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Have you ever experienced an abrupt malfunction of your CVD furnace? You are only a few days away from an important deadline but your equipment company is slow to respond to your S.O.S. Or as the production manager, you receive a report on the unstable behavior of your CVD furnace but the equipment company says you have to wait two weeks just to get a technician to arrive at your site.

Rest assured! This will never happen with Tystar’s equipment. Tystar furnaces are extremely robust and reliable. Even in the event of a malfunction, our engineers will walk you through a manual operation mode so that system operations can continue until we get there. This is only one of the 33 reasons why you should buy Tystar products.

Our engineering team, with over 30 years of experience, is quick to respond, highly experienced, and will never give up until the issues are completely resolved. Tystar’s mission is to meet the semiconductor/MEMS industries’ needs with quality products and service.

As the CEO of Tystar Corporation, I personally guarantee your full satisfaction as detailed in this catalog. I hope this catalog will enlighten you with the most up-to-date information on Tystar products and help you make the best choice for your R&D or production needs.

Sincerely,
Wayne H. Choe, PhD
President & CEO
Tystar Corporation

Count On Tystar

Tystar Corporation for Robustness, Reliability and Expediency
WHY Tystar?

- Each process tube (chamber) has its own monitor control computer.
- The computer has multiple recipes stored.
- The computer will retain its memory for 30 days in the event of a brown or black out.
- The Temperature Controller has a dual algorithm with Feedforward as well as PID functions.
- Sliding PCB drawers and swivel control consoles are used for ease of maintenance.
- All software used in the system is SECS II compatible.
- There is power on diagnostics.
- Gas control panels and scavenger exhausts are designed with low particle generation in mind.

Advanced Features

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High Return on Investment

Tystar’s proprietary isothermal system design enables:

- Very affordable price, beating any leading manufacturer.
- A small footprint, saving expensive clean room space.
- High efficiency through reducing gas and electricity use by >50%.

Excellent Post-Sales Support

- 24 hour response to any inquiry or service request even after the warranty expires.
- Unlimited process and system support for the entire lifetime of the equipment.
- Process data support utilizing the largest library of process data gathered over 30 years.

Robust & Reliable

- Auto/manual switching in the event of an unexpected controller failure.
- Sophisticated and high speed controls.
- Rigorously tested and certified parts.
- Individual tube control for failure independence from tube to tube.
- EPROM established safety controls.
- A multi-step abort sequence to prevent damage to the process or equipment in the event of an emergency shut down.
WHY TYSTAR?

1. **Layout Flexibility**: Tystar furnace layouts can be configured specifically to fit into a customer’s clean room floor plan.

2. **Autonomous Control of Tubes**: Each individual tube has its own control computer which can run autonomously without affecting other tubes in case of computer failure.

3. **Auto/Manual Switching**: Gas, boat loader, and temperature controls can run in the manual mode should there be a failure of the tube computer.

4. **Isothermal Chamber**: Our patented isothermal chamber design results in outstanding process control which guarantees superior uniformities and low operation costs.

5. **Multiple Recipe Loading**: The tube computer can accommodate multiple recipes so no downloading is required when changing recipes.

6. **Battery Backup**: Each tube computer has a battery backup to retain the configurations and recipes for 30 days and no downloading is required when a power failure occurs.

7. **Multi-Step Abort Sequence**: A multi-step abort sequence is utilized to protect the product and equipment in case of computer failure.

8. **Auto/Manual Display & Control**: In the event all computer controls fail, it is still possible to monitor and control the gas panel in the manual mode.

9. **PID Closed Loop Pressure Control**: Tystar’s MFS-460 gas controllers do not require external set points for closed loop pressure control.

10. **Local TCU Control/Diagnostics**: In the event all computer controls fail, the temperature controller runs in the manual mode.

11. **Flat Temperature Ramping**: An algorithm is built into the TCU logic for synchronizing each temperature zone.

12. **Recipe Guarantee**: Tystar offers starter recipes for every process utilizing its extensive library of process recipes with guaranteed process verification.

13. **Small footprint**: Tystar’s patented isothermal design creates the smallest footprint furnaces, which utilize less clean room space.

14. **High Efficiencies**: Tystar’s patented isothermal design creates low gas and electricity usage.

15. **Maintenance Friendly**: All Tystar furnaces are designed for easy access to all parts for ease of maintenance. We designed easily removable back panels for hard-to-reach parts. Electronic and electrical components are placed in sliding drawers, along with a slide-out interface plate. All other components are very easily accessed.

16. **Adaptable Quartz Boat Design**: The Tytan furnace design is adaptable to fit into a customer’s clean room floor plan. Each process tube has designed safety features can be included.

17. **Rigorously Tested Parts**: All parts used on Tytan furnace systems are name brand and certifiable. They have been rigorously tested over an extended period of time.

18. **Proven Supplier Records**: Tystar has a large worldwide installation base with over 1200 tubes installed. We can supply excellent customer references.

19. **Strong Customer Network**: Tystar’s customer network is comprised of prestigious universities, laboratories and corporations, including: National Institute of Standards and Technology, Harvard University, Jet Propulsion Lab, Communication Research of Canada, National Research Council of Canada (NRC), University of Alberta, UC Berkeley, Georgia Tech., Stanford University, University of Texas, Dallas and Arlington, UCLA, USC, UCSD, Princeton University and many more.

20. **Rapid Response (24 Hour)**: Tystar will respond to any service or support request within 24 business hours.

21. **Lifetime Support**: Complete process and technical support for the entire lifetime of the equipment.

22. **Dedicated Team**: Tystar’s primary engineers have worked together for over 25 years.

23. **Top-Rated Performance**: Tystar has affordable pricing for top-rated equipment performance and technical support.

24. **Support on Peripherals**: Other vendor clean room fab peripherals can be purchased through Tystar.

25. **SCE II Protocol**: Each control component has Semiconductor SECS II protocol embedded in the software.

26. **Multiple Safety Features**: Examples include: door must be closed to continue processing, gas flows must be accurate and mixed properly, proper pressure must be present before processing and many more. Customer designed safety features can be included.

27. **Dual T/C**: Temperature is controlled by a profile T/C, using spike T/Cs as backup and power measurements as tertiary backup so no wafer load is lost due to T/C failure.

28. **Power On Diagnostics**: Each process tube has extensive Power On diagnostics.

29. **Remote Access Diagnostics**: Available for quick analysis and rectification from Tystar’s facility.

30. **Clean Exhaust**: A unique proprietary exhaust system for silicon handle has been developed, with the help of UC Berkeley, to lower maintenance and prevent hazing on wafers.

31. **Built In Door Torque Down Logic**: Tystar’s boat loader has a built in torque down routine which assures a good, tight door seal.

32. **Low Particle Generation**: Tystar furnaces are designed for low particle generation.

33. **Dedicated Engineering Support Team**: Tystar’s engineering team has a proven record of excellence in furnace design.
**Tytan Standard Series**

The Tytan Standard Systems are designed for diffusion, oxidation and LPCVD applications. The systems are compact and suitable for use in manufacturing and/or R&D environments. The Standard series have been well accepted as dependable process tools both in the industry and in the R&D community. They offer superior performance and process uniformities. The design incorporates several of the most advanced concepts required for high performance wafer processing tools.

<table>
<thead>
<tr>
<th>Furnace Model</th>
<th>2000</th>
<th>8300</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wafers Tube</td>
<td>6&quot;</td>
<td>8&quot;</td>
</tr>
<tr>
<td>Wafers Per Tube</td>
<td>200 ATM</td>
<td>200 ATM</td>
</tr>
<tr>
<td>Flat Zone</td>
<td>≤ 34&quot;</td>
<td>≤ 34&quot;</td>
</tr>
<tr>
<td>Footprint</td>
<td>L 164&quot; H 82&quot; D 30&quot;</td>
<td>L 164&quot; H 82&quot; D 30&quot;</td>
</tr>
<tr>
<td>Maximum Power</td>
<td>60 KVA</td>
<td>75 KVA</td>
</tr>
</tbody>
</table>

**Tytan Solar Series**

<table>
<thead>
<tr>
<th>Furnace Model</th>
<th>8342</th>
<th>8442</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wafers Tube</td>
<td>6&quot;</td>
<td>8&quot;</td>
</tr>
<tr>
<td>Wafers Per Tube</td>
<td>200 ATM</td>
<td>200 ATM</td>
</tr>
<tr>
<td>Flat Zone</td>
<td>≤ 34&quot;</td>
<td>≤ 34&quot;</td>
</tr>
<tr>
<td>Footprint</td>
<td>L 164&quot; H 82&quot; D 30&quot;</td>
<td>L 164&quot; H 82&quot; D 30&quot;</td>
</tr>
<tr>
<td>Maximum Power</td>
<td>87 KVA</td>
<td>113 KVA</td>
</tr>
</tbody>
</table>

**Tytan Furnaces**

[Image of Tytan Furnaces]
Tytan Mini Series

The Tytan Mini Furnace Systems are designed for diffusion, oxidation and LPCVD applications. The systems require considerably less floor space and electrical power than conventional furnaces of equal capacity. The Mini tools are used both in the semiconductor/MEMS industry and in the R&D community. They offer superior performance and process uniformities. The design incorporates several of the most advanced concepts required for high performance wafer processing tools.

<table>
<thead>
<tr>
<th>TUBES (UP TO)</th>
<th>WAFERS PER TUBE</th>
<th>FLAT ZONE</th>
<th>FOOTPRINT (LENGTH, HEIGHT, DEPTH)</th>
<th>MAXIMUM POWER</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 TUBE</td>
<td>65 LPCVD</td>
<td>18</td>
<td>L 64” H 54” D 30”</td>
<td>18 KVA</td>
</tr>
<tr>
<td>≤ 3 TUBES</td>
<td>50 LPCVD</td>
<td>15</td>
<td>L 128” H 69” D 35”</td>
<td>28 KVA</td>
</tr>
<tr>
<td>≤ 4 TUBES</td>
<td>50 LPCVD</td>
<td>15</td>
<td>L 134” H 82” D 30”</td>
<td>40 KVA</td>
</tr>
<tr>
<td></td>
<td>50 LPCVD</td>
<td>15</td>
<td>L 127” H 82” D 30”</td>
<td>45 KVA</td>
</tr>
</tbody>
</table>

MAXIMUM POWER:

- 18 KVA
- 28 KVA
- 40 KVA
- 45 KVA
- 50 KVA

Tytan Tabletop Series

The Tytan Tabletop Systems are designed to provide high-quality resistance-heated thermal processing on a budget. The systems provide phenomenal performance and are repeatable with tight control. The interface and trace data/status display/recipe management software all provide seamless usability on the user’s end, and the systems are very safe and durable.

<table>
<thead>
<tr>
<th>FWNS MODEL</th>
<th>WAFFER SIZE</th>
<th>TUBES (UP TD)</th>
<th>FLAT ZONE</th>
<th>FOOTPRINT (LENGTH, HEIGHT, DEPTH)</th>
<th>MAXIMUM POWER</th>
</tr>
</thead>
<tbody>
<tr>
<td>1020</td>
<td>2”</td>
<td>1 TUBE</td>
<td>10”</td>
<td>L 64” H 34” D 30”</td>
<td>5 KVA</td>
</tr>
<tr>
<td>1060</td>
<td>6”</td>
<td>1 TUBE</td>
<td>8”</td>
<td>L 64” H 69” D 30”</td>
<td>12 KVA</td>
</tr>
<tr>
<td>1080</td>
<td>8”</td>
<td>1 TUBE</td>
<td>8”</td>
<td>L 64” H 82” D 30”</td>
<td>15 KVA</td>
</tr>
<tr>
<td>120</td>
<td>2”</td>
<td>1 TUBE</td>
<td>3”</td>
<td>L 64” H 82” D 30”</td>
<td>16 KVA</td>
</tr>
<tr>
<td>160</td>
<td>6”</td>
<td>1 TUBE</td>
<td>3”</td>
<td>L 64” H 82” D 30”</td>
<td>18 KVA</td>
</tr>
</tbody>
</table>

MAXIMUM POWER:

- 5 KVA
- 12 KVA
- 15 KVA
- 16 KVA
- 18 KVA
PHOTO-ENHANCED CVD REACTORS

Film Density
Refractive Index
Dielectric Constant
Dielectric Strength
Particle Density
Film Adhesion (Tension)
Etch Rate
Thickness Uniformity Across Substrate
Thickness Repeatability
Deposition Rate (150ºC, 1 Torr)
Cycle Time (1500Å)
Substrate Temperature
Reactor Pressure

< ±5%
< ±3%
120 Å/min.
45 min.
50 - 250ºC
0.3 - 1 Torr

higher deposition temperatures.
arsenide, indium antimonide and “III/V” materials, such as gallium
1000 reactor is used in a variety of
or dual-process chambers. The PVD
excellent step coverage. The PVD
The PVD 1000 deposited films offer
particles has been observed.
Since the UV photon energy used
to the low deposition temperature.
stress is observed in these films due

1.8 - 2.4 g/cm³
1.8 - 2.0
5.5
4 x 10⁶ V/cm
< 10/cm²
70 x 10⁶ Pa
90 Å/sec. 2)
2) B.O.E.

PHOTO-ENHANCED CVD REACTORS

The Tystar PVD 1000 Photo-
Enhanced CVD Reactor uses ultraviolet light as an energy source
for activating process gases for the
deposition of dielectric films at low
temperatures (<150ºC). Films of silicon dioxide (SiO₂), silicon nitride
(Si₃N₄), silicon oxy-nitride (SiCON) and others can be deposited. Minimal
stress is observed in these films due
to the low deposition temperature.
Since the UV photon energy used
does not ionize the process gases,
no radiation damage from charged
particles has been observed.

The PVD 1000 deposited films offer
excellent step coverage. The PVD
1000 system is available with single-
or dual-process chambers. The PVD
1000 reactor is used in a variety of
applications for film deposition on
“III/V” materials, such as gallium
arsenide, indium antimonide and
other materials that cannot tolerate
higher deposition temperatures.

PVD 1000 Process Data
Thickness Uniformity Across Substrate < ±8%
Thickness Repeatability < ±5%
Deposition Rate (150ºC, 1 Torr) 60 Å/min.
Cycle Time (1500Å) 55 min.
Substrate Temperature 50 - 250ºC
Reactor Pressure 0.3 - 0.5 Torr

PVD 1000 Film Characteristics (Typical Data)
Film Density 2.10 g/cm³
Refractive Index 1.45 - 1.48
Dielectric Constant 3.9
Dielectric Strength 6 x 10⁶ V/cm
Particle Density < 10/cm²
Film Adhesion (Tension) 70 x 10⁶ Pa
Etch Rate 90 Å/sec. 2) 2) B.O.E.

PVD 1000 REACTOR SPECIFICATIONS
Dimension / Weight
Height 41 in. / 1041 mm
Depth 26 in. / 711 mm
Width 81 in. / 2057 mm
Weight 970 lbs. / 427 kg

Gas Supplies
Reagent Gases
Fittings: 1/4” Metal Face Seals (VCR)
SiH₄ 20 sccm / 15 psi
NH₃ 200 sccm / 20 psi
N₂O 200 sccm / 20 psi

Interface
Mass Flow Controllers For All Standard Models
Set Point Out 0...5 VDC
Analog Singal 0...10 VDC
Output Impedance 6 Ohms
Input Impedance 25 Ohms
Digital Input Open Collector
Gas Flow Loops Up to Six
Shut-off Valve +24VDC Out
Thermocouple Input Type R, -50 - 1375ºC Range
Control Communication RS 232
Maximum Cable Length 25 ft./8m
Remote Control 0.5 VDC, Contact Closure, Input/Output
Keyboard Membrane Switch 4x4 Matrix
Alphanumeric Display 10 Digit, 14 Segment Vacuum Fluorescent

Electrical
Power 85 to 264 VAC ±10%, 47/63 Hz
Power Consumption 153 W max
Power Supply Regulated: +15VDC/15A, -15VDC/15A, +5VDC/2A, 24VDC/3A
Unregulated: 24VDC Out

Environmental
Ambient Operating Temperature 5ºC to 43ºC (40ºF to 110ºF)

Dimensions
Height 10.8 in. / 275 mm
Width 6.0 in. / 152 mm
Depth ATM 8.5 in. / 216 mm
LPCVD 7.5 in. / 191 mm
MAX 7.9 in. / 191 mm
Weight MAX 7.9 lbs / 3.6 kg

INSTRUMENTS

Gas Control Systems

Tystar’s gas control equipment
provides precise control and mixing of
industrial process gases used
not only in the semiconductor but
do in many other industries. The
gas panels use compact, modular
designs and are fabricated from 316
stainless steel with orbital-welded
joints and connections. They are leak
tested to 10^-3 cm³/s with helium.

MFS 460
Electronic Gas Controller

The Tystar MFS 460 Electronic Gas
Controller directs the process gas
flows of up to six individual mass
flow controllers. In either manual
or automatic mode, the MFS 460
monitors gas flows, provides flow
error bands, and displays set
points and actual gas flows. For
low-pressure CVD applications,
the unit provides reactor pressure
readout and closed loop pressure
control. The MFS 460 also stores
gas interlocks, gas ratio controls
and error bands in an EPROM,
guaranteeing safe handling of all
process gases. It interfaces (via an
RS 232 serial communication data
link) with the master controller, such
as the Tystar FCS 10. The MFS 460
Electronic Gas Controller provides
safety interlocks and other critical
gas control features.
The Tystar MFC Tester is an inexpensive, hand held, lightweight instrument for the testing of most commercial Mass Flow Controllers and Mass Flow Meters (MFCs) with a standard 20-pin card edge connector. The data are displayed on a large backlit LCD. A miniature rotary switch is used to select different test points of the Mass Flow Devices. At the back of the instrument is a Printed Circuit Board, PCB, with test points for manual purge or closing the valve of the MFC. It can be used remotely at some distance from the gas control panel, which is sometimes hard to reach. The MFC Tester can measure a number of the following voltages (Set Point, Flow Output, Valve, Zener, and Supply Voltages).

**Specifications**

| Display | 0.47"/1.2 mm, Backlit LCD |
| Switch Positions | Off, Control, Output, Valve, Zener Diode, ± 15 V |
| Maximum Voltage Range | ±20 VDC |
| Accuracy | ±0.02% Full Scale |
| Sampling Rate | 2.5 per second |
| Supply Voltage | ±5.00 VDC, (Regulated from MFC Power Supply) |
| Supply Current | 37 mA |
| Input Independence | 1 M Ω |
| Over-range Indication | Yes |
| Operating Temperature | 0-50°C |
| Size | 3.8" x 2.4" x 1.0" (96 x 61 x 25 mm) |
| Weight | 3.5 oz (100 g) |

**Controls & Functions**

| ON/OFF Power Switch | Set Point Selection Digital Switch |
| Flow Standard/Test Unit Display Switch | Test Unit Electrical Connection |
| Flow Standard Selection Switch | Gas Inlet/Outlet Fittings |
| Auto-Zero Switch | 5-Digital Set Point/Flow Digital Display Meter |

**Performance**

- **Standard Ranges:**
  - Gas Pressure: 0-60 psig (0.4-4.13 kPa)
  - Temperature: 0...50°C
- **Accuracy:**
  - 0.5% of full scale

**Electrical**

- **Input Power:**
  - 115 VAC/.77 A or 230 VAC/1.2 A
- **Mechanical**
  - Gas Fittings: 1/4" Face Seal (VCR) inlet and outlet
  - Gas Tubing: 316L SS/15μ in. Ra
  - Leak Integrity: <10⁻⁹ atm cm³/sec He
- **Gas Inlet/Outlet Fittings:**
  - 1/4" Face Seal (VCR) inlet and outlet
  - 316L SS/15μ in. Ra
  - <10⁻⁹ atm cm³/sec He

**Dimensions**

- **Height:** 7.0" / 185 mm
- **Width:** 16.5" / 420 mm
- **Depth:** 12.6" / 320 mm
- **Weight:** 43 lbs / 19 kg

**Warm-up Time**

- 30 minutes
Service and Repairs

The complexity of modern semiconductor process equipment and the scarcity and high cost of knowledgeable, experienced service engineers make a service contract with Tystar an intelligent choice. Drastically reduced equipment downtime, fast, efficient service by factory trained service engineers, protection from unexpected repairs, upgraded software packages, etc. are some of the benefits of a Tystar Service Contract.

Repair and maintenance service for Tystar's furnace and CVD equipment is provided by our field service engineers, strategically located in different parts of the world. We provide assistance in equipment start up and process technology, equipment trouble shooting and repair at the customer facility.

Tystar has a complete repair, test and calibration facility at its headquarters. All electronic circuit boards, process controllers, gas control equipment, temperature controllers, vacuum components, etc. can be repaired, calibrated and tested to the original equipment specifications.

Spare Parts Inventory

Tystar maintains a well stocked inventory of major spare parts at its facility in Garden Grove, CA. Minimum stock of critical parts is maintained. Spare parts or direct replacements for all Tytan furnaces and PVD 1000 installed systems are available. Tystar guarantees the availability of identical or equivalent-in-function spare parts for a minimum of 10 years from date of equipment purchase.

Remote Service

Tystar offers Remote Monitoring & Diagnostics Service (RMDS) plans that take advantage of the most up-to-date Internet technology. A majority of the system problems may be resolved over an Internet connection, eliminating the need for travel time and expenses. The customer can purchase a service plan and get immediate attention from our technical staff for any system malfunction. Should there arise a need for repair or service, our staff can remotely monitor and diagnose the system. RMDS is a new way the customer can cut down on the cost of service while enabling quick actions on the system.

Training and Seminar Classes

Tystar offers complete training for all of our systems and components, either at our headquarters or at the customer site.

The objective of Tystar's Tytan Furnace System Training Seminar Classes is to make buyer representatives familiar with the design, operation, service and maintenance of the Tytan Furnace System. Specific items discussed in detail are installation, set-up, operation, troubleshooting and repair of the entire furnace system and its subassemblies, electronic controls, assemblies and printed circuit boards. Printed seminar materials and notes will be provided to participants at no cost.

This seminar provides participants an opportunity to gain in-depth knowledge into the theoretical and practical aspects of Tystar equipment. The material presented will be in a logical, step-by-step sequence through lectures, demonstrations and practical "hands-on" exercises.