Equipment Required:

1. Dial indicator with magnetic base attachments.
2. Vernier caliper
3. 100 ml Burette with flow control petcock (a stand and holding fixture is very helpful).
4. Fluid for burette (mixture of 80% kerosene and 20% automatic transmission fluid (ATF) is most suitable).
5. Grease for sealing around top of piston ring, cc'ing plate, etc.
6. Plexiglass cover plate - with a machined chamber of known volume on one side.
7. Internal micrometer or expanding caliper – for measuring bore.

As with other measurements, the compression ratio is determined on the engine in an **as-raced** condition. No alterations shall be made, including cleaning, before the components are measured.

The Basic Formula for Compression Ratio is:

$$\frac{\text{Swept Volume} + \text{Unswept Volume}}{\text{Unswept Volume}}$$

1. Calculation of Swept Volume

The formula is $\Pi/4\ D^2h$ (16.387) or 3.1416 x bore x bore x stroke x 16.387 (inches to cc.)

Using a dial gauge on the top of the piston, bring the piston up to Top Dead Center (TDC) and measure the deck height using a depth micrometer or vernier. Using a dial gauge, take the piston to Bottom Dead Center (BDC) and measure the deck height. Now subtract the deck height at TDC from the deck height at BDC to obtain stroke.

Note: A Cortina G.T. engine may have a positive deck height due to the piston protruding above the surface of the block. This can be measured as above using depth micrometer or vernier caliper or by using a straight edge across the top of the piston and a set of feeler gauges. In this case, the deck height at TDC is added to the deck height at BDC.

Measure the diameter of the bore well down in the cylinder below the ridge of the top ring with the internal micrometer or vernier caliper. Calculate the swept volume using above formula.

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2. **Calculation of Unswept Volume:**

   Unswept volume is the sum of:

   a. Volume from the top of the top ring to the top of the piston.

   b. Volume from the top of the piston to the top of the block.

   c. Volume of the head gasket.

   d. Volume of the cylinder head.

   The volume from the top of the top ring to the top of the piston is very difficult to measure. This volume is therefore specified in the GCR as:

   1.64 cc – Cortina G.T. 1.33 cc – uprated engines

3. **Volume of Block:**

   a. Run the piston down about ½ inch from TDC and smear grease around the cylinder walls, enough to ensure a perfect seal. Using a dial gauge, run the piston up to TDC, tap the top of the piston lightly to take out any slack and remove excess grease from the top of the piston and cylinder wall. Cover the top of the bore with the plexiglass plates, sealing it with grease (enough for a perfect seal, but not too much to go down the bore).

   b. In order to allow all air to escape as you fill with fluid, the engine block must be tipped so that the top surface is level.

   c. Move the tip of the burette over the plexiglass plate filling port and adjust the holding fixture so that the tip is well down into the chamber.

   d. With the level of the liquid meniscus at "zero" on the burette, slowly begin to fill the chamber of the cylinder head. Be certain that the grease is providing a good seal.

   e. Displace all air in the chamber with the liquid. Fill to the point where the fluid is at the very bottom of the filling port, and that all bubbles are out.

   f. Read the level of liquid in the burette and record it in the appropriate space on the worksheet.

   g. If the engine is an up-rated and the block volume is less than 42.55 cc, the volume of the cylinder head **must** be checked.

   h. If the engine is a Cortina G.T. with positive deck height (protruding piston), the volume of the protruding piston and its bowl must be

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measured using a plexiglass cc'ing plate with a machined recess with a known volume.

4. **Volume of Head (spark plugs installed)**

   a. For up-rated head with valves protruding from surface:

      Use standard negative volume – 0.3cc's.

   b. For up-rated head with valves recessed, or for all Cortina G.T.:

      Volume of head combustion chamber must be checked by lightly greasing the surface of the head normally covered by the head gasket and placing the plexiglass plate over the combustion chamber portion of the head. There must be a perfect seal without grease going into the chamber.

      Note: It may be necessary to use a plexiglass cc'ing plate that has a machined recess with a known volume to clear the valve seats when checking capacity of the up-rated cylinder head. If the amount of fluid filing the known volume chamber exceeds the volume of the chamber itself this excess is volume of the head and is recorded in the appropriate space on the worksheet.

   c. Level the cylinder head on a sturdy surface so that the filling port is at the highest point. This is done so that as the chamber is slowly filled with fluid, air may escape through the port and will not be trapped in the chamber.

   d. Move the tip of the burette over the plexiglass plate filling port and adjust the holding fixture so that the tip is well down into the chamber.

   e. With the level of the liquid meniscus at "zero" on the burette, slowly begin to fill the chamber of the cylinder head. Be certain that the grease is providing a good seal.

   f. Displace all air in the chamber with the liquid. Fill to the point where the fluid is at the very bottom of the filling port, and that all bubbles are out.

   g. Read the level of liquid in the burette and record it in the appropriate space on the worksheet.

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TYPICAL FIGURES FROM A COMPRESSION RATIO CHECK:

Stroke: Deck Height at BDC: 3.068″
Deck Height at TDC: 0.015″

Stroke 3.053″
Bore: 3.195″

Swept Volume: $\frac{3.1416 \times 3.195 \times 3.195 \times 3.053 \times 16.387}{4}$ = 401.105cc's

Unswept Volume:

Volume from top of top ring to top of piston (fixed specification from GCR)	= 1.33 cc's
Volume from top of piston to top of block (measured by fluid) see 3.g	= 42.6 cc's
Volume of head gasket (fixed specification)	= 4.75 cc's
Volume of head (fixed specification – see 4.a and 4.b)	= -0.3 cc's
UNSWEPT VOLUME Total	48.38 cc's

Compression Ratio:

$$\frac{\text{Swept Volume + Unswept Volume}}{\text{Unswept Volume}} = \frac{401.105 + 48.38}{48.38} = 9.29 \text{ to } 1$$

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