

# Al and ICT Based High Safety & Long life Lithium Battery Company

































# AI Lithium is the Answer!







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STARTING MOTIVE POWER INDUSTRIAL

ESS



# **KPC Introduction**



#### **KPC** (Korea Power Cell)

As an Al and ICT- based lithium-ion battery packaging company, we are an industry leader leading the high-safety lithium battery mark.

# 1st

### **No.1 Domestic SMEs for Lithium Battery**

The company achieved the No. 1 (LFP standard) in the industry by producing and selling lithium-ion battery needed for various industries such as golf carts, sweepers, FRTU, AGV, KTX, electric vehicles, forklift vehicles, and UPS and is recognized as a leading company in the industry with.

# 10 years

**10%** 

### Rich experience in battery development

Through 10 years of research and development, manufacture and sales of battery system, we have rich experience and vast operational data that other companies do not possess. This provides our customers with the most reliable, safe and optimized battery.

# R&D investment of more than 10% of sales

We participate in government R&D such as the Ministry of SMEs and Startups, the Ministry of Science and Technology, and the Ministry of Industry and Energy to provide the best products and technology services in the industry in recognition of R&D investment and technical skills, which are 5 to 10% in terms of annual sales.

# **120MWh**

### **High cumulative Sales**

Based on our differentiated technology, we have sold our products to many industries including starting, motive power, industrial and ESS. As a result, the company achieved 125MWh cumulative sales, making it the lead in the SME lithium battery industry.

# 30+

### Owns 30 + industry-leading BMS

We concentrate our energy on developing high performance BMS with the best engineers in BMS field. With 10 years of experience and extensive operational data, we have dozens of top- performing BMS that can be used immediately in various industries.

# 1st

# Introduction of the first defect prediction system based on ICT and AI in Korea

KPC, which has been leading the development of "high safety lithium battery" with abundant experience and technology, introduced ICT remote monitoring system and AI analysis system for the first time in the domestic SME lithium battery industry.

# **KPC History**





#### 2008 ~ 2014

- · Established "R" before Korea Power Cell
- · Developed basic technology for lithium battery pack
- · Developed BMS (battery management system) technology
- · Developed lithium battery for electric motorcycle
- · Developed Medium-sized modular lithium battery
- · Developed lithium battery for electric control devices
  - · Developed lithium battery for UPS
  - · Developed lithium battery for ESS
  - · Developed EV monitoring SW

### 2015~2016

- · Established a new corporation, Korea Power Cell
  - · Acquired ISO9001 certificate
- · Developed lithium battery for Golf cart
- · Developed lithium battery for FRTU
- · Developed inspection equipment for FRTU
- · Developed lithium battery for Sweeper
- · Developed lithium battery for AGV
- · Expansion of affiliated research center



#### 2018

- · Acquired lithium battery certificate for KTX
- · Participated in developing lithium battery for Clark forklift
- $\cdot$  Developed lithium battery for KEPCO's DAS terminal devices
  - · Participated in R&D (multi- HESS development) with Ministry of Industry & Energy
- · Participated in network type R&D (high-safety lithium) for SME institutions
- · Developed lithium battery for Samsung Lifespan Insurance's new AGV
- · Established a Joint Venture with Razzler Energy (ESS specialized Company)
  - · Factory relocation (33,000m² in Daejeon)

#### 2017

- · Venture company approval
- $\cdot \ \mathsf{Certificate} \ \mathsf{of} \ \mathsf{qualified} \ \mathsf{test} \ \mathsf{for} \ \mathsf{FRTU}$
- · Achieved No. 1 market share in the lithium battery (LFP) for golf carts
- · Selected for a government project (ESS battery & module development)



### 2019

- Received "New Growth Leading Company" commendation from Daejeon City
- Established the 2nd technology research center (Daejeon)
   Exported lithium battery (\$200,000)
- · Built lithium battery remote integrated control system
- · Established an AI affiliate for lithium battery defect prediction with KAIST
- $\cdot \ \mathsf{Developed} \ \mathsf{multi} \ \mathsf{BMS} \ \mathsf{technology} \ \mathsf{for} \ \mathsf{medium} \ \mathsf{and} \ \mathsf{large} \ \mathsf{lithium} \ \mathsf{application}$ 
  - · Participated in the development of lithium battery for Hyundai Construction's forklift & excavator

# 2020

- · Acquired "INNOBIZ" company approval
- · Selected as "Star Company" by Daejeon City 2020
- $\cdot$  Developed the 1st stage of AI defect prediction solution for lithium battery
  - · Started supply to Hitachi Golf cart (domestic) to OE
  - $\cdot \ \mathsf{Developed} \ \mathsf{products} \ \mathsf{for} \ \mathsf{Hitachi} \ \mathsf{Golf} \ \mathsf{cart} \ (\mathsf{Japan}) \ \mathsf{export}$
  - · Developed monorail (48V 1000Ah) lithium battery
  - $\cdot \ \mathsf{Developed} \ \mathsf{lithium} \ \mathsf{battery} \ \mathsf{for} \ \mathsf{road} \ \mathsf{electric} \ \mathsf{sweeper}$
  - · Certificate by Korea Transportation Safety Authority for lithium for road electric sweepers
  - · Developed ESS lithium battery for drilling machine
  - · Developed lithium battery for cable vehicle in Sacheon city
  - · Commercialized lithium battery for rental of aerial work platform
    - · Acquired supplier qualification for lithium battery for Hyundai Construction's forklift

# **KPC Performance**

# "Record massive cumulative Sales - 120MWh"



# Golf cart lithium battery

- · Supplied 11,000 sets to 150 golf courses (8MWh)
- No. 1 market share
- · Supplied for Yamaha Golf cart in OE ('15~'18
- · Supplied for KIOTI Golf cart in OE ('16~'17)
- · Supplied for Hitachi Golf cart in OE ('20~)



# AGV lithium battery

· Supplied 1,000 sets to a number of large companies including Hyundai Motor Company, Samsung Electronics, Samsung Semiconductor, SK Hynix, Hyundai Mipo Shipbuilding, GM Daewoo, CJ, Canon Korea, and Donghee Auto



# Sweeper lithium battery

- · No. 1 market share
- · Exclusive supply contract with Cleantech Inc (No. 1 in the industry)
- · Supplied 500 sets to major Sweeper companies



# Forklift lithium battery

- · Joint development with Korea Pallet Pool ('17)
- · Participated in the development of lithium battery for Clark's forklift ('18)
- · Participated in the development of Hyundai Construction Machinery's forklift ('19~) and delivered 10 sets



# **UPS lithium battery**

- · Supplied 1,000 sets to the Ministry of Defense
- · Supplied to KEPCO substation delivery
- · Supplied to general companies



# · Supplied to KEPCO KDN

- · Supplied to Seungil Electronics
- · Supplied FRTU BMS to KEPCO
- · Supplied DAS BMS to KEPCO
- · Supplied BMS to HKT
- · Supplied BMS 20,000 sets

"We are doing business with large, medium, and public companies such as Samsung Electronics, Hyundai Motor, Samsung Semiconductor, Hyundai Construction Machinery, KEPCO, Incheon International Airport, etc. and companies based on demand for technology."



- · Supplied ESS for PV supply (11.2MWh)
- · Supplied to the National Pension Service (BESS 24KWh)
- · Supplied to KD Power delivery (240KWh)

Development and supply of HESS

· Supplied to Seoraksan National Park (45KWh)





# KTX lithium battery

- · Exclusive development of lithium battery for KTX
- Supplied to Hyundai Rotem (Motrex)



# KEPCO DAS lithium battery

- · Exclusive development with KEPCO KDN
- · Supplied to KEPCO KDN
- · 7,000 sets in 2017
- · 10,000 sets in 2018
- · 5,000 sets in 2019
- · No. 1 market share



# Electric vehicle lithium battery

- Acquired safety certificate from the Road Traffic Safety Authority for electric vehicle's lithium battery ('20)
- · Passed fall safety, submerged input, overcharge, over- discharge, short circuit, heat exposure, and combustion test
- · Supplied batteries to Cleantech's road electric



# FRTU lithium battery

- · First developer of FRTU lithium battery
- · No. 1 market share
- · Supplied to KEPCO HQ
- · Supplied to KEPCO's 130 branches



# Other machinery's lithium battery

- · Emergency rescue vehicles
- · Incheon Airport ticketing device
- · Sacheon Cable Vehicle
- · Monorail
- · Tunnel lighting
- · Drilling machine

100~250Wh/kg

Lithium batter

99% charge efficiency

Lithium battery

900

when battery is damage (Sealed Type)



# Technology

Lithium-ion battery

#### **Li-ion Battery**

Battery with advantages such as high energy density, high efficiency charge and discharge, high stability, ultra- Long lifespan, light weight, compact, and eco- friendliness compared to existing lead acid battery, NiCd battery, and NiMH battery

# Lithium-ion battery type [Prismatic Type] [Can Type]

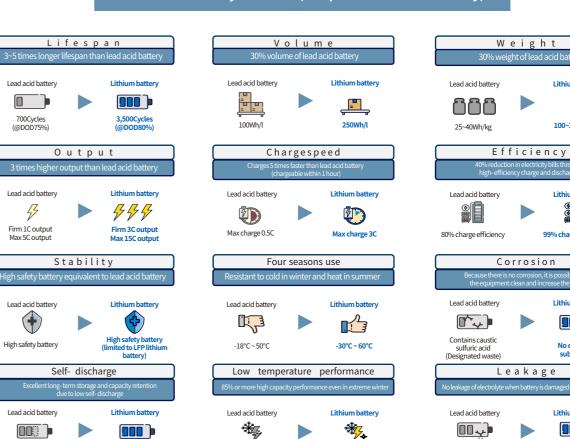
#### **KPC Cell's features**

- · Use long- lifespan lithium-ion battery (LFP)
- · Lithium-ion battery (LFP) lifespan is 1.5~2 times that of lithium-ion battery (NCM)
- · Chemical stability of the olivine structure minimizes the possibility of fire
- · LFP lithium-ion battery's excellent thermal stability allows it work well in a wide range of temperatures
- · Holds 1Ah~400Ah range of single cells
- $\cdot$  Global Top 10 cell applications
- · Capacity design optimizable for various applications

Model (capacity)		20Ah	30Ah	40Ah	50Ah	70Ah	100Ah	200Ah	300Ah	400Ah
Non	ninal voltage [V]					3.2~3.7				
	Length [mm]	72	126	126	126	126	126	142	365	365
Dimension	Width [mm]	42	46	46	46	65	65	57	63	73
	Height [mm]	152	190	190	204	190	243	493	312	312
Interna	al resistance [mΩ]	≤1.6	≤0.8	≤0.8	≤0.8	≤0.7	≤0.6	≤0.6	≤0.5	≤0.5
Prod	luct weight [kg]	0.7	1.4	1.4	1.8	2.0	2.8	5.7	10.6	13.2
Discharge condition	Discharge current [A]	10	15	20	25	35	50	100	150	200
	Discharge end voltage [V]	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8
Charge	Charge current [A]	5	7.5	10	12.5	17.5	25	50	75	100
condition	Charge end voltage [V]	3.65	3.65	3.65	3.65	3.65	3.65	3.65	3.65	3.65
Rapid charge	Charge current [A]	20	30	40	50	70	100	200	300	400
condition	Charge end voltage [V]	3.65	3.65	3.65	3.65	3.65	3.65	3.65	3.65	3.65
Maximum cont	inuous discharge current [A]	60	90	120	150	210	300	400	600	800
Maximum pulse	discharge current (A for 10sec)	200	300	400	500	700	1,000	2,000	3,000	4,000
Self- discharge					:	≤ 1% / mont	h			
Cycle Lifes	span (0.5C/DOD80%)	3,000 ~ 6,000 Cycles								
Use	e temperature		During charg	ge: 0 to 65°C	During discl	harge: - 20 to	65°C Storag	ge temperatı	ıre: - 20~65°C	:

 ${}^\star \text{We have various Lithium Cells other than the above table}$ 

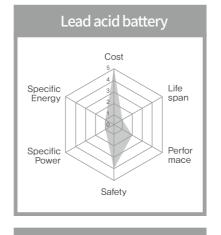
# Lithium-ion battery's features (compared to lead acid battery)



capacity

# Comparison of main performance by battery Lead acid battery vs Lithium battery (NCM) vs Lithium battery (LFP)

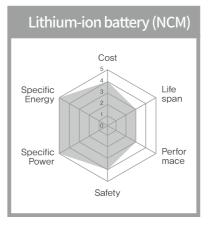
-18°C



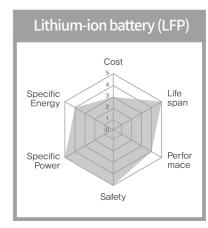
Less than 1% monthly

Less than 4% monthly

Cheap · Stability
Starter · Industry · Spare power



High power · Compact Light weight · Electric vehicle Tool · Home appliances · Industry



Sulfuric acid leakage occurs

when the battery is damaged

(Flooded Type)

Long lifespan · Safety Excellent low temperature performance Drive · Industry · Energy storage





# **Technology**

(Battery Management System)

# **BMS**

applications such as motive power, industry, communication, and ESS. Optimized product and the highest reliability with the vast application of operational data collected through 120MWh sales.



# **KPC BMS's features**

- · Low heat generation
- · Diagnosis and remote control
- · Remote monitoring
- · SOC, SOH, voltage, current, balancing, etc.
- · Cell balancing
- · Wired/wireless communication module attachment (option)
- · GUI Interface
- · Battery protection (overcurrent cutoff, over discharge protection)
- · 1Ah~400Ah
- · Battery information black box attachment (SD storage device)
- · Data logging
- Defect cause tracking and other history management

	BMS type	V105	V106	V108	V120	V122	V123	V124	V131
	Voltage	48~72V	24~36V	24~36V	48~72V	48~72V	48~72V	48V Only	24~36V
	Cell balancing	•	•	•	•	•	•	•	•
	Block charge	•	•	•	•	•	•	•	•
М	Cut off discharge	•	•	•	•	•	•	•	•
a	Temperature measurement	•	•	•	•	•	•	•	•
l n	Current measurement	•	•	•	•	•	•	•	•
"	indicator	•	•	•	•	•	•	•	•
f	Capacity calculation	•	•	•	•	•	•	•	•
u	DQ communication	•	•	•					
C	RS-232				•	•	•	•	•
ţ	RS-485				•		•	•	
0	CAN2.0A				•	•	•	•	
n	CAN2.0B				•	•	•	•	
	TCP/IP								
	Wired monitoring				•	•	•	•	•
	Data storage				● (Opti	on)			
	Remote monitoring				● (Opti	on)			
Ар	plication Model	Golf cart	Agricultural machinery Tunnel sweeper	Hyundai Motor Company KEPCO	Golf cart Others	Leisure Others	Leisure Others	Hyundai Samsung AGV	Modern Samsung AGV

# **KPC BMS development history**



2008년 Started development 2010년 Completed development

- · Analog-based BMS
- · Korea's first mass production BMS application model for Golf cart
- · Applied to various applications such as AGV and agricultural machinery

2012년 Started development 2013년 Completed development

- · 8bit MCU based BMS various communication possible
- Applied Golf cart mass production model
- · Applied to various applications such as KEPCO FRTU, DAS terminal

Samsung AGV, sweeper, etc.

2013년 Started development 2014년 Completed development

- · 8bit MCU- based BMS modular BMS structure suitable for high voltage
  - and modular pack design · UPS application

2014년 Started development 2016년 Completed development

- · Enhanced response rate and performance by
- development and in process

2020년 Started

- upgrading 32bit MCUbased BMS MCU
- · Modular BMS structure suitable for high voltage and modular pack design
  - · UPS and ESS application

· 32bit MCU- based BMS standalone BMS advancement

- in progress · Plan to apply mass- production model after development completion
- · Wired/wireless communication module
- · SD Memory storage
- · Combine AI Solution

141.00	// VI 22   VI 40   VI 50		1/454	V30				V401		VEGG	
V132	V133	V140	V150	V151	Master	Slave	Com.	Master	Slave	Com.	V520
24~36V	24~36V	24V	24V	48~72V	48~72V	48~72V	48~72V	48~72V	48~72V	48~72V	48~72V
•	•	•	•	•	•	•	•	•	•	•	•
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						ption)					
						ption)					
Rotem KTX	Sweeper	Hyundai Samsung AGV	KEPCO compact power supply	For protection of KEPCO connected devices	ESS UPS EV	ESS UPS EV	ESS UPS EV	ESS UPS EV	ESS UPS EV	ESS UPS EV	Hyundai Construction Machinery





# 3 Technology

Technology differentiation

# First Mover 🔊

- 1. 1st company to launch a lithium-ion battery (LFP) in Korea (2010)
- 2. The company preparing an ICT- based lithium battery remote monitoring system
- 3. The company obtaining lithium battery real-time big data (Cloud System)
- 4. The company preparing lifespan and defect prediction systems through AI analysis

# KPC's technology differentiation

**High Safety** 

BMS

Real-time active

safety monitoring

and BMS control

High safety lithium

Existing  $\rightarrow$ 

battery

Safest lithium-ion \_ battery (LFP) structure (Olivine Structure) Explosion Hazard "Zero" Ultra-long lifespan Lithium

lithium-ion
battery (LFP)
that is more than
twice as long as
the existing lithium-ion
battery (NCM)

**ICT&Big Data** 

Real-time ICT remote
monitoring and
big data collection
system using
LoRa and WiFi
wireless communication

Al analysis failure prediction

Defect and accident prediction system through Al analysis n affiliate with KAIST)

# Remote monitoring control system + AI failure prediction







- 1. Real-time condition monitoring
- 2. Predict lifespan and defect
- 3. Analysis of failure cause
- 4. Effective BS or AS response

Lifespan prediction + defect prediction



- 1. Real-time condition monitoring
- 2. Lifespan and defect prediction
- 3. Claim application
- 4. Customer satisfaction

 $^{\star}$  Operation of the AI analysis system is scheduled for 2021

# **Starting Battery**





<b>Usage</b>			
· Vehicle · Taxi · Truck	· Bus · Ship · Motorcycle	· Camper · Tractor · Cultivator	· Other starter

# **KPC Specialty**

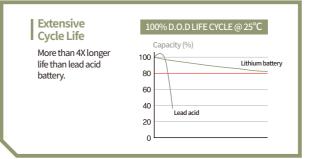
- · Tiny battery

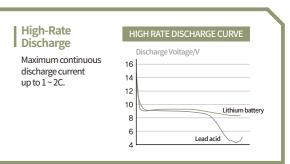
- · Ultra-light battery (30% of lead acid battery)
- · Excellent high rate discharge features(instant 5C, · Low self- discharge (≤1%/month) continuous 3C discharge possible)
  - · Battery for four seasons (low temperature resistance)
- · Ultra-long lifespan battery (3~4 times lead acid battery) · Leak-proof battery (can be used in

  - · Excellent heat resistance properties
  - · Eco-friendly battery (non-toxic, no sulfuric

# ☑ 제원

Proc	luct Name	KPC-ST 1210	KPC-ST 1218	KPC-ST 1240	KPC-ST 1250	KPC-ST 1280	KPC-ST 12100	KPC-ST 12150	KPC-ST 12200
Nom	inal Voltage [V]	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8
Nominal Capacity [Ah] 10 18 40				50	80	100	150	200	
Nomi	nal Energy [Wh]	132	238	528	660	1056	1320	1980	3640
Charging Voltage [V]		14.4	14.4	14.4	14.4	14.4	14.4	14.4	14.4
Final Dis	charge Voltage [V]	9.6	9.6	9.6	9.6	9.6	9.6	9.6	9.6
Charg	ging Current [A]	10	18	40	50	80	100	150	200
Peak Discharge Current [A]		10	18	40	50	80	100	150	200
Product	Width	181	166	256	197	260	323	532	532
Size [mm]	Length	76	175	173	165	170	175	205	269
[IIIIII]	Height	167	125	220	169	220	235	220	220
W	eight(kg)	2.2	3.2	7.8	6	12	15	19	25
Tempe	Discharging			,	-20°C	~60°C			
rature Condi	Charging				0°C ~	55°C			
tion	Long-term storage				0°C ~	35°C			
	BMS				bui	lt-in			





# **Motive Power Battery**





# Usage

Golfcart

- · E-Wheelchair

· Electric farm machinery

- - · 2 wheel vehicle · Forklift

· Eco-friendly battery (non-toxic, no sulfuric acid,

· No need to refill distilled water

# **■** Features

- · Ultra-long lifespan
- (3~4 times the lead acid battery)
- · High safety (no explosion)
- (30% of lead acid battery)
- (40~60% of the volume of lead acid battery) (can be used in horizontal position)
- · High charge/discharge efficiency (40% reduction in electricity bill)
- Excellent low temperature capacity performance Excellent high rate discharge
- (instant 5C, continuous 3C discharge possible)
- · Low self- discharge (≤1%/month) Rapid charge battery (30-50% of lead acid battery charge time)

# **E** KPC Specialty

- · Developed and supplied driving lithium battery(LFP) for the first time in Korea
- · Possession of massive operational
- · Companies with the largest number









#### KPC Specialty

- · Long lifespan (3~4 times the lead acid battery)
- High safety (no explosion)
  High charge/discharge efficiency (40% reduction in electricity bill)
  Excellent low temperature feature (2nd round in winter)

- Eco-friendly battery
   No need to refill distilled water (no corrosion)
- Features 😿

- 01 Developed and commercialized LFP Battery for golf cart for the first time in Korea (2010)
   3 to 4 times the lifespan of a lead acid battery
   Reduce operating costs by about 40% compared to
- 102 Secured operating technology data of all golf carts
  with 10 years of experience
  103 Possess the largest number of lithium batteries for golf carts (12 models)
  104 Supply to Hitachi, a domestic golf cart handling company, in OE
  105 Supplied 12,000 sets and No. 1 market share (as of 2020)

# Specification (replacement specification for existing lead acid battery)

#### \* Can produce in various specifications

Model	Nominal Voltage	Capacity	[	Wt		
Model	[V]	[AH]	L	W	Н	[Kg]
KPC-GV4840		40	224	560	193	25
KPC-GV4870		70	289.6	580	197	37
KPC-GV48100		100	289.6	580	248	50
KPC-GV48113	51.2V	113	720	200	250	45
KPC-GV48120		120	289	1080	193	69
KPC-GV48160		160	640	290	280	65
KPC-GV7240		40	224	821	193	40
KPC-GV7270		70	224	1079	193	55
KPC-GV7280	76.8V	80	730	225	200	48
KPC-GV72100		100	224	1079	248	72
KPC-GV72113		113	750	240	280	60









#### **F** KPC Specialty

Features 🔀

- · Long lifespan (3~4 times the lead acid battery)
- · Increased operating time
  (more than twice the lead acid battery)
  · Lightweight & low volume battery
- (easy exchange)

  High charge/discharge efficiency
  (40% reduction in electricity bill)

  No need to refill distilled water
- for electric sweeper (2016)
   Applied proven lithium iron phosphate battery technology for golf cart
- Developed lithium battery (LFP) for sweeper with various specification (24V, 36V, 48V, etc.)

   Business alliance with Cleantech, Korea's No. 1 Electric sweeper manufacturer

- OE supply in progress
   Distributor contract for electric sweeper
   Completed lithium battery (LFP) test and supplied to companies such as Cleantech (Korea No. 1 company)





Model	Nominal Voltage	Capacity	[	Dimension [mm]		
Model	[V]	[AH]	L	W	Н	[Kg]
KPC-FM24100		100	265	323	248	26
KPC-FM24113		113	290	212	252	20
KPC-FM24120	25.6V	120	265	694.2	197.5	37
KPC-FM24140		140	265	694.2	197.5	37
KPC-FM24200		200	265	694.2	248	52
KPC-FM36100		100	224	566.6	248	39
KPC-FM36113		113	293	240	279	30
KPC-FM36120	38.4V	120	448	566.6	193.3	55
KPC-FM36140		140	448	566.6	193.3	55
KPC-FM36200		200	448	566.6	248	72









# KPC Specialty

- · Long lifespan
  (3~4 times the lead acid battery)
  · Increased operating time
  (more than twice the lead acid battery)
  · Lightweight & low volume battery
  (easy exchange)
  · High charge/discharge efficiency
  (40% reduction in electricity bill)
  · No need to refill distilled water
  (no corrosion)

- (no corrosion)

  · Eco-friendly battery

  · High safety (no explosion)
- Features 🕃

- 01 Developed various product lines and dedicated BMS in cooperation with a number of large customer companies
   Provide customized design and technical support service according to AGV specification
  02 Important supply details (recognized as a company with excellent technology)
   Hyundai Motor Company (Brazil factory, Turkey factory, Beijing factory), Hyundai Heavy Industries, Hyundai Mipo Shipbuilding, POSCO, GM Daewoo (Gunsan), Maru (Japan), Donghee Auto, Samsung Electronics (Onyang, Pyeongtaek), etc.
  03 High performance
   Long lifespan
  (3~4 times of lead acid battery, 2~3 times of other batteries)
   Long operating time
  (more than twice the lead acid battery at the same volume)
   Quick charge (1C)
   Cost reduction (40% reduction compared to lead acid battery)

# **Specification** (replacement specification for existing lead acid battery)

\* Can produce in various specifications

	Model KPC-AGV24		KPC-AGV36	KPC-AGV48
	Capacity 50~100AH		50~100AH	50~100AH
Non	ninal Voltage	25.6V (3.2VX8)	38.4V (3.2VX12)	51.2V (3.2VX16)
Char	Charge current [A] Max. 1C		Max. 1C	Max. 1C
Charge voltage [V] 28		28.4V (3.55VX8)	42.6V (3.55VX12)	56.8V (3.55VX16)
charging method		CC→CV	CC→CV	CC→CV
Maximu	ım discharge current	3C	3C	3C
Dischar	ge end voltage [V]	22.4V (2.8VX8)	33.6V (2.8VX12)	44.8V (2.8VX16)
Con	nmunication	RS-232, RS-485	RS-232, RS-485	RS-232, RS-485
Tem	At discharge	-25∼65°C	-25∼65°C	-25∼65°C
per ature con	At charge	0~45°C	0~45°C	0~45°C
dition	During long- term storage	0~45°C	0~45°C	0~45°C









# **F** KPC Specialty

- (no corrosion)

   Excellent low temperature features (good winter capacity)

   Eco-friendly battery

   High safety (no explosion)

- 02 High performance
   Long lifespan (3~4 times the lead acid battery)
   Uniform output stability & strong lifting ability during use
   Long operation time (with high energy density, more than twice the lead acid battery at the same volume)
   Cost reduction (40% reduction compared to lead acid battery)

Ol Developed lithium battery (LFP) for electric forklift (2017)
- Completed joint development with a large company with the largest number of forklifts in Korea (2016–2017)
- Acquired OE supplier qualification for "H", a domestic electric forklift manufacturer (2020)
- Secured electric forklift operation data and developed optimized BMS

Features 🚡



**Specification** (replacement specification for existing lead acid battery)

Evicting load acid	Existing lead acid battery specification			neral Model	Lithium Advanced Model		
Existing lead acti				lead- acid battery	Uses 2 times as much lead battery		
Model	Lead battery	specification	Lithium replace	ement standard	Lithium replace	ement standard	
Model	[V]	[AH]	[V]	[AH]	[V]	[AH]	
VCF(D)400	24	400	24	270	24	400	
VCJ3	48	300	48	200	48	300	
VCF320(335)	48	320	48	240	48	360	
VCD(F)400	48	400	48	270	48	400	
VCD450	48	450	48	300	48	450	
VCD500	48	500	48	360	48	500	
VCD600	48	600	48	400	48	600	









- Long lifespan
  (3~4 times the lead acid battery)
   Increased operating time
  (1~1.5 times the lead acid battery)
   High charge/discharge efficiency
  (40% reduction in electricity bill)
   No need to refill distilled water
  (no corrosion)

- (no corrosion)

  · Excellent low temperature features (good winter capacity)

  · Eco-friendly battery

  · High safety (no explosion)

Features 😿



- 01 Developed lithium battery for aerial work platform (2015)
   Jointly developed with companies with the largest number
  of aerial work platforms in Korea (2015)
   Secured operating data and developed optimized BMS for
  aerial work platform

- 02 Differentiation
   Long lifespan (3~4 times lead acid battery)
   Uniform output stability during use
   Powerful lifting ability
   Long operation time (1.5 times or more with high capacity product)
   Cost reduction: reduced distilled water cost and corrosion
  prevention cost

- prevention cost
   BMS for high place work platform
   Enhanced communication function
   Battery monitoring function
   Sleep & Wakeup function

- **Specification** (replacement specification for existing lead acid battery)

\* Can produce in various specifications

Evicting load acid	Existing lead acid battery specification			neral Model	Lithium Advanced Model	
Existing lead acid				Uses 1 to 1.2 times lead- acid battery		Uses twice as much lead battery
Model	Lead battery	specification	Lithium replace	ement standard	Lithium replacement standard	
Model	[V]	[AH]	[V]	[AH]	[V]	[AH]
KPC-T105	6	225	24	113	24	226
KPC-T125	6	240	24	160	24	226
KPC-T145	6	260	24	160	24	226











- Long lifespan
   (3-4 times the lead acid battery)
   Increased operating time
   (1~1.5 times the lead acid battery)
   High charge/discharge efficiency
   (40% reduction in electricity bill)
   No need to refill distilled water
- no corrosion)
  Excellent low temperature featur
  (good winter capacity)
  Eco-friendly battery
  · High safety (no explosion)

- 02 Passed the safety evaluation of lithium battery for road driving Performance and Standards of Vehicle Parts under Regulation Article 18.3 and Safety Test No. 48 of the Enforcement Rules [Appendix 1]

Item	Test result
Drop Safety Test	Pass
Submerged Safety Test	Pass
Overcharge Safety Test	Pass
Over discharge Safety Test	Pass
Short Circuit Safety Test	Pass
Heat Exposure Safety Test	Pass
Combustion Safety Test	Pass

# **Specification** (replacement specification for existing lead acid battery)

can produce in various specifications	
Item	Lithium General Model (KPC- FL481000)
Battery Type	LiFePo4
Nominal voltage	48V
Battery capacity	1,000 Ah
Operating voltage	39.8V~54.8V
Charge current	250A
Maximum continuous discharge current	250A
Maximum discharge current	500A
Charge current	250
Service lifespan	≤3,000 Cycles @ 80%DoD
Operating temperature	-20°C ~ 65°C
Battery size	951mm x 827 x 627
Battery weight	430
Battery output (continuous)	12 kw
Battery output (maximum)	24 kw
	·

# **Industrial Battery**





# Usage

- · Power plants
- · UPS
- · Railroad · Data center
- · Medical devices
- Electrical pane
- · Fire extinguishing and
- disaster prevention syste
- FR1
  - Security & fire alarm systemsVarious mechanical equipment
  - and spare power









01 High power - Excellent response to instant power output with 3 times higher output than lead acid battery

02 Long lifespan
- 3~5 times (15 years or more) compared to lead acid battery lifespan (3~7 years)

03 Ultra-light weight / low volume
- Installation space is 20% of lead acid battery
- Reduction of building cost, load reinforcement cost, construction cost, space management service cost, heating and cooling cost, rental cost (when renting)

04 Remote meter reading management possible through ICT Cloud



· Ultra-long lifespan

· Ultra-light/low volume

(3~5 times the lead acid battery)

Low self-discharge (≤1%/month)
 Leak-proof battery
 (can be used in horizontal position)

· Wide operating temperature

· Eco-friendly battery

(more than 3 times of lead acid battery) (non-toxic, no sulfuric acid,

no heavy metals)

· High safety (no explosion)

Output		Lifes	pan	Installati	Installation space		Management	
Lead acid battery	Li-ion battery	Lead acid battery	Li-ion battery	Lead acid battery	Li-ion battery	Lead acid battery	Li-ion battery	
5	555		900		=			

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# UPS RACK System





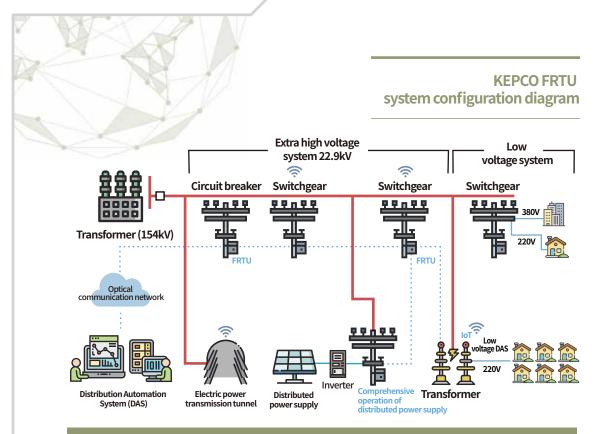
[Li Module for UPS]

[Li Rack System for UPS]

NO.											
	Unit Model	KPC-UPS38	KPC-UPS230	KPC-UPS461	KPC-UPS576						
1 sy	system configuration	12S1P	72S1P	144S1P	180S1P						
2 Bá	Battery configuration	$12S1P \times 1$ Unit	$12S1P \times 6$ Unit	$12S1P \times 12$ Unit	12S1P × 13 Unit						
3	Rated capacity	100 AH	100 AH	100 AH	100 AH						
4	Rated voltage	51.2 V 230.4 V		460.8 V	576 V						
5	Voltage range	30.0 V ~ 43.8 V	180 V~262.8V	360V~525.6V	450V~657V						
6 o <sub>r</sub>	perating voltage range	33.6 V ~ 42.0 V	201.6V~252.0V	403.2V~504.0V	504V~630V						
7	Rated power	3.84 kWh	23.0 kWh	46.1 kWh	57.6 kWh						
8 м	Maximum charge current	100A (1C)									
9 Ma	aximum discharge current	100A (1C)									
10	Peak current	120A (25°C,50%SOC,10s)									
11	Ip Grade	IP20									
12 Dis	ischarge temperature	-20°C~55°C									
13 c	Charge temperature	0°C~55°C									
14	System weight	about 45kg about 225kg abou		about 425kg	about 460kg						







Installing lithium-ion batteries for terminals for obtaining and controlling information such as current, voltage, and fault detection for all sections from high voltage to low voltage during the power distribution process of generated electricity

# FRTU for high voltage









FRTU for low voltage





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# **Product features**

#### 01

#### Developed "first" lithium-ion battery for FRTU

- Participated in the demonstration project of lithium-ion battery for FRTU
- Participated in the purchase standard of KEPCO for FRTU
- Battery safety test certified company for FRTU
- Conduct lithium-ion battery tests with a number of switchgear companies

02

#### Specialized lithium-ion battery for FRTU

- FRTU Peak Current response 6C
- Over 70 open/close operation possible
- Abnormality detection (current, voltage, temperature, BMS power, converter, etc.)
- EMC Pass (IEC 61000-4-5)
- Remote monitoring technology applied

Madal	FR	TU	Low Voltage DAS		
Model	FRTU-2410	FRTU-2420	FRTU-2405	FRTU-2405C	
Use	High Volta	age FRTU	Low Voltage FRTU	Low Voltage FRTU - Compact	
Voltage	3.2 X 8ea	3.2 X 8ea	3.2 X 8ea	3.2 X 8ea	
Capacity	10Ah	20Ah	5Ah	5Ah	
Charging Current	Max. 5A	Max. 10A	Max. 5A	Max.3A	
Peak Discharge Current	6C (more than 1 sec)	6C (more than 1 sec)	6C (more than 1 sec)	6C (more than 1 sec)	
Weight	2.84kg	6.50kg	1.5kg	1.5kg	
Size [mm]	180x77x166.5	180x154x166.5	150x140x45	150x140x35	
Delivery Place	KEPCO	KEPCO	KEPCO KDN	KEPCO KDN	
lmage			Volume : 24V Capacity : 5Ati	Li pavita	

# **Energy Storage System**



# Usage 🛅

- · CESS (15kw ~ 100kw)
- · FESS (100kw~1Mwh)
- · ESS for transmission and distribution
- · Micro Grid ESS (1Mwh~More)
- · Solar power (standalone/grid-connected) + ESS
- · Wind power (standalone/grid-connected) + ESS
- Other energy storage
- Frequency adjustment ESS
- UES (UPS + ESS)

# **KPC Specialty**



- · Ultra-light battery
- · High charge and discharge efficiency battery
- · Wide operating temperature range · Convenience of maintenance

- Volume saving battery Eco-friendly battery Excellent strategic stability

# Features 📴



- **01** Battery lifespan of more than 15-20 **05** RS232, RS485 communication
- 02 Simple design, ultra-light weight,

- interface and ICT remote monitoring
- **06** LED Display: operation status indication and abnormal signal indication function
- ${\bf 04}\;\; {\bf Eco-friendly}\; {\bf battery}\; {\bf with}\; {\bf no}\; {\bf harmful} \qquad {\bf 08}\;\; {\bf Modular}\; {\bf product}, {\bf expandable}\; {\bf through}\;$
- 09 Customized system construction possible for grid only, (solar - wind power) hybrid base station and energy poor area







# ESS MODULE



# \* Can produce in various specifications

NO.	Unit Model	KPC-U48100	KPC-U72100	KPC-U48150	KPC-U72150	
1	Battery configuration	16S1P	24S1P	16S1P	24S1P	
2	Rated capacity	100 AH	100 AH	150 AH	150 AH	
3	Rated voltage	51.2V	76.8V	51.2V	76.8V	
4	Voltage range	40V~58.4V	60V~87.6V	40V~58.4V	60V~87.6V	
5	Rated power	5.12 kWh 7.68 kWh		7.68 kWh	11.52kWh	
6	Maximum charge current	100A	(1C)	150A (1C)		
7	Maximum discharge current	100A	(1C)	150A (1C)		
8	Peak current	120A (25°C, 5	0%SOC, 10s)	180A (25°C, 50%SOC, 10s)		
9	Ip Grade	IP20				
10	Discharge temperature	-20°C∼55°C				
11	Charge temperature	0°C~55°C				
12	Module size	395x477x250mm	395x620x250mm	510x451x242mm	450x683x242mm	
13	Module weight	49 kg	65.5 kg	65.5 kg	92 kg	







# ESS RACK System



NO.	Unit Model	KPC-ESS768	KPC-ESS1152	KPC-ESS1728	KPC-ESS2649		
1	System configuration	240S1P	240S1P	180S1P	184S3P		
2	Battery configuration	24S1P	16S1P	12S1P	8S3P		
3	Rated capacity	100 AH	150 AH	300 AH	450 AH		
4	Rated voltage	768V	768V	576V	588.8V		
5	Voltage range	600V~876V	600V~876V	450V~657V	460V~671V		
6	Operating voltage range	672V~840V	672V~840V	504V~639V	515V~653V		
7	Rated power	76.8 kWh	115.2 kWh	172.8 kWh	264.9 kWh		
8	Maximum charge current	100A (1C) 150A (1C)					
9	Maximum discharge current	100A (1C)	100A (1C) 150A (1C)				
10	Peak current	120A	20A 180A (25°C, 50%SOC, 10s)				
11	Ip Grade	IP20					
12	Discharge temperature	-20°C∼55°C					
13	Charge temperature	0°C~55°C					
14	System size	720x830x1791mm	720x940x2341mm				
15	System weight	about 800kg	about 1,050kg	about 1,430kg	about 2,190kg		



Korea Power Cell, a company specialized in lithium battery

# **KPC lithium battery** will reward you with quality.



**Venture business** certificate



Affiliated research institute certificate



ISO 9001 Quality management system



Main Biz certificate



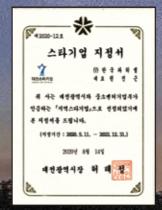
Innobiz certificate



**Battery Test Report** 



New growth leading company certificate



Daejeon City's 2020 Star Enterprise certificate

# AI LITHIUM IS THE ANSWER!

AI Lithium is the Answer