

10,000t/a waste lithium-ion battery monomer crushing and sorting System complete equipment

Technical data

When: April 26, 2023

Device name, quantity

Equipment name: 10,000t/a waste lithium-ion battery monomer crushing and sorting system complete set of equipment

Number of equipment: 1 set;

Device model: LVJIE 10.00

Annual crushing output: 10,000 t/a (the processing capacity is calculated according to the specific gravity of the lithium-ion battery monomer 2.0t/m³, the average processing capacity is 1t/h, and the processing capacity is calculated according to 24 per day h, annual production of 300 days) waste power lithium-ion battery monomer (including square, cylindrical, soft package lithium iron phosphate batteries, ternary lithium batteries, 3C lithium batteries, specific production classification treatment) crushing pyrolysis sorting system.

The crusher allows the size of used lithium-ion batteries; Cylindrical battery diameter 18~80mm, length ≤ 500mm; Battery metal housing thickness ≤ 2mm.

Scope of equipment supply

Scope of supply

Supply list of used lithium-ion battery monomer crushing and sorting system

serial N°	Device name	Specifications and models	quantity	Detailed configuration instructions			
10000t/a waste lithium-ion battery crushing and sorting system Party B supply list (single set of equipment configuration).							
One. Feeding and crushing equipment							
1.1	Feeder		1	Body material	Carbon steel lined PP	Stand material	carbon steel
		Lvjie 01. 01		Form factor	B1560xL3900xH2100mm		
				Motor power	2x3. 0kW (variable	Motor model	YZO-40-6

					frequency control) .			
	Attached: weighing device	2T sensor	4	Brand: Changsha Tihe				
1.2	Belt feeding device	Lvjie 01.03	1	Belt material	Flame retardant	Stand material	carbon steel	
				Form factor	B1100xL13280xH8427mm			
				Motor power	4kW (variable frequency control).			
1.3	The crusher feeds the hopper	Lvjie 01.04	1	Material	Q235B	Dimensions	760x1400x580	
1.4	Coarse crusher	Lvjie 01.05	1	Body material	carbon steel	Blade material	D2	
				Number of knives	60	Number of fixed knives	2	
				Form factor	B2283xL2070xH1740mm			
				Motor power	55kW			
1.6	Hopper under the crusher	Lvjie 01.06	1	Material	Q235B	Dimensions	620x870x500	
1.7	Crusher feeding device	Lvjie 01.07	1	Body material	Carbon steel lined PP			
				Form factor	Φ1800xH770mm			
				Motor power	3kW (variable frequency control).			
1.8	Discharge transfer screw	Lvjie 01.08	1	Main material	Q235B	Helix length	6600mm	
				Spiral blades	Φ290x5	Motor power	5.5kW	
				Reducer model	GFAF79-Y 5.5-4P-19.7-M1			
1.9	Explosion venting system	Lvjie 01.12	1	Material	Assemblies	manner	Water seal	
Two. Material pyrolysis plant								
2.1	Rotary pyrolysis furnace	Lvjie 02.01	1	Furnace tube material	SUS304	Furnace material	carbon steel	

				Form factor	B2400xL26255xH5300mm		
				Heating method	Gas heating	Heat the air source	natural gas
				Furnace tube rotation power	15kW	Material conveying power	5.5kW
2.2	Atmosphere system	Lvjie02.02	1	Material	Assemblies	Media conditions	nitrogen
2.3	Cooling system	Lvjie02.03	1	Material	Air-cooled unit, assembly	Media conditions	Tap water cooling
2.4	Rotary kiln discharge device	Lvjie02.04	1	Body material	carbon steel		
				Form factor	Φ1500xH770mm		
				Motor power	2.2kW (variable frequency control).		
				Reducer model	GSAF77-Y 2.2-4P-161.6-M5		
2.5	Pyrolysis material conveying plant	Lvjie02.05	1	Scraper material	Aluminum alloy	Stand material	carbon steel
				Form factor	B1000xL4750xH3500mm		
				Motor power	2.2kW		
Three. Dry screening equipment (320,000).							
3.1	Vibrating screen for pyrolysis materials	Lvjie03.01	1	Body material	carbon steel	Stand material	carbon steel
				Form factor	B1670xL5800xH1875mm		
				Motor power	2x3.7kW	Motor model	YZO-50-6
3.2	mill	Lvjie800	1	Body material	carbon steel	Stand material	carbon steel
				Form factor	B2000xL1750xH2500mm		
				Motor power	55kW		
3.3	Magnetic separator	lvjie03.03	1	Main material	Q235B	Motor power	3kW
3.4	Tummel screen	Lvjie15-7000	1	Main material	carbon steel	Form factor	7530x3040x4000
3.5	Winnowing unit	Lvjie03.05	3	Main material	carbon steel	length	5300mm

				Fans	4-72	Motor power	3kW
				Reducer model	GFAF79-Y3-4P-58.32-M1		
Four. Dry stripping sorting equipment							
4.1	Shredder	Lvjie04.01	1	Body material	304	Main unit lining	Ceramic plate
				Pelletizing host power	55kW	Induced draft fan power	22kW
					(variable frequency control) .		(variable frequency control) .
4.2	Airflow feeder	Lvjie04.02	1	power	5. 5kW (variable frequency control) .	Body material	304
4.3	Circular vibrating sieve	Lvjie04.06	1	Body material	304	Motor power	2. 2kW
4.4	Grinder	Lvjie800	1	Material	carbon steel	Tool material	H13
				Form factor	B800xL5200xH6340mm		
				Motor power	45kW		
4.5	Pneumatic loader	Lvjie04.09	1	Body material	carbon steel	Rack material	carbon steel
				Form factor	B1900xL3100xH1900mm		
4.6	Rotary vibrating sieve	Lvjie1500	1	Body material	304	Rack material	Q235B
				Form factor	B1050xL3100xH1900mm		
4.7	Aluminum pellet conveyor	Lvjie4.13	2	Scraper material	Aluminum alloy	Stand material	carbon steel
				Form factor	B600xL4900xH3100mm		
				Motor power	1.5kW		
				Reducer model	GKA77-97.05-1.5kw-4P		
4.8	Storage hopper	Lvjie04.14	1	Form factor	1140x1420x1800		
4.9	Specific gravity sorting device	Lvjie900	2	Body material	Q235B	Rack material	Q235B
				Form factor	2200x1500x1200	power	5.5x2
5. Environmental protection system							

1	Burner (2 chambers).	JYLP10.32	1	Form factor	Φ 1800×1500mm+Φ1800×6500mm,壁厚 8mm		
				Ignition method	The burner ignites automatically		
				Housing material	Carbon steel Q235	Refractory material	corundum
				Furnace pressure	Micro negative pressure - (50-100) PA	Furnace content volume	≥7m ³
2	Quenching tower	JYLP10.33	1	Housing material	Carbon steel 6mm	Lining material	corundum
				Quenching pump	Flow: 1t/h, head: 70m, power: 0.75kw		
				Quenching water tank	Effective volume: 3m ³ Accessories: level gauge, sewage outlet, etc., material: PP		
				Form factor	Φ1600×7000mm		
4	Alkaline washing tower	JYLP10.35	1	Material	pp	Form factor	Φ1500 x 6000
				nozzle	1t/h,1 5 个	stuffing	Spherical filler, φ50
				Sprinkler pumps	Flow: 15t/h, head: 32m, power: 5.5kw; Steel lined with tetrafluoride		
				Deacidification efficiency	≥90%		
5	Washed tower	JYLP10.36	2	Material	PP	Form factor	F1500X8000
				nozzle	1t/h,1 5 个	stuffing	Spherical filler, φ50
				Sprinkler pumps	Flow: 15t/h, head: 32m, power: 5.5kw; Steel lined with tetrafluoride		
				Deacidification efficiency	≥90%		
				Lye tank	500L, mixer 0.75KW, Q235B		
6	Flue gas catalytic combustion device	JYLP10.34	1	Activated carbon box	Kit, 3 sets		
				Catalytic chamber	1 set, catalyzed by metal support		
				Form factor	3.5X2.2X7.0 (frame is carbon steel anti-corrosion) Q235B + high temperature cement		
7	Induced draft fan	JYLP10.38	1	flow rate	8,500m ³ /h	pressure	8857
				power	30Kw, frequency conversion	version	Centrifugal
8	chimney	JYLP10.39	1	Form material	Φ500×15000mm, carbon steel lined with vinyl anticorrosive cement		
9	Environmental dust collection	JYLP10.43	1	Duty cycle	B7000xL8800xH8500mm		
				Handle air volume	19646-28105m ³ /h		

				Filter area	450 m ²	Chimney size	Φ 700 x15000
10	Dust removal spray tower	JYLP10.43	1	Material	PP		
				Form factor	Φ2000 x6000		
Six. Pumps, platforms and piping							
6.1	Rotary kiln cooling water reuse pump	DCZ32-160A	1	Overcurrent material	304	flow rate	20m ³ /h
				Head	35m	Motor power	5.5kW
6.2	Cooling water pump	DLF4-40	2	Overcurrent material	304	flow rate	4m ³ /h
				Head	30m	Motor power	0.75kW
6.3	Steel structure and pipes	Platforms, stairs, equipment supports	1 batch	Material	Painted Q235B	remark	With handrail railings
		Nitrogen pipelines	1 batch	Material	304	remark	Instrumentation included
							Automatic, manual valves
		Exhaust gas treatment pipelines	1 batch	Material	304	remark	Instrumentation included
	Automatic, manual valves						
Compressed air piping	1 batch	Material	304	remark	Instrumentation included		
					Automatic, manual valves		
Seven. Electrical control system (200,000).							
7	Electrical control system	PLC control cabinet	1 batch	size	1600 wide×800 deep×2200 high	remark	Siemens S7-1200
		Power control cabinet	1 batch	size	800 wide×1000 deep×2200 high	remark	Including frequency converter, etc
		In-place control box	1 batch	Material	combination		
		Wire and cable tray	1 batch	Material	Domestic first-line		

1. Some equipment parameter suppliers in the above table can be designed and adjusted according to the actual situation, but the process and production indicators must be guaranteed.

2. All motors are national environmental protection and energy-saving motor pyrolysis equipment motor explosion-proof grade Exd II.BT4, protection grade IP54.

Selection of devices

Device selection list

Equipment/material description	Supply brand or manufacturer
cutting tool	D2 Tool Steel
Crusher screen	304 stainless steel
Vibrating screen mesh	304 stainless steel
Rolling bearing	SKF、NSK、FAG
PLC	Siemens S7-1200
Expansion modules and communication modules	Siemens
Frequency converters	Zhongchen, Sunland
Low-voltage components	Chint or domestic first-line brands
GB cable	Valin, Hengfei
Meters, sensors	Domestic first-line brand
Rubber seals and shock absorption	Domestic first-line brand
Reducer	Guomao, permanent teeth
Ordinary, explosion-proof motor	Domestic first-line brand
valve	Yuanen and other domestic first-line brands

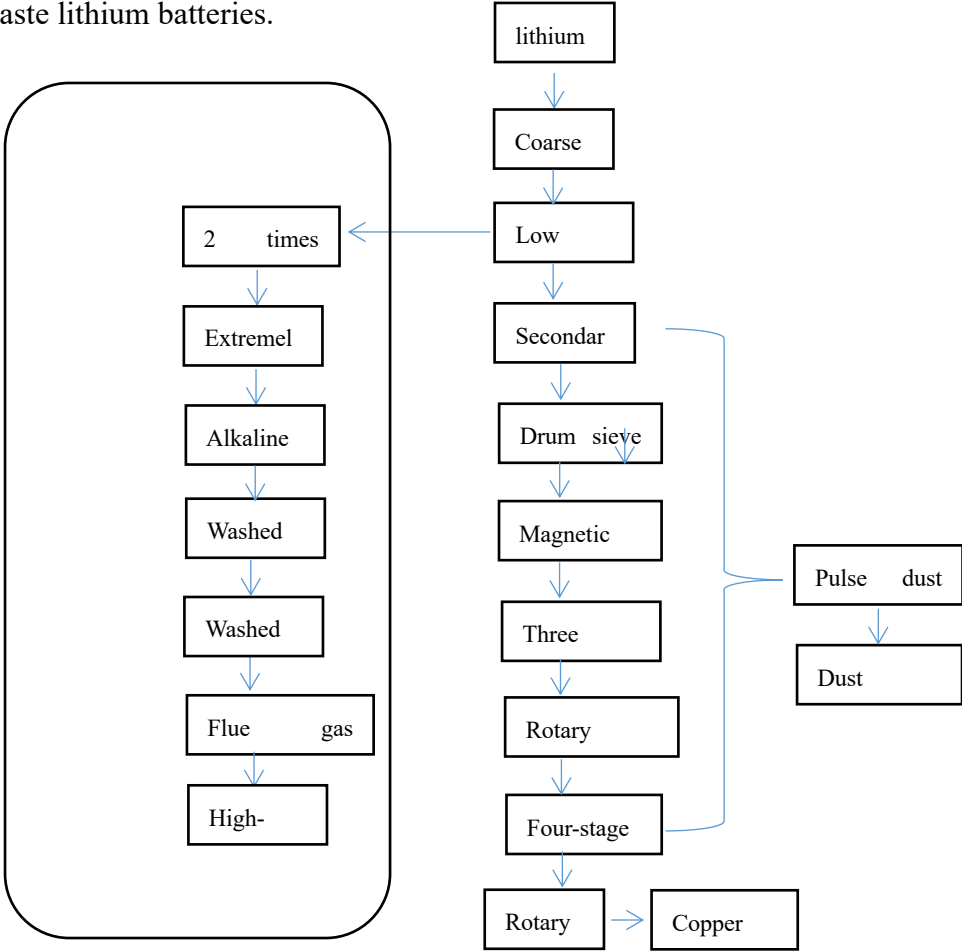
Note: The types and manufacturers such as hardware seals, general parts, instruments and instruments not involved in the list choose domestic first-line brands, and Party B is responsible for the final safety, applicability, performance and quality of the selected accessories according to the principle of turnkey engineering.

Equipment system process description

The whole process adopts monomer **broken+high temperature drying/pyrolysis+Multi-component sieving and sorting+Dry peeling+Copper and aluminum sorting**

The process realizes efficient recovery of valuable metals in battery cells. The process can separately process waste lithium iron phosphate and ternary power lithium batteries, and realize

the efficient recovery of valuable metals of lithium batteries through physical sorting methods, and the products are pile heads, magnetic shells, copper foils, aluminum foils, and polar powder in waste lithium batteries.



Crushing and sorting system for waste lithium-ion batteries

The process consists of six systems: feeding crushing system, high-temperature pyrolysis, multi-component screening system, stripping and sorting system, environmental protection treatment system, and electrical control system. The systems are interconnected to recover valuable components from used lithium-ion batteries.

Feeding:

Through feeding device, sequencing conveying device, battery feeding device and other equipment, the automatic feeding of single lithium-ion batteries (including square, cylindrical, pouch batteries) is realized. Feeding and crushing chain control, according to different materials, select the appropriate feeding speed to ensure that the battery cell is fully broken and dissociated.

The recycled waste lithium-ion battery monomer is stored in the warehouse by the owner (Party A insulates the monomer pole to prevent short circuit), and the battery cell is poured into the feeding hopper of the feeding system by forklift or crane, and uniformly and automatically fed by the vibrating feeding device.

Broken:

This process is uncharged crushing, and the single battery obtained by dismantling is transported to the crusher for crushing through the feeding system (the battery cell treated by discharge can also be crushed, and the brine discharge cell needs to be filtered in advance and enter the crushing system). The crusher can prevent and control the risks of ignition and a large amount of heat generation in the crushing process of the live monomer, and at the same time can fully dissociate and disperse the crushed material without wrapping. The volatile electrolyte in the crushing process is pumped to the flue gas treatment system through the induced draft fan, and discharged up to the standard after secondary combustion + quenching + dust removal + water washing + alkaline washing.

Tumble dry:

The crushed material contains electrolyte, diaphragm, plastic and polar powder coating material PVDF and other organic matter, and the organic matter is harmlessly treated by drying technology. The system technology can avoid the risk of explosion caused by the volatilization of the electrolyte and the risk of poisoning of toxic gases such as HF caused by the decomposition of LiPF_6 in the electrolyte.

Multi-component screening:

The recycling system maximizes the recovery of valuable metals, improving environmental and economic benefits. After drying, the positive and negative electrode powder collected by the screening + winnowing + magnetic separation equipment is stored in the silo.

Crushing and depowdering sorting:

After drying, the materials enter the primary pulverizer - depowdering, winnowing machine - (winnowing diaphragm) secondary pulverizer-(Depowdering) magnetic separation shell, tertiary grinder (copper aluminum separation).

Copper and aluminum recycling:

The positive and negative electrode current collectors after stripping the polar powder are copper foil, aluminum foil mixture, in order to ensure the separation accuracy, the copper foil and aluminum foil in the process are sorted twice by high-precision sorting machine, the method has high sorting accuracy and no pollution to the environment, and the purity of the copper foil and aluminum foil products obtained is more than 97%. The sorted copper foil and aluminum foil are bagged separately.

Eco-friendly treatment:

Waste gas: The waste gas generated by the system is mainly the volatile organic steam when the battery cell is crushed, the pyrolysis waste gas generated by pyrolysis and the dust containing nickel and cobalt and other metals generated during the crushing and sorting process, which is discharged up to standard after the process of high temperature combustion + quenching + dust removal + 2-stage water washing + alkali washing. Environmental indicators refer to the following standards: particulate matter $10\text{mg}/\text{m}^3$; Non-methane total hydrocarbons $80\text{mg}/\text{m}^3$ (Yuhuan Attack Office [2017] No. 162); Nickel and its compounds $4.0\text{mg}/\text{m}^3$, cobalt and its compounds $5.0\text{mg}/\text{m}^3$, manganese and its compounds $5.0\text{mg}/\text{m}^3$ (None Emission Standards for the Mechanographic Industry"); Fluoride $3.0\text{mg}/\text{m}^3$ (provincial and local standard "Industrial Furnace Air Pollutant Emission Standard" (DB41/1066-2020)). The secondary high-temperature combustion chamber adopts the method of natural gas combustion to prevent corrosion of the equipment. The heat released by pyrolysis gas combustion is supplied to the auxiliary system for heating, HF gas is washed with water and absorbed by alkaline washing, and then Party A reacts with a high calcium ion solution to generate CaF_2 Precipitation. Battery

feeding, screening, winnowing, color sorting operation material transportation adopts closed transportation, and set up negative pressure dust collection cover, through the environmental dust collection system for centralized bag dust collection, the dust collection product is incorporated into the pole powder. After dust collection, the exhaust gas is sprayed through a stage of water, and the standard is discharged after further dust removal. The wastewater sprayed by environmental dust collection is treated by Party A.

The electrolyte and pyrolysis gas are burned by natural gas, and the natural gas consumption is about 40 m³/h, the single consumption is about 28.6m³/t, and the combustion chamber temperature is controlled At 1000-1200°C, the pyrolysis gas stays in the combustion chamber for 2-3s. The combustion exhaust gas is quenched (the flue gas temperature is quickly controlled below 200 °C), and the dust is removed by the high-temperature bag filter after quenching. After dust removal, the exhaust gas is purified and absorbed by three-stage water washing + alkaline washing, and finally reaches the standard discharge. PF 5 in pyrolysis gas is hydrolyzed to produce HF, H3PO₄ acid gas, which is neutralized, purified and absorbed by water washing, alkali washing and other processes. The agents NaOH and Ca(OH)₂ are added to the lye spray tower to finally generate CaF₂. The wastewater of the waste gas washing treatment system is neutralized by Ca(OH)₂, and CaF₂ and CaCa₃(PO₄) are finally generated 2. Precipitation, after dehydration, it will be sold by Party A or outsourced.

Wastewater: The system has no wastewater discharge, and the wastewater treatment system is mainly circulating spraying of tailwater after defluorination, and the tailwater of neutralization and settlement is reused for water replenishment in the flue gas quenching system.

Main technical parameters

Handling capacity of used lithium-ion battery cells: see "2.4 Capacity per hour" for details.

Consumption of auxiliary materials

serial number	project	unit	deplete	remark
1	Installed power	Kw		
2	Natural gas consumption	m ³ /h	40	10~20Kpa
3	Nitrogen consumption	m ³ /h	100	Party B configuration

4	pressurized air	m ³ /min	12	0.6~0.8MPa, provided by Party A
5	Flake alkali	t/a	20	The consumption of flake alkali is calculated according to the check adsorption consumption of fluorine, and the specific consumption fluctuates according to whether the raw material contains sulfur
6	Water consumption	m ³ /t	5.5	Water circulation rate 9to 6%.

Technical indicators of material yield of each component

Main products	Yield (%).	remark
Positive and negative pole powder	45-48	The content ratio of each component of the actual battery cell shall prevail
copper	10-12	The content ratio of each component of the actual battery cell shall prevail
aluminium	3-4	The content ratio of each component of the actual battery cell shall prevail
enclosure	10-12	The content ratio of each component of the actual battery cell shall prevail

Technical indicators

serial N°	Inspection items	Inspection standards
1	The physicochemical parameters of the main product obtained after treatment	The comprehensive recovery rate of battery powder is 97%.
		The purity of the battery powder is 97%.
		The removal rate of organic matter in battery powder is 98%.
		The copper + aluminum content in the battery powder is 3%.
		After sorting, the copper foil grade is 9 to 7%.
		After sorting, the aluminum foil grade is 97%.
		After sorting, the shell is 96%.
2	environmental protection	Particulate matter 10mg/m ³ ; Non-methane total hydrocarbons 80mg/m ³ (Yuhuan Attack Office [2017] No.

		162); Nickel and its compounds 4.0mg/m ³ , cobalt and its compounds 5.0mg/m ³ , manganese and its compounds 5.0mg/m ³ (Inorganic Chemical Industry Emission Standards)); Fluoride 3.0mg/m ³ (Henan Province local standard "Industrial furnace air pollutant emission standard" (DB41/1066-2020)).
3	Tightness	During the operation of the equipment, a closed soft connection is set up, and a negative pressure dust collection cover is configured, and the dust in the working environment meets the requirements of the occupational exposure limit of dust in the workplace.
4	Noise requirements	Reaching GBJ87 "Industrial Enterprise Noise Design Code", the measured noise of 1.5 meters above the machine or 1 meter around is less than or equal to 85dB.
5	Standard parts brand confirmation	In accordance with the brand, model and specifications specified in the technical agreement
6	Safety standards	1) Alarm bell prompt in various regions before the equipment starts;
		2) Emergency stop switch button, internal maintenance area safety rope;
		3) Protective cover for moving, transmission, crushing and crushing parts;
		4) The maintenance platform and equipment platform have protective stairs and protective fences;
		5) The crushing system has nitrogen protection facilities;
		6) Crushing and pyrolysis containing organic operating equipment motor explosion-proof grade Exd II.BT4, protection grade IP54.
7	Device appearance	Before painting, the equipment needs to be sandblasted or shot peening and other surface treatment, and the surface

	requirements	roughness after treatment is not less than Ra12.5, and the local is not less than Ra25. After painting, the surface should be uniform in color, smooth and flat. No cracks and obvious flow scars, accumulated sand grains, wrinkled skin, paint leakage and other defects. The acceptance standard implements the "JB/T5946-9 General Technical Conditions for Painting of Construction Machinery". The color and requirements of the surface paint of the equipment shall be agreed in the equipment technical agreement or determined during the design contact according to Party A's requirements. Set up the visit channel sign according to the requirements of Party A, and Party B can be set up LOGO
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Electrical control

The electrical and automation control part is mainly composed of power cabinet, PLC control cabinet, industrial computer system, cable, bridge, etc.

The whole system adopts PLC + host computer control, and the system has its own independent control system, controls the entire crushing and sorting, and sets up an independent central control room for data collection and management.

The system adopts two control modes, local and remote control, and the mode switching function is set on the local control box, and the two control modes do not interfere with each other to facilitate debugging. In-place control is set for commissioning and maintenance, and remote control is in normal operation mode. The method of distributed IO is to simplify the diagnosis of complicated lines. The system provides a variety of real-time reports to facilitate customers to monitor production status.

The system adopts RS485 and Ethernet communication mode for control. RS485 communication protocol is standard MODBUS RTU, Ethernet communication external protocol is OPC, convenient to connect with Party A's data system. Each communication interface has a large site expansion function, which is convenient to increase equipment and data.

The cable wiring uses a bridge frame and PVC flame retardant electrical pipe, and the power cable and the control cable are arranged separately.

The system is configured with a remote service system, which can be turned on as needed, but must meet the network requirements.

Crushing and pyrolysis plant motors require explosion-proof, explosion-proof grade Exd II.B T4.

Waste lithium battery crushing and sorting unit public engineering conditions

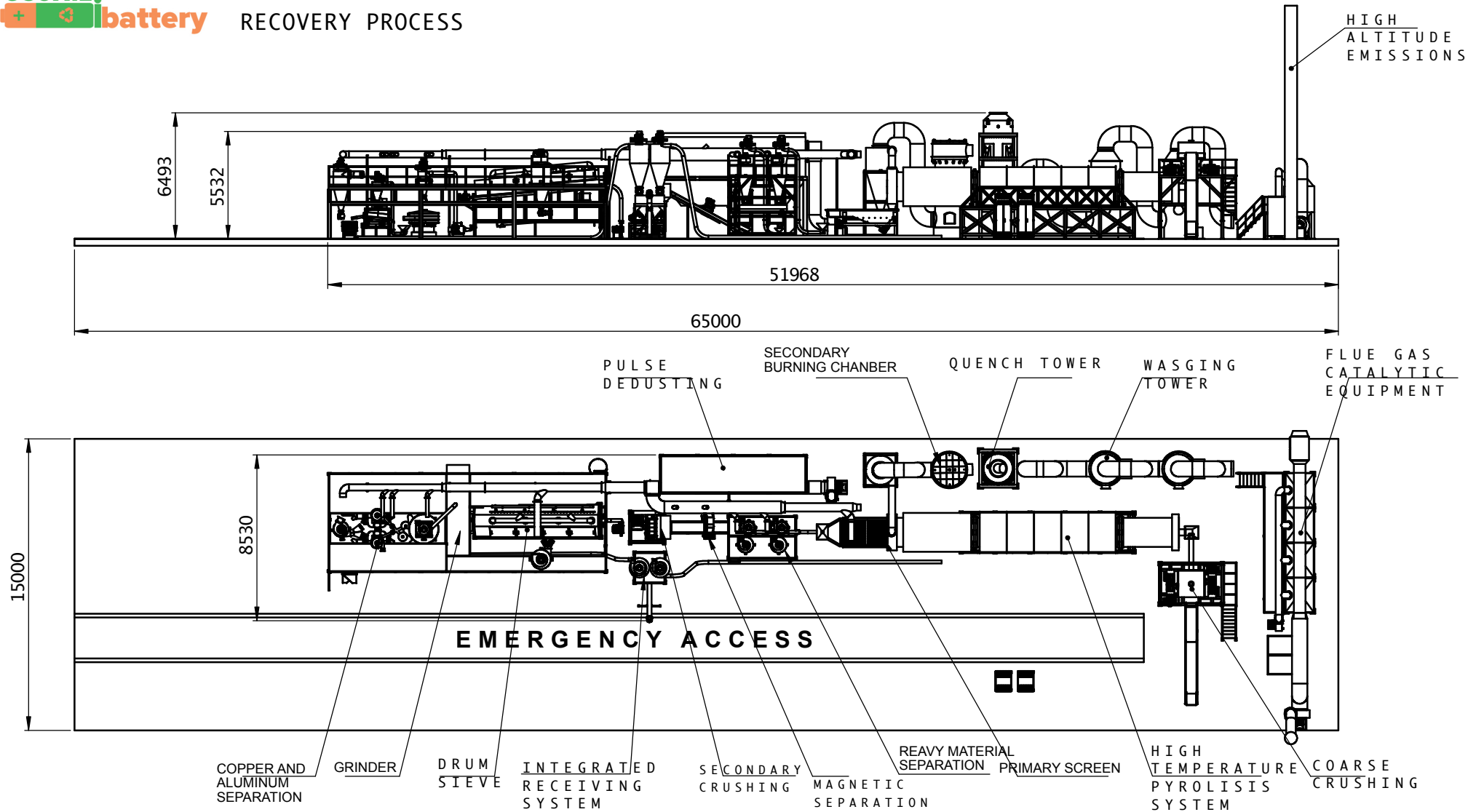
Media name	Parameter/Indicator name	Parameter/Indicator value
electricity	voltage	AC380V±10%
	frequency	50 HZ±1%
	Access method	Three-phase five-wire system, Party B power cabinet is an upward structure

	Total installed power of the equipment	500kW
	Emergency power	Pyrolysis furnace tube rotating motor 1: 15kW
		One exhaust gas treatment spray pump motor: 5.5kW
		1 exhaust gas treatment emergency fan: 2.2kW
tap water	pressure	0.3-0.4MPa
	temperature	≤35°C
	pH	6~9
	Chloride concentration	≤150 ppm
	salinity	≤2%
	Normal consumption	6m ³ /h
	Nozzle specifications	DN50
Circulating cooling water	pressure	0.2-0.4MPa
	temperature	30-35°C
	pH	6~9
	Chloride concentration	≤150 ppm
	salinity	≤2%
	Circulation amount	30m ³ /h
	Nozzle specifications	DN65
Compressed air	pressure	0.6~0.8MPa
	temperature	room temperature
	dew point	-40°C
	Normal consumption	12m ³ /min
	Nozzle specifications	DN40
Sky gas	Burner inlet pressure	10~30Kpa
	Design temperature	25°C
	CH ₄ content	≥95%(V)
	Low calorific value	8600Kal/Nm ³

	Maximum gas consumption of primary burner	40m ³ /h(30kPa)
	Nozzle specifications	DN40
	Maximum gas consumption of secondary burner	80m ³ /h(30kPa)
	Nozzle specifications	DN50
	Dosage for start-up	100m ³ /h(30kPa)
	Uptime usage	≤25m ³ /h(30kPa)
Flake alkali	Dosage	20t/a
nitrogen	Party B provides a nitrogen generator, 100m ³ /h	Party A is responsible for reporting the qualification of the pressure vessel, and Party B assists



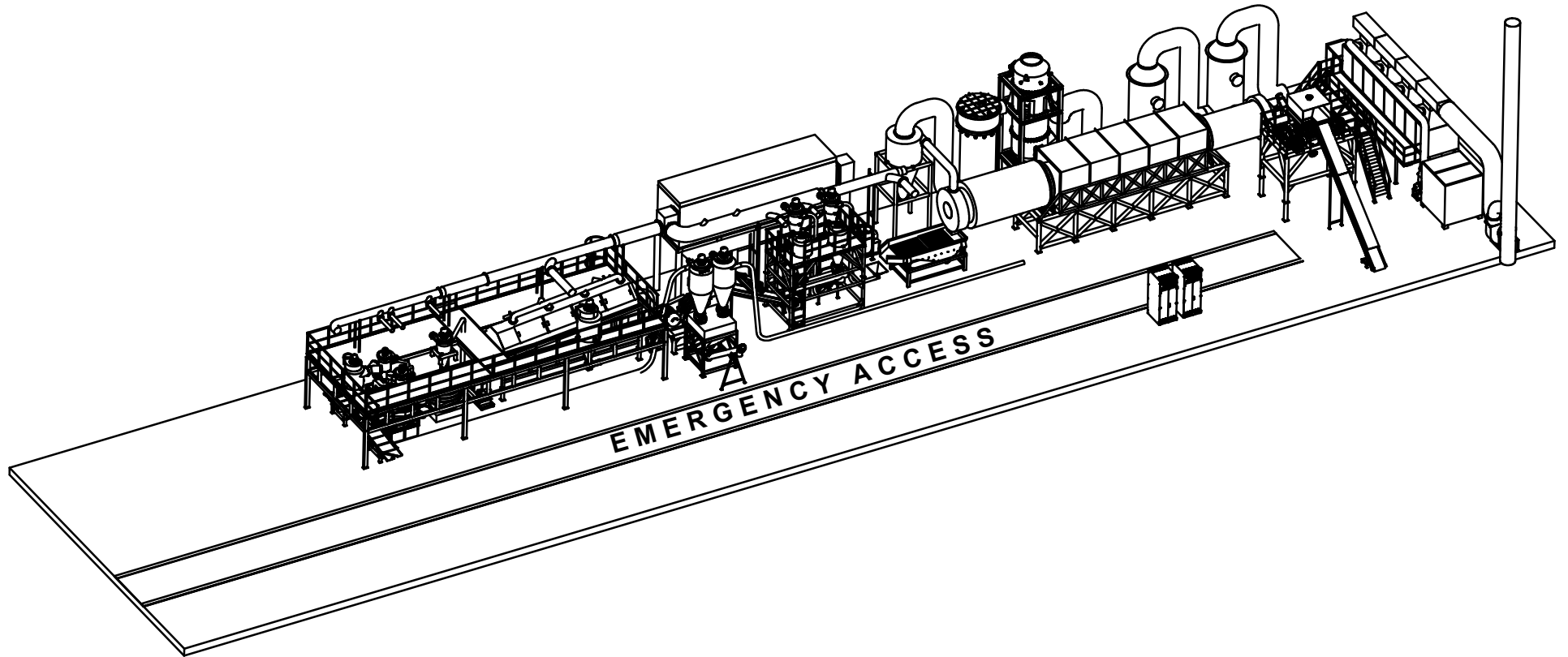
LAYOUT OF WASTE LITHIUM BATTERY PYROLYSIS AND CRUSHING SEPARATION AND RECOVERY PROCESS



LAYOUT OF WASTE LITHIUM BATTERY PYROLYSIS AND CRUSHING SEPARATION AND RECOVERY PROCESS	
ANGLE	
SCALE	1:1000



LAYOUT OF WASTE LITHIUM BATTERY PYROLYSIS AND
CRUSHING SEPARATION AND RECOVERY PROCESS



		ECONILI BATTERY PTE. LTD.	
		LAYOUT OF WASTE LITHIUM BATTERY PYROLYSIS AND	
		CRUSHING SEPARATION AND RECOVERY PROCESS	
ANGLE			
		SCALE	
		1:1000	

