



Upright Piano Regulation
A Service Manual

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1. Clean the instrument

Open the lid and remove the upper panel and the fall board. Be careful removing the cabinet parts in order not to damage any parts. In order to access the keys also remove the key rail. Remove the muffler (**see picture**).



Remove the muffler.

Unscrew the action-bolt nuts from the action-bracket and take the action out of the instrument (**see picture**). Be careful not to damage the dampers with the action bolts. You must remove the pedal rods before you remove the action assembly. Slightly lift the half-blow arm in order to remove the damper rod for the left pedal. Then tilt the action towards you in order to remove the rod of the right pedal (**see picture**). Take out all the keys.

Remove all dust or dirt inside of the instrument. You can gently vacuum-clean the instrument and the action. Be careful not to bend or damage any action parts, dampers, etc. during cleaning. In order to clean the entire keyboard you might have to remove the key-strip.

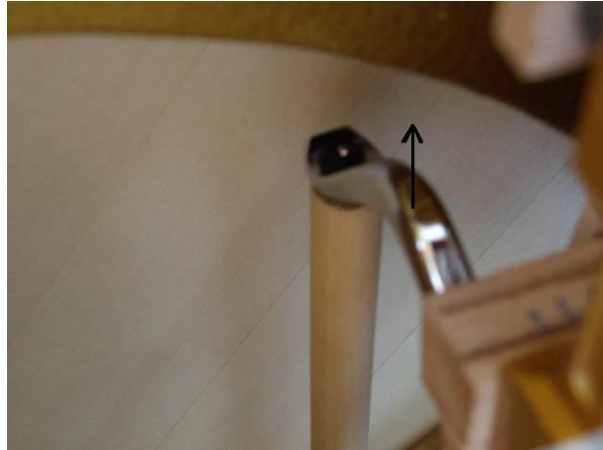
Be careful with all parts of the action. A brush can help you carefully eliminate dust there. Clean the key tops with a damp cloth. Clean the front- and balance-pins with a cloth moistened with clear spirit and treat the front pins with lubricant such as Protek. Then you can replace the keys and action back into the instrument.



unscrew the action- bolt



raise up the half-blow arm to release the pedal-rod



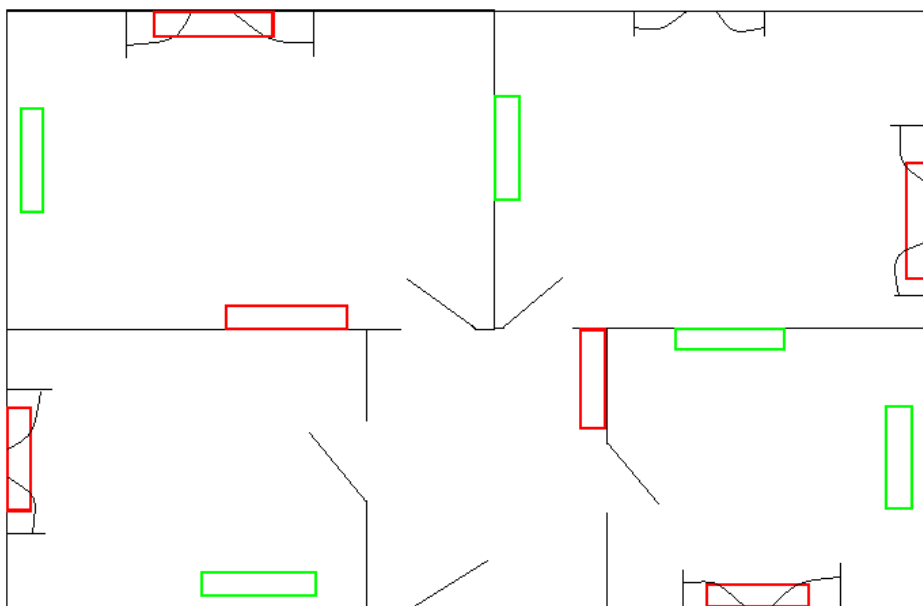
raise up the half-blow arm

2. Analyze the condition of the instrument

Before you start servicing the instrument, take the time to analyze the condition of the instrument and the action regulation as follows: check the tuning, key-dip, damper lift, let-off, pedal adjustment and function, after-touch, dampers and touch-weight.

If the regulation has changed significantly, find out whether the instrument is situated in an unfavourable environment with vast climatic changes or near a window, which is frequently opened, or exposed to draft between 2 rooms, etc.... In case the back of the instrument is located at or against an outer wall, there should be 10cm (4-5 inches) between the wall and the upright piano-back. If you know that the room has floor heating, you should protect the instrument by laying out insulating material under the instrument (you can use a mix of Styrofoam and aluminium usually used to insulate walls, cut about 30 cm wider and deeper than the instrument's dimensions) and cover it with a carpet for a better appearance. If necessary due to climate, it may be advisable to install a humidity controlling system that humidifies as well as dehumidifies. Keep in mind: drastic changes of tuning and / or regulation usually have a cause; therefore you should find and eliminate it.

Do not place your upright piano in the positions marked red, rather place it in the positions marked green (see picture).



3. Tighten all screws

It is important to tighten the screws, because they provide a stable foundation for the regulation and eliminate noise. Screws come loose due to climatic changes. Please check the screws of the action (flange screws, action rail screws) and screws at the cabinet and at the iron frame. Be careful not to over-tighten the screws.

It is advisable to align the hammers to the strings before tightening the hammer shank flange screws.

4. Check hammer-butt flange centre pins

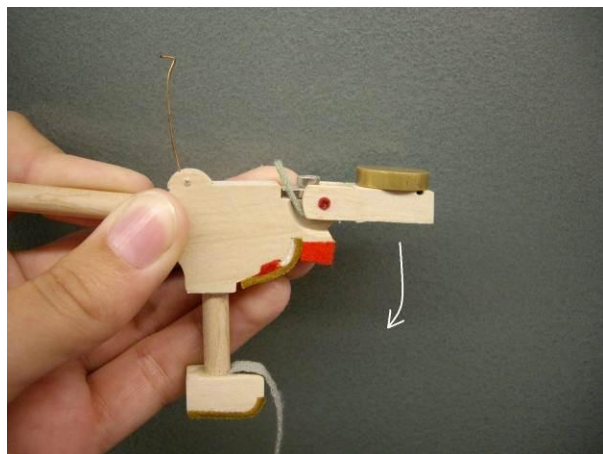
Check the centre pins of the hammer-butt flange for loose or tight pins or soft bushings. Position a finger on the hammer and move it carefully (without pressure) to the left and right (**see picture**). If the pin is loose you will feel the pin's movement within the bushing or the hammer butt.

Please note that you must be careful not to bend the pins. This procedure requires skill and experience.

Install a new centre pin when the pin is too loose. The friction of the hammer centre pin is correct, when the flange moves slowly downwards when holding the hammer-shank horizontally. When you insert a screw into the flange the flange should end in a 90° angle to the shank. If the hammer flange does not move down by a weight of 3-5g (too much friction) you can apply Protek with a syringe and needle to the centre pin, in order to reduce the friction. If this is not enough, you may have to re-pin the centre.



check the hammer centre pins



check with the weight

5. Position of wippen heel to the capstans

Check to see that the wippen heels are centred on the capstans. All wippens should be spaced equally and they should be parallel. If there are capstans which are not centred under the wippen heel felt, bend the capstan wire with the wire bending pliers. In order to move the capstan to the right, bend the wire above the key first to the right and then under the capstan to the left, always bending in both positions to align the capstans vertically (**see picture**).

Make sure that the jack is also centred to the hammer butts. If not unscrew the flange screw and adjust the wippen heel in the direction to the capstan / jack. Adjust the distances of the wippens and the wippen heels with the flange spacer (**see picture**). In the end all wippens should be spaced evenly and should be parallel. All capstans should be spaced evenly and should be parallel. The capstans should be centred to the wippen heels. The jacks should be centred to the hammer butts.



adjust the distances between the wippen heels
the flange spacer



adjust the capstans centrally under the wippen
heel



flange spacer



wire bending pliers

6. Striking distance and lost motion

Check the hammer-rest rail with a straight edge to see, if it is straight (**see picture**).). Unscrew the screws to adjust the hammer-rest rail, and gently move the rail toward you or away from you to make it straight, and tighten the screws (**see picture**).



check hammer-rest rail with
straight edge



screw of angle bracket
unscrew the screws for adjustment of hammer-rest rail



screw of middle bracket

Before checking the striking distance, run your hand gently over the keys near the capstans and check if the hammers are moving (**see picture**). Then turn the capstan button down (to the left) until no hammer is moving when you gently run over the rear part of the keys near the capstans. Please note that adjusting lost motion affects key levelling and vice versa.



run your hand over the keys



turn the capstan to left or right

The striking distance is the distance between hammer and strings, it should be 45mm \pm 2mm for the smaller models and 47mm for the bigger models (more than 1.24m height). If the distance is too great, glue a thin felt strip under rest felt (**see picture**). If the distance to the strings is too short; you could reduce the thickness of the rest felt with a hot felt burnishing tool. Gently iron the half-blow rest felt with the tool (**see picture**). Work slowly; do not iron too much at a time. Make sure that all the hammers are in one line and the striking distance is the same for each hammer. In the factory we use a jig to check this (**see picture**).

Please note that striking distance and key depth affect the after touch. With more striking distance after touch is less, provided the key depth stays the same.



Insert and glue a thin felt strip



iron the rest rail felt by using a hot tool



jig for striking distance

Check (adjust) lost-motion between the jack and the hammer butt. This is important to optimise the energy transfer. The top surface of the jack should gently contact the skin of the hammer butt. Any movement of the key should result in simultaneous movement of the wippen heel and the hammer assemblies. Tap at the front of the key and if the back checks move while the hammer does not move, turn the capstan buttons to the right / up. You can also double check this by running your hand gently over the keys just in front of the capstans. If a hammer is moving turn the capstans button to the left and control this by tapping on the key. Strike the key and have the hammer checked. Upon releasing the key slowly into rest position, the jack should re-enter underneath the hammer-butt entirely until it rests on the hammer butt cushion. If the jack does not re-enter completely, add lost motion. Adjust the distance between each hammer with the flange spacer.

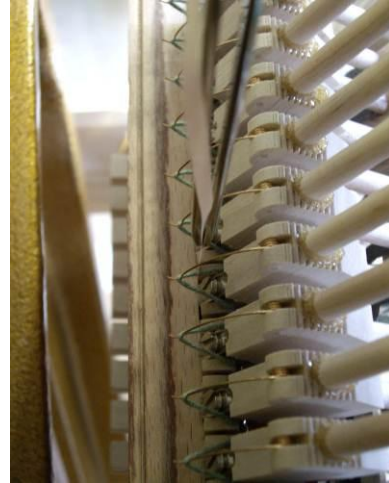
7. Hammer travelling

The hammer plane should remain constant through its path of motion.

When pushing the half-blow rest-rail with the fingers in direction to the strings, the space between the hammers should remain the same. If a hammer travels sideways unscrew the hammer-butt flange screw and glue a paper shim between the hammer-butt flange and the hammer-rail beam. Check the direction in which the hammer travels and apply paper shims on the opposite side. (If the hammer travels to the right, apply the paper on the left side). Glue the paper to the flange, not to the action rail. The angle in which the hammer travels can be adjusted by the length, thickness and placement of the paper shim (**see picture**). Please check the hammer alignment and the travelling a number of times.



Push the hammer-rest rail with fingers to the strings to check lateral movement of hammer due to flange.



Glue shimming papers between hammer-flange and hammer-rail beam

8. Hammer angling

All hammers should be vertical and parallel. Observe carefully and compare the space between each hammer. The space must remain parallel both in movement and at rest. In order to angle the hammer, heat the hammer shanks with a spirit lamp (**see picture**) and twist the hammer in the appropriate direction using the thumb and the index finger (**see picture**). Be sure that the shank is sufficiently heated. If not, the hammer shank can break or the centre pin can be warped. Pay attention not to burn or mar the shank. If there is soot on the shank, you can sand it away.



heat the hammer shank



twist the hammer in the appropriate direction

9. Hammer alignment

Align the hammer heads to the strings, so that when they are striking they should be aligned to the centre of the string group or choir. Adjust the distances between each hammer (**see picture**).



adjust the distances between each hammer

10. Key adjustment for lateral movement

All keys should have 0,2mm lateral movement at the front guiding pin and at the balance rail, when at rest and also when the key is depressed (**see picture**). Check each key by moving it from side by side, while holding the key with the thumb and index finger. Stabilise the key with the left hand at the balance pin (**see picture**). Check the front rail guide-pin. It has to be smooth, polished and free from scratches and corrosion.



check the lateral movement at the front pin
with key at rest



check the lateral movement at the front pin
with depressed key

If there is insufficient lateral movement, you can compress the front key bushing and the balance (key button) key bushings with a (heated) parallel key-easing pliers (**see picture**). If there is too much lateral movement, you can use a key bushing tightener (**see picture**). If the lateral movement is a little too much, you can needle the felt bushing. If it is excessive, you must insert a new key bushing, i.e. re-bush. Do not apply too much pressure with the key-easing pliers otherwise you will introduce too much play in the key.



compress the front key bushing with the key-easing pliers



compress the balance rail bushing



lateral movement at the balance rail button



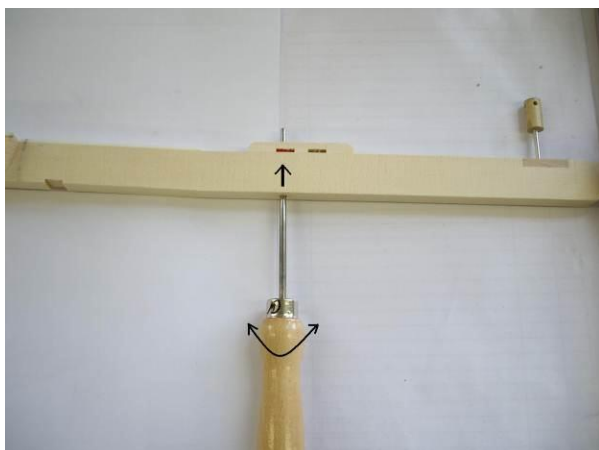
needle the balance rail bushing



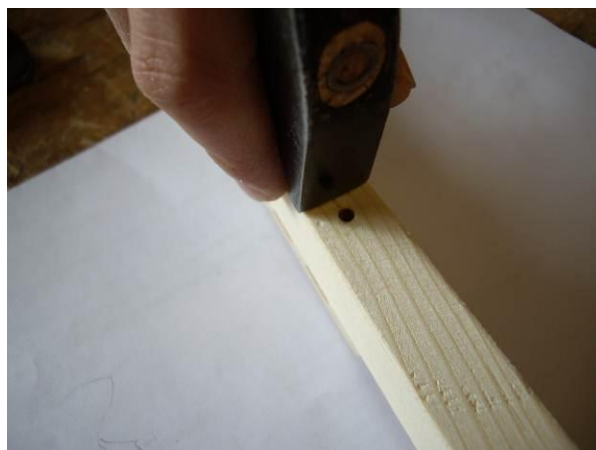
key bushing tightener, tap gently

The size of the balance pin hole must be adjusted so that the key when lifted and released returns to rest position slowly. If it is too tight, you can gently use the balance pin hole reamer (**see picture**). If the key is a little loose you can compress the hole, rub the bottom of the key for example, with a hammer (**see picture**). If it is too large, you must size the hole by applying hot, very watery glue. Then let it dry for 24 hours. In extreme cases you may have to install a new –longer- balance pin or plug the hole and re-drill it.

This work is important for the following steps in regulation. If the friction is too high (key too tight), it will not be possible to balance the key down- or up-weight or the key return.



balance pin hole reamer (use very gently so as not to remove a lot of wood)



tightened balance hole with use of a hammer

11. Hammer let-off

The hammer let-off distance is determined by the amplitude of string vibration and the movement of the action unit. The longer and thicker the string is, the higher the amplitude, the more let-off distance is required. Depress each key slowly and observe the distance between the string and the striking point of the hammer at its point of travel nearest to the string. We distinguish between pianos with felt mute and those with a variosystem / midi-system (playing with headphones). The let-off with a felt mute is 3mm from the strings whereas the let-off with the variosystem is 6 mm (depending on adjustment of the stop-rail). With both let-off adjustments, the hammer should hit the strings and fall back again, so that the repetition will function properly and the note can be repeated by the player (**see picture**).

Adjust the let-off with the jack button regulator. Adjust the let-off distance by turning the let-off button (**see picture**). By turning the button to the left (clockwise if seen from above), the let-off distance will increase (**see picture**). If the let-off is too close to the strings, the hammer might touch the vibrating strings or with the muffler engaged it will press against the muffler felt, causing the player to feel a strong resistance at let-off. If the let-off is too far away, the pianist loses contact with the hammer too early thus losing control.



Let-off distance between hammer and strings



Turn the regulating screw with the jack button regulating tool.

12. Key levelling

The white keys should be horizontal and parallel to the key-bed. Check with a ruler (straight edge) whether the top of the white keys is parallel to the ruler (**see picture**). Adjust the angle of the key surface at the balance point (**see picture**).

Make sure that the first and the last white keys are in one height. The distance from the key-bed to the surface of the white key should be 65mm \pm 1mm. Level all white keys by inserting or extracting paper washers with different thickness at the balance pin (**see picture**). The thinner paper washers should be placed on top, thicker washers below; all papers under the felt punching. Check and adjust the distance between each key with the key alignment tool at the front pin (**see picture**).



middle key surface not parallel to others



adjust the spacing at the balance pins



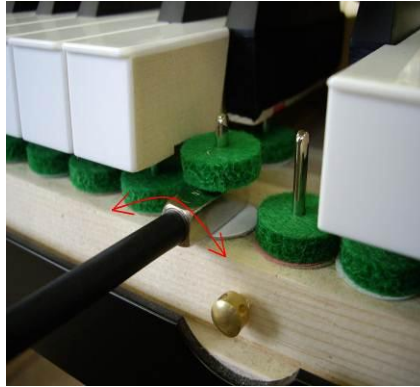
to insert or remove the different paper washers at the balance pin

The surface of the black keys should be 12mm above the surface of the white key tops (**see picture**). But before you begin to level the black keys, space them centred between the white keys at the balance point. Level the black keys with the ruler.

Please note that key depth, keyboard levelling and the after touch influence one another. So if you change the key height the other functions just mentioned will also change. Therefore check these functions keeping their relationship in mind.



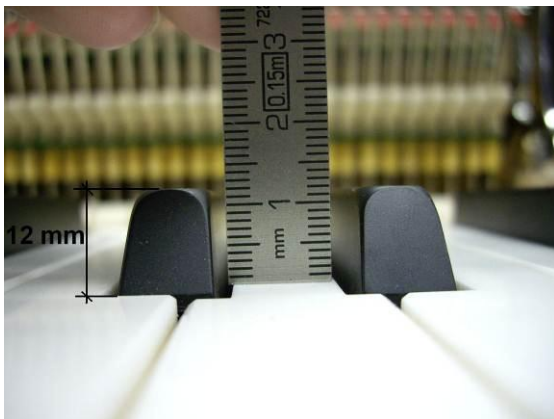
key alignment tool



adjust the distances of the keys
with the key aligning tool



different distances between the
keys must be adjusted



adjust the black key height to the white keys

13. Key depth

The key depth is 10mm (+/- 0.2mm), pianos with the vario-system have 9,8mm key depth.

Check the key depth using a touch block. Depress the touch block with the same pressure on every key and with the other hand compare the height of the touch block and the height of the adjacent key top (see picture).

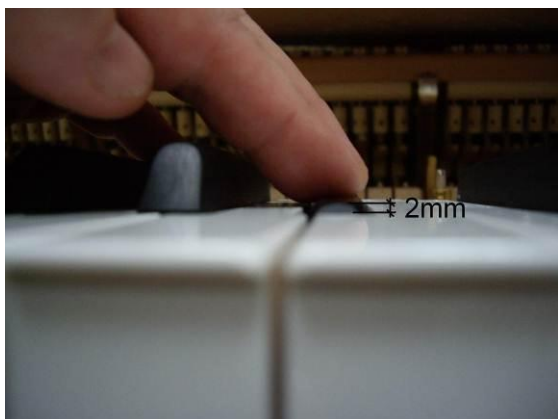
If the adjacent key higher than the key you are adjusting, insert paper washers with the respective thickness; if the adjacent key is lower, take out a paper punching. Place thinner papers on the top, just under the front felt punching, thicker papers below (see picture).

Double check the after touch. If there is not enough after touch the key depth has to be increased. Depress three adjacent keys together and compare with the fingers of the other hand to see if the height is the same. Regulate the key depth of black keys by adjusting the after touch to the same level as the white keys. When the black key is depressed it should protrude 2mm above the white keys (see picture).



jig for key depth

insert the paper washers at the front pin



black key -fully depressed- is 2mm over the white key tops

14. Back check adjustment and hammer catching

The back checks should catch the hammers as close to the strings as possible. They have to be parallel, vertical and in line with each other. Take a straight edge and adjust the back checks with flat nose pliers (**see picture**). Bend the back check wire at the top and / or at the bottom of the wire or both until the desired position (alignment) is achieved (**see picture**).

Make sure the checks do not contact the adjacent back checks.



adjust the back check with the straight edge



bend the back check to the back stop

Strike the white keys and adjust the back checks to catch the hammers 15mm from the strings (**see picture**). Push or pull the back check carefully with your finger in the right position (**see picture**). Then adjust the back check of the black keys to the back checks of the white keys. Strike the black keys together with the adjacent white keys. If the hammer of the black key is nearer to the strings than the hammers of the white keys, reduce the key depth of the black keys by inserting a paper punching. If the hammers of the white keys are nearer to the strings, extract a paper punching from underneath the black key. Make sure that the hammer heads are in one line, when you depress adjacent keys. That means that the hammers are checked at the same time by the back checks. Re-check by comparing the after-touch of each key. It should be the same for each key (**see picture**).



checked key 15mm before the strings



push the back check to desired position



adjust the black keys according to the white keys



The hammer (of the black key) in the middle is nearer to the strings than the adjacent hammers (white keys). You have to reduce key depth by inserting paper punching.



left picture: position of the back check when hammer is caught

15. Damper regulation

Make sure that there is enough lost motion between the damper lifting rod and the damper lever cloth. Never bend the damper wire when the damper felt is in contact with the strings. Use the regulating tool; lift the damper felt from the strings and then bend the wire. The dampers should be centred on the strings and parallel to them. The wedge felts of dampers must travel into the strings perfectly centred,

damping both adjacent strings at the same time (**see picture**). Dampers should be spaced equally, i.e. so the distances between the dampers should be the same. The felts have to be parallel to the strings. When the dampers lift earlier at either the upper or lower end, bend the damper wire accordingly above the damper arm and under the damper button (**see picture**).

Please note: bending the wires affects damper lift both at the spoon as well as at the rod.

Be sure that the longitudinal direction of the dampers is parallel to the strings and is centred to the group of strings; damper lift must be consistent for all dampers and keys (**see picture**).



position and distances between the dampers



felt touches the right string first, not centred



bending the damper wire for adjustment parallel to the strings



bend the damper wires for parallel adjustment to the strings



Check if all the dampers mute their respective string groups. You may have to gently tap the individual string closer to the damper (**see picture**), or check if the damper-spring force is strong enough to mute the strings.



adjust gently tap the string spacing

Make sure the damper adjustment at the pedal allows the damper to follow the string for 2-3mm when you push the strings towards the soundboard (**see picture**).



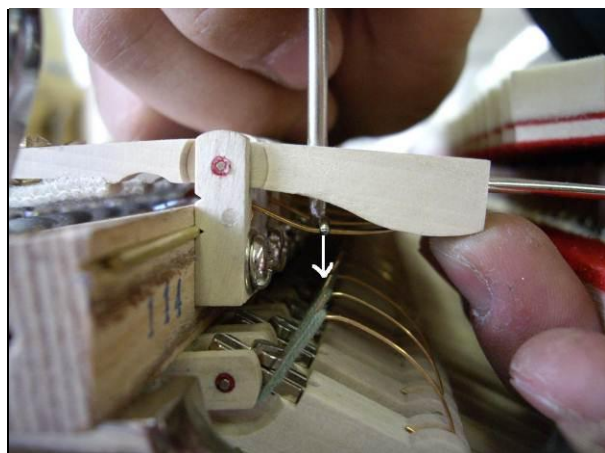
Pushing the strings, the dampers have to follow for 2-3mm. If they do not, re-adjust the pedal-rod or check the force of the damper spring.

Here is a list of the force for the damper spring:

	bass	middle	treble
smaller models to 120cm	45-50g	40-45g	30-35g
taller models from 124cm to Concert 8	40-45g	35-40g	25-30g



check the force of the damper spring



expand the force of the damper spring

16. Damper lift with pedal

All the dampers have to lift from the strings at the same time. To adjust the lift of the dampers, depress the right pedal. If one lifts very early, bend the damper wire in the same way as when adjusting the damper felt, parallel to the strings. Bend the wire under the damper in the direction of the strings and back at the lower part of the wire. Double check the damper function and its alignment. Small adjustments can be made by turning the damper-lift regulating-screw. When turning the screw down, the damper lifts earlier and by turning up or out, it will lift later (**see picture**). To check if all dampers lift at the same time, look from the top over all the dampers. If the treble dampers lift slightly earlier, it is acceptable.



adjust the damper-lift with the damper-lift regulating-screw

17. Damper lift at half blow

Upon pressing down the keys the dampers must lift when the hammer has travelled 23mm from the rest position (**see picture**). Push the key slowly down and check when the damper starts to lift. While depressing adjacent keys, the dampers should lift simultaneously, they all should lift when the hammer is at the same distance from the strings. (**see picture**). To adjust the dampers to lift earlier, bend the damper spoon in direction of the strings and for a later lift bend away from the strings. Make sure that the spoons are centered to the damper lever.

Note: while bending the spoon, steady the wippen by either holding the respective hammer at the rest position or by holding the wippen itself.



damper begins to lift at this moment



damper lift



dampers and hammers are aligned



bending of the spoons



steady the hammer

18. Bridle-tape and damper stop rail adjustment

Adjust the bridle wire sideways. The bridle straps should not touch the back check wire. If it touches, rubbing can generate noise and abrasion of the bridle-tape (**see picture**). The distance between the bridle-tape and the back check wire should be 1mm. Make sure that the bridle wire does not touch the adjacent back check wire when you play.

Push the half-blow-rest rail back and forth. All the bridle-tapes should follow and lift the wippens after the half-blow-rest rail moved 13-15 mm (**see picture**). Bend the bridle-tape wire in direction of the strings, if the wippens move too early (**see picture**) and vice versa.



aligned bridle strap-tapes: Make sure 1mm space is between back check wire and bridle strap.



bridle-tapes follow half-blow-rest rail after moving 13 -15mm



bending the bridle wire

19. Damper stop rail adjustment

Depress the first key of any section of the piano. Then pull the damper towards the stop rail. The allowed movement of the damper should be 2 mm, when the key is fully depressed (**see picture**).



2mm distance between damper and damper stop rail (when key is depressed)

20. Pedal adjustment

Damper pedal:
(right pedal)

This adjustment is made at the nut-and-bolt assembly on the damper pedal (**see picture nr.1**). While depressing adjacent keys, the dampers should lift simultaneously, they all should lift when the hammer is at the same distance from the strings. (**see picture**). To adjust the dampers to lift earlier, bend the damper spoon in direction of the strings and for a later lift bend away from the strings. Make sure that the spoons are centered to the damper lever. Check whether the damper-stop rail has been set to a 2mm clearance between the damper wires and the stop rail when the keys are fully depressed.

Mute pedal:
(middle pedal)

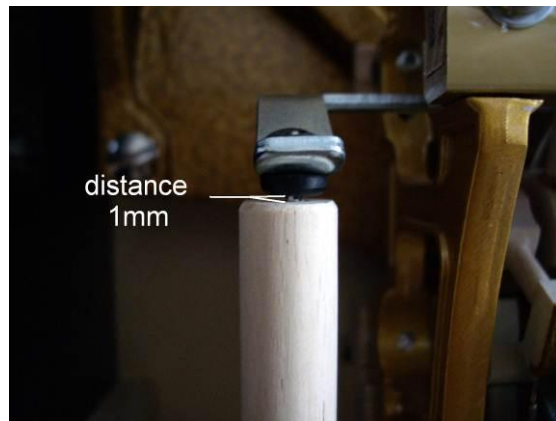
When you depress the middle pedal, the hammers hit the felt, which acts as a muffler between the hammer and strings, before hitting the strings. The hammer should hit the felt about 10 mm from its lower edge. (**see picture nr.4**). You can change the height of the rail by turning the screw of the lever mounted underneath the key bed clockwise, the muting rail will then move downwards (**see picture nr. 2**).

Soft pedal:
(left pedal)

There has to be 1-3 mm distance between the pedal-rod and the half blow lever (**see picture nr.1**). The rail should move the hammers towards the strings for about 12 mm. You can adjust it by turning the screw accordingly (**see picture nr.2**).



picture nr.1: pedal-rail nuts



picture nr.3: distance between pedal rod and rod-lever



picture nr.2: adjust screw of mute rail



picture nr. 4:hammer hit the muting-felt at this level

21. Touch – weight

The touch-weight is the resistance which the pianist needs to overcome in order to press the key down. The piano technician refers to it as “weight” or the down weight (**see picture**). Touch-weight is defined by the down-weight or the energy to press the key down and the up-weight, the energy the key needs to return to its rest position. Before measuring touch-weight, lift all dampers. The spoon must not touch the dampers. You can achieve this by simply pressing the sustain pedal or by placing a wedge under the damper-rod. Here is a list with the touch-weights:

	bass	middle	treble
down-weight	55g +/- 3g	55g +/- 3g	50g +/- 3g
up-weight	30g +/- 4g		

The difference of the down and up weight is defined by the friction in the action.

The weight is balanced in the factory with key-leads inserted individually in the keys. If there is too much friction in any of the action parts, than check the points where you can manipulate friction. Start at the jack/hammer-butt cloth, hammer-centre pin, capstan / wippen heel and/or the wippen centre pin. You can apply Protek CLP on the centre pins with an injection needle, in order to reduce friction there. To reduce friction between the jacks and hammer butt cloth use Teflon-powder applied with either a small brush or a piece of wood coated with leather (e.g. a wooden treble tuning wedge for upright pianos).



check the down weight (please refer to chart)



check the up weight (please refer to chart)

Frequently, customers request alterations to the touch weight of their pianos wanting lighter or heavier touch. Some requests of this nature can be satisfied by changes to regulation standards. It is seldom necessary to add extra lead weights to the keys.

Changing regulation dimensions affects the touch weight sensation. For example, a change of 5 mm in damper engagement (faster or slower) will have considerable effect for the player on the touch weight. The amount of hammer striking distance and key depth also influence touch sensation.

Please note that with any adjustment made to the regulation specifications to change touch weight discretion must be used. Changing from the standard can result in problems in the function of the action such as double hitting hammers or other malfunctions.

22. Regulating specifications for upright pianos

- hammer-butt flange centre pins: → The hammer flange should fall down by a weight of 3-5g
- striking distance: → The striking distance of the smaller models is 45mm +/- 2mm and 47mm for the bigger models with more than 1.24m height.
- key adjustment for lateral movement: → 0,2mm lateral movement at the front guiding pin and at the balance rail
- hammer let-off: → The let-off with a felt mute is 3mm and with the variosystem is 6mm.
- key levelling: → The height of the white keys are from the key-bottom 64mm and from the lock-rail 20mm +/- 2mm.
→ The surface of the black keys are 12mm above the surface of the white keys.
- key depth: → The key depth is 10mm +/- 0,2 and instruments with a variosystem have 9,8mm key depth
→ When the black key is depressed it should protrude 2mm above the white keys.
- damper spring adjustment: → The force of the damper spring is from 45-50g in the bass section to 30-35g in the treble section for the models to 1.20m height. The instruments with a height of 1.24m have a force in the bass section of 40-45g decreasing to 25-30g in the treble section.
- damper lift at half blow: → The damper must lift, when the hammer has travelled 23mm from the rest position.
- bridle-tape adjustment: → The distance between the bridle-tape and the back check wire has to be 1mm. The bridle-tapes have to follow the half-blow-rest rail after moving 13-15mm.
- damper stop rail adjustment: → The allowed movement of the damper should be 2mm, when the key is fully depressed.
- pedale:
- damper pedal: → The rod should lift the dampers just as far as the spoon lifts the damper , when the key is fully depressed.
 - mute pedal: → The hammer should hit the felt about 10mm from the lower end of the felt.
 - soft pedal: → There has to be 1-3mm between the pedal rod and the half-blow lever.
→ The rail should move the hammers towards the strings for about 12mm.
- touch weight: → The up-weight is 30g +/- 4g. The down-weight is in the bass section 55g +/- 3g and decreasing to 50 +/- 3g in the treble section.