

Coordinate Dimensioning and Tolerancing



Unit

Engineering Graphics Principles

*Manufacturing Processes - 2, IE352
Ahmed M El-Sherbeeney, PhD
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ENGINEERING GRAPHICS

COORDINATE
DIMENSIONING and
TOLERANCING

Basic Hole, Basic Shaft
and Using Tables

Calculating Mating Part Fits

• *While there may be several ways to calculate the dimensions and tolerances for mating part fits, they all eventually narrow down to essentially one concept—function.* The major questions deal with the purpose to be served by the assembly of parts that fit together. What it is supposed to do, and how the elements in the assembly are supposed to perform in relation to one another. Answering these questions regarding mating part fits, greatly diminishes the challenge of determining the appropriate values for dimensions and tolerances.

We will explore the applications of the principles of the Basic Hole and Basic Shaft systems. They can be extremely helpful in instances where the basic parameters are known and the designer must establish the values on the drawing. It should be fun for you to try on your own.

BASIC HOLE SYSTEM

Tolerances—Basic Hole and Shaft Systems

- To calculate a fit between mating parts, and place the dimension values on the drawing, the first thing you have to know is the purpose for fitting the parts together. There are standard fit tables that identify many functions that are served by mating part assemblies.
- Knowing the function, you can identify the nominal size and the limit tolerance range of the mating parts.*** Let's presume a half-inch shaft fitting into a half-inch hole. Next, you must determine the intentional difference between the mating parts—positive or negative allowance—along with the tolerance values for both the shaft and hole diameters. ***All of these values are available in the standard fit tables.*** When these parameters are known, you can employ what is called the *Basic Hole System* or *Basic Shaft System* to compute the dimension values and the appropriate tolerances to be assigned to each of the individual part drawings.
- The Basic Hole System is a procedure for calculating and placing mating part dimensions and tolerance information on the drawing. If followed, you can know ahead of time exactly what the tolerance accumulation, or “build-up” will be under any increment of size variation in either of the mating parts. You can also be assured that if the parts are manufactured according to the specifications on the drawing, they will fit together and function as intended.

Calculating Standard and Non-Standard Fits (32a)

The Basic Hole and Basic Shaft systems are excellent tools to have in your tool box. Most authors will wax eloquent (and endlessly) about these procedural tools. I have tried to reduce them down to three simple steps. Four basic parameters must be known to use these systems: ***Basic Size, Allowance, Hole Tolerance, and Shaft Tolerance.***

- *Basic size is the hole or shaft at MMC. All tolerance values are generated from that value.*
- *Allowance is the minimum clearance or maximum interference. It can be positive (clearance) or negative (interference).*

BASIC HOLE SYSTEM – *Allowance based on the hole at MMC*

1. The basic size is always equal to the ***minimum hole size (Hole MMC)***
2. ***Subtract the allowance*** from the basic size to get the ***maximum shaft size (Shaft MMC)***
3. Apply the appropriate tolerances to the hole and to the shaft (Hole & Shaft LMC)

BASIC SHAFT SYSTEM – *Allowance based on the shaft at MMC*

1. Basic size is always equal to the ***maximum shaft size***
2. ***Add the allowance*** to the basic size to get the ***minimum hole size***
3. Apply the appropriate tolerances to the shaft and the hole

Basic Hole System

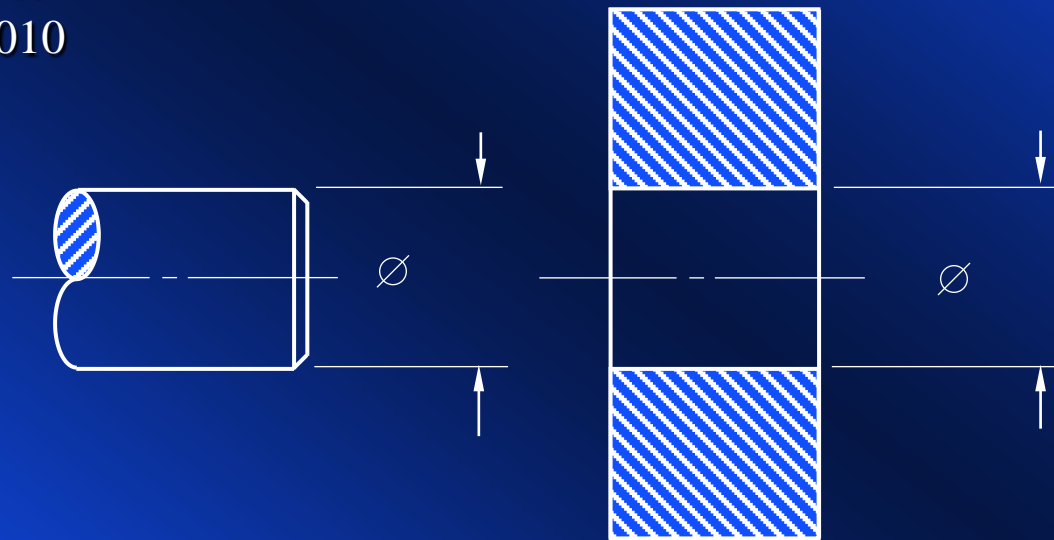
The basic size is determined by converting the nominal size into its decimal equivalent. Remember, the basic hole system mandates that the basic size must be equal to the minimum hole size. When you have converted the value to a decimal equivalent, place the value as the low limit for the hole size.

Basic Size = $.9/16''$ (.5625)

Allowance = .0006

Shaft Tolerance = $-.0009$

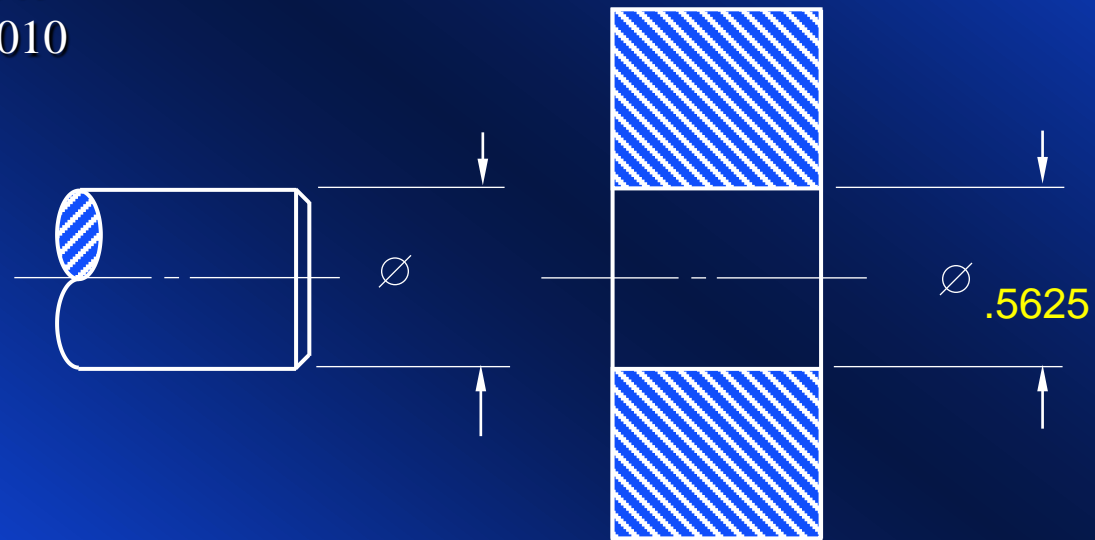
Hole Tolerance = $+.0010$



Basic Hole System

The basic hole system always establishes the basic size as the minimum hole size.
(Remember, the smallest size limit *always* goes on the bottom in a stacked limits form.)

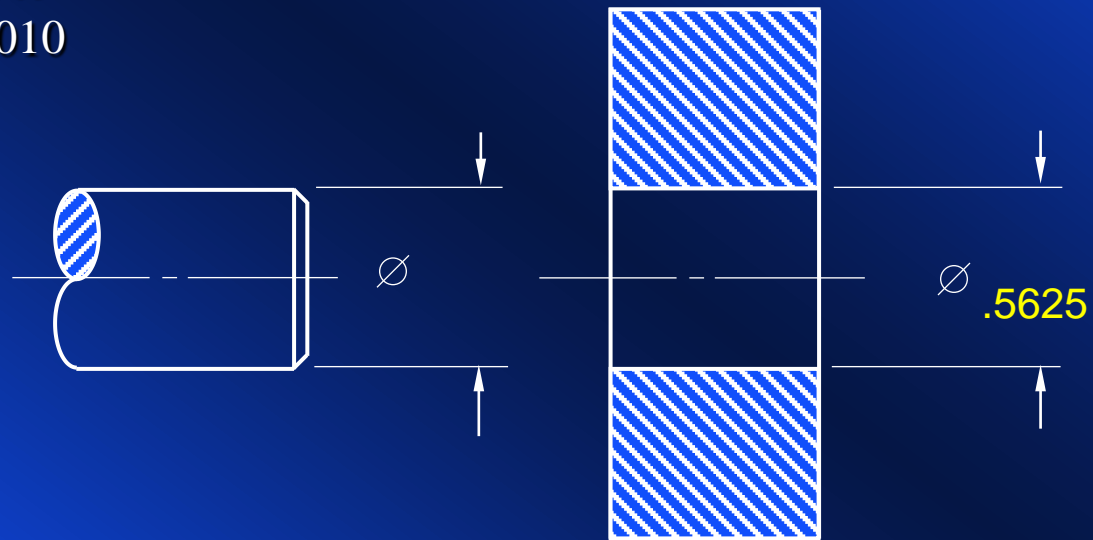
Basic Size = .5625
Allowance = .0006
Shaft Tolerance = -.0009
Hole Tolerance = +.0010



Basic Hole System

Subtract the *allowance* (the intentional difference between mating parts) from the basic size to obtain the maximum shaft size (Maximum Material Condition). Place the value as the upper limit of the shaft dimension.

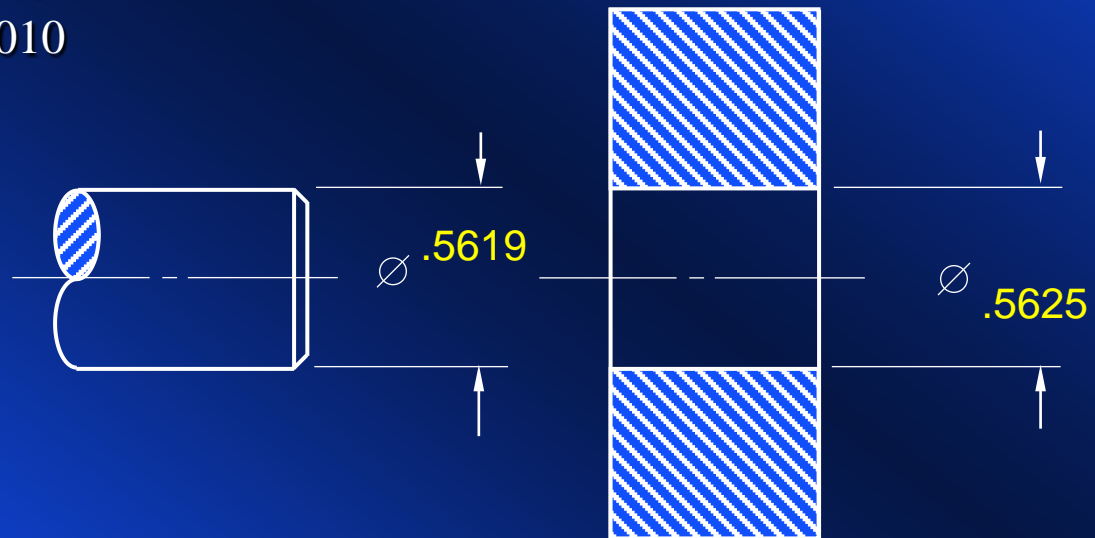
		Max Shaft	
Basic Size =	.5625	.5625	Basic Size
Allowance =	.0006	<u>-.0006</u>	Allowance
Shaft Tolerance =	-.0009		
Hole Tolerance =	+.0010		



Basic Hole System

Subtract the *allowance* (the intentional difference between mating parts) from the basic size to obtain the maximum shaft size (Maximum Material Condition). Place the value as the upper limit of the shaft dimension.

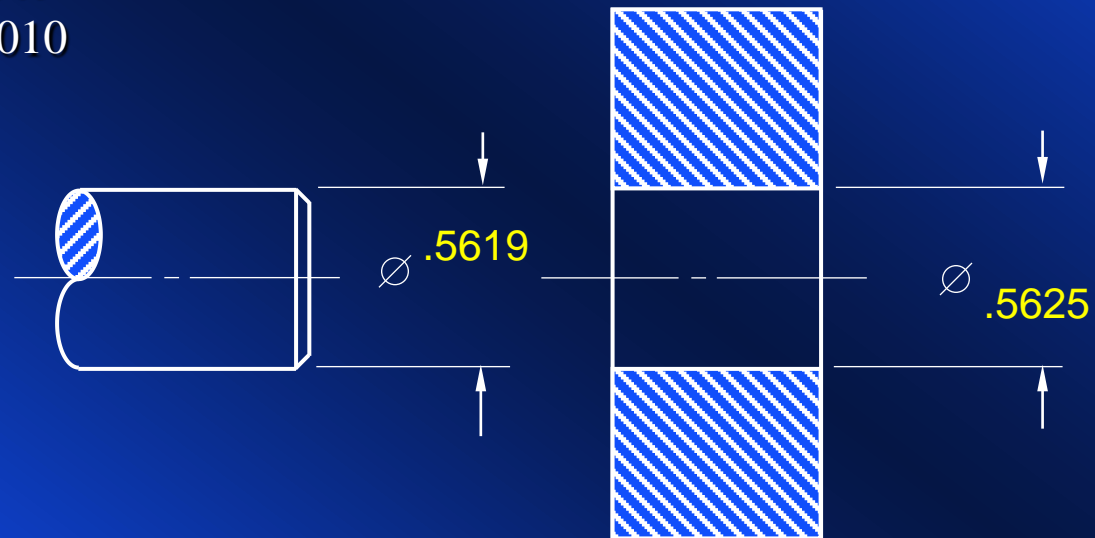
		Shaft MMC	
		.5625	Basic Size
Basic Size =	.5625	<u>-.0006</u>	Allowance
Allowance =	.0006	.5619	Shaft MMC
Shaft Tolerance =	-.0009		
Hole Tolerance =	+.0010		



Basic Hole System

Apply the *tolerances* to both the hole and the shaft to complete the dimensions; *add* the hole tolerance to the hole lower limit, and *subtract* the shaft tolerance from the shaft upper limit. Do the arithmetic and apply the values.

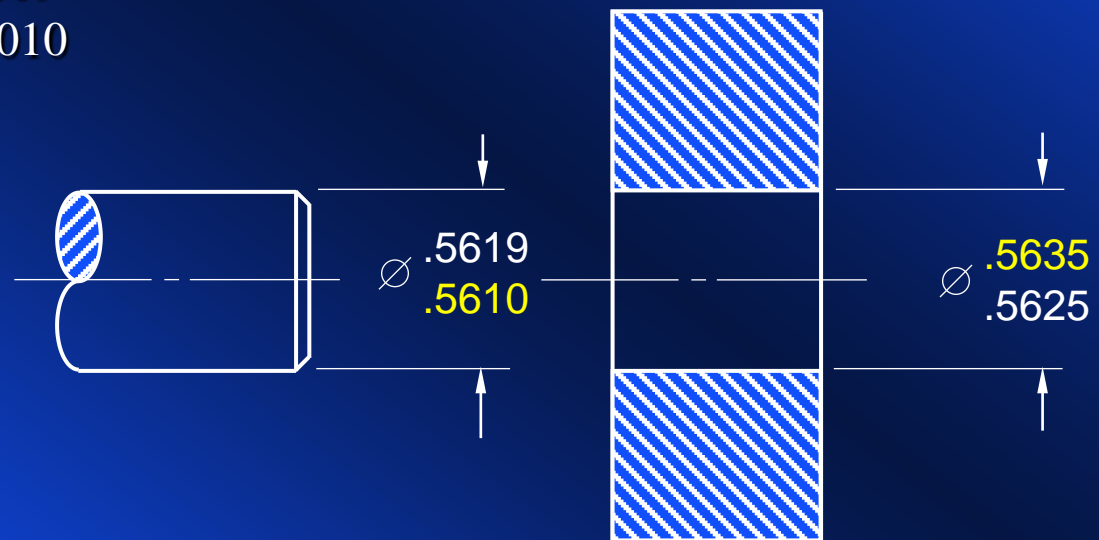
		Shaft MMC	Shaft	Hole
Basic Size =	.5625	.5625	.5619	.5625
Allowance =	.0006	<u>-.0006</u>	<u>-.0009</u>	<u>+.0010</u>
Shaft Tolerance =	-.0009	.5619		
Hole Tolerance =	+.0010			



Basic Hole System

Apply the *tolerances* to both the hole and the shaft to complete the dimensions; *add* the hole tolerance to the hole lower limit, and *subtract* the shaft tolerance from the shaft upper limit. Do the arithmetic and apply the values.

		Shaft MMC		Shaft Tol		Hole Tol
Basic Size =	.5625	.5625		.5619		.5625
Allowance =	.0006	<u>-.0006</u>		<u>-.0009</u>		<u>+.0010</u>
Shaft Tolerance =	-.0009	.5619		.5610		.5635
Hole Tolerance =	+.0010					

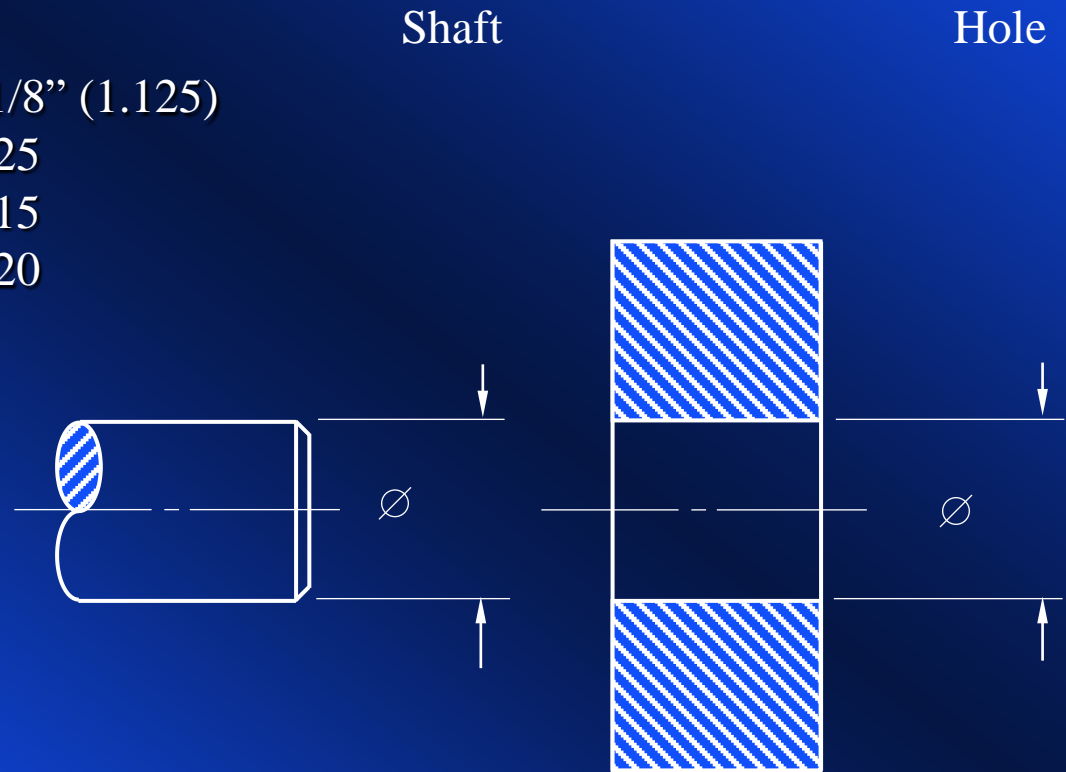


Values Referenced to Basic Size: $\varnothing .5625$ $\begin{matrix} -.0006 \\ -.0015 \end{matrix}$ $\varnothing .5625$ $\begin{matrix} +.0010 \\ -.0000 \end{matrix}$

Basic Hole System

STOP! Do NOT advance to the next slide. Let's have you solve a problem on your own. Retrieve **problem #38** in your book, and, using the basic hole system, apply the dimensions on the drawing. Use stacked limits when placing the information on the sheet. Then, when you have finished, check your work against the next slide.

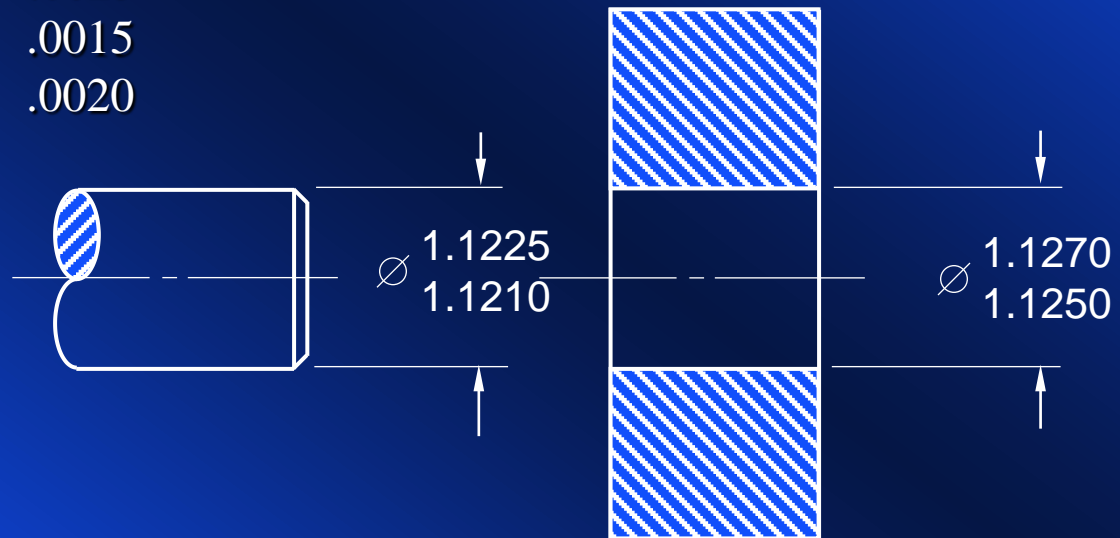
Basic Size = 1-1/8" (1.125)
Allowance = .0025
Shaft Tolerance = .0015
Hole Tolerance = .0020



Basic Hole System

How did you do? Are your dimension values the same as these? Are you comfortable with the process? If not, go back to the beginning of this topic and review the major concepts. Understanding this procedure will assist you as we move into the next concept.

Nominal Size =	1-1/8"	Shaft	1.1225	Hole	1.1250 Basic Size
Basic Size (BS) =	1.1250		<u>- .0015</u>		<u>-.0025</u> Allowance
Allowance (A) =	.0025		1.1210		1.1225 Max Shaft
Shaft Tolerance (ST) =	.0015				
Hole Tolerance (HT) =	.0020				

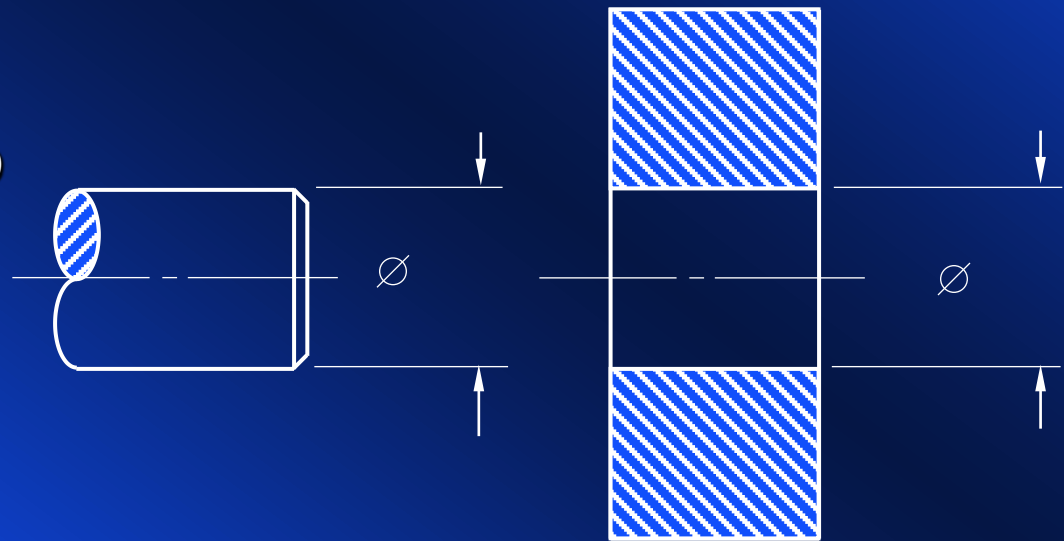


BASIC SHAFT SYSTEM

Basic Shaft System

STOP! Do NOT proceed to the next slide. Using the *Basic Shaft System* and the following data, complete the drawing by placing the appropriate dimensions on both the shaft and the hole. Use the *stacked limits* expression for the dimensions. (Relying on your memory of the rules for application of the Basic Shaft System, complete the problem before advancing through the next series of slides. Use **Problem #39** in your book.)

Basic Size = .5625
Allowance = .0004
Shaft Tolerance = -.0008
Hole Tolerance = +.0010

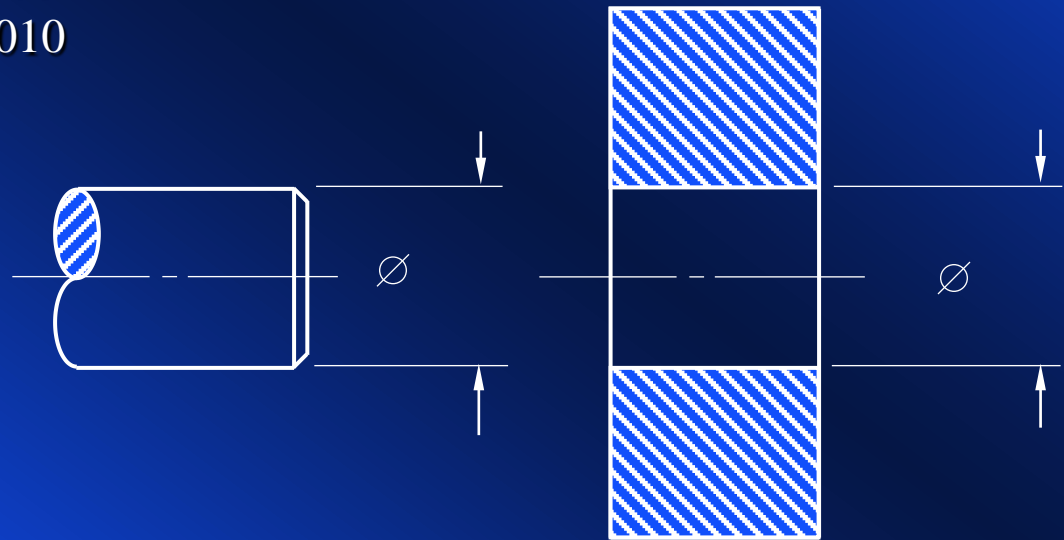


Shaft stays at nominal size and hole adjusts for MMC allowance

Basic Shaft System

The basic shaft system establishes the basic size as the maximum shaft size. Place the value as the upper shaft limit in the stacked orientation for limits dimensioning. (Remember, the upper size limit *always* goes on top in a stacked expression.)

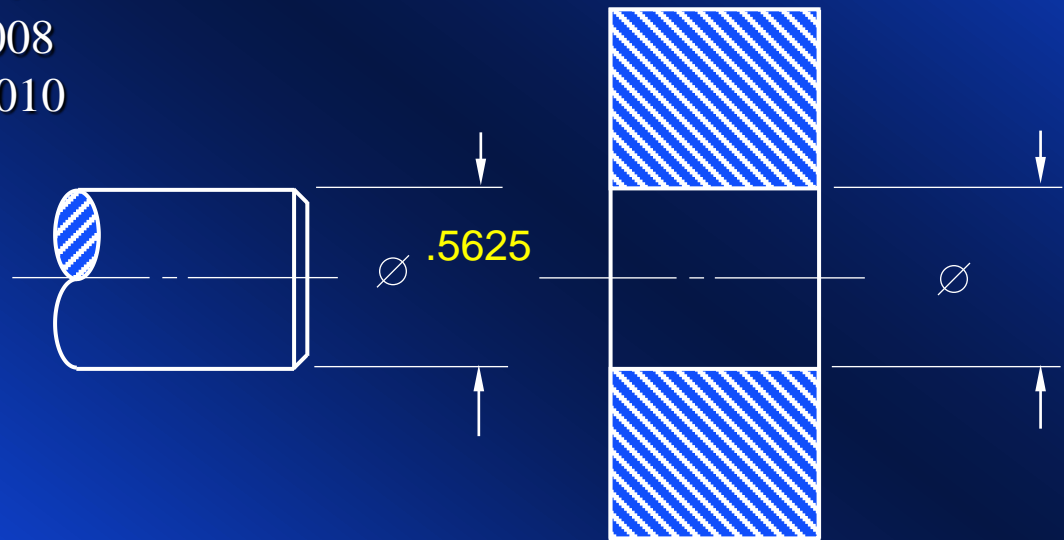
Basic Size = .5625
Allowance = .0004
Shaft Tolerance = -.0008
Hole Tolerance = +.0010



Basic Shaft System

The basic shaft system establishes the basic size as the maximum shaft size. Place the value as the upper shaft limit (MMC) in the stacked orientation for limits dimensioning. (Remember, the upper size limit *always* goes on top in a stacked tolerance expression.)

Nominal Size = 9/16"
Basic Size = .5625
Allowance = .0004
Shaft Tolerance = -.0008
Hole Tolerance = +.0010

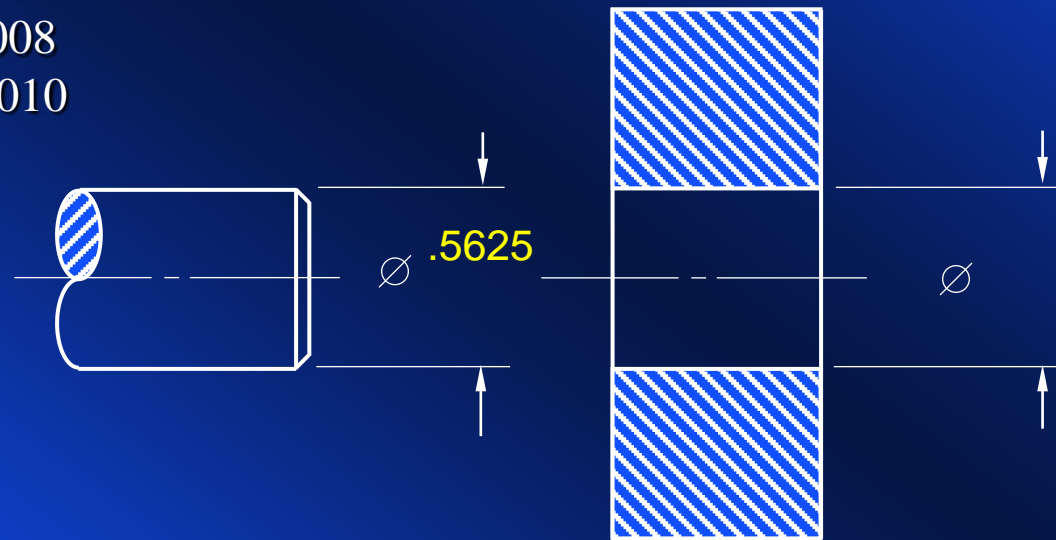


Basic Shaft System

The lower limit of the hole size (MMC) is obtained by *adding* the allowance to the basic size. Do the addition and place the dimension as the lower limit of the hole size.

Nominal Size = 9/16"
Basic Size = .5625
Allowance = .0004
Shaft Tolerance = -.0008
Hole Tolerance = +.0010

$$\begin{array}{r} .5625 \\ +.0004 \\ \hline \end{array}$$



Basic Shaft System

The lower limit of the hole size (MMC) is obtained by *adding* the allowance to the basic size. Do the addition and place the dimension as the lower limit of the hole size. The process is completed by applying the tolerances to the respective components by subtracting the shaft tolerance from the shaft upper limit, and adding the hole tolerance to the hole dimension lower limit. Apply your results to the drawing.

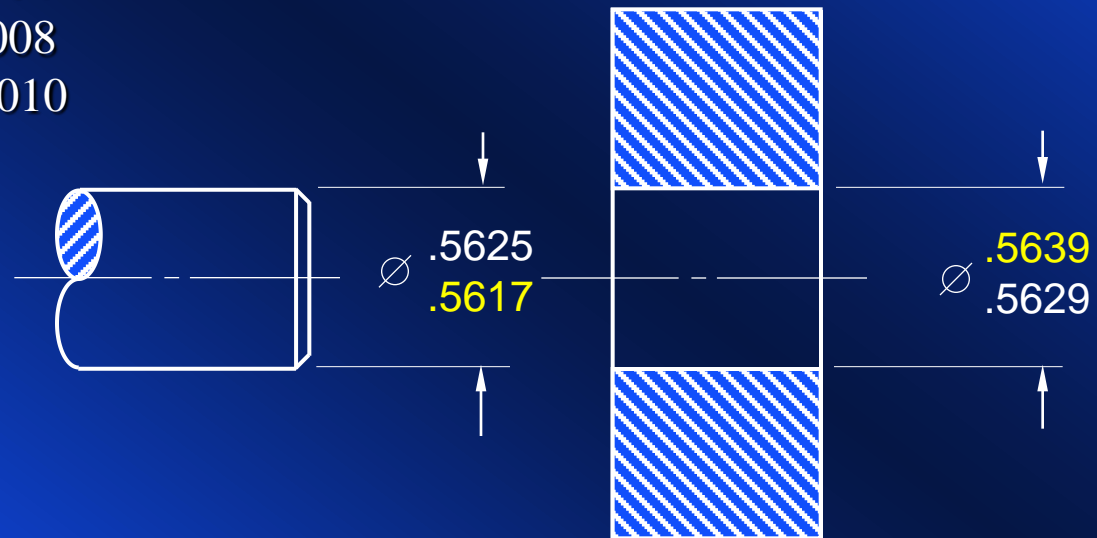
Nominal Size =	9/16"	.5625
Basic Size =	.5625	<u>+.0004</u>
Allowance =	.0004	.5629
Shaft Tolerance =	-.0008	
Hole Tolerance =	+.0010	



Basic Shaft System

The dimensioning process of the mating parts is now complete. Do you understand the procedures that we followed? If you don't, review them again from the beginning of this series of slides.

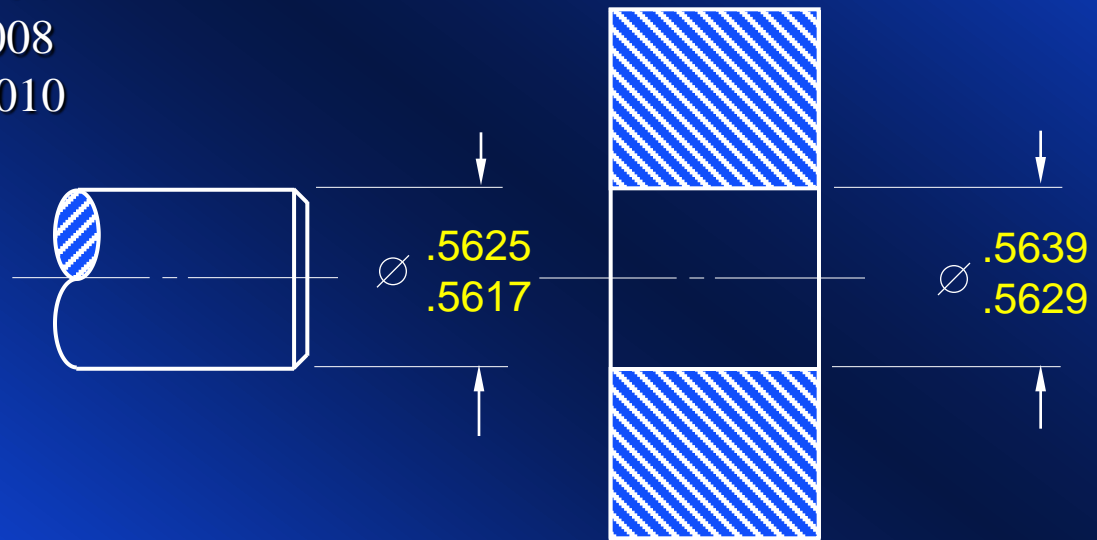
Nominal Size =	9/16"	Shaft	.5625	Hole	.5629
Basic Size =	.5625		<u>-.0008</u>		<u>+.0010</u>
Allowance =	.0004		.5617 Shaft LMC		.5639 Hole LMC
Shaft Tolerance =	-.0008				
Hole Tolerance =	+.0010				



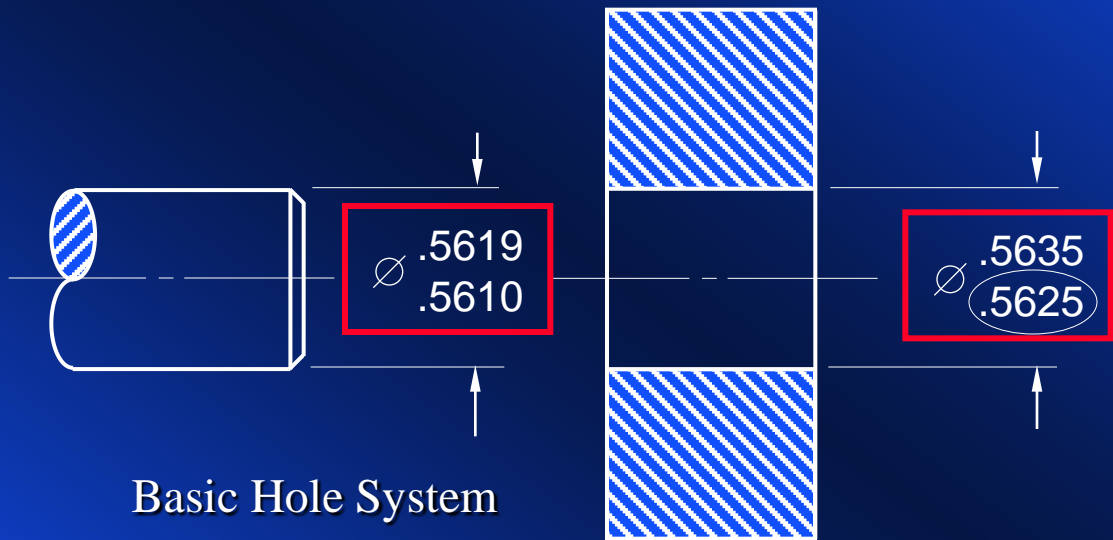
Basic Shaft System

The dimensioning of the mating parts is completed by applying the tolerances to the respective components. *Subtract* the shaft tolerance from the upper limit, and *add* the hole tolerance to the lower limit. Apply them to the drawing.

Nominal Size = $9/16''$
Basic Size = $.5625$
Allowance = $.0004$
Shaft Tolerance = $-.0008$
Hole Tolerance = $+.0010$

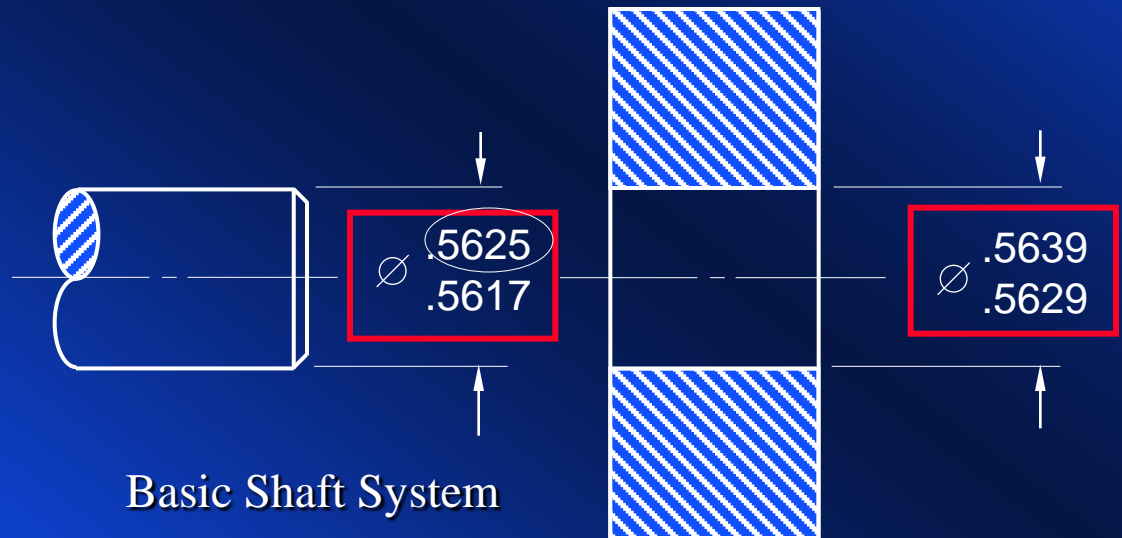


Basic Hole Compared to Basic Shaft System



Basic Hole System

The same basic size (.5625) was used for both calculations. Compare the two results for actual sizes of the shaft and the hole.



Basic Shaft System

STANDARD FITS

American National Standard Fit Tables

- Tremendous advantages have been gained by standardizing fits, and publishing them in tables. They are the means for establishing tolerances for any given size, type, or class of fit. Each of the possible fit options within the tables are prescribed according to their intended function.
- If the designer or engineer knows the functional requirements for the fit, a match can easily be found that conforms to the specific need. The standard provides choices for a series of types and classes of fits on a unilateral hole basis such that the fit produced by mating parts in any one class will produce approximately similar performance throughout the entire range of sizes.
- The standard fit tables are consistent with the *basic hole system*. It is important that you understand how the tables themselves can be used to satisfy functional specifications and provide dimensional data to be used on engineering drawings.
- We will examine a portion of only one page of the tables, and use the information to solve a simple problem dealing with a specific class of running and sliding fit. You may want to review the example application several times to assure yourself that you understand the procedure.

American National Standard Fit Tables

- The tables reflecting standard fits between mating parts may be found in virtually any design handbook, Machinery's Handbook, and in any reputable drafting manual.
- Standard fits fall into 3 major *categories* and 5 basic *types* of fits. Within each of these divisions there are several *classifications* of fits. The first category, *Running* and *sliding* fits, for instance, has nine different classifications of this specific type of fit. The second category, *Location* fits, is a broad category of standardized fits, within which there are 3 major sub-categories: *clearance*, *transition*, and *interference* fits. Finally, there is a category for *Interference*, or *Force* fits consisting of 5 different classifications.

The five divisions of standard fits are designated by letters:

<u>Category</u>	<u>Type</u>	<u>Classification</u>
Sliding	RC = Running/Sliding (Rotational or Reciprocal Motion) Clearance Fits	(RC 1 - RC 9)
Location	LC = Location Clearance Fits	(LC 1 - LC 11)
	LT = Location Transition Fits (Clearance through Interference)	(LT 1 - LT 6)
	LN = Location Interference Fits	(LN 1 - LN 3)
Force	FN = Force or Shrink Fits	(FN 1 - FN 5)

The specification is complete when the category and the classification are combined, such as RC 3 or FN 5, and coupled with a specific diameter size.

Running and Sliding Fits* -- American National Standard

- RC 1 Close sliding fits are intended for the accurate location of parts which must assemble without perceptible play.
- RC 2 Sliding fits are intended for accurate location, but with greater maximum clearance than class RC 1. Parts made to this fit move and turn easily but are not intended to run freely, and in the larger sizes may seize with small temperature changes.
- RC 3 Precision running fits are about the closest fits which can be expected to run freely, and are intended for precision work at slow speeds and light journal pressures, but are not suitable where appreciable temperature differences are likely to be encountered.
- RC 4 Close running fits are intended chiefly for running fits on accurate machinery with moderate surface speeds and journal pressures, where accurate location and minimum play are desired.
- RC 5 } Medium running fits are intended for higher running speeds, or heavy journal pressures, or both.
- RC 6 }

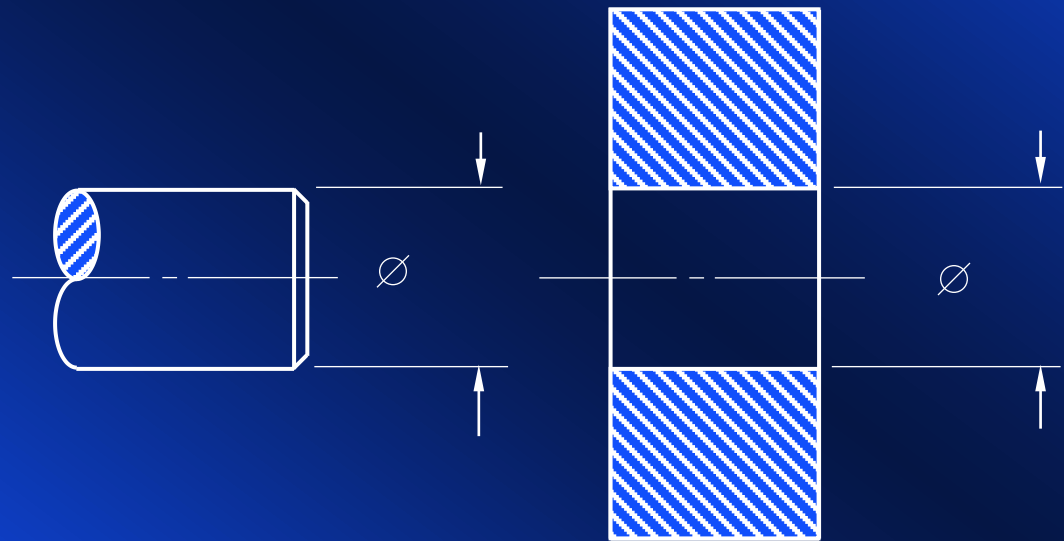
Basic hole system. Limits are in thousandths of an inch.

Nominal Size Range in Inches	Class RC 1			Class RC 2			Class RC 3			Class RC 4			Class RC 5			Class RC 6		
	Limits of Clearance	Standard Limits		Limits of Clearance	Standard Limits		Limits of Clearance	Standard Limits		Limits of Clearance	Standard Limits		Limits of Clearance	Standard Limits		Limits of Clearance	Standard Limits	
		Hole H5	Shaft g4		Hole H6	Shaft g5		Hole H7	Shaft f6		Hole H8	Shaft f7		Hole H8	Shaft e7		Hole H9	Shaft e8
0 - 0.12	0.1	+0.2	-0.1	0.1	+0.25	-0.1	0.3	+0.4	-0.3	0.3	+0.6	-0.3	0.6	+0.6	-0.6	0.6	+1.0	-0.6
	0.45	-0	-0.25	0.55	-0	-0.3	0.95	-0	-0.55	1.3	-0	-0.7	1.6	-0	-1.0	2.2	-0	-1.2
0.12 - 0.24	0.15	+0.2	-0.15	0.15	+0.3	-0.15	0.4	+0.5	-0.4	0.4	+0.7	-0.4	0.8	+0.7	-0.8	0.8	+1.2	-0.8
	0.5	-0	-0.3	0.65	-0	-0.35	1.12	-0	-0.7	1.6	-0	-0.9	2.0	-0	-1.3	2.7	-0	-1.5
0.24 - 0.40	0.2	+0.25	-0.2	0.2	+0.4	-0.2	0.5	+0.6	-0.5	0.5	+0.9	-0.5	1.0	+0.9	-1.0	1.0	+1.4	-1.0
	0.6	-0	-0.35	0.85	-0	-0.45	1.5	-0	-0.9	2.0	-0	-1.1	2.5	-0	-1.6	3.3	-0	-1.9
0.40 - 0.71	0.25	+0.3	-0.25	0.25	+0.4	-0.25	0.6	+0.7	-0.6	0.6	+1.0	-0.6	1.2	+1.0	-1.2	1.2	+1.6	-1.2
	0.75	-0	-0.45	0.95	-0	-0.55	1.7	-0	-1.0	2.3	-0	-1.3	2.9	-0	-1.9	3.8	-0	-2.2
0.71 - 1.19	0.3	+0.4	-0.3	0.3	+0.5	-0.3	0.8	+0.8	-0.8	0.8	+1.2	-0.8	1.6	+1.2	-1.6	1.6	+2.0	-1.6
	0.95	-0	-0.55	1.2	-0	-0.7	2.1	-0	-1.3	2.8	-0	-1.6	3.6	-0	-2.4	4.8	-0	-2.8
1.19 - 1.97																		
1.97 - 3.15																		

*From ANSI B4.1--1967 (R 1987). Larger diameters and RC 7 through RC 9 not included in this presentation.

Using the Standard Fit Tables to Assign Dimensions to Mating Parts

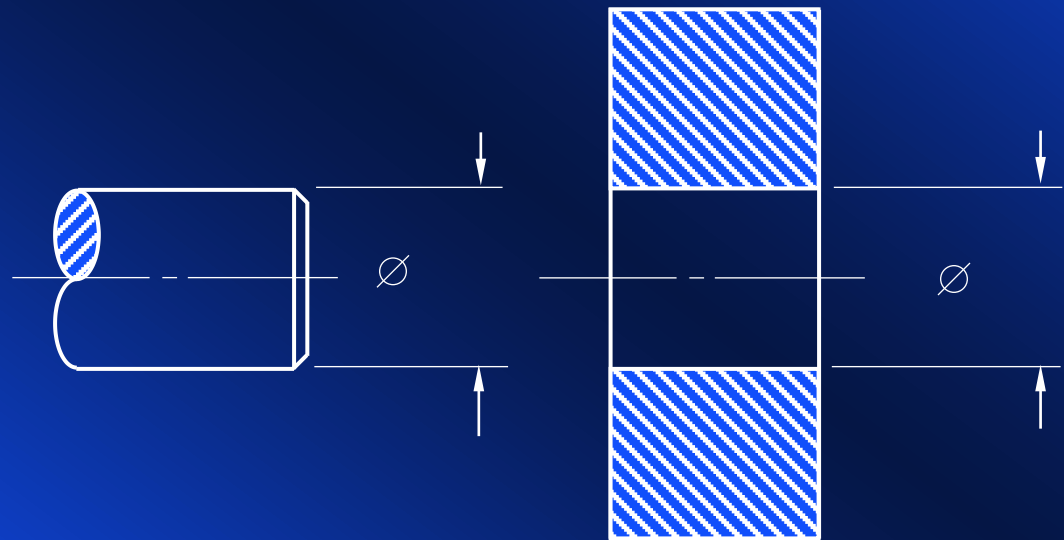
Using the standard fit tables, determine the limits for a nominal 9/16 (.5625) inch diameter RC 4 fit between a shaft and a hole. Place the dimensions on the drawing using stacked limits form.



Using the Standard Fit Tables to Assign Dimensions to Mating Parts

First, identify the size range in the left-most column in the fit table for RC fits. I have highlighted the row that identifies the size range that will include the designated diameter in the problem. (Note that this column is specified in inches. All other columns in the table are specified in *thousandths* of an inch.)

Nominal Size Range in Inches
0 - 0.12
0.12 - 0.24
0.24 - 0.40
0.40 - 0.71
0.71 - 1.19
1.19 - 1.97
1.97 - 3.15

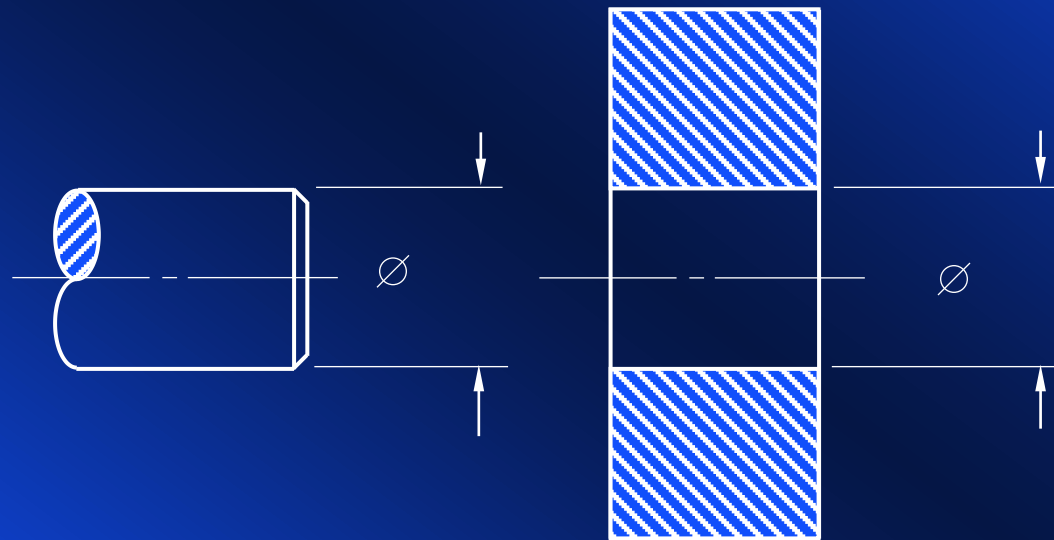


Using the Standard Fit Tables to Assign Dimensions to Mating Parts

First, identify the size range in the left-most column in the fit table for RC fits. I have highlighted the row that identifies the size range that will include the designated diameter in the problem. (Note that this column is specified in inches. All other columns in the table are specified in *thousandths* of an inch.) It is important that you remember that this is the *only* column in the table that has values expressed in *inches*.

The remaining columns are expressed in thousandths of an inch.

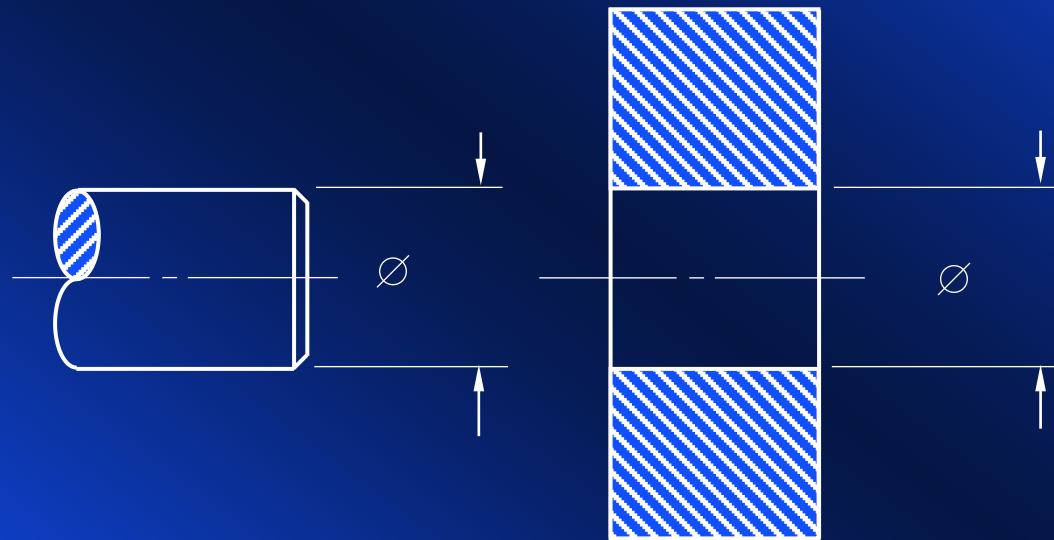
Nominal Size Range in Inches
0 - 0.12
0.12 - 0.24
0.24 - 0.40
0.40 - 0.71
0.71 - 1.19
1.19 - 1.97
1.97 - 3.15



Using the Standard Fit Tables to Assign Dimensions to Mating Parts

Next, read across the table on the row that is highlighted to identify the parameters for an RC 4 fit. Because of the lack of space, I have excluded the columns for fits other than the RC 4. You may wish to return to a previous slide where you can review a more complete representative page from the standards.

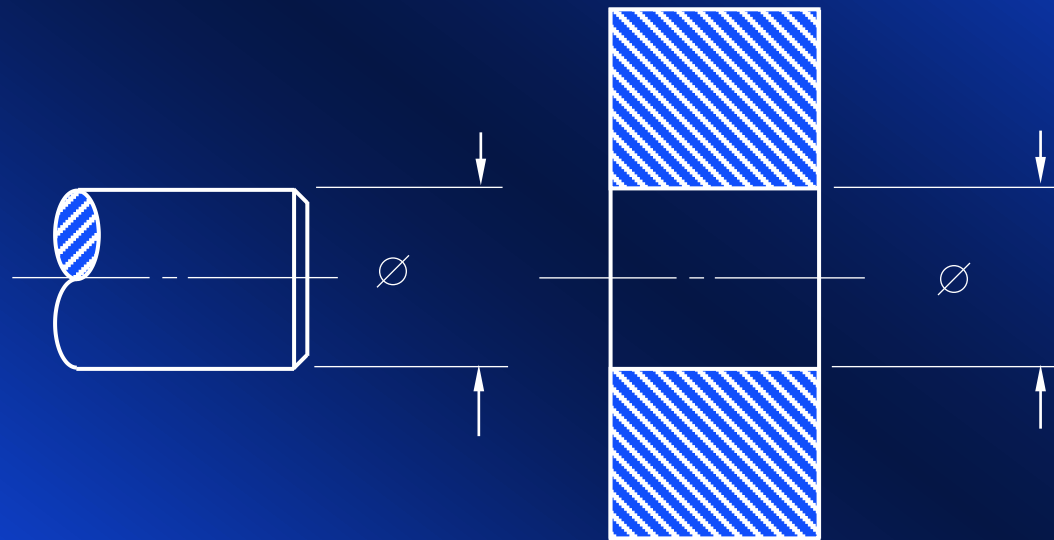
Nominal Size Range in Inches	Class RC 4		
	Limits of Clearance	Standard Limits	
		Hole H8	Shaft f7
0 - 0.12	0.3 1.3	+ 0.6 - 0	- 0.3 - 0.7
0.12 - 0.24	0.4 1.6	+ 0.7 - 0	- 0.4 - 0.9
0.24 - 0.40	0.5 2.0	+ 0.9 - 0	- 0.5 - 1.1
0.40 - 0.71	0.6 2.3	+ 1.0 - 0	- 0.6 - 1.3
0.71 - 1.19	0.8 2.8	+ 1.2 - 0	- 0.8 - 1.6
1.19 - 1.97			
1.97 - 3.15			



Using the Standard Fit Tables to Assign Dimensions to Mating Parts

The first column for a class RC 4 fit establishes the *limits of clearance*. The number on top is the *allowance* at MMC. Converted to inches (by moving the decimal 3 places to the left), this number would be .0006, six tenths of one-thousandth, or six ten-thousandths. The number below (2.3) is the maximum clearance at LMC, or twenty-three ten-thousandths (.0023).

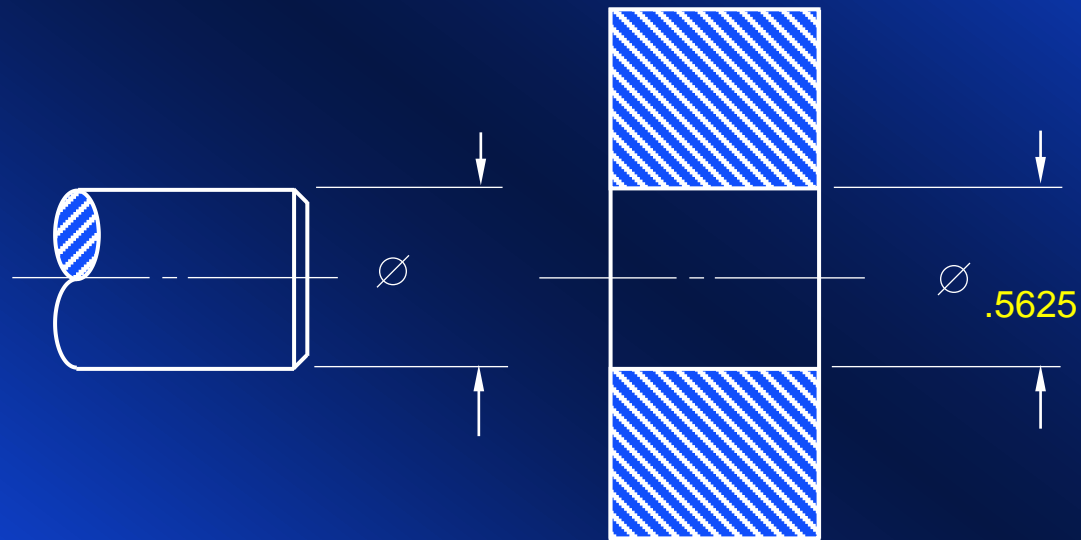
Nominal Size Range in Inches	Class RC 4		
	Limits of Clearance	Standard Limits	
		Hole H8	Shaft f7
0 - 0.12	0.3 1.3	+ 0.6 - 0	- 0.3 - 0.7
0.12 - 0.24	0.4 1.6	+ 0.7 - 0	- 0.4 - 0.9
0.24 - 0.40	0.5 2.0	+ 0.9 - 0	- 0.5 - 1.1
0.40 - 0.71	0.6 2.3	+ 1.0 - 0	- 0.6 - 1.3
0.71 - 1.19	0.8 2.8	+ 1.2 - 0	- 0.8 - 1.6
1.19 - 1.97			
1.97 - 3.15			



Using the Standard Fit Tables to Assign Dimensions to Mating Parts

Notice that the *Hole* size, at its *lower* limit, reads “- 0”. Therefore, use the basic size (nominal 9/16 inch, converted to its decimal equivalent, .5625) as the lower limit for the dimension of the hole.

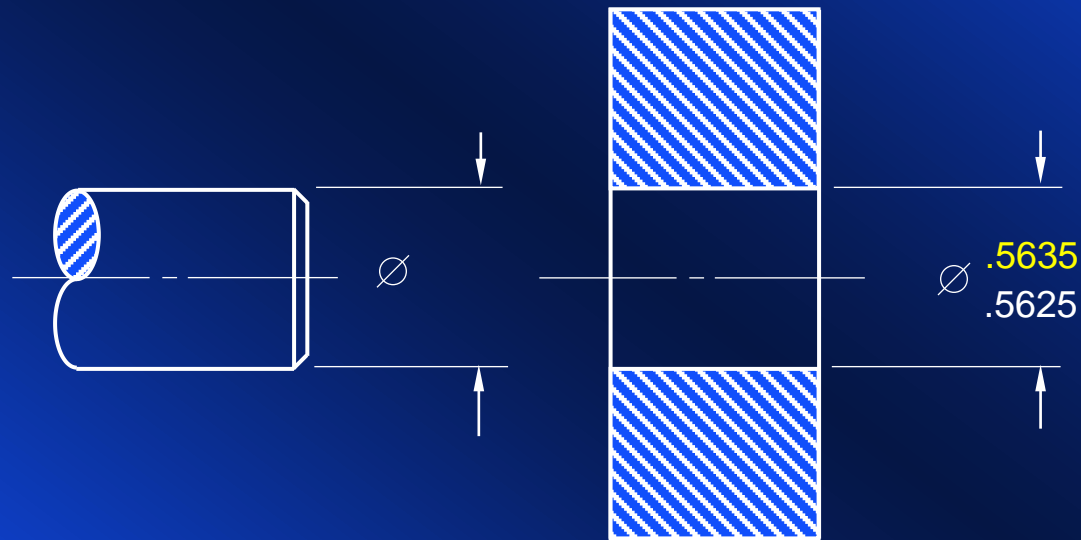
Nominal Size Range in Inches	Class RC 4		
	Limits of Clearance	Standard Limits	
		Hole H8	Shaft f7
0 - 0.12	0.3	+ 0.6	- 0.3
	1.3	- 0	- 0.7
0.12 - 0.24	0.4	+ 0.7	- 0.4
	1.6	- 0	- 0.9
0.24 - 0.40	0.5	+ 0.9	- 0.5
	2.0	- 0	- 1.1
0.40 - 0.71	0.6	+ 1.0	- 0.6
	2.3	- 0	- 1.3
0.71 - 1.19	0.8	+ 1.2	- 0.8
	2.8	- 0	- 1.6
1.19 - 1.97			
1.97 - 3.15			



Using the Standard Fit Tables to Assign Dimensions to Mating Parts

For the upper size limit for the hole you will notice that the value on the chart is +1.0. This value when converted into inches equals one thousandth of an inch—or ten ten-thousandths. Add the required .0010 to the basic size for the upper limit of the hole (.5625 + .0010 = .5635). This is the upper size limit of the hole, which can now be added to the drawing. *It is added to the basic size value.*

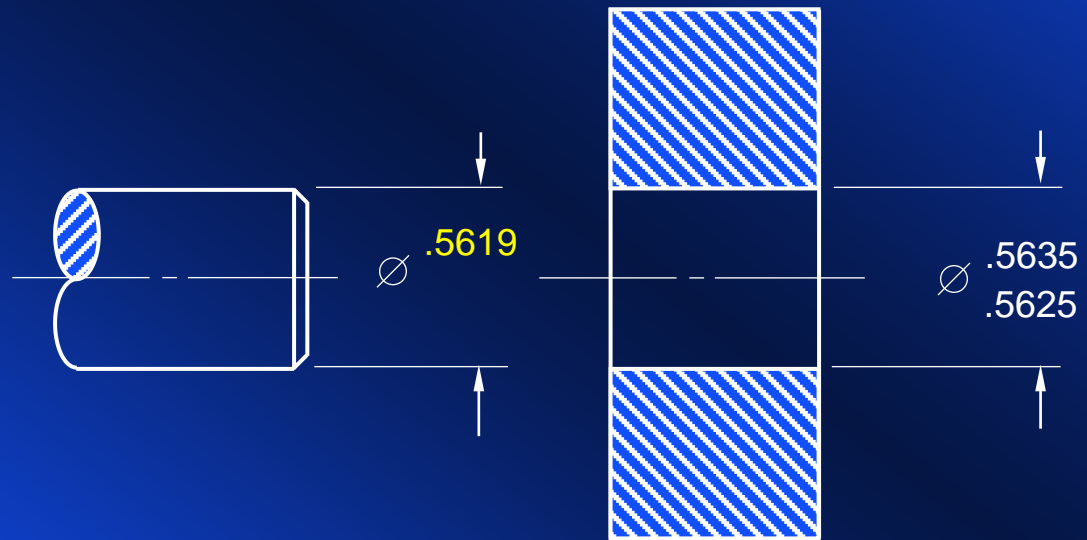
Nominal Size Range in Inches	Class RC 4		
	Limits of Clearance	Standard Limits	
		Hole H8	Shaft f7
0 - 0.12	0.3	+ 0.6	- 0.3
	1.3	- 0	- 0.7
0.12 - 0.24	0.4	+ 0.7	- 0.4
	1.6	- 0	- 0.9
0.24 - 0.40	0.5	+ 0.9	- 0.5
	2.0	- 0	- 1.1
0.40 - 0.71	0.6	+ 1.0	- 0.6
	2.3	- 0	- 1.3
0.71 - 1.19	0.8	+ 1.2	- 0.8
	2.8	- 0	- 1.6
1.19 - 1.97			
1.97 - 3.15			



Using the Standard Fit Tables to Assign Dimensions to Mating Parts

To determine the upper size limit of the shaft, we must subtract (note the sign in the table for the upper size limit of the shaft) 0.6 thousandths (or six ten-thousandths) from the basic size. The result will be .5619 ($.5625 - .0006 = .5619$). Add this value to the drawing as the upper size limit on the shaft.

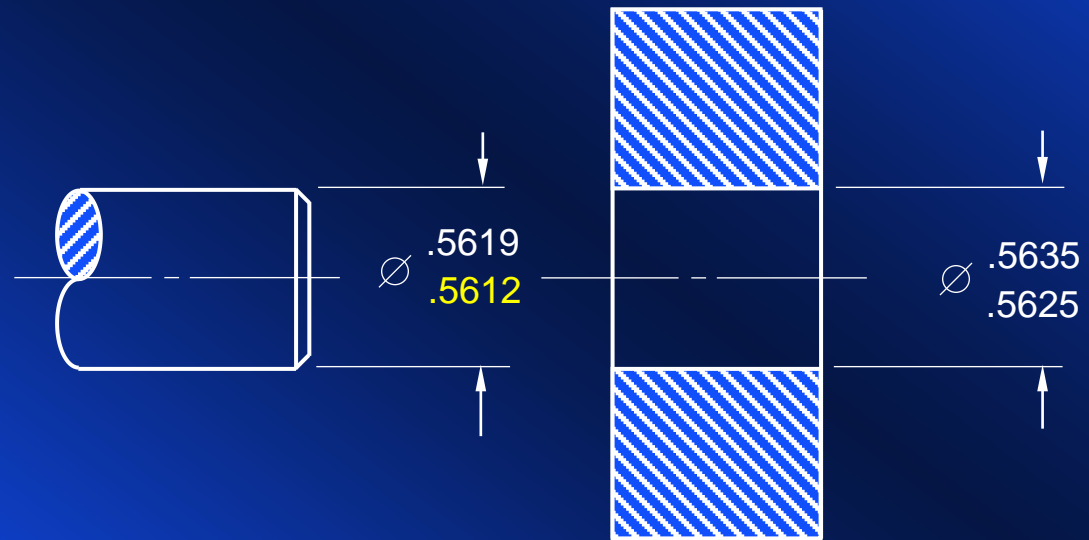
Nominal Size Range in Inches	Class RC 4		
	Limits of Clearance	Standard Limits	
		Hole H8	Shaft f7
0 - 0.12	0.3	+ 0.6	- 0.3
	1.3	- 0	- 0.7
0.12 - 0.24	0.4	+ 0.7	- 0.4
	1.6	- 0	- 0.9
0.24 - 0.40	0.5	+ 0.9	- 0.5
	2.0	- 0	- 1.1
0.40 - 0.71	0.6	+ 1.0	- 0.6
	2.3	- 0	- 1.3
0.71 - 1.19	0.8	+ 1.2	- 0.8
	2.8	- 0	- 1.6
1.19 - 1.97			
1.97 - 3.15			



Using the Standard Fit Tables to Assign Dimensions to Mating Parts

Finally, determine the lower limit of the shaft diameter by subtracting 1.3 thousandths (or thirteen ten-thousandths) from the *basic size*, and include the value in the drawing.

Nominal Size Range in Inches	Class RC 4		
	Limits of Clearance	Standard Limits	
		Hole H8	Shaft f7
0 - 0.12	0.3	+ 0.6	- 0.3
	1.3	- 0	- 0.7
0.12 - 0.24	0.4	+ 0.7	- 0.4
	1.6	- 0	- 0.9
0.24 - 0.40	0.5	+ 0.9	- 0.5
	2.0	- 0	- 1.1
0.40 - 0.71	0.6	+ 1.0	- 0.6
	2.3	- 0	- 1.3
0.71 - 1.19	0.8	+ 1.2	- 0.8
	2.8	- 0	- 1.6
1.19 - 1.97			
1.97 - 3.15			

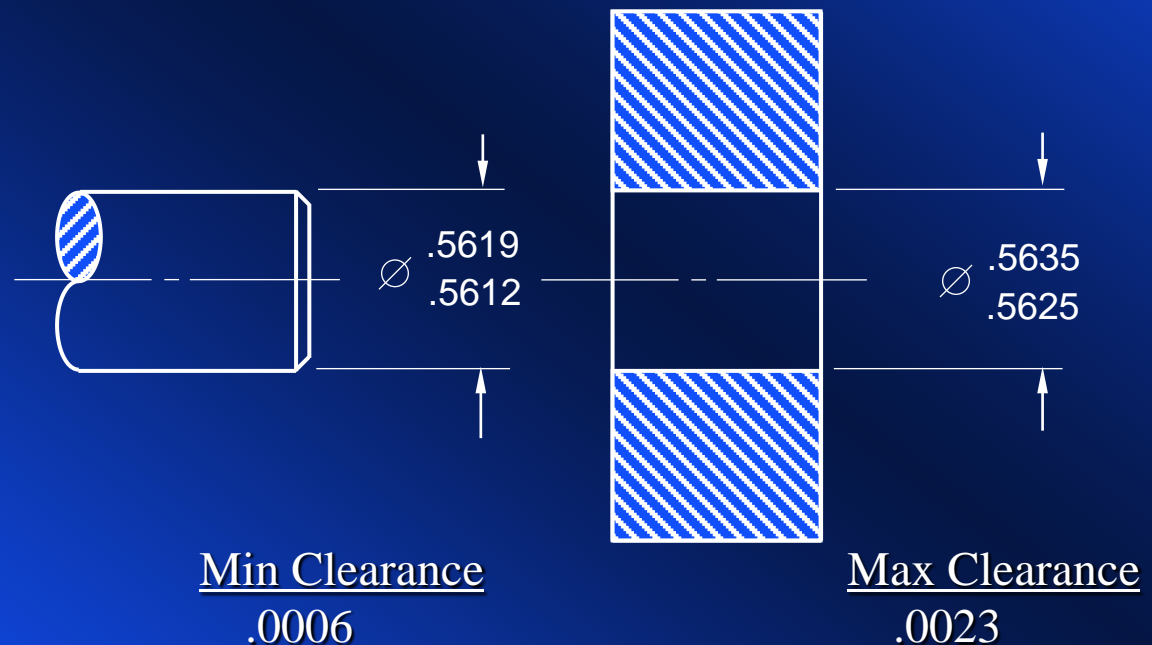


Using the Standard Fit Tables to Assign Dimensions to Mating Parts

Now, look back to the column labeled “Limits of Clearance”. These values reveal the total amount of variation that can be allowed on a 9/16” RC 4 fit--when the parts are at maximum material condition and at least material condition.

On the *drawing*, compare the dimensions diagonally.

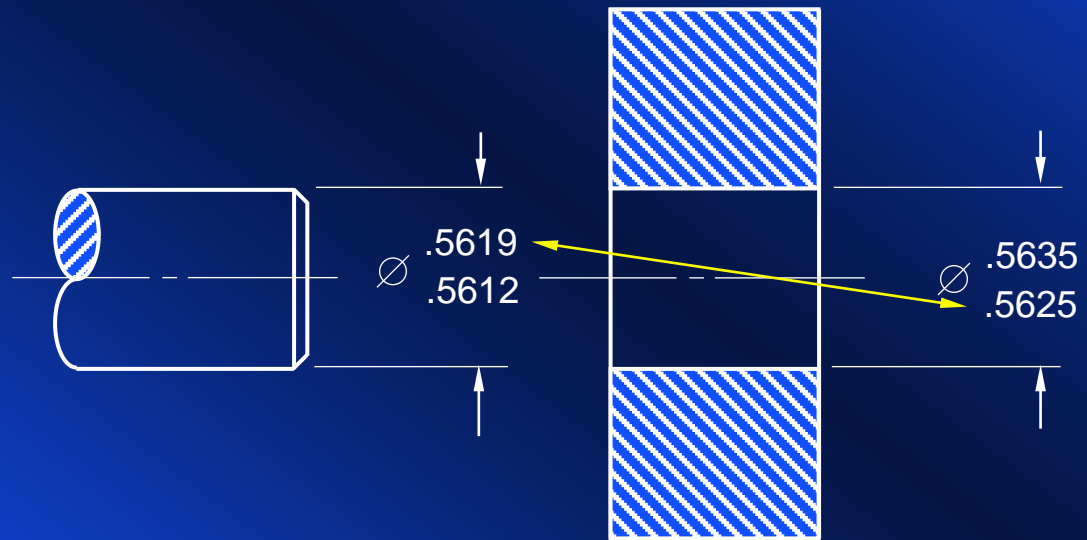
Nominal Size Range in Inches	Class RC 4		
	Limits of Clearance	Standard Limits	
		Hole H8	Shaft f7
0 - 0.12	0.3	+ 0.6	- 0.3
	1.3	- 0	- 0.7
0.12 - 0.24	0.4	+ 0.7	- 0.4
	1.6	- 0	- 0.9
0.24 - 0.40	0.5	+ 0.9	- 0.5
	2.0	- 0	- 1.1
0.40 - 0.71	0.6	+ 1.0	- 0.6
	2.3	- 0	- 1.3
0.71 - 1.19	0.8	+ 1.2	- 0.8
	2.8	- 0	- 1.6
1.19 - 1.97			
1.97 - 3.15			



Using the Standard Fit Tables to Assign Dimensions to Mating Parts

At maximum material condition (MMC—largest shaft; smallest hole), the difference is .0006, or 0.6 thousandths.

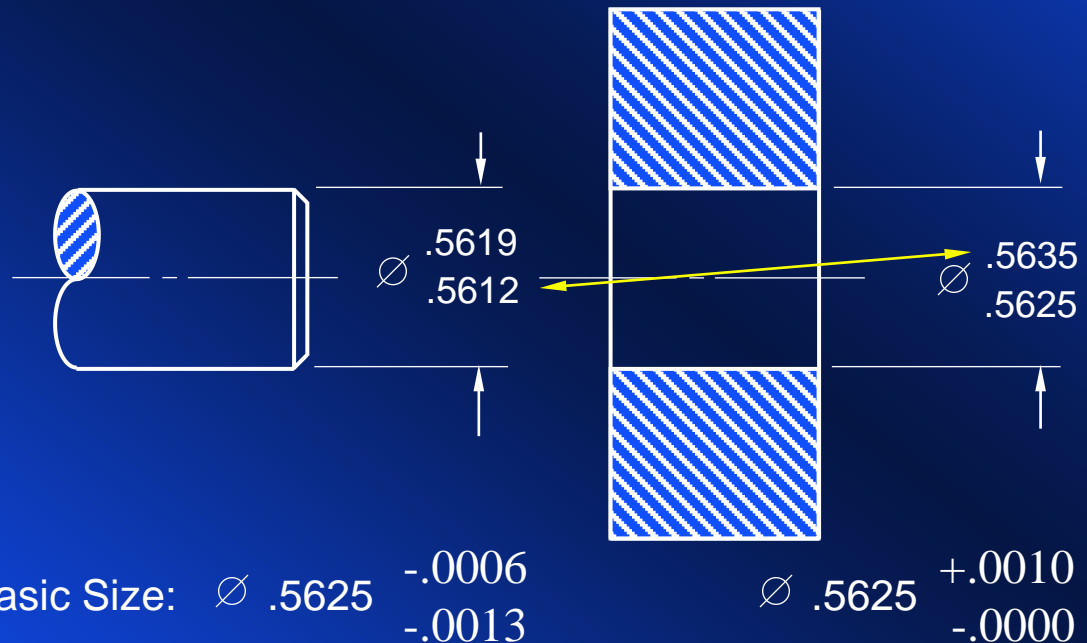
Nominal Size Range in Inches	Class RC 4		
	Limits of Clearance	Standard Limits	
		Hole H8	Shaft f7
0 - 0.12	0.3	+ 0.6	- 0.3
	1.3	- 0	- 0.7
0.12 - 0.24	0.4	+ 0.7	- 0.4
	1.6	- 0	- 0.9
0.24 - 0.40	0.5	+ 0.9	- 0.5
	2.0	- 0	- 1.1
0.40 - 0.71	0.6	+ 1.0	- 0.6
	2.3	- 0	- 1.3
0.71 - 1.19	0.8	+ 1.2	- 0.8
	2.8	- 0	- 1.6
1.19 - 1.97			
1.97 - 3.15			



Using the Standard Fit Tables to Assign Dimensions to Mating Parts

At least material condition (LMC—smallest shaft; largest hole), there is a clearance of .0023, or 2.3 thousandths.

Nominal Size Range in Inches	Class RC 4		
	Limits of Clearance	Standard Limits	
		Hole H8	Shaft f7
0 - 0.12	0.3 1.3	+ 0.6 - 0	- 0.3 - 0.7
0.12 - 0.24	0.4 1.6	+ 0.7 - 0	- 0.4 - 0.9
0.24 - 0.40	0.5 2.0	+ 0.9 - 0	- 0.5 - 1.1
0.40 - 0.71	0.6 2.3	+ 1.0 - 0	- 0.6 - 1.3
0.71 - 1.19	0.8 2.8	+ 1.2 - 0	- 0.8 - 1.6
1.19 - 1.97			
1.97 - 3.15			



Web Sites for Fits and Tolerances

<http://www.cobanengineering.com/Tolerances/ANSILimitsAndFits.asp> (very good)

http://www.mech.uq.edu.au/courses/mech2110/standard_fits/index.html

End of Unit Number Four