



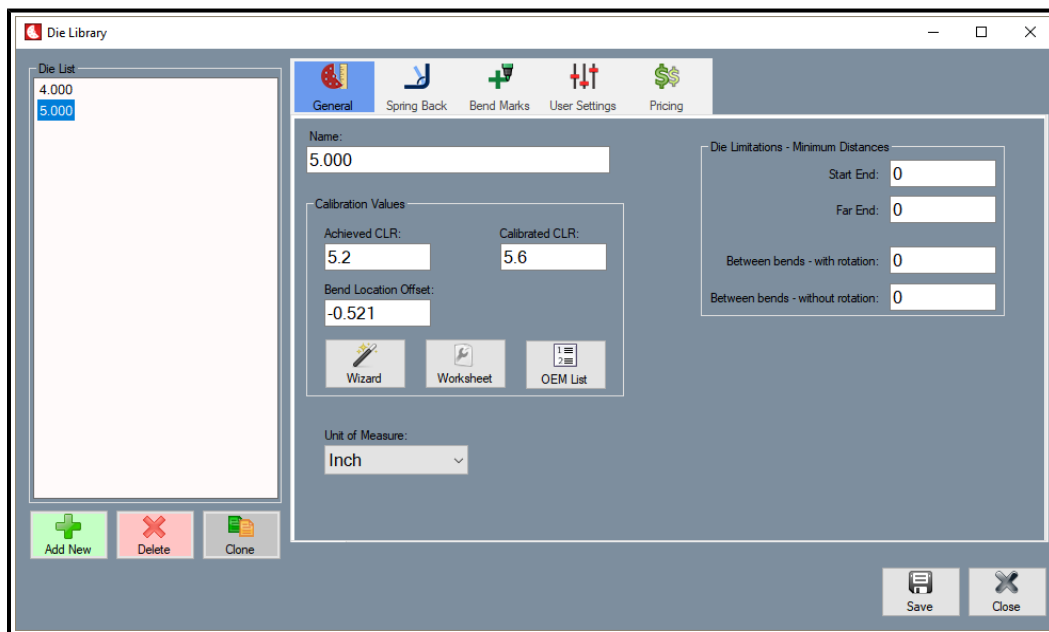
BEND-TECH, LLC.

Quality software & machines developed and manufactured in USA

Die Calibration and Springback Library Guide

Bend-Tech's tube-bending software allows fabricators to design accurate parts and projects in a virtual environment, but that accuracy can easily be lost during the fabrication process. An improperly calibrated die or missing Springback values will always cause discrepancies between a software design and its end result. Fortunately our software provides a few features which will allow you to achieve the highest degree of accuracy during the fabrication process – the Die Library and Springback Library.

The Die Library stores the information about your various dies, and that information is used by the software to calculate the bending instructions for your project:

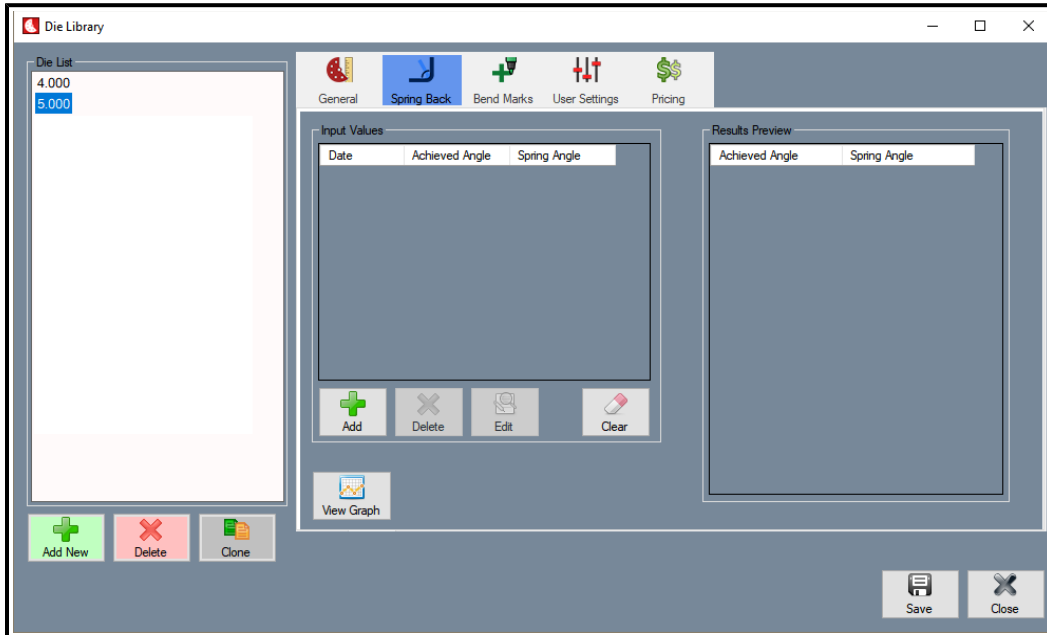


Clicking the green "**Add New**" button on the bottom left will create a new die entry. "**Delete**" will remove an existing die entry. "**Clone**" will duplicate an existing die's entry along with that die's information. After creating a new die entry, all die values will be blank and will have to be filled in by the user. To determine the values that should be entered into their respective fields the user can either select the die from the OEM die list, the Die Calibration Wizard, or the Worksheet (Advanced Users). The OEM die list allows you to quickly and easily create a new die entry, but the die information provided by the manufacturer might not match the actual values created by the die. For greater accuracy we recommend using the Die Calibration Wizard to manually calibrate your die. Be sure to click "**Save**" in the lower right after making any changes.

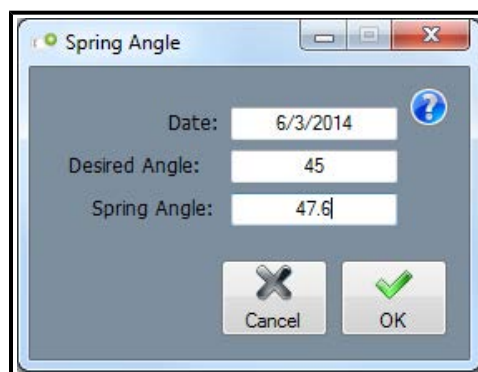
The Die Calibration Wizard involves bending a 90° section of tubing, taking various measurements, and entering those values into the Calibration Wizard. The software will then calculate your die's achieved centerline radius, calibrated centerline radius, and bend location offset. Ensure that your test part has a perfect 90° bend for the calibration process, or else your values will be incorrect and all parts bent with that die will be wasted.

Springback is the phenomenon where a bent piece of metal will warp slightly towards its original shape immediately after bending. For example, a tube bent to 90° might "spring back" to an 87° bend. The exact amount of Springback is determined by the type and thickness of the material, die size, and the angle of the bend. Failure to take Springback into account will cause all of your bends to be inaccurate, including the 90° bend required for the Die Calibration Wizard.

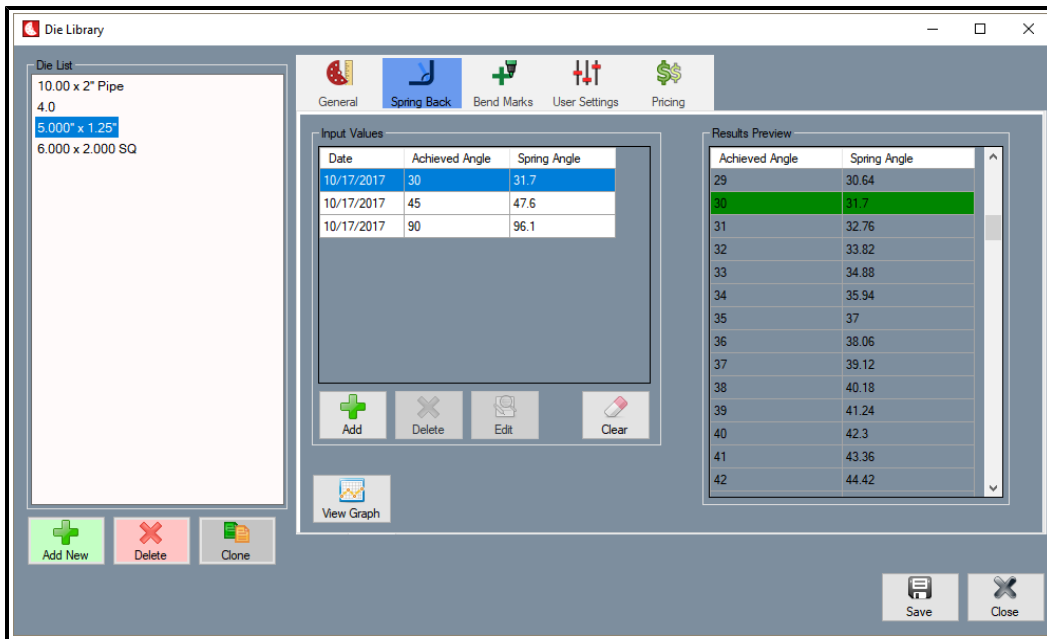
Although Springback is determined by both material and die, the Springback Library is found within the Die Library:



Select a die from the Die List, then click on the “Spring Back” tab. Upon the creation of a new die, that die's Springback Library will be blank and must be filled with information provided by the user. Click on the “Add” button to create a new entry in the Springback Library.



In this example, a fabricator wanting a 45° bend would have to bend the tubing to 47.6°, resulting in a 45° angle after Springback. Clicking “OK” after entering the values will save the entry. The more entries a Springback Library has the more accurate the software will be when calculating Springback angles. We recommend at least three entries per die, with the entries spanning the range of the die’s bending angles. For example, a 90° die might have Springback values for 30°, 45°, and 60° bends, and a 180° die might have Springback values for 45°, 90°, 135° bends. These three distinct values will allow the software to more accurately calculate Springback angles.



In this screen, three Springback entries have been submitted into the “Input Values” column. The software takes those entries and calculates the Springback angle for any bend between 1° and 180°, which is displayed in the “Results Preview” column.

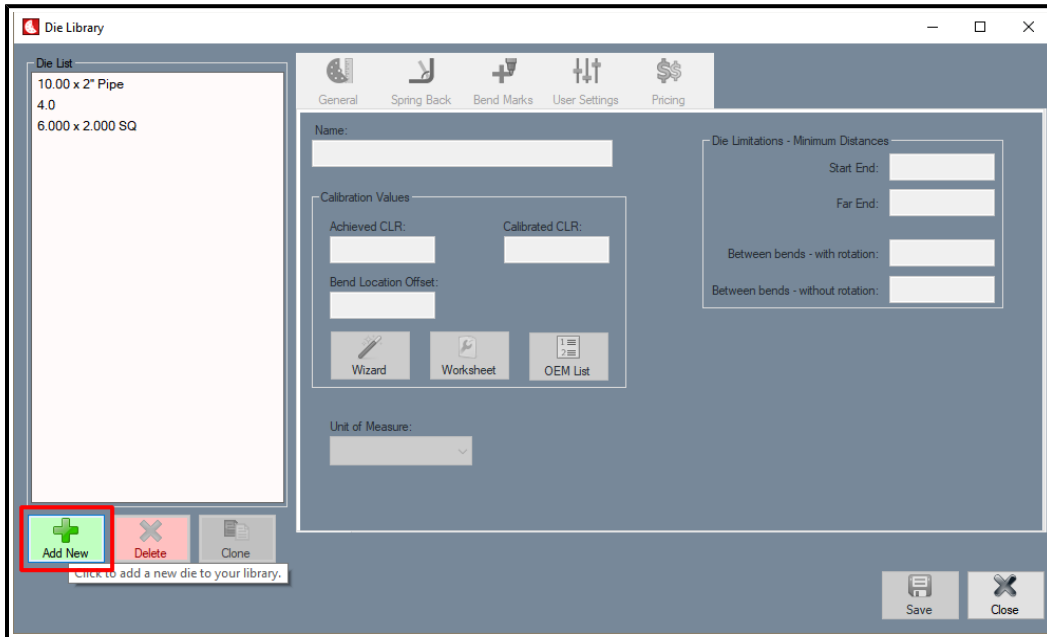
There is one extremely important factor to consider: there is only one Springback library per die. Because one die might be used on a variety of different materials, it is highly recommended that your Die Library has multiple entries of each die – one entry for each type of material you plan on bending with that die. That way, each combination of die and material has its own Springback Library which ensures the highest degree of accuracy while bending material.

The process of creating a die entry for every possible combination of die and material, calibrating each die, and determining the Springback values for each entry might seem daunting, but the following instructions can simplify the process

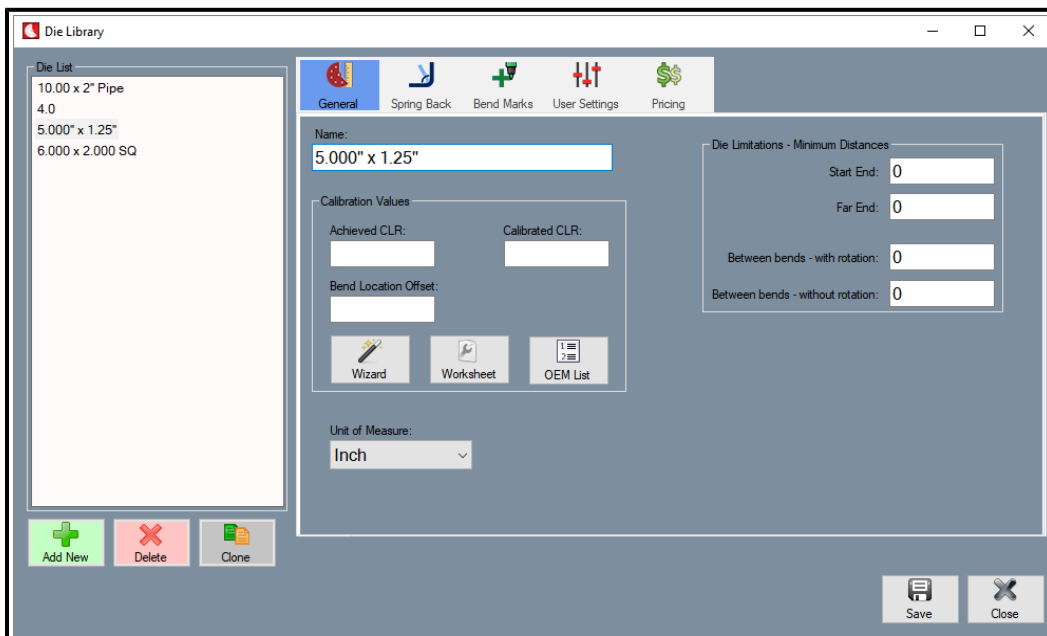
Die Calibration and Springback Library Creation Made Easy

The following is a step by step tutorial which details the process of starting with an empty die library and ending with multiple die entries, each with their own Springback Libraries.

1.) Create a New Entry in the Die Library



Open the Die Library and click the “**Add New**” button. This creates a blank entry in the Die Library. Assign a name to the Die and select the proper unit of measurement for that Die. For the purpose of this tutorial the Die was generically named **5.000" x 1.25"**.



2.) Calibrate the Die

Click on the “Wizard” button to launch the Die Calibration Wizard. The software will walk you through the process of bending a test part to 90 degrees, taking measurements, and then entering those values into the software. Ensure that your test part is exactly 90 degrees or else the calibration process will fail.

Calibration Test - Instructions

Bond-Tech Calibration Instructions

Please follow the steps below to bend a test piece of material in order to calibrate your die. Enter your measurements on the appropriate lines below.

Step 1: Obtain the radius of your die. (usually stamped on the die).

Step 2: Measure the outside diameter of your material.

Step 3: Cut a test piece of material. Measure the cut length AFTER you cut.

Step 4: Make a mark a few inches from one end. Measure the distance from the closest end.

Step 5: Place the tube in the bender and align the mark to your reference location on the bender.

Step 6: Bend the tube to 90 degrees. You may need to over-bend to accommodate spring-back. The part should be +/- 1 degree of 90 degrees.

Step 7: Measure the length of leg 1. This is the leg with the mark on it. Stand the leg straight up in the air and measure down to the floor/table.

Step 8: Measure the length of leg 2. This is the leg WITHOUT the mark on it. Stand the leg straight up in the air and measure down to the floor/table.

Step 9: Using these results, return to the software and enter the values into the software.

Die Radius (step 1): _____

Material OD (step 2): _____

Cut Length (step 3): _____

Mark Location (step 4): _____

Leg 1 Length (step 7): _____

Leg 2 Length (step 8): _____

Print Close

3.) Clone the Die Entry

Use the “Clone” button to create a duplicate entry of your die, one duplicate for each type of material you will use with that die. In this example we will clone the **5.000" x 1.25"** die entry twice, creating a total of three entries for the **5.000" x 1.25"** die.

Die Library

Die List

- 10.00 x 2' Pipe
- 4.0
- 5.000" x 1.25"**
- 5.000" x 1.25" (copy)
- 5.000" x 1.25" (copy) (copy)
- 6.000 x 2.000 SQ

General Spring Back Bend Marks User Settings Pricing

Name: 5.000" x 1.25"

Calibration Values

Achieved CLR: 5.2 Calibrated CLR: 5.6

Bend Location Offset: -0.521

Wizard Worksheet OEM List

Die Limitations - Minimum Distances

Start End: 0

Far End: 0

Between bends - with rotation: 0

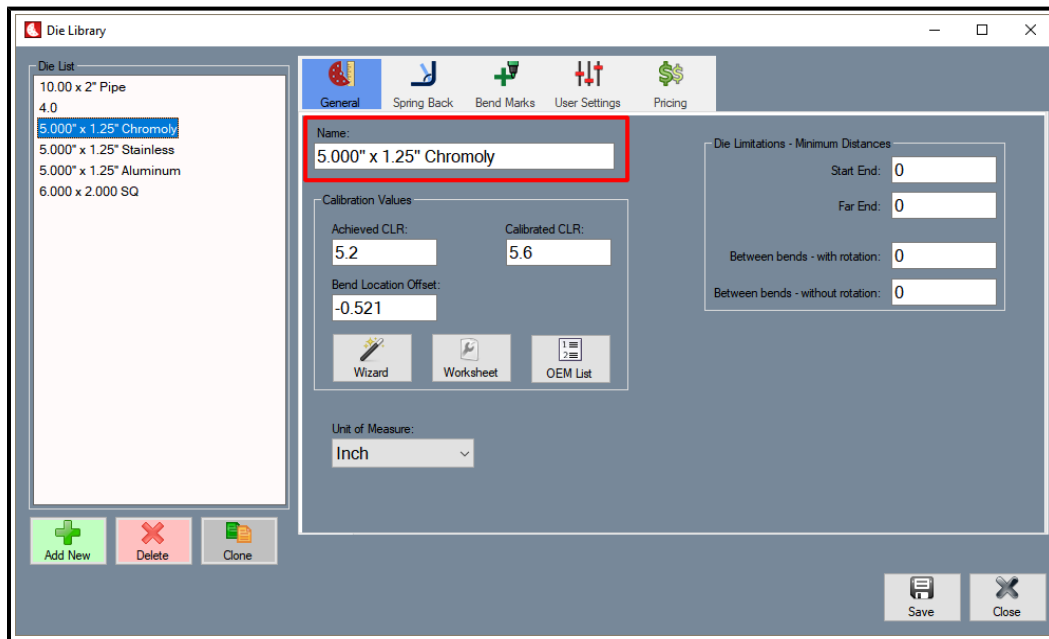
Between bends - without rotation: 0

Unit of Measure: Inch

Add New Delete Clone

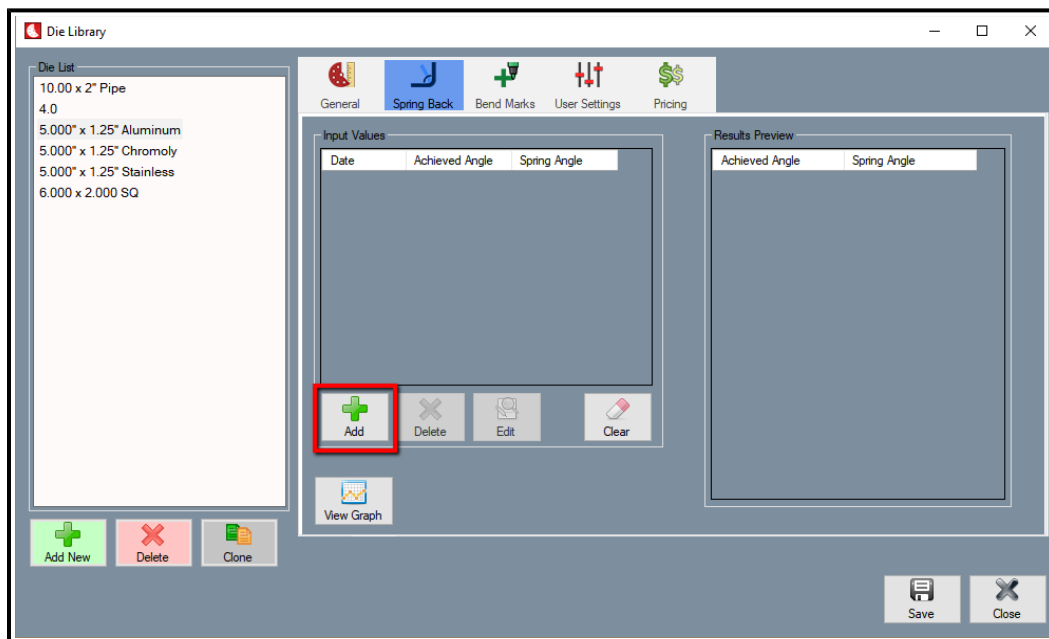
Save Close

The three entries for the **5.000" x 1.25"** die will be for the three different types of material that die will bend: Aluminum, Stainless Steel, and Chromoly. To rename a die entry, select the die you wish to rename from the **Die List** on the left and then edit the text in the **Name** field.

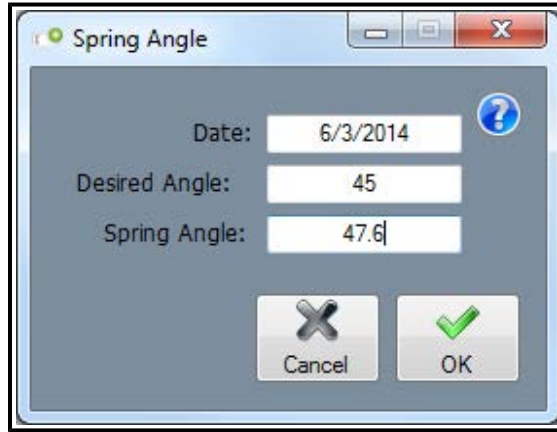


4.) Perform Test Bends to Determine Springback Values

Navigate to the "Spring Back" tab at the top of the Die Library window. A newly created die will not have any Springback information.

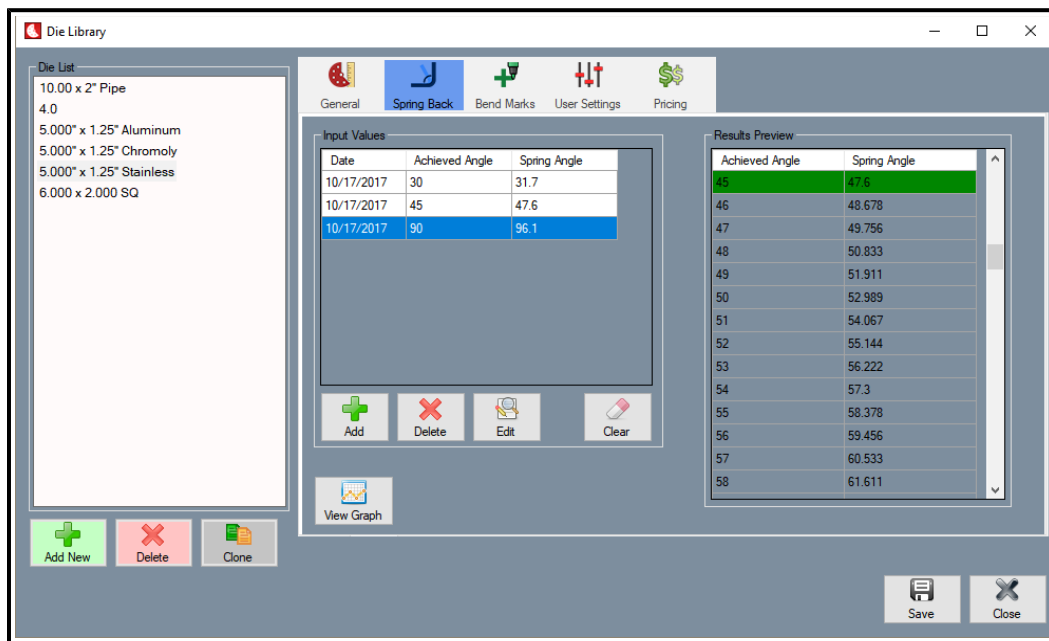


Enter the Springback values by clicking the “Add” button under the “Input Values” column.



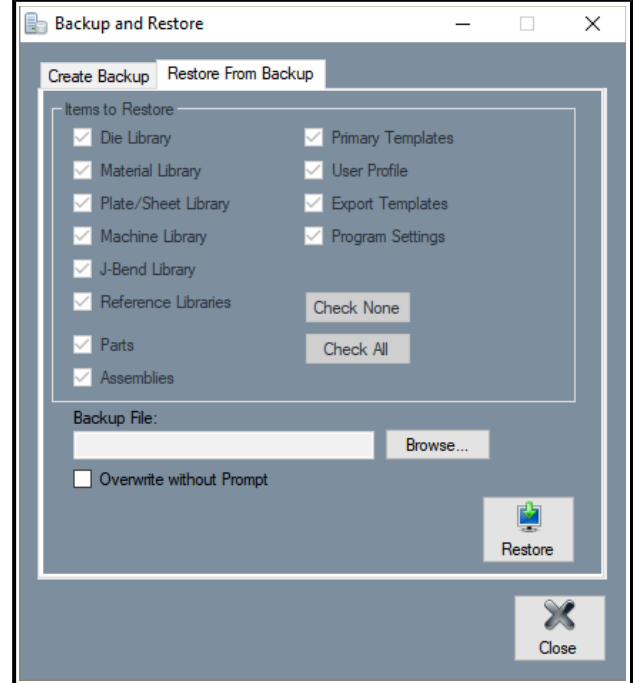
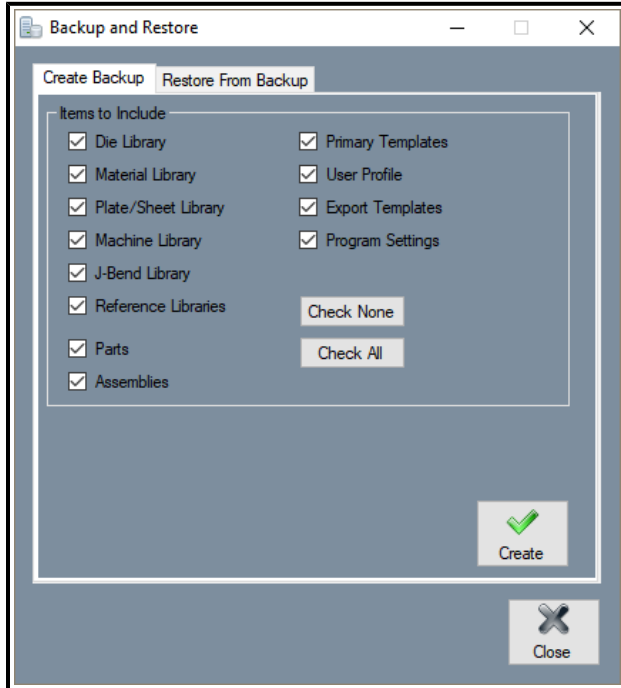
Each entry in the Die List will need at least three test bends for the purpose of determining the Springback value for that Die and Material combination. For example, a 90° die might have Springback values for 30°, 45°, and 60° bends, and a 180° die might have Springback values for 45°, 90°, and 135° bends. These three distinct values will allow the software to more accurately calculate Springback angles.

Please note that each test bend must be made on a fresh piece of material. Using the same piece of material to attain Springback information for a 30°, 45°, and 60° bend will give skewed values, which will create incorrect bending instructions, which will cause wasted time and money.



The end result will be a completed Springback Library for each die entry. This will give you the most accurate bending instructions possible.

Backup And Restore



The Backup and Restore feature allows a user to make a copy of their Bend-Tech software settings. It is highly recommended to create a backup of the various Libraries and software settings once you have finished setting up your Die, Springback, and Material libraries. If anything happens to your computer then you can easily transfer your software settings to another computer, saving you a significant amount of time and money.

The Backup and Restore feature is also incredibly useful for users who have Bend-Tech's software installed on more than one computer. Instead of manually creating Die, Springback, and Material libraries on each computer the user simply creates a backup of the first computer's libraries and then transfers those settings to the second computer.