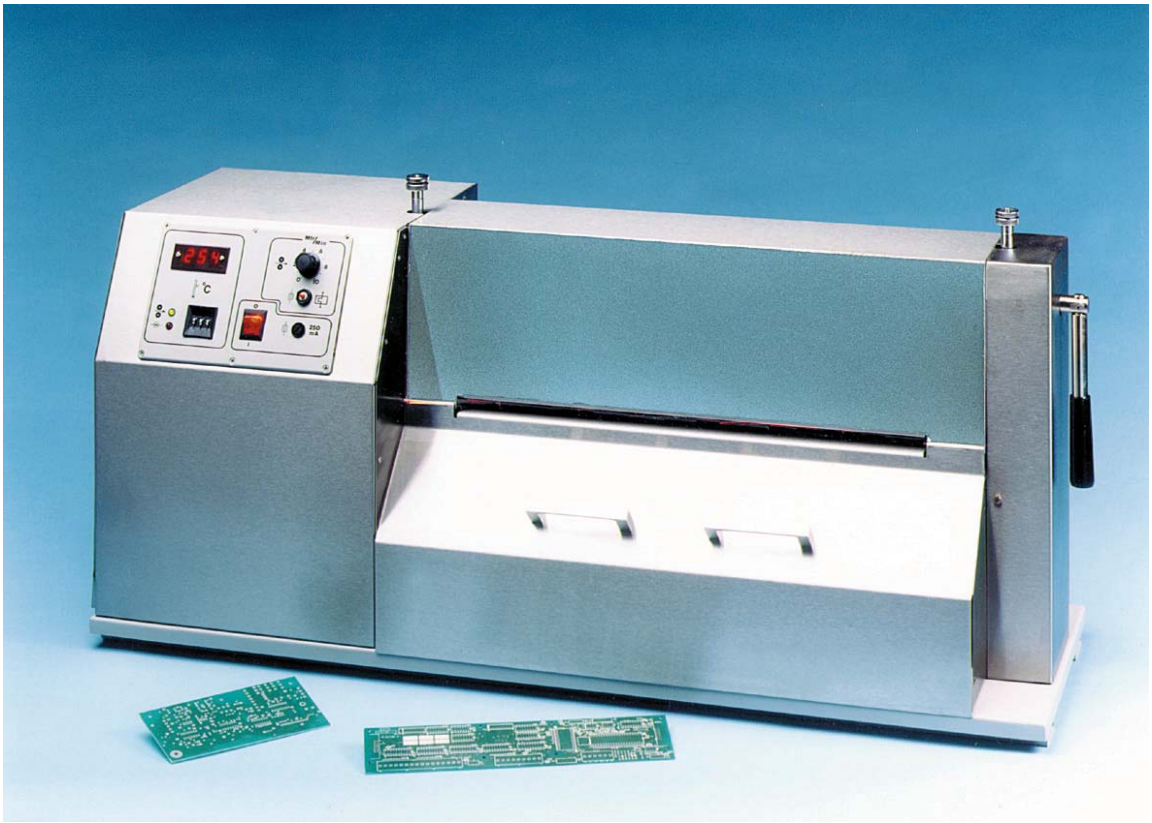
Roller Tinning Machines



Operating Instructions

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Operating Instructions

The 305 bench mounting Roller Tinning Machine has been designed for use by all producers of high quality printed circuit boards. Only components of proven reliability are used in it's construction and great attention has been paid to their positioning to ensure that they are fully protected from corrosive flux. There is no direct heat path from the solder tank to other parts of the machine, therefore heat transfer to neighbouring components is minimal.

The tank is constructed from high grade stainless steel, suspended from a linkage mechanism which allows it to be easily lowered from the coating roller for trouble-free maintenance and heater replacement. The solder tank has two externally mounted 1200 Watt heaters, which give a very fast heat up time. The operating temperature is electronically controlled via a thermocouple probe mounted at the centre of the tank. The tank has two wide scrapers in contact with the ends of the coating roller to ensure that the salts are contained at the trailing side of the roller.

The sealed electronic control module contains many unique systems: digital temperature display, thumbwheel temperature setting and motor/temperature interlock to prevent the motor being switched on, while solder is solid. One heater automatically switches off when the required temperature is reached to reduce the power load, leaving one heater to maintain the set temperature. The control module compartment, which contains the motor and the electronic assembly, is fan cooled so that no over-heating can occur.

The two rollers, which rotate in maintenance free bearings, are driven from a variable speed motor by chain drive to eliminate heat transfer.

The bottom roller is constructed of steel with a fibre glass core and is supplied pre-tinned. The top pressure roller is coated with silicone rubber to equalise the pressure over the total board area.

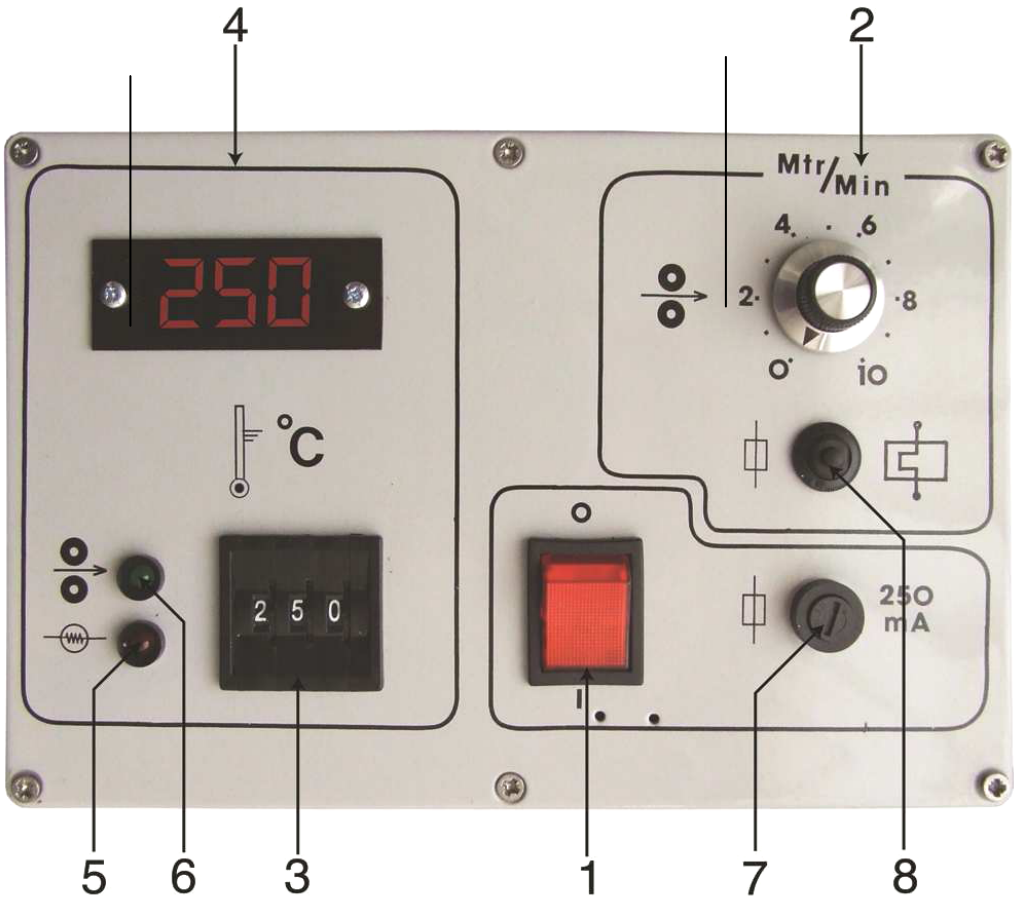
The top pressure roller can be raised and lowered by a single lever eccentric mechanism with two separate adjusting screws: this enables the roller to be returned to the preset position without the need for resetting. The top roller is also spring loaded to allow a thicker board than intended to feed through the two rollers without causing damage.

The machine is fitted with all stainless steel covers which provide complete protection for the operator, but allows quick and easy access to the tank for replenishing salts and solder.

UNPACKING

Unpack the roller tinning machine from the transport case and remove the tank covers, to expose the tank area. Remove the protective cardboard between the tank and the bottom roller. Connect the three heater wires on the tank; blue to blue, yellow to yellow and red to red. Check the thermocouple which is positioned above the entry point of the three wires. to ensure that it is at the bottom of the tank sheath. The tank must also be checked to ensure that it is in position on the raise / lower linkage, two lugs on both sides of the tank locate in the linkage.

The machine now requires a 240 / 220 V supply through a 13 Amp fuse.



1. **On / Off**

2. **Motor on / off switch and speed control**

3. **Temperature selection switch; range 220°C – 299°C**

4. **Temperature display**

5. **Red light: all heaters on, motor will not switch on.**

6. **Green light: motor on.**

7. **Motor overload: 630 mA**

8. **Electronic control unit fuse: 250 mA**

INITIAL STARTING UP PROCEDURE

Remove the covers with handles to expose the solder tank area.

For initial starting, solder grains or small pieces of solder bar are required. The total solder requirement is 12 kg for the 12" (305mm) machine. Place either solder grains or pieces of solder bar (long solder bars can be sawn in half) along the centre line of the tank (i.e. the line running from left to right). Set the Temperature to 250ºC with the thumb wheels (3)

Switch on the machine with the main switch (1). Leave for 2 minutes and then switch off, to allow the heat to conduct through the base. One minute later, switch on again and leave for a further 2 minutes. Repeat this process until the areas of molten solder flow over the whole base. At this point more solder is added, until the required amount as below, but do so slowly, as a fast addition could solidify the molten solder.

NOTE: Care must be taken to avoid splashes when adding the solder and for safety protection gloves and eye glasses must be worn at all times.

When about 10 kilos of solder has been added and the display temperature (4) is at the set temperature (3), Switch the motor on (2) at low speed and allow to run slowly, the roller at this point may start to collect solder when the cold part of the roller meets the hot solder, at this point stop the roller rotating and leave the sold side in the solder for 3-4 mins and then start the roller rotating again, keep repeating until the roller is fully heated. Add more solder to within a maximum of 7mm of the top of the roller side scrapers and about 10mm to the tank top (the level should not be allowed to drop below 20mm of the tank top at any time) Replace the centre top cover and add roller tinning salts to the rear of the tank, sufficient salts must be added to cover the whole area at the rear of the tank. The salts must be added slowly as some initial foaming may occur, but this will subside. The machine must be left rotating slowly at speed 3 or 4 so that the roller can gradually "tin" with solder – this can take a few minutes to 15 mins. Depending on the type of solder used, i.e. leaded solder or lead-free solder.

The machine will be ready for use, after running for a further 5 minutes. The handle on the right of the machine raises and lowers the top rubber pressure roller to eliminate burning of the silicone rubber when no boards are being passed through the roller. Two pairs of knobs on the top of the machine are used to set the gap between the top and bottom rollers. Lower the top roller, using the handle at the right hand side of the machine, to the lowest position and then adjust the gap between both rollers with the knobs on the top. The gap should be adjusted to just below the thickness of the printed circuit board that is being tinned, and the position locked with the lock knobs.

The final setting will be dependant upon tinning results, (see section on tinning practice) once this bas been set, it is possible to raise and lower the top roller, always returning to the

same setting. With gap set and the speed selected (about 5 – 6 metres/min is a general setting) and the Printed Circuit Boards suitably fluxed, the roller tinning process can begin by passing a board from the front to the back of the machine. It may be noted that roller tinning salts have a limited life and should be changed when tinning results deteriorate.

On normal starting up of the machine, from cold, the motor speed control must be **switched off.** It is possible that because of the very fast heat up time, the motor can be switched on by the temperature interlock at 5ºC below the selected temperature, thus leaving small areas of the tank with solid solder, which in turn inhibits the roller rotation. In the event of this happening, the motor will stall and trip the motor overload, this is a safety feature and will not damage the machine and then it will need to be reset.

MAINTENANCE

Although the machine requires little maintenance, the very nature of roller tinning dictates that the machine be cleaned regularly, to ensure good tinning results and a long life. As previously mentioned the salts should be changed regularly and completely removed if the machine is left idle for a long period. The top roller should be cleaned using water or flux and in a severe case a P.C.B. can be used (with the motor off) to remove solder splatters and roller tinning salt lumps. Periodically, when salts are seen to escape from the back to the front of the tank (via the side scrapers) the tank must be lowered and the side scrapers bent inwards to ensure contact with the roller at both ends.

After every 75 hours use, remove end cover and inspect the motor brushes.

TINNING PRACTICE

A P.C.B. can be successfully roller tinned if it has had the required pre-cleaning and fluxing operations. Pre-cleaning can be achieved, either mechanically or chemically; mechanical cleaning can leave a grained surface, but will remove solder resist coatings. Chemical cleaning by either the spray or dip method may be better, but it is essential that the P.C.B. be washed and dried as soon as possible, to stop oxidisation of the copper surface. After cleaning it is necessary to apply flux to prevent oxidisation during roller tinning and to remove the thin layer of oxide formed during the washing and drying. The flux must be readily displaced by the solder as it passes through the machine and it is recommended that it contains an agent that evaporates rapidly. It can be applied by using a brush or lint free cloth, however consistently good results can only be achieved by using a flux application machine. It should be noted that some flux application machines use a heated air drying system and that excessive heat will cause the flux to neutralise.

The top roller pressure is adjusted to give a greater or lesser degree of thermal conductivity between the bottom roller and the copper.

In general the greater the copper density the higher the pressure required, in practice however the difference is small.

Roller speed and the top roller pressure are arrived at by trial and error, the track width and coating thickness determining the setting. However higher speeds and roller pressure generally reduce blips and coating thickness.

FAULTS AND THEIR POSSIBLE CAUSES

(1)	Gritty surface finish	Low solder temperature: Solder contamination.
(2)	Spiky finish	Roller speed too fast: Low temperature.
(3)	Dull surface finish	P.C.B. brushed finish: Solder contamination: P.C.B. not washed after tinning.
(4)	De-lamination of tracks	Rollers not parallel: Solder temperature too high: Top roller pressure too high.
(5)	Large blips	Inadequate top roller pressure: Roller speed too low.
(6)	Patchy de-wetting and incomplete coverage	Bad cleaning of P.C.B. Old flux. Water in holes at fluxing stage Solder contamination: Insufficient fluxing: Roller speed too fast.
(7)	De-wetting	Bad cleaning of P.C.B. Old flux.
(8)	Splatter	Water present in holes: Flux agent contains poor evaporation.
(9)	Discolouration after tinning	Bad cleaning before tinning: Too much flux present: P.C.B. not cleaned in water after tinning.
(10)	Salts transfer to front of tank	Side Scrapers need cleaning and tensioning: Solder level too low
(11)	Poor roller tinning	Salts need changing: Too much flux on P.C.B.

MACHINE BREAKDOWN

Isolate the machine from the mains before fault finding.

(**1**) No drive to both rollers:

Check Motor overload on Control Panel:
Check Motor is running.
Check for breakage in chain link.
Check motor brushes.

(**2**) Slow heat up:

If heating is only on one side of the tank – heater failure.
Check resistance of heater 1200 Watts 240 Volts.

PROTECTIVE GLOVES AND GLASSES MUST BE WORN

Remove both the front and rear covers and also the centre panels from the tank area. With the solder molten remove the stop screw from left side of compartment and lower the tank i.e. pull the tank pivot bar down from a vertical position to a horizontal position.

When the tank is cold, remove thermocouple and disconnect the heater wires.
Slide the tank forward and remove, clean off the cover salts, turn upside down and remove the 4 screws retaining the base and separate. Care must now be taken in removing the insulation material around the heaters. The faulty heater is easily taken out by the screws holding the two clamp bars across the tank, but disconnect the heater wires from the ceramic terminal block before doing so.

Replacement is the reverse of the above procedure.

(**3**) Over heating:

Thermocouple incorrectly located in sheath of the solder tank.

(**4**) No display of lights:

Check the fuse in the plug:
Check 250mA fuse on Control Panel.

SPARES LIST

Electronic panel fuse 250mA
Tank heater
Cooling Fan

OPERATING PROCEDURE

(**1**) Set the thumb wheel on control unit to 255ºC – 265°C or 265°C – 275°C for lead free solder

(**2**) Switch motor speed control OFF (to Zero)

(**3**) Switch on machine via rocker Switch (display should be 20ºC approx.)

(**4**) After 30 minutes the temperature should stabilise at 255ºC - 265ºC or 265ºC - 275ºC for lead free solders (10 – 15 minutes after first reaching this temperature). Rotate the roller slowly so that the cold part of the roller enters the molten solder and switch off the motor. Leave for a few minutes then repeat this procedure until the roller is free to rotate without collecting layers of solid solder either on the surface of the roller or at the ends. If this happens due to being impatient then the side scrapers will be forced away from the roller and the cover salts with migrate to the front and in some cases the side scrapers will be forced too far back and then not be able to return to the side of the roller. In this case the tank needs to be lowered and the side capers bent back inwards so that they make contact with the ends if the roller.

(**5**) Inspect salts at rear of tank and add where necessary to cover all of the exposed area of solder surface.

(**6**) Set gap between bottom and top roller to approx. thickness of circuit board.

(**7**) Flux circuit board and pass through machine at approx. 5 metres/minute not square to the roller axis but at an angle as this minimises the solder blips at the edges of tracks, and if necessary pass through a second time to fully solder circuit board.

Roller tinning with Lead free solders

These lead free solders must have a silver content to reduce the tin spikes and also to give a good reflective shinny surface very similar to lead/tin solder finish as opposed to a slightly dull tin only surface. The amount of silver content is critical and must be between 3.0% - 3.8%. The addition of pure silver has the effect of reducing the spikes, blips and bumps on the surface of the roller tinned circuit board to a minimum, without this addition of silver the circuit board surface would be unacceptable.
The machine should be running at 275 degrees with the covers on the machine in position, without the covers there is high heat loss and is dangerous for the operator, but after about 1 1/2 hours this temperature is able to be lowered to the temperature **10.**
265°C which will still produce good tinning results. This lower temperature will also reduce the smoke vapours associated with the roller tinning salts placed at the back of the solder roller.
It seems that water based fluxes give better tinned results and the circuit boards are cleaned more easily than alcohol based fluxes

Typical Analysis of Lead Free solder with 3.8% Silver

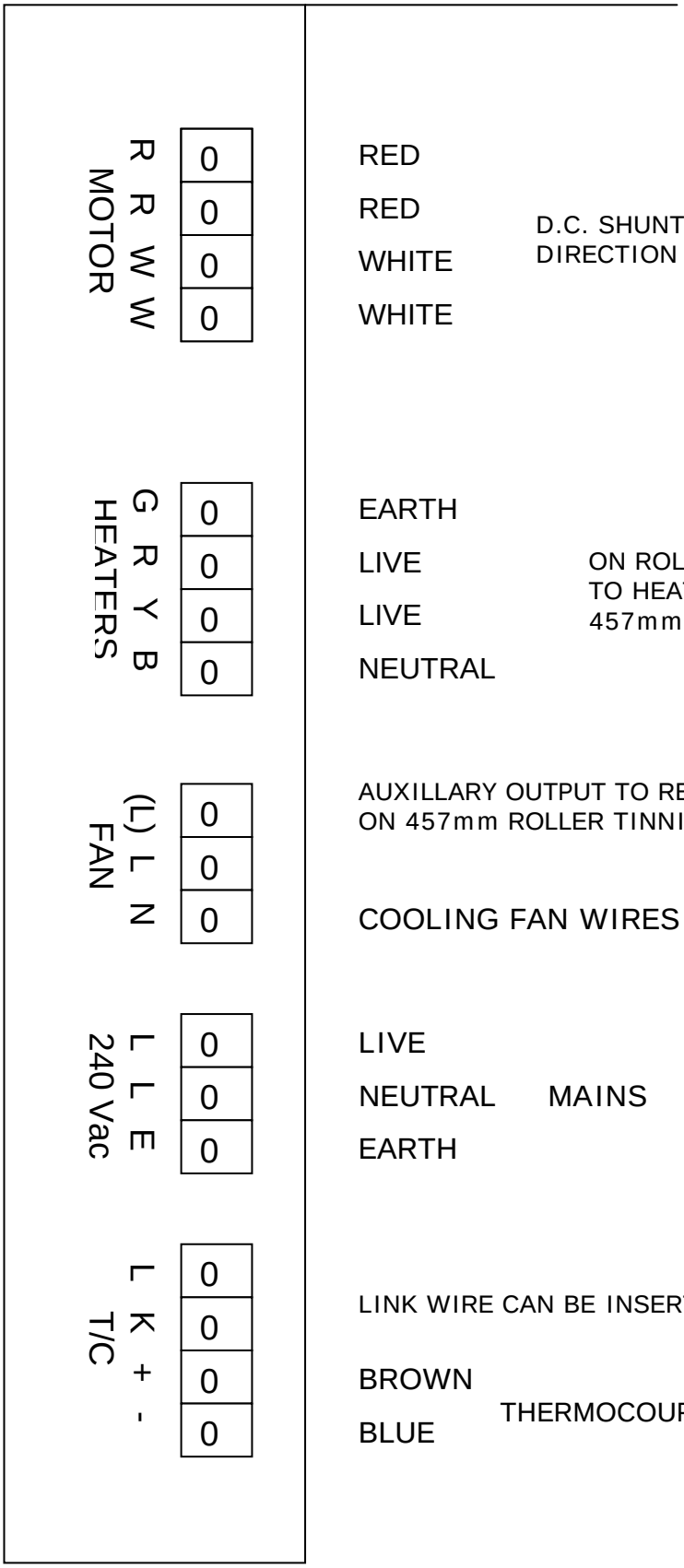
Tin	95.47% 94.5-95.5.0%
Silver	3.80% 3.75-3.9%
Copper	0.70% 0.6-1.0%
Arsenic	< 0.001% 0.001-0.01%
Gold	< 0.001% 0.001-0.1%
Bismuth	0.05% 0.05-0.10%
Cadmium	< 0.001% 0.001-0.003%
Iron	< 0.001% 0.001-0.02%
Lead	< 0.015% 0.001-0.1%
Antimony	0.02% 0.02-0.1%

Physical Properties SAC/P/0307

Melting point	217-219°C.
Tensile Strength	48 N mm /-2 at 0.004s/-1 strain rate
Elongation at failure	29%
Density	7.5g/cm³
Hardness	15 HB
Wetting Balance	0.65 seconds

Tolerance to copper 1.0% Maximum

Regular solder analysis is fundamental in the control of the Lead Free Solder, with calculated additions of Tin/Silver dosing alloy, to ensure the correct balance of all critical metal elements is maintained.

TECHNICAL SPECIFICATION	
	IGP- 305
Maximum board width	305mm (12")
Maximum board thickness	12mm
Solder bath capacity	12 Kilos
Heat up time (ambient to 240°C)	20 minutes. (approx.)
Temperature control	± 2ºC
Throughput speed	0 – 10 metres / Min.
Electrics	220 – 240V 50 Hz 1ph
Dimensions (mm)	L850 x D330 x H490

WIRE CONNECTIONS ON ROLLER TINNING MACHINE