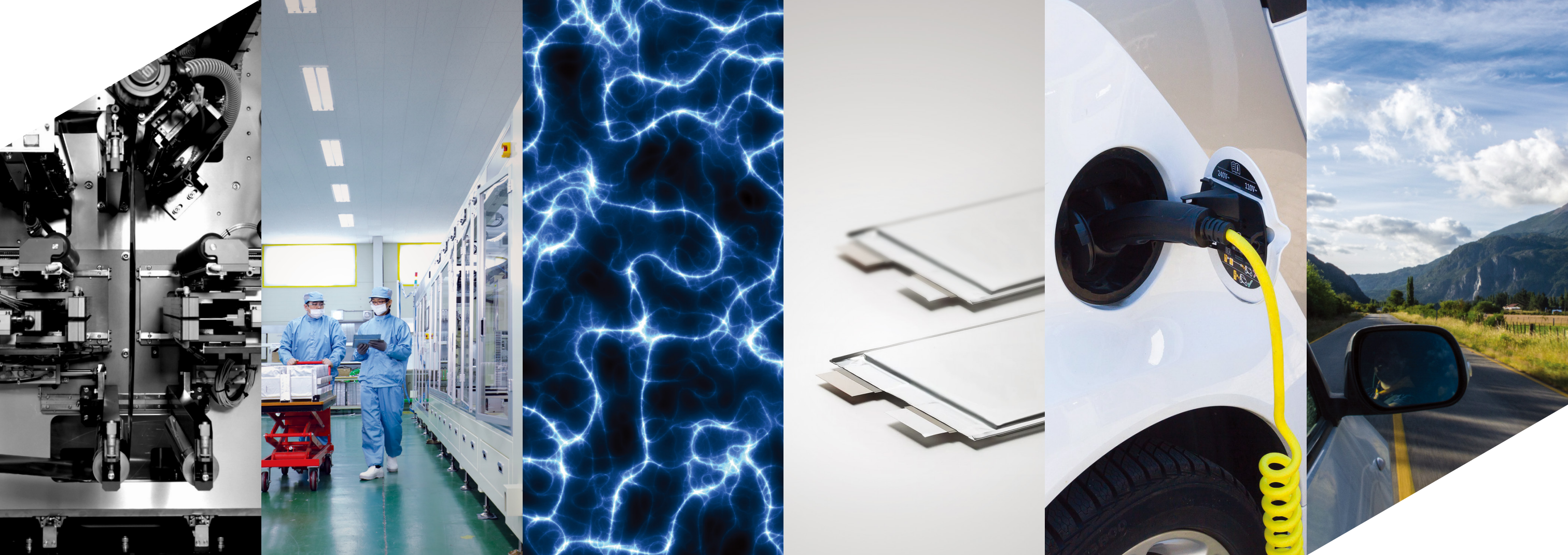


TOTAL SOLUTION  
PROVIDER FOR  
ASSEMBLY  
PROCESS OF  
LITHIUM-ION  
RECHARGEABLE  
BATTERY





# mPLUS HISTORY

Continues to grow with creative innovation and challenging spirit.

## Establishment 2003~2009

Entered secondary battery equipment market

- |             |                                                                                                                                                                                                                                                                                                                                                                                                                |
|-------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>2003</b> | <ul style="list-style-type: none"> <li>Established mPLUS CORP. in 2003</li> </ul>                                                                                                                                                                                                                                                                                                                              |
| <b>2005</b> | <ul style="list-style-type: none"> <li>Developed ultrasonic Sc_Softwareibe System for FPD.</li> <li>Acquired ISO9001 certification</li> </ul>                                                                                                                                                                                                                                                                  |
| <b>2008</b> | <ul style="list-style-type: none"> <li>Obtain an Order A123 System Korea/China (Electrolyte injector, Assembly Line etc.)</li> <li>Obtain an Order of Neotis Co., Ltd. Drill Step Grinding M/C</li> </ul>                                                                                                                                                                                                      |
| <b>2009</b> | <ul style="list-style-type: none"> <li>Established R&amp;D center</li> <li>Selected as export promising small and medium enterprise (Chungbuk province business administration)</li> <li>Certified Inno-biz</li> <li>Certified venture company</li> <li>Awarded \$1 million export</li> <li>Obtain an Order of A123 System USA Assembly Line</li> <li>Obtain an Order of SK innovation Notching M/C</li> </ul> |

## Growth period 2010~2013

Established R&D capability client network

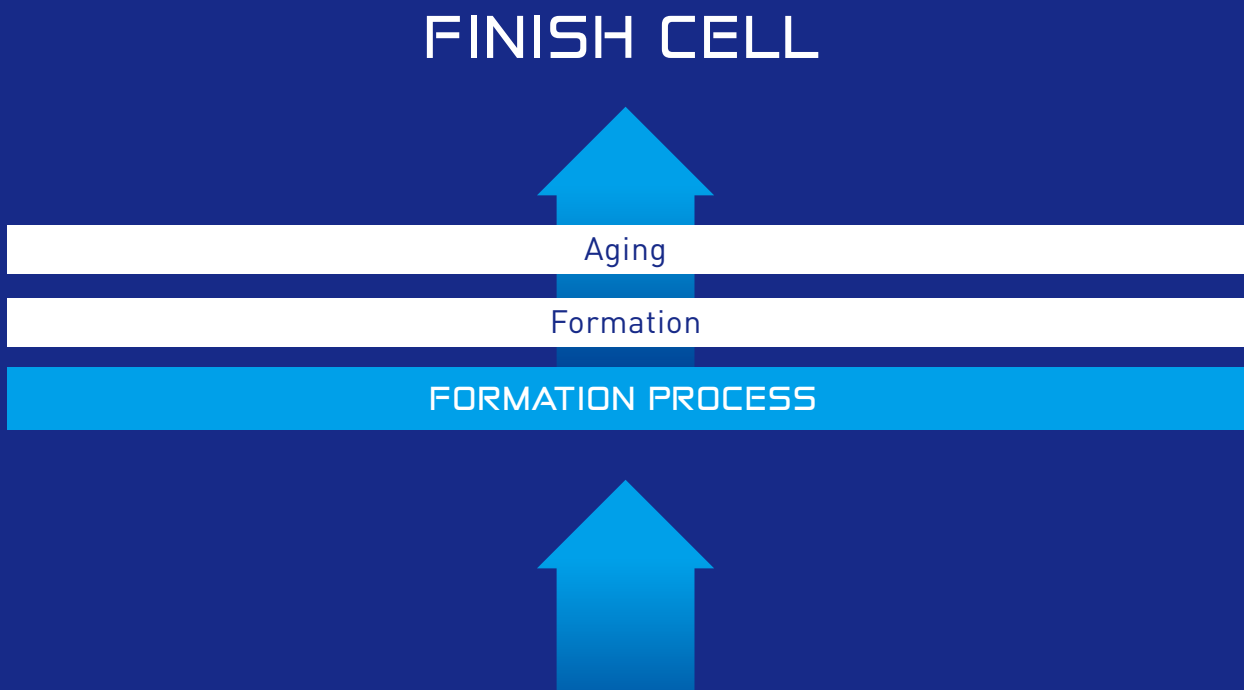
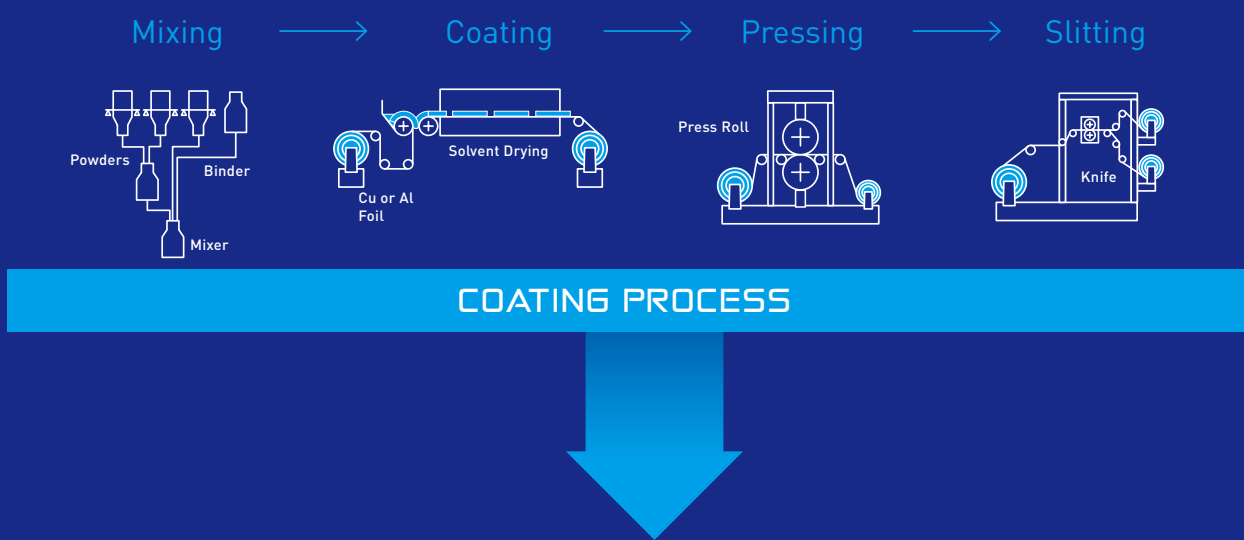
- |             |                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|-------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>2010</b> | <ul style="list-style-type: none"> <li>Obtain an Order of 2010 Wanxiang Ev Notching M/C</li> <li>Obtain an Order of SK innovation Degassing M/C</li> <li>Awarded Knowledge Economy Minister Award in Korea venture business</li> <li>Awarded grand prize at Chungbuk province small and medium business technology conference</li> <li>Awarded Presidential prize on the 47th Trade day</li> <li>Awarded \$10 million tower</li> </ul> |
| <b>2011</b> | <ul style="list-style-type: none"> <li>Relocation of office (Oksan-myeon, Cheongju)</li> <li>Obtain an Order of SK innovation Notching and Packaging M/C</li> </ul>                                                                                                                                                                                                                                                                    |
| <b>2012</b> | <ul style="list-style-type: none"> <li>Obtain an Order of Hyundai motor Pilot Line</li> <li>Selected as the best partner of SK innovation</li> <li>Developed High Speed Notching System</li> <li>Developed Fuel cell assembly equipment</li> </ul>                                                                                                                                                                                     |
| <b>2013</b> | <ul style="list-style-type: none"> <li>Obtain an Order of SK innovation Wetting, Stacking M/C</li> <li>Developed micromini Stack System</li> <li>Developed Pouch Type high speed assembly equipment</li> </ul>                                                                                                                                                                                                                         |

## Take-off stage 2014~present

Started full response to electric car market

- |             |                                                                                                                                                                                                                                                                                                                 |
|-------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>2014</b> | <ul style="list-style-type: none"> <li>Obtain an Order of Assembly Line Michigan university, USA</li> <li>Obtain an Order of Tianjin EV Notching M/C</li> </ul>                                                                                                                                                 |
| <b>2015</b> | <ul style="list-style-type: none"> <li>Obtain an Order of Wanxiang A123 Notching M/C</li> <li>Obtain an Order of SK innovation Notch and Stack M/C</li> <li>Obtain an Order of Tianjin EV Notching M/C</li> </ul>                                                                                               |
| <b>2016</b> | <ul style="list-style-type: none"> <li>Obtain an Order of Wanxiang A123 Degassing M/C</li> <li>Obtain an Order of cell tower Assembly Line</li> <li>Obtain an Order of Tianneng Energy Assembly Line</li> <li>Obtain an Order of Longpower System Assembly Line</li> </ul>                                      |
| <b>2017</b> | <ul style="list-style-type: none"> <li>Obtain an Order of EVE Energy Assembly Line</li> <li>Obtain an Order of MGL(China) Notching</li> <li>Obtain an Order of SK Innovation Seosan line (Packaging, etc)</li> <li>Obtain an Order of Wanxiang A123 Notching and Degassing</li> <li>Listed on KOSDAQ</li> </ul> |

# BATTERY MANUFACTURING PROCESS



ASSEMBLY PROCESS

**mPLUS Product line**

1 Notching system

Input | Output

2 Stacking system

Input | Output

3 Tab Welding system

Input | Output

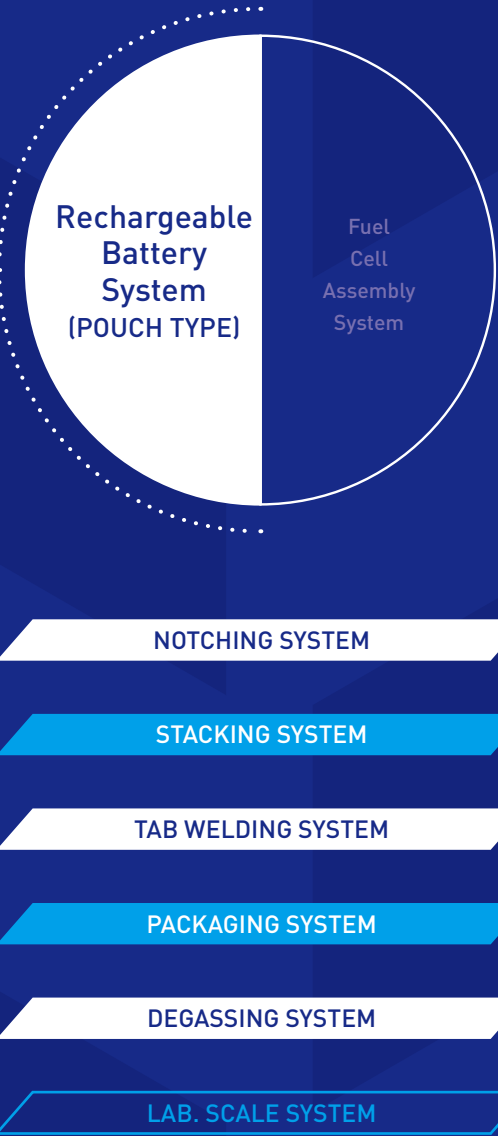
4 Packaging system

Input | Output

5 Degassing system

Input | Output

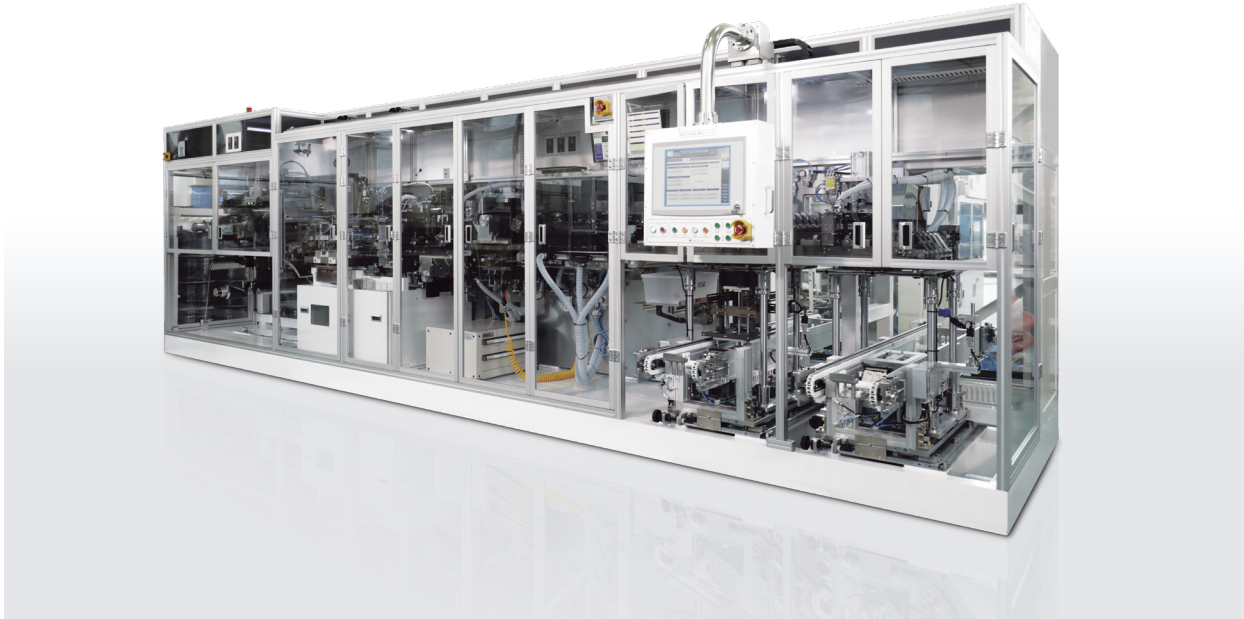
# PRODUCTION EQUIPMENT



Secondary Battery is a device that can be charged and used repeatedly after storing electricity, and because of their environmentally friendly and economic benefits, they are widely used in household appliances, transportation power grids, etc. In addition, due to the weight reduction, high voltage, and high-density trend, the lithium ion battery market is expanding which has superior performance to existing nickel metal hydride battery.

# NOTCHING SYSTEM

Cutting notched electrode into a pitch-controlled sheet, then loading it into a magazine

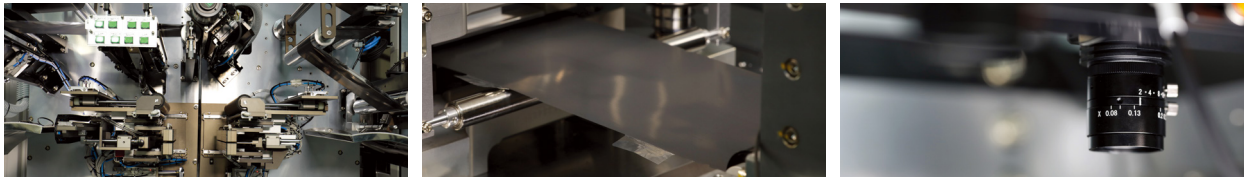


## SPECIFICATIONS

Model	MPNT-240P
Machine speed	Max 240PPM [as of 2017]
Roll size	Max. Dia. 600mm
Notching type	Notching mold type
Cutting Type	Knife cutting type
Electrode tension control	Max. 10kgf (Auto control)
Inspection	Vision System
Electrode Cleaning	Brush Suction
Electrode Stacking	Auto stacking (Magazine auto change)
Power	380V, 3P, 40Kw
Dimension	6.5m(L) x 1,4m(W) x 2.2m(H)

## KEY FEATURES

- High-speed notching stability improvement
- Model change flexibility & promptness
- Notching & cutting scrap handling improvement



# STACKING SYSTEM

Stacking electrodes(anode/cathode) and separator

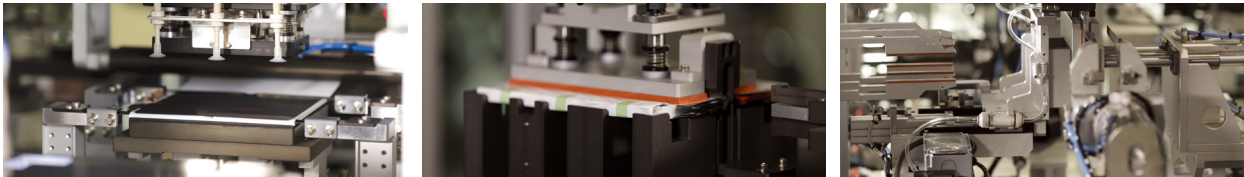


## SPECIFICATIONS

Model	MPST-075P
Machine speed	Max 0.75 sec/sheet [as of 2017]
Separator Roll size	Max. Dia. 300mm
Stack type	"Z" Folding stack type
Separator cutting Type	Knife cutting type
Electrode Supply	Magazine type (V/D Magazine)
Electrode align type	Vision System
Separator termination	Bonding type (TBD-Taping type)
Jelly roll winding pattern	Max 2 rotation
Power	380V, 3P, 45Kw
Dimension	4.5m(L) x 4,0m(W) x 2.2m(H)

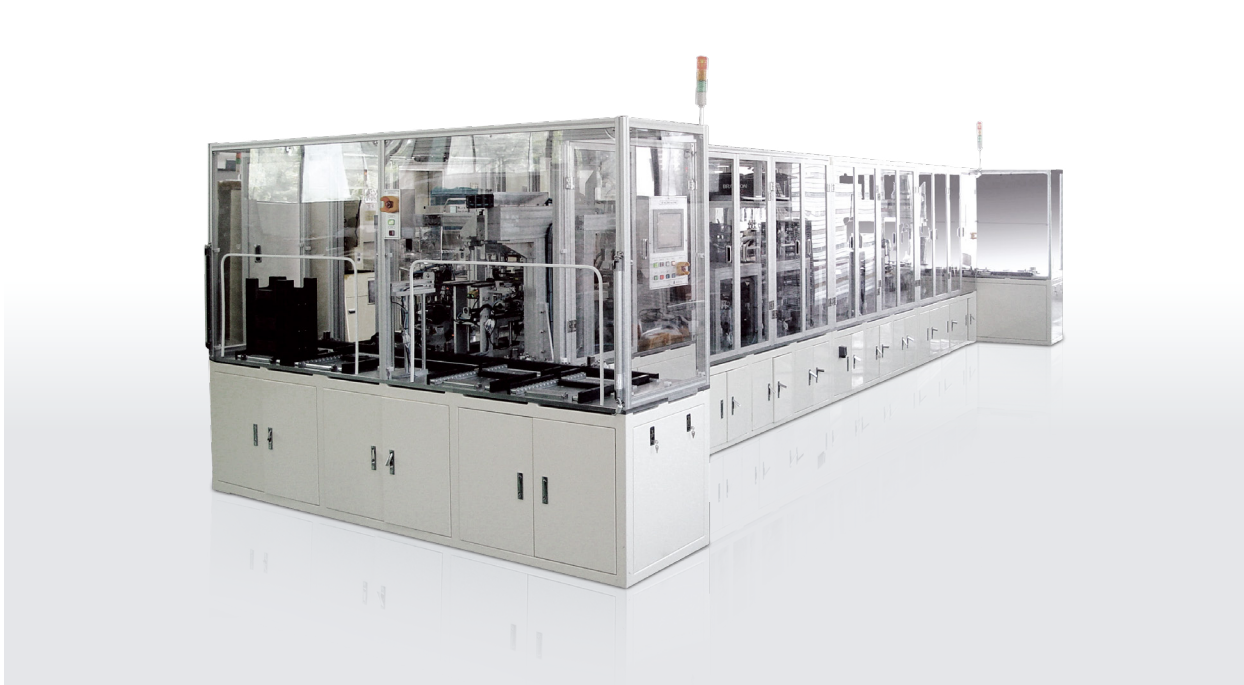
## KEY FEATURES

- High-speed stacking & folding
- Vision align system : Detective electrode automatic discharge
- Double/multiple electrodes separation when electrodes feeding
- Separate double arms to reduce waiting time



# TAB WELDING SYSTEM

Tab welding to the grid using ultrasonic welder

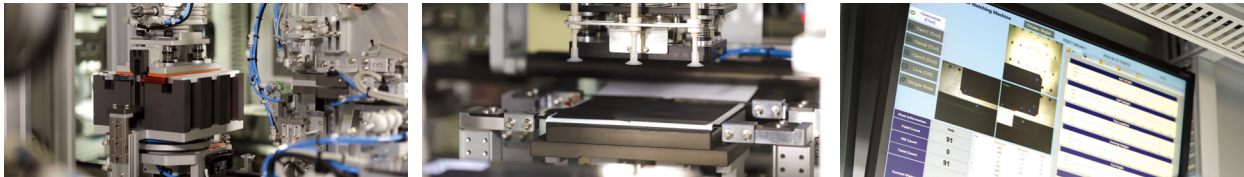


## SPECIFICATIONS

Model	MPWL-015P
Machine speed	Max 15PPM [as of 2017]
Welding type	Ultrasonic welding type
Tab supply	Magazine type
Tab cleaning	Brush cleaning
Tab Inspection	Vision inspection
Jelly roll moving	Jelly roll pallet type
Particle control	Particle suction
Foil inspection	Vision system (TBD-Sensor)
Power	380V, 3P, 50Kw
Dimension	8.5m(L) x 4,0m(W) x 2.2m(H)

## KEY FEATURES

- Foreign matters prevention & removal
- Position verification after horn & anvil installation
- Random stackable with tab position detection function



# PACKAGING SYSTEM

Consitute of three separate processes, pouch forming, packaging and E/L filling process



## SPECIFICATIONS

Model	MPPA-015P
Machine speed	Max 15PPM [as of 2017]
Pouch type	Al pouch (Max dia. 400mm)
Sealing type	Heat sealing (Max 230°C)
Sealing inspection	Vision system
Soaking type	Vacuum soaking type (Max 100torr)
E/L Filling	Max 200g
Vacuum sealing	Max 100torr , Heat sealing type
Cell weight check	Loadcell type (per cell)
Cell loading type	Cell tray (Formation tray)
Power	380V, 3P, 170Kw
Dimension	26.0m(L) x 7,2m(W) x 2.2m(H)

## KEY FEATURES

- Variety of pouch size applicable
- Sealing unit with rigid structure & Accurate position control by servo motor
- Apply pollution prevention unit
- Apply cell detection for cell tracking



# DEGASSING SYSTEM

Getting rid the gas generated in pre-charging process



## SPECIFICATIONS

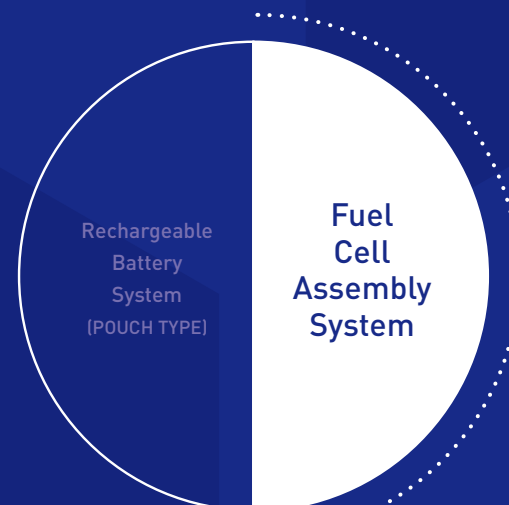
Model	MPDG-015P
Machine speed	Max 15PPM [as of 2017]
Rolling type	Steel roller type
Degassing type	Max 10torr, Heat sealing (Max 230°C)
Sealing thickness	±15um
Cell weight check	Loadcell type (per cell)
Pouch cutting type	Knife cutter
Folding & forming	Roller type
Lot marking	Inkjet marking
Cell loading type	Cell tray (Formation tray)
Power	380V, 3P, 120Kw
Dimension	13.5m(L) x 7,4m(W) x 2.2m(H)

## KEY FEATURES

- Minimize internal pollution of chamber
- Vacuum degree in chamber : Double sealing
- All 4-sides maintainable system



# PRODUCTION EQUIPMENT



MEA LAMINATING SYSTEM

MEA HOT PRESSING SYSTEM

MEA PUNCHING SYSTEM

SUB-GASKET LAMINATING SYSTEM

GDL PUNCHING SYSTEM

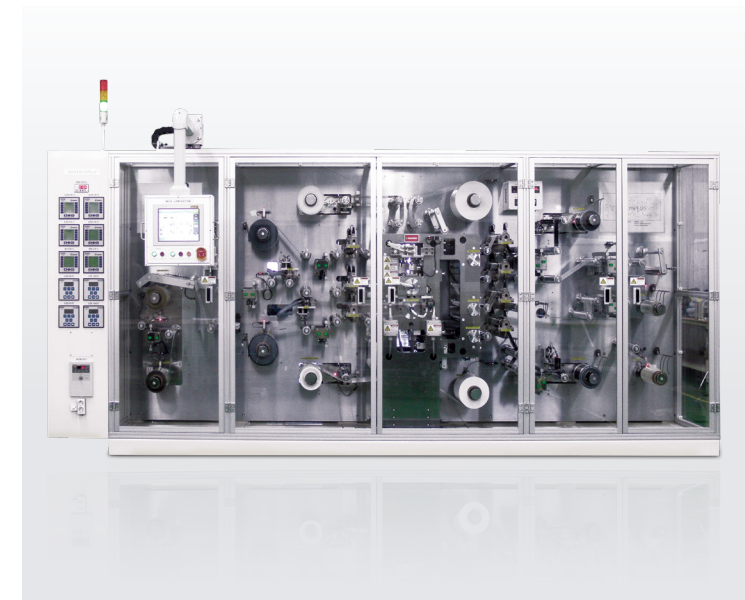
STACK PRESS SYSEM

**INSPECTION SYSTEM**  
Mea permeability test, Seperator plate pin hole,  
Stack leak test, vision insepction

Fuel Cell is a future-friendly new energy that generates electric energy from hydrogen energy. mPLUS has the technology and experience to make turnkey from laminating to stack and inspection equipment.

## MEA LAMINATING SYSTEM

Laminating Membrane and electrode



### PRODUCTION CAPA.

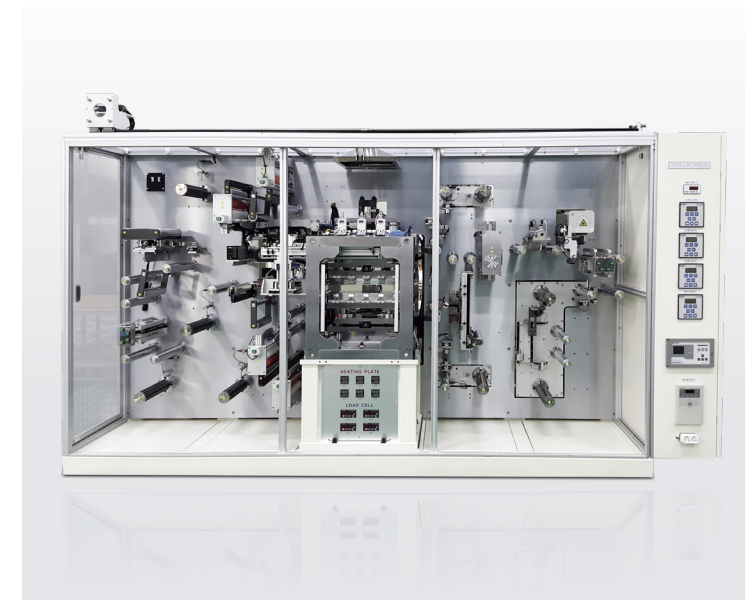
Lab scale ~ Mass production  
Speed : 500mm/min.

### KEY FEATURES

- Automatic reel unwinding & rewinding system
- Cathode & Anode pattern roll lamination system
- Heating roll laminating
- Lot marking
- Particle suction system

## MEA HOT PRESSING SYSTEM

Pressing MEA using hot plate



### PRODUCTION CAPA.

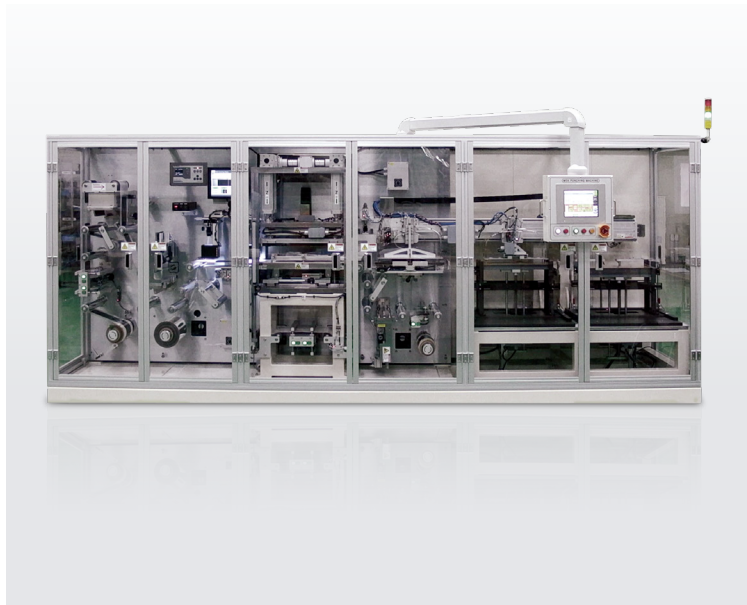
Lab scale ~ Mass production  
Speed : 15~40sec/pitch

### KEY FEATURES

- Automatic reel unwinding & rewinding system (Roll to Toll)
- Cathode & Anode pattern heat pressing system
- Vision align
- Precision temp. control
- Precision hot press
- Precision tension control
- Auto EPC system

# MEA PUNCHING SYSTEM

Cutting MEA into a pitch-controlled sheet



## PRODUCTION CAPA.

Lab scale ~ Mass production  
Speed : 6 sheet/min

## KEY FEATURES

- Automatic reel unwinding (Roll to Sheet)
- Auto punching system
- Vision align
- Auto EPC system
- Precision tension control
- Auto pick & place to magazine
- Automatic stack with protection sheet

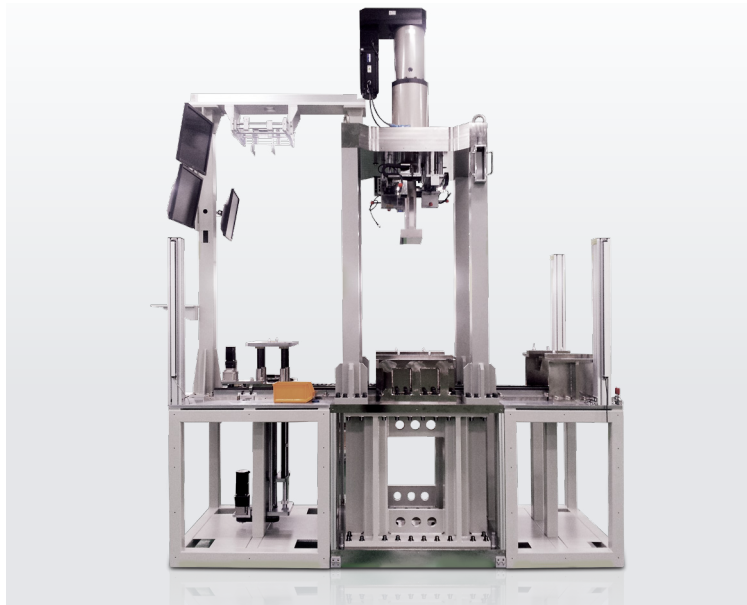
# INSPECTION SYSTEM



SEPA. PLATE PIN-HOLE INSPECTION SYSTEM

# STACK PRESS SYSTEM

Stacking MEGA and separator

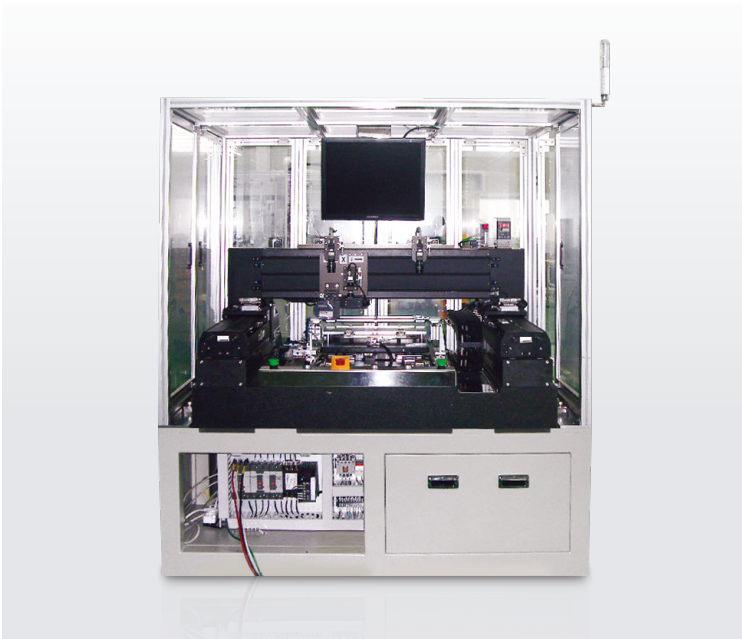


## PRODUCTION CAPA.

Lab scale ~ Mass production  
Speed : 1~5 stack/day

## KEY FEATURES

- Manual loading & unloading
- Recipe auto information
- Real time stacking vision inspection
- Stack height check by using laser & probe
- Stack flatness check by using laser & probe
- Servo pressing system



SEPA. PLATE THICKNESS MEASURING SYSTEM



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