



## Briggs & Stratton Animal – TECH MANUAL

**Version 1.6**

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### Section 1 General Rules

1. Only stock Briggs & Stratton Animal # 124332-8201 and 124332-8203 - 01 engine will be allowed in this class. All parts will be stock unaltered Briggs & Stratton Animal parts specifically made for this engine by Briggs and Stratton. No aftermarket parts to be used unless specified in this tech manual. No deburring, machining, honing, grinding, polishing, sanding, media blasting, etc,etc. No addition or subtraction of material in any form or matter.  
**Unless it says you can do it you cannot do it.**
2. Direct Drive: Clutches are not allowed.
3. Unless otherwise specifically required or allowed by this Tech manual no machining or alterations of any kind will be allowed to the Animal engine or replacement parts to be used in any Animal engine for USAC unless specifically stated in these rules. **ALL PARTS ARE SUBJECT TO COMPARISON WITH A KNOWN STOCK PART.**
4. Modifications or machining of any parts in order to bring them to stated minimum / maximum specs, (or for any reason). “Blueprinting” is not legal unless as stated in this tech manual.
5. Fuel: Gasoline only, no additives. Tech procedure is per USAC Rule Book.
6. ALL PERTINENT PENALTIES WILL APPLY.

### Section 2 Required Modifications

1. Gearbox: Only Briggs & Stratton gear box part number 555721 and crankshaft part number 555722 is allowed. Any modifications to this gear box and crankshaft is prohibited.
2. Recoil Starter: Recoil starter must be removed. Starter cup must be removed and can be replaced with a flat washer, Briggs Part number 691736 is recommended flat washer, but any washer can be used or no washer.
4. Exhaust: Must use exhaust port extension in port. Minimum of a 0.520 length measured from the bottom of the exhaust flange to the end of the pipe using a depth mic. The total maximum exhaust header length, not including the muffler, must not be longer than 18 inches in length using a small 1/ 4 inch wide tape measure in the inside of header tube. The exhaust header inside diameter cannot be larger than .905 inches for its entire length. No steps or tapers. The only approved muffler is the RLV B91 part number 4100. Muffler holes = .1285 inches max. Muffler must be clamped to header. All exhaust must exit from the muffler end, leaks are not allowed.
5. Optional allowed exhaust system - Must use exhaust port extension in port. Minimum of a 0.520 length measured from the bottom of the exhaust flange to the end of the pipe using a depth micrometer. Any style pipe and max of four, 40 B&S mufflers only. ( This is the same exhaust system spec as used in World Formula )
6. Oil Breather: Oil breather must vent to catch can under the tail cone within the engine compartment.
7. Carburetor Overflow: Carburetor overflow may be vented to the ground.
8. The blower housing cover rewind guard, Briggs part number 555255 must be removed. The blower housing opening must not be altered in a manner that would impede air flow into the flywheel fan area.

### Section 3 Allowable Modifications

1. Crankshaft Seal: No tech on the crankshaft seal on gearbox side, seal can be removed.
2. Fuel Pump: Fuel pump, B&S part number 557033 may be used. If used, fuel pump must be pulsed from a pulse fitting mounted on the engine crankcase side cover fitting only. It is prohibited to pulse from the intake manifold.
3. Black Top Plate Control Cover: Black control cover B&S part number 555699 and ON/OFF switch part number 557028 may be removed and can be, but not required, replaced with any other type of metal or aluminum cover.
4. Rocker Cover: Rocker cover B&S part number 55528 may be modified for installation of oil breather line fitting. (It is allowable to have secondary drilling of holes in the breather valve area of the valve cover.)
5. The installation of the Briggs Breather By-pass system, part number 555688, per included ms-3742 sheet.
6. Mill block and head deck surfaces & hone cylinder bore per specification outlined in this tech manual listed below.
7. Heat Dispenser, Briggs part number 555690, may be installed per included ms-3758.

8. Any engine valve lash settings are allowed.
9. Heat protective wrapping of header / exhaust pipe up to but not including muffler is legal.
10. It is allowable to machine additional keyway slots and or snap ring groove in gear box sun gear output shaft. Also the end of the sun gear shaft can be shortened.
11. Color of sheet metal is a non tech item, any color is acceptable. This refers to blower housing, head shroud, top plate and valve cover.

## Section 4 Tech Procedure

### 1. General

- a. Heli-Coiled threads for shrouds, (all), valve cover, oil drain, oil fill holes, blower housing, and exhaust pipe attach studs on the head and lower brackets are allowed.
- b. Blocking airflow: No device may be used that will, or appears that it may impede airflow into the engine cooling system. This may require that the engine be run at a speed above idle by the tech personnel at the scale, after the car has qualified or raced.

### 2. Carburetor & Intake Manifold

Remove Carburetor

- a. Check for restrictor plate correct placement if applicable. Restrictor plate must be placed between carburetor and intake manifold. There must be 1 gasket between the restrictor plate and the intake manifold. This gasket must not be thicker than .070 inches. Briggs gasket part number 691885 or equivalent is acceptable. There must not be a gasket between the carburetor and the restrictor plate. This surface is sealed with the O-ring in carburetor groove.
- b. Stock Walbro PZ22 carburetor part number 555658 carb only. No alterations allowed unless stated below. All parts will be compared to stock known part for legality. This includes the nozzle, emulsion tube, jets, float, float needle and all other carb parts. It will be allowed however to adjust the float height setting by means of bending the small tab on the float arm. Slide must remain stock unaltered. Stock unaltered aluminum needle is required part number 555602 marked #BGB.
- c. Needle Jet C-clip must be properly installed but may be installed at any of the 5 factory settings on the needle jet.
- d. Throttle cable cap on the top of the carburetor must be used and properly installed in tight position.
- e. Choke: Unaltered, but lever may be fastened open with a spring, rubber band, wire, etc.
- f. Idle pilot jet – Any size is allowed.
- g. Main jet – Any size is allowed.
- h. Main nozzle – Stock unaltered – hole size = .101 min and .103 max inches. No drilling, reaming, slotting or oblonging of hole.
- i. Emulsion tube – Stock unaltered – 4 small holes = .018 min inches to .020 max inches  
4 big holes = .026 min inches to .028 max inches. Main center hole = .110 min inch to .112 max inch
- j. Venturi Measurement: Vertical: .792 max inches. Horizontal: .615 max inches at widest part and .602 max inches at narrowest part.
- k. Air pick off hole - .061 max inches and .057 min inches
- l. Throttle bore – Must be as cast and bore max diameter = .874 inches.
- m. Venturi idle fuel hole = .036 inches max
- n. Air filter: Any style air filter allowed but is not required to be used. Filter adapters are not allowed, filter must attach directly to carb airhorn.
- o. Carburetor overflow: may be vented to the ground.
- p. O-Ring part number B&S part number 555601 is required and must be unaltered.
- q. Intake manifold – max length = 1.740 inches min to 1.760 inches max
- r. Intake manifold – bore diameter = .885 inches min to .905 inches max
- s. Briggs gasket part number 691885 or equivalent is acceptable between the intake manifold and cylinder head port mounted surface. This gasket must not be thicker than .070 inches

### 3. Engine Cooling Shrouds/Blower Housing

- a. All pieces of the stock engine cooling shroud must be stock and properly installed. The blower housing cover must be removed.
- b. Starter cup must be removed.
- c. Color of sheet metal is a non tech item, any color is acceptable. This refers to blower housing, head shroud, top plate and valve cover.

### Check valve lift & ignition timing:

Remove valve cover & blower housing

1. Max. valve lift will be checked from the top of the valve spring retainer. Valves must be adjusted to zero clearance.
2. Valve Lift: first camshaft check will be taken at the valve spring retainers. With the last set at zero, the movement of the valve spring retainers may not exceed the following: Intake and exhaust: .252 inches max.
3. Install degree wheel, using positive stop method. Check ignition timing. With the right edge of the magnet, (not the magnet holder), aligned with the right edge of the notch of the right leg of the coil, the engine must be from 23 degrees BTDC to 27 degrees BTDC you must use stock key way and unaltered flywheel stock Briggs and Stratton only allowed.

4. Tech camshaft at pushrods. Push gently down on dial indicator stem to ensure that there is no lash when push rods are going down.

## 4. Cylinder Head & Head Gasket

Remove cylinder head.

### Head Gasket:

- a. Stock, unaltered B&S part numbers 555698 or 555621 are the only head gaskets allowed.
- b. Minimum gasket thickness between head bolt holes .041 inches. Measurements are to be made with dial caliper from inside of fire ring for gasket part number 555698.

### Head:

- a. Cylinder head, 555635 must be stock unaltered and be "as cast" and in factory machined condition except head gasket deck surface may be machined to the following specs. Depth of head at shallow part of head .011 inch min. This measurement to be taken with a depth gage on both the combustion side and spark plug side of cylinder head. Depth at floor of head is. 319 inch min. Depth to top of valve seat is .315 inch min to .360 inch max.  
Head overall thickness from head gasket surface to head plate gasket surface is 2.405 inches min. No deburring, machining, honing, grinding, polishing, sanding, media blasting, etc,etc.  
The transition from Intake bowl to port **must** have factory defined machining **burr** at this junction. No addition or subtraction of material in any form or matter.  
**Unless it says you can do it you cannot do it.**  
No additions to or subtractions from any part of head with the exception of Heat dispenser, Briggs part number 555690 may be installed per included ms-3758.
- b. Exhaust pipe attachment stud may be heli-coiled.
- c. No alterations of any kind may be made to the intake or exhaust ports.
- d. Intake Port: Maximum diameter measurement = .918 inches max.
- e. Exhaust Port AS CAST: Maximum ID of shoulder in bottom of exhaust port = .854 inches.
- f. Valve Seats, Intake and exhaust: Must remain factory spec. with one 45 degree angle only. Multi angle valve seats are not permitted.
- g. Intake valve seat diameter inside = .965 to .972 inches.
- h. Exhaust valve seat diameter inside = .844 to .850 inches.
- i.) Valve guides – Stock valve guides as supplied from factory. Stock replacement guide part # 555645 allowed. Maximum depth from head gasket surface to top of intake valve guide is 1.255 inches.

Remove Valves

Inspect retainers for alterations that would increase valve spring pressure..055 to .075 max flange thickness. Both intake and exhaust must have stock B&S valve keepers.

## 5. Valves

- a. Check valves for dimensions and weight. Stock and unaltered B&S part #555552 (exhaust) and #555551 (intake).Titanium valves are not allowed. Valve surface must be unaltered factory ground and have one 45 degree sealing surface only. There will be no other angles ground on any part of the valve.
- b. Valve Guides: Replacement of valve guides with B&S factory part #555645 only is allowed.
- c. Intake Valve: Minimum Weight of Valve 29.26 grams min.  
Diameter of valve stem .246 to .247  
Diameter of valve head 1.055 to 1.065 inches  
Diameter of valve seat .965 to 972 inches ID  
Valve length 3.372 +/- .010 inches
- d. Exhaust valve: Minimum weight of valve 28.62 grams min.  
Diameter of valve stem .246 to .247  
Diameter of valve head .935 to .945  
Diameter of valve seat .844 to .850 inches ID  
Valve length 3.372 +/- .010 inches

## 6. Valve Springs

- a. Valve Springs will be single coil stack, unaltered B&S part # 26826. Must be identical in appearance to factory part and have 4.25 to 4.75 coils in stack. Caution – If higher pressure springs would be used cam lobe wear will result and reduce performance.
- b. Spring Wire Diameter .103 to .107 inches
- c. Valve spring length .930 max inches
- d. Inside diameter .615 to .635 inches
- e. Spring pressure - TBD

## 7. Rocker Arms, Rocker Ball and Rocker Arm Studs

- a. Rocker arms will be stock B&S part # 691230 and will not be altered in any way.

- b. Rocker studs will be stock, unaltered B&S part # 694544 and in stock location.
- c. Rocker Ball must be stock. Diameter .590 inch min. to .610 inch max.
- d. Rocker arm mounting positions may not be altered in any manner. No heli-coiling of mounting holes. No bending of studs. Rocker arm stud plate must be bolted to the head with one stock B&S gasket only - no alterations. Max thickness of gasket is .060 inches.
- e. Rocker arm – overall length 2.865 inches min

## 8. Push Rods

- a. Push rods will be stock, unaltered B&S part #555531. Push rod length 5.638 min inches to 5.656 max inches. Push rod diameter .185 min inches to .190 max inches.

## 9. Engine Block

- a. Engine block must be in “as cast-stock factory machined condition with no alterations except head gasket deck surface can be milled down to allow a piston pop per below specification. There must be no addition or subtractions of metal or any substance to the inside or outside of the cylinder block.
- b. Machining of deck surface is permitted. Piston pop up can be .007 inches max. Piston pop up to be checked with flat bar in center of piston parallel to piston pin and then again checked 90 degrees to piston pin. Angle milling or peak decking is not allowed It is allowable to remove carbon buildup in needed to meet .007 max pop up rule.
- c. There will be no polishing, sand blasting, or glass beading to any interior surfaces.
- d. Cylinder bore will not be bored oversize
- e. Cylinder bore will not be re-sleeved.
- f. Cylinder bore position will not be moved or angled in any manner.
- g. Cylinder bore dimension - 2.693 max inches for entire length top to bottom.
- h. Check stroke from BDC to TDC - 2.204 max. push piston down at BDC to take up rod play.

### Camshaft Profile Limits.

- a. Tech camshaft at pushrods. Push gently down on dial indicator stem to ensure that there is no lash when push rods are going down.

### Intake lift

<u>0.006</u>	<u>59 to 49 BTDC</u>
<u>0.020</u>	<u>16 TO 12 BTDC</u>
<u>0.050</u>	<u>.5 TO 4.5 ATDC</u>
<u>0.100</u>	<u>17 TO 21 ATDC</u>
<u>0.150</u>	<u>33.5 TO 37.5 ATDC</u>
<u>0.175</u>	<u>43 TO 47 ATDC</u>
<u>0.200</u>	<u>54 TO 58 ATDC</u>
<u>0.225</u>	<u>68 TO 72 ATDC</u>
<u>MAX LIFT</u>	<u>0.257</u>
<u>MIN LIFT</u>	<u>0.252</u>
<u>0.225</u>	<u>38 TO 34 BBDC</u>
<u>0.200</u>	<u>24.5 TO 20.5 BBDC</u>
<u>0.175</u>	<u>14 TO 10 BBDC</u>
<u>0.150</u>	<u>4.5 TO .5 BBDC</u>
<u>0.100</u>	<u>12 TO 16 ABDC</u>
<u>0.050</u>	<u>29 TO 33 ABDC</u>
<u>0.020</u>	<u>45.5 TO 49.5 ABDC</u>
<u>0.006</u>	<u>81 to 91 ABDC</u>

### Exhaust lift

<u>0.006</u>	<u>101 to 91 BBDC</u>
<u>0.020</u>	<u>59 TO 55 BBDC</u>
<u>0.050</u>	<u>43 TO 39 BBDC</u>
<u>0.100</u>	<u>26 TO 22 BBDC</u>
<u>0.150</u>	<u>9 TO 5 BBDC</u>
<u>0.175</u>	<u>1 TO 5 ABDC</u>
<u>0.200</u>	<u>11.5 TO 15.5 ABDC</u>
<u>0.225</u>	<u>25 TO 29 ABDC</u>
<u>MAX LIFT</u>	<u>0.257</u>
<u>MIN LIFT</u>	<u>0.252</u>
<u>0.225</u>	<u>76 TO 72 BTDC</u>
<u>0.200</u>	<u>62.5 TO 58.5 BTDC</u>
<u>0.175</u>	<u>52 TO 48 BTDC</u>

<u>0.150</u>	<u>42 TO 38 BTDC</u>
<u>0.100</u>	<u>25.5 TO 21.5 BTDC</u>
<u>0.050</u>	<u>8.5 TO 4.5 BTDC</u>
<u>0.020</u>	<u>8 TO 12 ATDC</u>
<u>0.006</u>	<u>44 to 54 ATDC</u>

## 10. Flywheel

- No modifications allowed to flywheel. – Min weight of flywheel, fins and attachment bolts = 4 pounds 1 oz.
- Stock B&S part # 555683 only. No machining, glass beading, sand blasting, painting or coating of flywheel is allowed.
  - The plastic flywheel fan part number 692592, with broken fins must be replaced.
  - Plastic starter ring gear between flywheel and engine may be removed.
  - Stock, unaltered flywheel key is required. No offset keys allowed.
  - Can use any flat washer under flywheel nut.

## 11. Ignition System

- Unaltered B&S stock ignition part #555718 is mandatory. Only “GREEN” Coil allowed. Ignition coil or its position, other than air gap may not be altered in any way. Coil mounting bolts must be stock and cannot be altered in any way to advance or retard timing. Attachment bolts and/or bolt holes may not be altered.
- Spark plug: Must use Briggs & Stratton factory unaltered spark plug part number # 491055 - Champion RC12YC. Sealing washer must be in place as from factory. **Spark plug gap is a non tech item.**
- Magneto air gap is non-tech.
- Timing: Normal = 25 degree BTDC  
Min. = 23 degree BTDC  
Max. = 27 degree BTDC
- (Space reserved for future use)

## 12. Gear Box

- Briggs & Stratton part number 555721 is the only approved gear box. **Must be in stock form and color.**
- It is allowable to machine additional keyway slots and or snap ring groove in gear box sun gear output shaft. Also the end of the sun gear shaft can be shortened.**

## 13. Crankcase Cover

Remove crankcase cover

- Cover must be in stock, unaltered, “as cast in factory” condition. No alterations or subtractions of metal or any other substance to crankcase cover.
- Aftermarket gaskets are approved, however must be of same size and material as stock gasket. Only one gasket is allowed.

## 14. Piston

Remove rod and piston

- Stock standard bore unaltered B&S piston part # 555660 only.
- It is allowed to carefully remove the raised material only from the stamped numbers and letters on the top of the piston. Recommended method is a dull pocket knife or a small stone.
- Minimum from top of piston to top of wrist pin on circlip side is .658 inches.
- Minimum overall piston length is 1.762 inches.
- Oversized pistons are not allowed.
- Arrow on top of piston must point towards flywheel side.

## 15. Rings

- Must be stock, unaltered B&S rings part # 555664 only.
- No decreasing of ring tension by heating, machining or any other means.
- Three rings mandatory
  - Top chrome compression ring must have chamfer or O toward top of piston.
  - Second scraper ring must be installed with inside chamfer down and O toward the top of piston.
  - Oil ring must be installed as from factory
- Minimum width of top two rings is .095 inches.
- Thickness of top two rings is .059 to .064 inches (each ring)
- Minimum width of oil ring is 0.65 inches. Ring groove must be present.
- Thickness of oil ring is .098 to .102 inches.
- Oil expander ring total overall length = 8. 200 min
- All 3 rings including oil expander ring must be in 1 piece when removed from engine during tech. Broken rings are not allowed.
- Rings must be self supporting in cylinder bore of the engine being teched.

## 16. Wrist Pin

- a. Must be stock, unaltered B&S part #555520 wrist pin and lock part #555521
- b. Wrist Pin: Maximum I.D.= .414”  
Max. O.D.= .626”  
Minimum length – 1.901”

## 17. Connecting Rod

- a. Must be stock, unaltered B&S part # 555626.
- b. Rod length, measurement from bottom of wrist pin hole of top of crank journal hole is 2.419 inches minimum to 2.429 inches maximum.
- c. Diameter of big end = 1.005 inch max
- d. Diameter of small end – .6265 in max

## 18. Crankshaft

- a. Stock B&S part # 555722 crankshaft must remain unaltered. No polishing, grinding or deburring allowed.
- b. Crankshaft journal diameter = 1.094 inches to 1.100 inches
- c. Stock, unaltered B&S ball bearings required. PTO side part number # 692517 & Flywheel side part number # 690824. Ceramic bearings are not allowed.
- d. B&S part # 555049 woodruff key – cam gear
- e. B&S part # 222698s aluminum key - flywheel
- f. Shim, (s), Briggs part #55619, if used must be installed as from factory.
- g. Stock, unaltered part #555574 timing gear installed in stock location on crankshaft only.
- h. No offset keyways allowed on cam gear for crankshaft or flywheel key.
- i. The use of Loctite to retain crank gear secure to crankshaft is acceptable and legal.

## 19. Camshaft

- a. Stock, unaltered B&S part # 696816 ground camshaft. Aftermarket camshafts are not legal.
- b. There will be no additions or subtractions to any part of the camshaft except for the compression release tabs as outlined below..
- c. Note – The older style Briggs broached cams are not allowed.
- d. Compression release will remain intact however the centrifugal force tabs can be removed or altered for easier starting.
- e. Cam base circle .870 inch max , TBD inch min.
- f. Lobe center angle will not be altered by any means.
- g. Lobe profile will not be altered in any way.
- h. No deburring, machining, honing, grinding, polishing, sanding, media blasting, etc,etc.  
No addition or subtraction of material in any form or matter to cam except as outlined for compression release tabs..  
Unless it says you can do it you cannot do it.  
Cam lodes cannot be welded.

## 20. Tappets

- a. Stock, unaltered B&S part # 690977 tappets only.
- b. Tappet diameter = .820 min to .860 max.
- c. Tappet overall length = 1.515 min to 1.525 max

## Torque Specifications:

Non Tech, recommended by B&S

Flywheel Nut	55-75 ft. lbe. (74.5-101 Nm)
Cylinder Head	200-220-in. lbs. (20-25 Nm)
Connecting Rod	115-120 in. lbs. (13.5-15.8 Nm)
Crankcase Cover	95-125 in. lbs. (13.5-15.8 Nm)
Cylinder Head Plate	70-90 in. lbs. (8-10 Nm)
Rocker Arm stud	90-120- in. lbs (8-12.5 Nm)
Valve Cover	30-60 in. lbs (11-16 Nm)
Spark Plug	95-145 in. lbs. (11-16 Nm)