# INSTRUCTION MANUAL

## *MULTIDYNE™ 1000m / 2000m*
## CORONA TREATING SYSTEMS

**MULTIDYNE 1000m Part Numbers: 10000-67, -69, -71, -73**
**MULTIDYNE 2000m Part Numbers: 10000-68, -70, -72, -74**


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**TABLE OF CONTENTS** **PAGE**

# 1 Description of System

In order to operate your *MULTIDYNE™ 1000m/*2000*m* generator correctly, safely and economically, please read this installation and operation manual first.

Operate the generator only in ideal conditions, for its intended purpose and observe any warnings, safety rules and all other instructions contained in this manual.

## 1.1 Introduction

Corona treatment is utilized in the plastic industry as a solution for solving adhesion difficulties. Polymer materials, such as polyethylene are treated prior to the printing, gluing, or laminating process.

The *MULTIDYNE™ 1000m/2000m* Low Frequency Corona treating system is very effective in pre-treatment of injection and blow-molded components, as well as extruded parts. The system can be operated manually or incorporated as an automated feature in existing and new lines of production.

The standard treating head delivers treatment to unlimited lengths of material with widths of up to 2.50” (65mm). Both flat surfaces and complex 3-dimensional parts are treatable with the flexibility of the *MULTIDYNE™ 1000m/2000m* system.

### 1.1.1 Intended Purpose

The *MULTIDYNE™* corona treatment may only be applied using an appropriate corona treating head. Only use genuine 3DT heads that are suitable for the system and for the material to be treated. Any other application is deemed to be beyond normal operation and the operator is solely responsible for any consequences. The use of the system for any type of product other than specified is considered non-intentional and prohibited by the manufacturer.

**Note:**

Normal operation includes the observance of our prescribed installation, initial operation, operating and maintenance conditions and waste disposal measures.

Only qualified, authorized and trained personnel may operate the system. Each person involved in transport or working on / with the system must have previously read and understood the corresponding passages of the operating manual, especially the chapter entitled “Safety Instructions”. The operator must inform the appropriate personnel of any risks that may occur.

The operator must ensure that the operating manual has been understood by the appropriate personnel. It is advisable to keep the operating manual in a suitable place near where the system is in operation.

## 1.2 System Configuration

The *MULTIDYNE™ 1000m/2000m* system is furnished as a complete set of components including the generator cabinet, treating head(s), and accessories.

The corona generator and high voltage transformers are housed in a compact, durable, powder coated steel cabinet. This cabinet contains the power supply, high voltage transformers, medium velocity blower, an operator control panel with an LCD display screen, the control and safety circuitry, and an interface connector for the connection of additional remote and required safety circuitry.

The treating heads, which generate the low frequency corona discharge, are connected to the cabinet by means of flexible conduit that is several meters in length. Each treating head includes two separate conduits, one for the high voltage cables and one for the air supply.

This design provides for convenient and space saving installation of the treating heads at the production line. The flexible conduits also make it possible to mount the discharge heads on linear or robotic motion systems.

## 1.3 Principle of the *MULTIDYNE*™ Corona Treatment System

The principle of the corona treating system is shown in Figure 1.3.1. Two hook-formed wire electrodes, arranged in close proximity to each other, are connected to the secondary windings of a high voltage transformer. This transformer converts line voltage to a high voltage of 12 kV. For safety reasons, the secondary windings have a center ground which decreases the potential between the high voltage leads and ground by 50 percent. The transformer is capable of limiting the current to the electrodes, should a short circuit occur.

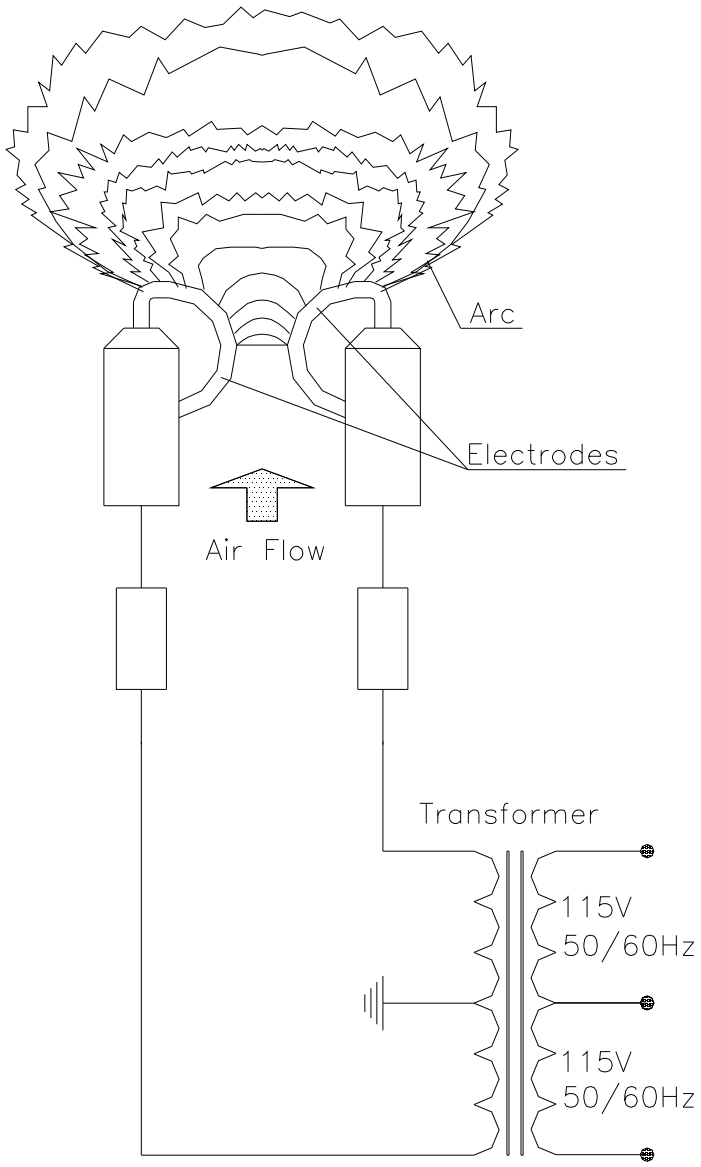



**FIGURE 1.3.1 *MULTIDYNE*™ Principle of Operation**

As power is supplied to the electrodes, the electric arc only occurs between the points of the electrodes that are closest to each other. A constant flow of air supplied by a blower deflects the arc causing it to spread and follow the hook formed curvature of the electrodes. A constant arc is produced at a rate of 50 to 60 cycles per second.

The ability of the arc to spread depends on the secondary voltage of the transformer, the air velocity created by the blower, and the geometry or shape of the electrodes. The higher the voltage and air velocity, the further the arc can be spread. Too much air velocity can break up the arc prematurely, reducing the useful treatment width.

The continuous arc produces a corona discharge between the electrodes that is dispersed on all sides. This corona discharge is loaded with highly energized ions. This energy field is capable of increasing the wettability of the surfaces exposed, providing the necessary cross-linking between polymer surfaces and inks, coatings or adhesives.

In a typical production setup, the object surface to be treated is either placed or moved past the electrodes at a distance of approximately 0.2 in. (5 mm). The treatment pattern on a stationary object is oval as shown in Figure 1.3.2.

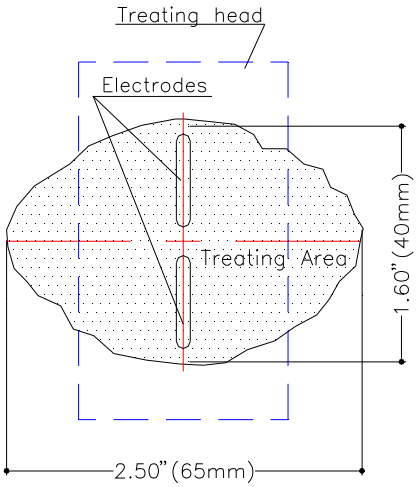



**FIGURE 1.3.2 Treatment Pattern**

The treatment width is limited to 2.50 in. (65 mm) when the object to be treated moves in the direction indicated by the arrow in Figure 1.3.3. The *MULTIDYNE*™ system is therefore capable of accurately treating smaller areas and objects. By using more than one treating head, greater treatment coverage area can be realized.

The velocity the object can travel past the treating head and still obtain the desired treating level depends on the material to be treated, the required treatment level and the width of the area to be treated.

If it is not necessary to treat to the maximum 2.50" (65mm) width of the treatment area, the head can be rotated as shown in Figure 1.3.3. The further the head is rotated, the greater the exposure time. This can help to improve either the treating level or the speed that the object moves past the treating head.

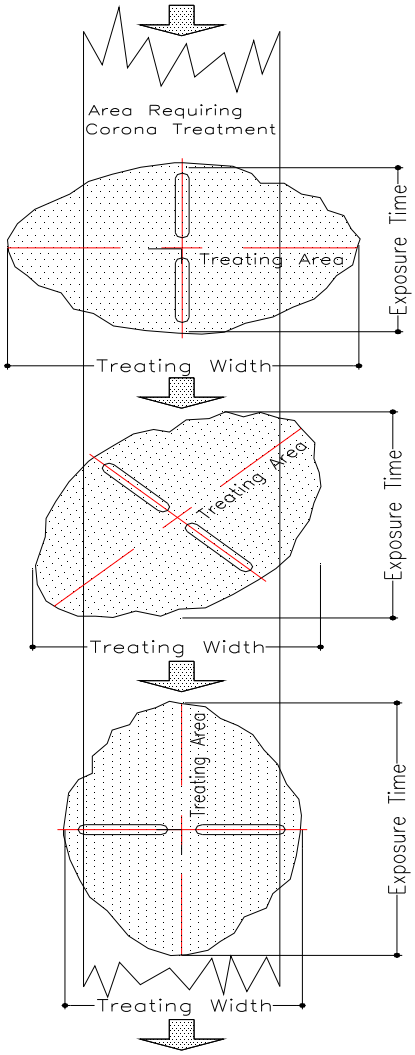



**FIGURE 1.3.3 Treatment Direction**

The *MULTIDYNE*™ *1000m/2000m* systems can treat a wide variety of applications. Treatment on surfaces adjacent to metal inserts and areas held in metal fixtures are possible with the *MULTIDYNE*™ treating system. Smaller bottles or containers can be treated 360º with one treating head on each side without rotating the object. Small tubes are able to be treated with 360º coverage using only one head.

## 1.4 System Specifications

### 1.4.1 *MULTIDYNE*™ 1000m Specifications

**Generator Technical Specifications:**

| | |
|---|---|
| Model: | MD1000m |
| Part Number(s): | 10000-67, -69, -71, -73 |
| Mains Voltage: | 100 – 120 / 200 – 240 VAC |
| Voltage Fluctuation: | ± 10% |
| Frequency: | 50/60 Hz |
| Phase: | Single |
| Input Power: | 1.5 kVA max. |
| Circuit Breaker: | 16 Amp |
| Full Load Amperage: | 6 A @ 100VAC, 4.7 A @ 240VAC |

**Treatment Head Specifications:**

| | |
|---|---|
| Number of Heads: | 1 |
| Voltage at Electrode: | 2 x 12 kV |
| Treatment Head Assembly: | Mechanical |
| Head Conduit Length: | |
| • 10000-67 | 2 m (79 in.) |
| • 10000-69 | 3 m (118 in.) |
| • 10000-71 | 4 m (157 in.) |
| • 10000-73 | 5 m (197 in.) |
| Maximum Treating Area with Treatment Head in Stationary Position: | 65 x 40 mm (2.5 x 1.6 in.) max. |
| Optimal Treating Distance from Head: | 5 mm (0.2 in.) |

**Control Specifications:**

| | |
|---|---|
| System Operation: | Local or Remote (Menu selectable) |
| Treat Activation Method: | External Treat Input |
| Treatment Mode: | Continuous or Timed (Menu selectable) |
| Timed Treat Duration: | User programmable, 0.1 to 25.5 seconds |
| Active Fault Monitoring: | |
| • HVT Secondary Current | Programmable min and max Current Limit |
| • Treatment Head Air Flow | Programmable min and max Blower Speed |
| • E-STOP Safety Contact | Treating Output Disabled when Open |

**External I/O Specifications:**

| | |
|---|---|
| External I/O Connector: | Female Receptacle, 16-pin |
| Power Supply: | 24 VDC, 300 mA fused |
| Control Inputs (2): | |
| • Remote Run Input | Opto-isolated, 10 – 30 VDC, 10 mA sink |
| • Intermittent (Treat) Input | Opto-isolated, 10 – 30 VDC, 10 mA sink |
| Safety Contact Input (1): | |
| • E-STOP / Safety Interlock | NC contact (24 VDC rating) required |
| Control Outputs (2): | |
| • Fault Output | Relay contact, SPST NC (Form B)[Note1] |
| • Treating Output | Relay contact, SPST NO (Form A)[Note1] |

**Environmental Specifications:**

| | |
|---|---|
| Ambient Temperature Range: | +5º C to +40º C (41 - 104º F) |
| Relative Humidity: | 20% to 85% RH |
| Maximum Altitude: | 1000 meter above sea level |
| Noise Emissions: | 75.5 dB(A) |

**Mechanical Specifications:**

| | |
|---|---|
| Dimensions (W x H x D): | 500 x 524 x 225 mm (19.7 x 20.63 x 8.86 in.) |
| Weight (approximate): | 35 kg (77 lbs.) |

Notes:

1. All output relay contacts are rated for 250VAC – 30VDC, 2 A max.

### 1.4.2 *MULTIDYNE*™ 2000m Specifications

**Generator Technical Specifications:**

| | |
|---|---|
| Model: | MD2000m |
| Part Number(s): | 10000-68, -70, -72, -74 |
| Mains Voltage: | 200 – 240 VAC |
| Voltage Fluctuation: | ± 10% |
| Frequency: | 50/60 Hz |
| Phase: | Single |
| Input Power: | 2.8 kVA max. |
| Circuit Breaker: | 16 Amp |
| Full Load Amperage: | 5.3 A @ 240VAC |

**Treatment Head Specifications:**

| | |
|---|---|
| Number of Heads: | 2 |
| Voltage at Electrode: | 2 x 12 kV |
| Treatment Head Assembly: | Mechanical |
| Head Conduit Length: | |
| • 10000-68 | 2 m (79 in.) |
| • 10000-70 | 3 m (118 in.) |
| • 10000-72 | 4 m (157 in.) |
| • 10000-74 | 5 m (197 in.) |
| Maximum Treating Area (per head) with Treatment Head in Stationary Position: | 65 x 40 mm (2.5 x 1.6 in.) max. |
| Optimal Treating Distance from Head: | 5 mm (0.2 in.) |

**Control Specifications:**

| | |
|---|---|
| System Operation: | Local or Remote (Menu selectable) |
| Treat Activation Method: | External Treat Inputs (2) |
| Treatment Mode: | Continuous or Timed (Menu selectable) |
| Timed Treat Duration: | User programmable, 0.1 to 25.5 seconds |
| Active Fault Monitoring: | |
| • HVT Secondary Current | Programmable min and max Current Limit |
| • Treatment Head Air Flow | Programmable min and max Blower Speed |
| • E-STOP Safety Contact | Treating Output Disabled when Open |

**External I/O Specifications:**

| | |
|---|---|
| External I/O Connector: | Female Receptacle, 16-pin |
| Power Supply: | 24 VDC, 300 mA fused |
| Control Inputs (3): | |
| • Remote Run Input | Opto-isolated, 10 – 30 VDC, 10 mA sink |
| • Intermittent (Treat) Input (Head 1) | Opto-isolated, 10 – 30 VDC, 10 mA sink |
| • Intermittent (Treat) Input (Head 2) | Opto-isolated, 10 – 30 VDC, 10 mA sink |
| Safety Contact Input (1): | |
| • E-STOP / Safety Interlock | NC contact (24 VDC rating) required |
| Control Outputs (2): | |
| • Fault Output | Relay contact, SPST NC (Form B)[Note1] |
| • Treating Output | Relay contact, SPST NO (Form A)[Note1] |

**Environmental Specifications:**

| | |
|---|---|
| Ambient Temperature Range: | +5º C to +40º C (41 - 104º F) |
| Relative Humidity: | 20% to 85% RH |
| Maximum Altitude: | 1000 meter above sea level |
| Noise Emissions: | 75.5 dB(A) |

**Mechanical Specifications:**

| | |
|---|---|
| Dimensions (W x H x D): | 500 x 524 x 225 mm (19.7 x 20.63 x 8.86 in.) |
| Weight (approximate): | 55 kg (121 lbs.) |

Notes:

2. All output relay contacts are rated for 250VAC – 30VDC, 2 A max.

### 1.4.3 *MULTIDYNE*™ PCB1 Control Board Specifications

| | |
|---|---|
| Input Voltage: | 90 – 265 VAC |
| Input Frequency: | 50/60 Hz |
| Input Power: | 110 W max. |
| Control Input Voltage: | 10 30 VDC |
| Control Input Current: | 15 mA max. |
| Control Output Voltage: | 24 VDC max. |
| Control Output Current: | 300 mA max. |

# 2 Safety Instructions

## 2.1 Definition of Safety Symbols

The following safety symbols can mark passages in the text warning of possible risks and sources of danger. Familiarize yourself with these symbols.

**DANGER: General Risk Area!**
Failure to observe these warnings may result in death, injury and / or damage to the corona station. This manual must be consulted in all cases where this symbol is used.

**DANGER: Hazardous Voltage!**
Failure to observe this warning may result in death or injury.

**CAUTION: Electromagnetic Field!**
Possible interference with cardiac pacemakers due to electromagnetic field exists. Failure to observe this warning may result in death or injury and could endanger health.

**CAUTION: Hot Components, Do Not Touch!**
Failure to observe this warning may result in injury by burning. Observe specific danger notices.

**CAUTION: Poisonous or Harmful Chemicals**
Failure to observe this warning may result in exposure to noxious or harmful chemicals.

**Note:** Materials/fuels for treatment and/or disposal in accordance with legal requirements such as WEEE Directive 2012/19/EU.

**Note:** This symbol indicates explanations or references.

Protective Earth (Ground) IEC 60417 – 5017.

## 2.2 Definition of Terms

### 2.2.1 Operator

The operator is any person using the system himself or upon whose orders the system is used. The operator may appoint a designee to protect his/her rights and perform the operator duties on their behalf.

### 2.2.2 Skilled and Qualified Personnel

Skilled and qualified personnel are persons having sufficient knowledge in a particular specialized field, based on special training and experience, and who are acquainted with the relevant industrial safety regulations as well as the generally accepted rules of the art.

### 2.2.3 Specialized Electrical Personnel

On the basis of specialized training and experience, electrical personnel will have acquired special knowledge in the field of electrical engineering. They will be acquainted with the relevant industrial safety regulations as well as the generally accepted rules of the art.

### 2.2.4 Trained Personnel

Trained personnel are those who have been informed and trained as required by a skilled person on the tasks with which they are entrusted and about the possible danger due to improper handling. They must also be instructed on the necessary means and measures of protection.

### 2.2.5 Authorized Personnel

Authorized personnel are those who have been designated by the operator to run the system.

## 2.3 General Safety Instructions

Industrial safety and accident prevention are the aims of these safety instructions.
They must be observed.

### 2.3.1 Operating the System

The system must only be operated by trained and authorized personnel. Personnel must be physically capable of carrying out this activity and must not be under the influence of any substances that detract from speed of reaction.

All safety and warning instructions on the system must be observed.

In the event of a malfunction, the system must be shut down immediately and secured against reactivation. Faults must be remedied immediately.

Operating personnel are obligated to report immediately any changes occurring in the system that may affect safety to the operator or to their designee.

Operating personnel must ensure that unauthorized persons do not work on or with the system.

The operator is obligated to take steps to ensure that the system is only operated in a safe and operable condition. This implies that all means of protection, (e.g. limit switches) are available and operative.

Safety fixtures must not be removed or rendered inoperative. When the removal of safety fixtures is necessary for installation, initial operation, maintenance or repair, they must be replaced immediately on completion of such work.

### 2.3.2 Installation, Setup, Maintenance and Repair

The system may only be installed, setup, maintained and repaired by qualified personnel.

The operator must delegate responsibility for installation, setup, maintenance and repair to qualified personnel and ensure that all applicable safety procedures are observed.

All work on the system may only be performed when the system is shut down.

**Before beginning such work, the system must be secured against accidental activation. Turn off the main power disconnect switch and then Disconnect the line cord from the power entry module.**

**Qualified personnel must follow local and international lock-out tag-out procedures. Apply a warning notice to the system and ensure that the system is de-energized.**

### 2.3.3 Safeguarding

While operating, the electrodes of the treating head(s) are charged with high voltage at line frequency (see specifications).

To prevent contact of any person with the corona discharge present at the treating head(s), a proper safeguard (follow all local and federal standards), must be installed.


**MD1000m**


**MD2000m**

**FIGURE 2.3.3 Corona Treatment Heads**

**DANGER:**
**It is the sole responsibility of the operator to install and maintain proper safeguarding of the treating head(s). Operation of the treating system without proper guarding in place is prohibited by the manufacturer and may result in death, injury or health impairment. See Safety Guard Monitoring.**

**DANGER:**
**The treating heads are to be mounted in a customer supplied enclosure. Proper Lock-Out/Tag-Out (LOTO) procedures apply.**

**WARNING:**
**The treating head electrodes may be hot for a few seconds after operation. The time required to open the customers' protective enclosure and obtain access to the treating head may not be enough time to allow the treating heads to be cool enough to touch.**

**DANGER:**
**Mounting the treating head(s) inside of an enclosure with proper LOTO procedures in place should prevent personnel from encountering death, injury or health impairment from the heat of the treating head.**

### 2.3.4 Accident Prevention Regulations

Read the company, local and federal OSHA accident prevention regulations. These regulations must be observed. These regulations take precedence over any others stated in this manual.

To maintain a safe working environment:

- You must protect yourself and others from avoidable danger and injury.
- Any procedure adversely affecting the safety of the system must be avoided.
- Modifications to the system are only permissible with written approval from 3DT.
- After performing maintenance and repairs, check the operational safety of the system.
- Use original spare parts only.

### 2.3.5 Airborne Noise Emissions

While operating, the *MULTIDYNE*™ treating system will emit noise with a maximum level of 79 dB(A) (refer to the System Specification section). The manufacturer recommends hearing protection for persons present in the vicinity of the equipment.

### 2.3.6 Cardiac Pacemakers

During operation, the high-voltage cables and electrodes of this corona station are surrounded by a high-frequency electromagnetic field.

**Note:**

The probability of interference of the function of cardiac pacemakers in the vicinity of this field and subsequent health hazards cannot be excluded. Possible consequences are fatality, injury or health impairment.

It is recommended that a minimum distance of 0.6m (2 ft.) be maintained between the *MULTIDYNE™ 1000m/2000m* treating equipment and persons who have cardiac pacemaker devices.
Wearers of cardiac pacemakers can be identified by their pacemaker-wearer's identity card or by an operation scar to the left or right of the chest or abdomen.

In the event of interference of the cardiac pacemaker (e.g., unconsciousness):

- Remove the pacemaker wearer immediately from the interference signal zone.
- Switch off interference source (corona generator).
- In normal cases the pacemaker will resume its usual stimulation pattern.
- If necessary, seek medical attention.

**Note:**

The intensity of an electrical field may be reduced by proper shielding.

## 2.4 Operating Safety Instructions

### 2.4.1 Electrical

Electrical work on the system may only be carried out by specialized electrical personnel.

In the event of a malfunction of the electrical energy supply, switch off the *MULTIDYNE*™ generator immediately.

During inspection, maintenance and/or repair work:

- De-energize the *MULTIDYNE*™ system **AND**
- Secure the unit against accidental activation (e.g. disconnect the power cord from the power entry module).

Check the electrical equipment on the system regularly. Remove faults such as loose connections or scorched cables immediately.

Use only original fuses with the prescribed amperage.

After electrical assembly or repair, test all protective measures applied (e.g., resistance to Protective Ground connection point).

### 2.4.2 Gaseous Emissions

Due to the fact that gaseous emissions are generated from the electric arc of the corona treatment head, small amounts of gaseous emissions are produced. Depending on the conditions at the operating site, these concentrations are usually below permissible levels.

Certain installations may require some provisions for exhausting these gaseous emissions which can be easily accomplished.

### 2.4.3 Exhaust

The exhaust system removes gases and vapors from the electrode area and cools the corona electrode. The exhaust air may be vented above the roof of the building with a rainproof outlet. Care must be taken that the outlet is not located near the air intake of an air conditioning system.

**It is the sole responsibility of the operating facility to provide proper exhaust to the system that complies with the environmental, company, local, state, and federal occupational safety standards.**

Check with your local EHS (Environmental, Health and Safety) advisor for Permissible Limits (PEL and TLV) of gaseous emissions.

### 2.4.4 Electrostatics

Plastic films are electro-statically charged by the corona output.

Any conductive material that is not grounded properly can be electrically charged by the corona and pass that electrical discharge onto the machine or the machine operator, which could cause harm to both.

**Note:**

It is very important to ground conductive materials properly to prevent such an electrostatic discharge.

Products are commercially available that can reduce the buildup of charge on a material.

## 2.5 Safety Functions

Company, local, state and federal occupational health and safety regulations must be observed during the life cycle of the equipment (installation, operation, service, etc.).

Any regulations stated or implied in this manual that are different from these regulations should not be followed unless authorized by local EHS (Environmental, Health and Safety) personnel or authorities.

### 2.5.1 Remote Control Selection

To prevent accidental activation of the treating system from more than one operator control station, the *MULTIDYNE*™ control interface features a Remote Control menu selection that must be enabled if the system is to be operated by an external controller.

The remote control mode inhibits the use of the local green ON button found on the front panel of the *MULTIDYNE*™ cabinet. In remote control mode, the ON function is controlled externally by the remote RUN input. See Control Signals for more details.

**Note:**

The functionality of the red OFF button on the front panel does not change when operating in remote control mode.

### 2.5.2 Safety Guard Monitoring Device

In order to comply with safety standards and regulations, the treating head(s) of the system must be guarded (see Safeguarding).

For applications where frequent access to the treating area is required, a removable guard may be used when interlocked with an approved safety device.

The output of this safety device is to be directly connected to the input of the *MULTIDYNE*™ safety circuit. See the Control Signals and Safety Interlock sections.

### 2.5.3 Safety Guards for Internal High Voltage

**DANGER:**
**Internal safety guards are installed as shown below. These guards must remain in place to protect against accidental contact with high voltages that are present inside the *MULTIDYNE*™ enclosure.**

**It may be necessary to remove these guards for maintenance or service. If removed, these guards must be re-installed before power is restored to the system.**

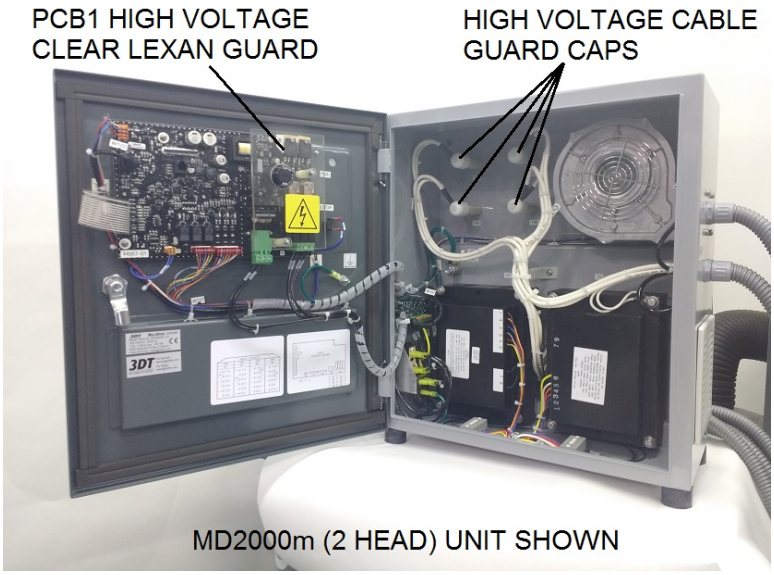



**FIGURE 2.5.3 High Voltage Safety Guards**

**DANGER:**
**Before opening the cabinet, the system must be secured against accidental activation. Turn off the power using the main disconnect switch and then disconnect the line cord from the power entry module.**

**Qualified electrical personnel must follow local and international Lock-Out/Tag-Out (LOTO) procedures. Ensure that the system is de-energized and apply a warning notice to the system.**

**Safety procedures must be in place to protect against accidental contact with high voltage inside the enclosure of the *MULTIDYNE™ 1000m/2000m*.**

## 2.6 Other Hazards

There may be other hazards such as non-obvious risks that may result from using the system. The system must therefore only be used in a technically sound condition, taking into account the safety aspects and risks involved.

Observe the rules of accident prevention, all relevant safety regulations and any applicable environmental protection specifications. In addition, the operating, maintenance and repair instructions found in this manual must be understood and adhered to.

## 2.7 Waste Disposal

The *MULTIDYNE™ 1000m/2000m* corona treating stations contain materials that are subject to special disposal requirements.

Some of the materials that may require special disposal procedures include:

- Silicone Rubber
- Ceramic
- HDPE (Polyethylene)
- PVC Pipe & Corrugated Tube
- Metals (Steel, Stainless Steel, Aluminum)
- Electronic Components and Printed Circuit Boards

The operator is responsible for observing the environmental regulation(s) in force at the time of disposal.

# 3 Transport

## 3.1 General

Eyebolts are provided on the top of the generator cabinet for removing the unit from the crate and moving it into position for installation. The eyebolts are to be attached to a customer supplied strap or harness connected to a lifting system such as a forklift.

**Note:**

Proceed carefully when lifting and transporting the system to prevent damage due to force.

**Warning:**
**The *MULTIDYNE*™ generator must only be transported by using the supplied eyebolts.**

**After the unit is installed, remove the eyebolts and replace with the two M8 x 16 mm stainless flat head screws supplied with the unit.**


**Figure 3.1 Cabinet Eyebolts**

## 3.2 Transport and Storage Temperature

Do not transport or store equipment outside the +5° C to +40° C range. For short periods of time (up to 24 hours), the storage temperature may reach +70° C.

**Note:**

Electrical equipment susceptible to damage at low temperatures includes PVC insulated cables.

Suitable means must be provided to prevent damage from humidity, vibration and shock.

### 3.3 Transport Weights and Dimensions

Please refer to the MD1000m or MD2000m Mechanical Specifications section for details.

### 3.4 Packing

Observe the symbols on the packaging. The unit will be packaged in accordance with any customer specifications.

### 3.5 Interim Storage

**Caution:**
**The *MULTIDYNE*™ system must be completely dry when in operation. If the system is moved from a cold place to a warmer location, humidity will condense on the surface of the unit. During operation this may lead to dangerous discharge faults and/or short-circuits.**

When moving / storing / setting up the *MULTIDYNE*™ corona treating station:

- Store the system in a dry place free from frost.
- Acclimatize the corona system prior to initial operation.

### 3.6 Incoming Goods Inspection

Upon delivery of the system, check and ensure that:

- The Model Number and Serial Number on the rating plates correspond to the order and delivery documents.
- The equipment is complete and all parts are in perfect condition.

**Note:**

Any transport damage and / or missing parts must be reported immediately to 3DT LLC.

# 4 Installation

## 4.1 Mechanical Installation

**WARNING:**
**The system must only be moved and assembled by qualified and authorized personnel.**

To lift, transport and position the *MULTIDYNE*™ generator, suitable hoisting equipment should be used. To lift the generator, use the eyebolts included with the unit. Refer to the applicable system specifications section to obtain the generator weight and dimensions.

### 4.1.1 Installation Conditions

Observe the following guidelines when selecting the location for the corona station:

- The place of installation must be free from vibration and dust.
- The installation location must be dry. The relative humidity must not exceed that given in the operating specifications.
- The ambient temperature must not exceed 40°C.
- Do not position the *MULTIDYNE*™ generator in a position that is difficult to operate the disconnect switch, DISC1.
- Do not obstruct the ventilation system.
- Do not install in an area where combustible gases or mixtures are present or likely.
- Observe a minimum distance of 2 meters to sources of gas and vapors (e.g. extruder dies, processing plants) as well as heat sources.
- The place of installation should be clear from water sources, such as drinking fountains and sinks.
- Adequate accessibility must be provided for setup, operation and maintenance in a production line.

### 4.1.2 Generator Mounting

The following recommendations should be followed when mounting the *MULTIDYNE*™ generator cabinet:

- The generator must be mounted in a vertical position.
- Each of the rubber feet supporting the unit has a threaded insert to accommodate M8 screws and washers for permanently mounting the unit.
- The generator must be mounted in a position that allows a minimum clearance of 100mm (4”) from all sides, top, and back of the *MULTIDYNE*™ enclosure to any other installation or surface.
- The area in front of the *MULTIDYNE*™ must be kept clear (typically 920mm or 36”) to allow a safe access area to the inside components for maintenance and service.
- Position the generator so that the door can be opened to a minimum angle of 90°.

### 4.1.3 Treating Head Mounting

Observe the following recommendations when mounting and securing the corona treating head(s) for operation:

Each treating head is connected to the generator via two flexible conduits. One conduit is for the high voltage cable and one is for the air supply.

In order to avoid damage to the treating head conduits, they must be properly mounted and kept away from any moving obstacles.

The treating head has a threaded M8 hole for mounting as shown in the mounting-hole detail diagram on the right. No other holes should be drilled into the treating heads.

The treating heads should be mounted at a distance of 0.2 to 1.0 in. (5 to 25 mm) from the surface to be treated (see treating head distance diagram at right). The closer this distance is to the surface, the higher the treatment level will be. The optimal distance is 0.2 in. (5 mm).

**CAUTION:**
The manufacturer strongly recommends that safety precautions such as enclosures and / or light barrier sensors be installed in the proximity of the high voltage discharge. This will ensure that no person can come within close proximity of the electrodes or the corona discharge during operation (see Safety Interlocks). No attempts should be made to disassemble a treating head for any reason without the consent of the manufacturer.

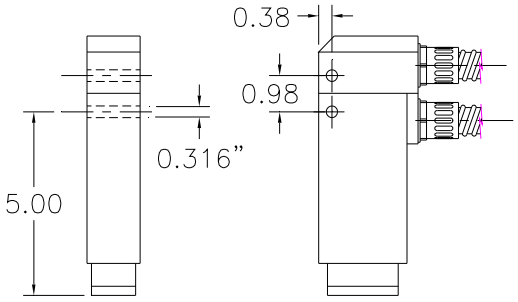



**FIGURE 4.1.3.1 Head Mounting Hole**

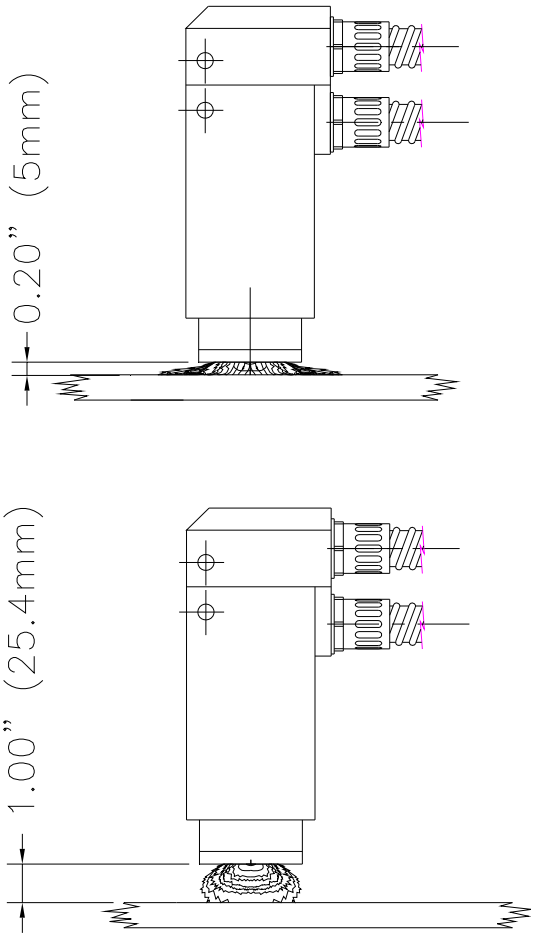



**FIGURE 4.1.3.2 Treating Head Distance**

## 4.2 Electrical Installation

**DANGER: The electrical installation of the system may only be carried out by specialized electrical personnel.**

Observe the following instructions for electrical installation:

- Cables must be laid properly. Use conduit or wire-ways to protect and secure the cabling.
- Perform electrical installation in conformity with the System Specifications and Control Signals.

### 4.2.1 Input Voltage

**DANGER: Before opening the cabinet, the system must be secured against accidental activation. Turn off the power switch and disconnect the line cord from the power entry module.**

**Qualified personnel must follow local and international Lock-Out/Tag-Out (LOTO) procedures. Apply a warning notice to the system and ensure that the system is de-energized.**

The *MULTIDYNE*™ generator input line voltage requirements vary by model. One head *MULTIDYNE*™ *1000m* generators are capable of operating from an input line voltage of either 100 – 120 VAC or 200 – 240 VAC. The two head *MULTIDYNE*™ *2000m* units are restricted to an input line voltage range of 200 – 240 VAC.

#### 4.2.1.1 High Voltage Transformer Wiring

The high voltage transformer(s) inside of the *MULTIDYNE*™ cabinet must be wired to the correct input line voltage. These transformers are factory wired to the voltage indicated on the type tags found on the unit. One type tag is located on the side of the cabinet beneath the power entry module as shown below. The second type tag is located on the inside of the cabinet door.


**FIGURE 4.2.1.1 Type Tag Location**

Prior to installing the generator, please check the actual input line voltage available at the customers' facility. The high voltage transformer(s) should be wired to match the local factory voltage only if this voltage is different than the voltage indicated on the type tags.

The *MULTIDYNE™ 1000m* provides a high voltage transformer (HVT) terminal block, TB1 (shown below). This terminal block must be wired for the correct input voltage according to Table 4.2.1.

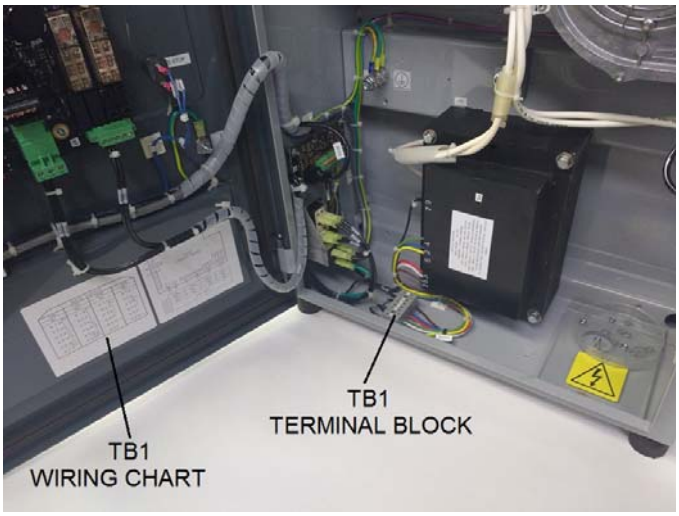



**FIGURE 4.2.1.2 MD1000m High Voltage Transformer (HVT) Wiring**

**Table 4.2.1: MD1000m HVT Voltage Wiring**

| LOCAL LINE VOLTAGE | TB1 VOLTAGE SETTING |
|---|---|
| 90 – 110 VAC | 100 V |
| 108 – 132 VAC | 120 V |
| 180 – 220 VAC | 200 V |
| 220 – 264 VAC | 240 V |

Figure 4.2.1.3 shows the wiring chart that illustrates how to wire the TB1 terminal block for the appropriate voltage setting from Table 4.2.1. This wiring chart can be found on the inside of the *MULTIDYNE™ 1000m* door.

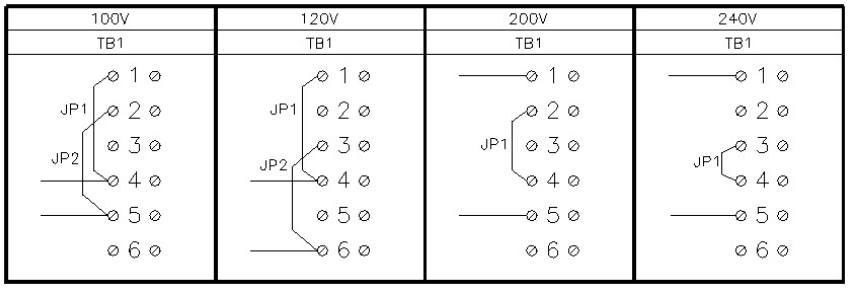



**FIGURE 4.2.1.3 MD10000m HVT Wiring Chart**

For the *MULTIDYNE™ 2000m* generator, there are two HVT terminal blocks, TB1 and TB2 (see below). These terminal blocks must be wired according to Table 4.2.2.

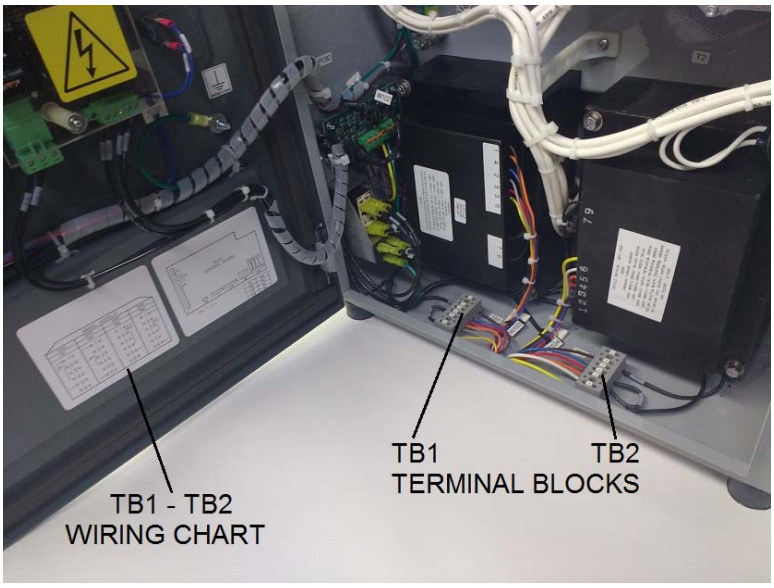



**FIGURE 4.2.1.4 MD2000m High Voltage Transformer (HVT) Wiring**

**Table 4.2.2: MD2000m HVT Voltage Wiring**

| LOCAL LINE VOLTAGE | TB1 - TB2 VOLTAGE SETTING |
|---|---|
| 180 – 220 VAC | 200 V |
| 216 – 264 VAC | 240 V |

The TB1 and TB2 wiring chart for the MD2000m 2-head generator is shown in Figure 4.2.2 below. This wiring chart is also found on the inside door of the *MULTIDYNE™ 2000m*

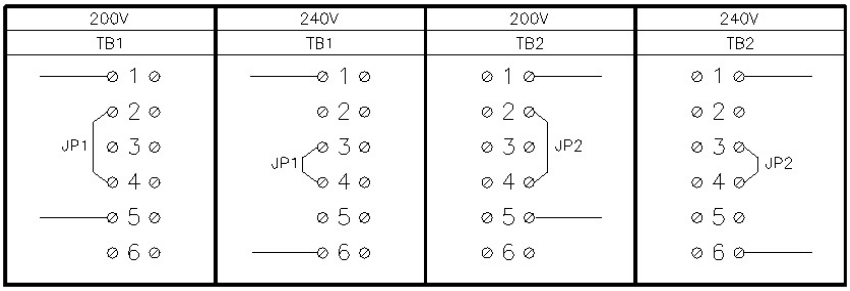



**FIGURE 4.2.1.5 MD2000m HVT Wiring Chart**

## 4.3 External Connections

On the left-hand side of the *MULTIDYNE™ 1000m/2000m* generator cabinet are two connectors, the power entry module (DISC1) and the external I/O receptacle (J11). The power entry module accepts the power cord and is used to provide power to the system. The external I/O connector allows the *MULTIDYNE™ 1000m/2000m* generator to interface with external safety and control systems that the customer may require.

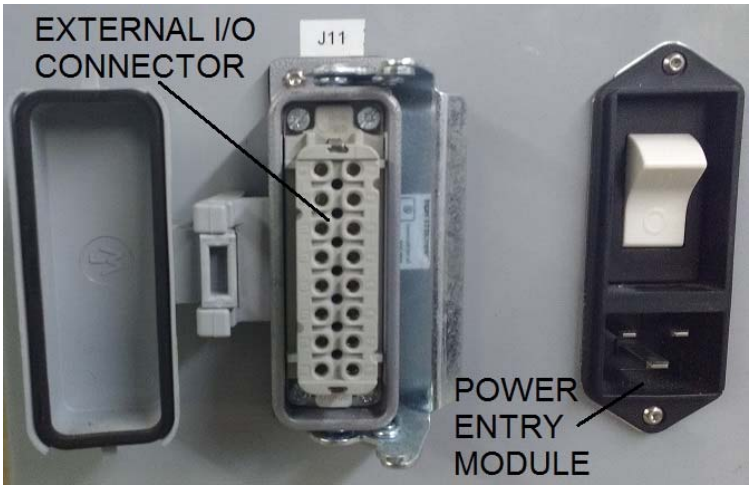



**FIGURE 4.3 External Connector Receptacles**

### 4.3.1 Power Cord

The *MULTIDYNE™* corona generator is supplied with a standard 3-conductor molded power cord with a L6-20P plug and an IEC-style C19 connector. To supply power to the generator, plug the C19 power cord connector into the power entry module.

### 4.3.2 Safety Interlocks and Remote Controls

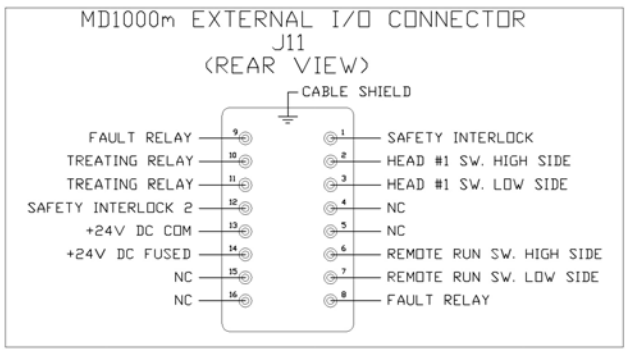
The *MULTIDYNE™ 1000m/2000m* circuitry is designed to accommodate remote control devices. These devices as well as any approved safety controls such as safety interlock switches, light curtain switches, safety mats, etc are to be wired into the connector J11. For further wiring details, please refer to the Control Signals section of this manual. For specifications regarding each signal, see the System Specifications.

**Note:**

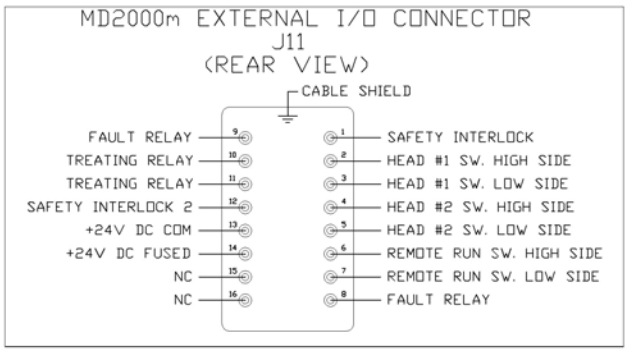
The treating heads are factory wired and do not require any further electrical installation.

### 4.3.3 External I/O Connector

Figure 4.3.3 shows the terminal assignments for the *MULTIDYNE™ 1000m/2000m* external I/O connector. The left side shows the connections for an MD1000m one head system. The right side details the connections for the two head MD2000m.




**MD1000m (One Head)**




**MD2000m (Two Head)**

**FIGURE 4.3.3 External I/O Connector Terminal Assignments**

## 4.4 Control Signals

The *MULTIDYNE™* circuitry is designed to accommodate remote control devices such as press controls, PLCs and foot switches.

These devices are to be connected to the Interface connector (J11) located on the left side of the unit. The following sections contain a description of each input and output present on the customer hookup connector. For technical specifications on these inputs and outputs, refer to System Specifications.

The *MULTIDYNE™* has two operating modes:

1. STANDBY Mode:
   - The output cannot be energized.
   - Operation of the Intermittent (Treat) signal is inhibited.

2. READY Mode:
   - The output can be energized.
   - Activation of the Intermittent (Treat) signal is enabled.

If the *MULTIDYNE™* generator is configured for Local operation, the following five conditions must be met to obtain the corona discharge:

1. The safety interlock must be closed.
2. The customer interface wiring of J11 must have the Hd #1 Intermittent pins connected properly. (If a *MULTIDYNE™ 2000m*, the Hd#2 Intermittent pins must also be connected).
3. The control mode must be set up for Local Control.
4. The *MULTIDYNE™* must be put into Ready mode by pressing the green ON button.
5. The corona must be turned on using the external Intermittent (Treat) input signal.

If the *MULTIDYNE*™ is set up for Remote Control operation, the following five conditions need to be met in order to obtain corona discharge:

1. The safety interlock must be closed.
2. The customer interface wiring of J11 must have the Remote Run switch and Hd #1 (also Hd #2 for *MULTIDYNE*™ *2000m*) Intermittent pins connected properly.
3. The control mode must be set up for Remote Control.
4. The system must be put into the Ready mode using the external Remote Run input signal.
5. The corona must be turned on with the external Intermittent (Treat) input signal.

**Note:**

The status indicators (LED's) are available to alert the operator of the status of the unit. The red Standby LED indicates the unit is in standby mode. The green Ready LED indicates the unit is in ready mode.

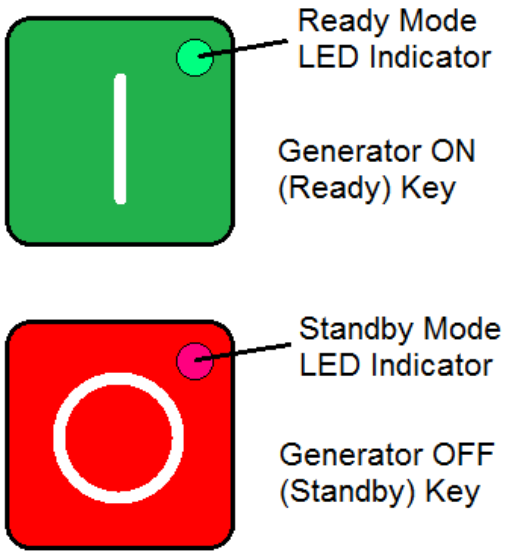



**FIGURE 4.4 Status Indicator LED's**

### 4.4.1 Remote Run Input (Pins 6 and 7)

**The remote run input allows an operator to switch from Standby mode to Ready mode remotely. This input must be maintained to stay in Ready mode. Safety precautions must be taken to ensure that the Remote Run signal is not activated when personnel may be exposed to the corona output. This input is not meant for repetitive on / off switching of the output.**

#### 4.4.1.1 Local Mode Operation

In local mode, the Remote Run input pins are not used.

#### 4.4.1.2 Remote Mode Operation

In remote mode, the Remote Run input pin needs to be activated via an external switch or contact. If using the internal 24V power supply, connect the external switching device as follows:

- Jumper pin 14 to one side of the external switching device. This will connect the switch or contact to the 24V power supply positive terminal.
- Jumper pin 6 to the other side of the external switch.
- Jumper pin 7 to pin 13. This will connect the Remote Run low side input pin to the 24V power supply common.

When the external switch is closed, the Remote Run high side input pin will be connected to the 24V positive terminal, activating the Remote Run input.

### 4.4.2 Intermittent (Treat) Input(s) (Pins 2, 3, 4*, 5*)

The Intermittent inputs are used to control the corona output. These inputs are only enabled while the system is in the Ready mode. The Intermittent inputs are activated via an external switch or contact. Refer to the Operation Sequencing section for details regarding the Intermittent input timing requirements.

***** Intermittent input pins 4, 5 are used on the *MULTIDYNE™ 2000m* for the Hd #2 input signal.

**Note:**

For a two head *MULTIDYNE™ 2000m* model, a second external switch or contact is required to activate the second head independently.

If using the internal 24V power supply, connect the external switching device in the following manner:

- Jumper pin 14 to one side of the external switching device. For a two head system, connect pin 14 to one side of the second switching device as well. This will connect the switch or contact to the 24V power supply positive terminal.
- Jumper pin 2 to the other side of the external switch.
- For a two head *MULTIDYNE™ 2000* unit, Jumper pin 6 to the other side of the second switch. This switch will control the second head corona discharge independent of the first head.
- Jumper pin 3 to pin 13. This will connect the Hd #1 low side input pin to the 24V power supply common.
- If the generator is a two head *MULTIDYNE™ 2000*, jumper pin 5 to pin 13. This will connect the Hd #2 low side input pin to the 24V power supply common terminal.

The Intermittent inputs are only active when the unit is in ready mode. When active, if the Intermittent (Treat) switch contact is open, the corona discharge is off. When the Intermittent switch contact is closed, the Hd #1 (or Hd #2) high side input pin(s) will be connected to the 24V positive terminal turning on the corona.

**Note:**

If the *MULTIDYNE™ 1000m/2000m* treatment mode is set up for Timed Operation, closing the external Intermittent switch will turn on the corona and also start the treat timer. During Timed Operation, the Intermittent switch does not need to be maintained in a closed state. Once timed treating has started, the Intermittent switch contact should be opened before the end of the timer duration (see Operation Sequencing and Timed Treat Mode).

### 4.4.3 Fault Relay (Pins 8 and 9)

The internal fault relay indicates when the *MULTIDYNE™ 1000m/2000m* unit is in a faulted or power loss state. The fault relay contacts are closed during normal operation. When a fault occurs, the contacts will open.
For a description of faults, see Fault Monitoring and Fault Reset.

### 4.4.4 Treating Relay (Pins 10 and 11)

The treating relay indicates when the corona treating operation is active. The treating relay contacts are closed while corona treating is active. The contacts are open if the corona is not on.

### 4.4.5 Safety Interlock (Pins 1 and 12)

The safety interlock is provided for approved safety devices that provide at least one normally closed (NC) contact. These pins should be connected to at least one approved safety device such as an emergency stop switch or a guard door interlock.

### 4.4.6 Power Supply (Pins 13 and 14)

The internal power supply is provided to power external sensing devices and switches only! DO NOT exceed the 300mA maximum current draw.

### 4.5 Footswitch Operation

A footswitch may be provided for testing and/or operation purposes. In order to use the footswitch, the *MULTIDYNE™ 1000m/2000m* must be configured for local control. To use the footswitch, follow these instructions:

- Ensure that the footswitch is properly wired to the external I/O connector (J11). Please refer to the Example I/O Connections section.
- Apply power to the *MULTIDYNE™ 1000m/2000m* using the disconnect switch located on the lower left side of the unit.
- Press the green Generator ON button on the front of the *MULTIDYNE™* panel.
- Depress the footswitch. This will start the corona treating operation.
- Releasing the footswitch will stop the corona treating output.

### 4.6 Operation Sequencing

The *MULTIDYNE™ 1000m/2000m* system requires that the Remote Run and Intermittent (Treat) inputs are sequenced. If this is not done properly, premature wear may occur.

#### 4.6.1 Continuous Operation

The Remote Run signal must be activated **BEFORE** the Intermittent input signal is applied. When corona treating is complete, the Intermittent signal must be turned off before the Remote Run signal is removed.

The following timing sequence diagram demonstrates the proper signal progression for continuous treatment.

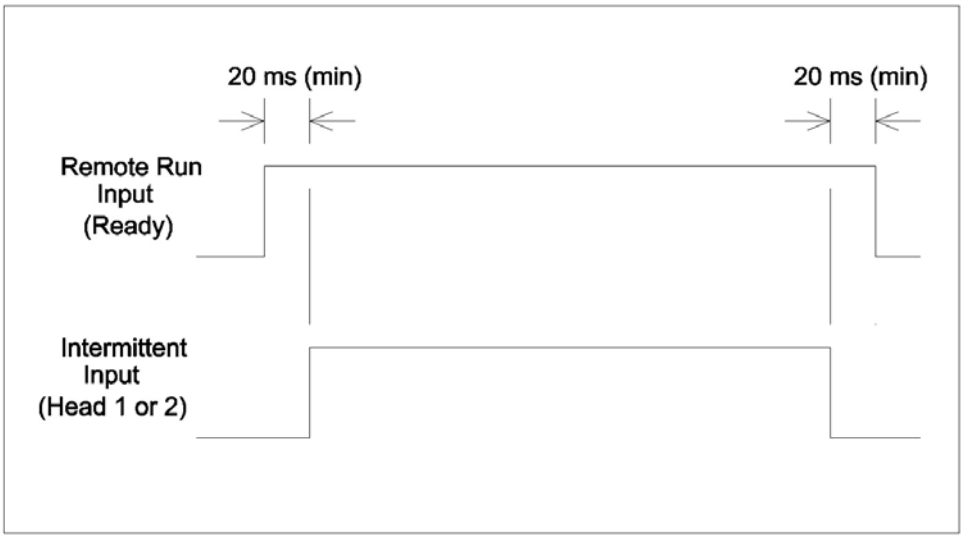



**FIGURE 4.6.1 Continuous Operation Timing Sequence**

### 4.6.2 Timed Operation

If the *MULTIDYNE*™ system is set up for timed treatment, the Remote Run signal needs to be activated before the Intermittent (Treat) input signal as before. However, during timed treat operation, the Intermittent input signal does not need to be maintained for the duration of the treatment process. In fact, the Intermittent input should be turned off before the end of the treat time duration.

The following timing diagram shows the sequence of operation for a system set up for timed treatment operation.

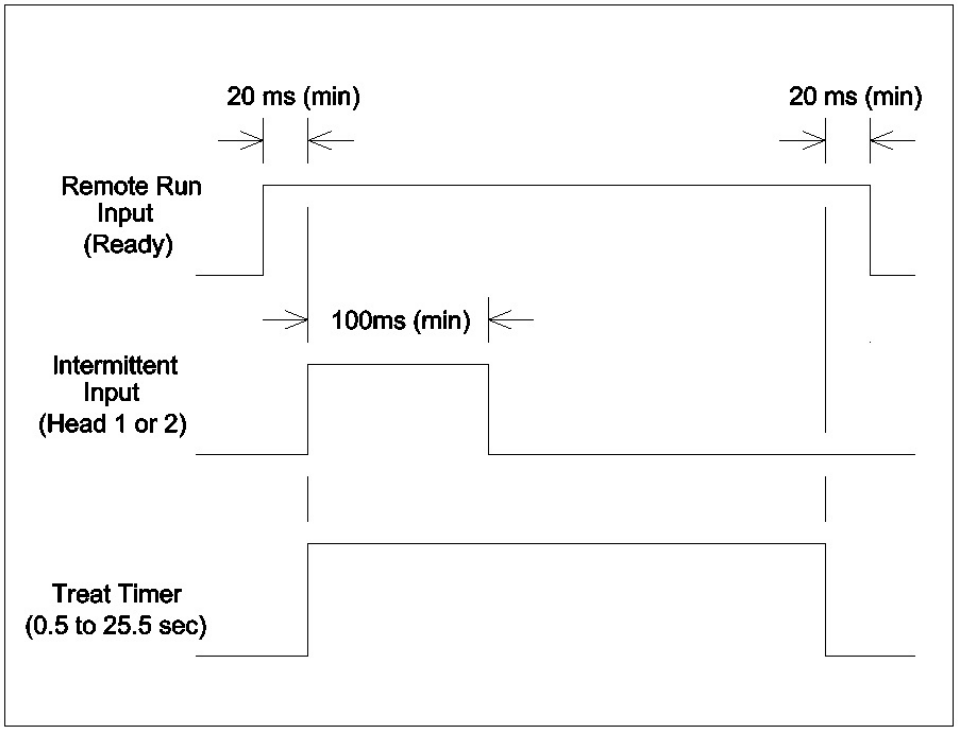



**FIGURE 4.6.2 Timed Operation Timing Sequence**

### 4.6.3 Example I/O Connections

#### 4.6.3.1 *MULTIDYNE™ 1000m* in local mode with footswitch trigger:

- Run Input: Controlled by Front Panel ON button.
- Treat Input: Controlled by Footswitch.
- Safety Circuit: Connected to Proper Safety Device.
- Outputs: Not Connected.

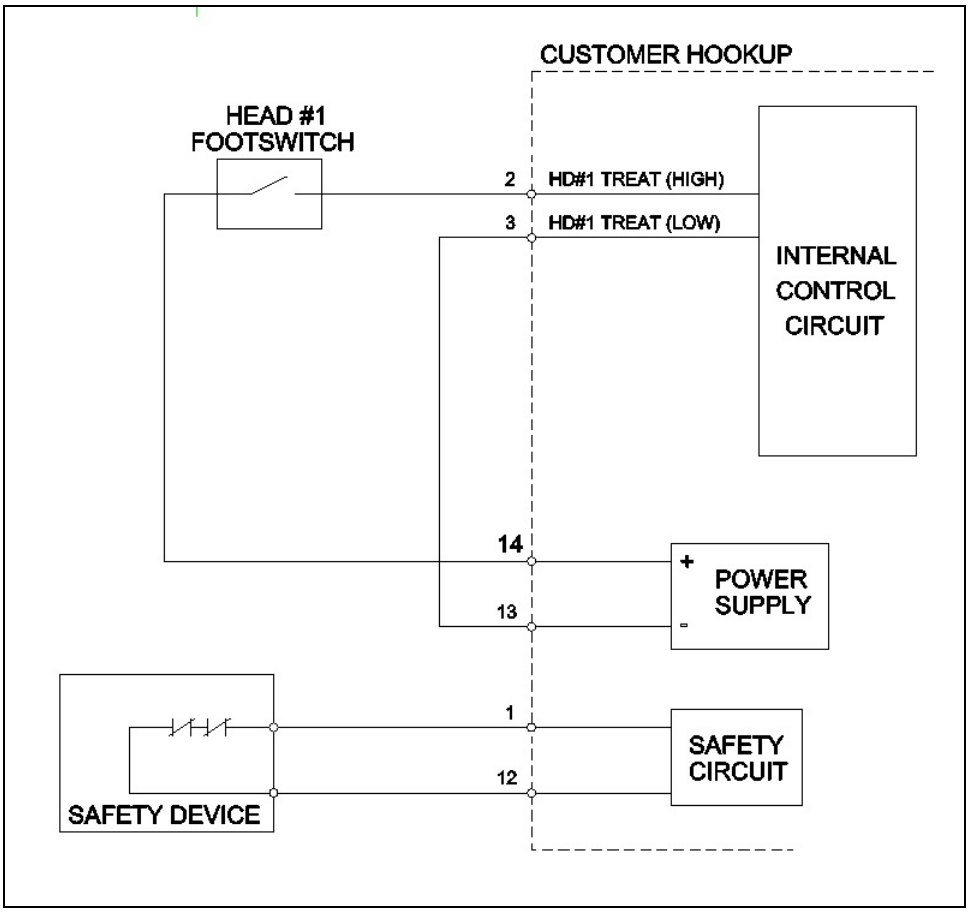



**FIGURE 4.6.3.1 MD1000m Connection Example with Footswitch Control**

### 4.6.3.2 *MULTIDYNE™ 1000m* in remote mode controlled by external PLC

- Run Input: Controlled by PLC.
- Treat Input: Controlled by PLC.
- Safety Circuit: Connected to Proper Safety Device
- Outputs: Connected to PLC Inputs for Monitoring

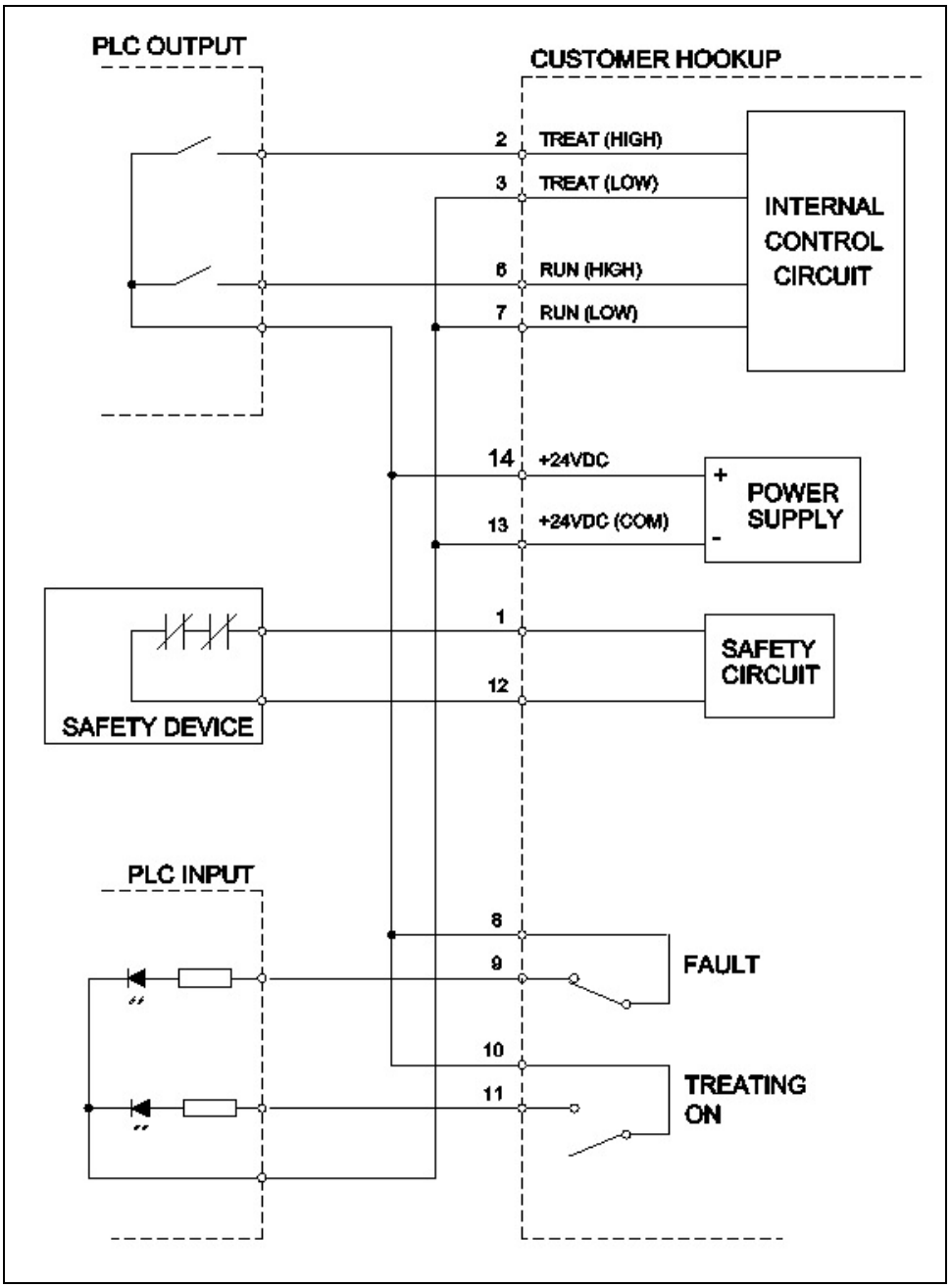



**FIGURE 4.6.3.2 MD1000m Connection Example with PLC Control**

### 4.6.3.3 *MULTIDYNE™ 2000m* in local mode with dual footswitch triggers:

- Run Input: Controlled by Front Panel ON button.
- Treat Input: Controlled by Footswitch.
- Safety Circuit: Connected to Proper Safety Device.
- Outputs: Not Connected.

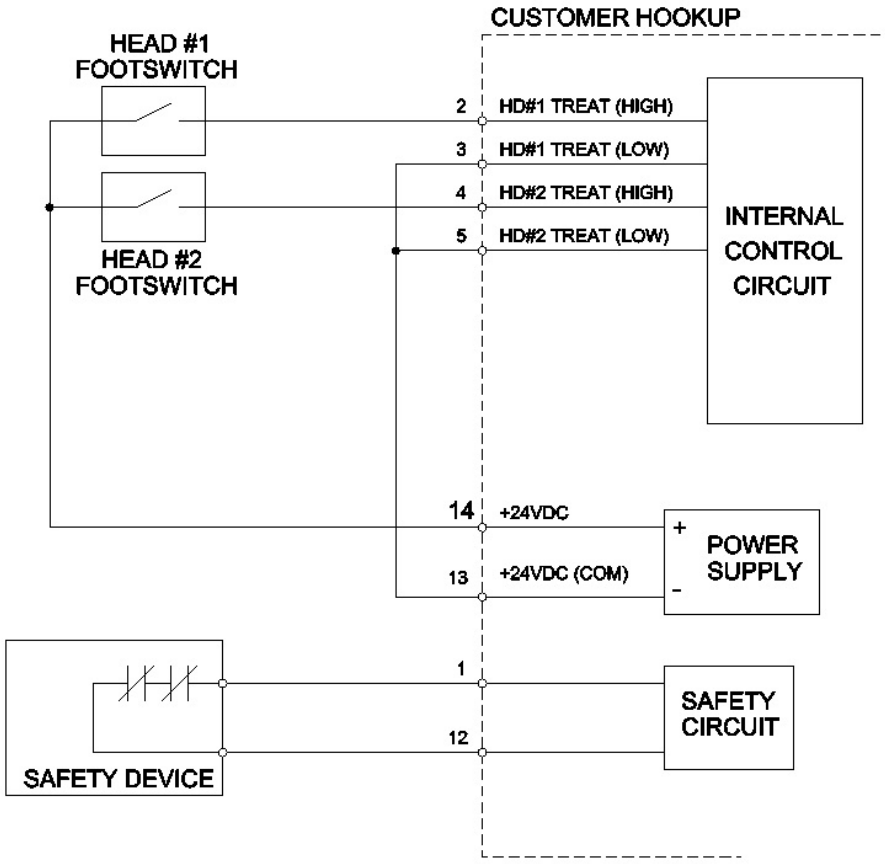



**FIGURE 4.6.3.3 MD2000m Connection Example with Dual Footswitch Control**

### 4.6.3.4 *MULTIDYNE™ 2000m* in remote mode controlled by external PLC

- Run Input: Controlled by PLC.
- Treat Input: Controlled by PLC.
- Safety Circuit: Connected to Proper Safety Device
- Outputs: Connected to PLC Inputs for Monitoring

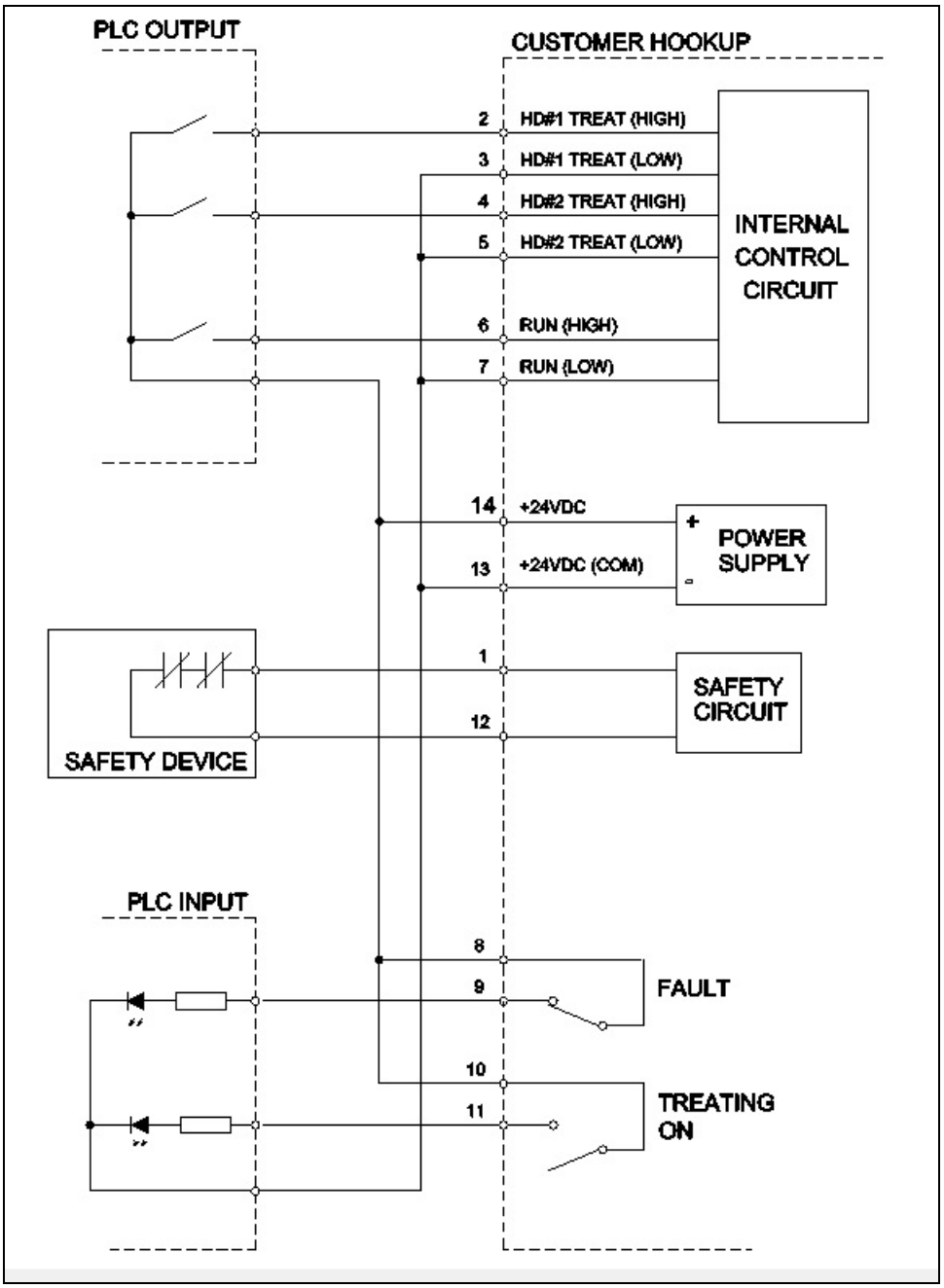



**FIGURE 4.6.3.4 MD2000m Connection Example with PLC Control**

### 4.7 Disassembly

When the *MULTIDYNE*™ corona treatment station has reached the end of its useful service life, disassembly (for demolition or scrapping purposes) should be carried out in the reverse order of installation.

**WARNING:**
**Disassembly of the corona station may only be carried out by qualified personnel. An electrical specialist must carry out the electrical disassembly.**

**CAUTION:**
**Observe the provisions contained in the section on waste disposal.**

# 5 Initial Operation and System Checks

## 5.1 General

**WARNING:**
**Initial operation and test of the *MULTIDYNE™ 1000m/2000m* corona station may only be performed by qualified and authorized personnel.**

**WARNING:**
**Electrical work may only be carried out by an electrical specialist.**

**Danger of Burning!**
**The electrodes are hot during operation and for a short time after the corona station has been switched off. Do not touch components until they have cooled.**

**WARNING:**
**In the event of a failure presenting risk to persons, equipment, the corona station and/or the environment, de-activate the corona system immediately.**

**Before starting work on the corona station, secure any actuators against accidental activation and switch off the generator.**

**The plant and the corona system may not resume operation until the cause of failure has been removed and there is no risk to persons, equipment, the corona station and/or the environment.**

**Note:**
After installation of the system, check all mechanical and electrical functions.

## 5.2 System Checks

### 5.2.1 Generator Checks

First, check that the system is as prescribed. This means that:

- The generator has been duly installed.
- The generator is properly ventilated.
- All cables have been laid as specified.
- Electrode(s) is/are correctly adjusted.
- Protective devices (electrode cover, limit switch) are available and operational.
- Station extraction system is operable.

### 5.2.2 Electrical Installation Checks

Check that the electrical installation is as follows:

- The main voltage must correspond to the voltage indicated on the rating plate.
- All electrical connections must be made in accordance with the wiring diagrams.
- The generator and treating head(s) must be grounded.

### 5.2.3 Safety Switch Checks

The generator should shut down when the safety relay contact is opened.
Verify that all the EMERGENCY STOP features are functional.

If the system is integrated into the EMERGENCY STOP chain of the entire plant:

- The necessary electrical connections must be checked **AND**
- The function of the EMERGENCY STOP actuator must be verified.

Before restarting, the EMERGENCY STOP switch must be released.

### 5.2.4 Exhaust System Checks

If the exhaust system fails to operate, the maximum permissible limits for emissions may be exceeded.

# 6 Operation

## 6.1 General Safety

**WARNING:**
**The system may only be operated by authorized, trained and qualified personnel.**

**If a fault occurs that could endanger persons or could damage the equipment, the system must be shut down immediately. If the corona system is integrated into an EMERGENCY OFF chain, the system and the plant must be de-activated using the EMERGENCY OFF procedure.**

**Before beginning any work on the system it must be secured against accidental activation. Turn off the main power switch (DISC1) and disconnect the line cord from the power entry module.**

**Qualified personnel must follow local and international Lock-Out Tag-Out procedures. Apply a warning notice to the system and ensure that the system is de-energized.**

**The equipment must not be switched on again until the fault has been remedied and there is no danger to persons or to the system.**

## 6.2 EMERGENCY STOP

In case of an emergency, push the E-STOP button on the control panel. This immediately turns the system off. Turn off the main disconnect switch (DISC1), unplug the power cord from the power entry module and clear the emergency situation. Before energizing the system and disengaging the E-STOP button, ensure that the system, including all safety devices, is fully operational.

To disengage the E-STOP button, turn the actuator button clockwise and then release it.

**WARNING:**
**Failure to follow these instructions may result in damage to the system. Serious or fatal injuries may occur.**

**NOTE:**
**Do not use the E-STOP button for routine de-activation.**

### 6.3 System Shutdown

Before switching on the system, it is essential to know how it can be shut down. The *MULTIDYNE™ 1000m/2000m* system is shut down using the appropriate procedure described below:

#### 6.3.1 Remote Operation Shutdown:

- Deactivate the corona discharge by turning off the remote Intermittence (Treat) input(s)
- Place the system in Standby mode by turning off the Remote Run input.

#### 6.3.2 Local Operation Shutdown:

- Deactivate the corona discharge by turning off the remote Intermittence (Treat) input(s)
- Place the system in Standby mode by pressing the generator OFF key on the front panel.

After the system has been placed in the Standby mode, switch off the main power switch (DISC1) above the power entry plug.

## 6.4 Front Panel Components

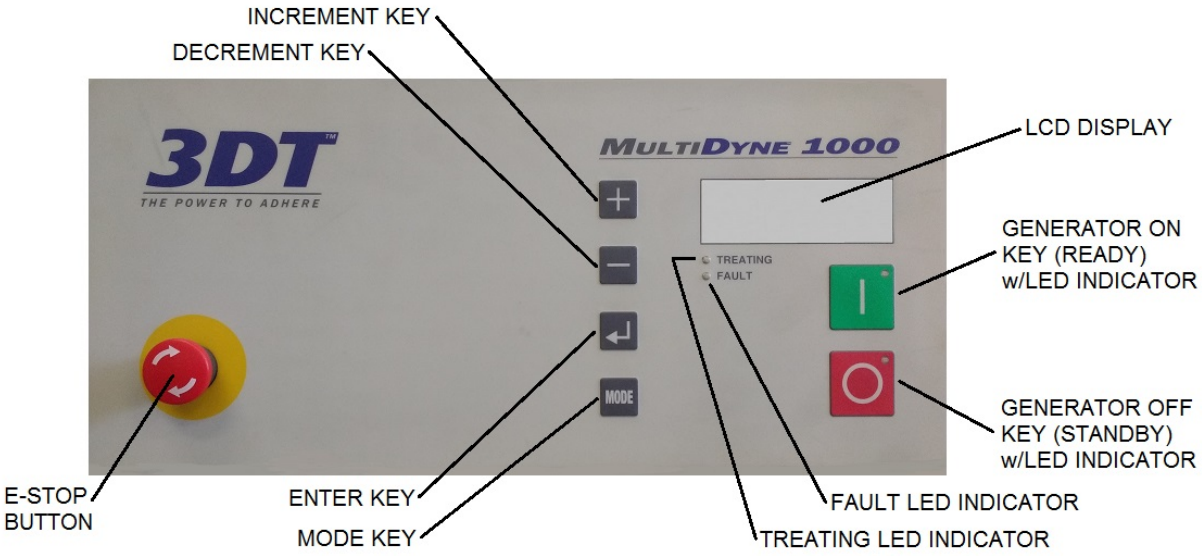



**FIGURE 6.4 *MULTIDYNE*™ Front Panel**

**Table 6.4 Front Panel Component Functions**

| PANEL COMPONENT | FUNCTION |
|---|---|
| E-STOP | Emergency Shut Down Button<br>Push to activate. Twist to release |
| GENERATOR ON | Press to Enable the generator (Ready mode) |
| GENERATOR OFF | Press to Disable the generator (Standby mode) |
| TREATING LED | Green LED indicator<br>When lit the generator is treating |
| FAULT LED | Red LED indicator<br>When lit, there is a Fault condition |
| READY LED | Green LED indicator<br>When lit, the system is in Ready mode |
| STANDBY LED | Red LED indicator<br>When lit, the system is in Standby mode |
| INCREMENT (+) | Press to change the Operation mode selection<br>Increments Timed Treating value (seconds) |
| DECREMENT (-) | Press to change the Operation mode selection<br>Decrements Timed Treating value (seconds) |
| ENTER | Press to enable or disable changes |
| MODE | Press to cycle through the Operation modes |

**Note:**

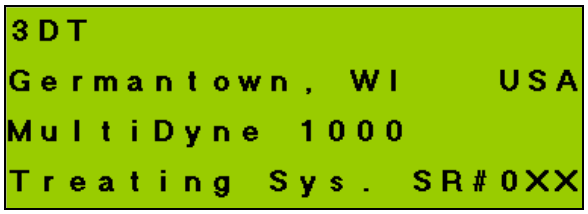
The front panel keys (excluding Generator ON and OFF) must be pressed and held for one second to activate.

## 6.5 First Time Operation

### 6.5.1 System Power Up

Once the *MULTIDYNE™ 1000m/2000m* corona generator installation is finished and all system and safety checks have been completed, it is safe to apply power to the unit.

- Ensure that the power disconnect switch (DISC1) is in the off position, and then plug the power cord into the power entry module receptacle.
- Turn on the main power switch to energize the *MULTIDYNE™* generator.
- With power applied to the unit, the front panel LCD should display the following initialization message for approximately four seconds.




**Initialization Message**

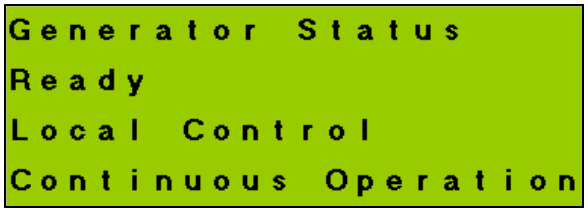
The initialization message shows the model of the generator, either the MD1000m (MultiDyne 1000) or the MD2000m (MultiDyne 2000). Also displayed is the software revision number (SR#0XX) where XX is a two digit number that is used to identify the version of the installed control software, for example SR016. After a four second delay, the initialization message screen will change to a screen that shows the generator status.

**Note:**

The initialization message is only displayed for four seconds after the power is first applied to the system. To return to the initialization message screen, safely shut down the *MULTIDYNE™ 1000m/2000m* generator and then cycle the power switch off and then on again.

### 6.5.2 System Standby

After the initialization screen clears, the *MULTIDYNE™ 1000m/2000m* will be in the Standby mode. The red LED of the Generator OFF key will be lit and the display will show the Generator Status screen. This screen shows that the system is ready for operator input. Also shown are the control mode and treatment operation that the system was previously set up for.



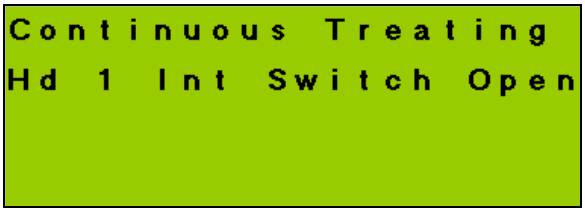

**Generator Status Display**

### 6.5.3 System Ready

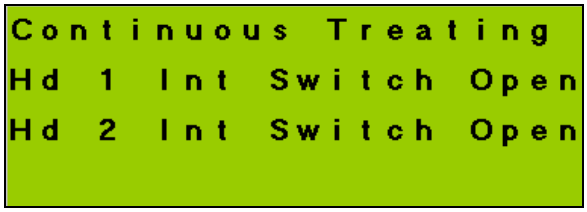
Before corona treatment can begin, the *MULTIDYNE*™ must be placed into the Generator ON or Ready mode. To do this while set up for Local Control, the operator simply needs to press the green Generator ON button.

If the *MULTIDYNE*™ is configured for remote control, the Remote Run input needs to be activated. When the Remote Run input is active, the generator will be in the Ready mode.

Regardless of the control method used, when the *MULTIDYNE*™ *1000m/2000m* system is in the Ready mode the red Standby LED will turn off and the Ready LED (green Generator ON button LED) will be lit. While in the Ready mode, the LCD screen will show the current mode of operation (Continuous or Timed) as well as the status of the head Intermittent switch(es) as shown below.




**Ready Mode (MD100m)**

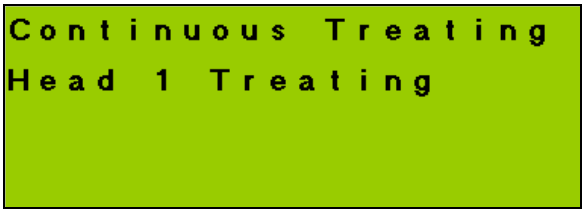



**Ready Mode (MD2000m)**

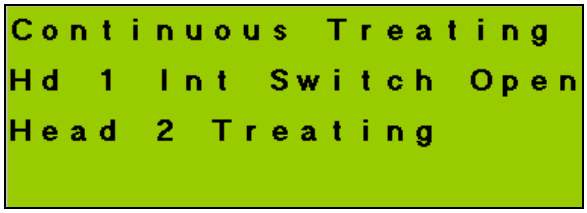
### 6.5.4 System Treating

With the *MULTIDYNE*™ *1000m/2000m* corona station in the Ready mode, activate the Intermittent switch to begin the corona treatment process. For a two head *MULTIDYNE*™ *2000m* system, the Intermittent switch for either head may be activated independent of one another.

When treating, the green Treating LED will turn on and corona discharge at the head should be observed. The LCD display will also indicate which head is treating.




**Head 1 Treating (MD1000m)**




**Head 2 Treating (MD2000m)**

To stop the corona treatment, turn off the active Intermittent switch input. When the Intermittent switch is turned off on a one head *MULTIDYNE™ 1000m* system, the generator will return to the Ready mode. If the unit is a two head *MULTIDYNE™ 2000m*, the generator will return to the Ready mode when both Intermittent switches are in the off position.

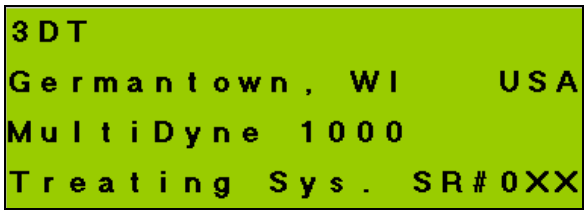
**Note:**

In Timed Treat mode, the corona treatment will stop when the time period of the treat timer expires.

## 6.6 Display Screens

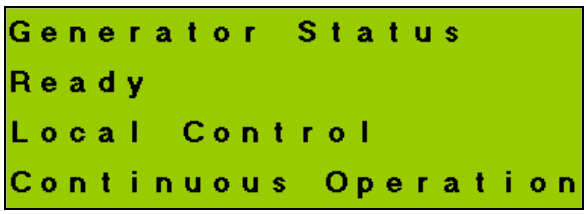
### 6.6.1 Initialization Display

Upon power up, this screen appears displaying the generator model and software revision number. Treatment will not be enabled until this screen disappears (approximately four seconds).




### 6.6.2 Generator Status Display

This screen displays that the *MULTIDYNE™ 1000m/2000m* generator is in Standby mode. It also shows the current control mode (Local or Remote) and the selected treating operation (Continuous or Timed Treat).
Whenever the *MULTIDYNE™* system is in Standby mode, the red LED associated with the Generator OFF key will be lit




#### 6.6.2.1 Local / Remote Control Mode

The *MULTIDYNE™ 1000m/2000m* may be setup to operate in either local control or remote control mode. In local control mode, the generator is activated by pressing the generator ON key from the front panel. Once activated, an additional trigger switch, sensor or footswitch connected to the external I/O connector (J11) will start the corona discharge.

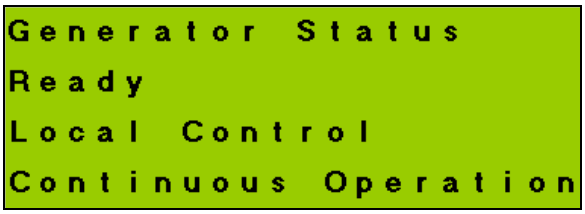
In remote control mode, the generator is activated by a signal on the external I/O connector J11. Once activated, an additional trigger switch, sensor or footswitch connected to the I/O connector will start the corona discharge (See Control Signals for a description of the control functions). In remote control mode, pressing the front panel generator ON key will NOT activate the *MULTIDYNE™*.

**Note:**

The status indicator LED's on the front panel are active regardless of the control mode selected. These LED's are used to show the operator the current state that the *MULTIDYNE™ 1000m/2000m* generator is in.

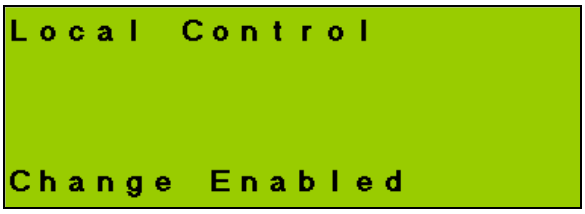
The following steps are used to change the control mode of the *MULTIDYNE™ 1000m/2000m* generator. Changes to the control mode can only be made with the system in the Ready or Standby mode.

- With the system in the Ready mode (Screen 1), press the MODE key once. The LCD display will now show the control mode change screen (Screen 2).
- Press the ENTER key to enable changing the control mode. The display should show Change Enabled (Screen 3).
- Change the control mode:
  - If the current control mode is Local Control, press the Increment (+) key to change to Remote Control (Screen 4).
  - If the current control mode is Remote Control, press the Decrement (-) key to select Local Control.
- Once the desired control mode is selected, press the ENTER key to save the change (Screen 5).

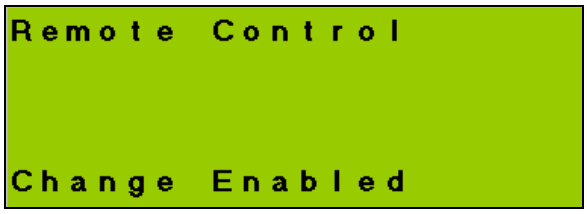



**Screen 1**

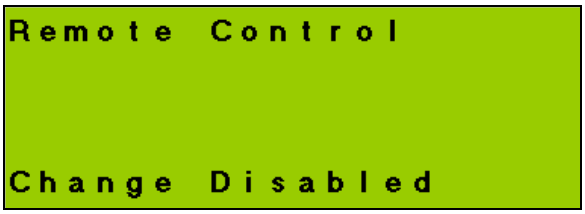

**Screen 2**




**Screen 3**




**Screen 4**




**Screen 5**

### 6.6.2.2 Continuous / Timed Treat Mode

The *MULTIDYNE™ 1000m/2000m* has two modes of treatment operation, continuous or timed. If the system is configured for continuous treatment, corona will discharge from the head for as long as the Intermittent (Treat) switch signal is active.

In timed treatment operation, a timer is used to control how long the corona discharge will be generated. This treating time duration can be set by the operator and has a range of 0.5 to 25.5 seconds. When using the timed treatment mode of operation, activating the Intermittent switch signal will start the corona discharge and the treat timer will begin. After the treating time duration has expired, the corona discharge will stop. The corona will only be generated for as long as the treating time duration. In timed treat mode, re-triggering the Intermittent signal while the corona output is being discharged will cause the treat timer to restart. As long as the Intermittent input is retriggered before the timer expires, the timer will restart, effectively extending the treating time and maintaining the corona discharge. The following diagram illustrates the two methods of using the timed treatment operation.

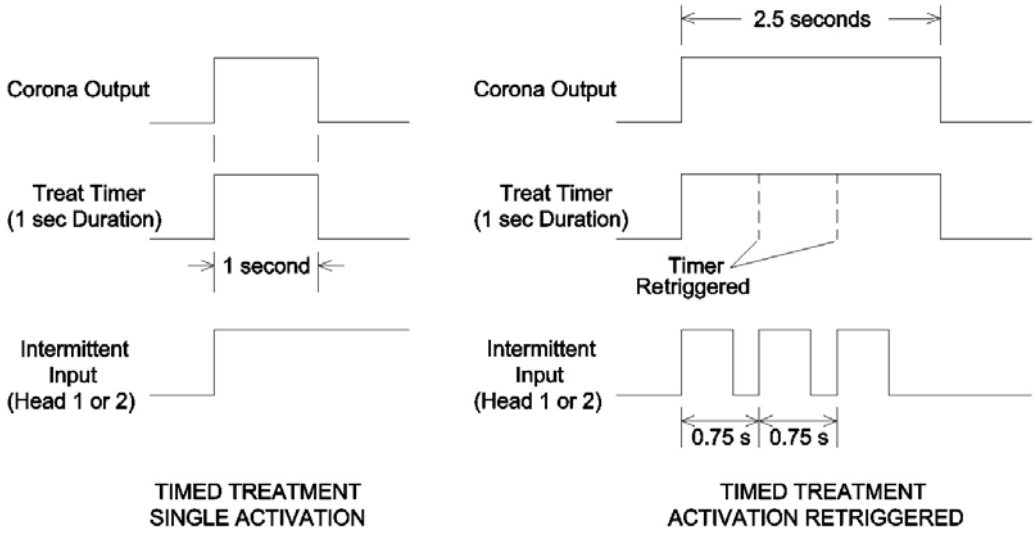
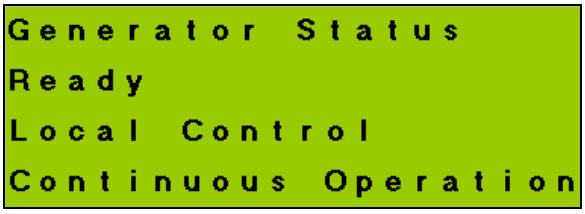



**FIGURE 6.6.2.2 Timed Treatment Activation Methods**

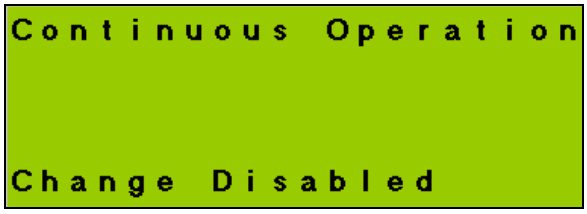
- Single Activation:
  A single Intermittent signal is applied. The treat timer begins counting for one second and the corona discharge begins. After the one second duration, the timer stops and the corona discharge will shut off.
- Activation Retriggered:
  The first Intermittent input signal is applied. This starts the treat timer counting for one second and the corona discharge begins. After 0.75 seconds, the Intermittent signal is applied again. Since this occurs before the treat timer has completed its one second count, the timer re-starts its one second count. After 0.75 seconds, the Intermittent signal is re-applied one last time. The timer will now count for one second and then stop, turning the corona discharge off. In this example, the total amount of time that the corona output is on is 2.5 seconds (0.75 s + 0.75 s +1 s)

To change the treatment operation of the *MULTIDYNE™ 1000m/2000m*, follow these steps:

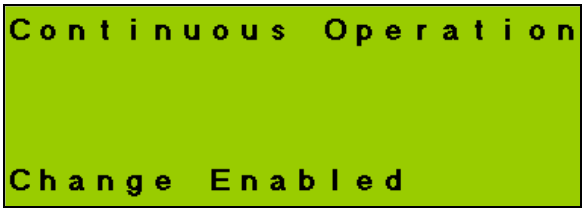
- With the system in the Ready mode (Screen 1), press the MODE key twice. The LCD display will now show the treatment operation change screen (Screen 2).
- Press the ENTER key to enable changing the operation mode. The display should show Change Enabled (Screen 3).
- Change the mode of operation:
    - If the current mode of operation is Continuous, press the Increment (+) key to change the operation to the Timed Operation (Screen 4).
    - If the current mode is Timed Operation, press the Decrement (-) key to select Continuous treatment.
- Once the desired treatment operation is selected, press the ENTER key to save the change (Screen 5).



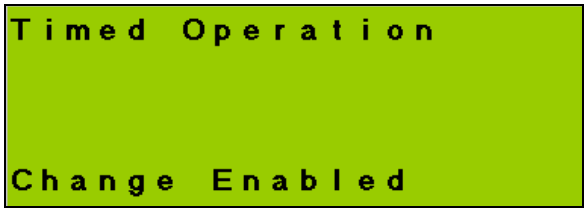

**Screen 1**




**Screen 2**




**Screen 3**




**Screen 4**


**Screen 5**

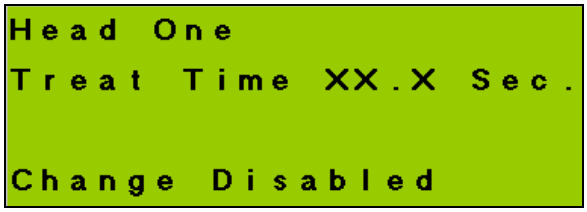
### 6.6.2.3 Timed Operation Timer Setting

If the treating mode is set up for Timed Operation, it is possible to adjust the length of time that the corona discharge will be on after activation. The treat timer can be set by the operator for a treat time duration anywhere from 0.5 seconds to 25.5 seconds and can be adjusted in 0.1 second increments. If the *MULTIDYNE™* is a two head system (MD2000m), each treating head has a dedicated timer that can be set independent of one another. This means that head 1 and head 2 can each be set to treat for different lengths of time.

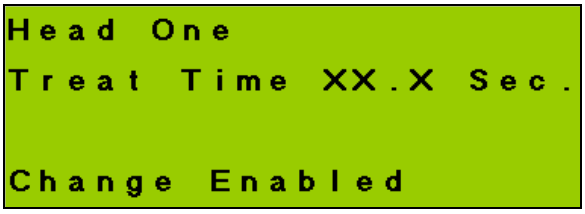
The following procedure is used to adjust the treat timer value:

- With the system in the Ready mode and set up for Timed Operation (Screen 1), press the MODE key three times. The LCD display will step from the Local / Remote control mode setup screen to the Continuous / Timed Operation setup screen to the Head One Treat Time screen (Screen 2). This screen allows the operator to make changes to the Treat Time value (XX.X denotes the current timer value displayed in seconds).
- Press the ENTER key to enable changing the Treat Time value. The display should show Change Enabled (Screen 3).
- Press either the Increment (+) or Decrement (-) key to adjust the timer value up or down until the desired Treat Time is displayed (YY.Y).
- When the desired Treat Time value is correct, Press the ENTER key to save the change (Screen 5).

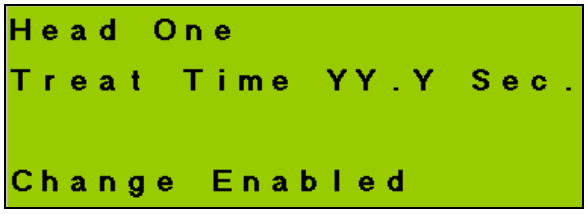

**Screen 1**



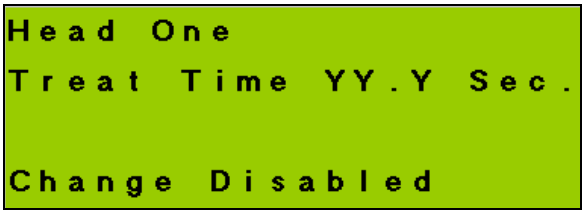

**Screen 2**




**Screen 3**




**Screen 4**



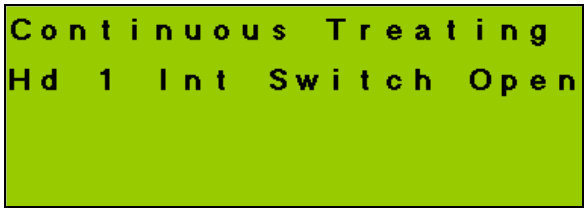

**Screen 5**

**Note:**

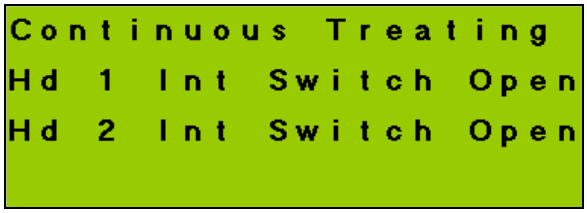
If the *MULTIDYNE*™ generator is a two head model (MD2000m), pressing the MODE key again will display the Head Two Treat Time screen. This screen allows changes to the Head 2 treat timer using the above procedure.

### 6.6.3 Generator Ready Display

To enter the Ready mode, press the Generator ON (Ready) key. If the control mode is set up for remote control, activating the Remote Run input will place the generator in the Ready mode. In the Ready state, the display will show the control mode (Continuous or Remote) and the message that the Intermittent (Int) switch is open. This means that the generator is ready to treat and is waiting for the Intermittent signal activation.
A *MULTIDYNE™ 2000m* system would display that head 1 and head 2 Intermittent switches are open as shown below.




**Generator Ready (MD1000m)**

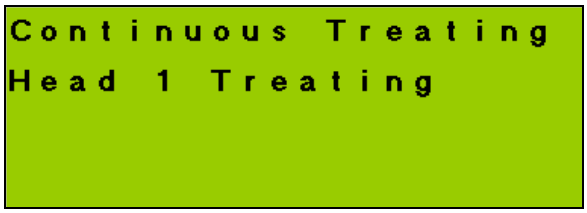



**Generator Ready (MD2000m)**

When the *MULTIDYNE™ 1000m/2000m* generator is switched from Standby to the Ready mode, the red Generator OFF key LED will turn off and the Generator ON key LED will turn on.

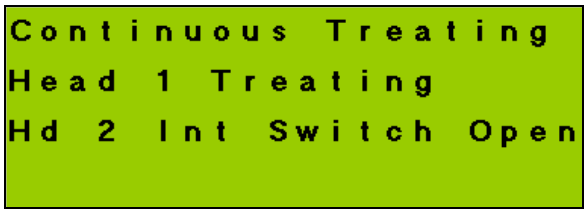
### 6.6.4 Generator Treating (Corona On) Display

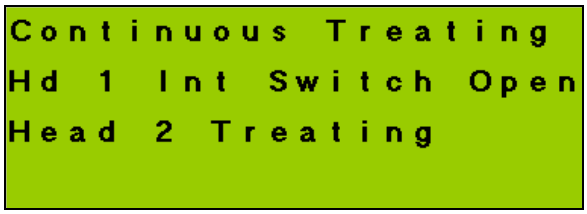
While in the Ready mode, the corona treatment operation may be turned on by activating the external Intermittent (Treat) switch connected to the interface connector J11. While the corona discharge is on, the TREATING LED will be lit and the display will show that the head is treating.

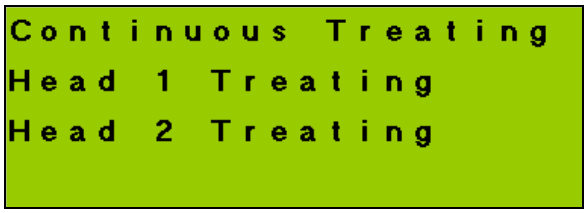



**Generator Treating (MD1000m)**

During treating with a two head *MULTIDYNE™ 2000m* system, the display will show the treating status of each head as shown below.




**Generator Treating (MD2000m)**

# 7 Troubleshooting

## 7.1 General

**WARNING:**
**If a fault occurs that could endanger persons or could damage the equipment, the system must be closed down immediately. If the system is integrated into an EMERGENCY STOP chain, switch off using the EMERGENCY STOP switch.**

**WARNING:**
**Failures with the *MULTIDYNE™ 1000m/2000m* system may only be serviced by qualified, trained, and authorized personnel.**

**Before beginning any work on the system it must be secured against accidental activation. Turn off the main disconnect switch (DISC1).**

**Disconnect the line cord from the power entry module.**

**Qualified personnel must follow international and local lockout tag out procedures.**

**Apply a warning notice to the system and ensure that the system is de-energized.**

**Faults may only be remedied by authorized, trained and qualified personnel.**

**The equipment must not be switched on again until the fault has been remedied and there is no danger to persons or to the system.**

## 7.2 Generator

The plant and the *MULTIDYNE™* corona treatment system may not resume operation until the cause of the failure has been removed and there is no risk to persons, equipment, the corona system and/or the environment.

### 7.2.1 Fault Monitoring

The *MULTIDYNE™* is equipped with a fault monitoring system. This system monitors the electrical current flowing to the treating head electrodes and the internal blower speed. The measured values are compared to the minimum and maximum allowed limits that are programmed into the setup menu. The minimum and maximum alarm limits are factory set and do not need to be modified.

### 7.2.2 Fault Reset

In the event of a fault condition, perform the following operations to reset the *MULTIDYNE*™ generator:

- Remove the fault condition.
- If the generator is set up for local operation, turn off all active Intermittent input signals and then press the red OFF button on the front panel. This will reset the system to the Standby state.
- If the generator is operating in remote mode, first, turn off all Intermittent (Treat) input signal(s) and then remove the Remote Run input signal. This will reset the system and place it in Standby mode.

## 7.3 Treating Head(s)

Deposits and moisture on the treating head(s) can lead to a loss of insulation and electric arcing. This may lead to serious damage of the electrodes or the treating head assembly.

### 7.4 Troubleshooting Chart

The following chart can be used to troubleshoot the *MULTIDYNE™ 1000m/2000m* fault conditions.

| FAULT CONDITION | CAUSE | REMEDY |
|---|---|---|
| The LCD display does not come on after switching on the power entry switch | 1. No supply voltage to the generator.<br>2. Circuit breaker on DISC1 is tripped. | 1. Power cord is not plugged in to the power entry module receptacle.<br>2. Reset the DISC1 circuit breaker by turning the DISC1 switch off and then on again. |
| Does not treat in Remote Control mode. (Fault LED is not lit) | 1. External I/O connector (J11) is not connected or is not wired correctly.<br>2. The Remote Run switch is not in the ON position. | 1. Connect the external I/O plug into J11.<br>2. Confirm that the Remote Run switch is wired correctly.<br>3. Activate the Remote Run switch or contact. |
| Does not treat in Local Control mode. (Fault LED is not lit) | 1. External I/O connector (J11) is not connected or is not wired properly. | 1. Connect the external I/O plug into J11.<br>2. Check the external I/O wiring. |
| Does not treat in Local Control mode. (Fault LED is lit) | 1. Head fault: Arcing internally to the head.<br>2. Blower fault: Blower speed out of range (4320-4920 RPM).<br>3. Blown fuses: Fuse F1 and/or F2 on PCB1 are open.<br>4. Tripped fuse: Resettable fuse F5 on PCB1 is tripped. Auxilliary power supply overload. | 1. Disassemble the treating head and replace any defective parts.<br>2. Check the blower for proper operation. Check the air tubing for any kinks, dust or holes.<br>3. Check the fuses and replace if blown.<br>4. Check the current draw at J7-pin 14 or J11 pin 14. Use an external power supply if current draw is greater than 300mA.<br>**Note:** F5 will reset upon cool down. |

# 8 Maintenance

## 8.1 General

**WARNING:**
**Maintenance work on the *MULTIDYNE™ 1000m/2000m* system may only be carried out by qualified, trained, and authorized personnel.**
**The system must be switched off and secured against reactivation before any maintenance work is carried out.**

**Before beginning any work on the system, it must be secured against accidental activation:**

- **Turn off the main disconnect switch (DISC1).**
- **Disconnect the line cord from the power entry module.**

**Qualified personnel must follow local and international lockout-tag out procedures. Apply a warning notice to the system and ensure that the system is de-energized.**

**On completion of maintenance work, the system must be checked by qualified personnel for operational reliability.**

When operated under normal conditions, the *MULTIDYNE™ 1000/2000m* Corona treating system will require minimum service. It is important that the discharge head is frequently checked and is free from dirt build-up.

Any accumulation of dirt on the electrodes, the electrode housing, the air passage between the electrodes, or the ceramic can cause serious arcing and subsequent damage to the assembly. It is recommended that this area be cleaned weekly.

The hook-formed electrodes are considered wearing parts and must be replaced after 2-4 months of use. The frequency of replacing the electrodes depends on the hours of treating use and how well the electrodes are cleaned.

When pitting of the electrode surface limits the spread of the arc, replacement is required.

When cleaning the electrodes, the area marked with an arrow on figure 9.1.1 is particularly important. Cleaning is performed with a buffing wheel or a 1500 grid emery cloth. Follow by rinsing in a non-flammable alcohol bath. The electrodes must be absolutely dry before reinstalling.

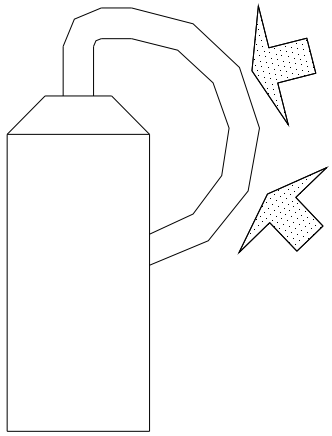


**FIGURE 8.1 Electrode Cleaning Area**

## 8.2 Maintenance Table

The *MULTIDYNE™ 1000/2000m* system must be maintained in accordance with the instructions found in the following maintenance table.

| Maintenance Table | |
|---|---|
| **Interval** | **Activity** |
| **Daily / As Required** | Clean corona electrodes, treating head, etc.<br>(blow, brush and wipe with a damp cloth, then dry)<br>Check, clean and replace air intake filters as required. |
| **Maximum 2 weeks following initial operation** | Check the fit of screws and fasteners, tighten if necessary. |
| **Weekly** | Check high-voltage cable and electrode assembly for scorched area.<br>Clean electrode area.<br>Repair or replace damaged components. |
| **Monthly** | • Clean as required (wipe with a damp cloth and dry).<br>• Clean corona electrode assembly.<br>(blow, brush and wipe with a damp cloth, then dry).<br>• Check the ozone filter (if equipped) for proper emissions.<br>• General cleaning of the entire corona station. |
| **Yearly** | • Tighten screws on wiring (connecting cables), the corona generator, transformer and enclosure.<br>• Check the fit of screws and tighten if necessary. |

### 8.2.1 Cleaning

**If solvents are used for cleaning, the relevant instructions in the safety data sheets pertaining to these solvents must be strictly observed. If necessary, wear personal protective equipment (PPE) such as mask, goggles, and gloves.**

Only keep sufficient quantities of solvents in the vicinity of the system as are required for a single cleaning operation.

**Solvents and greases endanger health and the environment. They must be disposed of in accordance with statutory requirements.**

To prevent discharge faults and short circuits, the entire corona system must be dry before it is returned to service and energized.

### 8.3 Short Circuit Damage

If there is damage due to a short circuit condition, the following steps should be taken:

- Repair or replace the damaged components.
- Re-connect or replace the High Voltage Electrode connecting cables.

## 8.4 Changing the Electrodes

### 8.4.1 Disassembly

- Secure the body of the treating head in a padded vise with the electrodes pointing upward.
- Remove the four nylon screws that hold the ceramic end plate.
- Carefully lift the end plate upward without prying. Use a slight rocking motion if necessary.
- Use a small screwdriver to carefully lift the electrodes out of the white body.
- Remove the electrodes and replace them with new ones. Be sure to align the electrodes with the slots in the white body.
- Use finger pressure to push each electrode into the white body. Observe a spring back of about 1/16 in. when the electrode base is flush with the top of the white body.
- If there is no spring back, insert a needle-nose pliers into the opening of the treating head and carefully pull upward on the small wire, approximately 1/16 in. Test for spring back as described in the previous step.

### 8.4.2 Assembly of the Treating Head

- Align the electrode with the slot in the white body and push it slowly down into position. Do not pound it or force it.
- Push the ceramic end plate over the electrodes using a slight rocking motion. Do not force pr pry the end plate.
- Use finger pressure at the ends of the slot on the ceramic end plate to compress the springs and push the electrodes into their seated position.

**WARNING:**
**Do not press on the ceramic plate sides as this may cause breakage.**

- Install and tighten the four (4) nylon screws. Do not exceed 0.5 Nm of torque.

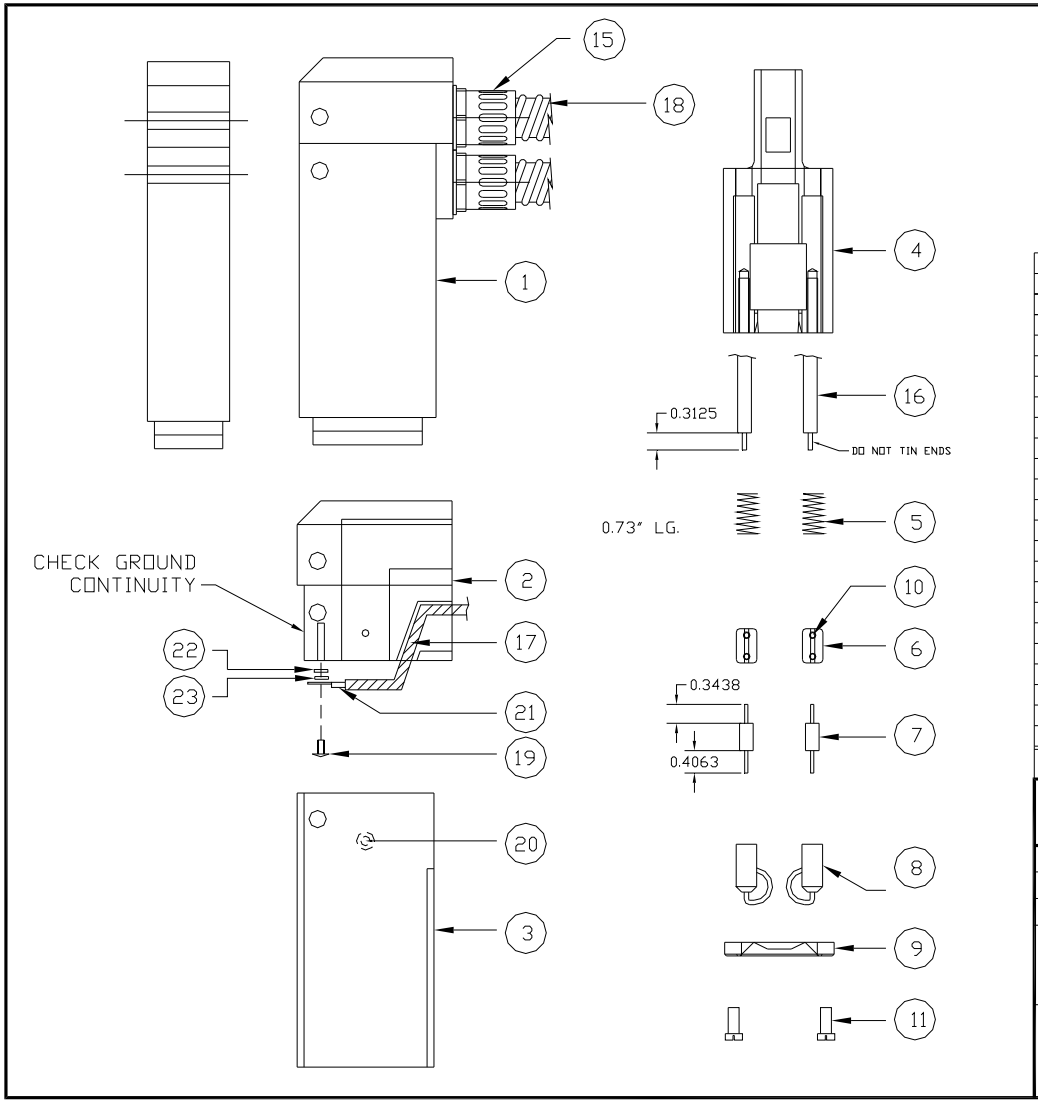
## 8.5 Spare Parts List for *MULTIDYNE™ 1000m/2000m*

**WARNING:**
**For safety reasons, use only parts which meet 3DT LLC specifications.**

**Note:**
The following parts may only be supplied by 3DT LLC or a recognized agent .of 3DT LLC.

| PART NUMBER | DESCRIPTION |
|---|---|
| **44010-56** | Customer J11 Interface Connector<br>includes hood and strain relief. |
| **34010-06** | Fuse, F1 and F2<br>8A 250V, SLO-BLO, 5 x 20 mm body. |
| **44010-80** | Treating Head, 2 meter<br>Complete final assembly. |
| **44010-17** | Electrode, set of two (2) |
| **44010-18** | Resistor for treating head, set of two (2) |
| **44010-19** | Ceramic cover<br>includes four (4) plastic screws. |
| **44567-01** | PCB1 Assembly<br>includes heat sink and LCD display. |
| **44000-73** | PCB2 Assembly. |
| **30010-26** | High Voltage Transformer, T1 (T2) |
| **72400-11** | High Voltage Post Caps<br>Use for TB2, TB3, TB4, TB5, or TB6 |

**Note:**
Consult 3DT LLC if you need to change the length of the treating head from the factory supplied length. Several internal changes/settings will be required for this change.




| REVISIONS | | | |
|---|---|---|---|
| REV. | DATE | DESCRIPTION | BY |
| 1 | 07-06-15 | Removed mounting bolts due to adding thru mounting holes | DW |

| ITEM NO. | PART NO. | DESCRIPTION | NO. REQ'D. |
|---|---|---|---|
| 24 | | | |
| 23 | 35030-10 | #8 S.S. FLAT WASHER | 1 |
| 22 | 35030-25 | #8 SERRATED WASHER | 1 |
| 21 | 28050-09 | RING, #8 STUD, #14AWG, NON-INSUL | 1 |
| 20 | 35010-32 | SCREW, #8-32 X 1/2, FH | 1 |
| 19 | 35010-33 | SCREW, #8-32 X 1/4, BTH | 1 |
| 18 | 35050-51 | FLEX CONDUIT, SPIRAL REINFORCED PVC | 2 @ 78 " |
| 17 | 29010-06 | WIRE, #16, WHITE, 15kV DC | 107" |
| 16 | 29010-19 | WIRE, 16 GA. WHITE, 40KV UL | 2 @ 116" |
| 15 | 35050-52 | CONDUIT CONNECTOR | 2 |
| 14 | | | |
| 13 | | | |
| 12 | | | |
| 11 | 35010-24 | SCREW, M5X12MM, CH,SL,NY, CHEESEHEAD | 4 |
| 10 | 35010-51 | SET SCREW, M3 X 4MM, SS | 4 |
| 9 | 44010-19 | END COVER, CERAMIC W/ (4) 35010-24 | 1 |
| 8 | 44010-17 | ELECTRODE SET | 1 |
| 7 | 44010-18 | 330 OHM, 5W WIRE RESISTOR SET | 1 |
| 6 | 36010-22 | SLEEVE, BRASS | 2 |
| 5 | 35050-20 | SPRING, 0.375 OD CUT IN 1/2 TO MAKE 2 | 1 |
| 4 | 36010-10 | MD INSULATOR BODY | 1 |
| 3 | 36010-09 | MD HOUSING, ALUM | 1 |
| 2 | 36010-82 | AIR MANIFOLD W/PG-16 THREADS | 1 |
| 1 | 44010-80 | COMPLETE TREATING HEAD ASS'Y | 1 |

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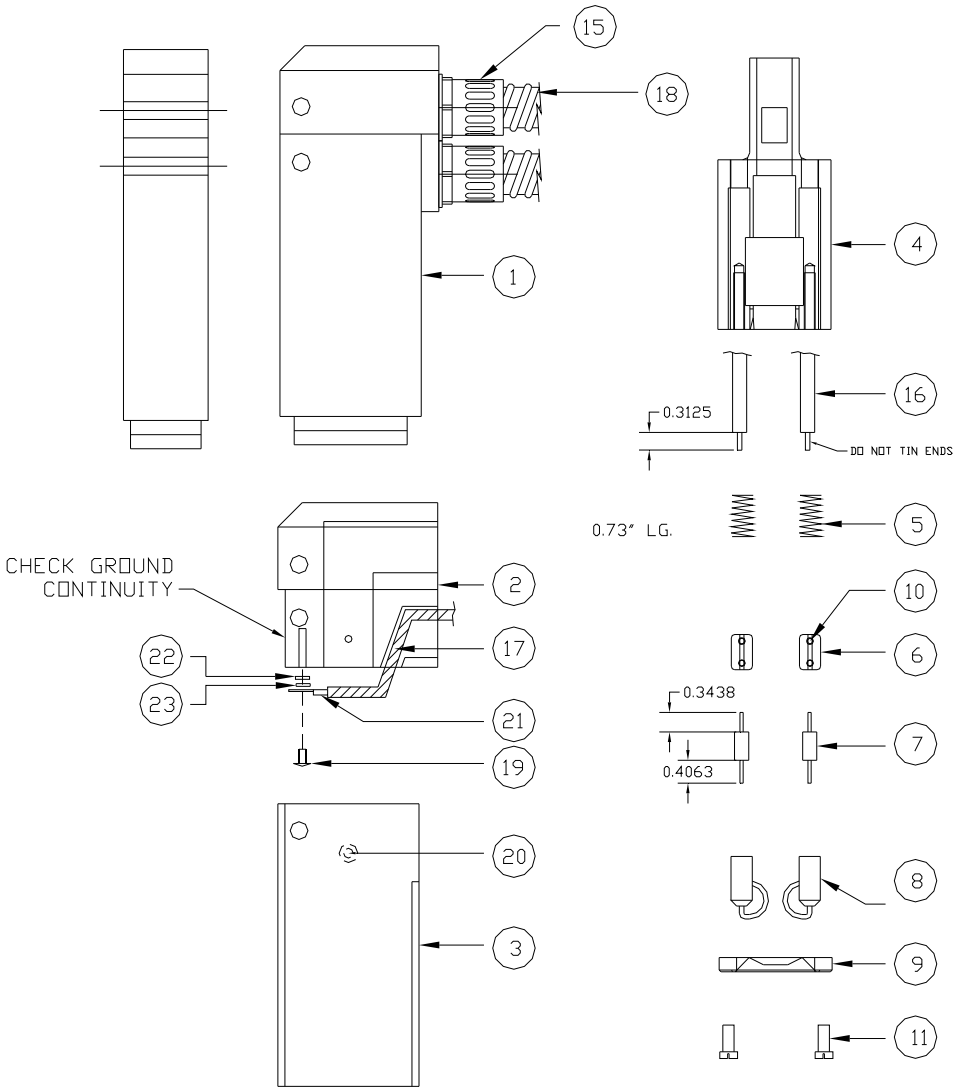
| | | |
|---|---|---|
| DRAWN BY: DW | CHECKED BY: | ENG/DATE: |
| DATE: 03-31-15 | | QA/DATE: |
| SCALE: 1:2 | DO NOT SCALE PRINT | PROD/DATE: |

TOLERANCE UNLESS OTHERWISE SPECIFIED:
X: ±.03 XXX: ±.005
XX: ±.01 XXXX: ±.0005
ANGLES: ±0°30'



| TITLE: | PART NO: | REV. |
|---|---|---|
| 2M MD TREATING HEAD ASSEMBLY MD1000/2000 | 44010-80 | 1 |
| | DWG. SIZE B — SHEET 1 OF 1 | |




| REVISIONS | | | |
|---|---|---|---|
| REV. | DATE | DESCRIPTION | BY |
| 1 | 07-06-15 | Removed mounting bolts due to adding thru mounting holes | DW |

| ITEM NO. | PART NO. | DESCRIPTION | NO. REQ'D. |
|---|---|---|---|
| 24 | | | |
| 23 | 35030-10 | #8 S.S. FLAT WASHER | 1 |
| 22 | 35030-25 | #8 SERRATED WASHER | 1 |
| 21 | 28050-09 | RING, #8 STUD, #14AWG, NON-INSUL | 1 |
| 20 | 35010-32 | SCREW, #8-32 X 1/2, FH | 1 |
| 19 | 35010-33 | SCREW, #8-32 X 1/4, BTH | 1 |
| 18 | 35050-51 | FLEX CONDUIT, SPIRAL REINFORCED PVC | 2 @ 118 " |
| 17 | 29010-06 | WIRE, #16, WHITE, 15kV DC | 147" |
| 16 | 29010-19 | WIRE, 16 GA. WHITE, 40KV UL | 2 @ 156" |
| 15 | 35050-52 | CONDUIT CONNECTOR | 2 |
| 14 | | | |
| 13 | | | |
| 12 | | | |
| 11 | 35010-24 | SCREW, M5X12MM, CH,SL,NY, CHEESEHEAD | 4 |
| 10 | 35010-51 | SET SCREW, M3 X 4MM, SS | 4 |
| 9 | 44010-19 | END COVER, CERAMIC W/ (4) 35010-24 | 1 |
| 8 | 44010-17 | ELECTRODE SET | 1 |
| 7 | 44010-18 | 330 OHM, 5W WIRE RESISTOR SET | 1 |
| 6 | 36010-22 | SLEEVE, BRASS | 2 |
| 5 | 35050-20 | SPRING, 0.375 OD CUT IN 1/2 TO MAKE 2 | 1 |
| 4 | 36010-10 | MD INSULATOR BODY | 1 |
| 3 | 36010-09 | MD HOUSING, ALUM | 1 |
| 2 | 36010-82 | AIR MANIFOLD W/PG-16 THREADS | 1 |
| 1 | 44011-12 | COMPLETE TREATING HEAD ASS'Y | 1 |

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|---|---|---|
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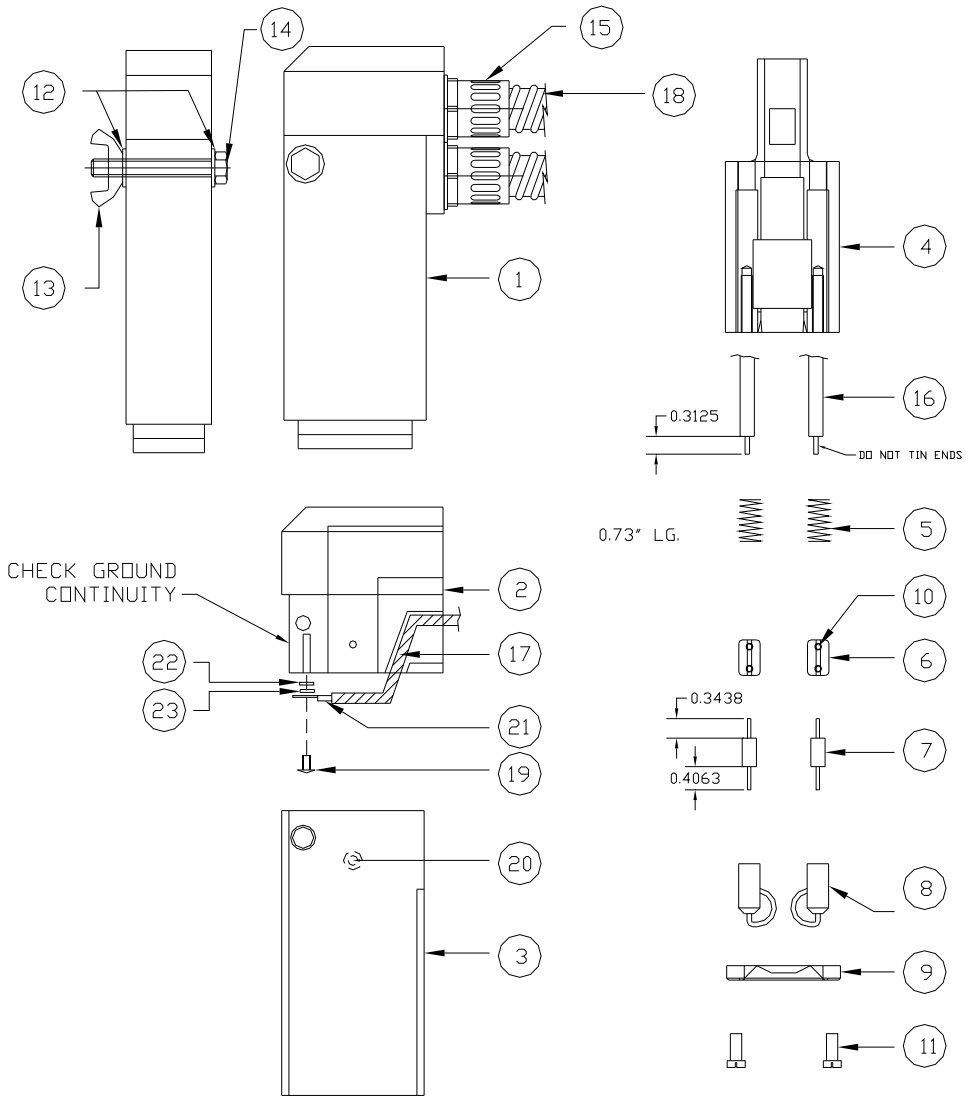
| SCALE: 1:2 | DO NOT SCALE PRINT | PROD/DATE: |

TOLERANCE UNLESS OTHERWISE SPECIFIED:
X: ±.03 XXX: ±.005
XX: ±.01 XXXX: ±.0005
ANGLES: ±0°30'



| TITLE: | PART NO: | REV. |
|---|---|---|
| 3M MD TREATING HEAD ASSEMBLY MD1000/2000 | 44011-12 | 1 |
| | DWG. SIZE B SHEET 1 OF 1 | |




| REVISIONS | | | |
|---|---|---|---|
| REV. | DATE | DESCRIPTION | BY |

| ITEM NO. | PART NO. | DESCRIPTION | NO. REQ'D. |
|---|---|---|---|
| 24 | | | |
| 23 | 35030-10 | #8 S.S. FLAT WASHER | 1 |
| 22 | 35030-25 | #8 SERRATED WASHER | 1 |
| 21 | 28050-09 | RING, #8 STUD, #14AWG, NON-INSUL | 1 |
| 20 | 35010-32 | SCREW, #8-32 X 1/2, FH | 1 |
| 19 | 35010-33 | SCREW, #8-32 X 1/4, BTH | 1 |
| 18 | 35050-10 | 1/2" FLEX CONDUIT, SPIRAL BLACK | 2 @ 157" |
| 17 | 29010-06 | WIRE, #16, WHITE, 15kV DC | 186" |
| 16 | 29010-19 | WIRE, 16 GA. WHITE, 40KV UL | 2 @ 195" |
| 15 | 35050-13 | 1/2" CONDUIT CONNECTOR | 2 |
| 14 | 35010-39 | SCREW, M8 X 50MM, HH, SS | 1 |
| 13 | 35020-10 | NUT, WING, #8MM, SS | 1 |
| 12 | 35030-14 | WASHER, M8 FLAT, 1.6 THK, SS | 2 |
| 11 | 35010-24 | SCREW, M5X12MM, CH,SL,NY, CHEESEHEAD | 4 |
| 10 | 35010-51 | SET SCREW, M3 X 4MM, SS | 4 |
| 9 | 44010-19 | END COVER, CERAMIC W/ (4) 35010-24 | 1 |
| 8 | 44010-17 | ELECTRODE SET | 1 |
| 7 | 44010-18 | 330 OHM, 5W WIRE RESISTOR SET | 1 |
| 6 | 36010-22 | SLEEVE, BRASS | 2 |
| 5 | 35050-20 | SPRING, 0.375 OD CUT IN 1/2 TO MAKE 2 | 1 |
| 4 | 36010-10 | MD INSULATOR BODY | 1 |
| 3 | 36010-09 | MD HOUSING, ALUM | 1 |
| 2 | 36010-82 | AIR MANIFOLD W/PG-16 THREADS | 1 |
| 1 | 44011-13 | COMPLETE TREATING HEAD ASS'Y | 1 |

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| | | |
|---|---|---|
| DRAWN BY: DW | CHECKED BY: | ENG/DATE: |
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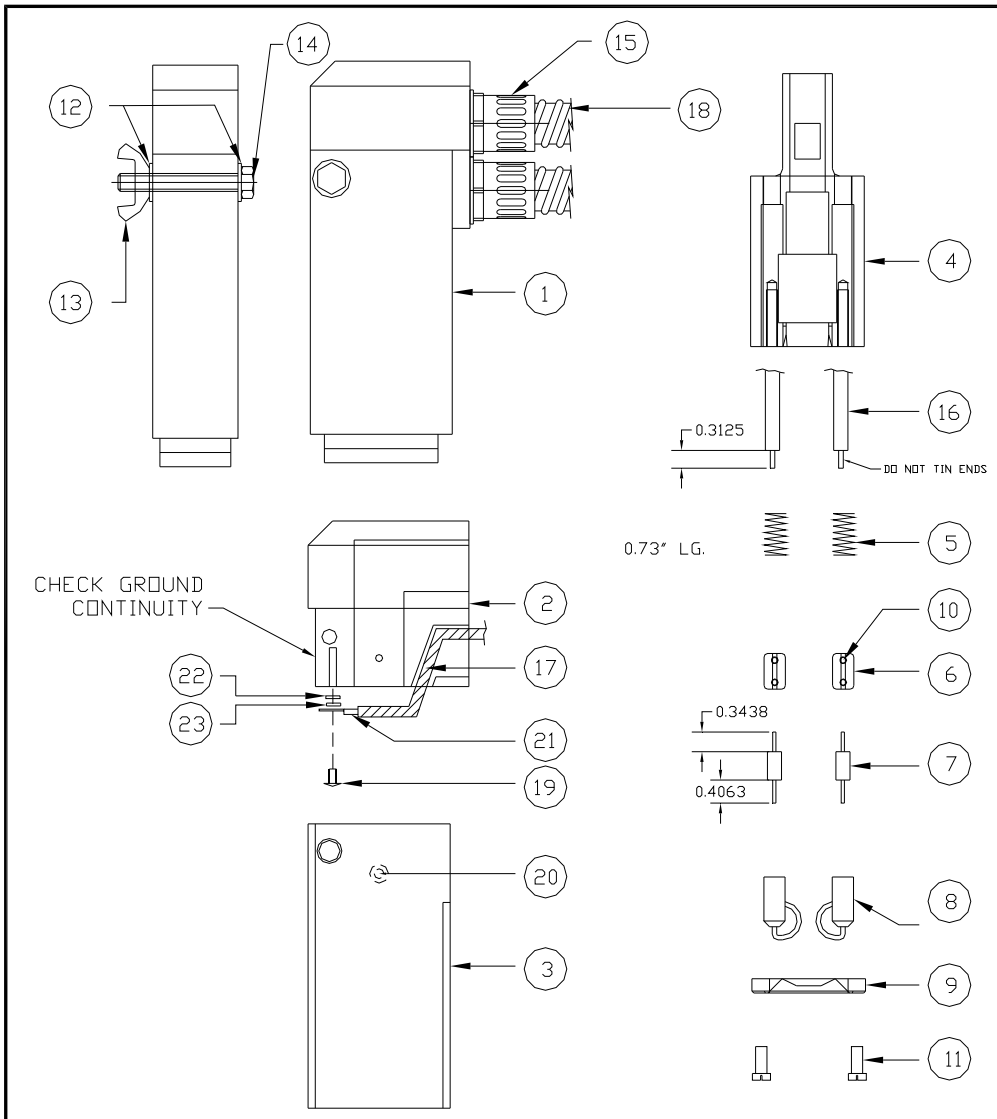
| SCALE: 1:2 | DO NOT SCALE PRINT | PROD/DATE: |

TOLERANCE UNLESS OTHERWISE SPECIFIED:
X: ±.03 XXX: ±.005
XX: ±.01 XXXX: ±.0005
ANGLES: ±0°30'



| TITLE: | PART NO.: | REV. |
|---|---|---|
| 4M MD TREATING HEAD ASSEMBLY MD1000/2000 | 44011-13 | 0 |
| | DWG. SIZE B — SHEET 1 OF 1 | |




| REVISIONS | | | |
|---|---|---|---|
| REV. | DATE | DESCRIPTION | BY |

| ITEM NO. | PART NO. | DESCRIPTION | NO. REQ'D. |
|---|---|---|---|
| 24 | | | |
| 23 | 35030-10 | #8 S.S. FLAT WASHER | 1 |
| 22 | 35030-25 | #8 SERRATED WASHER | 1 |
| 21 | 28050-09 | RING, #8 STUD, #14AWG, NON-INSUL | 1 |
| 20 | 35010-32 | SCREW, #8-32 X 1/2, FH | 1 |
| 19 | 35010-33 | SCREW, #8-32 X 1/4, BTH | 1 |
| 18 | 35050-10 | 1/2" FLEX CONDUIT, SPIRAL BLACK | 2 @ 198" |
| 17 | 29010-06 | WIRE, #16, WHITE, 15kV DC | 228" |
| 16 | 29010-19 | WIRE, 16 GA. WHITE, 40KV UL | 2 @ 228" |
| 15 | 35050-13 | 1/2" CONDUIT CONNECTOR | 2 |
| 14 | 35010-39 | SCREW, M8 X 50MM, HH, SS | 1 |
| 13 | 35020-10 | NUT, WING, #8MM, SS | 1 |
| 12 | 35030-14 | WASHER, M8 FLAT, 1.6 THK, SS | 2 |
| 11 | 35010-24 | SCREW, M5X12MM, CH,SL,NY, CHEESEHEAD | 4 |
| 10 | 35010-51 | SET SCREW, M3 X 4MM, SS | 4 |
| 9 | 44010-19 | END COVER, CERAMIC W/ (4) 35010-24 | 1 |
| 8 | 44010-17 | ELECTRODE SET | 1 |
| 7 | 44010-18 | 330 OHM, 5W WIRE RESISTOR SET | 1 |
| 6 | 36010-22 | SLEEVE, BRASS | 2 |
| 5 | 35050-20 | SPRING, 0.375 OD CUT IN 1/2 TO MAKE 2 | 1 |
| 4 | 36010-10 | MD INSULATOR BODY | 1 |
| 3 | 36010-09 | MD HOUSING, ALUM | 1 |
| 2 | 36010-82 | AIR MANIFOLD W/PG-16 THREADS | 1 |
| 1 | 44010-61 | COMPLETE TREATING HEAD ASS'Y | 1 |

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|---|---|---|
| DRAWN BY: DW | CHECKED BY: | ENG/DATE: |
| DATE: 05-05-15 | | QA/DATE: |
| SCALE: 1:2 | DO NOT SCALE PRINT | PROD/DATE: |

TOLERANCE UNLESS OTHERWISE SPECIFIED:
X: ±.03 XXX: ±.005
XX: ±.01 XXXX: ±.0005
ANGLES: ±0°30'



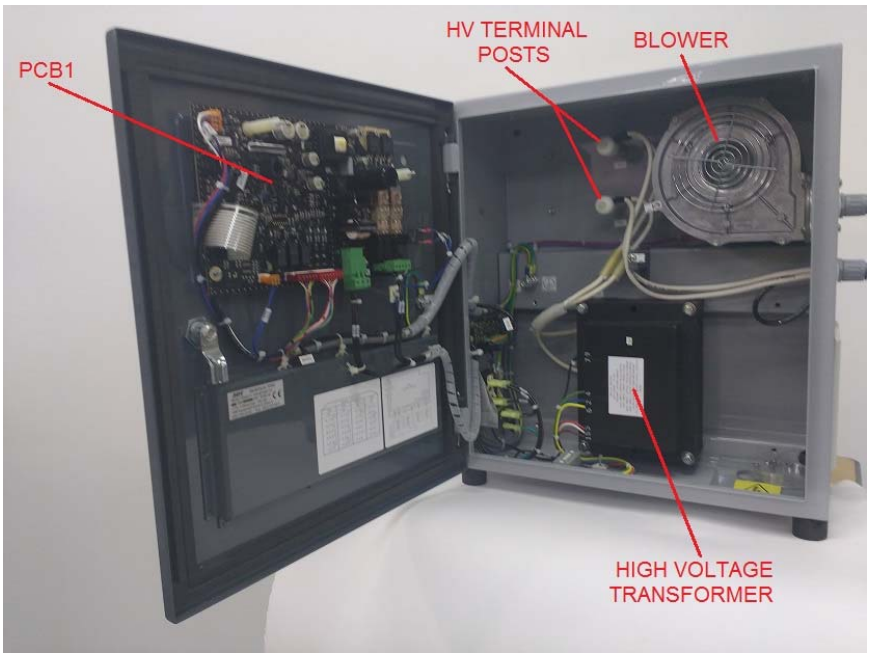
TITLE: 5M MD TREATING HEAD ASSEMBLY MD1000/2000

PART NO: 44010-61 REV. 0

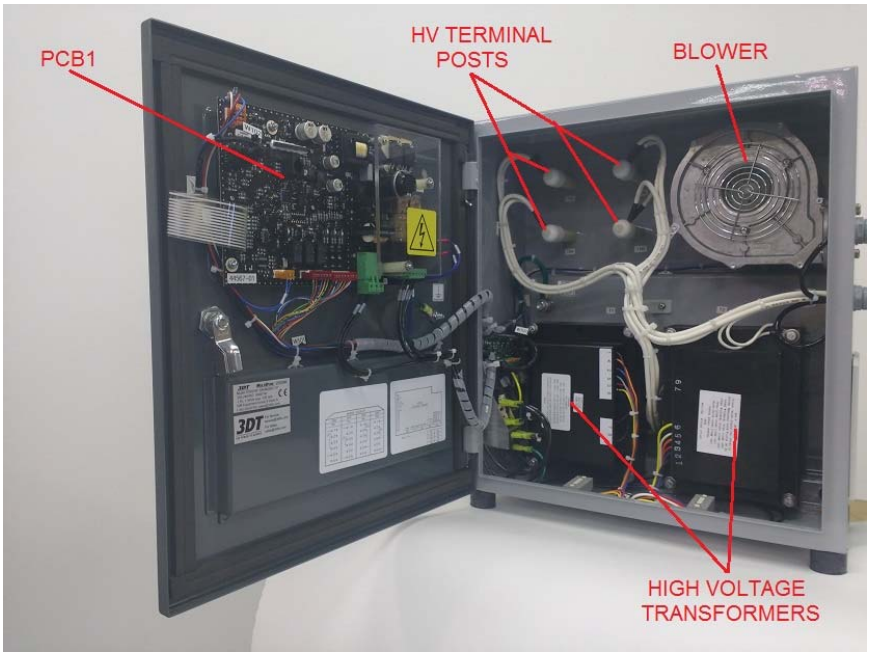
DWG. SIZE B SHEET 1 OF 1

# 9 Layouts

## 9.1 Generator Cabinet



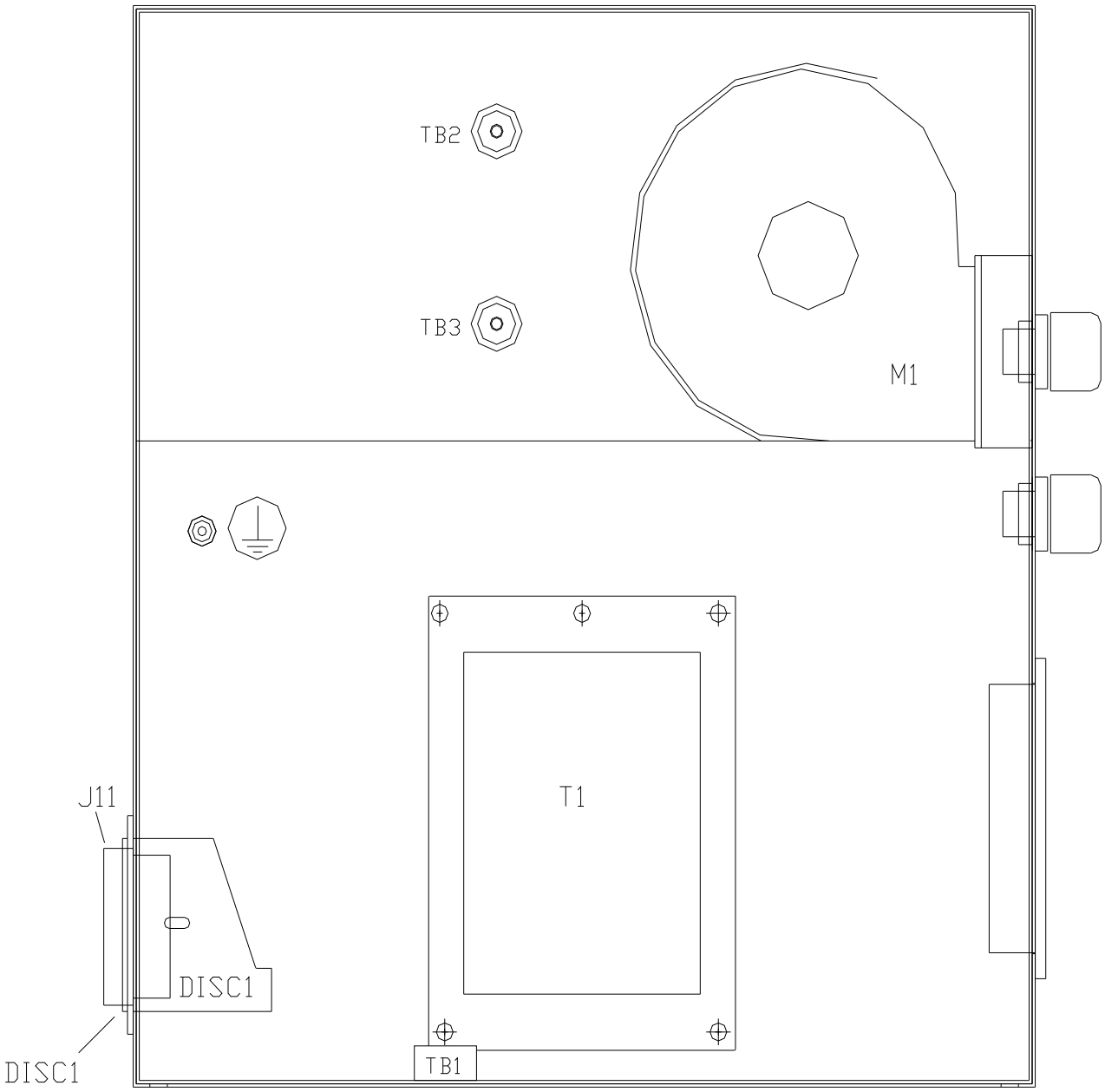

***MULTIDYNE™ 1000m***



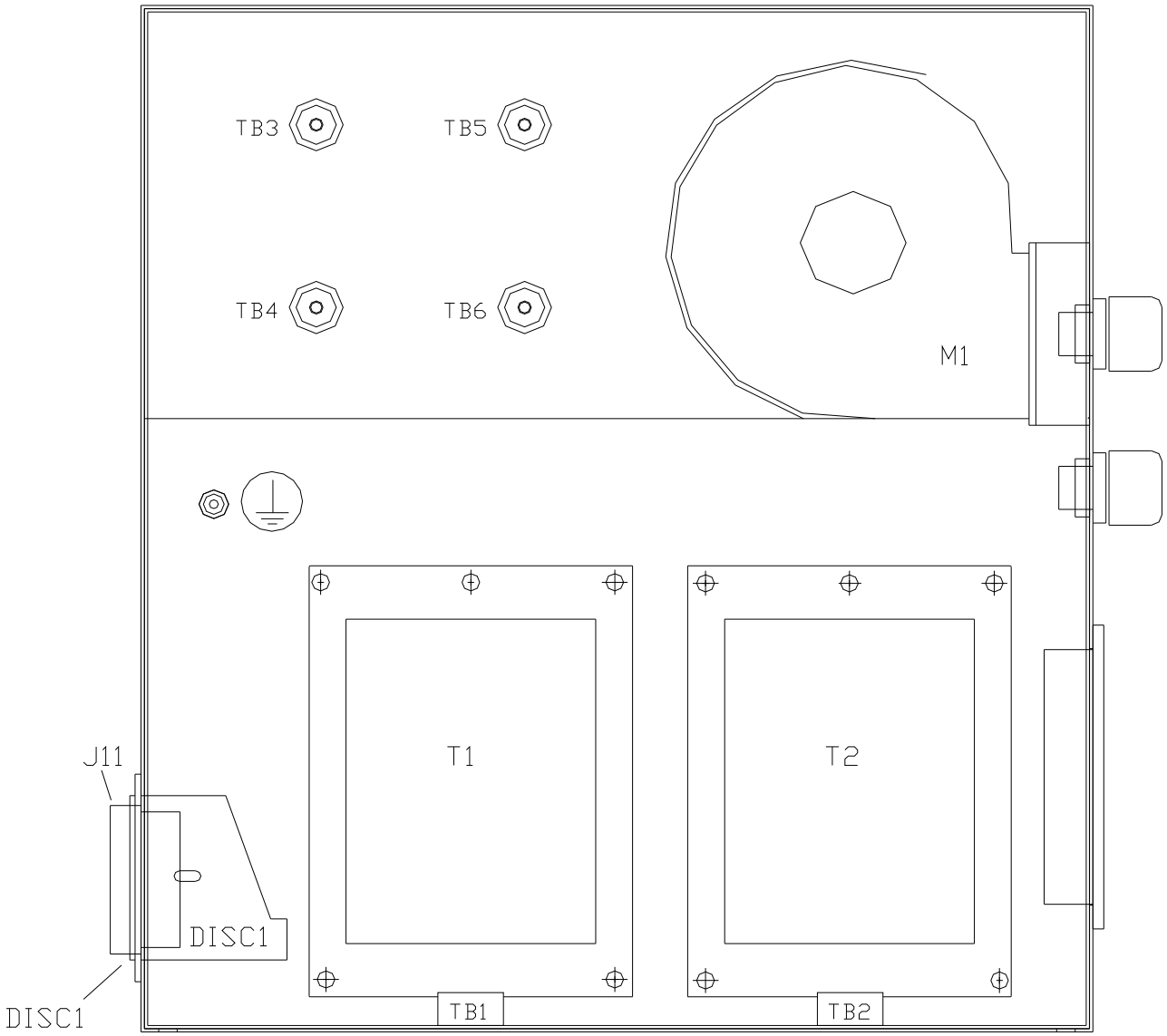

***MULTIDYNE™ 2000m***

## 9.2 Enclosure Layouts

### 9.2.1 *MULTIDYNE™ 1000m*

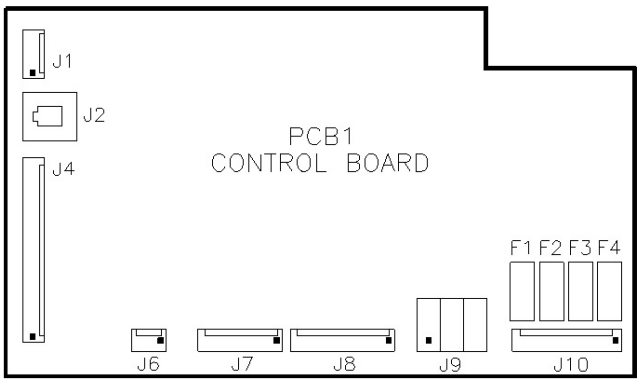


### 9.2.2 *MULTIDYNE™ 2000m*



## 9.3 PCB1 Connector and Fuse Locations

### 9.3.1 *MULTIDYNE™ 1000m*



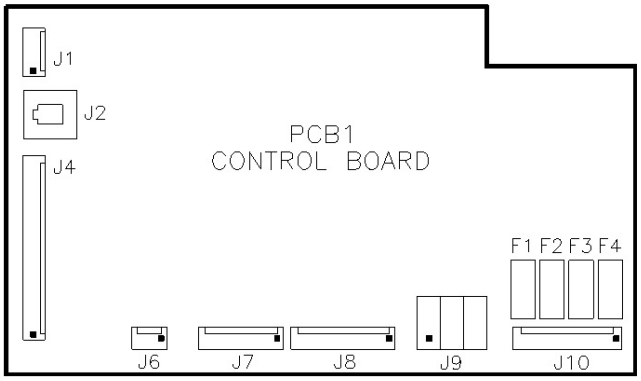

Pin 1 = ▪

| | |
|---|---|
| F1 | 8A. |
| F2 | 8A. |
| F3 | UNUSED |
| F4 | UNUSED |

**Note:**

Fuses F1 and F2 are 8A 250V SLO-BLO, 5 x 20 mm body

### 9.3.2 *MULTIDYNE™ 2000m*




Pin 1 = ▪

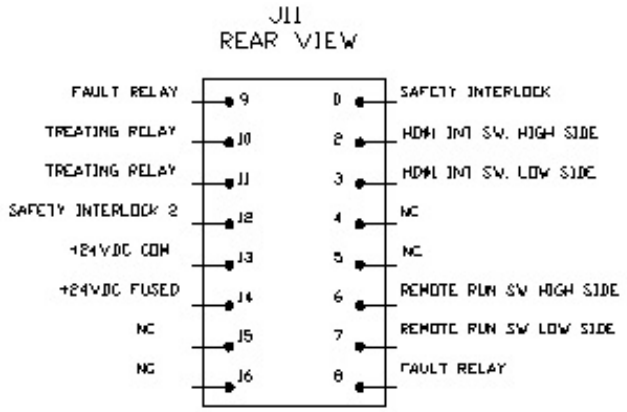
| | |
|---|---|
| F1 | 8A. |
| F2 | 8A. |
| F3 | 8A. |
| F4 | 8A. |

**Note:**

Fuses F1, F2, F3 and F4 are 8A 250V SLO-BLO, 5 x 20 mm body

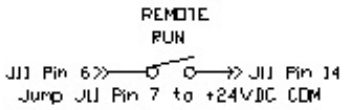
# 10 Wiring Diagrams

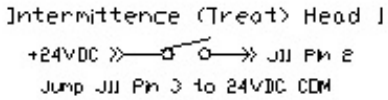
## 10.1 *MULTIDYNE™ 1000m*




NOTE: +24VDC (Pin 14) and 24VDC COM (Pin 13) is provided on J11
24VDC, 300 ma. Max.

NOTE: The internal 24VDC supplied across Pins 13 and 14 is
supplied for the hookup of external sensing devices only!
DO NOT EXCEED 300 ma draw on the internal supply!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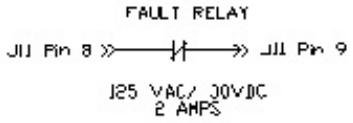
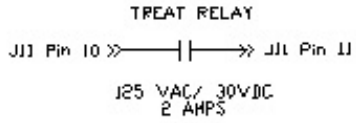
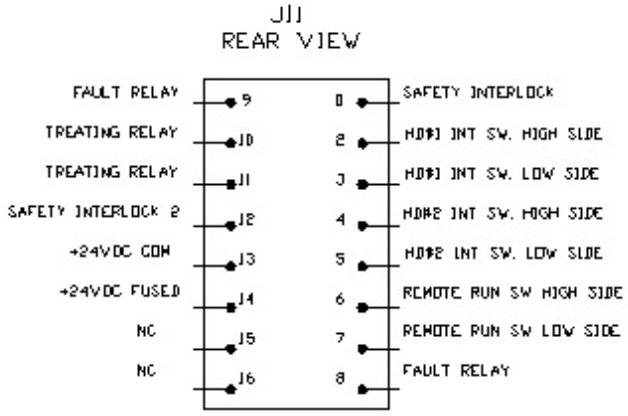
INTERNAL RELAYS



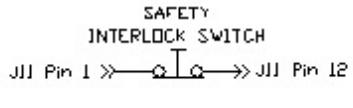



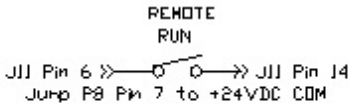
## 10.2 *MULTIDYNE™ 2000m*

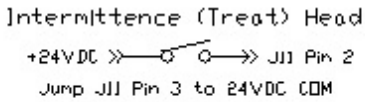


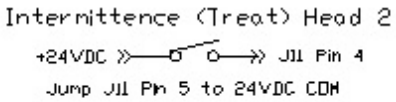

NOTE: +24VDC (Pin 14) and 24VDC COM (Pin 13) is provided on J11
24VDC, 300 ma. Max.

NOTE: The Internal 24VDC supplied across Pins 13 and 14 Is
supplied for the hookup of external sensing devices only!
DO NOT EXCEED 300 ma draw on the internal supply!

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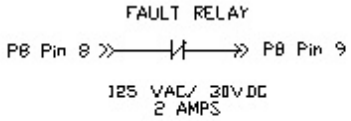
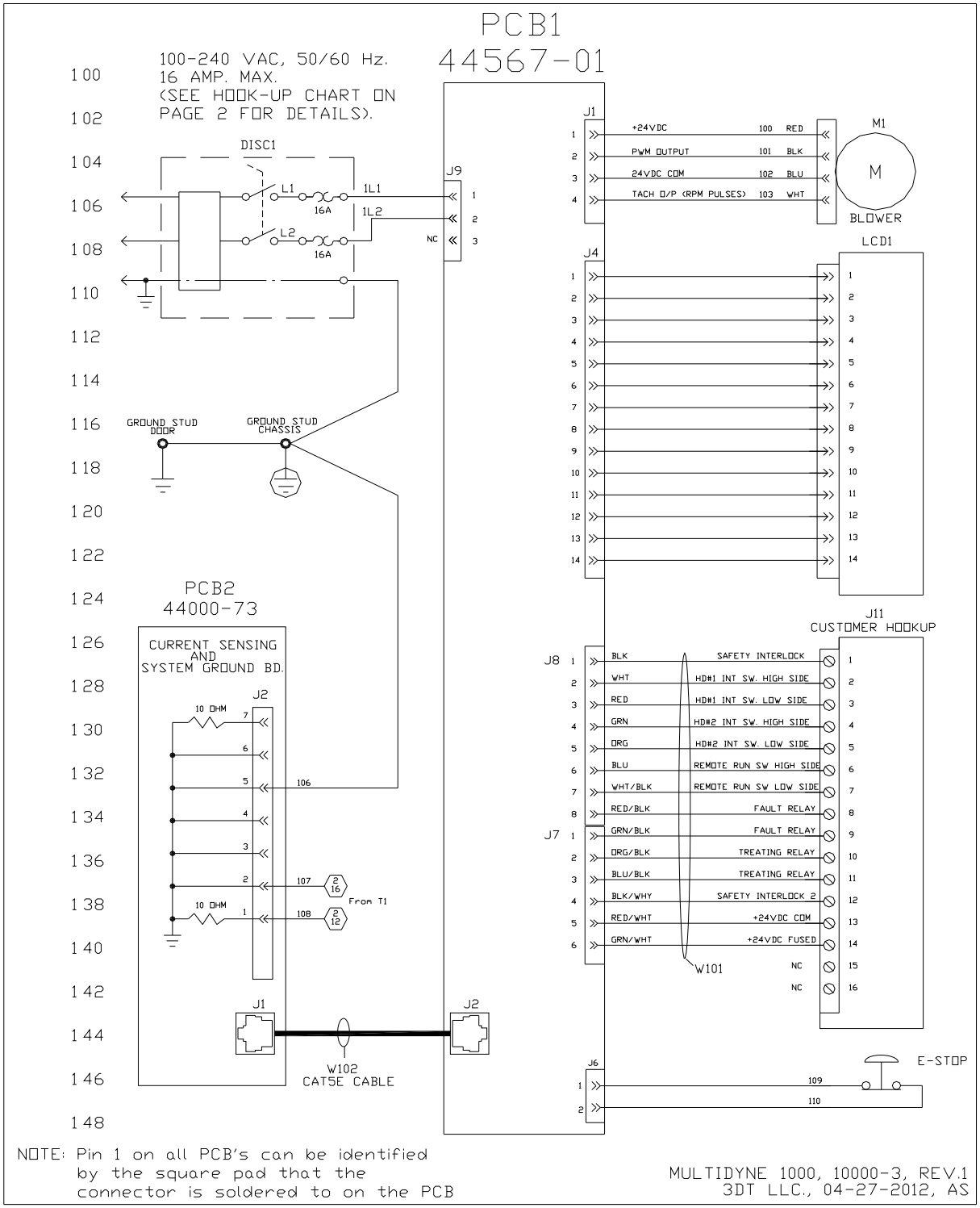
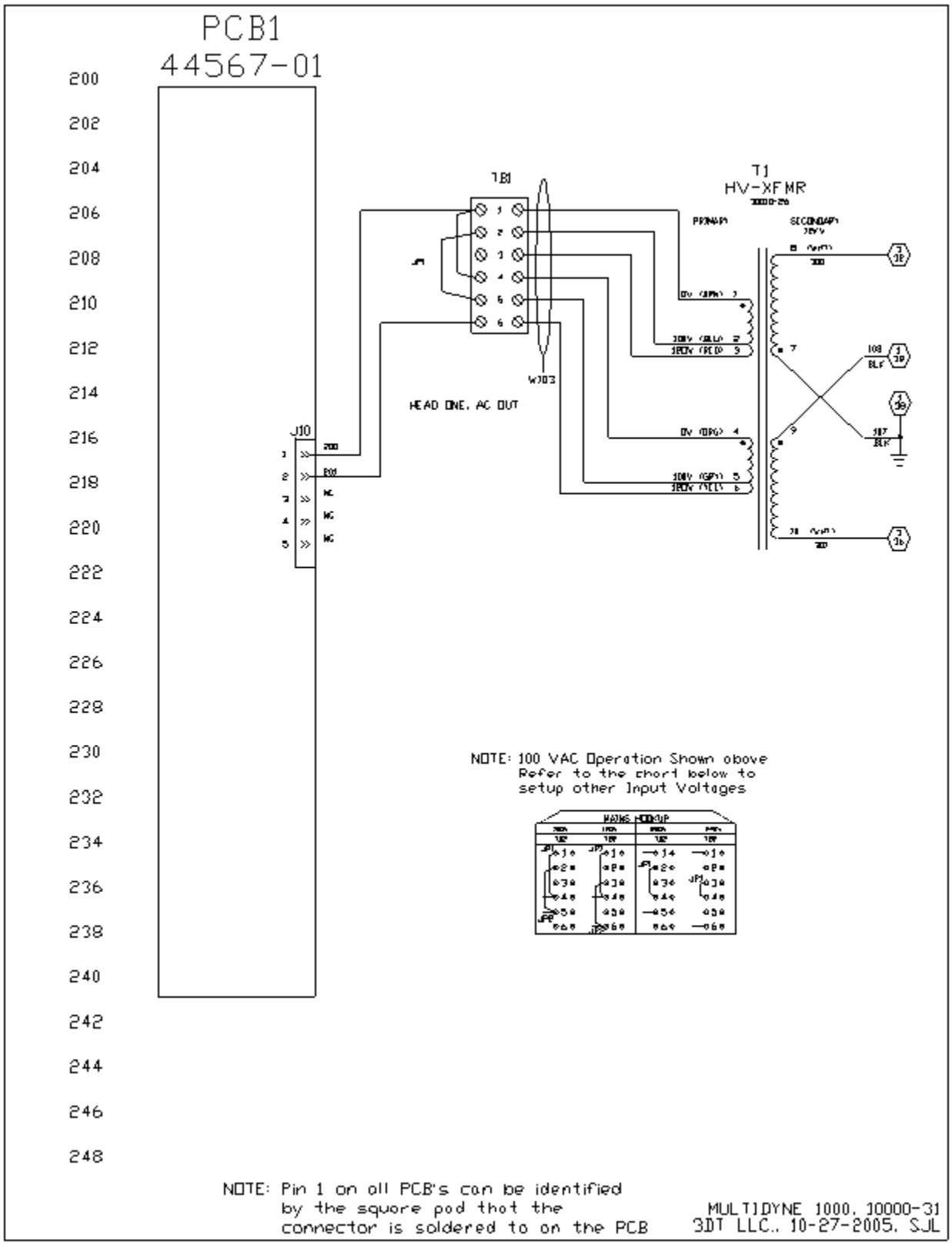
INTERNAL RELAYS

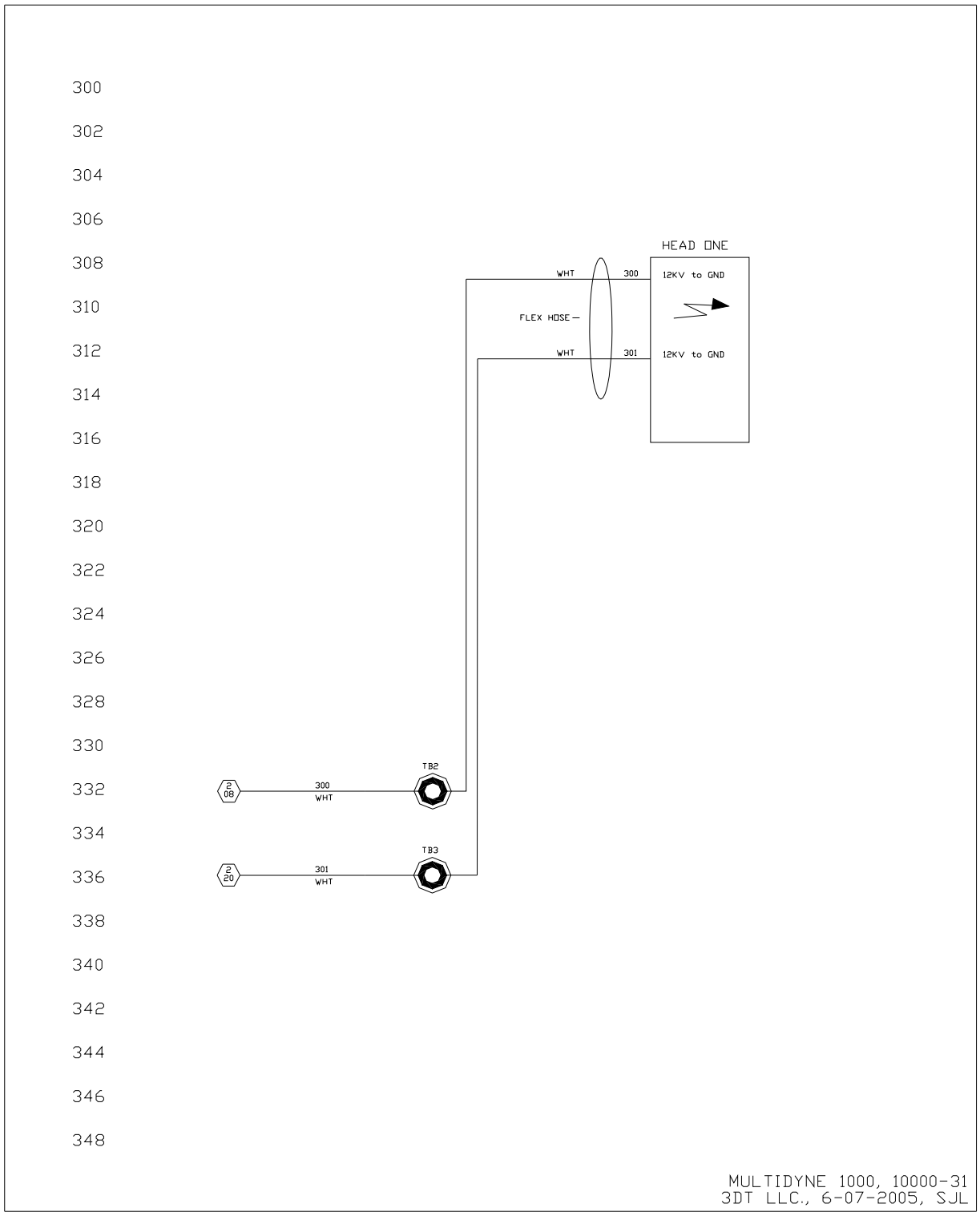



# 11 Electrical Schematics

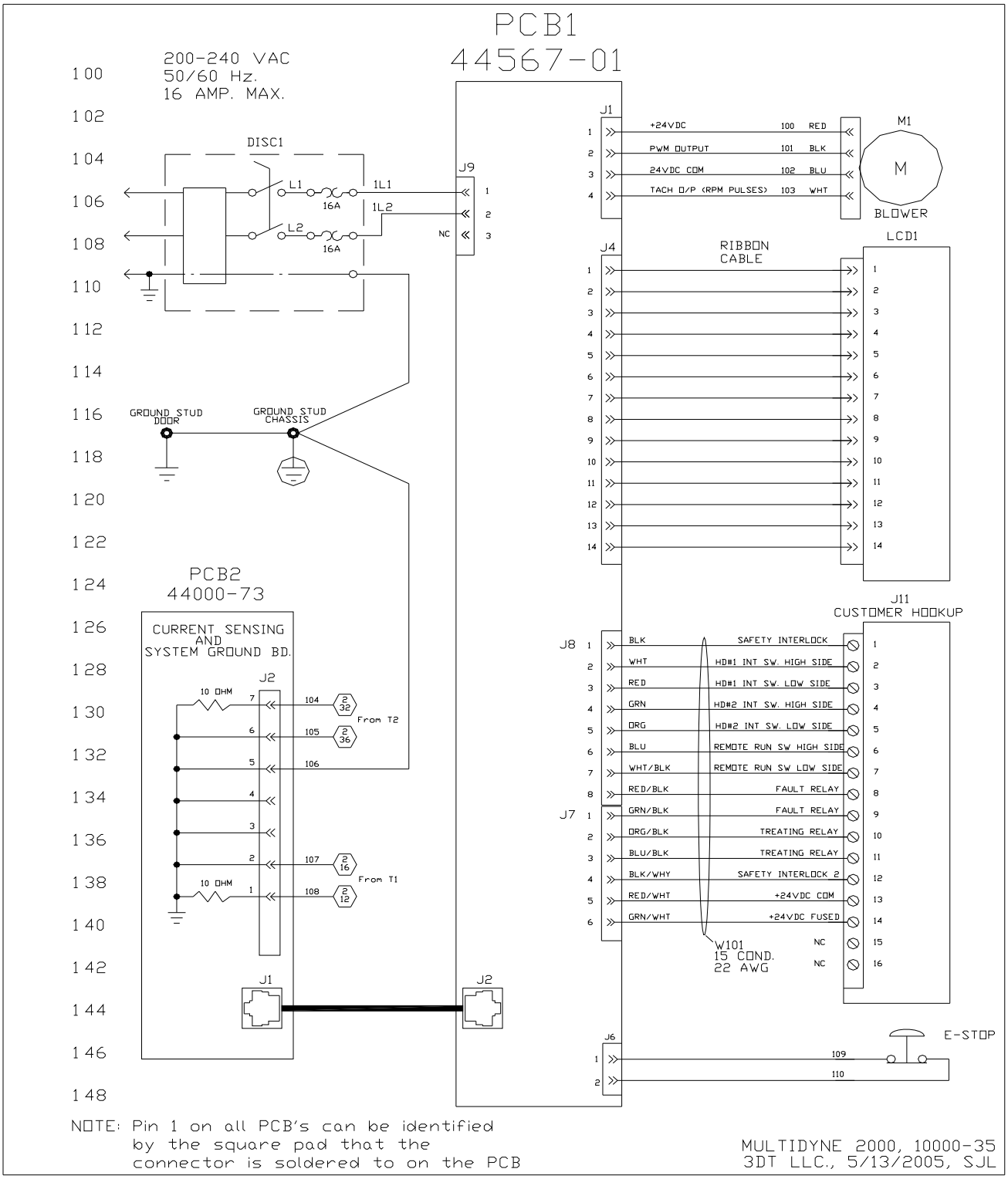
## 11.1 *MULTIDYNE™ 1000m*

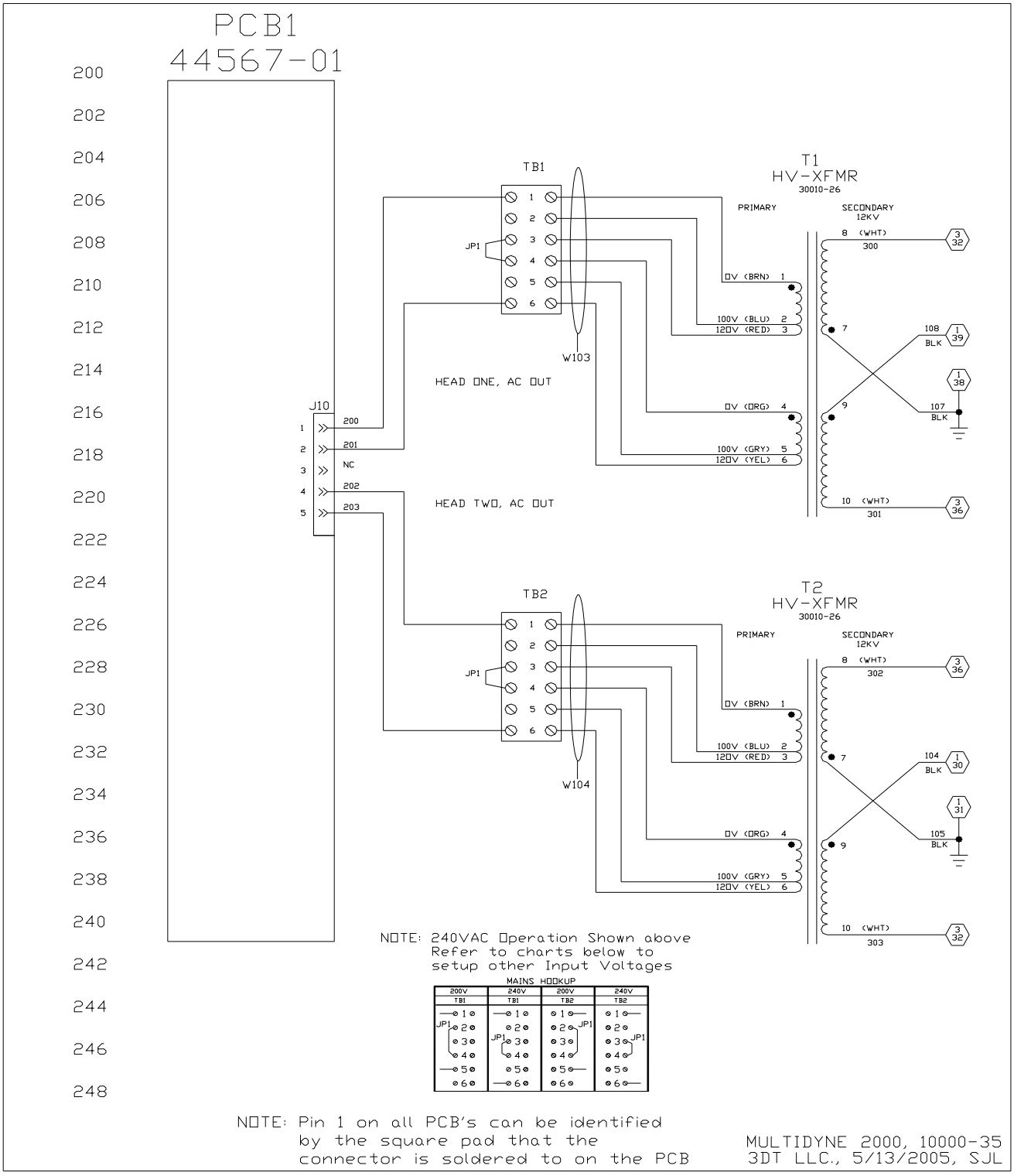


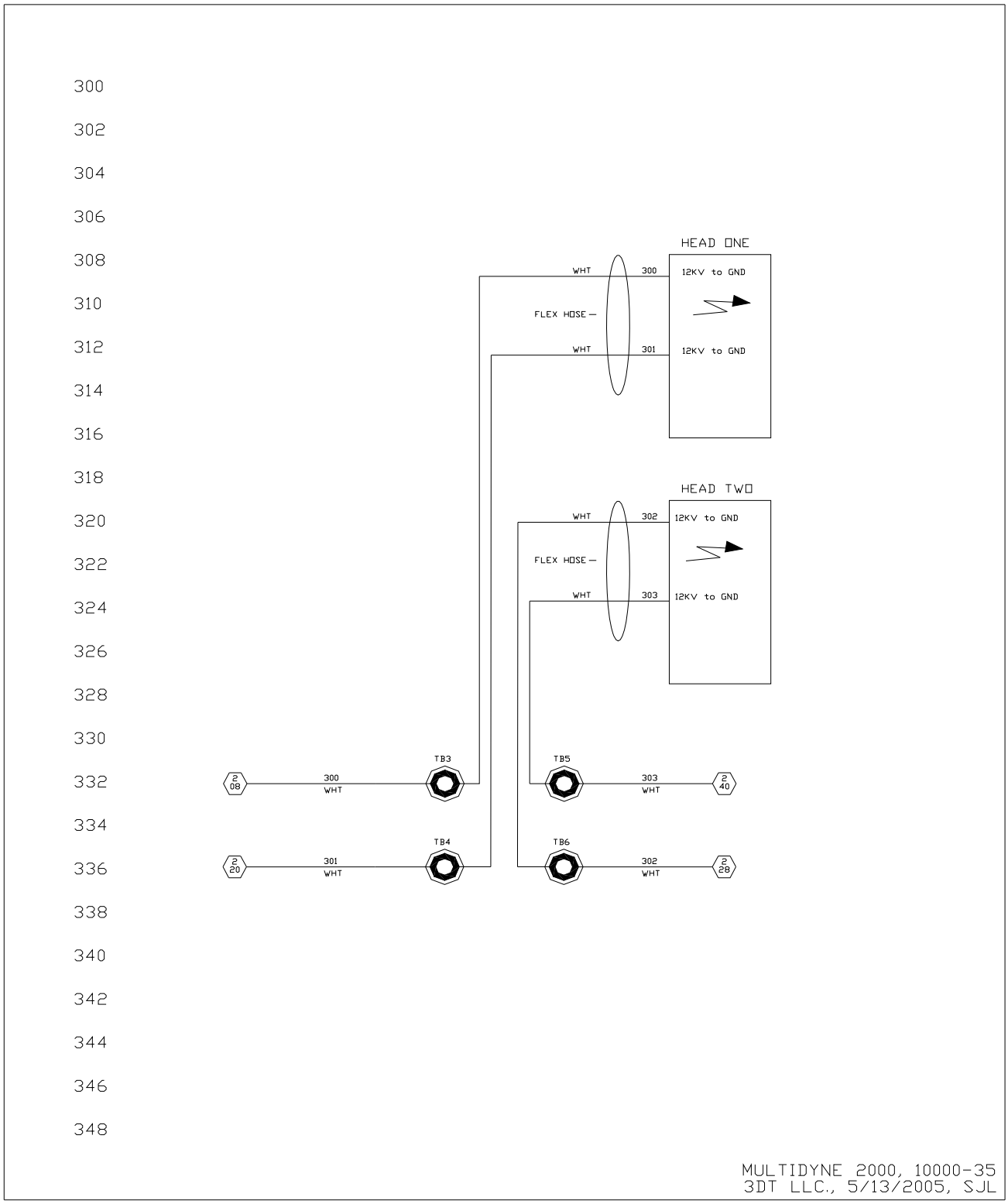




## 11.2 *MULTIDYNE™ 2000m*





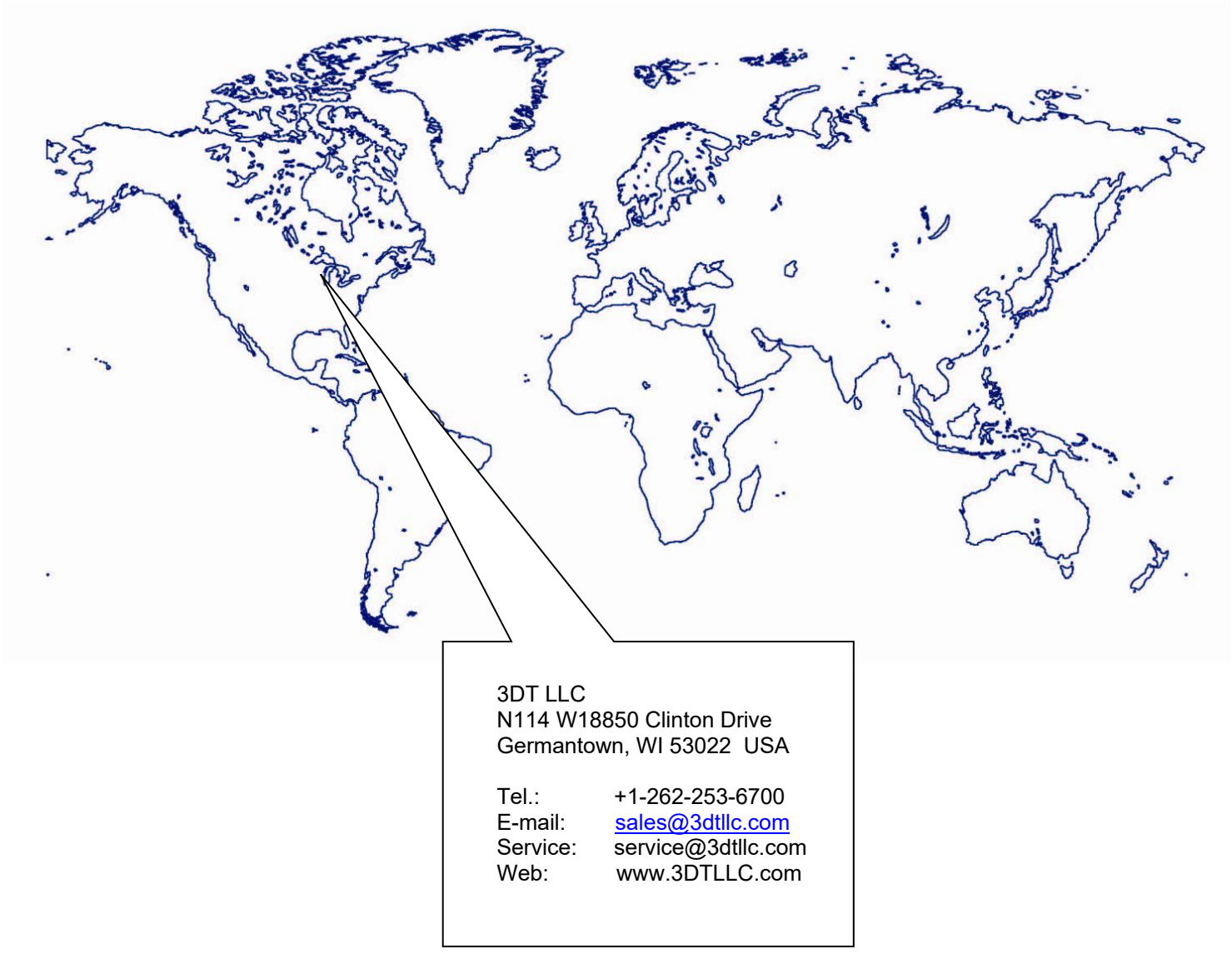


## 12 Worldwide Sales Representatives and Service

**Sales Agents & Representatives-** For a complete list of sales agents and representatives please refer to our website at wwww.3DTLLC.com under the **Contact Us** page.

**Service-**
For service contact 3DT headquarters in Germantown, Wisconsin, USA at service@3DTLLC.com

For service in Europe please contact SICATECH at service@sicatech.dk



3DT LLC
N114 W18850 Clinton Drive
Germantown, WI 53022 USA

Tel.: +1-262-253-6700
E-mail: sales@3dtllc.com
Service: service@3dtllc.com
Web: www.3DTLLC.com

## 13 Terms and Conditions

1. This writing constitutes an offer or counter-offer by 3DT LLC ("Seller") to sell the products and/or services described herein and in the accompanying quotation ("Quotation") in accordance with these terms and conditions, is not an acceptance of any offer made by buyer, and is expressly conditioned upon assent to these terms and conditions. Buyer will be deemed to have assented to these terms and conditions unless Seller receives written notice of any objection within 10 days after buyer's receipt of this form. No additional or different terms or conditions will be binding upon Seller, unless specifically agreed to in writing; failure of Seller to object to provisions contained in any purchase order or other communication from a buyer shall not be construed as a waiver of these terms and conditions nor an acceptance of any of such provisions. No order may be canceled or altered by the buyer except upon terms and conditions acceptable to Seller, as evidenced by Seller's written consent. In the event of such an approved cancellation by buyer, Seller shall be entitled to payment of the full price, less the amount of any expenses saved by Seller by reason of the cancellation.

2. PRICES AND PAYMENT. Except as described in the Quotation, all prices are subject to change without notice; and the price of products on order but unshipped will be adjusted to the price in effect at the time of shipment. Payment is due as described in the Quotation. Interest will be charged at the rate of 18% per year (but not more than the highest rate permitted by applicable law) on accounts more than 30 days past due.

3. TAXES AND OTHER CHARGES. Any manufacturer's tax, occupation tax, use tax, sales tax, excise tax, duty, custom, inspection or testing fee, or any other tax, fee or charge of any nature whatsoever imposed by any governmental authority, on or measured by the transaction between Seller and the buyer shall be paid by the buyer in addition to the prices quoted or invoiced. In the event the Seller is required to pay any such tax, fee or charge, the buyer shall reimburse Seller therefore.

4. DELIVERY, CLAIMS AND FORCE MAJEURE. Delivery of products to a carrier at Seller's plant or other loading point shall constitute delivery to buyer; and regardless of shipping terms or freight payment, all risk of loss or damage in transit shall be borne by buyer. Seller reserves the right to make delivery in installments, unless otherwise expressly stipulated herein; all such installments to be separately invoiced and paid for when due per invoice, without regard to subsequent deliveries. Delay in delivery of any installment shall not relieve buyer of its obligations to accept remaining deliveries.

Claims for shortages or other errors in delivery must be made in writing to Seller within 10 days after receipt of shipment and failure to give such notice shall constitute unqualified acceptance and a waiver of all such claims by buyer. Claims for loss or damage to goods in transit should be made to the carrier and not to Seller.

All delivery dates are approximate. Seller shall not be liable for any damage as a result of any delay or failure to deliver due to any cause beyond Seller's reasonable control, including, without limitation, any act of God, act of the buyer, embargo or other governmental act, regulation or request, fire, accident, strike, slowdown, war, riot, delay in transportation, or inability to obtain necessary labor, materials or manufacturing facilities. In the event of any such delay the date of delivery shall be extended for a period equal to the time lost because of the delay. Buyer's exclusive remedy for other delays and for Seller's inability to deliver for any reason shall be rescission of this agreement.

5. STORAGE. If the products are not shipped within 15 days after notification to the buyer that they are ready for shipping, for any reason beyond Seller's reasonable control, including the buyer's failure to give shipping instructions, Seller may store such products at the buyer's risk in a warehouse or yard or upon Seller's premises, and the buyer shall pay all handling, transportation and storage costs at the prevailing commercial rates upon submission of invoices therefore.

6. CHANGES. Seller may at any time make such changes in design and construction of products as shall constitute an improvement in the judgment of Seller. Seller may furnish suitable substitutes for materials unobtainable because of priorities or regulations established by governmental authority or non-availability of materials from suppliers.

7. WARRANTIES. Seller warrants products manufactured by it and supplied hereunder to be free from defects in materials and workmanship and to perform within the limits of the written Quotation for a period of 12 months from date the Buyer receives the product; provided, that wearing parts, including electrodes and dielectric material, are not warranted by Seller. If within such 6 month period any such product or mechanical or electrical part, under proper and normal use, shall be proved to Seller's satisfaction to be defective, such product or part shall be repaired or replaced at Seller's option. Such repair or replacement shall be Seller's sole obligation and buyer's exclusive remedy hereunder and shall be conditioned upon Seller's receiving written notice of any alleged defect within 10 days after its discovery and, at Seller's option, return of such products to Seller, f.o.b. its factory. Buyer shall allow Seller to inspect the alleged defective product for 15 days following Seller's receipt of such notice. No allowance will be granted for repairs or alterations made by the Buyer without the Seller's written consent. **THIS WARRANTY IS EXCLUSIVE AND IN LIEU OF ALL OTHER REPRESENTATIONS AND WARRANTIES, EXPRESS**

**OR IMPLIED, AND SELLER EXPRESSLY DISCLAIMS AND EXCLUDES ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR PURPOSE. NO TRAINING OR USE INSTRUCTIONS PROVIDED BY SELLER SHALL GIVE RISE TO ANY WARRANTY CLAIM OR OTHER CLAIM BY BUYER AGAINST SELLER.**

Any description of the products, whether in writing or made orally by Seller or Seller's agents, specifications, samples, models, bulletins, drawings, diagrams, engineering sheets or similar materials used in connection with buyer's order are for the sole purpose of identifying the products and shall not be construed as an express warranty. Any suggestions by Seller or Seller's agents regarding use, application or suitability of the products shall not be construed as an express warranty unless confirmed to be such in writing by Seller.

8. RETURNS. Products may be returned to Seller only when Seller's written permission shall be obtained by buyer in advance. Returned products must be securely packaged to reach Seller without damage; and any cost incurred by Seller to put products in marketable condition will be charged to buyer.

9. PATENTS, TRADEMARKS AND COPYRIGHTS. Seller will, at its own expense, defend any suits that may be instituted by anyone against buyer for alleged infringement of any United States patent, trademark or copyright relating to any products manufactured and furnished by Seller hereunder, if such alleged infringement consists of the use of such products, or parts thereof, in buyer's business for any of the purposes for which the same were sold by Seller, and provided buyer shall have made all payments then due hereunder and shall give Seller immediate notice in writing of any such suit and transmit to Seller immediately upon receipt all processes and papers served upon buyer and permit Seller through its counsel, either in the name of buyer or in the name of Seller, to defend the same and give all needed information, assistance and authority to enable Seller to do so. If such products are in such suit held in and of themselves to infringe any valid United States patent, trademark or copyright, then: (a) Seller will pay any final award of damages in such suit attributable to such infringement, and (b) if in such suit use of such products by buyer is permanently enjoined by reason of such infringement, Seller shall, at its own expense and at its sole option, either (i) procure for buyer the right to continue using the products, (ii) modify the products to render them noninfringing, (iii) replace the products with noninfringing goods, or (iv) refund the purchase price and the transportation costs paid by buyer for the products.

Notwithstanding the foregoing, Seller shall not be responsible for any compromise or settlement made without its written consent, or for infringements of combination or process patents covering the use of the products in combination with other goods or materials not furnished by Seller. The foregoing states the entire liability of Seller for infringement, and in no event shall Seller be liable for consequential damages attributable to an infringement.

As to any products furnished by Seller to buyer manufactured in accordance with drawings, designs or specifications proposed or furnished by buyer or any claim of contributory infringement resulting from the use or resale by buyer of products sold hereunder, Seller shall not be liable, and buyer shall indemnify Seller against any award made against Seller for any and all patent, trademark or copyright infringements.

10. CONSEQUENTIAL DAMAGES AND OTHER LIABILITY; INDEMNITY. Except as otherwise agreed in writing, Seller's liability with respect to the products and/or services sold hereunder shall be limited to the warranty provided in section 7 hereof, and, with respect to other performance of this contract, shall be limited to the contract price. **SELLER SHALL NOT BE SUBJECT TO ANY OTHER OBLIGATIONS OR LIABILITIES, WHETHER ARISING OUT OF BREACH OF CONTRACT, WARRANTY, TORT (INCLUDING NEGLIGENCE AND STRICT LIABILITY) OR OTHER THEORIES OF LAW, WITH RESPECT TO PRODUCTS SOLD OR SERVICES RENDERED BY SELLER, OR ANY UNDERTAKINGS, ACTS OR OMISSIONS RELATING THERETO.** Without limiting the generality of the foregoing, Seller specifically disclaims any liability for property or personal injury damages, penalties, special or punitive damages, damages for lost profits or revenues, loss of use of products or any associated equipment, cost of capital, cost of substitute products, facilities or services, down-time, shut-down or slow-down costs, or for any other types of economic loss, and for claims of buyer's customers or any third party for any such damages. **SELLER SHALL NOT BE LIABLE FOR AND DISCLAIMS ALL CONSEQUENTIAL, INCIDENTAL AND CONTINGENT DAMAGES WHATSOEVER.**

Buyer shall indemnify Seller against any and all losses, liabilities, damages and expenses (including, without limitation, attorneys' fees and other costs of defending any action) which Seller may incur as a result of any claim by buyer or others arising out of or in connection with the products and/or services sold hereunder and based on product or service defects not proven to have been caused solely by Seller's negligence.

11. TECHNICAL INFORMATION. Any sketches, models or samples submitted by Seller shall remain the property of Seller, and shall be treated as confidential information unless the Seller has in writing indicated a contrary intent. No use or disclosure of such sketches, models and samples, or any design or production techniques revealed thereby, shall be made without the express written consent of the Seller.

12. BUYER'S PROPERTY. Any property of the buyer placed in Seller's custody for performance of this contract is not covered by insurance, and no risk is assumed by Seller in the event of loss or damage to such property by fire, water, burglary, theft, civil disorder or any accident beyond the reasonable control of the Seller.

13. TOOLS AND DESIGN. Any molds, dies, jigs or tools (collectively, "Tools") which Seller manufactures or acquires for performance of this contract shall remain the property of Seller, notwithstanding any charges therefore. Tool charges convey to buyer the right to have the Tools used by Seller for performance of this contract, but they do not convey title or right of possession. Seller shall be responsible for routine maintenance and repair of such Tools. Major overhauls, replacements or changes shall be charged to the buyer. Seller may use such Tools for other customer work, in its sole discretion. All design rights, know-how, copyrights, trademarks, service marks, patents and other intellectual property involved in the design, manufacture and sale of products shall remain the exclusive property of Seller.

14. GOVERNING PROVISIONS. **THIS CONTRACT AND THESE TERMS AND CONDITIONS SHALL CONSTITUTE THE ENTIRE AGREEMENT BETWEEN SELLER AND BUYER, AND SHALL BE GOVERNED BY AND SHALL BE CONSTRUED ACCORDING TO THE INTERNAL LAWS OF THE STATE OF WISCONSIN (WITHOUT REFERENCE TO PRINCIPLES OF CONFLICTS OF LAWS). THE RIGHTS AND OBLIGATIONS OF THE PARTIES HEREUNDER SHALL NOT BE GOVERNED BY THE 1980 U.N. CONVENTION ON CONTRACTS FOR THE INTERNATIONAL SALE OF GOODS. SELLER RESERVES THE RIGHT TO IMPOSE ADDITIONAL TERMS OF SALE ON ANY PRODUCTS SOLD OR USED BEYOND THE BOUNDARIES OF THE UNITED STATES.**

## 14 Revision List

| REVISION | DATE | BY | NOTES |
|---|---|---|---|
| **20160624** | 06/24/2016 | DW/KT | First Draft |
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