

# Retro-Spec Inspections

## Intellispec

4.2 Software



Pressco Technology Inc.

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# Table of Contents

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## Chapter 1

<b>Retro-Spec Inspections .....</b>	<b>3</b>
Circular Region for Retro-Spec .....	3
Before adding Circular Region.....	3
Adding a Circular Region.....	3
How to create an arc region.....	4
About Circular Region Sampling Pattern.....	4
Using Retro-Spec Inspections.....	6
What is Retro-Spec?.....	6
Viewing the Retro-Spec interface .....	6
How to view another Retro-Spec inspection.....	7
How to Identify Inspection Type.....	7
How to Add a Retro-Spec Inspection .....	8
How to save changes in Retro-Spec .....	9
About the Retro-Spec Part Detail Graph View .....	10
About the Retro-Spec 100 Parts Graph View.....	12
About the Retro-Spec Comparison View.....	13
About the Retro-Spec 10,000 Part View.....	14
About the Retro-Spec Data Sets .....	15
How to Save Retro-Spec Images .....	16
How to Remove the Retro-Spec Inspection Region from the Image.....	17
How to Scroll Through Retro-Spec Images.....	17
How to Apply Retro-Spec Changes to Your Job .....	17
Retro-Spec Contrast Inspection .....	18
How to Adjust Contrast Inspection for Your Part.....	18
How to Adjust Sensitivity in Retro-Spec Contrast Inspection .....	21
How to Identify Failed Parts in Retro-Spec Contrast Inspection .....	21
Additional Advanced Options in Retro-Spec Contrast inspection .....	21
Retro-Spec Measurement Inspection.....	24
What the Retro-Spec Measurement Inspection Measures.....	24
About the Retro-Spec Measurement Graphs .....	25
How to Adjust Tolerance in Retro-Spec Measurement Inspection.....	29
How to Make Advanced Adjustments in Measurement Inspection .....	31
Detailed Calibration Information for Retro-Spec Measurement.....	32
Retro-Spec Intensity Inspection .....	35
What the Intensity inspection measures.....	35
How to Adjust Intensity inspection for your part .....	36
<b>How to Contact Pressco .....</b>	<b>38</b>
24/ 7 Customer Support:.....	38
E-mail:.....	38
Customer Service Fax: .....	38

Mailing Address: ..... 38  
Main Phone:..... 38  
Web Site: ..... 38  
Business Hours:..... 38  
**Index .....39**

# Chapter 1

## RETRO-SPEC INSPECTIONS

This book explains the Retro-Spec family of inspections. It contains an explanation of the common user interface, the graphs, then details about the available Retro-Spec inspections.

### CIRCULAR REGION FOR RETRO-SPEC

The *Retro-Spec* (see "Using Retro-Spec Inspections" on page 6) inspections use the Circular Region to place the region of interest. Placing the region of interest separately from the inspection allows you to have more than one inspection in that region of interest. It also keeps inspection time very short.

#### Before adding Circular Region

Before adding a Circular Region to your job, use a part registration, such as Circular Registration, to locate the part or feature. The Circular Region will use the reference points from the registration. If you have a part on which the Retro-Spec inspection needs to be oriented, place an Orientation, such as Orientation Pattern Match, to locate the orientation feature.

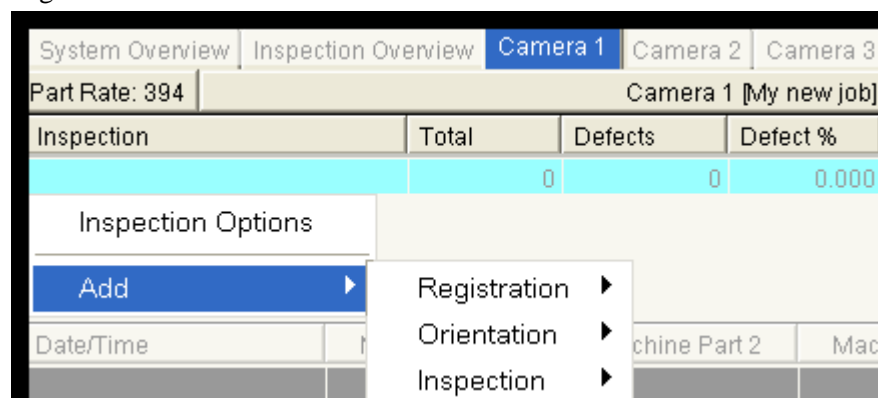
#### *Sample inspection order:*

- 1) Circular Registration
- 2) Orientation
- 3) Circular Region
- 4) Retro-Spec

#### Adding a Circular Region

#### *To add the Circular Region registration:*

- 1) Log in as Administrator.
- 2) Select the desired channel.
- 3) Right-click in the statistics area.



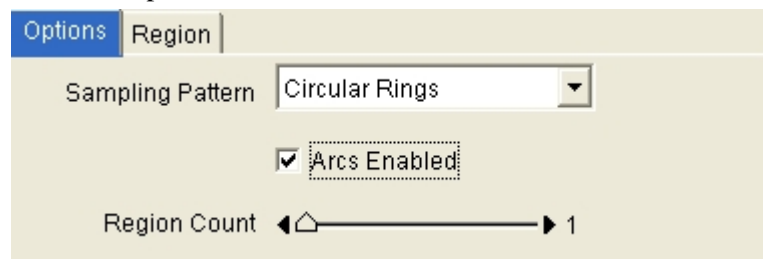
- 4) Select Add >> Registration >> Circular Region registration. The default region is placed on the image, and the registration menus are displayed in the upper right screen.
- 5) Using the Region menu, place the circles over the desired inspection area.
  - If you are going to add a Retro-Spec **Contrast** or **Intensity** inspection, place the region exactly where you want the inspection to take place
  - If you are going to add a **Measurement** inspection, the circles should fall on either side of the actual inspection area – the inspection needs to find the feature’s edges
  - From the Options menu, you can set up arcs or change the sampling pattern. See below.


## How to create an arc region

This is for parts where you do not want to inspect the full circle.

### To create an arc region:

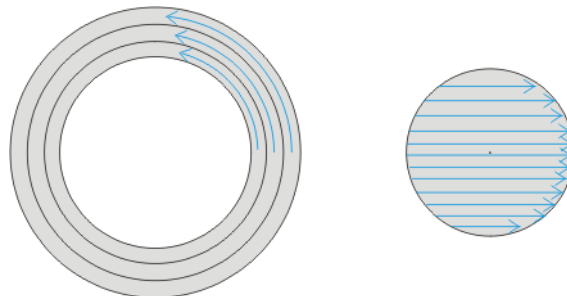
- 1) Make sure you have an Orientation set up in the job. If not, add one.
- 2) Add the Circular Region as described above.
- 3) From the Options menu, check the Arcs Enabled box.



- 4) From the Region menu, place the circles over the desired inspection area.
- 5) In the Region menu, move the Arc Size slider to create the arc.
- 6) Move the Start Angle slider to re-position the arc.
- 7) Alternately move the Arc Size and Start Angle sliders until the arc is positioned the way you want it on the image.
- 8) Click the  button a few times to make sure the region follows the part’s orientation correctly.
- 9) Click OK and exit.

## About Circular Region Sampling Pattern

From the Options menu, you can choose a sampling pattern. This is used for changing the inspection direction based on the shape of your region.



### **Circular Rings**

This is good for inspecting donut shaped areas.

### **Linear Stripes**

This is good inspecting circle shaped areas, particularly in the center of a part.

- You cannot use a Retro-Spec Measurement inspection with Linear Stripes.

# USING RETRO-SPEC INSPECTIONS

## What is Retro-Spec?

*Retro-Spec* (patent pending) is an easy to use interface that allows you to see pass/fail information for one part up to 10,000 previous parts. It also allows you to change the sensitivity and see how that inspection would have performed at different sensitivities over the recent inspection population. This is valuable because it allows you to try different settings without inspecting and rejecting more parts.

This inspection can be viewed and modified while the system remains online inspecting new parts. It uses an archive of previously inspected parts. It does not apply parameter changes to actual inspection until you are ready.

The *Retro-Spec* interface is available for the following inspections (the common interface is described below):

- **Contrast inspection** (see "Retro-Spec Contrast Inspection" on page 18)
- **Measurement inspection** (see "Retro-Spec Measurement Inspection" on page 24)
- **Intensity inspection** (see "Retro-Spec Intensity Inspection" on page 35)

Retro-Spec requires a **Circular Region** (see "Circular Region for Retro-Spec" on page 3).

## Viewing the Retro-Spec interface

The interface is displayed when you place or edit the inspection (only Mechanic or Administrator user levels can edit an inspection).

### *To display a Retro-Spec screen:*

- Right-click over the related inspection area in the Part Graphic (if available).  
Or:
  - Double-click the related area in the Part Graphic (if available). From the pop-up statistics menu, double-click the inspection name. Or:
  - Double-click the name of the inspection in the standard statistics area.
- 
- ❖ *Note: if the inspection is not a RETRO-SPEC inspection, then the appropriate inspection will be displayed.*
- 

What views are available

There are up to four different Retro-Spec graph views available:

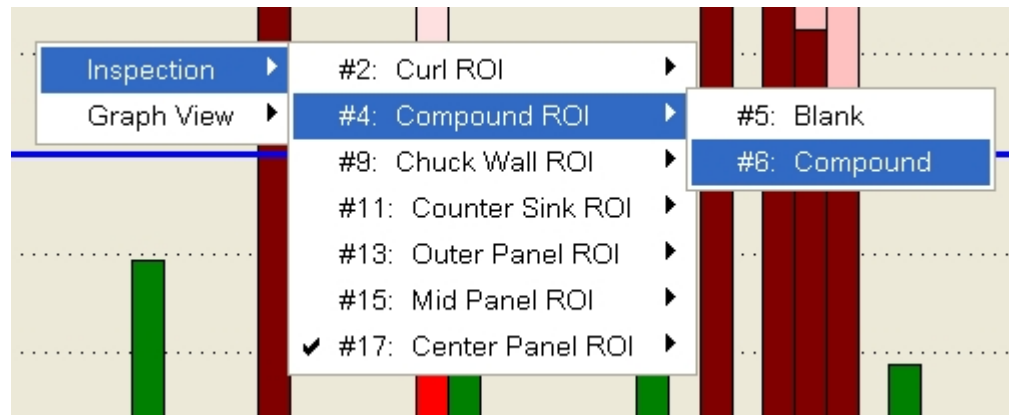
- **Part Detail** (see "About the Retro-Spec Part Detail Graph View" on page 10) – shows data for a single part (not available for Intensity inspection)
- **100 Parts** (see "About the Retro-Spec 100 Parts Graph View" on page 12) – shows data for 100 parts
- **Comparison** (see "About the Retro-Spec Comparison View" on page 13) – shows data for up to 100 parts compared to another set of up to 100 parts
- **10,000 Parts** (see "About the Retro-Spec 10,000 Part View" on page 14) – shows data from a 10,000 part archive (if enabled)

## How to view another Retro-Spec inspection

You can see other Retro-Spec inspections on the same part, or on the selected data sets.

### *To view another Retro-Spec inspection:*

- 1) Right-click over the graph.
- 2) Choose Inspection.
- 3) Move your cursor over the available choices and select the desired inspection.



- The inspections are grouped by Circular Region. In the example screen above, #2, #4, #9, etc. are all different Circular Regions.
- All *Retro-Spec* inspections in the current job (and current channel) are available through this method, including Contrast, Intensity, and Measurement inspections
- If you have made changes to the current inspection, you will be asked whether you want to save changes when you switch inspections
- If an inspection has been disabled previously, it is not available for viewing

## How to Identify Inspection Type

It is important to appropriately name the registrations and inspections in the job. However, you may need to identify the registration or inspection type (for example, identify Retro-Spec inspections).

### *To identify registration or inspection type:*

- 1) Make sure the system is offline.
- 2) Log in.
- 3) Click the tab for the desired channel.
- 4) Right-click the tab to show the channel options menu.
- 5) Click Review Inspections.
- 6) From the pop-up menu, select a job to review its inspections and click OK.  
Another pop-up window shows all registrations, orientations, and inspections in the job.

## How to Add a Retro-Spec Inspection

You can add or insert a Retro-Spec inspection to almost any job.

---

### *Before adding a Retro-Spec inspection*

Place a **Circular Region** (see "Circular Region for Retro-Spec" on page 3) to set the inspection area.


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### *Adding the Retro-Spec inspection*

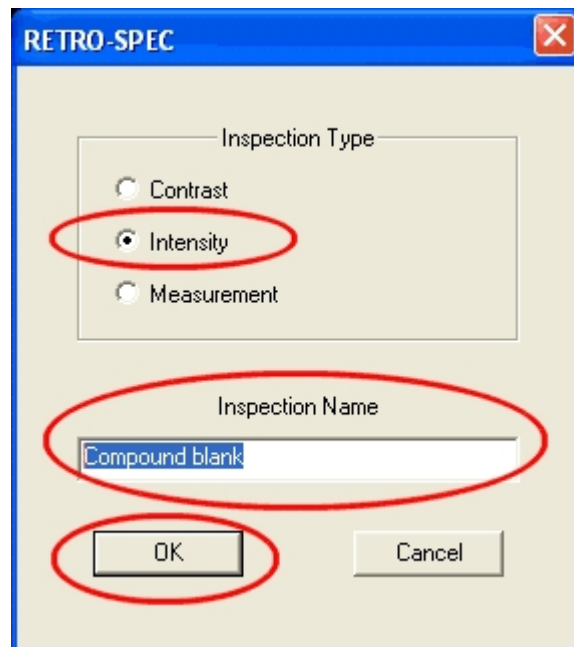
#### **To add or insert the Retro-Spec inspection:**

- 1) Log in as Administrator.
- 2) Select the desired channel.
- 3) Make sure the job already has a Circular Region in place.
- 4) Run several parts through the system so that Retro-Spec collects some images:

Right-click the  button and click Continuous Snap. Let it run for about a minute.

- 5) Click the  button when finished, to stop collecting images.
- 6) Right-click in the statistics area.
- 7) Choose Add (or Insert after the correct Circular Region, if in an existing job) >> Inspection >> Retro-Spec >> Retro-Spec Wizard Dialog... The dialog box appears.

- Instead of using the Wizard Dialog, you can choose Contrast, Intensity, or Measurement from the menu, and re-name the inspection later.



- 8) Choose an **inspection type**.
- 9) Type an **inspection name** – this should describe the area of inspection, or the type of defect you are looking for.
- 10) Click OK. The Retro-Spec screen is displayed. The system will assign default settings.
- 11) Set up the **Contrast**, (see "Retro-Spec Contrast Inspection" on page 18) **Intensity**, (see "Retro-Spec Intensity Inspection" on page 35) or **Measurement** (see "Retro-Spec Measurement Inspection" on page 24) inspection.

## How to save changes in Retro-Spec

### *To save changes:*

- 1) Click Exit.
- 2) The system will ask whether you want to save your changes.
- 3) Click Yes. The system will exit the Retro-Spec inspection.

## About the Retro-Spec Part Detail Graph View

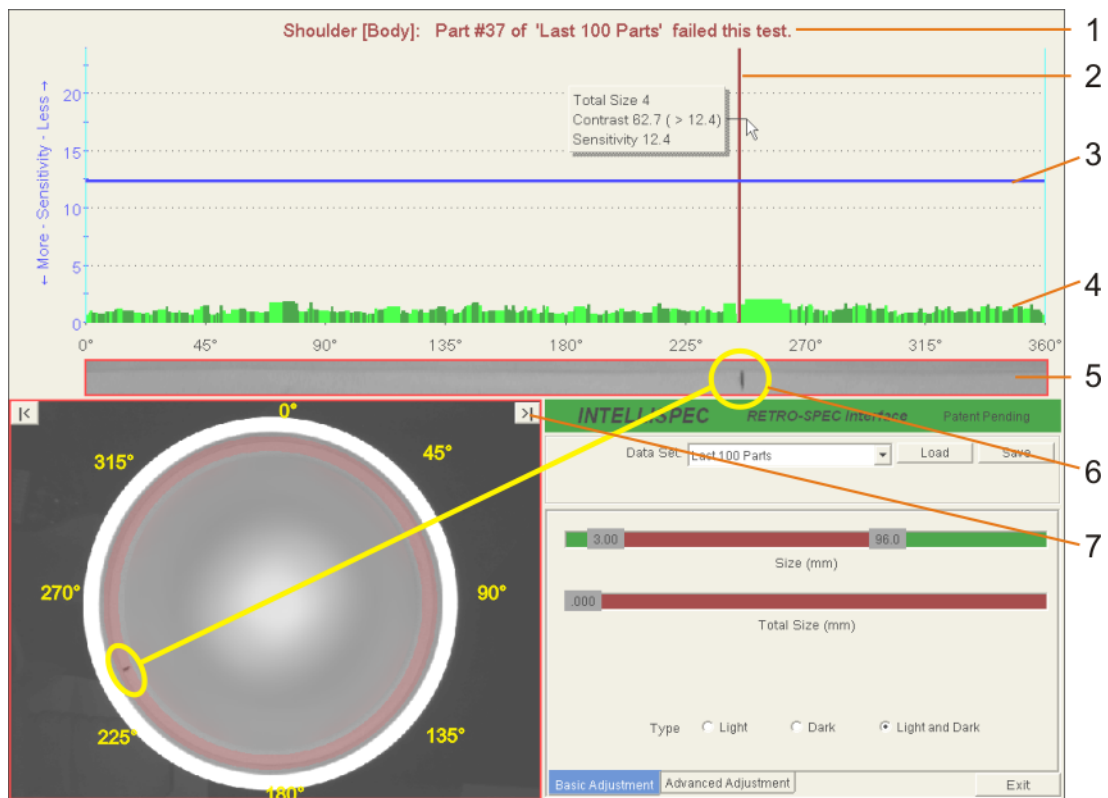
❖ Available for Contrast and most Measurement inspections, but not Intensity.

This view shows data from each inspection vector. Click anywhere on the graph to see inspection details. If you have segments, each arc's information is displayed when you click in the related area. You will see the arc area highlighted, including its overlap range.

### To view the Part Detail graph:

- 1) Right-click on the *Retro-Spec* graph.
- 2) Choose Graph view.
- 3) Choose Part Detail. The Part Detail graph is displayed.

The part displayed is the one that was highlighted on the graph prior to entering this view.



Referring to the above illustration:

1	Title of graph displays name of inspection, which part (out of 100) passed or failed. The title is displayed in red if the part failed, and green if the part passed.
2	The bars in red show the defective area of the inspection region. When you click on the graph as shown in the example, the inspection data is displayed.
3	The blue line shows the sensitivity level of the inspection. Click and drag this bar to change sensitivity.
4	The bars in green show the passing area of the inspection region.

5	This is the unwrapped region of interest. It is outlined in red if the region failed, and in green if the region passed inspection. The degrees represent where the unwrapped region begins and ends.
6	If there is a defect, it will be displayed in the unwrapped region, and correlate to the part image. If the inspection is set up to catch that type of defect, you will also see red bars above that defective area.
7	Click the right or left arrows* to scroll through remaining parts in the data set. The part image is outlined in red if the inspection region failed, and in green if the inspection region passed. * These can be disabled by right-clicking the image and de-selecting Image Selection Controls.

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❖ *If your settings are such that Total Size passes, but Contrast does not, the bars are displayed in **yellow**. This is for Contrast inspection. The most common occurrence of yellow bars is when the registration or orientation of the part fails.*

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### *Using Orientation in Retro-Spec*

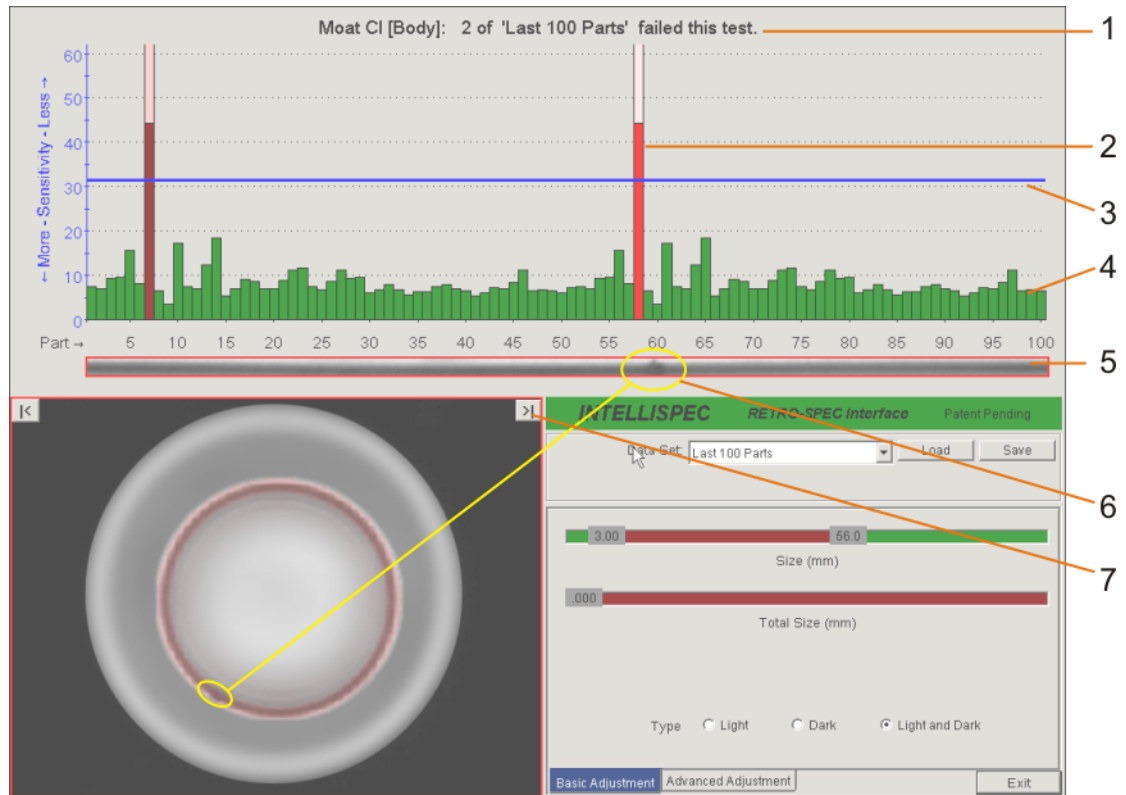
If the inspection region is an arc and uses orientation, zero degrees would be at the top of the circle (on the image). The graph displays the start to end angles of that part's search region instead of zero to 360 degrees.

## About the Retro-Spec 100 Parts Graph View

This shows how many parts out of 100 passed or failed. You can click on each bar to see the related image and its inspection information in the pop-up box.

**To view the 100 Parts View graph:**

- 1) Right-click on the *Retro-Spec* graph.
- 2) Choose Graph view.
- 3) Choose 100 Parts View. The 100 Parts View graph is displayed.



Referring to the above illustration:

1	Title of graph displays name of inspection, and how many parts out of the last 100 failed that inspection.
2	The bars in red show the parts that failed inspection. The currently selected part is highlighted on the graph, in bright green, bright red, or bright cyan.
3	The blue line adjusts sensitivity or tolerance (depending on inspection). Click and drag this line to change the value.
4	The bars in green show the parts that passed inspection.
5	This is the unwrapped region of interest. It is outlined in red if the currently selected part failed, and in green if the part passed inspection. The numbers represent the part number up to 100.
6	If there is a defect, it will be displayed in the unwrapped region, and correlate to the part image.

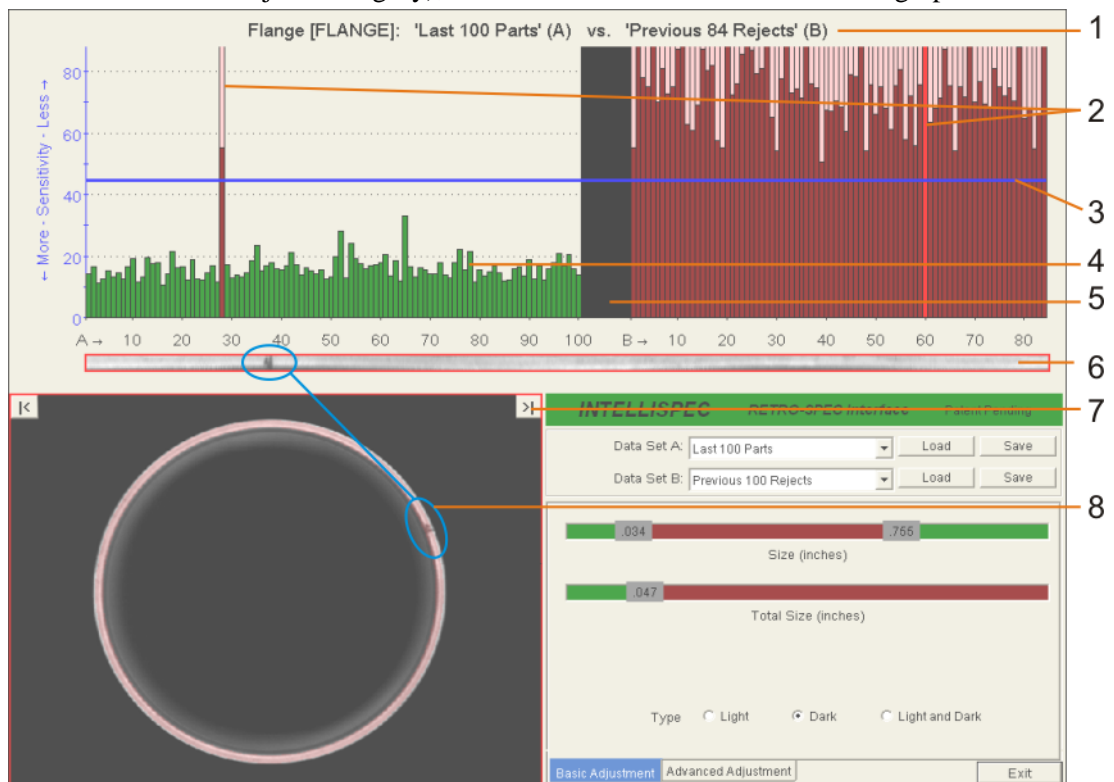
7	Click the right or left arrows to scroll through remaining parts in the data set. The part image is outlined in red if the part failed, and in green if the part passed.
---	--

## About the Retro-Spec Comparison View

This shows two different views at once. It displays graphs of Last 100 Parts vs. Previous 100 Rejects, for example. The system automatically selects a different data set from the one you already had displayed. The large black bar is the divider.

### To view the Comparison graph:

- 1) Right-click on the *Retro-Spec* graph.
- 2) Choose Graph view.
- 3) Choose Comparison. The Comparison graph is displayed.
  - See the lower right screen for choosing **data set A and data set B** (see "About the Retro-Spec Data Sets" on page 15)
  - When comparison view is selected, two Data Set selectors are available. You can load data from an image set saved previously and compare it to the most recently inspected parts.
  - If no data is available for one of the views (example, no parts in the Previous 100 Rejects category), the black bar falls at either end of the graph



Referring to the above illustration:

1	Title of graph displays name of inspection, Data Set A, and Data Set B.
---	---

2	The bars in red show the parts that failed inspection. The currently selected part is highlighted on the graph in bright green, bright red, or in some graphs, bright cyan.
3	The blue line adjusts sensitivity or tolerance (depending on inspection). Click and drag this line to change the value.
4	The bars in green show the parts that passed inspection.
5	The black bar visually divides Data Set A from Data Set B.
6	This is the unwrapped region of interest. It is outlined in red if the currently selected part failed, and in green if the part passed inspection. The numbers represent the part number up to 100, for both Data Sets A and B.
7	Click the right or left arrows to scroll through remaining parts in the data set. The part image is outlined in red if the part failed, and in green if the part passed.
8	If the part has a defect, it is displayed in the unwrapped region as well as the part image.

## About the Retro-Spec 10,000 Part View

This is available when Data Set = 10,000 part archive. It shows a graph of up to 100 bars, and the X axis is labeled Groups instead of Parts. Each bar represents a group of 100 parts. The value of each bar represents the highest contrast, or worst part, found in each group.

When the 10,000 part archive is collected, it collects groups of 100 consecutive parts. These *groups* are not consecutive. That is, the archive will collect images for 100 parts, then several hundred more parts may be inspected by Intellispec, then the archive will collect data for another 100 parts. This provides a good sampling of parts over time.

If there is no archive available when you select the 10,000 part data set, an error message will be displayed.

### **To view the 10,000 Parts View graph:**

- 1) Right-click on the *Retro-Spec* graph.
- 2) Choose Graph view.
- 3) Choose 10,000 Parts View. The 10,000 Parts View graph is displayed.

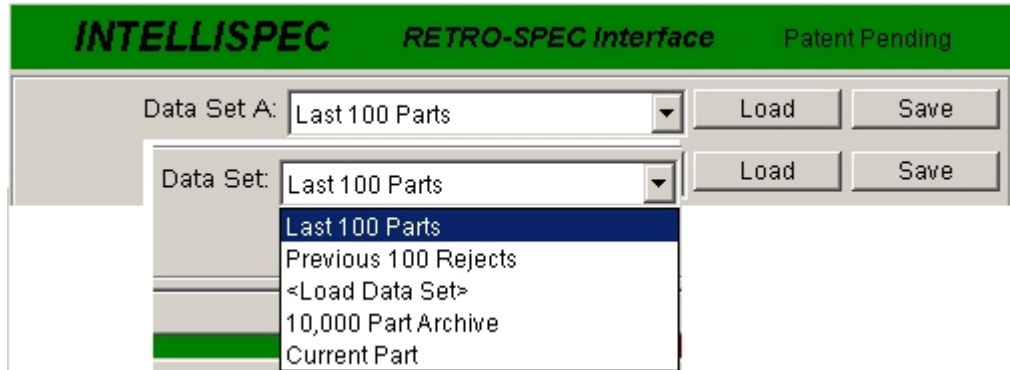
---

❖ *Archiving must be enabled by Pressco. The archive will be stored on one of the hard drives. This is available on Series IV Intellispec systems where two hard drives have been installed. Not available on Series III systems.*

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## About the Retro-Spec Data Sets

The *Retro-Spec* interface allows you to view and/or load data from previously inspected parts. Choose which data to display through the Data Set area of the interface.



### Data Set A or Data Set B

These two choices appear when you choose Comparison graph view. In other graph views, only one data set is necessary. Data Set choices are described next.

### Last 100 Parts

Shows the results of inspection for up to the last 100 parts. Results could be from online or offline inspection.

### Previous 100 Rejects

Shows the results of inspection for up to the last 100 rejects. Results are from online inspection only. The parts were rejected based on the settings when they were inspected – if inspection parameters were changed subsequently, parts could be shown as passing.

- If Archiving is not enabled, Previous 100 Rejects shows up to the last 100 rejects available in memory
  - If less than 100 parts were rejected online, it displays only the number of parts actually rejected
  - Memory stores a total of 100 rejects from each inspection. When you switch inspection views, the number of displayed rejects may change.

### <<Load Data Set>>/ Load button

Click this option from the drop-down menu or the Load button. The inspection will load any set of bitmap images saved on the hard drive(s). This option is useful for loading a set of “Golden Part” images to make sure the inspection is running correctly. Also, a set of part images with certain defects can be loaded to make sure the inspection is catching those defects.

- Browse to the desired folder and click Open. If \*.bmp is shown as file name, all bitmap images from that folder will be loaded.
- To load specific images, highlight the desired images while holding the Shift (for contiguous files) or Ctrl (for non-contiguous files) key and click Open.
- Notice that the image set name will be displayed in the Data Set drop-down box.

### Save button

Saves the images currently in memory. A default folder and image set name is provided, but you can browse to any folder and name the image set as you wish. The grayscale images are saved without the inspection region displayed on them.

This saves the images currently selected by the Data Set parameters: The Last 100 parts, Previous 100 Rejects, etc. If a data set was loaded from disk, clicking Save saves those images again under a different folder name.

### 10,000 Part Archive

Archiving must be enabled by Pressco. The archive will be stored on one of the hard drives. This is available on Series IV Intellispec systems where two hard drives have been installed. Not available on Series III systems.

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❖ *Note: if you do not have an archive of 10,000 inspected parts, an error will be displayed.*

---

### Current Part

Displays Part Detail view for the most recently acquired image.

## How to Save Retro-Spec Images

### To save a Retro-Spec image:

- 1) Right-click on the image.
- 2) Choose Save Image to save a bitmap of the image. Your choice of images include:
  - **Color** – Saves the inspection region on the part image. The image is named “\*\_c.bmp”, where “\*” changes for every image.
  - **Gray** – Saves only the grayscale part image.
  - **Both** – Saves two images – one grayscale image with the inspection region, and one without the inspection region.

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### *Where the image is saved*

A default image name and folder is provided when you save the image. However, you can re-name the images and choose any folder before saving.

## How to Remove the Retro-Spec Inspection Region from the Image

Sometimes, you might want to see the defect more clearly. You can remove the inspection region, then display it again if you wish.

### *To remove the inspection region:*

- 1) Right-click on the image.
- 2) Choose Graphics >> Clear.

To display the inspection region again, right-click on the image and choose Graphics >> Refresh.

## How to Scroll Through Retro-Spec Images

Click the left or right arrow to scroll through the images in the currently selected data set. If you reach the first or last image in the data set, the image will not change.

### *To disable scrolling:*

- 1) Right-click on the image.
- 2) Un-check Image Selection Controls.

To enable scrolling again, right-click on the image >> check Image Selection Controls.

## How to Apply Retro-Spec Changes to Your Job

Retro-Spec does not make changes to the actual inspection of your products until you are ready. After you have made all the desired changes to the Retro-Spec inspection, simply click Exit.

A pop-up window asks whether you want to save your changes.

- **Yes** applies the changes to the job, and exits the inspection.
- **No** reverts to the Retro-Spec settings from when you entered the interface, and exits the inspection.
- **Cancel** does not save changes, and returns you to the Retro-Spec interface.

# RETRO-SPEC CONTRAST INSPECTION

Contrast inspection uses Pressco's *Retro-Spec* (patent pending) interface. Contrast inspection can discriminate defects based on their size, contrast, and whether they are dark or light. The contrast results are represented by bars on the graph. When the system finds a defect, it displays a higher bar.

For many applications, Contrast inspections can replace Radial Line Integration and/or Circle inspections.

- 
- ❖ *This inspection can be viewed and modified while the system remains online inspecting new parts. It uses an archive of previously inspected parts. It does not apply parameter changes to actual inspection until you are ready.*
- 

Contrast inspection is available for the All Inspection Product Type (Channel Product Type or Job Product Type).

See *how to add a Contrast inspection* (see "How to Add a Retro-Spec Inspection" on page 8).

## How to Adjust Contrast Inspection for Your Part

You can change inspection parameters to see how they perform on the current part or a set of archived images.

---

### *Making Basic Adjustments*

This area of the screen provides data set selection, and allows you to determine what type of defects you want to catch.

The screenshot displays the 'INTELLISPEC RETRO-SPEC Interface' with a 'Patent Pending' notice. At the top, there is a 'Data Set:' dropdown menu set to 'Last 100 Parts', with 'Load' and 'Save' buttons. Below this, two horizontal bars represent inspection parameters: 'Size (mm)' with values 4.00 and 112, and 'Total Size (mm)' with a value of .000. At the bottom, there are radio buttons for 'Type' with options 'Light', 'Dark', and 'Light and Dark' (which is selected). Navigation buttons at the bottom include 'Basic Adjustment' (highlighted), 'Advanced Adjustment', and 'Exit'.

---

❖ See **Data Sets** (see "About the Retro-Spec Data Sets" on page 15).

---

## Size

Choose the range of defect size you want to catch – hold the left trackball button and drag the markers for min and max size. For example, you may want to pass very small defects but fail larger ones.

---

❖ *The effect of these settings is best viewed through **Part Detail view** (see "About the Retro-Spec Part Detail Graph View" on page 10).*

---

The area between the size markers is red to indicate defects, while the area outside of them is green to indicate passing size.

The size units depend on how the channel is calibrated. This can be measured in millimeters, pixels, inches, or custom units. The administrator can calibrate the channel through Pixel Calibration.

## Total Size (or Total Area)

Total Size should be left at its default setting of zero unless you have a part with one or more small anomalies you want to pass. If so, set Total Size to the total acceptable amount of anomalies. If a part has more than an acceptable amount of anomalies, it fails.

This setting is called Total Area if Linear Stripes was chosen in the Region of Interest.

## Type

Choose the type of defects you want to catch – Light, Dark, or Light AND Dark. For example, if the material is normally dark, you might want to catch Light defects.

## To save changes:

- 1) Click Exit.
- 2) The system will ask whether you want to save your changes.
- 3) Click Yes. The system will exit the Retro-Spec inspection.

---

## Making Advanced Adjustments

This menu divides the inspection region into segments and/or ring segments. It also provides additional options for advanced users.

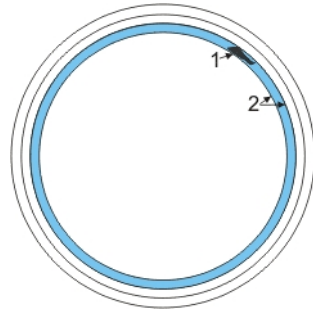


## Ring Size (or Sample Size)

Ring Size can improve inspection sensitivity to defects that do not span the width of the inspection region. An example would be nicks on the inner edge of a Seal Surface.

To optimize sensitivity for a particular defect, set Ring Size to approximately the size of the defect. You cannot see the rings on the image. You might have to measure the actual defect to see the size.

The maximum Ring Size (slider all the way to the right) equals the width of the inspection region. This creates one ring (not divided). The smaller the Ring Size, the greater the number of rings.



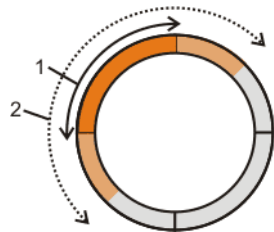
1	Defect
2	Ring Size

This setting is called **Sample size** if Linear stripes was chosen in the Region of Interest. Set Sample Size to approximately the number of pixels of the defects you want to catch. With Sample Size, Segments are not used.

### Segments

Divide the region into a number of segments between one and 360. Segments can be used if you want the system to catch a cluster of small anomalies, while passing parts with a similar number of widely scattered small anomalies. When Total Size = 0 (in Basic Adjustment), segments have no effect on the inspection.

You can view the segments in **Part Detail View** (see "About the Retro-Spec Part Detail Graph View" on page 10) when you click an area of the graph. These are represented by cyan divider lines which include overlap. The segments have a standard 50% overlap, ensuring that small anomalies do not get divided between segments.



1	Segment
2	Segment with overlap

### To save changes:

- 1) Click Exit.
- 2) The system will ask whether you want to save your changes.
- 3) Click Yes. The system will exit the Retro-Spec inspection.

## How to Adjust Sensitivity in Retro-Spec Contrast Inspection

This is best done through *100 Part View* (see "About the Retro-Spec 100 Parts Graph View" on page 12) or *Comparison view* (see "About the Retro-Spec Comparison View" on page 13) graphs.

Using the data on the graph, click and drag the blue line up or down to change sensitivity. Click on one of the green or red bars on the graph to see its corresponding image. If you think a passing (green) part should have failed, adjust sensitivity towards zero until that bar turns red.

### Caution

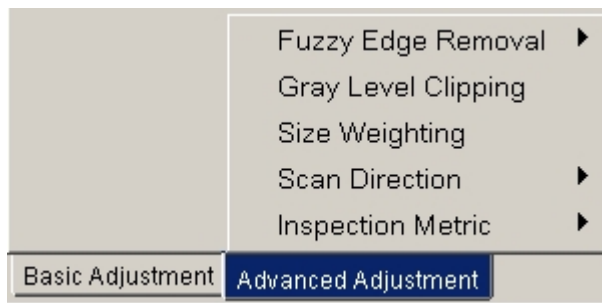
Once you change sensitivity and save your changes, the inspection will operate with the new settings. Making the inspection too insensitive may cause the system to miss certain defects.

## How to Identify Failed Parts in Retro-Spec Contrast Inspection

If a part on the graph has a red bar, it has failed inspection. These bars are extended in pink to the top of the graph for easy identification.

## Additional Advanced Options in Retro-Spec Contrast inspection

The following options are available by right-clicking on the Advanced Adjustment tab. These are intended for advanced users.

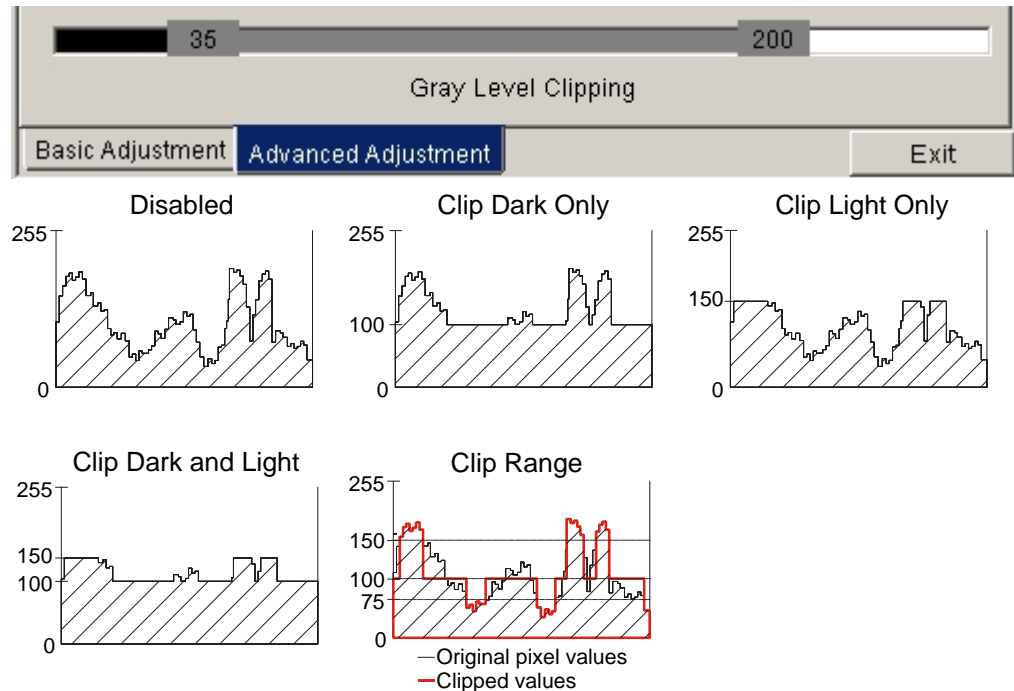


### Fuzzy Edge Removal

This is for parts that have normal anomalies that are fuzzy, but the defects are sharp and clear on the image. The default is disabled. The higher the Filter Level, the stronger the fuzzy edge removal. Be aware that this filtering increases inspection time.

## Gray Level Clipping

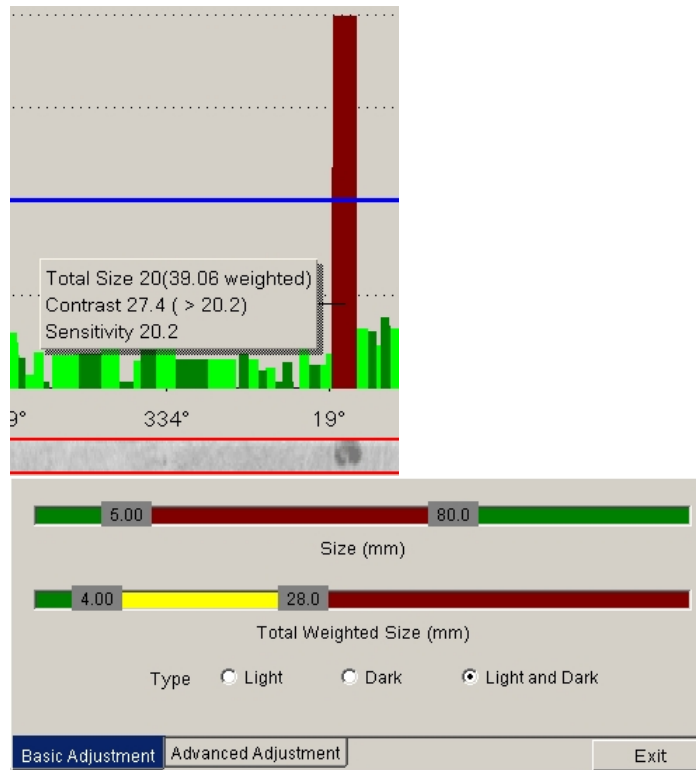
This is the same clipping as used in Circle, Radial Line Integration, and other inspections. It is enabled if there is a check mark next to it.



## Size Weighting

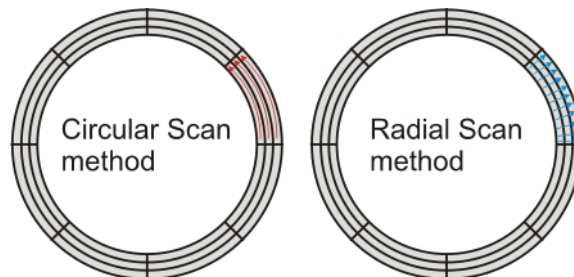
This feature is similar to Moment in Radial Line Integration. It is enabled if there is a check mark next to it. This feature helps find defects such as wrinkles on metal parts.

- If an area of the part fails, it is weighted. If the area does not fail, it is not weighted.
- The Basic Adjustment sliders change to provide adjustment for weighting.
- The left slider is Total Size, as in the standard Contrast sliders.
- The right slider adjusts the weighted size limit.



### Scan Direction

This feature is similar to Scan Method in Circle Edge inspection. It allows you to set the inspection to use Circular or Radial scanning.



### Inspection Metric

This allows you to choose between Width and Area for the inspection.

**Width**, the default setting, adds the number of units (pixels, millimeters, etc.) of defective bars at or above the sensitivity level within an inspection region or segment.

**Area** adds all the defect pixels. Suppose your part had two small defects along the same radial line. Normally, the width of the predominant defect would be counted. But with Area enabled, all defect pixels are counted. This results in a larger defect area counted.

# RETRO-SPEC MEASUREMENT INSPECTION

The Measurement inspection measures circular part features. It can be used in place of the Circle Dimension inspection. This inspection has several measurements available for each region of interest.

See *how to add a Measurement inspection* (see "How to Add a Retro-Spec Inspection" on page 8).

- ❖ *Note that when adding a Circular Region for a Measurement inspection, the region circles should fall outside of the actual inspection area – the inspection needs to find the feature's edges.*

## What the Retro-Spec Measurement Inspection Measures

This inspection can inspect a part with up to 10 criteria, depending on what is enabled. These include:

- Min/ Max dimensions (up to 3)
- Average dimension (up to 3)
- Range of measurement (up to 3)
- Feature Contrast

The initial measurements will be made based on the images you have just run. The default unit of measure is based on the channel's calibration unit.



Referring to the above example, the following are the components of the measurement inspection:

1	The number on the button indicates the average value of the measurement. <ul style="list-style-type: none"><li>• You can disable or enable any of the measurements by clicking the check boxes</li><li>• You can also <b>independently</b> (see "Detailed Calibration Information for Retro-Spec Measurement" on page 31) enable or disable the Min/Max, Average, or Range measurements</li></ul>
---	---

2	<p>Each of these is a button and an indicator for each measurement in the inspection. The highlighted button (bright green, bright cyan, or bright red) is the measurement shown in the graph at the top of the screen.</p> <ul style="list-style-type: none"> <li>• Select any button to view another measurement on the graph</li> <li>• If a button is <b>red</b>, at least one part in the data set has failed that measurement</li> <li>• If a button is <b>green</b>, all parts in the data set have passed that measurement</li> <li>• If a button is <b>cyan</b>, it indicates that the selected part failed some portion of the Measurement inspection, but not from the currently selected graph.</li> <li>• If a button is <b>yellow</b> or <b>gold</b>, then the part most likely failed registration or orientation.</li> </ul>
3	<p>The Learn button will take measurements of the parts in <b>Data Set A</b> (see "About the Retro-Spec Data Sets" on page 15), and automatically adjust parameters and tolerance based on those parts.</p> <ul style="list-style-type: none"> <li>• If you entered Measurement inspection with only one image, it will learn parameters from just that image</li> <li>• If a defective part is included in Data Set A, it may skew the measurements</li> <li>• You can load a set of images into Data Set A (perhaps a set of Golden Parts) from which you can learn the measurements</li> </ul>

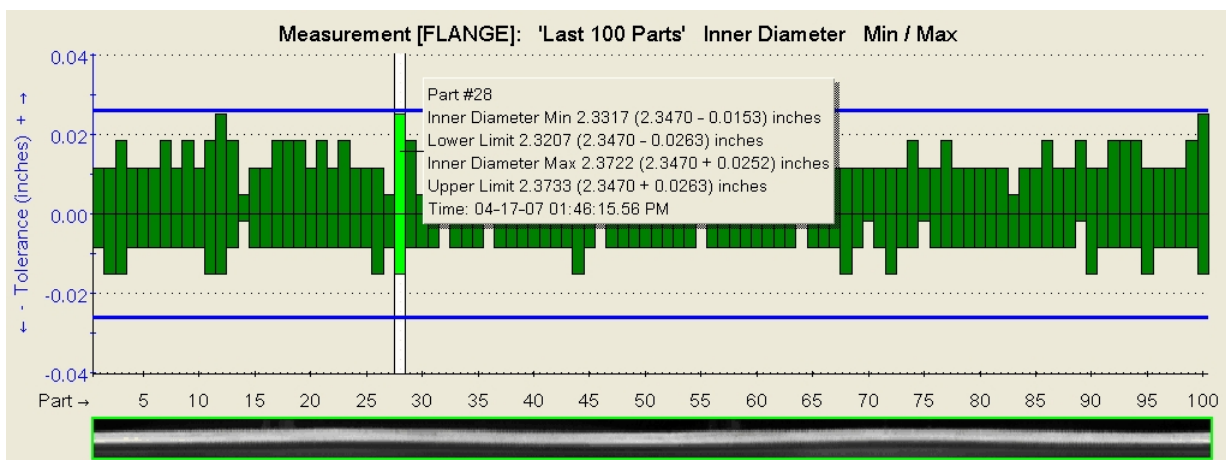
## About the Retro-Spec Measurement Graphs

Each measurement has a different graph. To see different graphs, click the dimension buttons in the *measurement screen* (see "What the Retro-Spec Measurement Inspection Measures" on page 24).

- ❖ *Also to select a graph: right-click over the graph >> choose a measurement (example, Inner Diameter) >> and choose a dimension (example, Min/Max).*

### Min/ Max graph

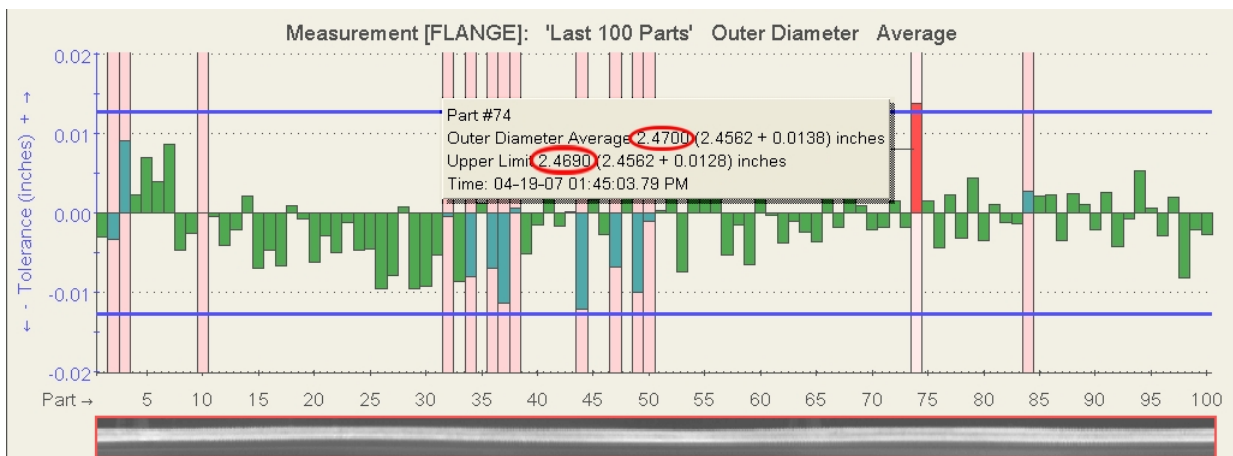
This graph shows the minimum and maximum values measured. In the example below, it shows the minimum and maximum values measured for Inner Diameter for the Last 100 Parts. The blue lines represent Tolerance, which you can adjust simply by clicking and dragging.



- One Min/ Max graph is available for each enabled measurement (Inner Diameter, Outer Diameter, or Width)
- Click on any part on the graph to see its measured values
- This graph also has Part Detail and Comparison views available. To see another view, right-click over the graph >> select Graph View >> and select the desired view.
- The Part Detail view shows each segment of the part (the inspection is automatically segmented, although you can change the number of *segments* (see "How to Make Advanced Adjustments in Measurement Inspection" on page 31)). The graph shows the average measurement of each segment - whether it measured above, below, or at the nominal measurement value.

### Average graph

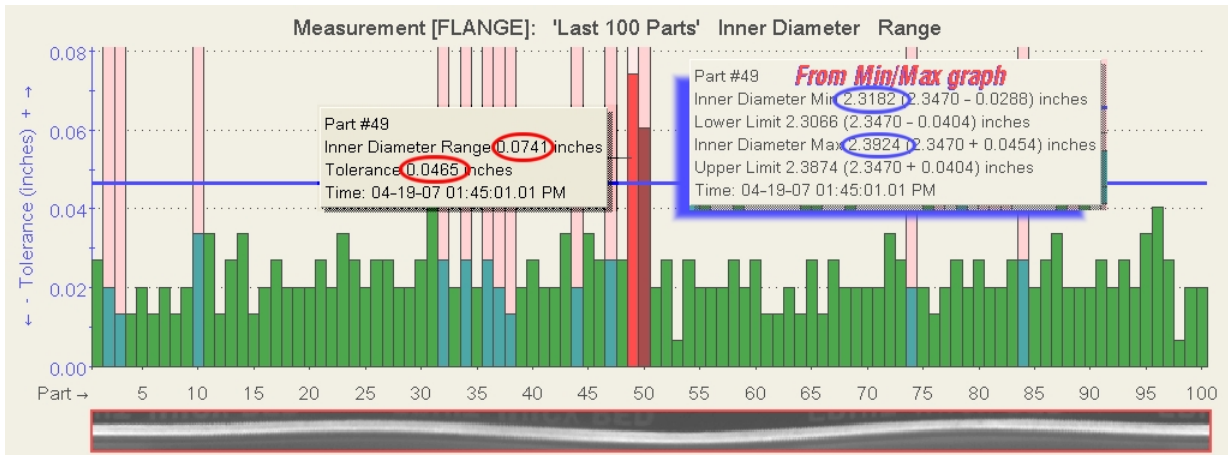
This graph shows the average value of Inner Diameter, Outer Diameter, or Width. The example below shows a failed part – the Outer Diameter exceeded the Upper Limit.



This graph also has Comparison view available. To see another view, right-click over the graph >> select Graph View >> and select the desired view.

## Range graph

This graph shows the range of values for each measurement. The example below shows that the range of values from Inner Diameter Max - Inner Diameter Min exceeds Range Tolerance.

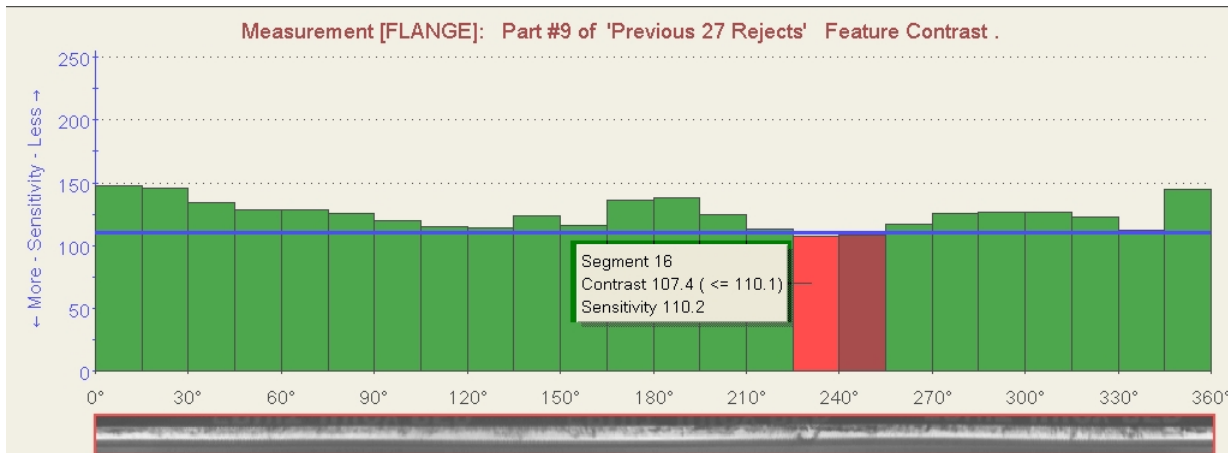


❖ *The Range dimension is good for catching defects such as ovality.*

## Feature Contrast graphs

This graph shows whether the edges of the feature have enough contrast to compute the measurements. In this graph, the failed parts fall below the blue line (not enough contrast), as opposed to standard Retro-Spec graphs, where the failed parts go above the blue line.

The example below shows that two segments did not have enough contrast at the edges of the feature to complete the measurements.



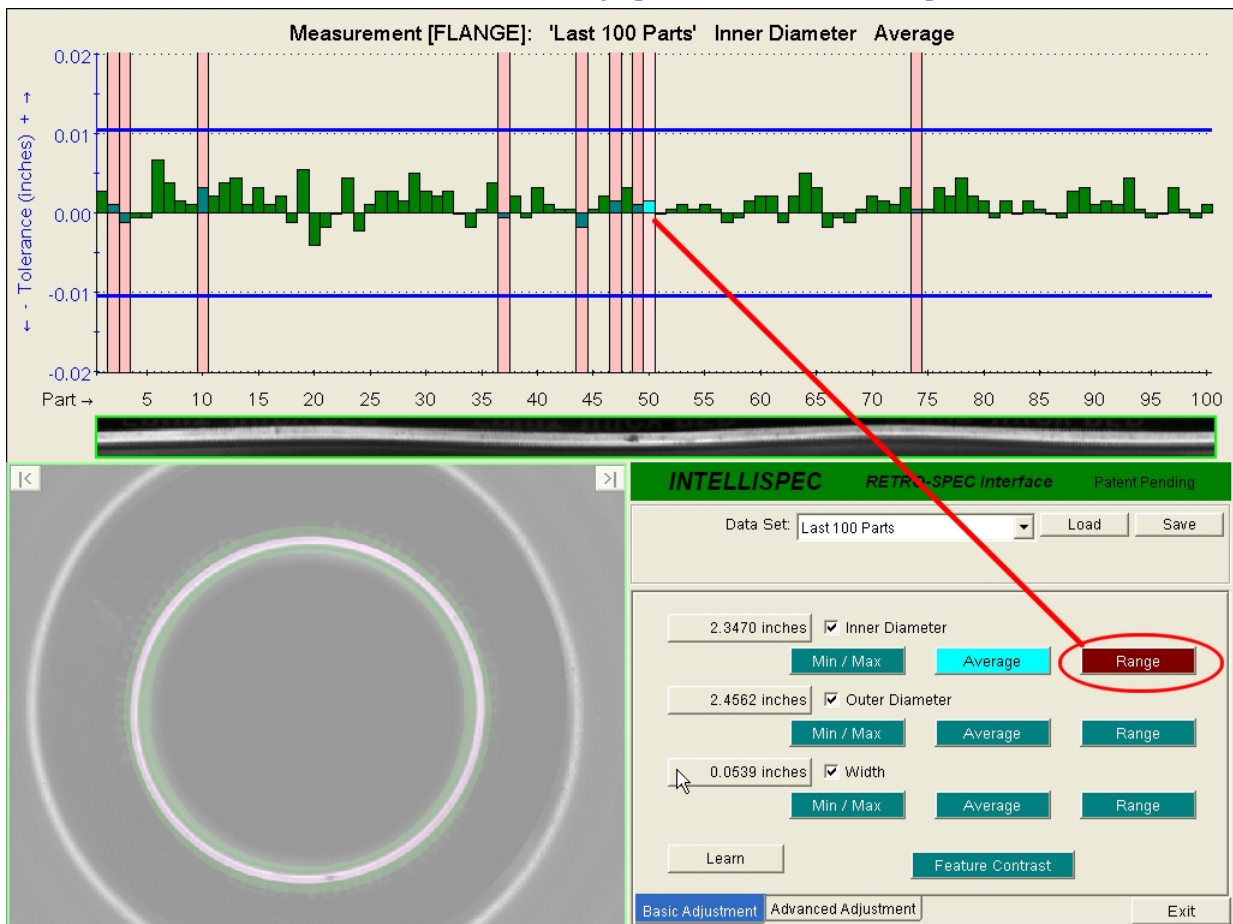
## Identifying Failed Parts

The Measurement graphs make it easy to identify which parts failed. The failed parts always have a pink bar extended to the top and bottom of the graph.

### PINK BARS AND RED BUTTONS

When you view a graph, you may see that some parts obviously failed that measurement. The failed parts have a red bar, continuing in pink to the top of the graph. However, you may view a graph in which no parts failed that measurement, as shown below.

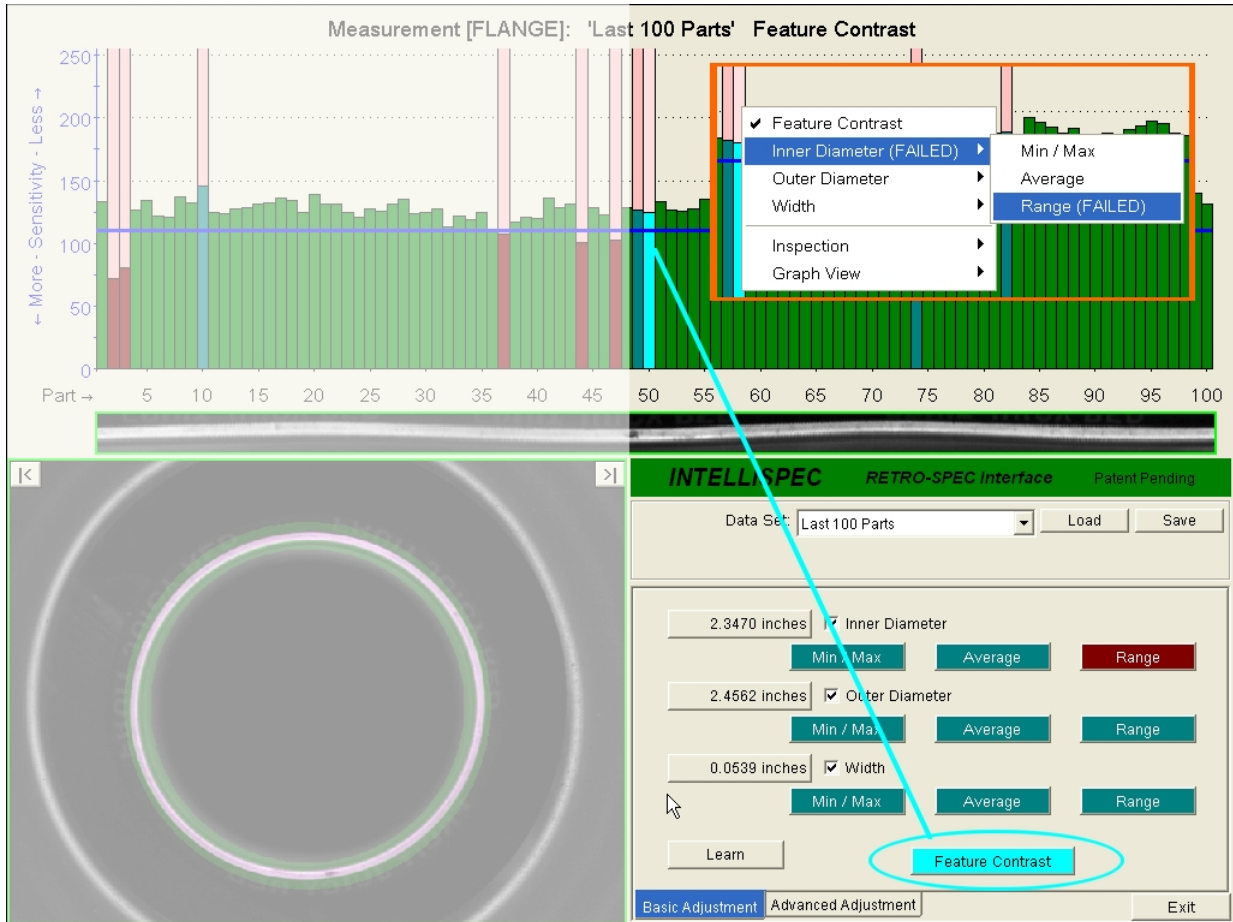
- The pink bars indicate that those parts failed another measurement. In this example, the selected part failed Range.
- The red buttons indicate which portion of the inspection failed. You can click a red button to view the graph in which the selected part failed.



## CYAN BARS AND BUTTONS

When a bar or a button is cyan, it indicates that the selected part failed some portion of the Measurement inspection, but not from the currently selected graph.

You can right-click over the graph to quickly see which portion of the inspection failed. In the example below, the Range dimension of the Inner Diameter measurement failed on the selected part. In this example, if you select Range (FAILED), you will see the Range graph in which this part failed.



## How to Adjust Tolerance in Retro-Spec Measurement Inspection

To adjust tolerance, simply click and drag the blue line for each dimension measurement. Click on the blue line to see current Tolerance.

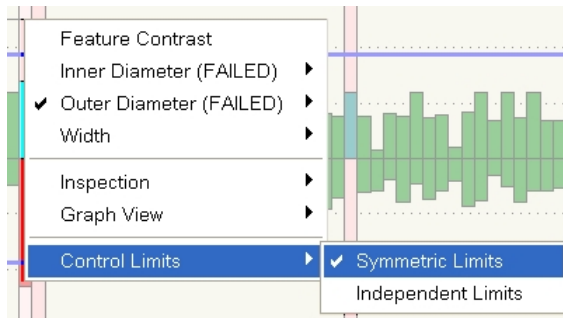


## Upper and Lower Limits

In the graphs that have 2 blue lines (Min/Max and Average graphs), tolerance is displayed in the Upper Limit and Lower Limits.

Part #49  
Outer Diameter Min 2.4102 (2.4562 - 0.0460) inches  
Lower Limit 2.4184 (2.4562 - 0.0377) inches  
Outer Diameter Max 2.4842 (2.4562 + 0.0281) inches  
Upper Limit 2.4939 (2.4562 + 0.0377) inches  
Time: 04-19-07 01:45:01.01 PM

The Upper and Lower limits can be adjusted symmetrically or independently. Right-click over the graph >> select Control Limits >> and select the desired control.

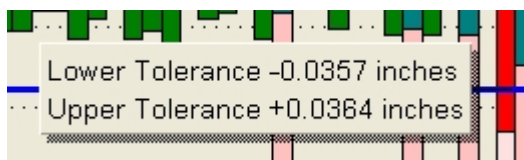


### Symmetric Limits

The blue lines will move together, either towards the center or away from the center. This makes the Upper Limit the same tolerance as the Lower Limit.

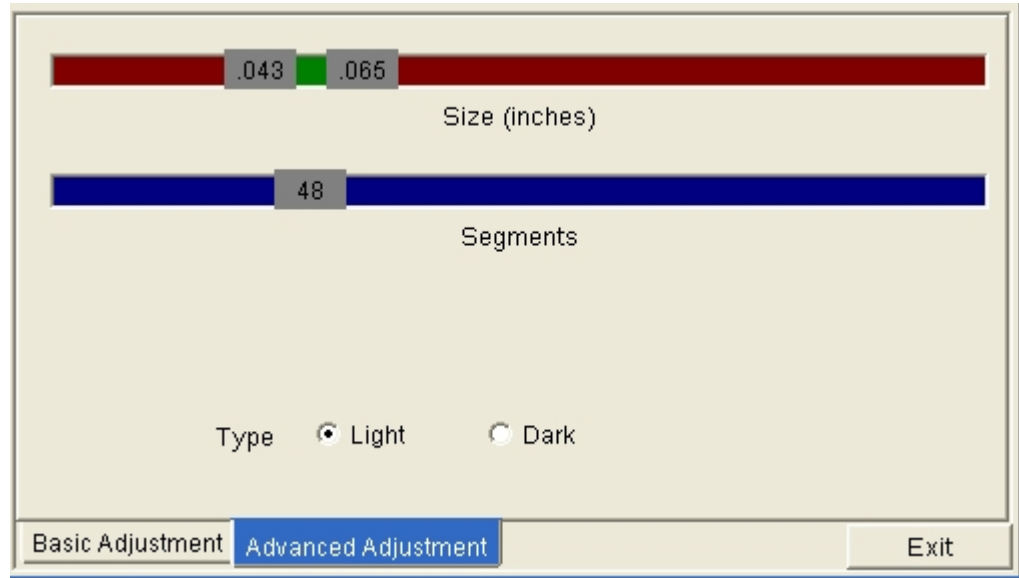
### Independent Limits

The blue lines will move independently. For your reference, both Upper Tolerance and Lower Tolerance are displayed on screen as you move the blue lines.



## How to Make Advanced Adjustments in Measurement Inspection

You can adjust the acceptable size of the feature through the Advanced Adjustment menu.



- ❖ *You can see changes to the inspection from this menu by viewing a Part Detail Graph from a Min/Max measurement. (Click a Min/Max button in Basic Adjustment menu, then right-click over the graph >> choose Graph View >> Part Detail).*

### Size adjustment

Set the minimum and maximum size of the feature. Any feature with a width that falls outside this range is ignored. If no feature can be found that matches these size requirements, then the inspection fails.

- The setting is opposite that of Retro-Spec Contrast inspection. That is, in Measurement inspection, the size that falls between the markers is OK.
- The unit of measure matches that in the **Calibration** (see "Detailed Calibration Information for Retro-Spec Measurement" on page 31) section of the Measurement inspection.

### Segments

This breaks up the inspection area into a number of wedges. Each segment is averaged to determine the measurement. A greater number of segments means smaller wedges, which can catch smaller defects or variations in measurement on the part.

### Type

Determine the type of feature you want the inspection to search for. If the feature is light against a background of dark pixels, choose Light.

## Detailed Calibration Information for Retro-Spec Measurement

Click a measurement button  to see the calibration details. You can manually change calibration units, Golden Part measurements, and tolerance, if desired.

- 
- ❖ *You do not have to manually enter any of this information – it is done for you by other means in the Retro-Spec interface, as well as through Pixel Calibration.*
- 

### CALIBRATION INFO

These settings are used instead of Pixel Calibration for Measurement inspection (if you have used Pixel Calibration for other inspections). Regardless, you will need an actual measurement from a part to type in this menu.

The following terms in [brackets] are variables, depending which measurement button you clicked to get to this screen. For example, the screen could read [Inner Diameter] instead of [Outer Diameter], or [mm] instead of [inches].

### Calibration Mode

- **Common to Channel** - writes the calibration information to the channel. That is, if another inspection requires a measurement, it uses the values in this menu.
- **Common to Inspection** - changes calibration information for the current inspection. Does not affect calibration for any other inspection (say, a Circle Dimension inspection).
- **All Independent** - sets calibration information for each measurement individually. That is, Inner Diameter can be calibrated differently than Outer Diameter.

### Calibration Unit

Choose from millimeters, inches, pixels, or percent. Percent is similar to the Custom value used in Dimension inspections.

### Calibration Standard

Choose from Data Set A or the current part:

- **Data Set A** - uses the average value of the measurement from all parts in *Data Set A* (see "About the Retro-Spec Data Sets" on page 15).
- **Current Part** - this is good to use if you have a Golden Part. This compares all future measurements to only one part.

### [Outer Diameter] in Pixels

This is an Intellispec measured value - it cannot be changed.

### [Outer Diameter] in [inches] (measured)

Measure your sample part and type the measured value here.

### [Inches] per Pixel

This is computed by Intellispec.

The following parameters allow you to set quality control limits.

Outer Diameter in inches (nominal)	2.4562
<input checked="" type="checkbox"/> Min / Max	Single Tolerance Mode
Tolerance (inches)	0.0366
<input checked="" type="checkbox"/> Average	Single Tolerance Mode
Tolerance (inches)	0.0128
<input checked="" type="checkbox"/> Range	
Tolerance (inches)	0.0492
<input type="button" value="Close"/>	

### [Outer Diameter] in [inches] (nominal)

Type the measurement that each part SHOULD measure, according to your Golden Part, or your quality assurance team.

## INDEPENDENT MEASUREMENTS

The following dimensions, Min/ Max, Average, and Range, can all be enabled or disabled independently. If one is disabled, no button is shown on the Retro-Spec measurement screen.

### Tolerance Mode

Allows you to set tolerance either equally or independently.

---

❖ **Tolerance** (see *"How to Adjust Tolerance in Retro-Spec Measurement Inspection" on page 29*) can also be easily set through Retro-Spec interface.

---

- **Single Tolerance Mode** - computes tolerance equally above and below the nominal value.
- **Dual Tolerance Mode** - allows you to set upper and lower tolerance independently. Two boxes are available to type upper and lower limits.

### Tolerance ([inches])

Type the allowable tolerance for the appropriate measurement, as computed above or below the nominal value.

# RETRO-SPEC INTENSITY INSPECTION

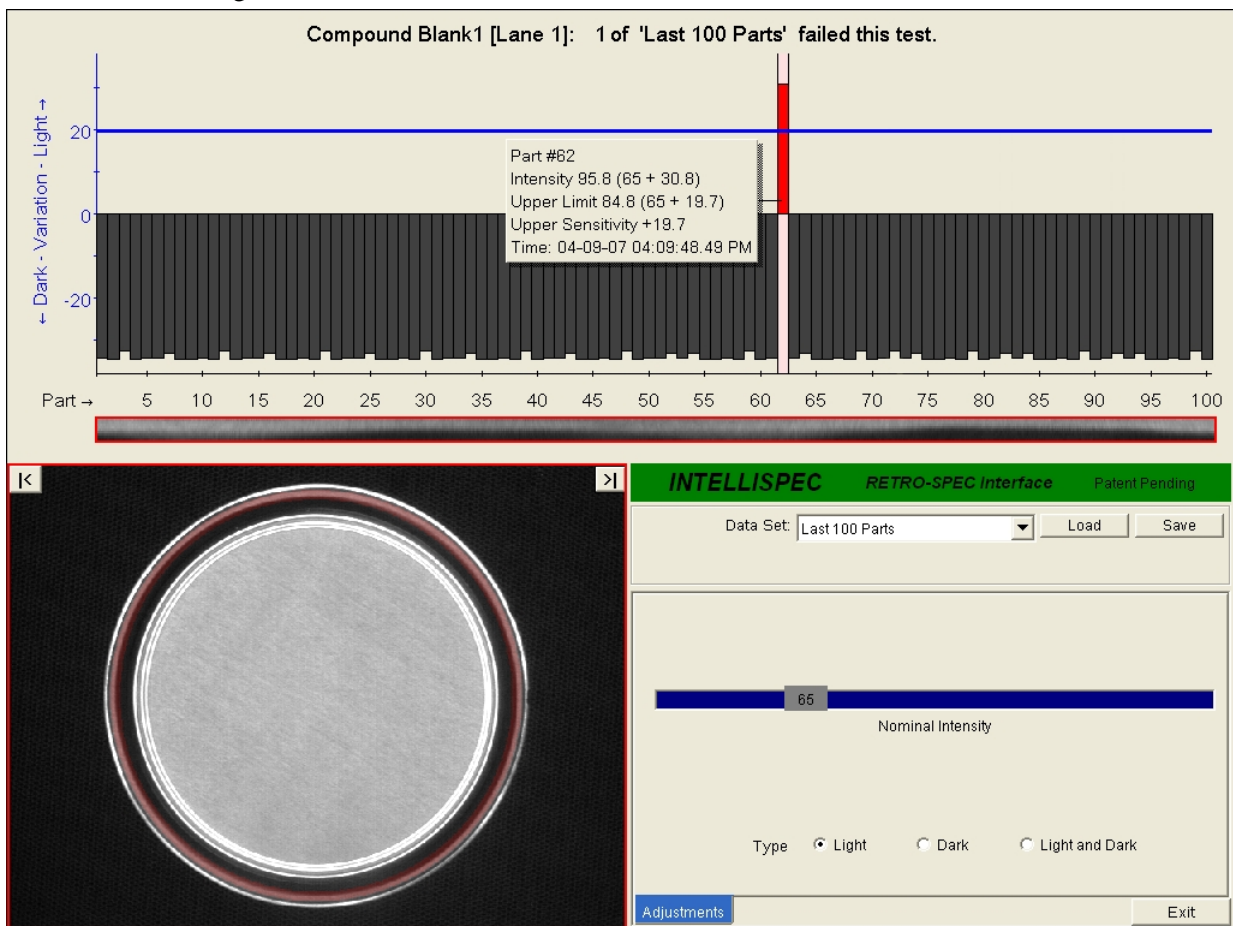
The Intensity inspection finds areas of parts that are lighter or darker than normal. It is good for catching defects such as compound blanks, or wrong color parts.

See *how to add an Intensity inspection* (see "How to Add a Retro-Spec Inspection" on page 8).

The system will use default Intensity values.

## What the Intensity inspection measures

The Intensity inspection measures the degree of brightness of the region of interest. The part is rejected if it measures outside of the allowable tolerance values. In the example below, the inspection found a compound blank – the inspection area was too light.



### Green bars

Passing parts.

### Red bars

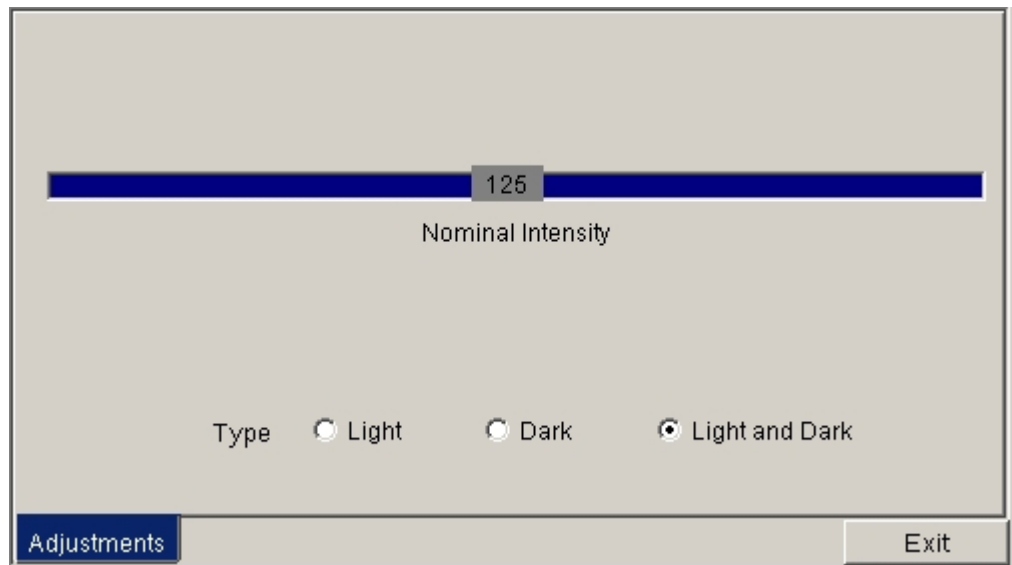
Failing parts.

## Gray bars

Gray bars are used for only Light or only Dark inspection types. These parts are OK – the intensity value is in the opposite direction of failing parts.

## How to Adjust Intensity inspection for your part

### *To adjust Intensity inspection:*



- 1) Using the slider, set Nominal Intensity to a gray scale value that the inspected area SHOULD measure. This number is used as the zero line on the graph.
  - You can adjust the slider while watching the graph - adjust so that the most parts have the smallest bars
  - If you need to measure the gray scale value, exit Retro-Spec and use Image Analysis
- 2) Choose whether to inspect for Light areas, Dark areas, or both. Select the correct button.

Next, adjust Tolerance (the blue line).

---

### *How to adjust Tolerance*

#### *To adjust tolerance:*

- 1) Using the data on the graph, click and drag the blue line up or down to change tolerance.
- 2) Click on one of the green, red, or gray bars on the graph to see its corresponding image. If you think a passing (green) part should have failed, adjust Tolerance towards zero until that bar turns red.
  - If you are searching for Light and Dark features, you have 2 blue lines on screen. By default, they move symmetrically towards or away from zero. To adjust separately, right-click over the graph >> choose Control Limits >> and choose Independent Limits.

***To save changes:***

- 1) Click Exit.
- 2) The system will ask whether you want to save your changes.
- 3) Click Yes. The system will exit the Retro-Spec inspection.

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# INDEX

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## C

CIRCULAR REGION FOR RETRO-SPEC • 3

## P

PRESSCO - HOW TO CONTACT • 38

## R

RETRO-SPEC CONTRAST INSPECTION • 18

RETRO-SPEC GRAPHS • 10, 12, 13, 14, 15, 25

RETRO-SPEC INTENSITY INSPECTION • 35

RETRO-SPEC MEASUREMENT  
INSPECTION • 24