TECHNICAL DESCRIPTION
for a NICE Technology
Solar Module Assembly Line
SMAL 20

SUPPLIER reserves the right to modify the equipment subject to ameliorations or simplifications of processes in respect of the required performances

A. Configuration
- Standard line
- Options

B. Detailed description
- Components & functionalities of the stations

C. Technical characteristics
- For a standard line

D. Comparison Nice technology vs. Lamination technology

A. Configuration:

Standard line:

01 & 01-1- Rear sheet loading & labeling station

02- Glue deposition station

03 & 04- Even cells & contact ribbons deposition station

05 & 06- Odd cells & contact ribbons deposition station

07- Bus bar deposition station

08- Sealing & output ribbons deposition & welding station

09- Rear glass Plasma cleaning & Mechanical sealing station

10- Visual control station

11- Sealing Press

- 11.1- Manual front sheet loading
- 11-2- Front glass Plasma cleaning station
- 11.3- Press
- 11.4- Automatic module unloading
- 11.5- Manual module unloading

12- Connector sticking station

13- S contact welding station

Control system

Safety system

Options:

14- Electrical control & final labeling station

B. Detailed description:

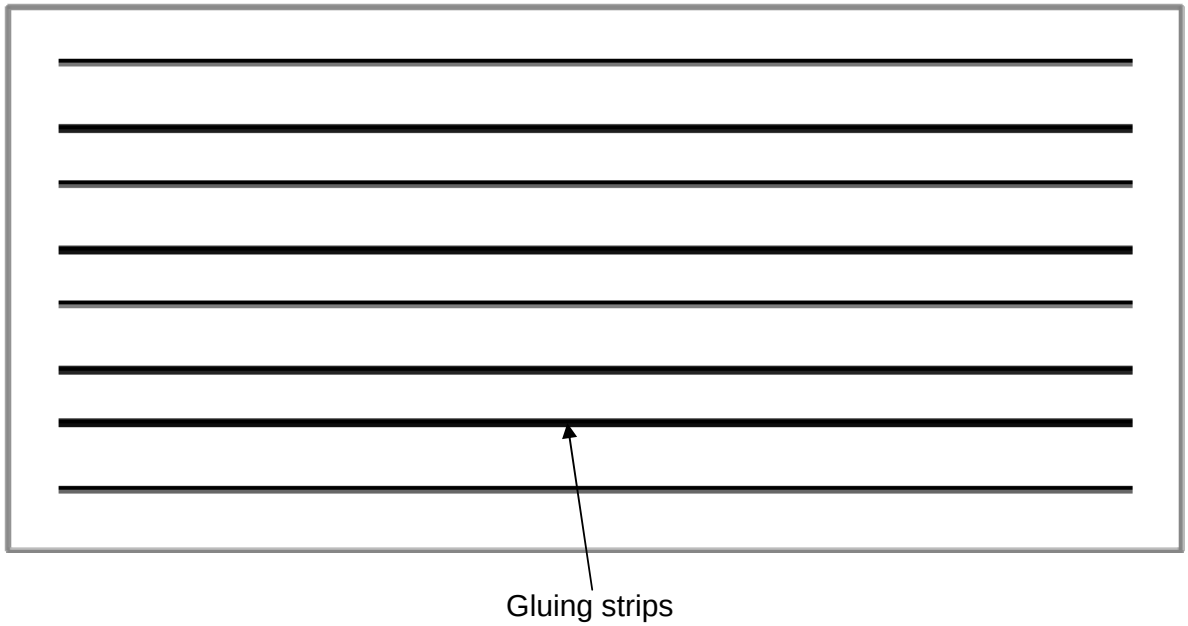
Note: Conveying between stations 01 to 17 is facilitated by a roller conveyor, breathe in / blowing table or band conveyor. Sheet transfer is done by meaning of introduction & evacuation devices from 01 to 14.

01 & 01-1 Rear sheet loading & labeling station:

This station is equipped with a loading assistance handling system.
Rear sheet is picked by a vacuum gripper then lifted. Operator moves gripper & rear sheet up to line conveyor. Rear sheet is then precisely positioned. Glass packing interlayers are leaved into a retrieve container by operator.
Identification bar code is automatically placed on module rear sheet by a printing & deposing system.

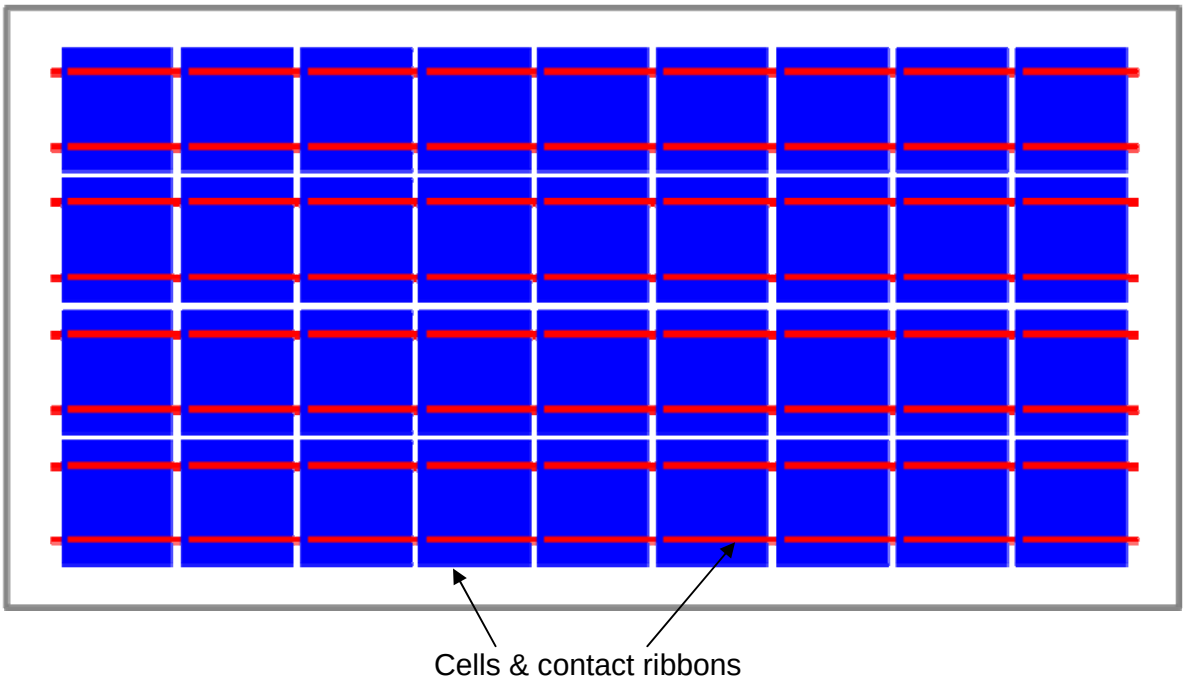
02- Glue deposition station:

A feeding system delivers glue to deposing heads moved by an automatic device. Cells & ribbons gluing strips are automatically deposed this way.



03 & 04- Even cells & contact ribbons deposition station:

A preparation station ensures contact ribbons derolling, cutting & straightening. This station prepare simultaneously 3x2 contact ribbons, these contact ribbons are picked & automatically deposed on module rear sheet by an handling system.
A second preparation station ensures cells distributing. Cells supplying conveyor ensures cells boxes transfer up to a constant level distributing device. Cells are then precisely positioned by a video vision system & after are picked by a handling device that ensures automatic deposing of 3x1 cells on module rear sheet.
Sets of 3x2 contact ribbons & 3x1 cells are automatically deposed in an alternative way deposed so that string electric continuity is ensured.
Both stations ensure cells & contact ribbons even lines deposition.

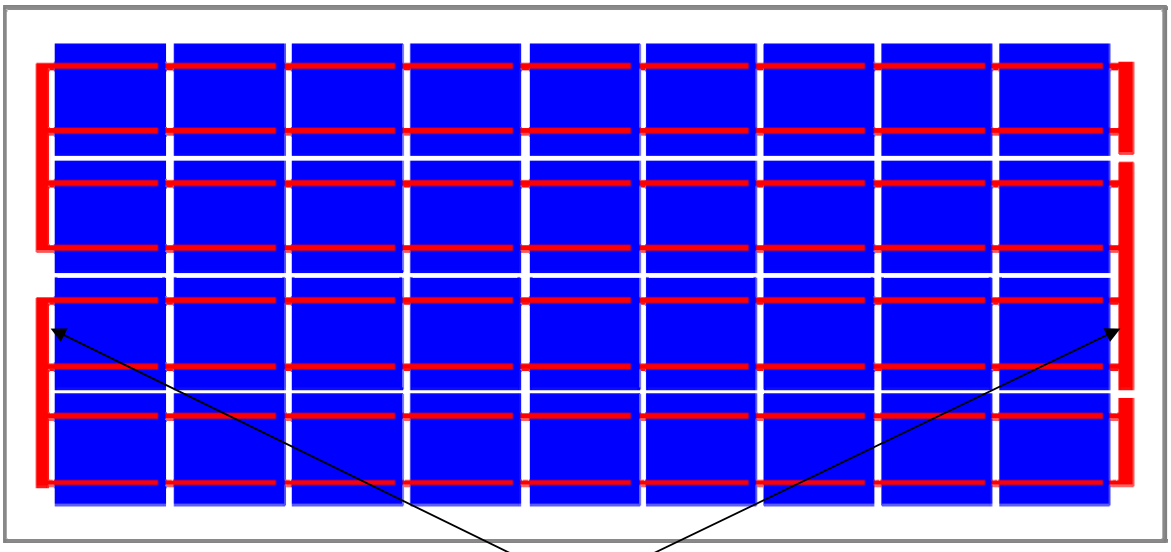


05 & 06- Odd cells & contact ribbons deposition station:

A preparation station ensures cells distributing. Cells supplying conveyor ensures cells boxes transfer up to a constant level distributing device. Cells are then precisely positioned by a video vision system & after are picked by a handling device that ensures automatic deposing of 3x1 cells on module rear sheet.
A second preparation station ensures contact ribbons derolling, cutting & straightening. This station prepare simultaneously 3x2 contact ribbons, these contact ribbons are picked & automatically deposed on module rear sheet by a handling system.
Sets of 3x2 contact ribbons & 3x1 cells are automatically deposed in an alternative way deposed so that string electric continuity is ensured.
Both stations ensure cells & contact ribbons odd lines deposition.

07- Bus bar deposition station:

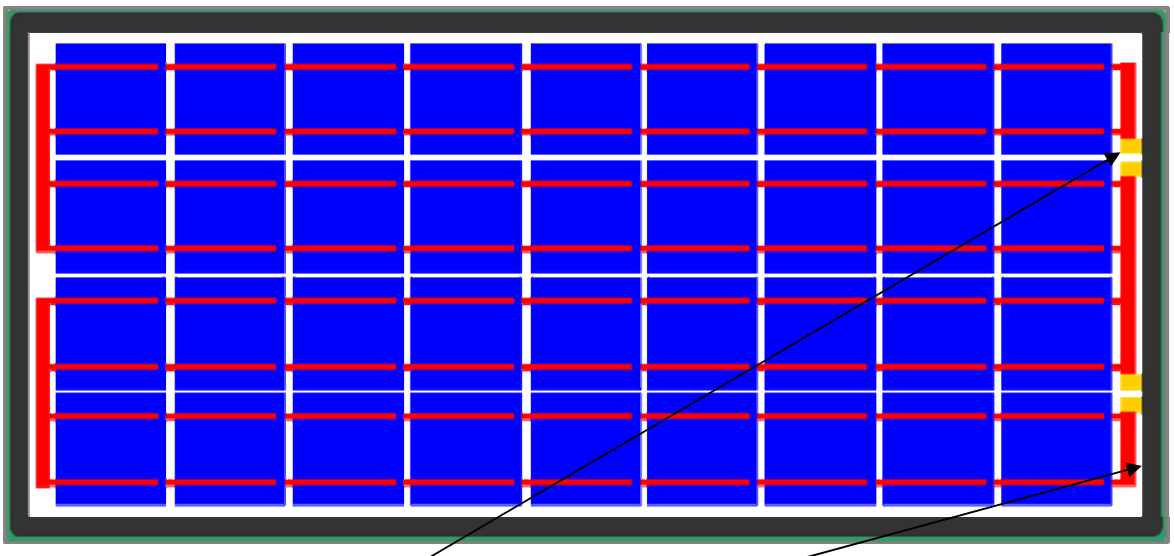
A preparation station ensures busbars derolling, cutting & straightening. This station prepares inter lines busbars successively, each busbars column is picked & automatically deposed by a handling device on module rear sheet.



Busbars

08 - Watertight sealing & output ribbons deposition & welding station:

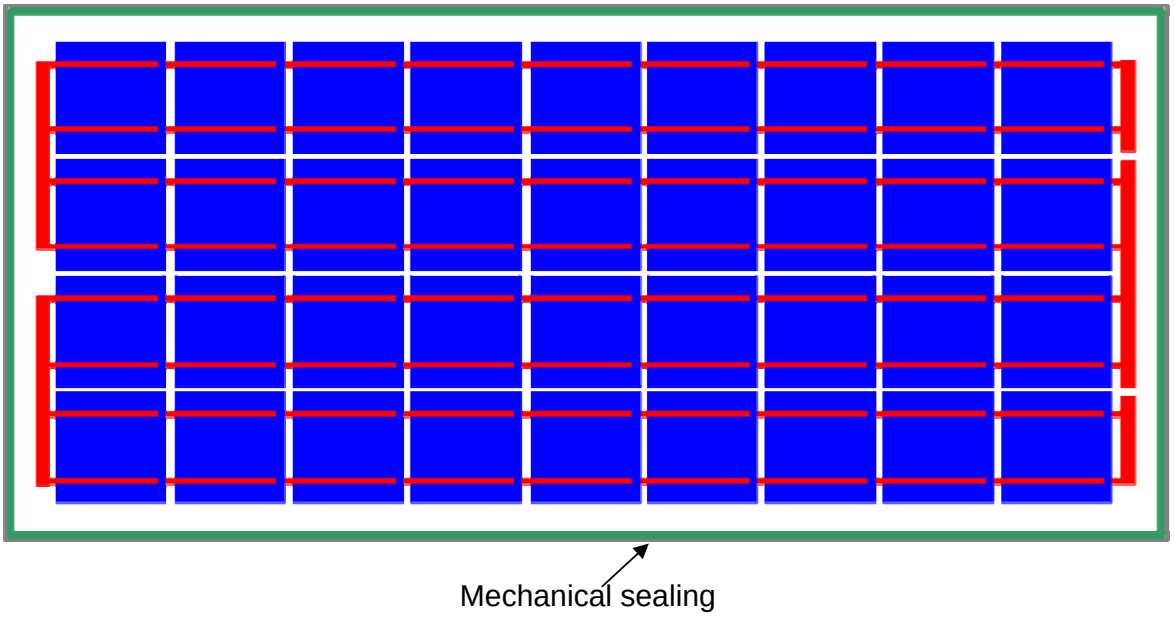
A supply system distributes watertight sealing product to a deposition head moved by a system that ensures automatic peripheral sealing joint deposition.
A preparation station ensures output ribbons derolling, cutting & straightening. This station prepares successively these output ribbons that are picked & automatically deposed on module rear sheet.
A welding device ensures Busbars & ribbon connection by soldering.



Output contacts & peripheral watertight sealing joint

09- Rear Glass Plasma cleaning & Mechanical sealing station:

This station is equipped with a plasma cleaning device to ensure perfect sticking of sealant materiel on module sheets.
This station is also equipped with a mechanical sealing product supply system that distributes sealing product to a deposition head moved by a system that ensures automatic mechanical sealing product deposition on module rear sheet.



10- Visual control station:

This station is equipped with a module rear sheet conveying end stop that maintains rear sheet in station & then allows operator to have visual control of module components assembly quality.

11- Sealing Press

11.1- Front sheet loading station:

This station is equipped with a loading assistance handling system.
Front sheet is picked by a vacuum gripper then lifted. Operator moves gripper & front sheet up to line conveyor. Front sheet is then precisely positioned. Glass packing interlayers are leaved into a retrieve container by operator.

11.2 Front glass Plasma cleaning station:

This station is equipped with a plasma cleaning device to ensure perfect sticking of sealant materiel on front face module sheets.

11.3- Press:

Front & Rear sheets are precisely positioned on bottom press introduction device.
Press is equipped with two tools sets, top tools set to press front sheet, &, lower tools set to press rear sheet.
Module vacuum is ensured by meaning of a mobile tightness enclosure closing press that is empty by a vacuum pump. During vacuum sequences, a neutral gas introduction system provided by customer allows oxygen rate reduction into module.
Both press tools sets are then bring closer then pressed by meaning of automatic actuator in order to close module.
A pressed module evacuation device ensures its take out from press.

11.4- Automatic module unloading:

A pressed module automatic evacuation device ensures its take out from press up to manual module unloading station..

Note: Following stations are equipped with transferring assistance handling system. Module is picked by a vacuum gripper the lifted. Operator moves gripper & module up to desired station.

11.5- Manual module unloading

This station allows operator to pick pressed module to transport it in desired next working station.

12- S contact welding station:

This station is equipped with a welding system that allows fixing of intermediate S contact on module connector.

13- Connector sticking station:

Operator places connector into deposition device, then he use gluing deposition pistol & finally operates pressing device that ensure fixing on module.

Control system:

Electric power supply & distribution components, motion driving, PLC are gathered into electric cabinets. Control panels equipped with color touch screen type MMI interfaces allow operators to operate various line stations.
Main functions are: operation mode selection (manual, automatic, step by step), manufacturing parameters introduction, error messages display & record. A mobile control device should be used for setting or maintenance operations.

Safety system:

Dangerous stations are equipped with peripheral fences & light curtains in order to ensure operator safety. These devices make Solar Modules Assembly Line in accordance with CE safety rules demands.

Options:

14- Electrical control & final labeling station:

Module is inserted into station by meaning of bar code reading & introducing system. Module is then precisely positioned & a contacting device links connectors to measuring system. A sun simulation device allows modules characteristics evaluation. A qualification label is then printed & automatically deposed on module. An evacuation device extracts module from this station.

C. Technical characteristics:

1. Typical automatic stations cycle time is 4mn per 6x10 cells module.

2. Setting time:
    - Module dimension change: according to changes to do (module configuration, cells size).
    - Cells dimension change: according to cells size changes amplitude.

3. Necessary maximal feeding time:
    - Copper ribbon drum changing: about 1 min
    - Cells stacks changing: about 5 min
    - Module sheet loading: about 30 s (without automatic loading station)
    - Neutral gas tank replacement: according to customer facilities.

4. Necessary unloading maximal time:
    - Module unloading: about 1 min

5. Basic components characteristics:

1.1. Cells:

Nominal dimensions: 150 x 150 mm or 156 x 156 mm (for other dimensions, 125 x 125 mm minimum, a line layout recombination study can be done under request).
Used cells dimension tolerances:

- Cells 150 x 150 mm: ±0,5 mm
- Cells 156 x 156 mm: ±0,5 mm

Thickness: 160 to 240 µm
Bus bars number: 2
Distance between busbars & cell edge:

- Size 150 x 150: 36,5 mm ± 0,5 mm
- Size 156 x 156: 39,5 mm ± 0,5 mm

Distance between busbars:

- Size 150 x 150: 75 mm ± 0,5 mm
- Size 156 x 156: 75 mm ± 0,5 mm

Storing mode: manually stacked into magazine-boxes.

- Typical consumption: 900 per hour for 60 cells modules manufacturing (Module 6X10)
- Feeding conveyor capacity: 2 x 6 boxes (height 50 mm = about 250 cells)
- Operation time without feeding: about 3 hours (with 200 µm thickness cells)

1.2. Contact ribbons:

Dimensions: width 2mm by thickness 0.2mm
Material: annealed copper
Delivery mode: drums:

- Diameter 150 to 180 mm
- Width 110 to 120 mm
- Maximal drums weight: 10 kg
- Maximal drums lenght: approximately 1400 m
- Consumption per derolling system (1 drum): 57,5 m per hour
- Operation time without feeding: 24 hours
- Number of drums simultaneously in use : 12

1.3. Busbars:

Dimensions: Width 3mm by thickness 0.5mm
Material: annealed copper
Delivery mode: drums manually placed into derolling systems
Drums delivery mode:

- Diameter 150 to 180 mm
- Width 110 to 120 mm
- Maximal drums weight: 10 kg
- Maximal drums lenght: approximately 800 m
- Consumption per derolling system : 32 m per hour
- Operation time without feeding: 25 hours
- Number of drums simultaneously in use: 1

1.4. Output ribbons:

Dimensions: Width 5mm by thickness 0.2mm
Material: annealed copper
Delivery mode drums:

- Diameter 150 to 180 mm
- Width 110 to 120 mm
- Maximal drums weight: 10kg
- Maximal drums lenght: approximately 700 m
- Consumption per derolling system: 2,25 m per hour
- Operation time without feeding: 311 hours
- Number of drums simultaneously in use: 1

1.5. Glue – peripheral sealing joint (PIB):

Type: poly-isobutylene Helioseal PVS 101 - KOMMERLING
Delivery mode: interchangeable barrel 200 Kg

- Consumption: 0,7 L per hour
- Operation time without feeding: 200 hours

1.6. Mechanical sealing product:

Type: silicone mono-component – Helioseal PVS 210 - KOMMERLING
Delivery mode: barrel 20L, simultaneously in use: 4

- Consumption: 0,25 L per hour
- Operation time without feeding : 320 hours

1.7. Neutral gas (customer providing):

Maximal necessary flow: 120 liters / second
Nominal consumption: 30m^3 / hour
Delivery mode: cylinder, removable tank or generation station

1.8. Front & rear glass sheets:

Dimensions:

- Maximal width: 1984 mm -/+1.5 mm (module 6x12 C156)
- Maximal height: 990 mm -/+1.5 mm (module 6x12 C156)
- Minimal width: 1606 mm -/+1.5 mm (module 6x10 C150)
- Minimal height: 954 mm -/+1.5 mm (module 6x10 C150)
- Thickness (float glass): 3,0 mm ± 0,05 mm

Material: tempered ultra white glass
Delivery mode: horizontal stacking with maximum 100 sheets &interlayers.
Glass maximal weight: 15 kg

1.9. Glue – wafer and contacts (PIB):

Type: poly-isobutylene Helioseal PVS 101 - KOMMERLING
Delivery mode: interchangeable barrel 200 Kg

- Consumption: 0,3 L per hour
- Operation time without feeding: 500 hours

6. Products components characteristics:

6.1. Module:

Dimensions: Module 6x12 cells 156m maximum
Module 6x10 cells 150 minimum (for other dimensions, module 6x5 cells 150 minimum, a line layout recombination study can be done under request).
Line module manufacturing size is fixed at order.
Packing mode: horizontally stacked on pallets separated by interlayers.
Module maximal single weight: to be defined after module size definition.
Module dimension tolerances: ± 2 mm

6.2. Line dimension:

Operation lenght: to be defined according to ordered options (50m mini)
Operation width: to be defined according to ordered options (13m mini)
Operation height: 3500mm

6.3. Network supply:

Supply voltage: 400 V
Supply frequency: 50 Hz
Maximal power: 500KVA installed, hourly consumption less than 110 KW
Maximal electric consumption: to be defined according to ordered options
Air pressure: 5 to 8 bars
Maximal air flow: less than 600 m3/h
Water pressure: 1.5 to 3 bars

D. Comparison Conventional Module vs NICE