

# BG 4 Benching Trainer Instructor's Guide



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## **System Requirements**

To run the software effectively, your computer should meet the following system requirements:

- Administrative rights to install the software
- Windows® 7 or Windows® 8 operating system
- Dual core processor or equivalent
- At least 4 GB of RAM
- A nonintegrated graphics card
- 500 MB of free disc space
- DirectX® Version 9.0 or higher
- Sound card and speakers

# BG 4 Benching Trainer Instructor’s Guide

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# BG 4 Benching Trainer Instructor's Guide

## Overview

The BG 4 Benching Trainer software provides a virtual environment for mine rescue team benchmen to practice benching—the process of visually inspecting and testing a Draeger BG 4 closed-circuit breathing apparatus. The BG 4 Benching Trainer software, which complements current BG 4 training regimens, has several modes of operation that are accessed through the Main Menu:

**Tutorial.** This mode serves as an introduction to the BG 4 and teaches trainees how to use the benching trainer software through step-by-step instructions.

**Intro to BG 4.** This mode helps trainees to learn how to bench a BG 4 without any prompting, and like the Tutorial, serves as an introduction to the BG 4.

**Quick Bench.** This mode, for more experienced trainees, introduces random flaws into the various BG 4 components for trainees to find while they practice benching.

**Scenarios.** This mode allows trainers to create custom bench training scenarios by introducing flaws into the parts of the BG 4.

This Instructor's Guide provides information to set up and conduct a training class using the BG 4 software. Instructors and trainees may also refer to the Help File located within the software for detailed information on how to use the BG 4 Benching Trainer.



This document is for BG 4 Benching Trainer software *instructors only*. It contains descriptions of the flaws that are possible to introduce into the BG 4 apparatus during training.

## Requirements for Instructors

Instructors using this software in a classroom setting should have experience teaching benching with a Draeger BG 4 closed-circuit breathing apparatus. Instructors should have basic computer skills (including knowing how to connect the computer to a video projector, if necessary), have experience operating the BG 4 Benching Trainer software, and be able to answer trainee questions related to the BG 4 benching process.

## Setting Up Computers for Training

Ideally, each trainee should run the BG 4 Benching Trainer software on his or her own PC or laptop. However, you can have two or three trainees pair up to work together on a single PC or laptop so that they can help each other while benching the apparatus.

Alternatively, in a group setting, you can use a video projector to display the screen from a single computer for viewing by multiple trainees. This approach is especially useful for introducing the BG 4 to trainees who have never used the apparatus.

If you choose to conduct the training in a larger group using a video projector, it is helpful to select a trainee to run the BG 4 Benching Trainer software on a computer who has prior experience playing video games because the controls in the software are similar to those used in games.

### Installing the Software

Before your training class begins, install the software on your training computers. NIOSH distributes the BG 4 Bench Training software as a single ZIP file. Once you copy or download the file to your computer(s), extract it to your PC hard drive. To install the software, open the folder where you extracted the installation software and run **setup.exe**. Follow the instructions in the setup wizard.



## Options Menu

Use the Options menu to adjust the settings on the computer(s) that will be used by the trainees. When you select the **Options** feature on the BG 4 Benching Trainer Main Menu, the **Options** menu appears (see Figure 1) with a number of adjustable settings:

**Volume.** Move the blue circle slider to the right or left to adjust the volume up or down.

**Graphics Quality.** Click the box to display a drop-down menu to adjust the video display. You can select one of four graphics quality settings. The quality of the graphics card in the PC determines the selections available. Depending on the type of computer hardware you are running, changing the graphics quality can significantly alter the performance of the software.

**Player Name.** Identifies the current trainee. The Player Name appears on the score sheet at the end of the training session.

**Rotation Sensitivity.** Move the blue circle slider to the right or left to fine-tune the rotation speed of a BG 4 part that the trainee is inspecting.

**Default Settings.** Click this button to restore the BG 4 Benching Trainer settings to their default state.

When you have finished making changes to the Options settings, click the **OK** button to accept your changes.

### Changing the Player Name in the Options Menu

When you launch the BG 4 Benching Trainer, the Main Menu displays the Player Name. By default, the player name is the name of your computer. Before starting a training session, you should have each trainee customize the Player Name:

1. Instruct trainees to click **Options** from the Main Menu to open the Options menu.
2. Have trainees type their name in the Player Name text field provided. Clicking the dice icon generates a random name (“Benchman” plus a 4-digit number), which may not be ideal for an instructor-led session.
3. Click the **OK** button. The trainee’s name appears on the Main Menu.

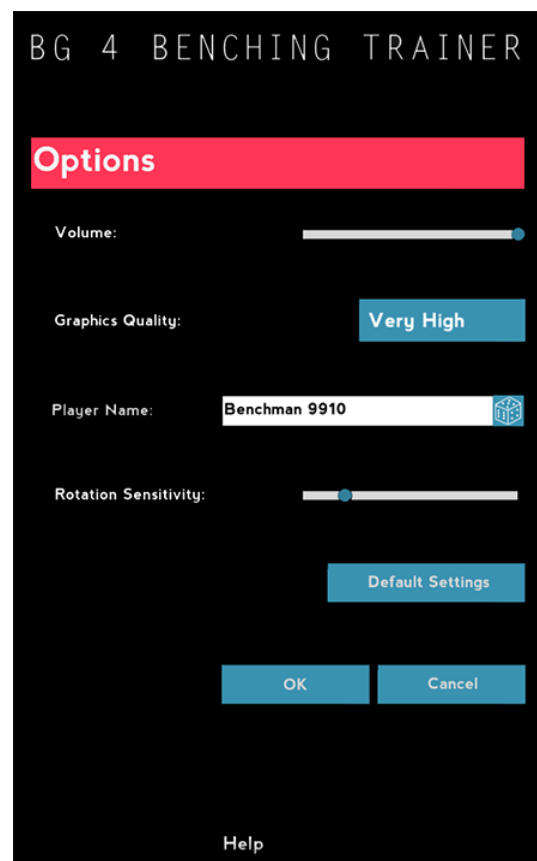


Figure 1. The Options menu.

## Training Modes

The Main Menu includes three modes for practicing benching. You should have the trainees run the Tutorial and Intro to BG 4 modes on their own to familiarize themselves with both the BG 4 software and the parts of the BG 4 apparatus.

### Tutorial Mode

The **Tutorial** mode is a step-by-step guide for using the tools in the software to learn how to bench a BG 4. All trainees who are new to benching the BG 4 and who have never used the BG 4 Benching Trainer software should complete the Tutorial. The Tutorial covers all aspects of using the software, but it does not allow trainees to inspect all the parts of the BG 4. Instead, it uses one part as an example. Allow approximately 20 minutes for trainees to progress through the Tutorial.

Note: The Tutorial does not explain how to conduct the tests with the RZ-tester, but it will show you the tools that you will use to operate the RZ-tester within the software. You can find information related to the tests in the manual “Dräger BG 4 AP/CP Closed-circuit Breathing Apparatus: Instructions for Use,” which is included with a purchased Draeger BG 4 unit.

### Intro to BG 4 Mode

The **Intro to BG 4** mode allows you to practice benching a BG 4 that has no flaws in any of the parts. It is similar to the Tutorial except that it does not have the dialog windows with step-by-step instructions, and you are able to inspect, install, and test all of the parts instead of just one part. At the end of the session, the software calculates a score based on your ability to inspect and install parts, and on the testing of the BG 4 assembly. The software then automatically displays a score sheet showing the results from the trainee’s benching practice on the Benching Complete page.

After running the Tutorial and Intro to BG 4 modes, the trainees should be ready to run the Quick Bench mode or to go through a custom scenario created by the instructor through the Scenarios option.

### Quick Bench Mode

In the Quick Bench mode, the software introduces random flaws in arbitrarily selected BG 4 parts. Trainees inspect all the parts on the table for flaws and can swap a part when a flaw is found. At the end of the session, the software displays a score sheet showing the results from the trainee’s benching session.

## Scenarios Option

The Scenarios option on the BG 4 Benching Trainer Main Menu allows instructors to set up a custom scenario for trainees. While setting up a scenario, you (as a trainer) must select the flaws you want to introduce to the various parts of the BG 4, decide whether the timer should be active, select whether the session should start with the BG 4 already assembled, and if the checklist should be hidden. You may also import previously created scenarios or export scenarios that you created.



It is important to instruct the trainees to not select the Scenarios option so that they do not gain prior knowledge of the instructor-selected flaws in the BG 4 parts.

### Create a Scenario

1. Click **Scenarios** on the Main Menu. The Scenarios screen appears (see Figure 2).
2. Click the **New** button. A Scenario Editor Warning dialog box appears. Click the **Yes** button to proceed. The Scenarios screen displays all of the parts of the BG 4.
3. In the Scenario Name field, enter a new scenario name. This name can be anything you want that reflects the training class you are setting up (such as date and time). For this example, we will name the new scenario “Test Scenario.”
4. Select the flaws that you want for each BG 4 part from the drop-down menus next to each part name (see Figure 3). If you prefer to have the software automatically select flaws for the BG 4 parts, click the **Random** button to create random flaws for random parts.

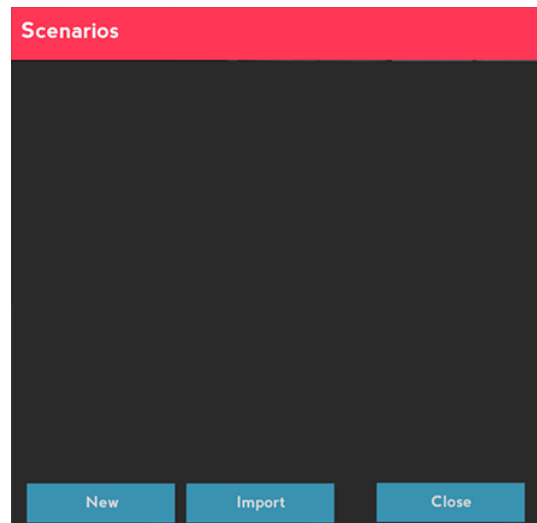


Figure 2. The empty Scenarios screen as it appears when selected from the Main Menu for the first time.

### Other Scenario Options:

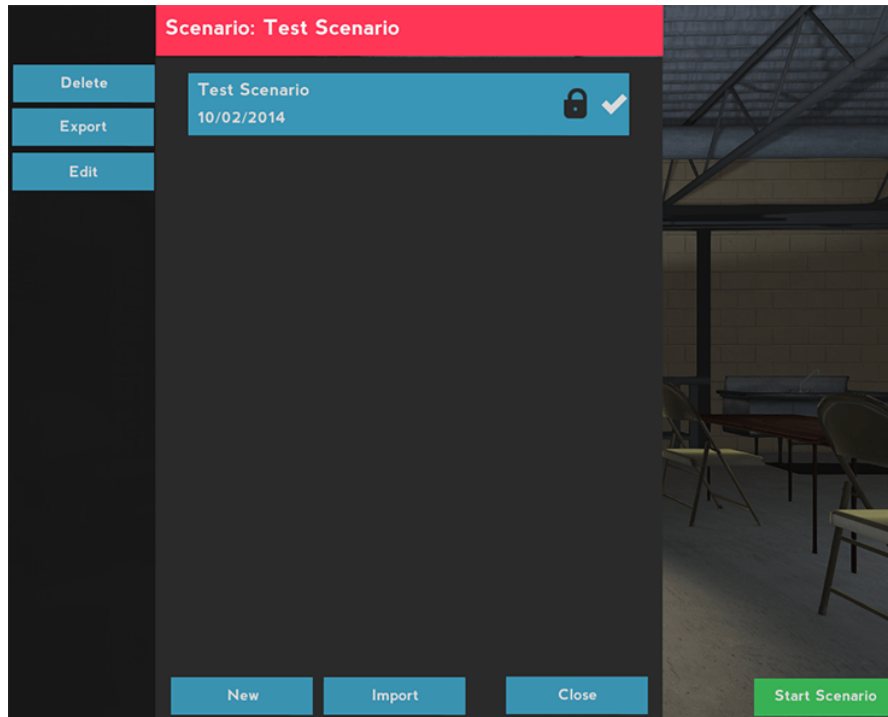
- **Timed Benching.** Deselect this option if you do not want the timer on the session. When this option is selected, the trainee’s benching session will be timed, with the amount of time to complete the session displayed in the Time to Complete field on the score sheet.
- **BG 4 Starts Assembled.** Select this option if you want all the parts automatically installed into the BG 4 when the Scenario starts, including flawed parts.

- **Password Protected.** You can select this option if you want to assign a password to your scenario. Click the white box and the “Enter password here” field will appear. Type your password in the blank text box. Password protection is useful when you do not want trainees to view or edit an existing scenario.
- **Hide Checklist.** Selecting this option hides the checklist that appears when you select a part for inspection. This is useful for more experienced trainees.



**Figure 3. The Scenario Editor screen showing BG 4 parts.**

5. When you are satisfied with your selections, click the **Save** button to save your scenario. The newly created scenario now appears on the Scenarios Editor screen (Figure 4). If your password protects the scenario, a lock icon appears to the right of the scenario name.



**Figure 4. A newly created scenario with password protection, as indicated by the lock icon. On the left and bottom of the screen are options for performing specific scenario-related tasks.**

### Open a Saved Scenario

1. Select the scenario that you want to open from the Scenarios list. The selected scenario will have a check mark to the right of its name.
2. Click the **Start Scenario** button. The benching table appears where you can inspect and install each part.

### Edit a Saved Scenario

1. Select the scenario you want to edit from the Scenarios list. The selected scenario will have a check mark to the right of its name.
2. Click the **Edit** button. The Scenario Editor Warning dialog box will open; click **Yes** to proceed. The selected scenario will open. If the scenario is password protected, enter the password.
3. Make your changes to the scenario. If you want the scenario to be password protected, enter a password in the blank text box to the right of the Password Protected field.
4. When you are satisfied with your changes, click the **Save** button. Click **Yes** on the overwrite confirmation dialog box.

## Delete a Scenario

1. Select the scenario you want to delete from the Scenarios list. The selected scenario will have a check mark to the right of its name.
2. Click the **Delete** button. Click **Yes** on the delete confirmation dialog box.

## Export a Scenario

Exporting a scenario is useful if you wish to use the same scenario on different computers. Exporting and then importing a scenario saves you from having to create the scenario manually on each computer. You can use a portable USB plugged into your computer or network drive to export the scenario and then import the scenario onto other computers running the BG 4 Benching Trainer.

1. Select the scenario you want to export from the Scenarios list. The selected scenario will have a check mark to the right of its name.
2. Click the **Export** button. The Export dialog box appears telling you the export location on your computer. By default, the export location is the **Documents\BG4\ImportedSaves** folder. A default file name will be displayed in the File name text box. If you wish, you can rename the file by backspacing over the default name and typing another name.
3. Click **OK** to confirm.
4. Navigate to the **Documents\BG4\ImportedSaves** folder on your computer. You will see a file with the same name as the Scenario you named and exported. The extension of the file is **.xml**.
5. Copy that file to a portable USB plugged into your computer or to a network drive.
6. The file is now ready to be imported onto another computer.

## Import a Scenario

1. For the computer onto which you want to import the scenario, first make sure that the BG 4 Benching Trainer is running with the Main Menu open.
2. Copy the scenario file from the portable USB or network drive where you saved it into the **Documents\BG4\ImportedSaves** folder of the other computer(s) into which you are importing the scenario.
3. Select **Scenarios** from the Main Menu.
4. Click the **Import** button. A dialog box will appear asking you to select a file to import. Click the down arrow to display a drop-down list of files and select the file you want to import.
5. Click the **OK** button. The scenario will now appear in the Scenarios list.

## Score Sheets

When the trainee clicks the **Finish** button, regardless of the training mode, a dialog box appears asking if they would like to complete the exercise. Click the **Yes** button to display the score sheet (see Figure 5) with a tally of the trainee's overall score. Use the scroll bar on the score sheet to view information about the score. Listed below are the scoring calculations used to calculate a score:

- Successfully install an unflawed part: +10 points
- Successfully complete an RZ Test: +10 points
- Forget to install a part: -5 points
- Finish benching with a flawed part: -5 points
- Swap out a good part: -5 points
- Failure to complete an RZ Test: -5 points

Below the trainee's scores, several logs are shown with details about the exercise:

- The Installation Log displays the time it took for the trainee to install, remove, or swap each part, along with the points associated with the action.
- The RZ Test Log details the amount of time it took to complete a test with the RZ Tester, the name of the test, and whether the test completed successfully or failed.
- The General Log lists the flawed parts in the session. To view the General Log, scroll down to the bottom of the score sheet.

## Saving Score Sheets

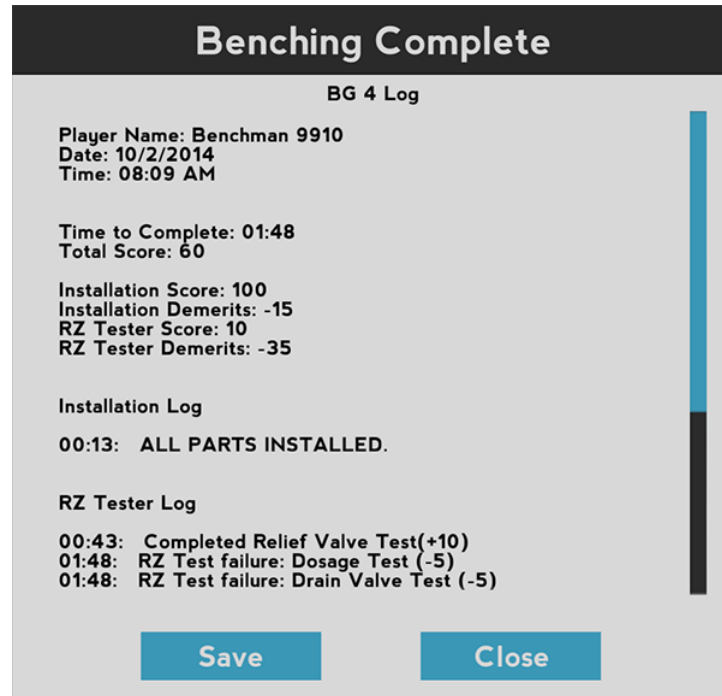
Instructors can save the score sheets of trainees as a record and for ongoing evaluation of the trainees' performance in benching the BG 4.

To save a score sheet:

1. Click the **Save** button on the Benching Complete screen. The Save Score Sheet dialog box appears with a default file name consisting of the Player Name and the current date.
2. Click the **OK** button to save the score sheet with the default name, or click on the file name to edit it before you click the **OK** button.

To access a saved score sheet:

1. Navigate to the **Documents\BG4\ScoreSheets** folder on your computer. Saved score sheet files have an **.html** extension.
2. Double-click a score sheet file to open it in your default browser, where you can view or print it.



**Figure 5. Example of a score sheet displayed on the Benching Complete screen. Note: The user may have to use the scroll bar on the right to view the General Log.**

## Post-Training Debriefing and Discussion

Post-training discussion following training is important for reinforcing the learning of key concepts. After trainees complete the training modes in the BG 4 Benching Trainer, you should allow time for discussion and a post-training debriefing with the trainees. Trainers should solicit feedback from trainees during the discussion session, and help the trainees to relate the just-completed training to situations and circumstances they may encounter during benching of a live apparatus. Following are some general discussion points/questions to discuss with trainees:

- For trainees who are veterans of benching a BG 4 apparatus, how does the virtual training compare with actual hands-on training?
- Did the virtual training module help improve the trainee's understanding of the benching process?



- For new mine rescue team members, did the virtual training help them learn about the BG 4, its components, and how the parts function?

For each exercise the trainee completes, use the score sheet generated for the training session to provide additional discussion points to review with the trainee. Display the score sheet on the computer screen and discuss the trainee's performance with them. Using the score sheet, the trainer can show the trainee their Total Score, Installation Score, and RZ Tester Score, and where they lost points.

Trainers should discuss the following elements with trainees:

- Trainee's scores and point deductions in all areas
- Amount of time to complete a specific training mode, including component installation time and RZ tester time
- Areas where trainees performed very well in the virtual BG 4 benching
- Areas where the trainee had difficulty and needs to improve their proficiency
- Any observations the trainer made while the trainee was benching the virtual BG 4

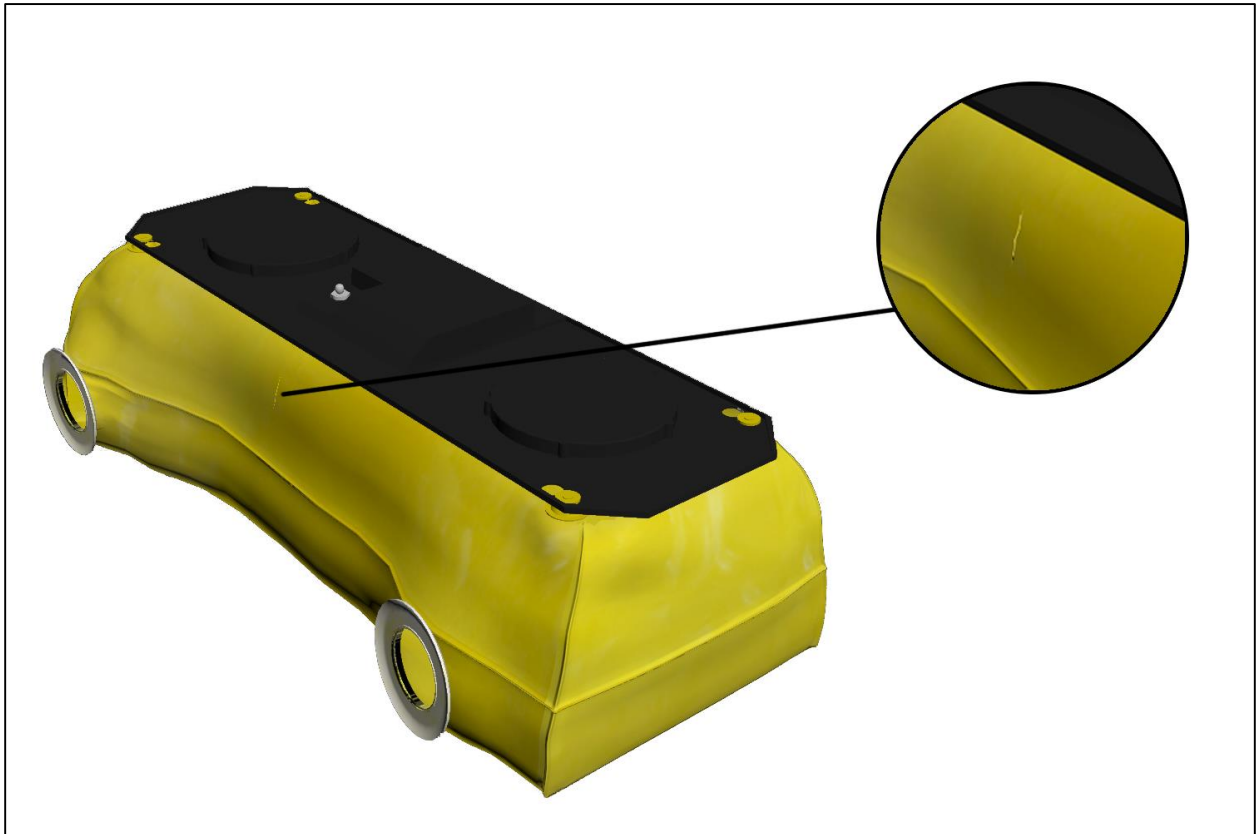
If possible, the trainer should observe each trainee working through the BG 4 Benching Trainer software and note how the trainee performs during the session. Trainers can use their observations to enhance the post-training discussion and debriefing.

## Appendix A - Index of Flaws

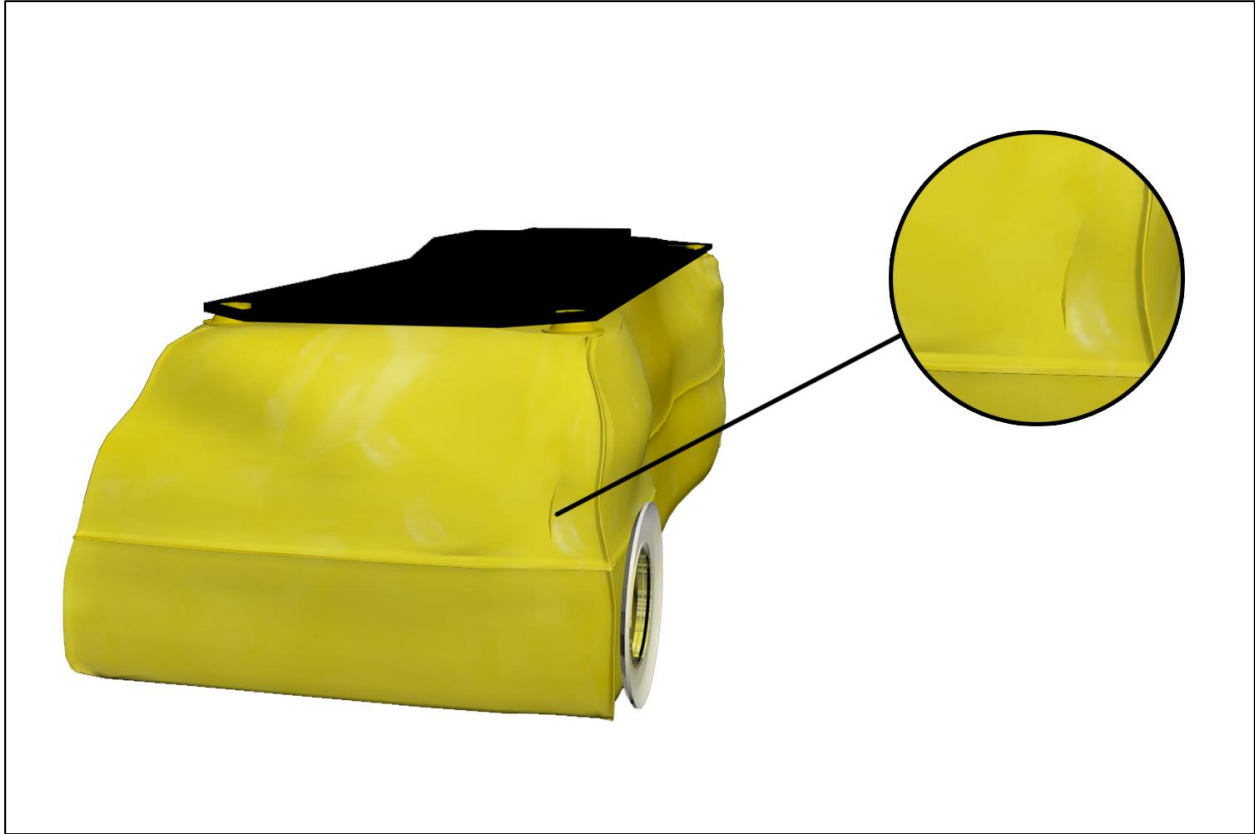
These images illustrate possible parts flaws within the BG 4 Benching Trainer. Many of the flaws are only visible in exploded view.



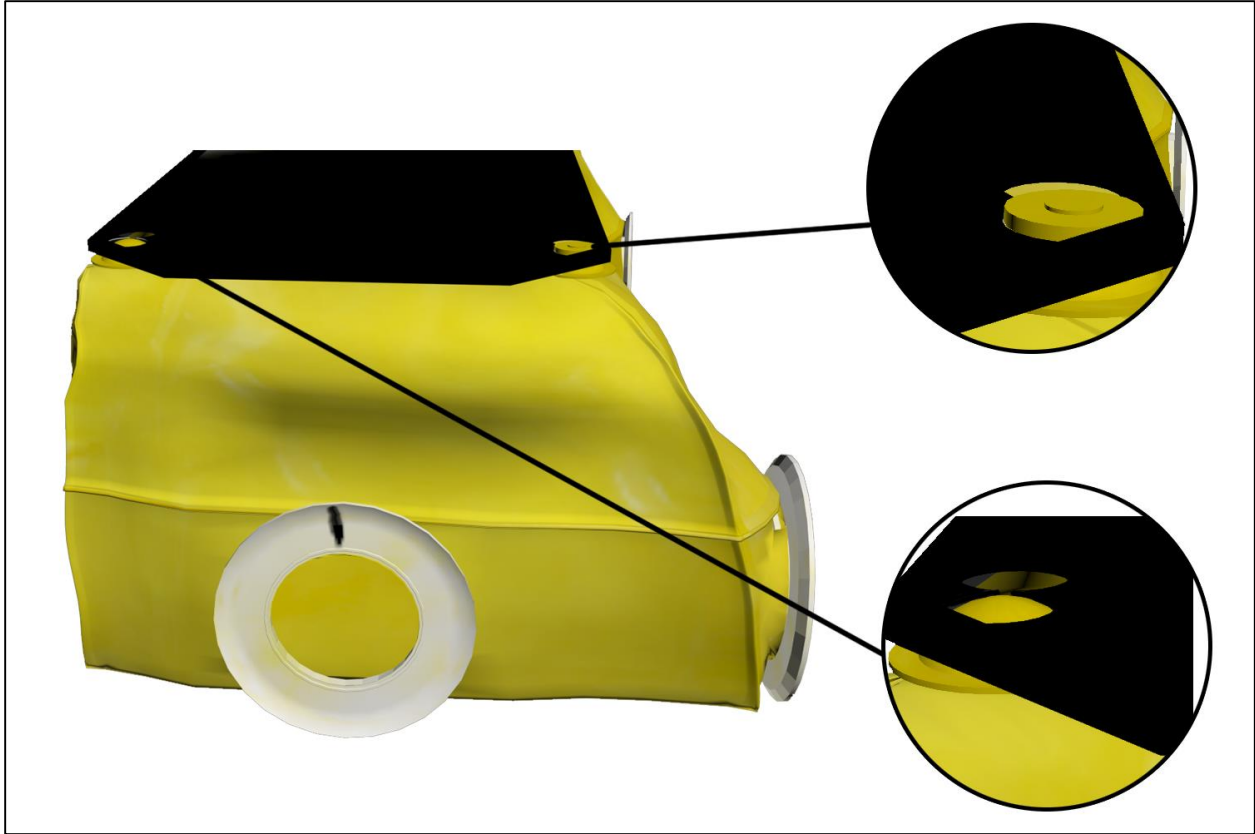
This appendix is for BG 4 Benching Trainer *instructors only*. It contains descriptions of the flaws that are possible to introduce into the BG 4 apparatus during training.



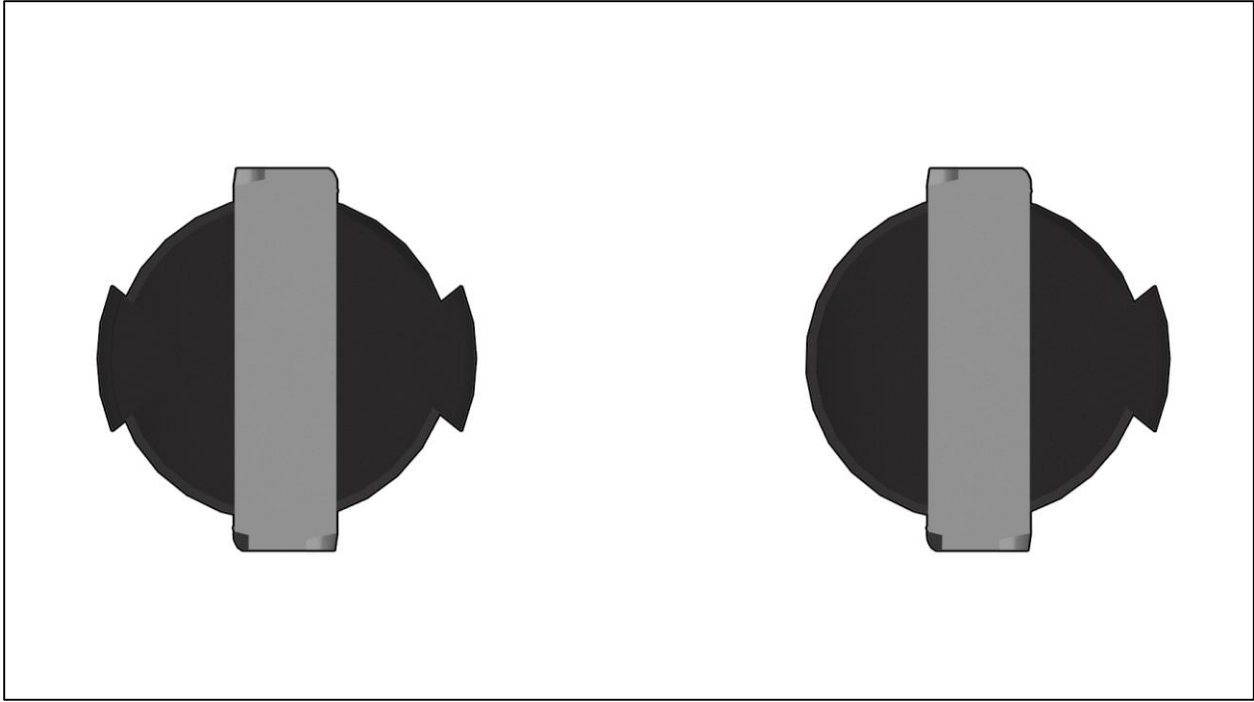
**Figure 6. Tear on the back-side of the breathing bag. A close-up on the right shows the tear.**



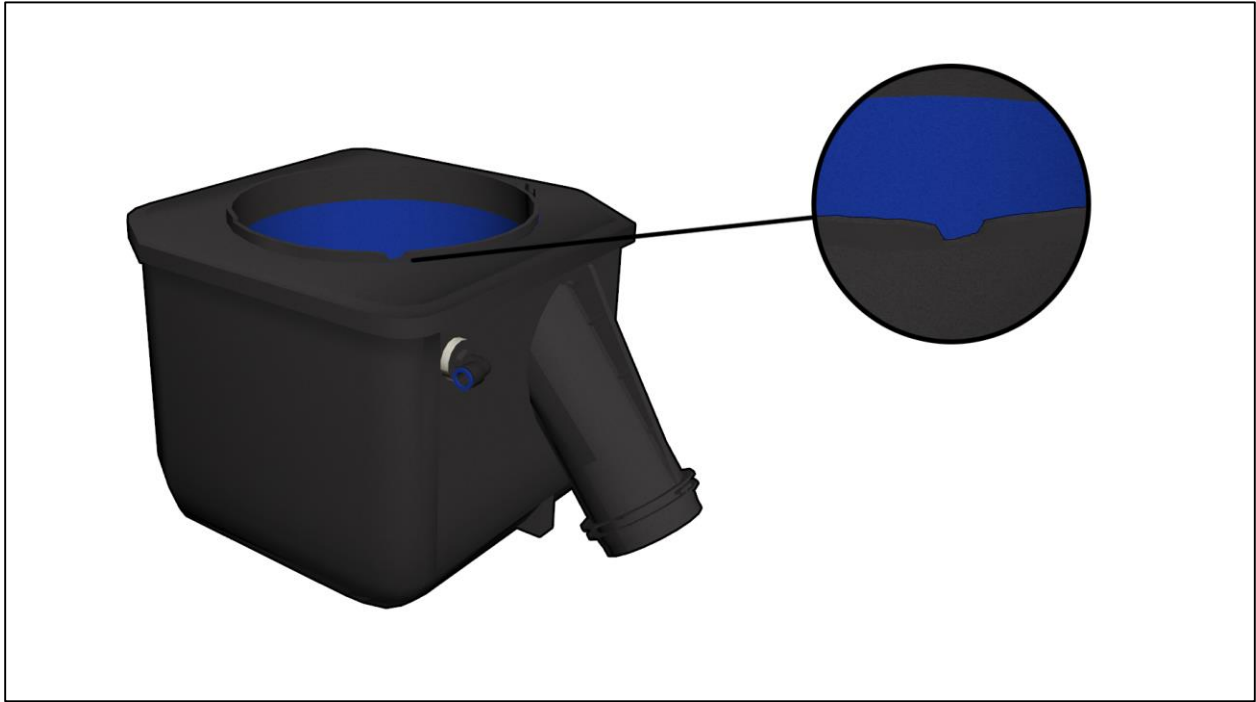
**Figure 7. A tear on the left-side of the breathing bag. A close-up on the right shows the tear.**



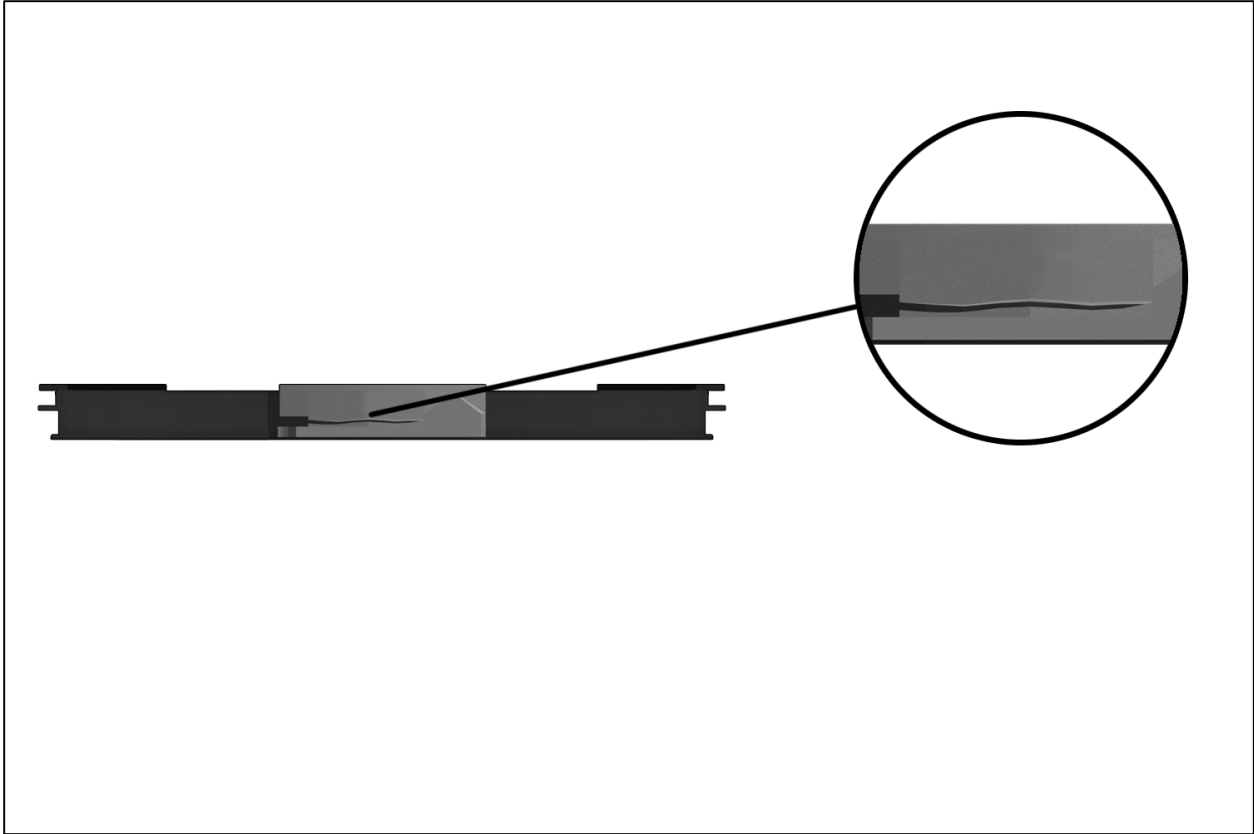
**Figure 8. A missing peg on the breathing bag as shown in the close-up on the bottom right. The close-up on the top right shows a peg present on the breathing bag.**



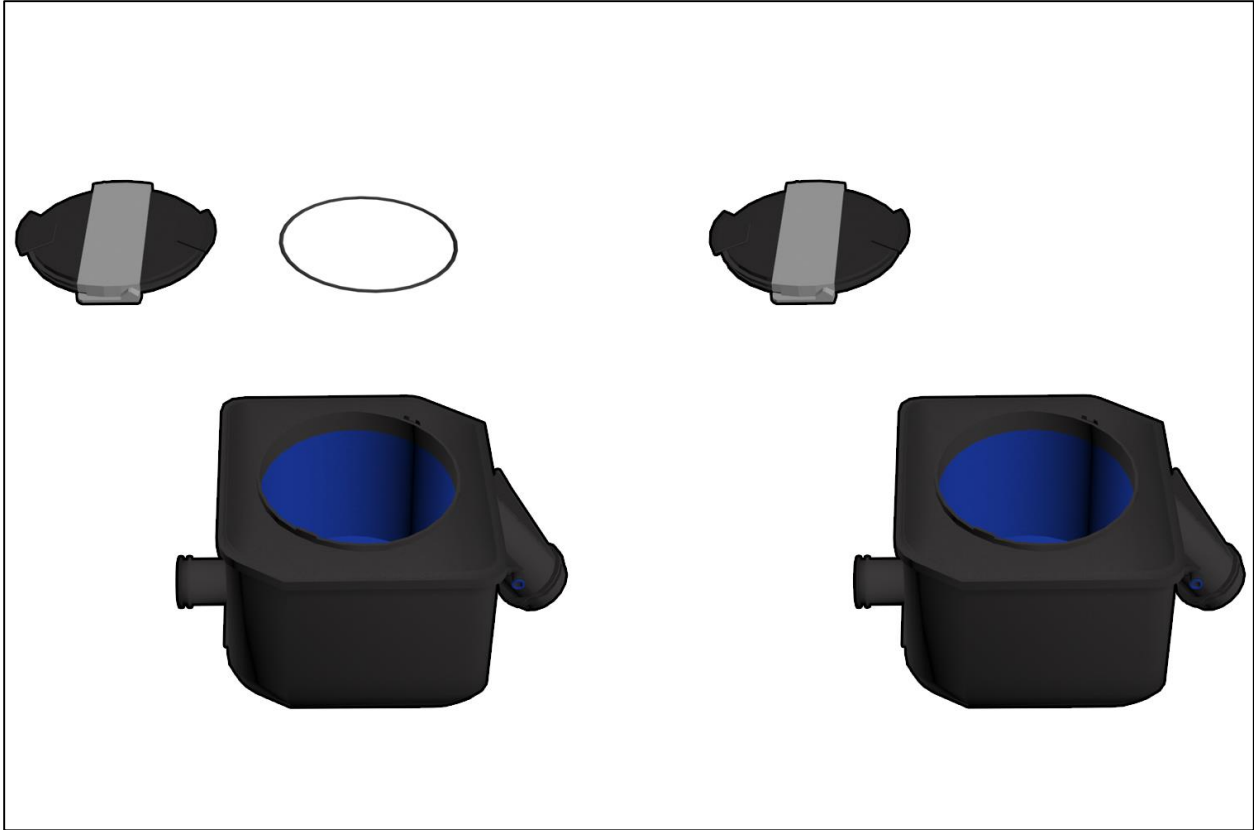
**Figure 9. A broken locking tab on the air cooler as shown on the right. The nonflawed version is shown on the left.**



**Figure 10. A broken seal on the air cooler onto which the lid fits, with the flaw also shown in the close-up.**

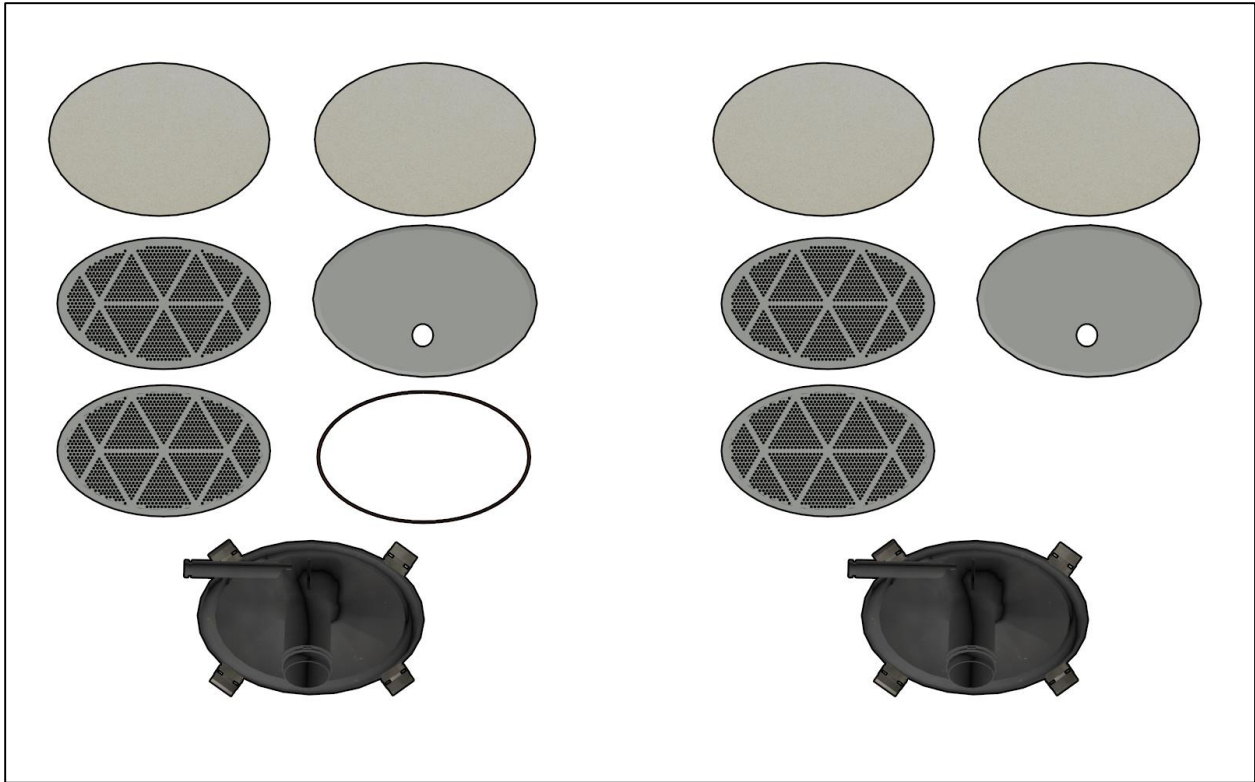


**Figure 11. A cracked lid on the air cooler. A close-up on the right shows the crack on the air cooler lid.**

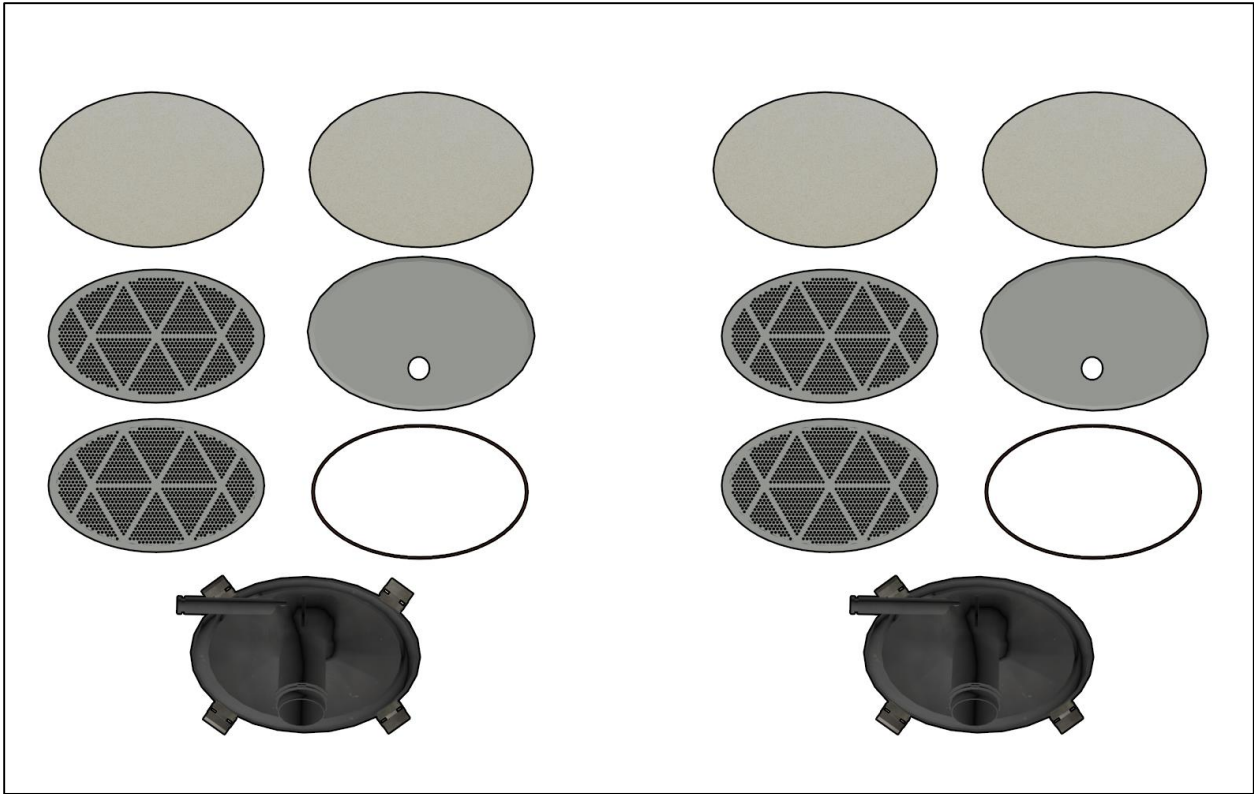


**Figure 12. A missing O-ring from the air cooler on the right. The air cooler on the left shows a nonflawed version.**

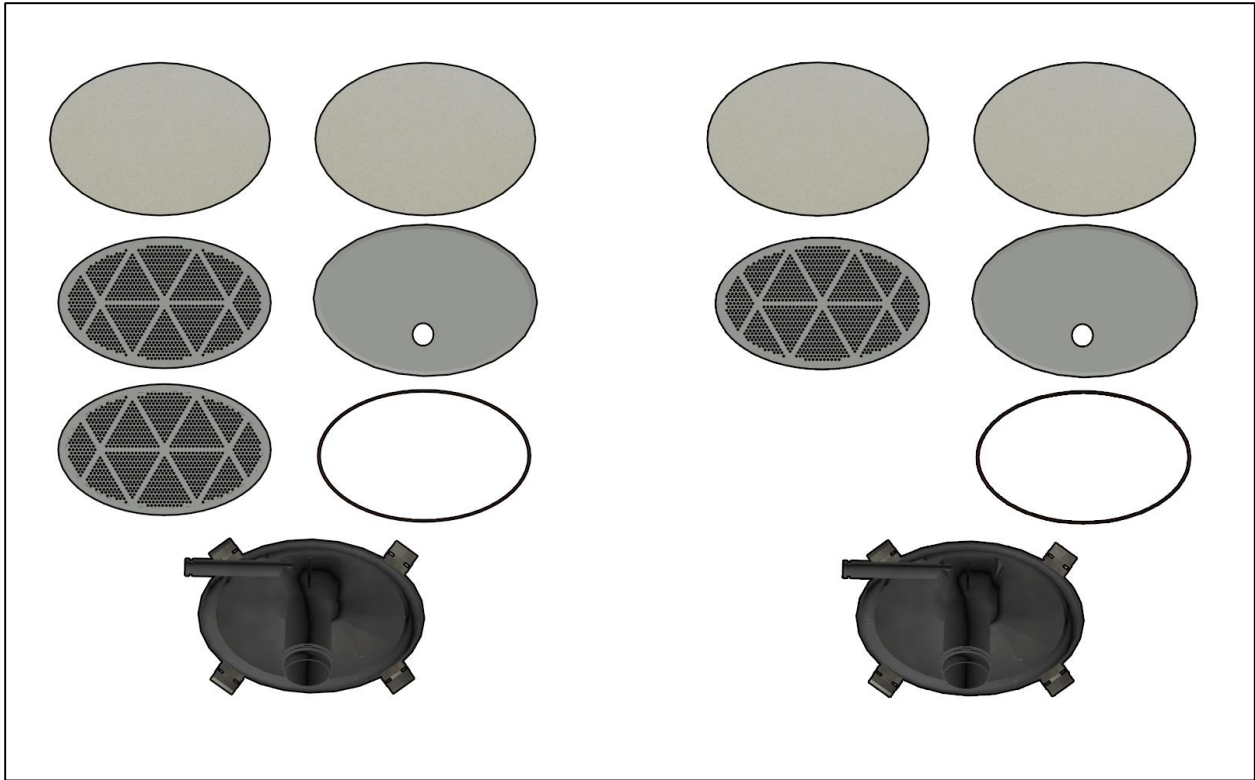




**Figure 13. An O-ring is missing from the CO<sub>2</sub> absorber parts shown on the right. The nonflawed CO<sub>2</sub> absorber is shown on the left**



**Figure 14. A latch is missing from the CO2 absorber shown on the bottom right. The nonflawed CO2 absorber is shown on the left.**



**Figure 15. A mesh filter is missing from the CO2 Absorber shown on the right. The nonflawed CO2 absorber is shown on the left.**

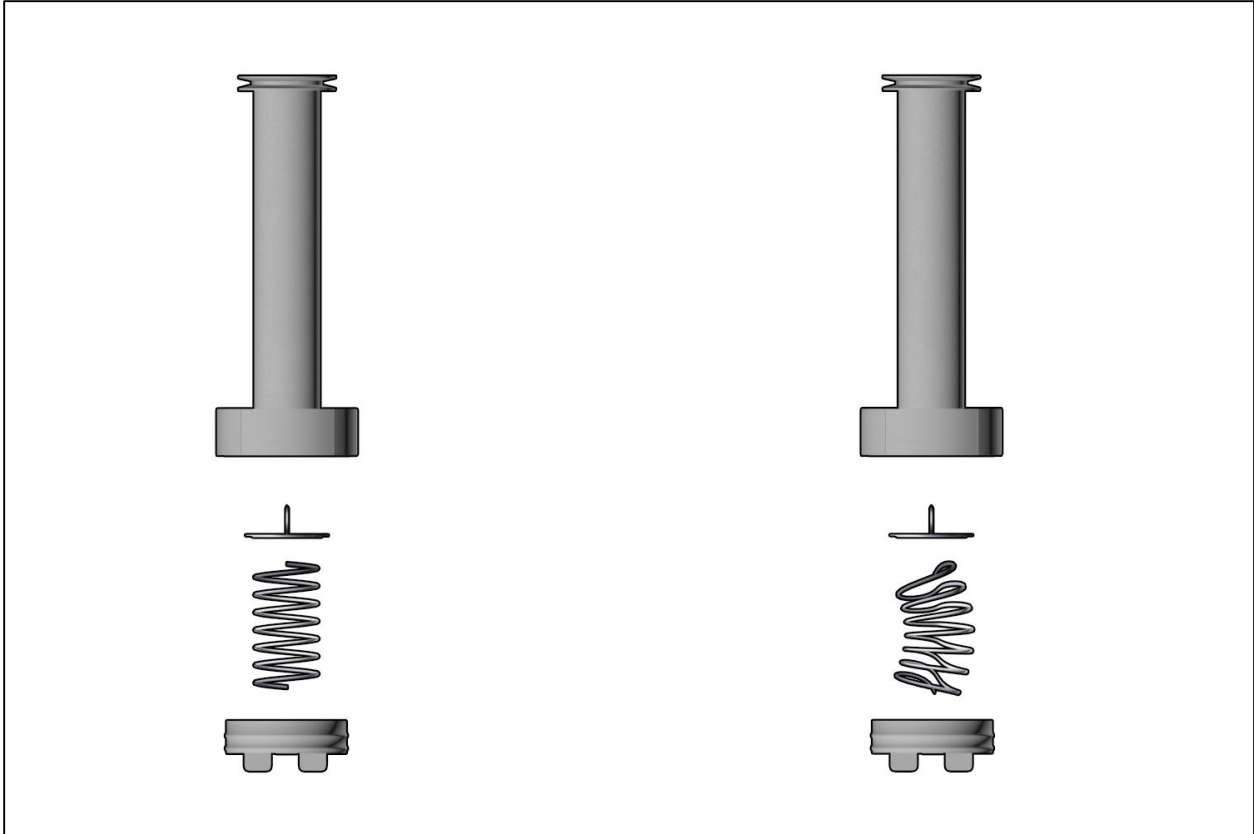
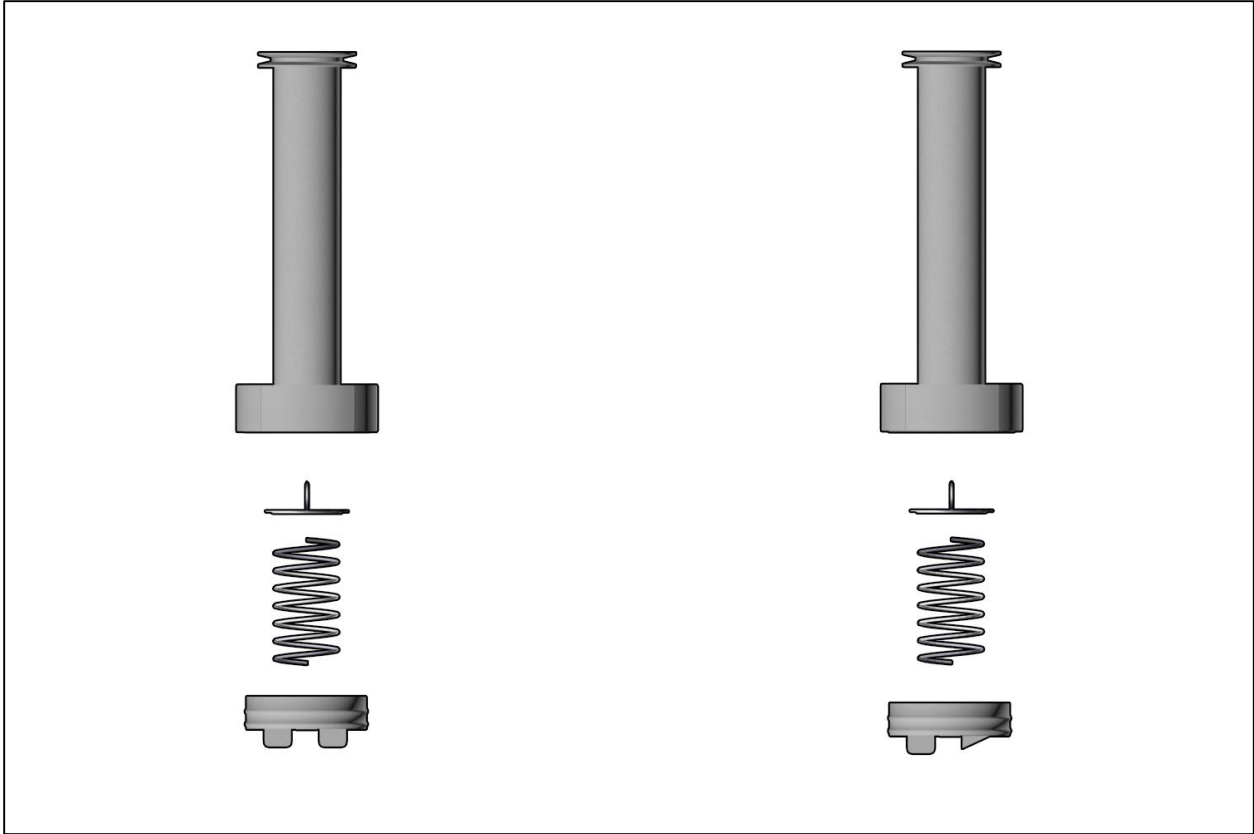
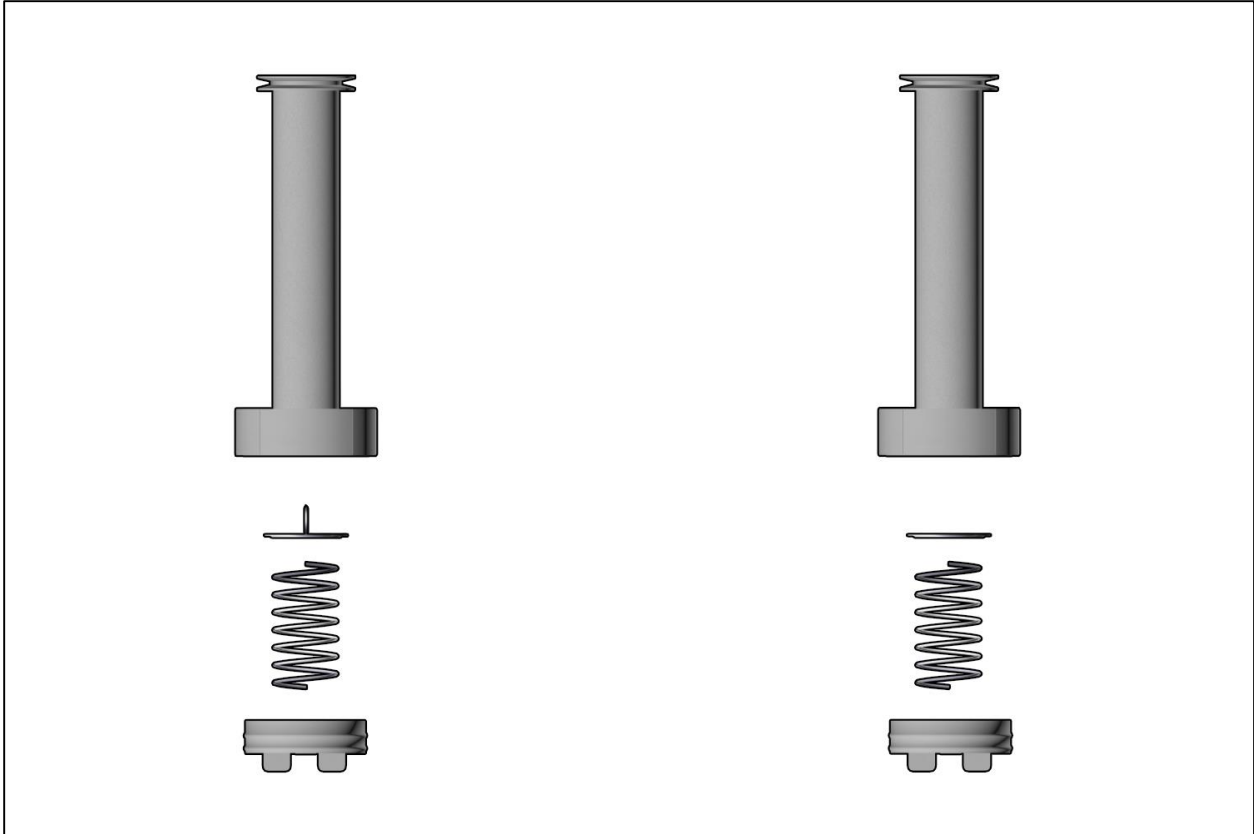


Figure 16. A bent spring in the drain valve shown on the right. The nonflawed drain valve is shown on the left.



**Figure 17. A broken cap on the drain valve is shown on the right. The nonflawed drain valve is shown on the left.**



**Figure 18. A missing pin on the drain valve shown on the right. The nonflawed drain valve is shown on the left.**

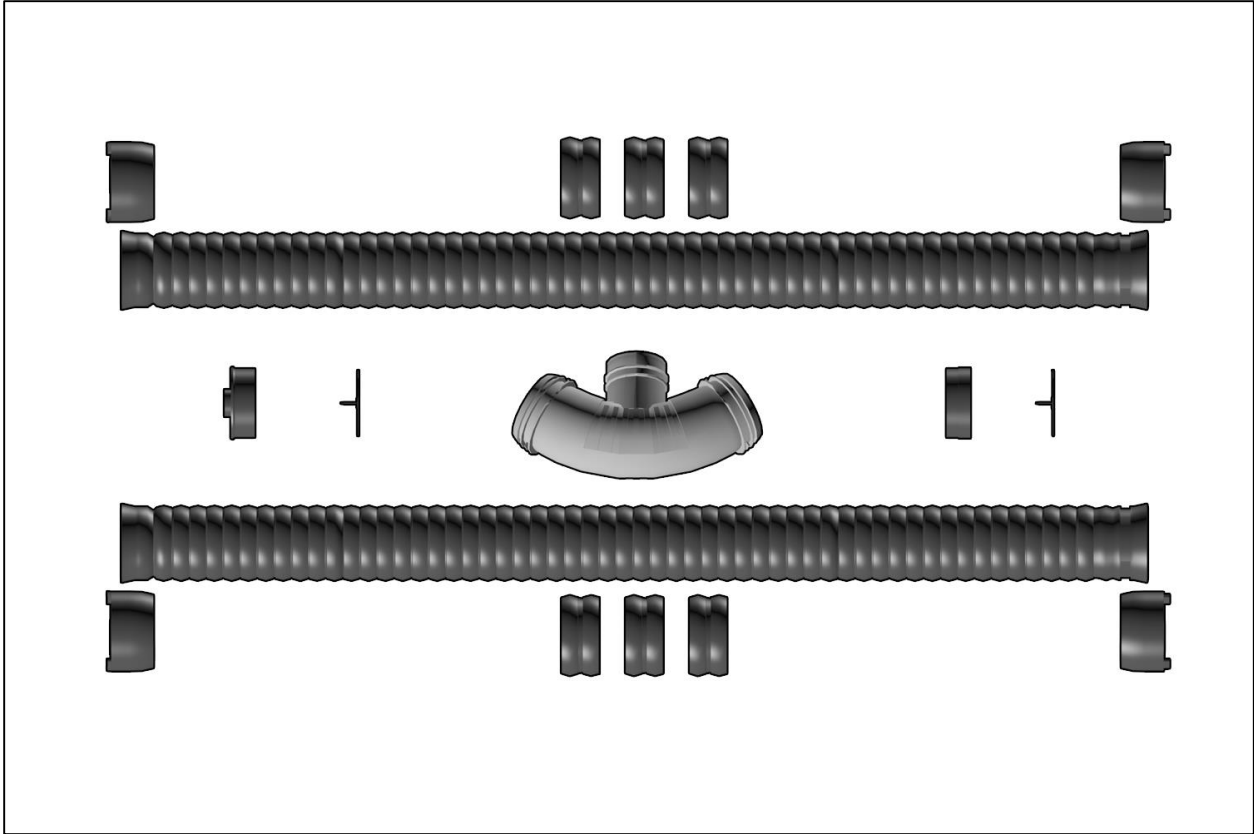


Figure 19. A missing O-ring on the breathing hose. The O-ring is visible in the center of Figure 20.

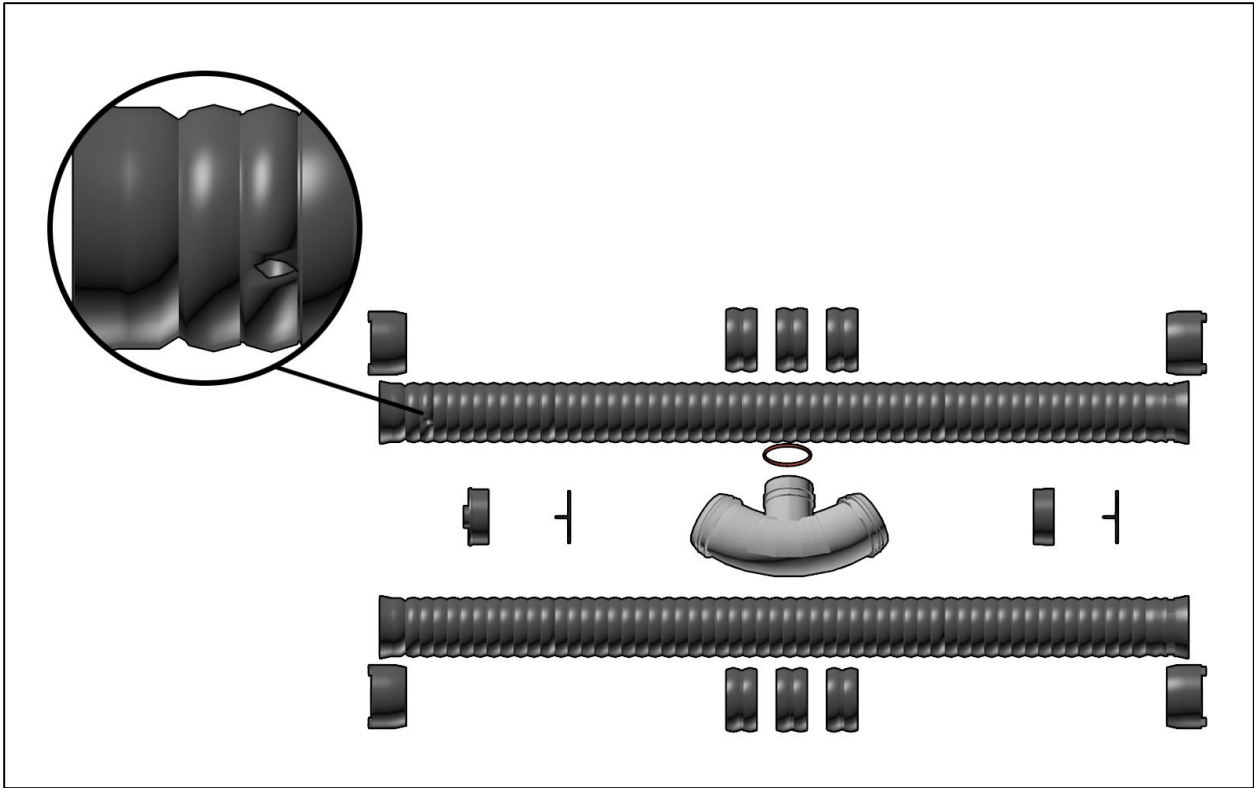


Figure 20. A tear in the breathing hose shown in the close-up on the left.



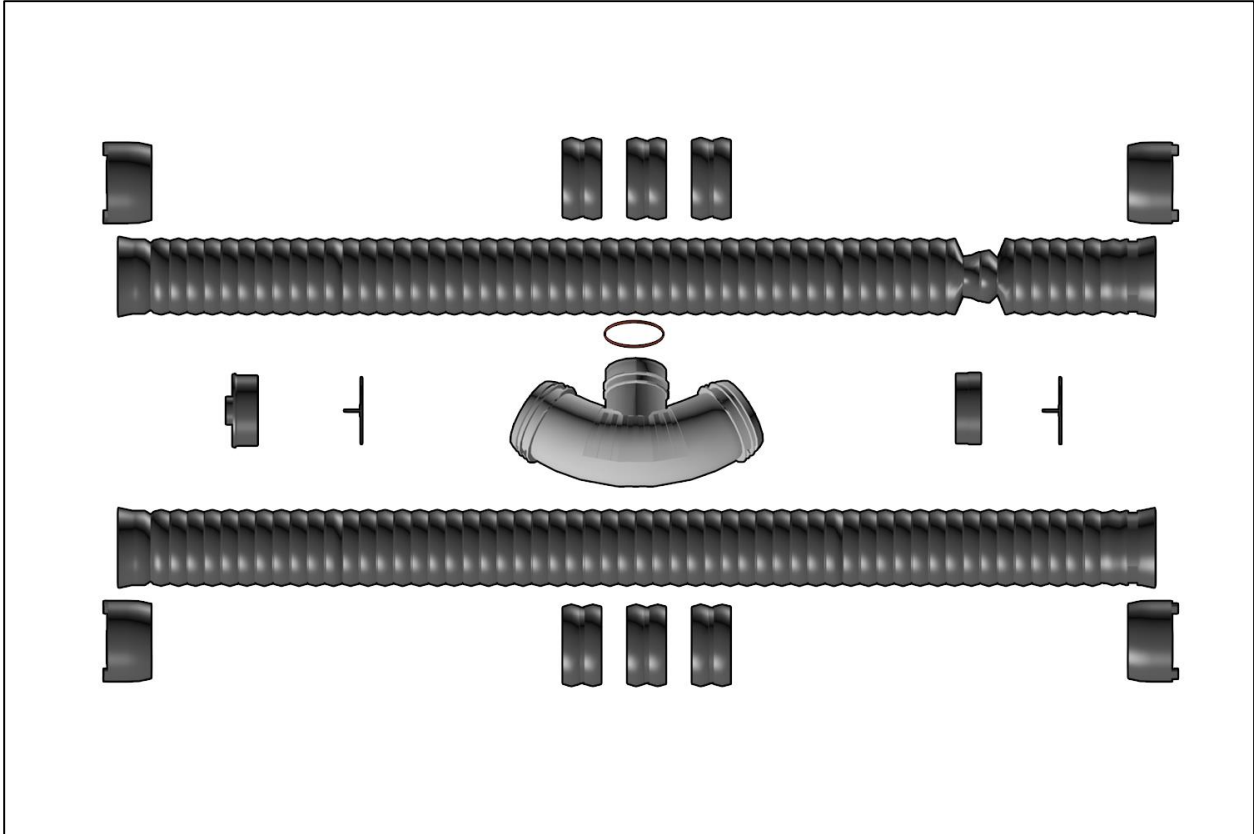


Figure 21. A crushed breathing hose. The flaw is visible in the top right of the image.



**Figure 22. Cracked glass on the full face mask is shown on the right. The nonflawed full face mask is shown on the left.**



**Figure 23. A missing wiper on the full face mask shown on the right. The nonflawed full face mask is shown on the left.**



**Figure 24. A broken strap on the full-face mask, shown on the mask on the right. The nonflawed full-face mask is shown on the left.**

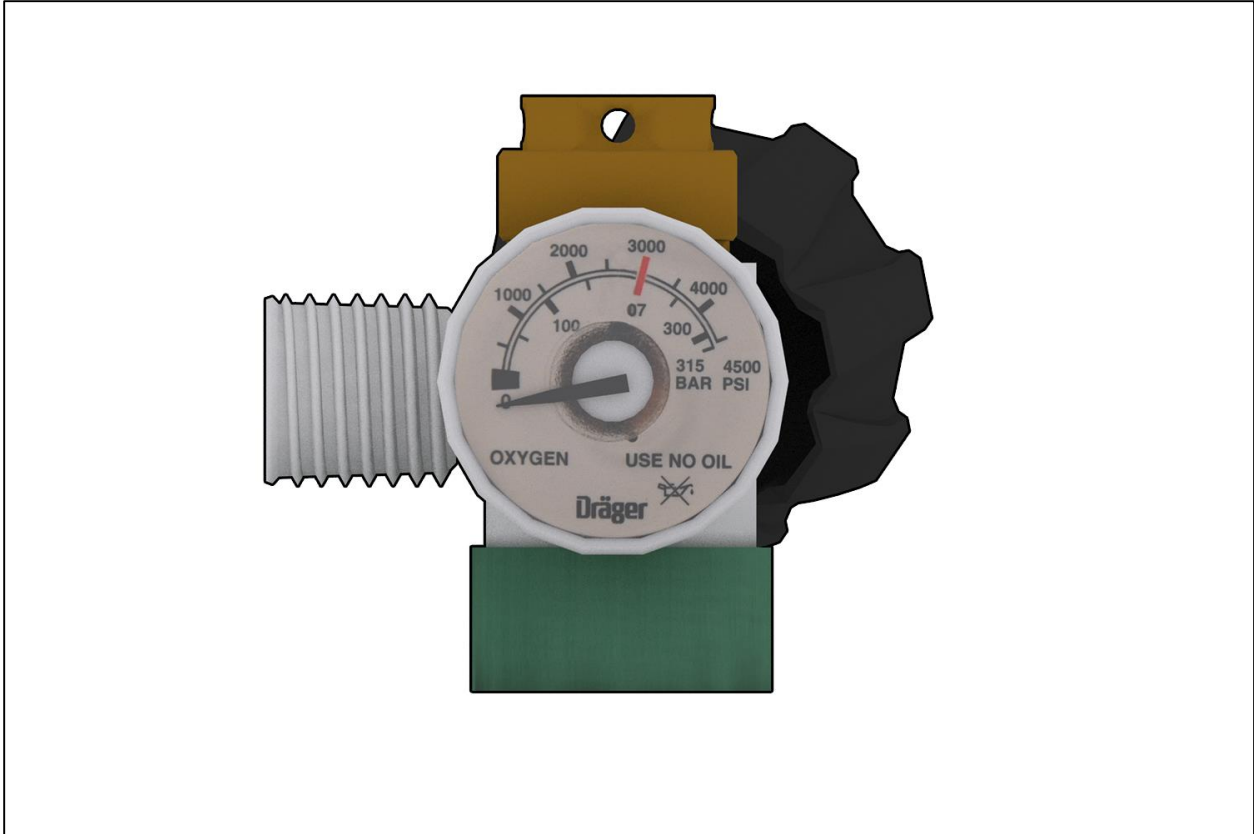


Figure 25. An empty oxygen cylinder tank as shown by the gauge needle on “0” (zero).

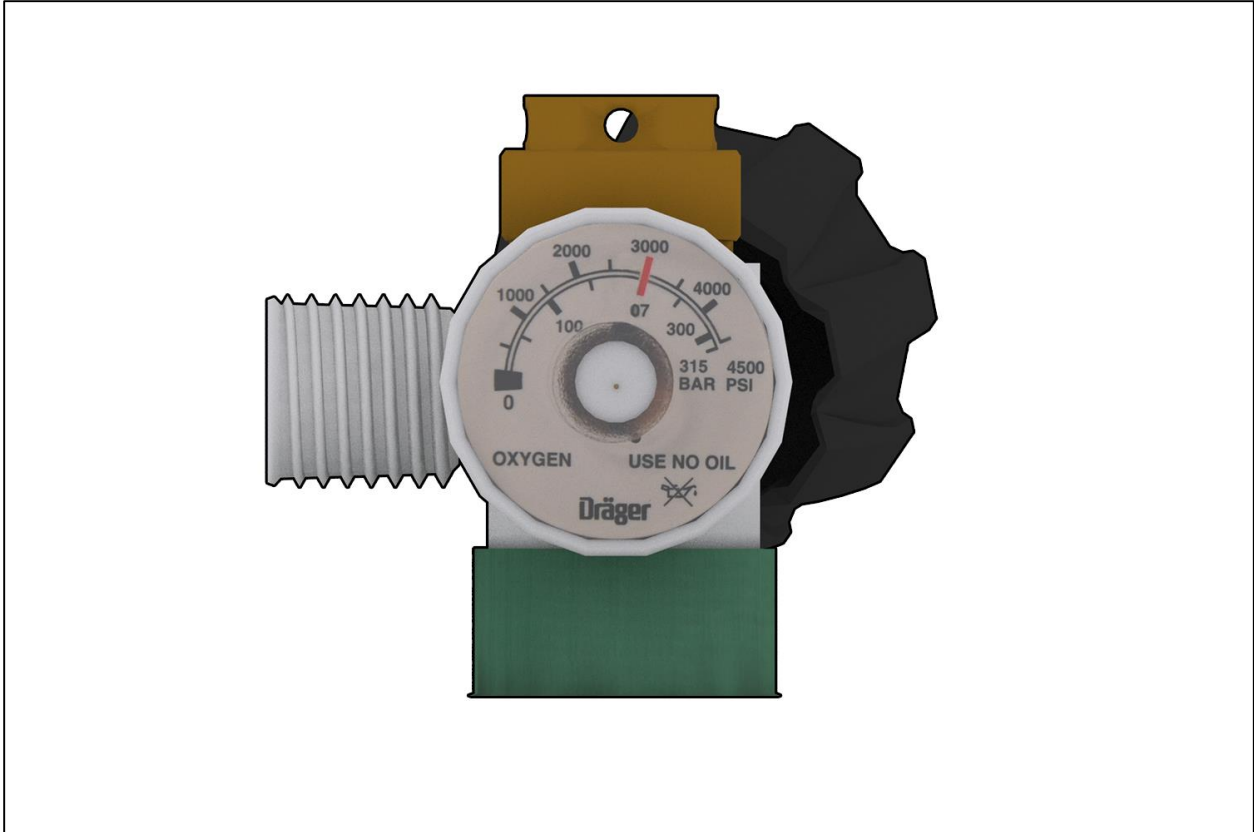
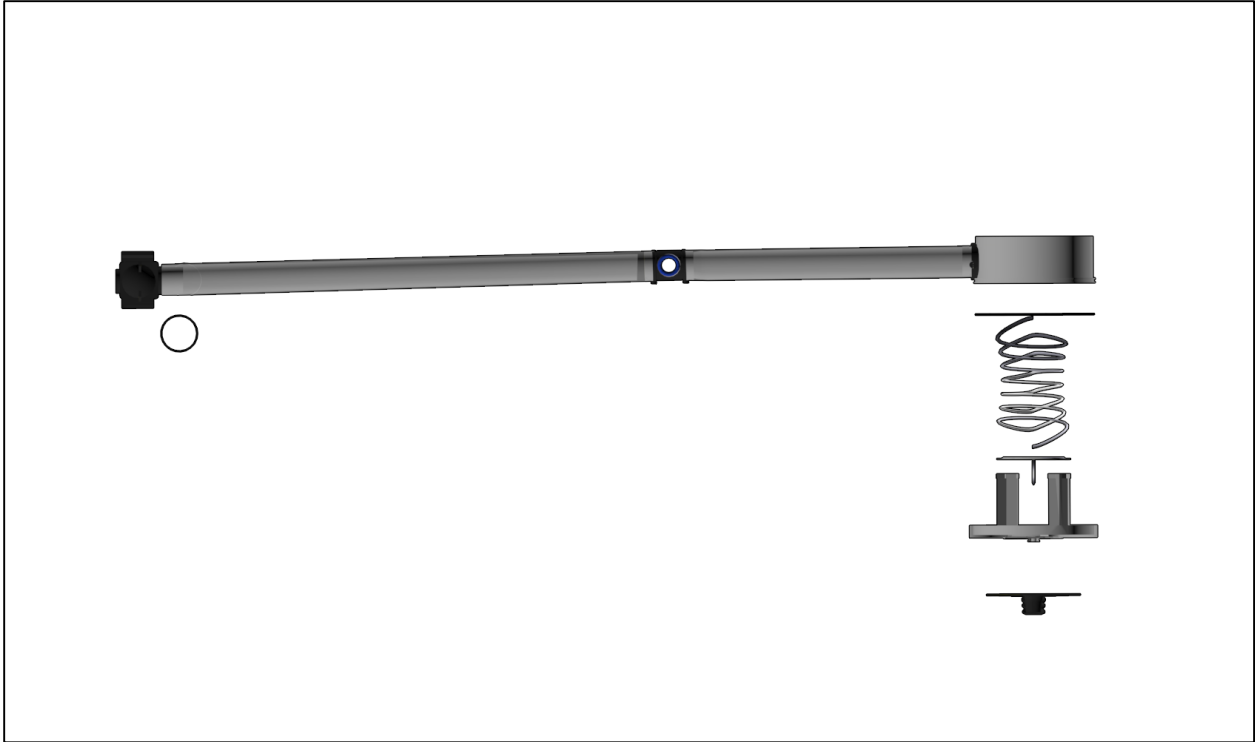


Figure 26. A missing needle on the oxygen cylinder gauge. The gauge needle can be seen in Figure 25.



**Figure 27. A dent on the oxygen cylinder shown on the back side.**



**Figure 28. A bent spring in the pressure relief valve. You can reference a normal-looking pressure relief valve spring in Figure 29.**



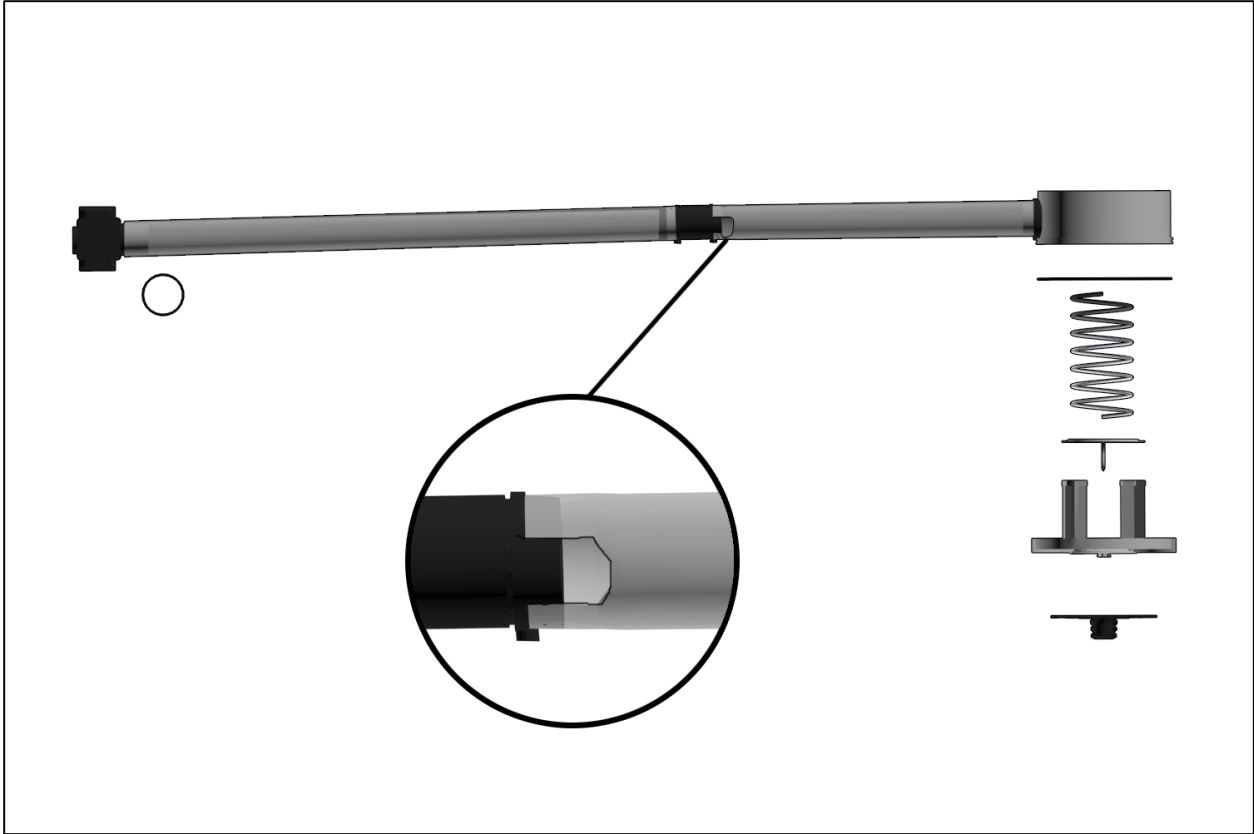
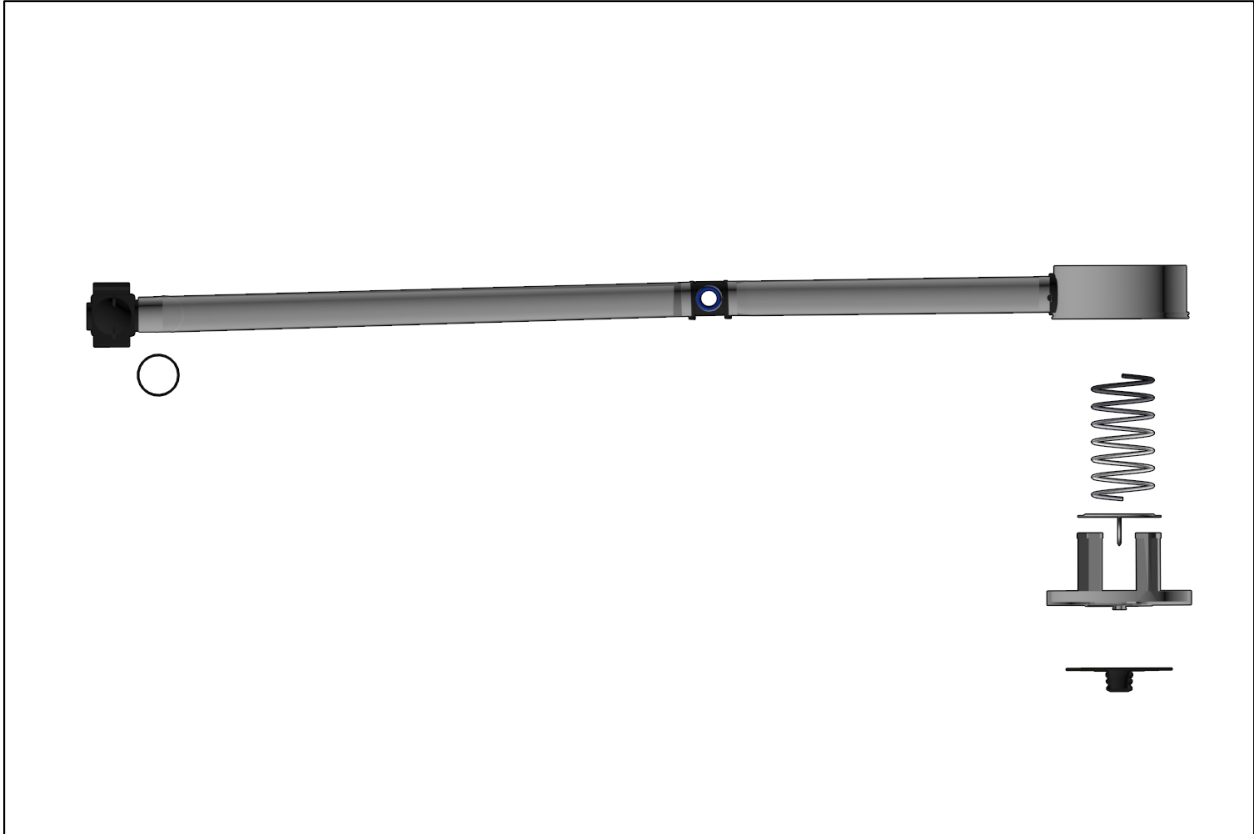
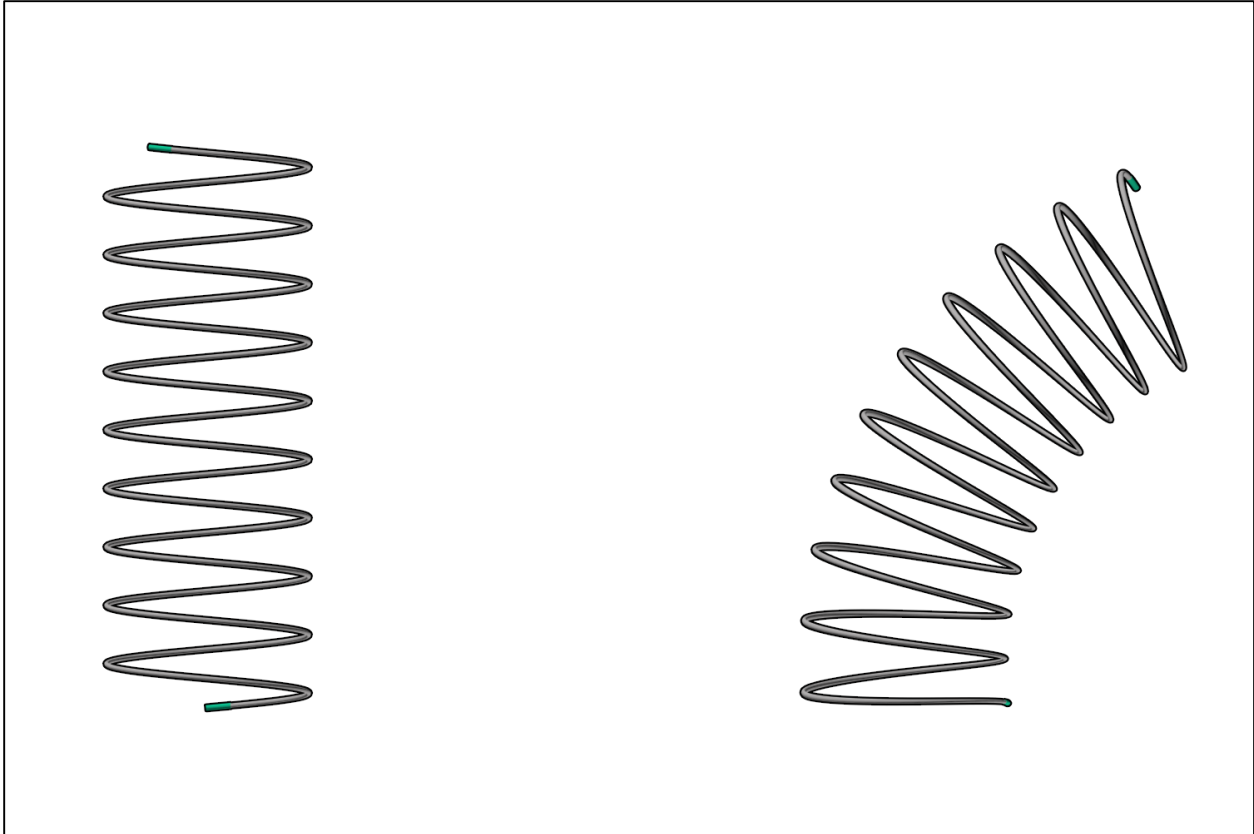


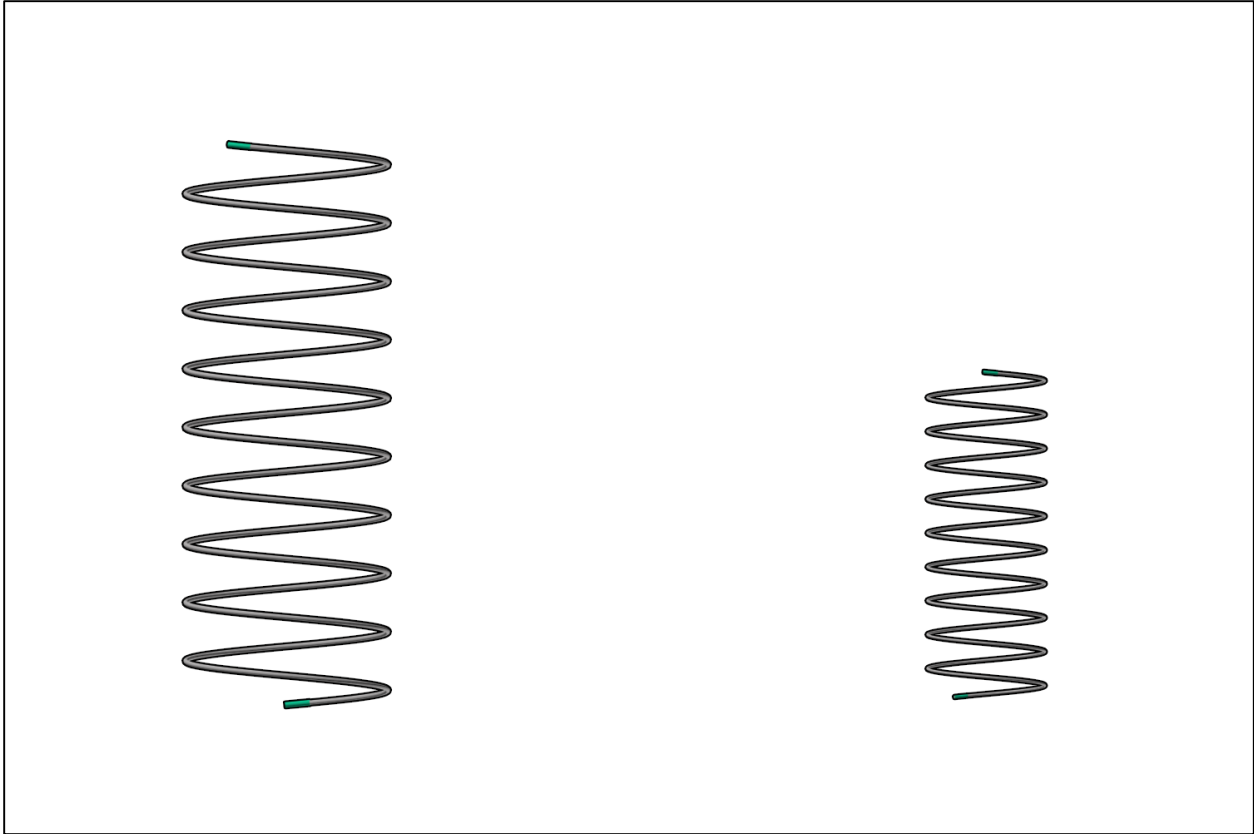
Figure 29. A close-up of torn tubing in the pressure relief valve.



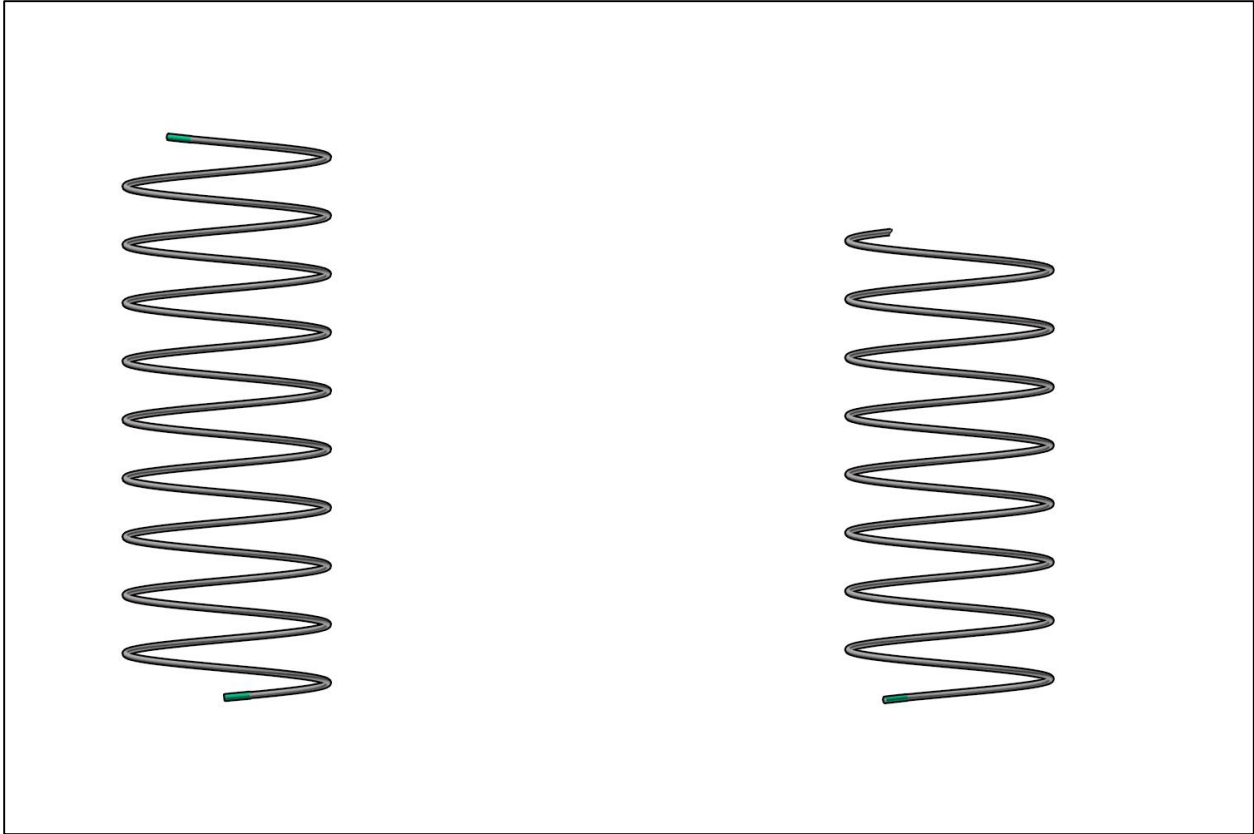
**Figure 30. An O-ring is shown as missing in the pressure relief valve. The O-ring is visible in Figure 29 on the right side of the pressure relief valve (directly above the spring).**



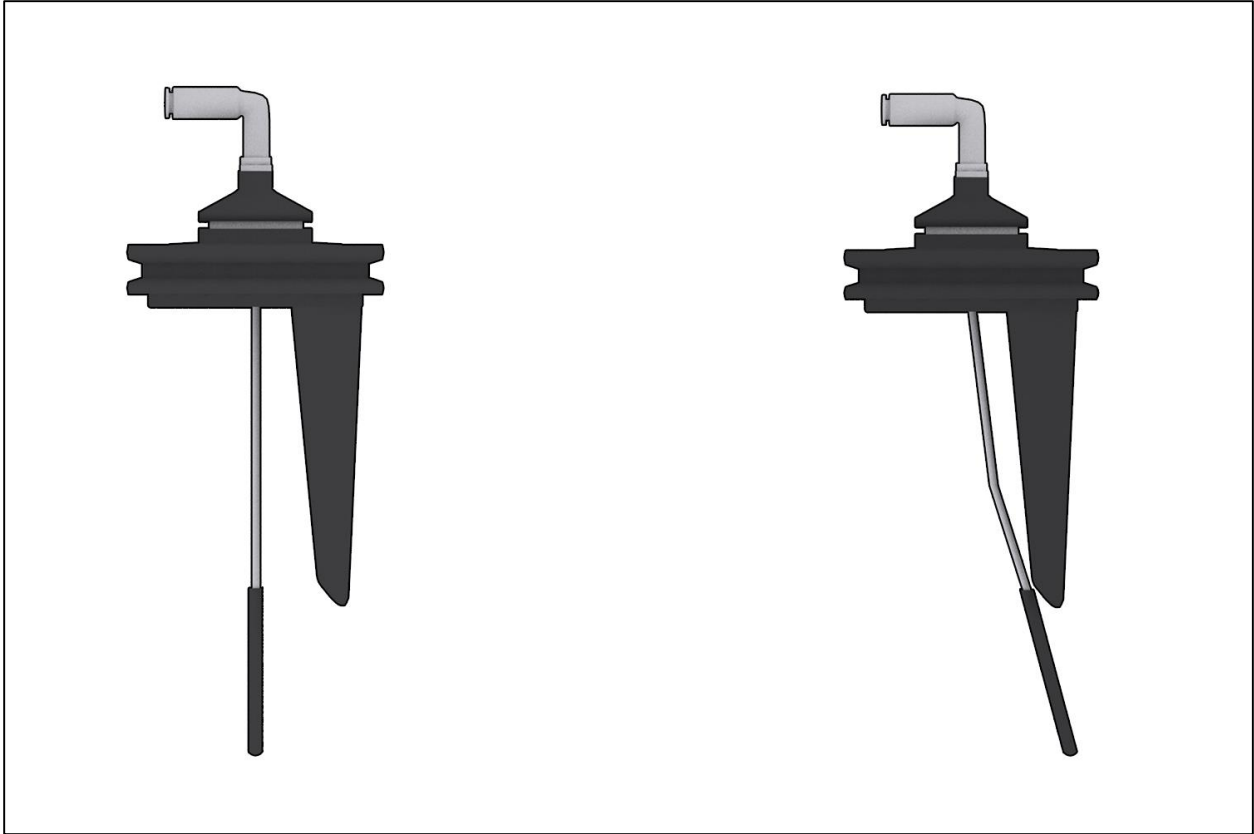
**Figure 31. A bent breathing bag spring shown on the right. The nonflawed spring is shown on the left.**



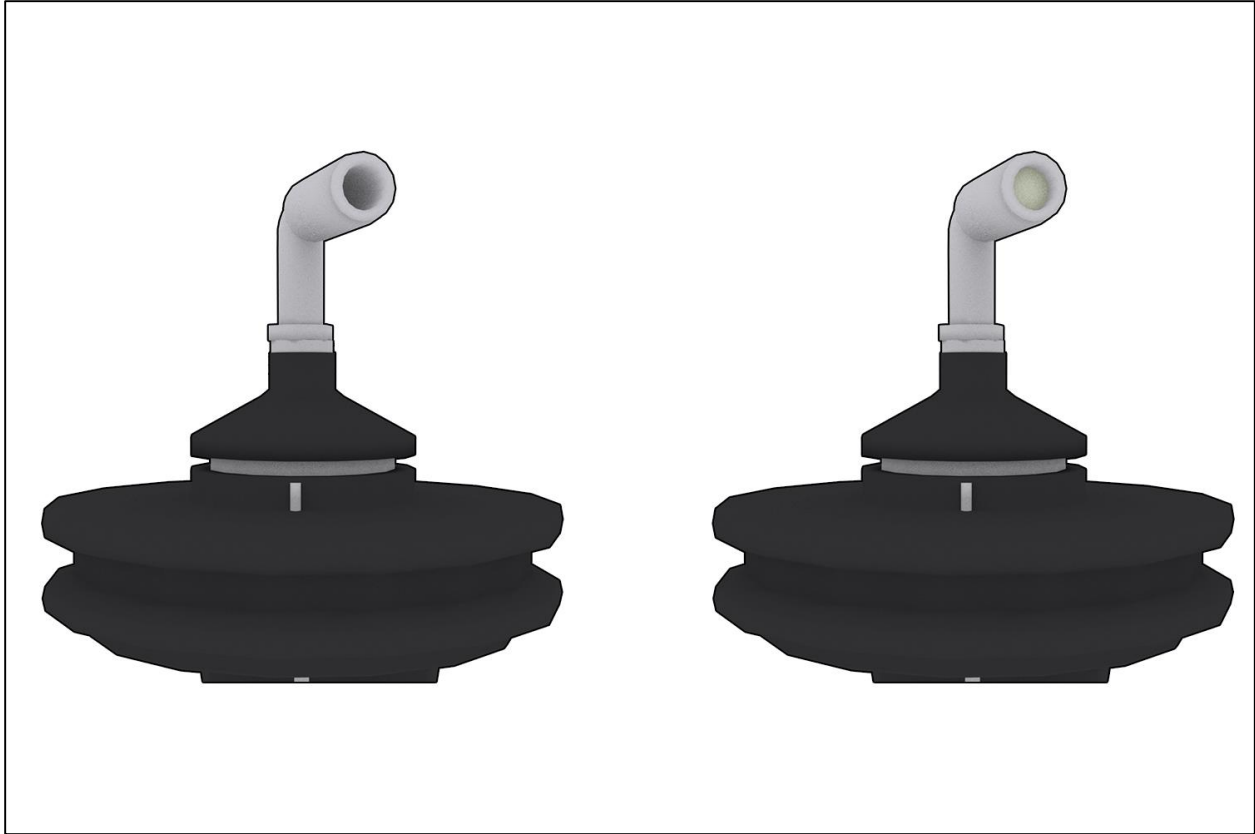
**Figure 32. A wrong size breathing bag spring shown on the right. The nonflawed spring is shown on the left.**



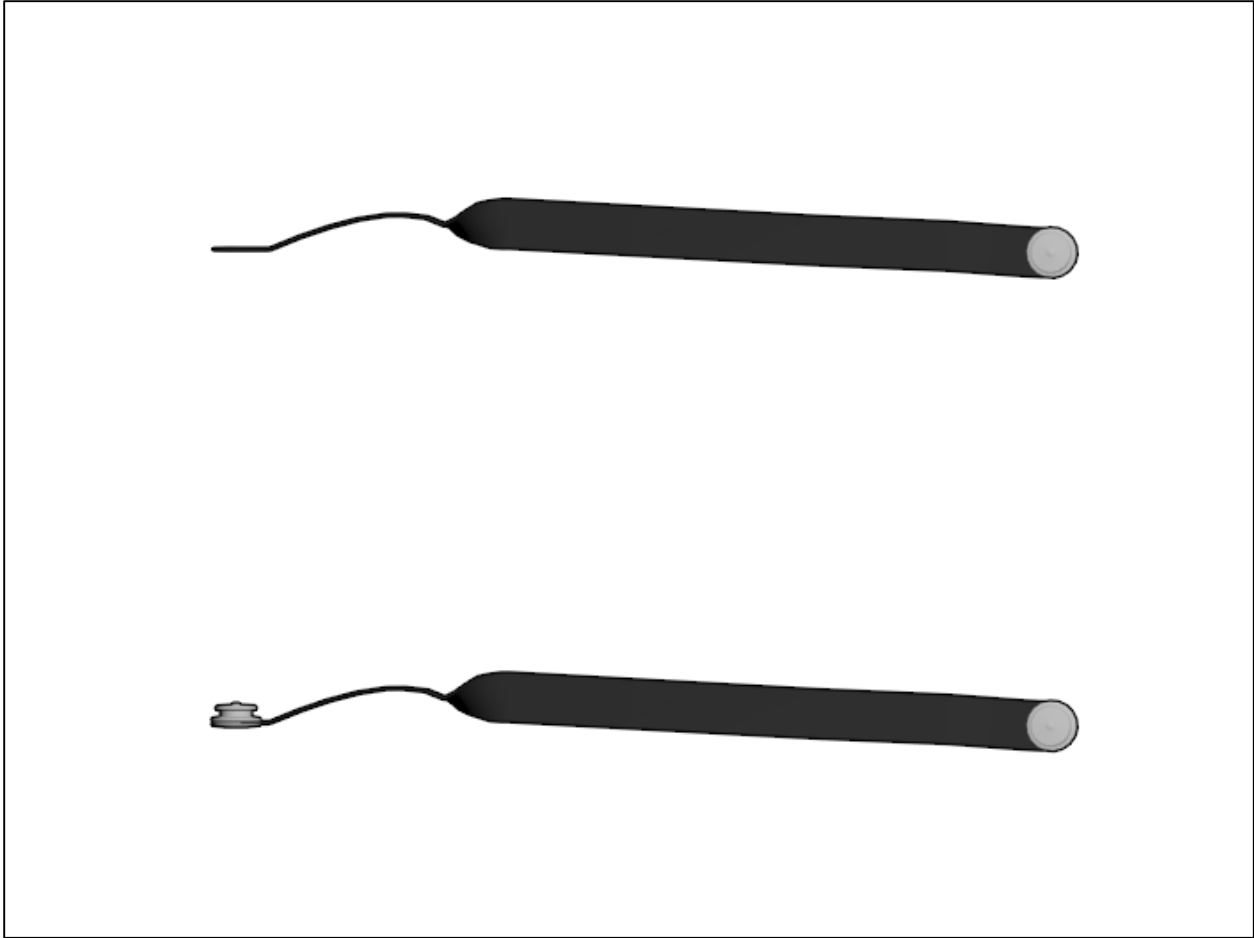
**Figure 33. A breathing bag spring cut short is shown on the right. The nonflawed spring is shown on the left.**



**Figure 34. A bent pin on the minimum valve is shown on the right. The nonflawed version is shown on the left.**

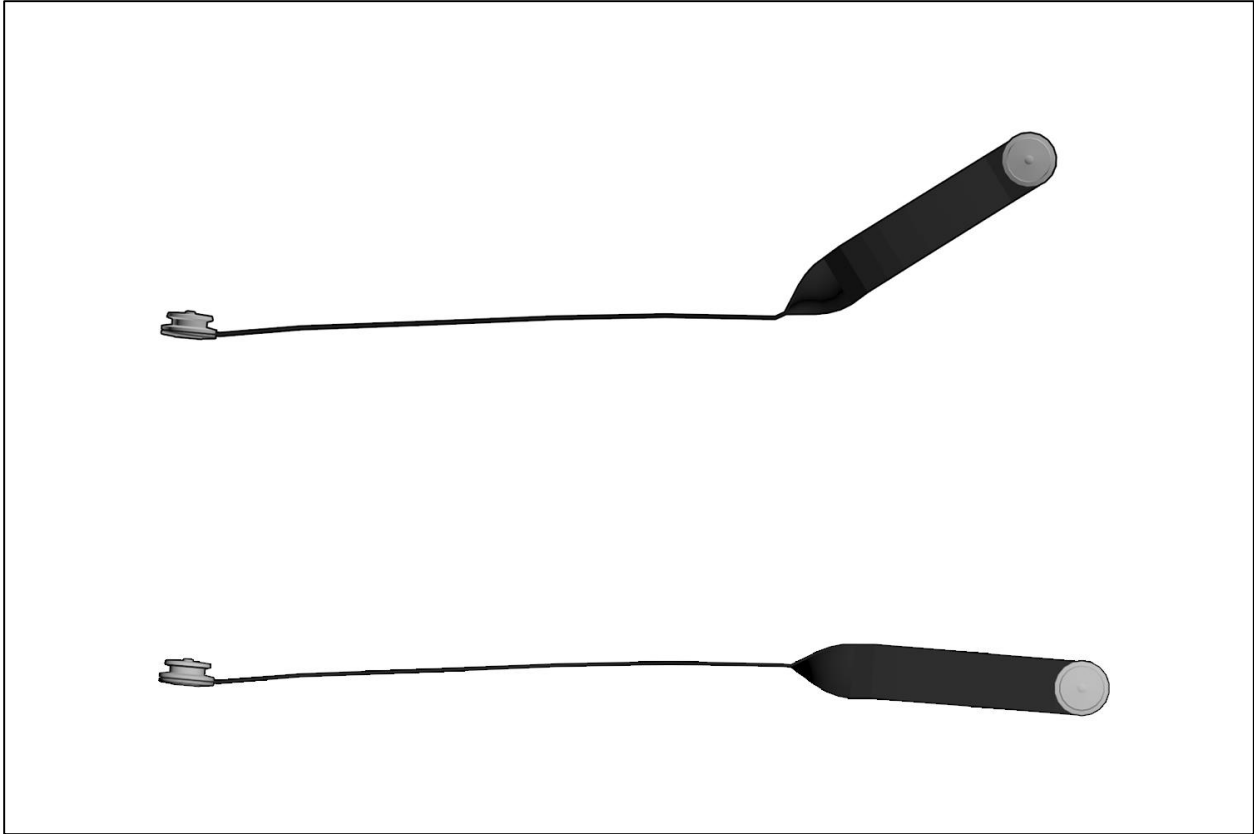


**Figure 35. A gummed-up tube on the minimum valve is shown on the right. A green substance signifies the blockage in the valve. The nonflawed version is shown on the left.**

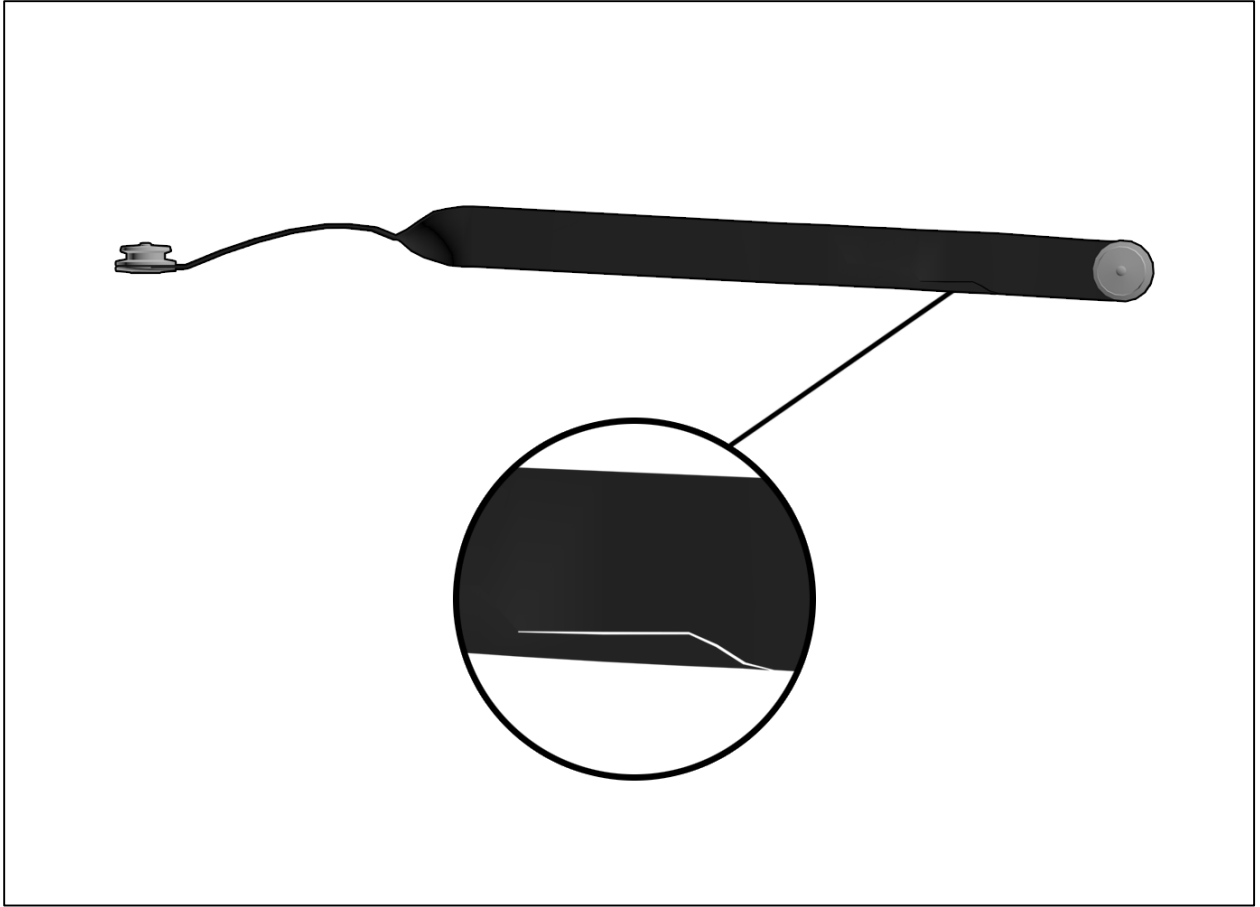


**Figure 36. A broken motion arm is shown in the top image. The bottom image shows the nonflawed version.**

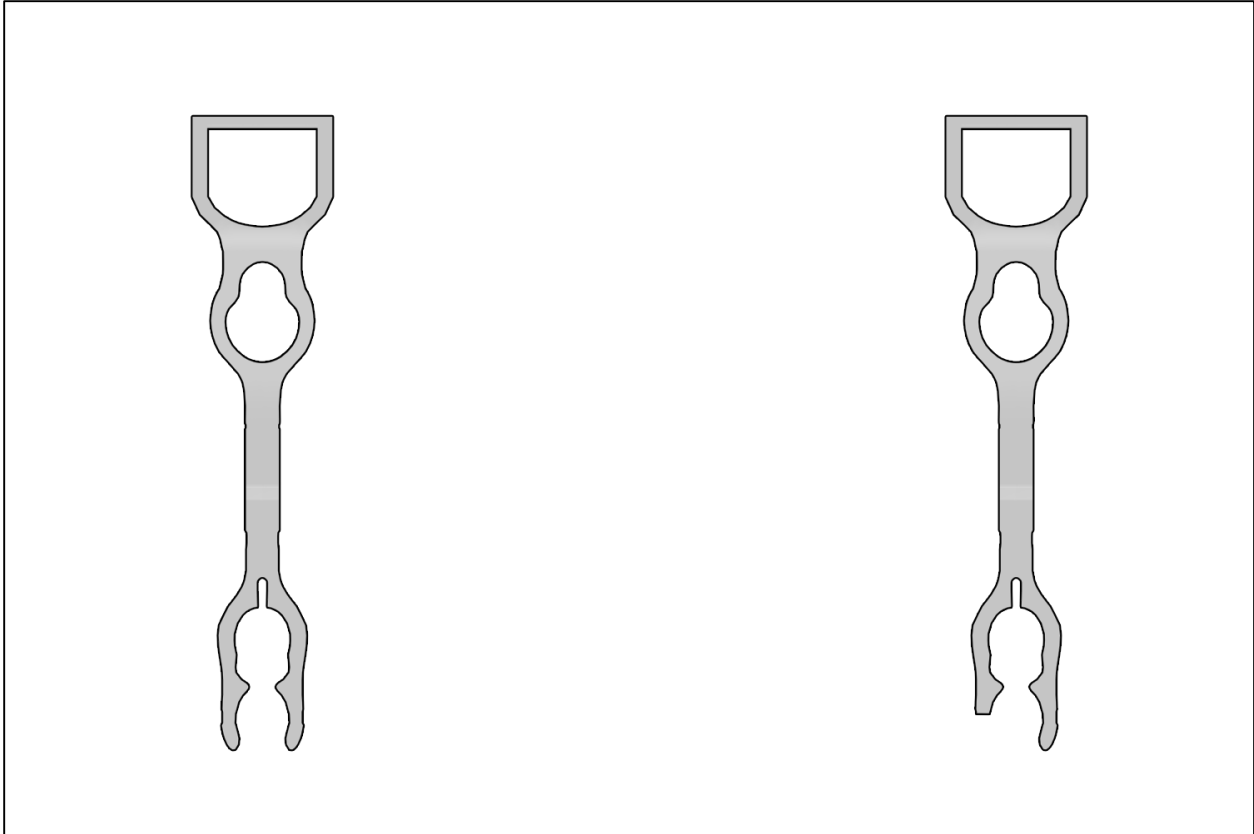




**Figure 37. A bent motion arm is shown in the top image, and the bottom image shows the nonflawed version.**



**Figure 38. A cracked motion arm with a close-up image showing the crack.**



**Figure 39. A broken clip is pictured on the right. The nonflawed version is shown on the left.**

