1. MODEL

TN-500IP Fully Automatic Screen Printing Machine
for boards size of 600 x 600mm
(Right to Left Flow Direction)

2. QUANTITY

Total one (1) set

3. CONFIGURATION

3-1 Automatic Screen Printing Section
3-2 Automatic Alignment Section

4. MANUFACTURING LIMITS

4-1. Manufacturing, testing and adjustment of Automatic Screen Printing Machine
Model TN-500IP.

4-2. Accessories

<table>
<thead>
<tr>
<th>Item</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Squeegee</td>
<td>L=400, 550 and 660mm each 1 pc.</td>
</tr>
<tr>
<td>Scraper plate</td>
<td>L=400, 550 and 660mm each 1 pc.</td>
</tr>
<tr>
<td></td>
<td>(effective length)</td>
</tr>
<tr>
<td>Scoop plate</td>
<td>L=420, 570 and 680mm each 1 pc.</td>
</tr>
<tr>
<td></td>
<td>(effective length)</td>
</tr>
<tr>
<td>Grease and grease gun</td>
<td>1 set</td>
</tr>
<tr>
<td>Halogen lamp</td>
<td>2 pcs.</td>
</tr>
</tbody>
</table>

4-3. Spare Parts

As per attached Spare Parts List

4-4. Installation

Construction of installation site, electric power supply, air supply and
connections are provided by yourself.
5. SPECIFICATIONS

5-1 Automatic Screen Printing Section

1) Boards

Material: Rigid printed circuit boards
Dimensions: Printing direction ... 250 - 800mm
: Plow direction ....... 250 - 600mm
Thickness: 0.8 - 2.0mm
: 0.3 - 2.0mm (FLEX mode)

2) Screen Frame

Outer frame dimensions: (W) 750 - 1000mm
 : (D) 750 - 1100mm
 : (H) 30 - 50mm
Frame setting: Front ...... clamps
 : Rear ...... air clamps
Frame up/down: 30mm
Frame up/down repeatability: Within ±0.02mm
Screen separation: 0 - 15mm (from rear side)
Screen gap: 0 - 7mm (with 1/10 div. indication)
Frame cleaning: Approx. 560mm from printing table
Cleaning safety: Tape/beam sensors

3) Squeegee

Drive method: DC Motor (analog servo)
Stroke: 0 - 740mm
Speed: 0 - 600mm/sec.
Speed Display: .□□□□ m/sec.
Squeegee angle: 60 - 80 degree
Squeegee pressure: 30mm (with 1/10 div. indication)
Mounting adjustment range: 0 - 140mm (at squeegee angle of 70°)
Squeegee bias angle: 0 - ±15 degree
Delay timer: 0 - 5sec.
Length: 400, 550, 660mm
Thickness: 9 - 10mm
Height: 35 - 55mm
Squeegee hardness: 70 degree

4) Scraper

Speed: 0 - 800mm/sec.
Up/down adjustment range: 10mm
Front/back adjustment range: 0 - 70mm
Material: SUS303
Effective length: 400, 550, 660mm
Thickness: 1.5mm
5) Printing table

<table>
<thead>
<tr>
<th>Dimensions</th>
<th>640 - 660(W) x 900(D) mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Materials</td>
<td>Aluminum table and rubber sheet</td>
</tr>
<tr>
<td>Rubber sheet</td>
<td>Nitoryle rubber</td>
</tr>
<tr>
<td>Hardness</td>
<td>More than 70HS</td>
</tr>
<tr>
<td>Suction holes</td>
<td>2.5mm dia.</td>
</tr>
<tr>
<td>Thickness</td>
<td>1.5mm</td>
</tr>
<tr>
<td>Flatness</td>
<td>±0.1mm (within printing area) (Incl. squeegee perpendicularity)</td>
</tr>
<tr>
<td>Board mounting method</td>
<td>Vacuum suction</td>
</tr>
<tr>
<td>Suction holes pitch</td>
<td>Vacation</td>
</tr>
</tbody>
</table>

Flow direction

<table>
<thead>
<tr>
<th>0mm fixed</th>
<th>130 - 150 mm variable</th>
<th>160 - 180 mm variable</th>
</tr>
</thead>
<tbody>
<tr>
<td>220 - 240</td>
<td>250 - 270</td>
<td></td>
</tr>
<tr>
<td>280 - 300</td>
<td>310 - 330</td>
<td></td>
</tr>
<tr>
<td>340 - 360</td>
<td>370 - 390</td>
<td></td>
</tr>
<tr>
<td>400 - 420</td>
<td>430 - 450</td>
<td></td>
</tr>
<tr>
<td>460 - 480</td>
<td>490 - 510</td>
<td></td>
</tr>
<tr>
<td>520 - 540</td>
<td>550 - 570</td>
<td></td>
</tr>
<tr>
<td>580 - 600</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Printing direction

<table>
<thead>
<tr>
<th>91mm fixed</th>
<th>212, 242 mm fixed</th>
<th>262, 282 mm fixed</th>
</tr>
</thead>
<tbody>
<tr>
<td>302, 328</td>
<td>362, 392</td>
<td></td>
</tr>
<tr>
<td>422, 456</td>
<td>492, 520</td>
<td></td>
</tr>
<tr>
<td>550, 580</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* 91mm is distance on front side of printing table from center of carrier table, and it is provided on the front table only.

6) Carrier stage

<table>
<thead>
<tr>
<th>Drive method</th>
<th>DC motor (digital servo)</th>
</tr>
</thead>
<tbody>
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<td>Dimensions</td>
<td>640 - 660(W) x 130(D) mm</td>
</tr>
<tr>
<td>Materials</td>
<td>Aluminum table and rubber sheet</td>
</tr>
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<td>Rubber sheet</td>
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<td>Hardness</td>
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</tr>
<tr>
<td>Suction holes pitch</td>
<td>2.5mm dia.</td>
</tr>
</tbody>
</table>
Suction holes pitch:

Flow direction

0mm fixed
130 - 150mm variable 180 - 180 variable
220 - 240 " 250 - 270 "
280 - 300 " 310 - 330 "
340 - 360 " 370 - 390 "
400 - 420 " 430 - 450 "
460 - 480 " 490 - 510 "
520 - 540 " 550 - 570 "
580 - 600 "

Printing direction

0, 20mm fixed
40, 60 "
80 "

Transport accuracy : ± 0.005mm

7) Feed-in conveyor
Belt speed : 3.5 - 42m/min.

8) Feed-out conveyor
Belt speed : 3 - 36m/min.

5-2 Automatic Alignment Section

5-2-1 Position control unit

1) Model
TN-115

2) Controls of alignment table

Alignment & home point (0 point) movement

3) Measurement

Area of mark, upper/down limits of area judgement & center of gravity of mark

4) Automatic learning

Illumination, contrast, threshold value, reference marks, camera magnification & table theta angle
5-2-2 CCD video camera

Model : TN-043 & TN-072
Number of pixel : 510(H) x 492(V)
Size of pixel : 12.2μ(H) x 9.4μ(V)
Pied of view : 9(H) x 7(V)mm - 7(H) x 5(V)mm
Illumination system : Optical fiber, ring illumination
Light source : TN-060 halogen lamp 12V 50W

5-2-3 Alignment table

1) XY θ table

Model : TN-211
Drive system : X, Y, Theta, 3-axis pulse motor control
Alignment resolution : 0.0025mm/pulse
Travels : X & Y .... ±5mm, Theta .... ±1.0 degree

2) Alignment table

Board holder : Urethane foot clamps with warp-proof mechanism
Material : Aluminum, Alumite finish
Rough positioning method : Corners guide
X, Y pushers : 30mm stroke
Adjustment : Max. 15mm
Accuracy : ±0.05mm

Alignment repeatability : Within ±0.01mm
Alignment time : Approx. 1.0 sec. (for X, Y=1mm, Theta=0°)

5-3 Printing Capacity

Max. 600 boards/hour (at 1 sec. alignment and 1 sec. printing)

5-4 Flow-line height

Input : 945mm from floor level
Output : 935mm from floor level
Adjustment range : ±25mm

5-5 Flow Line Direction : Right to left

5-6 Alarm Light : Yellow

5-7 Required Air Supply

Air pressure : 5Kg/cm²
Air consumption : 150NL/min.
Intake connector : 30SH coupler (hose 8mm dia.)
5-8 Power Requirement : 3 phase AC 200V ±10%, 4KW

5-9 Operational Conditions

- Temperature : 5 - 40 centigrade
- Humidity : Less than 85%

5-10 Outer Dimensions : 2920(W) X 1490(D) X 1585(H)mm

5-11 Weight : 2000Kgs

5-12 Color : Sky blue (Japan Paint Society NO. 746)

6. OTHER CONDITIONS

Scoop unit to be supplied.

Scoop plate : L=420, 570 and 680mm each 1 pc. (effective length)
: t=1.5mm
7.1 Recommended Board Condition

Center of board

Reference Mark for Solder Resist/Symbol Printing φ1.5mm (range φ1.0 to φ4.0mm) Reference Mark (Hole) for

Mark Pitch

Pattern Dimension B

Suction Holes Pitch C

Board Dimension A 250 - 600mm

Blank Suction

Pattern

Suction Direction

Blank Suction

Area 8mm or more

Remark: 1.5mm dia. of reference marks or holes are recommended in the accepted range of 1.0 - 4.0mm
1) Vacuum-hold blank area

* This area is used to fix the board on the printing table and at least 8mm is required.
* The suction position is fixed on every board size. (Refer to 4).

2) Reference marks (holes)

* The reference mark (holes) should be independently marked or drilled on the center of board. The size of mark (hole) should be within 1 - 4mm dia.
* The CCD camera's field of view is 8mm in X axis (flow direction) and 6mm in Y axis (printing direction).
* The CCD camera's adjustable position range is within ±15mm, thus the reference marks (holes) have to be arranged within the range.

3) Reference marks pitch is 240 - 600mm

4) Relation between size of board and position of suction holes

<table>
<thead>
<tr>
<th>Workpiece</th>
<th>Board size A (mm)</th>
<th>Pattern pitch B (mm)</th>
<th>Suction hole pitch C (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>less than A-16</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>250</td>
<td>more than 250</td>
<td>(up to 232)</td>
<td>220 - 240 variable</td>
</tr>
<tr>
<td>300</td>
<td></td>
<td>288</td>
<td>280 - 300</td>
</tr>
<tr>
<td>330</td>
<td></td>
<td>318</td>
<td>310 - 330</td>
</tr>
<tr>
<td>400</td>
<td></td>
<td>378</td>
<td>370 - 390</td>
</tr>
<tr>
<td>450</td>
<td></td>
<td>438</td>
<td>430 - 450</td>
</tr>
<tr>
<td>500</td>
<td></td>
<td>498</td>
<td>490 - 510</td>
</tr>
<tr>
<td>600</td>
<td></td>
<td>588</td>
<td>580 - 600</td>
</tr>
</tbody>
</table>
7-2 Recommended Stencil for Primary Image Printing

Pattern Center

(below *)

Frame

Printing Direction

(below **)

Frame

Detection Mark for SR

\[ \phi 1.5 \text{mm} \]

Ink

6mm or bigger

Above 6mm

Ref. Mark for Pattern Printing

\[ O/D \phi 3.5 \text{mm} \]

\[ I/D \phi 2.5 \text{mm} \]

Ref. Mark \[ \phi 1.5 \text{mm} \]

Ink

6mm or bigger

Masked with Emulsion

* Pattern should be placed in the center of the screen frame.

* There should not be any patterns except the reference mark in 6 x 6mm square.

* Reference mark for primary printing shall be used for dummy-printing and for print-shift check.
7-3 Recommended Stencil for Solder Resist and Symbol Printing

* Pattern should be placed in the center of the screen frame.

Reference Mark

* There should not be any patterns except the reference mark in 6 x 6mm square.
* Reference mark for primary printing shall be used for dummy-printing and for print-shift check.