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PRAXAIR
SURFACE TECHNOLOGIES

Model 3710
Plasma Control Console
Operator's Manual

Manual Part Number: 5008575



EC Declaration of Conformity

We, Praxair Surface Technologies, 146 Pembroke Road, Concord, NH 03301 USA, declare under sole responsibility that the Model 3710 Control Console to which this declaration relates is in conformity with the relevant provisions of the following standard(s) or other document(s):

Applied Directive(s):	Low Voltage 2006/95/EC EMC 2004/108/EC
Standard(s):	EN 60204-1 EN 61000-6-4 EN 61000-6-2
Equipment:	Thermal Spray Control Console
Brand Name:	Praxair Surface Technologies
Model:	3710

We hereby declare that the equipment specified above conforms to the above directive(s) and standard(s).

Signature: _____

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Safety First

Read This Before Using Thermal Spray Equipment



WARNING

Read and understand operator's manual before using this machine. Failure to follow operating instructions could result in injury or damage to equipment.

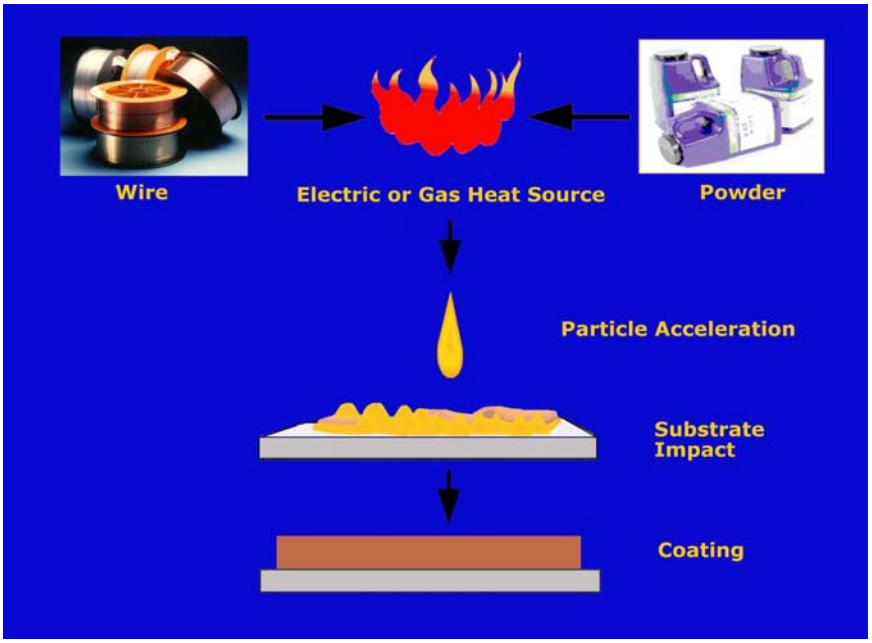
Thermal spraying is powerful technology. Do not use equipment carelessly or without observing safe practices. **Be safe!**
Learn the recommended procedures and standards.
Failure to follow recommended procedures and standards can result in severe injury to people and damage to equipment.

Who should use Thermal Spray Equipment?

Use the equipment only if you have been trained fully in safely using it. Do **not** allow untrained persons to install, operate, or maintain the equipment.

Understand what to do before you do it!

Make sure that you have read and understand the contents of this manual - especially the safety guidelines and operating procedures - **before** installing, operating, or maintaining this equipment. Contact a Factory Representative if you do not fully understand any guidelines or instructions.



Generic Thermal Spray Process

Sources of Information

To work safely with thermal spray equipment, become familiar with these items:

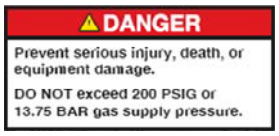
- This manual and related documentation, especially:
  - Safe practices and safety guidelines described in section 1 and in highlighted paragraphs throughout this guide
  - Operating instructions (see section 4)
- Technical bulletins included with or referred to in this manual. This includes industry publications that contain standards that may apply to your work. (See page vi of this guide for a list of industry publications.)
- Labels, tags, other instructions, and warnings that come with or are attached to the equipment
- Guidelines and practices your specific site has established as standard

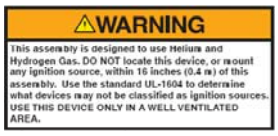
About This Manual

This manual presents information about setting up, operating, maintaining, and troubleshooting your equipment.

Conventions

Throughout this manual, certain words and symbols are used to draw your attention to important information. These symbols and words have the following meaning:

Praxair Surface Technologies RECOMMENDS	A procedure or setting that will produce optimum results
	Information that can help to operate the equipment more effectively.
	Refer to the manual before doing any maintenance.
	**Wear respirator.**
 	**Risk of eye injury. Eye protection required.** **Wear opaque eye protection.**
 	**Wear protective clothing, gloves.**
	**Wear hearing protection.**
	**Pressure Relief**
	**DANGER** Prevent serious injury, death, or equipment damage. DO NOT exceed 200 PSIG or 13.75 BAR gas supply pressure.



WARNING

This assembly is designed to use Helium and Hydrogen Gas.
DO NOT locate this device, or mount any ignition source, within 16 inches (0.4 M) of this assembly. Use the standard UL-1604 to determine what devices may not be classified as ignition sources.
USE THIS DEVICE ONLY IN A WELL VENTILATED AREA.



WARNING

PERSONAL INJURY HAZARD:

Use caution when handling the powder feeder, feed lines and fittings. There is a possibility of static electricity discharge from the powder feed system which could result in significant discomfort or injury.



HAZARD

Hazards that can result in minor or major damage to equipment, bodily injury to people, and how to prevent such hazards.



EXPLOSION HAZARD



ELECTRIC SHOCK HAZARD



FIRE HAZARD



HIGH TEMPERATURE HAZARD



ELECTROMAGNETIC FIELDS HAZARD



LIGHT EMISSION HAZARD



People with Heart Pacemakers Not Allowed

Related Publications



Information that can help

OSHA (Occupational Safety and Health Administration) establishes mandatory federal safety regulations. For information about the regulations, refer to **OSHA Standards, Code of Federal Regulations, Title 29, Part 1910.**

Handling compressed gas is among the safety hazards associated with thermal spraying. **ANSI/AWS Z49.1, Safety in Welding and Cutting** and the **Williams-Steiger Occupational Safety and Health Act of 1970 (84 Stat. 1943)** cover safe handling of compressed gases. More recently, the **Resource Conservation and Recovery Act (RCRA)**, dealing with the disposal of toxic wastes, potentially affects the thermal spray industry.

Occupational Safety and Health Act Standards (29CFR 1910), available from the Superintendent of Documents, U.S. Government Printing Office.

Ventilation Control of Grinding, Polishing and Buffing of Metals, ANSI Z43.1, available from the American National Standards Institute.

Safety in Welding and Cutting, AWS/ANSI Z49.1, available from the American Welding Society.

Environmental, Health, and Safety Guidelines, available from **TSS** an affiliate society of ASM International (ASM TSS).

Standard Practices for Respiratory Protection, ANSI Z88.2, available from the American National Standards Institute.

Safety Requirements for Industrial Hand Protection, ANSI Z89.1, available from the American National Standards Institute.

National Electrical Code, NFPA 70-2008, available from the National Fire Protection Association, updated annually.

Safe Handling of Compressed Gases, CGA Pamphlet P-1, available from the Compressed Gas Association.

Oxygen, CGA Pamphlet G-4, available from the Compressed Gas Association.

NFPA 50 Bulk Oxygen Systems at Consumer Sites, available from the National Fire Protection Association.

NFPA 55 Compressed & Liquefied Gases in Portable Cylinders, available from the National Fire Protection Association.

NFPA 30 Flammable and Combustible Liquids Code, available from the National Fire Protection Association.

Recommended Safe Practices for the Preparation for Welding and Cutting of Containers That Have Held Hazardous Substances, ANSI/AWS F3.1, available from the American Welding Society.

Safety Release Device Standards - Cylinders for Compressed Gases, CGA Pamphlet S1.1, available from the Compressed Gas Association.

Standard for Gaseous Hydrogen at Consumer Sites, CGA Pamphlet G5.1, available from the Compress Gas Association.

Power Piping, ANSI B31.1, available from the American National Standards Institute.

Acetylene, CGA Pamphlet G-1, available from the Compressed Gas Association.

Oxygen-Fuel Gas Systems for Welding and Cutting, NFPA 51, available from the National Fire Protection Association.

Standard for Fire Prevention in Use of Cutting and Welding Processes, **NFPA 51B**, available from the National Fire Protection Association.

Standard for the Storage and Handling of Liquefied Petroleum Gases, ANSI/NFPA 58, available from the National Fire Protection Association.

Industrial Ventilation: A Manual of Recommended Practice ACGIH (25th Ed., 2004)

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Section 1

Safety Guidelines

This section covers potential hazards and safety issues associated with thermal spraying, preparing for its use, and its finishing processes. Subjects include:

Fire prevention and protection
Safe operating conditions
Flame spray and HVOF equipment
Plasma and arc equipment
Abrasive blast machines
Safe operation of the equipment
Worker's protection
Ventilation
Toxic material handling
Relevant safety standards

1.1 Reminder: Safety First!



Thermal spraying equipment is very powerful. Do not use equipment carelessly or without observing safe practices. Be safe! Learn the recommended procedures and standards. Failure to follow recommended procedures and standards can result in severe damage to equipment and injury to people.

Use the equipment only if you have been trained fully in its safe operation. Do not allow untrained persons to install, operate, maintain, or troubleshoot the equipment.

Make sure that you have read and understand the contents of this manual - especially the safety guidelines and operating procedures - before installing, operating, or maintaining this equipment. Contact a Factory Representative if you do not fully understand any guidelines or instructions.

1.2 General Guidelines

All persons concerned with thermal spraying must know and understand these safe practices and the safety regulations contained in established standards. Pertinent established standards are listed in "Related Publications" on page vi.

Information presented in this manual and on various labels, tags, and plates on the unit pertains to equipment design, installation, operation, maintenance, and troubleshooting that should be read, understood, and followed for the safe and effective use of this equipment.

The installation, operation, maintenance, and troubleshooting of thermal spray equipment requires practices and procedures that ensure personal safety and the safety of others. Therefore, this equipment is to be installed, operated, and maintained by qualified persons as specified in this manual and in accordance with all applicable codes such as, but not limited to, those listed in section 1, and the corresponding sections of the manual. You should thoroughly understand and comply with local, state, and federal (OSHA) health standards, especially when handling toxic materials.

1.3 Fire Protection and Prevention

1.3.1 Work Areas

Keep the work area clean! Avoid accumulating metal dusts. Inspect rafters, tops of booths, and floor cracks for dust accumulation.

NEVER store paper, wood, oily rags, or cleaning solvents within the spray room or enclosure.

1.3.2 High Temperatures

Thermal spraying operations generate extremely high temperatures.
NEVER point thermal spray equipment at any person or flammable material.

1.3.3 Hazardous Materials

Toxic Wastes

Preparations for thermal spraying, the process itself, or subsequent finishing operations may generate toxic materials. Dispose of them according to the **EPA Resource Conservation and Recovery Act (RCRA).**

Flammable Solvents and Sealer Bases

Certain de-greasing solvents and sealer bases are flammable and require special use, handling, and storage precautions in and around the thermal spray area.

Metal Dusts and Powders



Treat airborne metal dusts, finely divided solids, or accumulations as explosives. Minimize the danger from dust explosions by providing adequate ventilation in spray booths. Install a cartridge-type dry dust collection system to collect spray dust.

1.4 Safe Operating Conditions

1.4.1 Compressed Gas Cylinders

Always comply with local, state, municipal and federal regulations regarding compressed gas cylinder storage and follow recommendations in **ANSI/AWS Z49.1, Safety in Welding and Cutting; CGA Pamphlet P-1, Safe Handling of Compressed Gases; NFPA 55, Compressed & Liquefied Gases in Portable Cylinders; NFPA 51, Oxygen-Fuel Gas Systems in Welding and Cutting; and NFPA 51B Standard for Fire Prevention in the Use of Cutting & Welding Processes**. Improper storage, handling, and use of gas cylinders **Creates A Safety Hazard**. If the site plan includes manifolding cylinders to permit longer spray times before changeover, follow **ANSI/AWS Z49.1** recommendations in designing the plan.

NEVER use oil or grease on oxygen equipment. Use **ONLY** special oxidation- resistant lubricants. Consult the equipment manufacturers or a qualified dealer for more information.



Be sure the work area is adequately ventilated before opening any gas valves. Drain the regulator of gas and release the regulator adjusting screw before SLOWLY opening the cylinder valves. ALWAYS stand away from the direction of force when opening cylinder valves.

Install pressure reducing regulators in accordance with **ANSI/AWS Z49.1**. Use only the appropriate regulator for each gas cylinder: **USE ONLY ACETYLENE REGULATORS ON ACETYLENE TANKS OR MANIFOLD SYSTEMS.** Always use the correct size wrench to connect the regulator to the cylinder valve outlet; **NEVER** force or overtighten a connection.

NEVER use oil or grease on a regulator.

1.4.2 Flow Meters

Install and use flow meters in accordance with **ANSI/AWS Z49.1**. Avoid unsafe operating conditions and ensure proper flame balance by installing backflow prevention devices in conjunction with the flow meters. Place a protective shield on flow meters with glass tubes.

Install and use hose and hose connections according to **ANSI/AWS Z49.1 and the Specification for Rubber Welding Hose** published by the Rubber Manufacturer's Association and the CGA. Handle hoses carefully to avoid damage. Use hoses only in the applications for which they are designed. Blow out hoses to remove any dust. Avoid any ignition sources.

Turn regulator adjusting screws slowly to prevent surges that may crack or burst flow meter tubes. Overtightening can collapse the nipple nose, so **NEVER OVERTIGHTEN** the connecting nuts on pressure reducing regulators and flow meters. If a fitting does not seal without undue force, replace it.

NEVER use a flame to check for gas leaks. Use soapy water to check all hose connections for leaks. Soapy water provides a safer, more sensitive test.

If any connections leak, depressurize, open the connection, clean the sealing surfaces and threads, re-assemble, pressurize, and test for leaks. If a leak persists, depressurize the system.



EXPLOSION HAZARD:

NEVER USE LEAKING THERMAL SPRAY EQUIPMENT.

Place a "Danger Do Not Operate" tag on the defective equipment to alert others to the unsafe condition.

Obstructed gas lines caused by defective hoses, collapsed hose stems, or dirt in the gun head gas passages or nozzle jets require excessive gas pressure to obtain proper gas flow.

If required oxygen and fuel gas pressure are more than 3 psi (0.2 bar) over the recommended pressure, check for a fouled nozzle or incorrect air cap. Low pressures often indicate a serious leak. Shut down the equipment and correct the condition before restarting the system.



EXPLOSION HAZARD:

Acetylene pressures exceeding 15 psig (1.03 bar) may cause the gas to detonate. If this pressure of 15 psig (1.03 bar) is insufficient, use another fuel gas.

1.4.3 Compressed Air

Always refer to gases by their proper names to avoid confusion.
Never use compressed air, oxygen, or fuel gas to clean clothing.

For thermal spraying or blasting operations, use compressed air only at recommended pressures. Keep the air line free of oil and moisture. Consult an equipment dealer for filter and after-cooler recommendations.

1.4.4 Flame Spray and HVOF Equipment

Thoroughly read and understand this manual and familiarize all operators with gun operation before lighting the gun. Maintain guns according to recommendations.



PERSONAL INJURY (BURN) HAZARD:

Using a match to light a flame spraying gun can result in serious injury. Use a friction lighter, pilot light, or arc ignition instead.

Properly seating and lubricating the gun's oxygen, fuel gas and compressed air valves helps the gun operate freely and shut off completely.



Extinguish gun backfires as quickly as possible.

Determine the cause of gun backfires or blowouts BEFORE relighting.

When you have completed spray operations, when you are shutting down the equipment, or when you leave the equipment unattended, release all gas pressure from the regulators and hoses.



EXPLOSION OR FIRE HAZARD:

NEVER hang a flame spraying gun or its hoses on regulators or cylinder valves.

1.4.5 Plasma and Arc Spray Equipment

Plasma and arc spray equipment differ from flame and HVOF equipment. They use high voltages and amperages that represent an electrical hazard. Train operators how to use the equipment safely before they actually use it. Specifically, ensure that operators know and understand all the operating and safety recommendations in the operator manuals. Always observe standard safety precautions for electrical equipment and operate in accordance with ANSI/AWS Z49.1

Frequently clean arc guns and power supplies to prevent metal dust accumulation that causes electrical short circuits. Properly insulate or ground the wire feed units used with the arc spray equipment. If the gun is suspended, insulate or ground the suspension hook. Ground or insulate all exposed plasma gun electrodes and cable connections. Interconnect all ground cables.

Periodically inspect cables, insulation, hoses, and gas lines. All pushbuttons, pilot lights, plugs, and cables should be intact and meet **ANSI/NFPA 70-1979**, **National Electrical Code** standards. Repair or replace faulty equipment at once. Never adjust, clean, or repair any part of the power supply, console, or gun without first disengaging the entire system, including the power supply.



Avoid contact between any ungrounded portion of the plasma or arc gun and the spray booth or chamber. Electrically isolate plasma guns and nozzles from support brackets to prevent stray high frequency current from damaging other electrical equipment and controls.

1.4.6 Abrasive Blast Machine

Maintain and inspect abrasive blast machines according to manufacturer's instructions. Remove and repair or replace worn parts as needed. Do not exceed recommended air pressure in the blast tank.

Keep blast hoses as straight as possible between the blast machine and blasting area. Sharp hose bends cause excessive friction and wear that can lead to a blowout at those points. If hoses must be curved around an object, use long radius curves. Store blast hoses in cool, dry areas.

Be sure blast hose controls function properly. They should require continuous pressure on the activating lever for operation. Releasing the lever should cause the system to shut off (dead man control).



PERSONAL INJURY:

NEVER point a blast nozzle at a person.

Most blasting operations require respiratory protection for the operator. Select, operate, and maintain the protective device according to **ANSI Z88.2, Standard Practices for Respiratory Protection**, described in section 1.5.2.

1.4.7 Handling and Manipulating Equipment

Most thermal spray and blasting applications require rotation or other manipulation of the part being worked on. Some handling equipment can impart high rotational speeds to parts being coated. Affix and balance parts when necessary. Provide protection for the operator in case a rotating part becomes airborne. Never leave operating equipment unattended.

1.5 Protecting Workers

The general requirements for the protection of thermal spraying operators and welders are the same as those published in **ANSI/AWS Z49.1, Safety in Welding and Cutting; ANSI Z87.1, Standard Practices for Occupational and Educational Eye and Face Protection; ANSI Z88.2, Standard Practices for Respiratory Protection; and ANSI Z89.1, Standard Practices for Industrial Head Protection with Low Voltage Hazards.**

1.5.1 Eye Protection

Spraying and blasting operations require eye protection in the form of helmets, hand shields, face shields, or goggles. See **ANSI Z87.1 and Z89.2** for recommendations. Operators **MUST** use protection against infrared and ultraviolet radiation and flying particles. Provide all helpers and adjacent operators with suitable eye protection as well. Equip the eye protection with a suitable filter plate to protect against ultraviolet, infrared, and intense visible light radiation (see Table 1-1).

Table 1-1
Eye Protection

Operation	Required Type of Eye Protection
Wire Flame Spraying (except Molybdenum)	Shades 2-4
Molybdenum Wire Spraying	Shades 3-6
Flame Spraying of Metal Powder	Shades 3-6
Flame Spraying of Exothermic Ceramic Powder or Rod	Shades 4-8
Plasma and Arc Spraying	Shades 9-12
Arc Bonding	Shades 5-6
Fusing Operations	Shades 4-6

In thermal spray operations where additional respiratory protection is not required, operators may wear eye protecting goggles alone. The goggles should have indirect ventilating fins to reduce fogging and eliminate danger from flying particles. In plasma spray operations, replace the goggles with helmets or hand shields that provide face, chin, and neck protection from infrared and ultraviolet radiation.

When blasting, use face shields or helmets equipped with dust hoods to protect eyes, face, chin and neck. Provide respiratory protection, as well as other protection discussed in the following paragraphs.

1.5.2 Respiratory Protection

Respiratory protection is necessary for most spray and blast operations. Selection of device is determined, in accordance with **ANSI Z88.2**, by the nature, type, and magnitude of the fume and gas involved. **Select only devices approved by the U.S. Bureau of Mines, National Institute of Occupational Safety and Health (NIOSH), or an other approved authority.** Suggested devices for typical thermal spraying and blasting operations include:

Blasting in the open: use a **mechanical filter respirator** with a face shield and dust hood **or** a self-contained breathing apparatus.

Thermal spraying in confined or semi-confined spaces: use an **air line respirator**. Use a device similar to the one described below for abrasive blasting.

Abrasive blasting in confined or enclosed spaces: use a **continuous flow air line respirator** consisting of a continuous flow air line respirator, a full face piece or helmet, and dust hood sufficient to protect the head and neck from rebounding abrasive material. Minimum air flow to the respirator should be 4 cfm (11.2 L/minute) at the face piece and 6cfm (19.6 L/minute) entering the helmet or hood. Fresh air blowers are preferred to compressed air as an air source of respirator air. If adequate ventilation is not provided, use an in-line vortex cooler when possible for operator comfort. Filter the air supply line to remove objectionable odors, oil or water mist (or both), and rust particles from the air. Locate the air intake to ensure the respirator receives clean, dry air (CDA). If gaseous air contaminants such as carbon monoxide are possible, use a separate air purifier. Grad D. or better compressed air is considered breathable.

Thermal spraying in an open or a well-ventilated work area: additional respiratory protection may not be necessary. In borderline cases, use approved **mechanical filter respirators** for protection against dust and metal fumes. Borderline cases are those that consist of light work or short duration with nontoxic materials, but with some dust exposure.

Continuous flow air line respirators are adequate for thermal spraying operations involving most commonly used materials. If the respirator air supply fails and the contaminant in the space is not immediately harmful to health, the operator may stop operations, remove the supply line, and return to breathable air.

When highly toxic materials are being applied, the contaminated air is considered immediately harmful and the operator **MUST NOT** remove the respirator. In these applications, the respirator must be equipped with an emergency auxiliary source of breathable air that the operator can breathe while working in the confined space.

1.5.3 Noise Protection

The **Occupational Safety and Health Administration (OSHA)** requires employers to provide safe working conditions. OSHA also requires employees to comply with all rules, regulations and orders that apply to their actions and conduct. **OSHA** does not provide thermal spraying-specific rules but establishes general rules for the control of unsafe and unhealthy elements.

1.5.3.1 Noise and Noise Level

Noise is an unneeded and objectionable sound. Excess noise reduces productivity, slows reaction times, and causes tension, hearing impairment, and nervousness.

Noise level is a measurement of sound wave energy (pressure). The standard unit of sound measurement is decibels (dB). See Table 1-3 for safe exposure times at different noise levels.

Thermal Spray Noise Levels

Thermal spray processes generate high noise levels. Table 1-2 shows typical noise levels of various environments. To verify whether a problem exists, measure the noise and noise levels at your site.

Table 1-2 Typical Noise Levels of Various Environments		
Equipment	**Setup**	**dBA**
Arc Guns	Steel	
	24 V/200	111
	32 V/500 A	116
Powder Guns	Acetylene	
(Normal)	w/o spray booth	89
	w/spray booth	90
	w/spray booth & air jet cooling	110
	Hydrogen	
	w/o spray booth	100
	w/spray booth	101
Powder Guns	Acetylene	
(High Capacity)	w/spray booth	94
	w/spray both & airjet cooling	111
Wire Combustion Guns	Acetylene	114
1/8 & 3/16 inch	Propane	118
(3.2 & 4.8 mm)	Propane & nonload hardware	125
	Methylacetylene-propadiene gas	118
Plasma gun	Nitrogen - 600 A	134
	Nitrogen/Hydrogen - 600 A	133
	Argon - 1000 A	128
	Argon/Hydrogen - 600 A	133
	Argon/Helium - 600 A	127
	Argon/Nitrogen - 1000 A	131
HVOF	Oxygen plus kerosene	~126
Grit-blasting Equipment	Compressed air	80-85
Exhaust Equipment	Air	<90

1.5.3.2 Noise Duration

Noise of sufficient intensity and duration can create physiological effects. The louder the noise, the shorter the permissible exposure. Table 1-3 shows tolerable noise limits for various exposure times.

Table 1-3 Tolerable Noise Limits of Various Exposure Times	
Exposure Duration (Per Day)	**Sound Level (dBA)**
Hours	
24	80
16	82
8	85
4	88
2	91
1	94
Minutes	
30	97
15	100
7.5	103
3.75	106
1.88	109
0.94	112
Seconds	
28.12	115
14.06	118
7.03	121
3.52	124
1.76	127
0.88	130
0.44	133
0.22	136
0.11	139

1.5.3.3 Hearing Protection

If noise at your site exceeds the limits established by **OSHA in paragraph 1910.95**, entitled **"Occupational Noise Exposure"** of the **Occupational Safety and Health Standards**, you should provide ear and/or other protection to everyone near thermal spray operations to bring the exposure within OSHA permissible, tolerable noise levels. Limit workers' exposure to noise according to federal standards prescribed under the **Occupational Safety and Health Act.**

Protect operators, nearby workers, and transient passers-by from thermal spray noise: at the source, during its transmission, or at the receiver. Managing any of these can solve the noise problem. Each situation

contains many variables, so each case must be treated individually. This manual can provide only general suggestions for noise control.

Use engineering or administrative controls to reduce noise or noise exposure. Engineering controls include: redesign equipment, relocate equipment, change operating conditions, isolate equipment acoustically, insulate work area, and provide operator hearing protection. Administrative controls include planning and scheduling to reduce exposure.

If engineering and administrative controls do not achieve acceptable noise control, **OSHA** regulations allow use of suitable personal protective equipment. This also applies while engineering and administrative controls are being established.

Mufflers on thermal spray equipment are impractical and ineffective. Simple baffles between the gun and nearby personnel are not effective because noise scatters around the baffle. Specially designed sound absorbing materials provide a 5 dB reduction to adjacent areas. Sound absorbing materials on walls and hanging baffles can reduce nearby levels but do not solve the problem for the operator.

Relocate Equipment

Increasing the distance between the noise source and the receiver lowers the sound pressure level. Table 1-4 lists how increasing distance can reduce decibels in a free field.

Table 1-4
Using Distance to Reduce Decibels

Distance from Source	Theoretical dBA Reduction
3 feet (1 m)	0
10 feet (3 m)	10
30 feet (9 m)	20
90 feet (27 m)	28

Isolate Equipment

Isolate noise by moving it away from affected personnel or placing the equipment in an acoustically insulated enclosure. Praxair Surface Technologies offers spray rooms that enclose spray operations and confine noise. These rooms are designed to limit the noise level to specified limits

outside the room. Contact Praxair Surface Technologies for additional information.

Insulate Work Area

Blocking the path of sound transmission by lining the work area with sound absorbing materials provides significant noise reduction. Consult noise control experts for material recommendations.

Plan and Schedule to Reduce Exposure Time

Engineering controls focus on eliminating, reducing, or containing the noise hazard. Administrative controls attempt to reduce exposure time.

Planning and scheduling are best used where spraying is intermittent. Usually, spraying time is a small percentage of the total job compared with setup, surface preparation, and finishing.

If spraying time exceeds the permissible levels for noise exposure, schedule jobs over more than one shift or day to keep exposure within maximum limits. More than one operator can spray jobs to keep the exposure of any one person within limits. Spraying outside of regular plant hours can control exposure of persons near the operation. Also, rotate personnel assignments in the vicinity of the thermal spraying operation to control exposure.

1.5.4 Protective Clothing

When working in confined spaces, wear flame resistant clothing and leather or rubber gauntlet gloves. Clothing should fit snugly around the wrists and ankles to keep sprayed materials and dust away from the skin.

For work in the open, ordinary clothing may be sufficient. However, open shirt collars and unbuttoned pocket flaps are potential hazards. Always wear high-top shoes and cuffless trousers that cover the tops of the shoes.

If workers will be spraying toxic materials, consult a material supplier for information on protective clothing.
Plasma spraying generates intense ultraviolet radiation that can cause a "sunburn" through normal clothing. When plasma spraying, wear clothing such as thick, tightly woven wool clothing that provides protection against radiation. Also wear appropriate eye protection. For more intense exposure, leather capes or aluminized clothing is necessary. Take care to attach aluminized clothing to the outside of the face shield so radiation is

not reflected onto the face shield. Wear aluminized gloves and dark, fire-retardant clothing.

Arc spraying radiation protection is similar to that for electric arc welding and is outlined in **ANSI/AWS Z49.1**. Some arc spraying guns are equipped with an arc shield that protects the operator from direct exposure to the arc. Also use a helmet if any parts of the body are exposed to direct arc radiation or if exceptionally reflective substrates are being sprayed.

1.5.5 Confined Spaces

Spaces such as a closed tank, boiler, pressure vessel or ship compartment are considered confined spaces. Review **AWS F3.1, Recommended Safe Practices for the Preparation for Welding and Cutting of Containers and Piping That Have Held Hazardous Substances**, if the confined space previously held combustible materials.

Work in confined spaces requires ventilation. See the standards referred to in "Compressed Gas Cylinders" in section 1.4.1 of this manual for ventilation requirements. When you are thermal spraying in any confined space, keep the gas cylinders out of the work space.

1.5.5.1 Rapid Emergency Exit

If operators must enter a confined space through a small opening, provide the means for rapid emergency exit. If operators are using safety belts and life lines for this purpose, attach them to the operator's body so they will not jam in a small exit space. Station at least one attendant trained in rescue work outside the confined space at all times and verify this person's ability to remove the operator from the confined space if an emergency should occur.

1.5.5.2 Factors to Consider

To eliminate the chance of gas escaping through leaks or improperly closed valves, prior to entering the confined space, close the gun valve and shut off the gas supply at a point outside the confined space. If possible, remove the gun and hose from the confined space. Evaluate oxygen level inside the confined space with oxygen monitoring equipment. The amount of contamination to which an operator is exposed during spray operations depends on many factors. Consider the following factors when selecting ventilation systems for operator safety:

Volume of space in which the operation is performed
Number of spray/abrasive blast units operating in that space
Sources of hazardous fumes, gases, or dusts (varies depending on material sprayed)
Heat generated by the spraying process
Presence of volatile solvents

Where thermal spraying operations are incidental to general operations, apply local exhaust ventilation to the spray areas to prevent contamination of the general work area.

Carefully maintain individual respiratory protective devices. Clean and disinfect devices before transferring them between employees (see **ANSI Z88.2**).

Provide mechanical ventilation for operations not performed in the open or in a properly designed and ventilated room. Ventilation equipment usually consists of motor driven portable exhausters with flexible piping or ducts that remove dust rapidly and allows operators suitable visibility. A ventilation system does not preclude the need for respiratory protection devices. See "Respiratory Protection," section 1.5.2, for recommendations on protective devices and filtration systems.

When thermal spraying on a machine tool such as a lathe, mount an exhaust hood at the end of the carriage so that it travels with the gun, exhausting dust and fumes into the dust collector. Aim the gun so the sprayed material enters the face of the hood. An average lathe hood is about 2 ft^2 ($0.2m^2$) and the velocity of air entering the opening should be at least 200 feet/minute (1 m/s). The hood opening design should eliminate turbulence along the sides that could force spray dust into the operator's breathing zone. In permanent installations, the entire tool is enclosed except the front; air enters the enclosure at approximately 300 feet/minute (1.5 m/s). The hood top can be hinged to facilitate loading and unloading with a crane. In automatic and production spraying, the entire mechanism is often totally enclosed. Refer to "**Industrial Ventilation**" published by the American Conference of Governmental Industrial Hygienists (ACGIH).

Provide exhaust equipment for dry grinding or lapping operations performed on sprayed coatings. Consult **ANSI Z43.1, Ventilation Control of Grinding, Polishing and Buffing Metals.**

Equip spray cabinets used for spraying small and medium size parts with exhaust ventilation with an air velocity of 200 to 400 feet/minute (1 to 2 m/s) entering the hood opening. This is often referred to as the "face velocity." Operate the spray equipment within the face area of the hood and direct the spray into it. Design the cabinet to eliminate turbulent currents. Refer to "**Industrial Ventilation**" published by ACGIH.

Blasting Rooms

Design and maintain separate rooms for grit-blasting and thermal spraying. Design of a blasting room should include adequate lighting and a dry cartridge-type ventilation system having ventilation down draft and longitudinal air flow at a velocity of at least 80 to 100 feet/minute (0.2 to 0.5 m/s). Thoroughly investigate local, state, and federal regulations before exhausting directly into the atmosphere. A blasting room should include a dust collection system that satisfies all laws and local ordinances for the type of work being done in the room.

Grit-blasting and thermal spraying will require their own independent dust collectors. Although dry cartridge-type dust collectors are suitable for use in both the grit blast and thermal spray environments, it is suggested to refer to **"Industrial Ventilation"**, a manual of recommended practice with a compilation of research data and information on design, maintenance and evaluation of industrial exhaust ventilation systems. This manual is not intended to be used as law, but rather as a guide. In addition, the NFPA guidelines should be used for the handling of metallic and other materials.

Avoid using the grit-blasting room for thermal spraying because the dust collectors can quickly become clogged with a combination of thermal spray and grit dust. Also, an accumulation of metallic dust may create a fire or an explosion hazard.

Replace ventilation-removed air with clean, breathable air. Choose fans that provide at least 10 air changes per minute. If your site uses portable gasoline or diesel engines to drive ventilators, position them so that engine exhaust cannot be drawn into the ventilating system or the intake of the respirator air compressor.
Provide operators with respiratory protection as detailed in "Respiratory Protection" in section 1.5.2.

Ground all fans, pipes, dust arrestors and motors. DO NOT ground to piping that carries fuel gas, oxygen, or other flammables or combustibles.

Run ventilation fans when operators are cleaning out booths, pipes, etc. to prevent accumulation of dust or fumes in the system. NEVER weld or cut while repairing any ventilation or dust collecting equipment unless the equipment has been thoroughly cleaned.

1.6 Toxic Material



PERSONAL INJURY HAZARD:

Almost any material, in finely divided form, can damage the respiratory system. Damage is often not sensed immediately. Take care to keep floors, work benches, and booths free of dusty residues. Carefully clean protective clothing to remove dust, or discard clothing after use. Specific precautions for protecting the health of spray equipment operators vary according to the type of material being sprayed.

1.6.1 Beryllium and Lead

Praxair Surface Technologies does not recommend spraying beryllium, lead, or their compounds because they are highly toxic and hazardous.

1.6.2 Cadmium

Cadmium is highly toxic and hazardous. Use respiratory protective equipment such as fume respirators approved by the U.S. Bureau of Mines, National Institute of Occupational Safety and Health (NIOSH), or other approving authority.

1.6.3 Cobalt, Chromium, and Tellurium

The principal hazard when spraying or blasting these materials comes from ingestion, inhalation, and the subsequent absorption of fumes, dust, or vapors.

The fumes and dust from chromium alloys (such as stainless steels, nickel chromium, and chromium oxide) and tellurium are toxic and hazardous. Provide respiratory protection and adequate ventilation wherever the fume and dust concentration is above the threshold limit (see "Threshold Limit Valves" in section 1.6.6).

1.6.4 Tin and Zinc

Usually encountered in the forms of their oxides and not considered toxic, tin and zinc may cause violent illness, including coughing, headache and, particularly in the case of zinc oxide fumes, nausea, vomiting, chills, fever, muscle and joint pain, and marked thirst. (In the case of zinc oxide, the effect has been known as "brass founder's ague," "brass chills," "zinc fever," or "metal fume fever.") Temporary short term immunity can be developed.

Prevention consists of adequate ventilation and proper respirators (see "Respiratory Protection" in section 1.5.2 and "Confined Spaces" in section 1.5.5). Preclude from the work any operators with pulmonary disease or those who continue to suffer discomfort even with proper ventilation and respirator measures.

1.6.5 Solvents

The radiation generated by plasma or arc spraying causes rapid decomposition of some solvent vapors into noxious and toxic gases, even at considerable distance from the arc. Slow extraction of the part from the solvent cleaning tank can reduce this problem. When spraying vapor-degreased parts, take extra care to see that all solvent (vapors or liquid films or drops of solvent caught by pockets and crevices) is removed prior to thermal spraying.

The ultraviolet radiation from plasma and arc spraying generates airborne ozone. The amount of ozone produced may exceed the maximum allowable concentration in confined spaces. Excess ozone production should be avoided.

1.6.6 Threshold Limit Values

Threshold Limit Values (TLV) are air concentration levels of hazardous materials for exposures not exceeding a total of eight hours daily. TLVs are published annually by the **ACGIH**. Consult a current TLV list concerning the maximum allowable concentration of toxic material allowed.
Conduct air sampling to determine the ventilation requirements for operations involving the previously listed materials. When less toxic metals are sprayed, the concentration of dust or fumes in the work area must not exceed the TLV for eight-hour exposure. Provide respiratory protection devices and exhaust ventilation when the dust or fume

concentration is sufficiently high to cause operator discomfort even when the appropriate TLV is not exceeded.

1.7 Safety Standards

In addition to the contents of this chapter, a variety of industry publications contain safety standards. See the related publications list on page vi.

Section 2

Equipment Description

2.1 Specifications



Physical		
Weight	100 lbs. (45.4 kg) net 180 lbs. (81.6 kg) crated	
Width	31 in. (787 mm)	
Depth	15.5 in. (394 mm)	
Height	37 in. (940 mm)	
Electrical		
Input	115 VAC, 1 phase, 50/60 Hz 20 amps	
Air & Gas	**Orifice #**	**Pressure/Flow**
Purge Air Input	N/A	80 psi (550 kPa) minimum
Argon (primary gas)	56	71.3 - 430 SCFH (33.5 - 202 l/min) at 30 - 200 psi (207 - 1380 kPa)
Helium (secondary gas)	80	15 - 92.6 SCFH (7.1 - 43.5 l/min) at 30 - 200 psi (207 - 1380 kPa)
Hydrogen (secondary gas)	97	4.3 - 26.4 SCFH (2 - 12.4 l/min) at 30 - 200 psi (207 - 1380 kPa)
Argon (carrier gas)	77	8.2 - 46.2 SCFH (4 - 22.6 l/min) at 30-200 psi (207 - 1380 kPa)

Note: All flow rates referenced at 70°F (21°C).

A. Arc Gas Recommendations

Praxair recommends Argon as the primary arc gas:

1. Argon is inert, does not react with the powder or substrate and provides an inert cover for the deposit.

2. Argon's arc temperature is high, approximately 20000°K (35500°F, 19704°C), but an Argon plasma stream or plume has a low heat content, compared to diatomic gases, e.g., nitrogen and hydrogen, thus transferring less heat to the substrate than other gases, enhancing substrate cooling.

3. Unlike nitrogen, argon forms no dangerous compounds.

Some circumstances may require adding small percentages of helium or other secondary gases to the arc gas.

If the plasma does not melt the powder completely, adding a small percentage of helium or another secondary gas to the primary arc gas increases the heat level. However, adding these gases WILL CHANGE OPERATING CHARACTERISTICS.

Consult with your gas supplier to determine appropriate facilities for your expected spray operations.



Praxair recommends storing pressurized and/or flammable gases in a separate gas storage facility, isolated from occupied work areas. Gases should be routed to the spray booth area via "hard plumbed" lines fitted with appropriate safety devices and shut-off valves. Always follow national and local regulations and codes for safe storage and handling of gases.

Gas storage and availability requires serious consideration. Actual usage depends on specific parameters used, the amount of spraying required, and overall system efficiency.

B. Recommended Gas Purity

Arc gas purity is important to optimum electrode life and system operation. Generally, commercial-grade gases are recommended for most applications.

C. Gas Pressure Regulator Requirements

Use three dual stage (N.C.G. Series 6500, or equivalent) regulators: one for arc gas, one for powder gas, and one for auxiliary gas. Outlet working pressure must not exceed 300 psig (2068 kPa). Inlet fitting must be compatible with the gas cylinder. The outlet of each gas pressure regulator must be standard male oxygen (9/16-18 thread) to be compatible with gas hoses supplied with this system.

2.2 Description

The Model 3710 Control Console represents the latest offering in our successful line of compact controllers. The 3710 is CE compliant with added features including two powder feeder control (one at a time, for top coat- bond coat applications), and an auxiliary power circuit that can be used for actuating part cooling, etc. Like its predecessor, the 3710 is an economically priced plasma spray process controller designed for production environments. Easy to understand controls coupled with a compact cabinet design make the 3710 an ideal control console for any plasma spray application.

The console features critical orifice gas control. Jeweled critical orifices used in the 3710 offer extremely accurate gas control. Critical orifices are relatively insensitive to back pressures, unlike similar gas measuring devices such as rotometers. Consistent and repeatable parameters ensure coating repeatability and quality, day after day.

The console features safety interlocks, preventing gun operation in case of failure of the cooling water, power, and/or gas pressure circuit. The console incorporates NFPA Type "Z" purging and audio/visual alarm that warns the operator in case of purging malfunction. Solid-state power control permits selection of the operating current before ignition of the gun and maintains current setting within 1% of setpoint.

Operating Features

- Critical orifice gas flow control
- Supply pressure gauges
- Built-in PC-100 power supply controller with digital voltage and amperage displays
- Solid-state controls
- Two powder feeder control (exclusive either-or)
- Auxiliary power on/off control

Safety Features

- NFPA Type "Z" purging with audio/visual alarm
- 24 V DC purge circuit
- Remote E-stop box
- Stainless steel flammable gas plumbing
- Safety interlocks

Power Control

The Model 3710 operates with the Model PS-1000 60 kW or HPS-100 100 kW three-phase, constant current DC plasma power supplies. The PC-100 Control Module (integral to the 3710 console) regulates power from the either power supply and allows the user to set plasma current before gun ignition.

PC-100 controls include status indicator lights for:

- UNIT READY condition
- FAN ON condition
- TRANSFORMER TEMP HIGH condition
- RECTIFIER TEMP HIGH condition

Plus:

- Digital volt and amp meters
- Knobs to set:
  - Maximum current limit
  - Current level for secondary gas introduction.

2.3 Options

Figure 2-1. Model 3621 Voltage Control



A. Voltage Control

Model 3621 Voltage Control is designed for easy monitoring of the gun voltage (measured at the plasma spray gun), or the system voltage (measured at the input terminals of the high frequency starter). As the water-cooled power cables deteriorate with use, their increasing resistance to current flow can seriously affect the system performance. The 3621 remote pendant (not shown) allows the operator to switch between monitoring of the system and gun voltage, displayed on the PC-100 power supply controller. This allows for easy determination of voltage drop across the water-cooled power cables and evaluation of their condition.

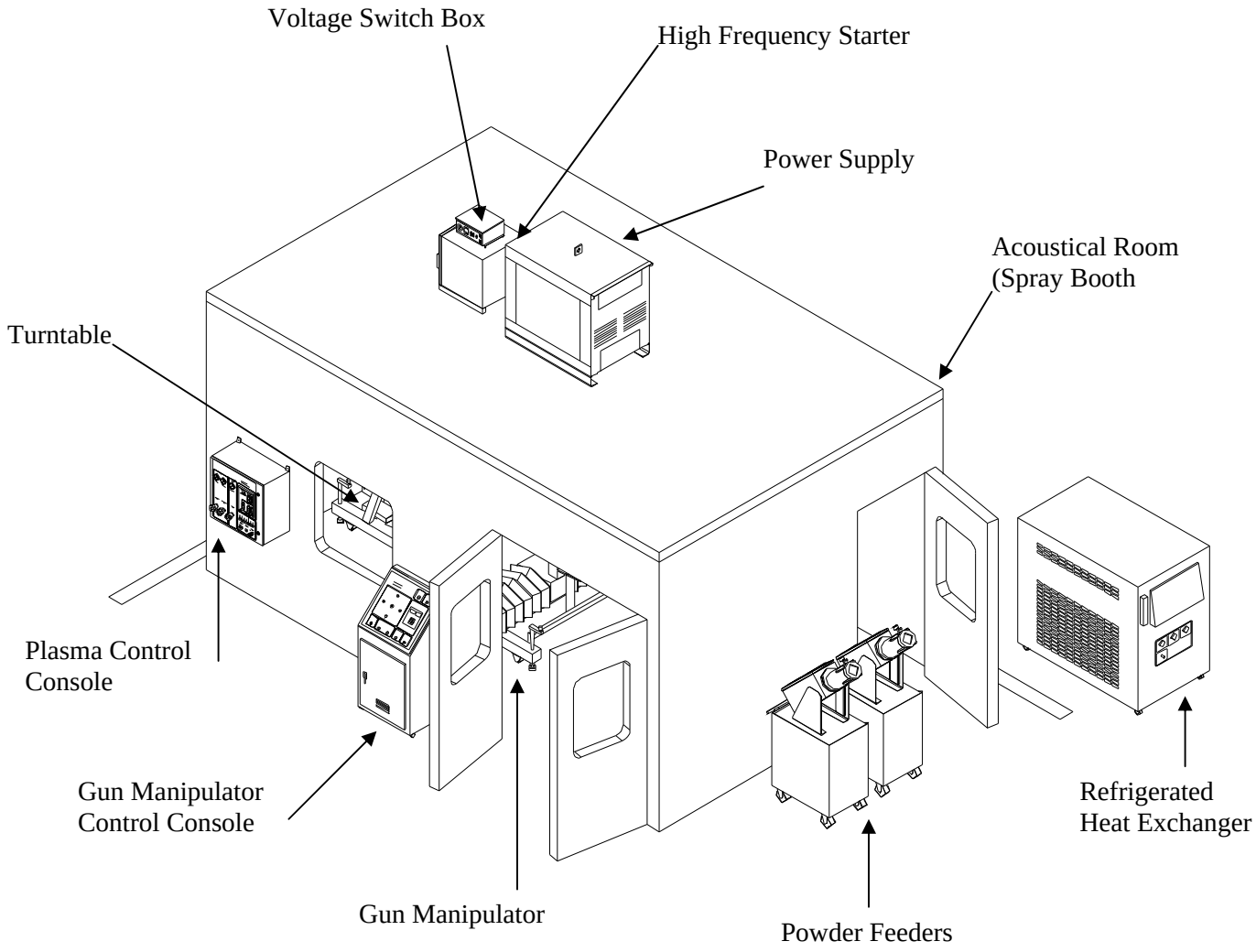


Figure 2.2. Typical 3710 System Layout

Section 3

Installation

3.1 Unpacking/Mounting

1. Remove shipping crate panel marked "FRONT" to reveal console.

2. Remove all packing material and parts containers from around console.

3. Have two workers lift the console clear of the crate and place console (rear panel down) on a cart for transport to working location. Alternately, place console on a two-wheel dolly with left side down and rear panel toward dolly, then fasten the console to the dolly with a securing strap.

CAUTION

Before moving, carefully inspect for any shipping damage. Purchaser must file any claims for loss or damage incurred in transit with the carrier. The manufacturer will supply a copy of the bill of lading on request if occasion to file a claim arises. When requesting information about this equipment it is essential that Model Description and Serial Number of the equipment be supplied.

4. Use the cart or two-wheel hand dolly to carefully move the console to its intended working location.

A. Console Wall-Mounting

1. To mount console to a wall, determine the appropriate height. (Placing the console top at a height between 66 and 70 in. [168 and 178 cm] accommodates most operators.)



Verify that the wall to which the console is to be mounted is sturdy enough to support the console's weight (100 lbs. [45.4 kg]). Have maintenance or carpentry personnel reinforce the wall as needed BEFORE attempting to mount the console.

2. Make two marks approximately 1/2 in. (13 mm) above the desired cabinet height and 21 1/2 in. (546 mm) apart at the desired console location (use a carpenter's level to line up the marks level with each other).

3. Drill a 3/8 in (10 mm) hole at each mark. Drill through the wall, if possible.

4. Place lock washers and flat washers on two 3/8 in (10 mm) diameter bolts of sufficient length to pass through the wall (washers, bolts, nuts are purchaser-supplied).

5. Have two workers lift and hold the console so its mounting brackets match up to the drilled holes.

6. Pass the bolts through the mounting brackets and then through the drilled holes.

7. On the opposite side of the wall from the console, Place a flat washer of sufficient size and strength to prevent bolt from tearing out of wall material, a lock washer and a hex nut on each bolt. Tighten both nuts until secure. The two workers can then release the console.



Above instructions are for the recommended mounting method. If unable to drill through wall, (cement block or other masonry, for example), use lag screws and shields sufficient to support console weight (100 lbs. [45.4 kg]).

Mounting to a sheet-rock and frame wall is NOT recommended. If this type of mounting is attempted, the wall must be reinforced and modified to support the console and match its mounting hardware. Note that the mounting brackets WILL NOT match up to standard 16 in. (406 mm) wall stud placement.

3.2 Location

Verify that required utility connections (electrical, gases, etc.) described in section 2 are located near the console.

Place system components so all interconnecting cables and hoses terminate without strain.

3.3 Installation

ELECTRIC SHOCK HAZARD: Do not touch live electrical parts.

Shut down the power supply and disconnect input power employing lockout/tagging procedures before making cable connections.

Install the 3710 using a floor plan compliant with local rules and regulations and in accordance with general safety instructions described in Section 1.

After positioning system components, connect the 3710 Console to the components. See appropriate operator's manuals for more information on connecting other system components. Cable numbers refer to the callout numbers in Figures 3.1 or 3.2.

Most cable and hose part numbers end with dash and a number telling cable length in feet (example: 5005224-25 is a 25 ft. cable). Since cable and hose lengths may vary, we do not reference actual lengths, unless they are not variable. Standard cable and hose lengths are listed in Section 6.

Symbols shown on the left refer to the connection symbols used on the 3710 control console.

Be sure to use "good wiring practices" when routing wires and cables. For example, keep power and control cables separated where practical.

A. E-stop Box Installation and Connections

The console is supplied with an integrated emergency stop (E-stop) box (P/N 5007776). Install the E-stop box inside the spray cell/enclosure, preferably near the exit.

JX

1. Attach E-Stop circuit cable # 2 (P/N **5007777**) to the console's JX (E-Stop IN) connector, then to the E-Stop box's JY (E-Stop OUT) connector.

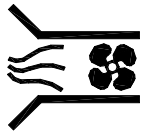
JY

2. If there is another system component requiring connection to the E-stop chain (such as turntable, gun manipulator, or a robot), remove the jumper plug from the JY connector, attach another E-Stop circuit

cable (P/N **5007777**) to the console's JY connector and then to the JX connector on the E-Stop-equipped system component.

JY

3. When there are no more units with open JX connections, place the E-Stop circuit completion plug in the JY connector of the last unit (plug is supplied with the E-stop box). If the console is the only system component connected to the E-stop box, the E-Stop circuit completion plug will be placed in the JY connector on the console.



4. Connect a user-supplied cable from a switch closure to console's DUST COLLECTOR INTERLOCK connector.

Dust collector interlock is designed to prevent system operation without the booth exhaust system in operation. The dust collection system must be on before the console can be energized. An air-flow switch in duct work, connected to the console DUST COLLECTOR INTERLOCK connector is one of the means to satisfy this safety requirement. For more information on this feature, contact our service department.



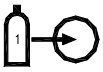
Console will not power up if interlock is not connected to air flow sensor or jumpered out.

B. Compressed Air Connections

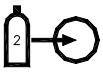


1. Attach hose # 4 (P/N **5005064**) to console AIR IN fitting, then to a clean, dry, oil-free compressed air supply.

C. Supply Gas Connections



1. Attach hose # 5A (first of three P/N **5005071**) to console PRIMARY IN fitting on manifold, then to primary gas supply.



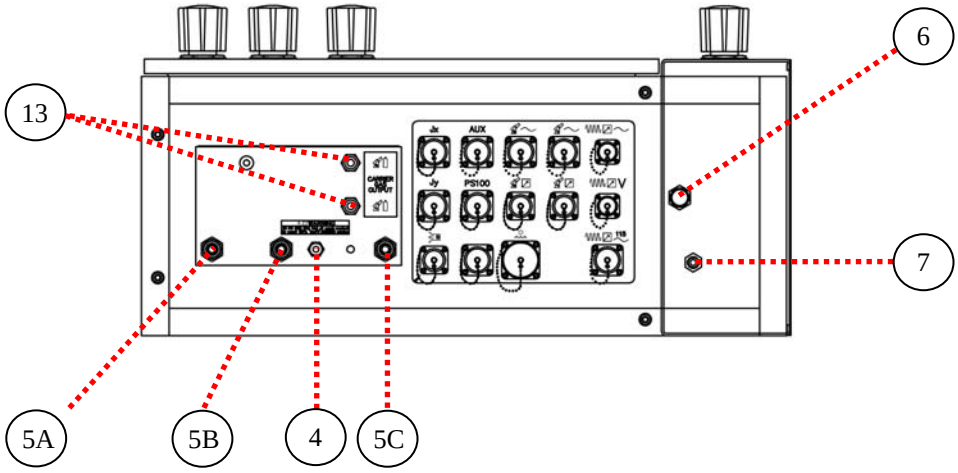
2. Attach hose # 5B (second of three P/N **5005071**) to console SECONDARY IN (inert gas) fitting on manifold, then to inert secondary gas supply.



3. Attach hose # 5C (third of three P/N **5005071**) to console CARRIER GAS IN (inert gas) fitting on manifold, then to inert carrier gas supply.

4. Attach hose # 6 (P/N **5005067**) to console HYDROGEN IN fitting located behind the hydrogen control panel on the right side of the console, then to hydrogen supply.

Figure 3-1 3710 Console Connections



D. Gun Connections



1. Attach hose # 7 (P/N **985-2**) to console ARC GAS OUT fitting on manifold, then to plasma spray gun arc gas fitting.

E. Powder Feeder Connections



1. Attach hose # 13 (P/N **5005135**) to console POWDER GAS # 1 out fitting and then to Powder Feeder # 1.



2. If using a second Powder Feeder, attach the second hose # 13 to console POWDER GAS # 2 out fitting, then to the # 2 Powder Feeder # 2.



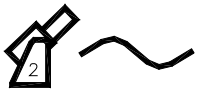
3. Attach control cable P/N **5005293** to console POWDER FEEDER # 1 ON/OFF connector, then to the # 1 Powder Feeder.



4. If using a second Powder Feeder, attach second control cable to console POWDER FEEDER # 2 ON/OFF connector, then to the # 2 Powder Feeder.



5. Attach power cable P/N **5005296** to console POWDER FEEDER # 1 POWER connector, then to the # 1 Powder Feeder.



6. If using a second Powder Feeder, attach second control cable to console POWDER FEEDER # 2 POWER connector, then to the # 2 Powder Feeder.

F. Heat Exchanger/Pump Connections



1. Attach control cable # 12 (P/N **5005265**) to console J2 connector, then to heat exchanger or pump.

G. Power Source and High Frequency Unit Connections



Verify that the Power Supply and the High Frequency Unit is locked out from any input power source.

PS-1000

HPS-100

1. A. For PS-1000 Power Supply only, attach cable P/N **5008637** to the console PS100 connector, then to the Junction Box.

   B. For HPS-100 Power Supply only, attach cable P/N **610402-25** to the console PS100 connector, then to the HPS-100 Power Supply.



2. Attach cable # 9 (P/N **5005224**) to console HIGH FREQUENCY POWER connector, then to the High Frequency Unit.



3. Attach cable # 10 (P/N **5005222**) to console HIGH FREQUENCY CURRENT connector, then to the High Frequency Unit.



4. Attach cable # 11 (P/N **5005272)** to console HIGH FREQUENCY VOLTAGE connector, then to the voltage sense connections on the High Frequency Unit.

5. For PS-1000 Power Supply only, attach cable P/N **5008632** to the PS-1000 Power Supply and then to the Junction Box.

H. Power Connections



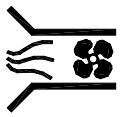
1. Verify that console E-STOP button is pushed in. Assemble an appropriate length of 14AWG, 3 conductor, shielded cable to the supplied power connector plug (P/N **5004713**), then connect the plug to the console J1 connector.

2. Assemble an appropriate plug to the opposite end of the power cable and connect the plug to a 115 VAC power source.

3. Attach the E-stop box power cable P/N **5005028** to E-stop box 115 VAC POWER IN connector, and then to a 115 VAC power source.

I. Auxiliary/Optional Equipment Connections

AUX



1. Connect cable # 3 (P/N **5008540**) to console AUXILIARY POWER OUTPUT connector, then to a user-defined auxiliary device.

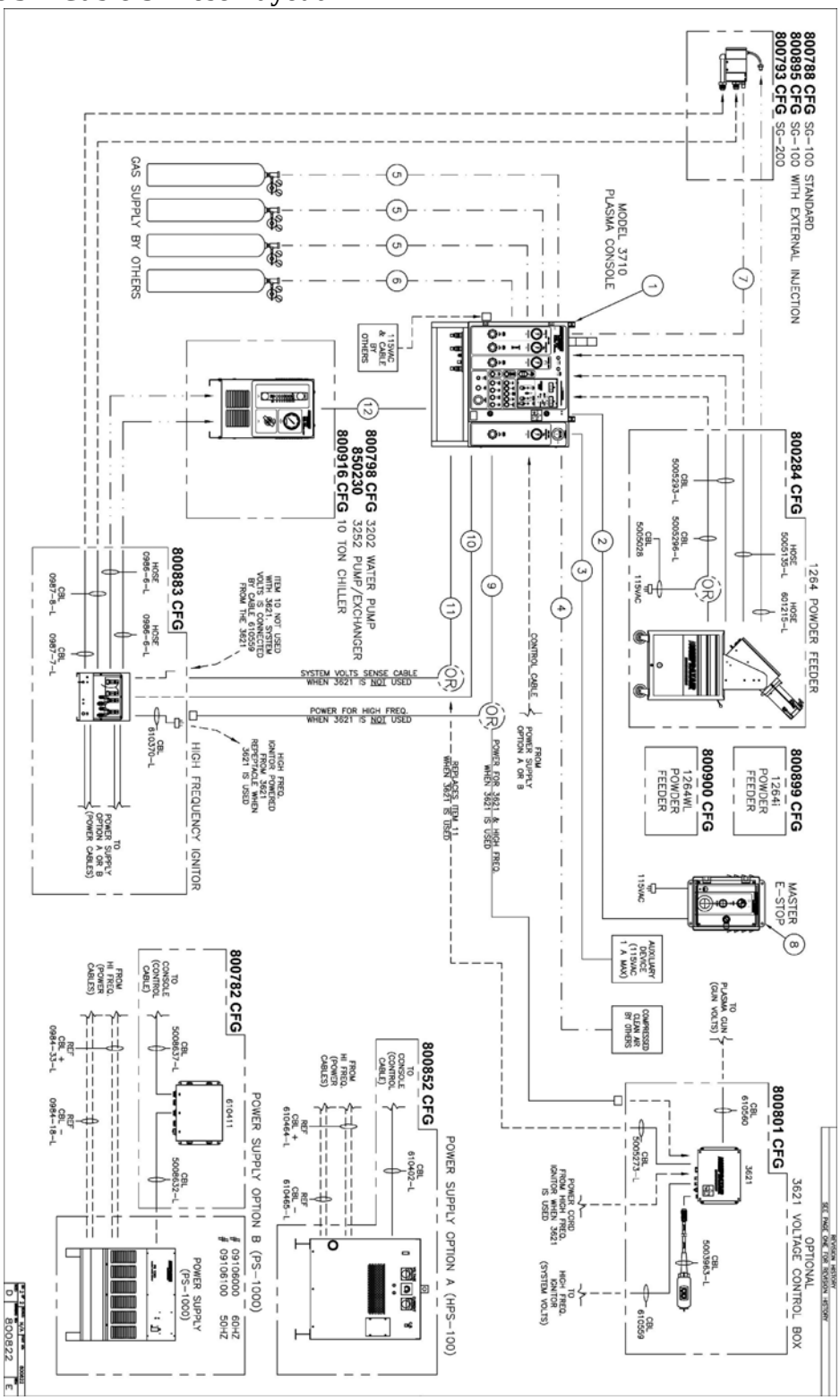
2. Connect a user-supplied cable from a switch closure to USER - DEFINED INTERLOCK connector located on the E-stop box.

User-defined interlock is designed to allow the user to prevent system operation before certain conditions, or states, are satisfied. In essence, certain conditions, such as dust collection system operation, light curtain on, doors opened/closed, must be met before the operator can proceed with spray operations. Connecting a switch closure to the USER-DEFINED INTERLOCK connector allows for this added layer of safety. For more information on this feature, contact our service department.



Console will not power up if the E-stop box is not connected to a user-defined interlock or jumpered out.

Figure 3-2 Cable & Hose Layout



Section 4

Operation



WARNING: ELECTRIC SHOCK can kill.

Shut down unit and disconnect input power and employ "Lockout/Tagout" procedures on power source before making any connections to the gun. Lockout/tagging procedures consist of padlocking line disconnect switch in open position, removing fuses from fuse box, or shutting off and red-tagging circuit breaker or other disconnecting device.



ELECTRICALLY ISOLATE the plasma gun when gun is to be machine mounted. Only use a non-conductive isolation mounting bracket for machine mounting of PlazJet II gun.





ELECTROMAGNETIC FIELDS HAZARD

A plasma gun creates electro-magnetic fields which could adversely affect the operation of electronic instruments in its vicinity. Persons with heart pacemakers should avoid proximity to the plasma gun while it is operating.



HIGH TEMPERATURE HAZARD

The temperature of the plasma gun reaches up to 20,000° C. The plasma plume radiates much of this heat and therefore can heat objects (e.g. spray room walls, hoses and cables, etc.) to high temperatures and cause them to catch fire or cause burns if touched.





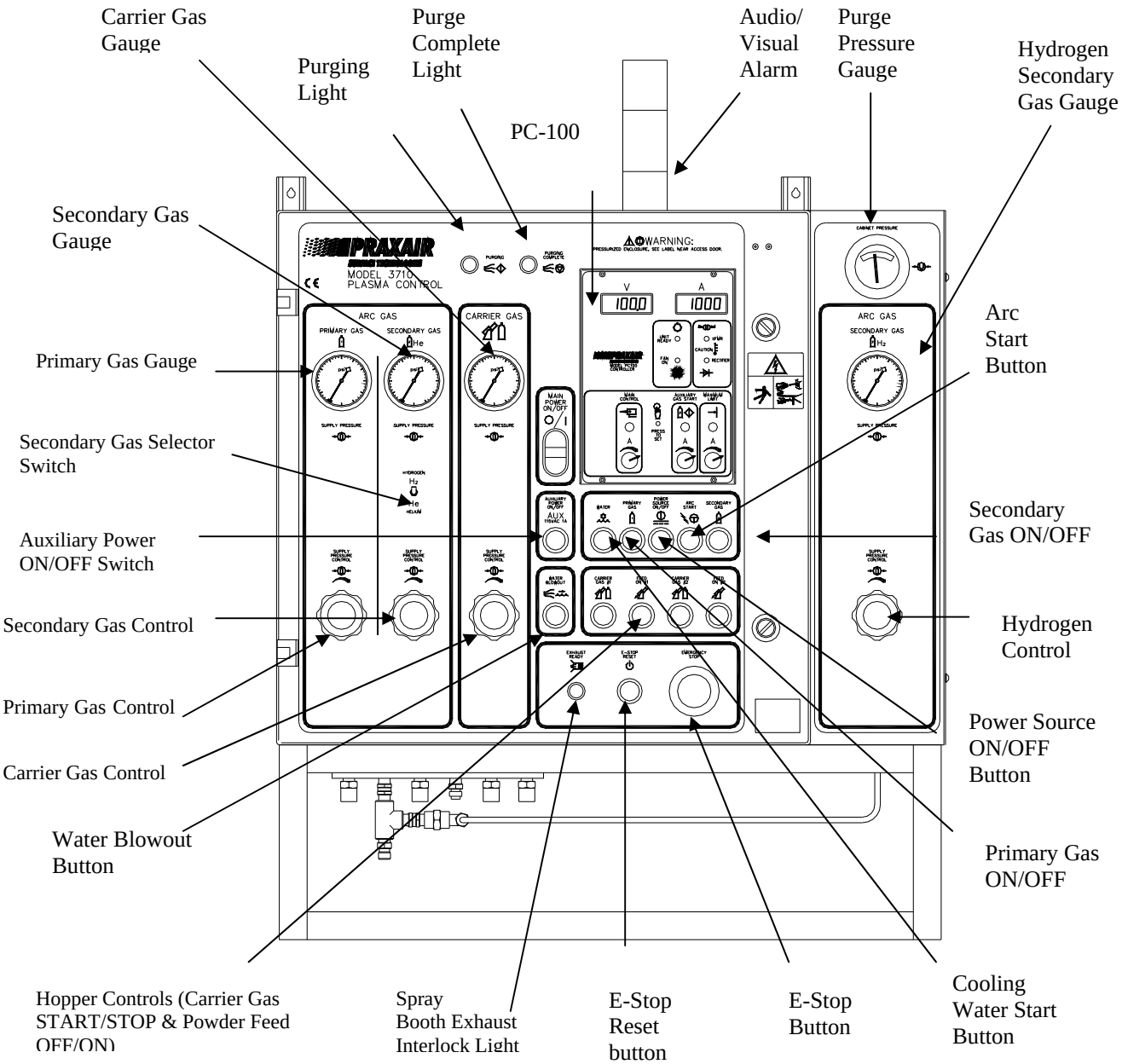
LIGHT EMISSION HAZARD

A plasma gun emits electro-magnetic radiation in the form of visible light as well as in the form of infrared (radiant heat) and UV radiation. This radiation is dangerous and can permanently blind unprotected eyes. UV radiation is also harmful to skin that is exposed to radiation for excessive periods.



Wear hearing protection.

Operation of a plasma gun generates strong noise emissions (> 130 dBa), which can cause damage or loss of hearing.


Carrier Gas Gauge
Purging Light
Purge Complete Light
PC-100
Audio/ Visual Alarm
Purge Pressure Gauge
Hydrogen Secondary Gas Gauge
Secondary Gas Gauge
Primary Gas Gauge
Secondary Gas Selector Switch
Auxiliary Power ON/OFF Switch
Secondary Gas Control
Primary Gas Control
Carrier Gas Control
Water Blowout Button
Arc Start Button
Secondary Gas ON/OFF
Hydrogen Control
Power Source ON/OFF Button
Primary Gas ON/OFF
Hopper Controls (Carrier Gas START/STOP & Powder Feed OFF/ON)
Spray Booth Exhaust Interlock Light
E-Stop Reset button
E-Stop Button
Cooling Water Start Button
MODEL 3710
PLASMA CONTROL
WARNING:
ARC GAS
CARRIER GAS

4.1 Safety Features

Purging: This console incorporates NFPA Type "Z" purging consisting of five major components: air supply; purge-air orifice; purging timer; purge air pressure switch and; purge air exhaust. In case of inadequate purge pressure, the system shuts down the system. Audible and visual alarm on top of the console warns the operator of the purge failure.



NFPA regulations require 25 complete air exchanges in the purged portion of the cabinet before power is applied to the console. The purging system maintains 0.25 in./water column during and after the purge operation.

4.2 PC-100 Controls



ELECTRIC SHOCK HAZARD: Do not touch live electrical parts.

Shut down unit, disconnect input power and employ "lockout/tagging procedures" on power source before making any gun connections. Lockout/tagging procedures consist of padlocking line disconnect switch in open position, removing fuses from fuse box, or shutting off and red-tagging circuit breaker or other disconnecting device.



SHORT CIRCUIT or improper connections can damage equipment. Ammeter deflection shows a short circuit or improper connection. Correct fault and restart operation procedure.

The PC-100 Control Module controls the PS-1000 three-phase, constant current (CC) DC plasma spray power source. The PC-100 allows setting of power source parameters (amperage and voltage settings, auxiliary gas start, and maximum amperage limit settings) before starting the plasma spraying operation. The PC-100 also has Unit Ready, Fan On, and Transformer and Rectifier Overheating indicator lights.

See the PC-100 operator's manual for discussion of VOLTMETER, AMMETER, TRANSFORMER INDICATOR, RECTIFIER INDICATOR, UNIT READY INDICATOR, FAN ON INDICATOR, MAIN CONTROL knob, AUXILIARY GAS START knob, and MAXIMUM LIMIT knob.

4.3 3710 Console Controls



A. Main Power ON/OFF Button

Press the green portion of the two-segment MAIN POWER ON/OFF button to energize the console controls. Console will not energize unless the air purge cycle is complete and cabinet purge air pressure is at least 0.2 inches water column. Press the red segment to de-energize the console (see B - Auxiliary Power ON/OFF Button).

AUX

Pressing the AUX button allows the operator to maintain power to the purge system and the powder feeders, while de-energizing the console. This allows faster start-up (no waiting for the purge cycle to complete) and maintains the powder feeder heater blanket temperature between operating cycles.



C. Water Blowout Button

Momentarily pressing the WATER BLOWOUT button injects compressed air into the cooling water circuit at the heat exchanger to remove any in-line water from the system before disassembling the gun. Button illuminates when blowback process is started.



D. Cooling Water Button

Pressing the COOLING WATER button starts the heat exchanger, circulating cooling water through the gun circuit.



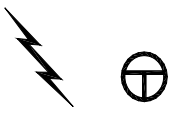
E. Primary Gas Button

Press PRIMARY GAS button to start primary gas flow. Button illuminates when gas pressure reaches 30 psi. (207 kPa) Pressing PRIMARY GAS button again stops primary gas flow.



F. Power Source ON/OFF Button

The POWER SOURCE button controls the power supply's open circuit voltage. Pressing POWER SOURCE button closes the contactor that supplies open circuit voltage. Button illuminates when open circuit voltage is supplied to the output terminals. Pressing POWER SOURCE button again opens the contactor that supplies open circuit voltage.



G. Arc Start Button

Momentarily pressing ARC START button lights the arc. Button illuminates when arc is started.



H. Secondary Gas Button

Pressing SECONDARY GAS button starts secondary gas flow and illuminates button. Press SECONDARY GAS button again to stop secondary gas flow.



I. Carrier Gas Buttons

Pressing CARRIER GAS #1 button starts carrier gas flow to powder feeder #1 and illuminates button. Pressing CARRIER GAS #2 button starts carrier gas flow to powder feeder #2 and illuminates button. Press CARRIER GAS buttons again to stop carrier gas flow.



Select ONLY ONE powder feeder at a time. The Model 3710 Console controls EITHER feeder #1 OR feeder #2, but not both simultaneously.



J. Powder Feed ON/OFF Buttons

Pressing the POWDER FEED ON #1 button feeds powder from hopper #1 through system and illuminates button. Pressing POWDER FEED ON #2 button feeds powder from hopper #2 through system and illuminates button. Press POWDER FEED button again to stop the process.



Select ONLY ONE powder feeder at a time. The Model 3710 Console controls EITHER feeder #1 OR feeder #2, but not both simultaneously.

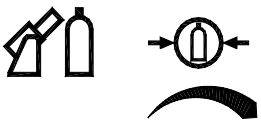
K. Emergency Stop (E-Stop) Button

Pressing EMERGENCY STOP stops the entire plasma spray system. Press the RESET button and twist and pull EMERGENCY STOP button out for normal operation. Push EMERGENCY STOP button to shut down the system in an emergency.



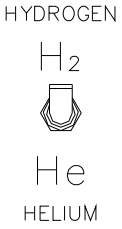
L. Purge Indicator Lights

The yellow PURGING light indicates that cabinet purging is underway. The green PURGE COMPLETE light illuminates and the yellow PURGE light remains illuminated when the system purge is complete.



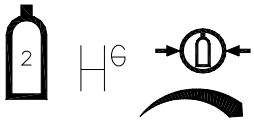
M. Carrier Gas Regulator

The CARRIER GAS SUPPLY PRESSURE CONTROL knob regulates carrier gas line pressure, which displays on the CARRIER GAS SUPPLY PRESSURE gauge. Turn knob CLOCKWISE to increase carrier gas pressure or COUNTERCLOCKWISE to decrease pressure. (Start carrier gas by pressing CARRIER GAS button.)



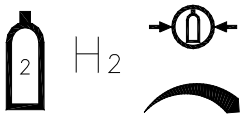
N. Secondary Gas Selector Switch

Moving the Secondary Gas Selector to the HYDROGEN position enables the Hydrogen gas system and disables the Helium gas system. Moving the switch to HELIUM position enables the Helium gas system and disables the Hydrogen gas system.



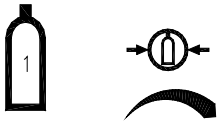
O. Secondary Gas Regulator (Helium)

With the SECONDARY GAS SELECTOR SWITCH in HELIUM position, the SECONDARY GAS SUPPLY PRESSURE CONTROL knob regulates helium pressure which displays on the HELIUM SECONDARY GAS SUPPLY PRESSURE gauge. Turn knob CLOCKWISE to increase secondary gas pressure or COUNTERCLOCKWISE to decrease gas pressure. (When secondary gas amperage setpoint is reached, start secondary gas by pressing SECONDARY GAS button.)



P. Secondary Gas Regulator (Hydrogen)

With the SECONDARY GAS SELECTOR SWITCH in HYDROGEN position, the HYDROGEN SECONDARY GAS SUPPLY PRESSURE CONTROL (located on the far right side of the console) regulates hydrogen pressure. Turn knob CLOCKWISE to increase hydrogen pressure or COUNTERCLOCKWISE to decrease pressure. (When secondary gas amperage setpoint is reached, start secondary gas by pressing SECONDARY GAS button.)



Q. Primary Gas Regulator

The PRIMARY GAS SUPPLY PRESSURE CONTROL knob regulates primary gas pressure, which displays on the PRIMARY GAS SUPPLY PRESSURE gauge. Turn knob CLOCKWISE to increase primary gas pressure or COUNTERCLOCKWISE to decrease pressure. (To start primary gas, press PRIMARY GAS button.)

4.4 System Safety Operation

Before entering full operation, test the system's safety features.

A. Testing the E-Stop Circuit

1. With all appropriate hose and cable connections made and checked, energize the console.

2. Press COOLING WATER button to start cooling water flow.

3. With console energized, press the E-STOP button on the console, remote E-stop panel, or on any other device connected to the E-STOP system. System should immediately stop and all power should be removed from the console (except the purge-air circuit).

B. Restarting after Emergency Shutdown



Before resetting the system, make sure that the system is back to safe operating condition, and that the event causing the shutdown has been identified and corrected.

1. Twist and pull out all E-STOPS.

2. Press the 3710 console E-STOP RESET button.

3. If all E-STOPS are satisfied, E-STOP RESET button illuminates and the purge sequence begins.

4. If EMERGENCY STOP RESET doesn't illuminate, check for an E-STOP that has not been pulled out.

5. Refer to the following subsections for normal operating instructions.

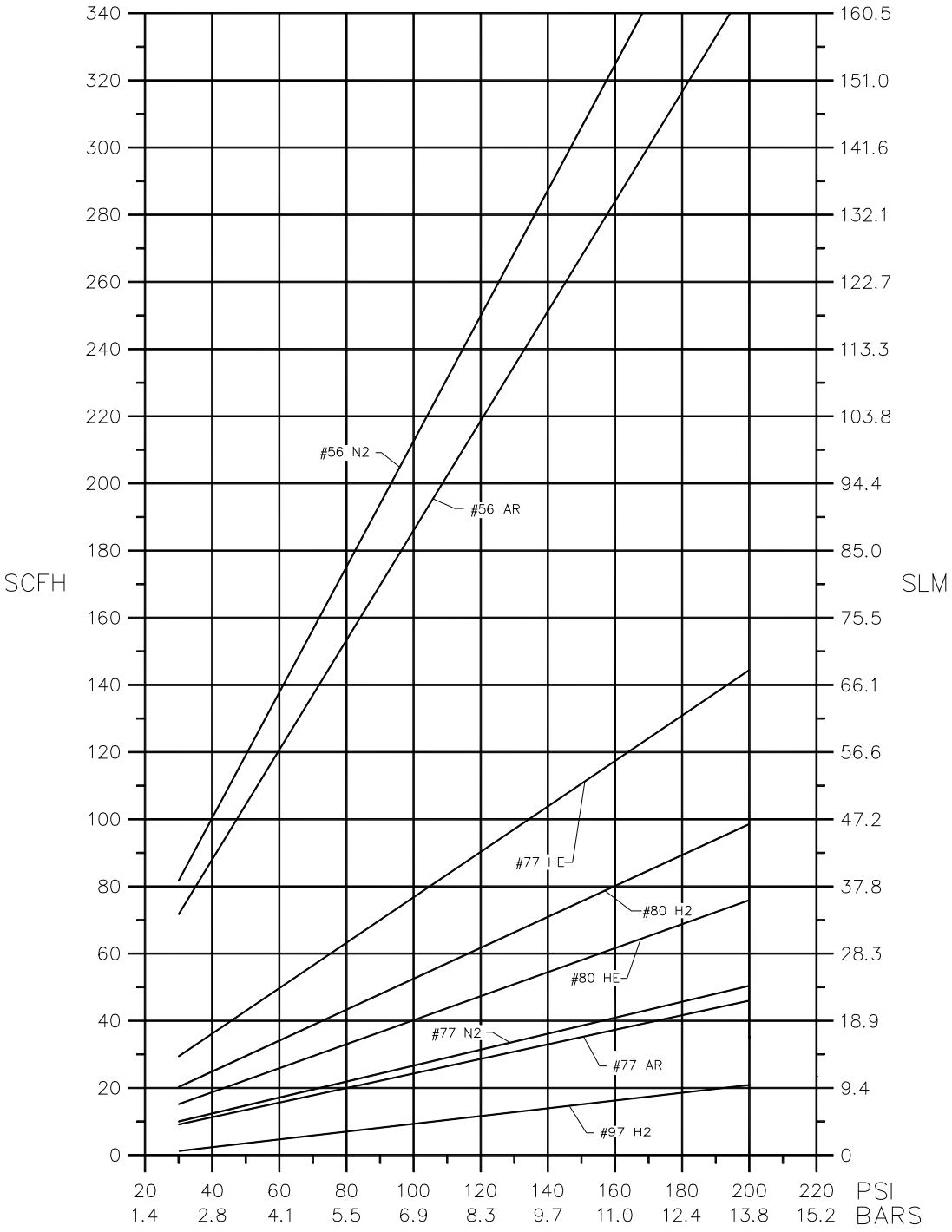


Figure 4.2 Orifice Flow Chart

5003935, rev. D

4.5 Plasma Spray System Checkout

After completing the installation in Section 3, press the COOLING WATER button to turn on water supply. Check all hose and cable connections for leaks. Repair or replace any leaking hose or cable connection.

Check control and DC power wiring and cables for proper connections.

Determine the material to be sprayed. Complete system checkout as follows:

1. Verify that proper anode, cathode, and gas injector are installed in plasma gun as specified by the gun instruction manual.

2. Place SECONDARY GAS SELECTOR SWITCH in HYDROGEN or HELIUM position, according to the parameter used.

3. Adjust powder feeder RPM as recommended in powder feeder manual. Switch MODE SELECTOR to FEED.

4. Put the specified powder in the powder feeder canister and secure lid.

5. Place a properly prepared piece of material or coupon on the work area.

4.6 Sequence of Operation

Check all wiring, both control and DC power, for proper connections before operating. Fill powder canister of the powder feeder.

1. Switch 230/460 VAC primary power disconnect ON.

2. Open compressed air regulator or valve. Set regulator to at least 50 psi (345 kPa).



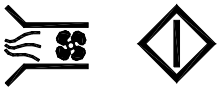
3. Switch 115 VAC power disconnect ON. Yellow "PURGING" light illuminates. Allow console to purge at .25 in./water column until green "PURGE COMPLETE" light illuminates.

4. After purge is complete, open arc gas cylinder valve.

5. Set primary (arc) gas supply regulators for outlet pressures no higher than 200 psi (1380 kPa).

6. Open carrier gas and secondary gas cylinder valves.

7. Set secondary gas source regulator for outlet pressure no higher than 200 psi (1380 kPa).



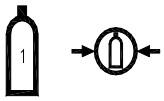
8. Energize spray booth exhaust fan.



9. Pull EMERGENCY STOP button to ON position and press the RESET button. Illuminated RESET button indicates energized console.



10. Press COOLING WATER switch. Switch illuminates. Recheck system for leaks. Verify water flow rate is AT LEAST 6.0 gpm (22.8 l/m).



11. Press the PRIMARY GAS switch and adjust primary gas to the recommended pressure for the parameter used. The Critical Orifice Flow Rate graph (Figure 4-2) shows flowrates of various critical orifices.



12. Press the CARRIER GAS switch for the powder feeder to be used and adjust carrier to the required pressure.



13. Push POWER SOURCE button for open circuit voltage.



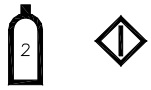
14. Press and hold MAIN CONTROL button on PC-100 and adjust MAIN CONTROL potentiometer until required amperage displays on the ammeter LCD.



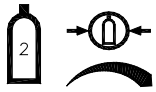
15. Press and hold PC-100 MAX LIMIT button and adjust MAX LIMIT potentiometer until amperage displayed on ammeter LCD is 75 to 100 amps above MAIN CONTROL set point.



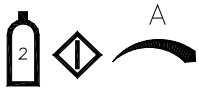
16. Rotate PC-100 AUXILIARY GAS CONTROL potentiometer fully counterclockwise.



17. If auxiliary gas is desired, press SECONDARY GAS button ON. Auxiliary gas flows.



18. Adjust auxiliary gas with console SECONDARY GAS SUPPLY PRESSURE CONTROL regulator until the SECONDARY GAS SUPPLY PRESSURE gauge shows the desired pressure.



19. Press and hold PC-100 AUXILIARY GAS START button and adjust AUXILIARY GAS START control potentiometer until ammeter LCD displays desired drop in amperage. Normally, the auxiliary gas start setting is 30% of the Main Amps setting.



20. Momentarily (three seconds or less) press ARC START switch. Plasma arc initiates.

21. Monitor the ramping process on the PC-100 and verify that the Secondary Gas is automatically energized at the setpoint.



22. Press the FEED ON button for the powder feeder desired. Button illuminates and powder flows.



OPERATING WITHOUT POWDER GASES damages system.

Do NOT test fire system with POWDER GAS switches OFF. Verify that POWDER GAS switches are ON when operating or test firing system.

4.7 Spray Procedure

After completing above steps, test spray as follows:

1. Make sure powder enters plasma arc in a suitable pattern. Slight adjustments to POWDER GAS flow, ARC GAS flow, amperage or hopper control may be necessary.

2. Move gun to within three to four inches (76 to 102 mm) of the part to be coated. Traverse gun across the part at approximately 18 inches per second (457 mm/sec.). Powder stream should be as perpendicular to the part as possible. Index each pass to overlap the previous pass about 50%. Use cooling gases when applying heavy coatings or when part temperature exceeds 350°F (177°C).

4.8 Shutdown Procedure

Shut down system after operation as follows:



1. Press console POWDER FEED switches to OFF.



2. Press console POWER SOURCE switch to OFF.

3. Press console POWDER GAS switches to OFF.



4. Wait 7-10 seconds. (This interval with arc gases and water running cools the electrodes and protects the O-ring seals from overheating.)



5. Turn OFF water supply.

Shut off water supply and close the gas regulators at the source if the system will not be used for several hours.

4.9 Gas Purge System

This console incorporates NFPA Type "Z" purging consisting of five major components: air supply; purge-air orifice; purging timer; purge air pressure switch and; purge air exhaust. NFPA regulations require 25 complete air exchanges in the purged portion of the cabinet before power is applied to the console. The purging system must maintain a minimum of 0.25 in./water column during and after the purge operation.

Purging operates as follows:

1. Purging air, supplied from the purchaser's compressed air system, enters the console enclosure through a factory-selected and installed orifice designed to provide sufficient air pressure for changing the console's internal air volume five times in a specific time interval.

2. The purging timer relay blocks power to the console until a factory-set amount of time (sufficient to allow the required exchanges of air volume) has elapsed. To set:

   a. Turn timer faceplate to pink side and rotate dial numbers so that 10 minutes shows as the maximum.

   b. Set DIP switch fully to the right.

   c. Set digital switch to 7

   d. Re-install faceplate with pink side up.

   e. Turn timer knob to 8.5 minutes.

3. The pressure switch is factory set to trigger a visual alarm if the internal cabinet pressure drops below the required 0.25 in./water.

   To verify its operation:

   a. With console closed and power ON, reduce compressed air pressure until low purge pressure alarm sounds.

   b. Check the water column gauge. If it reads less than 0.2 in. water, pressure switch must be adjusted.

   c. Disconnect power and open front panel.

   d. Use a small screwdriver to turn adjustment screw located on the bottom of the pressure switch.

   e. Close and latch front panel, apply purge air and power up console.

   f. Open purge vent until alarm sounds. Water column gauge should read at least 0.2 in./water.

g. If gauge reads 0.2 in./water, switch is working properly. If reading is less than 0.2 in, repeat steps c through f.

4. The purge air exhaust vent is factory set to provide an internal air pressure of 0.25 in./water.

Purging system power is independent of other console circuits. To allow purge system operation when console main power is off, press the AUXILIARY POWER switch ON, then press the red section of the MAIN POWER switch to de-energize the main console. Purging and hopper circuits remain energized. To de-energize the purging and hopper circuits, press the AUXILIARY POWER switch OFF.

Section 5 Maintenance & Troubleshooting

5.1 Maintenance

Regular maintenance, calibration and leak testing is critical to assure safe and accurate operation of the 3710 console. Praxair recommends developing a maintenance schedule to assure the correct tasks are performed at the proper times. A suggested schedule follows:

Table 5-1. Suggested Maintenance Schedule

Procedure	When Due	Performed By
Check water flow through gun (refer to spray gun manual for recommended flow levels)	Each startup	Operator
Check gas cylinders for adequate pressure	Each startup	Operator
Check for water leaks	Each startup	Operator
Inspect all hoses for cuts, cracks, or abrasion (replace as required)	Weekly	Operator
Wipe off excessive dirt/dust	As Needed	Operator
Perform console leak test (see Leak Test Procedure in section 5.1, A.)*	Monthly	Maintenance Technician
Replace input gas filters	Annually	Maintenance Technician
Certify pressure and electrical gauges	Annually	Praxair Service Technician
Remove and clean critical orifices	Annually	Maintenance Technician

* Perform leak test after ANY disassembly of gas lines, gauges, regulators or hoses.

A. Leak Test Procedures

A-1. Check Console Safety Systems

A1.1 Check these timers for correct settings:
- K1 set for 5 minutes
- K8 set for 0.5 seconds.

A1.2 Check console purge pressure switch for proper operation:
a. Close and lock front console cover.
b. Remove the purge pressure control vent guard, located on the upper left side of the console.
c. Remove the purge pressure control vent position-locking screw.
d. Connect a filtered, dry, oil-free, 80 psi (550kPa) compressed air source to the console.
e. Slowly increase purge air pressure by closing the pressure control vent until purging light illuminates. The pressure shown on the water column gauge should read at least 0.2 in/water. If the gauge reads less than 0.2 inches/water, adjust the pressure switch (see A1.3).

A1.3 Set pressure switch for 0.2 in./water minimum:

a. With console closed and power ON, reduce purge air pressure by opening the purge pressure control vent until low purge pressure alarm is triggered.
b. Check the water column gauge. If it reads less than 0.2 in. water, adjust pressure switch as follows.
c. Disconnect power and open front panel.
d. Use a small screwdriver to turn adjustment screw located on the bottom of the pressure switch.
e. Close and latch front panel, apply normal pressure purge air and power up console.
f. Reduce purge air pressure until alarm is triggered. Water column gauge should read at least 0.2 in./water.
g. If gauge reads at least 0.2 in./water, continue with step A3.5. If gauge reads less than 0.2 in./water, repeat steps c through f.

A1.4 Test purging circuit for proper function: slowly decrease the air pressure to verify that system shuts down.

A1.5 Open front console door to verify that the door interlock interrupts all power.

A1.6 Close the door and re-energize the console.

A-2. Leak Testing

Inspect the 3710 plasma console gas system for leaks.

Praxair Surface Technologies RECOMMENDS

Helium is preferred for testing due to its small molecular size. Argon or nitrogen gas are acceptable if helium is not available.



These tests are to be performed by qualified personnel only!



EXPLOSION HAZARD -- Air purge system must be connected and operating properly to avoid possible accumulation of flammable gases. Purge system for at least five minutes before starting procedure.



Test ONLY with inert gases (helium, argon or nitrogen)! DO NOT test with combustible or oxidizing gases!

- **Collected gases present an asphyxiation risk. Work with sufficient, active ventilation to assure airflow.**
- **Fumes and gases can harm health or create potential fire hazards.**
- **Examine all hoses before starting test procedure. Replace cut, burned, worn or damaged hoses.**
- **Be sure console area is free of open flame, potential spark creating devices or heat-generating devices.**
- **Follow all lockout/tagout procedures when disconnecting power.**

A-3. Set Up and Primary/Secondary Arc Gas Test



EXPLOSION HAZARD -- DO NOT perform ANY work until the purge air line is connected and operated at a minimum of 80 psi (276 kPa) for 5 minutes or more to purge the cabinet. Console main power is not required to purge.

A3.1 Turn off all gases (argon, nitrogen, helium and hydrogen) at their sources.

- Turn the PC100 Auxiliary Gas Start control fully counter-clockwise.
- Pull E-STOP out.
- Rotate each Primary, Secondary and Carrier Gas regulator clockwise two turns to open the internal diaphragms.
- Press COOLING WATER, PRIMARY GAS, SECONDARY GAS, CARRIER GAS and POWER SUPPLY buttons in order.



The power supply will be live at this point.

- After gases are bled off, press POWER SUPPLY button to turn power supply OFF.

A3.2 Using a test manifold, connect a regulated (0-150 psi, [0-1035 kPa]) inert gas supply to the arc gas, auxiliary gas and carrier gas in fittings. Connect pressure tester to the test manifold.



EXPLOSION HAZARD -- Be sure the test gas supply tank/line has a safety over-pressurization relief valve installed.

A3.3 Seal the ARC GAS OUT and CARRIER GAS OUT fittings with supplied caps for simultaneous leak testing of all gas lines.

A3.4 Turn the test manifold regulator fully counterclockwise (mini-mum pressure) before opening any gas supply valves.

A3.5 Energize console main power. Press the WATER ON a switch. The light illuminates, indicating when water flow reaches 5 gpm (19 l/min.) or more, and the water pump rotates.

A3.6 Press ARC GAS switch. Slowly turn test manifold regulator handle clockwise to increase pressure.

A3.7 Open the test manifold valve and slowly rotate the regulator clockwise to increase the pressure to 100 psi (690 kPa), as indicated by the pressure tester). Rotate the primary and secondary console regulators clockwise to 100 psi (690 kPa).

A3.8 Turn the gas supply OFF at the test manifold main valve and rotate both console regulators an additional one-half turn clock-wise to balance input and output pressures. Maintain console power to keep solenoid valves open during testing. Note the pressure indicated on the tester and observe the pressure reading periodically over a 15 minute period.

A3.9 A pressure decrease of 0.3 psi or more at any time in the 15-minute time period indicates a leak. Refer to section 4, locate and correct the leak. A pressure drop on both gauges indicates a leak in the primary gas circuit. A pressure drop on the secondary gauge only indicates a leak on the secondary gas circuit. Keep gas connected after this test to satisfy the arc gas pressure switch safety.

A-4. Pressurized Gas Leak Test: Carrier Gas



EXPLOSION HAZARD -- Be sure the testing gas supply tank/line has a safety over-pressurization relief valve installed. Perform this test only after completing step 1.1 to prepare the system for testing.

A4.1 Turn the gas supply OFF at the test manifold and relieve pressure from previous testing (if any).

A4.2 Press the carrier gas switch. Switch light illuminates when the solenoid energizes. Increase carrier gas regulator pressure to 100 psi (690 kPa), as indicated by the pressure tester.

A4.3 Turn gas supply source OFF and turn the regulator control clockwise an additional one-half turn to balance input and output pressures. Maintain console power to keep the solenoid valve open during testing. Note the pressure indicated on the tester and monitor it for 15 minutes. A pressure decrease of 0.3 psi or more at any time in the 15-minute time period indicates a leak. Refer to section 4, locate and correct the leak.

A-5. Final Cleanup and Adjustment

A5.1 Disconnect and remove all test fittings, plugs and other items used during the test procedure.

A5.2 Reconnect all cables and hoses to the console. Inspect supply hose connections for leaks before resuming operations.

A5.3 Consider testing complete ONLY if these conditions are met:

- No leaks were found in the gas circuits.
- Any leaks found were corrected (see section A-6).

A-6. Corrective Action: Locate and Correct Leak



This section outlines the procedure to be used to correct a leak if found.



EXPLOSION HAZARD -- Be sure the testing gas supply tank/line has a safety over-pressurization relief valve installed.



ELECTRIC SHOCK HAZARD -- Some circuits inside the console carry 115 volts AC. Procedures may require disabling some of the safety circuits during the corrective action procedure. Use extreme caution when working inside the console. All safeties must be restored to proper operation.

A6.1 Turn off all gases and disconnect console power using lock-out/tagout procedures.

A6.2 Disable the purge switch by placing a jumper across **wires 3 and 5 on relay K1**.



The jumper is installed to override the safety circuit. THE JUMPER MUST BE REMOVED UPON COMPLETION OF THE CORRECTIVE ACTION.

A6.3 Pull the door interlock switch out, allowing door to remain open.

A6.4 Reconnect console power, turn the gases on, and re-pressurize the console.

A6.5 Use leak-detecting solution to pinpoint the location of the leak. Check fittings, hose connections, regulators and other items.



Avoid getting leak-detecting solution on electrical contacts or wiring!

A6.6 When the leak is located, disassemble and inspect the affected components. Replace any worn or defective items.

A6.7 Reassemble the unit, using Loctite #242 or equivalent thread locking compound on all threaded components. **DO NOT use Teflon tape as a sealant!** Replace any leaking hose or tubing components, as they cannot safely be repaired.

A6.8 Disconnect and lock/tagout console power. **Remove the jumper installed in step A4.2** and close the console door.

A6.9 Repeat leak test in sections 1 through 3 to verify that the problem is corrected.

A6.10 Fill out and affix leak check certification sticker in a visible location on console front. Next test due date should be one year from date of current test.



If ANY leaks cannot be corrected, IMMEDIATELY shut down and use a lockout/tagout system to disable the console and contact the Praxair Thermal Spray Products Service Department at 603-224-9585.

5.2 Troubleshooting Chart

The following chart helps diagnose and remedy problems that may develop in this console. Use this table and circuit diagram to perform troubleshooting. If the problem is not remedied after performing these procedures, contact the Praxair Thermal Spray Systems Service Department at 603-224-9585. In cases of equipment malfunction, the manufacturer's recommendations must be strictly followed.



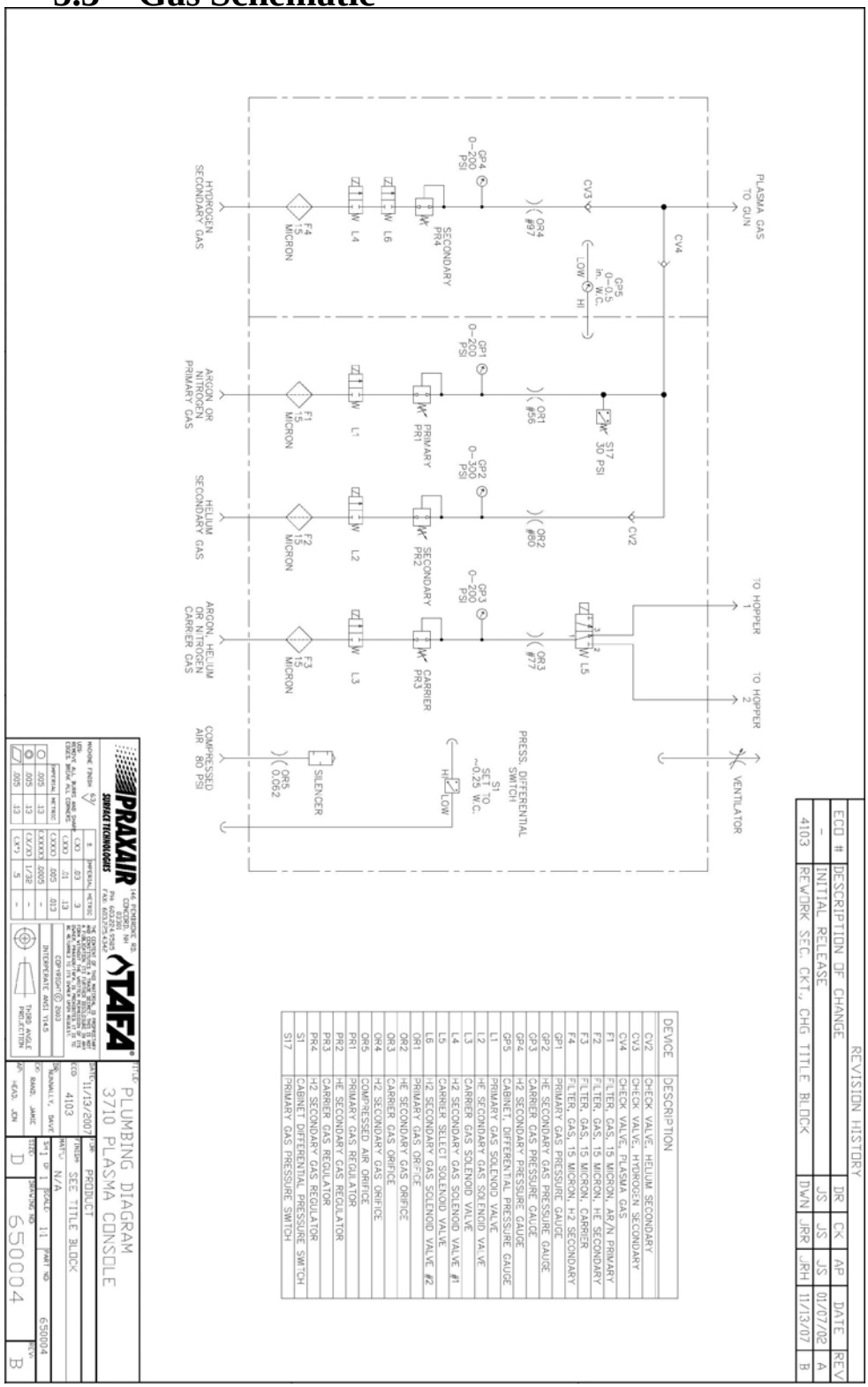
ELECTRIC SHOCK HAZARD: Do not touch live electrical parts.

Shut down unit, disconnect input power and employ lock/tag out power source before attempting any repairs.

5.2 Troubleshooting Chart

Trouble	Probable Cause	Remedy
Water pump Fails to Start	Solenoid S10 Bad	Replace Solenoid.
	Bad Water Flow Switch in Heat Exchanger	Replace Water Flow Switch.
	Bad Magnetic Contactor in Heat Exchanger Disconnected or Faulty Cable Connections	Replace Magnetic Contactor. Inspect and repair/replace as needed.
No Main Power	Fuse F2	Replace Fuse F2.
	Master Switch	Replace Master Switch.
No Arc Power	Power Switch	Replace Power Switch.
	Arc Gas Pressure Switch	Replace Arc Gas Pressure Switch.
	Arc Gas Pressure Too Low	Increase Arc Gas Pressure.
	Low Water Flow Condition	Increase Water Pressure.
	Water Pressure Switch	Replace Water Pressure Switch.
	Arc Gas Solenoid	Replace Arc Gas Solenoid.
Master Push Button Fails to Light When Activated	Light Bulb	Replace Light Bulb.
No Voltmeter Readouts	Voltmeter	Replace Voltmeter.
	Cable P/N 5005275	Check Cable Continuity. Replace If Necessary.
No High Frequency	High Frequency Switch	Repair or Replace High Frequency Switch.
	Fuse	Replace Fuse.
	Cables P/N 5005222 and P/N 5005224	Replace or Replace Cable.
No Aux. Gas	Aux Gas Solenoid	Repair or Replace Aux. Gas Solenoid.
	Low Gas Supply	Replenish Gas Supply
No Powder Gas	Powder Gas Solenoid	Repair or Replace Powder Gas Solenoid
	Low Gas Supply	Replenish Gas Supply

5.3 Gas Schematic



REVISION HISTORY							
ECO #	DESCRIPTION OF CHANGE	DR	CK	AP	DATE	REV
-	INITIAL RELEASE	JS	JS	JS	01/07/02	A
4103	REWORK SEC. CKT., CHG TITLE BLOCK	DWN	JRR	JRH	11/13/07	B

DEVICE	DESCRIPTION
CV2	CHECK VALVE, HELIUM SECONDARY
CV3	CHECK VALVE, HYDROGEN SECONDARY
CV4	CHECK VALVE, PLASMA GAS
F1	FILTER, GAS, .15 MICRON, AR/N PRIMARY
F2	FILTER, GAS, .15 MICRON, HE SECONDARY
F3	FILTER, GAS, .15 MICRON, CARRIER
F4	FILTER, GAS, .15 MICRON, H2 SECONDARY
GP1	PRIMARY GAS PRESSURE GAUGE
GP2	HE SECONDARY GAS PRESSURE GAUGE
GP3	CARRIER GAS PRESSURE GAUGE
GP4	H2 SECONDARY PRESSURE GAUGE
GP5	CABINET DIFFERENTIAL PRESSURE GAUGE
L1	PRIMARY GAS SOLENOID VALVE
L2	HE SECONDARY GAS SOLENOID VALVE
L3	CARRIER GAS SOLENOID VALVE
L4	H2 SECONDARY GAS SOLENOID VALVE #1
L5	CARRIER SELECT SOLENOID VALVE
L6	H2 SECONDARY GAS SOLENOID VALVE #2
OR1	PRIMARY GAS ORIFICE
OR2	HE SECONDARY GAS ORIFICE
OR3	CARRIER GAS ORIFICE
OR4	H2 SECONDARY GAS ORIFICE
OR5	COMPRESSED AIR ORIFICE
PR1	PRIMARY GAS REGULATOR
PR2	HE SECONDARY GAS REGULATOR
PR3	CARRIER GAS REGULATOR
PR4	H2 SECONDARY GAS REGULATOR
S1	CABINET DIFFERENTIAL PRESSURE SWITCH
S17	PRIMARY GAS PRESSURE SWITCH

PRAXAIR SURFACE TECHNOLOGIES — 144 PENNSYLVANIA AVE. CONCORD, NH 03301 — P/N: 602329-4349

TITLE: PLUMBING DIAGRAM 3710 PLASMA CONSOLE

DATE: 11/13/2007 — DRAWN: JRR — PRODUCT: 3710 PLASMA CONSOLE

ECO: 4103 — CHK'D: JRH — SEE TITLE BLOCK

DRAWING NO.: 650004 — SHT: 1 OF 1 — SCALE: 1:1 — PART NO.: 650004

SIZE: D — REV: B

APP'D: HEAD, JON — CHK'D: BAND, JAMIE — DRAWN: BENJAMIN, DAVE

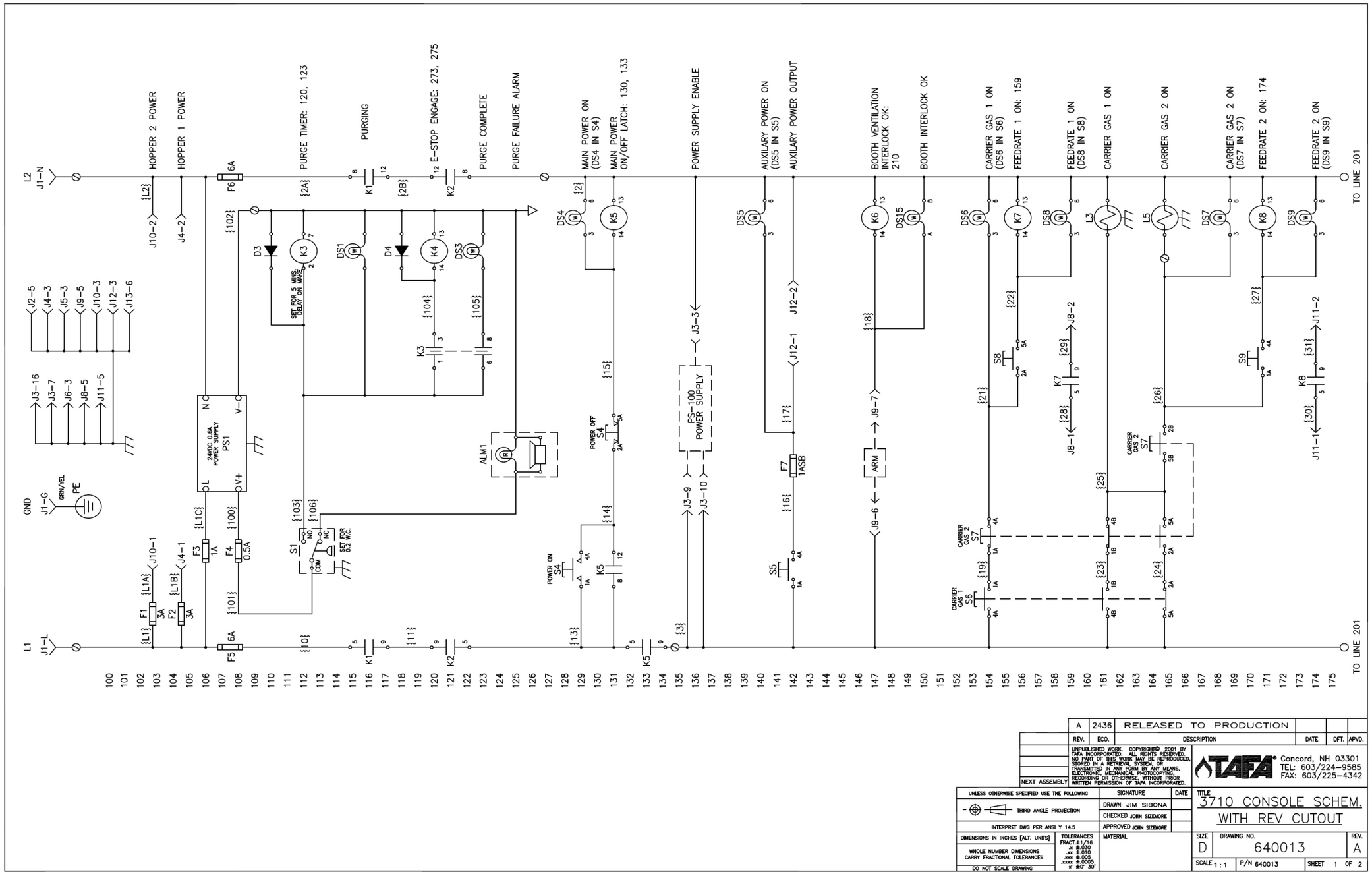
UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES / MM; TOLERANCES: FRACTIONAL ±1/32, .XX ±.03, .XXX ±.005, ANGULAR ±1°; MACHINE FINISH 63; REMOVE ALL BURRS AND SHARP EDGES; INTERPRET GEOMETRIC TOLERANCING PER ASME Y14.5; THIRD ANGLE PROJECTION

5.4 3710 Electrical Schematic

Electrical Notes

DEVICE	DESCRIPTION
ALM1	ALARM, AUDIO/VISUAL 24VDC
DS1, DS3	LAMP, INDICATOR 24VDC
DS2,DS4-DS14, DS16	LAMP, SWITCH 115VAC
DS15	LAMP, INDICATOR 115VAC
F1, F2	FUSE, 3A SLOW BLOW 120VAC
F3, F7	FUSE, 1A SLOW BLOW 24VDC
F4	FUSE, 0.5A SLOW BLOW 24VDC
F5, F6	FUSE, 6A FAST BLOW 120VAC
ILS1	SWITCH, INTERLOCK 2 POLE 115VAC
K1, K2, K4	RELAY, DPDT 24VDC (E-STOP, PURGE)
K3	RELAY, DPDT DELAY 24VDC
K6-K8	RELAY, SPDT 115VAC
K5, K9	RELAY, DPDT 115VAC
K11	RELAY, 3PDT 115VAC
K10	RELAY, DPDT ONE SHOT 115VAC
L1-L4	VALVE, SOLENOID 2-WAY 115VAC
L5	VALVE, SOLENOID 3-WAY 115VAC
PS1	POWER SUPPLY, 24VDC @ 0.6A
S1	SWITCH, DIFFERENTIAL PRESSURE
S2, S4, S11, S16	SWITCH, MOMENTARILY LIGHTED
S5-S10, S5-10, S16	SWITCH, ALTERNATE LIGHTED
S15	SWITCH, TOGGLE
S3	SWITCH, E-STOP, RED MUSHROOM

CONNECTORS	CABLES
J1 = MAIN POWER CONNECT	- USER SUPPLIED
J2 = HEAT EXCHANGER CONNECT	- HX Dependant
J3 = POWER SUPPLY CONNECT	- 5005226
J4 = HOPPER 1 POWER CONNECT	- Hopper Dependant
J5 = HF UNIT POWER CONNECT	- 5005224
J6 = VOLTAGE SENSE CONNECT	- 5005272
J7 = HF UNIT CONTROL CONNECT	- 5005222
J8 = HOPPER 1 SIGNAL CONNECT	- Hopper Dependant
J9 = BOOTH EXHAUST INTERLOCK	-
J10 = HOPPER 2 POWER CONNECT	- Hopper Dependant
J11 = HOPPER 2 SIGNAL CONNECT	- Hopper Dependant
J12 = AUXILIARY POWER CONNECT	-
J13 = TURNTABLE CONNECT	- Jumper 610346
JX = E-STOP IN CONNECT	- 5007777
JY = E-STOP OUT CONNECT	- 5007777



REV.	ECO.	DESCRIPTION	DATE	DFT.	APVD.
A	2436	RELEASED TO PRODUCTION			

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NEXT ASSEMBLY

TAFA Concord, NH 03301
TEL: 603/224-9585
FAX: 603/225-4342

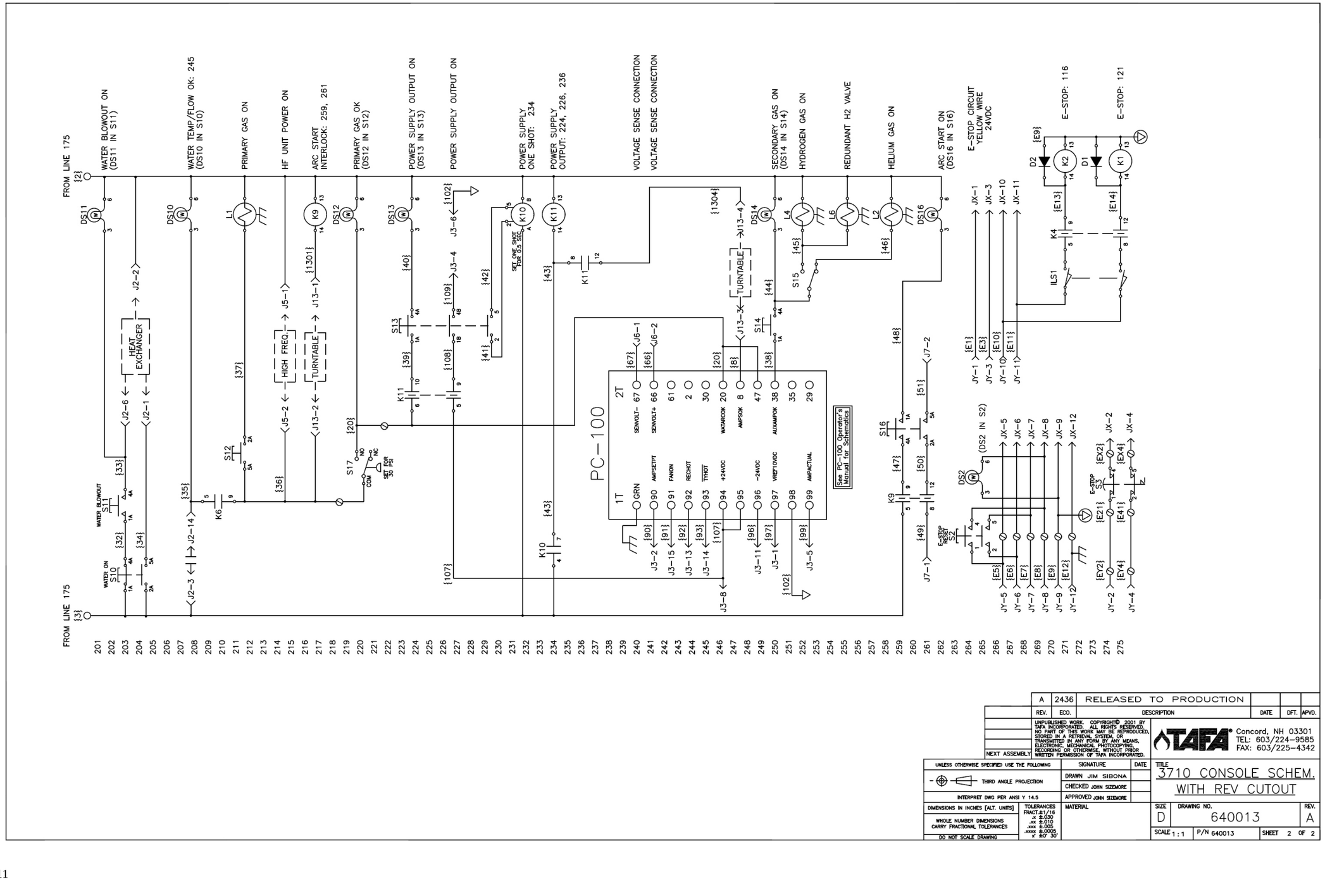
UNLESS OTHERWISE SPECIFIED USE THE FOLLOWING
THIRD ANGLE PROJECTION
INTERPRET DWG PER ANSI Y 14.5
DIMENSIONS IN INCHES [ALT. UNITS]
WHOLE NUMBER DIMENSIONS CARRY FRACTIONAL TOLERANCES
DO NOT SCALE DRAWING

	SIGNATURE	DATE
DRAWN	JIM SIBONA	
CHECKED	JOHN SIZEMORE	
APPROVED	JOHN SIZEMORE	

TOLERANCES FRACT.±1/16 .x ±.030 .xx ±.010 .xxx ±.005 .xxxx ±.0005 ∠ ±0° 30'
MATERIAL

TITLE: 3710 CONSOLE SCHEM. WITH REV CUTOUT

SIZE D | DRAWING NO. 640013 | REV. A
SCALE 1:1 | P/N 640013 | SHEET 1 OF 2



REV.	ECO.	DESCRIPTION	DATE	DFT.	APVD.
A	2436	RELEASED TO PRODUCTION			

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UNLESS OTHERWISE SPECIFIED USE THE FOLLOWING	SIGNATURE	DATE
THIRD ANGLE PROJECTION	DRAWN JIM SIBONA	
	CHECKED JOHN SIZEMORE	
INTERPRET DWG PER ANSI Y 14.5	APPROVED JOHN SIZEMORE	

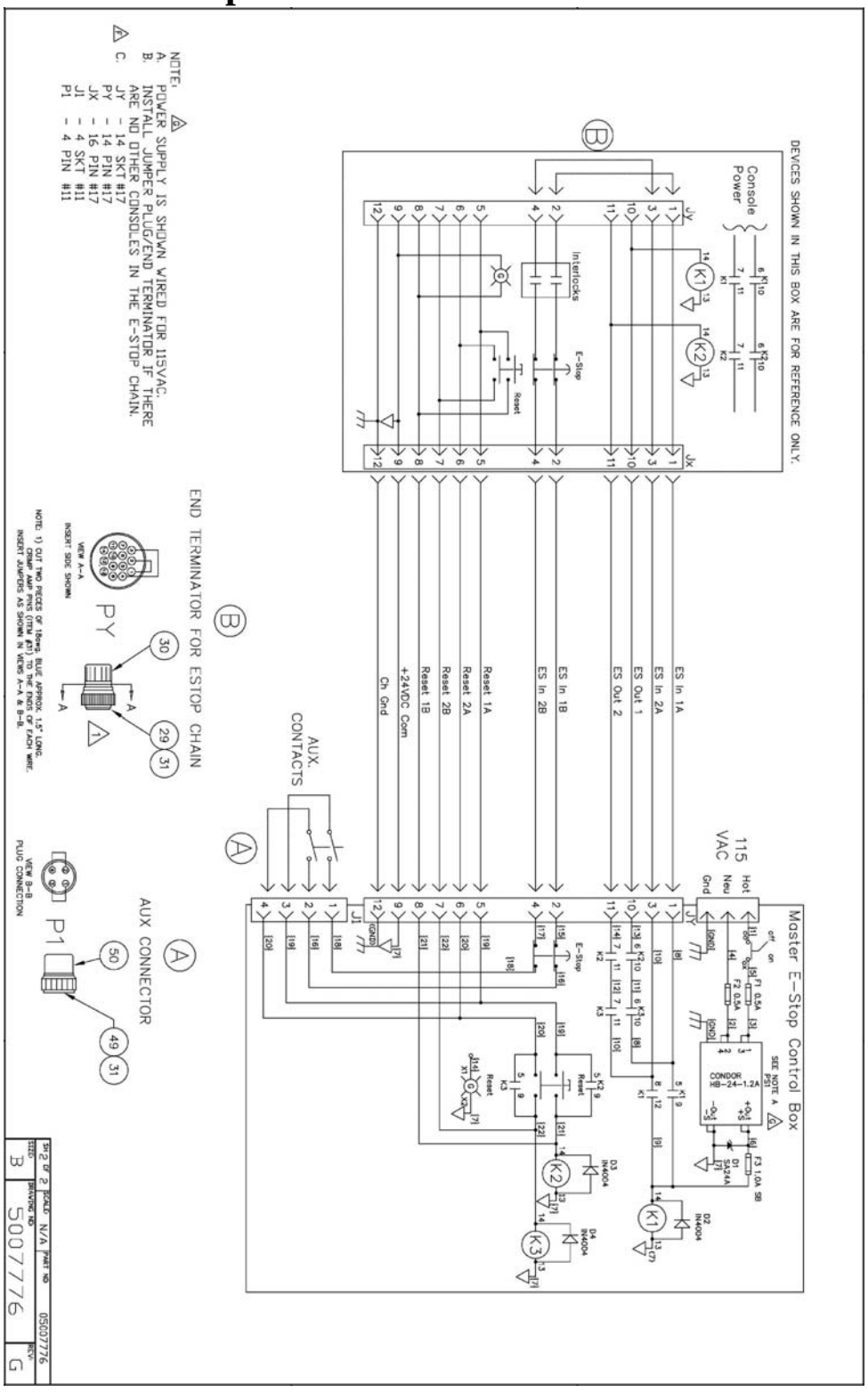
DIMENSIONS IN INCHES [ALT. UNITS]	TOLERANCES	MATERIAL
WHOLE NUMBER DIMENSIONS CARRY FRACTIONAL TOLERANCES	FRACT. ±1/16 .x ±.030 .xx ±.010 .xxx ±.005 .xxxx ±.0005 x° ±0° 30'	
DO NOT SCALE DRAWING		

TITLE: 3710 CONSOLE SCHEM. WITH REV CUTOUT

SIZE	DRAWING NO.	REV.
D	640013	A

SCALE 1:1 | P/N 640013 | SHEET 2 OF 2

5.5 E-Stop Electrical Schematic



Section 6

Parts List

6.1 3710 Console

Figure 6-1. Model 3710 Assembly Key Drawing, 610343 Rev. M, S1

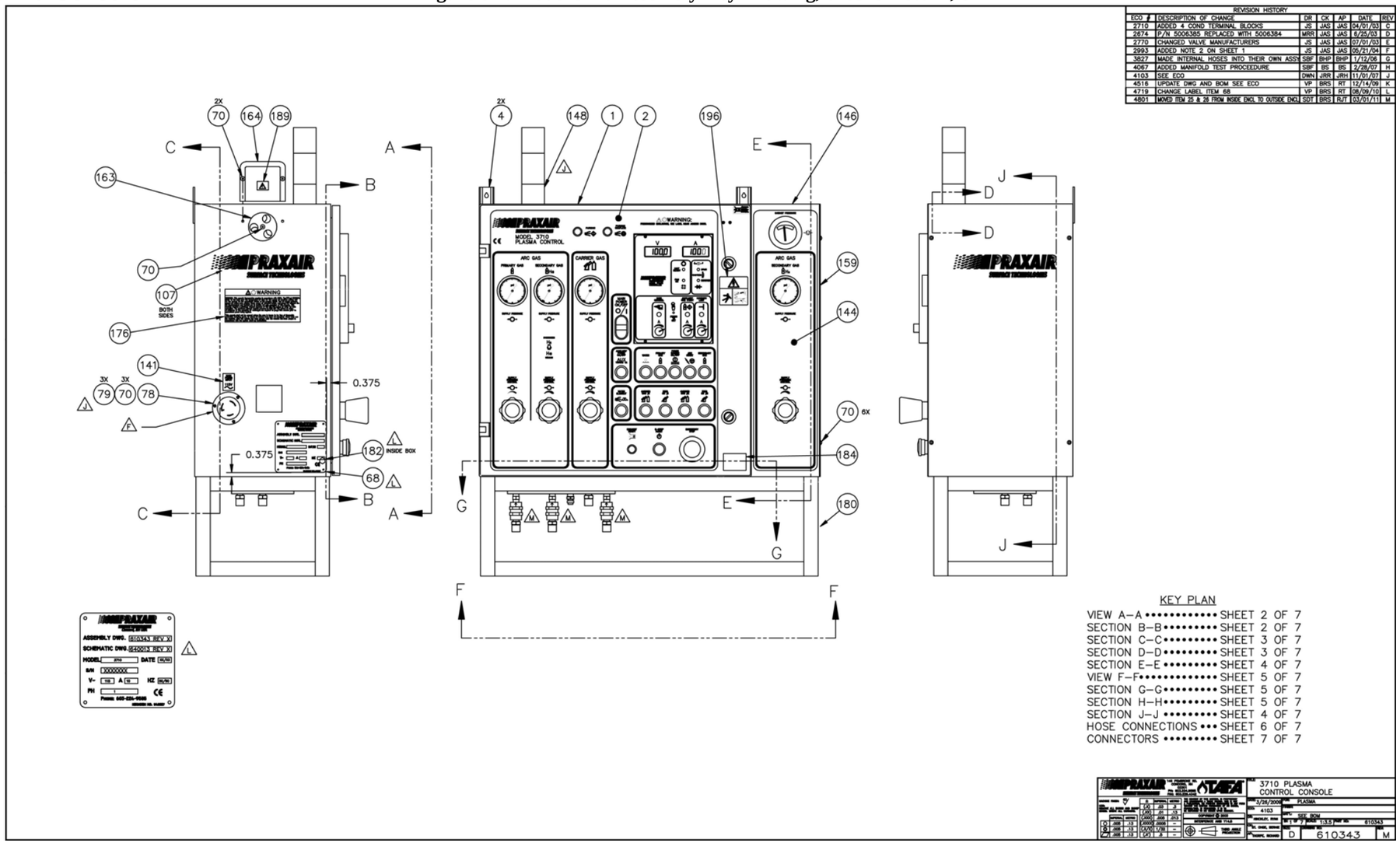
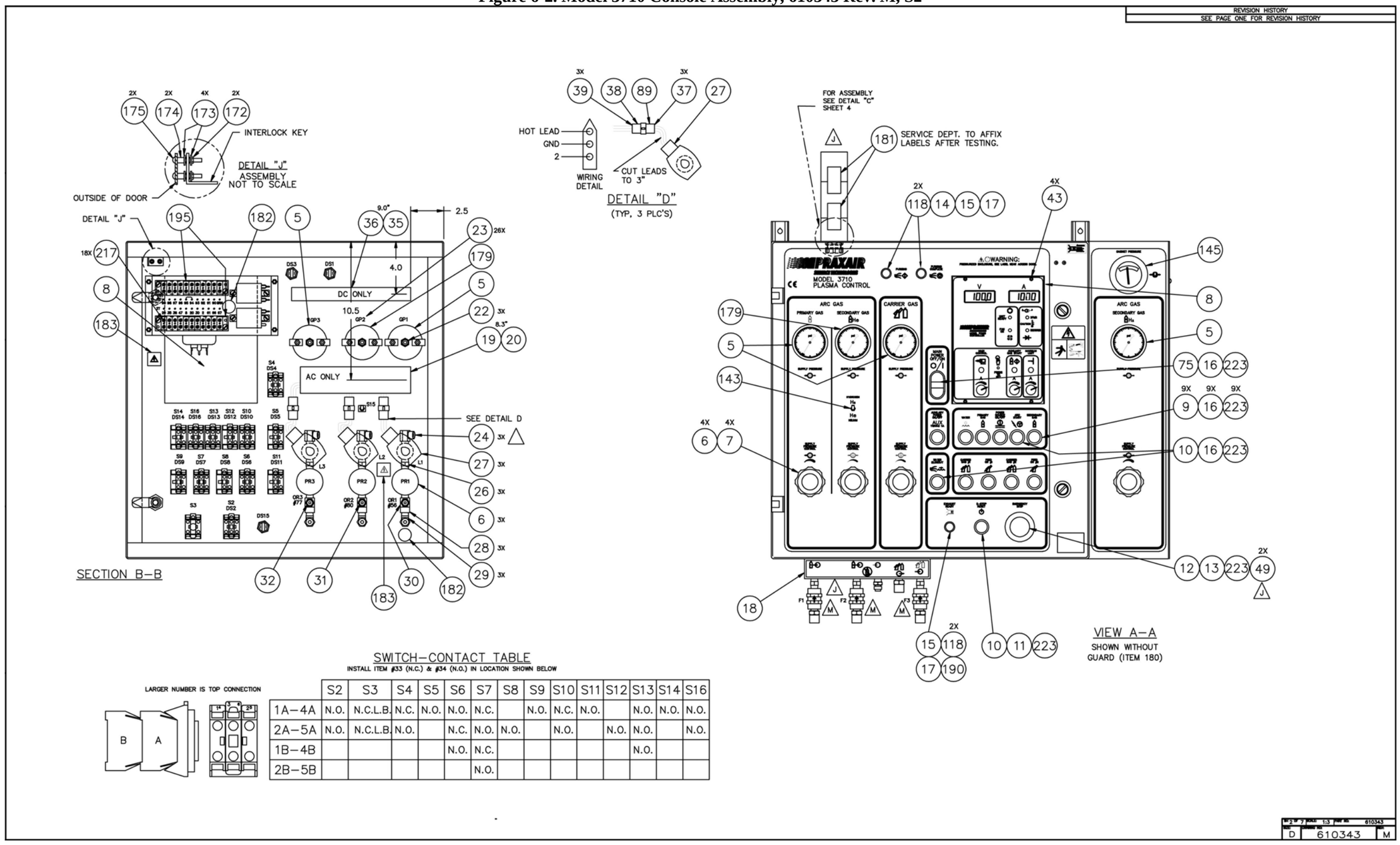


Figure 6-2. Model 3710 Console Assembly, 610343 Rev. M, S2



	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14	S16
1A–4A	N.O.	N.C.L.B.	N.C.	N.O.	N.O.	N.C.		N.O.	N.C.	N.O.		N.O.	N.O.	N.O.
2A–5A	N.O.	N.C.L.B.	N.O.		N.C.	N.O.	N.O.		N.O.		N.O.	N.O.		N.O.
1B–4B					N.O.	N.C.						N.O.		
2B–5B						N.O.								

Figure 6-3. Model 3710 Console Assembly, 610343 Rev. M, S3

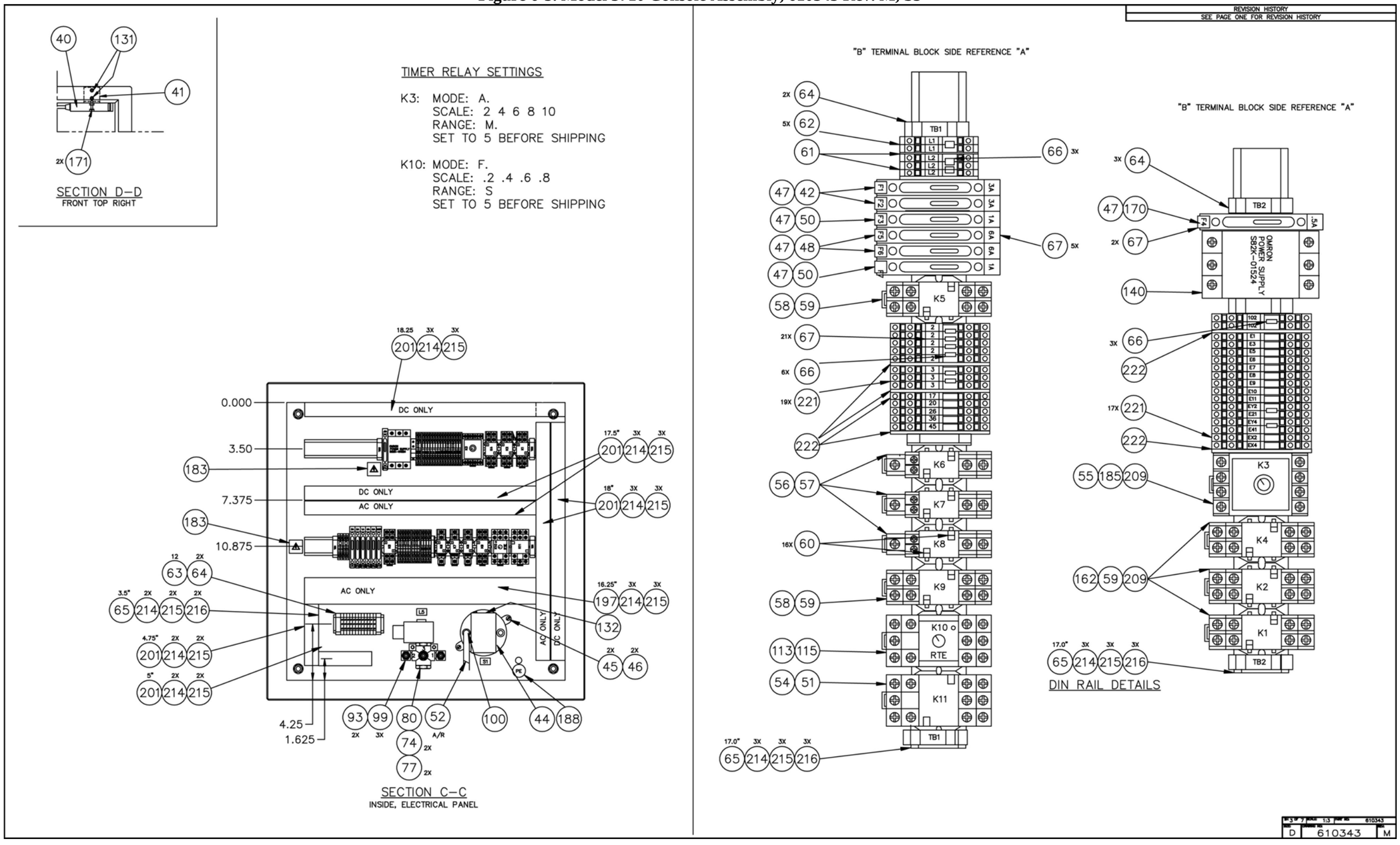


Figure 6-4. Model 3710 Console Assembly, 610343 Rev. M, S4

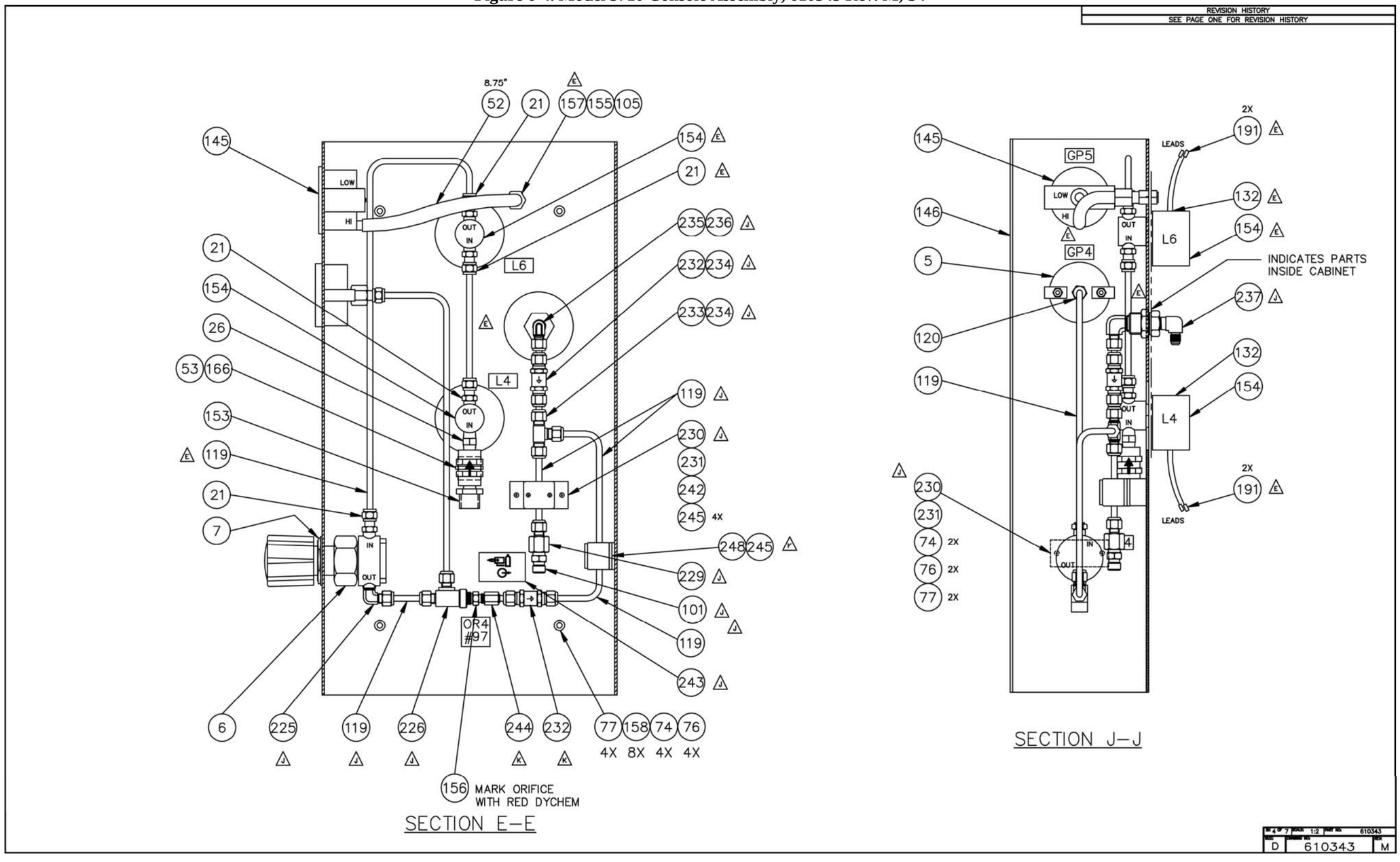


Figure 6-5. Model 3710 Console Assembly, 610343 Rev. M, S5

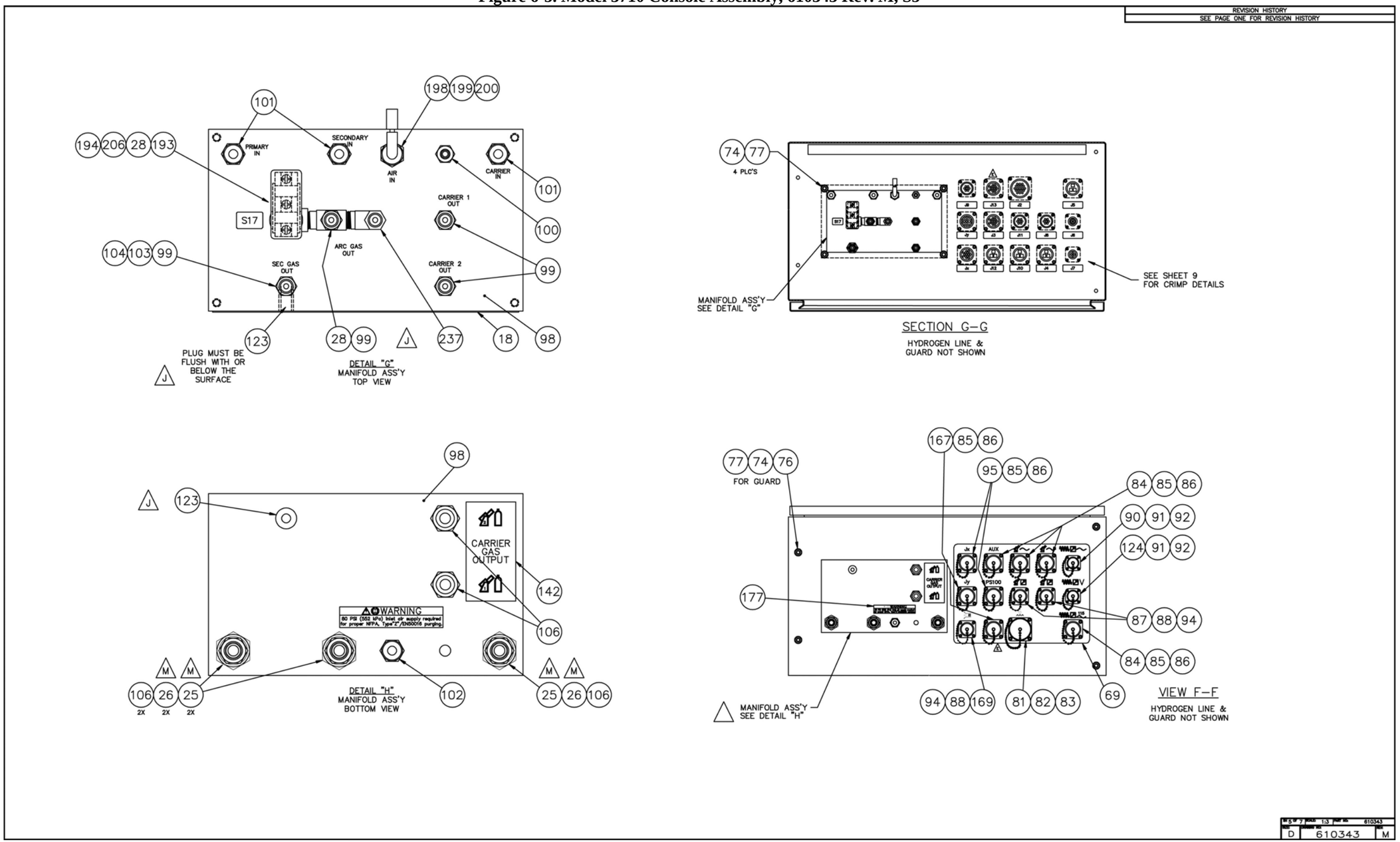


Figure 6-6. Model 3710 Console Assembly, 610343 Rev. M, S6

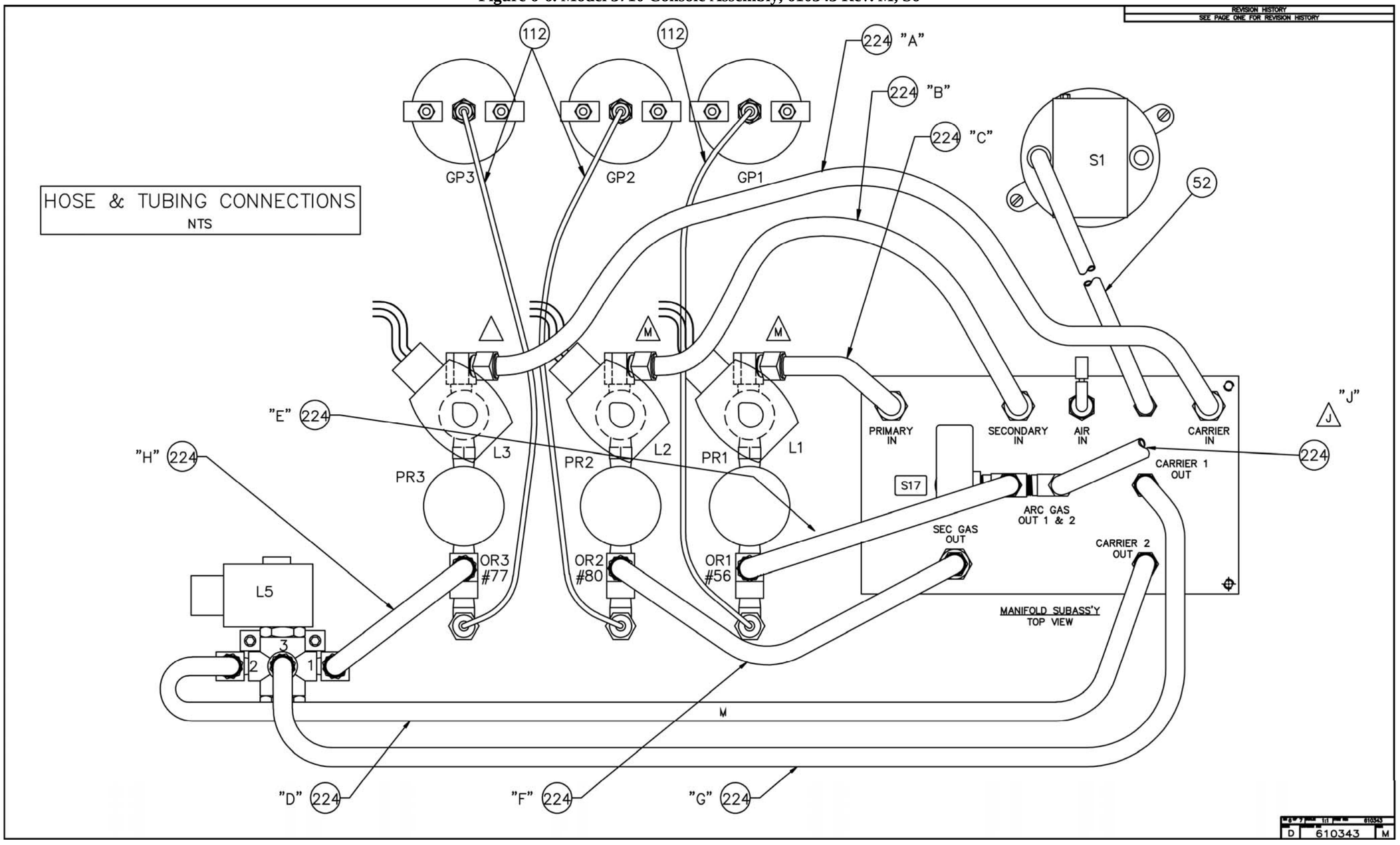
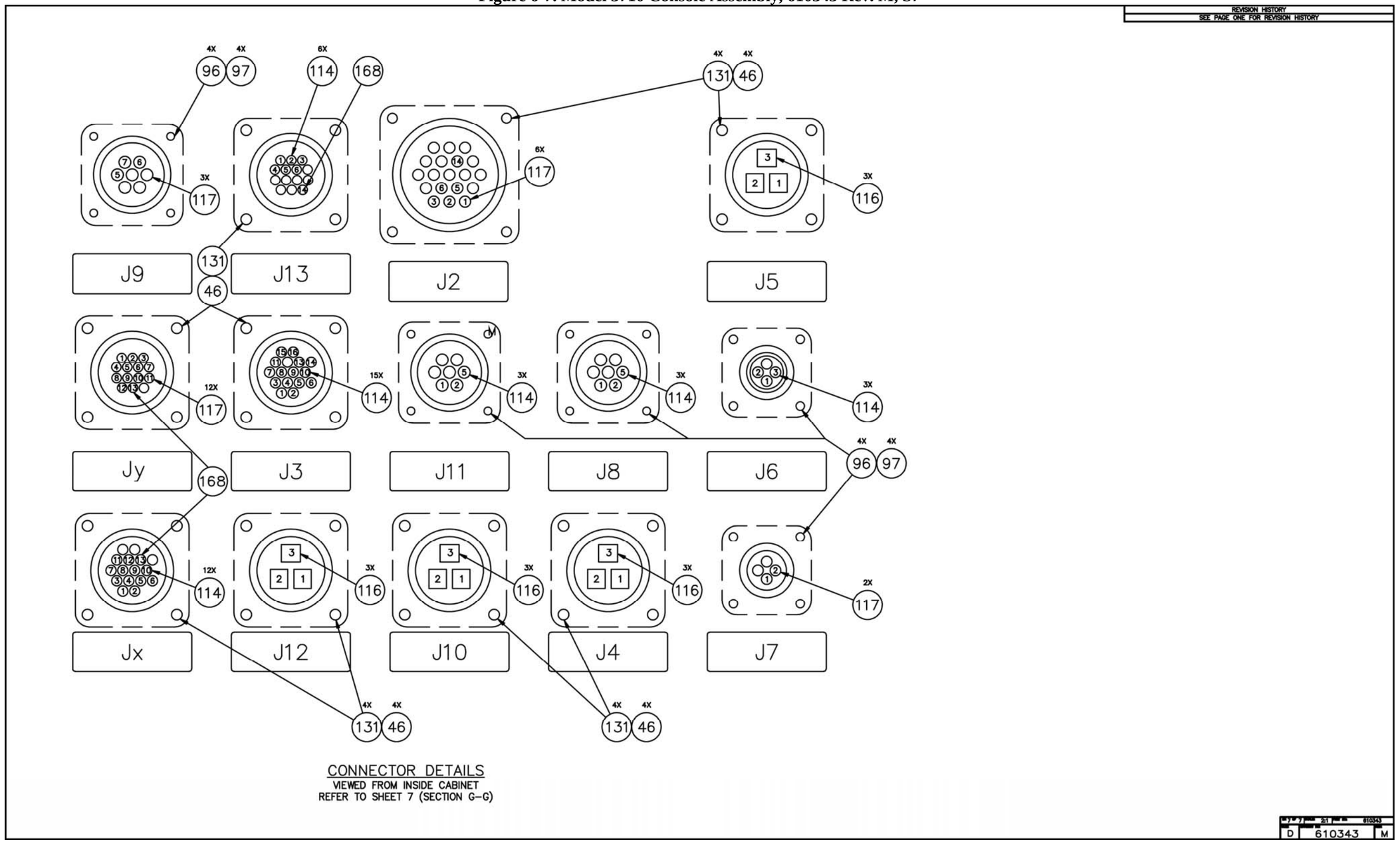


Figure 6-7. Model 3710 Console Assembly, 610343 Rev. M, S7



PART #	ITEM	DESCRIPTION	QTY	UM
610343		**CONSOLE, PLASMA, 3710, Rev M**		**EA**
5007970	1	BOX, ELECTRICAL W/HOLES	1	EA
5007973	2	PANEL, 3710 FRONT LEXAN	1	EA
5007526	4	FOOT,MOUNTING, INDIVIDUAL	2	EA
5002915	5	GAUGE, PRESS 0-200 PSI/KPA	3	EA
410227	6	REGULATOR, 0-500 PSI OUT	4	EA
5006197	7	WASHER, FLAT	4	EA
017605A	8	CONTROL, PC100	4	EA
251211	9	OPERATOR, BUTTON, PB, CLEAR FLUSH, ILLUM, ALT ACT	9	EA
251210	10	OPERATOR, BUTTON PB CLEAR FLUSH, ILLUM, MOM, PLASTIC	3	EA
251167	11	MODULE LED, 24V AC/DC ILLUM PUSH BUTTON	1	EA
251214	12	OPERATOR, BUTTON, MUSH, 2 POS	1	EA
251105	13	PLATE, LEGEND, E-STOP YELLOW	1	EA
5007950	14	BULB, LIGHT	2	EA
250124	15	SOCKET, LAMP, 120 VAC	3	EA
251230	16	MODULE, LED, WHITE, 120 VAC	12	EA
5003014	17	LENS, WHITE, FLAT BEZEL	3	EA
5007972	18	PANEL, 3710 MANIFOLD, LEXAN	1	EA
5001679	19	WIREWAY, COVER, WIRING DUCT	0.83	FT
5001677	20	WIREWAY, DUCT SLOTTED	0.83	FT
5007909	21	CONN,TUBE SWAGE SS	4	EA
5000555	22	CONN,TUBE SWAGE BR	3	EA
5001071	24	ADAPTOR,GAS BR R.H. OXY	3	EA
5003823	25	FILTER, FLUID, GAS	4	EA
5001291	26	NIPPLE,PIPE HEX BR	7	EA
014018	27	VALVE, SOLENOID	3	EA
5002050	28	TEE,PIPE STREET BR , SAME AS 210151	5	EA
210360	29	ELBOW, SAME AS 5000296	3	EA
01079-003	30	ORIFICE,CRITICAL NO.56	1	EA
01079-002	31	ORIFICE,CRITICAL NO.80	1	EA
01079-004	32	ORIFICE,CRITICAL NO.77	1	EA
251111	33	CONTACT BLOCK, STANDARD, SCREW TERM.	5	EA
251113	34	CONTACT BLOCK, STANDARD, SCREW TERM.	19	EA
5001680	35	WIREWAY, COVER	1.89	FT
5001678	36	WIREWAY	1.89	FT
5001687	37	MOLEX,CRIMP	9	EA

PART #	ITEM	DESCRIPTION	QTY	UM
5004794	38	MOLEX,CONN RECP	3	EA
5001688	39	MOLEX,CRIMP	9	EA
5007968	40	SWITCH, INTERLOCK	1	EA
5007134	41	BRACKET, FOR INTERLOCK SWITCH, ANGLE	1	EA
5002527	42	FUSE, 3 AMP, SLOW BLOW, F1 + F2	2	EA
200668SS	43	SCREW, BHSCS	4	EA
5004177	44	SWITCH, LOW PRESSURE, DIFFERENTIAL	1	EA
7000393	45	SCREW, MACH PAN HD	2	EA
200257	46	WASHER, LOCK, SAME AS 7000209	34	EA
240560	47	BLOCK, FUSE, SAME AS 240391	7	EA
5001240	48	FUSE, 6 AMP, FAST BLOW, F5 + F6	2	EA
251112	49	CONTACT, BLOCK	2	EA
5003113	50	FUSE, 1 AMP, SLOW BLOW, F3 + F7	2	EA
10291	51	SOCKET RELAY	1	EA
5000299	52	HOSE, BULK GAS, RED	2	FT
5000172	53	TIE DOWN, WIRE TIE HOLDER	8	EA
10290	54	RELAY, 3PDT 120 VAC	1	EA
5007951	55	RELAY, 2PDT 24VDC, TIME DELAY	1	EA
5006096	56	SOCKET, RELAY SPDT	3	EA
5006095	57	RELAY, 1PDT 120 VAC	3	EA
5002983	58	RELAY, 2PDT 120 VAC	2	EA
5002982	59	SOCKET RELAY	5	EA
5004586	60	RELAY, TIE DOWN	16	EA
240557	61	BLOCK,END, END BARRIER FOR 240556	2	EA
240556	62	BLOCK,TERMINAL	5	EA
240562	63	BLOCK,TERMINAL,GND	12	EA
240125	64	END STOP	8	EA
240128	65	CHANNEL, MNTNG, DIN RAIL	29	IN
240558	66	JUMPER,BLOCK	12	EA
240563	67	LABEL,CARD	0.35	EA
540327	68	SYSTEM, NAMEPLATE 4" SERIAL NUMBER CE	1	EA
5007971	69	PANEL, 3710 CONNECTION	1	EA
201089	70	SCREW, BHSCS	6	EA
5004713	72	PLUG 30A 125V 2PL 3WR CN	1	EA
5008347	73	ADAPTOR, PLUG, 90 DEG. ELBOW	1	EA
200048	74	WASHER, LOCK	16	EA
251212	75	OPERATOR, BUTTON, 2 FUNCTION	1	EA
7000017	76	NUT, HEX, SAME AS 200037	10	EA
7000613	77	SCREW, BHSCS	16	EA
5004457	78	RECPT., 30A, 125V,	1	EA

PART #	ITEM	DESCRIPTION	QTY	UM
200553	79	WASHER, LOCK, INT	4	EA
5008334	80	VALVE, SOLENOID	1	EA
5004704	81	AMP, RECP, 19-SKT	1	EA
5004697	82	AMP, SEAL, PERIPHERAL	1	EA
5004312	83	AMP, CAP, SEALING	1	EA
5004458	84	AMP, RECP, 3-SKT	4	EA
5004696	85	AMP, SEAL PERIPHERAL	8	EA
5004340	86	AMP, CAP, SEALING	8	EA
5004409	87	AMP, RECP, 7-PIN, SAME AS 240507	2	EA
5004695	88	AMP, SEAL, PERIPHERAL,	3	EA
5001135	89	MOLEX, CONN RECP	3	EA
240221	90	MOLEX, CONN RECP., SAME 5003864	1	EA
5004694	91	AMP, SEAL, PERIPHERAL	2	EA
5004311	92	AMP, CAP, SEALING,	2	EA
5000214	93	ELBOW, PIPE, BR, SAME AS 210025	3	EA
5004428	94	AMP, CAP, SEALING	3	EA
5004339	95	AMP, RECP, 16-PIN SAME AS 240488	2	EA
7000517	96	SCREW, BTN HD, HEX SKT	20	EA
7000363	97	WASHER, LOCK, INT TOOTH	20	EA
5008395	98	MANIFOLD, 3710 CSL	1	EA
5001905	99	CONN, TUBE, FLARE BRASS	9	EA
5003817	100	CONN, HOSE BR	2	EA
5000402	101	ADAPTOR, GAS BR R.H. OXY	4	EA
5008394	102	CONN, MACH, BR R.H. MALE	1	EA
5000221	103	COUPLING, PIPE BR, SAME AS 210454	1	EA
14016	104	VALVE, CHECK	1	EA
5003054	105	ADAPTOR, PIPE	1	EA
5002315	106	ADAPTOR,GAS BR R.H. INRT	5	EA
5000802	107	LABEL, PRAXAIR LOGO, SMALL	2	EA
5002925	112	TUBING, NYLON	5.5	FT
5000458	113	RELAY, TIME DELAY	1	EA
5004274	114	AMP, CRIMP, PIN	36	EA
5000459	115	RELAY, TIMER SKT	1	EA
5004268	116	AMP, CRIMP, SKT	12	EA
5004275	117	AMP, CRIMP, SKT, SAME AS 240017	23	EA
5004237	118	TERM, RECP	6	EA
310029	119	TUBE, SS	72	IN
5008087	120	CONN, TUBE SWAGE SS	1	EA
5006356	123	PLUG, PIPE, BR	2	EA
5004309	124	AMP,RECP, 4-PIN	1	EA
200077	131	SCREW, BHSCS	34	EA

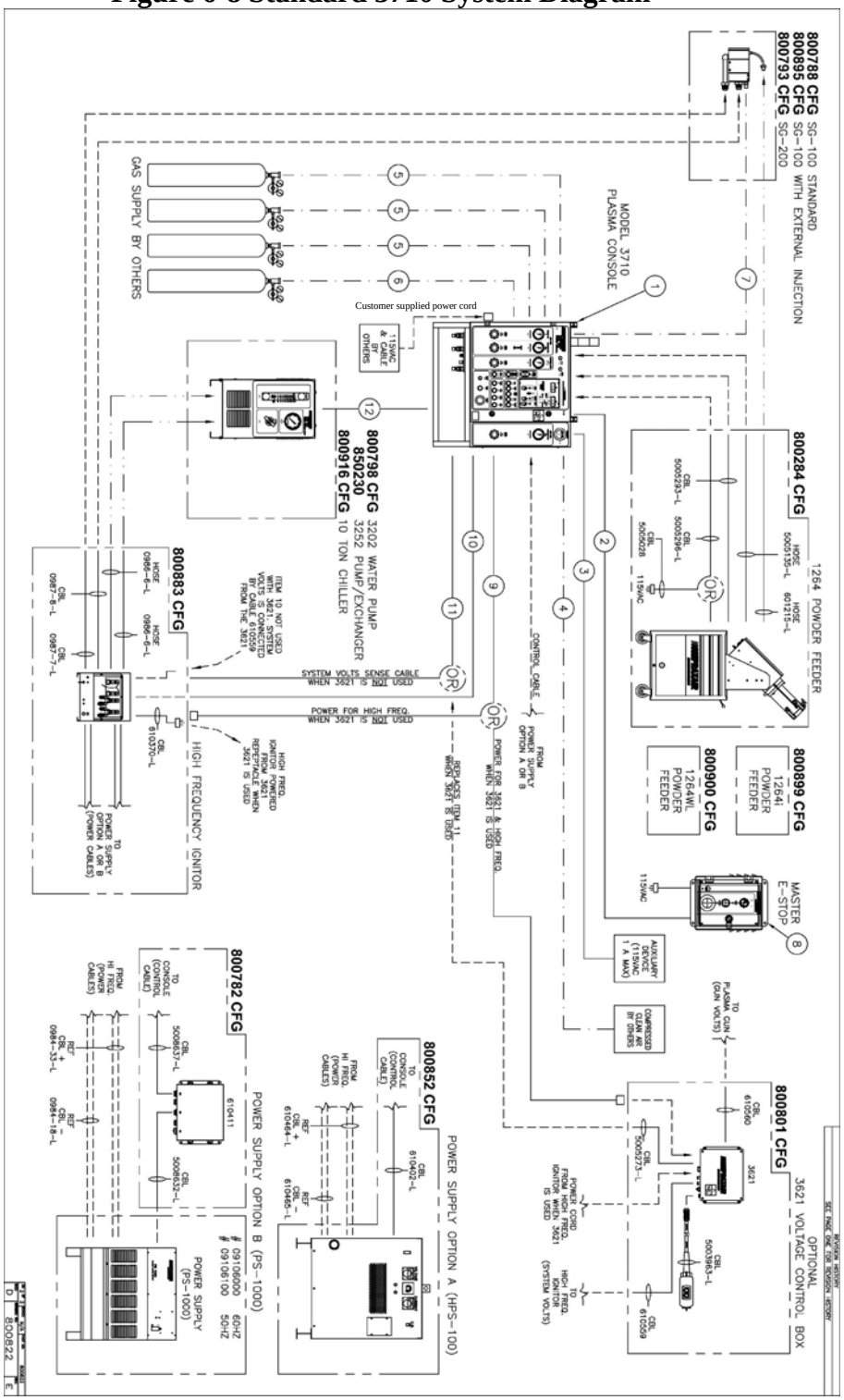
PART #	ITEM	DESCRIPTION	QTY	UM
5001136	132	CAP, PLASTIC	3	EA
5000510	138	RELAY, TIE DOWN	3	EA
5008095	140	POWER SUPPLY, 24VDC	1	EA
5008461	141	LABEL, 3710 MAIN POWER INPUT, 115 AC	1	EA
5008462	142	LABEL, 3710 CARRIER GAS OUTPUT	1	EA
5006094	143	SWITCH, TOGGLE	1	EA
5007974	144	PANEL, 3710 HYDROGEN LINE LEXAN	1	EA
5003016	145	GAUGE, PRESSURE	1	EA
5008390	146	PANEL, 3710 HYDROGEN	1	EA
5007959	148	ALARM, STACKLIGHT ASSY., 24VDC	1	EA
5007704	153	ADAPTOR, GAS, BR, L.H. FUEL, MALE	1	EA
5002158	154	VALVE, SOLENOID	2	EA
5003056	155	NUT, LOCK	1	EA
5004606	156	ORIFICE,CRITICAL NO.97	1	EA
5003055	157	CONN, HOSE, BR	1	EA
7000018	158	WASHER FLAT, SAME AS 200479	10	EA
5007763	159	PANEL, COVER 3702 HYDROGEN	1	EA
7000182	160	WASHER, FLAT	4	EA
200243	161	SCREW, BHSCS, SAME AS 7000612	4	EA
5004612	162	RELAY, 2PDT 24 VDC	3	EA
5007721	163	VENTILATOR, PLATE, PURGE AIR	1	EA
5007722	164	GUARD, VENTILATING PURGE AIR	1	EA
5006388	166	TIE, CABLE INTERMED	1	EA
5004703	167	AMP, RECP, 14-SKT	2	EA
5004403	168	AMP, KEYING PLUG	3	EA
240509	169	CONN, RECPT, 7-PIN, SAME 5004404	1	EA
5007161	170	FUSE, 0.5 AMP, SLOW BLOW, F4	1	EA
7000544	171	SCREW, BHSCS	2	EA
7000060	172	NUT, HEX, SAME AS 200082	2	EA
200083	173	WASHER, FLAT, SAME AS 7000440	4	EA
7000312	174	SPACER	2	EA
200991SS	175	SCREW, BHSCS	2	EA
5007890	176	LABEL, WARNING, NFPA TYPE 2 PURGING	1	EA
5007892	177	LABEL, 80 PSI AIR REQUIRED	1	EA
5006327	179	GAUGE, PRESSURE	1	EA
5008396	180	GUARD, 3710 HOSES AND CABLES	1	EA
5007782	181	LABEL, TAMPER WARNING	2	EA
5007088	182	LABEL, PROTECTIVE EARTH SYMBOL	4	EA
5007087	183	LABEL, ELECTRICAL HAZARD SYMBOL	4	EA
5007158	184	LABEL, (MADE IN U.S.A.)	1	EA
10273	185	SOCKET, RELAY	1	EA

PART #	ITEM	DESCRIPTION	QTY	UM
5003609	186	WIREWAY	6.5	FT
5007294	188	LABEL, (PE) PANDUIT	1	EA
5007086	189	LABEL, SAFETY, TRIANGLE	1	EA
5003020	190	BULB LIGHT INDICATOR 120 VAC, SAME AS 250126	1	EA
5008133	191	TERM, RECP.	4	EA
240095	192	DISCONNECT, FEMALE, SAME 5004236&OM	2	EA
5008579	193	SWITCH, PRESSURE	1	EA
5006384	194	COVER, PRESSURE SWITCH,	1	EA
5007094	196	LABEL, ELECTRICAL WARNING	1	EA
270128	197	WIREWAY, W/COVER	16.25	IN
5008256	198	SILENCER, QUICK DISCONNECT	1	EA
5008255	199	ELBOW, QUICK DISCONNECT	1	EA
210184	200	FITTING, SAME 5008393	1	EA
270126	201	WIREWAY, W/COVER,	63.50	IN
5004442	202	AMP,PLUG, 7-PIN	1	EA
5004471	203	AMP, BOOT, HT SHRK	1	EA
5008098	204	AMP, PIN	2	EA
5000473	206	BUSHING,PIPE, BR	1	EA
250051	209	DIODE	4	EA
5008463	211	DRAWING, 3710 HOSE & CABLE CONN.	1	EA
200202	214	SCREW, PHMS-S	30	EA
200125	215	WASHER, FLAT	30	EA
200800	216	WASHER, LOCK, SPLIT	6	EA
5001559	217	TERM, FORK SPRING SPADE	18	EA
610346	218	JUMPER,E-STOP, 14-PIN (PINS 1-2 & 3-4 CONNECT)	1	EA
251048	221	TERM, BLOCK	29	EA
251049	222	END, PLATE, TERM BLOCK, ORANGE	5	EA
251106	223	LATCH, MOUNTING, PB SWITCH	14	EA
610482	224	KIT, HOSE, GAS INTERNAL	1	EA
210822	225	ELBOW, SS	1	EA
5008318	226	TEE, TUBE SWAGE, SS	1	EA
5008269	229	CONN, TUBE SWAGE SS	1	EA
210987	230	KIT, TUBE, SUPPORT	2	EA
210988	231	KIT, TUBE, WELD PLATE FOR TUBE SUPP	2	EA
414052	232	VAVLE, CHECK, POPPET	2	EA
210989	233	FITTING, TEE, BRASS	1	EA
210990	234	FITTING, TUBE	2	EA
5008082	235	ELBOW, TUBE SWAGE SS	1	EA
210048	236	FITTING, BULKHEAD, BRASS	1	EA

PART #	ITEM	DESCRIPTION	QTY	UM
210423	237	FITTING, ELBOW	2	EA
210083	238	REDUCER, MALE TO FEMALE, SAME 5000548	1	EA
620306	242	SPACER, MOUNT FOR TUBE CLAMP	1	EA
540277	243	LABEL, LEXAN, PLASMA GAS OUT	1	EA
210994	244	FITTING, TUBE, SS, ADAPTER	1	EA
200281	245	SCREW, BHSCS	6	EA
220659	246	WRAP, WIRE, SPIRAL	120	IN
540244	247	LABEL, WARNING, DUST BY-PRODUCT	1	EA
201080	248	NUT, JAM, ¼-20, STL/ZNC	2	EA

6.2 Hoses and Cables

Figure 6-8 Standard 3710 System Diagram



				LENGTH	
ITEM	**P/N**	**QTY**	**DESCRIPTION**	**Ft**	**M**
	800822		**3710 CONSOLE CONFIGURATION**		
2	5007777-20	1	CABLE, CTRL, E-STOP CHAIN	20	6.1
3	5008540-25	1	CABLE, POWER, CNSL(AMP)-AUX. DEVICE	25	7.6
4	5005064-25	1	HOSE, AIR, SPLY-CONSOLE	25	7.6
5	5005071-25	3	HOSE, GAS INERT, SPLY-CNSL	25	7.6
6	5005067-25	1	HOSE, GAS FUEL, SPLY-CONSOLE, HYD/ACE	25	7.6
7	985-2-12	1	HOSE, GAS (PLAS) HOPR/GUN-CNSL	12	3.7
9	5005224-25	1	CABLE, POWER, CNSL-HF-2210	25	7.6
10	5005222-25	1	CABLE, CTRL, CNSL-HF-2210	25	7.6
11	5005272-25	1	CABLE, CTRL, CNSL-HF-2210 (VOLTAGE SENSE)	25	7.6
12	5005265-25	1	CABLE, CTRL, CNSL(AMP)-HEATEX	25	7.6
	800883		**HF-2210 HIGH FREQUENCY CONFIGURATION**		
	986-6-12	2	HOSE, WATER 3/4"	12	3.7
	987-7-12	1	CABLE,WATER COOLED NEG., HF-2210-SG100	12	3.7
	987-8-12	1	CABLE, WATER COOLED POS., HF-2210-SG100	12	3.7
	610370-L	1	CABLE, POWER, TO 115V	8	2.4
	800782		**PS-1000 POWER SUPPLY CONFIGURATION**		
	5008632-25	1	CABLE, PS-1000 TO JUNCTION BOX	25	3.0
	5008637-25	1	CABLE, CTRL, CNSL (AMP) TO JUNCTION BOX (for PS-1000)	25	7.6
	984-18-8	2	CABLE, POWER 4/0 PWR SPLY TO H FRQ POSITIVE – For PS-1000 60 kW Power Supply	8	2.4
	984-33-8	2	CABLE, POWER 4/0 PWR SPLY TO H FRQ NEGATIVE – For PS-1000 60 kW Power Supply	8	2.4
	800852		**HPS-100 POWER SUPPLY CONFIGURATION**		
	610402-25	1	CABLE, CTRL, CNSL TO HPS-100	25	7.6
	610464	2	CABLE, POWER 300MCM PWR SPLY TO H FRQ POSITIVE – For HPS-100 100 kW Power Supply	8	2.4
	610465	2	CABLE, POWER 300MCM PWR SPLY TO H FRQ NEGATIVE – **For HPS-100 100 kW Power Supply**	8	2.4
	5005226-25	1	CABLE, CTRL, CNSL **TO PS-100** (Archived)	25	7.6
800284, 800899 OR 800900			**1264, 1264*i* OR 1264WL POWDER FEEDER CONFIGURATION**		
	5005135-12	1	HOSE, GAS, HOPR-CNSL	12	3.7
	5005293-20	1	CABLE, CTRL 1264/70-3702/3440 NO 1260	20	6.1
	601215-12	1	HOSE, GAS POWDER (PLAS) HOPPER-GUN	12	3.7
	5005296-20	1	CABLE, POWER, 1264/70-3701/3710/4500	20	6.1
	5005028	2	CABLE, POWER, 15A 125V 3 CON.PLUG	10	3.0

6.3 E-Stop Box

Figure 6-9. E-STOP Controller

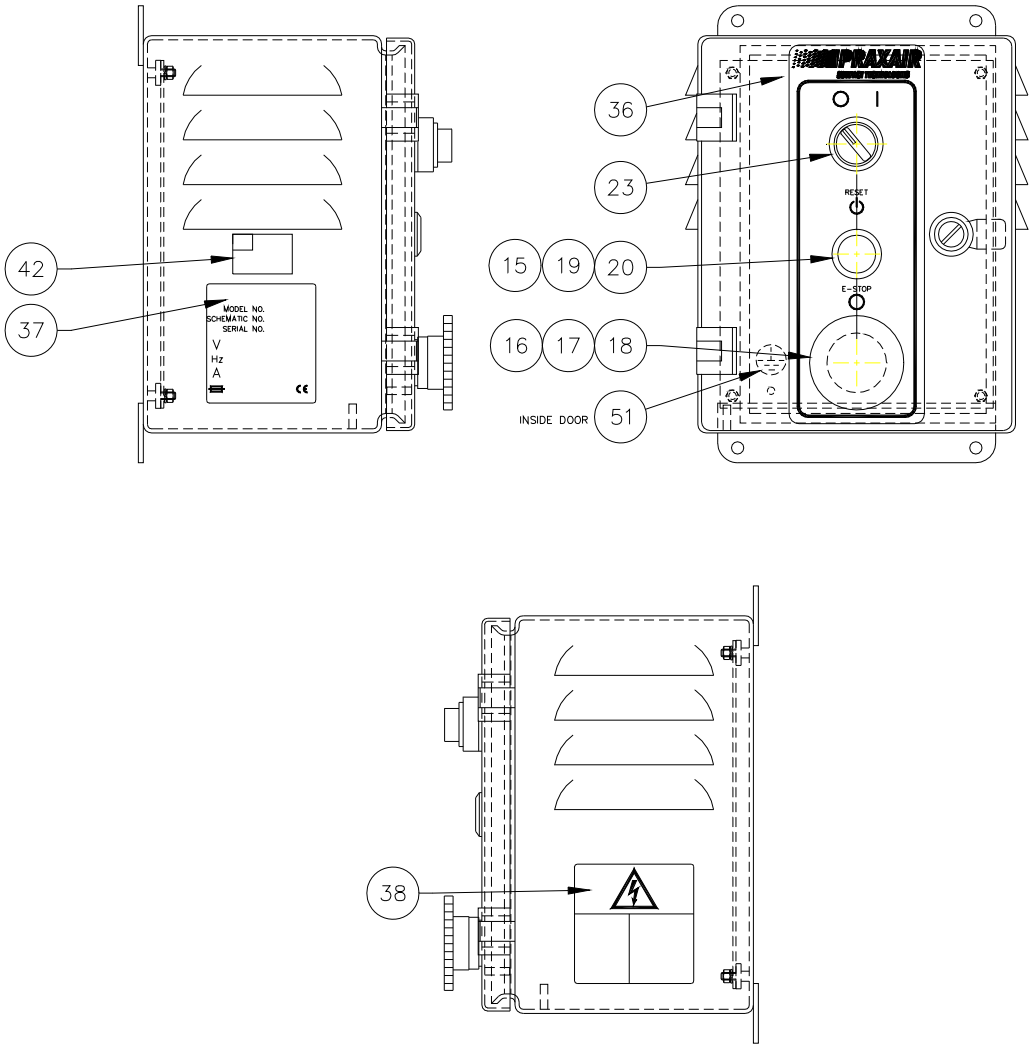


Figure 6-10. E-STOP Controller, Internal Layout

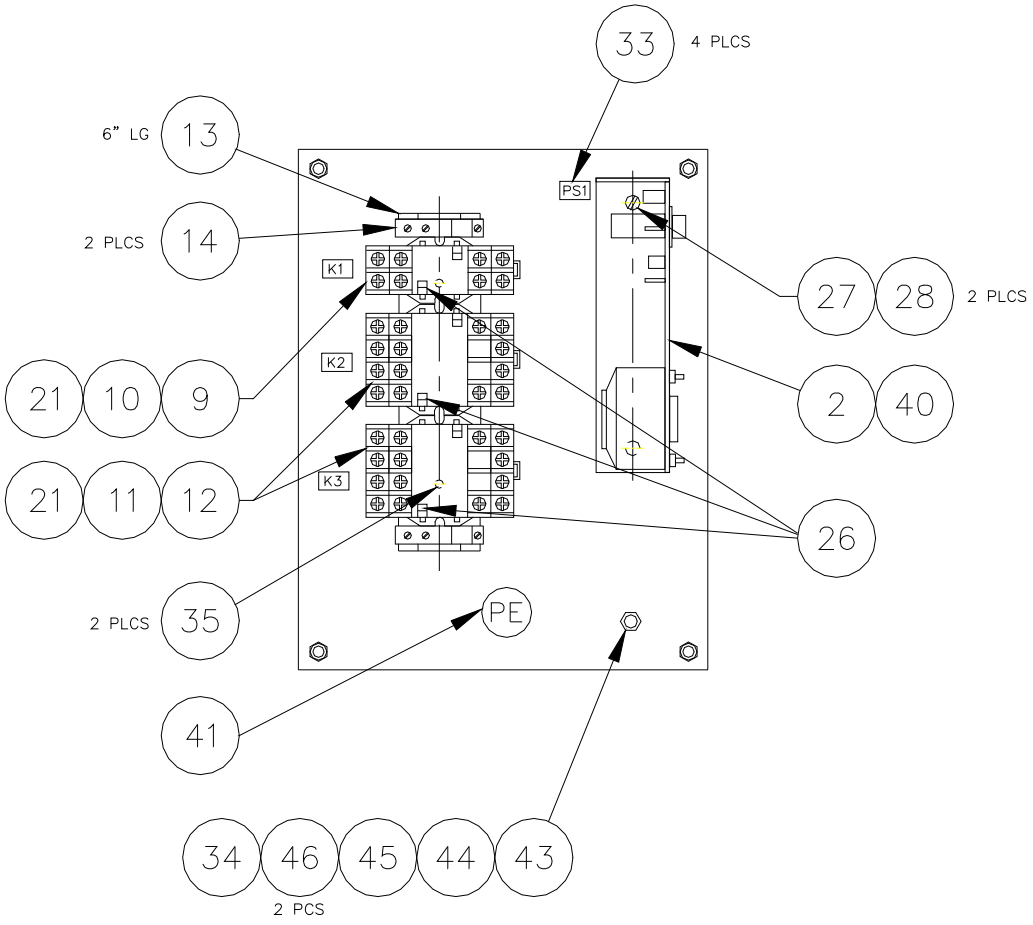


Figure 6-11. E-STOP Controller Connection Panel

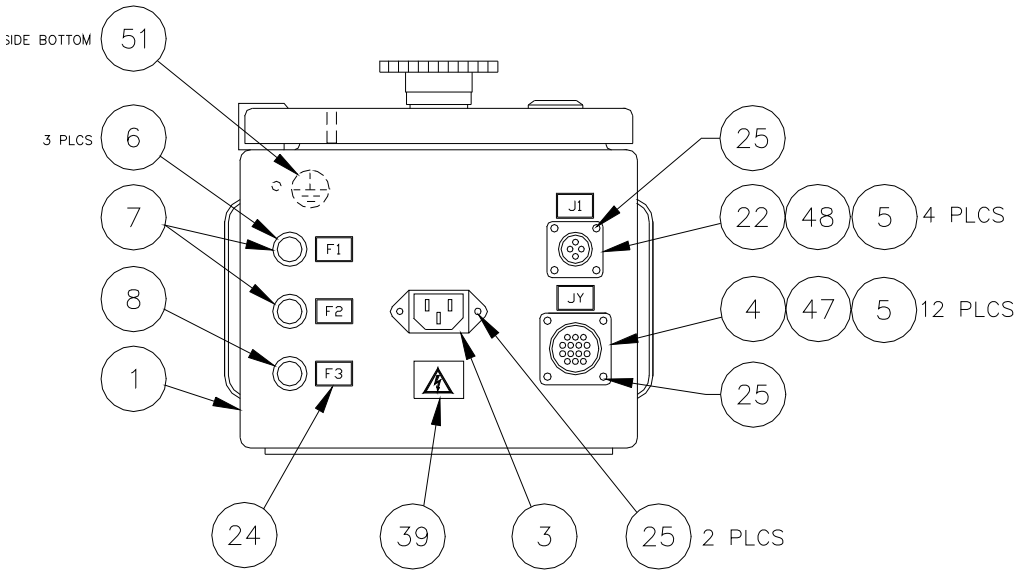
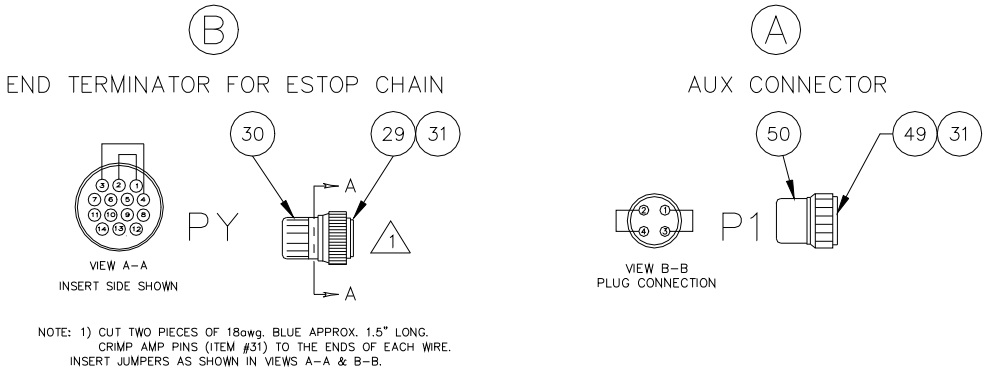


Figure 6-12. E-STOP Controller Connector and Terminator



ITEM	PART #	DESCRIPTION	QTY
1	5007823	BOX, MASTER E-STOP	1
2	5003807	POWER SUPPLY, SINGLE +24 VDC AT 1.2 AMP	1
3	5002580	RECPT. 15A 250V 2POLE 3WIRE FLNG INLT	1
4	5004703	AMP, RECP	1
5	5004275	AMP, CRIMP	16
6	10031	FUSE HOLDER	3
7	5007161	FUSE, 0.50 AMP, SLOW BLOW	2
8	5001265	FUSE, 1 AMP, AGC-1	1
9	5004612	RELAY, 2PDT 24 VDC	1
10	5002982	SOCKET, RELAY	1
11	5007423	RELAY, 4PDT, 24VDC	2
12	5002985	SOCKET, RELAY	2
13		NOT USED	
14	5001057	PHNX, TERM BLOCK END CLAMP	2
15	5007504	BULB, LIGHT 24VDC	1
16	5007130	BUTTON, RED, MUSHROOM E-STOP NO CONTACTS	1
17	5007131	CONTACT, ASM FOR RED BUTTON	1
18	5007132	LEGEND, YELLOW BLANK	1
19	5007128	BUTTON, GREEN, LIGHTED	1
20	5007129	CONTACT, ASM FOR GREEN BUTTON	1
21	5001675	DIODE	3
22	5003864	AMP, RECP	1
23	10137	SWITCH, ASSY, SELECTOR	1
24	5007844	LABEL, MASTER E-STOP BOX (KIT – 5 LABELS)	1
25	7000634	SCREW, BTN HD	10
26	5004586	RELAY, TIE DOWN	3
27	7000438	SCREW, BTN HD	2
28	7000199	WASHER, LOCK	2
29	5004700	AMP, PLUG	1
30	5003171	CAP, PLASTIC	1
31	5004274	AMP, CRIMP	8
32	5005028	CABLE, POWER, 15A 125V 3 CON.PLUG, 10 FT	1
33	7000607	WASHER, LOCK, INTERNAL TOOTH	1
34	7000058	RIVET, POP	2
35	5007824	PANEL, COVER, LEXAN MASTER E-STOP BOX	1
36	1007-52	LABEL, SERIAL NUMBER FOR PRAXAIR PRODUCT	1
37	5007094	LABEL, ELECTRICAL WARNING (CE)DISCONNECT POWER BEFORE	1
38	5007087	LABEL, ELECTRICAL HAZARD SYMBOL	1
39	5007152	TRANZORB, 24V 3W	1
40	5007294	LABEL, (PE) PANDUIT	1
41	5007158	LABEL, (MADE IN U.S.A.) 2IN X 1.5IN	1
42	7000386	SCREW, BTN HD HEX SKT (BLACK)	1
43	7000562	WASHER, LOCK, STAR EXTERNAL TOOTH	1
44	7000182	WASHER, FLAT	1

ITEM	PART #	DESCRIPTION	QTY
45	7000062	NUT, HEX	2
46	5004696	AMP, SEAL, PERIPHERAL	1
47	5004694	AMP, SEAL, PERIPHERAL	1
48	5002196	AMP, PLUG	1
49	6002017	SUPPLY PACKAGE, CAP THREADED PLASTIC	1
50	5007088	LABEL, PROTECTIVE EARTH SYMBOL	2
51	5004237	TERM, RECP	6
52	5003382	TERM, RING	6
53	5001478	TERM, RING	2

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