PC 650

Plasmarc Cutting Console

Service Manual

This manual provides service / troubleshooting instructions for PC650 consoles beginning with Serial Number P*J 623080

208/230 Volt	PN: 0558003179
460 Volt	PN: 0558005328
220/230 Volt CE	PN: 0558005151
400 Volt CE	PN: 0558005152

Manual # 0558006136 - Rev. 0 **9/2006**

BE SURE THIS INFORMATION REACHES THE OPERATOR.
YOU CAN GET EXTRA COPIES THROUGH YOUR SUPPLIER.

CAUTION

These INSTRUCTIONS are for experienced operators. If you are not fully familiar with the principles of operation and safe practices for arc welding and cutting equipment, we urge you to read our booklet, "Precautions and Safe Practices for Arc Welding, Cutting, and Gouging," Form 52-529. Do NOT permit untrained persons to install, operate, or maintain this equipment. Do NOT attempt to install or operate this equipment until you have read and fully understand these instructions. If you do not fully understand these instructions, contact your supplier for further information. Be sure to read the Safety Precautions before installing or operating this equipment.

USER RESPONSIBILITY

This equipment will perform in conformity with the description thereof contained in this manual and accompanying labels and/or inserts when installed, operated, maintained and repaired in accordance with the instructions provided. This equipment must be checked periodically. Malfunctioning or poorly maintained equipment should not be used. Parts that are broken, missing, worn, distorted or contaminated should be replaced immediately. Should such repair or replacement become necessary, the manufacturer recommends that a telephone or written request for service advice be made to the Authorized Distributor from whom it was purchased.

This equipment or any of its parts should not be altered without the prior written approval of the manufacturer. The user of this equipment shall have the sole responsibility for any malfunction which results from improper use, faulty maintenance, damage, improper repair or alteration by anyone other than the manufacturer or a service facility designated by the manufacturer.

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SECTION 1 SAFETY PRECAUTIONS

1.0 Safety Precautions

Users of ESAB welding and plasma cutting equipment have the ultimate responsibility for ensuring that anyone who works on or near the equipment observes all the relevant safety precautions. Safety precautions must meet the requirements that apply to this type of welding or plasma cutting equipment. The following recommendations should be observed in addition to the standard regulations that apply to the workplace.

All work must be carried out by trained personnel well acquainted with the operation of the welding or plasma cutting equipment. Incorrect operation of the equipment may lead to hazardous situations which can result in injury to the operator and damage to the equipment.

1. Anyone who uses welding or plasma cutting equipment must be familiar with:
   - its operation
   - location of emergency stops
   - its function
   - relevant safety precautions
   - welding and / or plasma cutting

2. The operator must ensure that:
   - no unauthorized person is stationed within the working area of the equipment when it is started up.
   - no one is unprotected when the arc is struck.

3. The workplace must:
   - be suitable for the purpose
   - be free from drafts

4. Personal safety equipment:
   - Always wear recommended personal safety equipment, such as safety glasses, flame proof clothing, safety gloves.
   - Do not wear loose fitting items, such as scarves, bracelets, rings, etc., which could become trapped or cause burns.

5. General precautions:
   - Make sure the return cable is connected securely.
   - Work on high voltage equipment **may only be carried out by a qualified electrician**.
   - Appropriate fire extinquishing equipment must be clearly marked and close at hand.
   - Lubrication and maintenance **must not** be carried out on the equipment during operation.

SECTION 1 SAFETY PRECAUTIONS

WARNING

WELDING AND PLASMA CUTTING CAN BE INJURIOUS TO YOURSELF AND OTHERS. TAKE PRECAUTIONS WHEN WELDING OR CUTTING. ASK FOR YOUR EMPLOYER'S SAFETY PRACTICES WHICH SHOULD BE BASED ON MANUFACTURERS' HAZARD DATA.

ELECTRIC SHOCK - Can kill.

- Install and earth (ground) the welding or plasma cutting unit in accordance with applicable standards.
- Do not touch live electrical parts or electrodes with bare skin, wet gloves or wet clothing.
- Insulate yourself from earth and the workpiece.
- Ensure your working stance is safe.

FUMES AND GASES - Can be dangerous to health.

- Keep your head out of the fumes.
- Use ventilation, extraction at the arc, or both, to take fumes and gases away from your breathing zone and the general area.

ARC RAYS - Can injure eyes and burn skin.

- Protect your eyes and body. Use the correct welding / plasma cutting screen and filter lens and wear protective clothing.
- Protect bystanders with suitable screens or curtains.

FIRE HAZARD

- Sparks (spatter) can cause fire. Make sure therefore that there are no inflammable materials nearby.

NOISE - Excessive noise can damage hearing.

- Protect your ears. Use earmuffs or other hearing protection.
- Warn bystanders of the risk.

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SECTION 1 SAFETY PRECAUTIONS

Full responsibility for the safety of personnel working on or near these systems rests on user of ESAB Welding Equipment.

Incorrect operation can lead to an abnormal situation, injury to the operator and /or damage to the equipment.

All personnel working with Plasma Cutting equipment must be fully familiar with

- handling of equipment
- location of emergency stops
- functions of equipment
- applicable safety regulations
- Plasma Cutting Process

Operator must make sure

- no one stays inside work area while machine starts
- no one is unprotected while arc is being struck

Work area must be

- free of machine parts, tools and other objects that can obstruct operator moving within the work area
- so arranged, that emergency stop buttons are easily accessible
- free from draughts

Personal safety equipment

- always use proper safety equipment such as goggles, non flammable clothing, protective gloves
- never wear loose clothing, belts, bracelets, rings etc., which may catch on equipment or cause burns

Miscellaneous

- only authorized personnel may operate connected equipment
- check whether return cables are properly connected and grounded
-required fire fighting equipment should be easily available in specially and clearly marked areas

WARNING

ARC WELDING AND CUTTING CAN BE INJURIOUS TO YOURSELF AND OTHERS. TAKE PRECAUTIONS WHEN WELDING OR CUTTING. ASK YOUR EMPLOYER FOR SAFETY PRACTICES THAT SHOULD BE BASED ON MANUFACTURER'S HAZARD DATA.

ELECTRIC SHOCK - Can kill

- Install and ground welding equipment in accordance with obligatory standards.
- Do not touch live electrical parts or electrodes with bare skin, wet gloves or wet clothes.
- Insulate yourself from ground and workpiece.
- Ensure your work position is safe.

FUMES AND GASES - Can be dangerous to your health

- Do not breath the fumes.
- Use ventilation and/or extraction to keep fumes and gases away from your breathing zone and surroundings.

FLASH - Can injure eyes and burn skin

- Protect your eyes and skin. Use correct helmet, lenses and wear protective clothes.
- Protect bystanders with suitable screens or curtains.

FIRE HAZARD

- Sparks (spatter) can cause fire. Make sure there are no inflammable materials nearby.

NOISE - Excessive noise can damage your hearing.

- Protect your ears. Use hearing protection.
- Warn bystanders of the risk.

MALFUNCTION - Call expert assistance in event of a malfunction.

SECTION 2 INTRODUCTION

2.0 Introduction

The PC650 is a compact Inverter Plasma unit designed to deliver up to 40 Amps of power at approximately 120 cutting volts. It has an adjustable output and a built in trigger "lock-in" circuit. This lightweight unit is supplied in versions that allow input voltages of 208/230/400/or 460 volts AC.
The system comes equipped with a PT31XL "drag type" torch and a spare parts kit. When connected to a source of compressed air (250 CFH, 90 – 150 psi), the unit is capable of cutting 5/8" material and severing ¾" with an output current range of 10 to 40A.

2.1 Scope

The purpose of this manual is to provide qualified repair personnel with technical information, which will assist in troubleshooting and repairing malfunctions

2.2 Service Manual format

The "machine operation" flow diagram starts the breakdown of the functionally of the PC650. Each of the major components is divided into sections, which are described in the pages that follow. Each section in the flow chart has a matching section on the main schematic and is applied to the description pages. Each section starts with the schematic view with description, if the section includes a printed circuit PC board, it is followed by a PC board schematic, the layout of the board and then the component list for the board. Some PC boards will also have "mini descriptions" of selected circuits. This information is for troubleshooting purposes only, PC board repair is not recommended.

3.0 Power Specifications

PC650 Power Specifications		
Output:	40% duty cycle	40A/120V
	60% duty cycle	30A/120V
	100% duty cycle	22A/120V
Output Current Range	10 to 40 Amperes	
Open Circuit Voltage	290 Vdc Nominal	
Input @ 40A/120V	208/230 vac 1 ph. 50/60 Hz., 35/32 amps	
Input @ 40A/120V	460 vac 3 ph. 50/60 Hz., 8/5 amps	
Power factor @ 40A Output	76% (1 Phase)	
Efficiency @ 40A Output	85% (Typical)	
Air requirements	250 cfh at 80 psig	

PC650 PHYSICAL INFORMATION	
Length	16" (406 mm)
Length w/handles	25.70" (653 mm)
Height	16.38" (416 mm)
Width	12.50" (318 mm)
Weight	53 lbs (16 kg)
Shipping Weight	71 Lbs (32.3 Kg)

208/230 Volt PN: 0558003179 Console only
460 Volt PN: 0558005328 Console only

The Powercut 650 is available as 208/230 VAC single-phase power, or as 460 VAC 3 phase.
The 208/230 volt model comes configured from the factory for 230 VAC operations. If using a 208 VAC source for operation, the Powercut 650 must be reconfigured before using a 208 VAC source (See Section 3.1).

Note: The 460 VAC 3 phase unit is designed to work best when 3 phase input power is used, however with a slight de-rating of the machine output, the PC650 can be used on single phase.
Reasons for de-rating:

Input diode stress. 1 phase uses 4 diodes at higher current levels
Buss capacitors will see higher ripple currents

3.1 208 / 230 Wiring

PC650 CE Power Specifications		
Output:	40% duty cycle	40A/120V
	60% duty cycle	30A/120V
	100% duty cycle	22A/120V
Output Current Range	10 to 40 Amperes	
Open Circuit Voltage	290 Vdc Nominal	
Input @ 40A/120V	220/230 vac 1 ph. 50/60 Hz., 37/20 amps	
Input @ 40A/120V	400 vac 3 ph. 50/60 Hz., 9 amps	
Power factor @ 40A Output	76% (1 Phase)	
Efficiency @ 40A Output	85% (Typical)	
Air requirements	118 l/m @ 5.5 bar	

PC650 CE PHYSICAL INFORMATION	
Length	406 mm
Length w/handles	653 mm
Height	416 mm
Width	318 mm

Weight	16 kg
Shipping Weight	32.3 Kg

220/230 Volt PN: 0558005151 Console only
400 Volt PN: 0558005153 Console only

The Powercut 650 "CE model" is available as 230 VAC single-phase power, or as 400 VAC 3 phase.

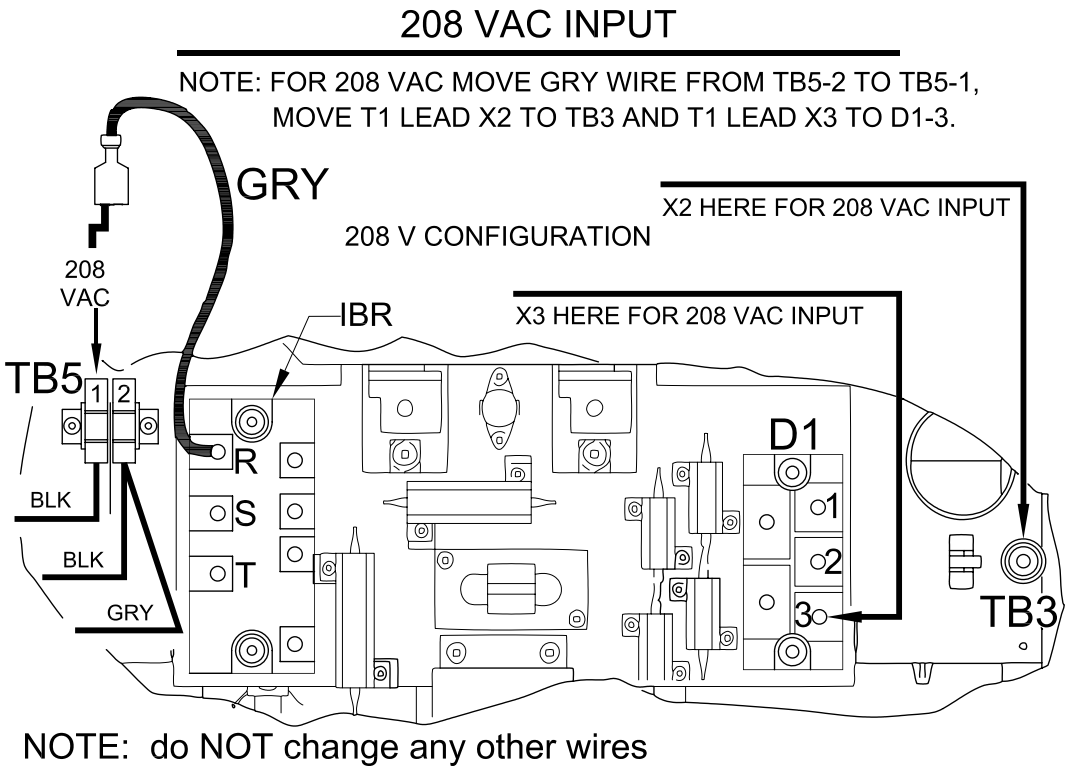
Note: The 400 VAC 3 phase unit is designed to work best when 3 phase input power is used, however with a slight de-rating of the machine output, the PC650 can be used on single phase.
Reasons for de-rating:

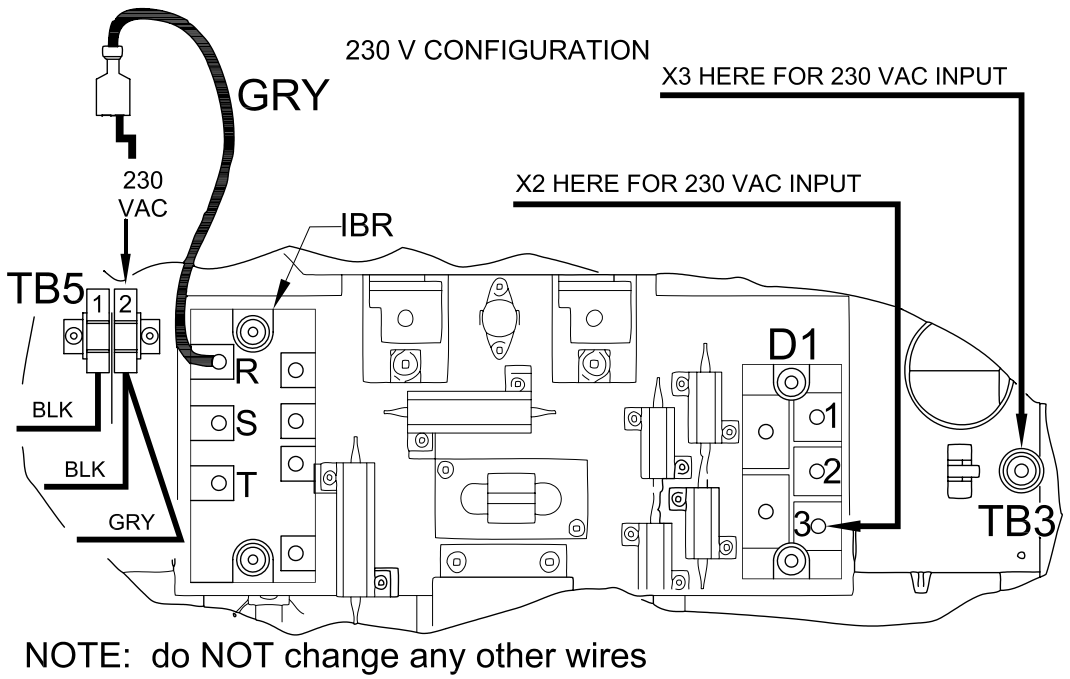
Input diode stress. 1 phase uses 4 diodes at higher current levels
Buss capacitors will see higher ripple currents

Connecting PC650 for 208 VAC input:

1. Unplug the unit from the primary input power.
2. Remove the left side panel by removing the rear handle and sliding the cover forward from the aluminum frame rail.
3. Locate the input bridge (IBR) and the two-position terminal block on the left side of the unit towards the rear panel. Locate the gray wire connected to TB5-2 and to IBR terminal "R". For 208-vac input, disconnect the gray wire from TB5-2 and then firmly connect it to TB5-1.
4. Locate the output bridge (D1) on the left side towards the front panel. Disconnect and swap leads X2 and X3 from the main transformer. For 208 VAC input, X2 is connected to TB3 and X3 is connected to terminal 3 of D1. Make sure the connections are firmly tightened.
5. Leave all other wires the same.
6. Reinstall cover by sliding it back into the frame rail. Connect the front handle and connect the Powercut 650 to the 208 VAC input power.

3.1 208 / 230 Wiring





3.1 208 / 230 Wiring

WARNING

ELECTRIC SHOCK CAN KILL! Precautionary measures should be taken to provide maximum protection against electrical shock. Be sure that all power is off by opening the line (wall) disconnect switch and by unplugging the power cord to the unit when connections are made inside of the power source.

CAUTION

Be sure that the power source is properly configured for your input power supply. DO NOT connect a power source configured for 208/230 V to a 460 V input power supply. Damage to the machine may occur.

CONNECTIONS

PRIMARY ELECTRICAL INPUT CONNECTIONS (FIGURE 3.1)

A line (wall) disconnect switch with fuses or circuit breakers should be provided at the main power panel (see Fig. 3-1 and Table 3-1 for fuse sizes). The input power cable of the console may be connected directly to the disconnect switch or you may purchase a proper plug and receptacle from a local electrical supplier. If using plug/receptacle combination, see Table 3-1 for recommended input conductors for connecting receptacle to line disconnect switch.

NOTE: PC650 input cable differences
The colors of input phases of the CE models differ from those of the "non CE" models. Below is a table comparing the two:

Input	Standard
L1	Black
L2	Red
L3	White
GND	Green

Input	CE
L1	Brown
L2	Grey
L3	Black
GND	Green/Yellow

400 & 460-Volt CE

For the 400 and 460-Volt units, it isn't important which leg is connected to L1, L2 and L3, when 3-Phase input is used, however if inputting 1 phase power, L2 will be the un-used leg. The T2 must have power to operate and it is connected across L1 and L3.

208/230-Volt models

****FOR SINGLE-PHASE CONNECTION OF 230-Volt CE MODELS:****

If single-phase connection is desired, connect the **BLACK** leg to **"L3"** and the **BROWN** leg to **"L1"** with the **GREY (L2)** leg disconnected, lugged, and taped back. , L2 will be the un-used leg. The T2 must have power to operate and it is connected across L1 and L3

SECTION 3 SPECIFICATIONS

3.1 208 / 230 Wiring

Recommended Sizes for Input Conductors and Line Fuses

Rated Input			Input & GND Conductor CU/AWG*	Fuse Size Amps
Volts	Amp	Phases		
208	35	1	No. 10	50
230	32	1	No. 10	50
400	9	3	No. 12	15
460	8	3	No. 12	15

* Sized per National Code for 80°C rated copper conductors @ 30°C ambient. Not more than three conductors in raceway or cable. Local codes should be followed if they specify sizes other than those listed above.

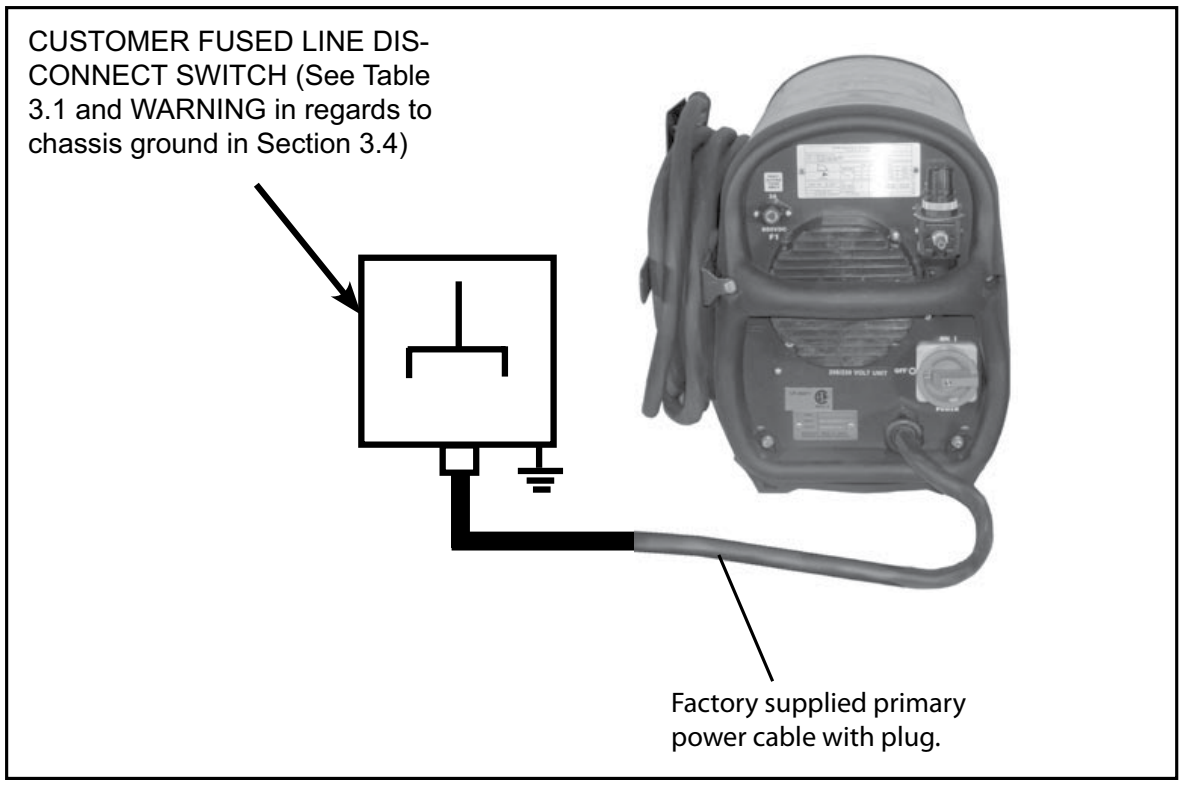
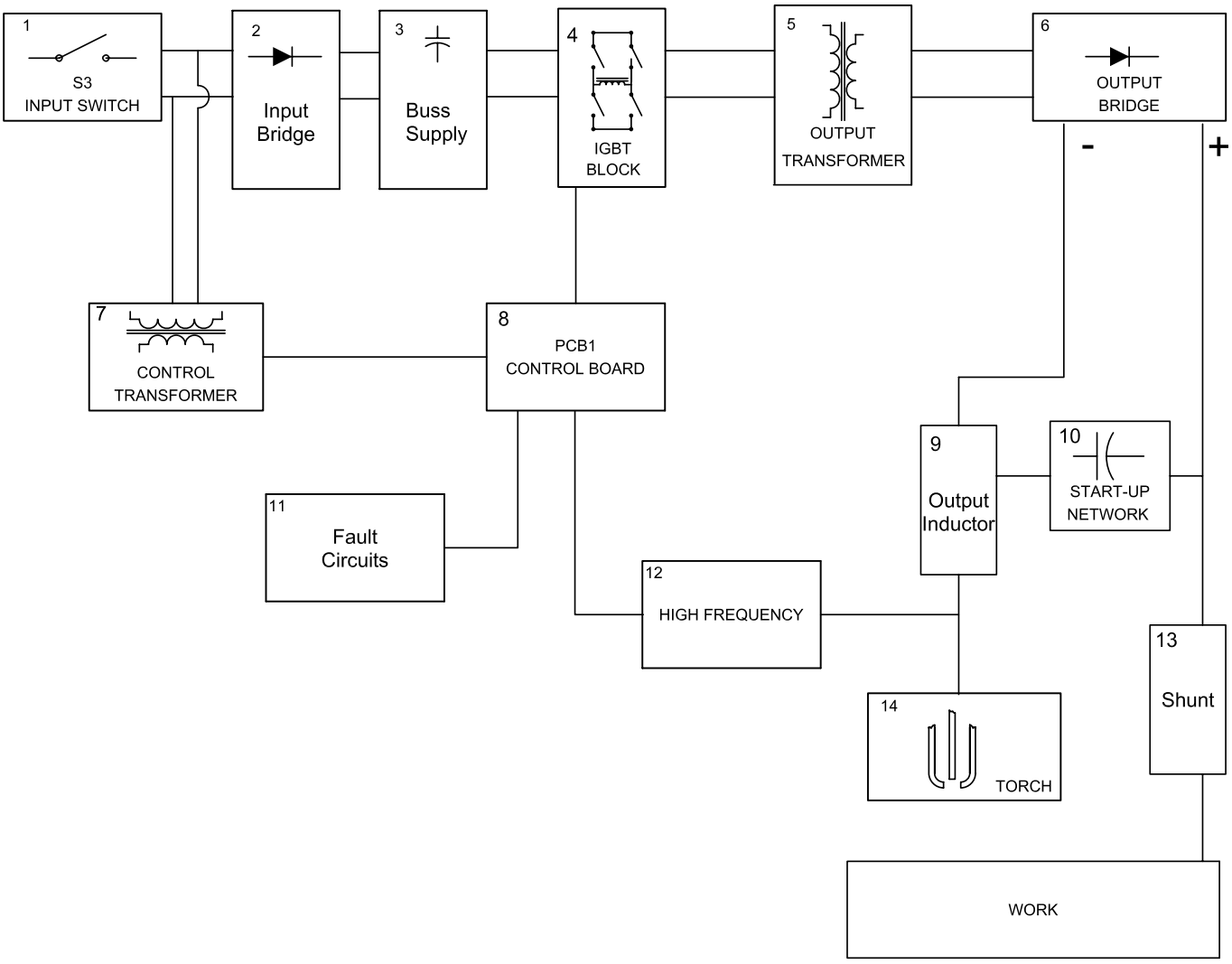


Figure 3.1 Customer Fused Line Disconnect and Receptacle

3.2 Machine Operation Flowchart



3.3 PC650 Machine Section Index

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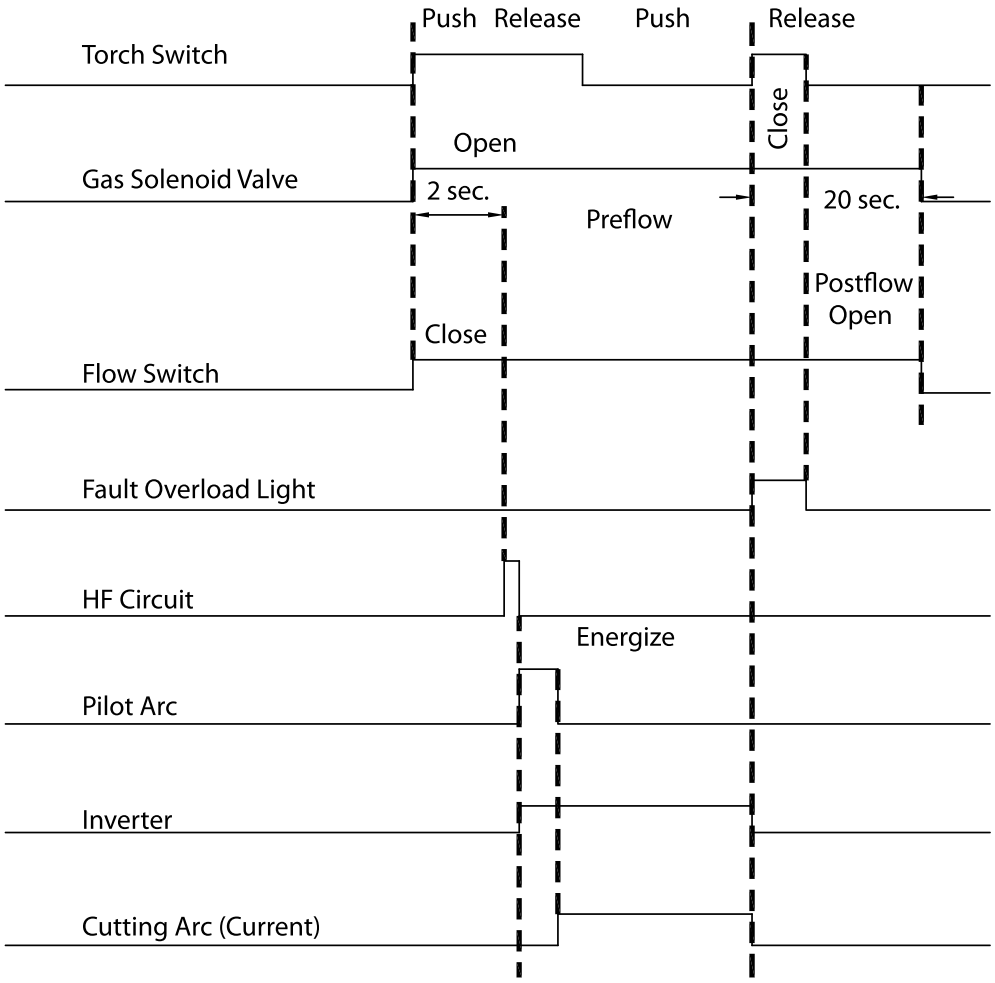
3.3 Sequence of Operations

SEQUENCE OF
OPERATION
Trigger LOCK "**LOCK**" position (Manual Cutting Only with PT-32EH Torch)



NOTES:

1. When the torch switch is pushed during postflow period, the postflow time is reset, the preflow time is canceled, and the HF is energized immediately.

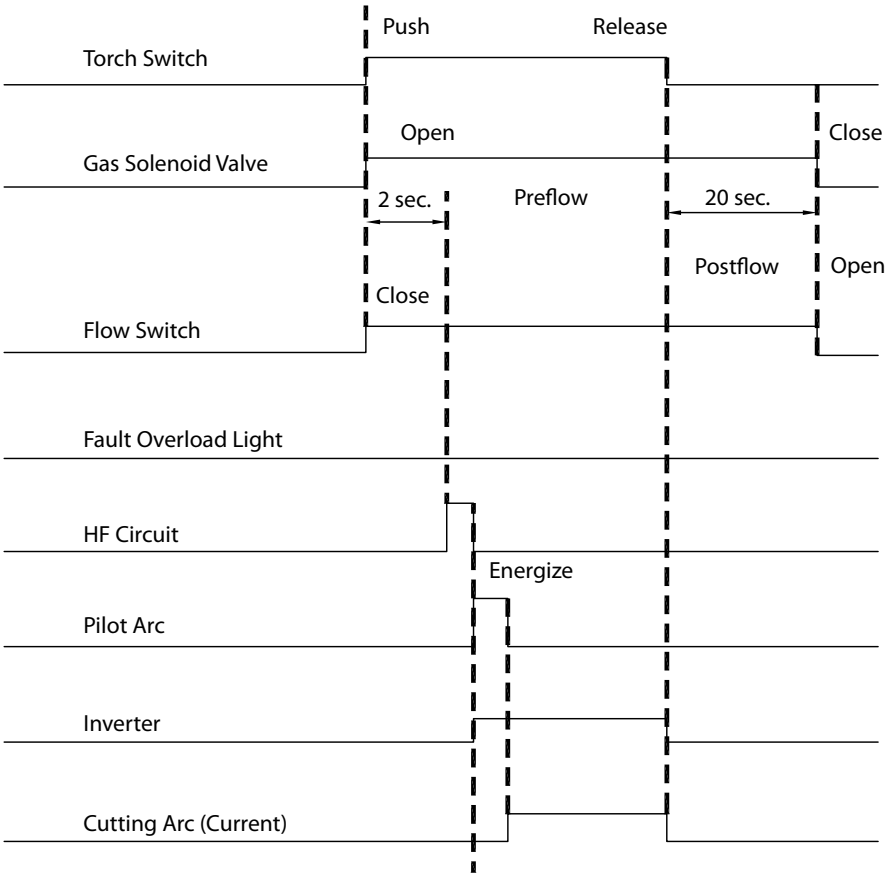
2. When the red fault light comes on, cutting operation should be stopped. The postflow time starts from the moment the torch switch is released.

3. FAULT light is on during second "turn-off" trigger only. This does not affect performance in any way.

3.3 Sequence of Operations

1. The operator engages the torch switch on the torch, requesting a cutting operation. This closes the torch switch connection at the control PCB (P5-1, P5-2). This enables the torch switch circuit, which, ultimately, sends two logic signals out of that circuit. One signal leaves IC1-4 to enable the control chip IC2 on PCB-1. The other signal leaves IC9-5 destined for the current control logic chip IC10 –1 via D22. The start LED, LED1, lights up indicating start voltage is present. See Section 5.8.2.
2. The gas flow solenoid is engaged and air moves through the torch.
3. The Flow Switch closes.
4. After a 2 second preflow delay, PCB1 relay K1 closes sending 115 VAC out to the HF circuit. The Spark Gap unit, SG, engages.
5. IGBTs' are gated on and open circuit voltage is available at the torch
6. The operator brings the torch nozzle in contact with the work surface
7. The HF signal ionizes the air and sets an environment conducive to main arc creation.
8. Main arc is established.

SEQUENCE OF
OPERATION
Trigger LOCK "**UNLOCK**" position (Applies to PT-21AMX and PT-32EH Torches)

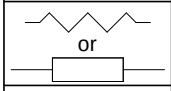
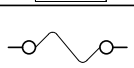
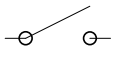
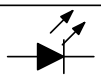
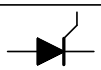
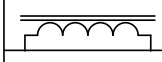
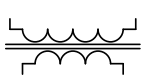


NOTES:

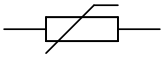
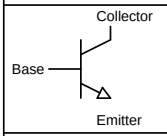
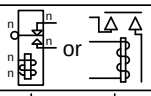
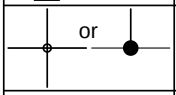
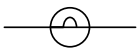
1. When the torch switch is pushed during postflow period, the postflow and preflow times are canceled, and the HF is energized immediately.

2. When the red fault light comes on, cutting operation should be stopped. The postflow time starts from the moment the torch switch is released.

4.0 Glossary (General Definitions and Symbols)

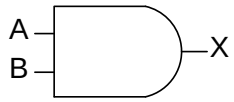
SYMBOL	NOTATION	NAME	VALUES	DESCRIPTION
	A	Amperage	n	Current: effectively the "amount of flow" of electricity.
	V	Volts	n	Electromotive force: effectively the "pressure" of electron movement.
	R	Resistance	n	Opposition to electron transfer: expressed in OHMS.
	W	Watt	n	A measure of Power. Watts = V*A
	F	Farad	n	Amount of electrical storage in a capacitor.
		BIAS		A voltage used to control or stabilize an electronic circuit. A forward bias is voltage applied in the direction of the current flow within a transistor, tube or circuit. A reverse bias is voltage applied in the opposite direction.
		OCV	n VOLTS	Open Circuit Voltage:
	n	Number		Indicates that any number may be used in its place.
	µ	micro	0.00000n	One Millionth of any unit.
	+	ANODE:		+ Positive element of device.
	-	CATHODE:		- Negative element of device - the banded end of a diode.
	C n	CAPACITOR	µF	Stores energy in the electrostatic field generated between two metal plates separated by an insulator. Typical values are in µF.
	C n	ELECTROLITIC CAPACITOR	µF	Electrolitic capacitors will be damaged if polarity is not correct. Capacitors can charge themselves from ambient electric fields and should be handled with caution.
	R n	RESISTOR	Ω, W	Component that opposes current flow proportionately to its Ohm (Ω) rating. Power dissapation is expressed in Watts (Ω).
	F n	FUSE	n A, n V	Device in series with a load which opens the circuit if its current rating (A) is exceeded.
	SW n	SWITCH	n A, n V n P, n T	Device which opens and closes a circuit.
	D n	DIODE		A semi-conductor that conducts in only one direction
	D n	ZENER DIODE		A diode that permits high current flow without damage, the reverse voltage remains almost constant over a wide range of currents, used esp. to regulate voltage.
	D n	LIGHT EMITTING DIODE		Semiconductor diode that emits light when conducting current
	SCR	SILICON CONTROLLED RECTIFIER		Device having primary and secondary inductors for altering a-c signal amplitudes, impedance matching,and isolation purposes. . A reverse blocking triode thyristor
	L n	COIL		Wound wire device; current through the coil generates a electro-magnetic field causing inductive reactance, which increases with number of turns and density.
	L n	COIL (Iron Core)		Adding a core to a coil increases the inductance produced.
	T n	TRANSFORMER		Wound wire device with a primary and secondary coil(s) which increases or decreases voltage applied to the primary based on coil and core configuration. 1:1 transformers are used for isolation.
		GROUND		Identifies the earth (ground) connection. NOTE: Not for a protective earth connection.

4.0 Glossary (General Definitions and Symbols)

SYMBOL	NOTATION	NAME	VALUES	DESCRIPTION
		NEUTRAL		Electronic neutral or common.
		PLUG CONNECTION		Variously configured male/female separable connectors.
	SOL n	SOLENOID		Electro-magnetically operated valve.
	M n	MOTOR	n Ø,HP,V	A device which converts electrical energy to mechanical energy (motion).
		THERMISTOR		A resistor whose resistance changes with temperature.
	T SW n	THERMAL SWITCH		Protective device that protects circuits from over temperature.
	Q n	TRANSISTOR		A transistor amplifies current. A small base current controls the larger collector current.
	TP n	TEST POINT		Dedicated location for obtaining quantification.
	K n	RELAY	n A, n V	Electro-mechanical device for opening / closing a circuit.
		WIRE NODE		Schematic representation of physical connection of wires.
	Y n	CRYSTAL	n MHz	Device using the mechanical resonance of a physical crystal of piezo-electric material to create an electrical signal with a very precise frequency.
		LAMP		Produces light by heating a filament.

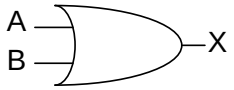
4.0 Glossary (General Definitions and Symbolsl)

LOGIC SYMBOLS

SYMBOL	NAME	DESCRIPTION
	AND GATE	An AND gate can have two or more inputs. The output of an AND gate is true when all its inputs are true.

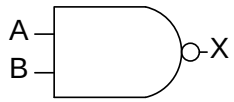
AND

INPUT		OUTPUT
A	B	X = AB
0	0	0
0	1	0
1	0	0
1	1	1

	OR GATE	An OR gate can have two or more inputs. The output of an OR gate is true when at least one of its inputs is true.

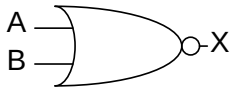
OR

INPUT		OUTPUT
A	B	X = A+B
0	0	0
0	1	1
1	0	1
1	1	1

	NAND GATE	A NAND gate can have two or more inputs. The 'o' on the output means 'not' showing that it is a Not AND gate. The output of a NAND gate is true unless all its inputs are true.

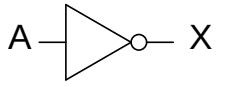
NAND

INPUT		OUTPUT
A	B	$X = \overline{A \circ B}$
0	0	1
0	1	1
1	0	1
1	1	0

	NOR GATE	A NOR gate can have two or more inputs. The 'o' on the output means 'not' showing that it is a Not OR gate. The output of a NOR gate is true when none of its inputs are true.

NOR

INPUT		OUTPUT
A	B	$X = \overline{A + B}$
0	0	1
0	1	0
1	0	0
1	1	0

	NOT (INVERTER)	A NOT gate can only have one input. The 'o' on the output means 'not'. The output of a NOT gate is the inverse (opposite) of its input, so the output is true when the input is false. A NOT gate is also called an inverter.

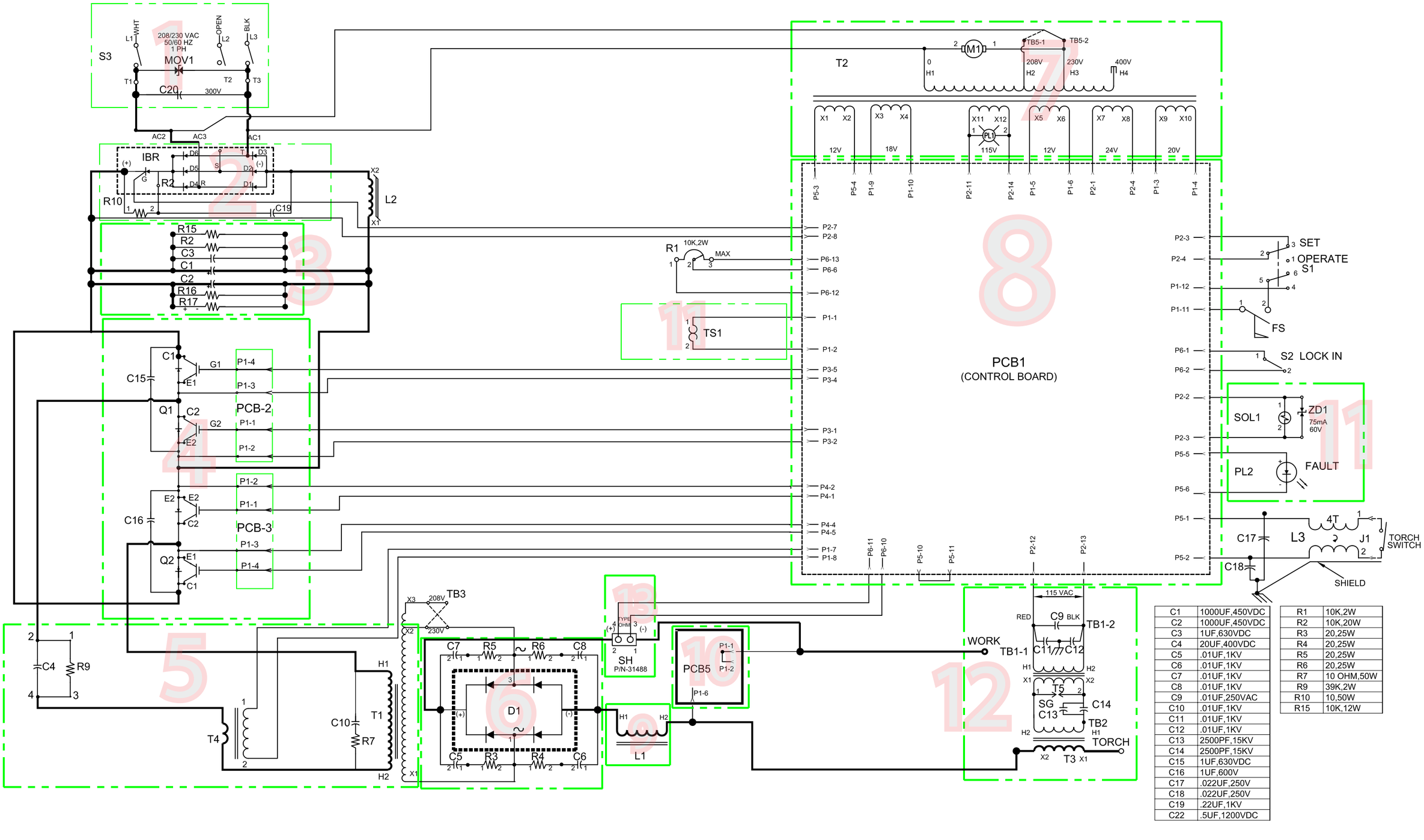
NOT

INPUT	OUTPUT
A	$X = \overline{A}$
0	1
1	0

CONTENTS

SECTION 5 MACHINE TESTING / TROUBLESHOOTING / SERVICE

5.0 Schematic Section Map 208/230 V 0558003302



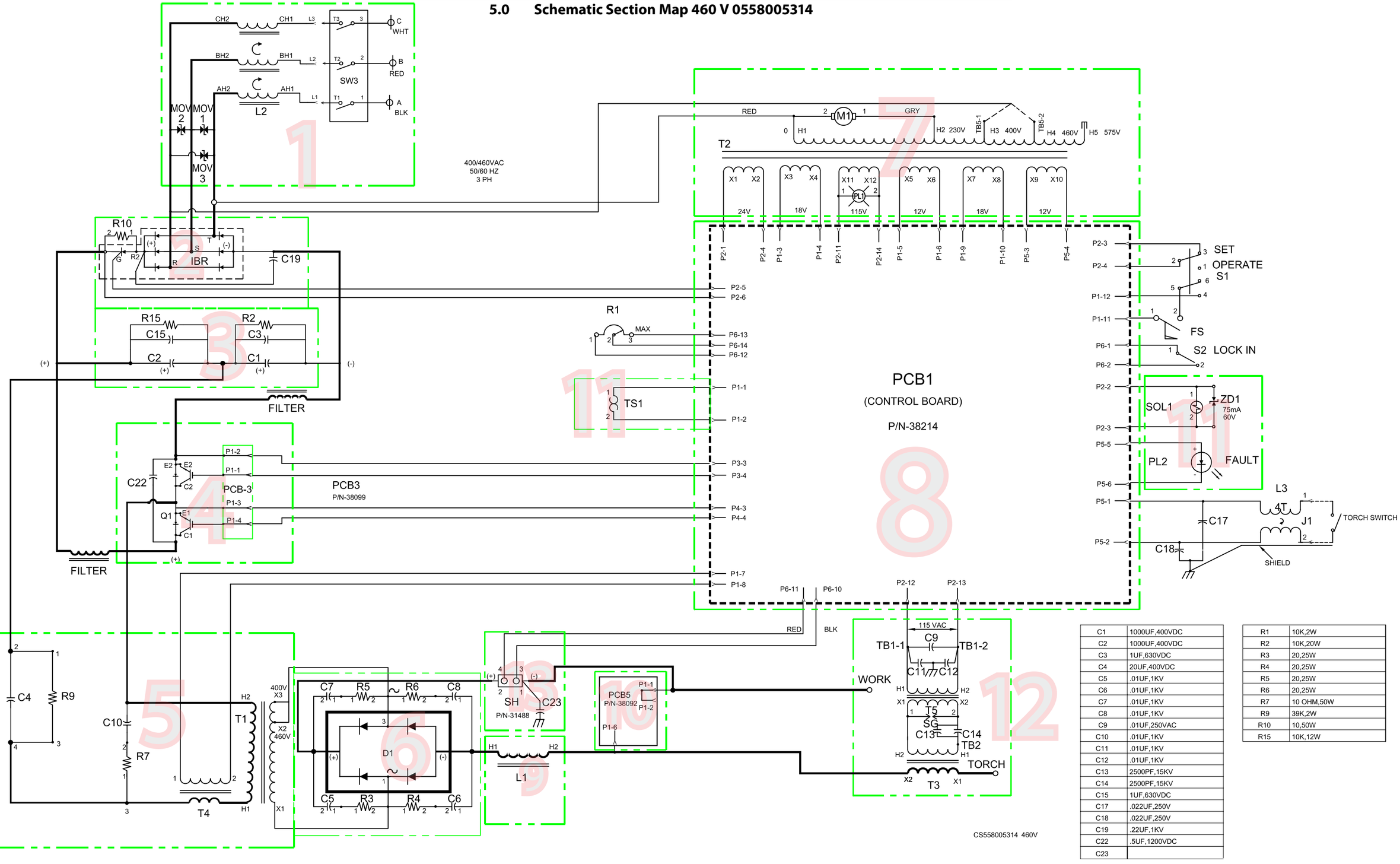
C1	1000UF,450VDC
C2	1000UF,450VDC
C3	1UF,630VDC
C4	20UF,400VDC
C5	.01UF,1KV
C6	.01UF,1KV
C7	.01UF,1KV
C8	.01UF,1KV
C9	.01UF,250VAC
C10	.01UF,1KV
C11	.01UF,1KV
C12	.01UF,1KV
C13	2500PF,15KV
C14	2500PF,15KV
C15	1UF,630VDC
C16	1UF,600V
C17	.022UF,250V
C18	.022UF,250V
C19	.22UF,1KV
C22	.5UF,1200VDC

R1	10K,2W
R2	10K,20W
R3	20,25W
R4	20,25W
R5	20,25W
R6	20,25W
R7	10 OHM,50W
R9	39K,2W
R10	10,50W
R15	10K,12W

CONTENTS

SECTION 5 MACHINE TESTING / TROUBLESHOOTING / SERVICE

5.0 Schematic Section Map 460 V 0558005314



CS558005314 460V

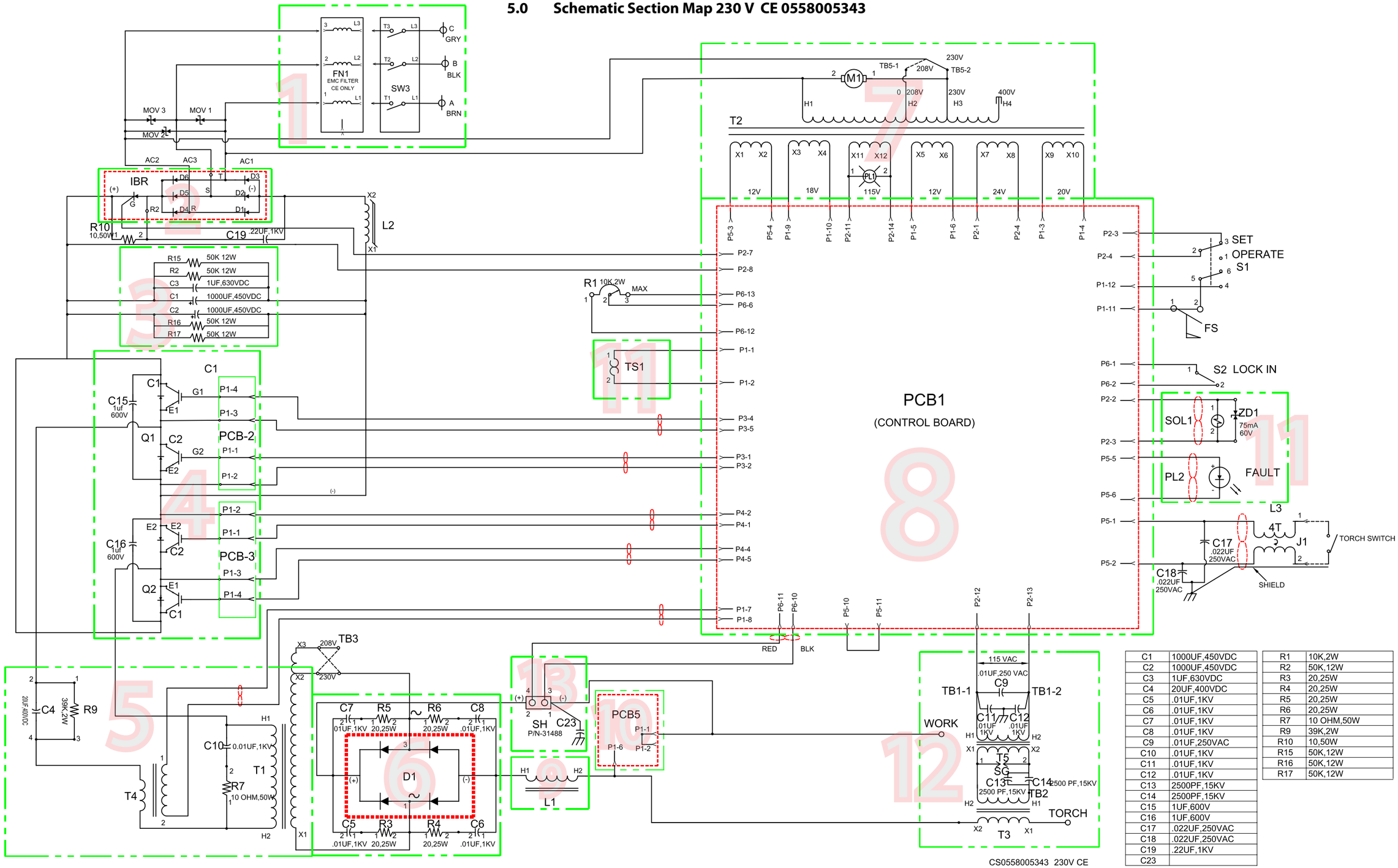
C1	1000UF,400VDC
C2	1000UF,400VDC
C3	1UF,630VDC
C4	20UF,400VDC
C5	.01UF,1KV
C6	.01UF,1KV
C7	.01UF,1KV
C8	.01UF,1KV
C9	.01UF,250VAC
C10	.01UF,1KV
C11	.01UF,1KV
C12	.01UF,1KV
C13	2500PF,15KV
C14	2500PF,15KV
C15	1UF,630VDC
C17	.022UF,250V
C18	.022UF,250V
C19	.22UF,1KV
C22	.5UF,1200VDC
C23	

R1	10K,2W
R2	10K,20W
R3	20,25W
R4	20,25W
R5	20,25W
R6	20,25W
R7	10 OHM,50W
R9	39K,2W
R10	10,50W
R15	10K,12W

CONTENTS

SECTION 5 MACHINE TESTING / TROUBLESHOOTING / SERVICE

5.0 Schematic Section Map 230 V CE 0558005343



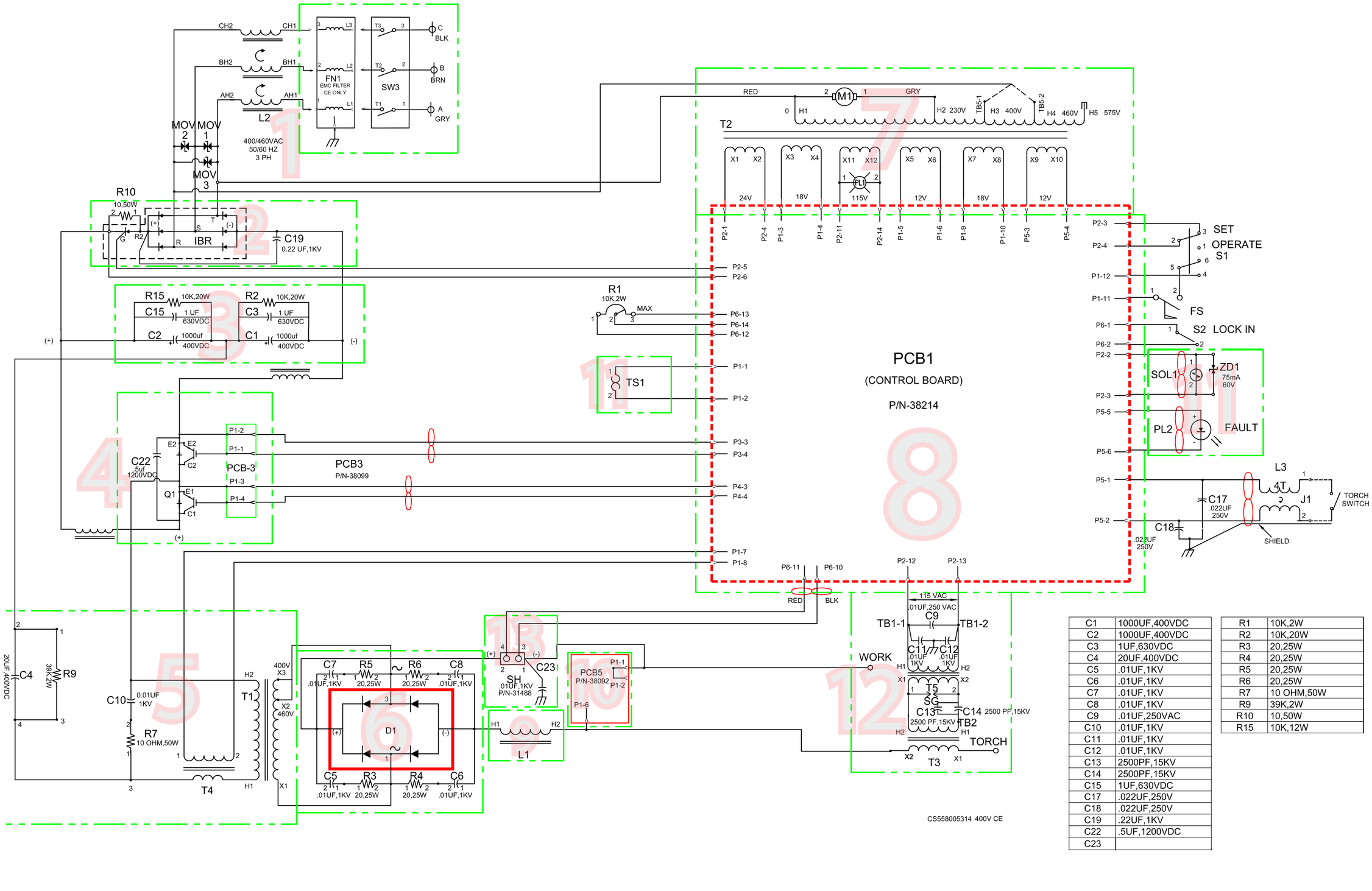
C1	1000UF,450VDC
C2	1000UF,450VDC
C3	1UF,630VDC
C4	20UF,400VDC
C5	.01UF,1KV
C6	.01UF,1KV
C7	.01UF,1KV
C8	.01UF,1KV
C9	.01UF,250VAC
C10	.01UF,1KV
C11	.01UF,1KV
C12	.01UF,1KV
C13	2500PF,15KV
C14	2500PF,15KV
C15	1UF,600V
C16	1UF,600V
C17	.022UF,250VAC
C18	.022UF,250VAC
C19	.22UF,1KV
C23	

R1	10K,2W
R2	50K,12W
R3	20,25W
R4	20,25W
R5	20,25W
R6	20,25W
R7	10 OHM,50W
R9	39K,2W
R10	10,50W
R15	50K,12W
R16	50K,12W
R17	50K,12W

CONTENTS

SECTION 5 MACHINE TESTING / TROUBLESHOOTING / SERVICE

5.0 Schematic Section Map 400 V CE 0558005314



C1	1000UF,400VDC
C2	1000UF,400VDC
C3	1UF,630VDC
C4	20UF,400VDC
C5	.01UF,1KV
C6	.01UF,1KV
C7	.01UF,1KV
C8	.01UF,1KV
C9	.01UF,250VAC
C10	.01UF,1KV
C11	.01UF,1KV
C12	.01UF,1KV
C13	2500PF,15KV
C14	2500PF,15KV
C15	1UF,630VDC
C17	.022UF,250V
C18	.022UF,250V
C19	.22UF,1KV
C22	.5UF,1200VDC
C23	

R1	10K,2W
R2	10K,20W
R3	20,25W
R4	20,25W
R5	20,25W
R6	20,25W
R7	10 OHM,50W
R9	39K,2W
R10	10,50W
R15	10K,12W

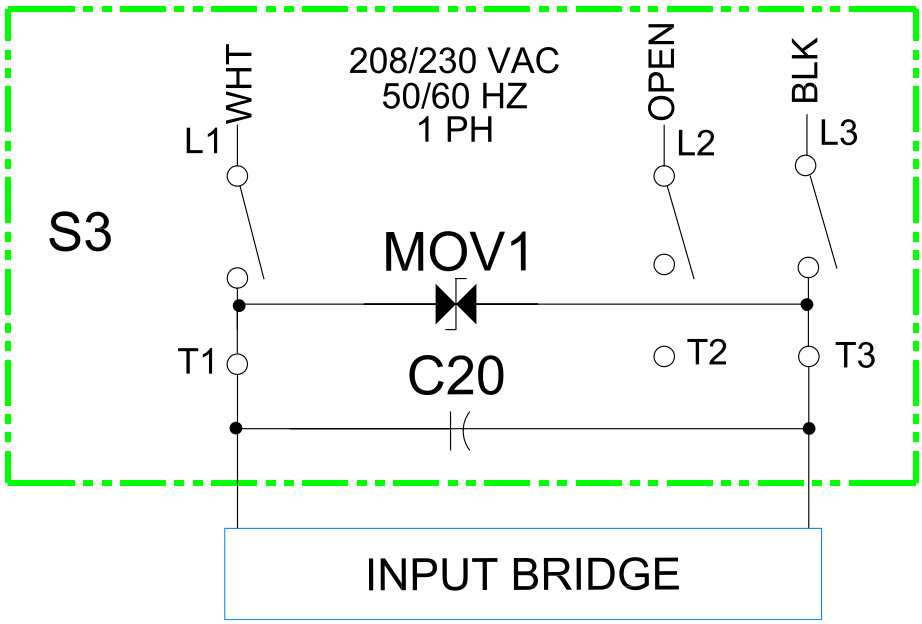
5.1 Input Power Switch (0558004125)

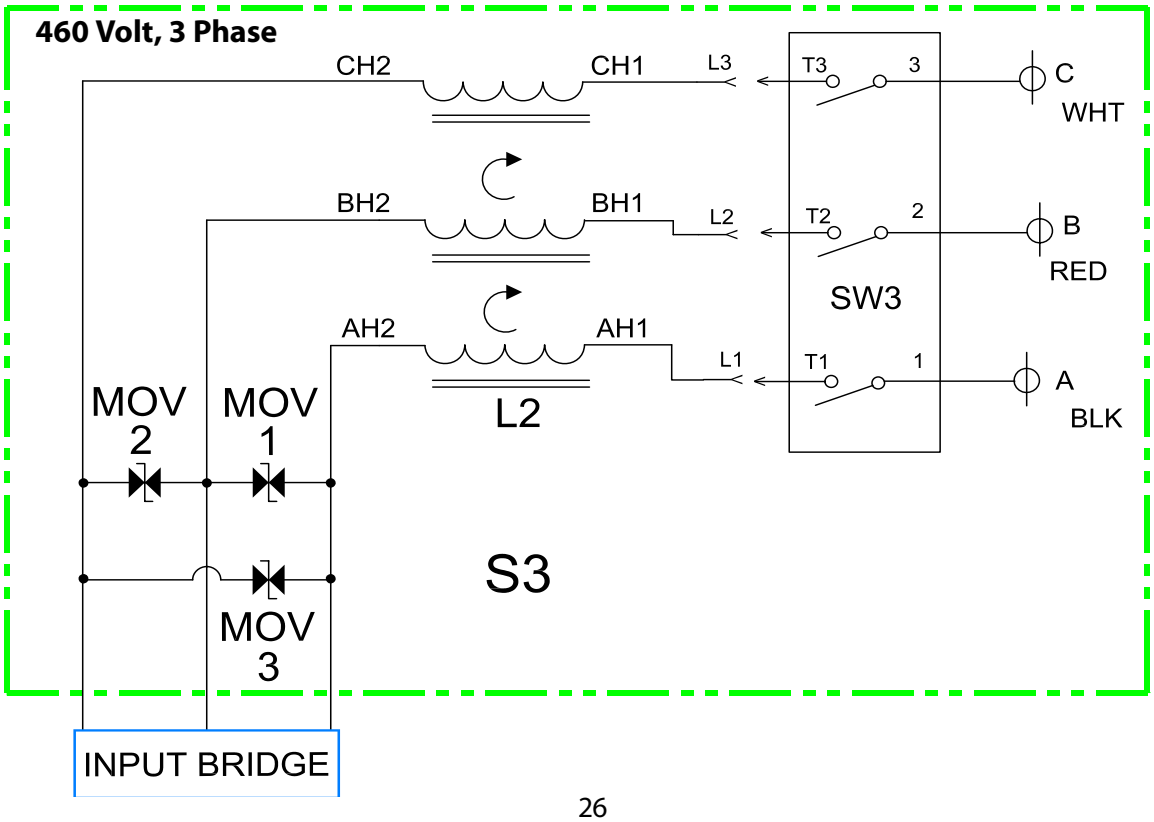
The power input switch S3, when in the "ON" position, passes the input voltage, either 208 or 230 VAC, to the input bridge IBR. Across the switch is a 275V, Metal Oxide Varistor (MOV1) for surge protection. Also connected across S3 is a .047µF, 300V capacitor (C20) for filtering of the input power.

Switch testing:
With power disconnected from the unit:
Switch open:
L1 of the switch to T1 of the switch - open Or High resistance
L3 of the switch to T3 of the switch - open Or High resistance

Switch Closed:
From L1 of the switch to T1 of the switch low resistance or shorted
From L3 of the switch to T3 of the switch low resistance or shorted

MOV testing:
With power disconnected from the unit:
Measure across the MOV. The component should read high or open resistance. Replace the component if it reads low or short.





5.1 Input Power Switch

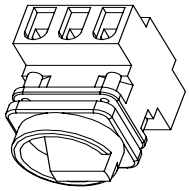
PN: 0558004125 (208 / 230 V Units)

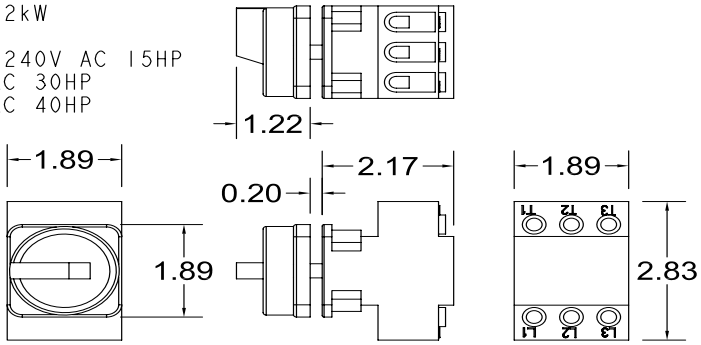
DESCRIPTION:
CIRCUIT INTERRUPTER SWITCH 600V 1 PH 2 POLE
PANEL MOUNTING: FOUR HOLE MOUNTING
DEGREE OF PROTECTION: FRONT IP55
UL/CSA & IEC APPROVED
OPERATIONAL VOLTAGE Ue 440V AC
OPERATIONAL CURRENT Ie 40A
AC-21A
0A

UL/CSA
GENERAL USE 230V AC 4
AT 50-60HZ, SINGLE PHASE

AC-23A 220-240V 15kW
380-440V 22kW
500V 22kW
660-690V 22kW

UL/CSA 220-240V AC 15HP
440-480V AC 30HP
550-660V AC 40HP





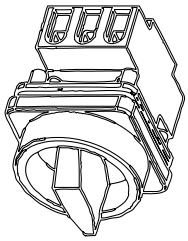
PN: 36107 (400 / 460 V Units)

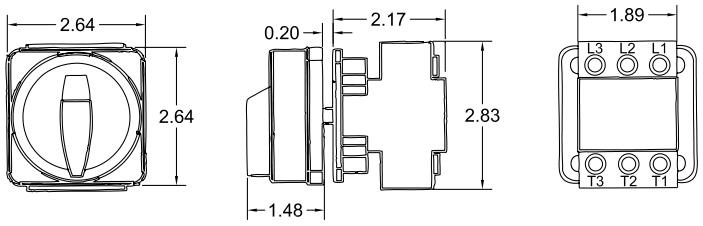
DESCRIPTION: PN: 36107 (400/460V UNIT)
CIRCUIT INTERRUPTER SWITCH 600V 3 PH 3 POLE
PANEL MOUNTING: FOUR HOLE
DEGREE OF PROTECTION: FRONT IP55
UL/CSA & IEC APPROVED
OPERATIONAL VOLTAGE Ue 690V AC
OPERATIONAL CURRENT Ie 63A
AC-21A

UL/CSA
GENERAL USE 600V AC
AT 50-60 HZ, 3 PHASE

AC-23A 220-240V 15KW
380-440V 22KW
500V 22KW
660-690V 22KW

UL/CSA 220-240V AC 15HP
440-480V AC 30HP
550-660V AC 40HP





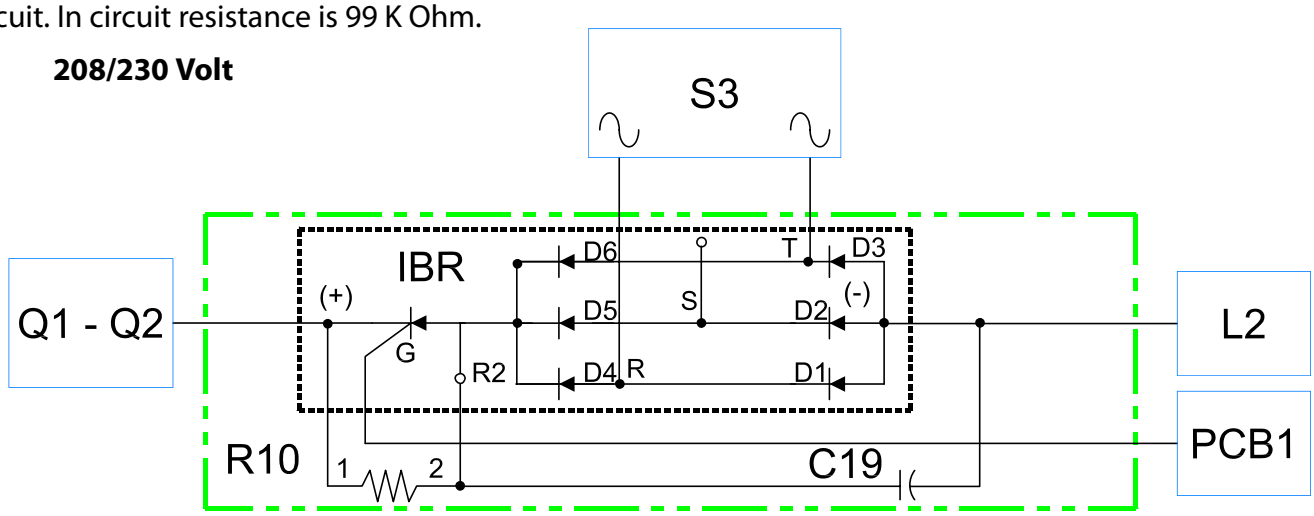
5.2 Input Bridge

Single-phase 208 or 230 VAC power enters the rectifier block where it is rectified by the IBR and gated on and off by an SCR. The rectified 325 VDC output (230VAC input) is coupled to the Bus Supply via L2 on the negative side of the bridge, and is directly coupled to the IGBTs on the positive side.
L2 is an inductor that has 2 purposes. First to prevent the initial surge of current from damaging the bridge rectifier and second as a bus filter device, assisting in DC ripple reduction.
SCR (Silicon Controlled Rectifier) is used as a series switch for the DC power during plasma operation. The SCR is gated on by the PWM on PCB1 and is on when cutting and off when unit is at idle conditions. During initial charging of the buss caps, power flows through the "precharge" resistor (R10), but when cutting, R10 is bypassed by the SCR.

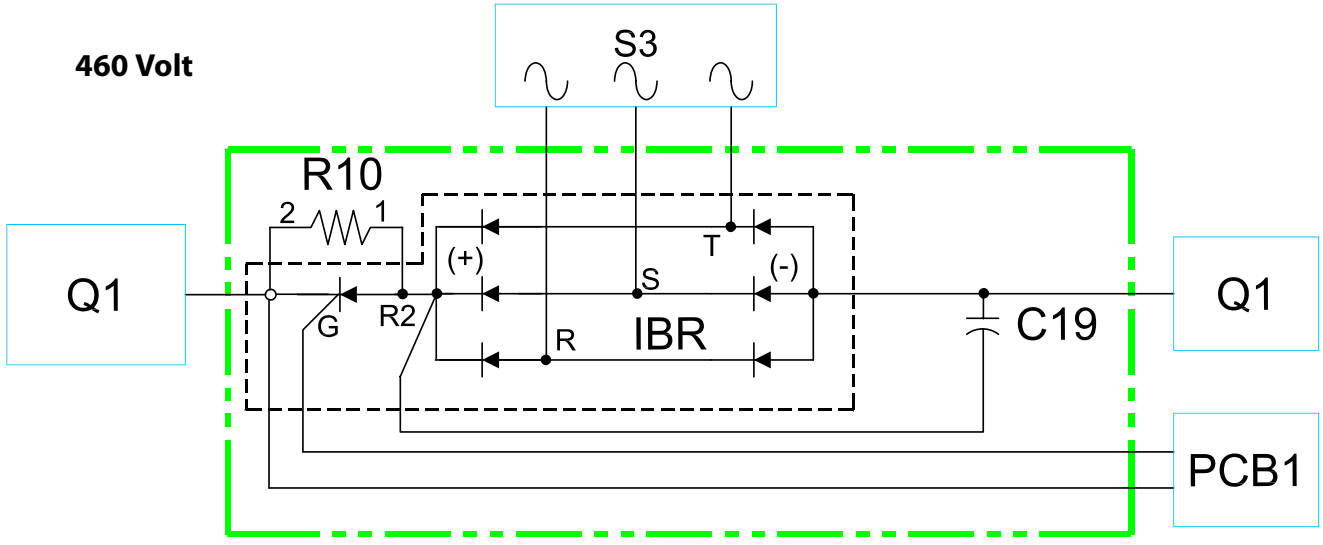
IBR Testing	
Mode	Ω
Forward Resistance	500 K
Reverse Resistance (out of circuit)	20 Meg+
Reverse Resistance (in circuit)	99 K

Testing: 500 K Ohm forward resistance, reverse resistance - high resistance (20 Meg ohm or greater) out of circuit. In circuit resistance is 99 K Ohm.

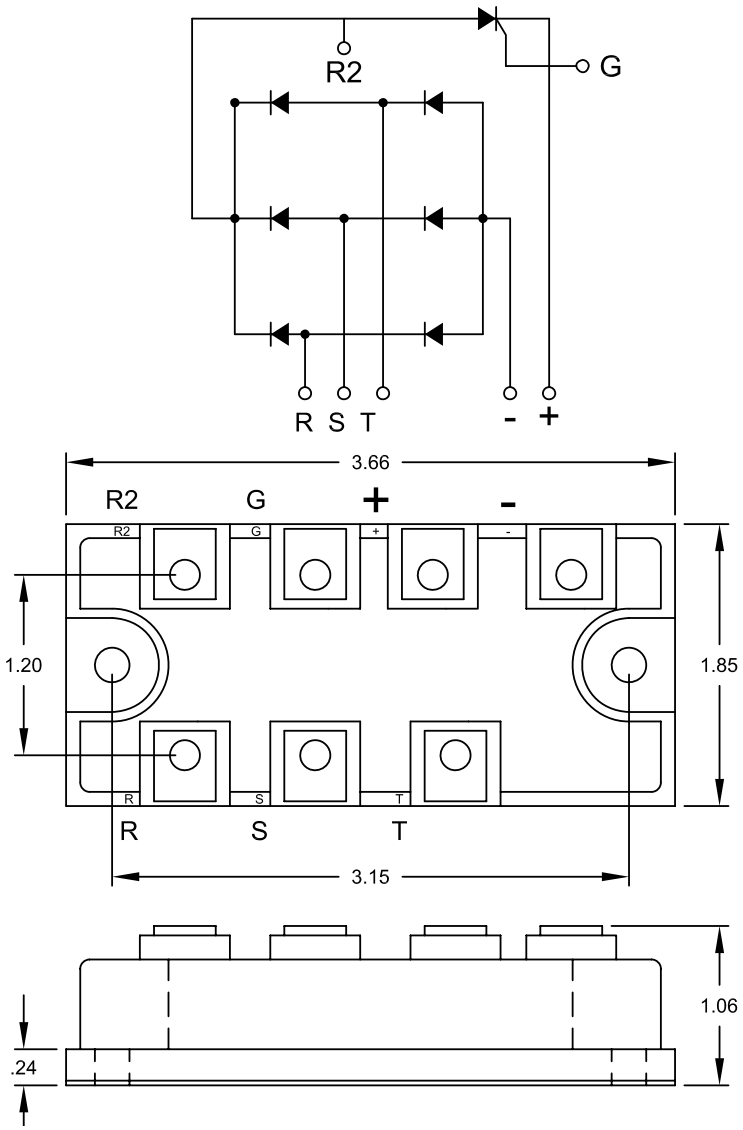
208/230 Volt



460 Volt



5.2 Input Bridge



MAXIMUM RATINGS & CHARACTERISTICS

DIODE PORTION

V RRM = 1600V
V RSM = 1700V
I D = 40A
IFSM = 300A
Ti = —30° — +150°C
IRRM = 6mA
V FM = 1.40V
R th i—c = 0.45 °C/W

THRYRISTOR PORTION

V RRM = 1600V
V RSM = 1630V
V DRM = 1600V
IT(AV)= 40A
ITSM = 300A
I sp t 875A sq t
sq I di/di = 10OA/us
Ti = —30° — +135°C
IDRM—IRRM = 50mA
V TM = 1.23V dv/dt = 500V/Us
R fh i—c = 0.65 °C/W

ENTIRE MODULE

Tstci —30 — 125°C
MOUNTING TORQUE M4 = 12-14 in-lb
MOUNTING TORQUE M5 = 19-22 in-lb
V ISOmis 2500VAC 1 MINUTE

5.3 Buss Supply

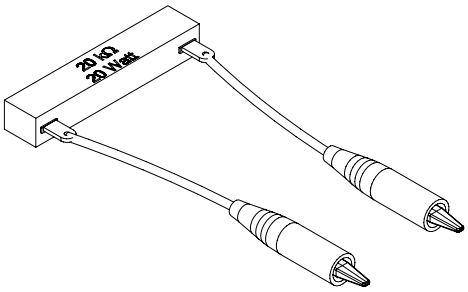
Capacitor Information

CAUTION

Serious Shock Possible!

Buss cap warning

BLEEDER RESISTOR
6" Min. 16AWG
600 V Insulation



Serious Shock Possible

The "buss capacitors" in the PC650 will maintain a voltage charge for approximately 2 minutes after power is removed from the input of the machine.
The arcing caused by discharging a capacitor into a short-circuit can cause injury and component damage
To eliminate the voltage from the capacitor, connect the "bleeder resistor" across the poles of a charged capacitor and the stored energy will discharge harmlessly through the resistor.
The approximate discharge time is 30 seconds.
When discharged, the cap can be partially tested by using a multimeter set to the ohms scale. When checking a capacitor…Connect the + meter lead to the + pole of the capacitor, and the – lead to the – pole. The meter display will show a number that will change while the leads are connected, if the meter leads are reversed, the display will change polarity and the value will change in the opposite direction from the first test, if the capacitor is good.

208 / 230 Volt

The buss supply of the 208 / 230 Volt PC 650 consists of 2 paralleled, 1000µF, 450Vdc capacitors (C1 & C2) that charge up to the rectified DC voltage output from the input bridge (IBR). This stored voltage is input to the high-speed switching transistors (IGBTs) and inverted to form high frequency, square-wave AC that is then input to the main transformer (T1).

Across C1 & C2 are 4, 50kΩ/12W resistors and a 1µF, 630Vdc capacitor. The capacitor, C3 and the resistors reduce electrical noise, plus the resistors provide a discharge path for the buss caps during "off" conditions.

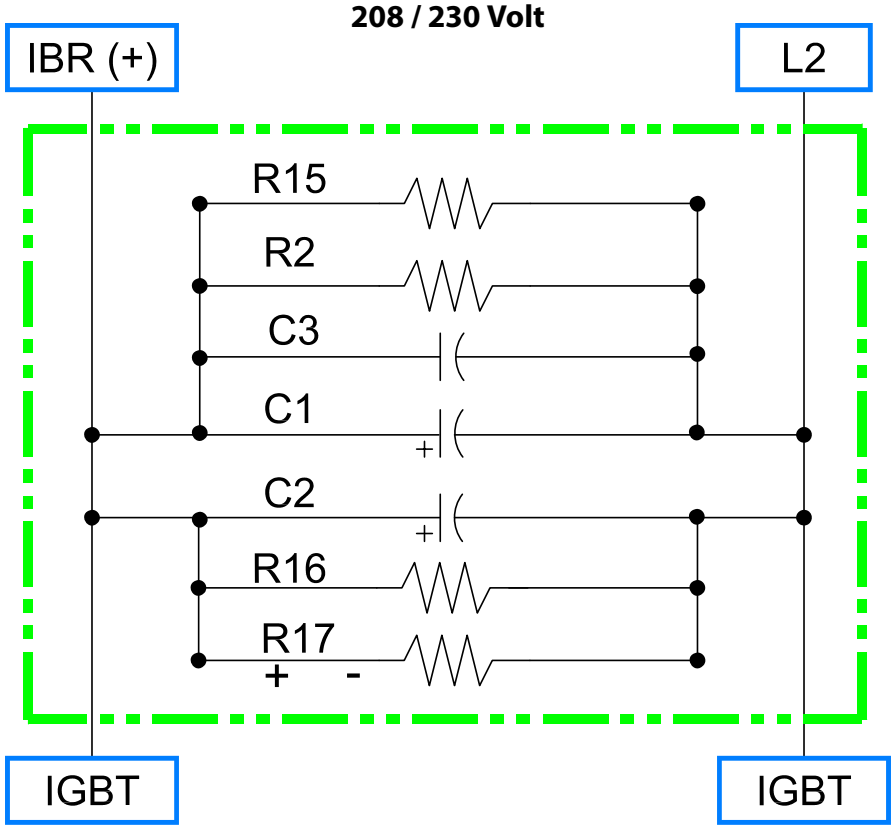
460 Volt

The buss supply consists of 2 1000µF, 400Vdc capacitors (C1 & C2), connected in series that charge up to the rectified DC voltage output from the input bridge (IBR). This stored voltage is input to the high-speed switching transistors (IGBTs) and inverted to form high frequency, square-wave AC that is input to the main transformer (T1).

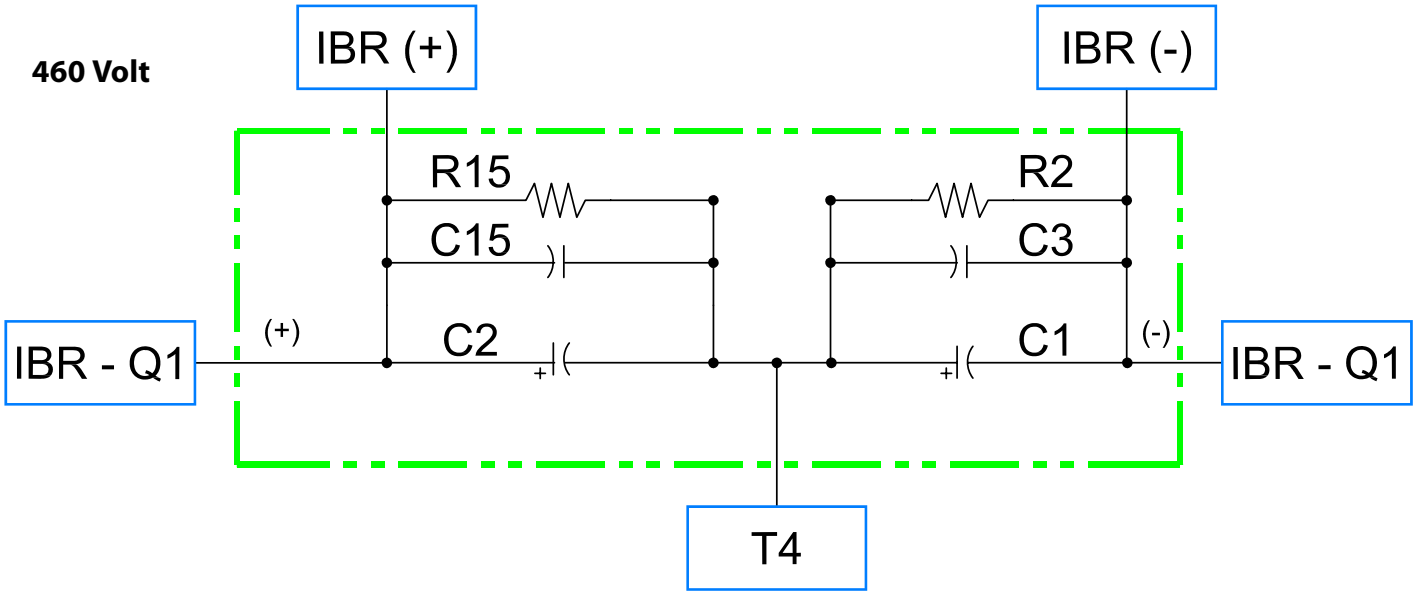
Across each of the series caps is an RC network, which is comprised of a 10kΩ resistor in parallel with a 1µF capacitor. This network is used for noise reduction, plus the resistors provide a discharge path for the buss caps during "off" conditions.

5.3.1 Buss Supply Schematic

208 / 230 Volt



460 Volt



5.3.2 Buss Supply Values

Buss Supply Values & Testing

208 / 230 Volt Model

The buss supply for the 208/230 Volt model of the PC650 consists of 3 capacitors and 4 resistors. R2, R15, R16 & R17 are all 50kΩ 12W resistors. The resistors are used for providing a discharge path for the buss supply. C3, a 1µF / 630Vdc capacitor, is used primarily for filtering.

The key components in the buss are the polarized capacitors, C1 & C2. These two caps are both 1000µF / 450Vdc capacitors. The buss can be measured across either cap because they are connected in parallel. To measure this buss, connect the positive (red) lead of a voltmeter to "+" post of either buss cap and the negative (black) lead to the "-" of the same cap. The nominal buss voltage value is 325Vdc. However, since the tolerance of the input voltage is +/- 15%, the range of acceptable voltage buss readings is 277 – 375Vdc.

--WARNING---Buss caps can maintain a charge for some time after input power has been removed from the system. It is imperative that these caps be discharged before testing. It is recommended that a bleeder resistor be used to discharge the buss caps. The specifications of which should be approximately a 20kΩ, 20W resistor with high voltage insulation on its leads.
--See beginning of section 5.3 for details--

460 Volt Model

The 460 Volt model of the PC650 consists of 4 caps and 2 resistors. Capacitors C15 & C3 (1µF, 630Vdc) are used for filtering and resistors R15 & R2 (10kΩ, 20W) are used for providing a discharge path.

C1 & C2 (1000µF, 400Vdc) are the main buss components and because C1 & C2 are connected in series in the 460 Volt model, the buss voltage is divided in half, with ½ of the buss voltage being across C1 and the other ½ being across C2. To measure the total voltage, place the positive (red) lead on the "+" of the C1 and the negative (black) lead on the "-" of C2.

Ideally, the buss should read 650Vdc with 325Vdc being across C1 and 325Vdc being across C2. Due to the +/- 15% tolerance of the input would yield a total buss voltage (across C1 & C2) of 553 – 748Vdc.

It is recommended to use a bleeder resistor to discharge the buss caps.

5.3.3 Buss Supply Testing

Testing Buss Capacitors

The buss capacitors can be easily tested to insure that they are good. It is recommended that a capacitance meter be used to measure the capacitance, however, a good indication of a good cap can be determined by conducting an ohms test.

With the machine powered down and caps fully discharged, place the red lead of a voltmeter, in the ohms scale, on the "+" post of the buss cap and the black lead on the other post of the same cap. The resistance reading should be in the MΩ range and should be increasing. Reverse the leads and the resistance reading should remain in the MΩ range, however, the value should be decreasing.

Again, this is only a "good indication" that the capacitor is good. It is still recommended that the capacitance be checked with a capacitance meter.

5.4 IGBT Block

The Inverter block consists of the IGBT driver board and the IGBT block.

5.4.1 IGBT Driver Board

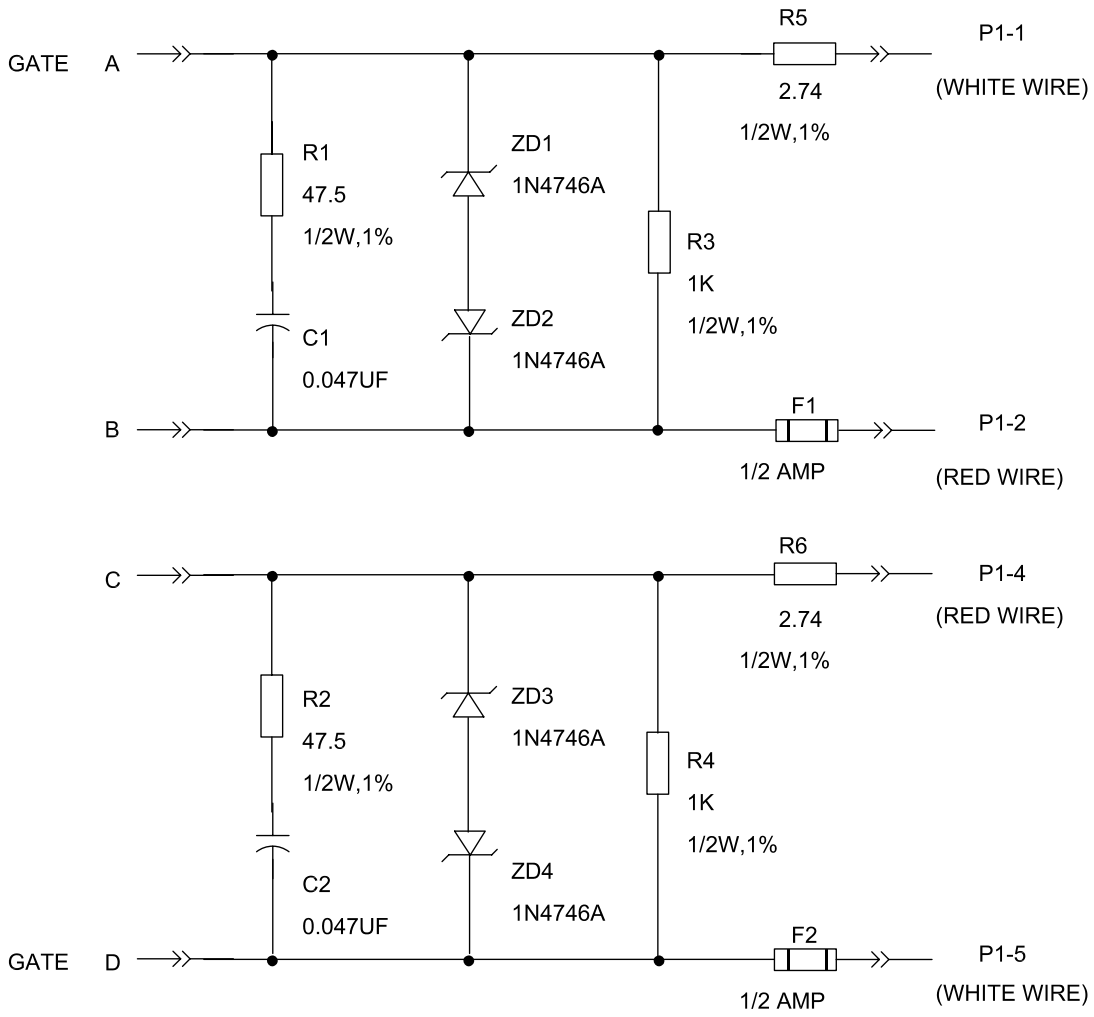
The IGBT driver board conditions the 13 VAC gating signals coming from PCB1. This is done to reduce noise on these signals and also to protect the IGBTs.
Signals are passed from the secondary of the PCB1 pulse transformer (T1) to the IGBT driver boards. These signals feed through the driver board and connect to the IGBT module. Each IGBT module has a driver board attached.

The IGBT block consists of 2 IGBT devices mounted on a corresponding heat sink. Each IGBT device is a pair of IGBT transistors contained within a single package. These devices function as high-speed switches to convert 325VDC to 325VAC. See test procedure Section 6.2.

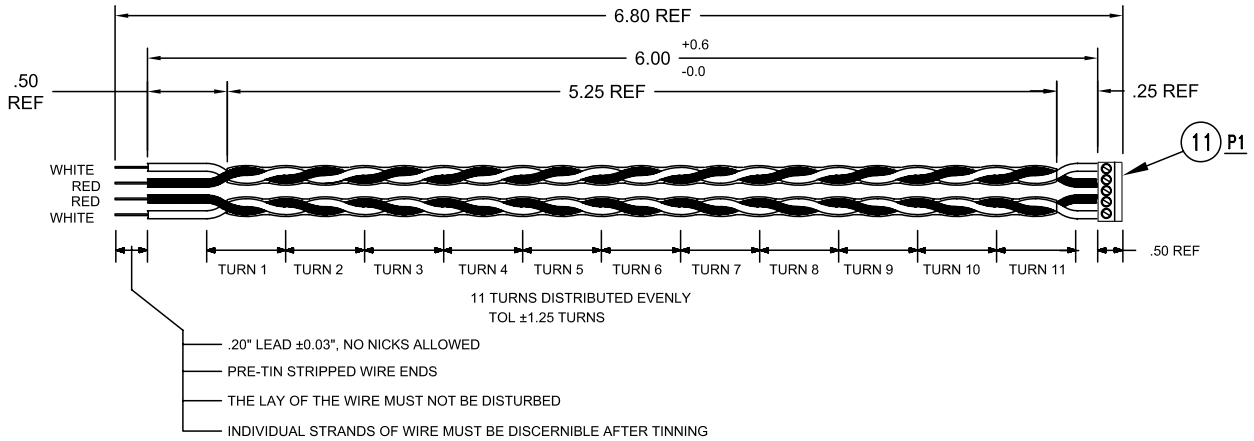
Testing:

- Perform continuity test on fuse F1 and F2.
- Perform diode test on the four zener diodes to insure 0.7V diode drop

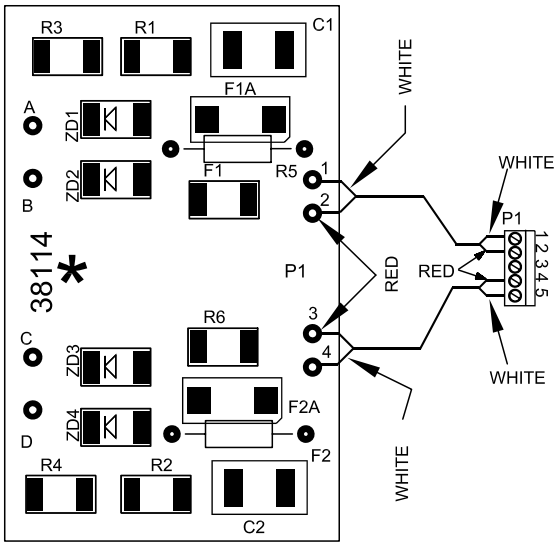
****It is recommended that both IGBTs and both IGBT driver boards be replaced if one is found to be faulty****



5.4.1 IGBT Driver Board



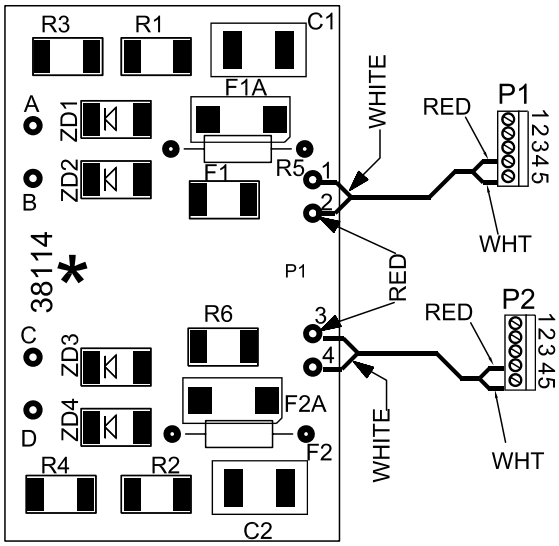
PN: 0558001177



COLOR CHART P1

P1-1 WHITE
P1-2 RED
P1-4 RED
P1-5 WHITE

PN: 0558001178



COLOR CHART P1 & P2

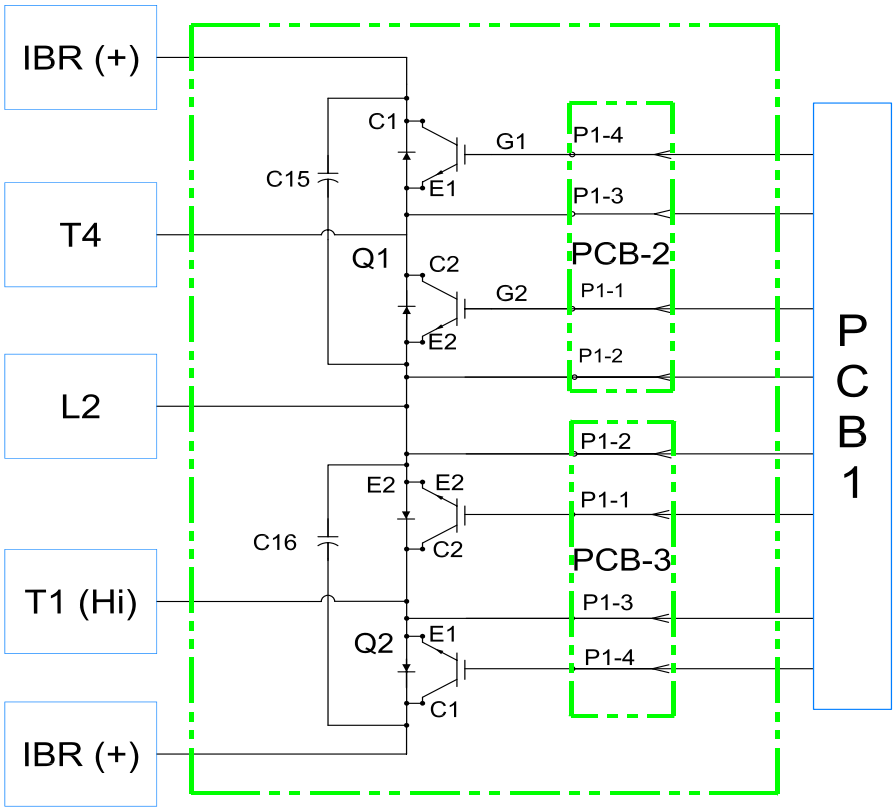
P1-4 RED
P1-5 WHITE
P2-4 RED
P2-5 WHITE

* = VENDOR PART # FOR BLANK BOARD

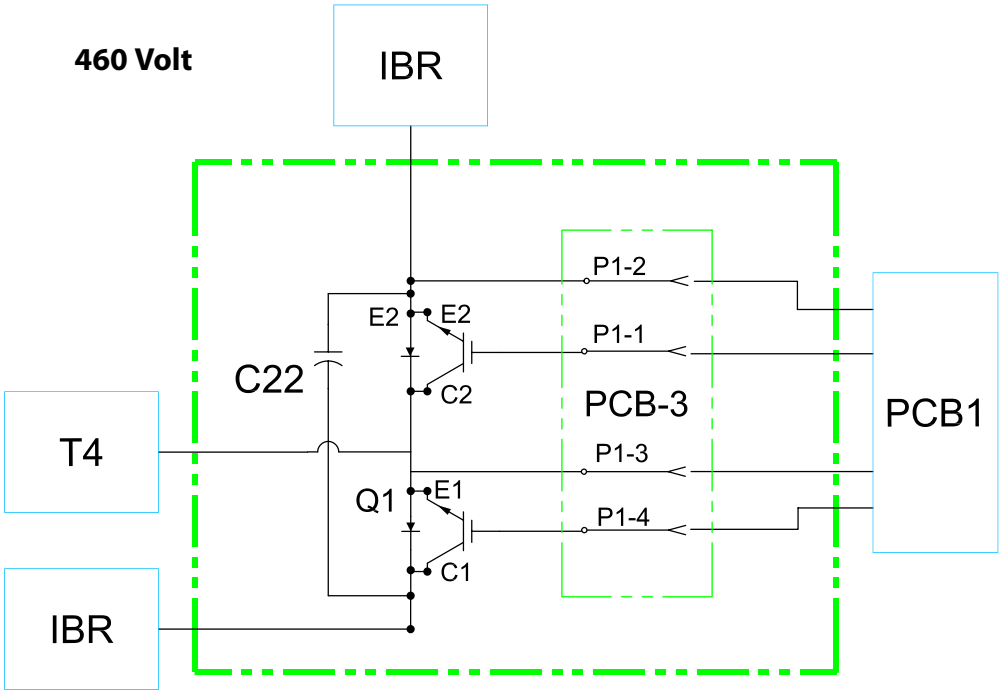
IGBT DRIVER BOARDS REPLACEMENT PARTS			
ITEM	QTY	DESCRIPTION	SYMBOL
2	2	CAPACITOR, .047UF @ 63V	C1,2
4	4	DIODE, ZENER 18V, 2W 5% (1N4746A)	ZD1-ZD4
6	2	RESISTOR, 47.5 OHM 1/2W 1%	R1,R2
7	2	RESISTOR, 1K 1/2W 1%	R3,4
8	2	RESISTOR, 2.74 OHMS 1/2W 1%	R5,6
10	4	TERMINAL, FASTON .110TSX22-18GA	
11	AR	PLUG COMBICON 5 POS	P1
16	2	FUSE, 1/2 AMP	F1,2

5.4.2 IGBT Block

208 / 230 Volt



460 Volt

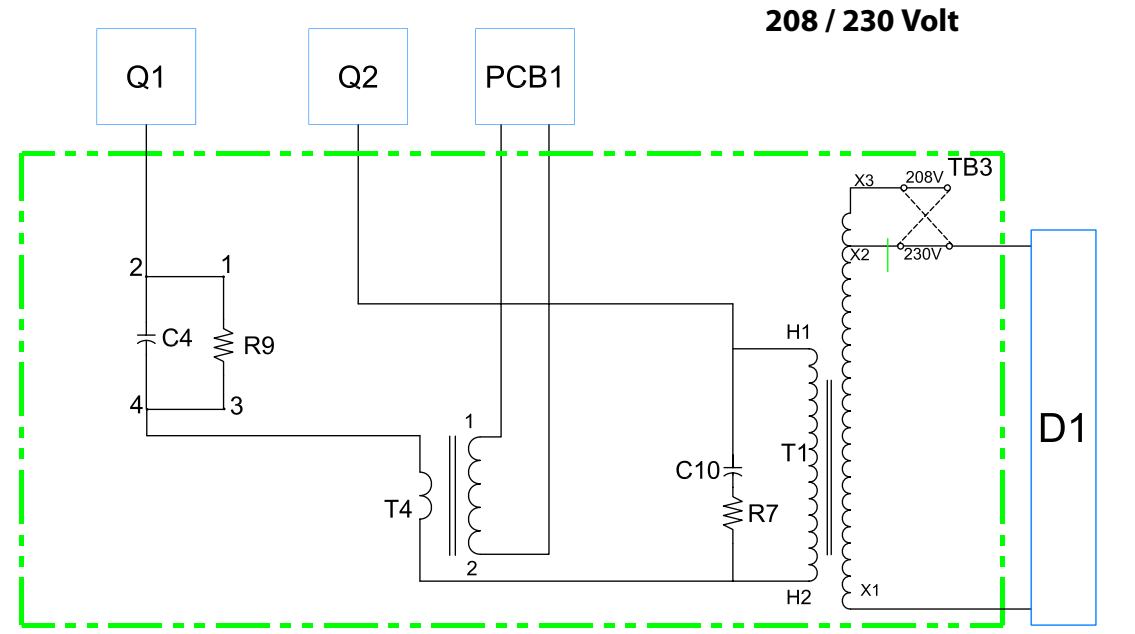


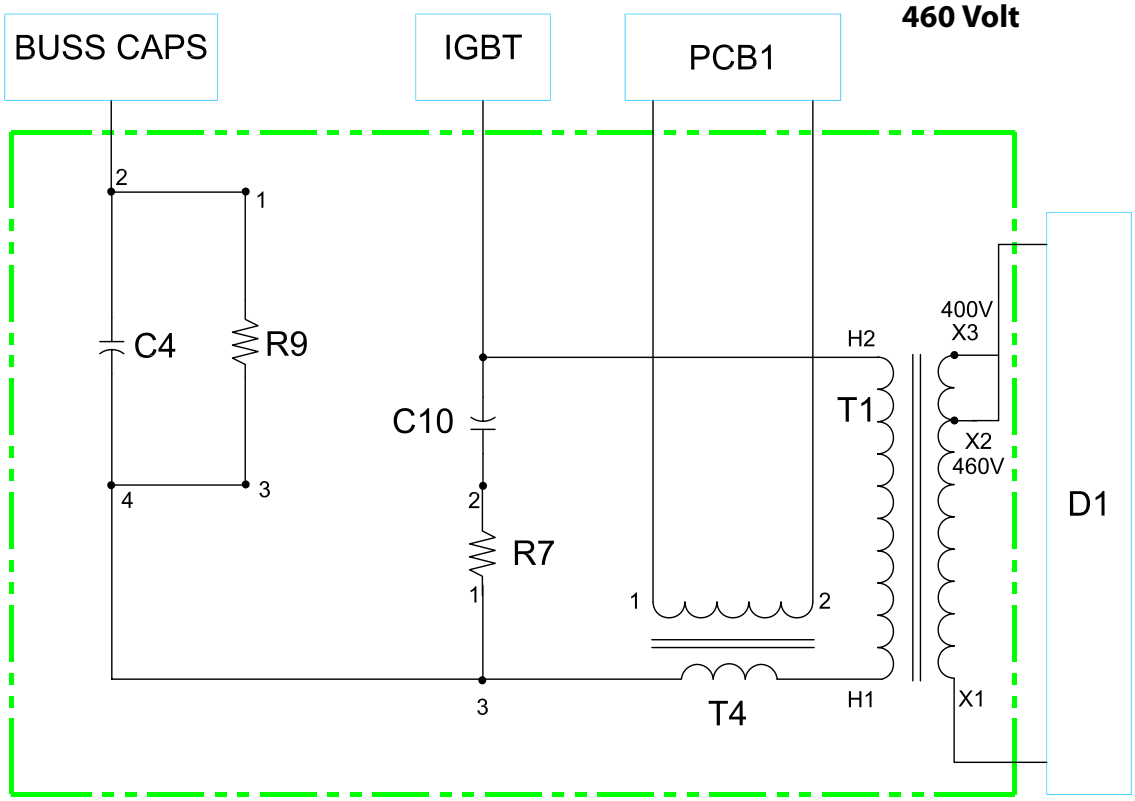
5.5 Main Transformer T1

The Main Transformer T1 takes the 325 VAC received from the IGBT block, and steps it down to 290 VAC.

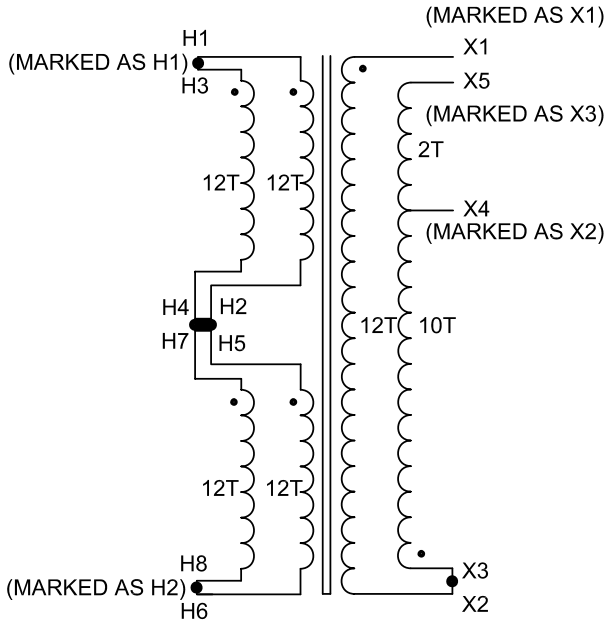
Testing:

H1 – H2 Less than 1 Ohm
X1 – X2 Less than 1 Ohm
X1 – X3 Less than 1 Ohm

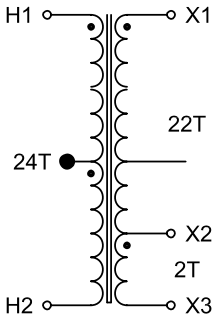




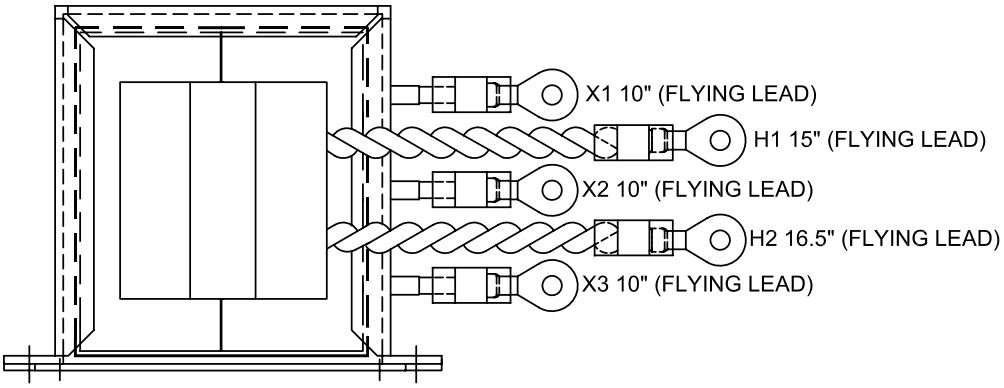
5.5 Main Transformer T1 (35941)

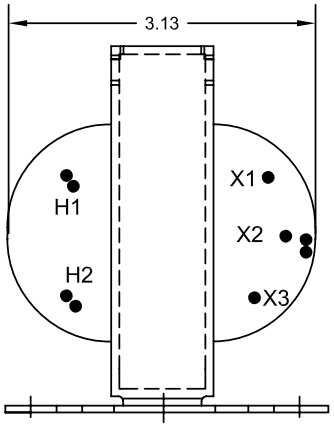


WINDING ORDER



SCHEMATIC





RIGHT SIDE VIEW

TRANSFORMER LEADS POINTING OUTWARD.

TEST VALUES: (BEFORE & AFTER VARNISH OPERATION)

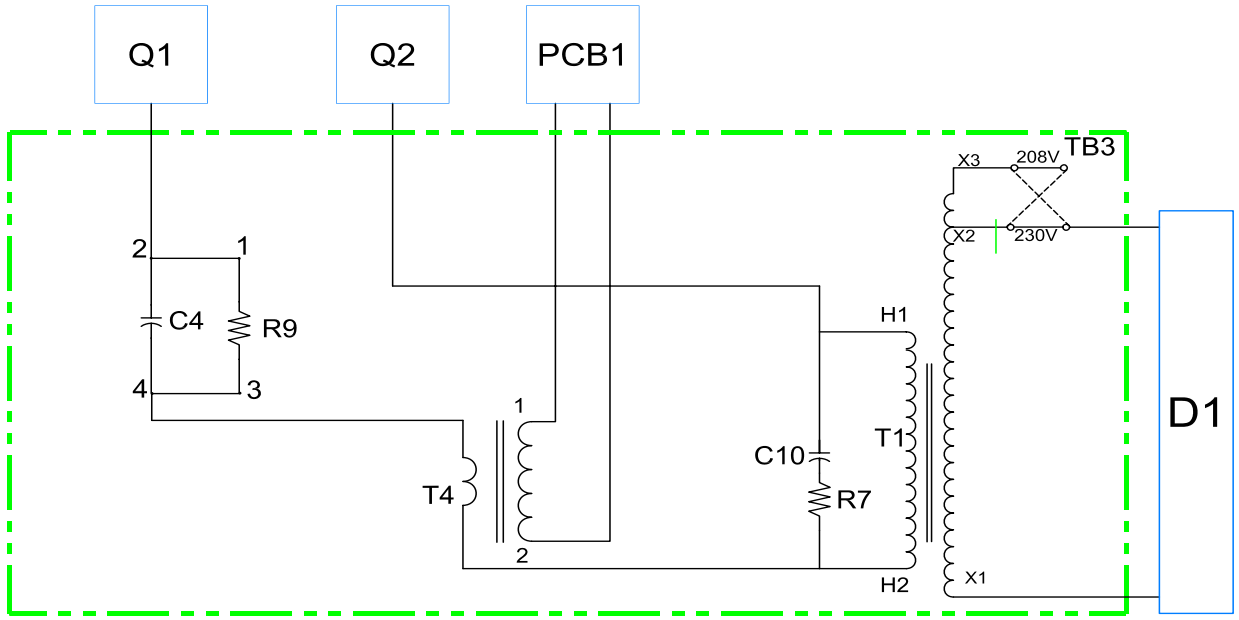
PARAMETER	VALUE	NOTES
PRIMARY INDUCTANCE (H1 - H2)	0.515 +/- 20% (0.412 TO 0.618) mH	1V AT 10 KHZ
SECONDARY INDUCTANCE (X1 - X2)	0.433 +/- 20% (0.346 TO 0.519) mH	1V AT 10 KHZ
SECONDARY INDUCTANCE (X1 - X3)	0.515 +/- 20% (0.412 TO 0.618) mH	1V AT 10 KHZ
PRIMARY LEAKAGE (SECONDARY SHORTED)	0.0020 mH MAX	1V AT 100 KHZ
SECONDARY LEAKAGE (PRIMARY SHORTED)	0.0020 mH MAX	1V AT 100 KHZ
CAPACITANCE (PRIMARY TO SECONDARY)	500 pF MAX	1V AT 100 KHZ

5.5.1 Coupling Circuit

The coupling circuit consists of resistor R9 (39kΩ, 2W) and capacitor C4 (20µF, 400Vdc). The purpose of this network is to prevent DC power from flowing into the primary of the main transformer (T1). C4 acts as a short to the 20 KHz AC power and acts as an open circuit to DC.

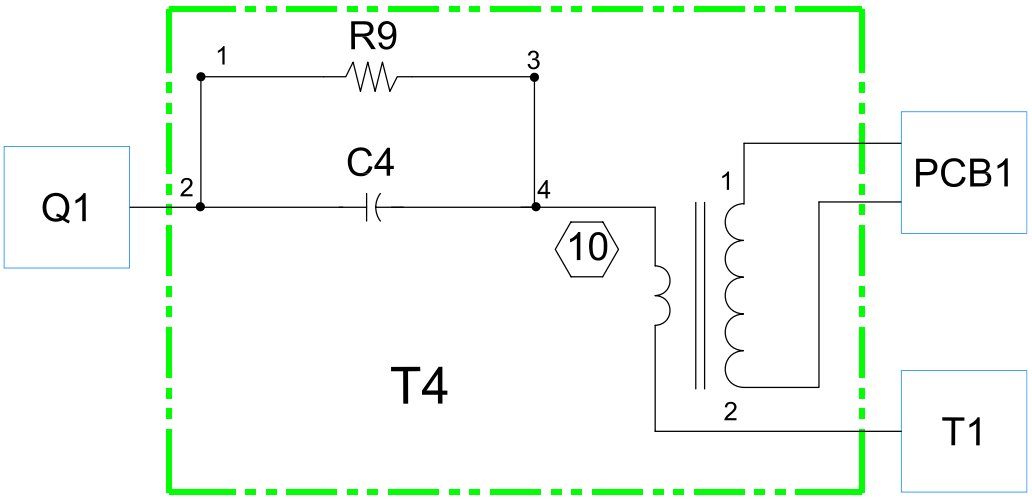
Testing:
It is recommended that a capacitance check be done on C4; however, with a meter in the diode scale the value read should increase showing that the cap is charging up. This is a good indication that this is a good capacitor.

For R9, perform a resistance test. The meter should read approximately 39kΩ.

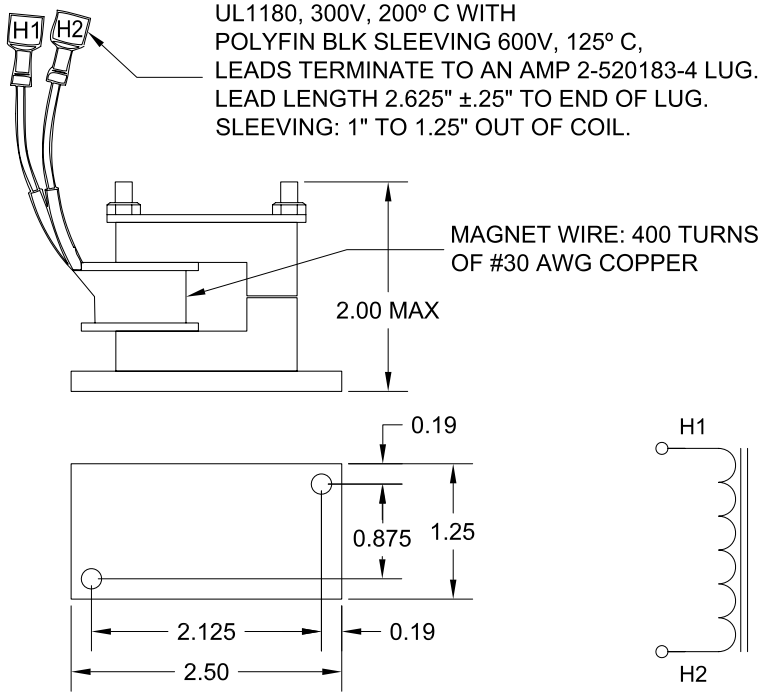


5.5.2 Current Transformer T4 (32958)

Current transformer (T4) measures the current flowing through the primary of the main transformer (T1). If this current is too high (100 amps), a signal (1 volt) is sent to the control board via P1-7 and P1-8 to the over current circuitry (IC2, pin 3) that will indicate an over current fault on the PC650.



TRANSFORMER ASSY CURRENT
32958



NOTE:
USE CLASS 'B', 130° INSULATION SYSTEM

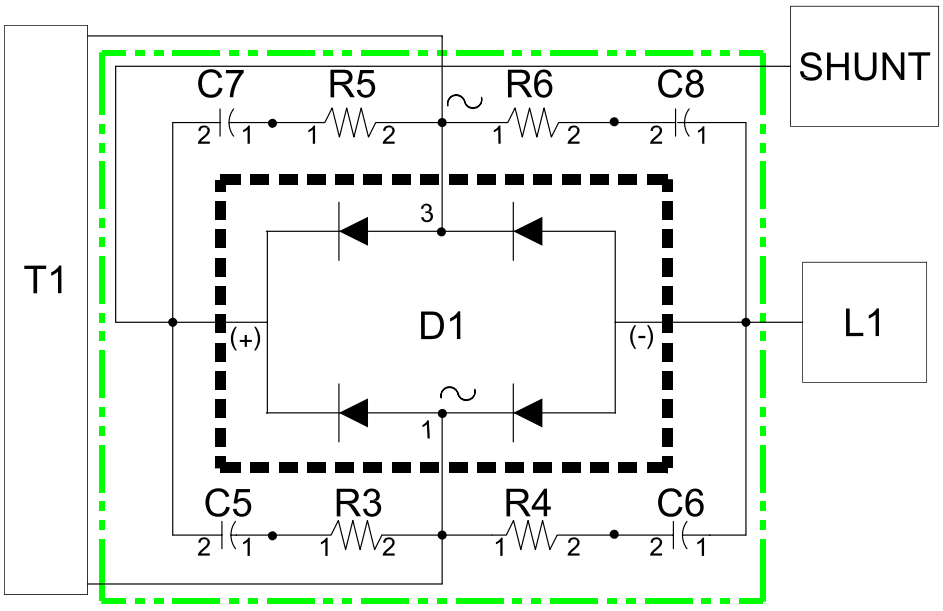
5.6 Output Rectifier 1 (952150)

The Bridge diode D1 is a full wave bridge rectifier, which converts the IGBT's 290 VAC output to dc volts which is supplied to the shunt and output inductor (L1). Due to the tolerance of the inputs, the range of values for this dc voltage is from 260Vdc to 290Vdc. The resistors in the circuit, R3 through R6, as well as capacitors C5 through C8 are used for electrical noise suppression.

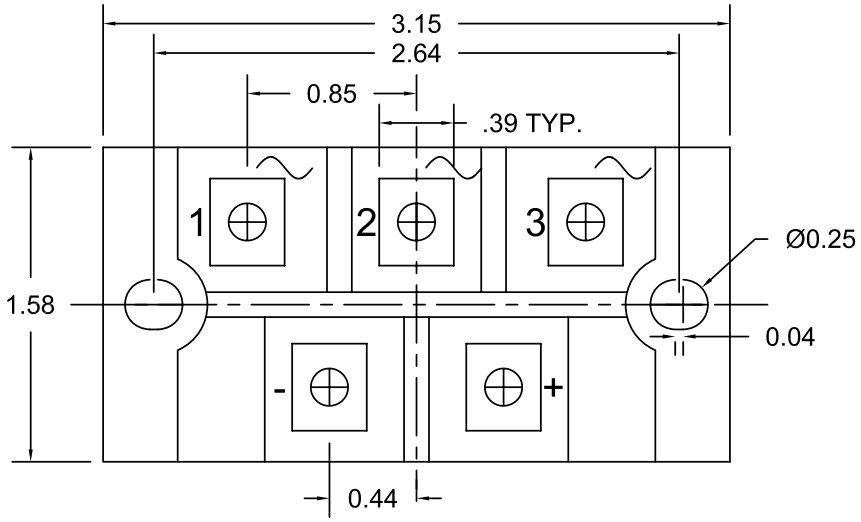
Testing:
With the unit shut down, disconnect the diode from the circuit and test it with an Ohmmeter in the diode scale. Be mindful that the middle ac input post is not connected on the output bridge. Viewing the diode with the positive / negative terminals to the left, the 3 ac input terminals are number 1 through 3 from top to bottom although this is not denoted on the diode itself.

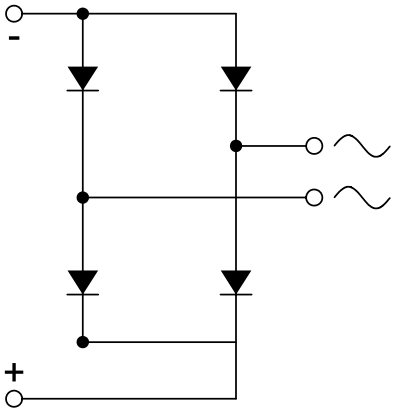
To test, perform the following diode voltage checks:

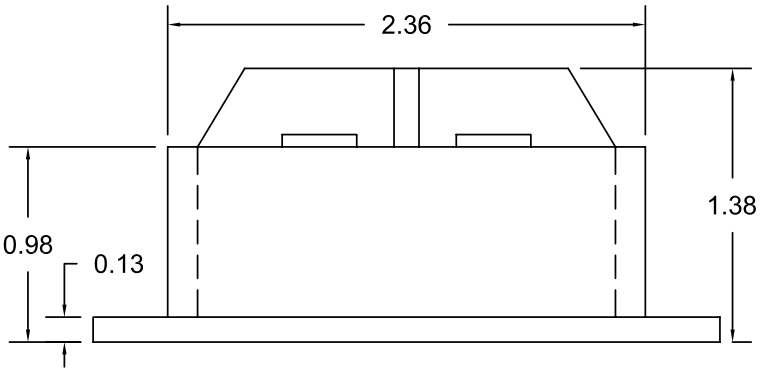
Output Bridge Diode Voltage Checks		
Probe (+)	**Probe (-)**	**Value (V)**
-	3	0.3
1	+	0.3
Post #2 is not connected		



5.6 Output Rectifier 1 (952150)





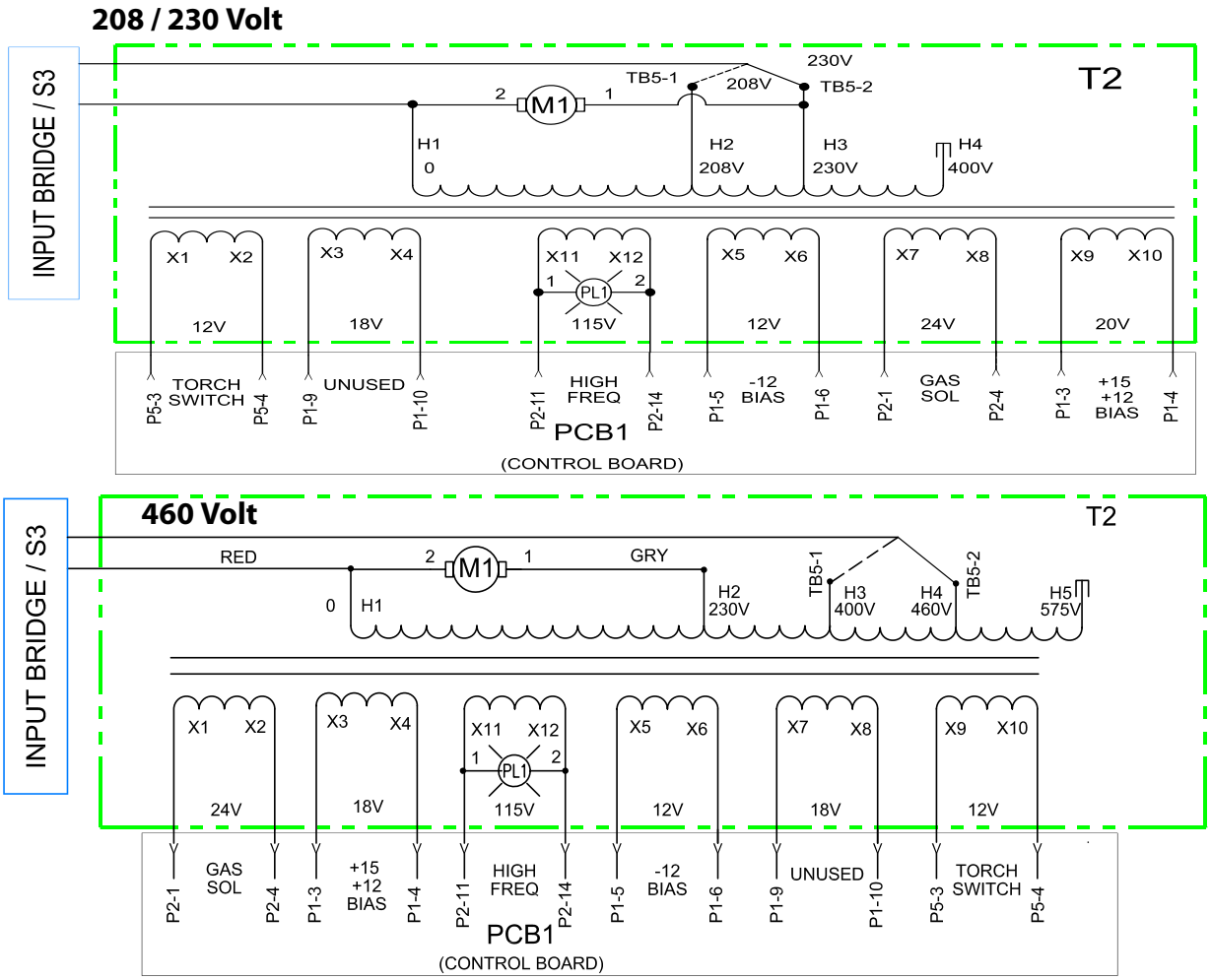


SINGLE PHASE BRIDGE

OUTPUT CURRENT = 60 DC
SURGE FORWARD CURRENT = 600 A
I^2t = 1490 A^2S
JUNCTION TEMP = -40° — +150°C
STORAGE TEMP = -40° — +125°C
ISOLATION VOLTAGE = 2500 V
MASS = 200 g

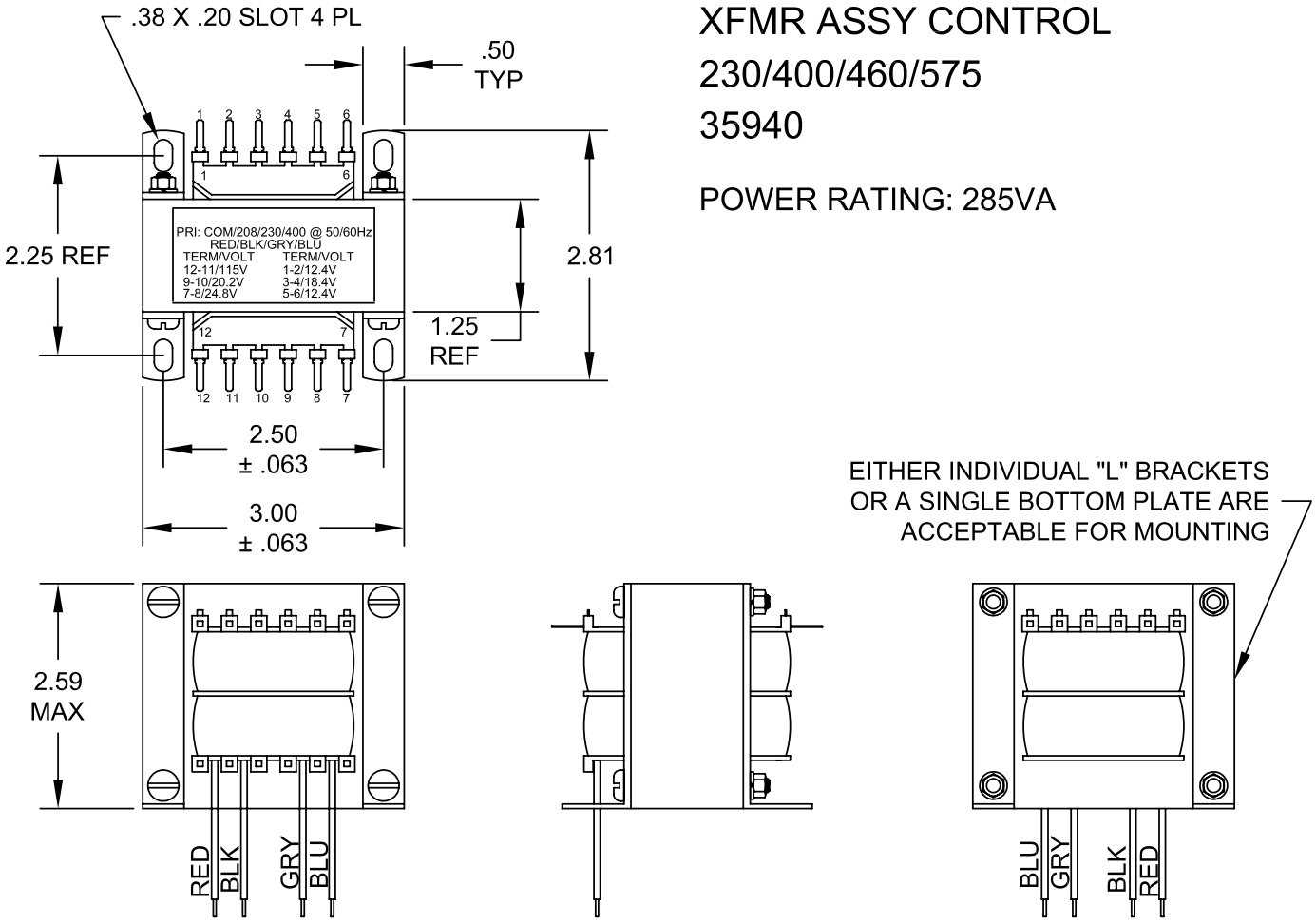
5.7 Control Transformer T2 (35940)

This transformer supplies reduced AC voltages to the PCB1 control board. It receives 230 volts on the H1 (red) and H3 (gray) leads on the primary, which is stepped down to multiple secondary voltages (See the accompanying chart).
For the PC 650, the X1- X2 winding feeds 12VAC to the torch switch circuit. The X3-X4 18VAC winding is not connected. The X5-X6 winding sends 12VAC to the –12VDC bias supply. Winding X7-X8 sends 24VAC to the gas relay. The X9 – X10 winding sends 20VAC to the +12 & +15VDC bias supplies.



WINDING	RESISTANCE VALUE ± 15%	VAC ± 15%
H1 - H2	20 OHMS	208V, 50/60 Hz
H1 - H3	23 OHMS	230V, 50/60Hz
H1 - H4	43 OHMS	400V, 50/60 Hz
X1 - X2	1.2 OHMS	12.3V ± .2
X3 - X4	1.6 OHMS	18.3V ± .2
X5 - X6	1.2 OHMS	12.3V ± .2
X7 - X8	2.4 OHMS	24.9V ± .2
X9 - X10	2.0 OHMS	20.3V ± .2
X11 - X12	9.5 OHMS	125 V ± 1.0

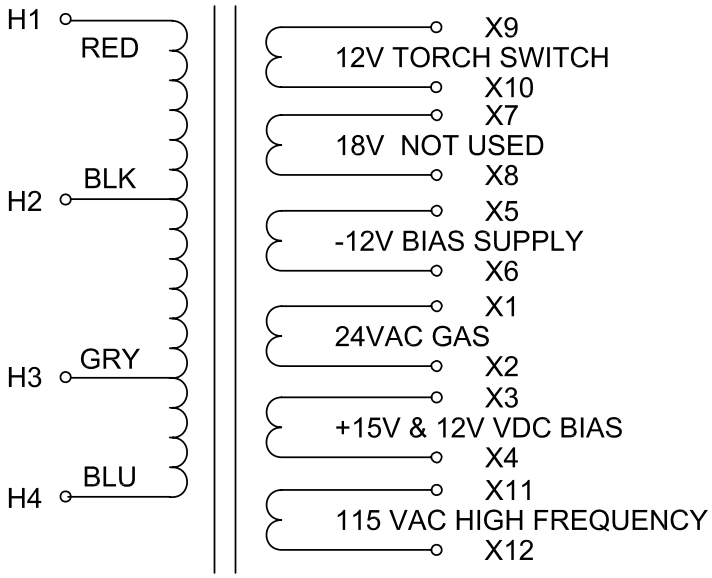
5.7 Control Transformer T2 (35940)



XFMR ASSY CONTROL
230/400/460/575
35940

POWER RATING: 285VA

SCHEMATIC

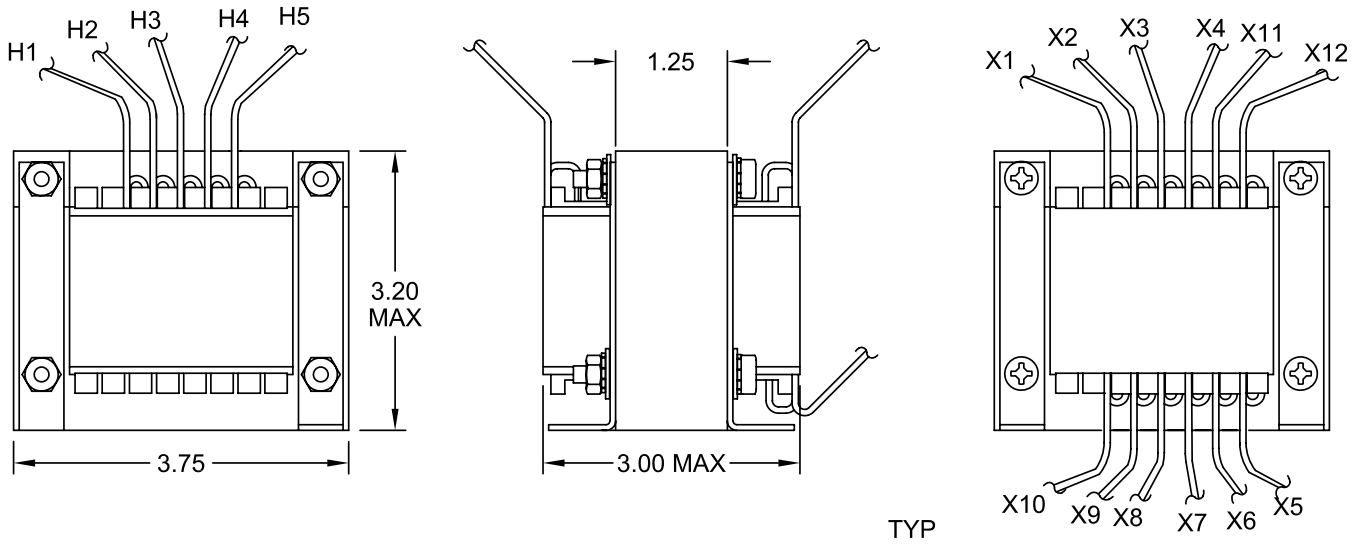


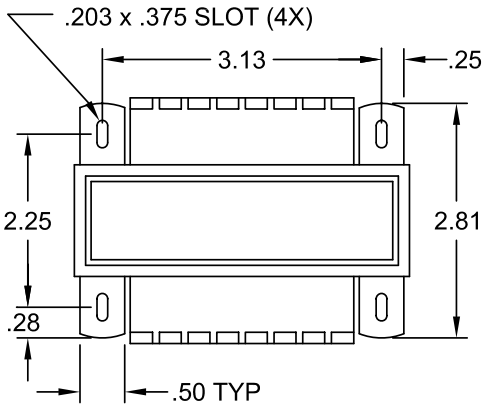
5.7 Control Transformer T2 - 230/400/460/575V (332914)

TERMINAL	VOLTAGE	TURNS	AWG
H1 - H2 *	230.0	600T	26
H1 - H3	402.5 ± 0.4	1050T	26
H1 - H4	460.0 ± 0.4	1200T	26
H1 - H5	575.0 ± 0.4	1500T	26
X2 - X2	24.8 ± 0.5	65T	25
X3 - X4	20.2 ± 0.4	53T	25
X5 - X6	12.4 ± 0.4	32T	25
X7 - X8	18.4± 0.4	48T	25
X9 - X10	12.4 ± 0.4	32T	25
X11 - X12	125 ± 0.4	326T	25

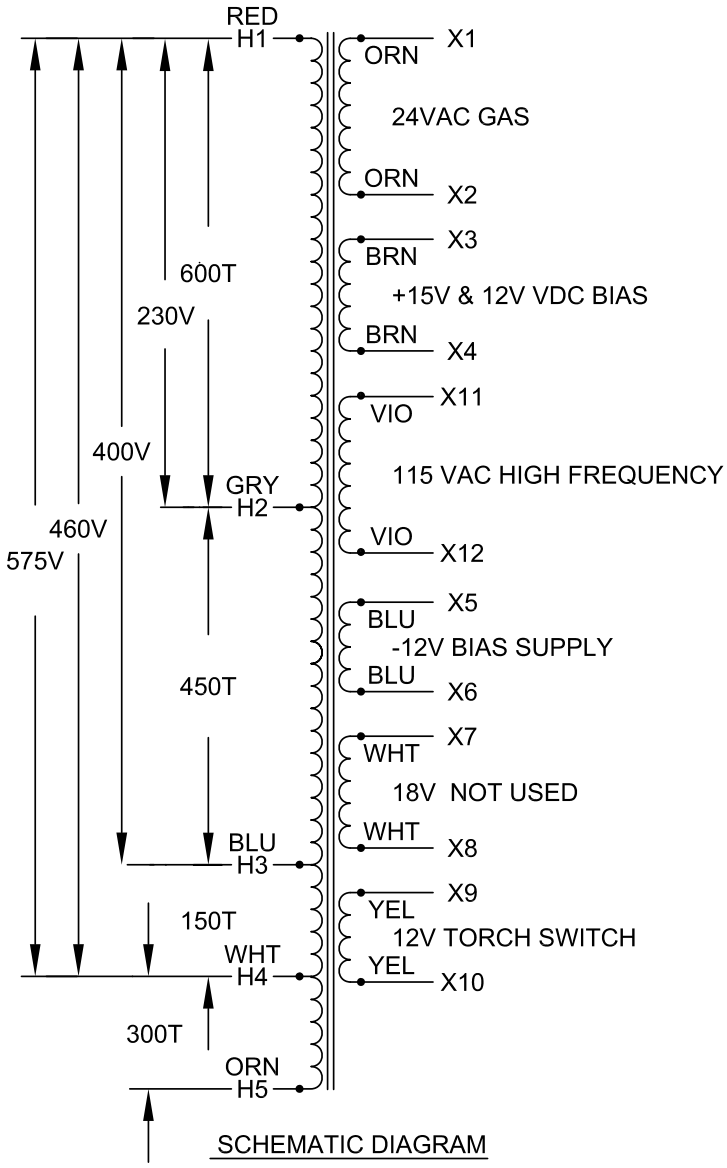
* H1 - H2 COIL IS EXCITATION WINDING

5.7 Control Transformer T2 - 230/400/460/575V (32914)





LEAD LIST		
POINT	COLOR	LENGTH
H1	RED	23.0
H2	GRAY	20.0
H3	BLUE	20.0
H4	WHITE	20.0
H5	ORANGE	20.0
X1	ORANGE	36.0
X2	ORANGE	36.0
X3	BROWN	33.0
X4	BROWN	33.0
X5	BLUE	34.0
X6	BLUE	34.0
X7	WHITE	33.0
X8	WHITE	33.0
X9	YELLOW	49.5
X10	YELLOW	49.5
X11	VIOLET	38.0
X12	VIOLET	38.0



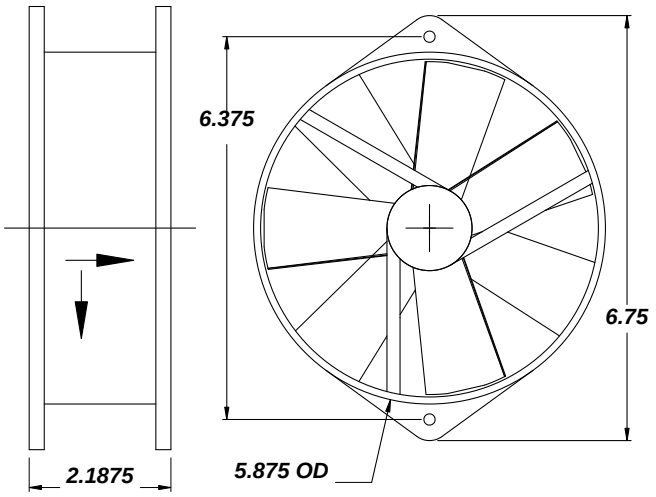
5.7.1 Axial Fan (951182)

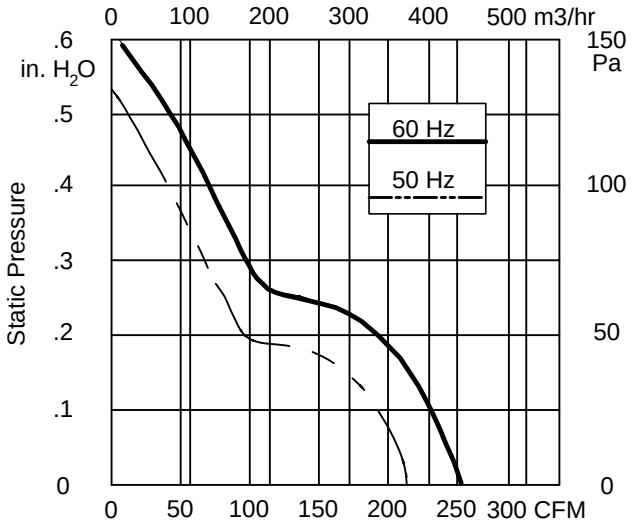
Active device cooling (the IGBTs, IBR and D1) is performed by axial fan M1.
This fan is connected across the 230-volt primary of the T2, and is on while the PC650 is in operation.

Open circuit resistance is 150 Ohms.

Specifications:
5.9 DIA. x 2.16 In., 247.2 CFM
230V 60Hz/ 55dB(A)/ -40 ~ +55°C
Metal housing and impeller
Shaded pole motor, air output over struts
Elec. connection via 2 leads AWG 18, 14 in. (365 mm) from outer edge of housing.
Mass = 38.8 oz (1100g)

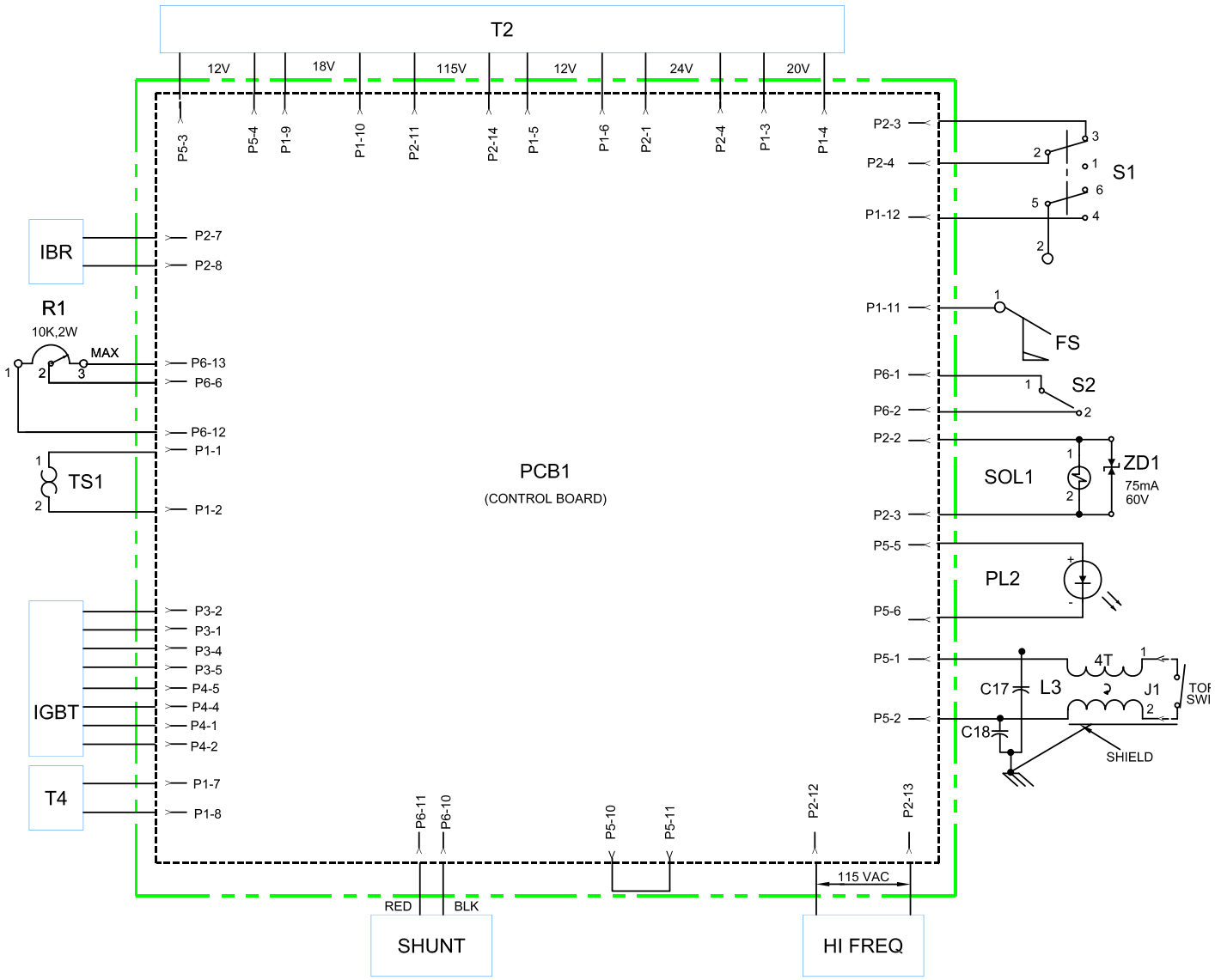
AC AXIAL FAN
5.9 DIA. x 2.16 In., 247.2 CFM
230V 60Hz/ 55dB(A)/ -40 ~ +55°C
Metal housing and impeller. Shaded pole motor, air output over struts.
Elec. connection via 2 leads AWG 18, 14 in. (365 mm) from outer edge of housing.
Mass = 38.8 oz (1100 g).





5.8 Plasma Control Board (38214)

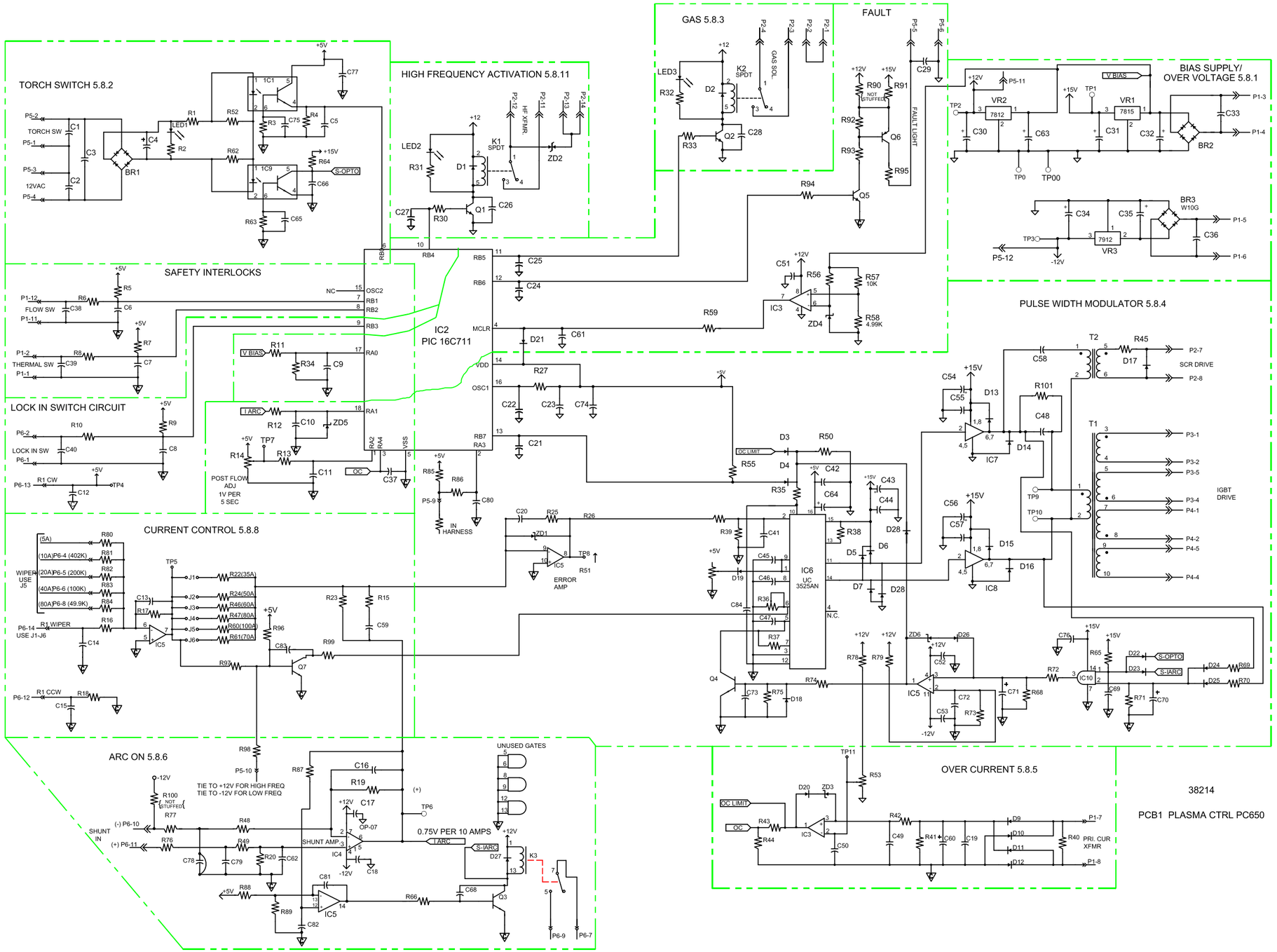
PCB 1 is the control module for the PC 650. The module develops bias voltages for the onboard circuitry, and has on it the control functions, PWM functions, error functions (current limit, over current detection) and Arc on circuitry.



CONTENTS

SECTION 5 MACHINE TESTING / TROUBLESHOOTING / SERVICE

5.8 Plasma Control Board Schematic (38214)



5.8.1 PCB1 Control Board and Bias Supplies

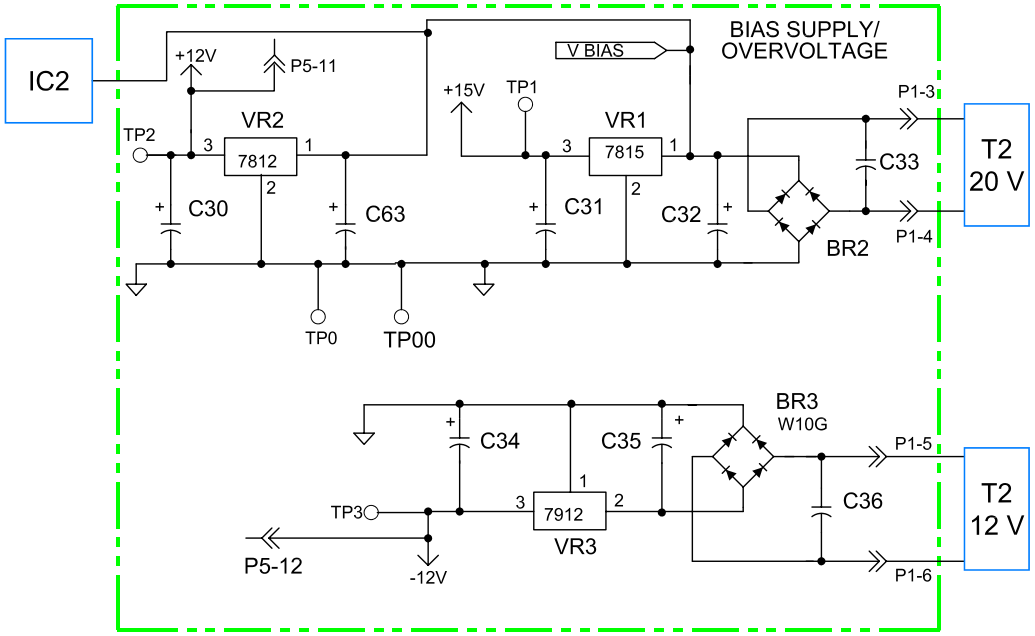
BIAS POWER SUPPLIES

The PCB1Control Board creates 4 bias voltages for circuit function. These voltages are +/- 12 volts DC, +15 Volts DC and +5 volts DC. This provides operating voltages to the Pulse Width Modulator (PWM), the control circuit, the torch switch circuit, the over current protection circuit and the arc on circuit.

Positive 12 and 15 volts are created on the board by VR1 and VR2 respectively. This circuit receives 20 Volts AC from the PCB module control transformer on the connector plug P1 pins 3 and 4 (P1-3, P1-4). The voltage is applied to BR2, a full wave bridge rectifier and converted to pulsating DC. The pulsating DC is then filtered by filter capacitor C32, a 1000 Microfarad capacitor, and fed to a 3-pin voltage regulator, VR1, an LM 7815 +15 volt regulator. The positive DC is input on pin one of the regulator and outputted on pin 3. Pin 2 of the regulator is tied to ground. The 15-volt output is then connected to C31, a 47 Microfarad capacitor for ripple and noise suppression, and then distributed throughout the board.
Filtered DC from the rectifier circuit is also fed to VR2, an LM7812 3 pin voltage regulator. The capacitor C63, a 1000-microfarad capacitor, is installed for additional filtering before applying voltage to pin 1 of the regulator. The Positive 12 volt output is derived from pin 3 of the regulator, and then fed across C30, a 47 Microfarad capacitor for ripple and noise suppression, and then distributed throughout the board.
Capacitor C33 is installed ahead of the rectifier bridge for noise suppression

Negative 12-volt power is created by VR3, An LM7912 3 pin voltage regulator. 12 Volt power from the mains module control transformer is supplied to the rectifier bridge via connector plug P1 pins 5 and 6 (P1-5, P1-6). The voltage is applied to BR3, a full wave bridge rectifier and converted to pulsating DC. The pulsating DC is then filtered by filter capacitor C35, a 1000-microfarad capacitor. The filtered DC is then applied to pin 2 of the LM7912, a negative 12 volt 3 pin voltage regulator chip. Pin one is connected to the negative output of the Rectifier Bridge and negative 12 volts is distributed throughout the board via pin 3 of the LM7912. A 47 microfarad capacitor is applied across the output of the LM7912 for ripple and noise reduction.

The 5 volts for the board is derived from the reference voltage pin, pin 16, of the UC3525an chip, IC6.



Testing:
With the unit energized and the protective cover of the PCB removed, perform the following voltage checks:

POSITIVE SUPPLY TESTING

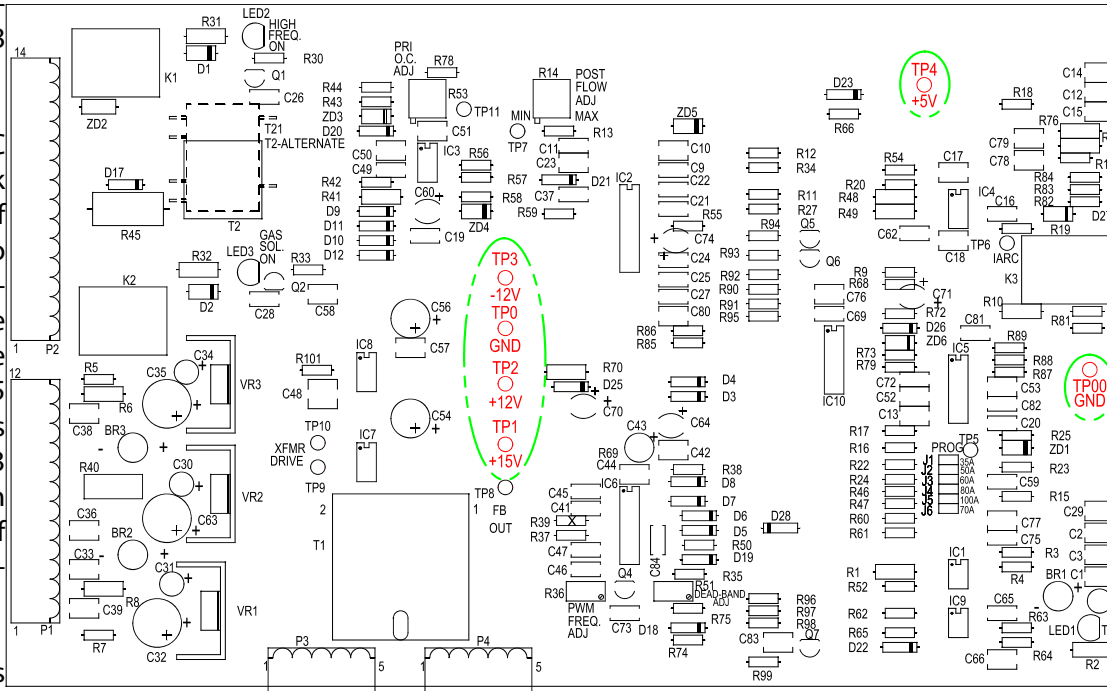
If the +12 **and** +15 volt rails are missing, check for AC voltage at the bridge rectifier BR2 – 20 VAC. If there is AC voltage is present, check for DC voltage from the output of rectifier BR2 – approximately 25VDC.
If there is AC voltage at the input of the bridge, but no DC output, replace the PCB module.

5.8.1 PCB1 Control Board and Bias Supplies

If the 20VAC signal is not there, check the PCB module transformer and associated cabling for output. If there is no 20VAC from the transformer, check for 230 VAC input to the transformer. If there is voltage there, deenergize the unit and test the windings with an Ohmmeter. If there are any open windings, replace the transformer.

TEST POINT	REFERENCE VALUE	FUNCTION
TP0	GND	Reference Ground
TP00	GND	Reference Ground
TP1	Pos 15 VDC	15 vdc bias supply
TP2	Pos 12 VDC	12 vdc bias supply
TP3	Neg 12 VDC	Neg 12 vdc supply
TP4	Pos 5 VDC	Pos 5 VDC ref supply

If there is only one of the two voltages missing +12 or +15, check the associated VR IC for a short, an open or for obvious signs of physical damage. Replace the PCB module.



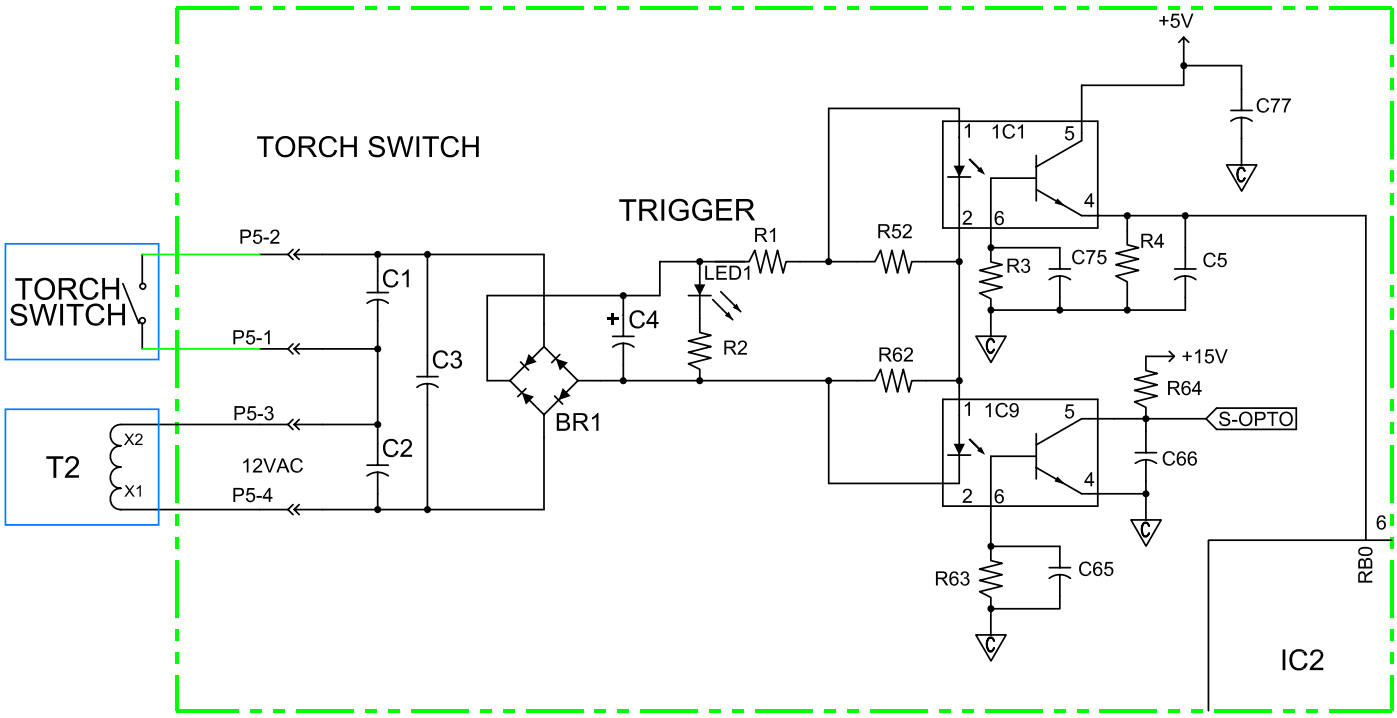
If the 12VAC signal is not there, check the PCB module transformer and associated cabling for output. If there is no 12VAC from the transformer, check for 230 VAC input to the transformer. If there is voltage there, deenergize the unit and test the windings with an Ohmmeter. If there are any open windings, replace the transformer.

If the 13.5VDC voltage is not available, replace the PCB module.

If the +5 volt reference voltage is absent, first ensure that there is +15VDC available at pin 15 of IC6. The 5-volt reference is dependant upon the generation of 15 volts to power IC6. If there is +15VDC available and no 5-volt reference voltage available, replace the PCB module.
If there is no +15 VDC available at pin 15 of IC6, and the +15VDC voltage is available at the test point, replace the PCB.

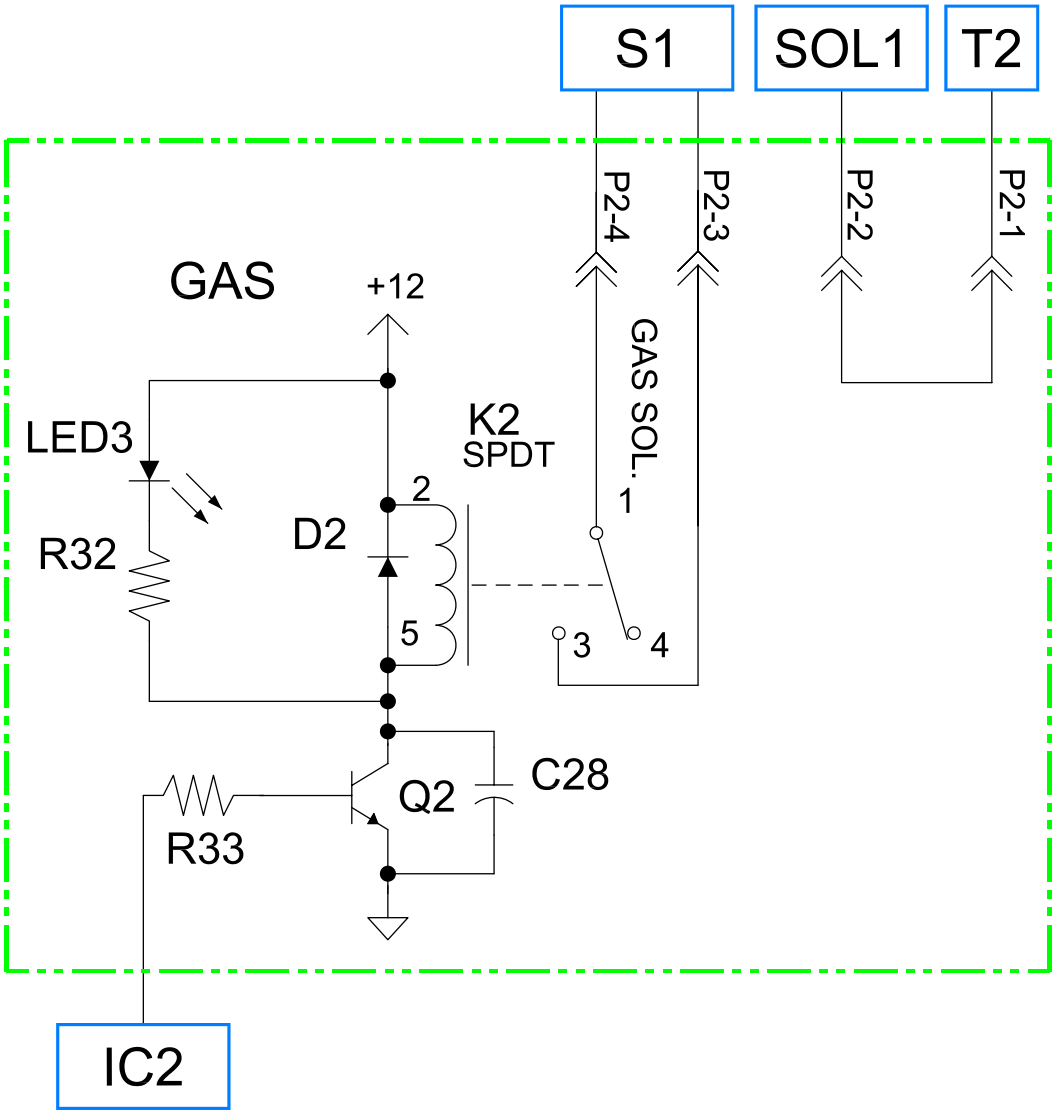
5.8.2 PCB Torch Switch

The switch on the torch closes the circuit requesting a cutting operation sending 12 VAC across rectifier bridge BR1 on the PCB control board. This 12 VAC signal originates from the PCB control transformer T2, but it is routed through the torch. The torch closes the circuit that completes the 12VAC circuit on the PCB module on Plug 5, pins 1 and 2 (P5-1 and P5-2). Capacitors C1, 2, 3 are installed for HF noise protection of the circuit. The rectified voltage from BR1 is fed across filter capacitor C4, LED1 lights up (which indicates a START circuit condition) and then to a pair of opto isolator ICs. IC1 sends a "torch request on" signal to the control chip IC2 pin6. This enables the logic circuit on IC2. IC9 sends a signal to the AND gate IC10 in the Current Control circuit.



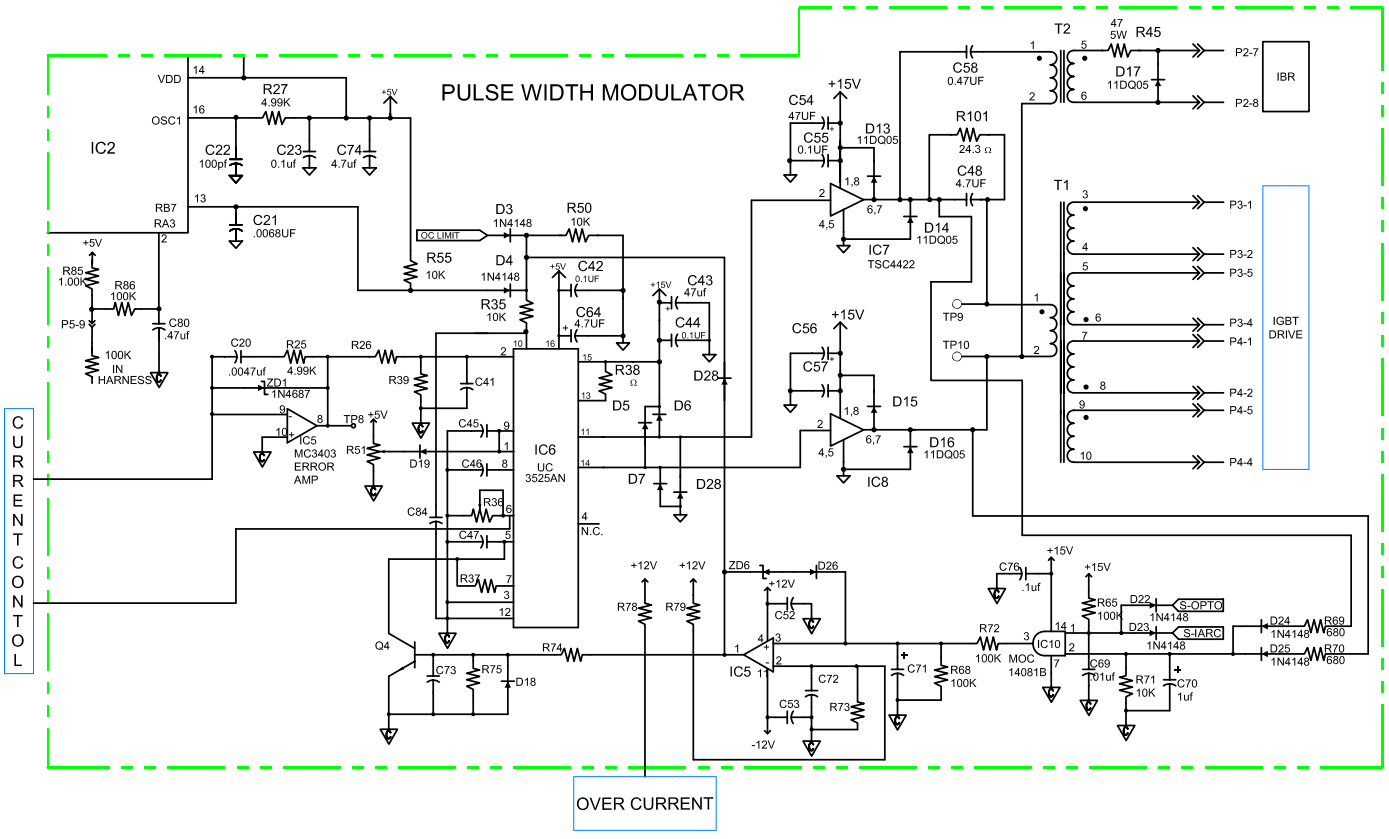
5.8.3 Gas Circuit

Once the torch switch circuit has been completed, the PC650 air will flow out of the torch. This is accomplished from the PCB1 control board. IC2 sends a high state signal out on pin 11. This places Q2 in conduction and allows relay K2 to energize. This closes K2 contacts 1 and 3. With these contacts closed, 24VAC is routed from the control transformer, through PCB relay K2, to the gas solenoid, SOL1, via P2-2 and P2-3. This allows air to pass through the solenoid and out to the nozzle. The relay and the flow switch may be bypassed for troubleshooting using the air test switch on the front panel of the unit. This bypasses the PCB1 K2 relay and energizes the solenoid directly.



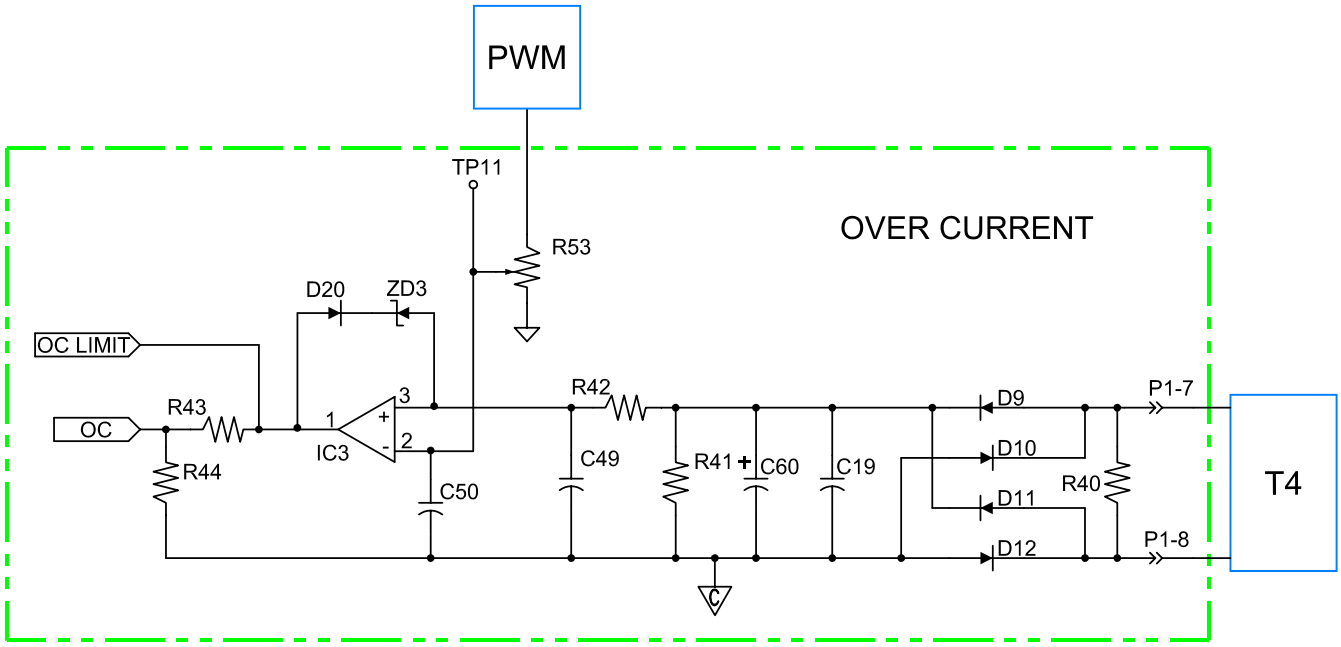
5.8.4 Pulse Width Modulator

IC6 is the Pulse Width Modulator IC and it generates the drive signals, which drive the IGBT circuitry. This chip also provides the +5-volts for the board.
Current control comes into the board on Plug 6 pin 14 (P6-14) and is routed through IC5 on pin 6, out through pin 7, through the 50-amp jumper J2, then input to IC6 on pin 2. The IC has two adjustments, R34, the frequency adjustment and R51, the dead band adjustment. The frequency adjustment is set to 16 KHz. at the factory. The output of IC6 is routed to IC7 and IC8 from pins IC6-11 and IC6-14 respectively. These signals are then routed to the IGBT drive transformer T1 and to the SCR drive transformer T2.



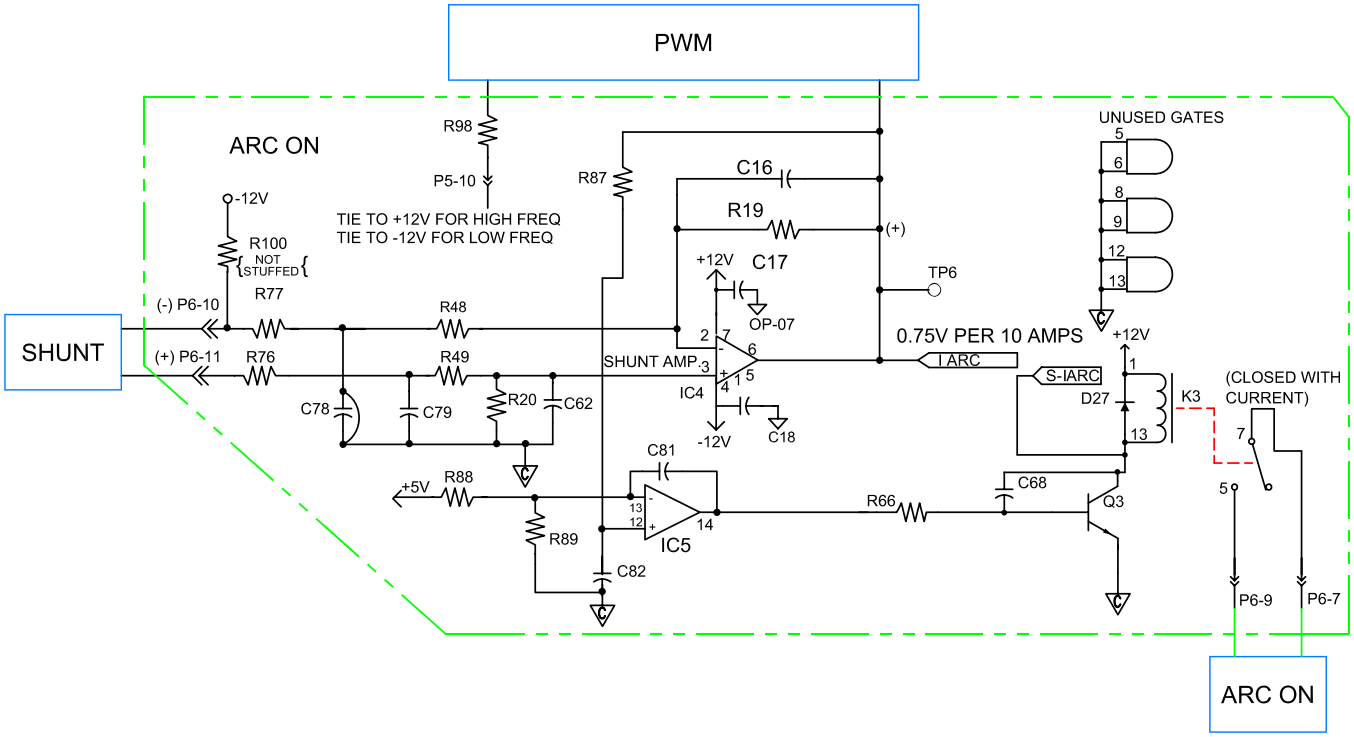
5.8.5 Overcurrent Sense

The current limit circuitry receives an input from the current sense transformer T4 and inputs that signal on pin 3 of IC3. This IC is a voltage comparator circuit and when its threshold is reached, 1V from the T4 transformer, sends an error signal to Pin 10 of IC6 and pin 3 of IC2. This has the effect of shutting down the pulses generated from IC6, and thereby shutting down the PC650.



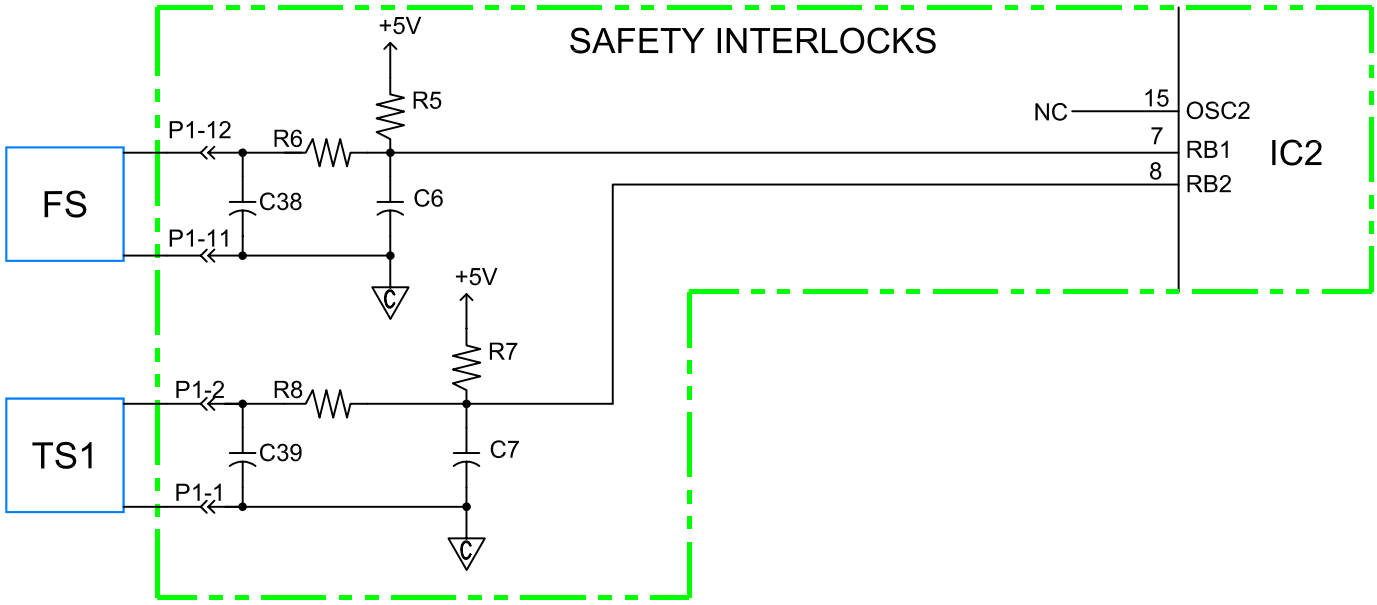
5.8.6 Arc On Circuit

The Arc On circuit consists of IC4 and IC5 and their immediate supporting components. The input from the shunt is routed to the PCB control board module via Plug 6, pins 10 and 11 (P6-10, P6-11). The shunt circuit develops 75mV per amp, which it sends to the shunt amplifier. The shunt amplifier is set to fire the arc on circuit with as little as 5 amps of cutting torch draw (0.375 Volts from the shunt). This output is routed to IC2, as I ARC, and to a pair of inputs of IC5. The pin 12 input triggers the K3 relay via IC5 pin 14. This is not utilized on the PC650.
The I ARC signal routed to pin 18 of IC2 is what turns off the HF relay, PCB1 K1, from the control board internally.



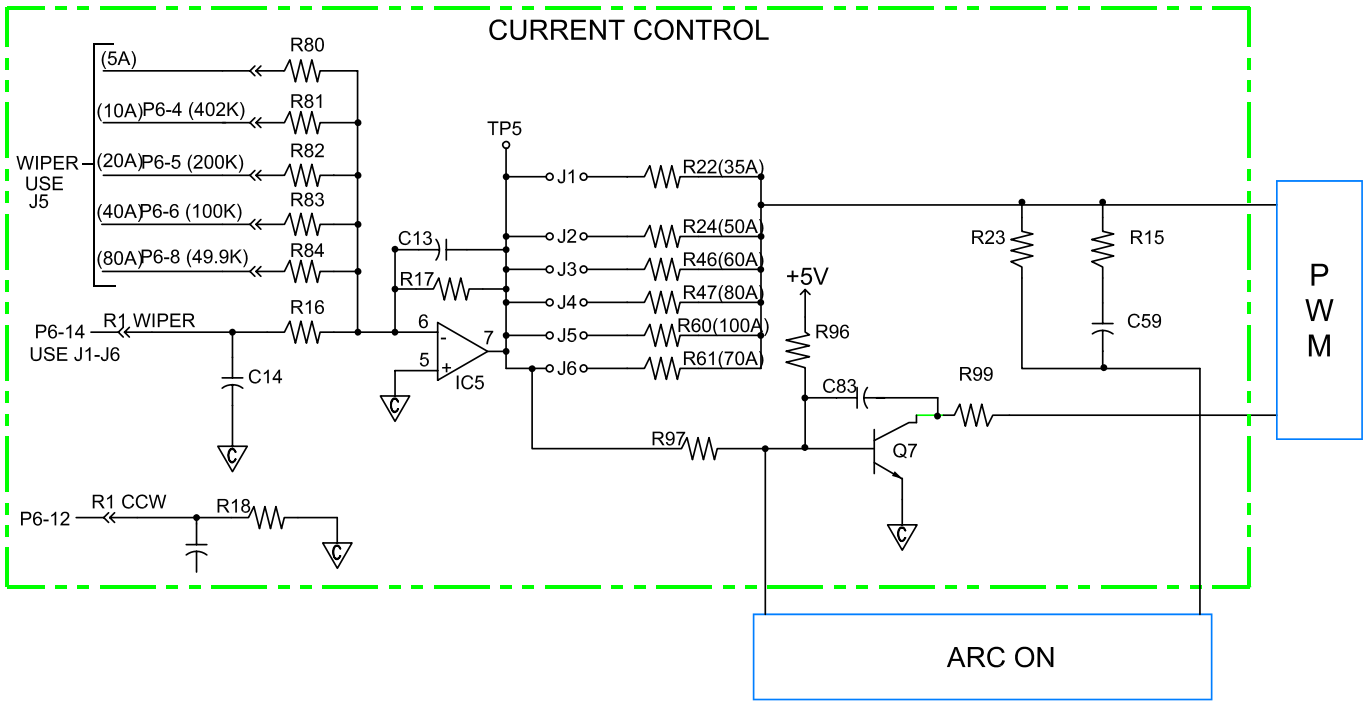
5.8.7 Lock In Switch Circuit

The PCB module incorporates some safety interlocks into the system. There are 2 safety switch functions built into the board, a gas flow switch, and a thermal switch.
The Thermal switch is a normally closed switch and is routed to IC2 via Plug 1 pins 1 and 2 (P1-1, P1-2). When an over temperature condition exists, the thermal switch opens, and an error signal is generated by IC2 output on pin 13 and sent to pin 10 of IC6. This shuts down the PWM generation and shuts down the main arc. The flow switch is connected to the PCB control board on P1-11 and P1-12.
The Flow switch detects airflow through the unit and when the flow dips below 190CFH, the flow switch opens up, and an error signal is generated by IC2 output on pin 13 and sent to pin 10 of IC6. This shuts down the PWM generation and shuts down the main arc.



5.8.8 Current Control

Current control on the Powercut 650 is controlled from the front panel. The variable resistor R1 mounted on the front panel is connected to the positive 5-volt source of PCB1 on R1 pin 3 via P6-13 and to the 40A branch of the PCB1 voltage divider on R1 pin 2 via P6-6. R1 pin 1 is connected to ground through the P6-12 connection of the PCB1 control board.
The variable of R1 connected to P6-6 flows to pin 6 of the voltage comparator IC5 on the control board. The output signal of the comparator modulates Q7, the output of which is connected to pin 6 of the pulse width modulator chip. This has the effect of varying the duty cycle of the generated waveform and thereby increasing or decreasing a given current level.

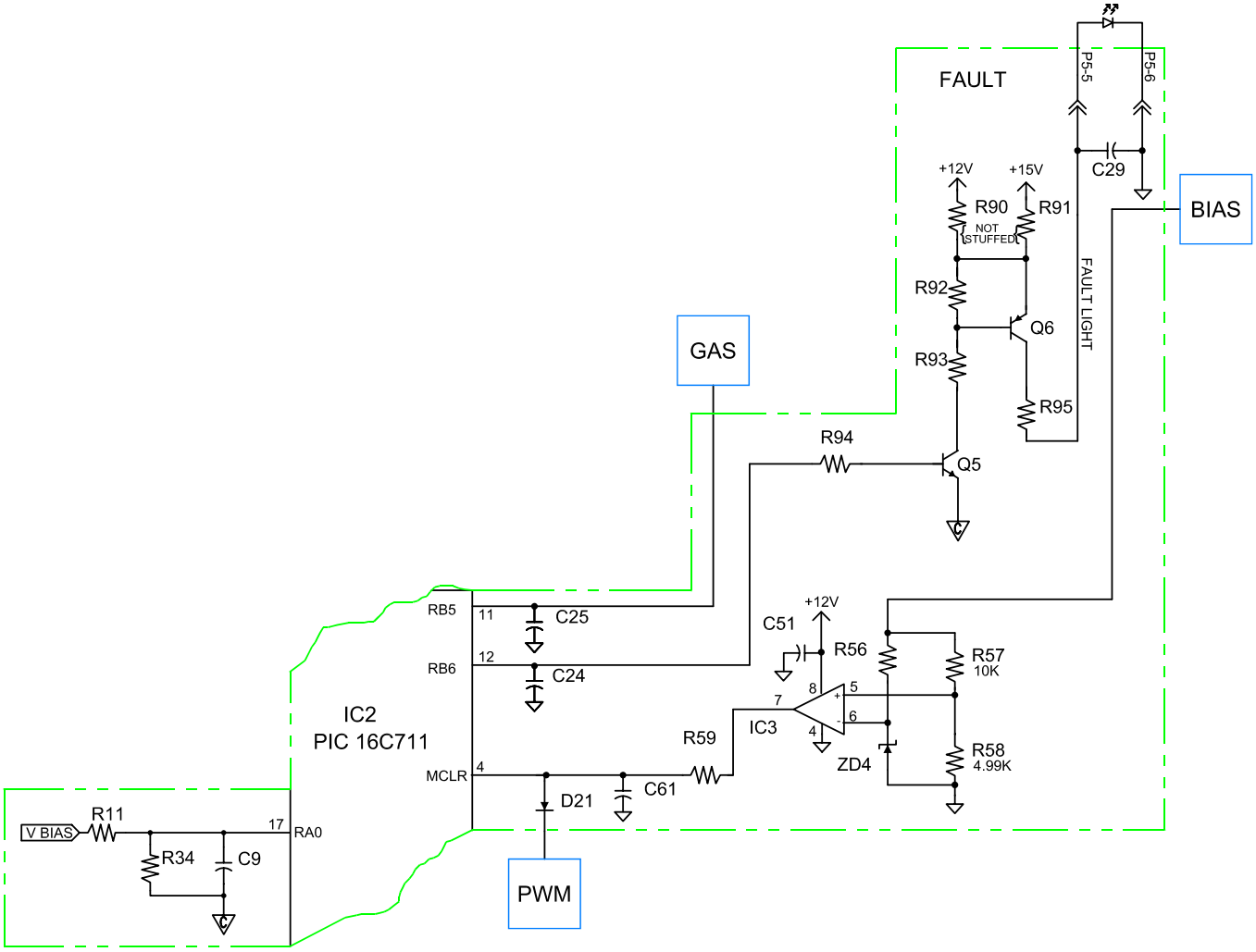


5.8.9 Over / Under Voltage Fault Circuit

The PCB Control board has a voltage monitoring circuit and major fault logic built onto it.
IC3 is a voltage comparator circuit, which monitors the unregulated voltage that feeds the positive 12 and 15 volt supplies. If the voltage dips below 11.8VDC IC3 sends an error signal to IC2 pin 4 and this signal sets the fault on IC2 pin 6 turning on Q5 and Q6. This turns on the under voltage/over voltage fault LED on the front panel. This shows on the front panel as a flashing light.

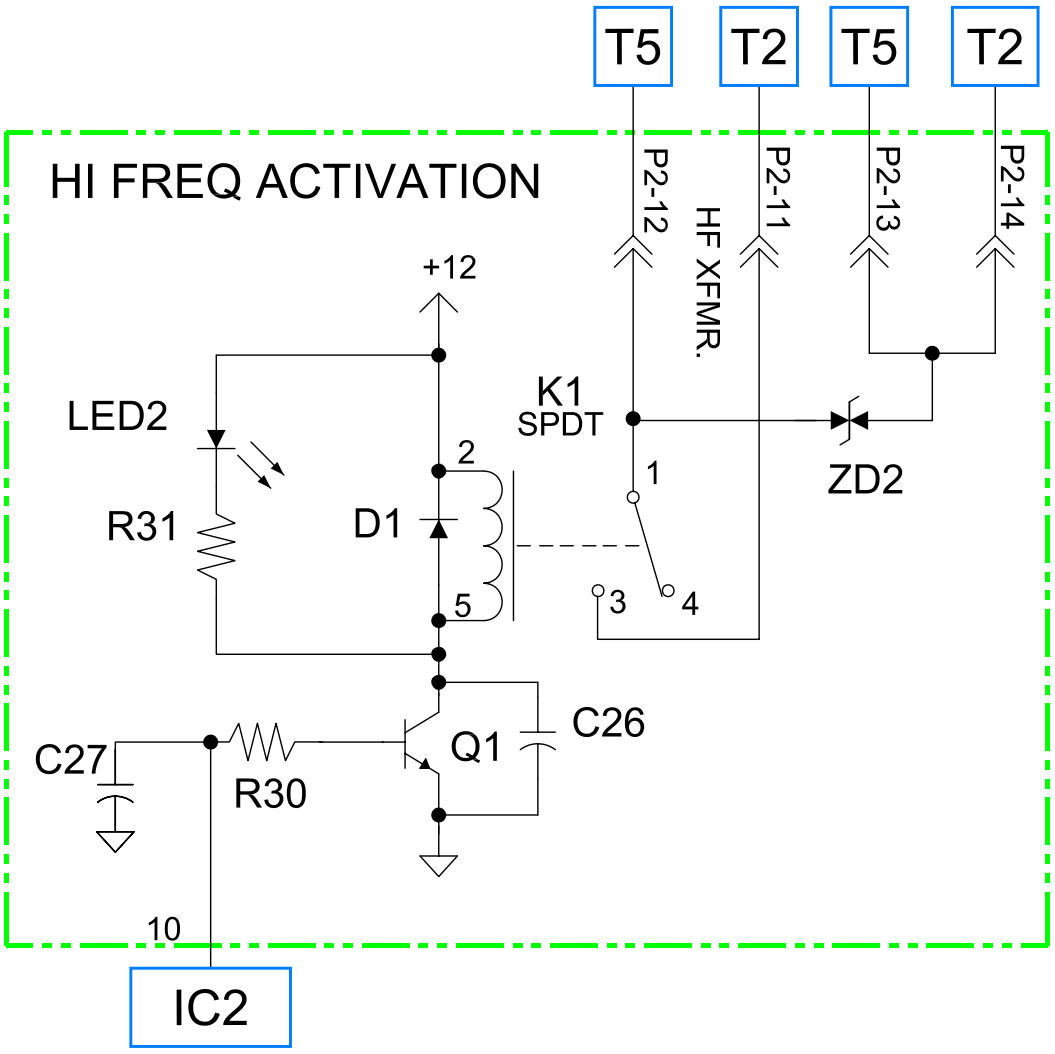
From the same unregulated reference point on the positive 12 and 15-volt bias supplies, the over voltage sense circuit is monitored. This involves the voltage being input on IC2 pin 17 where it is monitored and when it reaches 25VDC this will set the fault on IC2 pin 6 turning on Q5 and Q6. This turns on the under voltage/over voltage fault LED on the front panel. This shows on the front panel as a flashing light.

Lastly, IC2 monitors the state of the PCB itself and in the event of a major fault, it will initiate turning on the fault by setting IC2 pin 6 high and turning on Q5 and Q6. This turns on the under voltage/over voltage fault LED on the front panel. This shows on the front panel as a steady light.



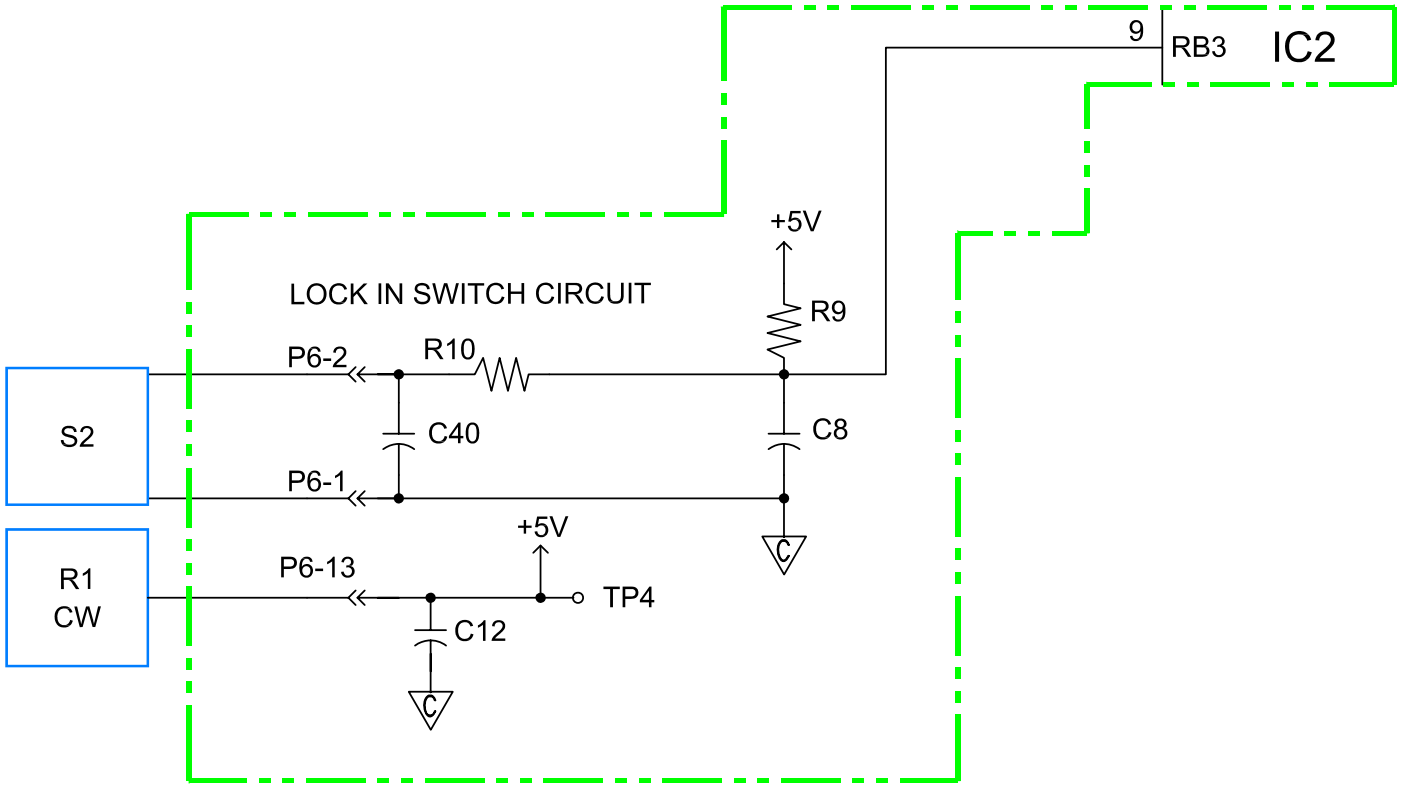
5.8.10 HF Activation

When the operator requests a cutting operation to begin, after the start voltage is acquired, the control board will energize the onboard K1 relay. This occurs when IC2 pin 10 biases transistor Q1 into conduction. This allows the relay K1 to close, sending 120VAC out of the PCB1 control board on P2-12 and P2 -13. This voltage is routed to the spark gap unit for HF generation.



5.8.11 Lock In Switch Circuit

When the Trigger lock switch on the front panel is engaged, this closes the lock in switch circuit on the PCB control board. This engages the logic that allows the PC650 to continuously fire without depressing the torch trigger constantly. The trigger lock switch is connected to the PCB control board via P6-1 and P6-2. This activates the logic on IC2 pin 9 which maintains a continuous arc on regardless of the torch switch input. The logic of the circuit is designed so that depressing the torch a second time will allow the arc to be discontinued.



5.9 Output Inductor L1 - (952606)

The Output Inductor L1 filters the ripple out of the output of the output rectifier D1 and couples the 300 VDC to the torch output on the PC650.

Testing:
With the device disconnected from the unit, the output inductor should read less than 1 Ohm of resistance.

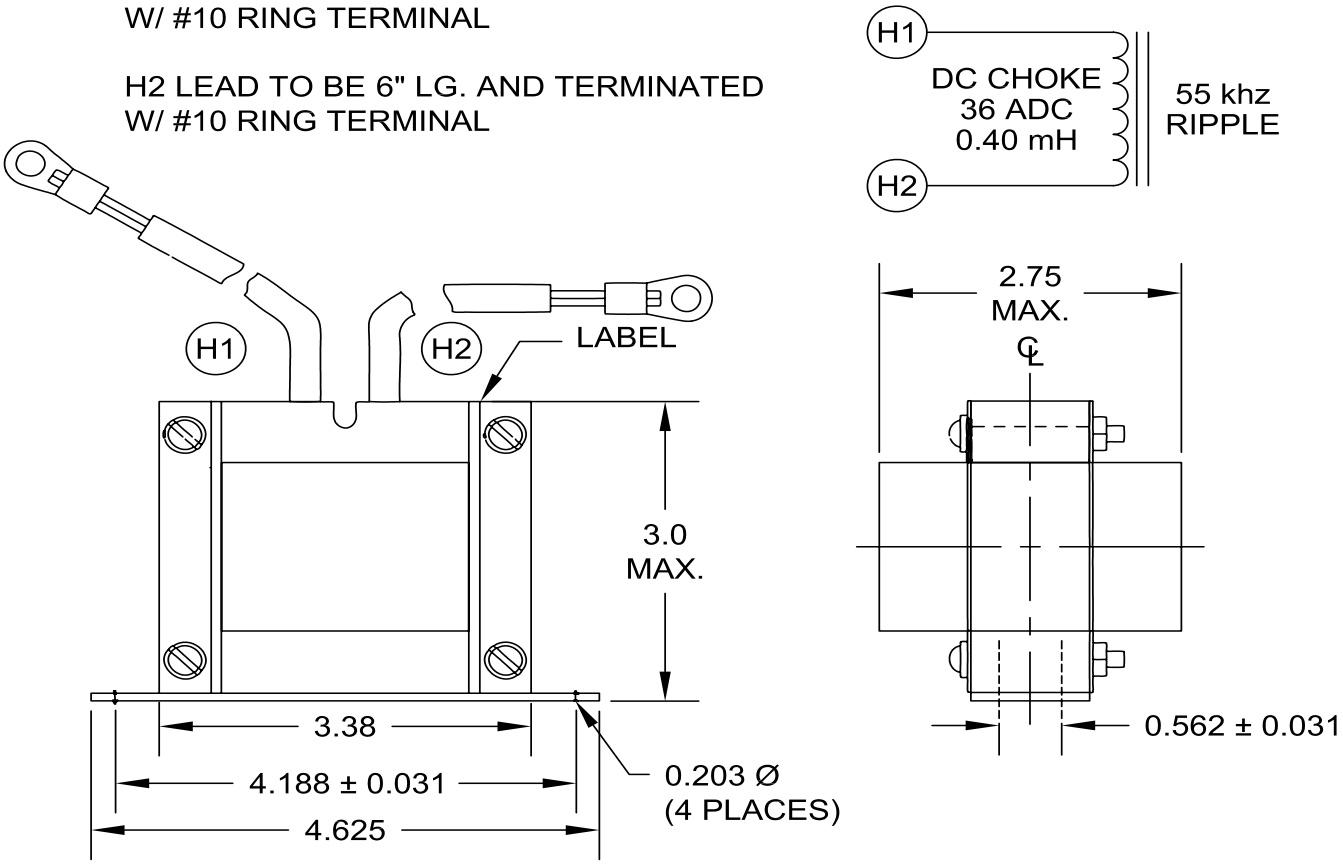
The Output Inductor L2 provides a final filter for any remaining AC ripple.

OHM READINGS:
H1 –H2 = < 1 Ohm
H1 –GROUND = Open

VOLTAGE TEST at 50 AMP LOAD:
H1 –H2 = < 5 VAC

NOTES:
H1 LEAD TO BE 13" LG. AND TERMINATED W/ #10 RING TERMINAL

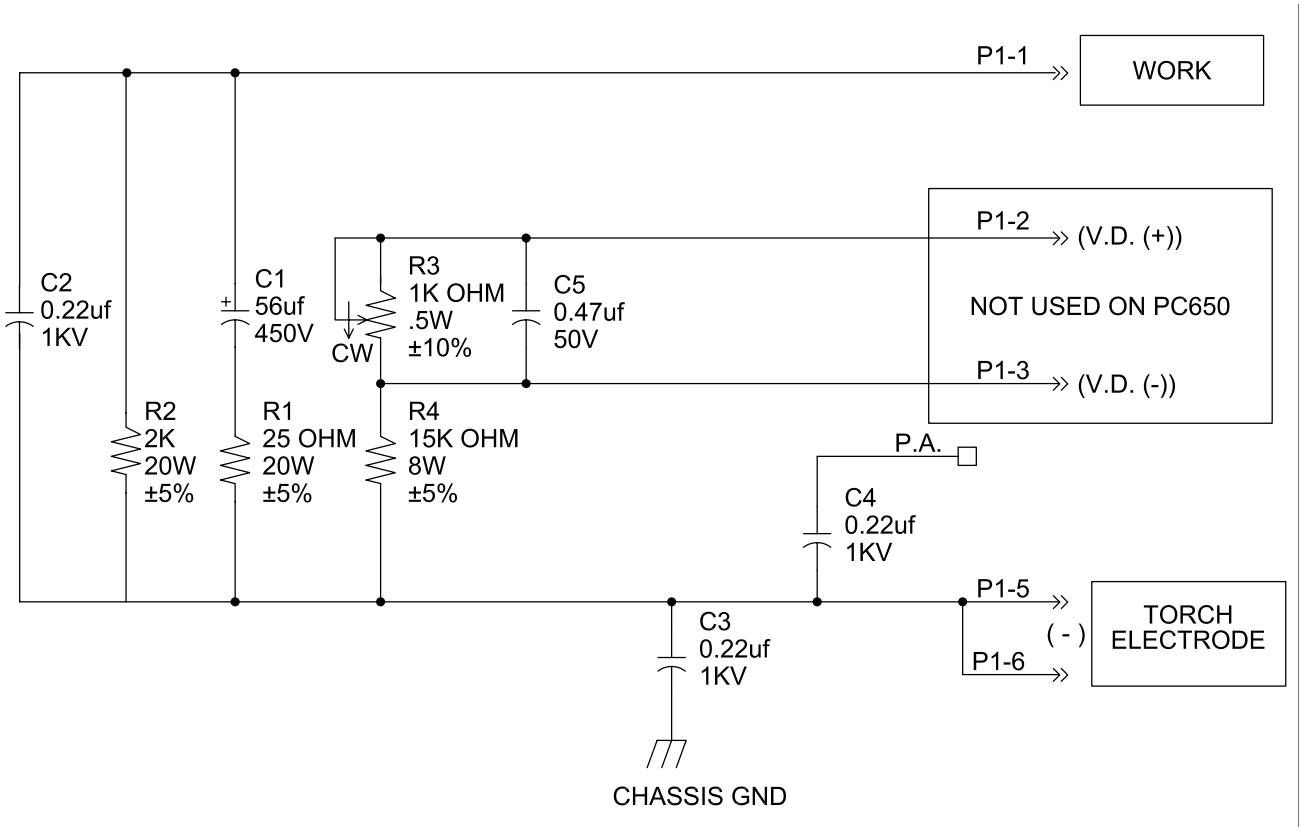
H2 LEAD TO BE 6" LG. AND TERMINATED W/ #10 RING TERMINAL

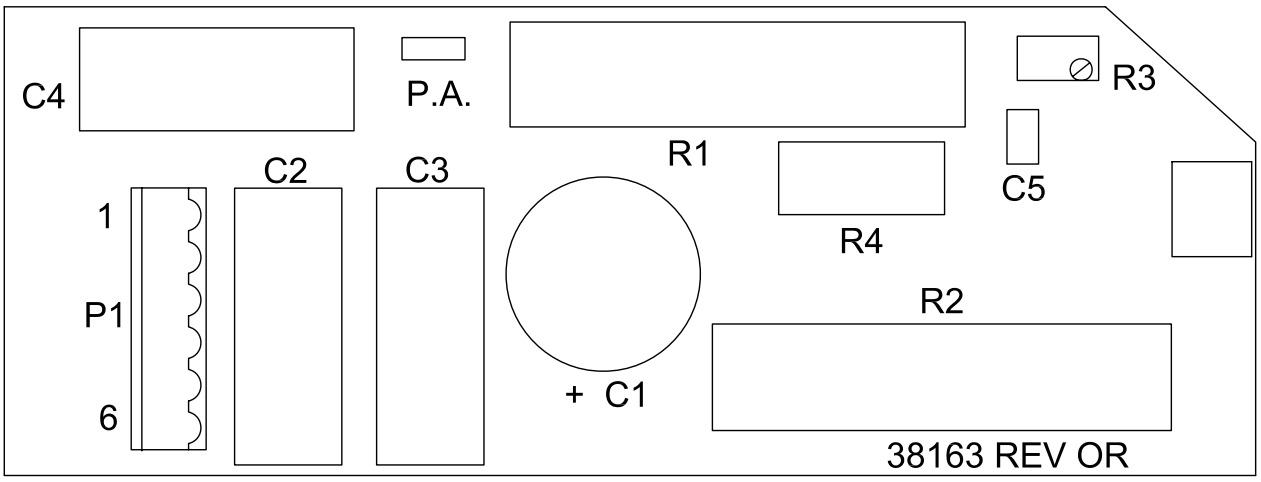


5.10 Startup Board PCB5 - (38131)

The startup board assists with the arc creation process. This board provides a current boost during main arc creation. Arc starting consists of C1and R1 providing increased starting performance. The C1/R1 circuit provides additional current to overcome the inductance of the output inductor at the start of the main arc.

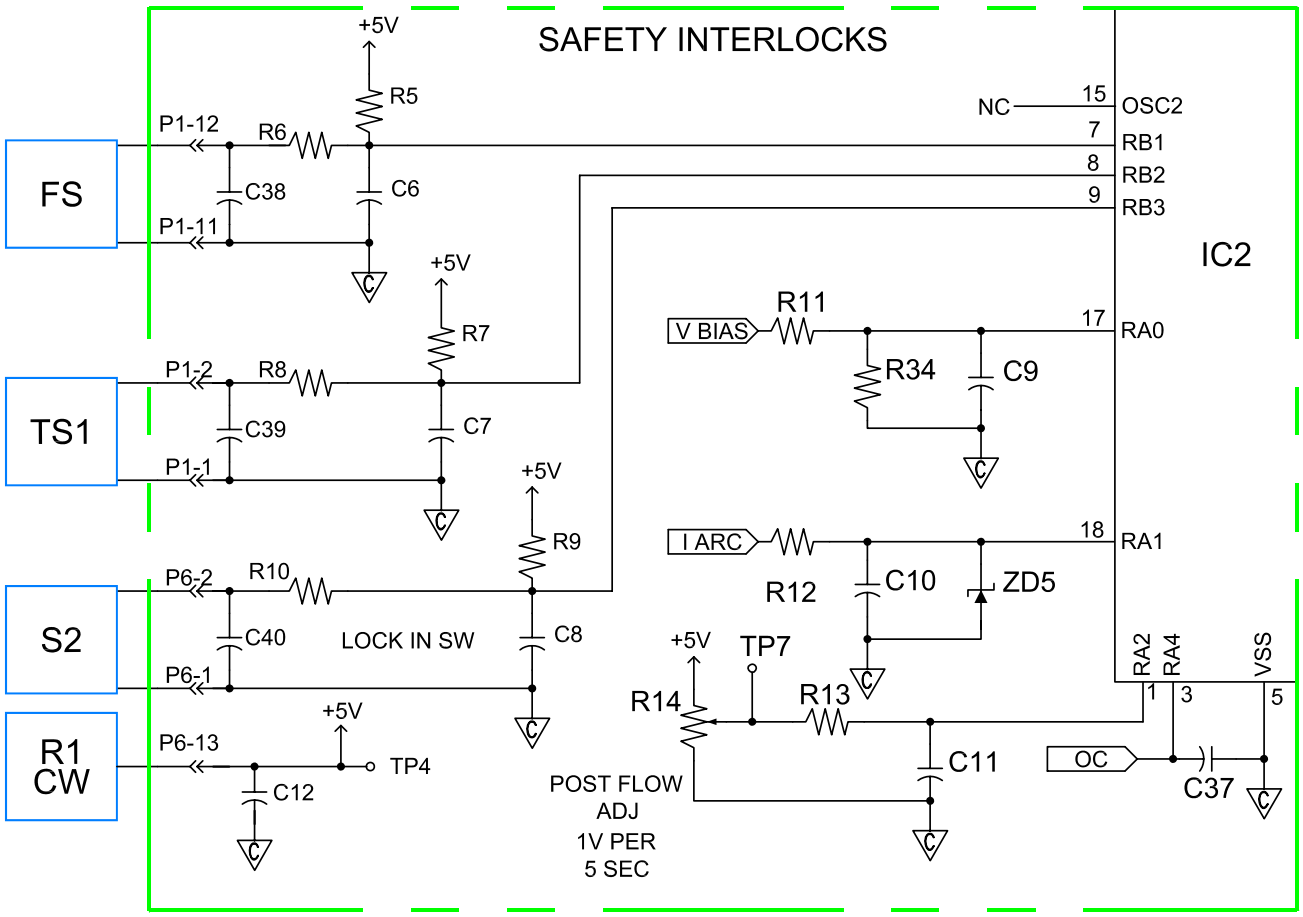
Testing: Using a capacitance checker to measure, the value of C1, C1 is 56µF capacitor. Using an ohmmeter to check the resistance, the value of R1 is equal to 25Ω.





5.11 Trigger Lock Switch S2

The Torch lock switch reduces operator fatigue by allowing the operator to start main arc by depressing the torch switch and then once the arc is created, allows the operator to release the trigger switch and continue cutting with the torch. To discontinue the arc the operator simply depresses the trigger switch and releases it.
This is governed by logic on the IC2 chip. The Switch is connected to PCB1 on pins P6-2 and P6-1. This connects to the trigger lock in switch circuitry on PCB1.



5.11.1 PC650 Fault Monitoring

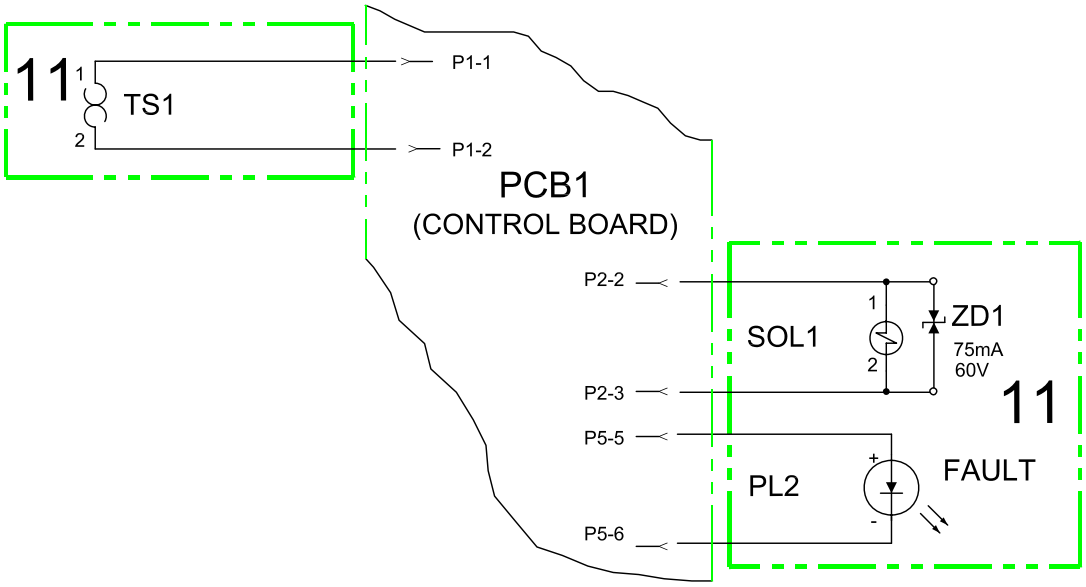
Over/Under voltage fault—Flashes 5 times per second.

Over voltage--This condition is the only one that will activate before the torch switch is closed. The PCB1 Control board has a voltage monitoring circuit and major fault logic built onto it. IC3 is a voltage comparator circuit, which monitors the unregulated voltage that feeds the positive 12 and 15 volt supplies. If the voltage dips below 11.8VDC IC3 sends an error signal to IC2 pin 4 and this signal sets the fault on IC2 pin 12 turning on Q5 and Q6. This turns on the under voltage/over voltage fault LED on the front panel. Under voltage-- From the same unregulated reference point on the positive 12 and 15-volt bias supplies, the over voltage sense circuit is monitored. This involves the voltage being input on IC2 pin 17 where it is monitored and when it reaches 25VDC this will set the fault on IC2 pin 12 turning on Q5 and Q6. This turns on the under voltage/over voltage fault LED on the front panel.

Thermal Fault—LED is "Mostly On" --This circuit is activated when an open thermal switch is present when the trigger switch is closed. The thermal switch fault will generate a flashing light on the fault light on the front panel. This light is described as mostly on. Mostly on is when the LED is on for 9/10 of a second and off for 1/10.

Flow Fault—LED is Mostly Off-- This circuit is activated when an open flow switch is present when the trigger switch is closed. The Flow switch will generate a flashing light on the fault light on the front panel. This light is described as mostly off. Mostly off is when the LED is off for 9/10 of a second and on for 1/10.

Over Current Fault—LED is on solid
Lastly, PCB1 monitors the current in the main transformer (T1) primary, in the event of a major fault, current in the primary will increase and at 100 amps a 1-volt AC signal is generated and supplied to pins, P1-7 and P1-8. This voltage is rectified and fed to IC3 where a "Limit" signal is created and transferred to IC2. IC2 will create an over current fault and will turn on the fault by setting IC2 pin 12 high and turning on Q5 and Q6. This turns on the under voltage/over voltage fault LED on the front panel. This shows on the front panel as a steady light.



5.11.2 Fault Light

On the front panel of the PC65
0 is the fault light. This is a visual indication of problems with the unit. The fault light will flash an error code for the user to translate. The fault codes are as follows:

In the event that the PCB control board has a voltage problem on the board, this turns on the under voltage/over voltage fault on the front panel. This shows on the front panel as an evenly flashing light meaning the light is on and off for equal durations, flashing 5 times per second.

The thermal switch fault will generate an error on the fault light of the front panel. This light is described as mostly on – meaning it is on for 9/10th of a second off for 1/10th.

The Flow switch will generate an error on the fault light of the front panel. This light is described as mostly off – meaning it is off for 9/10th of a second on for 1/10th.

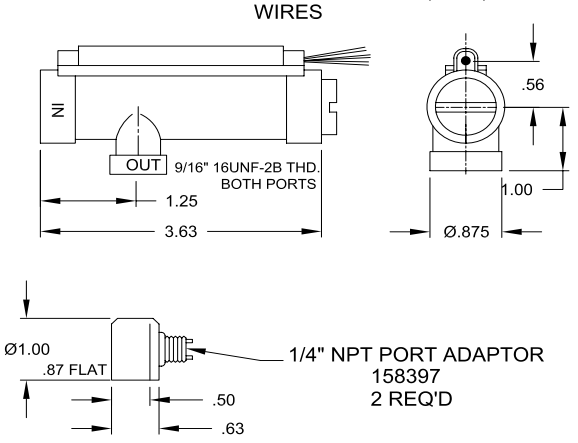
In the event of a major fault – referred to as a current fault, the fault is shown as a steadily illuminated fault light on the front panel of the PC650.

5.11.3 Flow Switch (951202)

The Flow switch FS detects the presence of airflow in the unit. When there is air flowing to the torch in the unit, the switch closes and allows the unit to operate. Should there be a loss of airflow through the unit, the switch opens and main arc ceases.
The flow switch is connected to the PCB control board on P1-11 and P1-12, and detects any gas flow over 2.5 SCFM. Any flow less than that and the switch will open.

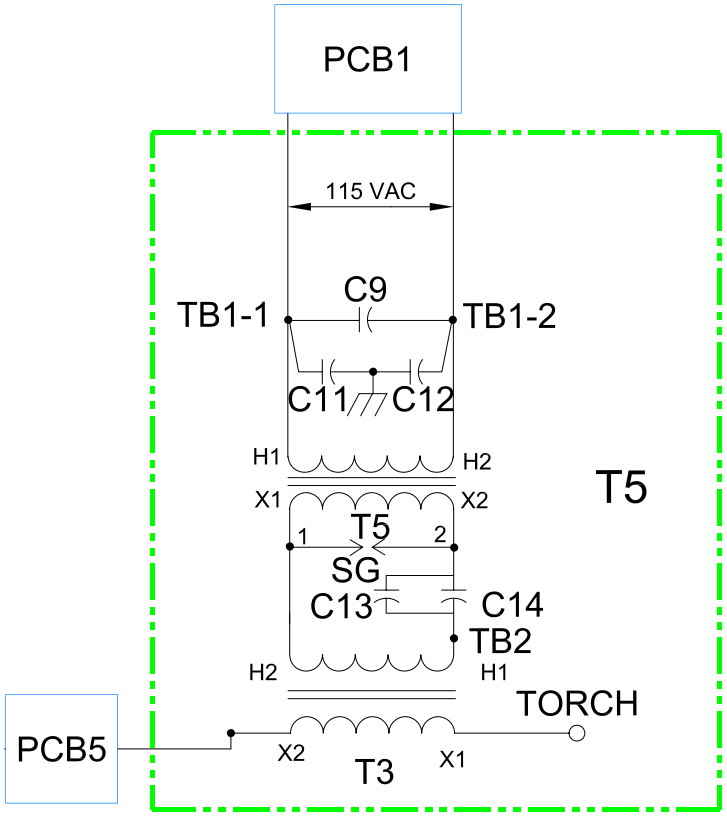
DESCRIPTION
FLOW SWITCH: FS-4 SERIES MOLDED PLASTIC CONSTRUCTION
FLOW RATE SETTINGS: 2.5 SCFM AIR @ 50 PSIG

SPECIFICATIONS:
OPERATING PRESSURE, MAXIMUM: 250 PSIG @ 70°F
OPERATING TEMPERATURE: 0°F to 225°F (-17°C to +107°C)
SET POINT ACCURACY: ±25% MAX AIR INLET DOWN
SET POINT DIFFERENTIAL (HYSTERESIS): 20% MAXIMUM
SWITCH: SPST 20 VA @ 120 VAC
INLET/OUTLET PORTS: 9/16"-18 UNF-2B THREAD
ELECTRICAL TERMINATION: NO. 18 AWG, 24"L, POLYMERIC LEAD WIRES



5.12 High Frequency (951179)

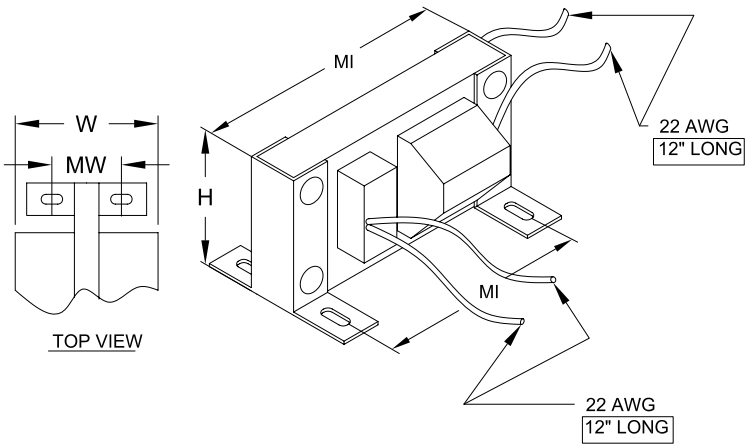
When the PCB control board enables the 120VAC for HF activation from relay K1, the 120VAC is routed to the high voltage transformer T5. This transformer steps up the 120VAC to 3500 VAC and passes it to the Spark gap generator. This feeds a continuous HF signal to the torch at roughly 1.5 MHz.



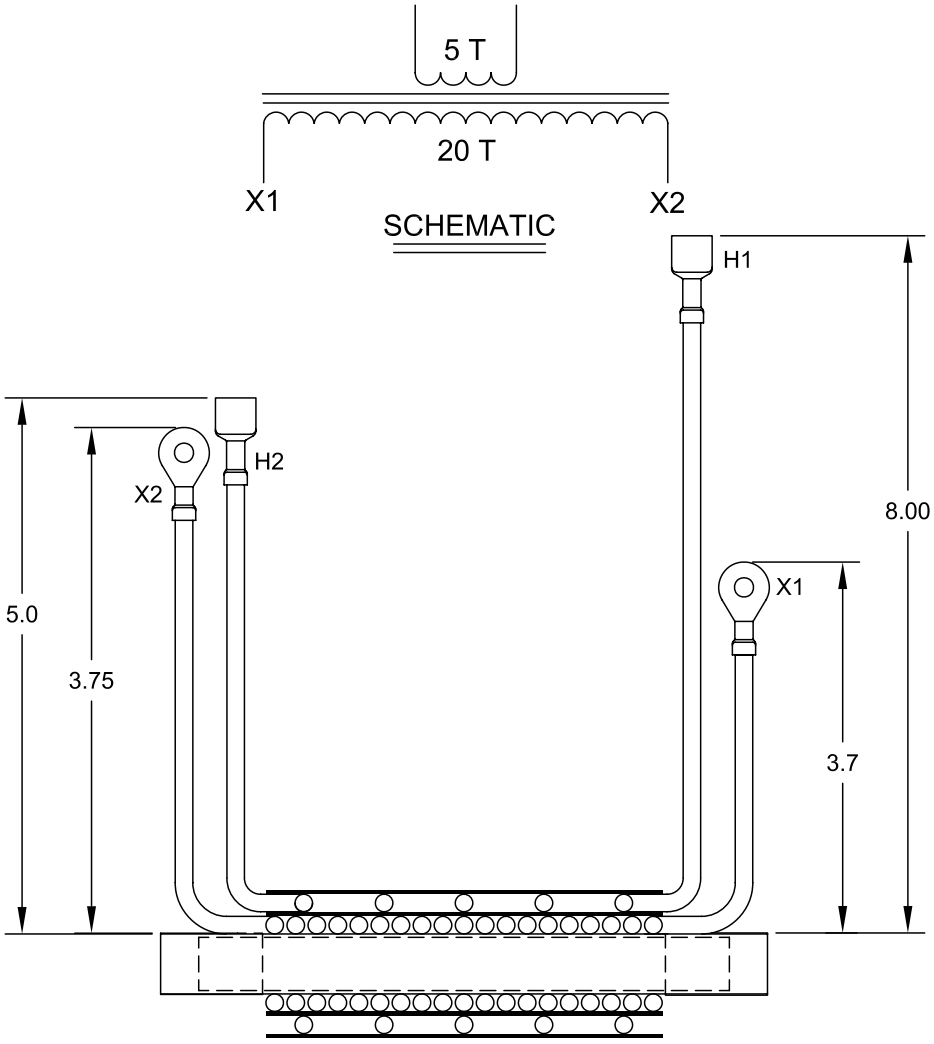
DESCRIPTION

HIGH VOLTAGE TRANSFORMER

			DIMENSIONS				
PART NUMBER	OUTPUT VOLTAGE	CURRENT MA	LENGTH L	HEIGHT H	WIDTH W	MOUNTING	
						MW	MI
FG-3424	3500	8	3.812	3.000	1.930	1.625	3.312



5.12.1 T3 High Frequency Transformer



TEST VALUES: (ALL MEASUREMENTS ARE MADE AT 1.0 KC/S)

PRIMARY INDUCTANCE: 2 uH ± 0.5 uH / 0.5 uH MEASURED AT 1.0 KHz

SECONDARY INDUCTANCE: 27 uH I3uH MEASURED AT 1.0 KHz

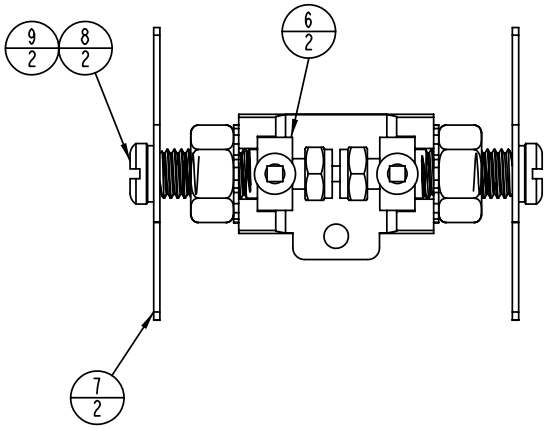
PRIMARY LEAKAGE INDUCTANCE: 0.5 uH MAX MEASURED AT 1KHz
(MEASURED WITH SEC. SHORTED)

SECONDARY LEAKAGE INDUCTANCE:15 uH MAX MEASURED AT 1KHz
(MEASURED WITH PRIMARY SHORTED)

PRIMARY/SECONDARY CAPACITANCE: 20 pf ± 5 pf

5.12.2 Spark Gap (0558001180)

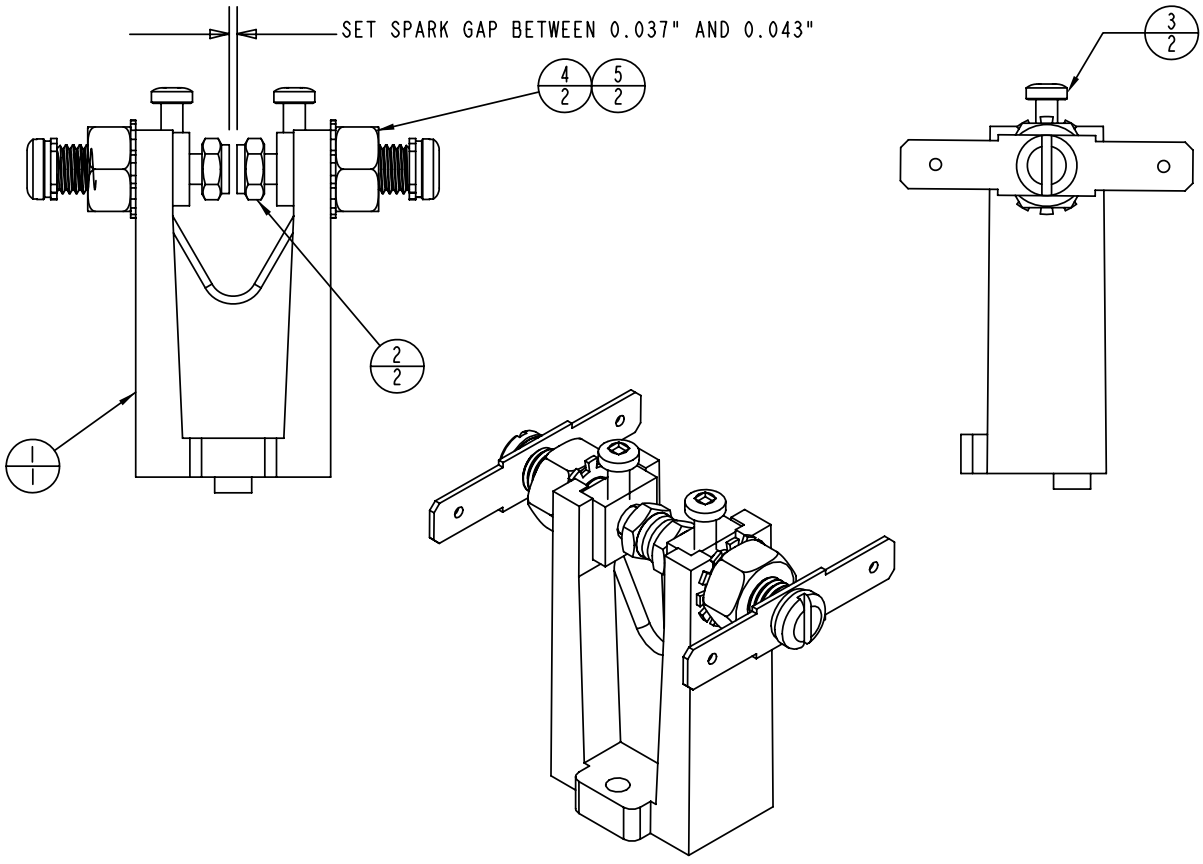
The spark gap unit generates the HF necessary to create main arc in the PC650.
The unit receives 115 VAC from PCB1 control board via relay K1. This voltage is stepped up to 3500 volts AC by transformer T5 in the spark gap unit. The interaction of components T5, C13 and C14 form a tuned circuit that creates a High Frequency of roughly 1.5 MHz. This is coupled to the torch on T3 and when the operator brings the torch in contact with the work piece, main arc is established.



BILL OF MATERIALS

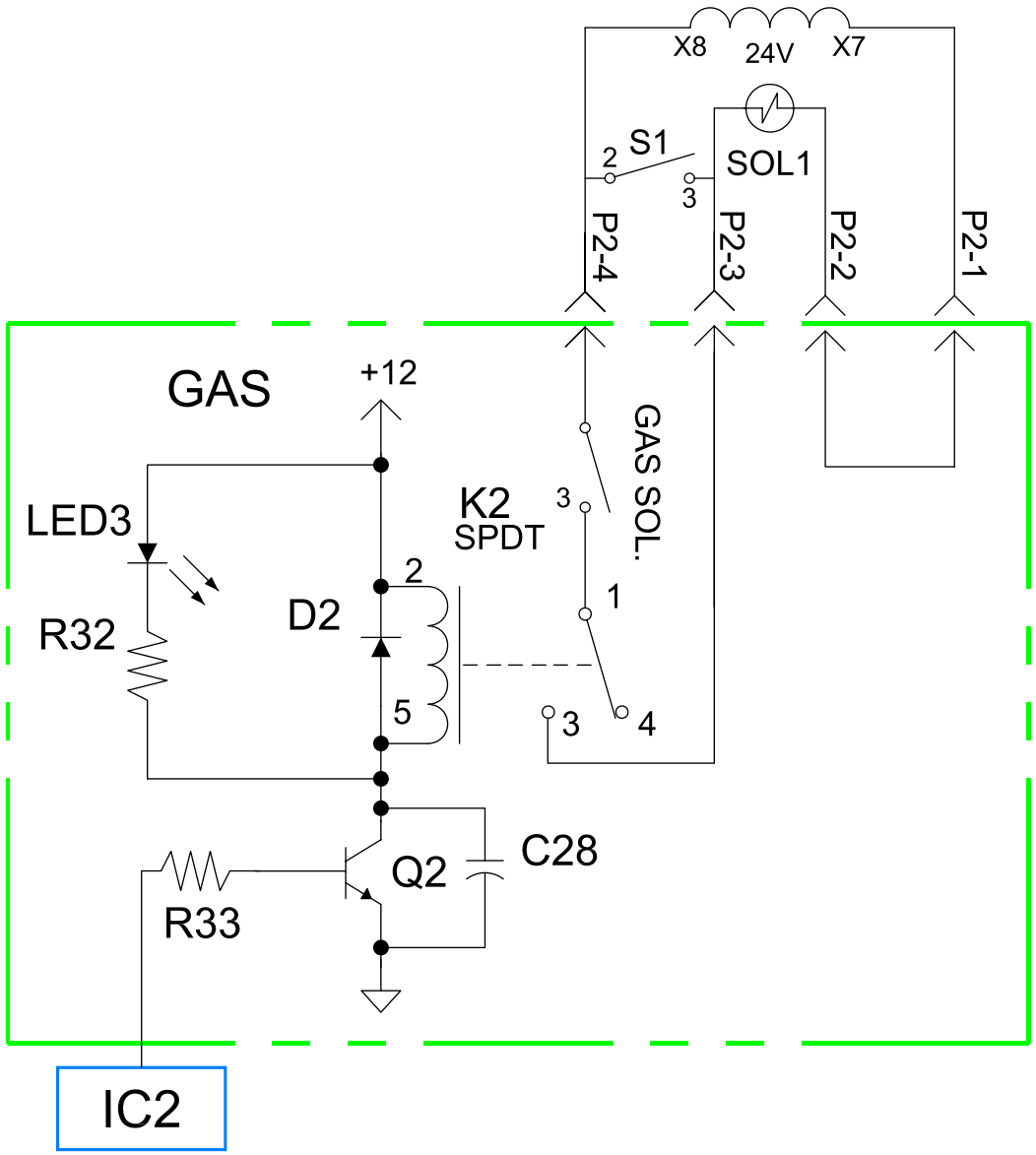
QUANTITIES ARE IN U/M ESTABLISHED BY INVENTORY

SYMBOL	ITEM NO.	PART OR CODE NO.	QTY.	DESCRIPTION
	1	37997	1	HOLDER, SPARK GAP
	2	837999	2	SCREW ASSY, CONTACT
	3	61325824	2	SCREW PHTF #4-40 X .25
	4	63109101	2	NUT HEX BRASS 1/4-28
	5	64307996	2	WASHER LOCK EXT TOOTH 1/4
	6	0558001196	2	HOLDER, CONTACT
	7	0558001459	2	TAB QUICK DISCONNECT STRAIGHT
	8	04S04006	2	SCREW PH M4-0.7 X 6
	9	04W10041	2	WASHER LOCK M4



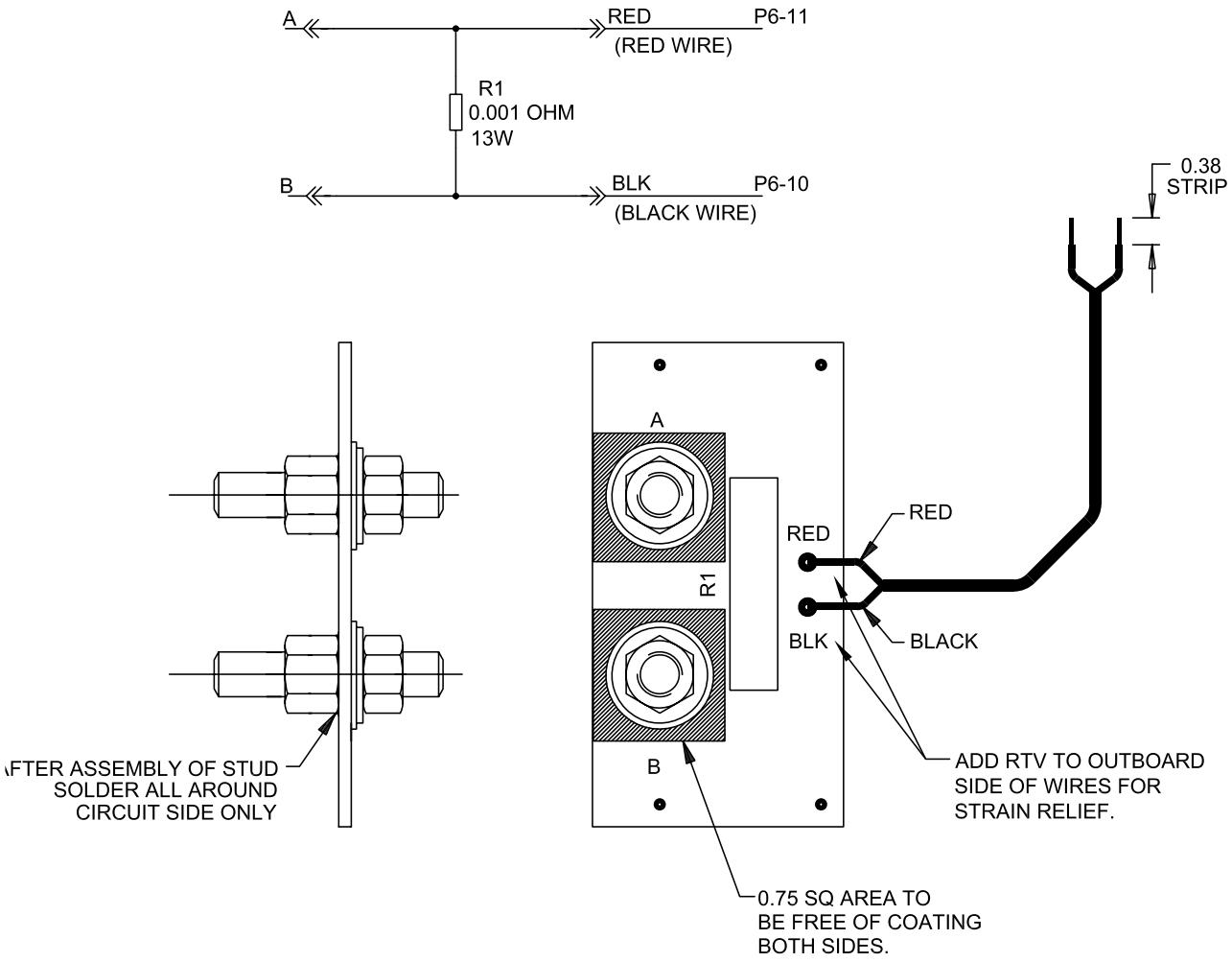
5.12.3 Air Test Switch

The Air test switch (S1) bypasses the flow switch and opens the gas test solenoid to test integrity of the gas flow circuit. In the test position, the switch couples the 24VAC from transformer T2 to the gas solenoid, bypassing the PCB relay and the flow switch.



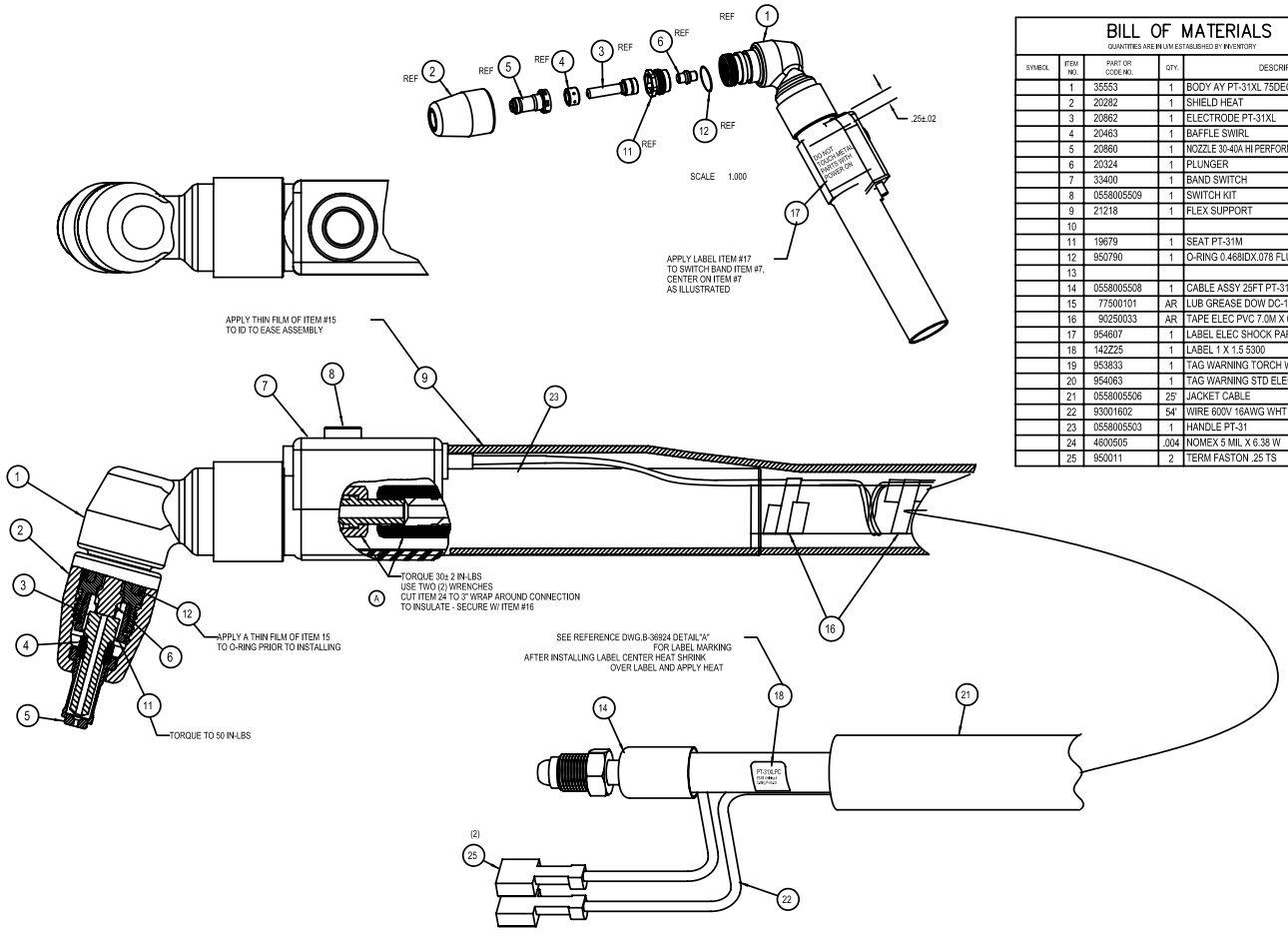
5.13 Shunt (31488)

The Feedback shunt consists of a .001Ω resistor that feeds back a 0 – 100 mV signal to the PCB control module on P6-10 & P6-11. This voltage is input to the shunt amplifier on IC4 and a positive voltage is output to the error amp section of IC5 pin 9. This is compared to the reference signal entering the circuit on Pin 6 of IC5. The negative output of this op amp, on pin 7, is sent to Pin 9 of IC5 where they are summed. Any voltage difference here results in an error signal being generated from pin 8 of IC 5 and sent to the PWM chip, IC 6 on pin 2. This will increase or decrease the Duty cycle of the PC650 accordingly until the current level is corrected.



5.14 PT31 Torch (0558003183)

The PC650 uses the PT-31XLPC torch. It comes ready to use out of the box and can cut material 5/8" inch and server ¾" material.
Constructed of glass-reinforced phenolic, it is a rugged lightweight torch for general-purpose cutting.
The torch must come in contact with the material to draw an arc.



BILL OF MATERIALS
QUANTITIES ARE IN U/M ESTABLISHED BY INVENTORY

SYMBOL	ITEM NO.	PART OR CODE NO.	QTY.	DESCRIPTION
	1	35553	1	BODY AY PT-31XL 75DEG
	2	20282	1	SHIELD HEAT
	3	20862	1	ELECTRODE PT-31XL
	4	20463	1	BAFFLE SWIRL
	5	20860	1	NOZZLE 30-40A HI PERFORMANCE PT-31XL
	6	20324	1	PLUNGER
	7	33400	1	BAND SWITCH
	8	0558005509	1	SWITCH KIT
	9	21218	1	FLEX SUPPORT
	10			
	11	19679	1	SEAT PT-31M
	12	950790	1	O-RING 0.468IDX.078 FLUOR 75A
	13			
	14	0558005508	1	CABLE ASSY 25FT PT-31XLPC
	15	77500101	AR	LUB GREASE DOW DC-111 5.3 OZ
	16	90250033	AR	TAPE ELEC PVC 7.0M X 0.75
	17	954607	1	LABEL ELEC SHOCK PART IN PLACE
	18	142Z25	1	LABEL 1 X 1.5 5300
	19	953833	1	TAG WARNING TORCH W/PROPER PS.
	20	954063	1	TAG WARNING STD ELECTRIC
	21	0558005506	25'	JACKET CABLE
	22	93001602	.54'	WIRE 600V 16AWG WHT
	23	0558005503	1	HANDLE PT-31
	24	4600505	.004	NOMEX 5 MIL X 6.38 W
	25	950011	2	TERM FASTON .25 TS

6.0 Maintenance

6.0 IGBT Testing

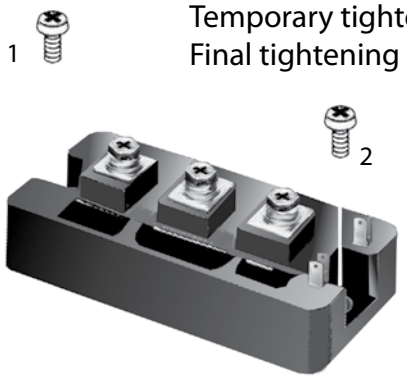
IGBT Handling & Replacement
Since IGBT gates are insulated from any other conducting region, care should be taken to prevent static build up, which could possibly damage gate oxides. All IGBT modules are shipped from the factory with conductive foam contacting the gate and emitter sense pins. Always ground parts touching gate pins during installation. In general, standard ESD precautions application to FETs should be followed.

Other handling precautions that should also be observed are as follows:
- Use grounded work station with grounded floors and grounded wrist straps when handling devices.
- Use a 100Ω resistor in series with the gate when performing curve tracer tests.
- Never install devices into systems with power connected to the system.
- Use soldering irons with grounded tips when soldering to gate terminals.

When mounting IGBT modules on a heatsink, certain precautions should be taken to prevent any damage against a sudden torque. If a sudden torque ("one-sided tightening") is applied at only one mounting terminal the ceramic insulation plate or silicon chip inside the module may get damaged. The mounting screws are to be fastened in the order shown in figure below. Also, care must be taken to achieve maximum contact (i.e. minimum contact thermal resistance) for the best heat dissipation. Application of a thermal pad on the contact surface improves its thermal conductivity. See Replacement Parts section for the required pad.

If an IGBT has failed, BOTH IGBTs must be replaced. Failure of either transistor always subjects the rectifier bridge to a high current surge, which substantially shortens its life. The rectifier bridge should be replaced if the transistors have failed.

Two-Point Mounting Type
Temporary tightening = 1 then 2
Final tightening = 2 then 1



Completely clean mating surfaces and apply thermal conducting paste / tape.

NOTE:
Small amounts of dirt between mating surfaces can cause component failure or degraded performance; DO NOT use silicon seal or other adhesives in place of thermal paste.

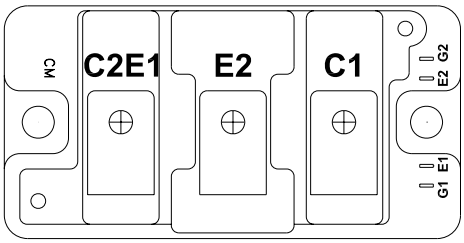
Torque

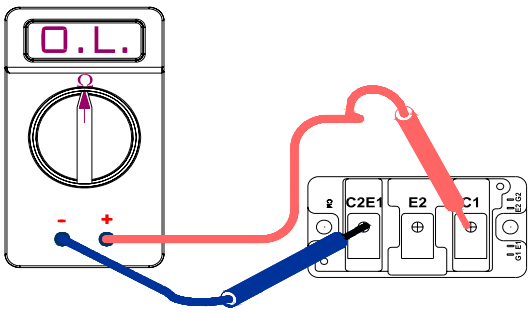
Mounting .....26 in-lb
Electrical Connection .....19 in-lb

6.1 Buss Supply Power Control / IGBT Testing Procedure (1)

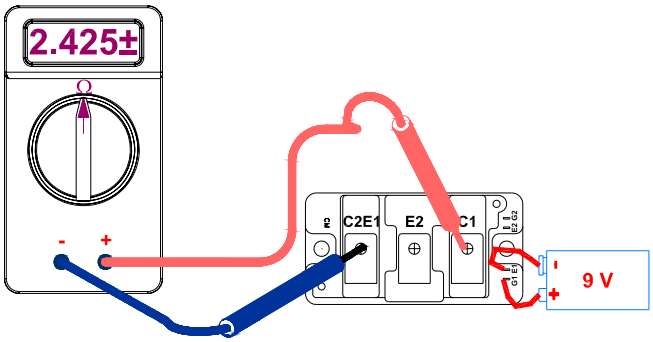
IGBT Testing

Take measurements on threaded part below insulated chrome plated spacer.

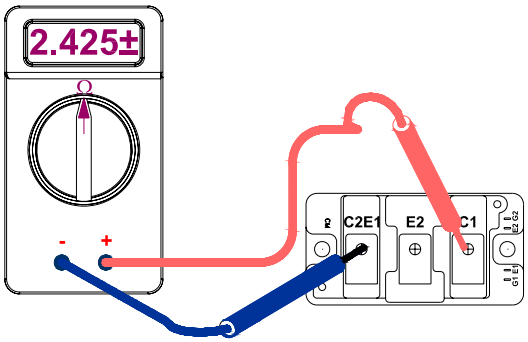




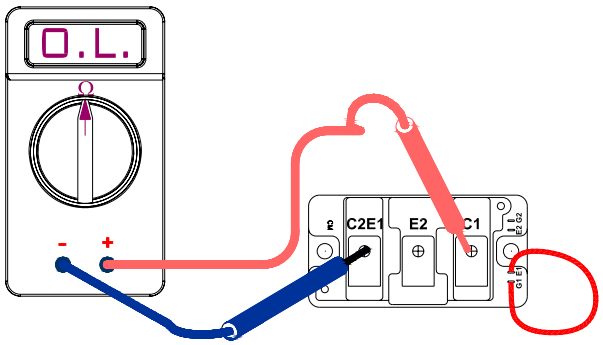
With meter on "OHMS (Ω)" setting, measure resistance by placing the red (+) lead on the Collector (C2 E1) and the black (-) lead on the Emitter (C1) of the IGBT.



Connect a 9 VDC battery with the negative on the Emitter (E1) and the positive on the Gate (G1). The meter should register a low reading.



The Gate should remain on once it has activated.

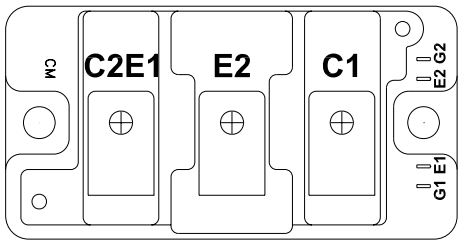


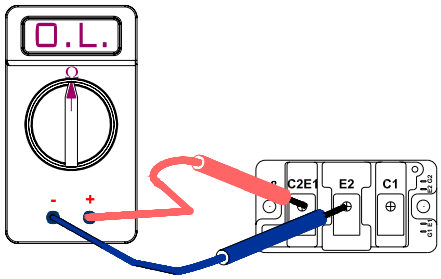
Short the Emitter / Gate (G1-E1) leads to turn the IGBT off.

6.1 Buss Supply Power Control / IGBT Testing Procedure (2)

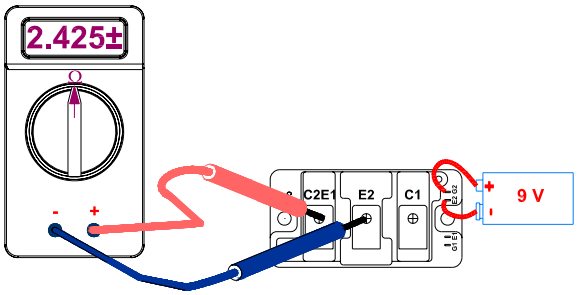
IGBT Testing

Take measurements on threaded part below insulated chrome plated spacer.

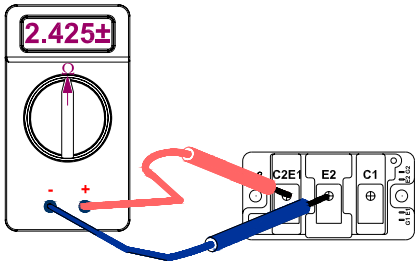




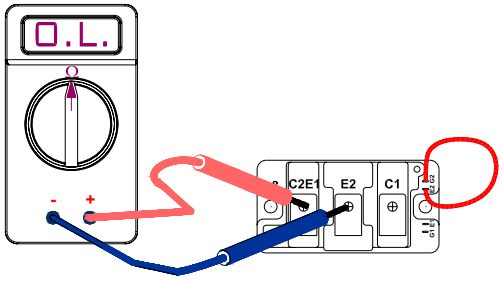
With meter on "OHMS (Ω)" setting, measure resistance by placing the red (+) lead on the Collector (C2 E1) and the black (-) lead on the Emitter (E2) of the IGBT.



Connect a 9 VDC battery with the negative on the Emitter (E2) and the positive on the Gate (G2). The meter should register a low reading.



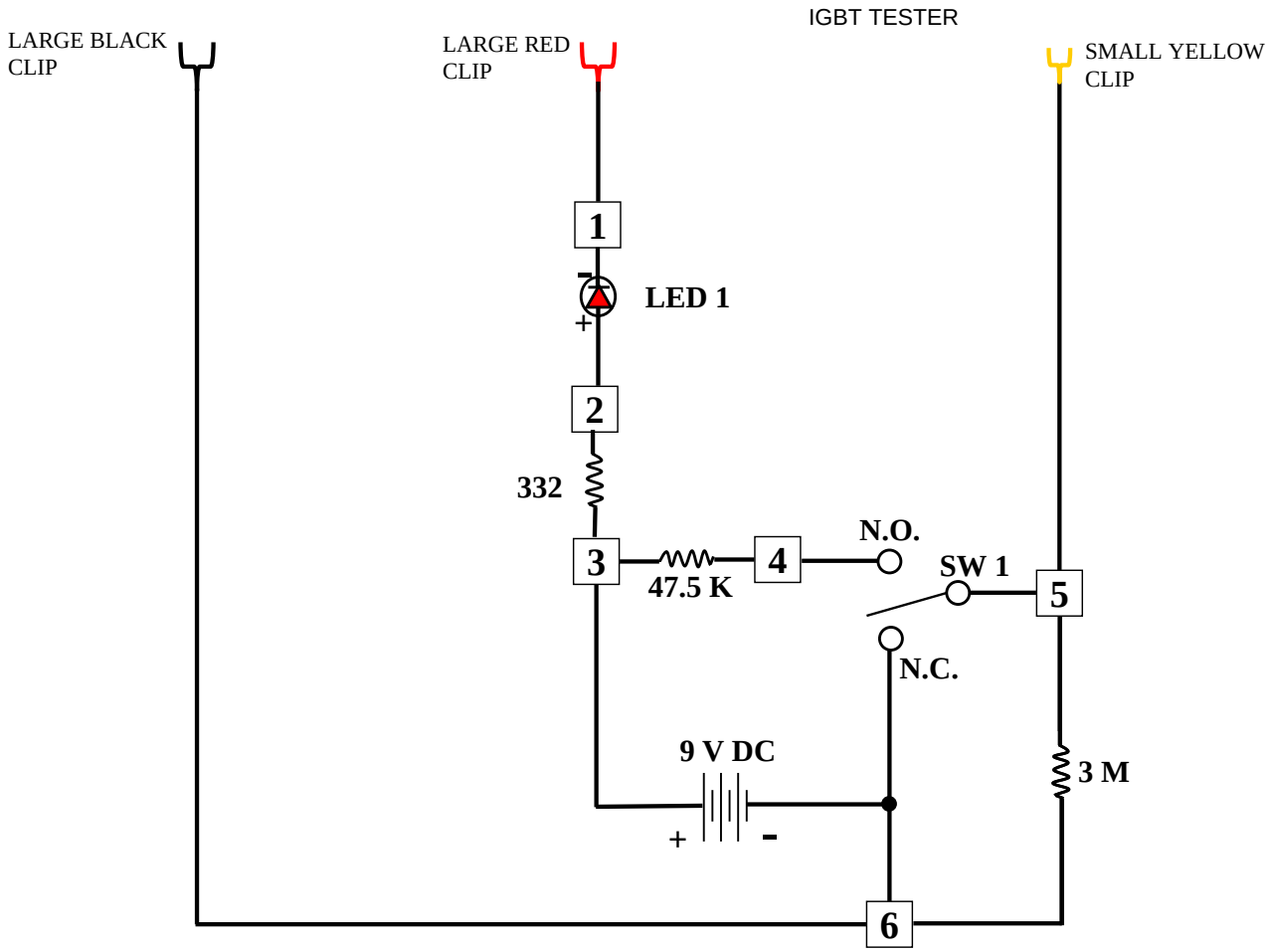
The Gate should remain on once it has activated.



Short the Emitter / Gate (G2-E2) leads to turn the IGBT off.

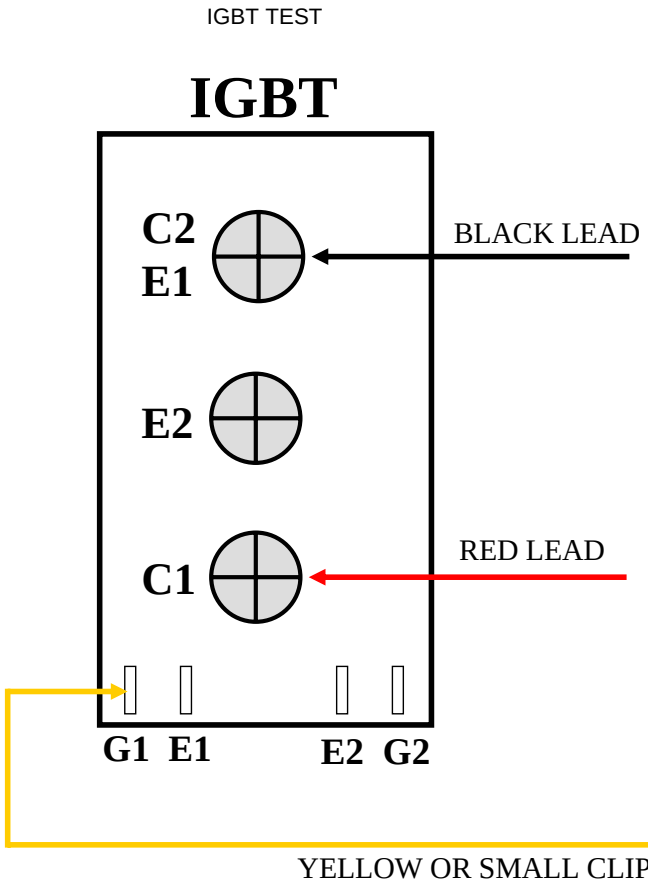
6.2 Buss Supply Power Control / IGBT Tester Schematic

IGBT Tester Schematic



6.3 Buss Supply Power Control / IGBT / MOSFET Testing

IGBT Tester

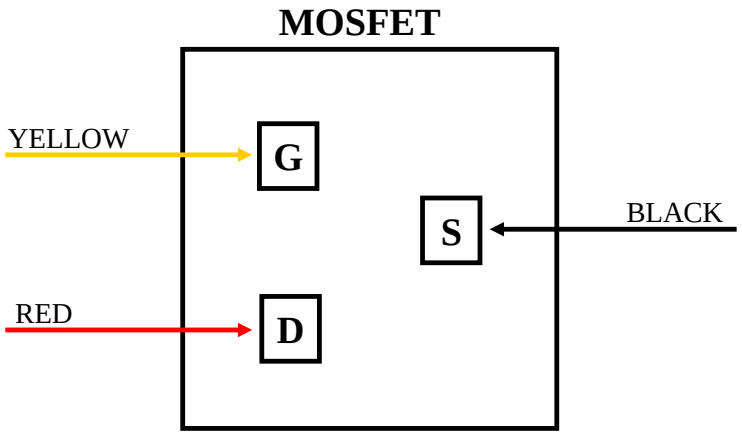


1. Connect as shown
2. Led On = Shorted Junction, Replace Part
3. Press Push-button Switch:
   Led On = Good
   Led Off = Bad Or Open, Replace Part

** Repeat steps for E2, C2 and G2

NOTE:
Black lead always on emitter
Red lead always on collector
Yellow on gate connections

G1 = GATE 1
G2 = GATE 2
E1 = EMITTER 1
E2 = EMITTER 2
C1 = COLLECTOR 1
C2 = COLLECTOR 2



1. Connect as shown
2. Led On = Shorted Junction, Replace Part
3. Press Push-button Switch:
   Led On = Good
   Led Off = Bad Or Open, Replace Part

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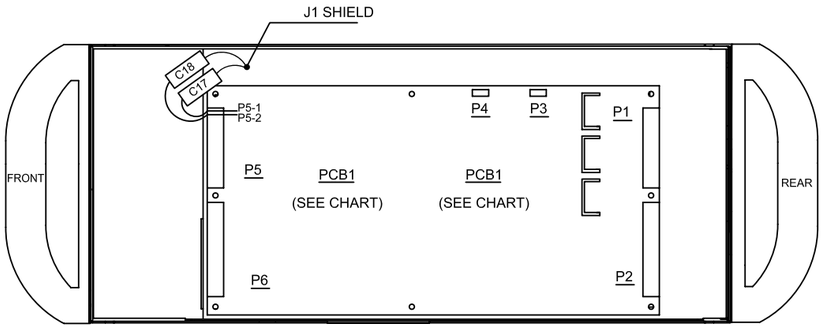
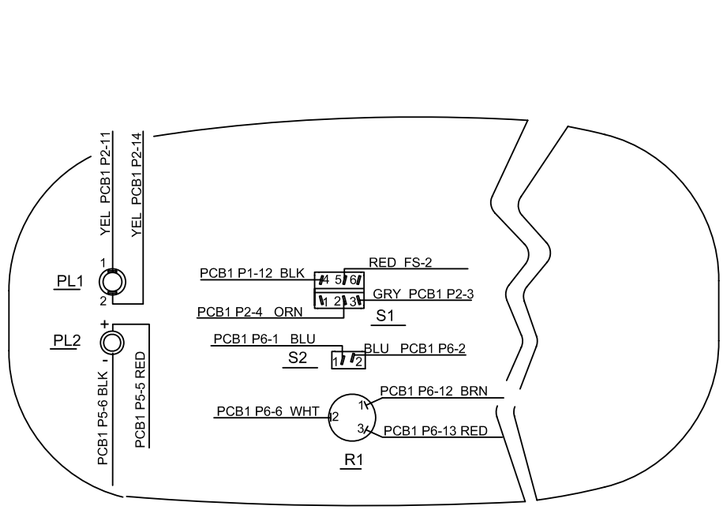
SECTION 6 WIRING DIAGRAMS

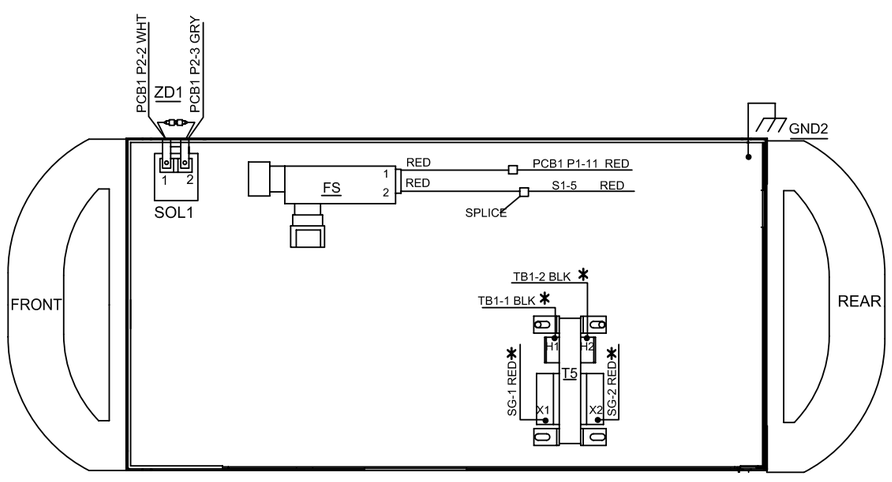
6.4 208/230 V Wiring Diagram (0558003179)

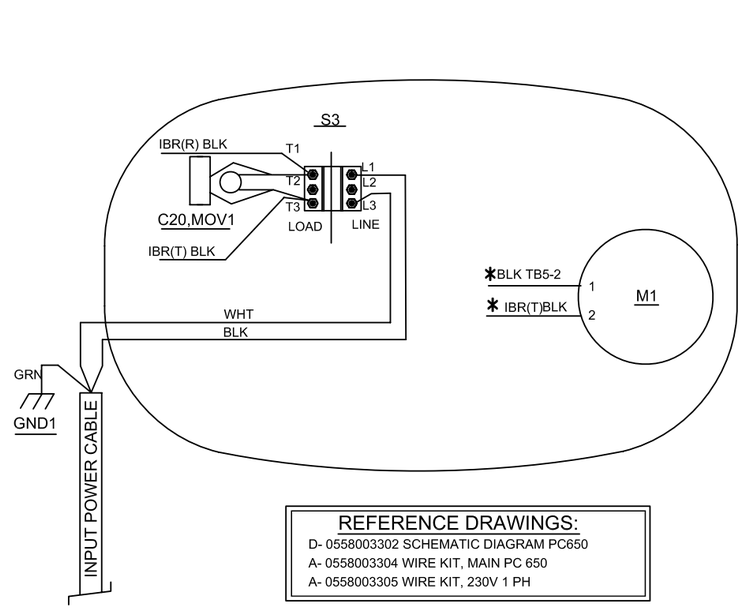


DETAIL "A" (PCB1)

P1			P2			P5			P6		
1	TS1-1	VIO	1	T2-X7	ORN	1	J1-1	CLR (TP)	1	S2-1	BLU
2	TS1-2	VIO	2	SOL1-1	WHT	2	J1-2	BLK (TP)	2	S2-2	BLU
3	T2-X9	BRN	3	SOL1-2	GRY	3	T2-X1	YEL	3	——	——
4	T2-X10	BRN	3	S1-3	GRY	4	T2-X2	YEL			
5	T2-X5	BLU	4	T2-X8	ORN	5	PL2-(+)	RED	4	——	——
6	T2-X6	BLU	4	S1-2	ORN	6	PL2-(-)	BLK			
7	T4-1	ORN	5	——	——				5	——	——
8	T4-2	ORN	6	——	——	7	——	——	6	R1-2	WHT
9	T2-X3	WHT	7	IBR-G	YEL	8	——	——	7	——	——
10	T2-X4	WHT	8	IBR(+)	BRN	9	——	——	8	——	——
11	FS-1	RED	9	——	——	10	PCB1 P5-11	WHT	8	——	——
12	S1-4	BLK	10	——	——	11	PCB1 P5-10	WHT	9	——	——
			11	T2-X11	VIO	12	——	——	10	PCB4-3	BLK (TP)
			11	PL1-1	YEL				11	PCB4-4	RED (TP)
			12	TB1-1	BLU				12	R1-1	BRN
			12						13	R1-3	RED
			13	TB1-2	BLU				14	——	——
			13								
			14	PL1-2	YEL						
			14	T2-X12	VIO						







NOTES:
1- ✱DENOTES SELF LEADS.

REFERENCE DRAWINGS:
D- 0558003302 SCHEMATIC DIAGRAM PC650
A- 0558003304 WIRE KIT, MAIN PC 650
A- 0558003305 WIRE KIT, 230V 1 PH

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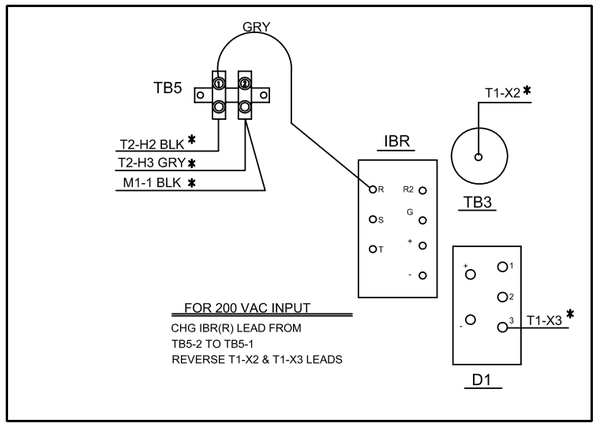
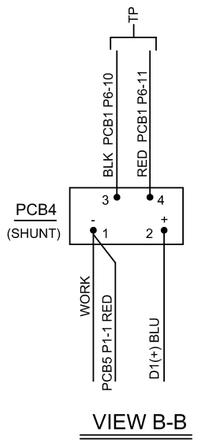
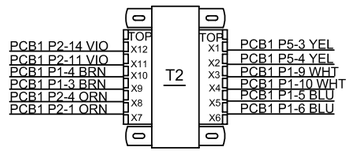
SECTION 6 WIRING DIAGRAMS

6.4 208/230 V Wiring Diagram (0558003179)



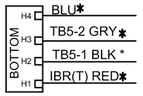


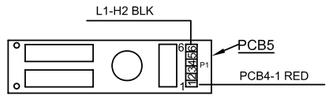
VIEW B-B



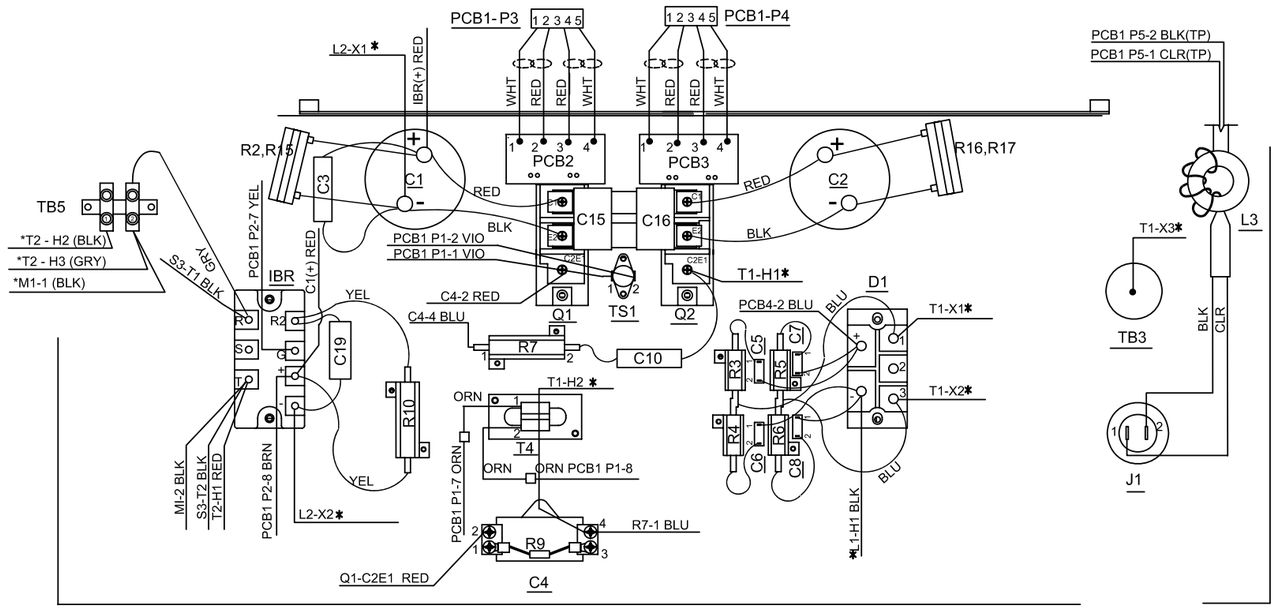
VIEW C-C

TOP AND BOTTOM

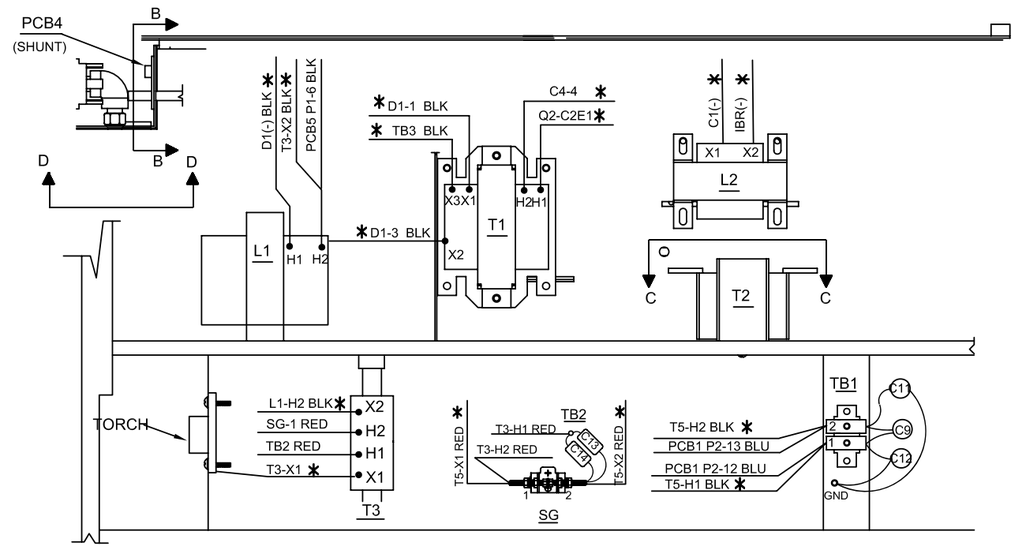




VIEW D-D



LEFT SIDE VIEW



RIGHT SIDE VIEW

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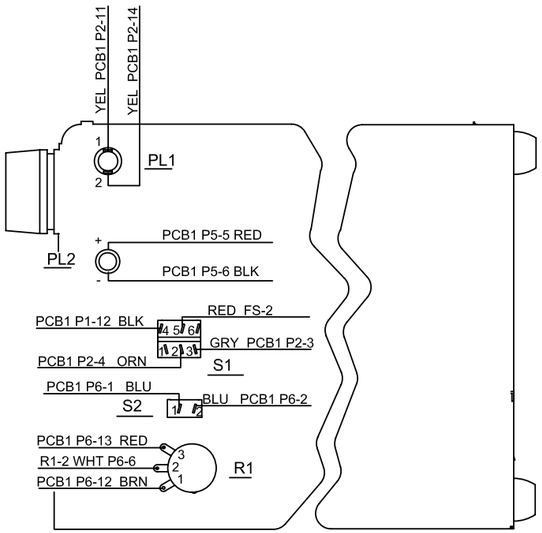
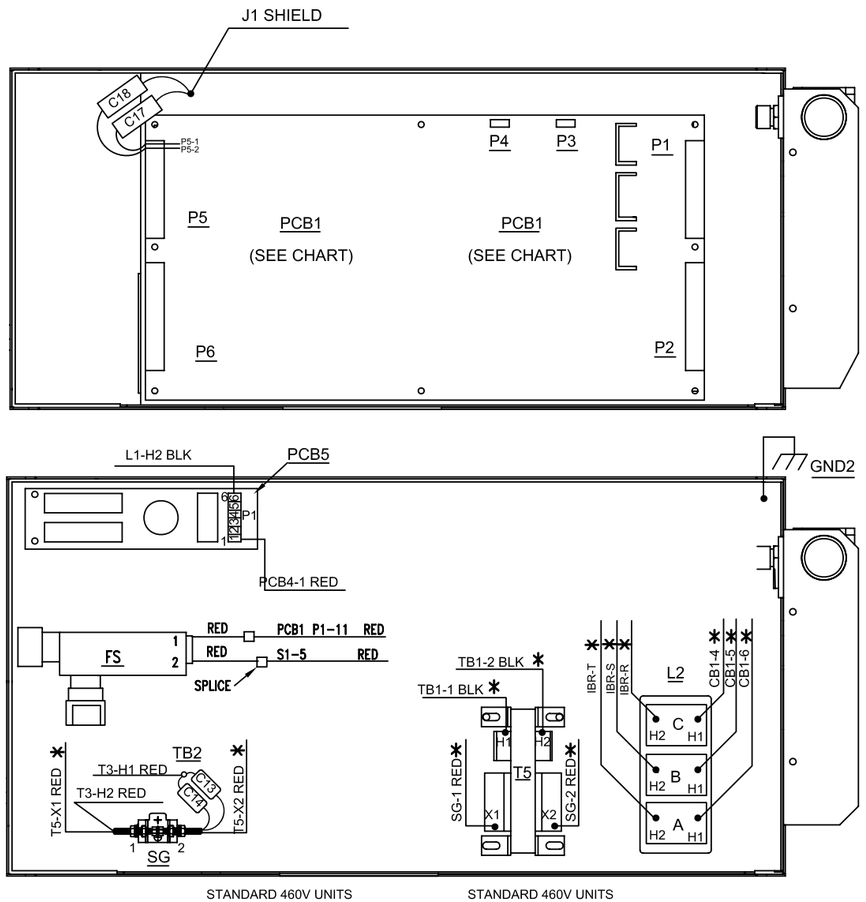
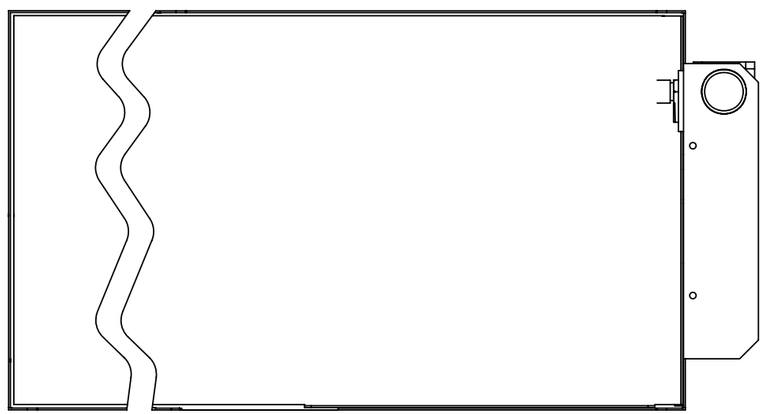
6.5 460 V Wiring Diagram (0558005328)



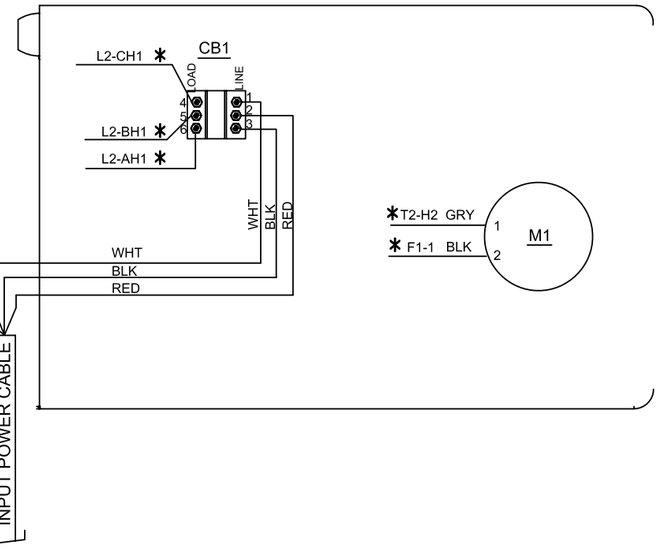


STANDARD 460V UNITS STANDARD 460V UNITS



DETAIL "A" (PCB1)

P1			P2			P5			P6		
1	TS1-1	VIO	1	T2-X7	ORN	1	J1-1	CLR (TP)	1	S2-1	BLU
2	TS1-2	VIO	2	SOL1-1	WHT	2	J1-2	BLK (TP)	2	S2-2	BLU
3	T2-X9	BRN	3	SOL1-2	GRY	3	T2-X1	YEL	3	——	——
4	T2-X10	BRN	3	S1-3	GRY	4	T2-X2	YEL	4	——	——
5	T2-X5	BLU	4	T2-X8	ORN	5	PL2-(+)	RED	5	——	——
6	T2-X6	BLU	4	S1-2	ORN	6	PL2-(-)	BLK	6	P6-6-WHT R1-2	
7	T4-1	ORN	5	——	——		PCB1 P6-10	BLK	7	——	——
8	T4-2	ORN	6	——	——	7	——	——	8	——	——
9	T2-X3	WHT	7	P2-7 IBR-G	YEL	8	——	——	8	——	——
10	T2-X4	WHT	8	P2-8 IBR-+	BRN	9	——	——	9	——	——
11	FS-1	RED	9	——	——	10	P5-10 P5-11	WHT	10	PCB4-3	BLK (TP)
12	S1-4	BLK	10	——	——	11	P5-11 P5-10	WHT		PCB1 P5-6	BLK
			11	T2-X11	VIO	12	——	——	11	PCB4-4	RED (TP)
			11	PL1-1	YEL				12	R1-1	BRN
			12	TB1-1	BLU				13	R1-3	RED
			12						14	R1-2	WHT
			13	TB1-2	BLU						
			13								
			14	PL1-2	YEL						
			14	T2-X12	VIO						



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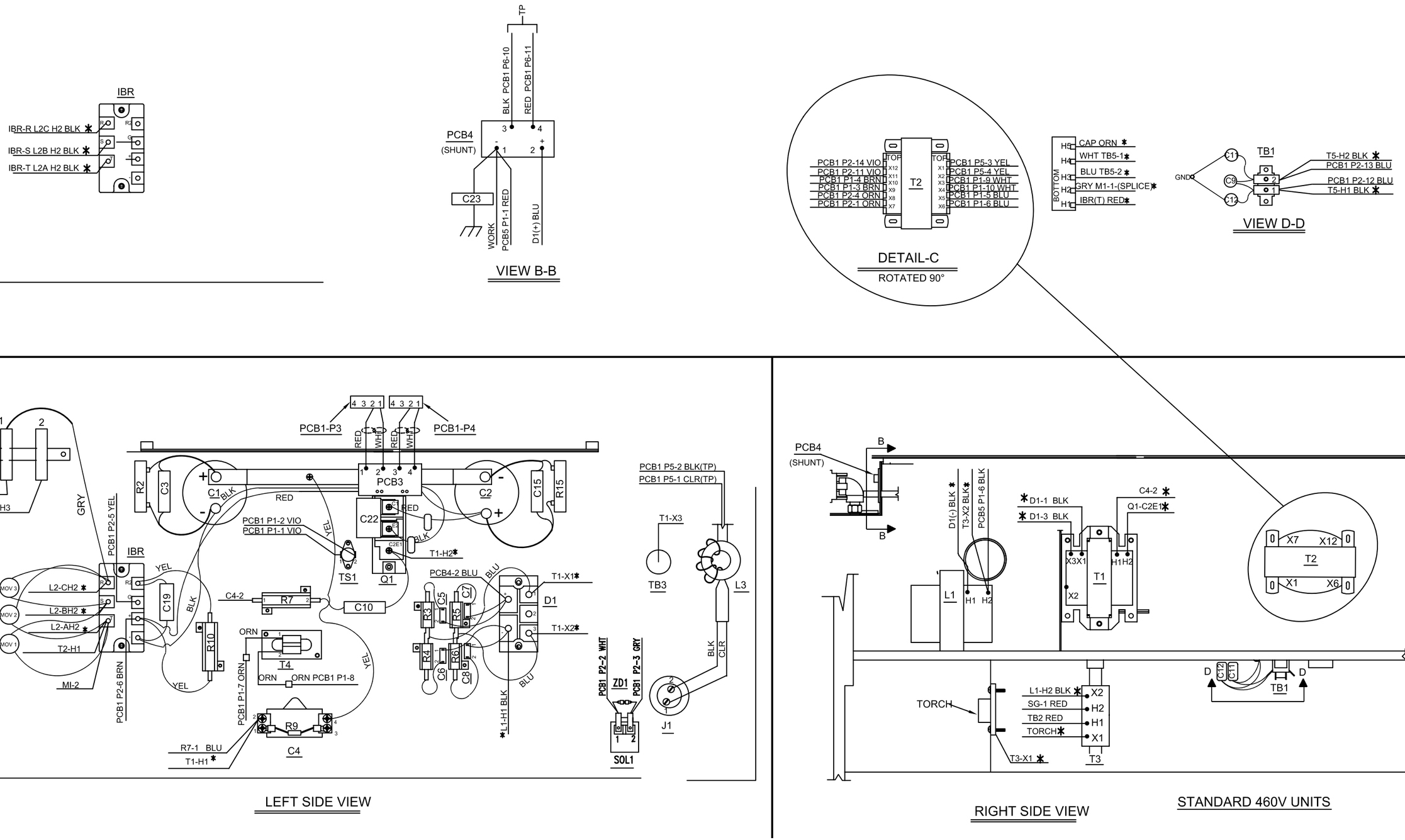
SECTION 6 WIRING DIAGRAMS

6.5 460 V Wiring Diagram (0558005328)



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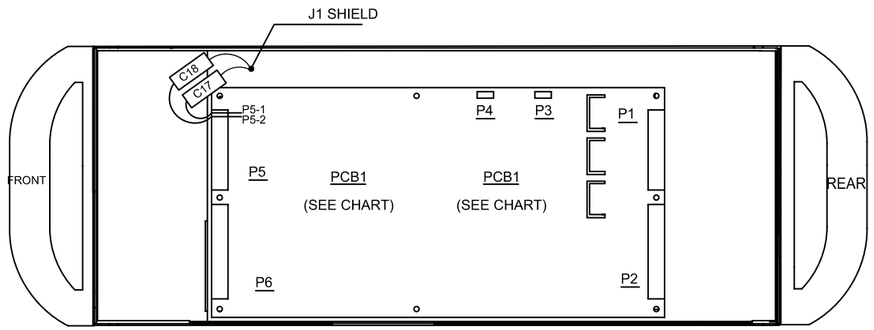
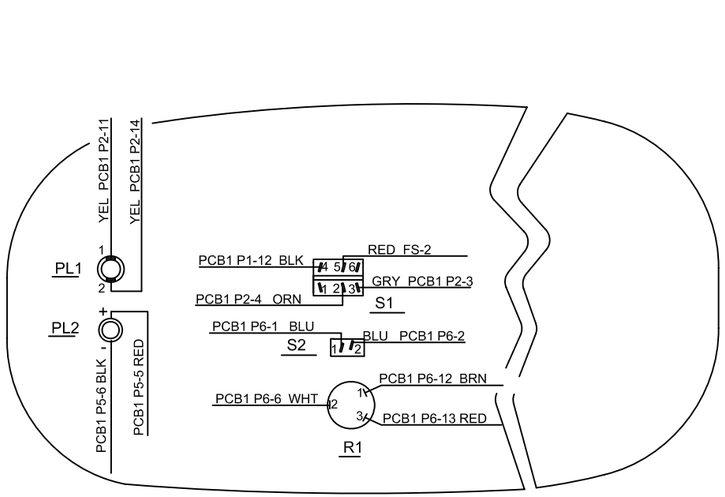
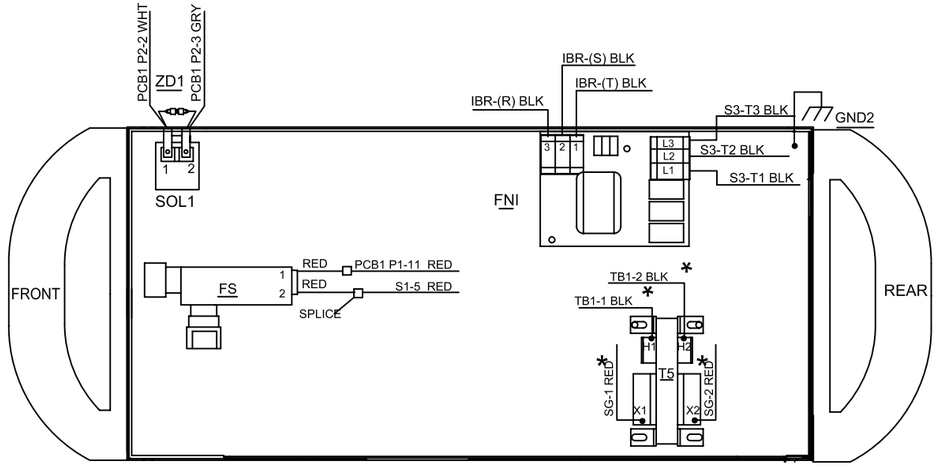
6.6 230 V CE Wiring Diagram (0558005151)

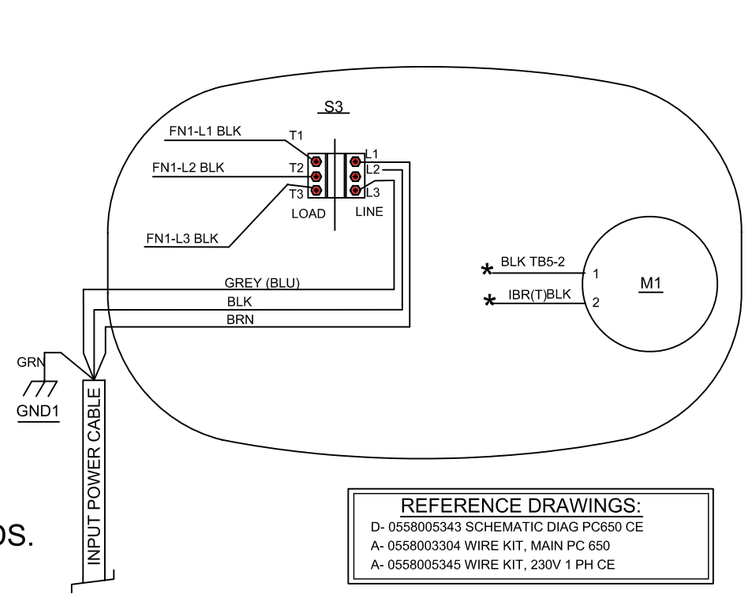


DETAIL "A" (PCB1)

P1			P2			P5			P6		
1	TS1-1	VIO	1	T2-X7	ORN	1	J1-1	CLR (TP)	1	S2-1	BLU
2	TS1-2	VIO	2	SOL1-1	WHT	2	J1-2	BLK (TP)	2	S2-2	BLU
3	T2-X9	BRN	3	SOL1-2	GRY	3	T2-X1	YEL	3	——	——
4	T2-X10	BRN	3	S1-3	GRY	4	T2-X2	YEL			
5	T2-X5	BLU	4	T2-X8	ORN	5	PL2-(+)	RED	4	——	——
6	T2-X6	BLU	4	S1-2	ORN	6	PL2-(-)	BLK			
7	T4-1	ORN	5	——	——				5	——	——
8	T4-2	ORN	6	——	——	7	——	——	6	R1-2	WHT
9	T2-X3	WHT	7	IBR-G	YEL	8	——	——	7	——	——
10	T2-X4	WHT	8	IBR(+)	BRN	9	——	——	8	——	——
11	FS-1	RED	9	——	——	10	PCB1 P5-11	WHT	8	——	——
12	S1-4	BLK	10	——	——	11	PCB1 P5-10	WHT	9	——	——
			11	T2-X11	VIO	12	——	——	10	PCB4-3	BLK (TP)
			11	PL1-1	YEL						
			12	TB1-1	BLU				11	PCB4-4	RED (TP)
			12						12	R1-1	BRN
			13	TB1-2	BLU				13	R1-3	RED
			13						14	——	——
			14	PL1-2	YEL						
			14	T2-X12	VIO						







NOTES:
1-✱ DENOTES SELF LEADS.

REFERENCE DRAWINGS:
D- 0558005343 SCHEMATIC DIAG PC650 CE
A- 0558003304 WIRE KIT, MAIN PC 650
A- 0558005345 WIRE KIT, 230V 1 PH CE

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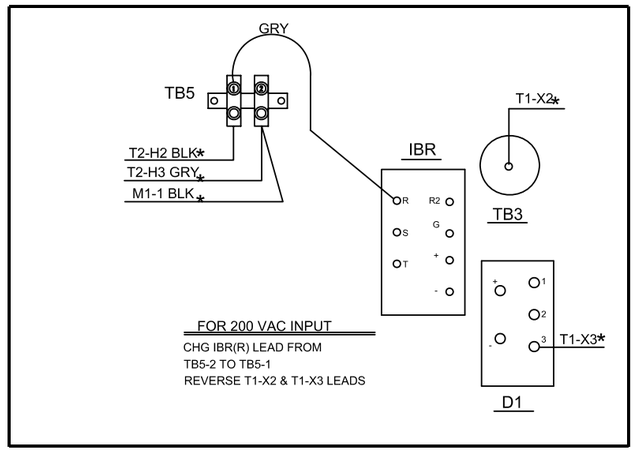
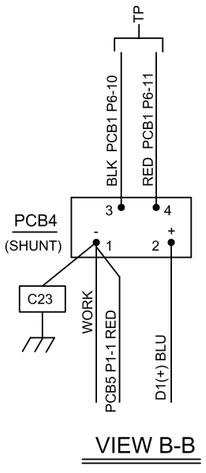
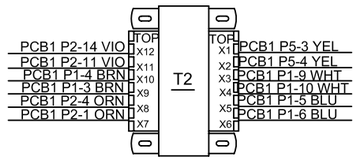
6.6 230 V CE Wiring Diagram (0558005151)



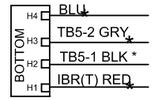


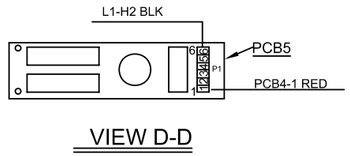
VIEW B-B



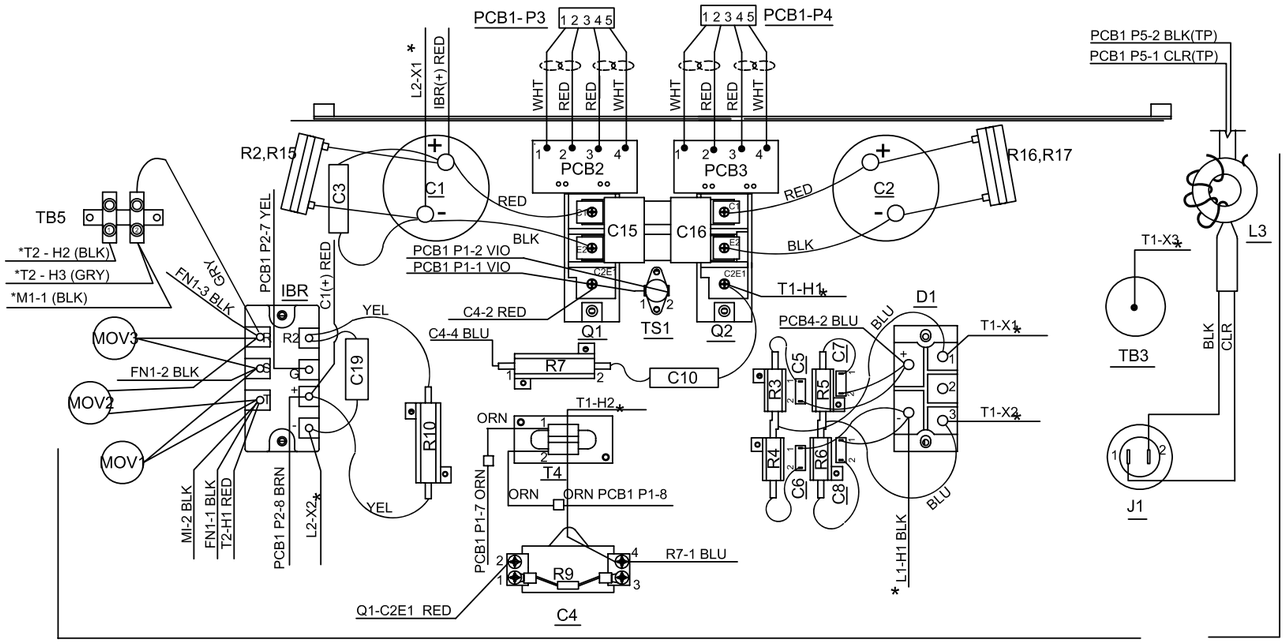
VIEW C-C

TOP AND BOTTOM

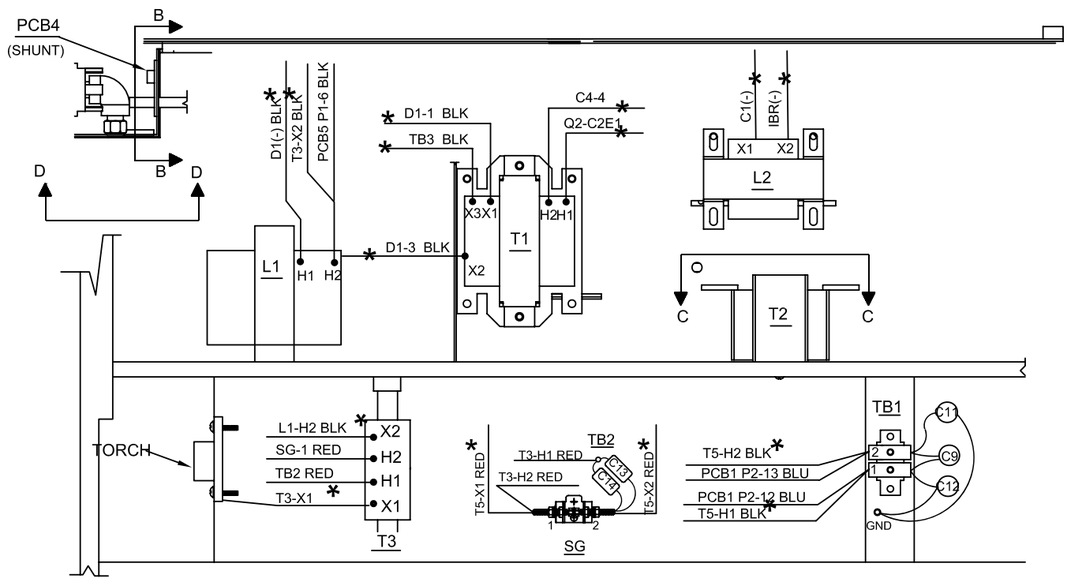




VIEW D-D



LEFT SIDE VIEW



RIGHT SIDE VIEW

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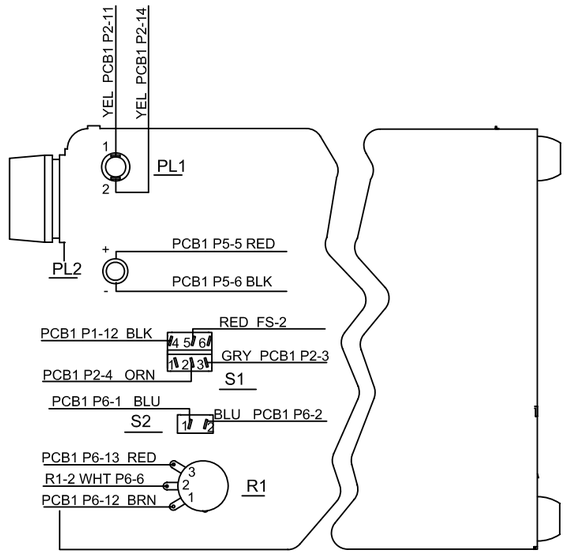
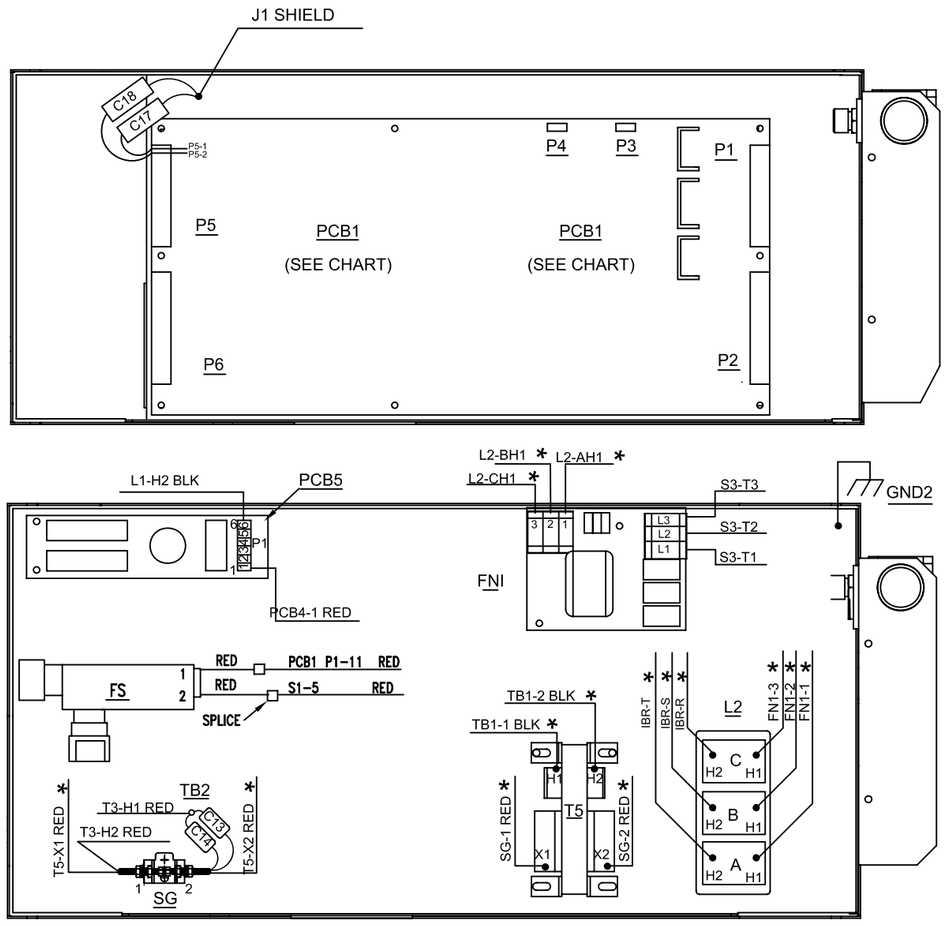
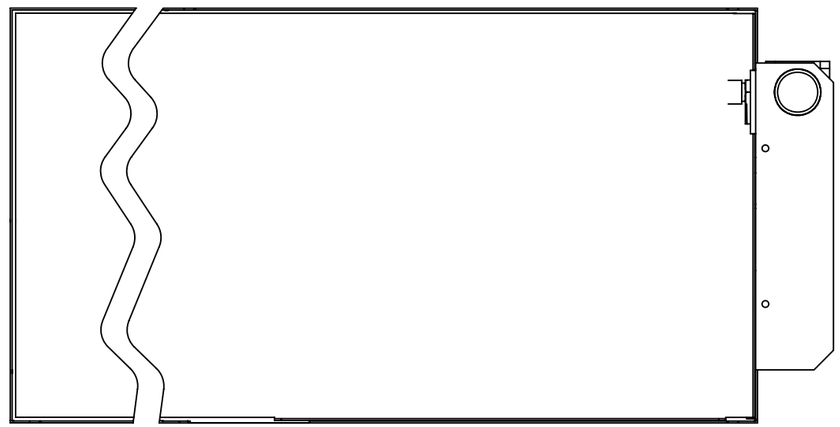
SECTION 6 WIRING DIAGRAMS

6.7 400 V CE Wiring Diagram (0558005152)

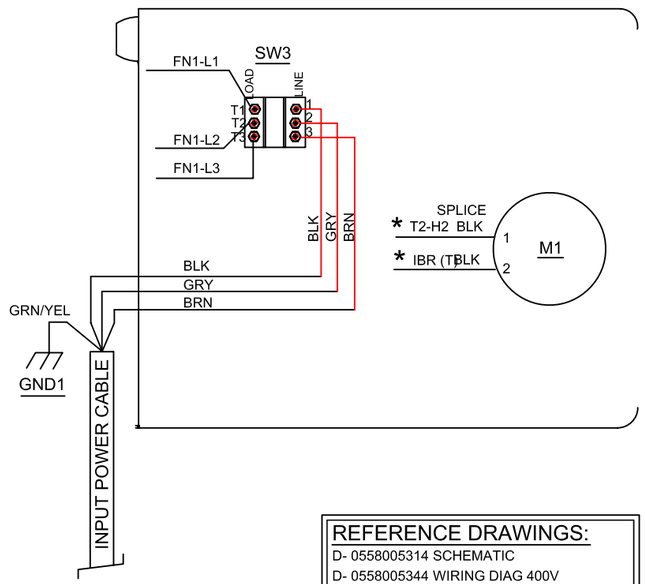






DETAIL "A" (PCB1)

P1			P2			P5			P6		
1	TS1-1	VIO	1	T2-X7	ORN	1	J1-1	CLR (TP)	1	S2-1	BLU
2	TS1-2	VIO	2	SOL1-1	WHT	2	J1-2	BLK (TP)	2	S2-2	BLU
3	T2-X9	BRN	3	SOL1-2	GRY	3	T2-X1	YEL	3	——	——
4	T2-X10	BRN	3	S1-3	GRY	4	T2-X2	YEL	4	——	——
5	T2-X5	BLU	4	T2-X8	ORN	5	PL2-(+)	RED	5	——	——
6	T2-X6	BLU	4	S1-2	ORN	6	PL2-(-)	BLK	6	P6-6-WHT	R1-2
7	T4-1	ORN	5	——	——		PCB1 P6-10	BLK	7	——	——
8	T4-2	ORN	6	——	——	7	——	——	8	——	——
9	T2-X3	WHT	7	P2-7 IBR-G	YEL	8	——	——	8	——	——
10	T2-X4	WHT	8	P2-8 IBR-+	BRN	9	——	——	9	——	——
11	FS-1	RED	9	——	——	10	P5-10 P5-11	WHT	10	PCB4-3	BLK (TP)
12	S1-4	BLK	10	——	——	11	P5-11 P5-10	WHT		PCB1 P5-6	BLK
			11	T2-X11	VIO	12	——	——	11	PCB4-4	RED (TP)
			11	PL1-1	YEL				12	R1-1	BRN
			12	TB1-1	BLU				13	R1-3	RED
			12						14	R1-2	WHT
			13	TB1-2	BLU						
			13								
			14	PL1-2	YEL						
			14	T2-X12	VIO						



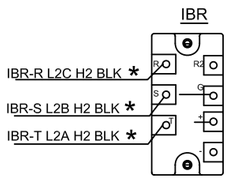
REFERENCE DRAWINGS:
- D- 0558005314 SCHEMATIC
- D- 0558005344 WIRING DIAG 400V
- A- 0558005316 WK MAIN 400/460V
- A- 0558005346 WIRE KIT 400V

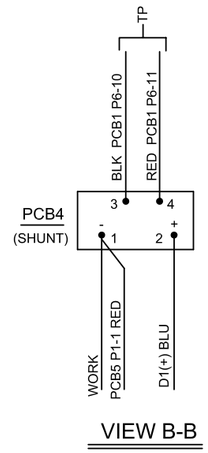
NOTES:
1-*DENOTES SELF LEADS.

CONTENTS

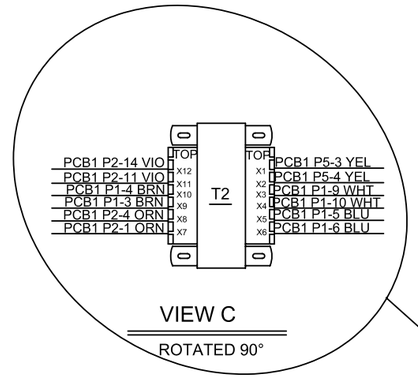
SECTION 6 WIRING DIAGRAMS

6.7 400 V CE Wiring Diagram (0558005152)



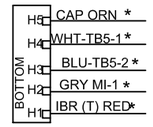


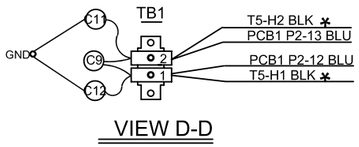
VIEW B-B



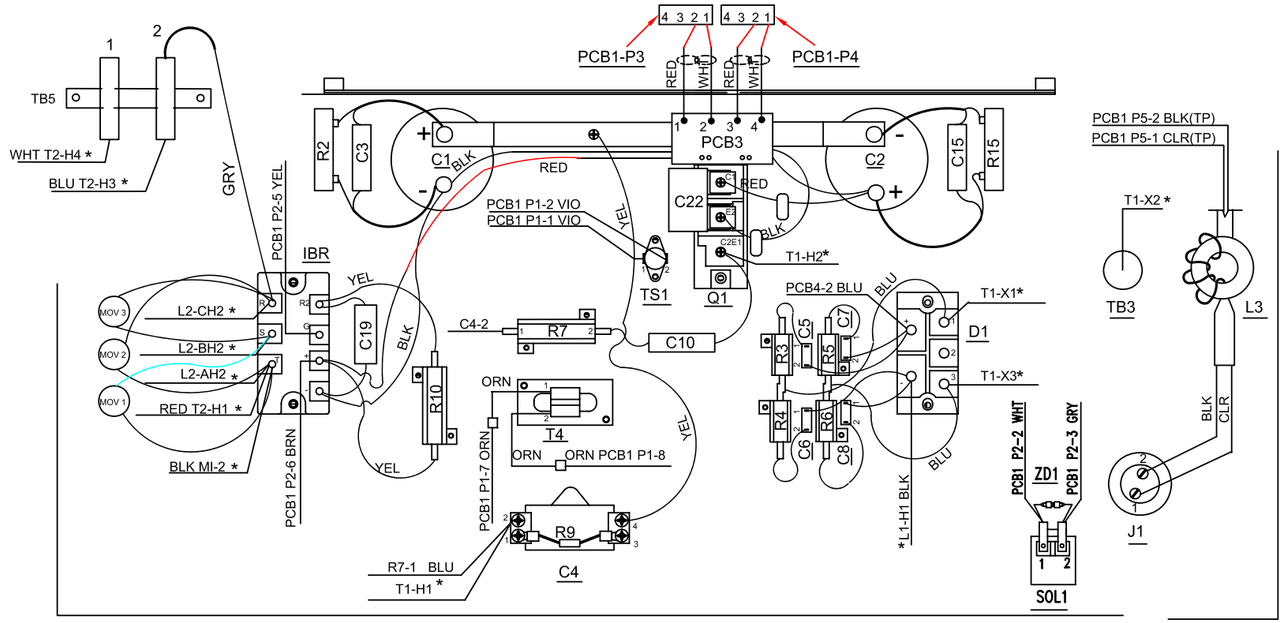
VIEW C

ROTATED 90°

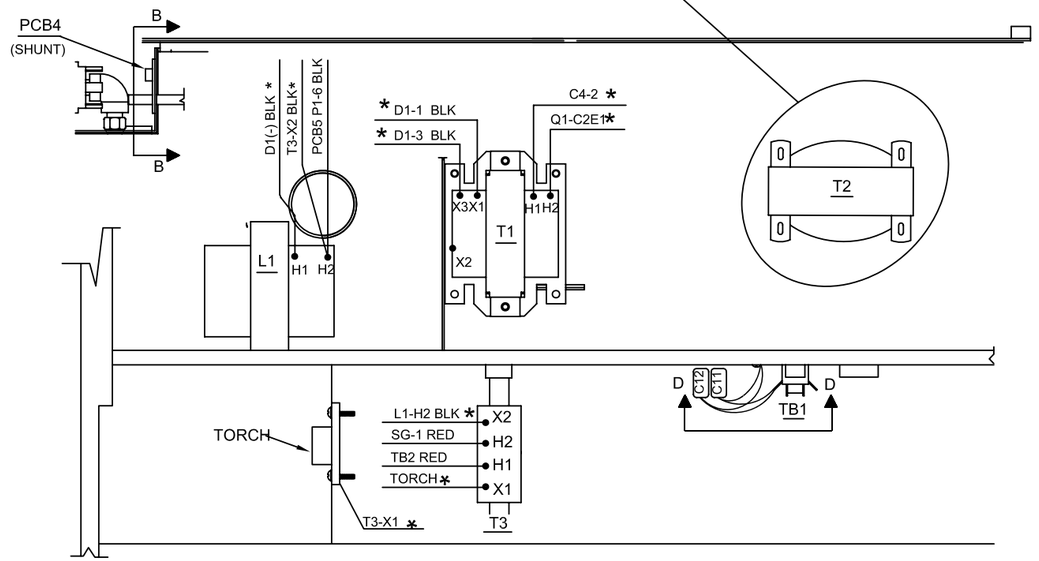




VIEW D-D



LEFT SIDE VIEW



STANDARD 460V UNITS

RIGHT SIDE VIEW

7.0 Replacement Parts

7.1 General

Always provide the serial number of the unit on which the parts will be used. The serial number is stamped on the unit nameplate.

7.2 Ordering

To ensure proper operation, it is recommended that only genuine ESAB parts and products be used with this equipment. The use of non-ESAB parts may void your warranty.

Replacement parts may be ordered from your ESAB Distributor.

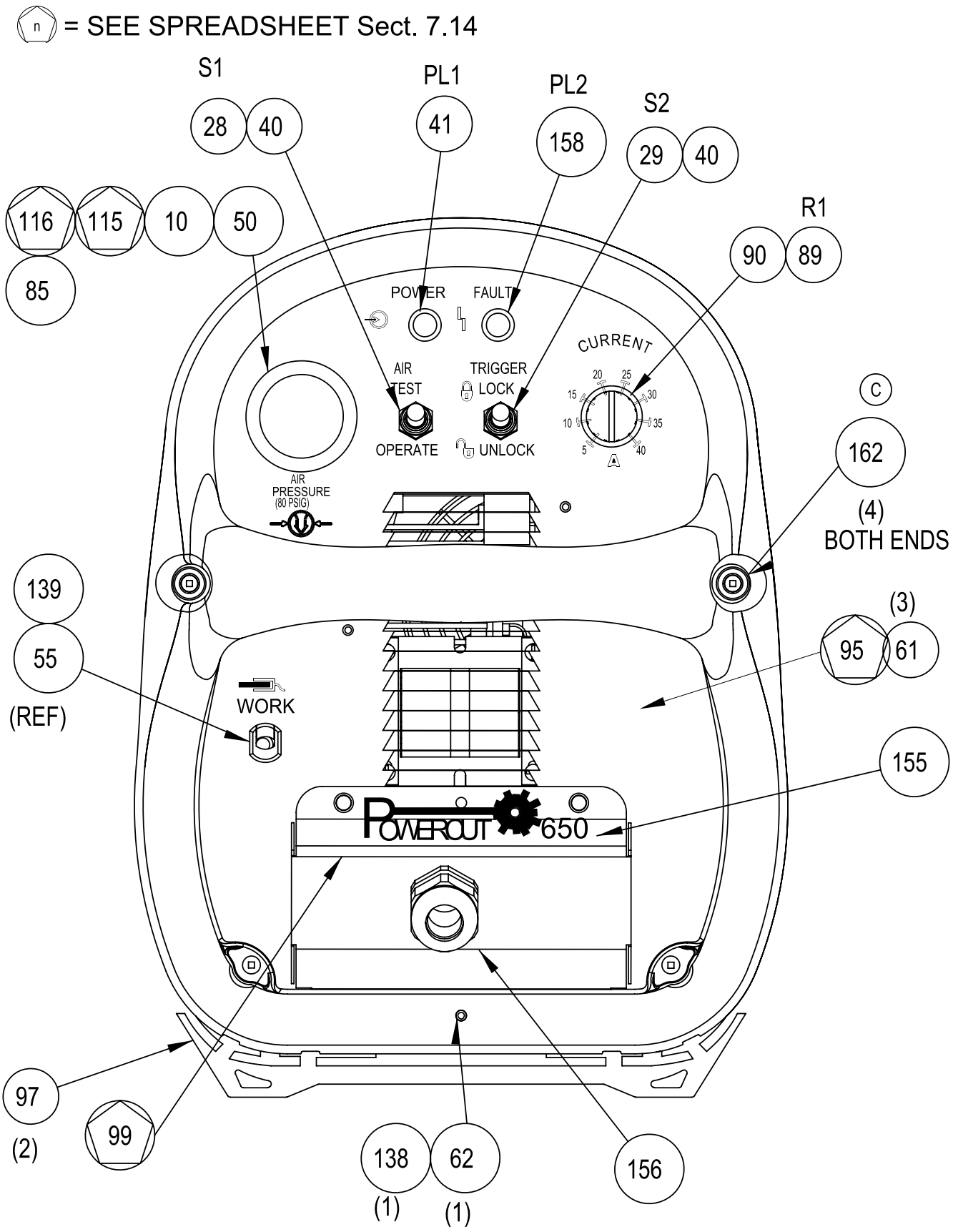
Be sure to indicate any special shipping instructions when ordering replacement parts.

Refer to the Communications Guide located on the back page of this manual for a list of customer service phone numbers.

Note

Bill of material items that have blank part numbers are provided for customer information only. Hardware items should be available through local sources.

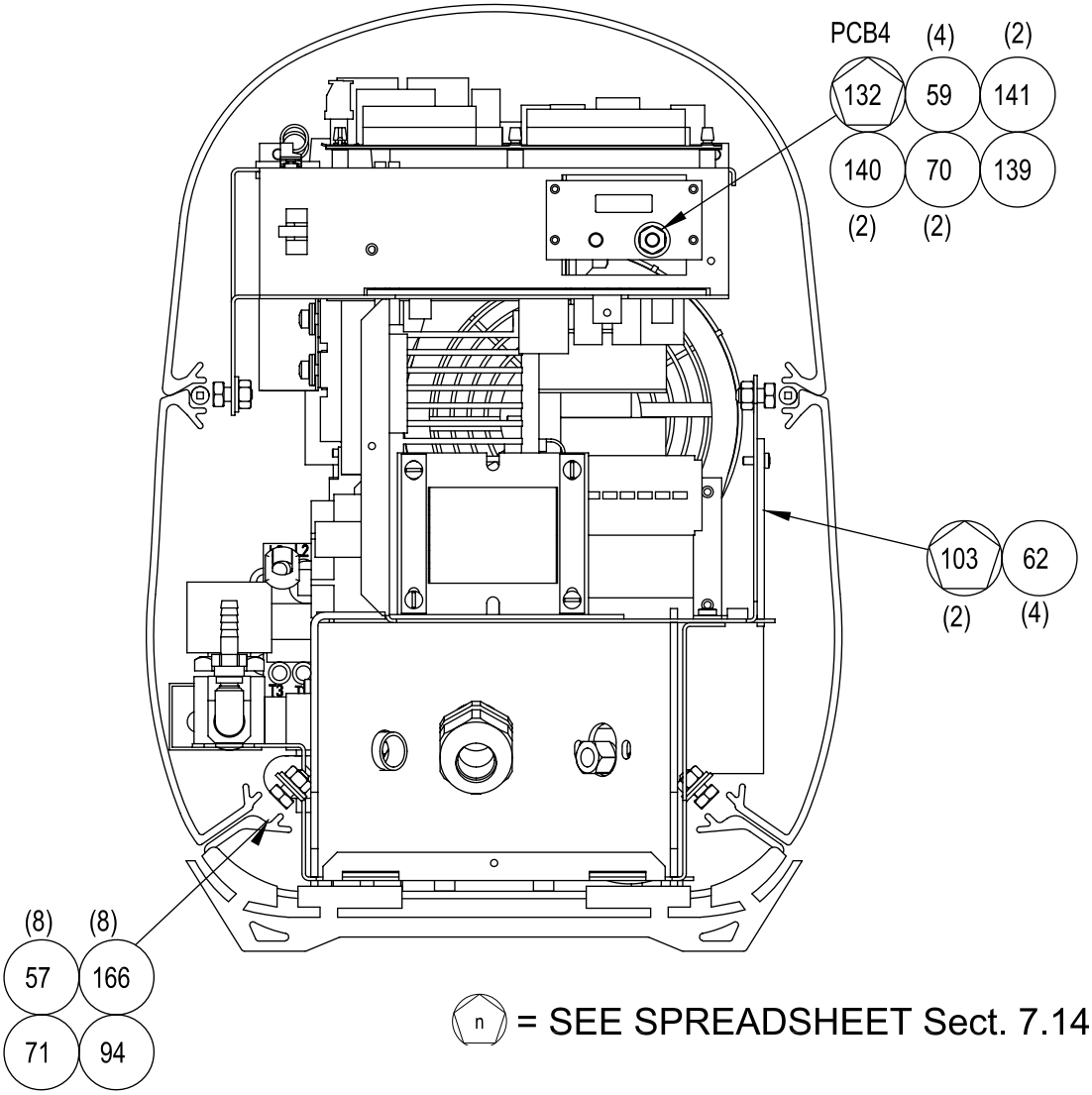
7.3 PC650 Replacement Parts Front



7.3 PC650 Replacement Parts Front BOM

PC650 REPLACEMENT PARTS				
ITEM	QTY	P/N	DESCRIPTION	SYMBOL
10	1	21711	GAUGE 1.50 160PSI WHT CBM STL	1
28	1	634518	SWITCH TOGGLE DPDT 2POS 15A 125V Q/D	S1
29	1	673213	SWITCH TOGGLE SPST 2POS 15A 125V Q/D	S2
40	2	951474	SWITCH SEAL BLACK	
41	1	951526	LAMP NEON WHT	PL1
50	2	993426	GROMMET RUB 1.50ID 1.75GD X .06W	
55	1	23602576	STRAIN RELIEF, (WORK CABLE)	
61	AR	61325849	SCREW PHTF #6-32 X .25	
62	AR	61325851	SCREW PHTF #6-32 X .38	
85	AR	9910003	SEALANT PIPE SS PST	
89	1	0558001176	POTENTIOMETER 10K 3W	R1
90	1	0558001388	KNOB 1.17 DIA 1/4” SHAFT	
95	1	0558003086M	PANEL FRONT PC 650 TUBE	
97	2	0558002780	FOOT PLASMA TUBE	
138	AR	64307860	WSR LOCK #6 EXT TOOTH	
139	1	680560	CABLE WORK/GND	
156	1	0558003353	STRAIN RELIEF INPUT NPT3/4	
158	1	951754	LAMP LED YELLOW 12V	PL2
162	8	61325090	SCR 24006 STLZPC 0.250-20 X 1.00	

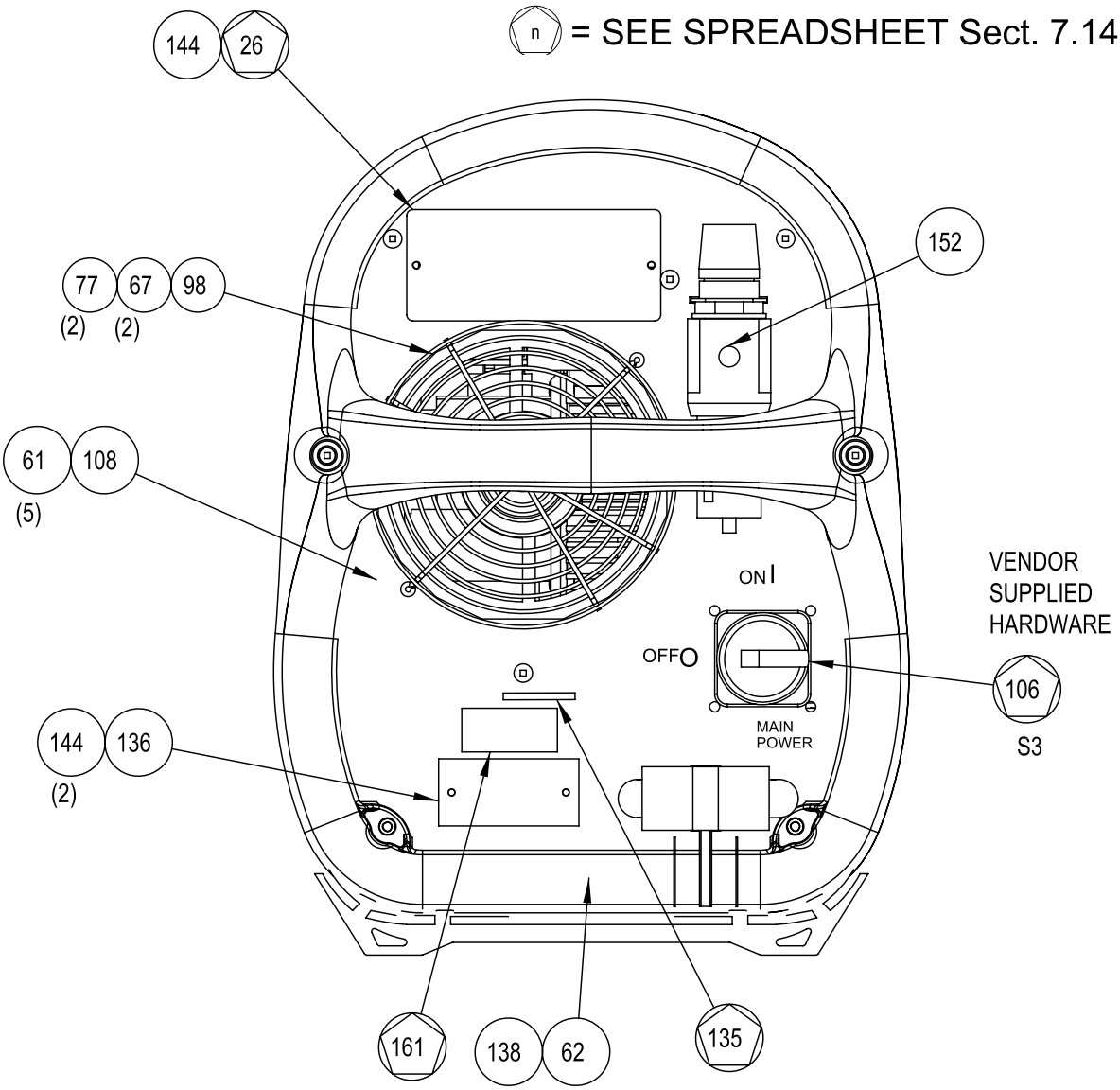
7.4 PC650 Replacement Parts Front Inside



7.4 PC650 Replacement Parts Front Inside BOM

PC650 REPLACEMENT PARTS				
ITEM	QTY	P/N	DESCRIPTION	SYMBOL
57	AR	61341087	SCREW MACH. HEX HD .25-20 X 0.05	
59	AR	61325826	SCREW PHTF #4-40 X .38	
62	AR	61325851	SCREW PHTF #6-32 X .38	
70	AR	63100100	NUT HEX BRASS 1/4-20	
71	AR	63300100	NUT HEX STLZPC .250-20	
94	4	0558001930	PLASMA TUBE EXTRUDED BAR 16”	
139	1	680560	CABLE WORK/GND	
140	2	64102996	WASHER LOCK BRONZE 1/4	
141	2	64104075	WASHER FLAT BRASS 1/4	
166	4	64302996	WASHER LOCK .250	

7.5 PC650 Replacement Parts Rear

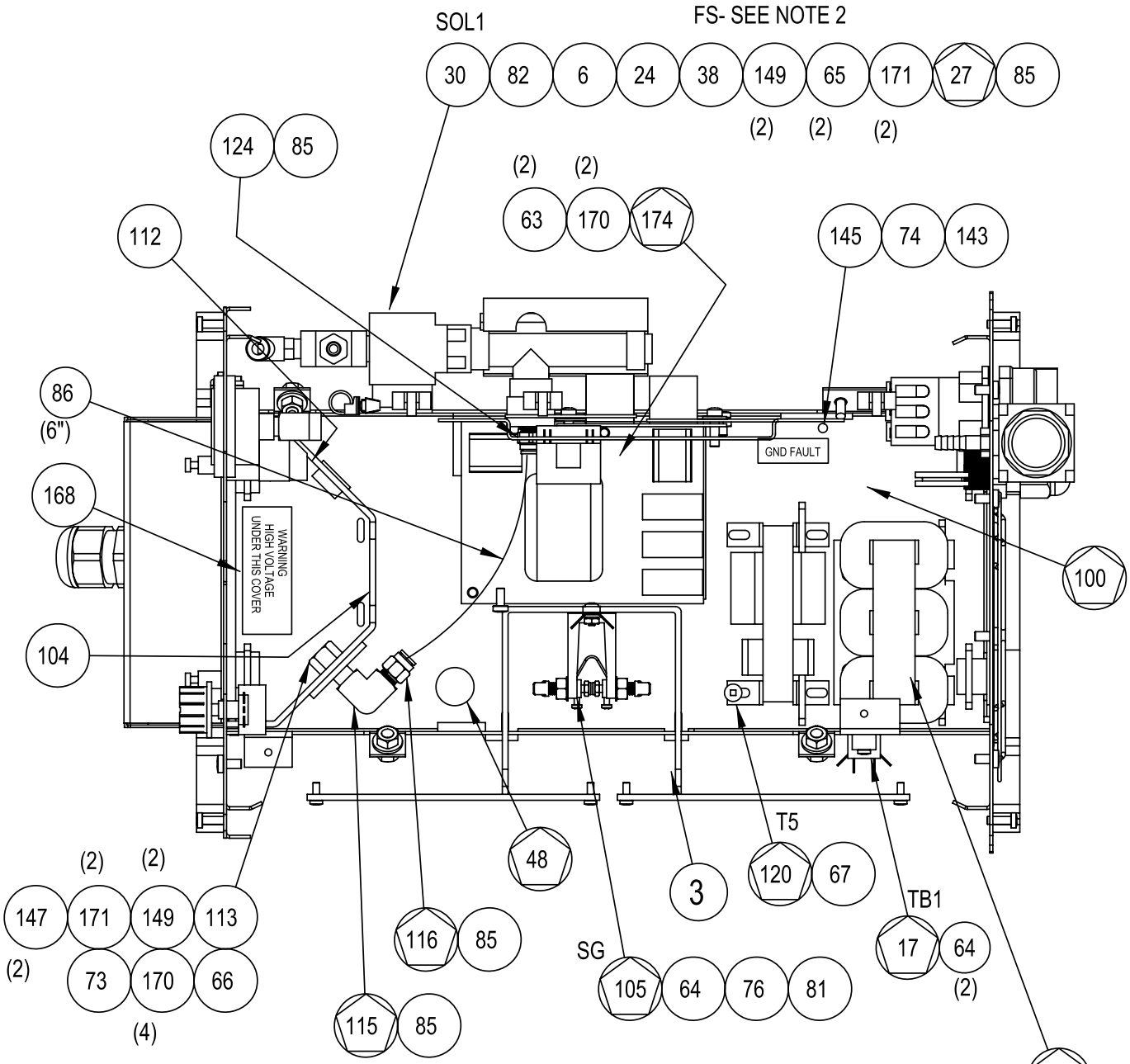


7.5 PC650 Replacement Parts Rear BOM

PC650 REPLACEMENT PARTS				
ITEM	QTY	P/N	DESCRIPTION	SYMBOL
61	AR	61325849	SCREW PHTF #6-32 X .25	
62	AR	61325851	SCREW PHTF #6-32 X .38	
67	AR	61325900	SCREW PHTF #10-24 X .38	
77	AR	64302920	WASHER LOCK #10	
98	1	0558005659	FINGER GUARD	
136	1	13730763	NAMEPLATE CODE SERIAL STOCK	
138	AR	64307860	WSR LOCK #6 EXT TOOTH	
144	AR	65509506	RIVET 1/8 GRIP .251-.312	
152	1	60909075	CAP LUG	

7.6 PC650 Replacement Parts Top Inside 2

n = SEE SPREADSHEET Sect. 7.14



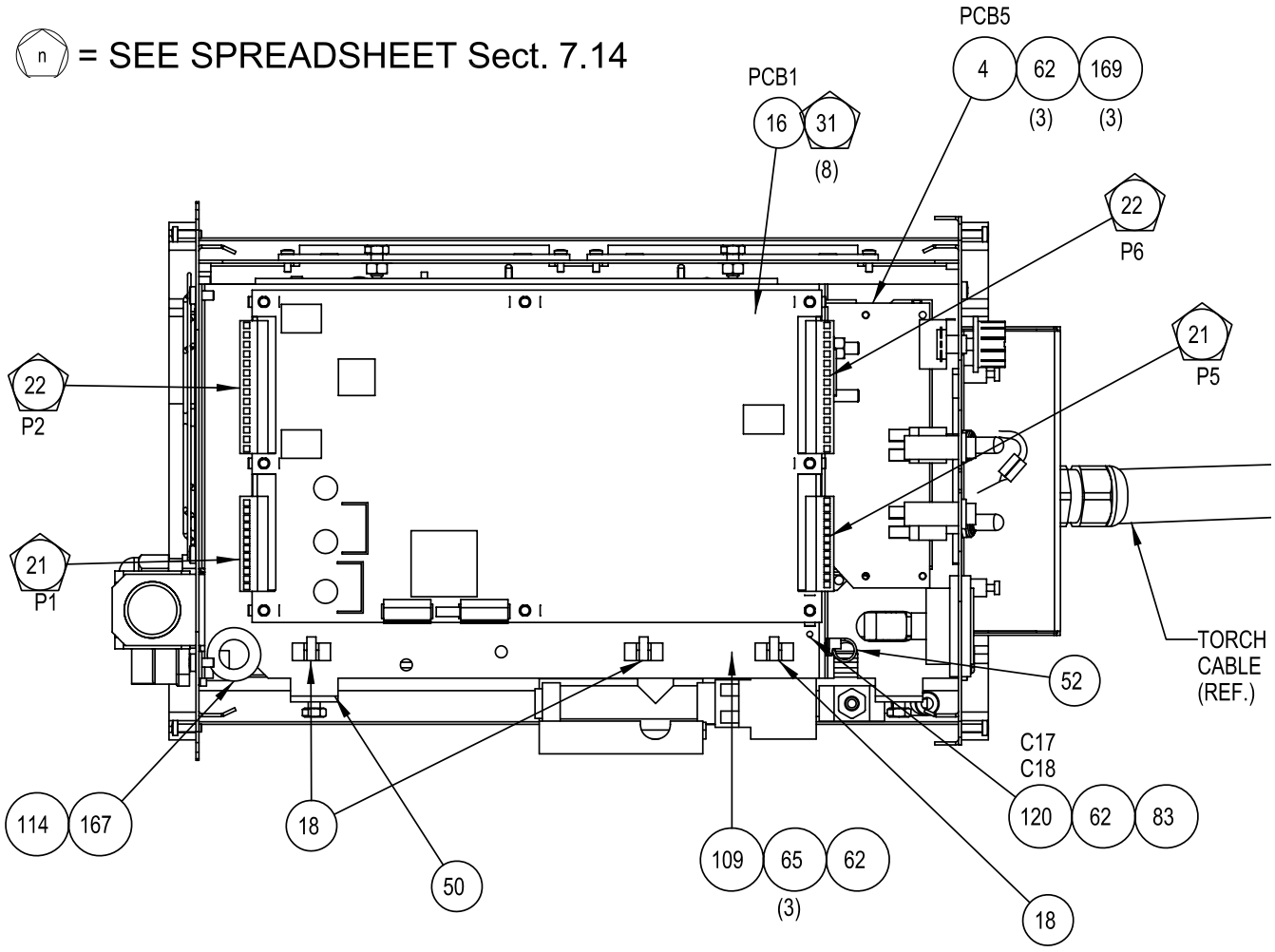
NOTE 2: TRIM FLOW SWITCH (ITEM 38) LEADS TO 6.00" LG., STRIP .25" AND ATTACH TERMINALS (ITEM 118)

FOR 400V CE & FOR 460V

7.6 PC650 Replacement Parts Top Inside 2 BOM

PC650 REPLACEMENT PARTS				
ITEM	QTY	P/N	DESCRIPTION	SYMBOL
3	1	0558002183	COVER HIGH FREQ KYDEX	
6	1	461107	TEE STREET 1/8-27 NPT	
24	1	952086	ELBOW MALE SWIVEL 90 DEG 1/4NPTM	
30	1	0558006156	VALVE SOL 1/8NPT 24VAC 60HZ	SOL1
38	1	951202	SW FLOW .25GPN SPST	FS
63	AR	61325852	SCREW PHTF #6-32 X .50	
64	AR	61325853	SCREW PHTF #6-32 X .63	
65	AR	61325878	SCREW PHTF #8-32 X .38	
66	AR	61325880	SCREW PHTF #8-32 X .50	
67	AR	61325900	SCREW PHTF #10-24 X .38	
73	AR	63300886	NUT HEX #8-32	
74	AR	63300916	NUT HEX #10-24	
76	AR	64302860	WASHER LOCK #6	
81	AR	64304860	WASHER FLAT #6	
82	1	67100030	NPL PIPE 1/4 X .38 L BRS	
85	AR	9910003	SEALANT PIPE SS PST	
86	AR	90858003	TUBING PLAS .250ODX.040W BLK	
104	1	0558003313	PARTITION TORCH PLUMB PC650	
105	1	0558001180	SPARK GAP ASSEMBLY	
112	1	13730583	TERM BUSING .687”	
113	1	647134	ADAPT A/I-G* F 1/8NPTM BKHD	
124	1	952172	CONNECTOR MALE 1/4NPTM	
143	AR	64307004	WASHER LOCK EXT TOOTH #10	
147	AR	61325881	SCREW PH #8-32 X .625	
149	AR	64302887	WASHER LOCK #8	
170	AR	64307887	WASHER LOCK EXT TOOTH #8	
171	AR	64304887	WASHER FLAT #8	

7.7 PC650 Replacement Parts Top Inside

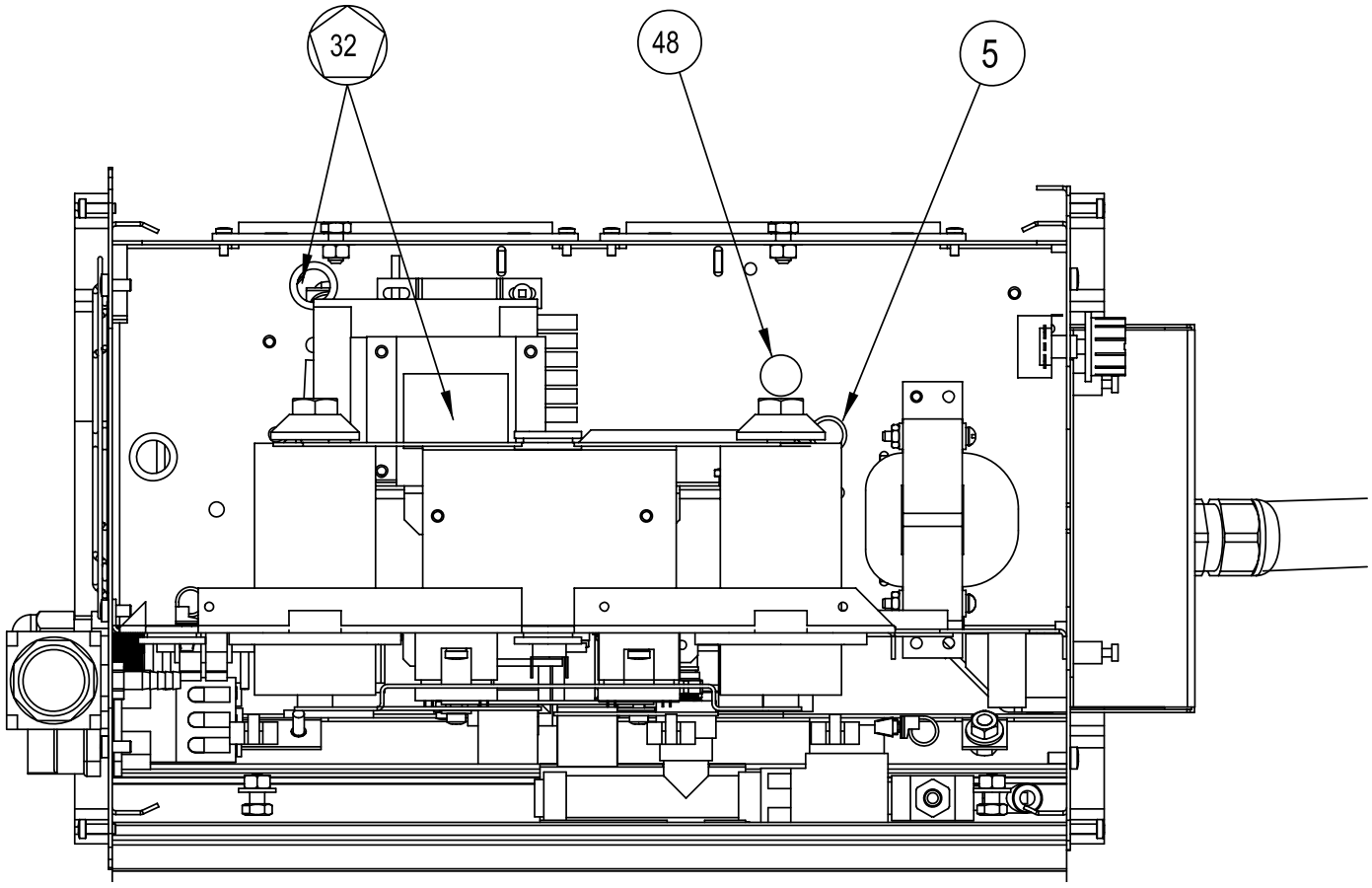


7.7 PC650 Replacement Parts Top Inside BOM

PC650 REPLACEMENT PARTS				
ITEM	QTY	P/N	DESCRIPTION	SYMBOL
4	1	38131	PCB START UP NETWORK	PCB5
16	1	38214	PCB PLASMA CONTROL UNIVERSAL	PCB1
18	AR	950908	CABLE TIE PUSH MOUNT	
50	2	993426	GROMMET RUB 1.50ID 1.75GD X .06W	
52	1	993837	GROMMET RUB 0.44ID 0.56GD X .06W	
62	AR	61325851	SCREW PHTF #6-32 X .38	
65	AR	61325878	SCREW PHTF #8-32 X .38	
83	AR	71200732	ADH SILICON RBR CLR	
109	1	0558003311M	BRACKET CONTROL BOARD MTG PC650	
114	4	92W57	GROMMET RUB .63 ID X .88 GD X .06	
169	AR	64307860	WSR 52010 STLZPC 0.138	

7.8 PC650 Replacement Parts Top Inside 3

n = SEE SPREADSHEET Sect. 7.14

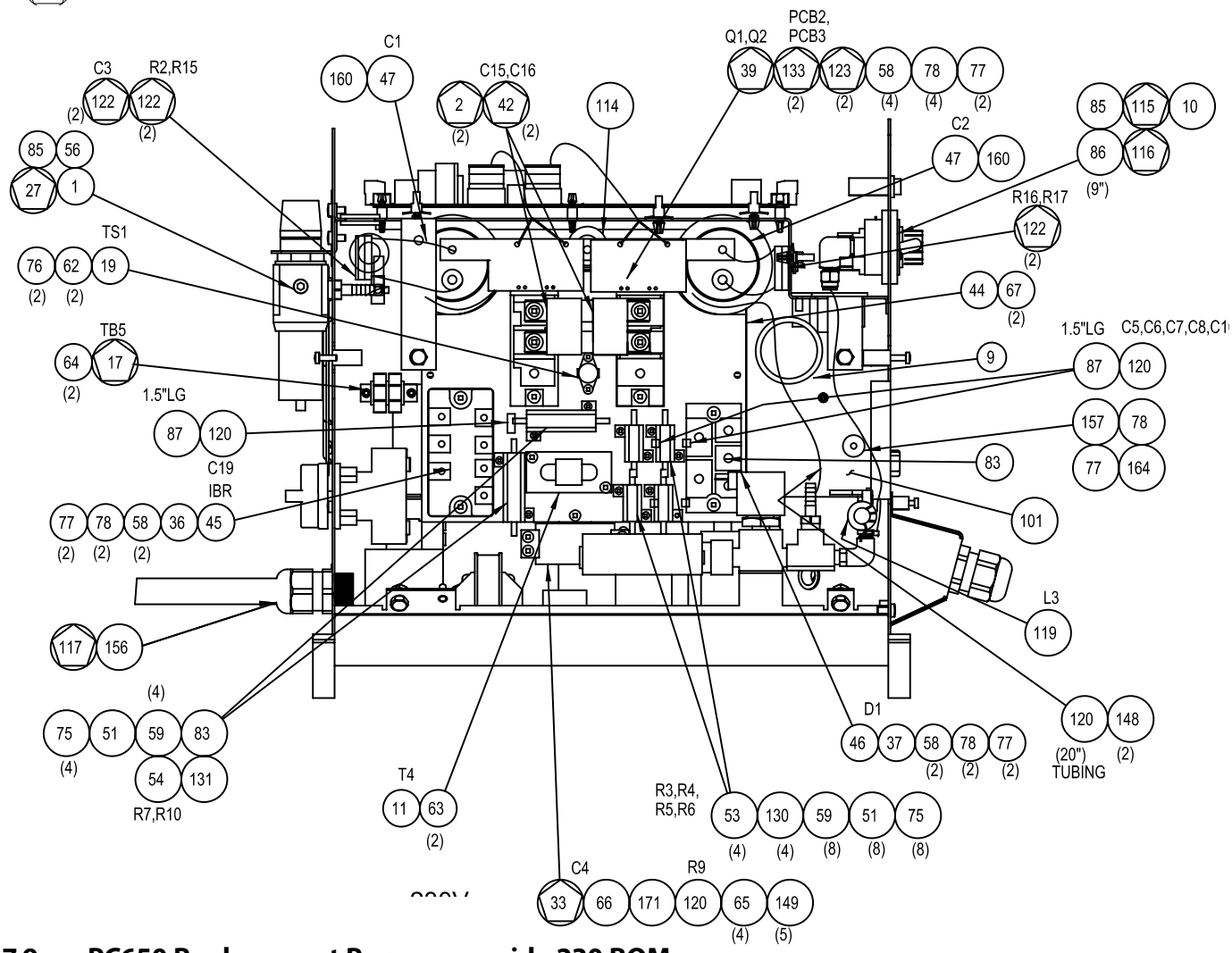


7.8 PC650 Replacement Parts Top Inside 3 BOM

PC650 REPLACEMENT PARTS				
ITEM	QTY	P/N	DESCRIPTION	SYMBOL
5	1	13730222	BUSHING SNAP .56	
48	2	952207	HOLE PLUG NYLON	

7.9 PC650 Replacement Parts Left Inside

n = SEE SPREADSHEET Sect. 7.14



7.9 PC650 Replacement Parts Left Inside 230 BOM

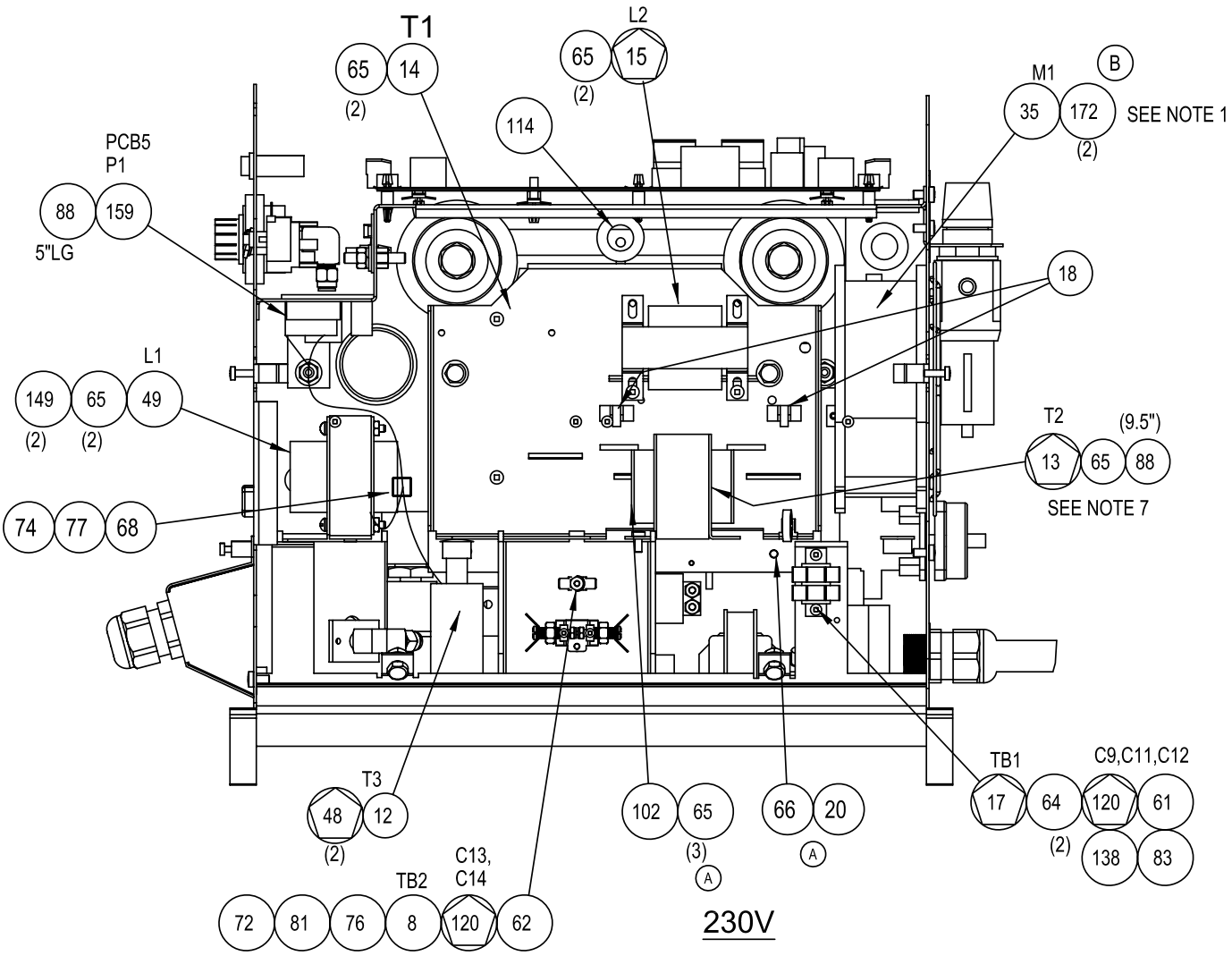
PC650 REPLACEMENT PARTS				
ITEM	QTY	P/N	DESCRIPTION	SYMBOL
1	1	0558005394	FILTER REG AIR LINE B07-234-A1KA	
9	1	673038	BUSHING SNAP 1.38 ID X 1.75 MH	2
10	1	21711	GAUGE 1.50 160PSI WHT CBM STL	1
11	1	32958	TRANSFORMER ASSY CURRENT	T4
19	1	951085	SWITCH TERMAL D/T 176 15A 120V	TS1
36	1	951191	PAD THERMAL INPUT BRIDGE	
37	1	951192	PAD THERMAL OUTPUT BRIDGE	
44	1	952147	HEATSINK 500I	
45	1	952149	MODULE INPUT BRIDGE 40 AMP 1600V	IBR
46	1	952150	BRIDGE MODULE OUTPUT 60A @ 600V 100N	D1
47	2	952185	CAPC 1800UF 450VDC W/NUT	C1,2
51	AR	10981006	SOLDER SN60 0.062 DIA. WRAP3	

7.9 PC650 Replacement Parts Left Inside 230 BOM

PC650 REPLACEMENT PARTS				
ITEM	QTY	P/N	DESCRIPTION	SYMBOL
53	4	17721020	RESISTOR 20 OHM, 25 WATT	R3,4,5,6
54	2	17750010	RESISTOR 50W 10 OHM 3%	R7,10
56	2	60101025	PLUG HOLE HEX HD .25-20 X 0.50	
58	AR	61308903	SCREW PHTF #10-24 X .62	
59	AR	61325826	SCREW PHTF #4-40 X .38	
62	AR	61325851	SCREW PHTF #6-32 X .38	
63	AR	61325852	SCREW PHTF #6-32 X .50	
64	AR	61325853	SCREW PHTF #6-32 X .63	
65	AR	61325878	SCREW PHTF #8-32 X .38	
66	AR	61325880	SCREW PHTF #8-32 X .50	
67	AR	61325900	SCREW PHTF #10-24 X .38	
75	AR	64302837	WASHER LOCK #4	
76	AR	64302860	WASHER LOCK #6	
77	AR	64302920	WASHER LOCK #10	
78	AR	64304050	WASHER FLAT #10	
83	AR	71200732	ADH SILICON RBR CLR	
85	AR	9910003	SEALANT PIPE SS PST	
86	AR	90858003	TUBING PLAS .250ODX.040W BLK	
87	AR	90860018	TUBING .042ID X .016W BLK #16	
101	1	0558003309	HEATSINK BRACKET PC650	
114	4	92W57	GROMMET RUB .63 ID X .88 GD X .06	
119	1	951198	CORE SATURABLE	
130	4	951193	PAD THERMAL POWER RESISTOR 25W	
131	2	951194	PAD THERMAL POWER RESISTOR 50W	
148	4	950626	CLAMP 1-EAR W/INSERT 13.3 GER	
156	1	0558003353	STRAIN RELIEF INPUT NPT3/4	
157	1	952208	STANDOFF INSULATING NYLON	
160	2	950518	GROMMET 2.12IC 2.5GD X .06W	
164	AR	61325910	SCR STZP #10-32 X .38LG	
171	AR	64304887	WASHER FLAT #8	

7.10 PC650 Replacement Parts Right Inside 230

(n) = SEE SPREADSHEET Sect. 7.14



NOTE 1: TRIM FAN MOTOR LEADS(ITEM 35) TO 8" AND STRIP APPROX .25". TRIM, STRIP, & TERMINATE (T2) TRANSFORMER (ITEM 13) LEADS WITH FAN LEADS AS FOLLOWS: FORM 208/230V 1PH

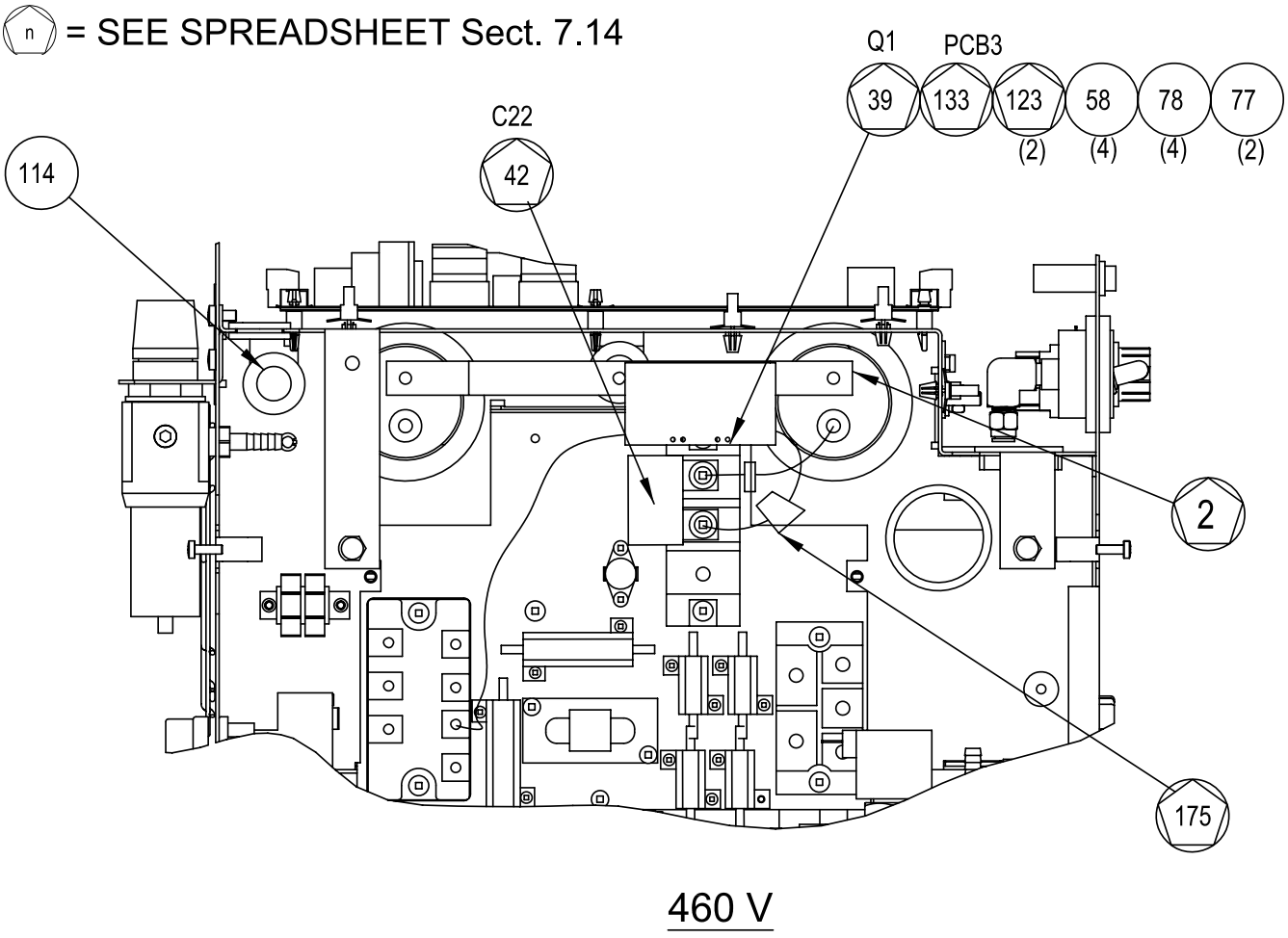
LEAD	LENGTH	TERMINAL
HI - RED	11.00"	(ITEM 564773) WITH FM-1 LEAD
H2 - BLK	11.00"	(ITEM 125)
H3 - GRY	11.00"	(ITEM 126) WITH FM-2 LEAD
H4 - BLU	2.00"	(ITEM 127)

NOTE 7: BEFORE ASSEMBLING KNOB (ITEM 90) TURN POTENTIOMETER TO ITS MAXIMUM POSITION ASSEMBLE KNOB WITH POINTER TOWARD MAXIMUM SHOWN ON ARC AND TIGHTEN SET SCREW.

7.10 PC650 Replacement Parts Right Inside 230 BOM

PC650 REPLACEMENT PARTS				
ITEM	QTY	P/N	DESCRIPTION	SYMBOL
8	1	634220	TAB	1
12	1	32969	REACTOR ASSY HIGH FREQ	T3
14	1	35941	XFMR ASSY MAIN 230V & 460V	T1
18	AR	950908	CABLE TIE PUSH MOUNT	
20	1	182W58	CABLE TIE SCREW MTG.	
35	1	951182	FAN AC AXIAL	M1
49	1	952606	INDUCTOR OUTPUT	L1
61	AR	61325849	SCREW PHTF #6-32 X .25	
64	AR	61325853	SCREW PHTF #6-32 X .63	
65	AR	61325878	SCREW PHTF #8-32 X .38	
66	AR	61325880	SCREW PHTF #8-32 X .50	
68	AR	61325902	SCREW PHTF #10-24 X .50	
72	AR	63300862	NUT HEX #6-32	
74	AR	63300916	NUT HEX #10-24	
76	AR	64302860	WASHER LOCK #6	
77	AR	64302920	WASHER LOCK #10	
81	AR	64304860	WASHER FLAT #6	
83	AR	71200732	ADH SILICON RBR CLR	
88	AR	90861726	TUBING SHRINK .38 ID	
102	1	0558003310	TRANSFORMER BRACKET PC650	
114	4	92W57	GROMMET RUB .63 ID X .88 GD X .06	
138	AR	64307860	WSR LOCK #6 EXT TOOTH	
149	AR	64302887	WASHER LOCK #8	
159	1	951009	RCPT P/C* * 6POS 10A 300A	PCB5 P1
172	2	05S04016	SCR PAN HD M5-0.8 X 16 LG	

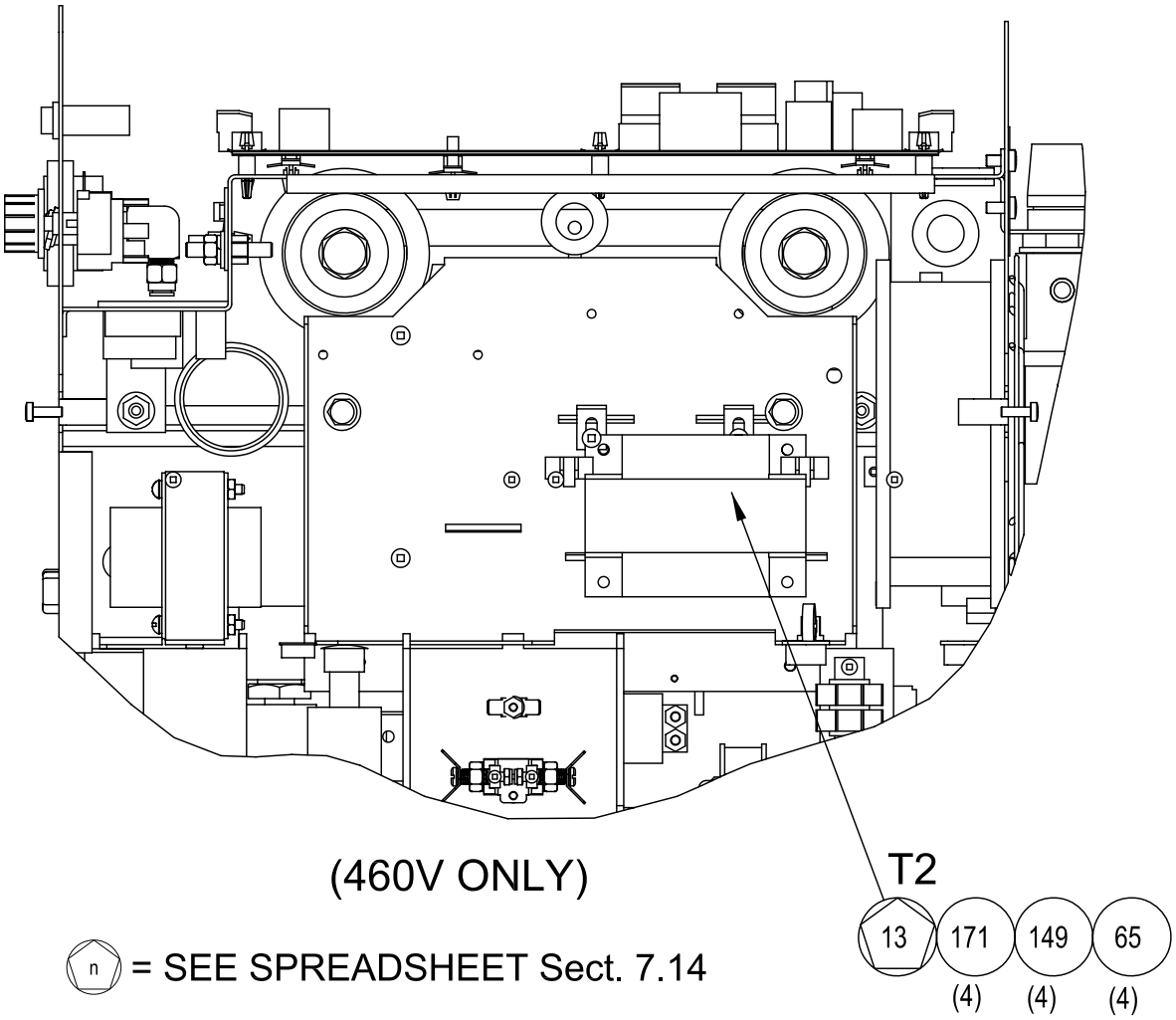
7.11 PC650 Replacement Parts Left Inside Detail 460



7.11 PC650 Replacement Parts Left Inside Detail 460 BOM

PC650 REPLACEMENT PARTS				
ITEM	QTY	P/N	DESCRIPTION	SYMBOL
58	AR	61308903	SCREW PHTF #10-24 X .62	
77	AR	64302920	WASHER LOCK #10	
78	AR	64304050	WASHER FLAT #10	
114	4	92W57	GROMMET RUB .63 ID X .88 GD X .06	

7.12 PC650 Replacement Parts Right Inside Detail 460

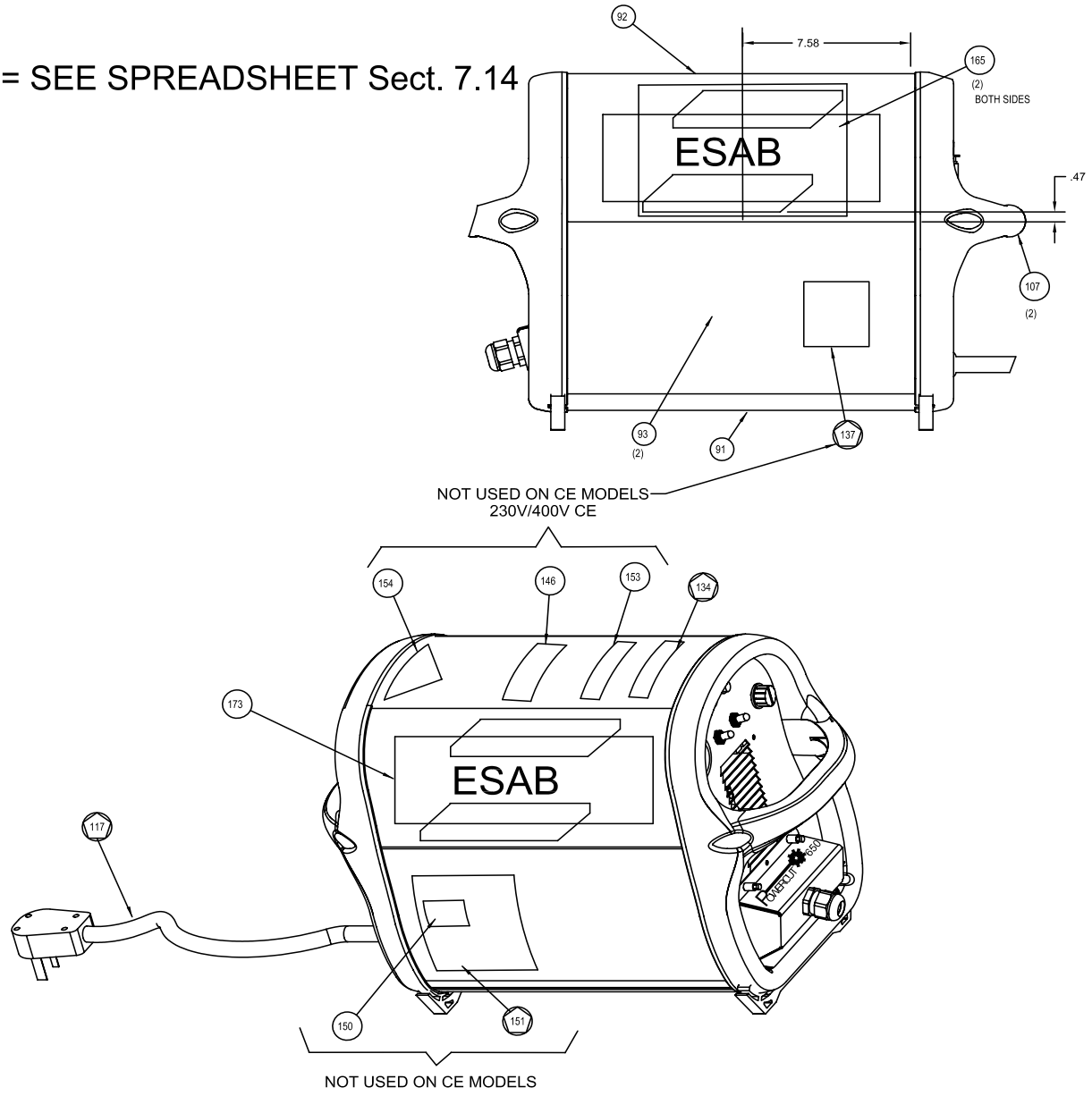


7.12 PC650 Replacement Parts Right Inside Detail 460 BOM

PC650 REPLACEMENT PARTS				
ITEM	QTY	P/N	DESCRIPTION	SYMBOL
65	AR	61325878	SCREW PHTF #8-32 X .38	
149	AR	64302887	WASHER LOCK #8	
171	AR	64304887	WASHER FLAT #8	

7.13 PC650 Replacement Parts Outside

n = SEE SPREADSHEET Sect. 7.14



7.13 PC650 Replacement Parts Outside BOM

PC650 REPLACEMENT PARTS				
ITEM	QTY	P/N	DESCRIPTION	SYMBOL
91	1	0558001918	PLASMA TUBE BOTTOM COVER 16”	
92	1	0558001922	PLASMA TUBE TOP COVER 16”	
93	2	0558001926	PLASMA TUBE SIDE COVER 16”	
107	2	0558001916B	PLASMA TUBE END COVER	
165	2	13734588	LABEL ESAB	

7.14 PC650 Replacement Parts Spreadsheet

PC650 REPLACEMENT PARTS							
QTY				ITEM	P/N	DESCRIPTION	SYMBOL
0558005152-400 V CE	0558005151 - 230 V CE	0558005328 - 460 V	0558003179 - 208/230 V				
	2		2	2	36404	BUSBAR IGBT	
1		1		2	36425	BUSBAR 500i 400V	
	1		1	13	35940	XFMR AY CONTROL 208/230/400V	T2
1		1		13	32914	XFMR AY CONTROL 460V	
	1		1	15	35945	INDUCTOR POWER FACTOR CORRECT	L2
1	2	1	2	17	950487	TERMINAL BLOCK (2 POS 20A)	TB1,5
1	2	1	2	21	951339	PLUG FEMALE PC 12 POS	P1,5
1	2	1	2	22	951340	PLUG FEMALE PC 14 POS	P2-6
1	4	1	4	23	951889	ADAPTOR TAB PUSH ON 90 DEG	
		1	1	25	0558954034	LABEL CUSTOMER ASSISTANCE	
	1		1	26	955227	LABEL RATING PC-650 208/230	
		1		26	0558954004	LABEL RATING PC-650 460V 3PH	
1				26	0558954005	LABEL RATING PC-650 400V 3PH CE	
1	2	1	2	27	030354	HOSE CONNECTION 1/4 * BUY F/MFG	
	8		8	31	950708	BOARD SUPPORT CIR/LOCK	
1	4	1	4	32	950823	BUSHING SNAP	
	1		1	33	951161	CAPACITOR 20 UF, 400VDC	C4
	2		2	39	0558005445	MODULE DUAL IGBT 100A 600V SEMIKRON	Q1,2
1		1		39	0558005462	MODULE DUAL IGBT 150A 1200V SK	
	2		2	42	951940	CAPACITOR IGBT 1uf @ 630W VDC	C15,16
1		1		42	951917	CAPACITOR 1200VDC 50uf	C22
1	2	1	2	48	952207	HOLE PLUG NYLON	
		1	1	95	0558003086M	PANEL FRONT PC 650 TUBE	
1	1			95	0558005339M	PANEL FRONT PC 650 TUBE (CE)	
		1	1	99	0558003307M	TORCH COMPARTMENT COVER PC650	
1	1			99	0558005498M	TORCH COMPARTMENT COVER PC650 CE	
		1	1	100	0558003308	BASE ALUMINUM PC650	
1	1			100	0558005341	BASE ALUMINUM PC650 CE	
1	1	1	2	103	0558003312	COVER KYDEX PC650	

7.14 PC650 Replacement Parts Spreadsheet

PC650 REPLACEMENT PARTS							
QTY				ITEM	P/N	DESCRIPTION	SYMBOL
0558005152-400 V CE	0558005151 - 230 V CE	0558005328 - 460 V	0558003179 - 208/230 V				
1	1	1	1	105	0558001180	SPARK GAP ASSEMBLY	
			1	106	0558004125	SWITCH POWER DISCONN PC650	S3
1	1	1		106	36107	SWITCH POWER DISCONN PC650 600V 63A	
		1	1	108	0558003306M	REAR PANEL PC650	
1	1			108	0558005340M	REAR PANEL PC650 CE	
1	1	1	2	115	0558006261	ELBOW UNION 90DEG 1/8NPTM	
1	1	1	2	116	952083	CONNECTOR MALE 1/8NPTM	
			1	117	0558003360	PC-650 CABLE INPUT POWER 10'LG	
		1		117	37574	CABLE POWER INPUT PC-650 10FT	
	1			117	0558002799	PC-650 CABLE INPUT POWER 10'LG CE 6MM	
1				117	0558001181	CABLE INPUT POWER 10FT 4MM	
KIT COMPONENTS WIRE MAIN POWERCUT 650 208/230 V & CE							
	1		1	120	0558003304	KIT WIRE MAIN POWERCUT 650 (SEE COMPONENTS BELOW)	
	1		1		951179	TRANSFORMER HIGH VOLTAGE	T5
	1		1		17145339	RESISTOR 39K 2W	R9
	1		1		951471	DIODE ZENER 60V 75mA	ZD1
	2		2		672348	CAPACITOR .01uf 1KV	C11,C12
	5		5		951313	CAPACITOR .01 uf 1KV	C5-8,C10
	1		1		952204	CAPACITOR .01uf 250VAC	C9
	2		2		951342	CAPACITOR 2500uf 15KV	C13,14
	2		2		951469	CAPACITOR .022uf 250VAC	C17,C18

7.14 PC650 Replacement Parts Spreadsheet

PC650 REPLACEMENT PARTS							
QTY				ITEM	P/N	DESCRIPTION	SYMBOL
0558005152-400 V CE	0558005151 - 230 V CE	0558005328 - 460 V	0558003179 - 208/230 V				
KIT COMPONENTS WIRE MAIN PC-650 400/460V & CE							
1		1		120	0558005316	KIT WIRE MAIN PC-650 400/460V (SEE COMPONENTS BELOW)	
1		1			951179	TRANSFORMER HIGH VOLTAGE	T5
1		1			17145339	RESISTOR 39K 2W	R9
1		1			951471	DIODE ZENER 60V 75mA	ZD1
2		2			672348	CAPACITOR .01uf 1KV	C11,C12
5		5			951313	CAPACITOR .01 uf 1KV	C5-8,C10
1		1			952204	CAPACITOR .01uf 250VAC	C9
2		2			951342	CAPACITOR 2500uf 15KV	C13,14
2		2			951469	CAPACITOR .022uf 250VAC	C17,C18
KIT COMPONENTS _230V 1 Phase (PN: 0558003305)							
			1	122	0558003305	KIT WIRE POWERCUT 650 230V 1PH (SEE COMPONENTS BELOW)	
			1		951028	CAPACITOR 1uf 630 VDC	C3
			1		951470	CAPACITOR .047uf 300 VAC	C20
			1		951321	VARISTOR METAL OXIDE, 275 V	MOV1
			4		17235150	RESISTOR WW FIXED, 50K 12W	R2, R15-17
			1		2062282	CAPACITOR .22uf 1 KV	C19
			1		951515	CAPACITOR .047uf 660 VAC	C23
KIT COMPONENTS_460 V 3 Phase (PN: 0558005317)							
		1		122	0558005317	KIT WIRE POWERCUT 460V 3PH (SEE COMPONENTS BELOW)	
		2			951028	CAPACITOR 1uf 630 VDC	C3, C15
		3			950591	VARISTOR METAL OXIDE, 510 V	MOV1,2,3
		2			17290210	RESISTOR WW FIXED, 10K 20W	R2,R15
		1			2062282	CAPACITOR .22uf 1 KV	C19
		1			952212	LINE REACTOR 3 PH 3%	L2
		1			951515	CAPACITOR .047uf 660 VAC	C23

7.14 PC650 Replacement Parts Spreadsheet

PC650 REPLACEMENT PARTS							
QTY				ITEM	P/N	DESCRIPTION	SYMBOL
0558005152- 400 V CE	0558005151 - 230 V CE	0558005328 - 460 V	0558003179 - 208/230 V				
KIT COMPONENTS_230 V 1 Phase CE (PN: 0558005345)							
	1			122	0558005345	KIT WIRE POWERCUT 230V 1PH CE (SEE COMPONENTS BELOW)	
	1				951028	CAPACITOR 1uf 630VDC	C3
	3				951321	VARISTOR METAL OXIDE, 275V	MOV1,2,3
	1				951515	CAPACITOR .047uF 660VAC	C23
	4				17235150	RESISTOR WW FIXED, 50K 12W	R2,R15-R17
	1				2062282	CAPACITOR .22UF 1KV	C19
KIT COMPONENTS_400 V 3Phase CE (PN: 0558005346)							
1				122	0558005346	KIT WIRE POWERCUT 400V 3PH CE (SEE COMPONENTS BELOW)	
2					951028	CAPACITOR 1uf 630VDC	C3,C15
3					950591	VARISTOR METAL OXIDE, 510V	MOV1,2,3
2					17290210	RESISTOR WW FIXED, 10K 20W	R2,R15
1					2062282	CAPACITOR .22UF 1KV	C19
1					952212	LINE REACTOR 3PH 3%	L2
1					951515	CAPACITOR .047uf 660VAC	C23
2	2	1	2	123	951190	PAD THERMAL IGBT AL-370-134	
1	1	1	1	132	31488	PC BOARD SHUNT	PCB4
	2		2	133	0558001177	PC BOARD IGBT DRIVER	PCB2/PCB3
1		1		133	0558001178	PC BOARD IGBT DRIVER	PCB3
		1	1	134	954707	LABEL WARNING	
1	1			134	955269	LABEL READ MANUAL	
			1	135	954716	LABEL 208/230 VOLT UNIT	
		1	1	137	2091514	LABEL WARNING	
		1	1	145	2091558	LABEL GROUND	
		1	1	146	955228	LABEL S/P KIT PT-31XLPC 40A	
		1	1	150	954008	LABEL DANGER HIGH VOLTAGE	

7.14 PC650 Replacement Parts Spreadsheet

PC650 REPLACEMENT PARTS							
QTY				ITEM	P/N	DESCRIPTION	SYMBOL
0558005152-400 V CE	0558005151 - 230 V CE	0558005328 - 460 V	0558003179 - 208/230 V				
			1	151	954700	LABEL INPUT 200VAC PCM-125	
		1	1	153	954746	LABEL FAULT INDICATOR	
		1	1	154	954506	LABEL ISO 9002	
		1	1	155	954981	DECAL PC-650 6.25 X 1.75	
1	1			155	0558954003	DECAL PC-650 CE 6.25 X 1.75	
			1	161	954425	LABEL LR-30071 CSA NRTL /C	
1	1			161	954565	LABEL CE LOGO	
		AR	AR	167	71200434	ADH LOCTITE Q-SET 49550	
		1	1	168	995204	LABEL WARNING ELECTRICAL SHOCK	
1	1			174	0455803880	EMC PC BOARD	
2		2		175	951199	CORE SATURABLE	
DRAWINGS							
			1	128	0558003302	SCHEMATIC POWERCUT 650 208/230V 1PH	
	1			128	0558005343	SCHEMATIC PC-650 230V 1PH CE	
1		1		128	0558005314	SCHEMATIC POWERCUT 650 460V 3PH	
			1	129	0558003303	DIAGRAM WIRING POWERCUT 650 230V 1PH	
	1			129	0558005342	DIAGRAM WIRING PC-650 230V 1PH CE	
1				129	0558005344	DIAGRAM WIRING PC-650 400V 3PH CE	
		1		129	0558005315	DIAGRAM WIRING POWERCUT 650 460V 3PH	

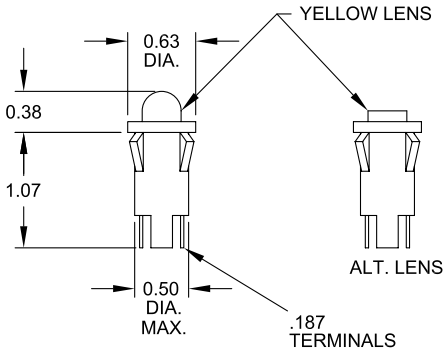
8.0 Solenoid - Potentiometer - LED

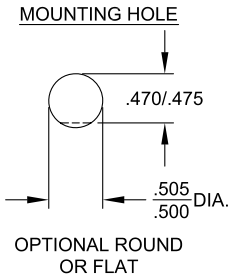
Yellow LED

LAMP LED YELLOW 12V

DESCRIPTION

12V LED SOLID-STATE INDICATOR LIGHT COMPLETE WITH BUILT-IN CURRENT-LIMITING RESISTOR AND RECTIFIER DIODE
MOUNTING: WILL SNAP FIT INTO .500/.505 DIA. HOLE IN PANELS .020/.100 THICK.
TERMINALS: QUICK CONNECT, TINNED BRASS
LENS: YELLOW POLYCARBONATE
BEZEL: CHROME PLATED BRASS
HOUSING: WHITE NYLON

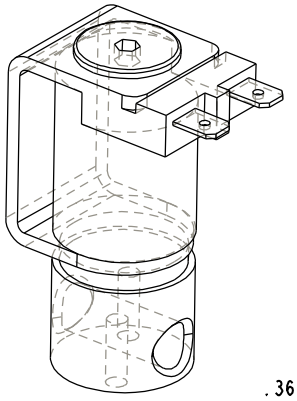


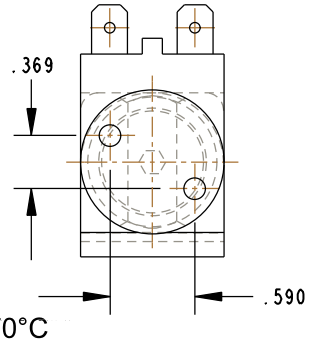


6156 Solenoid

DESCRIPTION

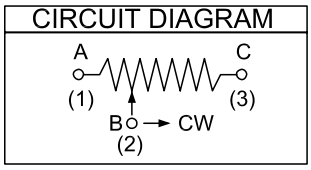
SERIES 50, 24V 60HZ
2 WAY VALVE BODY SINGLE STAGE ASSEMBLY
1/8 NPT
1/4" SPADE TERM, 6 WATTS, 100PSI
NORMALLY CLOSED
MAT'L: BRASS UNS C36000-H2
MTG HOLES: 8-32

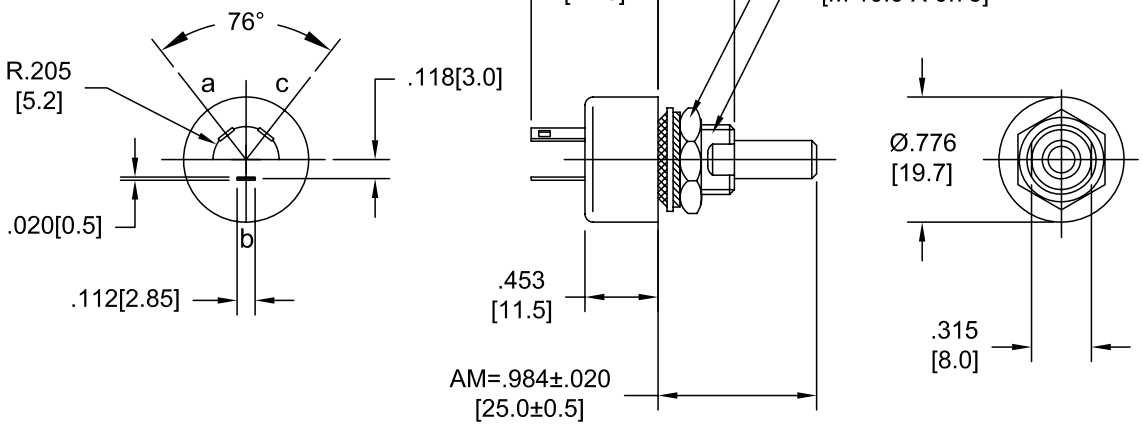




R1

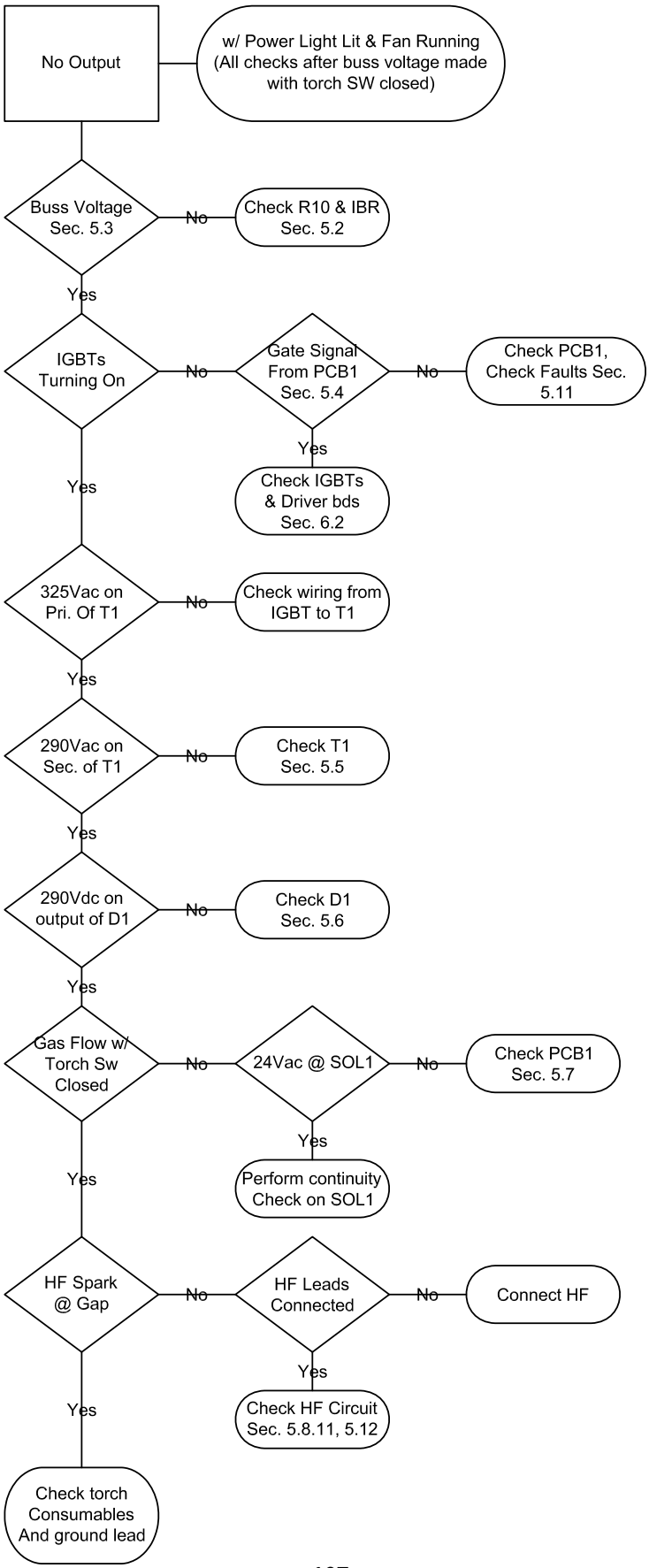
POWER RATING: Linear law 3.0 W @ +70°C
RESISTANCE VALUE: 10K Ω
RESISTANCE TOL: ±10%
DIELECTRIC STRENGTH: 2500 VAC RMS





[Numbers in brackets indicate millimeters]

8.1 Trouble Shooting Flow Chart



8.2 Low Voltage Check

****Before performing Low Voltage Check be sure that PC650 is powered down****

Connect the Variac across the AC2 (R) and AC1 (T) terminals of the IBR

Place a DC voltmeter across the IBR DC outputs, + and -. (Refer to IBR dwg)
Place an AC meter across the Variac outputs
Slowly increase the Variac voltage until the AC meter reads 50 VAC
Check the DC meter. It should read 70Vdc

Set a meter to measure VAC,
Place the meter across T2, X11 and X12 it should read approx 25 VAC

8.3 PT31 Torch

Test Procedure for PT31XLPC torch

Equipment Required:

A. Supply of 100 PSI Air or Nitrogen gas with regulator.
B. Test fixture P/N PG-071-16.
C. Reference documents:

Description	PT-31
Assembly drawings	20072
Instruction Manual	F-14-246-J

Visual Inspection:

Determine that all components are properly located and securely mounted. Check copper tube for proper angle and tightness; watch for interference with other connections and shorts. Check power cable connector for damaged threads.

Test Set-Up:

A. Verify that the power switch on bench is in the OFF position.
B. Verify that the bench Nitrogen switch is in the OFF position.
C. Verify that the bench Leak I switch is in the OFF position.
D. Connect the Nitrogen gas hose from fixture to supply line.
E. Attach the PT-31 torch to test fixture mark Torch Connection.

Test:

A. Turn the power switch on bench to the ON position.
B. Turn Nitrogen switch to bench test fixture ON.
C. Turn the Leak I switch on bench test fixture ON.
D. Verify that the valve on flow meter is to the ON position.
E. Adjust the pressure regulator is to read 45 PSI on pressure gauge.
F. Observe the ball in the flow meter. If any reading of CFH the torch body is bad.
G. Turn the Leak I switch on bench test fixture OFF.

Final Check:

If the visual checks of the torch and test items E and F are accomplished satisfactorily, then remove torch from test fixture and identify as tested and passed.

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REVISION HISTORY

1. Original release - 9/ 2006

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