Section 3 Topics

Tools, Materials and Equipment

- Shop Safety
- Engine Lift
- Parts Washers
- Engine Sealing
- Seal Installation
- Seal Packing
- Dye Penetrant
- Plastigage®
- Thread Cleaning
- Vernier Caliper
- Micrometer
- Inside Diameter Gauges
- Dial Indicator

- Using a Micrometer Worksheet

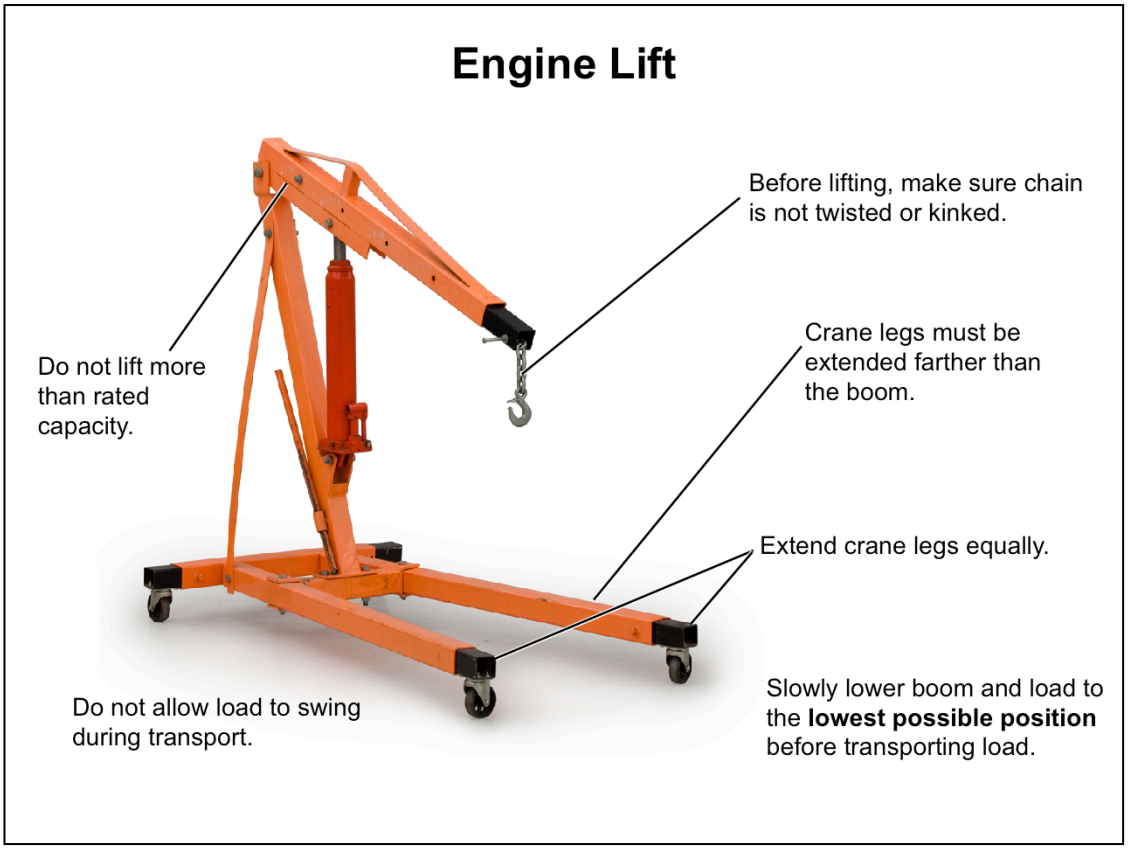
Shop Safety

Be sure to watch out for the **safety of coworkers** when working together. Keep the work area clean and neat.

When working with the engine running, make sure to provide **ventilation for exhaust fumes** in the workshop.

If working on high temperature, high pressure, rotating, moving, or vibrating parts, wear appropriate safety equipment and **take extra care** not to injure yourself or others.

When lifting the vehicle, be sure to support the specified location with a **safety stand** and use appropriate **safety equipment**.



Engine Lift Always follow the safety procedures outlined by your dealership and/or the lift manufacturer. Use extreme caution when lifting, lowering and moving heavy loads. Always use proper engine mounting equipment and make sure they are securely connected. Refer to the Repair Manual for proper service procedures.

Parts Washers

- All parts must be cleaned before reassembly
- Know what type of solvent the washer uses. Some types are harmful to aluminum
- Immersion cleaners may be most effective at cleaning a cylinder head's oil galleys and blind passages

Manual Parts Washer

Parts Washers

Parts washers will use either a water-based solvent or a solvent-based solution. Be sure you know which type is used because some solvents are harmful to aluminum parts.

- For water based solvent, be sure to blow parts dry and lightly oil them.
- For a solvent-based washer, wash with water, then dry and lightly oil.
- Use a wire wheel to clean bolts, if necessary, to remove rust corrosion, loctite, sealant, etc.

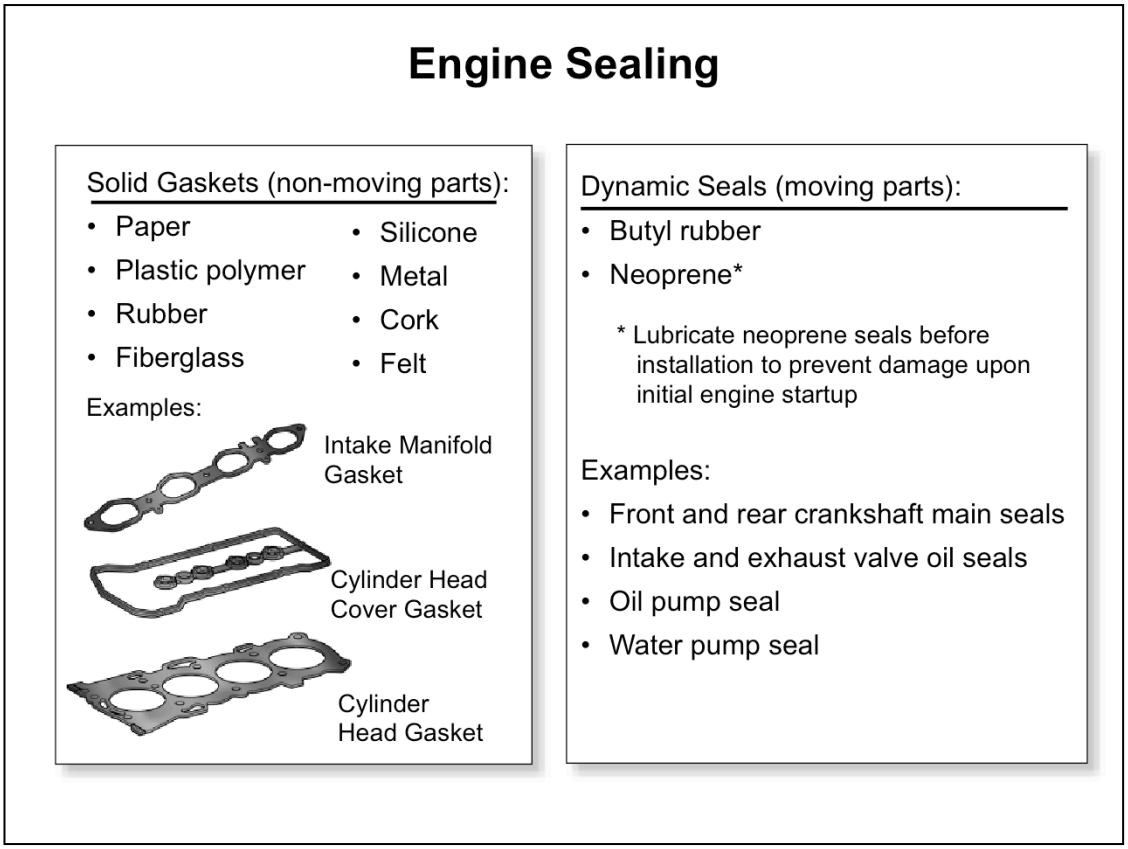
Cylinder Head Cleaning

Clean the entire cylinder head prior to disassembly if it has excessive residue.

- After the parts are removed, wash the cylinder head again separately.
- Cleaning valves – Use a wire wheel to remove carbon buildup.
- Immersion cleaners may be most effective at cleaning a cylinder head's oil galleys and blind passages.

Cylinder Block Cleaning

- Remove plugs from oil galleries and coolant passages.
- Remove all gasket material and/or seal packing.
- Do not hot tank aluminum parts as they will be damaged.
- Spray with an appropriate water and solvent mixture following supplier's precautions.
- Have a variety of wire brushes available to clean with. Use a rifle brush to clean oil galleries.
- Spray iron/ferrous components thoroughly with a rust inhibitor and dry immediately.
- Dry thoroughly with compressed air and paper towels.



Engine Sealing

Automotive engines have dozens of mated surfaces and moving parts. For the engine to function properly these surfaces, orifices, and moving parts need to be sealed off from one another depending on their function or design.

Toyota uses various methods for engine sealing depending on application or function. Solid gaskets are typically used to seal between non-moving parts. These gaskets can be made of various material such as paper, cork, plastic polymer and rubber. For moving parts such as oil or water pumps a dynamic seal is used. These seals are often made of rubber or neoprene.

NOTE It is important to always clean mating surfaces before installing gaskets or seals. Some dynamic seals may require a small amount of lubrication upon installation. See the Repair Manual for proper installation procedure.

Seal Installation

Front Crankshaft Oil Seal Driver

SST: 09223-22010
SST: 09506-35010

Rear Crankshaft Oil Seal Driver

SST: 09223-15030
SST: 09950-70010

Note:
- Keep the lip free of foreign matter
- Do not tap oil seal at an angle

Seal Installation To ensure seals are not damaged during installation, special SSTs are available. It is important to use these SSTs to ensure the seal is properly aligned, at the correct depth, and not damaged during installation.

NOTE Care must also be taken when removing seals so as not to scratch or otherwise damage the contact surfaces. If using a screwdriver to pry out a seal, tape the screwdriver tip to reduce the risk of scratching the contact surface.

Seal Packing

Form-in-place Gasket (FIPG)

For engine oil application:

- Toyota Formed-In-Place Gasket - Oil Pan (aka Toyota Seal Packaging 102)
- Replaces Toyota Genuine Seal Packing Black (or Three Bond 1207B or equivalent)

Part No. 00295-00103

For engine coolant application:

- Toyota Genuine Seal Packing 1282B (or Three Bond 1282B, or equivalent)

Part No. 08826-00100

T-TT-0060-10

FIPG Form-in-place gasket (FIPG) is used to seal a multitude of surfaces on modern Toyota engines. There are many different types of FIPG on the market for various applications. It is important to use the proper sealer for each application.

For sealing against oil leaks, use Toyota Formed-In-Place Gasket - Oil Pan (part no. 00295-00103). Also known as Toyota Seal Packaging 102, this product replaces Toyota Genuine Seal Packing Black, (or Three Bond 1207B, or equivalent) that is specified in the Repair Manuals.

For sealing against water leaks, use Toyota Genuine Seal Packing 1282B (part no. 08826-00100). The Repair Manual specifies Three Bond 1282B or equivalent as alternatives.

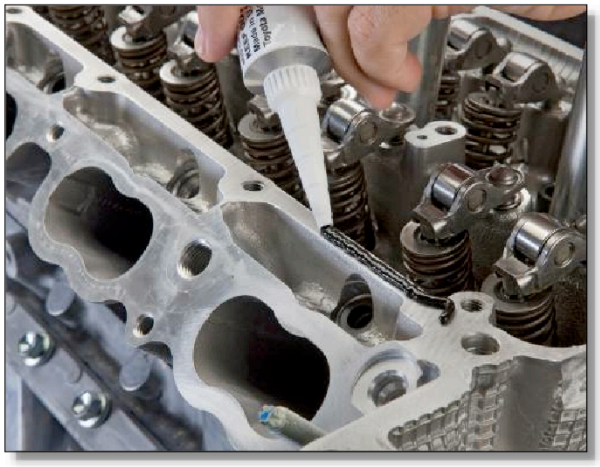
Seal Packing Application

Preparation

- Remove any old material
- Be sure contact surfaces are clean, dry and oil free

Application

- Apply bead of specified width (usually between 2 mm and 4 mm)
- Apply in a continuous line
- Assemble parts within 3 minutes of application
- Allow to dry as specified (one to two hours) before putting assembly into operation



Seal Packing Application

During application, it is crucial that certain protocols are followed to ensure the mating surfaces seal. The surface must be thoroughly cleaned of used FIPG as well as oil and any other residues. Caution must be taken while cleaning the surface. To prevent damage to the mating surface do not use abrasive pads or pneumatic tools. Consult the Repair Manual for where to apply the sealer and the correct amount to use.

NOTE It is important to apply sealer in the correct diameter and only in the prescribed areas. This minimizes seepage and most importantly prevents FIPG from entering and blocking oil feed holes or coolant passages.

Dye Penetrant

- Reveals cracks and surface defects in metal parts

Dye Penetrant System

- Cleaner
- Penetrant
- Developer

Application

- Clean surface thoroughly with cleaner
- Spray or brush on penetrant and allow to soak for 15 minutes
- Remove penetrant using cleaner and a rag
- Apply developer evenly over the surface and inspect for red marks indicating defects

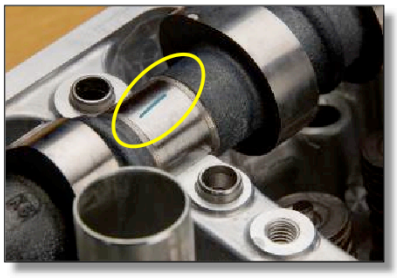
Dye Penetrant

Although cracks in the cylinder head or cylinder block are not common, un undiscovered crack can result in a misdiagnosis and a failed repair attempt. It's important to check for cracks, especially around the combustion chamber, coolant passages and oil passages.

One way to check for cracks is to use dye penetrant. This multistep application uses various dyes and chemicals to highlight trouble areas that could be otherwise hard to see. If you are not confident using this product it's advisable to send the components to a professional machine shop to have the component checked using alternative methods.

Plastigage®

Lay a strip of Plastigage on bearing or journal and reassemble.



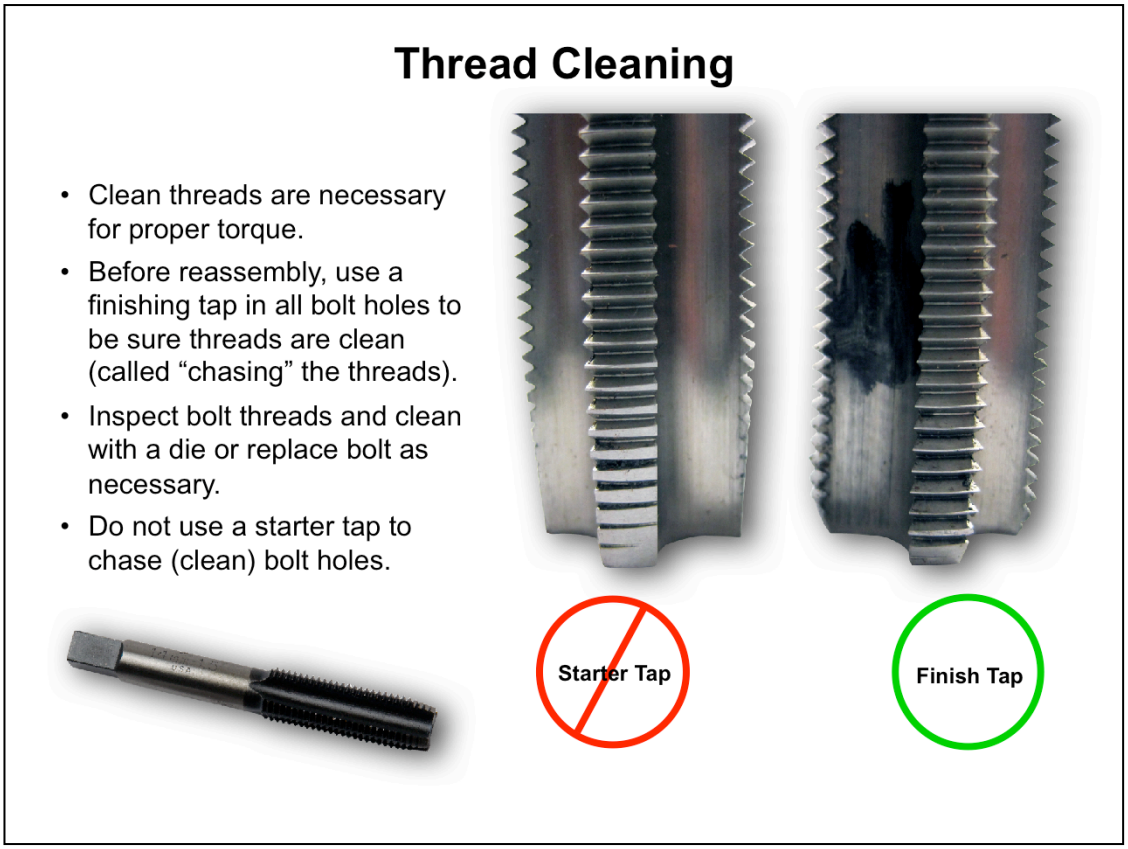
Disassemble and use the gauge on the packaging to measure the width of flattened Plastigage to determine oil clearance.

Plastigage

Plastigage provides an effective method for measuring clearances between fitted surfaces such as bearings and journals. Plastigage is ideally suited for measurements on components such as crankshaft journals because clearances can be measured without removing the component.

Plastigage is a thin plastic thread that is placed between two surfaces where clearance is to be measured. When the components are assembled and properly torqued, the plastic thread is compressed and flattened. The width of the flattened plastic is then compared to a measurement chart to determine the clearance between the two mating surfaces. Plastigage comes in different diameters suitable for different clearance ranges.

NOTE It is important to clean the bearing and journal surfaces beforehand, and to remove the Plastigage residue with a clean cloth afterward.



Thread Cleaning

Bolt threads and threads in bolt holes must be free of FIPG and oily dirt in order to achieve proper torque during reassembly.

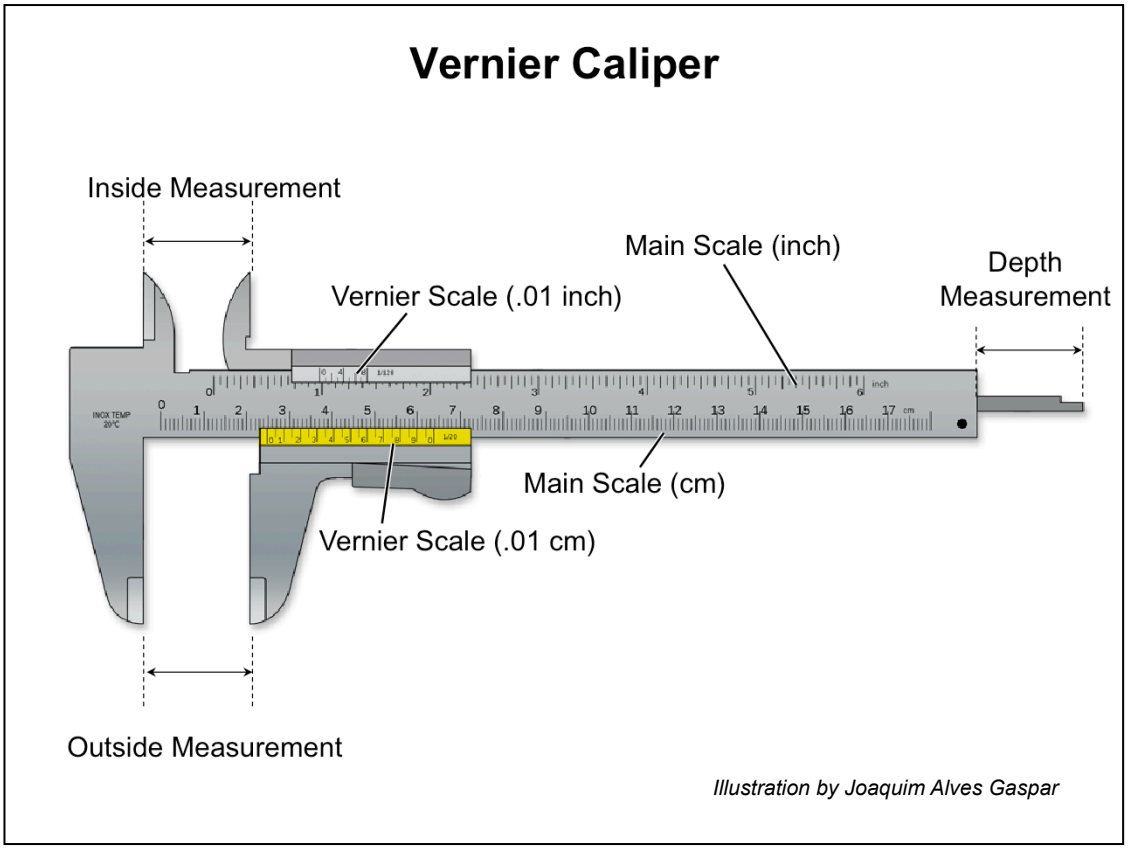
A finishing tap should be used to “chase” (clean) bolt holes. Do not confuse a finishing tap with a starter tap. A starter tap is tapered at the end to gradually begin the thread cutting in a new hole. In a blind hole that is already threaded, the tapered end will not clean the threads at the bottom of the hole.

NOTE A finishing tap may not be included in every tap and die set.

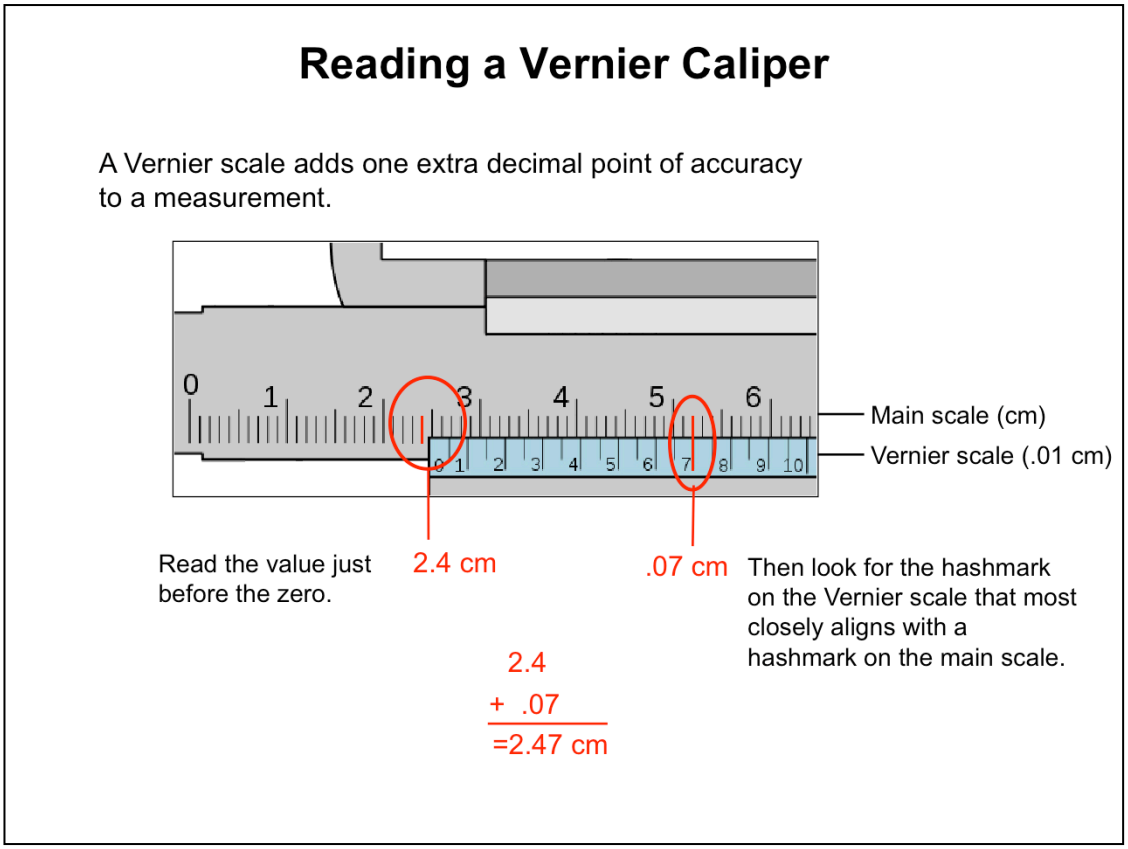
Use an appropriate size die to clean bolt threads. Inspect threads for damage and replace as necessary.

Start all bolts by hand. If the bolt gets too tight to turn by hand, stop. Remove the bolt and inspect it, and chase the bolt hole.

Be careful that there is no coolant or oil in a blind bolt hole. When the bolt reaches the uncompressible liquid, it cannot be tightened any further.



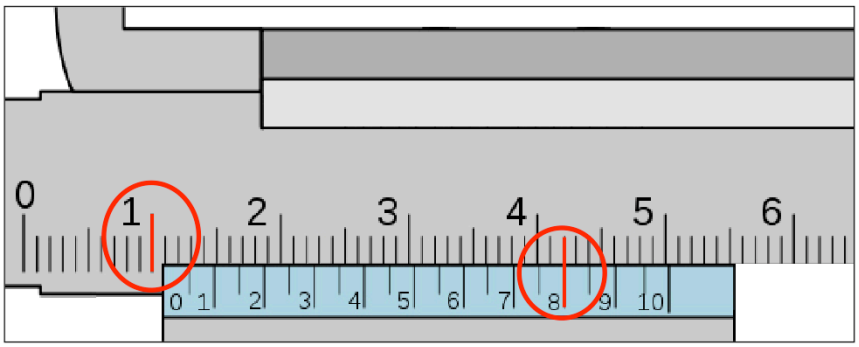
Vernier Caliper The caliper, in this case a Vernier caliper, is a versatile measuring tool that can be used for making inside, outside, and even depth measurements. The Vernier caliper is different from traditional calipers because of the addition of the Vernier scale. The Vernier scale allows for an additional decimal point of accuracy.



Reading a Vernier Caliper To read the Vernier scale, find a hash mark on the Vernier scale that aligns perfectly with any hash mark on the main scale. Then read the value from the Vernier scale associated with that hash mark.

Reading a Vernier Caliper

What is the reading on this caliper?



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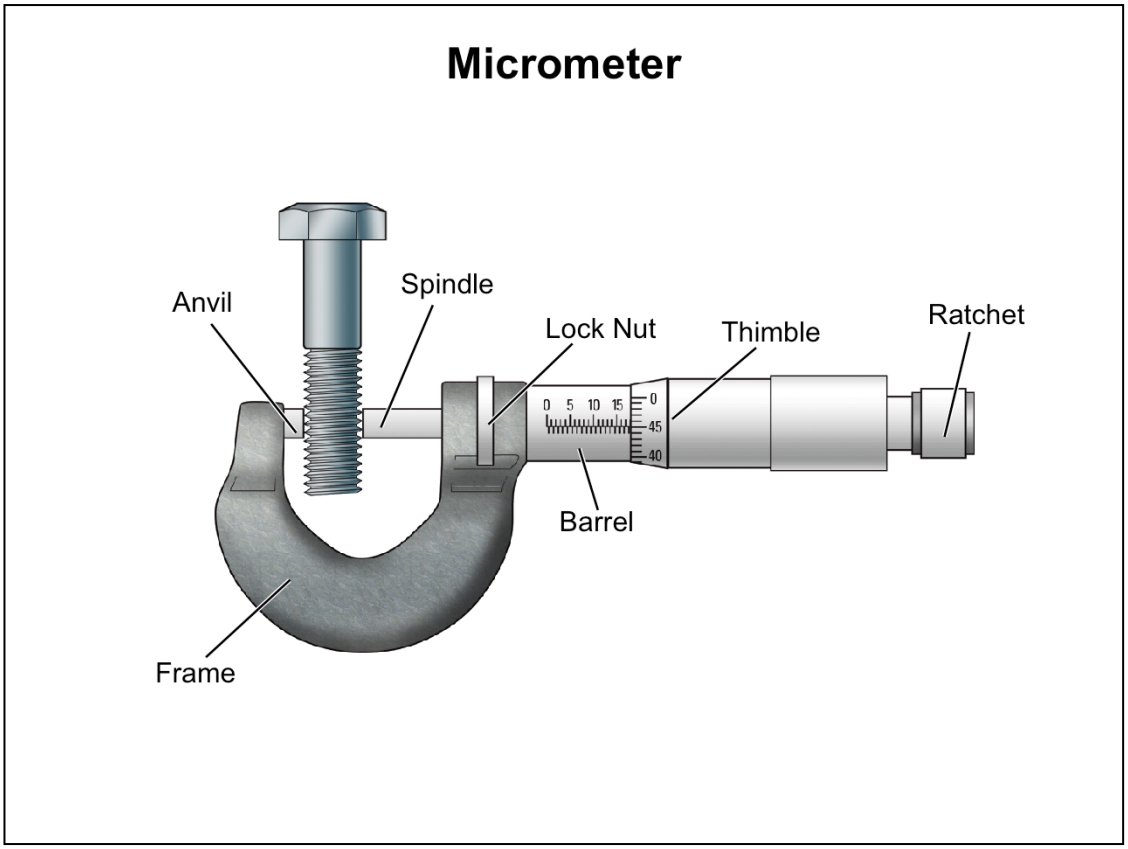
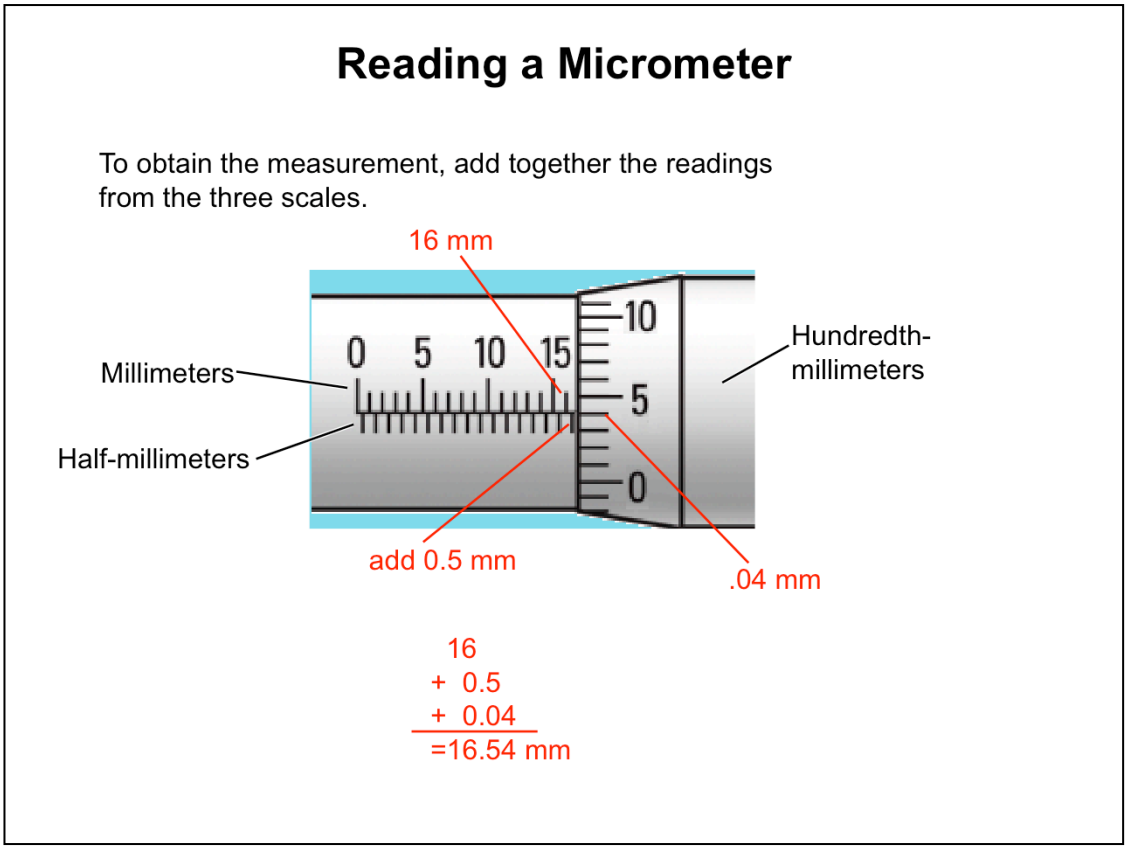


Micrometer The micrometer is used exclusively for outside diameter measurements. Micrometers come in ranges of measurement diameters. It is important to select a micrometer with the correct measurement range for the component being measured.



Reading a Micrometer

The micrometer is fairly easy to read. First, note the largest value visible on the millimeter scale. In the example above, the reading is 16 mm.

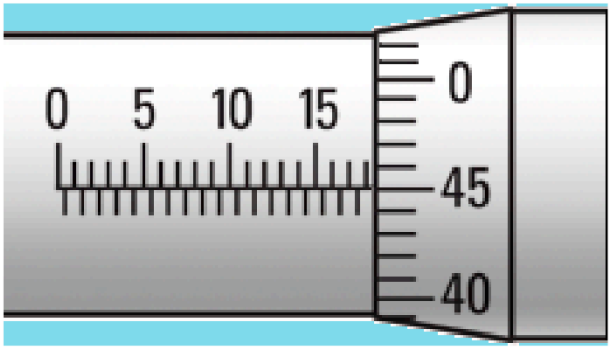
Next note if there is a half-millimeter mark displayed. In the example above, there is a half-millimeter mark showing, so we add 0.5 mm to the measurement.

Finally, we take the reading on the thimble that aligns most closely with the millimeter scale, in this case 0.04mm.

Adding all the readings together we obtain a measurement of 16.54 mm.

Reading a Micrometer

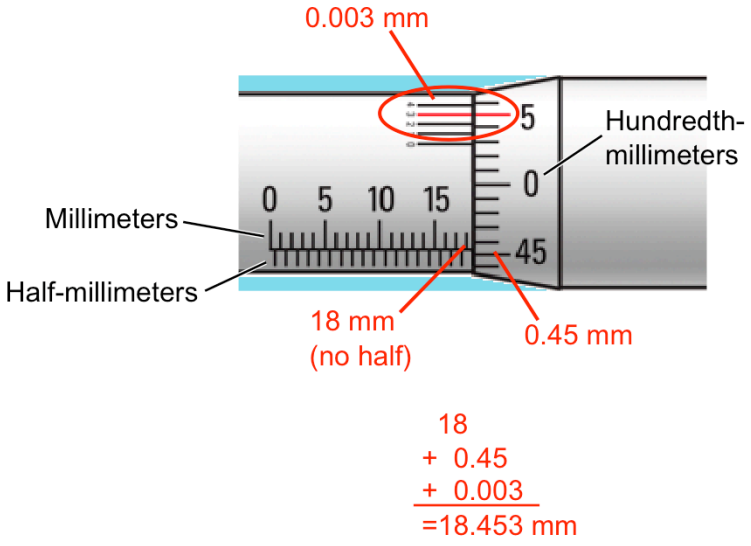
What is the reading on this micrometer?



NOTES:

Micrometer with Vernier Scale

When there is a Vernier scale, look for the hashmark on the Vernier scale that most closely aligns with a hashmark on the 1/100th millimeter scale.



18
+ 0.45
+ 0.003
=18.453 mm

Micrometer with Vernier Scale

As with the calipers, micrometers often come equipped with a Vernier scale. The Vernier scale allows us to obtain an extra decimal place of accuracy on our measurements.

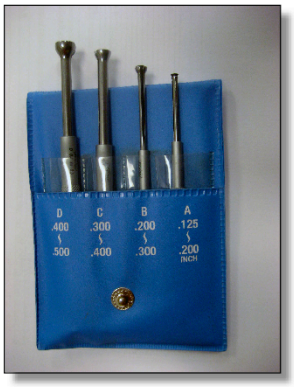
When there is a Vernier scale, look for the hashmark on the Vernier scale that most closely aligns with a hashmark on the 1/100th millimeter scale.

Digital Micrometer Some technicians prefer the speed and simplicity of a digital micrometer.

Inside Diameter Gauges

Measure:
- Cylinder bore
- Valve guide bush

Measure:
- Valve guide bush



Inside Diameter Gauges

Inside diameter gauges come in a variety of different configurations and designs to fit a variety of applications. Typically, the inside diameter gauge is inserted and expanded to the dimension to be measured, and then locked in place. It is then removed and measured with a micrometer to obtain the actual measurement.

Dial Indicator

Measure:

- Runout
- Endplay
- Thrust

Dial Indicator

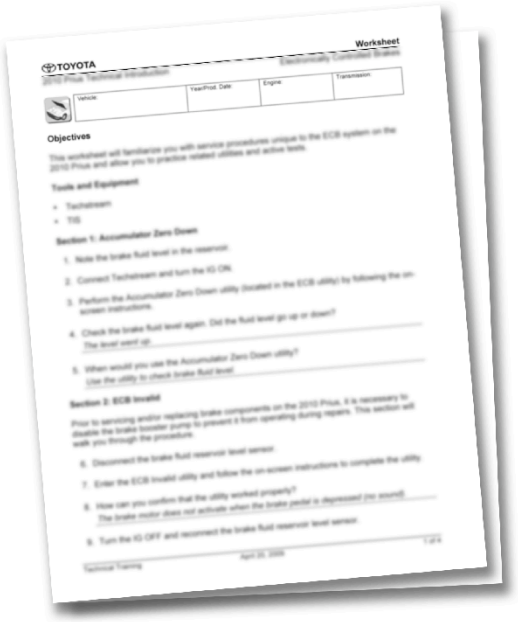
Dial indicators use a spring loaded pin to translate up and down movement into an incremental measurement. Dial indicators are extremely useful for measurements of surface variation such as run-out or allowable movement between components such as endplay.

Typically, dial indicators need to be firmly mounted to a fixed surface or component. This is accomplished by either a magnetic base or, as shown in the image above, a pair of vise grip pliers.

Worksheet

Using a Micrometer

In this worksheet you will practice making measurements using a micrometer.


Worksheet

TOYOTA

Vehicle | Year/Prod. Date | Engine | Transmission

Objectives

Tools and Equipment

- Techstream
- TIS

Section 1: Accumulator Zero Down

1. Note the brake fluid level in the reservoir.
2. Connect Techstream and turn the IG ON.
3. Perform the Accumulator Zero Down utility (located in the ECB utility) by following the on-screen instructions.
4. Check the brake fluid level again. Did the fluid level go up or down?
   The level went up.
5. When would you use the Accumulator Zero Down utility?
   Use the utility to check brake fluid level.

Section 2: ECB Invalid

6. Disconnect the brake fluid reservoir level sensor.
7. Enter the ECB invalid utility and follow the on-screen instructions to complete the utility.
8. How can you confirm that the utility worked properly?
   The brake motor does not activate when the brake pedal is depressed (no sound).
9. Turn the IG OFF and reconnect the brake fluid reservoir level sensor.

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Use this space to write any questions you may have for your instructor.

NOTES: