Interference Checking +

This webtask will introduce two concepts: Interference Checking and Collision Detection. We'll learn how to check for interferences between components in an assembly, and also how to use the visual (and audible) Collision Detection tool to aid in creating a correctly designed product. We'll also use Visual Bookmarks and other helpful techniques to help us in repairing our design. The initial design of our motor is shown below. LET'S BEGIN!
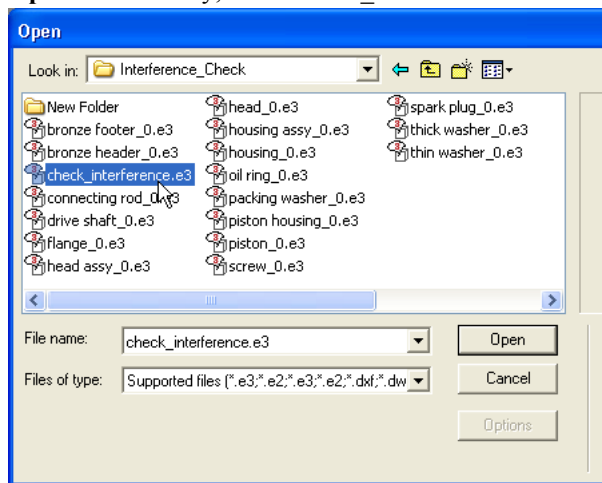
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1. Step 1: First Interference Check - Two Groups

In this step we'll open the assembly in ThinkDesign, hide a subassembly and get right into checking for interferences on the displayed components. Let's go!

**Open** the assembly, called check_interference.e3.

Right-click on the Housing_assy from the History Tree and click **Hide Entities** to remove it from sight.
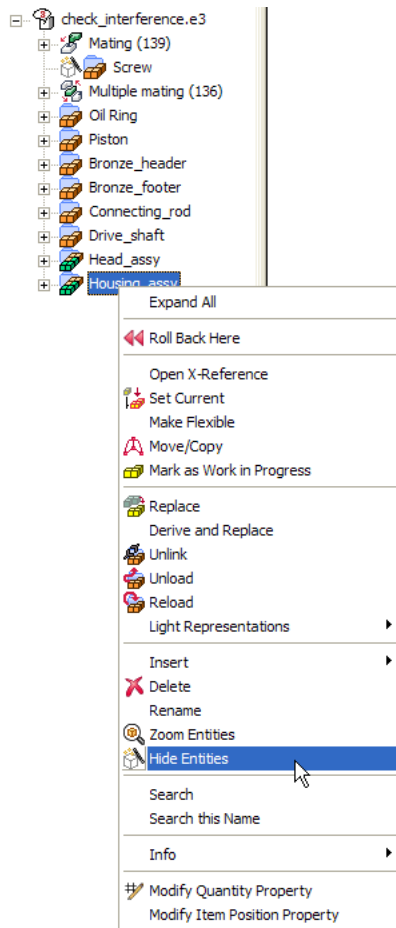
Now let's use the new **Tools✣Info✣Check Interferences** command in ThinkDesign to check for interferences between the components in this assembly.

- Click **Tools✣Info✣Check Interferences**, and notice what we're prompted for in the Selection List.

- Click on ⬤ Components/Solids (Group 1) and select the Head_assy from the Selection List. (This can also be selected with a window select.)

- Now let's choose items for Group 2. Click on ⬤ Components/Solids (Group 2) and select all of the components under the Head_assy with a window select in the Graphics Area.

- In the Selection List, make sure this mode is set:Check mode: Among groups (see image below).
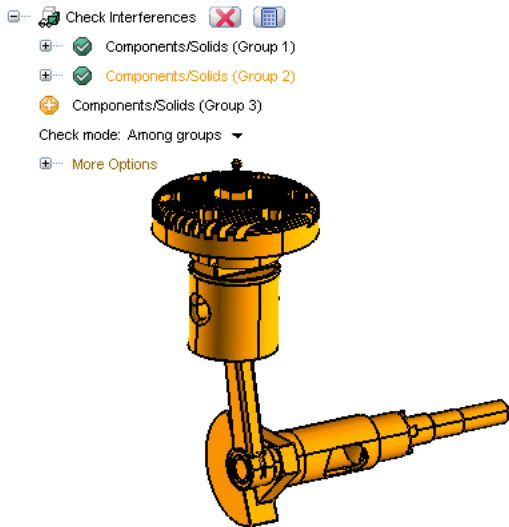
- Click calculator button in the Selection List to start the interference checking. Notice the result shown below:

There is no interference between the two groups we just selected.

- Now, change the mode in the Selection List to:Check mode: Inside groups. This will check within each of the selection groups for any interference.

- Click calculator button again to start the checking. Notice the results below:
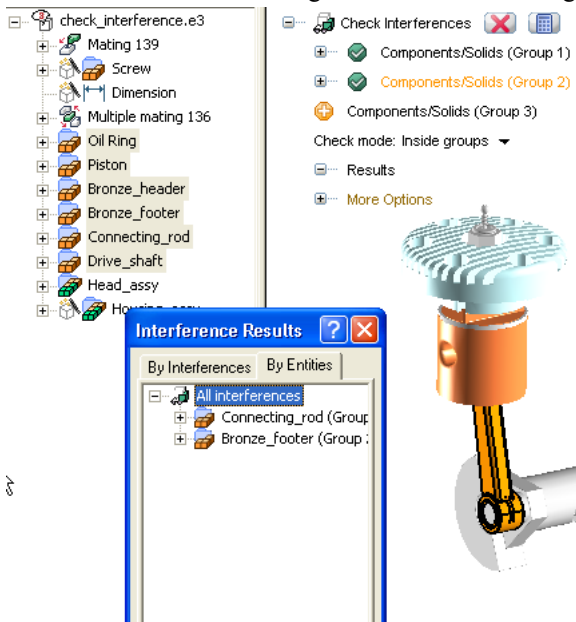
An interference was found in Group 2 between the Bronze_footer and the Connecting_rod. The Interference Results form displays the interference information, and the corresponding components are highlighted on the assembly.

❌ Cancel out of the Check Interferences command.

2. Step 2: Second Interference Check - One Group

In this step we'll look at using the **Select Filter** to help in the selection of components into one group for interference checking. Then we'll actually create a new solid from this interference volume.

- Start the **Tools⇨Info⇨Check Interferences**command.

- Before selecting anything, right-click to the **Select Filter** and turn ON the ☑ Component box, then close the Selection Filter form by clicking the X in the upper right corner.
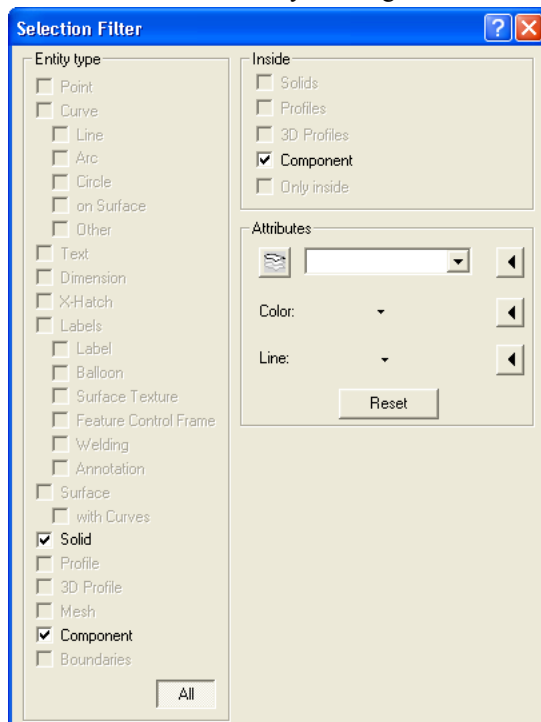

- Now, for ⊖ Components/Solids (Group 1) select the Spark_plug component from the Graphics Area.

- Also select the Head component. Remember these components are all in ⊖ Components/Solids (Group 1).

- Click calculator button to check for interferences between these two components. See the image below for results.
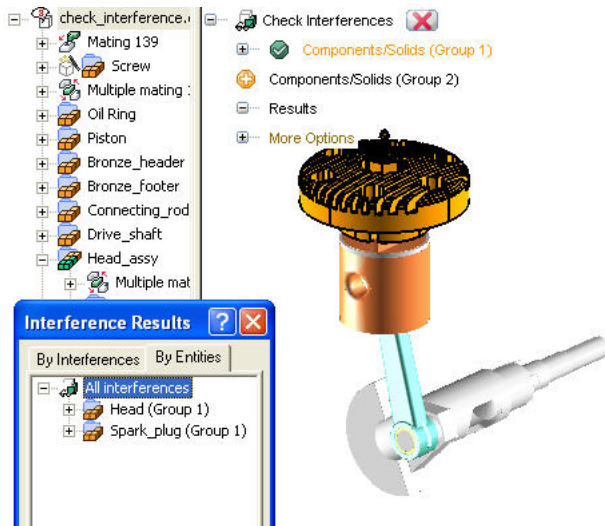
An interference does exist between these two components. Could you see this from a simple visual inspection?

• Click the Create Interference Solid(s) button from the Interference Results form.
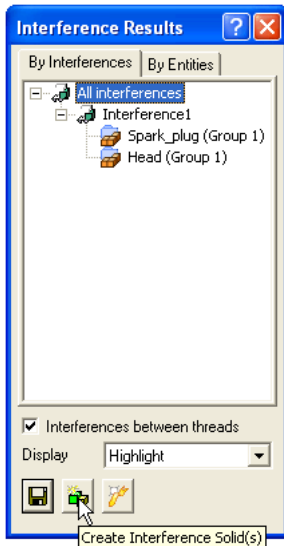
• Switch to Interferences mode and select Interference solid & fit as Display: try to rotate model, here you can see static solid made by interference

• Notice the new solid in the History Tree

Cancel to get out of the Check Interferences command.

Use the **Hide Entities** command to display just the Interference Solid.
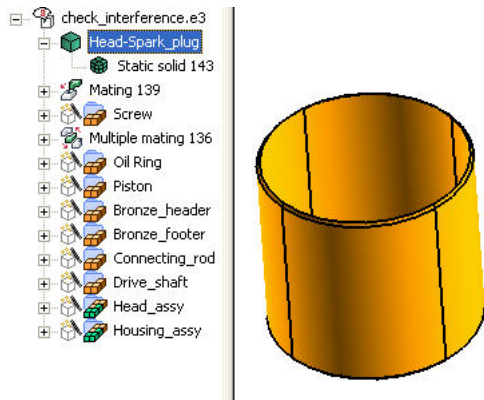
3. Step 3: Third Interference Check - Group Combination and Other Cool Stuff :-)

We'll continue checking for interferences in our assembly, using some selection techniques to create new groups, and also use some tools in the Interference Results form to help us in finding and visualizing the interferences.

Use the **Hide Entities** command to hide the interference solid created in the last step. Then use **Unhide Entities** to display everything else but the Housing_assy. We'll use the new **Tools☞Info☞Check Interferences**command again to examine the assembly.

- Click the **Tools☞Info☞Check Interferences**command.

- Right-click on 🔴 Components/Solids (Group 1) in the Selection List to Reset it if necessary.

- Before selecting anything, right-click on the **Select Filter** and turn ON the ☑ Component box. Close the form with the X button.

- For 🔴 Components/Solids (Group 1), select the Spark_plug component.

- Also for 🔴 Components/Solids (Group 1), select the Head component.

- Click on 🔴 Components/Solids (Group 2) in the Selection List, and select _everything_ on the screen with window drag-n-select. (Select everything!!)

- Make sure Check mode: Inside groups is set in the Selection List.

- Click calculator button to start the interference checking. See results below:
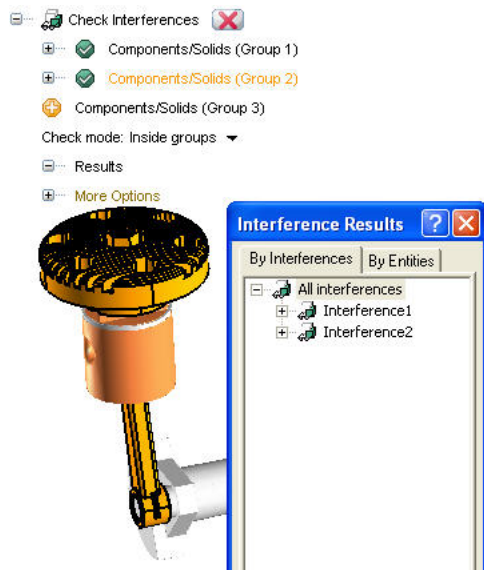
Two interferences were found - one in Group 1 and one in Group 2. They are both highlighted on the assembly.

- Display the interference results using the "By Interferences" tab in the form. Notice two interferences that were detected.

- With   All interferences selected, click the Create Visual Bookmark(s) button from the Interference Results form. Then click OK at the Visual Bookmark creation form. (We'll look at these next.) Two new Visual Bookmarks were just created!!
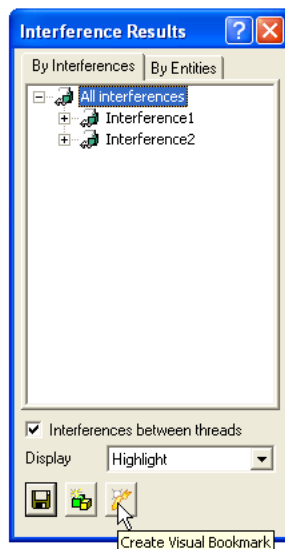

- Move to Interference1 and select Highlight & fit as Display: try to rotate and take a look about highlighted interference. Same switching to Interference2

- Click the Save Interference Results button from the Interference Results form and save these results as a .txt file. These results can be used later for reports, design reviews, etc.
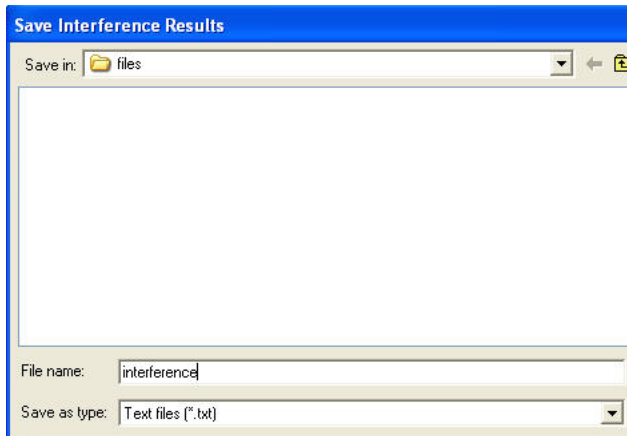
 Cancel out of the Check Interferences command.

Examining the Visual Bookmarks of the Interferences. Click the Visual Bookmarks tab and let's examine the Visual Bookmarks you've just created. Activate each Visual Bookmark to display the corresponding interference and the components involved in the interference.
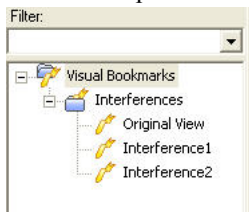

Activate the Original View Visual Bookmark to display the assembly again, and click on the Model Structure tab.

4. Step 4: Modifications and Re-checking

We need to fix the interference the Bronze_footer and the Connecting_rod that we just saw in the Visual Book-marks. In this step we'll modify a part within the context of the assembly in which it resides, update the part and then the assembly, and do another interference check to see if our modifications helped. Let's continue...

• Use the **Set Current Component** command -- right click the Connecting_rod in the History Tree and click Set Current. We need to modify it.

• Use **Unhide Entities** to display Profile 16 located below Through Slot 19 in the Connecting_rod 's History Tree (see image below).

• Double-click the radius dimension and change it from 3.7 to 3.8, then Rebuild the Connecting_rod.

• Use **Hide Entities** to hide Profile 16 when the rebuild of the part is complete.

• Make the assembly current again by double-clicking in the background, and then Rebuild it.
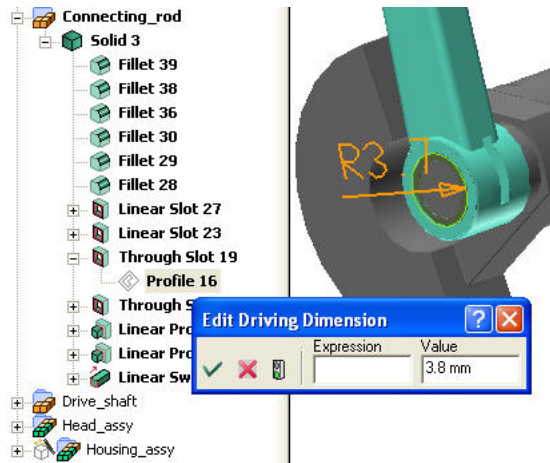
Now let's check the interferences again...

- Click the **Tools**↘**Info**↘**Check Interferences** command.

- For ⊙ Components/Solids (Group 1) select everything in the assembly except the Head_assy.

- Click calculator button, and check the results...

The interference is fixed! :-)

# 5. Step 5: Fourth Interference Check - Threads

This next step will demonstrate how the Check Interferences command can be selective about which components it reports interference. Calculating interferences on components with threads is a perfect example of when we would not want an interference to be detected.

- Use the **Hide Entities** command to hide the entire assembly, then use **Unhide Entities** to display the Screw component and the Housing_assy.

- Click the **Tools**↘**Info**↘**Check Interferences** command.

- Select the Screw for ⊙ Components/Solids (Group 1).

- Select the Housing_assy for ⊙ Components/Solids (Group 2).

- In the Selection List, make sure this mode is set:Check mode: Among groups.

- Click calculator button to calculate the interference results (see image below).
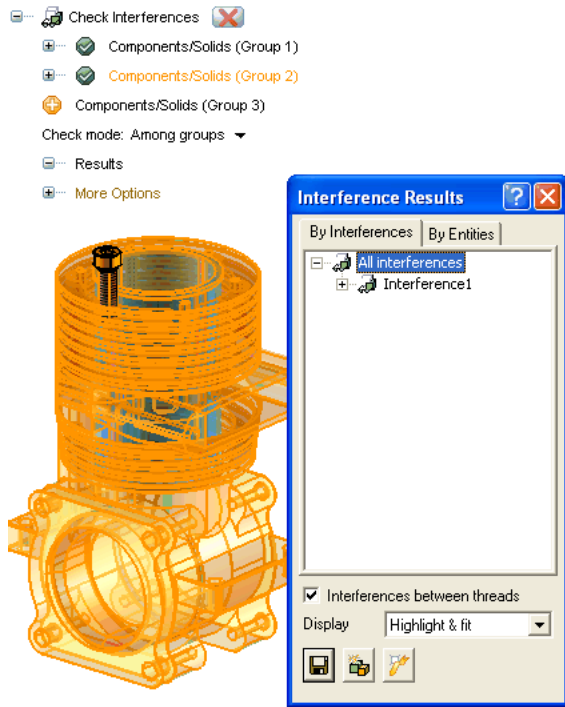
As expected, an interference is found between the two selected components.

- Click OFF the ☑ Interferences between threads box in the Interference Results form, and notice the new results (see image below).
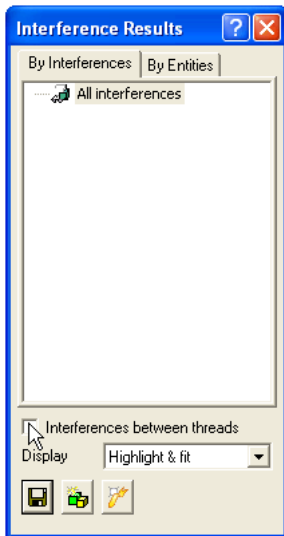
No interferences are found between the Screw's threads and the Housing component when the ☑ Interferences between threads box is checked OFF.

☒ Cancel out of the Check Interferences command.

To prepare for the final step, use **Hide Entities** and **Unhide Entities** to display everything but the Screw component, the Housing_assy and the Interference Solid.
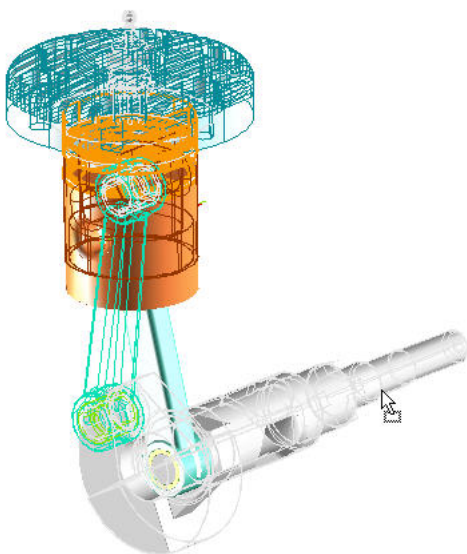
6. Step 6: Using Collision Detection

Another new functionality in ThinkDesign is Collision Detection. We'll use this capability in this step to give us visual feedback during the animation of the assembly. This visual feedback will then be used to modify some components in the assembly and update and finish the design.

The command for Collision Detection can be found in the **Tools ✇ Options/Properties** form ... in the Clipboard/ Drag & Drop tab. The "Collision detection mode" can be set to Highlight colliding faces or Stop on collision.
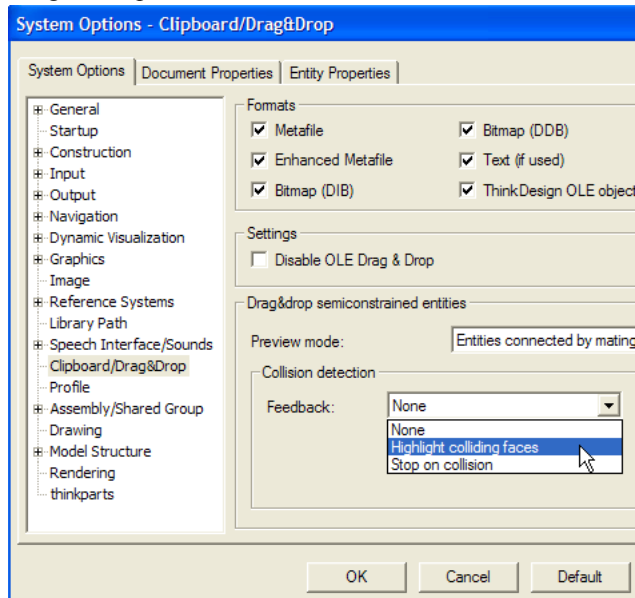
- Go to **Tools ✇ Options/Properties**... Clipboard/Drag & Drop and set Collision detection to Highlight colliding faces. Click OK when finished.

- Click and drag the Drive_shaft component so that the assembly animates. (This may take some trial and error -- be patient and select the Drive_shaft in the correct area!)

- Notice the interference -- by the orange highlighting faces -- between the Piston and the Head_assy (see image below).

Using "Stop at collision" option.

Use **Tools**↳**Options/Properties**... Clipboard/Drag & Drop and set Collision detection to Stop on collision. Now when the assembly is animated, it will stop at all collisions and an audible noise - not unlike the one heard when using the **Solid Mating** command - will be heard.

We need to change the length of the Connecting_rod to fix the interference.

- Use the **Set Current Component** command and Set Current the Connecting_rod.

- Click on **Tools**↳**Spreadsheet**to expose some dimensions of the Connecting_rod. Change the length (L) of the Connecting_rod from 45 to 38 mm (see image below).


- Click Update and OK from the Spreadsheet form and ⬛ Rebuild the Connecting_rod if necessary.

- Make the assembly current by double-clicking in the background, and ⬛ Rebuild it.

The interference between the Piston and the Head_assy is fixed, but now we have a new problem! When the Drive_shaft component is clicked-and-dragged so that the Piston is at its lowest point, notice the collision between it and the Drive_shaft -- see image below, which is displayed using the Highlight colliding faces option.
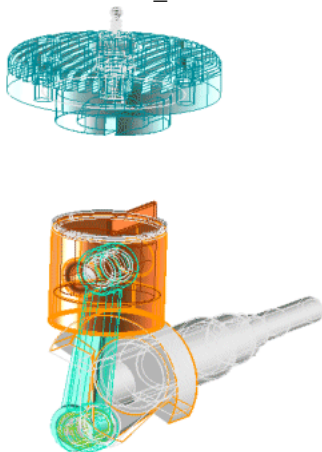

Let's fix this:

- Use the **Set Current Component** command -- right click the Piston in the History Tree and click Set Current.

- Use **Unhide Entities** to display Profile 53 under Through Slot 65 in the Piston's history tree.

- Create a **Linear Slot** on the Piston using Profile 53, in BOTH DIRECTIONS, using □┄ Extension Thru all. See image below.
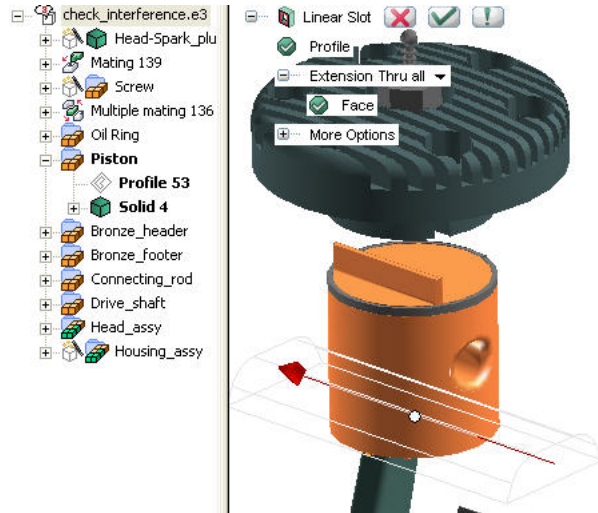
- Click ▣ Rebuild to update the Piston.

- Make the assembly current by double-clicking in the background, and ▣ Rebuild it.

Now when the assembly is animated by clicking-and-dragging the Drive_shaft, all components are free to move with no interference! The final image is shown below:
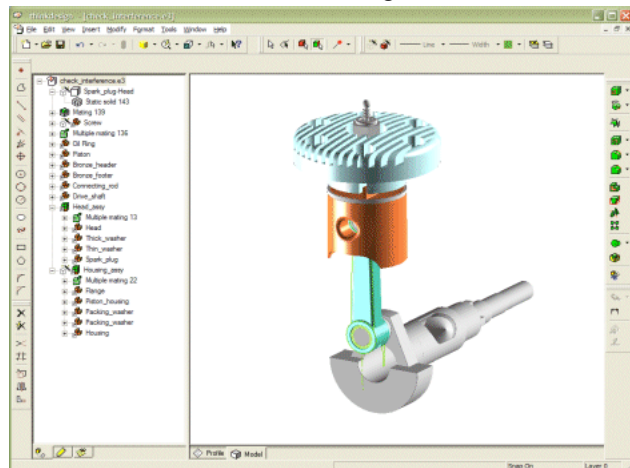
All finished! Here's what we've learned:

- Interference Checking with two groups

- Interference Checking with one group

- Interference Checking with a combination of groups

- Creation of Interference Solids, Visual Bookmarks and Interference Results files -- all from the Interference Results form

- Modification and updating of assembly components using Collision Detection techniques.

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