



# 2019 Stock Outboard Technical Manual

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(New, reduced & changed rules are shaded)

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JB – 11/23/18



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### Conversion Table

Fraction	Decimal	Millimeters	Fraction	Decimal	Millimeters
1/64	0.015625	0.3969	33/64	0.515625	13.0969
1/32	0.03125	0.7938	17/32	0.53125	13.4938
3/64	0.046875	1.1906	35/64	0.546875	13.8906
1/16	0.0625	1.5875	9/16	0.5625	14.2875
5/64	0.078125	1.9844	37/64	0.578125	14.6844
3/32	0.09375	2.3813	19/32	0.59375	15.0813
7/64	0.109375	2.7781	39/64	0.609375	15.4781
1/8	0.125	3.1750	5/8	0.625	15.8750
9/64	0.140625	3.5719	41/64	0.640625	16.2719
5/32	0.15625	3.9688	21/32	0.65625	16.6688
11/64	0.171875	4.3656	43/64	0.671875	17.0656
3/16	0.1875	4.7625	11/16	0.6875	17.4625
13/64	0.203125	5.1594	45/64	0.703125	17.8594
7/32	0.21875	5.5563	23/32	0.71875	18.2563
15/64	0.234375	5.9531	47/64	0.734375	18.6531
1/4	0.25	6.3500	3/4	0.75	19.0500
17/64	0.265625	6.7469	49/64	0.765625	19.4469
9/32	0.28125	7.1438	25/32	0.78125	19.8438
19/64	0.296875	7.5406	51/64	0.796875	20.2406
5/16	0.3125	7.9375	13/16	0.8125	20.6375
21/64	0.328125	8.3344	53/64	0.828125	21.0344
11/32	0.34375	8.7313	27/32	0.84375	21.4313
23/64	0.359375	9.1281	55/64	0.859375	21.8281
3/8	0.375	9.5250	7/8	0.875	22.2250
25/64	0.390625	9.9219	57/64	0.890625	22.6219
13/32	0.40625	10.3188	29/32	0.90625	23.0188
27/64	0.421875	10.7156	59/64	0.921875	23.4156
7/16	0.4375	11.1125	15/16	0.9375	23.8125
29/64	0.453125	11.5094	61/64	0.953125	24.2094
15/32	0.46875	11.9063	31/32	0.96875	24.6063
31/64	0.484375	12.3031	63/64	0.984375	25.0031
1/2	0.5	12.7000	1	1	25.4000

#### Length

1 in = 25.4 mm

1 in = 2.54 cm

1 ft = 0.3048 m

#### Volume

1 in<sup>3</sup> = 16.387 cm<sup>3</sup>

1 ft<sup>3</sup> = 1728 in<sup>3</sup>

#### Liquid

1 gal = 3.785 L

1 qt = 0.946 L

1 gal = 231 in<sup>3</sup>

#### Weight

1 oz = 23.35 g

1 lb = 4536 g

1 lb = 16 oz

# INSPECTION:

## Inspection Area Requirements

Inspection of a motor is not a public exhibit. Pit crews are welcome for help in lifting rigs on and off the scales, if required, but only the driver and the mechanic of the motor being inspected are allowed in the motor teardown area. The Inspector is in full charge of the entire inspection area. A person representing the Race Committee is recommended to maintain order and keep outside people from interfering with the Inspector in his work.

## The Race committee should:

1. Provide an enclosed area by using either snow fence or roping off the area.
  - a. Provide at least two tables:
    - i. One for the Inspectors' tools
    - ii. One for engine disassembly
  - b. Provide motor stands
2. Place the scales in such a position so they are easily accessible to both the drivers and the Inspector.
3. Radio, telephone, or other good communications should be provided between the judge's stand and the inspection area. In case of a disqualification the other contestant's positions have to be recomputed by the scorers on the basis that the disqualified boat did not participate in the race. Such recompilation does not always advance all contestants but at times also changes their relative position therefore this information is required by the Inspector.
4. Provide cardboard boxes for motors that have been torn down along with small plastic bags for the small parts.
5. Provide a Pit Manager to be in charge of tagging the engines as the rig is weighed. Wired shipping tags are recommended. The tag should contain class, final position, boat number and weight.

## Levels of Inspection

1. Level 1 - Inspection at all races. (recommended)  
Check height, weight, fuel with Digitron meter, and tuck where applicable.
2. Level 2 – at Divisional, Western Championships & Eastern Championships. (min.)  
Level 1 inspection, plus fuel specific gravity or water solubility, cc's of engine, carburetor dimensions, gear case dimensions, gear ratios, water inlet (where applicable), stroke & bore with thru spark plug hole checker.
3. Level 3 – at Summer National Championships, Marathon National Championships and Record Runs, this will be mandatory.  
Level 1 & 2, plus tear down and internal inspection to verify all internal dimensions comply with the current inspection manual. A level 1 inspection will be conducted prior to sealing a motor.

### Inspection Tools

The following is intended only as a guide in the acquisition of tools. The experienced Inspector has frequently substituted other equally satisfactory tools.

1. 0"-1" Micrometer, 1"-2" Micrometer, 2"-3" Micrometer.
2. 6" or 8" Dial or Digital Calipers.
3. Large Outside Calipers.
4. Set of Telescoping Gauges (Lufkin 79-L or equivalent).
5. Depth Vernier (Dial & Digital type are also available).
6. 16' Flexible Steel Tape Rule (Carlson 416 or equivalent).
7. 50 cc Burette
8. 6" Steel Scale.
9. 5/32", 11/64", 1/4", 0.209" (#4), 0.228 (#1) Drills or Drill Blanks.
10. Penlight.
11. APBA Rule Book and Stock Outboard Inspection Manual.
12. Two parallel blocks about 8" long with several holes to serve as measuring surfaces for some measurements.
13. "S" shape spark plug hole bore gauge.
14. Engine and Gear case templates and instruction sheets (for OMC "A", 45SS and Mercury 25SX, 44XS).
15. Fuel meter and related equipment.
16. Lynco port checking gages for class A OMC

### Lynco Gage Instructions

The Lynco plug gages are designed to be used exactly 90 degrees to the port window opening. This positioning of the gage is crucial to the accurate use of the tool. Although it is possible to use without an additional guide, it is recommended that some type of a guide be used to assist in keeping the gage perpendicular to the window being measured. A small v-block can be used for this purpose. The cut end of the gage is used to inspect each port opening. A set of gages consists of three sizes. (.650, .640, and .635). See Specification chart for proper maximum dimension of each port. As each port is measured, the gage should be rotated and tried at various positions. The proper gage should not pass through the port opening while in a perpendicular position. The SO chief inspector may approve the manufacture of Lynco gages by a source other than Lynco.

### Fuel Rules

1. The Stock Outboard Category allows the use of pump gasoline, aviation gasoline and automotive racing gasoline. They may be used separately or mixed together. Pump gasoline is defined as any product, which is offered to the general public for use in passenger automobiles.
2. The addition of any substance other than oil, which is produced for use in consumer 2-cycle marine or off-road recreational products, is strictly prohibited.
3. The race committee may take samples of any competitor's fuel to be sent for analysis.
4. The race committee may, when notice is given, have available at the race site, a gasoline product for purchase at a reasonable price and require competitor's to purchase and use that gasoline.
5. In addition, the APBA Board of Directors is in process of establishing a list of banned harmful substances that might be used additives in fuel. The SORC has agreed that this list, when available, will be part of the

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Stock Outboard Category Fuel Rules and any substance contained on the banned list would be treated in the same manner as Dioxane.

6. All fuel tanks must have a minimum sized opening of 1" and be able to accept the Digatron fuel meter probe.
7. Additives which produce power in excess of that produced by standard pump gasoline and petroleum base oils shall not be permitted. The list of illegal additives includes, but is not limited to, alcohols, nitrates, and other oxygen bearing compounds. Gasohol is not a legal fuel.
8. The baseline for determining legal fuel will be a zero reading on a Digatron meter or equivalent as defined by this manual. At each regatta the inspector may purchase a sample of local gasoline, mix it with TCIII oil at a ratio of 8:1 and test it. If the test fuel exceeds the zero Digatron threshold, the higher reading will become the maximum limit of the day. The source and grade of the gasoline must be announced when registration opens. At that time, testing equipment must be available to all competitors.
9. This "fuel of the day" rule is not applicable at the Closed Course Nationals, Marathon Nationals, Eastern Championships, Western Championships, Divisionals, North American Championships, straightaway record runs or competition record races.
10. Any driver using fuel which does not meet this rule will be disqualified. Additional fuel disqualification in the same day will result in the driver being automatically suspended for the remainder of the day.
11. A driver may appeal a fuel disqualification by following the appeal procedure as covered in the Stock Outboard Racing Rules. The driver must do this before leaving the inspection area, so a sample of the subject fuel can be collected and other tests performed with complete assurance that there has been no substitution or addition. All cost for transportation and such tests will be assessed against the appealing member. It is advisable to have unknown gasoline and oil checked before competition.

## Fuel Testing Guidelines

It is recommended that evaluation of fuels be conducted using the following tests, in preference as listed. Additional tests may be used if deemed necessary.

- Digatron DT-15, Digatron DT 47 FT or the Digatron FT 64 Fuel meter Tester
- Specific gravity Test
- Water Solubility Test
- Ceric Nitrate Reagent Test
- Germaine Fuel Test

Instructions for each of the above four tests are given below.

### ***Digatron DT-15/47FT Fuel Meter Instructions***

The purpose of this test is to measure certain electrical properties of the fuel sample and determine if they are within the permissible limits. The test procedures described herein are in accordance with the instructions supplied by the Digatron DT15 fuel meter manufacturer. Before performing your fuel testing, ensure that the fuel meter is in good working order:

1. Sensor Condition -Visually check the sensor and its connecting wire to assure that it has not been damaged.
2. Battery Condition -When the meter is on, the words "LO BAT" will appear in the upper left corner of the display if the battery needs to be replaced. Do not use the meter if the "LO BAT" is displayed, as its readings will not be accurate.

3. The recommended fuel test procedure is as indicated below:
  - a. Turn the meter on and allow it to warm up at least 15 minutes before doing any testing. This will allow the internal components to stabilize at their normal operating temperature.
  - b. Attach the sensor's connecting wire to the meter. Hold the sensor's connecting wire and lower the sensor into the calibration liquid—Cyclohexane (C<sub>6</sub>H<sub>12</sub>)—such that the sensor is completely submerged. Take care to assure that the sensor is not in contact with the container. Gently wiggle the sensor wire to displace any air bubbles that may be trapped between the sensor plates. Using the knob on the front of the meter, adjust until “-75” is shown on the display.
  - c. Remove the sensor from the calibration liquid, and blow any excess liquid from between the plates. Lower the sensor into the fuel sample, in the fashion described in item “b” above.
  - d. Observe the reading on the meter's display. If the reading is zero or a negative number, the fuel is legal. If the reading is greater than zero (a positive number), the fuel is not legal.
4. The electrical characteristics of gasoline change somewhat with temperature. As such, it is important that the temperature of the calibration liquid and the fuel sample be within about 15 degrees F of each other. When a fuel sample is found to be illegal, per the above procedure, it is recommended that the following additional steps be performed:
  - a. Clean the sensor with some spray-on brake cleaner and allow it to air-dry at least 30 seconds.
  - b. Re-check the calibration setting (-75) of the meter in Cyclohexane and adjust if necessary.
  - c. Allow the fuel sample to stabilize to the same temperature as the Cyclohexane and then repeat the test as described in item 3 above. During the course of the day, it is recommended that the calibration setting in Cyclohexane be occasionally checked. It is interesting to note that the calibration reading of “-75” in Cyclohexane has a corresponding reading when the sensor is in air, although this corresponding air reading varies somewhat with each particular meter. As such, the specific corresponding air reading for the particular meter being used can be a useful reference during the time between occasional Cyclohexane calibration checks.

### ***Specific Gravity Testing Instructions***

The purpose of this test is to measure the relative density of a fuel sample and determine if it is within the permissible limits. Two pieces of special equipment are required to perform this test:

1. Specific gravity hydrometer(s) which cover the range of 0.750 -0.800 (at 60F).
2. A clear glass container, which is at least as tall as the hydrometer. A “graduated cylinder” works well for this purpose. The recommended fuel testing procedure is as indicated below:
  - a. Assure that the glass container and hydrometer are clean.
  - b. Place the glass container on an essentially level surface and fill with the fuel that is to be tested. The depth of the fuel should be equal to or greater than the length of the hydrometer.
  - c. Carefully insert the hydrometer into the fuel sample with the weighted end facing down. Take care to minimize the contact between the hydrometer and the container.
  - d. When the hydrometer has reached a stable free float in the fuel sample, read the specific gravity from the scale within the hydrometer. This is done by visually sighting along the upper surface of the fuel and reading where the scale crosses the fuel's surface. Record this reading.

- e. Measure the temperature (°F) of the fuel. The specific gravity characteristics of fuel (gasoline and oil) change somewhat with temperature. As such, the maximum permissible specific gravity reading will change as the fuel temperature changes. Below is a listing of the maximum permissible specific gravity readings and their corresponding fuel temperature: The Minimum Specific Gravity reading for fuel is .700.

Fuel Temperature (°F)	Maximum Permissible Specific Gravity Reading
40°	0.785
50°	0.780
60°	0.775
70°	0.771
80°	0.776
90°	0.761
100°	0.757
110°	0.752

### ***Water Solubility Testing Instructions***

The purpose of this test is to determine if water-soluble additives are present in a fuel sample. The only piece of special equipment necessary to perform this test is a graduated container. It is recommended that a good quality clear glass graduated cylinder be utilized, with a capacity of 100 ml and subdivisions of 0.1 ml (or less). The recommended fuel testing procedure is as indicated below:

1. Assure that the graduated cylinder is clean.
2. Place the graduated cylinder on an essentially level surface.
3. Pour approximately 60 ml of the fuel sample into the graduated cylinder.
4. Carefully measure and record the amount of fuel in the graduated cylinder using the scale on the cylinder.
5. Slowly pour approximately 35 ml of water into the graduated cylinder.
6. The liquid in the cylinder will separate into two layers. The water will settle to the bottom of the cylinder, carrying water-soluble additives with it. Froth may form in the lower layer. Allow time for the froth to clear.
7. Measure and record the total amount of liquid in the graduated cylinder using the scale on the cylinder.
8. Subtract the amount of fuel in the cylinder (step 4) from the total liquid (step 7) to determine the exact amount of water that was added. Record this result.
9. Carefully measure and record the amount of liquid in the lower layer of the graduated cylinder using the scale on the cylinder.
10. If the amount of liquid in the lower layer (step 9) is greater than the amount of water added (step 8), the fuel contains water-soluble additives and is not legal.



### ***Ceric Nitrate Reagent Testing Instructions***

The purpose of this test is to determine if alcohol is present in a fuel sample.

1. Following is a list of special equipment necessary to perform this test:
  - 50 ml graduated cylinder with subdivisions of 1.0 ml (or less).
  - 100 ml glass beaker.
  - 18 mm X 150 mm clear glass test tube.
  - 2 ounce glass dropper bottle with dropper assembly.
2. Following is a list of the chemicals necessary to perform this test:
  - Ceric Ammonium Nitrate  $(\text{NH}_4)_2\text{Ce}(\text{NO}_3)_6$ .
  - Nitric Acid  $(\text{HNO}_3)$  (70%).
3. The Reagent Solution should be made prior to the race (within a couple of days) and is done as follows:
  - a. Pour 41 ml of distilled water into the glass beaker.
  - b. Carefully add 9.0 ml of Nitric Acid to the water in the glass beaker.
  - c. Add 20 grams of Ceric Ammonium Nitrate to the solution in the glass beaker.
  - d. Dissolve the Ceric Ammonium Nitrate by gently stirring. Slight heating of the solution will speed the process; however, DO NOT BOIL!
  - e. Pour the Reagent Solution into the dropper bottle and secure the cap. The Reagent Solution should have a yellow color.
4. Recommended fuel test procedure:
  - a. Pour approximately 10 ml of the fuel sample into the test tube.
  - b. Carefully add six (6) drops of the Reagent Solution to the fuel sample in the test tube.
  - c. Seal the open end of the tube and invert several times.
  - d. The Reagent Solution should accumulate at the bottom of the test tube. Observe the color of the accumulated Reagent Solution. If it is the same color (yellow) as the original solution in the dropper bottle, the fuel sample contains no alcohol. If the accumulated Reagent Solution in the test tube has changed its original color (yellow) to orange or red, the fuel sample contained alcohol and is not legal.

### ***Germaine Fuel Test***

Because of the serious health risks of the agent Dioxane, a very serious penalty has been adopted by the SORC if it is found at a race. Dioxane is a very powerful carcinogen! The MSDS information is posted on APBA's website. Anyone found to have Dioxane in his or her fuel will be suspended for a period of one year from the date of disqualification! Specifically, the rule is:

"Using the prescribed Germaine Fuel Test as outlined following this rule. If a participant is disqualified for failing the Germaine fuel test, he/she will be allowed to compete in subsequent races only if their fuel is pre-qualified with inspection prior to each race. If the official lab results confirm the initial Germaine test results, the one-year suspension

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is retroactive to the time of the initial disqualification. Any races that the participant competed in since that initial disqualification will be re-scored to reflect the suspension. This would mandate an automatic appeal for the driver, unless the driver specifically requests that the sample not be submitted to the lab”.

1. Equipment required:

- Disposable test tubes
- Test tube rack suitable to hold test tubes above
- Disposable eyedroppers or pipettes
- Protective latex or rubber gloves
- Bottle of Germaine reagent - The Germaine Reagent is available from John Copeland at Fox Valley Kart Shop, 520 N 9th St., Lafayette, IN 47904. Phone number 765-7420935 - Fax 765-429-8395  
Email: foxvalle@pop.nlci.com
- Optional:
- Bottle of 1.4 dioxane
- A bottle of known legal fuel

Test tubes and pipettes can be purchased from most supply houses. Fisher Scientific part numbers below:

- Test Tubes – p/n 14958D – 13 x 100 ml
- Test Tube Rack – p/n 14809A – supports 72 tubes 10-13 ml
- Pipettes – p/n 137117 – 7.7 ml

Nitril Gloves can be purchased locally. Safety glasses should be worn.

NOTE: Try to keep your chemicals shaded while using, stored in dark container. Reagent is light sensitive and will turn color.

### ***Germaine Reagent Fuel Test Procedure***

1. Using a new, clean pipette or eyedropper, draw a fuel sample from competitor's tank or fuel line and fill test tube approximately 2/3 full. Always use a new pipette and a new test tube for each competitor.
2. Wearing protective latex or rubber gloves carefully squeeze one drop of Germaine Reagent directly into the center of the fuel sample in the test tube. Do not allow reagent to run down the side of the test tube, as it makes reading the test more difficult.

NOTE: Most users will find the test easier to read by holding the tube up at eye level when the reagent is added to make viewing any reaction more convenient.

3. When the Germaine reagent drop first hits the fuel sample, any oil dissolved and/or suspended in the gasoline will come out of solution and fall immediately to the bottom of the test tube. This is not a positive reaction. Different oils may react differently, but a single, fast falling drop is typical.
4. The formation of a white or light brown precipitate (like little snowflakes) at the point where the Germaine Reagent hits the fuel sample is a positive indication of the presence of 1.4 dioxane. The precipitate will drift, depending on size and density, to the bottom of the test tube. Within a few minutes it will darken from contact with oil drop in the bottom of the tube.
5. It is always advisable to repeat a positive test to insure that no error has been made.
6. It is a good practice to carry a sample of known legal fuel and a sample of 1.4 dioxane to use as a verifying test. Simply make up 3 test tubes, one containing the known legal fuel, one containing known legal fuel to which you then

add some 1.4 dioxane, and one containing the competitor's fuel. Then repeat the test, observing any reaction in the known legal sample, then the known legal sample containing 1.4 dioxane, and finally the competitor's sample. Having observed the reaction of the sample known to contain 1.4 dioxane, it will be easier to confirm the reaction in the competitor's sample.

### ***Recommended Procedure for Measuring Combustion Chamber Volume***

1. The engine should be elevated in such a manner so that the face of the cylinder head is horizontal in position.
2. The piston in the cylinder to be measured should be set at top dead center (TDC).
3. A titrating burette (preferably 50 ml capacity) graduated in 0.1 cc increments should be used.
4. A mixture of 50% mineral spirits and 50% TCW II or III outboard motor oil should be used as the measuring fluid. This mixture should be prepared in a separate container not the burette.
5. The burette should be filled with the measuring fluid to well above the 0.0 cc marks. Note: The liquid in the burette should be inspected to insure that there are no bubbles present especially at the location of the meniscus. Air bubbles will cause an erroneous reading. Gently tapping the side of the burette will disperse the bubbles.
6. The burette should be drained through the use of the stop-cock so as to read exactly 0.0.  
Note: The burette should be read at the bottom of the meniscus (the concave line at the top of the column of fluid). A reading taken from other than the bottom of the meniscus will be inaccurate.
7. The burette should now be drained into the cylinder containing the piston placed at TDC (step 2) until the fluid reaches the bottom of the spark plug threads. At this point close the stop-cock and carefully rock the engine slightly from side to side and top to bottom to evacuate any air from within the cylinder.  
Note: Drain the burette slowly so as not to introduce air bubbles into the combustion chamber.
8. Continue to drain the burette until the fluid level reaches the very top of the spark plug threads.  
Note: In the case of engines with angled spark plugs the centerline axis of the spark plug should be vertical (i.e. the OMC A engine).
9. The combustion chamber volume may now be read from the burette. Remember, the reading should again be taken at the bottom of the meniscus. Your reading should be recorded to within five-hundredths (0.05) of a cc. To accomplish this you must estimate if the meniscus is half way between two tenth (0.1) cc graduation lines.
10. Compare the reading obtained from the burette to the cc specification of the engine being measured. If the burette reading is equal to or greater than the minimum cc requirement, then the engine is legal. In the event the burette reading is less than the minimum cc requirement the engine is not legal.

Note: Should the first cylinder measured be found to be right at or less than the minimum cc specification, the above process should be repeated on the remaining cylinders. Should it become necessary to repeat this process on a cylinder that has just been measured, under no circumstances should solvents be used to flush the measuring fluid from the cylinder. If the engine has a removable cylinder head it is not to be removed to allow cleaning of the combustion chamber. The only acceptable method of cleaning the measuring fluid from the cylinder is to run the engine for several minutes. This will restore the combustion chamber to its original state (as raced).

It is recommended that you try to have another Inspector assist you during this procedure. He or she will be able to verify the accuracy of the measurements.

# GENERAL GUIDELINES & RESTRICTIONS

1. **Responsibility-** The driver shall be responsible for the condition of the motor and boat as raced. For instance, errors on the part of the manufacturer, boat builder, mechanic, or previous owner will not excuse non-compliance with the rules.
2. **Parts comparison-** Allowable modifications herein are for either safety reasons or repair purposes. An Inspector may compare questionable parts to new ones. Use of these rules for an unfair advantage will be grounds for disqualification.
3. **Machining-** Internal machined surfaces may be re-machined so long as minimum and maximum dimensions are met. Cast or forged surfaces must remain as cast with no alterations, bead blasting, sand blasting, media blasting, or blasting by any other material, or polishing. NOTE: It is not permissible to re-machine internal machined surfaces that do not have specific dimensions. (See specific class rules for other restrictions or exceptions).
4. **Substitution-** There shall be no substitution of components such as lower units, carburetors, etc. unless replacement components are specifically designated as stock for a particular model by the SORC.
5. **Part alteration-** Any make of spark plugs or propellers (except 300SSH) may be used provided other parts are not altered to accommodate them.
6. **Broken or damaged parts-** may be repaired by welding or the use of plastic compounds, provided that all internal dimensions, contours, and surfaces remain the same as the original cast or machined surface. The Inspector will pass repairs which meet the word and spirit of this rule, but will disqualify engines having repairs which are obviously intended to provide an unfair advantage.
7. **Broken skegs and cavitation plates-** may be used provided that the edge of the break or breaks have not been filed or smoothed or otherwise altered, and provided that reasonable time was not available for repair or replacement. One or two weeks will be considered a reasonable amount of time. At championship events, the Inspector may rule out the use of broken skegs or cavitation plates.
8. **Helicoils-** It is permissible to repair stripped threads by tapping oversize or using helicoils or threaded inserts.
9. **Ports-** It is permissible to break the edge of the port windows, but it is not legal to chamfer them. (Note: some of the current motors we race have chamfered ports and it is legal in those class motors to have a chamfered port. For example, Hot Rod engines).
10. **Towing-** Each boat must be equipped with a device enabling it to be towed, such as a hole, handle or screw eye on the bow that is capable of handling a rope.

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### **11. Replacement parts-**

- a) Only such parts shall be permitted as are standard production OEM parts used on the motor as the purchaser may obtain from the dealer as a stock item or products as approved by the Stock Outboard Technical Committee and the Stock Outboard Racing Commission, and published in the Propeller, and available to the general public through dealers. These products cannot provide any performance advantage over original OEM parts.
- b) Final approval of non-OEM parts for use in Stock racing shall not be given until the Chairman of the SORC has advised the Technical Chairman that he or she is satisfied that all provisions of these rules have been complied with.
- c) Non-OEM parts must be submitted for approval to the Chairman of the SORC.
- d) The Chairman shall then take those steps as are necessary to insure that the non-OEM parts substantially comply with the OEM specifications for which the non-OEM part would be used as a replacement.
- e) With such submission, the manufacturer of the non-OEM part shall submit drawings, pictures and accompanying specifications for the part to the Chairman.
- f) The Stock Outboard Technical Committee reserves the right to deny approval of such parts for any reason and to retain all submitted parts for a period of one year.
- g) A list of approved non-OEM parts shall be listed in the Stock Outboard Inspection Manual. This list shall include the name of the manufacturer and the OEM identification for that part.

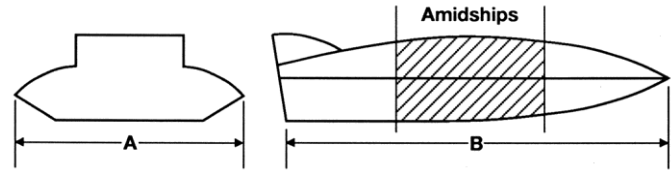
## Classes and Motor Eligibility

- 1) An outboard motor is defined as a complete combustion power and propulsion unit that can be attached to a boat and which can be lifted bodily by human power from the hull as one unit. Batteries used for ignition and starting, tachometer, throttle control and steering arrangements are not included in this description.
- 2) Only one motor shall be used on a hull.
- 3) There shall be only one propeller of three (3) blades or less.
- 4) The eligibility rules in situations involving commercial connections are as follows:
  - i) No equipment can be campaigned as the entry of any corporation or business concern. Names and advertisements in good taste will be allowed.
  - ii) No part of this rule is to be construed as a ban on individuals who sell boats and motors through recognized dealerships.
- 5) Motors shall be divided into classes as follows:

<b>Class</b>	<b>Permitted Motors</b>	<b>(*Motor of choice)</b>
<b>ASR &amp; ASH</b>	<b>Johnson &amp; Evinrude 'A', Mercury &amp; Mariner 'A' &amp; Sidewinder 15s*</b>	
<b>15SSR &amp; 15SSH</b>	<b>Hot Rod 15ci, Sidewinder 15H &amp; Sidewinder 20s* (with 3/4" restrictor)</b>	
<b>BSR</b>	<b>Mercury 25xs with restrictor, Sidewinder 20s* (w/o restrictor)</b>	
<b>BSH</b>	<b>Mercury 25xs with restrictor, Yamato 80 &amp; Sidewinder 20s* (w/o restrictor)</b>	
<b>CSR &amp; CSH</b>	<b>Yamato 102, 302 &amp; 321*</b>	
<b>DSR &amp; DSH</b>	<b>Mercury 55-H &amp; Super Thunderbolt, Mercury 44xs &amp; Tohatsu Ram 50*</b>	
<b>20SSH</b>	<b>Yamato 80, Yamato 102 (with 7/16" restrictor) &amp; Yamato 302 - 321* (with 7/16" restrictor)</b>	
<b>25SSR</b>	<b>Mercury 25xs w/o restrictor, Yamato 102, 302 &amp; 321* (1/2" or 9/16" restrictor),</b>	
<b>300SSH</b>	<b>Yamato 302 &amp; 321*</b>	
<b>45SS</b>	<b>Johnson &amp; Evinrude 45SS*</b>	

## Hulls

The following hull dimensions shall apply:



CLASS	MOTOR	WIDTH "A"	LENGTH "B"
ASR & 15SSR	Any legal	44"	9' 5"
BSR	Sidewinder 20s	44"	9' 5"
	Mercury / Mariner	44"	9' 5"
25SSR	Mercury / Mariner	44"	9' 5"
	Yamato 102, 302 & 321	48"	11' 5"
CSR & DSR	Any legal	48"	11' 5"

"A" Minimum beam measured at widest point where the transom and chine meet, but not to include spray rails or rub moldings.

"B" Minimum length measuring centerline of hull from trailing edge of bottom to a point perpendicular to stem and planing surface.

A. A Runabout hull is defined as a racing monoplane as qualified in this rule.

1) The planing surface of a runabout shall be the lowest immersed surface at the aft end of the hull to a point 36 inches forward. Also, the planing surface shall be flat forward for 18 inches at the keel. For purpose of inspection, all measurements shall be made with a tolerance plus or minus 1/16 inch, as applicable.

2) No part of the immersed surface may have a negative dead rise. The immersed surface may have a maximum notch of 5/8", and turning fins may also be added to the immersed surface.

3) Runabouts shall have no through the hull air passages, vented surfaces or wings. The intent of this rule is to have the air flow over the outside surfaces of the hull.

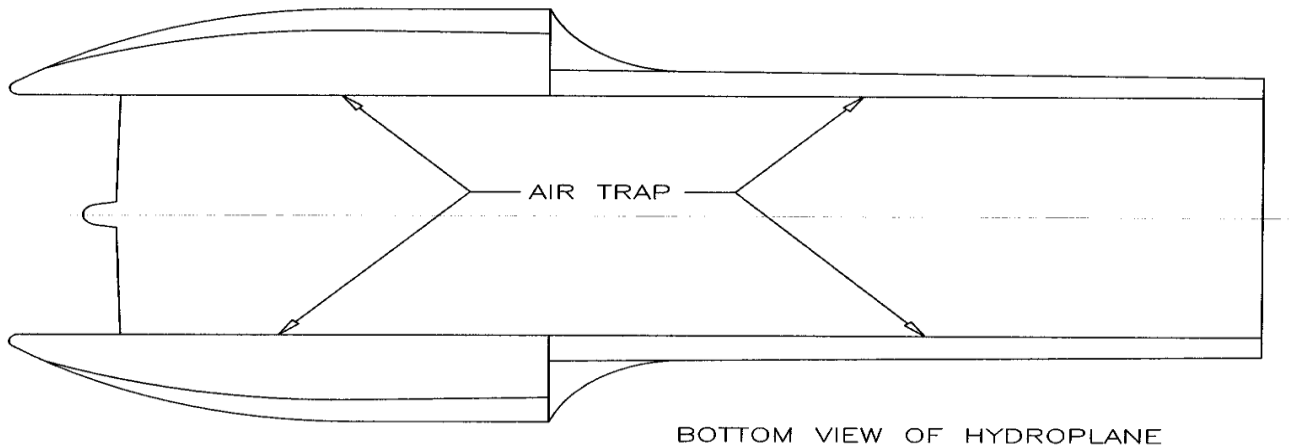
## 2019 Stock Outboard Technical Manual

4) A runabout shall not have a sponson/pod protruding from the side of the boat which interrupts the line of the side, non-trip, or bottom of the boat.

### B. Hydroplanes—

1) Hulls primarily defined as Runabout may not compete in a race advertised for Hydroplanes.

2) ASH motor height shall be measured relative to the lowest planing surface at the aft end of the boat. After planes will not be included. The planing surface shall be flat\* transversely between the air traps and forward for 18". Air traps shall be limited to a maximum depth of 5/8" at the aft end of the boat and 1-5/8" depth 18" forward, and at no point shall the air trap depth exceed the line created by the maximum depth dimensions provided. The maximum width of the air traps is 7/8".



\*Flat shall be given a tolerance of 1/16 inch for inspection purposes.

3) 300SSH hulls must meet the following specifications:

- a. After plane length shall not be less than 5' 9" (69"). Measured from the trailing edge of the sponsons to the trailing edge of the bottom.
- b. A minimum depth measurement of 1-3/4" between the bottom of the hull and the bottom of the sponson at the trailing edge of the sponson.
- c. A minimum bottom width measured between the sponsons and air traps of 35".
- d. A minimum boat bottom length not to be less than 8' 9" (105"). Measured from the trailing edge of the bottom to the furthest most point forward along either bottom edge, beside the base of the air traps and sponsons.



## Weight Restrictions

Minimum Overall Racing Weights (in pounds)		
Class	Hydro	Runabout
A	345 330 with Mercury 15	350 335 with Mercury 15
15SS	365	360 w/o side fin / 375 w/ side fin
B	400 with 20S & Y80 / 420 with 25XS	395 with 20S / 420 with 25XS
20SS	400	N/A
25SS	N/A	102, 302 & 321 With 9/16" Restrictor = 430 102, 302 & 321 With 1/2" Restrictor = 405 Merc 25xs = 395
300SS	420	N/A
C	440	475
D	480	515
45SS	700	N/A

Overall weights shall include driver, hull, motor, steering bar, steering wheel with cables and pulleys, motor controls, propeller, permanently attached speedometer and tachometer, permanently attached cushions and hardware, securely fastened weights, securely fastened fuel tank with remaining fuel, helmet, goggles and life jacket. The overall weight shall not include tools, fire extinguishers, water, or loose equipment in boat or in driver's clothing.

## **CLASS RULES**

### **A CLASS**

#### Permitted Motors

- a. Johnson Model # JKT
- b. Evinrude Model # EKT
- c. Mercury 15
- d. Sidewinder Model # 15S

### **A Class Changes History**

- Aft end of the prop shaft or aft end of gear housing motion that the ASH height measurement will be measured at whichever is higher.
- Motion to accept a detuned Hot Rod as a prototype for 2005 and a probationary engine for 2006 and a legal A motor for the 2007 year. The SORC will be updated with data yearly on the progress.
- OMC A Engines –
  - Motion to approve the pre 1986 belly pans and steering bracket. Part #s and specs to follow.
- Mercury A Engines –
  - Motion to allow after market or modified motor mounts.
  - Motion to allow the hole in the service butterfly to be soldered closed or closed with epoxy.
  - Motion to allow the use of any bearing or seal.
  - Motion to allow the honing of the connecting rod as long as it meets the current specs.
  - Motion to allow the honing of the center main bearing as long as it meets current specs.
  - Motion to allow any Bowden cable clamp to accommodate the use of electric start.

#### **2006**

- Motion made for the ASH height will be measured at the aft end of the prop shaft (1 3/8 below bottom) and also at the forward end of the gear case split line. The difference of these measurements shall not exceed 1/2 inch (of tuck under).
- Motion made to extend the approval of the Hot Rod A engine for 1 more year.

#### **2007**

- Motion made to approve this ignition kit from Mercury.
- Motion made to approve the use of oversized pistons for the Mercury/Mariner.
- Motion to place the A class 15cc sidewinder motor on probationary status for the 2007 season.

#### **2008**

- Motion made to make the Sidewinder A engine probationary for 2008 and 2009.

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### 2009

- Motion made to remove the Mercury as an eligible motor in the A class.
- Motion made to accept aftermarket 16-glm pistons as a replacement part for the OMC.
- Motion to remove probationary time period for the sidewinder a, thus leaving it without a probationary end date.  
Motion made to accept "ASH" air trap rule 20 section 4 – air traps shall be limited to a maximum depth of 5/8" at the aft end of the boat and 1-5/8" depth 18" forward, and at no point shall the air trap depth exceed the line created by the maximum depth dimensions provided. The maximum width of air traps in 7/8" each.
- Motion to extend date of deletion for Mercury motor in A class from November 1, 2009 to November 1, 2010.

### 2010

- The Mercury 15 is reinstated in the A classes beyond October 31, 2010
- The Mercury water discharge hose can be any length as long as the restrictor in the hose end is left in.
- It is allowable to countersink and use flat head screws in the reed block for ease of changing the restrictor plate on the Mercury.
- On the Mercury any fuel line may be used from the gas fitting to the carb.
- On the Mercury any piston ring may be used as long as the piston is not altered.
- The Sidewinder 15S motor is off probation on August 15, 2010

### 2011

- The parity committee changed the minimum cc's of the Sidewinder 15S to 18.5
- The parity committee changed the carburetor venturi is 15mm (0.590 +/- 0.010 on the 15S Sidewinder
- It is permissible to use an adjustable high speed jet on the 15S Sidewinder
- Any 1/4-20 bolt may be used to attach the gear case on the OMC engine after 11/1/11.

### 2012

- The OMC power head may be fitted with double ended studs and attached to the drive housing and through the steering bar brackets and secured with washers and lock nuts.
- The Sidewinder cc's are changed from 18.5 cc's to 15.0 cc's minimum - 16.5 cc's maximum by the A parity committee.
- The Dellorto PHBG 21mm carburetor, adaptor, and new spray shield have been approved for the Sidewinder 15S by the A parity committee.
- The fuel fitting may be removed on the Mercury 15 in A classes.

### 2013

- OMC engine pistons and rings – WSM .030" over Approved. Part no. 100-101-06K
- 8 lb flywheels in the OMC A are no longer a legal part.
- New carb mounting adapter and new intake manifold approved for the 15S.
- The A class parity committee lowered the 15S engine in ASH to 1-3/4" and lowered the weight 15 lbs for entries using the Mercury 15 engine in both classes.

### 2014

- OMC engine pistons and rings – WSM .030" over removed. Part no. 100-101-06K
- OMC engine pistons and rings – Wiseco .040" over approved. Part no. 3136P4
- Sidewinder electric start approved.
- Entries using the Mercury and OMC engines may now race at 1" below the bottom.

**2015 – 2016**

No changes.

**2017**

- Mercury engine adapter plate tolerance thickness is changed from +/- 0.010 to +0.010 / - 0.025.

**2018**

No changes.

**2019**

- (add changes here)

**15 CLASS**

Permitted Motors

- a. Hot Rod Model #15
- b. Sidewinder Model # 15H (No longer permitted on November 1, 2019)
- c. Sidewinder Model # 20S

**15 Class Changes History**

**2005**

- Hot Rod - Single unit ignition coil and 6 hp flywheel part #3584222 approved.

**2006**

No changes.

**2007**

- Sidewinder 15cc made a probationary motor for the 2007 and a legal motor for 2008.

**2008**

- Hydro height restriction set at 0.50".

**2009**

- 15 cid Sidewinder added to tech manual. Hot Rod horizontal split line gear case skeg & down housing can be used with the new Sidewinder power heads. These must meet skeg dimensions and specifications for the Sidewinder.

## **2019 Stock Outboard Technical Manual**

### **2010**

No changes.

### **2011**

- Reduced the cc's by 1 in the 15H Sidewinder motor to 11.5.
- Maximum bore size changed in the 15 cu. in. Hot Rod to +0.040".

### **2012**

- The short stroke crankshaft is permissible to use in the 15ci Hot Rod engine.
- The Dellorto VHST 28mm carburetor, spray shield bracket and velocity tubes are approved for the 15H Sidewinder by the B parity committee.

### **2013**

- New intake manifold approved for the 15H and 20S. 20S Sidewinder approved.
- The B class parity committee approved the 3/4" restrictor for the Sidewinder 20S engine using the 30mm Dellorto carburetor only on 3-25-13.
- The 20S engine height in BSH was lowered to 1" below.

### **2014**

- Sidewinder electric start approved.
- Balancing of new and old Hot Rod full circle crankshafts is approved by the addition of material only.

### **2015**

- Engine height raised from 1-3/8" to 1" for BSR entries using the Hot Rod engine.

### **2016 – 2017**

No changes.

### **2018**

- The Sidewinder Model # 15H engine is permitted for two more years. (Until November 1, 2019)
- It is permissible to use chine trailing fins on runabouts used in marathon racing.
- The side fin rule is removed for the runabout class.
- Class name changes back to 15SS from B.

### **2019**

- (add changes here)

## B CLASS

### Permitted Motors

- a. Sidewinder Model # 20S & Mercury 25XS in Runabout
- b. Sidewinder Model # 20S, Mercury 25XS & Yamato Model 80 in Hydro

## B Class Changes History

### 2018

- The old B Class is renamed 15 once again and a new B class is created for the unrestricted Sidewinder 20S engine.
- The Mercury / Mariner 25XS & Yamato Model 80 are permitted in hydro and the Mercury / Mariner in runabout for three years until November 1, 2020. This removal will only occur if there are at least 30 drivers that have raced the class a minimum of four races during the third season while using the Sidewinder 20S engine in the respective class.
- In BSR, all entries will have a minimum hull width of 44" and a minimum hull length of 9'5".

### 2019

- (add changes here)

## 25SS CLASS

### Permitted Motors

- a. Yamato Model # 102 Runabout only
- b. Yamato Model # 302 Runabout only
- c. Yamato Model # 321 Runabout only
- d. Sidewinder Model # 20S Hydro only
- e. Mercury Model # 25XS Runabout only

## 25 Class Changes History

### 2005

- Motion to remove restrictor from 25SSR.

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### 2006

- OEM Restrictors: Remove Rule 13 from Tech manual and replace with:  
“All 25XS engines shall be run with a carburetor restrictor securely in place behind the carburetor which shall conform to the diagram herein. OEM and non-OEM restrictors are legal as long as they conform to the specifications and dimensions of the OEM restrictors.”
- Motion made to approve the OEM restrictors made by wings and things as a legal replacement part.
- Flywheels: “The service flywheel may be machined down to the dimensions and size of the racing flywheel, balanced and bust tested.”
- Motion made to approve the machined flywheels made by wings and things. They will need a part identification # for the tech manual so inspectors know this is the approved flywheel.
- Motion made to approve adaptor and tuner plate from wings and things. With a maximum id dimension to be provided by Mercury technical committee.
- Motion made to run the 102/302 with a ½ inch restrictor and have a parity committee set up with the power to make changes during the racing season.
- Motion made to allow the Hot Rod 20 cubic inch to run at 1 inch height restriction.
- Allow the use of any replacement block to be run in the 25SS Mercury. Replace Paragraph 4 of Technical Rules with:  
“Any Cylinder Block and crank case manufactured by Mercury Marine 1986 or later with thermostat housing is a legal 25XS replacement part. OEM Pistons and Rings for these blocks are also legal.”
- Motion made to approve all blocks manufactured by Mercury since 1986 with thermostat housing for the 25 cubic inch engine.
- The Yamato 102s and 302s may run a 9/16" restrictor (the current one) at 430 lbs minimum weight.
- The Yamato 102s and 302s have the alternative of running a 1/2" restrictor at 405 lbs (the current weight).
- The Weight for the Mercury's, Yamato 80s and Hot Rods is reduced from 405 lbs to 395 lbs.
- The Hot Rod engines shall run at a 1.0" height restriction.
- The Mercury's continue to run with NO restrictor.

### 2007

- Motion to remove the restrictor plate in 25SSH.

### 2008

- Motion to raise the minimum age to 16 years in 25SSR.
- Motion to make the 20 cid sidewinder engine in the 25SSR a probationary engine for 2008 at 395lbs.
- Motion to remove the 2008 restriction for the 20 cid sidewinder engine in the 25SSR class. This would make the engine a probationary one indefinitely.
- Motion to make the "a" hull dimension 46" and the "b" dimension 10' for 25SSR for entries using sidewinder engines beginning in 2009.

### 2009

- Motion to remove probationary time period for the sidewinder 20, thus leaving it without a probationary end date.
- Motion made to remove the restricted Yamato restricted motors as of November 1, 2010.
- Motion made stating that the Yamato 80 will no longer be legal in 25ssr. Amended motion to state that this will be effective November 1, 2010.
- Motion to accept 25XS an aftermarket impellor as long as it is a replica of the current impellor.

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- Motion to make the only permissible block 1986 & newer a 7 bolt rear water jacket.
- Motioned to change 6.540 + - .030 "k" dimension in inspection manual.
- Motion to make 25XS rules previously passed at this meeting to make go into effect 2009.
- Motors from the 25SSR class. Amended to remove

### **2010**

- The height for 25SSH is ½" below the bottom of the boat measured at the aft end of the prop shaft centerline.
- The Sidewinder 20S is a legal motor for the 2010 season in both 25SSR and 25SSH classes.
- The Yamato 102 and 302 were reinstated in the 25SSR class past the November 1, 2010 date.
- The BRP flywheel #584222 was approved on the 20 cu. in. Hot Rod.

### **2012**

- The 20S Sidewinder may utilize the Dellorto VHS 30mm carburetor, new spray shield bracket, and velocity tubes. All approved by the 25 parity committee.

### **2013**

- New intake manifold approved for the 20S.

### **2014**

- Sidewinder electric start approved.
- Yamato 302 new style pulley and transistor unit may be used but must be used together.

### **2015**

- Yamato 321 approved for 25SSR, effective November 1, 2015.

### **2016**

- It is permissible to replace the points with an electronic point replacement module, such as the Nova II module on the Model 102.

### **2017**

- It is permissible to have old cylinder walls recoated in the 25xs engine.
- The Yamato Model 300 series ignition may be installed on the Model 102. It is permissible to add a shim or gasket between the bowl and the crankcase. Note: See the specifics on rope plate size on page 78.
- Water inlet enlargement and grooving rule for cooling added for all approved Yamato engines in this class.
- 7-26-17 The Yamato restrictor plate shall have a maximum thickness dimension of .0065" without chamfer. All edges of this plate must be 90 degrees.

### **2018**

- The restrictor plate is now required in the Mercury 25xs engine in 25SSH.
- It is now permissible to use a two piece drive shaft with a coupler in the Mercury 25XS engine.
- Hot Rod 20ci is removed.
- Yamato 300 series named "motor of choice" in 25SSR.
- Sidewinder 20s named "motor of choice: in 25SSH.



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- The Mercury 25ss engine is removed .
- Sidewinder 20s is removed from 25SSR.
- Improved restrictor plate rule added for Yamato engines
- Gasket rule added for all Yamato engines.

### 2019

- The 25SSH class is discontinued due to a lack of participation. The Mercury 25XS engine is now only legal in 25SSR & BSH.

## C CLASS

### Permitted Motors

- a. Yamato Model # 102
- b. Yamato Model # 302
- c. Yamato Model # 321

## C Class Changes History

### 2005

- Yamato 102 and 302 motor:
- It is permissible to enlarge the fuel tank or build a complete new tank. If the tank is removed, the tank-mounting bracket may be also removed.
- A fuel filter may be added to the fuel line.
- Any type thrust bracket is allowed.
- It is permissible to drill two holes at the forward end of the cavitation plate to facilitate the mounting of a thrust bracket block.
- Re-word to read: It is permissible to mill the cylinder head within the H and I dimensions. No changes may be made to the combustion chamber. (Rule 20)It is legal to re-machine the squish band for repair purposes only. The angle is 15 degrees +/- 2 degrees, 2.612 +/- 0.015.

### 2006

No changes.

### 2007

- Motion made to allow the remounting of any coil on a 102.
- Motion to set up an advisory committee to monitor the CSH class in 2007 and come up with a solution to make this class more equally matched and report these findings to the SORC.
- Motion to approve the  $\frac{3}{4}$  height restriction for all CSH class using both 102 and 302

## **2019 Stock Outboard Technical Manual**

- Motion made to allow any aftermarket roping plate on the 102 Yamato roping add the thickness, diameter, and dimensions for the aftermarket roping plate.

### **2008**

- Motion to remove the h & i dimensions on the Yamato 102 & 302 engines.

### **2009 to 2011**

No changes

### **2012**

- It is permissible to use gear ratio 14:15 straight cut or helical cut gears in the Yamato 102.

### **2013**

No changes

### **2014**

- Yamato 302 new style pulley and transistor unit may be used but must be used together.

### **2015**

- Yamato 321 approved, effective November 1, 2015

### **2016**

- It is permissible to replace the points with an electronic point replacement module, such as the Nova II module on the Model 102.

### **2017**

- The Yamato Model 300 series ignition may be installed on the Model 102. It is permissible to add a shim or gasket between the bowl and the crankcase. Note: See the specifics on rope plate size on page 78.
- Water inlet enlargement and grooving rule for cooling added for all approved Yamato engines in this class.

### **2018**

- The enhanced cooling rule passes for all Yamato engines.
- Roping plate rule changed due to the old model becoming NLA.
- Gasket rule added for all Yamato engines.

### **2019**

- (add changes here)

## **20SS CLASS**

### **Permitted Motors**

- a. Yamato Model # 80

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- b. Yamato Model # 102
- c. Yamato Model # 302
- d. Yamato Model # 321

## **20 Class Changes History**

### **2005**

- Motion to approve any aftermarket 14:16 gears for replacement on the Yamato 80.
- Motion to eliminate the exhaust relief hole in the y-80 tuning pipe elbow. It is permissible to have a hole or fill that hole.
- The 16mm Yamato prop shaft may be welded and a new shear pinhole drilled. In any case only one shear pin is allowed.
- Any type thrust bracket is allowed.
- It is permissible to drill two holes at the front of the cavitation plate to facilitate the mounting of a thrust bracket block.
- It is not permissible to fill holes in the exhaust pipe holder to fit the exhaust pipe.
- Mufflers, expansion chambers, or other exhaust system components must remain as furnished by the manufacturer.
- It is legal to re-machine the squish band to match the Modified rule angle 15 degrees +/-2 degrees, 2.350 +/- 0.015.
- No changes may be made to the combustion chamber. There must be a visible ledge surrounding the squish band.
- There must be an exhaust relief hole in the exhaust elbow and pipe assembly. The old style elbow may be drilled to simulate the new style elbow. Minimum diameter for the hole is .187" (3/16). There is no maximum dimension, as the larger hole will only diminish performance. For reference the hole is located .500" (1/2) to the rear and .440" (7/16) above the current clamping slot, or the hole may be drilled in the pipe at the top of the clamping slot.

### **2006**

- Motion made to allow any ignition coil and the mounting to be altered to accommodate the coil on a Y-80.

### **2007 - No changes**

### **2008**

- Motion to approve the 20CID Sidewinder engine as a probationary motor in the 20SSH class for 2008.
- Motion to remove the 2008 restriction for the 20CID sidewinder engine in the 20SSH class. This would make the engine a probationary one indefinitely.

### **2009**

- Motion to remove probationary time period for the sidewinder 20, thus leaving it without a probationary end date.
- Motion to accept Wiseco pistons, part number 0186m06046.
- Motion made for the Yamato 102 to no longer be legal for competition in 20SSH.

### **2010**

- The restricted Yamato 102 was reinstated in the 20SSH class.
- The Sidewinder 20S was approved for the 20SSH class November 1, 2010 with a parity committee to be appointed.

### **2011**

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- A parity committee was appointed to oversee the Sidewinder 20. They set the prop shaft height at 1 3/8" below the bottom of the boat.

### **2012**

- The parity committee raised the prop shaft height to 1" below on entries using the Sidewinder 20S and also approved the Dellorto carburetor for use on the Sidewinder 20S.

### **2013**

- New intake manifold approved for the 20S.

### **2014**

- Yamato 302 new style pulley and transistor unit may be used but must be used together.
- Sidewinder electric start approved.
- 

### **2015**

- Yamato 321 approved, effective November 1, 2015

### **2016**

- It is permissible to replace the points with an electronic point replacement module, such as the Nova II module on the Model 80 & 102.

### **2017**

- The Yamato Model 300 series ignition may be installed on the Model 102. It is permissible to add a shim or gasket between the bowl and the crankcase. Note: See the specifics on rope plate size on page 78.
- Water inlet enlargement and grooving rule for cooling added for all approved Yamato engines in this class.
- 7-26-17 The restrictor plate shall have a maximum thickness dimension of .0065" without chamfer. All edges of this plate must be 90 degrees.

### **2018**

- The Yamato Model 300 series engines are named the motor of choice.
- The enhanced cooling rule passes for all Yamato engines.
- Roping plate rule changed due to the old model becoming NLA.
- 20S Sidewinder removed from class.
- Improved restrictor plate rule added.
- Gasket rule added for all Yamato engines.

### **2019**

- (add changes here)

### 300SS CLASS

Permitted Motors from the Yamato 300 Series.

- a. Yamato Model # 302
- b. Yamato Model # 321

**Intent:** This class shall lower barriers to entry, have very low startup costs and provide a place for new members to hone their racing skills before making a transition into the faster classes. It will also offer a class to current drivers that no longer wish to race at higher speeds.

**Governing of class rules:** Each year the Stock Outboard Chairman may appoint members to join the Chair on the 300 Super Stock Competition Committee. This committee will act as an advisory board to the SORC to keep the original intent of the class moving forward and address issues as they arise during the racing season.

**Permitted Motor:** Yamato Model # 302 and #321.

Before shipping or buyer pickup, the following will be ensured:

- a. The following wire and lead seals with his trademark are in place: Intake to crankcase and crankcase to block.
- b. All paperwork has been completed: Propeller agreement, EPA compliance, APBA membership card copied and all documents mailed to the APBA.
- c. A kill switch plug has been installed.
- d. The reed stops are within tolerance.
- e. New piston rings have been installed.
- f. The cylinders have been honed.
- g. The exhaust housing has been flattened.
- h. The gear foot meets all 300SSH measurements with the stock 16mm prop shaft.
- i. A 300SSH, stainless steel, two blade propeller is provided.

As of 1/2/16, Model 302 engines may be refreshed only. No additional 302's will be added to the class.

The 300 series engines may not be bored oversize. Only standard OEM pistons and standard OEM rings are permitted.

No fuel pumps are permitted. Extended OEM gas tanks, aftermarket spark plug wires, fuel lines and fuel filters are permitted. The 302 spray shield may have one hole on the starboard side for access to the carburetor. This hole may not be larger than 1-3/8". The OEM spark plug protector must remain as received from the manufacturer. The water exit tube must be stock and in the stock configuration as received. Any additional engine parts that appear to have been altered may be compared to other engines by the inspector for validation if necessary. Any parts deemed to be altered, will result in a technical disqualification.

**Speed:** It is the intent of this class to have a maximum speed of 60 mph. If the class exceeds this speed, restrictions may be set to reduce the speed by the SORC.

**Propellers:** All entries must race the APBA 300 Super Stock propellers (stamped with the number 302) provided with the engines. An engine owner only owns the rights to "a" propeller and not a specific propeller.

- a. If an engine has its seals removed, the propeller must be returned to the chief inspector. Once received, the propeller and shipping cost will be refunded.

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- b. At driver's meeting the day of the race all 300 Super Stock propellers in the pits (whether entered or not) will be turned in to the race inspector (or a person designated by the inspector). The race inspector (or designee) will place one propeller each in a bag or box to conceal it. A driver will then pull one new propeller from the bag or box. Once the propeller is pulled, there will be no trading or trade-ins unless they are deemed damaged by the Inspector. The propeller pulled must be the propeller raced. Any deviation thereof shall result in an immediate disqualification for all heats raced with the propeller in question.
- c. In the event a second day of racing is scheduled on the same day, the process must be repeated after the first day of racing. At championship races, this process must occur after each completed heat.
- d. Once all racing for the class has been completed, the Inspector will then release any additional propellers in his or her possession.
- e. Any participant who damages, alters or marks on the propeller(s) in order to later identify them will receive a technical disqualification and be required to return the propeller to the chief inspector for repair or replacement with all costs incurred by the participant.

**Repair Centers:** East - Jerry Davids Sr., Northeast – Alex Poliakoff Sr., Midwest - Tom Johnston, Northwest - Ric Montoya and Southwest - Roger Carr. There will be only five authorized centers and the centers will be appointed each year by the Stock Outboard Chairman. They will provide all internal mechanical repairs and refresh for the sealed portions of the engine. It is not permissible for an engine to be certified by the same repair center more two consecutive times. Ric Montoya, Tom Johnston and Jerry Davids will conduct the first sealing of all engines. They may also inspect a previously raced 321 engine and detune the engine (if necessary) to make it legal for this class. Those costs will be determined by the repair center for labor and parts used. Once their work is completed, they will seal the engine and therefore approve it for racing after notifying the Chief Inspector that they have done so.

If any of the five repair center member's wish to participate in this class, another repair center must be used for certification and initial sealing of the member's engine. Engine refresh may be done by a member on their own engine as long as two unrelated current 300SSH owners are in attendance for verification during the entire process.

## 300SSH Class Changes History

### 2014

- New Model 321 tower housing approved for the 2015 season. Effective November 1, 2014 all entries must use the new tower.
- Yamato 302 new style pulley and transistor unit may be used but must be used together.

### 2015

- Model 321 tower housing requirement from last year is removed due to a lack of available engines.
- Three year rule freeze begins for 2015, 2016 & 2017 seasons.

### 2016

- Model 321 is added as a legal engine to the class. The two models will race together as received from the manufacturer. Engines identified as a Model 302 must have all parts included and the same for the Model 321. Therefore, no swapping of parts except when upgrading a 302 to a 321 completely. Sealing of additional Model 302's will cease. 14mm spark plug inserts are permitted. Class name will change from 302SSH to 300SSH. Effective January 2, 2016.

### 2017

- Q = Reed stop heights are established at .272" maximum for both engines.

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- The squish band depth on both engines will be .025" minimum.

### 2018

- Jerry Davids added as a first sealer of engines.
- Removal of the magneto stop to allow water drainage is now permitted.
- Drilling of holes in the plate cover that is underneath the magneto is now permitted to allow water to exit. It is suggested that one hole of approximately 1/8" is drilled in each of the six compartments.
- The enhanced cooling rule is approved to mirror the engines in the rest of the Yamato classes.
- Roping plate rule changed due to the old model becoming NLA.
- The 321 is named the "motor of choice".

### 2019

- (add changes here)

## D CLASS

1. Permitted Motors
  - a. Mercury/Mariner 44XS
  - b. Mercury 55H
  - c. Mercury Thunderbolt
  - d. Tohatsu RAM50

## D Class Changes History

### 2005

- Motion to approve new Bass/Tohatsu motor with an advisory committee to monitor the progress and parity.
- Motion to have Neil Bass send Mike Wienandt a new Bass/Tohatsu motor for dyno testing so the SO commission has data to review. Testing to be done within 6 months. Shipping costs to be incurred by SORC.
- Motion to accept the Super Thunderbolt D motor with the addition of the 44xs tower housing and gear case. Also all gear ratios will be 1 to 1.
- Motion to approve breaking the edge rather than chamfering the engine ports on 44xs engines.
- Proposal 1: Add a new specification to the table of the MERCURY/MARINER 44XS SPECIFICATIONS (D CLASS) of the 2004 Stock Outboard Inspection Manual. The new specification states: Port Chamfer Tolerance: .030.
- Rationale: Engine builders have been chamfering the ports in Mercury "D" motors for several decades. These engines have consistently passed inspection. However, the SO inspection manual has never explicitly stated that port chamfering is legal.
- Proposal 2: Add the following sentence to the list of specifications for the MERCURY/MARINER 44XS SPECIFICATIONS (D CLASS) of the 2004 Stock Outboard Inspection Manual.

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- Motion to approve any starter housing manufactured by Mercury marine that bolts to the cylinder block/case assembly with no modification to the starter housing or cylinder block/case assembly may be used.
- Rationale: Mercury Marine has continued to refine the starter housing. The currently produced starter housing is a better (stronger) housing than the original 44XS starter housing.
- Proposal 3: Add the following sentence to the list of specifications for the MERCURY/MARINER 44XS SPECIFICATIONS (D CLASS) of the 2004 Stock Outboard Inspection Manual. Mercury gears produced by Dennis Hansen are legal replacement parts for Mercury gears. Only gears manufactured in the 14:14 ratio may be used.
- Motion to approve any straight cut 14:14 gears for a Merc 44XS be used.

### 2006

- Motion made to approve aftermarket pistons for the 44XS from Sierra and Vertex with part #s to be provided for inspection purposes.
- The Bass Tohatsu M50D2 racing engine is a legal Class D Stock Outboard Engine.
- On November 1, 2006, The Mercury "Super Thunderbolt" became a legal Class D engine approved for competition in the Stock Outboard Division. Rules and Specifications are included in the 2006 inspection manual at the end of the Class D section.

### 2007

- Clean up to the 44XS rules: Add the work "tell-tale" to the first sentence of number 14 on page 26 of our current inspection manual. The sentence should state, "Only one engine cooling water tell-tale outlet may be used." Reason: The first sentence in number 14 is currently incorrect. There is actually a main water outlet into the drive shaft housing and the tell-tale water changed to an alternative outlet in the cylinder head cover.
- D Parity Committee Passed Rules:
  - The use of fiber reeds (Boyesen)
  - New weight for either motor configuration.
    - DSH – 480
    - DSR – 515
  - Keep the 1 inch below bottom measurements for DSH. Only the measurements to be at the aft end of the propeller shaft.

### 2008

- Motion to approve the D class Superthunderbolt proposed changes. The changes are as follows:
  - Page numbers are from the 2007 SO Rules.
  - Pg 69 rule #1 *Blocks*. Change to: Blocks must be 44 cu.in. service blocks that have "Super Thunderbolt" cast in them.
  - Pg 69 rule #4 *Flywheels*. Change to: Any flywheel allowable for the 55H motor shall be allowed on the Super Thunderbolt.
  - Pg 70 rule #18 *Cowlings*. Add the use of the 44xs cowl with a Super Thunderbolt to the existing OEM cowl listed as allowable.
  - Pg 70 rule #19 *Pistons*. Change to: Aftermarket pistons manufactured by Sierra, Vertex, and Wiseco +.020" part # 1049PS / +.040" 1049P2 as well as Mercury pistons shall be allowed on the Super Thunderbolt.
  - Pg 70 rule # 22 *Exhaust splitters*. Change to: Exhaust splitters are allowed on a Super Thunderbolt if originally equipped with one.
  - Pg 70 Lower Unit Option #1 rule #1 Allow the 44xs drive shaft housing on a Super Thunderbolt with either the 55H gear case or the 44xs gear case with 14:14 gears. Also allowed are the 55H, 402x or 35ss drive shaft housing with either the 55H or 44xs gear case assembly with 14:14 gear ratio. This includes the IAI drive shaft housing.
  - Pg 70 Lower Unit Option #1 rule #4 *Exhaust tuners*. Change to: Exhaust tuners are allowed on a Super Thunderbolt if originally equipped with one.
  - Pg 70 Lower Unit Option #2 rule #7 *Exhaust tuners*. Change to: Exhaust tuners are allowed on a Super Thunderbolt if originally equipped with one.



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- Motion to approve the 55H gear case on the Mercury 44XS in the D stock classes.
- Motion to implement the super thunderbolt changes immediately.
- Motion to implement the use of the 55H gear case on a 44XS in the D classes immediately.

### **2009**

- Proposal 3-DSR height to be  $\frac{3}{4}$  in for any rule. Discussion. Note will be added to tech manual to match the rule book.

### **2010**

- The Bass/Tohatsu inspection tech were accepted.
- Rub or lifting rails are allowed on the DSR boats. They will be attached to the outside of the boat and not exceed 1  $\frac{1}{2}$  inches in depth and width.

### **2011**

- It is legal to seal the holes in the butterflies.

### **2012**

- It is permissible to use foam inside the cowling for floatation.
- It is permissible to use standard and oversize Wiseco pistons and matching rings part numbers 3156ps2/2677kd, 3156p2/2697kd, 3156p3/2707kd.
- It is permissible to use the new gear foot with larger bearings PN 100T.
- The Tohatsu M50 engine previously manufactured by Bass Machines of Bremerton, Washington is now manufactured by Richmond Aero Marine of Richmond, Maine. The engine is now called the RAM50.

### **2013**

- RAM50 top cowlings must retain their original appearance.
- RAM50 cowling front plugs are optional.
- RAM50 removal of manual rewind starter and pulley is optional when an electric starter is installed, as long as the handle opening is sealed closed on the manual start cowl.
- RAM50 cylinder head shaving is approved.

### **2014**

- RAM50 cc minimums changed due to different size cylinder volume.
- RAM50 new tower has been approved for use.

### **2015**

- RAM50 .005 inch wear allowance added to the maximum bore size.

### **2016**

No changes.

### **2017**

- RAM50 timing restriction is removed.
- RAM50 reed stop requirement is removed.
- RAM50 one tooth under gears are approved. These ratios are now legal - 16:17 & 17:17

### **2018**

- Mercury 402xs engine is removed.
- Tohatsu head gasket thickness is removed. Must have a removable Tohatsu or aftermarket gasket.
- The use of a copilot tension device to adjust tension in the Tohatsu tower is now permitted.

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- Removal of the thermostat and the anti-corrosion anode are now permitted in the Tohatsu.
- DSR will become “marathon only” on November 1, 2018. All competition records will be retired. Both straightaway records will continue.

### **2019**

- (add changes here)

## **45SS CLASS**

OMC 45SS ENGINE SPECIFICATIONS (45SS CLASS)

FOR OMC 45SS ENGINE SPECIFICATIONS, SEE THE  
MOST CURRENT OPC CATEGORY INSPECTION  
MANUAL.

## **MOTOR SPECIFICATIONS, CHARTS & DIAGRAMS:**

### **EVINRUDE/JOHNSON 15 (A CLASS)**

#### **Johnson / Evinrude Specifications**

The engine should be raced as received from the manufacturer, without modification. Following is a list of restrictions, descriptions, and modifications, which apply to this engine.

1. It is permissible to leave the gear case unpainted (bare Aluminum). Unpainted gear cases may be polished.
2. The engine shall be operated with the production upper and lower motor covers installed as originally supplied by the manufacturer. All knobs, grommets and plugs shall remain in place or covered with tape.
3. The mounting of a fuel tank to the engine or steering bar is prohibited.
4. Adjustable high-speed carburetor jets are not permissible. Larger or smaller fixed jets are permissible.
5. The addition or removal of material from any moving part is prohibited, including the flywheel.
6. The addition or removal of material from internal engine components or surfaces is prohibited. However, the addition of material is permissible in the following circumstances: (1) the water slot hole at the bottom of the cylinder block and (2) the small hole at the top of the water passages around the exhaust ports.
7. The exhaust passage in the gear case shall retain its original cast surface finish.
8. The gear case may be profiled as long as minimum dimensions and templates are met.
9. It will be permissible to use a thrust bracket of any manufacture, provided the engine is not altered.
10. The steering bar brackets shall have their retainer bolts safety wired as supplied by the manufacturer.
11. Only genuine OMC service parts for this model (1986 or later) will be considered as legal replacement parts. This includes gear case bolts, connecting rod bolts, throttle plate screws, reed stop screws and cylinder head gasket. Other than listed above, any make or type of bolt, nut, screw, washer, or gasket may be used, provided it is equivalent to the original. Steering bar bracket bolts shall be grade 8 heat-treated and drilled for safety wire to match the OEM bolt. Steering bar bolts shall be grade 5 heat treated and fitted with elastic stop nuts and the steering bar swivel bolts are to be cross drilled and fitted with cotter pins to match the OEM configuration. All steering bar bracket and steering bar bolts shall have their heat treat markings clearly visible.
12. Only a minimal amount (thin film) of sealer may be used on engine gaskets.
13. The intake and exhaust ports are drilled (round) holes. Only the center transfer port and the center exhaust port for each cylinder break through fully into the cylinder bore. All other ports do not fully break through into the cylinder bore.
14. The gear case split line screw cavities shall be left as supplied by the manufacturer (i.e. -unfilled).
15. The only legal cylinder block is OMC part number 396780. The part number is cast on the top of the block on the exhaust side. Service number 396010 includes block 396780.



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16. Any OEM piston manufactured for this model engine is permissible for use in the OMC A engine. These include part numbers 332364 (standard), 568523 (0.010" oversize), and 393852 (0.030" oversize). The part number is cast on the under-side of the piston. Service number 397487 includes 332364. Any OEM piston ring manufactured for this year and model engine is permissible for use in the OMC A engine. This includes the standard (P.N. 386279) or the 0.030" oversize (P.N. 386288) piston rings. The 0.030" oversize ring may be used on the 0.010" oversize piston in addition to the 0.030" oversize piston and may be cut down to fit the cylinder bore for use on the 0.010" oversize piston.
17. It is permissible to hone the wrist pin bores of the pistons to allow for a slip fit of the wrist pin.
18. The factory performs a small de-burring operation on the top of the piston dome to remove flashing at the mold parting line.
19. The only legal cylinder heads are OMC part numbers 332162 and 336160. The part number is cast on the back of the head on the lower port side.
20. The only legal flywheels are OMC part numbers 583077 or 583913. The part number is cast on the underside of the flywheel.
21. OMC Carburetor assembly part number 397653 is stamped into a tag that is fastened to the carburetor. 388275 is stamped into the top of the die-cast carburetor body assembly. Earlier sand-cast carburetors may also be used as long as they meet all specifications.
22. It is permissible to remove transom cleats, located on the transom surface of the stern bracket.
23. The engine must meet the requirements of OMC inspection templates as listed below:
  - a. OMC part number 568050, for the gear case. Sold by BTM (btmco.com).
  - b. OMC part number 568051, for the shape of the combustion chamber only. (Do not use the template to measure the top of the piston or the shape of the piston dome.)
  - c. OMC part number 568052, for the height of the piston and ports.
24. In order to compensate for engines used in the APBA Universal J Class, it is permissible to use two standard gaskets, OMC part number 318932, between the carburetor and the intake manifold.
25. The only legal transfer port covers are part #328820 #333733, and #336637.
26. It is permissible to machine a portion of the cast surface on the cylinder head adjacent to the head gasket surface
27. OMC p/n 323497 inner exhaust plate is legal.
28. It is permissible to use plastic reeds—Boyesen #122 and #122R. The shim may be removed provided the reed stop height is maintained.
29. The screw fastening the carburetor butterfly to the throttle shaft must be furnished by the manufacturer. With that exception, any make or type of nut, bolt, screw, washer or stud may be used anywhere in the engine.
30. It is permissible to install replacement solid motor mounts.
31. It is permissible to use an electric starter, as provided by the motor manufacturer and limited to a 12 volt DC system. The associated electric start flywheel is also allowed
32. It is permissible to secure the water pump impeller to the prop shaft by any means.
33. Port diameters will be measured with the Lynco plug gauges (520-782-0607). Instructions for use may be found on page 3. Port openings may have plastic compound added for repair. The entire hole may not be filled and re-drilled.

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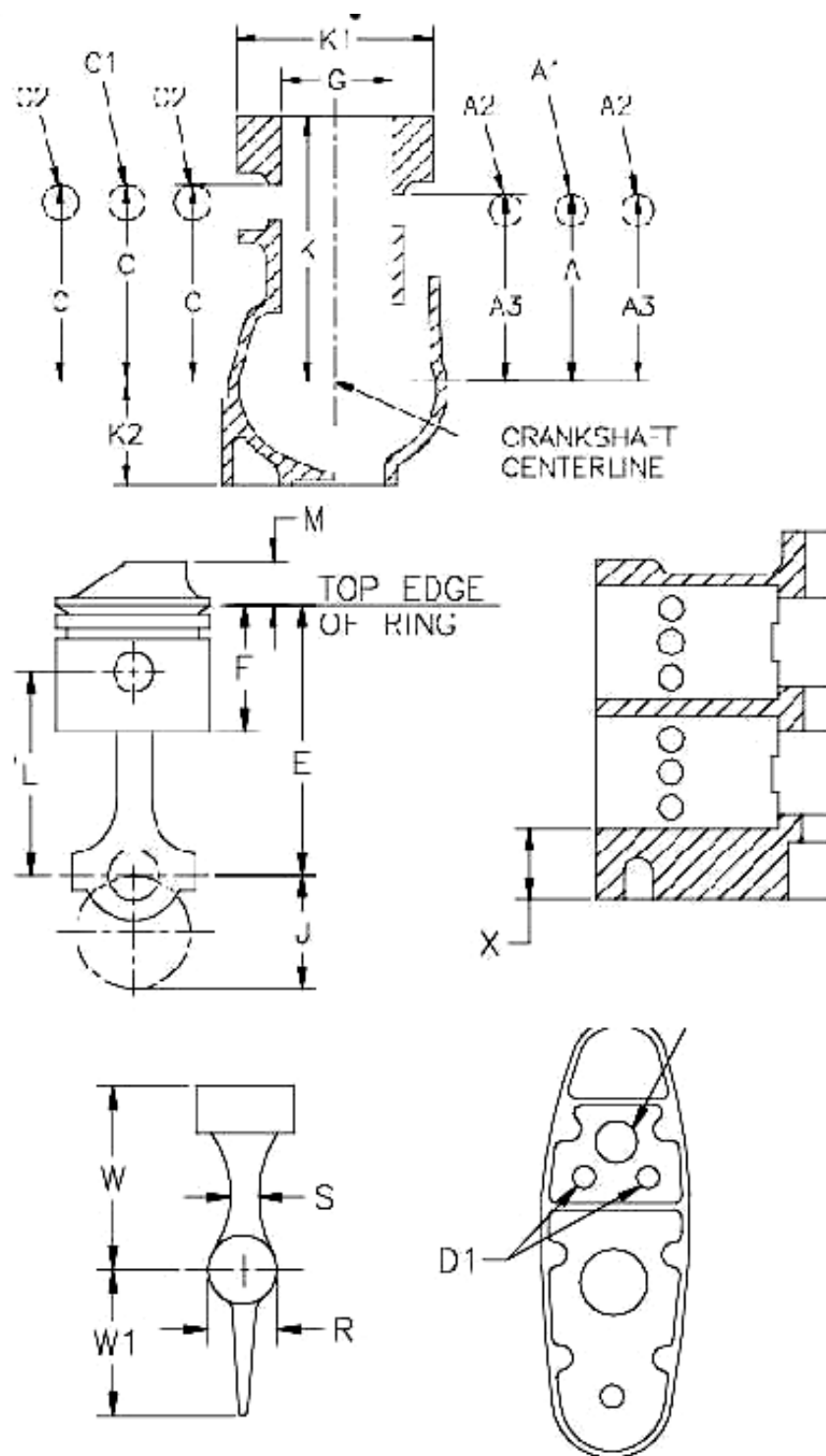
34. It is permissible to weld broken carburetors. (Suggested source of repair -Mike Schmidt, Durham, CT. (860) 349-9310). Weld penetration into the throat may be smooth; however, under no circumstances may the ID be honed. Caution: Original throttle plate screws must be used.
35. Steering Bars, brackets, and throttle linkages of any manufacture are permissible.
36. Re-sleeving of cylinder block for repair purposes is legal.
37. After-market racing components are legal as long as the parts are substantially similar to OEM parts.
38. Pre 1986 Belly Pan and steering bracket are legal. Aftermarket or modified motor mounts are legal.
39. It is permissible to solder or epoxy the hole closed in the OEM service carb butterfly.
40. The use of any bearing or seal is permissible.
41. It is permissible to hone the connecting rod and center main as long as current specs are maintained.
42. Any bowden cable clamp may be used to accommodate the use of an electric starter.
43. Wiseco .040" over pistons and rings are legal. Part no. 3136P4

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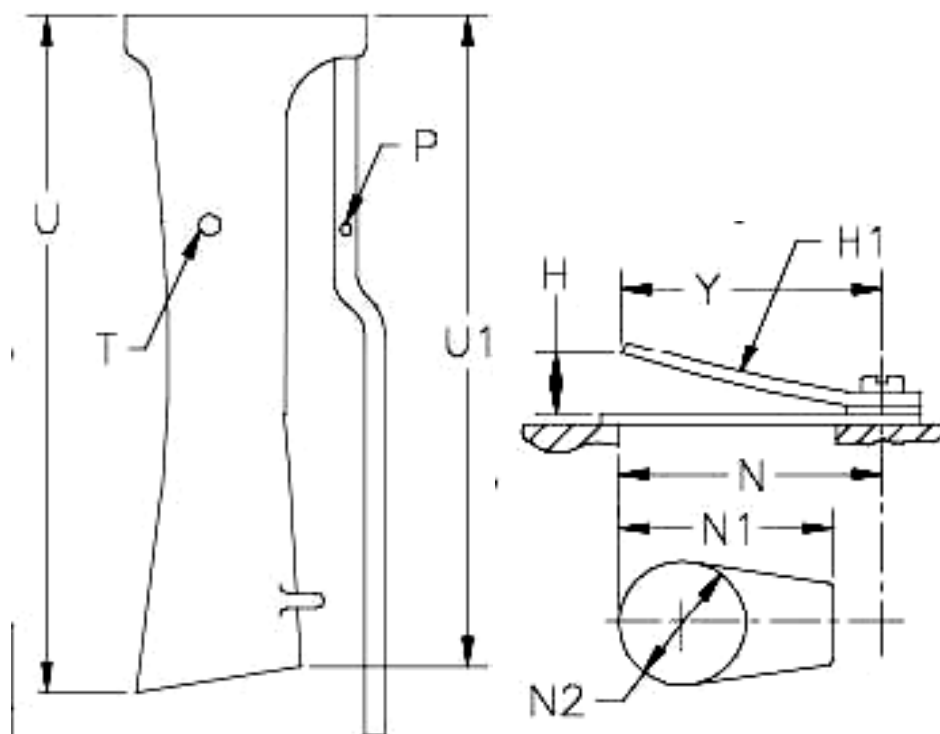
Engine Model		Evinrude		EKT			
		Johnson		JKT			
P O W E R H E A D S P E C I F I C A T I O N S	Group	Ref. #	Item	Dimension	Units	Definition	
	General Specs		Number of Cylinders	2			
			Engine Displacement	13.2	In <sup>3</sup>	The Volume of all cylinders excluding the combustions chamber	
			Minimum CC	13.5	Cm <sup>3</sup>	Volume of each Cylinder at T.D.C. filled to top of spark plug hole	
		J	Stroke	1.760 ±0.008	In	Distance the crank moves in 180° of rotation. Or the distance the piston moves	
			Flywheel Weight	5 lbs 4 oz			
	Cylinder Bore Diameter	G	Standard	2.188	In	This is a Reference only Dimension	
			0.010 OS (Ten Over)	2.198	In	This is a Reference only Dimension	
			0.030 OS (Thirty Over)	2.218	In	This is a Reference only Dimension	
			Max Size	2.225	In	Maximum bore size including piston clearance	
	Rods	L	Rod Length	3.000 ±0.006	In	Length of the rod from center of crank pin hole to center of wrist pin hole	
	Piston	E	Rod Piston Length	3.918 ±0.010	In	Length of piston and rod from crank pin center to the top edge of the top ring	
		F	Piston Height (minus Crown)	1.868 ±0.010	In	Piston Height measured to the top edge of the top ring	
		G	Crown Height	0.642 ±0.014	In	Measured from the top edge of the top ring to the top of the piston	
	Piston Rings		Number per Piston	2			
		Upper	Design	Pressure Back		Also known as a keystone ring	
		Lower		Rectangular			
		Upper	Thickness	0.068 ±0.002	In		
		Lower		0.062 ±0.002	In		
		Upper	Free Diameter	2.235 ±0.025	In	Ring Diameter on bench before being compressed.	
		Lower		2.235 +0.030 / -0.070	In		
	Ports		Number of Exhaust	3			
			Number of Transfer	3			
		A	Height of Transfer	3.480 max	In	Measured from center of crank to head edge of the port	
		A3	Height of Transfer	3.490 max	In	Measured from center of crank to head edge of the port	
		C	Height of Exhaust	3.680 max	In	Measured from center of crank to head edge of the port	
		A1	Transfer Diameter	0.625 ±0.010 Ø	In	Checked in both directions using Lynco gages	
		C1	Exhaust Diameter	0.625 ±0.015 Ø	In	Checked in both directions using Lynco gages	
		A2	Transfer Diameter	0.625 ±0.025 Ø	In	Checked in both directions using Lynco gages	
		C2	Exhaust Diameter	0.625 ±0.025 Ø	In	Checked in both directions using Lynco gages	
	Block	K	Cylinder Height	4.880 ±0.015	In	Measured from crank center to head surface.	
		K1	Cylinder Width	4.520 ±0.025	In	Measured from exhaust machined surface to the intake machined surface	
		K2	Crankcase Height	1.830 ±0.020	In	Total height of crank case	

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		X	Cylinder Base	1.056 min	In	Measured from bottom of block to bottom of bottom cylinder
	Intake		Intake Manifold Height	1.040 ±0.025	In	
	Reeds and Reed Plate		Reed Material	Stainless Steel or Composite		
			Reed Thickness	0.011 ±0.0005	In	
			Shim Thickness	0.012 ±0.001	In	
		H	Reed Stop Heights	0.256 ±0.020	In	
		H1	Reed Stop Radius	5.000 ±0.500	In	
		Y	Checking Distance	1.260 ±0.030	In	
		N	Port Location	1.430 ±0.015	In	
		N1	Port Length	1.010 ±0.030	In	
		N2	Port Width	0.675 ±0.025	In	
C a r b	Carburetor		Venturi Diameter	0.875 ±0.005	In	
			Bore Diameter	1.000 ±0.005	In	
T o w e r	Exhaust Pipe	U	Meg Length	10.633 ±0.050	In	
		U1		10.510 ±0.050	In	
		T	Meg. Relief Hole	0.280 ±0.020 Ø	In	
		P	Water Relief Hole	0.040 ±0.010 Ø	In	
	Tower	D	Large Exhaust Outlet	0.880 ±0.020 Ø	In	
		D1	Small Exhaust Outlet	0.500 ±0.020 Ø	In	
			Housing Relief Holes	0.310 ±0.020 Ø	In	
G e a r C a s e			Impeller Blades	5		
			Gear Ratio	14:19		
		Q		11.550 ±0.200	In	
		Q1		9.100 ±0.200	In	
		R		2.050 Min	In	
		S		0.980 Min	In	
		W		4.765 ±0.020	In	
		W1		4.340 ±0.100	In	
		V		18.000 ±0.060	In	
B e a r i n g s		1		Roller		
		2		Roller		
		3		Ball		
		4		Roller w/Retainer		
		5		Roller		
		6		Roller		
		7		Roller/Roller Thrust		
		8		Roller/Roller Thrust		
		9		Roller/Roller		







## MERCURY/MARINER 15 (A CLASS)

### Mercury Specifications

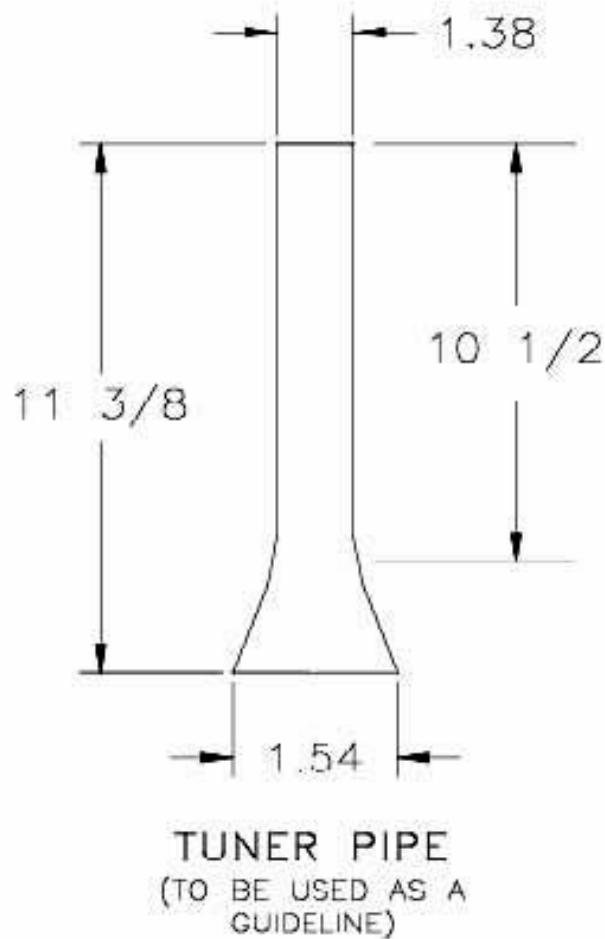
1. The Carburetor venturi diameter is 1.000 +/- .010" The removal of the OEM fuel connector is permitted.
2. It is permissible to use the Mercury "High energy ignition kit" p.n. 339-7370A40
3. Any fuel fitting may be used on the Mercury 15 A class.
4. It is permissible to remove the thermostat and to restrict the water in any manner within the thermostat housing. Water may be restricted at the 1/8" diameter tuner pipe cooling hole in the powerhead adapter plate.

Engine Model		Mercury 15				
POWERHEAD SPECIFICATIONS	Group	Ref. #	Item	Dimension	Units	Definition
	General Specs		Number of Cylinders	2		
			Engine Displacement	15.9	In <sup>3</sup>	The Volume of all cylinders excluding the combustions chamber
			Minimum CC	16	Cm <sup>3</sup>	Volume of each Cylinder at T.D.C. filled to top of spark plug hole
		J	Stroke	1.800 ±0.010	In	Distance the crank moves in 180° of rotation. Or the distance the piston moves
			Flywheel Weight	7 lbs 14.4 oz		
	Cylinder Bore Diameter	G	Standard	2.376	In	This is a Reference only Dimension
			Max Size	2.410	In	Maximum bore size including piston clearance
	Rods	L	Rod Length	3.100 ±0.005	In	Length of the rod from center of crank pin hole to center of wrist pin hole
	Piston	E	Rod Piston Length	4.180 ±0.015	In	Length of piston and rod from crank pin center to the top edge of the piston
		F	Piston Height (minus Crown)	2.653 ±0.030	In	
		V	Crown Height	0.563 ±0.005	In	
	Piston Rings		Number per Piston	2		
		Upper	Design			
		Lower		Rectangular		
		Upper	Thickness		In	
		Lower			In	
	Ports		Number of Exhaust	3		
		A1	Length of Transfer	0.630 ±0.010	In	
		A	Height of Transfer	3.640 ±0.015	In	
		C	Height of Exhaust	3.781 ±0.015	In	
			Width of Transfer	0.950 ±0.020	In	
		C1	Length of Exhaust	0.630 ±0.010	In	
		C2	Width of Exhaust	2x0.950, 1x0.900 ±0.020	In	

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	Block	H	COMB. CH. Corner HT.	5.713 $\pm$ 0.010	In	
		P	Reed Stop Heights	0.325 max	In	
		P1	Reed Stop Length	1.230 $\pm$ 0.020	In	
			# of Ports	3	In	
		M	Port Length	0.906 $\pm$ 0.015	In	
		N	Port Width	0.510 $\pm$ 0.015	In	
	Carburetor		Venturi Diameter	1.000 $\pm$ 0.010	In	
			Bore Diameter	1.130 $\pm$ 0.010	In	
Tower	Exhaust		Meg Length	11.375		This is a REF dimension
			Meg Length	10.500		
			Diameter at large end	1.540		
			Diameter at small end	1.380		
		D	ESH. Adapt. & Pipe	13.280 $\pm$ 0.125		
		V	DS HSC	16.000 $\pm$ 0.250		
			Adapter Plate	0.500 +0.010 / -0.025		
Gear Case	Gear Case		Impeller Blades	5		
			Gear Ratio	14:19		
		Q		11.550 $\pm$ 0.200		
		Q1		9.100 $\pm$ 0.200		
		R		2.050 Min		
		S		0.980 Min		
		W		4.765 $\pm$ 0.020		
		W1		4.340 $\pm$ 0.100		
		V		16.000 $\pm$ 0.250		

\*See Mercury 25xs for reference number diagrams



## Sidewinder Specifications

**It is the intention of the Manufacturer that the engine be raced as received with the following exceptions.**

1. Addition or removal of material on any internal engine surface is prohibited with the following exceptions:
  - a. The manufacturer de-burr's machined edges with a hand scraper, a rotary file or file.
  - b. It is permissible to clearance the corners of the cylinder head for the top and bottom edges of the piston deflector.
2. It is permissible to profile and polish the gear case as long as minimum dimensions and templates are met.
3. Timing, carburetor jets and metering rods may be adjusted or changed. Adjustable main jets (needle valves) are legal. No other modifications to the carburetor are permissible.
4. Steering bars of any make or manufacture are permissible as long as racing association standards are met. The manufacturer does not recommend the mounting of a fuel tank to the steering bar or engine.
5. The use of oversize pistons and boring of cylinders to accept oversized pistons is legal, as long as the cylinder bore does not exceed the maximum allowed cylinder diameter. Oversize pistons are available in  $+.005$ ,  $+.010$  and  $+.020$ " diameter. Oversized pistons must be used as supplied. Finish honing of the cylinder bores is permitted.

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6. It is permissible to machine the cylinder head to achieve minimum cc's and/or to achieve a flat surface.

**The following descriptions are provided to familiarize you with the Sidewinder engines as manufactured.**

1. Crankcase-  
Internal crankcase transfer area is CNC machined and matches block transfer area, all other internal surfaces of the crankcase are sand cast and must retain the original finish.
2. Crankshaft/Rods/Bearings-
  - a. Crankshaft: is a full circle multi-piece press together design. There are two lightening holes .825" diameter on early production parts, .750 diameter on late production parts, the holes are located in each crankshaft disc.
  - b. Crankshaft Bearings: Top main is a heavy duty cased needle bearing. Center main is a split sleeve with 36 loose needles. Bottom main is a ball bearing.
  - c. Rods: Are forged one piece with the outside diameter of the large end machined for cleanup.
  - d. Rod Bearings:
    - i. Big End- Caged needle bearings in a silver plated race.
    - ii. Small End- 22 loose needles retained by two spacers, one on each side of the rod with the small diameter facing the needle bearings. Wrist Pin: Ground and Hardened retained by 2 circlips in the piston.
  - e. Piston: Aluminum casting with 2 rings. Skirt is scalloped on the intake side. Wrist pin is a slip fit in wrist pin bore; grooves are machined in the bore for the retaining clips with a machined relief for clip removal.
3. Cylinder Block-
  - a. Exhaust: The exhaust port openings in the block are machined. There is a 45 degree bevel machined in the exhaust outlet area between the water jacket rib and the power head mounting whole boss. The remaining exhaust area is sand cast and must be run as cast.
  - b. Intake: The intake port opening in the blocks is machined. The transfer opening is machined as well as the outer perimeter of the transfer area. The floor of the transfer area is sand cast with a 3/16 radius blending the floor into the perimeter. There is a rectangular window machined through the cylinder sleeve and transfer wall. This window connects the transfer passage to the cylinder below the piston. The intake window is closed by the piston skirt prior to the opening of the intake ports. The aluminum around three sides of the window is chamfered.
  - c. Water Passages: Water passages in the block are drilled. The water inlet is a 5/16" hole. A 5/16" diameter hole intersects the inlet and supplies water to the water jacket on the exhaust side of the block. A 3/8" diameter hole intersects the water inlet and supplies water to the cylinder water jacket.
4. Cylinder Sleeves-
  - a. Ports: Ports are machined with a small chamfer on edges of the ports. Exhaust ports are beveled at a 15 degree angle for the 15S and a 25 degree angle for the 15H & the 20S on the head side. Port timing is measured at the interface of the port edge and cylinder wall. The exhaust port openings of the 15S engine are "D" shaped with the flat facing the head and a radius in the corners transitioning into a round lower half. The 15H and 20S utilize a squared port opening with radius corners.
  - b. The intake port web on the 15S engine is a radius while the 15H utilizes a squared port web with radius corners. (*inspection area to verify 15S/15H sleeve*)
5. Cylinder Head and Gasket-
  - a. Cylinder Head Combustion Chamber: The cylinder head combustion chamber is cast, it is permissible to clearance the corners of the chamber to prevent contact between the piston deflector and the head.
  - b. Cylinder Head Gasket: the cylinder head gasket may be a machined aluminum plate, a Hot Rod style head gasket or the later production multi-layer steel gasket. The gasket has three 3/16" holes in the top and one 1/16" hole in the bottom. The aluminum gasket may be o-ringed. All listed gasket types are legal as long as cc specifications are met. (The three larger holes must face the top of the cylinder head or overheating will occur.)

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6. Intake-
  - a. Intake Housing: The area of the intake housing that extends into the transfer area of the block is fully machined. The internal passage of the housing is cast with the block side of the opening machined to size.
  - b. Intake Manifold: The internal surface of the manifold is cast with de-burring operations performed on the edges of the machined surfaces.
  - c. Reed Cage and Reeds: Reed cages are cast with the reed surfaces and the mounting surface machined. Reeds are of the 2 stage designs.
7. Carburetor-

15H: The Lectron high velocity carburetor is a legal carburetor for the 15H & 20S model Sidewinder. On the 15H, the throat of this carburetor is fitted with a sleeve. The 15H may also utilize a Dellorto VHST 28mm carburetor. 15S: The 15S Sidewinder will utilize a Dellorto PHBG 21mm carburetor. The carburetor must be run with the plastic Dellorto intake adapter as supplied. Velocity stacks and modifications to the internal areas of the spray shield are not allowed on the 15S engines.

20S: The 20S Sidewinder may utilize a Dellorto VHS 30 mm carburetor or the 34mm Lectron. The Dellorto 30 mm VHS is the only legal carburetor for use in the 15SSR & 15SSH classes with a .750" restrictor plate. The 34mm Lectron is legal in the BSR, BSH & 25SSH class.

Velocity stacks are legal on the 20S Sidewinder engines. The velocity stack may not pass through the shield and no internal modifications to the shield are allowed.

The OEM spray shield must be in place on all Sidewinders. The late style carburetor shield and bracket does not attach to the carburetor. A gasket will be used between the shield bracket and the manifold. The manufacturer would appreciate the retention of the decal on the Sidewinder engine spray shield.
8. Exhaust Housing-

Internal surfaces are as cast. There are 4 drilled 1/2" diameter exhaust relief holes in the exhaust housing. These holes are optional. They may be left un-drilled, filled, plugged or covered by any external option. It is permissible to use the previously manufactured Hot Rod tower and clamp handles.
9. Ignition System-
  - a. Flywheel: The flywheel is cast steel. The number 3584222 is cast on the underside of the flywheel. The minimum flywheel diameter is 5.990".
  - b. Power pack: The power pack is identified by a sleeve on the input wires labeled Racing Outboards, LLC Part#60-01-0001. The ignition cut off wiring harness is integral and terminates with a 2 wire flat plug.
  - c. Armature Plate: The armature plate mounts 2 coils—a sensor coil and a charge coil.
  - d. Ignition Coil: The ignition coil is mounted with 2 bolts and contains 2 individual coils in a single housing.
  - e. Starter: It is permissible to add the aftermarket electric starter supplied by Racing Outboards on all Sidewinder engines. It is necessary to remove approximately .030" from the bottom of the flywheel to accommodate the ring gear. Once this flywheel is trimmed it will not be legal without the ring gear attached.

**SEWINDER 15S (A CLASS)**

Engine Model		15S			
Group	Ref. #	Item	Dimension	Units	Definition
General Specs		Number of Cylinders	2		
		Engine Displacement	14.94	In <sup>3</sup>	The Volume of all cylinders excluding the combustions chamber
		Minimum CC Maximum CC	15 16.5	cm <sup>3</sup>	Volume of each cylinder at T.D.C. filled to top of spark plug hole
	J	Stroke	2.031 ±0.005	In	Distance the crank moves in 180° of rotation. or the distance the piston moves
		Flywheel Weight	4 lbs min		
		Flywheel Diameter	5.990 min		
Cylinder Bore Diameter	G	Standard	2.166	In	This is a reference only dimension
		Max Size	2.196	In	Maximum bore size including piston clearance
Rods	L	Rod Length	3.562 ±0.004	In	Length of the rod from center of crank pin hole to center of wrist pin hole
Pistons	F	Piston Height (minus Crown)	2.082 ±0.015	In	Piston height measured to the timing edge of the piston
	M	Crown Height	0.640 ±0.015	In	Measured from the timing edge of the piston to the top of the piston
Piston Rings	N	Pin to Crown edge	1.204 ±0.015	In	Wrist pin center to timing edge
		Number per Piston	2		
	Upper	Design	Rectangular		
Ports	Lower		Rectangular		
		Number of Exhaust	3		
		Number of Transfer	2		
	A	Height of Transfer	2.244 ±0.010	In	Measured from block face
	A1	Height of Transfer	0.600 ±0.005	In	Measured from sleeve flange
	C	Height of Exhaust	2.460 ±0.010	In	Measured from block face
	C1	Height of Exhaust	0.378 ±0.010	In	Measured from block face
	D	Exhaust Height	0.562 ±0.010	In	Height of port
	D1	Exhaust	0.610 max	In	Port height to top of bevel
	D2	Exhaust Width	0.562 ±0.010	In	Width of center exhaust port
	D3	Exhaust Width	2.102 ±0.020	In	Width-edge to edge outside ports
	B	Height of Transfer	0.437 ±0.010	In	Height of port
	B1	Width of Transfer	2.186 ±0.020	In	Edge of edge of outside ports
	B2	Port Web Width	0.094 ±0.010	In	Width of web at narrowest point
Sleeves	A1	Top of Transfer Port to Sleeve Flange	0.600 ±0.010	In	
	B1	Width of Transfer Ports	2.186 ±0.020	In	Outside edge to outside edge at sleeve o.d.
	C1	Top of Exhaust Port to Sleeve Flange	0.378 ±0.010	In	
	D1	Width of Exhaust Port	2.102 ±0.020	In	Outside edge to outside edge at sleeve o.d.

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	Block	K	Cylinder Height	3.919 $\pm 0.010$	In	
		K1	Cylinder Width	5.380 $\pm 0.015$	In	
	Crankcase	K2	Crankcase Height	1.843 $\pm 0.010$	In	
Intake	Intake	T	Intake Housing Height	1.656 $\pm 0.010$	In	
		U	Intake Manifold Reed opening	Early 1.062 $\pm 0.025$ Late 1.012 $\pm 0.025$	In	Intake manifold reed opening to inlet face
	Reeds		Reed Thickness Top	0.016	In	
			Reed Thickness Bottom	0.032	In	
	Carburetor	Dellorto	Bore Diameter	21mm .826 $\pm 0.005$	mm / in.	It is permissible to use an adjustable high speed main jet
			Adapter	.850 $\pm 0.010$	In	late style adapter chamfer 1.050 max & is 1.062" $\pm 0.062$ " long
Tower	Tower		Relief Holes	4X0.500 dia $\pm 0.032$		
			Height	14.562 $\pm 0.062$		Height; power head flange to gear case flange
Gear Case	Gear Case		Impeller Blades	5		
			Gear Ratio	14:19		
		Q		12.000 max		
		R		2.050 min		(See gear case diagram for measurement locations)
		S		0.750 min		
		W		4.750 $\pm 0.020$		Also: The skeg must meet the template #90-01-0001 available from Racing Outboards, LLC.
		W1		4.350 $\pm 0.100$		
Bearings	Bearings					
		1		Caged Roller		
		2		36 loose Roller		
		3		205 Ball		
		4		Roller w/Retainer		
		5		22 loose Roller		
		6		Roller		
		7		Roller/Roller Thrust		
		8		Roller/Roller Thrust		
		9		Roller x2/Roller Thrust		



**SIDEWINDER 15H (15 CLASS)**

Engine Model		15H			
Group	Ref. #	Item	Dimension	Units	Definition
General Specs		Number of Cylinders	2		
		Engine Displacement	14.94	In <sup>3</sup>	The Volume of all cylinders excluding the combustions chamber
		Minimum CC	11.5	cm <sup>3</sup>	Volume of each Cylinder at T.D.C. filled to top of spark plug hole
	J	Stroke	2.031 ±0.005	In	Distance the crank moves in 180° of rotation. Or the distance the piston moves
		Flywheel Weight	4 lbs min		
		Flywheel Dia.	5.990 min		
Cylinder Bore Diameter	G	Standard	2.166	In	This is a Reference only Dimension
		Max Size	2.196	In	Maximum bore size including piston clearance
Rods	L	Rod Length	3.562 ±0.004	In	Length of the rod from center of crank pin hole to center of wrist pin hole
Pistons	F	Piston Height (minus Crown)	2.082 ±0.015	In	Piston Height measured to the timing edge of the piston
	M	Crown Height	0.640 ±0.015	In	Measured from the timing edge of the piston to the top of the piston
Piston Rings	N	Pin to Crown edge	1.204 ±0.015	In	Wrist pin center to timing edge
		No. per Piston	2		
	Upper	Design	Rectangular		
	Lower		Rectangular		
Ports		Number of Exhaust	3		
		Number of Transfer	2		
	A	Height of Transfer	2.244 ±0.010	In	measured from block face
	A1	Height of Transfer	0.596 ±0.005	In	measured from sleeve flange
	C	Height of Exhaust	2.466 ±0.010	In	measured from block face
	C1	Height of Exhaust	0.378 ±0.005	In	measured from block face
	D	Exhaust Height	0.594 ±0.005	In	
	D1	Exhaust	0.670 max	In	Height top of Bevel
	D2	Exhaust Length	0.696 ±0.005	In	Width Center Port
	D3	Exhaust Length	2.186 ±0.020	In	Width-edge to edge outside ports
	B	Width of Transfer	0.436 ±0.005		
	B1	Length of Transfer	2.186 ±0.020		Edge of edge of outside ports
	B2	Port Web Length	0.094 ±0.005		

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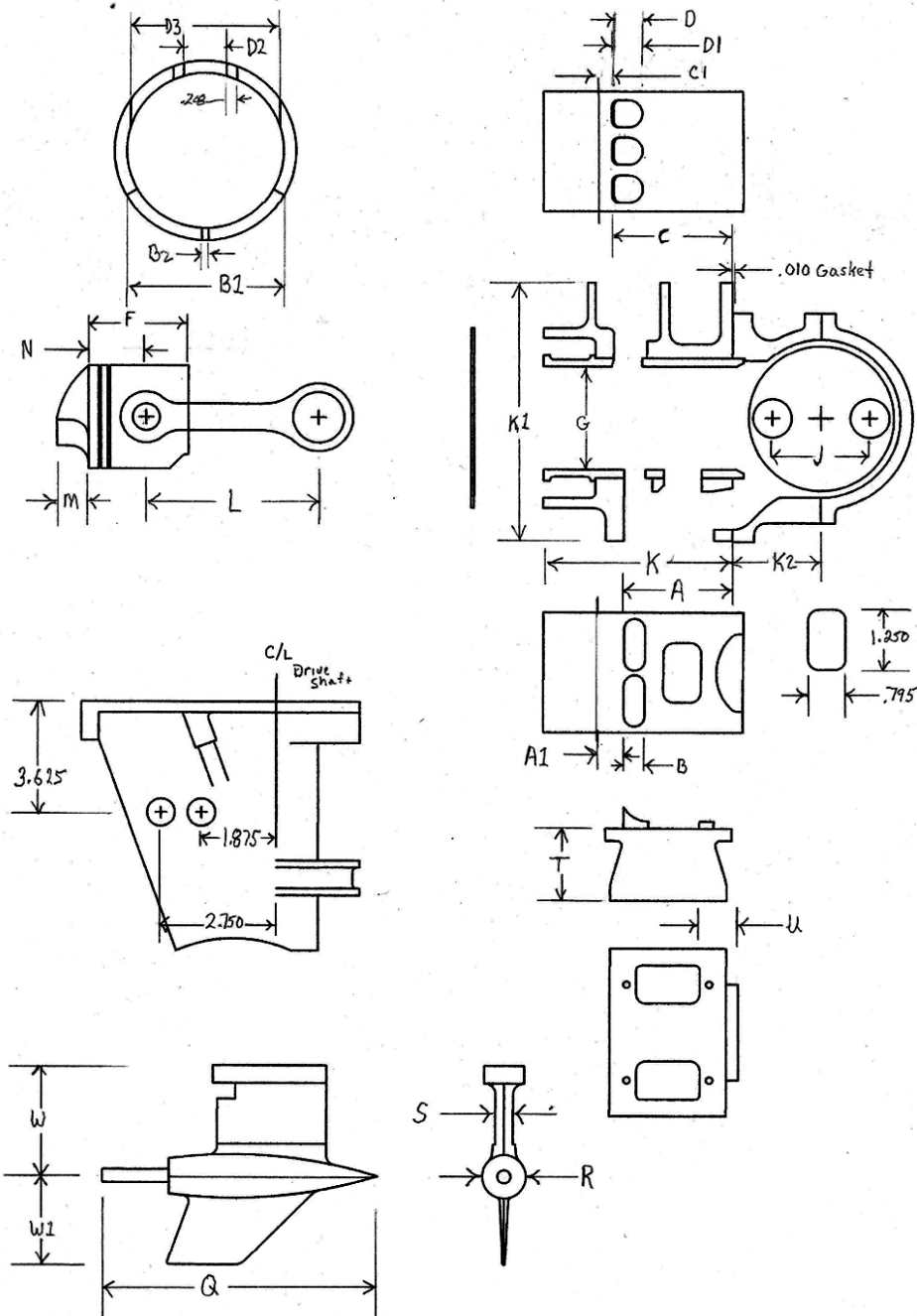
	Sleeves	A1	Top of Transfer Port to Sleeve Flange	0.600 ±0.010	In	
		B1	Width of Transfer Ports	2.186 ±0.020	In	Outside edge to outside edge at sleeve o.d.
		C1	Top of Exhaust Port to Sleeve Flange	0.378 ±0.010	In	
		D3	Width of Exhaust Port	2.186 ±0.020	In	Outside edge to outside edge at sleeve o.d.
	Block	K	Cylinder Height	3.919 ±0.010	In	
		K1	Cylinder Width	5.380 ±0.015	In	
		K2	Crankcase Height	1.843 ±0.005	In	
		T	Intake Manifold Height	1.656 ±0.010	In	
	Intake	U	Reed opening	1.062 ±0.025	In	Intake Manifold Reed Opening to inlet face
			Reed Thickness Top	0.016	In	
			Reed Thickness Bottom	0.032	In	
	Carburetor		Venturi Diameter	28mm 1.102 ±0.010	Mm	
			Bore Diameter	30mm 1.181 ±0.010	Mm	
Gear Case	Tower		Relief Holes	4X0.500 dia ±0.032		
			Height	14.562 ±0.062		Height; power head flange to gear case flange
	Gearcase		Impeller Blades	5		
			Gear Ratio	14:19		
		Q		12.000 max		
		R		2.050 min		(See gear case diagram for measurement locations)
		S		0.750 min		
		W		4.750 ±0.020		Also: The skag must meet the template #90-01-0001 available from Racing Outboards, LLC.
		W1		4.350 ±0.100		
Bearings	Bearings	1		Caged Roller		
		2		36 loose Roller		
		3		205 Ball		
		4		Roller w/Retainer		
		5		22 loose Roller		
		6		Roller		
		7		Roller/Roller Thrust		
		8		Roller/Roller Thrust		
		9		Roller x2/Roller Thrust		

**SIDEWINDER 20S (15, B & 25 CLASSES)**

Engine Model				20S		
POWERHEAD SPECIFICATIONS	Group	Ref. #	Item	Dimension	Units	Definition
	General Specs		Number of Cylinders	2		
			Engine Displacement	19.94	In <sup>3</sup>	The Volume of all cylinders excluding the combustions chamber
			Minimum CC	18.0	cm <sup>3</sup>	Volume of each Cylinder at T.D.C. filled to top of spark plug hole
		J	Stroke	2.031 ±0.005	In	Distance the crank moves in 180° of rotation. Or the distance the piston moves
			Flywheel Weight	4 lbs min		
			Flywheel Diameter	5.990 min		
	Cylinder Bore Diameter	G	Standard	2.500	In	This is a Reference only Dimension
			Max Size	2.530	In	Maximum bore size including piston clearance
	Rods	L	Rod Length	3.562 ±0.004	In	Length of the rod from center of crank pin hole to center of wrist pin hole
		F	Piston Height (minus Crown)	2.068 ±0.015	In	Piston Height measured to the timing edge of the piston
		M	Crown Height	0.740 ±0.015	In	Measured from the timing edge of the piston to the top of the piston
	Piston Rings	N	Pin to Crown edge	1.190 ±0.015	In	Wrist pin center to timing edge
			Number per Piston	2		
		Upper	Design	Rectangular		
		Lower		Rectangular		
	Ports		Number of Exhaust	3		
			Number of Transfer	2		
		A	Height of Transfer	2.246 ±0.010	In	measured from block face
		A1	Height of Transfer	0.596 ±0.005	In	measured from sleeve flange
		C	Height of Exhaust	2.466 ±0.010	In	measured from block face
		C1	Height of Exhaust	0.378 ±0.005	In	measured from block face
		D	Exhaust Height	0.597±0.005	In	
		D1	Exhaust	0.675max	In	Height top of Bevel
		D2	Exhaust Length	0.695 ±0.005	In	Width Center Port
		D3	Exhaust Length	2.455 ±0.020	In	Width-edge to edge outside ports
		B	Width of Transfer	0.381 ±0.005	In	
		B1	Length of Transfer	2.596 ±0.010	In	Edge of edge of outside ports
		B2	Port Web Length	0.100 ±0.005	In	

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	Sleeves	A1	Top of Transfer Port to Sleeve Flange	0.600 ±0.010	In	
		B1	Width of Transfer Ports	2.596 ±0.020	In	Outside edge to outside edge at sleeve o.d.
		C1	Top of Exhaust Port to Sleeve Flange	0.385 ±0.010	In	
		D3	Width of Exhaust Port to Sleeve Flange	2.455 ±0.020		Outside edge to outside edge at sleeve o.d.
	Block	K	Cylinder Height	3.919 ±0.010	In	
		K1	Cylinder Width	5.380 ±0.015	In	
		K2	Crankcase Height	1.843 ±0.005	In	
		X	Cylinder Base	1.062 ±0.025	In	
	Intake	T	Intake Manifold Height	1.656 ±0.010	In	
		U	Reed opening	1.062 ±0.025	In	Intake Manifold Reed Opening to inlet face
	Carb		Reed Thickness	0.016	In	(top)
			Reed Thickness	0.032	In	(bottom)
			Venturi Diameter	32	mm	
			Bore Diameter	34mm 1.338 ±0.015	mm	
			Bore Diameter	30mm 1.181 ±0.015	mm	
			Relief Holes	4X0.500 dia ±0.032		
Tower	Gear Case		Height	14.562 ±0.062	In	Height; power head flange to gear case flange
			Impeller Blades	5		
	Gear Case		Gear Ratio	14:19		Must meet Sidewinder template 90-01-0001
		Q		12.000 max	In	
		R		2.050 min	In	(See gear case diagram for measurement locations)
		S		0.750 min	In	
		W		4.750 ±0.020		Also: The skeg must meet the template #90-01-0001 available from Racing Outboards, LLC.
		W1		4.350 ±0.100	In	
Bearings	Bearings	1		Caged Roller		
		2		36 loose Roller		
		3		205 Ball		
		4		Roller with retainer		
		5		22 loose Roller		
		6		Roller		
		7		Roller/Roller Thrust		
		8		Roller/Roller Thrust		
		9		Roller x2/Roller Thrust		



## HOT ROD 15 (15 CLASS)

### Hot Rod Specifications

1. Polishing and filing of the Hot Rod engines, in general, is permissible.
2. Connecting rods with four oil slots approximately 0.500" wide and 0.062" deep are permissible. Rods may be polished as long as minimum weights are met. It is not permissible to remove any metal from any flywheel configuration. Some flywheels are balanced at the factory.
3. Rod caps are nicked at factory for clearance.
4. It is permissible to grind the corners of the head to provide clearance for the top and bottom corners of the piston deflector. Only American Hot Rod heads with integral cast head catcher are legal.
5. Transfers in block are cast not machined (1984 and up). A small de-burring operation is performed at the parting line.
6. The Lectron 30MMHV (High Velocity) is also a legal carburetor. The front half is labeled 32 and the back half is labeled 30. The throat of this carb is fitted with a sleeve. The throat bore behind the restrictor may be partially machined at the rear.
7. Any make of piston ring, seal, and bearing or magneto parts may be used provided other parts are not altered to accommodate them.
8. Any type brackets for throttle spark, steering controls and tachometer will be permitted.
9. Flexible fuel lines may be installed on any motor. Any standard hose fittings may be used, but there shall be no alteration of the threads in the carburetor or fuel pump.
10. Throttle disks of any manufacture may be used, but must be of sufficient diameter to match the carburetor throats in which they are used. Any needle valve may be used in any carburetor provided that no change is made in the threaded section or the pointed end of the needle valve in order to use it. Crossbars may be added to the exterior end of needle valves to facilitate adjustment.
11. The screw fastening the carburetor butterfly to the throttle shaft must be furnished by the manufacturer. With that exception, any make or type of nut, bolt, screw, washer, or stud may be used anywhere in the engine. Gaskets of any make of manufacture, including homemade, are permitted providing they are equivalent to the original in shape and thickness and, in case of cylinder base gaskets, maintain the cylinder port dimensions within the limits of the engine specifications.
12. Oversize pistons furnished by the manufacturer of the motor may be used in the mode for which they are furnished. The bore of the engine may be enlarged by the amount that the oversize piston differs from the standard piston. An additional total 0.005-inch enlargement of the bore will be allowed due to wear or re-machining errors, or measuring tolerances. Under no circumstances will the bore be enlarged more than 0.040 inches over the original dimension. It is not legal to coat or plate cylinder walls with chromium or any other material.
13. Main bearing bores in crankcases may be bored and fitted with bushings to provide a good fit on standard crankcase main bearings. Alternatively, the crankcase may be re-bored to accept any bearings having oversize outside diameters but which are otherwise standard. Similarly, on engines having flywheel magnetos, the magneto neck of the crankcase may be fitted with a sleeve to provide a tight fit in the magneto

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stator bore. Conversely, the stator bore may be fitted with a bushing for the same purpose. Magneto stator plates may be clamped or otherwise fixed in position on the crankcase by any means.

14. It shall be permissible to use studs of larger than standard diameter for the purpose of joining the lower unit to the exhaust housing. Also, modification of the exhaust housing to accommodate the larger studs is permissible.
15. The removal of material from aluminum flywheels by drilling or any other method, for any reason, is specifically prohibited. Weight such as solder, lead or copper may be added to the flywheel for balancing.
16. It is permissible to re-sleeve any block provided engine specifications are maintained.
17. It is permissible to install a lubrication line between the top and bottom bearing.
18. To repair stripped spark plug holes, heli coils, oversize holes, or bushings are permissible.
19. Knurling of pistons is not permitted.
20. Separate fuel tanks may be installed in the hull or on the outside of the transom or on the motor or steering bar so long as mounted in a safe manner. There shall be no restrictions on design or manufacture of such tanks other than for safety. Auxiliary fuel lines and connections may be added as needed. A filter or pressure regulator may be added to any fuel line or fuel tank. Electric fuel pumps may not be used.
21. No drilling or modifications of any type, except repair, may be done on the water jackets to change the cooling pattern.
22. A shim may be added when using the new style head gasket in order to meet minimum cc's.
23. The PBL ignition system is an approved system. The single unit ignition coil and new 6HP Flywheel #3584222 is approved.

Engine Model		Hot Rod 15				
Group		Ref. #	Item	Dimension	Units	Definition
POWERHEAD SPECIFICATIONS	General Specs		Number of Cylinders	2		
			Engine Displacement	14.94	In <sup>3</sup>	The Volume of all cylinders excluding the combustions chamber
			Minimum CC	13	Cm <sup>3</sup>	Volume of each Cylinder at T.D.C. filled to top of spark plug hole
		J	Stroke	2.031 ±0.006	In	Distance the crank moves in 180° of rotation. Or the distance the piston moves
			Flywheel Weight	OMC 4 lbs Motoplatt Heavy 3 lb 8 oz Motoplatt Light 7 oz		
			Flywheel Diameter	5.990 min		This is for the Sidewinder Flywheel only
	Cylinder Bore Diameter	G	Standard	2.166	In	This is a Reference only Dimension
			Max Size	2.206	In	Maximum bore size including piston clearance
	Rods	L	Length	3.562 ±0.004	In	Length of the rod from center of crank pin hole to center of wrist pin hole

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			Weight	4 oz		Including bearing and cap screws
	Piston	E	Position at Bottom of Stroke	1.890 ±0.015	In	Including 0.031 in gasket
		F	Piston Height (minus Crown)	2.062 ±0.015	In	Piston Height measured to the timing edge of the piston
			Weight	4 oz	In	Including rings, pin and bearings
	Piston Rings		Number per Piston	2		
		Upper	Design	Rectangular		
		Lower		Rectangular		
		Upper	Thickness		In	
		Lower			In	
	Ports		Number of Exhaust	3		Per cylinder
			Number of Transfer	2		
		A	Height of Transfer	2.280 ±0.020	In	Including 0.031 in gasket
		C	Height of Exhaust	2.498 +0.020/-0.030	In	Including 0.031 in gasket
		K	Crankcase Height	1.843 ±0.005	In	
	Rotary Value	N	Opens	1.875 – 1.938	In	Distance from TDC when value opens
		P	Close	0.625 – 0.750	In	Distance from TDC when value closes
Carb	Carburetor		Venturi Diameter	HL239A 0.875 Lectron 1.100	In	
			Bore Diameter	HL239A 1.020 ±0.030 Lectron 1.180 ±0.015*	In	Measured at crankcase side
			Plate	0.500 ±0.031		
			Tower Exhaust Outlet Holes	0.500Ø ±0.031		
Gear Case	Gear Case		Impeller Blades	5		
			Gear Ratio	14:19 or 14:15		
		Q		12.000 max		
		R		2.062 Min		
		S		0.750 Min		
		V		19.312 ±0.062		
		1		Ball		
		2		Ball		
		3		Needle		
		4		Ball		
		5		Roller		
		6		Roller		
		7		Roller		



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		8		Roller		
		9		Ball		
		10		Roller		
		11	Old	Ball		
			New	Roller		
		12	Old	Ball		
			New	Roller		

## MERCURY 25XS (BSR, BSH & 25SSR CLASSES)

### MERCURY / MARINER 25XS SPECIFICATIONS (B & 25 CLASS)

- Note: It is the intention of the manufacturer and the SORC that the 25XS engine to be raced as received from the manufacturer without modification.
- No modifications of any kind including grinding, polishing, machining shot peening, bead blasting, etc. will be allowed on any engine or drive components unless otherwise noted in this section. No material may be added or removed from any engine or drive components unless otherwise noted in this section.
- The paint may be removed from the external cast surfaces of the cylinder block.
- Only cylinder blocks, pistons and piston rings manufactured by Mercury Marine are allowed.
- The only permissible block is 1986 and newer with a 7 bolt rear water jacket.
- The minimum allowable volume of the combustion chamber, at T.D.C., to the top of the spark plug hole for engines with chrome bores is 21.7 CM. The minimum allowable volume of the combustion chamber, at T.D.C., to the top of the spark plug hole for engines with Mercosil aluminum bores is 21.2 CM.
- Phillips head fasteners may be replaced with hex head screws. Larger diameter starter mounting screws and/or studs, washers and nuts with rubber isolation washers are permissible. Throttle butterfly screws, connecting rod fasteners and nuts must be factory original. Gear case mounting studs must be factory original but may be altered to allow increased clearance.
- Any make of seals, bearings, fuel line, throttle bracket, or thrust bracket, may be used provided other parts are not altered to accommodate them. It is permissible to use an aftermarket water pump impeller that replicates the OEM impeller.
- It is not permissible to machine off the mating surfaces of the split crankcase.
- The main bearing bores in the crankcase may not be bored to accept oversize bearings or fitted with bushings.
- Material may be added to the recoil housing. Internal flywheel to housing clearance must not be changed.
- Honing of the cylinder bores and connecting rod journal bores is permitted.
- The 25XD 1986 and newer service carburetors are legal for the 25XS engine if it is fitted with a full butterfly.
- It is permissible to add a second pair of cross drilled holes, at 90°, to the original fuel inlet holes in the high speed jet holder. They must be the same diameter (0.096 inches) as the original holes. It is NOT permissible to add an adjustable needle valve to any of the legal carburetors.
- The following reeds are approved for the 25XS engine:
  - Steel reed (Mercury P/N 34-99319 & P/N 34-816806)
  - Plastic reed (Mercury P/N 34-814764A1, 34848066)
  - Reed cage P/N 14112: use plastic reed 34-848066 or the steel reeds supplied with P/N 14112.
- It is permissible to use replacement reeds manufactured by Boyesen. It is highly recommended to use only this reed.
- There are two (2) legal flywheels for the 25XS engine.
  - P/N 258-8274A6 (9 lb. 7 oz. min. weight)
  - P/N 258-8274A11 (7 lb. 8 oz. min. weight)
  - It is legal to use the machined flywheel made by Dave Young. (This is the only machined flywheel that is legal!)
- There are two legal drive shaft housings for the 25XS engine:

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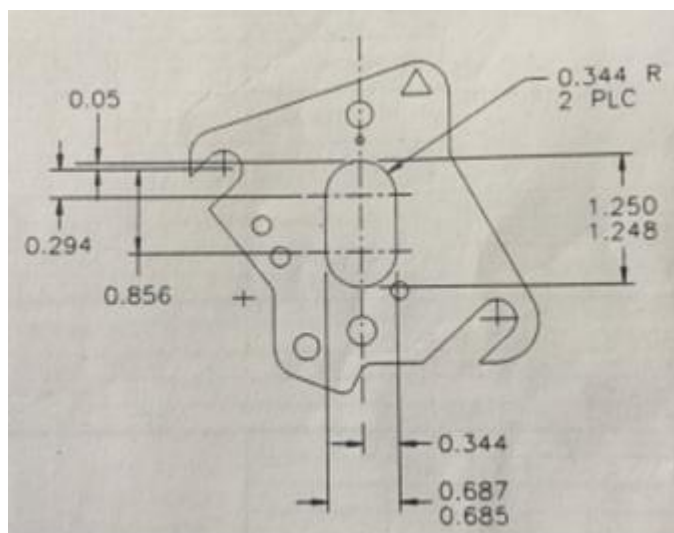
- The “long” housing manufactured before 1986
- The “short” housing manufactured after 1986.
- The only legal gear case for the 25XS engine is the larger skeg gear case (P/N 16041116A15). The gear case may be unpainted or must be completely painted original factory colors (tail cone need not be painted). This gear case must meet the specifications on the attached page and on the Mercury template (#91-17456). Note: This inspection template must be checked for dimensional accuracy before each use.
- The clamp bracket screw handles may be repaired or replaced with an alternative handle as long as no modifications are required on the bracket of the drive shaft housing.
- The steering arms that come standard on the “short” 25XS drive shaft housing may be replaced with new arms if they have at least the same minimum cross section dimensions (1.0 inch horizontal X 0.25 inch vertical. Material may be either steel or aluminum.
- The lower tower housing swivel pin bushing may be replaced with any type of bushing provided no modifications are made to the tower housing, pin or clamp bracket assembly.
- It is permissible to remove the plastic baffle in the top of the upper engine cowling on all models.
- It is permissible to use replacement ignition parts manufactured by CDI Components
- It is permissible to use an electric starter, as provided by the motor manufacturer and is limited to a 12-volt DC system.
- Any throttle linkage is allowed as long as the operation is similar to OEM linkage.
- Drive Shaft Housings (DSH) manufactured by IAI Performance are legal replacement parts for the Mercury/Mariner 25 XS engines.
- OEM Type Restrictors made by Shawn Cavanaugh are legal replacement parts.
- It is permissible to repair the cylinder walls. The existing cylinder bore specification of 2.563” +/- .005” must be met.
- 25XS engines in BSR & BSH shall be run with a carburetor restrictor securely in place behind the carburetor which shall conform to the diagram herein. OEM and non-OEM restrictors are legal as long as they conform to the specifications and dimensions of the OEM restrictors.
- It is permissible to use a two piece drive shaft with a coupler in the 25XS engine.

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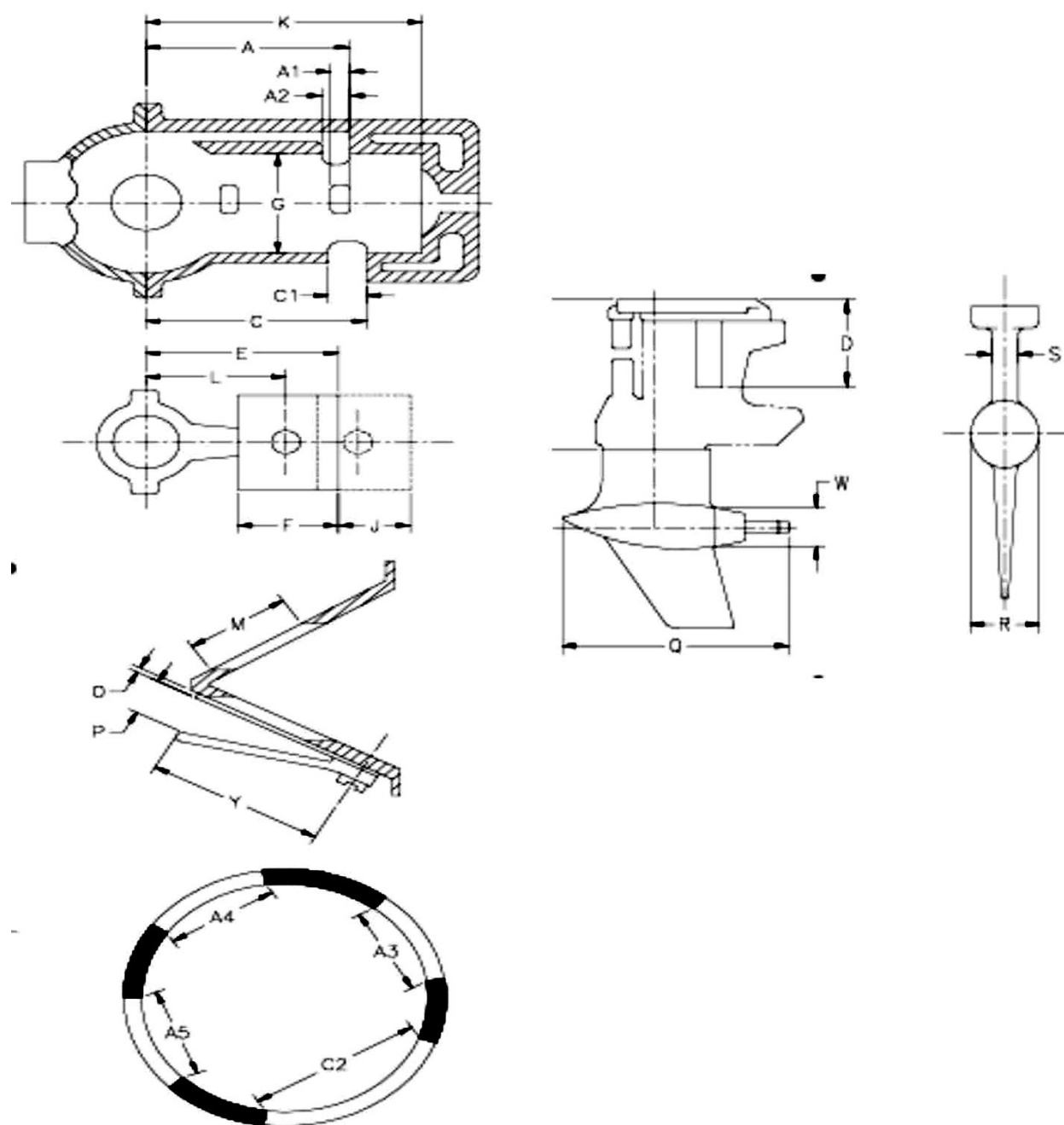
Engine Model		Mercury			25XS		
		Mariner			25XS		
POWERHEAD SPECIFICATIONS	Group	Ref. #	Item	Dimension	Units	Definition	
	General Specs		Number of Cylinders	2			
			Engine Displacement	24.4	In <sup>3</sup>	The Volume of all cylinders excluding the combustions chamber	
			Minimum CC	21.7 Chrome bore 21.2 Mercosil	Cm <sup>3</sup>	Volume of each Cylinder at T.D.C. filled to top of spark plug hole	
		J	Stroke	2.362 ±0.005	In	Distance the crank moves in 180° of rotation. Or the distance the piston moves	
			Flywheel Weight	7lbs. 8oz small 9lbs 7oz large			
			Flywheel Diameter				
	Cylinder Bore Diameter	G	Standard	2.563 ±0.005	In	This is a Reference only Dimension	
			Max Size	2.566	In	Maximum bore size including piston clearance	
	Rods	L	Rod Length	4.062 ±0.005	In	Length of the rod from center of crank pin hole to center of wrist pin hole	
	Piston	E	Rod Piston Length	5.277 ±0.020	In	Length of piston and rod from crank pin center to the top of the piston	
		F	Piston Height	2.525 ±0.030	In	Piston Height measured to the top edge of the piston	
	Piston Rings		Number per Piston	2			
		Upper	Design	Half Keystone		Also known as a keystone ring	
		Lower		Rectangular			
		Upper	Thickness	0.060 ±0.002	In		
		Lower		0.060 ±0.002	In		
	Ports		Number of Exhaust	1			
			Number of Transfer	3			
		A	Height of Transfer	4.493 ±0.030	In		
		A3	Height of Transfer	1.079 ±0.030	In		
		C	Height of Exhaust	4.863 ±0.030	In		
		A1	Transfer Diameter	0.395 ±0.030	In		
		C1	Exhaust Diameter	0.750 ±0.030	In		
		A2	Transfer Diameter	0.450 ±0.030	In		
		C2	Exhaust Diameter	1.448 ±0.030	In		
		A4		0.957 ±0.030			
		A5		1.114 ±0.030			

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	Block	K	Cylinder Height	6.540 $\pm$ 0.030	In	
	Reeds and Reed Plate		Reed Material	Steel or Fiber	In	
			Reed Thickness	Steel 0.008 $\pm$ 0.0008 Fiber 0.020 $\pm$ 0.002	In	
		P	Reed Stop Heights	0.260 $\pm$ 0.030 0.285 $\pm$ 0.020	In	
		Y	Reed Stop Radius	1.260 $\pm$ 0.020 1.165 $\pm$ 0.020	In	P/N 42471-2 P/N 14112
		M	Port Length	0.700 $\pm$ 0.030	In	
		N2	Port Width	0.550 $\pm$ 0.020	In	
Carb	Carburetor		Venturi Diameter	1.120 $\pm$ 0.015	In	
			Bore Diameter	1.250 $\pm$ 0.015	In	*see diagram below for the 25XS restrictor plate
Tower	Exhaust	D	Meg Length	7.120 $\pm$ 0.150		From top of adaptor to bottom of pipe
		V		14.625 $\pm$ 0.060		Measured with exhaust adaptor long
		V		9.750 $\pm$ 0.060		Short
		D	Tower Exhaust Outlet Holes	2.000x2.000 +0.250		
Gear Case	Gear Case		Impeller Blades			
			Gear Ratio	16:21 or 15:15		
		Q		11.250 max		
		R		2.090 min		
		S		0.980 min		
		W		1.870 min		



**25XS Restrictor Plate**



## YAMATO-102, 302 & 321

The intent of these rules is for the Yamato 102, 302 & 321 engines to be raced as received from the manufacturer without modification except as specifically listed below. If a specific dimension is not listed in these rules, the Inspector may compare the dimensions of a new part to assist in making a decision regarding part legality.

### Permissible Modifications

1. It is permissible to use any make of bearings, seals, ignition components, piston rings, steering bar, or prop shaft provided no engine modifications are made to accommodate them. (Except 300SSH)
2. It is permissible to drill water drain holes in the ignition castings (coil plates and crankcase top end cap), and these holes may be tapped and plugged.
3. It is permissible to enlarge the fuel tank or build a complete new tank. If the tank is removed, the tank mounting brackets may also be removed. A fuel filter may be added to the fuel line.
4. A fuel pump may be used for racing, but the carburetor shall not be modified in any way. (Except 300SSH)
5. It is permissible to grind, file, or polish the lower unit as long as all dimensions and templates are met. The "bulge" may be ground flush with the sides of the skeg. (Except 300SSH)
6. Any type of thrust bracket adjustment is allowed. It is permissible to drill 2 holes at the front of the cavitation plate to facilitate the mounting of a thrust bracket block.
7. The tilt lock lever and spacer on the tilt bracket bolt may be removed.
8. The magneto stator plate may be locked in position by any means and the stator plate timing knob may be removed.
9. The spray shield may be modified for use with throttle cable to allow easier access for engine priming and it may be painted. (Except 300SSH)
10. The prop shaft may be turned down to 9/16 inch minimum diameter or a new propeller shaft may be made (9/16 inch minimum diameter). In either case, only one shear pinhole is permissible. The prop nut thread size is optional.
11. It is legal to bore the cylinders one size larger than standard bore. It is permissible to re-sleeve any block provided engine specifications are maintained. (Except 300SSH)
12. It is permissible to mill the cylinder head. No changes may be made to the combustion chamber. It is legal to re-machine the squish band for repair purposes only. (angle  $15^{\circ} \pm 2^{\circ}$ ,  $2.612 \pm 0.015$ ). There must be a visible ledge surrounding the squish band.
13. It is permissible to substitute the Yamato 302 – 321 gear case assembly for use on the 102 engine. The 102 gear case assembly may not be used on the 302 – 321 engine.
14. The 102 exhaust megaphone may have any type of welding, gusset, strap, etc. used on the outside only, to repair or reinforce as long as all other dimensions are met. It will be left to the discretion of the inspector to decide if any changes to the inside of the megaphone were due to welding "melt through" or were done to intentionally change the interior configuration.
15. It is permissible to use non-OEM crank pins and exhaust stacks. (The inspector may compare to new). (Except 300SSH)
16. The water inlet hole(s) may be repaired with weld or plastic compounds. It is permissible to create a groove from the forward side entrance of the original hole location thru the leading edge of the exhaust snout. The lowest point of the water inlet hole(s) and groove may not be more than 1.500" below the bottom of the cavitation plate. The original contour of the exhaust snout must be maintained. This is permissible on all approved Yamato engines. (See photos in this manual & the instruction guide on the resource page of the APBA website).
17. It is permissible to reposition the ring groove stop pin to allow the use of the Model 302 - 321 piston in the 102.

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18. It is permissible to use the Yamato Model 202 magneto on the Model 102.
19. It is permissible to remount any coil on the 102 and to replace the points and condenser with a Nova II.
20. Aftermarket roping plate is legal on the 102 as long as it meets OEM dimensions.
21. Extended length, flexible water outlet "dump" hoses are permissible.
22. The Yamato Model 300 series ignition may be installed on the Model 102. It is permissible to add a shim or gasket between the bowl and the crankcase. (See the specifics on rope plate size in the specifications chart.
23. It is permissible to drill out the Model 321 exhaust nipple that currently has a 4 mm hole to .315" maximum which is the same as the Model 302 exhaust nipple.

### **Non-Permissible Modifications**

1. With the exception of the inlet supply holes mentioned in the previous rule #16, no drilling or modifications of any type may be made to the cooling system.
2. Addition or removal of metal on any cast or forged internal engine components, surfaces or passages including the intake system, carburetor, or exhaust system is prohibited. Honing of cylinder bores and connecting rods is permitted.
3. Bead blasting, sand blasting, or blasting by any other media of internal engine components is not permissible.
4. Addition or removal of material from any moving parts including the flywheel, crankshaft, and pistons is prohibited.
5. The two water outlet drain holes in the bottom of the cylinder block must not be restricted.

### **General**

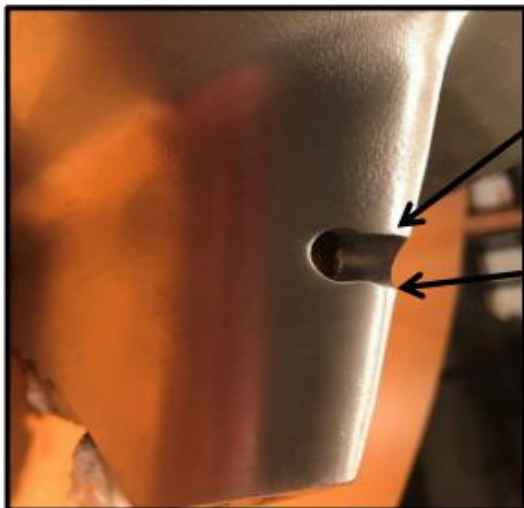
1. The volume of the combustion chamber will be measured with all the spark plugs and bushings removed without removing the cylinder head from the engine.
2. Only Yamato parts will be considered as legal replacement parts (except as specifically noted in these rules). This includes (but is not limited to) all engine components, gaskets, etc.
3. To measure the reed stop heights (Q): lightly depress the reed and the bottom edge of the end of the reed stop.
4. For identification of the legal model 102, the outside dimension of the exhaust cover is 3-3/16 inches wide.
5. The 302- 321 gear case assembly can be identified by the snap ring and metal plate on the rear outside of the prop shaft cone. Some gear cases were supplied by the manufacturer without oil fill plugs. It is not permissible to add oil fill plugs to these units. Also, it is not permissible to eliminate the oil fill plugs from gear cases that were furnished by the manufacturer with oil fill plugs.
6. In compensation for measuring the gear case skeg without the factory "bulge", an additional 0.250 inches should be added to existing gear case templates in order to properly measure a gear case without the "bulge".
7. The latest replacement Carburetor has been approved for use on the 102 and 302.
8. The restrictor plate used in all Yamato engine classes must be flat and made out of solid aluminum. It shall have a minimum thickness dimension of 0.057" and a maximum thickness dimension of 0.066" without chamfer. All edges of this plate must be 90 degrees. The slot in the plate cannot go past the outside edge of the gasket.
9. All Yamato engines must have one complete gasket behind the carburetor. In all Yamato classes that use a restrictor plate, they must have one complete gasket on each side of the plate. It is permissible to use two standard gaskets between the carburetor and the intake manifold. All gaskets used must be solid.



## Yamato Engine Cooling

The photos below describe what area is permitted to have a concave groove on all approved Yamato engines in the 25SSR, CSR, CSH, 300SSH and 20SSH classes. For more information, see our enhanced drilling guide at:

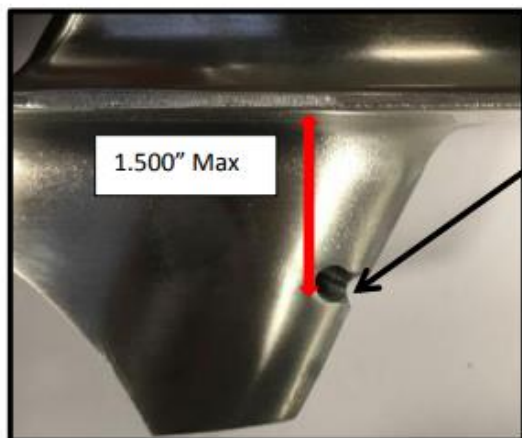
<http://www.apba.org/resources/stock-outboard-yamato-enhanced-drill-guide-8896>



The water inlet hole(s) may be repaired with weld or plastic compounds. The original contour of the exhaust snout must be maintained.

It is permissible to create a groove from the forward side entrance of the original hole location thru the leading edge of the exhaust snout. The lowest point of the water inlet hole(s) and groove may not be more than 1.500" below the bottom of the cavitation plate.

Any water intake in question may be compared to other engines to assist in making a decision regarding legality.



The inlet hole may not be relocated and the bottom of the entire inlet (hole and groove included) may be no more than 1.500" below the bottom of the cavitation plate.



### For Reference Only:

This unit is drilled with a .2656 (17/64") drill bit directly into the center of the leading edge of the exhaust snout. (See Drilling Instructions)



**YAMATO 102 (25SSR, CSR, CSH & 20SSH)**

Engine Model		Yamato		102		
POWERHEAD SPECIFICATIONS	Group	Ref. #	Item	Dimension	Units	Definition
	General Specs		Number of Cylinders	2		
			Engine Displacement	24		The Volume of all cylinders excluding the combustions chamber
			Minimum CC	14mm 25.5 18mm 26		Volume of each Cylinder at T.D.C. filled to top of spark plug hole
		M	Stroke	2.286 ±0.010		Distance the crank moves in 180° of rotation. Or the distance the piston moves
			Flywheel Weight	1500 min	g	
			Crank Weight	5200 min	g	
			Roping plate	415 min	g	
			Ignition	Magneto		(or the 300 series ignition is permissible)
	Cylinder Bore Diameter		Max Size	2.625	In	Maximum bore size including piston clearance
	Rods	K	Rod Length	4.204 – 4.221	In	Length of the rod from center of crank pin hole to center of wrist pin hole
			Weight	184 min	g	With both bearings
	Piston		Piston Weight	260 min	g	With rings, wrist pin, and clips
		L	Piston Height (minus crown)	2.322 – 2.402	In	
		N	Wrist Pin to top (minus crown)	1.291 ±0.010	In	
			No. per Piston	2		
	Piston Rings	Upper	Design	Rectangular		
		Lower		Rectangular		
		Upper	Thickness		In	
		Lower			In	
	Ports		Number of Exhaust	2 per cylinder		
			Number of Transfer	2 per cylinder and 1 boost		
		D	Height of Transfer	1.890 – 1.915	In	
		D1	Height of Transfer	1.855 – 1.900	In	
		E	Height of Exhaust	1.430 – 1.455	In	
		D2	Transfer Diameter	n/a	In	
		D3	Exhaust Diameter	n/a	In	
		E1	Transfer Diameter	n/a	In	
	Block	C	Cylinder Height	4.104 ±0.010	In	

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		F	Gasket	0.012±0.004	In	
		A	Crankcase Height	2.550 ±0.010	In	
		B		2.545 ±0.010	In	
		G	Head Gasket	0.020 ±0.004		
	Intake		Block water hole near head	0.140 ±0.005	In	
	Reeds and Reed Plate		Block water hole near exhaust man.	0.120 ±0.005	In	
			# of Holes	8	In	
			Hole Size	0.793 x 1.041	In	
			Reed Thickness	0.012 ±0.002		
		Q	Reed Stop Heights	0.289 max	In	
		Q1	Reed Stop Radius	1.342 – 1.421	In	
Carb	Carburetor Mikuni BV-36		Venturi Diameter	1.102 ±0.012	In	
			Bore Diameter	1.407 ±0.012	In	
Tower	Exhaust	P	Meg Length	11.625 ±0.050		
		P3		2.180 max		
		P4	Meg. Relief Hole	1.060 max		
		P2	Tower Exhaust Outlet Holes	2.400 ±0.040		
		P1	Housing Relief Holes	0.203 Ø max		
			Water Inlet Hole	**		**see rule #16 under "Permissible Modifications"
Gear case			Gear Ratio	14:15		Helical cut
	Tower Housing	O		18.464 – 18.622		
		S		1.195 min		
		T		8.465 ±0.050		
		U		4.724 ±0.050		
		V		10.800 max		
		W		2.205 min		
		X		2.980 ±0.030		
		Y		50°		
		Z1		0.190 min		
		Z2		0.190 min		
		Z3		0.150 min		
		Z4		0.150 min		
		Z5		1.949 min		
		CL		1.772 max		
		CD		2.100 min		

**YAMATO 302 - 321 (25SSR, CSR, CSH, 300SSH & 20SSH)**

Engine Model		Yamato		302 - 321		
Group	Ref. #	Item	Dimension	Units	Definition	
POWERHEAD SPECIFICATIONS	General Specs	Number of Cylinders	2			
		Engine Displacement	24		The Volume of all cylinders excluding the combustions chamber	
		Minimum CC	14mm 25.5 18mm 26		Volume of each Cylinder at T.D.C. filled to top of spark plug hole	
		M Stroke	2.276 – 2.291		Distance the crank moves in 180° of rotation. Or the distance the piston moves	
		Flywheel Weight	1500 min	g		
		Crank Weight	5300 min	g		
		Roping plate (old style)	360 min	g		
		Ignition (old style)	Transistor Magneto		Part no. BM9101	
		Roping plate (new style)	315 min	g		
		Ignition (new style)	Transistor Magneto		Part no. BM9103	
	Cylinder Bore Diameter	Max Size	2.625	In	Maximum bore size including piston clearance	
	Rods	K Rod Length	4.204-4.221	In	Length of the rod from center of crank pin hole to center of wrist pin hole	
		Weight	191 min	g	With both bearings	
	Piston	Piston Weight	260 min	g	With rings, wrist pin, and clips	
		L Piston Height (minus crown)	2.346 – 2.378	In		
		N Wrist Pin to top (minus crown)	1.291 – 1.307	In		
	Piston Rings	Number per Piston	2			
		Upper Design	Rectangular			
		Lower Design	Rectangular			
		Upper Thickness		In		
		Lower Thickness		In		
	Ports	Number of Exhaust				
		Number of Transfer				
		D Height of Transfer	1.890 – 1.913	In		
		D1 Height of Boost Port	1.772 – 1.827	In		
		E Height of Exhaust	1.380 – 1.402	In		
		D2 Transfer Width	1.255 – 1.295	In		
		D3 Boost Port Width	0.978 – 1.018	In		
		E1 Exhaust Width	1.791 – 1.831	In		
	Block	C Cylinder Height	4.102 – 4.114	In		
		F Gasket	0.012 ±0.004	In		
		A Crankcase Height	2.827 – 2.843	In		
		B	2.539 – 2.551	In		
		G Head Gasket	0.020 ±0.004			
	Intake	Block water hole near head	n/a	In		

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	Reeds and Reed Plate		Block water hole near exhaust man.	0.118 ±0.002	In	
			# of Holes	12	In	
			Hole Size	0.512 x 1.142	In	
			Reed Thickness	0.012 ±0.002		
		Q	Reed Stop Heights	0.289 max	In	
		Q1	Reed Stop Radius	1.272 – 1.350	In	
			Venturi Diameter	1.102 ±0.012	In	
Carb	Carburetor Mikuni BV-36		Bore Diameter	1.407 ±0.012	In	
Tower	Exhaust	P	Meg Length	10.157 – 10.315		
		P3		1.732 – 1.811		
		P4	Meg. Relief Hole	1.535 – 1.614		
		P2	Tower Exhaust Outlet Holes	2.469 ±0.040		
		P1	Housing Relief Holes	0.185 – 0.209		
	Tower Housing		Water Inlet Hole	**		**see rule #16 under “Permissible Modifications”
*NOTE: (The upper exhaust relief square hole must stay as cast. With a maximum dimension of 26mm x 26mm within the tower of the Model 321. No addition or removal of metal will be permitted inside the 321 tower)						
Gear case			Gear Ratio	14:15		Helical cut
		O		17.283 – 17.402		
		S		1.195 min		
		T		8.465 ±0.050		
		U		4.754 ±0.050		
		V		10.800 max		
		W		2.205 min		
		X		2.980 ±0.030		
		Y		50°		
		Z1		0.190 min		
		Z2		0.190 min		
		Z3		0.150 min		
		Z4		0.150 min		
		Z5		1.949 min		
		CL		1.772 max		
		CD		2.115 min		

**YAMATO 302 (300SSH)**

Engine Model		Yamato		302		
		Ref. #	Item	Dimension	Units	Definition
	General Specs.		<b>All current Yamato Model 302 specifications apply except the following:</b>			
POWER	Cylinder Head	I	Squish Band thickness 14mm head thickness	.025 min. 1.440 min.	in	(Engine must also meet minimum cc measurement of 27.5)
	Tower Housing		Water Inlet Hole	**		**see rule #16 under "Permissible Modifications"
Gear case		W		2.225 min.		
		Z1		0.200 min.		
		Z2		0.195 min.		
		Z3		0.150 min.		
		Z4		0.150 min.		
	Bulge Thickness			0.225 min.		
	Skeg Radius leading and trailing edge			7/64 min.		
	Nose Cone Radius			7/16 min.		
	Top of gear foot leading radius (above nose cone)			7/64 min.		
	Top of gear foot trailing radius (above cone nut)			15/64 min.		

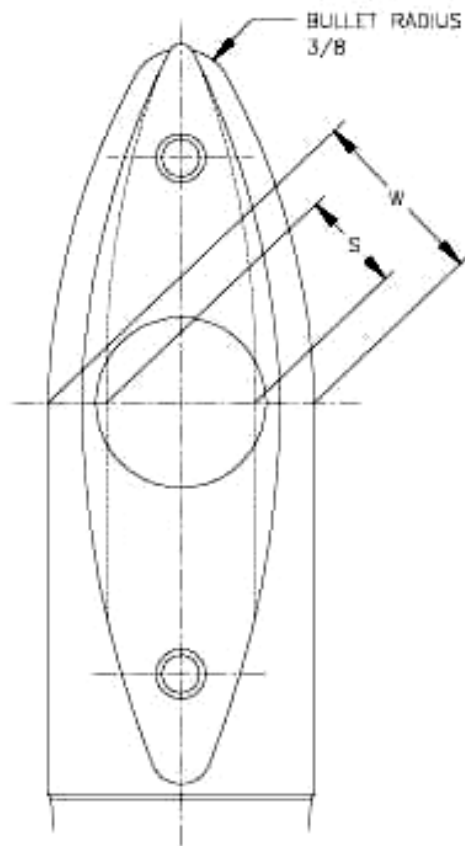
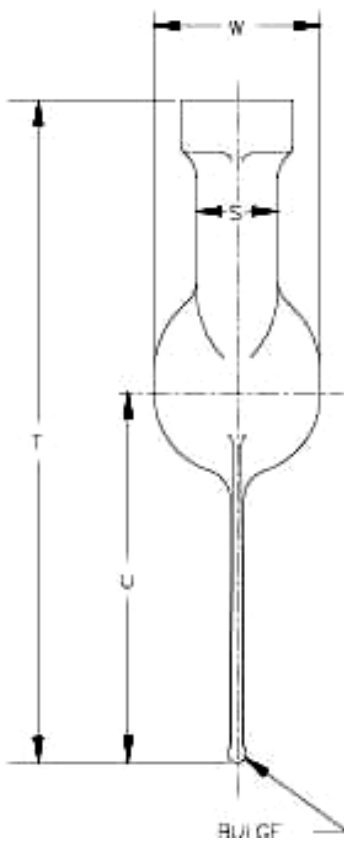
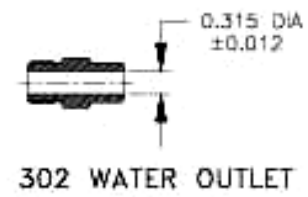
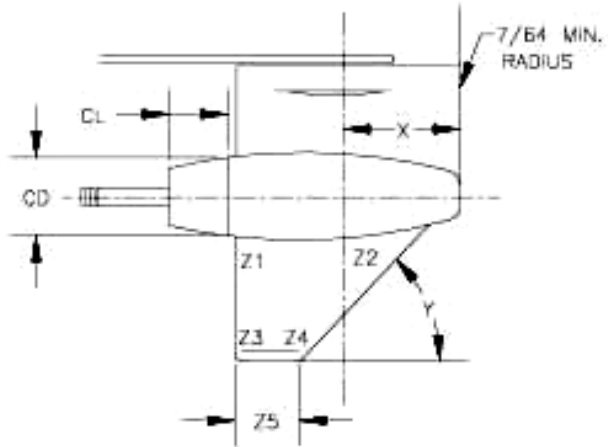
- 1) It is permissible to remove the magneto stop and the magneto stop fasteners.
- 2) It is permissible to drill holes in the plate cover that is underneath the magneto.
- 3) It is permissible to enhance the water inlet hole to comply with the rest of the Yamato classes.

**YAMATO 321 (300SSH)**

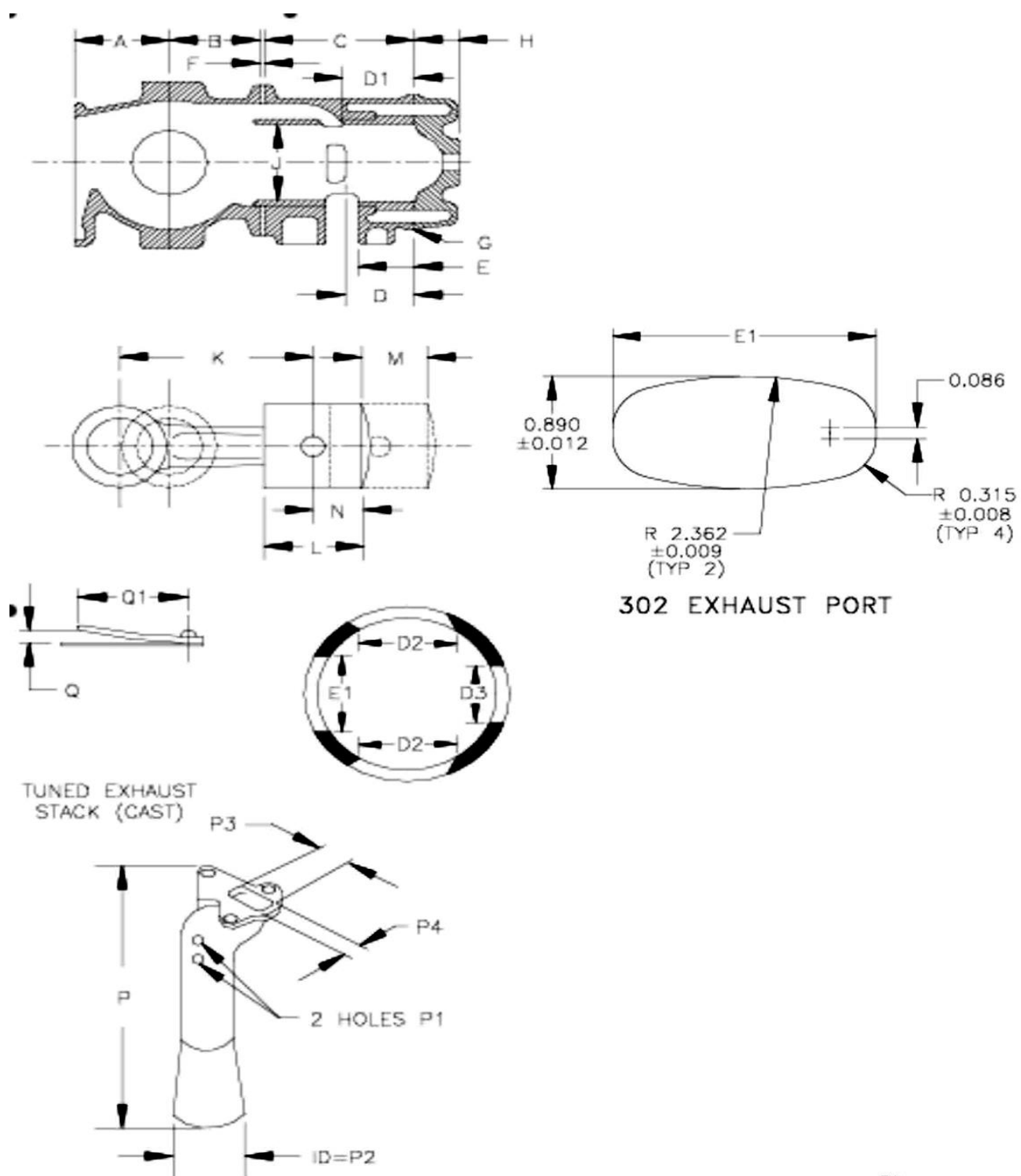
Engine Model		Yamato		321		
	General Specs.	Ref. #	Item	Dimension	Units	Definition
			<b>All current Yamato Model 321 specifications apply except the following:</b>			
POWER	Cylinder Head*	H	18mm head thickness Squish Band thickness	1.265 min. .025 min.	in	(Engine must also meet minimum cc measurement of 28)
	Tower Housing		Water Inlet Hole	**		**see rule #16 under "Permissible Modifications"
		W		2.225 min.		
		Z1		0.200 min.		
		Z2		0.195 min.		
		Z3		0.150 min.		
		Z4		0.150 min.		
	Bulge Thickness			0.225 min.		
	Skeg Radius leading and trailing edge			7/64 min.		
	Nose Cone Radius			7/16 min.		
	Top of gear foot leading radius (above nose cone)			7/64 min.		
	Top of gear foot trailing radius (above cone nut)			15/64 min.		

- 1) It is permissible to use inserts to allow the use of 14mm spark plugs in the 18mm head as long as the minimum cc measurements are not affected.
- 2) It is permissible to remove the magneto stop and the magneto stop fasteners.
- 3) It is permissible to drill holes in the plate cover that is underneath the magneto.
- 4) It is permissible to enhance the water inlet hole to comply with the rest of the Yamato classes.
- 5) It is permissible to convert a Model 302 into a Model 321. When raced as a 321 all parts used to switch the models must be used. (Rubber sealed carb funnel, #170 jet, airbox spray shield, baffled tower & 18 mm head.

**HEAD THICKNESS MEASUREMENT**







## YAMATO 80 (20SSH & BSH CLASSES)

### Yamato-80 Engine Specifications (20 Class)

1. No use of parts other than Yamato 80 parts are allowed, except as approved herein.
2. Any make of spray shield may be used. It is permissible to use any make of gaskets (other than head gaskets), bearings, seals, ignition components, piston rings, or prop shaft, provided no engine modifications are made to accommodate them.
3. Any make of prop shaft may be used. The minimum diameter shall be 9/16". Only one shear pin hole is permissible. This allows the fabrication of a new 9/16" prop shaft without the forward shear pin hole. The fabricated shaft will be similar to the original but is not required to use metric threads.
4. It is permissible to enlarge the fuel tank or build a complete new tank. If the tank is removed, the tank mounting brackets may also be removed.
5. A fuel pump may be used for racing, but the carburetor shall not be modified in any way.
6. It is permissible to remove the timing knob. The magneto stator plate may be fixed in position on the crankcase by any means.
7. Any type of thrust bracket adjustment is allowed. It is permissible to drill 2 holes at the front of the cavitation plate to facilitate the mounting of a thrust bracket block.
8. Any fuel line or fittings are permissible provided the threads in the fuel tank and on the carburetor are not changed. A fuel filter may be used.
9. No polishing or removal of metal on any internal passages of the carburetor, intake manifold, crankcase, exhaust bypass, or tuned exhaust system is allowed. Bead blasting, sand blasting, or blasting by any other media of any internal engine components is not permissible.
10. A metal head gasket is mandatory (0.5 mm or 1 mm size only).
11. No modifications are permitted to reed port openings or reeds.
12. It is legal to bore the cylinders one size larger bore size than the standard bore.
13. It is permissible to re-sleeve any block provided engine specifications are maintained.
14. No expanding or knurling of pistons is permitted.
15. The Yamato carburetor butterfly must remain intact. No thinning or tapering is allowed.
16. Except for the butterfly screw, any type, size, or make of nut, bolt, screw, or washer may be used.
17. No balancing of reciprocating or rotating parts is allowed.
18. There shall be no substitution of components such as lower units, carburetors, etc. unless replacement components are specifically designated as stock for a particular model by the SORC.
19. No drilling or modifications of any type, except repair, may be done on the water jackets to change the cooling pattern.
20. It is permissible to grind, file, or polish the lower unit as long as all dimensions and templates are met. The "bulge" may be ground flush with the sides of the skeg.
21. Drilling of water drain holes in the ignition casting (coil plate and crankcase end cap) is permissible, and these holes may be tapped and plugged.
22. One or two water outlet tube(s) on Y-80 are permissible.

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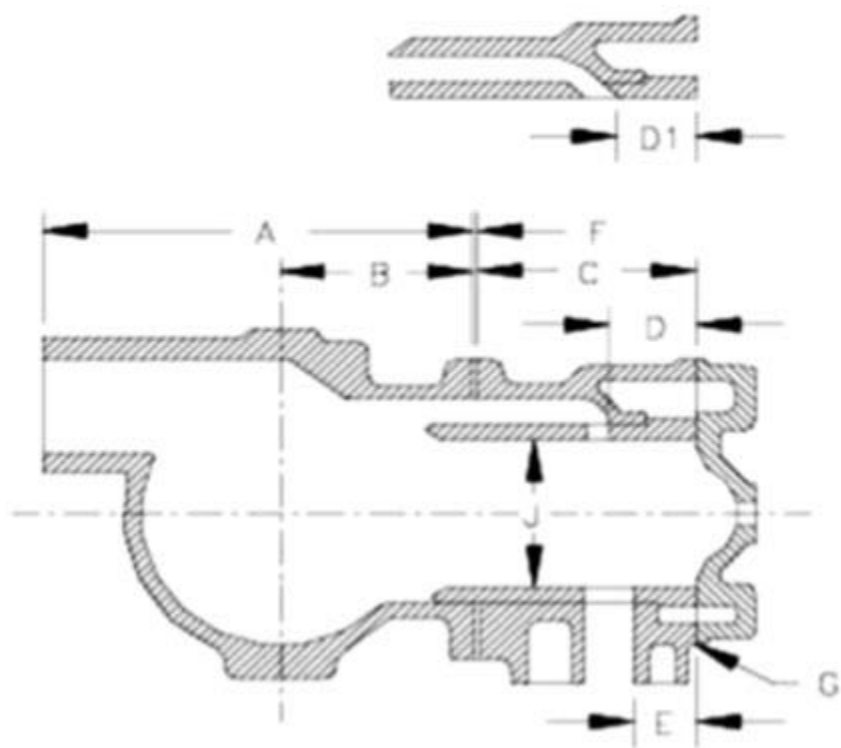
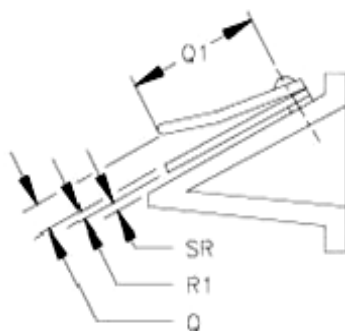
23. To measure the Q dimension, lightly depress the reed against the reed block. Next, measure between the top of the reed and the bottom edge of the reed stop. NOTE: Do not remove the shim from under the reed.
24. In order to compensate for the removal of the “bulge” from gear cases, Inspectors should add an extra 0.275 inches to the template to properly measure a gear case without the “bulge”.
25. It is permissible to use non-OEM crank pins and exhaust stacks. (The inspector may compare to new).
26. The water inlet hole(s) may be repaired with weld or plastic compounds. It is permissible to create a groove from the forward side entrance of the original hole location thru the leading edge of the exhaust snout. The lowest point of the water inlet hole(s) and groove may not be more than 1.500” below the bottom of the cavitation plate. The original contour of the exhaust snout must be maintained. This is permissible on all approved Yamato engines. (See photos in this manual & the instruction guide on the resource page of the APBA website).
26. It is legal to re-machine squish band area to match Mod rule angle  $15^{\circ} \pm 2^{\circ}$ ,  $2.350 \pm 0.015$ . No changes may be made to the combustion chamber. There must be a visible ledge surrounding the squish band.
27. Any aftermarket 14:16 straight cut gears may be used on the Y-80.
28. Any ignition coil may be used on the Y-80 and the mounting may be altered to accommodate the coil. It is permissible to replace the points with an electronic point replacement module, such as the Nova II module.
29. The volume of the combustion chamber will be measured with all the spark plugs and bushings removed without removing the cylinder head from the engine.
30. All Yamato engines must have one complete gasket behind the carburetor.

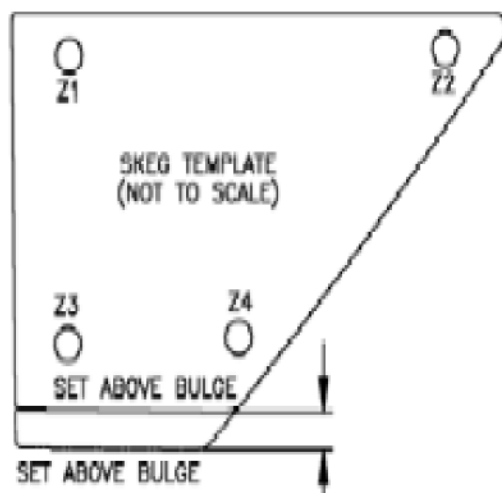
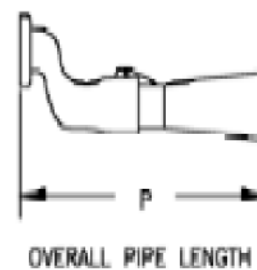
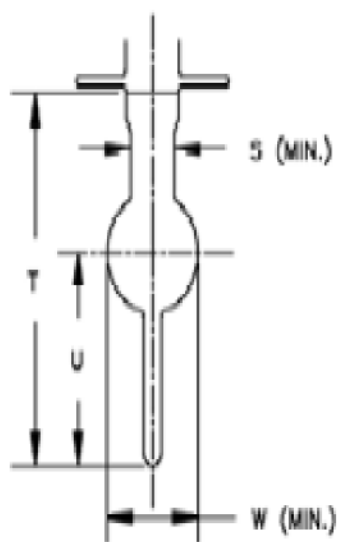
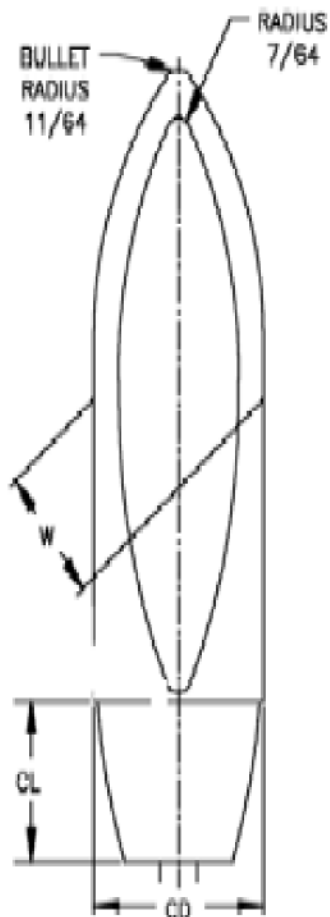
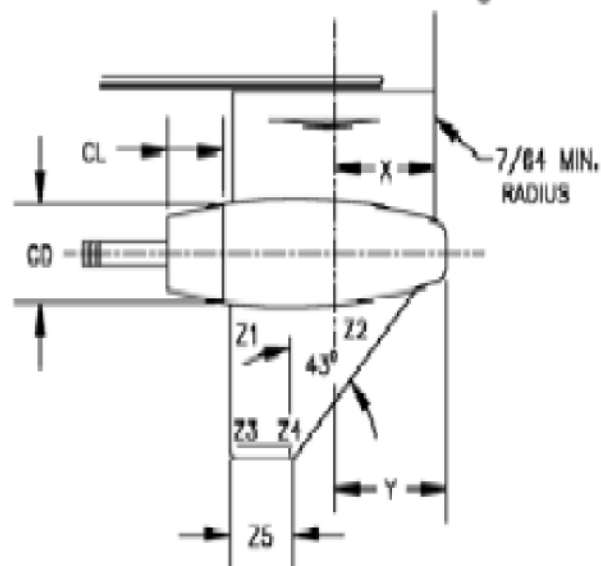
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Engine Model		Yamato		80		
POWERHEAD SPECIFICATIONS	Group	Ref. #	Item	Dimension	Units	Definition
	General Specs		Number of Cylinders	2		
			Engine Displacement	20		The Volume of all cylinders excluding the combustions chamber
			Minimum CC	14mm 18 18mm 18.5		Volume of each Cylinder at T.D.C. filled to top of spark plug hole
		M	Stroke	2.279 – 2.288		Distance the crank moves in 180° of rotation. Or the distance the piston moves
			Flywheel Weight	2.86 min	Lbs.	
			Standard bore .015 over	2.360 2.375		
	Cylinder Bore Diameter	J	Max Size	2.387	In	Maximum bore size including piston clearance
	Rods	K	Rod Length	4.204 – 4.221	In	Length of the rod from center of crank pin hole to center of wrist pin hole
			Weight	min	g	
	Piston		Piston Weight	min	g	
		KN	Rod Piston Length	5.496 – 5.527		
		L	Piston Height (minus crown)	2.322 – 2.402	In	
	Piston Rings		Number per Piston	2		
		Upper	Design	Rectangular		
		Lower		Rectangular		
		Upper	Thickness		In	
		Lower			In	
	Ports		Number of Exhaust			
			Number of Transfer			
		D	Height of Transfer	1.800 – 1.830	In	
		D1	Height of Transfer	1.840 – 1.875	In	
		E	Height of Exhaust	1.420 – 1.460	In	
	Block	C	Cylinder Height	3.885 – 3.906	In	
		F	Gasket	0.010 – 0.020	In	
		A	Crankcase Height	5.980 – 6.024	In	
		B		2.752 – 2.760	In	
		G	Head Gasket	0.016 – 0.040		
	Reed Block		# of Holes	8	In	

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			Hole Size	0.512 x 1.142	In	
		R1	Reed Thickness	0.012 ±0.002		
		SR	Shim Thickness	0.006 – 0.009		
		Q	Reed Stop Heights	0.281 max	In	See item 32
		Q1	Reed Stop Radius	1.350 – 1.420	In	
Carb	Carburetor Mikuni BV-36		Venturi Diameter	0.984 ±0.015	In	
			Butterfly Thickness	0.058 ±0.005	In	
Tower	Exhaust	P	Meg Length	10.625 ±0.062		
		P4	Meg. Small Diameter	1.614 ±0.050		
		P5	Meg Large Diameter	2.598 ±0.050		
		P2		4.724 ±0.050		
			Housing Relief Holes	0.788 – 0.850		
			Water Inlet Holes			**see rule #26 above
Gear case			Gear Ratio	14:16		Straight cut
	Tower Length	O		18.464 – 18.622		
		S		1.195 min		
		T		8.465 ±0.100		
		U		4.724 ±0.100		
		V		11.340 max		
		W		2.300 min		
		X		2.874 - 3.031		
		Y		3.267 – 3.425		
		Z1		0.185 min		
		Z2		0.185 min		
		Z3		0.130 min		
		Z4		0.130 min		
		Z5		1.969 ±0.050		
		CL		1.772 max		
		CD		2.150 min		
		1	Oil Seal	25 x 40		
		2	Needle	30 x 30		
		3	Needle	28 x 35		
		4	Ball	25 x 55		
		5	Oil Seal	25 x 38		
		6	Needle	28 x 35		
		7	Needle	15 x 20		
		8	Oil Seal	16 x 30		
		9	Ball	15 x 35		
		10	Needle	17 x 24		
		11	Ball	15 x 35		
		12	Needle	17 x 30		
		13	Oil Seal	16 x 30		





## MERCURY 44XS (D CLASS)

### Mercury / Mariner 44XS Specifications

NOTE: It is the intention of the manufacturer and the SORC that the 44XS engine to be raced as received from the manufacturer, without modifications.

1. No modifications of any kind, including grinding, polishing, machining, shot peening, bead blasting, etc. will be allowed on any engine or drive components unless otherwise noted in this section. No material may be added or removed from any engine or drive components unless otherwise noted in this section.
2. The engine must retain its original factory color. The engine must display manufacturer's decals. The cylinder block must retain the original factory finish.
3. It is permissible to add two louvers to the top of the cowl with the opening facing aft. The front cowling cover must remain in position as manufactured.
4. Phillips head fasteners may be replaced with hex head screws. Throttle butterfly screws, connecting rod fasteners and gear case mounting studs and nuts must be factory original.
5. Any make of seals, bearings, fuel line or thrust brackets may be used provided other parts are not altered to accommodate them. It is permissible to use a pressure regulator in the fuel system.
6. It is not permissible to machine off the mating surfaces of the split crankcase. These surfaces must retain their original finish.
7. The main bearing bores in the crankcase may not be bored to accept oversize bearings or fitted with bushings. The outlet water dump tube restrictor must be in place.
8. Legal flywheels for the 44XS engine are P/N 249-6080A27 and flywheels from Mercury / Mariner service motors. It is permissible to assemble 44XS components and SST 120 components as long as all 44XS specs are met. It is permissible to balance the 44XS flywheel. The addition or removal of material from any flywheel by drilling or any other method for any other reason is prohibited. It is not permissible to cut down service flywheels.
9. Honing of the cylinder bores and connecting rod journal bores is permitted.
10. It is permissible to re-sleeve the cylinder block provided that 44XS specifications are maintained.
11. Only pistons and piston rings manufactured by Mercury/Mariner specifically for this engine are allowed.

Legal parts for three-ring pistons are:

- Pistons:
  - P/N 743-5172A6 (standard)
  - P/N 743-3366A2 (0.015 oversize)
  - P/N 743-7716A2 (.030 oversize)
- Rings:
  - P/N 39-27841A12 (standard)
  - P/N 39-28616A12 (0.015 oversize)
  - P/N 39-89822A12 (0.030 oversize)

Legal parts for two ring pistons are:

- Pistons:
  - P/N 780-9229A7 (standard)
  - P/N 780-9229A10 (0.015 oversize)
  - P/N 780-9229A11 (.030 oversize)
- Rings:
  - P/N 39-18653A12 (standard)



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- P/N 3918653A1 (0.015 oversize)
- P/N 39-18653A2 (0.030) oversize

It is permissible to “collapse” the bottom ring on the older, three-ring pistons if these are used.

12. Mercury / Mariner stock fiber reeds are allowed (P/N 34-16684). It is also permissible to use reeds manufactured by Boyesen (part number 16684).

13. Only one engine cooling water outlet may be used. It may be at either the top of the block or the rear of the block. The stock threaded holes must be used. No holes or fittings may be enlarged. No other modifications of any kind may be made to the water cooling system.

14. There is one legal drive shaft housing for the 44XS engine. It is the “short” housing manufactured in 1986 and later. The part number is 3501-9544A12.

15. It is permissible to use service cylinder block/case assemblies provided that, with the exception of the fuel pump mounting bosses that are cast into the front of the case, they are of the same configuration as Mercury/Mariner 44XS cylinder block/case assemblies and provided that they meet all 44XS specifications. Service cylinder block/case assemblies need not have the fuel pump bosses on the front of the case, but must use the 44XS fuel pump. The 44XS fuel pump may mount on the cast bosses on the front of the case or may be mounted on another part of the engine. If the fuel pump is not mounted on the case bosses on the case, the case may be drilled and tapped to provide an impulse line for the fuel pump. The service block must accept the 44XS upper end cap without modification to the end cap, block, or case. The intent of this rule is to allow only service cylinder block/case assemblies that were produced during the same era as 44XS cylinder block/case assemblies sold by Mercury Performance Products.

NOTE: Currently produced service blocks do not meet 44XS specifications. The appropriate range of blocks begins in 1976 and ends in 1992.) Other legal cylinder blocks are those sold by Mercury Performance Products.

Their serial numbers are:

- OB135471 through OB135570
- OB290165 through OB290184
- OC276360 through OC276379
- OB135486 through OB135545
- OC175690 through OC175699
- OD937373 through OD937379 (LONG BLOCKS)
- 89C200 through 89C209
- 90H400 through 90H409

It is permissible to use the late model 44XS cylinder block/case assemblies that do not have reed block locating bolts. It is permissible to fill the oil gear cavity and the oil pump drive shaft cavity in the crankcase of late model block/case assemblies.

16. The only legal Mercury/Mariner gear case for the 44XS engine is the large skeg gear case (P/N 1603-1148A1). The gear case may be unpainted or must be completely painted original factory color (tail cone need not be painted). The Mercury/Mariner gear case must meet the specifications shown on the attached page and on the Mercury Inspection Template (P/N 91-17708). NOTE: This template must be checked for dimensional accuracy before each use.

It is permissible to use gears manufactured by Phil McDaniel as legal replacement parts for Mercury/Mariner gears. The only legal gear ratio is 14:14. The BASS model 100T gear case is legal; however no modifications are permitted to any 44XS components to facilitate its installation. Two-piece drive shaft's are permitted with either the Mercury/Mariner or the Bass gear case.

17. The one piece tail cone manufactured by Lee Tietze is a legal replacement for the Mercury two piece design.

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18. Propeller shafts made by Steckbauer Speedmaster Service are legal replacements for the OEM propeller shaft.
19. The clamp bracket screw handles may be repaired or replaced with an alternate handle provided no modifications are required on the bracket or drive shaft housing. Mercury's transom bracket kit (P/N 1497-8794A5) is a legal replacement part.
20. The standard steering arms may be replaced provided the replacement arms have at least the same minimum cross section dimensions (0.38" vertical X 1.00" horizontal). The material may be either steel or aluminum. The co-pilot may be modified to increase the tension as long as no modifications are made to the tower housing assembly.
21.
  22. The lower tower housing swivel pin bushing may be replaced with any type of bushing, provided no modifications are made to the tower housing, pin or clamp bracket assembly.
  23. The upper tower housing swivel pin tab washer may be replaced with any type of washer, provided no modifications are made to the tower housing, pin or clamp bracket assembly.
24. The crankcase and cylinder block is furnished by the manufacturer as a matched set. However, it is permissible to mismatch these components. The crankcase to cylinder block dowel pins may be removed.
  25. Any Mercury or RAPAIR ignition part which is a direct replacement part for O.E.M. 44XS ignition components may be used on Mercury/Mariner 44XS engines.
  26. It is permissible to use an electric starter, as provided by the motor manufacturer; the starter is limited to a 12 volt DC system.
  27. It is permissible to lap reed block surfaces.
  28. The balance tube must remain in place. The balance tube, balance tube elbows, and the holes in the block where the elbows mount must not be plugged.
  29. There are two legal exhaust baffle plates.

The Mercury part numbers are:

    - 90421
    - 90421-1
30. There are two legal transfer port covers.

The Mercury part numbers are:

  - 87553A1
  - 18827A1
31. Internal machined surfaces may be re-machined so long as minimum and maximum dimensions are met. Cast or forged surfaces must remain as cast with no alterations, bead blasting, media blasting or polishing.

NOTE: It is not permissible to re-machine surfaces that do not have specific dimensions.
32. It is permissible to clean reed stops with abrasives or media blasting as long as all original dimensions and contours are maintained. The purpose of this rule is to allow rust removal.
33. It is permissible to replace the 44XS throttle linkage with any throttle linkage similar to the 44XS throttle linkage.
34. It is permissible to use any Mercury connecting rod that meets current 44XS specifications and is compatible with 44XS pistons and crankshaft. Only connecting rods that can be used without modification to the rod, piston, or crankshaft are allowed.
35. It is permissible to use any Walboro WMA series carburetor that meets current 44XS specifications. Service carburetors must use full butterflies.

NOTE: This also requires a change in the table that provides Mercury/Mariner 44XS carburetor specifications. The relevant line should state: "Top/bottom: Any Walboro No. WMA series carburetor. (In the event that the ears are broken off a Walboror WMA series carburetor, the carburetor may be repaired by welding)".

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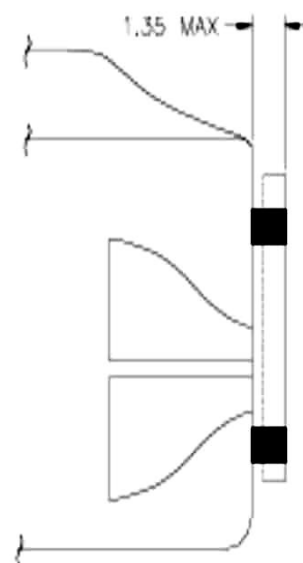
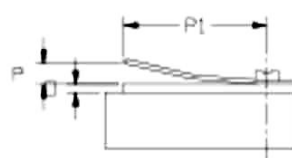
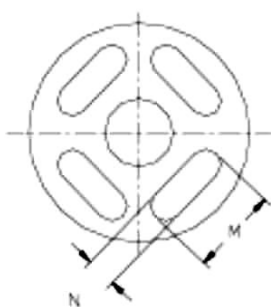
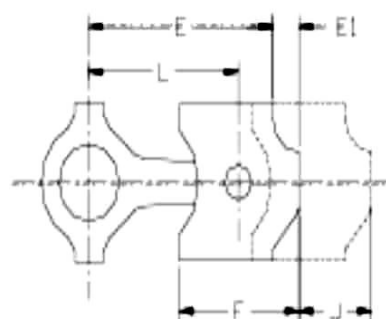
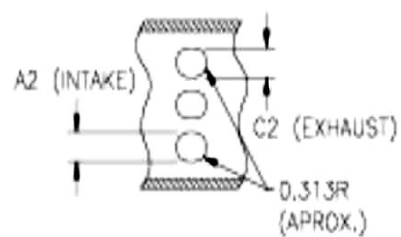
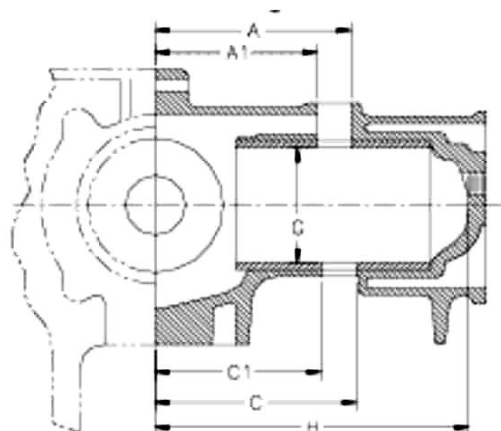
36. It is permissible to use butterflies from Walboro WMA series service carburetors as replacement butterflies for 44XS full butterflies. When butterflies from service carburetors are used, the idle holes in the butterflies must be soldered shut. These butterflies may be lapped, but must retain a minimum thickness of .025".
37. Drive shaft housing manufactured by IAI Performance are legal replacement parts for the Mercury/Mariner 44XS engines.
38. It is legal to modify current (new) 44 carbs to meet technical specs of the old carbs.
39. Any starter housing manufactured by Mercury Marine that bolts to the cylinder block/case assembly with no modification to the starter housing or cylinder block/case assembly may be used.
40. Any straight cut 14:14 gears for a Mercury 44XS may be used.
41. Aftermarket pistons manufactured by "Vertex" and "Sierra" in OEM sizes are legal replacement parts for the 44XS Mercury.
42. It is permissible to chamfer/break the edge of the ports.

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Engine Model		Mercury		44XS			
		Mariner		44XS			
POWERHEAD SPECIFICATIONS	Group	Ref. #	Item	Dimension	Units	Definition	
	General Specs		Number of Cylinders	4			
			Engine Displacement	43.9	In <sup>3</sup>	The Volume of all cylinders excluding the combustions chamber	
			Minimum CC	23	Cm <sup>3</sup>	Volume of each Cylinder at T.D.C. filled to top of spark plug hole	
		J	Stroke	2.125 ±0.010	In	Distance the crank moves in 180° of rotation. Or the distance the piston moves	
			Flywheel Weight	6 lbs 4 oz			
			Flywheel Diameter				
	Cylinder Bore Diameter	G	Standard	2.563 ±0.005	In	This is a Reference only Dimension	
			0.010 OS (Ten Over)		In	This is a Reference only Dimension	
			0.030 OS (Thirty Over)		In	This is a Reference only Dimension	
			Max Size	2.598	In	Max bore size including piston clearance	
	Rods	L	Rod Length	3.625 ±0.005	In	Length of the rod from center of crank pin hole to center of wrist pin hole	
			Weight	6.7 oz min		With bearings and washers	
	Piston	E	Rod Piston Length	4.595 ±0.015	In	Length of piston and rod from crank pin center to the top edge of the top ring	
			Weight	10.2 oz max			
		F	Piston Height	2.756 ±0.031	In	Piston Height measured to the top of the crown	
		E1	Crown Height	0.562 ±0.005	In	Measured from the top edge of the top ring to the top of the piston	
	Piston Rings		Number per Piston				
		Upper	Design				
		Lower					
		Upper	Thickness		In		
		Lower			In		
	Ports		Number of Exhaust	3			
			Number of Transfer	3			
		A	Height of Transfer upper	4.007 ±0.015	In		
		C	Height of Exhaust upper	4.221 ±0.015	In		
		A1	Height of Transfer Lower	3.382 +0.015/- 0.025	In		
		C1	Height of Exhaust Lower	3.596 +0.015/-0.025	In		

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		A2	Transfer Diameter	0.625 ±0.010	In	
		C2	Exhaust Diameter	0.625 ±0.010	In	
	Block	H	Combustion Chamber corner hgt.	6.468 ±0.010	In	
	Front Inlet Cover		Mounting Space Length	1.350 max	In	
	Reeds and Reed Plate		Reed Material		In	
		O	Reed Thickness	0.020 ±0.002	In	
		P	Reed Stop Heights	0.156 ±0.031	In	
		P1	Checking Distance	1.690 ±0.020	In	
					In	
		M	Port Length	1.300 ±0.015	In	
		N	Port Width	0.620 ±0.015	In	
Carb	Carburetor Top Walboro WMA6-1		Venturi Diameter	Main 1.000 ±0.010 Boost 0.250 ±0.005	In	
	Bottom Walboro WMA6-3		Bore Diameter	1.125 ±0.005	In	
Tower	Exhaust	D	Meg Length	6.000 ±0.250		
		D1		7.280 ±0.250		
		V		10.030 ±0.060		
Gear Case	Gear Case			Merc		
			Gear Ratio	14:14		
		Q		12.500 max		
		Y		n/a		
		R		2.300 min		
		S		1.120 min		
		W		2.095 min		
		X		n/a		
		X1		n/a		
		Z		n/a		
		1		6206TNC3		
		2		ROLLER 28&28		
		3		6206TNC3		
		4		25 needles		
		5		27 needles		
		6		Ball ND R-12		
		7		Roller GB-1112		
		8		Roller GB-1112		
		9		Ball 6005		
		10		Roller B-118		



## MERCURY 55H (D CLASS)

### Mercury 55H Specifications

1. Any 4 cylinder magneto used on a Mercury motor is legal.
2. Aluminum reed block 527-16191A1 is a legal replacement for bronze reed blocks. Any reed block is permissible which meets the specifications.
3. Any curved or straight port covers are permissible. Some have chamfered edges.
  - Pistons:
    - 726-1611A2 (std.)
    - 726-1612A2
      - (0.015 oversize)
    - 726-5052A2
      - (0.030 oversize)
4. The turning and balancing of pleasure engine flywheels to two lbs. weight minimum with the timing belt pulley on is permissible. It is not permissible to turn and balance the 55-H flywheel.
5. It is permissible to cut the flange off the top main bearing cap so a timing belt can be replaced without taking off the flywheel.
6. It shall be permissible to repair the magneto adapter housing.
7. It shall be permissible to use the old prop shaft which utilizes the C prop nut.
8. Any KA series carburetor can be used as long as the venturi stays at one inch and the throat diameter at one and one-eighth inches. Any needle and seat is legal. Thread change is not permissible.

The allowable Carter carburetors are:

  - N2150-S
  - N2537-S
9. All stock 4 cylinder Mercury blocks are allowed to be used for racing excluding padded blocks (larger pads than MARK 55). The front case may be milled out to 55-H specs so the Carter or Tillotson carburetors can be used. It is not permissible to port the cylinder block. It is permissible to mismatch cylinder block and case.
10. It is permissible to use the KG9H and MK40H tower housings.
11. It is illegal to use two fuel pumps.
12. It is illegal to run the short skeg gear case from the KG9H or MK40H unless the skeg is welded on to match the 55H skeg as closely as possible.
13. On small port fishing blocks only, add the following port width dimensions: the 5/8" round hole ports to be 0.625 +/-0.020 width only; on the 9/16" oval hole ports to be 0.563 +/-0.020 on width only. Evidence of the ridge between the two milled holes must be present.
14. It is legal to machine the carburetor opening of small reed blocks to match the 55H specs.
15. Replacement gear cases are manufactured with the leading edge of the skeg sharpened.
16. No polishing or balancing is permitted.
17. The 35SS tower housing is a legal replacement part for these engines.
18. The MK-40 small carburetor hole face is legal.
19. It is permissible to use an electric starter, as provided by the motor manufacturer and is limited to a 12 volt DC system.
20. Any make of piston ring, seal, and bearing or magneto parts may be used provided other parts are not altered to accommodate them.
21. Any type brackets for throttle spark, steering controls and tachometer will be permitted.

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22. Any standard hose fittings may be used, but there shall be no alteration of the threads in the carburetor or fuel pump.
23. Solid swivel bushings of any make or manufacture may be used on the swivel pins of all motors.
24. Throttle disks of any manufacture may be used, but must be of sufficient diameter to match the carburetor throats in which they are used and must be of .025" minimum thickness. Any needle valve may be used in any carburetor provided that no change is made in the threaded section or the pointed end of the needle valve in order to use it. Crossbars may be added to the exterior end of needle valves to facilitate adjustment.
25. The screw fastening the carburetor butterfly to the throttle shaft must be furnished by the manufacturer. With that exception, any make or type of nut, bolt, screw, washer, or stud may be used anywhere in the engine. Gaskets of any make or manufacture, including homemade, are permitted providing they are equivalent to the original in shape and thickness.
26. Oversize pistons furnished by the manufacturer of the motor may be used in the model for which they are furnished. The bore of the engine may be enlarged by the amount that the oversize piston differs from the standard piston. An additional total 0.005 inch enlargement of the bore will be allowed due to wear or re-machining errors, or measuring tolerances. Under no circumstances will the bore be enlarged more than 0.035 inches over the original dimension. It is not legal to coat or plate cylinder walls with chromium or any other material.
27. It shall be permissible to use studs of larger than standard diameter for the purpose of joining the lower unit to the exhaust housing. Also, modification of the exhaust housing to accommodate the larger studs is permissible.
28. Exhaust relief holes may not be added or enlarged. Exhaust plates must be in place and properly secured as designed.
29. It is not permissible to grind the reed block or to re-pin it to line it up with the crankcase.
30. It is permissible to re-sleeve any block provided engine specifications are maintained.
31. To repair stripped spark plug holes, helicoils, oversize holes, or bushings are permissible.
32. Tail cones may be made for replacement of gear cases which require re-bore and rethreading providing outside dimensions meet those of originals. There is no minimum number of threads for tail cones. Lock screws are allowed.
33. Knurling of pistons is not permitted.
34. Separate fuel tanks may be installed in the hull or on the outside of the transom or on the motor or steering bar so long as mounted in a safe manner. There shall be no restrictions on design or manufacture of such tanks other than for safety. Auxiliary fuel lines and connections may be added as needed. A filter or pressure regulator may be added to any fuel line or fuel tank. Electric fuel pumps may not be used.
35. No drilling or modifications of any type, except repair, may be done on the water jackets to change the cooling pattern.
36. It is permissible to add an additional needle bearing or to use a roller-type bearing in the Mercury tail cone.
37. Tolerance on reed block port opening dimensions is +/-0.010.
38. Omit all – "minus" dimension tolerances on the "Crankcase Carb Opening Machining Detail" drawing.

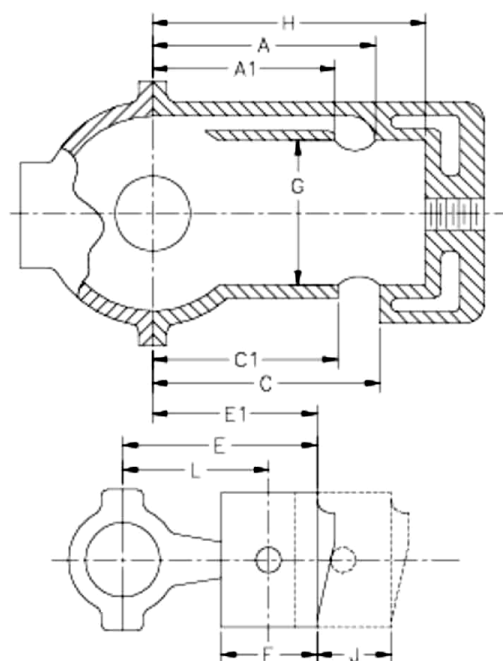
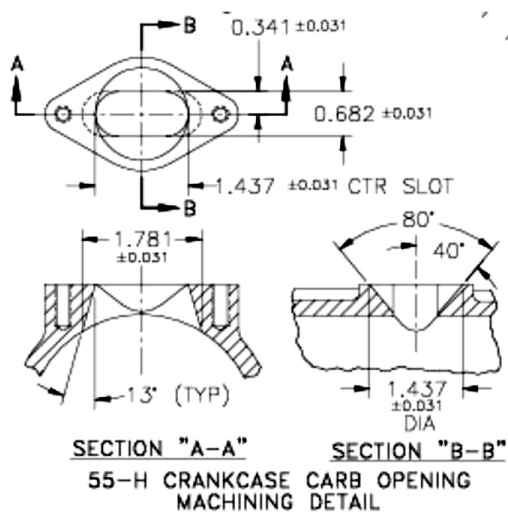
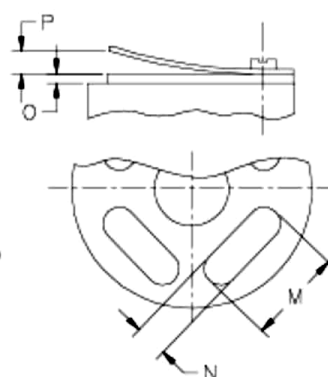
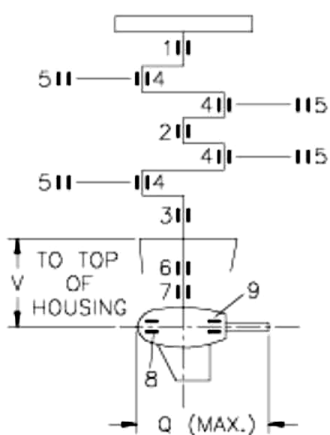
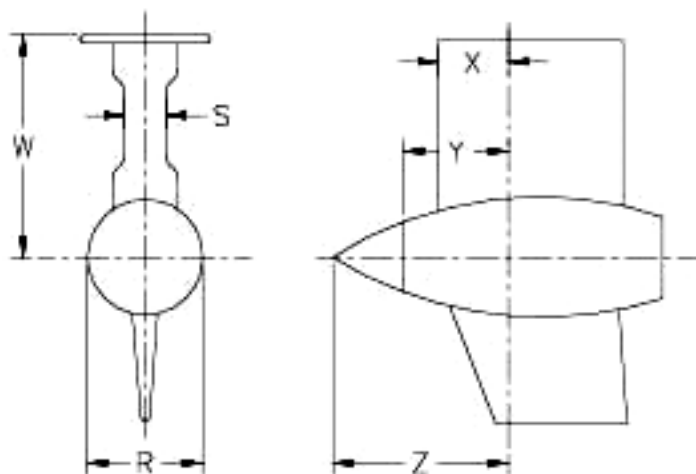


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Engine Model		Mercury		55H			
		Mercury		55			
POWERHEAD SPECIFICATIONS	Group	Ref. #	Item	Dimension	Units	Definition	
	General Specs		Number of Cylinders	4			
			Engine Displacement	39.6	In <sup>3</sup>	The Volume of all cylinders excluding the combustions chamber	
			Minimum CC	20.5	Cm <sup>3</sup>	Volume of each Cylinder at T.D.C. filled to top of spark plug hole	
		J	Stroke	2.125 ±0.004	In	Distance the crank moves in 180° of rotation. Or the distance the piston moves	
			Flywheel Weight	1 lbs 12 oz			
			Flywheel Diameter				
	Cylinder Bore Diameter	G	Standard	2.441 ±0.002	In	This is a Reference only Dimension	
			Max Size	2.458	In	Maximum bore size including piston clearance	
	Rods	L	Rod Length	3.719 ±0.006	In	Length of the rod from center of crank pin hole to center of wrist pin hole	
			Weight	6.75 oz min		With both bearings and washers	
	Piston	E	Rod Piston Length	4.412 ±0.018	In	Length of piston and rod from crank pin center to the top edge of the top ring	
			Weight	7.5 oz min		With rings, wrist pin, and clips	
		F	Piston Height (minus Crown)	2.187 ±0.031	In	Piston Height measured to the top edge of the top ring	
		E1	Piston Position at BDC	3.534 ±0.015	In		
	Piston Rings		Number per Piston				
		Upper	Design				
		Lower					
		Upper	Thickness		In		
		Lower			In		
	Ports		Number of Exhaust				
			Number of Transfer Upper				
		A	Height of Transfer	55H- 4.076 ±0.010 55- 4.007 ±0.010	In		
		C	Height of Exhaust Upper	55H- 4.281 ±0.010 55- 4.221 ±0.010	In		
		A1	Transfer Lower Height	3.329 ±0.010	In		
		C1	Exhaust Lower height	3.543 ±0.010	In		
	Block	H	Cylinder Height	6.307 +0.005/ -0.010	In		

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		O	Reed Thickness	0.012	In	
		P	Reed Stop Heights	0.156 ±0.031	In	
		M	Port Length	1.000 or 1.219 ±0.033	In	
		N	Port Width	0.625 ±0.033	In	
Carb	Carburetor Tillotson		Venturi Diameter	KA 1.000 ±0.015 Carter 0.937	In	
			Bore Diameter	KA 1.125 ±0.015 Carter 1.312	In	
Tower	Exhaust	D	Housing	Cast Snout		
	Drive Shaft Housing	V		55H- 17.062 ±0.062 55- 12.062 ±0.062		
Gear Case	Gear Case			Merc		
			Gear Ratio	14:14		
		Q		12.500 max		
		R		2.375 ±0.031		
		S		1.093 ±0.031		
		W		4.400 min		
		X		3.062 min		
		Y		3.312 min		
		Z		5.250 min		
		1		206K		
		2		ROLLER		



## TOHATSU RAM50 (D CLASS)

### Tohatsu RAM50 MOTOR SPECIFICATIONS (D CLASS)

The Tohatsu RAM50 consists of a factory stock power head of type found on Tohatsu M50D or Nissan NS50D series two stroke carbureted motors produced by Tohatsu or the Nissan Company under license to Tohatsu since approximately 1997. The power head is mounted on a Bass Machines tower with an internally provided water pump. The gear foot is a Bass Machines unit designed to drive the water pump with a 16:17 or a 17:17 gear ratio.

1. The engine is exempt under 40CFR 91.704 from emissions standards and related requirements. A placard stating this is affixed to the bottom cowling. The placard **MUST** remain in place. The top cowling **MUST** retain the original appearance. As a minimum, the top cowling must display the decals as found on Tohatsu M50D series engine top cowls.
2. Transom attachment methods are optional. Any clamping arrangement may be used from a 40cu in or larger motor.
3. Any throttle linkage and choke system is permissible.
4. Any fuel filter or fuel line may be used as long as it fits into the pump fitting securely.
5. The use of any cowling restraints may be used.
6. Tohatsu head gaskets **MUST** be used.
7. As long as all dimensions are met, honing of cylinders and rods are permissible.
8. It is permissible to re-sleeve the cylinder block provided that Tohatsu specifications are maintained.
9. The bottom engine cowling may have two 5/8 in. holes drilled at the rear to facilitate head bolt removal.
10. Installation of cowling plugs in the bottom cowl is optional.
11. Any bolt may be used to secure the fuel pump.
12. The use of any steering system is permissible.
13. Fiber reeds of single petal or dual petal configuration are allowed. Installation of a reed stop is optional. No modification of the reed block itself is permitted.
14. Shaping the profile of the gear foot is acceptable as long as all specifications are maintained.
15. The addition of grease fittings to lubricate the pivot pin is permissible.
16. Crank shafts may have the pins welded or fused to prevent the shaft from growing in length or twisting.
17. The ground system for ignition coils may be modified. Ground wires may be attached to the bolts on the exhaust cover.
18. The spark plug caps may be replaced.
19. The starter rewind housing may have a window cut into it to facilitate the checking of engine timing.
20. The link connecting the throttle cam to the timing plate may be modified to set timing.
21. Carburetor jets may be changed or resized.
22. It is permissible to lap the surface of the reed block which attaches to the intake manifold to achieve flatness.
23. It is permissible to use an electric starter as provided by the manufacturer. Removal of the manual rewind starter and pulley is optional when an electric starter is installed, as long as the handle opening is sealed closed on manual start top cowls.
24. The cylinder head may be surfaced to remove unevenness. The amount removed shall **NOT** remove the squish-band on the center cylinder. No material may be added and the cylinder chamber **MUST NOT** be reshaped.
25. No tuner pipe is permissible for use.
26. The only legal gear ratios permitted are 16:17 & 17:17.
27. The new tower housing has been approved for use in the 2014 season and beyond.

## **2019 Stock Outboard Technical Manual**

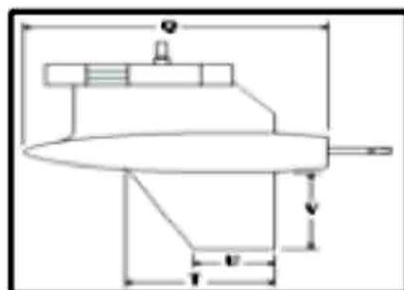
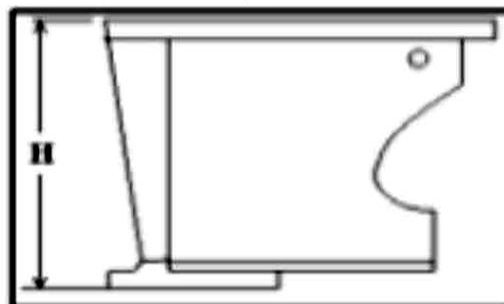
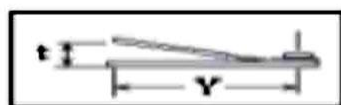
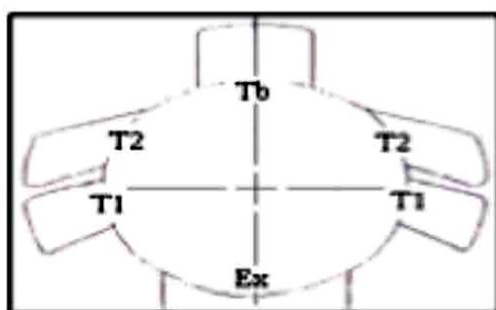
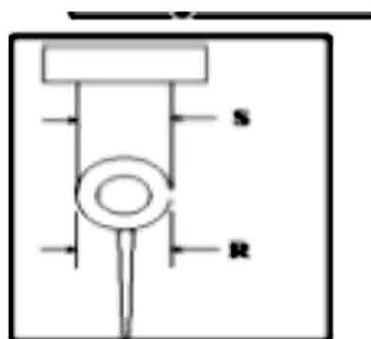
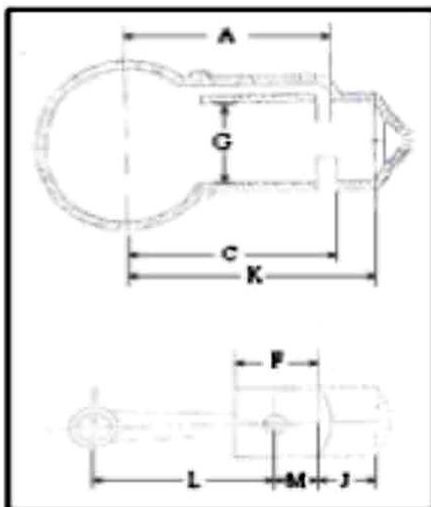
28. There is no longer a head gasket thickness measurement. Although, you must have one removable Tohatsu or aftermarket head gasket.
29. The use of a copilot tension device to adjust tension in the tower is permitted.
30. Removal of the thermostat and the anti-corrosion anode are permitted.

## 2019 Stock Outboard Technical Manual

Engine Model		RAM50		M50			
Group		Ref. #	Item	Dimension	Units	Definition	
POWERHEAD SPECIFICATIONS	General Specs		Number of Cylinders	3			
			Engine Displacement	42.6	In <sup>3</sup>	The Volume of all cylinders excluding the combustions chamber	
			Minimum CC	25 for #1 & #3 26 for #2	Cm <sup>3</sup>	Volume of each Cylinder at T.D.C. filled to top of spark plug hole	
		J	Stroke	2.520 ± 0.002	In	Distance the crank moves in 180° of rotation. Or the distance the piston moves	
			Flywheel Weight	8.818 lbs. Minimum			
			Flywheel Diameter				
	Cylinder Bore Diameter	G	Standard	2.677 ±0.005	In	This is a Reference only Dimension	
			Max Size	2.707	In	Maximum bore size including piston clearance	
	Rods	L	Rod Length	4.587 ±0.007	In	Length of the rod from center of crank pin hole to center of wrist pin hole	
	Piston	F	Piston Height (minus Crown)	2.638 ±0.018	In	Piston Height measured to the top edge of the top ring	
		M	Wrist Pin To Top Ring	1.260 ±0.008	In	Measured from the top edge of the top ring to the center of the wrist pin	
	Piston Rings		Number per Piston	2			
		Upper	Design				
		Lower					
		Upper	Thickness	0.079	In		
		Lower		0.0776 ± 0.0015	In		
	Ports		Number of Exhaust				
			Number of Transfer				
		A	Height of Transfer	5.000 ±0.039	In		
		C	Height of Exhaust	5.492 ±0.039	In		
		EX	EX Width	1.575 ±0.059	In		
		HE	Finger Height	0.413 ±0.059			
		T	Finger Width	0.118 ±0.020			
			Transfer Width	T1- 0.610 ±0.059 T2- 0.827 ±0.059 TB- 0.787 ±0.059	In		
	Block	K	Cylinder Height	7.087 ±0.008	In		
	Head		Head Gasket	Removable	In	Must have one, Tohatsu or aftermarket	
	Reeds and Reed Plate		Reed Material	Plastic or Steel	In		
			Steel Reed Thickness	0.008 ±0.001	In		

## 2019 Stock Outboard Technical Manual

		Y	Reed Stop Length	1.390 ±0.020		
		T	Steel Reeds, Reed Stop Heights	0.396 ±0.028	In	
			Port Length	1.181 ±0.020	In	
			Port Width	0.591 ±0.020	In	
Carb	Carburetor		Venturi Diameter	1.024 ±0.020	In	
			Throttle Housing	1.260 ±0.028	In	
Gear Case	Gear Case			Bass		
			Gear Ratio	16:17 or 17:17		
		Q		11.700 min		
		Y		3.750 min		
		R		1.950 min		
		S		1.950 min		
		X		3.000 min		
		T		5.000 min		
			Prop Shaft Diameter	11/16		
			Shear Pin Diameter	0.250		





## **SUPER THUNDERBOLT (D CLASS)**

### **Mercury “Super Thunderbolt”**

1. Blocks must be pre-1968 44 cu. in. service blocks that have “Super Thunderbolt” cast in them. 1968 and newer type blocks with offset spark plug holes are not be allowed.
2. Parts from the “Super Thunderbolt” motors allowed herein may be interchanged. Earlier model small flywheel taper crankshafts are not allowed.
3. The Fairbanks Morse or Mercury 4-cylinder, belt drive magneto ignitions, are the only legal ignition systems.
4. It is permissible to cut the flange off the top main bearing cap so a timing belt can be replaced without taking off the flywheel.
5. Any KA series carburetor may be used as long as the venturi stays at one inch and the throat diameter stays at one and one-eighth inches. Any inlet needle and seat, high speed adjusting needle and seat or fixed jets are legal. Thread change is not permissible.
6. Full carburetor butterflies are required. They may be of any manufacture, but must be of sufficient diameter to match the carburetor throats in which they are used.
7. The screw fastening the carburetor butterfly to the throttle shaft must be as furnished by the manufacturer. With that exception, any make or type of nut, bolt, screw, washer, or stud may be used anywhere in the engine. Gaskets of any make of manufacture, including homemade gaskets, are permitted providing they are equivalent to the original in shape and thickness.
8. Replacement flexible fuel lines may be installed on any motor. Any standard hose fittings may be used, but there shall be no alteration of the threads in the carburetor or fuel pump.
9. The original type of fuel pump and mounting location must be used. It is permissible to use either the top inlet or side inlet type fuel pump. It illegal to use two fuel pumps.
10. A steering bar mounted fuel tank is permitted as long as mounted in a safe manner. A filter or pressure regulator may be added to any fuel line or fuel tank. Electric fuel pumps may not be used.
11. The front case on motors with small carburetor openings may be milled out to 55-H specs and the studs reset so the KA carburetor can be used.
12. It is permissible to mismatch cylinder block and case.
13. Any OEM aluminum or brass/bronze reed block that meets specifications is permissible. It is not permissible to enlarge the reed openings of the brass/bronze or small aluminum reed cages. (See Specification Sheet for reed block opening dimensions and tolerances.) Boyesen reeds, part #16684 are allowed. Only the long type reed stops are permissible on the large (1.300” reed opening) 44XS type aluminum reed cage. Any OEM reed stop is permissible on other reed cage types.
14. It is legal to machine the carburetor opening of small reed blocks to match the 55H specification. It is not permissible to grind the reed block or to re-pin it to line it up with the crankcase.
15. Any make of piston ring, seal, and bearing or magneto parts may be used provided other parts are not altered to accommodate them.
16. Any type brackets for throttle, spark advance, steering controls and tachometer will be permitted.
17. Rewind starter and full OEM cowlings are required. This includes lower cowl “pan”, rewind starter top cowl of either 1959 and newer “square top” or 1958 “round top” type, and any front plate appropriate to the top cowl type and wraparound. Holes may be made to accommodate controls or priming only. The water tube snout may be removed from the lower OEM cowl for fitting the cowl to the Bass drive shaft housing.
18. Any style Mercury (OEM) 44 standard or oversize pistons may be used. Three ring or two ring pistons are allowed. However, only three ring pistons may be used with small wrist pin connecting rods. The bore of the

## 2019 Stock Outboard Technical Manual

engine may be enlarged by the amount that the oversize piston differs from the standard piston. An additional total 0.005 inch enlargement of the bore will be allowed due to wear or re-machining errors, or measuring tolerances. +0.030" will be the largest oversize piston allowed. Knurling of pistons is not permitted. It is not legal to coat or plate pistons or cylinder walls with chromium or any other material.

19. It is permissible to re-sleeve any block provided engine manufacturer's specifications are maintained.
20. No drilling or modifications of any type, except repair, may be done on the water jackets to change the cooling pattern.
21. Motors with 1/4" exhaust plate bolts may be refitted with 5/16" bolts. Exhaust plates with 1/4" mounting holes maybe enlarged to accommodate 5/16" bolts. Later model exhaust plates with a "splitter" between cylinder pairs 1&2 and 3&4, are not allowed.
22. Later style "fractured" large wristpin rods, that meet specifications are allowed.

### Lower unit option #1

1. Mercury 55H or 35SS drive shaft housing with the 55H or 44XS gear case assembly, 14:14 gear ratio.
2. Solid swivel bushings of any make or manufacture may be used.
3. Multiple piece drive shafts of any manufacture may be used.
4. No exhaust tuners are allowed.
5. Exhaust relief holes may not be added or enlarged. Exhaust plates must be in place and properly secured as designed.
6. It is be permissible to use studs of larger than standard diameter for the purpose of joining the lower unit to the drive shaft housing. Also, drilling of the drive shaft housing to accommodate the larger studs is permissible.
7. Tail cones may be made for replacement, which require re-bore and rethreading of gear cases providing outside dimensions meet those of originals. There is no minimum number of threads for tail cones. Lock screws are allowed.

### Lower unit option #2

1. Bass enclosed exhaust housing with the Bass model 100U gear case assembly and water pump kit, 17:17 gear ratio only.
2. A 3/4" thick adaptor plate of any manufacture may be used for mounting and to route cooling water to inlet location on block.
3. External water lines are not allowed.
4. Mercury Mark 55H type cast aluminum saddle and forged clamps must be used.
5. Multiple piece drive shafts of any manufacture may be used.
6. Exhaust relief holes may not be added.
7. No exhaust tuners are allowed.

SEE MERCURY / MARINER 44XS SPECIFICATIONS (D CLASS) and RAM50 Spec Sheet page for drawings.

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Engine Model		Super Thunderbolt				
Group		Ref. #	Item	Dimension	Units	Definition
POWERHEAD SPECIFICATIONS	General Specs		Number of Cylinders	4		
			Engine Displacement	43.9	In <sup>3</sup>	The Volume of all cylinders excluding the combustions chamber
			Minimum CC	22	Cm <sup>3</sup>	Volume of each Cylinder at T.D.C. filled to top of spark plug hole
		J	Stroke	2.125 ±0.004	In	Distance the crank moves in 180° of rotation. Or the distance the piston moves
			Flywheel Weight	5 lbs		With Timing Belt Pulley
			Flywheel Diameter			
	Cylinder Bore Diameter	G	Standard	2.565 ±0.003	In	This is a Reference only Dimension
			Max Size	2.602	In	Maximum bore size including piston clearance
	Piston	E	3 Ring Piston Weight	8.7 oz	In	With rings, wrist pin, and clips
			2 Ring Piston Weight	10.2		With rings, wrist pin, and clips
		F	Piston Height (minus Crown)	2.187 ±0.031	In	Piston Height measured to the top edge of the top ring
		E1	Deck Height	3.534 ±0.015	In	
	Piston Rings		Number per Piston			
		Upper	Design			
		Lower				
		Upper	Thickness		In	
		Lower			In	
	Ports		Number of Exhaust			
			Number of Transfer			
		A	Height of Transfer	4.007 ±0.010	In	3 round ports per cylinder
		C	Height of Exhaust	4.221 ±0.010	In	3 round ports per cylinder
		A1	Transfer Height	3.382 ±0.010	In	3 round ports per cylinder
		C1	Exhaust Height	3.596 ±0.010	In	3 round ports per cylinder
	Block	H	Combustion Chamber Corner Height	6.307 +0.005/ -0.010	In	
	Reed Block	O	Reed Thickness	Metal 0.012 ±0.001 Plastic 0.012 ±0.002	In	
		P, P1	Reed Stop Heights	0.156 ±0.031, Long: 1.690 ±0.020 Short: 1.438 ±0.010	In	

## 2019 Stock Outboard Technical Manual

		M	Port Length	1.300 ±0.015 Big Aluminum 1.000 or 1.219 ±0.033 Bass or Small Aluminum	In	
Carb	Carburetor Tillotson		Venturi Diameter	1.000 ±0.015	In	
			Bore Diameter	1.123 ±0.015	In	
Tower	Exhaust	D	Housing	Cast Snout Bass 7/8" max		
		V	Housing Height	55H/33SS 17.062 ±0.062 Bass 8.500 ±0.062		
		A	Bass Adapter	0.750 ±0.032		
Gear Case	Gear Case		Model	55H	44XS	Bass
			Gear Ratio	14:14	14:14	17:17
		Q		12.500 max	12.500 max	11.700 min
		R		2.375 ±0.031	2.300 min	1.950 min
		S		1.093 ±0.031	1.120 min	1.950 min
		T				5.000 min
		U				3.000 min
		V				3.750 min
		W		4.400 min	2.095 min	
		X		3.062 min		
		Y		3.312 min		
		Z		5.250 min		
		1		206K		
		2		ROLLERS		
		3		206K		
		4		25 rollers		
		5		22 rollers		
				55H	44XS	Bass
		6		5-8K	BALL 12-R	Roller
		7		Roller GB-1112		Ball
		8		Roller GB-1112		n/a
		9		9105K	6005	Ball & Roller