

신재생에너지 저장 및 모빌리티 어플리케이션 전문기업

**Bumhan** Unisolutions

**ESS/Standalone/EV/EM  
Battery Module & Pack**

Lithium Ion Battery Pack  
for ESS & Standalone & EV



**Bumhan**

범한유니솔루션

## Overview

배터리 팩 개발 제조 경쟁력과 전력변환장치 사업 역량을 결합하여  
에너지 솔루션 전문기업으로 출범

## Bumhan Unisolutions

회사명	범한유니솔루션 주식회사
대표이사	박기욱
설립일	2017년 7월 31일 (합병일 2024년 3월 27일)
자본금	약 71억원
매출액	약 135억원 (2025년)
임직원수	56명
주소	경기도 평택시 서탄면 사리길 19
사업영역	- ESS/ EV / E-mobility 배터리 팩 및 모듈 - ESS, EV 충전기, 태양광



## Bumhan Group Companies

범한그룹은 에너지 기술을 기반으로  
다양한 산업 분야로 사업 영역을 확장해 온 에너지 전문 그룹입니다.

각 계열사는 소재·부품·시스템 전반에 걸쳐 에너지 가치사슬 내 핵심 역할을 수행하며,  
그룹의 기술력과 품질 경쟁력을 통해 지속 가능한 에너지와 산업의 미래를 만들어가고 있습니다.

### Bumhan 범한산업

공기 & 수소 압축기



### Bumhan 범한메카텍

초저온(LNG·수소·CO2 등) 저장·공급 솔루션 외



### Bumhan 범한퓨얼셀

잠수함/선박/건물용 연료전지, 수소 충전소



### Bumhan 범한자동차

친환경 전기버스, 수소버스



### Bumhan 범한유니솔루션

ESS&EV Charger, 배터리 모듈&팩



### Bumhan 범한비나헤비인더스트리

발전/에너지 플랜트 기자재, 산업 및 항만 구조물



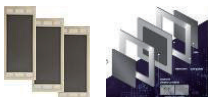
### Bumhan 범한케이블앤시스템

선박용/산업용 케이블



### Bumhan 범한머티리얼즈

연료전지 소재 개발 및 생산



### Bumhan 범한캔두

화학/정유/가스/발전 등 플랜트 설계



### Bumhan (주)범한

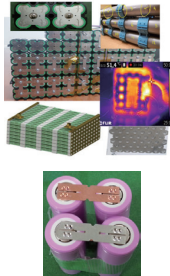
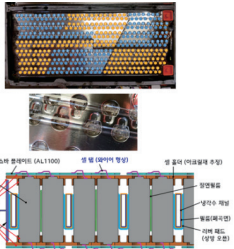
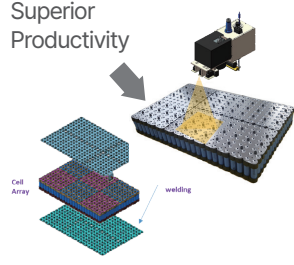
건물 임대 및 부동산 개발



## Advanced Battery Module Technology

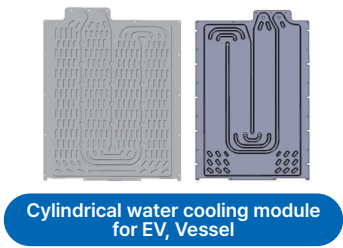
### ▶ 차별화된 레이저 용접 기술

진화된 모듈 제작 기술로 우수한 모듈 밸런스 및 높은 신뢰성, 생산성 향상으로 제작비용 절감

Spot welding	Wire bonding	Laser welding
		
Ni tab (Cond.15%)	Al10 (Cond.60%, 230W/mK)	Al10 (Cond.60%, 230W/mK)
Material Price : (10times)	1/10	1/10
Productivity : 1.5sec/cell	1.5sec/cell	0.1~0.3sec/cell (>4times faster)
1S/4~32P large cell welding 6~12S/1~4P bolting connection	Uni body type module	Uni body type module ★열 균형과 긴 사이클 주기를 위한 최적의 배터리 팩 디자인★

### ▶ 원통형 수냉 모듈 기술

미국 Tesla사와 동등수준의 원형 수냉모듈 개발, EV용/국방용/선박용에 적용 확대



#### ▶ 전기추진 선박용 수냉모듈 (IP44)



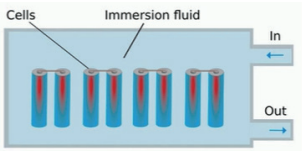
#### ▶ EV / 국방용 Vehicle 수냉모듈



### ▶ 액침식 냉각 시스템

액침냉각형 쿨링 기술 적용 배터리 모듈 및 팩 제조 기술로 배터리 열폭주 현상 방지 및 화재 예방

\* 냉각 플루이드가 배터리셀에 직접 접촉하여 냉각하는 방식



- 배터리를 비전도성 유체에 직접 담가 냉각하는 기술로 **배터리 화재 시 가장 높은 레벨의 안전성 보유**
- 기존 공랭식 대비 **에너지 소비량을 최대 50%까지 절감**
- 혹독한 환경에서도 사용 가능하며, **장비 수명성능 연장**
- 데이터센터 서버 뿐만 아니라 전기차 배터리, ESS 배터리, 전기차용 급속 충전기 등 **다양한 분야에서 활용 중**

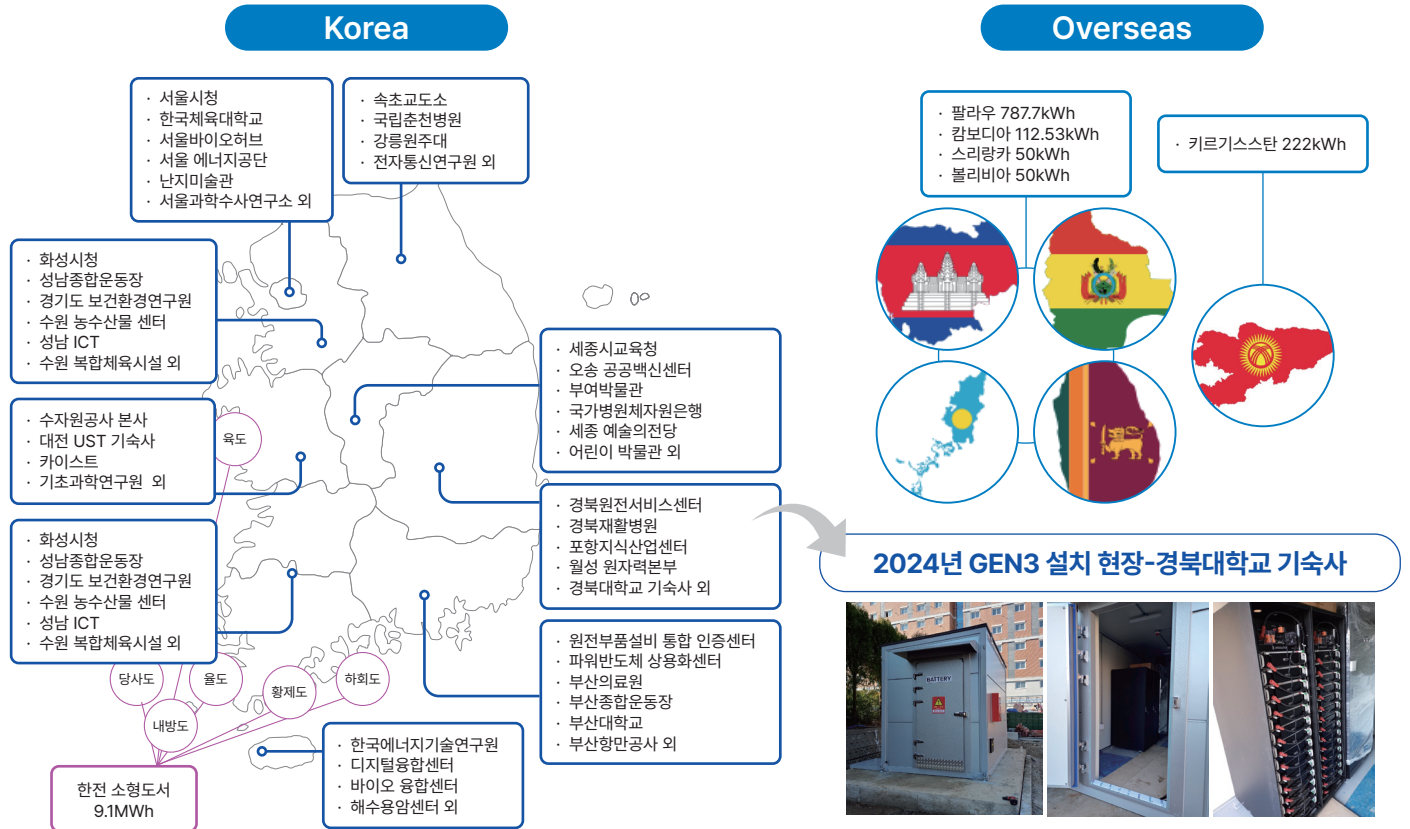
ESS 타입	공랭형 ESS	액침냉각-공랭열교환	액침 fluid 순환 열교환
구조			
초기투자비용	중간 (HVAC 및 주수장치 배관 필요)	낮음	가장 높음 (칠러 및 배관 필요)
유지비용	다소 높음	낮음	높음
PPR	낮음 (주수장치 필요)	고안전	고안전
전력소모	다소 높음(HVAC 전력소모)	낮음	다소 높음
수명	낮음	높음	높음

## 배터리 팩 및 모듈 납품실적

원통형셀을 AI Laser Welding Unibody 모듈 기술로 제작 → 고출력 모듈 및 원통형 수냉 모듈, 팩 납품실적

### ▶ ESS용 배터리 실적- 약 60MWh

국내 공공기관 및 도서지역 195개소, 해외 신재생연계ESS 배터리 5개소



### ▶ EV/EM 분야 원통형 배터리 모듈 및 팩 누적 실적- 약 150MWh (ESS포함)



# Immersion Cooling Battery for CNI Applications “Power Cool” Lineup

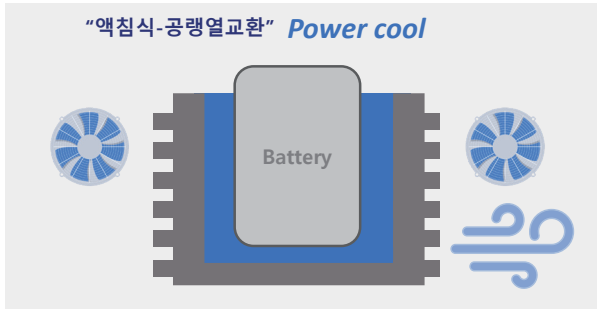
- Industrial ESS
- Vessel ESS
- EV Charger ESS
- UPS Battery



# Immersion Cooling Battery, The New Standard in Safety and Efficiency

Immersion Cooling Battery(액침냉각배터리)를 선택해야 하는 이유

## ▶ Power Cool Immersion Cooling Battery 특징점



*Economic & High performing! Perfect Fire suppression!*

- 가장 경제적이고 효과적임
- 설치 용이 (칠러 및 배관 불필요)
- 낮은 유지보수 비용
- 높은 냉각효율로 낮은 소모전력
- 수명 특성 증가 및 높은 안전성
- High C-rate 충방전이 가능
- 배터리 셀을 유전체 액체 (dielectric fluid)에 담가 냉각
- 각 셀에서 발생하는 열 직접 제거 + 산소 차단 → 화재 예방
- 배터리 열 관리와 화재 안전을 동시에 달성

- 가혹한 환경에서도 안정적으로 작동하는 효율적인 액침 냉각 시스템으로, 제품의 수명과 성능을 연장시키며, 유틸리티 전력 소비를 감소시켜 경제성 극대화
- 배터리 화재에 대한 최고 수준의 안전성을 보장 (cell to cell, module to module, system to system, all level fire suppression)

## ▶ Bringing battery safety up to server standards 서버 수준의 안전성을 갖춘 배터리

- 서버 환경에서 검증된 액침 냉각 → 리튬이온 배터리 열/화재 위험 관리 탁월
- 컴퓨팅 열 관리 전략을 에너지 저장 시스템에 적용 → 안전·효율 인프라 구현
- BESS 용량 확대나 열 관리 현대화를 계획하는 시설은 안전 기준에 기반한 현실적이고 신뢰 가능한 옵션으로 고려해야 함.

### Check Point!

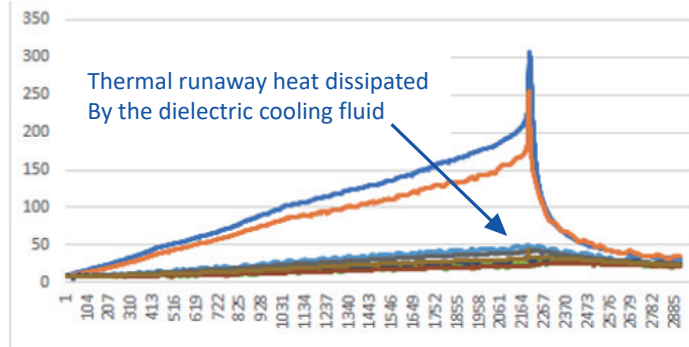
- ✓ 시스템 구성: '스탠다드 랙' 구성에 적합한 '모듈러 디자인'
- ✓ 모니터링 시스템: BMS와 시설관리 모니터링을 결합
- ✓ 표준적합성: 국내 KC62619, NFPC607, 해외 UL 9540, UL 1973, and NFPA 855 규격에 부합
- ✓ 유지보수: Fluids는 반영구적이어서 거의 교체가 필요 없고, 전장부는 유지보수가 가능해야 함.

## ▶ 제품 구성

CELL	Power Cool Module	Power Cool Rack System
<p><b>LGES</b></p> <p>-NCM 21700 (18.2Wh, 5.0Ah)</p>	<p>Immersion cooling module -Nom. Energy: 7.93kWh</p>	<p><b>135kWh (878Vdc)</b></p> <p><b>111kWh (723Vdc)</b></p> <p><b>50kWh (716Vdc)</b></p>

### ▶ PPR Test Result

"Perfect fire suppression"

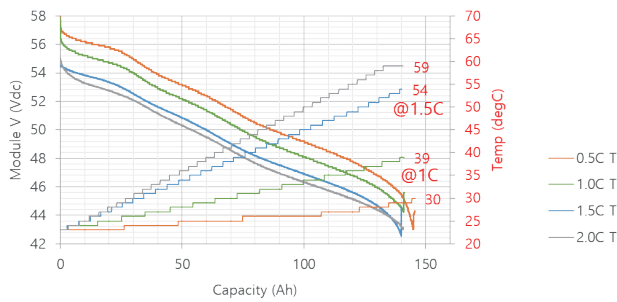


### ▶ Module Performance

액침 모듈은 0.5~2.0C 전 구간에서 공랭 모듈 대비 향상된 방전 성능 제공

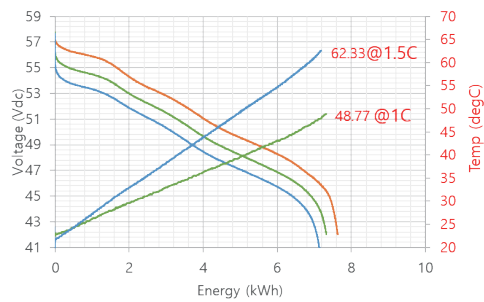
#### Power Cool (Immersion) Module [액침]

14S32P-M50L Power Cool module C-rate test  
(0.5C/1.0C/1.5C/2.0C-rate, 3.1-4.15Vdc/cell)



#### Air Cool Module [공랭]

14S32P-M50L Module C-rate test  
(0.5C/1.0C/1.5C-rate, 3.1-4.15Vdc/cell)



## Power Cool ESS Applications

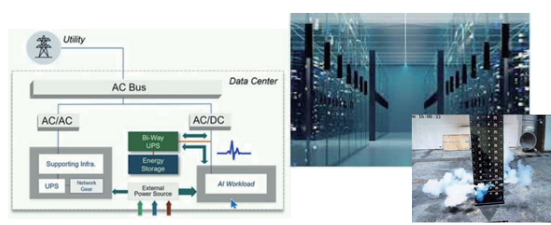
### 핵심 적용 분야

- 조달시장 대상 피크저감 ESS
- 데이터센터용 UPS 시스템
- 선박 및 충전기 연계형 ESS 솔루션

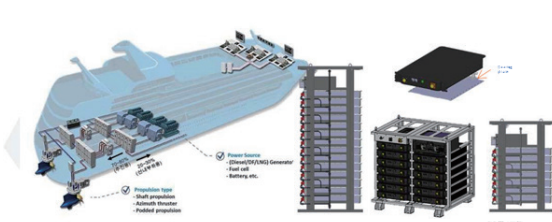
#### Commercial & Industrial ESS Battery



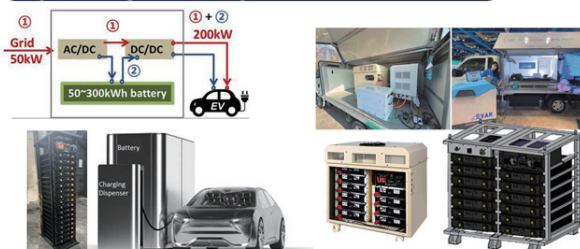
#### AI Data Center ESS/UPS Battery



#### E. Vessel ESS Battery

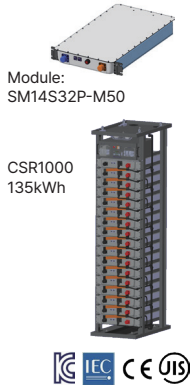




#### Hybrid Charger ESS Battery



# ESS Battery (21700-M50L) Rack Lineup

액침식(Power Cool) 구조로 NFPC607 소방청 화재인증과 KC인증을 받은 가장 안전한 배터리

Module	SM14S32P-M50			SM28S16P-M50
Rack	CSR1000	CSR800	CSR750	CLR800
Configuration (modules)	17S	14S	13S	7S
Rated Energy [kWh]	134.9	111.1	103.2	50.0
Rated Capacity [Ah]	153.6	153.6	153.6	69.8
Rated Voltage [V]	878.2	723.2	671.6	716.3
Voltage Range [V]	714~988	588~814	550~755	588~807
Load Max(Chg/Dchg) [KW] <i>*Over 1C rate high power*</i>	100 / 190	80 / 160	80 / 160	40 / 80
Dimension [WHD, mm] <i>*100mm 베이스 포함*</i>	530*850*2400	530*850*2050	530*850*2050	530*850*1300
Weight [kg]	1050	876	830	526
Image	 <p>Module: SM14S32P-M50 CSR1000 135kWh</p> <p>IEC CE U18</p>	 <p>Module: SM14S32P-M50 CSR800 111kWh CSR750 103kWh</p> <p>IEC CE U18</p>	 <p>Module: SM28S16P-M50 CLR800 50kWh</p> <p>IEC</p>	

- 주수 탱크 등 별도의 주수장치가 필요 없어 공간 및 비용 절약
- 칠러 및 순환 배관이 필요하지 않아 설치가 용이
- 설치 사례



▶ 청주 예술의 전당, 111kWh 2Racks



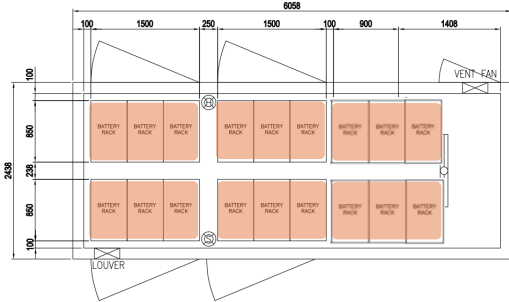
▶ 키르기스스탄, 111kWh 2Racks

## Industrial ESS

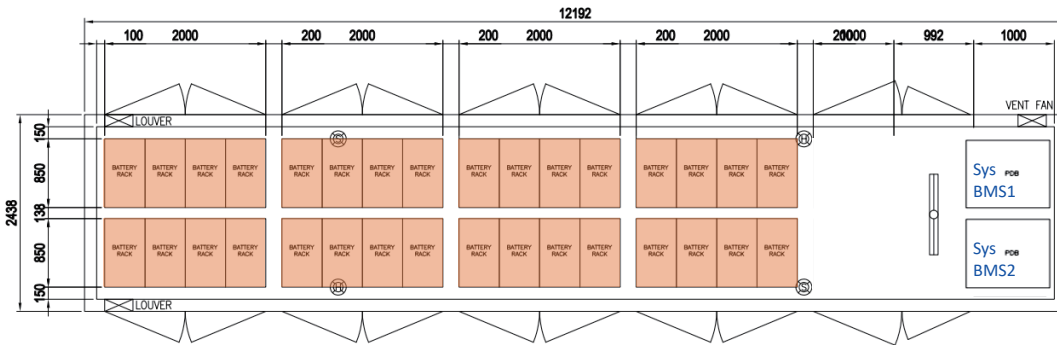
# Container Type ESS (PV, Peak-Cut, Ancillary)



**20ft container** 18Racks (2.43MWh), 714 ~ 988Vdc



**40ft container** 32Racks (4.32MWh), 714~988Vdc

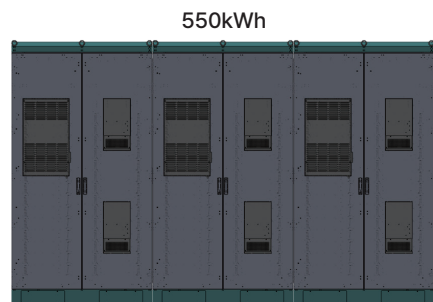
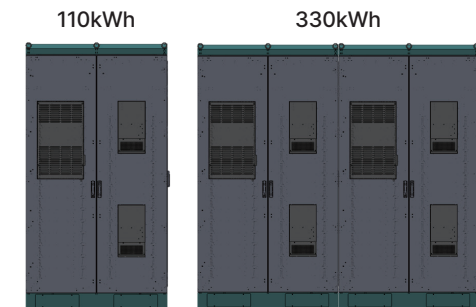


## Outdoor Type ESS

Outdoor 환경에 최적화된 고신뢰성 ESS 배터리 시스템

- 합체 사이즈 : W1360 x D1131(돌출부 제외) x H2607 mm
- 기본형 : CSR800(111kWh) 1Rack + 분전반
- 확장형 : CSR800(111kWh) 2Racks  
최대 2SET 확장 가능 (총 5Racks / 555kwh)

Module	SM14S32P-M50
Rack	CSR800
Configuration (modules)	14S
Rated Energy [kWh]	111.1
Rated Capacity [Ah]	153.6
Rated Voltage [V]	723.2
Voltage Range [V]	588~814
Load Max(Chg/Dchg) [KW] <i>*Over 1C rate high power*</i>	80 / 160



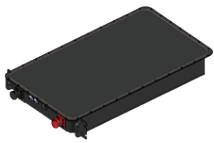
# Vessel ESS

## Module & Rack Specification

Module	SM14S32P-M50	Rack	CSR750	
			SM14S32P-M50	
Nominal Energy[kWh]	8.18	Configuration (module serial)	13S	
Rated Energy[kWh]	7.7	Nominal Energy[kWh]	106.4	
Nominal Capacity[Ah]	158.4	Rated Energy[kWh]	100	
Rated Capacity[Ah]	149	Rated Capacity[Ah]	149	
Rated Voltage[V]	51.66	Rated Voltage[V]	671.6	
Voltage Range[V]	37.8 ~ 58.59 (Dchg End Voltage ~ Chg End Voltage)	Voltage Range[V]	491.4~761.67 (Dchg End Voltage ~ Chg End Voltage)	
Standard Chg Current[A]	44.7	Standard Chg Current[A]	44.7	
Standard DChg Current[A]	74.5	Standard DChg Current[A]	74.5	
Max Chg Current[A]	130	Max Chg Current[A]	130	
Max Dchg Current[A]	212	Max DChg Current[A]	212	
Dimension[WDH, mm]	509.9 * 794.4 * 105.5	Operating temperature	23 ± 5 °C	
Weight[kg]	50	Humidity	The battery room average relative humidity does not exceed 40%.	
		Communication	IsoSPI, CAN2.0B, TCP/IP	
		Dimension[WDH, mm]	560 * 850 * 1900	
		Weight[kg]	800	

Module	SM14S32P-H51	Rack	CSR750	
			SM14S32P-H51	
Nominal Energy[kWh]	8.15	Configuration (module serial)	13S	
Rated Energy[kWh]	7.7	Nominal Energy[kWh]	106	
Nominal Capacity[Ah]	160	Rated Energy[kWh]	100	
Rated Capacity[Ah]	151	Rated Capacity[Ah]	151	
Rated Voltage[V]	50.96	Rated Voltage[V]	662.48	
Voltage Range[V]	37.8 ~ 58.59 (Dchg End Voltage ~ Chg End Voltage)	Voltage Range[V]	491.4~761.67 (Dchg End Voltage ~ Chg End Voltage)	
Standard Chg Current[A]	75	Standard Chg Current[A]	75	
Standard DChg Current[A]	200	Standard DChg Current[A]	200	
Max Chg Current[A]	225	Max Chg Current[A]	225	
Max Dchg Current[A]	450	Max DChg Current[A]	450	
Dimension[WDH, mm]	454.4 * 794.4 * 104 (±4)	Operating temperature	23 ± 5 °C	
Weight[kg]	52 (±2)	Humidity		
		Communication	Iso SPI, Ethernet	
		Dimension[WDH, mm]	560 * 850 * 1900	
		Weight[kg]	826(±20)	

### ▶ 모듈



### ▶ 1열 구조



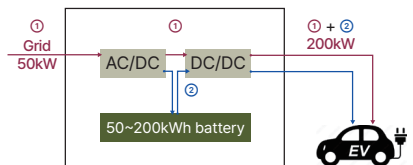
### ▶ 2열 구조



# EV Charger ESS

## EV Charger ESS Battery Rack

### STATIONARY BATTERY



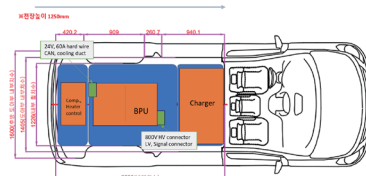
CSR750 (103.2kWh)



CLR800 (50kWh)



### CARRIABLE BATTERY



CSR750 (103.2kWh)



QLR400 (29.07kWh)

## UPS Battery

액침식(Power Cool)구조로 NFPC607 소방청 화재인증을 받은 가장 안전한 배터리

### ▶ 30분 이상 백업용 (중출력)

Module	SM14S32P-M50						
Rack	CSR700	CSR650	CSR600	CSR450	CSR400	CSR300	CSR250
Configuration(modules)	12S	11S	10S	8S	7S	5S	4S
Rated Energy [kWh]	95.2	87.2	79.3	63.4	55.5	39.7	31.7
Rated Capacity [Ah]	154	154	154	154	154	154	154
Rated Voltage [V]	618	566.5	515	412	360.5	257.5	206
Voltage Range [V]	504~688.8	462~631.4	420~574	336~459.2	294~401.8	210~287	168~229.6
Load Max(Chg/Dchg) [KW]	80 / 160	80 / 160	80 / 160	80 / 160	80 / 160	80 / 160	80 / 160
Dimension [WHD(TBD), mm]	530*1900*850 (베이스포함,100mm)			530*1450*850 (베이스포함,100mm)			
Weight [kg(TBD)]	780	730	680	580	530	430	380

**Notes**



**LG Energy Solution**  
INR21700-M50L



**SM14S32P-M50**  
7.93kWh  
(51.5Vdc / 154Ah)



14S32P-M50L Power Cool module C-rate test  
(0.5C/1.0C/1.5C/2.0C-rate, 3.1-4.15Vdc/cell)



### ▶ 10~20분 백업용 (고출력)

Module	SM14S32P-40T					
Rack	USR650	USR600	USR450	USR400	USR300	USR250
Configuration(modules)	11S	10S	8S	7S	5S	4S
Nominal Energy [kWh]	71	64.5	51.6	45.2	32.3	25.8
Nominal Capacity [Ah]	128	128	128	128	128	128
Nominal Voltage [V]	554	504	403	353	252	202
Voltage Range [V]	431~631.4	392~574	314~459.2	294~401.8	196~287	157~229.6
Load Max(Chg/Dchg) [KW]	80 / 300	80 / 250	80 / 200	80 / 160	80 / 130	80 / 100
Dimension [WHD(TBD), mm]	530*1900*850 (베이스포함,100mm)			530*1450*850 (베이스포함,100mm)		
Weight [kg(TBD)]	730	680	580	530	430	380

**Notes**



**SAINPOWER**  
INR21700-40T



**SM14S32P-40T**  
Nom. 6.45kWh  
(50.4Vdc / 128Ah)

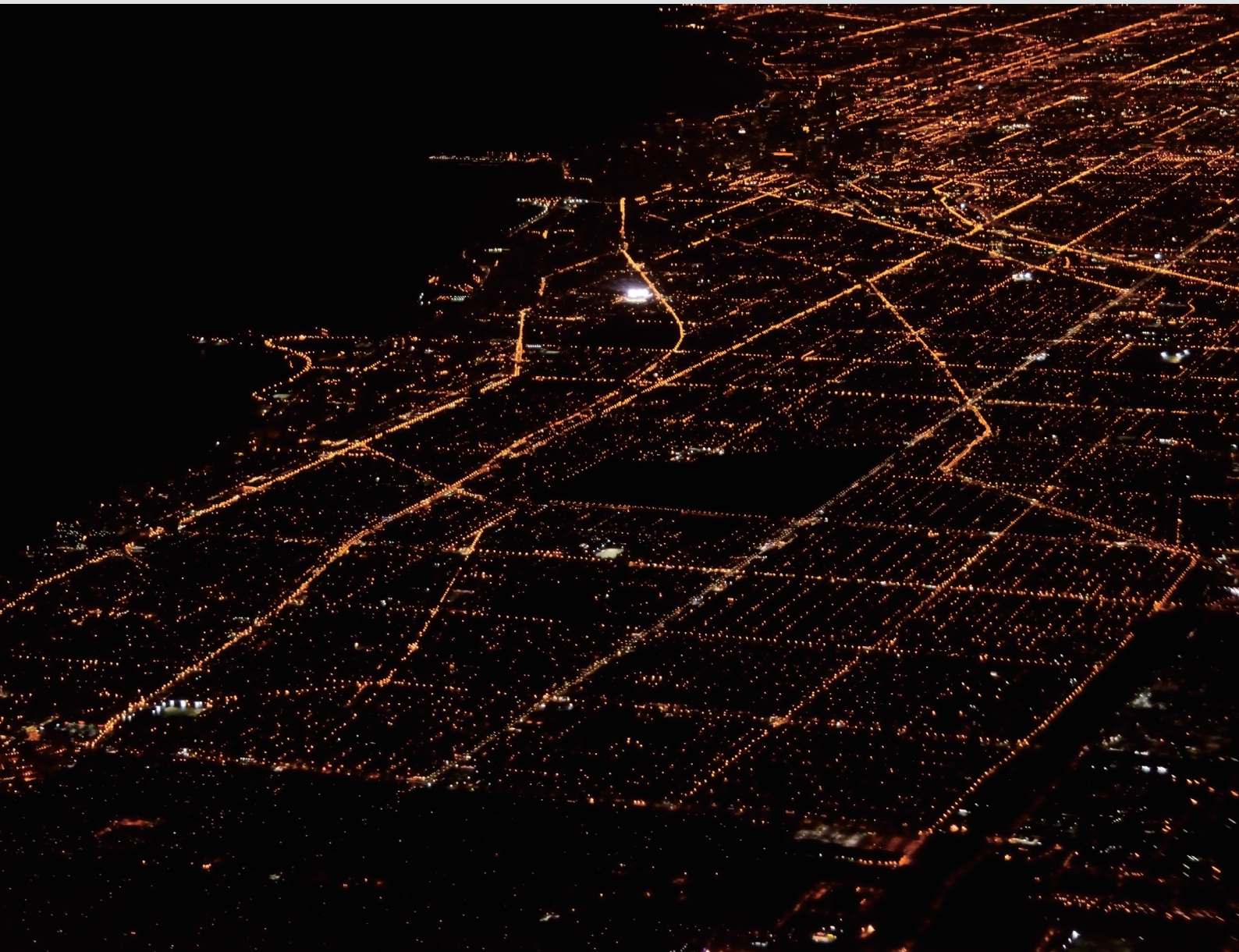


SM14S32P-40S module performance test



# Standalone Type ESS

- BTS Battery
- 가로등 ESS



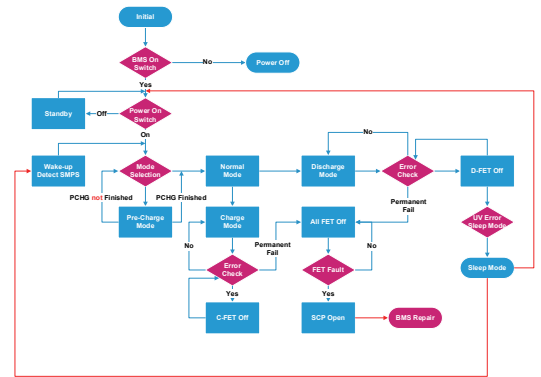


**BTS Battery**

**21700 M50 - 51Vdc series BTS Battery**

Models	SM14S/11P-M50	SM14S/16P-M50	SM14S/18P-M50
Total Energy[kWh]	2.80	4.08	4.59
Rated Energy[kWh]	2.59	3.77	4.24
Rated Capacity[Ah]	50.6	73.6	82.8
Rated Voltage[V]	51.5	51.5	51.5
Voltage Range[V]	42.0~58.1	42.0~58.1	42.0~58.1
Usable Voltage	44~57.4Vdc	44~57.4Vdc	44~57.4Vdc
Max. Chg Current	20A	30A	30A
Max. Dchg Current	40A	60A	60A
Dimension[WDH]	380*450*90	380*450*90	425*450*90
Weight[kg]	About 16	About 23	About 26
Protocol	CAN2.0A	CAN2.0A	CAN2.0A
Expandability	1 to 8trays	1 to 8trays	1 to 8trays

IEC60730,  
functional safety certified  
(이중화 보호)



**Flexible Capacity configuration.**



**All-in-One Type (5kW PCS included)**



PV 5kW (DC120~430V)  
AC IN/Out 5kW (220/240V)



4.6kWh \* 3~4modules (DC51V)



PCS efficiency: 95%  
WHD = 700\*1312\*298mm

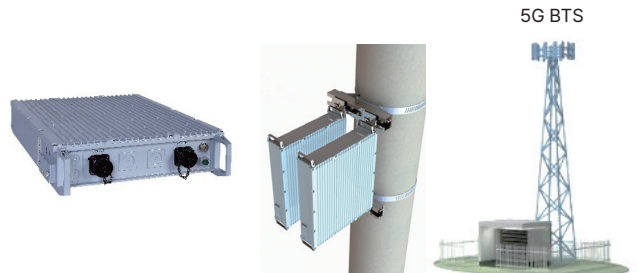
**Rack Mount Type BTS Battery**

2.8 / 4.59kWh for 1000~1800VA

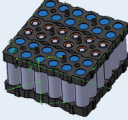

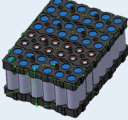
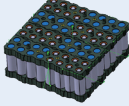



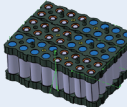

**Enclosure Type BTS Battery**

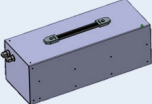


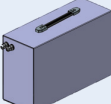
4.08kWh for 1200~1800VA



## 가로등 ESS

Configuration	3S12P	4S8P	4S12P	4S16P
Design				
Energy (kWh)	0.66	0.58	0.87	1.17
Capacity(Ah)	59.4	39.6	59.4	79.2
Nom. Voltage (Vdc)	11.0		14.7	
Voltage range (Vdc)	9.0 - 12.5	12.0 - 16.6	12.0 - 16.6	12.0 - 16.6
I <sub>max</sub> (A <sub>dc</sub> )	20A	20A	20A	20A
Protection	PCM	PCM	PCM	PCM
Dimension	150*150*90	200*100*90	150*200*90	200*200*90

Configuration	6S6P	6S8P	6S12P
Design			
Energy (kWh)	0.66	0.87	1.31
Capacity(Ah)	29.7	39.6	59.4
Nom. Voltage (Vdc)		22.1	
Voltage range (Vdc)	18.0 - 24.9	18.0 - 24.9	18.0 - 24.9
I <sub>max</sub> (A <sub>dc</sub> )	20A	20A	20A
Protection	PCM	PCM	PCM
Dimension	150*150*90	230*150*90	150*330*90

Configuration	7S10P	7S14P	7S16P	7S20P
Design				
Energy (kWh)	1.28	1.79	2.04	2.55
Capacity(Ah)	49.5	69.3	79.2	99
Nom. Voltage (Vdc)		25.8		
Voltage range (Vdc)	19.6 - 29.1	21.0 - 29.1	21.0 - 29.1	19.6 - 29.1
I <sub>max</sub> (A <sub>dc</sub> )	20A	20A	20A	40A
Protection	PCM	PCM	PCM	PCM
Dimension(WDH)	150*400*141	196*370*88	200*220*220	150*400*230

# EV, E-mobility Standard Module Lineup



## EV Battery Pack

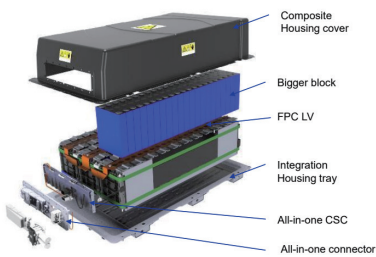
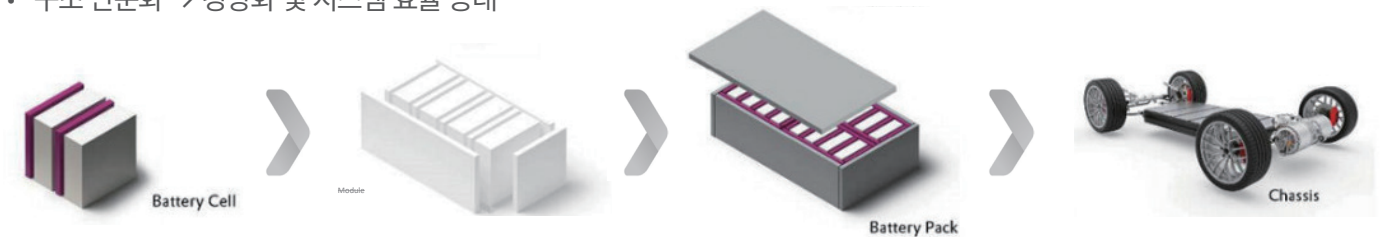
# EV Applications - 4680 / 4695 Series

주행거리 증가를 위해 고에너지 밀도 요구, 팩기술은 Module → Cell to Pack → Cell to Chassi 로 진화 중

### ▶ 셀투팩(cell-to-Pack, CTP): 모듈을 없애고 효율을 높인다

모듈 구조를 생략하고 배터리 셀을 직접 팩에 조립하여 공간 효율과 에너지 밀도를 극대화한 혁신 설계

- 동일 공간 대비 주행거리 향상
- 공정 간소화 → 생산성 향상 및 비용 절감
- 구조 단순화 → 경량화 및 시스템 효율 증대



### Cold plate Type

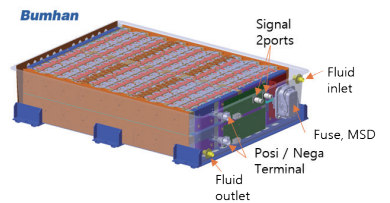
30kWh

Higher integration efficiency  
85%~90%

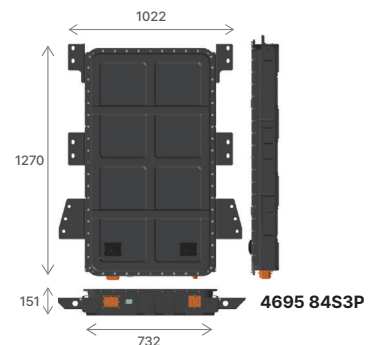
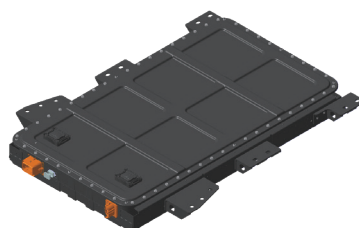
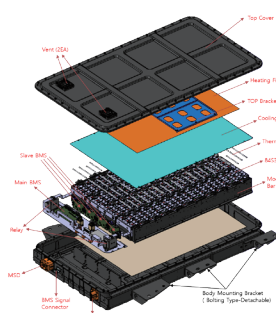
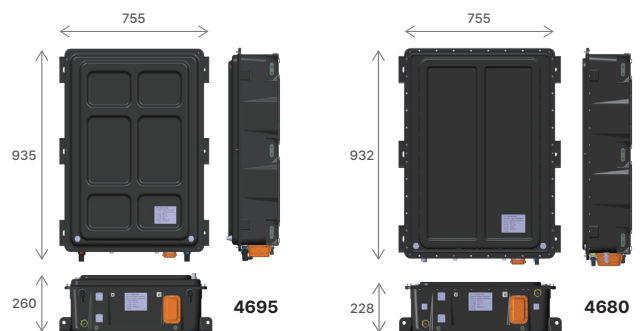
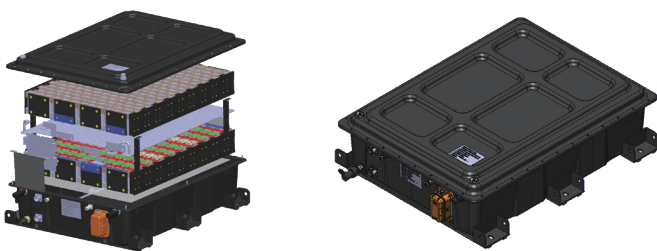
### Most Advanced Technology! Immersion Type

41kWh (4680)  
51kWh (4695)

EXO efficiency  
137~170%


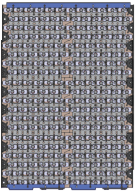
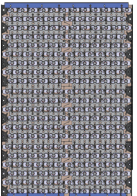

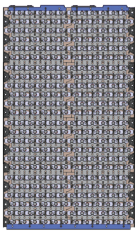


### ▶ 셀투팩(CTP) Structure


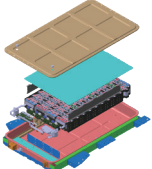


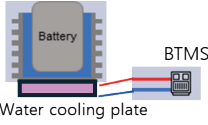
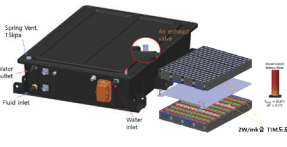
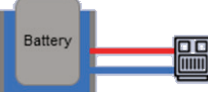
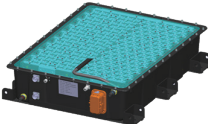


▶ Pack Lineup

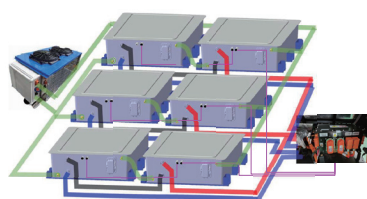
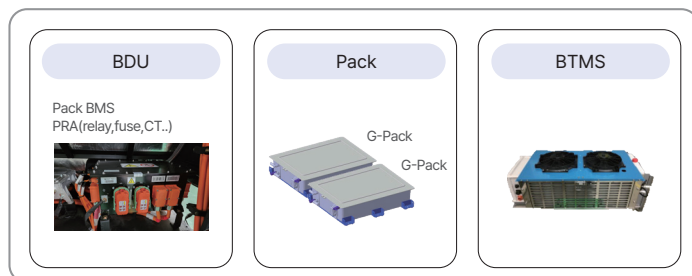
표준팩 기반으로 용도에 맞는 다양한 구성과 맞춤 제작 가능

System Configuration		144S (2packs serial)	160S (2packs serial)	168S (2packs serial)	176S (2packs serial)	96S (1pack)
Pack Configuration		36S6P*2모듈	40S6P*2모듈	42S6P*2모듈	44S6P*2모듈	48S6P*2모듈
Voltage (Vdc)		264.2	293.6	308.3	323.0	352.3
Nominal Energy (kWh)	4695 Cell	51.5	55.7	60.0	62.9	68.6
	4680 Cell	41.3	45.8	48.2	50.2	55.1
Applications		버스	국방	버스	버스/화물	General EV
Size(W*D, mm)		622*798 	622*902 	622*944 	622*986 	622*1070 

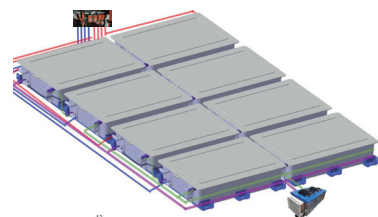
▶ 4kinds cooling performance comparison

<p><b>Air passive</b></p>  <p>About Δ6°C/10min @1C</p> 	<p><b>Immersion only</b></p>  <p>About Δ3.5°C/10min @1C</p> 	<p><b>Immersion/TIM hybrid</b></p>  <p>About Δ1.5°C/10min @1C</p> 	<p><b>Immersion fluid circulation</b></p>  <p>Zero 0°C/10min @1C</p> 
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▶ EV Installation



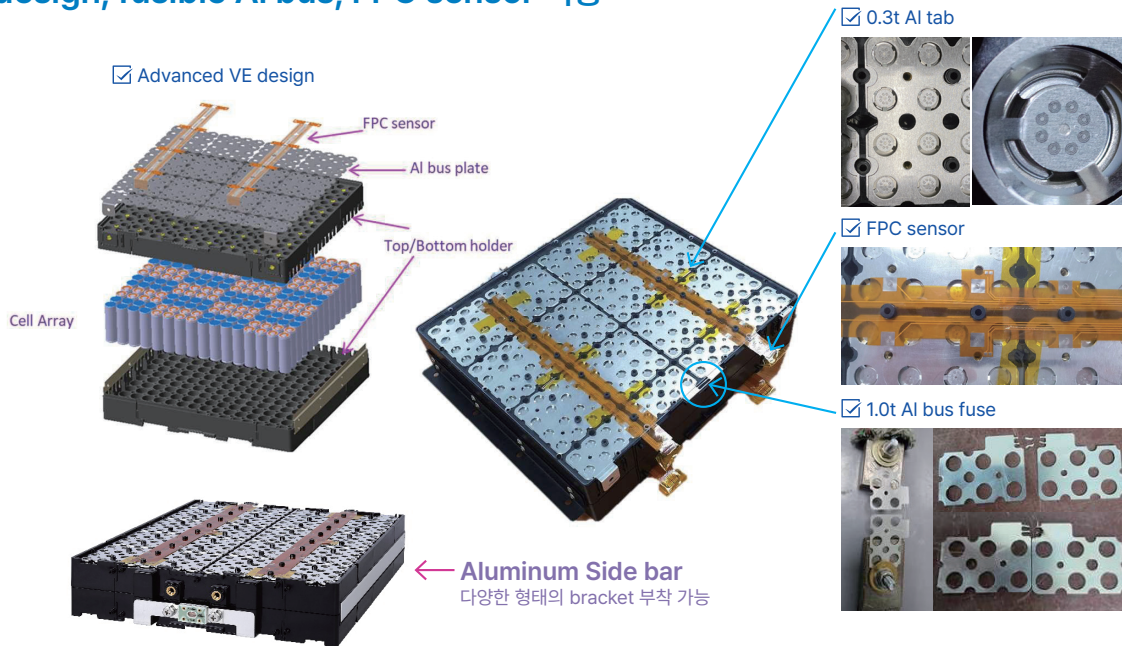
3Systems Parallel (6Pack) 구성 예시



4Systems Parallel (8Pack) 구성 예시

# EV Applications – 21700 Series

## ▶ VE design, fusible AI bus, FPC sensor 적용



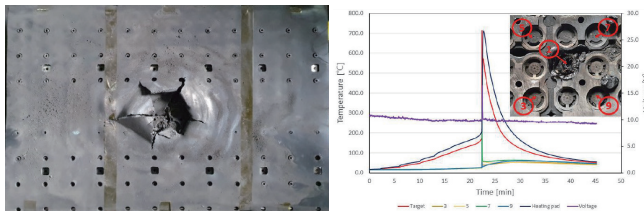
## ▶ Cylindrical water cooling module (for EV, Vessel)

### 수냉 모듈 Configuration

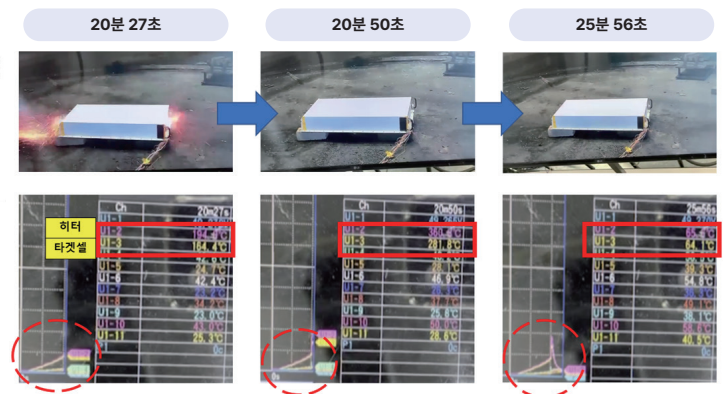
Config.	12S32P	14S32P
Energy	6.99kWh (Usable 6.51kWh)	7.93 kWh
Capacity	158.4Ah (usable 148.9Ah)	154Ah
Voltage range:	33.6 ~ 49.8Vdc	42~58.1Vdc
크기(W*D*H)	440*580(623_cooling)*90	410*750*94
중량(kg)	37(TBD)	49(TBD)



### ☑ 1차, 열폭주 시험(KTC-211223)



### ☑ 2차, 열폭주 시험(KERI-220223)



## ▶ Module & Pack Lineup

Module	SV24S8P-M50	SV12S16P-M50	SV12S24P-M50	SV12S32P-M50	SV12S36P-M50	SV20S16P-M50	SV10S32P-M50	SV7S64P-M50
Energy[kWh]	3.49	3.49	5.24	6.99	7.86	5.82	5.82	8.15
usable energy	3.25	3.25	4.87	6.5	7.31	5.42	5.42	7.58
Capacity[Ah]	39.6	79.2	118.8	158.4	178.2	79.2	158.4	316.8
Usable capacity	37.2	74.4	111.7	148.9	167.5	74.4	148.9	297.8
Nominal Voltage[V]	88.32	44.16	44.16	44.16	44.16	73.6	36.8	25.76
Voltage Range[V]	72~99.6	36~49.8	36~49.8	36~49.8	36~49.8	60~83	30~41.5	21~29.1
Design								
Dimension[WDH]	368*305*88		400*460*90	368*578*88	440*595*90	368*487*88		368*668*88
Weight[kg]	20		29	38	42	32		43

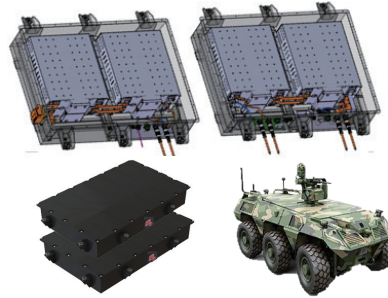
  

Pack Energy(kWh)	14.0 kWh	21.0 kWh	41.9 kWh	55.9 kWh	62.9 kWh	11.6 kWh	23.3 kWh	16.3 kWh
Configuration	4 modules	6 modules	8 modules	8 modules	8 modules	2 modules	4 modules	2 modules
Pack Voltage[Vdc]	353.3	353.3	353.3	353.3	353.3	147.2	147.2	51.5

### Truck Battery



### Military Robot Battery



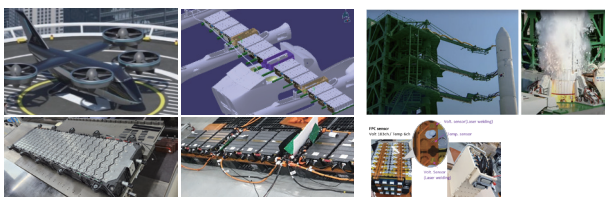
### EV emergency charging battery



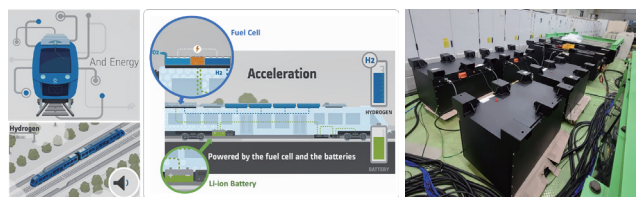
### Battery modules for Electric Vessel



### 항공기 및 발사체 Battery



### 수소하이브리드 철도배터리



Module	SP20S16P-M50	SP20S18P-M50	SP10S24P-M50	SP10S32P-M50	SP10S36P-M50	SP7S64P-M50
Energy[kWh]	5.82	6.55	4.37	6.01	6.55	8.15
usable energy	5.42	6.09	4.06	5.59	6.09	7.58
Capacity[Ah]	79.2	89.1	118.8	158.4	178.2	316.8
Usable capacity	74.4	83.8	111.7	148.9	167.5	297.8
Nominal Voltage[V]	88.32	88.32	36.8	36.8	36.8	25.76
Voltage Range[V]	60~83	60~83	30~41.5	30~41.5	30~41.5	21~29.1
Dimension[WDH]	400*504*90	440*504*90	440*413*90	440*504*90	440*504*90	400*690*90
Weight[kg]	31.8	35.4	24.6	31.8	35.4	43.3

Pack Energy(kWh)	11.6	26.2	17.5	12.0	13.1	16.3
Configuration	2 modules	4 modules	4 modules	2 modules	2 modules	2 modules
Pack Voltage(Vdc)	176.6	353.3	147.2	73.6	73.6	51.5

Module  
SP20S16P



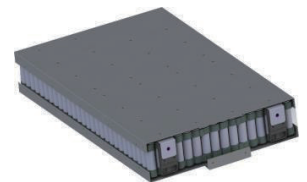
Module  
SP20S18P



Module  
SP10S32P



Module  
SP7S64P



**PACK 11** ~13 kWh (145.2 Vdc)

2modules  
connected  
in series



**급속 PACK 26** kWh (290 Vdc)

4modules  
connected  
in series



**PACK** 12 kWh (73.6 Vdc)

2modules  
connected  
in series



**PACK** 16.3 kWh (51.5 Vdc)

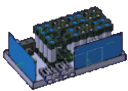
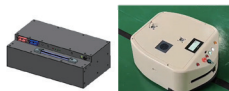
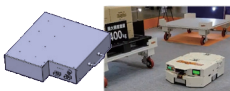



2modules  
connected  
in series



## EM Battery Pack

# E-mobility Applications - AGV, CART, Industrial

### 21700-M50L-25Vdc series

Models	SP7S/4P-M50	SP7S/6P-M50	SP7S/8P-M50	SP7S/12P-M50	SP7S/16P-M50	SP7S/24P-M50	SP7S/32P-M50	SP7S/36P-M50	SP7S/64P-M50
Nom. Energy[kWh]	0.51	0.76	1.02	1.53	2.04	3.06	4.08	4.59	8.15
Capacity[Ah]	19.8	29.7	39.6	59.4	79.2	118.8	158.4	178.2	316.8
Nominal Voltage[V]	25.8	25.8	25.8	25.8	25.8	25.8	25.8	25.8	25.8
Voltage Range[V]	21.0~29.0	21.0~29.0	21.0~29.0	21.0~29.0	21.0~29.0	21.0~29.0	21.0~29.0	21.0~29.0	21.0~29.0
Usable Voltage	22~28.7Vdc	22~28.7Vdc	22~28.7Vdc	22~28.7Vdc	22~28.7Vdc	22~28.7Vdc	22~28.7Vdc	22~28.7Vdc	22~28.7Vdc
Max. Chg Current	10A	15A	20A	20A	35A	60A	60A	60A	100A
Max. Dchg Current	20A	50A	50A	50A	100A	150A	150A	200A	300A
Dimension[WDH]	155*325*90	230*580*90	230*480*90	300*385*90	370*385*90	638*148*84	380*470*175	638*201*84	183*470*470
Weight[kg]	About 6	About 7	About 8	About 11	About 13	About 19	About 24	About 24	About 45
Protocol	CAN2.0A	CAN2.0A	CAN2.0A	CAN2.0A	CAN2.0A	CAN2.0A	CAN2.0A	CAN2.0A	CAN2.0A
Product	0.51kWh 	0.76kWh / 1.02kWh 	1.53kWh / 2.04kWh 	3.06kWh 	4.08kWh / 4.59kWh 	8.15kWh 			

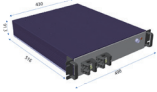
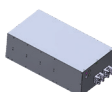
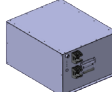

### 21700-M50L-48Vdc series

Models	SP13S/6P-M50	SP13S/12P-M50	SP13S/32P-M50
Nominal Energy[kWh]	1.42	2.84	7.57
Capacity[Ah]	29.7	59.4	158.4
Nominal Voltage[V]	47.8	47.8	47.8
Voltage Range[V]	39.0~53.6	39.0~53.6	39.0~53.6
Usable Voltage	41~53.3Vdc	41~53.3Vdc	41~53.3Vdc
Max. Chg Current	15A	30A	60A
Max. Dchg Current	50A	70A	150A
Dimension[WDH]	150*350*200	380*470*264	380*470*264
Weight[kg]	about 10	about 17	about 42
Protocol	CAN2.0A	CAN2.0A	CAN2.0A
Product	7~9 kWh (48Vdc) 	6~9 kWh for golf cart 	

### 21700-M50L-36Vdc series

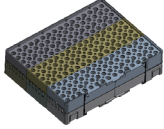
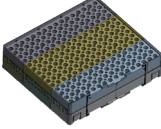
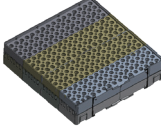
Models	W10S/8P-M50	W10S/24P-M50
Nominal Energy[kWh]	1.46	4.37
Capacity[Ah]	39.6	118.8
Nominal Voltage[V]	36.8	36.8
Voltage Range[V]	30.0~41.5	30.0~41.5
Usable Voltage	30~41Vdc	30~41Vdc
Max. Chg Current	20A	60A
Max. Dchg Current	70A	200A
Dimension[WDH]	180*235*84	683*192*84
Weight[kg]	about 7	about 22
Protocol	CAN2.0A	CAN2.0A
Product	2.9kWh for scooter (36Vdc*2S) 	

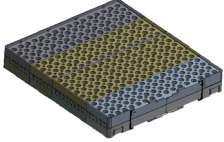
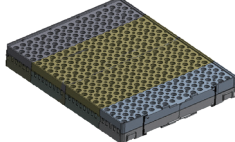
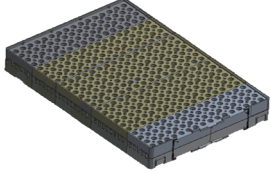
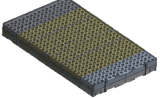
### 21700 M50L - 51Vdc series

Models	SP14S/18P-M50	SP14S/24P-M50	SP14S/32P-M50	SP14S/36P-M50	SP14S/64P-M50
Nominal Energy[kWh]	4.59	6.12	8.15	9.17	16.31
Capacity[Ah]	89.1	118.8	158.4	178.2	316.8
Nominal Voltage[V]	51.5	51.5	51.5	51.5	51.5
Voltage Range[V]	42.0~58.1	42.0~58.1	42.0~58.1	42.0~58.1	42.0~58.1
Usable Voltage	44~57.4Vdc	44~57.4Vdc	44~57.4Vdc	44~57.4Vdc	44~57.4Vdc
Max. Chg Current	40A	60A	60A	70A	120A
Max. Dchg Current	150A	150A	150A	180A	300A
Dimension[WDH]	430*516*90	300*516*264	380*470*264	TBD	425*800*264
Weight[kg]	about 26	about 40	about 45	about 50	about 90
Protocol	CAN2.0A	CAN2.0A	CAN2.0A	CAN2.0A	CAN2.0A
Product	4.59 kWh 	6.12 kWh 	8.15 / 9.17 kWh 	16.3 kWh 	

## Standard Module

# M50 Standard Module Lineup

Module	87.8Vdc	58.6Vdc	43.9Vdc	102.5Vdc	51.2Vdc	25.6Vdc	58.6Vdc	29.3Vdc
	SM24S8P-M50	SM16S12P-M50	SM12S16P-M50	SM28S8P-M50	SM14S16P-M50	SM7S32P-M50	SM16S16P-M50	SM8S32P-M50
Nominal / Rated Energy	3.49 / 3.23kWh			4.08 / 3.77kWh			4.66 / 4.31kWh	
Nominal / Rated Capacity	39.6 / 36.8Ah	59.4 / 55.2Ah	79.2 / 73.6Ah	39.6 / 36.8Ah	79.2 / 73.6Ah	158.4 / 147.2Ah	79.2 / 73.6Ah	158.4 / 147.2Ah
Rated Voltage[V]	87.8	58.6	43.9	102.5	51.2	25.6	58.6	29.3
Voltage Range[V]	72.0~99.6	48.0~66.4	36.0~49.8	84.0~116.2	42.0~58.1	21.0~29.1	48.0~66.4	24.0~33.2
Usable Voltage Range[V] (SOC 85% operation)	75.6~98.4	50.4~65.6	37.8~49.2	88.2~114.8	44.1~57.4	22.0~28.7	50.4~65.6	25.2~32.8
Design								
Dimension [WDH, mm]	368*305*88			368*350*88			368*396*88	
Weight[kg]	19			22			25	
Protocol	ISO-SPI			ISO-SPI			ISO-SPI	

Module	65.9Vdc	43.9Vdc	73.2Vdc	36.6Vdc	58.6Vdc	43.9Vdc	51.2Vdc
	SM18S16P-M50	SM12S24P-M50 / 24S12P	SM20S16P-M50	SM10S32P-M50	SM16S24P-M50	SM12S32P-M50	SM14S32P-M50
Nominal / Rated Energy	5.24 / 4.85kWh		5.82 / 5.39kWh		6.99 / 6.46kWh		8.15 / 7.54kWh
Nominal / Rated Capacity	79.2 / 73.6Ah	118.8 / 110.4Ah	79.2 / 73.6Ah	158.4 / 147.2Ah	118.8 / 110.4Ah	158.4 / 147.2Ah	158.4 / 147.2Ah
Rated Voltage[V]	65.9	43.9	73.2	36.6	58.6	43.9	51.2
Voltage Range[V]	54.0~74.7	36.0~49.8	60.0~83.0	30.0~41.5	48.0~66.4	36.0~49.8	42.0~58.1
Usable Voltage Range[V] (SOC 85% operation)	56.7~73.8	37.8~49.2	33.0~82.0	31.5~41.0	50.4~65.6	37.8~49.2	44.7~57.4
Design							
Dimension [WHD, mm]	368*442*88		368*487*88		368*578*88		368*668*88
Weight[kg]	28		32		38		43
Protocol	ISO-SPI		ISO-SPI		ISO-SPI		ISO-SPI



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