

Lithium battery recycling equipment(1500Kg/h)

1、 Equipment process layout

(1) Equipment process layout



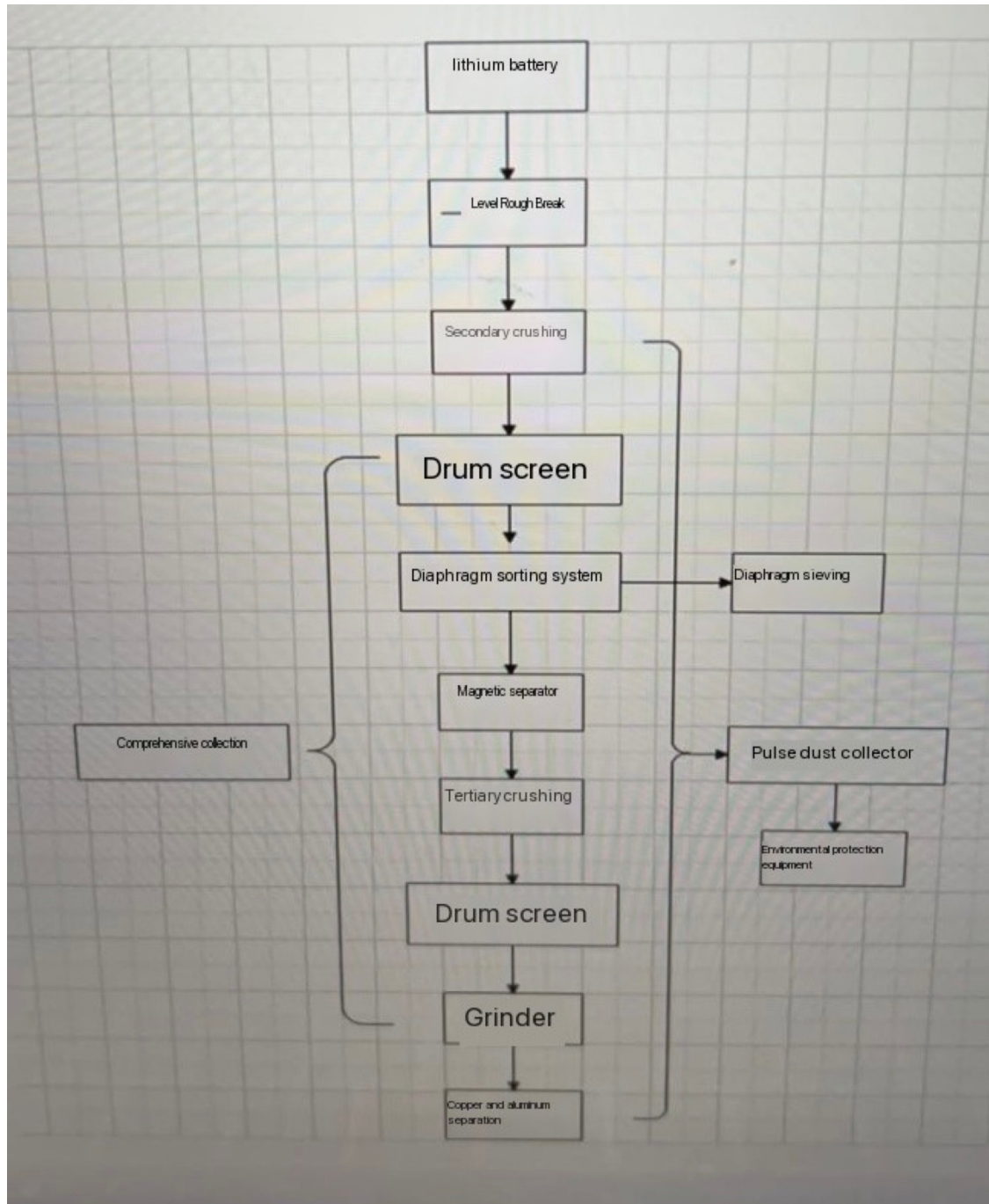
(2) Introduction to the process

The scrapped lithium battery enters the shredder for shredding, the shredded battery enters the special crusher for crushing, the positive and negative electrode sheets and diaphragm paper inside the battery are scattered, the scattered materials enter the collector through the induced draft fan, and then the dust generated in the crushing is collected and purified by the pulse dust collector, and the materials entering the collector enter the airflow sorting screen through the air closer, and the diaphragm paper in the positive and negative electrode sheets is collected through the airflow plus vibration, and the dust generated by the airflow separator is collected at the same time. Then, the mixture is separated and recycled by hammer vibration crushing, vibrating screening and air flow sorting combined processes. ICP-AES was used to

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analyze the experimental samples and separate the metal grades of the enriched products. The results show that after crushing and screening of the positive and negative electrode materials, the grade of copper and aluminum in the crushed material with a particle size greater than 0.250 mm is 92.4%, while the grade of the positive and negative electrode materials in the crushed material with a particle size less than 0.125 mm is 96.6%, which can be directly recovered, and the grade of copper and aluminum in the crushed material with a particle size of 0.125~0.250 mm is low, and the operating air velocity is 1.00 m/s by air flow sorting. Realize the effective separation and recycling of copper, aluminum and positive and negative electrode materials. As shown in the figure (lithium battery processing process flow diagram).

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Pyrolysis crushing and recycling process of waste lithium batteries

The pyrolysis crushing and sorting of waste lithium battery monomer in this project refers to the requirements of "Technical Code for Crushing, Sorting and Recycling of Waste Batteries" (YST1174-2017), and the main operation process and operation requirements are as follows:

1. Level 1 shredded

The discharged and drained waste battery is poured into a large

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inclination angle by the loader, lifted into the shredder, and the pusher device inside the crushing box (fully enclosed setting) sends the battery cells to the blade box, and uses the blade to cut the battery cells.

2. Secondary crushing

The dried lumps enter a special crusher for crushing.

3. Level 1 screening

The crushed material pneumatic feeding conveyor enters the first-stage screening process, which can screen out the positive and negative electrode material powder with small particle size after crushing, and screen out 50% of the electrode powder, and the material with larger particle size continues to enter the next process.

4. Diaphragm separation

The material after the first level of sieve powder is sent into the air flow sorting device by the pneumatic feeding conveyor, and the diaphragm is separated by three groups of gravity material sorter with different air volumes, at this time, the separated diaphragm will have part of the residual black powder and a small amount of copper and aluminum, enter the diaphragm high-speed friction machine for friction to rub the residual black powder down, and enter the diaphragm screen at the same time to effectively separate the diaphragm from black powder / copper and aluminum.

5. Magnetic separation

After the material is screened, the magnetic separation conveyor is used to enter the next process, and the magnetic separation conveyor can screen out the iron powder.

6. Heavy material sorting

After magnetic separation, the material enters the heavy material sorting machine, and the battery head and aluminum shell are separated.

7. Three-stage crusher

The copper and aluminum electrode flakes screened by the heavy material sorting machine are crushed by the pulverizer, and the depowdering rate reaches more than 40%.

8. Secondary drum sieving machine

The material crushed by the pulverizer is sent to the inside of the drum screen powder machine by the material fan for sifting powder

9. Magnetic separator

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Secondary magnetic separation of sieved powdered materials (nickel, iron, etc.)

10. Milling

The material is crushed by magnetic separation conveyor into the mill. The pulverizer processes all materials into powder.

11. Spin selection

The powdery material enters the spin separator, which screens out 20% of the electrode powder

12. Secondary screening

The spinned material enters the secondary screening, and the secondary screening equipment has a total of 2 outlets, of which the discharge port can screen out copper powder, and the discharge port can screen out aluminum powder.

13. Tertiary screening

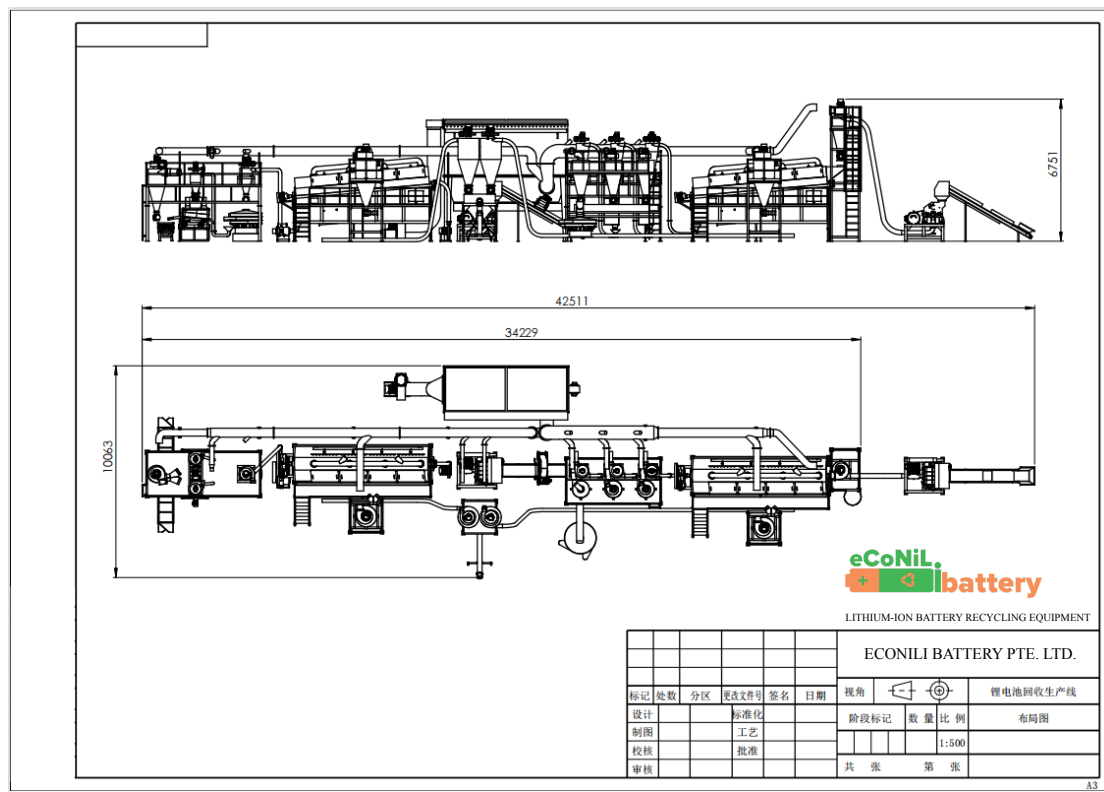
The material enters the three-stage screening, the three-stage screening equipment has a total of 2 outlets, and the two outlets. The screened materials are electrode powder, and 40% of the electrode powder can be screened out in this process.

14. Product packaging

The screened products are packed by a packaging machine.

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2、Equipment floor plan



3、Output type and particle size of individual devices

serial number	Device name	Output type	granularity	unit
1	shredder	Block mixture	≤ 25	mm
2	crusher	Mixture	< 8	mm
3	Drum screening machine	Black powder	100	eye
4	Rotary vibrating sieve	Black powder	120/160	eye
5	Specific gravity sorting	Copper aluminum particles	1-1.5	mm

4、Technical specifications and operating procedures for all equipment

(1) Equipment maintenance matters:

1. 2 of the 4 butter holes of the shredder, replenish the oil

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- once a week and add ordinary oil, and the gear oil can be replaced after one year of the reducer of the shredder.
2. The conveyor regularly checks the conveyor belt, and the bearing position is filled with ordinary oil.
 3. The crusher works for 50 hours to replenish the oil once (high temperature resistance), and the hydraulic pump can only be used when replacing the blade.
 4. Replace the gear oil once after one year of the trommel screen, pay attention to the screen inspection, and add ordinary oil once after half a month to the bearing.
 5. Grinder, water function heat dissipation Bearing position oil (high temperature resistance) pay attention to the water addition.
 6. Disc screen Regularly check the nut for looseness, find that the bundle ring is loose, and use a hammer to hit the lock.
 7. The equipment operates for 2-3 days to check whether the bolts are loose.
 8. The screw conveyor pipe is checked regularly, and the bearings and reducers are checked when abnormal sounds are found and vibrate.
 9. The cycloid needle reducer is regularly inspected and gear oil is added, generally once a year.
 10. The fan is regularly checked to see if the fan vibrates, and if it proves that the blades have debris, clean them up in time.

(2) Precautions for operating the switch on and off:

1. When booting, first turn on the back-end device →→ then turn on the front-end device

1 When starting, first turn on the dust removal solenoid valve power supply and air compressor (cabinet 3)

2 When the production line is started, the preferred order is: start-up: cabinet 3 - cabinet 1

Power off: cabinet 1 - cabinet

3

The order of cabinets 1-3 is the same.

3 No. 3, the first choice is to open the No. 1 line, and then from the No. 1 switch - the No. 2 switch, each interval is 4-6 seconds. Pay special attention (the interval between No. 2-3 switches is not less than 15 seconds, and the interval between each switch is at least 1 minute when shutting down).

(3) Front-end feeding considerations:

1. Remember that there are ferrous metals on the machine, and

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remove other metal products in time.

2. When the material is shredded, it is evenly loaded to prevent jamming.
3. Debris removal except the battery.

(4) Precautions for the use of dust collector:

1. When the production line is stopped, the dust removal fan is turned off, and the pulse valve function is turned on to allow the equipment to automatically spray ash and clean the bag for more than 30 minutes.
2. Ash is found in a certain place during production, which proves that the dust removal cloth bag absorbs too much dust and cannot be self-cleaned, and the solution is to replace all the cloth bags of the dust collector.

5、 Conditions of use for device installation

(1) Site Environmental Requirements:

- (1) Ambient temperature: -15°C — 42°C ;
- (2) Relative humidity: 20%–80% HR;

(2) Electricity:

(1) Main power supply: AC380V (determined according to the actual situation of the project), three-phase; voltage fluctuation is less than 10%;

- (2) Grounding requirements: the workshop is well grounded;

(3) Pressurized air:

- (1) Compressed air: pressure 0.4–0.6Mpa;
- (2) Vacuum requirements: none;

(4) Load-bearing requirements for the ground:

- (1) Ground load-bearing requirements: $1500\text{ (kg/m}^2\text{)}$;

6、 Electricity and water consumption data

Energy and energy consumption working fluid consumption structure table

serial number	Energy/energy-consuming working fluids	unit	Physical quantities	source
1	electricity	10,000 kW·h/a	900,000 kW·h/a	Based on 8h/day*300 days
2	cooling water			The equipment cools the circulating water

7、 List of production line equipment

List of major production facilities

serial number	Device name	Quantity (units)	Equipment power (kW).	
			Stand-alone power	Total power
1	Loading conveyor	1	3kw	3kw
2	shredder	1	18.5+18.5kw	37kw
3	Loading conveyor	1	2.2kw	2.2kw
4	crusher	1	55 kw	55 kw
5	Wind conveying feeding	1	7.5+1.5 kw	9 kw
6	Drum screening machine	1	9.1 kw	9.1kw
7	Cyclone discharger fan	1	1.1 kw	1.1 w
8	Air Closer	1	1.1 kw	2.2kw
9	Except diaphragm system	1	39.5kw	39.5kw
10	Rotary vibrating sieve	1	2.2kw	2.2kw
11	Conveyor	1	2.2kw	2.2kw
12	Magnetic separator	1	0.75kw	0.75kw
13	Secondary crusher	1	45kw	45kw
14	Material fan	1	11kw	11kw
15	Drum screening machine	1	9.1kw	9.1kw
16	Cyclone discharger fan	1	6.6kw	6.6kw
17	Air Closer	2	1.1kw	2.2kw
18	Turbo grinder	1	45 kw	45 kw
19	Cyclone discharger	1	6.6kw	6.6kw
20	Rotary vibrating sieve	1	2.2kw	2.2kw
21	Specific gravity sorter	2	8.5kw	17kw
22	Cyclone discharger	1	3+1.1kw	4.1kw
23	vibrating screen	2	0.12kw	0.24kw
24	Integrated receiving system	1	16kw	16kw
25	Screw conveying	1	4kw	4kw
26	Pulse dust collector	1	37kw	37kw
27	Dust collector spiral	1	5.5kw	5.5kw
28	Air Closer	1	1.5kw	1.5kw
total				377.39 kw

Lithium battery processing production line equipment and main role

1. Shredder: Shred the lithium battery

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2. Crusher: hammer and crush the shredded lithium battery
3. Magnetic separator: separate the steel shell in the mixture
4. Drum screening machine: the materials crushed by the crusher are screened, and the metal materials and positive and negative electrode powders are separated separately
5. Cyclone dust collector: collects the dust generated when screening and separating materials
6. Cyclone collector: The diaphragm paper is collected by a induced draft fan
7. Diaphragm removal system: the diaphragm paper and positive and negative powder are screened and separated
8. Grinder: grind the sorted materials
9. Rotary vibration screening machine: the ground material is screened and separated
10. Integrated receiving system: the positive and negative electrode powder is collected and discharged
11. Pulse purifier: collect and discharge the dust generated during the operation of the whole set of equipment.

8、Details of equipment wearing parts

serial number	name	Specificatio ns and models	Material
1	Pulverizer knives	Model 1000	Cr12m0v
2	Pulverizer screen	Model 1000	65 manganese
3	Shredder knives	Type 800	h13
5	Grinder tools	Type 800	65 manganese
6	Grinder liner	Type 800	65 manganese
7	Pulverizer bearings	Model 1000	
8	Shredder bearings	Type 800	

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9	Drum screens	100 mesh	304 stainless steel
10	Rotary vibrating screen	120 mesh	304 stainless steel
11	Turn off the fan strip	8L/9L/16L	silica gel
15	Pulse controller	assorted	
16	Pulse valve	2.5 inches	
17	Spiral in the hanging	Matching trommel screen	
21	Magnetic separator belt	assorted	
23	The specific gravity of the air flow is blowing the air net	assorted	
25	Eccentric shaft bearings	assorted	
26	Spring plate	assorted	

9、Manpower required for plant operations.

1. Pretreatment roughing link: 1-2 people/shift (feeding and material transfer)
2. Crushing and sorting line: 2-3 people/shift (feeding and finished product receiving and transferring)
3. Equipment inspection and maintenance: 1-2 people/shift (flexible and mobile configuration)

Total manpower required for operation: 3-5 people/shift

10、Description of equipment characteristics and advancedness

1. Through the combined process of hammer vibration crushing, vibrating screening and air flow sorting, the

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resource utilization of metal and positive and negative electrode powder in the positive and negative electrode materials of waste lithium batteries can be realized.

2. The positive and negative electrode materials can effectively realize the mutual peeling between the positive and negative electrode powder and the metal after hammer vibration crushing, and then the metal and the positive and negative electrode powder can be initially separated by vibrating screen based on the size difference and shape difference between the particles. The results of hammer vibration stripping and sieving separation showed that the metal and positive and negative electrode powder were enriched in the particle size range of more than 0.250 mm and less than 0.125 mm, respectively, with grades as high as 92.4% and 96.6%, respectively, which could be directly sent to downstream enterprises for recycling.
3. For crushed particles with a particle size of 0.125~0.250 mm and a low metal grade, the effective separation between the metal and the positive and negative electrode powder can be realized by air flow sorting, and a good recovery effect can be achieved when the air velocity is 1.00 m/s, and the recovery rate of the metal can reach 95% and the grade can reach 90%
4. The equipment is mainly used by lithium-ion battery manufacturers to separate the metal in the scrapped positive and negative electrode sheets from the positive and negative electrode materials for the purpose of recycling. The complete set of equipment operates in the negative pressure state, no dust

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leakage, and the separation efficiency can reach more than 99%.

11、 Output material purity and yield

serial number	Project content		Detection method	remark	
1	Capacity indicators	1500kg/H	Commissioning inspection	Delivery is in normal operation	
2	Working with objects	lithium battery	Gage measurement		
3	recovery	Positive and negative electrode material powder (black powder)	$99 \geq \%$	Gage measurement	Dust collection and recycling with cloth bags
		Aluminum powder	$98 \geq \%$	Gage measurement	
		Copper powder	$98 \geq \%$	Gage measurement	
4	purity	Positive and negative electrode material powder (black powder)	$99 \geq \%$	Gage measurement	Dust collection and recycling with cloth bags
		Aluminum powder	$98 \geq \%$	Gage measurement	Contains a small amount of plastic powder and other materials
		Copper powder	$98 \geq \%$	Gage measurement	Contains a small amount of plastic powder and aluminum powder
5	diaphragm	Lithium content	$0.2 \geq \%$	Gage measurement	
6	Workshop dust	Dust concentration	Less than $20\text{mg}/\text{m}^3$	Instrument measurement	