

Early Ghibli Engine Assembly

Part 1

4.7 liter, keyed crankshaft sprocket 8mm flywheel bolt

By Claus Groth

SUMMER 1992

CLEAN

- A. Scrape all gasket surfaces clean.
- B. Use only lint-tree towels to clean parts.
- D. Bag as many parts as possible after cleaning,
 - 1. Use zip-lock bags, trash bags, lawn & leaf bags.
 - 2. Cover the engine with plastic.
- E. Clean crankshaft with soap and water, including oil passages with rifle brush.
 - 1. Spray with WD-40 or oil to prevent flash rust.
- F. Clean engine block with soap and water, including oil passages with rifle brush-
 - 1. Spray cylinder liners with WD-40 or oil to prevent flash rust.
- G. Clean all parts that were not stored in "zip lock" bags.
- H. Inspect all 0-rings for cuts.
 - 1. 0-rings that are flat (most of them) should be replaced.
 - a. Viton 0-rings withstand higher temperatures than the commonly available Buna-N 0-rings.
- I. Inspect all 0-ring grooves for scratches.
 - 1. Sand evenly with 400 grit paper. (Without creating a depression)
 - 2. Fill deep scratches with epoxy and sand.

1. MAIN CHAIN IDLER SPROCKET

- A. Install sprocket assembly with thicker spacer toward front.
 - 1. Use an 11 mm socket.
 - 2. Orient the flat on shaft toward adjacent stud.
- B. Install special "D" shaped washer against the flat.
- C. Torque lock washer and nut to 11 Ft/Lbs.

11. CRANKSHAFT

Caution. Insure that main chain idler sprocket is installed.

Caution. Crankshaft and "flywheel shall have been balanced if either has been ground or machined.

- A. Install new pilot bearing in crankshaft using Loctite 609 and attach retaining clip.
- B. Install flywheel bolts into flange holes.
- C. Install gasket at oil pump outlet hole.
 - 1. O-ring may be used but is not needed since gasket was required to correct design error.
- D. Install plastic or rubber tubes over main bearing studs before installing crankshaft to prevent scratching journals.
- E. Place main bearing halves into block.
 - 1. If reinstalling used bearings, choose the half with the most wear to be on top. These are evident by being darker in color or less silvery.
- F. Place main bearings into caps.

- G. If main bearing clearance was not measured with Plasti-gage during disassembly, do it now.
 - 1. Oil main bearings.
 - 2. Place crankshaft into block.
 - 3. Place green Plasti-gage longitudinally on each main journal.
 - 4. Install thrust bearings per description below.
- S. Install bearing caps and torque per description below.
- 6. Remove bearing caps, check width of Plasti-gage and record.
 - a. Maximum clearance is .002.
- 7. Remove Plasti-gage with wax and grease remover.
- H. Install #1 main cap and oil pump onto crankshaft while on workbench
 - 1. Place bearing into #1 cap and oil bearing.
 - 2. Place two round keys into crankshaft keyway.
 - 3. Align oil pump impeller keyway with the notch on pump body so that keys can slide through.
 - 4. Hold cap onto #1 journal and slide oil pump onto shaft.
 - S. Hand tighten pump to journal with washers and nuts.
 - 6. Apply sealant to oil pump outlet flange.
- I. Install new rear seal with wire spring groove facing forward.
 - 1. Fasten spring around crankshaft and push into groove with small screwdriver.
- J. Apply oil to main bearings in block.
- K. Place crankshaft into block while sliding #1 cap over studs.
- L. Oil and install front and rear thrust bearings on either side of #5 main bearing.
 - 1. Front bearing has oil grooves toward front.
 - 2. Rear bearing has oil grooves toward rear. (The Ghibli parts book shows this incorrectly)
 - 3. Check thrust bearing clearance.
 - a. Maximum clearance is .0079.
- M. Oil studs and install all main bearing cap washers and nuts.
- N. Torque main nuts to 10 Ft/Lbs with a 19mm socket.
 - 1. Rotate crankshaft to insure that no binding exists.
- O. Torque main nuts sequentially to 30, 60, and 72 Ft/Lbs.
 - 1. Rotate crankshaft after each setting.
- P. Torque secondary nuts to 22 Ft/Lbs with a 13mm socket.
- Q. Tighten oil pump flange nuts with a 10mm wrench.
- R. Torque oil pump to main bearing cap #1 with 13mm socket to 19 Ft/Lbs.
- S. Torque oil pump to main bearing cap #1 with 17mm socket to 39 Ft/lbs.
- T. Retorque all nuts to insure that none were missed.

III. MAIN CHAIN

- A. Install long key onto crankshaft with tapered end toward front.
- S. Install sprocket onto crankshaft.
- C. Rotate crankshaft until 'O' on sprocket aligns with 'O' on bearing cap.
- D. Turn idler sprocket until 'O' on sprocket aligns with "O" on block.
- E. Wrap chain around sprockets and join ends with link.
 - 1. Add two thick spacers between rows.
 - 2. Add thin spacer last.
 - 3. Install retaining clip with opening on left side when viewing from the front.

IV. DISTRIBUTOR SHAFT

- A. Install shaft through distributor opening and attach gear.
 - 1. Align cross drilled hole in gear with shaft hole.
 - 2. Fasten gear with spring pin.
 - 3. Place spring wire into groove over roll pin.
- B. Align "O" on shaft coupling with "O" on housing in distributor hole.
- C. Rotate gear 90 degrees counterclockwise and slide crankshaft gear onto key.
- D. Check "O" alignment and adjust if necessary.

V. FRONT PULLEY (Temporary)

- A. Slide pulley onto key and tighten bolt with a 19mm socket.
 - 1. Do not use round oil pump key at this time.
 - 2. Do not attach the lock clip at this time.

VI. PISTONS

- A. Right side cylinders are numbered #1 to #4, front to rear.
- B. Left side cylinders are numbered #5 to #8, rear to front.
- C. Insure that connecting rods are installed correctly on pistons that have skirts offset to one side. (Some pistons have symmetrical skirts)
 - 1. Note that studs are offset when viewing end of connecting rod.
 - 2. Skirt offset must be on same side as stud offset.
- D. Align rings
 - 1. Align rings #1 with one wrist pin end.
 - 2. Align rings #2 and #4 with other wrist pin end.
 - 3. Align ring #3 sections per manufacturers instructions.
- E. Install rod bearings and oil them.
- F. Install cap bearings and oil them.
- G. Oil cylinder liners.
- H. Place rubber or plastic tubes over connecting rod studs of first piston.
 - 1. Oil soak first piston in pan.
- J. Tighten piston ring compressor around rings leaving piston skirt exposed.
- K. Align the crankshaft journal to a position farthest from the liner.
 - 1. Rotate crankshaft using a 19 mm socket and breaker bar on pulley bolt.
- L. Carefully slide piston assembly into cylinder liner.
 - 1. Use wooden hammer handle to push piston.
 - 2. Pistons #1 through #4 have offset studs toward rear of engine.
 - 3. Pistons #5 through #8 have offset studs toward front of engine.
- M. If bearing clearances were not measured with Plasti-gage during disassembly, do it now. Maximum clearance is .0024.
- N. Attach bearing cap, apply Loctite #242 and snug nuts using a 14mm socket.
 - 1. Rotate crankshaft to insure that no binding exists.
- O. Torque nuts sequentially to 30 and 58 Ft/Lbs.
 - 1. Turn crankshaft after each setting.
- P. Repeat for other pistons.
- Q. Retorque all nuts to insure that none were missed.

VII. FLYWHEEL

Con. Flywheel shall have been balanced with the crankshaft if either has been ground or machined.

- A. Install flywheel bolts and not in place.
- B. Place " " over center hub locating largest hole over stud in crankshaft flange.
- C. Attach castellated nuts and torque to 22 Ft/Lbs in a star pattern.
- D. Turn each nut until hole in bolt aligns with opening in nut.
- E. Attach cotter pins and bend ends tight to minimize movement.

VIII. OIL PAN

Caution- Insure that flywheel bolts are installed in crankshaft flange.

- A. Install pan baffle, washers and hex screws using an 11 mm socket and torque to 10.5 Ft/Lbs.
- B. Remove all oil from flange faces on block and pan.
- C. Use gasket sealer (many use silicone sealer) on flange from rear seal to front.
 - i. Maserati placed string around center of flange to seal uneven areas.
- D. Place pan on block.
 1. Install flat washers and nuts and torque to 10.5 Ft/Lbs using an 11 mm socket.
 - a. One stud is located inside of front opening.
 - b. Two studs are located in recesses in bottom of pan near rear.
- E. Install two copper washers and plugs into threaded holes in pan bottom using a 10mm alien wrench.
 1. Replace copper washers or sand smooth.
- F. Install one copper washer and oil drain plug into hole in pan bottom using a 17mm alien wrench.
 1. Replace copper washer or sand smooth.
- G. Retorque all nuts to insure that none were missed.

IX. OIL PUMP INLET

- A. Attach flanged tube to oil pump with three lock washers and nuts and torque to 10.5 Ft/Lbs using a 10mm socket.
- B. Install flanged ring into oil pan.
 1. Install O-ring into flanged ring.
 - a. Clean O-ring groove well.
 - b. Oil O-ring and install.
 2. If ring does not easily slide into hole, carefully tap ring insuring that O-ring does not slip out.
- C. Place ring with triangular cross-section in hole with point facing out.
- D. Install oiled seal ring onto the pointed ring.
- E. Install the tab washer.
- F. Install the castellated nut and tighten.
- G. Bend two tabs on washer to lock nut in place.
- H. Install banjo bolt.
 1. Inspect banjo bolt seal surfaces for burrs or scratches.

- a. Sand if necessary.
2. Slide copper washer, banjo fitting and second copper washer onto banjo bolt.
 - a. Replace copper washers or sand smooth.
3. Hand tighten assembly until proper alignment with oil tank is achieved.
4. Attach hose and tighten hose clamp.
 - a. Seal hose end with plastic bag and rubber band.

X. FRONT COVER

- A. Replace shaft seat even if the existing one is soft. its inexpensive.
- B. Attach oil pickup tube, lock washers and nuts using an 11 mm socket and torque to 10.5 Ft/Lbs.
- C. Retract chain tensioner.
 1. Straighten tang on lock washer.
 2. Remove 7/16" hex screw.
 3. Turn 3mm allen wrench clockwise while pushing chain tensioner rubbing block into housing.
 4. Save hex screw and tab washer for later installation.
- D. Remove bolt and pulley from crankshaft.
- E. Attach gasket to block using sealer.
 1. Keep sealer away from top oil hole.
- F. Install front cover using sealer while exercising caution at oil hole.
 1. Tighten washers and nuts using a 10mm socket.
- G. Release automatic chain tensioner.
 1. Turn the 3mm allen wrench counterclockwise through hole where oil filter housing attaches.
 2. Attach lock tab and hex screw using 7/16" socket.
 - a. Bend lock tab against screw.
- H. Position cylinder #1 at top dead center.
- I. Turn the oil pump drive gear with your fingers until the narrowest groove is on top.
 1. The oil pump drive has three grooves: two are wide, one is narrow.
 2. Position it as accurately as possible or the pulley will not slide in place.
- J. Glue the round oil pump drive key into the groove on the pulley shaft.
 1. Use Loctite or any gasket sealer.
- K. Align pulley with external round key on the shaft facing up.
 1. Be as accurate as possible.
- L. Slide pulley shaft slowly through the seal until it stops.
 1. The pulley will be approximately 5/16" from the boss on the front cover when properly installed.

- a. If the pulley shaft does not engage completely, remove, realign the oil pump narrow groove and try again.
- M. Install lock clip and bolt.
 - 1. Torque bolt to 73 Ft/Lbs using a 19mm socket.
 - 2. Do not bend the tab on the lock clip against the bolt head until it is no longer necessary to turn the crankshaft.
 - a. It is suggested that it be done after the engine is installed in the car and before the oil tank is installed.
- N. Retighten all fasteners to insure that none were missed.

This is part I of an 18-page compilation. The rest of the document will be published in a future issue (maybe two). Ed.

Early Maserati Ghibli Engine Assembly

Part II

FALL 1992

(Refer to the Summer 1992 Issue for Part 1)

By Claus Groth, with review by Chuck Sternbung

XI. OIL FILTER HOUSING

Caution., Insure that automatic chain tensioner has been released.

- A. Attach gasket to block using sealer
- B. Install filter housing using sealer.
 - 1. O-rings may be used but are not needed since gasket was required to correct design error: access to chain tensioner.
 - 2. Torque three lock washers and nuts to 19 Ft/Lbs with an 11 mm socket.

XII. RIGHT CAMSHAFT CHAIN IDLER SPROCKET

- A. Install shaft through hole in side of distributor mount.
 - 1. Note hole in head gasket surface above shaft hole.
 - a. Align flat on shaft parallel with head gasket surface.
 - 2. Slide shaft through sprocket until flat is below hole.
 - a. Check with flashlight.
 - b. If inserted too far, use a long M6 screw to extract.
- B. Place pin in hole.
 - a. Insure that pin does not protrude above flange surface.
- C. Install screw to seal shaft access hole.
 - 1. Use sealer on gasket.

XIII. RIGHT CAMSHAFT CHAIN RUBBING BLOCK

- A. Install rubbing block adjacent to cylinder liner #1.
 - 1. Use sealer around base of studs.
 - 2. Torque two flat washers and M5 acorn nuts to 56 In/Lbs. using a 10mm socket.

XIV. HEADS

A. VALVES

- 1. Intake guides must have new teflon seals installed.
- 2. Exhaust guides must not have seals, even if guides are machined to accept them.
- 3. Coat one valve stem with moly-lube and install.
 - a. Valve should be labeled with cylinder number.
- 4. Install valve spring washer over stem.
- 5. Install both valve springs.
 - a. Orient springs with the closely spaced coils toward the head.
- 6. Install the collet washer on top of the springs.
- 7. Install the two half collets.

8. Repeat for other valves.

B. SHIMS AND CAMSHAFTS

1. If camshaft bearing clearance was not measured with Plasti-gage during disassembly, do it now.
 - a. Oil bearings.
 - b. Place camshaft into head.
 - c. Place green Plasti-gage longitudinally on each journal.
 - d. Install bearing caps and torque per description below.
 - e. Remove bearing caps, check width of Plasti-gage and record.
 - (1) Maximum clearance is .0024.
 - f. Remove Plasti-gage with wax and grease remover.
 - g. Use feeler gauge to check end clearance.
 - (1) Maximum clearance is .006.
2. Measure shim thicknesses.
 - a. Shims with valve stem indentation on both sides should be ground flat on one side (and parallel) before use. (1) To use a shim with double indentation:
 - (a) Permanently mark the indentation on one side with a scribe or center punch without protruding above the shim surface.
 - b) Place an .030 thick feeler gauge over the marked indentation.
measure the total thickness and subtract .030.
 - b. Clean and mark thicknesses on shims with a marking pen.
3. Install the eight thinnest shims on intake valves.
 - a. Valve stem indentation must be against valve.
 - b. Record thickness at each location.
4. Install the eight thickest shims on exhaust valves.
 - a. The side of shim indented by valve stem must be against valve.
 - b. Record thickness at each location.
5. Place caps on shims.
6. Install camshafts after oiling bearing surfaces.
 - a. Turn each camshaft until journals rest on bearings.
 - (1) Right intake camshaft is marked TD-ASP.
 - (2) Right exhaust camshaft is marked TD-SCA.
 - (3) Left intake camshaft is marked TS-ASP.
 - (4) Left exhaust camshaft is marked TS-SCA.
7. Install bearing caps after oiling bearing surfaces.
 - a. Caps are numbered 1 through 6.
 - (1) Orient number on cap with matching number on head near cap location.
 - b. Torque flat washers and nuts to 22 Ft/Lbs with 14mm socket.
8. Place 2x4 boards under each end of heads to provide valve opening clearance before turning camshafts.
9. Check and record each valve clearance
 - a. Rotate each camshaft at least one-full turn to seat shims and caps. Caution. Head must be elevated to avoid bending valves.
 - b. Turn camshafts by the rear nut using a 22mm socket.
 - c. Check thicknesses using a flat feeler gauges.
 - (1) Optimum intake clearance is .012.
 - (2) Optimum exhaust clearance is .020.
 - d. Determine the required shim thickness.

- (1) At each valve, add shim and clearance thicknesses together and subtract optimum thickness.
10. Grind or sand shims to the required thicknesses.
 - a. Turn shim while sanding to maintain parallelism.
11. Repeat installation and check clearances.
12. Confirm that all of the camshafts are at piston #1 top dead center
 - a. Align the scribe lines on the front bearing caps and camshafts.
 - (1) The front bearing caps have a scribe line on the rear surface above the camshaft.
 - (2) The right camshafts each have only one long scribe line for #1 TDC.
 - (3) The left camshafts each have a long scribe line for #1 TDC and a short scribe line for #8 TDC
 - b. Place a small piece of paper under one bearing cap, 0 necessary, to maintain the correct camshaft position.

C. RUBBING BLOCKS

1. Install two rubbing blocks in the chain cavity of the left head.
2. Use sealer around base of studs.
3. Tighten two flat washers and M5 acorn nuts using an 8mm socket.

D. CHAIN TENSIONERS

1. Oil the shaft and insert it through the outside hole.
2. Oil the sprocket bearing surface and insert through chain access hole.
 - a. Position the offset sprockets toward rear of engine.
3. Insert the shaft completely.
4. Install the shaft housing.
 - a. Insure that 0-rings are clean and smooth.
 - b. Oil the 0-rings.
 - c. Tighten lock washers and nuts using an 11 mm socket.
5. Turn the shaft until the sprocket is closest to the camshafts and centered between them.
6. Mark the head or outer edge of the shaft housing to indicate the direction that the flat is facing.
 - a. The number of degrees of shaft rotation after the chain has been tensioned indicates the amount of stretch. Maximum rotation is 180 degrees.

XV. CAMSHAFT CHAINS IN BLOCK

- A. Position piston #1 at top dead center.
- B. Install longest chain on right side and encircle the main chain idler sprocket.
 1. Attach an 18" long thin wire through the rear link hole.
 - a. Provide a finger loop in the end of the wire.
 2. Curve the wire and route it under the idler sprocket and through the left access hole.
 3. Return the chain above the sprocket.
 4. The upper part of the chain should project 21" above the flange when perpendicular to ft.
 - a. This will position the chain ends at the top of the exhaust camshaft sprocket.
 5. Attach a 12" long thin wire through the rear link at the other end.

- a. Provide a finger loop in the end of the wire.
- 6. Rest the chain inside the block near the flanged opening.
- 7. Bend the upper chain wire to position the loop near the top of the opening.
- 8. Bend the lower chain wire to position the loop near the bottom of the opening.
- C. Install shortest chain on left side and encircle the main chain idler sprocket as above.
 - 1. The upper part of the chain should also project 21" above the flange.

XVI. HEAD ON BLOCK

Caution. Insure that camshafts are positioned for piston #1 at top dead as center as described above.

- A. Rotate crankshaft to position piston #1 at TDC.
- B. Thoroughly clean all block/head mating surfaces.
- C. Wipe graphite from head gaskets with wax & grease remover or a dry, lint free towel.
- D. Apply copper coat gasket sealer on both sides of cylinder rings and oil ring.
- E. Apply gasket sealer to all other surfaces of head.
- F. Install gasket.
- G. Apply gasket sealer to all surfaces of gasket except those with copper coat gasket sealer.
- H. Place head over alignment pins.
- I. Hand tighten flat washers and head bolts using an 18mm socket.
 - 1. Place engine lift bracket under center washers and head bolts.
- J. Torque head bolts to 80 Ft/Lbs in 20 Ft/Lbs in the followig

order:

7	5	2	3	9
10	4	1	6	8

- K. Torque two front lock washers and nuts to 14 Ft/Lbs using a 13mm socket.
- L. Retorque all bolts and nuts to insure that none were missed.

XVII. CAMSHAFT CHAINS IN HEADS

Caution: Insure that camshafts are positioned for piston #1 at top dead center as described above.

- A. Fabricate two 12" long hooks (coat hanger) with a finger loop at the other end.
- B. Hook both chain wire loop before pulling either one through the head.
 - 1. Secure the lower loop from underneath the exhaust camshaft sprocket.
 - 2. Secure the upper loop from above the intake camshaft sprocket.
- C. Pull both chains tight.
- D. Fasten the lower chain wire to a stud.
- E. Route the upper chain under the chain tensioner sprocket to the exhaust camshaft sprocket.

1. Insert the upper chain wire into the head below the intake camshaft sprocket.
2. Hook the wire loop from above the exhaust camshaft.
3. Pull the chain out and over the exhaust camshaft sprocket.
 - a. If the chain ends are not adjoining, check the following:
 - (1) There is slack above the intake camshaft sprocket
 - (2) There is slack below the exhaust camshaft sprocket.
 - (3) The chain links have not engaged one of the sprockets.
- F. Attach the closure link.
 1. Place lint-free towels around the sprocket to prevent loss of parts.
 2. Slide the closure link through the front row chain ends.
 3. Remove the wires from the rear chain ends.
 4. Insert the thick link spacer between rows.
 5. Insert the thin link spacer last.
 6. Install retaining clip with opening on left side when viewing from the front.

XVIII. ADJUST CHAIN TENSIONERS

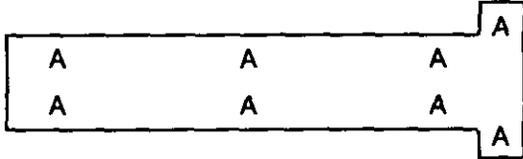
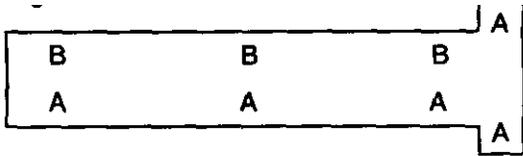
- A. Position piston #1 at top dead center.
- B. Install the multi-hole washer over the chain tensioner shaft.
- C. Rotate each chain tensioner so that the top of the shaft turns toward center of engine.
 1. Turn shaft with double nuts or special spanner wrench.
 - a. A spanner wrench is a flat, "Y" shaped handle with a pin at each of the two tips, correctly spaced apart.
 2. Torque to 1 Lb/Ft.
 - a. Too loose is better than too tight.
- D. Install the pin through the one set of holes that are aligned.
 1. Insert the chamfered end first.
- E. Attach the large flat washer, lock washer and nut using a 19mm socket.
- F. Repeat the timing chain tension adjustment for the other head.

XIX. SPARK PLUGS

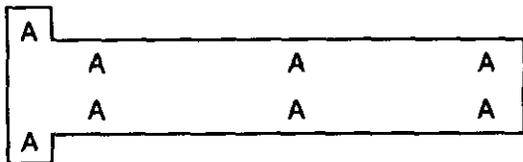
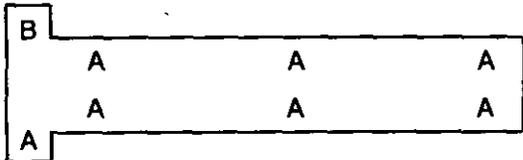
- A. Adjust gap to .032.
- B. Apply anti-seize to threads.
- C. Torque plugs to 20 - 22 ft/Lbs.

XX. CAM COVERS

- A. Fit the rubber covers into heads at each end of camshafts.
 1. Apply non-hardening sealant to curved edge.
- B. Thoroughly clean all head/cam cover mating surfaces.
- C. Apply gasket sealer to surfaces of head.
- D. Install gasket.
- E. Apply gasket sealer to gasket.
- F. Install cam cover.
- G. Install sealing flat washers or O-rings and flat washers over studs.
- H. Torque fasteners to 10.5 ft/lbs using an 11 mm socket.
 1. Fasten acorn nuts at location 'A'.
 2. Fasten male/female standoff at location 'B'.
 3. Right cam covers:



Left cam covers:



5. Attach the vent tube to the front of the lower right cam cover.

The concluding Part III of this expose will be in the next issue. Ed.

Early Ghibli Engine Assembly

WINTER 1993

(Refer to the Fall 1992 Issue for Part 11)

By Claus Groth, with review by Chuck Stemburg

XXI. TOP COVER

- A. Install vent fitting and copper washer onto cover.
- B. Attach copper tube to vent fitting inside cover.
 - 1. Loctite in place.
- C. Install baffle plate with lock washers and screws ...
- D. Apply gasket sealer to one side of gasket and place on block.
- E. Apply sealer to cover and place on gasket.
- F. Torque acorn nuts and new copper washers to _ Ft/Lbs using a 13mm socket.
- G. Attach 3/8" I.D. x 3" long hose to fitting if the air cleaner base has a PCV valve under the right rear corner.
 - 1. If not, attach a 3/8" I.D. x 24" long hose.
 - a. Fuel hose or power steering hose is suitable.

XXII. DISTRIBUTOR Caution.- Insure that the right head idler sprocket has been installed.

- A. Replace O-ring on distributor body and apply oil.
- B. Remove distributor cap.
- C. Position cylinder #1 at top dead center.
 - 1. Insure that "O" on shaft coupling is opposite (180 degrees) from the "O" in distributor recess.
- D. Align coupling on distributor with shaft coupling.
 - 1. Notice that the drive blade is offset from center.
- E. Insert distributor in hole.
 - 1. With distributor cap installed, rotor should point toward #1 spark plug wire.
 - a. Rotor should point toward approximately 2 o'clock when viewed from side of engine.
 - b. If rotor points 180 degrees away, coupling on distributor has been installed backwards.
- F. Align distributor body mark with mark on block if it exists.
 - 1. If marks do not exist, position the oil fill cap, on the side of the housing, toward the thermostat.
- G. Attach clamp and hand tighten lock washers and nuts.
- H. Set the crankshaft to 8 degrees before top dead center (BTDC).
 - 1. Use the flywheel timing marks if they exist.

2. Set the piston height using a dial indicator through the spark plug hole.
 - a. Turn the crankshaft to TDC.
 - b. Set the dial indicator to "0".
 - c. Turn the crank counterclockwise about 90 degrees.
 - d. Turn the crank slowly clockwise until the indicator shows .021.
1. Adjust points using an Ammeter or continuity test light.
 1. Turn the distributor clockwise until there is continuity or the light energizes (points are closed).
 2. Turn the distributor counterclockwise until the points just open.
- J. Torque two lock washers and nuts to 19 Ft/Lbs using 13mm wrench.
- K. Turn cap on oil fill fitting at top of distributor and add several drops of oil.
- L. Attach distributor cap.

XXIII. WATER PUMP

Caution. Rebuild water pump if there is any sign of leakage.

Caution., Inspect water pump cable for damage.

- A. Remove paint from six bosses on inside of water pump housing where compressor mounts.
- S. Install O-ring into water pump housing.
- C. Install housing onto studs.
- D. Fasten with internal star lock washers and nuts using _mm wrench.
- E. Install the idler pulley bracket.

XXIV. AC COMPRESSOR

Caution.- Replace compressor shaft seal if oil is present around pulley.

- A. Clean water pump housing bosses where compressor mounts.
- B. Install alternator drive belt onto crankshaft pulley.
- C. Install drive belts into compressor pulley grooves and route under crankshaft pulley.
- D. Attach compressor to water pump housing.
 1. Place stud on compressor pulley into outboard hole in water pump shaft bracket.
 2. Hand tighten star lock washers and six bolts.
 - a. The two longer bolts attach at the side.
 3. Snug all bolts to insure side and top contact.
 4. Tighten bolts with a 14mm socket.
- E. Turn pulley until end of water pump cable is accessible.
- F. Attach cable to pulley.
 1. Slide screw through cable eyelet.
 2. Slide screw through spacer.
 3. Tighten screw using a 10mm wrench.
- G. Tighten the air conditioner belt between 80 and 85 Ft/Lbs.
 1. Use Gates No. 150 Tensionmeter.

XXV ALTERNATOR

- A. Install pivot bolt through bracket and alternator and tighten nut.
- B. Hand tighten bolt through slot in tension bracket and into alternator.
- C. Attach drive belt.
 - 1. Tighten the alternator bolts when belt tension is between 55 and 69Ft/Lbs.
 - 2. Use Gates No. 150 Tensionmeter.

XXVI. STARTER

- A. Install starter with solenoid on top.
 - 1. Torque lock washers and nuts to 56 Ft/Lbs with a 16mm wrench.
 - a. A 5/8" wrench may be substituted.
- B. Attach battery cable to the large stud.
- C. Attach solenoid wire to the small stud.

XXVII. EXHAUST HEADERS

- A. Scrape block smooth at exhaust ports.
- B. Place new exhaust gaskets over studs (they are inexpensive).
 - 1. An exhaust leak can cause a burned exhaust valve.
 - 2. Use of high temperature silicone sealer is recommended.
- C. Fasten starter shield to right header with strap around tube.
- D. Install headers.
 - 1. Attach rear of starter shield to bottom rear stud.
 - 2. Torque new M8 copper lock nuts to 20 Ft/Lbs with a 12mm wrench.

XXVIII. INTAKE MANIFOLD

- A. CARBURETORS
 - 1. Install thick gaskets (1/16") onto intake manifold.
 - 2. Install plastic heat spacers onto gaskets (3/16m).
 - 3. Install thick gaskets (1/16") onto spacers.
 - 4. Install carburetors using 13mm wrench on lock washers and nuts.
 - a. Installation sequence must be front to rear.
 - b. Slide all carbs forward to insure repeatable replacement.
 - 5. Retract all idle screws.
 - 6. Inspect all butterfly valves to insure that they are closed.
 - 7. Attach throttle return spring to the bottom ball on the rear carburetor throttle lever.
 - 8. Attach throttle link between carbs 3 and 4.
 - a. Loosen nuts using 7mm and 8mm open end wrenches.
 - (1) Note that one thread is left hand, one is right hand.
 - b. Screw nuts and ball sockets toward center.
 - (1) This will insure that both ball sockets will be fastened with an equal number of threads.
 - c. Attach one socket on the top ball of carb 4 throttle lever.
 - d. Unscrew turnbuckle and attach other socket to carb 3.
 - a. Slowly screw turnbuckle clockwise and counterclockwise to feel maximum and minimum free play.

f. Adjust the turnbuckle to the center of free play and tighten nuts.

(1) Insure that ball socket openings are aligned with each other.

g. Attach lock wire clips through holes in ball sockets and snap into place.

9. Attach throttle link between carbs 2 and 3.

a. Cable bracket is attached at front end of turnbuckle.

b. Repeat above sequence.

10. Attach throttle link between carbs 1 and 2 per above sequence.

11. Install throttle return spring on unused front throttle lever ball.

12. Install front gas banjo fitting using large and small fiber washers.

a. Inspect filter for dirt or damage before installing.

13. Cut gas hose to length and attach.

a. 7.3mm hose should be cut 3-3/4" long.

(1) Hose clamps were not factory installed on this hose.

b. 3/8" hose should be cut 3-1/2" long.

(1) Use hose clamps with rolled edges.

(a) Clamps are available from any Mercedes mechanic.

c. Use silicone lubrication or a little oil on end of hose.

14. Slide second banjo fitting into hose.

15. Install banjo fitting as above.

16. Repeat for the remaining carburetors.

B. THROTTLE CABLE CLAMP

1. Screw nut onto clamp shaft.

2. Screw clamp into manifold.

a. Align center of hole with lower ball sockets on carburetor throttle linkage.

3. Tighten nut using a 12mm wrench.

C. THERMOSTATS

I. Test thermostat opening in pan of boiling water with a thermometer.

a. Use meat thermometer.

b. Thermostat should start opening between 180 - 195°F.

(1) Distance between disks when closed is 1-1/8".

(2) Full opening distance between disks is 1-1/2"

(a) Maximum disk movement in housing is 1-5/16".

2. Grease O-rings and place in grooves.

3. Install thermostats with small disks down.

4. Install cover.

5. Fasten three lock washers and nuts using a 13mm socket.

D. VACUUM FITTINGS

1. Install vacuum banjo bolts/fittings with new copper washers.

2. Clean intake manifold ports with compressed air to remove thread debris before installing manifold on engine.

E. HEATER VALVE

1. Test valve by blowing through tube while turning lever.
 - a. Disassemble and clean if necessary.
2. Apply sealer to gasket and place on manifold.
3. Apply sealer to valve flange and place over studs.
4. Torque nuts and lock washers to 95 In/Lbs using an 11 mm wrench.

F. WATER TEMPERATURE SWITCH

1. Install switch into side of thermostat housing.
 - a. Clean probe end with chrome polish or fine sandpaper.
 - b. Gasket is not required as switch seals on taper near probe end.

XXIX. INTAKE MANIFOLD ONTO BLOCK

- A. Grease O-rings and place into grooves in heads.
 1. Vaseline works well.
- B. Grease O-ring mating surfaces on intake manifold.
- C. Place intake manifold evenly on heads.
- D. Snug four lock washers and bolts evenly.
 1. Place the throttle return spring bracket under the left front bolt.
- E. Torque bolts to 19 Ft/Lbs using a 13mm socket.

XXX. OIL PRESSURE AND TEMPERATURE SWITCHES

- A. Install oil temperature switch at left rear top of engine.
 1. Clean probe end with chrome polish.
 - a. Gasket is not required as switch seals on taper near probe end.
- B. Install oil pressure switches at right rear top of engine.
 1. Use new copper washers or sand old washers smooth.
 2. Turn large housing toward temperature switch.

XXXI. CLUTCH (Single Disk)

Caution-Insure that flywheel nuts have been torqued and that cotter pins have been installed.

Caution. Clutch may have been balanced with the crankshaft and flywheel.

- A. Insert a Ford clutch alignment tool into the pilot bearing hole.
 1. Or machine a 6" long bar with a slip fits into the pilot bearing hole and through the clutch disk splined hole.
- B. Slide the disk against the "eel".
 1. It only fits against the "" one way.
 - a. Most disks have the orientation stamped near the center on the flywheel side.
 2. Turn the disk and the Ford tool in opposite directions
 3. until the crowns of the splines bind.
- C. Position the pressure plate onto the three flywheel studs.
 1. The orientation should have been marked at time of removal.
 2. If balanced with the flyweel, alignment position is usually painted at the edge.
- D. Torque the bolts, star lock washers and flat washers to 22 Ft/Lbs using a 17mm socket.

1. Tighten in half turn increments in a crisscross pattern to maintain parallelism with the "eel.

E. Remove the alignment tool.

XXXII. CLUTCH (Double Disk)

- A. The same cautions and instructions (in general) apply as for the single disk clutch.
- B. It is hoped that the location and orientation of the parts was noted at the time of disassembly to insure correct reassembly.

XXXIII. MANUAL TRANSMISSION

- A. Replace the front seal.
 1. Remove the bellhousing.
 2. Clean the bellhousing/transmission sealing surfaces.
 3. Remove the old seal.
 4. Oil the new seal and install it.
 5. Oil the bearing spacer and place it into the bellhousing cavity to hold it in place during reassembly.
 6. Apply sealer to the bellhousing/trans mating surfaces and join together.
 7. Torque (4) bolts and nuts to 80 Ft/Lbs using a 19mm socket.
 - S. Torque (4) bolts to 22 Ft/Lbs using a 13mm socket.
- B. Lubricate the throwout bearing pivot pins with anti-seize grease.
- C. Fasten the throwout bearing to the pivot shaft with the spring clips,
- D. Grease the pivot shaft through the fitting at the bottom end until grease appears at the joints.
- E. Center the transmission input shaft with the pressure plate hole.
- F. Slide the transmission toward the engine until the flanges mate.
 1. The transmission must be accurately aligned with the crank shaft centerline for engagement.
 2. Measure the gap between flanges in several places to determine realignment direction.

G. Torque lock washers and nuts to 22 Ft/Lbs using a 13mm socket. Caution., Do not forget to bend the crankshaft pulley bolt lock clip tab against the bolt head.

TORQUE SPECIFICATIONS
METRIC HEX HEAD CAP SCREWS (REGULAR PITCH)

	CLASS 8.8	CLASS 9.8	CLASS 10.9	CLASS 12.9
	DRY LUBED	DRY LUBED	DRY LUBED	DRY LUBED

Values in inch-pounds

M4	27.5	17	30	18	38.5	24	53	32.5
Ms	66.5	33.5	61	37	78	47	107	65
M6	95	57.5	103	61	132	79	180	109

Values in foot-pounds

M8	19	12	21	13	27	16	37	22
mio	39	23	42	25	63	32	73	
M12	67	40	73		92	55	127	76
M14	107	64	116	69	148	89	203	122
M16	167	100	181	108	230	138	316	190
M20	325	196	352	211	"9	269	617	370
M24	562	337	609	366	775	465	1066	640
M30	1117	670	1210	726	1540	924	2188	1271

This completes the series on Ghibli engine assembly. Others are encouraged to create similar tomes for other engines, perhaps using this as a model. A marked-up copy of this one would be a fine basis for another procedure, even if it's not as complete. Of course, any corrections or additions to this article would be welcomed by Claus.