Building Instructions For Vibraphone Frame M55

Content

1 Introductions

This construction manual attempts to describe all the steps involved in building a vibraphone frame that folds according to the accordion principle, down to the last detail and with lots of pictures.

- All critical components have been designed in such a way that they can be procured as a finished product either via 3D printing or as a laser-cut and possibly bent sheet metal part based on digital data. Many corresponding manufacturers can also be found online.
- Only the springs are not available online or easy to make yourself. However, there are also suppliers for this (typically spring manufacturers) or I can supply them on request.
- All base materials (e.g. aluminum sheet thickness 3 mm, T-slot profile 40 x 20, ...) are selected in accordance with widely used, common standards.
- The materials for 3D printing are also standard PETG and TPC. I was able to produce all the components on my own small 3D printer (Prusa i3 MKS) without any problems, but there are plenty of online suppliers for this too.
- The T-slot profiles can also be ordered pre-cut in many cases, so that no sawing device is required.
- The metalwork required is limited to drilling, thread cutting, countersinking, sawing (shortening) threaded rods and deburring (file).
- Drilling templates are included in the kit for the only somewhat difficult drill holes as they are at an angle to the surface.

2 Tools required

The following tools are required to build the frame:

- a set of taps (explicitly M3, M5 and M8)
- Metal drill bits (explicitly Ø4.3 and Ø5.0)
- a set of Allen keys
- one 90° metal countersink
- a cordless drill
- some oil to lubricate the taps
- Needle and thread for sewing the pedal straps
- A candle for welding the pedal strap ends
- Tape measure or folding rule
- Scriber and/or felt-tip pen for marking
- Hacksaw for sawing threaded rods
- File for deburring
- Pliers for counter-holding (damper adjustment)

Abb. 1 Tools required

3 3D Printed Parts

All 3D printed parts can be produced by the corresponding providers, which can be found in large numbers on the Internet (search term: 3D printing service). The corresponding data is available in step format. If you have your own 3D printer, you can also produce the parts yourself.

3.1 Settings for 3D printing

I print all 3D printed parts with the following settings:

Tabelle 1: Process data 3D printing

Layer height	0,2 mm	Schichthöhe
Wall loops	4	Wandschleifen
Top shell layers	4	Obere Wandschichten
Bottom shell layers	4	Untere Wandschichten
Sparse infill density	25 %	Fülldichte
Sparse infill pattern	Gyroid	Füllmuster

I use **BASF Ultrafuse TPC 45D** filament for the TPC and commercially available PETG for the other frame parts. Alternatively, PLA or PLA with glass fiber content would also be possible for higher loads.

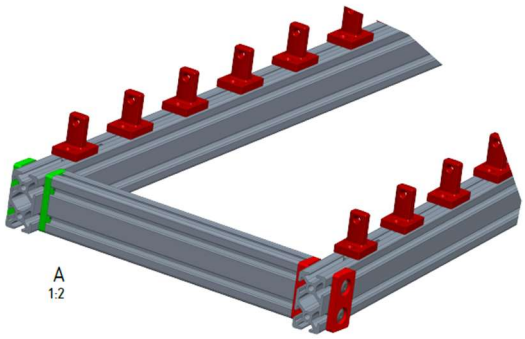
3.2 Preliminary Planning of Bar Posts

There are basically several variants of how the bar posts can be designed or arranged. The choice of variant depends largely on the intended use of the frame.

As the bar posts are different for each variant, it is necessary to decide on a variant before ordering the bar posts.

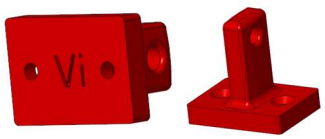
3.2.1 Bar posts with hole (A)

Bar posts with a hole for the cord to pass through are used if the panels are to remain firmly on the frame at all times. This variant is particularly recommended for applications with pickups. The bars are then held securely during transportation and the pickup plugs remain permanently plugged in. Set-up and playability are then possible extremely quickly. However, the bars can only be removed from the frame by completely unthreading the cord.



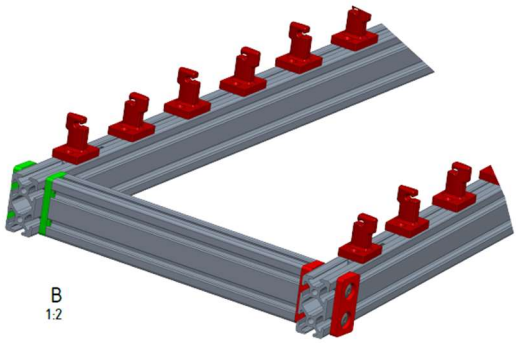
The following are required for this arrangement:

- 23 posts of the type 0000187323 with the marking Hi,
- 21 posts of type 0000187325 with the marking Vi,
- 21 posts of type 0000187324 with the marking Va,
- 23 posts of type 0000187322 with the marking Ha



3.2.2 Bar posts with hook opening arranged alternately or in the same direction (B)

This arrangement with alternating arrangement represents a compromise between the use with pickups and the corresponding retention of the bars on the frame for transportation and, on the other hand, the possibility of removing the bars. Due to the alternating arrangement, the bars are held relatively well during transportation, but can also be removed again with a little more effort.



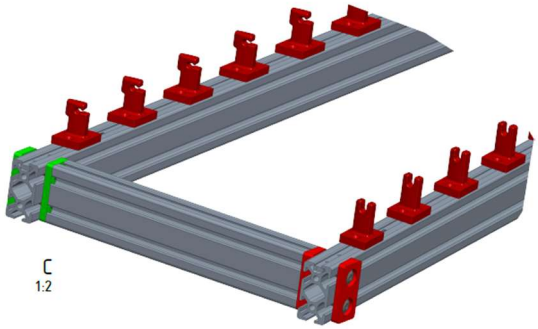
This arrangement requires the following:

- 23 posts of the type 0000200909 with the marking Hi,
- 21 posts of the type 0000200911 with the marking Vi,
- 21 posts of the type 0000200910 with the marking Va,
- 23 posts of the type 0000200906 with the marking Ha

These posts are fitted with a deeper hook for better line retention. This hook is designed for 3 mm Musser lines.

3.2.3 Standard arrangement of open bar posts and those with hooks (C)

This arrangement is used if the bars are always removed for transportation. This is the standard arrangement for commercially available frames.

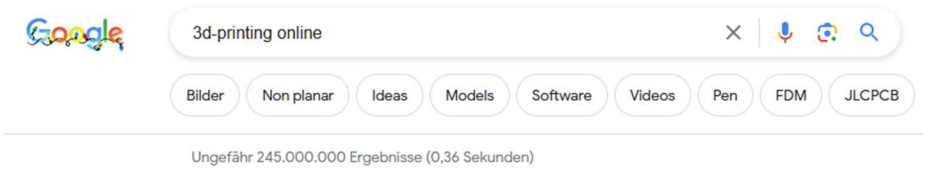


This arrangement requires the following:

- 23 posts of the type 0000187329 with the marking Hi,
- 21 posts of the type 0000187330 with the marking Vi,
- 21 posts of the type 0000187332 with the marking Va,
- 23 posts of the type 0000187331 with the marking Ha,

3.3 Compilation of 3D Print Parts

Abb. 2 shows a list of all components to be procured via 3D printing (bar posts for variant C). The red components (bar posts) are printed from flexible material (TPC 45D), the blue components from PETG or PLA. The required STP data for all these parts is available in the kit. A large number of corresponding online providers for 3D printing can be found via Google.



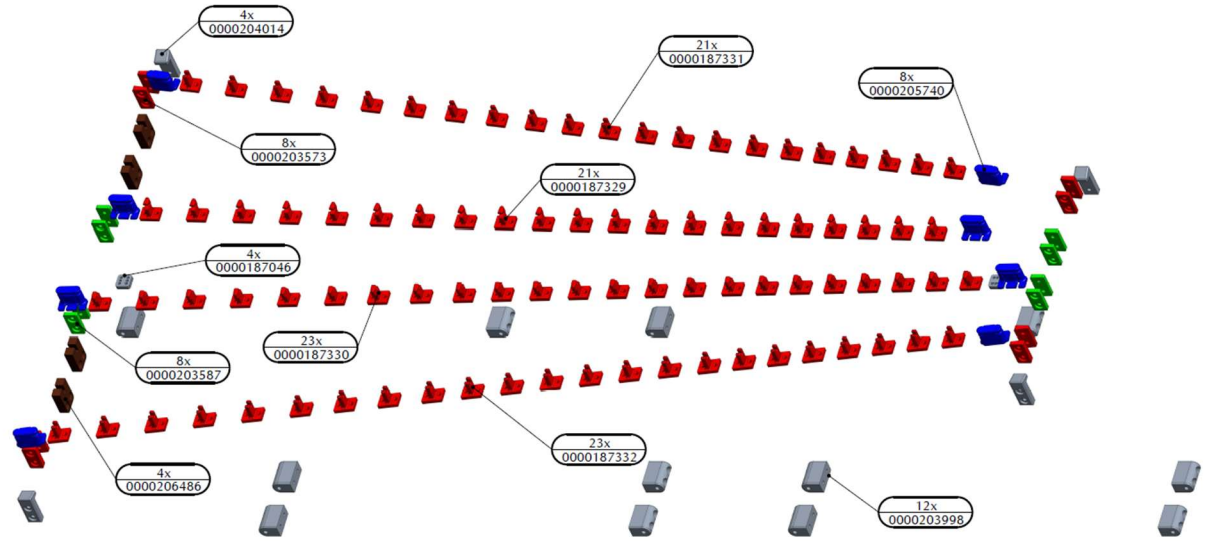


Abb. 2 3D Printed Parts (bar posts variant C)

4 Sheet metal blanks or sheet metal bent parts

Abb. 3 shows all parts and quantities that are produced as laser-cut and partially single-bent parts from 3 mm thick aluminum (AlMg3, F18, EN AW-5754, 3.3535).

Abb. 4 shows that all laser-cut parts and quantities are made from 5 mm thick aluminum (AlMg3, F18, EN AW-5754, 3.3535).

Abb. 5 shows all laser-cut parts and quantities made of 3 mm thick aluminum AlCu4Mg1 (F40, EN AW-2024, 3.1355). If this high-strength aluminum is not available, these parts can also be made from 3 mm thick stainless steel sheet.

The pedal (Abb. 6) is cut out of 3 mm stainless steel sheet (laser cutting).

The digital data required for production is included in the kit in STP format (Step).

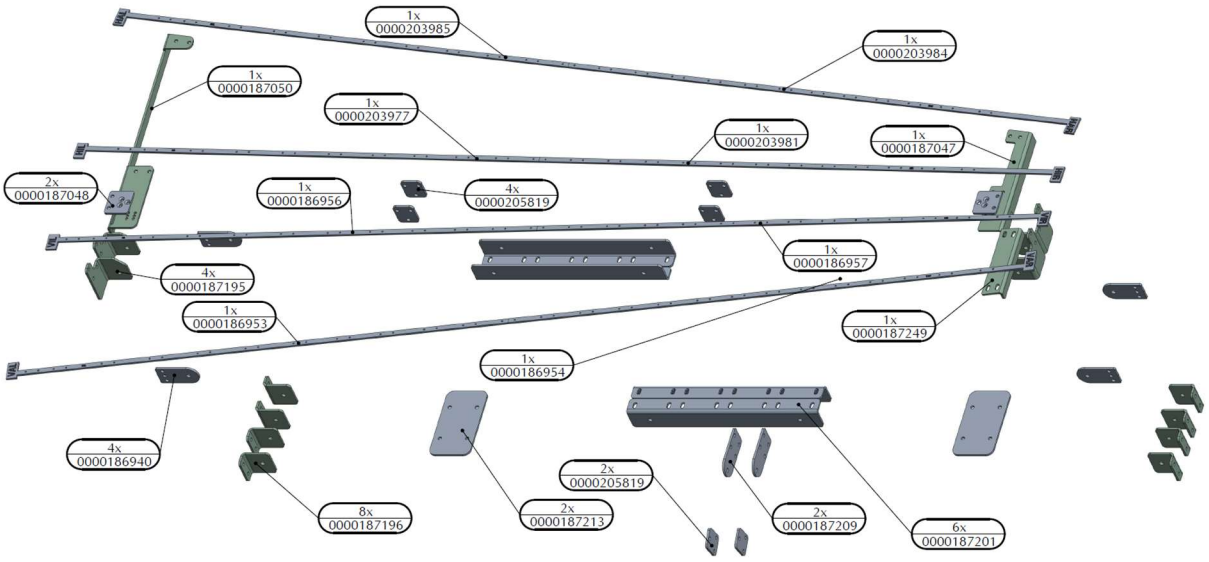


Abb. 3 Laser-cut and bent parts made from 3 mm AlMg3 (F18, EN AW-5754, 3.3535)

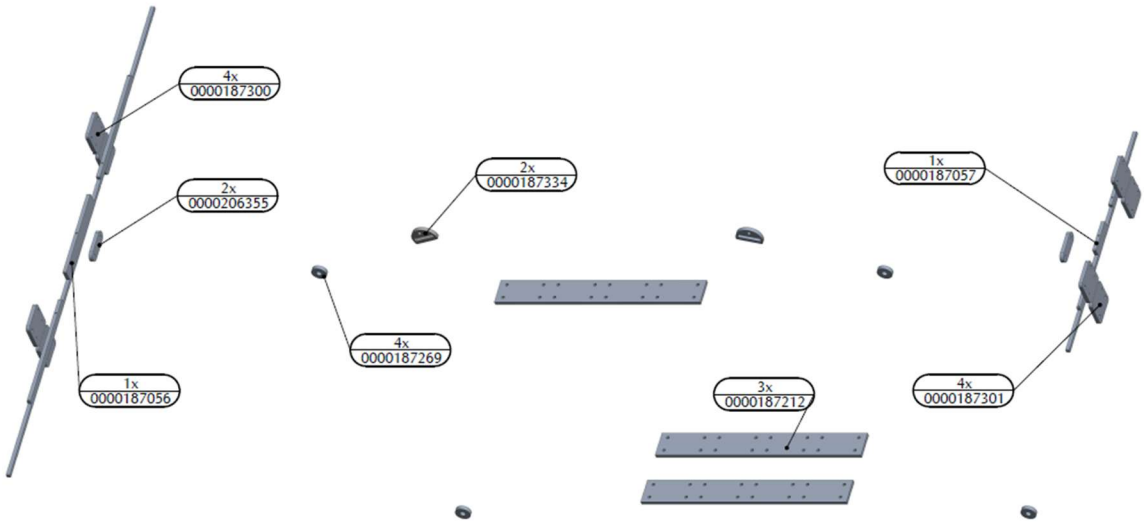


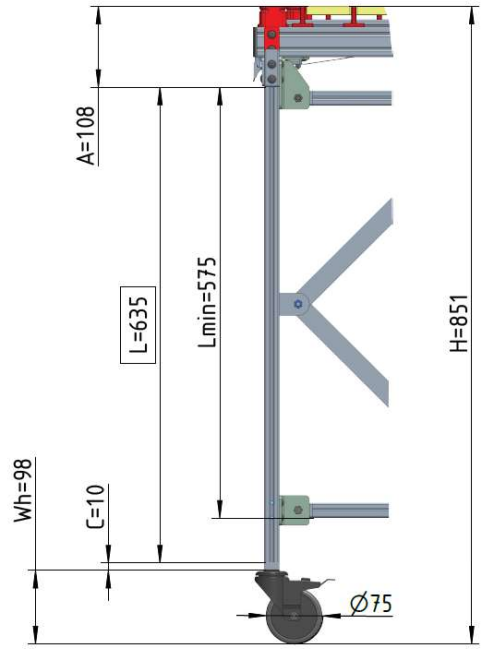
Abb. 4 Laser-cut from 5 mm AlMg3 (F18, EN AW-5754, 3.3535)

Abb. 5 Laser-cut from 3 mm AlCu4Mg1 (F40, EN AW-2024, 3.1355) or 3 mm stainless steel

Abb. 6 Laser-cut from 3 mm stainless steel

5 T-slot-profiles

5.1 Length specification for the desired table height



The desired table height H is set via the profile length L. This depends on the wheels used and the corresponding housing height W_h:

$$L = H - A - C - W_h$$

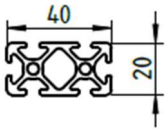
L must not be less than a minimum length of $L = 585\ mm$.

Für die vorliegende Konstruktion wurde ein Rad mit $75\ mm$ Raddurchmesser und einer Gehäusehöhe von $W_h = 98\ mm$ verwendet.

For the present design, a wheel with a wheel diameter of $75\ mm$ and a housing height of $W_h = 98\ mm$ was used.

Abb. 7 Spieltischhöhe

5.2 Profile cuts



The aluminum profiles can be ordered with the determined profile length L. All profiles have the format 40 x 20 (ITEM, Parker or similar suppliers).

The required lengths and quantities are shown in the following illustration. The 4 profiles that must be procured according to the height calculation are marked in green. All other lengths and quantities can be found in the illustration.

For later assignment, it is useful to label each profile with a sticker and the corresponding ID number.

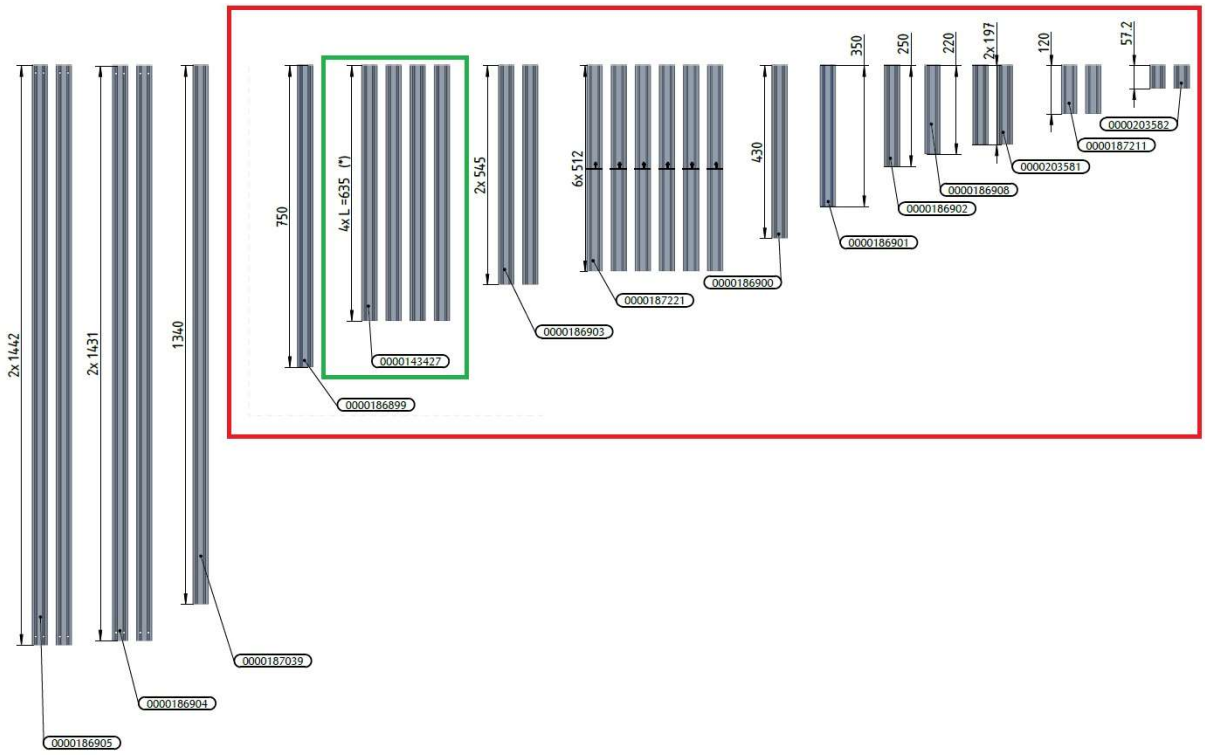
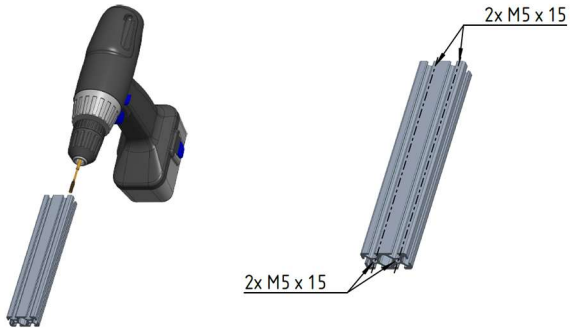


Abb. 8 Profil Cuts

5.3 Profile Processing

5.3.1 Thread in the profile ends



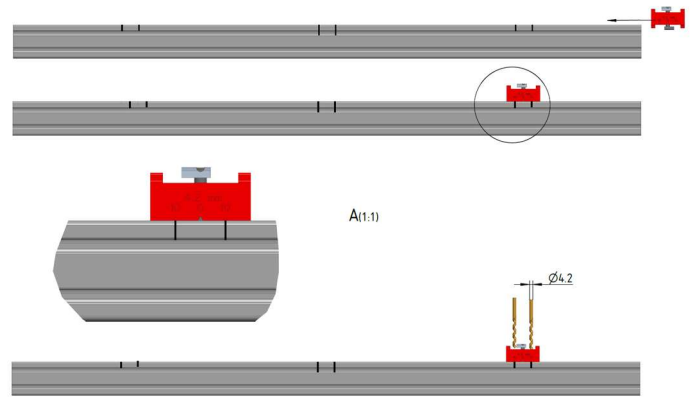
For the profiles in the red box Abb, M5 threads must be cut approx. 10 to 15 mm deep in both holes on both sides.

After each thread, remove the chips from the tap with a small brush and apply a drop of oil to the tap before each new thread.

If a vice is not available, the profiles can also be fixed to a table with a screw clamp for thread cutting. Use thin cardboard to protect against scratches.

5.3.2 Using the drilling templates on the profiles

A double-sided drilling template is used to drill the required holes in the profiles. In one application, drill holes of 4.2 mm and in the second application, drill holes of 5.0 mm are drilled into the profiles at 20 mm intervals. The respective application direction can be read off the drilling template.



First, the positions of the drill holes are marked with a sharp pencil or scriber. The template is then inserted into the profile and fixed in the correct position. The two holes are then drilled through the template.

Abb. 9 Template Application

Drill at a relatively slow speed so as not to put too much thermal stress on the template (plastic).

6 Base Frame Structure

6.1 Left Side Frame

Drilling and pre-assembly on left-hand side frame:

6.1.1 4.2 mm holes on the left side frame

The following diagram shows all the drilling positions for the 4.2 mmm through-holes on the left-hand side frame. First mark the drilling positions and then use the drilling template for the 4.2 mm holes. The parts list with all the details of all the components can be found in the appendix.

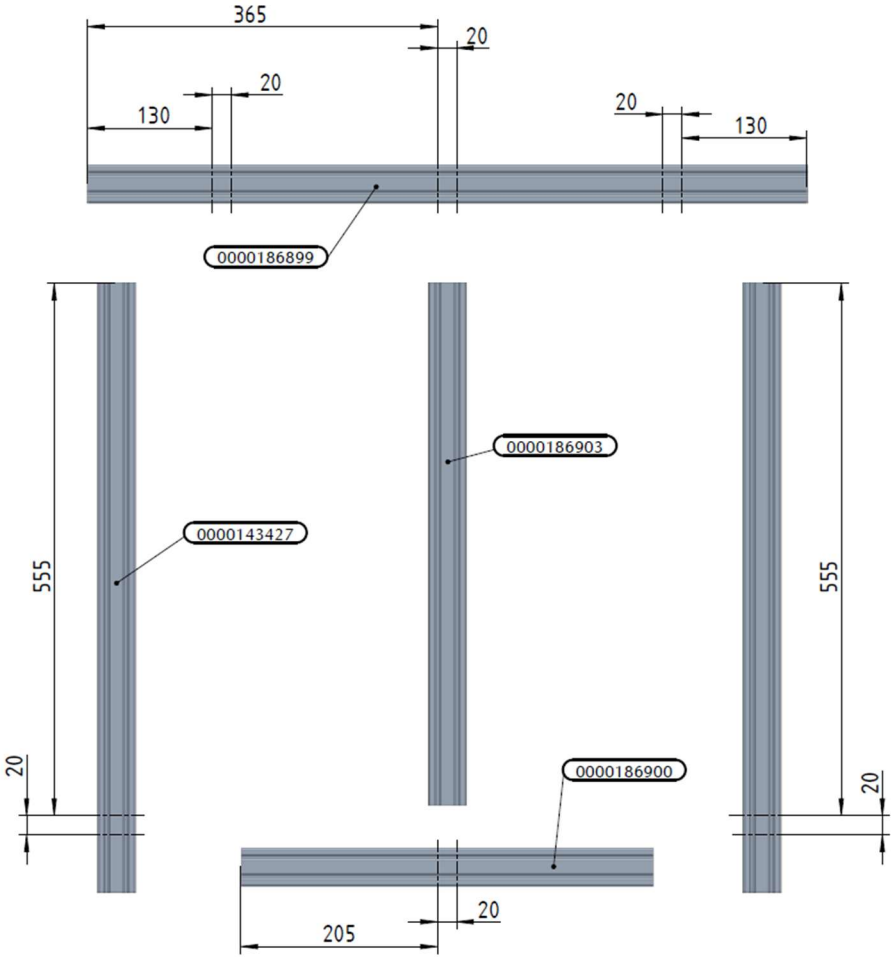


Abb. 10 Drilling positions left side frame

6.1.2 Pre-assembly

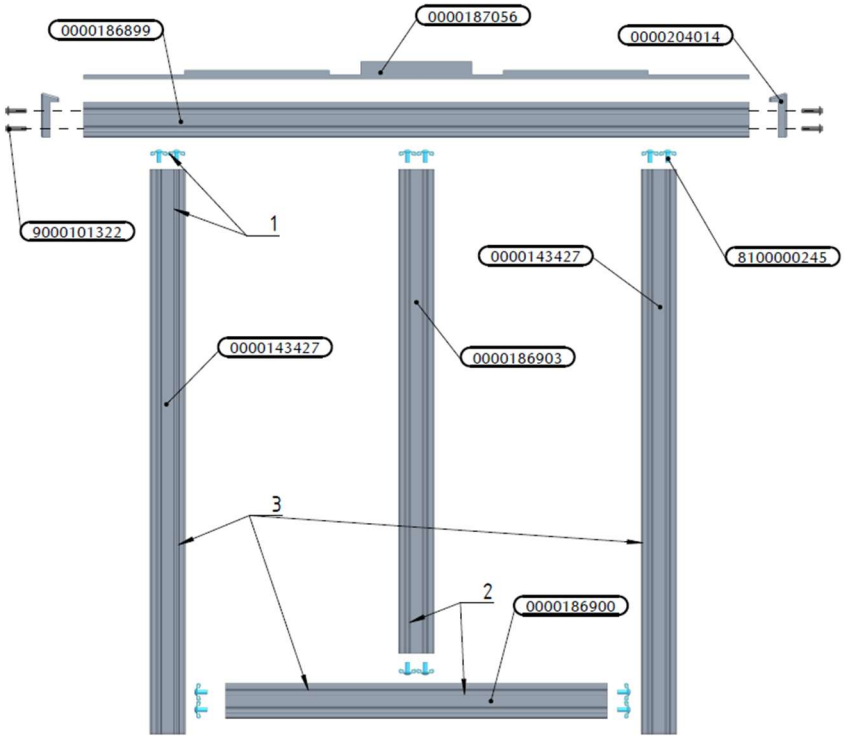
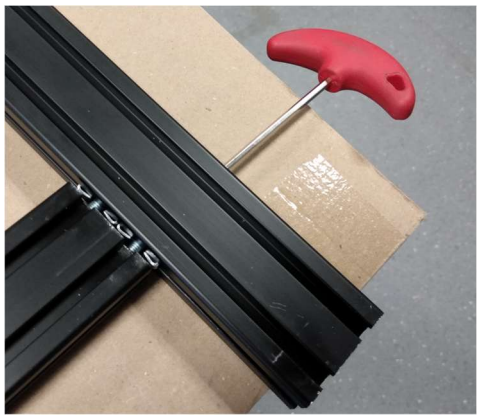


Abb. 11 Pre-assembly left side frame

Use a clean and chip-free cardboard as a base for all work on the profiles so that the anodized layer is not scratched.



1. fit all the standard connectors ID 8100000245 into the profiles.
   The screws must remain completely loose!
2. mount profile 0000186903 on profile 0000186900
3. mount both profiles 0000143427 on profile 0000186900
4. mount profile 0000186899 on the previously created frame
5. place the frame on a flat surface and fix all screws
6. insert the sheet 0000187056 into the groove and fit the side brackets 0000204014.

To avoid possible noises due to the play between the sheet metal 0000187056 and the profile groove, it is advisable to glue a few small, thin (approx. 1 mm) strips of felt to the sheet metal.

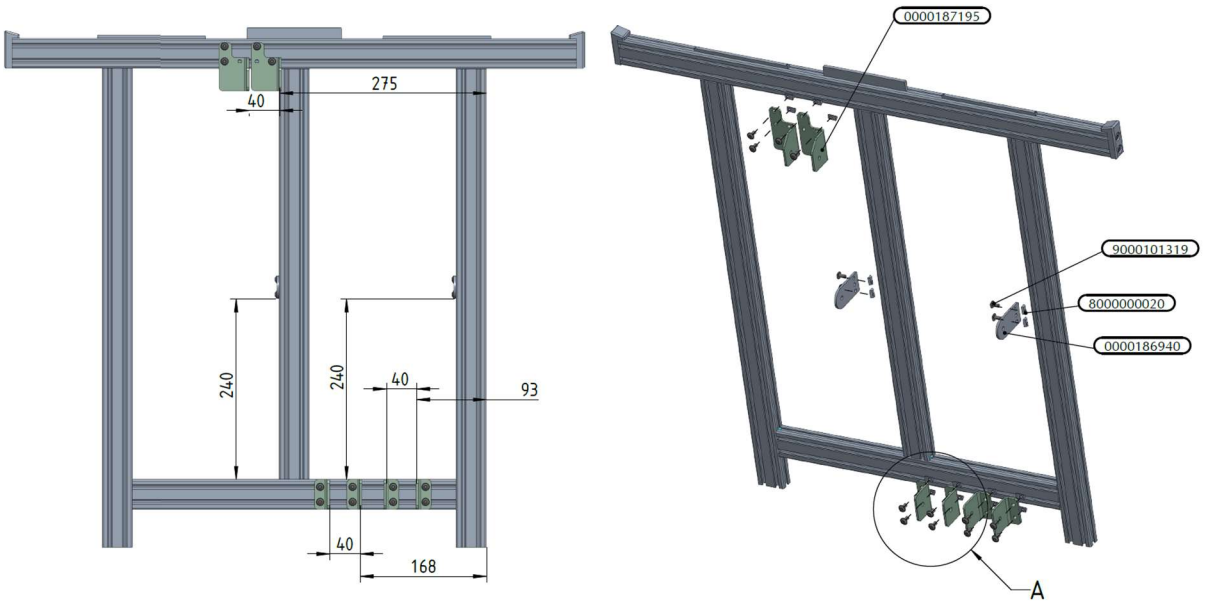
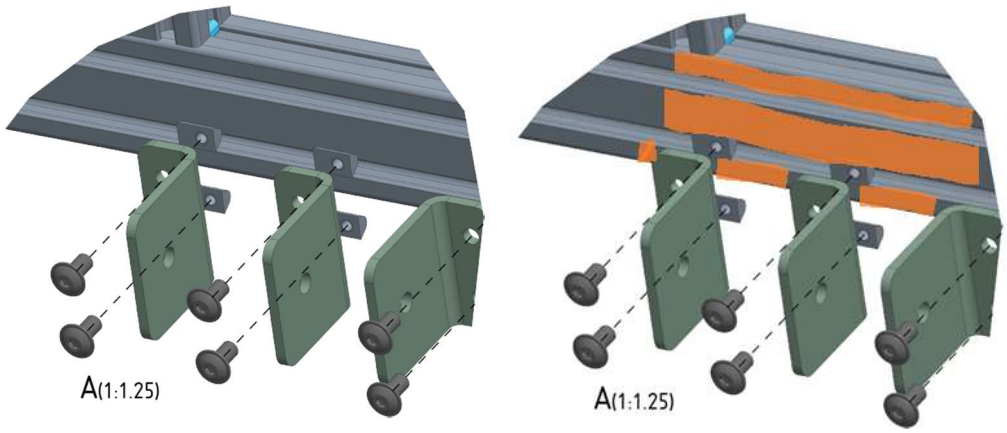


Abb. 12 Attachment parts left side frame

7. insert the sliding blocks into the profile grooves and screw on the add-on parts according to the dimensions given in Abb. 12.

   As the strength of the T-slot profiles and the bending plates are different, micro-sliding can occur between the bolted parts when playing (pedal operation), which then results in a slight "creaking". This can be avoided by sticking a strip of adhesive tape onto the profile in the area of the screw connection as a separating layer.



6.2 Right Side Frame

Drill holes and pre-assembly on right-hand side frame:

6.2.1 4.2 mm holes on the right-hand side frame

Abb. 13 hows all drilling positions for the 4.2 mmm through-holes on the right-hand side frame. The parts list with all details of all components is attached.

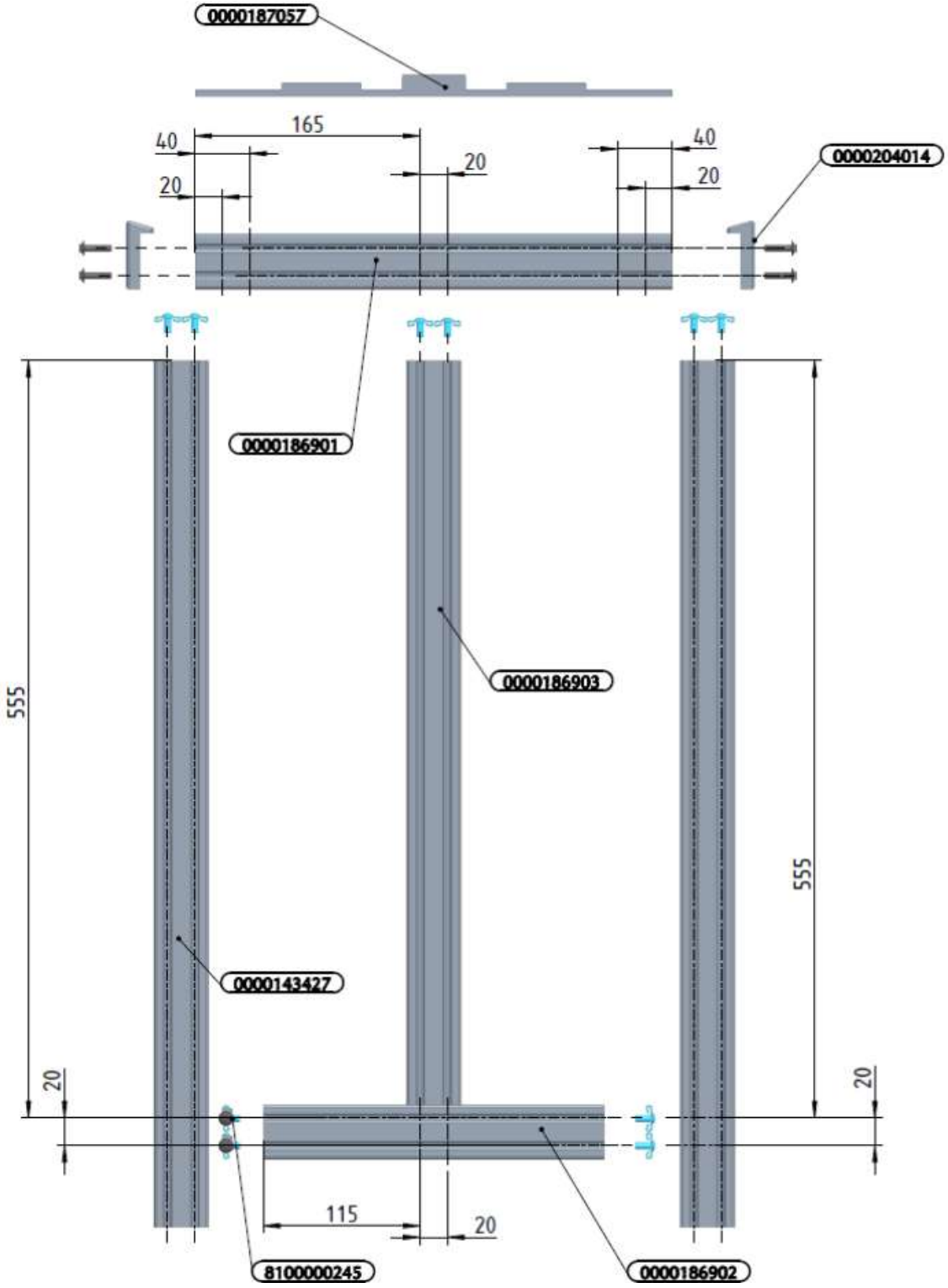


Abb. 13 Drilling positions on the right-hand side frame

6.2.2 Pre-assembly

The right-hand side frame is pre-assembled in the same way as the left-hand side frame.

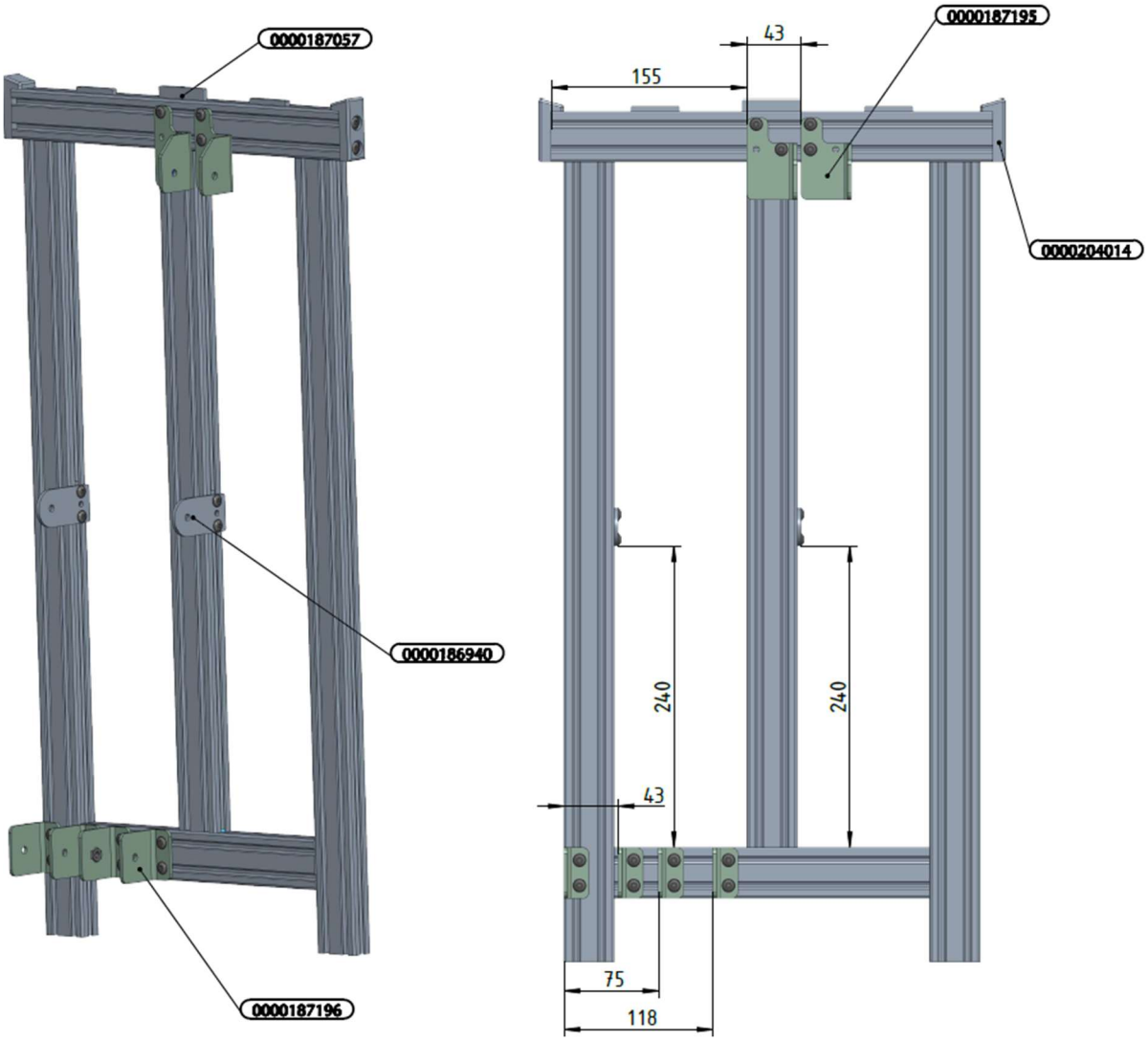


Abb. 14 Pre-assembly right side frame

6.3 Folding Struts

6.3.1 Hole on the folding struts

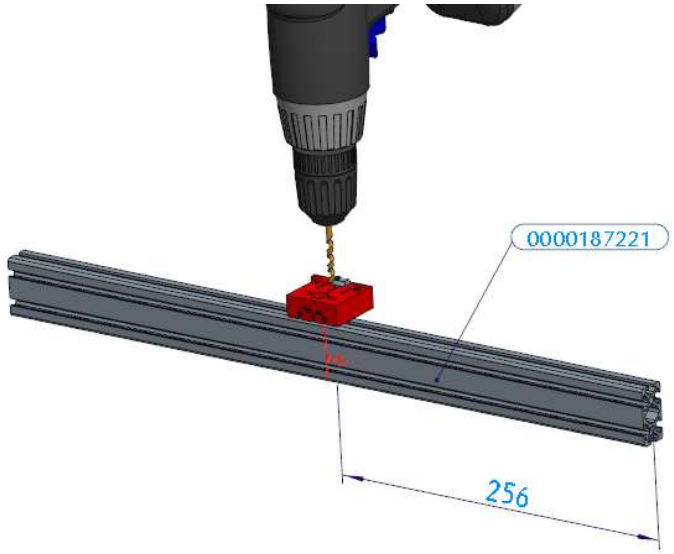


Abb. 15 Bohrung an den Klappstreben

To assemble the folding struts, holes with a diameter of 5.0 mm must first be drilled through the upright profile in **all** 6 struts 0000187221.

Use the drilling template with the 5.0 mm marking.

Mark the direction from which you measured the distance with a felt-tip pen or a center punch dot (see illustration below).

6.3.2 Pre-assembly folding strut

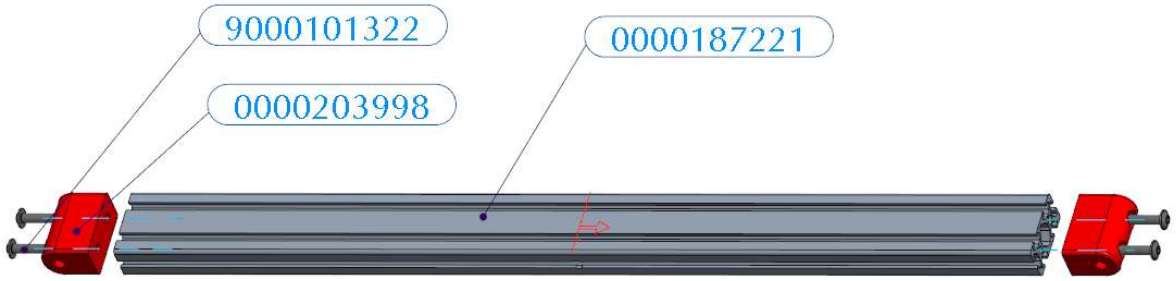
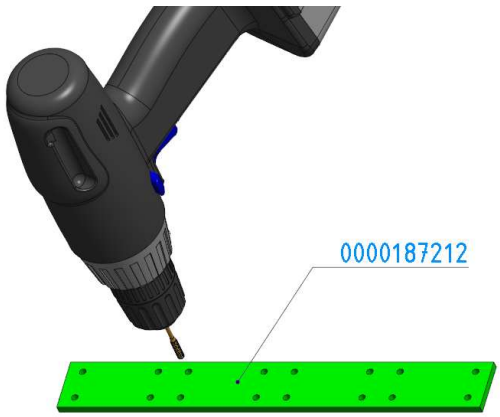


Abb. 16 Hole on the folding struts



Screw the rod ends 0000203998 to all folding struts on both sides using 2 screws 9000101322 each as shown in **Fehler! Verweisquelle konnte nicht gefunden werden.**.

Drill an M5 thread into each of the holes in the plate 0000187212.

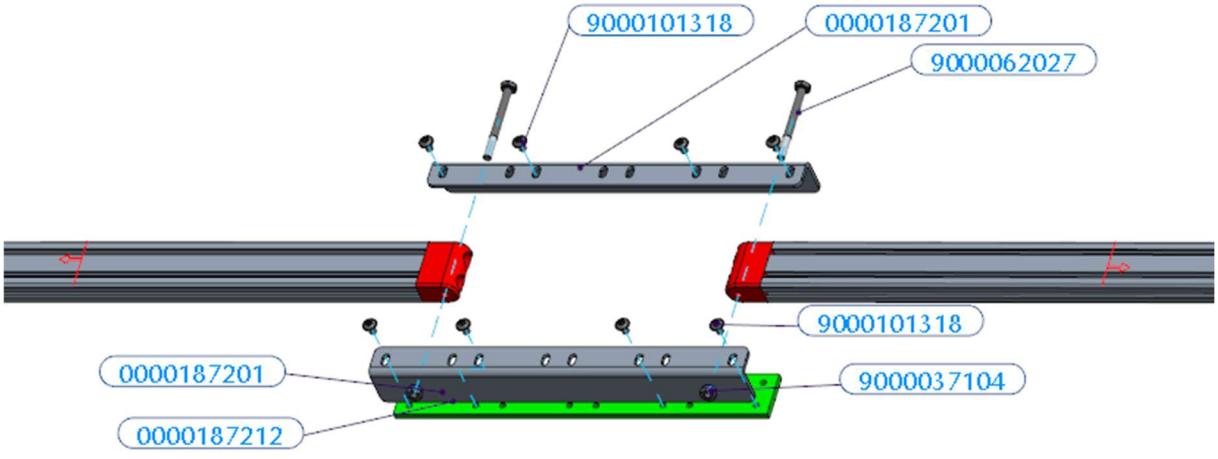


Abb. 17 Folding Struts Assembly

Now screw the baffle plate 0000187212 into the first bracket 0000187201 using the screws 9000101318. Now connect the pre-assembled folding struts to the two brackets.

- Make sure that the markings on the folding struts are both facing outwards!
- Push the brackets (0000101318) together until the folding struts are free of play.

Connect the folding struts with the bolts 9000062027 and nuts 9000037104. Only tighten the nuts to the extent that the folding struts can still be moved without force.

Finally, insert the bolts 9000101318 between the second bracket and the baffle plate.

6.4 Base Frame

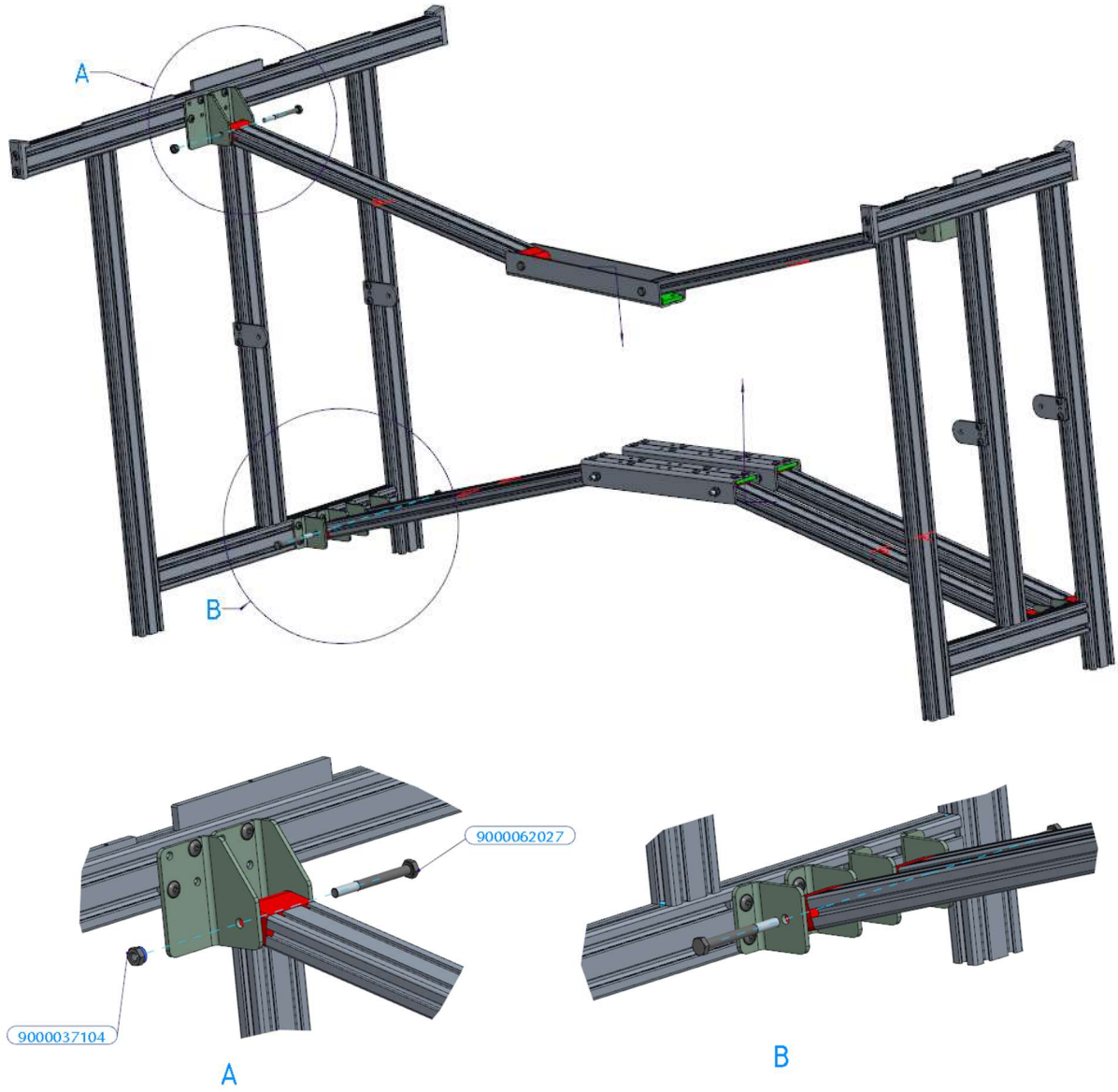


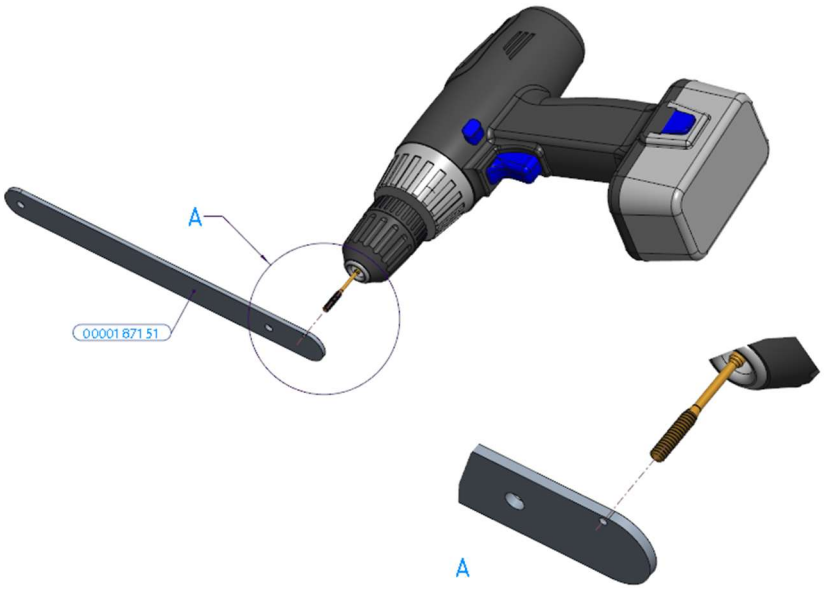
Abb. 18 Assembling the base frame

Connect the folding struts to the side sections as shown in Abb. 17 using the screws 9000062027 and nuts 9000037104. Only tighten these nuts so that the joints can be moved with a little force.

During assembly, make sure that the two lower folding struts can be folded upwards and the upper folding strut can be folded downwards.

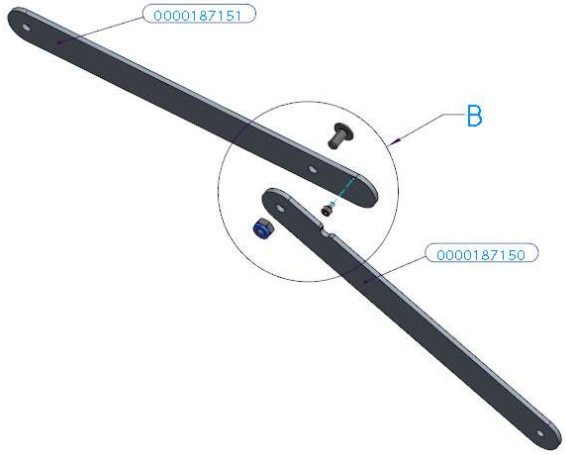
6.4.1 Coupling Elements

6.4.1.1 Tapping on the coupling elements



First drill an M3 thread into the small hole of all 4 profiles 0000187151.

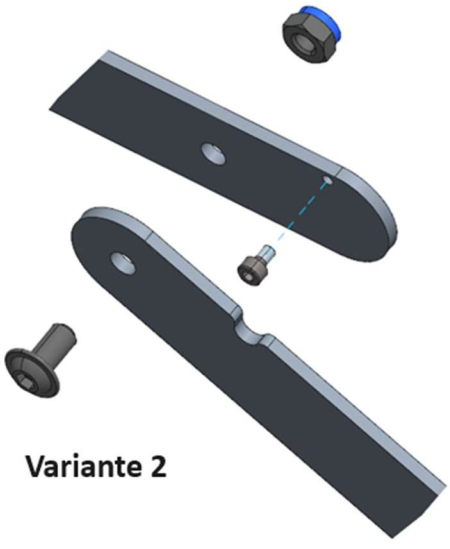
6.4.1.2 Mounting coupling elements



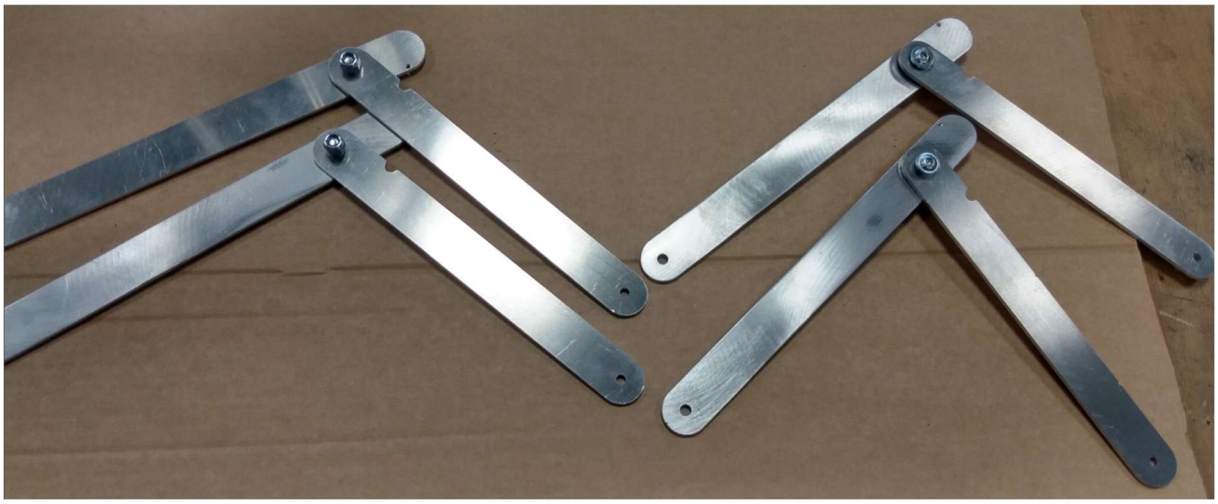
The coupling elements are assembled in two different versions to form two units.

The only difference is the direction of the screw connection. The components are the same.

Variante 1



Variante 2



6.4.2 Assembling the left side with coupling elements

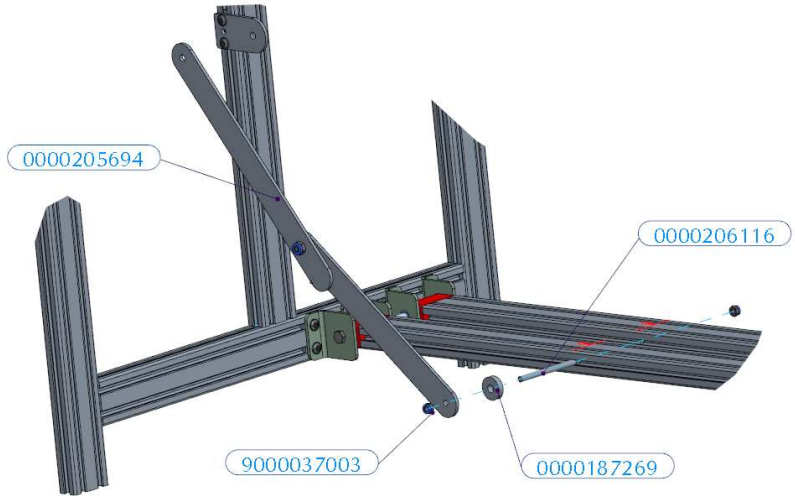


Abb. 19 Assembly bottom left

First fit the coupling element at the bottom left. Use the coupler with the screw head on the inside in this orientation (nut on the outside as shown in Abb. 19). In this orientation, the coupling element must be able to fold downwards.

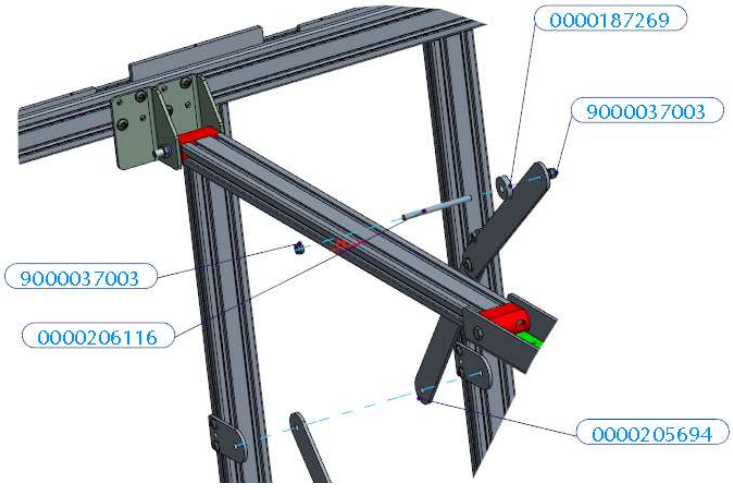


Abb. 20 Assembly top left

Now fit the coupling element at the top left. Use the coupler with the screw head on the inside in this orientation (nut on the outside as shown Abb. 20). In this orientation, the coupling element must be able to fold upwards.

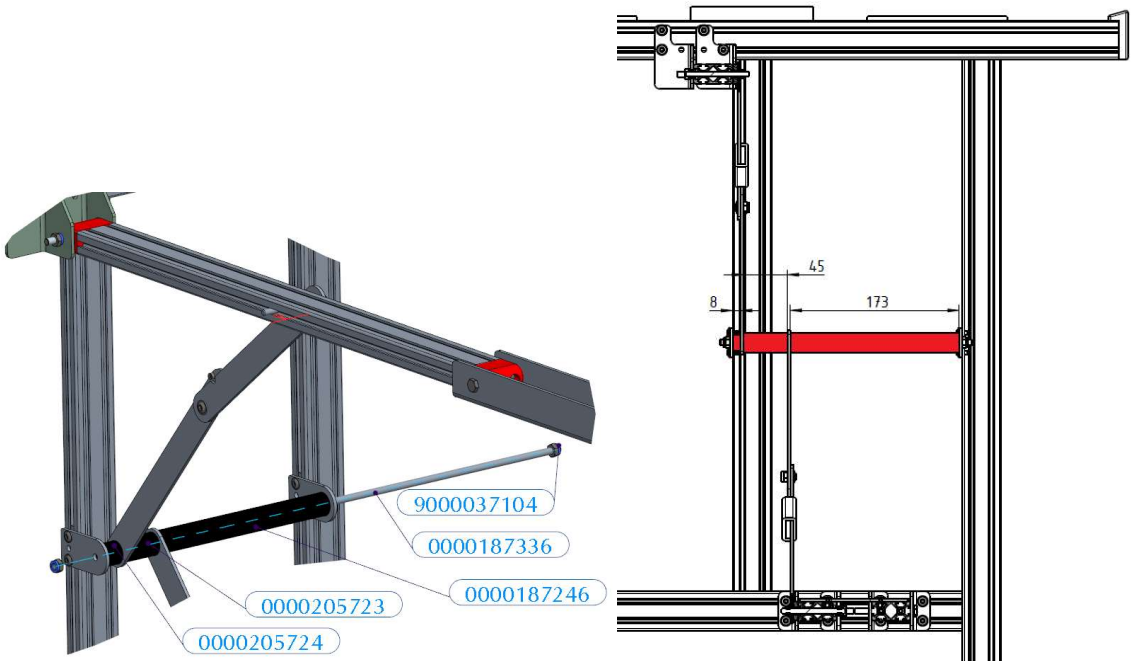


Abb. 21 Querkoppel linke Seite

Now fit an M6 threaded rod with the three spacer tubes as shown in Abb. 21. Here too, the two nuts are only tightened to the point where everything can be moved with little effort.

The arrangement of the corresponding pipe lengths is shown again separately in Abb. 21.

6.4.3 Assembling the right-hand side with coupling elements

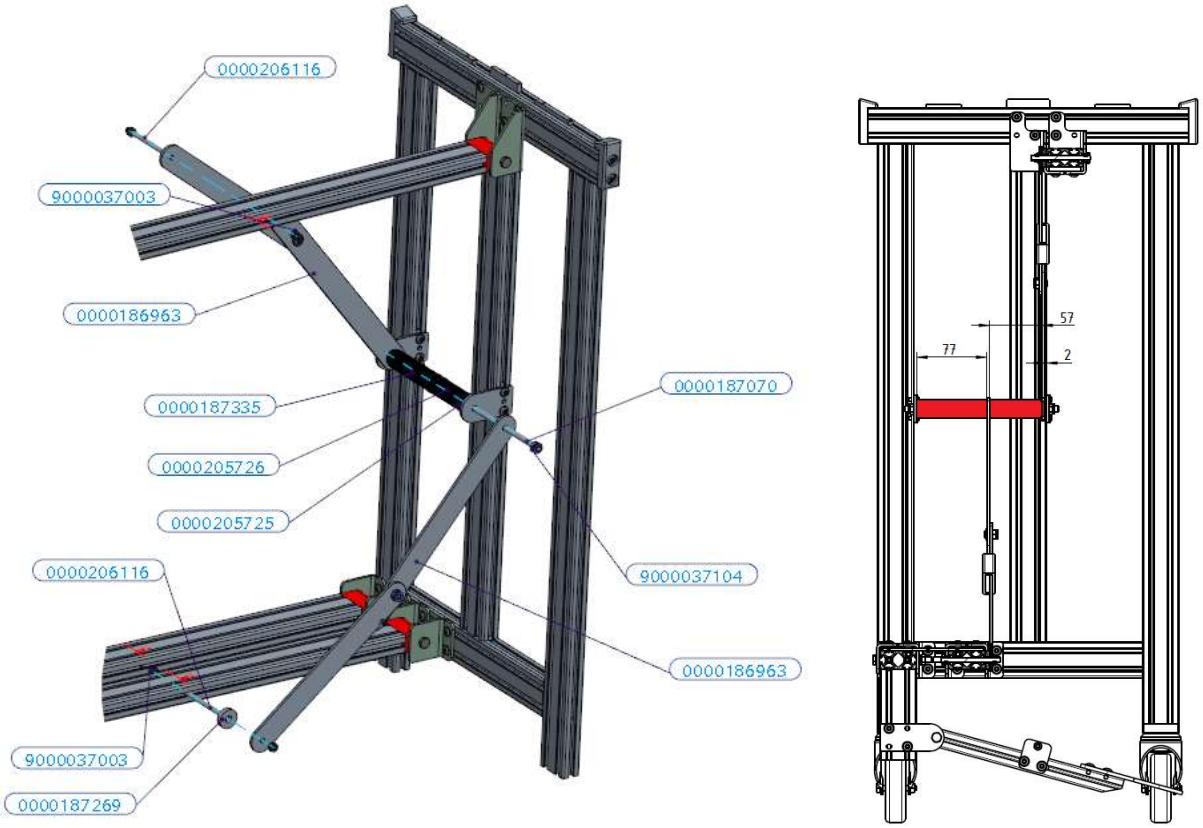


Abb. 22 Cross coupling right side

The coupling elements on the right-hand side are mounted in the same way. Here too, the screw heads of the pre-assembled couplers must face inwards, the upper coupler must be folded upwards and the lower coupler downwards.

The arrangement of the corresponding pipe lengths is shown again separately in Abb. 22.

6.4.4 Fitting connecting plates

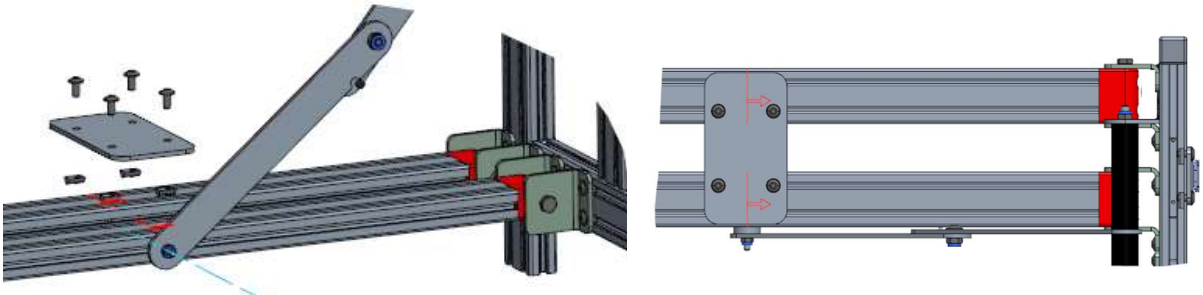
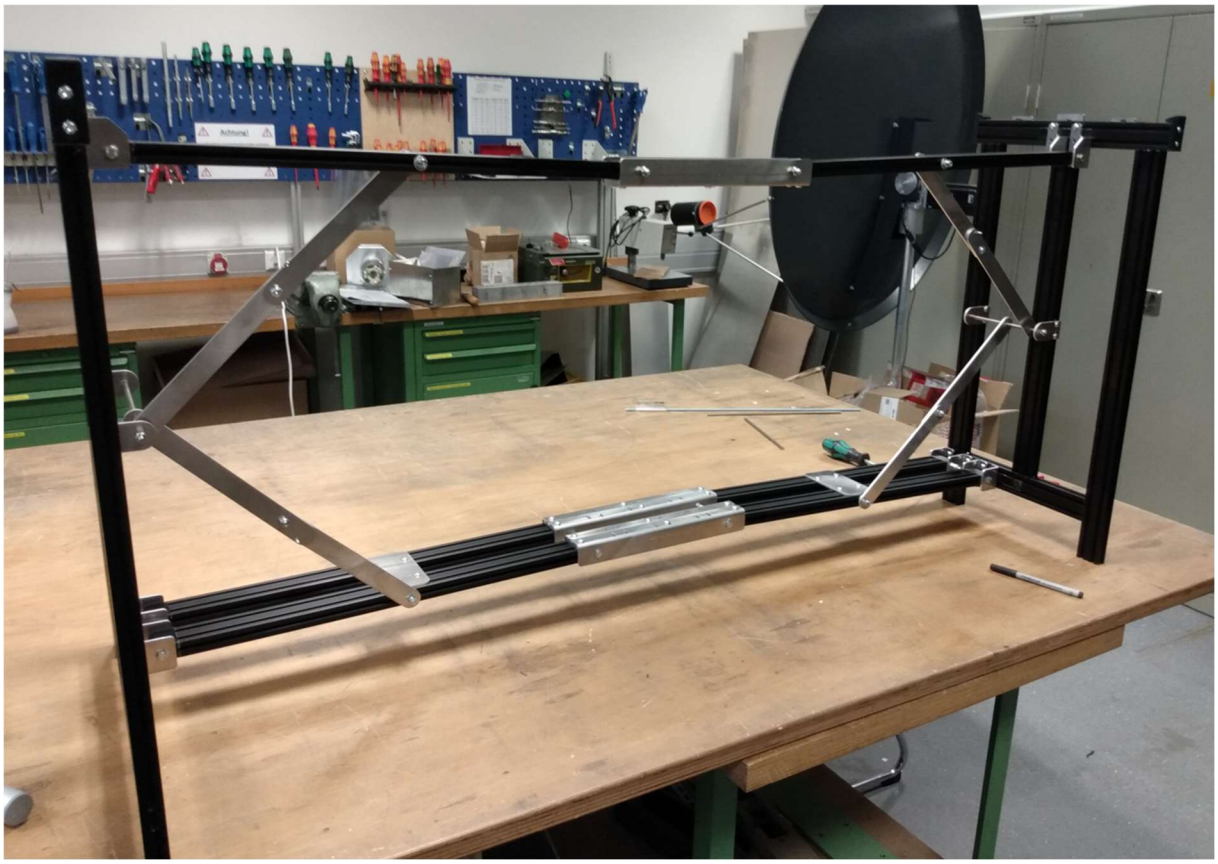


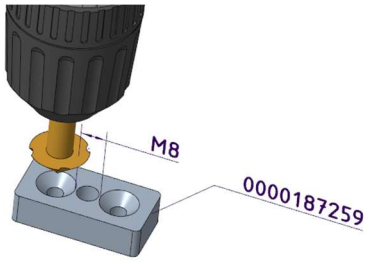
Abb. 23 Connecting plates

Now fit the two connecting plates for the two lower folding struts centrally over the positions of the threaded rods.

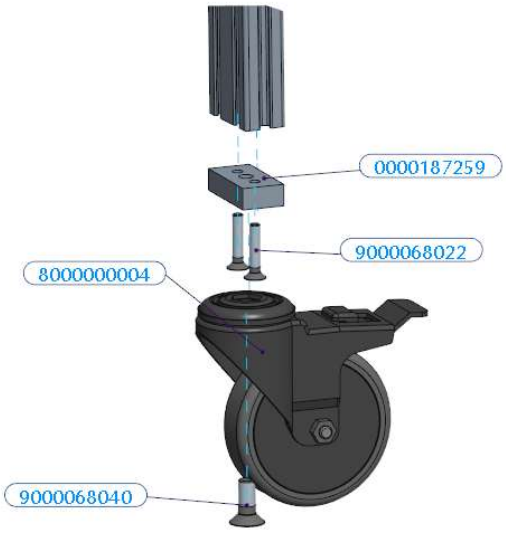


6.4.5 Fitting the castors

Cut an M8 through-hole thread in the middle hole of the intermediate plate 0000187259. Then countersink the two outer holes sufficiently far so that the countersunk screw 9000068040 does not protrude above the surface after insertion.



To mount the castors, first mount the intermediate plates 0000187259 to the profiles using two screws 9000068022 each. The castors are then mounted to the intermediate plate using the countersunk screw 9000068040.



6.4.6 Fitting the Pedal Assembly

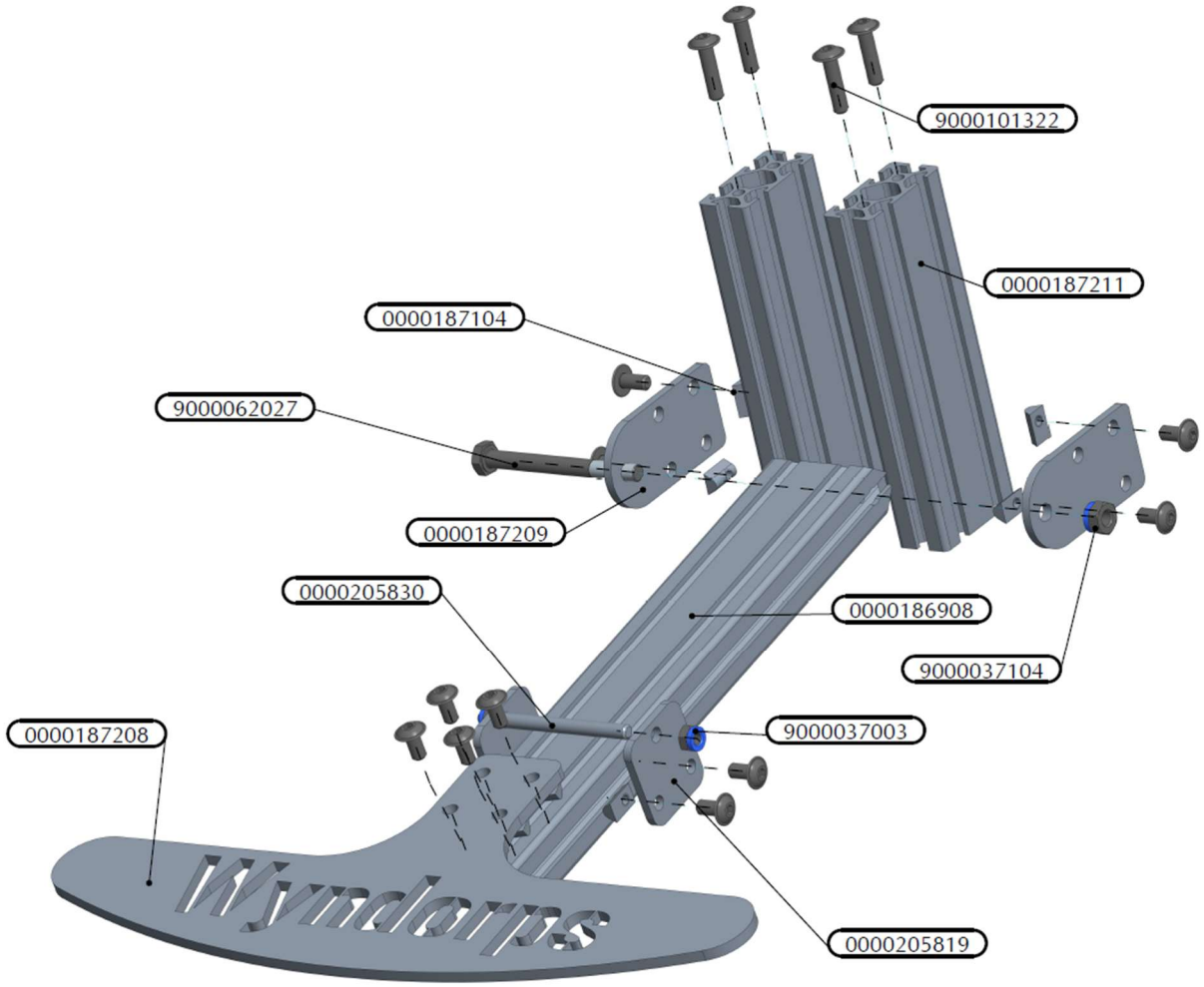
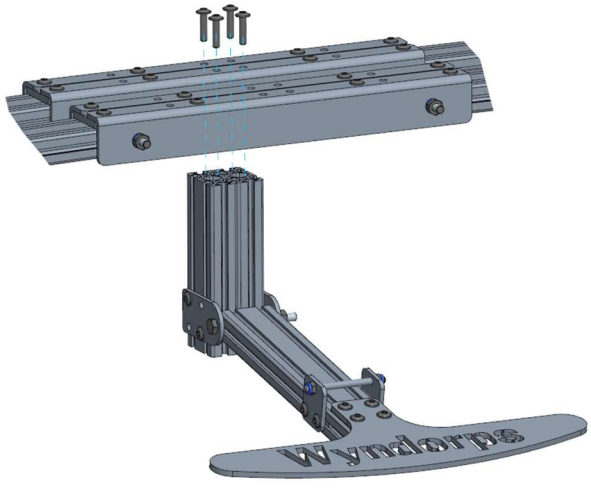


Abb. 24 pedal assembly

Once the pedal assembly has been pre-assembled, it is completely bolted to the rear folding strut of the base frame.

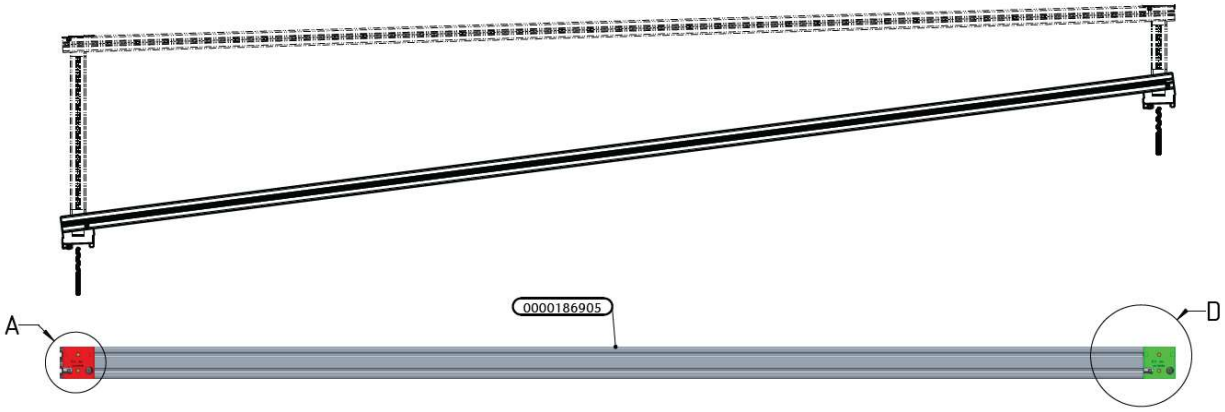


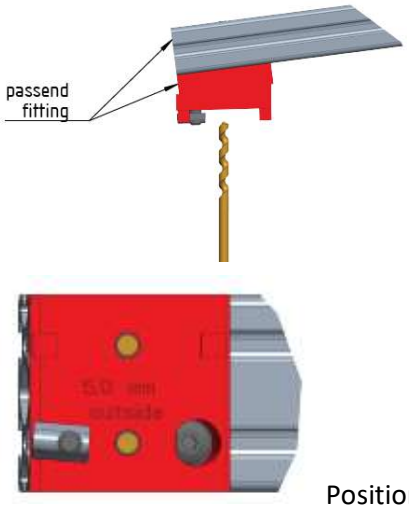
7 Structure of the support frames

To assemble the two support frames for the sound panels, holes must be drilled at an angle in the longitudinal profiles. Another drilling template is used for this purpose.

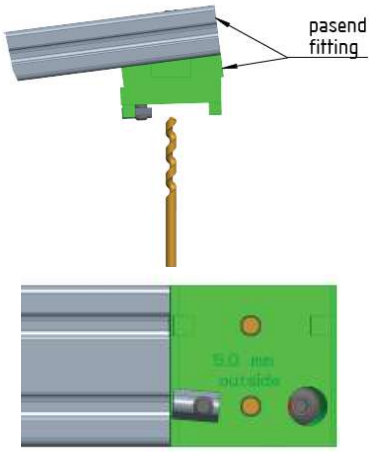
7.1 Drill holes in the longer outer profiles 0000186905

Insert the drilling template (000204228) into the profile 0000186905 so that the "**outside**" information can be read. Position the template to fit the outer edge as shown and fix the template in place.



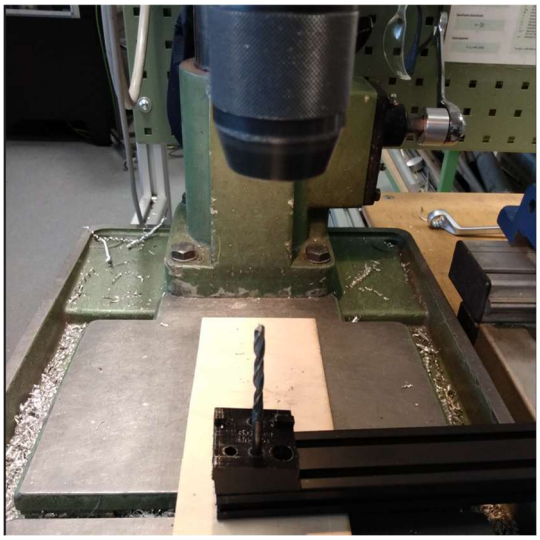


Position D

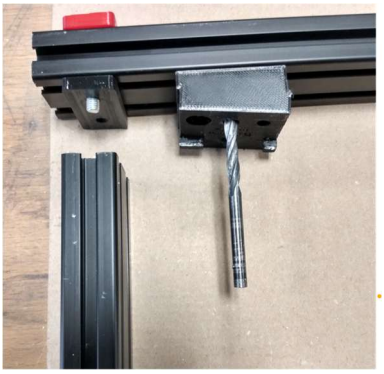


Position A

Do not simply drill through the template. This would be destroyed by the frictional heat generated.



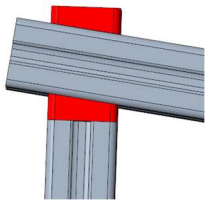
- Insert the drill bit (diameter 5.0 mm) into the mounted template.
- Align the profile by placing it underneath so that the drill bit is perpendicular to the axis of the drilling machine.
- Now insert the drill bit into the drill chuck and guide it up and down the drilling template **without switching on the drill!**
- If this works without any noticeable resistance, the corresponding hole can now be drilled at a **slow drill speed**.



Do not remove the drilling template from the profile, just move it slightly towards the center of the profile.

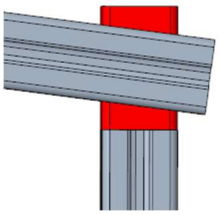
This is necessary so that you do not lose the alignment of the profile!

The left-hand cross profile 0000203581 is then positioned from the drilled side and joined together using the two outer wedges 0000203573 and two M5 x 35 screws.
The adjacent illustration shows the alignment of the two wedge element



Do not tighten the screws firmly, but leave a little air (approx. 1 mm).

Now slide the template to the other end of the profile - again matching the outer edge, align the drilling angle again, fix the template in place and create the other two 5.0 mm holes in the same way as described above.



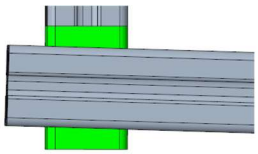
Install the cross profile 0000203582 on the right-hand side in the same way. The alignment of the outer wedges 0000203573 for the right-hand side is shown in the adjacent illustration.

Repeat this procedure for the second, outer longitudinal profile (front and rear support frame).

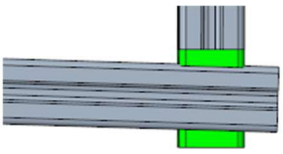
7.2 Drill holes on the inner profiles

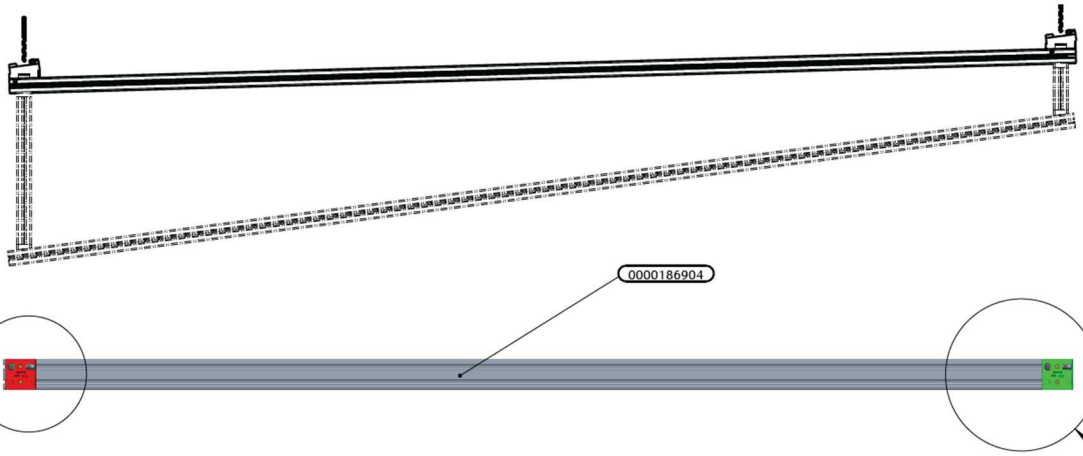
Insert the drilling template into the profile 0000186904 so that the "**inside**" information can be read. Position the template to fit the outer edge as shown, align the hole with the axis of the drilling machine, fix the template in place and drill the two 5.0 mm holes through the profile.

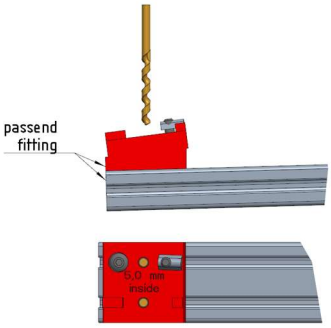
Then slide the template to the other end of the profile, again matching the outer edge, fix the template again and create the other two 5.0 mm holes there.

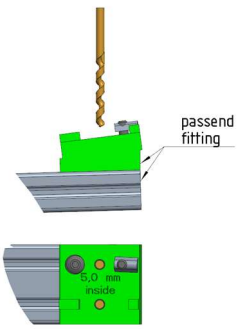


The angular alignment of the inner wedges 0000203587 can be seen in the two illustrations.





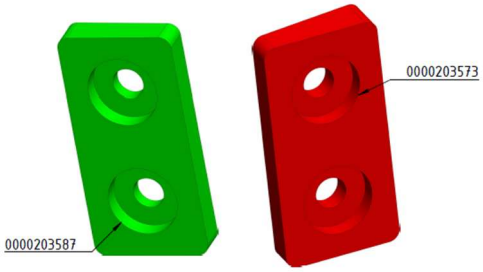


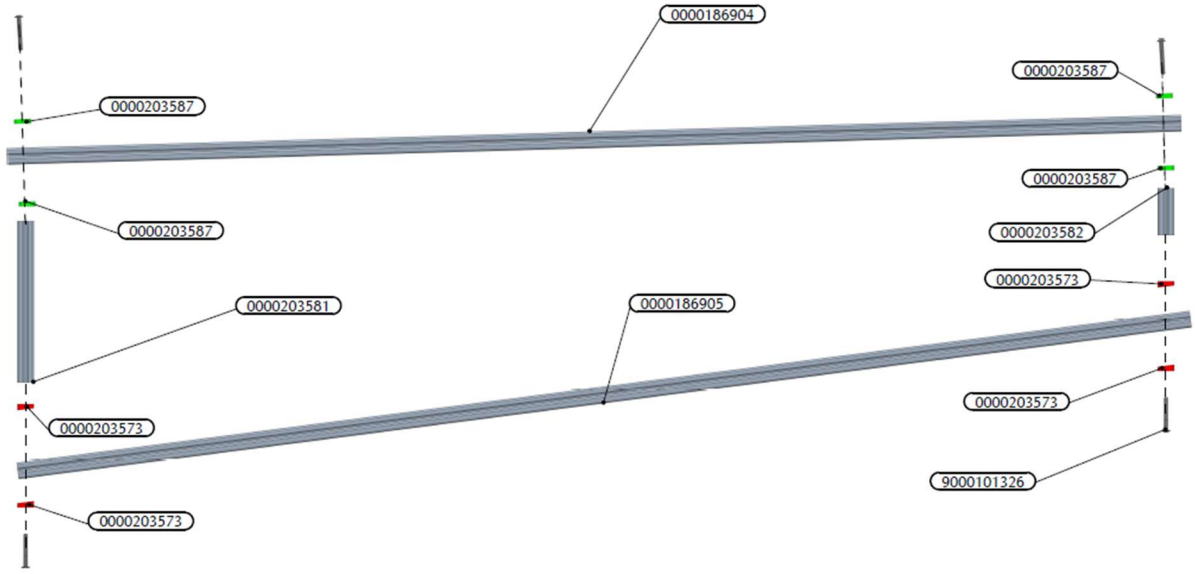


7.3 Pre-assembly of the support frames

Assemble two identical support frames!

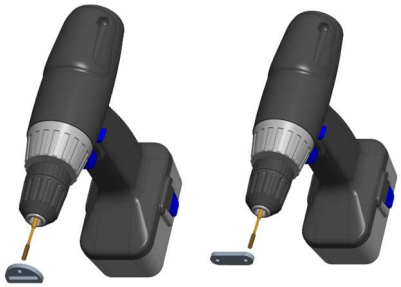
The wedges are used to compensate for the angle to the parallel side profiles.



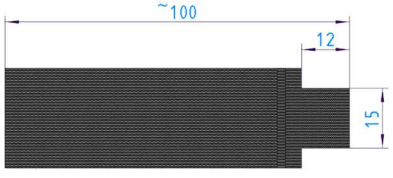


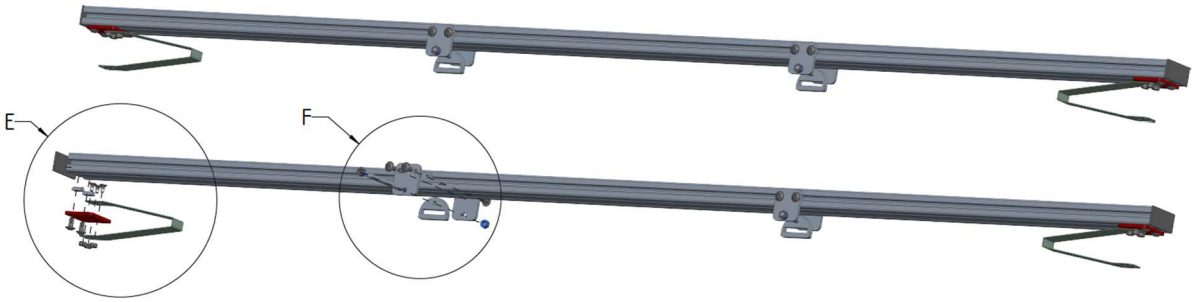
7.4 Assembling the damping unit

Cut an M5 thread in the hole of each of the 4 hinge mounts 0000187334 and two M5 threads in each of the two hinge clamps 0000206354.

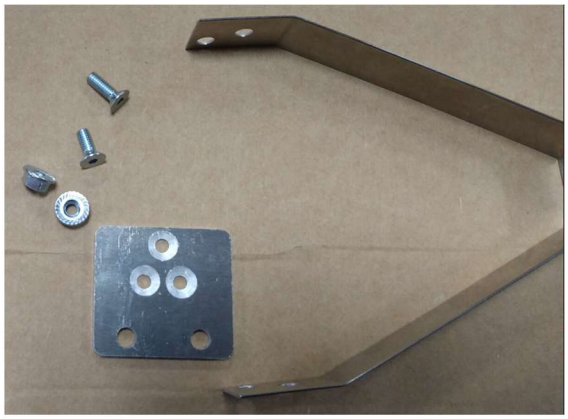


Cut two approx. 100 mm long strips from the tapes (see **Fehler! Verweisquelle konnte nicht gefunden werden.**) according to the dimensions given. Fuse the ends together with a soldering iron or candle to prevent them from fraying.

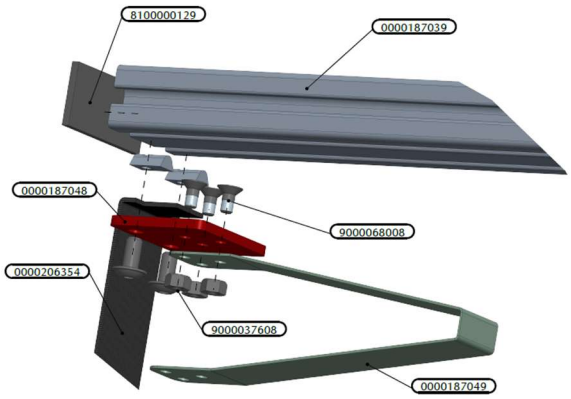




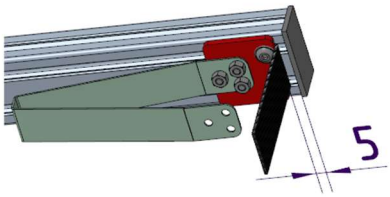
First screw the springs to the connecting pieces 0000187048 using the countersunk screws 9000068008 and nuts 9000037608.



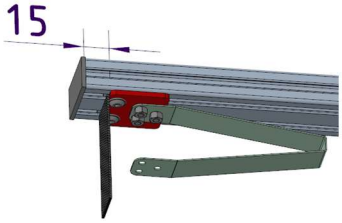
Now screw the springs to the connecting pieces 0000187048 using the countersunk screws 9000068008 and nuts 9000037608.



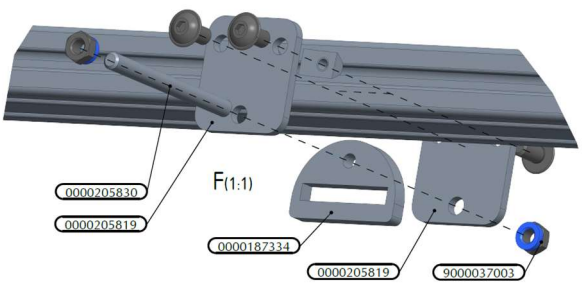
Now insert the two pre-assembled spring units into the damper beam 000187039 facing inwards.



Clamp the prepared strap 0000206354 under the connecting piece 0000187048 and fix the position at a distance of 5 mm from the right-hand profile end and 15 mm from the left-hand profile end.

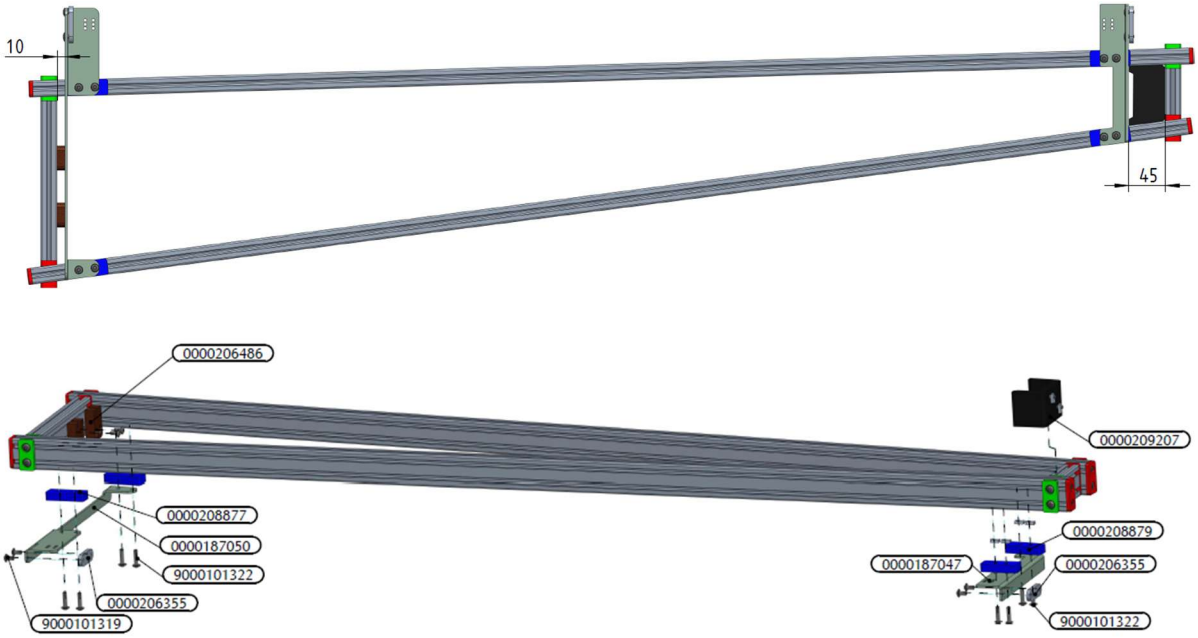


Continue to insert the two side plates 0000205819 with screw and sliding block into the damper profile twice. The final position on the damper beam is only determined when setting up the damping. To start with, positions at 1/3 and 2/3 of the beam length are suitable.



Now guide the threaded rod 0000205830 through the hole in the side plates and screw it approx. 50% of the way through the pedal band holder 0000187334. Fit the nuts 9000037003 on both sides.

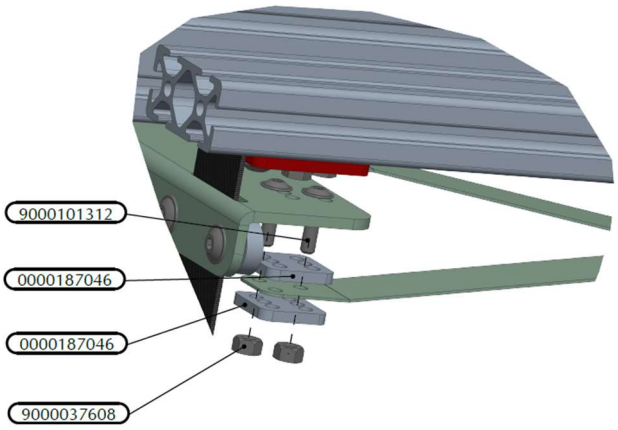
7.5 Assembling the rear support frame (Sharp)



Screw the parts 0000187050 and 0000187047 with the spacers 0000208877 and 0000208879 to the rear support frame as indicated on the underside. These are intended to hold the damping. Part 0000187050 is positioned on the left at a distance of 10 mm from the left profile, part 0000187047 at a distance of 45 mm from the right profile. Then fit the resonance tube support 0000209207.

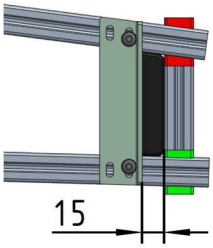
Now fit the pre-installed damper unit to the rear support frame.

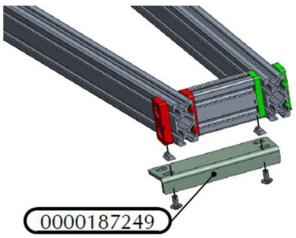
The intermediate plates 0000187046 are used to adjust the damping force. Depending on requirements, they can be fitted individually or in duplicate between the spring plate and mount. Alternatively, the spring plate can also be mounted above the mount with or without intermediate plates.
If the spring is mounted further upwards, the force of the damper is higher and correspondingly lower downwards.



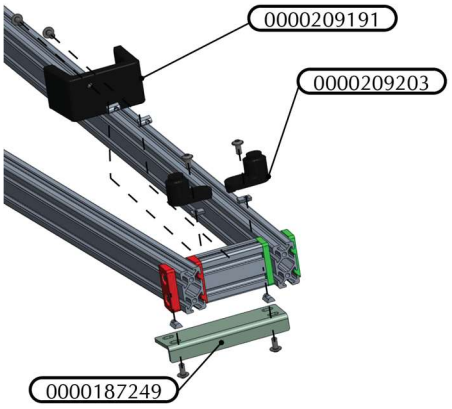
7.6 Assembling the front support frame

The support plate for the resonance tubes 0000187249 is mounted from below on the front support frame. The exact position is only determined in conjunction with the resonance tubes used.





The deflections for the cord 0000209203 and the support for the resonance tubes 0000209191 are then fitted.



7.7 Installing the bar posts

The bar posts are designed in such a way that they are adapted to the angle of the profiles. Furthermore, the insertion sheets for screwing the bar posts are designed so that the position and alignment of the bar posts are clearly defined and they can be mounted without alignment effort. The bar posts have a marking on the underside (VI, VA, Hi and Ha) for assignment to the corresponding profiles. At the same time, the insertion sheets also have a marking (HAL, HAR, HIL, HIR, VIL, VIR, VAL and VAR). The assignment of the insertion sheets and bar posts can be seen in Abb. 25. The illustration corresponds to a view of the instrument from above.

The following table shows the assignment of the designation:

V = Front (Vorne)
H = Rear (Hinten)
A = Outside (Aussen)
I = Inside (Innen)
R = Right (Rechts)
L = Left (Links)

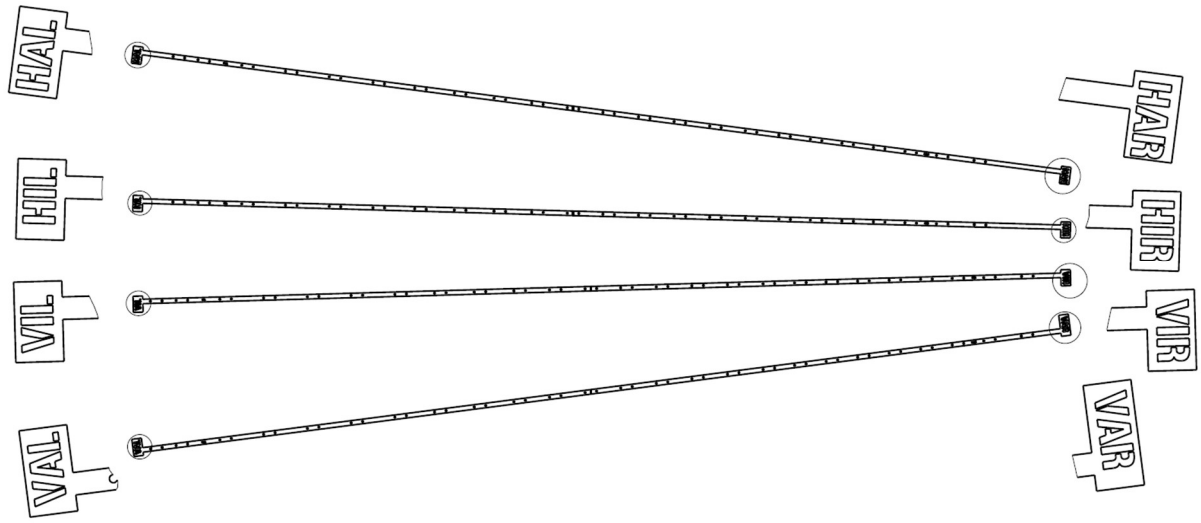


Abb. 25 Labeling of the panel holders and insertion plates

The insertion sheets are inserted into the upper groove of the longitudinal T-profiles according to their marking. The cord deflector and the bar posts are then fitted using the screws 9000068012. The insert plates lie flush against the profile at both ends with the marking flags. The position is fixed by screwing the bar posts in place.

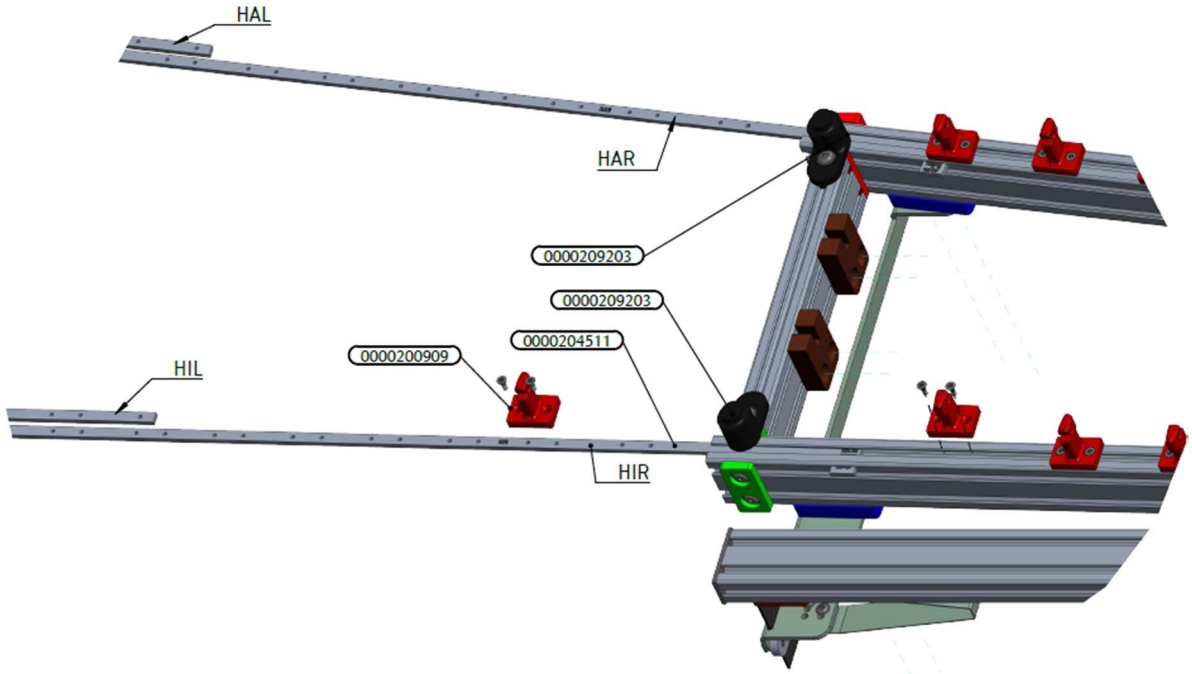


Abb. 26 Bar posts installation

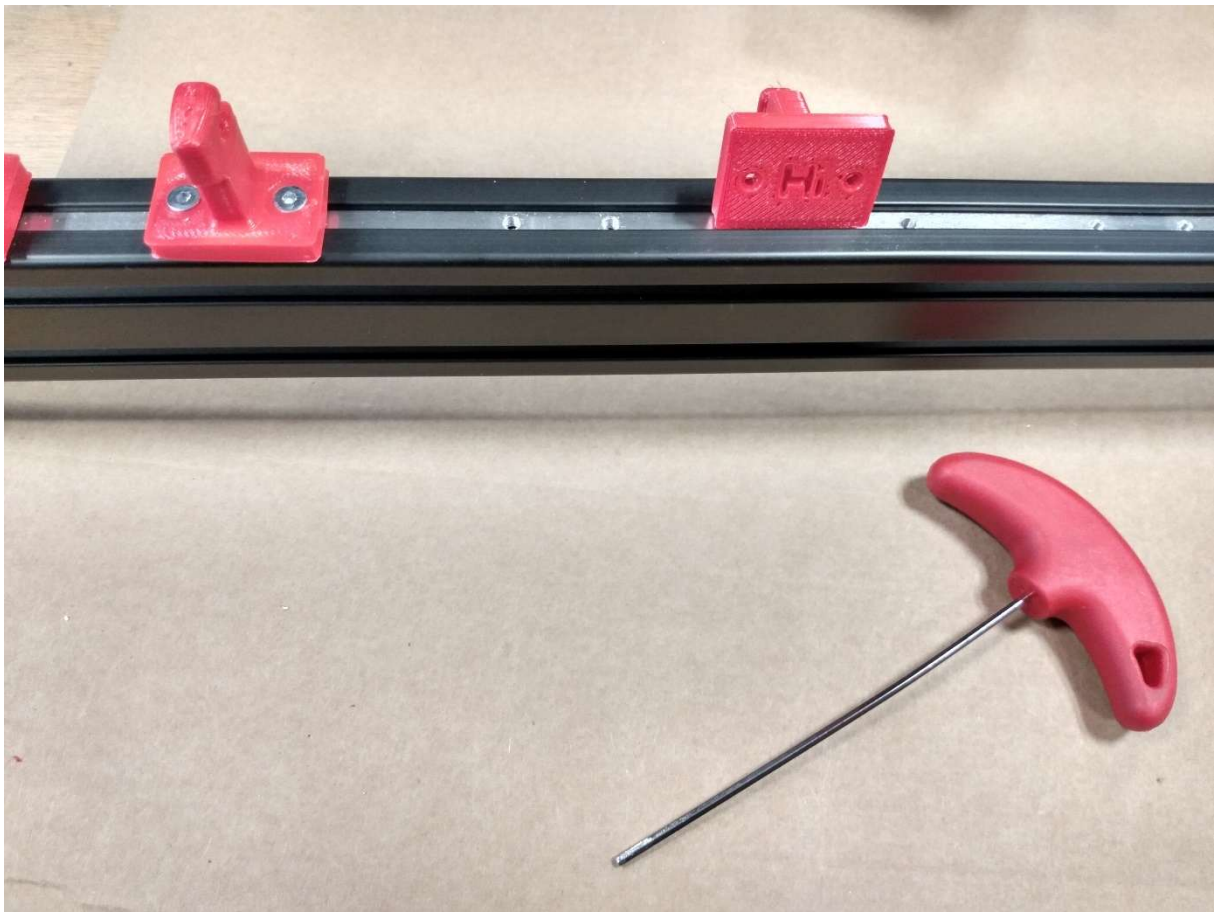


Abb. 27 Bar posts installation (holder with marking)

Once all the bar posts and cord deflectors have been fitted, the console looks as shown in Abb. 28.

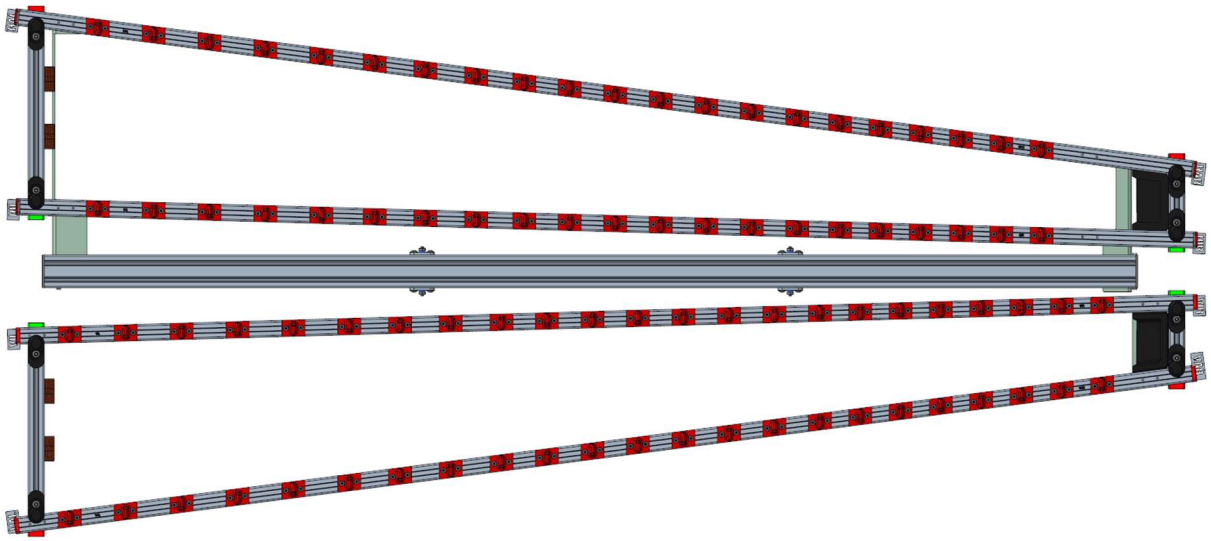


Abb. 28 Table fully assembled

8 Wedding

Now that the support frames and the base frame have been completed, they can be "married". The position of the support frames on the base frame is clearly defined by the guide plates highlighted in red in Abb. 29. The protruding areas of the guide plates (2) and (4) are used for lateral guidance and stabilization and the surfaces (1) and (3) serve as a stop for the support frames.

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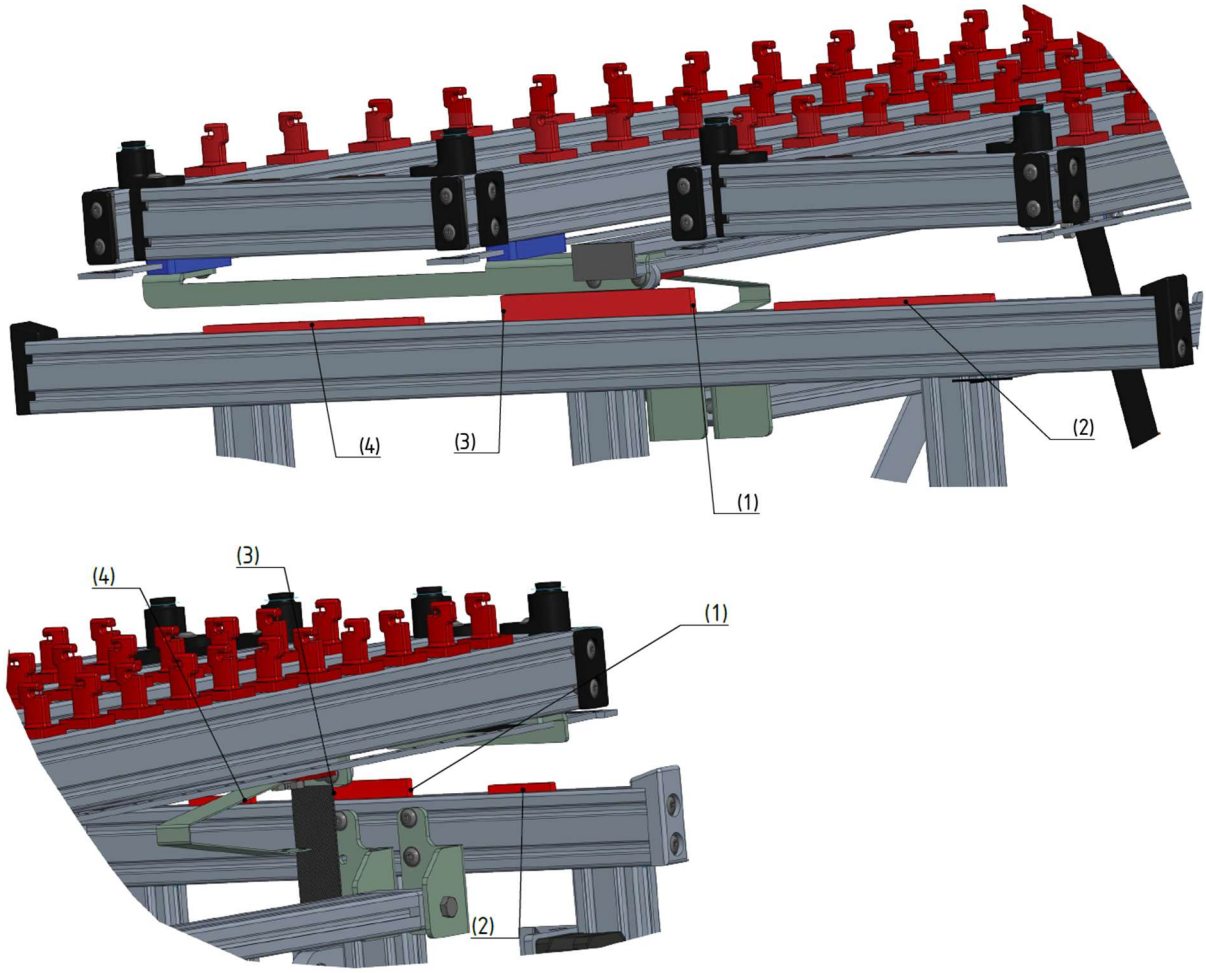
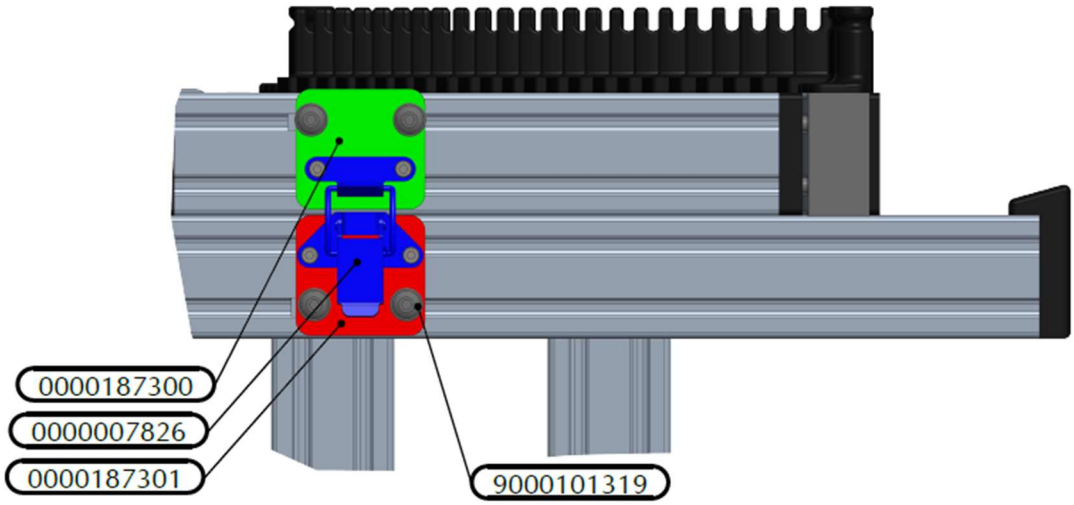


Abb. 29 Frame wedding

8.1 Frame connection

If a fixed connection between the support frame and the base frame is required, commercially available case locks can be used, for example.

The fastener I use is available from www.ganternorm.com under item number GN832.2. Similar latches can also be found in the USA at www.macmaster.com. This may require different hole positions in the parts 0000187300 and 0000197301.

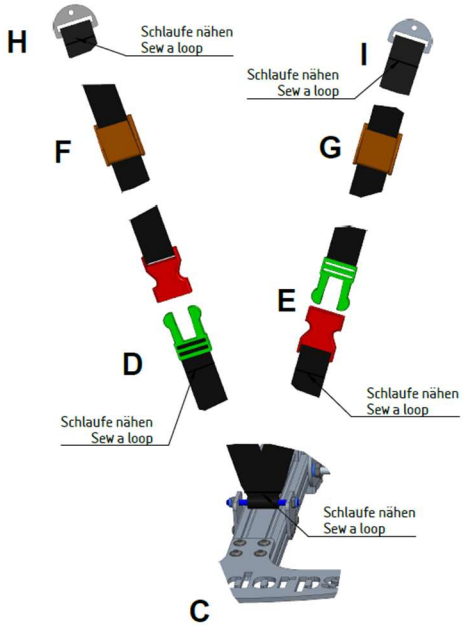


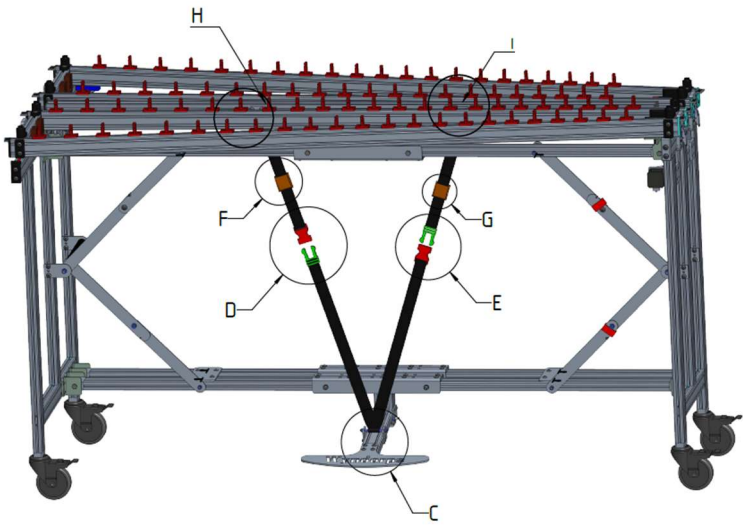
8.2 Pedal straps

I use polypropylene (PP) straps 1.4 mm thick and 25 mm wide as pedal straps, available in Germany from www.baender24.de.

Because the idea that a pedal buckle could open while playing is quite unpleasant, some use buckles with a safety button buckles with a safty button. I myself only use "normal" buckles without a safety catch (cheaper and more suppliers) and have never had any problems.
You need two buckles for the frame.

I also use two polyacetate clamp buckles to adjust the pedal strap length on the frames that I occasionally rent out. On my frames, which are only used privately, I have sewn the position firmly.





A loop is sewn around the threaded rod at point C.

Loops are also sewn around the buckle at points D and E. On the opposite side, the strap is only passed through. To avoid confusion when putting them together, I always use opposite closer parts, i.e. one male and one female on the pedal side.

At points F and G, the tape is passed through the clamp twice. Loops are sewn again at points I and H.

8.3 Damper felt

Finally, cover the damper beam with a 40 mm wide felt tape of your choice.

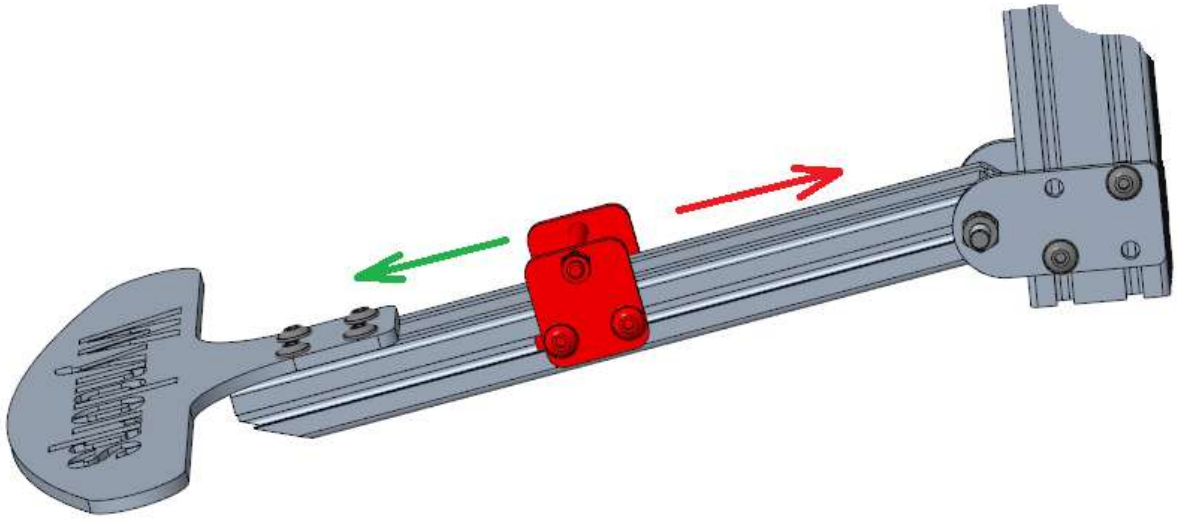
I found very inexpensive and self-adhesive felt tapes by the meter at https://www.hmfilze.de. However, I find this felt too rough and scratchy and therefore wrap it with a soft molton cloth.

Very high-quality, but also significantly more expensive self-adhesive wool felts are available from Filzfabrik Neumann. I prefer a felt called Neufilz 125 with a specific weight of 0.22 kg/m³.

9 Adjusting the damping

9.1 Adjusting the pedal ratio

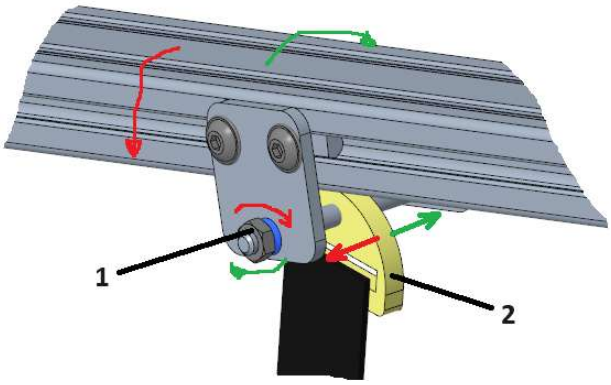
The pedal ratio is set by moving the pedal band connection on the pedal. The closer the connection is to the pivot point (red direction), the lower the transmission ratio, i.e. the damper travel in relation to the stroke of the pedal.



9.2 Adjusting the damper beam angle

Since the damping used here does not require the circular guide known from other vibraphones (M55), the damper must now be guided parallel to the sound plates by a balance of force between the spring force and the pedal stroke. This balance is set by the points of application of the pedal cable on the damper bar.

To adjust the force application points, the front nut (1) facing the player is loosened. To do this, hold the threaded rod with pliers. Now, by turning the threaded rod, the strap connection (2) shown in yellow can be moved forwards (red, clockwise) or backwards (green, anticlockwise). When moving in the red direction, the damper bar tilts more forwards when lowered from the sound plates by pedaling, and correspondingly more backwards in the green direction.



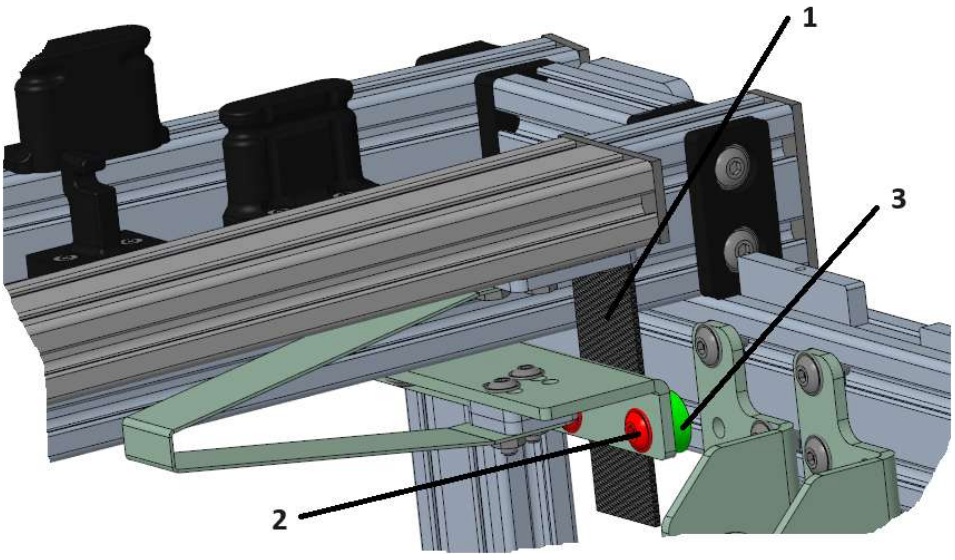
The damper beam angle is optimally adjusted when the beam is lowered parallel to the plates. Once this has been achieved, the nut (1) is tightened again with the threaded rod held firmly so that the threaded rod does not twist.

9.3 Adjusting the damper alignment

By adjusting the pedal strap lengths, the damping is set so that the damping reacts evenly to high and low tones. The pedal strap length is adjusted using the clamp buckles. Once a good position has been found and tested, this position can also be permanently secured by sewing the straps together.

9.4 Adjusting the damper end position

To adjust the damper end position (maximum upward stroke of the damper), the straps (1) are fixed at the desired height on both sides using the tension disk (3) and the screws (2) with the sound plates removed.



10 Parts list

Lfd.Nr	Menge	Sachnummer / Norm	Benennung / Naming	IdNr
1	1		Führungsblech (rechts) Guide plate (right)	0000187057
2	1	-	- -	0000160904
3	1	-	- -	0000160905
4	1	-	- -	0000187224
5	1	-	- -	0000187226
6	1	-	- -	0000187227
7	1	-	- -	0000187228
8	1	-	- -	0000187231
9	1	-	- -	0000187232
10	1	-	- -	0000187252
11	1	-	- -	0000187253
12	8	-	- -	0000187254
13	5	-	- -	0000187255
14	12	-	- -	0000187256
15	19	-	- -	0000187257
16	11	-	- -	0000187258
17	8	-	- -	0000208622
18	2	-	- -	0000208707
19	2	-	- -	0000208710
20	2	-	-	8000000005
21	2	-	- -	8000000006
22	2	-	- -	8000000007
23	2	-	- -	8000000008
24	2	-	- -	8000000009
25	4	-	- -	8000000012
26	4	-	- -	8000000013
27	4	-	Abedckkappe Covering cap	0000204014
28	4	-	Achshalter axis holder	0000186940
29	4	-	Anpassungen adjustments	0000187046
30	8	-	Ausgleichskeil (aussen) Wedge element (outside)	0000203573
31	8	-	Ausgleichskeil (innen) Wedge element (inside)	0000203587
32	2	-	Band-Spannblech Belt tensioning plate	0000206355
33	2	-	Bandklemme Strap clamp	0000206348
34	2	-	Biegefeder bended spring	0000187049

35	2	-	Dämpferunterlage links Damper base left	0000208877
36	2	-	Dämpferunterlage rechts Damper base right	0000208879
37	1	-	Einbaudummy -	0000187434
38	1	-	Einlegeblech VAL Insert plate VAL	0000186953
39	1	-	Einlegeblech VAR Insert plate VAR	0000186954
40	1	-	Einlegeblech VIL Insert Plate VIL	0000186956
41	1	-	Einlegeblech VIR Insert Plate VIR	0000186957
42	2	-	Federaufnahme spring holder	0000187048
43	1	-	Federaufnahme (Links) spring holder (left)	0000187050
44	1	-	Federlager spring base	0000187047
45	1	-	Führungszapfen pilot	0000187056
46	4	-	Gewindestange M5 Threaded Rod M5	0000205830
47	4	-	Gewindestange M5 x 65 Threaded Rod M6 x 65	0000206116
48	1	-	Gewindestange M6 Threaded rod M6	0000187070
49	1	-	Gewindestange M6 Threaded Rod M6	0000187336
50	24	-	ISO7380 M5x12 ISO7380 M5x12	8100000115
51	1	-	Klangplatten -	0000187107
52	4	-	Koppelblech 1 coupling sheet 1	0000187150
53	4	-	Koppelblech 2 coupling sheet 2	0000187151
54	4	-	Koppelklemme -	0000208881
55	6	-	Mittelstrebe middle beam	0000187201
56	2	-	Pedalachshalter pedal axis holder	0000187209
57	1	-	Pedalband Pedal band	0000206344
58	1	-	Pedalblech Pedal board	0000187208
59	1	-	Pedalhalter pedal holder	0000186908
60	2	-	Pedalschnurhalter Pedal cord holder	0000187334
61	1	-	Positioniereinheit (hinten aussen) positioning unit (sharp-outer)	0000203984
62	1	-	Positioniereinheit (hinten aussen) positioning unit (sharp-outer)	0000203985
63	1	-	Potizioniereinheit (hinten innen) positioning unit (sharp-inner)	0000203977
64	1	-	Potizioniereinheit (hinten innen) positioning unit (sharp-inner)	0000203981
65	3	-	Prallplatte stop plate	0000187212
66	12	-	Profil Gelenkkopf Profile connecting joint	0000203998
67	6	-	Quertraeger Crossbeam	0000187221
68	4	-	Radhalter wheel holder	0000187259
69	1	-	Resonanzrohre hinten -	0000187250

70	1	-	Resonanzrohre hinten -	0000187251
71	1	-	Rohrauflage vorne Tube support (front)	0000187249
72	4	-	Rohrhalter links Tube holder left	0000206486
73	4	-	Scheibe disk	0000187269
74	8	-	Schnurumlenkung Cord deflection	0000205740
75	6	-	Seitenblech für Pedalband Side plate for pedal band	0000205819
76	4	-	Spannverschlusshalter (oben) Tension lock holder (up)	0000187300
77	4	-	Spannverschlusshalter (unten) Tension lock holder (down)	0000187301
78	24	-	Std Verb Blech 5 Std Verb Blech 5	8100000236
79	2	-	Steckschnalle (männlich) Buckle (male)	0000206346
80	2	-	Steckschnalle (weiblich) Buckle (female)	0000206345
81	2	-	Stopperband Stopper tape	0000206354
82	2	-	Verbindungsblech connection sheet	0000187213
83	11	-	Vollgummi Haken stramm HA 22 Solid rubber hook tight HA 22	0000200906
84	11	-	Vollgummi Haken stramm HAx 22 Solid rubber hook tight HAx 22	0000208589
85	11	-	Vollgummi Haken stramm HI 22 Solid rubber hook tight HI 22	0000200909
86	11	-	Vollgummi Haken stramm HIx 22 Solid rubber hook tight HIx 22	0000208588
87	12	-	Vollgummi Haken stramm VA 22 Solid rubber hook tight VA 22	0000200910
88	12	-	Vollgummi Haken stramm VAx 22 Solid rubber hook tight VAx 22	0000208585
89	12	-	Vollgummi Haken stramm VI 22 Solid rubber hook tight VI 22	0000200911
90	13	-	Vollgummi Haken stramm VIx 22 Solid rubber hook tight VIx 22	0000208587
91	4	-	Winkel angle	0000187195
92	8	-	Winkel angle	0000187196
93	1	-	Zuschnittrohr 15 tube d20x6 245	0000205725
94	1	-	Zuschnittrohr 18 tube d20x6 245	0000205724
95	1	-	Zuschnittrohr 35 tube d20x6 245	0000205723
96	1	-	Zuschnittrohr 47 tube d20x6 245	0000205726
97	1	-	Zuschnittrohr 77 tube d20x6 245	0000187335
98	1	-	Zuschnittrohr 173 tube d20x6 245	0000187246
99	98	0.0.370.06	Nutenstein 5 St M4, verzinkt Nutenstein 5 St M4, verzinkt	8000000020
100	4	Artikel Nr. 71850066	Apparaterolle D75 / H 100 Castor D75 / H 100	8000000004
101	13	ISO 4014 - M6x60 - 8.8	Sechskantschraube mit Schaft Klassen A, B hexagonal bolt	9000062027
102	10	ISO 4033 M4-09	Sechskantmutter, Typ 2 (flach) engl. naming	9000037608
103	5	ISO 4762 - M3 x 12 - 8.8	Zylinderschraube mit Innensechskant hexagonal socket head cap screw	9000073041
104	20	ISO 4762 - M3 x 5 - 8.8	Zylinderschraube mit Innensechskant hexagonal socket head cap screw	9000073037

105	4	ISO 7380-2 - M4 x 16 - 010.9	Linsenschraube mit Bund M4 x 16 - 10.9 Hexagon socket button head screws with collar	9000101312
106	94	ISO 7380-2 - M5 x 10 - 010.9	Linsenschraube mit Bund M5 x 10 - 10.9 Hexagon socket button head screws with collar	9000101319
107	44	ISO 7380-2 - M5 x 20 - 010.9	Linsenschraube mit Bund M5 x 20 - 10.9 Hexagon socket button head screws with collar	9000101322
108	16	ISO 7380-2 - M5 x 40 - 010.9	Linsenschraube mit Bund M5 x 40 - 10.9 Hexagon socket button head screws with collar	9000101326
109	24	ISO 7380-2 - M5 x 8 - 010.9	Linsenschraube mit Bund M5 x 8 - 10.9 Hexagon socket button head screws with collar	9000101318
110	4	ISO 7380-2 - M6 x 12 - 010.9	Linsenschraube mit Bund M6 x 12 - 10.9 Hexagon socket button head screws with collar	9000101330
111	14	ISO 10511 M5 - 04	Sechskantmutter mit Klemmteil, niedrige Form engl. naming	9000037003
112	21	ISO 10511 M6 - 05	Sechskantmutter mit Klemmteil, niedrige Form engl. naming	9000037104
113	202	ISO 10642 - M3 x 8 - 8.8	Senkschraube mit Innensechskant Hexagon socket countersunk head screws	9000068012
114	6	ISO 10642 - M4 x 8 - 8.8	Senkschraube mit Innensechskant Hexagon socket countersunk head screws	9000068008
115	8	ISO 10642 - M5 x 25 - 8.8	Senkschraube mit Innensechskant Hexagon socket countersunk head screws	9000068022
116	4	ISO 10642 - M8 x 20 - 8.8	Senkschraube mit Innensechskant Hexagon socket countersunk head screws	9000068040
117	2	ITEM 0.0.370.04	Abstand Distance	0000187211
118	4	ITEM 0.0.370.04 5 40x20	Profil Profil	0000143427
119	1	ITEM 0.0.370.04 5 40x20	Profil Profil	0000186899
120	1	ITEM 0.0.370.04 5 40x20	Profil Profil	0000186900
121	1	ITEM 0.0.370.04 5 40x20	Profil Profil	0000186901
122	1	ITEM 0.0.370.04 5 40x20	Profil Profil	0000186902
123	2	ITEM 0.0.370.04 5 40x20	Profil Profil	0000186903
124	2	ITEM 0.0.370.04 5 40x20	Profil Profil	0000186904
125	2	ITEM 0.0.370.04 5 40x20	Profil Profil	0000186905
126	1	ITEM 0.0.370.04 5 40x20	Profil Profil	0000187039
127	2	ITEM 0.0.370.04 5. 40x20	Profil Profil	0000203581
128	2	ITEM 0.0.370.04 5. 40x20	Profil Profil	0000203582
129	10	ITEM 0.0.370.11	Abdeckkappe 5 40x20 Abdeckkappe 5 40x20	8100000129