Design & build guide · v1.0 · 2026-11-08

Passive wooden slat treadmill

A walking treadmill with no motor, battery or electronics, built from wood and off-the-shelf parts. You walk on a loop of 42 plywood slats bolted to two roller chains. The slats roll on 120 polyurethane wheels. Gravity drives the belt on a 3°–9° incline, and a magnet brake (no wires) sets the speed.

1810 × 620 footprint, mm (frame; 780 incl. brake box & platforms)	1247 × 500 walking surface, mm
227 mm step-up height at the rear	0.5–6 km/h walking speed, set by incline + brake
3° – 9° incline, 5 settings, tool-free	≈ 85 kg total; ≈ 73 kg without handrail
≤ 120 kg user weight (design load)	€ 730–1090 parts, ordered China + local store

1. See it (3D)
2. How it works
3. Drawings & key dimensions
4. Buy list
5. Cut list
6. Tools
7. Build, step by step
8. Set-up & tuning
9. Problems & how they are solved
10. Safety & maintenance

1 · See it



Fig. 1. Assembled at 6° incline, seen from the rear left. You walk toward the handrail and the top of the belt moves backwards under you.

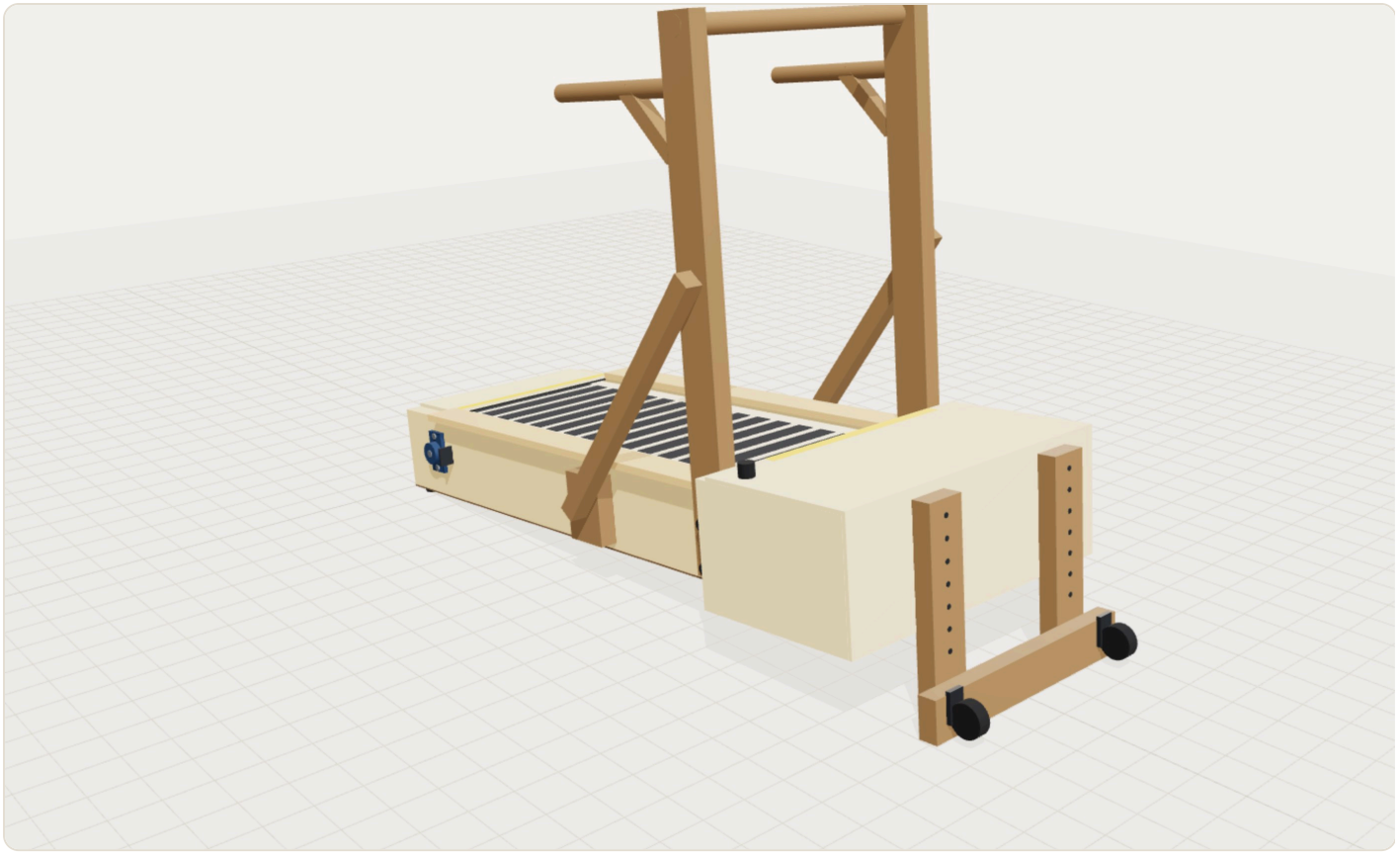


Fig. 2. Front: hood over the front sprocket and brake, incline legs with transport wheels.

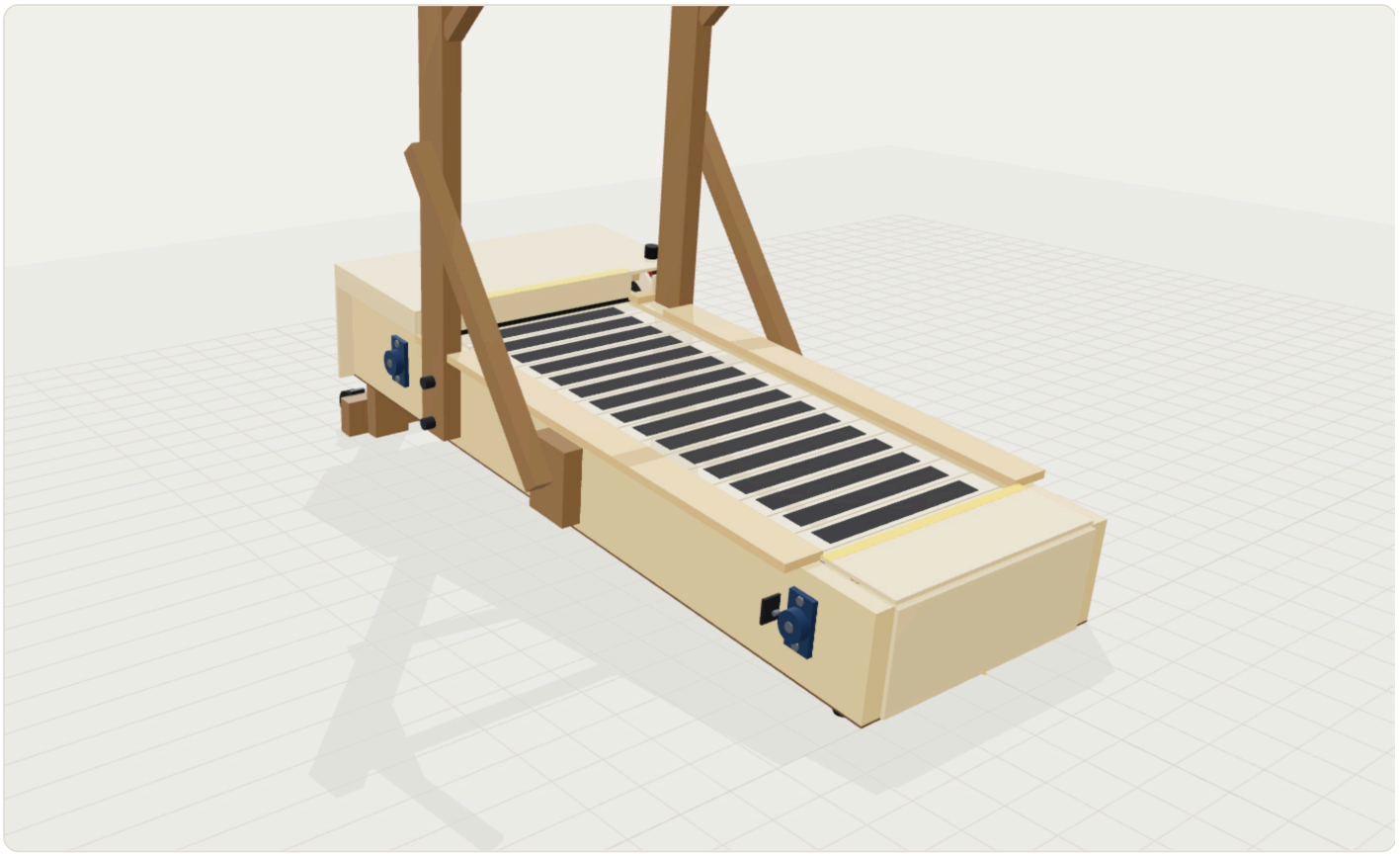


Fig. 3. Rear: rear guard with lifting slot, flange bearings, chain tensioners.

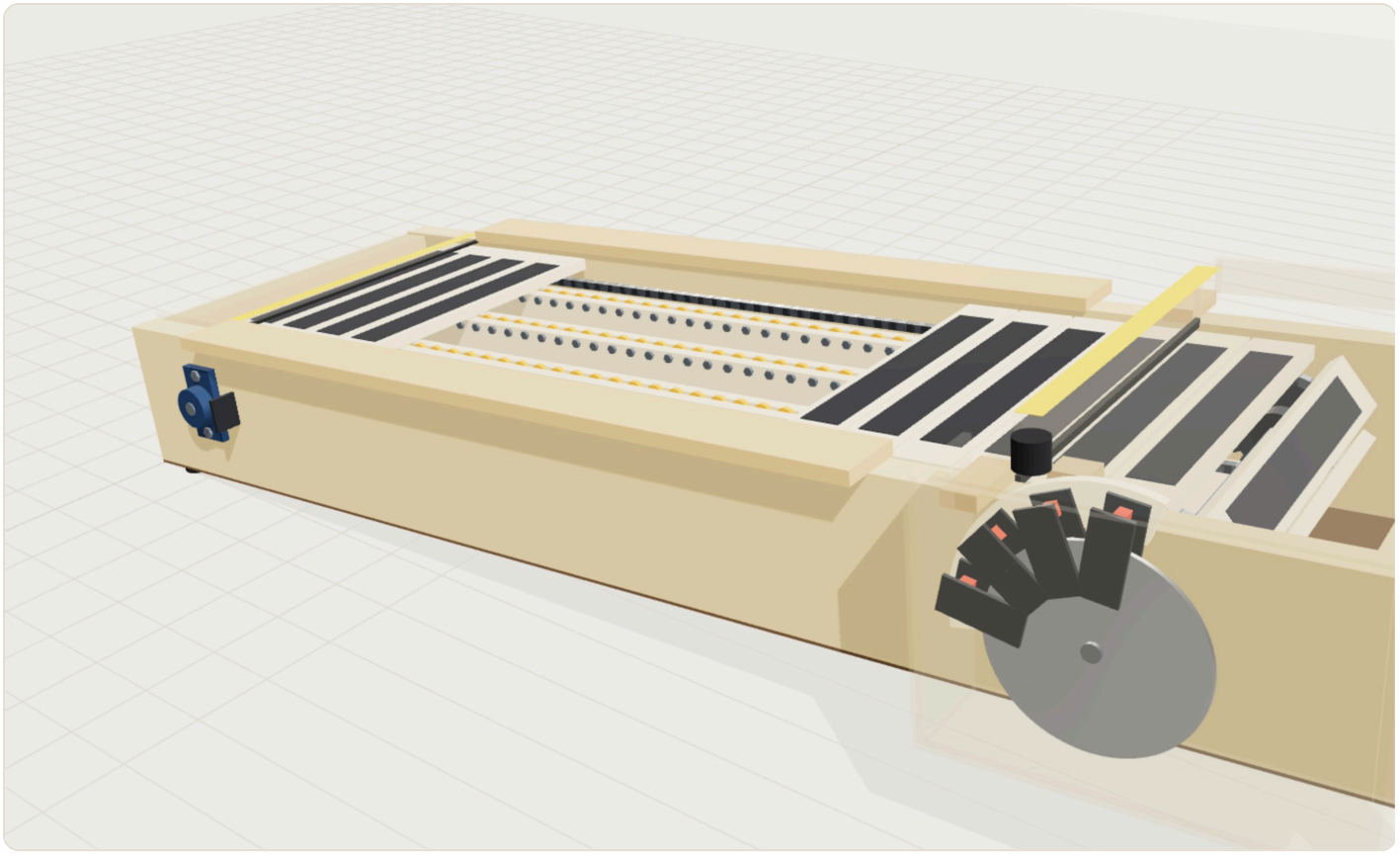


Fig. 4. Deck cut away: three bearing rails with PU rollers, crossmembers, chains with K1 tabs, return run.

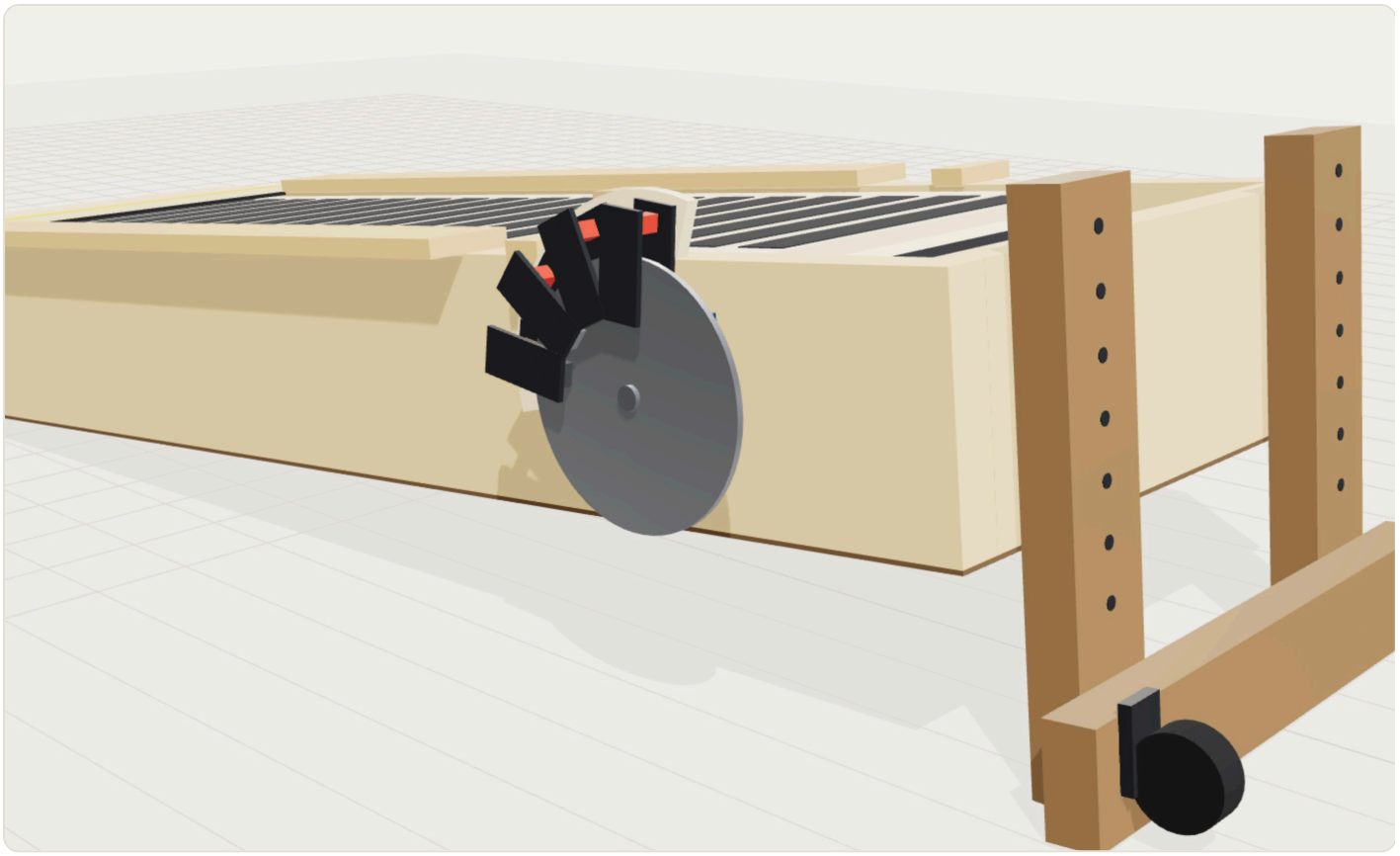


Fig. 5. Eddy-current brake on the front shaft (hood removed): aluminium disc and 4 sliding magnet C-units.

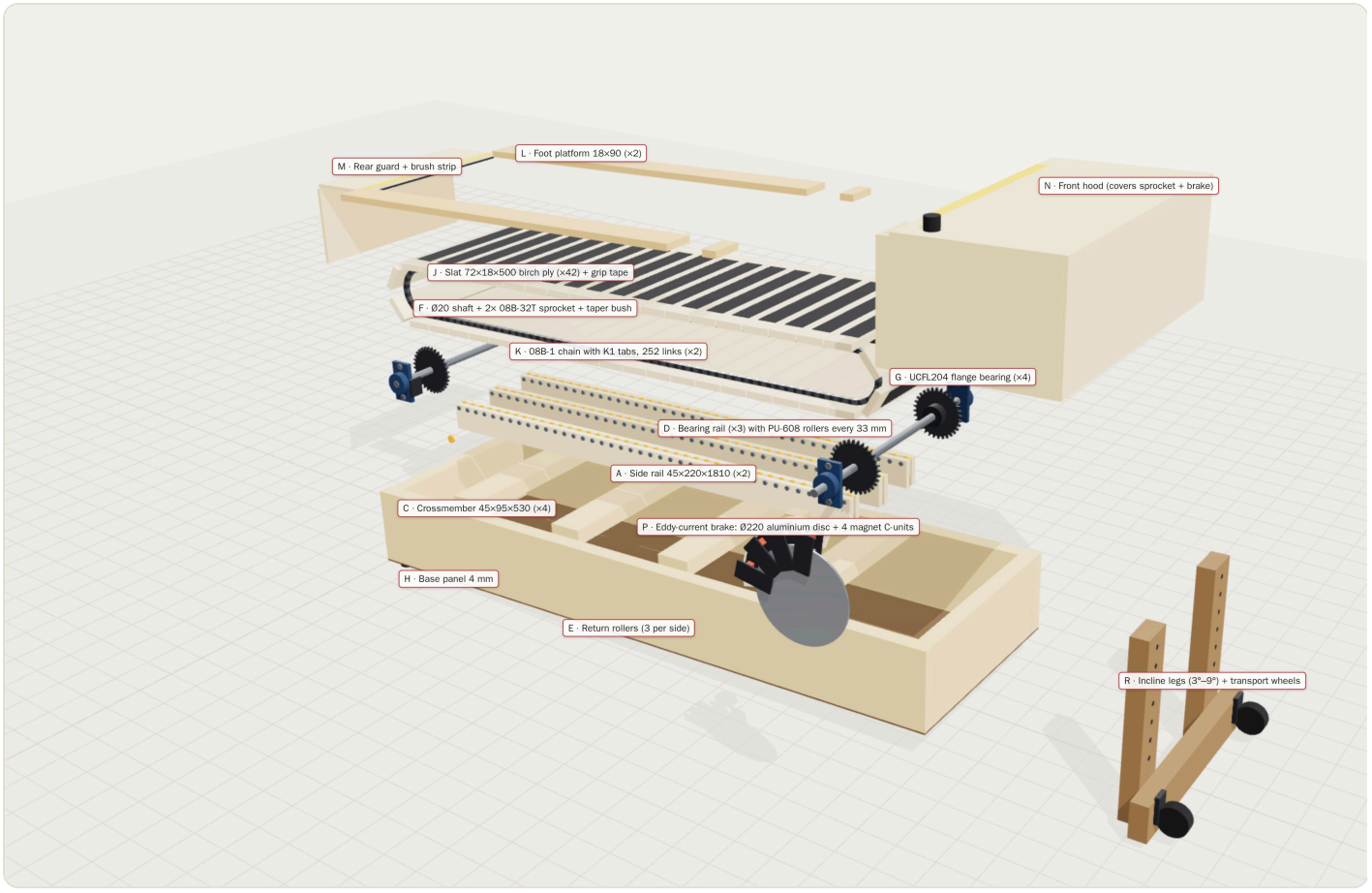


Fig. 6. Exploded view. The letters match the buy list and cut list.

2 · How it works

The belt. 42 slats of 18 mm birch plywood (72 × 500 mm) are screwed to the K1 tabs of two loops of 08B roller chain, one slat every 6 links (76.2 mm), which leaves 4.2 mm gaps. The chains run on four 32-tooth sprockets on two Ø20 shafts in UCFL204 flange bearings. This is a slat conveyor, the same principle as commercial non-motorised treadmills, built from industrial catalogue parts. Unlike a cloth belt it cannot drift sideways, stretch unevenly or slip on a roller.

The deck. Under the walking side the slats roll on three rails of polyurethane-tyred 608 bearings, 40 per rail at 33 mm pitch, so each slat always sits on 6 or more wheels. Nothing slides, which keeps friction low (about 15–20 N for an 80 kg walker).

The drive is you plus gravity. With the front raised, your weight pushes the belt backwards with a force of $m \cdot g \cdot \sin\theta$. You walk “uphill” and the belt carries you back down, so you stay in place. This is real exercise: at 6° and 80 kg you put in about 80 W, the same as walking up a 10 % slope.

The speed governor. A constant drag alone would give no stable speed: the belt would either stall or run away. So the front shaft drives a Ø220 aluminium disc that passes between pairs of neodymium magnets. Eddy currents give a drag that rises with speed (about 35 N per magnet unit at 1 m/s), so the belt settles where gravity equals drag. Slide magnet units in or out for more or less resistance. When you step off, the driving force disappears and the belt stops within about a second.

Incline	Drive force (80 kg)	Your power at 1 m/s	Expected steady speed, km/h, with magnet units fully in			
			1 unit	2 units	3 units	4 units
3°	41 N	41 W	2.4	1.2	0.8	0.6
4.5°	62 N	62 W	4.5	2.2	1.5	1.1
6°	82 N	82 W	6.6	3.3	2.2	1.6
7.5°	102 N	102 W	>8	4.3	2.9	2.2
9°	123 N	123 W	>8	5.4	3.6	2.7

> Estimates: brake strength is ±50 % until measured, and lighter walkers go slower (scale the drive force by weight). That is why both the incline and the magnet position are adjustable. Holding the handrail and leaning forward adds force and speeds the belt up; letting go returns it to its natural speed.

3 · Drawings & key dimensions

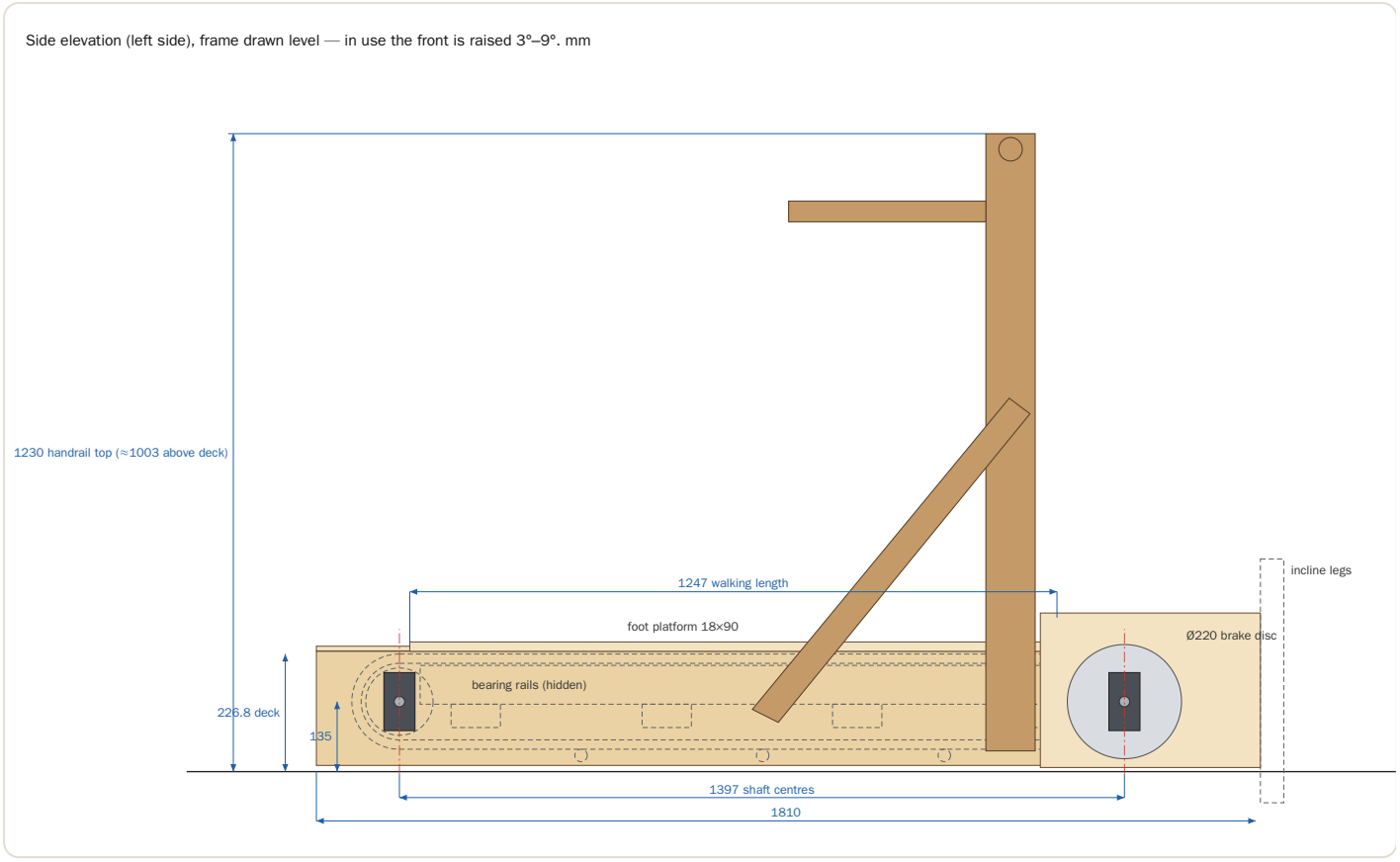


Fig. 7. Side elevation. Heights are measured from the floor with the frame level, on 12 mm feet.

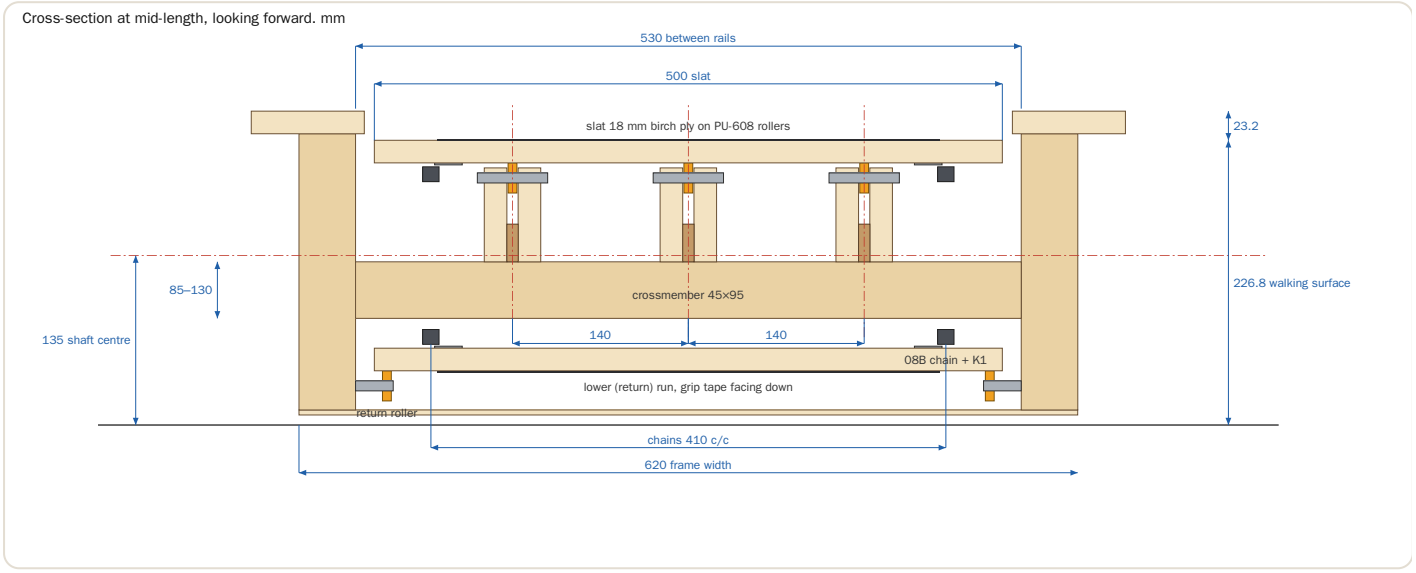


Fig. 8. Cross-section showing how everything stacks inside the 530 mm between the side rails. The crossmembers pass *through* the loop, between the upper and lower runs of the chain, with about 9 mm clearance.

Critical dimensions (verify against your parts before cutting)

What	Value	Why it matters
Chain loop	252 links = 3200.4 mm, 42 slats on every 6th *inner* link	Both chains identical. Connecting links are outer links, so they never land under a slat.
Shaft centre distance	1397 mm (rear slot ±25)	(252 − 32) × 12.7 / 2
Sprocket pitch diameter	129.6 mm (32T 08B)	Sets all heights
K1 tab height above chain centre line, *h*	9 mm (typical; measure)	If yours differs, move the rail tops by the difference
Bearing tops (= slat underside)	shaft centre + R + h = shaft + 73.8 mm	Flush transition from sprocket to rails
Bearing hole centre in rail	8 mm below rail top (for 24 mm wheels; = D/2 − 4)	Wheels stand 4 mm proud of the rail
Chain centre lines	±205 mm from centre = 60 mm in from each rail's inner face	Sprocket position on the shafts
Bearing-rail centre lines	−140 / 0 / +140 mm	Clear of the K1 tabs (≥ 17 mm)
Return rollers	±240 mm, axle 31.2 mm above floor	Run on the bare slat ends

4 · Buy list

Letters refer to the parts in Fig. 6. AliExpress / Alibaba search terms are given; the same parts are sold by bearing-and-transmission shops in Europe at 2–3× the price but delivered in days. Prices are 2026 euro estimates.

4a · Order from China (or an industrial parts shop)

	Part	Qty	Search for	€
K	Roller chain ISO 08B-1 (½″ pitch, European standard) with K1 attachments on every link (or every 2nd link)	7 m (2 loops × 252 links = 3.20 m each)	`08B K1 attachment chain every link`	60–110
K	Connecting (master) links 08B-1, plain	6 (2 used + spares)	`08B-1 connecting link`	3
F	Sprocket 08B-1, 32 teeth, taper-lock bore (bush size 1610), steel	4	`08B 32T taper lock sprocket`	60–90
F	Taper-lock bush 1610, bore 20 mm	4	`taper bush 1610 20mm`	15–25
G	Flange bearing UCFL204 (2-bolt, 20 mm bore, cast iron)	4	`UCFL204`	20–30
F	Steel shaft Ø20 mm (h7 chromed linear shaft or C45 bright bar), cut to 740 mm (front) and 700 mm (rear)	1 + 1	`linear shaft 20mm cut to length`	20–30
D	PU-coated 608 bearing, 8 mm bore × 24 mm OD × 7 mm (rated ≥ 30 kg each)	140 (126 used)	`polyurethane coated 608 bearing 8x24x7`	50–90
P	Neodymium block magnet 40×20×10 mm, N45SH (or N52), magnetised through the 10 mm	10 (8 used)	`N45SH 40x20x10 block magnet`	25–40
P	Aluminium disc Ø220 × 6 mm, alloy 1050/1060 (best) or 6061, Ø20 centre hole, 4× Ø6.5 on Ø50 PCD, 6× Ø10 lock holes on Ø100 PCD	1	`aluminium plate laser cut custom (or local water-jet shop)`	15–30
P	Rigid shaft flange / flange coupling, 20 mm bore, with set screws, 4-hole	1	`20mm shaft flange coupling`	5–8
J	M5 threaded inserts for wood (hex-drive, 10 mm long)	100	`M5 wood insert hex socket`	8

J	M5×12 button-head screws + M5 washers, stainless or 10.9 black	100 + 100	`M5x12 button head ISO7380`	8
D	Shim rings DIN 988, 8×14×1 mm	300	`DIN988 8x14x1 shim washer`	8
—	Chain breaker tool for 06B–12B chain	1	`chain breaker 40 50 60`	10
J	Anti-slip grip tape, 50 mm wide, coarse (60–80 grit), black	18 m	`anti slip tape 50mm 18m`	15
M/N	Door-sweep brush strip, nylon bristle 20–25 mm, aluminium holder	2 × 1 m	`brush strip door seal aluminium 25mm`	10
R	Fixed wheel, Ø75 mm rubber, plate mount	2	`75mm fixed castor rubber`	8
			Subtotal	≈ € 340–520

> When ordering: stick to ISO 08B (European) for chain and sprockets. ANSI #40 has the same pitch but a different roller, so do not mix the two. Ask the seller for the K1 tab height and hole offset, or measure on arrival before cutting rails and slats (step 0). If 32T taper-lock sprockets are not available, buy 32T with a finished 20 mm bore and 2 set screws.

4b · Local hardware / timber store

	Part	Qty	€
A, B	Spruce C24 / KVH structural timber 45×220, planed, dry (≤ 15 %)	5.0 m (2 × 1810 + 2 × 530 + waste)	35–50
C	Spruce C24 45×95	2.5 m	8
Q, R	Hardwood (beech or oak) 45×95 — posts, legs, leg crossbar; or good knot-free pine	5.5 m	40–70
Q	Round beech handrail / dowel Ø45 (stair handrail stock) and Ø40	1.0 m + 0.8 m	15–25
J, D	Birch plywood 18 mm, BB/BB, 1250×2500 (slats, bearing-rail sides, brake bracket)	1 sheet	85–120
D, M, N	Plywood 9 mm, 1250×2500 (rail spacers, hood, rear guard, brake box)	1 sheet	30–45
H	HDF / hardboard 4 mm (base panel)	1 sheet 1250×2500	10
L	Pine board 18×90 (foot platforms)	2 × 1.3 m	10

D, E	Hex bolts M8×60 (rails) + M8×50 (return rollers), nyloc nuts M8	126 + 6, 135 nuts	20
A, C	Furniture cross-dowel (barrel nut) M8 Ø10 + M8×100 bolts + washers	16 sets	12
G	M10×90 hex bolts + Ø30 washers + nylocs (UCFL204)	8	6
G	M10×80 bolt + 2 nuts (tensioner) and 2 pcs steel angle 50×50×5, 60 long	2 + 2	6
Q, R	M10×130 carriage bolts with star/T-knob nuts (posts & legs, tool-free)	8	15
P	Mild-steel flat bar 40×5 (brake plates, 8 × 90 mm)	1 m	5
P	M6×50 bolts, M6 star knobs, aluminium tube Ø10/Ø6.5 for 30 mm spacers	8 / 4 / 0.3 m	10
—	Wood screws (Spax-type) 4×40, 5×70, 6×100; PVA D3 or PU wood glue	box each	20
—	Rubber feet Ø40 (rear) or M10 levelling feet	2	6
—	Finish: hard-wax oil or water-based PU floor varnish	0.75 l	15–25
—	Thread-lock medium (blue, 243), dry PTFE chain lube	1 each	15
—	Optional: rubber equipment mat 2.0 × 0.9 m (noise, floor protection)	1	25–40
		Subtotal	≈ € 390–570

Most timber stores will rip the plywood into strips on their panel saw. Ask for 72 mm and 75 mm strips, but check widths: the slats must all match within ±0.3 mm, so a table saw at home gives better results.

5 · Cut list

	Part	Material	Length / size	Qty	Notes
A	Side rail	45×220 spruce	1810	2	Holes per drawing below
B	Rear beam / front beam	45×220 spruce	530	2	Rear beam ripped to 216 high
C	Crossmember	45×95 spruce, laid flat	530	4	
D1	Bearing-rail side	18 mm birch ply, 75 high	1317	6	Rip all 6 at one fence setting
D2	Bearing-rail spacer	9 mm ply, 30 high	1317	3	
J	Slat	18 mm birch ply, 72 wide	500	46	42 + 4 spare; width ±0.3 mm
L	Foot platform	18×90 pine	1105 + 39	2 + 2	Notched around the handrail post
M	Rear cover	9 mm ply	530 × 180	1	Hand-hold slot 120×30
M	Rear end panel	9 mm ply	530 × 216	1	
N	Hood top / front / sides	9 mm ply	see step 15	1 set	Front hood 810 wide × 392 deep
P	Brake bracket	18 mm birch ply	arc r110–195, 120°	1	
P	Brake plate	40×5 flat steel	90	8	
Q	Handrail post	45×95 hardwood	1190	2	
Q	Diagonal brace	45×45 hardwood	≈ 860 (fit)	2	Rip from 45×95
Q	Front bar / side bars	Ø45 / Ø40 round	710 / 380	1 / 2	
Q	Knee brace / spacer block	45×45 / 45×95	200 / 120	2 / 2	
R	Incline leg	45×95 hardwood	470	2	7 holes Ø11, pitch 47, first 153 from bottom
R	Leg crossbar	45×95 hardwood	600	1	

H	Base panel	4 mm HDF	1810 × 620	1	

Plywood layout (18 mm sheet 1250×2500): first rip the six 75 mm rail sides along the 2500 length and cross-cut them to 1317. From the remaining 782 × 1317 piece, cut 17 slats (500 long, across). From the 1183 × 1250 offcut, cut 2 × 15 more. That gives 47 slats; keep the leftovers for the brake bracket.

6 · Tools

Essential: table saw or track saw with a rip guide; drill press (for consistent rail and slat holes); drill/driver; Forstner bits Ø26 and Ø30; HSS bits Ø6.5–Ø11; jigsaw; hacksaw or angle grinder (shaft and steel flat); files; 1.5 m aluminium straightedge; feeler gauges; vernier caliper; carpenter's square; clamps (6+); spanners 8/10/13/17; 08B chain breaker; hex keys.
Useful: router with 2 mm round-over and chamfer bits; dial indicator (disc run-out); spring scale or luggage scale (for testing).

7 · Build, step by step

> Coordinates in this section: length is measured from the rear end of the side rails. Height is measured from the bottom edge of the side rail (the rail sits 12 mm above the floor on its feet). Width is measured from the treadmill centre line. The brake is on the left as you walk.

0. Check your parts. Lay a length of chain on a sprocket. Measure *h*, the height of the K1 tab top above the pin centres (design value 9 mm), and *e*, the inward offset of the K1 hole from the chain centre line. Measure the outer diameter *D* of a PU bearing (design value 24). Write the three numbers down: rail heights and slat hole positions below are given as formulas in *h*, *e* and *D*.

1. Side rails (A). Cut two rails to 1810 mm and mark them as a mirrored pair. Drill:
   - Front shaft hole: Ø26 at length 1557, height 123.
   - Rear shaft slot: 26 wide from length 135 to 185 (drill Ø26 at both ends, jigsaw between).
   - UCFL bolts: Ø11 at heights 78 and 168 on both shaft lines. The rear ones are slotted to match.
   - Crossmember bolts: Ø9 at height 95.5, two per crossmember at ±25 from its centre. Crossmember centres are at 307, 675, 1042, 1410.
   - End beam bolts: Ø9 at heights 50 and 170, at length 22 (rear) and 1788 (front).
   - Return roller bolts: Ø8.5 at height 19.2, lengths 510, 860, 1210.
   - Handrail post bolts: Ø11 at length 1337, heights 58 and 158.
   - Brace spacer block: screw holes at length 820–940.

   Round over all top edges.

2. Crossmembers (C) and end beams (B). Cut to 530 mm, square ends (the frame is only as square as these). In each end drill an Ø9 bolt hole 70 deep, and from the face an Ø10 cross-dowel hole 40 from the end. Rip the rear beam to 216 high.

3. Dry-assemble the frame. Bolt the side rails to the end beams and to the crossmembers. The crossmember undersides go at height 73, tops at 118. Measure both diagonals of the box; they must agree within 1 mm. Leave it bolted.

4. Bearing rails (D). For each rail, glue the 9 mm spacer (D2) flush with the bottom between two 18 mm sides (D1). Clamp 9 mm offcuts in the top of the gap while it dries so the slot stays parallel. Then drill on the drill press: fence set so the hole centre is D/2 − 4 = 8 mm below the top edge, Ø8.2 holes, first hole 16 mm from the end, pitch 33 mm, 40 holes. Use a pin in the previous hole as an index stop, so every rail is identical.
   Fit each bearing with a 1 mm shim on each side, an M8×60 bolt and a nyloc nut. Tighten until the inner race is clamped but the wheel still spins freely.

5. Mount and level the rails. Place the rails on the crossmembers on centre lines −140 / 0 / +140, from length 200 to 1517. Screw them down from below with 2 × 6×100 screws per crossing. Then level: every bearing top must sit at height 196.8 (= 123 + 64.8 + *h*) and in one plane. Check with the

straightedge across and along, and shim under the rails with veneer or plastic shims until feeler gauges show ≤ 0.3 mm. This step decides how smooth the ride is.

6. Return rollers (E). Fit an M8×50 bolt from outside each Ø8.5 hole. Inside, add a 21 mm spacer (washers or tube), the PU bearing, a shim and a nyloc. The wheel centre should end up 25 mm from the rail's inner face.

7. Shafts and sprockets (F, G). Deburr and chamfer the shaft ends; drill a Ø6 dimple for the brake flange 25 mm from the left end of the 740 front shaft. Slide the sprockets on with taper bushes loose, hubs facing the centre. Pass each shaft through its rails and fit the UCFL204s on the outside faces, with Ø30 washers inside under the M10 nuts. Front: tighten. Rear: hand-tight in the slots. The front shaft sticks out 43 mm beyond the left bearing. Move the sprockets so the tooth centres are 60 mm in from each rail's inner face, then check with the straightedge that front and rear sprockets line up on each side (±0.5 mm).

8. Tensioners. Screw a steel angle to the outer face of each rail just ahead of the rear UCFL. Its M10 push bolt (with lock nut) presses the bearing housing backwards.

9. Slats (J). Cut 46 slats 72 × 500 (±0.3 mm). Round over the top long edges 2 mm and chamfer the bottom long edges 1.5 mm. Using a drilling jig, drill two holes for the M5 inserts in the underside, centred on the width, at 45 + e mm from each end (≈ 58 mm for e = 13), 11 deep. Screw in the inserts. Sand, then apply 2–3 coats of finish (all faces and edges). When dry, stick a 50 × 400 strip of grip tape centred on the top. The last 50 mm at each end stays bare for the return rollers. Finish all other wooden parts now as well.

10. Chains (K). With the breaker, cut each chain to exactly 252 links. Lay both side by side and count again. On both chains, paint every 6th inner link starting from the same link: these 42 links carry the slats. Drape each chain over its two sprockets (rear shaft pushed fully forward) and close it with a connecting link, the clip's open end facing away from the direction of travel.

11. Fit the slats. Working at the top of the deck, screw a slat to the matching painted links of both chains with M5×12 button screws, washers and blue thread-lock, from below through the K1 holes. Square it to the side rail. Move the belt along by hand and repeat 42 times. Spin the belt a few turns, then tighten the taper bushes on all four sprockets: the chains will have settled the phase between left and right.

12. Tension. Turn both rear push bolts equally until the lower run sags about 5 mm between return rollers (roughly 300 N chain tension). Measure the shaft centre distance left and right; it must match within 0.5 mm. Tighten the rear UCFL bolts. Turn by hand: no tight spots, no slat touching anything.

13. Eddy-current brake (P).
    - Disc: bolt it to the flange hub, fit on the shaft stub and tighten the set screws into the dimple. Run-out at the rim should be under 0.5 mm; shim between flange and disc if needed.
    - Bracket: cut an 18 mm ply arc (r 110–195 mm, 120°, covering the rear-upper quadrant) and mount it on two 36 mm spacer blocks on the left rail.
    - Magnet units (×4): each is two 90 × 40 × 5 steel plates held 30 mm apart by an M6 bolt through a 30 mm aluminium tube at the outer end. A magnet is epoxied to the inner face of each plate at the other end. Orient the pair so they attract each other across the gap (N facing S). Use a wooden wedge while assembling and never let two magnets touch.

- Mounting: each unit straddles the disc rim and is held by its M6 bolt and star knob in a 50 mm radial slot in the bracket. Pushed fully in, the magnets cover the disc (centre at r 85). Pulled fully out, they are clear of it (no brake). Leave at least 2 mm between disc and magnet on each side.
- Parking lock: drill an Ø10 hole through the brake box wall in line with the Ø100 lock-hole circle on the disc, for an M10 pin.

14. Guards (L, M, N, H).
    - Foot platforms: screw them on the rails with an 8 mm gap to the slat ends (inner edge 258 from centre), notched around the handrail post.
    - Rear: fit the rear end panel and the rear cover (6 mm above the slats, front edge 20 mm forward of the rear shaft). Screw a brush strip under its front edge so the bristles touch the slats.
    - Front hood: build it as one removable box: top 70 mm above the deck, 9 mm ply. On the left it continues down as the closed brake box (with a hinged lid for magnet adjustment, ventilation slots and a 25 mm bottom clearance). Its rear edge sits 130 mm behind the front shaft with a brush strip touching the slats. Fix with 6 screws so it cannot be removed casually.
    - Base panel: screw the 4 mm base panel to the underside.
15. Legs and wheels (R). Drill two Ø11 holes through the front beam at heights 48 and 142 from its bottom, 200 mm either side of centre. In each leg drill 7 Ø11 holes at 47 mm pitch, starting 153 mm from the bottom. Join the legs with the crossbar (glue + 2 × 6×100 screws each side) and mount the wheels on the crossbar's front face, 10 mm above the floor when the legs stand upright. Fit rubber or levelling feet at the rear.
16. Handrail (Q). Glue and screw the front bar between the posts (Ø45 holes, 35 deep) and add the side bars with knee braces. Bolt the posts to the rails with two M10 carriage bolts and star nuts, then fit the diagonal braces outboard from the post to the spacer block on the rail. The bar sits about 975 mm above the deck; cut the posts shorter if you are under 165 cm.
17. First run. Set 4.5°, two magnet units fully in, the rest out. Check every bolt. Hold the handrail, step on from the side platform and start walking slowly.

Incline	Leg extension below frame at the legs	Leg holes used (1 = lowest)
3°	93 mm	1 + 3
4.5°	140 mm	2 + 4
6°	187 mm	3 + 5
7.5°	235 mm	4 + 6
9°	282 mm	5 + 7

8 · Set-up & tuning

- Measure your speed: mark one slat and count how many times it comes past in 30 s. One lap is 3.2 m, so speed in km/h = laps × 0.384. For example, 10 laps in 30 s is 3.8 km/h.
- Too fast: slide a unit further in, add a unit, or lower the incline by one hole.
- Too slow or heavy: slide a unit out, or raise the incline. For desk walking use 3°–4.5° and little brake. For a workout use 7.5°–9° with more brake.
- Belt friction test (no one on it): hook a luggage scale on a slat and pull steadily. It should need under 15 N to keep the belt moving with the magnets out. More than that means a misaligned sprocket, over-tight chain or a rubbing slat.
- Break-in: after 2 hours of use, re-check chain tension, slat screws and that all four sprocket bushes are tight.

9 · Problems & how they are solved

Problem	Cause	Built-in fix / what to do
Belt runs away / walker gets carried backwards	On an incline gravity drives the belt; with only constant friction there is no stable speed.	Eddy-current brake gives drag proportional to speed, so the belt settles at one speed. Start at 4.5° with 2 magnet units, then tune. The handrail lets you steady yourself.
Belt too hard to move / walking feels like dragging	Incline too low for your weight, too much brake, uneven bearing tops, chain too tight, sprockets misaligned.	Raise incline one step or slide a magnet unit out. Check bearing tops with a straightedge (±0.3 mm). Re-tension to 5 mm sag between return rollers. Re-align sprockets with a straightedge.
A flat “manual” treadmill does not work	With no motor and no slope, nothing pushes the belt backwards except awkward foot scraping.	Design is built around a 3°–9° incline (legs with 5 positions). This is how commercial manual treadmills work.
Fingers / toes / laces pulled in at the ends	Where slats come round the front sprocket the gaps close from 42 mm to 4 mm: a pinch point.	Front hood extends 130 mm behind the front shaft and carries a brush strip touching the slats. Rear cover + brush, enclosed sides, 4 mm base panel. Gaps on the walking surface are only 4.2 mm.
Bumpy, “clacking” ride	Bearings at different heights; slat edges hitting bearings; polygon effect of small sprockets.	Drill all rail holes on a drill press against one fence. Chamfer slat underside edges 1.5 mm. PU-coated bearings every 33 mm (each slat always sits on ≥ 2 per rail). 32-tooth sprockets keep chordal speed ripple below 0.5 %.
Step at the deck ends	Bearing tops not level with the slats where they ride on the sprocket.	Rails are shimmed on the crossmembers so bearing tops are flush with K1-tab tops on the sprocket (= shaft centre + 73.8 mm). Check with a slat laid across.
Slat cracks or sags	Heel strike on one slat can be ~1.5× body weight.	Three bearing rails: maximum span 140 mm (9 MPa at 1000 N, about 5× margin in birch ply); 110 mm end overhang (17 MPa, ~3× margin). Keep 4 spare slats; one slat swaps in 2 minutes.
Slats skew / chains fight each other	Chains of different length, sprockets out of phase, slats not square.	Cut both chains to exactly 252 links and count twice. Mount slats on matching links. Use taper-lock bushes so each sprocket can be rotated to match before you lock it. Square each slat to the side rail.

Return run sags onto the floor	25 kg of belt over 1.4 m would sag 63 mm.	3 return rollers per side reduce sag to ~4 mm. Grip tape stops 50 mm short of the slat ends so the rollers run on bare wood.
Chain stretch over time	Normal wear of roller chain.	Rear shaft in 50 mm slots with M10 push-bolt tensioners. If they run out of travel, remove 6 links and one slat.
Slat screws loosen	Vibration, wood movement.	Steel threaded inserts + M5 button screws + blue thread-lock. Check monthly, especially the first month.
Wood swells, warps or squeaks	Humidity changes.	Birch ply slats and rails (dimensionally stable); dry structural timber; finish every part before assembly; let wood acclimatise indoors for a week.
Wheel tracks dent the slat undersides	Steel bearing races on wood.	PU-coated bearings. If you only find steel 608s, glue a 0.5 mm aluminium strip under each slat on the three roller lines.
Slipping on the belt	Smooth varnished wood.	Coarse anti-slip tape on every slat; replace when worn.
Brake gets hot / magnets weaken	Up to ~100 W goes into the disc; N52 magnets lose strength above 80 °C.	Disc runs in air; expect < 50 °C. Specify N45SH (rated to 150 °C). Ventilation slots in the brake box.
Magnet injuries, or effects on pacemakers and electronics	Two 40×20×10 N45 blocks snap together with > 100 N.	Assemble with a wooden wedge and gloves; never let two magnets meet. Everything is boxed in; label the hood. Keep away from pacemakers (≥ 30 cm) and card wallets.
Treadmill creeps on the floor / transmits noise	Footfall impacts.	Rubber feet, rubber mat under the treadmill. Levelling feet at the rear stop rocking on uneven floors.
Hard to move (≈ 85 kg)	Wood and steel are heavy.	Lift the rear handle; it rolls on the front wheels like a wheelbarrow. Handrail (≈ 12 kg) and legs come off with star knobs. Two people to carry it upstairs.
Belt moves while you step on or off	Gravity drives the belt whenever weight is on it.	Step on from the side platforms while holding the handrail. Optional parking pin through the brake box into the disc locks the belt.
Sprocket slips on the shaft	Set screws on a round shaft.	Taper-lock bushes grip all round; driving torque is only ≈ 5 Nm. Fallback: grind a flat for the set screws and use thread-lock.

10 · Safety & maintenance

> Before every use: hood and rear guard fitted, no slat loose or cracked, nothing under the treadmill. Children and pets stay away while it is in use. Lock the belt with the parking pin when it is not in use. Wear shoes, not socks or bare feet. People with pacemakers keep 30 cm away from the brake box.

When	What
Weekly	Vacuum under and around the belt. Listen for new noises.
Monthly	Check slat screws (spot-check 10), chain tension, sprocket bushes and the UCFL set screws. Dry-PTFE lube on the chains (wipe off excess so it does not reach the grip tape).
Every 6 months	Turn every bearing by hand and replace any that feel rough (the slat comes off in 2 minutes). Re-level the rails if the ride gets bumpy. Renew worn grip tape.
When the tensioners run out	Remove 6 links from each chain and one slat; the shaft distance drops by 38 mm.

Possible upgrades

- Desk use: leave the handrail off, run at 3° with a desk-height bar, and turn the brake up so the belt cannot speed up.
- Remote resistance knob: mount the magnet units on one pivoting plywood arm, swung by an M8 threaded rod that comes out through the hood with a knob on top.
- Odometer: a bicycle computer with its magnet on a slat. It is battery-powered, but optional.
- Lighter build (≈ −10 kg): 15 mm birch slats with four bearing rails, and poplar ply for the hood.

This is a DIY design, not a certified fitness device. Strength figures assume birch plywood E ≈ 9 GPa, MOR ≈ 50 MPa and an 80–120 kg user. Brake figures are first-order estimates; tune on the real machine. You build and use it at your own risk.