PETROF
PIANOS SINCE 1864

Service Technicians Manual

UPRIGHT PIANOS MECHANISM REGULATION

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1. General

1.1 Upright Pianos Storage Conditions at Shops and at Customers

Conditions of upright pianos storage at shops, at customers (in apartments), or possibly in recording studios should be identical. Upright pianos must be located in sufficient distance from the windows, from heaters, so that moisture occurring when the window is open and the radiating heat from heaters does not act directly on the instrument. Instruments are capable of fulfilling their function well in an environment where they are stored and used, provided that the temperature and humidity conditions pursuant to Table 1 are observed:

Table 1.

Environment temperature °C	Minimum relative air humidity %	Minimum absolute wood moisture %	Maximum relative air humidity %	Maximum absolute wood moisture %
10	30	6,6	55	10.7
15	31	6,5	56	10.6
20	32	6.5	28	10.7
25	34	6.5	60	10.8
30	35	6.5	62	10.8

1.2 Tuning of Upright Pianos

Tuning of upright pianos is performed according to the chamber A^1 frequency – 440 Hz. Tuning using the small or large temperament is performed.

Table 2. Large temperament in the range D sharp - A^1

1	2	3	4	5	6	7	8	9	10
A^1	A	E^1	E	H	F sharp^1	F sharp	C sharp^1	G sharp^1	G sharp
		3-1	4-2	5-3	6-2	7-5	8-6	9-3	10-8
						7-3	8-2	9-6	10-4
							4-2-8	5-3-9	10-6
11	12	13	14	15	16	17	18	19	
D sharp^1	D sharp	A sharp	F^1	F	C^1	G^1	G	D^1	
11-9	12-10	13-11	14-1	15-13	15-2-16	16-3-17	18-16	2-19	
5-11	12-7	13-7	8-14	15-2	12-10-18	16-11-17	18-5	19-17	
5-7-11	12-8	13-8	10-8-14	15-10	16-14		12-18	19-6	
		13-9		15-11	10-16-9		18-13-11	18-5-19	
								15-13-19	

Table 3. Small temperament I in the range A - A^1

1	2	3	4	5	6	7	8	9	10	11	12	13
A^1	A	E^1	F	F sharp^1	C sharp^1	G sharp^1	D sharp^1	A sharp	F^1	C^1	G^1	D^1
	2-1	3-1	4-3	5-1	6-2	3-7	8-7	9-8	1-10	10-11	11-12	12-13
		3-2		5-2	2-6-3	6-7	8-4	6-9	9-10	2-10	1-3-10	13-2
						6-3-7	8-4-7	5-9-6	8-10-7	10-3		1-13
						4-3-7				1-10		
										1-10-1		

Table 4. Small temperament II in the range F - E^1

1	2	3	4	5	6	7	8	9	10	11	12	13
A^1	A	D^1	C	C^1	F	A sharp	D sharp^1	G sharp	C sharp^1	F sharp^1	H	E^1
	2-1	3-1	5-4	6-5	1-6	7-8	8-1	13-9	10-2	11-1	2-13	13-1
		3-2	5-13	2-6	7-6	7-10	8-12	10-9	2-10-13	11-2		13-2
				6-13	10-6	11-7-10	8-12-1	10-13-9				
				1-6				12-13-9				

2. Upright Piano Mechanism Regulation

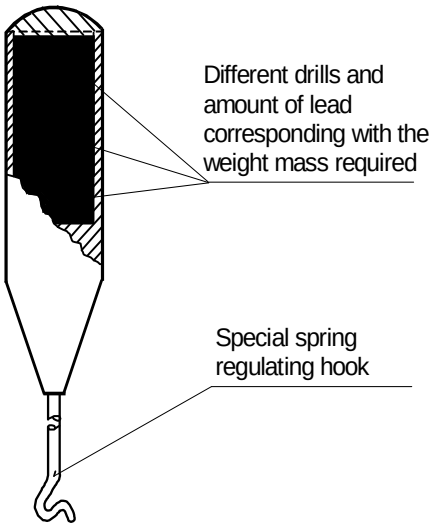
Piano must stand in place 2 – 3 weeks before the regulation. Moisture of wooden parts must be steady in accordance to local climatic conditions.
Before adjusting the mechanism, the upper panel, the fallboard with the fallboard holder and the name-board are dismantled from the upright piano.

2.1 Damper Springs Balancing

Damper springs balancing shall be done when the action is removed from the piano and lies on the hammer rest rail.

Balancing of damper springs is performed by a special balancing weight with a hook - Fig. 1. Bass dampers including the first 6 pcs of the middle section shall be balanced using the 80 g weight; the 70 g weight shall be used from the first flat middle section damper towards the descant. The last twenty descant dampers shall be balanced using the 55 g weight. Continuous gradation must be performed between separate balanced damper sections.

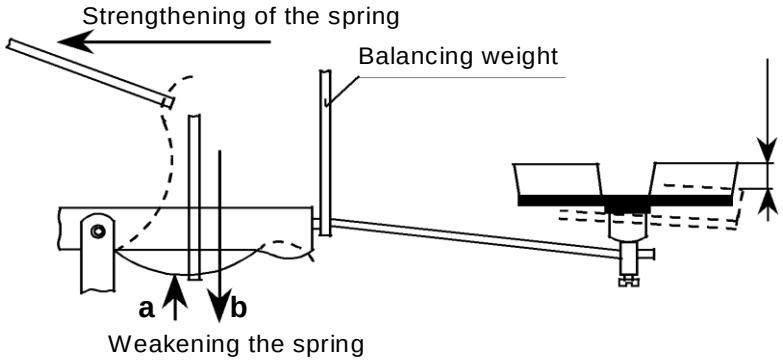
Figure 1 Weights for damper springs balancing of the mass 55 g, 70 g and 80 g



Description of the damper springs balancing

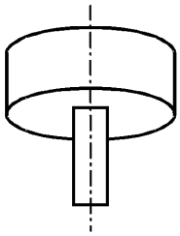
The appropriate balancing weight is placed onto the damper wire, closely near by the wooden part of the damper lever, in the perpendicular position to the damper wire. Properly sprang damper spring allows for going down of the glued damper caused by the appropriate weight mass by ca 5 mm.
If the damper goes down in balancing by more than the ca 5 mm required, its proper springing is performed using the weight hook - Fig. 2.
If the damper does not go down in balancing by the ca 5 mm required, its proper de-springing is performed using the weight hook, namely in two ways:
a) When performing small de-springing, the weight hook is inserted from above between the damper parts and the spring arc is compressed slightly in the up direction - Fig. 2, direction a.
b) When performing intensive de-springing, the weight hook is inserted between the damper parts, the damper spring is caught and pressed in the down direction, toward action hammer butts - Fig. 2, direction b.

Figure 2 Damper balancing



2.2 Checking of Spaces between Dampers, Damping of Strings, the Upstroke and the Dampers Motion (Run)

Figure 3 Screwdriver to regulate the damper-lift regulating screws



Adjustment of spaces between dampers and alignment of the dampers onto strings in the descant and middle section is performed by bending them using the action regulating bending tool (spacer).

Appropriate necessary damping is performed by adapting the felt of the dampers or by positioning the dampers on the strings as necessary. Adjustment of the damper run - identical upstroke of the dampers is performed by regulating the damper-lift regulating screw while pressing down the right pedal at the same time. The regulation is performed using a small screwdriver to regulate the damper-lift regulating screw - Fig. 3. Upstroke of the dampers from the strings required, while pressing down the right pedal completely, is 6 - 7 mm.

2.3 Capstan Screw Height Adjustment

Adjustment of the capstan screws is performed by changing the capstans height by turning them using the capstan regulator - special pointed tool.

2.4 Releasing of Key Bottom Balance Holes and Squeezing (Pressing Out) of the Keys

The key bottom holes are released using a small, round reamer file with the maximum diameter being identical with that of the balance rail pin. To release the keys, special squeezing key bushing pliers with parallel working jaws with a small wing are used. Clearance of the balance pins (between the pin and cashmere), when inclining the given key to one side, is 0.2 mm - Fig. 4. Clearance of front rail pins in openings for the pins (between the pin and cashmere), when the given key is depressed, is 0.5 mm - Fig. 5. In case the clearance of front rail pins is bigger than prescribed, the front pin is turned as necessary by the fork key spacer. In case of openings of keys for front pins are squeezed too much (the clearance is greater than the tolerance prescribed), a repair is performed - by means of manual re-cashmereing of the opening.

Figure 4 Clearance between the balance pin and the key cashmere

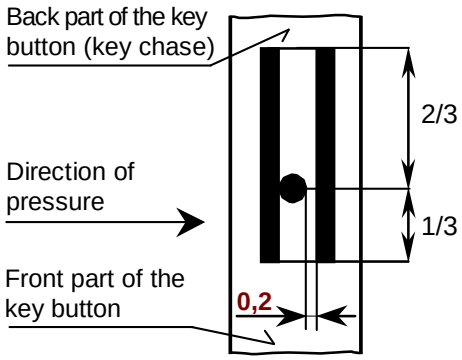
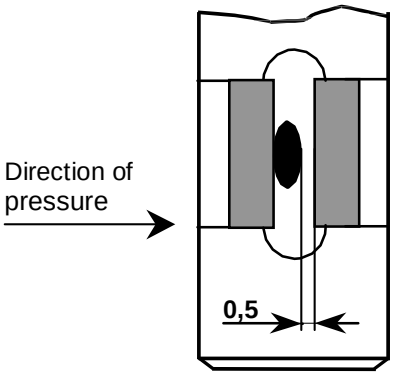


Figure 5 Clearance between the oval front rail pin and the key cashmere



2.5 Keyboard Alignment

2.5.1 Alignment of the side tilt of white keys

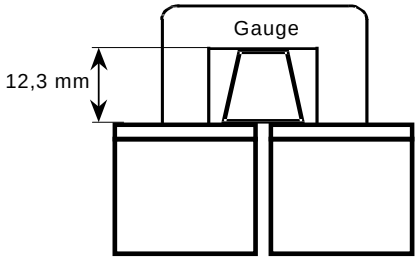
Alignment of the side tilt (“roof-like character”) of white keys is performed using a long and light wooden ruler located above the front edges of key top of the entire keyboard, by bending the balance rail pins slightly so that the upper face of key top of the white keys is parallel with the ruler applied; while doing so, it is also necessary to observe spaces between the keys, at the same time. When adjusting the side tilt of the white keys, position of the balance rail pins must be preserved on 1/3 of area towards the front part of the opening in the key button made of lime - Fig. 4.

2.5.2 Alignment (levelling) of height of white keys into the level (plane) (along the ruler)

When aligning the height of white keys into the plane, a long, thin and light wooden ruler is placed onto all white keys above the front edge of keys. Lowering of the keys into the ruler level is performed by removing paper washers from the balance rail pins, in extreme case by planing their lower surface, right in the area of key button holes for balance pins (in the length of ca 50 - 70 mm), using the "hobby" planer. Uplifting of low keys into the ruler level is performed by under laying them using paper washers (having the diameter of 12 mm) under the felt balance rail washers (punchings).

2.5.3 Alignment (levelling) of height of black keys

Figure 6 Gauge to mmeasure the black key height



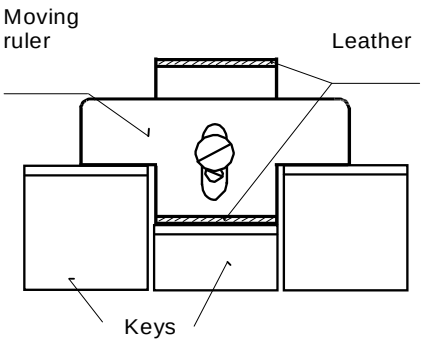
Height of the black keys (sharps) is adjusted according to the gauge - Fig. 6, which is placed on previously aligned white keys. Black keys must be found in the level of 12.3 mm ± 0.3 mm above the upper surface of the white keys top - measured on the front end of the black keys.

2.6 Alignment of Spaces between the Keys

Spaces between the keys are aligned by bending the balance and front pins using a special fork key spacer. Spaces between the keys must be identical along their entire length. Observing of spaces between the white key tops (front spaces) and at places between the capstan screws (back spaces) is most important.

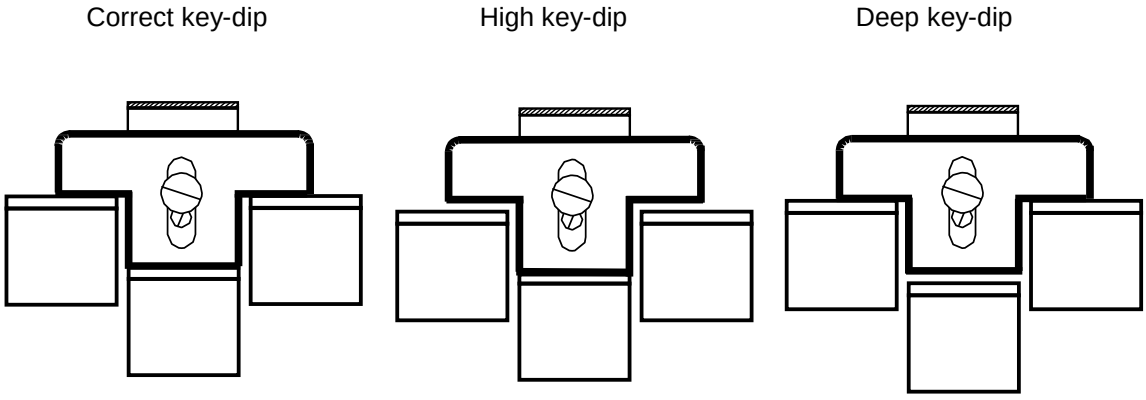
2.7 Dip of the Keys

Figure 7 Key-dip gauge



Measuring of the white keys dip is performed using a special gauge with constant weight, length, equipped with a sliding dip stick on the front side and with leather glued on its bottom surface - Fig. 7. The dip gauge is placed onto the front end of the white key, so that its back surface touches the black key (sharp). The key-dip is adjusted using paper washers, to be inserted under or removed from below the felt front rail punching. Upon pressing the white key onto the front rail washers (punchings), the height distance of its upper surface and the upper surface of the adjacent key is 10 mm + 0.5 mm.

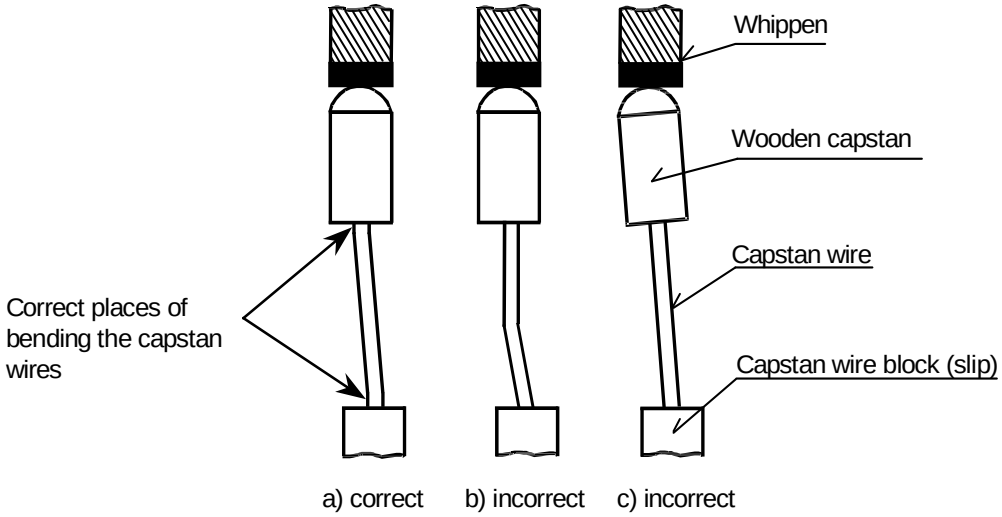
Figure 8 Key-dip measured using the dip gauge



2.8 Alignment of Capstans under the Action Whippens

In case of upright pianos of the model series 120 and 130, aligning of the wooden capstans under the action whippens is performed by their front-to-back levelling, according to the outer representative ones in every section (bass, middle, descant). Aligning of the capstans along the sides (under the whippens) is performed by their bending as necessary, by bending the
capstan wires using the special check bending pliers with lever technique, so that the spaces
between them are identical, so that they are parallel mutually, so that they form a vertical line together with the whippens, and so that they are directed precisely under the whippens aligned - Fig. 9.

Figure 9 Alignment of wooden capstans along the sides under the action whippens



2.9 Set-Off of Hammers from the Strings

Set-off (recoil) of hammers from the strings is adjusted by means of vertical regulation of set-off regulating screws, using a special set-off regulator - hollow screwdriver. The set-off distance of hammers from the strings is 4 mm in the bass section, 3 mm in the middle (tenor) section and 3 - 2.5 mm in the descant (treble) section from the left to the right.

2.10 Adjustment of the Damper Semi-Run

Adjustment of the damper semi-run is performed by bending of damper spoons of the whippens, using a special semi-run action regulator. The semi-run is adjusted in such a manner so that the damper starts to leave (lift) from the string after the corresponding hammer has overcome one haft of its distance to the string.

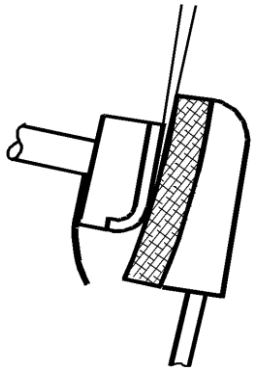
2.11 Adjustment of the Jack check-rail (Jack stop rail)

Adjustment of the jack check-rail is performed by turning the right-left regulating screws of jack check-rail in such a manner so that in case of complete pressing of key, meaning in case of the total key-dip down to 10 mm, in case of reaching the defined set-off of hammers from the strings and checking (capturing) of the hammer returning from the strings in the distance of 16 - 18 mm from the strings, clearance of 2 - 3 mm occurs between the protruded jack and the pad of the jack check rail.

2.12 Alignment of the Back Checks

The back checks must be aligned with balance-hammers (back stop, butt heel), and there must be uniform spaces between them. This can be achieved by bending the back check wires. In aligning the back checks, their mutual height level is to be checked. Bending of the back check wires is performed using the special check bending pliers with lever technique. When the balance-hammer
(back stop, butt heel) bears against the back check (viewed from the side), their mutual position must be adjusted so that their contact surfaces bear against each other completely or so that they are open imperceptibly in the wedge-shaped manner in the upper part - Fig. 10. Adjustment of bearing of the back checks against the balance-hammer (butt heel) is performed using the bending action regulator.

Figure 10 Bearing of the balance-hammer (butt heel, back stop) against the back check



2.13 Adjustment of the Hammer-check (Hammers Rebound) from the Strings

Adjustment of the hammer-check (rebound) from the strings to 16 - 18 mm is performed by making a compromise between the key-dip (by under laying or possibly removing of paper washers from below the felt punchings at oval front-pins of the keyboard), between imperceptible deflecting of the back check from the line (from the back checks level), between the hammer-check of the hammers from the strings and between the capstan screw height adjustment, while impact is laid on the correct key-dip.

2.14 The Bridle-tape (Bridle-strap) Clearance

The Bridle-tape clearance is adjusted by regulating (bending) the bridle wires so that in full depressing of the left pedal and approaching of all hammers by 1/3 towards the strings, all whippens of the action move slightly only, all of them in the same moment.

2.15 Direction of Hammer Heads onto the String Bundles (Choirs), Alignment of Spaces between the Hammers

Push all the hammers to strings, watch their right-left position on strings. Hammers of one string tones and more-string tones have to be positioned symmetrical to strings choirs. Adjust hammer´s position by gentle side turning of hammer flanges by special flat tool or by blade-type aligning action regulator for flanges. Or release the butt flange screw, set the hammer to the right position and tighten the screw.
At the same time, uniform spaces between individual hammers are adjusted.

3. Voicing verification.

3.1 Hammer Right-Left Positioning.

Starting voicing verification, chech the proper right-left positions of hammer on strings, according to point 2.15.

3.2 Hammer Posotioning on Strings.

Check the right contact of hammers on more-string tones. Push the hammer gently to strings, push right pedal (dampers up). Twang by plectrum the strings of one tone separately, none of them can play. If some of them sounds, sand the hammer under other strings of this tone carefully.

3.3 Voicing verification.

Play separated sections repeatedly, look for tones with different colour of tone, mark these tones. Stick the hammers of too sharp tone by voicing needles. Modify needling techniques according to required tone change. For example make the first deep stitch by single needle to sides or to arms of hammer. Then make only gentle stitches to arms of hammer by single or three needles tool. Check the tone colour when you press left pedal. Unify the different tones by additional needling. Then brush the hammers by brass brush in the end..