# Understanding GO/NO GO Gauges
# (Fixed Limit Gauging)

One of the most frequent questions that we are asked at A.A. Jansson is, “how do I choose a plug gauge for my measurement application.” Therefore I put together this document to help you understand the concept of fixed limit gauging.

Keep in mind the fundamental concept of fixed limit gauging is to never accept a bad part. In order to accomplish this the tolerance of the plug or ring will be designed to actually have the potential to reject good parts.

When this method rejects good parts that are near the extreme limits of the part tolerance the part can be rechecked with a more accurate method to determine if the part is actually in tolerance.

In the following examples I don’t want to get hung up about semantics. Some people call pin gauges, plug gauges, and others call plug gauges, pin gauges. Either way is acceptable.

Keep in mind that a Go plug has a plus tolerance and is designed to gauge the smallest acceptable hole size, and a NoGo plug has a negative tolerance, designed to gauge the largest acceptable hole size. Subsequently a Go gage should be able to pass through the hole and a NoGo plug gauge should not. This is why they call it Go NoGo gauging. Others call it Fixed Limit Gauging.

The opposite is true for ring gages. A Go ring has a negative tolerance and is designed to gauge the largest acceptable diameter and a NoGo ring has a positive tolerance and is designed to gauge the smallest acceptable diameter. The reasons for this will become clearer as we go through a couple of examples.

It is easy to get confused between how the tolerance of the ring and plug is applied in relationship to the Go and NoGo member. Sometimes it is easier to thing of the member you are measuring in terms of more or less material. The reason is that a Plus tolerance applied to a plug makes the actual plug size larger. The plus Tolerance applied to a ring makes the ring gauge diameter small. Please keep this in mind when you follow the examples.

## Plug Gauge Example

1. **Dimension on part to gauge**:
    a. The tolerance is taken from the blue print.
    b. The nominal hole size on part to gauge is 1.0000”
    c. Tolerance of the hole is +.002”/-.000”
    d. This means the hole must be manufactured somewhere between 1.0000” and 1.0020” in size.
2. **Go Plug:**
    a. Go plug would be designed for the smallest hole size. This size would be 1.0000” with a plus tolerance
    b. We will use the 10:1 rule to help us determine the tolerance of the plug that should be used.
        i. The part tolerance spread is .002”, therefore the tolerance of the plug gauge should be approximately 10% of the overall tolerance being measured. 10% of .002”=.0002”
        ii. Go plugs have a plus Tolerance
        iii. The tolerance of a class ZZ plug gauge with a nominal size of 1.0000 is +.00024. This is derived from the Gagemaker’s Tolerance Chart.
            1. This tolerance is very close to the desired .0002” tolerance when applying the 10:1 rule. Therefore a class ZZ plug should be acceptable.
        iv. This means that the actual plug gauge will have a diameter somewhere between 1.0000” and 1.00024, when the maximum allowable tolerance of the plug is considered.

c. Since the actual size of the plug could be larger than the minimum hole size designed by the Engineer realize that this gauge can actually reject good parts.
d. For example: if the hole size was exactly 1.0000” and the plug was 1.00024, the gauge would not pass through the whole. Therefore the part would be rejected. This happens when part size reaches its minimum acceptable size. (see figure 1)

3. **NO GO Plug**:
   a. A NoGo plug would be designed for the largest hole size. This size would be 1.002” with a – Tolerance
   b. We will use the10:1 rule help us determine the tolerance of the plug to be used.
      i. The part tolerance spread is .002”, therefore the tolerance of the plug should be approximately 10% of the overall tolerance. 10% of .002”=.0002”
      ii. NoGo plugs have a minus Tolerance
      iii. The tolerance of a class ZZ plug gauge with a nominal size of 1.0020” is -.00024”. This is derived from the Gagemaker’s Tolerance Chart.
         1. This tolerance is very close to the desired .0002 tolerance when applying the 10:1 Rule. Therefore we will use the class ZZ Plug.
      iv. This means that the actual plug gauge will have a diameter between .1.00176” and 1.0020”, when the maximum allowable tolerance of the pug is considered. In this case since this is a NoGo plug the tolerance is applied negatively.
   c. Since the actual size of the plug could be smaller than the maximum hole size designed by the Engineer, realize that this gauge can also reject good parts.
   d. For example: if the hole size was exactly 1.0002” and the plug was 1.00176” the plug would actually pass through the whole when it shouldn’t. (see figure 1)

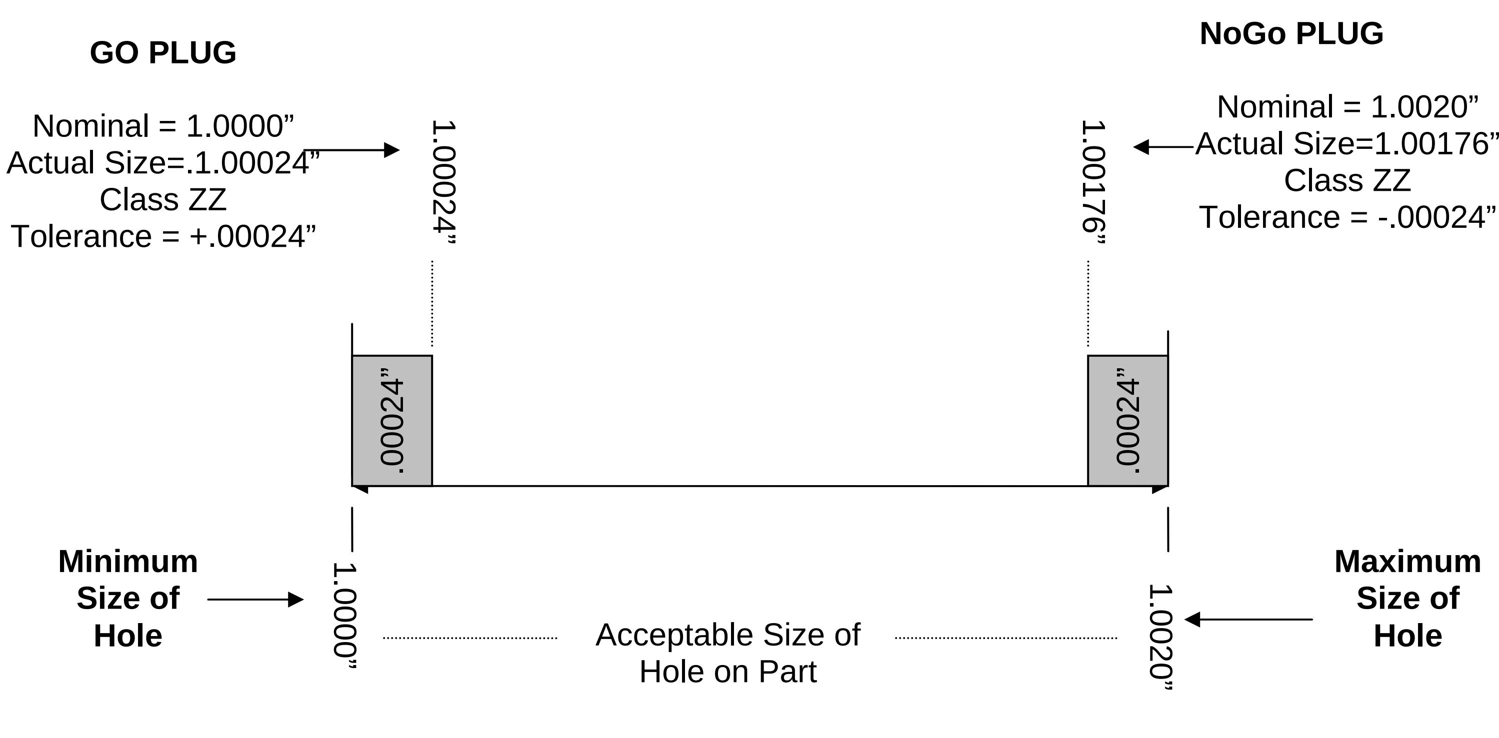
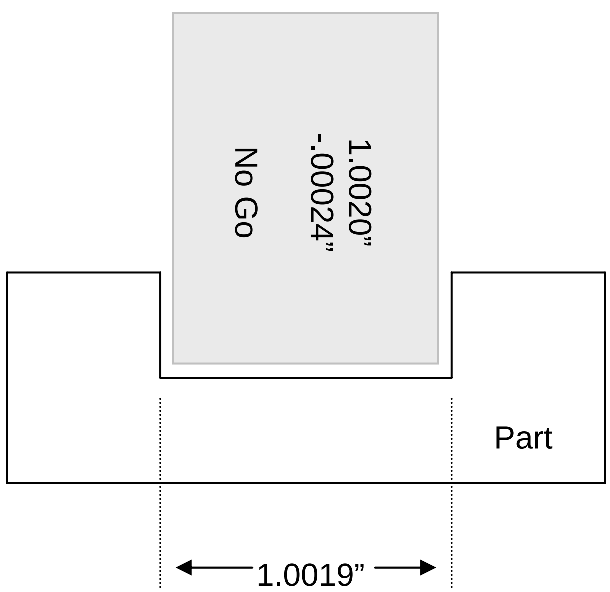



**Figure 1.**
**(Comparison of GO NoGo Plugs)**

4. **Rejects**: The proper use of a Go and NoGo plug will reject some good parts, when the part is manufactured near the extreme limits of its allowable size. The larger the tolerance of the plug (not the part) the more good parts will be rejected. However the tighter the tolerance of the plug the more it costs. There is always a trade off between accuracy and price. However it also costs money to re-inspect rejected parts to determine if they are acceptable.
5. Let's examine how the concept comes together. In example one lets assume the hole was made within tolerance somewhere near the largest acceptable size. The actual hole was 1.0019 in diameter. The concept of a NoGo gage is that it should not pass through the hole. The NoGo plug is designed and built to the high side of the tolerance. In this case the plug would have a nominal size of .102", with a tolerance of a -.00024". This means the plug could be as small as 1.00176" In this case the NoGo gage with a size of 1.00176" will pass through a whole that is 1.0019". This situation would cause the inspector to fail the part even though the part is within tolerance. The same is true of the Go Plug. If the hole is actually 1.0001" the 1.00024" plug will not go. See example two.

**NoGo Plug**
Nominal Size = 1.0020"
Tolerance = - .00024"
Actual Size = 1.00176"



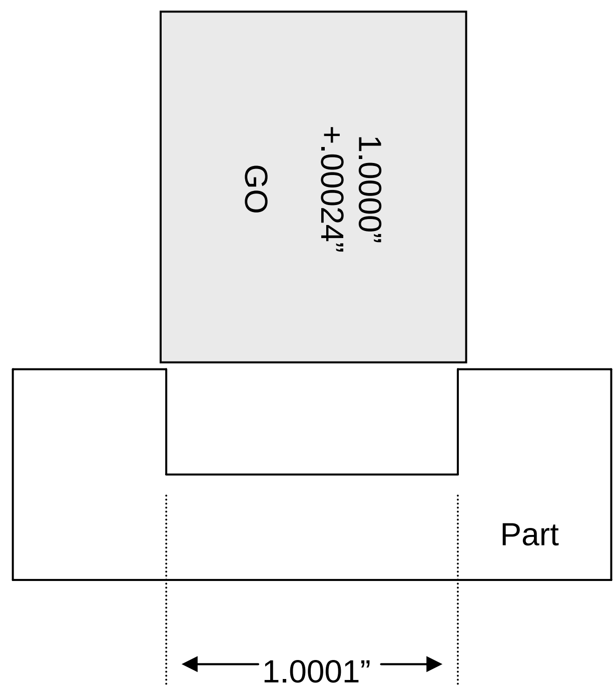
Actual Size of Hole

**Example One**

NoGo plug fits therefore part is rejected. Yet the part is a good part.

Acceptable part is with in 1.0000"-1.0020", Actual size of 1.0019"

**Go Plug**
Nominal Size = 1.0000"
Tolerance = + .00024"
Actual Size = 1.00024"



Actual Size of Hole

**Example Two**

Go plug does not fit therefore part is rejected. Yet the part is a good part.

Acceptable part is with in 1.0000"-1.0020", Actual size of 1.0001"

6. **What happens to these rejected parts that are actually good**? The parts are re-measured by a more accurate method. This is done either by a more accurate plug or an alternative-measuring device. Thus reducing the amount of parts that are rejected, and the amount of scrap material.
7. **What determines the accuracy of the plug you should use?** There are a number of factors that help determine the accuracy of the plug that you should use.
    a. The tolerance of the part being measured: The tighter tolerance parts will require tighter tolerance plug gauges. As you use a more accurate (tighter tolerance) plug gauge the amount of rejects will be reduced. However, as part tolerances become tighter you may reject more parts because of form (roundness, cylindricity) not necessarily because of size.
    b. The cost of the plug gauge.
    c. Measurement philosophy of the company. Historically, many companies would use low cost or economy class ZZ plugs. They are more than accurate enough for most applications. Then all rejected parts are measure by an alternative method. However, better manufacturing capabilities for plug gauges have reduced the price of class X gauges. Consequently many companies have elected to use class X gauges.

# Ring Gauge Example

1. **Dimension on part to gauge**:
    a. The tolerance of the post is taken from the blue print
    b. Post on part to gauge is 1.0000”
    c. Tolerance of Post on part is +.002”/-.000”
    d. This means the post will be somewhere between 1.0000” and 1.0020” in size
2. **Go Ring**:
    a. Go Ring would be 1.002 with a minus tolerance
    b. This is assuming we are using a 10:1 rule
        i. The part tolerance spread is .002”, therefore the tolerance of the ring would be 10% of the overall tolerance. 10% of .002”=.0002”
        ii. Go rings have a minus Tolerance
        iii. The tolerance of a class ZZ ring gauge with a nominal size of 1.0000” is +.00024”.
            1. The tolerance is very close to the desired .0002” tolerance when applying the 10:1 rule. Therefore a class ZZ ring should be acceptable.
        iv. This means that the actual ring gauge will have a diameter somewhere between 1.00176” and 1.0020”, when the maximum allowable tolerance of the ring is considered.
    c. Since the actual size of the ring could be smaller than the maximum post size allowable on the part this ring could potentially reject good parts.
    d. For example if the post was 1.0020” and the ring was 1.00176” the post would not pass through the ring. Therefore the part would be rejected. (see figure 2)
3. **NoGo Ring**:
    a. NoGo ring would be 1.0000” with a plus tolerance
    b. This is assuming we are using a 10:1 rule
        i. The part tolerance spread is .002”, therefore the tolerance of the ring would be 10% of the overall tolerance. 10% of .002=.0002”
        ii. NoGo rings have a plus tolerance
        iii. The tolerance of a class ZZ ring gauge with a nominal size of 1.000” is +.00024”
            1. The tolerance is very close to the desired .0002” tolerance when applying the 10:1 rule. Therefore a class ZZ ring should be acceptable.
    c. Since the actual size of the ring could be larger than the minimum post size allowable on the part, this ring could potentially reject good parts
    d. For example if the post was 1.000” and the ring was 1.00024” in diameter the post would pass through the ring. Therefore the part would be rejected. (see figure 2)

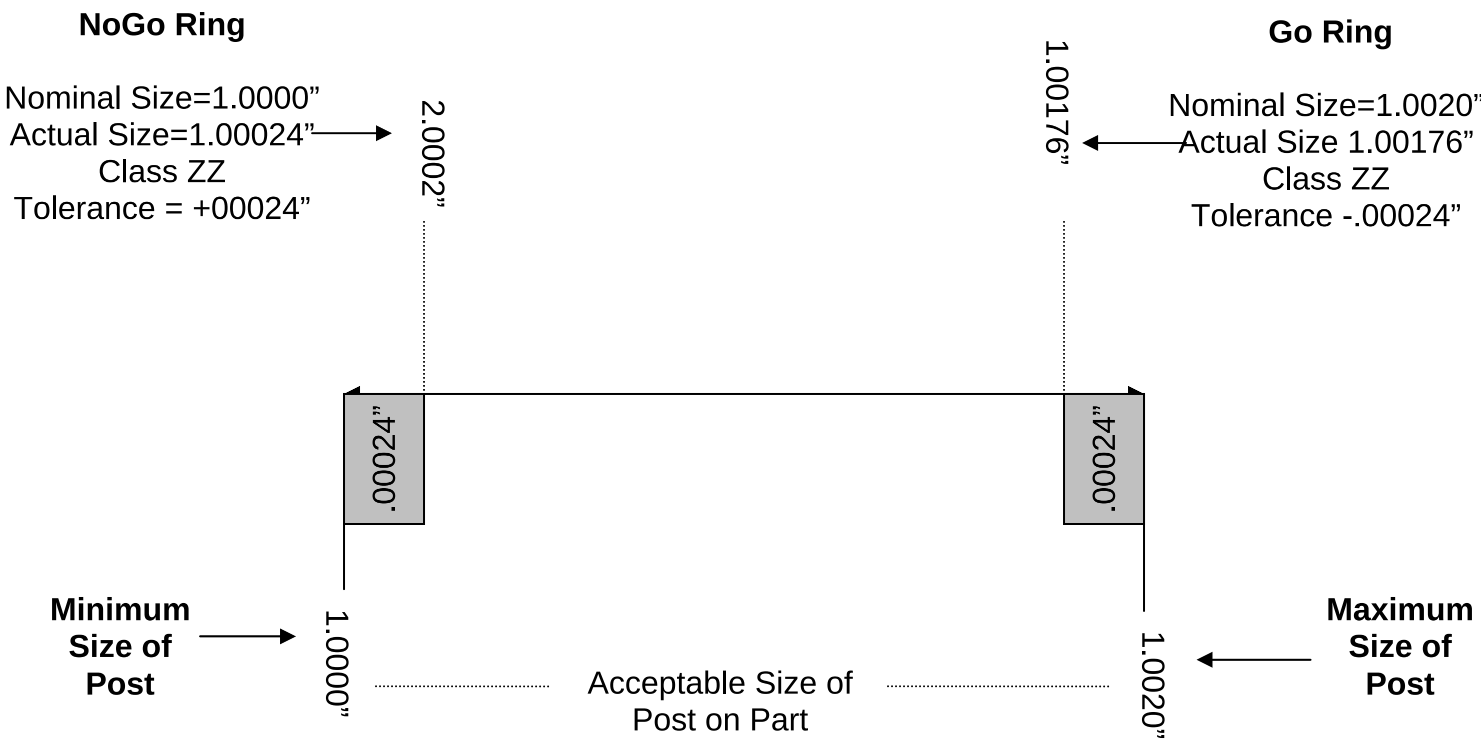
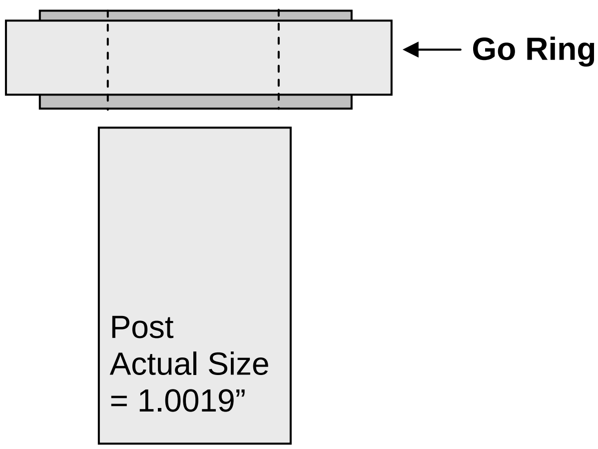



**Figure 2.**
**(Comparison of Go NoGo Rings)**

4. **Rejects:** The proper use of a Go and NoGo ring will reject some good parts. The larger the tolerance of the ring the more good parts will be rejected.
5. Let's examine how the concept comes together. In example one let's assume the post was made within tolerance somewhere near the largest acceptable size. The actual post had a diameter of 1.0019". The concept of a Go ring is that it should pass over the post. The Go Ring is designed and built to the low side of the tolerance. In this case the ring will have a nominal size of 1.0020" with a tolerance of -.00024. This means that the ring could be as small as 1.00176". In this situation the Go ring would not pass over an acceptable post size of 1.0019. This would result in the rejection of the part. The same is true for the NoGo ring. The NoGo ring is .00024" larger than the minimum size allowable (actual size could be 1.00024"). If the actual post size is 1.0001 the NoGo ring will go and the part will be rejected (example two).
6.

**Go Ring**

Nominal Size = 1.0020"
Tolerance = -.00024"
Actual Size = 1.00176"



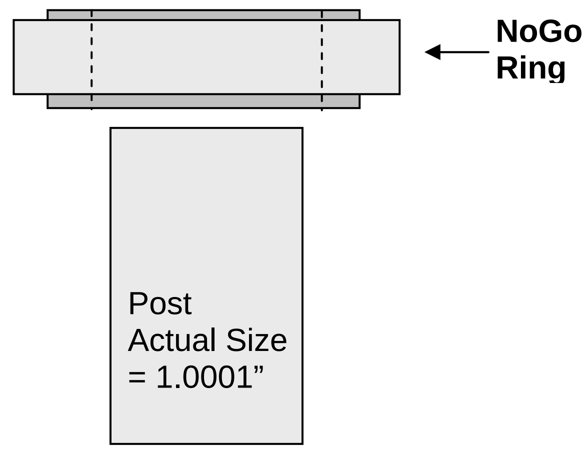

**Example One**

Go Ring Does not fit therefore part is rejected. Yet the part is a good part

Acceptable part is within 1.000"-1.0020". Actual Size of 1.0019"

**NoGo Ring**

Nominal Size = 1.0000"
Tolerance = +.00024"
Actual Size = 1.00024"




**Example Two**

NoGo Ring Does not fit therefore part is rejected. Yet the part is a good part

Acceptable part is within 1.000"-1.0020". Actual Size of 1.0001"

7. **What happens to these rejected parts that are actually good**? The parts are re-measured by a more accurate method. This is done either by a more accurate ring or an alternative-measuring device. Thus reducing the amount of parts that are rejected, and the amount of scrap material.
8. **What determines the accuracy of the ring you should use?** There are a number of factors that help determine the accuracy of the ring that you should use.
   a. The tolerance of the part being measured: The tighter tolerance parts will require tighter tolerance ring gauges. As you use a more accurate (tighter tolerance) ring gauge the amount of rejects due to size will be reduced. However, as part tolerances become tighter you may reject more parts because of form (roundness, cylindricity) not necessarily because of size.
   b. The cost of the ring gauge.

c. Measurement philosophy of the company. Historically, many companies would use low cost or economy class ZZ plugs. They are more than accurate enough for most applications. Then all rejected parts are measure by an alternative method. However, better manufacturing capabilities for ring gauges have reduced the price of class X gauges. Consequently many companies have elected to use class X gauges.