

Amphenol Sincere



**Connecting
People and Technology**

Electronic Integration & Flexible Printed Circuits

Battery Pack / EV Flex Solution 2022

About Amphenol Sincere

Amphenol GASF



Amphenol Sincere Industrial Products:
Location: Nansha, Guangzhou City, China
Revenue: USD \$30 million
Employee: 430
Products: Flex Circuits, RigidFlex Circuits, Battery Cover CCS etc (Design, Manufacture, and Assembly there of)

Certifications:
ISO 9001:2015
ISO 14001:2004
IATF16949
AS9100

Facility Area: 14,000 square meters

Amphenol ASIP

Amphenol Sincere Industrial Products:

Location: Near City of Pecs, Hungary
Facility Area: 7,000 square meters
Employee: ~130

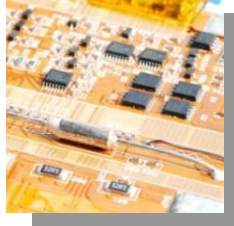
Revenue: €25 million

Products: Battery cover CCS, busbar, plastics and voltage measurement
Value Added on Flexible Printed Circuits

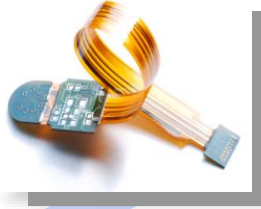
Certifications:
ISO 9001:2015
IATF16949 LOC



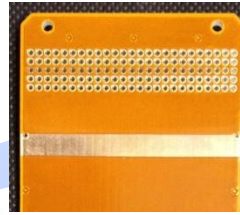
Amphenol Sincere Capabilities



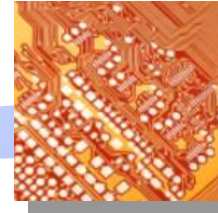
Component / Surface Mount / Hand Assembly and Other Value Added Assembly/ Services



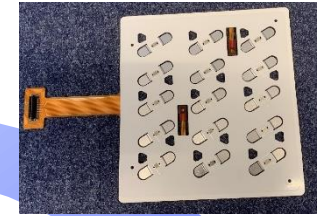
Rigid-Flex Double and Multi-layer $\leq 16L$



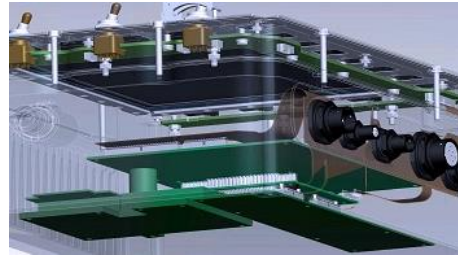
Multilayer FPC $\leq 12L$



Single- and Double-layer Flex Circuits (FPC)



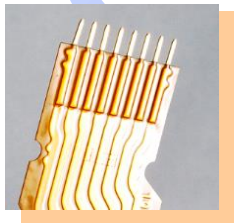
Laminated Busbar including voltage measurement and Temp sensing



Electronic Integration Box Build



Battery Sensing Covers (CCS) /Wiring, busbar with temp and Cell voltage measurement



Power Flex, Sculptured Flex for up to 100/200A



High Speed Flex



Heater Flex 1W – 300W

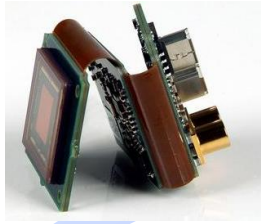


High Operating Temp Flex $\leq 200^{\circ} C$



Battery Flex up to 750mm or 1.2m+ specials

Amphenol Sincere Markets



Industrial



EV/HEV



EV/Energy
Storage Batteries



Medical



Comms



Rail



Aerospace



Oil & Gas

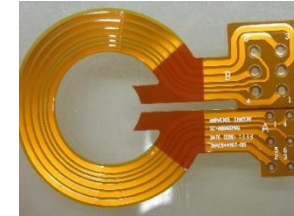
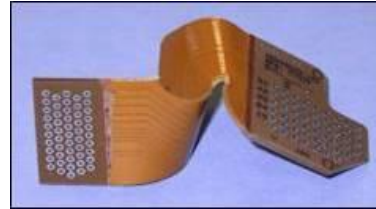


Robotics

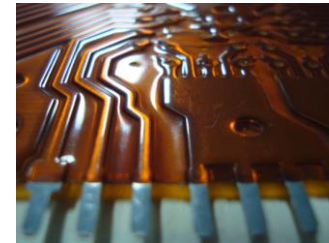
Are you in one of these industrial areas, perhaps you can save with Flex!

Products from Amphenol Sincere

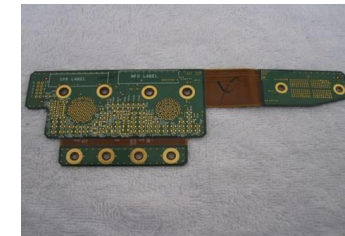
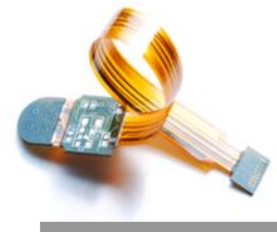
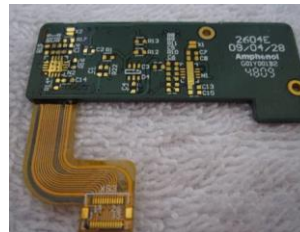
- Flex Circuits
 - Upto 12 Layers
 - Length 600mm, $\leq 750\text{mm} \leq 1.2\text{m}$
 - Operating temp up to 200C



- Power Flex circuits
 - $\leq 1/200$ Amps subject to design & Copper weight
 - Various terminations possible



- Rigid-Flex
 - Upto 16 Layers
 - Impedance control



- Flex with Connectors
 - Any connectors for FPC
 - Assembled and tested

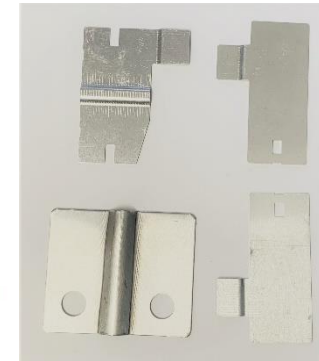


Products from Amphenol Sincere

- Busbar
 - Solid Busbar, AL or Cu
 - Flexible Busbar



- Welded Bars



- Busbar Aluminium or Copper or Combined



- Plastics by moulding as required



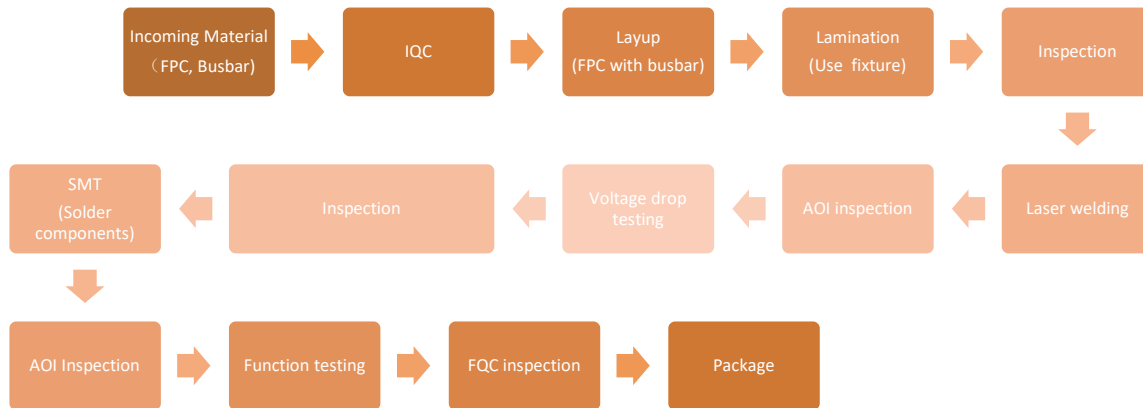
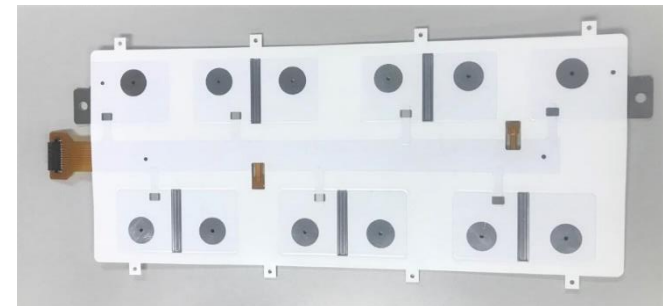
EV Products from Amphenol Sincere

- Battery covers / wiring/ sensing solutions
 - Hungarian production
 - Automated or manual assembly lines for CCS
 - A one stop shop / solution, consisting of: Plastic holder, Busbar, voltage sensing, flex interconnect, other sensing



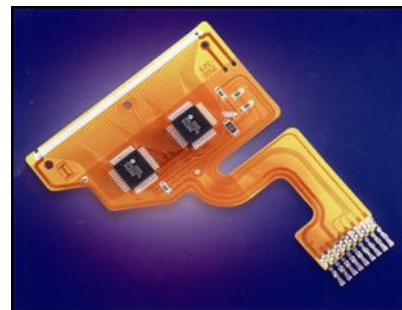
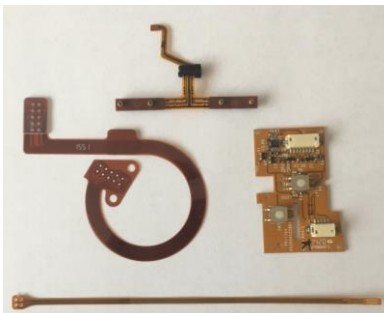
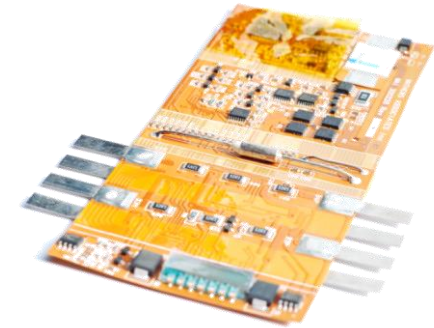
New Products from Amphenol Sincere

- Laminated Busbar for battery solutions
 - New from Sincere
 - A complete one piece solution consisting of: Busbar, voltage sensing, flex interconnect, other sensing
 - Prismatic or Cylinder batteries
 - Low weight
 - Low profile



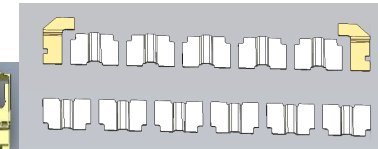
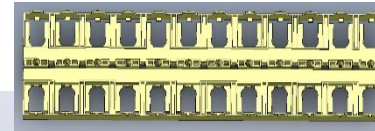
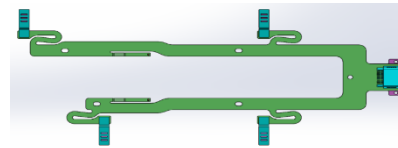
Assembly Services from Amphenol Sincere

- FPC with component assembly
 - Full Box build based on FPC
 - SMT or through hole components
 - Hand soldered or Reflow
 - Electrical & AOI testing
 - Mechanical fixings
 - Foams, Glue Pads etc
 - Conformal coatings

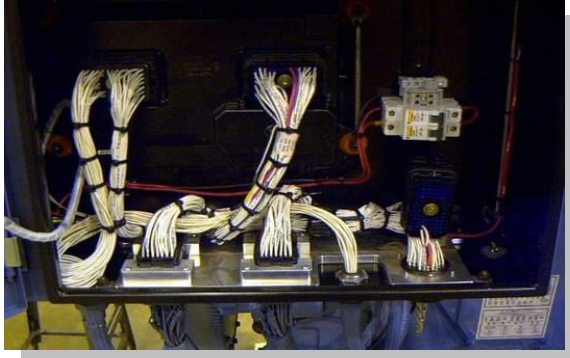


Services from Sincere

- Production/Assembly of battery covers / CCS
- Technical Support
 - Engineering, QA, Logistics
- Design Support
- Warehousing
- Procurement



General Flex Circuit Advantages



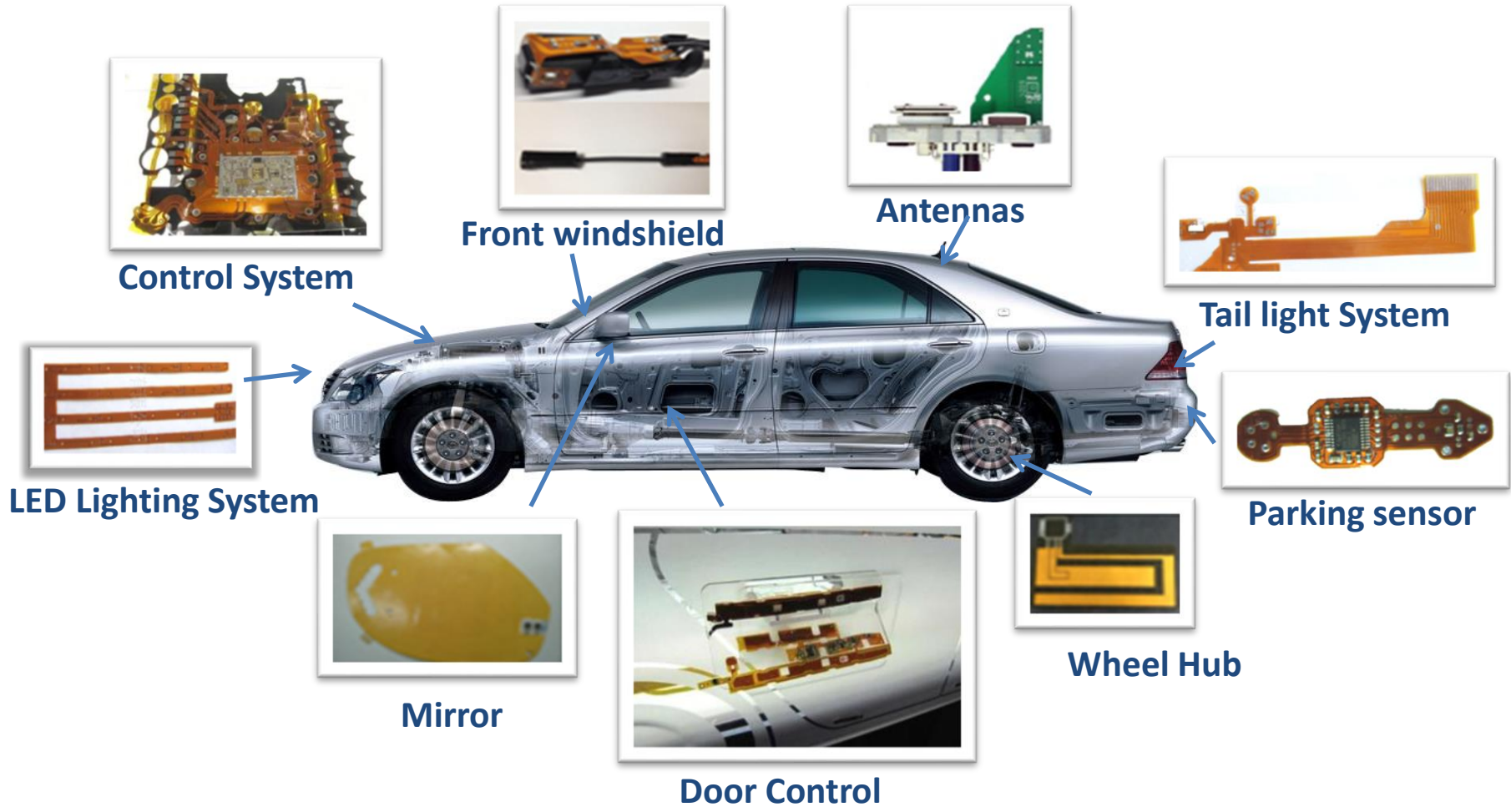
Minimize Weight & Maximize Component Areas To Reduce The Size Of The Total Package

Eliminate Wiring Labor, Reduce Manual Cable Assembly Errors, Save Cost For Rework And Re-Inspection

Streamline Mechanical & Electrical Design Increase Flexibility in Performance & Packaging

Reduce Packaging Size & Increase Reliability

Established Flex Applications in Auto / HEV



Flex Application in a typical Power Battery Pack

Application:

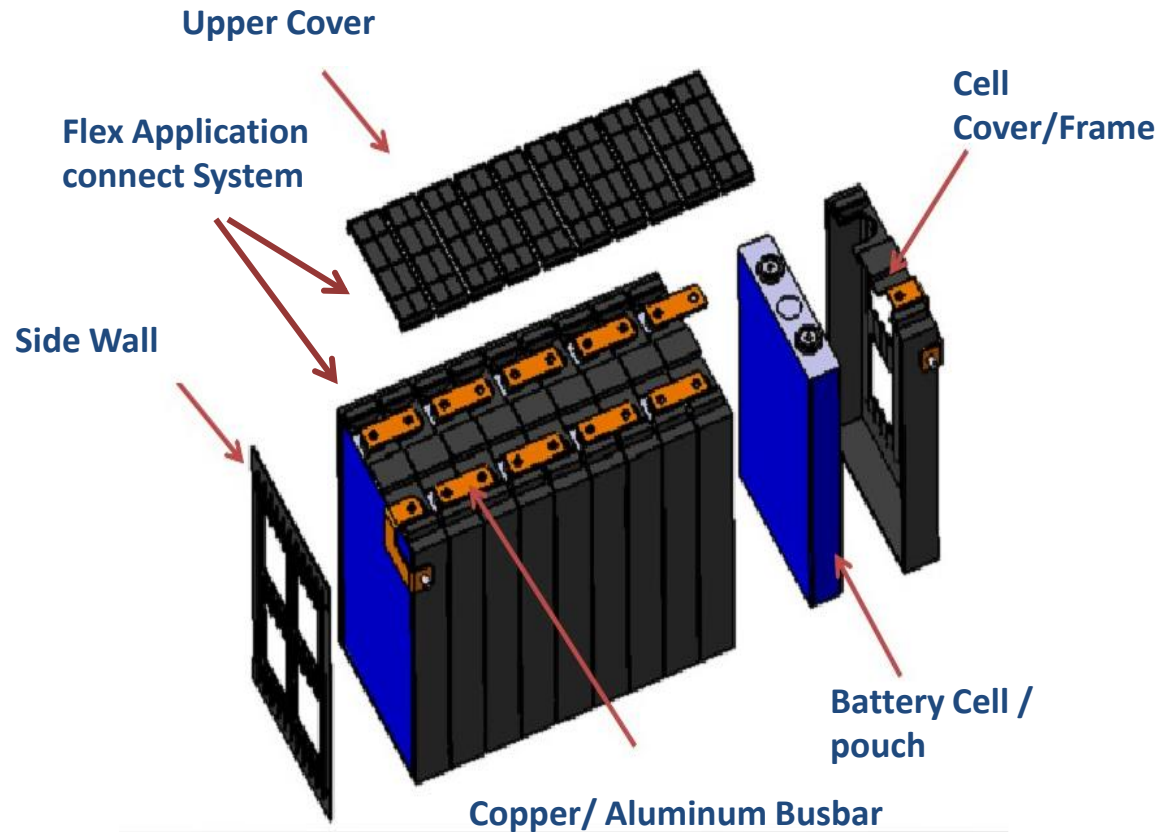
- Battery SOC Circuit(State of Charge)
- Battery Control Circuit
- BMS Control Circuit(Battery Management)

Purpose:

- Replace cable solution
- Replace PCB Circuit/s

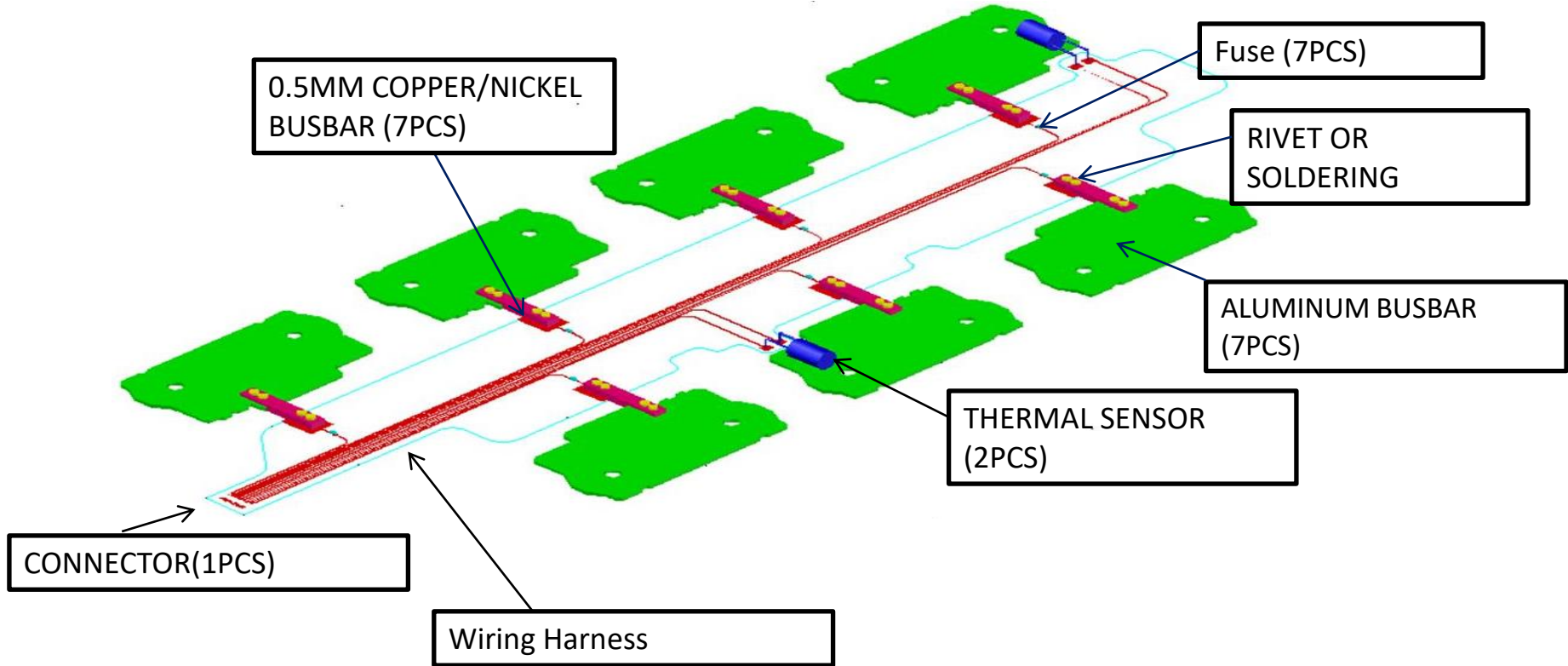
Benefit:

- Save Space & Weight
- High Reliability
- Better Heat Dissipation
- Easy assembly



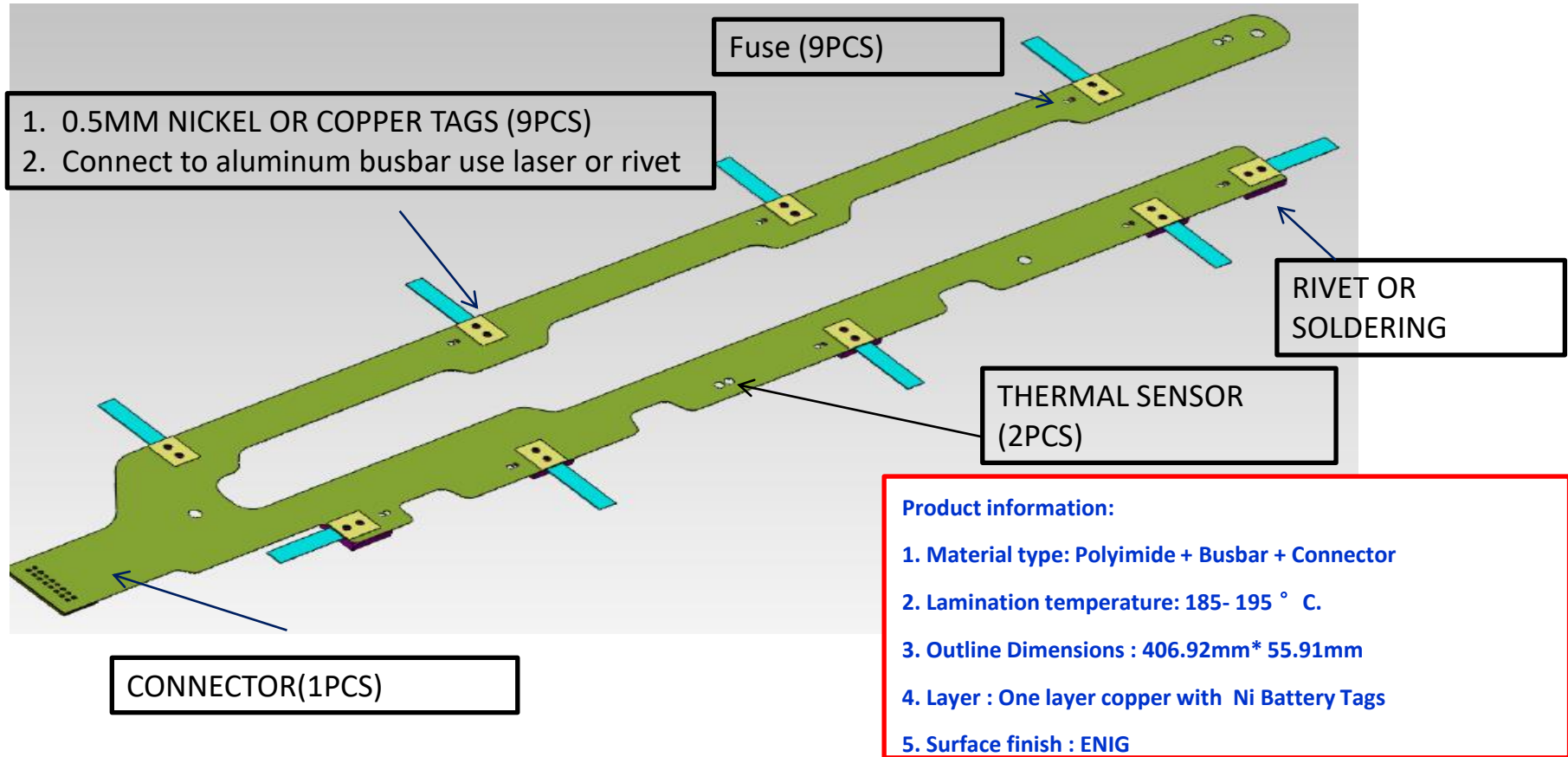
A Standard Battery Pack Module

Typical Voltage sensing by original cable harness method

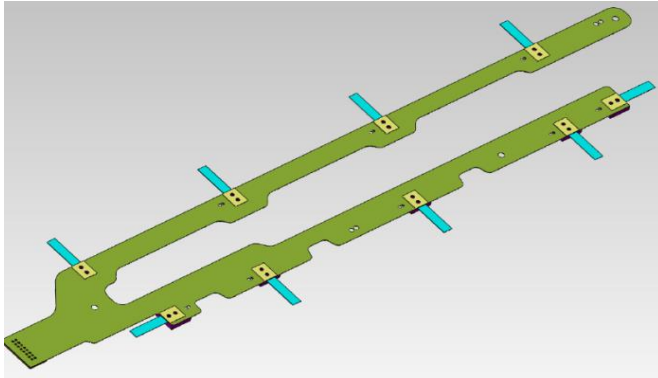


Low cost for proto-typing etc,
but higher total costs for
production

The Original Flex solution to voltage temperature sensing



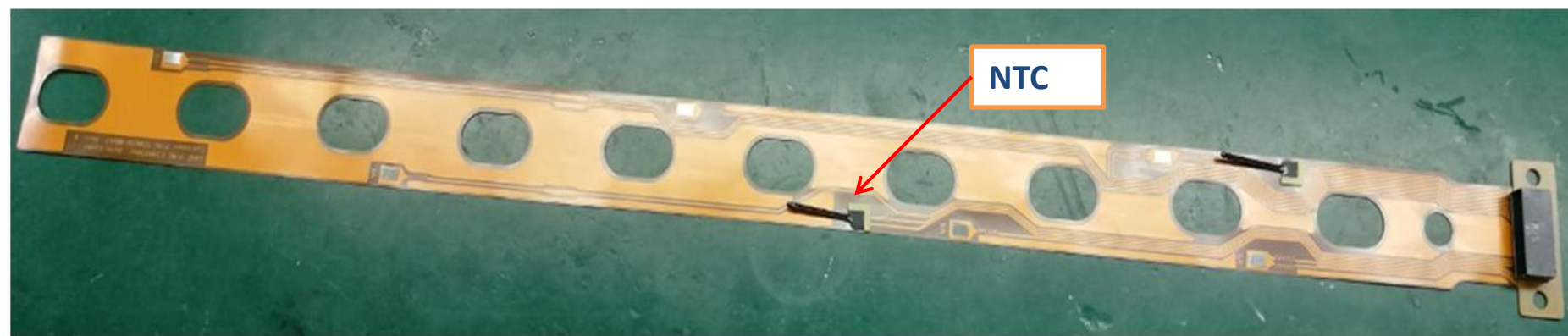
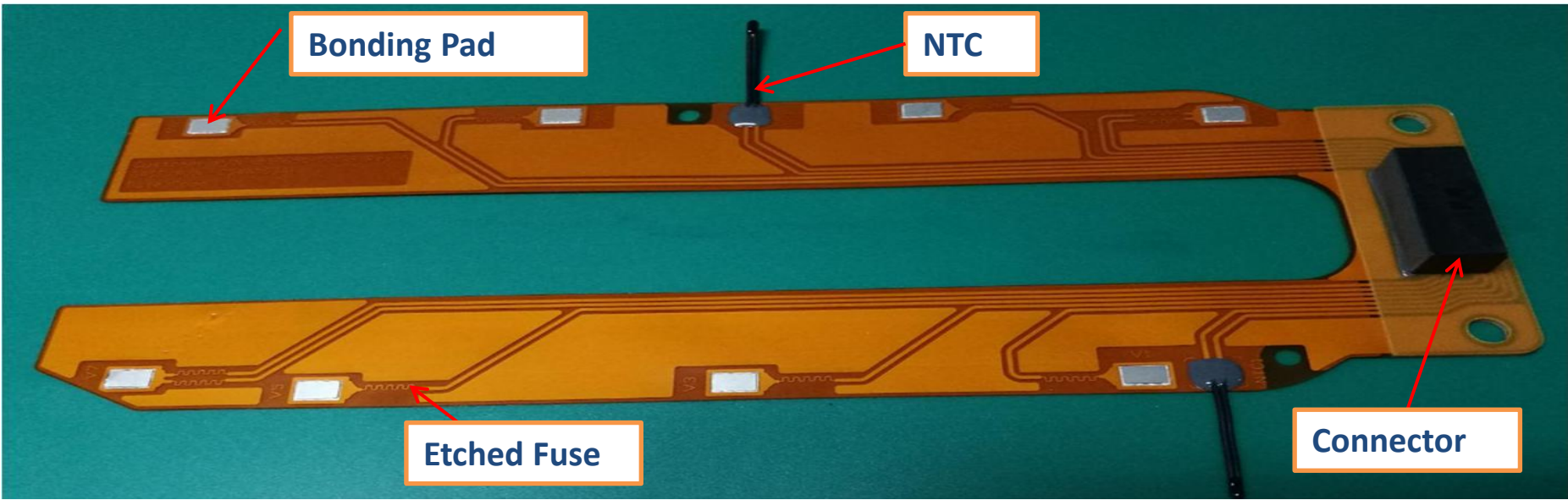
FPC Application—Power Battery --prismatic cells



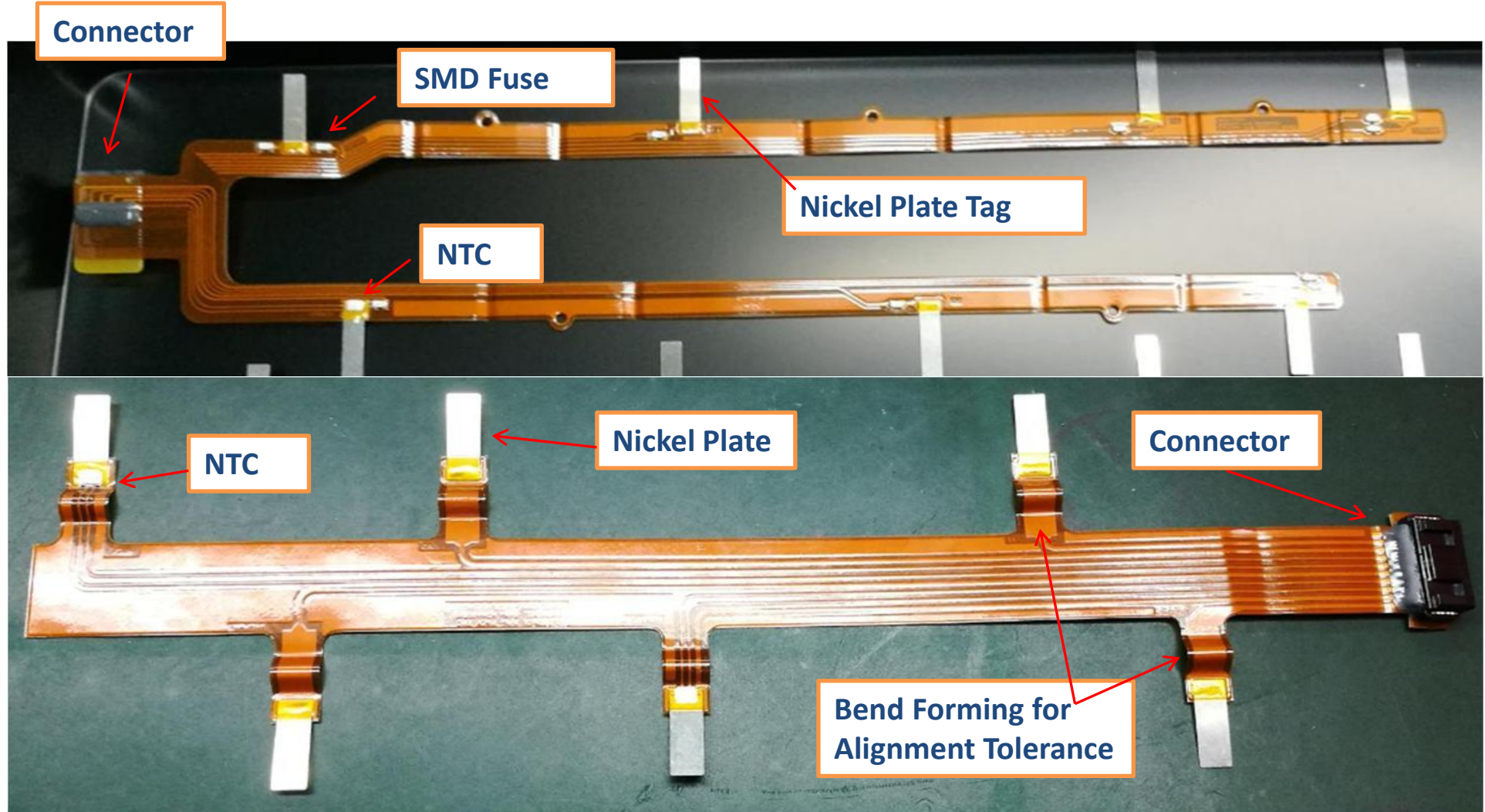
- Product information:
- Material type: Polyimide + Nickel strip + Busbar + Connector
- Lamination temperature: 185- 195 °C.
- Surface finish : ENIG



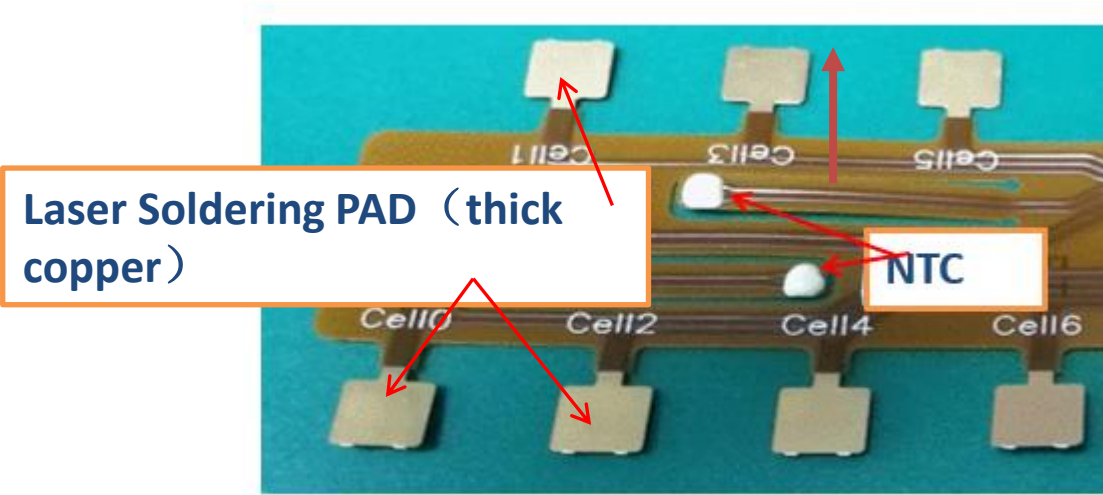
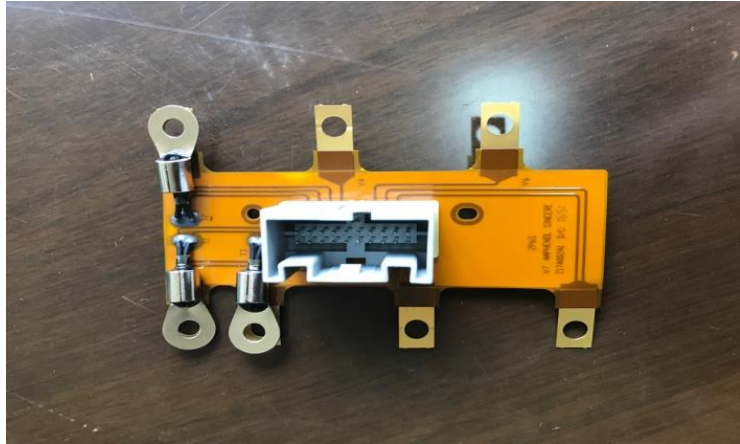
Flex solution for Wire Bonding Battery assembly:



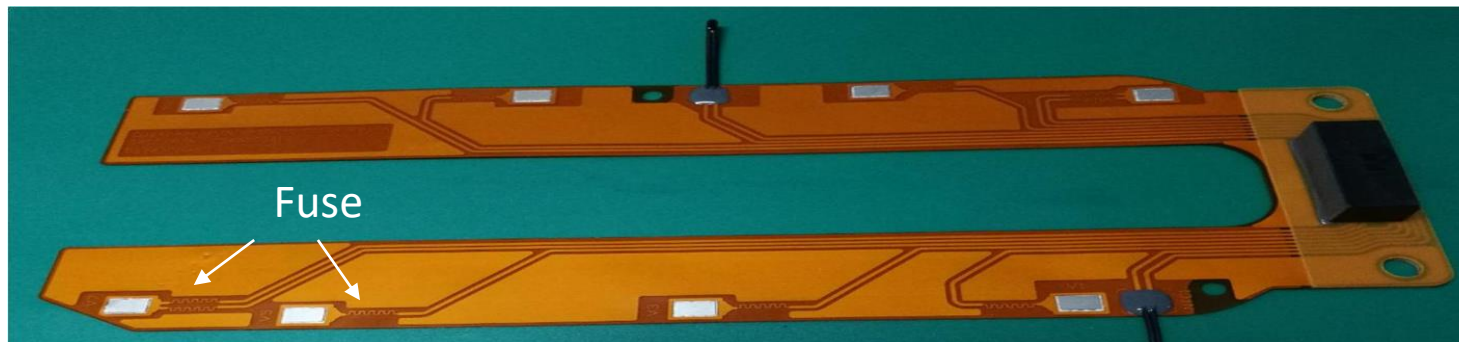
More Recent Flex solution for Prismatic cell and Laser Soldering / Ultrasonic welding Tag Solution:



Pouch type solutions plus other Terminal / Crimping Solutions:

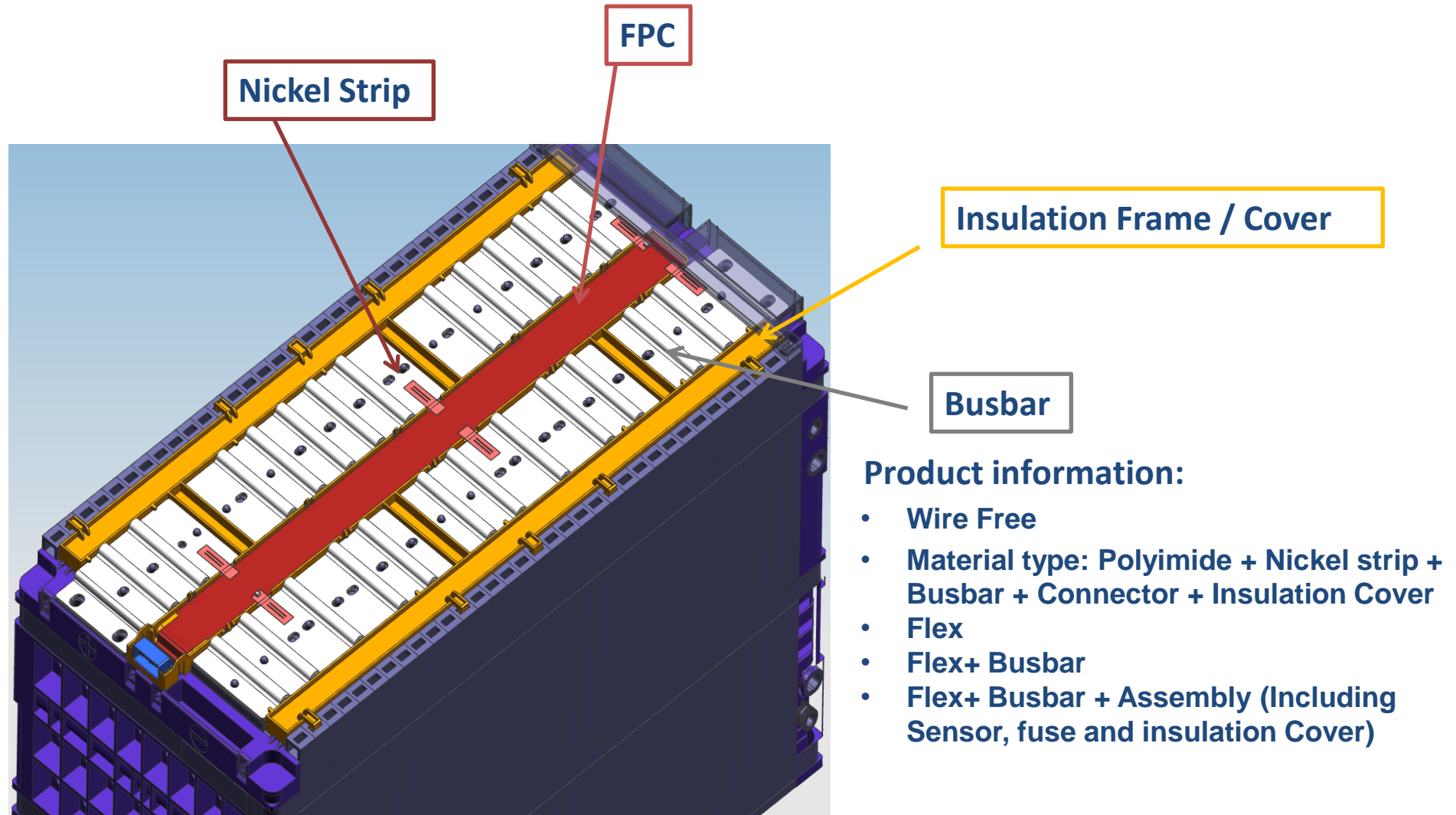


Fuse design



Type	Fuse design							Operation current	Fusing current
	Copper	Length	height	Pitch	width	spacing	Number of CVL laminate		
3A1S	0.5oz	10mm	0.7mm	1mm	0.08mm	0.92mm	1 time	200mA	3A
4A1S	1.0oz	10mm	0.7mm	1mm	0.09mm	0.91mm	2 times	300mA	4A
5A1S	1.0oz	10mm	0.7mm	1mm	0.11mm	0.89mm	2 times	400mA	5A
6A1S	1.0oz	10mm	0.7mm	1mm	0.13mm	0.87mm	2 times	500mA	6A
7A1S	1.0oz	10mm	0.7mm	1mm	0.15mm	0.85mm	2 times	600mA	7A
8A1S	1.0oz	10mm	0.7mm	1mm	0.17mm	0.83mm	2 times	800mA	8A
9A1S	1.0oz	10mm	0.7mm	1mm	0.19mm	0.81mm	2 times	900mA	9A
10A1S	1.0oz	10mm	0.7mm	1mm	0.21mm	0.79mm	2 times	1000 mA	10A

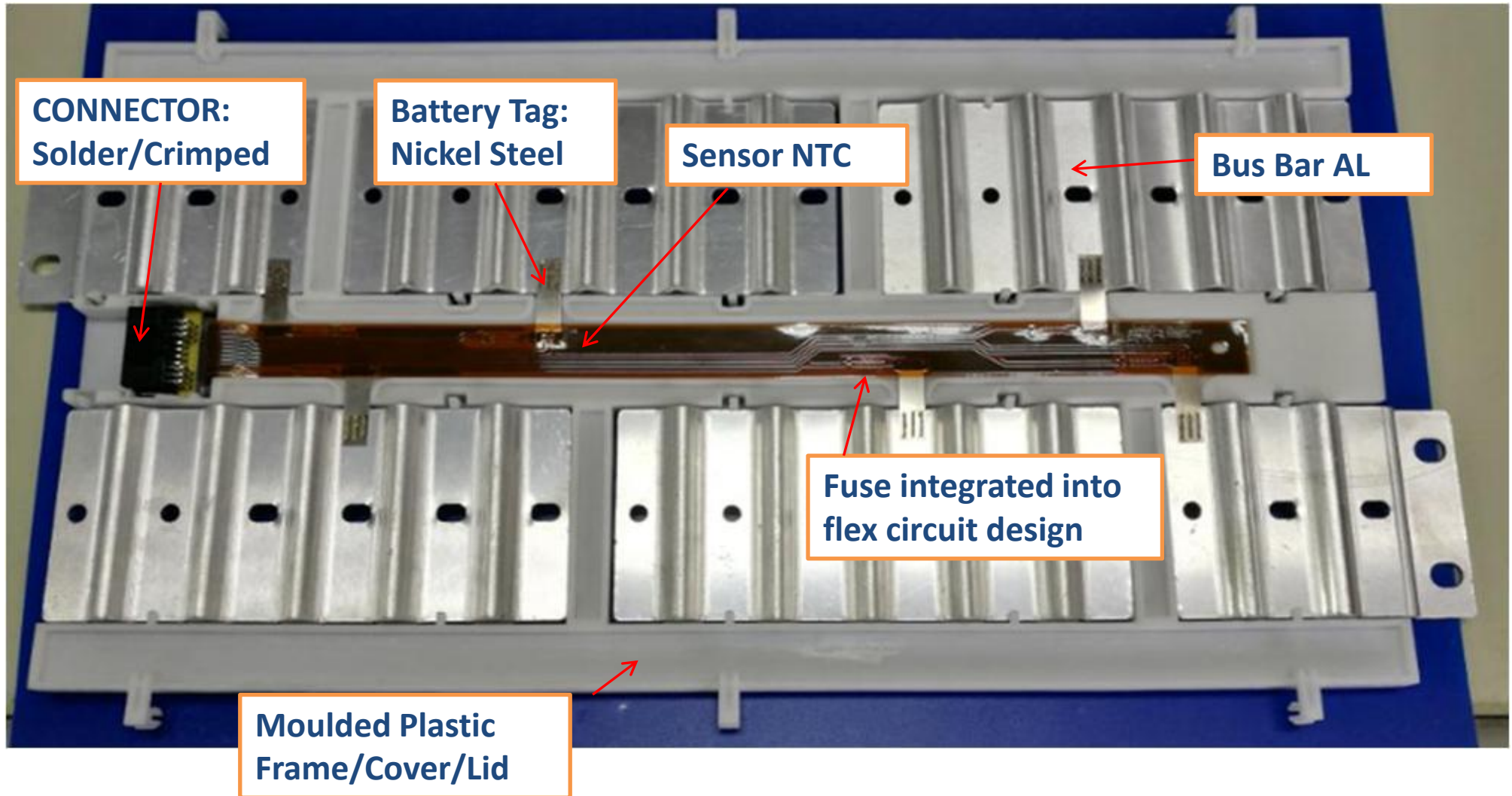
Showing typical FPC full CCS Application in a Prismatic cell Power Battery:



Product information:

- Wire Free
- Material type: Polyimide + Nickel strip + Busbar + Connector + Insulation Cover
- Flex
- Flex+ Busbar
- Flex+ Busbar + Assembly (Including Sensor, fuse and insulation Cover)

Example of CCS, FPC+ Insulation board/Cover + aluminium Bus Bar

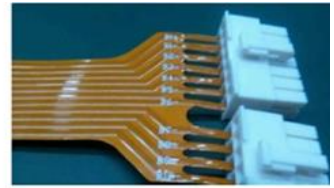


FPC Application—in Power Battery conversion of older wiring

Product Application – HEV & Better



PCB+Cable design Solution



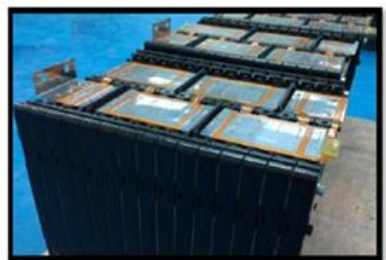
FPC Solution



Cable design Solution



FPC Solution

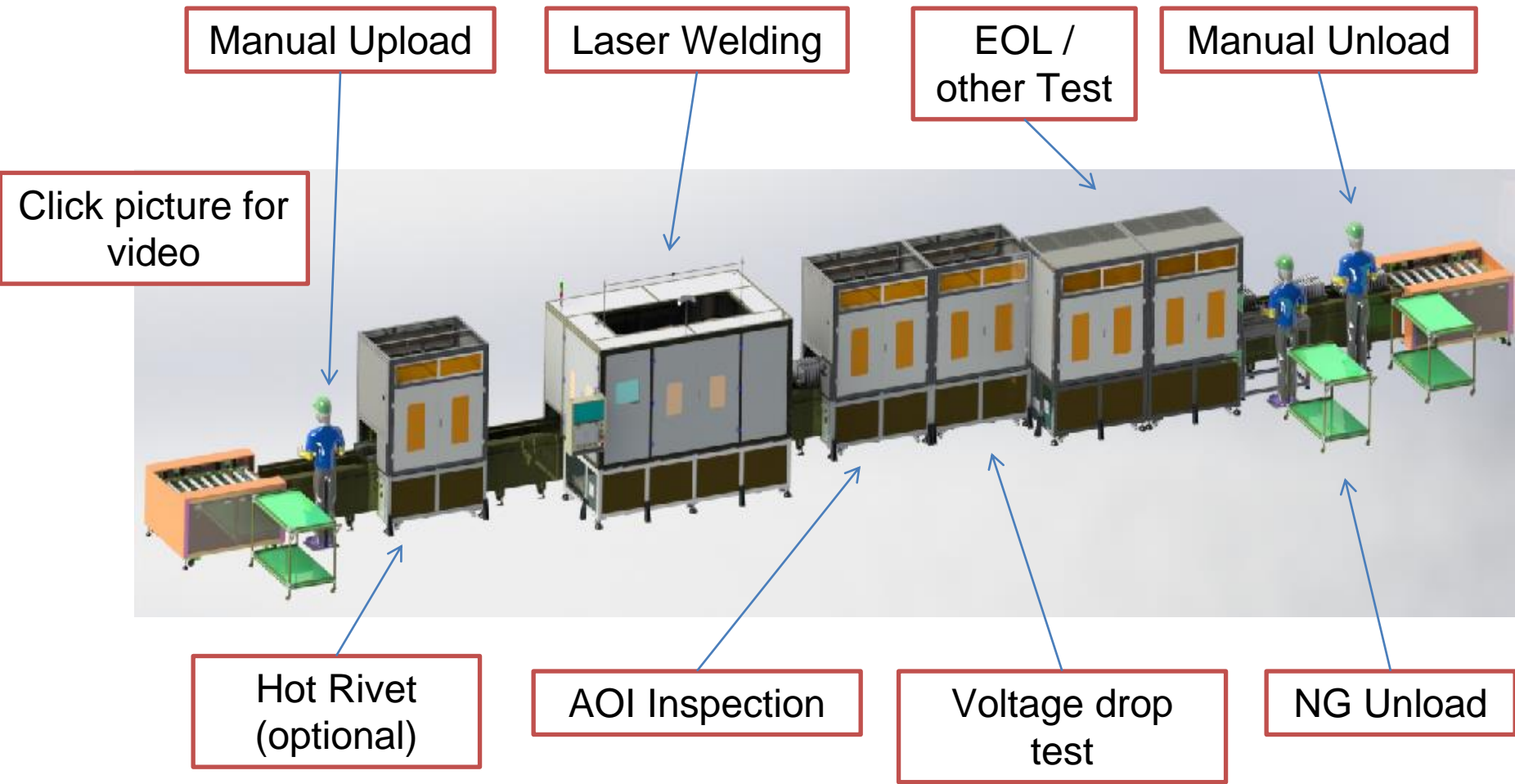


FPC Battery pack

ASIP Factory Hungary for battery CCS assembly



ASIP Battery Cover CCS A Typical Laser welding Line



Automated CCS Assembly possibilities

Discuss your requirements with us:

- Low through to high volume, sample to series
- Manual or Automated builds
- 3D Print Samples
- Hand made busbar in Cu or Al
- Soft tooled Flex
- Mechanical dummies
- Soft or semisoft plastics tooling subject to project volumes/sampling numbers
- Hard Tooled samples/series
- Full assembly and test in Europe

Sensor integration

- Voltage Sensing
- NTC
- Moisture
- Thermal runaway
- Others!

Flex Solution Advantages in Power Battery Pack

	Cable Solution	Flex Solution	Cost Impact
Assembly	Complicated, bulky, and easy to miss-assemble	Integrated design, high efficiency assembly	Saving labor cost
Reliability	Low, will have possible break risk in connection area	High, Copper and aluminum are a better malleable material, No solder embrittlement	Saving re-work cost
Heat Dissipation	Bad	Good, both Copper and aluminum are good heat dissipating material. Flat conductors have more surface area to dissipate heat better.	Increase battery pack output efficiency
Weight	Heavy weight	Light weight	Increase power density, reduce overall weight of pack/vehicle.
Circuit Design	Complicated and difficult to integrate with other components	Space saving, and easy to be integrated design	Saving Space and process cost

Saving labor cost + Re-work cost + Process cost + increasing efficiency= Saving Money!

Standard * and Possible Tests for the Battery Flex/System

	Test Items	Category	Refer Standard		Test Items	Category	Refer Standard
1*	Appearance	Appearance	IPC-6013C	14	High & Low Temp Shock	Environmental	USCAR2-6
2*	Dimension	Dimension	IPC-6013C	15	Thermal Stress	Environmental	IPC-TM-650
3*	Open/Short	Reliability	IPC-9252	16	Salt Spray	Environmental	USCAR2-6
4	Bending	Reliability	IPC-6013C, IPC-2223	17	High Temp exposure	Environmental	USCAR2-6
5*	Peel Strength	Reliability	IPC TM 650,IPC 6013	18	High Temp & Humidity	Environmental	USCAR2-6
6	Current cycle	Reliability	USCAR2-6	19	Short time High Temp	Environmental	Design requirement
7*	Temp Rise	Reliability	USCAR2-6	20	Water Immersion	Environmental	Design requirement
8	High Voltage	Reliability	IPC-6013	21	Vibration	Environmental	USCAR2-6
9	Insulation	Reliability	IPC-6013	22	Electrolyte Immersion	Environmental	Design requirement
10	Fusible link	Reliability	Design requirement	23	Flame retardancy	Environmental	UL
11	Resistance	Reliability	Design requirement	24	Low Temp Shock	Environmental	Design requirement
12*	Soldering	Reliability	IPC-610	25	NTC resistance	NTC	Design requirement
13*	Nickel Peel Strength	Reliability	Design requirement				

Typical Laser Welding Process:

Laser welding typ. quality criteria:

Y- tensile: 60N

Z- tensile: 60N

Customer specifics by design agreement and testing validation.

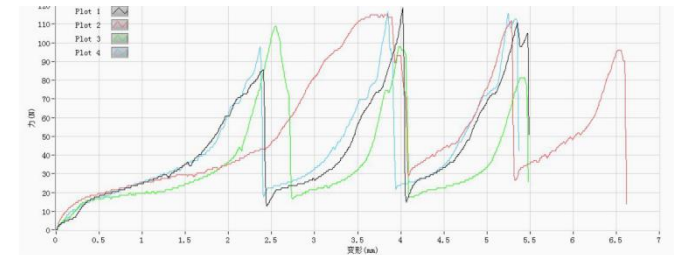
The Laser welding is the preferred method from GASF following work on other projects, A separate research project can always be considered and costed.

Typical functional Test

- 1.The device can automatically read DMC code, the test data is automatically saved in the form visual files (Excel).
- 2.Test of all NTC (Max. 8) resistance. The test uses the comparison test method with standard NTC to automatically judge.
- 3.Determine the on-off of PIN from aluminum bar to connector.
- 4.Determine the short circuit between all pins.
- 5.The internal resistance of each line on FPC is less than 1.5 ohm (1500 Milli-ohms).

All the above test data are automatically generated and judged.

- 6.The data correspond to DMC code one by one.
- 7.The data is stored for 15 years.



No.	最大力 (N)	产品名称	最小力 (N)
1	118.661	Z-tensile	0.000
2	114.739	Z-tensile	0.000
3	108.854	Z-tensile	0.000
4	116.700	Z-tensile	0.000
MAX	118.661	0.000	0.000
MIN	108.854	0.000	0.000
AVG	114.739	0.000	0.000

Quality System

- ✦ ISO 9001:2015
- ✦ ISO 14001:2015
- ✦ IATF 16949:
- ✦ AS9100 Rev D
- ✦ UL



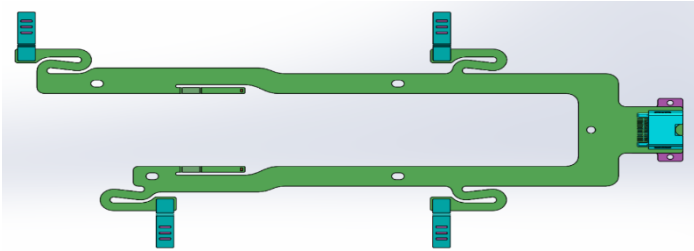
- ✦ ROHS
- ✦ REACH
- ✦ WEEE



Why work with us?

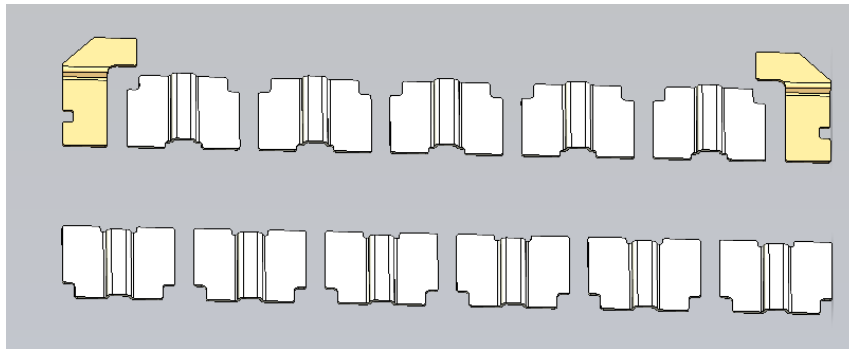
- From your sketches, we can produce a Flex design for battery covers or replacement wiring
- Conclude or produce plastics design work
- Design the Buss-Bar as required
- Produce 3D docs all in-house
- Manufacture FPC, and assemble, test all your parts for you.
- European or China facilities for assembly of Battery Covers CCS or other products

Let us deliver your next Battery Product

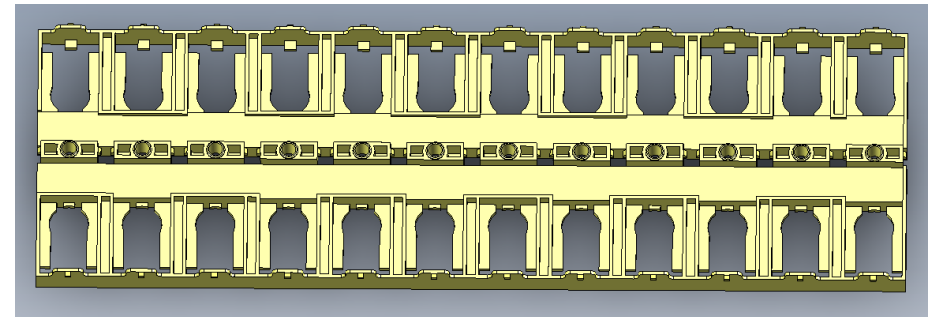


Typical FPC Design and Build

From Customers brief
through to production
Amphenol GASF can deliver
your project.

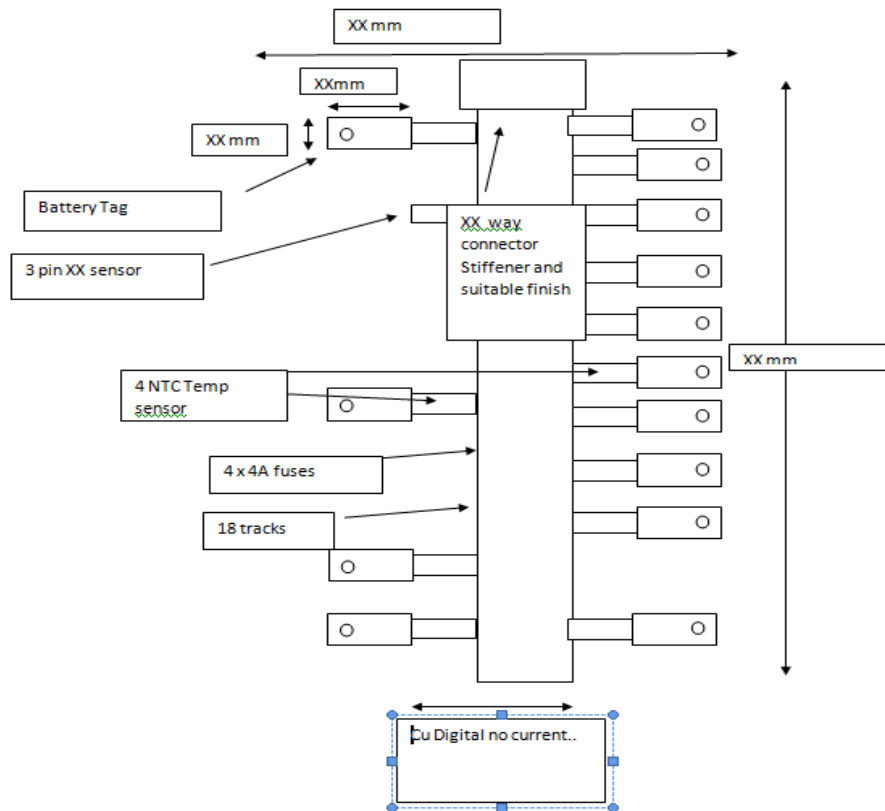


Typical BusBar Design and Build



Typical Plastic holder Design and Build

So why not send us your sketch, for RFQ Now?



For pricing or discussions we'd like as much of the following as possible:
Sketch & Dimensions, Gerber, Step file, DXF, Wish list, BOM, or Descriptive Notes



Thank You !

Amphenol Sincere Flex Circuit

Gary Woodford FAE for EMEA

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