

DRAFT



ELECTRON BEAM EVAPORATION SYSTEM
MODEL TFDS- 462B
P/N 71521

**Installation, Operation and
Servicing Instruction**

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S/N xxx

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| Special devices | INSTRUCTION MANUAL | Identification |
|  | ELECTRON BEAM EVAPORATION SYSTEM MODEL TFDS-462B, P/N 71521 | B71521MAN |
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1. INTERFACE CONTROL DRAWING, draw. B71521.ICD
2. VACUUM DIAGRAM, draw. B71521.VAC
3. PNEUMATIC DIAGRAM, draw. B71521.PNM
4. WATER FLOW SCHEMATIC, draw. B71521.HYD
5. ELECTRICAL DIAGRAM B71521.00.EL
6. DISK, draw. B64341.60.08
7. HOLDER PLATE, draw. B71521.10.10

ASSOCIATED DOCUMENTS:

1. **ISP-500C DRY SCROLL VACUUM PUMP. INSTRUCTION MANUAL**
2. MODEL 125 CRYOPUMP COMPRESSOR. USERS MANUAL
3. HIGH VACUUM CRYOPUMP MODEL 8 CRYO-PLEX®. USERS MANUAL
4. HIGH AND ULTRA-HIGH VACUUM STAINLESS STEEL VALVES GV-3000 THRU GV-12000. INSTALLATION, OPERATION AND MAINTENANCE INSTRUCTION, MDC VACUUM INC.
5. HIGH AND ULTRA-HIGH VACUUM STAINLESS STEEL VALVES GV-3000 THRU GV-12000. INSTALLATION, OPERATION AND MAINTENANCE INSTRUCTION, MDC VACUUM INC
6. BELLOWS-SEALED VALVES
7. CVM -211 CONVECTION VACUUM GAUGE MODULE. USER'S MANUAL
8. MODEL 266/267 MULTI-POCKET ELECTRON BEAM SOURCE. INSTRUCTION MANUAL
9. MODEL TT-6 E-BEAM SOURCE POWER SUPPLY & XY SWEEP WITH MEMORY MODULE. INSTRUCTION MANUAL
10. ANALOG XY SWEEP WITH MEMORY MODULE ELECTRON BEAM SOURCE. INSTRUCTION MANUAL
11. MODEL 880 DEPOSITION CONTROLLER. INSTRUCTION MANUAL
12. VALVE TERMINALS CPV-SC, SMART CUBIC. OPERATING INSTRUCTIONS
13. SWIVEL MODULES DSM/DSM-B. OPERATING INSTRUCTIONS
14. 100 SERIES FLOW SWITCHES. INSTALLATION AND OPERATING INSTRUCTION
15. CYLINDRICAL PROXIMITY SENSOR E2A. .OPERATING INSTRUCTIONS
16. PC COMPONENTS USER DOCUMENTATION (CD)

NOTE:

1. LICENSE of Windows® 7 Professional OEM Software is attached as label to PC rack mount
2. Backup of software OMNICONVAC II with application to TFDS-462B is attached

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1 HEALTH AND SAFETY

1.1. Introduction

The following safety notations are used in this manual:



Operating procedures, practices and conditions, this must be strictly observed to prevent equipment damage or destruction.



Operating procedures, practices and conditions, this must be strictly followed to prevent personnel injury or death.

It is therefore vitally important to carefully read this manual before proceeding with start up, use, maintenance or any other machine jobs.

The machine is equipped with all the safety devices necessary to ensure risk-free use under standard conditions.

Machine installation, maintenance and adjustment must be carried out in observance of all safety standards and in observance of all the precautions deemed suitable for each task.

The operator must be qualified. He must have expert machine knowledge and must have read this manual.

Extreme care must be taken to ensure constant operator safety standard.

We advise strict observance of the work safety standard as defined by the relative authorities in each nation.

The makers cannot accept responsibility for damage to persons or objects resulting from inobservance of safety standard.

1.2. Safety notes for machine use



The following safety practices must be complied with:

CAUTION and WARNING notices posted on the machine and safety notes in this manual must be complied with.

Only qualified personnel may operate the machine and/or perform maintenance on the machine. Operating personnel must not remove covers or panels.

Do not start the system if any safety cover is missing.

Ensure that all control panels and electrical panels are covered.

When maintaining the system post highly visible warning signs.

Before turning on the system, the operator must survey the machine doing the following steps:

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- Perform a visual test of the system components (e.g. ensure that the equipment is properly placed; view any messages on the display, etc.).
- Verify that the system is not undergoing maintenance.

The operator must always directly check for perfect operation of the emergency commands. Never leave the machine unattended when in use except in cases where this is allowed. During prolonged pause, turn the main switch to off.

The machine may stop during work cycle for any number of reasons. Whenever this happened and the situation required access to the inside of the cabinet containing the electrical equipment, always set the general switch to off.

Moving parts may bruise and cut.

Do not wear rings, wristwatches, or other jewelry while working on live electrical circuitry. Do not permit smoking or food in the working area.

Replace all safety shields after completing set-up, troubleshooting and maintenance procedures.

Report any unsafe conditions to the supervisor.

Secure electrical wires and cables to prevent damage.

Ensure that all personnel know the main power switch location and reaction ways in case of an electrical emergency.

Although the electrical cabinet has its own safety system, operator access to the cabinet interior is strictly forbidden without authorization guaranteeing proven experience in tasks of this type.

1.3. Safety notes concerning maintenance



Don't allow unauthorized personnel to carry out repair or maintenance tasks. Carefully read the use and maintenance instructions manual before starting or using the machine or effecting machine or plant maintenance tasks.

To avoid getting caught up in the moving parts do not lubricate, repair or adjust the machine while in operation unless expressly requested in the use and maintenance instruction manual.

Stop the machine according to the procedures laid down in the use and maintenance instruction manual before lubricating or carrying out other tasks.

Owing to the presence of flammable fluids, don't use matches, the cigarette lighters or torches as a means of lighting during work on the machine.

Replace all safety shields after completing set-up, troubleshooting and maintenance procedure.

For high mounted maintenance use a stable ladder to avoid high fall injuries.

1.4. Hazard Categories

Hazards and associated warnings relevant to Health and Safety which appear in the text of this manual and in this section will fall into the following categories:

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|--|---|
| a) Electrical | The system carries voltages high enough to cause injury or death. Even when the electrical power supply is isolated, electrical energy at dangerous levels is stored by capacitors. |
| b) Mechanical | Heavy components, wires and machinery in motion can cause injury. Rotated parts as instrumentation fans; substrate rotation device, substrate shutters can be dangers. Do not operate the system if any of the doors, panels or covers is removed. Take care when moving heavy components. Ensure that they remain stable to avoid any risk of toppling |
| c) High Temperature | N/A |
| c) Vacuum | Vacuum chamber, pumping system or other components under partial vacuum represent stored energy that can cause injury if released carelessly. |
| d) Compressed Air, Compressed Nitrogen | Compressed air/nitrogen can enter the body through the skin and cause serious injury. Pneumatically operated system components can be actuated suddenly, even when the system is not operating, causing serious injury. Never put your hand or any other obstruction in the path of a slit or gate valve blade unless it has been made safe. Retained air pressures can be at dangerous levels. Release the pressure as follows: <ul style="list-style-type: none"> a. Power off the system by switching off main circuit breaker. b. Disconnect the pneumatic supply pipes from the system. c. Disconnect the supply pipe at the point where it connects to the valve |

1.5. Specific Warnings

1.5.1. Electrical

- 1.5.1.1 Parts of the system carry high voltages that are capable of causing injury or death. Take great care when carrying out maintenance tasks.
- 1.5.1.2 Do not operate the system if any of the doors, panels or covers is removed. Parts of the system may still be 'live' even when shut down by a switch, blown fuse or control function.
- 1.5.1.3 Ensure that all system units are connected to electrical earth (ground). The earth (ground) wire (green/yellow) in the unit's AC power cable must be connected to the system's electrical earth (ground). Do not use extension cables without a protective earth (ground) conductor.

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- 1.5.1.4 Ensure that all safety interlocks are tested before the system is used for the first time and at scheduled intervals thereafter. These tests must be carried out by suitably qualified personnel
- 1.5.1.5 Power down the system by opening the main circuit breaker before attempting to provide maintenance work
- 1.5.1.6 Inspect the system regularly for damaged components, for example cables, connectors or switches. Any components found damaged must be replaced before continuing to operate the system.
- 1.5.1.7 Cables must be tested at regular intervals; test immediately if damage is suspected.
- 1.5.1.8 No servicing is to be carried out unless all personnel involved fully understand the danger of stored electrical energy.

1.5.2. Extreme High Temperature

N/A

1.5.3. Compressed air

- 1.5.3.1. Never put your hand or any other obstruction in the path of a slit or gate valve blade unless it has been made safe. Retained air pressures can be at dangerous levels. Release the pressure as follows:
- 1.5.3.2. Power off the system by switching off main circuit breaker
- 1.5.3.3. Disconnect the pneumatic supply pipes from the system.
- 1.5.3.4. Disconnect the supply pipe at the point where it connects to the valve.

1.5.4. Mechanical

- 1.5.4.1. Rotated parts as vacuum pump, compressors, fans or instrumentation fans; substrate rotation device can be dangers. Do not operate the system if any of the doors, panels or covers is removed.
- 1.5.4.2. Take care when moving heavy components. Ensure that they remain stable to avoid any risk of toppling.

1.5.5. General


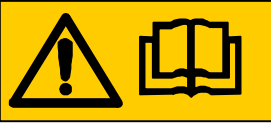



- 1.5.5.1. Ensure that local and national Health and Safety standards are studied and followed.
- 1.5.5.2. Ensure that all personnel who either operate or maintain this system are experienced and appropriately qualified.
- 1.5.5.3. Before carrying out any maintenance work, read the relevant manuals supplied by manufacturers of proprietary components.
- 1.5.5.4. Ensure that the main electrical supply, compressed air, all other gases are disconnected before starting maintenance work.

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1.5.5.5. Ensure that all personnel who may be expected to have access to the system during an emergency, such as firemen, paramedics etc. are familiar with the location of the main circuit breakers and valves.

1.6. Warning and advisory labels

During manufacture, warning and advisory labels are attached to the system to indicate potential hazards and components, which should not be operated or maintained without first reading the relevant manual. The labels and their meanings are as follows:

| | |
|---|--|
|  | Caution, hot surface IEC 417, No. 5041 |
|  | Read the relevant manual before proceeding to operate or maintain the labeled equipment. |
|  | Caution, refer to accompanying documents. ISO 3864, No. B.3.1 |
|  | Protective earth (ground) IEC 417, No.5019 |
| 3N ~ | Three phase alternating Current with Neutral wire. |
|  Disconnect the mains supply before removing this cover | Warns of any voltage be between 208V and 400V underneath the cover. |

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2 TECHNICAL SPECIFICATIONS

| | |
|--------------------------------|---|
| Chamber: | box type, water-cooled, stainless steel, 450 mm W, 1200 mm H, 475 mm D front door, three 4 " Pyrex® view port |
| Ultimate pressure: | less than 8×10^{-8} Torr |
| Pump Down Time: | 1.9×10^{-6} Torr in 28 min |
| Roughing Vacuum pump: | |
| Model: | XDS35I |
| Nominal pumping speed: | 35 m ³ /hrs |
| Guaranteed ultimate pressure: | 7.5 mTorr |
| Cryogenics Vacuum pump: | |
| Model: | CryoPlex 8P |
| Nominal pumping speed, water: | 4000 l/sec |
| air: | 1500 l/sec |
| Capacity, Argon | 1000 std. liters |
| Gauges: | |
| Measuring range | |
| Processing chamber | from 5×10^{-10} Torr to atmosphere |
| Cryogenic pump | from 1×10^{-3} to 100 Torr. |
| Valves: | All vacuum valves and gates and gate are stainless steel bellow sealed, pneumatic operated. |
| Evaporation source: | |
| Model: | 266-06, 6 pockets x 7cc |
| Max High voltage: | 10 kV |
| Cooling | indirect |
| Power supply: | |
| Model: | TT-6 |
| Maximum power | 6 kW 450ma @7kV 550ma @6kV 650ma @5kV |
| Shutters: | |
| Number of shutters: | 34 |
| Actuator type | pneumatic |
| Substrate holder | |
| Type | non-rotating, water-cooled |
| Distance to the holder | 450-550 mm |

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Deposition Controller:

| | |
|--------------------------|---|
| Model | Telemark Model 880 Thin-Film Thicknesses and Rate Controller |
| Sensor Crystal Frequency | 6MHz |
| High Resolution | ±0.02Hz (5-6MHz), 0.0088 Angstroms/Measurement (for Aluminum) |
| High Accuracy | ±0.5% thickness + 1 count |
| High Speed | Ten measurements/second |
| Measurement Range | 500KA Aluminum Equivalent |

Frame:

closed type, aluminum anodizes profiles, painted table, doors and panels, leveling wheels

Dimension:

see attached drawing B71521.00.ICD

Weight:

approx. **716 Kg** (without roughing pump, transformer and cryopump compressor)

Utility requirements:

Power required:

**400VAC, 50Hz, 3Ph, 5 wires, 63 Amp
Required circuit breaker curve D**

Compressed air:

filtered and dried, at 5 to 7 bar inlet pressure

Nitrogen:

filtered and dried, 0.5 to 1 bar, (low pressure regulator included)

Cooling Water:

| | |
|-------------------------------------|--|
| max. inlet temperature | + 22°C |
| min. inlet temperature | + 10°C |
| alkalinity : | 7.0 - 8.7 pH |
| Calcium carbonate | <75 ppm |
| resistivity | >100kOhm/ cm |
| Nominal Water Flow: | 15.2 l/min (4.0 gal/min) |
| - for E.Beam Gun: | |
| Nominal Water Flow: | 7.6 l/min (2.0 gal/min) at pressure 60 psi |
| - for vacuum chamber : | |
| Nominal Water Flow: | 5 l/min (1.30 gal/min) |
| - for cryopump compressor: | |
| Nominal Water Flow: | 1.9 l/min (0.50 gal/min) |
| - for quartz crystal holder: | |
| Nominal Water Flow: | 0,8 l/min (0.2 gal/min) at pressure 60 psi |
| Special ground requirements: | see below figure 4.1 |
| Process gas | according to process requirements |

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3 PACKING AND TRANSPORTATION

3.1 SAFETY NOTES FOR LIFTING AND TRANSPORT



The makers decline all responsibility for damage to object or persons caused by inobservance of the safety standards in force which concern lifting and movement of material within the user's factory.

Machine transfer and truck loading must only be carried out with the appropriate equipment as described in the Packing & Transporting section.

Always act with extreme care so as to prevent personal injury and damage to the machine or its individual parts.

Personnel must keep clear from the suspended load and, in any case, keep out of the crane, forklift truck, (or other suitable lifting/handling equipment), work areas.

The transit lanes inside the factory where the machine is to be installed must be kept clear. The floor must be kept clean and free from any obstacles which might make the forklift truck or crane "jump".

The load must always be securely fixed to a load-bearing part of the lifting and transport equipment, thus preventing any movement whatever the cause.

3.2 TRANSPORTING INSTRUCTION



Please note that specialized personnel trained for this type of maneuver must conduct handling and lifting operations.

Design the transportation concerning the dimensions of the package and the weight. Design and prepare the room for the machine concerning room dimensions and connecting to electricity and air.

The machine may be delivered:

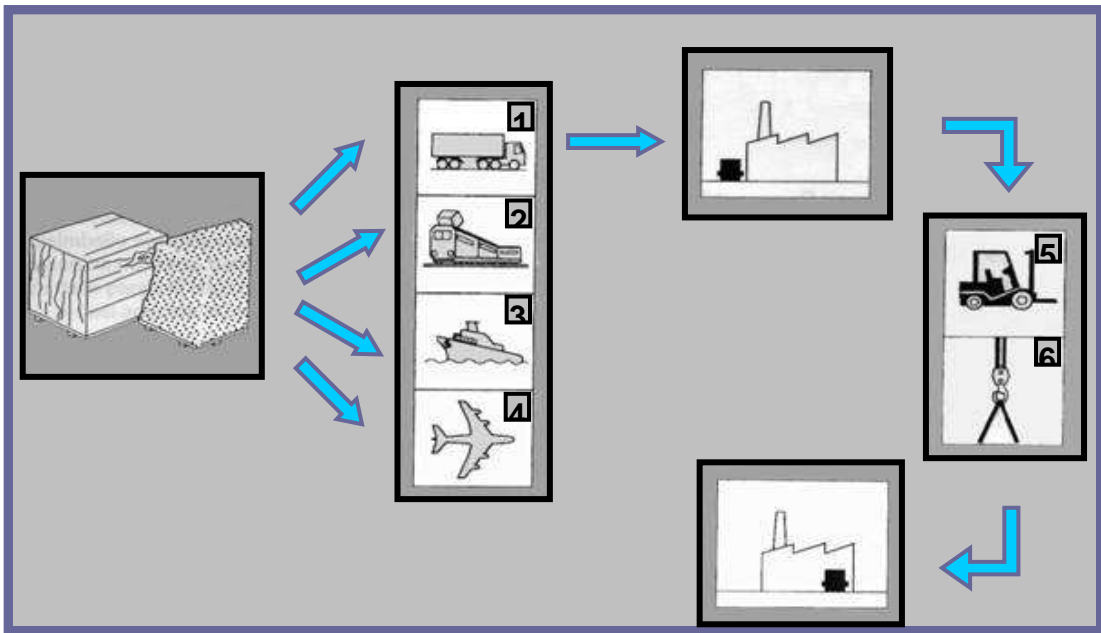
- By road
- By rail
- By sea
- By air

When the crate arrives at the user's site it must be handled with extreme care, outside and indoors, using suitable equipment for crate's weight.

- Fork lift
- Bridge crane

These two tools are also suitable for the lifting and movement of the uncrated machine or its parts.

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3.3 UNCRATING



The crating is reusable. Please save for future use, all the parts.
 Proceed with extreme care when effecting the below uncrating procedure since some machine parts may be up against the wooden panels. Do not break, open the crate with sharp tools and do not perforate the crate panels.
 Remove the side and upper crate panels. Mind out for nails.
 Remove the metal strip and wooden bars fixed to the crate base.
 Remove the internal plastic covers and check that the content corresponds to the shipping list in the enclosed documents. Inform the carrier or the company immediately of any missing or damaged part.

3.4 HANDLING THE MACHINE

When lifting and or moving the machine, it is absolutely necessary to respect the instruction in this manual of this machine, and all the safety instructions and local safety standard and regulations in force.
 Only high qualified personnel allowed to lift and handling the machine

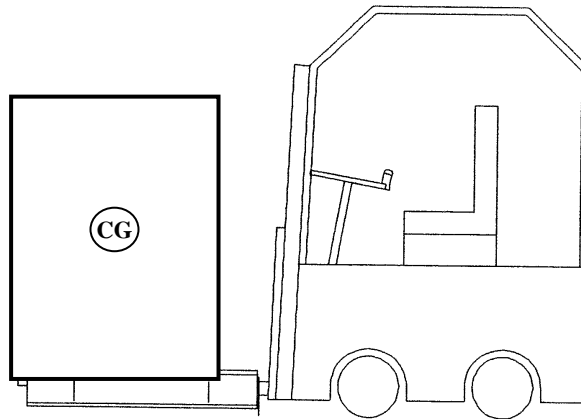


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Before starting any handling procedure, check the total weight of the machine with or without packaging and then use appropriate, correctly positioned equipment to lift or moving the packed or unpacked machine as per the procedure specified below.

3.5 LIFTING THE PACKED MACHINE (by means of fork lift truck or trans-pallet)

Insert the forks into the pallet in the position indicated in the following figure.



Primary equipment handling regulations:

- Ensure that the lifting device is suitable for the load to be handled.
- Open the lifting forks to the maximum required to correctly position them without damaging the pallet and/or the machine itself.
- Place the forks in the Center of Gravity position; witch does not always correspond to the center of the packed machine.
- Before lifting the packed machine, ensure that the end of the forks protrude from the pallet.
- While moving the machine, keep it close to the ground.
- Ensure that the area across which the load is moved is clear of objects, persons and animals.
- Wear suitable, protective clothing.



During the lifting procedure, the machine is in an incline position (3-5° on the heavier side towards the fork lift truck) since the centre of gravity has been shifted). However, this does not compromise the safety of the persons or of the machine itself. Avoid oscillations during this operation.

3.6 MOVING THE UNPACKED MACHINE MANUALLY



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Before any manually moving or maneuvers of the machine in any way, ensure that certified electrician disconnected the machine from the electric power supply by turning OFF the main switch and then disconnecting the machine main plug from its socket).

The unpacked machine can be moved manually through doors for short maneuvers.

To move the machine lift carefully one side of the machine a few centimeters above the floor and insert small trolley under two corners, then lift other side and insert other two trolley under the two corners. Now check that the whole four legs of the machine is no more then 2-3 cm above floor.

For short maneuvers machine can be also moved on its wheels.

Move the machine very slowly and very carefully.

The machine must only move across flat, smooth, solid surface, very clean and without any changes in level.

Now manually push the machine to the desired position. Released the four trolleys and lower the machine to the floor.

3.7 HANDLING OF THE UNPACKING COATER WITH THREE BELTS

The system frame is designed with 4 wheels and two sustaining adjustable legs. The net weight of the system is approximate 716 Kg.

The system has been carefully packed. There are three points to sustain the system along the frame.

When unpacking, observe to support points.

To remove the system from the would base, use care. There are two ways to accomplish the job:

- Use a forklift with wide fork. Observe the center of gravity, which is more towards the vacuum chamber.
- Use three different long belts and a crane. The belts should be placed in the aria of the sustaining wheels and / or adjustable legs.

After removing from box, roll the system to the final position and use adjustable legs to sustain the center part of the frame.

3.8 INSTALLATION ZONE FEATURES



Make sure that the load-bearing capacity of the floor is suitable for machine weight

Overall machine dimensions must be carefully considered to ensure rational installation. The machine should preferably be located in an area that gives access from all sides. The work zone must be well lighted



The site should be equipment with a suitable climbing equipment to enable safe and comfortable access to high areas.

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4 INSTALLATION


Observe that there are no visible damages due to transportation. Transport the system and components to the room and position it in the required location. Level the system frame using the adjustable feet then locks the feet.

The **TFDS-462B** Thin Film Deposition System is fully assembled and all mechanical and pneumatic parts are aligned, adjusted and tested prior to shipment.

4.1 UNPACKING


Unpack system components and check for damage and missing items against the packing list. If any items are damaged or missing, report immediately to the carrier and VST services Ltd.

4.2 POSITIONING THE SYSTEM COMPONENTS

| | |
|---|---|
|  | <p>WARNING</p> <p>LIFTING HEAVY OBJECTS INCORRECTLY CAN CAUSE SEVERE INJURY When handling heavy system components such as the system unit or vacuum pumps, ensure that the appropriate lifting equipment, operated by fully trained personnel, is used.</p> <p>When heavy rack-mounted components are handled, ensure that the weight is safely distributed between sufficient personnel.</p> |
|---|---|

Transport the system to the room and position it in the required location. Level the system frame using the adjustable feet then locks the feet. Install roughing pump and cryopump compressor (see. drw.B71521.ICD)

4.3 CONNECTING THE SERVICES

| | |
|---|--|
|  | <p>IMPORTANT</p> <p>BEFORE CONNECTING ANY OF THE SERVICES, ENSURE THAT THEY ARE TURNED OFF. E.G. COMPRESSED AIR SET TO THEIR OFF POSITIONS AND ELECTRICAL SUPPLIES SWITCHED OFF AND LOCKED OUT</p> |
|---|--|

| | |
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|  | <p>IMPORTANT</p> <p>Installation of TFDS-462B is executed by qualification specialists of VST services Ltd.</p> <p>In case to execute installation self-dependent ask detail step-by-step procedure instruction.</p> |
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Before you install the TFDS-462B, check that the services and facilities listed below are available.

The services must meet the requirements of Section 2:

- Cooling-water supply and return
- Dry compressed air
- Electrical supply
- Vent gas supply (optional)
- Process gas
- Ground

You must install the cables and pipelines for these services and facilities so that they do not present a safety hazard to operators, maintenance engineers or other people.

4.4 SYSTEM GROUNDING

A good ground is necessary to assure safe and proper operation of the power supply TT-6. The following practices are recommended to assure a good ground.

The vacuum tank and E-gun must be connected to a good earth ground. Under normal conditions, a good earth ground will consist of two 3/4 inch (19mm) diameter copper clad steel rods driven through the floor and into the earth near the tank location.

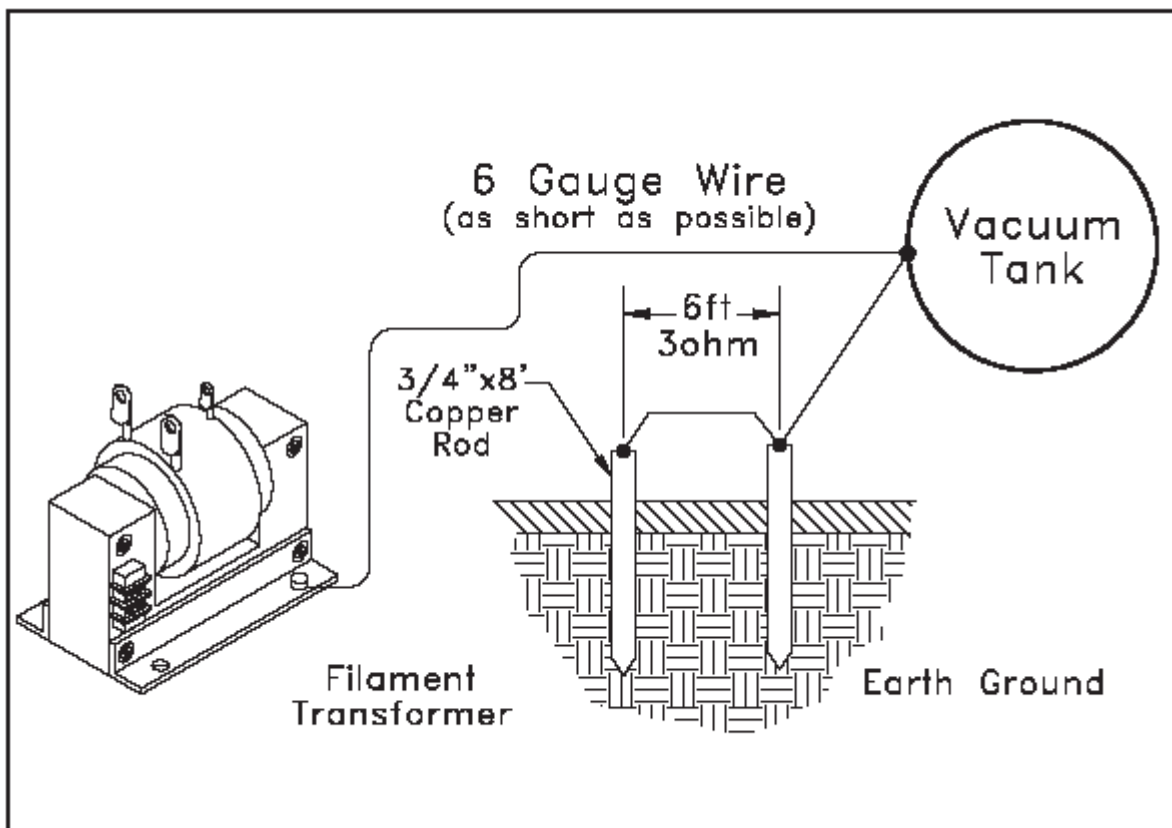


FIG.4.1 VACUUM CHAMBER GROUNDING

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The ground rods should be connected to the vacuum tank and the filament transformer by a #6 AWG or larger gauge copper cable. If the distance from the grounding rods to the tank is more than 10 feet (3 meters), but less than 20 feet, (6 meters), increase the size of the copper cable to #4 AWG. For distances of 20 to 100 feet (6 to 30.5 meters), use 2 to 4 inch (50-101.6mm) by .035-.050 inch (.089-1.27mm) copper strap. For distances over 100 feet (30.5 meters), use 4 to 6 inch (101.6-152.4mm) by .035-.050 inch (.089-1.27mm) copper strap.

| | | |
|---|----------------|---------------------------------|
|  | CAUTION | Do not use braided wire! |
|---|----------------|---------------------------------|

Be sure that the connection is made to clean metal. The rods must be approximately 6 feet (1.8m) apart and the resistance between the rods (without the cable connection) should be 3 ohms or less. The resistance of the soil can be reduced by adding copper sulfate or salt water around the rods. A drip system may be required to insure maintenance of a proper ground.

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5 Introduction



This manual should be used in conjunction with each of the OEM manuals, attached in the documentation package. Some of the features, operation and maintenance information are only available in the subsystem operation manuals.

The **TFDS-462B** (see Fig.5.1) is a thin film deposition system designed for research & development as well as low scale production. This system is consisting of process chamber, load-lock, pumping station, control console and frame.



FIG.5.1 FRONT VIEW

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5.1 PROCESS CHAMBER

The box type process vacuum chamber made of stainless steel is sealed with Viton® O-Rings.
Dimensions are

The front door chamber has three 4" nominal viewing windows with Pyrex® glass are design to enable observation of the substrate holder and source crucible, The view ports glass are protected with a removable glass. Viewport manual shutters are provided.

The vacuum chamber is provided with the following spare ports holes for future use:

- Top plate - 2 standard 1" holes with blank plugs, 1 port KF NW25 with blank flange
- Base plate - 3 standard 1" holes with blank plug
- Pumping port - 1 standard port KF NW40 with blank flange (leak port)

5.2 LOAD-LOCK SYSTEM

The coater is provided with the load-lock system, permits to load and unload sample in to the substrate holder.

Load-lock system is comprised of four basic components:

- chamber
- quick-access door
- gate valve
- sample transporter
- manual gimble

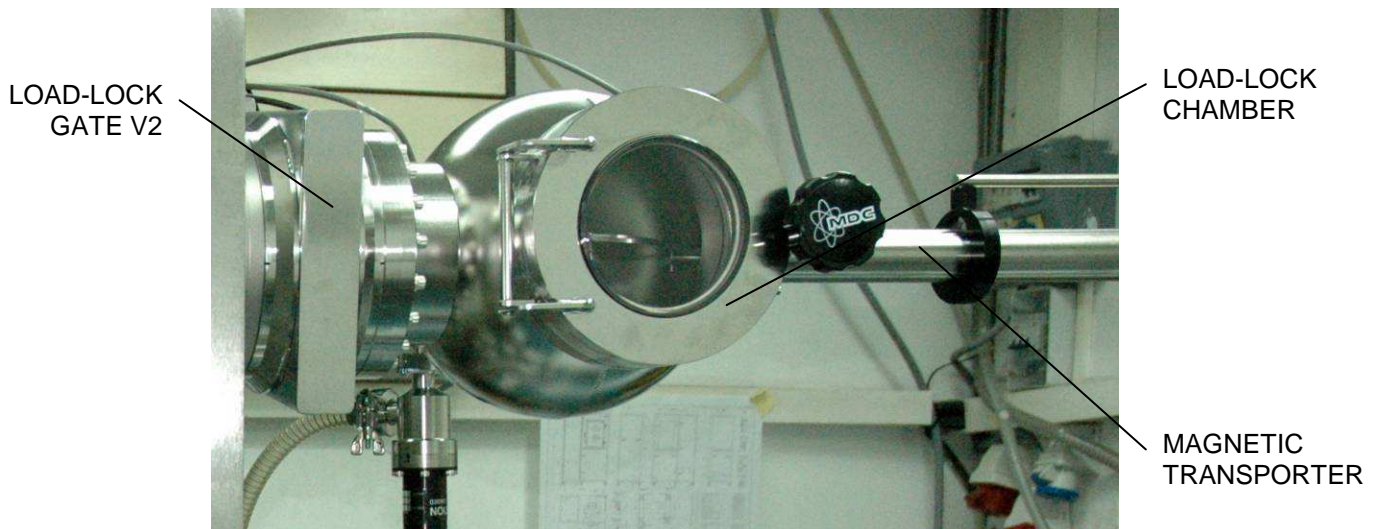


FIG.5.2 LOAD-LOCK SYSTEM

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Spherical sample staging chamber is constructed with six vacuum ports. Three of them are occupied by load-lock system components including a circular gate valve, magnetic transporter and a side mounted quick-access door. Three ports are used for system pumpdown and vacuum measurement, one port 1.33 CF is oxygen inlet

The stainless steel electro-pneumatically operated vacuum gate valve is used on load-lock systems. No contact is made between the valve's body and the locking mechanism, a feature which markedly decreases vibration and insures smooth valve operation. Valve low outgassing characteristics can be attributed to a fusion welded stainless steel body, edge welded stainless steel bellows as well as small cross-section o-rings and the elimination of blind internal cavities.

The valve's gate and carriage can be removed through the valve's bonnet flange for gate seal replacement, cleaning, etc., without removing the valve body from the system. Load-lock system is supplied with magnetically coupled sample transporter. Sample transporters provide manually actuated linear travel and a full 360° sample rotation, ideal for transporting samples between the sample staging chamber and a main process chamber. The load-lock transporter is locked for correct operation of clutch mechanism. Linear positioning is controlled by sliding an external sleeve which is magnetically coupled with the transporter rod and sample holder inside the system. Guide rods prevent sample rotation during linear travel.

The transporter is provided with sensor switch which permit to gate close only whole transporter is in "out" position.

Sample is first secured to platen. The loaded platen is placed inside a load-lock sample staging chamber through the chambers quick-access door. Inside, the platen is secured and attached to the platen fork previously installed to the tip of a magnetic transporter. Once the staging chamber is evacuated to the desired vacuum level and the gate valve is opened the sample is ready for transfer.

Quick-Access door provides convenient and fast manual loading of samples in and out of sample staging chamber. Access door is supplied with Viton® elastomeric seal. Door is hinged and uses a swing-away hand knob locking mechanism.

5.3 PUMPING SYSTEM

The pumping port NW200 is in the rear wall of the vacuum chamber.

The roughing vacuum pump is a dry scroll pump. The pump operation is based on moving of an orbiting scroll relative to a fixed scroll.

The orbiting scroll is driven by the electric motor through an eccentric cam on the motor drive shaft. The movements of the orbiting scroll, meshed with the fixed scroll, forms successive crescent shaped volumes in the pump. Gas entering the pump through the inlet is compressed by the movement of the orbiting scroll and swept towards the center of the fixed scroll. The compressed gas enters the exhaust port near the center of the stationary scroll and is exhausted from the pump through the outlet. All the bearings being lubricated with hydrocarbon lubricant are isolated from the vacuum space.

The high vacuum pump (see Fig.5.3) is a cryogenic pump mod. CryoPlex 8P for high vacuum application and provide fast, clean pumping of all gases in the 10^{-2} to 10^{-9} Torr range. The cryopump operates on the principle that gases can be condensed and held at

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extremely low vapor pressures, achieving high speeds and throughputs. The cryogenic pump connects with vacuum chamber through stainless main gate valve. All vacuum valves except gate valves are stainless steel bellow sealed, electro-pneumatically operated. Internal baffle (see Fig.5.4) mounted into the ISO 200 elbow of pumping system to protect cryogenic pump against over heating when system heater are working at max temperature

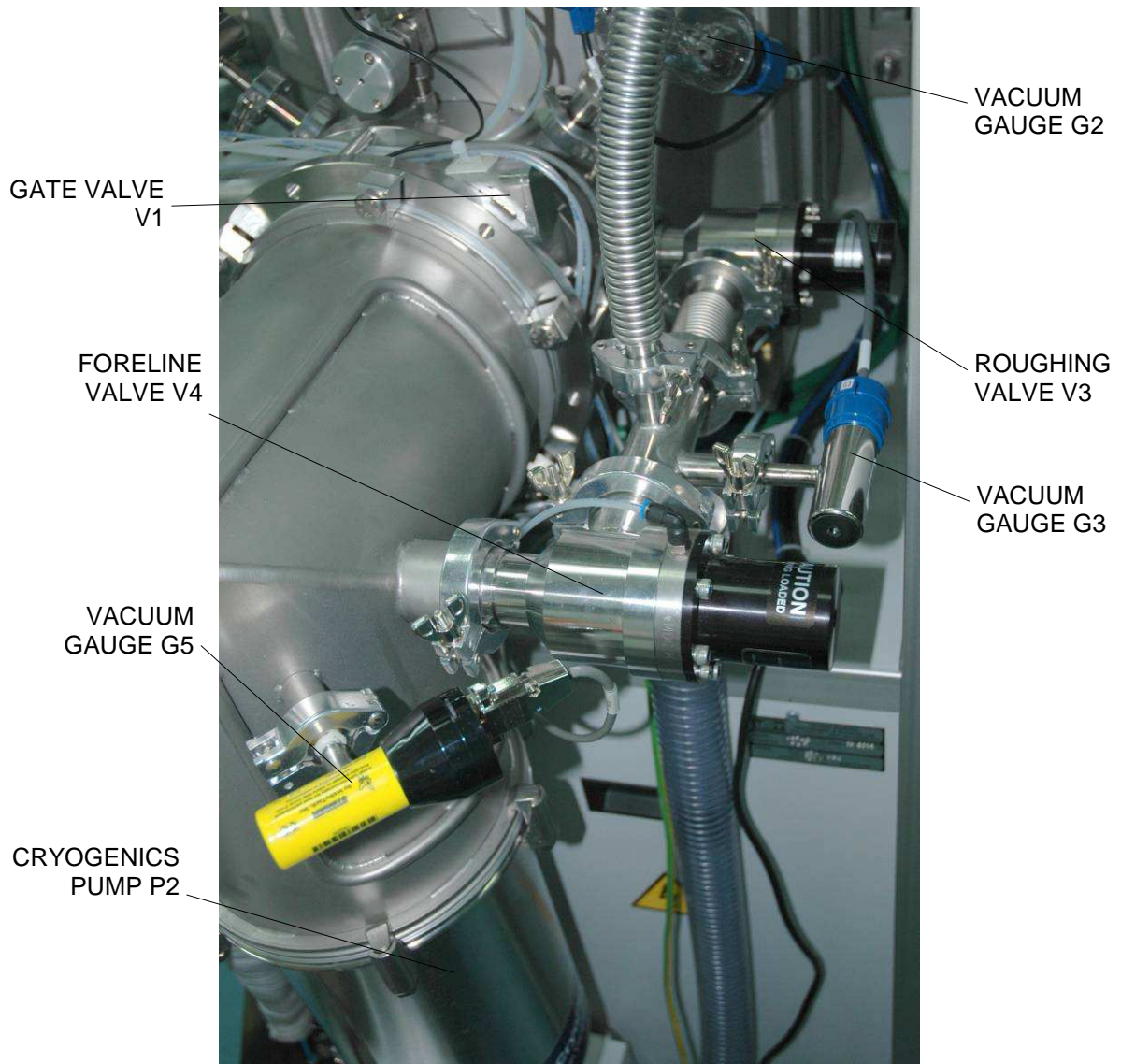


FIG.5.3 PUMPING SYSTEM

The pumping system of load-lock consists of turbomolecular pump **TURBO V-81-M** (see Fig. 5.4.), with integrated controller and vent valve, foreline valve V5 and vacuum sensor enhanced Pirani G5.

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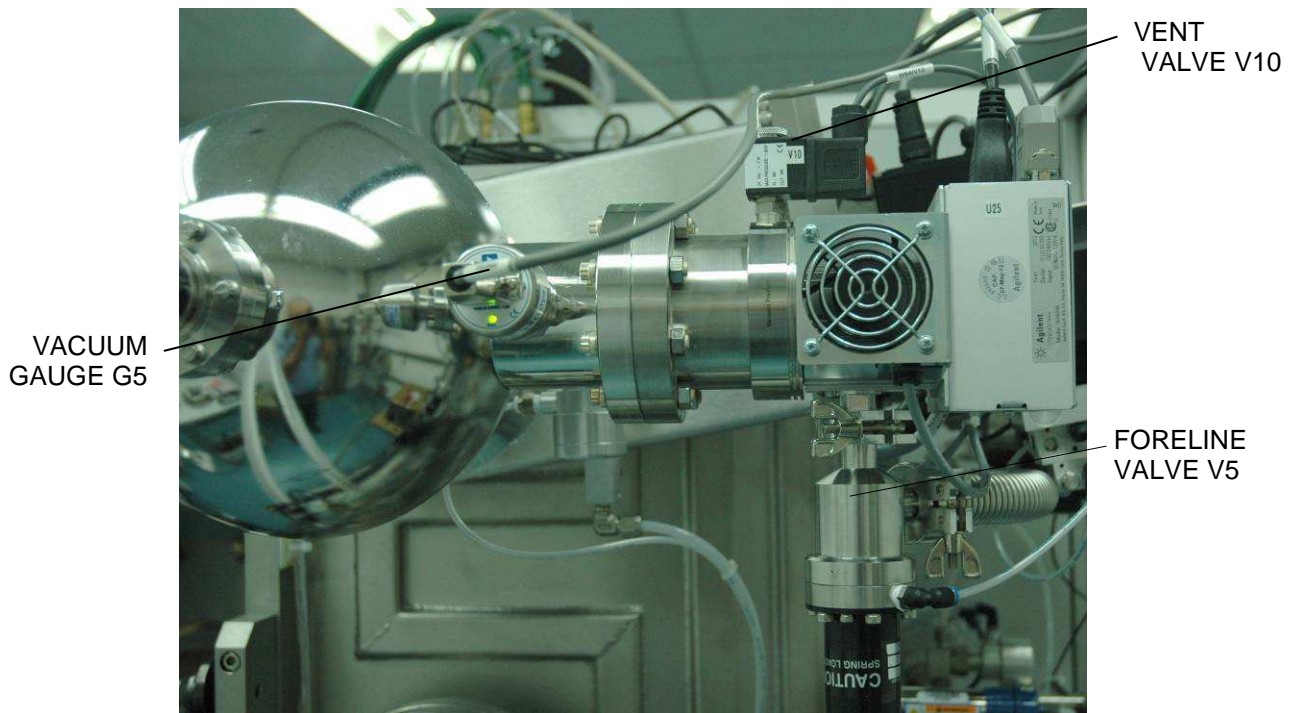


FIG.5.4 LOAD-LOCK PUMPING SYSTEM

5.4 VACUUM GAUGING

Vacuum is measured by

One Convectron gauge and Ionization gauge are placed in the rear pumping collar. Its measuring range is from 5×10^{-10} Torr to atmosphere. Second Convectron gauge measures vacuum of roughing line.

Rough vacuum in the cryogenic pump is measured by Convectron module G5 model CVM-211, measurement range 1×10^{-4} to 1000 Torr.

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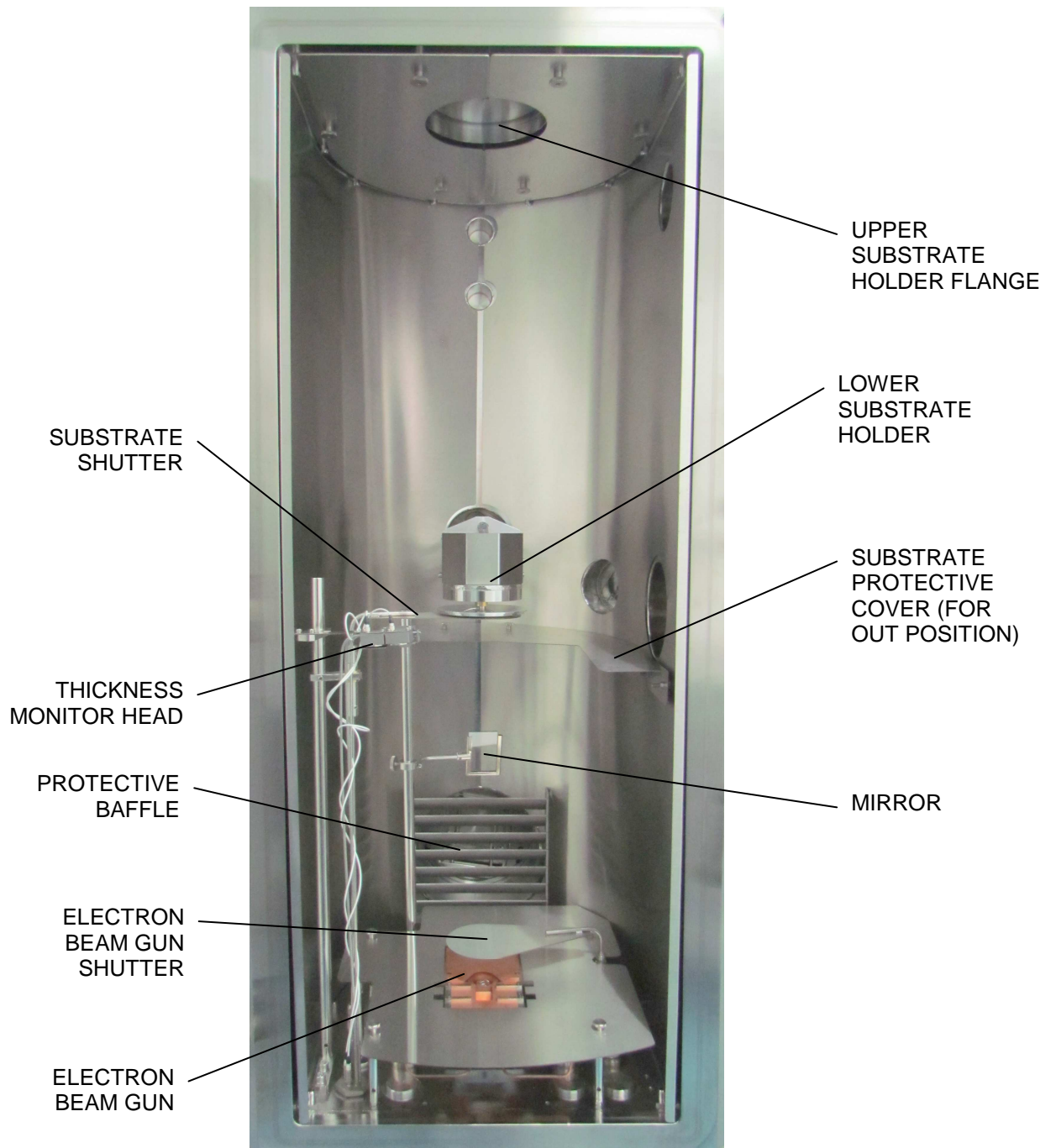


FIG.5.4 PROCESS CHAMBER INSIDE

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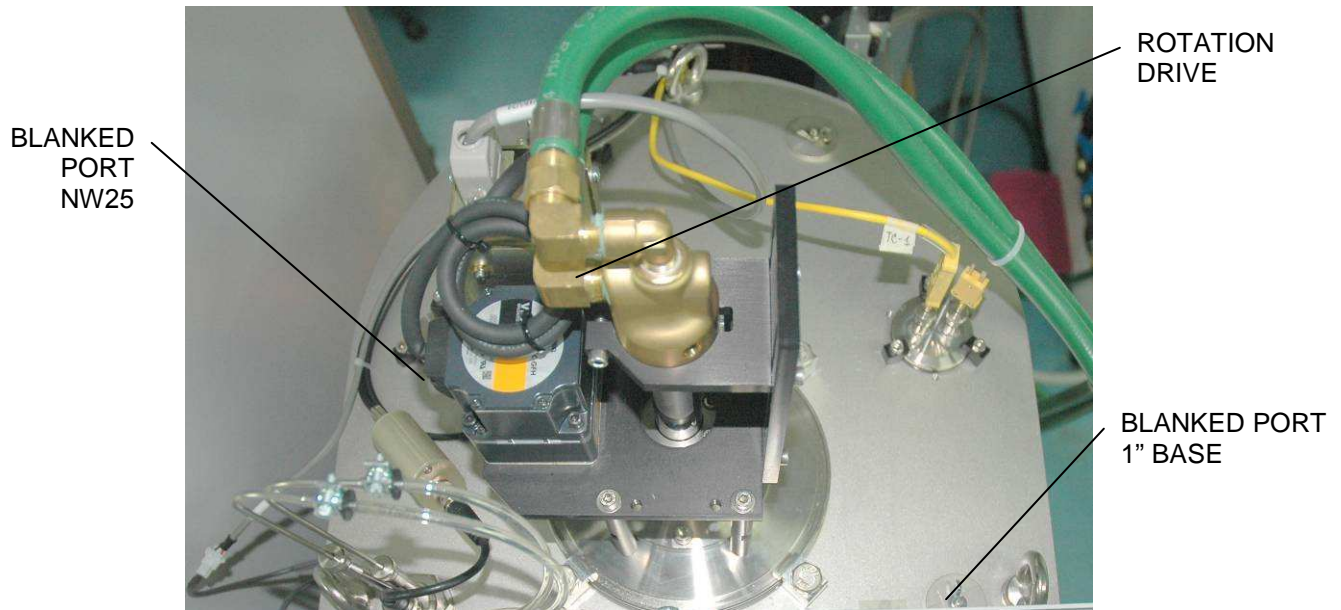


FIG.5.5 TOP PLATE

5.5 ELECTRON BEAM SOURCE

A 8-pockets 7 cc crucibles electron beam gun model 266 is used for deposition material evaporation. This state-of-the-art 270° beam deflection sources has a rugged well proved design. The stability and repeatability of the beam as well as the beam sweep provide uniform evaporation for long processes with several layers.

The TT-6 electron beam power supply is a constant-voltage power supply capable of continuously delivering 6.5 to 7.5 kilovolts DC (negative) at 750 ma @ 7kV.

The power supply's beam position control enables the operator to set high and low interlock limits for this current, thus ensuring that the electron beam will be shut off before it is driven beyond the target material.

The source sweep enables the user control the position, amplitude, and frequency of electron beam sweep in both the lateral and longitudinal axes. The sweep can thus be used to set up various beam patterns or to place the beam in any stationary position.

The crucible assembly position is set by the indexer drive through rotary feedthrough. Electron beam gun has a controlled pneumatically operated shutter.

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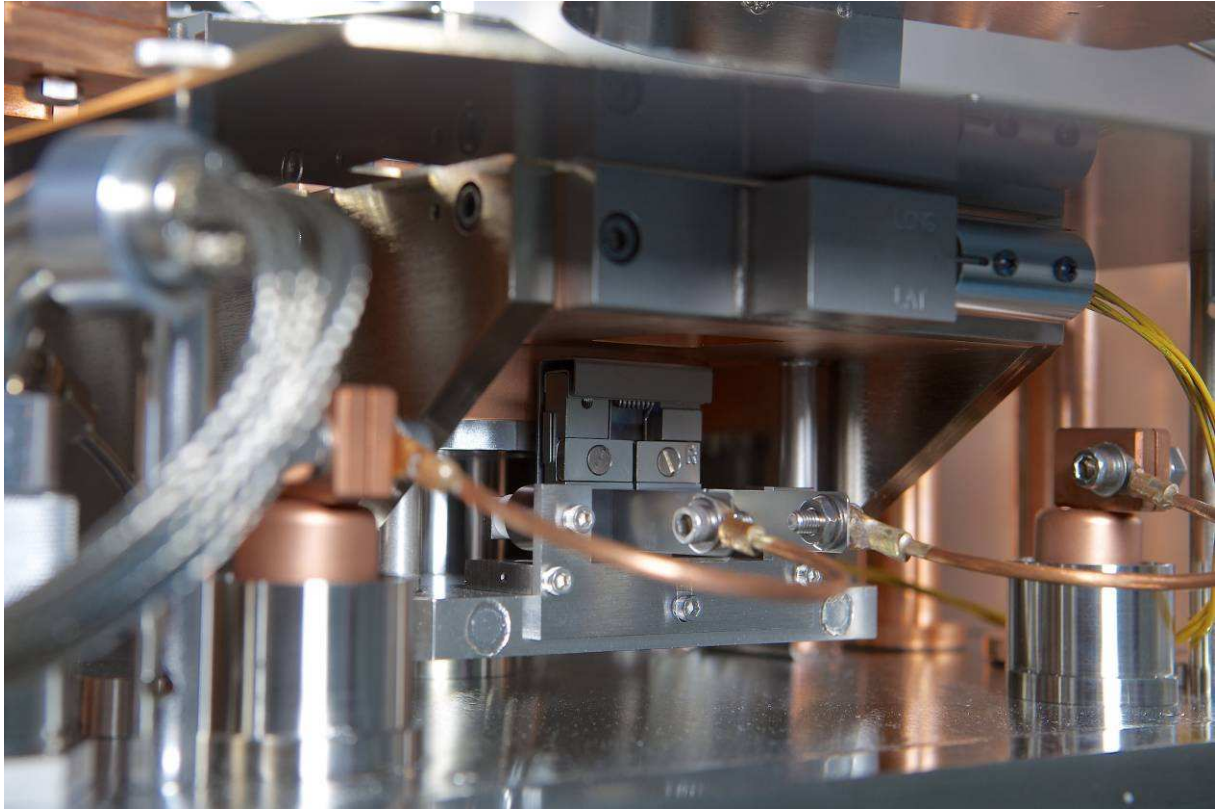


FIG.5.6 ELECTRON BEAM SOURCE

5.6 SUBSTRATE HOLDERS

Two substrate holders existing in the in SYSTEM:

Lower non-rotatable water-cooled substrate holder, mounted on read wall flange, permits to receive from load-lock and hold carriage for wafer max 4" or smaller

Two carriages are provided with the system.

Center of carriage is in the electron beam gun central axe.

Substrate holder can received carrier plate from load-lock, to firmly contact the carrier plate with the water-cooled surface and to perform unloading through the load lock.

Holder is mounted on special bellow sealed HV manipulator which allows moving the whole holder manually about 100 mm out of the evaporation beam, allowing coating of sample mounted on top substrate holder without any shadowing.

Water connectors of holder are separated from **TFDS-462B** cooling loop, allows to connect holder to independent recirculation chiller with regulated low temperature chiller (does not supplied)

The top plate of the vacuum chamber is provided with easy removable flange ISO 160 for CUSTOMER home-made special substrate holder. Top flange consist one hole with thread to fix the top sample holder ~ 10 mm deep.

Pneumatically operated substrate shutter with 125 mm plate is provided. It is effective for both low and top substrate holders.

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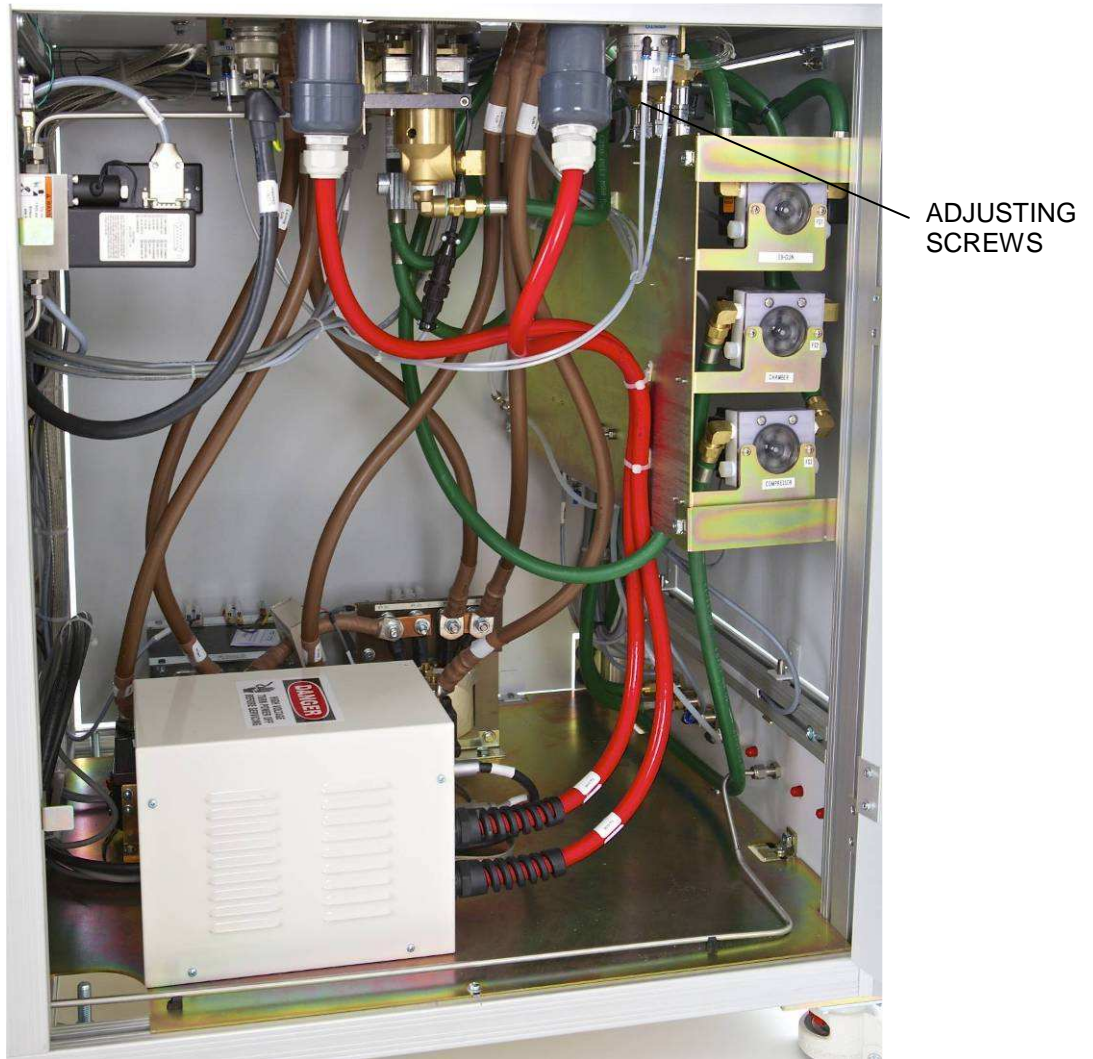


FIG.5.10 BOTTOM SECTION

5.7 SHIELDING

A set of covers is used to protect the chamber against coating. Each cover can be easily removed for cleaning out side the chamber. All covers are made of stainless steel. For order see Tabl.9.2.

5.8 SOURCE AND SUBSTRATES VIEWING

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Three viewing ports are design to enable direct observation of substrate holders and the source crucible.



FIG.5.11 MIDDLE VIEWPORT

Each viewport is provided with O-Ring sealed manual shutter. The view ports glass are protected inside with a removable glass. Middle viewport is also provided with easily removable eye protecting dark shade filter DIN 9-11 for process observation at comfortable light level (see Fig.5.11) However, additional eye protection may be required for long processes or certain bright materials.

Two additional viewports in rear and side wall on the chamber provided with camcorders, allow to visual observation status of substrate in the lower or top holders on the SYSTEM monitor

5.9 CONTROL CONSOLE

Front panel of the unit control consist: Main Switch, Emergency Switch, Thickness Controller, Electron Beam Gun Power Supply, Electron Beam Gun Source Control, Electron Beam Gun Sweep Control, PC, PC Keyboard, PC Touch Screen Monitor (see Fig.5.12)

The deposition controller 880 is the heart of the system being responsible for deposition process parameters control. A detailed description is available in the user manual attached. The microprocessor controlled quartz thickness monitor and process controller is fully interfaced with the main PLC and PC. All the relevant data of the process is recorded in the system HMI in a time base. Controller is provided with double crystal non-bakeable holder with shutter

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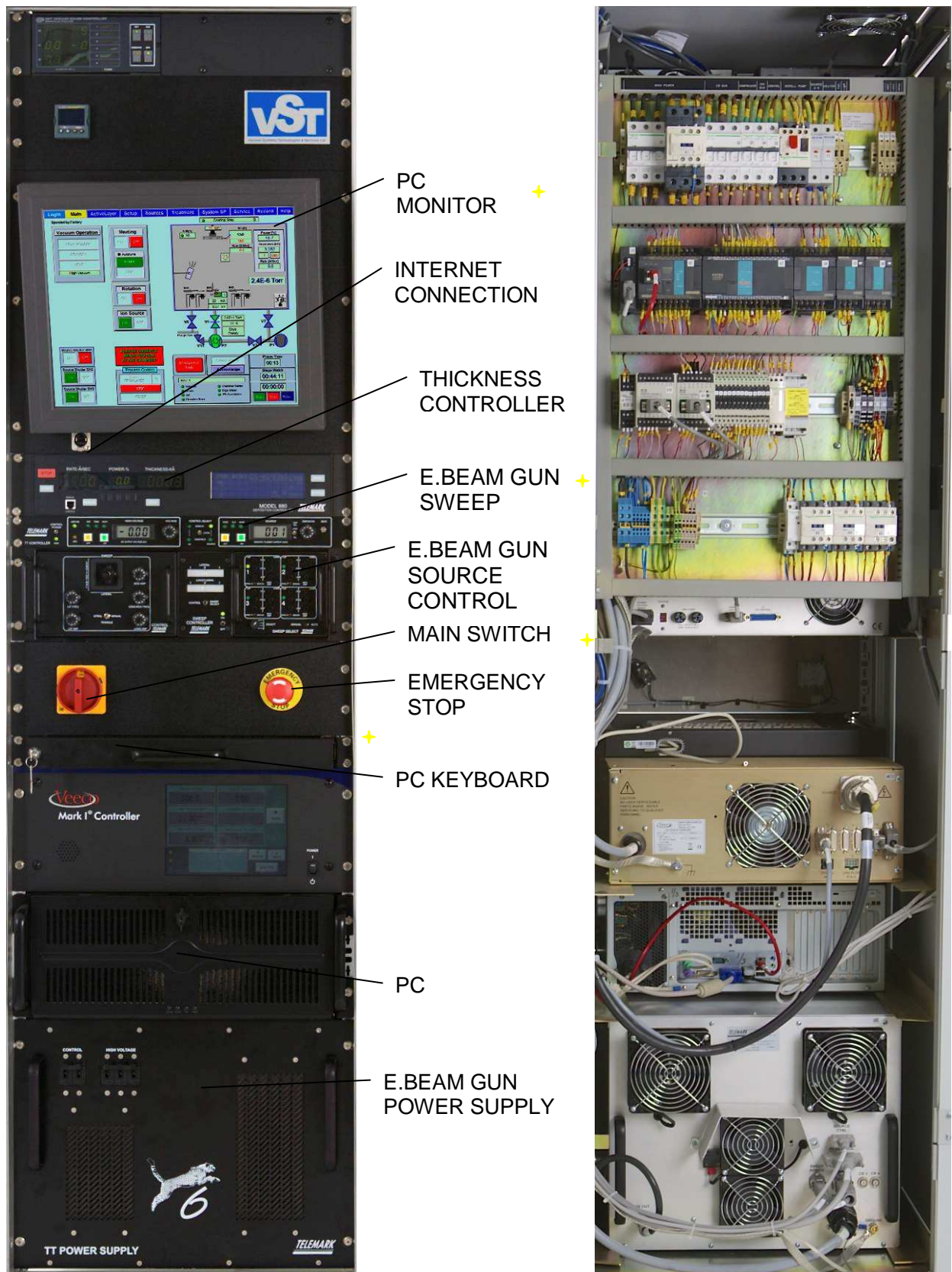


FIG.5.12 CONTROL CONSOLE

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PC monitor is mounted on the two arms holder, allows to use a monitor both in stationary position (as show in the picture) and turn in right to use it during load-lock manual manipulations.

5.10 FRAME

The closed frame is made of anodized aluminum profiles, compatible with clean room class 10000 conditions.

All doors and removed panels are interlocked.

The frame has four combination wheels with adjustable feet and two adjustable feet in the central parts of the frame

5.11 AIR SYSTEM

The compressed air is used to activate the system shutters and valves (see drw.B71521.PNM). The system interlock includes a pressure switch to protect system in case of air pressure-lose and pressure gauge. Minimum air pressure is 5 bar, maximum 7 bar. Some pneumatic valves are placed on the manifold; some are installed remotely, like for gate valve.

Note: The pressure switch is set at 4.5 bars to alert for low air pressure. There is no interlock for low pressure, just indication.

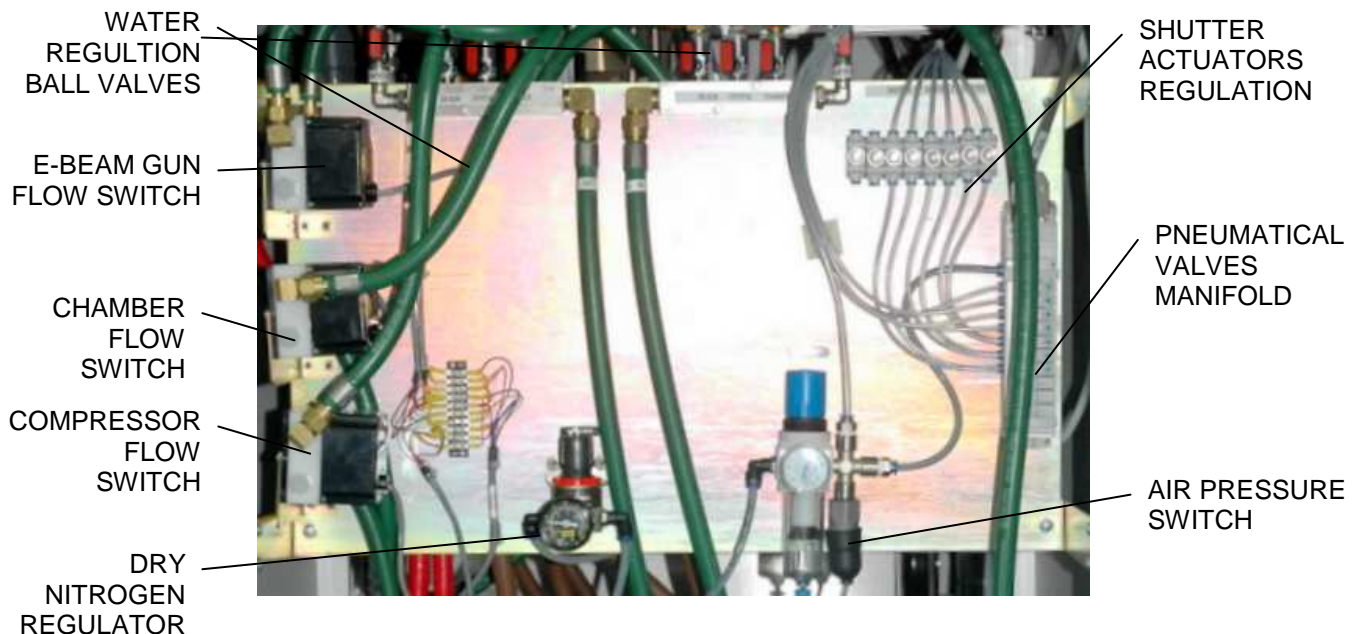


FIG.5.13 SERVICE PANEL

5.12 DRY NITROGEN SUPPLY

The dry nitrogen is used for process chamber venting and cryo pump regeneration.

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The system includes low pressure regulator with pressure gauge.

5.13 WATER SUPPLY SYSTEM

Four channels water system circuit is design for cooling of electron beam gun, vacuum chamber, cryopump compressor and thickness monitor head. Three rotary type water flow switches protect the electron beam gun, cryopump compressor and vacuum chamber the over temperature. A set of manual valves is used for regulate water flow.

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6 OPERATION

6.1 OPERATOR TRAINING AND CERTIFICATION



Before operate the machine the operator must be trained by official personnel from his company and certificate to work on this machine. Recommended training should include minimum of the following:

- A. Learn, know and understand the machine movements and hazards areas.
- B. Learn know and understand the machine electrical system, high voltage and low voltage and especially hazards areas. Opening of the electric cabinet only by authorized personnel and certified electrician.
- C. Learn, know and understand the machine computerized system and especially operation of the machine and stopping the machine and risk situations.
- D. Learning all possible risk in the machine especially blockage.
- E. Never operate the machine without another trained operator near the machine.
- F. Visually check that all doors and panel are in close and in lock position before any operation on the machine.
- G. Visually check that inside and around the machine is clean from any debris, parts, tools Etc.
- H. According to the kind of work, wear personal protection devices such as: helmet eyes protection glasses, protection shoes, ears noise protection Etc. all according state law and regulation and/ or according management orders.
- I. law and regulation and/ or according management orders.
- J. Learn, know and understand the machine operation stand and viewing all around the machine. In case of unauthorized personnel approaches – warning and remove.

| | |
|---|---|
|  | <p>Please read and fully understand the following procedure prior any attempt to operate system</p> <p>Although the software is fully protected, unprofessional use may activated unexpected system functions</p> |
|---|---|

6.2 MACHINE EMERGENCY STOP



The machine have an emergency stop push button, mushroom shape, color red on yellow, and the operator must be familiar with the location of all of them before operate the machine (see Figure 6.1).

After use, release mushroom button by quarter turn.

This switch cut electricity to the all components of the **DEPOSITION TOOL**

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FIG.6.1 EMERGENCY STOP PLACE

| | |
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|  WARNING | Only certified operator allowed to manually operating the machine. |
|--|---|

6.3 TURN OFF THE MACHINE

Turn Off the **System** is possible from the main control console of the **TFDS-462**.

6.4 SYSTEM CONTROL

The Control System consists of the subsystems listed below:


- Programmed Logic Controller (PLC)

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- Computer (PC) running Human Machine Interface software (HMI)

6.5 PLC

PLC operates all the equipment according to its software, instruction from operator and the current state of the system.

| | |
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|  | The logic behind the PLC is a VST Service Ltd. proprietary material and should not be copied or used without company written agreement. |
|---|--|

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7 Maintenance Instructions

The **TFDS-462B** is designed to offer reliability and long life. In order to maintain the value of the system, only qualified staff must perform maintenance. The following hints are meant to help performing specific jobs.

7.1 SAFETY

| | |
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|  WARNING | OBEY THE SAFETY INSTRUCTIONS GIVEN BELOW AND TAKE NOTE OF APPROPRIATE PRECAUTIONS. IF YOU DO NOT, YOU CAN CAUSE INJURY TO PEOPLE AND DAMAGE TO EQUIPMENT |
|--|---|

7.7.1 A suitably trained and supervised technician must maintain the **TFDS-462B**.

7.7.2 Ensure that the maintenance technician is familiar with the safety procedures which relate to the substances used in the chamber and to the fluoroelastomer 'O' rings used in the **TFDS-462B**.

7.7.3 Wear the appropriate safety-clothing when you come into contact with contaminated components. Dismantle and clean contaminated components inside a fume-cupboard.

7.7.4 Before you start maintenance work, switch off and isolate the **TFDS-462B** from the electrical supply so that it can not be operated accidentally.

7.7.5 Allow the cryogenics pump to warm up for at least 90 minutes before you start maintenance work.

7.7.6 Do not touch surfaces inside the **TFDS-462B** which are very hot (for example, the thermal evaporation source)

7.7.7 Check that all the required parts are available and of the correct type before you start work.

7.7.8 Do not reuse 'O' rings and seals if they are damaged.

7.7.9 Take care to protect sealing-faces from damage.

7.2 SEALING

The chamber is working under vacuum. Due to the specific behavior of a system under vacuum, special care must be taken to maintain seal performance. Unlike systems under pressure, finding leaks under vacuum is difficult and requires special equipment.

| | |
|--|---|
|  CAUTION | DO NOT TRY TO USE SOAP BUBBLE TO LOCATE A LEAK. WATER WILL BE PUMPED IN THE SYSTEM |
|--|---|

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7.3 CRYOGENIC PUMP SERVICE

Compressor maintenance is described in its operation and maintenance manual, section 5. Don't forget replace absorber each 3 years.

7.4 VACUUM VALVES

Vacuum valves do not require any special maintenance

7.5 CHAMBER SEALS


The O-rings should be checked monthly and replaced as necessary. Replacement O-rings should be made of Viton ®. The chamber O-rings should not need to be removed unless is damaged. Clean the O-rings *in situ* using a lint-free cloth wetted with Isopropyl Alcohol.

To change the O-ring (use gloves):

- a) Remove the O-ring, carefully using non-metallic tool not to damage the retaining groove.
- b) Use a lint-free cloth and IPA to clean the O-ring sealing face on the chamber and the groove on the plate.
- c) The new O-ring, cleaned with IPA, should be inserted with no twists. Stretch the O-ring evenly as it is inserted to avoid local regions of stretching.

| | |
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|  CAUTION | USE ONLY GENUINE REPLACEMENT PARTS DO NOT USE VACUUM GREASE ON NEW SEALS |
|--|---|

7.6 CLEAN THE BASE PLATE AND CHAMBER COMPONENTS

| | |
|--|---|
|  CAUTION | DO NOT USE WIRE WOOL TO CLEAN THE CHAMBER OR CHAMBER COMPONENTS. FINE WIRES WHICH BREAK OFF OF THE WIRE WOOL CAN DAMAGE THE 'O' RINGS AND SEALS IN THE TFDS-462 |
|--|---|

You must keep the baseplate and chamber free from coated deposits. Wipe off any deposits with a soft rag dampened with isopropyl or ethyl alcohol. Use a mild abrasive (such as 3M Scotchbrite or fine grade emery cloth) to remove any deposits which you cannot wipe off. If you have used aluminum foil to mask off parts of the chamber, remove and dispose of the foil and fit new foil.

Use a mild abrasive (such as 3M Scotchbrite) to clean any components in the chamber. Alternatively, use glass bead blasting to clean the components.

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7.7 INSPECT THE COOLING-WATER PIPELINES AND CONNECTORS

Inspect all cooling-water pipelines and check that they are not corroded or damaged and do not leak. Replace or repair any damaged or corroded pipelines and seal any leaks found. Inspect all cooling-water connections and check that they are tight and do not leak. Tighten any loose connections and replace any damaged connections.

7.8 INSPECT THE VACUUM PIPELINES AND CONNECTORS

Inspect all vacuum and exhaust pipelines and check that they are not corroded or damaged and do not leak. Replace or repair any damaged or corroded pipeline and seal any leaks found.

Inspect all vacuum and exhaust connections and check that they are tight. Tighten any loose connection.

7.9 INSPECT THE ELECTRICAL CABLES AND CONNECTORS

Inspect the electrical cables and connections as described below. Where necessary, refer to the electrical diagrams given in APPENDIX 5.

Inspect all electrical cables and check that they are not damaged and have not overheated. Replace any damaged or overheated cable.

Inspect all electrical connections and check that they are tight. Tighten any loose connections.

7.10 REMOTE TECHNICAL SUPPORT

1. Connect a cable to the PC Ethernet port
2. Check that the PC can surf on Internet
3. Surf internet and find "TeamViewer"
4. Launch the application "TeamViewer"
5. Under "Allow Remote Control" you will find "Your ID" and "Password"
6. Send it to VST service support and call

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8 SYSTEM COMPONENTS

The following main components are used in your system:

| Description | Model | S/N |
|----------------------------|---------------------|--------------|
| Roughing Vacuum Pump | XDS35I | 169420242 |
| Cryogenics pump | 10227, 350 | 350A1531 |
| Cryogenics pump compressor | 91-00003-0LW, M125 | 1251290 |
| Turbo pump | EXT750X | 160170705 |
| Gate valve | LGV-8000V-P | 08051607-G |
| Gate valve | EGV-5000V-P, 301017 | 12151618 |
| Roughing valve | KAV-150-P, 311074 | 08161638 |
| Foreline valve | KAV-100-P, 311073 | 06281604 |
| Foreline valve | KAV-75-P, 311072 | 03241509 |
| Vent valve | SS-4BK-1C | 0000785376 |
| Vent valve | SS-4BK-1C | 0000785376 |
| Vacuum gauge | FRG-720-NW25 | LI1616F003 |
| Vacuum gauge | FRG-720-NW25 | LI1622F139 |
| Vacuum gauge | CVM-211 GAL | 16C0695 |
| Vacuum gauge | CVM-211 GAL | 16K0395 |
| Deposition controller | 880-9901-1 | DC-1616 |
| Power supply TT-6 | 123-0606-1 | CH06400-0228 |
| XY Sweep Control | 132-0600-1 | XYT01260 |
| TT6 HV Control Module | 123-1026-1 | HVC060384 |
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9 Recommended spare parts list

Recommended spare parts list:

| DESCRIPTION | P/NUMBER | QTY p/unit | Note |
|---|--------------|---------------|-------------------------|
| Absorber | S67367.99.04 | 1 | Cryopump compressor |
| Vacuum chamber gaskets kit | S71521.62SE | 1 | Chamber |
| Gate & bonnet gaskets kit | S68016.63 | 1 | Gate valve |
| Valve gasket kit, | S68016.64 | 1 | Roughing valve |
| Valve gasket kit | S67367.65 | 1 | Foreline valve |
| Glass Gauge Single thoria-coated iridium filament 3/4 inch Kovar metallic | S65208101 | 1 | Vacuum Sensor |
| Convectron gauge tube NW16 | S65208102 | 1 | Vacuum Sensor |
| Vacuum transducer (cryogenic pump) | CVM-211 | 1 | Vacuum Sensor |
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| Shut-off valve | SS-4BK-1C | 3 | Vent valve |
| Insulator | B65208123 | 6 | Thermal evaporation |
| Insulator | B65208124 | 6 | Thermal evaporation |
| Emitter Assembly, e-beam gun | S65208181 | 1 | E-beam gun |
| Filament, 7-1/2 turn, e-beam gun (Box of 5) | 273-0001-1 | 1 | E-beam gun |
| Gasket kit, e-beam gun | 266-2000-1 | 1 | E-beam gun |
| Insulator, Cross, e-beam gun | 273-0005-1 | 2 | E-beam gun |
| Insulator, Collar, e-beam gun | 273-0006-1 | 4 | E-beam gun |
| Insulator, L, e-beam gun | 273-0008-1 | 2 | E-beam gun |
| Insulator, HV, (Box of 10) e-beam gun | 273-0010-1 | 1 | E-beam gun |
| Beam former, e-beam gun | 273-0004-2 | 2 | E-beam gun |
| Anode Plate, e-beam gun | 273-0003-1 | 2 | E-beam gun |
| HV Shield, (Box of 2) e-beam gun | 273-0011-1 | 1 | E-beam gun |
| Bearing | 281-0035-1 | 1 | E-beam gun |
| Belt | 376-9070-2 | 2 | Crucible indexer |
| Tetrode tube, part of Cheetah TT-6 | 114-0077-1 | 1 | E-beam gun power supply |
| Assembly, Cheetah Mother board, part of TT-6 | 120-0001-5-6 | 1 | E-beam gun power supply |
| Assembly, Resistor/Diode Red deck, part of TT-6 | 123-0610-1 | 1 | E-beam gun power supply |
| Capacitor, 0.5 mF 10kKVDC, part of TT-6 | 113-0045-1 | 1 | E-beam gun power supply |
| Diode 12 kV, 1A, part of TT-6, box of 6 | 114-0001-1 | 1 | E-beam gun power supply |
| 20Meg, 10W Resistor, part of TT-6 | 112-0004-1 | 1 | E-beam gun power supply |
| 100Ω 225W Resistor, part of TT-6, | 112-0001-1 | 1 | E-beam gun power supply |

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| box of 2 | | | |
| Spare kit for ion source | S680168105 | 1 | Ion source |
| Ferrofluidics feedthrough | S680168106 | 4 | Shutters |
| Rotary workholder ferrofluidics feedthrough | KY025-2Z | 1 | Rotary feedthrough |
| Mini Quartz crystal coaxial cable | S65208144 | 2 | Thickness controller |
| Shutter pneumatical actuator | S68016.71 | 4 | Shutters |
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Tabl.9.1 SPARE PARTS LIST

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Recommended consumable parts list

| # | DESCRIPTION | P/NUMBER | QTY p/unit | NOTE |
|----|-----------------------------------|------------|---------------|------------------------|
| 1 | Top cover (left half) | B715211004 | 1 | Vacuum chamber |
| 2 | Top cover (right half) | B715211012 | 1 | Vacuum chamber |
| 3 | Bottom cover | B715211003 | 1 | Vacuum chamber |
| 4 | Left side cover | B715211005 | 1 | Vacuum chamber |
| 5 | Right side cover | B715211006 | 1 | Vacuum chamber |
| 6 | Door cover | B715211007 | 1 | Vacuum chamber |
| 7 | Door cover (top part) | B652081005 | 1 | Vacuum chamber |
| 8 | Cover (viewports) | B675051008 | 2 | Vacuum chamber |
| 9 | Electron beam Gun's shutter plate | B715211600 | 1 | Electron beam Gun |
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| 14 | Viewport shutter plate | B652081014 | 2 | Vacuum chamber |
| 15 | Ion source cover | B680161601 | 1 | Ion source |
| 16 | Protective glass | S67312123 | 2 | Chamber's viewport |
| 17 | Crystal, gold , 6MHz, box of 5 | S65208143 | 1 | Thickness monitor head |

Tabl.9.2 CONSUMABLE PARTS LIST

Several consumable and repair spare parts are listed in subsystems operation manuals. Please refer to OEM manuals for full information. The above listed parts are related to the vacuum system and not to evaporation sources, pumps and other main system subassy-s.

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10 Warranty

SCOPE OF COVERAGE

VST Services Ltd. ("VST") warrants the **TFDS-462B** and accessories to be free from defects in material and workmanship for a period of TWO YEAR from date of shipment by VST or authorized representative to the original purchaser ("Purchaser"). Any product or parts of the product repaired or replaced by VST under this warranty are warranted only for the remaining unexperienced portion of the one-year original warranty period applicable to the product, which has been repaired or replaced. After expiration of the applicable warranty period, the Purchaser shall be charged VST's current prices for parts and labor, plus transportation for any repairs or replacements.

The parts replaced under warranty are shipped at client's expense.

REPAIRS

The obligations of VST under this warranty shall be at its option to repair, replace or adjust the product on an ex-works basis so that it meets applicable specifications published by VST. The shipment expenses for returning any item for repair under warranty are the client's responsibility.

WARRANTY PERFORMANCE

To obtain warranty satisfaction, contact the following: VST Service Ltd., 19 Imber st. Kiriath Arie P.O.B. 4137 Petah Tikva 4951153 Israel,
Phone: 972-3-9727710/2, Fax: 972-3-9727711.

WHAT IS NOT COVERED

The above warranties do not apply:

To damages or malfunctions due to failure to provide reasonable and necessary maintenance in accordance with VST operating instructions.

To damages or malfunction due to chemical or electrolytic influences or use of the product in working environments outside the specification.

To fuses and all expendable items which by their nature or limited lifetime may not function for a year.

To defects or damages caused by modifications or repairs not authorized in this manual effected by the original purchaser or third parties.

OTHER RIGHTS AND REMEDIES

These remedies are exclusive. VST shall not be liable for consequential damages, for anticipated or lost profits, incidental damages or loss of time or other losses incurred by the purchaser or other third party in connection with the product covered by this warranty, or otherwise. Any implied warranty on these products shall be limited to one year from date of shipment to purchaser.

Unless otherwise explicitly agreed in writing, it is understood that these are the only written warranties given by VST. Any statements made by any persons including representatives of VST that are inconsistent or in conflict with the terms of the warranty shall not be binding on VST unless reduced to writing and approved by an authorized officer of VST.

This warranty gives PURCHASER specific legal rights.