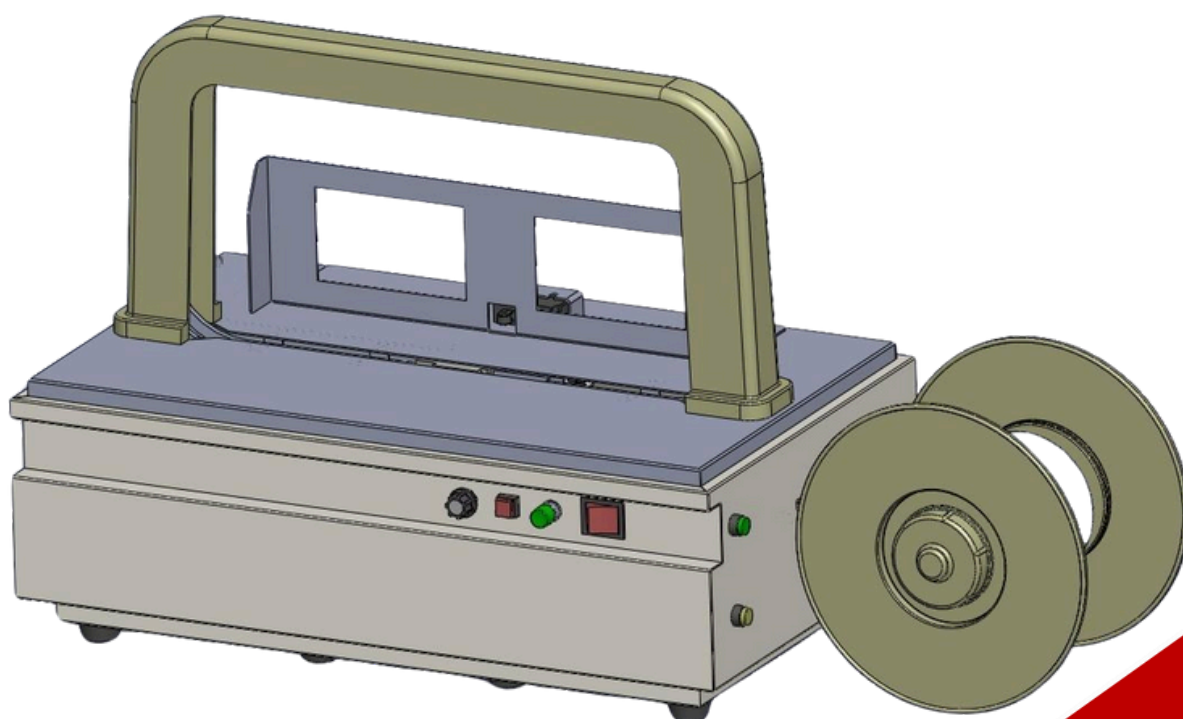




STEP ZD-08

Table Type Mini Automatic
Strapping Machine

SPAREPARTS
MANUAL-EN



1. Contents

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Please read the instructions carefully before operation and keep it for future reference for your safety.



2. Safety instruction

Before using this machine, please read the instruction carefully and using it flexibly at any time if necessary. So please keep or put it near the machine.

General safety rules

1. keep the “safety first” principle in mind, and please use the packaging tool correctly.
2. Please read the instructions before operation
3. Don't disassemble the safety part from the tool
4. Don't tear down or damage the safety label on the product.

Application

When using the machine, my company will not be responsible for the trouble causing by packaging belt if the packaging belt which is not designated by my company.

Notices when using the machine

1. To avoid the danger, please make sure the ground wire is connected.
2. Don't use the extension cord and please consult the after-sale service department if the extension cord must be used.
3. When adjusting the external part of the machine, please pull out the power plug.
4. When using the machine for a long time. Please clear away the melted belt residue attaching on the welding sheet.
5. The air feeder should be cleaned at regular period, it usually be cleaned once for a month.
6. Please avoid using the machine in the place filled with moisture, dust and medicine which are harm to machine.
7. Rubber wheel cannot be attached by the oil stain.

Security warning and notices



1. Don't place the machine in the room which is combustible, explosive, rainy and moist outdoor and closed to prevent the fire, electrification and explosion. 2. Please use the gas of air compressor or dry cloth or brush instead of combustibles or water when cleaning. 3. Don't insert the hard objects such as hand or iron rod into or touch the electrical equipment or rotator parts on machine. Note: don't touch the machine when it rotates. 4. Don't catch the packaging belt to carry the baling objects to prevent dropping or fracture and causing the damage. 5. Don't let the non-professionals disassemble, repair or refit the machine. 6. Before inserting the power plug, please make sure the single-phase is 110v or 220v.

Note: socket must meet the capacity of machine. please connect the specific residual current circuit-breaker before the power supply and make sure the ground wire is connected before using it.

7. When repairing the machine or no use for a long time, please pull out the plug from the socket.

Note: when pulling the plug, don't draw the power line and please catch the plug of the end. The power plug must be pulled out after using it.

8. Please use the specific power line. When there is dust on the surface of the metal part on the tip of plug, please clean it. Note: when using it, make sure the power line is hot or not. If it is hot, please stop using it and pull out the power plug.

9. Please make sure that wheelbarrow cannot grind or people cannot tread or other machines cannot press on the power line and pedal switching line to prevent the unnecessary damage.

10. When using the machine, its electric-heat high-temperature can reach 400-500°C, so please don't touch the machine. When it need to be repaired, please pull out the power plug and begin to work after it cools for 5 minutes to avoid get a burn.

3. Technical parameter



Introduction to packaging machine The STEP ZD-08 small table strap winding packaging machine which is manufactured by my company works on anti-static strap. Just put the obstacles which needs to be packaged in the middle of feeder shelf of machine, turn on the switch, and then the machine can finish winding strap, automatic pulling tightly, bonding and cutting (multiple options for switch on: manual operation, snap on and pedals.)

Power supply AC220V 50/60Hz (AC100/110V 50/60Hz)

Packing tape in use width of tape: 8mm (more or less 0.05mm),internal diameter of tube core: $\Phi 103\text{mm}$,external diameter: $\Phi 170\text{mm}$,height: 145mm

dimension of the machine length: 760mm、 width: 305mm、 height: 406mm

Net Weight 25kg

Tensile force 30~70N (can be adjusted)

Mode of welding welding by electric-heater bands

Max.weight of packing object 5Kgs

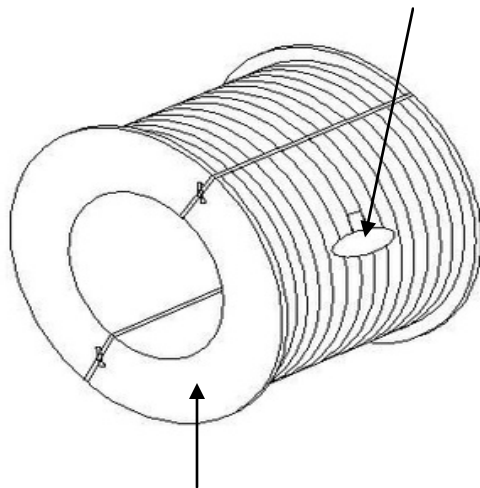
Packing time 3 seconds

Appendix	5.5-7double-end wrench	1
	8-10 double-end wrench	1
	1.5mm hexagon wrench	1
	2mm hexagon wrench	1
	2.5mm hexagon wrench	1
	3mm hexagon wrench	1
	5mm hexagon wrench	1
	Activated carbon	1
	brush	1
	Abrasive paper	1



4. Operation instruction

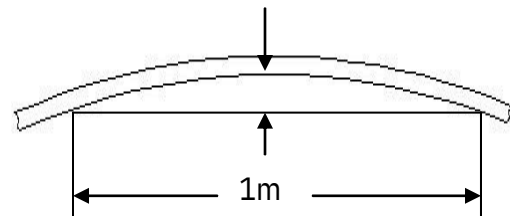
1) requirement for packing tape



10mm

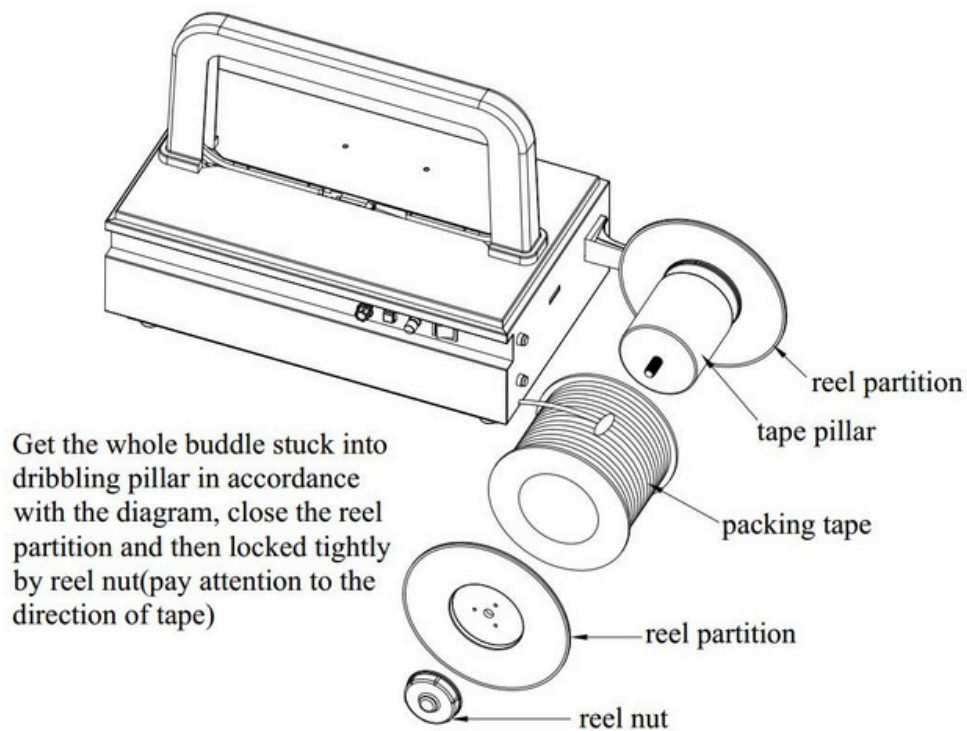
Please install the packing of two sides on the machine according to the origin.

10mm

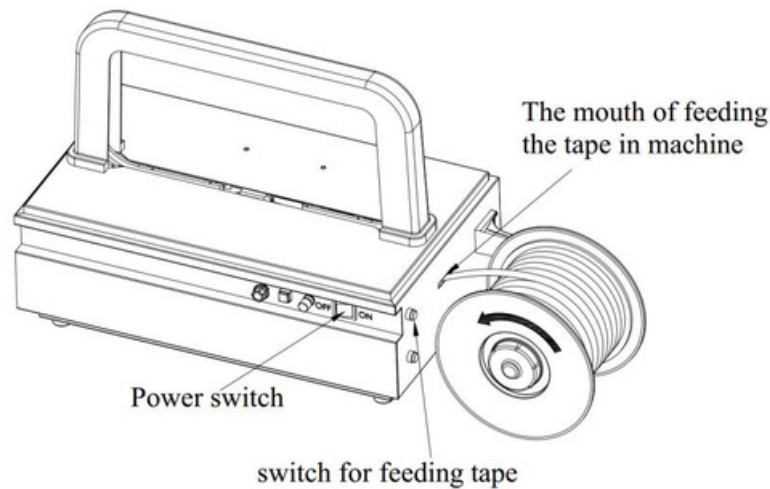


If the arc-shaped packing tape just like the above is put in the feeder shelf, the failure of stuck tape will occur

2) installation of packing tape

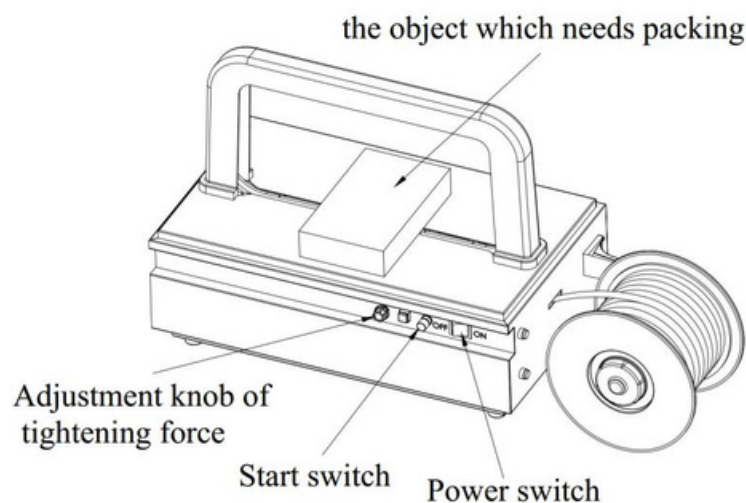


3) instruction for feeding tape to the machine and preparation



To avoid the tape relaxation, rotating the tape according to the arrow direction until feeling weight and then insert the tape into the mouth of putting the tape of machine. After inserting about 15cm and feeling collision, turn on the switch and then press the button which control feeding the tape, and then the tape can be automatically fed in the feeder shelf until it come into preparation status.

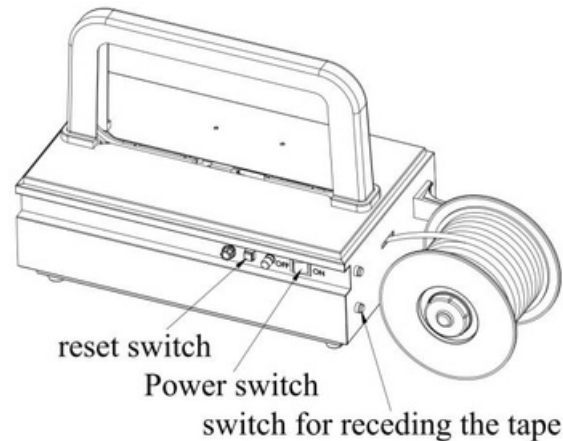
4) Adjustment for packing operation and tightening force



1. Turn on the power switch, and the machine can be used after the light is on for 15-30seconds.
2. Before packing, set the tightening force. When turning the tightening force knob clockwise, it is strongest, and it will decline otherwise.
3. Put the packing object in the middle of machine, press the button and the object can be packed.(lots of controlling modes for starting the switch: manual operation, gift box touching and pedals)

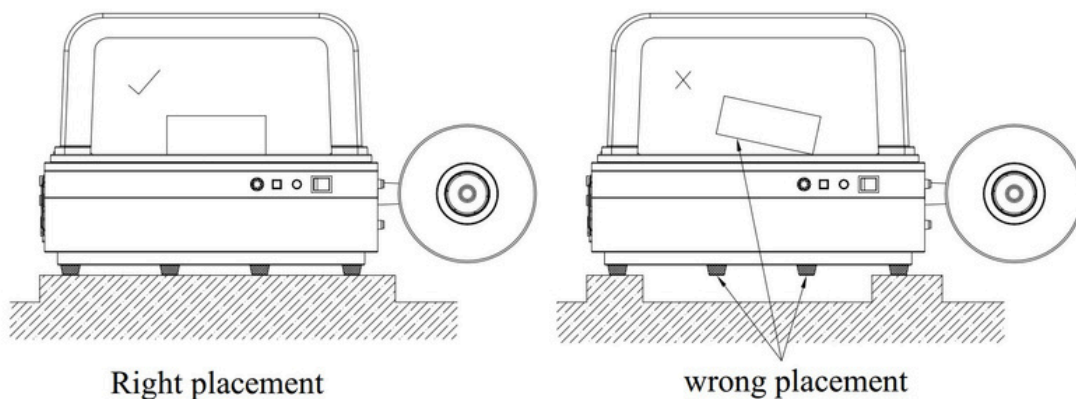


5) Receding tape and reset operation



1. Turn on the power switch and press the button for receding tap and pull out the tape
2. If there is abnormal noise or the motor runs all the time in the machine, press the reset switch, and the machine will stop after 3second around. Then cut the power and deal with that in accordance with troubleshooting guide.

6) Placing machine and object properly

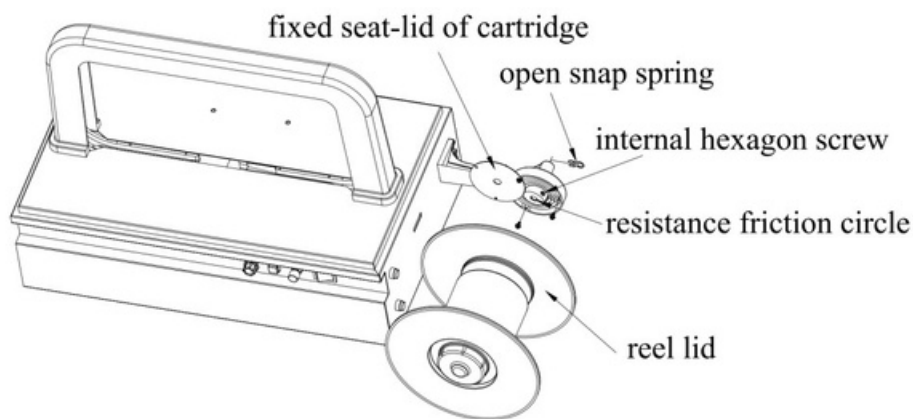


The left figure is the right placement; the machine cannot be used in the machine suspending or object overhead condition like the right figure, otherwise, the machine will be deformed and the object will be displaced which will cause unnecessary trouble.



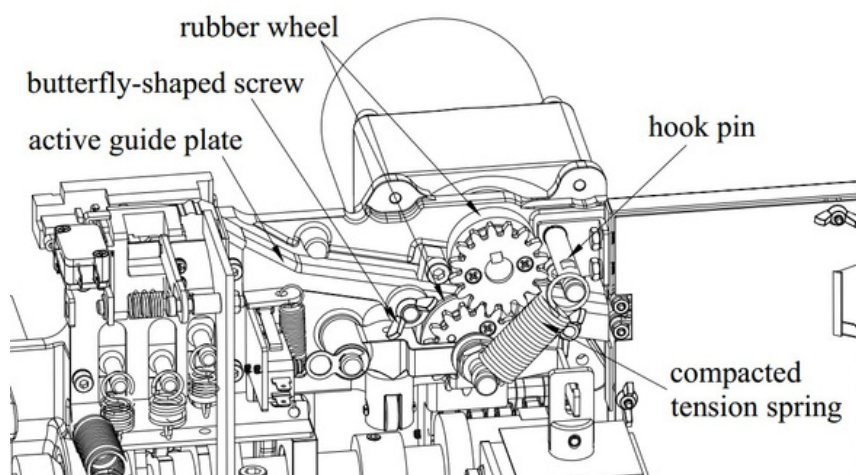
5. adjustment and disassembling

1) Adjustment for cartridge collision device When packing tape fall out of periphery of cartridge for relaxation, because the friction force between cartridge and collision device decline. Adjusting and increase the friction coefficient just like the following figure. 1. Unload the open snap spring and pull out the cartridge. 2. As shown in figure, Unload two screws, undo one of them, rotate the fixed seat-lid of cartridge and stop it, so the coiled spring cannot fly out and it can easily work. 3. As shown in figure, internal hexagon screw on the resistance rubber is rotated clockwise and locked tightly, and then replace them in turn.



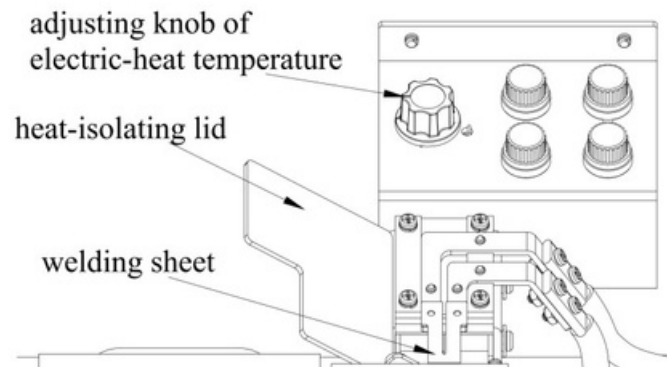
2) disassembling method when packing tape is blocked.

1. when it is blocked in the active guide plate, demount the butterfly-shaped screw and take out the active guide plate.
2. When it is blocked in the rubber wheel, demount the compacted tension spring from the pinhead of hook and pull out the tape.



3) adjustment method of electric-heat temperature

1. there are 5 gears on the machine to adjust the electric-heat temperature, and the knob is rotated clockwise, the temperature is highest, and it is lowest otherwise.
2. when using for long time (about 3000-4000 times), the soluble tape residue attaching on the welding sheet will cause bad welding. Open the heat-isolating lid and use the abrasive paper to clear away.



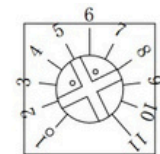
4) sketch of controlling circuit board and adjustment

RT1: regulator potentiometer of the length of feeding tape scale 9

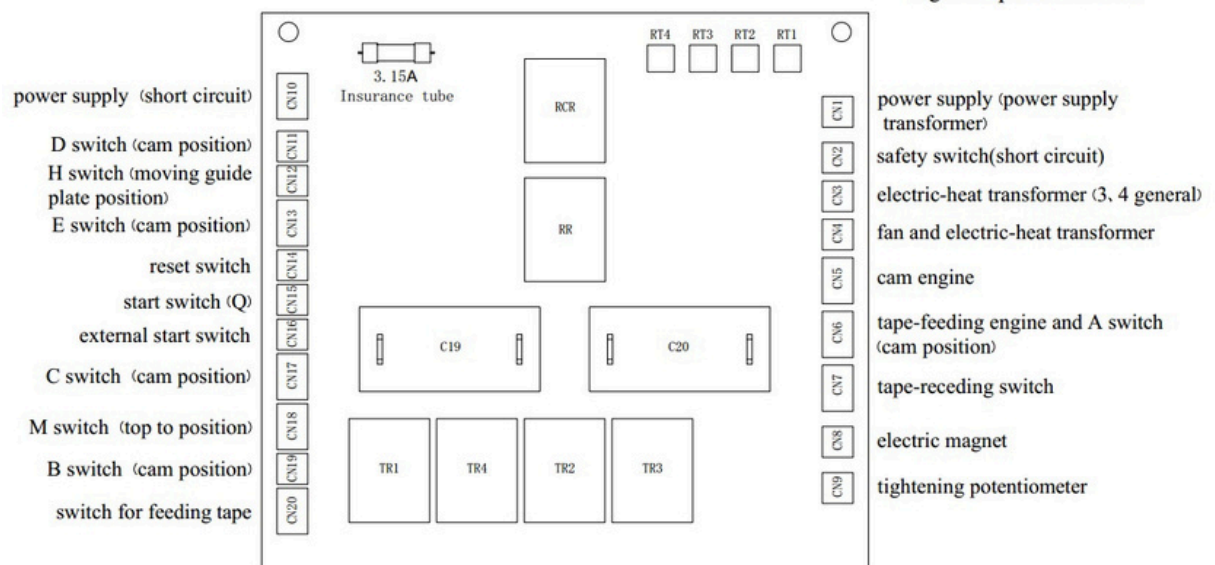
RT2: regulator potentiometer of M switch protection scale 6

RT3: regulator potentiometer of prevent midway ending scale 5

RT4: regulator potentiometer of open-end of rubber wheel of feeding tape scale 4



RT1、2、3、4
enlarged drawing of
regulator potentiometer



6. failure and remedy

1) Tape-feeding matter

phenomenon	General failure	remedy
No rotation for tape-feeding engine	1. carefully check whether there is power supply or not , , and check power supply switch, safety switch on and the top lid, protective tube electrical wire. 2. poor A, B, C, M switch 3. poor controlling circuit board appliance 4. poor tape-feeding engine	1. replacing 2. replacing or adjusting 3. replacing 4. replacing
Non-stop for tape-feeding engine	1.Damage or falling off for compacted tension spring 2.Poor switch for tape-feeding or poor controlling circuit board	1.Replacing or repairing 2.replacing
Blocking of tape	1.Distortion of tape 2.The wrong location for arch-shaped shelf and main body 3.Damage or falling off for the reset tension spring of main body 4. there are foreign body blocking in the path of tape	1.trimming the distorted tape 2. adjusting 3. adjusting or installation 4.removing the foreign body
No tape-feeding when pressing the switch for feeding tape	1.poor tape-feeding switch or controlling circuit board 2. poor M switch or C switch	1. replacing 2. replacing
Tape stops in the midway	1.there is dust or oil attaching on the surface of up and down rubber wheel 2.poor compacted ramp act. 3.poor M switch or other act. 4.the friction force between cartridge axis and cartridge resistance rubber is too large 5. The adjustment time of RT1 potentiometer of tape-feeding length is set too short.	1. removing dust and oil 2. removing rust and refueling 3. replacing or adjusting 4. adjusting 5. adjusting
Tape falling out of the arch-shaped shelf.	1.the torsion spring of separation blade in arch-shaped shelf is damaged. 2. the top of tape is curved. 3. the wrong location of arch-shaped shelf and main body 4. there is foreign body blocking in the path of tape 5. the cartridge is loose and coiled spring is damaged.	1. replacing 2. trimming the distorted tape 3. adjusting 4. removing the foreign body 5. replacing or adjusting
Pressing briquetting or second briquetting cannot be declined.	1.Pressing briquetting or the second briquetting is blocked by foreign body 2.Reset tension spring of briquetting is damaged or fell off.	1. removing foreign body 2. replacing or repairing



2) Take-up tape matter

phenomenon	General failure	remedy
No rotation for cam engine	1.Starting switch (manual pressing, gift box touching or pedal switch) is poor. 2.Cam engine and power supply switch is poor, and supply transformer or fuse is broken. 3.D switch, E switch and safety switch of the top lid are poor 4.The controlling circuit board appliance is poor. 5.There are foreign body blocking in the machine	1.replacing 2.replacing 3.replacing or adjusting 4.Replacing controlling circuit board 5.Removing foreign body
No rotation for tape-feeding engine	1.A switch or C switch is poor 2.Tape-feeding engine or controlling circuit board is poor.	1.replacing 2.replacing
Rotation or non-stop for tape-feeding engine	1.The compacted tension spring is damaged or fell off. 2.The appliance of controlling circuit board or tape-receding switch is poor. 3.C switch or H switch is poor 4.The act of active guide plate is poor(rusting) 5.there is dust or oil attaching on the surface of up and down rubber wheel	1.replacing or repairing 2.replacing 3. replacing 4.Repairing and removing rust 5.removing dust and oil
The tape is loose and fell when tightening	1.The tape is not fed to the position of M switch 2.The internal spring or bearing of the lower part in the first briquetting and the second is damaged. 3.the time set on the RT1 adjusting potentiometer of tape-feeding length on the controlling board is too short 4.the time set on RT4 adjusting potentiometer of loose tape on the controlling board is too long.	1. pressing the switch for feeding tape and then filling. 2. replacing 3. adjusting RT1 potentiometer 4. adjusting RT4potentiometer
It stops during the tightening	1.H switch is poor 2.Active guide plate tension spring is damaged or fell off. 3. the appliance f controlling circuit is poor.	1.replacing or repairing 2.replacing or repairing 3.Replacing controlling circuit board.
The tightening force cannot be adjusted or not stable	1.Adjusting of potentiometer tightening force or controlling circuit board is poor. 2.there is dust or oil attaching on the surface of up and down rubber wheel	1. replacing 2. removing dust and oil.

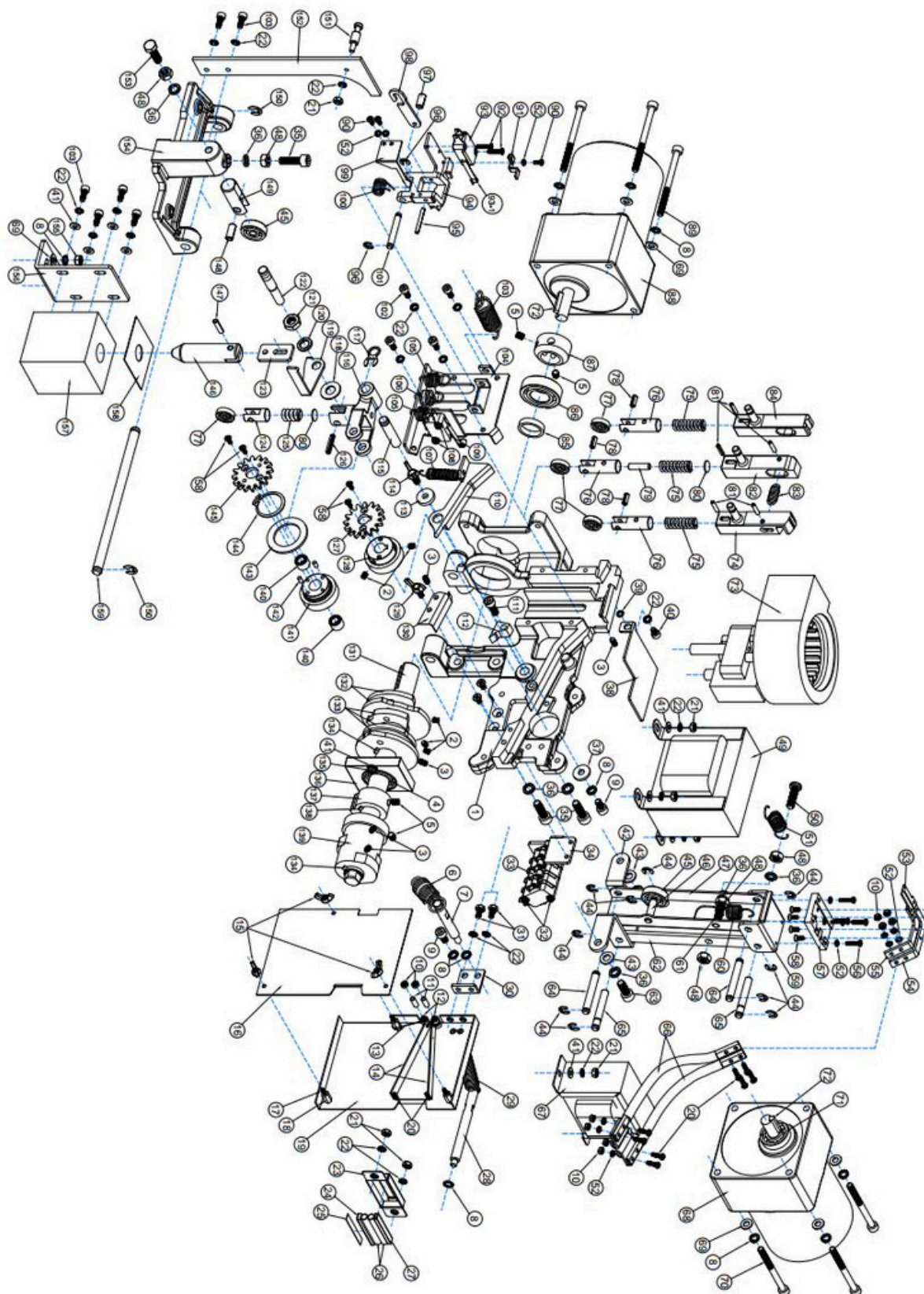


3) Cutting tape and welding

Phenomenon	General failure	remedy
Cutting tape is poor	1.The linking spring of pressing briquetting and the first briquetting is damaged or deformed. 2.The lid of briquetting is loose or worn. 3.The knife edge is worn or has notch. 4.The installing guide face of main body is worn 5.Compacted ramp act is poor, and the internal spring is damaged or the bearing of lower part is damaged. 1.The electric-heat sheet is fractured or heating transformer is burned out.	1.replacing 2.Fastening or replacing 3.replacing 4.replacing 5.replacing
No welding	2.electric-heat sheet don't go into the middle of two tapes, the electric-heat is deformed, the active shelf of electric-heat is deformed without act or is the reset tension spring of electric-heat fractured. 3.The pressing briquetting don't rise, and the internal spring is damaged or the bearing of lower part is damaged. 4.The time set on the adjusting potentiometer of loosing tape RT4 on the controlling board is too long. 1.There is dirt on the surface of electric-heat sheet	1.replacing 2.Repairing and replacing 3.replacing 4.adjusting
The effect of welding is poor	2.Electric-heat temperature cannot rise: the connecting part of electric-heat conducting wire is poor. 3.Pressure of pressing briquetting is not enough: the internal spring is damaged or the lower part of bearing is damaged. 4.Welding point movement: the internal spring in is first briquetting and second briquetting damaged or the lower part of bearing is worn. 5.The electric-heat temperature is too high or too low: the switch of band is not properly set.	1.Removing and polishing 2.The contact area should be polished and fastened 3. replacing 4. replacing 5.adjusting



7.Assembling map 1



8. Parts list 1

Number	Name	Specifications Model of parts	package numbers in each set
1	Main part	ZD.006	1
2	Tightly pinned internal hexagon screw	M4x5	8
3	Tightly pinned internal hexagon screw	M4x8	3
4	ball bearing	#6903Z	1
5	Tightly pinned internal hexagon screw	M5x6	4
6	compacting extension spring	ZD.068-1	1
7	hook pin of compacting extension spring	ZD.143	1
8	spring washer	M5	14
9	Inner hexagonal screw of cylinder head	M5x10	2
10	outer hexagonal nut	M3	22
11	neck bush with child guide block	ZD.039	2
12	Cross screw of cylinder head	M3x14	2
13	separation blade with child guide block	ZD.041-1	1
14	with child guide block	ZD.041	2
15	butterfly nut	M3	3
16	storage lid	ZD.042	1
17	Cross screw of cylinder head	M3x18	3
18	storage box spacer	ZD.040	3
19	storage box	ZD.043	1
20	Cross screw of cylinder head	M3x10	10
21	outer hexagonal nut	M4	23
22	spring washer	M4	47
23	resistant outer box	ZD.069	1



8. Parts list 1

Number	Name	Specifications Model of parts	package numbers in each set
24	resistant rubber	ZD.072	1
25	resistant pad	ZD.073	1
26	roller with child resistance	ZD.070	2
27	resistant trim strip	ZD.071	1
28	hook pin of extension spring for preventing vibration	ZD.144	1
29	extension spring for preventing vibration	ZD.043-1	1
30	storage box stator	ZD.026	1
31	outer hexagonal screw	M4x8	2
32	crossed screw with cylinder head (connected with flat cushion and spring cushion)	M3x55	2
33	ABCDE switch	XV-155-1C25	5
34	Switch installation seat	ZD.038	1
35	Inner hexagonal screw of cylinder head	M6x20	3
36	spring washer	M6	8
37	pad	M5x2	1
38	heat insulation cover	ZD.027	1
39	heat insulation cover of mobile washer	ZD.027-1	1
40	Inner hexagonal screw of cylinder head	M4x6	9
41	pad	M4x1	15
42	fulcrum frame of electrical heated seat	ZD.023	1
43	pad	M6x1.5	2
44	open-end snap spring	Φ6x0.8	10
45	ball bearing	#636Z	2
46	bearing location pin	ZD.111	1



8. Parts list 1

Number	Name	Specifications Model of parts	package numbers in each set
47	mobile frame of electrical heated seat	ZD.021	1
48	outer hexagonal nut	M6	5
49	step-down transformer	ZDB-EI864010259	1
50	Cross screw of cylinder head	M6x20	1
51	electrical heated back extension spring	ZD.021-1	1
52	spring washer	M3	45
53	electrical heated piece	ZD.078	1
54	electrical heated bar(length)	ZD.081	1
55	electrical heated bar(short)	ZD.079	1
56	Cross screw of cylinder head	M3x12	4
57	electrical heated safety seat	ZD.082	1
58	countersunk cross screw	M3x8	10
59	electrical heated seat	ZD.024	1
60	electrical heated auxiliary extension spring	ZD.021-2	1
61	Cross screw of cylinder head	M6x30	1
62	auxiliary rod of electrical heated seat	ZD.022	1
63	Inner hexagonal screw of cylinder head	M6x16	2
64	location pin one of electrical heated seat	ZD.029	2
65	location pin two of electrical heated seat	ZD.030	2
66	electrical heated wire	ZD.077	2
67	heating transformer	ZDB-EIC63010260	1
68	motor with feed	80BK-3	1
69	pad	M5x1	10



8. Parts list 1

Number	Name	Specifications Model of parts	package numbers in each set
70	Inner hexagonal screw of cylinder head	M5x60	4
71	ball bearing	#6000Z	1
72	location pin	4x4x20	2
73	air fan	FS-100	1
74	block one	ZD.062	1
75	spring for block pushing	ZD.061-1	3
76	bearing fixed axis for block pushing	ZD.112	3
77	ball bearing	#634Z	4
78	spring pin of cylinder	Φ4x10	3
79	pressure banking nail	Φ5x20	1
80	Pressure block inner pad	ZD.065	2
81	spring pin of cylinder	Φ3x14	6
82	Pressure block	ZD.061	1
83	Spring connected pressure block with block one	ZD.062-1	1
84	block two	ZD.060	1
85	bearing isolation	ZD.045	1
86	ball bearing	#6003Z	1
87	setting circles of camshaft	ZD.053	1
88	cam motor	80BK-30	1
89	Inner hexagonal screw of cylinder head	M5x65	4
90	cross screw of cylinder head	M3x6	3
91	handle stop with M switch	ZD.034	1
92	countersunk cross screw	M3x14	2



8. Parts list 1

Number	Name	Specifications Model of parts	package numbers in each set
93	switch M	XV-152-1C25	1
93-1	head stop with M switch	ZD.033	1
94	with child guide block	ZD.001	1
95	spring pin of cylinder	Φ3x25	1
96	open-end snap spring	Φ5x0.8	2
97	spring pin of cylinder	Φ5x12	1
98	guide block hook	ZD.035	1
99	with child push rod	ZD.036	1
100	guide block back	ZD.001-1	1
101	guide block connecting rod	ZD.110	1
102	Inner hexagonal screw of cylinder head	M4x10	10
103	main part back separation blade	ZD.006-1	1
104	block cover	ZD.020	1
105	block back separation blade	ZD.062-2	2
106	pressure block back separation blade	ZD.061-2	1
107	moving guide plate separation blade	ZD.025-1	1
108	crossed screw with cylinder head (connected with flat cushion and spring cushion)	M3x14	4
109	switch H	XV-156-1C25	1
110	moving guide plate	ZD.025	1
111	Inner hexagonal screw of cylinder head	M5x16	1
112	guide stop	ZD.031	1
113	thicken pad	M5x3	1
114	butterfly screw	M5x10	1



8. Parts list 1

Number	Name	Specifications Model of parts	package numbers in each set
115	locating shaft for tighten platen	ZD.054	1
116	Pressure support block	ZD.068	1
117	open-end snap spring with outer pull tab	Φ8x0.8	2
118	pad	M8x1.5	1
119	open-end hook with driven wheel	ZD.032	1
120	spring washer	M8	1
121	outer hexagonal nut	M8	1
122	driven roller shaft	ZD.127	1
123	electric magnet hook	ZD.116	1
124	Bearing fixed axis with pressed tightly and pushed	ZD.067	1
125	spring with pressed tightly and pushed	ZD.067-1	1
126	spring pin of cylinder	Φ4x18	1
127	drive gear	ZD.046	1
128	drive rubber wheel	ZD.052	1
129	butterfly screw	M4x10	1
130	guide block within child	ZD.037	1
131	camshaft	ZD.009	1
132	cam 1-2	ZD.008-12	1
133	cam 3-4-5	ZD.008-345	1
134	location pin	5x5x50	2
135	cross screw of cylinderhead	M4x8	7
136	camshaft bearing seat	ZD.010	1
137	cam 6	ZD.008-6	1



8. Parts list 1

Number	Name	Specifications Model of parts	package numbers in each set
138	location pin	5x5x20	1
139	7-11 cam 7-11	ZD.008-7-11	1
140	needle roller Bearing	BK0708	2
141	driven rubber wheel	ZD.049	1
142	location pin snail	Φ3x6	2
143	driven ring	ZD.048	1
144	outer snap spring	Φ24x1	1
145	driven gear	ZD.050	1
146	electromagnet core	ZD.116-1	1
147	spring pin of cylinder	Φ4x16	1
148	spring pin of cylinder	Φ6x14	1
149	main part pushing bearing fixed axis	ZD.112	1
150	open-end snap spring	Φ8x0.8	2
151	guide block hook pin	ZD.142	1
152	guide block hook pin fixed frame	ZD.028	1
153	outer hexagonal screw	M6x20	1
154	main part location seat	ZD.007	1
155	outer hexagonal nut	M5	2
156	electromagnet installation seat	ZD.115	1
157	electromagnet	DCT-100	1
158	rubber separation blade on electromagnet	ZD.128	1
159	main part support frame	ZD.055	1



10. Parts list 2

number	name	Specification and type of parts	Number of each part
160	Nut of cartridge	ZD.004	1
161	Partition of cartridge	ZD.003	2
162	External snap spring	Φ12x1	1
163	Cartridge pillar	ZD.126	1
164	crossed screw with cylinder head (connected with flat cushion and spring cushion)	M4x6	9
165	Cartridge axis	ZD.051	1
166	crossed screw with cylinder head (connected with flat cushion and spring cushion)	M3x6	3
167	Fixed seat-lid of cartridge	ZD.083	1
168	Coiled spring	ZD.117-1	1
169	Reinforced plate spring of coiled spring	ZD.117-2	1
170	Cylinder plastic pin	Φ2x10	1
171	crossed screw with cylinder head	M3x8	14
172	Resistance rubber of cartridge	ZD.108	1
173	Resistance friction cycle of cartridge	ZD.107	1
174	Fixed seat-lid of cartridge	ZD.019	1
175	internal hexagon screw with cylinder head	M6x12	5
176	Needle roller bearing	BK0810	2
177	internal hexagon screw with cylinder head	M3x15	1
178	Coiled spring installing ring	ZD.109	1
179	crossed screw with cylinder head	M3x4	2
180	Switch for feeding tape(green)	LAS2-green	1
181	Switch for receding tape (yellow)	LAS2-yellow	1
182	internal hexagon screw with cylinder head	M3x8	2
183	Switch for power supply	RK1-01	1
184	Starting switch	DS438	1
185	Reset switch (red)	A12-122-red	1
186	Adjusting potentiometer of tightening force	RV30YN	1

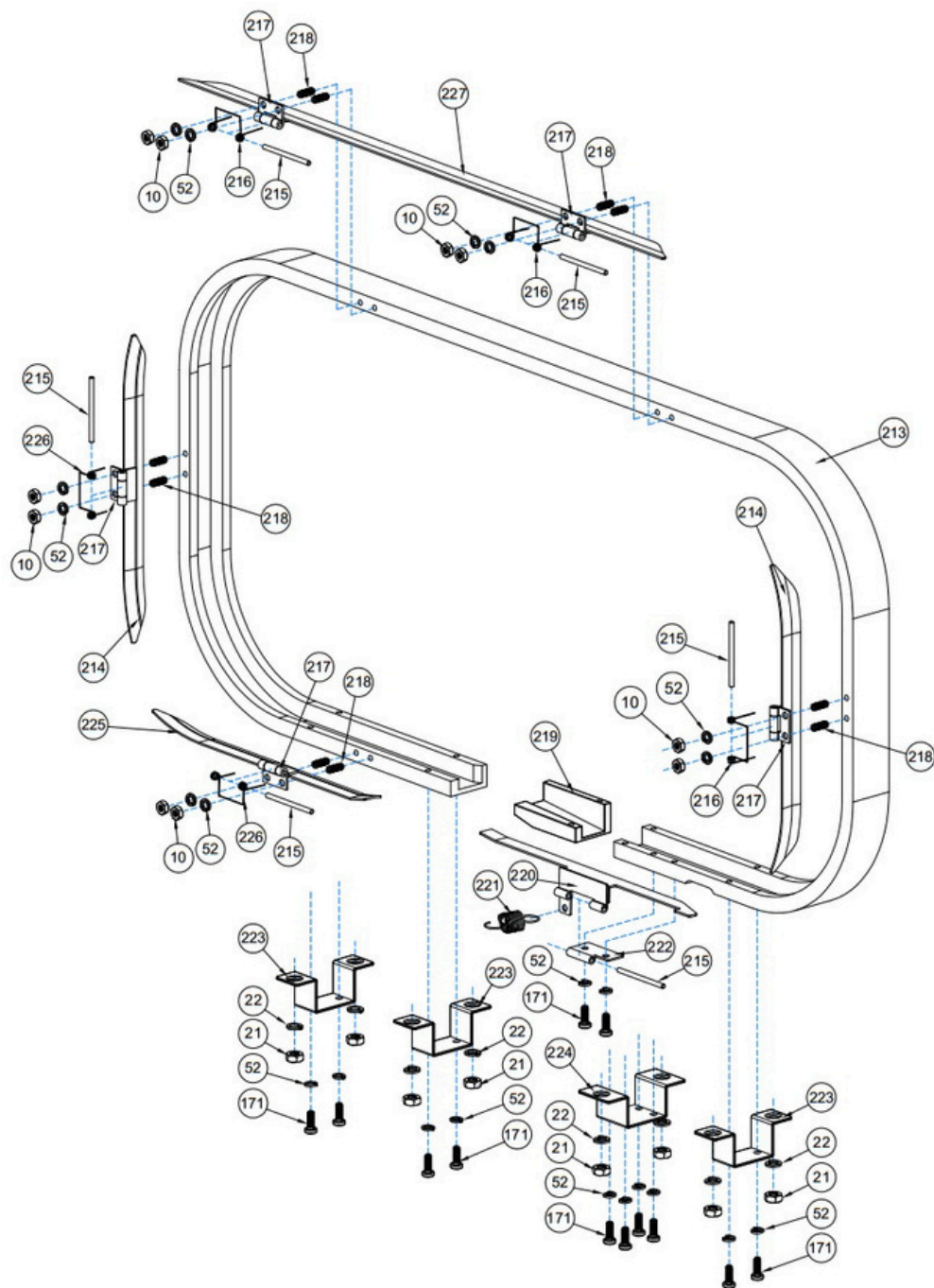


10. parts list 2

Number	Name	Specification and type of parts	Number of each part
187	internal hexagon screw with cylinder head	M5x12	2
188	Pedal switch	HY-102	1
189	internal hexagon screw with cylinder head	M4x14	2
190	Crossed screw with cylinder head (connecting flat cushion and spring cushion)	M5x8	10
191	Rubber pedal cushion	Φ30x16	8
192	Box body	ZD.012	1
193	Controlling circuit board	DL-145	1
194	Lid of controlling circuit board	ZD.119	1
195	Sunk crossed screw	M4x8	6
196	Net cover	83x83	1
197	rivet	Φ6x20	1
198	Safety switch of top lid	XV-153-1C25	1
199	Plug of pedal	CZ-M16	3
200	Plug of power supply	3CZ-1	1
201	Installing plug of protective tube	ZD.135	1
202	Switch for wave band	2knife5gear	1
203	Protective tube plug	BXG-M12	4
204	Prevent vibrating sponge	ZD.012-2	1
205	Starting switch lid	ZD.118	1
206	Top lid	ZD.013	1
207	Arch-shaped lid	ZD.005	1
208	Partition of workpiece	ZD.096	1
209	Sunk crossed screw	M4x28	2
210	Workpiece touching the switch	XZ-15GW22-B	1
211	Activated carbon box	ZD.011	1
212	Activated carbon	HXT-2	2



11. Assembling map 3



12. Parts list 3

number	Name	Specification and type of parts	Number of each part
213	Arch-shaped shelf	ZD.002	1
214	BD separation blade	ZD.145	2
215	Pin pivot for separation blade	Φ2x30	6
216	Reset torsion spring of CD separation blade	ZD.090-2	2
217	Hinge1 of separation blade	ZD.146	5
218	Tightly pinned internal hexagon screw	M3x8	10
219	Guiding block of end of arch-shelf	ZD.086	1
220	E separation blade	ZD.149	1
221	Reset tension spring of E separation blade	ZD.091-2	1
222	Hinge 2 of E separation blade	ZD.151	1
223	Fixed seat of arch-shaped shelf-small	ZD.085	3
224	Fixed seat of arch-shaped shelf-big	ZD.084	1
225	A separation blade	ZD.148	1
226	Reset torsion spring of AB separation blade	ZD.090-1	2
227	C separation blade	ZD.147	1



13. Controlling circuit diagram

