General characteristics

Machine series — Etchstar PP, Fine Line

Overall dimensions

Total length:	**4560mm**
Total width:	1990mm
Height:	1300mm
Conveyor height:	950mm±50
Conveyor direction:	**Left to Right**

Transport conveyor

Distance between rollers:	110 - 35 mm
Rollers diameter:	44,5 mm
Shaft diameter:	12 mm
Shaft material:	Carbon fibre

Processing board characteristics

Panel sizes:

Maximum width:	650mm
Maximum length:	1000mm
Minimum width:	150mm
Minimum length:	230mm

Panel thickness:

Minimum board thickness:	0,1mm **4 mils** (total thickness)
Maximum board thickness:	6,5mm **.260”**

NOTE: The panel must not be warped over 3 mm with the bend in the same direction.

Base material:

FR4, PTFE.
Other material to be approved by Wise.

Holes:

Minimum hole size:	--mm
Minimum Blind vias size:	--mm

Aspect Ratio:

PTH:	--:1
Blind vias:	--:1

Process parameters

Solution

Etching solution:	Alkaline

Speed

Working speed:	0,8- 0,9 m/min based on 1Oz copper thick
Conveyor speed adjustable:	from 0,3 to 5,5m/min
Dwell Time Etcher:	50-55 sec.

Consumption

Electrical power supply estimated

400 V 60 Hz three phases, Neutral, Ground. Transformer included

Control voltage:	24 V DC
Total power consumption:	15,00 kW

Rinsing water consumption:

City water approximately:	0,5 m³/hour, main pressure 2 to 3bar
D.I. water approximately:	-- m³/hour, main pressure 2 to 3bar

Cooling capacity

Etcher:	18.000 kcal/h

Cooling water

Maximum temperature:	10 °C
Minimum temperature:	3 °C
Capacity Etcher:	1,8 m³/hour

Compressed air:

Pressure:	6bar, flow rate negligible.

Exhaust:

Exhaust Etching:	Min-Max flow rate 100 - 200 m^3/hour
Exhaust Etching with doors open:	Min-Max flow rate 500 - 800 m^3/hour
Pressure:	from 20 to 50 mmH_2O

Process Outline

Step	Process	Material	Module length mm	Effective length mm	Dwell time sec	Work Temp. °C	Power kW	Exhaust m³/h
1	Input Conveyor w. exhaust	PP/Ti	770	550			0,35	50-100
2	Main Etching Module	PP/Ti	1130	900	50-55	48-50	11,00	500-800
3	Etching Compensation module	PP/Ti	440	220		48-50	1,10	50-80
4	Cascade Replenish Module	PP/Ti	660	3X110		RT	0,30	
5	Cascade Rinse Module	PP/Ti	660	3X110		RT	2,25	
6	Exit Conveyor	PP/PP	330	330				
7	Sliding Plate	PP/PP	570	700				
8								
9								
10								
Total			**4560**				**15,00**	**600-980**

A2 Stainless Steel AISI304 construction
A4 Stainless Steel AISI316 construction
PP Polypropylene construction
Ti Titanium construction
RT Room temperature

The dwell time can be adjusted by the line speed and depend of the chemistry solution, temperature and concentration. Please refer to the data sheets of the chemical supplier for dwell time and proof the recommended process time.
Wise cannot provide guarantee for chemical processing and for different application.

Features

1. **Adjustable conveyor speed by means of inverter driven AC motors and user friendly digital touch screen display. Display visualisation in English, German or Local Language whenever available.**

2. **Modification or exclusion of all start up modes.**

3. **External electrical console with PLC Siemens S7 and Touch screen Siemens display operator interface, allows to:**
   Preheating timer.
   Cascading start of all pumps activated by input sensor.
   PLC display minimum-maximum temperature control with alarms.
   Modification or exclusion of all start up modes.
   Main switch.
   Emergency stop.
   General error signal by visual and acoustic.
   Automatic start and stop button for the line.
   Selection of aggregates.
   Operating hour counter.
   Panel counter.
   Start-stop of the line by function keys.
   Stand-by system for automatic economic stop in production break time.
   Display and regulation of conveyor speed.
   Alarms with present and memorization of historical alarm with reference.
   Automatic and manual control of all motors, pumps and valves.
   Free electrical contact for the connection of automatic loader.
   Certain function is available only with the introduction of special key pass.
   20% free space is considered.

One copy of Electrical schematic manual inside the Electrical Cabinet

One copy of PLC programme inside the Electrical cabinet

Etching machine

1. **The Etcher machine has a self supporting structure totally constructed in Polypropylene with 20mm Polypropylene sheet for pump support. The module is installed on a painted steel frame.**

2. **Transparent side windows with double seals to avoid leakages and safety interlocks for easy access and maintenance.**

3. **Low preventive maintenance downtime due to one step quick disconnect parts.**

4. **Conveyor system driven by internal torque bar and conical gears. Safety torque couple clutch installed to avoid damage in case of board jam.**

5. **Wheel rollers in the entry conveyor and in the spray sections, carbon fibre shaft with polypropylene rollers at inlet and outlet of the chambers to minimise drag-out.**

6. **All sump bottoms are sloped to facilitate empting and cleaning operations. Each sump is connected to a drain pump through a valve, thus allowing selective emptying of all fluids.**

7. **Opalescent back side tank for visual control of solution level.**

8. **All filter housings are installed outside of the machine body to give the possibility to check and easily remove the cartridges.**

9. **Polypropylene catch filter with titanium net underneath lower spray manifolds in the chemical sections.**

10. **Valves and pressure gauges on pump outlets to upper and lower spray manifolds allows for selective pressure regulation in chemical section.**

11. **Upper spray pipes are parallel to the direction of board transportation for more precise etching capability.**

12. **The upper and lower spray manifolds can be easily removed from the side of the machine and repositioned after cleaning and maintenance operations. A catch solution polypropylene tray is supplied to avoid the solution will fall down on the floor.**

13. **Reduce fresh water consumption with automatic stand-by mode when production breaks.**

14. **Modular design to adopt additional modules in case of new production requirements.**

15. **Automatic pressure regulation, recirculation and filtration devices and other features are available as options, for more complex processing line.**

16. **Various materials are used for the best compatibility with chemistry, temperature and process needs. They include but are not confined to; AISI 304, AISI 316, glass, PVDF, Teflon®, PP, neutral PP EPDM, Viton®.**

17. **All modules equipped with security switches which shut down the machine if triggered.**

Process capability of WISE Etching machines 1 Pump with INTERMITTENT SPRAY MODULE 2 upper spray bars, utilising alkaline etching solution

The below listed results have been obtained by utilising 610 x 450 mm trial panels, having the following machine settings, carried out by our engineers:

- **Temperature:** **48 °C ± 1 °C**
- **Density:** **135-140 gr/l**
- **PH:** **8,0-8,2**
- **Pressures:** **Top Spray 2,6 bar;**
  Bottom Spray 2,0 bar approx.

30 µ width lines on 17,5 µ copper thickness: ± 2 µ
50 µ width lines on 17,5 µ copper thickness: ± 3 µ
75 µ width lines on 17,5 µ copper thickness: ± 5 µ
100 µ width lines on 35µ copper thickness: ± 8 µ

In order to further verify the etching uniformity, one more test was performed consisting in partial etching of the copper surface of 50% of a 610 x 450mm panel, with 35µ copper thickness. Copper residual reading was carried out on 77 spots of the panel, on both top and bottom side, by means of a Fischer x-ray instrument and results are as follows:.

Top side tolerance:± 3µ
Bottom side tolerance:± 2µ

Please note that the above tolerance figures do not consider the initial tolerance of the basic material utilised for the trial.

Technical description

001–Separate electrical console lectern type

The separate electrical control cabinet includes 10 meters of connection cable. The dimensions of the cabinet may vary in relation of the configuration line.

005–Traffic light for machine visual status

A three colour traffic light advises the machine status operation.

EPC–Etchstar 1 pump Fine Line – 650

Modular machine for alkaline etching solution in the manufacture of printed circuit boards. **This special version is dedicated to produce Fine Line circuitry.**

The modular design offers the possibility to install additional etching or rinsing modules for more complex processing lines to meet all production requirements.

Input conveyor

Gear reduction unit with electrical conveyor motor.

Free loading length: 550 mm.

Board sensors.

Exhaust chamber

Connection for air exhaust duct.

Two couple of squeegee rollers and catch tray.

The speed can be adjusted independently through the inverter.

Etching chamber

Transparent side windows with double seals to avoid leakages and safety interlocks for easy access and maintenance.

The whole transport system is also easily accessed from this side of the machine. This means less downtime for preventive maintenance and more guaranteed production time.

Upper spray manifold has Fourteen spray bars running almost parallel to the direction of the transport.

Lower spray manifold has Six spray bars running transversal to the direction of transport.

Upper and lower spray manifolds are mounted on guides. They can be easily removed for maintenance purposes from the side of the machine without removing the transport conveyor rollers. A catch solution polypropylene tray is supplied to avoid the solution will fall down on the floor.

Polypropylene catch filter with titanium net underneath lower spray manifolds.

One 4 kW vertical pump with self-draining safety filter housing with 200 µm cartridge filter; safety switches, to prevent the pump re-start and alarm when cartridge filter is not right positioned or the cover filter it is not close correctly. Finer grades of filtration are available upon request.

Quick disconnect fan-shape jet nozzles are straight to the panel surface.

Spray pressure roughly up to 3,5 bar.

Independent analogue pressure control for each upper and lower manifolds.

Two 3,5 kW hard ceramic heaters. The heaters can be removed without emptying the tank.

One titanium cooling coil controlled by solenoid valve.

Temperature control by thermostat; with alarm and shut-off in case of overheating.

Minimum level control and alarm for heaters and pump protection.

Connection for air exhaust duct at inlet and on the roof.

Waste solution is evacuated by a dedicated waste pump.

The drain system is through the waste pump.

Tank capacity: 450 litres approx.

NOTE: Sump capacity will be reduce approx.. to 350 litres.

One couple of squeegee rollers to minimize drag out to the following station.

209–Digital densimeter for Etching machine

The digital densimeter is specifically designed whenever a very accurate controlled bath is required.

It works on g/litre of solution and maintains the same within a range of ±1 g/l.

The tank has a constant level solution, through a by-pass drawn on the delivery pump that feeds the machine spray pipes; the flow is regulated by valve.

The controller changes the position in relation to the specific weight of the bath and is verified by sensor. The same sensor sends a proportional signal to the PLC which converts it into a value. This value is visualized on operator interface display. The inflow is even controlled by the same sensor for a constant density level.

Density Range	from 1000 to 1400 g/l
Hysteresis	40 g/l
Accuracy	± 1 g/l

312–Manual flow adjustment valves for longitudinal spray etch manifold

The second set of spray bars in the Etching module 2 pumps as well the first in the Etching module 1 pump run parallel to the direction of the transport.

This device is based on a manual regulation flow valve, for seven couple of pipes, in the upper spray manifold.

A manual valve is installed on each couple of spray pipes for setting the correct flow-rate.

This system permits to set different flow pressure over the total width of the panel, in order to achieve uniform etch on the panel surface and compensate the typical puddling effect that generally appears on the upper side of the panels.

650–Intermittent spray module 1 pump

Chemical spray module utilised at the end of the etching machine, to compensate the puddling effect that generally appears on the upper side of the panels.

The encoder connected to the PLC of the Etchstar gives a signal to detect the position of the boards at any time inside the etching chamber.

Two upper spray pipes are installed transversally to the conveyor direction, and equipped with on-off valves to intercept the incoming etching solution.

The spray pipes automatically work ON – OFF on the panel, over a pre-set area previously determined by the operator, through the display interface operator.

Two “buffer cylinders” fitted at the input of the spray pipes compensate the “hammer effect” and keep constant the pressure when the valves switch on and off.

At the end of the etching process this system can compensate the potential thickness differences remained over the panel with extreme accuracy and improving the etching uniformity.

This function is possible due to a PLC selectivity control of the four spray pipes.

Squeegee rollers at inlet.

One 1,1 kW vertical immersion pump with 200 micron PVC quick dismantle filter at outlets. Finer grades of filtration are available upon request. The pump is installed in the tank of the etching machine.

Four upper bayonet spray bar with quick disconnect fan-shape bayonet nozzles.

Exact repositioning of the spray pipes after cleaning and maintenance operations.

Quick disconnect fan-shape nozzles type, made in PP with insert in PVDF material. This solution, allow the replacement of the insert only, reducing the maintenance cost.

Spray pressure roughly 2,5 bar.

One Analogue pressure gauge

Squeegee rollers at outlet to minimize the drag out to the following station.

Internal spray safety transparent glass covers.

629–Replenish module 3 pumps, 3 chambers.

Replenish module for the fabrication of printed circuit boards.

This module is suited for reducing the contamination in the rinse section and replenishing the etching chamber with fresh solution.

Modular design for additional modules in case of new production requirements.

The module has self supporting structure totally constructed in Polypropylene.

Opalescent back side tank for visual control of solution level.

All the shafts are made in carbon fibre 12mm diameter.

Conveyor system driven by torque bar and conical gear.

Connection for air exhaust duct.

First replenish chamber.

Squeegee rollers at inlet.

One magnetic drive pump 0,10 kW.

Filter on pump outlet for nozzles protection.

One upper bayonet spray bar with quick disconnect fan-shape bayonet nozzles.

One lower bayonet spray bar with quick disconnect fan-shape bayonet nozzles.

The upper spray pipes can be removed from the top and lower spray pipes can be easily removed from the side of the machine and exact repositioned after cleaning and maintenance operations.

Spray pressure roughly 0,2 bar.

Analogue pressure gauge for upper and lower manifolds.

Internal spray safety transparent cover.

Tank capacity: 35 litres approximately.

The replenishing solution is re-circulated in a closed loop and is renewed with solution coming in cascade from the following section. The solution in excess overflows to the etching chamber.

Squeegee rollers at outlet to minimize the drag out to the following station.

Second replenish chamber.

Squeegee rollers at inlet.

One magnetic drive pump 0,10 kW.

Filter on pump outlet for nozzles protection.

One upper bayonet spray bar with quick disconnect fan-shape bayonet nozzles.

One lower bayonet spray bar with quick disconnect fan-shape bayonet nozzles.

The upper spray pipes can be removed from the top and lower spray pipes can be easily removed from the side of the machine and exact repositioned after cleaning and maintenance operations.

Spray pressure roughly 0,2 bar.

Analogue pressure gauge for upper and lower manifolds.

Internal spray safety transparent cover.

Tank capacity: 35 litres approximately.

The replenishing solution is re-circulated in a closed loop and is renewed with solution coming in cascade from the following section. The solution in excess overflows to following replenish chamber.

Squeegee rollers at outlet to minimize the drag out to the following station.

Third replenish chamber.

Squeegee rollers at inlet.

One magnetic drive pump 0,10 kW.

Filter on pump outlet for nozzles protection.

One upper bayonet spray bar with quick disconnect fan-shape bayonet nozzles.

One lower bayonet spray bar with quick disconnect fan-shape bayonet nozzles.

The upper spray pipes can be removed from the top and lower spray pipes can be easily removed from the side of the machine and exact repositioned after cleaning and maintenance operations.

Spray pressure roughly 0,2 bar.

Analogue pressure gauge for upper and lower manifolds.

Internal spray safety transparent cover.

Tank capacity: 50 litres approximately.

The replenishing solution is re-circulated in a closed loop and is renewed with fresh solution. The solution in excess overflows to following replenish chamber.

The fresh solution consumption can be controlled by a density meter and dosed by a dosing pump.

The same pump feeds the last replenish chamber as well as the main etching chamber for effective usage.

Squeegee rollers at outlet to minimize the drag out to the following station.

632–Rinse module 3 pumps, 3 chambers, L=660

Modular rinse module for the fabrication of printed circuit boards.

Modular design for additional modules in case of new production requirements.

The module has self supporting structure totally constructed in Polypropylene.

Opalescent back side tank for visual control of water level.

All the shafts are made in carbon fibre 12mm diameter.

Conveyor system driven by torque bar and conical gear.

Connection for air exhaust duct.

First rinsing chamber

Squeegee rollers at inlet to minimize the drag out from the following station.

One vertical immersion pump 0,75 kW.

One PVC upper quick disconnect bayonet spray bars.

One PVC lower quick disconnect bayonet spray bars.

The upper spray pipes can be removed from the top and lower spray pipes can be easily removed from the side of the machine and exact repositioned after cleaning and maintenance operations.

Quick disconnect fan-shape nozzles type, made in PP with insert in PVDF material. This solution, allow the replacement of the insert only, reducing the maintenance cost.

Spray pressure roughly 1,5 bar.

Analogue pressure gauge for upper and lower manifolds.

Manual valves to set up the pressure for top and bottom pipes

Transparent cartridge filter 150 micron on pump outlet, located in front the operator for visual control.

Squeegee rollers at outlet to minimize the drag out to the following station.

Internal spray safety transparent cover.

Tank capacity: 50 litres approximately.

The rinse water is re-circulated in a closed loop and is renewed with water coming in cascade from the following section. Water in excess is evacuated for overflow.

Second rinsing chamber

Squeegee rollers at inlet to minimize the drag out from the following station.

One vertical immersion pump 0,75 kW.

One PVC upper quick disconnect bayonet spray bars.

One PVC lower quick disconnect bayonet spray bars.

The upper spray pipes can be removed from the top and lower spray pipes can be easily removed from the side of the machine and exact repositioned after cleaning and maintenance operations.

Quick disconnect fan-shape nozzles type, made in PP with insert in PVDF material. This solution, allow the replacement of the insert only, reducing the maintenance cost.

Spray pressure roughly 1,5 bar.

Analogue pressure gauge for upper and lower manifolds.

Manual valves to set up the pressure for top and bottom pipes

Transparent cartridge filter 150 micron on pump outlet, located in front the operator for visual control.

Squeegee rollers at outlet to minimize the drag out to the following station.

Internal spray safety transparent cover.

Tank capacity: 55 litres approximately.

The rinse water is re-circulated in a closed loop and is renewed with water coming in cascade from the following section.

This water cascades backwards into the next rinsing tanks.

Third rinsing chamber

Squeegee rollers at inlet to minimize the drag out from the following station.

One vertical immersion pump 0,75 kW.

One PVC upper quick disconnect bayonet spray bars.

One PVC lower quick disconnect bayonet spray bars.

The upper spray pipes can be removed from the top and lower spray pipes can be easily removed from the side of the machine and exact repositioned after cleaning and maintenance operations.

Quick disconnect fan-shape nozzles type, made in PP with insert in PVDF material. This solution, allow the replacement of the insert only, reducing the maintenance cost.

Spray pressure roughly 1,5 bar.

Analogue pressure gauge for upper and lower manifolds.

Manual valves to set up the pressure for top and bottom pipes

Transparent cartridge filter 150 micron on pump outlet, located in front the operator for visual control.

Squeegee rollers at outlet to minimize the drag out to the following station.

Internal spray safety transparent cover.

Tank capacity: 75 litres approximately.

The water consumption is controlled by a solenoid valve and flow meter connected to the board sensor on input conveyor for effective usage.

This water cascades backwards into the next rinsing tanks.

Squeegee rollers at outlet to minimize the drag out to the following station.

403–Exit conveyor in PP

The option consists in a section of 330mm standard length conveyor for free unloading.

***– Polypro Sliding Plate

Sliding plate made in Polypropylene installed at the outlet of the rinse module to collect panels. The sliding plate will have three side frame of 50 mm thickness and two legs to support it.

420–Flexible conveyor system for linear meter

Plastic guide system for processing thin boards.