think clean

Components – Only

Single – Stack

Double – Stack

• SUPERCLEAN 1800-6 RINSER/DRYER •

• OPERATIONS AND MAINTENANCE MANUAL •

Manual Part Number: 9300153.1

Verteq, Inc.
1241 E. Dyer Rd., Suite 100
P.O. Box 35033
Santa Ana, CA USA 92705-6533
Telephone: (714) 445-2000
Fax: (714) 445-2428
http://www.verteq.com

Product Master Structure

Product Structure		Model No. and Description
Manual No.:	**9300153.1**	**SuperClean 1800-6** Up to 8-inch wafers
Schematic Numbers:		
Facility Drawing Centrifuge	**1085476.1**	
FREM Single-Stack Cabinet	**1074068.1**	
FREM “Ergo” Single-Stack Frame	**1088267.1**	
FREM “Ergo” Single-Stack Cabinet	**1094712.1**	
FREM Double-Stack Frame	**1080150.1**	
Bay and Chase Single-Stack Cabinet	**1073783.1**	
Bay and Chase Double-Stack Frame	**1078579.1**	
Plumbing Schematic	**1070261.1**	
Electrical Schematic	**1070811.1**	

Revision History

Date	Section	Description
09/18/00	Entire Manual	Initial Release of a complete re-write. New sections include: Software Functional Description Improved Operating Instructions Additional Maintenance Procedures Particle Troubleshooting Flowcharts SECS II Communications Schematics and IPBs Spare Parts Lists Technical Reference Optional IPAassist Module
01/15/01	Several Sections	Add new controller (1075227.710) information to appropriate sections.

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PREFACE

This preface includes the following topics:

- intended use and audience
- customer support
- determining the features and options on your dryer

CAUTION	
⚠	**USING IMPROPER CONFIGURATION VALUES CAN CAUSE PRODUCT OR EQUIPMENT DAMAGE** Do not enter configuration values outside the specified range for any given item. To do so can seriously damage your product or equipment.

Intended Use Of This Dryer

This dryer is not to be used for any purpose other than for which it was designed. What product is to be produced and how the hardware and software are to be configured for the allowed processing chemicals and parameters are stated in this manual.

Intended Audience

The level of detail in this manual assumes you have previously been trained by an authorized Verteq trainer to operate and maintain this system.

This document supplements the training class and addresses the comprehensive needs of Process Engineers and Maintenance personnel. After reading and understanding this information, Process Engineers are responsible for disseminating the appropriate level of information to their Equipment Operators.

Customer Support

For assistance in operating, troubleshooting, or maintaining this dryer, refer first to this manual. If this manual does not address your specific question, please contact Verteq Field Service:

Verteq, Inc. 1241 E. Dyer Rd., Suite 100 Santa Ana, CA USA 92705-6533	Phone: (714) 445-2000 Fax: (714) 445-2204
smpt:TAGTeam@verteq.com	From 8:00 a.m. to 5:00 p.m., PST, Monday through Friday

When calling, please be at the dryer, if possible, and be prepared to give a detailed description of the problem and the dryer's serial #.

NOTE
Review your contract warranty statements regarding specific instructions for receiving help.

Determining the Dryer's Features and Options

Your dryer can be configured with several features and options. The mix of features and options were determined at the time of sale. Since this Operations and Maintenance manual is comprehensive in content, (having all the information needed for all the features and options), the following tables will help you to determine the features and options on your dryer.

Once you are familiar with the configuration of your dryer model, you can then use the corresponding information in this manual to properly operate and maintain the dryer and ignore all other information not related to your dryer and it's features and options.

There are three major pieces of information needed to determine the features and options included at time of sale. They are:

- Software Version and Revision
- Standard Features and Options for each software version
- Additional Features and Options ordered at time of sales

The following tables may not take into account any feature or option added on after shipment of the dryer from the Verteq factory.

Software Version and Revision

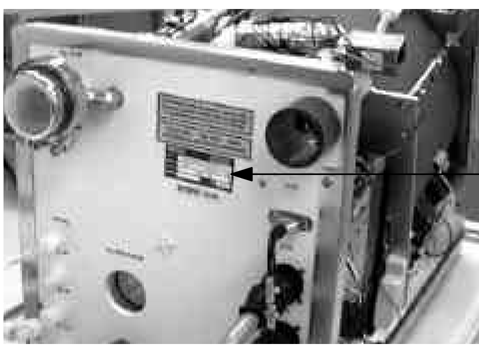
On the Control Panel type in the programmable code **1802**. The resulting group of numbers represent the software version and revision currently in the dryer's controller. The **1800** represents the dryer, the first set of dashed numbers represents the software version (i.e., **-005**) and the second set of dashed numbers represent the revision level (i.e., **-03**). As revisions occur, the second set of dashed number on your Control Panel may be greater in value then what is listed here but still applies.

If the Software Version number is:	these are the Standard Features on your dryer:
1800 – 003 – 02 **(Verteq Controller P/N: 1075227.707**	This is the standard baseline controller and software. There are no additional features. Ignore the information in Section 3.2.1, *Optional Features*.

If the Software Version number is:	these are the Standard Features on your dryer:
1800 – 004 – 02 (Verteq Controller P/N: 1075227.708	All standard features ***plus*** the AutoWash option. Refer to Section 3.2.1.2 for details.
1800 – 005 – 01 (Verteq Controller P/N: 1075227.709	All standard features ***plus*** the AutoWash and IPA Assist options. Refer to Sections 3.2.1.2 and 3.2.1.3 for details.
1800 – 007 – 01 (Verteq Controller P/N: 1075227.710	All standard features ***plus*** AutoWash, End of Process, Boat Detect and IPA Assist options. Refer to Sections 3.2.1.2 through 3.2.1.5 for details.

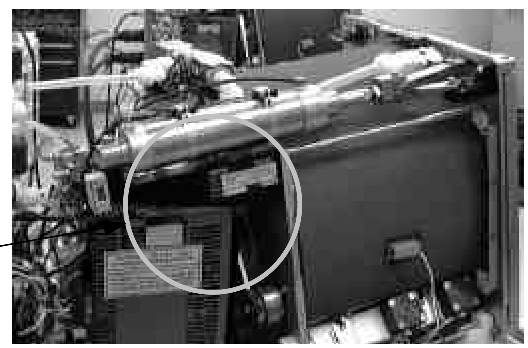
Additional Features and Options

The following list of options is not the complete list of all options available. Rather, this table lists the options, if ordered, that will affect the proper operations and/or maintenance of the dryer. To determine if your dryer has any of the following options, refer to the sales order for your dryer or call Verteq Inside Sales, then go to the section in the manual listed in the table for details about the option. When calling Inside Sales, please have the dryer's serial number ready.



For the serial number:

Either look on the outside rear panel, or on the inside on the right and/or left sides.



Options	Operations Sections:	Maintenance Sections:
Audible Alarm	**3.1.4, 3.2, 3.6, 3.7.2**	
EMO Pushbutton	**1.2, 3.2**	
Footswitch	**3.2, 3.4.4.1, 3.5**	
Hinged Doors	**3.2**	**4.3, 4.4**
N_2 Filter		**4.1.4**
Resistivity	**2.2.1, 2.2.4, 2.2.9, 2.4.3, 3.1.1, 3.1.3, 3.1.4, 3.3.1, 3.3.2, 3.5, 3.6.1**	**4.8**
Rotor Style		**4.2**
IPAassist Module	**10**	**10.10**
others:		

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CONTENTS

Preface

1 Safety Systems

2 Theory of Operations and Specifications

3 Operating Procedures

1 SAFETY SYSTEMS

1.1 S2-93 Specifications

Verteq recommends that persons servicing the dryer are Verteq-trained, experienced technicians with a basic understanding of the concepts and procedures inherent to electronic technology and chemistry. Without such knowledge, attempted servicing may render the dryer unfit or unsafe for use.

1.1.1 Hazards and Safety Issues

Verify that all persons installing, operating, or providing service and maintenance to the dryer adhere to the following guidelines:

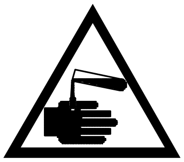
SAFETY ISSUES	
1.	Follow all procedures as outlined in this manual and comply with all WARNINGS and CAUTIONS pertaining to electrical or operating hazards. Voltages exceeding "safe" limits are present in the SRD and are identified by the WARNINGS throughout this manual. Failure to comply with these WARNINGS may result in severe electrical shock or death.
2.	DO NOT under any circumstances remove equipment covers that have warning labels prohibiting removal. These warning labels indicate safety hazards and require compliance.
3.	When handling chemicals always wear protective clothing and follow industry prescribed chemical handling techniques.
4.	All system service and maintenance must be performed by a trained, competent person. When performing service and maintenance always follow the appropriate procedure as outlined in this manual as a minimum.

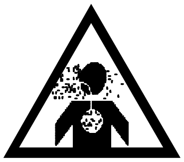
Important information in the manual is distinguished by the following notations:

NOTE
Specific information is placed in a NOTE box when clear procedural understanding is essential.

CAUTION
POTENTIAL PRODUCT OR EQUIPMENT DAMAGE! Caution notices will be used where equipment or product damage might occur if care and attention is not taken.

WARNING





HAZARDOUS CHEMICALS CAN CAUSE SEVERE INJURY OR DEATH!

Before attempting removal procedures apply your company's chemical and electrical lockout and tag procedures, which are supplemented by these procedures. Also, these procedures must be performed while wearing the appropriate level of personal protective equipment, such as, but not limited to:

- goggles
- apron
- boots
- gloves
- respirator

Your company's policies and procedures for safely operating the dryer supersede the safety considerations listed below. It is your responsibility to follow your company's safety procedures. If there are none, follow those established by these instructions, OSHA, DEQ, and/or the DOT, as a minimum.

1.1.2 Environmental Information

The following information is available from Verteq's Health and Safety department for the baseline process:

- Overall Chemical Mass Balance
- Exhaust Concentration – Un-reacted Process Chemicals
- Known Environmental Restrictions – Baseline Chemistry
- Volumetric Flow
- Waste Water Contaminants

1.1.3 Ergonomics

Verteq does not provide specific installation location requirements. However, the installation location should account for height, reach, load weight, and other factors to provide the operator a safe and comfortable access to the tank and the system keypad/display. To quote guidelines indicated in SEMI S2-93, the installation should account for the "5th percentile small Asian female to the 95th percentile large American male". Typical installations generally place the system so that the grasp height is approximately 35- to 38-inches above foot level, and no farther than a 7- to 18-inch reach.

WARNING

DRYER IS TOO HEAVY FOR ONE PERSON LIFT!

Due to the excessive weight of the dryer, handling (lifting) should be performed by two persons (minimum).

1.1.4 Seismic Activity Precaution

CAUTION	
⚠	**POTENTIAL PRODUCT OR EQUIPMENT DAMAGE!** The system should be secured to in such a fashion as to inhibit movement in the event of any seismic activity.

Regardless of the locating and leveling means, the dryer should be secured against both vertical and horizontal movement. Securing means should take into account the weight of the dryer under normal operating conditions.

1.1.5 User Supplied Devices

“User Supplied Devices" refers to signal lights, switches and alarms, etc., that may be interfaced with the dryer but are not supplied by or purchased from Verteq.

Before connecting a user supplied device to the dryer, always refer to the specifications outlined in the drawings to verify that the device can be supported and to determine which wires are used to interconnect the device to the dryer.

1.2 Dryer Safety Protection

Verteq suggests the following protection for all dryers.

- Dryer Circuit Protection
- Electrical Disconnect and Equipment Lockout and Tag Procedures
- Emergency Shutdown (EMO / EPO)

1.2.1 Dryer Circuit Protection

The facility circuit protection device should be rated to withstand the short circuit current of no less than 10,000 rms symmetrical amperes at 208/120 volts at the incoming terminals.

Power receptacle service requirements are standard #10 AWG 20 ampere wiring, NEMA receptacle configuration type 15-20R. If the specified receptacle is not used, rigid conduit, or flexible conduit for runs of less than 20 feet, must be used. A Ground Fault Interrupter (GFI) with a trip current of less than 7 mA should be employed for personal protection.

1.2.2 Electrical Disconnect and Equipment Lockout

Follow standard procedures when working on electrical equipment. The breaker box or branch circuit feeding the equipment must be locked and tagged with the appropriate information.

Verteq may not supply a lockable, safety-type electrical disconnect with some dryers. Verteq therefore suggests that the end-user provide a means of disconnecting power to the dryer with a lockable-type safety disconnect. Follow all equipment safety Lockout and Tag procedures as outlined in your country's and/or company's equipment safety manuals.

European standards require proper markings on the disconnect. If a mains plug is installed, is should conform to IEC 320. The EU end user should provide a main power cord that meets the requirements of IEC 227 or IEC 245, and is listed by a recognized European testing laboratory (i.e., HAR Cordage).

1.2.3 Emergency Shutdown

Verteq and S2-93 specifications recommend the installation of an Emergency Power Off (EPO) push-button on all dryers to shut main power off should an "EMERGENCY" situation arise. The EPO pushbutton should be of the red mushroom-type and labeled "*EMERGENCY POWER OFF*".

NOTE

The EPO mounting height should not exceed 63.5 inches from the floor. If planning to install an EPO, it is important to provide a separate POWER ON button to return power after MAIN POWER has been shut off.

CAUTION

POTENTIAL PRODUCT OR EQUIPMENT DAMAGE!

If installing an EPO button, a clear PVC sleeve surrounding the EPO button is required to prevent accidental activation of the EPO.

The following diagram (Figure 1-1) is a typical Emergency Power Off or Emergency Off circuit.

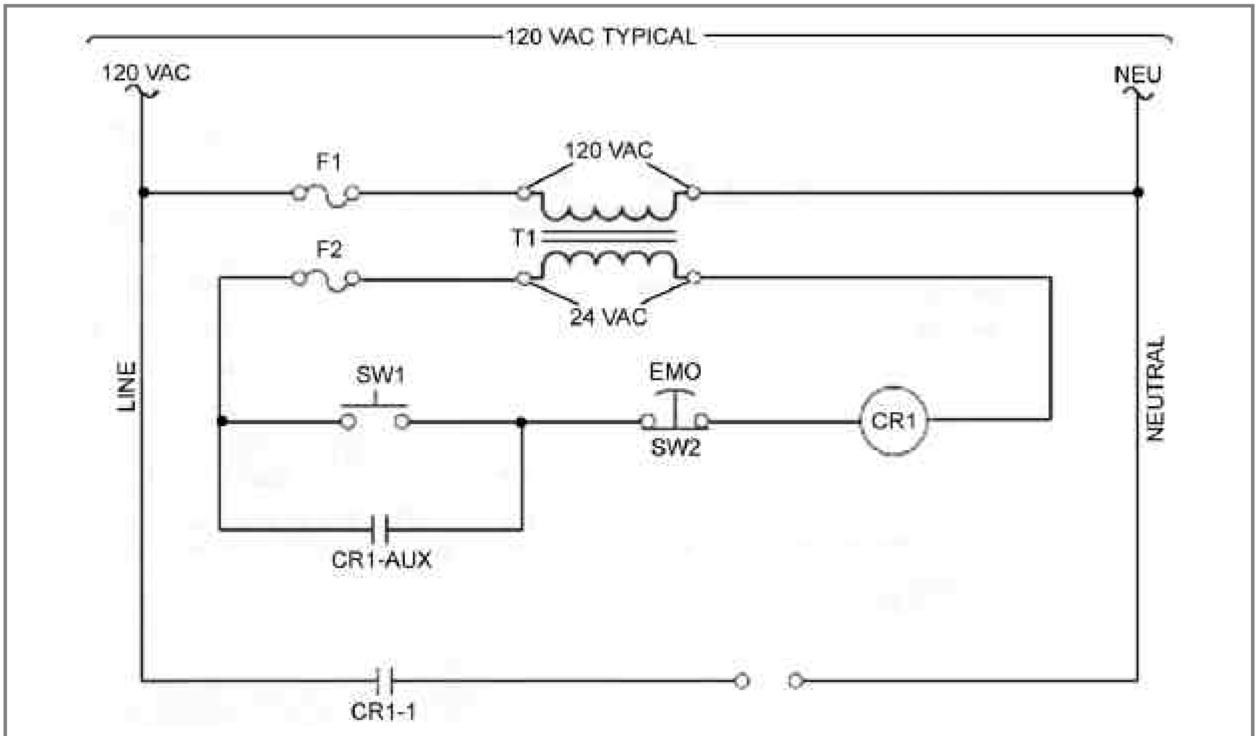


Figure 1-1. *A typical Emergency Power Off or Emergency Off circuit.*

Circuit Components	Description
F1	Primary protection for transformer T1
F2	Secondary protection for transformer T2
T1	24 VAC isolation transformer
SW1	Momentary POWER ON pushbutton (green)
SW2	EMO (EPO) pushbutton, red mushroom-type, 60 mm diameter with shroud
CR1	24VAC power contractor with N.O. auxiliary contact

If the input voltage is reduced to 24 VAC, SW1 energizes CR1 and is held using a CR1-AUX contact, also applying power to the dryer using a CR1-1 main contacts (120 VAC). Should an emergency arise, the operator presses the EMO pushbutton which will open the circuit and removing all AC input to the dryer.

1.3 Lighting in Work Areas

CAUTION	
!	**IMPROPER LIGHTING CAN CAUSE HAZARDOUS CONDITIONS** When performing maintenance in enclosed bays and cabinets, S2-93 safety requirements call for the lighting to be at or greater than 30 footcandles in power. Use additional lighting apparatuses where lighting is less than 30 footcandles in all work areas associated with Verteq equipment.

1.4 Optional IPA Assist Module

This section includes the following topics for the IPA Assist Module:

- System alarms
- Emergency modes
- Hardware interlocks

1.4.1 Overview of IPA Alarms

The IPA module's safety system interlock alarms are designed to ensure operator safety, prevent product damage, and maintain the parameters defined in the controller.

When an alarm occurs there is an automatic system response to ensure product safety. The module communicates alarms by:

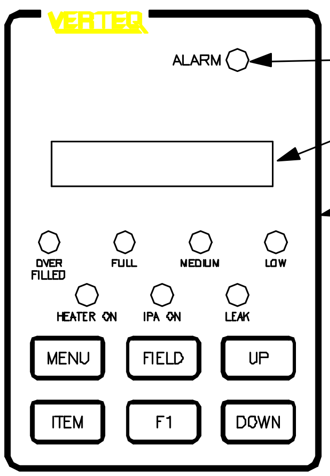


Figure 1-2. *IPAassist touchpad.*

- illuminating the ALARM LED, see Figure 1-2.
- posting an alarm message on the LCD screen
- sounding an on-board speaker
- sending an alarm message to the dryer
- sounding an alarm speaker on the dryer (optional, if equipped)

1.4.2 IPA Module Response to Alarms

Along with communicating any alarm that occurs (as stated in Section 1.4.1 above), the module's controller responds as follows using firmware:

- for software alarms, the heater is turned off
- N_2 is bypassed (does not flow into the canister)
- vent valve is opened
- the dryer immediately stops any recipe in progress and displays a HELP message indicating a general IPAassist alarm
- in addition, for safety hardware interlocks, power is removed from the heater using an electro-mechanical relay
- for all additional information refer to Section 10, *IPAassist Module*

1.4.3 Silencing Alarms – IPA

To silence the alarm speaker but leave the alarm message posted and the module in alarm mode, press any key, *except* **F1**, on the touchpad. **F1** will clear the alarm message and reset the controller to Initialize mode. Once the system is restarted the alarm will occur again if the condition that caused the alarm is not corrected.

1.4.4 Alarm Response Quick References – IPA

Table 1–1 summarizes the automatic system responses and necessary manual (operator) responses to recover from the software alarms.

***Table 1-1**. Alarm classification and response descriptions for the module.*

Automatic System Response	Manual Response	
Description	**Mandatory Attendant Response**	**Re-Start Procedures**
• Recipe in progress immediately stops, and cannot be restarted • New wafers are not allowed • Audible/visual alarms at IPA & dryer • Alarm message displayed on LCD touchpad and dryer	• View and record message for Maintenance • Notify Maintenance • Silence alarm	• After resolving the problem, silence the alarm: • Press F1 on the touchpad • Module is automatically placed in Idle Mode. • Normal processing can be started

Table 1–2 is a comprehensive list of any and all software alarms that can occur and their causing condition. Alarm levels are fixed in the firmware and cannot be changed.

***Table 1-2**. Alarm messages as they appear on the touchpad and their alarm causing condition.*

Alarm—Message	Condition
N2—PRESSURE BAD	Incoming N2 pressure error is detected. Indicates excessive or inadequate pressure, or improper pressure switch settings, or faulty pressure switch circuit.
TANK EMPTY	Canister low level switch is not detected. Indicates insufficient IPA level in the tank or faulty level switch circuit. This error is only created if the canister empty condition is true when the module is in IPA mode. Otherwise, the module will attempt to refill the canister.
FULL ON—MED OFF	Canister full level switch is detected while medium level switch is not detected. Indicates a faulty level switch circuit.
FULL ON—LOW OFF	Canister full level switch is detected while low level switch is not detected. Indicates a faulty level switch circuit.
MED ON—LOW OFF	Canister medium level switch is detected while low level switch is not detected. Indicates a faulty level switch circuit.
HTR ON S/B OFF	Current is detected in the heater circuit without being enabled by the controller. Indicates faulty heater circuit.
HTR OFF S/B ON	Current is not detected in the heater circuit while being enabled by the controller. Indicates faulty heater circuit.
DRYER REQ TEMP LO	Measured temperature did not reach setpoint before IPA was requested from the dryer. Indicates operator error or a faulty IPA request circuit.

Alarm—Message	Condition
POWR FAIL IN RUN	Controller has restarted and detected that an IPA run was in progress (IPA being delivered to dryer) when power was last turned off. Indicates operator error or a faulty power circuit.
BCD NOT READY	The required “BCD ready” signal is not detected. Indicates a problem with the BCD system or a faulty BCD interface circuit.
BCD ERROR MODE	The “BCD error” signal is being detected. Indicates a problem with the BCD system or a faulty BCD interface circuit.

Table 1–3 lists the alarm messages that appear at the corresponding dryer. Alarm levels are fixed in the firmware and cannot be changed after shipment of the module.

Table 1-3*. Alarm messages as they appear at the dryer.*

Alarm Message	Condition
001	A general alarm message stating the IPA module is in an alarm state.

1.4.5 Emergency Modes – IPA

This module has two emergency modes:

- EMO shutdown
- loss of main power

The emergency modes can be induced manually by an operator. Table 1–4 summarizes the two modes and the module’s responses. Figure 2–2 shows the location of emergency pushbuttons on a typical IPAassist module that an operator would use to induce these emergency modes.

Table 1-4*. Emergency modes and module / dryer responses.*

Emergency Mode	Cause	System Response
EMO	Emergency Power Off button pressed	All operating power is shut off at the module and dryer
Loss of Main Power	Power Switch Circuit Breaker disengaged	All power is removed from the IPA.

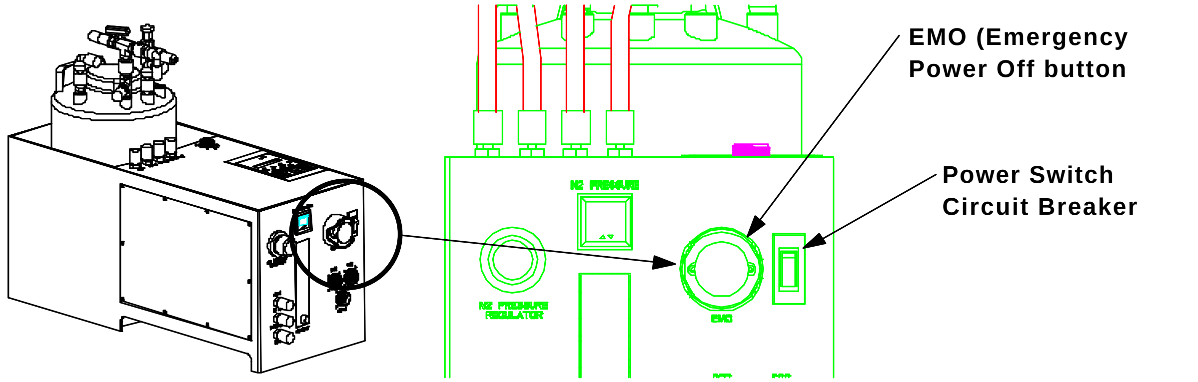


Figure 1-3*. Typical IPAassist module locations of emergency pushbuttons.*

1.4.6 EMO Shutdown – IPA

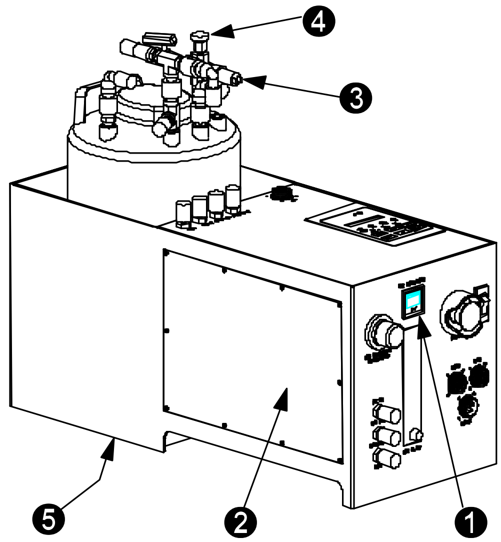
Two Emergency Power Off (EMO) pushbuttons, one local and one remote (wired in series), are provided for shutdown in case of an emergency. The IPAassist module and the dryer both shutdown upon activation of the EMO circuit.

1.4.6.1 IPA Level

The IPA level is monitored by floats in the IPA canister. An alarm is generated if the IPA level falls below the LOW level or exceeds the OVERFILLED level. The FULL and MEDIUM level indicators are used for automated bulk-fill chemical requests.

1.4.6.2 Heater and N_2 Flow and Pressure Protection

There are five devices installed to monitor and protect against harmful N2 flow and pressure damaging the module. Figure 2-3 outlines the function and location of each protective device.



1. **Facility N_2 Pressure Gauge and Switch**
   Set by the user. Sets, displays and monitors the high and low permissible pressure limits of incoming N_2. If facility supplied N_2 is outside these limits a software alarm "N_2 Pressure Bad" is sent to the controller.
2. **Heater N_2 Flow Switch**
   A flow switch is used to protect the heater from possible damage if the incoming flow of N_2 drops below 2.5-3.0 SCFH (Standard Cubic Feet per Hour). If N_2 drops below 2.5-3.0 SCFH, the heater is turned off immediately and a "N_2 Flow Bad" alarm is generated.
3. **Canister Pressure Switch**
   A pressure switch is used to inform the IPAassist controller of excessive canister pressure (greater than 45 psi) and generates the alarm "Tank Hi Pressure". N_2 will continue to flow but is diverted away from the canister.
4. **Canister Pressure Relief Valve**
   Should these devices fail, a pressure relief valve is installed in the module to release canister N_2 pressure if it exceeds 55 psi.
5. **Leak Detect Probe**
   At the bottom of the canister compartment is a leak detect probe. If liquid is detected by the probe, the alarm "Leak Detected" is generated. A LED is illuminated to advise of a leaking canister.

Figure 1-4. *Heater and N_2 Flow Protection Functions.*

1.4.6.3 Heater Thermostat

The heater thermostat is designed to interrupt the heater circuit in the event of excessive temperature. In order for the module to resume normal operation, the thermostat has to be manually reset once the surface of the heater has reached a temperature below 100 °C. Activate the button on the heater to reset the temperature. Wait 15 minutes after the N_2 has been turned on before re-starting processing.

1.4.6.4 Current Sensor

A current sensor placed in the heater circuit informs the IPA controller if the heater does not respond to its on/off commands. The IPA controller will immediately shut down the heater and generate either a "HTR ON S/B OFF", or, a "HTR OFF S/B ON" alarm.

1.4.7 Safety Interlocks – IPA

The IPAassist hardware safety interlocks are designed to ensure operator safety, prevent product damage, and maintain the parameters defined in the IPA module and the dryer recipe configuration. Some interlocks are hardwired electrical connections. Refer to Table 2–5 for a list of hardwired interlocks. Safety interlocks generate alarms that initiate some or all of the following responses:

- remove electrical power
- stop mechanical motion
- provide audible and visual alarms
- stop automatic recipe processing
- prevent entry of new wafers
- display a message on LCD touchpad

Table 1-5*. Hardware safety interlocks, device response, and manual response.*

Safety Interlocks	Device Response	Operator Notification	Manual Attendant Response	Re-start Procedures
EMO Pushbutton: Contactor at dryer de-energizes (opens) **dryer Type Contactor ID** 1600 K-2 1800 K-2 8201 CON-1 SC300 CON-1	• Automatic valves return to normal de-energized state • Recipes in process immediately stop, can not be resumed • All electrical circuits are disabled	• No notification. IPA module and dryer are shut down	• Notify maintenance	• Move the Main Power-On button to the ON position on the dryer • dryer and IPA module now in IDLE MODE
N_2 -FLOW BAD: **TANK HI PRESSURE**: **TANK OVER FILL**: **LEAK DETECTED**:	• Automatic valves return to normal de-energized state • Recipes in process immediately stop, can not be resumed • Heater control relay K1 de-energizes (opens)	• Audio alarm and message on IPA LCD touchpad • General alarm message on dryer	• Silence the alarm • Notify maintenance	• After cause is corrected, • Press F1 on touchpad

2 THEORY of OPERATIONS and SPECIFICATIONS

2.1 Product Introduction

The SuperClean 1800-6 is a single cassette, front-loading, programmable rinser/dryer used to rinse and dry semiconductor wafers, photomasks, and substrates up to eight inches (200mm) in diameter. The Component-only model's electrical components are in separate enclosures for easy integration into wet systems. The dryer can also be configured as 'single-stack' or 'double-stack' standalone models in two different configuration cabinets (Figure 2-1).

***Figure 2-1**. The SuperClean 1800-6 dryer models can be configured as a 'Component-only' (left), a 'single-stack' (middle) or a 'double-stack' (right). The models shown are typical examples. Your dryer may have less or more features than the ones shown here and some of the features may be in different locations such as the pushbutton controls.*

The patented noncontact nitrogen labyrinth seal is key to the effectiveness of the dryer. Filtered nitrogen gas flows through the seal area forming a gaseous barrier that seals the bowl from outside contaminants and keeps N_2 and water in the bowl from escaping. Since the shaft and bowl of the dryer have no mechanical contact, particulate contamination is virtually eliminated.

Upon completion of the final rinsing step of a wet process, the wafer and cassette surfaces are primarily dried through spinning action. Liquid droplets on the bowl and other surfaces are evaporated with heated nitrogen which absorbs moisture rapidly. Ionized nitrogen neutralizes static charges in order to prevent particle attraction and reattachment. The dryer provides effective drying while minimizing particles as small as 0.15 micron from being added to the wafers. The dryer can also be used to pre-rinse wafers prior to drying.

The dryer can run two types of cycles: rinse and dry. The cycles are controlled independently, therefore, a rinse and dry, rinse only, or dry only cycle can be programmed.

The process bowl is designed to eliminate as many welds as possible and electropolished to provide a corrosion resistant surface (Figure 2-2). The interior is meticulously detailed to provide an ultrasmooth surface with excellent rinsing characteristics to prevent particle trapping. To complement the cleanliness of the bowl, the dryer features an ultrapure plumbing design with an in-line 0.003µm rater nitrogen filter. A static eliminator is provided to prevent static buildup which can cause particles to reattach to product (wafer) surfaces. The dryer features multi-step, multi-recipe editing with user-programmable control over several processing options. The controller governs a full complement of safety features and has built in diagnostics to ensure that the dryer is well protected and very reliable. The dryer is designed to operate with a full or partial product load in manual or wet process systems, and in free standing cabinets. Systems used in automated environments include host communications and fully automated door control.

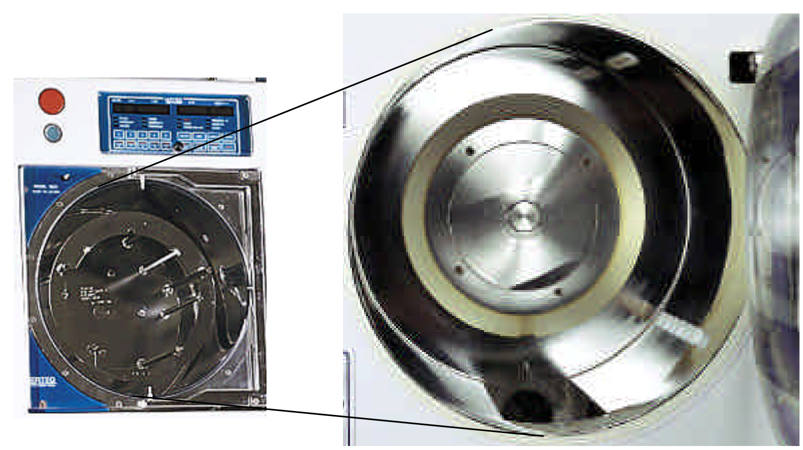


Figure 2-2*. The inside of the process bowl is designed to eliminate as many welds as possible and electropolished to provide a corrosion resistant surface.*

2.2 Theory of Operations

Verteq's SuperClean 1800-6 dryer uses centrifugal force to dry the surface of the wafers. A cassette is placed inside the drying chamber, held in place by a rotor, and spun at an appropriate speed depending on the nature of the load and the process. The drying chamber (bowl) is warmed with a continuous flow of hot filtered nitrogen and surface heaters on the outside walls. The liquid on the wafer surface is spun off and drained from the bowl while liquid droplets on the drying chamber surfaces are evaporated.

The dryer is configured to pre-rinse the wafers prior to the drying cycle with ultra-pure DI water. The water is sprayed from a line of strategically placed nozzles to provide even rinsing of the wafer surfaces. This is done to rinse residual chemistries from the surface, or to replace existing water with fresh water prior to drying. When the dryer is used for dry-only processing, the rinse cycle can also be used for periodic cleaning of the bowl surfaces between process sessions.

2.2.1 Rinsing

A typical rinse cycle consists of DI water being sprayed into the bowl through eight nozzles while the rotor (and cassette) rotates. The length of the rinse cycle is determined by either the programmed cycle duration, or by an optional resistivity monitor that measures when the resistivity of the rinse water has reached the desired setpoint.

2.2.2 Drying

A typical dry cycle consists of filtered nitrogen entering the bowl through the door blowoff nozzle, static eliminator manifold, and bowl nozzles. The nitrogen flowing into the bowl is heated if the heater has been programmed into the recipe. The nitrogen that floods the bowl is ionized if the static eliminator function has been programmed into the recipe. The duration of the dry cycle and speed of the rotor are determined by values programmed into the recipe.

2.2.3 Recipes / Steps

Recipes define the performance capabilities of the dryer. Process recipes include the cycle duration, spin speeds, and whether to include a rinse step or not. Speeds for different wafer sizes may vary as can the time required to dry the bowl and cassette surfaces. The dryer can be programmed to store up to ten recipes, with each recipe capable of containing up to ten steps. Each step of the recipe controls either a rinse cycle or a dry cycle, depending on the requirements of each unique process.

2.2.4 Cycles

The dryer runs two cycles - *rinse* and *dry*. The cycles are controlled independently, so the dryer can rinse and dry, rinse only or dry only. Cycles are initiated by recipes that have been programmed.

The dryer can store up to 10 preprogrammed recipes, each of which can contain 10 steps or *cycles*. The conditions in any particular rinse or dry cycle vary depending on the functions programmed into a recipe. Nitrogen, DI water, heater, resistivity monitor and static eliminator options function during a cycle, only if they are included in the recipe.

During a typical rinse cycle, DI water is sprayed into the bowl through eight (8) nozzles as the rotor turns at the speed selected. The length of any rinse cycle is determined by a rinse timer program or by measuring the resistivity of the rinse water to determine if it equals or exceeds a programmed setpoint.

A typical dry cycle consists of filtered nitrogen entering the bowl through the door blowoff nozzle, static eliminator manifold, and the bowl nozzles. The N2 flowing through the dryer is heated if programmed "ON". Ionized nitrogen floods the bowl if the optional static eliminator has been programmed into the recipe. The duration of the dry cycle and speed of the rotor are determined by values programmed into the recipe.

2.2.5 Bowl Seals

To keep particle contamination to an absolute minimum, the front and back of the bowl are sealed. The door is pulled shut, a recipe is selected and the dryer is started. An air cylinder system pulls the door against the door seal. The door can be unsealed and opened only when the last cycle in the recipe is complete or the cycle has been aborted. The bowl is nitrogen-purged prior to the door being sealed and when the door is opened to prevent possible contamination.

2.2.6 AutoWash Warning Function

If the dryer is used for dry cycles only, it must be periodically rinsed with DI water to ensure consistently clean operation. The dryer can be programmed to illuminate a warning LED if a user-programmed number of dry-only cycles have been run or a user-specified time interval has passed with the dryer in idle mode, indicating to the operator that a rinse cycle is due. The dryer will automatically initiate a rinse cycle after the cycle or time counter has expired. The bowl is rinsed for a user-specified number of minutes as it rotates at 100 RPM.

2.2.7 Labyrinth Seal

The area between the hub and seal plate at the back of the bowl is sealed by Verteq's patented labyrinth seal. Filtered nitrogen flows to the seal during a cycle, forming a gaseous barrier that seals the bowl from outside contaminants. Because this is a gaseous, non-contact seal, static charges are not produced nor do particles slough off and contaminate the wafers.

Figure 2-3 shows a cross-section of the bowl. The seal area is the gap between the hub and the seal plate. During operation, nitrogen is pumped into the gap from two sets of nozzles. One set blows filtered nitrogen through the seal area in the bowl so water can’t leak out. The second set blows nitrogen through the seal area and out the back of the bowl so contaminants can’t get in. The result is a perfectly sealed bowl without the stray charges of particle contamination of contact-type seals.

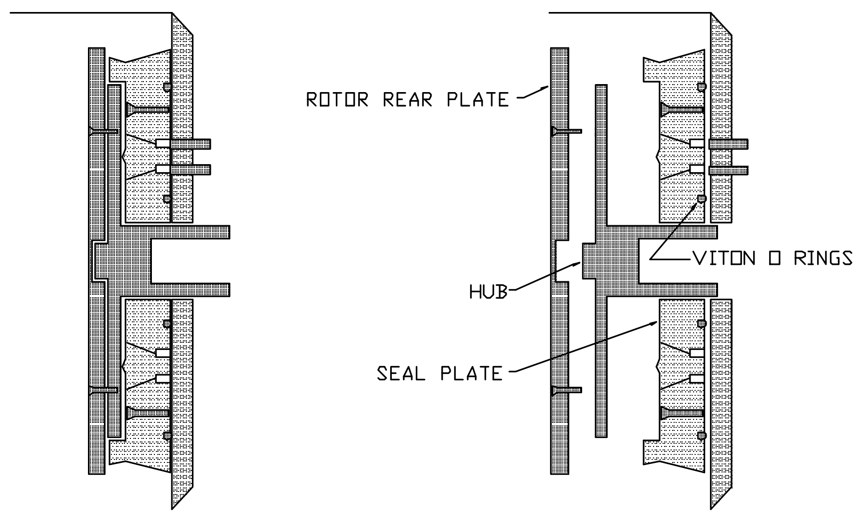


***Figure 2-3**. Labyrinth Seal.*

2.2.8 Autopositioner

To further protect the wafers, the dryer uses a rotor autopositioner to automatically index (to the upright position) the rotor at the end of every cycle. The autopositioner rotates the rotor so that the cassette stops in the upright position. The door will not unseal until the rotor is properly indexed, ensuring that the wafers cannot accidentally fall out of the cassette during automatic removal by a robot or manual removal by an operator.

2.2.9 Resistivity Controller

The electronic circuitry used in the resistivity controller combines a high input impedance analog amplifier with an 8-bit microprocessor to provide accurate and stable readings.

Accuracy is not dependent on a reference voltage, but rather on the stable reference resistors and the microprocessor's crystal clock. An AC square wave current is generated at 75 Hz for resistivity and applied to the cell through a multiplexer. The resistivity is then calculated as proportional to the voltage generated across the cell electrodes. Since this resistance varies with temperature, a correction must be made to relate the resistivity to what it would be at 25°C. This calculation is accomplished in the microprocessor by DC input from the resistance temperature detector (RTD) which is internal to the cell.

The RTD increases in resistance for increasing temperature. Metering the DC resistance of the RTD gives the microprocessor accurate temperature information to calculate resistivity to 25°C. This correction factor calculation assumes the solution resistivity varies with temperature as if all the impurity ions are sodium chloride (NaCI). Although NaCI is rarely the only impurity present, it is typical of many inorganic impurities and is the usual standard for this calculation. The microprocessor must sequence through the following measurements or calculations:

- AC resistance (uncorrected) of the cell
- DC resistance of the RTD
- Calculation of corrected resistivity to 25°C.
- Measurement of set point controls
- Comparison of corrected resistivity to setpoint
- Control output signal

2.2.9.1 Resistance-Temperature Data 18.3 megohm-cm (Pure Water)

Temperature °C	Resistivity (megohm-cm)	Resistance (± DC ohms)
0	88.2	500.0
10	44.4	520.8
20	23.8	542.3
25	18.3	553.3
30	13.7	564.5
40	8.5	587.3
50	5.6	610.8
60	3.9	634.8
70	2.9	659.3
80	2.1	684.2
90	1.7	709.5
100	1.3	735.1

2.2.10 Optional IPA Assist Module

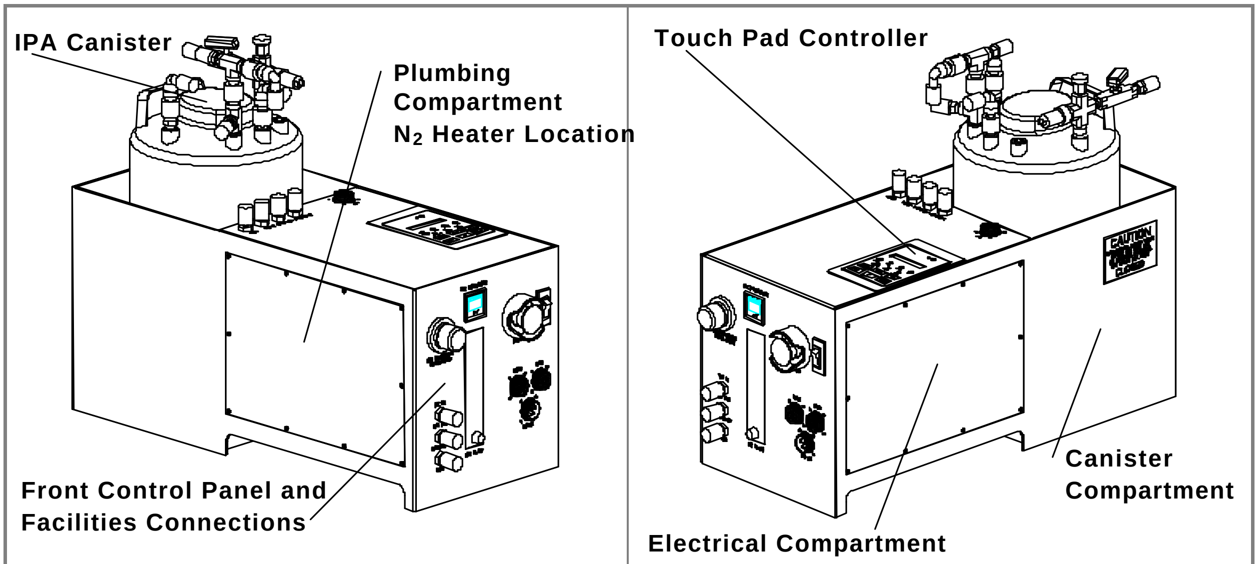
The IPAassist module is remotely installed and enables the injection of vaporized IsoPropyl Alcohol (IPA) into the SuperClean 1800-6, dryer. See Figure 2-4.

The IPAassist module is equipped with independent controls which are interlocked to the dryer's microprocessor controller.

The module has a three (3) gallon capacity canister containing ambient IPA. Heated nitrogen (N_2) passes through a $\geq 0.003\mu m$ removal-rated filter before entering the canister. The N_2 bubbles on the surface of the IPA liquid creating a vapor. The N_2 / IPA vapor is injected into the dryer through the static eliminator manifold.

The IPAassist module's two user defined operating parameters are:

- temperature of vaporized IPA (setpoint) set at the module and,
- injection On/Off times and duration (in seconds) set in the dryer's recipe



Right-Front View	Left-Front View

Figure 2-4. *Major features of the IPAassist module option for the 1800-6 dryer.*

NOTE

Refer to Section 10 of this manual for all operating and maintenance procedures regarding the IPAassist module.

2.3 Dryer's Software Functional Description

The dryer software functions within 6 basic modes of operation. These modes are:

Mode	Refer to Section:
Power Up	2.3.2
Idle	2.3.3
Alarm	2.3.4
Open Door	2.3.5
Close Door	2.3.6
Run Recipe	2.3.7

2.3.1 Overview

The **Power Up** mode is automatically executed when the dryer is turned on. If no alarms are encountered during this mode, the dryer enters **Idle** mode. The dryer maintains **Idle** mode until it is instructed to perform a function, or until it detects an alarm condition. While in **Idle** mode, the dryer can be instructed to enter the **Close Door** or **Open Door** mode, or **Run Recipe** mode. After successful completion of any of these modes, the dryer returns to **Idle** mode. If at any time the dryer detects an alarm, it enters the **Alarm** mode.

2.3.2 Power Up Mode

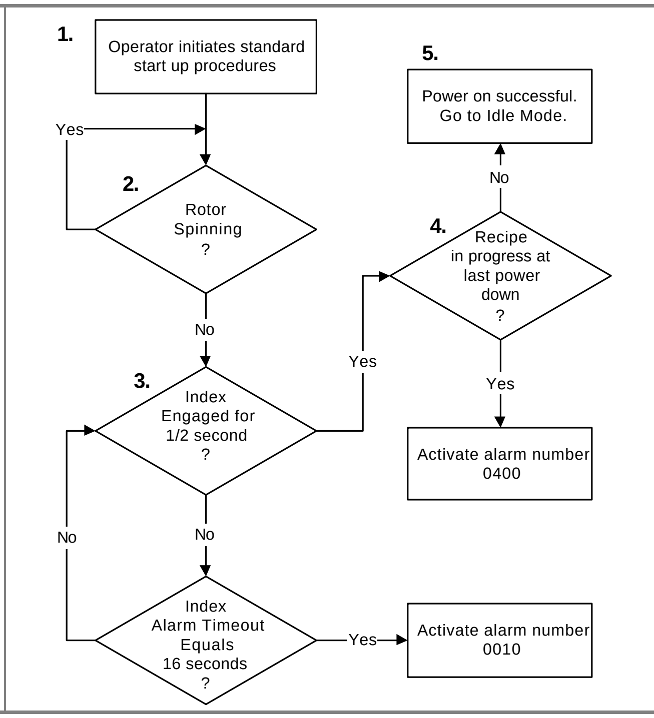
1. Operator applies power using normal start up procedures.

2. The software checks for a spinning rotor. Normally, the rotor won't be spinning at power up. If the rotor is spinning, the system waits indefinitely for the rotor to stop.

3. The index cylinder is engaged. A sensor reports when engagement occurs for longer than 1/2 of a second. If after 16 seconds the sensor has not reported engaged, an alarm is sent.

4. If a recipe was in progress during the last power down of the dryer, the system will activate an alarm at the next power up request.

5. If no alarms have occurred, then the dryer was successfully powered up and is in Idle mode.



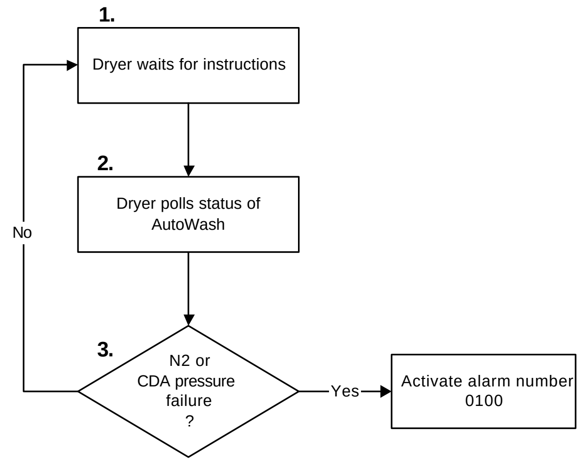
2.3.3 Idle Mode

1. The dryer is powered on and is waiting instructions from either an operator or commands from a Host operating system.

2. The dryer polls the time and cycle status of the optional AutoWash feature. If an AutoWash routine is called for, the dryer will AutoWash and return to Idle mode.

3. During Idle the dryer will activate any of two (2) alarms that may occur. These alarms are:

N_2 or CDA Pressure Failure

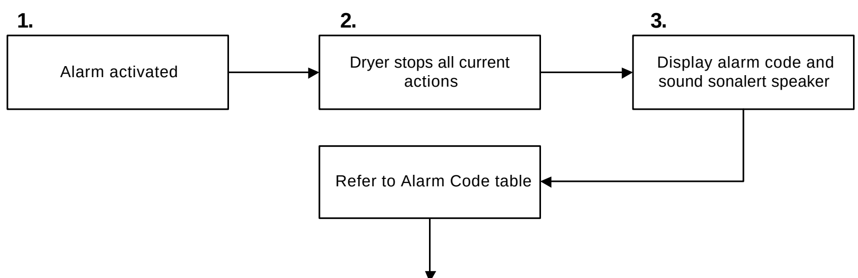


2.3.4 Alarm Mode

1. An alarm can occur during any mode.

2. The dryer halts all actions currently taking place.

3. The appropriate alarm code is sent to the control panel and the sonalert speaker is sounded. Refer to the attached Alarm code reference table.



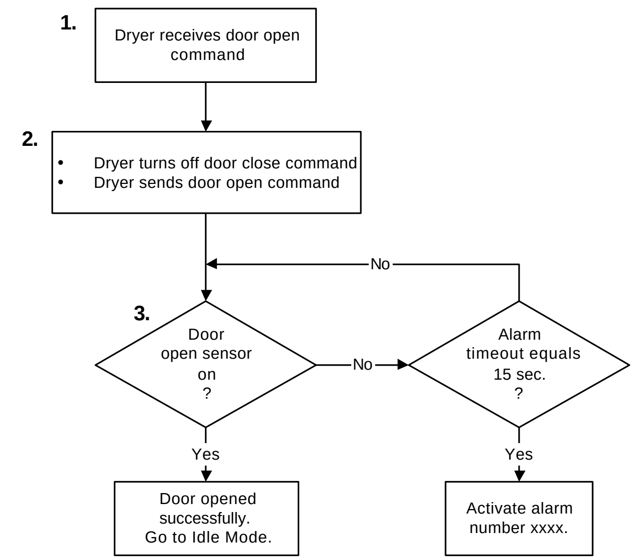
Help Code Displayed	Fault Description
0001	DI Pressure Low
0002	DI Flow
0004	Heater Failure
0010	Index Failure
0020	RPM Too High
0040	Door not Closed at Start
0100	N2 Pressure Failure
0200	N2 Flow Failure
0400	Power Failure
1000	Door Open in Run
2000	Door Unseal in Run
4000	Door Open / Close Error
8000	Front Door Obstruction
8888	Loss of Feedback

2.3.5 Open Door Mode

1. While in Idle mode, the operator presses the optional footswitch or the dryer receives a door open command from a host computer. The footswitch is ignored if the dryer is not in Idle mode.

2. The dryer ensures the door close command is off, and sends a door open command.

3. If the door open sensor does not report open within 15 seconds a timeout alarm is activated. If the door sensor reports open, then the dryer is placed in Idle mode.

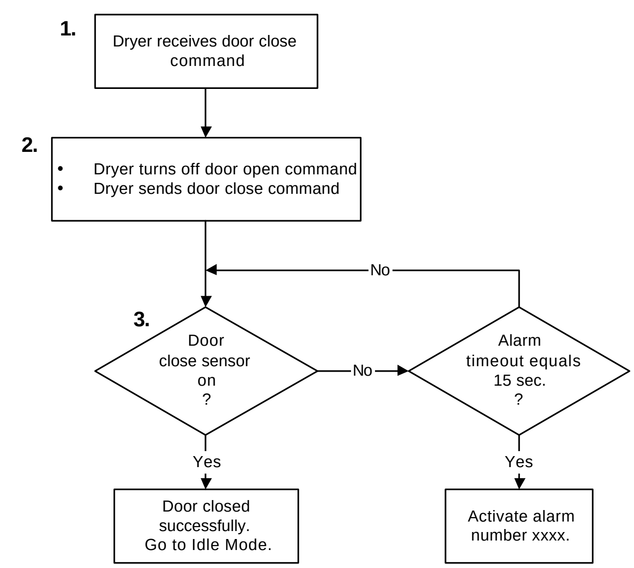


2.3.6 Close Door Mode

1. While in Idle mode, the operator presses the optional footswitch or the dryer receives a door close command from a host computer. The footswitch is ignored if the dryer is not in Idle mode.

2. The dryer ensures the door open command is off, and sends a door close command.

3. If the door close sensor does not report closed within 15 seconds a timeout alarm is activated. If the door sensor reports closed, then the dryer is placed in Idle mode.

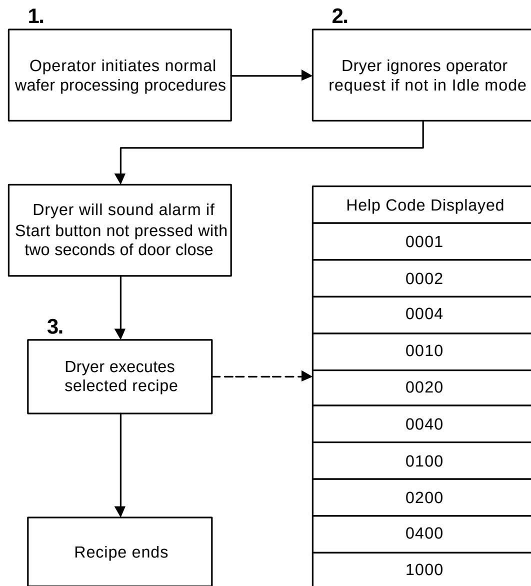


2.3.7 Run Recipe Mode

1. The operator starts a recipe run normally. If the dryer is not in Idle mode, the dryer ignores the operator request. If a optional boat sensor is installed, the dryer will sound the sonalert speaker if the operator has not pressed the Start pushbutton within two (2) seconds after the door close sensor has reported closed.

2. The dryer executes the selected recipe. While running the selected recipe, the dryer monitors for and responds to alarm conditions should they become active.

3. The recipe ends and the dryer is placed in Idle mode. The dryer also signals the operator to unload the wafers.



Help Code Displayed	Fault Description
0001	DI Pressure Low
0002	DI Flow
0004	Heater Failure
0010	Index Failure
0020	RPM Too High
0040	Door not Closed at Start
0100	N2 Pressure Failure
0200	N2 Flow Failure
0400	Power Failure
1000	Door Open in Run
2000	Door Unseal in Run
4000	Door Open / Close Error
8000	Front Door Obstruction
8888	Loss of Feedback

2.4 Specifications

The following tables outline various specification values for all standard model configurations.

2.4.1 Standard Features

Feature	Description
Capacity (depends on cassette used)	1 cassette with 0-25 wafers up to 8” or 1 cassette with 0-50 wafers up to 8”
Bowl Dimensions	14” inside diameter x 11” deep
DI/N_2 Nozzles	Eight (fan-type)
DI H_2O	All PFA fittings, TFE valves, TFE tubing, TFE flowswitches
System N_2	PFA tubing, PFA fittings, TFE flowswitches, stainless steel N2 heater, and 316 low carbon stainless steel regulators
Cycle speed	50 to 2250 RPM (Typically 1200 RPM)
Cycle Timer	0 to 9999 seconds

2.4.2 Load Capacities

The dryer can process up to fifty (50) 8-inch (200mm) or smaller silicon wafers. The dryer can also process square masks.

CAUTION	
⚠	**POTENTIAL PRODUCT OR EQUIPMENT DAMAGE!** Using the wrong cassette in the dryer may cause damage. Ensure the serial number of the cassette matches the number on the rotor. See Section 3, Operations, for location of these numbers. Never run a cycle without the cassette installed in the process bowl. The dryer is balanced with the cassette. Damage to the labyrinth seal and rotor will occur.

2.4.3 Operating Parameters

Dryer Operating Parameters and Ranges	
Rinse Cycle Speed	0 (50) to 2250 RPM (Typically 1200 RPM)
Dry Cycle Speed	0 (50) to 2250 RPM (Typically 1200 RPM)
Rinse Timer	0 to 9999 seconds
Dry Timer	0 to 9999 seconds
Resistivity	0 to 18.2 megohms

2.4.4 Facility Requirements

Refer to Table 2-1 for a single dryer, single-stack FREM or single-stack Bay and Chase model. Refer to Table 2-2 for a double-stack FREM or Bay and Chase model. Always defer to the facilities drawing for your dryer model supplied with this manual if the values differ.

Table 2-1*. Facility requirements for all single dryer model types.*

<table>
<tr><th colspan="4">Single Dryer Facility Requirements</th></tr>
<tr><td rowspan="4">DI H_2O Input</td><td colspan="3">3/8-inch OD Teflon tubing</td></tr>
<tr><td colspan="3">1.75 gpm minimum</td></tr>
<tr><td colspan="3">25 psi dynamic minimum</td></tr>
<tr><td colspan="3">70 psi dynamic maximum for high pressure valve</td></tr>
<tr><td rowspan="2">DI H_2O Return</td><td colspan="3">3/8-inch OD Teflon tubing</td></tr>
<tr><td colspan="3">minimum 5 psi lower than input pressure valve</td></tr>
<tr><td rowspan="3">System N_2</td><td colspan="3">3/8-inch OD Teflon tubing</td></tr>
<tr><td colspan="3">6-7 scfm (gauge reading)</td></tr>
<tr><td colspan="3">60 psi dynamic minimum</td></tr>
<tr><td rowspan="3">CDA / N_2</td><td colspan="3">Operates pneumatic components</td></tr>
<tr><td colspan="3">¼-inch OD Teflon tubing</td></tr>
<tr><td colspan="3">60-90 psi dynamic minimum</td></tr>
<tr><td rowspan="2">Drain</td><td colspan="3">1 ½-inch mnpt (drain box).</td></tr>
<tr><td colspan="3">1 ½-inch pvc pipe (drain plumbing option)</td></tr>
<tr><td>Vent</td><td colspan="3">1 ½-inch pvc pipe</td></tr>
<tr><td>Exhaust</td><td colspan="3">-0.5 max to -1.0 inches of water if not exhausted to fab</td></tr>
<tr><td rowspan="4">Power</td><td>Voltage</td><td>Hertz</td><td>Amps</td></tr>
<tr><td>120 vac</td><td>50/60</td><td>15 – Standard</td></tr>
<tr><td></td><td></td><td>18 – Step-Up Transformer</td></tr>
<tr><td></td><td></td><td>10 – Step-Down Transformer</td></tr>
</table>

NOTE

Always defer to the facilities drawing for your dryer model supplied with this manual if the values differ.

***Table 2-2**. Facility requirements for all double-stack dryer model types.*

<table>
<tr><th colspan="4">Double-Stack Dryer Facility Requirements</th></tr>
<tr><td rowspan="6">DI H_2O Input</td><td colspan="3">Dual $^3/_8$-inch OD Teflon tubing without single point option</td></tr>
<tr><td colspan="3">½-inch OD Teflon tubing with single point Flaretek</td></tr>
<tr><td colspan="3">½-inch OD Teflon tubing w/ single point compression</td></tr>
<tr><td colspan="3">3.5 gpm minimum</td></tr>
<tr><td colspan="3">25 psi dynamic minimum</td></tr>
<tr><td colspan="3">70 psi dynamic maximum for high pressure valve</td></tr>
<tr><td rowspan="4">DI H_2O Return</td><td colspan="3">Dual $^3/_8$-inch OD Teflon tubing without single point option</td></tr>
<tr><td colspan="3">½-inch OD Teflon tubing with single point Flaretek</td></tr>
<tr><td colspan="3">½-inch OD Teflon tubing w/ single point compression</td></tr>
<tr><td colspan="3">minimum 5 psi lower than input pressure valve</td></tr>
<tr><td rowspan="5">System N_2</td><td colspan="3">Dual $^3/_8$-inch OD Teflon tubing without single point option</td></tr>
<tr><td colspan="3">½-inch OD Teflon tubing with single point Flaretek</td></tr>
<tr><td colspan="3">½-inch OD Teflon tubing w/ single point compression</td></tr>
<tr><td colspan="3">12-14 scfm (gauge reading)</td></tr>
<tr><td colspan="3">60 psi dynamic minimum</td></tr>
<tr><td rowspan="5">CDA / N_2</td><td colspan="3">Operates pneumatic components</td></tr>
<tr><td colspan="3">Dual ¼-inch OD Teflon tubing without single point option</td></tr>
<tr><td colspan="3">½-inch OD Teflon tubing with single point Flaretek</td></tr>
<tr><td colspan="3">$^3/_8$-inch OD Teflon tubing w/ single point compression</td></tr>
<tr><td colspan="3">60-90 psi dynamic</td></tr>
<tr><td rowspan="2">Drain</td><td colspan="3">1 ½-inch mnpt (drain box).</td></tr>
<tr><td colspan="3">1 ½-inch pvc pipe (drain plumbing option)</td></tr>
<tr><td>Vent</td><td colspan="3">1 ½-inch pvc pipe</td></tr>
<tr><td>Exhaust</td><td colspan="3">-0.5 max to -1.0” of water if not exhausted to fab</td></tr>
<tr><td rowspan="4">Power
per dryer</td><td>Voltage</td><td>Hertz</td><td>Amps</td></tr>
<tr><td>120 vac</td><td>50/60</td><td>15 – Standard</td></tr>
<tr><td></td><td></td><td>18 – Step-Up Transformer</td></tr>
<tr><td></td><td></td><td>10 – Step-Down Transformer</td></tr>
</table>

NOTE

Always defer to the facilities drawing for your dryer model supplied with this manual if the values differ.

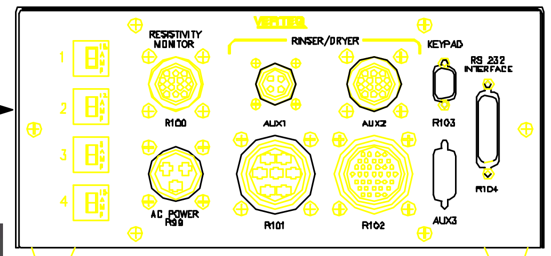
SuperClean 1800-6 Rinser / Dryer

Typical Verteq 1800-6 Rinser / Dryers are shown in various standard configurations. Your dryer may not contain all of the components, features and options shown. Features on your dryer may be in different locations than those shown in these examples. Not all components, features, options or configurations are shown. All information is for reference only. Dimensions are approximate.

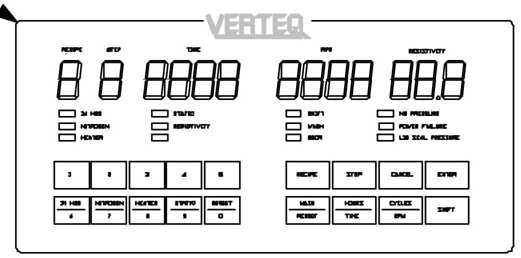
Typical Components

Resistivity Controller (2"h X 4"w X 8"d)

Controller (rear view) (5"h X 11"w X 16"d)



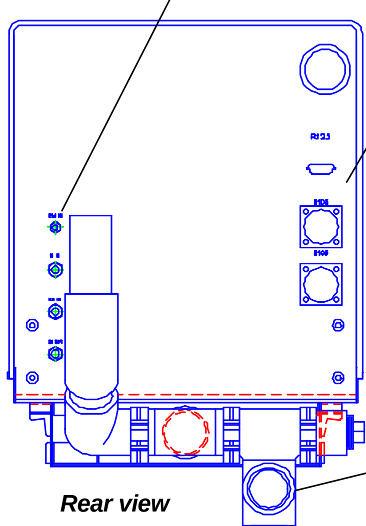
Control Panel (4"h X 11"w X 2"d)



Dryer unit also referred to as a Centrifuge
Dryer Dimensions: 19"h X 17"w X 27"d

Facilities connections

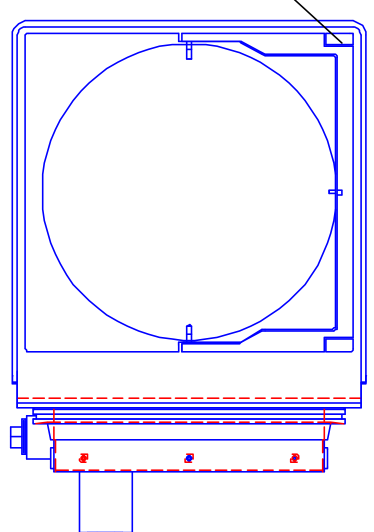
Controller Cable connections



Resistivity Connections

Rear view

Right-hand Hinge shown



Right-hand opening door shown

Typical Front-Removable (FREM) Single Dryer in a Cabinet

Cabinet Dimensions: 59"h X 20"w X 37"d

EMO Pushbutton

Control Panel

Power On/Off Start/Stop Pushbuttons

Alarm Light/Silence Pushbutton and Sonalert

Front Access

Door Open/CloseF ootswitch

Typical Bay and Chase Double-Stack Frame

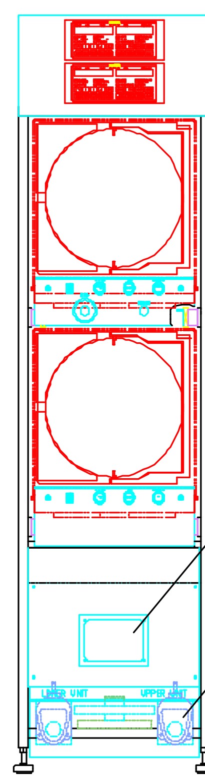
Frame Dimensions: 73"h X 21"w X 32"d

Typical Bay and Chase Single Dryer in a Cabinet

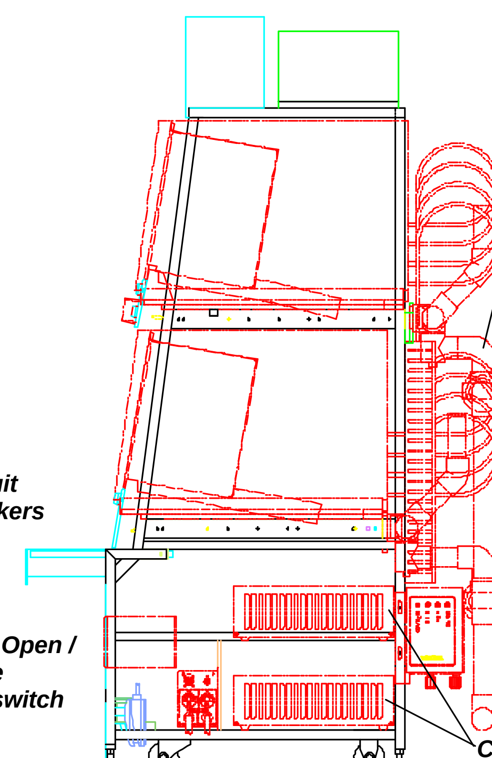
Cabinet Dimensions: 66"h X 22"w X 42"d

Typical FREM Double-Stack Frame (75"h X 20"w X 40"d)

Front view



Side view



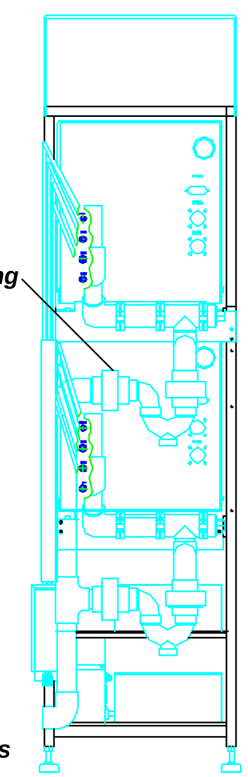
Circuit Breakers

Door Open / Close Footswitch

Plumbing

Controllers

Rear view



Verteq
think clean

Typical Features and Options	
Features	**Description**
Product Capacity	1 cassette / 0-25 200mm wafers or 0-50 200mm wafers
Bowl Dimensions	14" I.D. X 11" deep
DI H_2O	Eight (8) Fan-type. All PFA fittings, TFE valves, tubing, and flowswitches
System N_2	PFA tubing & fittings, TFE flowswitch, stainless steel N_2 heater, and 316 low carbon stainless steel regulators
Cycle Speed	50 to 2250 RPM (1200 Typically)
Cycle Timer	0 to 9999 seconds
Options (contact Verteq Sales for details)	
Left- or Right-hand Hinged Door	
2 Rotor Styles	
CE Marked	
Flaretek Fittings on DI H_2O Lines	
RA-10 Finish Bowl	
High Pressure Teflon DI H_2O valves	
Audible Alarm	
CO_2 Injection	
Door Open/Close Pushbuttons	
Cassette Detection	
Housing:	
Front Removable (FREM) Single Cabinet (PVC)	
FREM Single Cabinet (Fire Retardant Polypropylene)	
FREM Doublestack Frame (with Side Panels)	
Bay and Chase Single Cabinet	
Bay and Chase Doublestack Frame	
Housing Options:	
Resistivity Monitor and Probe	
EMO for FREM or Bay and Chase	
GFI	
Footswitch	
Drain Plumbing (PVC or Polypropylene)	
Doublestack Single-point Facility Hook up	
Doublestack Single-point Facility Hook up with Flaretek connections	
Step Down Transformer	

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3 OPERATING PROCEDURES

This section includes the following topics:

- Control Panel (Section 3.1)
- Pushbutton Controls and Optional Features (Section 3.2)
- Recipe Programming (Section 3.3)
- Operating Procedures (Section 3.4)
- Programmable Codes (Section 3.5)
- Fault Codes (Section 3.6)
- Controller Card Dipswitch Settings (Section 3.7)

3.1 Control Panel Functions

The alphanumeric displays on the control panel (Figure 3-1) have a dual purpose. In the programming, standby, and operating modes the display shows the programmed values. In a fault mode, 'HELP' will be displayed with a fault code number.

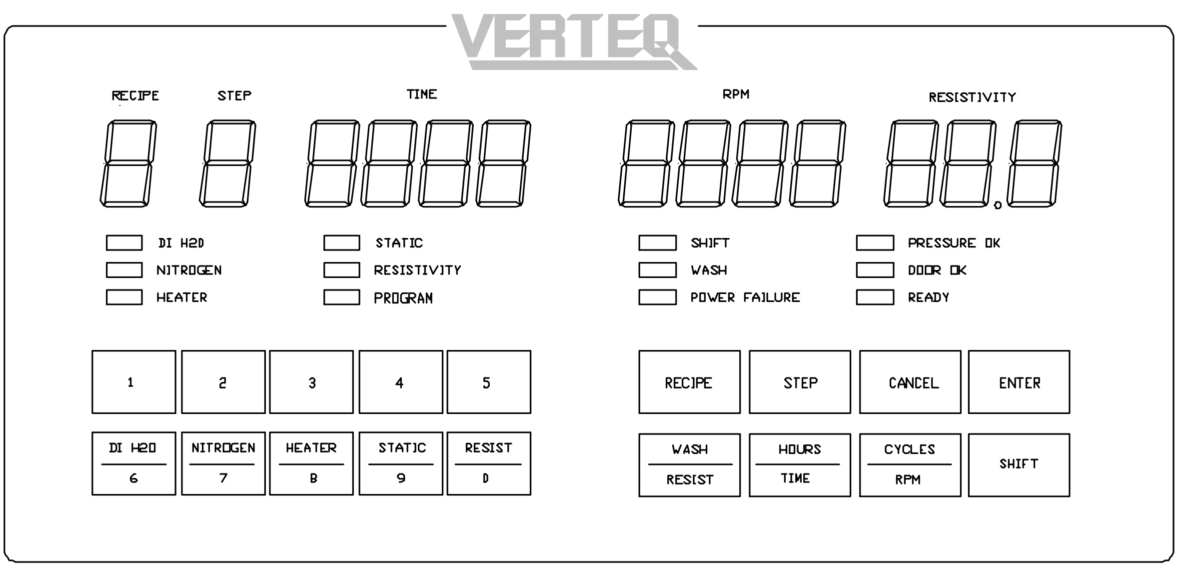


***Figure 3-1**. Control Panel and Keypad layout.*

3.1.1 Numeric Read-Out on the Control Panel

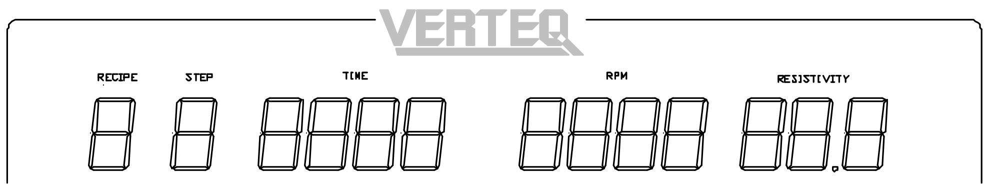


Figure 3-2. *Numeric read out on the Control Panel.*

RECIPE shows the recipe number from 0-9, with 0 designated as the first recipe.

STEP shows the step (cycle) number from 0-9, with 0 designated as the first step.

TIME shows the time programmed in seconds for each specific step. The time will count down during the cycle. When a system fault occurs, '**HELP**' will be displayed, Figure 3-3.

RPM indicates the programmed rpm. During a cycle, the actual rpm will be displayed. When a system fault occurs, the fault (**HELP**) code number will be displayed.

RESISTIVITY indicates the programmed resistivity setpoint of the drained DI water.

3.1.2 Fault (HELP) Display Mode

When a fault has occurred, the word '**HELP**' will be displayed under the TIME display and the fault or HELP code number will be displayed under the RPM display. For a list of HELP codes refer to Section 3.6.

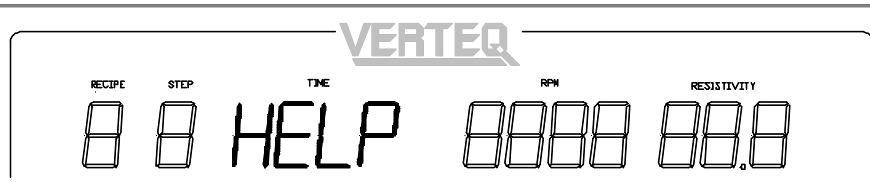


Figure 3-3. *HELP Display Mode.*

3.1.3 LEDs

Figure 3-4. *LED functions of the Control Panel.*

DI H_2O, **NITROGEN**, **HEATER**, **STATIC**, **RESISTIVITY** indicate the functions that have been programmed into the current step (cycle).

PROGRAM indicator will illuminate when in programming mode. See Section 3.5, *Programming Codes*, for details of Codes 1800 and 1801.

SHIFT indicator is actuated by the SHIFT key and is illuminated during the programming mode. SHIFT is used to program only the keys in orange (i.e., DI H_2O, NITROGEN, HEATER, STATIC, RESIST, WASH, HOURS, and CYCLES).

NOTE

SHIFT must be off to exit the programming mode.

WASH illuminates when a rinse cycle is necessary to clean the inside of the dryer. See Section 3.2.1.1, *Wash Warning*, and Section 3.2.1.2, *AutoWash*.

POWER FAILURE illuminates at the next power up event after the AC supply voltage has been interrupted during processing.

PRESSURE OK indicates that the Nitrogen and CDA supply pressures are adequate.

DOOR OK illuminates when the door is not properly closed and sealed.

READY will illuminate and the dryer will be ready to run when all of the following conditions are present:

- the door is closed and sealed
- the rotor has indexed
- no fault conditions are present
- when not in the programming mode

3.1.4 Control Panel Keys

The keys on the Control Panel are used to program or view recipes and steps. The numerical keys are used to program the recipe, step, cycle duration, rpm, and resistivity level. Several keys have dual functions that are controlled by the SHIFT key. With the SHIFT LED illuminated, the upper functions (displayed in orange) can be programmed. With the SHIFT LED **not** illuminated, the lower functions can be programmed.

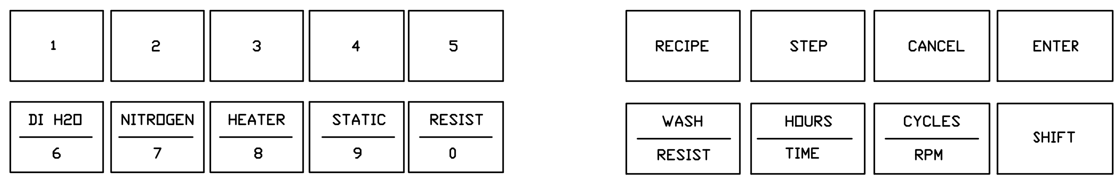


Figure 3-5. *Control Panel Keys functions.*

Numeric Keys are used to program the recipe, step, time, rpm, and resistivity values as well as Wash Warning values.

DI H_2O, **NITROGEN**, **HEATER**, **STATIC**, **RESIST**, **WASH**, **HOURS**, **CYCLES** are displayed in orange on the keypad are used to program the process selections of each cycle. To access these functions, press **SHIFT**.

RECIPE is used to select a recipe number from 0-9; up to ten recipes can be programmed.

STEP is used to select a step (cycle) number from 0-9; up to ten steps can be programmed.

CANCEL will erase any programming changes made while in the programming mode. Pressing ***CANCEL***, ***ENTER***, ***ENTER*** will revert to the recipe (if any) that had existed before any changes were programmed. The CANCEL key will silence the audible alarm, and will also put the dryer in standby mode when system faults (HELP codes) have been cleared.

ENTER is used to exit the programming mode by pressing it twice.

WASH is not used.

HOURS is used to program the Wash Warning parameters. Ensure all four numbers are keyed in. See Section 3.2.1.1, *Wash Warning Feature*.

CYCLES is used to program the Wash Warning. Ensure all four numbers are keyed in. See Section 3.2.1.1, *Wash Warning Feature*.

RESIST is used to program the resistivity setpoint. Ensure all three numbers are keyed in.

TIME is used to program the cycle duration and is shown in the TIME display. The time is programmed in seconds (e.g., a two minute cycle is programmed as 0120). Ensure all four numbers are keyed in.

RPM is used to program the speed of the rotor and cassette. The minimum and maximum RPM values are determined by the software version.

SHIFT will illuminate when in shift mode and is used to access the following (orange) keys:

- DI H_2O
- NITROGEN
- HEATER
- STATIC
- RESIST
- WASH
- HOURS
- CYCLES

NOTE
SHIFT must be off to exit the programming mode.

3.2 Pushbutton Controls

Figure 3-6 is for all dryer configurations. Some features are optional and may not be installed on your dryer. Also, the individual feature may be in a different location then what is shown. Refer to the numbered paragraphs for functional descriptions of the various pushbuttons. Refer to your dryer for the location of these features.

Figure 3-6. *Typical Single dryer in a cabinet. Pushbutton availability and location will vary on other model configurations.*

1. **EMERGENCY POWER OFF** (EPO) pushbutton will disconnect the main operating power from all dryers within the stack downstream of the Main Power circuit breakers.

2. **POWER** pushbutton supplies power to all dryers downstream of the EPO pushbutton. Power will not appear on the Control Panel unless the ON / OFF pushbutton is also toggled on.

3. **START / STOP** pushbutton will start and interrupt a cycle. When a cycle has been interrupted, pressing **START/STOP** again will restart a cycle from the beginning and not from the point of interruption.

4. **ON / OFF** pushbutton must be toggled ON to allow the SRD to function. The Control Panel lights will be illuminated when the ON / OFF pushbutton is toggled on. There is one pushbutton for each dryer within the stack.

5. **MAIN POWER** circuit breaker. Main power from the facility of each dryer is disconnected when the breaker is in the full down and off position. There is one for each dryer. Used this switch for Lockout and tag procedures.

6. **CONTROL PANEL KEYS** see Section 3.1.4.

7. **ALARM OFF** pushbutton silences the Alarm Speaker.

8. **DOOR OPEN / CLOSE** footswitch opens and closes the front door of it's assigned dryer. Positioned and designed to be activated with your foot. The door cannot be opened until all cycles in the recipe have been completed, or when the cycle has been interrupted (START / STOP). There may be a delay in opening while the rotor (cassette) indexes.

3.2.1 Optional Features

The following optional features and equipment may require programming or affect recipes. Refer to the Preface section of this manual and your sales order to determine if your dryer configuration has any of the following features.

3.2.1.1 Wash Warning Feature (Standard)

Your processing requirements may dictate the use of dry cycles only. In this circumstance, the bowl must be rinsed periodically with DI water to ensure a consistently clean operation. The dryer can be programmed to illuminate the WASH LED as a reminder that a rinse cycle is due. The WASH LED can be set to illuminate after a specific number of hours without a rinse cycle or after a specific number of consecutive dry cycles.

If values are set for both hours and cycles, the first to occur will illuminate the warning light. Once a DI water (rinse) cycle is run, the light extinguishes and the countdown starts over.

NOTE
For HOURS and CYCLES to function, both must be programmed with non-zero values. To set for Cycles only, set Hours to 0000. To set for Hours only, set Cycles to 0000. To disable this feature set both Hours and Cycles to 0000.

To set Wash Warning time and cycle parameters:

1. Enter 1801.

2. Press HOURS to clear the TIME display, then enter the desired time up to a maximum of 9999 hours.

3. Press CYCLES to clear the RPM display, then enter the desired number up to a maximum of 9999 cycles.

4. Press ENTER ENTER to save the settings and exit Wash Warning programming mode.

3.2.1.2 AutoWash Feature

An automatic AutoWash feature will run both a rinse and dry cycle. The rinse cycle duration can be programmed to run for up to 9999 seconds. The dry cycle is pre-programmed to run for 900 seconds (15 minutes). Both cycles are pre-programmed to run at 100 rpm.

NOTE

The AutoWash feature can be enabled and disabled with a dipswitch accessed by service personnel. The optional AutoWash EPROM must be installed to utilize this feature.

To program for AutoWash: (Wash Warning also must be enabled)

1. Enter 1804.
2. Press **HOURS** to clear the TIME display, then enter the desired time up to a maximum of 9999 seconds.
3. Press **ENTER ENTER** to save the settings and exit AutoWash programming mode.

If the dryer is in Idle mode with the door closed and then the WASH LED illuminates, the AutoWash recipe will automatically start. If the WASH LED illuminates during a recipe, the system waits until the recipe ends and the door is opened and closed before commencing the AutoWash.

3.2.1.3 End of Process Notification

This feature notifies an operator that the current recipe in process has ended. This feature is only available on Controller 1075227.710. If the correct dipswitch is selected, an alarm will sound and the Control Panel will illuminate with the letters EOP at the end of a recipe run. Refer to Section 3.7, *Controller Card Dipswitch Settings*.

Opening the door, starting a new recipe run, or pressing Cancel will silences the EOP alarm and return the Control Panel to Idle Mode.

3.2.1.4 Cassette Detection

The cassette detection feature ensures the dryer starts a cycle immediately after a cassette is placed in the rotor. This feature is only available on Controller 1075227.710. The photoelectric sensor detects if a cassette has been loaded. An alarm sounds if a cycle is not started within two seconds after the cassette is detected in the rotor and the door is closed.

3.2.1.5 IPA Assist Module

The IPA Assist module is remotely installed and enables the injection of vaporized IsoPropyl Alcohol (IPA) into the dryer. For all IPA Assist-related information refer to Section 10.

3.3 Recipe Programming

3.3.1 Recipe Options Descriptions

When programming a recipe, the following standard selectable items will function according to their descriptions when selected during the programming procedures. See Section 3.3.2 for programming a recipe.

DI H_2O. DI valve will open and DI water will flow into the bowl and rinse the wafers. DI H_2O is only selected in rinse cycles.

NITROGEN. The nitrogen valve will open and nitrogen will flood the bowl. NITROGEN is selected for every rinse and dry cycle.

HEATER. Allows the heaters to function when called upon within the recipe. This function can be used for both rinse and dry cycles. The nitrogen heater will not function unless NITROGEN has also been selected.

STATIC. Nitrogen will flow continually through the static eliminator during both rinse and dry cycles. Nitrogen is ionized when passing through the static eliminator before entering the bowl to neutralize any static charges. Operating the static eliminator is available for dry cycles only and will not function if selected with **DI H_2O**.

RESISTIVITY. Enables the resistivity monitor to measure the cleanliness of the outgoing DI water in megohms as it is drained during rinsing cycles. The rinse cycle will end when both the programmed time and resistivity setpoint have been reached. However, if the time expires prior to satisfying resistivity, the rinse cycle will run indefinitely until it is reached. If resistivity is not reached in the programmed time, the resistivity measurement can be bypassed by pressing **SHIFT 0** (zero) and the next step will begin.

NOTE
The Resistivity feature will function only when the DI H_2O feature is also selected.

3.3.1.1 Viewing an Existing Recipe

Recipes may be viewed before programming or processing wafers. To view a particular recipe, press the **RECIPE** key followed by the number key corresponding to the recipe number you want to view.

3.3.2 Programming a Recipe

Verteq recommends the following settings for optimum rinse and dry performance:

- **Step 1 Rinse**: 50 RPM; with DI H_2O, N_2, and Resistivity enabled for 60 seconds.
- **Step 2 Rinse**: 300 RPM; with DI H_2O, N_2, Heaters and Resistivity enabled for 45 seconds.
- **Step 3 Dry**: 1200 RPM; with N_2, Heaters and Static enabled for 240 seconds.
- **Step 4 Dry**: 500 RPM; with N_2, Heaters and Static enabled for 240 seconds.

NOTE

The following common rules must be followed for optimum performance:

- Nitrogen should be selected for every recipe step, rinse or dry.
- The static eliminator will not function if STATIC is selected with DI H_2O.
- The RESISTIVITY feature functions only when selected with DI H_2O.
- ***Before exiting programming mode, ensure that you are at the last step of the recipe or the following steps of that recipe will be erased. You do not need to be in the last recipe to safely exit.***
- SHIFT must be off to exit programming mode.

To program a new recipe or change an existing recipe:

1. Before entering programming mode, ensure that the dryer is in Idle mode (i.e., no ‘HELP’ codes are displayed).

2. To enter Programming mode, use the keypad to enter **1800**. The panel will perform a lamp test, then the parameters of step 0 of the current recipe will be displayed.

3. Enter the recipe number by pressing **RECIPE** and then the recipe number desired (0-9). For example, to program recipe 0 press **RECIPE**, then **0**. Step 0 of recipe 0 will be displayed.

4. To program step 0 of recipe 0 enter **STEP**, then **0**.

5. To enter a resistivity setpoint, press **RESIST** (SHIFT must be off). The current setpoint flashes, indicating the panel is ready to accept a three digit number. The optimal resistivity range is from 00.0 to 18.2 megohms. For example, to enter a value of 10.0, type **100**.

NOTE

Technically, you can enter a megohm value up to 20.0. Verteq does not recommend a value greater than 18.2.

6. To enter the time value, press **TIME** (SHIFT must be off). The panel will go blank to indicate it is ready to accept a four digit number (0000 to 9999 seconds). For example, to program a time of 120 seconds, type **0120**.

7. To enter the rotor (cassette) speed, press **RPM** (SHIFT must be off). The panel will go blank to indicate it is ready to accept a four digit number (minimum and maximum RPM speeds are determined by the dryer's software). For example, to program a speed of 500 RPM, enter **0500**.

8. To select the process options, press **SHIFT** to access the upper function of the dual-function keys.

9. Select the process options desired: DI H_2O, NITROGEN, HEATER, STATIC, or RESIST. Ensure each green LED is illuminated on the panel.

10. Press **SHIFT** to exit SHIFT mode.

11. To program the next step (or cycle) of the recipe, press **STEP** followed by the number. For example, to program step 1 of recipe 0 press **STEP** then **1**.

12. Follow the above procedure to program further steps and recipes.

NOTE

Before exiting programming mode, ensure that you are at the last step of the recipe or the following steps of that recipe will be erased. You do not need to be in the last recipe to safely exit.

13. When every recipe and step has been programmed, press **ENTER**, **ENTER** to exit the programming mode. The recipes and steps entered will be saved and will remain in the RAM memory until manually changed.

3.3.2.1 Rinse-*and*-Dry Recipe Programming Example

The following is a step-by-step routine for programming a typical rinse-*and*-dry recipe. See Section 3.3.2.2 for a typical dry-*only* recipe.

1. Enter 1800 to enter the programming mode.

Rinse Cycle:

3. Press RECIPE, then 0 to program recipe 0.

4. Press STEP, then 0 to program step 0 of recipe 0.

5. Press RESIST, then enter 100 for a resistivity setpoint of 10.0.

6. Press TIME, then enter 0120 for a rinse cycle time of 120 seconds.

7. Press RPM, then enter 0500 for a speed of 500 rpm.

8. Press SHIFT to access the keys in orange.

9. Press DI H2O to select DI water.

10. Press NITROGEN to select nitrogen.

11. Press HEATER to select heaters.

12. Press RESIST to select resistivity monitoring.

13. Press SHIFT.

Dry Cycle:

14. Press STEP, then 1 to program step 1 of recipe 0.

15. Press RESIST, then enter 000 as resistivity is not monitored during a dry cycle. (000 needs to be entered for the RAM address to function properly.)

16. Press TIME, then enter 0240 for a dry cycle time of 240 seconds.

17. Press RPM, then enter 1200 for a speed of 1200 rpm.

18. Press SHIFT to access the keys in orange.

19. Press NITROGEN to select nitrogen.

20. Press HEATER to select heaters.

21. Press STATIC to select the static eliminator.

22. Press SHIFT.

NOTE
Before exiting programming mode, ensure that you are at the last step of the recipe or the following steps of that recipe will be erased. You do not need to be in the last recipe to safely exit.

23. Press ENTER ENTER to save the settings and exit programming.

3.3.2.2 Dry-*only* Recipe Programming Example

The following is a step-by-step routine for programming a typical dry-*only* recipe.

1. Enter 1600 to enter the programming mode.

2. Press STEP, then 1 to program step 1 of recipe 0.

3. Press RESIST, then enter 000 as resistivity is not monitored during a dry cycle.
(000 needs to be entered for the RAM address to function).

4. Press TIME, then enter 0240 for a dry cycle time of 240 seconds.

5. Press RPM, then enter 1200 for a speed of 1200 rpm.

6. Press SHIFT to access the keys in orange.

7. Press NITROGEN to select nitrogen.

8. Press HEATER to select heaters.

9. Press STATIC to select the static eliminator.

10. Press SHIFT.

NOTE
Before exiting programming mode, ensure that you are at the last step of the recipe or the following steps of that recipe will be erased. You do not need to be in the last recipe to safely exit.

11. Press ENTER ENTER to save the settings and exit programming.

3.4 Operating Procedures

The following procedures are Verteq standard operating procedures to rinse and dry wafers including safe start up procedures, processing wafers and safe shut down procedures. Your procedures may vary depending on process needs, configured options, and specific location of pushbuttons and other controls.

3.4.1 Safe Start Up Procedures (Centrifuge Only)

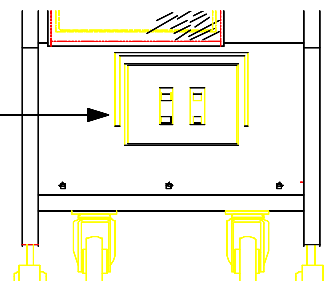
With the power cord, at the back of the controller, connected to the main power source:

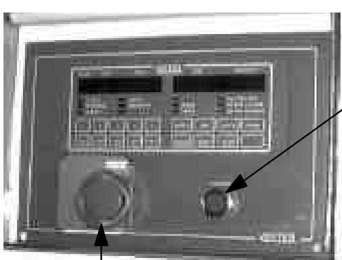
1. Ensure that the dryer door is closed.

2. Press the Power pushbutton on the front of the dryer.

3.4.2 Safe Start Up Procedures (Frame or Cabinet)

1. Ensure that the Main Power circuit breaker, for each dryer, is in the full up and on position.





2. Press the green control Power pushbutton. The rotor will index into the upright position.

Use the EMO to stop the dryer under emergency conditions.

3. If the rotor does not index or the Control Panel does not illuminate, press the amber Power ON/OFF pushbutton, then press the green control Power pushbutton again.

The dryer is now powered on. If there appears to be no power to the dryer, call for maintenance help.

3.4.3 Wafer Processing Procedures

CAUTION

LACK OF CASSETTE DURING DRYER OPERATION WILL CAUSE PERMANENT ROTOR VIBRATION, IMBALANCE AND DAMAGE!

During any type of rotor movement, at speeds greater than 100 RPM, requires at least an empty cassette present in the rotor.

1. Ensure that the dryer is powered on, the rotor is indexed correctly, the Control Panel is illuminated, and the door is closed.

2. Press the Door Open / Closed button (either a button or a foot peddle is installed).

3. Place the cassette correctly into the dryer. See Figure 3-7.

NOTE

Ensure that the cassette model number matches the stamped number on the dryer rotor.

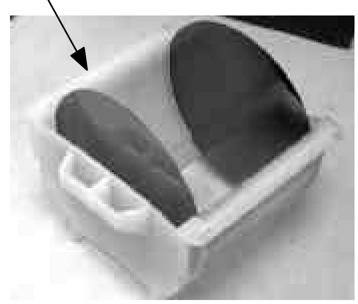
Rotor-stamped cassette model number	Cassette-stamped model number
	

Figure 3-7*. Correct placement of cassette in rotor.*

4. Press the Door Open/Close button (either a button or a foot peddle is installed) to close the door.

5. Select a recipe from the stored recipes. To do this, press the RECIPE key on the Control Panel, then press the appropriate numeric key (representing the desired recipe) on the Control Panel. See Section 3.1.4 for key descriptions.

6. Press the STOP / START pushbutton on the dryer. The dryer performs a series of checks; ensures the door is locked and that the dryer will spin, rinse, and dry according to the recipe selected.

7. When the recipe is done, the rotor will index to the upright position and the Ready LED will illuminate. Open the door and remove the cassette.

8. To process other cassette of wafers, start at step 1 of this procedure.

This ends the standard wafer processing procedures.

3.4.4 Emergency Shutdown Procedure

CAUTION

POTENTIAL PRODUCT OR EQUIPMENT DAMAGE!

The following Verteq standard emergency shut down procedure may not apply to your dryer. Contact your supervisor or system maintenance personnel for instructions on shutting down your dryer.

1. Press the red EMO (Emergency Power Off) pushbutton to disconnect the main power supply to the dryer downstream of the main power circuit breaker.
2. To restore power to the dryer press the POWER ON pushbutton.

3.4.4.1 Emergency Wafer Retrieval Procedure

As a safety feature to protect the operator from possible injury and the wafers from accidental contamination, the door cannot be opened once a process cycle has started. The door can only be opened with the DOOR OPEN/CLOSE pushbutton or footswitch when the final step of the recipe has been completed or the recipe has been interrupted and the rotor indexed.

In the event the dryer loses power during a cycle and there is a need to remove the wafers before power is restored, the door can be manually opened by performing the following:

1. Turn off the facility CDA pressure to the dryer.

2. Press the relief valve located adjacent to the static eliminator power supply on the right side of the dryer.

3. Manually rotate the cassette to the upright position to avoid spilling the wafers during cassette removal.

4. Remove the cassette.

3.4.5 Safe Shut Down Procedures

Refer to Figure 3-8 for the shut down procedure when the dryer will not be operated for an extended period of time or when power needs to be removed for maintenance purposes.

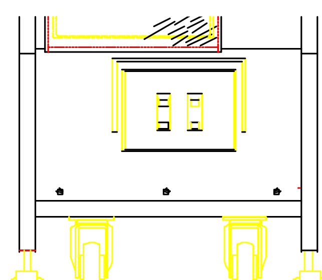
1. Ensure that the dryer is in Idle (Ready) mode.	
2. Ensure there is no cassette in the dryer.	
3. Move the main power circuit breaker switch to the full down and off position for each dryer. For Component-only models, disconnect the controller from the main power source.	

***Figure 3-8**. Procedure for removing power from the dryer.*

3.5 Programmable Codes

These codes are entered onto the Control Panel as the first step in programming certain features.

Table 3-1. *Codes used to program the dryer.*

Code	Function / Description
1 8 0 0	Program Recipe - Used to program rinse and dry parameters for recipes.
1 8 0 1	Wash Warning - Used to set the timer and counter in order to illuminate the WASH indicator on the keypad, warning the operator to wash the bowl. The WASH indicator is extinguished when DI water is used in a recipe. Pressing <SHIFT>, then <TIME> and enter the number of hours (0-9999), the machine can remain idle before the WASH light is illuminated. Pressing <SHIFT>, then <RPM> and enter the number of cycles (0-9999) the machine can run without DI water before the WASH light is illuminated. **Note:** Setting both hours and cycles to “0” disables Wash Warning.
1 8 0 2	Display Software Revision - Information is displayed on the keypad in the following format: 18 VVV RR, where 18 is the type of software, VVV is the version, and RR is the revision number. The display clears after a few seconds. Refer to the Preface section to interpret these values.
1 8 0 3	Display status of input sensors - Using the keypad readouts, displays the status of the following input sensors: 0 = Sensor Off 1 = Sensor On Recipe = Not Used Step = Footswitch Time (1000) = Not used Time (100) = Door open Time (10) = Door closed Time (1) = Bladder pressure RPM (1000) = N_2 Pressure RPM (100) = Start pushbutton RPM (10) = Stop pushbutton (Normally closed) RPM (1) = Not used Press CANCEL to exit this feature
1 2 3	Cycle stop indication - When entered, (after the problem that caused the interruption is corrected), process information is displayed indicating when the dryer last stopped. This options displays recipe number ,step, time remaining, RPM and recipe options (DI, N_2, static, heaters, and resistivity). Press CANCEL to exit this feature.

3.6 Fault (HELP) Codes

When an alarm occurs, the dryer will sound the Sonalert speaker and post a Fault code on the Control Panel. The word ‘**HELP**’ will be displayed under the **TIME** display and the fault or HELP code number will be displayed under the **RPM** display. Table 3-2 outlines the alarm type, the device affecting the alarm, and any applicable operator recovery procedures. Alarm types will only occur on your system if the affected option is installed or the dipswitch of a specific option is configured wrong.

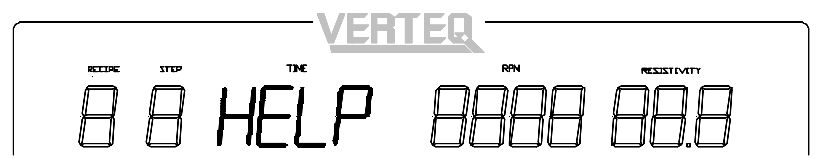


Figure 3-9. *HELP Display Mode.*

NOTE

More than one fault can occur at a time. If this occurs HELP codes will be added together. For instance, if Index Failure ***and*** RPM Too High alarms occur at the same time, the HELP code will be 0030. Verteq recommends that these alarms be resolved in order of lowest digit first. This means that the operator should attempt to recover from the DI Pressure alarm first. Refer to Table 3-2 for the HELP codes and recovery procedures.

Table 3-2. *Fault (HELP) Codes.*

HELP Code	Fault Description	Affecting Device	Operator Response
0001	DI Pressure Low	PSW1	• Correct the problem • Press **CANCEL** to clear the Control Panel.
0002	DI Flow	Flow Sensor, Controller Dipswitch #4	• Correct the problem • Press **CANCEL** to clear the Control Panel • Press **Power** to reset
0004	N_2 Heater Failure	PSW3, Thermoswitch D1, Current Sensor, Controller Dipswitch #5	• Correct the problem • Press **CANCEL** to clear the Control Panel • Press **Power** to reset
0010	Index Failure	Proximity Sensor on Index Cylinder	• Correct the problem • Press **START/STOP** to clear the Control Panel.
0020	RPM Too High	Optical RPM Sensor in Motor	• Correct the problem • Press **CANCEL** to clear the Control Panel.
0040	Door not Closed at Start	Door Microswitch, Rear Reed Switch	• Correct the problem • Press **CANCEL** to clear the Control Panel.

HELP Code	Fault Description	Affecting Device	Operator Response
0100	N_2 Pressure Failure	PSW2, PSW4, Thermoswitch D3	• Correct the problem • Press **CANCEL** to clear the Control Panel.
0200	N_2 Flow	Flow Sensor, Controller Dipswitch #4	• Correct the problem • Press **CANCEL** to clear the Control Panel • Press **Power** to reset
0400	Power Failure	N/A	• Correct the problem • Press **START/STOP** to clear the Control Panel.
1000	Door Open in Run	Rear Reed Switch	• Correct the problem • Press **CANCEL** to clear the Control Panel.
2000	Door Unseal in Run	Door Microswitch	• Correct the problem • Press **CANCEL** to clear the Control Panel.
4000	Door Open / Close Timeout Error	Door Position Sensors	• Correct the problem • Press **OPEN/CLOSE** to clear the Control Panel.
8000	Front Door Obstruction	Digital Pressure Switch	• Correct the problem • Press **OPEN/CLOSE** to clear the Control Panel.
8888	Loss of Speed Feedback while Running	Optical RPM Sensor in Motor, Overspeed Board Dipswitch	• Correct the problem • Press **Power** to reset

3.6.1 Faults with No Codes

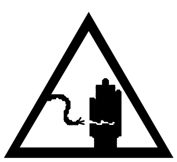
Problem	Possible Cause	Suggested Solution
Wafers wet and/or with water spots when removed	Faulty heaters	Call for Maintenance
Keypad flashing or recipe information disappearing	Bad RAM battery	Call for Maintenance
TIME display flashes between zeros and dashes, and the RESISTIVITY display flashes between the actual and programmed resistivity levels	Resistivity level has not been reached in the programmed time	Call for Maintenance
Door opens/closes slow	Low CDA supply pressure	See Section 4.6, *Door Position Adjustment Procedure*
Door water leak	Door seal insufficient	See Door Adjustment Procedure – Maintenance section
High particle count	Various	See Section 4.17, *Particle Troubleshooting Procedure*

3.7 Controller Card Dipswitch Settings

Dipswitches are mounted on the edge of the controller card, Figure 3-10, and are accessible through an opening in the controller enclosure. They are used to set several system parameters and enable installed optional features. The dipswitches are factory set and should not be changed without assistance from a Verteq Field Service Representative.

***Figure 3-10**. Dipswitch location.*

WARNING



RISK OF ELECTRICAL SHOCK!

Disconnect power before resetting dipswitches. Defer to qualified personnel for servicing.

To change dipswitch settings, disconnect power before altering dipswitch settings. Remove the black plug in the side of the controller enclosure to access the dipswitches (Figure 3-10). The switches are numbered 1 through 8 on the switch body. Tables 3-3 and 3-4 provide information on the correct settings for each software version and revision. Refer to the Preface section for instructions in finding your dryer's software version.

***Table 3-3**. Dipswitch settings for the following software versions.*

For Software Types:		
Dryer	**Version**	**Revision No.**
1800	**–003**	**–02**
1800	**–004**	**–02**
1800	**–005**	**–01**
Dipswitch	**Position / Function**	
NO. 1	Up = Obstruction sensor installed Down = No Obstruction sensor	
NO. 2	Up = No N_2 blow-off Down = N_2 blow-off enabled	

For Software Types:			
Dryer	**Version**		**Revision No.**
1800	**–003**		**–02**
1800	**–004**		**–02**
1800	**–005**		**–01**
Dipswitch	**Position / Function**		
NO. 3	Up = Blow-off continues until door closes Down = Blow-off for 30 seconds		
NO. 4	Up = DI and N_2 flow sensors installed Down = No Flow sensors		
NO. 5	Up = Heater failure detector enabled (1.5 amps) Down = No Heater failure detector		
NO. 6	Up = SECS II communications disabled Down = SECS II communications enabled		
NO. 7&8	NO. 7	NO. 8	Baud Rate
SECS II Communications	Down Down Up Up	Down Up Down Up	9600 BPS 4800 BPS 2400 BPS 1200 BPS

Table 3-4. *Dipswitch settings for the following software versions.*

For Software Types:		
Dryer	**Version**	**Revision No.**
1800	**–007**	**–01**
Dipswitch	**Position / Function**	
NO. 1	Up = Obstruction sensor installed Down = No Obstruction sensor	
NO. 2	Up = No N_2 blow-off Down = N_2 blow-off enabled	
NO. 3	Up = Blow-off continues until door closes Down = Blow-off for 30 seconds	
NO. 4	Up = Cassette detection warning enabled Down = Warning not enabled	
NO. 5	Up = Heater failure detector enabled (1.5 amps) Down = No Heater failure detector	
NO. 6	Up = AutoWash disabled Down = AutoWash enabled	
NO. 7	Up = End of Process enabled Down = End of Process disabled	
NO. 8	*Not Used*	

3.7.1 Overspeed Board Dipswitch Settings

Dipswitches on the Overspeed board are set to stop the rotor from spinning if the RPM reach a pre-determined unsafe speed. Cycle power after making Dipswitch settings adjustments.

For 8” rotors:
The RPM DIPSWITCH array should be set to achieve the desired limit. For 8-inch rotors the typical safe maximum speed is 1200 RPM. To set for a safe maximum limit of 1408 RPM, the following switches are set to their “ON” or “UP” position. See Figure 3-11 for location of dipswitches.

For 6” rotors:
The RPM DIPSWITCH array should be set to achieve the desired limit. For 6-inch rotors the typical safe maximum speed is 2250 RPM. To set for a safe maximum limit of 2304 RPM, the following switches are set to their “ON” or “UP” position. See Figure 3-11 for location of dipswitches.

For 8” rotors (1200 RPM max.)		For 6” rotors (2250 RPM max.)	
Dipswitch	**Setting**	**Dipswitch**	**Setting**
2048	Down	2048	UP
1024	UP	1024	Down
512	Down	512	Down
256	UP	256	UP
128	UP	128	Down
64	Down	64	Down

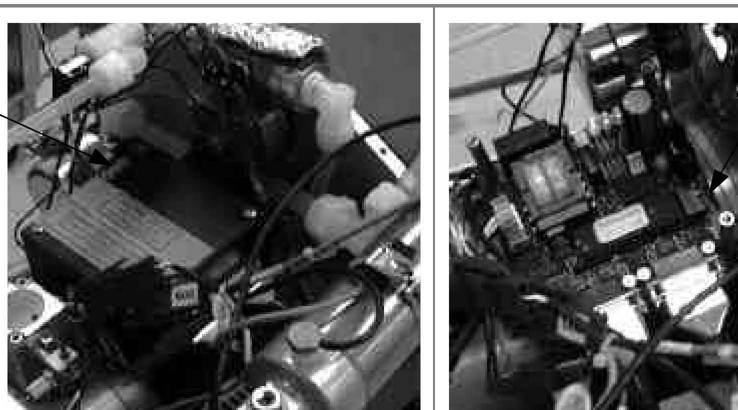


Figure 3-11. *Dipswitch and LED locations for the Overspeed Board.*

Table 3-5. *Overspeed Board LED Functions.*

LED	Function
RED	RPM. Simultaneously “blinks” with speed pluses received from optical encoder.
GREEN	POWER. Power is applied to the overspeed board.
YELLOW	RELAY. Power is applied to the overspeed board.

3.7.2 Controller Card LEDs

Fourteen LEDs are mounted on the controller I/O and CPU boards for factory-standard diagnostic purposes. See Table 3-5.

***Table 3-6**. I/O and CPU Board Controller LED Functions.*

I/O Board Controller LED Functions		CPU Board Controller LED Functions.	
CR# = LED	**Function**	**D#= LED**	**Function**
CR1	*Not Used*	D4	Index
CR2	*Not Used*	D5	Speed
CR3	Index	D6	Obstruction Sensor
CR4	*Not Used*	D7	*Not Used*
CR5	Nitrogen 2	D8	Start / Stop
CR6	DI Water	D9	N_2 Pressure OK
CR7	*Not Used*	D10	Door Seal
CR8	Motor Run	D11	Door Open
CR9	Heater	D12	Door Closed
CR10	*Not Used*	D13	Open / Close
CR11	Open Door	D14	N_2 Flow High
CR12	Alarm	D15	DI Flow High / Heater
CR13	Nitrogen 1	D16	DI Flow Low
CR14	Static Eliminator	D17	DI Pressure

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4 MAINTENANCE FREQUENCIES and PROCEDURES

This section includes the following maintenance precedes.

- PM Frequency (Section 4.1)
- Bowl Removal and Installation (Section 4.2)
- Door Adjustment Procedure (Section 4.3)
- Door Hinge Conversion (Section 4.4)
- Motor Removal and Install Procedure (Sec. 4.5)
- PFA Rod Maintenance (Section 4.6)
- Retaining Bar Tube Procedure (Section 4.7)
- Static Eliminator Test Procedure (Section 4.8)
- Resistivity Probe / Monitor Test (Section 4.9)
- Particle Troubleshooting (Section 4.10)

4.1 Preventive Maintenance Frequency

4.1.1 Daily Maintenance:

1. Clean the door seal with DI water and a lint-free cloth once per shift. Ensure cloth particles do not transfer onto the seal, ***do not*** use excessive pressure when wiping.

2. Inspect the door seal for nicks, wear, and proper positioning (check for leaks). Replace if necessary (PN 1070237.7).

3. Clean the cover and door with IPA and a lint-free cloth once per shift.

4. Check that the correct carrier is being used in the dryer.

5. Verify the resistivity level reaches the recommended level.

4.1.2 Weekly Maintenance:

1. Check that the door opens and closes properly. If necessary, perform the *1800-6 Door Adjustment Procedure, Section 4-3.*

2. Check that all rotor mounting screws are secure.

3. Run a complete cycle to check the operation of the dryer.

4. Check the dynamic pressure of all facilities.

5. Check all plumbing hardware for leaks.

4.1.3 Monthly Maintenance:

1. Rotate the PFA rods. If necessary, perform the *1800-6 PFA Rod Maintenance Procedure, Section 4.6*.

NOTE
The rotor will have Teflon sheaths or PFA rods depending upon the rotor type. Refer to the table in Section 4.7, *Retaining Bar Tube Replacement Procedure*.

2. Check all electrical wiring and connectors for wear and proper connections.

3. Inspect the process bowl and rotor for stains. If necessary, clean with a solution of DI water, 30% H_2O_2, and a small amount of IPA.
4. Perform amp tests on the blanket and N_2 heaters with a Fluke 30 clamp meter (or equivalent):
   - Position the probe around any wire on the blanket heater. The heater should draw at least 9 amps.
   - Position the probe around the N_2 heater supply wire. The N_2 heater should draw at least 1.2 amps.

4.1.4 Semi-Annual Maintenance:

1. Remove and replace the N_2 filter. Wipe the inside of the filter housing with IPA before installing the new filter (PN 4117955).
2. Remove and clean the labyrinth seal plate. Refer to the 1800-6 Process Bowl Replacement Procedure, Section 4.2).
3. Replace the rotor mounting screws (PN 1069258.1).
4. Remove the Index Cylinder. Inspect the cylinder for damaged roller bearings. Ensure that the rotor has less than 1-degree of play (movement) from left-to-right. Inspect the heart-shaped cam lobe for excessive wear. Replace the Index cylinder and cam lobe as needed.

4.2 Process Bowl Removal and Installation Procedure

The following procedure guides a technician in the removal and replacement of a damaged dryer process bowl.

4.2.1 Tools Required

- Slotted screwdriver
- Phillips screwdriver
- Torque screwdriver
- Hex wrench set
- Adjustable wrench
- Rotor screw tool
- Diagonal cutters
- Channelock pliers
- Ratchet wrench with sockets
- Hub spacing tool (0.080 - 0.150”)
- 910 Loctite adhesive or equivalent
- Cleanroom wipes

4.2.2 Parts List

- Process bowl (PN 1073408.1)

4.2.3 Bowl Removal Procedure

1. Ensure the quality of the drain-area welds of the replacement bowl are adequate before proceeding.

2. Move the main power circuit breaker to the full down and off position.

3. Disconnect the power cord from the power source.

4. Turn off the CDA, N2, and DI water supply to the SRD.

5. Disconnect all cables and plumbing from rear external panel of SRD.

6. Remove the SRD cover.

7. Slide the SRD out on its rails.

8. Refer to Figures 4-1 and 4-2. Perform the steps in order.

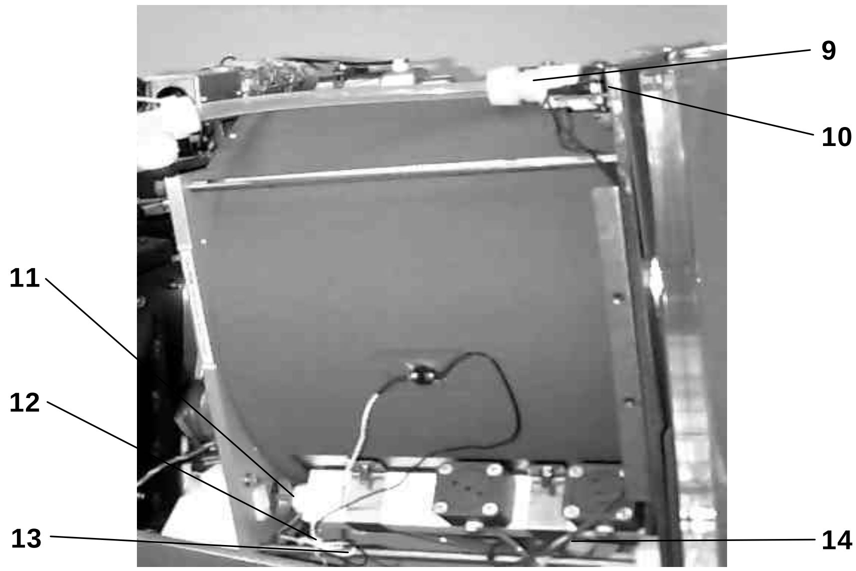

***Figure 4-1**. Steps 9 through 14 of Section 4.2.3 continue below.*

9. Disconnect the ½-inch tubing from the blow-off block.

10. Disconnect the wires from the door micro-switch.

11. Disconnect the 3/32-inch tubing from the DI water manifold purge.

12. Cut the wire tie.

13. Disconnect PJ204

14. Disconnect the green and yellow 1/8-inch tubing from the DI water manifold.

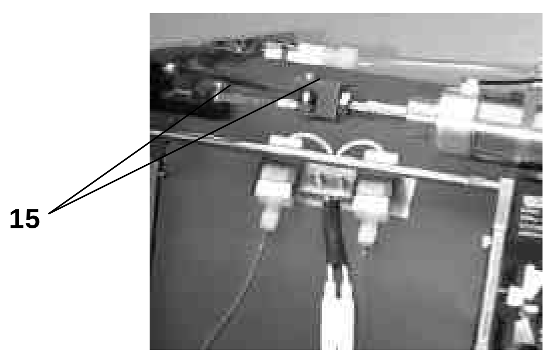

***Figure 4-2**. Step 15 of Section 4.2.3 continues below.*

15. Remove the shoulder screws.

16. Disconnect the 3/8-inch DI water tubing (PV6) from the inner side of DI/N2 Manifold (under the bowl).

NOTE

Ensure the flow restrictor remains inside the $^{3}/_{8}$-inch tubing after disconnecting.

17. Disconnect the 3/8” N_2 tubing (PV4) from the inner side of DI/N2 Manifold (under the bowl).

18. Remove the door assembly. To remove the assembly, remove three shoulder screws (Figure 4-3).

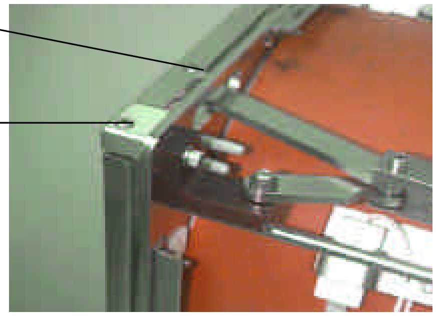

***Figure 4-3**. Removing the door assembly.*

19. Insert a cleanroom wipe into the bowl drain hole.

20. Remove the lower door hinge blocks.

NOTE
A heat source may be required to separate the retainer ring from the gasket.

21. Remove the Door Seal Ring and Door Seal Gasket from the front plates (remove 12 screws).

22. Remove the lower blue Verteq logo cover plate (remove screw).

23. Remove the upper blue cover with model number (remove screw, washer and nut).

24. Remove screw securing the upper left plate to the top left tie rod.

25. Remove screw securing the upper right plate to the top right tie rod.

26. Loosen, but do not remove, the tie rod nut (Figure 4-4).

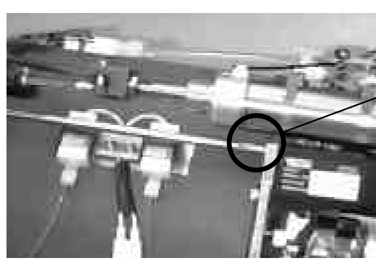

***Figure 4-4**. Loosen, but do not remove, the tie-rod nut.*

27. Remove the static eliminator manifold from the bowl, see Figure 4-5.

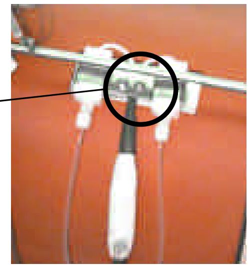

Figure 4-5*. Loosen, but do not remove, the tie-rod nut.*

28. Disconnect the 2-inch drain tube where it connects at the drain box.

29. Remove the Rotor from the Hub Shaft with the rotor screw tool (remove 4 screws).

30. Loosen 2 set screws from the Hub Shaft.

NOTE

Do not loosen the 3/16-inch key when removing the Hub from the Bowl.

31. Remove the Hub from the motor shaft.

NOTE

Do not loosen the black gasket located in the N_2 inlet hole to the process bowl.

32. Remove the Labyrinth Seal Plate (remove 8 screws and washers).

33. Remove the bowl from the SRD and place on a safe working table.

CAUTION

POTENTIAL PRODUCT OR EQUIPMENT DAMAGE!

Do not over-tighten screws when installing parts onto the replacement bowl. Damage to the interior of the bowl may result.

34. Remove the N_2 Blowoff Block (remove 2 nuts, washers and lock washers), then transfer and install onto the replacement bowl.

35. Remove the DI/N_2 Manifold, then transfer and install onto the replacement bowl.

36. Remove the 4” L-bracket from the top of the front plates (remove 2 screws).

37. Remove the Front Plates from the bowl and install onto the replacement bowl.

38. Install the L-bracket to secure the front plates but do not fully tighten screws.

39. Install the Door Seal Ring and Door Seal Gasket onto the replacement bowl (12 screws). Ensure the larger lip of the seal is facing inward.

40. Tighten the 2 screws to secure the L-bracket.

4.2.4 New Process Bowl Installation Procedure

1. Position the replacement bowl onto the SRD.

2. Insert a cleanroom wipe into the bowl drain hole.

3. Install the lower door hinge block but do not fully tighten.

4. Install the lower blue logo plate but do not fully tighten.

5. Connect the front plate to the upper tie rods (2 screws).

6. Reconnect the Static Eliminator probes, bracket and nuts.

7. Tighten all 4 tie rod screws.

8. Install the upper blue cover to the front plate (1 screw, washer and nut).

9. Insert the black gasket into the N_2 inlet hole.

NOTE
Clean the Labyrinth Seal Plate before installation. Inspect the O-rings for damage and ensure they are positioned correctly between the plate and bowl surface on installation. Also ensure the drain channel is at the 6 o'clock position.

10. Install the Labyrinth Seal Plate (8 screws). Torque the screws to 24 in/lb.

NOTE
The hub spacing tool (Figure 4-6) is used to set the clearance for both 6-inch (150mm) rotors and 8-inch (200mm) rotors. Use the 0.080-inch side of the tool for 6-inch rotors and 0.150-inch side for 8-inch rotors.

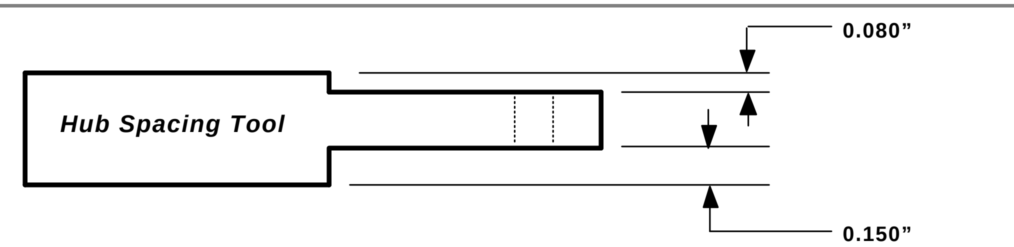

Figure 4-6*. Hub spacing tool dimensions.*

11. Fasten the hub spacing tool to the hub with any of the four hub mounting screws. Ensure the correct side of the tool faces and extends over the labyrinth seal plate (Figure 4-7.)

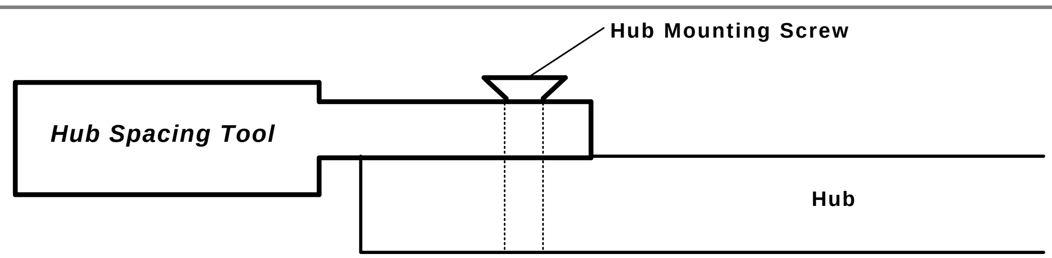

Figure 4-7*. Hub spacing tool dimensions.*

NOTE
Ensure the key is placed in the keyway before installing the hub onto the motor shaft

12. Position the hub onto the motor shaft.

CAUTION

POTENTIAL PRODUCT OR EQUIPMENT DAMAGE!

The following hub clearance procedure is critical and must be closely followed in order to avoid damage to the labyrinth seal plate and potential contamination of the bowl.

NOTE
When properly positioned, the hub spacing tool will rotate freely and make no contact on the labyrinth seal. However, when applying pressure, the tool will make contact with the labyrinth seal plate's highest point.

13. Rotate the hub until the spacing tool just makes contact with the labyrinth seal plate's highest point.

14. Tighten the key set screw, then the horizontal motor shaft set screw. Torque both screws to 45 in/lb.

15. Remove the spacing tool.

16. Install the rotor onto the hub (4 screws) and torque to 60 in/lb.

17. Install the Door Assembly to the door hinge blocks (2 hex-head shoulder screws).

18. Connect the 2" drain tubing to the drain box.

19. Connect the wires to the Door Microswitch (blue/N.O.; brown/COM).

20. Connect the blanket heater connector (PJ204).

21. Connect 3/8" tubing to the N_2 manifold input. Ensure the flow restrictor is installed.

22. Remove the cleanroom wipe from the bowl drain hole.

23. Ensure the sealing and grabber ferrules are positioned correctly when all tubing is reconnected. See Figure 4-8.

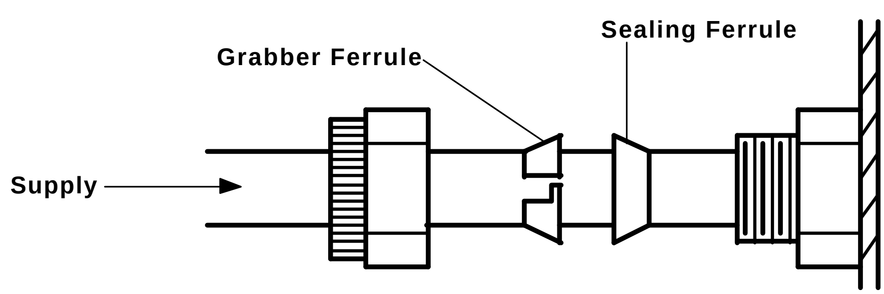

***Figure 4-8**. Sealing and Grabber Ferrules.*

24. Connect 3/8” tubing to the DI manifold.

25. Connect 3/32” tubing to the DI/N_2 manifold purge.

26. Connect the green and yellow tubing to the DI/N_2 Manifold Block. Note that the yellow tubing is at front.

27. Connect 1/2” tubing to the Blow-off block.

28. Install the shoulder screw to the Actuator Door Link.

29. Secure any wires and tubing with tie wraps as necessary.

30. Turn the facility supplies ON.

31. Connect the power cord.

32. Switch the unit ON.

33. Run a recipe to ensure correct operation of the system.

34. Install the SRD cover.

This ends the Process Bowl Removal Procedure.

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4.3 Door Adjustment Procedure

Perform the Door Adjustment Procedure when HELP codes **1000**, **4000**, or **8000** occur, and after performing a door hinge conversion.

4.3.1 Tools Required

- Slotted screwdriver
- Phillips screwdriver
- Tweeker

4.3.2 Adjustment Procedure

1. Ensure the facility CDA supply pressure is 80 psi.

2. Figure 4-9 is an overview of the location of the components related to this procedure.

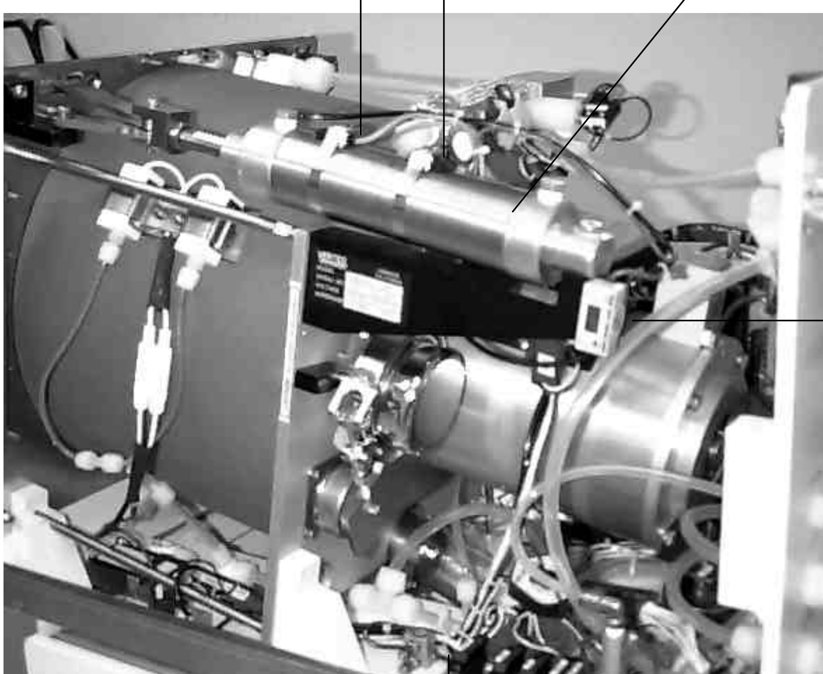
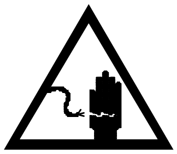


Figure 4-9. *Door component locations.*

WARNING



HAZARDOUS VOLTAGE IS PRESENT!

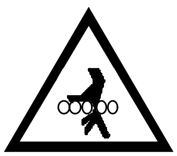
WARNING TYPE 4: Equipment is energized. Live circuits are exposed and accidental contact is possible. Voltage potentials are GREATER than 30 volts or radio frequency energy is present

To ensure operator, equipment, and product safety, follow the instructions and use care when operating this equipment.

3. Remove the SRD cover.

4.3.2.1 Bimba Cylinder Reed Switch Adjustment

WARNING



MECHANICAL PINCH POINTS MAY BE PRESENT!

If the rear reed switch is mis-adjusted, the door obstruction sensing function is inoperative and a hazardous pinch-point condition will exist.

To ensure operator safety in the following procedure, **do not** put hands inside the door when it is closing. Follow the instructions and use care when operating this equipment.

NOTE

- Use the DOOR OPEN / CLOSE pushbutton when opening and closing the door during the following adjustment steps.
- If this application uses a robot, ensure the door opens fully for robot arm access.

1. Open the door. Observe the red LED on the **front** reed switch as the door opens. The LED should illuminate when the door is at 90% or greater of its full travel. If it does not, keep the door fully open and slowly move and relocate the reed switch to a position where the LED remains on.

2. Close the door, then relocate the **rear** reed switch to the farthest point back on the Bimba cylinder until the LED illuminates. Open and close the door several times to verify proper positioning of the switch.

4.3.2.2 Digital Pressure Sensor Set-up

1. Set the Digital Pressure Sensor **UNIT** selector switch to the '**p**' position to read values in psi. Refer the Figure 4-10.

2. Adjust the pressure setting to **21 psi** by holding down the **SET** button and adjusting **P SET** with a small screwdriver or tweeker.

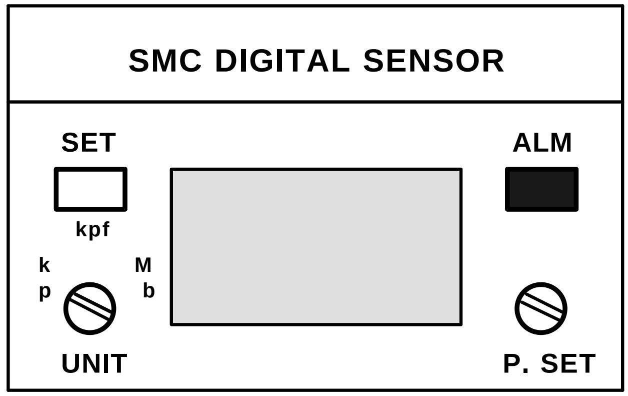


Figure 4-10. *Digital Pressure Sensor.*

4.3.2.3 Flow Control Valve Adjustment

1. Open the door. Observe the ALM (alarm) LED on the Digital Pressure Sensor as the door opens. The LED should illuminate when the door has reached at least 75% of its fully opened position. If not, loosen the screw and adjust the lower flow control valve (with brown tubing) (refer to Figure 4-9). Repeat this step until the condition is met, however, wait until 80 psi is read on the Digital Pressure Sensor before re-opening door.

2. Close the door. The pressure reading will change to display the facilities pressure (80 psi).

3. Open and close the door. Observe the ALM LED as the door closes. The LED should illuminate when the door has reached 75% of its fully closed position. If it does not, adjust the upper flow control valve (with black tubing). Repeat this step until the condition is met.

4. With both conditions met, tighten the jamb-nuts on both flow control valves.

4.3.3 Door Functional Test

1. Allow the door to remain open for approximately 5 minutes after performing the above adjustment procedure.

CAUTION

POTENTIAL PRODUCT OR EQUIPMENT DAMAGE!

Do not place tubing over the door seal in the following step or damage to the seal may occur.

2. To check the door obstruction function, position 1/2” tubing or similar as an obstruction to prevent the door from fully closing, then close the door.

3. If the door does not open when the obstruction has been sensed, perform the adjustment procedure above.

4. Run a recipe to ensure correct operation of the system.

5. Install the cover.

This ends the Door Adjustment Procedure.

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4.4 Door Hinge Conversion

The following procedure changes the direction the door currently opens.

4.4.1 Tools Required

- Slotted screwdriver
- Phillips screwdriver
- Hex wrench set
- Tie wraps
- Cleanroom wipes

4.4.2 Parts List

4.4.2.1 Right Hand Door Hinge Parts:

- Door Frame (PN 1071726.1)
- N_2 Heater Assembly (PN 1071465.1)
- Actuator Door Link (PN 1071724.3)
- Flange Bearings (2) (PN 4124136)
- Pivot Link Bracket (PN 1071722.1)
- Top Left Logo Cover (PN 1072115.1)
- Bottom Left Logo Cover (PN 1072116.1)

4.4.2.2 Left Hand Door Hinge Parts:

- Door Frame (PN 1071726.3)
- N_2 Heater Assembly (PN 1071465.2)
- Actuator Door Link (PN 1071724.3)
- Flange Bearings (2) (PN 4124136)
- Pivot Link Bracket (PN 1071723.1)
- Top Right Logo Cover (PN 1072115.2)
- Bottom Right Logo Cover (PN 1072116.2)

4.4.3 Conversion Procedure

1. Move the main power circuit breaker to full down and off position.

2. Disconnect the power cord from the power source.

3. Turn off the CDA and N_2 supply to the SRD.

4. Remove the SRD cover.

NOTE
The following procedure refers to a right-hand to left-hand door conversion. This procedure is also used for the left-hand to right-hand application.

5. Use the manual relief valve to open the door. See Figure 4-11.

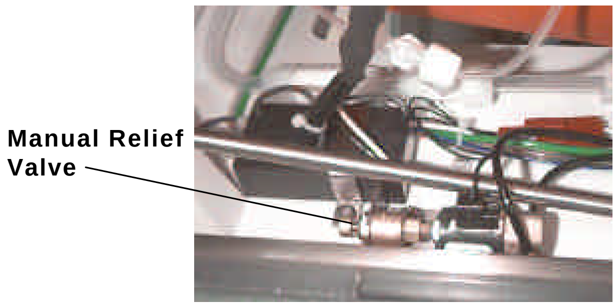

Figure 4-11*. Manual relief valve location.*

6. Remove the wafer carrier and insert a cleanroom wipe into the bowl drain hole.

7. Remove the upper and lower blue plastic Verteq logo cover plates (remove 2 hex socket screws). Remove any residual adhesive with IPA. (Do not scrape adhesive off with a metal tool).

8. Remove the door assembly (remove 3 shoulder screws). See Figure 4-12.

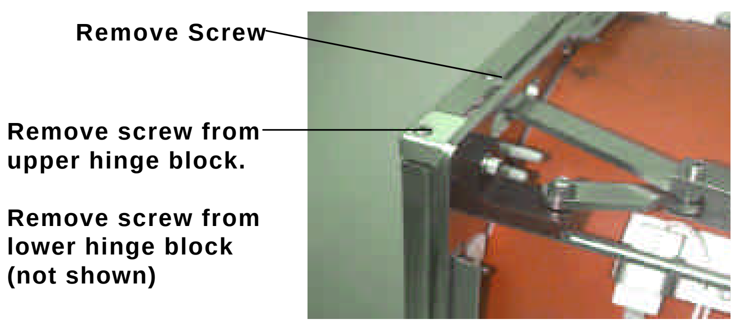

Figure 4-12*. Removing the door assembly.*

9. Remove the door frame (remove two socket head screws) from the clear door panel. Install the replacement door frame on the panel.

10. Remove the door microswitch actuator pin and install into the tapped hole provided in the adjacent quadrant.

11. Remove the top and bottom door hinge blocks. See Figure 4-13.

Figure 4-13. *Removing the hinge blocks.*

12. Remove the door linkage shoulder screw (Figure 4-14) that secures the shorter link on the pivot link bracket.

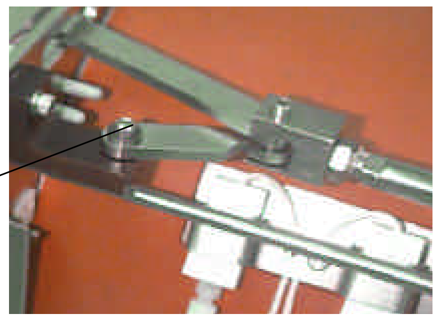

Figure 4-14. *Removing the door linkage shoulder screw.*

13. Remove the pivot link bracket (remove screw).

14. Remove the door microswitch and bracket from the unit (remove 2 screws).

15. Remove the microswitch from the bracket, then turn it over and re-mount onto the bracket.

16. Install the microswitch and bracket on the opposite side of the unit. Route the wiring under the bowl assembly.

17. Install the two door hinge blocks by reversing the top and bottom positions. (The upper right becomes lower left and lower right becomes upper left).

18. Install the new pivot link bracket.

19. Disconnect all pneumatic tubing to the door cylinder and digital pressure switch.

20. Disconnect the wiring to both reed switches and digital pressure switch (disconnect PJ200, PJ201 and PJ221).

21. Remove the screw, nut and washer from the top left tie rod.

22. Remove the screw from the top right tie rod.

23. Remove the digital pressure switch support bracket from the cylinder link bracket (2 screws).

24. Remove the digital pressure switch from the bracket and position so the display window will face inboard when the cylinder is installed on the opposite side.

25. Remove the Bimba cylinder and bracket assembly. Refer to Figure 4-15.

***Figure 4-15**. Removing the Tie-rod.*

26. Disconnect all wiring and plumbing from the nitrogen heater assembly (cut tie wraps as necessary).

27. Disconnect pin 2 (white wire) of PJ203.

28. Remove the nitrogen heater assembly (remove 2 socket cap screws).

29. Remove pressure switch PS3 and install it on the new nitrogen heater assembly, Figure 4-16.

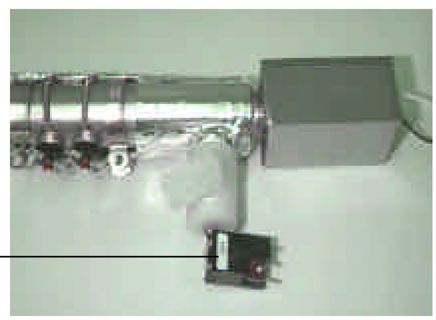

***Figure 4-16**. Removing pressure switch PS3.*

30. Install the new nitrogen heater assembly, then connect all wiring and plumbing.

NOTE

The 3/8-inch tubing from the heater assembly may need to be trimmed or extended to avoid contact with the motor shaft.

31. Install the Bimba cylinder and bracket assembly onto the opposite side of the SRD.

32. Install the short pivot link attached to the Bimba cylinder arm.

33. Connect all pneumatic tubing to the Bimba cylinder and digital pressure switch.

34. Connect the wiring to the front reed switch (PJ200), rear reed switch (PJ201), and digital pressure sensor (PJ221).

35. Install countersunk hex head screw, nut and washer to the top right tie rod.

36. Install new logo plates.

37. Install door assembly.

38. Align the door microswitch.

39. Secure any loose wiring with tie-wraps.

40. Turn on the CDA and N_2 supply to the SRD.

41. Connect the power cord.

42. Switch the unit ON.

43. Close the door. Verify there is a complete seal around the front of the bowl.

44. Perform the *1800-6 SRD Door Adjustment Procedure*.

45. Run a recipe to ensure correct operation of the system.

46. Install the SRD cover.

This ends the Door Hinge Conversion Procedure.

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4.5 Motor Removal and Installation Procedure

4.5.1 Tools Required

- Phillips screwdriver
- Ratchet set

4.5.2 Parts List

- Motor (PN 1070277.1)

4.5.3 Motor Removal Procedure

1. Move the main power circuit breaker to the full down and off position.

2. Disconnect the power cord from the power source.

3. Remove the SRD cover.

4. Figure 4-17 is an overview of component locations for this procedure.

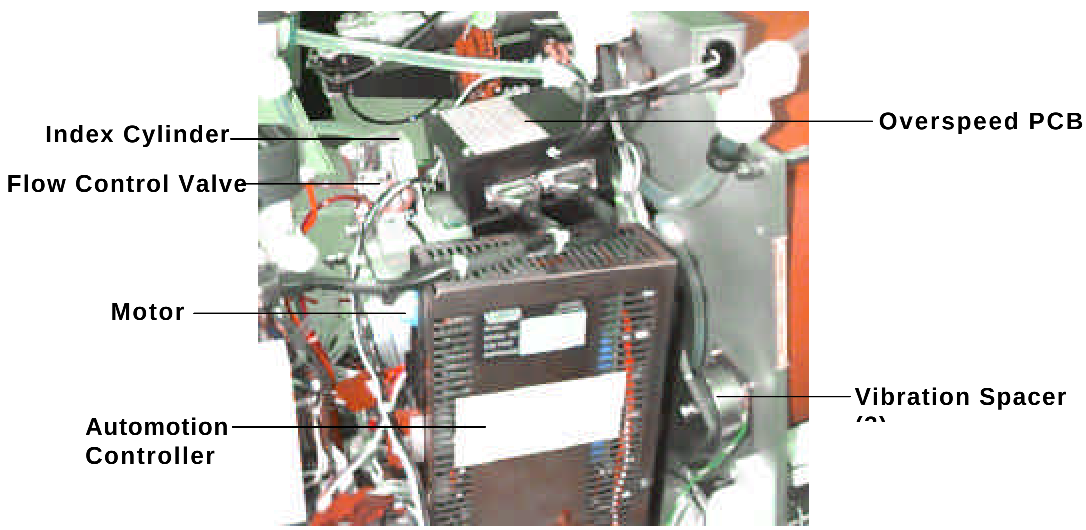

Figure 4-17*. Motor component locations.*

5. Remove the automotion controller (remove 2 mounting screws and disconnect PJ1, PJ2, PJ3, PJ4, and PJ9).

6. Disconnect two data cables (JP2 and JP3) from the Overspeed PCB.

7. Remove the Overspeed PCB cover (4 screws).

8. Disconnect TB1 from the Overspeed PCB.

9. Disconnect PJ206 from the underside of the motor.

10. Disconnect PJ210.

11. Disconnect the purple tygon tubes from the index cylinder.

12. Disconnect the pink tygon tubes from the flow control valve.

13. Remove three mounting screws, lock washers and vibration spacers.

14. Remove two mounting screws and star washers from rear bracket.

15. Lift and remove the motor.

4.5.4 Motor Installation Procedure

1. Position the replacement motor into the unit.

2. Insert all five motor mounting screws.

3. Tighten the front three mounting screws.

4. Tighten the rear two mounting screws.

5. Connect the pink tygon tubes to the flow control valve.

6. Connect the purple tygon tubes to the index cylinder.

7. Connect PJ210 and PJ206.

8. Connect TB1 to the Overspeed PCB.

9. Install the Overspeed PCB cover (4 screws).

10. Connect the two data cables (JP2 and JP3) to the Overspeed PCB.

11. Install the automotion controller and connect PJ1, PJ2, PJ3, PJ4, and PJ9.

12. Connect the power cord.

13. Switch the unit ON.

14. Run a recipe to ensure correct operation of the system.

15. Install the SRD cover.

This ends the Motor Removal Procedure.

4.6 PFA Rod Maintenance Procedure

Perform this procedure when rotating or replacing the 8-inch long PFA rods. The rods should be removed and rotated ¼ turn every month and replaced after 4 months of use.

4.6.1 Tools Required

- Phillips screwdriver
- Modified vise grip-type crimping tool (PN 1075752.1)
- Stainless steel mandril (PN 1074862.1)
- Wagner force gauge “push-pull” model FDK40 with tapered extension
- Rotor screw tool
- Single-edge razor blade or x-acto knife
- Cleanroom wipes
- IPA lubricant or equivalent

4.6.2 Parts List

- PFA Rod kit (PN 1075200.3)

4.6.3 Rod Removal Procedure

1. Move the main power circuit breaker to the full down and off position.

2. Disconnect the power cord from the power source.

3. Insert a cleanroom wipe into the bowl drain hole.

4. Remove the rotor (remove 4 mounting screws).

5. Remove the rod from the channel by pushing from the front end of the rotor with a suitable tool.

4.6.4 Rod Installation Procedure

CAUTION

POTENTIAL PRODUCT OR EQUIPMENT DAMAGE!

The crimping tool should never be used without the mandril in position.

1. Insert the mandril into the front of the vacated rod channel. Leave ½-inch of the mandril protruding from the rotor.

2. Fold a cleanroom wipe in half and wrap around the tube where the crimping tool will be placed.

3. Adjust the crimping tool so that the jaws meet, then crimp the tube 1 inch from the front of the rotor. If the crimping tool closes too easily, adjust the tool 1/2 turn clockwise and perform the crimp again. See Figure 4-18.

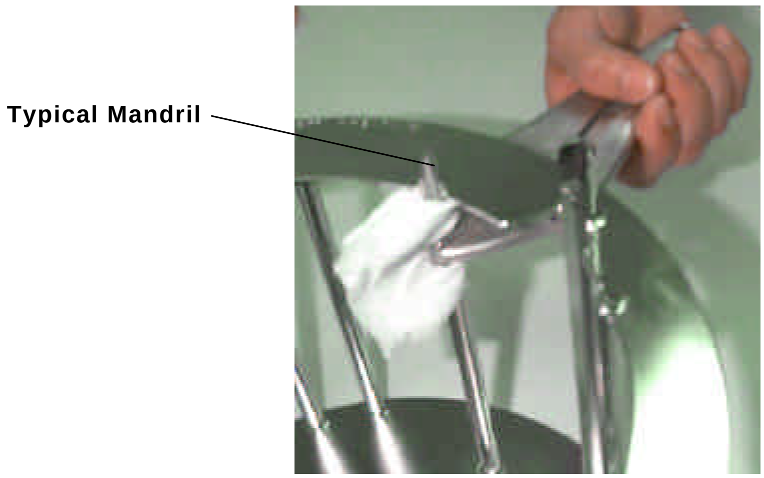

Figure 4-18*. Correct positioning of the crimping tool.*

4. Remove the mandril.

NOTE

Rotate all existing PFA rods 90° prior to installation.

5. Wipe down the new or existing PFA rod and rod channel with lubricant.

6. Insert the rod into the channel from the front of the rotor. Trim any excess length.

NOTE

Use only the force gauge when performing the push test - never use your hands.

7. At ambient temperature, perform a “push test” on the PFA rod with the force gauge. Push squarely on the rod while avoiding contact with the steel channel. If the rod moves with less than 10lb of force, remove it and perform another crimping.

8. Perform the replacement procedure for each rod.

9. Install the rotor (4 screws).

10. Connect the power cord.

11. Power the dryer on.

12. Run a recipe to ensure correct operation of the system.

13. Install the SRD cover.

4.7 Retaining Bar Tube Replacement Procedure

There are three types of rotor available for the 1800-6 dryer.

Type	Rotor Description
A	Rotor has wafer support tubing that slides on from the rear of the rotor.
B	Rotor has wafer support tubing that slides on from the front of the rotor.
C	Rotor uses a solid PFA rod that slides from the front of the rotor into a stainless steel tube.

NOTE
The Retaining Bar Tube Replacement Procedure or the PFA Rod Maintenance Procedure is used for rotor maintenance depending upon the type of rotor in the dryer. Rotor types “A” and “B” have Teflon tubes that shall be replaced following the steps prescribed in the Retaining Bar Tube Replacement Procedure. Rotor type “C” has PFA rods inserted in the rotor and shall be maintained according to the PFA Rod Maintenance Procedure.

The Teflon tube on the retaining bar must be replaced according to the Preventive Maintenance Schedule. The replacement tubing must be FEP Teflon, 5/16" OD, 1/4" ID.

4.7.1 Procedure

1. Run a Dry-Only recipe to heat the rotor.

2. Remove the rotor from the bowl. See Section 4.2, *Bowl Removal and Installation Procedure*.

3. Use a heat gun to expand the tubing. Slide the expanded tube off the bar and out the hole in the back or front of the rotor and discard the tube.

4. Use a small amount of IPA to lubricate the bar. Slide the new tube onto the bar.

5. Reinstall the rotor in the bowl. See Section 4.10, *Rotor Removal and Installation Procedure*.

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4.8 Static Eliminator Test Procedure

4.8.1 Tools Required

- Static Eliminator Power Supply test kit (PN 1077602.1):
- 10 Gigohm load box (PN 4121295)
- six foot extension cable (PN 4121296)
- two “Y” connectors (PN 4121297)
- hand-held static meter (TI 300) (PN 4121294)
- two digital multimeters (DMMs)

4.8.2 Test Set-Up

1. Move the main power circuit breaker switch to the full down and off position.

2. Disconnect the power cord from the power source.

3. Remove the cover.

CAUTION

POTENTIAL PRODUCT OR EQUIPMENT DAMAGE!

Observe polarities at all times. Gray/Red lead of static eliminator power supply is positive (+) and Gray/White is negative (-).

4. Remove the heat shield to access the static eliminator electrical probes (Figure 4-19). Disconnect probes and insert into either “Y” connector of the extension cable.

5. Connect the extension cable probes into the static eliminator manifold connectors (Figure 4-19).

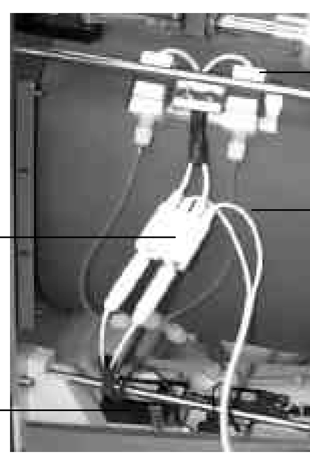

Figure 4-19*. Static eliminator with probes.*

6. Connect the probes from the 10 Gigohm load box into the female connectors of the extension cable (Figure 4-20).

7. Connect the probes of the Digital Multimeters to the 10 Gigohm load box and tighten. Set the meters to read DC voltages (Figure 4-20).

Figure 4-20*. Test devices.*

WARNING

HAZARDOUS VOLTAGE IS PRESENT!

WARNING TYPE 4: Equipment is energized. Live circuits are exposed and accidental contact is possible. Voltage potentials are GREATER than 30 volts or radio frequency energy is present

To ensure operator, equipment, and product safety, follow the instructions and use care when operating this equipment.

8. Plug the 10 Gigohm load box into a power outlet.

4.8.3 Test Procedure

NOTE

If any of the voltages measured are not within the specified tolerance, stop and replace the static eliminator power supply.

1. Connect the power cord.

2. Move the main power circuit breaker to the full up and on position.

3. Open the door and wait one minute to allow voltages to stabilize and the N_2 blowoff to stop.

4. Observe the DMM readings. (One meter will display a positive value and the other a negative value.) Both meters should display **.600 ± 0.1 VDC**.

5. Close the door and wait 3 minutes.

6. Observe the DMM readings. The (**+**) meter should display between **.450** and **.550 VDC**. The (**-**) meter should display between **.340** and **.460 VDC**.

7. Disconnect the (**-**) lead from the static eliminator manifold. The (**+**) meter should display **less than .740 VDC**.

8. Connect the (**-**) lead to the static eliminator manifold. Program the following recipe:

Rinse Cycle	Dry Cycle
DI	NITROGEN
NITROGEN	HEATER
RPM at 300 rpm	STATIC
TIME for 60 seconds	RPM at 1200 rpm
	TIME for 240 seconds

NOTE

The following system run requires a full wafer load.

9. Start the recipe and observe the meters during the rinse cycle. Both the (**+**) and (**-**) multimeters should display **less than .010 VDC**.

10. Verify there is no arcing in the bowl during the initial drying.

11. Observe the multimeters at the end of the dry cycle. The (**+**) meter should display between **.400** and **.500 VDC**. The (**-**) meter should display between **.310** and **.410 VDC**.

12. Open the door and wait one minute to allow the voltages to stabilize.

13. Observe the DMM readings. Both multimeters should display **.600 ± 0.1 VDC**.

14. Set the hand-held static meter to the **X1** range.

15. Hold the hand-held static meter so the top is approximately 1” from the inside surface of the door (Figure 4-21). The reading should be **less than 500 VDC** of either polarity. The charge may be higher near the outer edge of the door.

Figure 4-21. *Static meter held in correct location.*

16. Hold the static meter approximately 1-inch in front of the cassette in the bowl. The reading should be **less than 500 VDC** of either polarity.

***Figure 4-22**. Static meter measuring the cassette.*

17. Disconnect both leads from the static eliminator manifold. Both the (**+**) and (**-**) multi meters should display **0.9** to **1.05 VDC**.

18. Move the main power circuit breaker to the full down and off position.

19. Disconnect the power cord from the power source.

20. Connect the electrical leads of the power supply to the static eliminator manifold.

21. Install the heat shield.

22. Connect the power cord.

23. Move the main power circuit breaker to the full up and on position.

24. Run a recipe to ensure correct operation of the system.

This ends the Static Eliminator Test Procedure.

4.9 Resistivity Probe and Monitor Test Procedure

This procedure uses a known-good resistivity input signal (dummy-load test probe) to isolate the failing device in resistivity monitoring (Figure 4-23). The major devices to troubleshoot are:

- the resistivity monitor
- the resistivity probe (clean and/or replace)
- facility DI water

Figure 4-23. *Resistivity monitoring devices.*

4.9.1 Tools Required

- Test, Resistivity Probe Tester (P/N 1079159.1) (10 MΩ Dummy-Load)
- a small container of 10:1 solution of HCl

4.9.2 Resistivity Specification

The resistivity should read **10** megohms ± **0.2** megohms on the control panel during a rinse step.

4.9.3 Test Set-Up

1. Move the dryer's main power circuit breaker to the full down and off position.

2. Disconnect the existing resistivity probe from the resistivity monitor (Figure 4-23).

3. Assemble the dummy-load test probe and connect it to the existing resistivity monitor (Figure 4-24).

- connect the 10MΩ dummy-load test probe (**1**) to the test cable end (**A**)
- connect the test cable end (**B**) to input of the resistivity monitor (Figure 4-23)

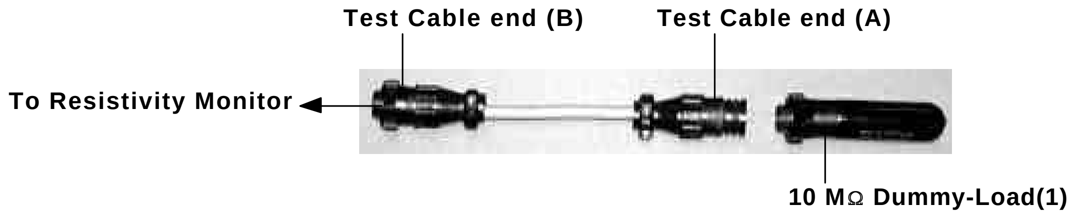

Figure 4-24. *10MΩ Dummy-Load Test Probe assembly instructions.*

4.9.4 Troubleshooting Procedure

4.9.4.1 Testing the Existing Resistivity Monitor

1. Move the dryer's main power circuit breaker to the full up and on position.

2. Ensure that Resistivity is enabled ON during the rinse cycle.

3. Perform a Rinse-only process in the dryer.

4. View the control panel and record the resistivity value.

5. Interrupt or stop the process.

6. If the resistivity value is outside the stated specification (10 megohms, ± 0.2 megohms), then replace the existing resistivity monitor with a new one. (Send the failed resistivity monitor to Verteq for repair).

7. Start at Section 4.9.4.1 and test the new resistivity monitor using the 10MΩ dummy-load. This will ensure a 'known-good' resistivity monitor. If the resistivity value is correct, then go to Section 4.9.4.2.

4.9.4.2 Testing the Existing Resistivity Probe

1. Move the dryer's main power circuit breaker to the full down and off position.

2. Ensure that the 10MΩ dummy-load test probe is disconnected.

3. Reconnect the existing resistivity probe to the new resistivity monitor.

4. Move the dryer's main power circuit breaker to the full up and on position.

5. Ensure that Resistivity is enabled ON during the rinse cycle.

6. Perform a Rinse-only process in the dryer.

7. View the control panel and record the resistivity value.

8. Interrupt or stop the process.

9. If the resistivity valve is within the specification then **end**.

10. If the resistivity value is out of the specification, then remove the resistivity probe and dip the metal tip into a 10:1 solution of HCl for 30 seconds. Rinse the probe in DI water for three minutes.

11. If this is the first pass through this procedure, go to Section 4.9.4.2 and retest. If this is the second or third pass through this procedure, go to step #12 below.

12. If the resistivity value is out of specification after cleaning the metal tip and retesting, then replace the resistivity probe and retest at Section 4.9.4.2. If the resistivity value is still out of specification, then check the facility DI water source.

13. Other areas to check if the resistivity value is still out specification is the dryer bowl for contamination.

14. Call the Verteq Technical Assistance Group (TAG) if the above procedure does not isolate the resistivity problems.

This ends the Resistivity Probe and Monitor Troubleshooting Procedure.

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4.10 Particle Troubleshooting Procedures–SRD 1800–6

4.10.1 Overview

In order to prove or eliminate the SRD as the device that is causing high particle count in the process, the following tests must be performed. After each test is run, decisions are made based on particle count.

1. **Initial Test Setup:** These procedures establish a known good set of parameters and conditions for the device under test that must be met before troubleshooting can begin.
2. **Troubleshooting Procedures:** After the ‘Initial Test Setup’ has been verified, specific procedures are implemented. Depending on where on the wafers high particle count is found, a decision can be made as to the cause. Each test is run an average of five (5) times. A brief discussion follows on the types of procedures used:

   a) **Pre-cleaning Routine**. As part of the initial test setup, this will ensure a clean cassette and ‘Hydrophilic’ test wafers.

   b) **Handling Test**. This will account for any particle count added due to the handling of the wafers outside of processing and is subtracted from the total add-ons to obtain the final particle count added by the SRD.

   c) A **‘Dry in–Dry Only’** recipe is run and particle count is taken and averaged over five tests and the amount of particles added due to *Handling* is subtracted from this total.

   d) A **‘Wet in– Dry Only’** recipe is run and particle count is taken and averaged over five tests and the amount of particles added due to *Handling* is subtracted from this total.

   e) A **‘Wet in–Rinse** and **Dry’** recipe is run and particle count is taken and averaged over five tests and the amount of particles added due to *Handling* is subtracted from this total.

If there is an increase of particles greater than acceptable levels after each troubleshooting step, then by measuring where on the wafers the particles are collecting a decision can be made as to the area or device that is most likely adding the particles.

4.10.2 Prerequisites

The following prerequisite helps declare that the SRD ***is*** or ***is not*** the device that is adding high particle count to the wafers:

‘Particle count is based on the amount of excursion from the original sales contract specification’.

4.10.3 Initial Test Setup #1 (Getting the SRD Ready)

The following checks and conditions must occur prior to performing particle count troubleshooting procedures on the SRD.

Precautions:

- *Minimize contact with the cassette.*
- *Use known good clean gloves.*
- *When loading and unloading cassette, do not touch the inside of the SRD's bowl or door with any part of your clothing.*

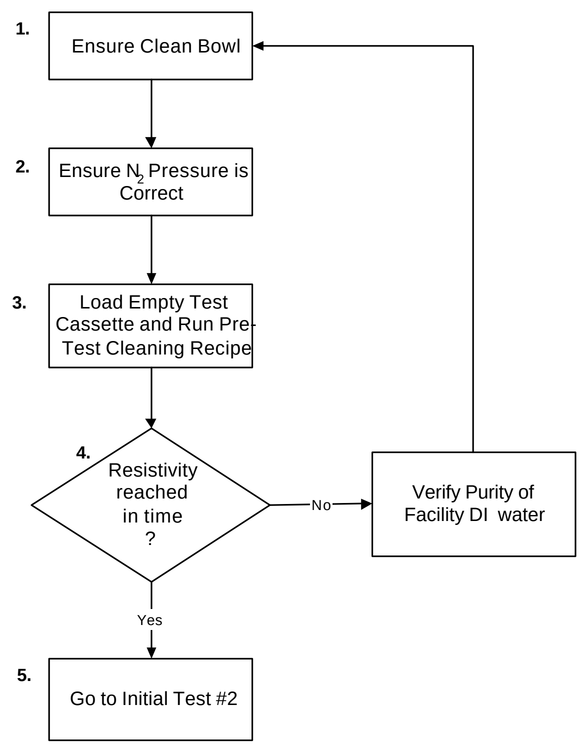
1. Ensure that the SRD bowl is clean. This may entail performing correct bowl cleaning procedures.

2. Ensure that facility N_2 pressure is at the correct level.

3. Load a known good, clean, and empty cassette (that will later hold the test wafers) into the SRD. Run the Pre-Test Cleaning Recipe with Resistivity set ON. See below.

4. If the resistivity is not reached within the allotted time, check the purity of the facility DI water, then go to step #1 of this procedure.

5. If resistivity is reached go to Initial Test Setup #2.



Pre-Test Cleaning Recipe (for cassette and SRD):

Rinse STEP	TIME	RPM	DI H_2O	N_2	STATIC	HEATER	RES.
1	60	50	ON	ON	OFF	ON	15 MegΩ
2	45	300	ON	ON	OFF	ON	15 MegΩ
Dry STEP							
1	240	1200	OFF	ON	ON	ON	OFF
2	240	500	OFF	ON	ON	ON	OFF

4.10.4 Initial Test Setup #2 (Getting the Test Wafers Ready)

The following checks and conditions must occur prior to performing particle count troubleshooting procedures on the SRD.

1. Ensure that the Metrology tool is functioning properly. Handle the test wafers properly, use vacuum wands (not tweezers).

2. Verteq recommends pre-cleaning the test wafers (usually three) in a solution of ammonia peroxide mixture (APM). The pre-cleaning process is as follow:

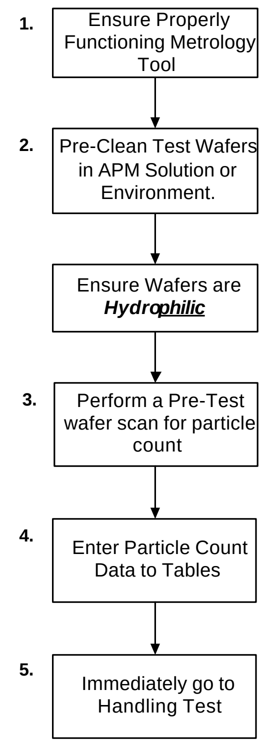
- **a.)** 10-minute dip in a,
- **b.)** APM concentration mix of H_2O:H_2O_2:NH_4OH at 5:1:1 (SCI)
- **c.)** Megasonic clean
- **d.)** Rinse and dry in a qualified SRD.

Ensure all three test wafers surfaces are hydrophilic. To do this, look at the test wafers during the rinse step of the above pre-cleaning process to ensure that the water is ***not*** sheeting off of the wafers.

3. Use the Data Collection Tables supplied in Section 4.9.9 for finding and keeping track of the particle count averages used in troubleshooting. Perform a Pre-Test particle count of the test wafers. Do not use wafers with particle counts >50 particles at ≥0.2 µm in size.

4. Enter the pre-scan particle count data to the table (See Table 4-1).

5. Immediately go to the Handling Test (Section 4.10.5) and start collecting particle count data using the tables at the end of this section.



This ends the Initial Test Setup.

4.10.5 Handling Test

This test establishes the amount of particles added to the wafers from operator handling, the cleanroom and metrology tool. The results of this test will be subtracted from the results of actual recipe testing in the SRD.

Precautions:

- *Minimize contact with the cassette.*
- *Use known good clean gloves.*
- *When loading and unloading cassette, do not touch the inside of the SRD's bowl or door with any part of your clothing.*

To perform this test:

1. Open the door of the SRD under test. Load the cassette with the three pre-scanned test wafers into the dryer. ***Do not run the SRD.*** Close the door.

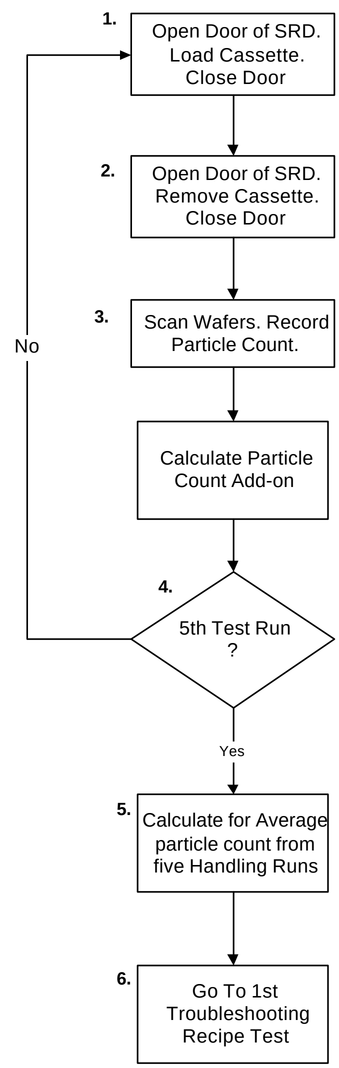
2. Open the door of the SRD and take out the cassette.

3. Scan the wafers and add this data to the Data Collection Table under the column *Handling Test Run*. See Section 4.10.9.1, Table 4-2. Calculate to particle count add-on (subtract the post-scanned number from the pre-scanned number).

4. Perform steps **1.** through **3.** four more times. After each Handling Run add and calculate the particle count data to Table 4-3.

5. Calculate for the average total particle count for the five Handling Runs. This total will be subtracted from the final particle count total of all troubleshooting recipe tests.

6. Go to the 'Dry-In, Dry Only' Troubleshooting Recipe Test.



This ends the Handling Test.

4.10.6 Troubleshooting Recipe Tests

Now that the average Handling particle count adder has been calculated, run the following recipe five times using the test wafers and the Data Collection Tables.

4.10.6.1 Dry-In, Dry Only Troubleshooting Recipe Test

Each time (5) this recipe is run, perform wafer scans and use the data collection tables to capture and calculate particle counts add-ons.

Precautions:

- *Minimize contact with the cassette.*
- *Use known good clean gloves.*
- *When loading and unloading cassette, do not touch the inside of the SRD's bowl or door with any part of your clothing.*

To perform this test:

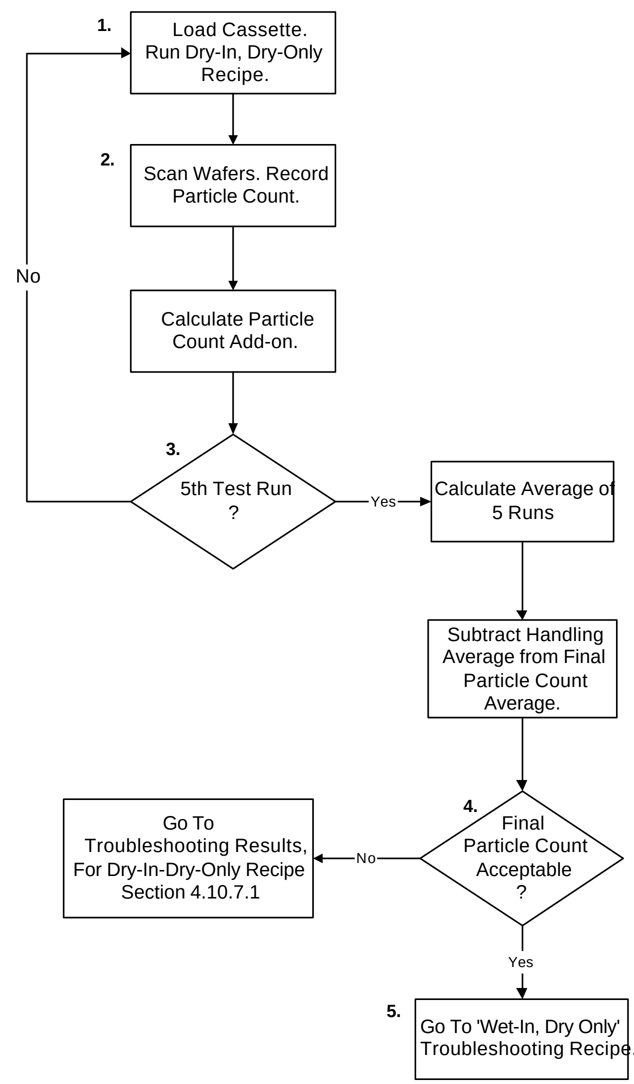
1. Place the test wafers in the SRD and run the Dry-In, Dry-Only recipe as configured in the table below.

2. After the first run, scan the test wafers and enter the data in the collection table, see Section 4.10.9.3. Calculate the particle count add-on (subtract the post-scanned number from the Handling Test final number).

3. After all five runs have been performed, calculate the average and subtract the Handling average from the final results (found in Section 4.10.9.2).

4. If the total particle count is unacceptable*, go to Section 4.10.7.1 for Dry-In, Dry-Only Troubleshooting Results.

5. If the total particle count is acceptable*, go to the second recipe test, Section 4.10.6.2, 'Wet-in, Dry Only'.



Dry-in, Dry-Only Recipe:

STEP	TIME	RPM	DI H_2O	N_2	STATIC	HEATER	RES.
1	240	1200	OFF	ON	ON	ON	OFF
2	240	500	OFF	ON	ON	ON	OFF

* ***'Particle count is based on amount of excursion from the original sales contract specification'.***

This ends the recipe troubleshooting tests for 'Hydrophobic' wafers.

4.10.6.2 Wet-In, Dry-Only Troubleshooting Recipe Test

Each time (5) this recipe is run, perform wafer scans and use the data collection tables to capture the particle counts.

Precautions:

- *Minimize contact with the cassette.*
- *Use known good clean gloves.*
- *When loading and unloading cassette, do not touch the inside of the SRD's bowl or door with any part of your clothing.*

To perform this test:

1. Pre-wet the test wafers in a known good, clean source of overflowing DI water for 30 seconds. Do not use any spray bars in this application.

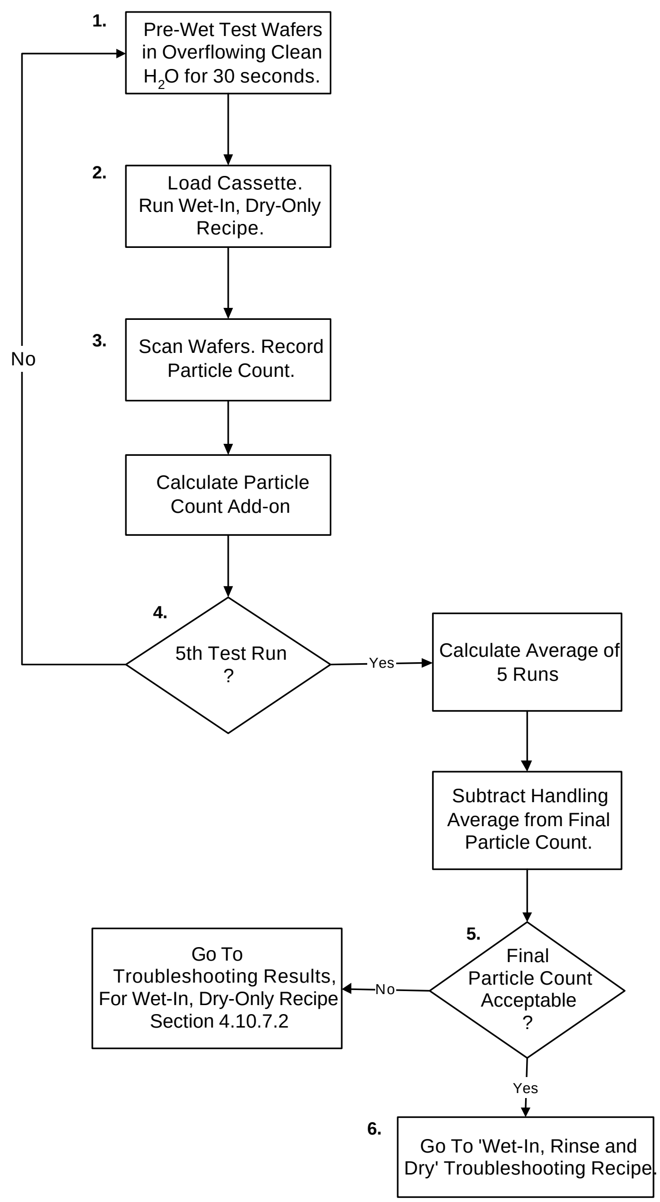
2. Place the test wafers in the SRD and run the 'Wet-In, Dry-Only' recipe as configured in the table below.

3. After the first run, scan the test wafers and enter the data in the collection table, see Section 4.10.9.5. Calculate the particle count add-on (subtract the post-scanned number from the 'Dry-In, Dry-Only' final number).

4. After all five runs have been performed, calculate the average of all runs and subtract the Handling Average from the final results (See Section 4.10.9.2).

5. If the total particle count is unacceptable*, go to Section 4.10.7.2 for 'Wet-In, Dry-Only' Troubleshooting Results.

6. If the total particle count is acceptable*, go to the third recipe test, Section 4.10.6.3, 'Wet-in, Rinse and Dry'.



Wet-in, Dry-Only Recipe:

Dry STEP	TIME	RPM	DI H_2O	N_2	STATIC	HEATER	RES.
1	240	1200	OFF	ON	ON	ON	OFF
2	240	500	OFF	ON	ON	ON	OFF

** 'Particle count is based on the amount of excursion from the original sales contract specification'.*

4.10.6.3 Wet-In, Rinse and Dry Troubleshooting Recipe Test

Each time (5) this recipe is run, perform wafer scans and use the data collection tables to capture the particle counts.

Precautions:

- *Minimize contact with the cassette.*
- *Use known good clean gloves.*
- *When loading and unloading cassette, do not touch the inside of the SRD's bowl or door with any part of your clothing.*

To perform this test:

1. Pre-wet the test wafers in a known good, clean source of overflowing DI water for 30 seconds. Do not use any spray bars in this application.

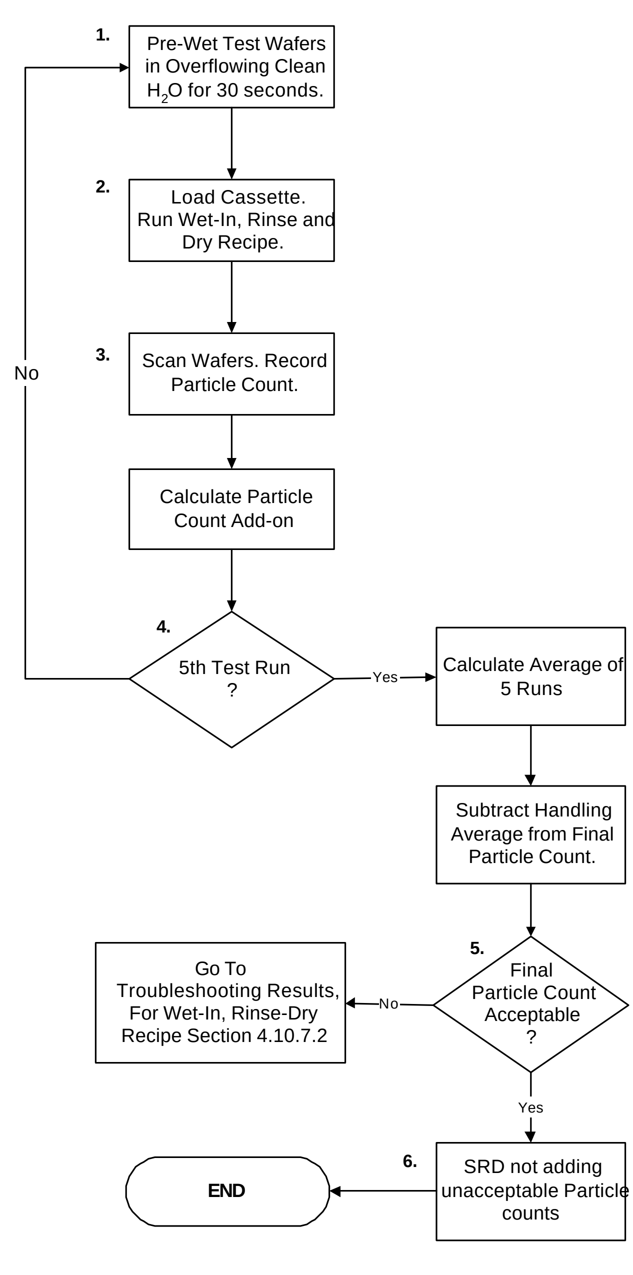
2. Place the test wafers in the SRD and run the 'Wet-In, Rinse and Dry' recipe as configured in the table below.

3. After the first run, scan test wafers and enter data in the collection table, see Section 4.10.9.7. Calculate the particle count add-on (subtract the post-scanned number from the 'Wet-In, Dry-Only' final number).

4. After all five runs have been performed, calculate the average of all runs and subtract the Handling Average from the final results (See Section 4.10.9.2).

5. If the total particle count is unacceptable*, go to Section 4.10.7.3 for 'Wet-In, Rinse and Dry' Troubleshooting Results.

6. If the total particle count is acceptable*, then the SRD is not adding unacceptable particle count.



Wet-in, Rinse and Dry Recipe:

Rinse STEP	TIME	RPM	DI H_2O	N_2	STATIC	HEATER	RES.
1	60	50	ON	ON	OFF	ON	15 MegΩ
2	45	300	ON	ON	OFF	ON	15 MegΩ
Dry STEP							
1	240	1200	OFF	ON	ON	ON	OFF
2	240	500	OFF	ON	ON	ON	OFF

* ***'Particle count is based on the amount of excursion from the original sales contract specification'.***

This ends the Troubleshooting Recipe Tests.

4.10.7 Troubleshooting Results

4.10.7.1 Dry-In, Dry-Only High Particle Count Results

Depending upon which test wafer has high particle count determines which components of the SRD to check. Follow the table below for the suggested solutions.

If Problem Wafer Is:	Component	Check:
Front	Door Seal	• CDA Pressure Setting • Door Seal Integrity
Rear	N_2 Labyrinth Seal	• Hub Spacing • Flow Rate at MV2
All	N_2 Filter N_2 Valve	• N_2 Filter • N_2 Pressure Setting • N_2 Lines for Contamination • Vibrations

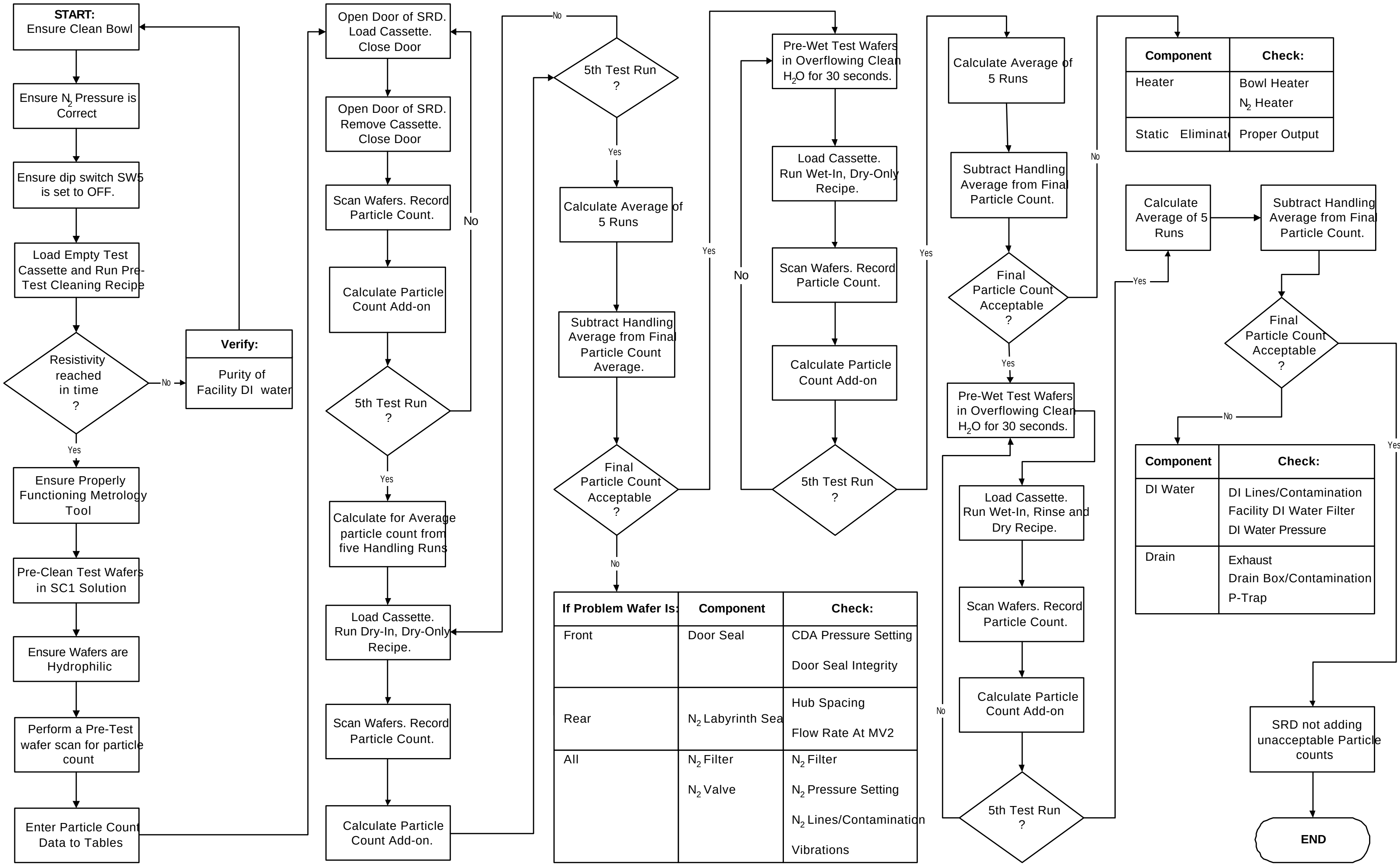
4.10.7.2 Wet-In, Dry-Only High Particle Count Results

Component	Check:
Heater	• Bowl Heater • N_2 Heater
Static Eliminator	• Proper Output

4.10.7.3 Wet-In, Rinse and Dry High Particle Count Results

Component	Check:
DI Water	• DI Lines for Contamination • Facility DI Water Filter • DI Water Pressure
Drain	• Exhaust • Drain Box for Contamination • P-Trap

4.10.8 Comprehensive Flowchart



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4.10.9 Data Collection Tables

The following tables will help in accumulating, organizing and analyzing particle count scans. Known-good (clean) wafers are essential for troubleshooting. A pre-test scan for particles on the Known-good (clean) wafers is needed before troubleshooting can begin. Three to six wafers can be used for testing.

The averaged results of these pre-test scans will be deducted from the Handling Test (see Section 4.10.5). Do not use wafers with particle counts >50 particles (Light Point Defect) at ≥0.2 µm in size.

The table below (broken into sections for understanding) will help organize the collection of data. Attached to the rear of this section are blank tables for use during actual data collection. The values entered in the following tables are for demonstration purposes only, your values will be different.

4.10.9.1 Collecting Data from Handling Test

***Table 4-1**. Sample Table. Pre-Test Scan results of wafers that will be used for troubleshooting.*

Wafer Slot Position	Pre-Test Scan Results
25	**18**
13	**13**
1	**52**

The three bolded totals will be subtracted from the first Handling Test results. See Table 4-2.

Note: The technician performing the pre-test scans may elect to clean or replace wafer number 1 as it has a particle count

***Table 4-2**. The results of Handling Test No. 1 subtracted from the Pre-Test Scan results .*

		Handling Test Run No. 1	
Wafer Slot Position	**Pre-Test Scan Results**	**Results**	**Delta**
25	**18**	**21**	**3**
13	**13**	**9**	**(-4)**
1	**52**	**50**	**(-2)**

Note: It is normal for the particle count to decrease after a test. This is an indication that the SRD is functioning properly.

Table 4-3. *Total results after all five Handling Tests are run.*

		Handling Test Run No. 1		Handling Test Run No. 2		Handling Test Run No. 3		Handling Test Run No.4		Handling Test Run No. 5		
Wafer Slot Position	**Pre-Test Scan Results**	**Results**	**Delta**	**Results**	**Delta**	**Results**	**Delta**	**Results**	**Delta**	**Results**	**Delta**	**Ave. Delta**
25	**18**	**21**	**3**	**20**	**(-1)**	**25**	**5**	**27**	**2**	**29**	**2**	**2.2**
13	**13**	**9**	**(-4)**	**10**	**1**	**11**	**1**	**17**	**6**	**19**	**2**	**1.2**
1	**52**	**50**	**(-2)**	**49**	**(-1)**	**45**	**-4**	**46**	**1**	**43**	**(-3)**	**(-9)**
										Overall Average:		**0.53**

4.10.9.2 Calculating for Overall Average Handling Test Add-on

The average particle count added to the wafers before troubleshooting due to handling is calculated in the following manner:

Wafer Position	**Total Delta**	**Average Delta per Run**	**Overall Average per Wafer**
25	11	2.2	
13	6	1.2	
1	(-9)	(-1.8)	
	Total: 8	Total: 1.6	**Total: 0.53**

The **0.53** particle count value is the average amount that is present on all three wafers due to handling. This total will be subtracted from the Troubleshooting Recipe Test particle count results. This will give a more precise count of added particles from the SRD.

4.10.9.3 Collecting Data from the 1st Troubleshooting Recipe Test

To start capturing data for troubleshooting record the values from the 5th Handling Test Results column to the table below. Run all five 'Dry-In, Dry-Only' Troubleshooting Tests and add the particle count data of each run. Calculate for each Delta and calculate for the overall average 'Dry-In, Dry-Only' addition. Subtract the Handling Test overall average from the 'Dry-In, Dry-Only' recipe overall average.

Table 4-4*. Final Handling Test Run Results added to the table to start Troubleshooting Recipe Tests.*

		Dry-In, Dry-Only Run No. 1		Dry-In, Dry-Only Run No. 2		Dry-In, Dry-Only Run No. 3		Dry-In, Dry-Only Run No. 4		Dry-In, Dry-Only Run No. 5		
Wafer Slot Position	**5th Handling Test Results**	**Results**	**Delta**	**Results**	**Delta**	**Results**	**Delta**	**Results**	**Delta**	**Results**	**Delta**	**Ave. Delta**
25	**29**	**47**	**18**	**20**	**(-27)**	**27**	**7**	**19**	**(-8)**	**22**	**3**	**(-1.4)**
13	**19**	**20**	**1**	**12**	**(-8)**	**22**	**10**	**15**	**(-7)**	**16**	**1**	**(-0.6)**
1	**43**	**13**	**(-30)**	**7**	**(-6)**	**18**	**11**	**28**	**10**	**19**	**(-9)**	**(-4.8)**
										Overall Average:		**(-2.27)**

4.10.9.4 Calculating for Average 'Dry-In, Dry-Only Add-on

The average particle count added to the wafers after the first troubleshooting recipe can now be calculated:

Wafer Position	**Total Delta**	**Average Delta per Run**	**Overall Average per Wafer**	**Minus Handling Test Overall Average**	**Overall Average per Wafer by SRD**
25	(-7)	(-1.4)			
13	(-3)	(-0.6)			
1	(-24)	(-4.8)			
	Total: (-34)	Total: (-6.8)	**Total: (-2.27)**	**0.53**	**(-2.8)**

The overall average per wafer particle count of **(-2.27)** is the amount that is present on the wafers after the first troubleshooting recipe test. The **(-2.8)** particle count value is the amount that is added to the wafers that was due to the SRD, or in this case the SRD cleaned away an additional 2.8 particles. If this value is unacceptable, go to Section 4.10.7.1 for troubleshooting results. If this value is acceptable, go to the 2nd troubleshooting recipe, Section 4.10.6.2.

4.10.9.5 Collecting Data from the 2nd Troubleshooting Recipe Test

Record the values from the 5th 'Dry-In, Dry-Only' Results column into the table below. Run all five 'Wet-In, Dry-Only' Troubleshooting Tests and add the particle count data of each run. Calculate for each Delta and calculate for the overall average 'Wet-In, Dry-Only' add-on. Subtract the Handling Test overall average from the 'Wet-In, Dry-Only' recipe overall average.

***Table 4-5**. 'Wet-In, Dry-Only' Troubleshooting Recipe Data Collection Table.*

		Wet-In, Dry-Only Run No. 1		Wet-In, Dry-Only Run No. 2		Wet-In, Dry-Only Run No. 3		Wet-In, Dry-Only Run No. 4		Wet-In, Dry-Only Run No. 5		
Wafer Slot Position	**5th Dry-In, Dry-Only Results**	**Results**	**Delta**	**Results**	**Delta**	**Results**	**Delta**	**Results**	**Delta**	**Results**	**Delta**	**Ave. Delta**
25	**22**	**27**	**5**	**45**	**18**	**46**	**1**	**46**	**0**	**52**	**8**	**6.4**
13	**16**	**22**	**6**	**25**	**3**	**27**	**2**	**38**	**11**	**39**	**1**	**4.6**
1	**19**	**30**	**11**	**35**	**5**	**40**	**5**	**45**	**5**	**49**	**4**	**6.0**
										Overall Average:		**17.0**

4.10.9.6 Calculating for Average 'Wet-In, Dry-Only Add-on

The average particle count added to the wafers after the first troubleshooting recipe can now be calculated:

Wafer Position	**Total Delta**	**Average Delta per Run**	**Overall Average per Wafer**	**Minus Handling Test Overall Average**	**Overall Average per Wafer by SRD**
25	32	6.4			
13	23	4.6			
1	30	6.0			
	Total: 85	Total: 17.0	**Total: 5.67**	**0.53**	**5.14**

The overall average per wafer particle count of **5.67** is the amount that is present on the wafers after the second troubleshooting recipe test. The **5.14** particle count value is the amount that is added to the wafers that was due to the SRD. If this value is unacceptable, go to Section 4.10.7.2 for troubleshooting results. If this value is acceptable, go to the 3rd troubleshooting recipe, Section 4.10.6.3.

4.10.9.7 Collecting Data from the 3rd Troubleshooting Recipe Test

Record the values from the 5th 'Wet-In, Dry-Only' Results column into the table below. Run all five 'Wet-In, Rinse and Dry' Troubleshooting Tests and add the particle count data of each run. Calculate for each Delta and calculate for the overall average 'Wet-In, Rinse and Dry' add-on. Subtract the Handling Test overall average from the 'Wet-In, Rinse and Dry' recipe overall average.

***Table 4-6**. 'Wet-In, Rinse and Dry' Troubleshooting Recipe Data Collection Table.*

		Wet-In, Rinse, Dry Run No. 1		Wet-In, Rinse, Dry Run No. 2		Wet-In, Rinse, Dry Run No. 3		Wet-In, Rinse, Dry Run No. 4		Wet-In, Rinse, Dry Run No. 5		
Wafer Slot Position	**5th Wet-In, Rinse-Dry Results**	**Results**	**Delta**	**Results**	**Delta**	**Results**	**Delta**	**Results**	**Delta**	**Results**	**Delta**	**Ave. Delta**
25	**52**	**60**	**8**	**65**	**5**	**66**	**1**	**67**	**1**	**69**	**2**	**3.4**
13	**39**	**45**	**6**	**52**	**7**	**68**	**16**	**72**	**4**	**75**	**3**	**7.2**
1	**49**	**64**	**15**	**66**	**2**	**70**	**4**	**76**	**6**	**80**	**4**	**6.2**
										Overall Average:		**5.60**

4.10.9.8 Calculating for Average 'Wet-In, Rinse and Dry Add-on

The average particle count added to the wafers after the first troubleshooting recipe can now be calculated:

Wafer Position	**Total Delta**	**Average Delta per Run**	**Overall Average per Wafer**	**Minus Handling Test Overall Average**	**Overall Average per Wafer by SRD**
25	17	3.4			
13	36	7.2			
1	31	6.2			
	Total: 84	Total: 16.8	**Total: 5.60**	**0.53**	**5.07**

The overall average per wafer particle count of **5.60** is the amount that is present on the wafers after the third troubleshooting recipe test. The **5.07** particle count value is the amount that is added to the wafers that was due to the SRD. If this value is unacceptable, go to Section 4.10.7.3 for troubleshooting results. If this value is acceptable, then the SRD is not adding unacceptable particle count to the wafers. This may point to other devices within the processing tool set (i.e., rinse bath, chemical tank, handling, cleanroom, facility fed chemicals, DI water and others).

TEST PERFORMED BY: ______________________________

DATE: ______________________________

SRD ID: ______________________________

		Handling Test Run No. 1		Handling Test Run No. 2		Handling Test Run No. 3		Handling Test Run No.4		Handling Test Run No. 5		
Wafer Slot Position	**Pre-Test Scan Results**	**Results**	**Delta**	**Results**	**Delta**	**Results**	**Delta**	**Results**	**Delta**	**Results**	**Delta**	**Ave. Delta**
25												
13												
1												
										Overall Average:		

		Dry-In, Dry-Only Run No. 1		Dry-In, Dry-Only Run No. 2		Dry-In, Dry-Only Run No. 3		Dry-In, Dry-Only Run No. 4		Dry-In, Dry-Only Run No. 5		
Wafer Slot Position	**5th Handling Test Results**	**Results**	**Delta**	**Results**	**Delta**	**Results**	**Delta**	**Results**	**Delta**	**Results**	**Delta**	**Ave. Delta**
25												
13												
1												
										Overall Average:		

		Wet-In, Dry-Only Run No. 1		Wet-In, Dry-Only Run No. 2		Wet-In, Dry-Only Run No. 3		Wet-In, Dry-Only Run No. 4		Wet-In, Dry-Only Run No. 5		
Wafer Slot Position	**5th Dry-In, Dry-Only Results**	**Results**	**Delta**	**Results**	**Delta**	**Results**	**Delta**	**Results**	**Delta**	**Results**	**Delta**	**Ave. Delta**
25												
13												
1												
										Overall Average:		

		Wet-In, Rinse-Dry Run No. 1		Wet-In, Rinse-Dry Run No. 2		Wet-In, Rinse-Dry Run No. 3		Wet-In, Rinse-Dry Run No. 4		Wet-In, Rinse-Dry Run No. 5		
Wafer Slot Position	**5th Wet-In, Rinse-Dry Results**	**Results**	**Delta**	**Results**	**Delta**	**Results**	**Delta**	**Results**	**Delta**	**Results**	**Delta**	**Ave. Delta**
25												
13												
1												
										Overall Average:		

TEST PERFORMED BY: ______________________________

DATE: ______________________________

SRD ID: ______________________________

		Run No. 1		Run No. 2		Run No. 3		Run No. 4		Run No. 5		
Wafer Slot Position	Results	Results	Delta	Results	Delta	Results	Delta	Results	Delta	Results	Delta	Ave. Delta
25												
20												
15												
10												
5												
1												
										Overall Average:		

		Run No. 1		Run No. 2		Run No. 3		Run No. 4		Run No. 5		
Wafer Slot Position	Results	Results	Delta	Results	Delta	Results	Delta	Results	Delta	Results	Delta	Ave. Delta
25												
20												
15												
10												
5												
1												
										Overall Average:		

5 SECS II COMMUNICATIONS

5.1 Programming the Host Computer

The SuperClean 1800-6 comes standard with Verteq's SECS-Interface. The SECS-II interface supports external process control by a host computer. The link between the dryer and a host computer is over an RS-232-C channel. Verteq's SECS-II interface supports:

- Remote verification of dryer status, error condition and current recipe number.
- Remote recipe selection
- Remote review of recipe parameters
- Remote reprogramming of recipe parameters
- Remote dryer reset and cycle start/stop. Remote rotor index and door open/close.
- Manual override of host control at any time

Verteq's implementation of the SECS-II protocol conforms to the SEMI (Semiconductor Equipment and Materials Institute, Inc.) SEC (Semi Equipment Communications) specification, versions E4-80 and E5-84. The electrical interface is made in accordance with EIA standard RS-232-C for interface type E, duplex communication. Standard transmission speed is 9600 bps. Other speeds may be available depending on the specific configuration.

The dryer will not initiate a session with the host, it will only respond to host commands. Recipe parameters cannot be modified by the host while cycles are in progress. Recipe selection is accepted by the rinser/dryer only when the machine is in standby mode.

5.2 System Components and Specifications

SECS II components are factory-set at 9600 BPS. The transmission rate can be reset using the table below and the dipswitches on the controller card. See Section 3.7, *Controller Card Dipswitch Setting*, for instructions.

Dipswitch	Position		Function
NO. 7&8	NO. 7	NO. 8	Baud Rate
SECS II Communications	Down Down Up Up	Down Up Down Up	9600 BPS 4800 BPS 2400 BPS 1200 BPS

Access to the communications port is made using a standard female Bell Modem 25-pin connector mounted on the controller. The pertinent signal lines are summarized in the following table.

Pin	RS-232	Circuit Description
1	AA	Shield
2	BA	Transmitted Data
3	BB	Received Data
7	AB	Signal Ground

Data is transmitted or received in 10-bit characters. Transmission asynchronous at one of the specified baud rates. Character structure is *1 start bit*, *8 data bits*, *1 stop bit*, and *no parity*.

5.3 Supported Functions

The host may request the dryer to perform the following functions and provide current machine status or error condition as outlined below:

- **Machine Status**:
  - ◊ Error mode
  - ◊ Standby mode
  - ◊ Cycle mode
  - ◊ Motor deceleration mode
  - ◊ Local programming mode
  - ◊ Indexing mode
  - ◊ Door open / close mode
  - ◊ Waiting for resistivity to reach setpoint
- **Cycle (run) Stop**:
  - ◊ Low N_2 pressure
  - ◊ High N_2 flow
  - ◊ Low DI pressure
  - ◊ Low or high DI flow
  - ◊ Door open while running
  - ◊ Window unsealed while running
  - ◊ Operator pressed STOP
  - ◊ SECS II STOP command received from host
- **Error Conditions**:
  - ◊ Low N_2 pressure
  - ◊ High N_2 flow
  - ◊ Door open while running
  - ◊ Window unsealed while running
  - ◊ Door error trying to open or close
  - ◊ Door obstruction while opening
  - ◊ Low DI pressure
  - ◊ High or low flow
  - ◊ Index error
- **Remote Commands**:
  - ◊ START or STOP cycle
  - ◊ Index the rotor
  - ◊ Resistivity bypass
  - ◊ Open or close the door
  - ◊ Reset error condition

- **View Recipe Parameters**:
  - ◊ Rinse time
  - ◊ Rinse speed
  - ◊ Dry time
  - ◊ Dry speed
  - ◊ Output options ON/OFF
  - ◊ Resistivity setpoint (in megohms)

- **Change Recipe Parameters**:
  - ◊ Rinse time
  - ◊ Rinse speed
  - ◊ Dry time
  - ◊ Dry speed
  - ◊ Output options ON/OFF
  - ◊ Resistivity setpoint (in megohms)

- **Output Options**:
  - ◊ DI water valve
  - ◊ Nitrogen valve
  - ◊ Heater
  - ◊ Static eliminator
  - ◊ Resistivity bypass

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5.4 Streams and Functions

Verteq's SECS II implementation conforms to the SEMI specification. Information is conveyed between the dryer and the host computer by means of categories (**Streams**) and detailed messages (**Functions**). Message content is structured as Items and Lists.

The dryer will respond to the messages listed below when received from the host:

S1, F1	Presence check
S1, F5	Status or error check
S2, F19	Remote error reset
S2, F21	Commands
S7, F1	Select Recipe
S7, F3	Change Recipe
S7, F5	Read Recipe

Dryer responses include:

S1, F2	Response to presence check inquiry
S1, F6	Response to status or error check
S2, F20	Response to remote error reset
S2, F22	Response to remote command
S7, F2	Response to recipe selection request
S7, F4	Response to recipe change request
S7, F6	Response to recipe read request
S9, F1	Unrecognized device ID
S9, F5	Unrecognized function type

All transactions are initiated by the host by sending an <ENQ> character and awaiting an <EOT> character from the dryer. When the <EOT> has been received, the host will send the appropriate stream and function in SECS-II format (one byte block length, 10 bytes header, x bytes message, and two bytes checksum. Correct reception is acknowledged by an <ACK>; incorrect reception by a <NAK>.

The dryer will respond to the message received from the host and will wait for an <ACK> or <NAK>.

Details for each transaction supported by the Rinser/Dryer are given in Section 5.5, *Transaction Detail*.

5.5 Transaction Detail

5.5.1 Presence Checking

Message			Response		
S1, F1 H ➜ E			**S1, F2 E ➜ H**		
0A	Block Length		1A	Block Length	
0A	ID		8A	ID	
28			28		
81	S1, F1		01	S1, F2	
01			02		
80	Blk. #	Header	80	Blk. #	Header
01			01		
XX	System		XX	System	
XX			XX		
XX			XX		
XX			XX		
H	Checksum		01	List of 2 items	
L			02		
			41	4 ASCII bytes	
X = Don't care			04	Item 1	
H = Checksum (Hi-byte)					Item 1
L = Checksum (Lo-byte)			31	MDLN #1800	
			36		
			30		
			30		
			41	6 ASCII bytes	
			06	Item 2	
			XX	REV = X	
			XX	X	Item 2
			XX	X	
			XX	X	
			XX	X	
			XX	X	
			H	Checksum	
			L		
			Presence check will produce the proper EPROM ID value for revision		

5.5.2 Status or Error Check

Message			Response		
S1, F5 H ➜ E			**S1, F6 E ➜ H**		
0D	Block Length		2A	Block Length	
0A	ID		8A	ID	
28			28		
81	S1, F5		01	S1, F6	
05			06		
80	Blk. #	Header	80	Blk. #	Header
01			01		
XX	System		XX	System	
XX			XX		
XX			XX		
XX			XX		
21	1 binary item		01	List of 7 items	
01			07		
00	Status 0		21	9 binary bytes	
H	Checksum		09		
L			XX	Error Number 1	
			XX	Error Number 2	
			XX	Run Stop 1	Item 1
			XX	Run Stop 2	
			XX	Outputs 1	
			XX	Outputs 1	
			XX	Inputs 1	
			XX	Inputs 2	
			XX	Status	
			41	1 ASCII bytes	
			01		Item 2
			XX	Recipe number (00-09)	
			41	1 ASCII byte	
			01		Item 3
			XX	Step #	
				•	
				•	
				•	
				•	

Status or Error Check (*continued*)

Response		
S1, F6 E ➜ H		
41	4 ASCII bytes	
04		
XX	1's current rpm	Item 4
XX	10's current rpm	
XX	100's current rpm	
XX	1000's current rpm	
41	4 ASCII bytes	
04		
XX	1's current time	Item 5
XX	10's current time	
XX	100's current time	
XX	1000's current time	
41	3 ASCII bytes	
03		
		Item 6
XX	.1's resistivity	
XX	1's resistivity	
XX	10's resistivity	
21	1 binary byte	
01		Item 7
XX	IOS	
H	Checksum	
L		
See below for Status, Error, and IOS details		

5.5.2.1 Status/Error Check Detail

ERROR 1 is one pair of binary bytes. These bytes should be checked if B0 of the STATUS byte is set.

B0 = 1 Low DI pressure
B1 = 1 Low DI flow
B2 = 1 High DI flow
B3 *Not used*
B4 = 1 Index error
B5 = 1 Overspeed condition during run
B6 = 1 Door not closed and sealed at power on
B7 *Not used*

ERROR 2 is one pair of binary bytes. These bytes should be checked if B0 of the STATUS byte is set.

B0 = 1 Low N_2 pressure
B1 = 1 Low N_2 flow
B2 = 1 Power lost during run
B3 *Not used*
B4 = 1 Door open during run
B5 = 1 Window unsealed during a run
B6 = 1 Door error trying to open or close
B7 = 1 Door obstruction while opening

NOTE
If B3 and B7, in ERROR 1 and 2 bytes, are set to “1” and all other bits are set to “0”, a hardware failure will be detected in the speed control circuit. The dryer must be powered off to reset.

RUN STOP 1 is one pair of binary bytes used to report the cause of premature cycle stop.

B0 *Not used*
B1 = 1 IPAassist error
B2 = 1 Overspeed
B3 = 1 N_2 pressure failure
B4 *Not used*
B5 = 1 Door opened while running
B6 = 1 Window unsealed during run
B7 = 1 Operator pressed stop

RUN STOP 2 is one pair of binary bytes used to report the cause of premature cycle stop.

B0 *Not used*
B1 = 1 Hardware failure in speed control circuit detected
B2 *Not used*
B3 *Not used*
B4 = 1 SECS II stop
B5 *Not used*
B6 *Not used*
B7 *Not used*

OUTPUTS 1 is one pair of binary bytes that provide information on the state of the relays being driven by the system.

B0 = 1 Heater on
B1 = 1 Static eliminator on
B2 = 1 Index plunger energized
B3 = 1 DI water on
B4 = 1 Door open
B5 = 1 Window vent on
B6 = 1 N_2 on
B7 = 1 N_2 blower on

OUTPUTS 2 is one pair of binary bytes that provide information on the state of the relays being driven by the system.

B0 = 0 Window vacuum on
B1 = 1 IPAassist request
B2 = 1 Time to wash
B3 *Not used*
B4 *Not used*
B5 *Not used*
B6 *Not used*
B7 *Not used*

INPUTS 1 is one pair of binary bytes that provide input status information.

B0 = 0 Window unsealed
B1 = 0 Door up
B2 = 0 Door down
B3 = 0 DI water pressure adequate (OR) IPAassist error
B4 = 0 DI water flow above low-flow setpoint
B5 = 0 DI water flow above high-flow setpoint
B6 = 0 N_2 flow exceeds high-flow setpoint
B7 = 0 Footswitch activated

INPUTS 2 is one pair of binary bytes that provide input status information.

B0 = 0 No door obstruction
B1 = 0 Window unsealed (fully retracted)
B2 = 0 Start / Stop pushbutton
B3 = 0 N_2 pressure is adequate
B4 *Not used*
B5 *Not used*
B6 *Not used*
B7 *Not used*

STATUS is a single binary byte.

B0 = 1 In error mode
B1 = 1 In standby mode
B2 = 1 In cycle (run) mode
B3 = 1 In motor deceleration mode
B4 = 1 In local programming mode
B5 = 1 In indexing mode
B6 = 1 In door open/close mode
B7 = 1 Waiting for resistivity to reach setpoint

IOS (recipe requests) is a single binary byte.

B0 = 1 DI water valve is open
B1 = 1 Nitrogen valve is open
B2 = 1 Heater is on
B3 = 1 Static eliminator is on
B4 = 1 Resistivity selected (rinse cycle ends when timer expires and rinse water reaches resistivity setpoint)
B5 *Not used*
B6 *Not used*
B7 *Not used*

5.5.3 Remote Error Reset

Message			Response		
S2, F19 H ➜ E			**S2, F20 E ➜ H**		
0D	Block Length		0D	Block Length	
0A	ID		8A	ID	
28			28		
82	S2, F19		02	S2, F20	
13			14		
80	Blk. #	Header	80	Blk. #	Header
01			01		
XX	System		XX	System	
XX			XX		
XX			XX		
XX			XX		
A5	1 integer		21	unsigned byte	
01	unsigned byte		01		
XX	RIC		XX	RIA	
H	Checksum		H	Checksum	
L			L		
RIC is a single unsigned integer that instructs the dryer to reset the error flags.			RIA is a single unsigned integer that notifies the host if reset is done or not		
RIC = 00h Reset error flags			RIA = 01h Reset denied RIA = 00h Reset to be done		
			Reset denied will be sent to the host when the source of the error has not been corrected		

5.5.4 Commands

Message		Response	
S2, F21 H ➜ E		**S2, F22 E ➜ H**	
0D	Block Length	0D	Block Length
0A	ID	8A	ID
28		28	
82	S2, F21	02	S2, F22
15		16	
80	Blk. # Header	80	Blk. # Header
01		01	
XX	System	XX	System
XX		XX	
XX		XX	
XX		XX	
21	1 integer	21	1 integer
01	unsigned byte	01	unsigned byte
X	RCMD	X	CMDA
H	Checksum	H	Checksum
L		L	
RCMD is a single binary remote command code.		CMDA is a single binary command acknowledge code.	
RCMD = 0	Stop the cycle	CMDA = 0	Command accepted
RCMD = 1	Start the cycle	CMDA = 1	Command does not exist
RCMD = 2	Index and system reset	CMDA = 2	Cannot perform now
RCMD = 3	Bypass resistivity		
RCMD = 4	Door open		
RCMD = 5	Door close		

5.5.5 Select Recipe

Message			Response		
S7, F1 H ➜ E			**S7, F2 E ➜ H**		
12	Block Length		0D	Block Length	
0A	ID		8A	ID	
28			28		
87	S7, F1		07	S7, F2	
01			02		
80	Blk. #	Header	80	Blk. #	Header
01			01		
XX	System		XX	System	
XX			XX		
XX			XX		
XX			XX		
01	List of 2 items		21	1 binary byte	
02			01		
41	1 ASCII byte		XX	PPGNT	
01		Item 1			
XX	PPID (Recipe #)				
A5	1 integer		H	Checksum	
0	unsigned byte	Item 2	L		
XX	Length				
H	Checksum				
L					
PPID is a single ASCII byte that contains the process program recipe number. Valid PPIDs are 30h through 39h (recipes 0 through 9). Anything else is invalid			PPGNT is a single binary byte that notifies the host if the recipe selection is granted or if there is an error		
Length is not used, and could be anything			PPGNT = 00h Selection accepted PPGNT = 03h Invalid PPID PPGNT = 04h Cannot perform now		
			Recipe selection is accepted only if the machine is in standby mode		

5.5.6 Change Recipe

Message

S7, F3 H ➜ E

XX	Message Length	
0A	ID	Header
28		
87	S7, F3	
03		
80	Blk. #	
01		
XX	System	
XX		
XX		
XX		
01	List of 2 items	
02		
41	1 ASCII byte	Item 1
01		
XX	PPID (Recipe #)	
01	Item #2 (includes Steps 0-9)	
XX	NOSPR (Number of recipe steps)	
A9	Item contains four 2 byte integers	
08	unsigned integers	
MS BYTE	Speed	Step #0
LS BYTE	(RPM)	
MS BYTE	Time	
LS BYTE	(sec)	
MS BYTE	Resistivity	
LS BYTE	(meg-ohm)	
00000000	Output	
LS BYTE	Options	

•
•
•

Response

S7, F4 E ➜ H

0D	Block Length	
8A	ID	Header
28		
07	S7, F4	
02		
80	Blk. #	
01		
XX	System	
XX		
XX		
XX		
21	1 binary byte	
01		
XX	ACK	
H	Checksum	
L		

ACK is a single binary byte

ACK = 00h Changes accepted
ACK = 04h PPID not found
ACK = 05h Mode unsupported (NOSPR > 10)
ACK = 40h Programmed speed > 3200 RPM
ACK = 41h Programmed time > 9999 seconds
ACK = 42h Programmed resistivity>19.9 meg-ohm
ACK = 43h Static eliminator & DI on at same time.

Change Recipe (*continued*)

Message		
S7, F3 H ➜ E		
A9 08	Item contains four 2 byte unsigned integers	
MS BYTE LS BYTE	Speed (RPM)	Step #1
MS BYTE LS BYTE	Time (sec)	
MS BYTE LS BYTE	Resistivity (meg-ohm)	
00000000 LS BYTE	Output Options	
A9 08	Item contains four 2 byte unsigned integers	
MS BYTE LS BYTE	Speed (RPM)	Step #8
MS BYTE LS BYTE	Time (sec)	
MS BYTE LS BYTE	Resistivity (meg-ohm)	
00000000 LS BYTE	Output Options	
A9 08	Item contains eight 2 byte integers unsigned integers	
MS BYTE LS BYTE	Speed (RPM)	Step #9
MS BYTE LS BYTE	Time (sec)	
MS BYTE LS BYTE	Resistivity (meg-ohm)	
00000000 LS BYTE	Output Options	
H L	Checksum	

Change Recipe (*continued*)

Message
S7, F3 H ➜ E
PPID is the recipe number. NOSPR is the number of steps per recipe It is not necessary to have all ten possible steps programmed in each recipe: a recipe can consist of only one step Output option assignments: LS Byte B0 = 1 DI water valve is open B1 = 1 Nitrogen valve is open B2 = 1 Heater is on B3 = 1 Static eliminator is on B4 = 1 Resistivity is selected (rinse cycle ends when timer expires and rinse water meets or exceeds resistivity setpoint). B5 *Not used* B6 *Not used* B7 *Not used* MS Byte B0 = 1 IPAassist on B1 *Not used* B2 *Not used* B3 *Not used* B4 *Not used* B5 *Not used* B6 *Not used* B7 *Not used*

5.5.6.1 Change Recipe Example

Assume you are to program recipe #5 with three steps, as outlined below:

Recipe Parameters	**Step 0 Rinse Cycle**	**Step 1 Dry Cycle**	**Step 2 Dry Cycle**
Speed	300 RPM	1000 RPM	600 RPM
Time	120 Sec	180 Sec	60 Sec
Resistivity Setpoint	17.8 Meg-ohm	N/A	N/A
DI valve	On	Off	Off
N2 valve	Off	On	On
Heater	On	On	On
Anti-static	N/A	On	On
Resistivity	On	N/A	N/A

NOTE

When the Resistivity option is "on", the rinse timer must expire before the resistivity set point will be checked.

A sample host message setting the above parameters is listed on the following page.

5.5.6.2 Sample Host Message

Message			Response		
S7, F3 H ➜ E			**S7, F4 E ➜ H**		
2F	Block Length		0D	Block Length	
0A	ID		8A	ID	
28			28		
87	S7, F3		07	S7, F4	
03			02		
80	Blk. #	Header	80	Blk. #	Header
01			01		
00	System		00	System	
00			00		
00			00		
00			00		
01	List of 2 items		21	1 binary byte	
02			01		
41	1 ASCII byte		00	ACK	
01		Item 1			
			H	Checksum	
35	PPID		L		
01	Item #2 (includes Steps 0-9)		ACK is a single binary byte		
03	NOSPR (Number of recipe steps)		ACK = 00h Changes accepted		
			ACK = 04h PPID not found		
A9	Item contains eight 2 byte integers		ACK = 05h Mode unsupported (NOSPR > 10)		
08	unsigned integers		ACK = 40h Programmed speed > 3200 RPM		
			ACK = 41h Programmed time > 9999 seconds		
01	Speed		ACK = 42h Programmed resistivity>19.9 meg-ohm		
2C	(RPM)		ACK = 43h Static eliminator & DI on at same time.		
00	Time				
78	(sec)				
		Step #0			
00	Resistivity				
B2	(meg-ohm)				
00	Output				
15	Options				

Sample Host Message (*continued*)

Message		
S7, F3 H ➜ E		
A9	Item contains four 2 byte integers	
08	unsigned integers	
03	Speed	
E8	(RPM)	
00	Time	
B4	(Sec)	Step 1
00	Resistivity	
00	(Meg-ohm)	
00	Output	
0E	Options	
A9	Item contains eight 2 byte integers	
08	unsigned integers	
02	Speed	
58	(RPM)	
00	Time	
3C	(Sec)	Step 2
00	Resistivity	
00	(Meg-ohms)	
00	Output	
0E	Options	
H	Checksum	
L		

5.5.7 Read Recipe

Message			Response		
S7, F5 H ➜ E			**S7, F6 E ➜ H**		
0F	Block Length		XX	Message Length	
0A	ID		8A	ID	
28			28		
87	S7, F5		07	S7, F6	
03			06		
80	Blk. #	Header	80	Blk. #	Header
01			01		
XX	System		XX	System	
XX			XX		
XX			XX		
XX			XX		
01	List of 1 item		01	List of 2 items	
01			02		
41	1 ASCII byte		41	1 ASCII byte	
01			01	Item #1	Item 1
XX	PPID		XX	PPID	
H	Checksum		01	Item #2	
L					
			XX	NOSPR	
X = Don't care			A9	Item contains four 2 byte integers	
H = Checksum (Hi-byte)			08	unsigned integers	
L = Checksum (Lo-byte)					
			MS BYTE	Speed	
			LS BYTE	(RPM)	
			MS BYTE	Time	
			LS BYTE	(Sec)	Step 0
			MS BYTE	Resistivity	
			LS BYTE	(Meg-ohms)	
			00000000	Output	
			LS BYTE	Options	
			•		
			•		
			•		

Read Recipe (*continued*)

Response		
S7, F6 E ➜ H		
A9 08	Item contains four 2 byte integers unsigned integers	
MS BYTE LS BYTE	Speed (RPM)	Step 1
MS BYTE LS BYTE	Time (Sec)	
MS BYTE LS BYTE	Resistivity (Meg-ohms)	
00000000 LS BYTE	Output Options	
A9 08	Item contains four 2 byte unsigned integers	
MS BYTE LS BYTE	Speed (RPM)	Step 8
MS BYTE LS BYTE	Time (Sec)	
MS BYTE LS BYTE	Resistivity (Meg-ohms)	
00000000 LS BYTE	Output Options	
• • •		

Read Recipe (*continued*)

Response		
S7, F6 E ➜ H		
A9 08	Item contains four 2 byte unsigned integers	
MS BYTE LS BYTE	Speed (RPM)	Step 9
MS BYTE LS BYTE	Time (Sec)	
MS BYTE LS BYTE	Resistivity (Meg-ohms)	
00000000 LS BYTE	Output Options	
H L	Checksum	

PPID is the recipe number

NOSPR is the number of steps per recipe

It is not necessary to have all ten possible steps programmed in each recipe: a recipe can consist of only one step

Output option assignment:

B0 = 1	DI water valve is open
B1 = 1	Nitrogen valve is open
B2 = 1	Heater is on
B3 = 1	Static eliminator is on
B4 = 1	Resistivity is selected (rinse cycle ends when timer expires and rinse water meets or exceeds resistivity setpoint)
B5	Not used
B6	Not used
B7	Not used

5.5.8 Stream 9 System Errors

Response	Response
S9, F1 E ➜ H	**S9, F5 E ➜ H**
0A Block Length 8A ID 28 09 S9, F1 01 80 Blk. # Header 01 XX System XX XX XX H Checksum L X = Don't care H = Checksum (Hi-byte) L = Checksum (Lo-byte) Response is sent from an unrecognized I. D.	0A Block Length 8A ID 28 09 S9, F5 05 80 Blk. # Header 01 XX System XX XX XX H Checksum L X = Don't care H = Checksum (Hi-byte) L = Checksum (Lo-byte) Response is sent from an unrecognized function

5.6 Optional IPAassist Module

The IPAassist module feature, on the dryer, is programmed and displayed for each step of each recipe as follows:

- status of IPAassist (on or off) is visible as bit 1 of Outputs 2
- the bit is 1 for feature enabled and 0 for feature disabled
- each step of each recipe is represented by four 2 byte integers
- the first byte (MS byte) of the 4th pair (Output Options) contains the IPAassist feature information
- if the first bit (B0) is a 1, the feature is enabled for that step
- if this bit (B0) is a 0, the feature is disabled for that step
- B1-B7 are not used.
- an error is displayed as bit 1 of Run Stop 1 (B1=1)
- instantaneous error input is displayed as bit 3 of Inputs 1 (B3=0)

6 INSTALLATION PROCEDURES

The following procedure is written for the trained technician.

Serial Number:	____________	**Location:**	____________
Customer:	____________	**Voltage:**	________ **Hz:** ______
Rotor P/N:	____________	**Carrier Type:**	____________
Rotor S/N:	____________	**Bal Std:**	____________
Hinge Direction:	***Left // Right***	**Software #:**	____________
Inspected By:	____________	**Date:**	____________
Customer Signature:	____________	**Date:**	____________

NOTE

Do not power up the dryer prior to all visual and hardware checks being verified. Prior to beginning start-up, verify that equipment and options (according to the sales order) are on the dryer.

☐ **1.** Remove covers from the dryer. (Both dryer and Controller)

☐ **2.** Verify proper hinge direction.

☐ **3.** Verify rotor P/N and record.

☐ **4.** Visually inspect dryer for:

- ☐ Bowl for scratches and dents.
- ☐ Cables / connectors for cuts and general condition.
- ☐ Verify all cables are connected properly.
- ☐ N2 and DI connections internally.
- ☐ All hardware for tightness and size.
- ☐ Overall appearance of machine (panels, covers, workmanship)
- ☐ Verteq labels on Keypad, Resistivity Monitor, Controller, Centrifuge and Motor Controller

5. Check circuit breaker sizes and labels:
   - Circuit breaker 1 1A
   - Circuit breaker 2 15A
   - Circuit breaker 3 3A
   - Circuit breaker 4 15A
6. Remove the rotor.
7. Verify hub set screws are tight.
   - Verify that the seal plate is centered with the hub.
   - Ensure that the hub spacing is correct:
     - 6 inch rotor .080 inch
     - 8 inch rotor .150 inch
8. Install rotor. tighten down screws in proper sequence.
   (12, 6, 9, 3 O'clock position)

NOTE

Do not operate the dryer without a carrier.

9. Install the proper carrier with the correct load requirements.

NOTE

Prior to connecting facility DI to dryer, run DI water into the drain for 5-10 minutes to discard particles in the line.

10. Plug in the dryer. Turn on facilities (N_2 and DI) check for DI water leaks in the manifold, connections, drain box and tubing.
11. Verify all L.E.D.'s on the keypad light up when powering up the dryer.
12. Verify that there are no N_2 leaks at connectors, manifold, static eliminator, clean coil fittings, regulators, switches and gauges.
13. Verify DI / N_2 check valve works properly (No DI in N_2 during the rinse cycle).
14. Verify maximum speed programming limitations. (2000 RPM's).

☐ **15.** With the door closed verify door microswitch D7 inside the controller turns on. With the door still closed verify that the door closed reed switch (SW. toward rear of dryer) turns D9 on in controller. Open the door and adjust the Bimba so that the door is open at 90°. Verify door open reed switch (SW. toward the front of dryer) turns D8 on inside the controller.

☐ **16.** Start the dryer and verify no excessive vibration.

☐ **17.** Verify the DI water nozzles are spraying correctly.

☐ **18.** Verify resistivity works.

- ☐ Resistivity override
- ☐ Timed resistivity

NOTE
If resistivity has not reached the set point at the end of the rinse cycle the resistivity reading will toggle between the actual reading and the set point, and the time display will flash.

☐ **19.** At the end of the cycle, verify that the index position is exactly at the 12 O'clock position. If not, loosen the four 1/4" bolts on the rear of the motor and turn the index housing to the correct position. Re-tighten the four 1/4"bolts and re-test.

NOTE
Verify the following adjustments while the dryer is running:

☐ **20.** With the facility set to 60 PSI (dynamic), adjust the dryer's main regulator to >35 PSI dynamic. Verify loss of pressure, should display a "HELP 100" on keypad in approximately 10 seconds.

☐ **21.** Using the temperature gauge, verify patch and clean coil are operational.

☐ **22.** Verify that the N_2 purge shuts off 30 seconds after the dryer has ended a cycle. (Check DIP switch settings.)

☐ **23.** Verify Labyrinth seal purge is set for 95 SCFH if not adjust the needle valve.

☐ **24.** Verify door obstruction sensor is operational. Insure door open and door close functions complete in 5 seconds (adjust needle valves.)

☐ **25.** Check the following error conditions.

NOTE
Refer to Section 3.6, *Fault (Help) Codes*.

- ☐ N_2 failure: Disconnect N_2 pressure switch
- ☐ Power failure: Turn power off while dryer is running.(Insure door relief valve is operational)
- ☐ Door open during cycle: Disconnect microswitch.
- ☐ Index failure: Disconnect wire connector on index solenoid (#8) on CDA manifold.

☐ **26.** Program and record the desired process parameters.

Rinse Time:	________________	seconds
Rinse Speed:	________________	RPM
Dry Time:	________________	seconds
Dry Speed:	________________	RPM

☐ **27.** Re-torque the seal and locktite any hardware that might have been readjusted.

☐ **28.** Wipe down the dryer and verify cleanliness.

☐ **29.** Assist in particle testing if required.

☐ **30.** Replace the covers and tighten all screws.

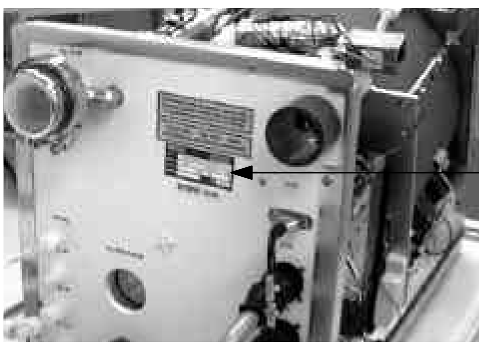
COMMENTS:

7 STANDARD SPARE PARTS LISTS

7.1 How to Order

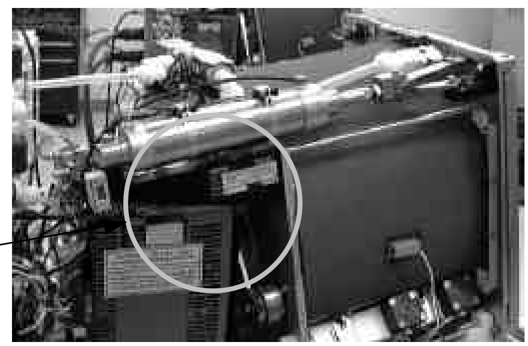
When ordering spare parts, please have your dryer's serial number ready for reference. The serial number can be found on the back outside panel of the dryer. If this label has been damaged or removed, the next best area to look for the dryer's serial number is to remove the cover to the dryer and look on the inside as shown below.

To contact Verteq to order spare parts, please call Verteq's main phone line at: (714) 445-2000. Ask for the Inside Sales department.



For the serial number:

Either look on the outside rear panel, or on the inside on the right and/or left sides.



7.2 How To Use the Spare Parts List

If the spare part is called out in a preventive maintenance procedure, the frequency and procedure number is also listed.

For CE Marked parts:

- if a part is listed with a "**Yes**", then that part can be used for non-CE Marked dryers as well as CE Marked dryers
- if a part is listed with "***Only***", then that part is for CE Marked dryers only. CE Marked dryers should use this part only
- if a part is listed with a "**Non**", then that part can be used only on non-CE Marked dryers. Do not order this part for CE Marked dryers

Spare Parts List for the 1800-6 Rinser/Dryer					
Description	**Part No.**	**CE Marked**	**Qty.**	**PM Frequency**	**Procedure No.**
Auto positioner cyl assy 1800	1070267.1	Yes	1		
Cable Assy, brushl brd-rear pn	1072053.1	Yes	1		
Cable Assy, NSRD Aux 1-2 1800	1072056.1	Yes	1		
Cable Assy, R123 to motor con	1072660.1	Yes	1		
Controller, speed control	4119839	Yes	1		
Controller, STD HC M/1800-6	1075227.707	Yes	1		
CRTBKR, 280VAC, 60A Box, 2 wire	4119730	Yes	1		
Cylinder, air, 2” B x 5”, str	4120066	Yes	1		
Damper, vibration 70lb	4119415	Yes	4		
Elbow, 1/8p x l/16 barb, nylon	4120356	Yes	1		
Elbow, barb polypro 1/8p x 1/8 ID	4118898	Yes	1		
Encl assy resist monitor hard	1067786.5	Yes	1		
Filter, 12stk phobic, gas	4117955	Yes	1	Semi-Annual	4.1.4
Fuse, 40A	4119735	Yes	1		
Gasket manifold 1800 Ar Al Ad	1072587.1	Yes	1		
Heater, nitrogen	4119386	Yes	1		
Hub	1062563.1	Yes	1		
Keypad Assy 1800-6	1087601.501	Yes	1		
Keypad assy, hardened	1083301.501	Yes	1		
Manifold Assy 1800-6H	1072598.1	Yes	1		
Probe, resistivity & cable assy.	1067803.1	Non	1		
Probe, resistivity CE Marked	1067803.5	***Only***	1		
Regulator 0-120psi	4119746	Yes	1		
Regulator, Pressw/0-100psi Gage	4119437	Yes	1		
Relay, pc mount 120 vac coil	4119644	Yes	3		
Ring, o, epdm, viton	4119398	Yes	1		
Ring, o, epdm, viton	4119402	Yes	1		
Ring, o, epdm, viton	4119403	Yes	1		
Ring, o, epdm, viton, teflon coat	4119404	Yes	1		
Ring, o, epdm. viton	4114314	Yes	1		
Screw, allen socket, f-hd, w/coat	1069144.3	Yes	4		
Seal door 1800 EPDM	1070237.7	Yes	1	Daily	4.1.1
Seal Plate Labyrinth	1071522.1	Yes	1	Semi-Annual	4.1.4, 4.2
Seal, static	1070125.1	Yes	2		
Static elim pwr source assy	1072603.1	Yes	1		
Switch A, door CYL1800	1072583.1	Yes	1		
Switch, press 45psi	4119576	Yes	1		
Switch, pressure 5psi	4119414	Yes	1		
Thermostat	4118312	Yes	2		
Valve Assy Safety 1800	1072597.1	Yes	1		
Valve pneu NV2-144NC-HP	4119165	Yes	1		

Spare Parts List for the 1800-6 Rinser/Dryer					
Description	**Part No.**	**CE Marked**	**Qty.**	**PM Frequency**	**Procedure No.**
Valve, 8port manifold DI/N2, pvc	4119723	Yes	1		
Valve, check flow control	4120061	Yes	2		
Valve, Sol 120 VAC	4119421	Yes	5		

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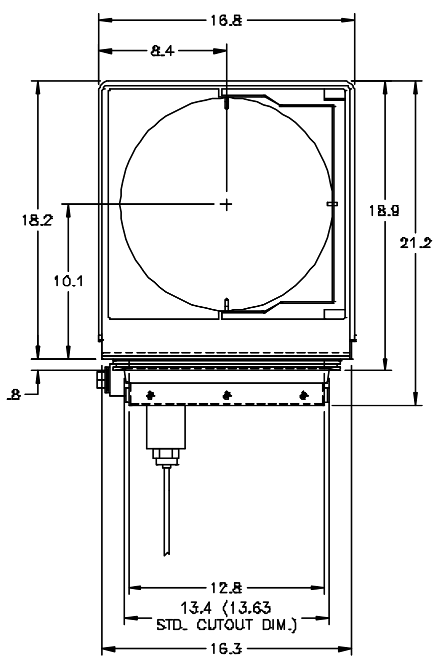
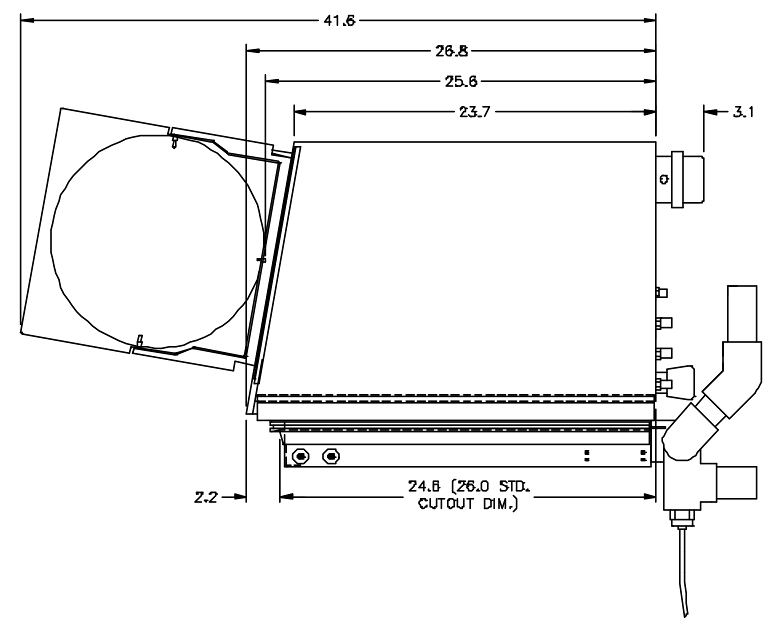
DWG NO: 1085476	SH: 1	REV: NC

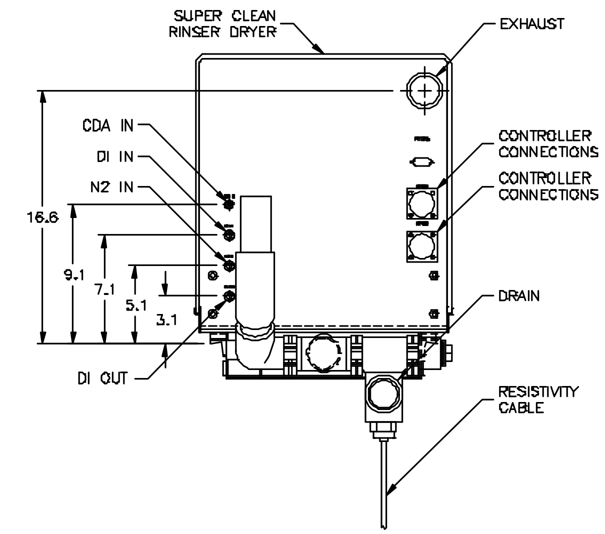
REVISIONS

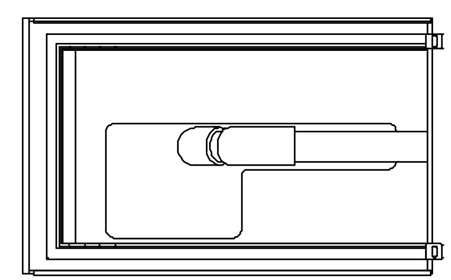
REV	DESCRIPTION	DATE	APPD
NC	INITIAL RELEASE	2-21-97	KJQ

MODEL 1800-6
SHOWN WITH RESISTIVITY

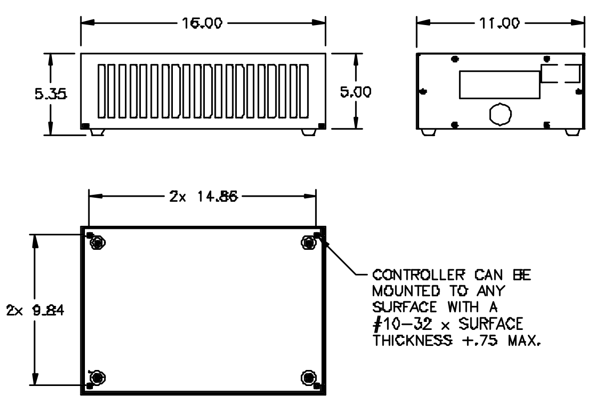




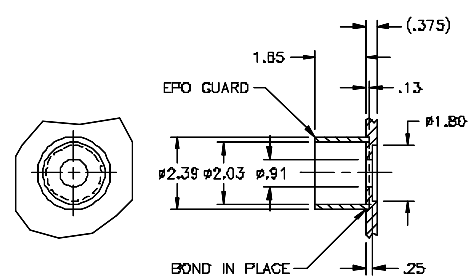




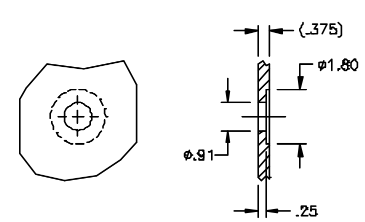
DRAIN REMOVED FOR CLARITY



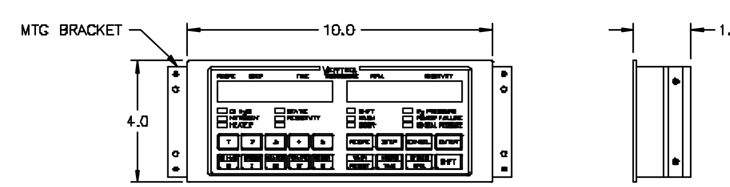
CONTROLLER ASSEMBLY 5.
SUPPLIED WITH UNIT



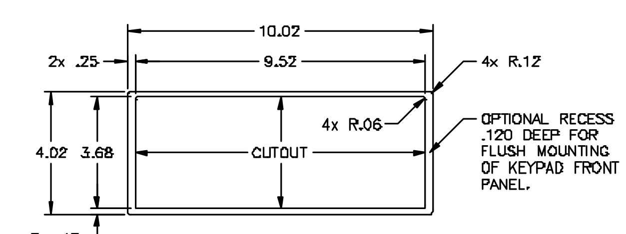
EPO CUTOUT DETAIL 4.
IF CUSTOMERS PANEL THICKNESS IS DIFFERENT THAN INDICATED, THEN MAKE THE NECESSARY DIMENSION ADJUSTMENTS
SCALE: 1/4



SWITCH CUTOUT DETAIL 3. 3X
IF CUSTOMERS PANEL THICKNESS IS DIFFERENT THAN INDICATED, THEN MAKE THE NECESSARY DIMENSION ADJUSTMENTS
SCALE: 1/4



STANDARD KEYPAD ASSEMBLY
SUPPLIED WITH UNIT
SCALE: 1/4



KEYPAD INSTALLATION DIMENSIONS 6.
SCALE: 1/4

FACILITY REQUIREMENTS:

DI WATER:	USE 3/8" OD TEFLON TUBING. 1.75 GPM DELIVERED UNDER A DYNAMIC PRESSURE OF 25 PSI MINIMUM (30 PSI DYNAMIC MAXIMUM FOR THE STANDARD VALVE, 50 PSI MAXIMUM FOR THE OPTIONAL HIGH PRESSURE VALVE). FITTINGS AVAILABLE: FLARETEK OR COMPRESSION.
DI RETURN:	USE 3/8" OD TEFLON TUBING UNDER A DYNAMIC PRESSURE THAT IS AT LEAST 5 PSI LESS THAN THE PRESSURE OF THE INCOMING DI WATER. FITTINGS AVAILABLE: FLARETEK OR COMPRESSION.
SYSTEM NITROGEN:	USE 3/8" OD TEFLON TUBING. SINGLE 6-7 SCFM DELIVERED UNDER A PRESSURE OF 60 PSI DYNAMIC. FITTINGS AVAILABLE: FLARETEK OR COMPRESSION.
SECONDARY NITROGEN:	USE 1/4" OD TEFLON TUBING UNDER STATIC PRESSURE (OR CDA) OF 60-90 PSI. FITTINGS AVAILABLE: FLARETEK OR COMPRESSION.
DRAIN:	1.5" NPT, VERTEQ RECOMMENDS THAT DRAIN TRAPS AND VENTS BE INSTALLED TO PREVENT CONTAMINANTS FROM MIGRATING BACK INTO THE BOWL. EXHAUST -0.5 TO -1.0 INCHES OF WATER.
ELECTRICAL:	120 VAC, 15 AMPERES, 50/60 HERTZ PER RINSER/DRYER. AVAILABLE OPTION: 240 VAC, AMPERES INPUT.

10.13.95.NC

NOTES

1. CUSTOMER CUTOUT REQUIREMENTS: SEE DRAWING FOR CENTRIFUGE CUTOUT DIMENSIONS.
2. CENTRIFUGE ASSEMBLY SHOWN WITH RESISTIVITY OPTION, IF RESISTIVITY IS NOT REQUIRED THEN CABLE WILL NOT BE SUPPLIED, SEE DRAWING.
3. AN ENCLOSED SWITCH ASSEMBLY IS SUPPLIED WITH UNIT. IF CUSTOMER REQUIRES SPECIAL MOUNTING, THEY CAN DISASSEMBLE THE SWITCHES AND REMOUNTED IN THEIR OWN CONFIGURATION. FOR MOUNTING INFORMATION, SEE SWITCH CUTOUT DETAIL FOR INSTRUCTIONS.
4. IF EPO IS REQUIRED, CUTOUT INFORMATION IS SUPPLIED FOR MOUNTING PURPOSES ONLY. SEE EPO CUTOUT DETAIL FOR INSTRUCTIONS.
5. STANDARD CONTROLLER CABLES COMES IN 5'-0" TO 20'-0" LENGTHS.
6. KEYPAD CUTOUT INFORMATION IS SUPPLIED FOR MOUNTING PURPOSES ONLY. SEE KEYPAD INSTALLATION CUTOUT DETAIL FOR INSTRUCTIONS.

CONFIG	DESCRIPTION
-1	

MATERIAL SPEC	FINISH SPEC

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES

TOLERANCES ON:

.XX DECIMALS ±	.03	X° ±	1°
.XXX DECIMALS ±	.010	X/X ±	

SIGNATURES		DATE
DRAWN:	K.QUALLEY	2-21-97
ENGR:	K.QUALLEY	2-21-97

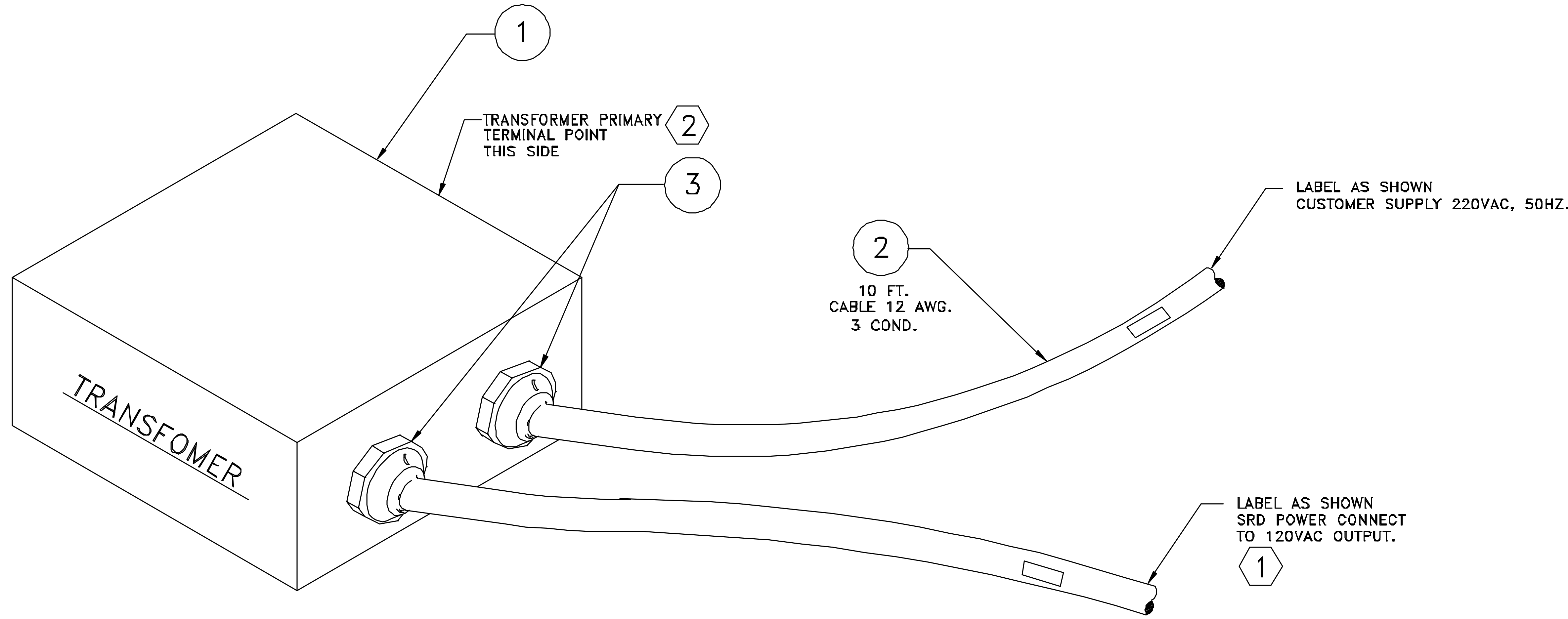
VERTEQ

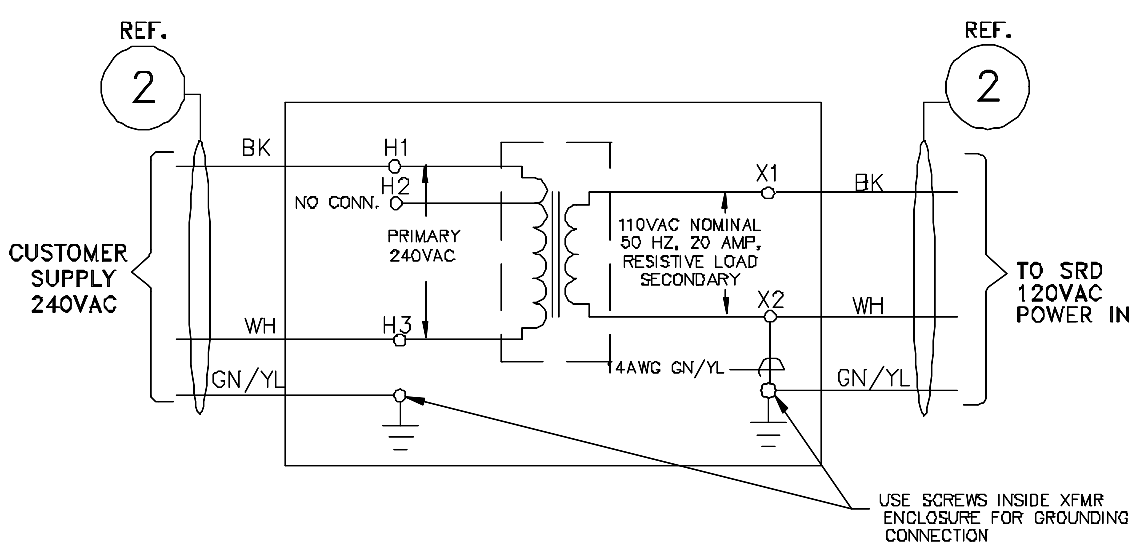
NEXT ASSY	USED ON

FACILITY DRAWING, 1800-6 CENTRIFUGE, SINGLE

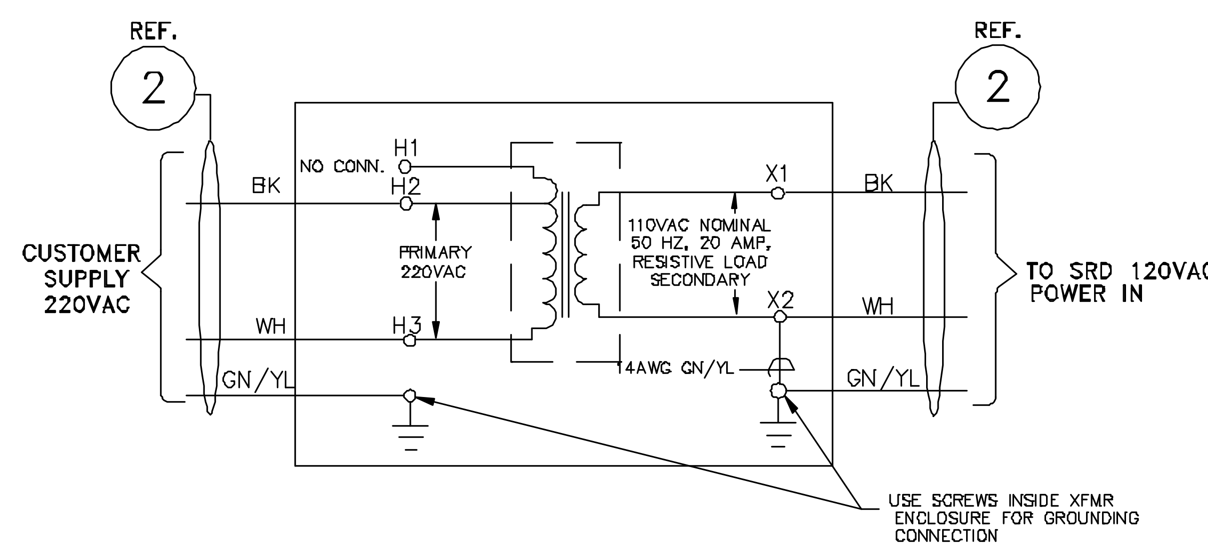
C	DWG NO: 1085476	
SCALE: 1/8	PRD: 1800-6	SHEET 1 OF 1

APPROVED FOR CONSTRUCTION - 5/22/98





−5 AND −7 CONFIGURATION ONLY



−1 AND −3 CONFIGURATION ONLY

DWG NO: 1087359 SH: 1 REV: D

REVISIONS

REV	DESCRIPTION	DATE	APPD
NC	INITIAL RELEASE	8-4-97	R.W.W
A	SEE E.O., ADD -3 CONFIG.	2-12-98	KJQ
B	ADDED LABELS	3-25-98	MJL
C	ADDED LABEL	11/09/99	MM
D	REMOVED LABEL	11/13/00	KJQ
E	ADD -5,-7, XFMR SCHEM.	12/13/00	B.B.

NOTES

1. FOR SRD 1600-3, REMOVE THE POWER CONNECTOR, BEFORE CONNECTING TO THE TRANSFORMER.
2. TRANSFORMER TO BE ORIENTED INSIDE OF ENCLOSURE AS NOTED.

CONFIG	DESCRIPTION
-7	XFMR, 240/120VAC "CE" DS
-5	XFMR, 240/120VAC "CE" DS
-3	XFMR, 220/120VAC "CE" DS
-1	XFMR, 220/120VAC "CE" SINGLE

MATERIAL SPEC | FINISH SPEC

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON:
.XX DECIMALS ± X° ±
.XXX DECIMALS ± X/X ±

SIGNATURES		DATE
DRAWN:	THANH NGUYEN	AUG 01, 1997.
ENGR:		

VERTEQ

NEXT ASSY | USED ON

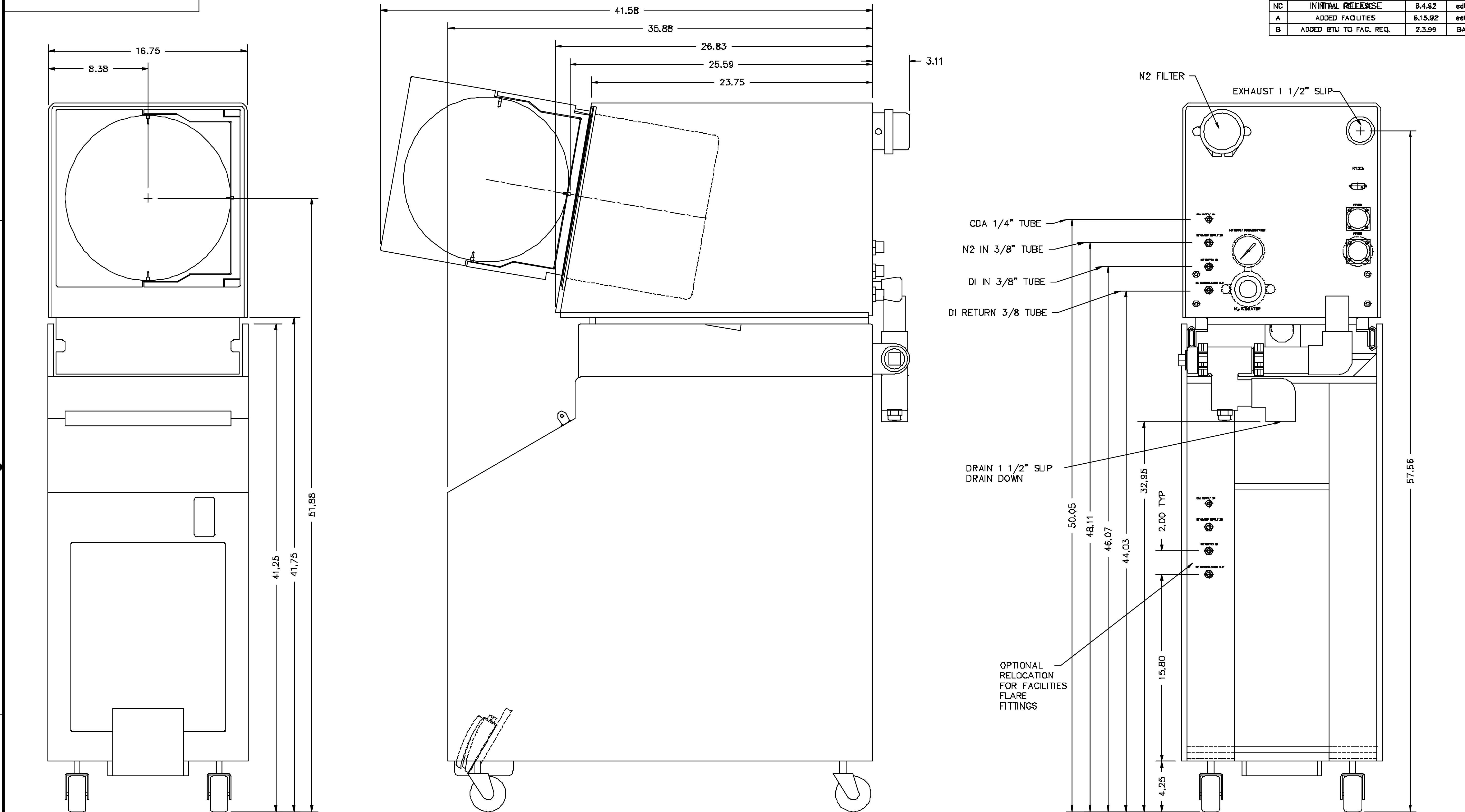
TRANSFOMER
240-220 TO 120V
ASSEMBLY

B DWG NO: 1087359

SCALE: NONE PRD: R/D SHEET 1 OF 1

10.13.95.NC

APPROVED FOR CONSTRUCTION - 12/21/00



REVISIONS			
LTR	DESCRIPTION	DATE	APPD
NC	INITIAL RELEASE	6.4.92	edt
A	ADDED FACILITIES	6.15.92	edt
B	ADDED BTU TO FAC. REQ.	2.3.99	BA

FACILITY REQUIREMENTS:

DI WATER: 1.8 – 2.2 GPM DELIVERED IN 3/8" OD 1/4" ID TEFLON TUBING UNDER A MINIMUM DYNAMIC PRESSURE OF 40 PSIG. TEMP LESS THAN 100?C

NITROGEN: 5–6 SCFM DELIVERED IN 3/8" OD 1/4" ID TEFLON TUBING UNDER A MINIMUM DYMAMIC PRESSURE OF 40 PSI (APPROXIMATELY 40 PSI STATIC.)

CDA: 80 PSI MINIMUM PRESSURE, 1/4" OD 5/32" ID TEFLON TUBING.

DRAIN: 1 1/2" NPT.

ELECTRICAL: 110VAC ± 10 %, 50/60Hz, 15A, WITH NEUTRAL AND GROUND, SINGLE PHASE. A BRANCH CIRCUIT PROTECTIVE DEVICE WITH 10,000 AMPERE INTERRUPTING CAPACITY IS REQUIRED.

CDA, DI WATER, DI RETURN, & NITROGEN BULKHEAD FITTINGS ARE FLARE TYPE.

BTU PER HOUR=5000.

NOTES:

1. ALL DIMENSIONS ARE FOR REFERENCE ONLY.

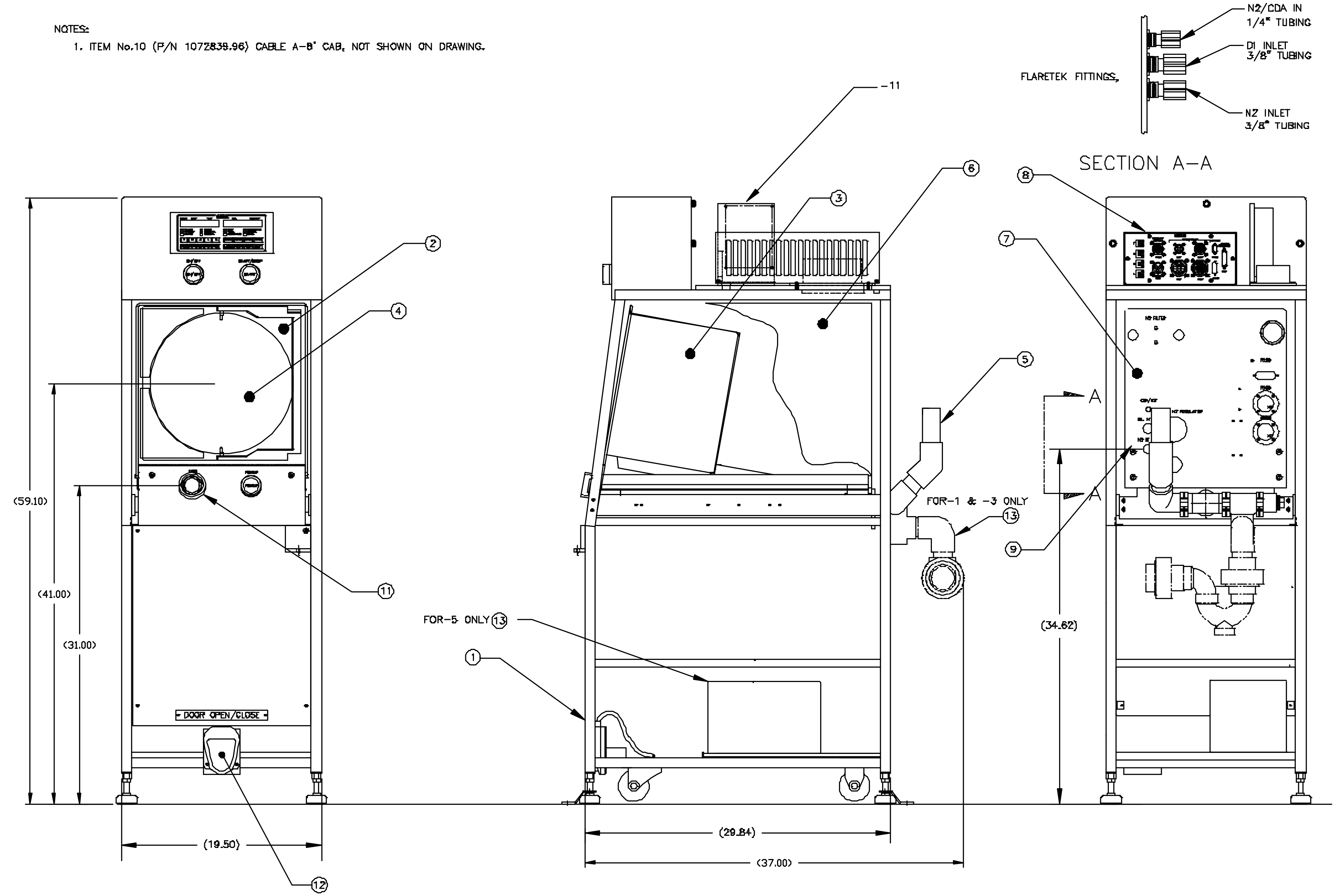
-1	PART NO.	DESCRIPTION	SIZE	ITEM NO.
QTY REQD	PARTS LIST			

NEXT ASSY: 1072838 (USED ON)	UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON DECIMALS ANGLES .XX ± ± .XXX ± BREAK EDGES/REMOVE BURRS	TITLE 1800–6 FRONT REM. AND CABINET
VERTEQ	DRAWN TUCKER	D 1074068
DATE OF DWG 6.4.92	CHECKED	SCALE 1:4
	APPD	1800–6 SHEET 1 OF 1

1074068

APPROVED FOR CONSTRUCTION - 2/8/99

NOTES:
1. ITEM No.10 (P/N 1072839.96) CABLE A-8' CAB. NOT SHOWN ON DRAWING.



SINGLE FREM 1800-6 HP
FACILITY REQUIREMENTS:

DI IN:	FLARETEK FITTING. 3/8" OD TEFLON TUBING. SINGLE 1.8-2.2 GPM DELIVERED UNDER A DYNAMIC PRESSURE OF 40 PSI MINIMUM.
SYSTEM NITROGEN:	FLARETEK FITTING. 3/8" OD TEFLON TUBING. SINGLE 5-6 SCFM (GAUGE READING) DELIVERED UNDER A PRESSURE OF 60 PSI IDLE.
SECONDARY NITROGEN: (CLEAN DRY AIR)	FLARETEK FITTING. 1/4" OD TEFLON TUBING UNDER IDLE PRESSURE OF 60-90 PSI, 2 SCFM.
DRAIN:	1.5" PIPE. VERTEQ RECOMMENDS THAT DRAIN TRAPS AND VENTS BE INSTALLED TO PREVENT CONTAMINANTS FROM MIGRATING BACK INTO THE BOWL. EXHAUST -0.5" TO -1.0" INCHES OF WATER.
ELECTRICAL:	PER CENTRIFUGE 120 VAC 50/60 Hz, SINGLE PHASE (1ϕ). 20 AMPERES.

DWG NO: 1088267 SH: 1 REV: H

REVISIONS

REV	DESCRIPTION	DATE	APPD
NC	INITIAL RELEASE	11-04-97	MJL
A	MOD. CONTROLLER, SWITCH, EPO, & ELBOW	11-24-97	MJL
B	ADDED POWER SWITCH ON PANEL	12-12-97	MJL
C	SHOWN DRAIN BRACKET ZN-B2	1-27-98	MJL
D	SEE E. O.	3-5-98	MJL
E	MOD. DRN PLMBNG & NEW -3	7-27-98	MJL
F	RELOCATED EPO & RESIS. MNTR.	8-13-98	MJL
G	ADDED -5 CONFIGURATION	8-26-98	BA
H	ADDED NOTE TO ITEM 13	9/1/98	BA
J	SEE E.O.	9/30/98	MJL

NOTES

CONFIG	DESCRIPTION
-5	FREM SINGLE, LH HINGE,W/RESIS NO DRAIN PLUMBING 230V
-3	FREM SINGLE, LH HINGE W/O RESIS.
-1	FREM, SINGLE RH HINGE W/RESIS.

MATERIAL SPEC	FINISH SPEC

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON:
.XX DECIMALS ± .50 X° ± 1°
.XXX DECIMALS ± X/X ±

SIGNATURES		DATE
DRAWN:	M. J. LOPEZ	11-03-97
ENGR:	MJL/AB	10-25--97

VERTEQ

NEXT ASSY	USED ON

FREM, SINGLE
1800-6 HP

C DWG NO: 1088267

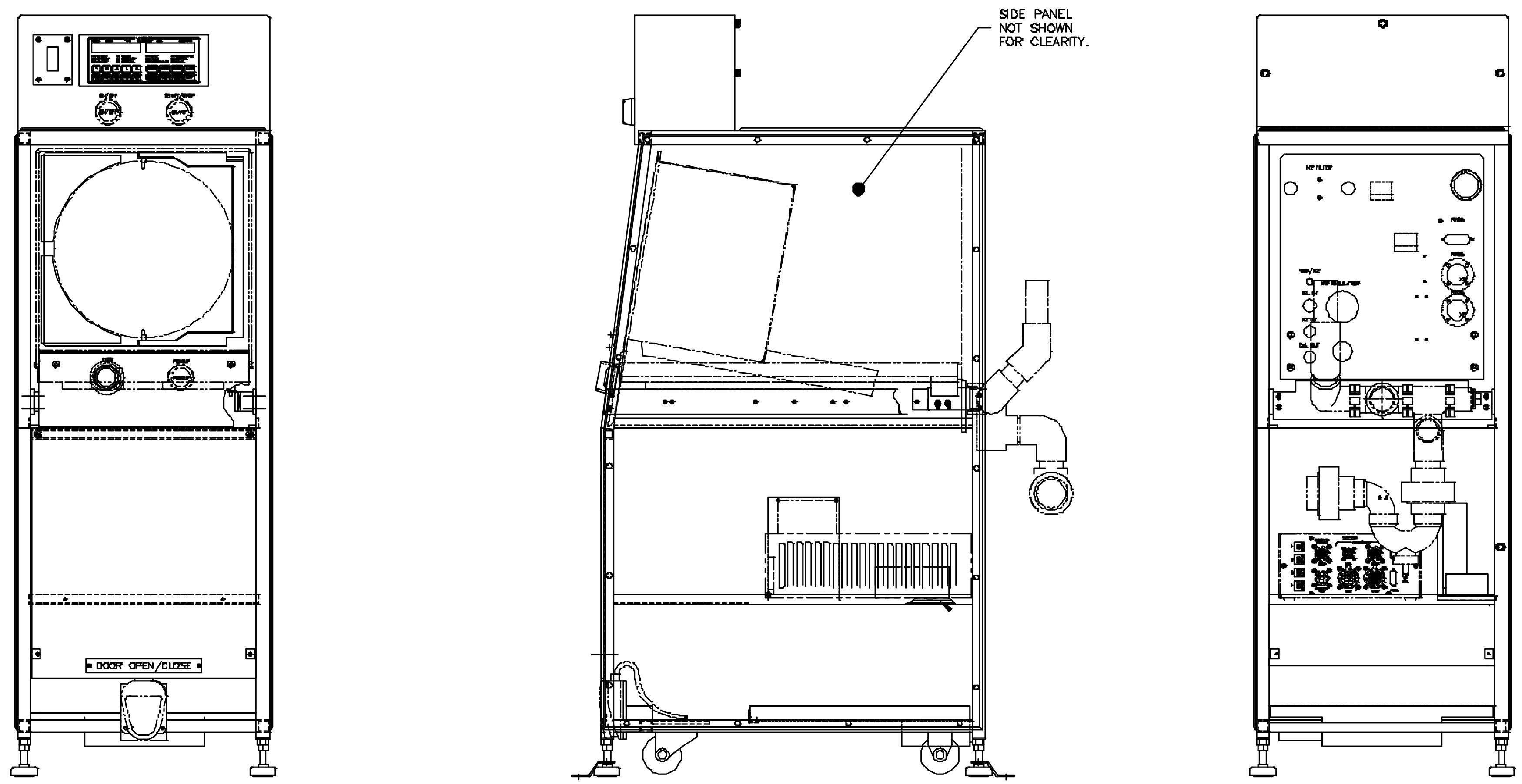
SCALE: 1/8 PRD: 1800.6 SHEET 1 OF 1

10.13.95.NC

APPROVED FOR CONSTRUCTION - 10/9/98

NOTES:

1. FOR FACILITY INFORMATION SEE DWG 1088267-1



DWG NO:	1094712	SH: 1	REV: B

REVISIONS

REV	DESCRIPTION	DATE	APPD
NC	INITIAL RELEASE	10/11/99	MM
B	RELEASE DWG TO B.O.M.	10/11/99	MM
C	SEE EO	1/7/00	BA

NOTES

CONFIG	DESCRIPTION
-3	FRPP,DARK PROCESS W/IPA ASSIST
-1	FRPP, ERGO,EPO,GFI,WSW,ALARM

MATERIAL SPEC	FINISH SPEC

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES

TOLERANCES ON:

.XX DECIMALS ± .03 X° ± 1°

.XXX DECIMALS ± .010 X/X ±

SIGNATURES		DATE
DRAWN:	W. GODWIN	10/11/99
ENGR:	MM	10/11/99

VERTEQ

NEXT ASSY	USED ON
	1094714.1

FRAME ASSY, 1800.6
FREM SINGLE FRPP

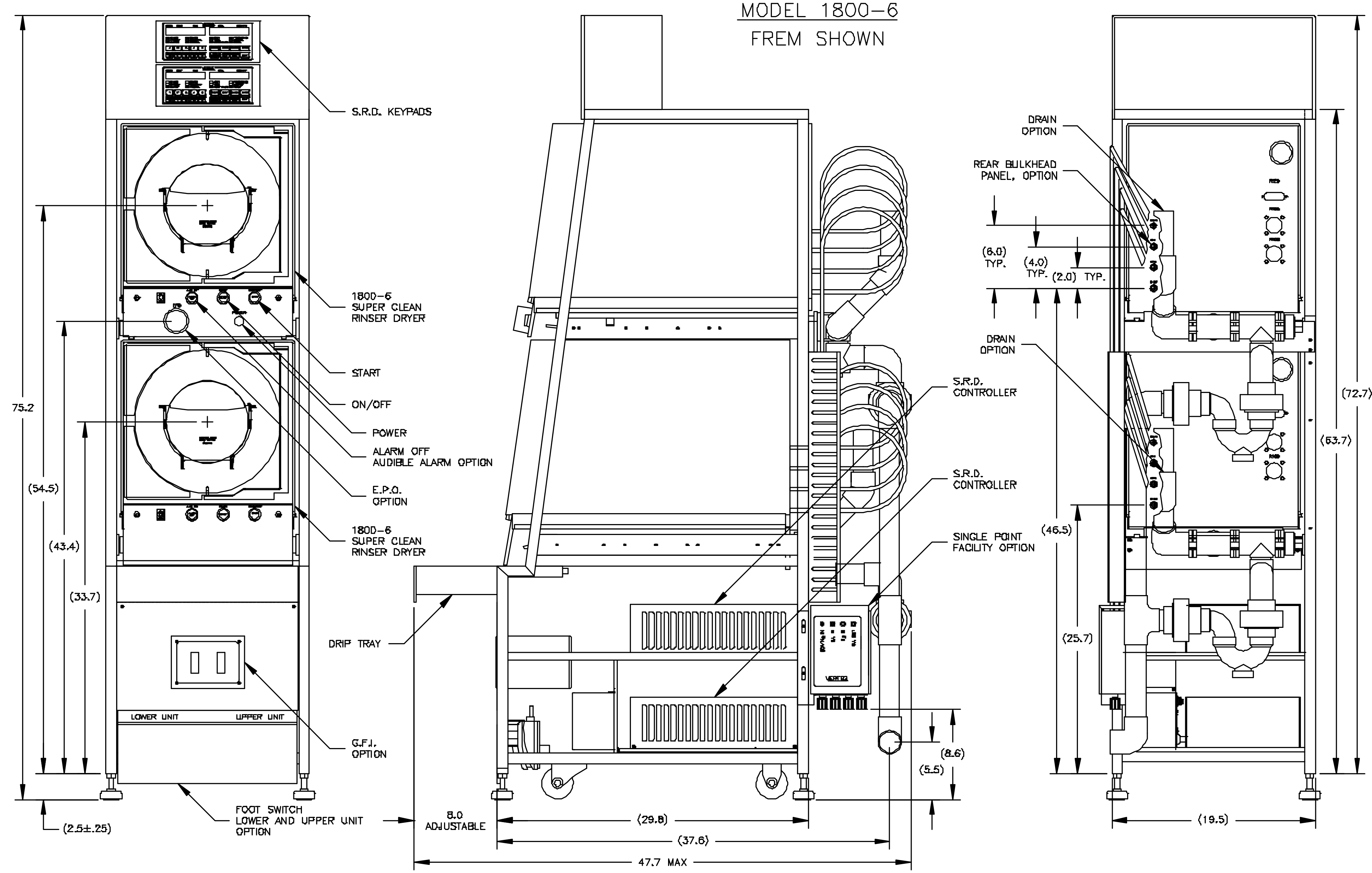
C DWG NO: 1094712

SCALE: 1/8 PRD: 1800.6 SHEET 1 OF 1

10.13.95.NC

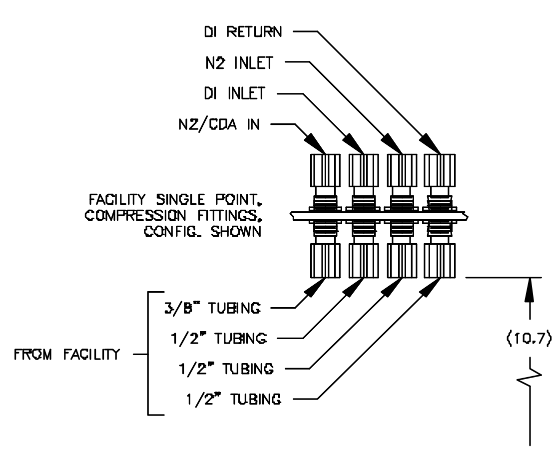
APPROVED FOR CONSTRUCTION - 1/7/00

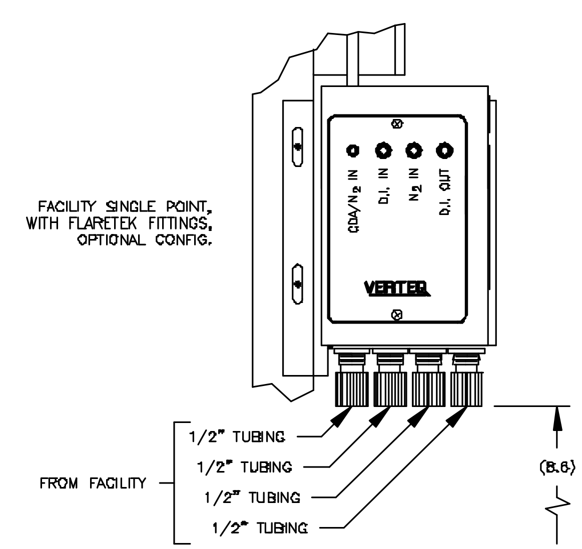
MODEL 1800-6
FREM SHOWN



FACILITY REQUIREMENTS:

D.I. WATER INPUT:	WITHOUT SINGLE POINT OPTION 3/8" O.D. TEFLON TUBING. SINGLE POINT FLARETEK 1/2" O.D. TEFLON TUBING. SINGLE POINT COMPRESSION 1/2" O.D. TEFLON TUBING. 3.5 GPM MINIMUM. 25 PSI DYNAMIC MINUMUM. 40 PSI DYNAMIC MAXIMUM FOR THE STANDARD LOW PRESSURE VALVE. 70 PSI DYNAMIC MAXIMUM FOR OPTIONAL HIGH PRESSURE VALVE.
D.I. WATER RETURN:	WITHOUT SINGLE POINT OPTION 3/8" O.D. TEFLON TUBING. SINGLE POINT FLARETEK 1/2" O.D. TEFLON TUBING. SINGLE POINT COMPRESSION 1/2" O.D. TEFLON TUBING. UNDER PRESSURE OF AT LEAST 5 PSI LOWER THAN D.I. WATER INPUT PRESSURE.
SYSTEM N2:	WITHOUT SINGLE POINT OPTION 3/8" O.D. TEFLON TUBING. SINGLE POINT FLARETEK 1/2" O.D. TEFLON TUBING. SINGLE POINT COMPRESSION 1/2" O.D. TEFLON TUBING. 12 - 14 SCFM (GAUGE READING). 60 PSI DYNAMIC MINIMUM.
CDA/OFA/N2:	(OPERATES PNEUMATIC COMPONENTS) WITHOUT SINGLE POINT OPTION 1/4" O.D. TEFLON TUBING. SINGLE POINT FLARETEK 1/2" O.D. TEFLON TUBING. SINGLE POINT COMPRESSION 3/8" O.D. TEFLON TUBING. 60 -90 PSI DYNAMIC.
DRAIN:	1 1/2" MNPT (DRAIN BOX) 1 1/2" PVC PIPE (DRAIN PLUMBING OPTIONS).
VENT:	1 1/2" PIPE (-0.5 TO -1.0 INCHES OF WATER IF NOT VENTED TO FAB).
POWER:	120 VAC, 15 AMPS, 50/60 HERTZ PER RINSER/DRYER.





DWG NO:	1080150	SH: 1	REV: B

REVISIONS

REV	DESCRIPTION	DATE	APPD
NC	INITIAL RELEASE	8-9-95	MM
A	SEE E.O. REVISED & REDRAWN	2-24-99	KJQ
B	SEE E.O.	4-13-00	KJQ

NOTES

1. SIDE COVERS FOR FRAME ARE OPTIONAL.

-1	
CONFIG	DESCRIPTION
MATERIAL SPEC	FINISH SPEC

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES

TOLERANCES ON:

.XX DECIMALS ± .03 X° ± 1°
.XXX DECIMALS ± .010 X/X ±

SIGNATURES		DATE
DRAWN:	M. MANRIQUEZ	8-9-95
ENGR:	M. MANRIQUEZ	8-9-95

VERTEQ

NEXT ASSY	USED ON

FACILITY DRAWING,
1800-6 FREM
DOUBLE STACK

C DWG NO: 1080150

SCALE: 1/8 PRD: 1800 SHEET 1 OF 1

10.13.95.NC

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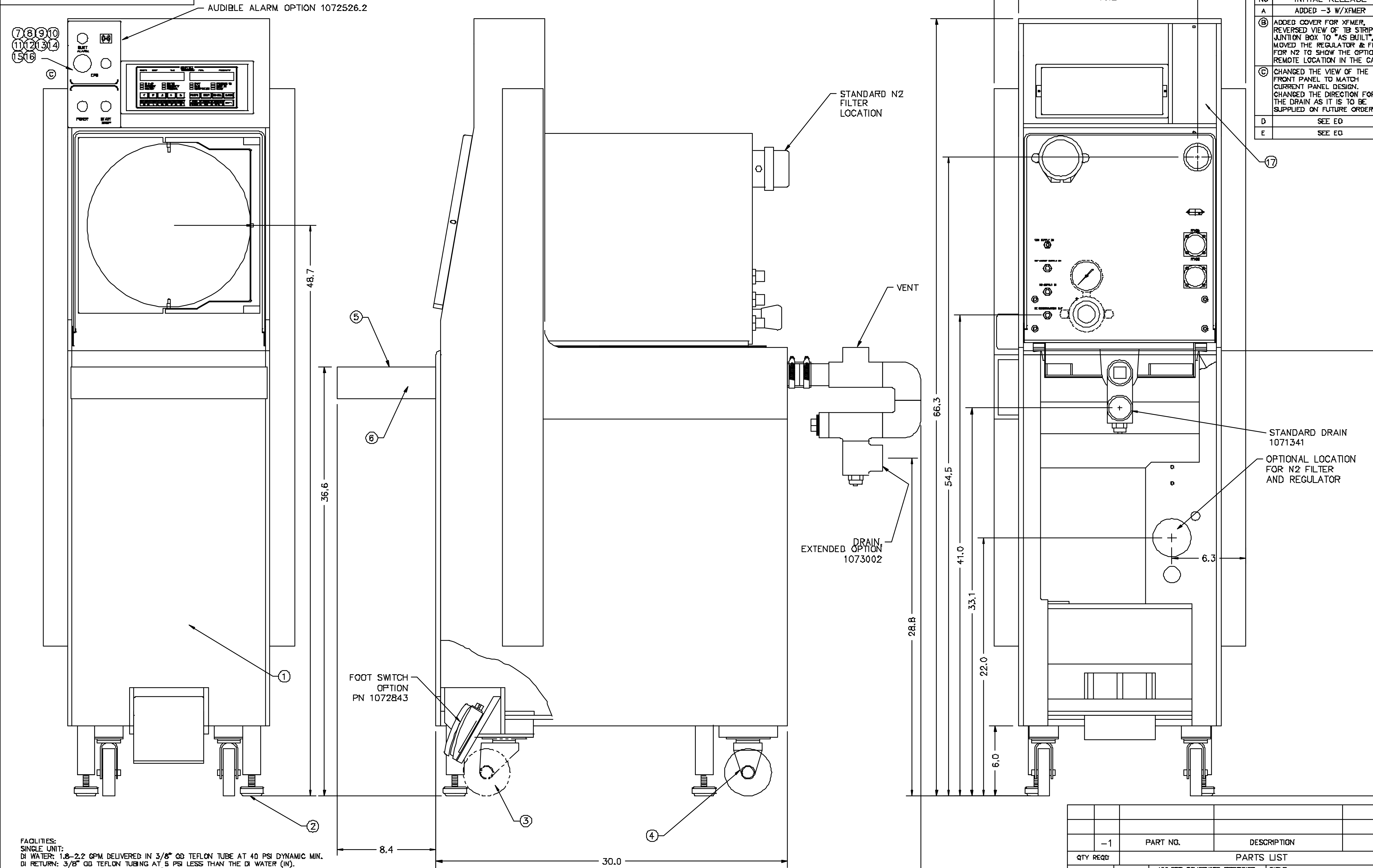
REVISIONS			
LTR	DESCRIPTION	DATE	APPD
NC	INITIAL RELEASE	11.2.92	EDT
A	ADDED -3 W/XFMER	1.29.93	edt
B	ADDED COVER FOR XFMER, REVERSED VIEW OF TB STRIP & JUNTION BOX TO "AS BUILT", MOVED THE REGULATOR & FILTER FOR N2 TO SHOW THE OPTIONAL REMOTE LOCATION IN THE CAB.	1.29.93	edt
C	CHANGED THE VIEW OF THE FRONT PANEL TO MATCH CURRENT PANEL DESIGN. CHANGED THE DIRECTION FOR THE DRAIN AS IT IS TO BE SUPPLIED ON FUTURE ORDERS.	3.19.93	edt
D	SEE EO	5.4.93	edt
E	SEE EO	5-27-93	M.M.



FACILITIES:
SINGLE UNIT:
DI WATER: 1.8–2.2 GPM DELIVERED IN 3/8" OD TEFLON TUBE AT 40 PSI DYNAMIC MIN.
DI RETURN: 3/8" OD TEFLON TUBING AT 5 PSI LESS THAN THE DI WATER (IN).
NITROGEN: 5–6 SCFM DELIVERED IN 3/8" OD TEFLON TUBING AT 60 PSIG DYNAMIC MIN.
CDA: 1 SCFM DELIVERED IN 1/4" TEFLON TUBING AT 80 PSI DYNAMIC MIN.
DRAIN: 1 1/2" NPT SCH 40 PVC PIPE, CONNECT TO VENT & "P" TRAP.
ELECTRICAL: 120VAC, 50/60Hz, 15A, WITH NEUTRAL AND GROUND, SINGLE PHASE.
A BRANCH CIRCUIT PROTECTIVE DEVICE WITH 10,000 AMPERE INTERRUPTING CAPACITY IS REQUIRED.
NITROGEN SYSTEM CONSISTS OF PFA TUBING, PFA FITTINGS, AND 316SS REGULATORS
DI WATER SYSTEM CONSISTS OF PFA TUBING, PFA FITTINGS, AND TFE VALVES

	-1	PART NO.	DESCRIPTION	SIZE	ITEM NO.
QTY REQD		PARTS LIST			

NEXT ASSY	USED ON
VERTEQ	
DATE OF DWG 10.21.92	

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON
DECIMALS ANGLES
.XX ± .030 ± 1°
.XXX ± .010
BREAK EDGES/REMOVE BURRS

DRAWN	tucker
CHECKED	
APPD	

TITLE
CABINET ASSEMBLY
BAY/CHASE 6" LEGS,ALARM,FT

D	1073783		
SCALE none	1800-6	SHEET 1 OF 2	

E 1073783

APPROVED FOR CONSTRUCTION - 5/22/91

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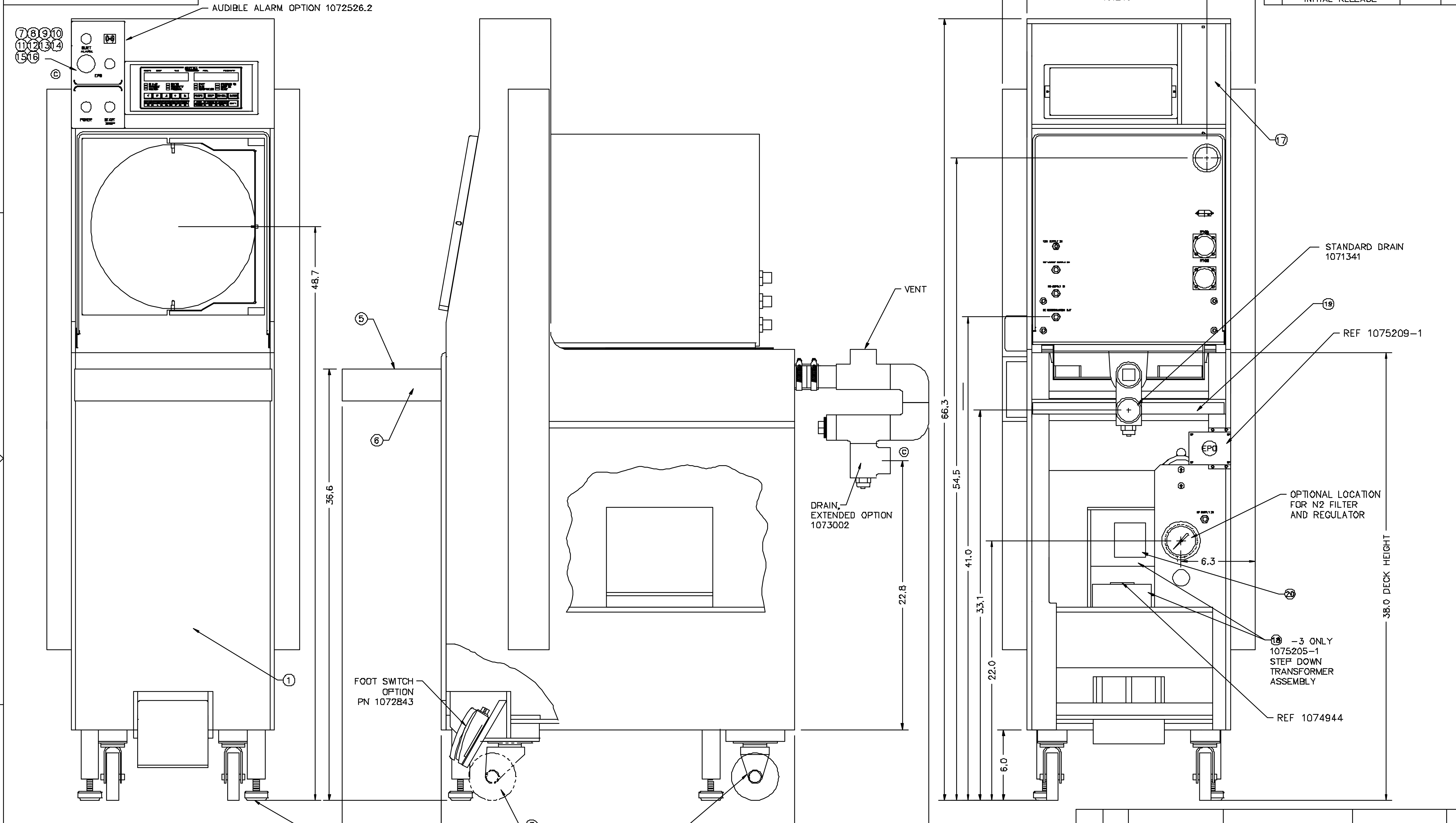
LTR	DESCRIPTION	DATE	APPD
	INITIAL RELEASE		

REVISIONS



FACILITIES:
SINGLE UNIT:
DI WATER: 1.8–2.2 GPM DELIVERED IN 3/8" OD TEFLON TUBE AT 40 PSI DYNAMIC MIN.
DI RETURN: 3/8" OD TEFLON TUBING AT 5 PSI LESS THAN THE DI WATER (IN).
NITROGEN: 5–6 SCFM DELIVERED IN 3/8" OD TEFLON TUBING AT 60 PSIG DYNAMIC MIN.
CDA: 1 SCFM DELIVERED IN 1/4" TEFLON TUBING AT 80 PSI DYNAMIC MIN.
DRAIN: 1 1/2" NPT SCH 40 PVC PIPE, CONNECT TO VENT & "P" TRAP.
ELECTRICAL: 120VAC, 50/60Hz, 15A, WITH NEUTRAL AND GROUND, SINGLE PHASE.
A BRANCH CIRCUIT PROTECTIVE DEVICE WITH 10,000 AMPERE INTERRUPTING CAPACITY IS REQUIRED.
NITROGEN SYSTEM CONSISTS OF PFA TUBING, PFA FITTINGS, AND 316SS REGULATORS
DI WATER SYSTEM CONSISTS OF PFA TUBING, PFA FITTINGS, AND TFE VALVES

-3 CONFIGURATION SHOWN. WITH TRANSFORMER.

	-1	PART NO.	DESCRIPTION	SIZE	ITEM NO.
QTY REQD		PARTS LIST			

NEXT ASSY | USED ON

VERTEQ

DATE OF DWG 10.21.92

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON
DECIMALS ANGLES
.XX ± .030 ± 1°
.XXX ± .010
BREAK EDGES/REMOVE BURRS
DRAWN tucker
CHECKED
APPD

TITLE
CABINET ASSEMBLY
BAY/CHASE 6"LEGS,ALARM,FT

D 1073783

SCALE none | 1800-6 | SHEET 2 OF 2

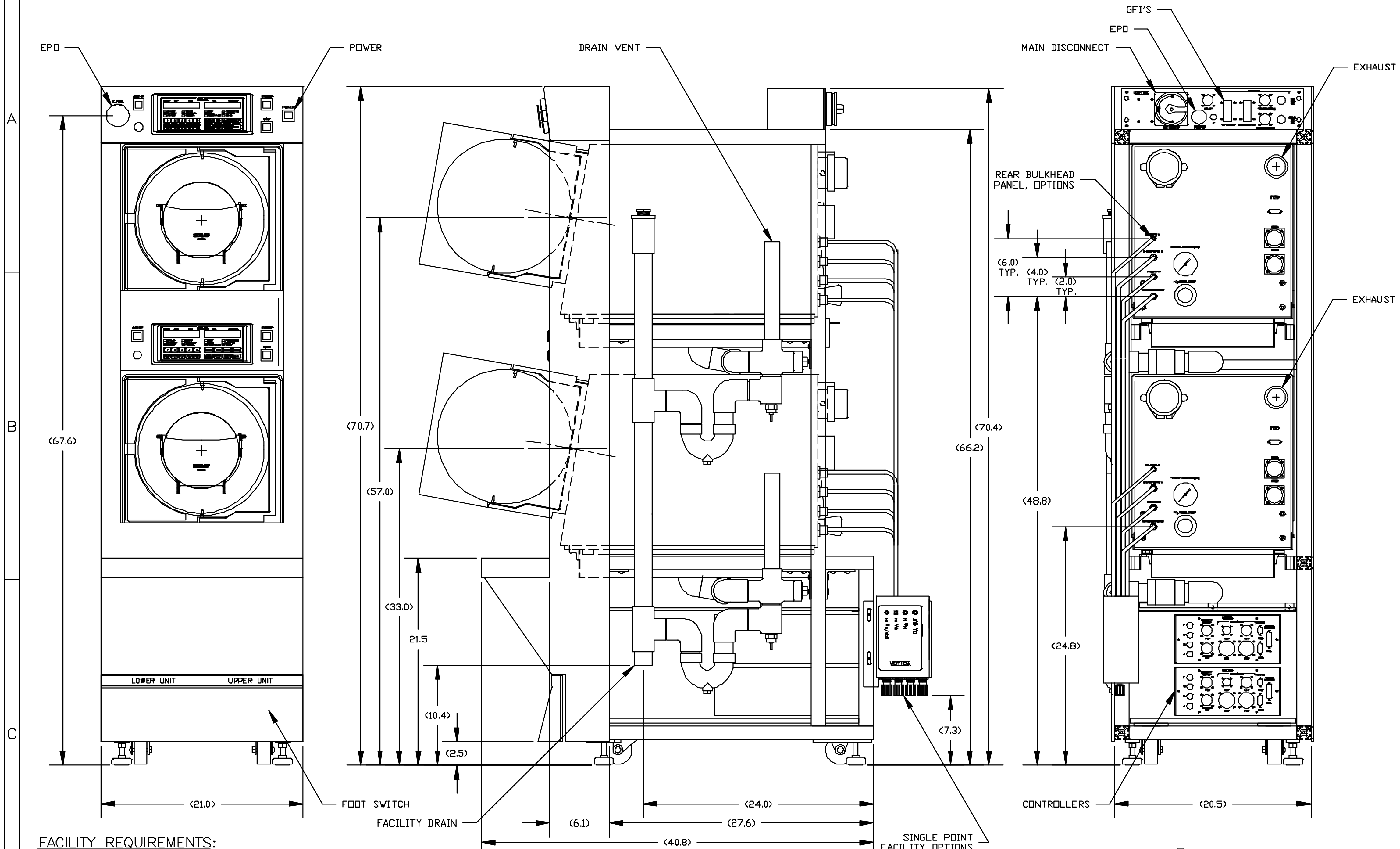
1073783 E

APPROVED FOR CONSTRUCTION - 5/22/91

P/N 1078579

REVISIONS

LTR	DESCRIPTION	DATE	APPD
NC	INITIAL RELEASE	12-27-94	M.M.
(A)	ADD FACILITIES HOOKUPS	4/13/00	KJG



NOTES:

1. CUSTOMER MINIMUM CUTOUT DIMENSION 20.60 x 72.50 IN CLEANROOM WALL.

FACILITY REQUIREMENTS:

D.I. WATER INPUT: WITHOUT SINGLE POINT OPTION 3/8" O.D. TEFLON TUBING.
SINGLE POINT FLARETEK 1/2" O.D. TEFLON TUBING.
SINGLE POINT COMPRESSION 1/2" O.D. TEFLON TUBING.
3.5 GPM MINIMUM.
25 PSI DYNAMIC MINUMUM.
40 PSI DYNAMIC MAXIMUM FOR THE STANDARD LOW PRESSURE VALVE.
70 PSI DYNAMIC MAXIMUM FOR OPTIONAL HIGH PRESSURE VALVE.

D.I. WATER RETURN: WITHOUT SINGLE POINT OPTION 3/8" O.D. TEFLON TUBING.
SINGLE POINT FLARETEK 1/2" O.D. TEFLON TUBING.
SINGLE POINT COMPRESSION 1/2" O.D. TEFLON TUBING.
UNDER PRESSURE OF AT LEAST 5 PSI LOWER THAN D.I. WATER INPUT PRESSURE.

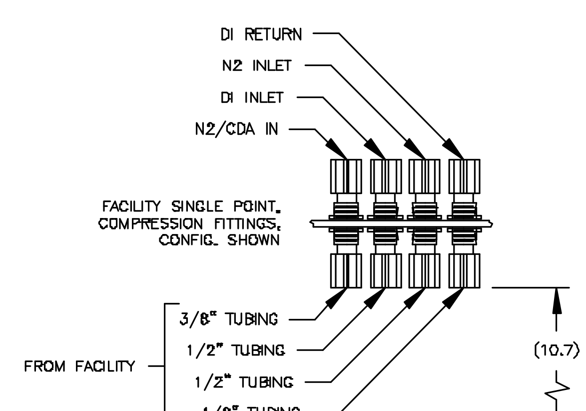
SYSTEM N2: WITHOUT SINGLE POINT OPTION 3/8" O.D. TEFLON TUBING.
SINGLE POINT FLARETEK 1/2" O.D. TEFLON TUBING.
SINGLE POINT COMPRESSION 1/2" O.D. TEFLON TUBING.
12 – 14 SCFM (GAUGE READING).
60 PSI DYNAMIC MINIMUM.

CDA/OFA/N2: (OPERATES PNEUMATIC COMPONENTS)
WITHOUT SINGLE POINT OPTION 1/4" O.D. TEFLON TUBING.
SINGLE POINT FLARETEK 1/2" O.D. TEFLON TUBING.
SINGLE POINT COMPRESSION 3/8" O.D. TEFLON TUBING.
60 –90 PSI DYNAMIC.

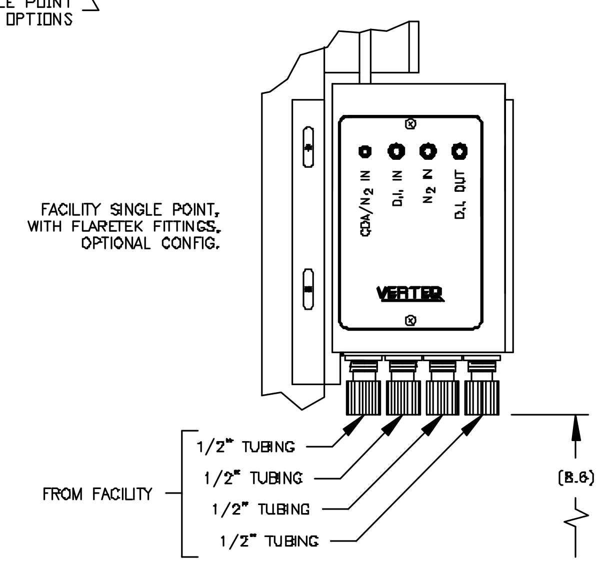
DRAIN: 1 1/2" MNPT (DRAIN BOX) 1 1/2" PVC PIPE (DRAIN PLUMBING OPTIONS).

VENT: 1 1/2" PIPE (–0.5 TO –1.0 INCHES OF WATER IF NOT VENTED TO FAB).

POWER: 120 VAC, 15 AMPS, 50/60 HERTZ PER RINSER/DRYER.



FACILITY SINGLE POINT, COMPRESSION FITTINGS, CONFIG. SHOWN



FACILITY SINGLE POINT, WITH FLARETEK FITTINGS, OPTIONAL CONFIG.

APPROVED FOR CONSTRUCTION - 4/17/00

-1	
CONFIG	DESCRIPTION
MATERIAL SPEC.	FINISH SPEC.

UNLESS OTHERWISE SPECIFIED, DIMENSIONS ARE IN INCHES
TOLERANCES ON
DECIMALS .XX± .XXX± ANGLES ±
BREAK EDGES/REMOVE BURRS

DRAWN MANRIQUEZ
CHECKED
APPROVED
DATE OF DWG 12-27-94

VERTEQ | 16677 | MTRLA | NEXT ASSY | USED ON

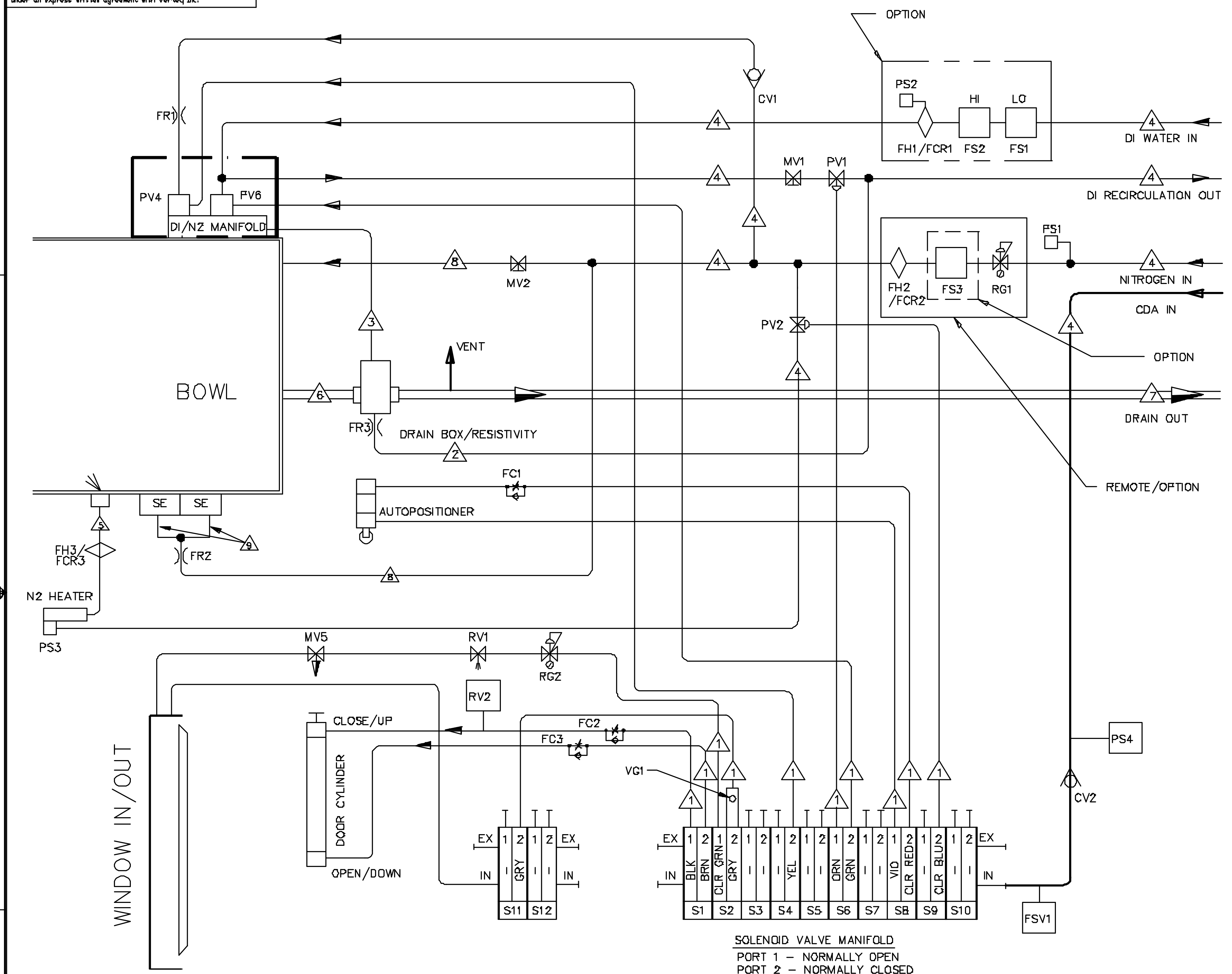
TITLE

FACILITY, 1800-6
BAY & CHASE

C 1078579

SCALE 1:8 1800-6 SHEET 1 OF 1

REVISIONS			
LTR	DESCRIPTION	DATE	APPD
NC	INITIAL RELEASE	4/19/90	B.W.
A	POST PROTOTYPE CHNGS	9/10/90	B.W.
B	SEE E.O.	11/12/90	B.W.
C	SEE EO	4-29-91	EDT
D	SEE E.O	7-30-91	MMS
E	SEE E.O	11-25-91	M.M.
F	SEE EO (DCR 6452)	9.29.93	RPB
G	SEE EO	5/24/96	TZ



LIST OF MATERIALS SEE PARTS LISTS					
SYM	ITEM	DESCRIPTION	SYM	ITEM	DESCRIPTION
RG1	1	REGULATOR W/ GAGE 0-100 PSIG	PV1	15	2WAY PNEU VALVE NO 3/8 TUBE
RG2	2	REGULATOR W/ GAGE 0-5 PSIG	PV2	15	2WAY PNEU VALVE NC 3/8 TUBE
FS1	3	FLOW SWITCH 0-10 GPM		16	DI/N2 MANIFOLD
FS2	4	FLOW SWITCH 0-10 GPM	PV4		2WAY PNEU VALVE NC 3/8 TUBE
FS3	4	FLOW SWITCH 0-12 CFM	PV6		2WAY PNEU VALVE NC 3/8 TUBE
			RV1	17	RELIEF VALVE 1/2 TUBE
FH1	6	FILTER HOUSING 4-INCH	M1	38	MANIFOLD
FH2	7	FILTER HOUSING 12 STACK	M2	39	MANIFOLD
FH3	7	FILTER HOUSING 12 STACK	M3	40	MANIFOLD VALVES
FCR1	9	FILTER CARTRIDGE 4-INCH	VG1	18	VACUUM GENERATOR (#10-32 THRD)
FCR2	10	FILTER CARTRIDGE 12 STACK			
FCR3	10	FILTER CARTRIDGE 12 STACK	MV1	24	MANUAL VALVE 3/8 TUBE
			MV2	25	MANUAL VALVE 1/4 TUBE
PS1	12	PRESSURE SWITCH 45 PSI			
PS2	13	PRESSURE SWITCH 15 PSI	MV5	27	MANUAL VALVE (#10-32 THRD)
PS3	14	PRESSURE SWITCH 5 PSI	FC1	32	FLOW CONTROL
PS4	12	PRESSURE SWITCH 45 PSI	FC2	32	FLOW CONTROL
CV1	30	CHECK VALVE (TFE)			
CV2	31	CHECK VALVE (BRASS)	FR1	35	FLOW RESTRICTER (ORIFICE)
			FR2	36	FLOW RESTRICTER (ORIFICE)
			FR3	37	FLOW RESTRICTER (ORIFICE)

1. ALL FITTINGS AND TUBING TO BE CLEANED PRIOR TO ASSEMBLY.
2. FACILITIES: DRAIN 1 1/2 NPT MALE
3. DI WATER SUPPLY: 1.8-2.2 GPM @ 40 PSIG (DYNAMIC) 3/8 OD TEFLON TUBE
4. NITROGEN SUPPLY: 5-6 SCFM @ 60 PSIG (DYNAMIC) 3/8 OD TEFLON TUBE

DI WATER SYSTEM CONSISTS OF PFA TUBING, PFA FITTINGS, AND TFE VALVES
NITROGEN SYSTEM CONSISTS OF PFA TUBING, PFA FITTINGS, AND 316SS REGULATORS

5. CDA: 1 SCFM @ 80 PSI (DYNAMIC) 1/4 OD TEFLON TUBE

DASH 1 VERSION
VERTICAL DOOR ONLY

PLUMBING MATERIALS				LEGENDS					
SYM	DESCRIPTION	SYM	DESCRIPTION	SYM	DESCRIPTION	SYM	DESCRIPTION	SYM	DESCRIPTION
1	1/16 ID TYGON TUBING	6	2-1/2 OD X 2 ID TYGON TUBE		CHECK VALVE		FLOW CONTROL		FLOW RESTRICTOR (ORIFICE)
2	3/32 ID TYGON TUBING	7	1-1/2 NPT PIPE		MANUAL VALVE (PLUNGER)		FLOW SWITCH		VENT
3	1/8 ID TYGON TUBING	8	1/4 OD X 1/8 ID PFA TUBE		PNEUMATIC VALVE (2 WAY)		PRESSURE SWITCH		
4	3/8 OD X 5/16 ID PFA TUBE	9	1/8OD X 1/16ID FEP (5115284)		PNEUMATIC VALVE (3 WAY)		REGULATOR W/GAGE		
5	1/2 OD X 7/16 ID PFA TUBE	10			MANUAL VALVE		FILTER HOUSING/CARTRIDGE		

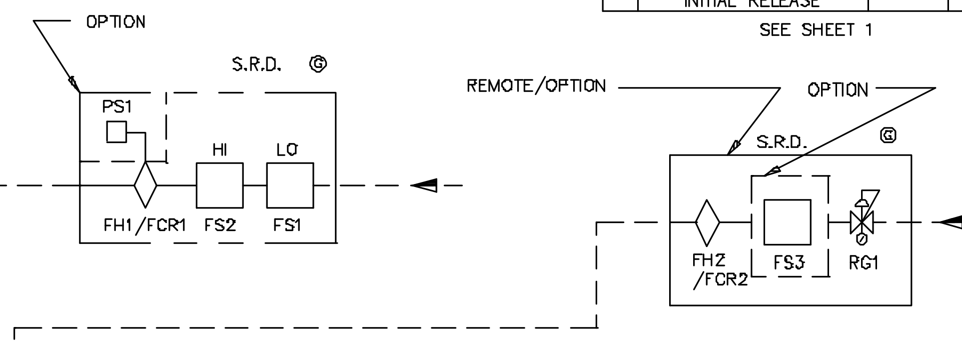
	-1	PART NO.	DESCRIPTION	SIZE	ITEM NO.
QTY REQD		PARTS LIST			

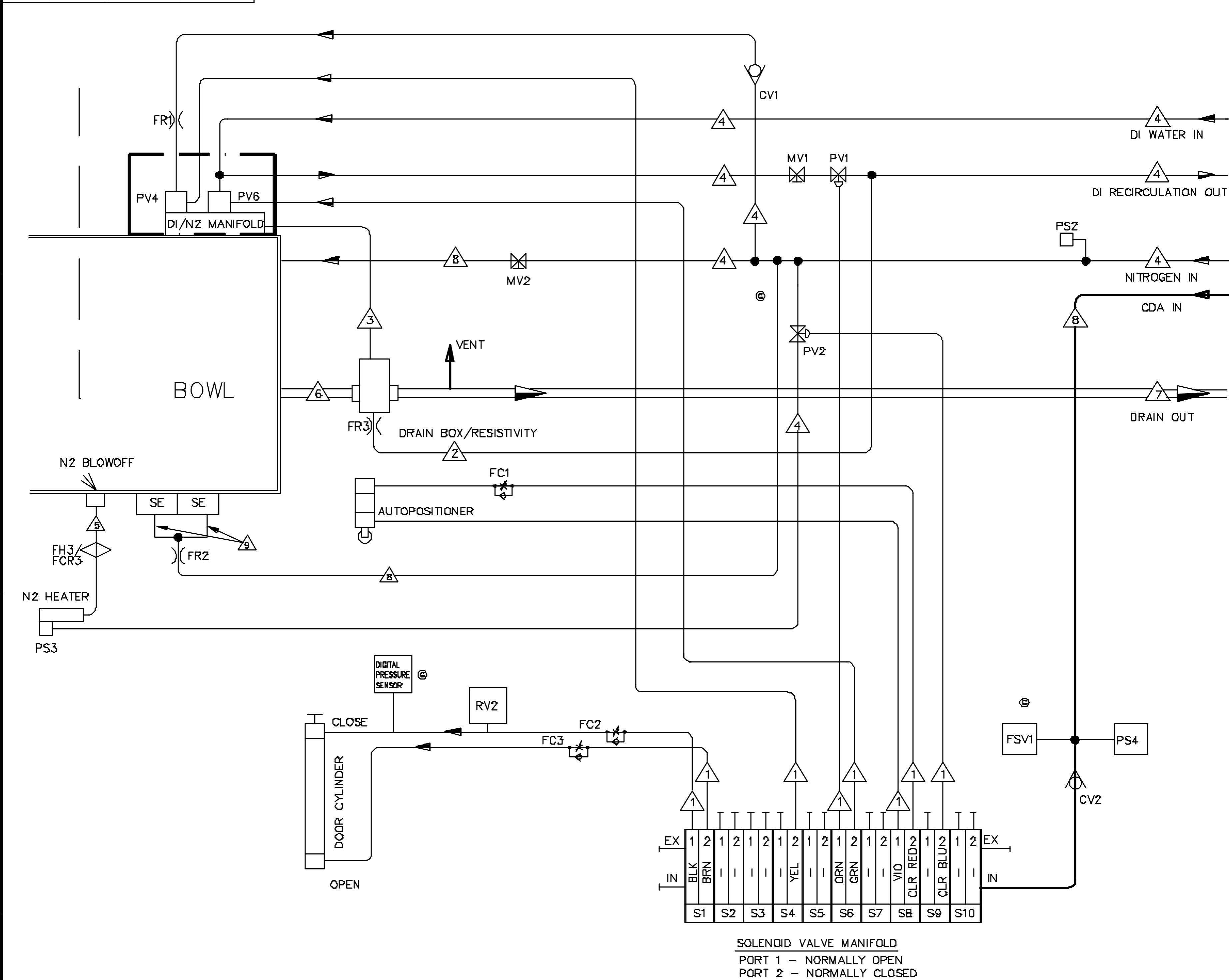
NEXT ASSY	USED ON	UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON DECIMALS ANGLES .XX ± ± .XXX ± BREAK EDGES/REMOVE BURRS	TITLE PLUMBING DIAGRAM 1800-6
VERTEQ		DRAWN B. WINDAUER 4/19/90	D 1070261
DATE OF DWG 4/19/90		CHECKED	SCALE 1800-6 SHEET 1 OF 3
		APPD	

G 1070261

APPROVED FOR CONSTRUCTION - 5/22/98

LTR	REVISIONS DESCRIPTION	DATE	APPD
	INITIAL RELEASE		
	SEE SHEET 1		





LIST OF MATERIALS SEE PARTS LISTS

SYM	ITEM	DESCRIPTION	SYM	ITEM	DESCRIPTION
RG1	1	REGULATOR W/ GAGE 0-100 PSIG	PV1	15	2WAY PNEU VALVE NC 3/8 TUBE
			PV2	15	2WAY PNEU VALVE NC 3/8 TUBE
FS1	3	FLOW SWITCH 0-10 GPM		16	DI/N2 MANIFOLD ASSY
FS2	4	FLOW SWITCH 0-10 GPM	PV4	/	2WAY PNEU VALVE NC 3/8 TUBE
FS3	4	FLOW SWITCH 0-12 CFM	PV6	/	2WAY PNEU VALVE NC 3/8 TUBE
			RV2	17	RELIEF VALVE NC
FH1	6	FILTER HOUSING 4-INCH	M1	38	MANIFOLD
FH2	7	FILTER HOUSING 12 STACK	M2	39	MANIFOLD
FH3	7	FILTER HOUSING 12 STACK	M3	40	MANIFOLD VALVES
FC1	9	FILTER CARTRIDGE 4-INCH			
FC2	10	FILTER CARTRIDGE 12 STACK			
FC3	10	FILTER CARTRIDGE 12 STACK	MV1	24	MANUAL VALVE 3/8 TUBE
			MV2	25	MANUAL VALVE 1/4 TUBE
PS1	12	PRESSURE SWITCH 45 PSI			
PS2	13	PRESSURE SWITCH 35 PSI			
PS3	14	PRESSURE SWITCH 5 PSI	FC1	32	FLOW CONTROL
PS4	12	PRESSURE SWITCH 45 PSI	FC2	32	FLOW CONTROL
			FC3	32	FLOW CONTROL
CV1	30	CHECK VALVE (TFE)			
CV2	31	CHECK VALVE (BRASS)	FR1	35	FLOW RESTRICTOR (ORIFICE) .050
			FR2	36	FLOW RESTRICTOR (ORIFICE) .020
FSV1	41	FAIL SAFE VALVE (NC)	FR3	37	FLOW RESTRICTOR (ORIFICE) .040

1. ALL FITTINGS AND TUBING TO BE CLEANED PRIOR TO ASSEMBLY.
2. FACILITIES: DRAIN 1 1/2 NPT MALE
3. DI WATER SUPPLY: 1.8-2.2 GPM @ 40 PSIG (DYNAMIC) 3/8 OD TEFLON TUBE
4. NITROGEN SUPPLY: 5-6 SCFM @ 60PSIG (DYNAMIC) 1/2 OD TEFLON TUBE

DI WATER SYSTEM CONSISTS OF PFA TUBING, PFA FITTINGS, AND TFE VALVES
NITROGEN SYSTEM CONSISTS OF PFA TUBING, PFA FITTINGS, AND 316SS REGULATORS

5. CDA: 1 SCFM @ 80 PSI (DYNAMIC) 1/4 OD TEFLON TUBE

DASH 2 VERSION
AUTO HINGED DOOR ONLY

PLUMBING MATERIALS

SYM	DESCRIPTION	SYM	DESCRIPTION
1	1/16 ID TYGON TUBING	6	2-1/2 OD X 2 ID TYGON TUBE
2	3/32 ID TYGON TUBING	7	1-1/2 NPT PIPE
3	1/8 ID TYGON TUBING	8	1/4 OD X 1/8 ID PFA TUBE
4	3/8 OD X 5/16 ID PFA TUBE	9	1/8OD X 1/16ID FEP (5115284)
5	1/2 OD X 7/16 ID PFA TUBE	10	

LEGENDS

SYM	DESCRIPTION	SYM	DESCRIPTION	SYM	DESCRIPTION
	CHECK VALVE		FLOW CONTROL		FLOW RESTRICTOR (ORIFICE)
	MANUAL VALVE (PLUNGER)		FLOW SWITCH		VENT
	PNEUMATIC VALVE (2 WAY)		PRESSURE SWITCH		
	PNEUMATIC VALVE (3 WAY)		REGULATOR W/GAGE		
	MANUAL VALVE		FILTER HOUSING/CARTRIDGE		

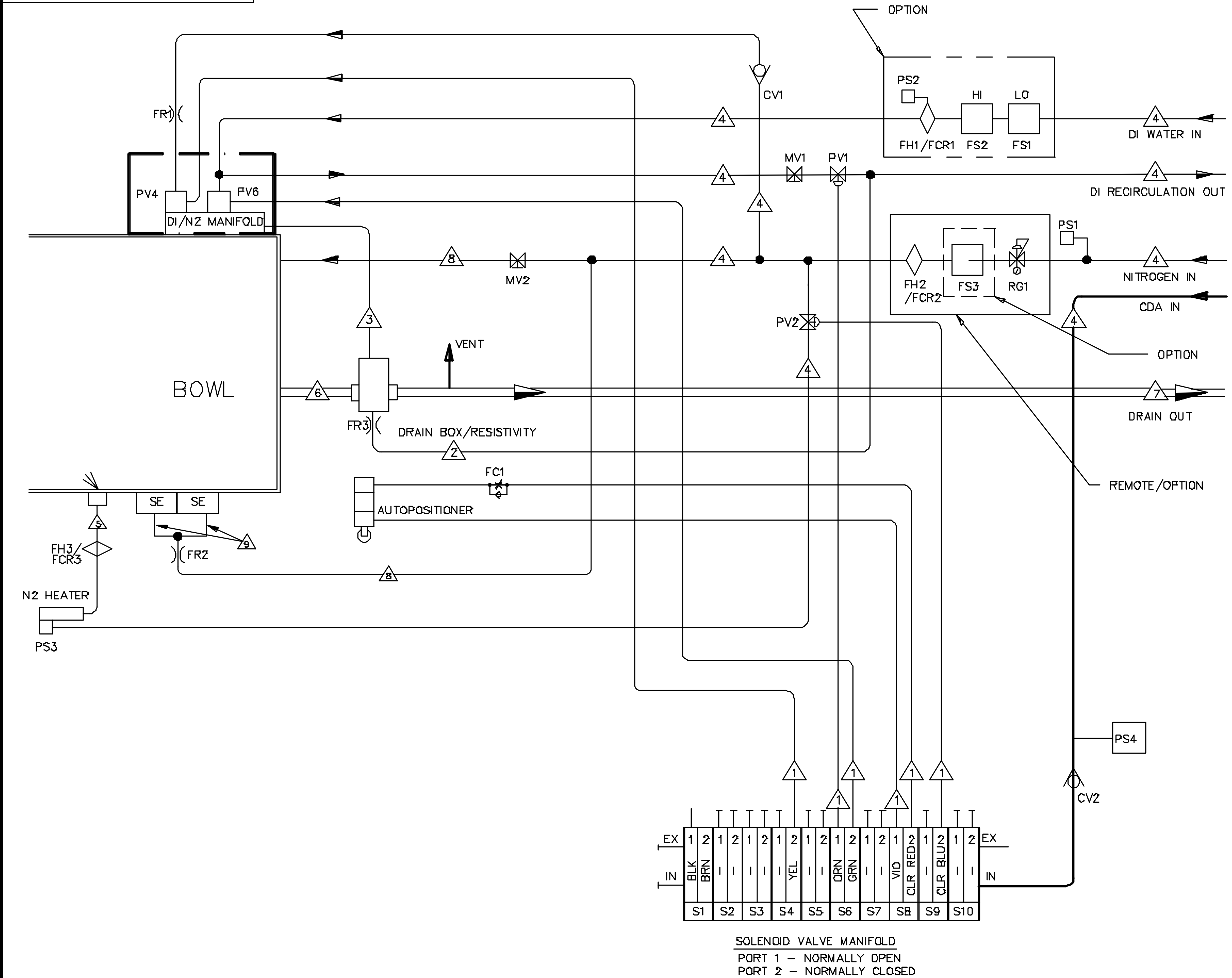
	-1	PART NO.	DESCRIPTION	SIZE	ITEM NO.
QTY REQD		PARTS LIST			

NEXT ASSY	USED ON
VERTEQ	
DATE OF DWG 4/19/90	
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON DECIMALS .XX ± .XXX ± ANGLES ± BREAK EDGES/REMOVE BURRS	TITLE PLUMBING DIAGRAM 1800-6
DRAWN B. WINDAUER 4/19/90	D 1070261
CHECKED	
APPD	SCALE 1800-6 SHEET 2 OF 3

1070261 G

APPROVED FOR CONSTRUCTION - 5/22/98

REVISIONS			
LTR	DESCRIPTION	DATE	APPD
	INITIAL RELEASE		
	SEE SHEET 1		



LIST OF MATERIALS SEE PARTS LISTS

SYM	ITEM	DESCRIPTION	SYM	ITEM	DESCRIPTION
RG1	1	REGULATOR W/ GAGE 0-100 PSIG	PV1	15	2WAY PNEU VALVE NO 3/8 TUBE
			PV2	15	2WAY PNEU VALVE NC 3/8 TUBE
FS1	3	FLOW SWITCH 0-10 GPM		16	DI/N2 MANIFOLD
FS2	4	FLOW SWITCH 0-10 GPM	PV4	/	2WAY PNEU VALVE NC 3/8 TUBE
FS3	4	FLOW SWITCH 0-12 CFM	PV6	/	2WAY PNEU VALVE NC 3/8 TUBE
			RV1	17	RELIEF VALVE 1/2 TUBE
FH1	6	FILTER HOUSING 4-INCH	M1	38	MANIFOLD
FH2	7	FILTER HOUSING 12 STACK	M2	39	MANIFOLD
FH3	7	FILTER HOUSING 12 STACK	M3	40	MANIFOLD VALVES
FCR1	9	FILTER CARTRIDGE 4-INCH			
FCR2	10	FILTER CARTRIDGE 12 STACK			
FCR3	10	FILTER CARTRIDGE 12 STACK	MV1	24	MANUAL VALVE 3/8 TUBE
			MV2	25	MANUAL VALVE 1/4 TUBE
PS1	12	PRESSURE SWITCH 45 PSI			
PS2	13	PRESSURE SWITCH 15 PSI			
PS3	14	PRESSURE SWITCH 5 PSI	FC1	32	FLOW CONTROL
PS4	12	PRESSURE SWITCH 45 PSI			
CV1	30	CHECK VALVE (TFE)			
CV2	31	CHECK VALVE (BRASS)	FR1	35	FLOW RESTRICTER (ORIFICE)
			FR2	36	FLOW RESTRICTER (ORIFICE)
			FR3	37	FLOW RESTRICTER (ORIFICE)

1. ALL FITTINGS AND TUBING TO BE CLEANED PRIOR TO ASSEMBLY.
2. FACILITIES; DRAIN 1 1/2 NPT MALE
3. DI WATER SUPPLY: 1.8-2.2 GPM @ 40 PSIG (DYNAMIC) 3/8 OD TEFLON TUBE
4. NITROGEN SUPPLY: 5-6 SCFM @ 60 PSIG (DYNAMIC) 3/8 OD TEFLON TUBE

DI WATER SYSTEM CONSISTS OF PFA TUBING, PFA FITTINGS, AND TFE VALVES
NITROGEN SYSTEM CONSISTS OF PFA TUBING, PFA FITTINGS, AND 316SS REGULATORS

5. CDA: 1 SCFM @ 80 PSI (DYNAMIC) 1/4 OD TEFLON TUBE

DASH 3 VERSION
MANUAL HINGED DOOR ONLY

1070261 G

PLUMBING MATERIALS

SYM	DESCRIPTION	SYM	DESCRIPTION
1	1/16 ID TYGON TUBING	6	2-1/2 OD X 2 ID TYGON TUBE
2	3/32 ID TYGON TUBING	7	1-1/2 NPT PIPE
3	1/8 ID TYGON TUBING	8	1/4 OD X 1/8 ID PFA TUBE
4	3/8 OD X 5/16 ID PFA TUBE	9	1/8OD X 1/16ID FEP (5115284)
5	1/2 OD X 7/16 ID PFA TUBE	10	

LEGENDS

SYM	DESCRIPTION	SYM	DESCRIPTION	SYM	DESCRIPTION
	CHECK VALVE		FLOW CONTROL		FLOW RESTRICTER (ORIFICE)
	MANUAL VALVE (PLUNGER)		FLOW SWITCH		VENT
	PNEUMATIC VALVE (2 WAY)		PRESSURE SWITCH		
	PNEUMATIC VALVE (3 WAY)		REGULATOR W/GAGE		
	MANUAL VALVE		FILTER HOUSING/CARTRIDGE		

	-1	PART NO.	DESCRIPTION	SIZE	ITEM NO.
QTY REQD		PARTS LIST			

NEXT ASSY | USED ON

VERTEQ

DATE OF DWG 4/19/90

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON
DECIMALS ANGLES
.XX ± ±
.XXX ±
BREAK EDGES/REMOVE BURRS

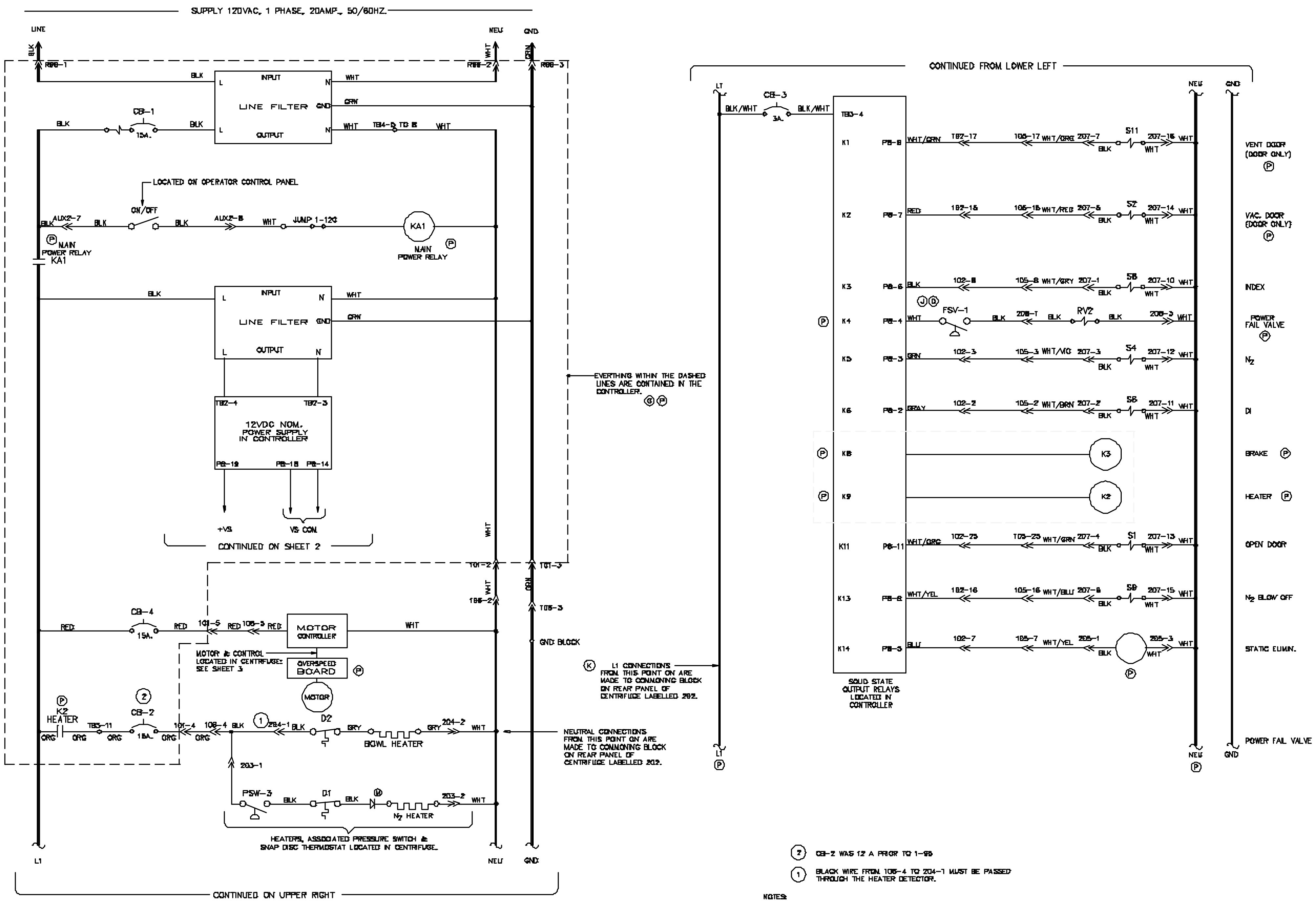
DRAWN B. WINDAUER	4/19/90
CHECKED	
APPD	

TITLE
PLUMBING DIAGRAM 1800-6

D 1070261

SCALE 1800-6 SHEET 3 OF 3

APPROVED FOR CONSTRUCTION - 5/22/98



(2) CB-2 WAS 12 A PRIOR TO 1-95

(1) BLACK WIRE FROM 108-4 TO 204-1 MUST BE PASSED THROUGH THE HEATER DETECTOR.

NOTES:

DWG NO: 1070811	SH: 1	REV: P

REVISIONS

REV	DESCRIPTION	DATE	APPD
NC	INITIAL RELEASE	8-5-91	AJH
P	(NEW FORMAT) SEE E.O.	7-16-96	LS

NOTES

CONFIG	DESCRIPTION
-1	

MATERIAL SPEC	FINISH SPEC

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES

TOLERANCES ON:

.XX DECIMALS ±	X° ±
.XXX DECIMALS ±	X/X ±

SIGNATURES		DATE
DRAWN:	THANH NGUYEN	8-1-91
ENGR:		

VERTEQ

NEXT ASSY	USED ON

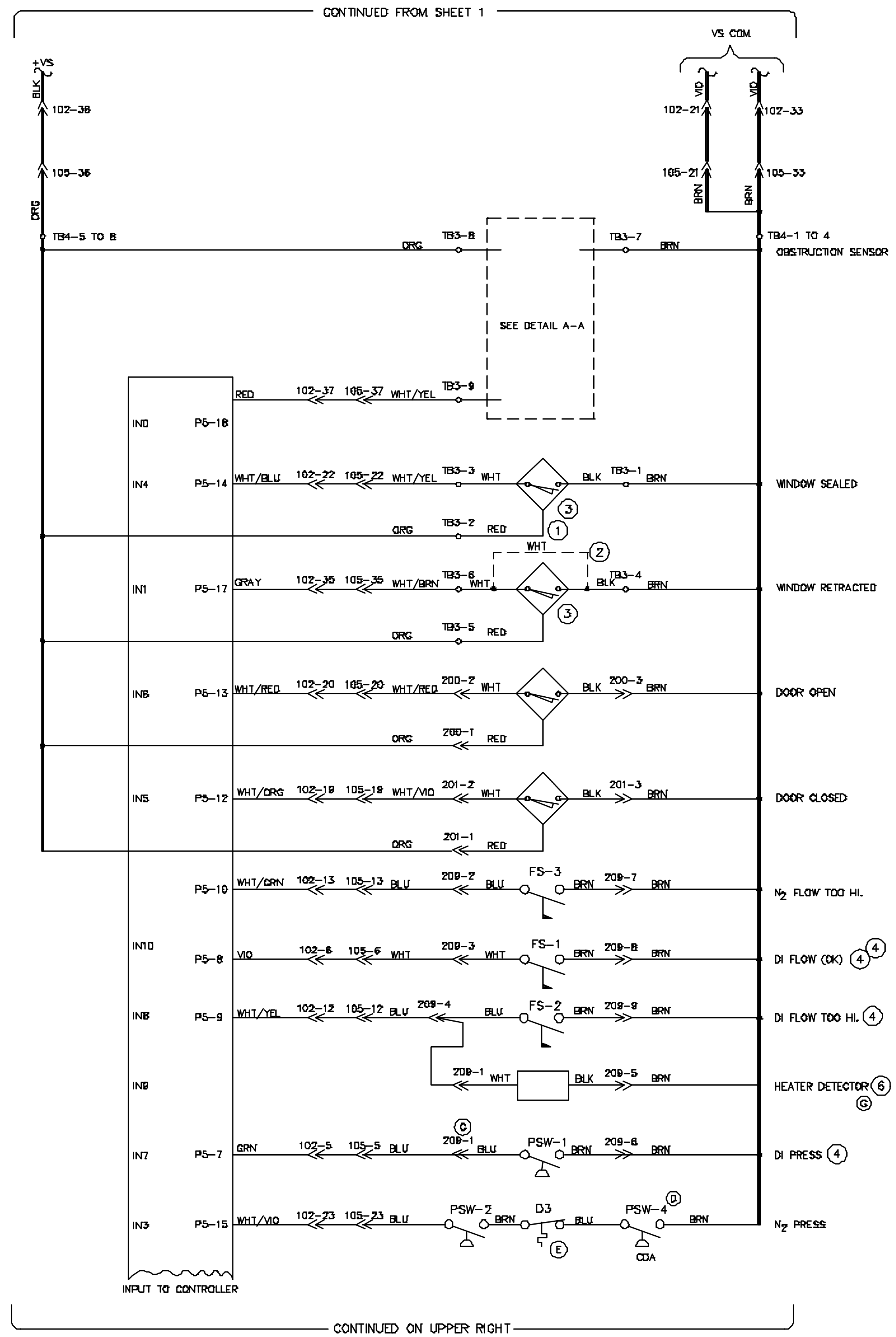
ELECTRICAL SCHEMATIC 1800-6 SRD

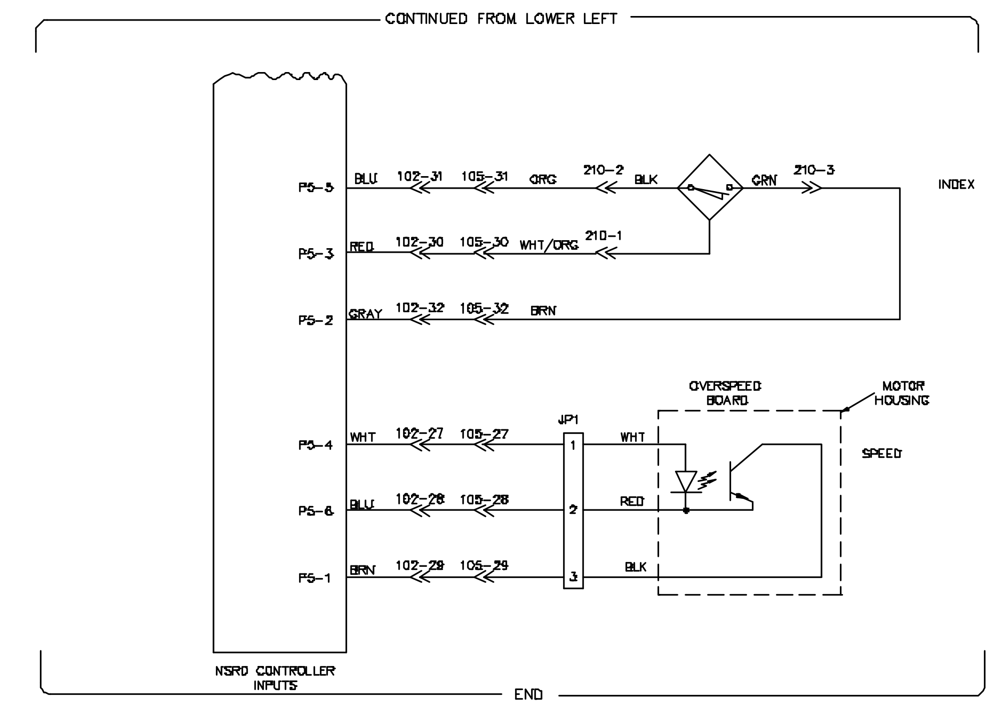
C	DWG NO: 1070811		
SCALE: NONE	PRD: SRD	SHEET 1 OF 3	

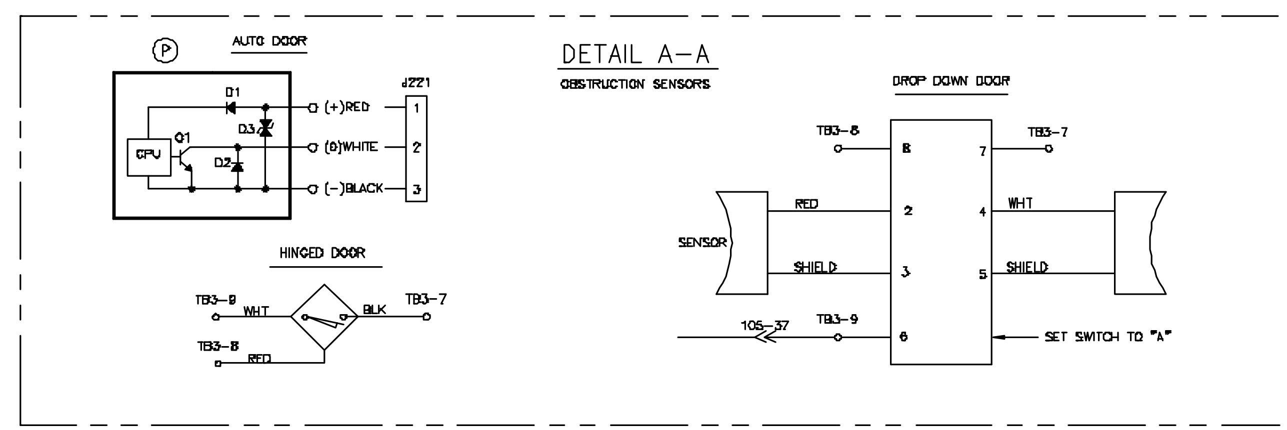
10.13.95.NC

APPROVED FOR CONSTRUCTION - 5/22/98

DWG NO:	SH:	REV:
1070811	2	P







6- THIS OPTION IS NOT AVAILABLE WHEN OPTION 4 IS INSTALLED.

5- WIRE COLORS BETWEEN CONNECTOR 105 AND 102 HAVE BEEN LEFT OFF. IF NEEDED REFER TO DWG#1072134.1

4- OPTIONAL.

3- IF KEYENCE FIBER OPTIC SENSOR USED; SET ALARM OFF, TIMER OFF, MODE = D.ON.

2- THIS SENSOR NOT USED ON 1800-6AR/AL - JUMPER AS SHOWN BY DOTTED LINE.

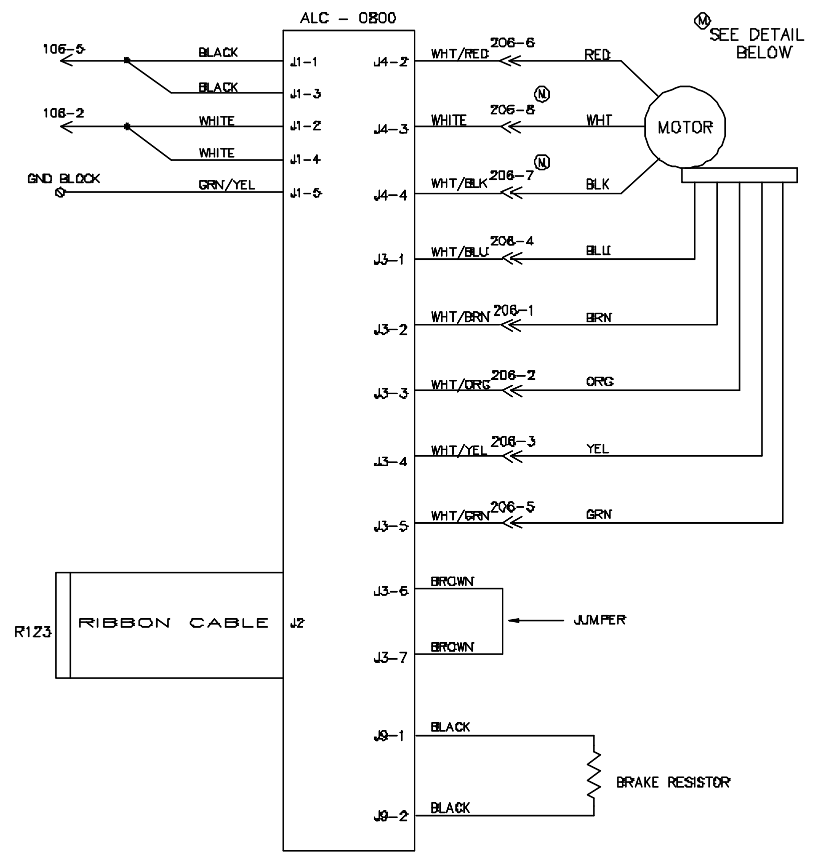
1- THIS WIRE NOT USED ON 1800-6AR/AL.

NOTES:

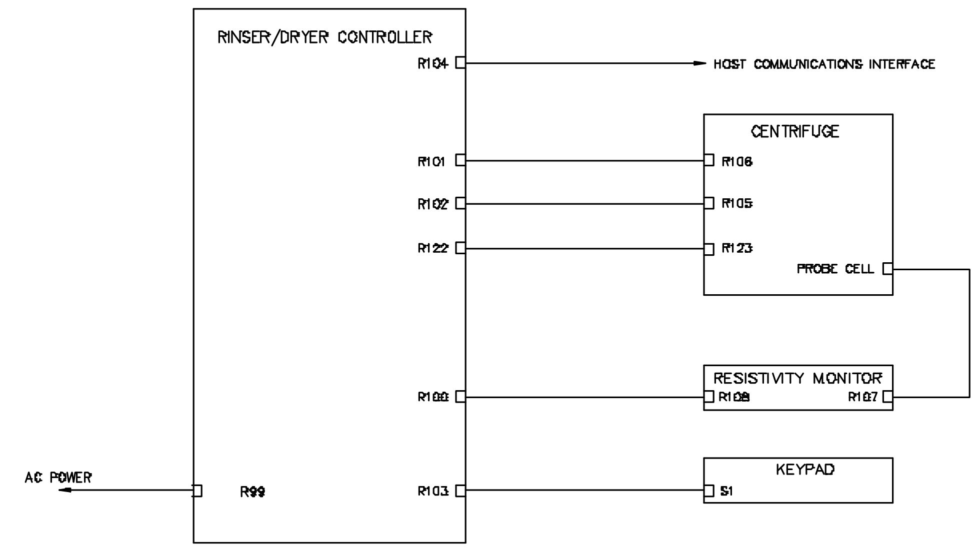
C	DWG NO: 1070811	
SCALE: NONE	PRD: SRD	SHEET 2 OF 3

10.13.95.NC

APPROVED FOR CONSTRUCTION - 5/22/98

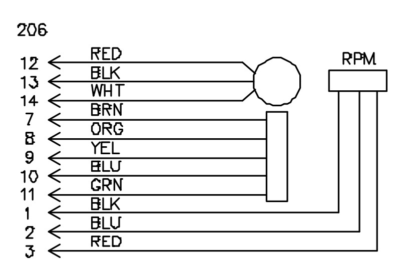


MOTOR & CONTROL DETAIL



SRD CABLE CONNECTION

DETAIL A (WIRING FOR MOTOR FOR EARLY MODELS)



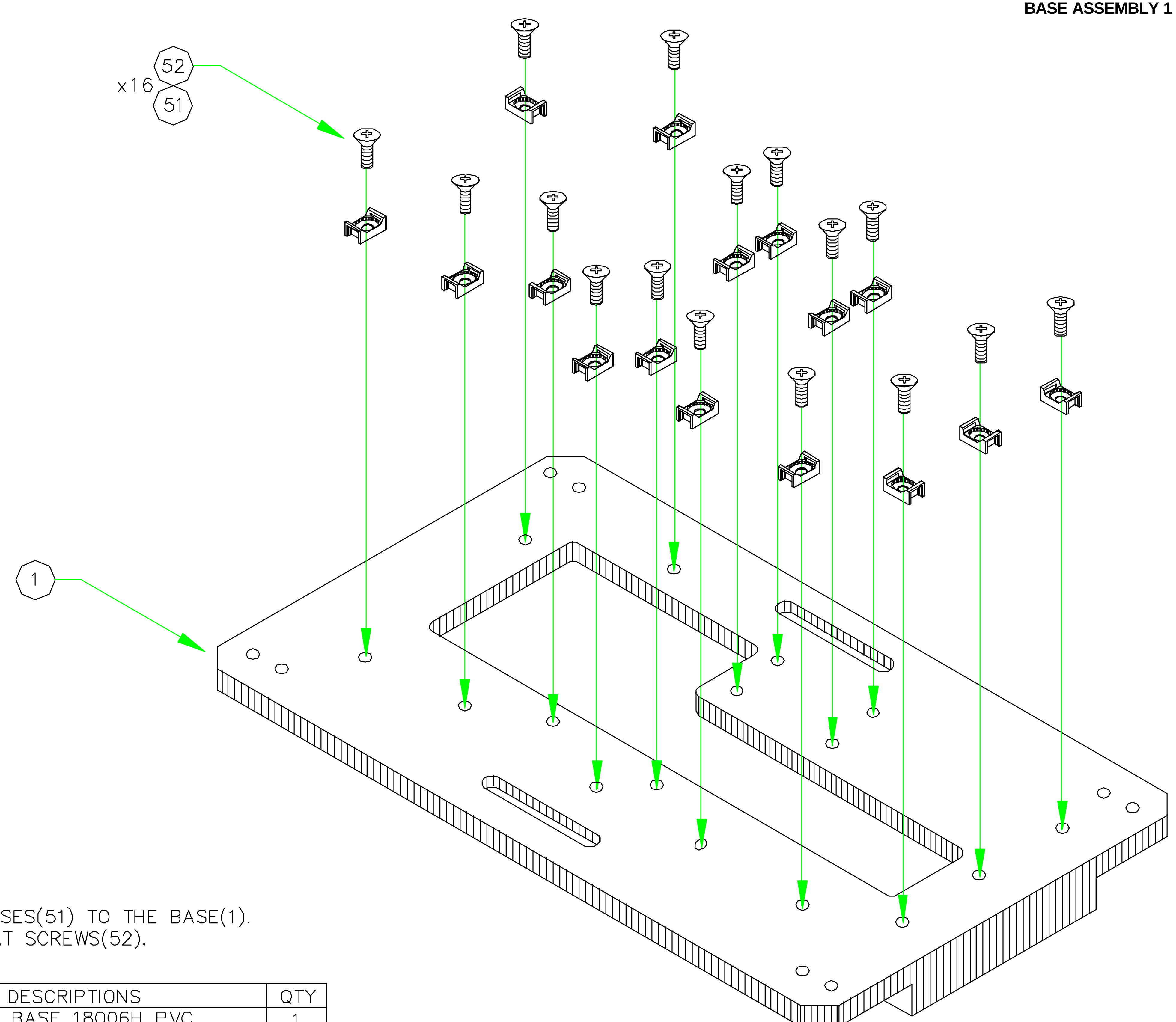
C DWG NO: 1070811

SCALE: NONE PRD: SRD SHEET 3 OF 3

10.13.95.NC

APPROVED FOR CONSTRUCTION - 5/22/98

BASE ASSEMBLY 1

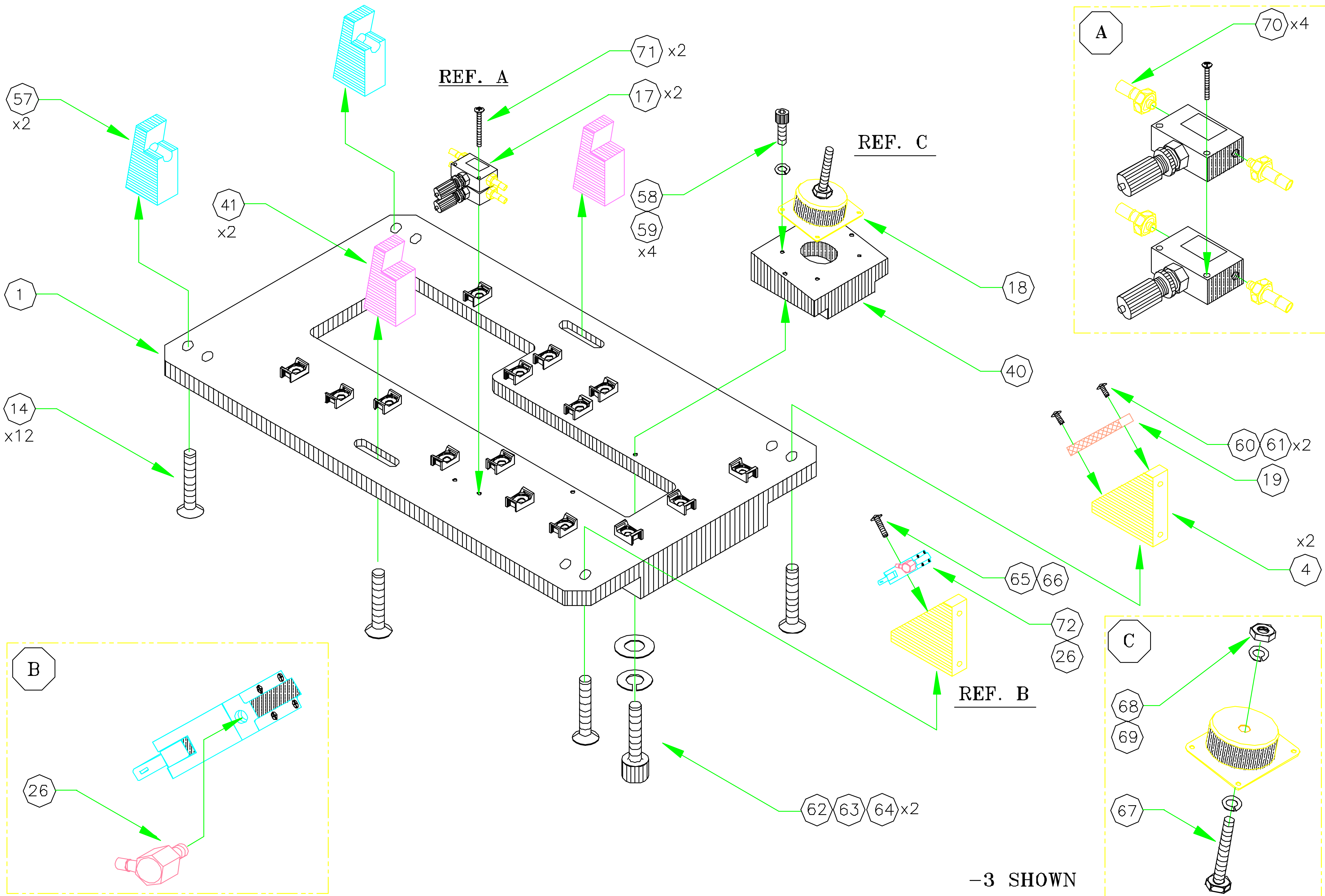


INSTRUCTIONS:

1– ATTACH 16–TIEWRAP BASES(51) TO THE BASE(1).
USING 12–6x32x3/8 FLAT SCREWS(52).

ITEM	PART #	DESCRIPTIONS	QTY
1	1072095.3	PLATE, BASE 18006H PVC	1
51	4120127	TIEWRAP BASE TM2–S8M	16
52	6x32x3/8	FLAT HEAD SCREWS	16

BASE ASSEMBLY 2



1800-X BASE ASSEMBLY INSTRUCTIONS

ITEM	PART #	DESCRIPTIONS	QTY
1	1072095.3	PLATE, BASE 18006H PVC	1
4	1070251.1	BLOCK, MOUNTING BULKHEAD	2
14	4120180	SCREWS, 1/4X20X3/4 FLAT SOCKET HEAD.	12
17	4120061	VALVE, CHECK FLOW CONTROL	2
18	4119415	DAMPER, VIBRATION 70LB	1
19	1070269.1	BAR, BUS GROUND	1
26	4115819	ELBOWL, BARBED BRASS	1
40	1071737.1	CLAMP, TOP	1
41	1070233.1	BLOCK, MOUNT CHAMBER	2
57	1074911.1	BLOCK, FRONT BOWL MOUNT	2
58	10X32X1/2	SOCKET HEAD SCREWS	4
59	10X32	STAR WASHERS	4
60	6X32X1/4	ROUND HEAD SCREWS	4
62	1/4X20X2"	SOCKET HEAD SCREWS	2
63	1/4X20	SPLIT WASHERS	2
64	1/4X20	FLAT WASHERS	2
65	6X32X3/4	ROUND HEAD SCREW	1
67	1/4X20X3"	HEX SCREW	1
68	1/4X20	SPLIT WASHER	1
69	1/4X20	HEX NUT	1
70	4115893	FITTING BAR BRASS	4
71	4X40	ROUND HEAD SCREWS	2
72	4119576	PRESS SWITCH 45PSI	1

1- ATTACH 2-FRONT BLOCKS(57), 2-CHAMBER BLOCK(41), AND 2-BULKHEAD BLOCKS(4) TO THE BASE. USING 12-1/4X20X3/4 FLAT SOCKET SCREWS(14).

2- PLACE 1-TOP CLAMP(40) TO THE BASE. USING 2-1/4X20X2(62), 2-1/4 SPLIT WASHERS(63), AND 2-1/4 FLAT WASHERS(64).

3- INSERT 1-1/4X20X3 HEX SCREW(67) THROUGH THE CENTER HOLE OF DAMPER VIBRATION(18), THEN TIGHTEN IT BY 1-1/4X20 HEX NUT(69), AND 1-1/4 SPLIT WASHER(68). (SEE REF. C).

4- ATTACH VIBRATION DAMPER(18) TO THE TOP CLAMP(40). USING 4-10X32X1/2 SOCKET HEAD SCREWS(58), AND 4-10x STAR WASHERS(59).

5- USING TEFLON TAPE TO WRAP 4-TIMES AROUND THE FITTING BAR BRASS THREAD(70). THEN INSERT TO THE VALVE CHECK(17). (2 FOR EACH VALVE).

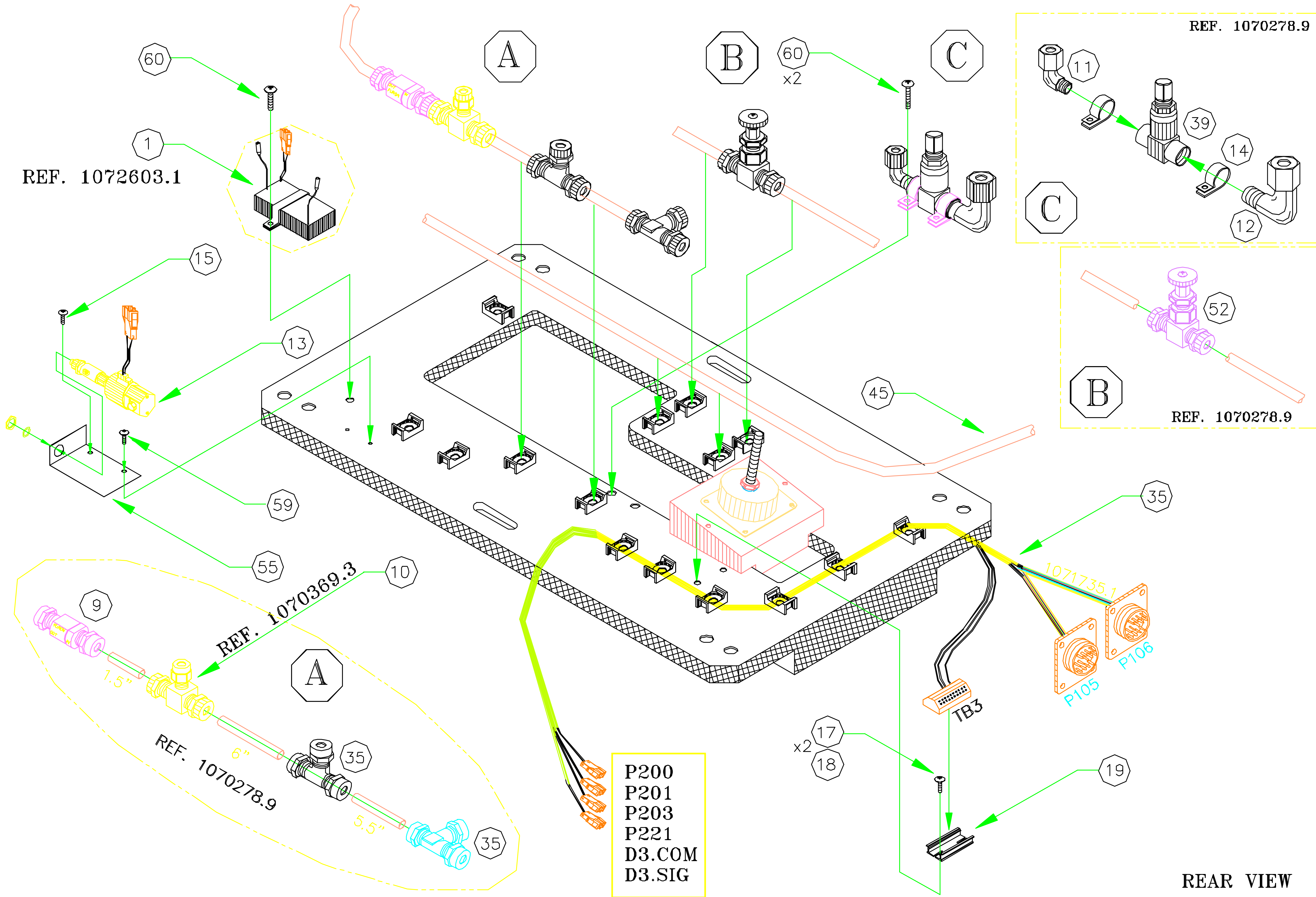
6- ATTACH 2-CONTROL CHECK VALVES(17). USING 2-4x40X1.1/2 ROUND HEAD SCREWS(71).

7- USING TEFLON TAPE TO WRAP 4-TIMES AROUND THE ELBOWL, BARBED BRASS THREADS(26). THEN TIGHTEN IT INTO THE PRESS SWITCH(72). (SEE REF. B).

8- ATTACH PRESS SWITCH(72) TO THE LEFT BLOCK(4) (SEE FROM REAR VIEW). USING 1-6X32X3/4 ROUND HEAD SCREW(65).

9- ATTACH BUS GROUND BAR(19) TO THE RIGHT BLOCK(4) (REAR VIEW). USING 2-10x32x1/2 ROUND HEAD SCREWS(60).

BASE ASSEMBLY REAR VIEW 4



1800-X BASE ASSEMBLY

ITEM	PART #	DESCRIPTIONS	QTY
1	1072603.1	STATIC ELIMINATOR, POWER SOURCE ASSY.	1
9	4119577	VALVE CHECK TFE 3/8T, 5/16RIF	1
10	4120184	TEE 3/8RUN 1/4 BRANCH TEFLON	1
11	4118943	ELBOWL, 1/4X1/4	1
12	4118953	ELBOWL, 3/8TX1/4NPT IMP64EAM	1
13	1072597.1	SAFETY VALVE ASSY.	1
14	4120102	CLAMP CABLE 3/4 BLACK	2
15	1/2X20X3/8	PHILLIP SCREW	1
17	6X32X1/4	PHILLIP SCREWS	2
19	1071526.1	DIN RAIL MOUNT 2.5"	1
35	1071735.1	HARNESS, 1800-6	1
35A	4118963	UNION TEE	2
39	4119510	METER VALVE 1/4X1/4	1
45	5115269	TUBE, 3/8X1/4 TFE, PASTE	120IN
52	4119181	PLUG VALVE, PV2-56X, FURON	1
59	10X32X1/4	PHILLIP SCREW	1
60	10X32X1/2	PHILLIP SCREWS	2

(A) CUT 3-PIECES 3/8X1/4 TUBE. 1.5", 5.5", AND 6".
- ATTACH EACH SIDE OF 3/8X1/4X5.5" TUBE TO EACH SIDE OF THE TEES(35).
- ATTACH 3/8X1/4X6" TO ONE SIDE OF 3/8X1/4 TEE(10) (REF. 1070369.3). THEN INSERT OTHER END OF 3/8X1/4 TUBE INTO ONE SIDE OF SECOND TEE(35).
- ATTACH 3/8X1/4X1.5" TUBE TO ONE SIDE MARKED <A> OF VALVE CHECK(9). THEN INSERT OTHER SIDE OF 3/8X1/4 TUBE INTO ONE SIDE OF TEE(10).
- FINALLY, ATTACH THE WHOLE <A>PART TO BASE PLATE. CHECK VALVE(9) MUST BE IN FRONT BASE DIRECTION. THEN TIGHTEN IT TO THE BASE BY 2-TIE WRAPS AT EACH SIDE OF SECOND TEE(35).

(B) CUT 2-PIECES 3/8X1/4X24"TUBE.
- ATTACH 2-3/8X1/4X24" TUBES TO EACH SIDE OF PLUG VALVE(52). THEN MOUNT IT TO BASE PLATE BY 2-TIE WRAPS TO EACH SIDE OF VALVE(52).

(C) APPLY TEFLON TAPE ONTO ELBOW THREADS, THEN ATTACH 1-1/4X1/4 ELBOW (11), AND 1-3/8X1/4 ELBOW(12) TO EACH SIDE OF 1/4X1/4 METER VALVE(39).
- ATTACH 2-3/4 CLAMP(14) TO EACH SIDE OF VALVE(39). THEN TIGHTEN IT BY 2-10X32X1/2 PHILLIP SCREWS(60).

(1) MOUNT SAFETY VALVE BRACKET(55) TO THE BASE. USING 1-10X32X1/4 PHILLIP SCREW(59), AND 1-1/4X20X3/8 PHILLIP SCREW(15), 1-1/2x20 STAR WASHER(16).

- UNSCREW HEX NUT & STAR WASHER FROM VALVE(13), AND INSERT VALVE(13) INTO VALVE BRACKET(55). THEN SCREW BACK THE HEX NUT & STAR WASHER.

(2) ATTACH STATIC ELIMINATOR PWR. ASSY.(1) TO THE BASE, NEXT OF THE SAEFTY VALVE(13). THEN TIGHTEN IT BY 1-10X32X1/2 PHILLIP SCREW(60).

(3) ATTACH DIN RAIL MOUNT 2.5"(19) TO BASE. USING 2-6X32X1/4 PHILLIP SCREW(17)

(4) ATTACH HARNESS(35)(1071735.1) TO BASE BY USING 4-TIE WRAPS. THEN SNAP <TB3> OF HARNESS INTO DIN RAIL MOUNT(19).

SEE DRAWING FOR MORE RELATIVE POSITIONS

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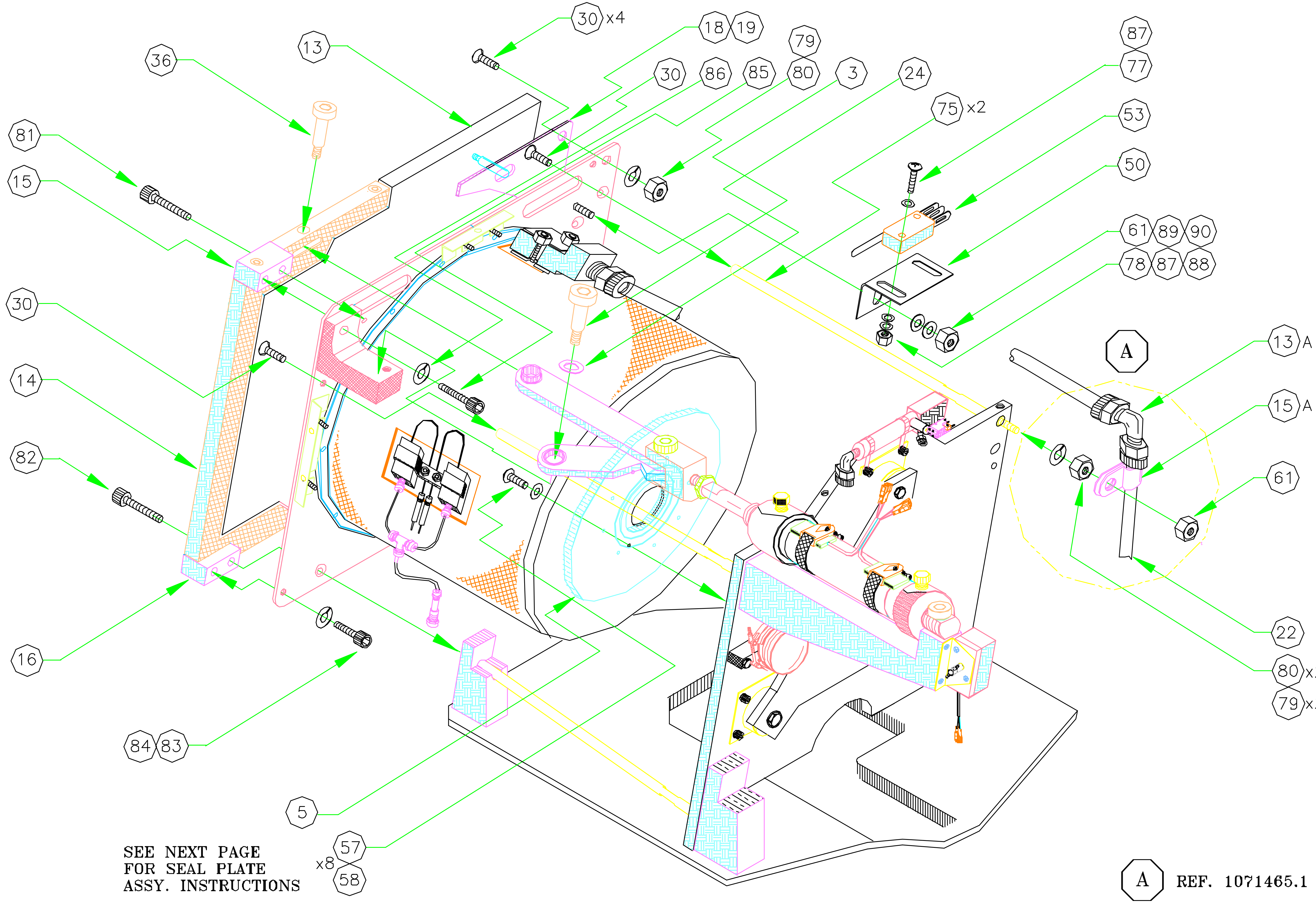
BOWL / FRONT DOOR ASSEMBLY 1



BOWL / FRONT DOOR INSTRUCTIONS 2

BOWL/DOOR ASSEMBLY INSTRUCTIONS

ITEM	PART #	DESCRIPTIONS	QTY
3	4119710	SHOULDER SCREW	1
5	1071522.1	SEAL PLATE LABYRINTH	1
13	1071725.1	CLEAR DOOR 1800-6	1
13A	4118973	FITTING, IMP8UE	1
14	1071726.2	FRAME DOOR	1
15	1071727.1	HINGE DOOR BLOCK TOP RH	1
15A	4121024	CLAMP, CUSHION 1/2	1
16	1071727.2	HINGE DOOR BLOCK BOTTOM RH	1
18	1072115.1	COVER FRONT TOP	1
19	1072116.1	COVER FRONT BOTTOM	1
22	5115720	TUBE 3/8X1/2	24IN
24	4120869	PLASTIC WASHER	1
30	4120180	1/4X20X3/4 FLAT SOCKET SCREWS	4
36	4119716	SHOULDER SCREW	1
50	1072118.1	MICROSWITCH BRACKET	1
53	4115848	MICROSWITCH	1
57	8X32X1/2	SCREWS, SPANHEAD SLOT	8
58	8X	FLAT WASHERS 316SS ELECTROPOLISH	8
61	10X32	HEXNUTS	2
75	1073513.1	ROD, TIE	2
77	4X40X5/8	PHILLIP SCREW	1
78	4X40	HEXNUT	1
79	1/4X	SPLIT WASHER	2
80	1/4X	HEX NUT	2
81	1/4X20X5/8	SOCKET SCREW	1
82	1/4X20X1.3/4	SOCKET SCREW	1
83	1/4X20X3/4	SOCKET SCREW	1
84	1/4X	SPLIT WASHER	1
85	1/4X20X1.1/4	SOCKET SCREW	1
86	1/4X	SPLIT WASHER	1
87	4X	FLAT WASHERS	2
88	4X	STAR WASHERS	1
89	10X	STAR WASHERS	2
90	10X	FLAT WASHERS	2

1- ATTACH BOWL ASSEMBLY TO FRONT BASE THEN ADJUST IT TO FIT INTO THE BASE. EACH CORNER OF FRONT PLATE ATTACH TO EACH ROD TIES(75). THEN SCREW 2-1/4X20X3/4 FLAT SOCKET SCREWS(30) THROUGH FRONT PLATE TO 2-TOP ROD TIES(75).

2- SEE NEXT PAGE FOR SEAL PLATE ASSEMBLY INSTRUCTIONS.

3- ATTACH FRONT BOTTOM COVER(19) TO BOTTOM LEFT SIDE OF FRONT PLATE. USING 1/4X20X3/4 FLAT SOCKET SCREW(30) MOUNT THROUGH FRONT BOTTOM COVER(19), TO BOWL PLATE, THEN TIGHTEN IT INTO ROD TIES(75).

4- ATTACH FRONT TOP COVER(18) TO TOP LEFT SIDE OF FRONT PLATE. USING 1/4X20X3/4 FLAT SOCKET SCREW(30) MOUNT THROUGH FRONT TOP COVER(18), TO BOWL PLATE, AND TIGHTEN IT BY 1-1/4X20 HEX NUT(80), 1/4X WASHER(79).

5- ATTACH FRONT DOOR ASSEMBLY(13)(REF.1071728.2) TO FRONT BOWL, ADJUST TOP AND BOTTOM HINGES TO MAKE IT FIT INTO BOWL PLATE. ON TOP RIGHT, USING 1-1/4X20X1 SOCKET SCREW(81) MOUNT THROUGH HINGE BLOCK AND TIGHTEN IT INTO BOWL PLATE. MOUNT SECOND 1/4X20X1.1/4 SOCKET SCREW(85) WITH 1/4X SPLIT WASHER(86) FROM PIVOT BRACKET THROUGH TOP HINGE BLOCK(15).

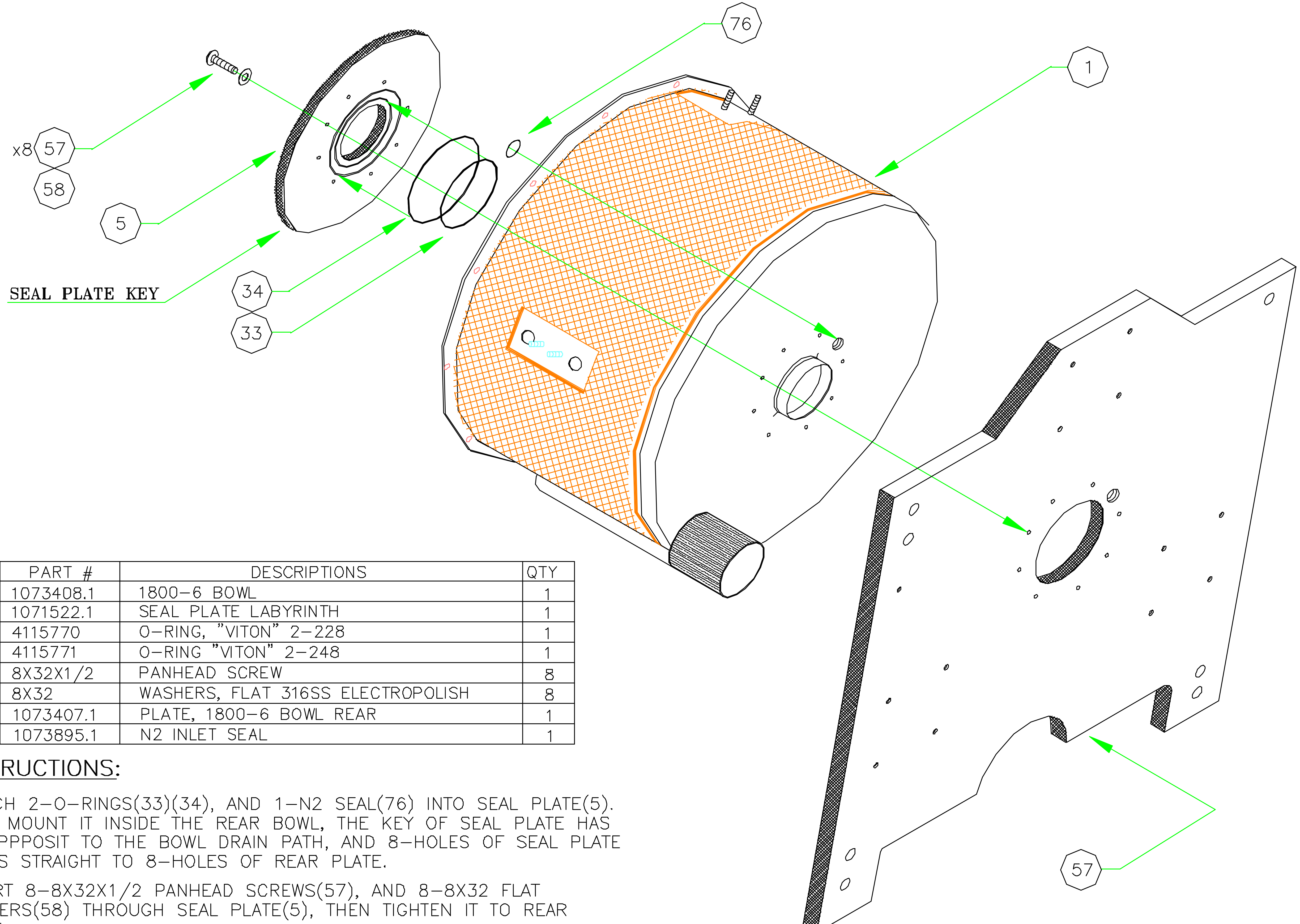
6- SCREW 1-1/4X20X1.3/4(82) INTO BOTTOM HINGE TO FRONT PLATE. THEN MOUNT THE SECOND 1-1/4X20X3/4 SOCKET SCREW(83) AND 1/4X SPLIT WASHER(84) FROM BACK OF FRONT PLATE TO THE BOTTOM HINGE BLOCK(16).

7- ATTACH BRACKET, MICROSWITCH(50) TO TOP LEFT FRONT PLATE STUD, AND TIGHTEN IT BY 1-10X32 HEX NUT(61), 1-10X FLAT WASHER(89), AND 1-10X STAR WASHER(90). THEN MOUNT MICROSWITCH(53) ONTO BRACKET, USING 1-4X40X5/8 PHILLIP SCREW(77) WITH 1-4X FLAT WASHER(87) INSERTS THRU MICROSWITCH TO BRACKET(50). THEN TIGHTEN IT BY 1-4X40 HEXNUT(78), 1-4X FLAT WASHER(87), AND 1-4X STAR WASHER(88).

8- CUT 24 INCH 3/8X1/2 TUBE(22), ATTACH CUSHION CLAMP(15) TO ONE END OF TUBE, THEN INSERT TUBE INTO ELBOW FITTING(13).

9- ATTACH 1-1/4X20 SPLIT WASHER(79) AND 1-1/4X20 HEX NUT(80) TO LEFT TOP ROD TIE STUD(75). INSERT CUSHION CLAMP(15) WITH ELBOW FITTING(13) INTO NEXT. THEN TIGHTEN IT BY 1-10X32 HEXNUT(61).

BOWL / SEAL PLATE ASSEMBLY 3



ITEM	PART #	DESCRIPTIONS	QTY
1	1073408.1	1800–6 BOWL	1
5	1071522.1	SEAL PLATE LABYRINTH	1
33	4115770	O–RING, "VITON" 2–228	1
34	4115771	O–RING "VITON" 2–248	1
57	8X32X1/2	PANHEAD SCREW	8
58	8X32	WASHERS, FLAT 316SS ELECTROPOLISH	8
67	1073407.1	PLATE, 1800–6 BOWL REAR	1
76	1073895.1	N2 INLET SEAL	1

INSTRUCTIONS:

1– ATTACH 2–O–RINGS(33)(34), AND 1–N2 SEAL(76) INTO SEAL PLATE(5). THEN MOUNT IT INSIDE THE REAR BOWL, THE KEY OF SEAL PLATE HAS TO OPPPOSIT TO THE BOWL DRAIN PATH, AND 8–HOLES OF SEAL PLATE LOOKS STRAIGHT TO 8–HOLES OF REAR PLATE.

2– INSERT 8–8X32X1/2 PANHEAD SCREWS(57), AND 8–8X32 FLAT WASHERS(58) THROUGH SEAL PLATE(5), THEN TIGHTEN IT TO REAR PLATE.

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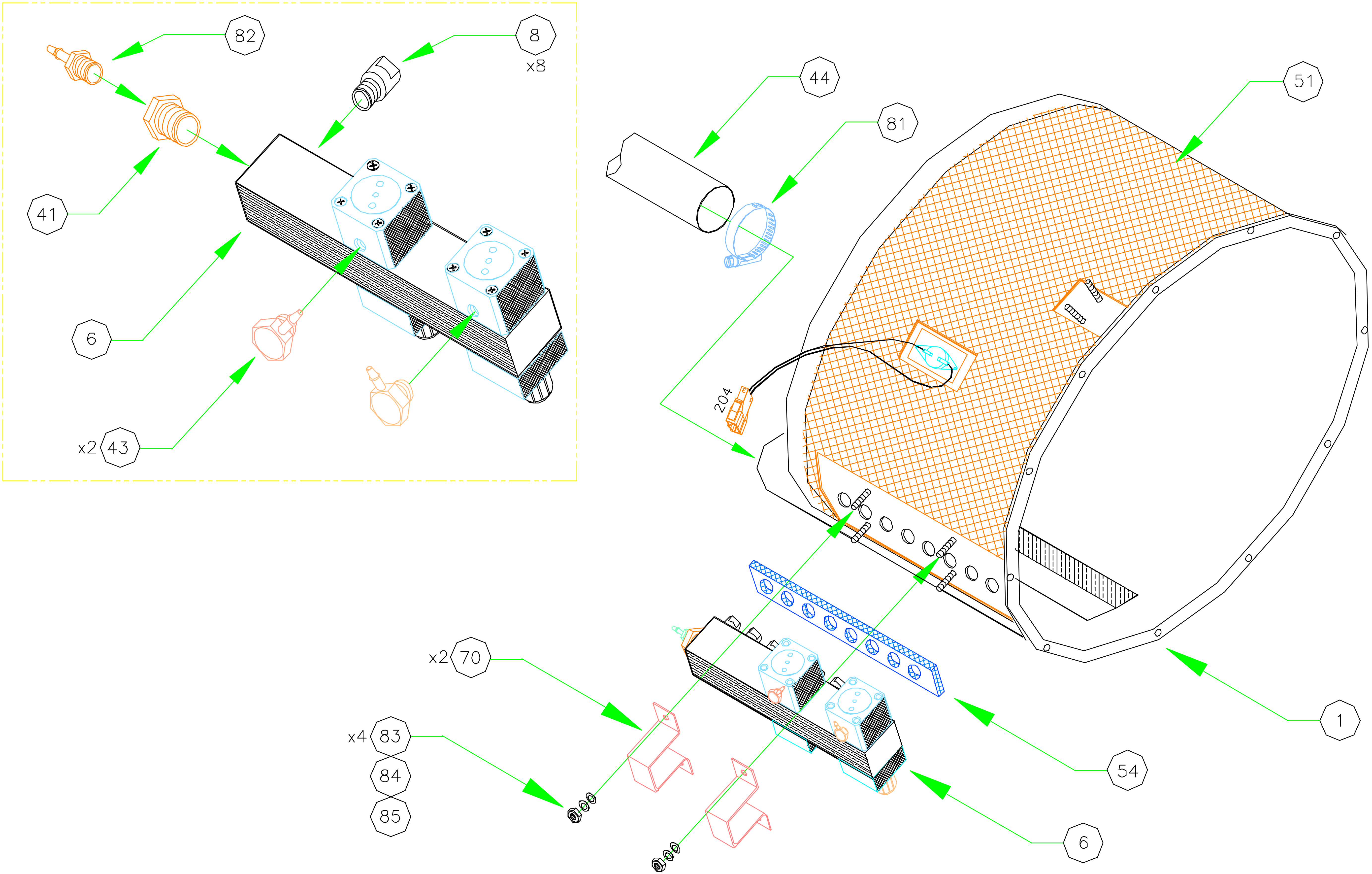
DI / N_2 MANIFOLD VALVE ASSEMBLY 1



DI / N_2 MANIFOLD VALVE ASSEMBLY INSTRUCTIONS 2

BLANKET AND MANIFOLD VALVES ASSEMBLY INSTRUCTIONS

ITEM	PART #	DESCRIPTIONS	QTY
1	1073408.1	BOWL 1800-6	1
6	4119723	8 PORTS MANIFOLD BLOCK	1
8	4117876	NOZZEL, SPRAY VEEJET	8
41	4119514	FITTING , RED BUSH 1/2X1/8	1
43	4115819	ELBOWL, BARBED BRASSS	2
44	5115521	TUBE 1.3/4X2	1
51	1072584.1	HEATER BLANKET	1
54	1072587.1	GASKET MANIFOLD	1
70	1073410.1	BRACKET, MANIFOLD	2
81	4120360	CLAMP HOSE	1
82	4115761	FITTING BAR	1
83	10X32	HEX NUTS	2
84	10X	STAR WASHERS	2
85	10X	FLAT WASHERS	2

1- TURN THE 1800-6 BOWL FACE DOWN. THEN PLACE THE HEATER BLANKET(51) TO THE BOWL, USING PENCIL TO MARK THE SIZE OF HEATER BLANKET ON BOWL.

2- USING WATLOW & MIXER APPLY ON SURFACE OF HEATER BLANKET(51), AND MARKING BOWL SURFACE. THEN WAIT FOR 20 MINUTE.

3- ATTACH HEATER BLANKET(51) TO THE 1800-6 BOWL(1).

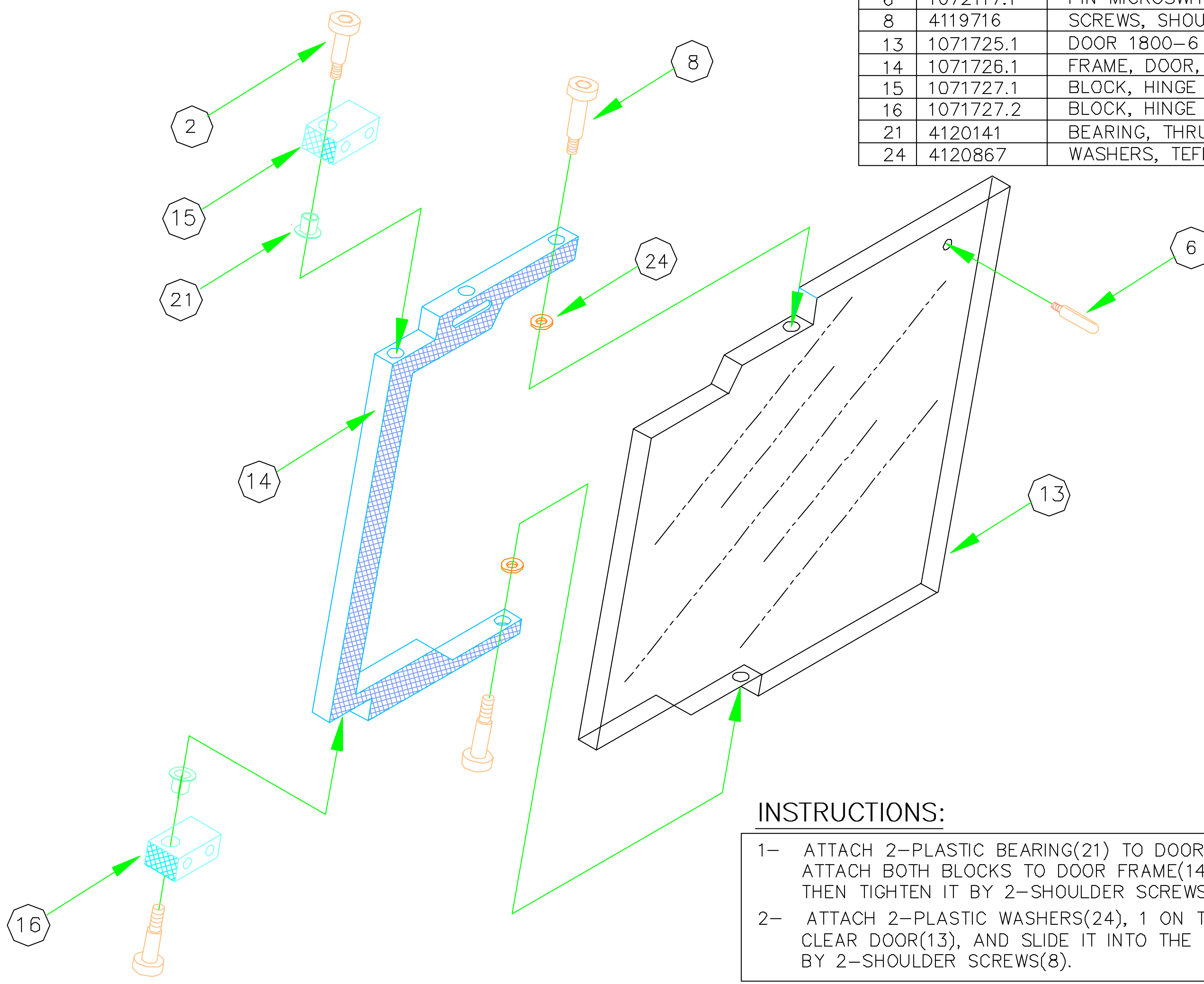
4- USING TEFLON TAPE TO WRAP 4-TIMES AROUND FITTING BAR(82), FITTING RED BUSH(41), AND BARBED BRASS ELBOW(43).

5- ATTACH GASKET MANIFOLD(54) TO THE BOWL(1). THEN ATTACH THE 8-PORT MANIFOLD BLOCK(6). USING 2-BRACKETS(70), THEN TIGHTEN IT BY 2-10X32 HEX NUTS(83), 2-10X STAR WASHERS(84), AND 2-10X FLAT WASHERS(85).

7- ATTACH TUBE(44) TO BOWL DRAIN(1). THEN TIGHTEN IT BY CLAMP HOSE(81).

DOOR ASSEMBLY & INSTRUCTIONS 1

ITEM	PART #	DESCRIPTIONS	QTY
2	4119709	SCREWS, SHOULDER .25DIAX.51G SS	2
6	1072117.1	PIN MICROSWITCH	1
8	4119716	SCREWS, SHOULDER .25D.62L,10-24	2
13	1071725.1	DOOR 1800-6 CLEAR	1
14	1071726.1	FRAME, DOOR, HINGE, 1800 RH	1
15	1071727.1	BLOCK, HINGE DOOR 1800 TOP	1
16	1071727.2	BLOCK, HINGE DOOR 1800-6 BOTTOM	1
21	4120141	BEARING, THRUST 1/4 PLASTIC	2
24	4120867	WASHERS, TEFLON FLAT .38X.63X.03	2

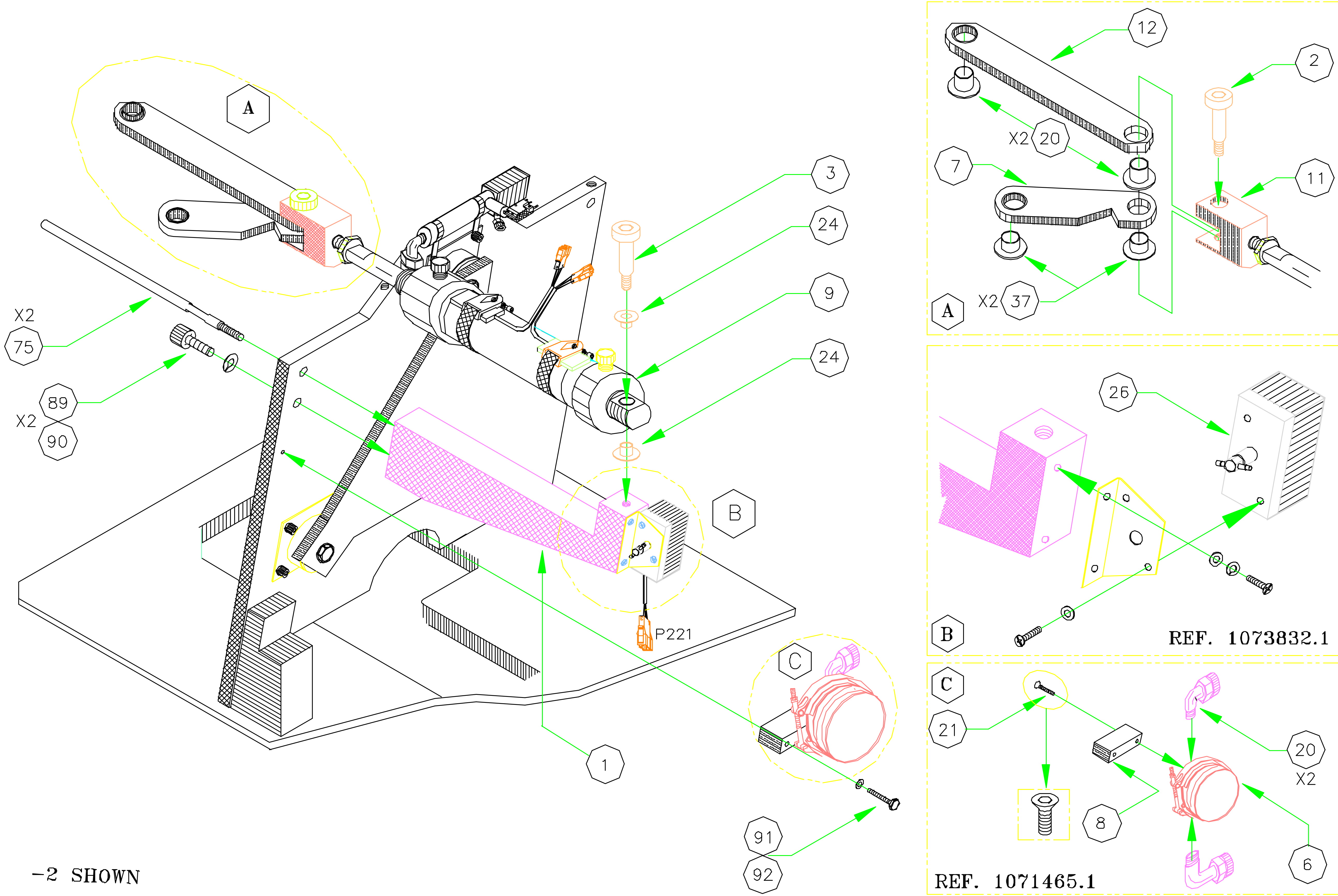


INSTRUCTIONS:

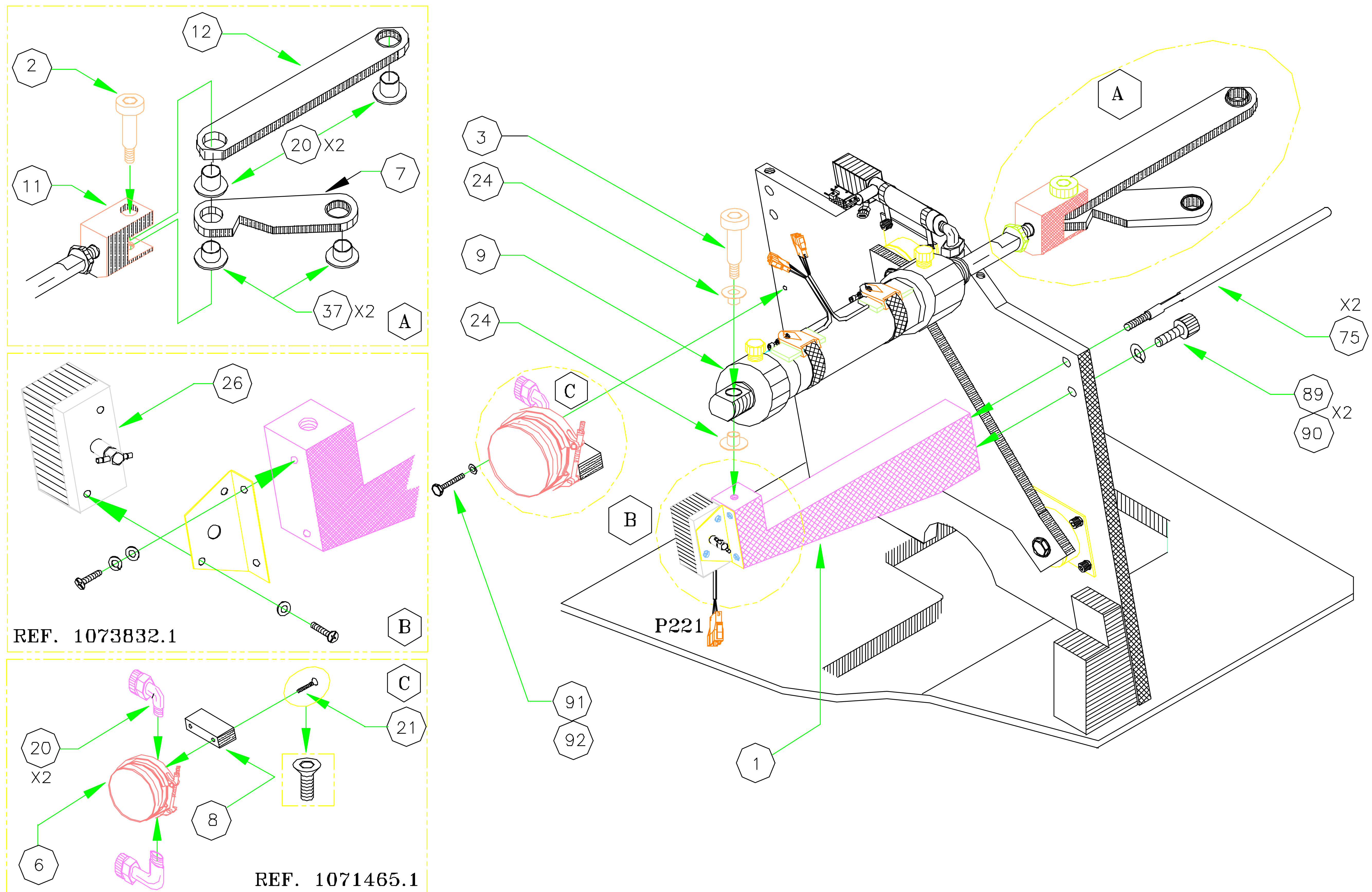
1- ATTACH 2-PLASTIC BEARING(21) TO DOOR HINGE BLOCKS(15)&(16), AND ATTACH BOTH BLOCKS TO DOOR FRAME(14). 1 ON TOP AND 1 AT BOTTOM. THEN TIGHTEN IT BY 2-SHOULDER SCREWS(2).

2- ATTACH 2-PLASTIC WASHERS(24), 1 ON TOP AND 1 AT BOTTOM OF THE CLEAR DOOR(13), AND SLIDE IT INTO THE DOOR FRAME(14). THEN TIGHTEN IT BY 2-SHOULDER SCREWS(8).

DOOR CYLINDER ASSEMBLY 2
RIGHT-HAND



DOOR CYLINDER ASSEMBLY 3
LEFT-HAND



DOOR CYLINDER ASSEMBLY INSTRUCTIONS 4

RH–LH DOOR CYLINDER ASSEMBLY INSTRUCTIONS

ITEM	PART #	DESCRIPTIONS	QTY
1	1071728.2	BRACKET, PIVOT CYLINDER	1
2A	4119709	SHOULDER SCREW	1
3	4119710	SHOULDER SCREW	1
6C	4119379	FILTER, HOUSING	1
7A	1071724.3	LINK, ACTUATOR DOOR	1
8C	1070271.1	BRACKET, N2 FILTER HOUSING	1
9	4120066	CYLINDER AIR, 2" BX5", BIMBA	1
11A	1071723.1	BRACKET, CLEVIS CYLINDER	1
12A	1071724.1	LINK, ACTUATOR DOOR	1
20A	4120140	FLANGE BEARING 1/4X3/8X3/8	4
20C	4118953	ELBOWL 3/8X1/4	2
21C	4120181	SCREW 1/4X20X1 FLAT HEAD SOCKET	1
24	4124386	INSULATING SHOULDER WASHER, PLASTIC	2
26B	1073832.1	DIGITAL OBSTRUCT. SENSOR	1
37A	4124136	FLANGE BEARING 1/4X3/8X1/4 PLC	2
75	1073513.1	ROD, TIE	2
89	1/4X20X3/4	SOCKET SCREWS	2
90	1/4X20	SPLIT WASHERS	2
91	10X32X1	HEX SCREW	1
92	10X32	STAR WASHER	1

A– ATTACH 2–1/4X3/8X3/8 FLANGE BEARING(20) TO LINK ACTUATOR(12). AND 2–1/4X3/8X1/4 FLANGE BEARING(37) TO THE SHORT LINK ACTUATOR(7). SLIDE BOTH LINK ACTUATORS INTO CLEVIS CYLINDER BRACKET(11). (THE LINK ACTUATOR(12) ON TOP, AND THE SHORT LINK ACTUATOR(7) IN BOTTOM WITH THE CUTTING ANGLE SIDE DIRECT INTO THE CLEVIS BRACKET. ALL 4–FLANGE BEARINGS ALWAYS IN UPSIDE DOWN POSITION. IF THE MACHINE BUILT FOR LEFT DOOR OPEN, THE CUTTING ANGLE OF SHORT LINK ACTUATOR(7) SHOULD BE ON LEFT SIDE TOO). OR VICE–VERSA.

B– MOUNT SENSOR BRACKET TO THE SENSOR OBSTRUCT(26). USING 2–SCREWS, AND WASHERS COME WITH SENSOR.

C– WRAP 4–TIMES TEFLON TAPE TO 2–ELBOW THREADS(20), AND ATTACH IT INTO FILTER HOUSING(6).
 – ATTACH N2 BRACKET(8) TO FILTER HOUSING(6), USING 1–1/4X20X1 FLAT SOCKET SCREW(21).

1– ATTACH BRACKET PIVOT LINK(10) TO 1800 PLATE, TIGHTEN IT BY 1–ROD TIE(75) INTO UPPER HOLE, AND 1–1/4X20X3/4 SOCKET SCREW(89), 1–1/4X20 SPLIT WASHER(90) INTO LOWER HOLE.

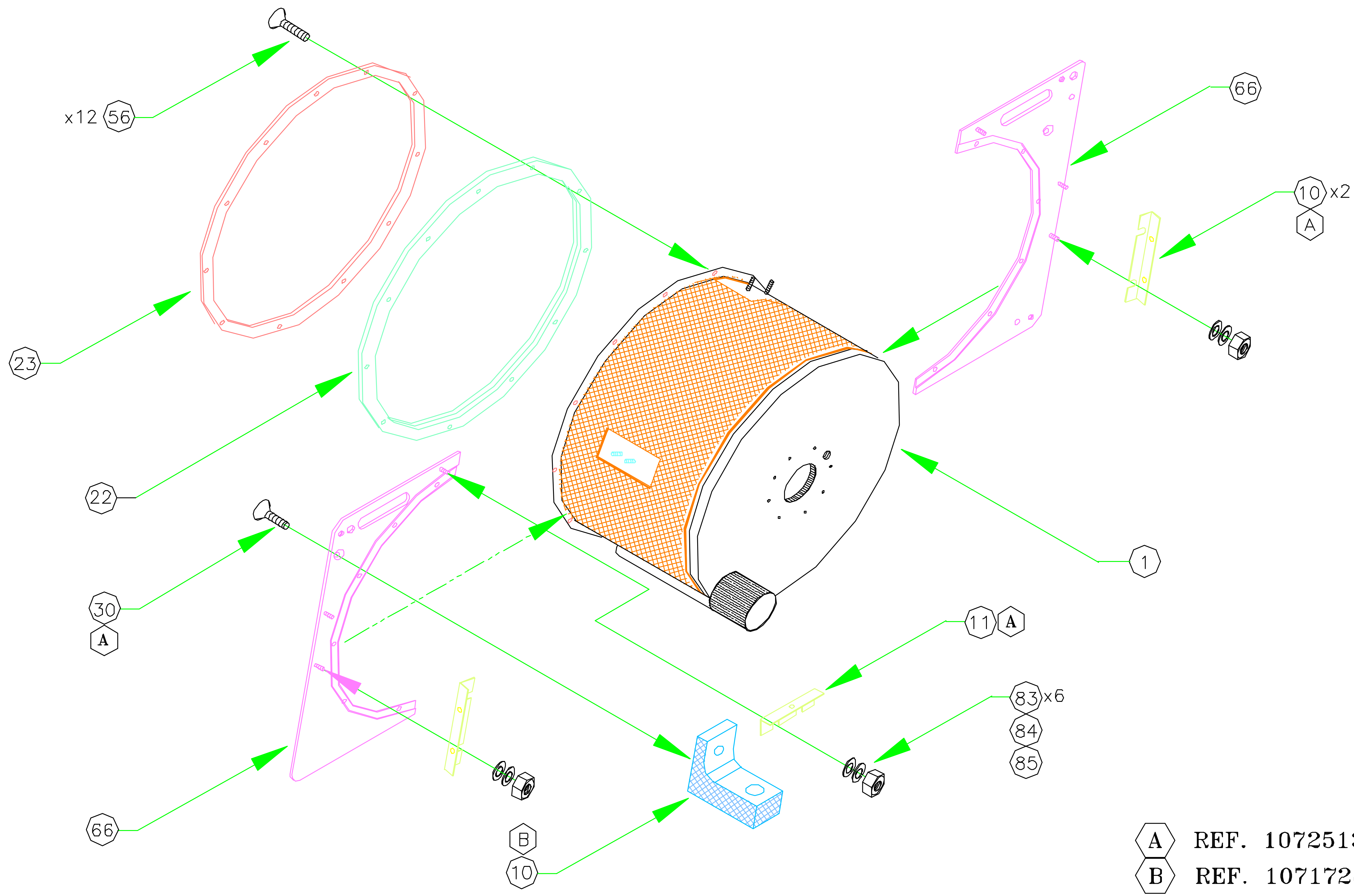
2– ATTACH SENSOR, DOOR OBSTRUCT(26) TO THE REAR OF BRACKET PIVOT LINK(10). THEN TIGHTEN IT BY 2–8X32X3/8 PHILLIP SCREWS, 2–8X STAR AND 2–8X FLAT WASHERS.

3– ATTACH CYLINDER ASSY.(9) TO BRACKET PIVOT LINK(10). USING 2–INS–PLASTIC WASHERS(24), AND 1–SCREW SHOULDER(3) TO TIGHTEN IT TO PIVOT BRACKET(10).

4– ATTACH FILTER(6) TO 1800 PLATE, USING 1–10X32X1 HEX SCREW(91), AND 1–10X32 STAR WASHER(92).

FRONT PLATE ASSEMBLY 1

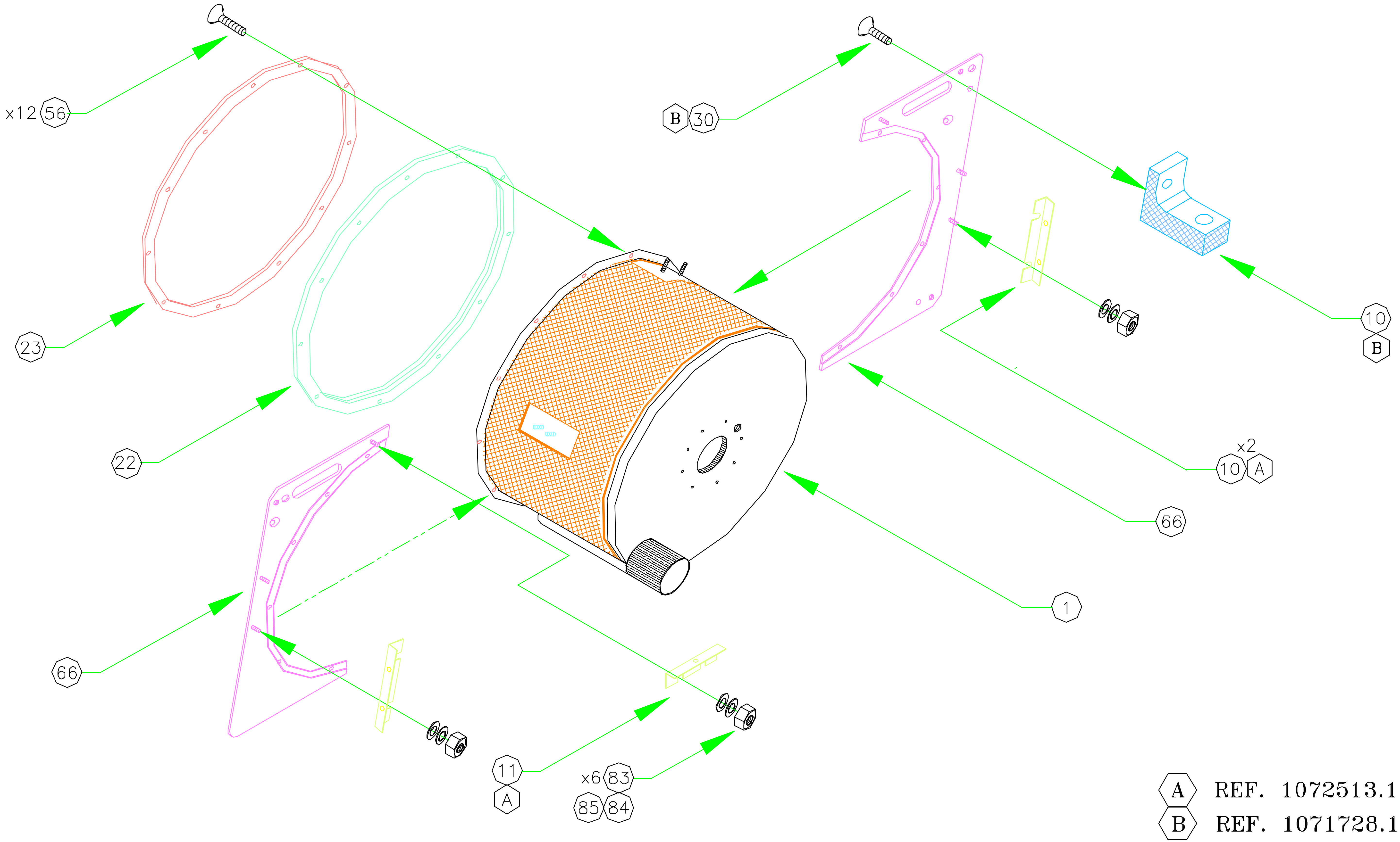
-9 SHOWN



A REF. 1072513.1

B REF. 1071728.1

FRONT PLATE ASSEMBLY 2



FRONT COVER & PLATE ASSEMBLY INSTRUCTIONS

ITEM	PART #	DESCRIPTIONS	QTY
1	1073408.1	BOWL 1800-6	1
10B	1071722.1	BRACKET, PIVOT LINK	1
10A	1073440.5	BRACKET 1800-6	2
11A	1073440.7	BRACKET 1800-6	1
22	1070237.5	SEAL DOOR 1800	1
23	1070238.1	RING SEAL BOWL	1
30B	4120180	FLAT SOCKET SCREWS 1/4X20X3/4	1
56	8X32X1/2	FLAT SCREWS	12
66	1073406.1	FRONT PLATE 1800-6	1
83	10X32	HEX NUTS	6
84	10X	STAR WASHERS	6
85	10X	FLAT WASHERS	6

1- ATTACH FRONT PLATE 1800-6(66) TO BEHIND OF BOWL FRONT RIM(1), AND ATTACH SEAL DOOR(22), THEN ATTACH RING SEAL(23) TO THE FRONT BOWL. USING 12-8X32X1/2 FLAT HEAD SCREWS(56).

2- ATTACH 1-BRACKET COVER(11A) TO THE TOP FRONT PLATE(66), AND 2-BRACKET COVERS(10A) TO LEFT AND RIGHT SIDE OF FRONT PLATE. THEN TIGHTEN IT BY 6-10X32 HEXNUTS(83), 6-10X STAR(84), AND FLAT WASHERS(85).

4- ATTACH BRACKET PIVOT LINK(10B) TO TOP RIGHT OF FRONT PLATE(66). THEN TIGHTEN IT BY 1-1/4X20X3/4 FLAT SOCKET SCREW(30B).

A REF. 1072513.1
B REF. 1071728.1

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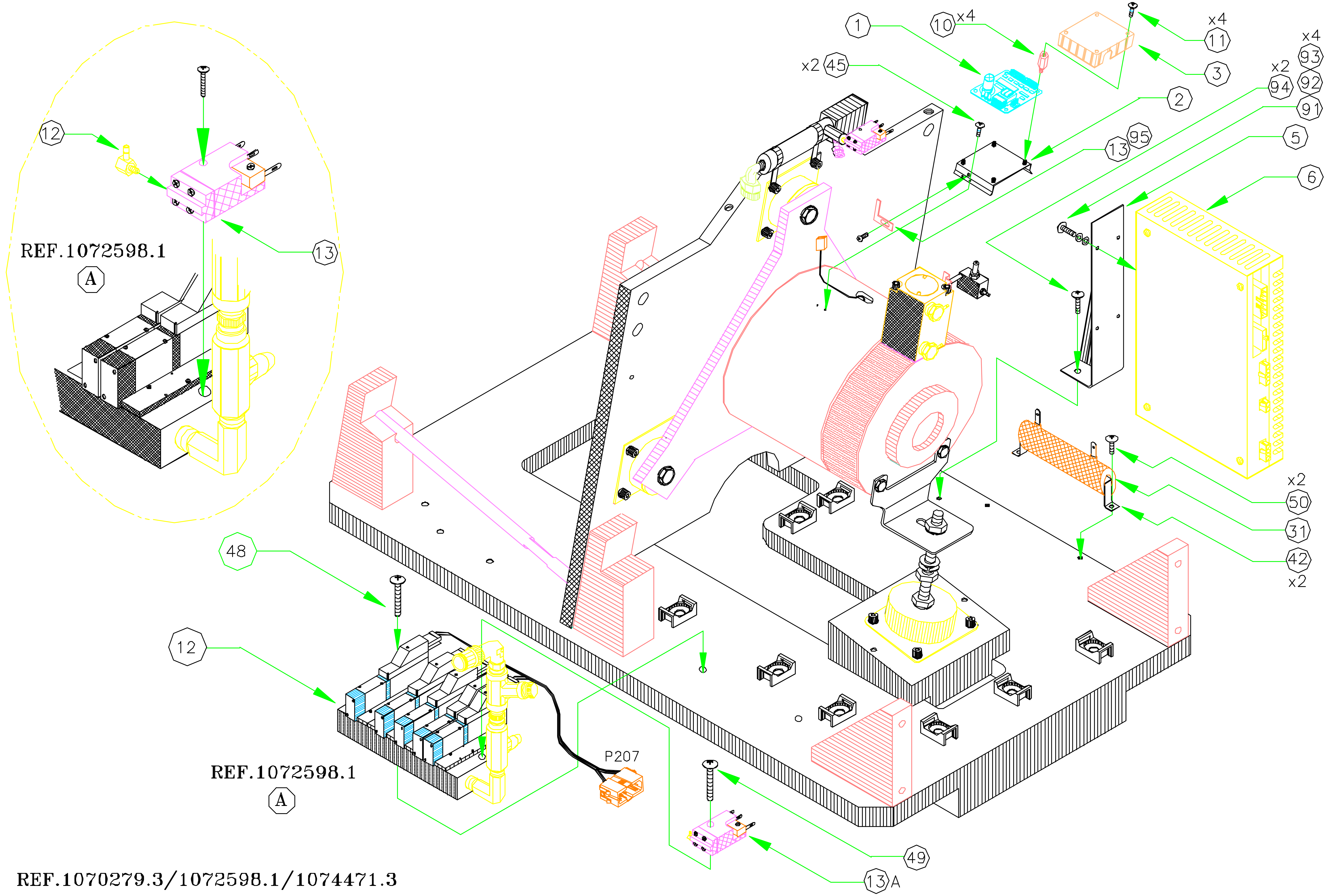
MANIFOLD / SPEED CONTROL BOARD ASSEMBLY 1



MANIFOLD / SPEED CONTROL BOARD ASSEMBLY INSTRUCTIONS 2

MANIFOLD/SPEED CONTROLL/BASE ASSEMBLY

ITEM	PART #	DESCRIPTIONS	QTY
1	1074438.1	OVERSPEED PCBOARD	1
2	1074443.1	OVERSPEED PCB MOUNT BRACKET	1
3	1074466.3	OVERSPEED PCB COVER	1
5	1070253.1	HEATSINK, CONTROLLER MOTOR	1
6	4119839	CONTROLLER, SPEED CONTROL	1
10	4120945	STANDOFF 6X32X1.1/2	4
11	4121021	6X32X3/8 PHILLIP SCREWS	4
12	1072598.1	MANIFOLD ASSY.1800-6	1
12A	4120168	ELBOW 10X32X.078 BARB	1
13	4120493	GUIDE, WIRE HOLDER	1
13A	4119576	SWITCH, PRESS 45PSI	1
31	4120013	RESISTOR, 50-OHM, 50W	1
42	4120114	BRACKET, RESISTOR	2
45	10X32X3/8	PHILLIP SCREWS	2
48	6X32X1	PHILLIP SCREWS	1
49	6X32X1.1/4	PAN HEAD SCREWS	1
50	6X32X1.3/4	PHILLIP SCREWS	2
91	8X32X3/8	PHILLIP SCREWS	4
92	8X	STAR WASHERS	4
93	8X	FLAT WASHERS	4
94	1/4X20X1/2	PHILLIP SCREWS	2
95	10X32X1/4	PHILLIP SCREW	1

(A) APPLY 4-TIMES TEFLON TAPE ONTO ELBOW BARB THREADS(12)-A, THEN ATTACH TO PRESSURE SWITCH(13).

1- ATTACH 1-6X32X1 PHILLIP SCREW(48) ON LEFT SIDE OF MANIFOLD BLOCK(12), AND INSERT 1-6X32X1.3/4 PAN HEAD SCREW(49) THROUGH THE PRESS SWITCH(13) TO RIGHT SIDE OF MANIFOLD BLOCK(12). THEN TIGHTEN IT ONTO BASE PLATE.

2- ATTACH CONTROLLER HEATSINK(5) TO SPEED CONTROLLER(6). USING 4-8x32x3/8 PHILLIP SCREWS(91), 4-8X STAR WASHERS(92), AND 4-8X FLAT WASHERS(93). THEN MOUNT CONTROLLER BRACKET(5) ON BASEPLATE BY 2-1/4X20X1/2 PHILLIP SCREWS.

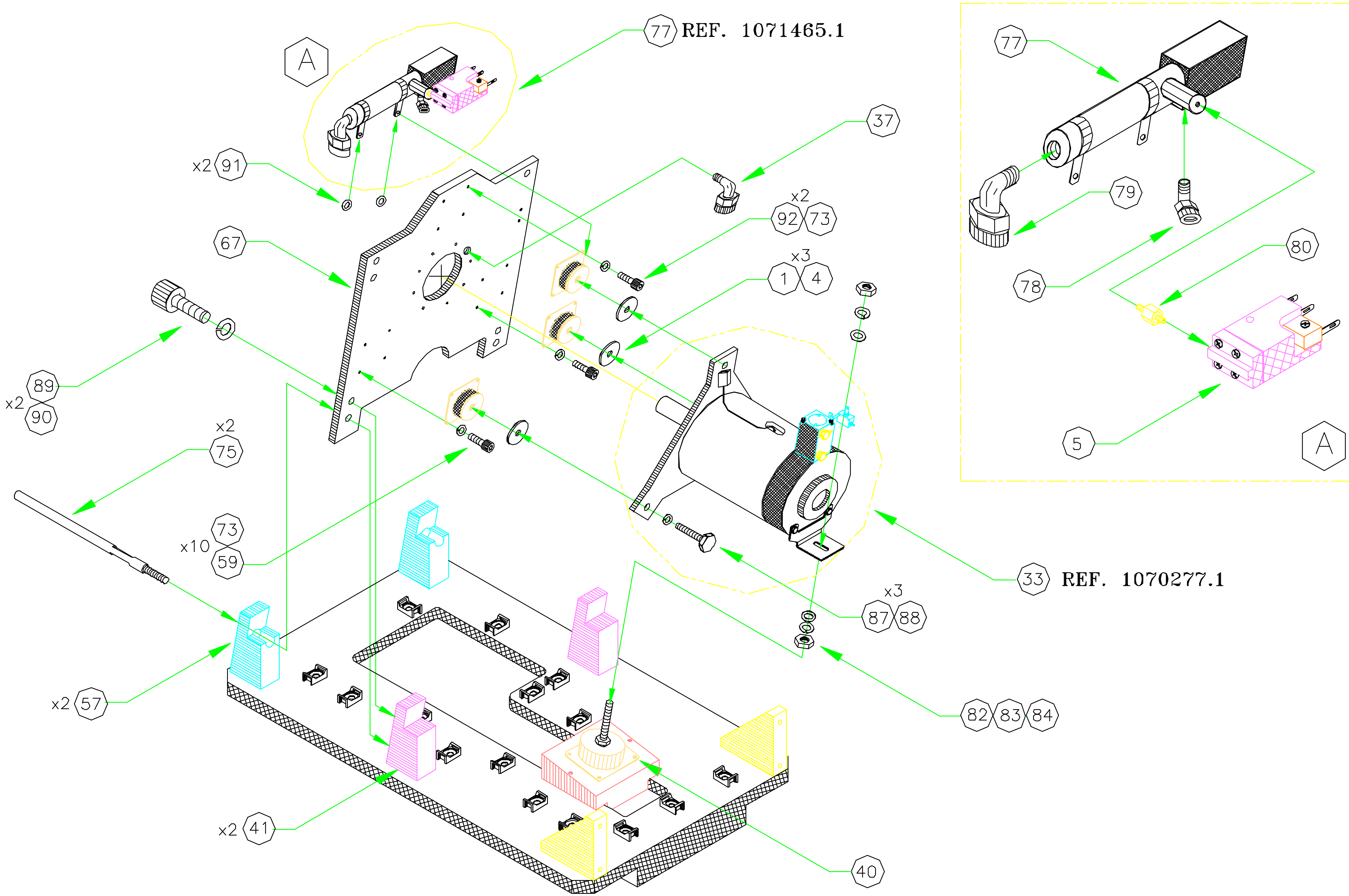
3- SNAP 2-RESISTOR BRACKETS(42) TO EACH SIDE OF RESISTOR(31). THEN TIGHTEN IT DOWN ON BASE PLATE BY 2-6X32X1/4 PHILLIP SCREWS(50).

4- ATTACH OVERSPEED BRACKET(2) ONTO TOP SURFACE OF MOTOR, THEN TIGHTEN IT BY 2-10X32X3/8 PHILLIP SCREWS(45).

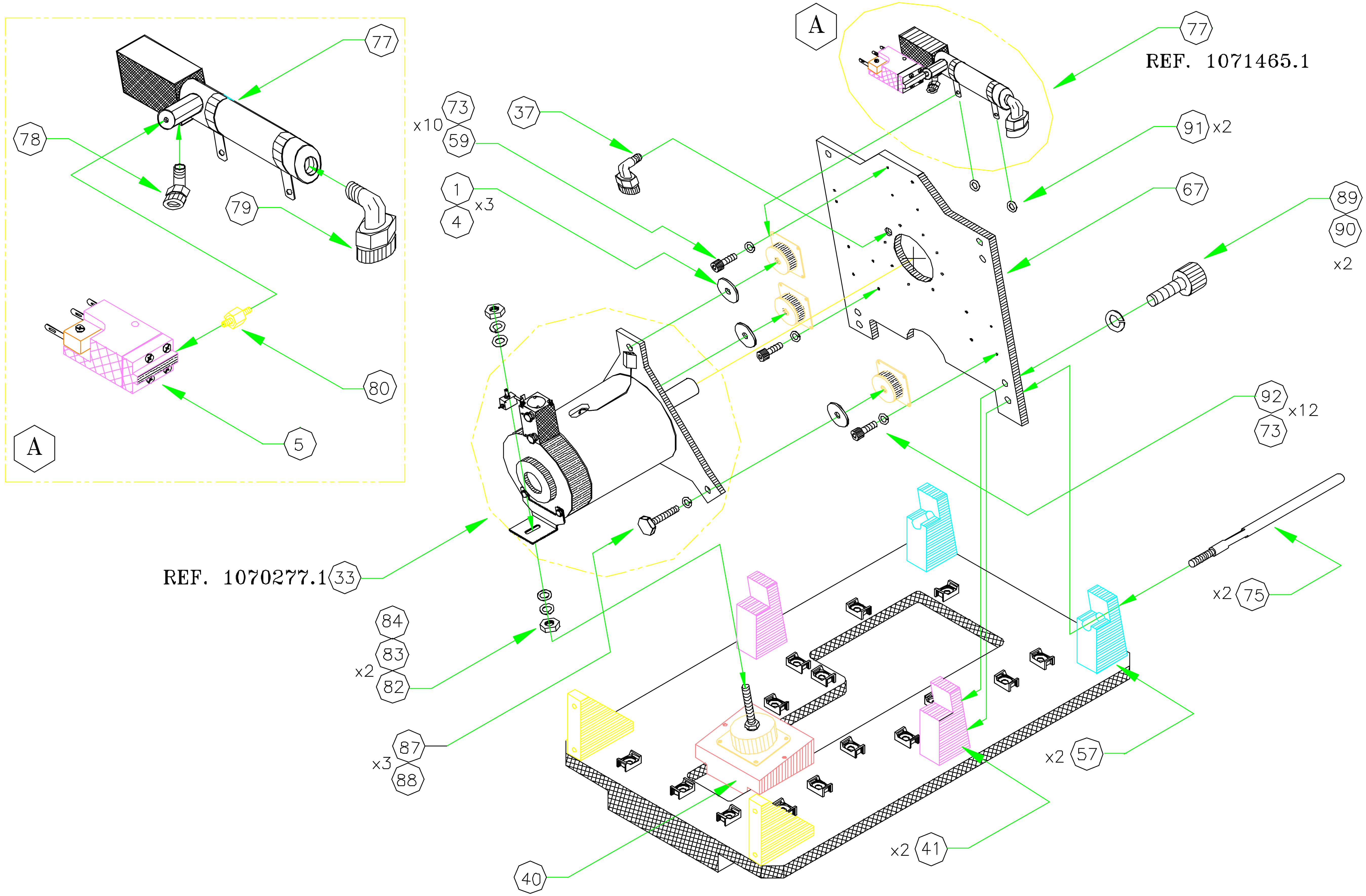
5- ATTACH OVERSPEED PCBOARD(1) ONTO OVERSPEED BRACKET(45), TIGHTEN IT BY 4-6X32X1.1/2 STANDOFF(10). THEN PLACE OVERSPEED COVER(3) ONTO IT, AND TIGHTEN IT BY 4-6X32X3/8 PHILLIP SCREWS(11).

6- ATTACH GUIDE, WIRE HOLDER(13) TO THE SIDE OF OVERSPEED BRACKET(2). THEN TIGHTEN IT BY 1-10X32X1/4 PHILLIP SCREW(95).

MOTOR ASSEMBLY 1



MOTOR ASSEMBLY 2



1800-6 BASE PLATE/MOTOR ASSEMBLY

ITEM	PART #	DESCRIPTIONS	QTY
1	1070259.1	SPACER, ISOLATOR VIBRATION	3
4	4119415	DAMPER, VIBRATION 70LB	3
33	1070277.1	MOTOR ASSEMBLY	1
37	4118941	ELBOW, 1/8X1/4, FURON	1
59	10X32X1/4	SOCKET HEAD SCREWS	10
67	1073407.1	PLATE, 1800-6	1
73	10X	STAR WASHERS	12
75	1073513.1	ROD, TIE	2
77	1071465.1	HEATER, NITROGEN ASSEMBLY	1
82	1/4X20	HEX NUTS	2
83	1/4X	FLAT WASHERS	4
84	1/4X	SPLIT WASHERS	4
87	1/4X20X1.1/4	HEX SCREWS	3
88	1/4X	SPLIT WASHERS	3
89	1/4X20X3/4	SOCKET SCREWS	2
90	1/4X	SPLIT WASHERS	2
91	10X	FLAT WASHERS	2
92	10X32X1/2	SOCKET HEEAD SCREWS	2

1- ATTACH REAR PLATE 1800-6(67) TO BLOCK MOUNT CHAMBER(41). INSERT 2-ROD TIES(75) FROM 2-FRONT BLOCKS(57) THROUGH THE 1800-6 PLATE(67), THEN TIGHTEN IT INTO THE 2-CHAMBER BLOCKS(41).

2- INSERT 2-1/4X20X3/4 SOCKET HEAD SCREWS(89), AND 2-1/4X SPLIT WASHERS(90) TO THE PLATE(67) THEN TIGHTEN IT TO THE CHAMBER BLOCKS(41).

3- ATTACH ELBOW(37) TO THE PLATE (67)

4- INSERT 1-1/4X20 HEX NUT(82), 1-1/4X SPLIT WASHER(83), AND 1-1/4X FLAT WASHER(84)TO THE MIDDLE OF STAND OFF SCREW OF THE TOP CLAMP(40).

5- ATTACH 3-DAMPER VIBRATIONS(4) TO THE PLATE)67). USING 10-10X32X1/4 SOCKET SCREWS(59),AND 10-10X STAR WASHERS(73). IN THE SAME TIME, LAYING THE HEATER NITROGEN ASSEMBLY(77) SIT ON TOP OF PLATE(67), THEN INSERT 2-10X FLAT WASHERS(91) IN BETWEEN 2-HEATER CLAMPS, AND TIGHTEN TOGETHER WITH THE TOP 2-SOCKET SCREWS(92) DAMPER VIBRATION(4).

6- ATTACH 3-SPACER ISOLATOR VIBRATION(1) TO 3-DAMPER VIBRATIONS(4), THEN ATTACH MOTOR ASSEMBLY(33) TO NEXT OF IT, AND THE MOTOR BRACKET GO THROUGH THE SCREW OF TOP CLAMP(40). THEN ATTACH 1-1/4X FLAT WASHER, 1-1/4X SPLIT WASHER, AND 1-1/4X HEX NUT.

7- ADJUST MOTOR ASSEMLY(33) INTO RIGHT POSITION WITH DAMPER VIBRATIONS(4), AND THE TOP CLAMP(40). THEN TIGHTEN ALL OF 3-1/4X20 SOCKET SCREWS(87), AND THE HEX NUT AT TOP CLAMP(40) WITH MOTOR BRACKET.

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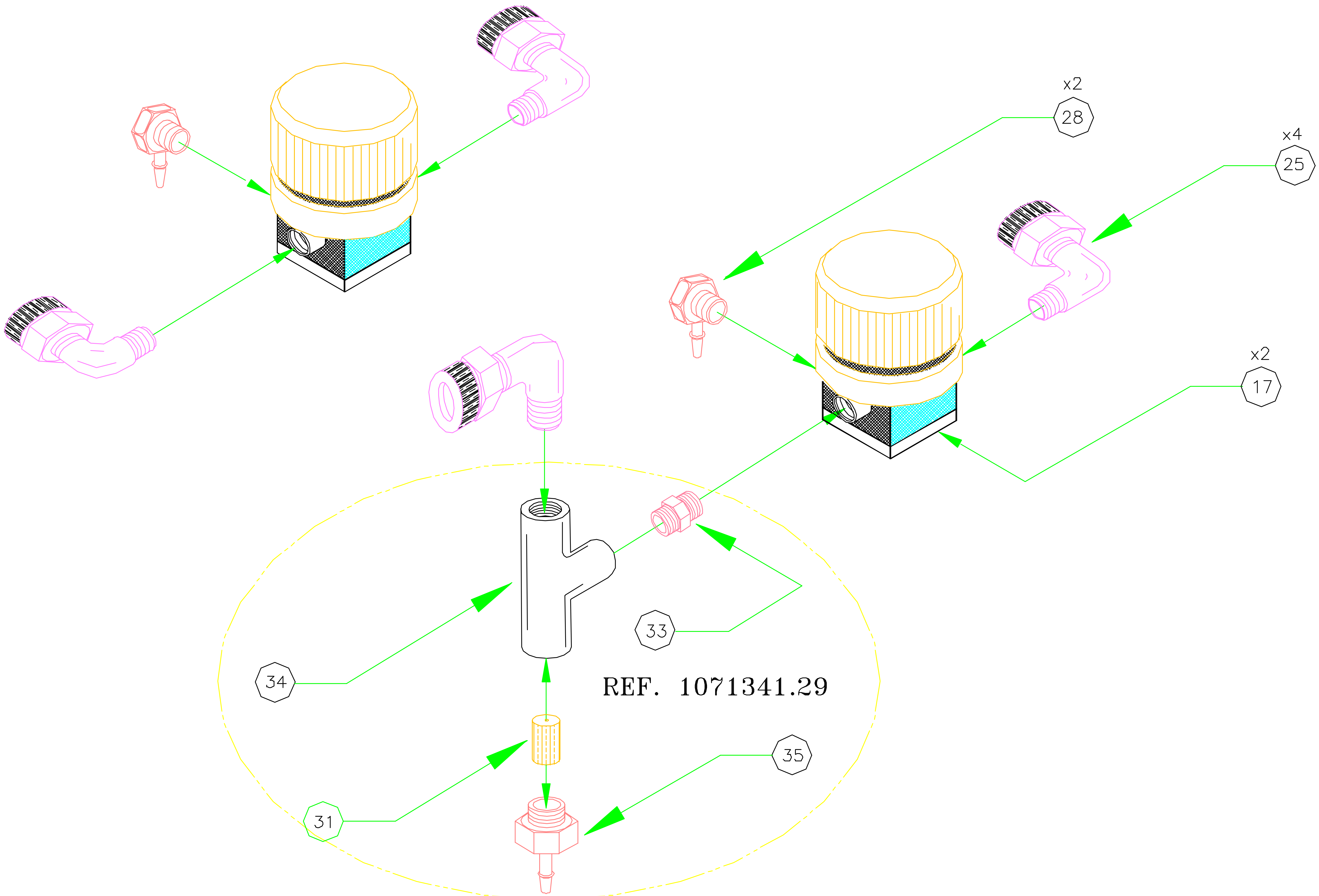
PNEUMATIC VALVES / REAR PANEL ASSEMBLY 1



PNEUMATIC VALVES / REAR PANEL INSTRUCTIONS 2

PNEUMATIC VALVES/REAR PANEL ASSEMBLY

ITEM	PART #	DESCRIPTIONS	QTY
17	4119165	VALVE PNEU. NV2-144NC-HP	2
25	4118953	ELBOWL, IMP64EAM 3/8TX1/4NPT	4
28	4115819	ELBOWL, BARBED, BRASS	2
31	1072668.1	RESTRICTOR, TRICKLE BYPASS	1
33	4119233	NIPPLE 1/4"NPT, MPF4T, FURON	1
34	4119234	TEE, 1/4 NPT MOLD, MPF4T, FURON	1
35	4114709	ADAPTOR, 1/4NPT, PLASTIC	1

INSTRUCTIONS:

1- APPLY 4-TIMES TEFLON TAPE TO ALL ELBOWS, NIPPLES, AND ADAPTOR THREADS. INSERT 1-RESTRICTOR(31) INTO ADAPTOR(35), THEN ATTACH TO ONE SIDE OF TEE(34).

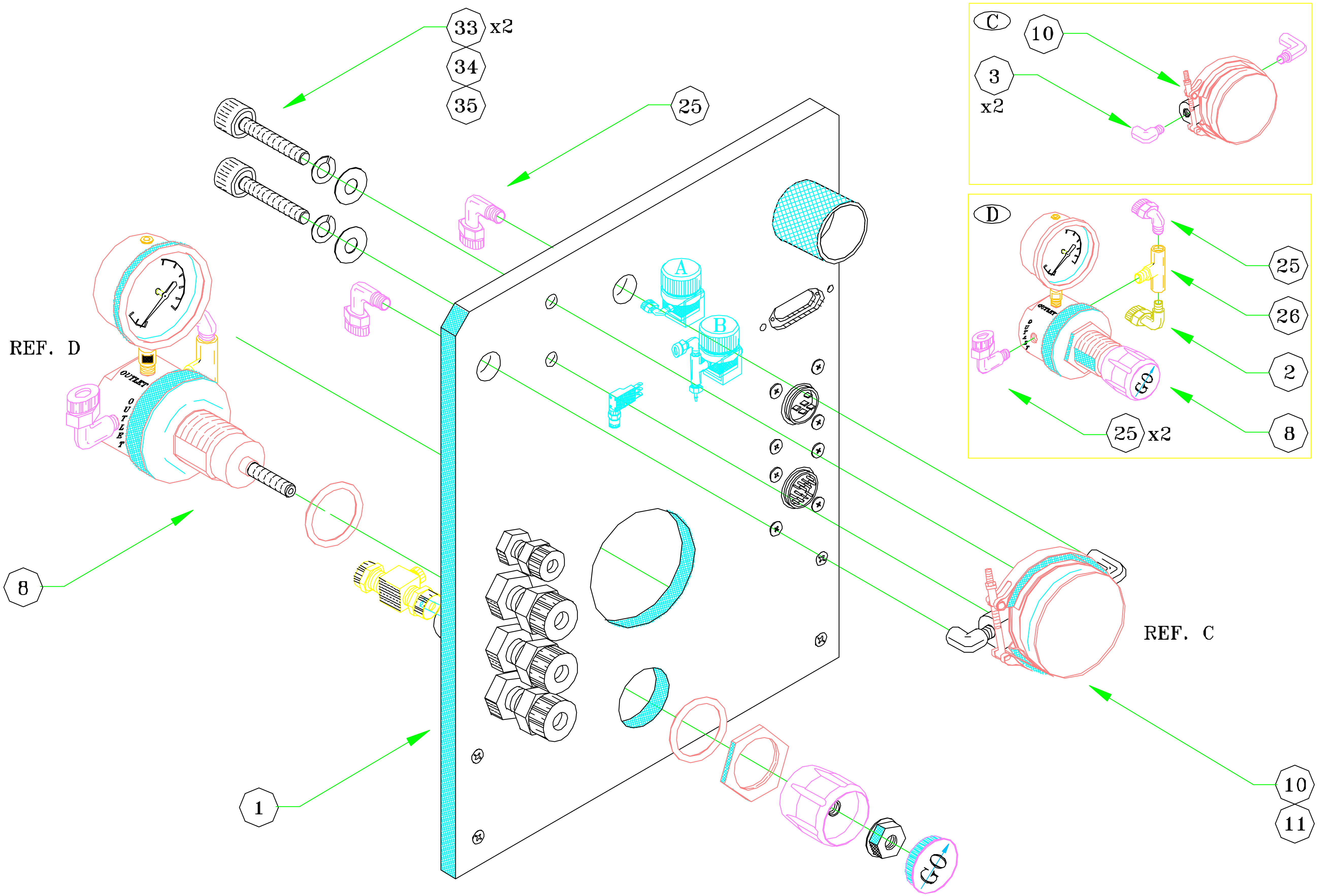
2- ATTACH 1-ELBOW(25) TO OPPOSIT SIDE OF TEE(34).

3- ATTACH 1-NIPPLE(33) TO THE BOTTOM OF TEE(34). THEN ATTACH TO <OUT> MARKED POSITION OF PNEUMATIC VALVE(17).

4- ATTACH 1-ELBOW(25) TO <IN> MARKED POSITION, OPPOSIT SIDE OF PNEUMATIC VALVE(17), THEN ATTACH BRASS BARBED ELBOW(28) TO PNEU. VALVE(17).

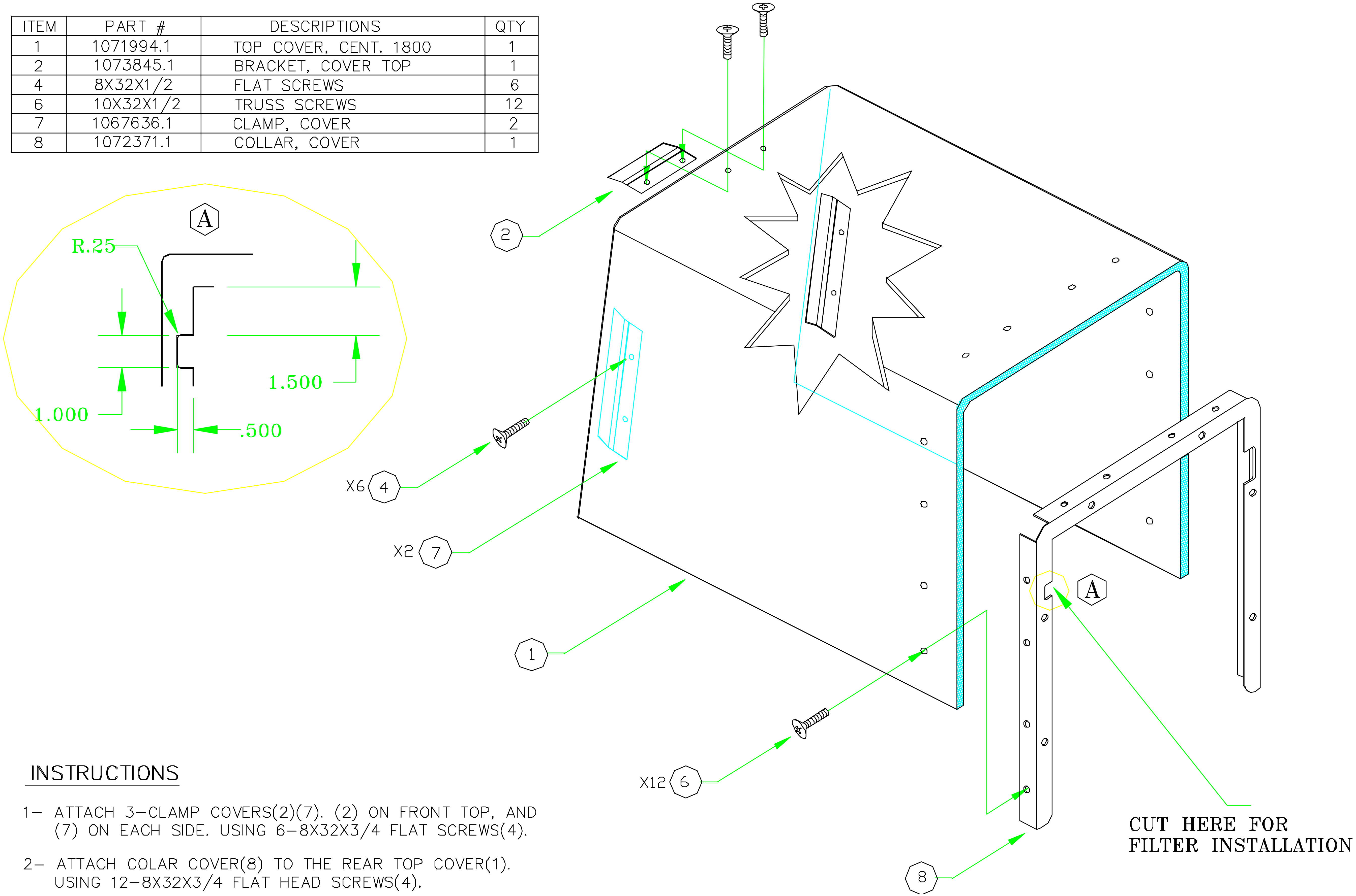
5- ATTACH ELBOW(25) TO EACH SIDE <IN & OUT> MARKED OF SECOND PNEUMATIC VALVE(17)AND 1-BRASS BARBED ELBOW(28) TO PNEUMATIC VALVE(17).

STANDARD REAR PANEL ASSEMBLY 1



STANDARD REAR PANEL ASSEMBLY 2

ITEM	PART #	DESCRIPTIONS	QTY
1	1071994.1	TOP COVER, CENT. 1800	1
2	1073845.1	BRACKET, COVER TOP	1
4	8X32X1/2	FLAT SCREWS	6
6	10X32X1/2	TRUSS SCREWS	12
7	1067636.1	CLAMP, COVER	2
8	1072371.1	COLLAR, COVER	1



INSTRUCTIONS

1– ATTACH 3–CLAMP COVERS(2)(7). (2) ON FRONT TOP, AND (7) ON EACH SIDE. USING 6–8X32X3/4 FLAT SCREWS(4).

2– ATTACH COLAR COVER(8) TO THE REAR TOP COVER(1). USING 12–8X32X3/4 FLAT HEAD SCREWS(4).

REAR-STD PVC PANEL ASSEMBLY

C-REF.

C- ATTACH 2-3/8X1/4 ELBOW(25) TO EACH SIDE OF FILTER HOUSING(10), AND INSERT THE FILTER HOUSING WITH ELBOW ATTACHED THRU 2-HOLES OF REAR PANEL(LEFT, TOP REAR VIEW). THEN TIGHTEN IT BY 2-1/4X20X1" SOCKET HEAD SCREW(33), WITH 2-1/4X SPLIT WASHERS(34), AND 2-1/4X FLAT WASHERS(35).

D-REF.

D- ATTACH 1-3/8X1/4 ELBOW(25), AND 1-ELBOW(2) TO EACH SIDE OF TEE(26).

1- HOLDING THE REGULATOR(8) WITH THE "GO" LOGO FACE TO YOU, THEN ATTACH 1-3/8X1/4 ELBOW(25) TO LEFT AT OUTLET POSITION, AND THE TEE SET (26)(25)(2) TO THE RIGHT SIDE OF REGULATOR. THE ELBOW(25) IS UP, AND THE ELBOW(2) IS BOTTOM POSITIONS.

2- REMOVE THE BIG HEXNUT FROM REGULATOR(8), THEN INSERT IT THRU THE REAR PANEL AND TIGHTEN THE HEXNUT BACK TO THE REGULATOR.

ITEM	PART #	DESCRIPTIONS	QTY
1	1071745.1	PANEL, SILKSCREEN PLUMB	1
2	4118479	ELBOW, SWIVEL, ML, 1/4X1/4	1
3	4118238	ELBOW, STREET	2
4	4122740	LABEL, 1800 ETL CERTIF.	1
5	5115269	TUBE 3/8X1/4TFE, PASTE	72IN
6	1072620.1	QUARD, TERM1800 REAR	1
7	4119576	SWITCH, PRESS 45PSI	1
8	4119437	REGULATOR, PRSSW/0-100PSI	1
9	4120178	SCREW, 1/4X20X1/2 SS	2
10	4119379	FILTER, HOUSING	1
11	4117955	FILTER, 12STK PHOBIC	1
12	4120180	SCREW 1/4X20X3/4 FHSOC SS	4
13	5115268	TUBE, 1/4X1/8 FEP	12IN
17	4119165	VALVE PNEU NV2-144NC-HP	2
22	1072649.1	PLATE, PANEL MTG T4 CUTOUT	1
25	4118953	ELBOW, IMP64EAM 3/8TX1/4NPT	8
26	4118809	TEE, MALE 1/4	1
28	4115819	ELBOW, BARBED BRASS	2
31	4119495	FITTING, MALE CONN 10-32X1/4	1
32	4118963	TEE UNION IMP6UT, FURON	1
33	1/4X20X1	SOCKET HEAD SCREWS	2
34	1/4X	SPLIT WASHERS	2
35	1/4X	FLAT WASHERS	2

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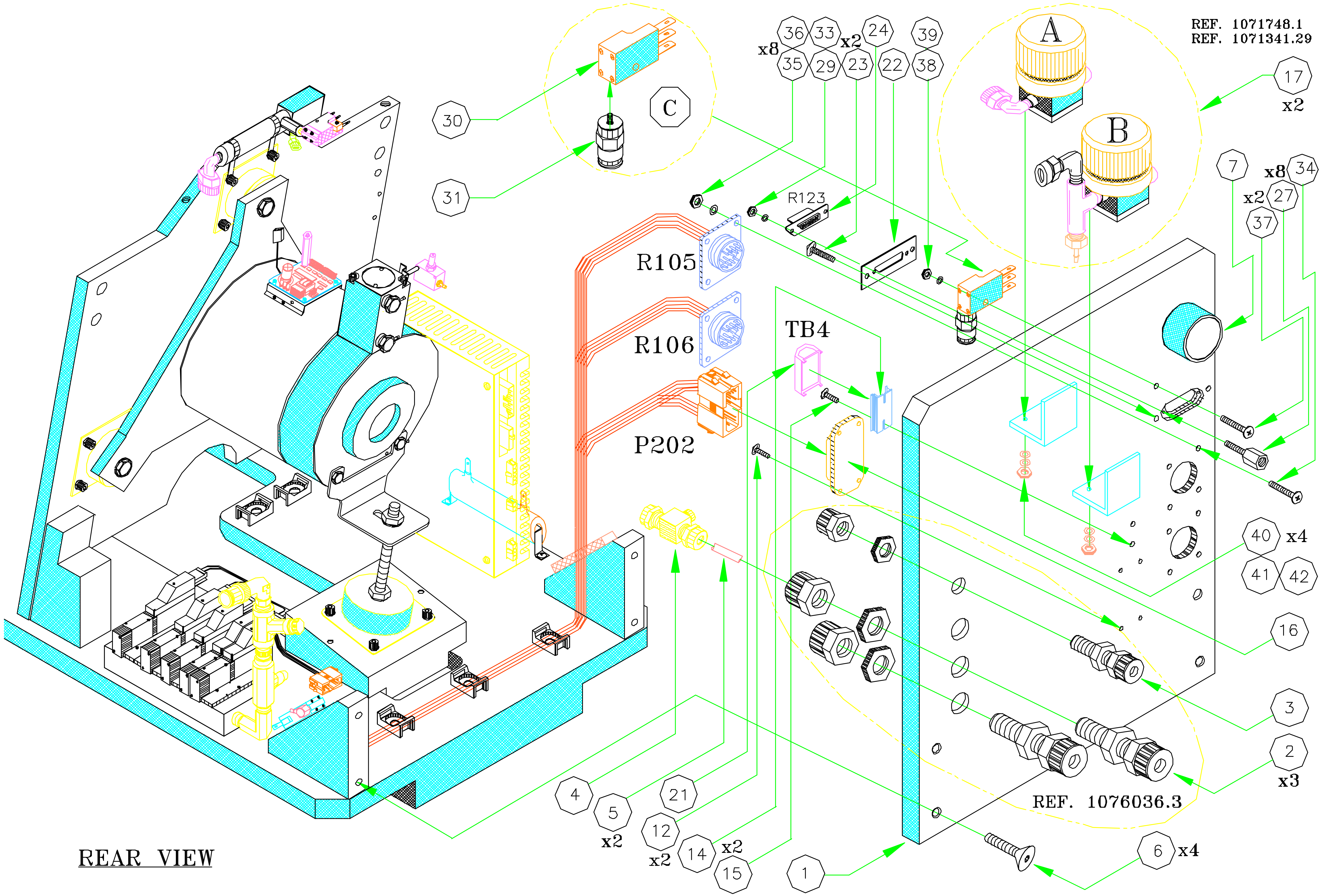
REAR PANEL ASSEMBLY 1



REAR PANEL INSTRUCTIONS 2

REAR PANEL ASSEMBLY INSTRUCTIONS

ITEM	PART #	DESCRIPTIONS	QTY
1	1071745.3	PANEL & SILK SCREEN PLUMP REAR	1
2	41121040	FITTING 3/8	3
3	41121041	FITTING 1/4	1
4	4120184	TEE 3/8RUN 1/4 LF664UTR, FURON	1
5	5115269	TUBE 3/8-1/4	2 IN
6	4120180	1/4X20X3/4 SOCKET FLAT SCREWS	4
7	5115257	PIPE, PVC, SCH.80	2 IN
12	6X32X1/4	PHILLIP SCREWS	2
14	1071526.1	RAIL DIN MOUNT 2.5"	1
15	6X32X1/4	PHILLIP SCREWS	2
16	4118342	J202 CONNECTOR	1
17	4119165	VALVES, PNEU. NV2-144NC-HP	2
21	4116541	TB4 TERMINAL BLOCK	1
22	1072649.1	PLATE PANEL MOUNTING T4 CUTOUT 1800	1
23	6X32X1/4	PHILLIP SCREWS	2
24	R123	R123 COVER	1
27,29,33	4120981	STANDOFF, JACK SOCKET KIT	1 EA
30	4119576	PRESS SWITCH 45PSI	1
31	4119495	MALE FITTING 10X32X1/4	1
34	6X32X1/2	PHILLIP SCREW	8
35	6X32	HEX NUTS	8
36	6X	STAR WASHERS	8
37	6X32X1.1/4	PHILLIP SCREW	1
38	6X32	HEX NUT	1
39	6X	STAR WASHER	1
40	4X40	HEX NUTS	4
41	4X	STAR WASHERS	4
42	4X	FLAT WASHERS	4

1– ATTACH REAR PANEL(1) TO REAR BASE PLATE BY USING 4–1/4X20X3/4(6).

2– APPLYING 4–TIMES OF TEFLON TAPE ON THE FITTING THREADS(31), THEN INSERT INTO PRESS SWITCH(30).

3– ATTACH <C>(30)(31) ASSY. TO REAR PLATE(1). USING 1–6X32X1.1/4 PHILLIP SCREW(37),1–6X32 HEX NUT(38), AND 1–6X STAR WASHER(39).

4– ATTACH PLATE(22) TO REAR PLATE(1). USING 2–6X32X1/4 PHILLIP SCREWS(23).

5– ATTACH R123(24) TO PLATE(22), THEN TIGHTEN IT BY STANDOFF JACKET SET(27)(29), AND(33).

6– ATTACH DIN RAIL 2.25"(14) TO REAR PLATE(1). THEN TIGHTEN IT BY 2–6X32X1/4 PHILLIP SCREWS(15).

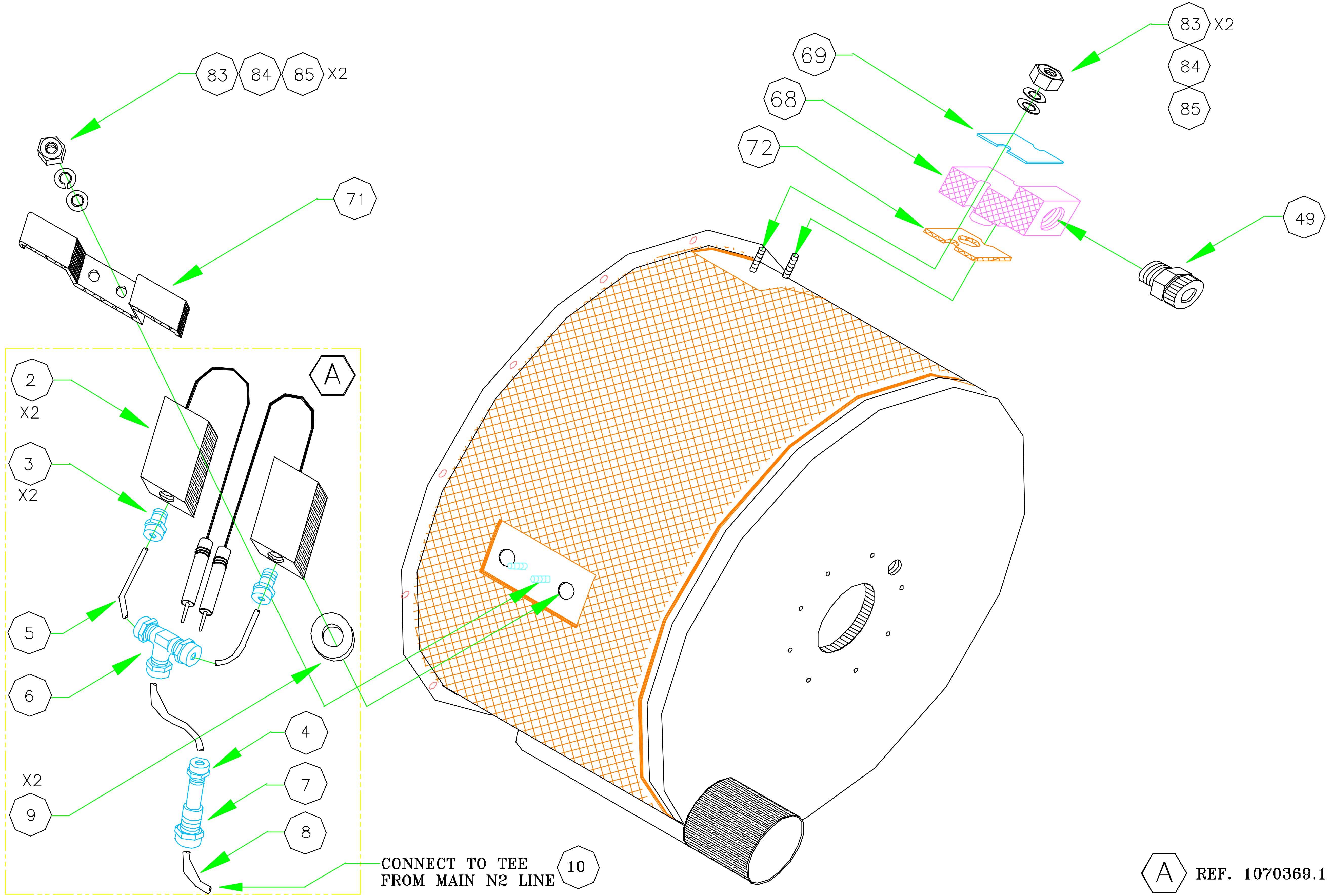
7– ATTACH J202 CONNECTOR(16) TO REAR PLATE(1). USING 2–6X32X1/4 PHILLIP SCREWS(12).

8– ATTACH 1–1/4 FITTING(3), AND 3–3/8 FITTING(2) TO REAR PLATE(1). THEN CUT ONE PIECE OF 3/8X1/4X2" TUBE(5), INSERT TO ONE SIDE OF 3/8 TEE, THEN CONNECT OTHER SIDE OF 3/8 TUBE TO THE SECOND 3/8 FITTING(2).

9– SNAP TERMINAL BLOCK TB4(HARNESS) TO DIN RAIL 2/5"(14), AND P202 PLUG INTO J202 CONNECTOR(16) ON REAR PLATE(1).

10– ATTACH R105 AND R106 TO REAR PLATE(1). USING 8–6X32X1/2 PHILLIP SCREWS (34), 8–6X STAR WASHERS(36), AND 8–6X32 HEX NUTS(35).

STATIC ELIMINATOR ASSEMBLY 1



STATIC ELIMINATOR INSTRUCTIONS 2

STATIC ELIMINATOR/BOWL ASSEMBLY INSTRUCTIONS

ITEM	PART #	DESCRIPTIONS	QTY
2A	4121195	STATIC ELIMINATOR	2
3A	4119154	FITTING IMP22UAM. FURON	2
4A	4121241	UNION REDUCER 1/8X1/4 IMP-24UR. FURON	1
5A	5115284	TUBE, 1/16IDX1/8OD FED 7006005. FURON	18 IN
6A	4118940	FITTING , TEE, UNION 1/8, IMP2UT	1
7A	1060932.1	RESTRICTOR FLOW	1
8A	5115268	TUBE 1/4X1/8	4 IN
9A	1070125.1	STATIC SEAL	2
49	4118966	FITTING, IMP86UAM	1
68	1070256.1	FITTING WINDOW	1
69	1073404.1	BRACKET, N2 BLOWOFF	1
71	1073409.1	BRACKET, STATIC	1
72	1073405.1	GASKET N2, BLOWOFF	1
83	10X32	HEX NUTS	4
84	10X	STAR WASHERS	4
85	10X	FLAT WASHERS	4

STATIC ELIMINATOR ASSEMBLY:

1- USING TEFLON TAPE WRAP 4-TIMES AROUNT 2-FITTING THREADS(3A). THEN ATTACH TO STATIC ELIMINATOR(2A).

2- CUT 2-TUBE 1/4X1/8(5A), 9" FOR EACH. THEN ATTACH TO THE FITTINGS(3A).

3- ATTACH TEE FITTING(6A) TO THE END OF EACH SIDE OF TUBE(5A).

4- ATTACH REDUCER(4A) AND RESTRICTOR(7A) TOGETHER, THEN CONNECT TO TEE FITTING(6A) BY 2" TUBE LENGTH.

5- CUT 4" TUBE(8A) TO CONNECT FROM THE END OF RESTRICTOR(7A) TO TEE FITTING FROM MAIN N2 LINE.

6- ATTACH 2-STATIC RING SEALS(9A) TO UNDERNEATH OF STATIC ELIMINATORS(2A), THEN PLACE THE WHOLE STATIC ASSY. TO THE BOWL.

7- ATTACH STATIC BRACKET(71) ONTO IT, THROUGH THE BOWL STUDS, THEN TIGHTEN IT BY 2-10X32 HEXNUTS(83), 2-10X STARS(84), AND 2-10X FLAT WASHERS(85).

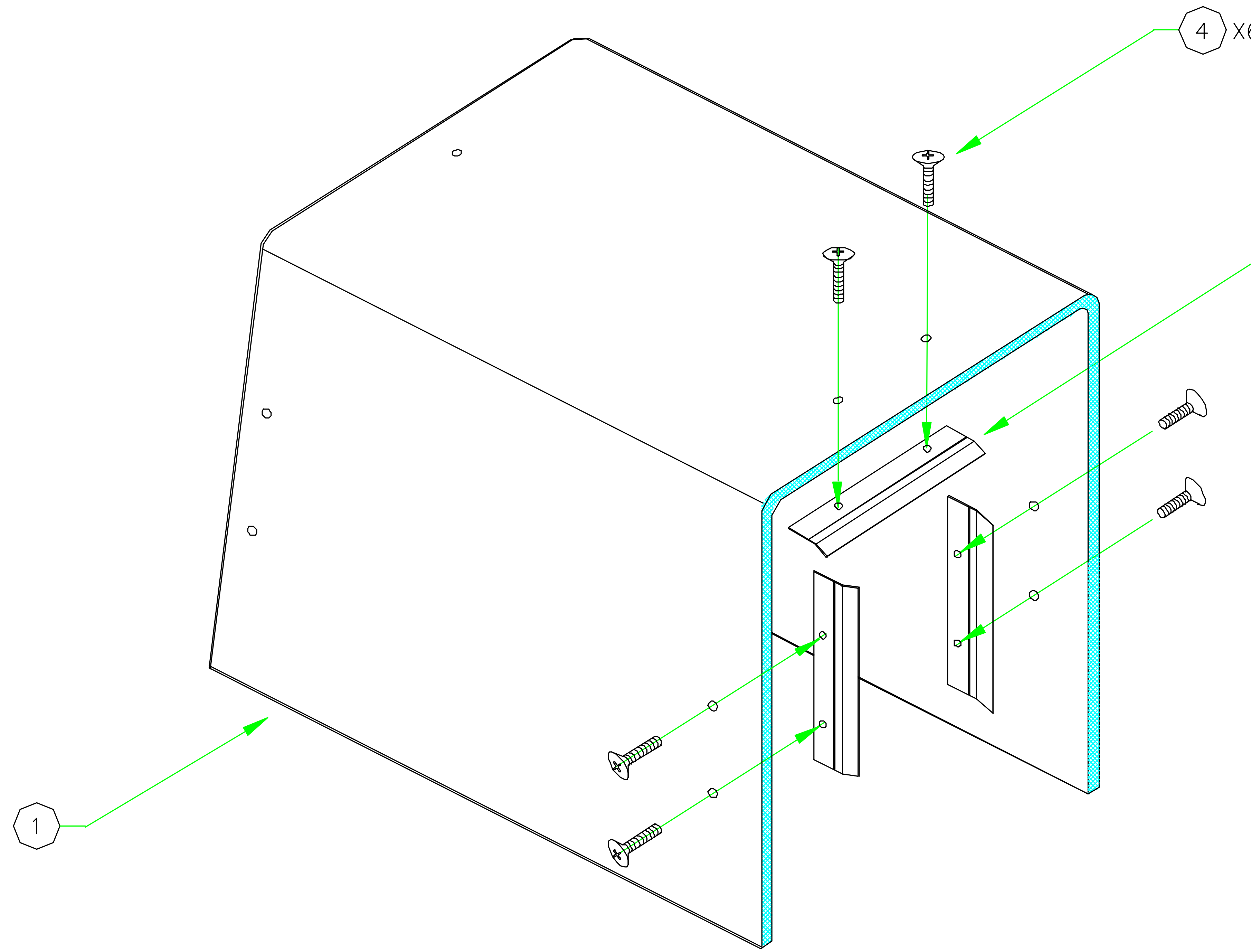
N2 BLOWOFF ASSEMBLY:

1- USING TEFLON TAPE APPLY ONTO FITTING THREADS(49),THEN ATTACH TO N2 FITTING WINDOW(68).

2- ATTACH ALL GASKET BLOWOFF(72), FITTING WINDOW(68), AND BRACKET N2 BLOWOFF(69) TO BOWL. THEN TIGHTEN IT BY 2-10X32 HEX NUTS(83), 2-10X STARS(84), AND 2-10X FLAT WASHERS(85).

A REF. 1070369.1

FREM TOP COVER ASSEMBLY 1

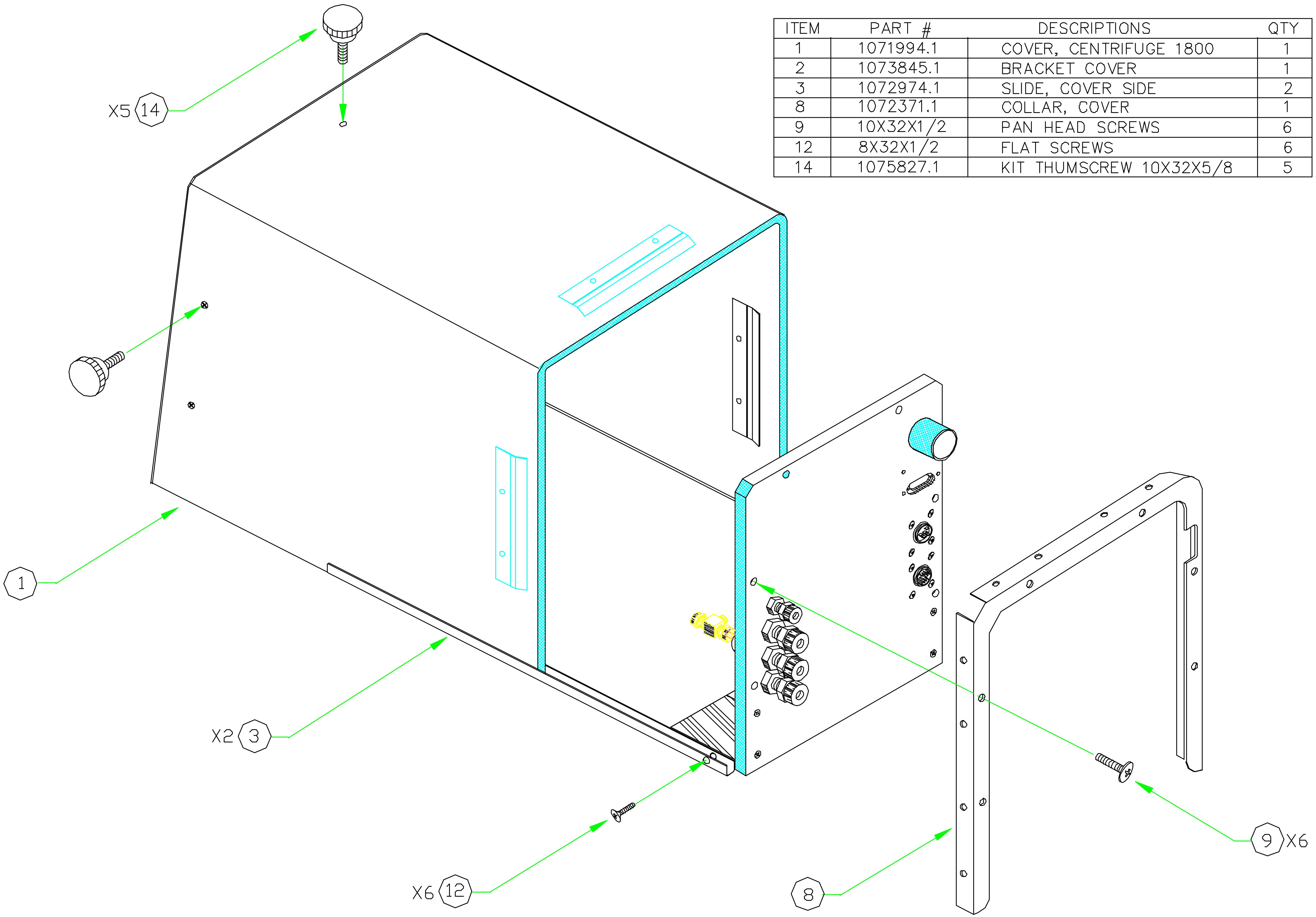


1— ATTACH 3–CLAMP COVERS(7) TO THE REAR OF TOP REMOVEABLE COVER (1), USING 6–6X32X3/4 FLAT HEAD SCREWS(4).

ITEM	PART #	DESCRIPTIONS	QTY
1	1071994.1	TOP COVER	1
4	8x32x3/4	FLAT SCREWS	6
7	1067636.1	COVER CLAMP	3

FREM TOP COVER ASSEMBLY 2

ITEM	PART #	DESCRIPTIONS	QTY
1	1071994.1	COVER, CENTRIFUGE 1800	1
2	1073845.1	BRACKET COVER	1
3	1072974.1	SLIDE, COVER SIDE	2
8	1072371.1	COLLAR, COVER	1
9	10X32X1/2	PAN HEAD SCREWS	6
12	8X32X1/2	FLAT SCREWS	6
14	1075827.1	KIT THUMSCREW 10X32X5/8	5



FREM TOP COVER INSTRUCTIONS 3

FRONT REMOVEABLE COVER ASSEMBLY

1- ATTACH 2-SLIDE COVER SIDES(3) TO EACH SIDE OF BASE PLATE, THEN TIGHTEN IT BY 6-8X32X1/2 FLAT SCREWS(12).

2- ATTACH COLAR COVER(8) TO REAR PANEL(1). USING 6-10X32X1/2 TRUSS HEAD SCREWS(9).

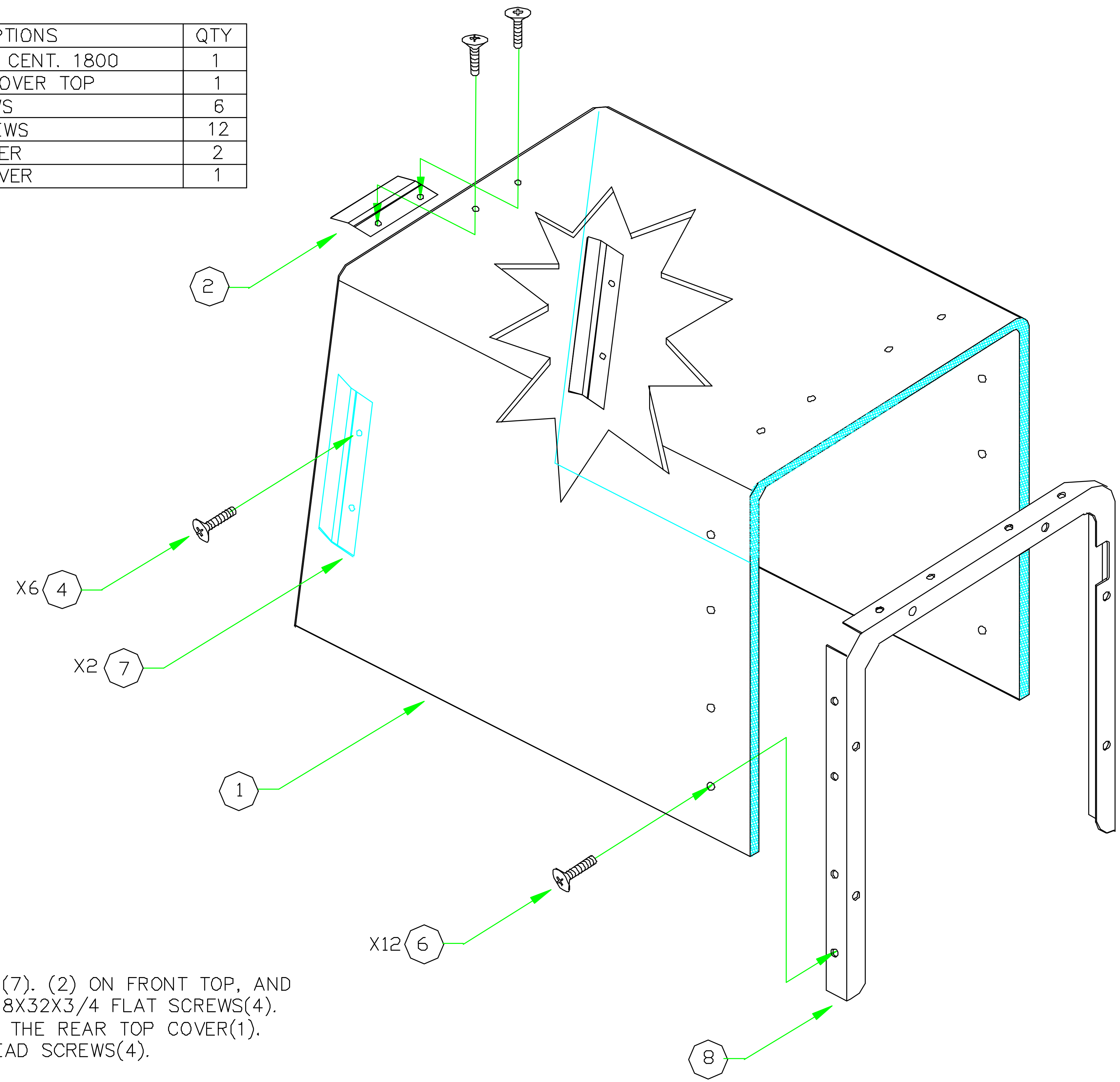
3- AFTER Q.C. FINAL TEST. SLIDE THE TOP COVER(1) FROM FRONT TO REAR PANEL, MAKE SURE THE CLAMP COVERS LOCK IN THE COLAR COVER(8).

4- ATTACH 6-KIT THUMSCREWS(14)(6-10X32X5/8 SOCKET SCREWS AND BLACK KNOB COVERS)TO FRONT TOP COVER, 2-ON TOP, AND 2-FOR EACH SIDE.

ITEM	PART #	DESCRIPTIONS	QTY
1	1071994.1	COVER, CENTRIFUGE 1800	1
2	1073845.1	BRACKET COVER	1
3	1072974.1	SLIDE, COVER SIDE	2
8	1072371.1	COLLAR, COVER	1
9	10X32X1/2	PAN HEAD SCREWS	6
12	8X32X1/2	FLAT SCREWS	6
14	1075827.1	KIT THUMSCREW 10X32X5/8	5

BAY and CHASE TOP COVER ASSEMBLY 4

ITEM	PART #	DESCRIPTIONS	QTY
1	1071994.1	TOP COVER, CENT. 1800	1
2	1073845.1	BRACKET, COVER TOP	1
4	8X32X1/2	FLAT SCREWS	6
6	10X32X1/2	TRUSS SCREWS	12
7	1067636.1	CLAMP, COVER	2
8	1072371.1	COLLAR, COVER	1



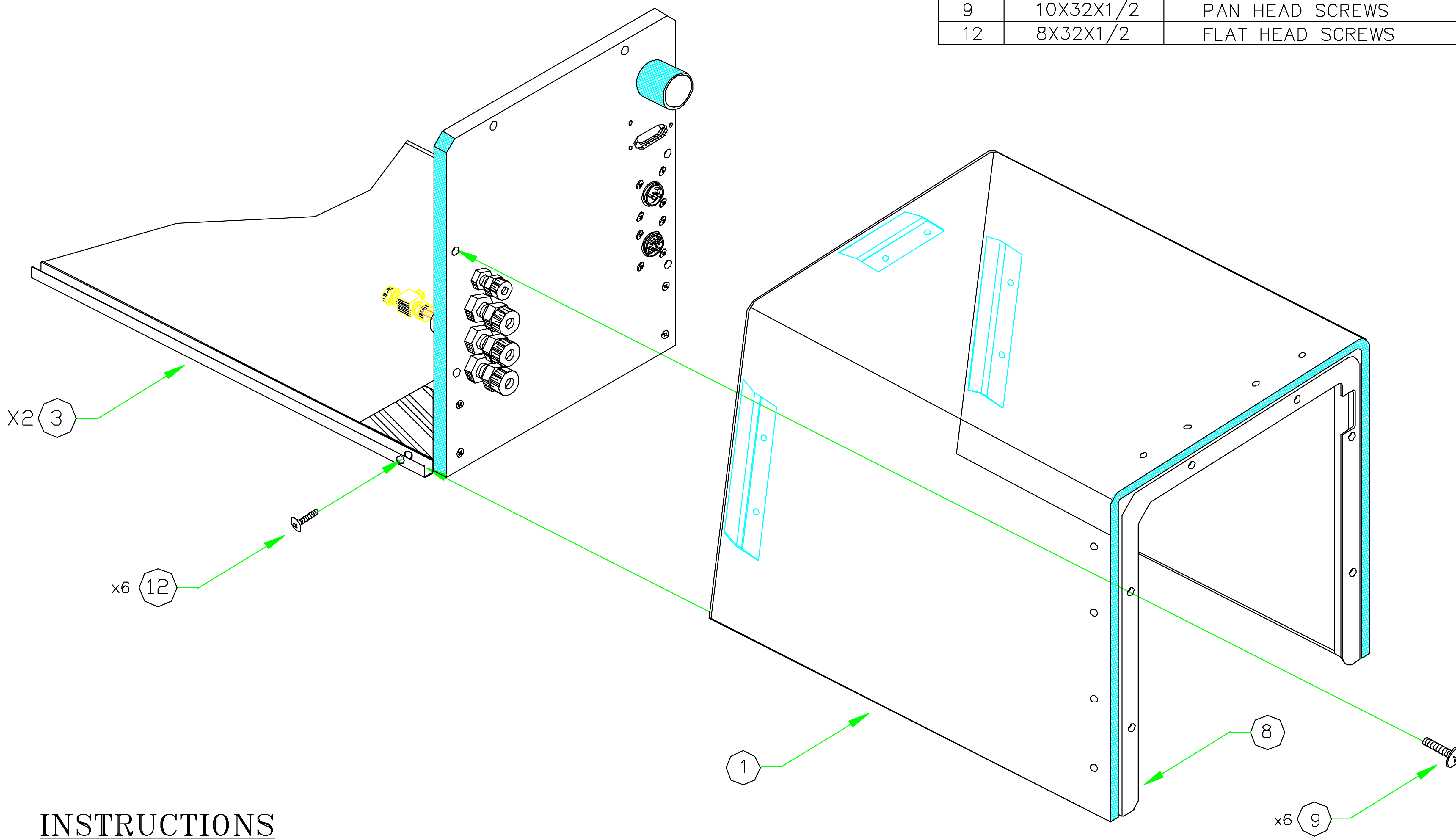
INSTRUCTIONS

1– ATTACH 3–CLAMP COVERS(2)(7). (2) ON FRONT TOP, AND (7) ON EACH SIDE. USING 6–8X32X3/4 FLAT SCREWS(4).

2– ATTACH COLAR COVER(8) TO THE REAR TOP COVER(1). USING 12–8X32X3/4 FLAT HEAD SCREWS(4).

BAY and CHASE TOP COVER ASSEMBLY 5

ITEM	PART #	DESCRIPTIONS	QTY
1	1071994.1	COVER, CENTRIFUGE 1800	1
3	1072974.1	SLIDE, COVER SIDE	2
8	1072371.1	COLLAR, COVER	1
9	10X32X1/2	PAN HEAD SCREWS	6
12	8X32X1/2	FLAT HEAD SCREWS	6



INSTRUCTIONS

1– ATTACH 2–SLIDE COVER SIDES(3) TO EACH SIDE OF BASE PLATE, THEN TIGHTEN IT BY 6–8X32X1/2 FLAT SCREWS(12).

3– AFTER Q.C. FINAL TEST. SLIDE THE TOP COVER(1) FROM REAR TO FRONT DOOR, MAKE SURE THE CLAMP COVERS LOCK IN THE FRONT BRACKETS (FRONT PLATE). THEN TIGHTEN IT BY 6–10X32X1/2 PAN HEAD SCREWS(9)

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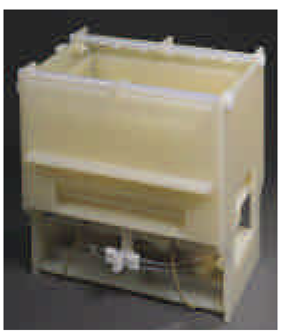
Process Systems

Cobra Series

Goldfinger Series

Process Components



Megasonic Series

Model SC200

1800–6 Series

1600–55 A/M Series

A
B
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Z

A

A See ampere.

Å See Ångstrom unit.

accident An unplanned, unwanted event that disrupts the orderly flow of the work process, involves the motion (energy) of people, objects, or substances, and is indicated by physical injury, illness, and/or property damage. Both a hazard and exposure to the hazard are required for an accident to occur.

accident investigation Inquiry to determine the root cause of an accident to prevent future similar accidents.

acetic acid $C_2H_4O_2$.

ACK Acknowledge. A touchscreen prompt.

agitation (EE wash tank) The introduction of N_2 into the end effector wash tank. This stream of gas keeps the DI water moving and free of stagnation. Parameters for this function are set in tank configuration.

agitation (mechanical) A platform inside the chemical process tank that moves cassettes up and down at a factory preset frequency of 30 cycles per minute and an amplitude of 1.1 inches (see figure below). This device is adjustable in both frequency and amplitude. The frequency is driven by city water and is adjusted using AOVs. The amplitude can be adjusted to one of three settings; 0.8 inches, 1.1 inches and 1.5 inches. For adjustment procedures see the Preventive Maintenance manual, Part III, Section 2.7, *Mechanical Agitation Adjustment*.

agitation (robot) Agitation is the “dipping” of product lots into and out of a tank. This function is used in semi-automated systems in which the robot holds the process cassette during the entire process recipe. Agitation parameters are configurable on the touchscreen, as described below.

Longer, slower movement of agitation is accomplished by configuring a relatively low frequency and high amplitude. See explanation below.

To edit robot agitation parameters, make the following touchscreen selections:

1. Select **Recipe** from the Process menu button.
2. Select **Edit**.
3. Select a recipe from the displayed list.
4. Select **Edit Parameters**.
5. Select the tank that is to be edited for robot agitation.
6. Select **Robot Agitation**.
7. Enter values as defined below.

Duration is the length of agitation time, which begins as soon as the robot delivers product into a tank. If the entered Duration is greater than the recipe's process time in that tank (set in recipe configuration), the system defaults to 3600 seconds or the process time, whichever is smaller. If agitation is not needed, set Duration to zero (0).

Agitation Parameters

Frequency is the number of agitation cycles per minute. In one cycle, the robot moves up from the taught tank position, to the Amplitude height, then back into the tank. If the value entered is greater than 60, the value defaults to 60.

Amplitude is the height the robot rises during agitation from the taught tank position. The amplitude cannot exceed the taught carry height, regardless of the value entered here.

NOTE

- The value entered for Amplitude places limits on Frequency.
- Maximum amplitude is 20 inches *or* the distance between the taught carry height and the taught tank position, whichever is less.
- The ranges for Frequency and Amplitude vary for wet systems, but not from module to module within one wet system.

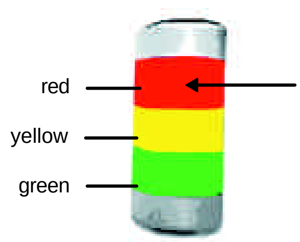
Maximum Configuration Values and Amplitude's Effect on Frequency, Acceleration, and Velocity			
Amplitude (inch)	**Maximum Resulting Frequency (cycles/min)**	**Maximum Acceleration (in/sec/sec)**	**Maximum Velocity (in/sec)**
1	60	16	4
2	58	30	8
3	47	30	12
4	41	30	14
5	21	10 in/sec/sec above 4-inch amplitude	8 in/sec above 4-inch amplitude
6	19		
7	18		
8	17		
9	16		
10 . . 20	15 . . 11		

Al_2O_3

Aluminum oxide.

alarm

An alarm is any abnormal situation that may endanger people, equipment, or material being processed. Every alarm is assigned one automatic response level (see table below) and displayed in real time on the touchscreen.



The status beacon on the wet system flashes red when an alarm is triggered.

Status Beacon

Also see critical alarms, exhaust alarms, and status beacon.

Alarm Response Levels		
Key	**Response Level***	**Automatic Actions**
0	No Action	• No effect on recipes in progress • New lots are allowed • Audible and visual alarms • Condition is displayed on the touchscreen and written to log file • Scheduler is *not* notified
1	Runout	• No effect on recipes in progress • New lots are *not* allowed • Audible and visual alarms • Alarm message is displayed on the touchscreen and written to log file
2	GoToSafe	• Lot is moved into or kept in a safe tank until problem is fixed • New lots are *not* allowed until alarm is cleared • Audible and visual alarms • Alarm message is displayed on touchscreen and written to log file
3	System Stop	• Automatic processing stops • Recipes in progress continue to count down and can be resumed • New lots are not allowed • Audible and visual alarms • Alarm message is displayed on the touchscreen and written to log file
4	Process Continues	• No effect on recipes in progress • New lots are allowed • Audible and visual alarms • Alarm message is displayed on the touchscreen and written to log file • Scheduler is notified
*Every alarm is assigned one response level.		

allocated A device (for example, a tank) is powered, functional, and designated for use in a processing recipe.

alloy Composition of two elements, one of which must be metal.

aluminum oxide Al_2O_3.

ambient Surrounding, as in *ambient air* or ambient temperature.

ambient temperature See temperature of process chemicals.

ammonia NH_3.

ammonium chloride NH_4Cl.

ammonium fluoride NH_4F.

ammonium hydroxide NH_4OH.

ammonium peroxide mixture (APM) See chemical processes.

ammonium persulfate $NH_4S_2O_2$.

amp See ampere.

ampere (A or amp) A unit of electric current.

amplifier An electronic circuit used to increase voltage, current, or power.

Ångstrom (Å) unit 1 Å = 1×10^{-4} µm or 1×10^{-10} m.

ANSI American National Standards Institute.

AOV Air-operated valve.

A/P Accounts payable.

APM Ammonium peroxide mixture. See chemical processes.

AQR Aqua regia. See chemical processes.

aqua regia See chemical processes.

Ar See argon.

AR Assigned responsibility.

A/R Accounts receivable.

argon (Ar) One of the noble (extremely nonreactive) gases.

ASCII American Standards Code for Information Interchange. A 7-bit standard code.

Aspirated drain (aspirator) Device in a tank drain line that mixes water, at a predefined ratio, with liquid draining from the tank. Used for cooling and diluting, aspirator typically has no moving parts. See recirculation, draining, and automated drain interlocks for heated tanks.

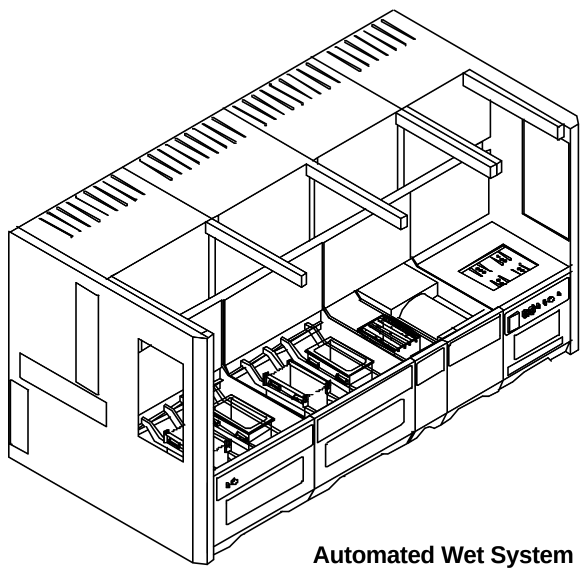
assist Any unplanned interruption or variance from specifications of equipment operation that requires human intervention of less than 6 minutes to correct. After 6 minutes, an assist becomes a *failure*. [From SEMATECH Official Dictionary, Rev. 5.0, 1995]

automated wet system (AWS)

Automated wet systems have the following features and capabilities:

- The operator enters and removes product lots.
- A one-arm, two-axis or a two-arm, three-axis robot transfers cassettes from one tank to another.
- The control software schedules cassette transfers, cleans the robot end effector when possible, and ensures that a safe (DI water) tank is always available for every product lot.
- Tanks are arranged from one end of the wet system to the other (and *end-to-end* arrangement).
- The wet system has a *dry in-dry out* capability (the robot removes the cassette from the dryer as the final processing step).
- Multiple product lots can be concurrently processed (lot threading). This feature is unique to automated wet systems. The robot retrieves cassettes from an input position and releases them during their dwell time in process tanks, leaving the robot free to retrieve and transfer other product lots.

Also see wet system; semi-automated wet system; manual wet system.



Automated Wet System

autopositioner (SRD)

A mechanical cylinder (air/N_2) that automatically positions the rotor at the end of every cycle so the carrier stops in the upright position, ensuring the wafers cannot fall out during removal

autowash (SRD)

SRD rinse/dry recipe, programmed to occur automatically after elapsed time intervals and/or number of completed operational cycles. Designed to maintain cleanliness in the SRD.

AWS

See automated wet system.

AWSF

Automated wet system, front access.

AWSR

Automated wet system, rear access.

axis

See robot axes.

B

bath	See chemical bath, also see tank.
battery-backed random-access memory (RAM)	RAM that is powered by a long-life battery so that it retains information if the unit it is in loses power.
baud	A unit for measuring data transmission speed. Divide the baud rate by the number of data bits plus stop bits plus start bits to calculate the characters per second (cps); for example, 9600 baud rate typically equals approximately 960 cps.
bay	A section of the cleanroom dedicated to specific pieces of equipment or processes. Also see cleanroom, bay-and-chase.
BCD	Bulk chemical distribution. See chemical delivery system (preferred term).
BCF	See bead- and crevice-free.
beacon	See status beacon.
bead- and crevice-free (BCF)	Refers to plastic welding.
bench	See wet system (preferred term).
beta site testing	Testing of new equipment (usually at the customer’s site).
BHF	See buffered hydrofluoric acid.
binary	Pertaining to a system that exists in two conditions, such as OFF/ON. Usually represented in computer code by 0 and 1.
binary files	Computer files generated in machine language that can be directly executed by the computer.
bit	*Abbreviation for* binary digit. The smallest unit of information recognized by a computer; represented as either of the digits 0 or 1.
bit map	Individual bits, because of their position in a byte, represent specific information.
bladder (SRD)	Seal inflated with nitrogen to keep the front door closed and contaminants out.
blanket heater	See temperature controls
block	A group of digits, characters, or words that are held in one section of an input/output medium and handled as a unit. *Block Length*: is a measure of the size of a block.

blocks A VcS recipe management term. Blocks are assigned a number (1 through 6) and are then assigned to a recipe STEP. There is flexibility in which Block number is assigned to which STEP (e.g., Block number 4 can be assigned to be the first Step (1) in the recipe.

Also see Steps and Periods

BNC connector Bayonet-Neill-Concelman backplate connector used with Thin Ethernet or ThinNet type coaxial cable to connect audio and video devices as well as network components.

boat See cassette (preferred term).

BOE Buffered oxide etch. See chemical process.

bowl (SRD) Process chamber for rinse and dry procedures.

bps Bits per second.

Bridgman Technique Method of growing an ingot of silicon by pulling a seed rod from the bottom of a crucible of liquid.

bubbler See N_2 bubbler.

buffered hydrofluoric acid (BHF) Hydrofluoric acid and some buffering chemical, typically ammonium fluoride (NH_4F).

buffered oxide etch (BOE) See chemical process.

bug A term used to denote an oversight or conflict in a computer program or system.

bulk chemical distribution (BCD) See chemical delivery system (preferred term).

bulk fill Chemical is brought directly into the wet-system tank through a facility plumbing line.

Also see manual fill.

bulkhead The wall (in the cleanroom) that separates the process area from the service chase.

Also see cleanroom, bay-and-chase.

bulkhead mounting See wet-system mounting.

byte A group of eight bits. Two bytes equal a word.

C

°C See degrees Celsius.

CH_3COOH Acetic acid.

calibration A set of graduations marked to indicate known values. Alignment of electrical or mechanical equipment against a known standard.

carbon dioxide See CO_2.

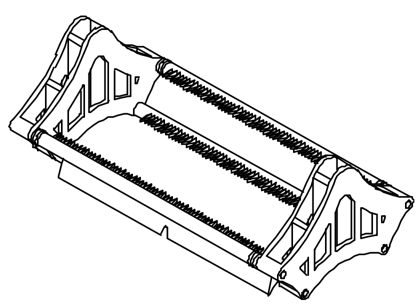
carrier See cassette (preferred term).

cascade rinse See chemical process.

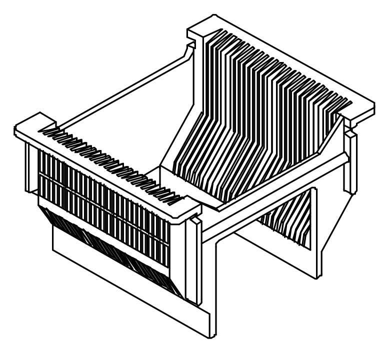
cassette Also known as boat; carrier. Also see H-bar.

The basket, or carrier, that holds the product to be processed (typically wafers). Process cassettes, usually made of PFA, hold wafers during processing. Transport cassettes look like process cassettes, but are usually made of PEEK or polypropylene. Transport cassettes are used to transport wafers from one device or wet system to another but are not used for processing. Some systems use the same cassette for both transport and process.

Cassettes commonly used in Verteq wet systems are shown below.

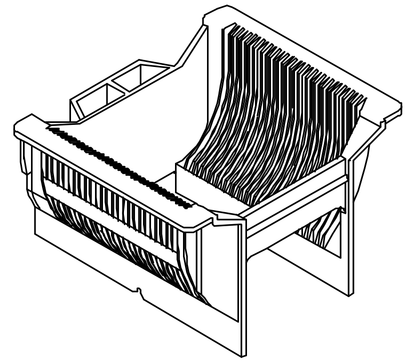


6-inch (150-mm) and 8-inch (200-mm) PEC (process enhanced cassette)



6-inch (150-mm) and 8-inch (200-mm) low-profile cassette

4-inch (100-mm),
5-inch (125-mm), and
6-inch (150-mm)
standard cassette



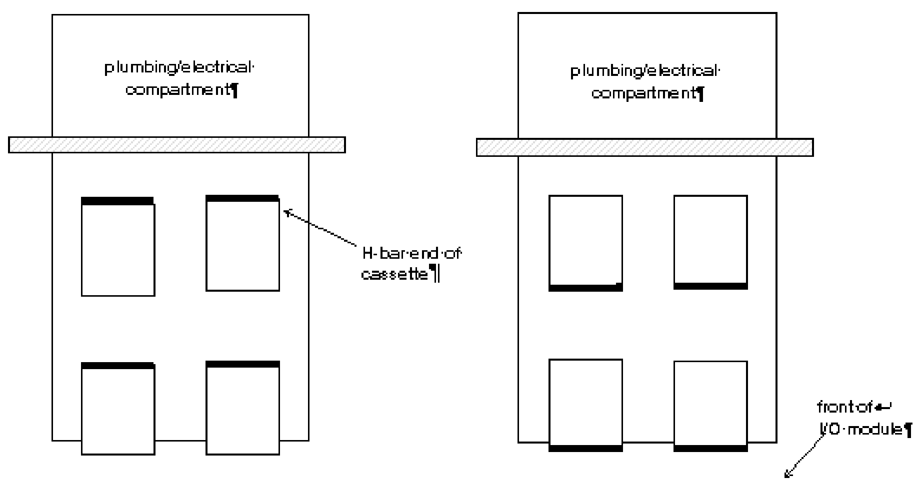
8-inch (200-mm) standard cassette

cassette placement

Placement of cassettes in the input/output queue of the wet system is extremely important. Improper placement can result in severe wafer damage. The following drawing shows proper placement of cassettes in the input queue of automated and semi-automated wet systems.

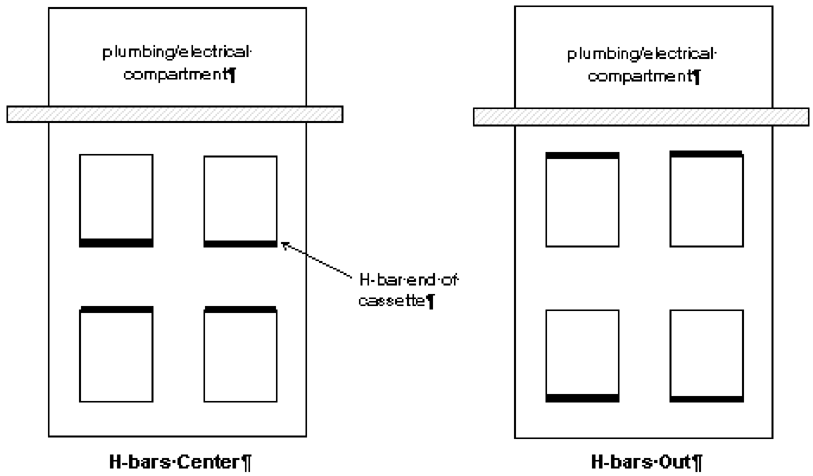
Input/Output Queue—Cassette Placement

A. Automated Wet Systems:



H-bars Rear (Standard)
(relative to the rear of the wet system)

H-bars Front

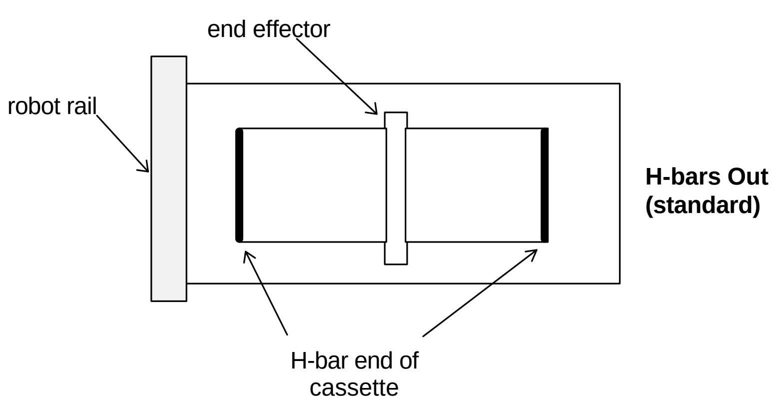


Convention:

1. If input and output queues are both in module 1:
   column of queues closest to module 2 is INPUT
2. If input and output queues are at opposite ends of the wet system:
   INPUT is in module 1
   OUTPUT is in last module (module n+1)

B. Semi-automated Wet Systems:

Semi-automated wet systems have dual cassettes for balance. The H-bars face away from each other with the end effector in the middle.



NOTE: Process enhanced cassettes (PEC) are symmetrical, so orientation is not an issue.

cassette, process

See cassette.

cassette, transport
See cassette.

CB
Circuit breaker.

ccm
Cubic Centimeters per Minute (cfm / 28320 = ccm).

See cfm.

CDA
Clean dry air.

CDS
See chemical distribution system.

CE
Commission of European Communities.

cell controller
Computer that houses a CPU and the control system software. The cell controller communicates with the PLC which controls system devices.

Also see wet-system control system.

Celsius
See degrees Celsius.

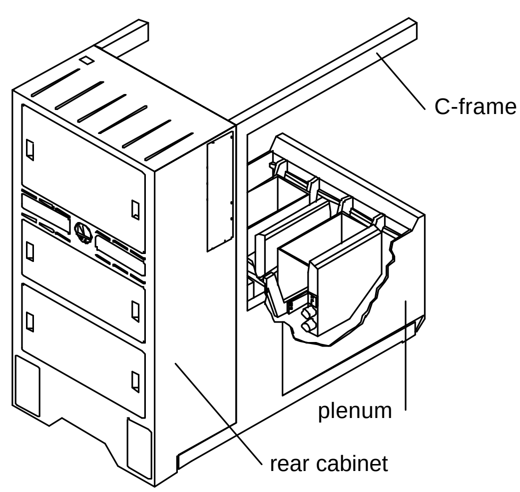
centigrade
See degrees Celsius (preferred term).

cfm
Cubic feet per minute (unit of volumetric flow rate).

See ccm

CFR
Code of Federal Regulations.

C-frame
Located between the rear cabinet and plenum (see drawing). Constructed of powder-coated steel covered with fire-retardant polypropylene (FRPP) or, white polypropylene (WPP), or other plastics.



Module

$CH_3CHOHCH_3$ Isopropyl alcohol (IPA). Also known as 2-Propanol.

CH_3COOH Acetic acid.

character Any symbol, digit, letter, or punctuation mark stored or processed by computing equipment, requiring approximately eight bits.

chase See service chase (preferred term).

checksum A summation of digits or bits used for checking purposes.

chemical The chemical used in wet processing; may be either a rinse chemical or a process chemical.

chemical bath (noun) A washing or soaking of the product in a chemical tank containing a process chemical.

chemical distribution system (CDS) The chemical distribution system (CDS) supplies chemicals to the wet system's processing modules. It is installed in the cleanroom or in the subfab below the wet system. A CDS comprises up to eight individual modules, each of which houses a chemical drum (up to 55-gallons). An air-operated pump dispenses chemical from the drum, through dedicated plumbing lines, to one or two wet system tanks.

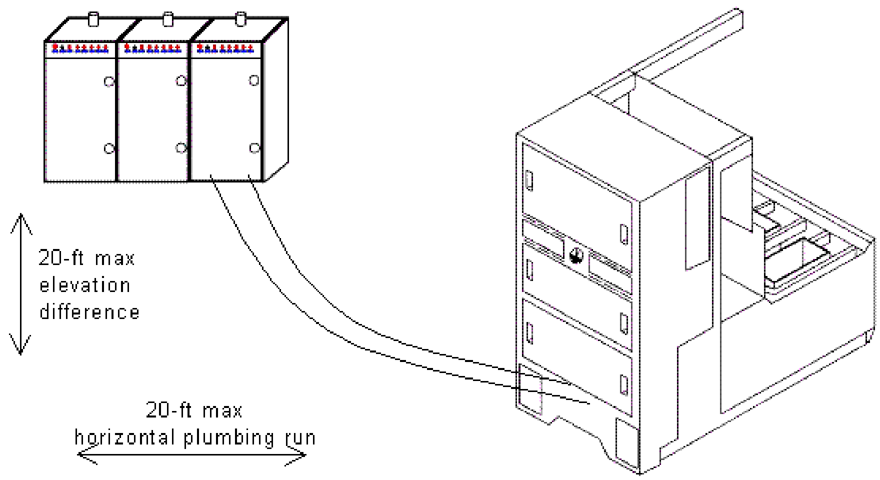
Each module is a stand-alone unit. If one module is shut down for refilling, maintenance, or is experiencing an alarm, the other modules remain functional. For safety, a single electrical disconnect and an EMO (emergency off) pushbutton, located on a main control cabinet, can shut down all modules in the CDS.

The CDS dispenses chemical only when the wet system calls for it during automated operation. There are no manual controls on the CDS for dispensing chemical to the wet system.

When the control system receives the proper signals, chemical is pumped from the specified chemical cabinet to the requesting module's processing or staging tank. When the chemical reaches the tank's process-level sensor, the pump and valves in the chemical cabinet shut down or off.

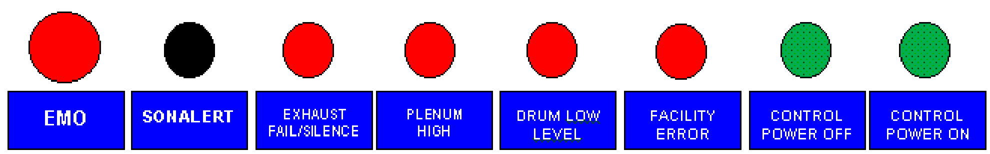
If the wet system simultaneously requests chemical for two tanks, the CDS dispenses chemical on a "first come, first serve" basis.

Also see *Chemical Distribution System* (Part No. 9340032.x).



Each CDS module dispenses only one chemical, but can supply two wet system tanks. Each CDS module has a control panel, with the following indications and controls.

CDS Control Panel



EMO (EMERGENCY POWER OFF)	Cuts all operating power (24 VDC) to the CDS module. Pumps, valves, communication with the wet system, and alarm functions all shut down. The EMERGENCY POWER OFF on the rear of the module also shuts down.
SONALERT	Sounds during an Exhaust Fail alarm.
EXHAUST FAIL/ SILENCE Alarm	• Silences the Sonalert. Does not correct the alarm. • Exhaust fail causes an emergency shutdown (EMO) of the affected module. This occurs after a configurable time delay, which allows transient losses of exhaust flow to recover without shutting down the CDS module.
PLENUM HIGH Alarm	Float switch triggers an EMO when liquid is sensed in the plumbing compartment.
DRUM LOW LEVEL Alarm	• Chemical drum needs to be replaced. • Pump stops and dispense valves close in that cabinet to minimize air introduced into the dispense line. • This alarm occurs after a preset time delay (typically 5 seconds). The delay ensures that all chemical has been dispensed from the drum. • Triggered by a differential pressure sensor (see Technical Reference).
FACILITY ERROR Alarm	• Illuminates when either CDA or N_2 supply is lost. CDA is used for the module's pumps and valves; N_2 is used for 1) purging the chemical drum and 2) the drum low-level sensing. • System Ready signal disabled

CONTROL POWER ON	Must be ON (illuminated) for the module to operate. Turns off automatically when any of the following occur: • door is opened • **CONTROL OFF** is pushed • **EMO** is pushed • exhaust alarm
CONTROL POWER OFF	Turns off the module's control power.

chemical fill

Chemicals are delivered to process tanks in the following ways:

- facility bulk fill directly into process tank
- facility bulk fill into staging tank
- chemical distribution system (CDS)
- manual fill into process tank
- manual fill into staging tank or reservoir

Typically, a wet system uses only one chemical-fill approach; however, different modules of the same wet system can use different chemical fills.

chemical mechanical polish (CMP)

A processing step used in multiple-layer semiconductor devices to flatten the tops of layers to provide a uniform base for subsequent layers.

chemical process

A process used to strip, etch, or clean the product.

Also see process; rinse process.

Verteq Baseline Chemical Processes

Name of Process*	Abbrevi-ation*	Other Names Commonly Used	Type of Process	Function	Chemical Composi-tion (Chemical Symbols)	Temper-ature Range (°C)
Chemical Processes						
Ammonium peroxide mixture	APM	Standard clean type 1 (SC1), RCA1, Huang 1	Clean	Removes particles and light organics	DI water/hydrogen peroxide/ ammonium hydroxide ($H_2O/H_2O_2/NH_4OH$)	60 to 70
		Ti strip Ti etch	Strip Etch	Removes titanium	DI water/hydrogen peroxide/ ammonium hydroxide ($H_2O/H_2O_2/NH_4OH$)	30 to 60
Aqua regia	AQR		Clean	Removes gold and mercury	Hydrochloric acid/nitric acid (HCl/HNO_3)	90
Buffered oxide etch	BOE	BHF	Strip or etch	Removes silicon dioxide	Ammonium fluoride/ hydrofluoric surfactant ($NH_4F/HF/$surfactant)	18 to 60
Dilute hydrofluoric acid	DHF	Hydrofluoric acid (HF), oxide etch	Etch or clean	Removes silicon dioxide	Hydrofluoric acid/DI water (HF/H_2O)	18 to 60
Hydrochlori c peroxide mixture	HPM	Standard clean type 2 (SC2), RCA2, Huang 2	Clean	Removes metal	DI water/hydrogen peroxide/ hydrochloric acid ($H_2O/H_2O_2/HCl$)	60 to 75
Nano strip (manufac-turer's product name)	NAN		Strip or etch	Removes photoresist and organics	Sulfuric acid/ hydrogen peroxide (H_2SO_4/H_2O_2)	20 to 80
Native oxide etch	NOE		Strip or etch	Removes silicon dioxide	Ammonium fluoride/ethylene glycol/DI water/ surfactant ($NH_4F/HOCH_2CH_2OH/H_2O/$surfactant)	20 to 28
Nitride strip	HP (hot phos-phoric acid)	Hot phos, PHOS	Strip or etch	Removes silicon nitride	DI water/ phosphoric acid (H_2O/H_3PO_4)	150 to 180
Phosphoric acetic nitric etch	PAN	Slope etch	Strip or etch	Removes aluminum	Phosphoric acid/ acetic acid/nitric acid ($H_3PO_4/CH_3COOH/HNO_3$)	55
		Al etch	Etch	Removes aluminum	Phosphoric acid/ nitric acid ($H_3PO_4/HNO_3/H_2O$)	30 to 45

(continued)

Verteq Baseline Chemical Processes						
Name of Process*	**Abbrevi-ation***	**Other Names Commonly Used**	**Type of Process**	**Function**	**Chemical Composi-tion (Chemical Symbols)**	**Temper-ature Range (°C)**
Chemical Processes *(continued)*						
Shipley Developer MF-501 (manufac-turer's product name)	DEV	Developer	Strip	Removes positive resist	Tetramethyl ammonium hydroxide ($(CH_3)_4NOH$)	18 to 35
Solvent (typically the name of the solvent such as EKC 944, SST-1, PSR-1)	SLV		Strip or etch	Removes photoresist	Varies	Varies
Sulfuric peroxide mixture	SPM	Piranha strip, resist strip	Strip or etch	Removes photoresist and organics	Sulfuric acid/ hydrogen peroxide (H_2SO_4/H_2O_2)	130 to 160
Verteq clean System	VcS		Strip or etch	Removes particles, metals, silicon dioxide, and organics	DI water/ surfactant/ ammonium hydroxide/ hydrogen peroxide hydrochloric acid/ hydrofluoric acid (H_2O/surfactant/ NH_4OH/H_2O_2/ HCl/HF)	18 to 70 (varies depending on process step)
Rinse Processes						
Overflow rinse	OFR	Cascade rinse	Rinse	Removes excess chemical	DI water (H_2O)	Ambient
Quick dump rinse	QDR		Rinse	Removes excess chemical	DI water (H_2O)	Ambient
Surfactant	SRF		Rinse	Removes excess chemical	DI water/ surfactant (H_2O/ surfactant)	Ambient
*Preferred terms or abbreviations used by Verteq.						

chemical processing

(verb) Processing (stripping, etching, or cleaning) the product by washing or soaking it in a chemical bath.

Also see process chemical.

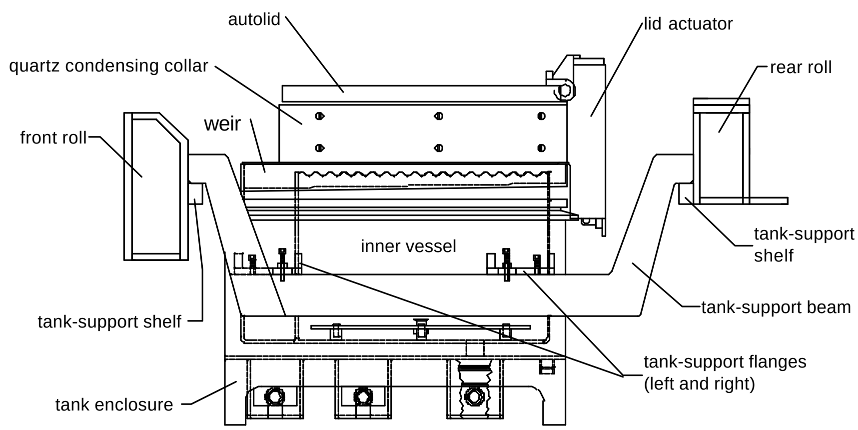
chemical spiking

See metering pump.

chemical tank

Container in which the product is chemically processed. An example of a chemical tank is shown below.

Also see rinse tank.



Chemical Tank (side view)

"chemraz"

A trade name for a blend of PTFE with elastomers to form a material used primarily as a sealing medium.

chilled water

Water at below-ambient temperature.

Also see temperature of process chemicals.

chilling

See temperature of process chemicals.

chip

A small component that contains a large amount of micro electronic circuitry.

chromium

Cr.

city water

Water supplied by the city (tap water). Usually not used in a rinse process. Used to open and close water-actuated tank lids.

cleaning

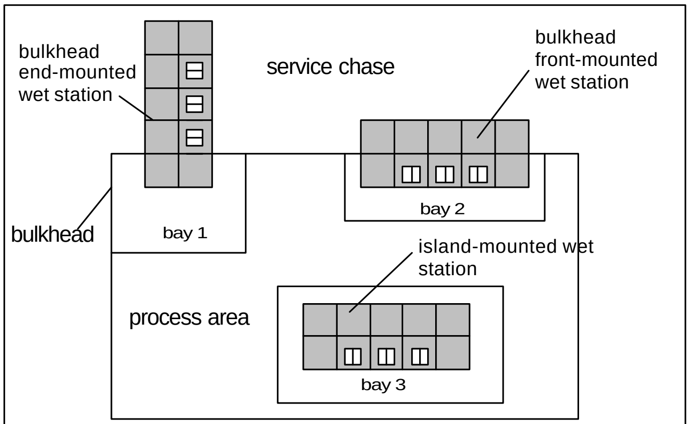
The removal of contaminants from the wafer surface during process steps.

cleanroom, bay-and-chase

Bay-and-chase cleanrooms usually consist of a process area and a service chase. The process area is the clean area. Wet systems are located in bays in the process area, and they may extend into the service chase. The service chase around or behind the process area allows access to the plumbing and electrical cabinets of process equipment for servicing.

A simplified bay-and-chase cleanroom is shown in the following drawing. Cleanrooms at customer sites may contain one or more wet systems and associated equipment laid out in any of a number of ways.

Also see wet-system mounting.



Typical Bay-and-Chase Cleanroom (top view)

cleanroom classification Cleanrooms are classified based on the concentration and size of airborne particles in the cleanroom measured in microns (µm) per cubic foot of air. A Class 100 cleanroom has 100 or fewer particles of 0.5 µm and larger (and/or no particles 5.0 µm and larger) in 1 ft^3 of air.

CMOS Complementary metal oxide semiconductor.

CMP See chemical mechanical polish.

CO_2 Carbon dioxide. Used as a fire suppressant.

coax See coaxial cable.

coaxial cable (coax) A special two-conductor shielded cable with fixed impedance that permits the transmission of electrical energy.

Color (in touchscreen displays) See touchscreen displays.

combustible liquid A liquid having a flash point at or above 100°F.

condensing coils Tubes, used to circulate ambient-temperature water, built into the top of some heated tanks. The ambient-temperature water cools chemical vapors and causes condensation on the bottom of the tank lid. If the process chemical includes DI water and the tank's operating temperature is above 100°C, the water boils off, is reduced to liquid on the cold condensing coils, and drips back into the tank. The result provides a more consistent chemical concentration in the process tank and reduces the loss of DI water in the exhaust system. See temperature control for nitride-strip processes. Also called reflux collar.

conductor A substance or body capable of conducting and carrying electric current, usually having low resistance.

contaminants Particles that can cause defects in physical structures or electrical functionality that may result in the failure of a semiconductor device. Contaminants typically come from humans, the chemicals used, the process equipment, the manufacturing environment, and the wafer itself as materials are added and removed.

contaminated part Wet-system parts that have been exposed to hazardous chemicals. Usually parts in the field or returned from the field.

control software See wet-system control system; robot control system.

cool-down box See cooling tank (preferred term).

cooling tank Used in draining of heated tanks to cool liquid before it is drained into waste or reclaim systems. Cooling tank operation is interlocked with recirculation system valves and pumps. See recirculation and draining.

core See service chase (preferred term).

CPFA Carbon-filled PFA.

cps Cycles per second.

Also see hertz.

CPU Central processing unit.

Cr Chromium.

CR Carriage return. A selection on the touchscreen keyboard; pressing CR enters information and advances the cursor to the next line.

crash detect See obstruction sensor (preferred term).

critical alarms Any alarm may be designated as critical, in addition to its automatic response level. Critical is provided to identify a high level of seriousness and requires an additional operator response on the touchscreen to recover from the alarm. (The CRITICAL button on the associated tank control screen turns red and must be touched to clear the alarm.) The Verteq default alarm responses include two critical alarm assignments:

- Plenum in module (#) is full
- Rear plumbing area in module (#) is full

Critical alarms do not disable manual commands from tank control screens, the DIO screen, or the robot joystick.

Also see alarms and status beacon.

crystal A quartz crystal that vibrates at a specific frequency when energy is supplied to it.

crystal structure A three-dimensional lattice of molecules or atoms of a specified material or element.

CVD Chemical vapor deposition.

cycle The application or step in a series that make up a process.

Czochralski Technique Method of growing an ingot of silicon by pulling a seed rod from the top of a crucible of liquid.

D

damper, exhaust

An adjustment flange (butterfly valve) used to adjust exhaust flow from a module.

Also see exhaust alarm and control systems.

dBA

Decibels (dB) on A-weighted scale.

DCR

See Document Change Request.

DDV

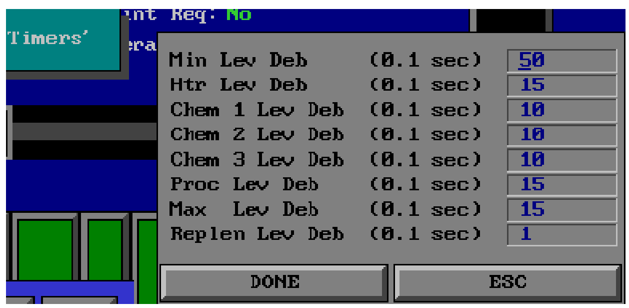
Diluted-drain valve.

dead leg

Any point in the plumbing where more than two times the diameter of the pipe has a possible stoppage of flow. No dead legs are allowed in any DI-water line. DI-water manifolds should have a flow-through design to maintain a continuous flow. Valves in the DI lines should have a trickle flow bypass or 1/8-inch bleeders.

debounce timers

Debounce timers eliminate needless errors and alarms. As tanks fill and drain, or when product enters or leaves, liquid can slosh and trigger sensors. Debounce values allow liquid levels to stabilize inside the tank before needless error messages are sent. Debounce values are set in tank configuration. Tank level operational functions and interlocks are defined in tank levels.



Typical Debounce Configuration Screen

debug

To troubleshoot and correct malfunctions.

decibel (dB)

A unit used to express relative difference in power between acoustic or electrical signals, equal to 10 times the common logarithm of the ratio of the two levels.

decktop

A cover over the plenum and around the chemical tanks to create a physical barrier between the process environment and the lower plenum area. Decktops create a local exhaust system.

default

An action automatically carried out or a value automatically used unless another one is specified.

defect

An area of the wafer that is damaged and thus unusable (the remainder of the wafer is usable). Also see scrap wafer.

degrees Celsius (°C)

A thermometric scale where 0° is the freezing point of water and 100° is the boiling point. Formula to convert to degrees Fahrenheit (°F): 9/5C + 32.

deposition

Application of material onto a substrate or wafer using a chemical, vapor, electricity, or vacuum process.

delta p See differential pressure.

DEQ Department of Environmental Quality.

DEV Developer. See chemical process.

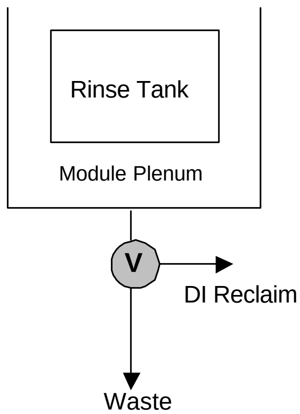
device A mechanism, tool, or piece of equipment designed to serve a special purpose or perform a special function (for example, the robot, SRD, or tank). Use the specific name of the device if possible, rather than the generic term *device*.

DHF Dilute hydrofluoric acid. See chemical process.

DI water Flowmeter Flow meter attached to flow switch or device designed to alarm at a specified rate of flow; may have adjustable threshold.

DI water Deionized water.

DI reclaim



Optional valve installed in the plenum waste-drain piping diverts DI water rinse cycles to facility waste line, then (after a specified number of rinse cycles) to DI reclaim facilities.

DI reclaim is enabled and configured in tank and recipe configuration.

Configure the tank:

1. Select **Process** menu button on the main screen, then **Tank Config**.
2. Select a rinse tank.
3. Select **DI Hardware**.
4. Enter 1 for **DI Reclaim**.
5. Select **Rinse** from the Tank Config menu.
6. Enter the number of rinse cycles to be drained to the facility waste line in **DI dumps to waste**, then save the configuration.

Verify recipe's rinse cycles:

In recipe management, verify that the recipe in question has enough dump cycles (the combined values for **Hot Dump Cycles** and **Cold Dump Cycles**).

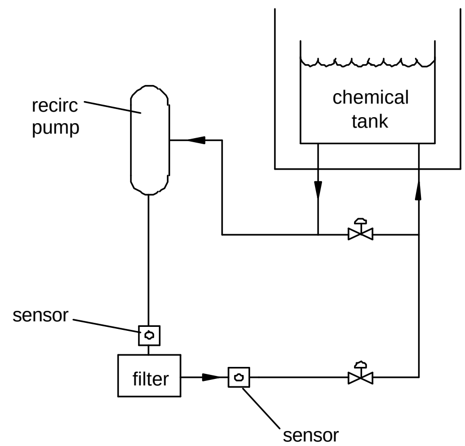
DI water drain

The system can drain DI water in one of three ways:

- all rinse cycles drain to facility waste.
- all rinse cycles drain to the facility's DI reclaim line.
- after a specified number of rinse cycles have drained to the chemical waste line, the remaining dumps are diverted to DI reclaim. See *DI reclaim*, above.

Differential pressure (DP)

The difference in pressure between two points ($\Delta P = P1 - P2$). Sensors in the chemical tank recirculation lines measure pressure upstream and downstream from the filter. When the pressure differential exceeds a configurable preset value, the filter must be changed. This condition can trigger an alarm and/or a message on the touchscreen advising the operator to change the filter).



Pressure Differential in Chemical-Tank Recirculation System

diffusion process

High-temperature process used to introduce dopant atoms into the silicon surface.

Also known as *doping*.

DI heater

See temperature controls.

DI inject

Injecting DI water into a nitride recirculation system to maintain concentration.

dilute hydrofluoric acid

Dilute hydrofluoric acid (DHF). See chemical process.

Dilution valving

Tank drain scheme that uses an aspirator (inline plumbing device) to dilute liquid draining from a tank. See aspirated drain.

DIO

Discrete input/output. See I/O.

DIP switch

Dual in-line package switch. Small switch used to set up or adjust equipment.

dispersion plate

A plate located in a tank that prevents liquid from spraying as it fills the tank and prevents recirculating liquid from exiting tank too quickly. Also allows laminar flow of liquid across the wafers (bottom to top).

disarm

Keyswitch position. See keyswitch.

DMM

Digital multimeter.

document control

Verteq's Document Control department is responsible for organizing the company's documents (primarily parts lists, manuals, and technical drawings) and managing the numerous and frequent changes made to these documents. One or more of the following forms are used, generally in the order listed, before manufacturing begins, and when changes to a document are needed (either during manufacturing or after shipping):

1. **Engineering Work Order (EWO)**
   The EWO form is prepared by a project engineer *before* manufacturing begins. The EWO lists the parts and documents needed for the project, and provides authorization for production to begin.

2. **Manufacturing Engineering Order (MEO)**
   The MEO form is used to request and order a change to any document *during* manufacturing.

3. **Engineering Change Request (ECR)**
   The ECR form is used:
   - to request a change to any document for a product, part, or assembly that has been shipped to the customer, and
   - to request a change on a "stand-alone" document (one that is not related to a particular Verteq product).

4. **Engineering Order (EO)**
   The EO form is used to *order* (direct an employee to make) the change specified on an ECR, and explains the change needed.

See the Document Control department for instructions on using these forms.

"dog house"

Plastic assembly covering the pillow block bearing above the swingarm.

dopant

Impurity added to semiconductor material to change or improve its ability to conduct electrical current.

doping

See diffusion process (preferred term).

DOS

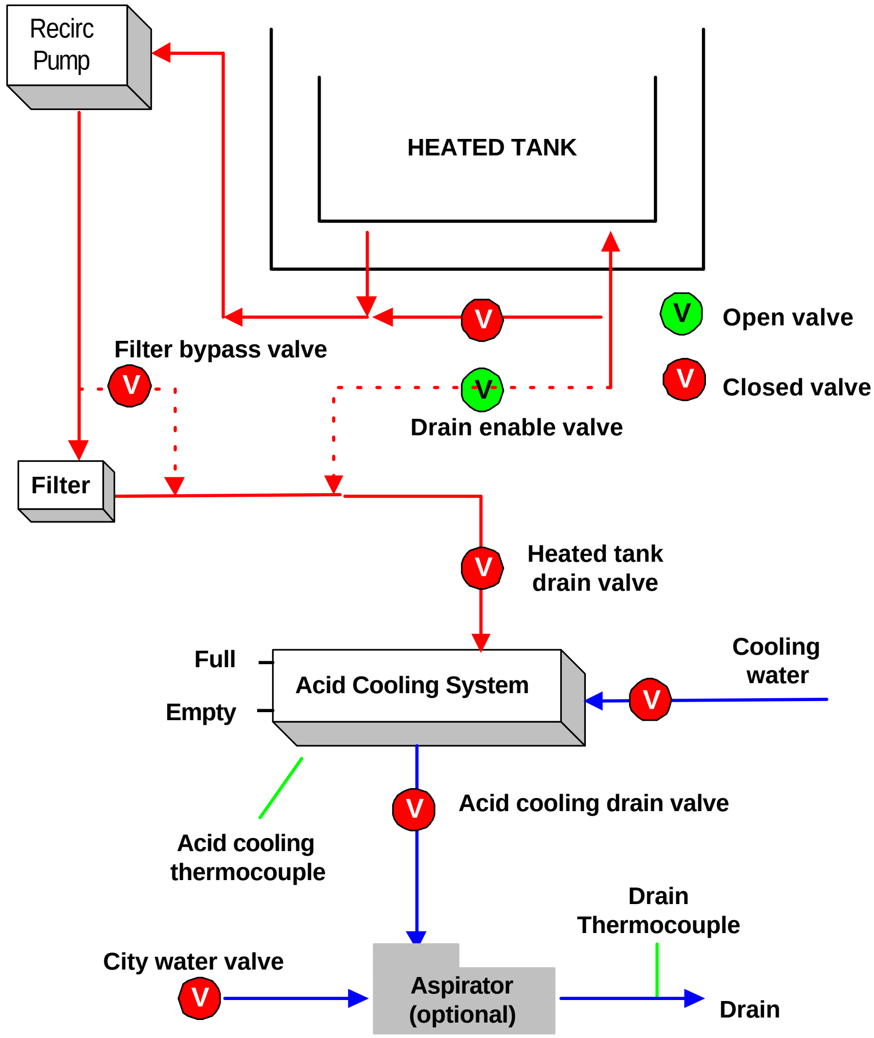
Disk operating system.

DOT

U.S. Department of Transportation. Regulates transportation of chemicals and other substances for the protection of the public.

draining (heated tanks)

Heated tanks drain when 1) a "Main Tank is overfull" alarm occurs, and 2) the REFILL or DRAIN button on the tank control screen is selected. During a drain, the recirculation pump pulls liquid from both the inner tank and the outer weir. The pump starts when liquid falls below the tank's process level.



Typical Heated-Tank Draining Process

Cooling system specifications

- acid cooling system holds a minimum of 105% of total recirculation system volume
- two N_2 bubbler level sensors with operational interlocks (see table below)
- built-in coils circulate water for heat-exchange function
- gauge located in wet system module enables adjustment of cooling water inlet pressure (inlet pressure must not exceed 40 psi; flow ≅ 4 gpm)
- process tank volume cools 180°C to 70°C within 1 hour (based on 65°C cooling water)

One or multiple aspirators can be plumbed in parallel downstream of the acid cooling system. Each aspirator produces a specified dilution ratio (city water:process chemical), and cools the chemical.

Automatic Interlocks for Heated-Tank Drains	
Interlock	**Function of Interlock**
Cooling-tank overtemp	Acid cooling thermocouple interlock prevents the acid cooling drain valve from opening before desired drain temperature is achieved.
City water flow	Allows the city water flow valve to open only when the acid cooling system drain valve is open.
Drain overtemperature	Drain thermocouple downstream of the optional aspirator(s) shuts off acid cooling drain valve if temperature is too high.
Acid cooling system levels	**Full** shuts off heated tank drain. **Empty** shuts off cooling tank drain.

dryer

A device used to remove water from wafers. Common dryer types include IPA (isopropyl alcohol) dryer, SRD (spin rinser/dryer), and Marangoni dryer.

dummy load

A resistive test device capable of absorbing power or matching a device's impedance. Used in testing device output.

E

ECR Engineering Change Request. See document control.

edge exclusion The outside edge of the wafer, which is reserve for handling, if necessary. No circuit printing takes place in this area.

EE See robot end effector.

EE wash tank See end-effector wash tank.

Emergency Action Plan Designated actions employees and managers must take to ensure employee safety from fire and other emergencies.

Emergency Off See EMO.

emergency modes Wet systems have three emergency modes:

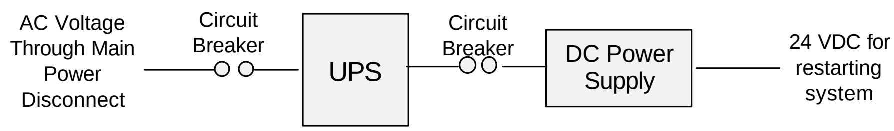
Emergency Mode	Cause	System Response
EMO	1. Fire 2. Emergency Stop button pressed 3. Exhaust Fail alarm	See EMO
Robot E-STOP	1. Robot E-STOP button pushed 2. Safety shield opened with keyswitch at AUTO position 3. Robot unable to move or to complete a move because of obstruction 4. Internal error	See Robot E-STOP
UPS	Main wet system power is lost	UPS engages. See GoToSafe.

EMO

Emergency Off (EMO). An EMO shutdown on a Verteq wet system is caused by 1) pushing an Emergency Off pushbutton, 2) loss of exhaust, or 3) a fire.

During an EMO shutdown, electrical power is maintained through the UPS to a DC power supply, which provides a 24-VDC output. This voltage is necessary to restart the wet system. Recipes in progress cannot be resumed; product lots cannot be moved with the robot until the EMO condition is cleared.

EMO pushbuttons are red mushroom-type buttons located on both the front and back of wet systems. After an EMO button has been pushed, it must be manually pulled out before the wet system can be powered up.



Simplified schematic of electrical flow (left to right) after an EMO has occurred.

Responses to an EMO Shutdown	
Device or Function	**Response**
UPS (uninterruptible power supply)	• UPS retains power, but supplies only 24-VDC to a restart circuit.
Robot	• Loses power • Loses home position • Must be rehomed before it is used again
SRD (spin rinser/dryer)	• Loses operating power • Stops communicating with cell controller
Automatic valves	• All automatic valves go to default position
External DI water heater	• Operating power to the DI heater is **not** interrupted • Control and communication with heater are cut off • Heating stops
External chemical tank heater/chiller	• Operating power to the heater/chiller is cut off • Communication with VcS module stops • Heating/chilling functions stop
Cell controller and touchscreen	• Both lose power
Recipes in progress	• Immediately stop • Cannot be resumed • Product lots **cannot** be moved with the robot until wet system is restarted
Electrical circuits	• All circuits are disabled except 24-VDC startup circuit

end effector (EE)

See robot end effector.

end-effector (EE) wash tank

The EE wash tank rinses and dries the robot's end effectors (the grippers that hold the cassettes) to prevent contamination of the next chemical bath or the spin rinser/dryer (SRD). After removing process cassettes from any chemical tank, the robot places the cassettes in a rinse tank. While the wafers are in their rinse cycle, the empty robot automatically moves into the EE wash tank according to the rules in the following table.

The end-effector wash is a sequence of DI water rinses and N_2 drying that is permanently set in the wet system's control system. However, each step is composed of various parameters and cycles that can be configured, including the duration and number of repetitions of each cycle in the step.

The EE Wash tank has an overflow function with a high/low flow feature. This allows the tank to fill at a high rate and overflow at a low rate. The EE Wash tank is filled from the bottom at a high flow rate until the DI-water level reaches the N_2 bubbler level sensor. The level sensor triggers the change from high to low flow rate.

N_2 spray bars are installed at the top of the tank to dry the end effectors as the robot rises to carry height.

EE Wash Tank Rules	EE Tank Sequence
1. Wash/dry before going to the input nest. (Wash is DI water; dry is N_2.) 2. Wash/dry before going to the SRD. 3. Wash if the next scheduled move is to a different chemical tank. 4. Wash if the next scheduled tank has the same chemical *and* if the control system determines there is enough time to complete a sequence before the next scheduled move.	1. EE tank is full and idle before the end effector enters. 2. Robot dips the end effector into the tank. **Wash Time** counter starts and the tank begins to overflow. 3. Wash time ends. **Drain Time** cycle starts and the tank empties. This completes one wash cycle. The wash cycle repeats for the number of times set in **Wash Cycles**. 4. **Drain Time** finishes. **Dry Cycle** starts for the amount of time set in **N_2 Spray Time**. 5. Robot lowers into tank, then raises. The N_2 spray is on. 6. **Dry Cycle** ends, then repeats for the number of times set in **Dry Cycles**. 7. Robot raises end effector to carry height and pauses for the time set in **Drip Time** before executing the next scheduled step in the recipe. The bolded items above are individually configured in the EE Wash tank configuration screen.

end mounting

See wet-system mounting.

endurance testing

Testing performed on the wet system before shipping to the customer; involves operating the wet system in standard mode with the intention of processing 5,000 wafers with assists but no failures.

Engineering Change Request (ECR)
See document control.

Engineering Order (EO)
See document control.

Engineering Work Order (EWO)
See document control.

environment, product
See product environment.

EO
Engineering Order. See document control.

EPA
Equipment purchasing agreement.

Epitaxial Method
Method of growing an ingot of silicon by depositing crystals onto the seed from a gas.

EPROM
See erasable programmable read-only memory.

erasable programmable read-only memory (EPROM)
A read-only memory in which stored data can be erased and reprogrammed repeatedly.

ergonomics
The science or study of the evaluation, planning, and adapting of equipment and tasks to promote the comfort of the human body for the health and efficiency of workers.

error
Any deviation outside a specified tolerance range or value.

ESC
Escape. A selection on the touchscreen and external keyboards and on the touchscreen menus.

ESD
Electrostatic Discharge

E-STOP
See Robot E-STOP.

Also see EMO.

etch
See etching.

etchant
The agent used to remove unwanted material from the product (etching). The most common etchants used in wet-chemical processing of semiconductors are mineral acids, particularly HF. By chemical action, the etchant removes all material that is not protected by resist.

etching

The process of removing (chemically dissolving) certain areas of layered materials on the wafer surface to leave the desired circuit pattern or to create the required thickness of the layer. Etch processes are typically named for the material being etched (for example, oxide etch and nitride etch). Etching is measured in Ångstrom units.

Also see stripping.

etch rate

Rate at which the surface of a wafer is etched (measured in Å/time, where time typically equals minutes).

ETFE

See Tefzel©

evaporation

Process where a metal capsule is heated in a chamber and becomes a vapor which solidifies as a metal film on exposed surfaces of semiconductor material. Also known as vapor deposition.

Evaporator Bell Jar

Chamber where the evaporation process occurs.

event

A detectable change in the condition of a system or equipment.

EWO

Engineering Work Order. See document control.

exhaust

Removal of gas, fumes, or vapor from the module.

Also see local exhaust system; exhaust alarm and control systems; exhaust flow patterns.

exhaust alarm and control systems

Every module in Verteq wet systems can trigger two exhaust alarms: low-exhaust and exhaust fail. **Low-exhaust** warns that a module’s optimum exhaust velocity is lost and triggers an automated Runout response. **Exhaust fail** causes an EMO shutdown after an immediate GoToSafe and a configurable time delay. The delay allows recovery from a transient loss of exhaust flow without triggering an unnecessary EMO shutdown. Each of these exhaust alarms can be configured for different automated responses.

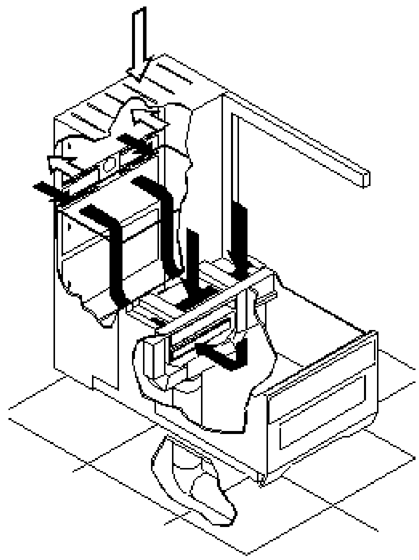
Also see *status beacon*.

exhaust and air-supply options

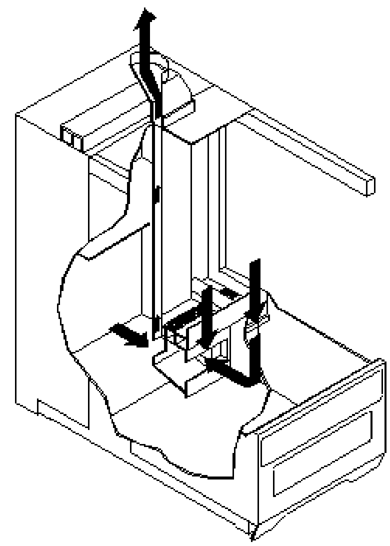
Three air-supply/exhaust options shall be available. A wet system can comprise modules that use different options.

Option	Hardware Used	Interlock Response
1	• Facility supplied air, air handlers, and filters • Air handlers controlled by the facility	• **EMO** – No control of air supply system. Standard EMO response. • **Low Exhaust** – Runout response after a 10-second time delay • **Exhaust Fail** – EMO is triggered after and immediate GoToSafe • **Fire** – EMO is triggered
2	• Air supplied from remote constant-speed air handlers through ULPA filters. These filters are assembled into filter plenum modules positioned over the wet system process area • 0.12-micron filters with 99.9995% efficiency • Aluminum perimeter framing and protective grill on the downstream side of the filter modules • Construction of 304, #4-finish stainless steel • Flex duct interconnect between blower and ULPA air plenum modules supplied by Verteq	• **EMO** – Air handlers ***do not*** shut down or change speed. Air flow continues at current velocity. • **Low Exhaust** – Runout response after a 10-second time delay • **Exhaust Fail** – EMO is triggered after and immediate GoToSafe • **Fire** – Air handlers shut down and an EMO is triggered
3	• Same hardware as option 2, except air handlers are two-speed	• **Safety shield open** – Two-speed air handlers adjust to a reduced velocity maintenance-mode, which conforms to OSHA fpm safety requirement (currently 150 fpm). • **EMO** – Two-speed air handlers adjust to a reduced velocity maintenance-mode. • **Low Exhaust** – Runout response after a 10-second time delay • **Exhaust Fail** – EMO is triggered after and immediate GoToSafe • **Fire** – Air handlers shut down; EMO is triggered

exhaust flow patterns



Bottom Exhaust
(Outline arrows indicate air returned to cleanroom.)



Top Exhaust

exhaust collar

Facility-connection port.

exhaust monitoring options

Two options shall be available to monitor exhaust. Both can be used in the same wet system on a module-by-module basis and in conjunction with any air-supply option.

Option 1: Pitot tube / photohelic gauge	Option 2: Photohelic only
• One Pitot tube and photohelic for each module • Devices measure velocity pressure (inches of water) of the exhaust stream • Tubing connecting the Pitot to photohelic gauge on the back of each module shall be installed by facility personnel at the time of system facilitation	• Photohelic gauge, on the back of each module, shall indicate the difference between the ambient pressure where it is located and the exhaust duct.

exposure

A condition of being exposed, a position in relation to an unacceptable event, or an interaction between an employee and a hazard.

extender board

A de-bugging printed circuit board used by service personnel to temporarily extend the length of the installed PCB for more convenient monitoring purposes.

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F

fab	Fabrication facility. See facility (preferred term).
facility	The customer's location; specifically, the site where wafers (or other product) are fabricated and the wet system is located. Also known as *fab*.
failure	Any interruption or variance from the specifications of equipment operation that requires the replacement of a component (other than specified consumables) because of degradation or failure. Also includes assists that interrupt operation and require more than 6 minutes. [From SEMATECH Official Dictionary, Rev. 5.0, 1995]
FARM	See filtered-acid recirculation module.
feedback	Electronic currents, coupled or directed from the circuit's output valve or amplitude back to the circuit that originated it. Normally used to control or compare.
FEM	Filtered etch module.
FEP	Fluorinated ethylene-propylene. Also see "Teflon."
filter bypass valve	See recirculation (heated tanks).
filtered-acid recirculation module (FARM)	A process module that has a chemical tank with an acid-recirculation system.
filtration	See recirculation (preferred term).
Fire Prevention Plan	Includes a list of major workplace fire hazards, procedures to control them, and the types of fire protection systems which can control potential fires.
fire-retardant polypropylene	FRPP.
fire suppression system	Typically uses CO_2 and/or water. See wet-system specification for details of fire detection and suppression system.
FLA	See full load amps.
flammable liquid	A liquid having a flash point below 100°F (37.8°C).
flash point	The temperature at which a liquid will give off enough flammable vapor to ignite.
fluorinated ethylene-propylene	FEP. Also see "Teflon."

FNPT

Female national pipe thread.

footprint

Physical dimensions (length and width) of a wet system.

force

Each tank control screen has a Forced / UnForced button that allows the direct control of individual valves, pumps, spray bars, and drains. In normal operation these buttons remain in the UnForced (automatic) mode. With the Forced button on, valves can be opened and closed, recirculation pumps can be operated, and other components individually controlled.

Tank control screens are accessed by selecting their icons on the main screen. Displaying control screens is not a password-protected operation. However, forcing and macro command functions require password permission.
A position in the password bit mask allows or denies operator permission to force wet-system components. This is a blanket permission, i.e., an operator may force any component on every control screen or force nothing at all.

The Forced function should be used only by trained technical personnel who have a thorough understanding of the wet-system operation. Also, it is extremely important to return the system to an **UnForced** condition before logging off or shutting down the control software.

To force a component:

1. Select a tank or device icon from the main screen.
2. Select the Forced/UnForced button on the displayed control screen. The button toggles between UnForced and Forced every time it is selected.
3. Select an ON/OFF or OPEN/CLOSED status box to toggle the status of a device such as a valve or pump.
    - Not all devices have forced capabilities.
    - On some control screens, devices do not have status boxes. In these cases select the icon itself to toggle its status.

When components are toggled to forced:

- Valves and other devices can be toggled ON/OFF or OPEN/CLOSED.
- The device will remain in a forced state until toggled again.
- Forcing overrides automatic control, preventing normal processing.

The wet system main control screen shows when a tank is in a forced condition.

fpm

Feet per minute (unit of velocity).

front-access module

A module in which the plumbing and electrical compartments can only be accessed from the front.

front mounting

See wet-system mounting.

FRPP
Fire-retardant polypropylene.

FRS
Filter recirculation system.

See recirculation

F_r
Resonant Frequency

frequency synthesizer PCB
Printed circuit board in Verteq's E-style Megasonics electronics packages. Used to produce a signal at Fr of transducer crystals that will drive the amplifier allowing the system to produce energy inside the process tank.

full load amps (FLA)
The peak load power requirement for a wet system or device (measured in amps). The FLA for each wet system is indicated on a label attached to the rear of the wet system near the main power disconnect switch.

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G

GaAs Gallium arsenide.

Ge Germanium.

GEM Generic Equipment Model. SEMI International standard for communications and control of semiconductor equipment.

GEM Host-Cell Controller Interface See *GEM Specification*.

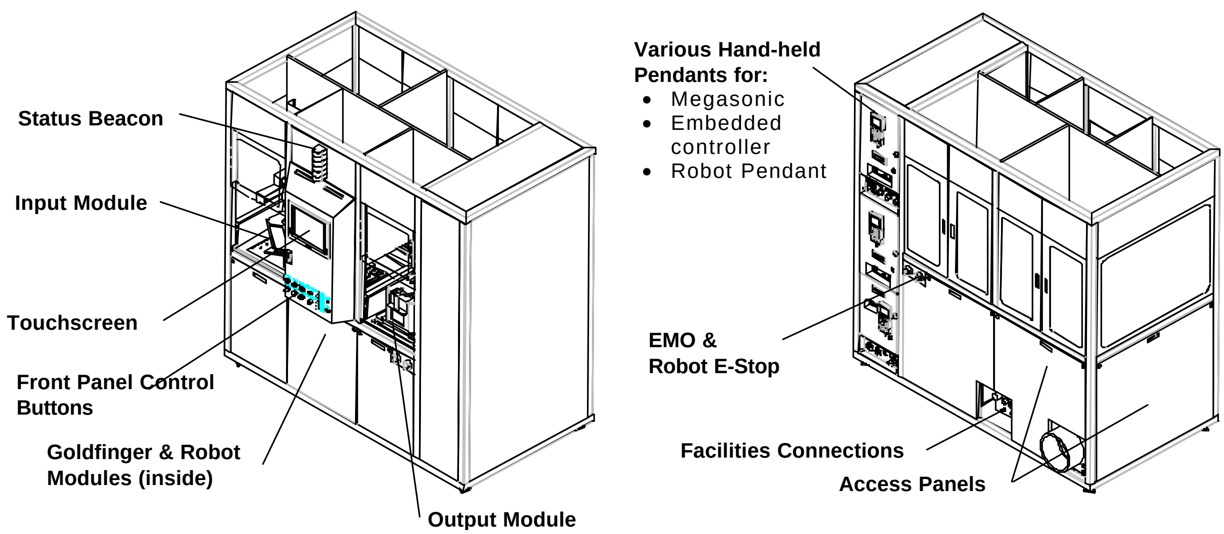
general safety rules General safe work practice rules adopted by Verteq, Inc.

geometry The critical dimensions (CDs) and shape of the end product, measured in microns (µm).

GFI Ground Fault Interrupter.

g/L Grams per liter.

Goldfinger The Goldfinger Cleaning System is a post-CMP single-wafer based processing system designed to accommodate non-contact cleaning to remove organic, ionic, and particulate contaminants after the mechanical polishing of a wafer. The system is constructed with standardized modules for flexibility and variety in cleaning. A system may be manufactured to include any selection of modules, depending upon the requirements of the user. It may be arranged around a robot (if equipped) or another system so that every module is accessible.



GoToSafe

GoToSafe is an automated recovery sequence that ensures wafers are in, or moved into, safe tanks after a loss of main power to the wet system. GoToSafe is also response can be assigned to any alarm.

All GoToSafe responses have the features listed below.

- Audible and visual alarms
- New lots are not allowed until alarm is cleared
- Alarm message displayed on touchscreen and written to log file
- Lot is moved into or kept in a safe tank until problem is fixed

The scenario table below describes variations on the main GoToSafe theme.

GoToSafe Scenarios

	After Loss of Main Power	**After an Alarm**
Required Conditions	• Wet system has a powered-up UPS • Robot is functional and not experiencing an error • No obstruction, such as an open lid, prevents a robot move • Robot completes any move in progress, including moving a cassette into a chemical tank	• Alarm is configured for GoToSafe • Robot is functional and not experiencing an error • No obstruction, such as an open lid, prevents a robot move • Robot completes any move in progress, including moving a cassette into a chemical tank, before starting GoToSafe
Lot is in Safe (DI Water) Tank	• Lot stays in safe tank • Recipe is interrupted and cannot be resumed	• Lot remains in safe tank • Recipe timing function continues • If alarm is cleared before next scheduled move, recipe continues without a GoToSafe response • If alarm is *not* cleared before next scheduled move, lot stays in safe tank • Recipe can be continued by selecting **Resume** in the Scheduler menu after alarm condition is cleared
Lot is in Chemical Tank	• Robot *immediately* moves lot into safe tank (unless an error prevents robot movement) • Recipe in progress stops and cannot be resumed	• Lot completes the chemical tank step • Robot moves lot into safe tank • Recipe timing function continues • If alarm is *not* cleared before next scheduled move, lot stays in safe tank • Recipe can be continued by selecting **Resume** in the Scheduler menu after alarm condition is cleared

gpm

Gallons per minute.

gripper movement

See robot axes.

H

H_2O Water.

H_2O_2 Hydrogen peroxide.

H_2SO_4 Sulfuric acid.

H_3PO_4 Phosphoric acid. Used in nitride strip baths.

“Halar” Trademark for fluoropolymer (ECTFE) produced by Ausimont, USA, Inc.

“Halon” Trade name for a compressed gas used in fire-suppression systems. Used in and around electronics because it is a gas. Consumes oxygen in a room. Is hazardous to humans.

hardware The physical components or equipment that make up a computer or other system.

hazard An unsafe condition or practice that could cause injury or illness to an employee. Hazards are preventable.

Hazard Communication Program A written program designed to inform employees about hazardous chemicals and corresponding protective measures.

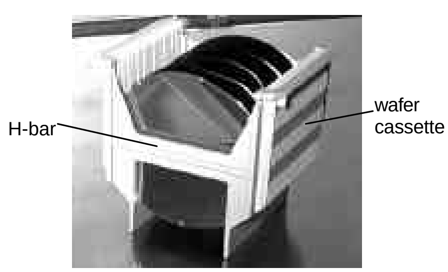
hazard control Reducing the probability of accidents by eliminating hazards, reducing exposure to hazards, or protecting employees from hazards.

hazard identification Noting the potential for accidents before they occur.

Hazcom Hazard communication program.

H-bar The narrow horizontal bar at one end of a wafer cassette (see photo). The vertical and horizontal reinforcing strips form an “H.” H-bar orientation is extremely important for secure mating with the robot’s end effector. Improper placement of cassette in the input queue can result in wafer damage.

Also see cassette placement.



Cassette H-bar Location

HCl Hydrochloric acid.

heater/chiller

Unit used t heat or cool fluids; typically used in chemical processing to control the temperature of a specific bath or tank.

Also see temperature controls.

heating

See temperature of process chemicals.

HEPA

High-efficiency particulate air filter.

hertz (Hz)

A unit of frequency equal to one cycle per second. Also known as *cycles per second*.

HF

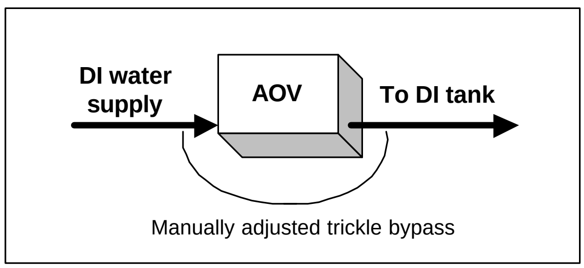
Hydrofluoric acid. See chemical process.

HF last

If the HF-rinse combination is the last step before the wafers go into the dryer, the step is referred to as the *HF last*.

high/low flow plumbing (trickle bypass)

DI water tanks fill at a high flow rate, then (to conserve water for the continuous overflow) change to a low flow rate when the tank has filled. During tank fills, an air-operated valve (AOV) opens automatically to provide high flow and fill the tank quickly. When the process level is reached, the AOV closes, but DI water continues flowing into the tank through a manually adjusted trickle bypass line.



High/Low DI Water Flow

HNO_3

Nitric acid.

home

Mechanical location of the robot used as a reference position for the robot points. The robot must be homed (with the touchscreen or the robot joystick) each time the robot is powered up. When the robot is homing, if finds its home position for each axis, starting with the vertical axis and ending with the horizontal axis.

The robot's home position for each axis is not taught; it is permanently encoded in the robot control system.

Also see robot points, robot axes, and robot control system.

hood

See VLF hood. *Hood* is also an industry term for *wet system* (preferred term).

horizontal obstruction sensor (HOS)

See obstruction sensor.

HOS

Horizontal obstruction sensor. See obstruction sensor.

host computer

A remote computer (located at a distance from the wet system cell controller) that can:

- enter lots
- download recipes
- upload recipes
- request status
- communicate in numerous other ways with the cell controller

A host computer does not disable or override system-mounted pushbuttons or operations manually initiated from the touchscreen interface.

The Verteq host/cell controller interface is GEM-compliant. See *GEM Specification*.

hot phos

Hot phosphoric acid. See chemical process.

HP

Hot phosphoric acid. See chemical process.

HPM

Hydrochloric peroxide mixture. See chemical process.

Huang 1

See chemical process.

Huang 2

See chemical process.

hydrochloric peroxide mixture (HPM)

See chemical process.

hydrofluoric acid (HF)

See chemical process.

hydrogen peroxide

H_2O_2.

hydrophobic

Lacking an affinity for, repelling, or failing to absorb or adsorb water (in the wet-processing industry, typically refers to materials such as wafers or filters).

Hydrophilic

Having a strong affinity for, attracting, absorbing, or adsorbing water (in the wet-processing industry, typically refers to wafers or filters).

Hysteresis

[ELECTRICAL]
An oscillator effect wherein a given value of an operation parameter may result in multiple values of output power of frequency.

This is a setting used to control OMEGA-type overtemperature controllers in the protection of Lufran In-Line heaters. It is the percentage of span which the temperature must fall or rise before the time changes state.

Hz

See hertz.

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I

IC
See integrated circuit.

icon
An image representing a function on a touchscreen display. Icons change color in real-time to represent real-time operational conditions. See touchscreen colors used in touchscreen displays.

idle
The device is powered and ready for use but is not in use (for example, a tank has reached the level and temperature for processing, but no wafers are currently being processed in the tank).

Also see parked.

ILH
Inline heater. See temperature controls.

immersion heater
See temperature controls.

Impedance-matching transformer
A transformer used to match impedance between source and load. Required on all Verteq Megasonic equipment.

implant
A method of semiconductor doping (adding impurities to an intrinsic material like silicon or germanium).

impurities
Materials used as dopants, e.g. boron, arsenic, and phosphorus. When these impurities are added to silicon or germanium they will produce P or N type materials.

incident
An unplanned, unwanted event that could or does degrade the efficiency of the business operation but does not include physical injury, illness, or property damage.

incident investigation
Inquiry to determine the root cause of an incident in order to prevent future incidents and accidents.

Ingots
The small piece left after a silicon crystal has been sliced into several wafers.

inline heater (ILH)
See temperature controls.

input/output (I/O)
Inputs are electrical signals from devices (such as the robot) that provide information about the status of the device to the cell controller or PLC. Outputs are electrical signals from the cell controller or PLC that turn devices on and off, open and close valves, and energize alarms, lights, and operator notifications.

Discrete I/O signals are 24 VDC, which are either on or off. *Analog input signals* are 4 to 20 mA, which correspond to measured resistivity, flow, pressure, and temperature values. *Analog output signals*, also 4 to 20 mA, drive heating systems from 0 to 100% capacity (depending on demand determined by PID loops).

Also see input/output module.

input/output (I/O) module
The module where the product enters and exits the wet system.

input/output (I/O) nest
See input/output queue (preferred term).

input/output (I/O) queue
Two or more sets of indented slots in the I/O module (module 1) for cassettes. Also known as I/O nest. (If the wet system has a WTU, the slots are for process cassettes only.)

insulator
A material or body that is a poor conductor of electricity.

integrated circuit (IC)
A complex electronic circuit fabricated on a substrate, usually a silicon chip.

interface
The connection between mechanical and/or electronic devices that allows them to function or pass information (data) back and forth between them (for example, the host/cell controller interface).

interlock
A device that prevents operation of a piece of equipment when an event exists. For example, an interlock causes the robot to stop when a safety shield is opened during processing.

ionic
Relating to, existing as, or characterized by means of ions.

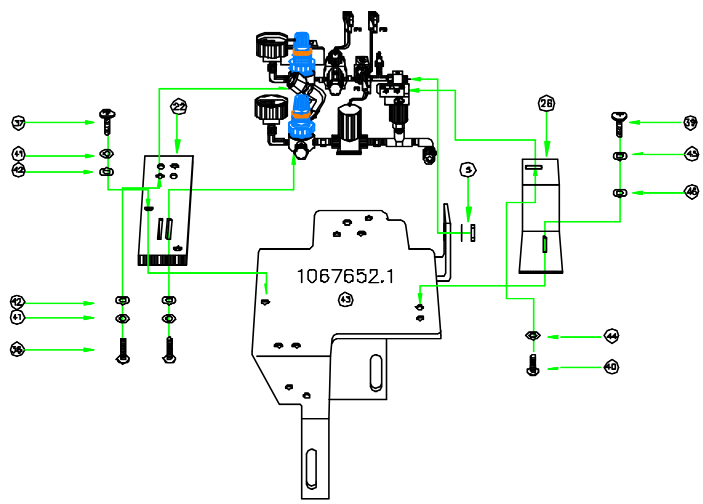
I/O
See input/output.

I/O Interface PCB
Used in Megasonics E-style electronics packages to communicate CPU commands to the 24VDC output board.

IPA
See isopropyl alcohol.

IPA dryer
Dryers that use isopropyl alcohol (IPA) to remove water from the surfaces of wafers and similar substrates.

IPB
Isometric Parts Breakdown, or Indented Parts BOM. Assembly instruction drawings used by the manufacturer and maintenance personnel. See below for an example:



Ironman A program used to test equipment around the clock to identify and correct causes of failure. Verteq uses endurance testing rather than Ironman testing.

island mounting See wet-system mounting.

IsoDRY Verteq's IPA Vapor Drying System (generic term)

isopropyl alcohol (IPA) $CH_3CHOHCH_3$. Also known as 2-Propanol.

isopropyl alcohol dryer See IPA dryer.

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J

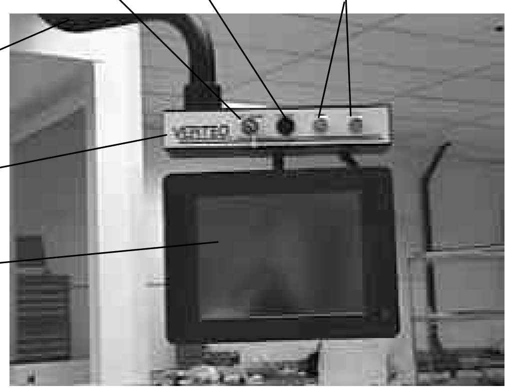
joystick See robot joystick.

K

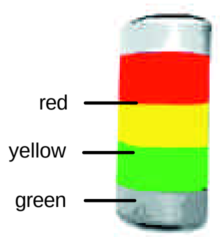
k (kilo-) One thousand.

keyboard (external) Typically located in the input module, this keyboard can be used to enter data and respond to touchscreen prompts. This keyboard is less convenient than the keyboards displayed on the touchscreen and is not normally used for wafer processing. The external keyboard, not the touchscreen keyboard, is used to install the wet system software.

keyswitch Two-position AUTO/DISARM switch located on the main control panel. For normal wet-system operations the keyswitch is kept in the AUTO position. When the keyswitch is turned to the DISARM position, the safety shields can be opened without causing a robot E-STOP. *This is a safety override that must be used with great caution.*



Operator Interface Assembly

Features and Interlocks when keyswitch is at DISARM	
Status Beacon	**Interlocks**
 **Status Beacon**	• A safety shield can be opened without causing an E-STOP. • Yellow light on the status beacon flashes. • Robot will complete a move in progress but will not respond to any automatic commands until the keyswitch is moved back to AUTO. • The robot will not respond to manual and joystick commands unless 1) the logged-on operator has special password permission to override this interlock and 2) a touchscreen prompt is acknowledged. • Exhaust flow will increase (for systems with exhaust control systems). • New lots cannot be entered.

kHz See kilohertz.

kilohertz (kHz) A unit of frequency equal to 1,000 hertz.

kinematics Study of motion without regard for masses or forces.

KOH Potassium hydroxide.

L

Labyrinth Seal Plate
Disc-shaped plate made of polypro material. Filtered nitrogen gas flows through small holes in the plate, forming a gaseous barrier that seals the bowl from outside contaminants and keeping air and water in the bowl from escaping.

laminar flow
Flow of liquid or gases in a smooth pattern without turbulence.

LCD
Liquid crystal display.

LED
Light-emitting diode.

Li
Lithium.

Lid
Pneumatically operated cover used on heated tanks. Lids open and close automatically during processing. Lids can also be opened manually when the tanks are not allocated by using the forcing or macro-command functions on the applicable tank control screen. Major lid safety interlocks include:

- lid cannot be opened or closed manually at any time during an automatic recipe, even if the tank is empty
- lid will not open if the robot is moving toward it
- robot will not deliver product lots into a tank if its lid is not fully open.

A lid can be configured to remain open during processing and to close at specified temperature conditions. See tank configuration.

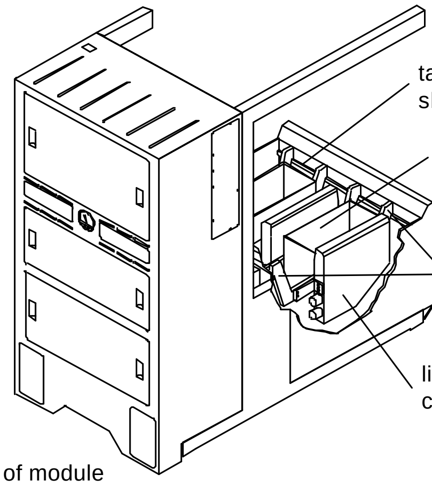
In semi-automated systems (in which the robot does not let go of cassettes during processing), an offset robot arm allows the effector to stay in the tank with the lid closed.

light point defect (LPD)
A feature (pit, particle, or peak) on a wafer's surface that causes light to be scattered from measurement tools that look for surface imperfections.

light tree
See status beacon (preferred term).

lip-exhaust collar
A mechanical structure mounted on the right and left sides of a chemical tank to create a local exhaust system. The lip exhaust system captures fumes from the process tank and draws them at an accelerated rate into the exhaust stream for removal from the module. The process localizes the chemical vapor and minimizes contamination of other components. When a lip-exhaust collar is present, a "deckless" system (a local exhaust system without a decktop) can be used.

Also see for exhaust flow patterns.



Typical Deck-less Module
(with local exhaust system)

lithium Li.

Lithographic A method of defining semiconductor patterns on wafers by use of a thin film of resistant material.

Load Transducer.

local- and remote-mode operation The wet system operates in either local or remote mode. The wet-system control system boots up in local mode, but remote-mode operation can be selected in the touchscreen Operations menu. Mode selection is a password-protected operation. In local mode, the wet system is controlled entirely through the touchscreen and external keyboard.

In remote-mode operation, the wet system is partially controlled through a host computer, which can:

- enter product lot IDs and select recipes
- monitor real-time touchscreen displays and log system events in automatically generated files
- receive "lot complete" messages
- add new recipes to control software

The wet system can be operated in only one mode at a time. Both local- and remote-mode processing typically involve a floor operator. In remote mode, the host-computer operator enters product lot IDs and recipes through the host computer; the floor operator monitors the process, acknowledges touchscreen prompts, and loads and unloads product lots.

Remote-mode operation requires a SEMATECH SECS-II compatible program on the host computer. For technical specifications, refer to *SECS-II Host-Cell Controller Interface*.

local exhaust system An exhaust system that captures contaminants at or near their source for removal from the module.

Also see lip-exhaust collar; decktop.

local mode See local- and remote-mode operation.

lockout box Mechanical box or device used as a safety precaution to prohibit a system being powered on by someone other than the service personnel.

Lockout / tag Program A program to protect employees from injury caused by the unexpected energization or startup of equipment or the unexpected release of stored energy.

lot See product lot.

lot threading Concurrent processing of multiple product lots. Automated wet systems have the lot-threading capability; manual and semi-automated wet systems do not.

Also see automated wet system; semi-automated wet system; manual wet system.

LPD See light point defect.

lpm Liters per minute (gpm x 3.786 = lpm).

LS byte Least Significant Byte

LSI Large Scale Integration

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M

m

Meter. Also stands for milli, a prefix for one-thousandth.

mA

See milliampere.

macro command buttons

CAUTION
Macro commands override automatic operations and can cause serious operating errors. DO NOT use macro command buttons when the wet system is running an automatic recipe.

Macro commands launch operational sequences that are defined in tank configuration and recipe management, as well as default sequences set in the control system.

manifold

A pipe fitting with several lateral outlets used to connect one pipe with others.

manual controls (pushbuttons)

Typical Front Panel Controls

Typical Rear Panel Controls

manual fill

Requires an operator to pour chemical directly into a wet-system tank.

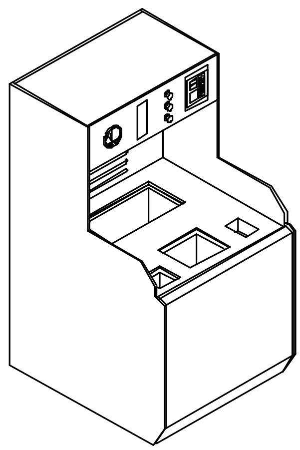
Also see bulk fill.

manual wet system (MWS)

Manual wet systems have the following features and capabilities:

- Manual wet systems are operated entirely by an operator. They have no robot or other independent automatic control systems. They may contain a touchscreen and a cell controller.
- The operator times the processes and transfers cassettes from one process to another.
- Tanks are arranged either end to end or in a front-to-rear arrangement.
- The product lot begins in a dry state and ends in a wet state. The wet system has **no** dry in-dry out capability (the operator removes the cassette from the final rinse tank and transfers it to the spin rinser/dryer (SRD) as the final processing step).
- Only one product lot is processed at a time. The operator transfers cassettes through all processing steps.

Also see wet system; automated wet system; semi-automated wet system.



Typical Manual Module

Manufacturing Engineering Order (MEO)

See document control.

manufacturing resource planning II (MRPII)

A computerized system of controls and planning techniques for all of manufacturing.

Also see material requirements planning.

Marangoni dryer

A drying technique that uses isopropyl alcohol (IPA) and the surface tension of DI water to dry wafers.

mask

A thin sheet of metal foil perforated with holes, used to protect specific areas of the product during a deposition process.

Also see photomask; etching.

material requirements planning (MRP)

A computerized planning system used by manufacturing for production control. MRP is one part of a larger manufacturing resource planning system, manufacturing resource planning II (MRPII).

material safety data sheet (MSDS)
The primary written means of conveying information concerning chemical hazards. Includes information on the properties and hazards of the chemical.

Max Metering Pump Count
The pump counter tracks the pump's operational cycles. Trebor pumps use a pressure sensor, mounted on the pump's exhaust side, to sense the movement of the pump bellows. Iwaki pumps use a proximity sensor to sense the pump's strokes.

MCS
See megasonic cleaning system.

megahertz (MHz)
A unit of frequency equal to 1,000,000 hertz.

megasonic cleaning system (MCS)
The cleaning system inside a process tank that uses the action of megasonic waves to force particles off wafers (or other substrates). Also known as megasonics.

The system cleans by vibrating a transducer crystal at its resonant frequency, which generates waves of sonic energy through a liquid solution. The high-energy waves repeatedly strike both sides of the wafers immersed in the cleaning solution. Liquid diffuses between particle and device and acts as a wedge, lifting particles and suspending them in the cleaning solution.

The system cleans with no moving parts. The quartz lens disperses high-frequency energy through the cleaning solution and across the face of the wafers, making chain drive, stepper motor, and other transport systems unnecessary.

megasonics
See megasonic cleaning system.

megohm (W)
A unit of resistance equal to 1,000,000 ohms.

menu
Options displayed on a screen.

MEO
Manufacturing Engineering Order. See document control.

metallic element
An element that is distinguished from a nonmetallic one by its iridescent and reflective properties, malleability, ability to conduct electricity, and ability to form positive ions.

metallurgical fabrication
The fabrication of semiconductors, employing the science and technology of metals as conductors.

metering
See metering pump.

metering pump
A metering pump is used in the wet system for two purposes: (1) to release a specified amount of chemical into a chemical bath during initial fill (*metering*), and (2) to add a specified amount of chemical to the chemical bath to maintain chemical concentration during processing (*spiking*).

mho (u)
A unit of electrical conductance. Reciprocal of ohm.

MHz
See megahertz.

micron (μ)

Unit of length equal to one millionth of a meter (10^{-6} m), one thousandth of a millimeter, and 0.000039 inch. Used for measuring size of particles. Also known as *micrometer* (μm).

milliampere

A unit of current equal to one-thousandth of an ampere (10^{-3} ampere). Abbreviated mA or milliamp.

mini-environment

An enclosed-system process environment that has controlled temperature, relative humidity, differential pressure, and exhaust flow.

Also see local exhaust system; exhaust alarm and control systems; exhaust flow patterns.

MIS

Management information system.

MK Safe

Make Safe

mm

Millimeter. To convert millimeters to inches, multiply by 0.0394.

MNPT

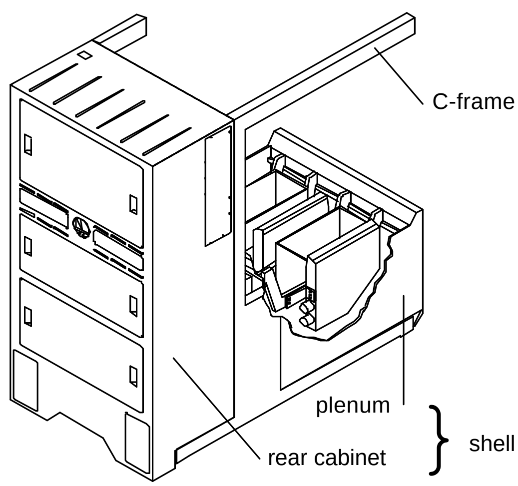
Male national pipe tread.

module

A group of interconnected wet-system devices that perform a process unit-operation (for example, an SRD module spins, rinses, and dries wafers). Several modules are connected to form a complete wet system.

A typical module (see drawing) is composed of a shell (rear cabinet plus plenum), C-frame, and internal equipment associated with the specific module.

Also see process module.



Typical Module

module, front access

See front-access module.

module, process

See process module.

module, rear access	See rear-access module.
monitor wafer	A control wafer used as a starting foundation.
mounting, robot	See robot mounting.
mounting, wet-system	See wet-system mounting.
mouse	Used for the *optional* screen editor utility, and in the timing diagram in recipe management for VcS wet systems.
MRP	See material requirements planning.
MRPII	See manufacturing resource planning II.
MS	Magnetic switch.
MS Byte	Most Significant Byte
MSDS	See material safety data sheet.
MTBA	Mean time between assists.
MTBF	Mean time between failures.
MTTR	Mean time to repair.
MV2	Metering Valve number 2
MWS	See manual wet system.
MWSF	Manual wet system, front access.
MWSR	Manual wet system, rear access.

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N

N_2

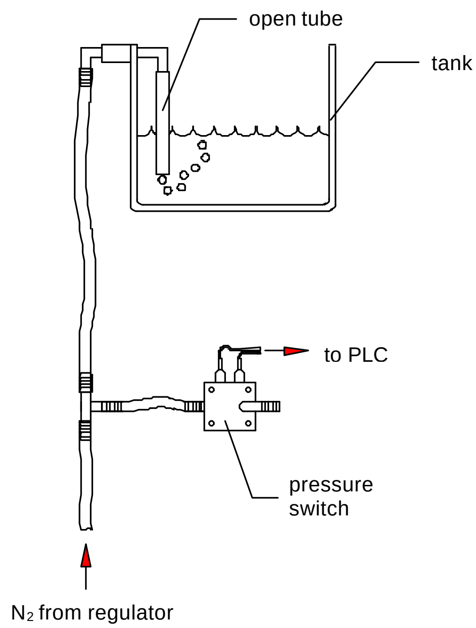
See nitrogen gas.

N_2 bubbler level sensors

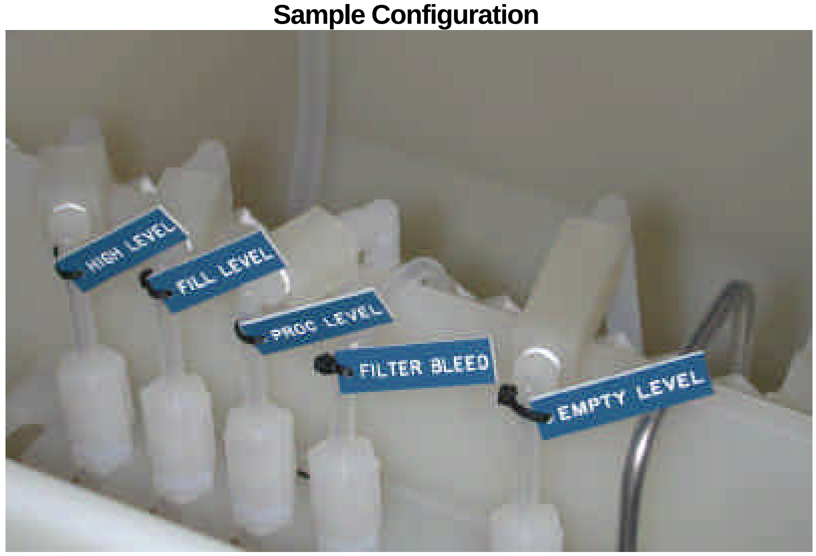
The device that senses liquid level in a tank (see drawing).

The N_2 bubbler senses liquid level in the following manner: The pressure switch monitors the pressure differential (ΔP) between the hydrostatic fluid pressure in the tank and the ambient atmospheric pressure in the plenum.

When fluid covers the open end of the tube, the switch senses backpressure of the fluid and closes. If the fluid is not present, there is no backpressure and the switch opens.



N_2 Bubbler Level Sensing
Sample Configuration



Available Level Sensors and Functions

EMPTY LEVEL

- Used in PLC logic *drain sequence*
- Used for hardware interlock for external *heater/chiller*
- Needed for every type of chemical tank (not QDR's or VcS tanks)

LOW LEVEL

- Used for hardware interlock for *Megasonic* transducer (chemical or QDR tanks)
- Used for hardware interlock for quartz tank *blanket heater*

PROCESS LEVEL

- Minimal level for *wafer coverage*
- Used for software interlock for recirc pump
- Used for software interlock for in-line heater (including external heater/chiller); in-line heater hardware interlock is capacitance sensor in recirc fluid path
- Combined with LOW LEVEL in static quartz tank to cover wafers and blanket heater

FILL LEVEL

- Used with *bulkfill* in PLC logic prep sequence (also used for manual pour systems)
- Used as *topoff* level (for DI or chemical)

MAX LEVEL

- Used only with *HF concentration* monitoring & control

HIGH LEVEL

- Used as *overfill* level – alarm condition
- Used with every type of chemical tank (not QDR's or VcS tanks)

Level Sensors Baseline Configurations	
Process Tank Type	**Levels Used**
APM with: • Bulkfill • Recirc • Megasonic • 0°C to 100°C • PVDF	**Empty** **Low** **Process** **Fill** **High**
HF with: • Bulkfill • Recirc • Concentration Monitor • 0°C to 100°C • PVDF	**Empty** **Process** **Fill** **Max** **High**
HP or **SPM** with: • Bulkfill • Recirc • High Temperature >100°C • Quartz	**Empty** **Low** **Process** **Fill** **High**
HP or **SPM** with: • Bulkfill • Static • High Temperature >100°C • Quartz	**Empty** **Low** (can serve as Process Level if using only four levels) **Fill** **High**
QDR with: • Megasonic	**Low** **Process**

N_2 Flowmeter Cylindrical-shaped device with a metal bead inside that moves on a graduated scale.

N_2O Nitrous oxide.

NaCl Sodium chloride.

NAK Information has been received but is incorrect.

NAN Nano strip. See chemical process.

nano strip See chemical process.

NaOH Sodium hydroxide.

native oxide Thin oxide layer grown during wafer processing.

native oxide etch (NOE) See chemical process.

NEC National Electrical Code.

nest, product See product nest.

NFPA National Fire Protection Association.

NH_3 Ammonia.

NH_4Cl Ammonium chloride.

NH_4F Ammonium fluoride.

NH_4OH Ammonium hydroxide.

$NH_4S_2O_2$ Ammonium persulfate.

NIOSH National Institute for Occupational Safety and Health.

nitric acid HNO_3.

nitride Compound of metal with nitrogen; formed by passing nitrogen over heated metal. Used in semiconductors to cause hardening or to form insulating layers.

nitride etch Chemical process that removes part of the nitride layer on a wafer. This process uses the same chemistries as nitride strip, but for shorter process times. See chemical process.

nitride strip Chemical process that removes all of the nitride layer on a wafer. See chemical process.

Also see temperature control for nitride-strip processes.

nitrogen gas (N_2) A very clean inert gas.

nitrous oxide N_2O.

NOE Native oxide etch. See chemical process.

NOSPR (SRD) Number of steps per recipe.

NPP Natural polypropylene.

NVR Nonvolatile residue.

O

O_2 Oxygen.

O_3 Ozone.

obstruction sensor (OS) A sensor on the robot arm that detects an object in the robot's path (when the object touches the arm), and stops the robot. The obstruction sensor, which is wired in series with the robot E-STOP circuit, helps assure that robot operation is safe.

Types of obstruction sensors include:

- *vertical obstruction sensor (VOS)*, which detects objects in the robot's vertical path,
- *horizontal obstruction sensor (HOS)*, which detects objects in the robot's horizontal path, and
- *obstruction sensor (OS)*, which detects objects in both the vertical and horizontal path of the robot.

OEM Original Equipment Manufacturer.

OFA Oil Free Air.

OFR Overflow rinse. See chemical process.

ohm (W) A unit of electrical resistance.

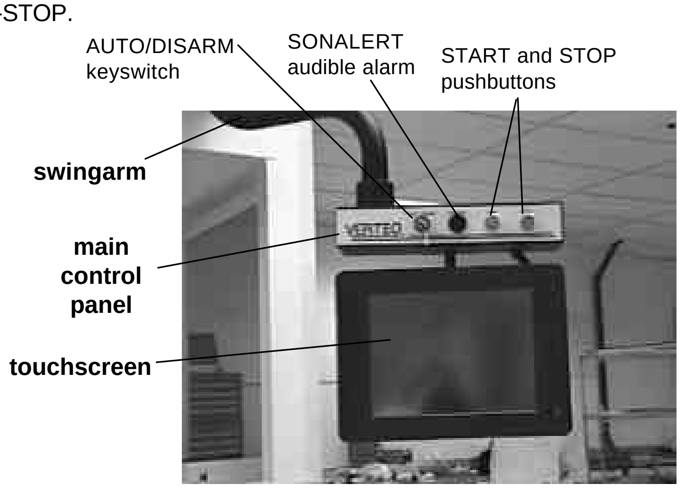
OIA See operator interface assembly.

operator controls See operator interface assembly.

Operator interface assembly (OIA) The main operator controls on a typical wet system are located on the operator interface assembly.

The operator interface assembly usually includes the *main control panel* (with keyswitch, audible alarm, and start and stop pushbuttons), and the *touchscreen* (see photo).

Also see interface; other operator controls: EMO, robot joystick, keyboard (external), mouse, and Robot E-STOP.



operator interface panel (OIP)
See operator interface assembly (OIA).

operator interface touchscreen
See touchscreen (preferred term).

opto-isolator
A solid-state relay with no moving parts; a light-emitting diode focused at the base of the photo transistor to control current flow.

organics
Chemical compounds based on carbon rings or chains and containing hydrogen.

organics strip
A chemical process used to strip organics.

OR-OSHA
Oregon Occupational Safety and Health Administration.

OS
See obstruction sensor.

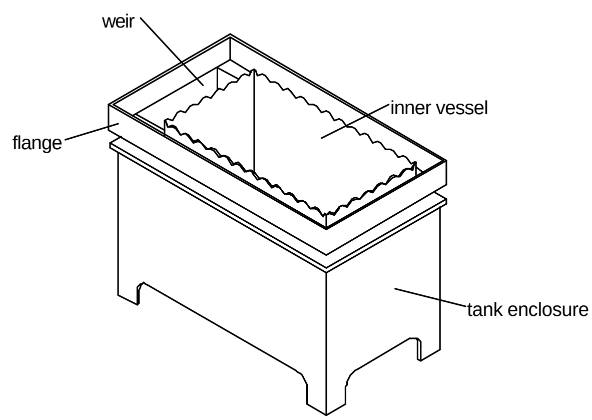
oscilloscope
Electronic test device used to display voltage vs. time, signals, or waveforms for identification and accuracy

OSHA
U.S. Occupational Safety and Health Administration.

OT
Overtemperature controller.

overflow
Liquid that flows over the top of a tank.

- In a chemical tank, the liquid flows over the top of the inner vessel into the weir (see drawing). *Input overflow* occurs when a loaded cassette is placed in the tank. *Recirculation overflow* occurs during normal recirculation.
- In a rinse tank, the liquid flows over the top of the tank directly into the plenum. The durations of pre-, process-, and post-overflow for a rinse tank are set in the recipe configuration.
- Rinse tanks can be equipped with high-and low-flow rates. High flow is used in filling the tank; low flow is used to conserve DI water after the tank is filled.



Chemical Tank (showing weir)

overflow rinse (OFR)

DI water is added to the tank at the bottom in a single-pass rinse until it runs over the edge of the tank and into the plenum. No megasonics and no quick dumps are involved.

Also see overflow; chemical process.

overtravel switch(es)

Switches located on the far ends of each robot axis rail. When contacted by the robot, the robot stops moving.

oxidation

A reaction with oxygen that forms an oxide, such as nitrous oxide (N_2O), carbon dioxide (CO_2), or silicon dioxide (SiO_2).

oxide

Binary compound of oxygen.

oxide etch

See etching; chemical process.

oxide layer

A layer of oxide on or in the wafer.

oxygen

O_2.

ozone

O_3.

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P

PAN Phosphoric acetic nitric etch. See chemical process.

parked

1. A device is powered but is not ready for use, and all physical movement is stopped (for example, a tank is powered but is not prepped, and no wafers are currently being processed in the tank).
2. Robot is raised to the carry height and is not moving.

particle An unwanted impurity that contaminates the wafer's surface.

particle count The number of particles in a particular location in the cleanroom or on the wafer.

Also see cleanroom classification.

PCB Printed circuit board.

PEC Process enhanced cassette.

Also see cassette.

PEEK Polyetheretherketone.

PEL Permissible exposure limit.

perfluoroalkoxy (PFA) See "Teflon."

personal protective equipment (PPE) Equipment such as goggles, gloves, and respirators that are necessary to protect employees from hazards.

PFA Perfluoroalkoxy. See "Teflon."

pH The scale (0-14) used to measure acidity and alkalinity. (<7 = acidity; 7 = neutral; >7 = alkalinity)

phos Hot phosphoric acid. See chemical process.

phosphoric acetic nitric etch (PAN) See chemical process.

phosphoric acid See H_3PO_4.

photo-lithography The process in which a thin layer of photographic chemicals (photoresist) is applied to the surface of a semiconductor substrate. A pattern is optically reproduced on film and transferred from the film to the wafer, later becoming the physical circuits.

photomask

A film or glass negative or positive used as a template for projecting an image onto a substrate. Light patterns projected through this mask onto the substrate produce subtle changes which, when exposed to specific chemicals, corrode and are washed away, leaving layers of metal that form electronic circuits.

photoprocess

A process that uses light to cause a chemical reaction.

photoresist

The light-sensitive, organic material deposited on the wafer surface during photoprocessing, certain portions of which may be dissolved after exposure to light to form a patterned mask.

PID parameter setup

Proportional-integral-derivative (PID) control systems. Also see scaling factors.

NOTE
Conventional PID control systems include **p**roportional, **i**ntegral, and **d**erivative functions. Verteq uses a modified PID control system, which includes *only* the proportional and integral functions. However, Verteq documentation uses the full acronym, PID, because it is commonly recognized in manufacturing industries.

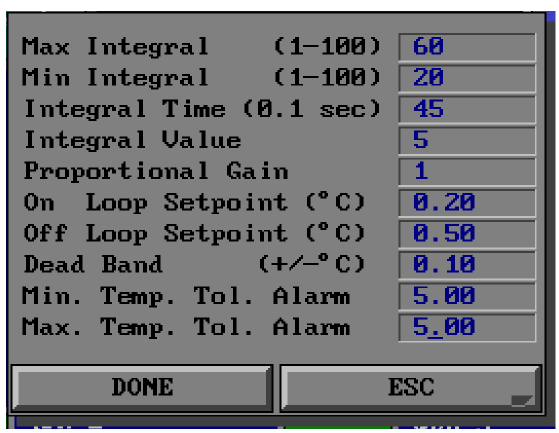
The temperature in process tanks is controlled by a proportional-integral loop within the PLC program.

The PID Parameter screen defines the default values for controlling process temperatures. The values entered are used by the PID in a mathematical formula that determines an **output value**. The output value is a combination of:

- error (proportional value of the actual temperature relative to the process-temperature setpoint) and
- integral (accumulation of the error over time).

This output value, derived from the mathematical formula is used in one of two ways:

- **Standard** PID loop
- **Inverse** PID loop



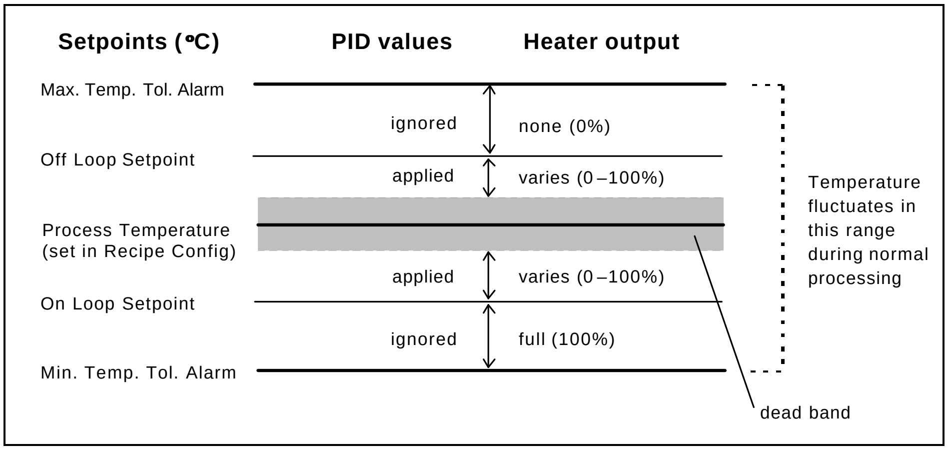
Standard PID Loop

The output value, through the PLC program, is converted to a control signal which drives the heater from 0 to 100% capacity, depending upon how close the current temperature is to the process-temperature setpoint. The process temperature (set in recipe configuration) is monitored and reported to the PID in real time, from a scaled input.

Inverse PID Loop

In this approach, used in nitride-etch processes, the heater is fully off when the tank content temperature is at or above the recipe setpoint. When the temperature of tank contents drops below the process setpoint, the heater comes on at 100%. The output value is subtracted from the whole integer **1** (1 - (output value) = the inverse output value). This inverse value, through the PLC program, is converted to a control signal which drives the DI inject devices to maintain the process temperature. The process temperature is monitored and reported to the PID in real time, from a scaled input. (Also see *temperature control for static-bath nitride-strip processes.*)

The remaining PID discussion is true for both PID loop versions.



PID-loop adjustments minimize over- and under heating to help stabilize tank temperature as rapidly as possible.

PID Parameters are described below:

Max Integral/Min Integral is used in calculations to determine the heater's reaction speed to PID outputs. The default values shown are usually adequate for tank heating and should be changed only by qualified personnel with an understanding of PID operation (see "Tips" below).

Integral Time is the time period at which the PID makes temperature corrections. When the current temperature is within the deadband range, no significant corrections take place. In the setup screen example shown above, the PID will make temperature corrections every 4.5 seconds. (Note that the Integral Time shown on the PID Setup screen is 45, which is equivalent to 4.5 seconds. To convert integral time into seconds, multiply the value for Integral Time as shown on the PID Setup screen by 0.1; in this example, 45 x 0.1 = 4.5 seconds).

Integral Value is the amount the PID output value is adjusted at each temperature correction when it is measuring temperatures between the On Loop and Off Loop setpoints (excluding the dead band).

Proportional Gain is a sensitivity factor used in the PID calculation. The Proportional Gain value is set at the factory and fine-tuned during on-site installation. It should not require adjustment unless the heater is replaced or the system is modified.

On Loop Setpoint. Below this temperature, the heater comes on at 100% output and the PID values are ignored.

Off Loop Setpoint. Above this temperature, the heater's output is 0% and the PID values are ignored.

NOTE
Between On Loop Setpoint and Off Loop Setpoint, the PID values are used to proportionally adjust the heater output, or for the Inverse PID loop, DI water inject.

Dead Band is the range of plus and minus values around the process temperature in which the PID makes no changes to the heater (or DI water inject) output.

Rcp. Tolerance (recipe tolerance). This parameter is used only on PID setups for staging tanks. This temperature of chemical in a staging tank must be at the chemical tank's process temperature, plus or minus the Rcp.Tolerance value (±°C), before it can be released to the process tank.

NOTE
The Min./Max. Temp. Tol. Alarm must be greater than the Temperature Tolerance parameters set in recipe management. For example, if the Temperature Tolerance is set at 5°C, and the PID Min./Max. Temp. Tol. Alarm is set at <5°C, a temperature error can occur even when the temperature of tank contents is within the recipe's allowable range.

Min./Max. Temp. Tol. Alarm is the allowable range in which the temperature can fluctuate without causing an alarm. In the example shown above, an error is generated if the temperature is 5°C above or below the process temperature. This function becomes operable *after* the process temperature is initially reached, to prevent unnecessary errors during startup.

Typical PID settings

These values are typically set at the factory before on-site installation adjustments.

Parameter	DHF Tank	HP Tanks	APM Tank
Max Integral (1-100)	80	80	80
Min Integral (1-100)	20	20	20
Integral Time (0.1 sec)	150	250	250
Integral Value	2	10	10
Proportional Gain	100	2	2
On Loop Setpoint (C)	0.30	2.50	2.50
Off Loop Setpoint (C)	0.20	0.50	0.50
Dead Band (C)	0.20	0.50	0.50
Min. Temp. Tol. Alarm	0.50	3.00	3.00
Max. Temp. Tol. Alarm	0.50	3.00	3.00

Tips for Setting PID Parameters

The typical values should be adequate for initial chemical testing. Proportional Gain and Integral Time are usually the only values that need adjustment. In general, when configuring process temperature, measure the actual temperature over time to understand the physical limitations of the environment. If adjustments are needed, change only one parameter at a time. Slight changes may have large effects over long periods of time. It is a bad idea to change too many parameters in a short time span.

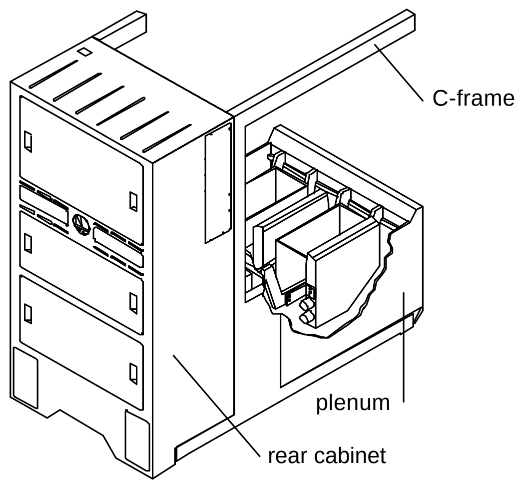
Proportional Gain: A value of one (1) is usually adequate for all tanks. To increase PID reaction time, increase this value by one whole number at a time and observe the response. A slow-acting PID works best with low- to high-temperature recipes.

Integral Time: Values between 45 and 60 (4.5 to 6 seconds) cause slow integral control. Adjustments to Integral Time are the best way to narrow the temperature's oscillation around the process temperature.

piranha strip
See chemical process.

PLC
Programmable logic controller. Controls individual devices (valves, pumps, process monitoring equipment) through input/output signals; provides timing and counting for process controls; and provides real-time information to the cell controller.

plenum
The area of the module around and beneath the process tanks or process plumbing. Sometimes refers to the floor of the module. See drawing.



plenum float
A level indicator inside the plenum that detects liquid height or volume.

PM
Preventive maintenance.

PMs
Particle monitors.

polypropylene
A hard, resinous material that resists moisture, oils, and solvents and can withstand temperatures up to 170°C. Transport cassettes and the wet-system shell are typically made of polypropylene.

polytetrafluoroethylene
PTFE.

Also see "Teflon."

port
An opening, such as the QDR drain port.

postmetallic strip A chemical process that removes excess metals after a metal-deposition process.

potassium hydroxide KOH.

POU, POUG Point of use, point-of-use generator.

pounds per square inch absolute (psia) Pressure measurement that utilizes a complete vacuum as a reference, or zero point.

pounds per square inch differential (psid) The difference in pressure between two points in a fluid-flow system, measured in pounds per square inch.

pounds per square inch gauge (psig) Pressure measurement that utilizes ambient (surrounding) pressure as a reference, or zero point. Ambient pressure is 14.7 psia, which would be 0 psig.

power tune Function performed in Megasonic applications where algorithmic power table is written in addresses of battery-backed RAM.

PP Peak to peak

ppb Parts per billion.

PPE See personal protective equipment.

PPID Recipe number

ppm Parts per million.

ppt Parts per trillion.

prediffusion clean A cleaning process that cleans the wafers before the diffusion process is performed. Typical cleaning agents are SPM, DHF, APM, and HPM.

PREP Prepare. A selection on the touchscreen that automatically prepares tanks (fill level, temperature, and related process conditions) and other devices for processing wafer lots.

pressure, differential See differential pressure.

process, processing

1. (noun) In semiconductor manufacturing, any series of operations used to strip, etch, clean, rinse, and dry the product (typically silicon wafers) by moving it through chemical baths, DI-water rinses, and drying cycles.
2. (verb) To perform the series of operations listed in no. 1.

Also see wet processing; chemical process; rinse process.

process area See cleanroom, bay-and-chase.

process bath See chemical bath (preferred term).

process cassette See cassette.

process chemical The chemical used during chemical processing. Some typical process chemicals include hydrofluoric acid (HF), hydrochloric acid (HCl), and nitric acid (HNO3).

Also see rinse chemical.

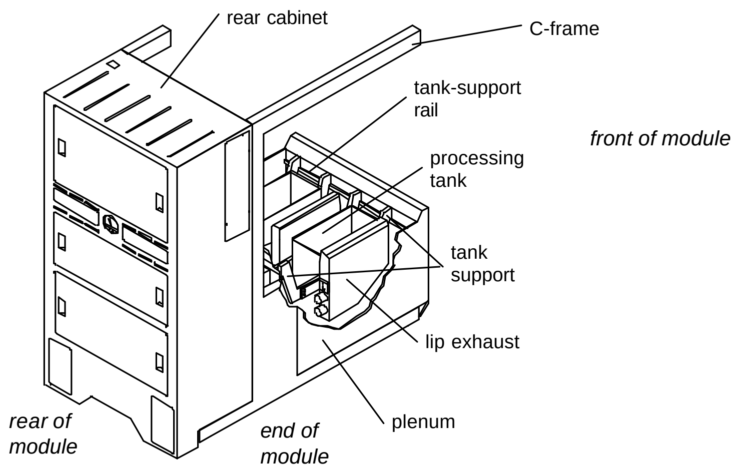
process enclosure The enclosure around the process modules. This enclosure isolates the process environment from the operators and core (gray areas) of the cleanroom.

process environment The environment inside the wet system where the wafers are processed (stripped, etched, cleaned, rinsed, and dried).

Also see product environment.

process liquid See chemical.

process module A module in which the product is chemically processed and rinsed.



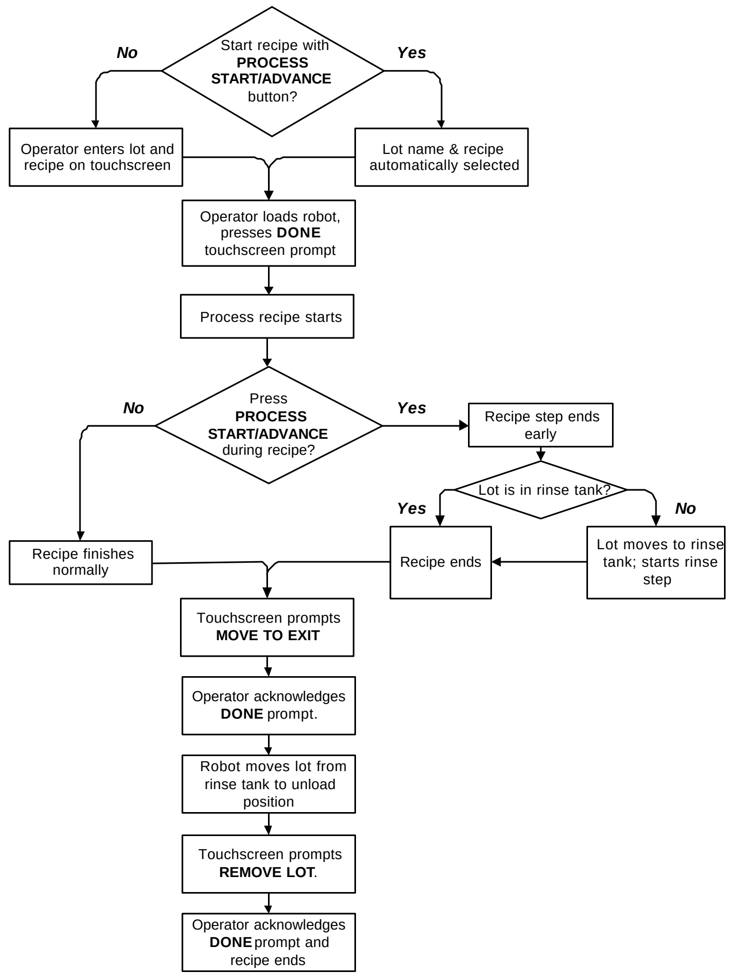
process start/advance pushbutton Optional pushbutton used on some semi-automated system. When pushed during an automated recipe, the step in progress finishes and the recipe advances to the next scheduled step. See operational sequences below for details.

Operational Sequences

Detailed flow charts and explanations of operational sequences for various wet system configurations. Specific operational sequences and associated control features are discussed below.

- Systems with PROCESS START/ADVANCE Button
- Systems without PROCESS START/ADVANCE Button
- Systems with In-Process Wafer View Capability

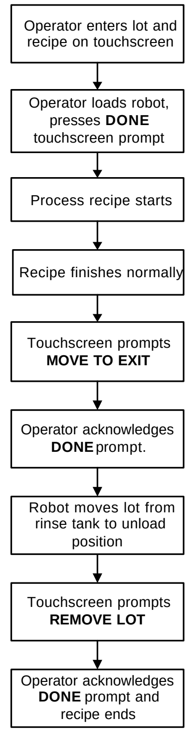
Semi-automated Wet Systems *with* PROCESS START/ADVANCE Button Operational Sequence



Semi-automated Wet Systems *with* (PROCESS START/ADVANCE Button) Control Features

Control Feature	Function
Touchscreen **DONE** prompt	Must be acknowledged to proceed to the next step. Operator may: • press the manual go button or • select DONE on the touchscreen.
PROCESS START/ADVANCE button	• Starts a recipe (automatically names lot and selects last recipe run). • Interrupts a step in progress and skips to the next step. • Acknowledges a touchscreen **DONE** prompt.
Indicator light on control assembly	• Flashes when **DONE** is displayed on touchscreen. • Steady illumination during a step in progress.
NOTE: Systems may be configured to end a recipe by acknowledging the **MOVE TO EXIT** prompt, bypassing the last **REMOVE LOT** prompt.	

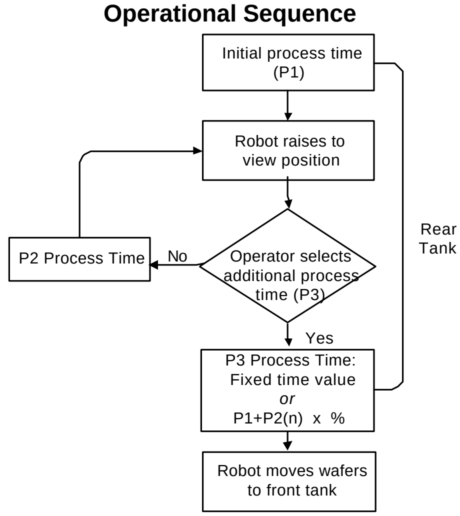
Semi-automated Wet Systems *without* PROCESS START/ADVANCE Button Operational Sequence



Semi-automated Wet Systems *without* PROCESS START/ADVANCE Button

Control Feature	Function
Touchscreen **DONE** prompt	Must be acknowledged to proceed to the next step.
Indicator light on control assembly	• Flashes when **DONE** is displayed on touchscreen. • Steady illumination during a step in progress.
NOTE: Systems may be configured to end a recipe by acknowledging the **MOVE TO EXIT** prompt, bypassing the last **REMOVE LOT** prompt.	

Semi-automated Wet Systems with In-Process Wafer View Capability Operational Sequence



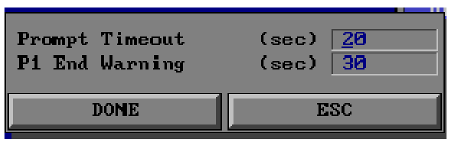
Operational Sequence (In-Process Wafer View)

1. Robot agitates wafers (moves vertically in and out) in rear tank for length of time set in P1.
2. Before P1 times out, operator is alerted that P1 is about to expire.
3. When P1 times out, robot raises above rear tank and pauses for operator to visually inspect wafers. The next step is operator-dependent (see following table).

If operator selects P3:	If operator *does not* select P3 within preset time (Prompt Timeout):
• robot moves back into rear tank for P3 • when P3 finishes, robot moves wafers into front tank	• robot moves back into rear tank for time set in P2 • when P2 finishes, robot raises above rear tank and pauses for visual inspection of wafers • this sequence repeats until operator selects P3

Configurable Recipe Timing Parameters

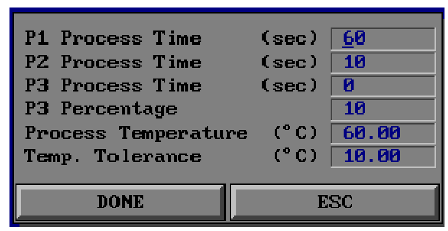
Tank Configuration Menu



Prompt Timeout: Length of time robot pauses above tank 1 for wafer inspection. If operator does not select P3, P2 occurs after this timeout. This automatic P2 selection repeats until the operator selects P3.

P1 End Warning: Time when a notification alerts operator that PI is about to finish.

Recipe Configuration Menu



P1 Process Time: Process time in tank 1.

P2 Process Time: Additional process time in tank 1.

P3 Process Time: Fixed process time. This supersedes P3 Percentage when any value other than zero is entered here. If both this item and P3 Percentage are set at zero, P3 process time defaults to 1 second.

P3 Percentage: Sets P3 process time as a function of total tank 1 process time. The value entered here sets a % multiplier:

$P3 = P1+P2_{(n)}$ %

---

process unit-operation

Physical transformation of the material (for example, etch or dry).

product

1. The substance (typically wafers) that is processed in the wet system.
2. The merchandise (such as wet systems and SRDs) Verteq sells to its customers.

product environment

The environment immediately surrounding the product (typically wafers).

Also see process environment.

product lot

The group of wafers (or other product) inside a cassette that are processed in the wet system using a particular recipe. Also known as *lot*; *wafer lot*.

product nest

Area inside a tank where the cassette containing the product is placed. The nest holds the cassette to keep it from moving.

production summary

Wafer production summaries of log files can be viewed on the OIP and/or copied to a DOS disk and printed out using a standard word processor. Wet system **entry** and **exit** times of wafer lots and **alarms** during a 24-hour period are recorded by date and stored with ***.prd*** filename extensions in log files. See the Files section of the operations manual for a sample of the summary and how to view or print it out.

proportional-integral-derivative setup

See PID parameter setup.

psi

Pounds per square inch.

psia

See pounds per square inch absolute.

psid

See pounds per square inch differential.

psig

See pounds per square inch gauge.

PSW

Pressure switch

PTFE

Polytetrafluoroethylene.

Also see "Teflon."

pump counters

Pump counters track operational cycles of recirculation and staging tank pumps. Trebor pumps use a pressure sensor, mounted on the pump's exhaust side, to sense the movement of the pump bellows. Iwaki pumps use a proximity sensor to sense pump strokes. In both cases, a **Pump cycle count exceeded -- service required.** message is displayed on the touchscreen when the pump has operated for the configured number of cycles. This event may be configured as a Runout alarm, in which case the wet system will finish the lot(s) in process, but new lots cannot be entered until the alarm is cleared.

Pump cycles are shown in real time on the tank control screen. As the pump operates, the displayed number increments. All pump counters are set in tank configuration.

Pump counters are reset to zero by selecting **RESET** on the tank control screen. (It is also necessary to select **CANCEL** if this message is configured as an alarm.)

purge

purge3

A preprogrammed procedure (see *macro command buttons*) that drains and flushes a chemical tank with recirculating DI water in order to remove traces of chemical and contaminants from the tank and any associated recirculation system. Chemical tanks are purged before performing maintenance tasks to protect personnel from exposure to any residual chemical.

A tank will have one of two purge routines: PURGE or PURGE3. Their operational sequences differ according to their plumbing hardware. Both can use cold, ambient, or heated DI water. View the tank's control screen to find out which type of purge routine is used. The PURGE macro command button indicates the tank is using the standard purge routine for standard plumbing hardware. The PURGE3 button indicates the tank is using the "three-way" valve purge routine for multiple-valve plumbing hardware.

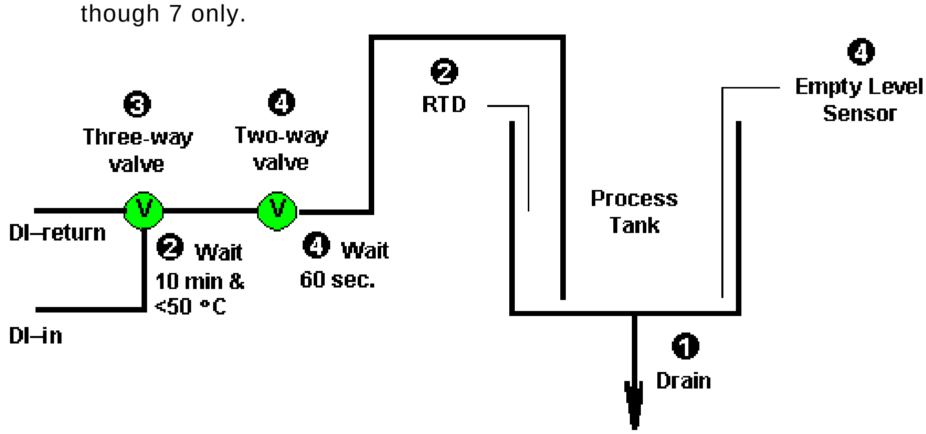
Pressing the PURGE (or PURGE3) macro command button on the tank control screen initiates the purge routine. Each routine is detailed below. The configuration items (such as length of time a pump operates or the number of times the purge routine repeats) of both purge routines are defined in Section 5 of the operations manual.

Standard PURGE routine:

1. Tank drains, if it contains any liquid.
2. Tank refills with DI water to its upper level (fill or process level).
3. Recirculation pump operates for a configurable length of time (see Section 5 for the *Purge Time* configuration item).
4. Tank drains.
5. Standard purge routine repeats for a configurable number of times (see Section 5 (AWS and SAWS) or Section 4 (MWS) for the *Purge Cycles* configuration item).

Three-way PURGE3 routine (see figure below)**:**

1. Tank drains, if it contains any liquid.
2. The purge3 routine waits for ten (10) minutes and monitors the tank temperature RTD to report a temperature of less than 50°C.
3. When 10 minutes have elapsed and the tank temperature reported is less than 50°C, a closed three-way valve opens and delivers DI water to a closed two-way valve.
4. The purge3 routine waits an additional 60 seconds, and:
   - At the end of this 60 second period, the two-way valve opens and delivers DI water to the tank.
   - During the 60 second period, if the Empty level sensor in the tank is triggered an alarm is sent and it is assumed that the two-way valve is leaking. Regardless of alarm status, the purge3 routine continues.
5. Tank refills with DI water to its upper level (fill or process level).
6. Recirculation pump operates for a configurable length of time (see Section 5 for the *Purge Time* configuration item).
7. Tank drains.
8. Three-way purge routine repeats for a configurable number of times (see Section 5 (AWS and SAWS) or Section 4 (MWS) for the *Purge Cycles* configuration item), but in the remaining purge cycles repeats steps 5 though 7 only.



PVDF

Polyvinyl difluoride or polyvinylidine fluoride.

Q

QA See quality assurance.

QC See quality control.

QD Quick dump. See quick dump rinse.

QDR Quick dump rinse. See chemical process.

QDR tank Tank that uses DI water to rinse wafers after treatment with chemicals. A large drain port in the bottom of the tank quickly opens to dump tank contents. DI water is sprayed on wafer lots during dumps.

QGS See quality gain share.

QNX The UNIX-based operating system used on Verteq wet-system computers. This is a multitasking, micro-kernel operating system, designed specifically for message-passing functions, with its own complete command structure.

QTF See quality task force.

qualification Procedure to accept a wet-system product.

quality Product and service performance that result in customer satisfaction.

quality assurance (QA) A planned and systematic pattern of all actions necessary to provide adequate confidence that a product will conform to established requirements.

quality control (QC) A management function that includes estimating overall quality of the product and determining any changes needed to achieve or maintain the required level of quality.

quality gain share (QGS) A program established by Verteq in 1991 that embraces various Total Quality Management (TQM) principles. The program is continually changing and is refined as a result of employee involvement and empowerment. Enables Verteq to provide its customers with superior process solutions, products, and services. Verteq employees: For complete details, obtain QGS packet from Human Resources.

quality task force (QTF) Various cross-functional committees established by QGS that concentrate on improving areas such as on-time shipments, supplier quality, and safety.

quartz lens Disperses high frequency energy through the cleaning solution.

queue The particular order in which cassettes are lined up for processing.

queue deck The platform inside the wet system where cassettes are placed in a particular order while awaiting processing, and where cassettes are placed after processing.

quick dump rinse (QDR) A rinse process in which a large drain port in the bottom of the tank quickly opens to dump tank contents. Also see QDR tank; chemical process.

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R

RAM

See random-access memory.

random-access memory (RAM)

Computer memory that can be read from and written to. RAM is the main internal storage available to the user for programs and data; RAM files may be accessed in any desired order.

RCA1

See chemical process

RCA2

See chemical process

RCD

Rinse Clean Dryer. A Vendor Supplied device. This is a process tank in which the wafers are rinsed and dried. The tank is a dual-contained vessel with an integrated dump-drain valve. Included in the RCD system is an anti-static generator, liquid level and cassette proximity sensors. A lid is positioned on top. Both the IPA and N_2 gas injector nozzles are mounted underneath the lid. The lid is closed and opened by a pneumatic operated lever, which is controlled by the wet system’s cell controller, or can be manually opened from the wet system’s RCD tank control screen.

The RCD can use up to a 20-step recipe process. Each step defines one function. The function of each step is selectable, but only one function can be selected per step. The time, in seconds, to run each step is associated with the selected function.

read-only memory (ROM)

Computer memory that can be read from but not written to.

rear-access module

A module in which the plumbing and electrical compartments can only be accessed from the rear.

recipe

A sequence of processing steps with associated parameters (such as time, temperature, and fill level) used to process a product.

recirc

See recirculation.

recirc pump

See recirculation pump.

recirculation and draining of heated tanks

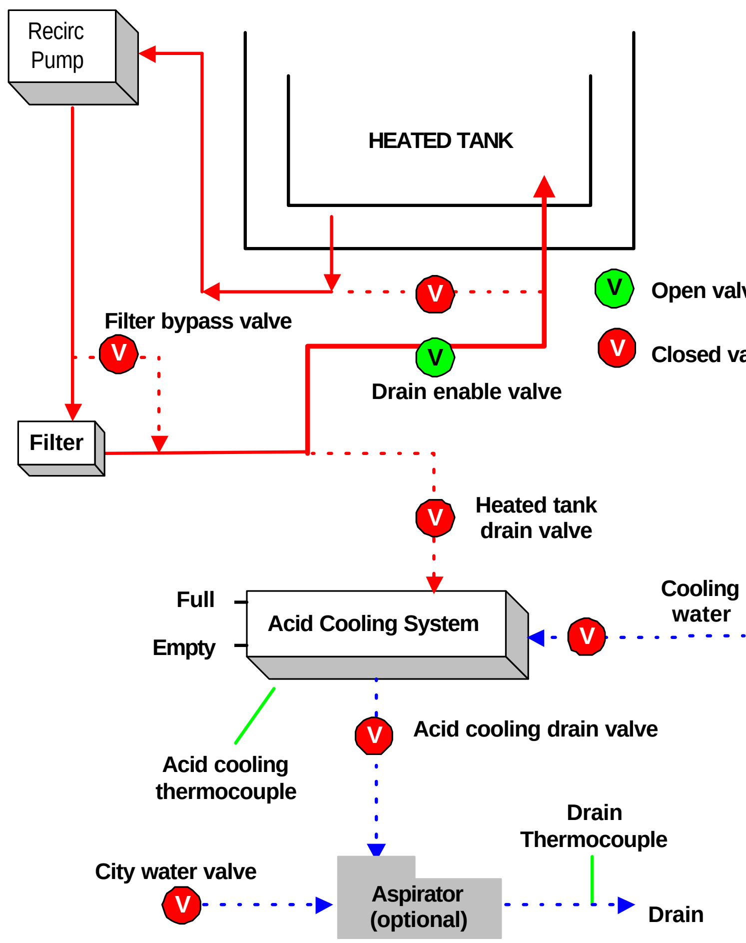
The process of removing contaminants (particles) from fluid by pumping liquid out of the tank's weir, through a filter, and back into the tank.

The process chemical in heated tanks recirculates continuously whenever it reaches the Process Level, regardless of whether a product lot is in the tank. The recirculation loop is shown by the solid lines in drawing to the left.

The filter bypass valve diverts chemical from the filter until it has reached an acceptable temperature. This feature is included if the unheated chemical has a high viscosity (is very thick). Without the bypass, chemical may barely flow through the filter until the heated chemical bath approaches process temperature. This function is configured in tank configuration.

During recirculation, the recirculation pump simultaneously pumps process chemical from the tank's inner vessel and the weir. The recirculation pump starts when the chemical falls below the Process Level. When the Low Level N2 bubbler trips, the drain timer starts.

Also see draining (heated tanks).



recirculation pump

The pump that recirculates liquid in the tank.

Also see recirculation; pump counter.

reclaim

To retrieve DI water normally destined for drainage and filtered and reprocessed. Reduces cost of DI production.

refill

To fill again.

REL

Recommended exposure limit.

remote mode

See local- and remote-mode operation.

Reset

Returns equipment to a specified state after a configured value (e.g. pump, SRD, or WTU cycle) has been reached. Touchscreen buttons on tank and device control screens enable quick resetting.

Also see *pump counters*.

resist

Coating placed on the wafer surface to prevent etching.

resistivity The ability of a material (typically liquid when referring to wet processing) to resist passage of electrical current either through its bulk or on a surface; usually measured in megohms (MΩ).

resistivity probe A device that measures resistivity of DI water for rinsing.

resist strip See chemical process.

Respiratory Protection Program Program to control occupational diseases caused by breathing air contaminated with harmful substances.

RET Return. A command on a touchscreen menu.

reverse osmosis (RO) The second step in the process of purifying water for use in semiconductor manufacturing. RO removes the bulk of ions, organics, bacteria, and particulates by forcing pretreated water under pressure through a semi-permeable membrane.

RF Radio frequency.

rinse, cascade See cascade rinse.

rinse chemical Chemical (typically DI water or IPA) used in the rinse process. Also see process chemical.

rinse process The process used to rinse the product. Typically performed after each chemical process. Also known as rinse, rinsing.

rinse, rinsing Immersing the product in a rinse chemical, typically DI water or IPA, usually after each chemical process. Also known as rinse process. Also see quick dump rinse; overflow rinse.

rinse tank Container in which the product is rinsed. Also see chemical tank.

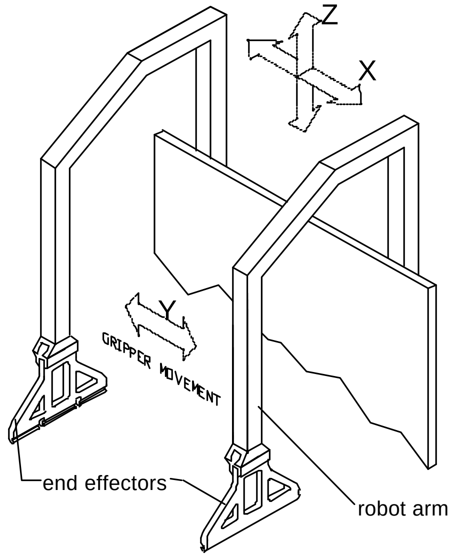
rinse to resistivity Resistivity monitors located on rinse tank exteriors measure the resistivity of overflowing DI water. Impurities increase conductivity. As chemical contaminants in the rinse water decrease, the resistivity rises. When a specified resistivity is reached, the rinse ends and the robot then transfers the product lot to the next position. Rinse to resistivity values are configurable on the touchscreen.

RO See reverse osmosis.

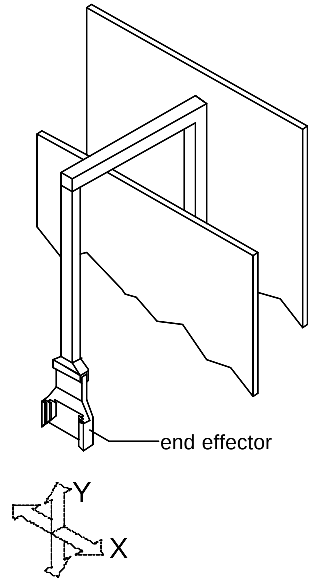
robot axes When referring to Verteq wet systems, axes refers to the directional movement of the robot arms (X, Y, and Z axes).

On two-arm robots, the robot moves horizontally (X axis) and vertically (Z axis), and the arms move in and out to grip and release cassettes (Y axis). The in and out movement of the robot arms is called gripper movement.

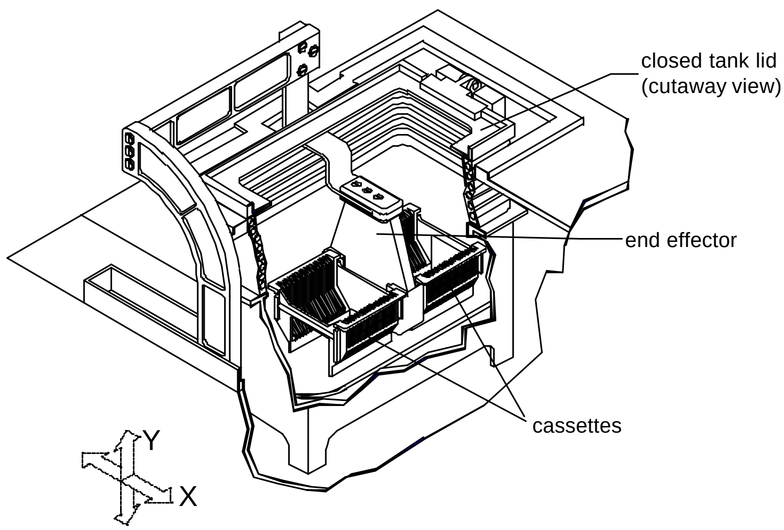
On one-arm robots, the robot moves horizontally (X axis) and vertically (Y axis), and there is no gripper movement. See drawings below.



Two-Arm, Three-Axis Robot
(used in automated wet systems)



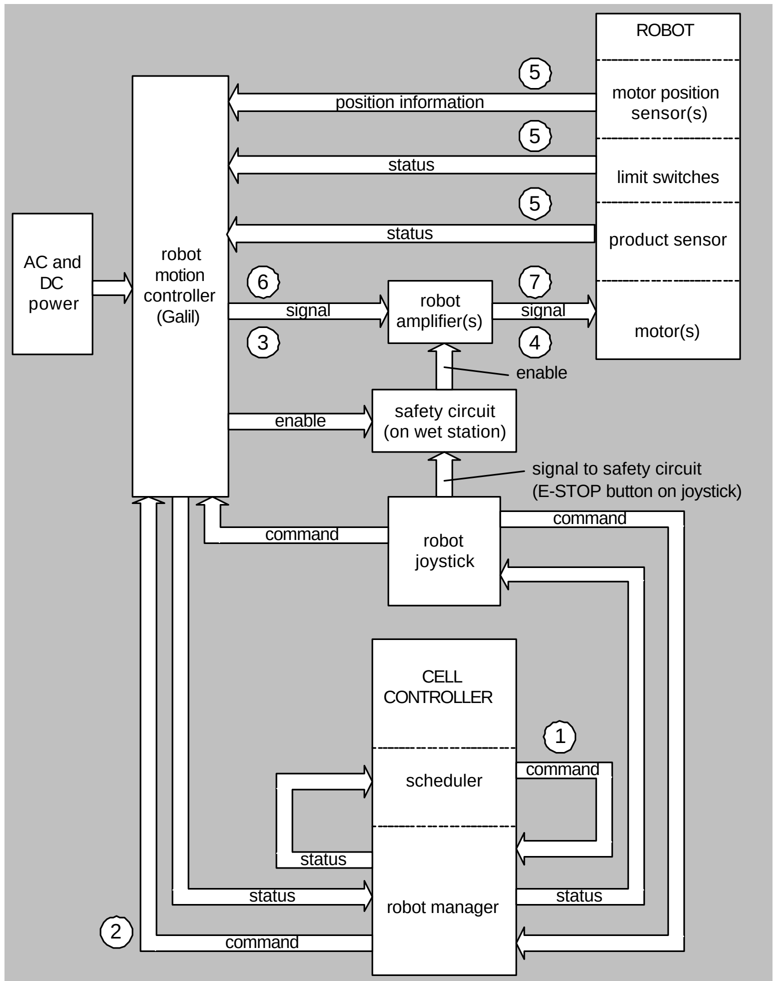
One-Arm, Two-Axis Robot
(used in semi-automated wet systems)



One-Arm, Two-Axis Robot with Lid Adapter
(used in semi-automated wet systems)

robot control system

The software and hardware that controls and monitors the robot (see drawing below). An explanation of the robot control system follows the drawing.



Robot Control System (simplified)

1. Based on a selected recipe, the scheduler (in the cell controller) sends a command to the robot manager (also in the cell controller).
2. The robot manager interprets the command, adds information as necessary, and sends it to the robot motion controller.
3. The motion controller sends a signal to an amplifier.
4. The amplifier sends a signal to the appropriate motor, which moves the robot. (Robots that have more than one axis will have a like number of amplifiers and motors.)
5. As the robot begins to move, the robot's motor-position sensor(s), limit switches, and product sensor send messages regarding the robot's status and position to the motion controller.
6. Using the information obtained in step 5, the motion controller sends a signal to the robot amplifier.
7. The amplifier sends a signal to the appropriate robot motor, which controls the movement of the robot.

During normal wet-system operations, the scheduler controls the robot. During maintenance and homing, the operator controls the robot manually using the robot joystick. The joystick can control the robot either by sending commands to the robot manager or to the motion controller.

The safety circuit, which can be activated by pressing a Robot E-STOP button (on the wet system or joystick) can immediately stop the robot movement by removing the enable signal. Also see robot controller; robot manager software; robot joystick; robot points; home.

robot controller

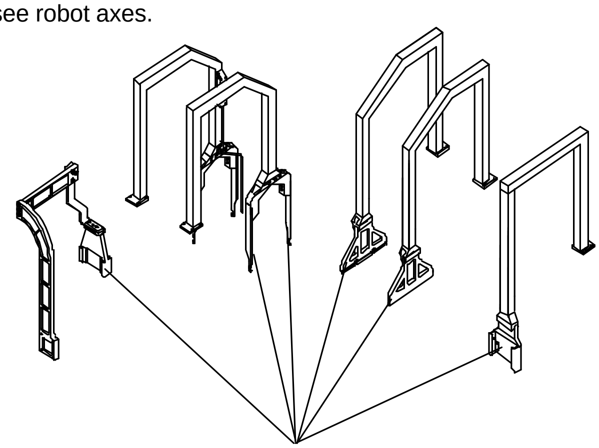
Consists of a multi-axis robot motion controller, amplifier(s), position sensor(s), safety circuit, and motion controller software. The robot controller interacts with the cell controller and robot joystick to activate the robot motors, which move the robot between taught points and at specific speeds and acceleration levels. Also see robot control system.

Robot Emergency Stop

See Robot E-STOP.

robot end effector (EE)

An accessory device attached to the robot-arm mounting plate that enables the robot to perform the intended task; specifically, the device used to pick up and hold the cassette of wafers. The following drawing shows the standard robot end effectors used in Verteq wet systems. Also see robot axes.



Standard End Effectors

Robot E-STOP (emergency stop)

This hard-wired safety circuit removes power from the robot and immediately stops all robot movement. A robot E-STOP can be triggered by one or more of the following:

- A safety shield is opened during automatic processing.
- Any E-STOP pushbutton on the wet system or robot joystick is pushed.
- An obstruction prevents the robot from moving or reaching a destination (in automatic, joystick, or manual modes of operation).
- Robot motor overheats.
- Robot control system reports a position error or internal problem.

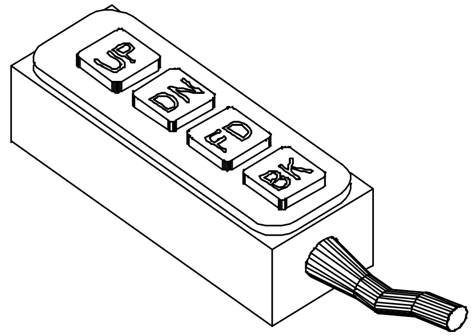
Automatic processing can continue uninterrupted after a robot E-STOP if:

1. the robot is not in motion when the error occurs, and
2. the problem is corrected before the next scheduled move.

robot joystick

A handheld, interactive terminal used to home the robot and teach points, control individual robot motors, recover from errors, and work with the robot during maintenance. The joystick can move the robot to taught positions or to any position within the overtravel limits. When the joystick is enabled, all automatic processing and manual moves from the robot control screen are disabled.

Robot Joystick for Automated Wet Systems



Robot Joystick for VcS and Semi-automated Wet Systems

Joysticks for automated systems include the following:

- point teaching capability
- robot E-STOP pushbutton
- move, home, teach, and gripper-movement controls
- instructions and prompts
- readout of exact robot position in real time
- onscreen help messages

Joysticks for VcS and semi-automated systems control robot movement along the horizontal and vertical axes.

Also see robot control system.

robot manager software

The software in the cell controller that interprets and coordinates commands and status messages to and from the scheduler, the robot joystick, and the robot motion controller. Also see robot control system.

robot mounting

The location of the robot in the wet system in relation to the tanks. Robots may be mounted behind the tanks (rear mounted), in front of the tanks (front mounted), or at the side of a tank (side mounted).

robot points

The exact locations in the wet system where the robot will pick up and put down cassettes containing the product. An operator "teaches" the points to the robot before processing begins. There is one taught point for each tank or device. Also see robot control system.

robot shield

The physical barrier(s) between the process tanks and the robot. Robot shields protect the robot from chemical damage and help keep particulates out of the process environment. One-arm robots typically have a lower robot shield; two-arm robots typically have an upper and a lower robot shield.

ROM

See read-only memory.

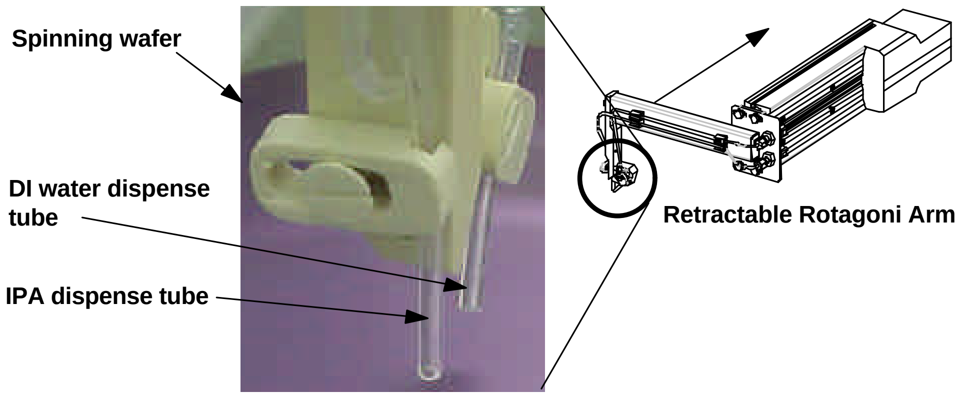
root cause (of an accident)

Weaknesses in the safety and health management system that have allowed the surface causes to exist. The underlying reason for an accident or incident.

Rotagoni Dry

A Goldfinger module drying technique that uses isopropyl alcohol (IPA) and the surface tension of DI water to dry wafers. This application is called the ‘Rotagoni’ dry, where the wafer rotates (*Rota*) as DI water and IPA vapor are applied to the top surface of the wafer as defined by the ‘Marangoni’ (*goni*) application. This results in removing the process liquids without evaporation (which leaves no water marks) and can be applied to patterned hydrophilic and hydrophobic surfaces.

During the final rinse step the wafer spins as the movable Rotagoni arm, holding two dispense tubes, is positioned at the center of the wafer (see figure below). As the arm is retracted from the center of the wafer, the first tube dispenses DI water and the second tube dispenses vaporized N_2 / IPA.



rpm

Revolutions per minute.

RS-232C

An industry standard 25-pin connector for asynchronous serial data communications.

RTD

Resistance temperature device. A device used to measure the temperature of process chemicals based on a change in resistivity proportional to the temperature. A small platinum coil (the resistance temperature detector) is the most common resistive medium used in the device.

Also see temperature controls.

RTP

Rapid thermal processing.

S

safe location

A position for the robot, before HOME is initiated, from which the robot can be moved without hitting an obstruction. The robot end effectors must not be in a tank or holding product.

safe tank

A DI water tank that can hold a cassette in case of a processing error or alarm. In automated wet systems, the control software ensures the availability of a safe tank for every product lot in process.

Also see GoToSafe.

Safety and Health Committee

Employee/manager group that advises management on improvements to the safety program, participates in accident investigations, and inspects the workplace for hazards.

safety shield

Clear-plastic sliding "window" across the front and sometimes the ends of the wet system. Safety shields provide a safety barrier between personnel and the robot and process chemicals. They also maintain cleanliness in the wet system.

Safety shields may be automatic or manual. A hardwired interlock causes a Robot E-STOP when a manual safety shield is opened during wet-system operation. Automatic safety shields may be opened for specified periods of time during wet system operations without causing an E-STOP. Check the operating manual for specific procedures.

Also see keyswitch.

SC1

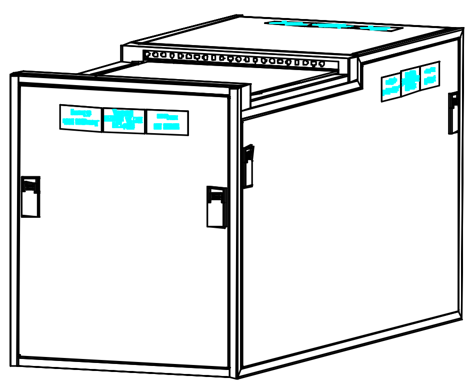
Standard clean type 1. See chemical process.

SC2

Standard clean type 2. See chemical process.

SC200

The SuperClean SC200 Spin Rinser Dryer is a horizontal top-loading programmable rinser/dryer used to clean semiconductor substrates such as wafers, photomasks, and other wafer manufacturing devices up to 8 inches (200mm) in diameter, and is compatible with front and rear 2-axis robotics.



scaling factor

Proportional term used in converting a milliamp (mA) input signal from a monitoring device into a physical measurement (engineering unit). A mA signal is an analog input because it corresponds proportionally to a measurable physical condition: the higher the amperage the device generates, the greater the physical reading.

Tank Temp Scaling and Resist Scaling factors are used in converting milliamp input signals to degrees Celsius and megaohms, respectively. These calculated values are:

1. displayed on the tank control screen for the operator to view
2. recorded in log and lot files
3. input to the heating control PID calculation

The milliamp-to-engineering unit conversion occurs in three major steps:

1. **Analog Signal**. A monitoring device sends a mA signal to the PLC.
2. **Analog-to-Digital Conversion**. The PLC converts the mA signal to a corresponding number based on 32,000 digital units.
3. **Engineering Unit**. The PLC uses the scaling factor (the ratio of the monitored range to the digital units) to calculate temperature, flow, or resistivity.

Calculating a Scaling Factor

NOTE
The scaling factor will not, in itself, ensure accurate monitoring. The monitoring device (thermometer, flowmeter, resistivity monitor) must be calibrated properly according to manufacturer's specifications.

To calculate a scaling factor, divide the PLC's digital unit value (32,000) into the device's maximum input range as follows:

- Find the high number of the device's monitored range and multiply it by the appropriate precision scaling value (see below).
- Dived 32,000 into that number.
- Enter the answer in the touchscreen configuration screen.

Precision Scale

A multiplier is used to calibrate the precision of the measure output. A 100,000 multiplier provides a 0.1 precision; a 100,000,000 multiplier produces a 0.01 precision. The following examples show how this function works.

For temperature if the monitor has a 0-200°C range:

200 x 100,000 / 32,000 = 625

In this example, entering 625 in the configuration screen will yield temperature monitoring with a 0.1 precision.

For resistivity if the monitor has a 0-18 megaohm range:

18 x 100,000,000 / 32,000 = 56,250

In this example, entering 56,250 in the configuration screen will yield resistivity monitoring with a 0.01 precision.

scfh

Standard cubic feet per hour (unit of volumetric flow rate).

scfm

Standard cubic feet per minute (unit of volumetric flow rate).

scheduler

The Verteq scheduler is designed to orchestrate the movement of multiple lots safely through various process scenarios in an efficient fashion. A recipe is a series of process steps at various stations. Some of these steps are at locations where the lot must be removed immediately upon process completion. Others, called safe havens, may hold product beyond the completion of process without harm. Moves from stations where product must be removed on process completion are called critical moves, and moves from safe havens are called safe moves. Transport resources, usually one or more robots, must be allocated for these movements.

Each recipe is broken down into a series of process segments, each of which ends at a safe haven. The segments from various work orders are interleaved for efficiency. Each work order contends for process and transport resources, and begins a process segment when all resources necessary to insure safe movement through the segment have been acquired. All process devices must be available and prepped to recipe parameters before product delivery.

The robot is a critical scheduling element, since it must be prepped(washed and/or dried) differently for different transfers. These preparations are time-consuming, and must be complete before the transfers can be made. The robot is typically a resource for multiple concurrent work orders, more than one of which may have critical moves scheduled, so accurate forecasting of process completion is essential so that these critical transfers can be prepared for and made on time. This may sometimes require the robot to stand idle rather than begin a safe transfer which could not be completed before the critical transfer time arrives.

SCR

Silicon-controlled rectifier. A device that controls electrical power.

scrap wafer

A wafer that has no commercial value, typically caused by a processing error.

SECS

SEMI Equipment Communications Standard. Note: GEM - Host Communications is a separate standard.

SECS-I and SECS-II

SEMI industry-standard protocol used for communications between devices and control computers.

selectivity

The ability of a substance to etch another substance (expressed as a ratio, usually a phosphoric acid etch rate ratio of Si_3N_4:SiO_2 of 100:1).

SEMI

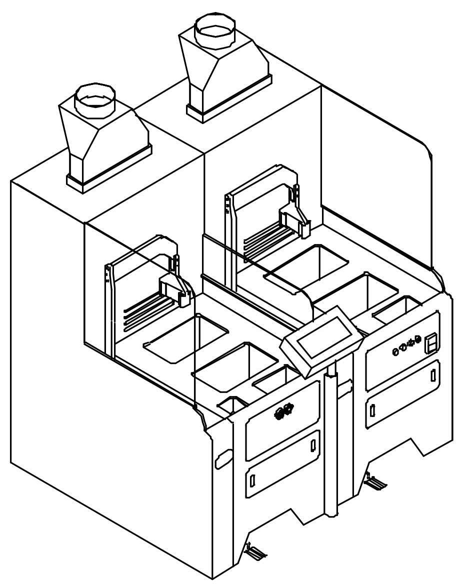
Semiconductor Equipment and Materials International.

semi-automated wet system (SAWS)

Semi-automated wet systems have the following features and capabilities:

- The operator manually loads and unloads cassettes from the robot's end effector, which does not release cassettes during processing.
- A one-arm, two-axis robot transfers cassettes from one tank to another and to the input position.
- The control software schedules cassette transfers, tank prepping, and wafer processing.
- Tanks are arranged from the front to the rear of the wet system (*front-to-rear* arrangement).
- The product lot begins in a dry state and ends in a wet state. The wet system has **no** dry in-dry out capability (the operator removes the cassette from the final rinse tank and transfers it to the spin rinser/dryer (SRD) as the final processing step).
- With exceptions; only one product lot is processed at a time. The robot does not release the cassette until the entire recipe has been completed.

Also see wet system; automated wet system; manual wet system.



semiconductor

A material that has a resistivity between that of metals and insulators. May or may not conduct depending on source.

semiconductor die

A slice of semiconductor material from a rod or ingot.

SEMI International Standards 1995

International standards for the semiconductor industry.

SEMI S2-93

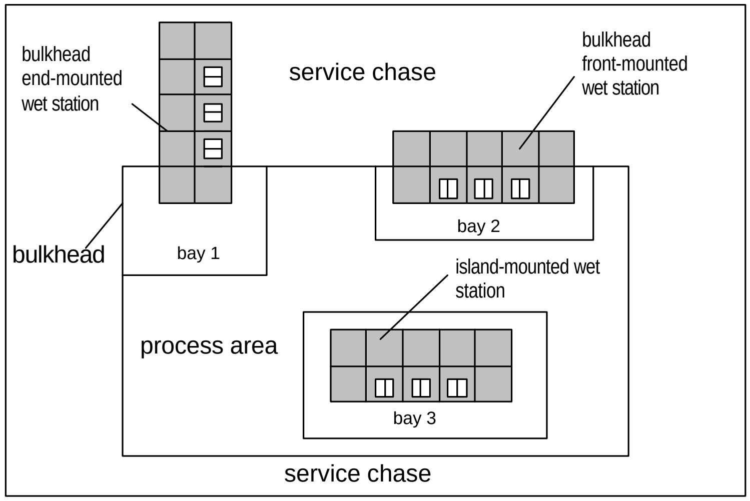
"Safety Guidelines for Semiconductor Manufacturing Equipment," chapter in *SEMI International Standards 1995*.

SEMI S6-93

"Safety Guidelines for Ventilation," chapter in *SEMI International Standards 1995*.

service chase

The area of the cleanroom surrounding (or behind) the process area. This area allows access to the plumbing and electrical cabinets of process equipment for servicing. Also known as *chase*; *core*; *service core*.



service core

See service chase (preferred term).

servo motor

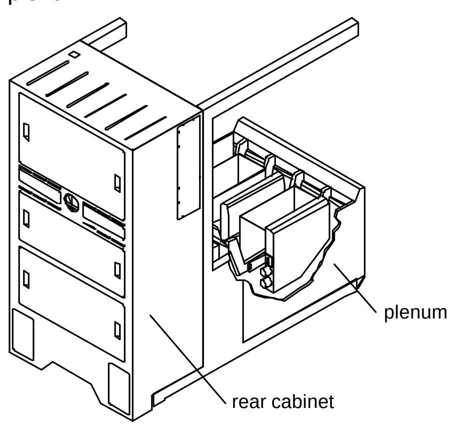
Motor used in robotics applications where motor speed or rotation are both controlled by a corrective signal that is amplified and fed to a motor circuit.

shared memory region (SMR)

A designated block of memory for data exchange between the PLC and cell controller.

shell, module

The rear cabinet plus the plenum.



shield, robot

See robot shield.

Si

See silicon.

Si_3N_4

Silicon nitride. Used as a mask.

signal generator

Electronic testing device used to supply a standard voltage of known amplitude and frequency.

SiH_4 Silane gas.

silicon (Si) A semi-metallic element used in the manufacture of integrated circuits. Next to oxygen, silicon is the most abundant element in the Earth's crust and is widely found in sand and clay. Silicon grows with a native oxide on its surface, and is perfect for delivering and protecting an exact wiring pattern of millions of integrated circuits that make up a chip.

silicon dioxide SiO_2. Used as a mask.

silicon nitride Si_3N_4. Used as a mask.

SiO_2 Silicon dioxide. Used as a mask.

slope etch See chemical process.

SLV Solvent. chemical process.

SMIF Standard mechanical interface.

SMR See shared memory region.

Smart DI Ultra Pure Water Heating System Rippey DI heating unit.

sodium chloride NaCl.

sodium hydroxide NaOH.

software Programs or instructions used to control the operations of a computer.

solvent See chemical process.

SPC Statistical process control.

spiking pump See metering pump (preferred term).

SPM Sulfuric peroxide mixture. See chemical process.

sputtering Process similar to evaporation.

SRD Spin rinser/dryer.

SRD module The module in which the product is rinsed and dried using the SRD (spin rinser/dryer).

SRF Surfactant. See chemical process.

SSQA Standardized supplier quality assessment.

SSR Solid-state relay.

staging tank

Reservoirs of chemical for release to the process tank. These tanks can be configured for several different functions:

- heating the chemical
- Initial filling of the process tank to a specified concentration
- replenishing the process tank to maintain liquid levels
- spiking the process tank to maintain chemical concentration

Staging tanks are located in their module's plumbing compartment. These small service tanks automatically dispense preset quantities of chemical to the module's chemical tank. The volume, frequency and number of dispense cycles are programmable.

Manual fill staging tanks are located in the plumbing compartment of the applicable modules. On manual-fill systems, chemical is poured into the staging-tank fill port (a funnel mounted on the front of the module) until the level of the liquid can be seen in the feed tube. The staging tank can then dispense preset quantities of chemical automatically. The volume, frequency and number of dispense cycles are set in each recipe.

Two level sensors, empty and low level, are mounted on the side of the staging tank. When the liquid level drops below the low-level sensor, a warning message appears on the touchscreen to notify the operator that the staging tank requires filling soon. If the tank is not refilled before the level drops to the empty-level sensor, the operator is alerted to refill the tank immediately.

Bulkfill staging tanks receive chemicals directly from the facility's chemical bulkfill system.

Three level indicators, low, process (or fill), and high, are mounted on the side of the staging tank. When liquid level drops below the low-level sensor, the tank fills automatically to the fill-level sensor. If chemical reaches the high-level sensor, the main fill valve closes immediately.

During wafer processing, staging tanks automatically release chemical to the process tank to (1) maintain chemical consistency, or (2) replenish the liquid to the process level. The liquid is delivered to the process tank by way of a metering pump or dispense valve. Metering (spiking) pumps precisely control the volume of chemical added to the process tank. Dispense valves are gravity fed. Because the flow rate to the process tank is greater than through a metering pump, the tanks fills more rapidly. However, the volume of fluid cannot be as accurately controlled.

Stage Tanks (Fixed-Volume Dispensing)

In fixed dispensing, the chemical bath operates at a particular chemical ratio set by a process engineer. Each of the bath's associated stage tanks is manually calibrated and configured to dispense a given volume. For example, to achieve a bath ratio of 10:2:1, the system would need to dispense 7000 ml of one chemical and 3500 ml of the second chemical. (The first value, 10, is DI water, which is not delivered to the bath via a stage tank.) The Fill level sensor on each stage tank is calibrated with graduated cylinders and set to dispense those volumes. A change in bath ratio requires adjustment and recalibration of the stage tank level sensors.

Level-Sensing Functions of Staging Tanks	
Manually-Filled Staging Tanks	
Low	When liquid level drops below this sensor, the operator is alerted to refill the tank immediately.
Process	When liquid level drops below the process-level sensor, a warning message appears on the touchscreen notifying operator that the staging tank requires filling soon.
Automated Bulkfill Staging Tanks (Fixed-Volume Dispense)	
Low	When liquid level drops below the low-level sensor, the bulkfill valve opens automatically, then closes when the process-level sensor is reached.
Fill or Process	When liquid reaches this level, the bulkfill valve closes.
High	Hardwired to a second fill valve plumbed in series with the primary fill valve. When chemical reaches this sensor, both fill valves close. This is a redundant valve for safety.
Automated Bulkfill Staging Tanks (Variable-Volume Dispense)	
Low	When liquid level drops below the low-level sensor, the bulkfill valve opens automatically, then closes when the A, B, or C level sensor is reached.
A, B, C	Three levels replace the single Process or Fill sensor used in a fixed-dispense system. When liquid reaches one of these levels, the bulkfill valve closes. The level to be reached is automatically determined to meet a configured chemical ratio. See the variable-volume dispensing example below.
High	Hardwired to a second fill valve plumbed in series with the primary fill valve. When chemical reaches this sensor, both fill valves close. This is a redundant valve for safety.

3-Level Stage Tanks (Variable-Volume Dispensing Of Dilute Chemistries)

Variable dispense schemes enable a bath ratio to be changed without adjusting and recalibrating stage tank level sensors. These schemes use five level sensors on the stage tank. Three variable level sensors, labeled A, B, and C, replace the single-variable Fill or Process level sensor. The desired chemistry ratio is specified in recipe management (**Chem [#] Ratio** line item).

There are two variable-dispense schemes. The first is for a process bath with a single dispense of a prediluted chemical (typically HF).The second is for a bath that uses two chemicals without predilution. In both schemes, a cell controller script derives chemical volume values (CHEMVOLs) from parameters that are set in tank configuration. These parameters include stage tank levels A, B, C, bath volume, and predilution ratios from. (See 3-Level Stage Setup in *Tank configuration*.)

NOTE
Chemical ratios can be changed in tank configuration only *after* the tank has been drained.

Example of Variable-Volume Dispensing of Two Chemicals

Desired ratio	10:02:01	**Stage level C**	4000 ml
Bath volume	49.1 liters	**Stage level B**	1200 ml
Chem1VOL	7538	**Stage level A**	135 ml
Chem2VOL	3769	**Pump volume**	8 ml per stroke

From the desired ratio and total bath volume, a cell controller subscript determines Chem1 volume is 7,538 ml, then sends this to the PLC as parameter CHM1VOL. The PLC uses a subroutine called BEAKER2 to compare CHM1VOL with stage tank levels, then dispenses 4000 ml on the first cycle, subtracts 4000 ml from CHMVOL, and adds it to BKRVOL, ending the first cycle. The new CHMVOL value is again compared with the stage tank level sensor volumes, and the greatest volume possible is dispensed—in this case 1200 ml. This cycle repeats until the CHMVOL value is less than the value of the stage tank Level A.

The metering pump dispenses the remaining volume, at 8 ml per stroke, until the volume dispensed equals or exceeds CHMVOL. Because the metering pump dispenses in 8-ml increments, it is possible for the total chemical to exceed the configured value by as much as 7 ml. When the dispense sequence for Chem1 is complete, the dispense sequence for Chem2 begins, using the same sequence described above.

Increments of chemical dispensing. All values are in milliliters.

Chem1			Chem2		
Dispense	**CHMVOL**	**BKRVOL**	**Dispense**	**CHMVOL**	**BKRVOL**
0	7538	0	0	3769	0
4000	3538	4000	1200	2569	1200
1200	2338	5200	1200	1369	2400
1200	1138	6400	1200	169	3600
135	1003	6535	135	34	3735
135	868	6670	8	26	3743
135	733	6805	8	18	3751
135	598	6940	8	10	3759
135	463	7075	8	2	3767
135	328	7210	8		
135	193	7345			
135	58	7480			
8	50	7488			
8	42	7496			
8	34	7504			
8	26	7512			
8	18	7520			
8	10	7528			
8	2	7536			
8					

standard clean type 1 (SC1)
See chemical process.

standard clean type 2 (SC2)
See chemical process.

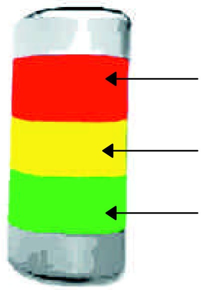
static
Without movement or change.

static eliminator

Device used to neutralize non-conductive materials by producing a region of ionized gas through which charged materials can pass.

status beacon

Also known as *light tree*. A three-light indicator that reveals wet-system status.



Red: (*blue* in European systems) Failure (alarm), abort, immediate assistance required.

Yellow: Keyswitch is in DISARM position.

Green: Equipment is enabled and running product.

Also see *critical alarms* and *exhaust alarms*.

Color	Condition	Wet System Condition	Operator Action	Example
RED or BLUE	**Flashing**	Emergency.	Immediate action; e.g. correct alarm condition or push EMO.	Robot malfunction; pressure exceeds safe limit
YELLOW	**Flashing**	Abnormal and/or hazardous.	Careful monitoring and/or intervention	Keyswitch is in **DISARM** position.
	Off	Normal.	No operator action indicated	Keyswitch is in **AUTO** position.
GREEN	**Steady On**	Powered on. No alarms or problems.	None required.	Wet system is processing normally.
	Flashing	Operator notification.	Mandatory operator action.	Operator prompted to enter or remove cassette.
	Off	Powered down.	None	

NOTES:

1. Blue is used in place of red in European countries. (See *European Standard EN-60204-1*).
2. Multiple lights may be lit simultaneously when multiple conditions are present.

Stepper motor

A compact DC motor with high torque used to transport a wafer load across an ultraclean Megasonic energy beam.

strip

See stripping.

stripping

The process of removing (chemically dissolving) and entire surface layer of the water, in contrast to etching, which removes only selected material. Stripping processes are typically named for the material being stripped (for example, oxide strip and nitride strip). Stripping is measured in Ångstrom units.

Also see etching.

subambient

See temperature of process chemicals.

subfab

The area below the cleanroom that contains auxiliary equipment such as DI water heaters, facility fire-suppression system, and bulk-chemical dispensers.

substrate — The physical material (sapphire, silicon, or ceramic) upon which an electronic circuit is fabricated. Used for mechanical support.

sulfuric acid — H_2SO_4.

sulfuric peroxide mixture (SPM) — See chemical process.

Sunburst Meg — Sunburst Megasonics.

surface cause (of an accident) — A readily apparent reason for an accident or incident that usually appears early in an accident/incident investigation, but is not the root cause. Usually a pre-existing unsafe condition or practice (a hazard).

surfactant — Detergent-like additive used in wet-system processes to clean wafers.

Also see chemical process.

SV — Solenoid valve.

swingarm — Curved pole mounted to the wet system upon which the operator interface assembly is attached. See operator interface assembly.

SWS — See semi-automated wet system.

SWSF — Semi-automated wet system, front access.

SWSR — Semi-automated wet system, rear access.

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T

tachometer

Measuring device for rotations / revolutions per minute.

TDC

Transducer Dead Center

tank, chemical

See chemical tank (preferred term).

tank configuration

Programming the control system, through a series of touchscreen displays, to define:

- hardware devices present on each tank
- process values to enforce (times, flows, resistivities, and other process limits that define recipes)

Tank configuration is password-protected and should be performed only by process engineers or other personnel with advanced understanding of wet-system operations and process chemistry.

tank draining

See recirculation.

tank heating and cooling

See temperature controls.

tank levels

Every wet system tank has at least one level sensor. Process and rinse tanks use N_2 bubbler sensors; staging tanks use capacitance sensors. Inputs from these sensors are interlocked to automated alarms, safety interlocks, and filling-draining functions. See the table below for more details.

<table>
<tr><th colspan="3">Level Interlocks for Wet System Tanks</th></tr>
<tr><th>Levels</th><th colspan="2">Interlocks</th></tr>
<tr><th colspan="3">Process Tanks</th></tr>
<tr><td>High</td><td colspan="2">Activates a Main tank is overfull alarm.</td></tr>
<tr><td>Fill</td><td colspan="2">During a tank prep, when this level is reached chemical stops dispensing into the tank. This level is above the Process level to compensate for filling the plumbing lines in the recirculation system.</td></tr>
<tr><td>Process</td><td colspan="2">Normal processing level. If the liquid level falls below this level during automatic processing, a Process Level Lost alarm occurs.</td></tr>
<tr><td rowspan="2">Low</td><th>With PREFILL LOW LEV</th><th>Without PREFILL LOW LEV</th></tr>
<tr><td>• Stops DI water prefill at this level during tank PREP.
• The heater starts when this level is reached, and turns off whenever this level is lost to protect the heater and Megasonic.</td><td>The heater starts when this level is reached, and turns off whenever this level is lost to protect the heater and Megasonic.</td></tr>
<tr><td>Empty</td><td colspan="2">Starts the drain timer. Tells the control system when the tank is empty following a drain command.</td></tr>
<tr><th colspan="3">Rinse Tanks</th></tr>
<tr><td>Process</td><td colspan="2">• Triggers an alarm if liquid drops below this process level (set high enough to ensure complete coverage of wafers during rinsing).
• Triggers change from high to low flow rate. The tank fills at a high flow rate, then (to conserve water) changes to a low flow rate when this sensor level is reached.</td></tr>
<tr><td>Low</td><td colspan="2">Used in rinse tanks equipped with Megasonic units to ensure that they are covered with DI water when they are active.</td></tr>
<tr><th colspan="3">Manually-filled Staging Tanks</th></tr>
<tr><td>Process</td><td colspan="2">When liquid level drops below the process-level sensor, a warning message appears on the touchscreen notifying operator that the staging tank requires filling soon.</td></tr>
<tr><td>Low</td><td colspan="2">When liquid level drops below this sensor, the operator is alerted to refill the tank immediately.</td></tr>
<tr><th colspan="3">Bulk-filled Staging Tanks</th></tr>
<tr><td>High</td><td colspan="2">Hardwired to a second fill valve plumbed in series with the primary fill valve. When chemical reaches this sensor, both fill valves close. This is a redundant valve for safety.</td></tr>
<tr><td>Process</td><td colspan="2">When liquid reaches this level, the bulk-fill valve closes.</td></tr>
<tr><td>Low</td><td colspan="2">When liquid level drops below the low-level sensor, the bulk-fill valve opens automatically, then closes when the process-level sensor is reached.</td></tr>
<tr><th colspan="3">EE-Wash Tank</th></tr>
<tr><td>Process</td><td colspan="2">The EE wash tank has an overflow function. The tank fills from the bottom at a high flow rate, then (to conserve water) changes to a low flow rate when this sensor level is reached.</td></tr>
</table>

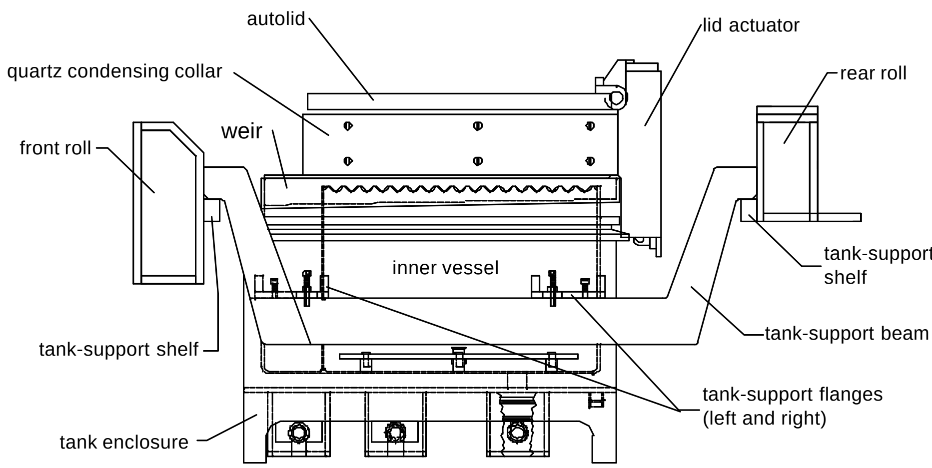
tank, process See chemical tank.

tank, rinse See rinse tank.

tank, safe See safe tank.

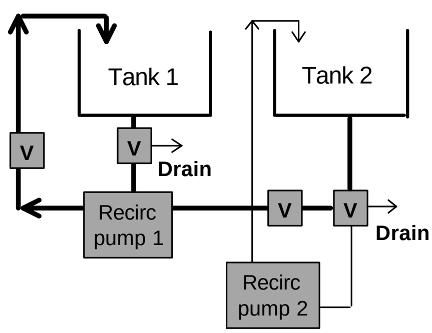
tank, staging See staging tank.

tank-support beam Supports the chemical tank and the lip-exhaust collar (if present). The tank-support beam rests on the tank-support shelf. See drawing below.



Chemical Tank (side view)

tank-to-tank chemical transfer



This automated sequence moves chemical from one chemical tank to another in the same module (not between different modules). This sequence, typically used in a two-step process that uses the same chemical, allows the cleaner chemical in tank 2 to be reused in tank 1 before being drained from the wet system. This sequence is often used at regular bath changeouts, but can be used whenever the tanks are not allocated.

The automated transfer sequence starts by selecting TRANSFER in the tank 2 control screen:

1. Tank 1drains.
2. When tank 1 level lowers to Empty, the tank 2 drain valve opens, and routes the flow through the tank 1 recirculation pump.
3. Tank 1 recirculation pump starts, directing chemical into tank 1.
4. When tank 2 level lowers to Empty, the transfer continues for the time set in Transfer Drain Timer (see Section 5.2.6 in the Operations Manual).
5. Tank 2 automatically reset to allow a new PREP sequence.
6. Tank 1 is topped-off with appropriate chemical, if so configured.

tank, VcS See VcS tank.

TC See thermocouple.

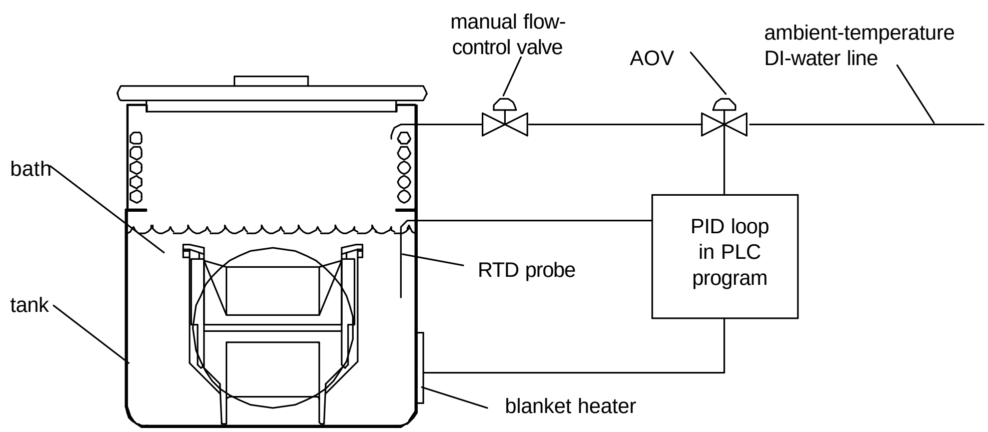
TDR Time-delay relay.

teaching points See robot points.

“Teflon” Family of fluoropolymers (including FEP, PFA, and PTFE) produced from resins manufactured by the DuPont Company.

Tefzelâ A Du Pont copolymer product of ethylene and TFE used for coating stainless steel robot end effectors

temperature control for static-bath nitride-strip processes Nonrecirculated nitride strip processes use the injection of ambient-temperature DI water to control bath temperature. See drawing below.



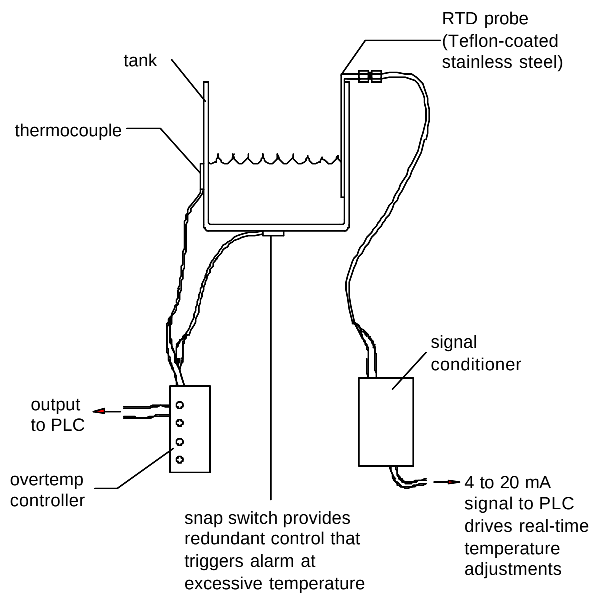
Temperature Control for Nitride-Strip Processes (simplified view)

The bath is heated by a blanket heater and cooled by injection of ambient-temperature DI water (see drawing). The blanket heater and an air-operated valve (AOV) in the DI water line are both controlled by a proportional-integral-derivative (PID) loop within the PLC program.

When the bath temperature is below the recipe's setpoint, the PID loop turns on the heater to 100% capacity and closes the AOV. When the temperature exceeds an upper tolerance, the heater turns off and the DI water valve opens, cooling the bath. A manual flow-control valve is adjusted to add enough DI water to (1) lower bath temperature, and (2) replace the DI water boiled from the bath, without significantly changing the phosphoric acid to-DI-water ratio. (This "on or off" function is different from the variable output usually associated with PID controls.)

This control scheme maintains nitride process bath temperature at 165± 2°C.

temperature controls Control the temperature of chemicals in chemical tanks, or DI water in hot-rinse tanks. Temperature-control components in Verteq wet systems include. See drawing below.



Standard Temperature-Control System

1. Heaters; heater/chillers:

   - Heater/chiller—device typically used with HF process to maintain near-ambient process temperature (usually about 20-35°C) by heating or cooling the fluid as it flows through coils in the recirculation loop heat exchanger.
   - Inline heater—device typically used with APM process to maintain a medium process temperature (about 60°C) by heating the process chemicals in a recirculation loop.
   - Blanket heater (also called integral heater)--device typically used with hot phosphoric process to maintain a high process temperature (above 100°C) by heating the outside of the tank with an electric coil.
   - Immersion heater--same as blanket heater except that the heater coils contact the process chemical in the tank.
   - External DI heater--device outside the wet system heats DI water for a hot-rinse process. Used when facility-supplied heated DI water is not available. A hot rinse reduces the thermal shock to wafers after hot chemical processing and quickly removes residual chemical.

2. Temperature monitors and controls:

   - Thermocouples measure the temperature of the heater elements. The output is sent to the PLC by way of an overtemperature controller.
   - RTD (resistance temperature device) probe monitors chemical temperatures in the tanks and sends signals to a signal conditioner. The signal conditioner, in turn, sends the signals to PID loops (within the PLC) that drive real-time temperature adjustments.

An RTD probe may be used to monitor the DI-water temperature in a rinse tank during a hot-rinse process but, in this case, it is used for information only and the signals bypass the control system.

3. Overtemperature control. Snap switches and overtemperature controls, hardwired to the heater contactor, trigger alarms and shut off the heater if a heater element reaches excessive temperature.

Also see temperature of process chemicals; temperature control for nitride-strip processes.

temperature of process chemicals

Temperature	Range (°C)	Tolerance (°C)	Control Device
Non-heated	N/A	N/A	Uncontrolled
Heated–Chilled	15-35	+/- 0.5	Heater/chiller
Heated (medium)	>36-100	+/- 1.0	Inline, blanket, immersion, or external DI heater
Heated (high)	>100	+/- 2.0	Inline, blanket, or immersion heater

TFE
See PTFE.

thermocouple (TC)
Used to measure temperature. Two dissimilar metals are welded together to develop a galvanic potential. The voltage output changes proportionally to the temperature.

three-axis robot
Also known as *two-arm robot*. See robot axes.

throughput
Processing capability of a wet system; that is, the number of wafers per hour a particular wet system can process using a particular recipe. Throughput is calculated using a formula that assumes the availability of a safe tank for every product lot in process

Ti strip
Titanium strip. APM is the preferred term. See chemical process

timers
See debounce timers.

TLV
Threshold limit value. The airborne concentration of a material to which nearly all persons can be exposed day after day without adverse effects.

TLV-C
Threshold limit value-ceiling. The ceiling exposure limit. The concentration that should not be exceeded even instantaneously.

TLV-STEL
Threshold limit value-short-term exposure limit. The short-term exposure limit or maximum concentration for a continuous 15-minute exposure period (maximum of four such periods per day, with at least 60 minutes between exposure periods) and provided that the TLV-TWA is not exceeded.

TLV-TWA
Threshold limit value-time weighted average. The allowable time-weighted average concentration for a normal 8-hour workday or 40-hour work week.

TOC
Total organic carbon.

tool
See wet system (preferred term).

topoff
An automated chemical fill sequence used to prevent unnecessary Process level lost alarms during processing. See topoff in tank configuration.

torque
(noun) A force that tends to produce rotation or twisting; used for large loads.

(verb) To tighten to a specific level.

total organic carbon
TOC.

touchscreen

A touch-sensitive computer screen used for operator interface, allowing input to the CPU by touching menu items and icons on the screen. The operator uses the touchscreen to perform wet-system control functions and view color graphics. Also known as *operator interface touchscreen*. Also see operator interface assembly.

The color of the icons on the touchscreen indicates the status of the corresponding wet-system components. Icon color on the touchscreen display indicates the status of the wet-system components.

transducer

1. A piezoelectric crystal bonded to a quartz lens; used to convert RF energy into acoustical energy. All Verteq Sunburst and Ultraclean cleaning systems use them.
2. Converts a physical measurement (such as pressure, flow, or temperature) to an electrical signal.

transport cassette

See cassette.

trickle bypass

See high/low flow plumbing.

two-axis robot

Also known as *one-arm robot*. See robot axes.

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U

UF Ultrahigh filtration.

ULPA Ultra-low particulate air.

UNC United national coarse (threads).

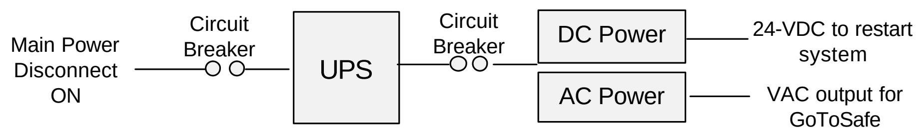
UNF United national fine (threads).

uniformity Consistent surface topography across a wafer's surface.

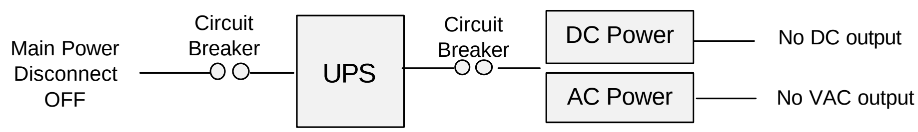
uninterruptible power supply (UPS) Supplies electric power to the wet system as follows:

Responses to Power Loss		
Power Loss Type	**UPS Response**	**Wet System Response**
Power outage	Supplies AC power to robot, touchscreen/cell controller, PLC, and 24-VDC power supply.	• Recipes in progress stop and cannot be recovered • Automated GoToSafe response
Main disconnect lever at OFF	All electrical input to and output from UPS are cut off.	• All automatic valves close • All physical movement and operations powered by wet system are disabled • All UPS output is cut off
EMO pushbutton engaged	Input VAC to UPS is not cut off but UPS supplies only a 24-VDC startup circuit.	• All automatic valves go to default position • All physical movement is disabled • Exhaust system response is configurable. See *Exhaust* in AWS Specification for details.

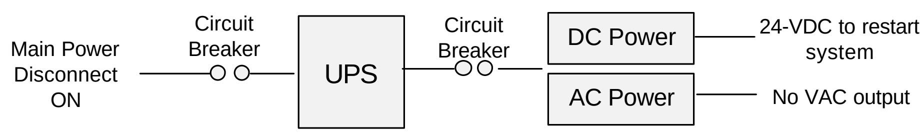
uninterruptible power supply (UPS) *continued*



UPS function in response to a power outage.



UPS function when primary power main disconnect is at OFF



UPS function in response to EMO shutdown.

UPS See uninterruptible power supply.

uptime The time during which a piece of equipment or the wet system is functioning or able to function.

UV/IR Ultraviolet/infrared.

V

VAC
Volts alternating current.

VcS
VerteqcleanSystem

VLSI
Very Large Scale Integration

vapor deposition
see evaporation

variable dip
Enables the Full-auto robot to hold onto a cassette, rather than release it, during a short step in a process recipe. The threshold can be set at any time value, but it is often used for a recipe step of <30 seconds, when the robot does not have enough time to complete another action before removing the cassette. Typically used in HF processes, this function is set by Verteq software engineers, not on the touchscreen interface.

VDC
Volts direct current.

VERTEQ (old style)

Verteq (current style)

VER	Versatility
T	Technology
E	Equipment
Q	Quality

Old Style Definition

Old Style

Current Style

vertical obstruction sensor (VOS)
See obstruction sensor.

VLF hood
Vertical laminar flow hood. A protective covering on the wet system that provides ventilation by removing fumes, dusts, and gases. Also known as hood.

Also see laminar flow.

VOS
Vertical obstruction sensor. See obstruction sensor.

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W

wafer
A thin circular disk (typically made from silicon) on which many integrated circuits are fabricated and subsequently diced up into individual chips.

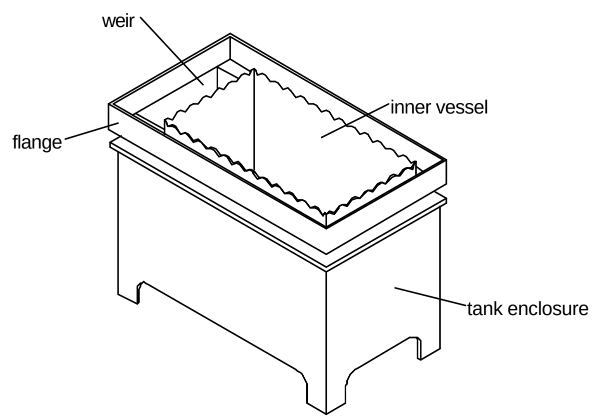
wafer lot
See product lot (preferred term).

wafer processing
See process.

watts
Unit of power; 1/746 horsepower

waveform
Graphic display of voltage (amplitude) vs. time (frequency); relationship of voltage, current, power vs. time.

weir
The area of the chemical tank between the inner vessel and the tank enclosure that accepts input overflow and normal recirculation overflow (see drawing). The weir also isolates overflow liquid for heating and cooling.



wet processing
The application of chemicals in a liquid state in the cleaning, etching, and stripping of the semiconductor-fabrication cycle. The principal challenge is to remove organic, ionic, and particulate contaminants from the wafer surface prior to the many manufacturing steps, without increasing wafer surface roughness.

Also see process.

wet system
An immersion-processing system that cleans, etches, and strips silicon wafers and other substrates by combining wet chemistry, rinse tanks, dryers, robotics, and control software.

Also see automated wet system; semi-automated wet system; manual wet system.

A typical Verteq wet system (Automated or Semi-Automated) with major parts labeled is shown in the foldout drawings. Note that the wet-system drawings were prepared for training purposes; consequently, they include parts from more than one type of wet system. A wet system sold at a customer's facility would not contain all of the parts shown in the drawings. Also, parts on an actual wet system may be in different locations than those shown on the drawings.

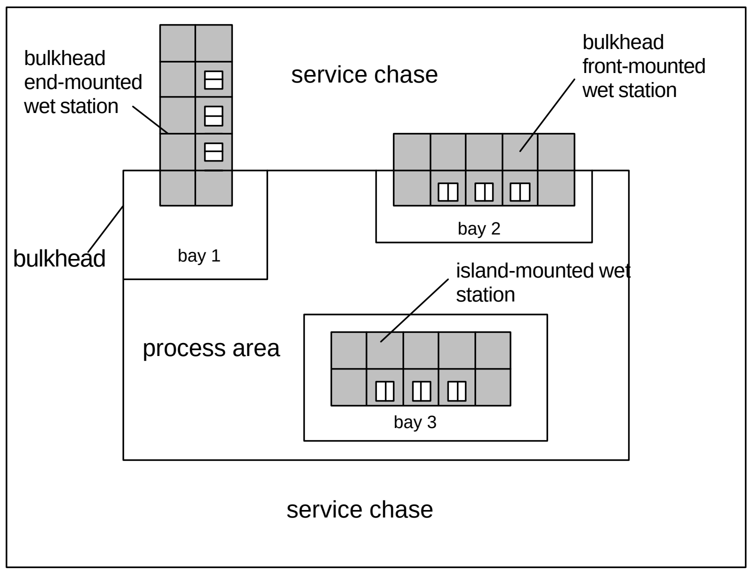
wet-system control system

The software and hardware that interact to control the wet system. See the foldout drawings.

wet-system mounting

Refers to the location and manner of placement of the wet system in the cleanroom. Types of wet-system mounting include the following (see drawing):

- *Bulkhead mounted:* The wet system is enclosed in a wall either transversely or longitudinally. Types of bulkhead mounting include:
  - *end mounted*—the operator I/O portion at the end of the wet system is accessible from the process area
  - *front mounted*—the front of the wet system is accessible from the process area
- *Island mounted:* The entire wet system is inside the process area of the cleanroom, not attached or surrounded by a wall.



WG

Water gauge. Used for measuring air pressure.

WIP

Wafers in process. Also known as work in process.

WPP

White polypropylene.

WTU

Wafer transfer unit.

X

x-ray lithography
A process similar to photolithography except that x-rays rather than light are used to expose the film coating.

Y

yield
Count of successful circuits at completion of a semiconductor manufacturing process, expressed as a percent of the total.

Z

There are no entries for **Z**.

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• PRODUCTS OVERVIEW •

Process Systems

Cobra Series

Goldfinger Series

Process Components

Megasonic Series

Model SC200

1600–55 A/M Series

1800–6 Series

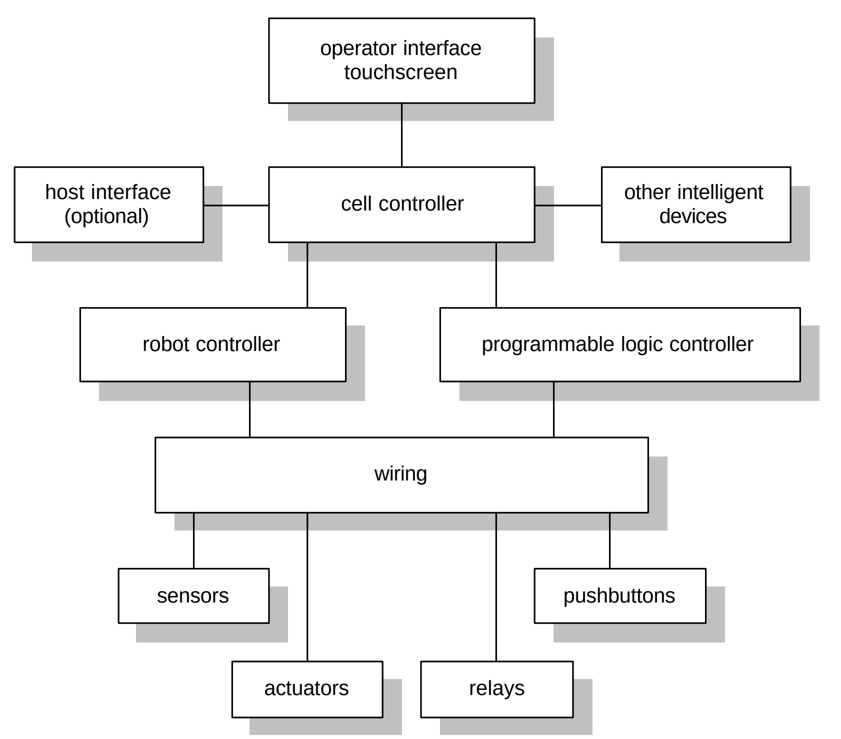
Verteq

think clean

BACK

Cobra–SA–VcS
Wet Process System Components

A typical Verteq Cobra–SA–VcS wet process system (single module) is shown in the drawings to the right. Each module contains all of the components shown. Components on your wet system may be in different locations than those shown in the drawings. The flow diagram below shows the control system interfaces.

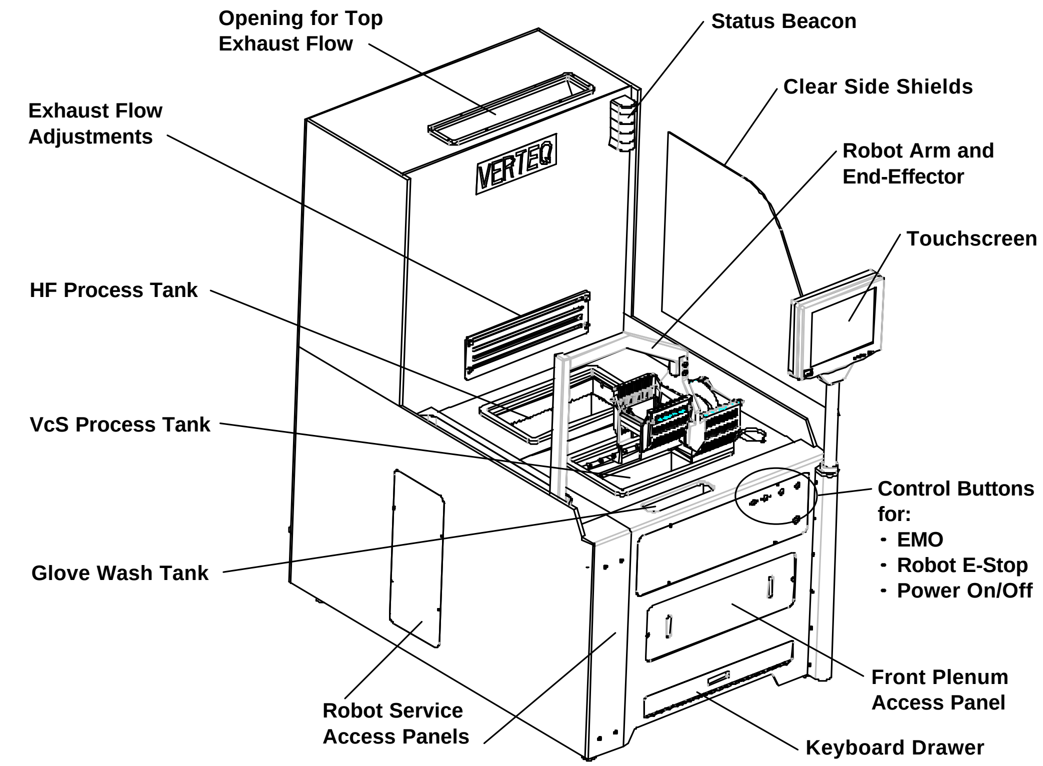


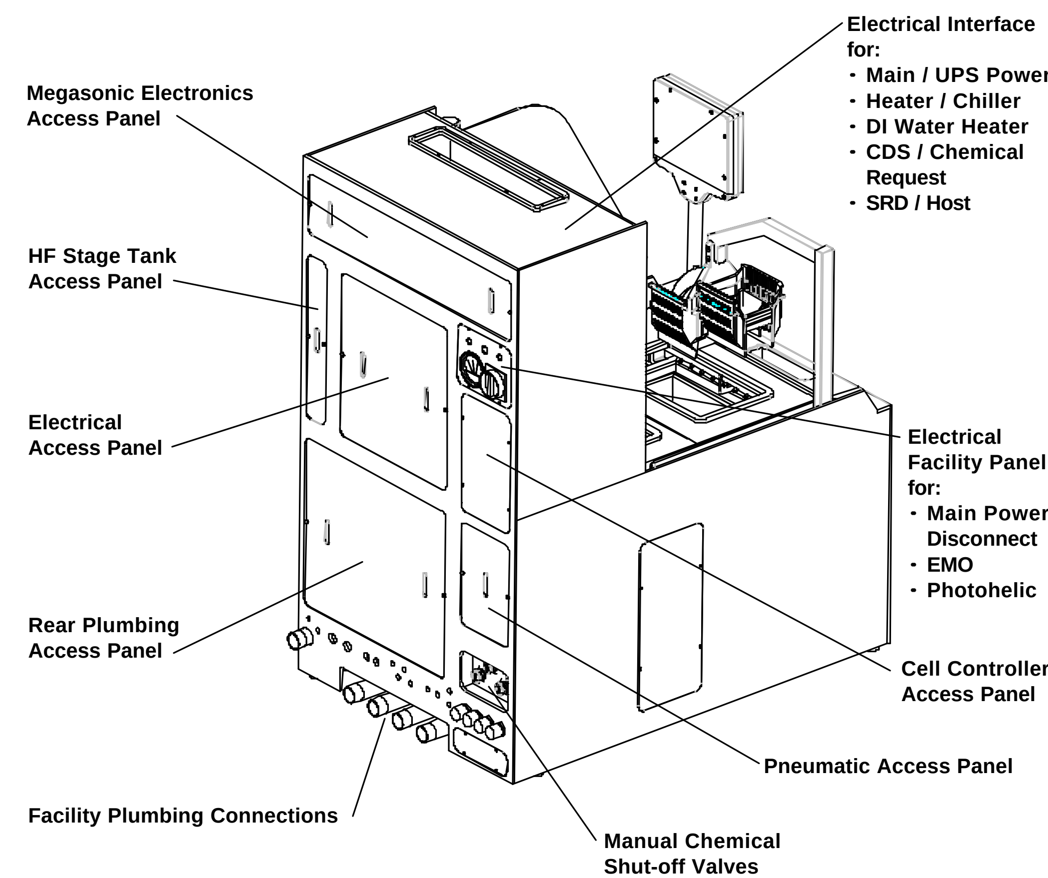
Wet-system Control System

Front View

Rear View

Component	Function	Component	Function
Cell controller and software	• Provides recipe management • Logs and graphs processing data • Sets and monitors process parameters • Displays real-time process status and alarms • Provides operator interface • Controls robot (through a robot controller) • Communicates with PLC • Provides link to host computer	**Robot control system**	• Provides power supply • Motion controller controls servo-motors that drive robot along each axis of movement • Manages point teaching homing, and robot movement functions
PLC and software	• Controls individual devices (pneumatic and electric valves; pumps; and level, resistivity, and temperature sensors) • Provides real-time operating information to the cell controller for particular devices	**Exhaust system**	• Photohelic gauges control low-exhaust and exhaust-fail alarm functions. Manual dampers are adjusted to modify the airflow





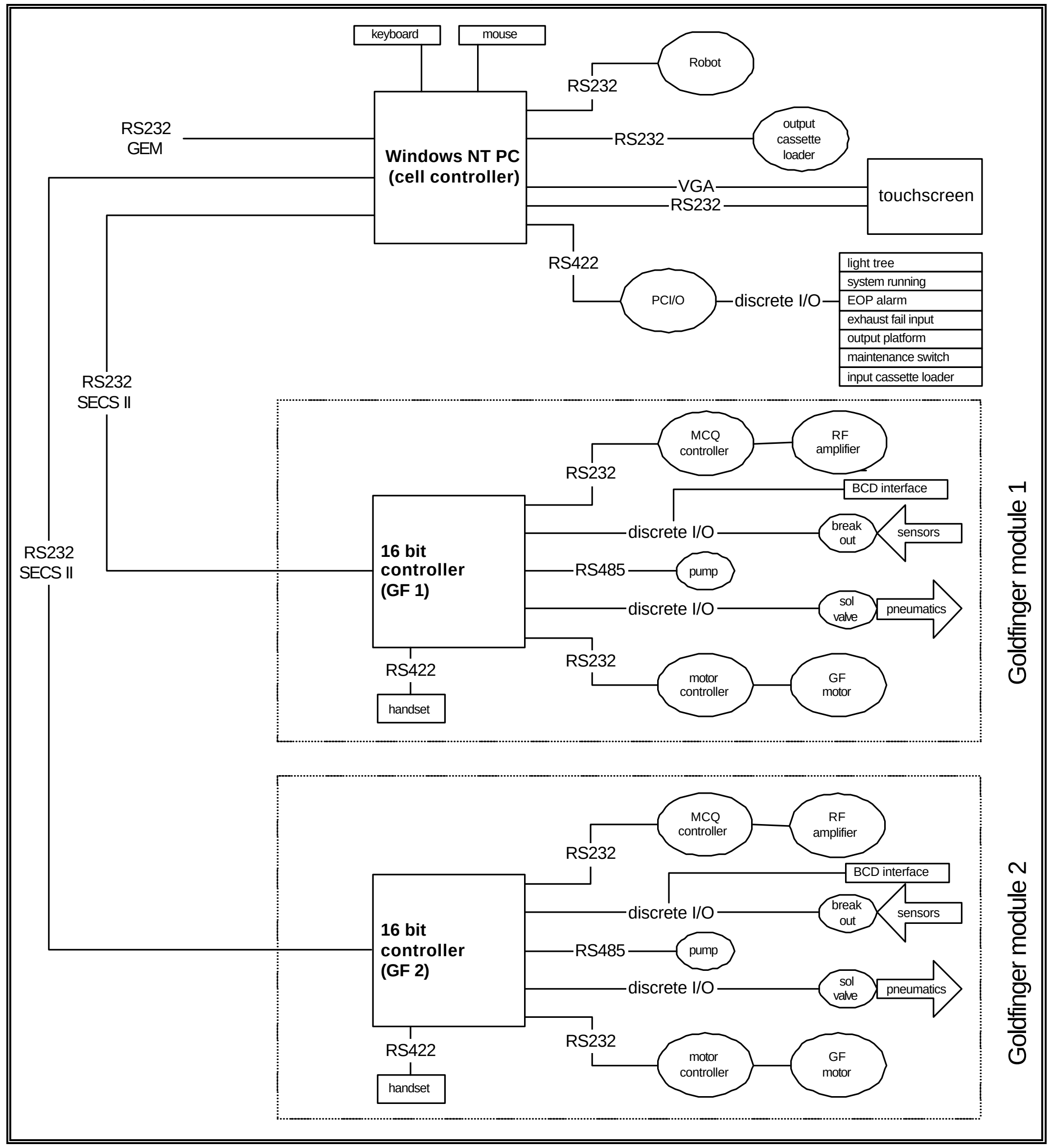
Features (Typical)	
Shell Dimensions	76.25” H 44” W 66” D
Total Weight	1900 lbs. Halar 1200 lbs. Polypro
Overall Facility Requirements	
Ambient DI H_2O	Flow 25 gpm Pressure 40-60 psi
Hot DI H_2O	Flow 7 gpm Pressure 40-60 psi
Nitrogen	Flow 6 scfm 170 slpm Pressure 30-100 psi
CDA	Flow 8 scfm 225 slpm Pressure 80-100 psi
Process Chemicals	
NH_4OH H_2O_2 HF HCI (PDC)	Flow 2gpm Pressure 15-45 psi
Airflow / Exhaust Requirements	
Supply Velocity	Nominal 80 fpm Maximum 100 fpm Uniformity ±10%
Flow Volume	1100 scfm
Electrical Requirements	
Main	120/208 VAC 3 phase 50/60 Hz 4 wires 25 amps
UPS	120/208 VAC 1 phase 50/60 Hz 3 wires 12 amps
DI Water Heater (Optional)	408 VAC 3 phase 50/60 Hz 4 wires 156 amps

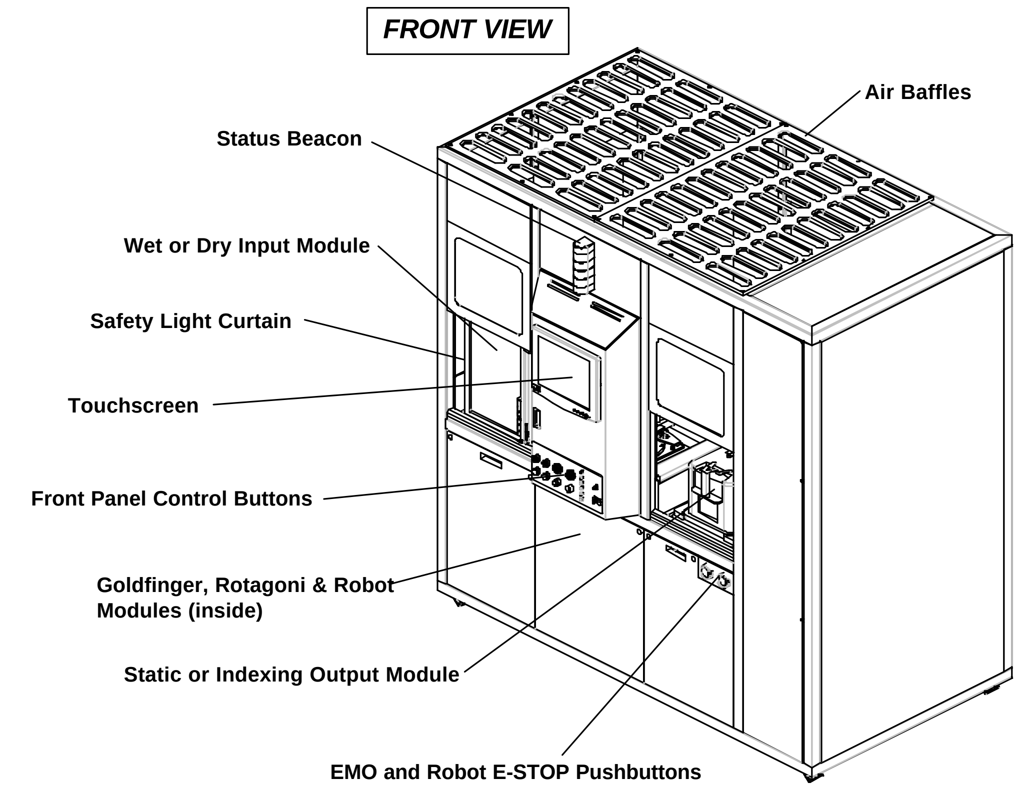
BACK

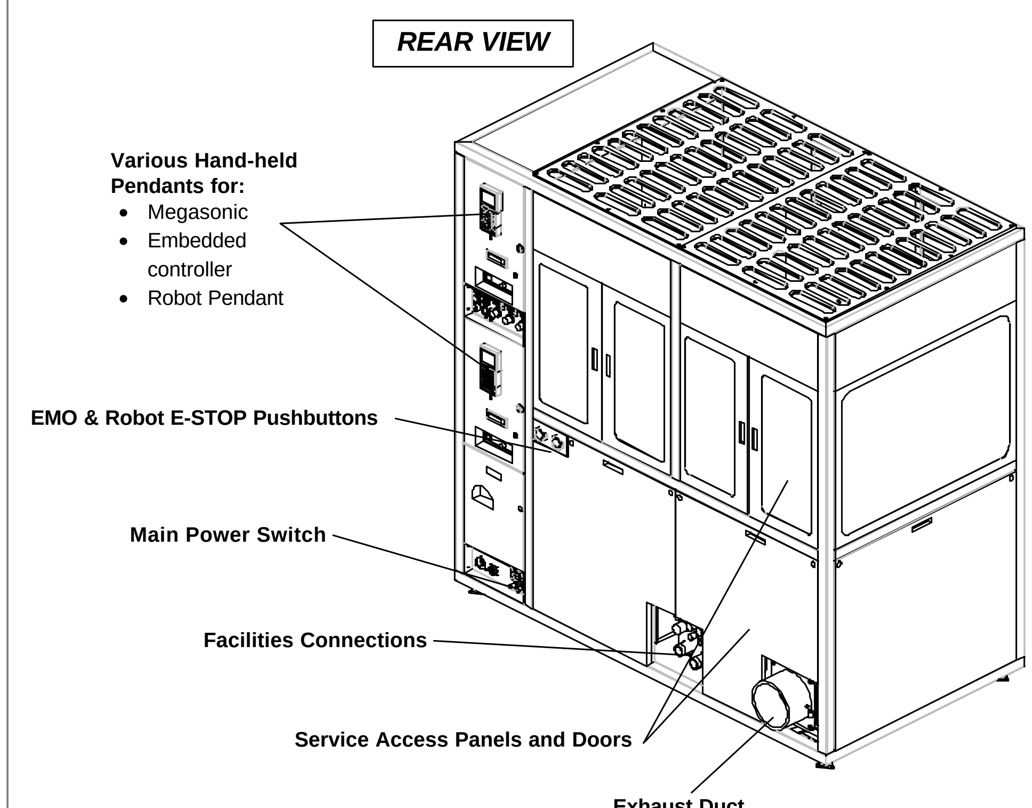
Goldfinger Cleaning System Components

A typical Verteq Goldfinger Cleaning System is shown in the drawings to the right. Your system may not contain all of the components shown. Components on your system may be in different locations than those shown in the drawings.

The block diagram below illustrates the control system interfaces.







Verteq

Control System

The control system integrates a microcomputer (the cell controller), one or more module embedded controllers, a robot control system, an exhaust system, and associated software. The list below summarizes these functions.

Cell controller and software

- Displays real-time process status and alarms
- Provides graphical operator interface
- Provides link to host computer
- Manages, schedules and executes system recipes
- Controls and monitors all system modules, including:
  - Input and Output
  - Robot
  - Goldfinger(s)

Module embedded controller and software

- Controls individual devices (pneumatic valves; pumps; and sensors)
- Executes module recipes
- Provides real-time operating information to the cell controller for particular devices

Robot control system

- Motion controller controls servo-motors that drive robot along each axis of movement
- Manages point teaching homing, and robot movement functions

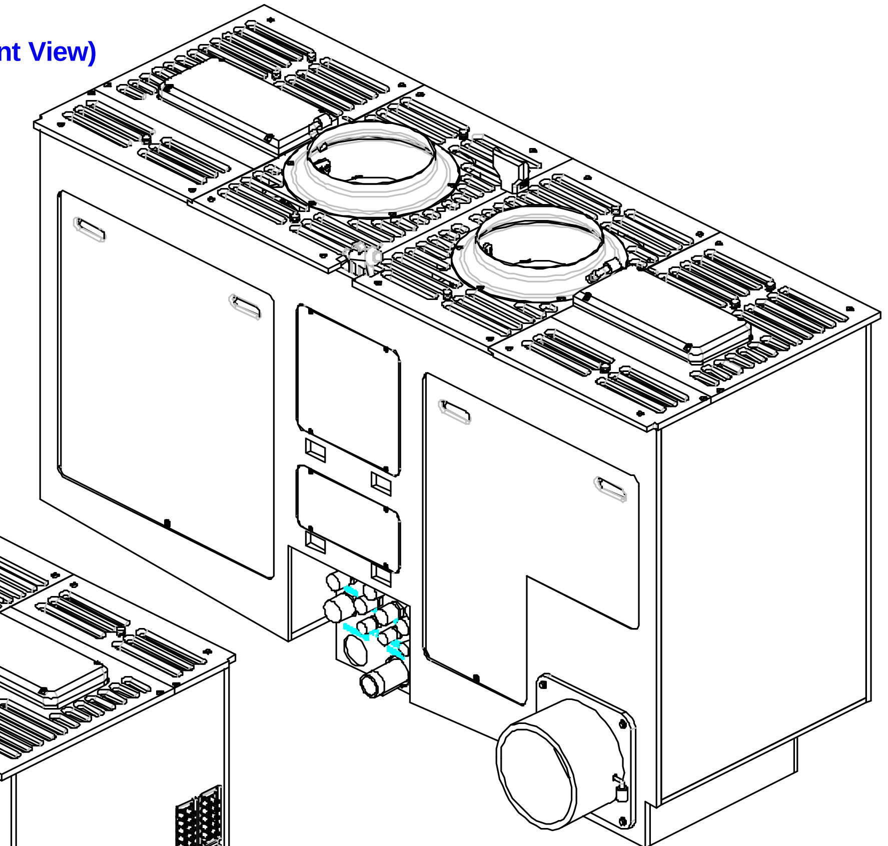
Exhaust system

- Photohelic gauges control exhaust-fail alarm functions. Manual dampers can be adjusted to modify the airflow

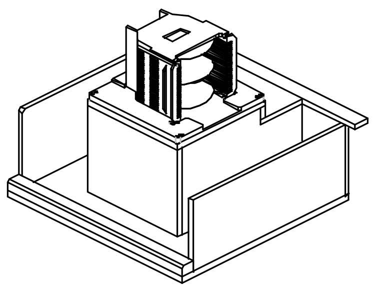
See reverse for inside module details

BACK

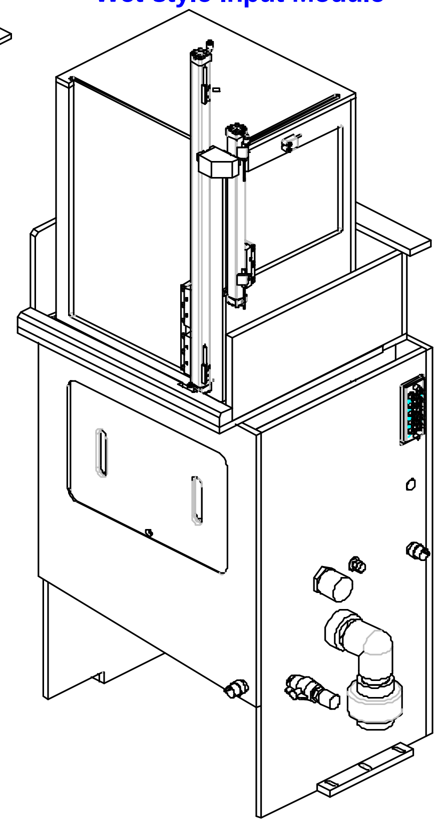
Typical Dual-Goldfinger Module (Front View)



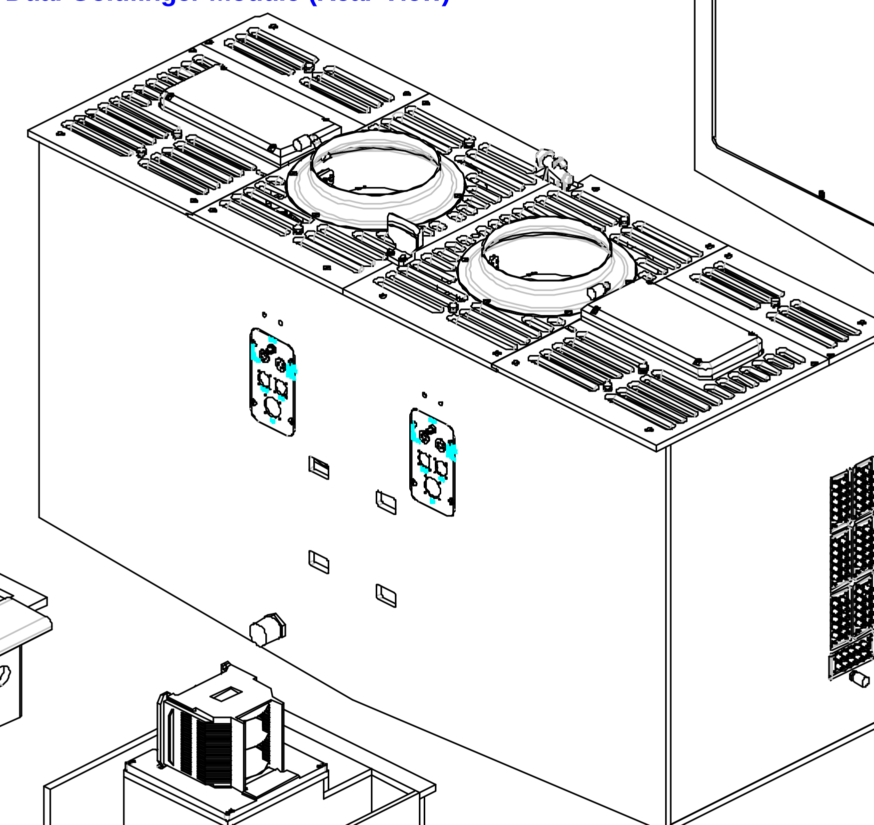
Dry-style Input Platform



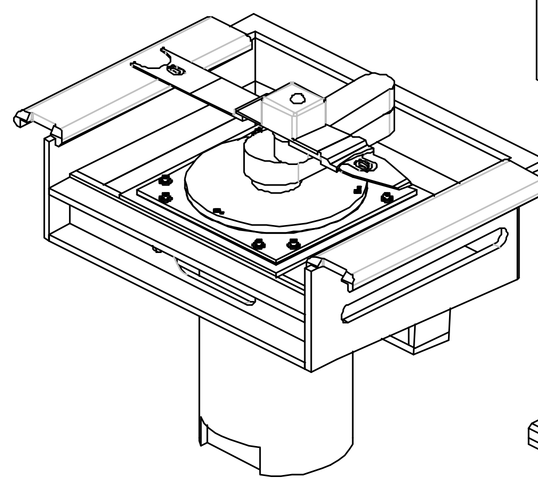
Wet-style Input Module

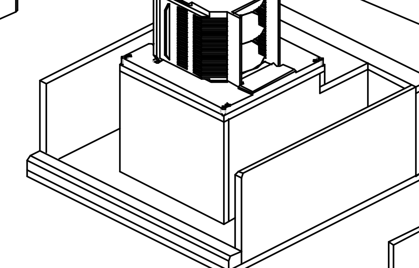


Typical Dual-Goldfinger Module (Rear View)

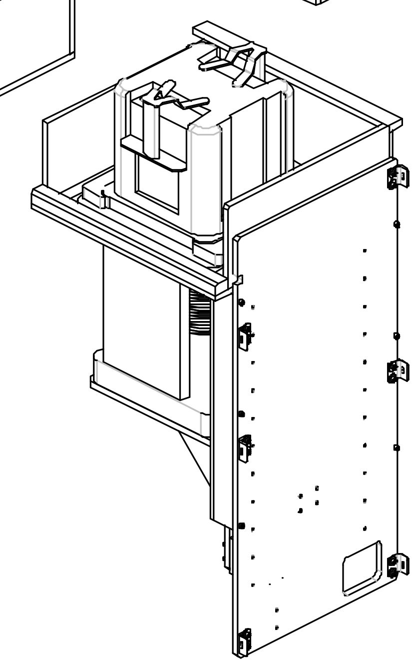


Robot Module



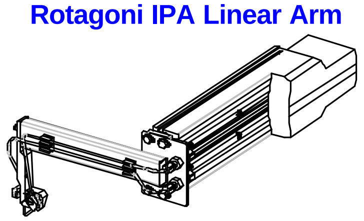


Dry-style Output Platform



Dry-Indexing Output Module

Rotagoni IPA Linear Arm



Back

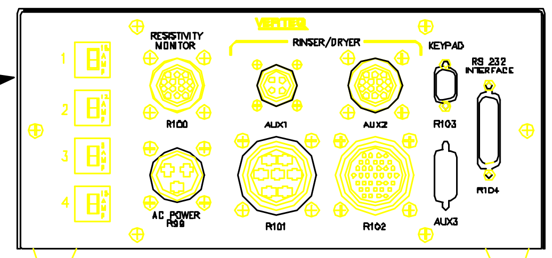
SuperClean 1600-55 A/M Rinser / Dryer

Typical Verteq 1600-55 A/M rinser / dryers are shown in various standard configurations. Your dryer may not contain all of the components, features and options shown. Features on your dryer may be in different locations than those shown in these examples. Not all componets, features, options or configurations are shown. All information is for reference only.

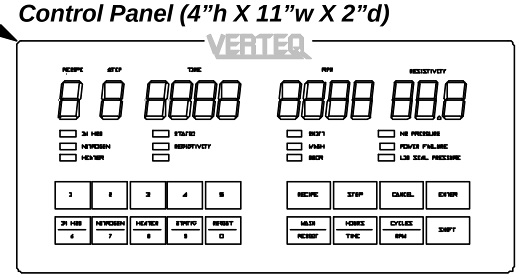
Typical Componets

Resistivity Controller (2"h X 4"w X 8"d)

Controller (rear view) (5"h X 11"w X 16"d)

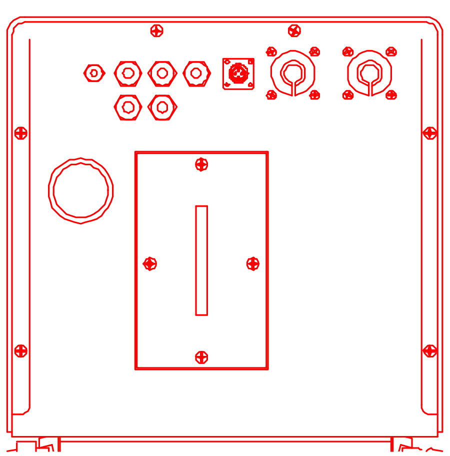


Control Panel (4"h X 11"w X 2"d)



Dryer unit also referred to as a Centrifuge
Dryer Dimensions: 19"h X 16"w X 27"d

Facilities connections



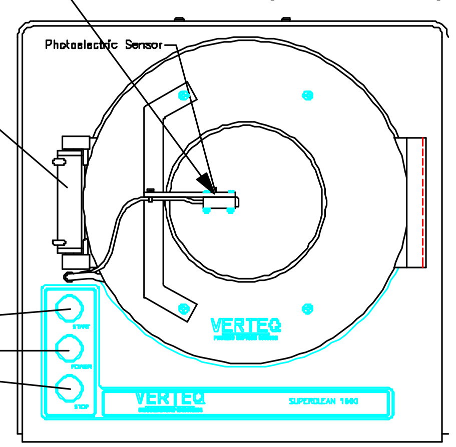
Rear view

Cassette Detect option shown

1600-55 A (Auto Door)

1600-55 M (Manual Door)

Left-hand Hinge shown



Start
Power
Stop

Right-hand opening door shown

Typical Front-Removable (FREM) Single Dryer in a Cabinet

Cabinet Dimensions: 55"h X 17"w X 36"d

EMO Pushbutton

Control Panel

Front Access

Footswitch

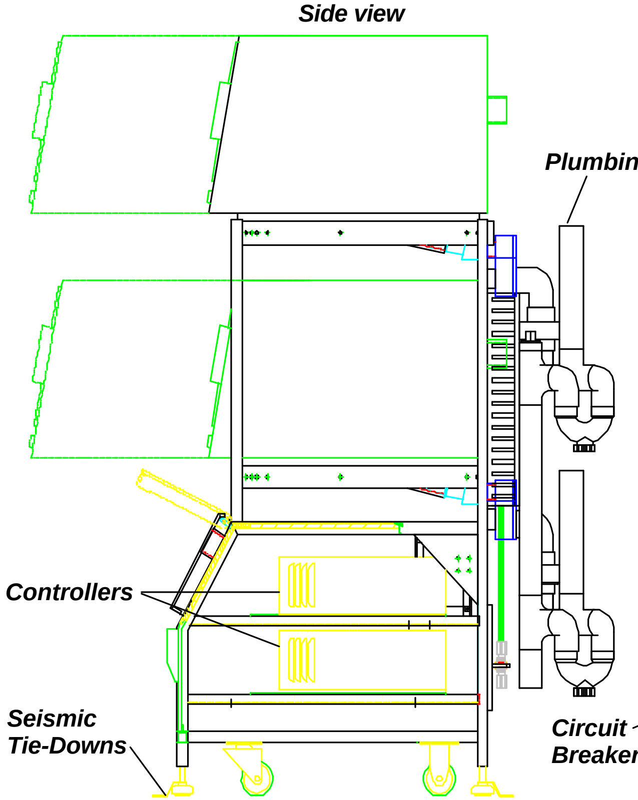
Typical Bay and Chase Double-Stack Frame

Frame Dimensions: 73"h X 20"w X 32"d

Single-Dryer Bay and Chase Cabinet 67"h X 22"w X 30"d (configuration not shown)

Typical FREM Double-Stack Frame (66"h X 19"w X 30"d)

Side view



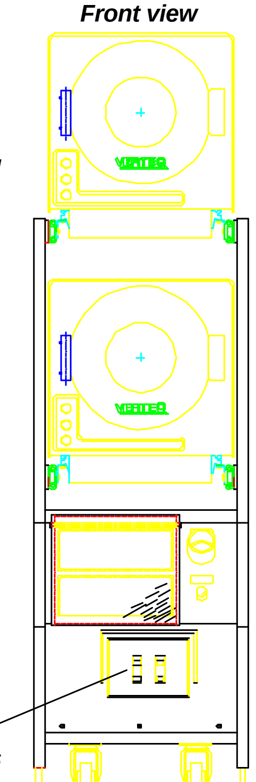
Plumbing

Controllers

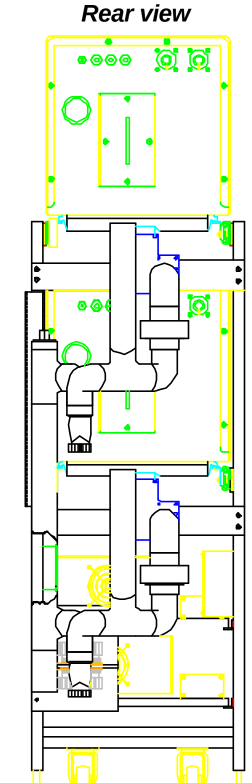
Seismic Tie-Downs

Circuit Breakers

Front view



Rear view



Typical Features and Options

Features	Description
Product Capacity	1 cassette / 0-25 150mm wafers
Bowl Dimensions	11.25" I.D. X 11" deep
DI H_2O	Six (6) Fan-type. All PFA fittings, TFE valves, tubing, and flowswitches
System N_2	PFA tubing, fittings, stainless steel N2 heater, and 316 low carbon stainless steel regulators
Cycle Speed	50 to 3200 RPM
Cycle Timer	0 to 9999 seconds

Options (contact Verteq Sales for details)

- Left- or Right-hand Hinged Door
- 2 Rotor Styles
- CE Marked
- Resistivity
- Flaretek Fittings on DI H_2O Lines
- RA-10 Finish Bowl
- High Pressure Teflon DI H_2O valves
- Millipore N_2 Filter Cartridge
- Heater Indicator Lights
- Audible Alarm
- N_2 Current Heater Detector
- Manual Safety Door Latch
- No Tools Drain Box
- CO_2 Injection (2 Versions)
- Cassette Detector Kit
- Housing:
  - Front Removable (FREM) Single Cabinet
  - Bay and Chase Single Cabinet
  - FREM Doublestack Frame
  - Halar Coating on FREM Doublestack Frame
  - Side Panels on FREM Doublestack
  - Bay and Chase Doublestack Frame
- Housing Options:
  - Resistivity Monitor and Probe
  - EMO for FREM or Bay and Chase
  - GFI
  - Footswitch
  - Drain Plumbing
  - Doublestack Single-point Facility Hook up
  - PVDF or PFA 0.2µ DI H_2O Filter
  - Step Down Transformer
- Controller Options:
  - AutoWash
  - Passcode
  - AutoWash and Passcode

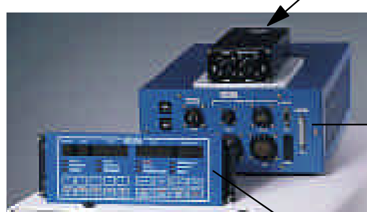
Back

SuperClean 1800-6 Rinser / Dryer

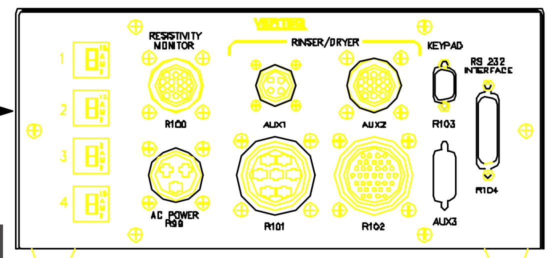
Typical Verteq 1800-6 Rinser / Dryers are shown in various standard configurations. Your dryer may not contain all of the components, features and options shown. Features on your dryer may be in different locations than those shown in these examples. Not all components, features, options or configurations are shown. All information is for reference only. Dimensions are approximate.

Typical Components

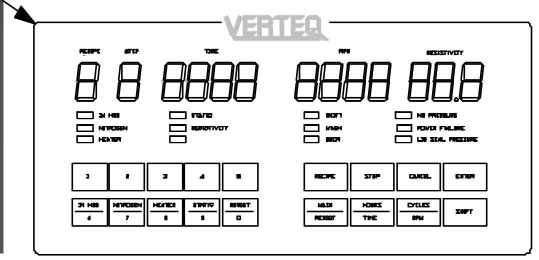
Resistivity Controller (2"h X 4"w X 8"d)



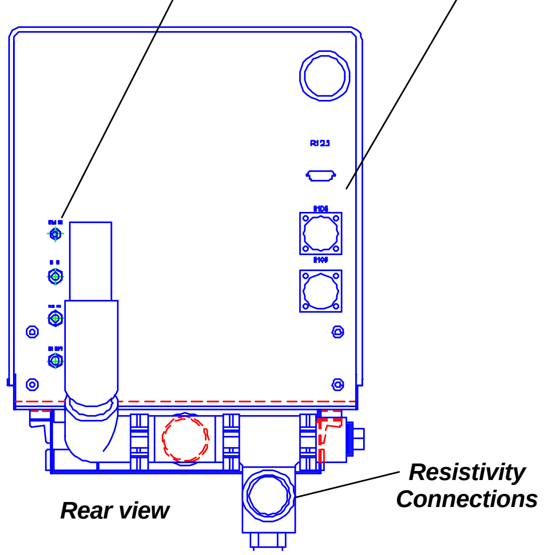
Controller (rear view) (5"h X 11"w X 16"d)



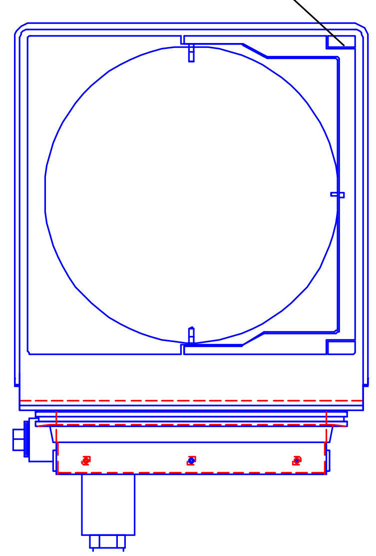
Control Panel (4"h X 11"w X 2"d)



Dryer unit also referred to as a Centrifuge
Dryer Dimensions: 19"h X 17"w X 27"d

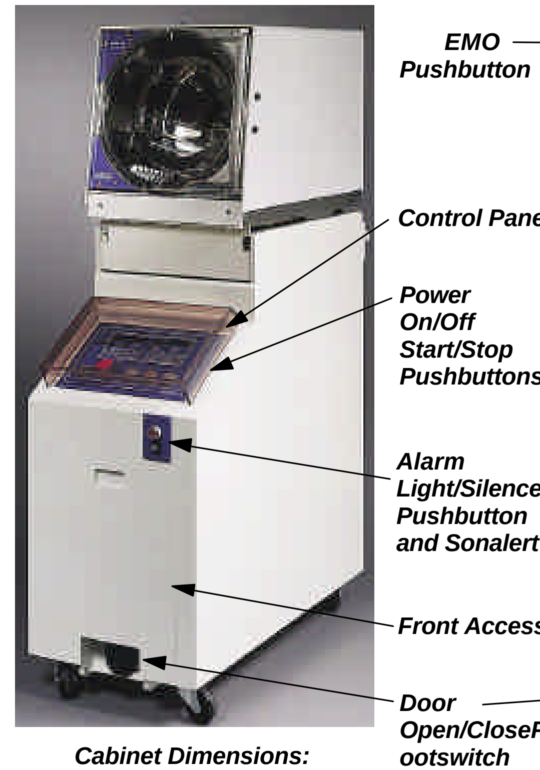


Rear view



Right-hand opening door shown

Typical Front-Removable (FREM) Single Dryer in a Cabinet



Cabinet Dimensions: 59"h X 20"w X 37"d

Typical Bay and Chase Double-Stack Frame

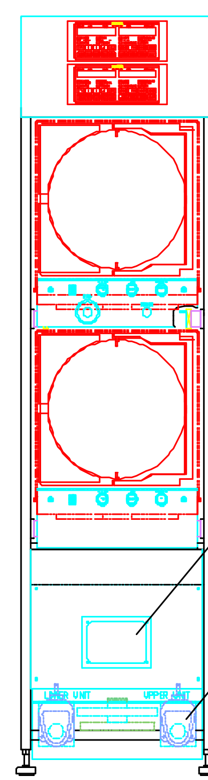
Frame Dimensions: 73"h X 21"w X 32"d

Typical Bay and Chase Single Dryer in a Cabinet

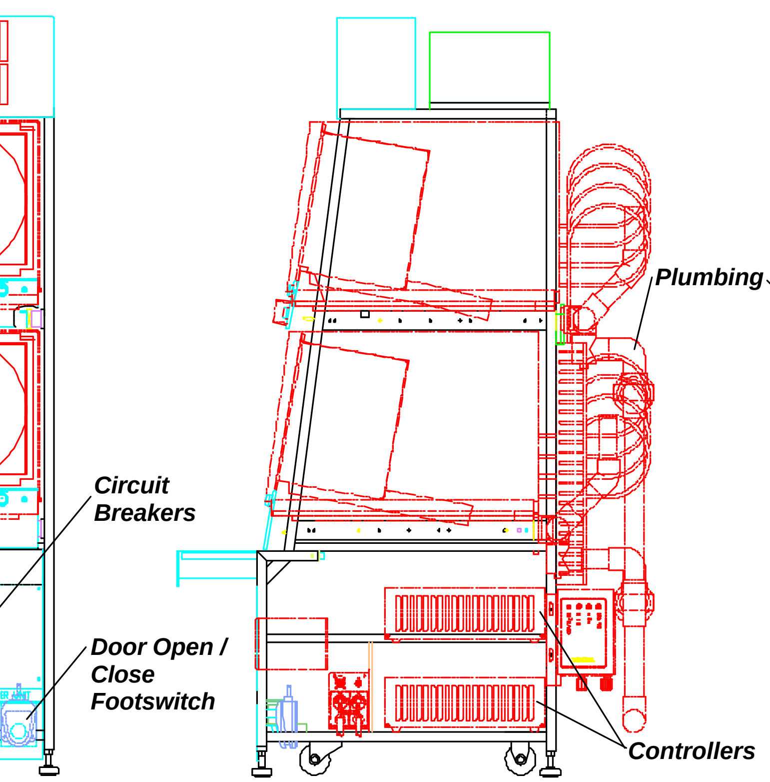
Cabinet Dimensions: 66"h X 22"w X 42"d

Typical FREM Double-Stack Frame (75"h X 20"w X 40"d)

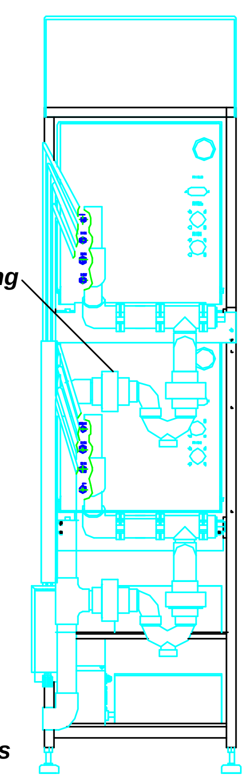
Front view



Side view



Rear view



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Typical Features and Options	
Features	**Description**
Product Capacity	1 cassette / 0-25 200mm wafers or 0-50 200mm wafers
Bowl Dimensions	14" I.D. X 11" deep
DI H_2O	Eight (8) Fan-type. All PFA fittings, TFE valves, tubing, and flowswitches
System N_2	PFA tubing & fittings, TFE flowswitch, stainless steel N_2 heater, and 316 low carbon stainless steel regulators
Cycle Speed	50 to 2250 RPM (1200 Typically)
Cycle Timer	0 to 9999 seconds
Options (contact Verteq Sales for details)	
Left- or Right-hand Hinged Door	
2 Rotor Styles	
CE Marked	
Flaretek Fittings on DI H_2O Lines	
RA-10 Finish Bowl	
High Pressure Teflon DI H_2O valves	
Audible Alarm	
CO_2 Injection	
Door Open/Close Pushbuttons	
Cassette Detection	
Housing:	
Front Removable (FREM) Single Cabinet (PVC)	
FREM Single Cabinet (Fire Retardant Polypropylene)	
FREM Doublestack Frame (with Side Panels)	
Bay and Chase Single Cabinet	
Bay and Chase Doublestack Frame	
Housing Options:	
Resistivity Monitor and Probe	
EMO for FREM or Bay and Chase	
GFI	
Footswitch	
Drain Plumbing (PVC or Polypropylene)	
Doublestack Single-point Facility Hook up	
Doublestack Single-point Facility Hook up with Flaretek connections	
Step Down Transformer	

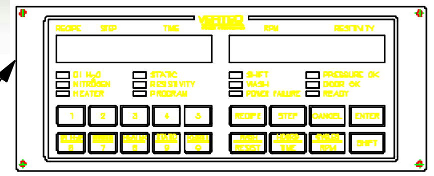
Back

SC200 Rinser / Dryer

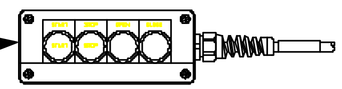
A Typical Verteq SC200 Top-Loading Rinser / Dryer is shown with various standard configurations. Your dryer may not contain all of the components, features and options shown. Features on your dryer may be in different locations than those shown in these examples. Not all components, features, options or configurations are shown. All information is for reference only. Dimensions are approximate.

Typical Controller Components

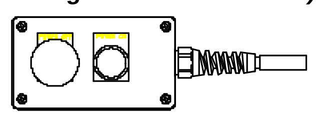
Typical Keypad Control Panel
(4"h X 11"w X 2"d)

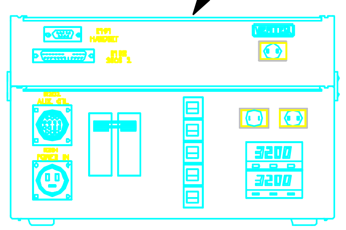


Typical Operator Control
(2.4"h X 2.7"w X 2"6.4 L)
(11 lengths from 72" to 240")

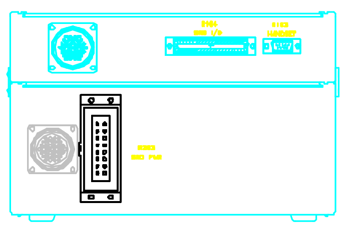


EMO to Controller
(4.6"h X 3.1"w X 6"L)
(11 lengths from 72" to 240")





Controller (front view)
(7.5"h X 11.5"w X 20"d)

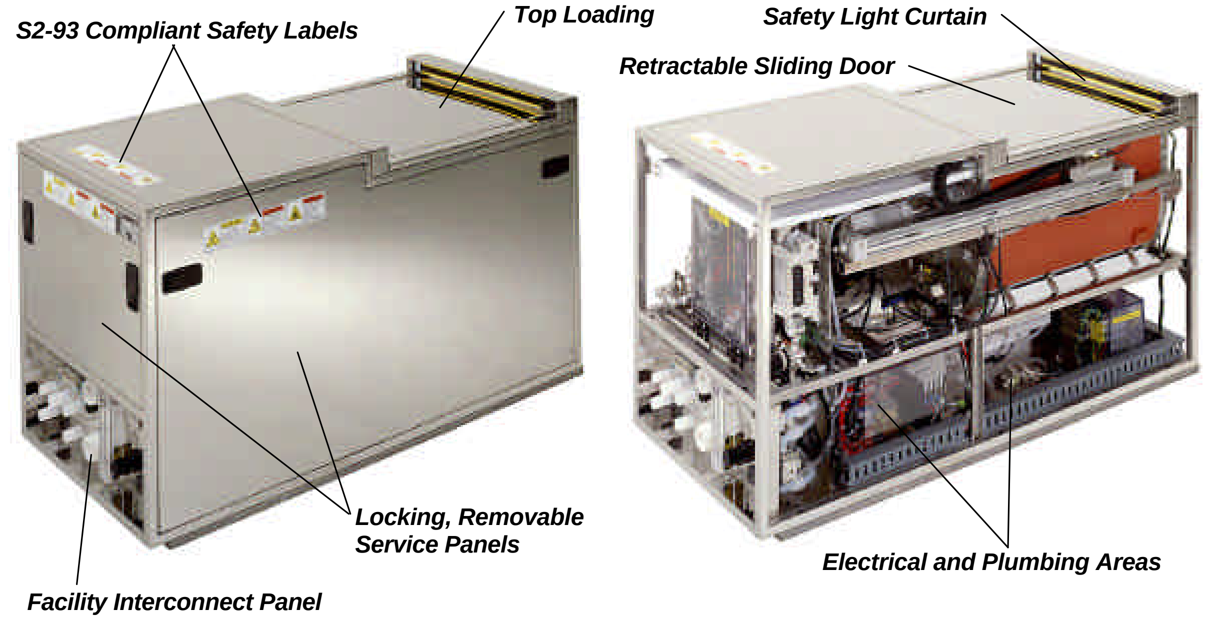


Controller (rear view)

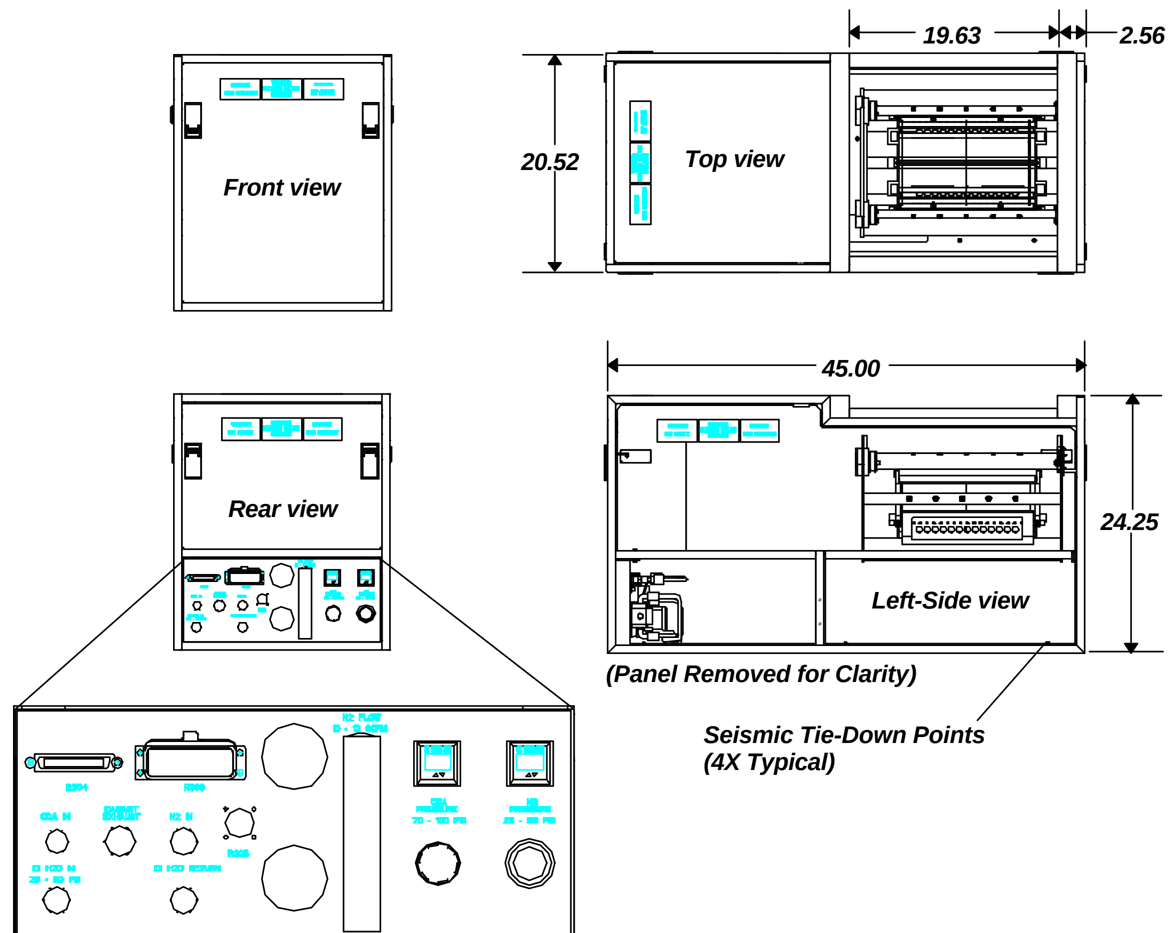
Typical Facility Requirements			
Liquids and Gases		**Electrical**	
DI Water In	$^3/_8$-inch tube flare	Supply Voltage	200 / 240 VAC
	2 to 3 gpm at 25 psi min and 80 psi max	Phase	1
DI Water Return	$^3/_8$-inch tube flare	Frequency	50 / 60 Hz
	2 to 3 gpm at a min of 5 psi drop of inlet	Full Load Current	20 amps
CDA In	¼-inch tube flare	Number of Wires	2
	70 psi min and 100 psi max at 2 cfm max	Load Current	8 amps (motor)
Nitrogen In	$^3/_8$-inch tube flare	Interrupt Capacity	22,000 amps
	10 to 12 scfm at 45 psi min and 80 psi max	**Seismic Design Information**	
Drain	1 ½-inch NPT Male Pipe	Equipment Weight	Total = 500 lbs.
	2 to 3 gpm with no back pressure	Weight Distribution	Front Ft=167 lbs.
Cabinet Drain	¼-inch NPT Female / no back pressure		Rear Ft = 83 lbs.
Vent	1 ½" Male Pipe		
	12 scfm with not back pressure		
Cabinet Exhaust	½-inch tube flare, 5 cfm / no back pressure		

Features	Description
Product Capacity (Rotor Dependent)	1 cassette / 0-25 wafers up to 200mm Dia. or 1 PEC / 0-50 wafers up to 200mm Dia.
N_2 / DI Nozzles	16
DI Water	PFA fittings, TFE valves, tubes and flowswitches
System N_2	PFA tubing, Flaretek fittings, TFE flowswitch, stainless steel N_2 heater, and 316 low carbon stainless steel regulators
Cycle Speed	50 to 1200 RPM (limited for certain rotors)
Cycle Timer	0 to 9999 seconds

Top, Left-side, Rear Views



Physical Dimensions



Lower Rear Facility Interconnect Panel

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Typical Features and Options
Alarm Board
Emergency Power Off (EPO)
N_2 Flow Sensor
N_2 Heater
No-Heat Detector
Remote Start, Stop // Door Open, Close Buttons
Resistivity Monitor Probe
Retainer Lock Verification
SECS II Interface
Static Eliminator
RA10 Bowl
Cassette with Wafer Detection
Automatic Door Light Curtain
CE Marked
Flaretek Fittings on DI Water Lines
Integral P-Trap and Vent

System Parameters	
Rinse Cycle Speed	0 (50) to 1200 RPM
Dry Cycle Speed	0 (50) to 1200 RPM
Rinse Timer	0 to 9999 seconds
Dry Timer	0 to 9999 seconds
Resistivity	0 to 18.2 megohms

Component Interconnect Cables
AC Power Cable
Data Cable (Controller to Rinser / Dryer
Keypad to Controller
EMO to Controller
Remote Start, Stop // Door Open, Close Buttons
Eleven (11) different cable lengths from 72" to 240"

Options (contact Verteq Sales for details)
Lower Frame for Standalone Applications. Note: *O.E.M. to provide for integration into wet system.*
RA10 Rotor Finish

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Reproduction Guide

DOCUMENT	PART NUMBER
Verteq 1800-6—Operations and PM Manual	**9300153.1**

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1. **Print this job on the Docutech at one (1) setting lighter than middle.**
2. **DO NOT include tab dividers with cleanroom copies. 3-hole punch and Double-bag shrink-wrap.**

ASSEMBLER'S INSTRUCTIONS

Order	Tab Name	Item		Paper
		Front	Back	(color/weight)
1.		1 sheet clear acetate	N/A	N/A
2.		Revision History ***(Cleanroom Starts Here)***	2-sided	White-60 or 70 lb
3.		Title page / Copyright page	2-sided	White-60 or 70 lb
4.	**Preface / Contents**	Preface / Table of Contents	2-sided	White-60 or 70 lb
5.	**Section 1** **Safety Systems**	Safety Systems	2-sided	White-60 or 70 lb
6.	**Section 2** **Theory of Operations**	Theory of Operations and Specifications Plus 11/17 foldout	2-sided	White-60 or 70 lb
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12.	**Section 8** **Schematics and IPBs**	**Schematics** *11 x 17 foldouts (**one-sided**)*	Single-sided	White-60 or 70 lb
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13.	**Section 9** **Technical Reference**	Technical Reference	2-sided	White-60 or 70 lb
14.	**Section 10** **IPAassist Module**	IPAassist Module	2-sided	White-60 or 70 lb