

Name: _____

Date: _____

Engine Repair Work Example 1

WorkKey Level: 4

NATEF Automotive Tasks: I.A.8, VIII.A.8

When doing a cylinder balance test, you come up with the following results.

Cylinder	RPM drops from 650 to
1	575
2	560
3	630
4	570

Predict which cylinder is not producing power.

The manufacturer requires at least a 10% drop in RPM when a cylinder is killed. Complete the following chart.

Cylinder	Percentage of Drop
1	
2	
3	
4	

According to your calculations in the above chart, which cylinder is not producing power?

Engine Repair Work Example 2

WorkKey Level: 4

NATEF Automotive Tasks: I.A.9

A good engine will have a fairly even compression from cylinder to cylinder. If the highest and lowest readings vary more than 25% of the highest reading, the engine should be repaired.

Compression readings for a 4-cylinder engine are shown below. Determine whether the engine compression range is within recommendations.

Cylinder 1	Cylinder 2	Cylinder 3	Cylinder 4
173	180	147	128

Which, if any, cylinder would you perform a cylinder leakage test on? Please explain.

Engine Repair Work Example 3

WorkKey Level: 4

NATEF Automotive Tasks: I.B.3, I.B.8

You measured the free height of a set of valve springs and have come up with the following:

Spring	Height (inches)	Acceptable	Not Acceptable
1	1 7/8		
2	1 15/16		
3	1 3/4		
4	1 7/8		
5	1 13/16		
6	1 29/32		
7	1 31/32		
8	1 15/16		

The manufacturer's spec for free height is 1 7/8 inches + 1/16 inch. Check each spring in the table above and determine whether each is acceptable or not.

Engine Repair Work Example 4

WorkKey Level: 4

NATEF Automotive Tasks: I.B.6

If the inside diameter of the guide you have measured is 0.3458" and the outside diameter of the valve stem is 0.3413", what is the valve-stem-to-valve-guide clearance?

The maximum valve guide clearance is 0.0015". Is this exhaust-stem-to-valve-guide clearance within service specifications?

Engine Repair Work Example 5

WorkKey Level: 4

NATEF Automotive Tasks: I.B.6, I.B.14, I.C.4, I.C.6, I.C.7, I.C.9

Find the difference between the major and minor diameter of the following components.

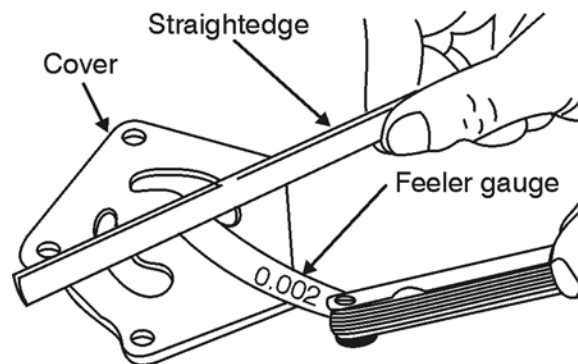
Type	Major diameter	Minor diameter	Difference
Valve stem	0.375"	0.368"	
Cylinder bore	3.692"	3.686"	
Crank shaft journal	2.499"	2.4965"	
Cam lobe	25.67 mm	20.86 mm	
Cylinder bore	93.77 mm	93.624 mm	

Engine Repair Work Example 6

WorkKey Level: 4

NATEF Automotive Tasks: I.D.2

The feeler gauge below is marked 0.002" with a light drag. The manual specifies that the space must be less than 0.0015". Is this an acceptable measure? By how much?



Engine Repair Work Example 7

WorkKey Level: 4

NATEF Automotive Tasks: I.B.8

You measured the installed height of a set of valve springs and have come up with the following:

Spring	Height (inches)	Acceptable	Shim thickness
1	1.85		
2	1.71		
3	1.75		
4	1.82		
5	1.78		
6	1.69		
7	1.72		
8	1.79		

The manufacturer's spec for installed height is 1.75 inches \pm 0.030 inch. Complete the table above to determine whether each spring is acceptable. Then select the most appropriate shims to do the job from the list below.

0.005" 0.010" 0.015" 0.030"

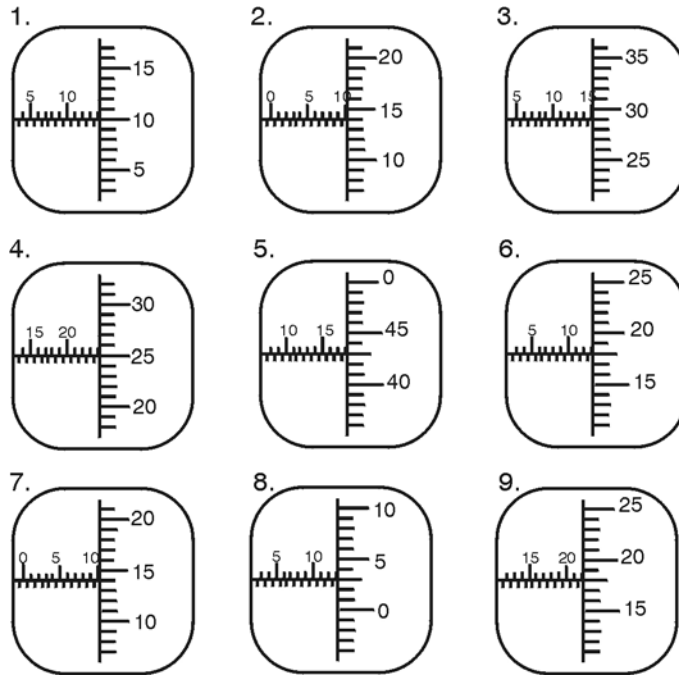
Engine Repair Work Example 8

WorkKey Level: 3

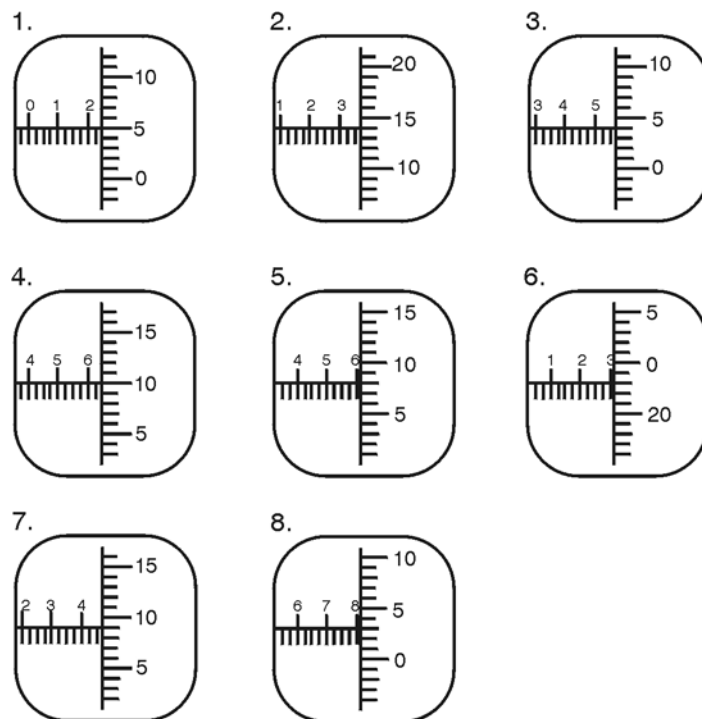
NATEF Automotive Tasks: I.B.6, I.B.12, I.B.14, I.B.15, I.C.6, I.C.7, I.C.8, I.C.10, I.C.12

Read the following 17 micrometer measures. Label your answers with the appropriate units.

Metric Micrometer Readings



American Standard Micrometer Readings

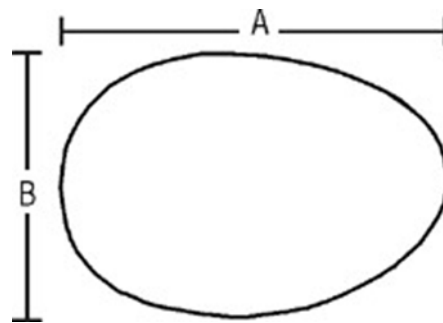


Engine Repair Work Example 9

WorkKey Level: 4

NATEF Automotive Tasks: I.B.14

The amount of wear that has taken place on a camshaft may be determined by taking two measurements of a cam lobe. One measurement, dimension A, is across the cam lobe and the other, dimension B, is across the base circle (see figure below). The lobe lift is determined by subtracting the B measurement from the A measurement.



The cam lobe dimension A is 35.90 mm and dimension B is 29.25 mm. What is the lobe lift?

Engine Repair Work Example 10

WorkKey Level: 4

NATEF Automotive Tasks: I.B.15

The outside diameter of a camshaft bearing journal is 1.125" and the inside diameter of the installed bearing measures 1.1273". How much clearance is there?

Solution

The amount of clearance is one-half the difference between the inside and the outside diameters.

$$1.1273" - 1.125" = 0.0023"$$

$$\frac{0.0023"}{2} = 0.00115"$$

Engine Repair Work Example 11

WorkKey Level: 4

NATEF Automotive Tasks: I.C.2, I.C.3

Find the proper tap drill size for a 3/4" by 10 tpi national (coarse) grade-5 bolt.

American National Screw Thread Pitches

Bolt or tap size	Threads per inch	Outside diameter at screw	Drill sizes	Decimal equivalent of drill
1	64	0.073	53	0.0595
2	56	0.086	50	0.0700
3	48	0.099	47	0.0785
4	40	0.112	43	0.0890
5	40	0.125	38	0.1015
6	32	0.138	36	0.1065
8	32	0.164	29	0.1360
10	24	0.190	25	0.1495
12	24	0.216	16	0.1770
1/4	20	0.250	7	0.2010
5/16	18	0.3125	F	0.2570
3/8	16	0.375	5/16	0.3125
7/16	14	0.4375	U	0.3680
1/2	13	0.500	27/64	0.4219
9/16	12	0.5625	31/64	0.4843
5/8	11	0.625	17/32	0.5312
3/4	10	0.750	21/32	0.6562
7/8	9	0.875	49/64	0.7656
1	8	1.000	7/8	0.8750
1 1/8	7	1.125	63/64	0.9843
1 1/4	7	1.250	1 7/64	1.1093

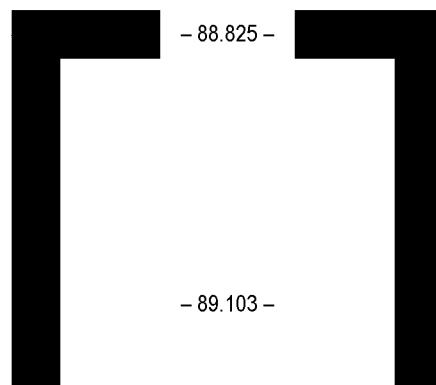
Engine Repair Work Example 12

WorkKey Level: 5

NATEF Automotive Tasks: I.C.5, I.C.6

You are doing an engine repair that requires the removal of a piston. Before you remove the piston, you must first measure the ring ridge. If the ring ridge is greater than 0.1 millimeter, it must be removed before the piston is removed. The top measurement in the unworn part of the cylinder is 88.925 mm. The measurement in the worn part of the cylinder is 89.103 mm.

1. What is the difference in the measurements you made?
2. Should the ring ridge be removed before the piston is removed? Explain your answer.



Engine Repair Work Example 13

WorkKey Level: 7

NATEF Automotive Tasks: I.C.10

A 4-cylinder Honda has a bore of 8 cm and a stroke of 9.1 cm. Find the piston displacement in cubic centimeters. Use the formula $V_d = 0.785 \times d^2 \times s \times n$

where: d is the bore or diameter of the piston
 V is the volume of the cylinders
 s is the stroke or piston travel length
 n is the number of pistons

Engine Repair Work Example 14

WorkKey Level: 7

NATEF Automotive Tasks: I.C.10

What is the total piston displacement on an 8-cylinder engine with a 3 1/2 inch diameter and a 4 3/8 inch stroke? Round your answer to the nearest whole number. Use the formula $V_d = 0.785 \times d^2 \times s \times n$

where: d is the bore or diameter of the piston
 V is the volume of the cylinders
 s is the stroke or piston travel length
 n is the number of pistons

Engine Repair Work Example 15

WorkKey Level: 7

NATEF Automotive Tasks: Background

An engine leaks 1/10 ounce drop of oil every 4 seconds at the rear seal. How many hours will the engine run before you have to add 1 qt of oil?

Engine Repair Work Example 16

WorkKey Level: 7

Engine Repair: I.C.10

What is the engine displacement in cubic inches on an 8-cylinder, 4.6-liter engine with a cylinder bore diameter of 3 1/2 inches and a piston stroke length of 4 3/8 inches?

Engine Repair Work Example 17

WorkKey Level: 4

NATEF Tasks: I.D.3, I.D.7

1. When filling a 15-quart system with a solution that is 40% water and 60% coolant, how many quarts of coolant would be required?

2. The chart below shows the relationship between the boiling point and freezing point of ethylene glycol coolant and the percent antifreeze coolant content of the coolant. According to the following chart, if you had a 15-quart system that contained 9 quarts of antifreeze and 6 quarts water, what would the boiling point of the antifreeze in the system be?

Antifreeze Boiling and Freeze Protection Chart
Percent Antifreeze Freezing Point (°C) Boiling Point (°C)

40 %	-24	126
50%	-37	129
60%	-52	132
70%	-64	136

Conditions: 100 kilopascals (15 psig) radiator cap in good condition

Engine Repair Work Example 18

WorkKey Level: 6

NATEF Tasks: I.C.5

A technician is rewiring a parallel circuit in an auto with a 12-volt system. The circuit has four branches each with one load with the following resistance values:

Load 1—6 ohms

Load 2—3 ohms

Load 3—2 ohms

Load 4—1 ohm

What is the circuit total amperage? (Hint: Don't forget Ohms law, $E = I * R$)

Solution

$$\text{Load 1} \quad 12 = I * 6 \quad I = 12/6 \quad \underline{I = 2}$$

$$\text{Load 2} \quad 12 = I * 3 \quad I = 12/3 \quad \underline{I = 4}$$

$$\text{Load 3} \quad 12 = I * 2 \quad I = 12/2 \quad \underline{I = 6}$$

$$\text{Load 4} \quad 12 = I * 1 \quad I = 12/1 \quad \underline{I = 12}$$

Parallel circuit amperage is the “sum” of all the branches.

$$2 + 4 + 6 + 12 = 24 \text{ amps}$$

Engine Repair Work Example 19

WorkKey Level: 4

NATEF Tasks: Background

Joe's Auto Repair shop ordered parts totaling \$418.90. The supplier requires 25% down and 5% for shipping with each order. If Joe plans to send \$125.00, will that amount be sufficient?

Engine Repair Work Example 20

ACT Work Keys Level: 3

NATEF Tasks: I.B.20

If a panel is 0.031 inch (0.79 mm) thick and you grind off 0.024 inch (0.61 mm) of metal, how thick is the remaining panel?

Engine Repair Work Example 21

WorkKey Level: 5

NATEF Tasks: I.A.12

As a technician you are frequently asked to repair older model vehicles. A customer has brought into your shop an older car, valued at \$2250, needing repairs to its suspension system resulting from an accident. After diagnosing the problem, you calculate that the parts needed for the repairs will be \$1250. In addition, you calculate that it will take you 29 hours (at \$35.00/hour) to complete the repairs. What is your advice to the customer? Go ahead with the repairs or "total" the car?

Engine Repair Work Example 22

ACT Work Keys Level: 5

NATEF Tasks: I.C.11

What is the engine displacement in cubic inches on an 8-cylinder, 4.6-liter engine with a cylinder bore diameter of 3 1/2 inches and a piston stroke length of 4 3/8 inches?

Engine Repair Work Example 23

WorkKey Level: 4

NATEF Tasks: Background

An auto parts distributor drives 129 miles on Monday, 135 miles on Tuesday, and 219 miles on Wednesday.

What was his average mileage for those 3 days?

Engine Repair Work Example 24

ACT Work Keys Level: 6

NATEF Tasks: I.B.20; III.B.13; III.B.14

As an auto body repairperson, you are asked to make repairs on a car that has been involved in a serious accident. Damage was sustained to the left front fender, as well as the right headlight, turn light, right fender, and right quarter panel. After consulting parts books and according to your calculations, these are the labor and parts costs:

Labor (nontaxable)

14 hours for repairs and repainting—\$27.50/hour

2 hours of washing and waxing—\$9.50/hour

Parts

Paint—\$105

Headlight—\$85

Turn light—\$55

New fender—\$265

New quarter panel—\$625

Washing/waxing materials—\$11.50

Discount on parts only (if paid in cash)

8.75%

Sales tax (on taxable items only)

6%

If the customer pays cash, how much will the repairs total?

Engine Repair Work Example 25

WorkKeys Level: 6

NATEF Tasks: I.C.5

A technician is overhauling a 6-cylinder engine with a bore of 3.800 inches and a stroke of 3.4 inches. Due to wear the engine block must be bored out 0.030. What will the new cubic inch displacement of the engine be when finished?

(Hint: Cylinder cubic inch = $\left(\frac{\text{Bore}}{2} * \pi\right)^2 * \text{stroke} * \text{cylinder}$)