FOUR STROKE OUTBOARD PETROL ENGINE HOMOLOGATION FILE

International Homologation File Number: 00534A		
Homologation Valid from	**2016**	**Expiry: 2026**
Valid for the following classes:	**CIRCUIT:** **OFFSHORE: X-CAT**	
Manufacturer:	**Mercury Marine**	
Engine Model:	**400 ROS**	
Number Manufactured:	**250+ (400R)**	
At the date:	**1 march 2016**	
Certified by the National Authority of:		
At the date:		
UIM Homologation Group Inspector	**Mikael Lundblad**	
At the date:	**31 march 2016**	
UIM Certification Approval:	**Mikael Lundblad**	**Thomas Kurth**
At the date:	**31 March 2016**	**11 April 2018**
Running Production Changes		
Change Detail	max rpm, Swivel bracket, Spark plug	Page No. 21, 23, 19
Date Approved for Use	11 April 2018	Approved by M Lundblad
Change Detail		Page No.
Date Approved for Use		Approved by

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PICTURES

Photo of the complete engine, 45° from the front at the port side.

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

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

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

Photo without top cover, 45° from the front at the port side.

Photo without top cover, 45° from the front at the starboard side.

Photo without top cover, 45° from the rear at the port side

Photo without top cover, 45° from the rear at the starboard side.

Cylinder head from the combustion chamber side 	Cylinder head from the valve assembly side. 
Cylinder head showing intake ports. 	Combustion chamber – close up 

Cylinder head showing exhaust ports. 	Cylinder head showing exhaust ports - detail 
Cylinder head showing intake ports - detail 	

Intake silencer air intakes 	Intake manifold 
Intake manifold port - Close up – CAC side 	Intake manifold port - Close up – Head side 

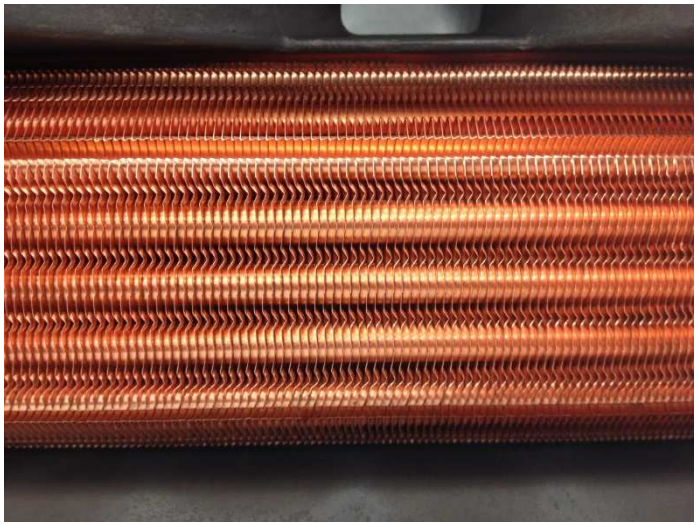
Fuel Injector Rail

Fuel Injector - Close up

Fuel injector holes

Charge Air Cooler – outlet overall

Intercooler – close up



Charge Air Cooler – inlet

Charge Air Cooler with manifold - overall

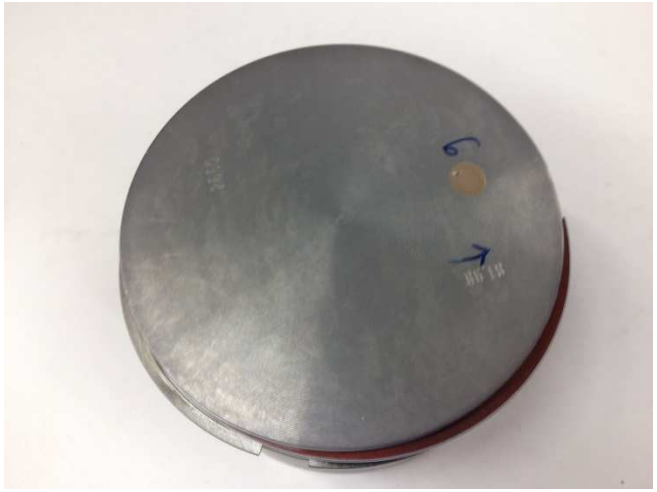
Supercharger – overall

Boost relief valve 	Throttle house 
Supercharger –inlet 	Supercharger – outlet 

Cylinder block, viewed 45° from front starboard side.

Cylinder block, viewed 45° from rear, port side

Piston viewed from the top



Piston viewed from the bottom

Piston, viewed 45° from the wrist pin.

Crankshaft.

High pressure Oil pump 	Conrod with crankshaft 
Exhaust outlet 	Scavanging oil pump 

ECU box Front 	ECU box back 
Flywheel – viewed from top side 	Flywheel – viewed from bottom side 

Gear house 	Gear house skeg - Close up from bottom side 
Gear House Skeg 	

Anti-tamper device - valvecover	Anti-tamper device - Supercharger
	

MEASUREMENTS

ENGINE FUEL

Type:		**Gasoline**	
Minimum octane required:		**90**	RON

ENGINE TYPE

Number of cylinders:		**6**	Cylinders
Cylinder arrangement:		**Longitudinal**	

ENGINE BLOCK	Tolerance	Measurement	Unit
Bore	+0.015/ -0.000	**82.000**	mm
Stroke	+/- 0.10	**82.00**	mm
Capacity (*displacement*) per cylinder	max	**434**	cc
Total Capacity	max	**2603**	cc
Cylinder block material		**A356-T6 Aluminum**	
Cylinder liner material	SAE J431	**G3000 Grey-iron**	
Distance from crankshaft centreline to cylinder block deck face.	+/-0.050	**204.500**	mm

CYLINDER HEAD	Tolerance	Measurement	Unit
Cylinder head material		**A356-T6 Aluminum**	
Volume of combustion chamber (without volume of spark plug hole)	min	**50.5**	cc
Compression ratio	max	**8.2**	
Thickness of cylinder head	+/- 0.15	**102.50**	mm
Inlet Port:			
Size of port at cylinder head/manifold face	+/- 1	**50.5 x 29.1**	mm
Internal diameter of valve seat insert	+/- 0.05	**27.95**	mm
Surface finish of port		**As-cast with a lost-foam glue bead and lost-foam bead topography**	
Exhaust Port:			
Size of port at cylinder head/manifold face	+/- 1	**60 x 60**	mm
Internal diameter of valve seat insert	+/- 0.05	**23.45**	mm

Surface finish of port		**As-cast with a lost-foam glue bead and lost-foam bead topography**	
Inlet Valves:			
Diameter of stem	+/- 0.01	**5.97**	mm
Diameter of head	max	**32.15**	mm
Overall length of inlet valve	min	**96.692**	mm
Exhaust Valves:			
Diameter of stem	+/- 0.01	**5.96**	mm
Diameter of head	max	**27.35**	mm
Overall length of exhaust valve	min	**94.678**	mm
Valve Springs:			
Diameter of wire	max	**2.95 axially** **3.55 radially**	mm
Inside diameter of coil	min	**17.5**	mm
Free length	max	**47.1**	mm
Number of working turns	+/- 0.5	**5**	turns

CAMSHAFT/SHAFTS	Tolerance	Measurement	Unit
Inlet:			
Tappet clearance for checking timing	+/- 0.050	**0.190**	mm
Total valve lift	+/- 0.080	**9.010**	mm
Total inlet opening angle at 0,1mm of valve lift (measured at flywheel in degrees)	+/- 14°	**272°**	degrees
Duration inlet opening angle 3mm under max lift (measured at flywheel in degrees)	+/- 4°	**124°**	degrees
Base circle diameter of lobe	+/- 0.06	**35.00**	mm
Total lift of lobe	+/- 0.030	**9.200**	mm
Exhaust:			
Tappet clearance for checking timing	+/- 0.050	**0.400**	mm
Total valve lift	+/- 0.080	**8.800**	mm
Total inlet opening angle at 0,1mm of valve lift (measured at flywheel in degrees)	+/- 5°	**248°**	degrees
Duration inlet opening angle 3mm under max lift (measured at flywheel in degrees)	+/- 4°	**132°**	degrees
Base circle diameter of lobe	+/- 0.06	**34.80**	mm
Total lift of lobe	+/- 0.030	**9.200**	mm

PISTONS

Material of piston		**Aluminum, Forged**	
Type and thickness of rings	1st: Square	**1.2**	mm
	2nd: Napier	**1.2**	mm
	Oil control expander and rings	**2.0**	mm

CONNECTING ROD	Tolerance	Measurement	Unit
Length of rod from big end to small end (centre to centre)	+/- 0.03	**133.00**	mm

CRANKSHAFT	Tolerance	Measurement	Unit
Number of main bearing journals		**7**	
Diameter of main bearing journals	+/-0.010	**60.009**	mm
Diameter of connecting rod journals	+/- 0.009	**50.009**	mm
Surface finish of crankshaft	Journals:	**0.1**	µm Ra

TYPE OF BEARINGS

Piston Pin	Bushing	
Connecting Rod journal	Planar	**2-piece**
Main journal	Planar	**2-piece**

FUEL INJECTION	Tolerance	Measurement	Unit
Make		**Walbro**	
Type of pump, model no.		**Water cooled Fuel Supply Module with integrated lift and high pressure pumps**	
Total number of injectors		**6**	Injectors
Type of injectors		**10 hole**	
Diameter of throttle bore	max	**80.8**	mm

COOLING SYSTEM

Type	**Raw water cooled**
Method	**Thermostat in parallel with exhaust sprayer**
Pump	**Rubber impeller vane pump**
Number of impeller blades	**6**
Dimensions of impeller	**OD = 88.90±0.51 and Height = 32.41±0.15**

SUPERCHARGER	Tolerance	Measurement	Unit
Pulley OD on supercharger	min	**60.009**	mm
Pulley OD on flywheel	max	**166.248**	mm

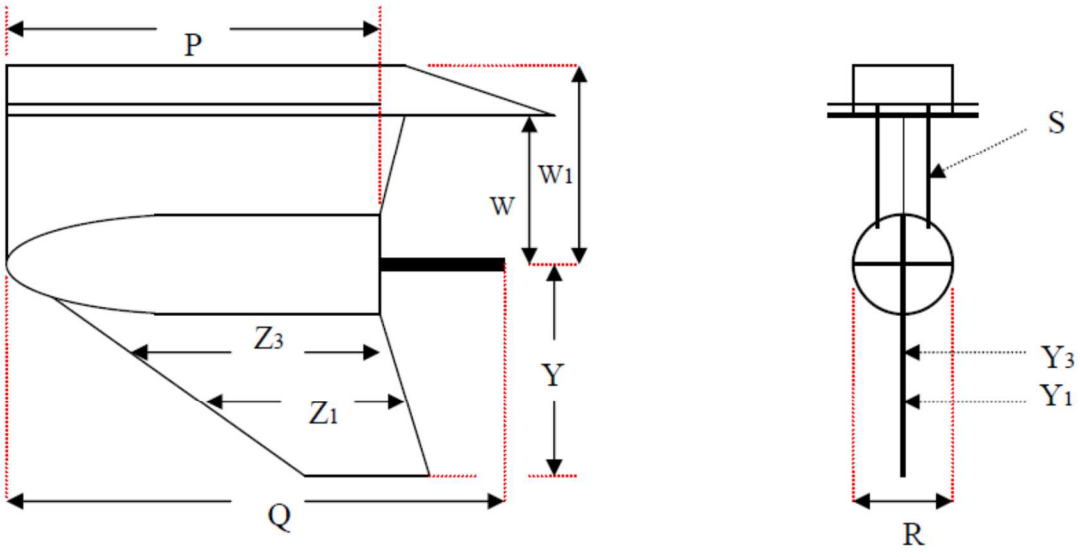
SPARK PLUG (update 534A)

Brand	**NGK**
Model	**ILFR6G-E or ILFR6G**

WEIGHTS	Tolerance	Measurement	Unit
Inlet valve (bare)	min	**38.0**	g
Exhaust valve (bare)	min	**34.0**	g
Inlet bucket	min	**30.0**	g
Exhaust bucket	min	**30.0**	g
Inlet/ Exhaust camshaft	min	**2 790**	g
Piston (with rings)	min	**287.0**	g
Piston Pin	min	**102.0**	g
Connecting Rod (with bearings)	min	**609.0**	g
Crankshaft	min	**21.0**	kg
Flywheel (bare)	min	**6.5**	kg
Supercharger	min	**14.0**	kg

UNDERWATER UNIT	Tolerance	Measurement	Unit
Gear Ratio		**1.75:1**	
P Longtitudinal length of gearcase torpedo	+/- 5.0	**492.0**	mm
Q Longtitudinal dimension of gearcase including propeller shaft	max	**650.0**	mm
R Transverse dimension of gearcase	min	**138.3**	mm
S Thickness of strut	min	**52.2**	mm
Z1 Skeg chord length, 25mm above bottom	+/- 5.0	**172.4**	mm
Z3 Skeg chord length, 75mm abobe bottom	+/- 5.0	**212.4**	mm
W1 Distance from propeller shaft to upper flange	+/- 5.0	**259.3**	mm
W Distance from propeller shaft to anti-ventilation plate	+/- 5.0	**211.1**	mm
Y1 Thickness of skeg, 25mm above bottom	min	**6.33**	mm
Y3 Thickness of skeg, 75mm above bottom	min	**8.83**	mm
Y Skeg depth from propeller shaft	+/- 5.0	**254.0**	mm

GEAR CASE DRAWING



FOUR STROKE OUTBOARD
PETROL ENGINE

NOTES

Engine is for X-Cat only

Powerhead is similar to Mercury 400R which has been produced in quantity over 250.
Midsection is special for 400 ROS

ECM (update 534A)
~~ECM boxes to be handed out by race officials at race site~~
~~Power and Torque curves to be set by WPPA~~
Overspeed limit - max 7100 rpm

Attachment 1 - Camlift measurement

INTAKE PROFILE

CAM∠(°)	LIFT(mm)
-88	0.00
-87	0.00
-86	0.00
-85	0.00
-84	0.02
-83	0.03
-82	0.05
-81	0.07
-80	0.08
-79	0.10
-78	0.12
-77	0.14
-76	0.15
-75	0.17
-74	0.19
-73	0.20
-72	0.22
-71	0.24
-70	0.26
-69	0.27
-68	0.29
-67	0.31
-66	0.33
-65	0.34
-64	0.36
-63	0.38
-62	0.40
-61	0.42
-60	0.46
-59	0.52
-58	0.60
-57	0.69
-56	0.81
-55	0.94
-54	1.10
-53	1.27
-52	1.45
-51	1.65
-50	1.87
-49	2.09
-48	2.32
-47	2.56
-46	2.80
-45	3.04
-44	3.29
-43	3.53
-42	3.77
-41	4.01
-40	4.25
-39	4.48
-38	4.71
-37	4.93
-36	5.15
-35	5.36
-34	5.57
-33	5.78
-32	5.97
-31	6.17
-30	6.36
-29	6.54
-28	6.71
-27	6.89
-26	7.05
-25	7.21
-24	7.36
-23	7.51
-22	7.65
-21	7.79
-20	7.92
-19	8.04
-18	8.16
-17	8.27
-16	8.38
-15	8.48
-14	8.57
-13	8.65
-12	8.73
-11	8.81
-10	8.87
-09	8.94
-08	8.99
-07	9.04
-06	9.08
-05	9.11
-04	9.14
-03	9.17
-02	9.18
-01	9.19
00	9.20

CAM∠(°)	LIFT(mm)
00	9.20
01	9.19
02	9.18
03	9.17
04	9.14
05	9.11
06	9.08
07	9.04
08	8.99
09	8.94
10	8.87
11	8.81
12	8.73
13	8.65
14	8.57
15	8.48
16	8.38
17	8.27
18	8.16
19	8.04
20	7.92
21	7.79
22	7.65
23	7.51
24	7.36
25	7.21
26	7.05
27	6.89
28	6.71
29	6.54
30	6.36
31	6.17
32	5.97
33	5.78
34	5.57
35	5.36
36	5.15
37	4.93
38	4.71
39	4.48
40	4.25
41	4.01
42	3.77
43	3.53
44	3.29
45	3.04
46	2.80
47	2.56
48	2.32
49	2.09
50	1.87
51	1.65
52	1.45
53	1.27
54	1.10
55	0.94
56	0.81
57	0.69
58	0.60
59	0.52
60	0.46
61	0.42
62	0.40
63	0.38
64	0.36
65	0.34
66	0.33
67	0.31
68	0.29
69	0.27
70	0.26
71	0.24
72	0.22
73	0.20
74	0.19
75	0.17
76	0.15
77	0.14
78	0.12
79	0.10
80	0.08
81	0.07
82	0.05
83	0.03
84	0.02
85	0.00
86	0.00
87	0.00
88	0.00

EXHAUST PROFILE

CAM∠(°)	LIFT(mm)
-91	0.00
-90	0.00
-89	0.00
-88	0.00
-87	0.02
-86	0.03
-85	0.05
-84	0.07
-83	0.08
-82	0.10
-81	0.12
-80	0.14
-79	0.15
-78	0.17
-77	0.19
-76	0.20
-75	0.22
-74	0.24
-73	0.26
-72	0.27
-71	0.29
-70	0.31
-69	0.33
-68	0.34
-67	0.36
-66	0.38
-65	0.40
-64	0.41
-63	0.44
-62	0.47
-61	0.53
-60	0.60
-59	0.70
-58	0.83
-57	0.98
-56	1.15
-55	1.34
-54	1.54
-53	1.76
-52	1.99
-51	2.23
-50	2.47
-49	2.72
-48	2.96
-47	3.20
-46	3.44
-45	3.68
-44	3.91
-43	4.13
-42	4.36
-41	4.58
-40	4.79
-39	5.00
-38	5.21
-37	5.41
-36	5.61
-35	5.80
-34	5.99
-33	6.17
-32	6.35
-31	6.52
-30	6.69
-29	6.85
-28	7.01
-27	7.16
-26	7.30
-25	7.45
-24	7.58
-23	7.71
-22	7.84
-21	7.96
-20	8.07
-19	8.18
-18	8.29
-17	8.38
-16	8.48
-15	8.56
-14	8.64
-13	8.72
-12	8.79
-11	8.85
-10	8.91
-09	8.97
-08	9.01
-07	9.06
-06	9.09
-05	9.12
-04	9.15
-03	9.17
-02	9.18
-01	9.19
00	9.20

CAM∠(°)	LIFT(mm)
00	9.20
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08	9.01
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15	8.56
16	8.48
17	8.38
18	8.29
19	8.18
20	8.07
21	7.96
22	7.84
23	7.71
24	7.58
25	7.45
26	7.30
27	7.16
28	7.01
29	6.85
30	6.69
31	6.52
32	6.35
33	6.17
34	5.99
35	5.80
36	5.61
37	5.41
38	5.21
39	5.00
40	4.79
41	4.58
42	4.36
43	4.13
44	3.91
45	3.68
46	3.44
47	3.20
48	2.96
49	2.72
50	2.47
51	2.23
52	1.99
53	1.76
54	1.54
55	1.34
56	1.15
57	0.98
58	0.83
59	0.70
60	0.60
61	0.53
62	0.47
63	0.44
64	0.41
65	0.40
66	0.38
67	0.36
68	0.34
69	0.33
70	0.31
71	0.29
72	0.27
73	0.26
74	0.24
75	0.22
76	0.20
77	0.19
78	0.17
79	0.15
80	0.14
81	0.12
82	0.10
83	0.08
84	0.07
85	0.05
86	0.03
87	0.02
88	0.00
89	0.00
90	0.00
91	0.00

Swivel Bracket

Reinforced Swivel Bracket **Part no 1400-8M0145740**

Swivel Bracket	Detail
	
Detail	**Detail**