# Installing a New Upright Action into an Old Piano

## Considerations:

- Upright Actions are much easier to install than grand actions
    - However, most technicians are better at grand actions
- Because of money, efficiency is important
- The tools that make a factory efficient are usually not readily available
- WNG has created a set of installation tools that solve this problem
- The WNG upright action is set up for dowel capstans. On a really tall upright, this can be a problem.

For WNG to create a new action, you need to create a scale stick.

A scale stick is a representation of the spacing of the notes and brackets in an action. In the case of a damper action (for grands), the spacing of the notes and tray flanges on the damper flange rail.

The name comes from days when a piano factory would mark this information on an actual piece of wood. A literal stick “of wood” is no longer required or even desirable. A strip of mylar or even heavy paper can be made to work.

Today, most factories will put the spacing into numbers and represent it in a CAD drawing.

A scale stick provides the information required for WNG to drill and machine the action rails.

## Scale Stick Basic Concepts

- The spacing of notes / strings at the strike line is NOT the spacing of the note in the action.
    - Related, Yes. But not the same.
- WNG Actions require a minimum spacing of 12.2 mm between note centers.
- Sections are not necessarily evenly spaced
    - Sometimes Yes, Sometimes No.
- Before investing a lot of time and effort, you should determine whether your action meets the 12.2 mm minimum spacing requirement.
- Measure the distance between the first and last notes in each section. Divide the distance by the number of notes in the section minus 1. (if there are 26 notes, divide the

distance by 25). This calculates the inherent distance between notes. If the result is less than 12.2 mm, then the WNG action will not work.

- It may be possible to stretch a section to achieve the required spacing if you are also replacing the keyboard. If this is the case, contact us to determine the feasibility.

## How to take a scale stick from a wooden action rail.

## The Scale Stick Kit

WNG provides a scale stick kit with all the materials needed for your action or damper action.

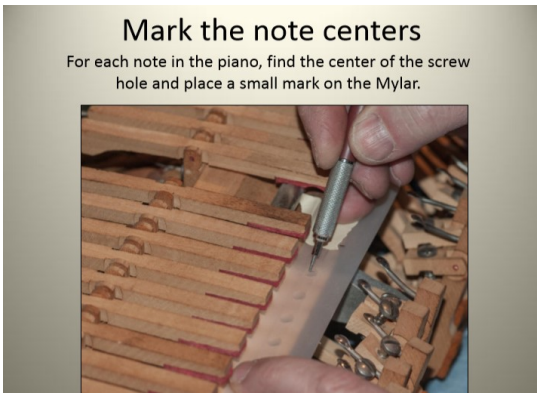
Scale Stick Kit

The kit includes the following:

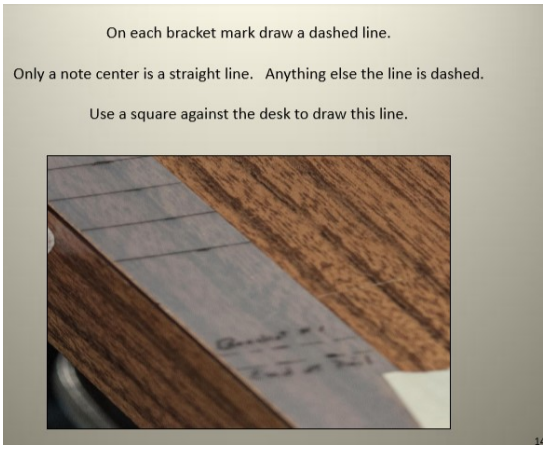
- Several strips of mylar, 25 mm (1”) wide
    - Mylar is dimensionally stable as humidity changes and is easy to work with. One side is coated so that a pencil can write on it.
- A mechanical pencil with the correct lead for mylar.
- A small square.

Using the Scale Stick Kit. (wooden action rail)

- Remove all the whippens from the whippen rail
- Tape the mylar strip to the action rail
    - Allign the strip to the edge of the action rail.
    - Allow 6’ on the bass end for labeling.
    - Mark the centers of each action bracket
    - If there is an offset bracket in the bass, the scale stick will be modified to take this into account. This will be explained later.
    - For each note, mark the center of each screw hole (flange centers)

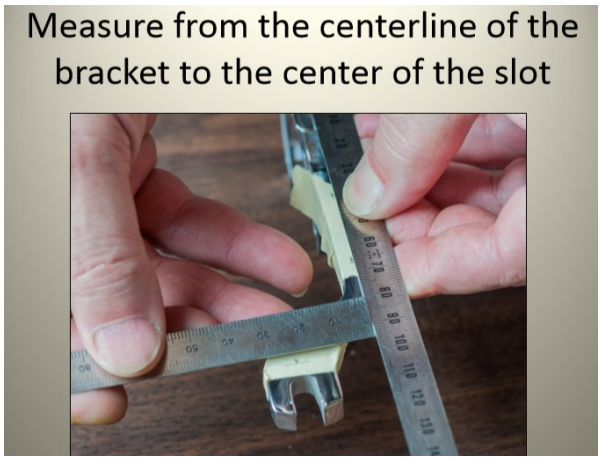




- Remove the mylar strip from the action and lay it on a table with a square edge.
    - Tape the Mylar to the table so that the edge of the mylar aligns with the front of the table.

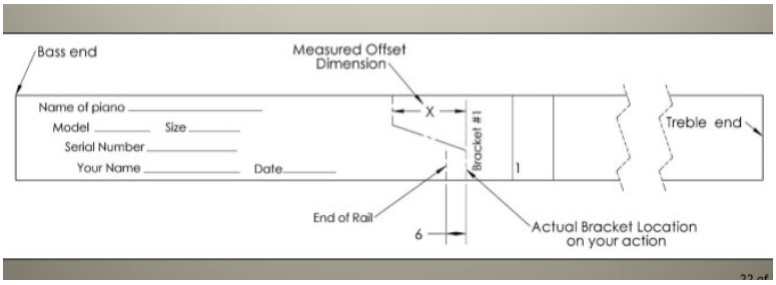




    - Use a square against the edge of the table and draw a dashed line across the mylar for each action bracket.
    - Measure 6 mm out from the bass and treble brackets to represent the ends of the rail. Draw a dashed line for each end and label them "end of rail – bass" and "end of rail – treble" respectively.
    - Draw a solid line for each note center.
    - Number the first and last notes of each section.

- **Offset Brackets**
    - For pianos that have and offset bracket, measure the distant from the center of the offset section to the center of the bracket.




    - Mark this distance on the mylar.
    - WNG will adjust the position of the bracket and lengthen the rail if necessary to align with the offset portion.
    - Number each bracket from left to right. (bass to treble)
- **Label the Scale Stick**
    - Write your name and the date on the scale stick
    - Write the name, model and serial number of the piano.




- Send the scale stick to:

    WNG
    Attention: Mark Burgett
    4111 North Freeway Blvd
    Sacramento, CA 95834

**Taking a scale stick from a piano with tubular action rails (Steinway) is the same process with the following exceptions:**

- The mylar strip will not lay flat on the rail because rails are soldered to the action brackets. Cut notches in the mylar at each bracket location so that the mylar strip can lay flat against the rail.


Notch Mylar strip to clear brackets

- After marking the strip for the bracket and note locations, tape the strip to the edge of the table. Lay a fresh mylar strip on top of the strip that has been marked and tape it to the table.
- Use a square to transfer the markings to the new strip. This will make for a stiffer strip so there is less chance for errors.

**Send the completed scale stick to WNG.**

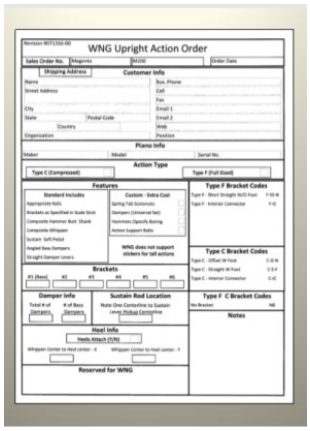
## Consider Even Spacing

- When your action was designed, some of the sections were evenly spaced.

- During the manufacture of the rail and your subsequent extraction of a scale stick, small errors will have occurred. Because of this, the note spacing on the scale stick you send us will be subtly different than the original.
- On a tight scale, because of the random nature of these deviations, the distance from one note to the other could fall below WNG mandatory minimums.
- When WNG receives a scale stick, each section will be evaluated for even spacing. If even spacing is not reasonable, WNG will go 100% from your scale stick.
- If even spacing is sensible for a particular section,
    - WNG will use the first and last notes from that section of your scale stick and evenly space the notes between.
    - If you plan to replace the keyboard, you will need the action scale stick from WNG to supply to your key maker.
    - WNG will gladly provide a copy of the final scale stick upon request.

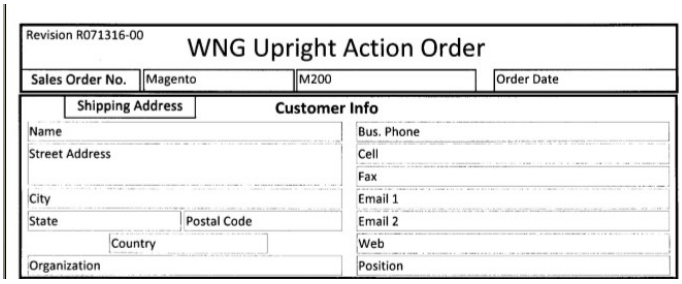
## How To Order an Action

- Complete the Upright Action Order Form.




    - The top section of the form is for WNG use.

- Fill in the “Customer Info” section.



Revision R071316-00

WNG Upright Action Order

| Sales Order No. | Magento | M200 | Order Date |
|---|---|---|---|

| Shipping Address | Customer Info |
|---|---|
| Name | Bus. Phone |
| Street Address | Cell |
| | Fax |
| City | Email 1 |
| State / Postal Code | Email 2 |
| Country | Web |
| Organization | Position |

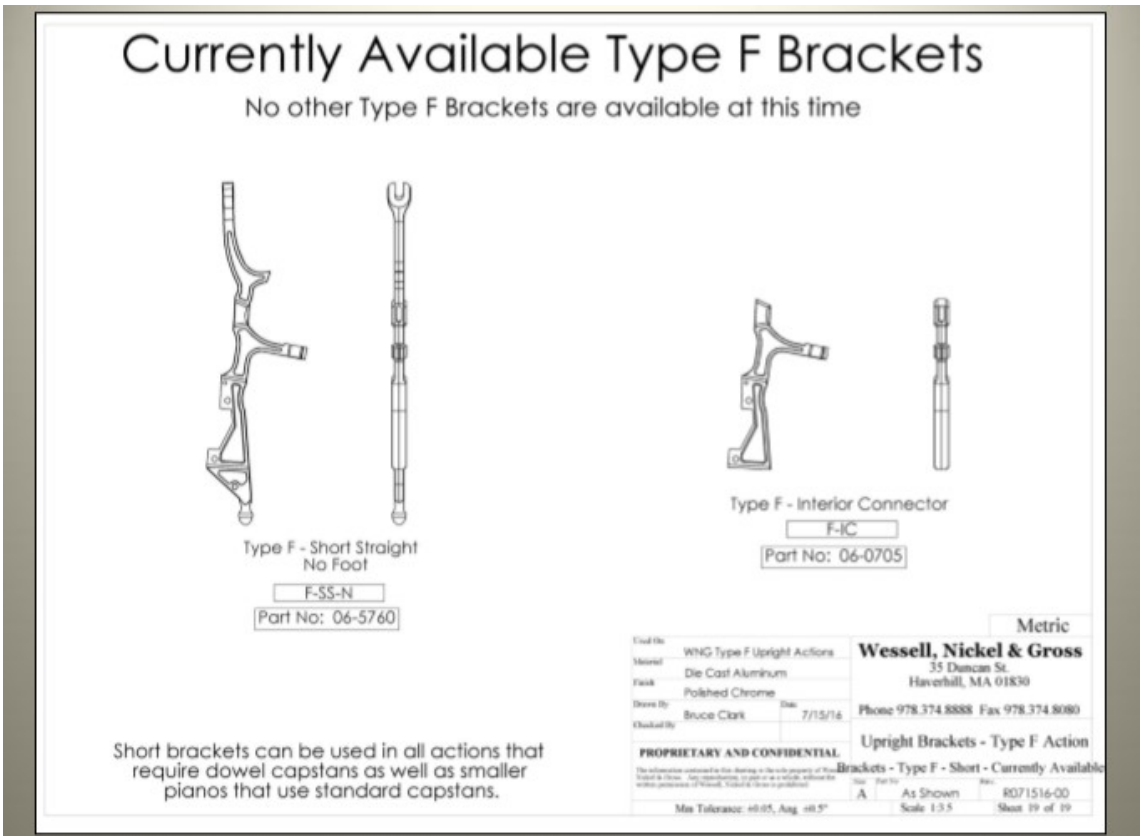
- Piano Info section – If WNG already has a scale for the same model of piano, a scale stick will not be necessary.

## About WNG Action Types

- WNG makes two types of upright actions
  - Type F
    - The type F WNG upright action uses the full sized action rail and jack as well as full sized action brackets.
    - This action is used in any upright piano with sufficient vertical room to accommodate it.
  - Type C
    - The Type C WNG upright action uses the compressed action rail and jack as well as compressed action brackets.
    - This action is used in upright pianos that are too small to accommodate a full sized action. A type C action will likely work in piano down to 42” (about 107 cm).

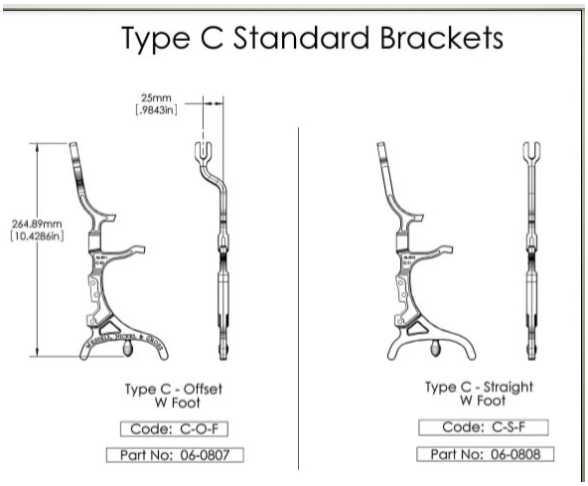
## Type F Bracket Types

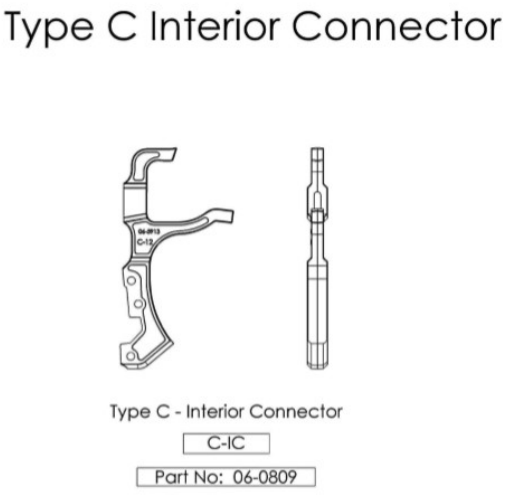
- Currently there are two types of F brackets available
    - **Short Straight**: These brackets can be used anywhere in an action. The center of the top action bolt hole is on the centerline of the bracket
    - **Interior connector**: These brackets can be used in pianos that do not use a top action bolt in the low treble.




## Type C Action Bracket Types

- **Straight:** These brackets can be used anywhere in an action. The center of the top action bolt hole is on the centerline of the bracket.
- **Offset:** These brackets are used for actions that require extra space in the bass. The center of the top action bolt hole is offset 25 mm toward the bass from the centerline of the bracket.
- **Interior connector:** These brackets can be used in pianos that do not use a top action bolt in the low treble.
- **Bottom Style:** All type C action brackets (except Interior connector) have a foot that allows the action to stand on its own on a bench.




## Bracket Identification

WNG uses a code to identify the various bracket types. The format is as follows:

- X-XX-X
    - The first section indicates the action type
        - F= full sized action (F-XX-X)
        - C= compressed action (C-X-X)
    - The second section indicates the bracket style.
        - S = Short Straight (F-SS-X)
        - O = Short Offset (C-O-X)
    - The third section indicates the bottom style of the bracket
        - N = No foot (F-S-N)
        - F = With foot (C-S-F)

**Example: F-SS-N**; indicates a full sized action, short straight bracket (no offset), and no foot.

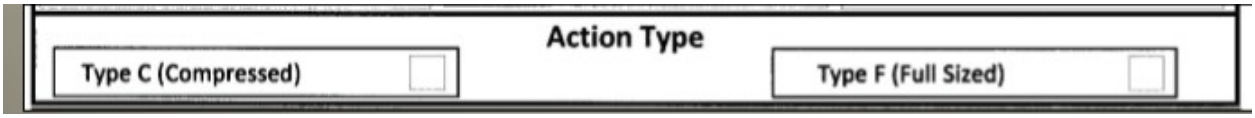
There are two types of interior connectors:

F-IC = Full sized interior connector

C-IC = Compressed interior connector.

## Select Action Type

- Select type “C” for console pianos that are around 42” tall ( 106 cm).
- Select type “F” actions for upright pianos that are more than 42”.

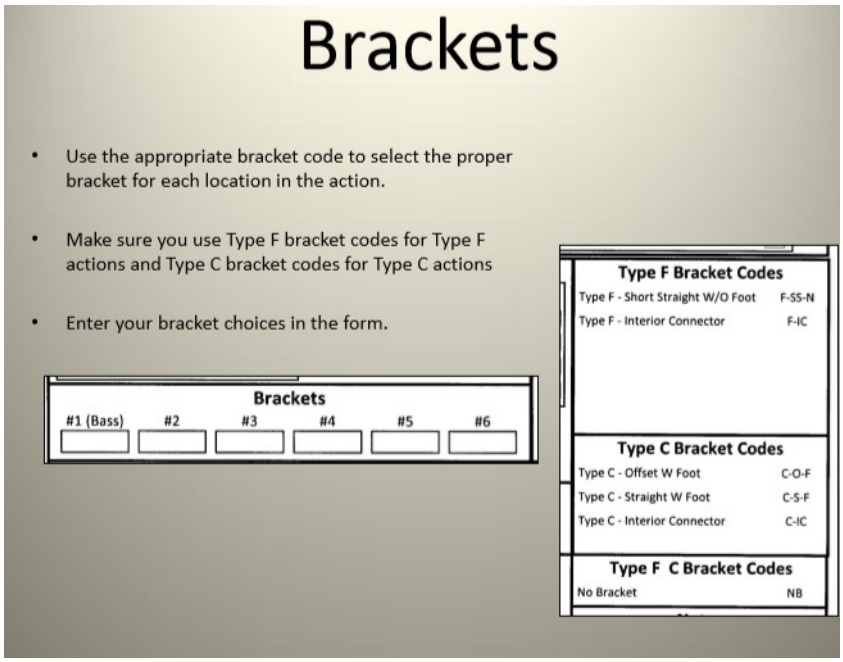



## Features

- Some features are standard
    - Appropriate rails
    - Brackets as specified on scale stick
    - Composite hammer butt & shank
    - Composite Whippen
    - Sustain & Soft pedals
    - Angled bass damper levers
    - Straight treble damper levers
- Some features are extra cost options.
    - Spring tab sostenuto
    - Dampers (universal Set)
    - WNG hammers (Specify boring)
- Some features are not yet available

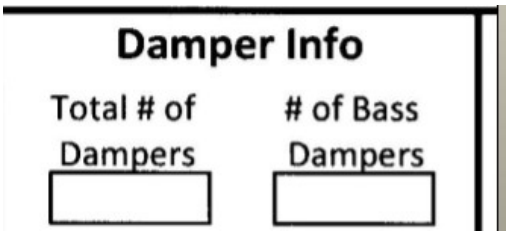
## Brackets

- Use the proper bracket code to select the brackets for each location in the action
- Use “F” type brackets for full sized action.
- Use “C” type brackets for compressed actions
- Enter the bracket choices on the order form.




## Damper Information

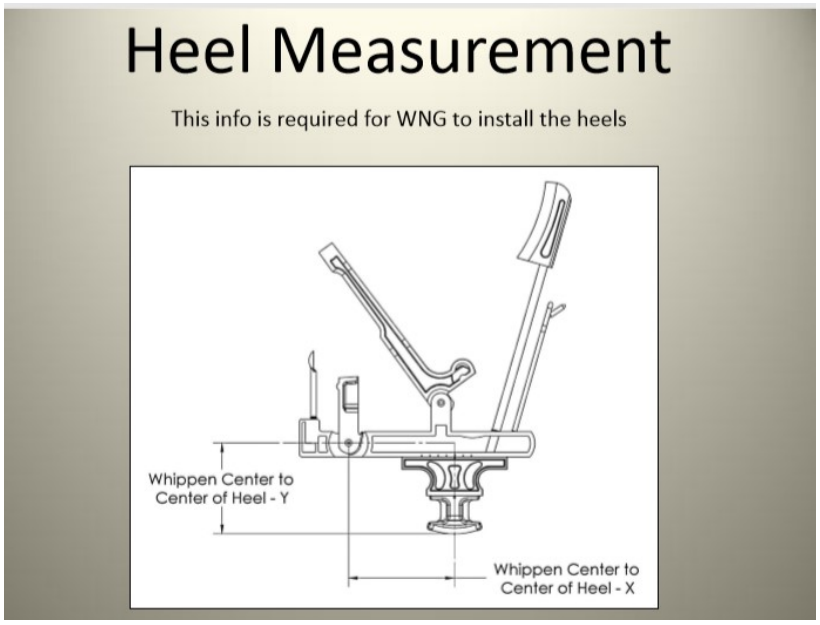
- WNG has a universal Damper sets that will cover virtually all upright actions
- For rail drilling purposes, WNG will need to know:
    - Total number of dampers in the action.
    - Total number of bass dampers.
    - Enter the numbers on the order form.




## Heel Measurements

- Measure the position and height of the heels from the old action
    - Measure from the center pin of the whippen flange horizontally to the center of the heel. This is the “X” axis and is used to determine the fore and aft position of the heel

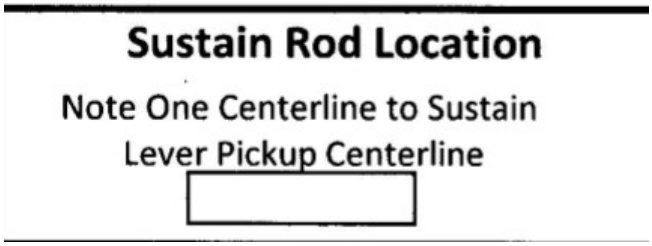
- Measure from the center pin of the whippen flange vertically to the bottom of the heel. This is the “Y” axis and is used to determine the height of the heel. To make this easier to measure, draw a line on the whippen body that is the same level as the flange center pin. Then measure straight down from the line to the tip of the heel.
- Enter the “X” and “Y” measurements on the order form.
- Note whether you want WNG to attach the heels. If you will be attaching the heels, then the “X” measurement is not necessary.




**Note:** WNG does not support sticker type actions but it may be possible to convert the action to a dowel capstan type. You will need to determine the best heel position and height based on the half stroke point of the heel and the capstan.

## Sustain Rod Location

- For the sustain lifter rod to align properly with the old pedal rods, WNG needs to know the measurement from the note #1 to the center of the pedal rod lifter arm.
- Note whether pedal lifter rod is on the bass or treble end. If the lifter rod is on the treble end, the measurement should be from note 88.




# Notes

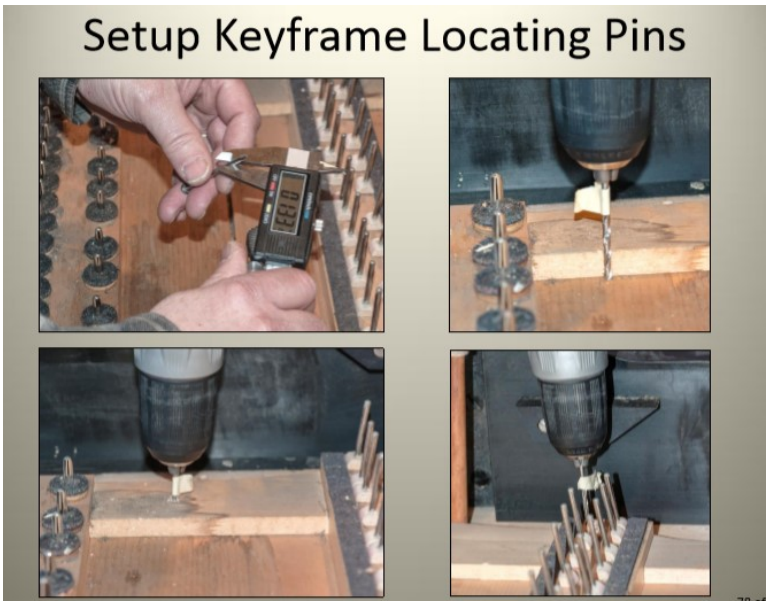
- Anything else you might want to tell us that is not covered by the form can be written in the "Notes" section.

## Tear Down

- Remove case parts.
- Remove the old action.
- Remove the keys from the keyframe.
- Clean up keyframe and keybed.

- Setup keyframe locating pins.
    - Get two balance rail key pins (Nails will also work).
    - Use a drill bit that is the same diameter as the key pins
    - Drill two holes, one at the bass end and one at the treble end, through the keyframe into the keybed.

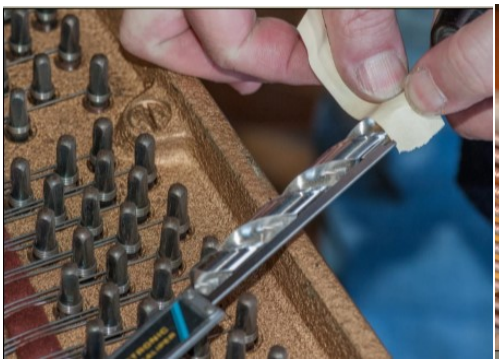
- Insert the key pins into the holes so that they bottom out in the keybed.




- Remove the keyframe.

- Remove the top action bolts.
- Remove action bracket support bolts
- Remove any other case parts.
- Plug the old top action bolt holes
  - Use ½" fluted dowels, 4" long.

  - Drill out the old bolts holes using a drill bit that is slightly larger than the dowel.
    - Drill to the depth of the old action bolt holes
    - Mark the drill bit for the depth of the holes



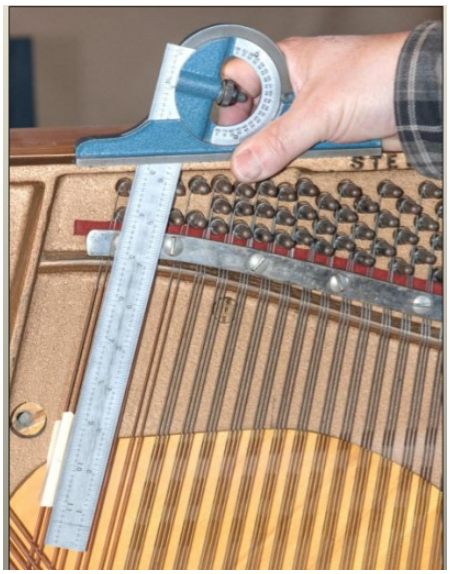

- Blow excess sawdust out of the holes

- Cut the dowel ¼" (6 mm) shorter than the depth of the holes.
- Use an upright tilter to tilt the piano onto its back.
- Use "West System" (or similar) epoxy
- Pour epoxy into the holes about ½" deep.
- Use a smaller dowel to swab the insides of the holes with epoxy.
- Swab some epoxy on the sides of the fluted dowels.
- Tap the fluted dowels into the holes so that the dowels are flush with the surrounding wood. (not the plate)



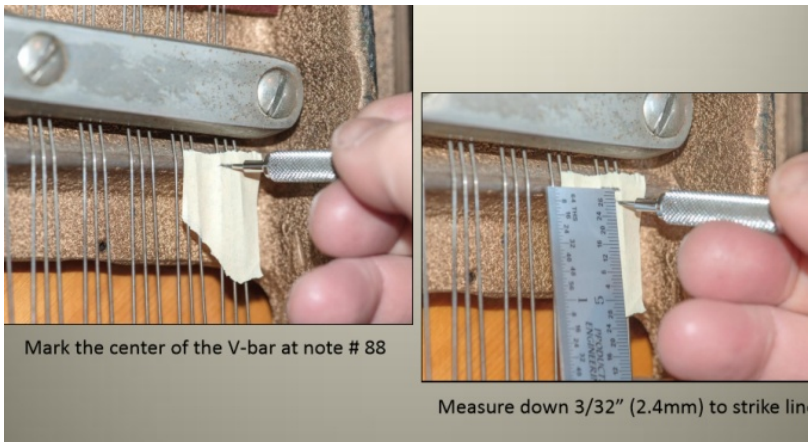
## Preparing For Action Installation

- Measure string angles for hammer boring.



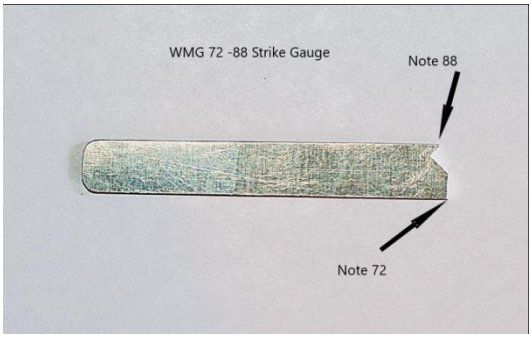
- Or use hammer angles from the old action if they are  acceptable

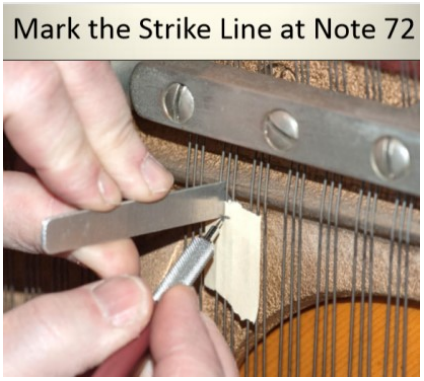
- Mark strike line at note 88
  - Put a piece of masking tape on the strings at note 88.
  - Mark the tape at the center of the “V” bar.
  - Mark the Strike point at 3/32” (2.4 mm) from center of “V” bar.



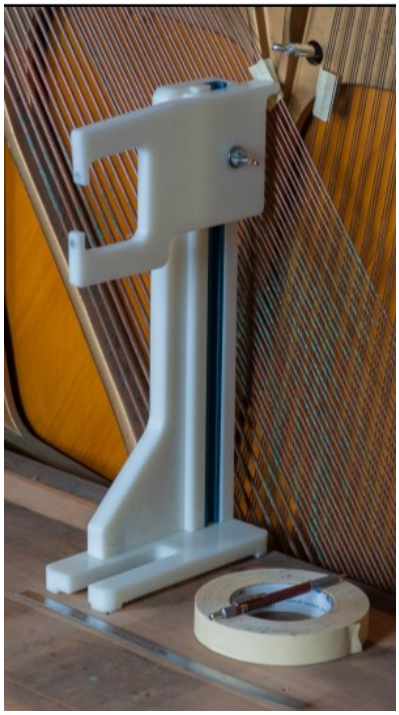

- Mark strike line for note 72.
  - Put a piece of masking tape on note 72
  - Mark the center of the “V” bar.
  - Mark the strike point at 3/8” (9.5 mm) from the center of the “V” bar.

**Note: WNG has a 72-88 strike gauge that makes these measurements easier. (included with WNG vertical installation tools.)**




- Mark strike line for each end of the bass section and the 1st note of the tenor section.
    - Set one of the action jacks from the WNG installation tools at the same height as the strike point at note 72.
    - Use this to mark the strike points at the ends of the bass section and the 1st note of the tenor section.

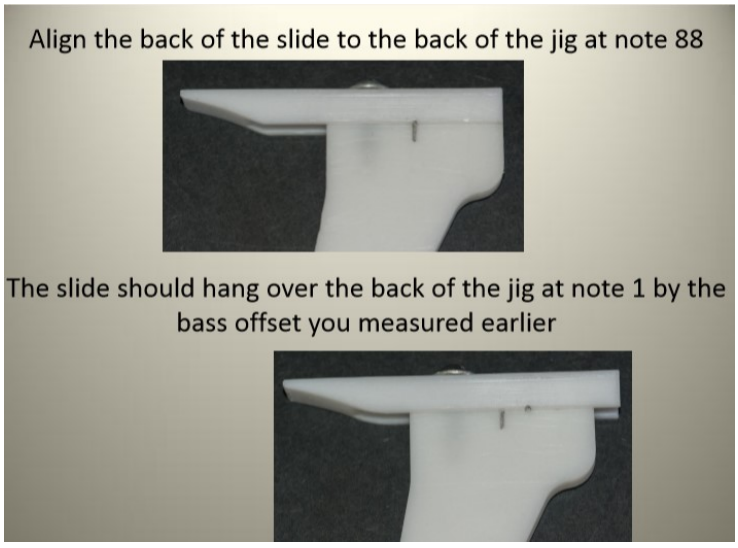


**Note: In some pianos, the lower end of the tenor section has an upswing of the strike line in order to provide clearance between the hammers and the dampers in that area. You will need to take this into account.**

- Measure the Bass Offset
    - Measure the height difference between the last note of the bass section and the 1st note of the tenor section at the strike line.

## Position The Action

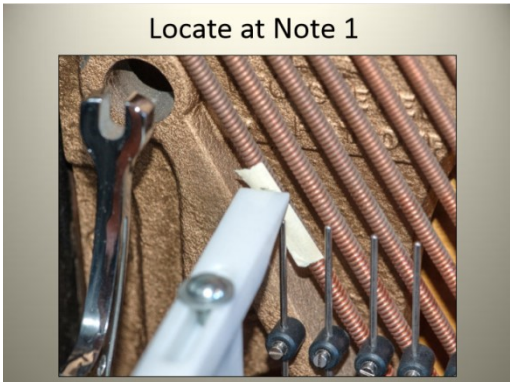
- Remove the hammer rest rail and set it aside.
- Remove the whippens and hammer butts from notes 1 and 88.
    - Install the strike location jigs on notes 1 & 88.
    - Adjust the slide on note 88 so that the back of the slide is flush with the back of the jig.
    - Adjust the slide on note 1 the amount of the bass/tenor offset. For example: If the offset is 5/16”, the slide should overhang the back of the jig by 5/16”



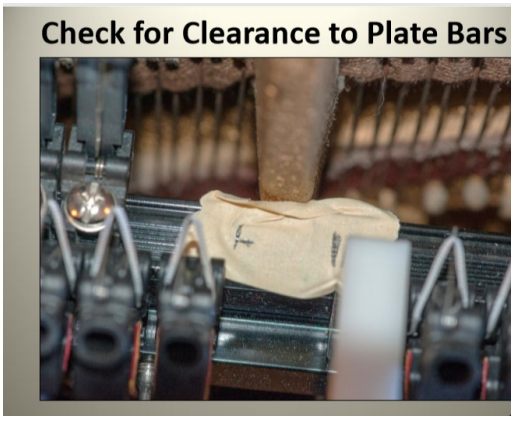
- Remove the whippen and hammer butts from a note near the bass/tenor break and near the middle of the treble section.
    - Install the two action height jigs onto the action where these were removed.
    - Slide the action jacks onto the height jigs.
    - Slide the action towards the strings until the strike line jigs are touching the strings at notes 1 and 88.



    - Adjust the action height to match the strike line marks on notes 1 and 88.
    - Slide the action side to side so that jig at note 88 aligns with the center string of note 88.
    - Check the side to side alignment at note 1.

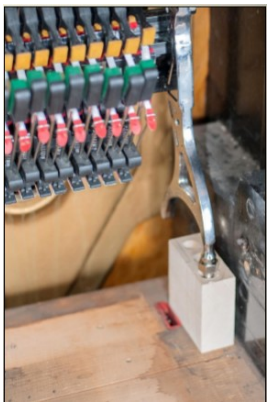


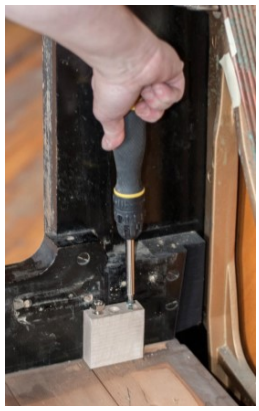

- Check for clearance to plate struts.
    - Some pianos have plate struts that may interfere with the main action rail.
    - Trim the action rail to fit around the plate strut if necessary




## Mounting The Action

- Prepare the action support blocks with cup bolts. Make enough to match the number of action brackets in the action. (interior connectors do not need support blocks)
    - The height of the blocks should be about ½" to ¾" below the bottom of each action bracket. This will allow enough space to adjust the cup bolts up or down.
- Use the position of the action to determine the location of the support blocks.
    - Place the support blocks under the bass and treble action brackets.
    - Adjust the cup bolts so that the ball ends of the brackets fit neatly into the cup bolts.
    - Glue and screw the support blocks to the keybed.
    - Use the same procedure for the interior support blocks, but check for clearance to the keys at the break areas. Sand the blocks to provide adequate clearance.



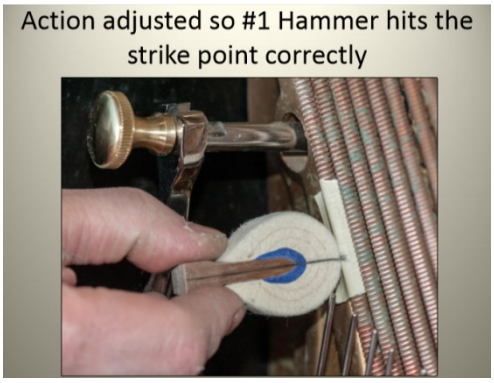


- Measure the top shoulder bolt height.
    - With the action still mounted on the location jig, measure the distance between the plate and the action brackets at the point  where they connect with the shoulder bolts.
    - Mark this distance on the shoulder bolts with masking tape.
    - Mark the depth required for drilling on a long ¼" drill bit.
    - Make it slightly deeper than the depth required for the bolt.
        - Make sure this will not drill through the back of the piano.
    - Use the action bracket as a guide for drilling the correct angle for the shoulder bolt.
        - In some cases it may be necessary to drill a new hole in the plate for proper alignment.




    - Remove the action and follow with a 5/16" drill bit.
        - Drill to the same depth as the previous hole
    - Screw the shoulder bolts in to the proper depth
        - Grind a flat spot on the point of the threads. This will help cut threads into the wood for easier installation.
        - It also helps to rub some bees wax on the threads for lubrication.

- Install Action
    - Remove action jacks and strike location jigs.
    - Place action brackets into the cup bolts and snap action onto the top action bolts.
    - Bend bolts sided to side as necessary to match the action brackets.
    - Adjust final height of action.
        - Take a shanked hammer for note #1 and note #88 and insert them in the correct hammer butts. (shanks must be cut to length)
        - Rotate each hammer to the strings and check them for the correct strike point.
        - Adjust the action cup bolts up or down as necessary.
        - Re-check both ends to make sure action is at the proper height.
        - If action needs to go lower, adjust internal cup bolt first, then use the outer cup bolts to make final adjustments. Then re-adjust the internal cup bolts.



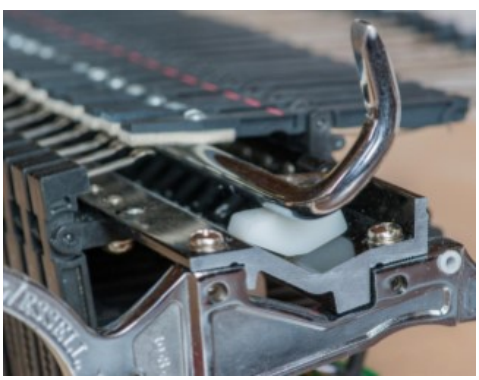
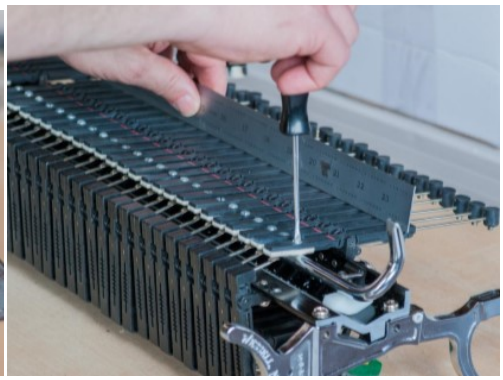

    - Bend top bolts up or down as necessary so that there is some downward pressure on the action brackets.
        - Use a pipe or a wrench to bend the bolts.
        - The action should snap into place with hand pressure only and without the use of tools.
    - Install the brass cap nuts on the top action bolts.


## Install Dampers

At this point, the hammers should be shanked and cut to length. This is necessary so that the dampers can be fit properly under the hammers. You will use sample hammers to ensure that there is proper clearance for the dampers. DO NOT INSTALL THE HAMMERS UNTIL THE DAMPERS HAVE BEEN INSTALLED.

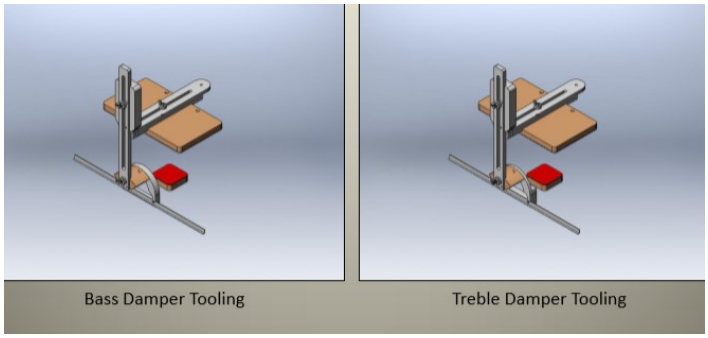
For your convenience, WNG provides shanked hammers that are cut to length. This is an optional service to make the installation of hammers easier. WNG has tools and fixtures that are well suited for this purpose.

- Align damper levers on sustain rod.
    - Remove the action from the piano and Set it on a work bench.
    - Block the sustain pickup lever so that all damper levers are being lifted by the sustain rod.
        - WNG provides a block in the tool kit for this purpose
    - Adjust the screws on the front of the damper levers to align the tops of the damper levers in a straight line.
    - This is an important adjustment for proper damper installation.
    - This is especially important when the optional sostenuto system is installed. The sostenuto cannot be adjusted properly if the damper levers are not in alignment.

- Remove the block from the sustain pickup lever.
- Put the action back in the piano.

- Move all dowels to the top of the wires.
- Setup and adjust the sustain pedal.
- Set up damper installation jig for the bass section.
  - Get sample dampers for the first and last notes in the bass section
  - Get the first and last hammers for the bass section (shank must be cut to length).
  - Put number 1 hammer into the hammer butt. (Do not glue it).
  - Place number 1 damper on the string so that there is about 1/8" clearance below the hammer.
  - Move the damper dowel down the wire and fasten so that it is the correct height with the damper. (Do not glue it).
  - Do the same with the last note in the bass section.
  - Remove the sample hammers and dampers.
  - Step on the sustain pedal to lift the damper dowels away from the strings.
  - Place the bass damper installation jig on top of the piano so that the damper guides hang in front of the strings.





Note: It may be necessary to cut the aluminum rail to match the length of the bass section.

- Adjust the jig front to back so that the jig rests against the strings
- Adjust the height of the jig so that the two damper dowel samples set earlier rest on the aluminum guide rail.
- Adjust the angle of the guide rail so that both samples contact the rail.
- Tighten all the adjusting screws on the jig to lock it in place.
- Loosen the screws on all the damper dowels in the section (including the samples) and lower them to rest on the aluminum rail.
- Use a wire bender to bend each damper wire so that the dowels are centered on the proper string unisons. (start with the highest note in the bass section).
    - Make sure the dowels maintain contact with the aluminum rail.


- Tighten the screws on the damper dowels making sure the dowels are square with the aluminum rail.
- Trim the wires flush with the damper dowels.


- Do a rough damper lift adjustment for the dampers in the bass section.

- Lower the damper jig slightly so the damper dowels will not drag on the aluminum rail of the jig.
- Use the wood blocks included in the tools to support the ends of the aluminum rail and prevent it from flexing.
- Operate the sustain pedal repeatedly and bend each damper wire so that they all lift off the jig at the same time


- Setup damper installation jig for treble section.
- Use the same procedure to set the damper dowels in the treble sections making sure there is adequate clearance under the hammers.
    - The treble jig is not long enough to span the entire treble damper section so you will have to do the tenor and high treble separately.
    - In some pianos, the first few notes of damper dowels are raised on the wire to provide clearance to the bass strings. So when setting the height of the jig, use the first note that is at the normal height.
    - When bending the damper wires in the tenor section, start with the first damper that is normal height.
    - When doing a rough damper lift in the tenor section, match the damper lift established in the bass section, then move to the high treble.
- Remove the damper installation tools.
- Glue Dampers
    - Use Go-2 Glue (a Loctite product) to glue dampers onto the composite dowels. (Goop or similar adhesives also work well)
    - Glue dampers to the dowels making sure the damper line is straight and level.
- Adjust final damper lift.
    - Operate the sustain pedal and bend the damper wires so that all the dampers lift at the same time.

- Make sure each damper contacts the string squarely. Make bends near the top of the wire as necessary to accomplish this.
- Re-check to be sure all dampers lift evenly.
- Check for ringing dampers and adjust as necessary.

## Install Hammers

- Re-install the hammer rest rail.
- Hammer spacing is more critical in an upright since there is little room for adjustment.
- Angled hammers should be tilted away from the bass/tenor break to minimize interference between hammers.
    - The WNG tool set includes a set of  five angle gauges for this purpose.
        - 92 degrees: For bass hammers that are angled more than 8 degrees.
        - 91 degrees: For Bass hammers that are angled 1 -7 degrees.
        - 90 degrees: For all hammers that are angled less than 1 degree.
        - 89 degrees: For tenor and treble hammers that are angled 1 – 7 degrees.
        - 88 degrees: For tenor and treble hammers that are angled more than 8 degrees.


    - For more extreme angles, it may also be necessary to taper the tails of the hammers to provide more clearance between hammers. (Usually only in the bass)
    - Hammers should be tapered only from the shank to the back of the hammer. If the entire length of the hammer is tapered, the angle gauges will not be accurate.
- WNG hammer butts use a elongated, conical shaped hole
    - In a typical wood action, the hammer shanks are tapered on the sides in order to space the hammers to the strings when they are being installed.
    - With carbon fiber tubular shanks, this is not possible.

- Instead, the hole in the hammer butt is elongated from side to side to allow for hammer spacing to the strings.

- Hammer gluing procedure.
  - Dry fit all the hammers to make sure the hammer line is level and straight.
    - If any hammer looks too high, sand a little off the bottom of the shank until the hammer level is correct.
    - If any hammer is too low, glue a piece of 1/8" dowel inside the shank tube then trim it until the hammer level is correct.
    - When all hammers look level, remove them from the action
  - Start in the bass using the appropriate angle gauge.
    - Make sure the hammers are angled away from the tenor break.
    - Make sure you have good clearance as you go.

  - Use WNG CA gel glue.

  - Put a bead of glue around the inside perimeter of the hole in the hammer butt.
  - Insert the 1st hammer into the butt.
  - Rotate the hammer forward to the string.
  - Use the angle gauge on the treble side of the hammer to set the angle.
  - Move the hammer side to side until it is centered on the string unison.
  - Carefully rotate the hammer back to the rest rail and let the glue set.
  - Move to the next hammer and proceed until all hammers have been glued.
  - Recheck previously glued hammers to make sure they have not moved.
  - Remember to transition to the appropriate angle gauges as you move from angled hammers to straight hammers.


- Let glue set at least 30 minutes.

- Set Blow Distance
  - Adjust the hammer rail to achieve the correct blow distance by adjusting the screws on the action brackets.
- Set Let-off
  - Lift each whippen with your finger to move the hammer toward the strings
  - Adjust let-off regulating screw to achieve 1/8” let-off from strings
- Adjust spoons for damper lift.
  - Get a block of wood that is ½” the distance of the hammer stroke (about 7/8”) and about as long as a section of hammers.
  - Hold the block against the strings at the strike line using two hammers (one at each end of the block) with wedges behind the hammer shanks to hold it in place.
  - Lift each whippen to move the hammer toward the block.
  - Use a spoon bender to adjust the spoon so that when the hammer hits the wood, the damper just starts to lift.
  - Move the block to each section as necessary to adjust all the spoons.

## Keyboard

It may be necessary to modify the keys to conform to the new action. The WNG action uses dowel type capstans using a composite material screwed onto a threaded wire. The top surface of the key needs to be about 2 ¾” to 3 ¼” below the heel of the whippen. If the distance in your piano is more than 3 ½”, you may need to add a taller hardwood cap onto the key to make up the difference.

# Dowel Capstans

There are a several of options for dowel capstans:

1. Use new WNG capstans on the old wires.
    a. This may be the best option if the old wires have a spade end that is pressed into the key.
    b. Removing a spade type wire will damage the keys requiring a lot of repair work.
2. Insert new WNG capstans into the old keys.
3. Re-use the old capstans if they are in good shape.
    a. New WNG capstans are preferred since the composite material provides a very slick surface for reduced friction.

- Installing new WNG capstans on old wires
    - Remove the wood captsans from the old wires
    - Remove the new WNG capstans from their wires.
    - Install new WNG capstans
        - Install 1 or 2 samples in the piano to get an approximate height.
        - Make a jig to screw all the capstans on at the same height.
- Preparing for new WNG capstans into the old keys
    - Remove the old capstans with wire.
        - Use a ½" dowel and a pair of diagonal wire cutters.
        - Place the dowel at the base of the wire.
        - Grab the wire with the wire cutter.
        - Use the dowel as a fulcrum to lift the wire out of the key.
    - Plug the old holes with hammer shank material
        - Drill out the hole with a 7/32" bit (do not drill through the bottom of the key)
        - Glue hammer shanks into the holes
        - Trim the shanks and sand smooth.

## Re-install keyboard into the piano

- Install back rail
    - Glue new back rail cloth onto rail
- Install the key frame

    - Make sure the key frame is in the same location
        - Use the locating pins that were setup earlier when the key frame was removed.
    - Key frame should be felted.
        - Use .020 paper punching on each balance rail pin.
        - Use two .050 punchings on each front rail pin.
    - Shim the balance rail to so that the key height is slightly below the correct height.
    - Shim the front rail so that the dip is slightly more that the correct dip.
    - Tighten all screws.
- Locate hole for new dowel capstans
    - Block keys 1 and 88 to half the key dip
    - Block the hammer rest rail so the hammers are about half the hammer blow distance. (1/6" closer to the strings).
    - Locate the dowel capstan so that it is perpendicular to the key.
    - The capstan should contact the heel in the center of the cloth.
        - The whippen must be raised so that the jack is in contact with hammer butt at half stroke.
    - Mark the capstan position on keys 1 & 88.
        - Use a straight edge to draw a line across all the keys.
        - Final adjustments can be made by bending the capstan wire.
        - Drill all the keys for the new dowel capstans
- Determine the height for the dowel capstan.
    - Set the hammer rail with the hammers at the proper blow distance.
    - Set a sample key at rest position.
    - Raise the whippen so that the jack has a very slight amount of clearance to the hammer butt.
    - Measure the distance from the key to the heel cushion.
    - Mark a capstan wire with this measurement (measure down the wire from the top of the capstan).
- Set up the drill press to install the capstans.
    - Put the capstan inserter in the drill press.
        - The jaws of the chuck should be contact with the nut on the inserter tool.
    - Make sure the dowel wire will not go through the bottom of the key.
    - Push the marked capstan into the key down to the mark.
    - Set the stop on the drill press to this depth.
    - Press in all the capstans.
- Install keys into the piano
- Regulate Piano.