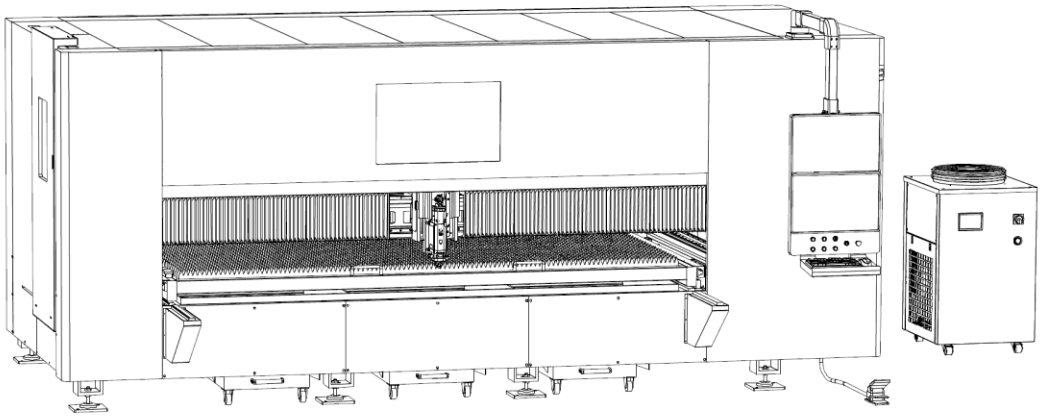
Product Manual

Linc-Cut 3015 CNC Fiber Laser

Original Instructions

Covered Models:
AD2599-1 (4kW)
AD2599-3 (2kW)



IMPORTANT!
Read carefully before use.
Keep for future reference.

Date Purchased:

Model Number:

Serial Number:

LC6000031 Rev A
Released: 01-NOV-2024

LINCOLN ELECTRIC CUTTING SYSTEMS
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Revision History

Rev	Date	Description of Change
A	01-NOV-2024	Initial release.

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Subject to Change

This information is accurate to the best of our knowledge at the time of publishing. Please refer to **www.lincolnelectric.com** to check for updated information.

Table of Contents

1.0 Safety

1.1 Signal Words

The following ANSI signal words will be used throughout:

⚠DANGER: This statement indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

⚠WARNING: This statement indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

⚠CAUTION: This statement indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury.

***NOTICE*:** This statement indicates the possibility of damage to equipment if the potential risk is not avoided.

1.2 Additional Safety Information

Bibliography and additional reading for laser safety and safety of related fabrication methods and equipment:

- **American National Standards Institute - Laser www.ansi.org**
  - ANSI Z136.1, Safe Use of Lasers
  - ANSI Z136.4, Recommended Practice for Laser Safety Measurements for Hazard Evaluations
  - ANSI Z136.5, Safe Use of Lasers in Educational Institutions
  - ANSI Z136.7, Testing and Labeling of Laser Protective Equipment
  - ANSI Z136.9, Safe Use of Lasers in Manufacturing Environments
- **American National Standards Institute - Other www.ansi.org**
  - ANSI Z87.1, Safe Practices For Eye and Face Protection
  - ANSI Z88.2, Respiratory Protection
  - ANSI Z49.1, Safety in Welding, Cutting, and Allied Processes
- **ASTM International www.astm.org**
  - F2413-18, Standard Specification for Performance Requirements for Protective (Safety) Toe Cap Footwear
- **National Fire Protection Association www.nfpa.org**
  - NFPA 51, Oxygen - Fuel Gas Systems for Welding, Cutting, and Allied Processes
  - NFPA 51B, Fire Prevention in the Use of Cutting and Welding Processes
  - NFPA 61, Prevention of Fires and Dust Explosions in Agricultural and Food Processing Facilities
  - NFPA 68, Explosion Protection by Deflagration Venting
  - NFPA 69, Explosion Prevention Systems
  - NFPA 70, National Electrical Code
  - NFPA 484, Combustible Metals
  - NFPA 652, Fundamentals of Combustible Dust
  - NFPA 654, Prevention of Fire and Dust Explosions from the Manufacturing, Processing, and Handling of Combustible Particulate Solids
  - NFPA 655, Prevention of Sulfur Fires and Explosions
  - NFPA 664, Prevention of Fires and Explosions in Wood Processing and Woodworking Facilities

- **American Welding Society**
  www.aws.org
  - Standard AWN-79, Arc Welding and Cutting Noise
  - Standard C5.2, Recommended Practices for Plasma Arc Cutting
  - Standard FSW, Fire Safety in Welding and Cutting
  - Standard F4.1, Recommended Safe Practices for Preparation for Welding and Cutting of Containers and Piping
  - Standard ULR, Ultraviolet Reflectance of Paint

- **Compressed Gas Association**
  www.cganet.com
  - CGA booklet P-1, Safe Handling of Compressed Gases in Containers

- **US Department of Labor**
  www.osha.gov
  - 29CFR 1910, Occupational Safety and Health Standards
  - 29CFR 1910.252, General Requirements
  - 29CFR 1910.253, Oxygen-fuel gas welding and cutting
  - 29CFR 1910.254, Arc welding and cutting
  - 29CFR 1040 Performance Standards for Light-Emitting Products

- **CSA Group www.csagroup.org**
  - W117.2, Safety in welding, cutting, and allied processes

- **Lincoln Electric**
  www.lincolnelectric.com/safety

- **Lincoln Electric Cutting Systems**
  www.torchmate.com/safety

1.3 General Warnings

⚠ WARNING

- Do not install, operate, or repair this machine without reading the safety warnings contained throughout this manual.
- Keep children away.
- Be sure that all installation, operation, maintenance, and repair procedures are performed by qualified individuals.
- Keep untrained persons away from this machine.
- Do not leave this machine unattended while power is applied to the computer, motion controller, or laser power source.

1.4 California Proposition 65

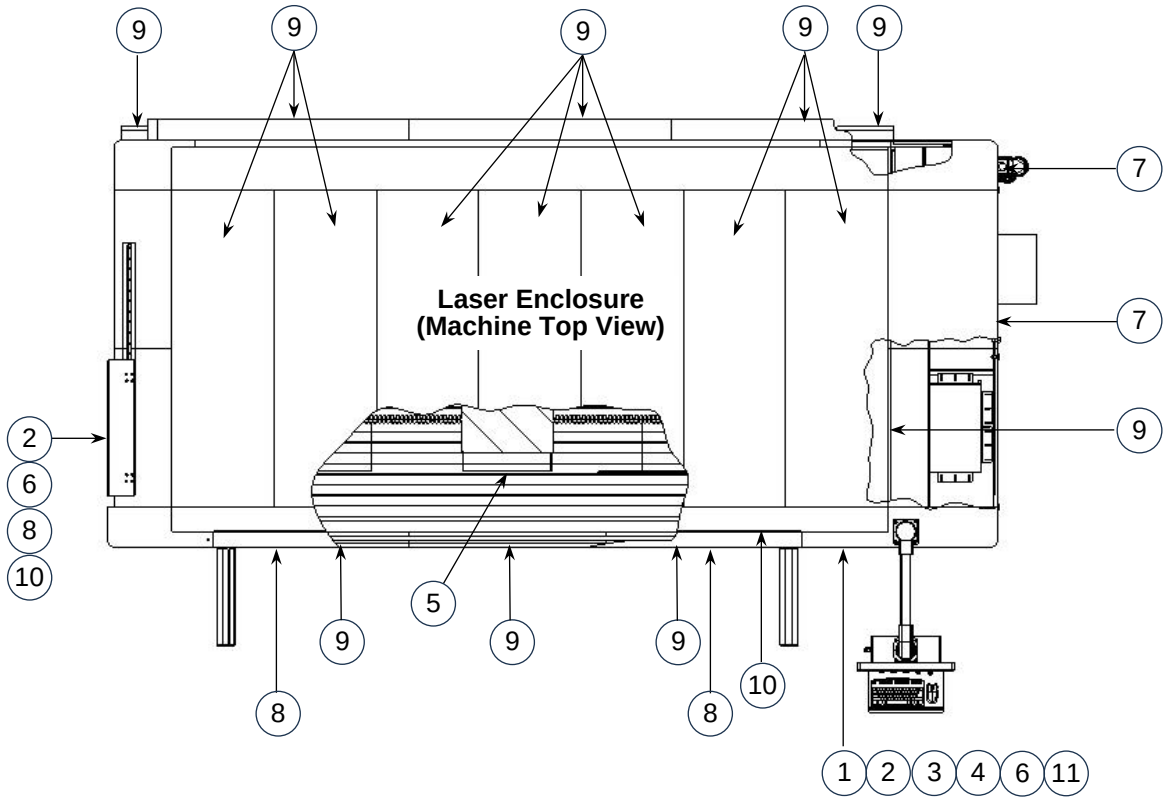
⚠**WARNING**: This product, when used for welding or cutting, produces fumes or gases which contain chemicals known to the State of California to cause birth defects and, in some cases, cancer. (California Health & Safety Code § 25249.5 et seq.)
⚠**WARNING**: Cancer and Reproductive Harm **www.p65warnings.ca.gov**

1.5 Laser Safety Officer

According to ANSI Z136.1, a Laser Safety Officer (LSO) is required for any workplace using Class 3B or Class 4 lasers. The LSO is an individual with sufficient training and knowledge to ensure compliance with safety standards, conduct hazard evaluations, and implement necessary control measures.

1.6 Meaning and Location of Graphical Symbols

The following safety markings appear on the machine in the locations shown. Specific warning details can be found in Section 1.7. Should labels become damaged or illegible, contact Lincoln Electric to obtain replacements.



ID	Symbol	Meaning
1		Mandatory use of gloves.
2		Mandatory to read the operator's manual before using machine.
3		Mandatory use of laser safety glasses.
4		Mandatory use of hearing protection.

ID	Symbol	Meaning
5		Warning of potential laser radiation hazard; both direct and radiated.
6		Warning of toxic fume particles being generated.
7		Warning of potential electric shock or electrocution hazard.

ID	Symbol	Meaning
8		Crush and cut hazard is present while operating this machine.
9		Class IV (4) radiation hazard when open. Operating the machine with this panel or cover removed could result in exposure to Class IV (4) laser radiation. This label appears on non-interlocked parts of the protective housing Do not operate this equipment when open. Only qualified personnel may conduct maintenance or repair this equipment.
10		Class IV (4) radiation hazard when open and interlock defeated. Operating the machine with this door open and interlock defeated could result in exposure to Class IV (4) laser radiation. This label appears on interlocked parts of the protective housing.

ID	Symbol	Meaning
11		Class 1 Laser Product. Class IV (4) radiation hazard when open and interlock defeated. Do not operate this equipment when open. Only qualified personnel may conduct maintenance or repair this equipment.

1.7 Specific Warnings

⚠ WARNING

Electric Shock Can Kill.

- Not all terminals inside the electrical cabinet are finger safe. Up to 480VAC may be present.
- Do not touch electrically live parts with skin or wet clothing. Insulate yourself from work and ground. Always wear dry insulating gloves.
- Disconnect input power before servicing.
- Do not operate with doors open; covers, panels, or guards removed.
- Only qualified personnel should install, use, or service this machine.

⚠ WARNING

Laser Radiation Hazard.

This machine uses a Class IV (4) laser with 1080nm ±10nm wavelength (infrared), which is hazardous radiation that may damage eyes and skin. This machine is surrounded by a light-safe enclosure that is certified to Class I (1), non-hazardous.

- Do not operate this machine if safety interlocks have been bypassed or otherwise defeated. Exposure to hazardous levels of Class IV (4) infrared laser radiation may occur.
- Do not operate this machine if the laser enclosure is modified or damaged. Exposure to hazardous levels of Class IV (4) infrared laser radiation may occur.
- Do not expose eyes or skin to direct, reflected, or scattered laser radiation.

⚠ WARNING

Laser Generated Air Contaminants.

Inhaling Laser Generated Air Contaminants (LGAC) from the laser cutting process may be hazardous to lungs and health. Fumes generated are composed of metallic oxides consistent with the alloy composition of the substrates being cut.

- Chrome bearing alloys will produce fumes containing hexavalent chromium compounds. Compounds of nickel, manganese, copper, and other metals may be present. Consult SDSs for alloy composition.
- Fume extraction must be turned on and operating properly before cutting begins and must continue to operate for 30 seconds after cutting ends.
- Do not operate this machine if fume extraction is not operating properly, or if associated ductwork is blocked, disconnected, or damaged.
- Some substrates produce toxic fumes that may be harmful or fatal to people in the vicinity of the cutting area.
- The customer is responsible to follow local, state or provincial, or national codes for industrial hygiene to determine worker exposure levels and appropriate controls.

⚠ WARNING

Fire and Explosion Hazard.

Fire and explosion may be caused by hot slag, sparks, oxygen cutting gas, or the laser cutting beam.

- Remove all combustible or flammable materials from the cutting area prior to operating.
- Have appropriately rated fire extinguisher readily available.
- Perform regular maintenance and cleaning to remove build-up of dirt, fine powder, and debris from cutting area.
- Laser cutting certain metals is known to produce flammable and/or explosive dust. It is the user's responsibility to comply with local, state or provincial, and national regulations for handling exhaust air from laser cell and fume extractor as well as the dust it contains. Refer to Section 1.2 for NFPA standards.

⚠ WARNING

Cylinder may Explode if Damaged.

- Use only compressed gas cylinders containing the correct gas for the process used and properly operating regulators designed for the gas and pressure used. All hoses, fittings, etc. should be suitable for the application and maintained in good condition.
- Always keep cylinders in an upright position, securely chained to an undercarriage or fixed support.
- Cylinders must be located away from areas where they may be struck or subjected to physical damage.
- They must be a safe distance from plasma cutting or gouging, arc welding operations and any other source of heat, sparks, or flame.
- Never allow any electrically "hot" parts to touch a cylinder.
- Keep your head and face away from the cylinder valve outlet when opening the cylinder valve.
- Valve protection caps should always be in place and hand tight except when the cylinder is in use or connected for use.
- Read and follow the instructions on compressed gas cylinders, associated equipment, and CGA publication P-1, "Standard for Safe Handling of Compressed Gases in Cylinders," available from the Compressed Gas Association, 1235 Jefferson Davis Highway, Arlington, VA 22202. (https://portal.cganet.com/publication/details?id=P-1).

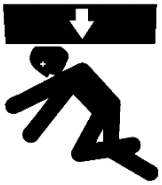
⚠ WARNING

Lockout Tagout Required.

Lockout Tagout of electrical and machine air supply is required before entering laser enclosure.

- Follow all regulatory body procedures.
- Engaging the emergency stop does not de-energize this machine.
- Do not enter laser enclosure with main power disconnect switch in the ON position or while the supply hose is connected to machine air inlet.

⚠ WARNING



Falling Equipment can cause injury.

- Never walk under a suspended load.
- Observe all safety regulations for handling suspended loads.
- Lift only with equipment of adequate lifting capacity.
- Only qualified personnel are allowed to transport heavy loads.

⚠ CAUTION

Caution—use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.

⚠ CAUTION

Environmental Hazard.

Glycol coolant is hazardous to the environment.

- If glycol coolant has been added to this machine, monitor for signs of leakage. Consult manufacturer's SDS. Clean up spills quickly and notify local regulatory bodies accordingly. Dispose of coolant and contaminated items per local and national codes. Do not allow coolant to reach ground water, water course, or sewage system.

Lubricating oil used in this machine is typically not hazardous to the environment; however, consult the manufacturer's SDS to verify.

- Monitor for signs of leakage. Clean up spills quickly. Do not allow lubricant to enter sewage system.

⚠ CAUTION

Hot Parts Burn Skin.

- Do not touch hot parts with bare hands.
- Always use gloves when handling finished parts, raw material, or the cutting head as they may be hot after cutting.
- Allow cooling period before working on the cutting head.

⚠ CAUTION

Noise Protection Required.

This machine may generate high noise levels during operation. Acceptable noise levels may be exceeded.

- Use proper hearing protection during operation when levels exceed 85 dB (A), or as defined by local, state or provincial, and national regulations.
- Refer to Section 2.10 for noise emission levels.

⚠ CAUTION

Cut Hazard.

Raw material and cut parts, especially thinner gauges, may have sharp edges.

- Always use gloves when handling cut parts and raw material.

⚠ CAUTION

Gas and Air Lines Under Pressure.

The flexible lines (tubing, hoses) that supply this machine with cutting gas and machine air may leak and cause injury.

- Inspect all lines prior to machine operation.
- Do not operate this machine with damaged lines.
- Hot sparks, flying debris, or wear may melt, burn, or puncture these lines which may cause injury.
- Route air and gas lines to keep away from traffic and from underfoot.

⚠ CAUTION

Lines/Tubing/Hoses may be Trip Hazard.

- Route lines/tubing/hoses to keep away from traffic and from underfoot.

⚠ CAUTION

Crush and Pinch Hazard.

The material door on this machine may crush or pinch digits or limbs.

- Ensure the material door is clear of personnel before closing it.
- Do not use the material door to enter the laser enclosure.
- Body parts may be crushed or pinched by moving elements of this machine.
- The operator must ensure all personnel are safely away from this machine before operating it.

⚠ CAUTION

Heavy Parts Hazard.

Parts used on this machine, raw materials, and cut parts may be heavy.

- To avoid injury, get additional personnel to help, or use appropriate mechanical lifting and handling devices.
- When using mechanical lifting and handling devices, follow all the manufacturer's safety guidelines.
- Use caution when placing or removing heavy material from cutting table.
- Use caution when opening the material drawer as parts/material may fall through the slats and onto feet. Always wear safety shoes.

⚠ CAUTION

Impact Hazard.

- Keep material drawer ejection pedal out of high traffic areas to avoid accidental activation.
- Stand clear of material drawer when actuating ejection pedal.

⚠ CAUTION

Slip Hazard.

Dust created by cutting process may cause slip hazard.

- Always practice good housekeeping by regularly removing dust.

Water or lubricant leaks may cause slip hazard.

- Immediately remove any leaked water or lubricant from floor.

1.8 Emergency Procedures

Emergencies happen when least expected. Knowing what to do before an emergency happens may keep you and those around you as safe as possible.

First and foremost, follow all safety training and procedures provided by your employer and always follow local, state or provincial, and national regulations for managing and reporting emergencies.

Next, take time now to make yourself aware of this machine's surroundings. Where are the nearest fire extinguishers? What about the location of the closest fire alarm? Where is the nearest first aid equipment? Knowing this information before an emergency occurs will save valuable time.

Since the initial step for many of these procedures involves the emergency stop (E-Stop) or main disconnect power switch, here is more information about both:

- The emergency stop is the red button located on the right side of the control panel. To engage the emergency stop, press in the button all the way and then let go; it will click as it latches in. The machine will immediately stop and the stack light on the laser enclosure will blink red. The machine still has both electrical and pneumatic power.

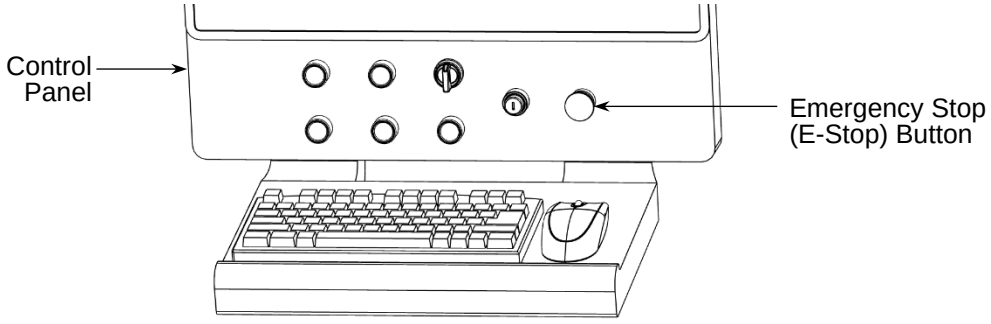


Figure 1: Location of Emergency Stop (E-Stop) Button

- The main disconnect power switch is located on the right rear side of the laser enclosure, near the air conditioner. Turn this switch to the left (counter-clockwise) to the 'Off' position to remove electrical power. The machine still has pneumatic power (machine air).

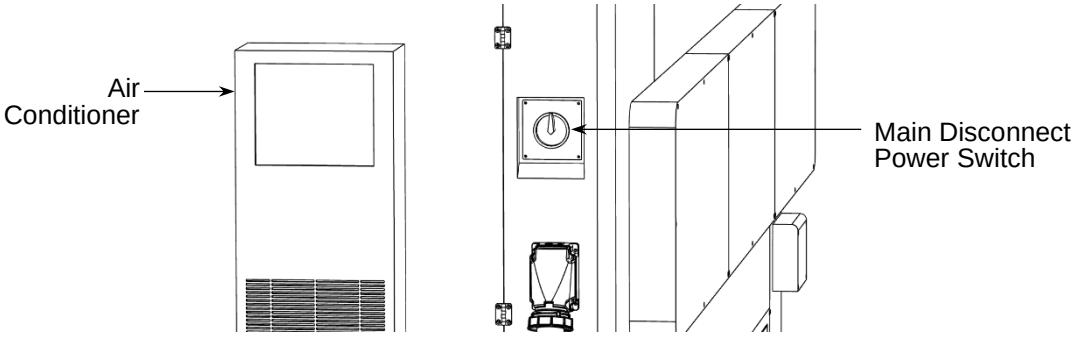


Figure 2: Location of Main Disconnect Power Switch

1.8.1 What to do if someone is shocked?

Never attempt to pull the person away from an electrical source because you may be shocked too.

Step 1 – Turn off the main disconnect power switch, or, if you are closer to it, the facility's primary power wall disconnect switch that feeds electricity to this machine.

Step 2 - Do not operate this machine again until the cause has been identified, repaired, and this machine has been returned to service.

1.8.2 What to do if the laser enclosure is damaged or modified?

The light safe enclosure contains hazardous Class (IV) 4 radiation such that the overall product is Class I (1), non-hazardous. If the laser enclosure is damaged or if it has been modified in any way:

Step 1 - Engage the emergency stop.

Step 2 - Do not operate this machine again until the extent of the damage or modification has been identified, repaired, and this machine has been returned to service.

1.8.3 What to do if something gets jammed?

If material or finished parts get jammed in the cutting table or material drawer, do the following:

Step 1 - Engage the emergency stop.

Step 2 - Remove the jammed material and then clear the E-Stop condition, per Section 6.1.2.

1.8.4 What to do with a gas leak?

The gases used by this machine are clear and odorless, but should you suspect a leak, do the following:

Step 1 - Engage the emergency stop.

Step 2 - Locate each of the gas supplies and turn them off at the source. Since each installation is different, if it is a gas cylinder, turn the cylinder valve clockwise to close it. If the source is a permanent supply line, use the shut-off valve closest to the source.

Step 3 - Do not operate this machine again until the cause has been identified, repaired, and this machine has been returned to service.

1.8.5 What to do if cutting head becomes damaged?

The protective window (or other consumable) in the cutting head may fail in such a way that it may damage the cutting head. If this occurs, do the following:

Step 1 - Engage the emergency stop.

Step 2 - Do not operate this machine again until the cause has been identified, repaired, and this machine has been returned to service.

1.8.6 What if the cutting movements are erratic?

If you see the cutting head moving erratically or unexpectedly, do the following:

Step 1 - Engage the emergency stop.

Step 2 - Do not operate this machine again until the cause has been identified, repaired, and this machine has been returned to service.

1.9 IT Security

Do not connect this machine to the internet, unless as directed by Lincoln Electric for troubleshooting purposes only.

Always perform virus and malware scans on any device that connects to this machine, such as USB drives.

Follow best practices to regularly backup important files stored on the computer.

2.0 Specifications

2.1 Machine Description

Linc-Cut™ 3015 is a light-industrial CNC laser cutting machine. It is equipped with a water-cooled continuous wave (CW) fiber laser; available in 4kW or 2kW models. A Class I (1) light-safe enclosure surrounds a gantry-style downdraft cutting table that accepts up to 5'x10' material. The motion control system includes a PC, CNC controller, servo drives, and servo motors that communicate over EtherCAT®.

2.2 Intended Use

This machine is intended for metal working, steel fabrication, HVAC, and similar workshops or trade schools that produce small to medium part runs. It is designed for 2D cutting/marking on sheet metal or plate. This machine is only designed for mild steel, aluminum, and stainless steel. All other materials are prohibited. Operators must be trained to use this machine and must be familiar with the associated risks. This machine must be operated as described in these instructions.

2.3 Machine Specifications

Cutting laser output, model AD2599-1:.....4kW, 1080nm ±10nm
Cutting laser output, model AD2599-3:.....2kW, 1080nm ±10nm

Alignment laser output: 1mW, 600-700nm
Maximum sheet/plate size: ..... 5'x10' (1.5m x 3m)
Maximum traverse speed: .....2,874 in/min (73,000mm/min) with 1.0G accel

Recommended cutting capacity at 4kW:
- Mild Steel with Oxygen.....5/8" @ 39.3 in/min (16mm @ 1000mm/min)
- Mild Steel with Nitrogen .....3/8" @ 35.4 in/min (10mm @ 900mm/min)
- Aluminum with Nitrogen .....3/8" @ 35.4 in/min (10mm @ 900mm/min)
- Stainless Steel with Nitrogen.....3/8" @ 35.4 in/min (10mm @ 900mm/min)

Maximum piercing capacity at 4kW*:
- Mild Steel with Oxygen.....3/4" @ 19.6 in/min (19mm @ 500mm/min)
- Mild Steel with Nitrogen .....1/2" @ 20.6 in/min (12mm @ 525mm/min)
- Aluminum with Nitrogen .....1/2" @ 17.7 in/min (12mm @ 450mm/min)
- Stainless Steel with Nitrogen.....1/2" @ 19.6 in/min (12mm @ 500mm/min)

*Operation at maximum piercing thickness may result in a deterioration of cut quality and reduced consumable life.

2.4 Certifications and Standards

- This machine, at the time of manufacture, is certified as a Class I (1) laser product to the requirements of the US Federal Product Performance Standard for Laser Products contained in the regulations in 21 CFR Subchapter J.
- U.S. Food and Drug Administration (FDA) registered device. All machines are reported to the FDA and provided with an accession number.
- Cut quality within ISO 9013 Range 3 or better.

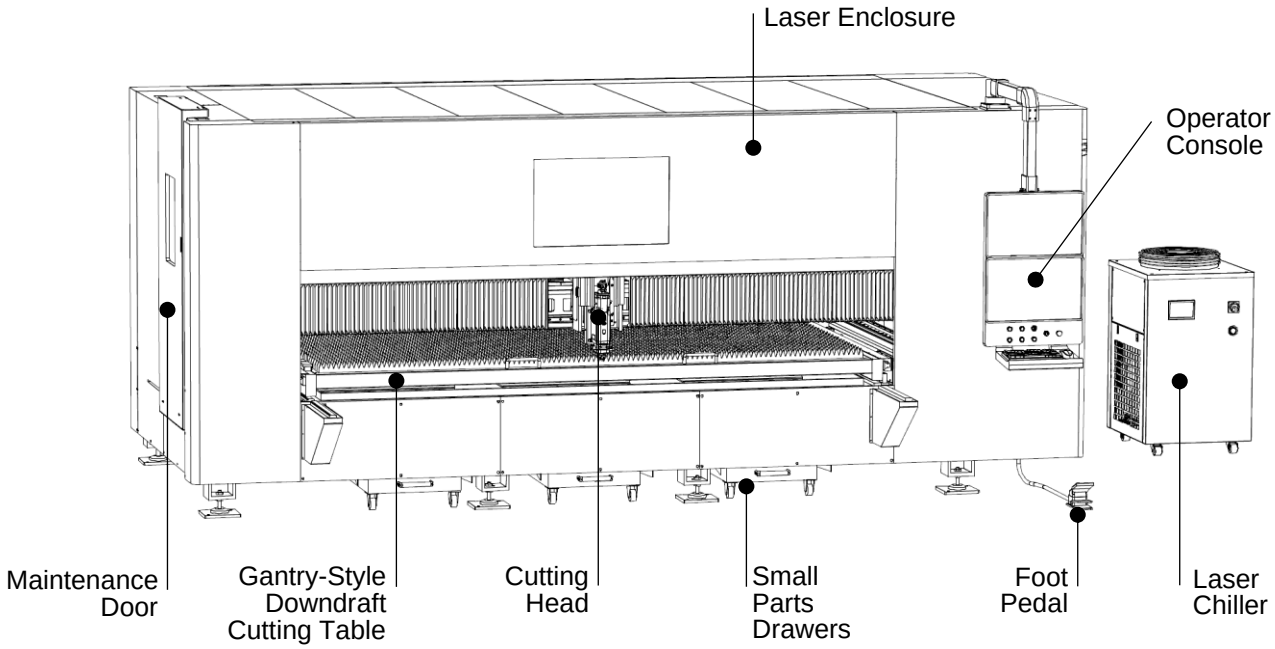
2.5 Operating Environment

- Nominal Operating Conditions*: ..... 50-83°F (10-28°C) ≤ 50%RH

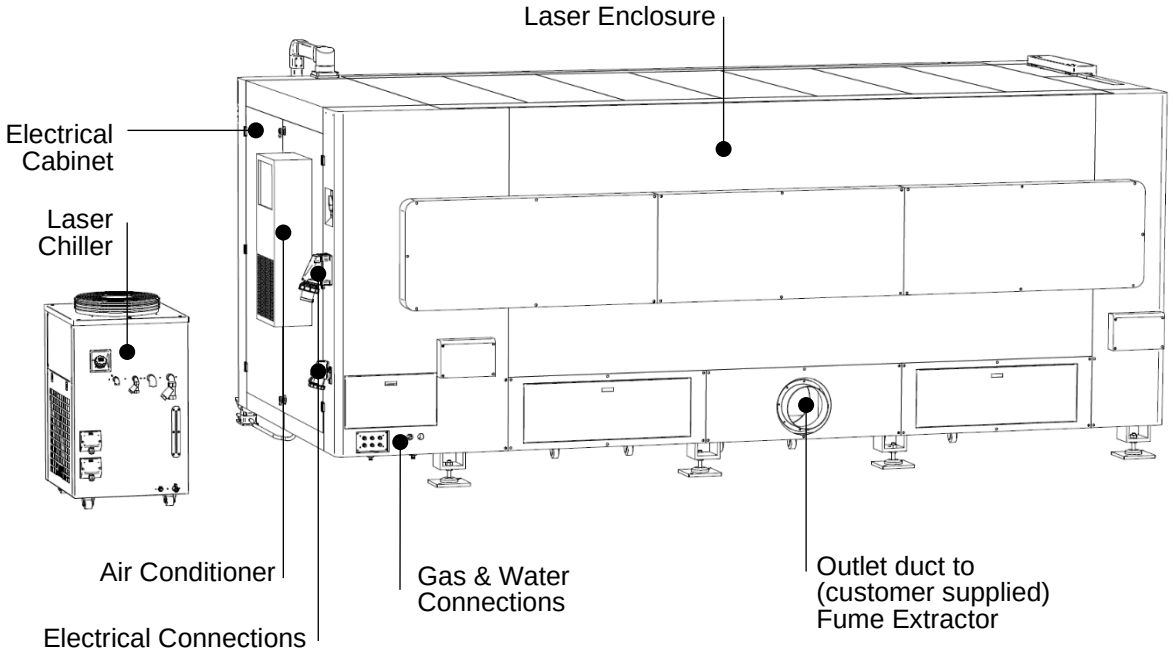
  * Refer to Appendix C for operating conditions outside this range.
- This machine is designed for indoor use only. Outdoor use is prohibited.
- This machine must be installed on 6” concrete slab, level to within 1” over the length and width of this machine.
- This machine must not be used in an explosive environment (ATEX).
- Do not store this machine in freezing temperatures.

2.6 Machine Components

2.6.1 Machine Front

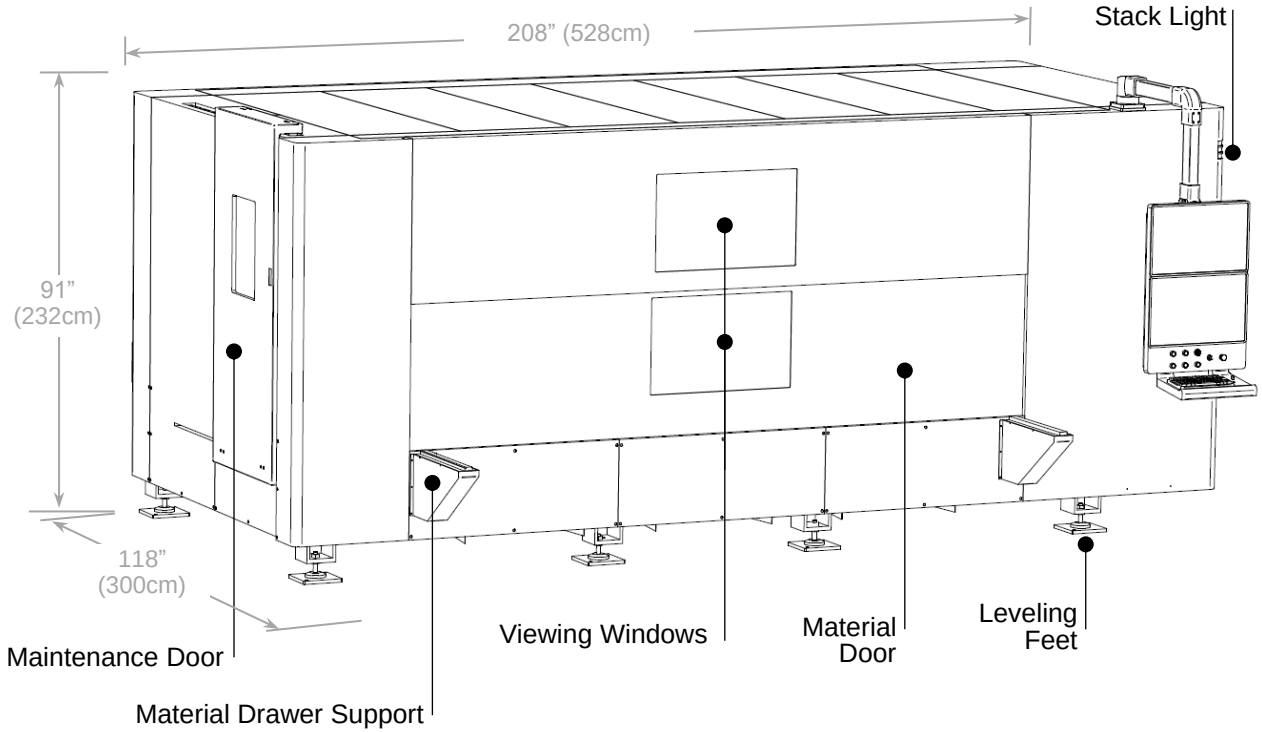


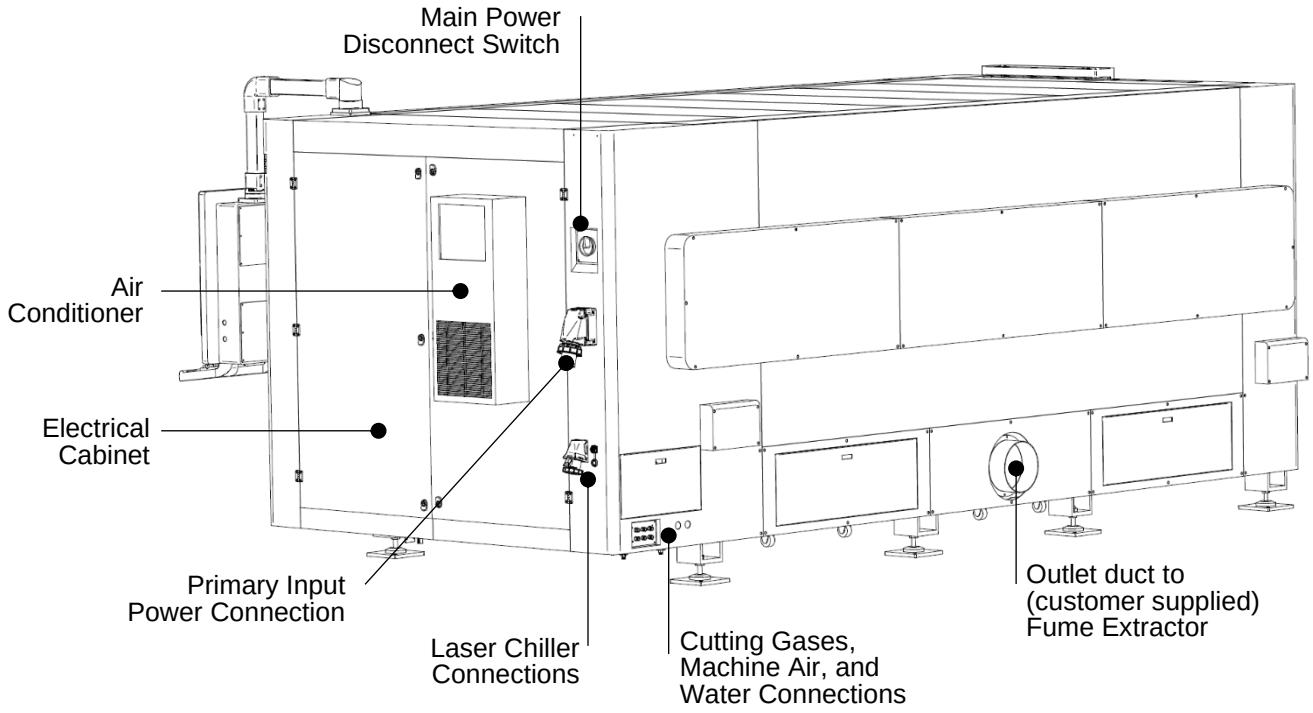
2.6.2 Machine Back



2.7 Supplied Components

2.7.1 Laser Enclosure Specifications





Purpose:

The laser enclosure safely contains the Class IV (4) laser radiation such that this machine is Class I (1) when operated with the protective housing intact and interlocks functioning. It also protects the operator from flying debris, like sparks and molten metal.

A knob on the control panel operates the material door up/down, which provides access to load/unload the machine. The maintenance door is secured by lock and key; the door slides left/right.

The laser enclosure also houses an air-conditioned electrical cabinet that contains the laser diode pump, motion control & servo drive systems, lubrication system, and all related safety and electronic components. The stack light near the operator console helps to indicate the current state of the machine.

Input power, cutting gas(es), machine air, laser chiller, and fume extractor all interface on the back or right sides of this machine.

Dimensions (LxWxH): ..... 208”x118”x91” (528cm x 300cm x 232cm)

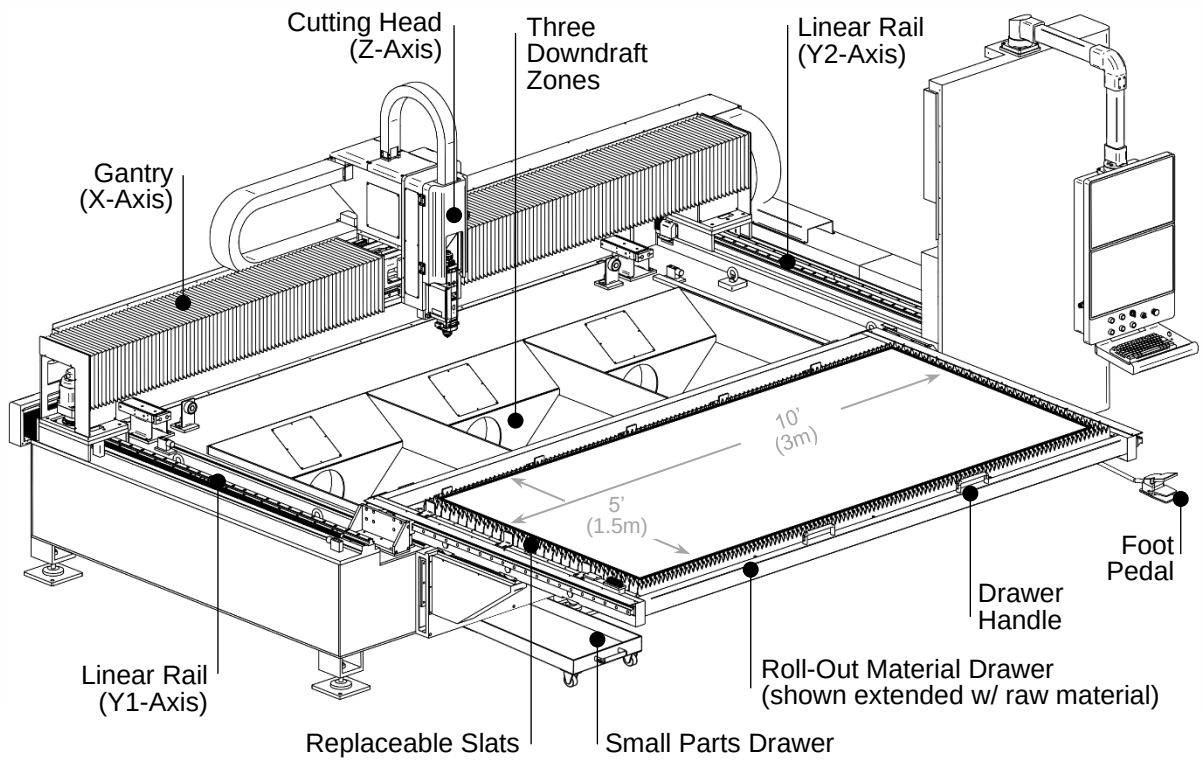
Weight: ..... 12,500 lbs (5,659 kg)

⚠ WARNING: Exposure to hazardous levels of Class IV (4) infrared laser radiation may occur if the safety circuit is defeated or the enclosure is damaged or modified. Lockout tagout is required before entering enclosure.

⚠ CAUTION: Do not climb on the enclosure.

2.7.2 Cutting Table Specifications

(Shown with Laser Enclosure hidden)



Purpose:

The gantry-style cutting table precisely moves the cutting head along three axes of motion (X, Y, Z) as commanded by the motion control system.

The cutting table also supports the raw material to be processed and includes a pneumatically assisted roll-out material drawer, which allows for the use of forklift or overhead material loading options.

Three pneumatically actuated downdraft zones automatically open/close based on the cutting head location. This helps contain cutting fumes/dust, which are then removed by a customer supplied fume extractor.

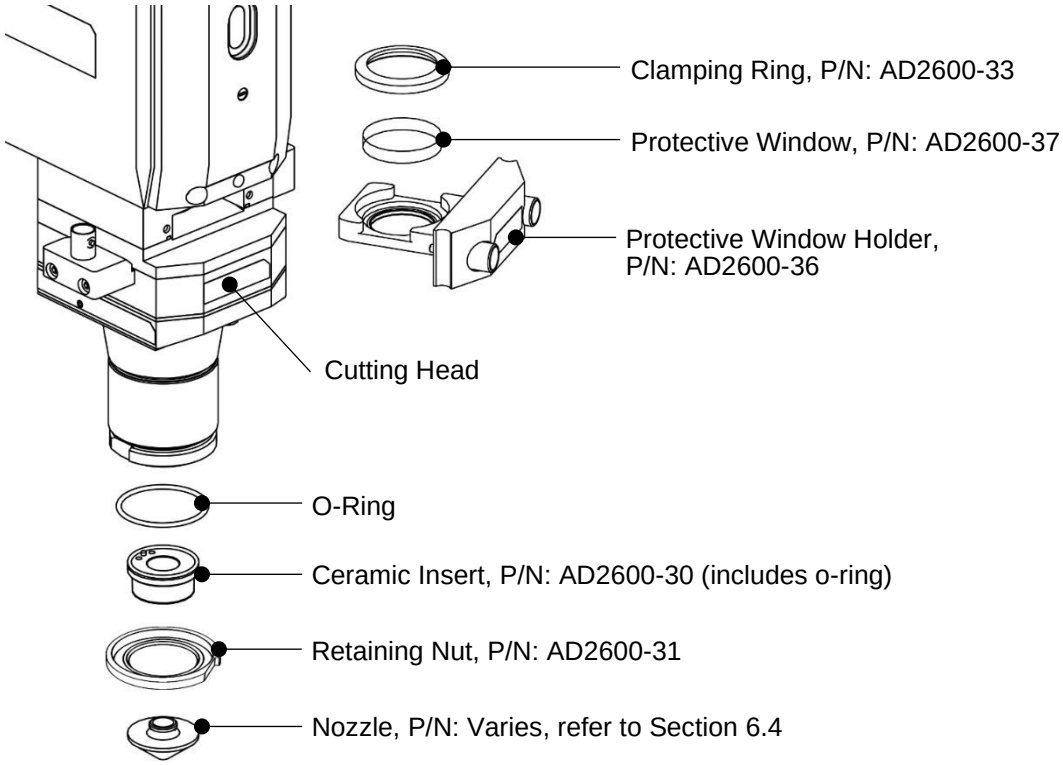
Small parts and dross fall between slats in the material drawer and collect into three pull-out drawers under the cutting table.

Maximum usable cutting area: .....60.5”x121” (154cm x 307cm)

Maximum weight capacity: .....1,322 lbs (599 kg)

⚠CAUTION: Do not sit on, climb on, or ride on the material drawer.

2.7.3 Cutting Head & Laser Diode Pump Specifications



Purpose:

The cutting head is mounted to the cutting table gantry. It houses the focusing elements that cause the laser beam to cut and mark. The nozzle, ceramic insert, and protective window are consumables that wear out and need to be replaced. Different raw material types, thicknesses, and cutting gases require different nozzles.

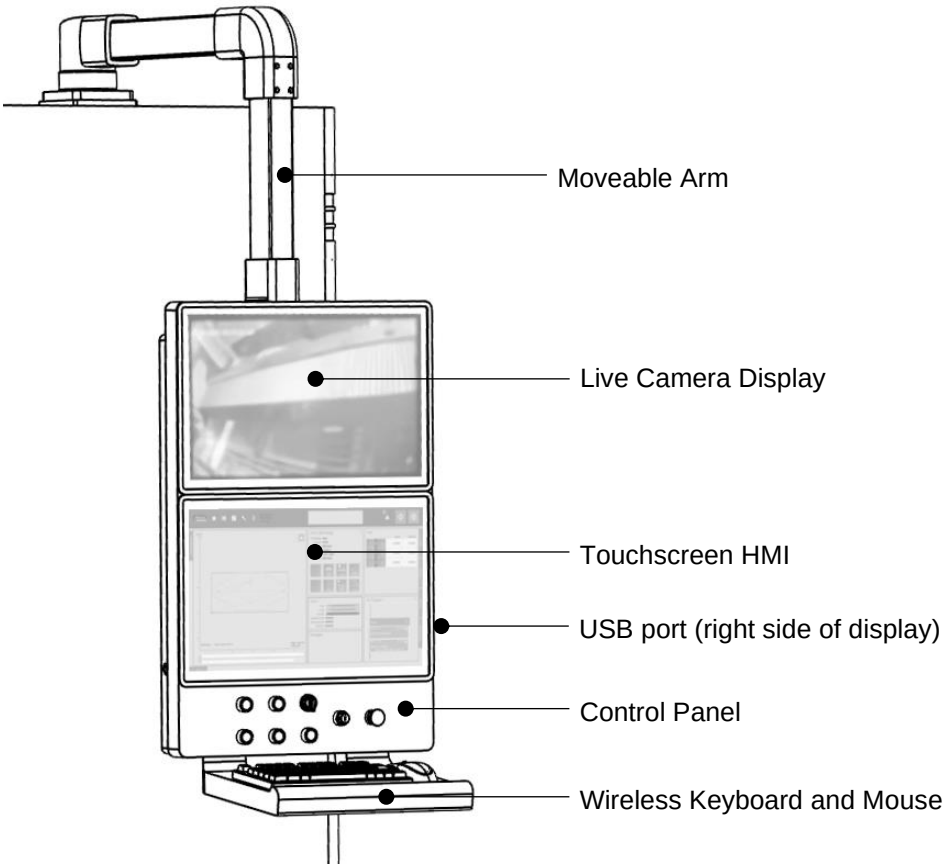
The laser diode pump is mounted inside the electrical cabinet. It creates the laser light that travels through fiber optic cable to the cutting head. The laser diode pump is maintenance free and contains no replaceable parts.

The cutting head and diode pump are water-cooled; supply and return hoses connect to laser chiller.

Type: ..... Continuous Wave (CW) Fiber Laser
Output Power (nominal): ..... 2kW or 4kW Class IV (4)
Emission Wavelength (nominal): ..... 1080nm ±10nm (infrared)
Alignment Laser Power (maximum):..... 1mW Class II (2)
Alignment Laser Wavelength: ..... 600-700nm (visible red)
Focal Length: 150mm
NA Specification: .....99% of power enclosed at Θ≤120mrad

NOTICE: Do not use the wrong consumables. Consumables are fragile.

2.7.4 Operator Console Specifications



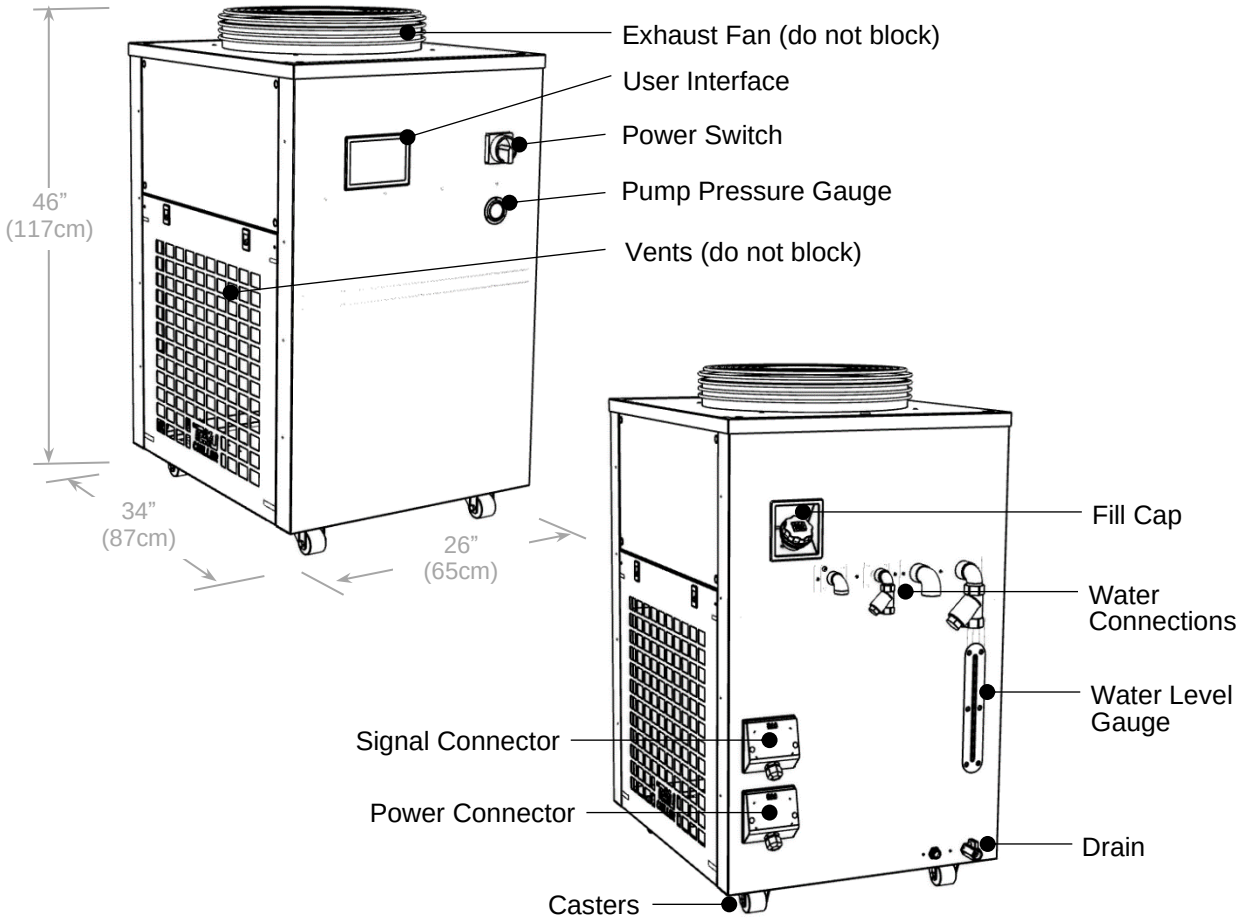
Purpose:

The operator console contains the primary controls needed to operate this machine. The live camera display provides a camera feed from inside the laser enclosure. The touchscreen Human-Machine Interface (HMI) displays the necessary software while the control panel contains important hardware buttons. Files can be transferred to this machine using the USB port.

The moveable arm allows the operator to position themselves for safe observation of machine operation.

NOTICE: Always scan USB drives for viruses and malware before connecting them to this machine.

2.7.5 Laser Chiller Specifications



Purpose:

The laser chiller uses de-ionized water to cool the cutting head and laser diode pump. De-ionized water is customer supplied. Refer to Section 2.8.2 for water specifications. Hoses and cables connect from the laser chiller to the laser enclosure. Refer to Appendix B for winterizing instructions.

Tank capacity: .....10.5 gal (40 L)

Dimensions (LxWxH): ..... 34”x26”x46” (87cm x 65cm x 117cm)

Weight Empty: .....298 lbs (135 kg)

Weight Full: .....340 lbs (154 kg)

⚠CAUTION: Do not sit on, climb on, or ride on the laser chiller.

***NOTICE*:** Do not use tap water, automotive coolant, rust inhibitors, or leak stoppers. Do not block vents or exhaust fan. Do not operate until it is filled with water.

2.8 Customer Supplied Components

The following components must be supplied by the customer. All components must be installed, plumbed, and operational prior to commissioning.

2.8.1 Fume Extractor Specifications

Minimum performance:.....2000 CFM @ 9in. WG (3400 m^3/hr @ 2240 Pa)
Outlet duct outside diameter: ..... 11.8” (300mm)

NOTE: Lincoln Electric offers the Prism® 2 Compact that meets these requirements for ferrous metals. Refer to national standards and manufacturer’s guidance for fume extractors for non-ferrous metals.

2.8.2 Gas and Air Specifications

Machine air is required. Cutting gas type is determined by the application. Oxygen is used for mild steel, nitrogen for aluminum and stainless steel. Nitrogen can also be used for mild steel, but at higher gas consumption.

NOTICE: Use of cutting gases that do not meet these specifications will result in degraded cut quality and potentially irreparable damage to cutting head optics.

Cutting Oxygen and Supply Hose

Purity: ..... ISO 8573-1: 2010 (2:2:2)
Maximum Input Pressure:.....120 psi (8.2 bar)
Flow rate:.....8.8 SCFM (250 liters/min)
Supply Hose: ..... 10mm OD

Cutting Nitrogen and Supply Hose

Purity: ..... ISO 8573-1: 2010 (2:2:2)
Maximum Input Pressure:.....300 psi (20 bar)
Max Flow: ..... 70.6 SCFM (2000 liters/min)
Supply Hose: ..... 16mm OD

Cutting Air* and Supply Hose*

Purity: ..... ISO 8573-1: 2010 (2:2:2)
Pressure: .....300 psi (20 bar)
Max Flow: ..... 70.6 SCFM (2000 liters/min)
Supply Hose: ..... 16mm OD

Machine Air and Supply Hose

Purity: ..... Dry and Oil-Free
Pressure: ..... 90-130 psi
Supply Hose: ..... 10mm OD

* Reserved for future use.

2.8.3 Water and Lubricating Oil

Water (for Laser Chiller)

Tank capacity: .....10.5 gal (40 L)

Purity: .....De-ionized

***NOTICE*:** Do not use tap water, automotive coolant, rust inhibitors, or leak stoppers.

Lubricating Oil

Reservoir capacity: 2.1qt (2L)

Viscosity: ..... 30-250 cSt

Recommendations:.....Mobil 5W-20 Synthetic,
Mobil Vactra™ Oil No 2, or
KLÜBEROIL GEM 1-46 N 200 LTR

2.8.4 A/C Condensate Drain Line

Provided drain line:..... 0.31” OD (8mm) x 0.20” (5mm) ID x ~8’ (~2.4m) long

Additional drain line and connectors are customer supplied.

2.9 Electrical Specifications

Wire and Fuse Sizes below are based upon the U.S. National Electric Code and maximum output. Choose input and grounding wire size according to local or national electric codes.

Input power requirement:..... 480VAC 3Φ 60Hz

Input Amperes: 45A

Fuse or circuit breaker size: 60A

Input power cable (customer supplied): ..... 6AWG/4C SOOW (L1, L2, L3, PE)

2.10 Airborne Noise Emissions

This machine may generate high noise during operation. Depending on the size of the nozzle orifice, selected gas purging pressure, and open/closed status of the front door, acceptable noise levels may be exceeded.

The customer is responsible to follow local, state or provincial, or national codes for industrial hygiene to determine worker exposure levels and appropriate controls.

Testing at the factory was conducted with a 4.0mm diameter nozzle orifice. The results were captured using a sound level meter. Other test conditions are noted below as well as the results:

- Purging nitrogen at 290psi (20bar), measured 3.28ft (1m) from the cutting head with the material door open. **Result = 129dB**
- Purging/cutting nitrogen at 290psi (20bar), measured 3.28ft (1m) from the material door (door was closed and the cutting head was in the middle of cutting table). **Result = 108.9dB**

3.0 Shipping & Placement

3.1 Shipping

3.1.1 Weights and Dimensions

Laser enclosure weight:..... 12,500 lbs (5,659 kg)
Laser enclosure dims (LxWxH):..... 217"x92”x98" (551cm x 234cm x 249cm)

Laser chiller weight: ..... 345 lbs (156 kg)
Laser chiller dims (LxWxH): ..... 36”x32”x48” (91cm x 81cm x 122cm)

3.1.2 Lift Points and Center of Gravity

⚠ DANGER: Suspended Loads. Falling loads can cause death or serious injury. Observe all regulations for handling heavy loads. Never walk under a suspended load. Use tested and appropriately sized tackle. Only use qualified personnel. Only use the provided lifting points.

The laser enclosure and laser chiller are shipped on pallets, which must be removed before use. The laser enclosure can be moved on its pallet using a sufficiently sized forklift. Only use the four lifting points shown below when removing the laser enclosure from the pallet and for placing. Laser enclosure roof panels must be removed to use lifting points.

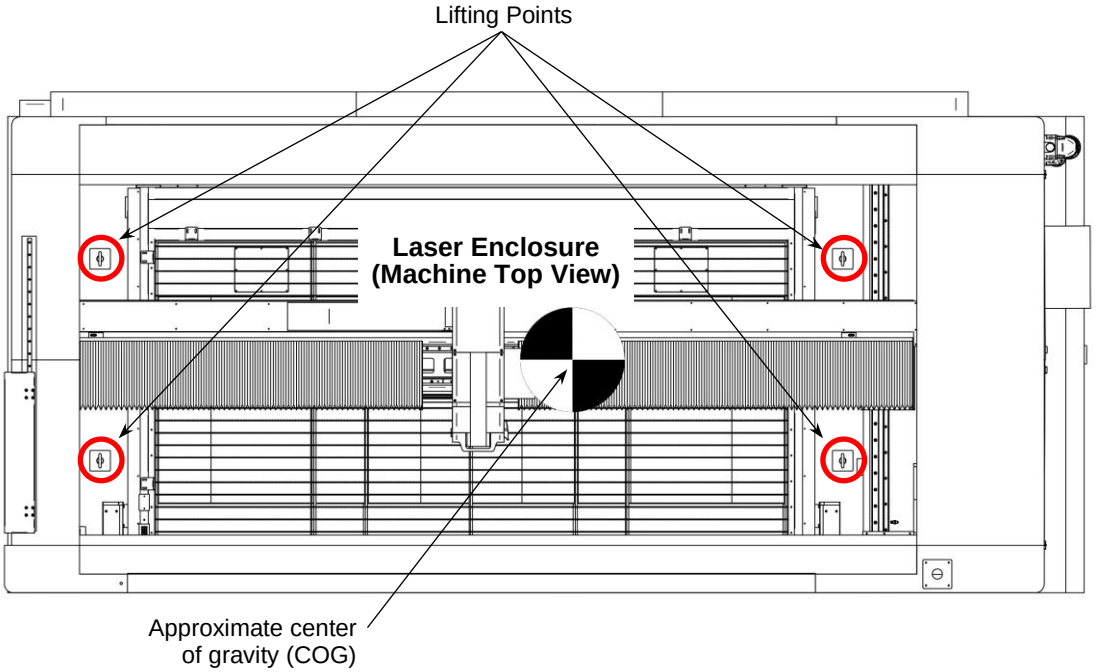


Figure 3: Laser Enclosure Lift Points & COG

3.2 Placement

Maintain 3’-0” (91cm) minimum work space on all sides of the laser enclosure. Maintain 6’-0” (183cm) for cutting table clearance in front of the laser enclosure.

Maintain 3’-4” (102cm) minimum clearance for ventilation on both sides of the laser chiller. Ensure enough clearance between the electrical cabinet door and laser chiller. Maintain 5’-0” (1.5m) clearance above the laser chiller.

Fume extractor layout and ductwork is customer defined. Maintain minimum clearances shown.

All leveling feet on the laser enclosure must contact the ground. Tighten all locking nuts after the machine has been leveled in all directions.

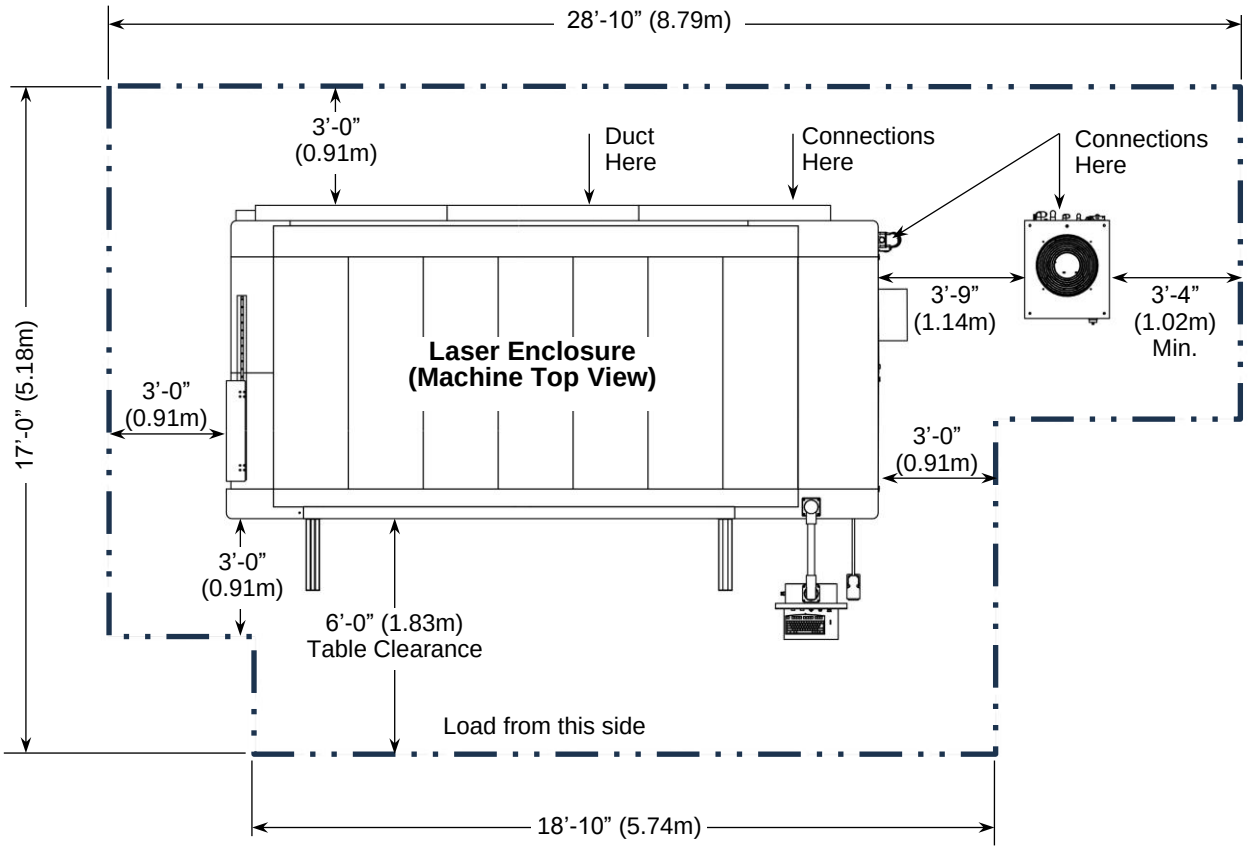


Figure 4 – Machine Placement

4.0 Installation

4.1 Grounding

Protective earth ground is provided through the primary input power connection. A separate ground rod is not necessary.

4.2 Input Power Connection

⚠ WARNING: Electrical shock can kill. Only qualified personnel should install, use, or service this machine.

Terminate the customer supplied primary input power cable into the supplied input power connector. The legs are labelled L1, L2, L3, and Ground.

Ensure the main power disconnect switch is in the 'Off' position, then insert the power connector into the receptacle on the laser enclosure. Twist the locking ring to secure the connector.

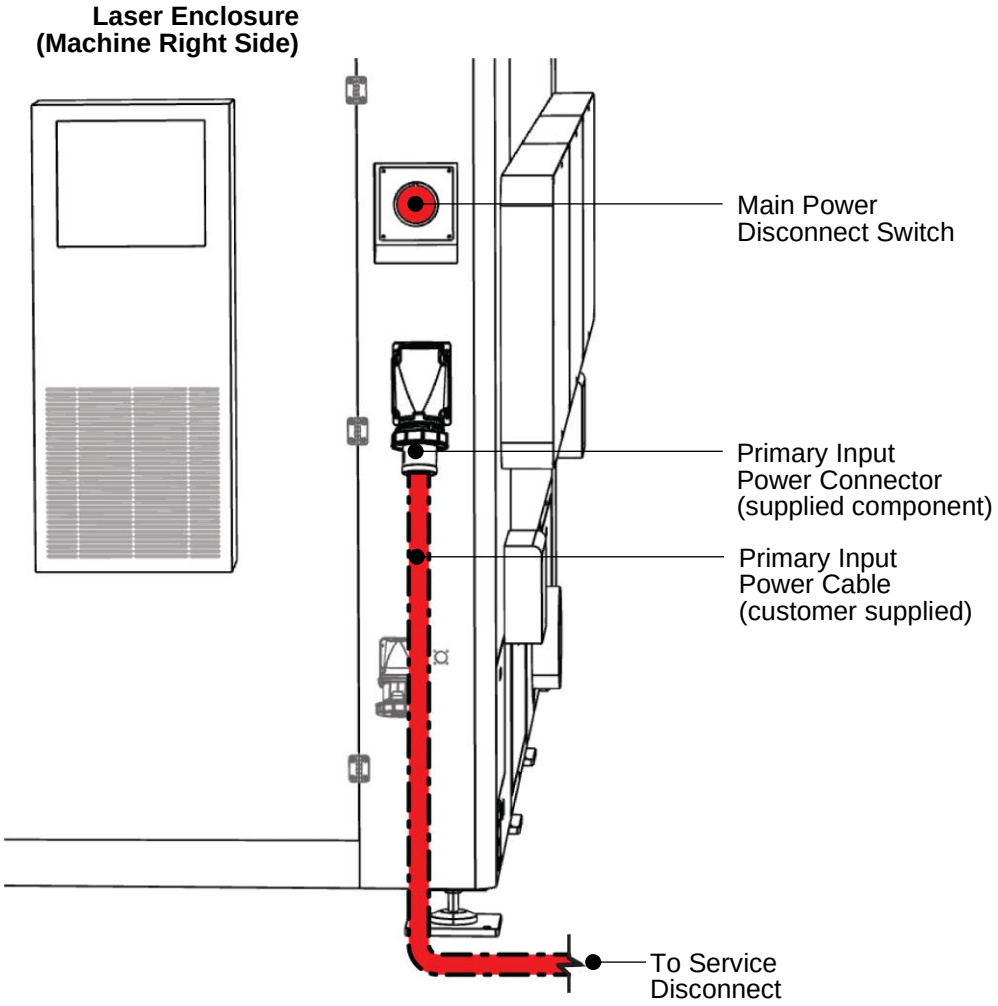


Figure 5: Input Power Connection

4.3 Laser Chiller Power & Signal Connections

Connect the laser chiller signal cable to the corresponding receptacle on the laser enclosure. Insert the chiller power cable connector into the receptacle on the laser enclosure. Twist the locking ring to secure the connection.

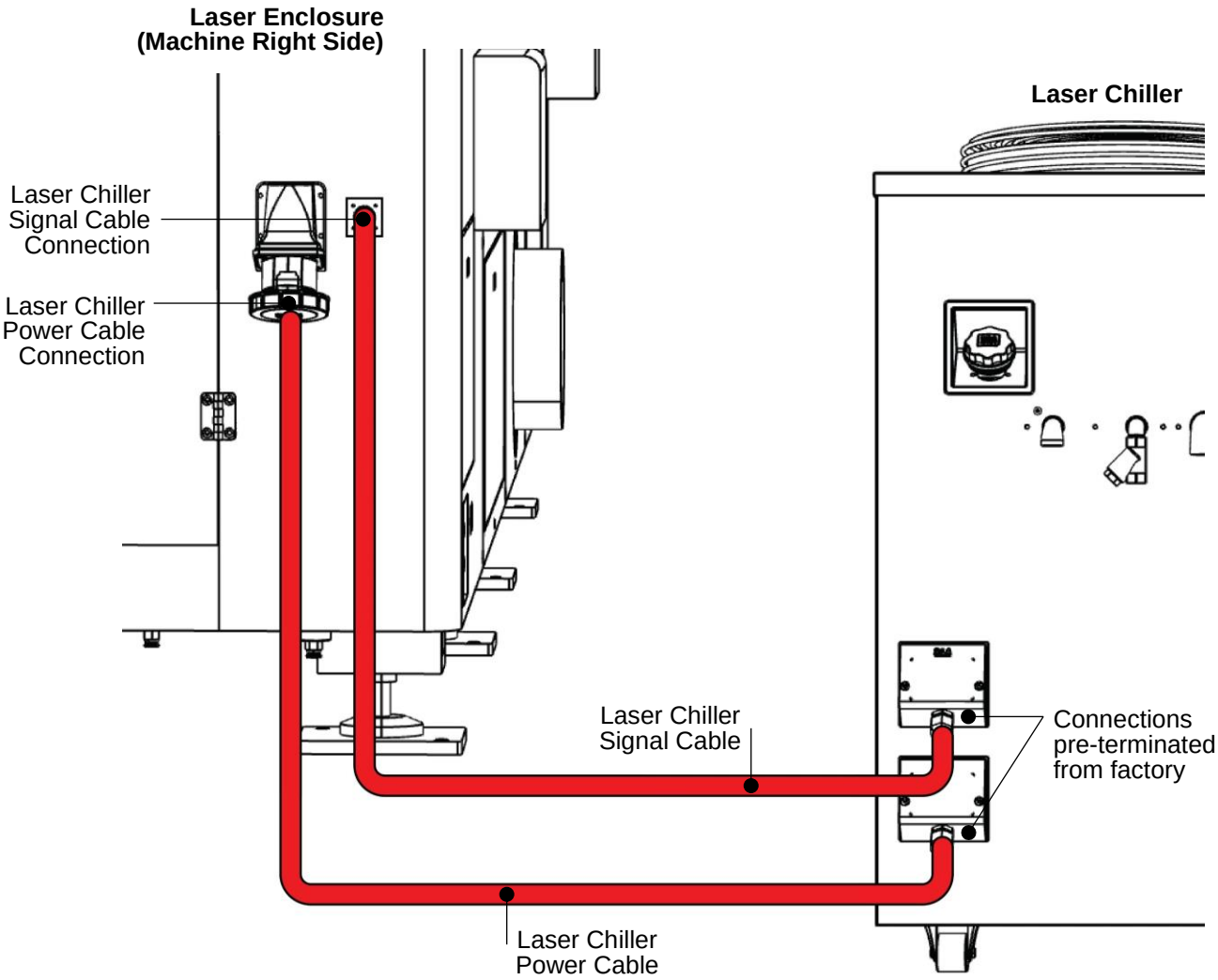


Figure 6: Laser Chiller Power & Signal Connections

4.4 Laser Chiller Water Connections

Push-to-connect fittings are provided for each water connection. Use the supplied hoses to make the connections shown between the laser chiller and laser enclosure.

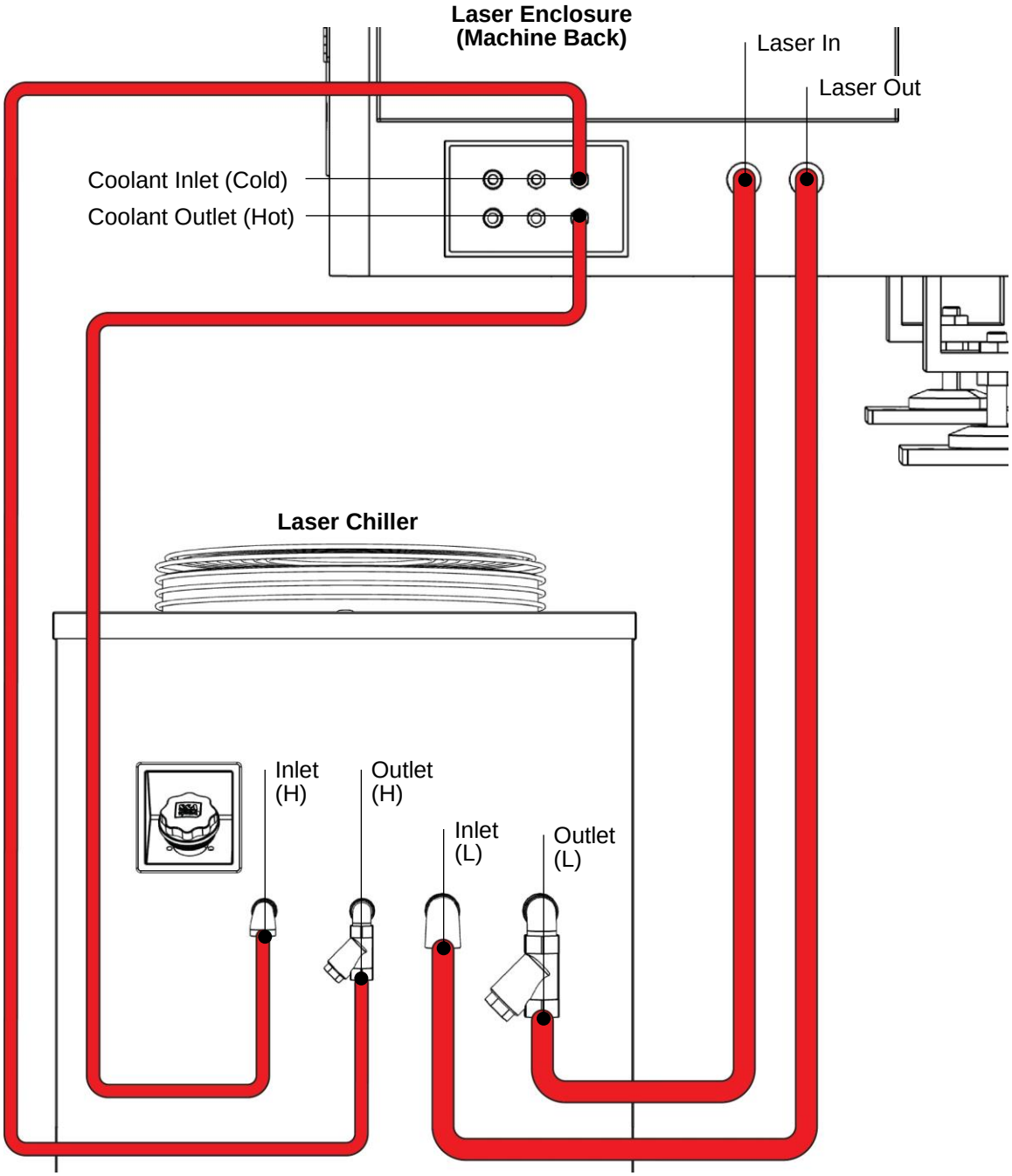


Figure 7: Laser Chiller Water Connections

4.5 Cutting Gas & Machine Air Connections

Push-to-connect fittings are provided for each supply connection on the laser enclosure. All hoses are customer supplied and must be sized appropriately. Gas purity requirements are critical. Gas filtration is customer supplied.

Machine air is required. Cutting gas type is determined by the application. Make the machine air connection and the cutting gas connection(s).

NOTICE: Use of cutting gases that do not meet purity specifications will result in degraded cut quality and potentially irreparable damage to cutting head optics.

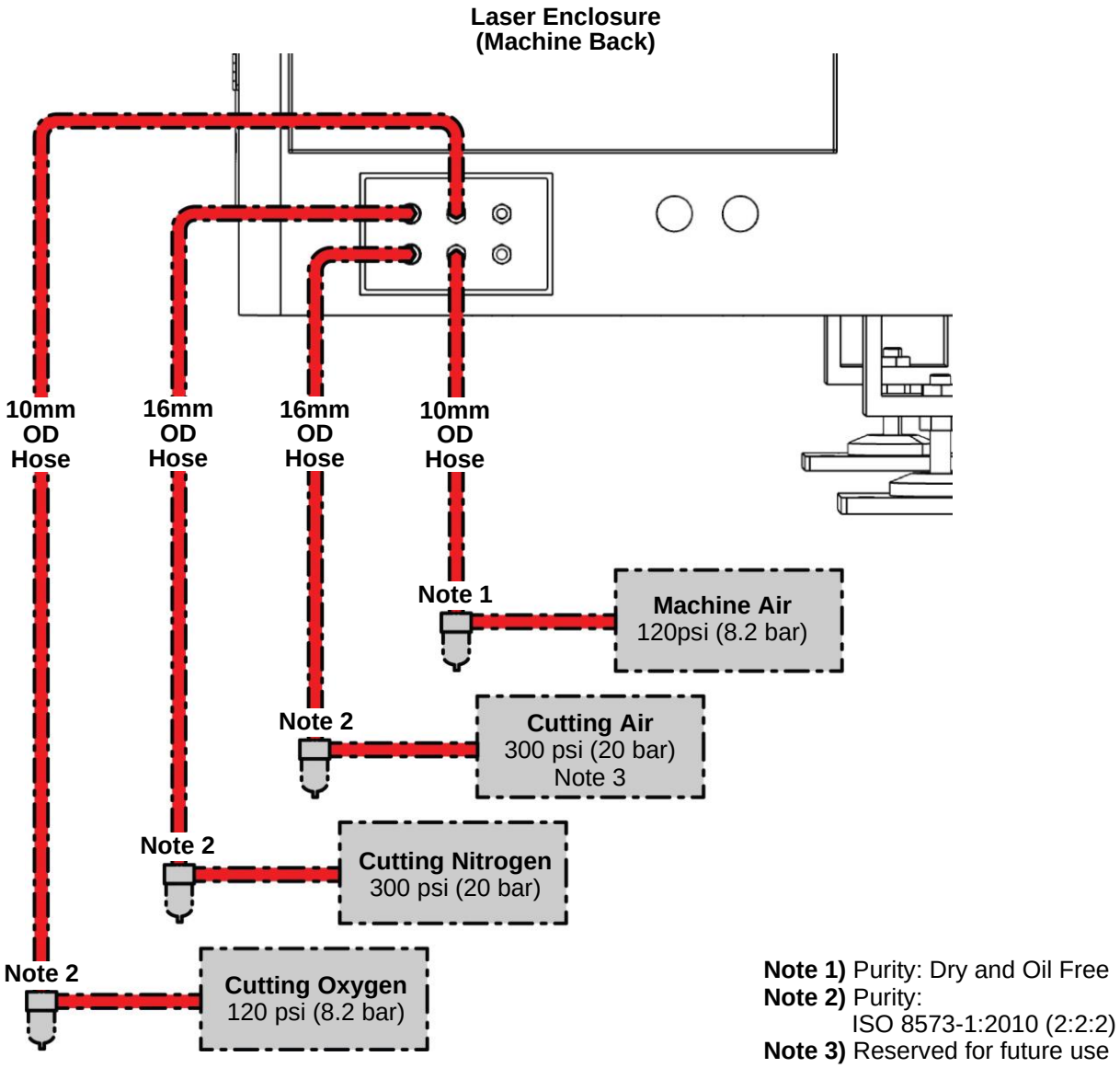


Figure 8: Cutting Gas, Machine Air, and Hoses

4.6 A/C Condensate Drain Connection

A rigid condensate drain line is provided from the air conditioner on the laser enclosure. The size is 0.31” OD (8mm) x 0.20” (5mm) ID x ~8’ (~2.4m) long. Additional drain line and any connections are customer supplied. Connect the condensate drain line to customer supplied floor drain (or similar).

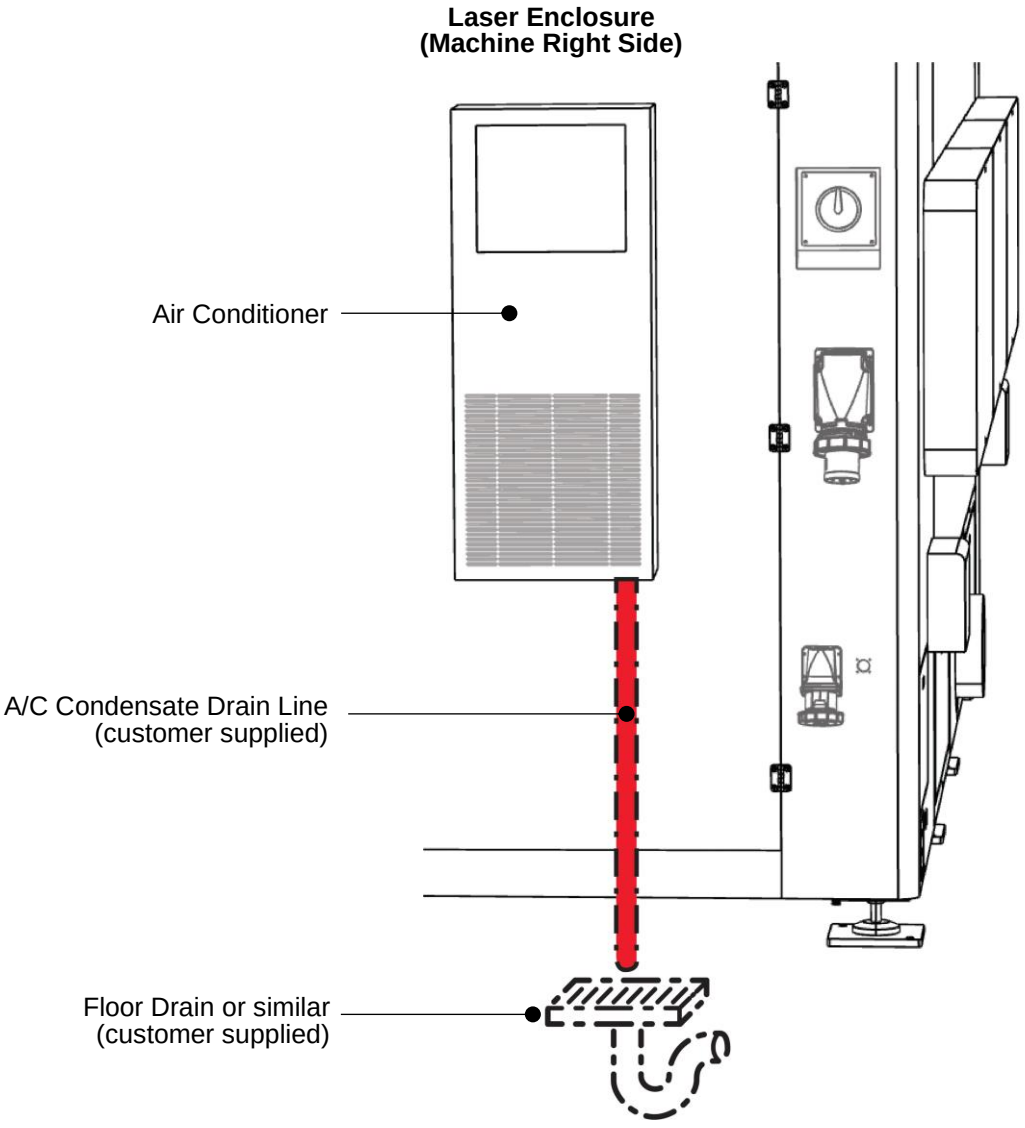


Figure 9: A/C Condensate Drain

4.7 Outlet Duct to Fume Extractor

The fume extractor and related ductwork are customer supplied. Refer to national standards for ductwork design and to select a fume extraction system.

Connect the required ductwork between the laser enclosure and the fume extractor.

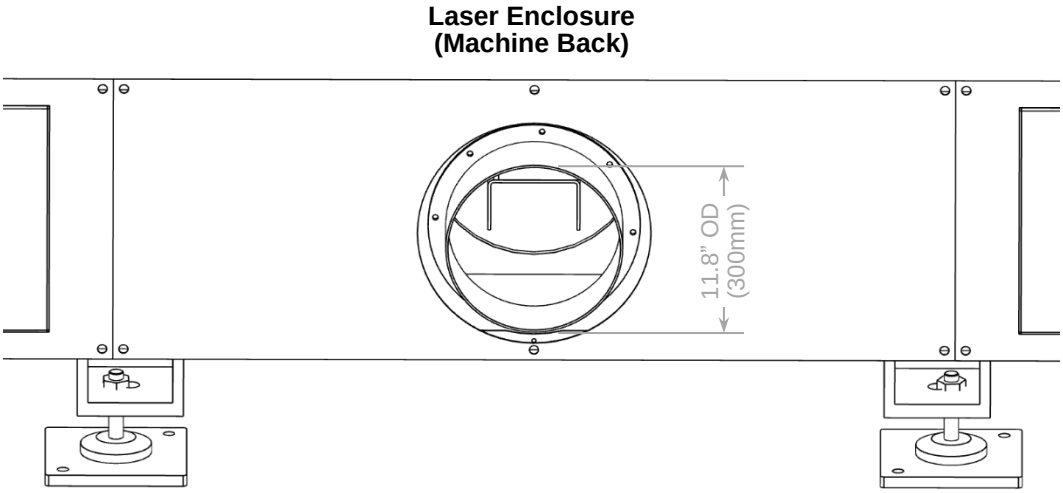


Figure 10: Outlet Duct to Fume Extractor

4.8 Prepare the Laser Enclosure

4.8.1 Material Drawer Supports

Install the left material drawer support into the pocket on the front of the laser enclosure. The left drawer support is identified by a machined rail. Use all provided fasteners. Next, install the sheet metal cover over the left material drawer support. Use all provided fasteners.

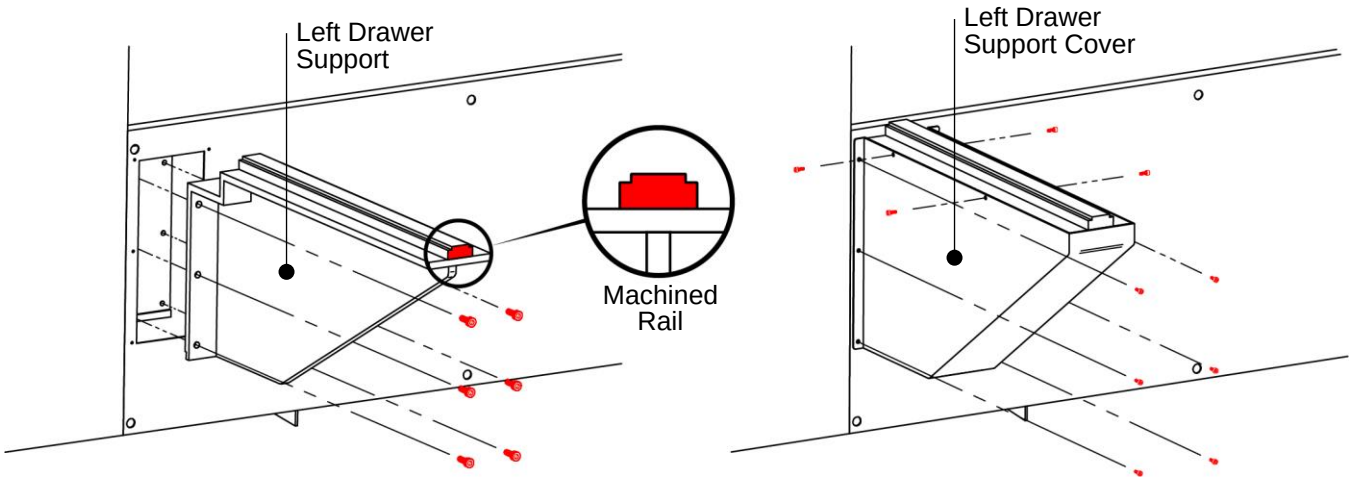


Figure 11: Left Material Drawer Support

Install the right material drawer support into the pocket on the front of the laser enclosure. The right drawer support is identified by a flat rail. Use all provided fasteners. Then, install the sheet metal cover over the right material drawer support. Use all provided fasteners.

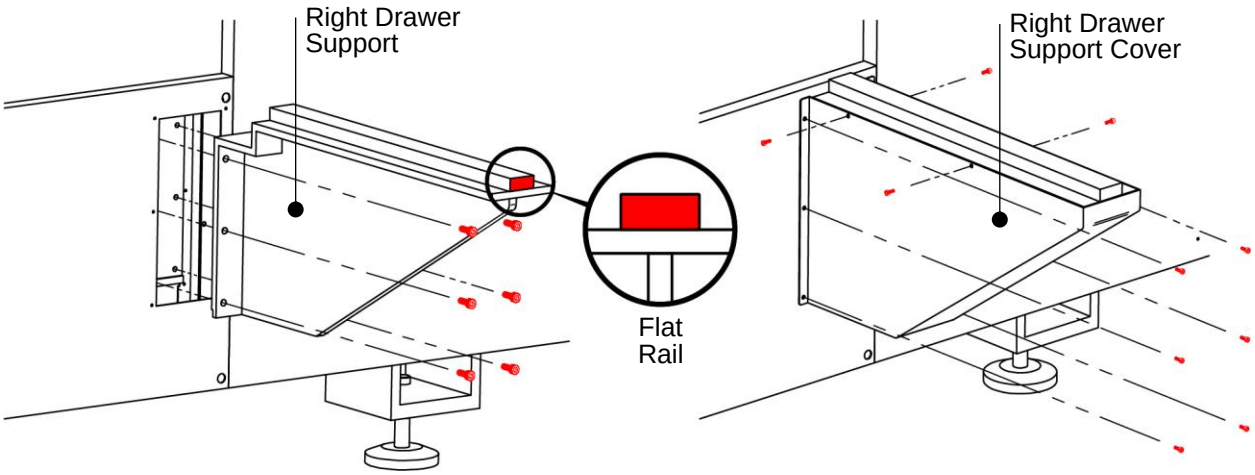


Figure 12: Right Material Drawer Support

4.8.2 Ceiling Panels

The laser enclosure may have shipped with some or all ceiling panels removed for access to lifting points. Install all ceiling panels using all supplied fasteners.

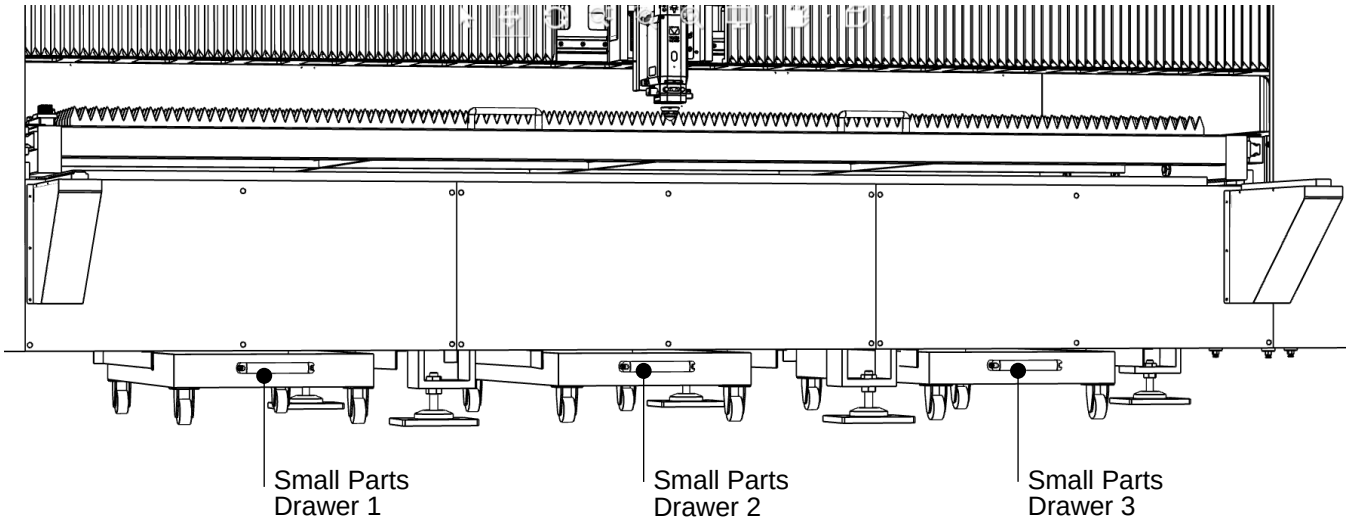
⚠ WARNING: Potential laser radiation hazard. All ceiling panels must be installed before commissioning this machine.

4.8.3 Small Parts Drawers

Install the three small parts drawers into the slots underneath the laser enclosure. Push in each drawer until it contacts the hard stop at the back.

⚠ WARNING: Potential laser radiation hazard. Do not operate this machine without all three drawers installed.

⚠ CAUTION: Do not operate this machine without all three drawers installed. Fume extraction may be compromised if the machine is operated without drawers installed.



4.9 Fill with Fluids

4.9.1 Laser Chiller Water

The fill cap is on the rear of the laser chiller. Remove the cap and add the specified amount and type of water until the level gauge is in the green region. Replace fill cap. The water is customer supplied.

***NOTICE*:** Do not start this machine before filling the water reservoir.

***NOTICE*:** When operating in a cold climate, refer to Appendix B.

4.9.2 Lubricating Oil

⚠ WARNING: Electric shock can kill. Turn off the main power disconnect before opening the electrical cabinet.

Open the electrical cabinet to access the lubrication system. Remove the fill cap and add the recommended amount and type of lubricating oil. Replace fill cap. The oil is customer supplied.

***NOTICE*:** Do not start this machine before filling the lubrication reservoir.

5.0 Commissioning

Commissioning of this machine shall be completed by Lincoln Electric, or their authorized representatives. As such, commissioning instructions are not provided. Contact Lincoln Electric for more details.

⚠ WARNING: Do not start this machine until it has been commissioned.

6.0 Operation

6.1 Operator Controls and Indicators

This section describes each component that is used to operate this machine.

6.1.1 Operator Console

Refer to the illustrations in Section 2.0 for component identification.

Moveable Arm

Swing the moveable arm to position the operator console in the best location for the operator to safely monitor this machine.

Live Camera Display

The display shows a live camera feed from inside the laser enclosure so the operator doesn't need to leave the operator console. This display is not a touchscreen. The display and camera turn on with the machine is powered on.

Touchscreen HMI

The touchscreen contains the software Human-Machine Interface (HMI) used to operate this machine. Use gloved or non-gloved hands or keyboard and mouse to interact with the HMI. Refer to Section 6.1.10 for more information on using the HMI. The touchscreen turns on when the machine is powered on.

6.1.2 Control Panel

These hardware controls are used in combination with the software HMI to operate this machine. A description of each hardware control follows.

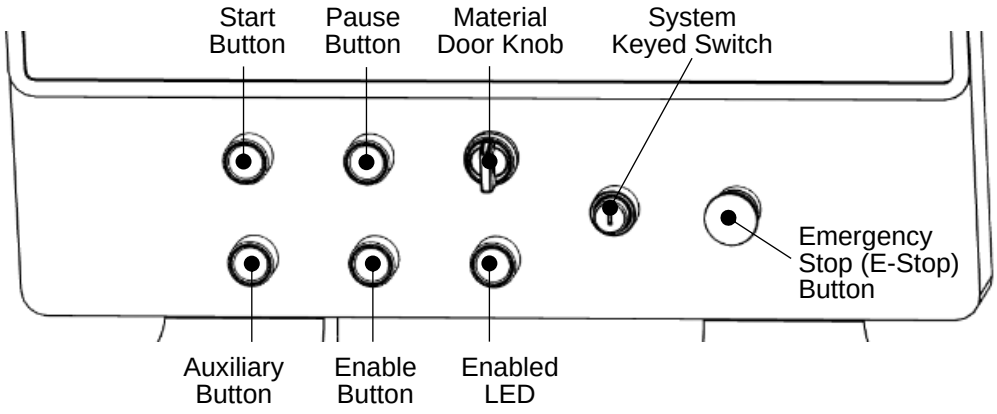


Figure 13: Control Panel Layout

System Keyed Switch (Off / On)

With the main power disconnect switch ‘On’, insert the system key and turn right toward ‘On’ (clockwise) to start this machine. Turn the key left toward ‘Off’ (counter-clockwise) to turn off this machine. Store the system key away from this machine when it is not being used.

⚠ WARNING: Turning off this switch does not de-energize this machine.

Emergency Stop (E-Stop) Button

Engage the E-Stop to immediately stop this machine; the laser stops emitting and machine motion stops.

Engage the E-Stop prior to reaching inside the material door, like to retrieve parts or to change consumables.

The operator is expected to continuously monitor this machine and to engage the E-Stop if a problem occurs or if a hazard is observed. The E-Stop should not be used to routinely stop machine movement for non-emergencies; instead, go to the HMI and select **Stop** on the **Toolbar**.

To engage the E-Stop, press in the button all the way and then let go; it will click as it latches in. The entire machine will immediately stop. Direct operator action is now required to safely clear this machine of the emergency stop condition.

⚠ WARNING: Engaging the E-Stop does not de-energize this machine.

To **Clear the E-Stop Condition**:

Step 1 - Correct the issue that caused the E-Stop condition.

Step 2 - Twist the red part of the E-Stop button in the direction indicated by the arrows on the button; it will unlatch and pop out.

Step 3 - Press the ‘Enable’ button on the control panel. The ‘Enabled’ LED will illuminate green. If not, verify the E-stop button is disengaged, the maintenance door is closed, check the HMI for error messages, and then troubleshoot that issue.

Step 4 – On the HMI, select **Clear Errors** on the **Toolbar**. “**Error condition**” on the **Messages** tile will disappear. The E-Stop condition is now cleared.

Material Door Knob (Down / Up)

Turn and hold the material door knob to the left (counter-clockwise) toward ‘Down’ to close the material door. Turn the door knob to the right (clockwise) toward ‘Up’ to open the material door. The door will not move up or down when the machine is in an E-Stop condition.

⚠ CAUTION: Crush and Pinch Hazard. Keep personnel away when operating door.

Enable Button

Press the Enable button when this machine is ready to be operated. The System Keyed Switch must be 'On' and the E-Stop button disengaged. If the safety circuit is ready, the Enabled LED will illuminate green. If the Enabled LED does not illuminate, verify E-stop is disengaged, maintenance door is closed, check the HMI for errors, and then troubleshoot the issue.

Enabled LED

This Enabled LED illuminates green when this machine is enabled (primary safety relay is closed). The LED extinguishes when this machine is not enabled (primary safety relay is open).

Start Button

The Start button works in conjunction with the HMI, which must be ready to start a program, otherwise pressing it will do nothing.

Pause Button

The Pause button works in conjunction with the HMI, which must be running a program, otherwise pressing it will do nothing.

Auxiliary Button

Reserved for future use.

6.1.3 Material Drawer

With the material door open, press and hold the foot pedal down to eject the roll-out material drawer. Use gloved hands to pull on the material drawer handles until the drawer stops. The drawer is pneumatically assisted. The drawer will not eject if the material door is closed.

Use gloved hands on the drawer handles to push in the material drawer until it stops. The door will not close if the drawer is not closed.

⚠CAUTION: Crush and Pinch hazard. Use drawer handles to open/close drawer.

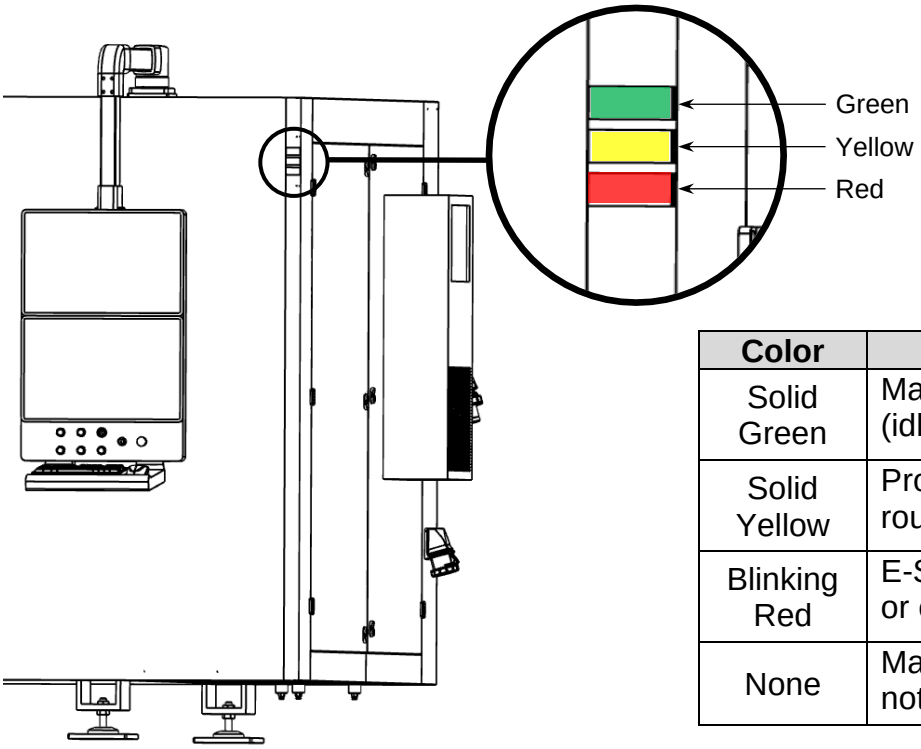
⚠CAUTION: Sharp Parts hazard. Wear gloves at all times.

⚠CAUTION: Heavy Parts hazard. Use mechanical lifting device for heavy parts.

⚠CAUTION: Impact hazard. Keep away from drawer when activating foot pedal.

6.1.4 Stack Light

The stack light provides useful information about the status of this machine.



Color	Meaning
Solid Green	Machine is ready (idle)
Solid Yellow	Program or routine is running
Blinking Red	E-Stop condition, or error condition
None	Machine is off or not ready

Figure 14: Stack Light Indications

6.1.5 Small Parts Drawers

The small parts drawer collects cut parts that may have fallen through the slats on the cutting table. Pull on the handle to roll out the drawer. Ensure all three small parts drawers are fully installed before operating this machine.

⚠ WARNING: Potential laser radiation hazard. Do not operate this machine without all three drawers in place.

⚠ CAUTION: Do not operate this machine without all three drawers in place. Fume extraction may be compromised if the machine is operated without drawers installed.

6.1.6 Maintenance Door

The maintenance door is manually operated; slide to the left to open, slide to the right to close. It is secured by lock and key. With the door open, the inside of the laser enclosure is accessible. The door must be completely closed and locked before this machine will operate. Opening this door during operation will cause an E-Stop condition.

6.1.7 Cutting Gas & Machine Air

Turn on each cutting gas and machine air supply before this machine's main power disconnect switch is turned 'On'. Ensure each supply is regulated to match the required specifications. Turn off each supply after this machine's main power disconnect switch is turned 'Off'.

6.1.8 Laser Chiller

The laser chiller must be manually turned 'On/Off' and must be running for at least 30 minutes prior to using this machine. To turn on/off the laser chiller, follow the startup or shutdown procedure in Section 6.2.

NOTICE: Do not block vents or exhaust fan. Do not operate the laser chiller with low water level. When operating in a cold climate, refer to Appendix B.

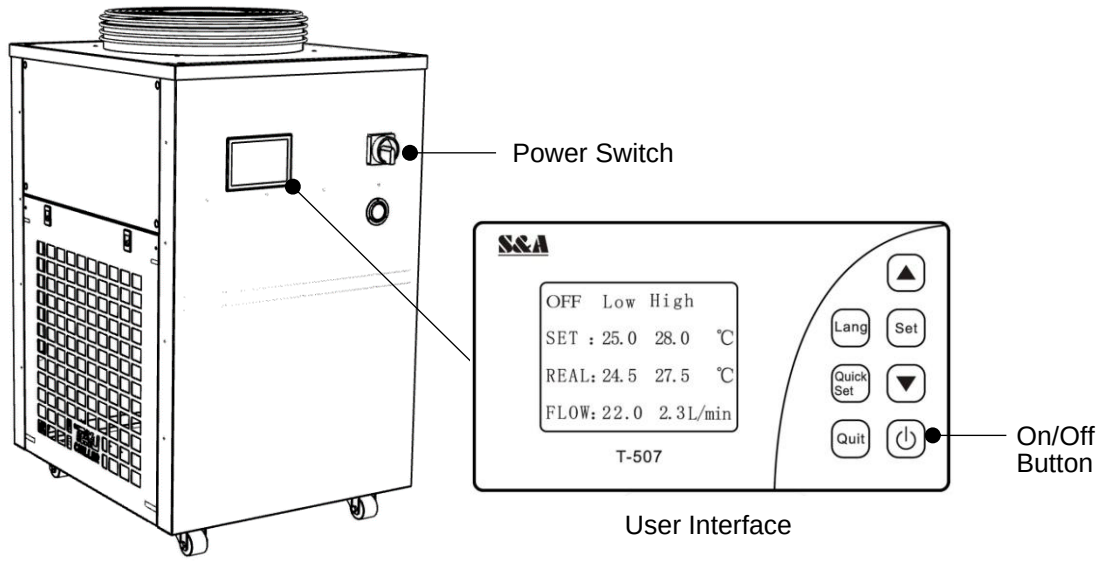


Figure 15: Laser Chiller Controls

6.1.9 Fume Extractor

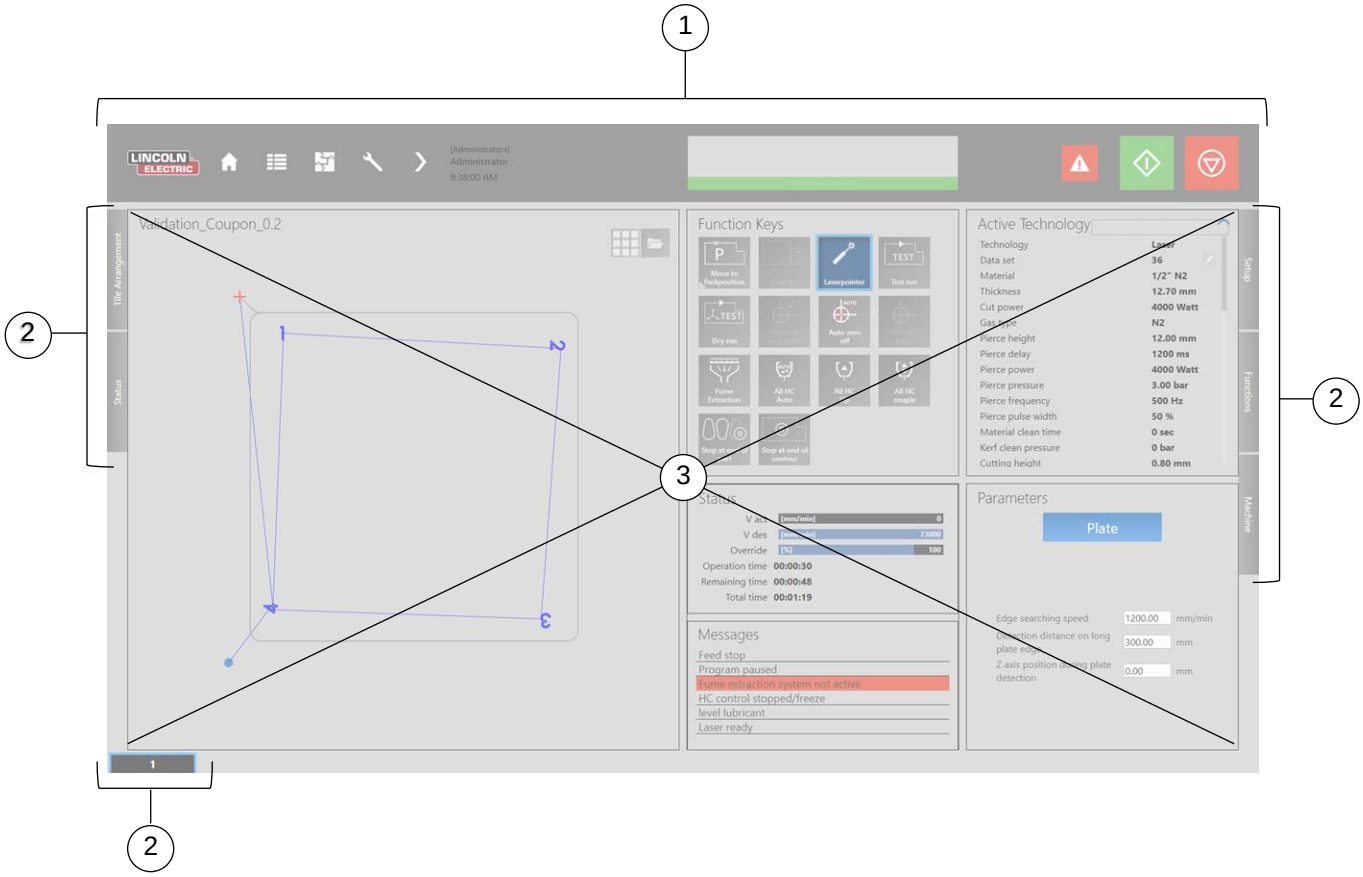
The customer supplied fume extractor is manually turned on/off. Follow the startup/shutdown procedure in Section 6.2. Refer to the manufacturer's operating instructions for more information.

6.1.10 Human Machine Interface (HMI)

The HMI provides a software interface to this machine. The operator can use the touchscreen (with or without gloves) and/or the keyboard and mouse.

Home Screen

The **Home** screen consists of three elements: **Toolbar**, **Tabs**, and **Tiles**. Each is described below. All settings and controls are accessed from the **Home** screen.



Element	Description
1	A **Toolbar** is located along the top of the screen and contains common tasks like return to Home, launch cncCUT, as well as program controls, like Start, Pause, and Stop.
2	**Tab Menus** are located on the left, right, and bottom of the screen. These containing additional settings and controls. Select a tab once to expand it, then again to collapse it.
3	**Tiles** make up the bulk of the screen area. Tiles are different sized groups of related settings. Select the **Tiles Arrangement** flyout menu to reposition the tiles.

Toolbar Icons

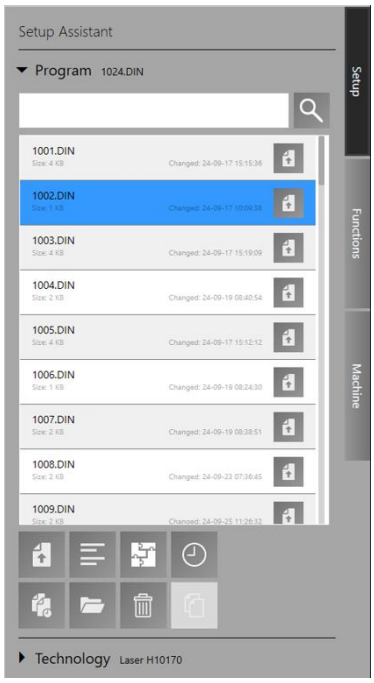
Select an icon on the **Toolbar** to perform the described action.

Icon	Name	Action
	Home	Returns the HMI to the **Home Screen** or closes an open flyout menu.
	Technology	Opens a screen to display: raw material, thickness, cutting gas, and nozzle size for the loaded job. Select **Home** to return to the **Home Screen**.
	Launch cncCUT	Launches cncCUT, which is integrated software that produces an NC Program from a drawing (.dxf, .dwg) or the standard shape library.
	Settings	Change HMI settings. Select **Home** to return to the **Home Screen**.
	Expand Arrow	Reveals additional choices to choose a different language, **Shut Down the HMI** ( ), or change user.
	No Errors	No errors are present.
	Clear Errors	One or more errors are present. Check the **Messages** tile to resolve the indicated error(s). Select the icon to clear error(s).
	Start	Select **Start** to begin various tasks and functions, including: to process the active job, or to initiate the homing sequence (once per machine startup), or during plate alignment, or to calibrate height control.
	Start Not Available	Start is “greyed out” when previewing a program in the **Program** list. Load the program first, then **Start** it.
	Pause	The job is running. Select to pause the program temporarily.
	Stop	The job has been paused. Select to stop the program from continuing.

Tab Menus

Select a tab once to open it, then again to close it. Several of the more frequently used tabs are briefly described below.

Setup Tab (Load NC Program)



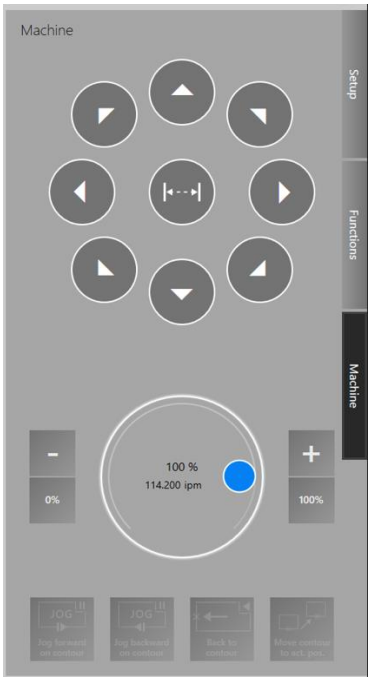
Select **Program** to see the list of available NC programs.

Select the program **Name**. It will highlight blue and a preview of the job will show in the **Contour Preview** tile.

Select **Load** ( )
to make it the active job.

Or select **Load** ( ) first, instead of the program name, to skip the preview and just load it as the active job.

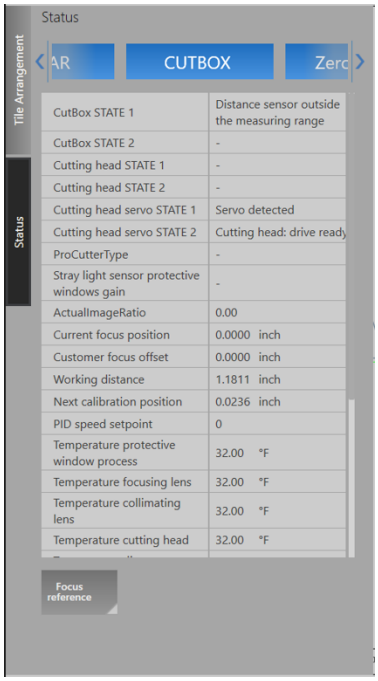
Machine Tab (Move Cutting Head)



Select and hold a **Direction Arrow** on the jog pad to move the cutting head in that (X/Y) direction. Release to stop moving.

Use the feedrate override dial or select increase ( ) or decrease ( ) to change machine speed.

Status Tab
(Status & Calibration)



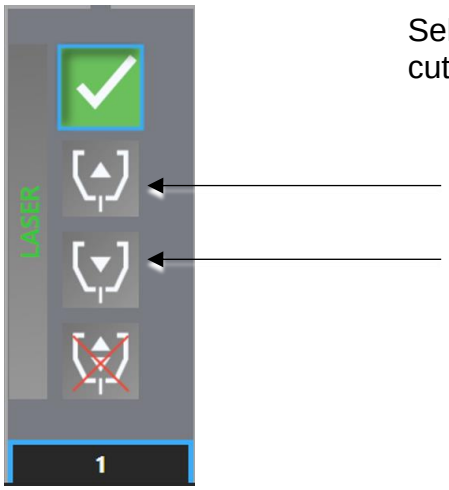
Select **Left** (‹) or **Right** (›) to display a different item:

CUTBOX = height control and cutting head. Focus reference calibration.

LASGAR = gas regulator. Proportional valve calibration.

Zero Point = current program zero point as well as a history or previous zero points (useful for recovery if the machine was turned off).

Height Control Tab
(Move Up/Down)



Select the icon to move the cutting head accordingly (Z-axis):

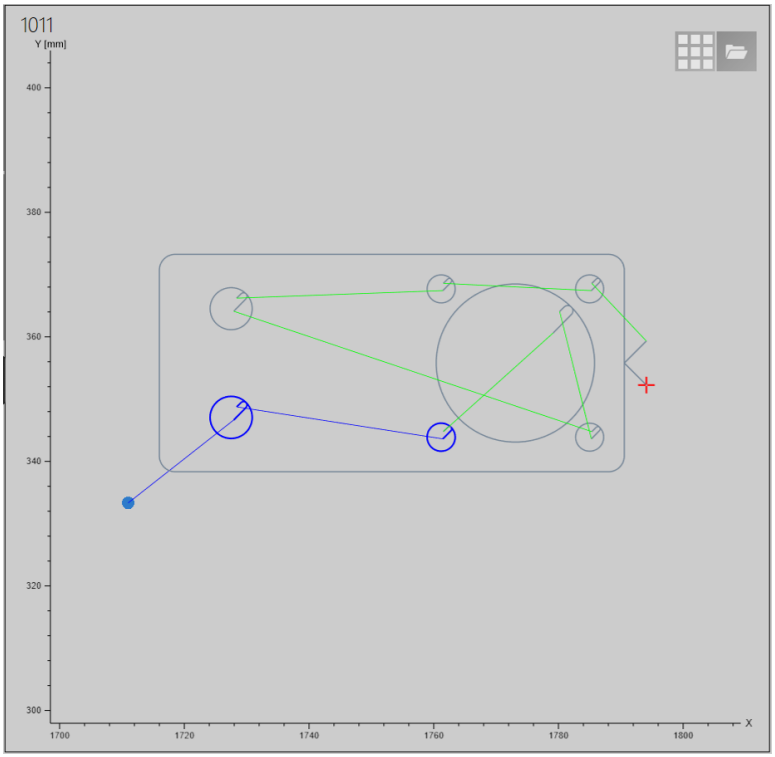
Tiles

The **Home** screen displays these tiles by default: **Contour Preview**, **Active Technology**, **Function Keys**, **Status**, **Messages**, and **NC Program**. Go to the **Tile Arrangement** tab to select different tiles or to change the tile layout.

Certain tiles can display additional information. Select  or  in the tile's upper right corner to see more or to change what information is displayed in the tile.

Several of the more frequently used tiles are briefly described below:

Contour Preview Tile



A preview of the selected NC program includes the filename in the upper left corner and a scale along the X/Y axes, useful for gauging finished part size.

Legend:

Grey Lines = part contour

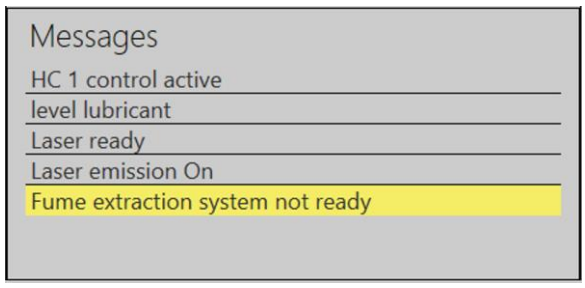
Blue Lines = completed path

Green Lines = tool path

Blue Dot = start point

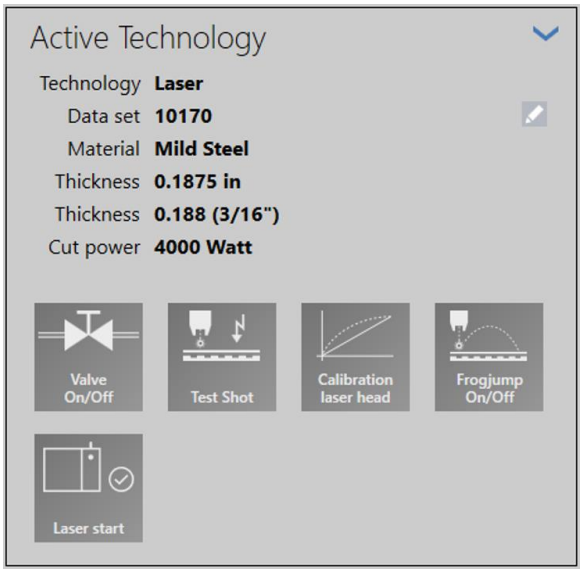
Red Cross = laser location

Messages Tile



Messages will appear and disappear in real-time. Check messages as a starting point for troubleshooting errors. Prioritized messages will be highlighted yellow or red. Blue indicates the action is currently being performed.

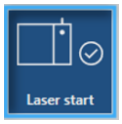
Active Technology Tile



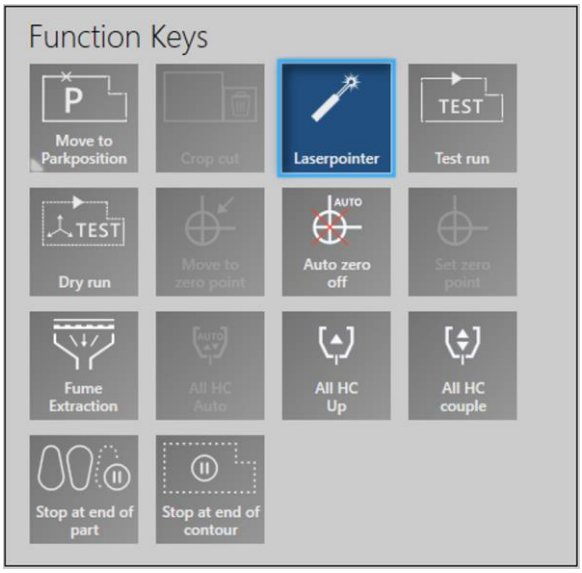
The **Active Technology** tile displays the material, thickness, and cutting gas (among other data) for the active NC program.

Select a function to activate it. Certain fuctions automatically activate or deactivate. Other functions need to be manually activated or deactivated.

Active functions are blue:



Function Keys Tile



Unavailable functions are greyed out.

Laserpointer = alignment laser

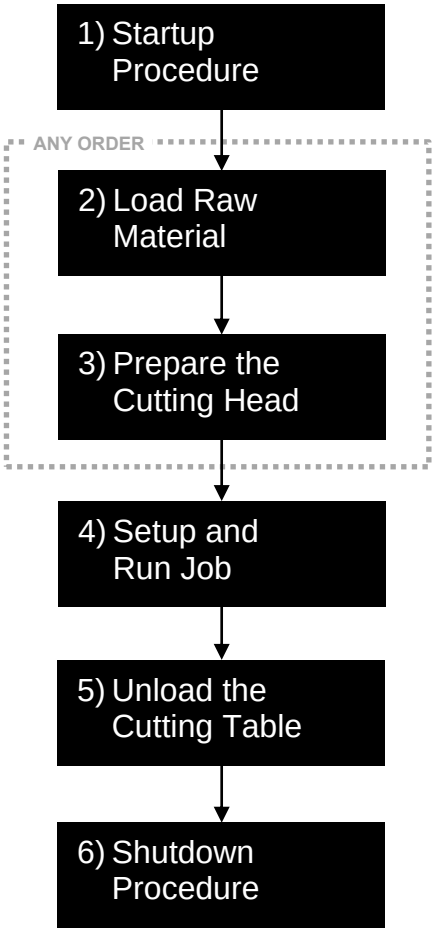
Test run = processes the job using X and Y axes only (no Z-axis). Cutting head moves at creep speed if material door is open. If material door is closed, then program feedrate (or override) speed is used.

Dry run = processes the job using X, Y, and Z axes. Cutting head moves at creep speed if material door is open. If material door is closed, then program feedrate (or override) speed is used.

NOTICE: **Dry run** process the job with Z-axis motion and height control enabled. Machine must have material loaded and be free of obstructions or the cutting head will crash.

6.2 Sequence of Operation

The following block diagram includes the high-level steps required to start up this machine, cut a part, and then shut it down. The dotted grey box indicates the steps may be performed in any order. Refer to the indicated section for details.



Refer to Section 6.2.1

Refer to Section 6.2.2

Refer to Section 6.2.3

Refer to Section 6.2.4

Refer to Section 6.2.5

Refer to Section 6.2.6

6.2.1 Startup Procedure

⚠ WARNING: Do not start this machine until it has been commissioned.

Read, understand, and follow all safety and operating instructions before performing this procedure. Do not continue this procedure without wearing the required Personal Protective Equipment (PPE), such as laser safety glasses, protective gloves, protective clothing, and protective footwear.

1) **⚠ WARNING:** Determine if this machine is in lockout tagout (LOTO). If LOTO is found, stop this procedure. If service or repair work was performed on this machine, stop this procedure until this machine is returned to service.
2) **⚠ WARNING:** Inspect the laser enclosure for damage and/or modification. Stop this procedure until light-safe integrity of the laser enclosure is restored. Inspect all fume extractor ductwork for damage and/or modification. Stop this procedure until ductwork integrity is restored.
3) **⚠ WARNING:** Empty small parts drawers. Stop this procedure until all three small parts drawers are re-installed under the laser enclosure.
4) **⚠ CAUTION:** Stop this procedure until all unnecessary personnel, materials, and tools have been removed from this machine and surrounding area.
5) Go to the right rear side of the laser enclosure. Turn ‘On’ the main power disconnect switch.
6) Go to the operator console. On the control panel, turn ‘On’ the System Keyed Switch. This machine will start and the HMI will boot up.
7) Go to the laser chiller. Ensure the water level gauge is in the green region; add the specified type of water if not. Turn ‘On’ the power switch. On the laser chiller user interface, press the power button. The laser chiller will turn on.
8) Go to the fume extractor. Follow the manufacturer’s instructions to turn on the fume extractor. If using the Prism 2 Compact, press the start button. It will illuminate green when the fume extractor is operating.
   ⚠ WARNING: Stop this procedure if the fume extractor is not operating.
9) Go to the cutting gas(es) and machine air supplies. Turn on all gas and air supplies. Ensure all pressures are regulated to specifications.
10) Go to the Operator Console. On the control panel, disengage the E-Stop. On the control panel, press the Enable button. If the safety circuit is ready, the Enabled LED will illuminate green. If not, check the **Messages** tile on the HMI for error messages. Correct the problem, then try again.
11) On the HMI, select **Clear Errors** from the toolbar. If errors don’t clear, check the **Messages** tile. Correct the problem, then try again.
12) **⚠ CAUTION:** The next step will cause machine movement. Ensure nearby personnel are aware and that nothing will interfere with machine movement.
13) On the **Messages** tile, “Need to be Homed!” and “HC 1 no reference” are displayed. Select **Start** from the **Toolbar** to begin the automatic homing sequence. The cutting head will move to home position in the front left corner of the cutting table.
14) End of procedure.

6.2.2 Load Raw Material

This machine accepts sheet metal or flat plate. ***NOTICE:*** Excess deviation in flatness will lead to height control collisions.

1) On the HMI, select the **Machine** tab. Use the **Direction Arrows** to move the cutting head to the back left corner of the cutting table. Select the **Height Control** tab. Select **Move Up** to raise the cutting head until it stops.
2) On the control panel, open the material door by turning the door knob toward 'Up'; the material door will move up. If the door is already open, skip to next step.
3) **⚠ CAUTION:** Stand clear of material drawer. Press down and hold the foot pedal to eject the roll-out material drawer.
4) Pull on the handles to fully open the material drawer.
5) **⚠ CAUTION:** Sharp parts. Wear gloves. Heavy Parts. Use material handling equipment to load the raw material onto the material drawer. Maximum weight capacity for the material drawer is 1,322 lbs (600 kg).
6) Push in the material drawer until it stops.
7) End of procedure.

6.2.3 Prepare the Cutting Head

During typical use, only the nozzle is checked during this step. The protective window only needs to be inspected once at the start of shift/day, or if cut quality decreases.

***NOTICE*:** Consumables are fragile. Wear disposable laboratory gloves when handling the protective window, to ensure no fingerprints or damage to the window.

1) On the HMI, select the **Machine** tab. Use the **Direction Arrows** to move the cutting head to the front of the cutting table for easy access.
2) Engage the E-Stop.
3) Perform steps 7-12 in Section 7.2.3 to inspect the protective window.
4) Perform steps 7-9 in Section 7.2.1 to inspect the nozzle.
5) Clear the E-Stop condition, per Section 6.1.2.
6) On the HMI, select the **Machine** tab. Use the **Direction Arrows** to move the cutting head directly above the raw material. Visually confirm the cutting head is safely over the raw material before proceeding.
7) Select **Calibration Laser Head** on the **Active Technology** tile, then select **Start** on the **Toolbar**. The cutting head moves down to find the plate, then moves up and stops the nozzle about 1.18” (30mm) off the plate. Perform a quick visual confirmation (not measured), then select **Start** again. The height control moves again until the calibration procedure is complete.
8) Select the **Status** tab. Use the **Left** or **Right** arrow to display **CUTBOX**, then select **Focus Reference** at the bottom of the menu. Do not leave the **Status** tab or the calibration will stop. When the calibration is complete, the **Current Focus Position** will change to “**0.0000”** (zero) and **Cutting head servo STATE 2** displays “**Cutting head: drive ready**”.
9) On the **Status** tab, use the **Left** or **Right** arrow to display **LASGAR**. Select **Calibration** at the bottom of the menu. Do not leave the **Status** tab or the calibration will stop. **Gas Status** will change to “**regulator ready**” when complete.
10) End of procedure.

6.2.4 Setup and Run Job

1) On the HMI, select the **Setup** tab, then select **Program** to see the list of available NC Programs. Refer to Section 6.3 to generate an NC program using the integrated software cncCUT.
2) Select the desired **Program Name**. It will highlight blue and a preview of the job will show in the **Contour Preview** tile. Select **Load** to make it the active job.
3) Alternatively, select **Load** first, instead of the **Program Name**, to skip the preview and quickly load it as the active job.
4) Select **Laser start** on the **Active Technology** tile, then select **Laserpointer** on the **Function Keys** tile. After a short warmup time (~45 seconds), the alignment laser (red dot) will appear directly under the nozzle.
5) Occasionally, the cutting head has been raised so high that the alignment laser appears dim. To correct this, select the **Height Control** tab, then select **Move Down** until the alignment laser is visible.
6) Select the **Machine** tab. Use the **Direction Arrows** to move the cutting head over the material to the desired location to start the job. Close the **Machine** tab.
7) On the control panel, close the material door by turning the door knob to ‘Down’; the material door will move down. When closed, “**Operator door open**” is removed from the **Messages** tile and “**Laser ready**” appears.
8) ***NOTICE:*** Verify the laser chiller has been running for at least 30 minutes before continuing with this procedure.
9) Select **Start** on the **Toolbar** to begin processing the job. If not previously set, the zero point will be set automatically to the start position when “**Auto Zero Off**” is disabled. Follow job progress on the **Contour Preview** tile until the job ends.
10) End of procedure.

6.2.5 Unload the Cutting Table

1) On the control panel, open the material door by turning the door knob to ‘Up’; the material door will move up.
2) Press down and hold the foot pedal to eject the roll-out material drawer.
3) Pull on the handles to fully open the material drawer.
4) **⚠ CAUTION:** Sharp parts. Wear gloves. Heavy parts. Use material handling equipment to remove the finished parts and the material skeleton.
5) Push in the material drawer until it stops.
6) If small part(s) dropped down between the slats in the cutting table, pull out the small parts drawer to retrieve them. Replace all three small parts drawer before proceeding.
7) End of procedure.

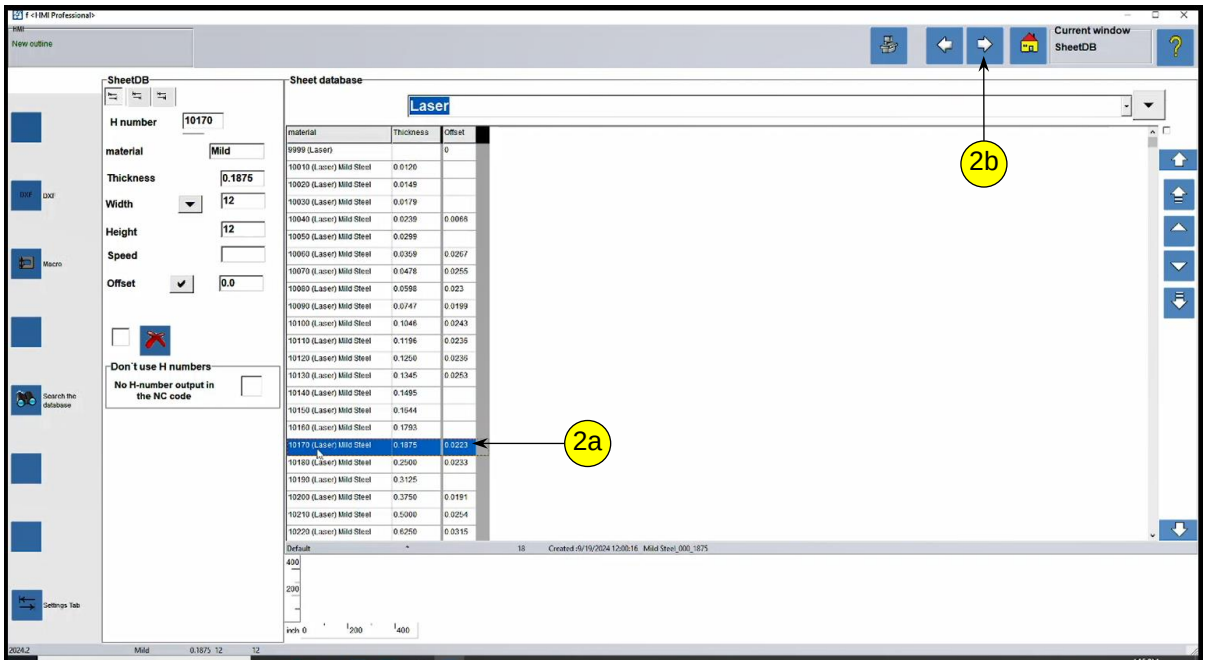
6.2.6 Shutdown Procedure

1) Go to the operator console. On the control panel, close the material door by turning the door knob toward ‘Down’; the material door will move down.
2) Go to the source of cutting gas(es) and machine air. Turn off all gas and air sources.
3) Go to the operator console. Engage the E-Stop on the control panel.
4) On the HMI, select **Expand Arrow** on the **Toolbar**, then select **Shutdown**. This will shut down the HMI software.
5) On the control panel, turn the System Keyed Switch ‘Off’ and remove the key.
6) Go to the right rear side of the laser enclosure, near the air conditioner. Turn the main disconnect power switch ‘Off’.
7) Go to the fume extractor. Follow the manufacturer’s instructions to turn off the fume extractor.
8) End of procedure.

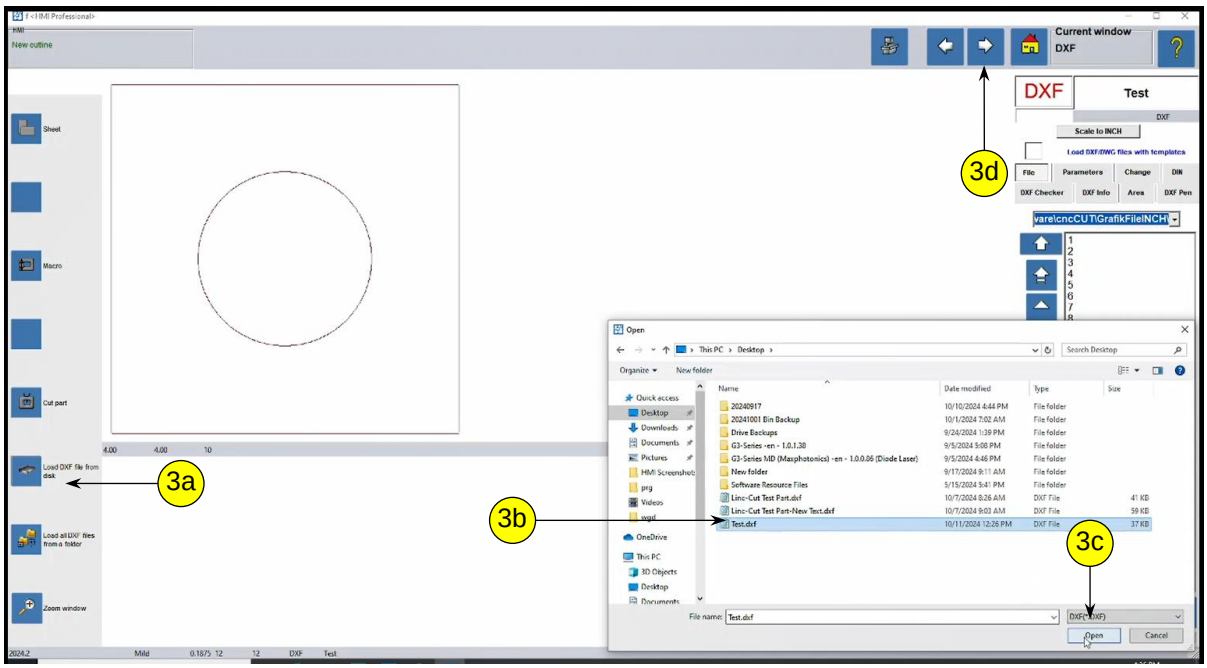
6.3 Create an NC Program (cncCUT)

This example features the integrated software cncCUT (version 2024.2), which is used to generate an NC Program. Refer to Appendix A for the full cncCUT manual.

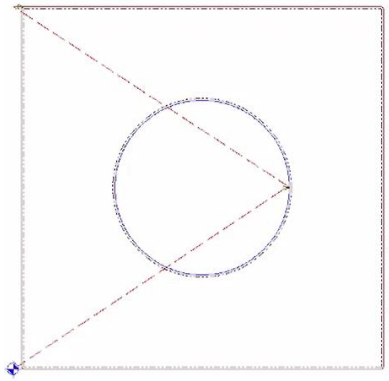
1) Go to the HMI, select **cncCUT** on the **Toolbar**, then select **New Job**.
2) Select the planned material and thickness from the list, then select the **Forward** arrow.



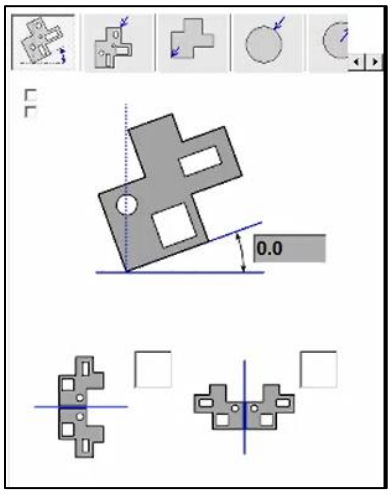
3) Choose a CAD drawing. **Test.dxf**, which is saved on the Windows desktop, will be used in this example. Select '**Load DXF file from disk**', locate the file (a preview is generated), select **Open**, then select the **Forward** arrow.



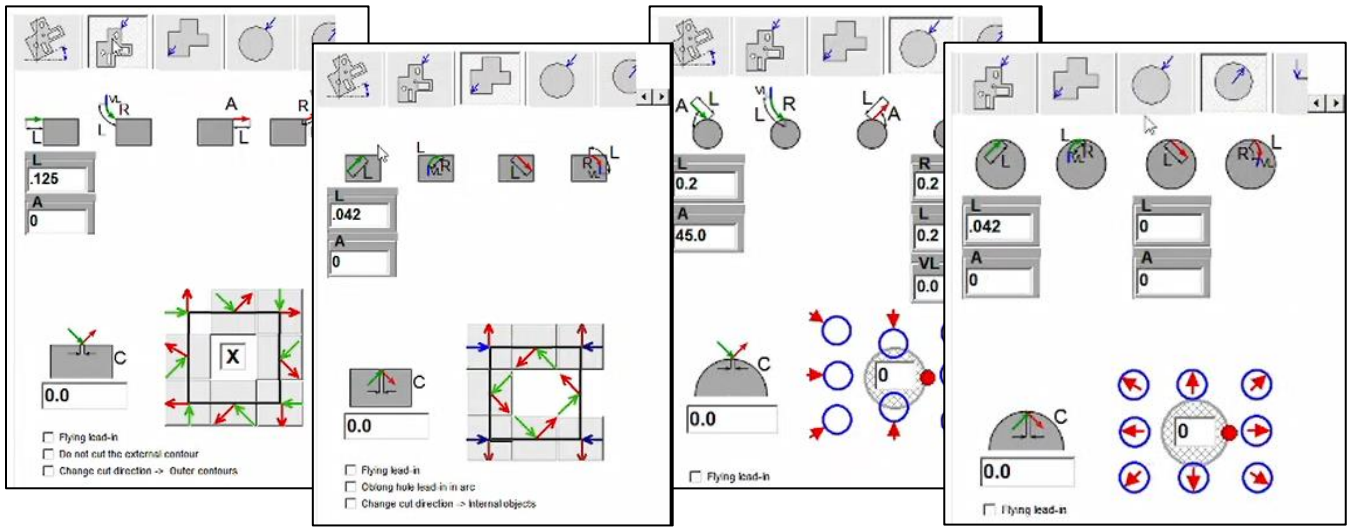
4) Leadins, toolpaths (dashed line), and kerf (phantom lines) are automatically applied to the part. Inspect the part to ensure it is as expected.



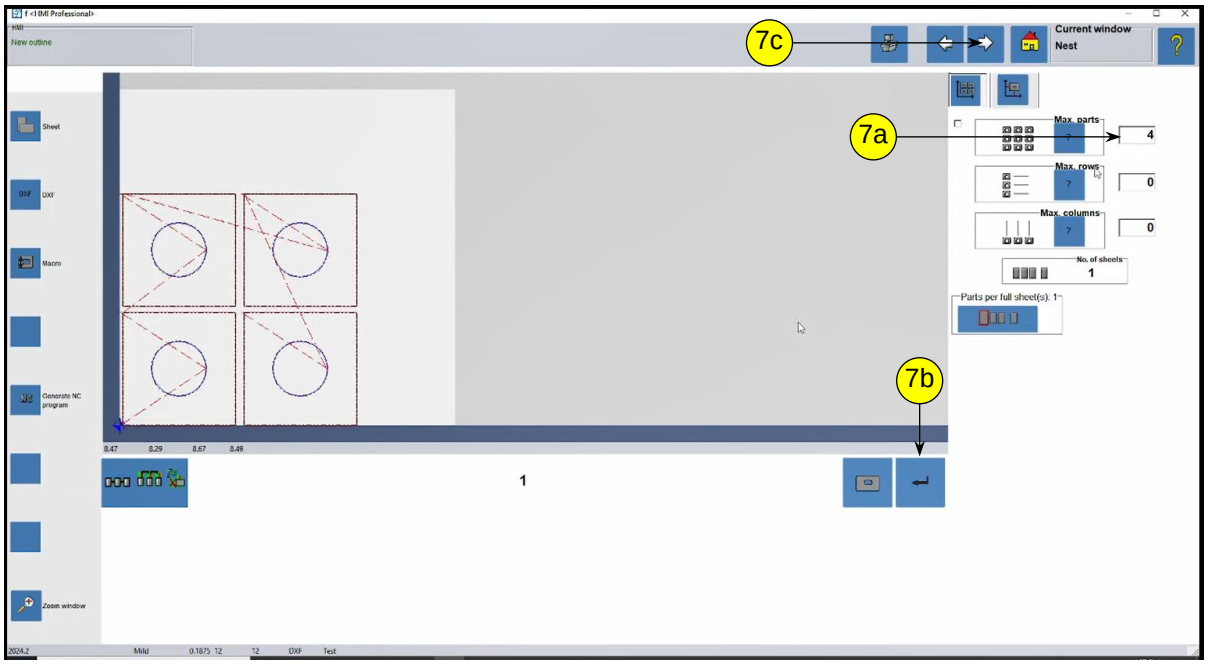
5) Optionally, use the controls to **Rotate** or **Flip** (mirror) the part.



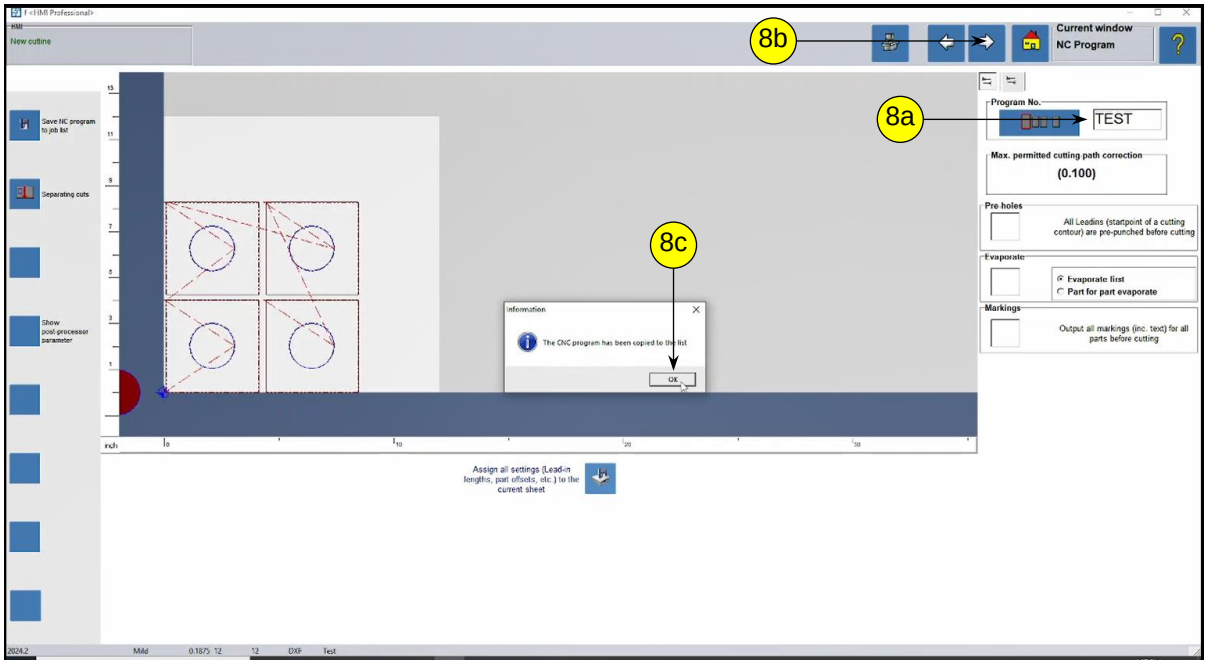
6) Optionally, use the controls to change the **Leadins**. Each leadin type has a separate tab: external contour, internal contour, external circle, and internal circle, etc.. Select the **Forward** arrow when all settings are complete.



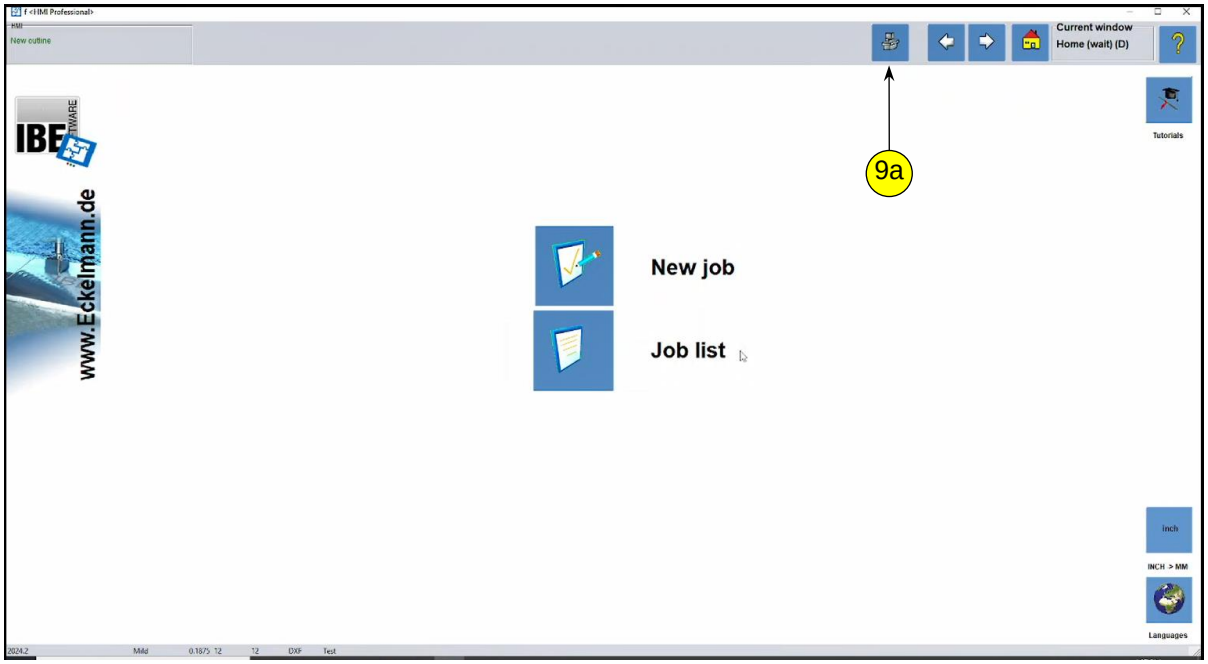
7) Create a nest. Enter "**4**" into the **Max parts** field, select **Enter**, then select the **Forward** arrow.



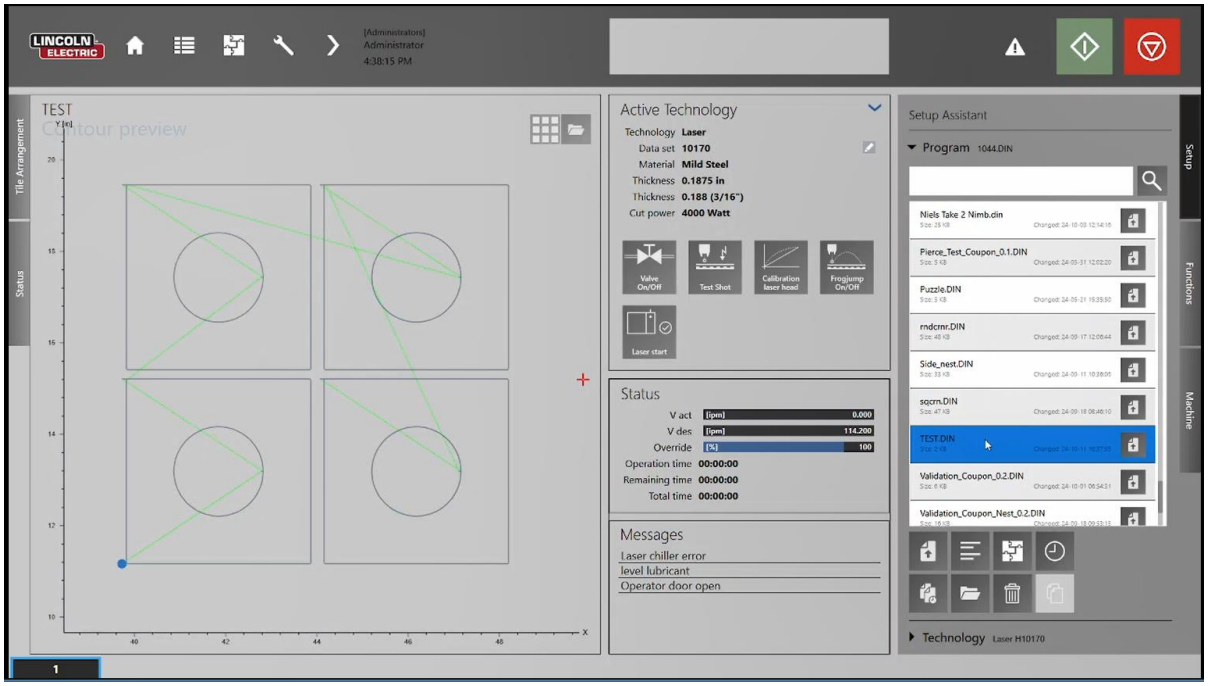
8) Prepare to output the file. The default filename is a program number; change to "**TEST**". Select the **Forward** arrow to generate the NC Program. Confirm the dialog by selecting **OK**.



9) Return to the HMI by seleting the **Back to HMI** icon.



10) The NC Program is automatically added to the list of programs in the HMI. To preview the file, select the **Setup** tab, select **Program**, scroll down to select the "**TEST**" program.

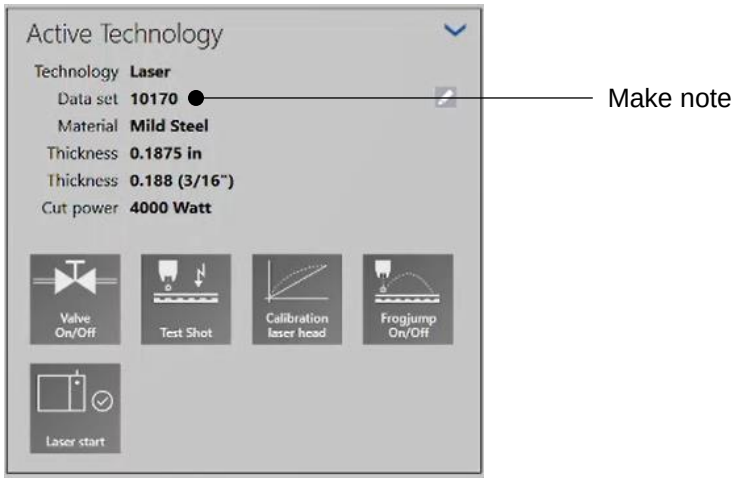


11) End of procedure.

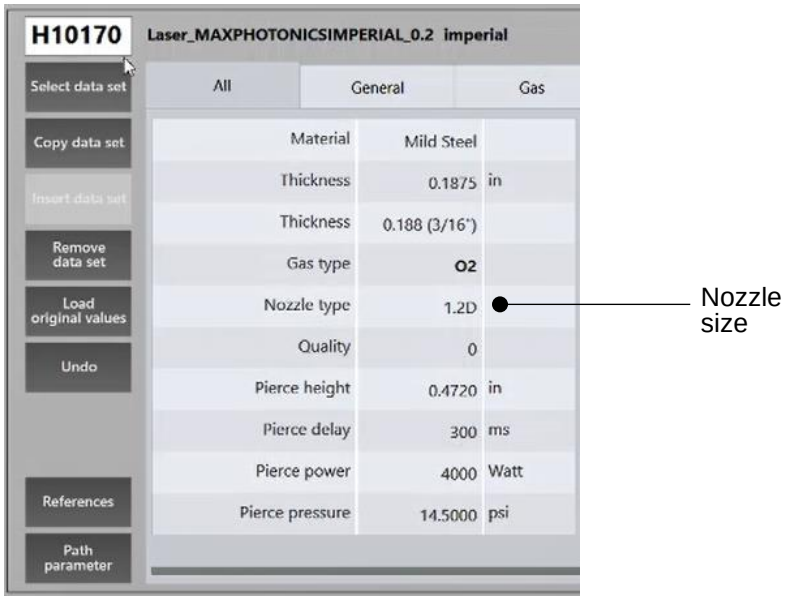
6.4 Determine the Nozzle Size

Different raw material types and thickness require different nozzle orifice sizes and nozzle types. Follow these steps to determine the nozzle size for the active job.

1) On the HMI, select **Setup** tab, then select **Program** to see the list of available NC Programs.
2) Select the desired **Program Name**. It will highlight blue and a preview of the job will show in the **Contour Preview** tile. Select **Load** to make it the active job.
3) Make note of the **Data set** number (10170) on the **Active Technology** tile.



4) Select **Technology** ( ) from the **Toolbar**.
5) The technology table (H10170) for the active job is displayed and should match the **Data set** noted earlier. The **All** tab displays the **Nozzle type** (size).



In this case, 1.2**D** is displayed. Install a 1.2mm **D**ouble wall nozzle for this job. If 1.2**S** had been displayed, install a 1.2mm **S**ingle wall nozzle instead. Ordering part numbers for the available nozzle sizes are listed in Section 9.0.

7.0 Maintenance

⚠ WARNING: Complete the shutdown for this machine procedure before performing these tasks. Only qualified personnel should service this machine.

7.1 Routine Maintenance Tasks

The frequency that these tasks need to be completed depends upon many factors, including the overall cleanliness of the environment and the number of hours per day this machine is used. At a minimum, perform these tasks on a weekly basis.

7.1.1 Check Water Level in Laser Chiller

1) Go to rear of chiller.
2) Inspect the level on the water level gauge.
3) Add water as required up to the full line (green region). Only use the specified water.
4) Drain and replace water every 3 months.

7.1.2 Check Oil Level in Lubrication System

⚠ WARNING: Electric shock can kill. Complete the shutdown procedure for this machine before opening the electrical cabinet.

1) Verify the main power disconnect switch is ‘Off’.
2) Open electrical cabinet to gain access to the lubrication reservoir.
3) Inspect level.
4) Add oil as required up to the full line. Only use the specified oil.

7.1.3 Clean Small Parts Drawers

1) Empty each of the small parts drawers so scrap and debris does not prevent the drawers from sliding out.
2) Ensure all three drawers are installed before operating this machine.

7.1.4 Clean Laser Chiller

Use compressed air to remove dust from the intake vents and the surface of the condenser.

Maintain at least 6” (150mm) from the air gun tip to the condenser fins. Sweep the air gun in the same direction as the condenser fins; do not blow across the fins.

7.1.5 Clean Touchscreen & Monitor Display

When the System keyed switch is off, use clean linen cloth and liquid cleaning product made for computer displays/monitors to clean the touchscreen and monitor display. Do not wipe screens using dry or rough material.

7.1.6 Clean Fume Extractor

Refer to the manufacturer's instructions for complete details.

7.2 Consumable Maintenance

7.2.1 Inspect / Replace the Nozzle

Different material types and thicknesses require different nozzle sizes to be installed in the cutting head. In addition, nozzles are a consumable item that need to be replaced as they wear out, and they can become damaged during use. Refer to Section 6.4 to determine the nozzle size.

⚠ CAUTION: Hot Parts Burn Skin. Do not touch hot parts with bare hands. Always use gloves when handling finished parts, raw material, or the cutting head as they may be hot after cutting. Allow cooling period before working on the cutting head.

***NOTICE*:** Do not use the wrong consumables. Consumables are fragile.

To Inspect or replace:

1) On the HMI, stop any running programs.
2) Close the material drawer.
3) Open the material door.
4) Use the controls on the HMI to move the cutting head near the material door.
5) **⚠ CAUTION:** If this machine has been cutting, allow a waiting period to let the cutting head cool before continuing with this procedure.
6) Engage the E-Stop.
7) Unthread the nozzle from the cutting head. Do not use tools.
8) Visually inspect the nozzle orifice for debris and damage. Remove debris with lint free rag; nozzle can be reused. If the orifice is not circular (round), or has dings or cuts, then replace it with a new nozzle. Always inspect new nozzles for damage too; ensure orifice is circular. Discard damaged parts.
9) Thread on the nozzle by hand until snug. Do not use tools.
10) Remove all packaging, old parts, and other debris from inside the laser enclosure.
11) Clear the E-Stop condition, per Section 6.1.2.
12) Use the controls on the HMI to move the cutting head over raw material.
13) Perform height calibration.
14) End of procedure.

7.2.2 Inspect / Replace the Ceramic Insert

The ceramic insert in the cutting head must be replaced if it becomes damaged, which can happen during a crash. It can also become damaged due to overheating, for example, when cutting with inadequate gas flow.

⚠CAUTION: Hot Parts Burn Skin. Do not touch hot parts with bare hands. Always use gloves when handling finished parts, raw material, or the cutting head as they may be hot after cutting. Allow cooling period before working on the cutting head.

***NOTICE*:** Consumables are fragile.

To Inspect or replace:

1) On the HMI, stop any running programs.
2) Close the material drawer.
3) Open the material door.
4) Use the controls on the HMI to move the cutting head near the material door.
5) **⚠CAUTION:** If this machine has been cutting, allow a waiting period to let the cutting head cool before continuing with this procedure.
6) Engage the E-Stop.
7) Unthread the nozzle and the retaining nut by hand. Do not use tools.
8) Remove the ceramic insert and o-ring from the cutting head.
9) Visually inspect for small cracks or other damage to the ceramic insert. Inspect the o-ring for nicks, cuts or other damage. If damage is found, replace with new parts. Always inspect new parts for damage too. Discard damaged parts. Install the o-ring into the groove on the ceramic insert. Do not use o-ring lubrication.
10) Insert the ceramic insert into the cutting head. Locators on the cutting head ensure proper orientation.
11) Thread on the retaining nut by hand until snug. Do not use tools.
12) Thread on the nozzle by hand until snug. Do not use tools.
13) Remove all packaging, old parts, and other debris from inside the laser enclosure.
14) Clear the E-Stop condition, per Section 6.1.2.
15) Use the controls on the HMI to move the cutting head over raw material.
16) Perform height calibration.
17) End of procedure.

7.2.3 Inspect / Replace the Protective Window

The protective window in the cutting head must be cleaned or replaced if it becomes dirty or damaged.

⚠ CAUTION: Hot Parts Burn Skin. Do not touch hot parts with bare hands. Always use gloves when handling finished parts, raw material, or the cutting head as they may be hot after cutting. Allow cooling period before working on the cutting head.

***NOTICE*:** Consumables are fragile. Wear disposable laboratory gloves when handling the protective window, to ensure no fingerprints or damage to the window.

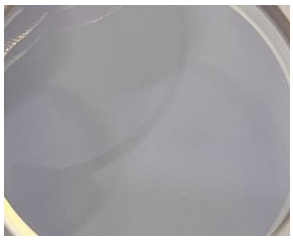
To Inspect or replace:

1) On the HMI, stop any running programs.
2) Use the controls on the HMI to move the cutting head near the material door.
3) **⚠ CAUTION:** If this machine has been cutting, allow a waiting period to let the cutting head cool before continuing with this procedure.
4) Engage the E-Stop.
5) ***NOTICE*:** The protective window and clamping ring are not secured in the holder. Keep the holder level at all times. Dropping the window may damage it.

   Unthread the two thumb screws on the protective window holder. Do not use tools. Remove the protective window holder from the cutting head.

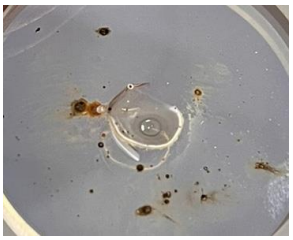
   ***NOTICE*:** Whenever the holder is removed from the cutting head, cover the opening so no dust or debris enters. Use a spare holder or tape.
6) Move the holder to a clean work surface. Remove the clamping ring to expose the protective window. Remove the window from the holder. Do not use tools.
7) Visually inspect the protective window and follow the recommended action:

Reuse



Possible Reuse
(if beam path isn't impeded)

Replace

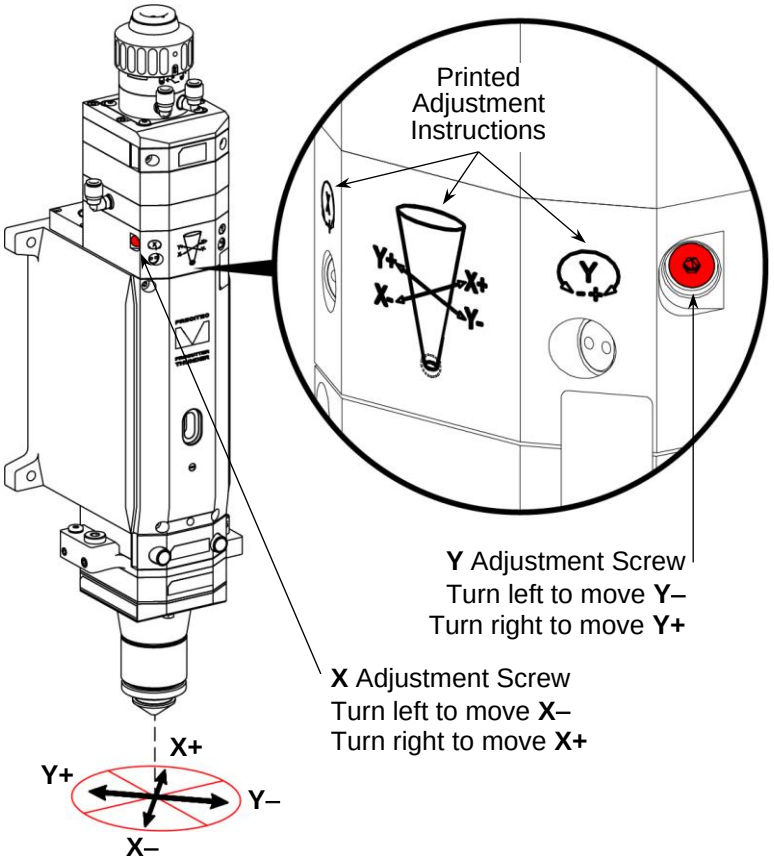


   If the protective window needs to be cleaned, use at least 99% isopropyl alcohol and lint-free, polyurethane foam swabs/wipes rated at Class 100 (ISO class 5). If damaged, replace it with a new protective window.
8) Install the protective window into the holder and then place the clamping ring on top. Do not use tools.
9) Insert the protective window holder into the cutting head. Tighten both thumb screws. Do not use tools.
10) Remove all packaging, old parts, or other debris from inside the laser enclosure.
11) Clear the E-Stop condition, per Section 6.1.2.
12) End of procedure.

7.3 Laser Beam Centering

The laser beam should be centered in the nozzle orifice. Follow this procedure to test the current beam location and then center the laser beam in the orifice.

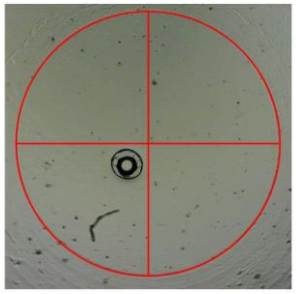
1) Use the HMI to move the cutting head for access to the nozzle.
2) Engage the E-Stop.
3) Thread a new nozzle with 2.0mm orifice onto the cutting head.
4) Clear the E-Stop condition, per Section 6.1.2. Close all doors and verify all small parts drawers are in place.
5) Navigate to the **Home** screen. Select **Test Shot** on the **Active Technology** tile to instantly fire a single laser pulse.
6) Open the material door and then engage the E-Stop.
7) Apply clear tape tightly over the nozzle orifice. Orient the tape so X and Y directions are known.
8) Repeat steps 4, 5, and 6.
9) Remove the clear tape. Maintain orientation to X and Y directions. Using a magnifying glass or microscope, evaluate the hole in the tape. Continue with this procedure if the hole is not centered on the orifice witness marks on the tape. If it is, then beam centering is not necessary.
10) To move the beam, turn the X or Y adjustment screw in the desired direction. Use a 2mm hex key in 1/8 turn increments or less. The maximum adjustment is ±1.5 mm.
11) Repeat steps 7 through 10 until the hole is centered in the orifice.
12) Repeat this procedure using a new nozzle with a 1.5mm orifice until the laser beam is centered.
13) End of procedure.



Example Adjustments (if starting centered)

X Screw Turned Right

X Screw Turned Left



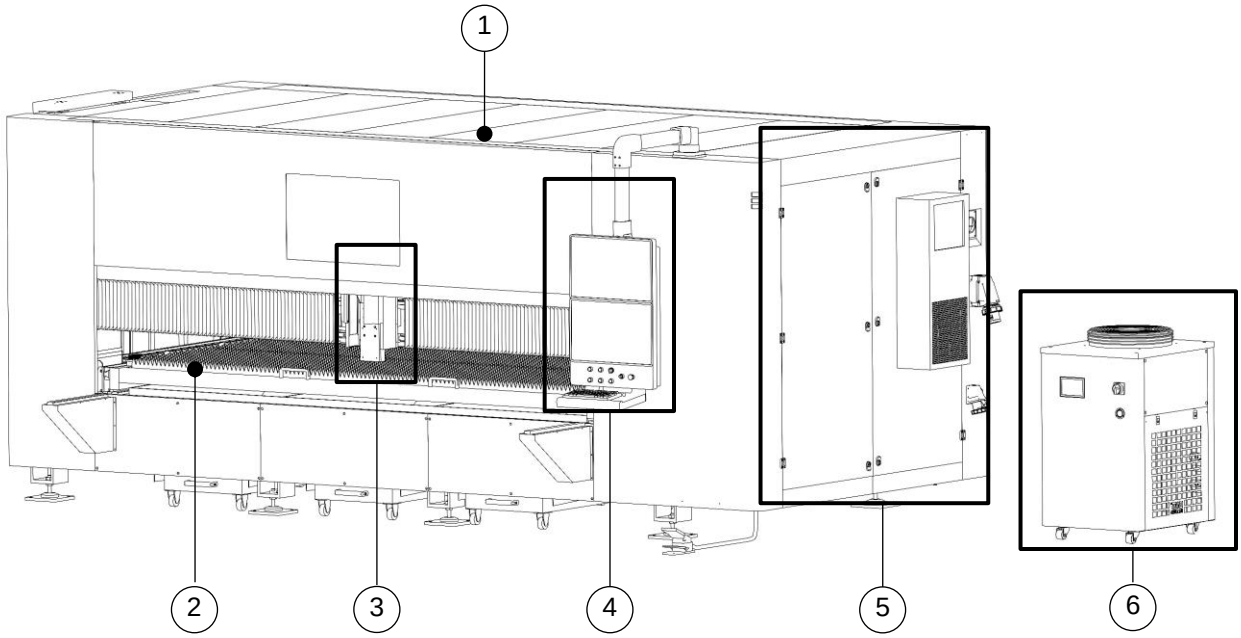
8.0 Troubleshooting

⚠ WARNING: Only qualified personnel should troubleshoot this machine. Follow all safety and operating instructions while troubleshooting.

Issue	Probable Cause	How to Detect	Procedure to Resolve
Failure to cut, Poor or reduced cut quality	Height control needs to be calibrated.	N/A	On the HMI, use controls on **Machine** tab to move the cutting head over raw material. Select the **Status** tab > **CUTBOX**, then select **Focus Reference** at the bottom of the menu.
	Proportional gas valve needs to be calibrated.	N/A	On the HMI, select the **Status** tab > **LASGAR**, then select **Calibration** at the bottom of the menu.
	Protective window is dirty or damaged.	Perform visual inspection of protective window. Refer to Section 7.2.3.	If protective window is dirty or damaged, refer to Section 7.2.3 to clean or replace.
	Nozzle is clogged, worn, or damaged.	Perform visual inspection of nozzle orifice. Refer to Section 7.2.1.	Refer to Section 7.2.1 to clean or replace nozzle.
	Laser beam is not centered in nozzle orifice.	Perform steps 1-9 in Section 7.3.	Perform laser beam centering in Section 7.3.
Mild steel dross, Inconsistent surface finish on different sides of the cut, Severance on 3 of 4 sides of rectangle	Laser beam is not centered in nozzle orifice.	Perform the testing described in Section 7.3.	Refer to Section 7.3 to perform the beam centering procedure.
	Dirt on protective window is blocking the beam.	Perform visual inspection of protective window. Refer to Section 7.2.3.	If protective window is dirty or damaged, refer to Section 7.2.3 to clean or replace.
Prominent striations on cut face	Cutting speed too slow.	On the HMI, select the **Machine** tab. Observe the feedrate override.	Increase feedrate override to increase cutting speed.
	Dirty protective window.	Perform visual inspection of protective window. Refer to Section 7.2.3.	If protective window is dirty or damaged, refer to Section 7.2.3 to clean or replace.

Issue	Probable Cause	How to Detect	Procedure to Resolve
Failure to pierce, or Failure to start cut properly	Gas supply not turned on.	Check cutting gas supply and regulator.	Turn on the supplied cutting gas and regulate to the specified pressure.
	The provided material type, thickness, or cutting gas do not match what is required for the active job.	Determine the raw material type and thickness on the cutting table. Determine the supplied cutting gas.	On the HMI, refer to the information on the **Active Technology** tile to ensure the active job matches the raw material, thickness, and cutting gas previously determined, or use the material type and thickness that match the active job.
Sparks from top surface of plate entering nozzle and damaging the protective window.	Cutting speed too fast.	On the HMI, select the **Machine** tab. Observe the feedrate override.	Decrease feedrate override to decrease cutting speed.
	The provided material type, thickness, or cutting gas do not match what is required for the active job.	Determine the raw material type and thickness on the cutting table. Determine the supplied cutting gas.	On the HMI, refer to the information on the **Active Technology** tile to ensure the active job matches the raw material, thickness, and cutting gas previously determined, or use the material type and thickness that match the active job.

9.0 Replacement Parts



1 Laser Enclosure	
P/N	**Description**
ZD900369	Side Access Door Assm
ZD900371	Bump Out Cover; Side
ZD900372	Bump Out Cover; Center
ZD900373	Bump Out Cover; Bellow
ZD900374	Roof Panel
ZD900389	Replacement Key Set
ZD900367	Downdraft Door Cylinder
ZD900368	Door Lift Cylinder
ZD900376	Drawer Handle
LC2000148	Lasgar Basic Digital Valve
LC2000138	Servo Motor; 1.8kW (Y1/Y2 Axis)
LC2000137	Servo Motor; 1.3kW (X Axis)
LC2000139	Servo Motor; 400W (Z Axis)

2 Cutting Table	
P/N	**Description**
ZD900352	Bellow; X Axis
ZD900353	Bellow; Y Axis
ZD900354	Drop Drawer
ZD900355	Leveling Foot
ZD900356	Felt Gear Assm
ZD900357	Gearbox W/Pinion
ZD900358	Y Axis Rail Assm
ZD900359	X Axis Rail Assm
ZD900360	Gear Rack 1M
ZD900361	Nozzle Brush
ZD900362	Drawer Support
ZD900363	Tool Cover Assm
ZD900364	Drawer Rail Assm
ZD900365	Proximity Sensor
ZD900366	Z Axis Stage

3 Cutting Head	
P/N	**Description**
LC2000140	Cutting Head
AD2600-30	Ceramic Insert
AD2600-31	Nut
AD2600-32	Sensor Insert
AD2600-33	Clamping Ring
AD2600-34	Sealing Ring
AD2600-35	Spatter Protection Plate
AD2600-36	Protective Window Holder
AD2600-37	Protective Window
AD2600-1	Nozzle, 0.8mm, Single, Clearance
AD2600-2	Nozzle, 1.0mm, Single, Clearance
AD2600-3	Nozzle, 1.2mm, Single, Clearance
AD2600-4	Nozzle, 1.5mm, Single, Clearance
AD2600-5	Nozzle, 1.8mm, Single, Clearance
AD2600-6	Nozzle, 2.0mm, Single, Clearance
AD2600-7	Nozzle, 2.5mm, Single, Clearance
AD2600-8	Nozzle, 3.0mm, Single, Clearance

AD2600-9	Nozzle, 0.8mm, Single, Cone
AD2600-10	Nozzle, 1.0mm, Single, Cone
AD2600-11	Nozzle, 1.2mm, Single, Cone
AD2600-12	Nozzle, 1.5mm, Single, Cone
AD2600-13	Nozzle, 1.8mm, Single, Cone
AD2600-14	Nozzle, 2.0mm, Single, Cone
AD2600-15	Nozzle, 2.5mm, Single, Cone
AD2600-16	Nozzle, 3.0mm, Single, Cone
AD2600-17	Nozzle, 4.0mm, Single, Cone
AD2600-18	Nozzle, 5.0mm, Single, Cone
AD2600-19	Nozzle, 1.0mm, Double, Cone
AD2600-20	Nozzle, 1.2mm, Double, Cone
AD2600-21	Nozzle, 1.5mm, Double, Cone
AD2600-22	Nozzle, 1.8mm, Double, Cone
AD2600-23	Nozzle, 2.0mm, Double, Cone
AD2600-24	Nozzle, 2.3mm, Double, Cone
AD2600-25	Nozzle, 2.5mm, Double, Cone
AD2600-26	Nozzle, 3.0mm, Double, Cone
AD2600-27	Nozzle, 3.5mm, Double, Cone
AD2600-28	Nozzle, 4.0mm, Double, Cone
AD2600-29	Nozzle, 5.0mm, Double, Cone

4 Operator Console

P/N	Description
ZD900351	HMI Assembly

5 Electrical Cabinet

P/N	Description
ZD900350	Air Conditioner; 800W; 220VAC
ZD900370	Lubrication Assm
ZD900375	480-240V Transform; 20KVA
ZD900377	Industrial Pc
ZD900378	Pilz Pnoz S5 Safety Relay
ZD900379	Pilz Psen Safety Interlock Sw
ZD900380	Cable; Armature; Pana
ZD900381	Cable; Armature; Pana; Y1
ZD900382	Cable; Armature; Pana; Y2
ZD900383	Cable; Armature; Pana; Z
ZD900384	Cable; Encoder; Pana; X
ZD900385	Cable; Encoder; Pana; Y1
ZD900386	Cable; Encoder; Pana; Y2
ZD900387	Cable; Encoder; Pana; Z
ZD900388	Hikv; Camera
ZD900390	Regulator; Smc
ZD900391	Cooling Gas Solenoid
ZD900392	3Pc Solenoid Assm
ZD900393	1Pc Solenoid
ZD900394	Drawer Assist Pedal
LC2000141	4kW Rack; Elite Diode Pump
LC2000143	2kW Rack; Elite Diode Pump
LC2000145	Signal Conditioner; 7-24VDC
LC2000133	Cutbox Pro Ec
LC2000146	Cable; 19 Pin; KC 20M Gw Ext
LC2000147	Cable; BNC; KS 20M Gw
LC2000136	Servo Drive; 1.8kW (Y1/Y2 Axis)
LC2000135	Servo Drive; 1.3kW Sto (X Axis)
LC2000134	Servo Drive; 400W Sto (Z Axis)
LC2000152	Controller; Eckelmann EXC880
LC2000172	Pendant; Eckelmann; EXC880

6 Laser Chiller

P/N	Description
LC2000144	4KW 220V 1PH 60HZ Chiller
LC2000173	Hose; 1"; JIC Female; 120" Long

10.0 Product Stewardship

Lincoln Electric is committed to the responsible management of our products throughout their entire life cycle. Our products are designed and manufactured with sustainability in mind, using materials and processes that minimize waste and energy consumption.

We encourage our customers to use our products responsibly and to dispose of them properly at the end of their life cycle.

⚠ **WARNING**: This product, when used for welding or cutting, produces fumes or gases which contain chemicals known to the State of California to cause birth defects and, in some cases, cancer. (California Health & Safety Code § 25249.5 et seq.)

⚠ **WARNING**: Cancer and Reproductive Harm **www.p65warnings.ca.gov**

10.1 Disassembly

It is important to follow all safety precautions described in this manual while disassembling this equipment.

1) Turn off and disconnect all power sources to the equipment.
2) Use appropriate tools to disconnect any electrical or mechanical connections.
3) Identify and remove any fasteners or bolts that hold the equipment together.
4) Remove any attachments or accessories that may have been added to this machine by the end-user. Contact end-user for disposal instructions.
5) Organize all parts by disposal method, like computers and other electronics that are e-waste.

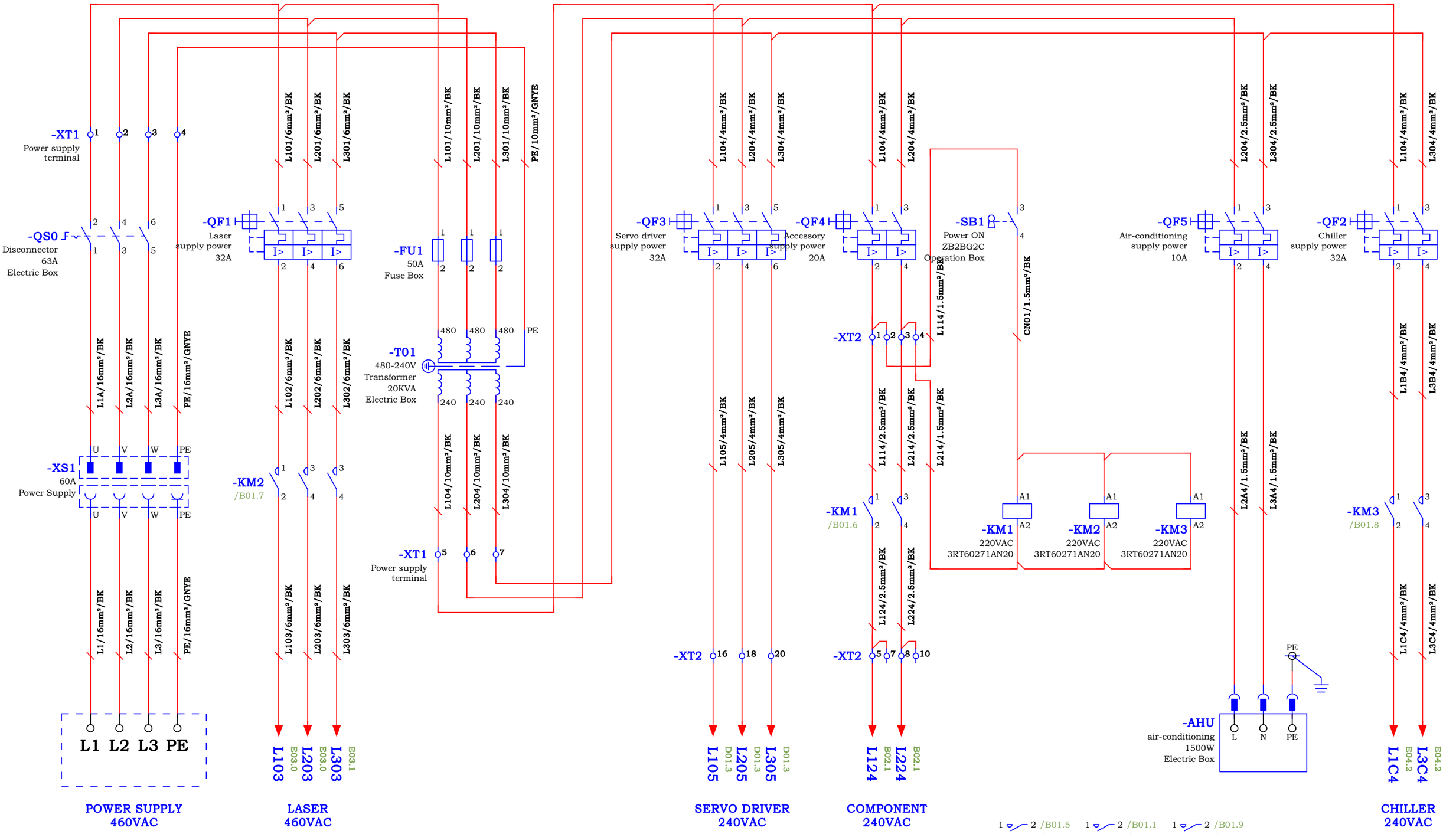
10.2 Disposal

Dispose of this machine, related materials, and all fluids in accordance with local, state or provincial, and national regulations.

This machine contains electronic devices (e-waste) that must be disposed of and/or recycled in accordance with local, state or provincial, and national regulations.

11.0 Schematics

Table of Contents



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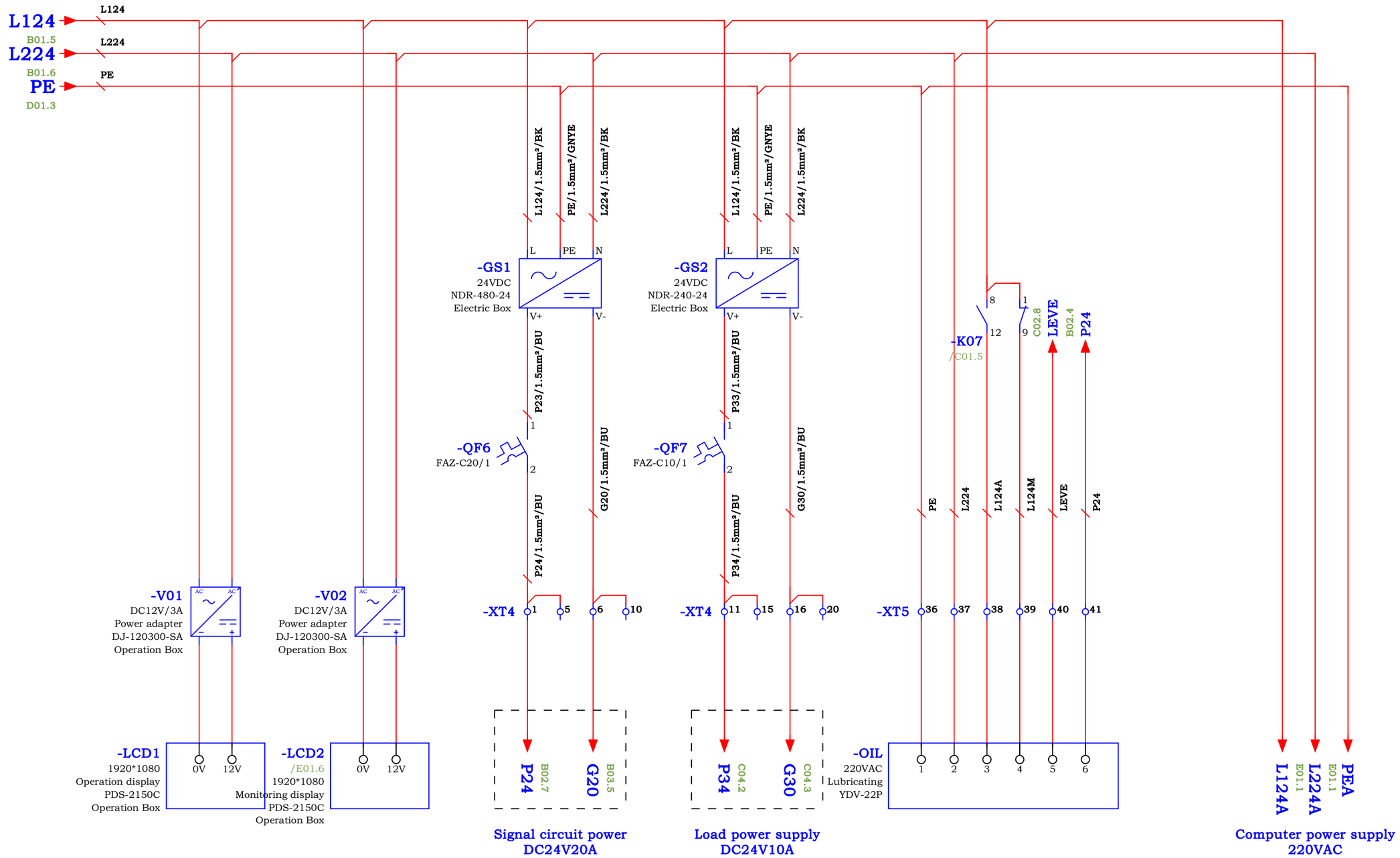

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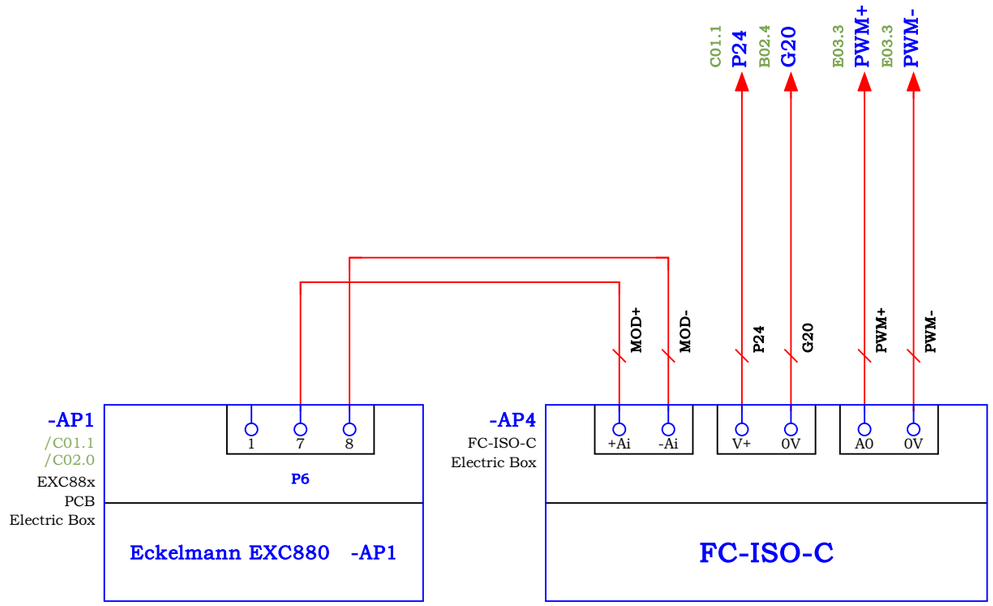

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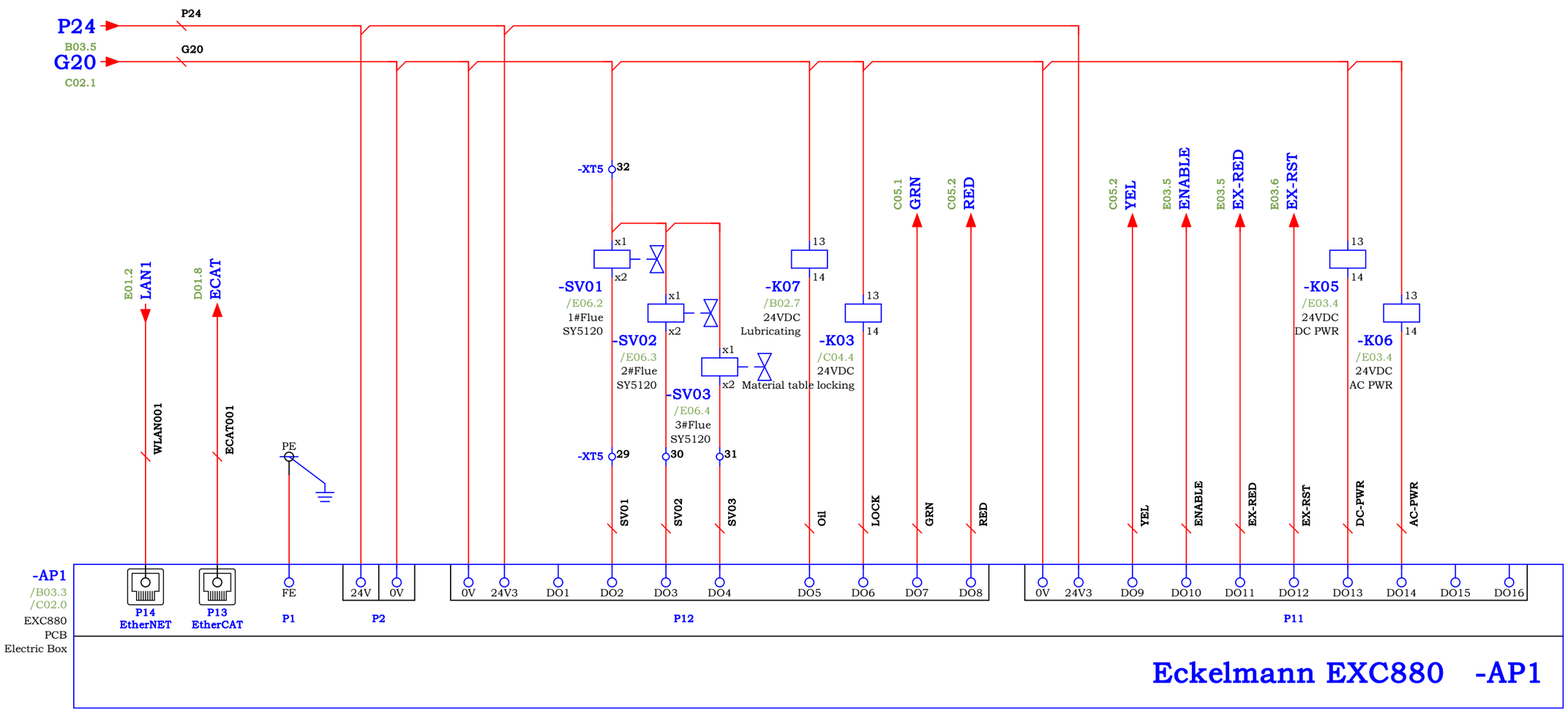

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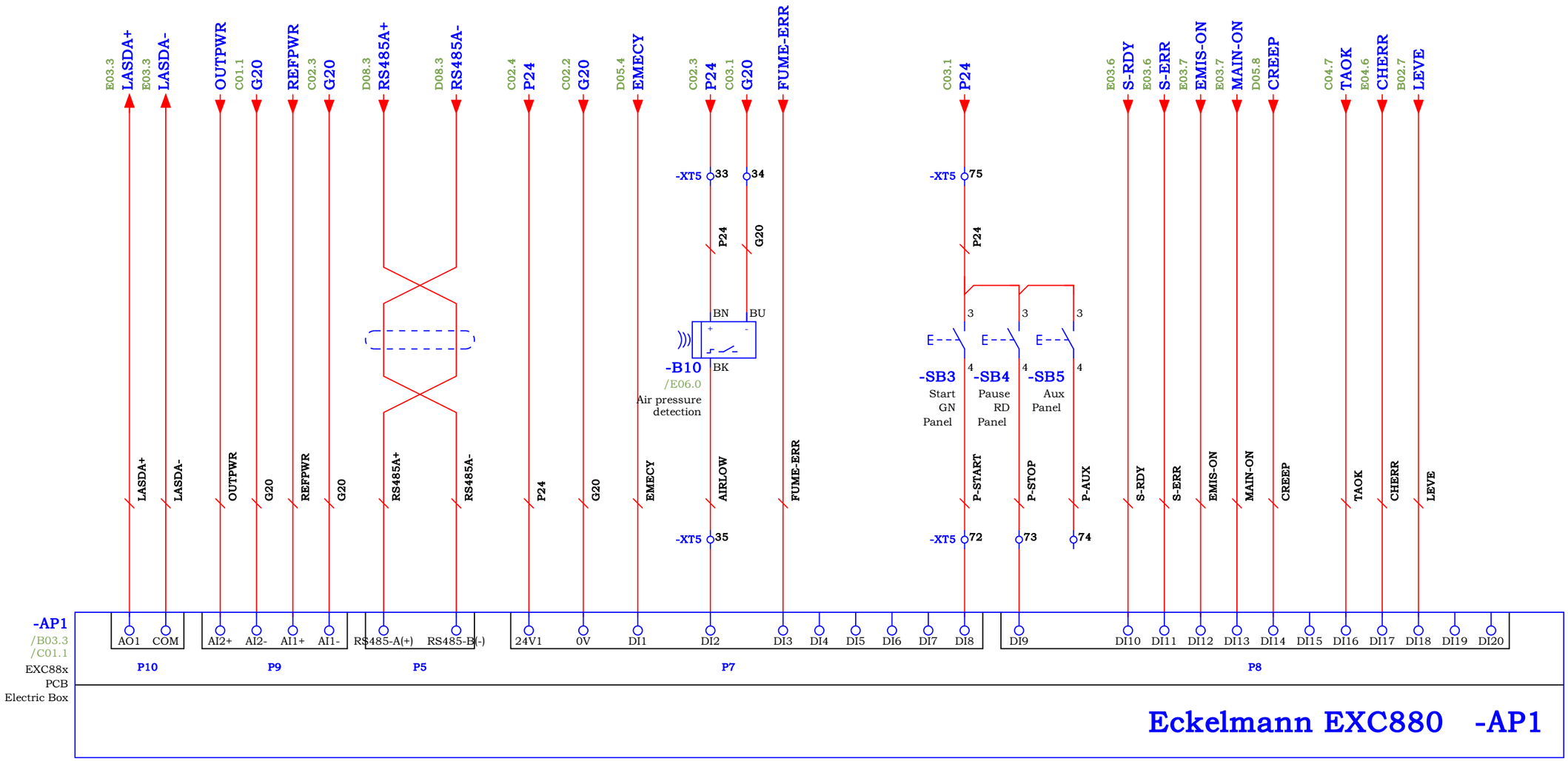

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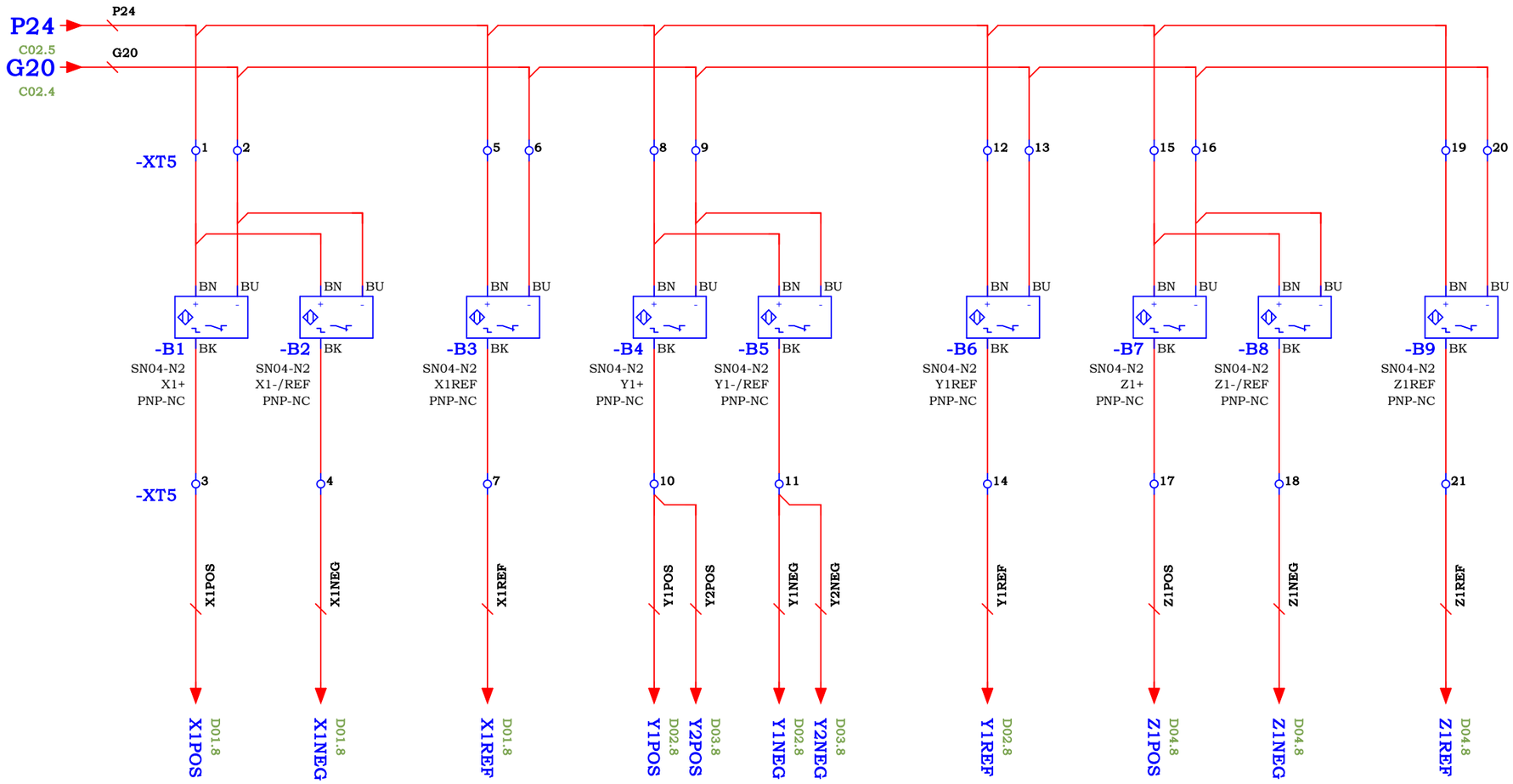

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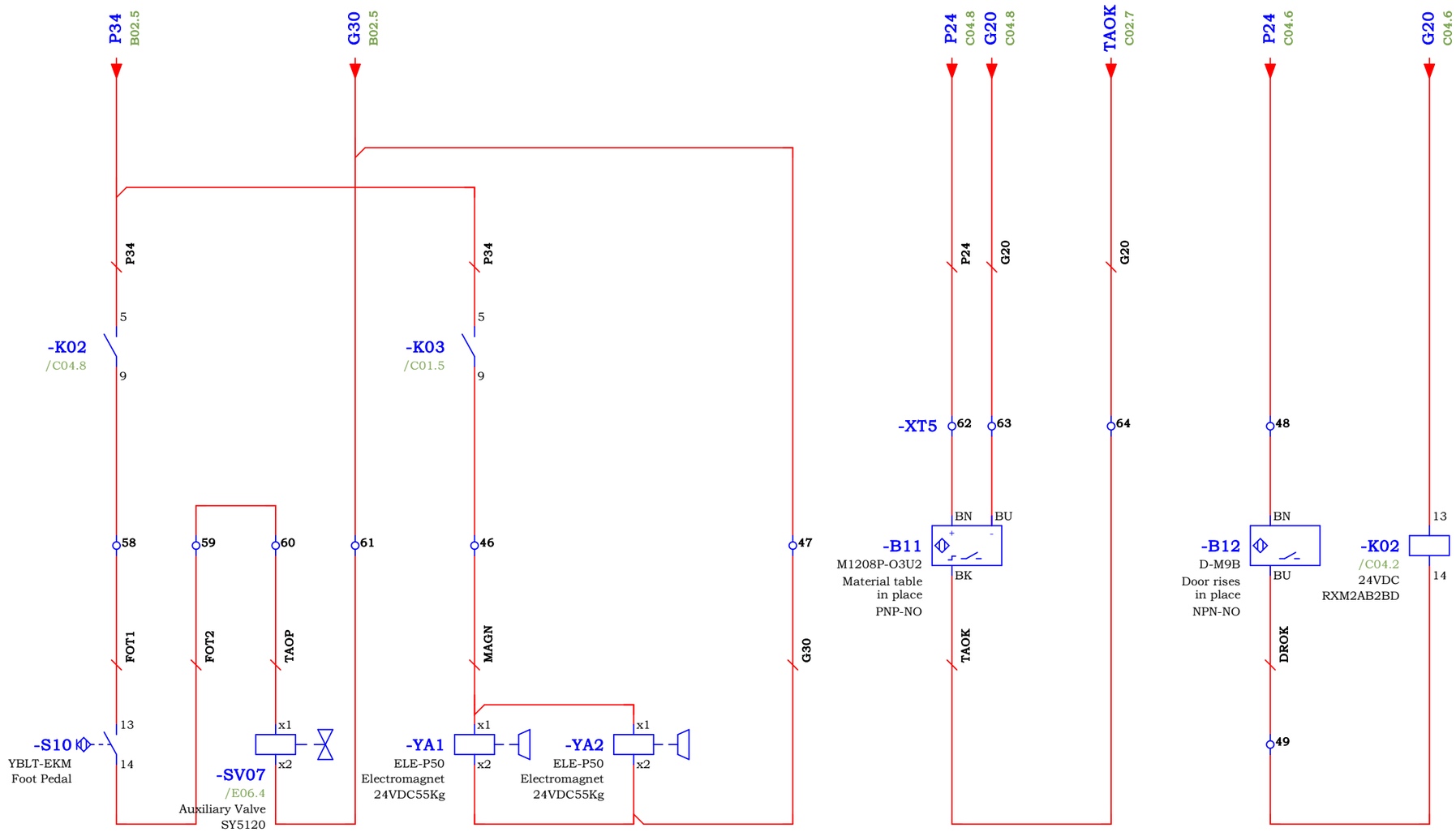

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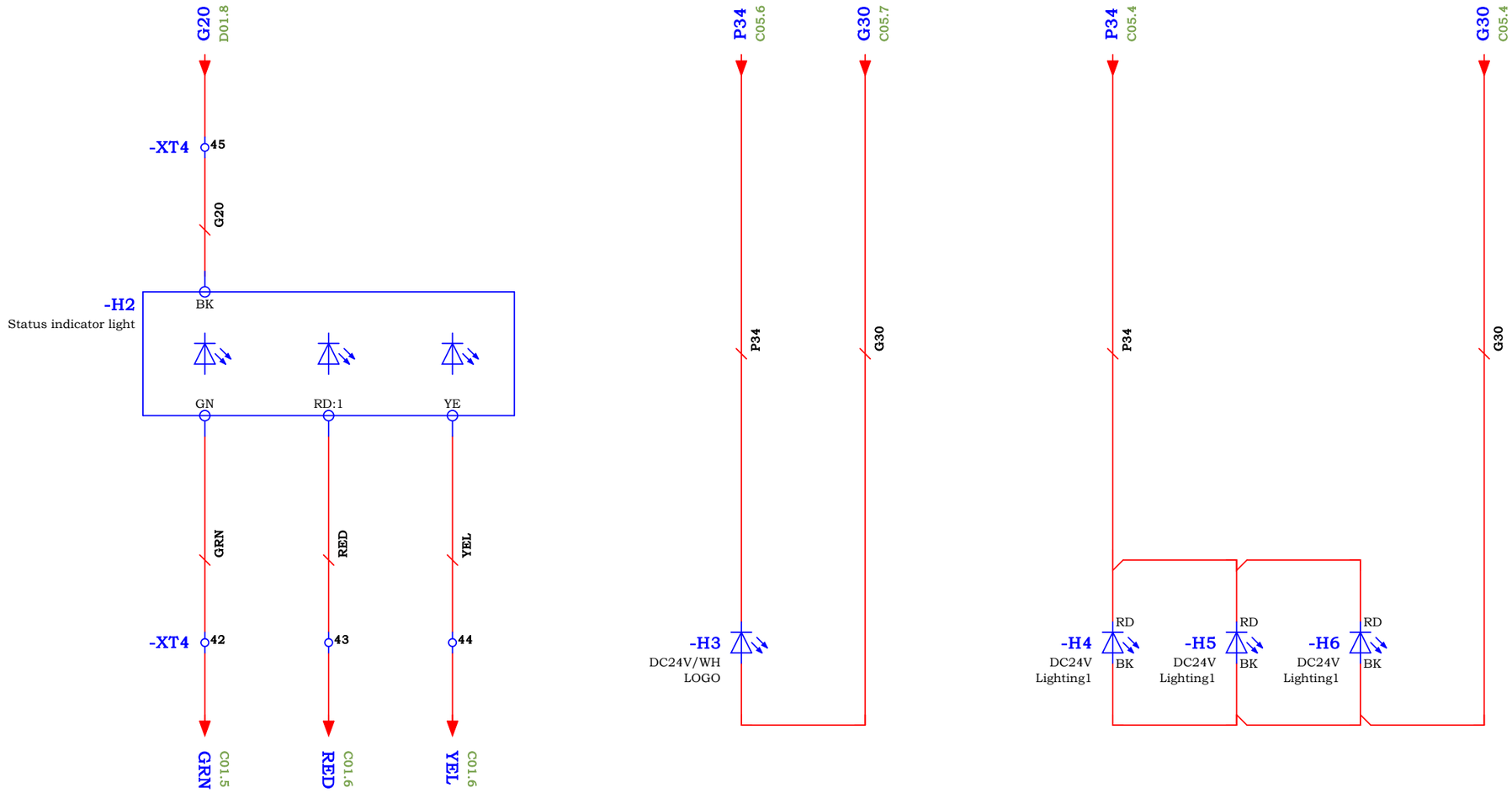

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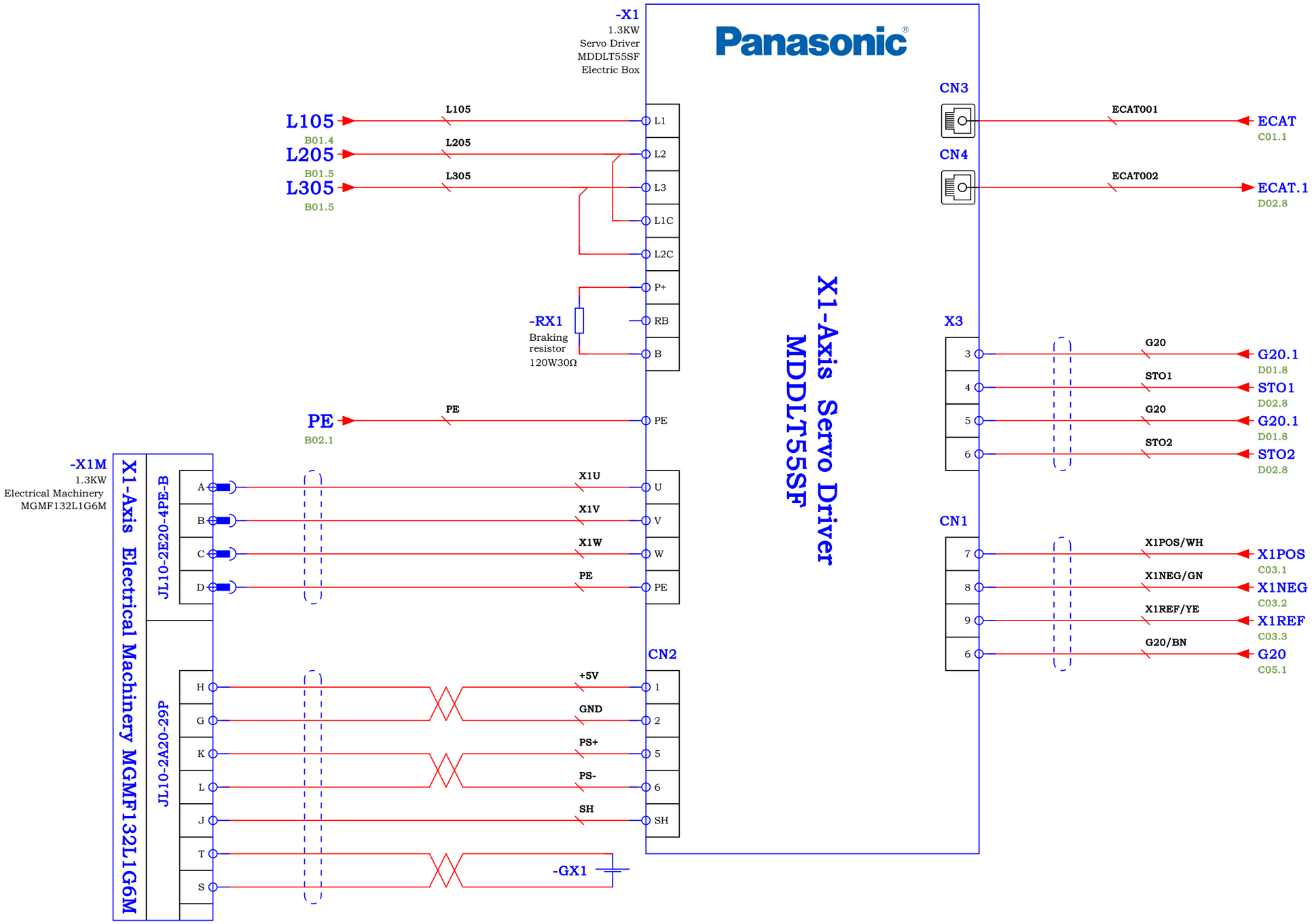

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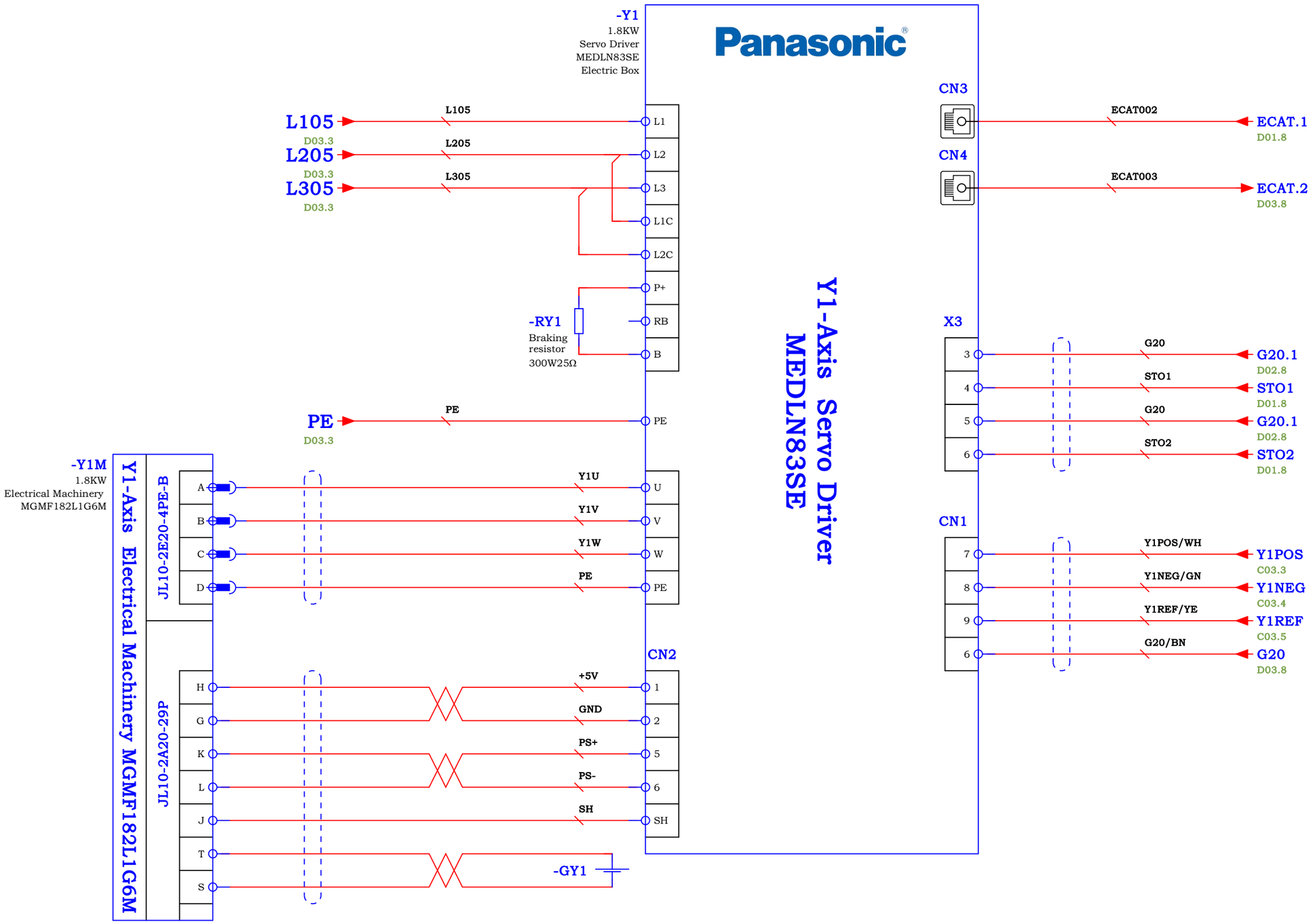

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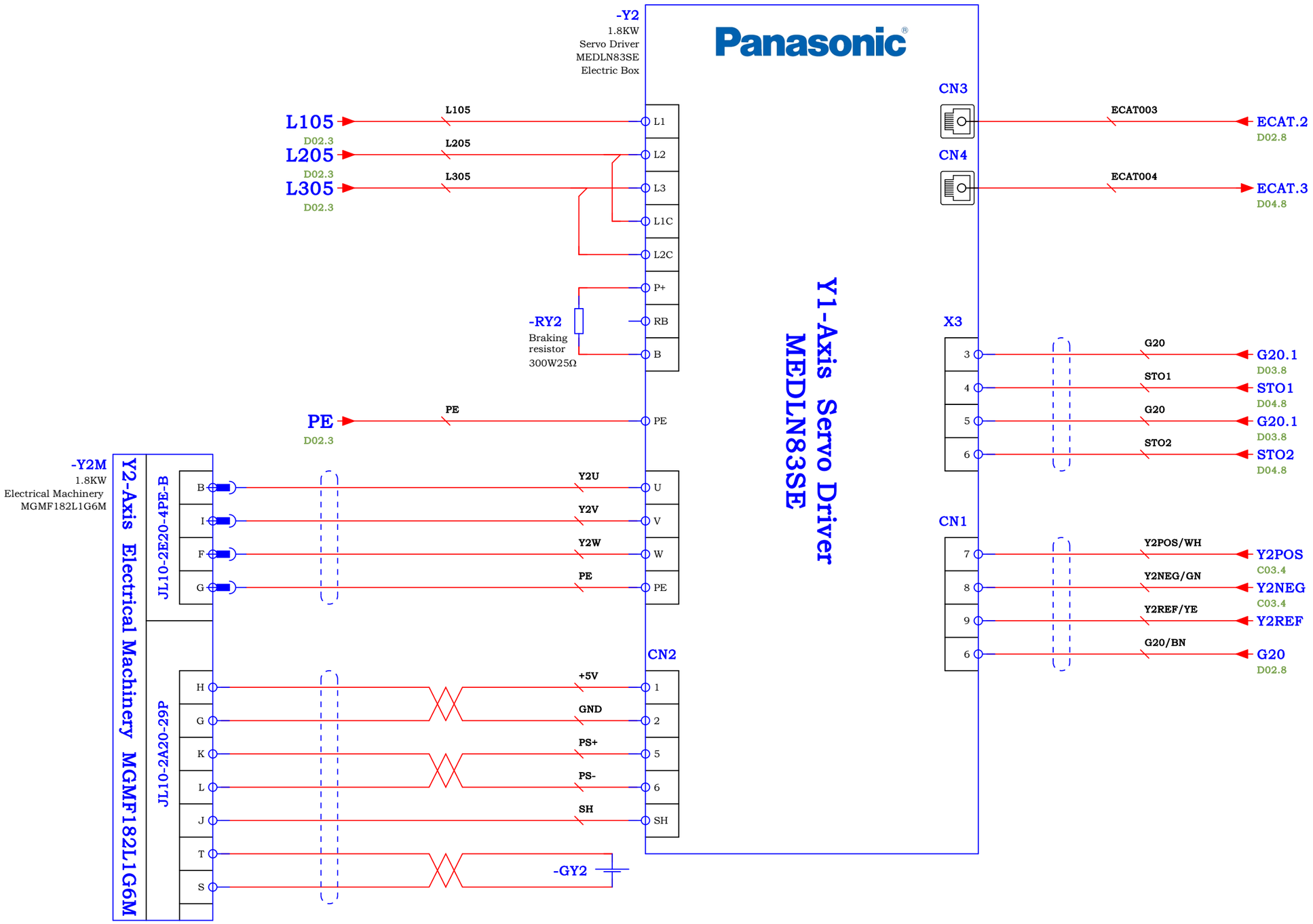

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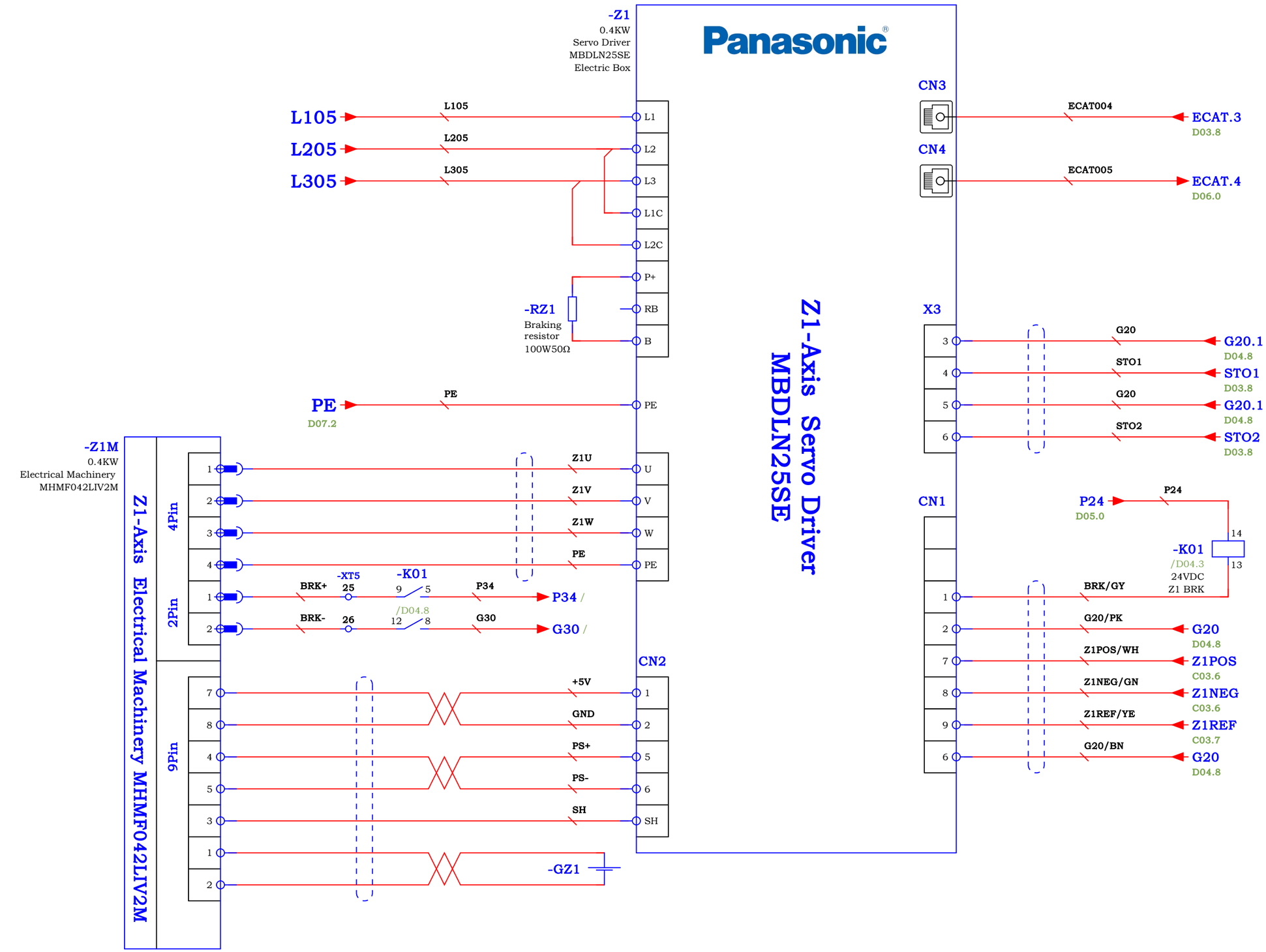

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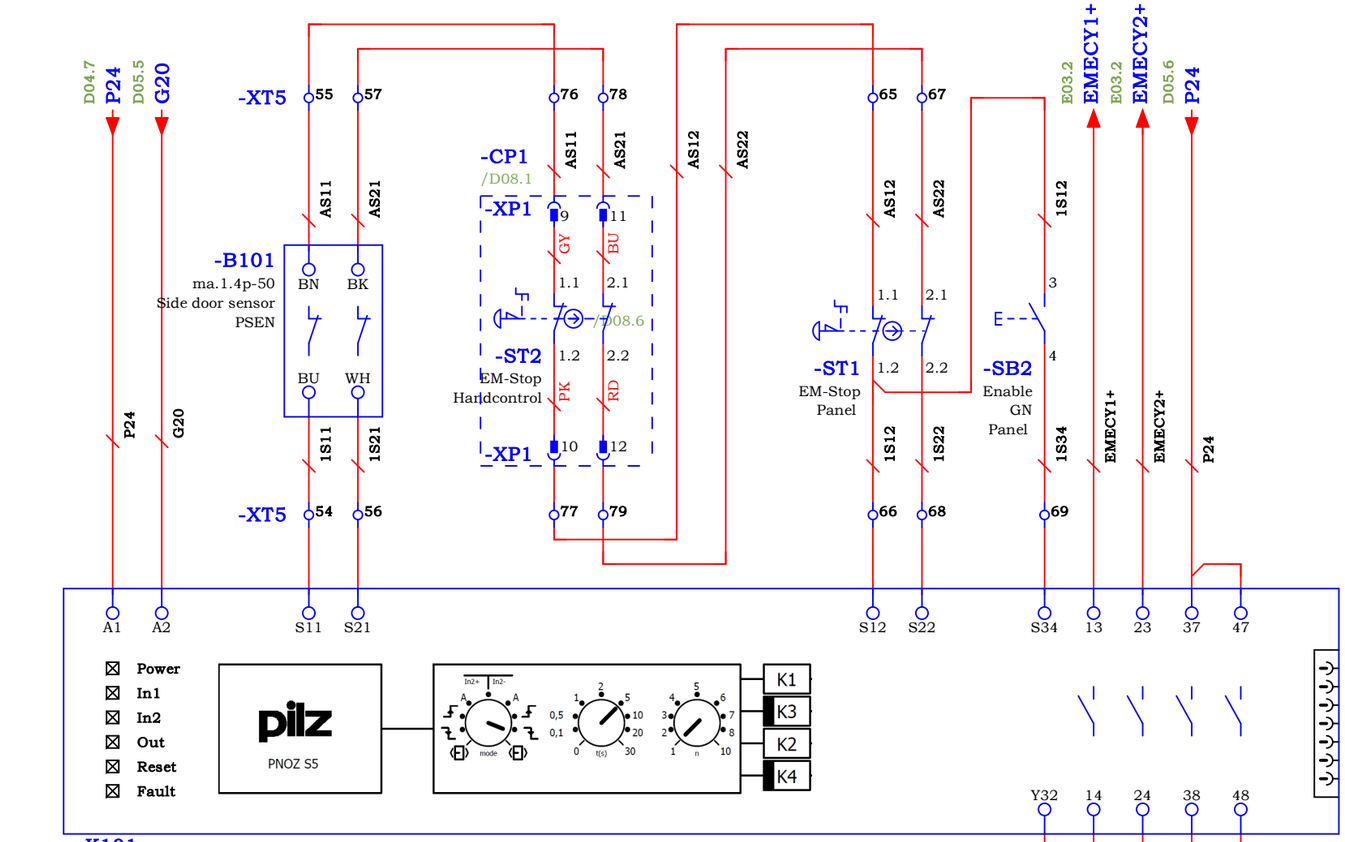

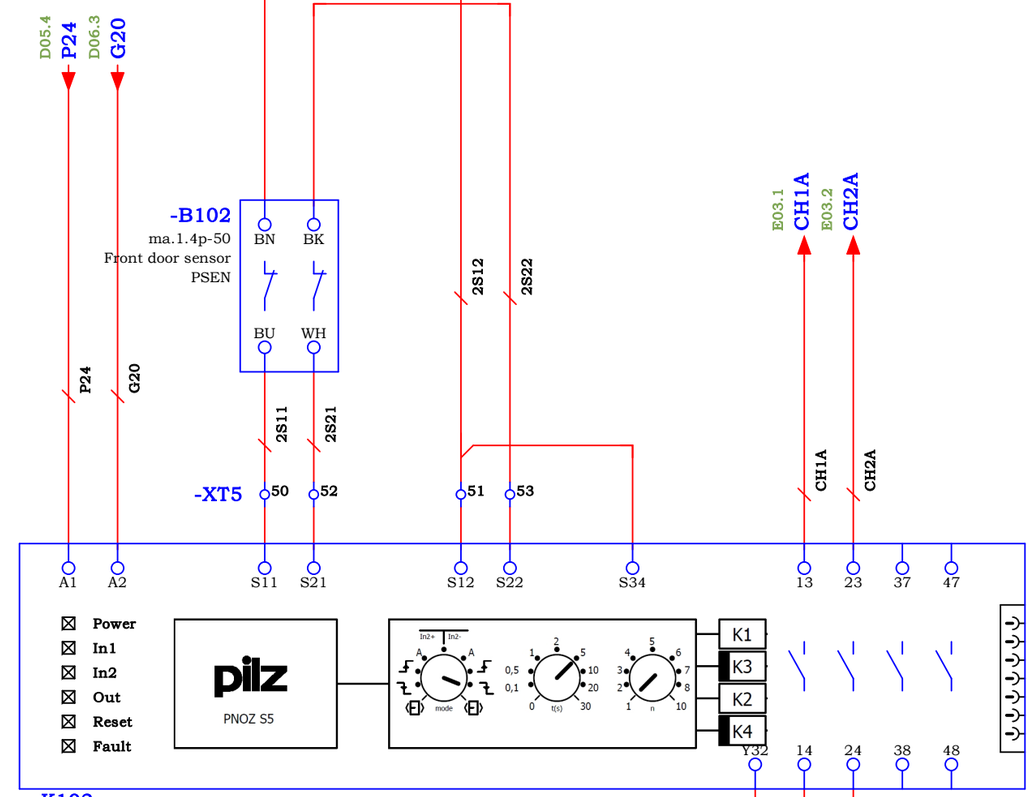

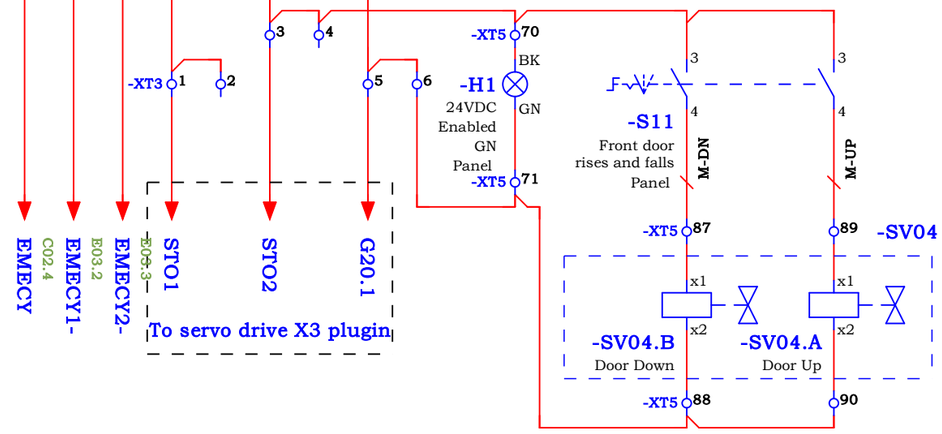

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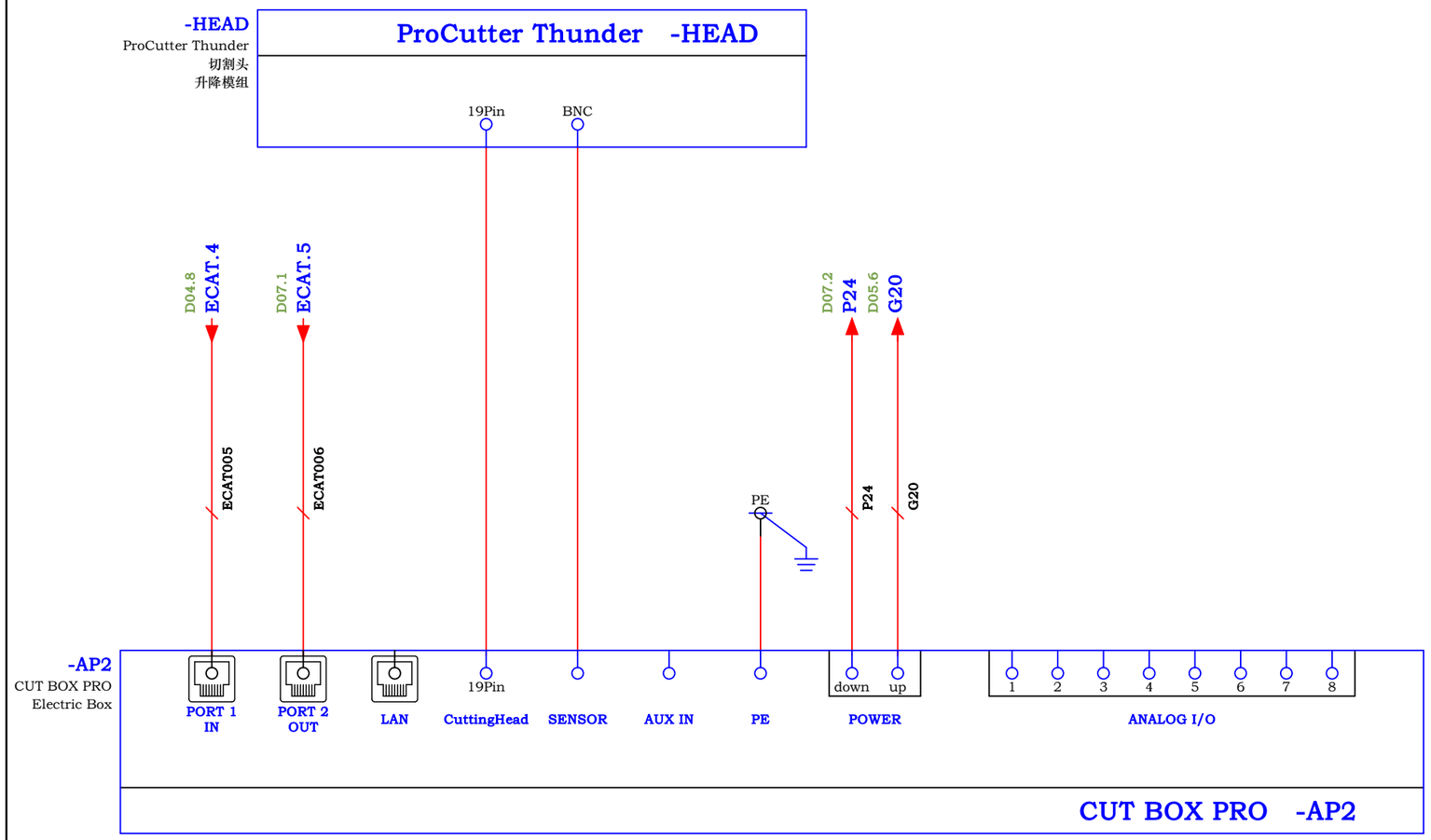

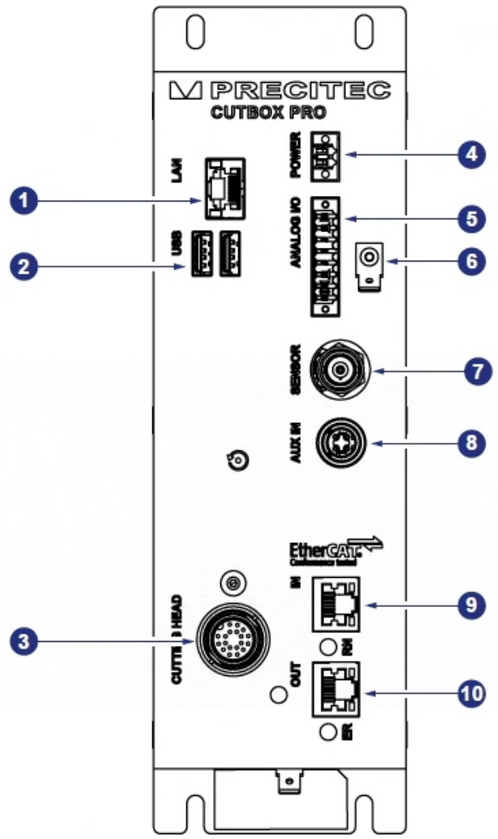

1	LAN connection	6	Analogue cable shield support
2	USB connections for additional peripherals	7	Sensor connection
3	Cutting head connection (19-pin)	8	Aux In connection
4	Power connection (24V)	9	Fieldbus connection 1
5	Analogue I/O connection	10	Fieldbus connection 2

D05

D07

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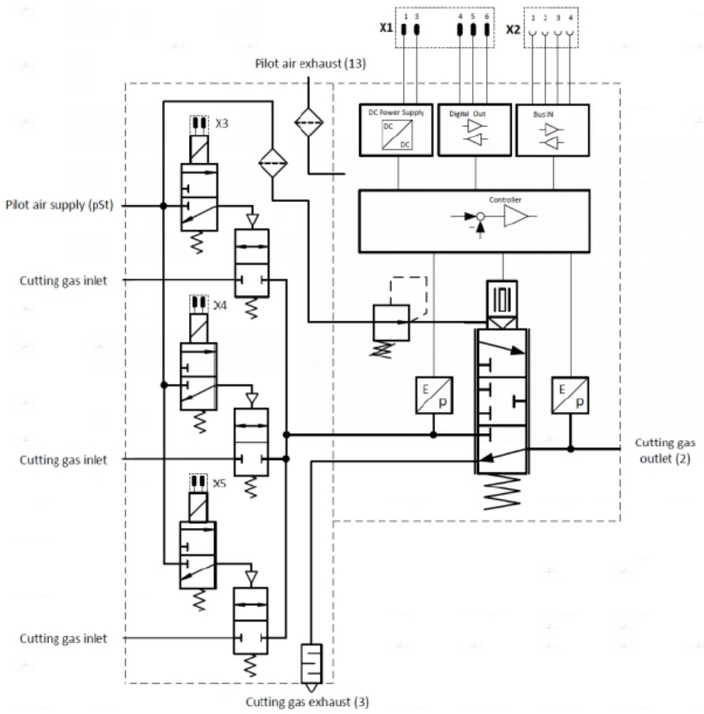
LASGAR BASIC DIGITAL WITH 3-GAS CONNECTION



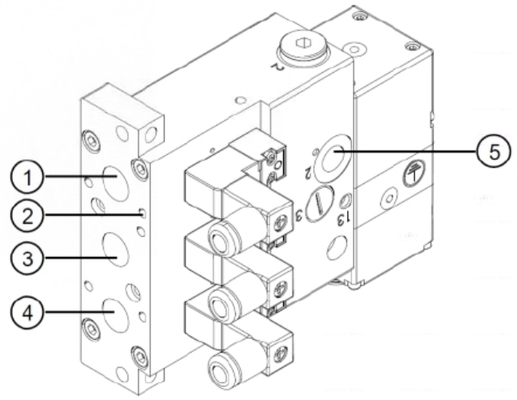
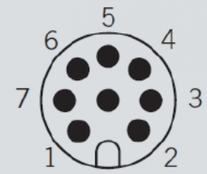
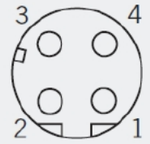


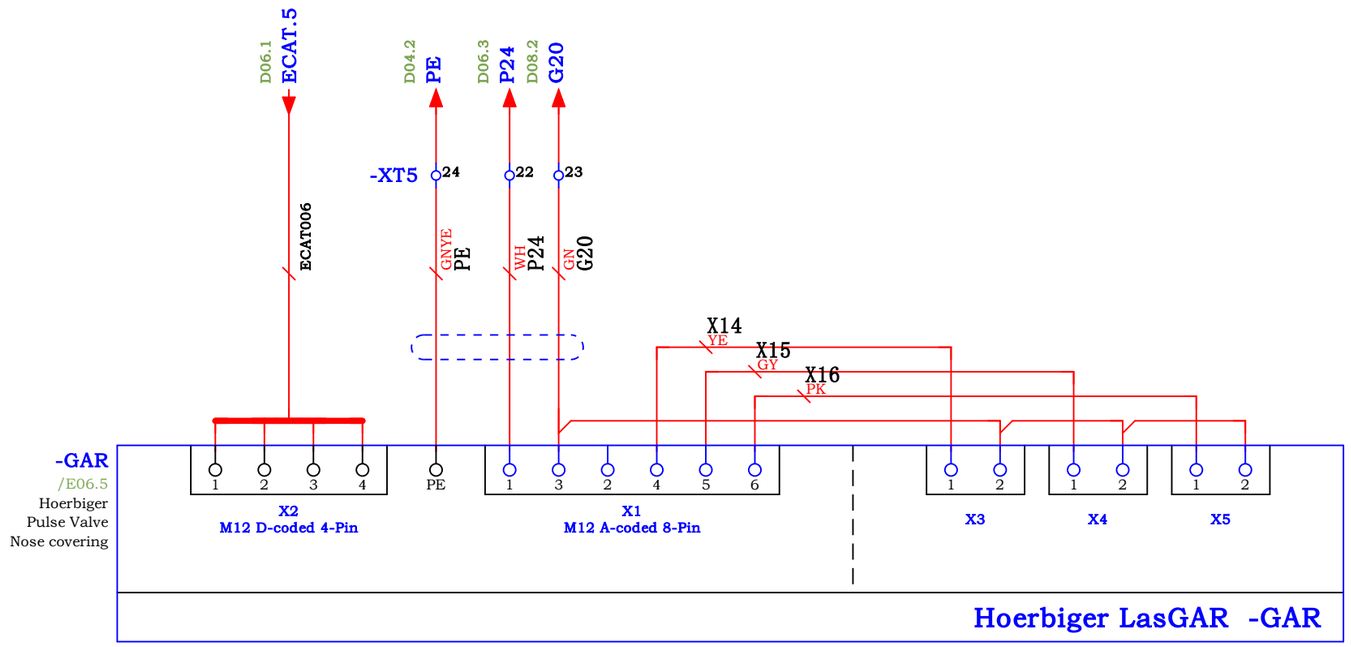
Fig. 18: Gas connection 2- and 3-gas variant with or without filter

1	Cutting gas input G⅜	O2	4	Cutting gas input G⅜	N2
2	Control air input M5	shop air	5	Cutting gas output G¼	
3	Cutting gas input G⅜	HP AIR			

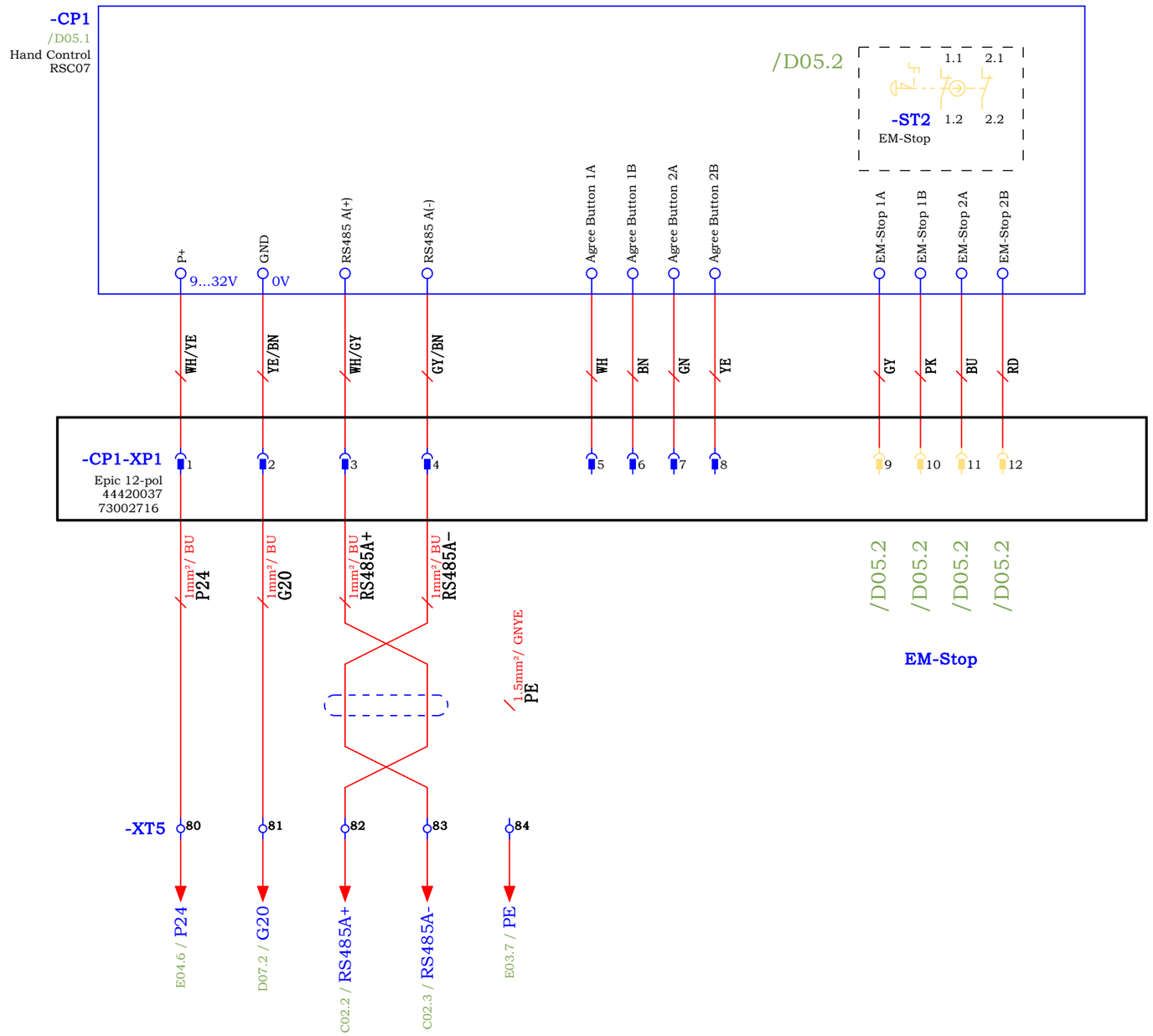
LASGAR BASIC DIGITAL

Digital I/Os	
Output voltage (U out)	OFF = 0 VDC ON = U(Nom) – 0.7
Output current (I out)	≤ 100 mA / short circuit-proof

Plug assignment (X1)		1 +24VDC Power 2 NC 3 GND 4 Out 1 / Gas_1 5 Out 2 / Gas_2 6 Out 3 / Gas_3 7 UART RxD 8 UART TxD
Plug assignment (X2)		1 TD + 2 RD + 3 TD – 4 RD –



			Entry name		Hoerbiger LasGAR	=	
			JWM3015-EXC88x-Panasonic-STO-20240407	Drawing No.			
						+	Page D07
Modify	Date	Name	Creator AWP	Approved by:			Number 21 From 27



D07

E01

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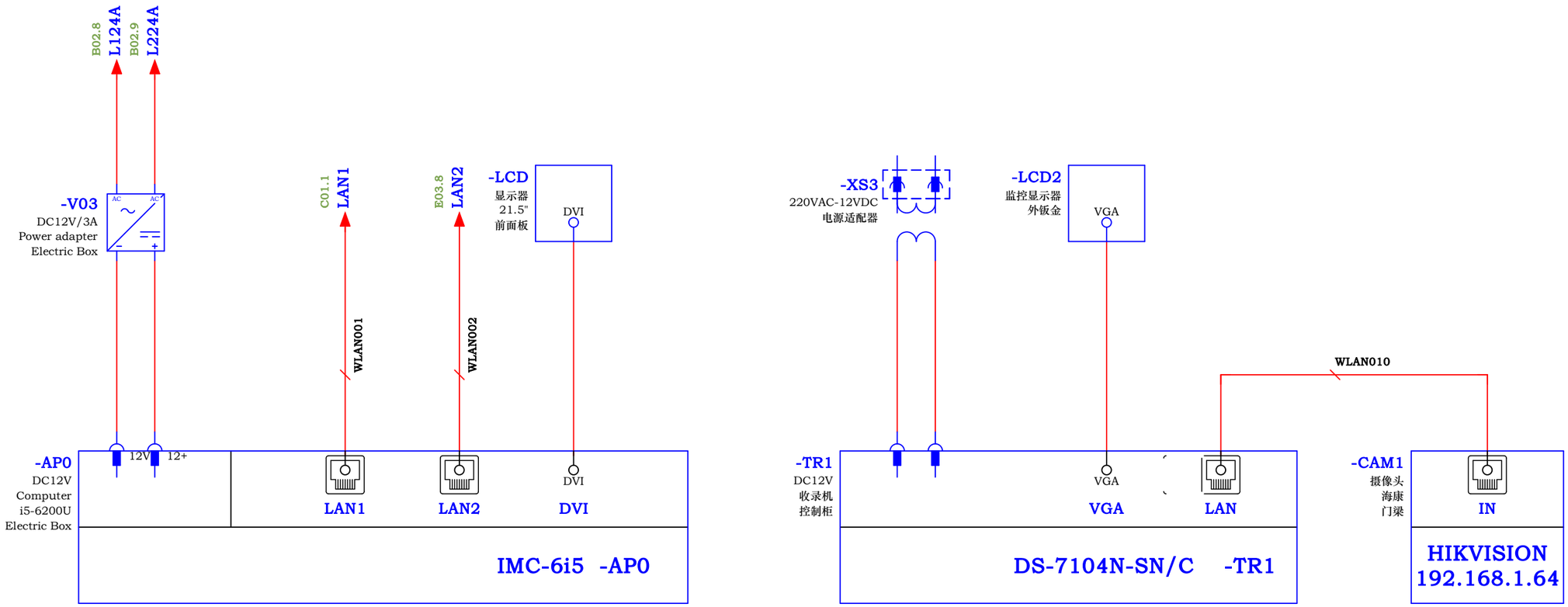

D08

E03

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			JWM3015-EXC88x-Panasonic-STO-20240407	Drawing No.				
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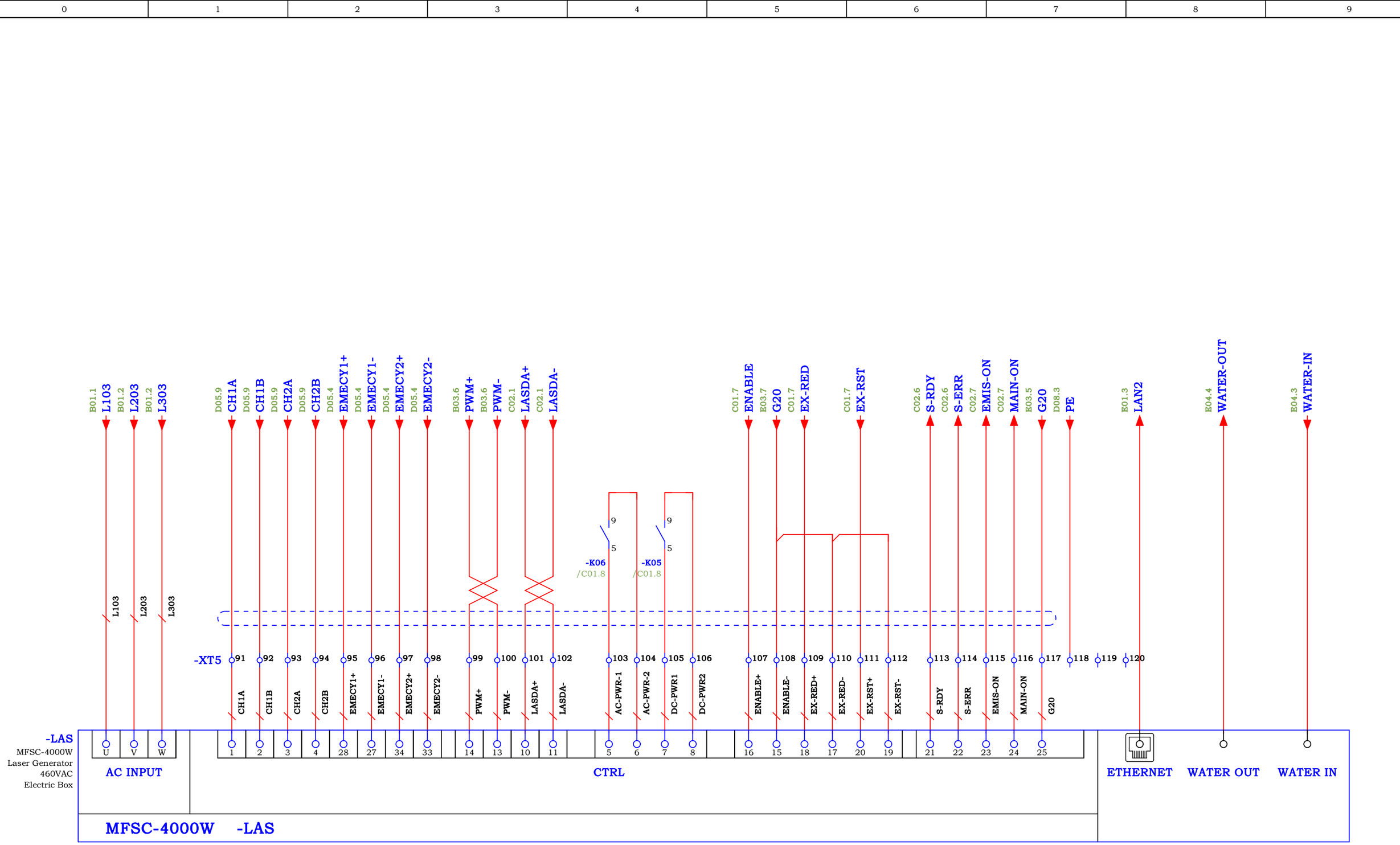
Modify	Date	Name	Creator AWP	Approved by:				Number 23 From 27

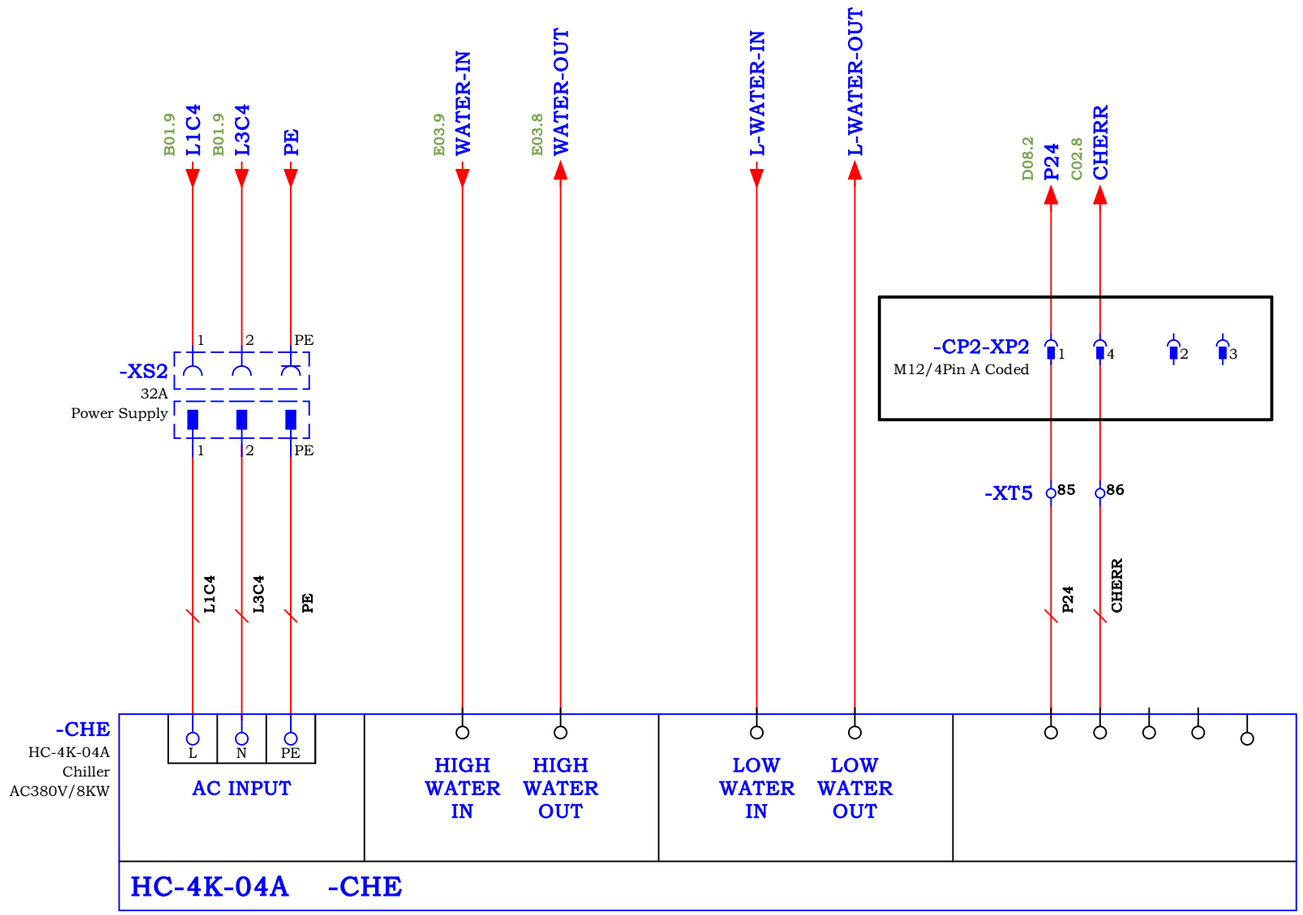


E01

E04

			Entry name		MAX-MFSC-4000W	=	
			JWM3015-EXC88x-Panasonic-STO-20240407	Drawing No.		+	Page E03
Modify	Date	Name	Creator AWP	Approved by:			Number 24 From 27

Laser QBH and cutting head cooling circuit

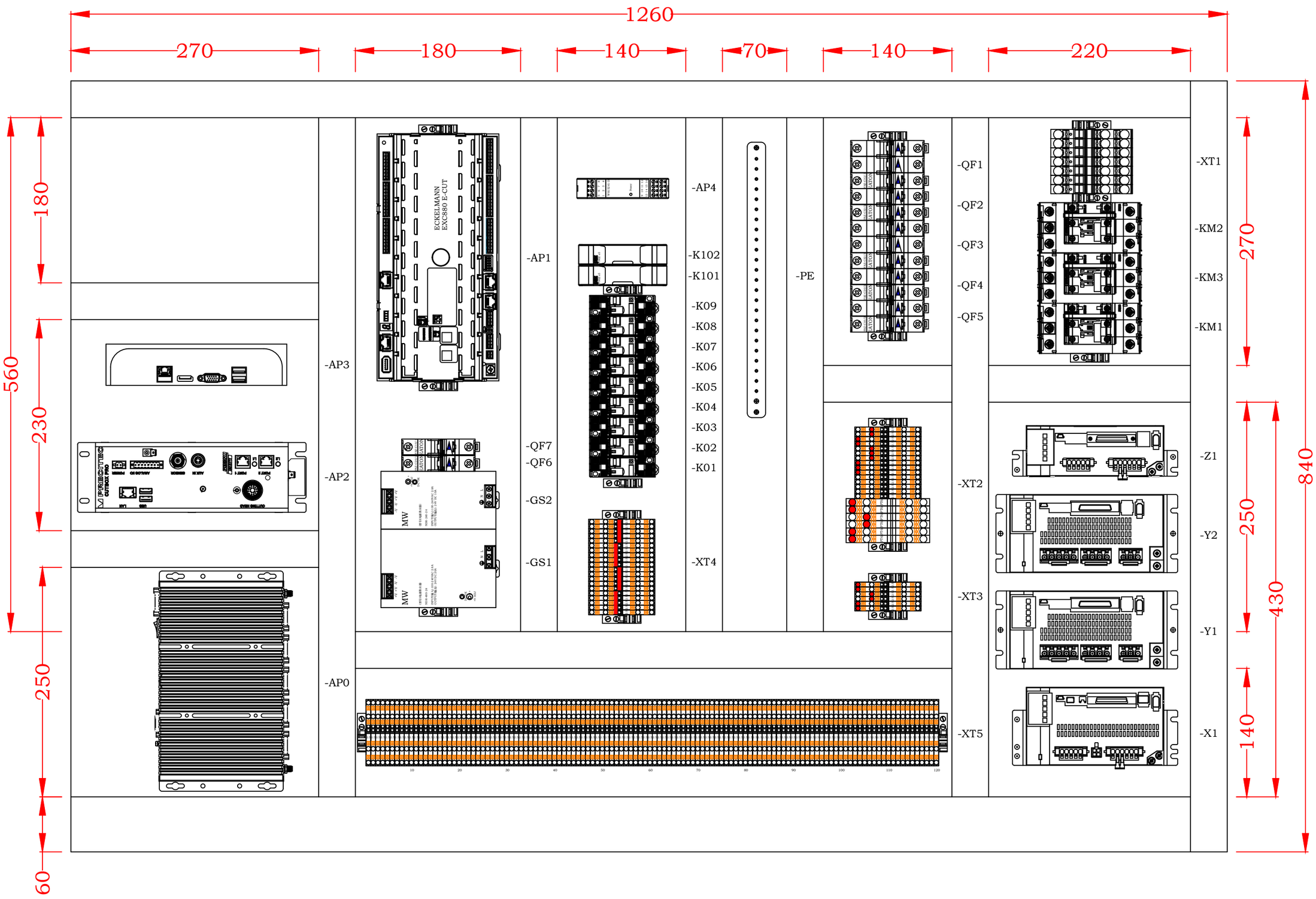


E03

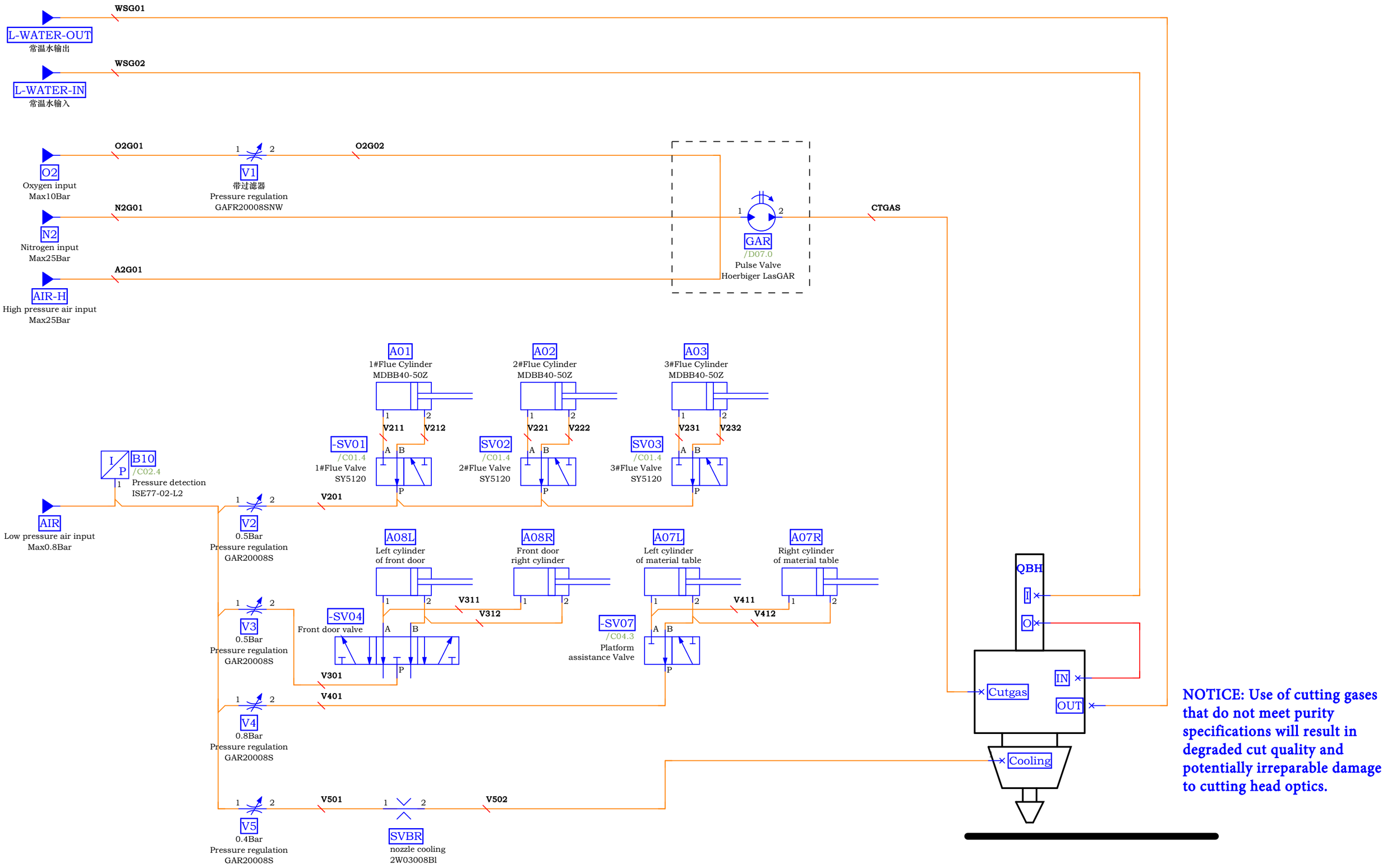
E05

			Entry name		HC-4K-04A		=	
			JWM3015-EXC88x-Panasonic-STO-20240407	Drawing No.				
							+	Page E04
Modify	Date	Name	Creator AWP	Approved by:				Number 25 From 27

0	1	2	3	4	5	6	7	8	9



			Entry name		Component layout		=	
			JWM3015-EXC88x-Panasonic-STO-20240407	Drawing No.			+	Page E05
Modify	Date	Name	Creator AWP	Approved by:				Number 26 From 27



NOTICE: Use of cutting gases that do not meet purity specifications will result in degraded cut quality and potentially irreparable damage to cutting head optics.

E05

			Entry name		Pipeline Connection	=	
			JWM3015-EXC88x-Panasonic-STO-20240407	Drawing No.			
Modify	Date	Name	Creator AWP	Approved by:		+	Page E06
							Number 27 From 27

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Appendix A : cncCUT User Manual

cncCUT is a very powerful program with many more features and options that can be covered in this manual alone. Use the link below or the QR code to access the complete manual.

https://lincolnelectriccutting.com/uploads/linc-cut/cncCUT-Manual.pdf

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Appendix B : Laser Chiller Winterizing Guidelines

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Winter Maintenance Guidelines for TEYU Water Chillers

In this guide, we will walk you through essential points to consider for winter maintenance of your chiller.

1. Optimal Chiller Placement and Dust Removal

(1)Chiller Placement

- Ensure the air outlet (cooling fan) is positioned at least 5ft (1.5m) away from obstacles.
- Keep the air inlet (filter gauze) at least 1m away from obstacles for efficient heat dissipation.

(2)Cleaning & Dust Removal

Regularly use a compressed air gun to clean the dust on the filter gauze and the surface of the condenser to prevent inadequate heat dissipation.

***Note:** Maintain a safe distance (approximately 6" (15cm)) between the air gun outlet and the condenser fins during cleaning. Direct the air gun outlet vertically toward the condenser.

2. Schedule Replacement of Circulating Water

- Over time, the circulating water can develop mineral deposits or scale buildup, which may interfere with the normal operation of the system.
- To minimize issues and ensure a smooth water flow, it is recommended to replace the circulating water every 3 months using specified water.

3. Regular Inspections

Periodically check the chiller's cooling system, including cooling water pipes and valves, for any leaks or blockages. Address issues promptly to ensure normal operation.

4. For Areas Below 32°F (0°C), Antifreeze Is Essential for Chiller Operation.

(1) The importance of Antifreeze

In chilly winter conditions, adding antifreeze is crucial to shield the cooling liquid, preventing freezing that could lead to pipe cracking in laser and chiller systems, which could threaten their leak-proof integrity.

(2) Careful Selection of the Right Antifreeze Is Crucial. Consider the 5 Key Factors:

- ✧ Effective anti-freeze performance
- ✧ Anticorrosive and rust-resistant properties
- ✧ No swelling and erosion for rubber sealing conduit
- ✧ Moderate low-temperature viscosity
- ✧ Stable chemical property

(3) Three Important Principles of Antifreeze Usage

- **Lower concentration is preferable.** Most antifreeze solutions tend to be corrosive, so, within the limits of maintaining effective freeze performance, a lower concentration is better.
- **Shorter usage duration is preferred.** When temperatures consistently exceed 41°F (5°C), it is recommended to completely drain the antifreeze and thoroughly flush the chiller with specified water. Subsequently, replace it with the specified water.
- **Different antifreeze should not be mixed.** Despite having similar ingredients, various brands may differ in their additive formulas. It is advisable to consistently use the same brand of antifreeze to prevent potential chemical reactions, precipitation, or the formation of bubbles.

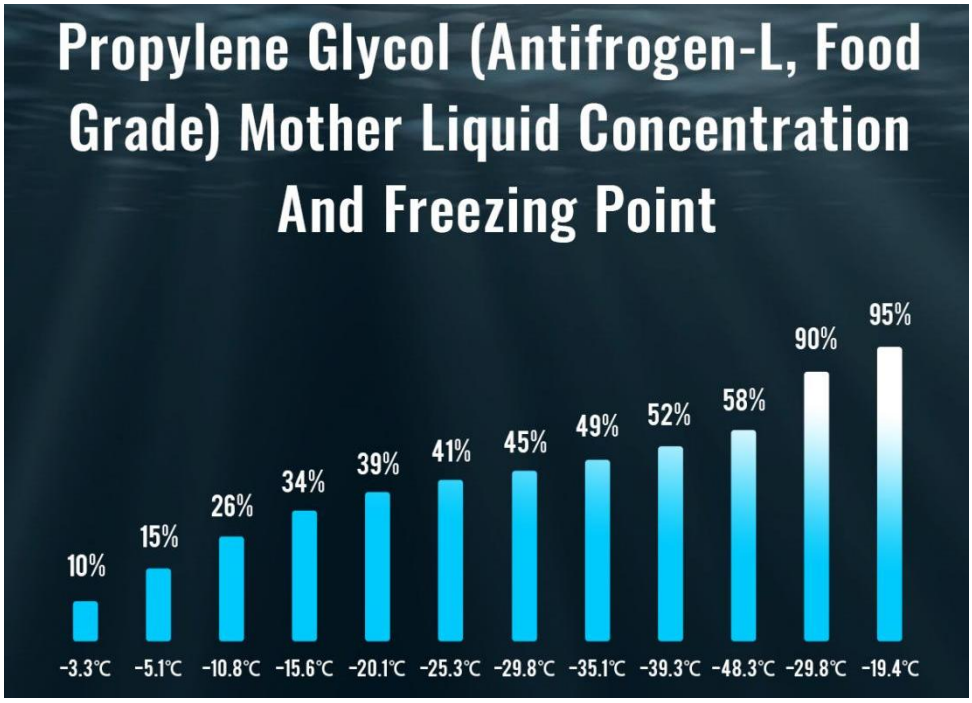
(4) Antifreeze Types

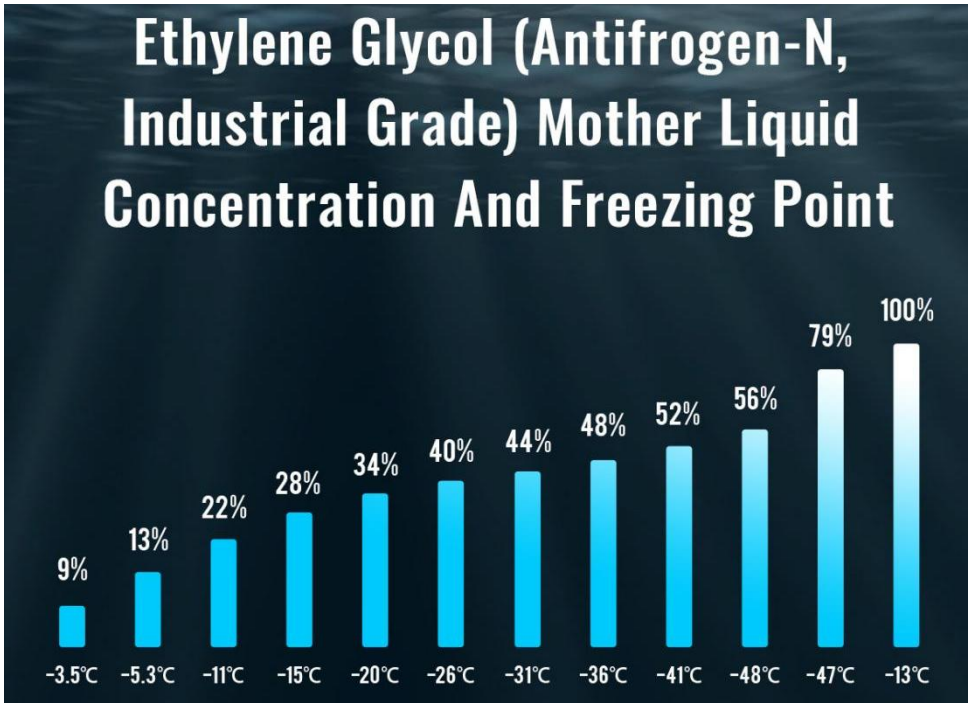
The prevalent antifreeze options for industrial chillers are water-based, employing ethylene glycol and propylene glycol.

Name	Corrosivity	Virulence	Volatility	Viscosity
Cut Sodium	Stronger	Nontoxic	Weak	Small
Methyl Alcohol	Strong	Highly Toxic	Strong	Small
Ethyl Alcohol	Weak	Slightly Toxic	Strong	Small
Ethylene Glycol	Strong	Low Toxic	Not Strong	Average
Propylene Glycol	Strong	Slightly Toxic	Not Strong	Average
Glycerol	Strong	Low Toxic	Not Strong	Large

(5) Proper Mixing Ratio Preparation

Users should calculate and prepare a suitable antifreeze ratio based on the winter temperature in their region. Following the ratio determination, the prepared antifreeze mixture can then be added to the industrial chiller, ensuring optimal performance and longevity.





***Note**

- To ensure the safety of the chiller and laser equipment, **please adhere strictly to the antifreeze-to-water ratio, preferably not exceeding 3:7. It is recommended to keep the antifreeze concentration below 30%.** High concentration antifreeze may cause potential blockages in the pipes and corrosion of equipment components.
- Some types of lasers may have specific antifreeze requirements. Before adding the antifreeze, it's recommended to consult the laser manufacturer for guidance.

(6) Example Illustration

As an illustration, we use the chiller CW-5200, which has a 1.59G (6L) water tank. If the lowest winter temperature in the region is around 25.7°F (-3.5°C), we can use a 9% volume concentration of ethylene glycol antifreeze mother solution. This means a ratio of approximately 1:9 [ethylene glycol: specified water]. For chiller CW-5200, this translates to approximately 0.16G (0.6L) of ethylene glycol and 1.43G (5.4L) of specified water to create a mixed solution of around 1.59G (6L).

(7) Steps for Adding Antifreeze to TEYU S&A Chillers

a. Prepare a container with measurements, antifreeze (mother solution), and the specified water needed for the chiller.
b. Dilute the antifreeze with specified water according to the specified ratio.
c. Turn off the water chiller's power, then unscrew the water-filling port.
d. Turn on the drain valve, empty the circulating water from the tank, then tighten the valve.
e. Add the diluted mixed solution into the chiller through the water-filling port while monitoring the water level.
f. Tighten the cap of the water-filling port, and start the industrial chiller.

(8) Maintain 24/7 Chiller Operation

For temperatures below 32°F (0°C), it is recommended to operate the chiller continuously, 24 hours a day, if conditions permit. This guarantees a steady flow of cooling water, preventing the possibility of freezing.

5. If the Chiller Is Inactive During Winter, the Following Steps Should Be Taken:

(1) Drainage

Before long-term shutdown, drain the chiller to prevent freezing. Open the drain valve at the bottom of the equipment to let out all the cooling water. Disconnect the water inlet and outlet pipes, and open the water filling port and drain valve for internal drainage.

Following the drainage process, use a compressed air gun to thoroughly dry the interior pipelines.

***Note**: Avoid blowing air at the joints where yellow tags are pasted near the water inlet and outlet, as it may cause damage.

(2) Storage

After completing the drainage and drying procedures, securely reseal the chiller. It is recommended to temporarily store the equipment in a location that does not disrupt production. For water chillers exposed to outdoor conditions, consider implementing insulation measures, such as wrapping the equipment with insulating materials, to minimize temperature fluctuations and prevent the ingress of dust and airborne moisture.

Appendix C : Dew Point Temperatures

NOTICE: Condensation may damage laser optics.

The laser chiller circulates coolant at a temperature of 68-75°F (20-24°C) in order to properly cool the cutting head and diode pump. To prevent condensation from forming on the laser optics, the environment must be controlled such that the coolant temperature is greater than the environmental dew point temperature. Refer to the table below.

Air Temp		Dew Point Temperature (Relative Humidity)																							
		20%		25%		30%		35%		40%		45%		50%		55%		60%		65%		70%		75%		80%		90%	
°F	°C	°F	°C	°F	°C	°F	°C	°F	°C	°F	°C	°F	°C	°F	°C	°F	°C	°F	°C	°F	°C	°F	°C	°F	°C	°F	°C
59	15					28	-2	32	0	36	2	39	4	41	5	43	6	45	7	48	9	50	10	52	11	54	12	55	13
68	20					36	2	39	4	43	6	46	8	50	10	52	11	54	12	57	14	59	15	61	16	63	17	64	18
77	25	34	1	39	4	45	7	48	9	52	11	55	13	57	14	61	16	63	17	64	18	66	19	68	20	70	21	73	23
86	30	41	5	46	8	52	11	55	13	59	15	63	17	66	19	68	20	72	22	73	23	75	24	77	25	79	26	81	27
95	35	48	9	54	12	59	15	63	17	68	20	70	21	73	23	77	25	79	26	82	28	84	29	86	30	88	31	97	36
104	40	55	13	63	17	66	19	72	22	75	24	79	26	82	28	86	30	88	31	90	32	93	34	95	35	97	36	115	46
113	45	63	17	70	21	75	24	79	26	82	28	86	30	90	32	93	34	97	36	99	37	100	38	104	40	106	41	138	59
122	50	70	21	77	25	82	28	86	30	91	33	95	35	99	37	102	39	104	40	108	42	109	43	113	45	115	46	167	75
131	55	77	25	84	29	90	32	95	35	99	37	102	39	106	41	109	43	113	45	115	46	118	48	120	49	124	51	180	82

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