# Radio Frequency Drying Systems for the Textile Industry

## Conveyor Dryer

SO125TS

**Features**

- Designed to dry a range of package and product types
- PLC control with fault diagnostics
- Highest quality finished product at optimum rates of production
- Flexible, precise and efficient at low rates of energy consumption
- Meets applicable regulations throughout the world

- Reduction of energy consumption
- Auto-control systems avoids operator error
- No steam requirements (Minimal steam requirements for Steam Heating TS version)
- No dye migration
- Pollution free
- Rapid pay-back
- Immediate heat - no warm-up time
- No contamination
- Automatic moisture control
- Improved workplace environment - no radiated heat-loss

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# Technical Specification

SO125TS Conveyor Dryer

| SO125TS Performance | | |
|---|---|---|
| Product | Moisture | Production/Hour |
| Polyester | 14%-2% | 875 to 1375 kgs |
| Acrylic | 15%-2% | 820 to 1270 kgs |
| Rame/Cotton | 29%-12% | 670 to 971 kgs |
| Poly/Cotton | 25%-4% | 610 to 786 kgs |
| Wool/Acrylic | 33%-11% | 560 to 750 kgs |
| Poly/Cotton | 35%-4% | 470 to 533 kgs |
| Wool | 42%-17% | 500 to 660 kgs |
| Acrylic/Cotton | 35%-3% | 440 to 516 kgs |
| Angora | 45%-14% | 420 to 533 kgs |
| Cotton | 52%-8% | 345 to 375 kgs |
| Silk | 55%-8% | 330 to 352 kgs |
| Rayon | 75%-11% | 250 to 258 kgs |

**E200 Operator Screen**
This system has the capacity to pre-set operating parameters for various product menus. The most commonly used machine settings are easily entered The operator can select the required product by the simple push of a button.

**Full Fault Diagnostic System**
If a fault occurs, the cause of a fault is immediately displayed for the operator to see. The fault display also provides information to the operator on the relevant circuit reference where the fault has occurred and gives a list of check items to clear the fault.

**Built-in-Maintenance Reminders**
The E200 Operator Screen automatically displays when maintenance should be undertaken and provides a message to the operator.

| SO125TS Technical Specification | |
|---|---|
| RF Power | 125kW |
| Frequency | 27.12MHz |
| Oscillator Conversion Efficiency | 67-72% |
| Switchgear | Moeller or Siemens |
| Unit Cooling | Water |
| Electrical Supply | 360-600V±5%<br>50/60Hz 3 Phase |
| Overall length single | 10076 mm |
| Overall height | 3467 mm |
| Overall width | 2030 mm |
| Max electrical mains supply | 230kVA SO125TS (Steam Heating)<br>260kVA SO125TE (Electric Heating) |

Strayfield has a policy of continued improvement and reserves the right to alter the specification at any time without notice.

For details of guarantee refer to Strayfield Standard Terms and Conditions of Sale

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# TECHNICAL SPECIFICATION

# CONVEYORISED DRYER - TYPE SO125TS

## GENERAL

The SO125TS Conveyorised Textile Dryer is the largest single generator Radio frequency Textile dryer to give a true 125 kilowatt output in manufacture today[1].

The dryer system comprises the 125kW industrial high frequency generator in conjunction with a drying chamber incorporating an electrode applicator and air extraction system. The equipment is suitable for drying most types of fibres which have had prior mechanical moisture extraction in either, cone, muff, bump or loose stock form. Many types of fibre can be dried (please refer to the performance sheet attached). The machine incorporates a modular polypropylene conveyor band and conveyor system.

Environmental Heating (to avoid condensation in low temperatures is provided by Steam heaters. (Alternatively electric environmental heating is also available if required).

[1] RF Output is 125 kilowatts into a directly equivalent water load, measured and verified by calorimetry to EN 61306:2006. (This allows comparison with other similarly rated devices).

# 1. GENERATOR TYPE SO125

## 1.1 GENERAL

The generator comprises an HT transformer, rectifier bank, oscillator and tank circuit together with switchgear panel, internal cooling system and instrument control box. It is designed to provide up to 125kW of RF power at a nominal frequency of 27.12 MHz into the workload.

## 1.2 CUBICLE CONSTRUCTION

The cubicle is of all-welded, heavy sheet aluminium construction supported by folded section frameworks. It is finished externally in a robust and high quality powder coated paint finish.

All panels are hinged and are fitted with flush easy locking handles. Figure safety locks are provided so that doors to all compartments containing dangerous high voltages can only be opened when the mains isolator is in the "OFF" position.

## 1.3 UNIT COOLING

To ensure that components are held within their temperature ratings, the equipment is supplied with an integral water/water heat exchanger for the purposes of cooling the triode valve, the oscillator circuit and generator cabinet.

The customer will be required to supply well filtered city water at a rate of 100 litres per minute at 4.0Bar (60psi) pressure, with an absolute maximum temperature of 32 degrees C and a minimum temperature of 15 degrees C.

## 1.4 HT SUPPLY

Air-cooled, solid-state silicon avalanche rectifiers, mounted on heat sinks and connected as a 3-phase, full-wave bridge are used to convert the high tension AC voltage to DC. An air-cooled HT transformer, steps up the incoming mains supply to the required high voltage. Spike suppression filters are incorporated in the AC and DC supplies to limit transients.

## 1.5 R.F. OSCILLATOR

The oscillator is water-cooled and uses a tuned, air spaced aluminium capacitor/copper inductor combination to generate the radio frequency. The copper inductor is plated to prevent decrease in efficiency due to ageing and oxidation. The circuit has a high "Q" factor and an output transformer coupling, making it suitable for matching into most electrode systems. All other components are selected for efficient and reliable operation when working in a radio frequency circuit. The oscillator has a conversion efficiency (DC) of between 67-72% at full load.

## 1.6 ELECTRONIC TUBE

All tubes used are water-cooled triodes. They are selected for their long life, high efficiency and reliability. The tube is designed to be easily removed when required.

## 1.7 OVERLOAD PROTECTION

Each generator has magnetic and thermal overloads to provide protection for the power supply and to prevent the customers' fuses operating under fault conditions. All motors, transformers and control circuits are suitably protected by overloads or fuses.

In the event of overload trips operating due to a temporary excessive load in the dryer, a recycling unit will automatically attempt to restart the machine up to five times. Repeated tripping of the equipment which cannot be cleared will cause an audible alarm to operate, warning that urgent inspection of the equipment is essential.

## 1.8 ELECTRICAL COMPONENTS

All electrical switchgear is of MOELLER manufacture except where suitable components are not available from that manufacturer, and all motors are to metric specification.

## 2. DRYING CHAMBER

### 2.1 CONSTRUCTION

The cabinet is of welded heavy gauge aluminium construction, with the exterior painted to match the generator. All panels are hinged and have figure safety interlocks so that doors can only be opened when the RF power is off and the equipment is "safe".

### 2.2 VENTILATION

To prevent condensation forming within the dryer, extraction fans are incorporated in the design. The damp air is normally drawn through ducting incorporated into the electrode system via centrifugal fans. The airflow from each fan is adjustable to enable correct balancing of the system to be carried out. In certain circumstances it is necessary to introduce extra hot air into the system in order to raise the dew point and prevent condensation forming. This hot air normally enters the cabinet through the base electrode, in order to provide through-ventilation. Heating is provided by a steam powered heat-exchanger. It is essential that the customer should provide the required control valves and devices for the steam system and also the ducting to carry the moist air removed from the product to atmosphere outside the factory.

For most systems, the rate of extraction is 50 cubic metres/minute of air at an approximate static pressure of 100mm water gauge.

### 2.3 OVERLOAD PROTECTION

All motors, fan and control circuits are suitably protected by overloads or fuses, the circuits being interlocked with the generator.

### 2.4 ELECTRICAL COMPONENTS

All electrical switchgear is of MOELLER manufacture and all motors are to metric specification. Where possible all switchgear and protection components are built into the main generator control panel.

### 2.5 ELECTRODE SYSTEM

The base or earth electrode is constructed of aluminium sheet being formed into a box and fitted with wear-strips, upon which runs the polypropylene modular conveyor band. Air is ducted through the base electrode to prevent condensation.

The top or live electrode is of similar construction but split into two sections to form a balanced output circuit. This arrangement forms a parallel plate electrode system allowing through field heating of the product.

The complete live electrode assembly is supported from a rigid framework being insulated with glass-fibre insulators. The base electrode is bonded to ground. The complete assembly is mounted on stainless steel lead screws and is driven by a motor via a reduction gear box. The lead screws are connected by a chain and sprocket drive and their movement is

controlled by an electronic servo system including limit switches and a safety crash switch protection device.

### 2.6 MOISTURE CONTROL

The main electrode assembly positioning is controlled by a Mitsubishi HMI operator panel. The electronic control system consists of high and low limit switches and position determining circuitry, electrically converted to the drive motor by reversing contactors. This provides accurate position control of the electrode throughout its operating range and hence fine control of the power delivered to the product. This circuit is arranged to drive to the minimum power position whenever the RF power is switched off, in order to reduce power surge at switch-on.

The electrode drive system also incorporates a completely separate high and low level crash switch which gives protection against over-run of the electrode system should the normal limit switches fail to stop the motor.

### 2.7 INSTRUMENTATION AND CONTROLS

The HMI panel provides all the main operating, diagnostic, and service functions for the machine and analogue metering of anode current, grid current and high voltage is also provided to aid servicing. Pushbuttons are fitted to start and stop the RF energy and conveyor, and an Emergency Stop pushbutton is also provided. Full details of the operator interface are given below in 4.

## 3. CONVEYOR

The conveyor band is 1.4m wide, of modular construction, made from polypropylene, and is self-tracking. Belt speed is electronically controlled from the HMI panel, and is indicated by a digital display. The conveyor is fed with power from the generator and is fully interlocked. The necessary inter-connections to the generator and oven are provided. Shafts are mounted on high quality bearings which are sealed for life. The conveyor is generally constructed from steel folded sections and covered where appropriate with aluminium sheeting, powder coated to match the rest of the machine. The loading and discharge sections of the conveyor are manufactured from folded stainless steel sheet. Adjustable feet are provided as a standard feature to accommodate uneven floors.

## 4. HMI AND PLC

The dryer is fitted with a Mitsubishi PLC (Programmable Logic Controller) and an HMI (Human Machine Interface) panel which provides the following facilities:

### 4.1 PRODUCT MENU SYSTEM

The HMI features manual and pre-set product menus. The most commonly used machine settings can be easily entered as pre-sets by the supervisor. It is the only necessary to select the required product by pushing a button. This eliminates over-drying and yellowing problems caused by the operator 'fiddling' with the machine controls.

### 4.2 AUTOMATIC CONVEYOR SPEED CONTROL SYSTEM (for 'Wetter than average' products)

All products passing through the RF dryer must of course be correctly centrifuged, however, (particularly in the case of products which have been stood around from some hours in carts between centrifuging and drying) products at the bottom of a cart tend to be wetter than those at the top. The PLC and HMI can automatically compensate for such product by slowing the conveyor band slightly to reduce the amount of water being presented to the dryer. Two stages of speed reduction are incorporated. When the moisture peak is past, the PLC restores the conveyor speed back to the original pre-set speed.

### 4.3 FULL FAULT DIAGNOSTIC SYSTEM

If a fault occurs, the cause of the fault is immediately displayed for the operator to see. The fault display also contains information on the relevant circuit where the fault has occurred and gives a list of check items which should resolve the fault.

### 4.4 BUILT IN MAINTENANCE REMINDERS

The HMI panel remembers when maintenance should be undertaken and provides a message to the operator when a maintenance operation is due.

### 4.5 ALARM LIST FACILITY

The last 32 faults are listed so that intermittent faults, or faults which occurred during a previous shift can be detected more easily by maintenance personnel.

## 5. ELECTRICAL SUPPLY

The supply voltage will be as specified in the final quotation and confirmation of order. Subject to information being provided prior to the preparation of quotations and the commencement of the manufacturing programme, units can be supplied to operate from 3 phase, 50 or 60Hz, 3 wire, 230kVA electrical mains supply, having voltage of between 360 and 600 volts (to be specified at time of ordering). Voltage regulation must be within ±5% of specified operating voltage.

## 6. COOLING WATER

A good quality filtered supply of 100 litres/minute at 4.0 bars (60psi) pressure minimum, of city water is required for the operation of the dryer. Absolute maximum temperature of the water is to be 32 degrees C, minimum temperature 15 degrees C. Also about 100 litres of Demineralised water having the following specification will be required for the internal circuit of the dryer including the amount for periodic top-up of the demineralised cooling circuit: Solids Content less than 30 parts per million, Conductivity less than 10 microSiemens (resistance greater than 100 kilo-ohms per centimetre).

## 7. STEAM

A supply of dry, saturated steam (up to 90kg/hr) is required at 3.5 bars working pressure for the environmental heating system. This is used to prevent condensation occurring in the winter months when the dewpoint is high and the ambient temperature is low. Pipework and controls for this supply are to be provided by the customer. Details of the requirements are given in the machine handbook and can be supplied by Strayfield on request.

# TECHNICAL SPECIFICATION FOR THE STRAYFIELD SO125TS DRYER

| | |
|---|---|
| Maximum Electrical Supply | 230 kVA |
| Operating Frequency (Nominal) | 27.12 MHz |
| Mains Frequency (specify) | 50/60Hz |
| Mains Voltage (specify) | 360 to 600 V<br>Stability +/- 5% |
| Maximum R.F. Output | 125kW |
| Approx. Maximum Evaporative Capacity | 150 kg/hr $H_2O$ |
| Electronic Valve Type | Triode |
| Overall Height<br>(from ground including lifting eyebolts of 92mm) | 3467 mm |
| Overall Length | 10,076 mm |
| Overall Width | 2030 mm |
| Loading Height | 1040 mm |
| Loading Aperture height | 250mm |
| Belt Width | 1400 mm |
| Electrode System | Flat Plate |
| Maximum Product height | 320 mm |
| Minimum Product height (special requirements can sometimes be accommodated) | 150 mm |
| Cooling Water (Secondary) | Sealed System<br>Demineralised |
| (Primary) | City Water |