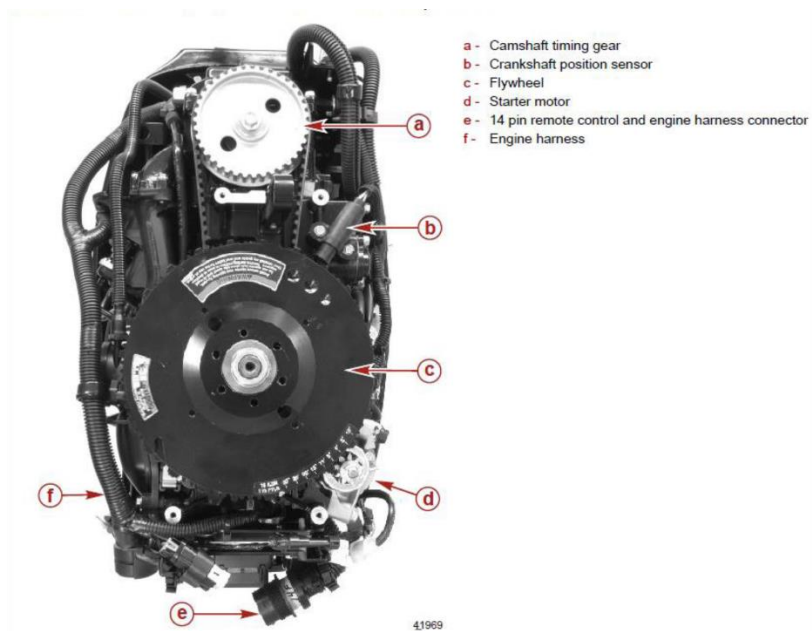
- a - Crankshaft position sensor
- b - Rear cowl latch
- c - Ignition coils (2)
- d - Engine oil dipstick
- e - Engine coolant temperature (ECT) sensor
- f - Oil filter
- g - Fuel cooler
- h - Power trim switch
- i - Vapor separator tank (VST)
- j - Voltage regulator
- k - Oil pressure switch
- l - Thermostat housing
- m - Starter motor
- n - Starter solenoid

Port view of powerhead



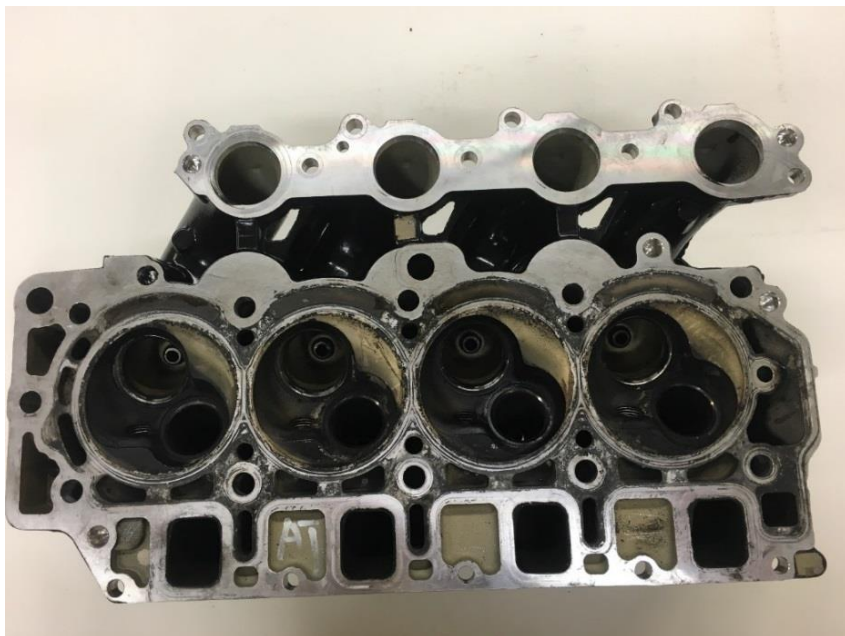
- a - Fuel distribution manifold
- b - Intake manifold
- c - Throttle air bypass hose
- d - Rigging grommet
- e - Shift barrel cover
- f - Shift bracket
- g - Throttle linkage
- h - Idle air control (IAC)
- i - Fuel injectors (4)
- j - Fuel filter
- k - Timing belt
- l - Camshaft timing gear
- m - Lifting eye
- n - High-pressure fuel line from VST
- o - Cam follower
- p - Throttle cam

Top View of powerhead.

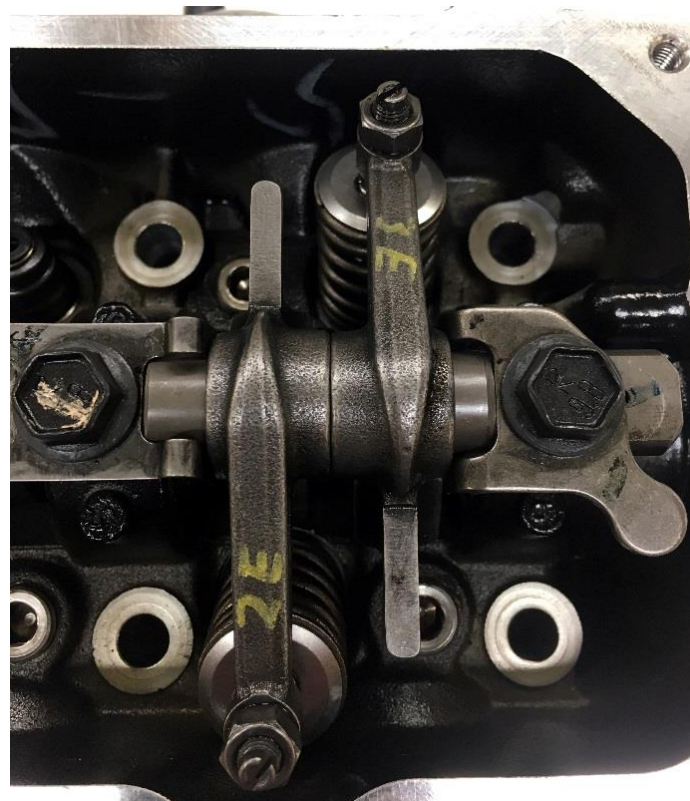




Cylinder head from the combustion chamber side.



Cylinder head from the valve assembly side.



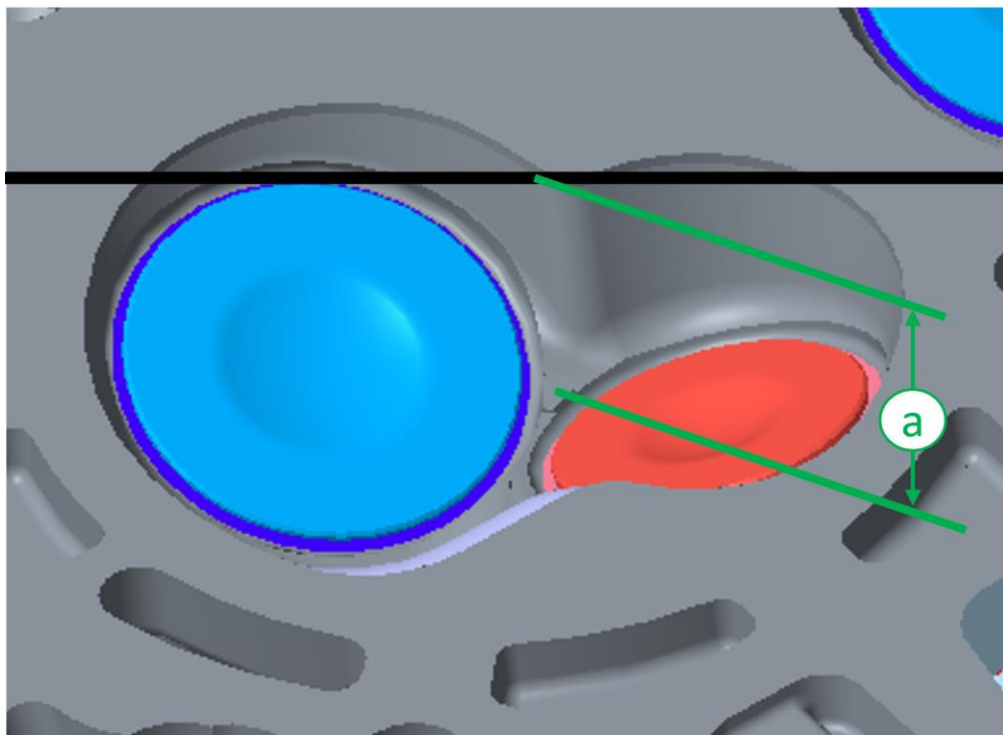
Cylinder head showing intake ports.



Cylinder head showing intake ports - detail



Combustion chamber height (a) min 13.8 mm





Cylinder head showing exhaust ports.



Cylinder head showing exhaust ports – detail





Piston viewed from the top



Piston viewed from the bottom



Piston, side view.



Crankshaft.



Connecting rod and piston.



Throttle Body.



Intake manifold.



Intake manifold, detail.





Fuel Injector Rail



Valves & Springs



ECU box front



ECU box, unplugged



Cylinder block, top view

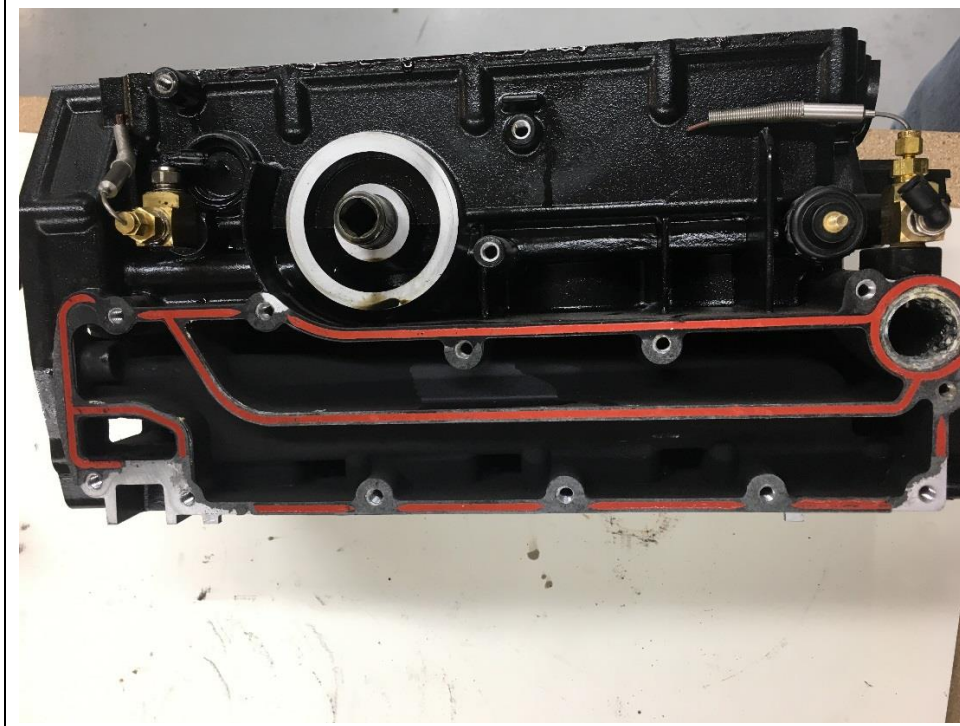


Cylinder block, detail





Cylinder block, exhaust



Exhaust cover, detail





Flywheel – viewed from top side



Flywheel – viewed from bottom side



Gear house



Gear house - Exhaust cooling



Gear House Skeg



Gear house skeg - Close up from bottom side



## MEASUREMENTS

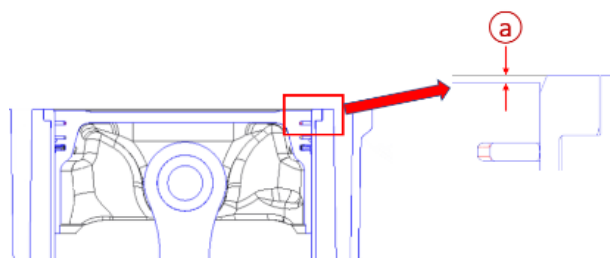
### ENGINE FUEL

Type:	<b>Gasoline 4 stroke</b>
Minimum octane required:	<b>90 RON</b>

### ENGINE TYPE

Number of cylinders:	<b>4</b> Cylinders
Cylinder arrangement:	<b>In-line</b>

<b>ENGINE BLOCK</b>	<b>Tolerance</b>	<b>Measurement</b>	<b>Unit</b>
Bore	+/- 0.05	<b>65.0</b>	mm
<i>Oversize Bores available +0.25, +0.50 mm</i>	+/- 0.05	<b>65.25, 65.50</b>	mm
Stroke	+/- 0.15	<b>75.0</b>	mm
Capacity per cylinder	nom	<b>248.9</b>	cc
Total Capacity	nom	<b>995.5</b>	cc
Cylinder block material		<b>Aluminium</b>	
Cylinder liner material		<b>Steel</b>	
Distance from crankshaft centreline to cylinder block deck face.	+/- 0.15	<b>175.5</b>	mm
Piston crown height from head deck at top dead center (a)	min	<b>0.10</b>	mm



<b>CYLINDER HEAD</b>	Tolerance	Measurement	Unit
Cylinder head material		<b>Aluminium</b>	
Volume of combustion chamber (with spark plug installed)	min	<b>24.5</b>	cc
Compression ratio	max	<b>9.7</b>	
Thickness of cylinder head	-min-	<b>96.8</b>	mm
<b>Inlet Port:</b>			
Size of port at cylinder head/manifold face	+/- 0.30	<b>Ø 30.5</b>	mm
Internal diameter of valve seat insert	+/- 0.15	<b>Ø 28.0</b>	mm
Surface finish of port		<b>machined</b>	
<b>Exhaust Port:</b>			
Size of port at cylinder head/manifold face	+/- 0.50	<b>27.0 x 22.0</b>	mm
Internal diameter of valve seat insert	+/- 0.15	<b>Ø 22.5</b>	mm
Surface finish of port		<b>machined</b>	
<b>Inlet Valves:</b>			
Diameter of stem	+/- 0.01	<b>5.48</b>	mm
Diameter of head	max	<b>32.2</b>	mm
Overall length of inlet valve	min	<b>83.0</b>	mm
<b>Exhaust Valves:</b>			
Diameter of stem	+/- 0.01	<b>5.47</b>	mm
Diameter of head	max	<b>26.2</b>	
Overall length of exhaust valve	min	<b>83.5</b>	mm
<b>Valve Springs:</b>			
Diameter of wire	max	<b>3.25</b>	mm
Inside diameter of coil	min	<b>17.6</b>	mm
Free length	max	<b>40.5</b>	mm
Number of working turns	+/- 0.5	<b>4.1</b>	turns



<b>CAMSHAFT/SHAFTS</b>	Tolerance	Measurement	Unit
<b>Inlet:</b>			
Tappet clearance for checking timing and lift	+/-	<b>0.20</b>	mm
Total valve lift (corrected 500A)	+/- 0.10	<b>8.67</b>	mm
Total inlet opening angle (added info 500A) (measured at flywheel in degrees at 0,1 mm lift)	+/- 4°	<b>250</b>	degrees
Duration inlet opening angle 3mm under max lift (added info 500A) (measured at flywheel in degrees)	+/- 2°	<b>120</b>	degrees
Base circle diameter of lobe	+/- 0.1	<b>26.0</b>	mm
Total lift of lobe (tolerance smaller 500A)	+/- 0.05	<b>30.93</b>	mm
<b>Exhaust:</b>			
Tappet clearance for checking timing and lift	+/-	<b>0.30</b>	mm
Total valve lift (corrected 500A)	+/- 0.10	<b>8.57</b>	mm
Total inlet opening angle (added info 500A) (measured at flywheel in degrees at 0,1 mm lift)	+/- 4°	<b>236</b>	degrees
Duration inlet opening angle 3mm under max lift (added info 500A) (measured at flywheel in degrees)	+/- 2°	<b>116</b>	degrees
Base circle diameter of lobe	+/- 0.1	<b>26.0</b>	mm
Total lift of lobe (tolerance smaller 500A)	+/- 0.05	<b>30.93</b>	mm
<b>PISTONS</b>			
Material of piston	<b>Aluminium</b>		
Type and thickness of rings	Rectangular	<b>1.2</b>	mm
	Taper Faced Napier	<b>1.5</b>	mm
	Oil Control	<b>2.5</b>	mm
<b>CONNECTING ROD</b>			
Length of rod from big end to small end (centre to centre)	+/- 0.20	<b>113.0</b>	mm
<b>CRANKSHAFT</b>			
Number of main bearing journals		<b>5</b>	
Diameter of main bearing journals	+/- 0.01	<b>5x43.0</b>	mm
Diameter of connecting rod journals	+/- 0.01	<b>33.0</b>	mm
Surface finish of crankshaft		<b>ground</b>	

## TYPE OF BEARINGS

Piston Pin	<b>Floating</b>
Connecting Rod journal	<b>Plain</b>
Main journal	<b>Plain</b>

## FUEL INJECTION

	Tolerance	Measurement	Unit
Make		<b>Delphi</b>	
Type of pump, model no.		<b>Electric</b>	
Total number of injectors		<b>Four (4)</b>	Injectors
Type of injectors		<b>Electric</b>	
Diameter of throttle bore	max	<b>42.5</b>	mm

## IGNITION

	Tolerance	Measurement	Unit
Sparkplug model		<b>Champion RA8HC</b>	

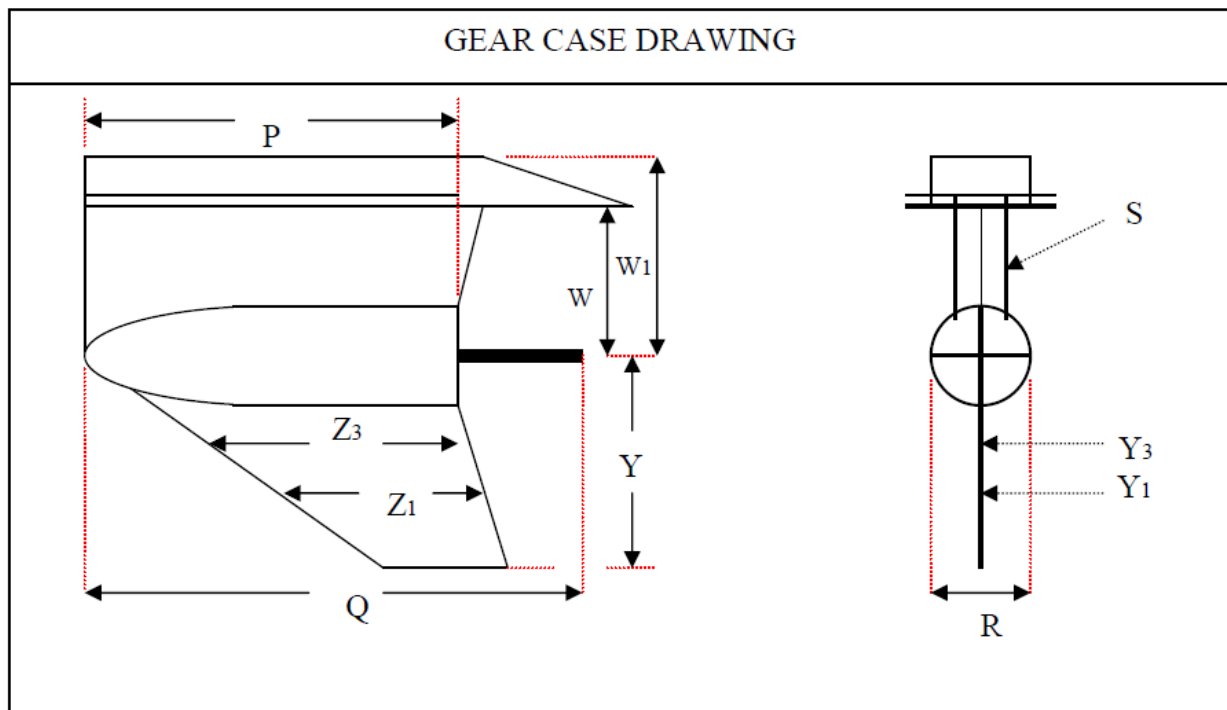
## COOLING SYSTEM

Type	<b>Water</b>
Method	<b>Thermostat Controlled</b>
Pump	<b>Impeller</b>
Number of impeller blades	<b>Six (6)</b>

## WEIGHTS

	Tolerance	Measurement	Unit
Inlet valve (bare)	min	<b>31.0</b>	g
Exhaust valve (bare)	min	<b>29.0</b>	g
Inlet rocker arm	min	<b>76.0</b>	g
Exhaust rocker arm	min	<b>76.0</b>	g
Inlet/ Exhaust camshaft	min	<b>1400</b>	g
Piston (with rings)	min	<b>149</b>	g
Piston Pin	min	<b>40</b>	g
Connecting Rod (with bearings)	min	<b>251</b>	g
Crankshaft	min	<b>6900</b>	g
Flywheel (bare)	min	<b>3900</b>	g

UNDERWATER UNIT	Tolerance	Measurement	Unit
Gear Ratio		<b>1.83:1</b>	
P Longitudinal length of gearcase torpedo	+/- 5.0	<b>270.0</b>	mm
Q Longitudinal dimension of gearcase including propeller shaft	+/- 5.0	<b>390.0</b>	mm
R Transverse dimension of gearcase	+/- 5.0	<b>87.0</b>	mm
S Thickness of strut	+/- 5.0	<b>39.0</b>	mm
Z1 Skeg chord length, 25mm above bottom	+/- 5.0	<b>99.0</b>	mm
Z3 Skeg chord length, 75mm above bottom	+/- 5.0	<b>150.0</b>	mm
W1 Distance from propeller shaft to upper flange	+/- 5.0	<b>250.0</b>	mm
W Distance from propeller shaft to anti-ventilation plate	+/- 5.0	<b>169.0</b>	mm
Y1 Thickness of skeg, 25mm above bottom	min	<b>5.0</b>	mm
Y3 Thickness of skeg, 75mm above bottom	min	<b>7.2</b>	mm
Y Skeg depth from propeller shaft	+/- 5.0	<b>155.0</b>	mm
Diameter Exhaust outlet at propeller recess	max	<b>80.0</b>	mm



## FOUR STROKE OUTBOARD PETROL ENGINE

### NOTES

#### Inspection of ECM

Model	60 EFI Gen 2 (48-pin)	60 EFI Gen 2 (70-pin)
ECM over speed limiter*	6240 rpm	6240 rpm
ECM software version	MY2007p4AAAA	BDR15AAC02
ECM calibration part number	8M0022615	8M0114324

\*Note, over speed limiter indicates speed at which one cylinder is cut. At 6,375 rpm all cylinders are cut. Instantaneous spikes over 6,375 rpm are possible if the prop completely exits the water (e.g. wave jump)

#### New ECM for 60 APX

New ECM for Gen 2 (70-pin) is allowed for all engines with 70-pin connector

Model	60 EFI Gen 2 (70-pin)
ECM over speed limiter**	6500 rpm
ECM software version	BDR19AAB01
ECM calibration part number	8M0227036

\*\*Note, the full-cut rpm on the 60 APX ECM is 6700 rpm



**Attachment 1 - Camlift measurement**

Valve Lift Table (in Cam angle) at Nominal Lash			
INTAKE (INT#1 Lobe Index Timing @ Max Lift: 112 degrees in Crank ATDC)		EXHAUST (EXH#1 Lobe Index Timing @ Max Lift: 110 degrees in Crank BTDC)	
Cam Angle	Valve Lift [mm]	Cam Angle	Valve Lift [mm]
-68	0.000	-62	0.000
-66	0.022	-60	0.048
-64	0.060	-58	0.110
-62	0.100	-56	0.216
-60	0.146	-54	0.380
-58	0.214	-52	0.607
-56	0.327	-50	0.896
-54	0.497	-48	1.240
-52	0.730	-46	1.631
-50	1.023	-44	2.058
-48	1.370	-42	2.511
-46	1.761	-40	2.980
-44	2.188	-38	3.456
-42	2.639	-36	3.931
-40	3.106	-34	4.398
-38	3.579	-32	4.851
-36	4.051	-30	5.286
-34	4.515	-28	5.699
-32	4.965	-26	6.089
-30	5.398	-24	6.453
-28	5.810	-22	6.789
-26	6.197	-20	7.097
-24	6.559	-18	7.377
-22	6.894	-16	7.627
-20	7.201	-14	7.848
-18	7.480	-12	8.039
-16	7.729	-10	8.202
-14	7.950	-8	8.334
-12	8.141	-6	8.437
-10	8.303	-4	8.511
-8	8.435	-2	8.555
-6	8.538	0	8.570
-4	8.611	2	8.555
-2	8.655	4	8.511
0	8.670	6	8.437
2	8.655	8	8.334
4	8.611	10	8.202
6	8.538	12	8.039
8	8.435	14	7.848
10	8.303	16	7.627
12	8.141	18	7.376

14	7.950	20	7.097
16	7.730	22	6.789
18	7.481	24	6.452
20	7.203	26	6.088
22	6.897	28	5.699
24	6.563	30	5.285
26	6.203	32	4.850
28	5.818	34	4.398
30	5.410	36	3.932
32	4.981	38	3.459
34	4.535	40	2.985
36	4.077	42	2.519
38	3.610	44	2.070
40	3.142	46	1.648
42	2.680	48	1.263
44	2.232	50	0.926
46	1.808	52	0.645
48	1.417	54	0.427
50	1.069	56	0.272
52	0.774	58	0.174
54	0.538	60	0.116
56	0.364	62	0.060
58	0.249	64	0.020
60	0.182	66	0.000
62	0.140		
64	0.092		
66	0.055		
68	0.017		
70	0.000		

**New Graphic design – Mercury 60 APX**

Photo of the complete engine, port side.



Photo of the complete engine, 45° from the rear at the starboard side.



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