

Fandrich-Rhodes Weightbench Instructions

Introduction:

The Fandrich-Rhodes keyweighting system enables the technician to quickly develop a visual picture of the weight and friction issues in a grand piano action.

A new method for measuring down and up weights makes the process far less time consuming (an hour or less) with significantly more accurate results. The measurements are entered into a computer and the software program produces a graph showing:

- 1) Downweight
- 2) Target downweight
- 3) Balance weight
- 4) Upweight
- 5) Projected upweight with target downweight
- 6) Friction

Using this visual aid the technician can quickly see where friction problems need to be corrected before determining an optimal downweight.

After friction levels and differences have been corrected, the Weightbench balance table is used to measure and record the existing front end keyweight from which the software calculates the keyweight changes for each key to achieve its target downweight.

After the weights have been changed each key can be re-checked on the jig for accuracy.

Weightbench kit:

The Weightbench kit includes:

- *Weightbench* program (requires Windows XP – SP2 or later)
- balance *Table* with *Tower* for balance pin
- digital *Scale*
- key rest *Block* for placement on scale
- metric *Ruler* (15 cm)
- *Mushroom Weights* for measuring down and up weights (30g, 45g, 70g brass)
- Sample *Lead Weights*

Instructions:

The down and up weights can be measured with the action on the bench or with the action in the piano if the sustain pedal is wedged to remove the effect of the dampers. If measured in the piano we recommend a laptop computer which can be set on the tuning pin area for convenience. Direct entry of measurements into the laptop is efficient, and also eliminates the potential for transcription errors.

1. **Create the measurement file:**

- A. Open the Weightbench program, enter 85 or 88 keys
- B. Enter identifying information (Name, Serial #)
- C. Click on “Diagram” button on the left side of the Weightbench window for clarification of steps D-G.
- D. Using a longer metric ruler, measure bottom bass note from front of balance pin to front end of keytop and enter in the indicated box (Bass WW). Note: All ruler measurements are in mm.
- E. Measure bottom sharp note from front of balance pin to top edge of beveled key end and enter in the indicated box (Bass BB).
- F. Measure bottom sharp note from front of balance pin to front edge of adjoining white keytop and enter in the indicated box (Bass BW).
- G. Repeat this process with the top treble key (Treble WW), top treble sharp to beveled edge (Treble BB), and top treble sharp to edge of adjoining white keytop (Treble BW).

These measurements enable the program to calculate the leverage from which to determine the downweight and upweight based on the position of the sliding mushroom weight on each individual key.

Retain the default target downweight settings (bass and treble) for the first set of down and up weight measurements.

2. **Measure down weights** using mushroom weights. Note: The default mushroom weight value is for the 70g weight. Some keys may require 100g to lift the hammer. Stack the 30g weight on the 70g weight. Check the box for the weight used for each key in the columns provided. The mushroom weight value may be changed with “quick keys” z for 45g, x for 70g and c for 100g when the typing cursor is in a key’s measurement box.

- A. Place the mushroom weight on the key, lifting and moving it forward and back until you find the position where it lifts the hammer enough to raise it to letoff. The speed of lifting is not important as long as it is consistent from note to note. Maintaining a consistent speed results in a much more even touch.
- B. Using the metric ruler provided with the Weightbench kit, measure the distance from the front of the mushroom weight stem to the end of the keytop and record the measurement (in mm) in the program. Sharps are measured to the front edge of the white keytops.

Note: The mushroom weights provide very high resolution of the action up and down weights. With the 70 gram weight, a move of 3.5mm equates to 1 gram of up or down weight! It is very easy to achieve ½-gram accuracy with this system.

3. **Measure up weights**. The default mushroom weight value is 45g for the up weights. Again check the box for the weight used for each key in the columns provided. Change the

setting using the same quick keys, z for 30g, x for 45g and c for 70g when the typing cursor is in the key's measurement box.

- A. Depress the key to the letoff point and place the mushroom weight on the key, sliding it forward and back until you find the position where the key will slowly return the hammer to approximately $\frac{1}{4}$ " above its resting position.
- B. Using the metric ruler measure the distance from the front of the mushroom weight to the end of the keytop. Again, sharps are measured to the front edge of the white keytops. Record the measurement in the program.

You will notice as you enter the up weights that a yellow line appears for the balance weight, a dark green line for the upweight, a light green line for the upweight at target downweight, and a red line for friction. Place the cursor on any dot and it will identify the note number. Save this graph as the "original".

4. **Correct friction.** Recommended friction (red line on the graph) is 15-18g in the bottom bass tapering to 10-12g in the top treble.

- A. Key bushings: inspect key bushings for wear or glue soaking. Often keys will need to be re-bushed, even though they look good, in order to get even friction. Spray key pins and saturate key bushings with dry Teflon spray. A good brand is Sprayon S00708 available from Grainger:
<http://www.grainger.com/Grainger/items/2W757>
- B. Carefully ease keys. (See **Tips** at end of instructions.)
- C. Make sure all action parts are correctly aligned and not contacting their neighbors during any part of the keystroke.
- D. Check hammer swings. An efficient way to do this is to lift all the hammers in one section (bass, tenor, treble) and using a straight edge evenly and gently push the hammers towards the rest position until they begin to fall. Note which hammer falls first, then remove the flange and check the swings. It should swing between 7 and 9 times. If it swings more than about 9 times, re-pin the flange. Continue this process until the fastest falling hammer swings no faster than 9 times. Follow the same procedure noting which hammer falls last. Again check swings, lubricating those that swing less than 7 times. A good lubricant is Goose Juice available from Mother Goose Tools:
<http://www.mothersgoosetools.com/lubricants/index.shtml>. Another good lubricant is a mixture of one teaspoon of Ballistol in one pint of ethanol. Lubricating usually corrects for small friction problems. Flanges that swing less than 5 may require burnishing or re-pinning. We recommend Don Manino's Flange Bushing Broach Kit available from Schaff (Catalog #220), or Joe Goss style from Mother Goose Tools:
http://www.mothersgoosetools.com/other_tools/center_pin_kit.shtml. Continue this process of checking hammer centers until the slowest falling keys are swinging at least 6 or 7 times (5 is acceptable in top treble).

5. **Re-measure** down and up weights.

6. **Fine tune friction** on any notes that differ 3 grams more or less than the average line. **Always re-check key easing before making any other changes.** If friction persists after correcting hammer centers, check for other sources such as tight wippen or high friction between jack and knuckle.

7. **Re-measure and enter downs and ups** for any notes where corrections to friction have been made.

8. **Determine optimum downweight target.** Examine the target upweights (light green dots). Low upweight (less than 20g) results in sluggish note return. Excess upweight (more than about 30g) results in the perception of heavy touch. Manipulate the target downweight line using the boxes in the Target section to the left of the graph. You will note the upweights change accordingly. We recommend the European style of a tapered down weight line that results in upweights approximately in the 20-30g range and more or less level from bass to treble. This will result in a tapered down weight that is from 4 to 8 grams heavier in the bass (54g in the bass tapering to 48g in the treble is typical). When you have selected the target downweight line you are ready to begin the key weight change process.

9. **Weigh each key,** using the Weightbench *table* provided in your kit. The digital *scale* can be moved to fit under the end of the key. The key rest *block* (the small square with black tubing installed) sits on the scale. The higher tube of the block sits under the played end of the white key so that the keytop edge (face) is lined up with the edge of the block. The sharp rests on the lower tube of the block with the tube positioned between the key and the mortise. Leave the block in the same position for both whites and sharps. (For pianos with tapered length keys, move the block to line up with the edge of the white keys as the keys get shorter. The sharps will automatically be correctly positioned.)

A. Turn on the digital scale, wait for it to register 0, set it for grams, and again tare it to 0 with the key rest block in place on the scale.

B. Starting with key #1, place the key on the balance pin of the *tower* with the played end resting on the block on the scale as described above.

C. Record the weight (grams) in the program in the fifth column from the left, current key weight (up/down icon). The sixth column (plus & minus icon) shows the amount and direction of weight change needed to meet the target.

D. The seventh column shows the key weight goal. Using the sample lead weights placed on the top of the key, adjust the weight of the key to meet the target.

- Remove existing weights as needed, using a punch with the key over a device that prevents splitting out the hole. Larger weights can replace the weights removed.
- Add or remove weights as needed, marking the side of the key with a pencil, indicating the size of weight to be installed.
- To lighten a key a weight may be added on the capstan end of the key if necessary.

Note: We recommend a minimum of two leads in each key to hold keys down during hard play. Treble keys often have no weights—weights can be added to both sides of the balance rail if needed to achieve the target.

10. **Drill keys.** Using a drill press, drill the keys using the appropriate size Forstner bit. Set the drill stop so the tip of the bit just punctures the other side of the key. Turn the key over and insert the tip in the puncture to cleanly drill out the hole. A jig to support the key around the hole is necessary to avoid splitting.

11, **Install weights.** Install the leads in each key on a hard surface such as an anvil. Use a spreading punch to secure the lead in the hole without splitting the key. Note: Be sure the spreading punch spreads the lead weight along the long axis of the key – not across the grain!

12. **Re-weigh the key on the scale to check for accuracy.** Accuracy of $\pm 2g$ is acceptable on the weighted key. This difference from note to note cannot be discerned by pianists during play. Make any necessary corrections.

13. **Take final measure of up and down weights (optional).** The before and after graphs are an excellent record of the improvement made to the action performance.

This completes the key weighting process.

Tips

Measuring initial down and up weight measurement before friction work is optional. We suggest doing it for at least the first few times the program is used, to become familiar with how it the program functions. The before and after graphs are a nice visual aid to show your customer, as they quantify the effect of the work you've done to the action.

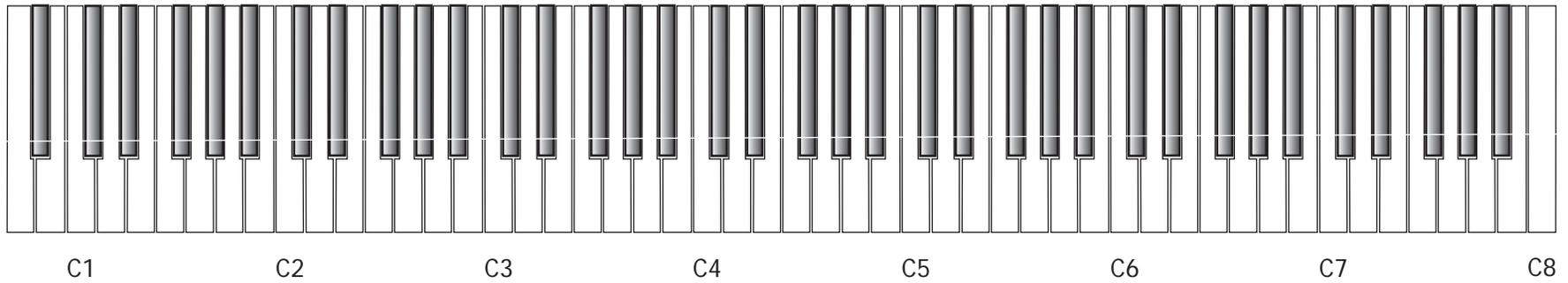
For optimum “silky” feel of touch we suggest replacing front and balance rail key bushings in most Asian made pianos, including new pianos, with high quality German felt.

For a simpler graph, click on Settings/Program Settings, and click on the Display tab. Downweight, Upweight and Balance Weight do not need to be displayed to determine optimum target downweight. Unclick to remove them from the graph.

Further information:

Visit this website for operating tips, answers to Frequently Asked Questions, and a PDF of the most current Instructions: <http://www.mypianotech.com/WB/>

Check the website periodically for changes and additional usage tips.



These keyboard drawings provide a quick visual assessment of your piano's touchweight. The highlighter marks on the white keys show where a 70 gram assessment weight exactly balances the downweight for that key.

The white line which runs across the drawing marks the center position for the 70 gram assessment weight for traditional downweighting found on many of the world's finest instruments. The line position in the bass corresponds to 52 grams, while the line position in the treble corresponds to 48 grams.

