HYPERTHERM®

A Hypertherm Associates Brand

XPR300™

Instruction Manual

809480 – REVISION 8

ENGLISH

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Benefits of registration

- ☑ **Safety:** Registration allows us to contact you in the unlikely event a safety or quality notification is required.
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- ☑ **Confirmation of ownership:** Registration can serve as proof of purchase in case of an insurance loss.

Go to **www.hypertherm.com/registration** for easy and fast registration.

If you experience any problems with the product registration process, please contact registration@hypertherm.com.

For your records

Serial number: ______________________________

Purchase date: ______________________________

Distributor: ______________________________

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Maintenance notes: ______________________________

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Original instructions

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For training and education resources, go to the Hypertherm Cutting Institute (HCI) online at www.hypertherm.com/hci.

ENGLISH

WARNING! Before operating any Hypertherm equipment, read the safety instructions in your product's manual, the *Safety and Compliance Manual* (80669C), *Waterjet Safety and Compliance Manual* (80943C), and *Radio Frequency Warning Manual* (80945C). Failure to follow safety instructions can result in personal injury or in damage to equipment.

Copies of the manuals can come with the product in electronic and printed formats. Electronic copies are also on our website. Many manuals are available in multiple languages at www.hypertherm.com/docs.

BG (БЪЛГАРСКИ/BULGARIAN)

ПРЕДУПРЕЖДЕНИЕ! Преди да работите с което и да е оборудване Hypertherm, прочетете инструкциите за безопасност в ръководството на вашия продукт, „Инструкция за безопасност и съответствие" (80669C), „Инструкция за безопасност и съответствие на Waterjet" (80943C) и „Инструкция за предупреждение за радиочестота" (80945C).

Продуктът може да е съпроводен от копия на ръководствата в електронен и в печатен формат. Тези в електронен формат са достъпни също на уебсайта ни. Много ръководства са налице на няколко езика на адрес www.hypertherm.com/docs.

CS (ČESKY/CZECH)

VAROVÁNÍ! Před uvedením jakéhokoli zařízení Hypertherm do provozu si přečtěte bezpečnostní pokyny v příručce k produktu a v *Manuálu pro bezpečnost a dodržování předpisů* (80669C), *Manuálu pro bezpečnost a dodržování předpisů při řezání vodním paprskem* (80943C) a *Manuálu varování ohledně rádiových frekvencí* (80945C).

Kopie příruček mohou být součástí dodávky produktu, a to v elektronické i tištěné formě. Elektronické kopie jsou k dispozici i na našich webových stránkách. Mnoho příruček je k dispozici v různých jazycích na stránce www.hypertherm.com/docs.

DA (DANSK/DANISH)

ADVARSEL! Inden Hypertherm udstyr tages i brug skal sikkerhedsinstruktionerne i produktets manual og i *Manual om sikkerhed og overholdelse af krav* (80669C), *Manual om sikkerhed og overholdelse af krav for vandstråleskæring* (80943C), og *Manual om radiofrekvensadvarsel* (80945C), gennemlæses.

Kopier af manualerne kan leveres med produktet i elektronisk og trykt format. Elektroniske kopier findes også på vores hjemmeside. Mange manualer er tilgængelige på flere sprog på www.hypertherm.com/docs.

DE (DEUTSCH/GERMAN)

WARNUNG! Bevor Sie ein Hypertherm-Gerät in Betrieb nehmen, lesen Sie bitte die Sicherheitsanweisungen in Ihrer Bedienungsanleitung, das *Handbuch für Sicherheit und Übereinstimmung* (80669C), das *Handbuch für Sicherheit und Compliance bei Wasserstrahl-Schneidanlagen* (80943C) und das *Handbuch für Hochfrequenz-Warnung* (80945C).

Bedienungsanleitungen und Handbücher können dem Gerät in elektronischer Form oder als Druckversion beiliegen. In elektronischer Form liegen sie auch auf unserer Website vor. Viele Handbücher stehen in verschiedenen Sprachen auf www.hypertherm.com/docs zur Verfügung.

ES (ESPAÑOL/SPANISH)

¡ADVERTENCIA! Antes de operar cualquier equipo Hypertherm, lea las instrucciones de seguridad del manual de su producto, del *Manual de seguridad y cumplimiento* (80669C), del *Manual de seguridad y cumplimiento en corte con chorro de agua* (80943C) y del *Manual de advertencias de radiofrecuencia* (80945C).

El producto puede incluir copias de los manuales en formato digital e impreso. Las copias digitales también están en nuestra página web. Hay diversos manuales disponibles en varios idiomas en www.hypertherm.com/docs.

ET (EESTI/ESTONIAN)

HOIATUS! Enne Hyperthermi mis tahes seadme kasutamist lugege läbi toote kasutusjuhendis olevad ohutusjuhised ning *Ohutus- ja vastavusjuhend* (80669C), *Veejoa ohutuse ja vastavuse juhend* (80943C) ja *Raadiosageduse hoiatusjuhend* (80945C). Ohutusjuhiste eiramine võib põhjustada vigastusi ja kahjustada seadmeid.

Juhiste koopiad võivad tootega kaasas olla elektrooniliselt või trükituna. Elektroonilised koopiad on saadaval ka meie veebilehel. Paljud kasutusjuhendid on erinevates keeltes saadaval veebilehel www.hypertherm.com/docs.

FI (SUOMI/FINNISH)

VAROITUS! Ennen minkään Hypertherm-laitteen käyttöä lue tuotteen käyttöoppaassa olevat turvallisuusohjeet, *turvallisuuden ja vaatimustenmukaisuuden käsikirja* (80669C), vesileikkauksen *turvallisuuden ja vaatimustenmukaisuuden käsikirja* (80943C) ja *radiotaajuusvaroitusten käsikirja* (80945C).

Käyttöoppaiden kopiot voivat olla tuotteen mukana sähköisessä ja tulostetussa muodossa. Sähköiset kopiot ovat myös verkkosivustollamme. Monet käyttöoppaat ovat myös saatavissa useilla kielillä www.hypertherm.com/docs.

FR (FRANÇAIS/FRENCH)

AVERTISSEMENT! Avant d'utiliser tout équipement Hypertherm, lire les consignes de sécurité du manuel de votre produit, du *Manuel de sécurité et de conformité* (80669C), du *Manuel de sécurité et de conformité du jet d'eau* (80943C) et du *Manuel d'avertissement relatif aux radiofréqunces* (80945C).

Les exemplaires des manuels qui accompagnent le produit peuvent être sous forme électronique ou papier. Les manuels sous forme électronique se trouvent également sur notre site Internet. Plusieurs manuels sont offerts en plusieurs langues à www.hypertherm.com/docs.

GR (ΕΛΛΗΝΙΚΆ/GREEK)

ΠΡΟΕΙΔΟΠΟΙΗΣΗ! Πριν θέσετε σε λειτουργία οποιονδήποτε εξοπλισμό της Hypertherm, διαβάστε τις οδηγίες ασφαλείας στο εγχειρίδιο του προϊόντος και στο *εγχειρίδιο ασφάλειας και συμμόρφωσης* (80669C), στο *εγχειρίδιο ασφάλειας και συμμόρφωσης του waterjet* (80943C) και στο *εγχειρίδιο προειδοποιήσεων για τις ραδιοσυχνότητες* (80945C).

Το προϊόν μπορεί να συνοδεύεται από αντίγραφα των εγχειριδίων σε ηλεκτρονική και έντυπη μορφή. Τα ηλεκτρονικά αντίγραφα υπάρχουν επίσης στον ιστότοπό μας. Πολλά εγχειρίδια είναι διαθέσιμα σε διάφορες γλώσσες στο www.hypertherm.com/docs.

HU (MAGYAR/HUNGARIAN)

VIGYÁZAT! Mielőtt bármilyen Hypertherm berendezést üzemeltetne, olvassa el a biztonsági információkat a termék kézikönyvében, a *Biztonsági és szabálykövetési kézikönyvben* (80669C), a *Vízsugaras biztonsági és szabálykövetési kézikönyvben* (80943C) és a *Rádiófrekvenciás figyelmeztetéseket tartalmazó kézikönyvben* (80945C).

A termékhez a kézikönyv példányai elektronikus és nyomtatott formában is mellékelve lehetnek. Az elektronikus példányok webhelyünkön is megtalálhatók. Számos kézikönyv áll rendelkezésre több nyelven a www.hypertherm.com/docs weboldalon.

ID (BAHASA INDONESIA/INDONESIAN)

PERINGATAN! Sebelum mengoperasikan peralatan Hypertherm, bacalah petunjuk keselamatan dalam manual produk Anda, *Manual Keselamatan dan Kepatuhan* (80669C), *Manual Keselamatan dan Kepatuhan Jet Air* (80943C), dan *Manual Peringatan Frekuensi Radio* (80945C). Kegagalan mengikuti petunjuk keselamatan dapat menyebabkan cedera pribadi atau kerusakan pada peralatan.

Produk mungkin disertai salinan manual atau petunjuk dalam format elektronik maupun cetak. Salinan elektronik juga tersedia di situs web kami. Berbagai manual tersedia dalam beberapa bahasa di www.hypertherm.com/docs.

IT (ITALIANO/ITALIAN)

AVVERTENZA! Prima di usare un'attrezzatura Hypertherm, leggere le istruzioni sulla sicurezza nel manuale del prodotto, nel *Manuale sulla sicurezza e la conformità* (80669C), nel *Manuale sulla sicurezza e la conformità Waterjet* (80943C) e nel *Manuale di avvertenze sulla radiofrequenza* (80945C).

Copie del manuale possono accompagnare il prodotto in formato cartaceo o elettronico. Le copie elettroniche sono disponibili anche sul nostro sito web. Molti manuali sono disponibili in diverse lingue all'indirizzo www.hypertherm.com/docs.

JA (日本語/JAPANESE)

警告！Hypertherm 機器を操作する前に、この製品説明書にある安全情報、「安全とコンプライアンスマニュアル」(80669C)、「ウォータージェットの安全とコンプライアンス」(80943C)、「高周波警告」(80945C) をお読みください。

説明書のコピーは、電子フォーマット、または印刷物として製品に同梱されています。電子コピーは当社ウェブサイトにも掲載されています。説明書の多くは www.hypertherm.com/docs にて複数の言語でご用意しています。

KO (한국어/KOREAN)

경고! Hypertherm 장비를 사용하기 전에 제품 설명서와 안전 및 규정 준수 설명서(80669C), 워터젯 안전 및 규정 준수 설명서(80943C) 그리고 무선 주파수 경고 설명서(80945C)에 나와 있는 안전 지침을 읽으십시오.

전자 형식과 인쇄된 형식으로 설명서 사본이 제품과 함께 제공될 수 있습니다. 전자 사본도 Hypertherm 웹사이트에서 보실 수 있으며 설명서 사본은 www.hypertherm.com/docs 에서 여러 언어로 제공됩니다.

NE (NEDERLANDS/DUTCH)

WAARSCHUWING! Lees voordat u Hypertherm-apparatuur gebruikt de veiligheidsinstructies in de producthandleiding, in de *Veiligheids- en nalevingshandleiding* (80669C) in de *Veiligheids- en nalevingshandleiding voor waterstralen* (80943C) en in de *Waarschuwingshandleiding radiofrequentie* (80945C).

De handleidingen kunnen in elektronische en gedrukte vorm met het product worden meegeleverd. Elektronische versies zijn ook beschikbaar op onze website. Veel handleidingen zijn in meerdere talen beschikbaar via www.hypertherm.com/docs.

NO (NORSK/NORWEGIAN)

ADVARSEL! Før du bruker noe Hypertherm-utstyr, må du lese sikkerhetsinstruksjonene i produktets håndbok, *håndboken om sikkerhet og samsvar* (80669C), *håndboken om vannjet sikkerhet og samsvar* (80943C), og *håndboken om radiofrekvensadvarsler* (80945C).

Eksemplarer av håndbøkene kan følge med produktet i elektronisk og trykt form. Elektroniske eksemplarer finnes også på nettstedet vårt. Mange håndbøker er tilgjengelig i flere språk på www.hypertherm.com/docs.

PL (POLSKI/POLISH)

OSTRZEŻENIE! Przed rozpoczęciem obsługi jakiegokolwiek systemu firmy Hypertherm należy się zapoznać z instrukcjami bezpieczeństwa zamieszczonymi w podręczniku produktu, w *podręczniku bezpieczeństwa i zgodności* (80669C), *podręczniku bezpieczeństwa i zgodności systemów strumienia wody* (80943C) oraz *podręczniku z ostrzeżeniem o częstotliwości radiowej* (80945C).

Do produktu mogą być dołączone podręczniki użytkownika w formie elektronicznej i drukowanej. Kopie elektroniczne znajdują się również w naszej witrynie internetowej. Wiele podręczników jest dostępnych w różnych językach pod adresem www.hypertherm.com/docs.

PT (PORTUGUÊS/PORTUGUESE)

ADVERTÊNCIA! Antes de operar qualquer equipamento Hypertherm, leia as instruções de segurança no manual do seu produto, no *Manual de Segurança e de Conformidade* (80669C), no *Manual de Segurança e de Conformidade do Waterjet* (80943C) e no *Manual de Advertência de radiofrequência* (80945C).

Cópias dos manuais podem vir com o produto nos formatos eletrônico e impresso. Cópias eletrônicas também são encontradas em nosso website. Muitos manuais estão disponíveis em vários idiomas em www.hypertherm.com/docs.

RO (ROMÂNĂ/ROMANIAN)

AVERTIZARE! Înainte de utilizarea oricărui echipament Hypertherm, citiți instrucțiunile de siguranță din manualul produsului, *manualul de siguranță și conformitate* (80669C), *manualul de siguranță și conformitate Waterjet* (80943C) și din *manualul de avertizare privind radiofrecvența* (80945C).

Produsul poate fi însoțit de copii ale manualelor în format tipărit și electronic. Exemplarele electronice sunt disponibile și pe site-ul nostru web. Numeroase manuale sunt disponibile în mai mult limbi la adresa: www.hypertherm.com/docs.

RU (РУССКИЙ/RUSSIAN)

БЕРЕГИСЬ! Перед работой с любым оборудованием Hypertherm ознакомьтесь с инструкциями по безопасности, представленными в руководстве, которое поставляется вместе с продуктом, в *Руководстве по безопасности и соответствию* (80669C), в *Руководстве по безопасности и соответствию для водоструйной резки* (80943C) и *Руководстве по предупреждению о радиочастотном излучении* (80945C).

Копии руководств, которые поставляются вместе с продуктом, могут быть представлены в электронном и бумажном виде. Электронные копии также доступны на нашем веб-сайте. Целый ряд руководств доступны на нескольких языках по ссылке www.hypertherm.com/docs.

SK (SLOVENČINA/SLOVAK)

VÝSTRAHA! Pred použitím akéhokoľvek zariadenia od spoločnosti Hypertherm si prečítajte bezpečnostné pokyny v návode na obsluhu vášho zariadenia a v *Manuáli o bezpečnosti a súlade s normami* (80669C), *Manuáli o bezpečnosti a súlade s normami pre systém rezania vodou* (80943C) a v *Manuáli s informáciami o rádiofrekvencii* (80945C).

Návod na obsluhu sa dodáva spolu s produktom v elektronickej a tlačenej podobe. Jeho elektronický formát je dostupný aj na našej webovej stránke. Mnohé z návodov na obsluhu sú dostupné vo viacjazyčnej mutácii na stránke www.hypertherm.com/docs.

SL (SLOVENŠČINA/SLOVENIAN)

OPOZORILO! Pred uporabo katerekoli Hyperthermove opreme preberite varnostna navodila v priročniku vašega izdelka, v *Priročniku za varnost in skladnost* (80669C), v *Priročniku za varnost in skladnost sistemov rezanja z vodnim curkom* (80943C) in v *Priročniku Opozorilo o radijskih frekvencah* (80945C).

Izvodi priročnikov so lahko izdelku priloženi v elektronski in tiskani obliki. Elektronski izvodi so na voljo tudi na našem spletnem mestu. Številni priročniki so na voljo v različnih jezikih na naslovu www.hypertherm.com/docs.

SR (SRPSKI/SERBIAN)

UPOZORENJE! Pre rukovanja bilo kojom Hyperthermovom opremom pročitajte uputstva o bezbednosti u svom priručniku za proizvod, *Priručniku o bezbednosti i usaglašenosti* (80669C), *Priručniku o bezbednosti i usaglašenosti Waterjet tehnologije* (80943C) i *Priručniku sa upozorenjem o radio-frekvenciji* (80945C).

Уз производ се испоручују копије приручника у електронском или штампаном формату. Електронске копије су такође доступне на нашем веб-сајту. Многи приручници су доступни на више језика на адреси www.hypertherm.com/docs.

SV (SVENSKA/SWEDISH)

VARNING! Läs häftet säkerhetsinformationen i din produkts *säkerhets- och efterlevnadsmanual* (80669C), *säkerhets- och efterlevnadsmanualen för Waterjet* (80943C) och *varningsmanualen för radiofrekvenser* (80945C) för viktig säkerhetsinformation innan du använder eller underhåller Hypertherm-utrustning.

Kopior av manualerna kan medfölja produkten i elektroniskt och tryckt format. Elektroniska kopior finns också på vår webbplats. Många manualer finns på flera språk på www.hypertherm.com/docs.

TH (ภาษาไทย/THAI)

คำเตือน! ก่อนการใช้งานอุปกรณ์ของ Hypertherm ทั้งหมด โปรดอ่านคำแนะนำด้านความปลอดภัยในคู่มือการใช้สินค้า คู่มือด้านความปลอดภัยและการปฏิบัติตาม (80669C), คู่มือด้านความปลอดภัยและการปฏิบัติตามสำหรับการใช้หัวตัดระบบวอเตอร์เจ็ต (80943C) และ คู่มือคำเตือนเกี่ยวกับความถี่วิทยุ (80945C) การไม่ปฏิบัติตามคำแนะนำด้านความปลอดภัยอาจส่งผลให้เกิดการบาดเจ็บหรือเกิดความเสียหายต่ออุปกรณ์

สำเนาคู่มือทั้งในรูปแบบอิเล็กทรอนิกส์และแบบสิ่งพิมพ์จะถูกแนบมาพร้อมกับผลิตภัณฑ์ สำเนาคู่มือในรูปแบบอิเล็กทรอนิกส์ของผลิตภัณฑ์และสำเนาคู่มือต่าง ๆ ในหลากหลายภาษานั้นยังมีให้บริการบนเว็บไซต์ www.hypertherm.com/docs ของเราอีกด้วย

TR (TÜRKÇE/TURKISH)

UYARI! Bir Hypertherm ekipmanını çalıştırmadan önce, ürününüzün kullanım kılavuzunda, *Güvenlik ve Uyumluluk Kılavuzu'nda* (80669C), *Su Jeti Güvenlik ve Uyumluluk Kılavuzu'nda* (80943C) ve *Radyo Frekansı Uyarısı Kılavuzu'nda* (80945C) yer alan güvenlik talimatlarını okuyun.

Kılavuzların kopyaları, elektronik ve basılı formatta ürünle birlikte verilebilir. Elektronik kopyalar web sitemizde de yer alır. Kılavuzların birçoğu www.hypertherm.com/docs adresinde birçok dilde mevcuttur.

VI (TIẾNG VIỆT/VIETNAMESE)

CẢNH BÁO! Trước khi vận hành bất kỳ thiết bị Hypertherm nào, hãy đọc các hướng dẫn an toàn trong hướng dẫn sử dụng sản phẩm của bạn, *Sổ tay An toàn và Tuân thủ* (80669C), *Sổ tay An toàn và Tuân thủ Tia nước* (80943C), và *Hướng dẫn Cảnh báo Tần số Vô tuyến* (80945C). Không tuân thủ các hướng dẫn an toàn có thể dẫn đến thương tích cá nhân hoặc hư hỏng thiết bị.

Bản sao của sổ tay có thể đi kèm với sản phẩm ở định dạng điện tử và in. Bản điện tử cũng có trên trang web của chúng tôi. Nhiều sổ tay có sẵn bằng nhiều ngôn ngữ tại www.hypertherm.com/docs .

ZH-CN (简 体中文/CHINESE SIMPLIFIED)

警告！ 在操作任何海宝设备之前，请阅读产品手册、《安全和法规遵守手册》(80669C)、《水射流安全和法规遵守手册》 (80943C) 以及 《射频警告手册》(80945C) 中的安全操作说明。

随产品提供的手册可提供电子版和印刷版两种格式。电子版本同时也在我们的网站上提供。很多手册有多种语言版本，详见 www.hypertherm.com/docs.

ZH-TW (繁 體中文/CHINESE TRADITIONAL)

警告！在操作任何 Hypertherm 設備前，請先閱讀您產品手冊內的安全指示，包括 《安全和法規遵從手冊》(80669C)、《水刀安全和法規遵從手冊》(80943C)，以及 《無線電頻率警示訊號手冊》(80945C)。

電子版和印刷版手冊複本可能隨產品附上。您也可以前往我們的網站下載電子版手冊。我們的網站上還以多種語言形式提供多種手冊，請造訪 www.hypertherm.com/docs 。

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Introduction

Hypertherm's CE-marked equipment is built in compliance with standard EN60974-10. The equipment should be installed and used in accordance with the information below to achieve electromagnetic compatibility.

The limits required by EN60974-10 may not be adequate to completely eliminate interference when the affected equipment is in close proximity or has a high degree of sensitivity. In such cases it may be necessary to use other measures to further reduce interference.

This cutting equipment is designed for use only in an industrial environment.

Installation and use

The user is responsible for installing and using the plasma equipment according to the manufacturer's instructions.

If electromagnetic disturbances are detected then it shall be the responsibility of the user to resolve the situation with the technical assistance of the manufacturer. In some cases this remedial action may be as simple as earthing the cutting circuit, see *Earthing of the workpiece*. In other cases, it could involve constructing an electromagnetic screen enclosing the power source and the work complete with associated input filters. In all cases, electromagnetic disturbances must be reduced to the point where they are no longer troublesome.

Assessment of area

Before installing the equipment, the user shall make an assessment of potential electromagnetic problems in the surrounding area. The following shall be taken into account:

- **a.** Other supply cables, control cables, signaling and telephone cables; above, below and adjacent to the cutting equipment.
- **b.** Radio and television transmitters and receivers.
- **c.** Computer and other control equipment.
- **d.** Safety critical equipment, for example guarding of industrial equipment.
- **e.** Health of the people around, for example the use of pacemakers and hearing aids.
- **f.** Equipment used for calibration or measurement.
- **g.** Immunity of other equipment in the environment. User shall ensure that other equipment being used in the environment is compatible. This may require additional protection measures.
- **h.** Time of day that cutting or other activities are to be carried out.

The size of the surrounding area to be considered will depend on the structure of the building and other activities that are taking place. The surrounding area may extend beyond the boundaries of the premises.

Methods of reducing emissions

Mains supply

Cutting equipment must be connected to the mains supply according to the manufacturer's recommendations. If interference occurs, it may be necessary to take additional precautions such as filtering of the mains supply.

Consideration should be given to shielding the supply cable of permanently installed cutting equipment, in metallic conduit or equivalent. Shielding should be electrically continuous throughout its length. The shielding should be connected to the cutting mains supply so that good electrical contact is maintained between the conduit and the cutting power source enclosure.

Maintenance of cutting equipment

The cutting equipment must be routinely maintained according to the manufacturer's recommendations. All access and service doors and covers should be closed and properly fastened when the cutting equipment is in operation. The cutting equipment should not be modified in any way, except as set forth in and in accordance with the manufacturer's written instructions. For example, the spark gaps of arc striking and stabilizing devices should be adjusted and maintained according to the manufacturer's recommendations.

Cutting cables

The cutting cables should be kept as short as possible and should be positioned close together, running at or close to the floor level.

Equipotential bonding

Bonding of all metallic components in the cutting installation and adjacent to it should be considered.

However, metallic components bonded to the workpiece will increase the risk that the operator could receive a shock by touching these metallic components and the electrode (nozzle for laser heads) at the same time.

The operator should be insulated from all such bonded metallic components.

Earthing of the workpiece

Where the workpiece is not bonded to earth for electrical safety, nor connected to earth because of its size and position, for example, ship's hull or building steel work, a connection bonding the workpiece to earth may reduce emissions in some, but not all instances. Care should be taken to prevent the earthing of the workpiece increasing the risk of injury to users, or damage to other electrical equipment. Where necessary, the connection of the workpiece to earth should be made by a direct connection to the workpiece, but in some countries where direct connection is not permitted, the bonding should be achieved by suitable capacitances selected according to national regulations.

Note: The cutting circuit may or may not be earthed for safety reasons. Changing the earthing arrangements should only be authorized by a person who is competent to assess whether the changes will increase the risk of injury, for example, by allowing parallel cutting current return paths which may damage the earth circuits of other equipment.
Further guidance is provided in IEC 60974-9, Arc Welding Equipment, Part 9: Installation and Use.

Screening and shielding

Selective screening and shielding of other cables and equipment in the surrounding area may alleviate problems of interference. Screening of the entire plasma cutting installation may be considered for special applications.

Attention

Genuine Hypertherm parts are the factory-recommended replacement parts for your Hypertherm system. Any damage or injury caused by the use of other than genuine Hypertherm parts may not be covered by the Hypertherm warranty, and will constitute misuse of the Hypertherm Product.

You are solely responsible for the safe use of the Product. Hypertherm does not and cannot make any guarantee or warranty regarding the safe use of the product in your environment.

General

Hypertherm, Inc. warrants that its Products shall be free from defects in materials and workmanship for the specific periods of time set forth herein and as follows: if Hypertherm is notified of a defect (i) with respect to the plasma power supply within a period of two (2) years from the date of its delivery to you, with the exception of Powermax brand power supplies, which shall be within a period of three (3) years from the date of delivery to you, and (ii) with respect to the torch and leads within a period of one (1) year from its date of delivery to you, with the exception of the HPRXD short torch with integrated lead, which shall be within a period of six (6) months from the date of delivery to you, and with respect to torch lifter assemblies within a period of one (1) year from its date of delivery to you, and with respect to Automation products one (1) year from its date of delivery to you, with the exception of the EDGE Connect CNC, EDGE Connect T CNC, EDGE Connect TC CNC, EDGE Pro CNC, EDGE Pro Ti CNC, MicroEDGE Pro CNC, and ArcGlide THC, which shall be within a period of two (2) years from the date of delivery to you, and (iii) with respect to HyIntensity fiber laser components within a period of two (2) years from the date of its delivery to you, with the exception of laser heads and beam delivery cables, which shall be within a period of one (1) year from its date of delivery to you.

All third-party engines, engine accessories, alternators, and alternator accessories are covered by the respective manufacturers' warranties and not covered by this warranty.

This warranty shall not apply to any Powermax brand power supplies that have been used with phase converters. In addition, Hypertherm does not warranty systems that have been damaged as a result of poor power quality, whether from phase converters or incoming line power. This warranty shall not apply to any product which has been incorrectly installed, modified, or otherwise damaged.

Hypertherm provides repair, replacement or adjustment of the Product as the sole and exclusive remedy, if and only if the warranty set forth herein properly is invoked and applies. Hypertherm, at its sole option, shall repair, replace, or adjust, free of charge, any defective Products covered by this warranty which shall be returned with Hypertherm's prior authorization (which shall not be unreasonably withheld), properly packed, to Hypertherm's place of business in Hanover, New Hampshire, or to an authorized Hypertherm repair facility, all costs, insurance and freight pre paid by the customer. Hypertherm shall not be liable for any repairs, replacement, or adjustments of Products covered by this warranty, except those made pursuant to this paragraph and with Hypertherm's prior written consent.

The warranty set forth above is exclusive and is in lieu of all other warranties, express, implied, statutory, or otherwise with respect to the Products or as to the results which may be obtained therefrom, and all implied warranties or conditions of quality or of merchantability or fitness for a particular purpose or against infringement. The foregoing shall constitute the sole and exclusive remedy for any breach by Hypertherm of its warranty.

Distributors/OEMs may offer different or additional warranties, but Distributors/OEMs are not authorized to give any additional warranty protection to you or make any representation to you purporting to be binding upon Hypertherm.

Patent indemnity

Except only in cases of products not manufactured by Hypertherm or manufactured by a person other than Hypertherm not in strict conformity with Hypertherm's specifications and in cases of designs, processes, formulae, or combinations not developed or purported to be developed by Hypertherm, Hypertherm will have the right to defend or settle, at its own expense, any suit or proceeding brought against you alleging that the use of the Hypertherm product, alone and not in combination with any other product not supplied by Hypertherm, infringes any patent of any third party. You shall notify Hypertherm promptly upon learning of any action or threatened action in connection with any such alleged infringement (and in any event no longer than fourteen (14) days after learning of any action or threat of action), and Hypertherm's obligation to defend shall be conditioned upon Hypertherm's sole control of, and the indemnified party's cooperation and assistance in, the defense of the claim.

Limitation of liability

In no event shall Hypertherm be liable to any person or entity for any incidental, consequential direct, indirect, punitive or exemplary damages (including but not limited to lost profits) regardless of whether such liability is based on breach of contract, tort, strict liability, breach of warranty, failure of essential purpose, or otherwise, and even if advised of the possibility of such damages. Hypertherm shall not be liable for any losses to Distributor based on down time, lost production or lost profits. It is the intention of the Distributor and Hypertherm that this provision be construed by a court as being the broadest limitation of liability consistent with applicable law.

National and local codes

National and local codes governing plumbing and electrical installation shall take precedence over any instructions contained in this manual. In no event shall Hypertherm be liable for injury to persons or property damage by reason of any code violation or poor work practices.

Liability cap

In no event shall Hypertherm's liability, if any, whether such liability is based on breach of contract, tort, strict liability, breach of warranties, failure of essential purpose or otherwise, for any claim, action, suit or proceeding (whether in court, arbitration, regulatory proceeding or otherwise) arising out of or relating to the use of the Products exceed in the aggregate the amount paid for the Products that gave rise to such claim.

Insurance

At all times you will have and maintain insurance in such quantities and types, and with coverage sufficient and appropriate to defend and to hold Hypertherm harmless in the event of any cause of action arising from the use of the products.

Transfer of rights

You may transfer any remaining rights you may have hereunder only in connection with the sale of all or substantially all of your assets or capital stock to a successor in interest who agrees to be bound by all of the terms and conditions of this Warranty. Within thirty (30) days before any such transfer occurs, you agree to notify in writing Hypertherm, which reserves the right of approval. Should you fail timely to notify Hypertherm and seek its approval as set forth herein, the Warranty set forth herein shall be null and void and you will have no further recourse against Hypertherm under the Warranty or otherwise.

Waterjet product warranty coverage

Product	Parts coverage
HyPrecision pumps	27 months from the ship date, or 24 months from the date of proven installation, or 4,000 hours, whichever occurs first
PowerDredge abrasive removal system	15 months from the ship date or 12 months from the date of proven installation, whichever occurs first
EcoSift abrasive recycling system	15 months from the ship date or 12 months from the date of proven installation, whichever occurs first
Abrasive metering devices	15 months from the ship date or 12 months from the date of proven installation, whichever occurs first
On/off valve air actuators	15 months from the ship date or 12 months from the date of proven installation, whichever occurs first
Diamond orifices	600 hours of use with the use of a thimble filter and compliance with Hypertherm's water quality requirements

Consumable parts are not covered by this warranty. Consumable parts include, but are not limited to, high-pressure water seals, check valves, cylinders, bleed-down valves, low-pressure seals, high-pressure tubing, low- and high-pressure water filters and abrasive collection bags. All third-party pumps, pump accessories, hoppers, hopper accessories, dryer boxes, dryer box accessories and plumbing accessories are covered by the respective manufacturers' warranties and not covered by this warranty.

1 Specifications

Terminology

XPR cutting system – The plasma power supply, gas connect console, torch connect console, and torch.

Cutting system or cutting machine – The XPR cutting system, CNC, torch lifter, cutting table, and other components.

Wet process – Any process that uses water as a shield fluid.

Dry process – Any process that does not use water as a shield fluid.

Ferrous – Mild steel

Non-ferrous – Stainless steel and aluminum

Gases – Hydrogen (H_2), argon (Ar), nitrogen (N_2), oxygen (O_2), water (H_2O), F5 (95% nitrogen, 5% hydrogen)

Mixed-fuel gas – A mixture of H_2-Ar-N_2 created in the OptiMix gas connect console.

XPR cutting system description

General

XPR cutting systems are designed for indoor use with correct ventilation to cut a wide range of thicknesses of mild steel, stainless steel, and aluminum.

Plasma power supply

The plasma power supply is a 300 A, 210 VDC constant-current supply. It contains a heat exchanger, fans, and a pump to cool the torch and other electronic components. The plasma power supply supports EtherCAT®, wireless, RS-422 serial, and discrete communication protocols to communicate with a CNC or wireless device.

The power-indicator LED on the plasma power supply indicates power status:

- It illuminates amber when the plasma power supply is receiving electric power and the remote on-off switch is in the OFF position.
- It illuminates green when the plasma power supply is receiving electric power and the remote on-off switch is in the ON position.

Gas connect consoles

There are 4 types of gas connect consoles: Core™, CorePlus™, VWI™ (vented water injection), and OptiMix™. Each type provides a different set of gas connection capabilities, which provide selecting and metering functions for the gas control system. The gas connect console has 2 printed circuit boards (PCBs): a control PCB and an ignition PCB. If your XPR cutting system is equipped with an OptiMix gas connect console, there is also a gas mixer that has its own control board. A green power LED illuminates when power is supplied to the console.

> For some cutting systems, a remote on-off switch controls the power that goes to the console.

The CorePlus gas connect console has many of the same features as the Core console. The primary difference is that CorePlus adds a gas line for Argon.

To use a CorePlus console, you must install revision U (or later) of the XPR firmware. Refer to the *XPR Web Interface and PCB Firmware Updates* Field Service Bulletin (809820). Technical documentation is available at www.hypertherm.com/docs.

TorchConnect console

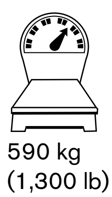
The TorchConnect™ console has proportional valves, solenoid valves, and pressure transducers. The TorchConnect console also has 2 PCBs, a control PCB, and an ohmic contact PCB. The TorchConnect console provides all power, gas, and cooling connections for connection to the torch. A power-indicator LED illuminates when power is supplied to the console.

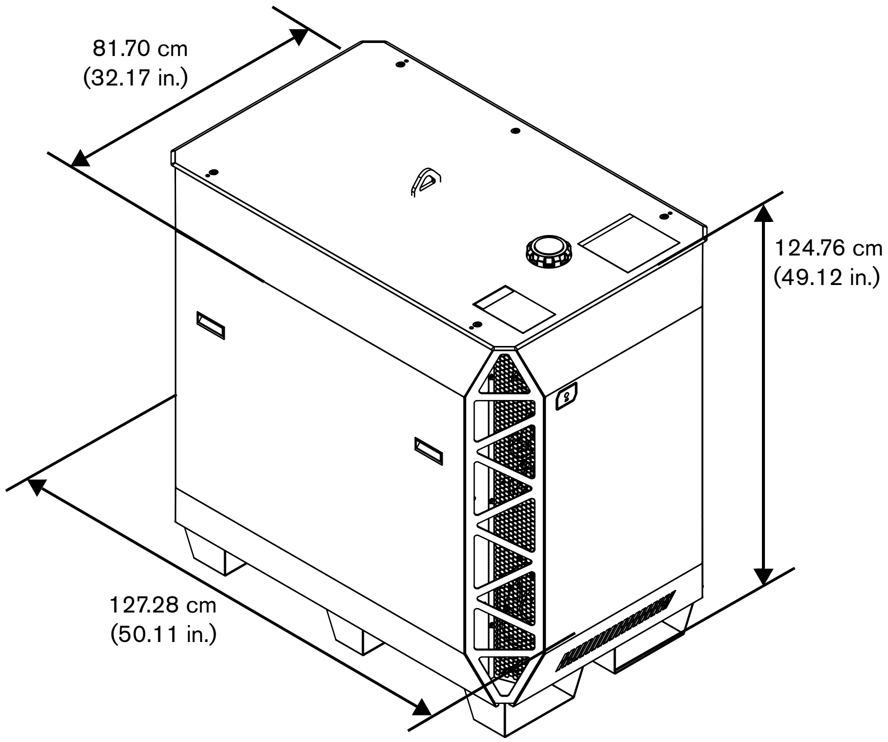
> For some cutting systems, a remote on-off switch controls the power that goes to the console.

Torch

The torch assembly consists of a torch mount sleeve, torch receptacle, torch, and water tube. The torch receptacle contains a solenoid valve. Consumables are installed on the torch.

Plasma power supply (part number varies)





The part number and specifications can differ for your plasma power supply. Refer to Table 1 on page 28 and Table 2 on page 28 for part numbers and specifications.

Table 1 – Plasma power supply general specifications

Maximum open-circuit voltage (U_0)	360 VDC
Maximum output current (I_2)	300 A
Output voltage (U_2)	50 VDC – 222 VDC
Duty cycle rating (X)	100% at 66.5 kW, 40°C (104°F)
Operational ambient temperature range	>0°C – 40°C (>32°F – 104°F) – Applies only to cutting systems that use water as a shield fluid. -10 °C – 40°C (14°F – 104°F) – Applies only to cutting systems that do not use water as a shield fluid. **Note**: Only VWI- and OptiMix-equipped cutting systems can use water as a shield fluid.
Power factor (cosθ)	0.98 at 66.5 kW
Cooling	Forced air (Class F)
Insulation	Class H
EMC emissions classification (CE models only)	Class A
Lift points	Top lift eye Bottom lift truck slots
Lift eye weight rating	680 kg (1,500 lb)

Table 2 – Plasma power supply part numbers and specifications

<table>
<tr><th>Part number</th><th>Voltage (VAC) (U_1)</th><th>Phase</th><th>Frequency (Hz)</th><th>Rated input current at 66.5 kW output (A) (I_1)</th><th>Regulatory approval
Safety/EMC</th><th>Power (kVA) (± 10%)
(U_1 X I_1 X1.73)</th></tr>
<tr><td>078620</td><td>200</td><td rowspan="10">3</td><td>50 – 60</td><td>218</td><td>cCSAus</td><td rowspan="10">75.4</td></tr>
<tr><td>078621</td><td>208</td><td>60</td><td>209</td><td>cCSAus</td></tr>
<tr><td>078622</td><td>220</td><td>50 – 60</td><td>198</td><td>cCSAus</td></tr>
<tr><td>078623</td><td>240</td><td>60</td><td>181</td><td>cCSAus</td></tr>
<tr><td>078624</td><td>380</td><td>50 – 60</td><td>115</td><td>CCC</td></tr>
<tr><td>078625</td><td>400</td><td>50 – 60</td><td>109</td><td>CE, RCM, EAC, UKr, and AAA</td></tr>
<tr><td>078626</td><td>415</td><td>50</td><td>105</td><td>CE, RCM, EAC, UKr, and AAA</td></tr>
<tr><td>078627</td><td>440</td><td>60</td><td>99</td><td>cCSAus</td></tr>
<tr><td>078628</td><td>480</td><td>60</td><td>91</td><td>cCSAus</td></tr>
<tr><td>078629</td><td>600</td><td>60</td><td>73</td><td>cCSAus</td></tr>
</table>

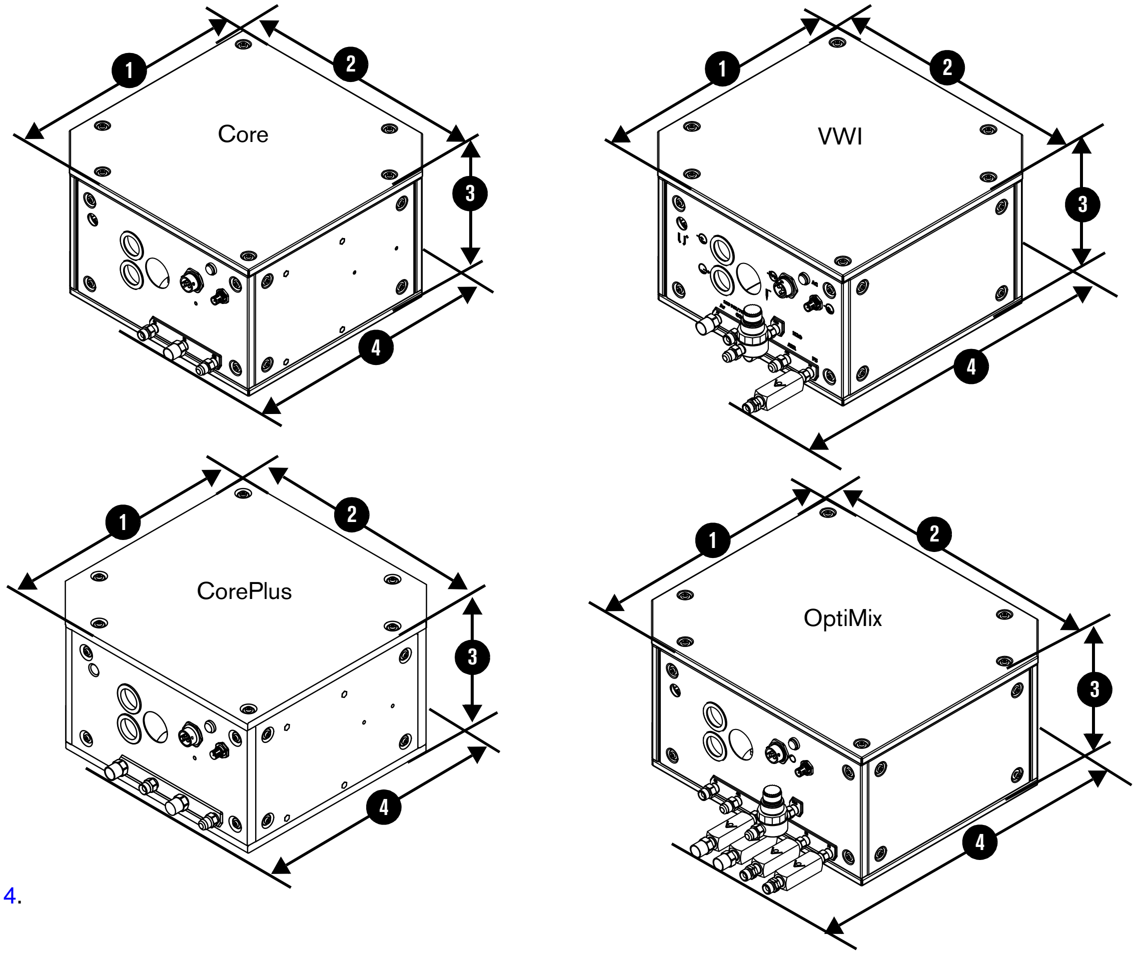
Ecodesign requirements (CE models)

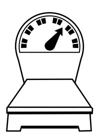
Table 3 – Ecodesign requirements and data

Ecodesign requirement	Idle	With load	Description
Output current	–	300.88 A	Measured at the rated duty cycle for the system at the highest output power.
Output voltage	–	222.94 V	
Output active power	–	67.05 kW	
Root mean square (RMS) of the supply voltage	401.35 V	398.65 V	Measured at idle state and at the rated duty cycle for the system at the highest output power.
Supply active power	40.1 W	73.08 kW	
Total harmonic distortion of the supply voltage (UTHD)	1.15%	5.72%	
Idle state power consumption by the power source	40.1 W	–	Measured at idle state.*
Efficiency	–	91.75%	Calculated at the rated duty cycle for the system at the highest output power.

* External devices were disconnected during idle measurement.

Gas connect console (part number varies)





Varies
Refer to Table 4.

The part number and some specifications differ by gas connect console type (Core, CorePlus, VWI, or OptiMix). Refer to Table 4.

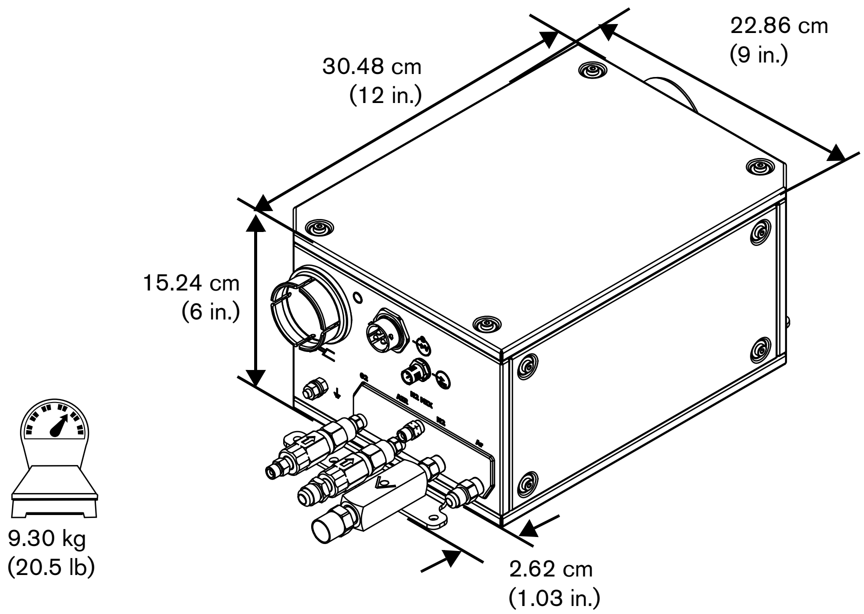
Do not remove the inlet check valves from the gas connect consoles.

Table 4 – Gas connect console part numbers and dimensions

<table>
<tr><th>Gas connect console</th><th>Part number</th><th>Dimension 1</th><th>Dimension 2</th><th>Dimension 3</th><th>Dimension 4 (with fittings)</th><th>Weight</th></tr>
<tr><td>Core</td><td>078631</td><td rowspan="4">374.65 mm
(14.75 in.)</td><td rowspan="3">383.80 mm
(15.11 in.)</td><td rowspan="4">205.99 mm
(8.12 in.)</td><td>431.80 mm
(17.00 in.)</td><td>16.58 kg
36.55 lb</td></tr>
<tr><td>CorePlus</td><td>078662</td><td>433.92 mm
(17.08 in.)</td><td>17.2 kg
37.92 lb</td></tr>
<tr><td>VWI</td><td>078632</td><td>522.22 mm
(20.56 in.)</td><td>19.46 kg
42.9 lb</td></tr>
<tr><td>OptiMix</td><td>078633</td><td>434.59 mm
(17.11 in.)</td><td>524.00 mm
(20.63 in.)</td><td>25.79 kg
56.85 lb</td></tr>
</table>

For mounting dimensions, refer to Gas connect console on page 85.

TorchConnect console (078618)



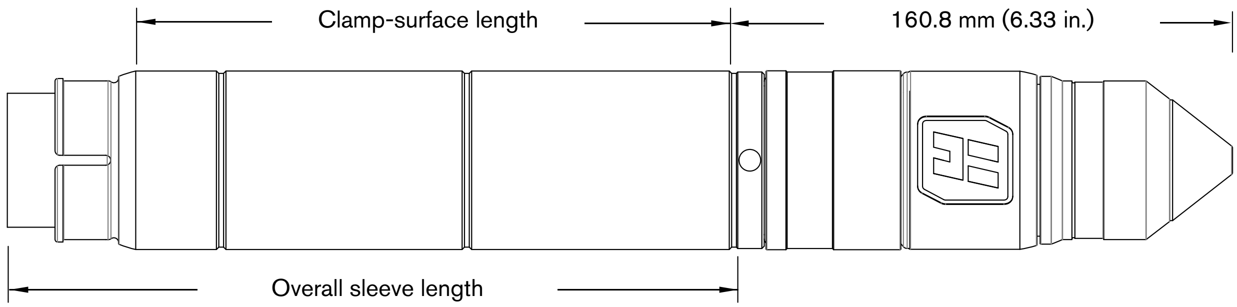
The TorchConnect console (078618) goes with the 4 types of gas connect consoles (Core, CorePlus, VWI, and OptiMix).

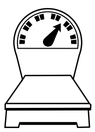
Do not remove the inlet check valves from the torch connect console.

The factory location for the mounting brackets is on the bottom of the torch connect console. However, you can move the mounting brackets to either side. Console placement with the torch lead connection on the bottom can minimize the risk of leaked water or coolant collecting inside of the console. Water or coolant collection inside of the TorchConnect console can damage internal electrical components.

For mounting dimensions, refer to TorchConnect console on page 87.

Torch (part number varies)





Varies

Table 5 – Length and weight by sleeve type

Sleeve type	Clamp-surface length	Overall sleeve length	Combined weight (torch head, receptacle, consumables)	Combined weight with sleeve
Short	111.7 mm (4.4 in.)	155 mm (6.1 in.)	1.4 kg (3 lb)	1.5 kg (3.3 lb)
Standard	189.6 mm (4.5 in.)	233 mm (9.2 in.)		1.6 kg (3.6 lb)
Extended	268.1 mm (10.6 in.)	311 mm (12.3 in.)		1.7 kg (3.9 lb)

The part number and some specifications for your torch can change because of torch sleeve dimensions and other features. Refer to Torch assembly on page 393 of the Parts List.

Table 6 – General torch specifications

Rated arc striking voltage	15.3 kV
Maximum gas pressure at inlet	7.9 bar, 792 kPa (115 psi)
Minimum gas pressure at inlet	7.2 bar, 723 kPa (105 psi)
Maximum torch-side and torch-front force	22.5 kg (50 lb)

Critical raw materials

Critical raw material	Components that contain more than 1 gram
Borate	All printed circuit boards, torch, torch mounting sleeve
Magnesium	Heatsinks, cold plates
Natural graphite	Pump motor, resistors
Phosphorus	Sheet metal panels
Rare earth elements (heavy and light)	Torch breakaway, pump motor
Silicon metal	Heatsinks, cold plates, transformers, inductors, IGBT modules
Tantalum	Capacitors
Tungsten	Power resistors

Symbols and marks

Safety and EMC symbols and marks

Your product may have one or more of the following marks on or near the data plate. Because of differences and conflicts in national regulations, not all marks are applied to every version of a product.

S mark

The S mark indicates that the power supply and torch are suitable for operations carried out in environments with increased hazard of electrical shock according to IEC 60974-1.

CSA mark

Products with a CSA mark meet the United States and Canadian regulations for product safety. The products were evaluated, tested, and certified by CSA-International. Alternatively, the product may have a mark by one of the other Nationally Recognized Testing Laboratories (NRTL) accredited in both the United States and Canada, such as UL or TÜV.

CE mark

The CE marking signifies the manufacturer's declaration of conformity to applicable European directives and standards. Only those versions of products with a CE marking located on or near the data plate comply with European Directives. Applicable directives may include the European Low Voltage Directive, the European Electromagnetic Compatibility (EMC) Directive, the Radio Equipment Directive (RED), and the Restriction of Hazardous Substances (RoHS) Directive. See the European CE Declaration of Conformity for details.

Eurasian Customs Union (CU) mark

CE versions of products that include an EAC mark of conformity meet the product safety and EMC requirements for export to Russia, Belarus, and Kazakhstan.

GOST-TR mark

CE versions of products that include a GOST-TR mark of conformity meet the product safety and EMC requirements for export to the Russian Federation.

RCM mark

CE versions of products with an RCM mark comply with the EMC and safety regulations required for sale in Australia and New Zealand.

CCC mark

The China Compulsory Certification (CCC) mark indicates that the product has been tested and found compliant with product safety regulations required for sale in China.

UkrSEPRO mark

The CE versions of products that include a UkrSEPRO mark of conformity meet the product safety and EMC requirements for export to the Ukraine.

Serbian AAA mark

CE versions of products that include a AAA Serbian mark meet the product safety and EMC requirements for export to Serbia.

RoHS mark

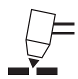
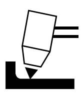
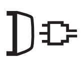
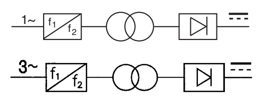
The RoHS mark indicates that the product meets the requirements of the European Restriction of Hazardous Substances (RoHS) Directive.

United Kingdom Conformity Assessed mark

CE versions of products that include a UKCA mark of conformity meet the product safety, EMC, RF, and RoHS requirements for export to the UK.

IEC symbols

The following symbols can appear on the data plate, control labels, and switches.

	Direct current (DC)
	Alternating current (AC)
	Plasma torch cutting
	Gouging
	AC input power connection
	The terminal for the external protective (earth) (PE) conductor
I	Power is ON
O	Power is OFF
	A 1-phase or 3-phase inverter-based power source
	Volt/amperage curve, “drooping” characteristic

2

Qualifications and Requirements

Document requirements

This manual refers to several other documents. These documents include:

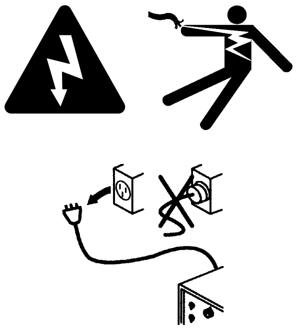
- *XPR Cut Charts Instruction Manual* (809830)
- *CNC Communication Protocol for the XPR Cutting System* (809810)
- *XPR Preventive Maintenance Program (PMP) Instruction Manual* (809490)
- *XPR Firmware Updates Field Service Bulletin* (809820)

You can find these documents on the USB memory stick that came with your plasma power supply. If you do not have these documents, technical documentation is available at www.hypertherm.com/docs.

> Technical documentation is current as of the date of its release. Subsequent revisions are possible. Refer to www.hypertherm.com/docs for the most recent revisions of released documents.

Operator qualifications

WARNING



ELECTRIC SHOCK CAN KILL

Disconnect electric power before doing installation or maintenance. You can get a serious electric shock if electric power is not disconnected. Electric shock can seriously injure or kill you.

All work that requires removal of the plasma power supply outer cover or panels must be done by a qualified technician.

Refer to the *Safety and Compliance Manual* (80669C) for more safety information.

A person is considered qualified to operate the cutting system if he or she is trained and knowledgeable about cutting system equipment construction, operation, and work methods, and about how to recognize and avoid hazards that can be present with certain cutting system equipment or work methods.

For your safety and for the best results:

- **Never** operate the cutting system unless you are qualified to do so.
- Follow NFPA70E Section 85 in North America.
- Follow IEC 60364 series outside of North America.
- Follow OSHA Section1910.331-335 in North America for 600 volts or less.
- Follow all local and national electrical safety requirements for both operator and service personnel.
- **Always** read, understand, and follow all of the safety instructions in this manual, the *Safety and Compliance Manual* (80669C), and on the labels that are on the cutting system.
- Get adequate operator training from a knowledgeable source **before** operation. Adequate training topics include (but are not limited to) the following:
  - How to start and stop the cutting system during routine operation and in an emergency.
  - Conditions and actions that can cause injuries to people or damage cutting system equipment.
  - How to operate all controls.
  - How to identify and respond to fault conditions.
  - How to do maintenance.
  - A copy of the instruction manual.

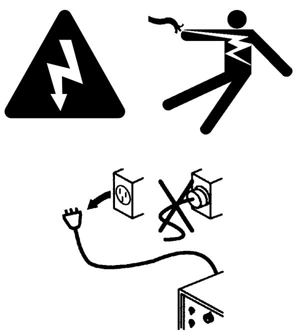
Additional qualifications apply for personnel who do maintenance and troubleshooting. Refer to Qualifications of service personnel on page 39.

- Do **not** operate the cutting system if you cannot follow all of the safety instructions or if you cannot satisfy the minimum operator qualifications. Refer to the *Safety and Compliance Manual* (80669C), *Radio Frequency Warning Manual* (80945C), and Safety instructions related to installation on page 78.

  Additional qualifications apply for personnel who do maintenance and troubleshooting. Refer to Qualifications of service personnel on page 39.

Qualifications of service personnel

WARNING



ELECTRIC SHOCK CAN KILL

Disconnect electric power before doing installation or maintenance. You can get a serious electric shock if electric power is not disconnected. Electric shock can seriously injure or kill you.

All work that requires removal of the plasma power supply outer cover or panels must be done by a qualified technician.

Refer to the *Safety and Compliance Manual* (80669C) for more safety information.

It can be hazardous to do service and maintenance on industrial cutting systems and equipment.

For your safety and for the best results:

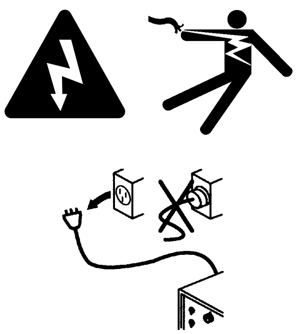
- **Always** read, understand, and follow all of the safety instructions in this manual, the *Safety and Compliance Manual* (80669C), and on the labels that are on the cutting system.
- Get adequate training from a knowledgeable source **before** you do any service or maintenance on the cutting system or equipment.

  The entity responsible for workplace safety where your XPR300 cutting system is used must do a risk assessment and establish the criteria for service personnel training and qualifications.

- Do not do any service or maintenance on the cutting system or equipment if you cannot follow all of the safety instructions or if you cannot satisfy the minimum service-personnel qualifications set by workplace safety at your organization. Refer to the *Safety and Compliance Manual* (80669C), *Radio Frequency Warning Manual* (80945C), and Safety instructions related to installation on page 78.
- Contact a professional repair person who has a license.

System electrical requirements

WARNING



ELECTRIC SHOCK CAN KILL

Disconnect electric power before doing installation or maintenance. You can get a serious electric shock if electric power is not disconnected. Electric shock can seriously injure or kill you.

All work that requires removal of the plasma power supply outer cover or panels must be done by a qualified technician.

Refer to the *Safety and Compliance Manual* (80669C) for more safety information.

Code conformity

- Follow all local and national electrical safety requirements, including requirements for correct electrical system design and installation.
- Always read, understand, and follow all of the safety instructions in this manual, the *Safety and Compliance Manual* (80669C), and on the labels that are on the cutting system.
- Contact a licensed electrician for information about the codes in your location.

Input power requirements

General input power requirements

As an installer or user, you are responsible for supplying all of the switches, time-delay fuses, and power cords necessary for cutting system installation and operation at the installation site. The switches, fuses, and cords that you supply must satisfy all applicable national and local electrical codes and requirements, and be installed by a licensed electrician.

General input power requirements appear in Table 7. For specific requirements for switches, fuses, and cords, refer to Line-disconnect switch requirements on page 41, Circuit breaker and fuse requirements on page 42, and Main power cord requirements on page 42.

Table 7 – Input power requirements

Part number	Input voltage (VAC)	Phase	Rated input current at 66.5 kW output (A)	Recommended time-delay fuse size (A)	Recommended size for the main power cord 90°C (194°F) (mm² [AWG*])	Power (kVA)
078620	200	3	218	250	141.3 (4/0)	75.4
078621	208		209	250	141.3 (4/0)	
078622	220		198	250	141.3 (4/0)	
078623	240		181	225	111.9 (3/0)	
078624	380		115	150	53.5 (1/0)**	
078625	400		109	150	70.5 (1/0)**	
078626	415		105	125	43.2 (2)	
078627	440		99	125	43.2 (2)	
078628	480		91	110	34.3 (3)	
078629	600		73	90	27.3 (4)	

* AWG requirements must comply with the latest version of the US National Electric Code (in North America) or the latest electric wiring and installation requirements (based on the codes in your location). Table 7 is for reference only; the requirements for your location can be different. Follow all local and national electrical codes in your location.

** Differences in cross-sectional diameters depend on the strand variations of each cable.

The strain relief for the input power cord that comes with the plasma power supply is sized properly (refer to Table 7). Contact a licensed electrician to make sure that your main power cord size and length meet the codes in your location.

Plasma power supply

As an installer or user, you must connect the plasma power supply to one of the branch-feed circuits. Use a separate, primary line-disconnect switch for the plasma power supply. Refer to Line-disconnect switch requirements on page 41.

Always follow the local and national electrical safety requirements for your location, including requirements for correct electrical system design and installation. Contact a licensed electrician for more information about the codes in your location.

Line-disconnect switch requirements

As an installer or user, you must supply a separate, line-disconnect switch for the plasma power supply. A means for disconnecting the cutting system shall be provided according to the installation, safety, and emergency requirements for the local codes and regulations, taking into account the input power requirements. Hypertherm does not supply this means of disconnection.

Circuit breaker and fuse requirements

For main feed protection, choose a circuit breaker or fuse that is large enough to withstand all branch-feed loads for both inrush and steady-state current. Refer to Table 7 on page 41 for the recommended time-delay fuse sizes.

As an installer or user, you must choose time-delay fuses and circuit breakers that can withstand inrush current that is up to 15 times the rated input current for 0.01 seconds and up to 10 times the rated input current for 0.1 seconds.

The size requirements for breakers or fuses at your site can change because of the following:

- Local line conditions (such as source and line impedance and voltage fluctuations)
- Product inrush characteristics
- Regulatory requirements

Always follow the local and national electrical safety requirements for your location, including requirements for correct electrical system design and installation. Contact a licensed electrician for more information about the codes in your location.

> If time-delay, high-inrush fuses are not permitted at your site because of national or local codes, use a motor-start circuit breaker or equivalent.

Main power cord requirements

As an installer or user, you must supply the main power cord for your cutting system. Refer to Table 7 on page 41 for recommended main power cord size.

The recommended main power cord sizes in Table 7 are based on Table 310.15 of the US National Electric Code (2017 Handbook). Table 7 shows stranded-flexible cord rates for 90°C (194°F). The size requirement for the main power cord at your site can change because of the following conditions:

- Wires with lower temperature ratings
- Wires with different insulation types
- Different distances between the line-disconnect switch/receptacle and the plasma power supply
- Local codes and regulations

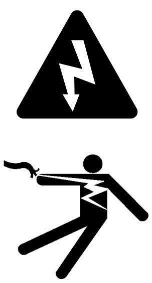
Always follow the local and national electrical safety requirements for your location, including requirements for correct electrical system design and installation. Contact a licensed electrician for more information about the codes in your location.

Input power requirements for CE units

The XPR cutting system is intended for use only in sites that have a service current capacity that is greater than (or equal to) 100 A per phase and supplied from a distribution network that has a nominal voltage of 400/230 V. The installer or user is responsible for verifying that the service current capacity for the installation site satisfies this requirement.

Remote on-off switch

WARNING



ELECTRIC SHOCK CAN KILL

The plasma power supply contains dangerous electric voltages that can seriously injure or kill you.

Even if the plasma power supply is turned OFF, you can still get a serious electric shock if the plasma power supply remains connected to an electric power source. When the remote on-off switch is in the OFF position, electric **power remains active** to the following components in the system:

- Control board
- Control transformer input and output
- 48 V power supply
- 24 V power supply
- 120 VAC and 220 VAC on the power distribution board
- Input side of the contactors
- Input side of the pump relay
- Power-indicator LED on the front of the plasma power supply

Use extreme caution if you do diagnosis or maintenance tasks when the plasma power supply remains connected to an electric power source and the outer cover or panels are removed. All work that requires removal of the plasma power supply outer cover or panels must be done by a qualified technician.

Refer to the *Safety and Compliance Manual* (80669C) for more safety information.

You must supply the remote on-off switch (or switches) for your cutting system.

A remote on-off switch lets you supply electric power to or remove electric power from the gas connect console, torch connect console, and some parts of the plasma power supply from a location that is remote from the main power source. A convenient location for a remote on-off switch is near the CNC.

For information about how to do this, refer to How to install a remote on-off switch on page 200.

Process gas requirements (Core, CorePlus, VWI, and OptiMix gas connect consoles)

As an installer or user, you must supply the process gases and supply gas plumbing for your cutting system. Refer to Table 8 on page 44 for supply gas quality, pressure, and flow requirements.

Process gas requirements include the following:

- Nitrogen is required for all processes.
- Air is required for H_2 mix processes.
- Water can be used as a shield fluid for plasma power supplies that have a VWI or OptiMix gas connect console. Refer to Shield water requirements (VWI and OptiMix) on page 50 for the specifications and requirements for water that is used for shield purposes.

Table 8 – Gas quality, pressure, and flow requirements

Gas	Quality	System inlet pressure (during gas flow*)	Flow rate
O_2 (oxygen)	99.5% pure, clean, dry, oil-free	Core, CorePlus, VWI: 7.5 bar ± 0.4 (110 psi ± 5) OptiMix: 7.9 bar ± 0.4 (115 psi ± 5)	71 slpm (150 scfh)
N_2 (nitrogen)	99.99% pure, clean, dry, oil-free	Core, CorePlus, VWI: 7.5 bar ± 0.4 (110 psi ± 5) OptiMix: 8.3 bar ± 0.4 (120 psi ± 5)	181 slpm (380 scfh)
Air**	Clean, dry, oil free consistent with 8573-1:2010 Class 1.4.2	Core, CorePlus, VWI: 7.5 bar ± 0.4 (110 psi ± 5) OptiMix: 7.9 bar ± 0.4 (115 psi ± 5)	118 slpm (250 scfh)
H_2 (hydrogen)	99.995% pure	OptiMix: 8.3 bar ± 0.4 (120 psi ± 5)	50 slpm (105 scfh)
Ar (argon)	99.99% pure; clean, dry, oil-free	CorePlus, VWI: 7.5 bar ± 0.4 (110 psi ± 5) OptiMix: 8.3 bar ± 0.4 (120 psi ± 5)	118 slpm (250 scfh)
F5 (95% nitrogen, 5% hydrogen)	99.98% pure	VWI: 7.5 bar ± 0.4 (110 psi ± 5) OptiMix: 7.9 bar ± 0.4 (115 psi ± 5)	40 slpm (85 scfh)

* When there is **no** gas flow, make sure that the pressure at the gas inlet connection is less than 8.6 bar (125 psi) to avoid system alerts.

** Any air compressors that supply air to the cutting system must remove oil prior to air delivery.

Hypertherm recommends that air compressors supply air that obey the following requirements of ISO Standard 8573-1:2010 Class 1.4.2:

Maximum particle count in 1.0 m³:	▪ 20,000 at 0.1 microns – 0.5 microns ▪ 400 at 0.5 microns – 1.0 microns ▪ 10 at 1.0 microns – 5.0 microns
Maximum water vapor pressure dew point:	3°C (37°F)
Maximum oil concentration:	0.1 mg/m³ (for aerosol, liquid, and vapor)

Speak to your air compressor manufacturer if you operate the cutting system in temperatures colder than 3°C (37°F) or if you are unsure that the air compressor can obey the ISO standard for air quality.

NOTICE

RUST IN GAS CYLINDERS CAN GET INTO THE GAS LINE

Rust can collect at the bottom of gas cylinders. If the rust mixes with the gas, it can get into the gas line and decrease cut quality and performance.

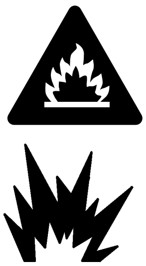
When you move gas cylinders, make sure that you do not put them on their side, roll, or shake them.

Code conformity

- All installer or user-supplied equipment must meet applicable national and local codes for supply gas and supply gas plumbing. Contact a licensed plumber for more information about the codes in your location.
- Any installation, modification, or repair of supply gas equipment or plumbing systems must be done by a licensed plumber.

Plumbing for supply gases

WARNING



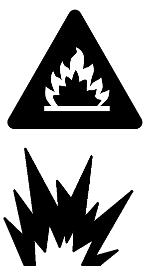
OXYGEN GAS CAN CAUSE A FIRE HAZARD

If you use oxygen as the plasma gas for cutting, it can cause a potential fire hazard due to the oxygen-enriched atmosphere that collects.

Hypertherm recommends that you install an exhaust ventilation system to remove the oxygen-enriched atmosphere that can collect when oxygen is used as the plasma gas for cutting. A fire can occur if oxygen is not removed.

Flashback arrestors are REQUIRED to stop the spread of fire to the supply gases (unless a flashback arrestor is not available for a specific gas or pressure).

As an installer or user, you must supply the exhaust ventilation and flashback arrestors for your cutting system. You can get them from your cutting machine supplier.



HYDROGEN GAS CAN CAUSE AN EXPLOSION OR FIRE

Hydrogen is a flammable gas that can cause an explosion or fire. Keep flames away from cylinders and hoses that contain hydrogen. Keep flames and sparks away from the torch when using hydrogen as a plasma gas.

Consult your local safety, fire, and building code requirements for the storage and use of hydrogen.

Hypertherm recommends that you install an exhaust ventilation system to remove the hydrogen-enriched atmosphere that can collect when hydrogen is used as the plasma gas for cutting. An explosion or fire can occur if hydrogen is not removed.

Flashback arrestors are REQUIRED to stop the spread of fire to the supply gases (unless a flashback arrestor is not available for a specific gas or pressure).

As an installer or user, you must supply the exhaust ventilation and flashback arrestors for your cutting system. You can get them from your cutting machine supplier.

As an installer or user, you must install the supply gases and supply gas plumbing for your cutting system.

- You can use flexible hoses that are designed to carry the appropriate gas and are rated for the correct pressure. Other hoses can crack and leak.
- For the best results, use the recommended torque specifications for plumbing and hose fittings. Refer to Table 12 on page 51.
- You can use rigid copper pipes.
- Do not use steel or aluminum.

Supply-gas hoses are available from Hypertherm. Refer to Supply hoses on page 407.

All installer or user-supplied equipment must meet applicable national and local codes for supply gas and supply gas plumbing. Contact a licensed plumber for more information about the codes in your location.

Hypertherm recommends an internal diameter of at least 10 mm (0.375 inch) for supply-gas hoses that are 76 m (250 feet) or less. Table 9 on page 47 describes the recommended sizes for gas fittings.

Table 9 – Recommended sizes for gas fittings

Fitting type	Size
N_2 / Ar	5/8 inch – 18 RH, internal (inert gas) “B”
Air	9/16 inch – 19, JIC #6
F5 / H_2	9/16 inch – 18, LH (fuel gas) “B”
O_2	9/16 inch – RH (oxygen)

The location of regulators and the number of elbow fittings can have an effect on inlet pressure. If the inlet pressure for your cutting system is not within recommended specifications, contact your cutting machine supplier or regional Hypertherm Technical Service team.

NOTICE

PTFE TAPE CAN CAUSE CLOGGED VALVES, REGULATORS, AND TORCHES

Never use PTFE tape on any joint preparation. Use only a liquid or paste thread sealant on male thread ends.

NOTICE

INCORRECT SUPPLY-GAS CONNECTIONS CAN CAUSE CUTTING SYSTEM DAMAGE

NEVER connect a supply gas to a hose, connection, or fitting that is not designed for that gas type or pressure.

Incorrect connections can reduce the life of consumables and damage the torch head, torch receptacle, torch leads, and torch connect console.

CAUTION

INCORRECT HOSES, CONNECTIONS, OR FITTINGS CAN CAUSE DAMAGE AND BAD PERFORMANCE

All hoses, hose connections, and hose fittings used for supply-gas plumbing must be designed for use with the appropriate gas and pressure rating. Incorrect hoses, hose connections, or hose fittings can crack or leak.

NEVER connect a supply gas to a hose, connection, or fitting that is not designed for that gas type or pressure.

A replacement hose, connection, or fitting must meet all applicable regulations and codes.

Non-compliant hoses, hose connections, or hose fittings can crack or leak. The wrong fittings can cause malfunctions with the internal valves because contaminants can enter the valves through damaged or loose fittings.

NOTICE

DIRTY, OILY AIR CAN CAUSE DAMAGE TO THE AIR FILTER BOWL

Some air compressors use synthetic lubricants that contain esters. Esters can damage the polycarbonates in the air filter bowl. Add additional gas filtration if necessary.

Regulators for supply gases

CAUTION

LOW-QUALITY REGULATORS CAN REDUCE PERFORMANCE AND CUT QUALITY

Do not use low-quality gas regulators. They do not provide consistent supply-gas pressure. Low-quality gas regulators can also reduce system performance and decrease cut quality.

NOTICE

DIRTY, OILY AIR CAN CAUSE DAMAGE TO THE AIR FILTER BOWL

Some air compressors use synthetic lubricants that contain esters. Esters can damage the polycarbonates in the air filter bowl. Add additional gas filtration if necessary.

The installer or user must supply the gas regulator (regulators) for the cutting system.

It is important to choose the correct gas regulator (regulators) for the conditions at the installation site. A gas regulator must be compatible with the gases used and appropriate for the environmental conditions. For example, certain regulators are recommended for specific temperature ranges. The type of gas (cylinder gas, line gas, or liquefied gas), and the gas-delivery pressure and flow, can also influence regulator selection.

Single-stage gas regulation	▪ Reduces source gas pressure to the necessary delivery pressure in 1 step. ▪ Delivery pressure is **not** tightly controlled with this type of gas regulation. ▪ Good choice for generic applications and where fluctuations in source gas pressure are small.
Dual-stage gas regulations	▪ Reduces source gas pressure to the necessary delivery pressure in 2 steps. Dual-stage regulation uses 2 single-stage regulators. The first regulator reduces the pressure to approximately 3 times the maximum delivery pressure. The second regulator reduces pressure to the necessary delivery pressure. ▪ Good choice for applications that require consistent delivery pressure and where fluctuations in source gas pressure are large.

Your gas supplier can recommend the best gas regulator (regulators) for the conditions at your site.

Local regulations and the type of gas that is used can influence the recommended inlet gas fittings for your gas connect console. Refer to Table 9 – Recommended sizes for gas fittings on page 47.

Shield water requirements (VWI and OptiMix)

If you use water as a shield fluid, refer to Table 10 for water pressure and flow requirements and Table 11 for water-purity guidelines.

If using shield water, the temperature range for cutting system operation and storage is reduced to above 0°C to 40°C (32°F to 104°F).

Table 10 – Quality, pressure, and flow requirements for shield water

Quality*	Minimum and maximum pressure	Flow rate required
Deionized water is **not** recommended to use as shield water. Deionized water will react with the copper components in the system and result in decreased life of components and consumables. Hypertherm recommends that you contact a water-quality expert for guidance.	2.76 bar (40 psi) minimum 8.27 bar (120 psi) maximum	35 L/h (9.4 US gal/h)

Table 11 – Purity requirements for shield water

Particulate type	Purity requirement
Total dissolved solids	< 61 PPM
Calcium + magnesium	< 40 PPM
Silica	< 5 PPM
pH	6.5 – 8.0

A TDS meter indicates the Total Dissolved Solids (TDS) of a solution. Dissolved ionized solids (such as salts and minerals) increase the electrical conductivity of a solution. Total dissolved solids can be tested with a TDS meter (Hypertherm Waterjet part number 1-13897) available from Hypertherm.

* Water that does not meet minimum purity specifications can cause excessive deposits on the torch nozzle and shield. These deposits can alter the water flow and produce an unstable arc. Refer to Shield water requirements (VWI and OptiMix) on page 50.

Plumbing and hose requirements for shield water

The installer or user must supply the plumbing and hoses for the shield water.

- You can use flexible hoses that are designed to carry water.
- For the best results, use the recommended torque specifications for plumbing and hose fittings. Refer to Table 12 on page 51.
- You can use rigid copper pipes.
- Do not use steel or aluminum pipes.

Install the plumbing and hoses consistent with all local and national codes. After installation, pressurize the entire system and test it for leaks.

To decrease the risk of leaks in the cutting system, make sure to tighten all connections to the recommended torque specifications in Table 12 on page 51.

Hoses are available from Hypertherm. Refer to Water (optional shield fluid) (blue) on page 408 of the Parts List.

Additional regulator requirement for shield water (optional)

Water pressure regulators are built into the VWI and OptiMix gas connect consoles. Additional water pressure regulators are only required when the water pressure is above 7.92 bar (115 psi).

Torque requirements for gas or water plumbing and hose connections

For the best results, use the recommended torque specifications for plumbing and hose fittings.

Table 12 – Torque specifications

	**Torque Specifications**			
	Gas or water hose size	**N·m**	**in·lbf**	**ft·lbf**
	Up to 10 mm (3/8 inch)	8.5 – 9.5	75 – 84	6.25 – 7
	12 mm (1/2 inch)	16.3 – 19.0	144 – 168	12 – 14
	25 mm (1 inch)	54.2 – 88.1	480 – 780	40 – 65

Requirements for shield water removal for freezing-ambient temperatures

If your XPR cutting system uses shield water and is stored in ambient temperatures at or below 0°C (32°F), Hypertherm recommends shield water removal.

Follow these steps to remove shield water from the gas connect console (VWI or OptiMix):

1. Remove the shield water supply line to the gas connect console.
2. Access a source of compressed air that is clean and dry. Use a regulator to adjust the compressed air to 5.52 bar (80 psi).
3. Connect the compressed air hose to the water inlet on the gas connect console.

   The air hose needs to adapt to a JIC 6 male fitting on the gas connect console.

4. Use the XPR web interface or CNC to select a process ID for a water process (such as 2028).
5. Select **Preflow** from the Plasma Process Selection menu.

   During preflow, water mist will exit the torch nozzle for approximately 45 – 50 seconds.

6. Repeat step 5 until shield water mist is no longer visible exiting the torch nozzle.

   It can take 7 – 10 preflow cycles for the shield water mist to stop.

Coolant requirements

The cutting system ships **without** coolant in the reservoir. Before you operate the cutting system, you must fill it with coolant. The capacity of the coolant system is between 22.7 liters – 45 liters (6 US gallons – 12 US gallons).

Lead length has an effect on the total coolant volume needed. A cutting system with long leads needs more coolant than a cutting system with short leads.

Before you fill the coolant reservoir (refer to Coolant Installation on page 203), choose the best coolant for your operating conditions. The ambient temperature range where your cutting system operates affects the coolant that you choose.

NOTICE

LOW COOLANT LEVELS CAN DAMAGE THE CUTTING SYSTEM AND COOLANT PUMP

Never operate the cutting system if you get a low coolant level notice. There is a risk of serious damage to the cutting system and to the coolant pump if you operate the cutting system with no coolant or with low coolant.

If your coolant pump is damaged, pump replacement can be necessary.

NOTICE

AUTOMOTIVE ANTIFREEZE CAN DAMAGE THE TORCH COOLANT SYSTEM

Never use automotive antifreeze in place of Hypertherm coolant. Antifreeze contains chemicals that can damage the torch coolant system.

Make sure to read and follow the warning and cautions below. Refer to the Material Safety Data Sheets (MSDS) and Safety Data Sheets (SDS) for safety data and information about how to handle and store coolant, propylene glycol, and benzotriazole. You can find the MSDS and SDS online. Technical documentation is available at www.hypertherm.com/docs.

WARNING

COOLANT CAN BE IRRITATING TO SKIN AND EYES AND HARMFUL OR FATAL IF SWALLOWED

Propylene glycol and benzotriazole are irritating to skin and eyes, and harmful or fatal if swallowed. When you come into contact, flush skin or eyes with water. If swallowed, seek immediate medical attention.

Coolant requirements for operation between -10°C – 40°C (14°F – 104°F)

Use Hypertherm premixed coolant (028872) when operating in a temperature range of -10°C to 40°C (14°F to 104°F).

> If using shield water, the temperature range for cutting system operation and storage is reduced to above 0°C to 40°C (32°F to 104°F).

If it is possible for the temperature to go below -10°C (14°F) when the cutting system is not in use, adjust coolant propylene glycol concentration to 50% to prevent damage to cooling system components.

> Operating your XPR system below -10°C (14°F) is not recommended due to reduced consumable life and performance.

To increase the coolant propylene glycol percentage, add 100% propylene glycol (028873) to the premixed Hypertherm coolant (028872) according to the calculation below. The maximum percentage of propylene glycol should never exceed 50%.

Total system coolant volume (in liters)*	X	0.4	=	Total volume in liters of 100% propylene glycol to add
Total system coolant volume (in US gallons)*	X	1.514	=	Total volume in US gallons of 100% propylene glycol to add

* Refer to Estimate the total coolant volume for your cutting system on page 258.

Coolant requirements for operation in temperatures above 40°C (104°F)

For operating temperatures above 40°C (104°F) and that can never go at or below 0°C (32°F) use treated water with no propylene glycol as coolant.

For operations in very warm temperatures, treated water provides the best cooling properties.

> Treated water is a mixture of purified water that meets the Purity requirements for coolant water on page 55 and 1 part benzotriazole (128020) to 300 parts of water. Benzotriazole acts as a corrosion inhibitor for the copper coolant system inside of the cutting system.

Flow requirements for coolant

- The maximum coolant flow rate is 11.36 liters per minute (3.0 US gallons per minute).
- The minimum coolant flow rate is 3.79 liters per minute (1 US gallon per minute).

The cutting systems stops automatically if the flow rate reaches this maximum or minimum flow rate. Automatic, low-flow shut-off protects the coolant pump from damage from low-flow or no-flow conditions. Automatic, high-flow shut-off protects the torch and leads from damage from a blow-out event.

For information about how to diagnose and troubleshoot coolant flow issues, refer to:

- Low coolant flow codes (540 – 542) on page 323
- High coolant flow codes (543 – 544) on page 325

Purity requirements for coolant water

Always use water that meets the specifications in Table 13 on page 55 when using a custom coolant mix.

Water that is too pure can also cause problems. Deionized water can cause corrosion in the coolant system. After deionization, add benzotriazole (128020).

Use water purified by any method (deionization, reverse osmosis, sand filters, water softeners, etc.) as long as the water purity meets the specifications in the table below. Contact a water specialist for advice in choosing a water filtration system.

Table 13 – Purity measurement methods for coolant water

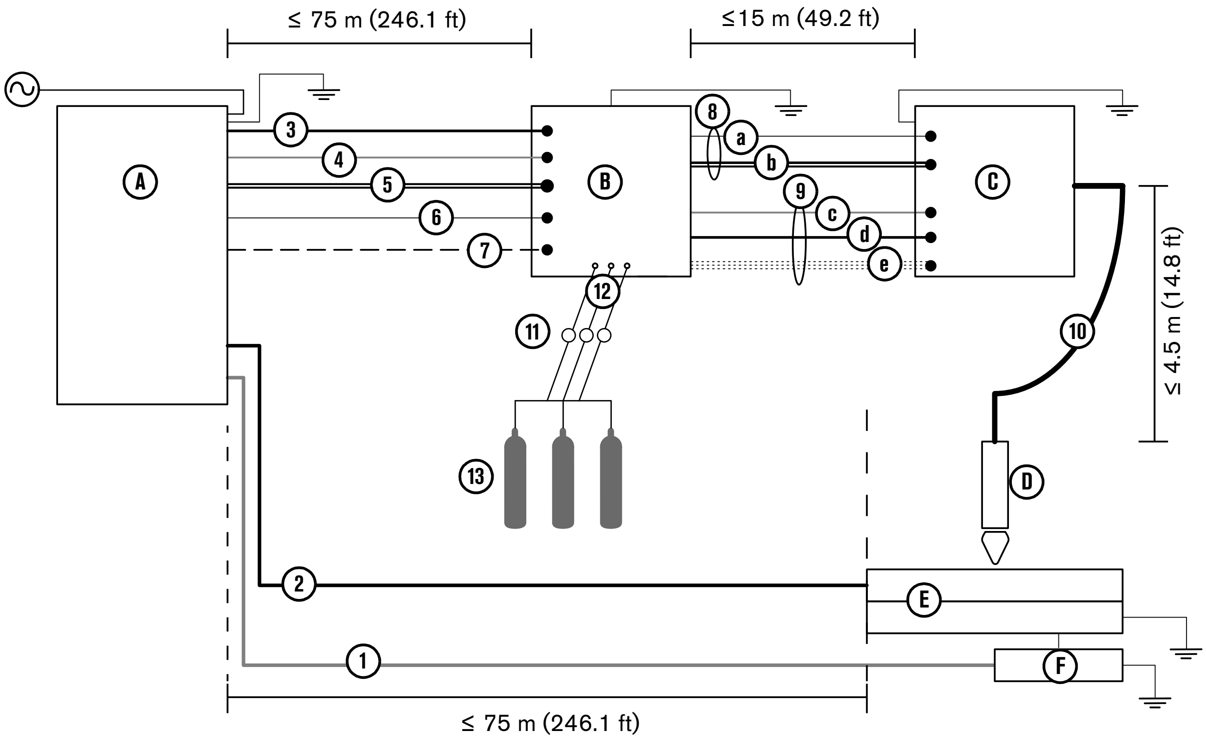
Methods to measure water purity				
Water purity level	Conductivity µS/cm at 25°C (77°F)	Resistivity mΩ·cm at 25°C (77°F)	Dissolved solids or hardness (ppm of NaCl)	Grains per gallon (gpg of $CaCO_2$)
Pure water (For reference only. Do not use.)	0.055	18.3	0	0
Maximum purity	0.5	2	0.206	0.010
Minimum purity	18	0.054	8.5	0.43
Maximum potable water (For reference only. Do not use.)	1000	0.001	495	25

Requirements to position system components

When you plan where to position the plasma power supply, gas connect console, torch connect console, and torch, use the following limitations and requirements:

- Site requirements on page 60
- Length requirements for hoses, cables, and leads on page 60
- Bend radius requirements for hoses, cables, and leads on page 61
- Distance requirements between high-frequency leads and control cables on page 62
- Distance requirements for ventilation and access on page 62
- Distance requirements for communications on page 63

Recommended configuration with the Core gas connect console



A Plasma power supply

B Gas connect console (Core)

C Torch connect console

D Torch

E Cutting table

F Computerized numeric control (CNC)

1 Computerized numeric control (CNC) lead

2 Work lead

3 Controller area network (CAN) cable

4 Power cable (120 VAC)

5 Coolant hoses (1 supply, 1 return)

6 Pilot arc lead

7 Negative lead

8 Pilot arc and coolant hose set assembly

- **a** Pilot arc lead
- **b** Coolant hose set (1 supply, 1 return)

9 Power, CAN, 3-gas assembly

- **c** Power cable (120 VAC)
- **d** CAN cable
- **e** 3 gas hoses (Core)

10 Torch lead

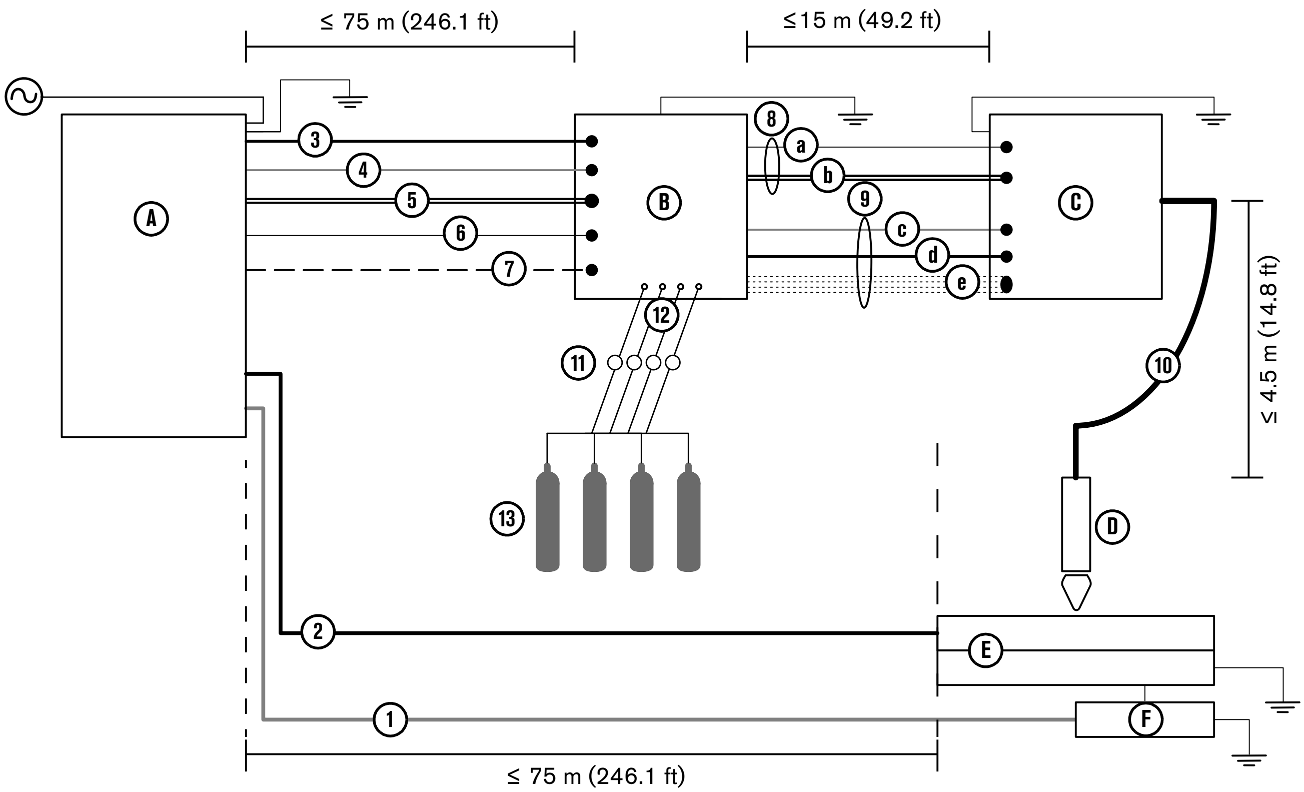
11 Regulators

Position a gas regulator within 3 meters (10 feet) of the gas connect console or take actions to adjust inlet gas pressures to tolerances specified in the process gas requirements.

12 Hoses for supply gases

13 Gases Core: O_2, N_2, and air

Recommended configuration with the CorePlus gas connect console

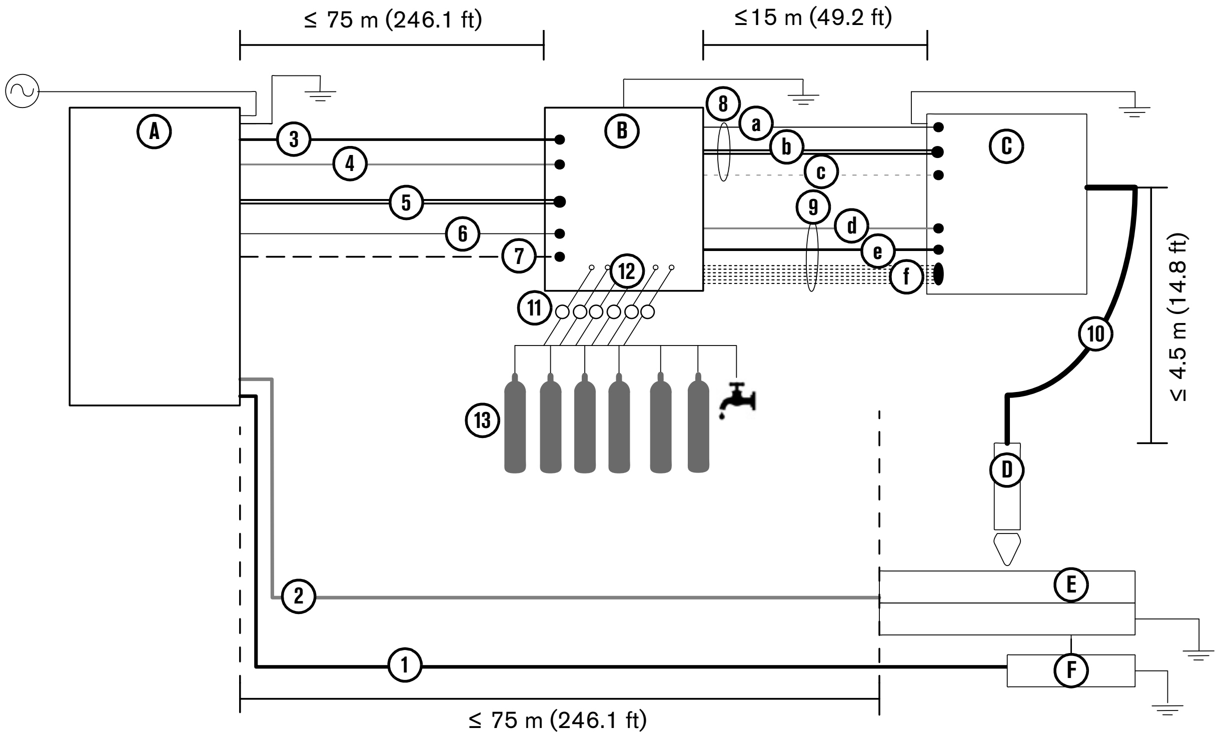


- **A** Plasma power supply
- **B** Gas connect console (CorePlus)
- **C** Torch connect console
- **D** Torch
- **E** Cutting table
- **F** Computerized numeric control (CNC)

- **1** Computerized numeric control (CNC) lead
- **2** Work lead
- **3** Controller area network (CAN) cable
- **4** Power cable (120 VAC)
- **5** Coolant hoses (1 supply, 1 return)
- **6** Pilot arc lead
- **7** Negative lead
- **8** Pilot arc and coolant hose set assembly
  - **a** Pilot arc lead
  - **b** Coolant hose set (1 supply, 1 return)
- **9** Power, CAN, 4-gas assembly
  - **c** Power cable (120 VAC)
  - **d** CAN cable
  - **e** 4 gas hoses (CorePlus)
- **10** Torch lead
- **11** Regulators

  Position a gas regulator within 3 meters (10 feet) of the gas connect console or take actions to adjust inlet gas pressures to tolerances specified in the process gas requirements.
- **12** Hoses for supply gases
- **13** Gases CorePlus: O_2, N_2, Ar, and air

Recommended configuration with the VWI or OptiMix gas connect console



A Plasma power supply

B Gas connect console (VWI or OptiMix)

C Torch connect console

D Torch

E Cutting table

F Computerized numeric control (CNC) lead

1 Computerized numeric control (CNC) lead

2 Work lead

3 Controller area network (CAN) cable

4 Power cable (120 VAC)

5 Coolant hoses (1 supply, 1 return)

6 Pilot arc lead

7 Negative lead

8 Pilot arc, coolant hose set, shield water assembly

- **a** Pilot arc lead
- **b** Coolant hose set (1 supply, 1 return)
- **c** Shield water hose (VWI or OptiMix)

9 Power, CAN, 5-gas assembly

- **d** Power cable (120 VAC)
- **e** CAN cable
- **f** 5 gas hoses (VWI or OptiMix)

10 Torch lead

11 Regulators

Position a gas regulator within 3 meters (10 feet) of the gas connect console or take actions to adjust inlet gas pressures to tolerances specified in the process gas requirements.

12 Hoses for supply gases

13 Gases and water

VWI: O_2, air, N_2, Ar, F5, and water

OptiMix: O_2, air, N_2, Ar, F5, water, H_2

Site requirements

Table 14 – Recommendations for where to position system components

Plasma power supply	▪ Level surface (less than 10° incline) ▪ Clean and dry area ▪ Able to support at least 680 kg (1,500 lb)
Gas connect console*	▪ Level surface (less than 10° incline) ▪ Clean and dry area ▪ Able to support the weight of your gas connect console (weight varies with type, refer to Specifications on page 25)
Torch connect console*	▪ Clean and dry area ▪ Able to support at least 9.3 kg (20.5 lb)

* The same recommendations are applicable for mezzanine locations.

Length requirements for hoses, cables, and leads

The distances between the plasma power supply, gas connect console, torch connect console, torch, and cutting table are limited by the lengths of the interconnect hoses, cables, and leads that connect them.

Table 15 – Length ranges for interconnect hoses, cables, and leads

From this component…	to this component…	…the length can range from:
Plasma power supply	Gas connect console (Core, CorePlus, VWI, OptiMix)	3 m (9.8 ft) – 75 m (246.1 ft)*
Gas connect console	Torch connect console	3 m (9.8 ft) – 18 m (59.1 ft)*
Torch connect console	Torch or cutting table	2 m (6.6 ft) – 4.5 m (14.8 ft)*

* Refer to Recommended configuration with the Core gas connect console on page 57, Recommended configuration with the CorePlus gas connect console on page 58, and Recommended configuration with the VWI or OptiMix gas connect console on page 59 for visual distance requirements.

For a complete list of hoses, cables, and leads refer to Parts List on page 367.

Make sure to install hoses, cables, and leads that are the correct length.

- Hoses, cables, or leads that are too short can cause restriction of mechanical movement.
- Cables and leads that are too long can cause electromagnetic interference (EMI).

EMI can have a negative effect on cut quality.

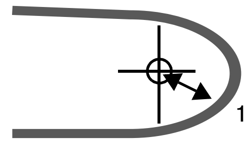
Contact your cutting machine supplier for recommendations about the best lead lengths for your cutting system.

Bend radius requirements for hoses, cables, and leads

The following hoses, cables, and leads cannot bend beyond a minimum bend radius of 15.25 cm (6 inches):

- Torch lead
- Pilot arc lead
- Coolant hose set
- Power cable
- CAN cable
- 3-gas hose bundle for the **Core** gas connect console
- 4-gas hose bundle for the **CorePlus** gas connect console
- 5-gas hose bundle for the **VWI or OptiMix gas** connect console
- Gas supply hoses

Minimum bend radius (measured inside diameter)

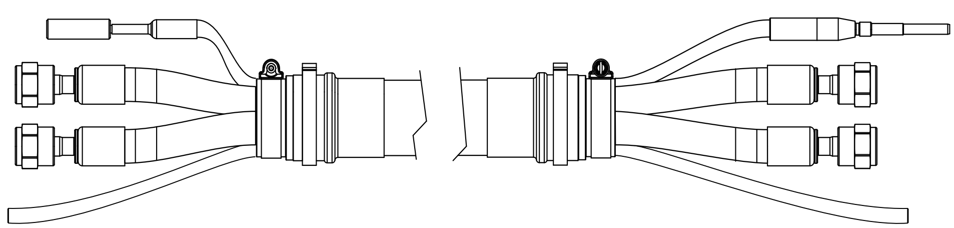


Maximum diameters for console-to-console lead sets

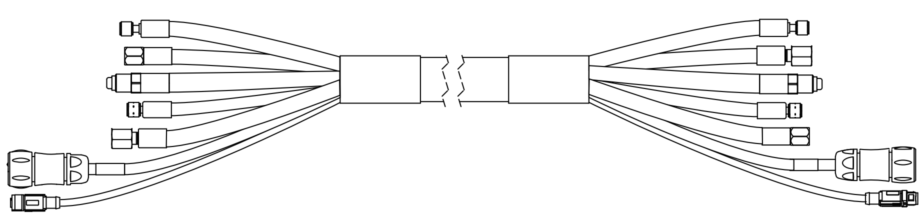
The connectors for the console-to-console lead sets have the following maximum diameters:

- 5.6 cm (2.2 in.) for the pilot arc / coolant-hose lead set
- 5.8 cm (2.3 in.) for the gas-hose set

Example OptiMix pilot arc / coolant-hose lead set*



Example OptiMix gas-hose set*



* OptiMix assemblies shown as examples. The connectors on all console-to-console assemblies (Core, CorePlus, VWI, and OptiMix) have the same diameter.

The 18 meter (59.1 feet) assembly is compatible only with the 2 meter (6.6 feet) or 2.5 meter (8.2 feet) torch lead. For lengths, refer to Gas connect console to torch connect console connections in Parts List on page 367.

Distance requirements between high-frequency leads and control cables

Electromagnetic interference (EMI) can occur if high-frequency leads (such as the pilot arc and negative leads) are too close to control cables (such as the 120 VAC power, CAN, and EtherCAT® cables).

If possible, use a separate track to isolate each lead and cable.

If separate tracks are not possible, Hypertherm recommends a minimum separation distance 150 mm (6 inches) between the high-frequency leads and control cables. Separate the pilot arc lead, negative lead, or any power cables that have a voltage higher than 120 VAC from the following:

- CAN cable
- Power cable (120 VAC)
- CNC lead (EtherCAT, serial RS-422, or discrete lead)

Distance requirements for ventilation and access

- Ventilation
  - Do not block the ventilation louvers on the corners or bottom panels of the front and back of the plasma power supply. A separation distance of least 1 m (3.3 feet) is required for ventilation.
  - Do not block the ventilation louvers on the gas connect console. A separation distance of least 1.27 cm (0.50 inch) is required for ventilation.
  - Do not block the ventilation louvers on the torch connect console. You must use the mounting brackets to allow space between the console and mounting surface.
- Service and maintenance access – Hypertherm recommends a minimum distance of 1 meter (3.3 feet) between the plasma power supply and other system components, or between the plasma power supply and an obstacle.

Distance requirements for communications

Table 16 – Maximum distance between the plasma power supply and controlling device

Communication type	Distance
Wireless	Unobstructed maximum radius of 30.5 m (100 ft)*
EtherCAT**	Maximum 75 m (246.1 ft)
Discrete**	Maximum 75 m (246.1 ft)
Serial RS-422**	Maximum 75 m (246.1 ft)

* Obstructions or distances greater than 30.5 meters (100 feet) can have an effect on communication between the plasma power supply and wireless device.

** Refer to Recommended configuration with the Core gas connect console on page 57, Recommended configuration with the CorePlus gas connect console on page 58, and Recommended configuration with the VWI or OptiMix gas connect console on page 59 for visual distance requirements.

Wireless compliance

Wireless devices use radio frequencies that may be regulated, but regulations differ from country to country. Wireless devices that conform to IEEE standards 802.11a, 802.11b, 802.11g, 802.11n, 802.16e, and others, are designed for, or certified for use in, specific countries. Certificates of Radio Frequency (RF) Compliance from wireless device manufacturers for wireless devices integrated into Hypertherm products can be found in the “Downloads library” at www.hypertherm.com.

The user of Hypertherm products that have integrated wireless devices is responsible for ensuring that each wireless device has been certified for the country of use and configured with the correct selection of frequency and channel for the country of use. Wireless devices that are integrated into Hypertherm products are not allowed to be operated in countries where regulations for wireless device certification have not been satisfied. Any wireless device or antennae modification or deviation from the permissible configuration, markings, power, frequency settings, and other local regulations on radio frequency wireless device for the country of use can be an infringement of national law.

Refer to the *XPR Wireless Compliance Manual* (80992C) for more information.

Torch mounting bracket requirements

You must supply the torch mounting bracket for your cutting system. Choose one that does the following:

- Holds a torch diameter that is 57.15 mm (2.25 inches)
- Holds the torch perpendicular (at a 90° angle) to the workpiece (for non-bevel cutting)
- Does not interfere with the torch lifter

The XPR torch mounting sleeve is larger than the torch mounting sleeve for HPR torches. Modification or replacement of previous mounting hardware is necessary for XPR torches.

Mounting brackets are available from Hypertherm. Refer to Torch bracket on page 394 of the Parts List.

Torch lifter requirements

Choose a lifter that has a weight capacity of at least 11.3 kg (25 lb). This includes the weight of a torch rotational sleeve, if used.

Refer to your torch lifter instruction manual for more information.

CNC requirements

Remote on-off switch

The CNC must have a remote on-off switch

Adjustable settings

The CNC must allow the adjustment of the following settings:

- Current setpoint
- Plasma cutflow
- Shield cutflow
- Gas mixing setpoints

Display settings

The CNC must show the following data:

- Plasma gas type
- Shield gas type
- Process ID selected
- System diagnostic codes
- Gas connect console firmware version
- Plasma power supply firmware version

The CNC must show the following data in real time to troubleshoot and diagnose system operation:

- Chopper current
- Work lead current
- System status codes
- Chopper temperature
- Transformer temperature
- Coolant temperature
- Coolant flow
- Process gas pressures
- Fan speeds

Diagnostics and troubleshooting

The CNC must be able to execute the following commands to diagnose and troubleshoot system operation:

- Test preflow gases
- Test pierceflow gases
- Test cutflow gases
- Test for gas system leaks

For more information on CNC commands, refer to the *CNC Communication Protocol for the XPR Cutting System* (809810).

Recommended grounding and shielding

Introduction

This section describes practices for grounding and shielding a plasma cutting system to minimize its susceptibility to electromagnetic interference (EMI) (also known as **noise**). It also describes the service ground, protective earth (PE) ground, and DC power ground. The diagram at the end of this section shows these types of grounds in a plasma cutting system.

The grounding practices in this section have been used on many installations with excellent results, and Hypertherm recommends that these practices be a routine part of the installation process. The actual methods used to implement these practices may vary from system to system, but should remain as consistent as possible. However, due to the variation in equipment and installations, these grounding practices may not succeed in every case to eliminate EMI problems. Hypertherm recommends that you consult your local and national electrical codes to make sure that the grounding and shielding practices that you use satisfy the requirements for your location.

Types of grounding

Service ground (also known as safety ground) is the grounding system that applies to the incoming line voltage. It prevents a shock hazard to any personnel from any of the equipment or the cutting table. It includes the service ground coming into the plasma system and other systems, such as the CNC and the motor drives, as well as the supplemental ground rod connected to the cutting table. In the plasma circuits, the ground is carried from the plasma system chassis to the chassis of each separate console through the interconnecting cables.

Protective earth (PE) ground is the grounding system inside the electrical equipment. The PE ground, which connects to the service ground, provides electrical continuity between the equipment and the AC service.

DC power ground (also known as cutting current ground or work) is the grounding system that completes the path of the cutting current from the torch back to the plasma system. It requires that the positive lead from the plasma system be firmly connected to the cutting table ground bus with a properly sized cable. It also requires that the slats, on which the workpiece rests, make firm contact with the table and the workpiece.

EMI grounding and shielding is the grounding system that limits the amount of EMI emitted by the plasma and motor drive systems. It also limits the amount of EMI that is received by the CNC and other control and measurement circuits. The grounding practices described in this section mainly target EMI grounding and shielding.

Grounding practices

1. Unless noted, for XPR cutting systems, use cables with a minimum gauge of 21.2 mm^2 (4 AWG) (047031) for the EMI ground cables shown in the Example grounding diagram with an XPR cutting system on page 70.

2. The cutting table is used for the common, or star, EMI ground point and should have threaded studs welded to the table with a copper bus bar mounted on them. A separate bus bar should be mounted on the gantry as close to each motor as possible. If there are motors at each end of the gantry, run a separate EMI ground cable from the far motor to the gantry bus bar. The gantry bus bar should have a separate, heavy EMI ground cable 21.2 mm^2 (4 AWG; 047031) to the table bus bar. The EMI ground cables for the torch lifter and the RHF or combined ignition/gas connect console must each run separately to the table ground bus.

3. Inadequate grounding not only exposes operators to dangerous voltages, but inadequate grounding also increases the risk of equipment failure and unnecessary downtime. Ideally a ground should be zero ohms resistance, but field experience indicates under 1 ohm resistance is satisfactory for most applications. Hypertherm recommends that you consult your local and national electrical codes to make sure that the grounding and shielding practices that you use satisfy the requirements for your location.

4. A ground rod (a PE ground) that meets all applicable local and national electric codes must be installed within 6 m (20 ft) of the cutting table. For XPR cutting systems, the PE ground must be connected to the cutting table ground bus bar using a minimum 21.2 mm^2 (4 AWG) grounding cable (047031). Consult an electrician in your location to make sure that your grounding meets all local and national electric codes.

5. For the most effective shielding, use the Hypertherm CNC interface cables for I/O signals, serial communication signals, between plasma systems in multi-drop connections, and for interconnections between all parts of the Hypertherm system.

6. All hardware used in the ground system must be brass or copper. While you can use steel studs welded to the cutting table for mounting the ground bus, no other aluminum or steel hardware can be used in the ground system.

7. AC power, PE, and service grounds must be connected to all equipment according to local and national codes.

8. For a system with a remote high frequency (RHF) console or combined ignition/gas connect console, the positive, negative, and pilot arc leads should be bundled together for as long a distance as possible. The torch lead, work lead, and the pilot arc (nozzle) leads may be run parallel to other wires or cables only if they are separated by at least 150 mm (6 inches). If possible, run power and signal cables in separate cable tracks.

9. For a system with a RHF console or combined ignition/gas connect console, Hypertherm recommends that you mount this console as close as possible to the torch. This console also must have a separate ground cable that connects directly to the cutting table ground bus bar.

10. Each Hypertherm component, as well as any other CNC or motor drive cabinet or enclosure, must have a separate ground cable to the common (star) ground on the table. This includes the ignition/gas connect console, whether it is bolted to the plasma system or to the cutting table.

11. For XPR cutting systems, the coupler on the pilot arc and coolant hose set assembly must be connected firmly to the gas connect console and torch connect console collars. Make sure to tighten the clamp. The collar on the torch lead must be connected firmly to the torch sleeve. Make sure to tighten the clamp. Connect a ground lead (10 AWG) to the flat terminal on the torch mounting sleeve.

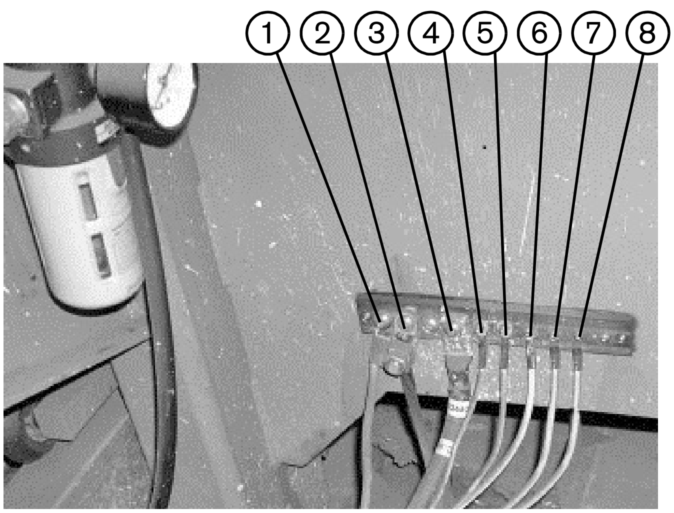
12. The torch holder and the torch breakaway mechanism – the part mounted to the lifter, not the part mounted to the torch – must be connected to the stationary part of the lifter with copper braid at least 12.7 mm (0.5 inches) wide. A separate cable must run from the lifter to the gantry ground bus bar. The valve assembly should also have a separate ground connection to the gantry ground bus bar.

13. If the gantry runs on rails that are not welded to the table, then each rail must be connected with a ground cable from the end of the rail to the table. The rail ground cables connect directly to the table and do not need to connect to the table ground bus bar.

14. If you are installing a voltage divider board, mount it as closely as possible to where the arc voltage is sampled. One recommended location is inside the plasma system enclosure. If a Hypertherm voltage divider board is used, the output signal is isolated from all other circuits. The processed signal should be run in twisted shielded cable (Belden 1800F or equivalent). Use a cable with a braided shield, not a foil shield. Connect the shield to the chassis of the plasma system and leave it unconnected at the other end.

15. All other signals (analog, digital, serial, and encoder) should run in twisted pairs inside a shielded cable. Connectors on these cables should have a metal housing. The shield, not the drain, should be connected to the metal housing of the connector at each end of the cable. Never run the shield or the drain through the connector on any of the pins.

The following picture shows an example of a cutting table ground bus with an XPR cutting system. The components shown here may differ from your system.



1 Gantry ground bus

2 Ground rod

3 Plasma system lead (+)

4 Gas connect console

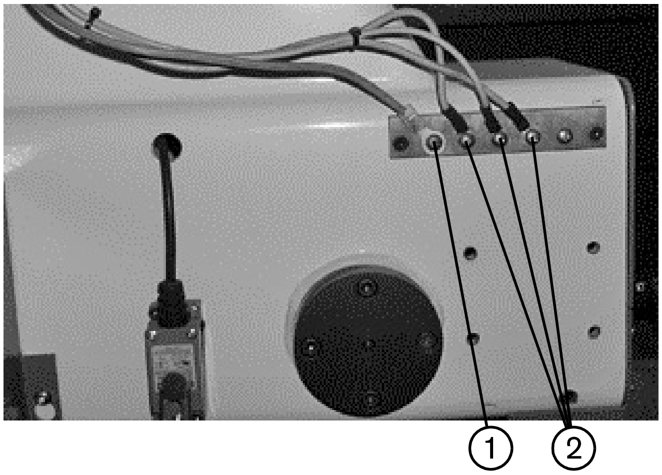
5 CNC enclosure

6 Torch holder

7 Plasma system chassis

8 Torch connect console

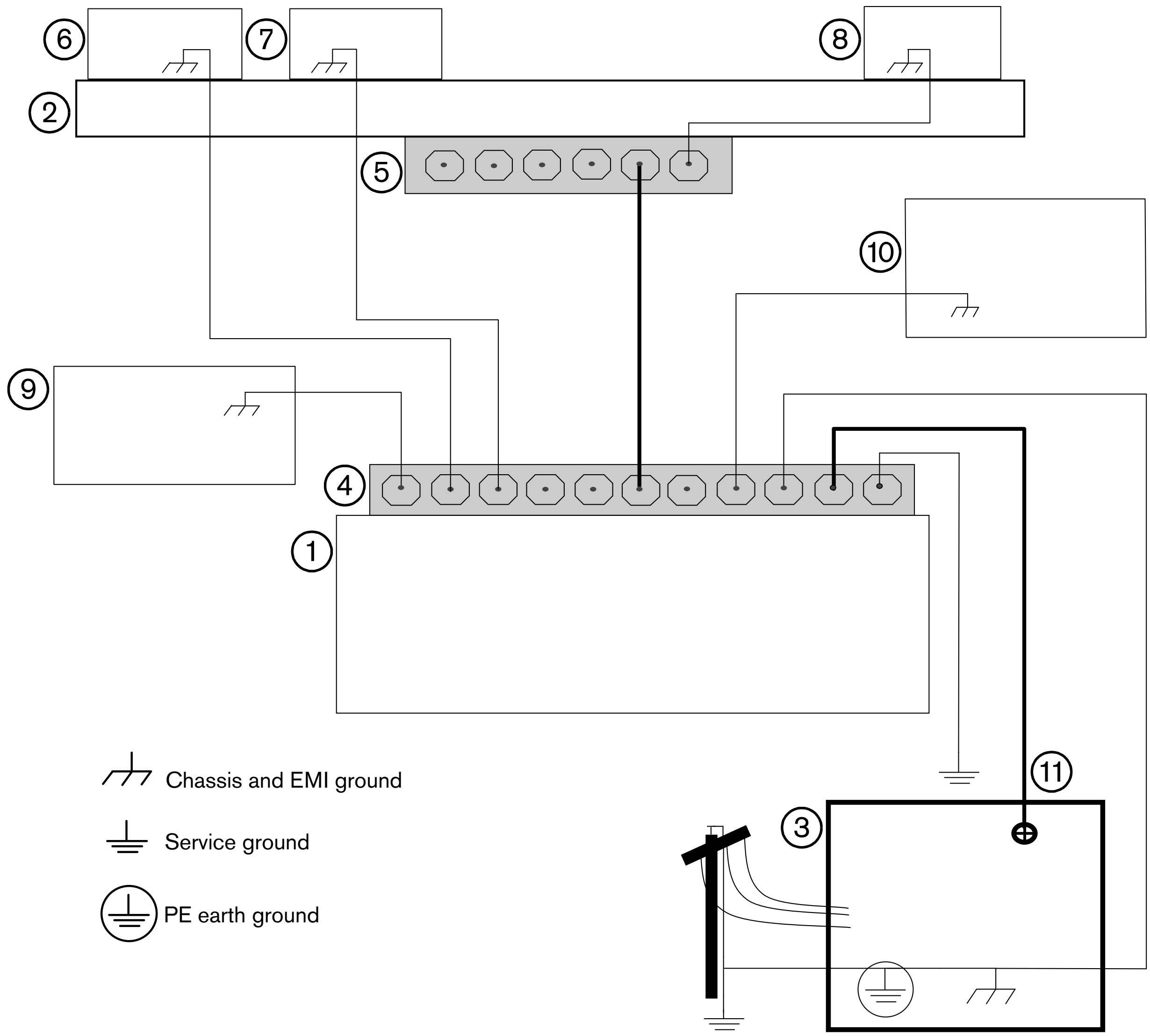
The following picture shows an example of a gantry ground bus. It is bolted to the gantry, close to the motor. All of the individual ground cables from the components mounted on the gantry connect to the bus. A single heavy cable then connects the gantry ground bus to the table ground bus.



1 Cable to the cutting table ground bus

2 Ground cables from components on the gantry

Example grounding diagram with an XPR cutting system



1 Cutting table
2 Gantry
3 Plasma system
4 Table ground bus bar
5 Gantry ground bus bar
6 Torch height control lifter
7 Torch connect console
8 CNC controller
9 Torch height control module
10 Gas connect console. Connect to table ground bus bar.*
11 DC power ground (work)

* The ignition console is integrated into the gas connect console for XPR cutting systems.

This example is based on practices in North America. Other regions can have different local or national electrical codes. Hypertherm recommends that you consult your local and national electrical codes to make sure that the grounding and shielding practices that you use satisfy the requirements for your location.

3

Installation

Before you begin

Before you begin installation, make sure to:

- Read, understand, and follow all of the safety instructions that are in this manual, the *Safety and Compliance Manual* (80669C), the *Radio Frequency Warning Manual* (80945C), and affixed to the cutting system. Failure to follow safety instructions can result in personal injury or equipment damage.
- Get all necessary reference documents. Refer to Document requirements on page 37.
- Consider the following requirements about where to position system components:
  - Site requirements on page 60
  - Length requirements for hoses, cables, and leads on page 60
  - Bend radius requirements for hoses, cables, and leads on page 61
  - Distance requirements between high-frequency leads and control cables on page 62
  - Distance requirements for ventilation and access on page 62
  - Distance requirements for communications on page 63
- Review the Installation checklist on page 72.

This plasma system can make more than the permitted acoustical noise levels as defined by national and local codes. Always put on correct ear protection when cutting or gouging. Any acoustical noise measurements taken are related to the specific environment in which the system is used. Refer to *Noise can damage hearing* in the *Safety and Compliance Manual* (80669C).

In addition, you can find an *Acoustical Noise Data Sheet* for your system at www.hypertherm.com/docs. In the search box, enter **data sheet**.

Installation checklist

System requirements

Electrical	
Refer to System electrical requirements on page 40.	
☐	Make sure that the electrical system conforms to all applicable codes.
☐	Make sure that the input power meets requirements. Refer to Input power requirements on page 40.
☐	Make sure that the circuit breaker or fuse meets requirements. Refer to Circuit breaker and fuse requirements on page 42.
☐	Make sure that the main power cord is the correct size and correctly installed. Refer to Main power cord requirements on page 42. As an installer or user, you must supply the main power cord for your cutting system.
☐	Make sure that there is a separate line-disconnect switch for the plasma power supply. Refer to Line-disconnect switch requirements on page 41. As an installer or user, you must supply the line-disconnect switch for your cutting system.
☐	Make sure that the emergency-stop switches are correctly installed. As an installer or user, you must supply the emergency-stop switches for your cutting system.
☐	Make sure that the remote on-off switch is correctly installed. Refer to Remote on-off switch on page 43. As an installer or user, you must supply the remote on-off switch for your cutting system.

Process gas and plumbing		
Refer to Process gas requirements (Core, CorePlus, VWI, and OptiMix gas connect consoles) on page 44. You must supply the process gases and supply gas plumbing for your cutting system.		
☐	Make sure that the gas quality meets requirements.	
☐	Make sure that the gas pressure meets requirements.	
☐	Make sure that the gas flow meets requirements.	
☐	Make sure that the gas plumbing and hoses meet requirements. Refer to Plumbing for supply gases on page 46. The cutting system comes with the hoses that connect the plasma power supply components. As an installer or user, you must supply the plumbing for the process gases.	
	☐	Make sure that the plumbing is the correct type and correctly installed. As an installer or user, you must supply flashback arrestors for your cutting system if you use oxygen as the plasma gas.
	☐	Make sure that the hoses are the correct type and length, and that they are correctly installed.
	☐	Make sure that the regulators are the correct type, installed in the correct locations, and correctly installed. Refer to Regulators for supply gases on page 48. As an installer or user, you must supply the gas regulators for your cutting system.
	☐	Make sure that the plumbing conforms to all applicable codes.

Shield water (VWI and OptiMix)

Refer to Shield water requirements (VWI and OptiMix) on page 50. You must supply the shield water for your cutting system.

- ☐ Make sure that the water quality meets requirements.
- ☐ Make sure that the water pressure meets requirements.
- ☐ Make sure that the water flow meets requirements.
- ☐ Make sure that the water plumbing and hoses meet requirements. Refer to Plumbing and hose requirements for shield water on page 51.

  As an installer or user, you must supply the plumbing and hoses for shield water.
  - ☐ Make sure that the plumbing is the correct type and correctly installed.
  - ☐ Make sure that the hoses are the correct type and length, and that they are correctly installed.
  - ☐ Additional water pressure regulators are only required when the water pressure is above 7.92 bar (115 psi). Refer to Additional regulator requirement for shield water (optional) on page 51.

Configuration

Refer to Requirements to position system components on page 56.

- ☐ Make sure that the configuration of system components is correct. Refer to Configuration with Core gas connect console on page 81, Configuration with CorePlus gas connect console on page 82, and Configuration with VWI or OptiMix gas connect console on page 83.
- ☐ Make sure that the spacing and ventilation for the plasma power supply meets requirements. Refer to Distance requirements for ventilation and access on page 62.

  Hypertherm recommends a minimum distance of 1 meter (3.3 feet) between the plasma power supply and other system components, or between the plasma power supply and an obstacle.
- ☐ Make sure that the surfaces that hold system components are flat, dry, clean, and can support the weight. Refer to Site requirements on page 60.
  - ☐ Make sure that the table ventilation meets requirements (if applicable) (check table type).
    - ☐ Water table
    - ☐ Downdraft table
    - ☐ Other (specify)

Hoses, cables, and leads

Do not bend the following hoses, cables, and leads beyond a minimum bend radius of 15.25 cm (6 inches): Torch lead, pilot arc lead, coolant hose set, power cable, CAN cable, 3-gas hose bundle (for the Core gas connect console), 4-gas hose bundle (for the CorePlus gas connect console), 5-gas hose bundle (for the VWI or OptiMix gas connect console), and gas supply hoses.

The cutting system comes with the cables and leads that connect system components. Refer to the following sections in the Parts List for part numbers and descriptions:

- Plasma power supply to gas connect console connections on page 400.
- Gas connect console to torch connect console connections on page 402.
- Plasma power supply to CNC connections on page 404.
- Plasma power supply to cutting table connection on page 405.
- Torch connect console to torch receptacle connection on page 406.

- [ ] Make sure that the hoses, cables and leads are the correct type. Refer to Prepare the hoses, cables, and leads on page 96.
- [ ] Make sure that the hoses, cables, and leads are the correct length. Refer to Length requirements for hoses, cables, and leads on page 60.

Grounding

- [ ] Make sure that the grounding meets requirements. Refer to Recommended grounding and shielding on page 66.
  - [ ] Plasma power supply
  - [ ] Gas connect console
  - [ ] Torch connect console
  - [ ] Cutting table
  - [ ] CNC
  - [ ] Torch lead collar

Installation steps

Connections			
☐	Make sure that the connections between the plasma power supply and the gas connect console are correctly installed. Refer to Connect the plasma power supply and gas connect console (Core, CorePlus, VWI, or OptiMix) on page 100.		
	☐	Coolant hose set	
	☐	Power cable	
	☐	CAN cable	
	☐	Negative lead (-)	
	☐	Pilot arc lead	
☐	Make sure that the work lead (+) connection between the plasma power supply and the cutting table is correctly installed. Refer to Connect the work lead to the plasma power supply and cutting table on page 105.		
☐	Make sure that the connections between the gas connect console and torch connect console are correctly installed. Refer to Connect the gas connect console (Core or CorePlus) to the TorchConnect console on page 110 and Connect the gas connect console (VWI or OptiMix) to the TorchConnect console on page 115.		
	☐	Core	Refer to Connect the gas connect console (Core or CorePlus) to the TorchConnect console on page 110.
		☐	Pilot arc and coolant hose set assembly. Refer to Connect the pilot arc and coolant hose set assembly (Core or CorePlus) on page 110.
		☐	Power, CAN, and 3-gas assembly (Core only). Refer to Connect the power, CAN, and 3-gas assembly (Core) on page 113.
	☐	CorePlus	Refer to Connect the gas connect console (Core or CorePlus) to the TorchConnect console on page 110.
		☐	Pilot arc and coolant hose set assembly. Refer to Connect the pilot arc and coolant hose set assembly (Core or CorePlus) on page 110.
		☐	Power, CAN, and 4-gas assembly (CorePlus only). Refer to Connect the power, CAN, and 4-gas assembly (CorePlus) on page 114.

Connections			
	☐	VWI / OptiMix	Refer to Connect the gas connect console (VWI or OptiMix) to the TorchConnect console on page 115.
		☐	Pilot arc, coolant hose set, and water assembly. Refer to Connect the pilot arc, coolant hose set, and shield water assembly (VWI or OptiMix) on page 115.
		☐	Power, CAN, and 5-gas assembly. Refer to Connect the power, CAN, and 5-gas assembly (VWI or OptiMix) on page 118.
☐	Make sure that the connection between the torch receptacle and torch connect console is installed correctly. Refer to Connect the torch receptacle to the TorchConnect console on page 129.		
	☐	Make sure that the hoses, cables, and leads are correctly installed.	
		☐	Make sure that the connections are the correct type and correctly installed.
		☐	Make sure that there is no damage or kinks.
		☐	Make sure that there are no coils in the cables that can create EMI problems.
		☐	Make sure that the distance between high-frequency leads and control cables meets requirements. Refer to Distance requirements between high-frequency leads and control cables on page 62.
		☐	Make sure that the distance for communication meets requirements. Refer to Distance requirements for communications on page 63.

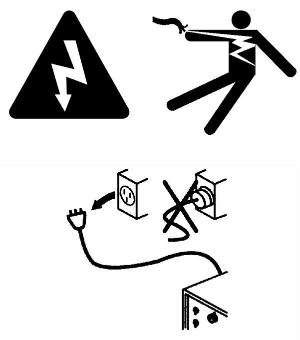
Installation steps		
☐	Make sure that the consumables are the correct type and correctly installed. A loose or overtightened electrode can cause torch damage. Hypertherm recommends between 2.3 N·m – 2.8 N·m (20 in·lbf – 25 in·lbf) torque to tighten an electrode. Refer to Install the consumables on page 136. The torch head that comes with the XPR torch assembly kit (428488) has 300 A mild steel consumables pre-installed.	
☐	Make sure that the torch is correctly installed.	
	☐	Make sure that the torch mounting bracket is correctly installed. Refer to Torch mounting bracket requirements on page 64. As an installer or user, you must supply the torch mounting bracket for your cutting system.
	☐	Make sure that the torch is correctly installed into the torch receptacle. Refer to Install the torch into the torch receptacle on page 138.
	☐	Make sure that the torch is correctly installed into the lifter. Refer to Torch lifter requirements on page 64. As an installer or user, you must supply the motorized torch lifter for your cutting system.
☐	Electrical power – Make sure that electrical power is supplied to the cutting system. Refer to Connect electric power to the cutting system on page 140.	

Installation steps		
☐	CNC interface – Make sure that the communication method is installed correctly. Refer to Connect for Communication on page 151.	
	☐	EtherCAT, and remote on-off must be wired discretely by the cutting system manufacturer
	☐	Wireless (XPR web interface) and discrete
	☐	Serial RS-422 and discrete
☐	Coolant – Make sure that the coolant is installed correctly. Refer to Coolant Installation on page 203.	
	☐	Make sure that the coolant type is correct. Refer to Coolant requirements on page 53.
	☐	Make sure that the coolant reservoir is full. Refer to How to fill the cutting system with coolant on page 204.

Safety instructions related to installation

Before installation, make sure to read, understand, and follow all of the safety instructions that are in this manual, the *Safety and Compliance Manual* (80669C), the *Radio Frequency Warning Manual* (80945C), and on to the cutting system.

WARNING



ELECTRIC SHOCK CAN KILL

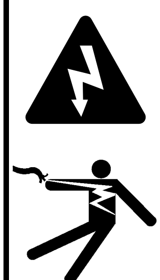
Disconnect all electric power from the plasma power supply before you move the plasma power supply or put it into position.

You can be seriously injured or killed if you move the plasma power supply while it is connected to electric power.

Damage to the plasma power supply also can occur if you move it while it is connected to electric power.

Refer to the *Safety and Compliance Manual* (80669C) for more safety information.

WARNING



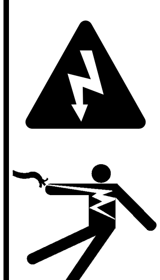
ELECTRIC SHOCK CAN KILL

The line-disconnect switch must be in the OFF position before you connect the power cord to the cutting system. It must REMAIN in the OFF position until all installation steps are complete.

If the line-disconnect switch is not in the OFF position you can get a serious electric shock. Electric shock can seriously injure or kill you.

In the United States, use a "lock out/tag out" procedure until installation is complete. In other countries, follow the appropriate national and local safety procedures.

WARNING



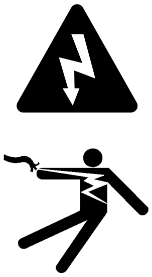
ELECTRIC SHOCK CAN KILL

When the line-disconnect switch is in the ON position, there is line voltage throughout the cutting system.

Voltages in the cutting system can cause serious electric shock. Electric shock can seriously injure or kill you.

Use extreme caution if you do diagnosis or maintenance tasks when the line-disconnect switch is in the ON position.

WARNING



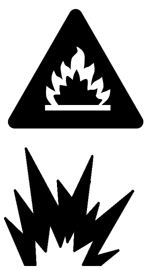
ELECTRIC SHOCK CAN KILL

The plasma power supply contains dangerous electric voltages that can seriously injure or kill you.

Even if the plasma power supply is turned OFF, you can still get a serious electric shock if the plasma power supply remains connected to an electric power source.

Use extreme caution if you do diagnosis or maintenance tasks when the plasma power supply remains connected to an electric power source and the outer cover or panels are removed.

WARNING



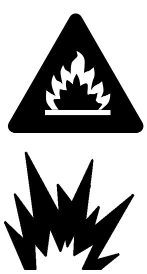
OXYGEN GAS CAN CAUSE A FIRE HAZARD

If you use oxygen as the plasma gas for cutting, it can cause a potential fire hazard due to the oxygen-enriched atmosphere that collects.

Hypertherm recommends that you install an exhaust ventilation system to remove the oxygen-enriched atmosphere that can collect when oxygen is used as the plasma gas for cutting. A fire can occur if oxygen is not removed.

Flashback arrestors are REQUIRED to stop the spread of fire to the supply gases (unless a flashback arrestor is not available for a specific gas or pressure).

As an installer or user, you must supply the exhaust ventilation and flashback arrestors for your cutting system. You can get them from your cutting machine supplier.



HYDROGEN GAS CAN CAUSE AN EXPLOSION OR FIRE

Hydrogen is a flammable gas that can cause an explosion or fire. Keep flames away from cylinders and hoses that contain hydrogen. Keep flames and sparks away from the torch when using hydrogen as a plasma gas.

Consult your local safety, fire, and building code requirements for the storage and use of hydrogen.

Hypertherm recommends that you install an exhaust ventilation system to remove the hydrogen-enriched atmosphere that can collect when hydrogen is used as the plasma gas for cutting. An explosion or fire can occur if hydrogen is not removed.

Flashback arrestors are REQUIRED to stop the spread of fire to the supply gases (unless a flashback arrestor is not available for a specific gas or pressure).

As an installer or user, you must supply the exhaust ventilation and flashback arrestors for your cutting system. You can get them from your cutting machine supplier.

WARNING

COOLANT CAN BE IRRITATING TO SKIN AND EYES AND HARMFUL OR FATAL IF SWALLOWED

Propylene glycol and benzotriazole are irritating to skin and eyes, and harmful or fatal if swallowed. When you come into contact, flush skin or eyes with water. If swallowed, seek immediate medical attention.

NOTICE

AUTOMOTIVE ANTIFREEZE CAN DAMAGE THE TORCH COOLANT SYSTEM

Never use automotive antifreeze in place of Hypertherm coolant. Antifreeze contains chemicals that can damage the torch coolant system.

CAUTION

INCORRECT COOLANT CAN DAMAGE THE CUTTING SYSTEM

Incorrect coolant can damage the cutting system. Refer to Coolant requirements on page 53.

NOTICE

PTFE TAPE CAN CAUSE CLOGGED VALVES, REGULATORS, AND TORCHES

Never use PTFE tape on any joint preparation. Use only a liquid or paste thread sealant on male thread ends.

NOTICE

DIRTY, OILY AIR CAN CAUSE DAMAGE TO THE AIR FILTER BOWL

Some air compressors use synthetic lubricants that contain esters. Esters can damage the polycarbonates in the air filter bowl. Add additional gas filtration if necessary.

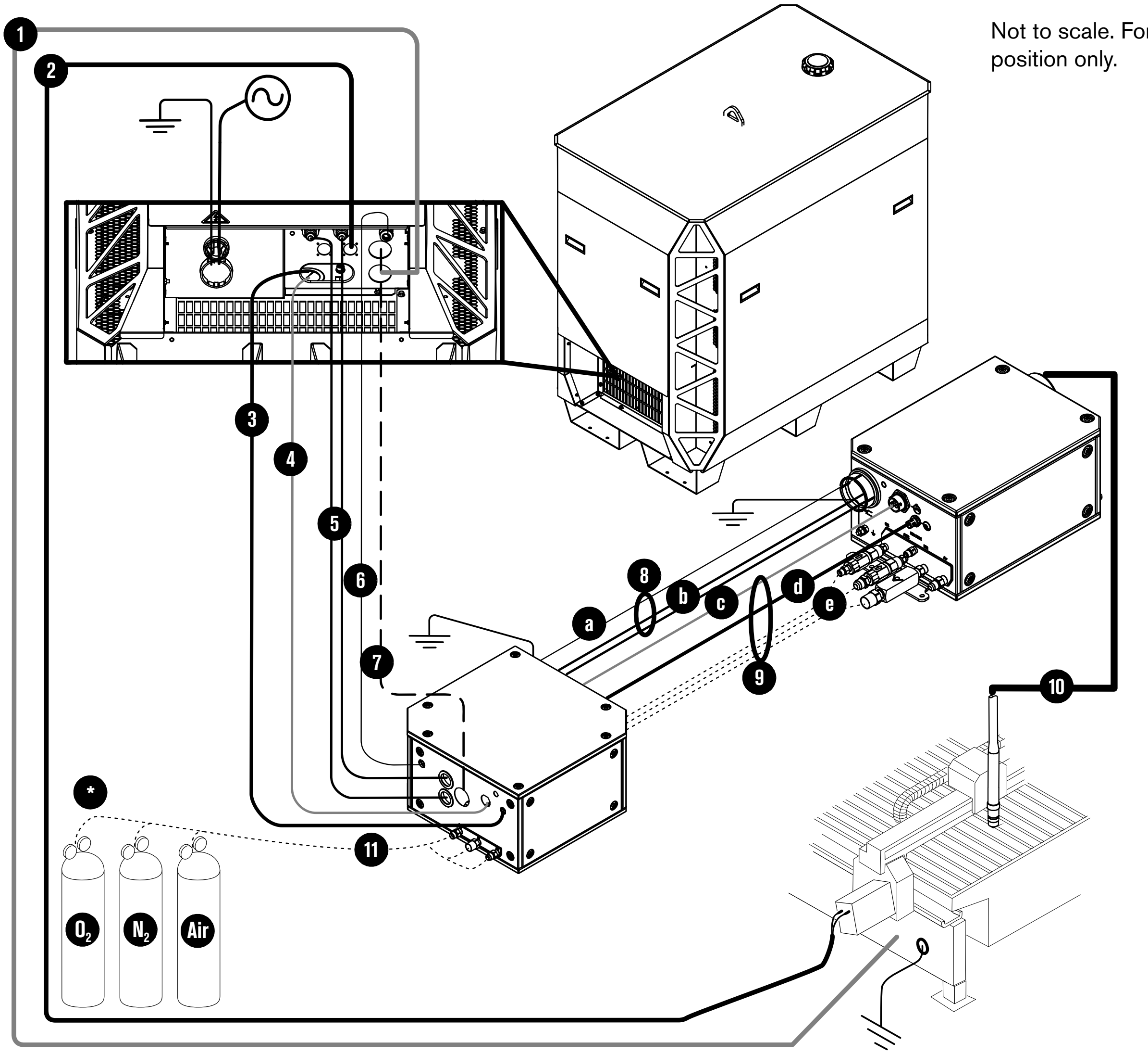
NOTICE

FOR THE BEST CUT QUALITY AND CONSUMABLE LIFE USE THE CORRECT LEAD LENGTHS

The manufactured lengths of torch and console leads are critical for system performance.

Never change the lengths of leads. Cut quality and the lifespan of consumables will be decreased if you change the lead lengths.

Configuration with Core gas connect console



1 Work lead

2 CNC connection cable (EtherCAT shown)

3 Controller area network (CAN) cable

4 Power cable (120 VAC)

5 Coolant hose set (1 supply, 1 return)

6 Pilot arc lead

7 Negative lead (2/0 or 4/0)

8 Pilot arc and coolant hose set assembly

- **a** Pilot arc lead
- **b** Coolant hose set (1 supply, 1 return)

9 Power, CAN, 3-gas assembly

- **c** Power cable (120 VAC)
- **d** CAN cable
- **e** 3 gas hoses (Core)

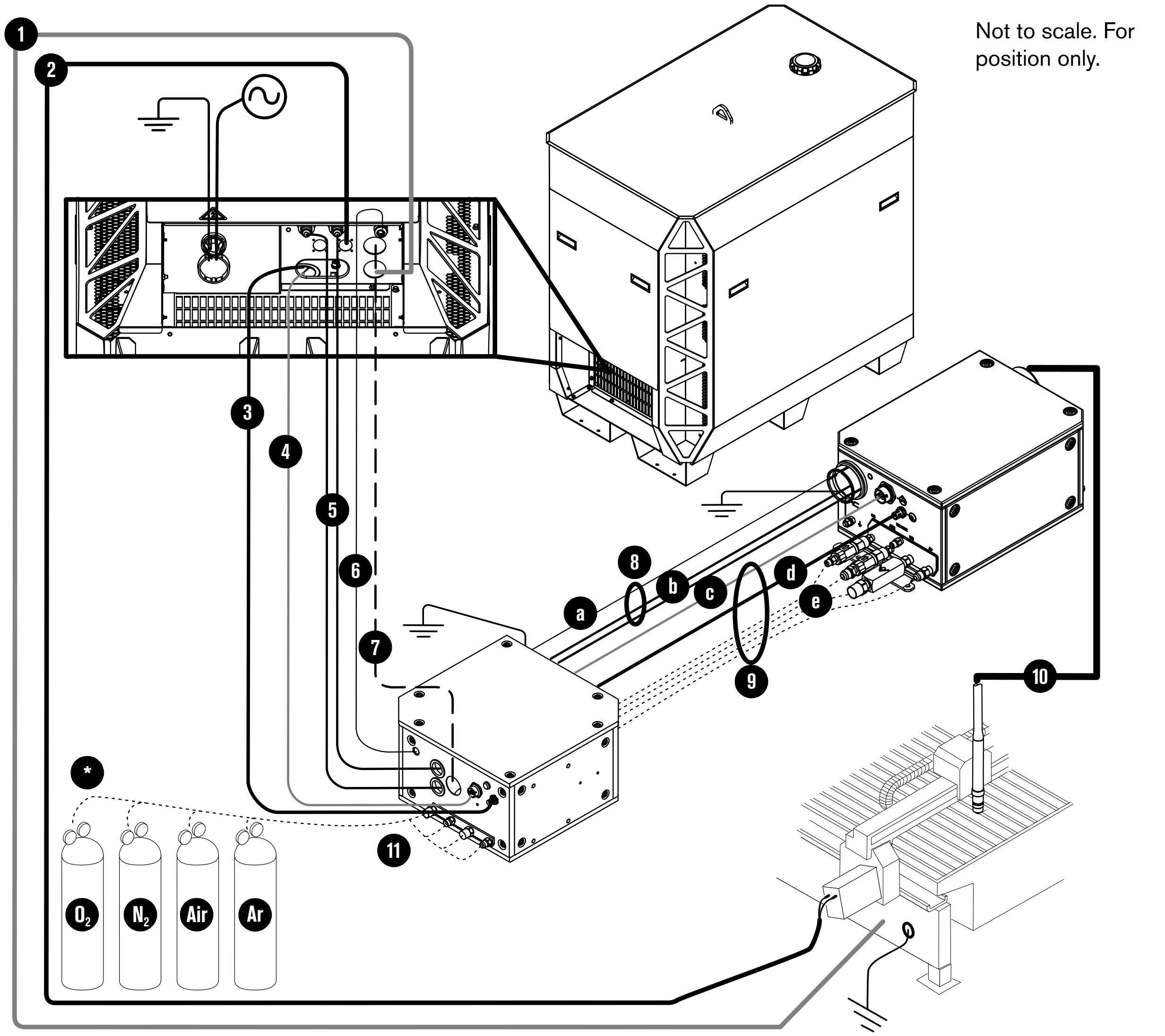
10 Torch lead

11 Hoses for supply gases

***** Regulator

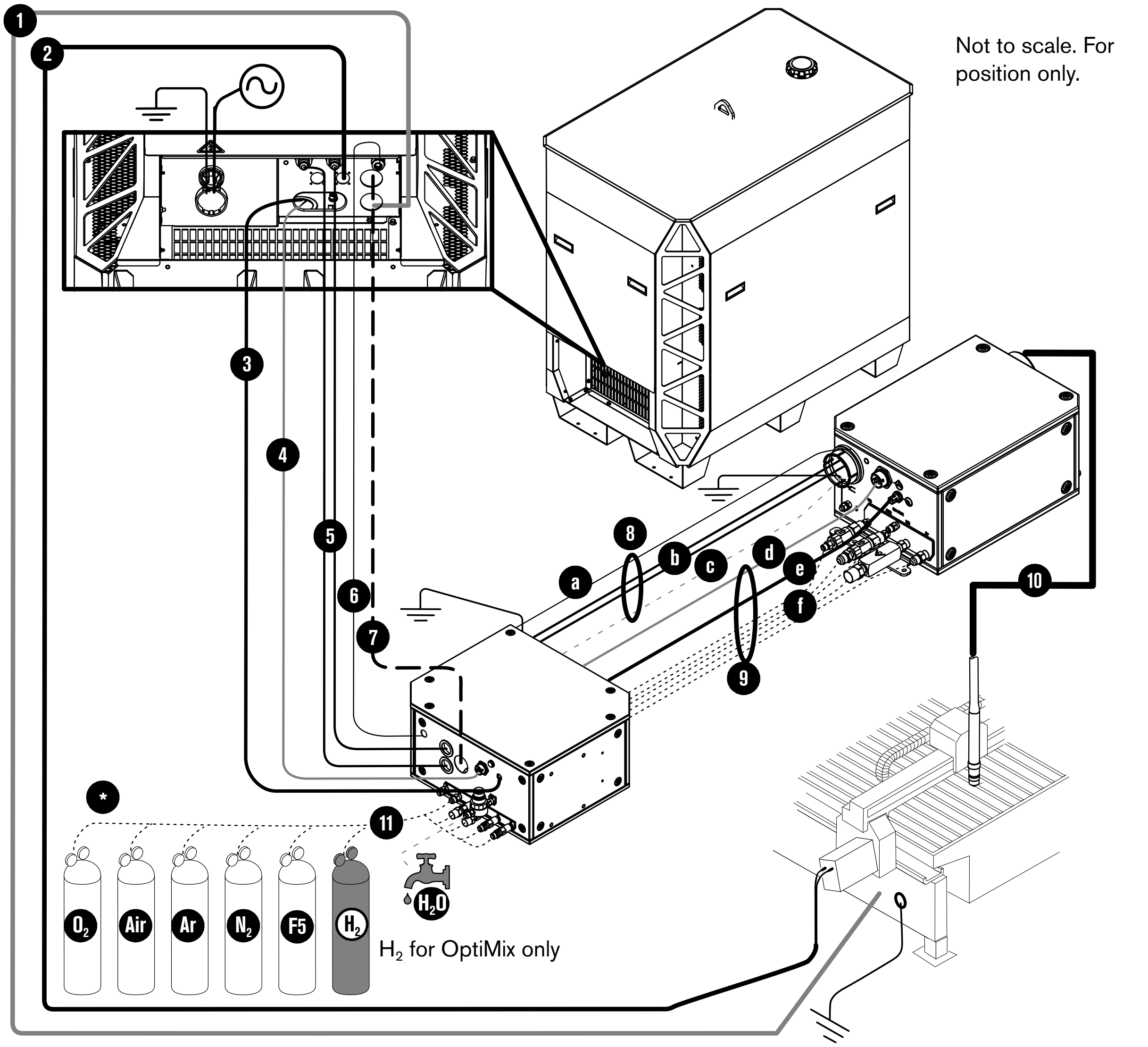
Position a gas regulator within 3 meters (10 feet) of the gas connect console or take actions to adjust inlet gas pressures to tolerances specified in the process gas requirements.

Configuration with CorePlus gas connect console



1 Work lead
2 CNC connection cable (EtherCAT shown)
3 Controller area network (CAN) cable
4 Power cable (120 VAC)
5 Coolant hose set (1 supply, 1 return)
6 Pilot arc lead
7 Negative lead (2/0 or 4/0)
8 Pilot arc and coolant hose set assembly
  a Pilot arc lead
  b Coolant hose set (1 supply, 1 return)
9 Power, CAN, 4-gas assembly
  c Power cable (120 VAC)
  d CAN cable
  e 4 gas hoses (CorePlus)
10 Torch lead
11 Hoses for supply gases
* Regulator
Position a gas regulator within 3 meters (10 feet) of the gas connect console or take actions to adjust inlet gas pressures to tolerances specified in the process gas requirements.

Configuration with VWI or OptiMix gas connect console



1 Work lead
2 CNC connection cable (EtherCAT shown)
3 CAN cable
4 Power cable (120 VAC)
5 Coolant hose set (1 supply, 1 return)
6 Pilot arc lead
7 Negative lead (2/0 or 4/0)
8 Pilot arc, coolant hose set, shield water assembly
- **a** Pilot arc lead
- **b** Coolant hose set (1 supply, 1 return)
- **c** Shield water hose (VWI or OptiMix)

9 Power, CAN, 5-gas assembly
- **d** Power cable (120 VAC)
- **e** CAN cable
- **f** 5 gas hoses (VWI or OptiMix)

10 Torch lead
11 Hoses for supply gases/shield water
***** Regulator

Position a gas regulator within 3 meters (10 feet) of the gas connect console or take actions to adjust inlet gas pressures to tolerances specified in the process gas requirements.

Installation steps

Position the system components

Put all system components into position prior to making connections.

Plasma power supply

WARNING

HEAVY EQUIPMENT CAN CAUSE SERIOUS INJURY IF DROPPED – LIFT CAREFULLY

When lifting or moving the plasma power supply:

- Remove all cables, wires, and other potential obstacles that can get caught on the plasma power supply.
- Only use lift equipment that can safely lift and support the plasma power supply.
- If you use the lift eye to lift the plasma power supply, lift only the plasma power supply. Do not exceed the maximum lift-eye rating. See Table 1 on page 28.
- If you use a lift truck, use one with forks that extend along the entire bottom of the plasma power supply. The bottom of the plasma power supply has lift-truck slots. Make sure to use them.
- Be gentle when you put the plasma power supply into position. Do not drop it from any height.

The XPR300 plasma power supply weighs 590 kg (1,300 lbs). You must use lift equipment to put it into position. Refer to Table 17. To protect the plasma power supply from drops and damage during lifting, make sure to balance it evenly and use slow speeds.

Table 17 – Equipment to lift or move the plasma power supply

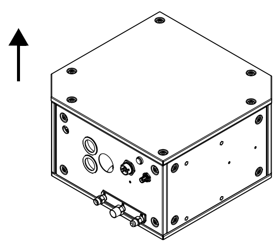
Lift truck	Lift truck forks must be long enough to fully support and extend along the entire bottom of the plasma power supply and rated to hold its weight.
Lift eye	The top of the plasma power supply has a lift eye. Prior to lifting, make sure that the lift equipment can hold the weight of the plasma power supply.

Gas connect console

All 4 gas connect consoles (Core, CorePlus, VWI, and OptiMix) have 3 mounting holes on the bottom panel. For mounting dimensions, refer to Figure 1 on page 85 and Figure 2 on page 86. If you have questions about when or how to use the mounting holes, contact your cutting machine supplier or regional Hypertherm Technical Service team.

Figure 1 – Mounting dimensions for the Core, CorePlus, and VWI gas connect consoles

Never position the gas connect console at an angle



Gas inlet side of gas connect console (Core)

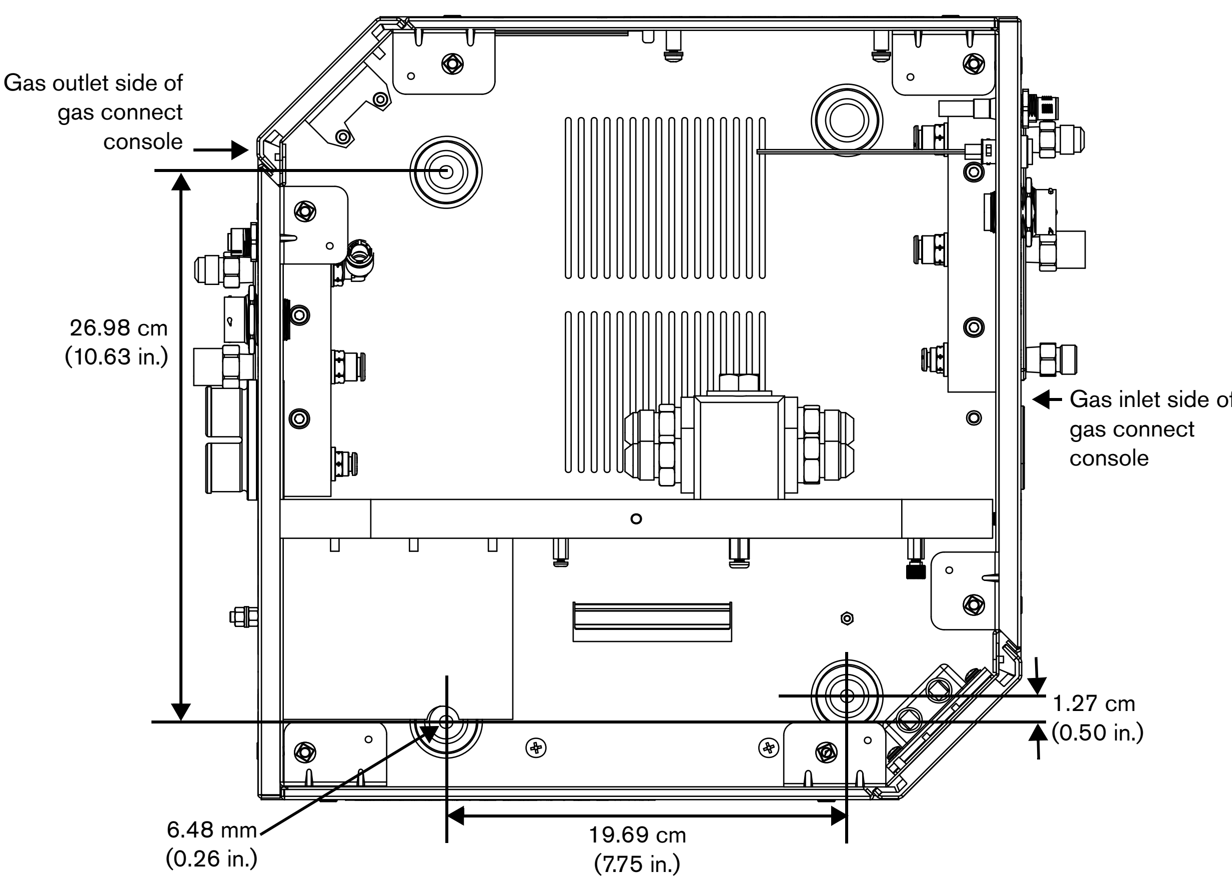
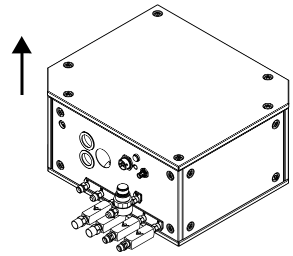
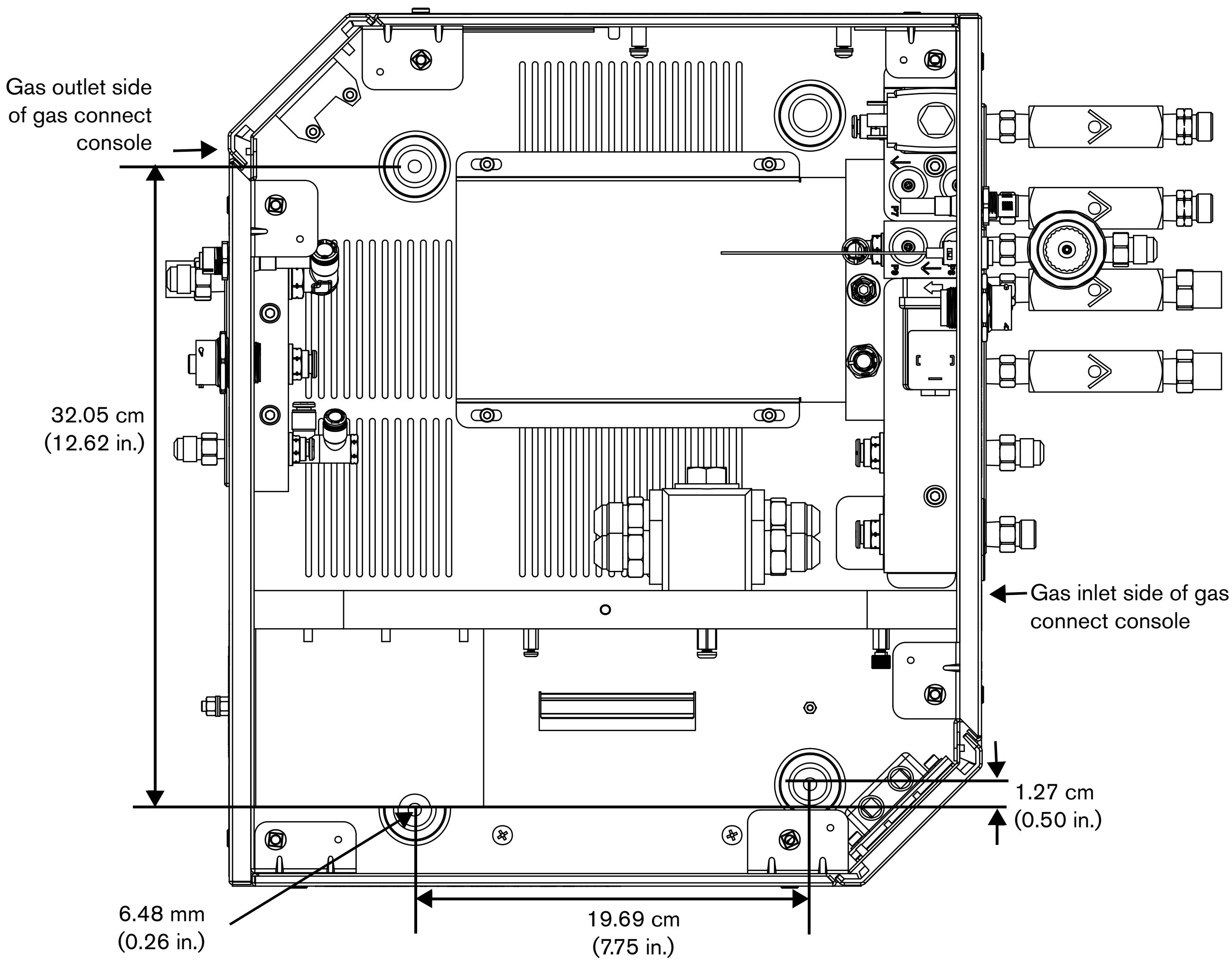


Figure 2 – Mounting dimensions for the OptiMix gas connect console

Never position the gas connect console at an angle



Gas inlet side of gas connect console (OptiMix)



TorchConnect console

There are 3 mounting orientations for the TorchConnect console: 1 bottom, 1 end, and 1 side. The factory-installed location for the mounting brackets is on the bottom. But, you can reposition them to the end or to the side.

Make sure to consider how console orientation can have the following effects:

- Console orientation with the torch lead connection on the bottom can minimize the risk of leaked water or coolant collection inside. Water or coolant inside the console can damage internal electrical components.
- If the EasyConnect connection points up, it is necessary to support the torch lead so the minimum 15.25 cm (6 in.) bend radius is maintained.

If you have questions about console orientation or about when or how to use the mounting brackets, contact your cutting machine supplier or regional Hypertherm Technical Service team.

Figure 3 – Recommended orientations for the TorchConnect console

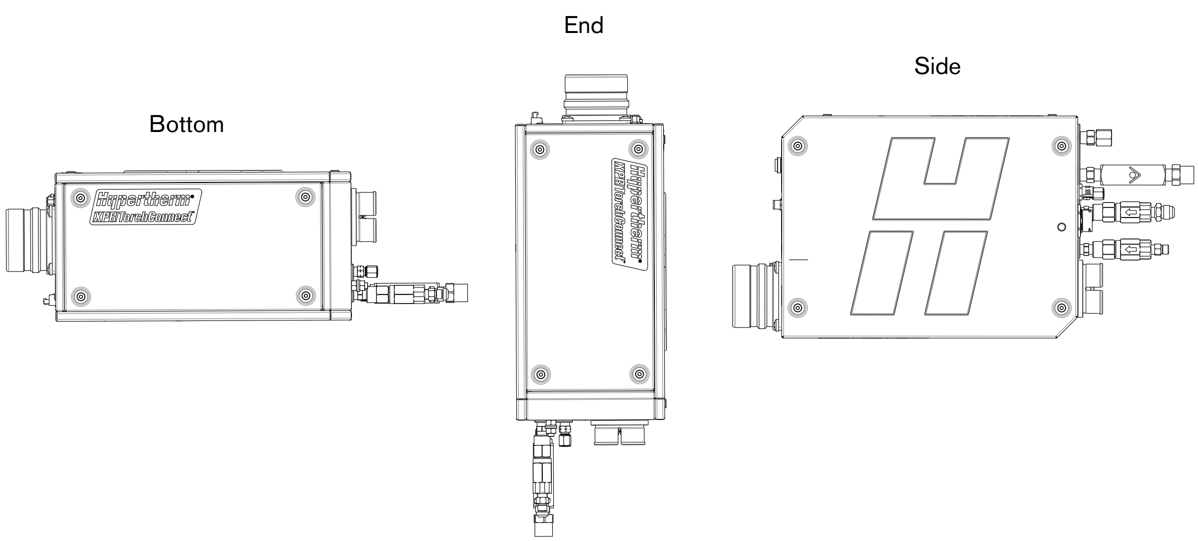


Figure 4 – Side-mount orientation and mounting-bracket dimensions for the TorchConnect console

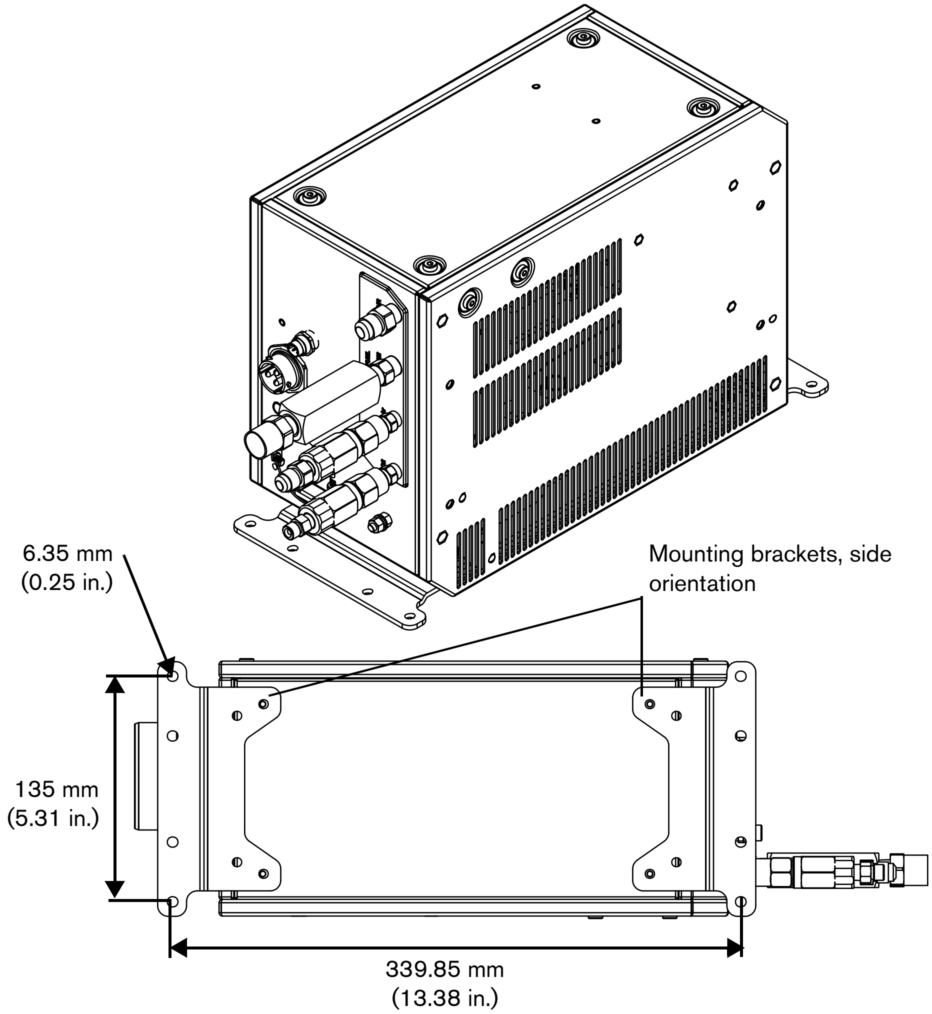
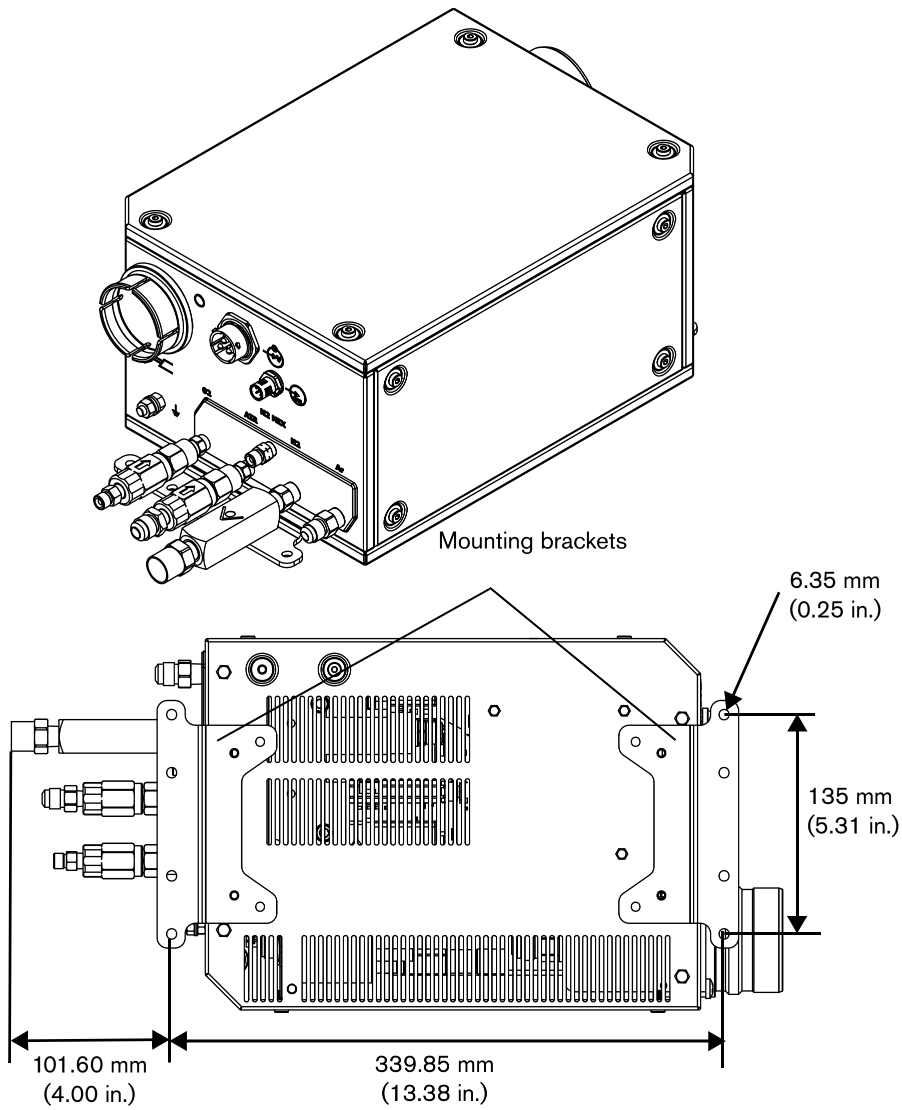


Figure 5 – Bottom-mount orientation and mounting-bracket dimensions for the TorchConnect console



Ground the system components

1. Prior to grounding, review all grounding and shielding recommendations. Refer to Recommended grounding and shielding on page 66.

2. Ground system components after you position them and before you connect the hoses, cables, and leads. Refer to Figure 6, Figure 7, Figure 8, and Figure 9 for grounding details.

Figure 6 – Plasma power supply grounding (detail)

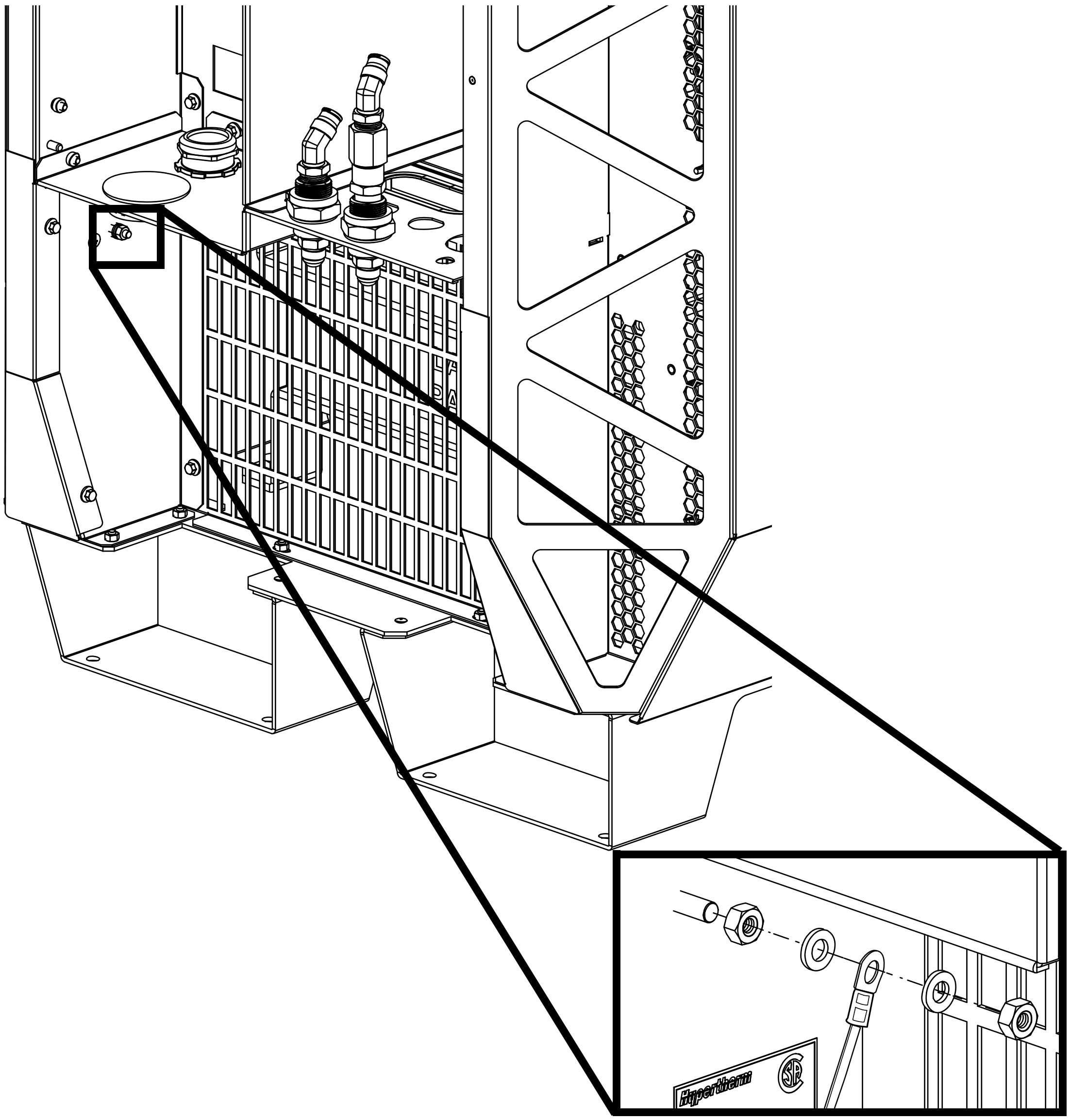


Figure 7 – Gas connect consoles grounding (detail)

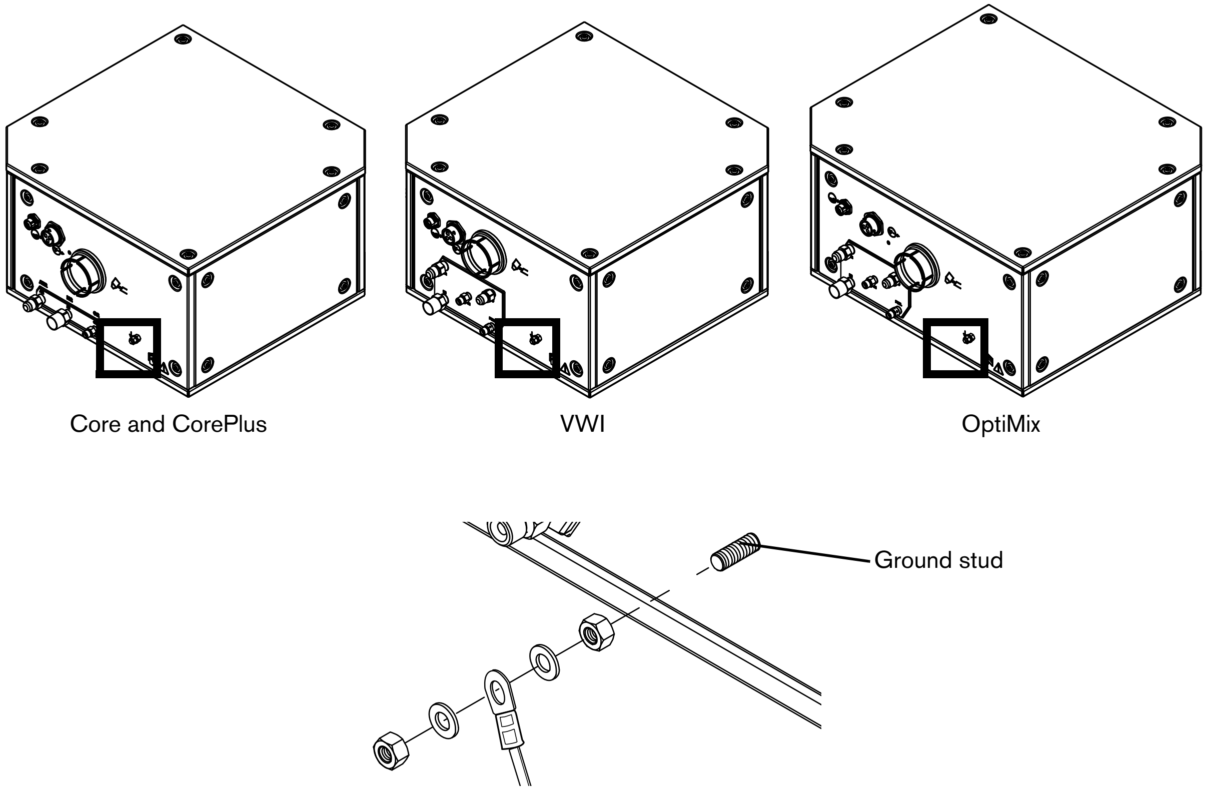


Figure 8 – TorchConnect console grounding (detail)

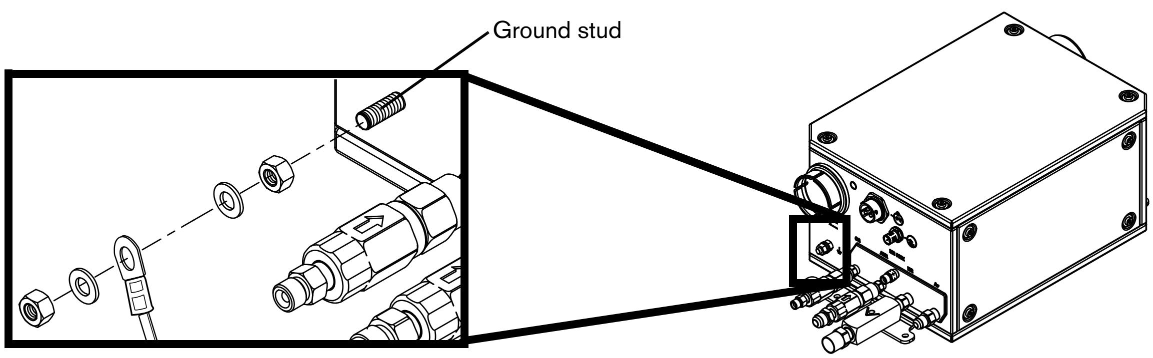
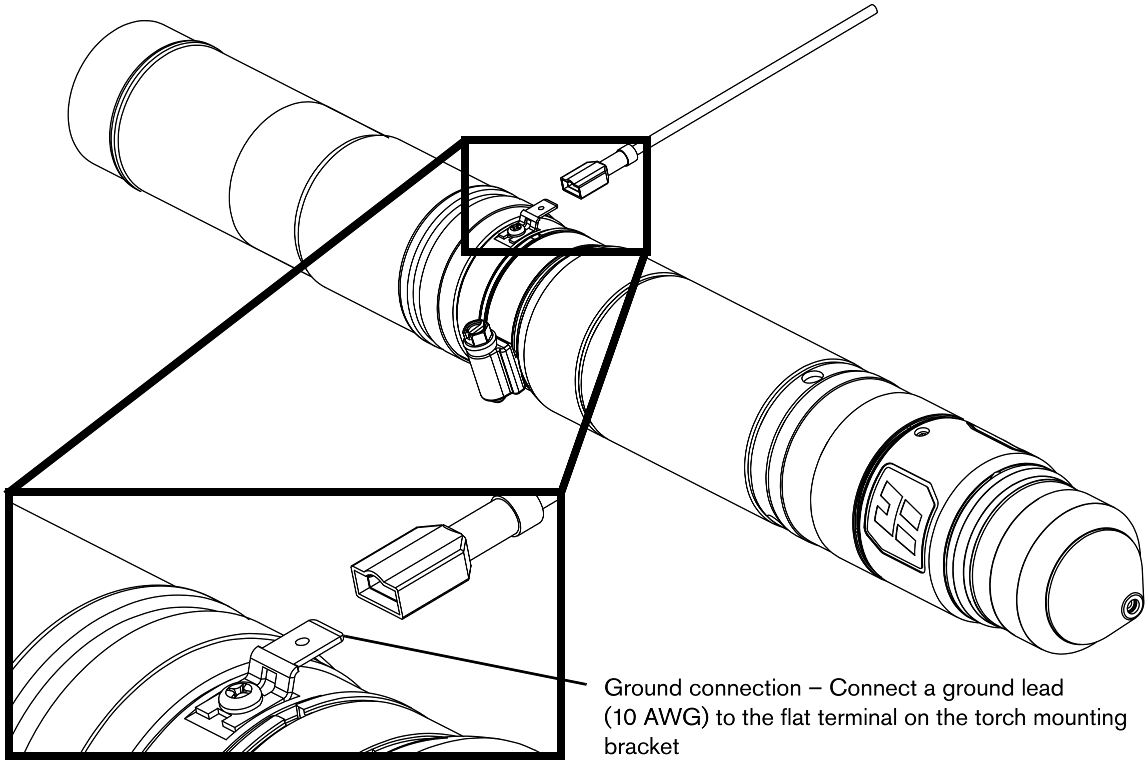
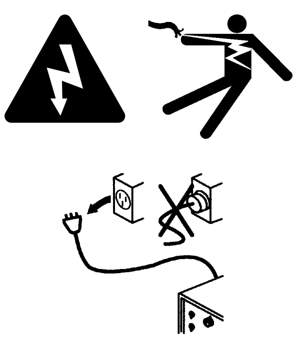


Figure 9 – Torch lead collar grounding (detail)



Remove the external panels from the system components

WARNING



ELECTRIC SHOCK CAN KILL

Disconnect electric power before doing installation or maintenance. You can get a serious electric shock if electric power is not disconnected. Electric shock can seriously injure or kill you.

All work that requires removal of the plasma power supply outer cover or panels must be done by a qualified technician.

Refer to the *Safety and Compliance Manual* (80669C) for more safety information.

WARNING

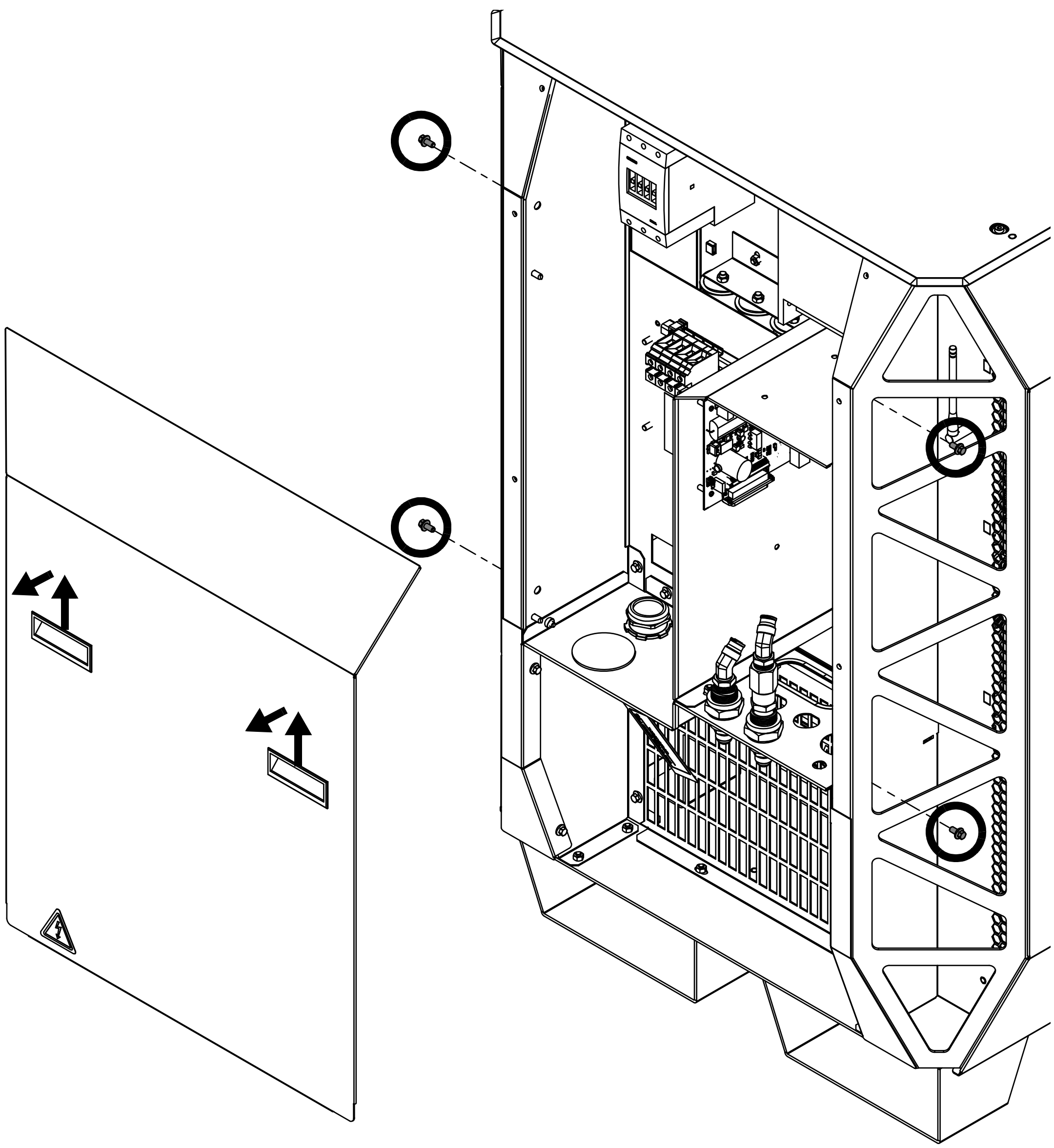
ELECTRIC SHOCK CAN KILL

The plasma power supply contains dangerous electric voltages that can seriously injure or kill you.

Even if the plasma power supply is turned OFF, you can still get a serious electric shock if the plasma power supply remains connected to an electric power source.

Use extreme caution if you do diagnosis or maintenance tasks when the plasma power supply remains connected to an electric power source and the outer cover or panels are removed.

Figure 10 – Remove the rear panel from the plasma power supply



For installation usually it is necessary to remove only the rear panel.

Figure 11 – Remove panels from the gas connect console

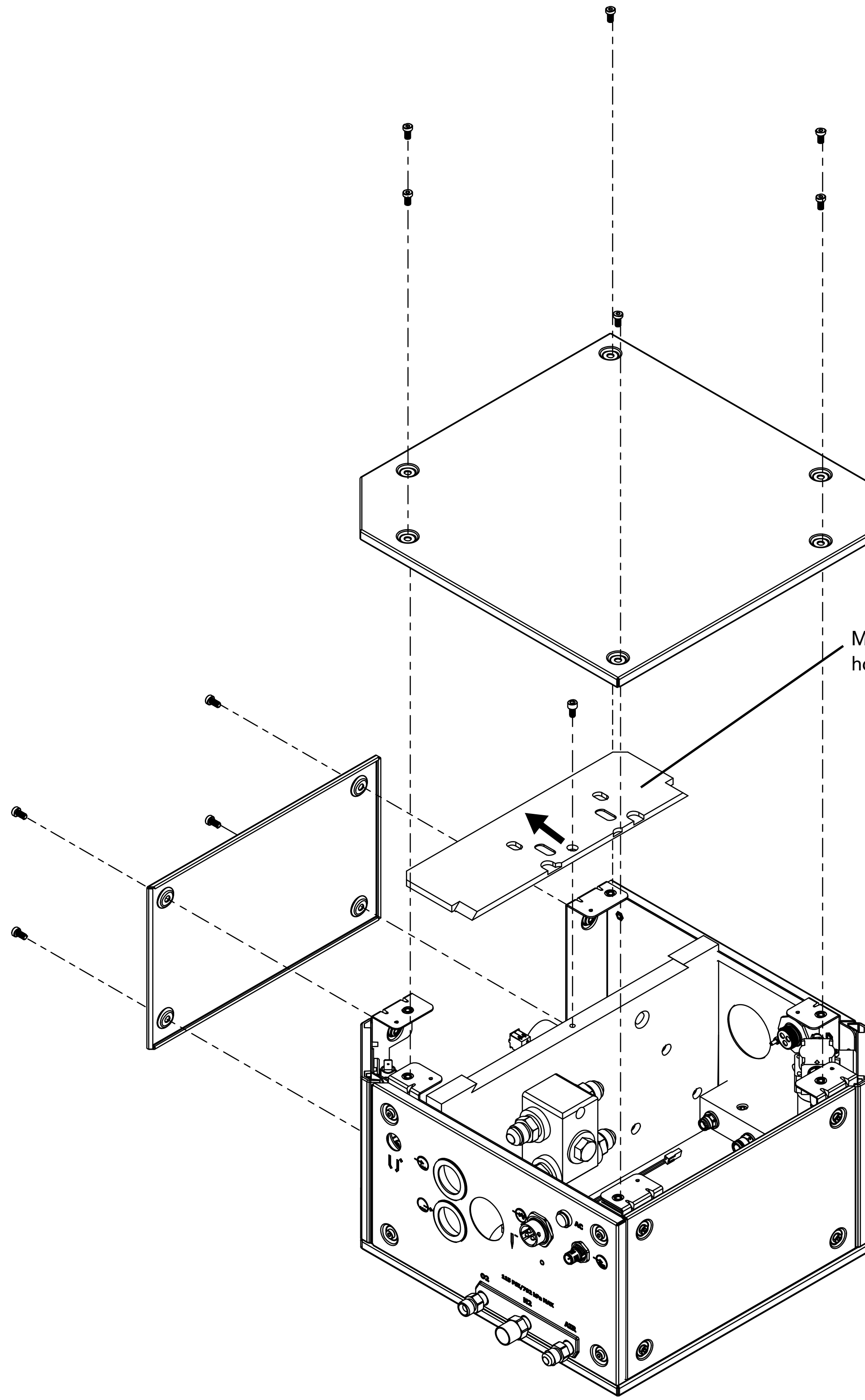
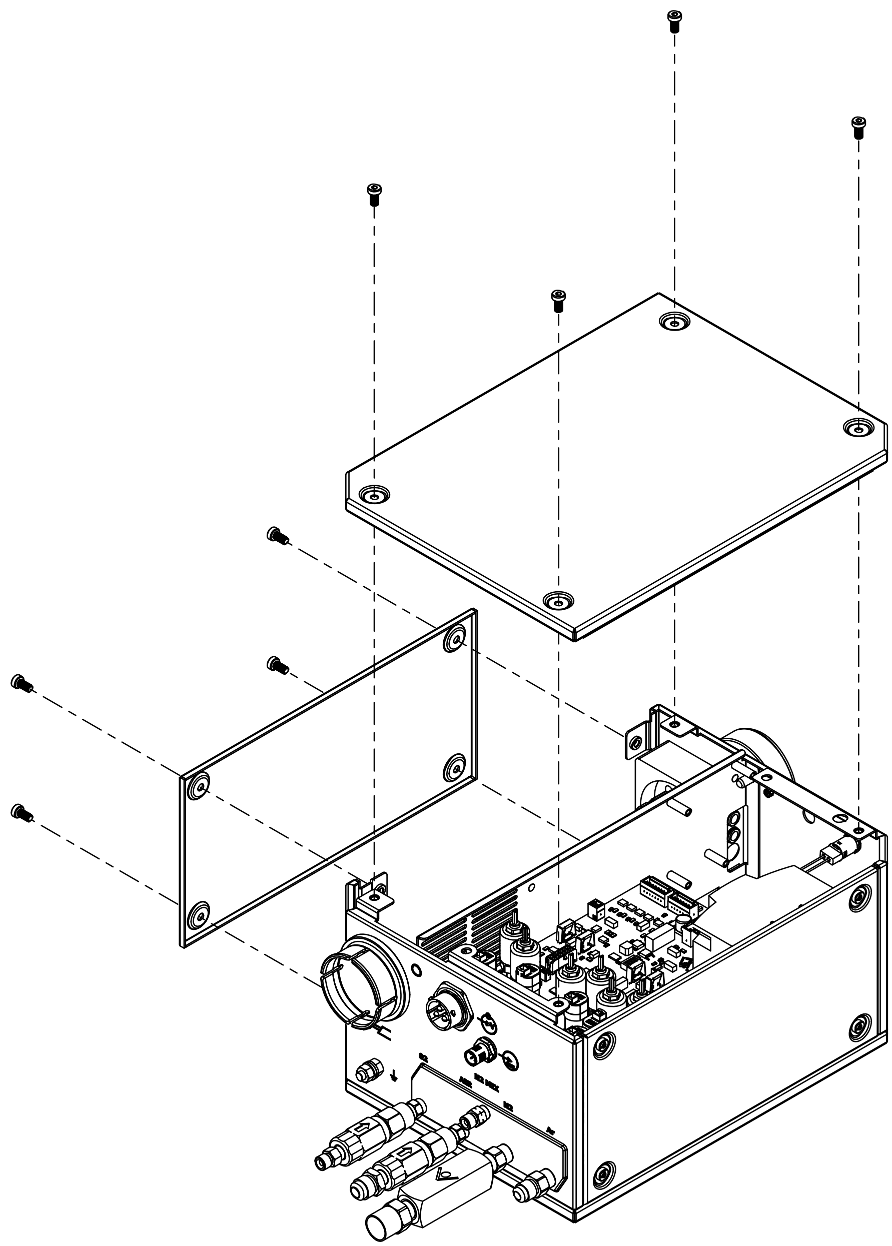


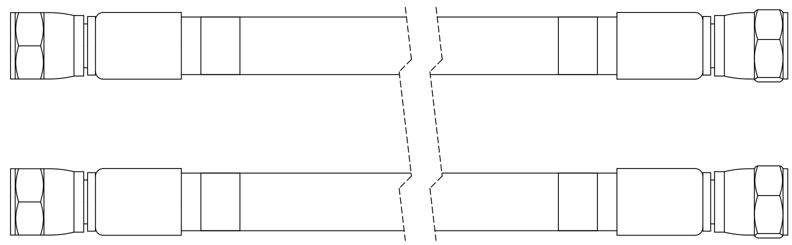
Figure 12 – Remove top and side panels from the TorchConnect console



Prepare the hoses, cables, and leads

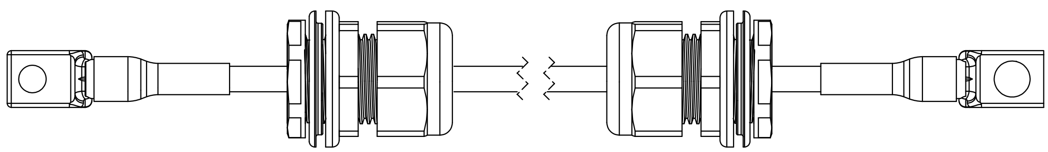
Use the following drawings to identify the correct hoses, cables, and leads prior to installation. For part numbers and specifications, refer to the Parts List on page 367.

Coolant hose set

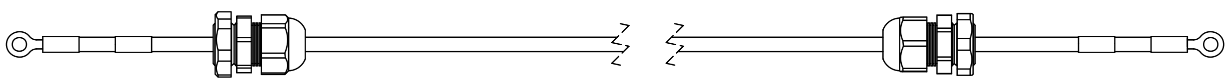


The coolant hose set includes 1 supply hose with green bands and 1 return hose with red bands.

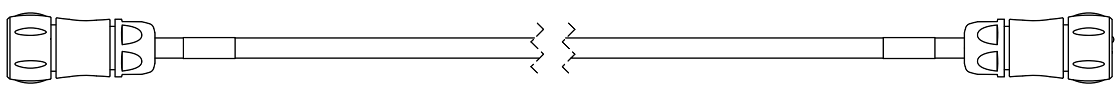
Negative lead with strain relief



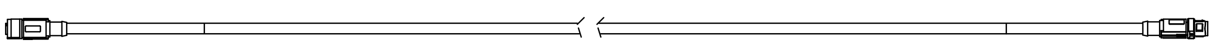
Pilot arc lead with strain relief



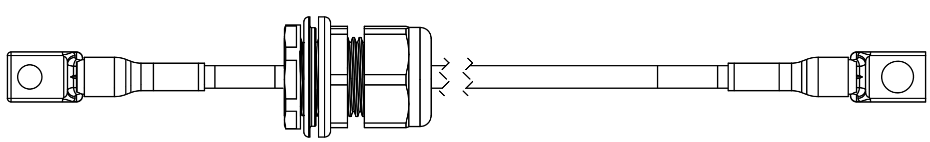
Power cable



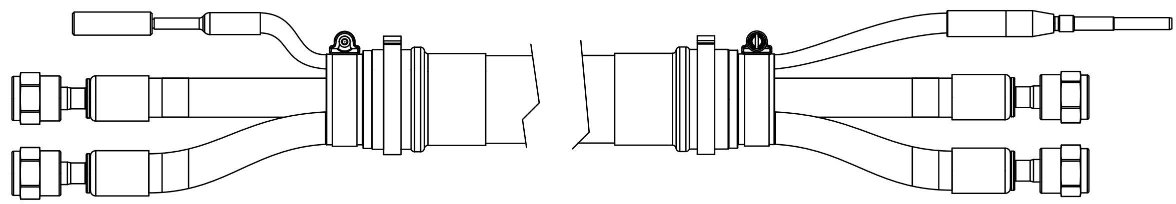
CAN cable



Work lead

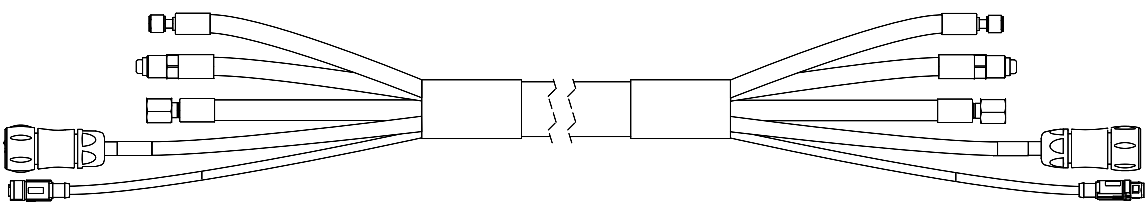


Pilot arc and coolant hose set assembly



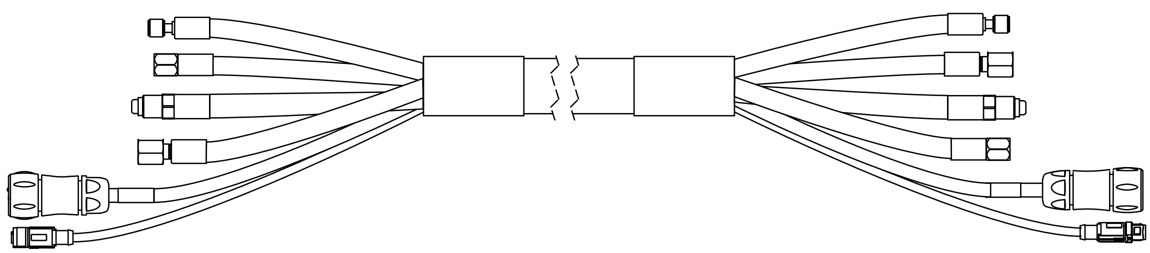
The coolant hose set includes 1 supply hose with green bands and 1 return hose with red bands. The 18 meter (59.1 feet) assembly is compatible only with the 2 meter (6.6 feet) or 2.5 meter (8.2 feet) torch lead.

Power, CAN, 3-gas assembly (only for Core)



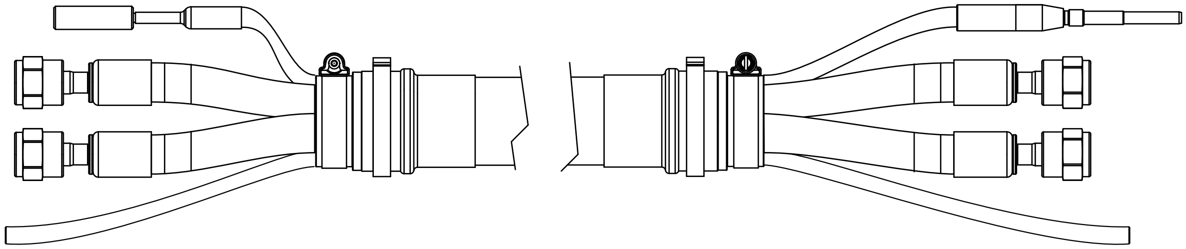
The 18 meter (59.1 feet) assembly is compatible only with the 2 meter (6.6 feet) or 2.5 meter (8.2 feet) torch lead.

Power, CAN, 4-gas assembly (only for CorePlus)



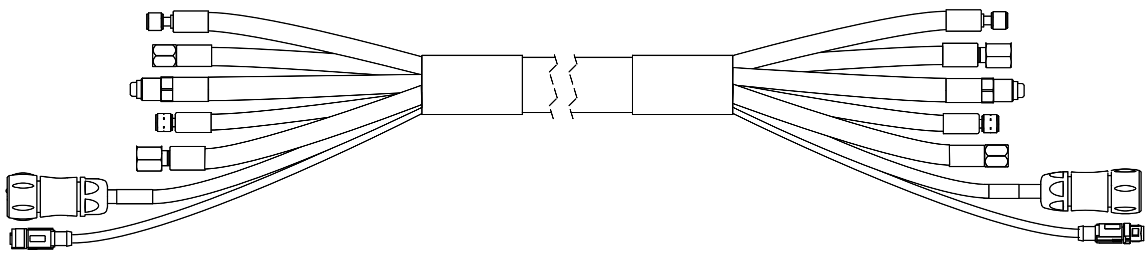
The 18 meter (59.1 feet) assembly is compatible only with the 2 meter (6.6 feet) or 2.5 meter (8.2 feet) torch lead.

Pilot arc, coolant hose set, and shield water assembly (only for VWI and OptiMix)



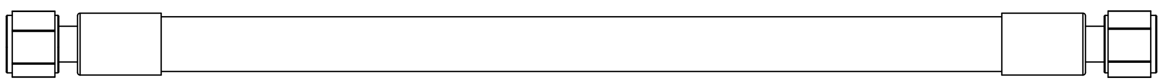
The coolant hose set includes 1 supply hose with green bands and 1 return hose with red bands. The 18 meter (59.1 feet) assembly is compatible only with the 2 meter (6.6 feet) or 2.5 meter (8.2 feet) torch lead.

Power, CAN, and 5-gas assembly (only for VWI and OptiMix)

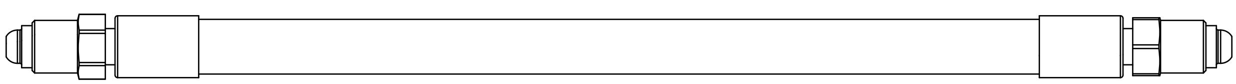


The 18 meter (59.1 feet) assembly is compatible only with the 2 meter (6.6 feet) or 2.5 meter (8.2 feet) torch lead.

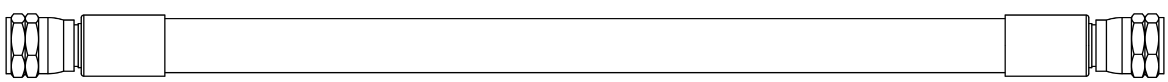
Oxygen hose (blue)



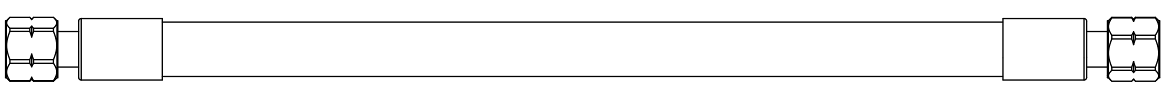
Nitrogen hose (black)



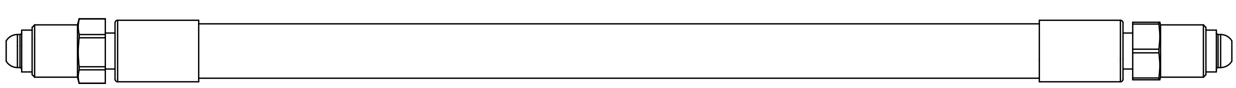
Air hose (black)



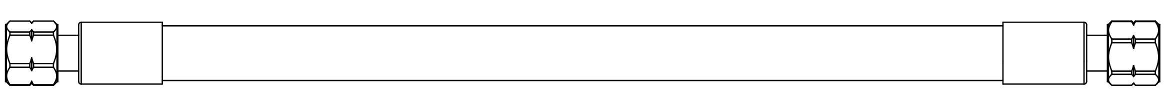
Hydrogen (OptiMix only) (red)



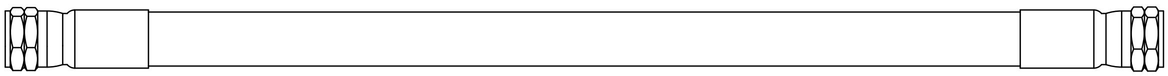
Argon (CorePlus, VWI, or OptiMix only) (black)



F5 (VWI or OptiMix only) (red)

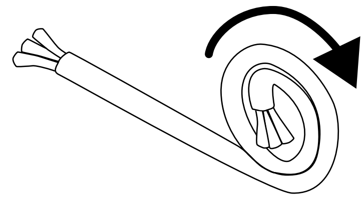


Shield water (VWI or OptiMix only) (blue)



Use a hand-over-hand motion to uncoil the hoses, cables, and leads. As you uncoil them, position the flat portion on the floor.

To avoid equipment damage, do **not** pull from one end of the hose, cable, or lead to uncoil it. Pulling from one end can cause damage.



Connect the plasma power supply and gas connect console (Core, CorePlus, VWI, or OptiMix)

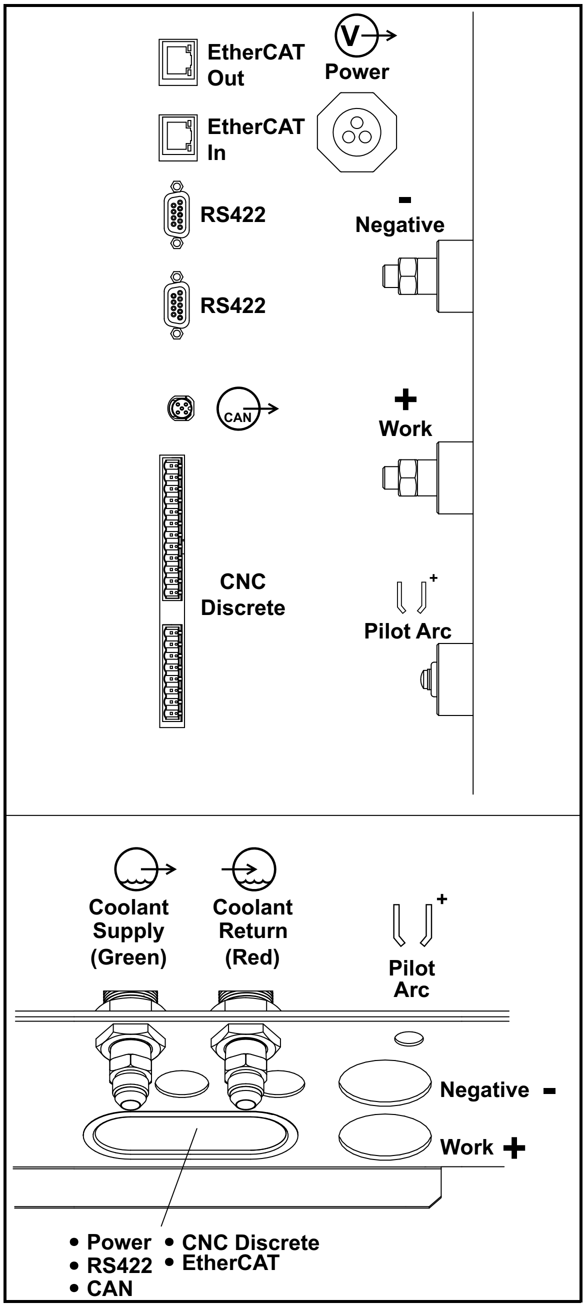
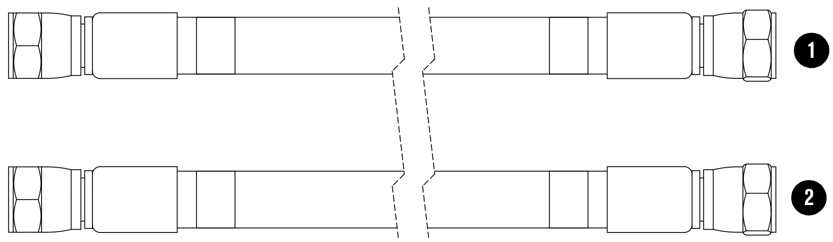


Table 18 – Definitions of symbols on the label inside the plasma power supply

CAN	CAN
V	Power
-	Negative
+	Work
	Pilot arc
	Coolant supply
	Coolant return

Connect the coolant hose set

Figure 13 – Coolant hose set



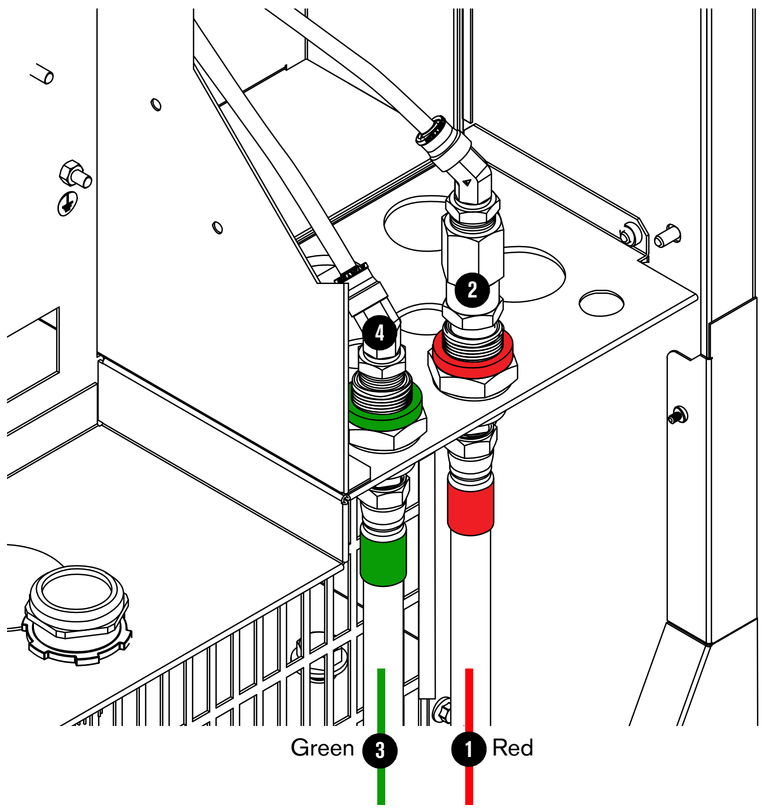
1 Coolant return hose (red band)

2 Coolant supply hose (green band)

For lengths, refer to Coolant hose set on page 401 of the Parts List.

1. Connect the coolant hose set to the plasma power supply:
   - **a.** Connect the coolant return hose (red) ❶ to the coolant return fitting (red) ❷.
   - **b.** Connect the coolant supply hose (green) ❸ to the coolant supply fitting (green) ❹.

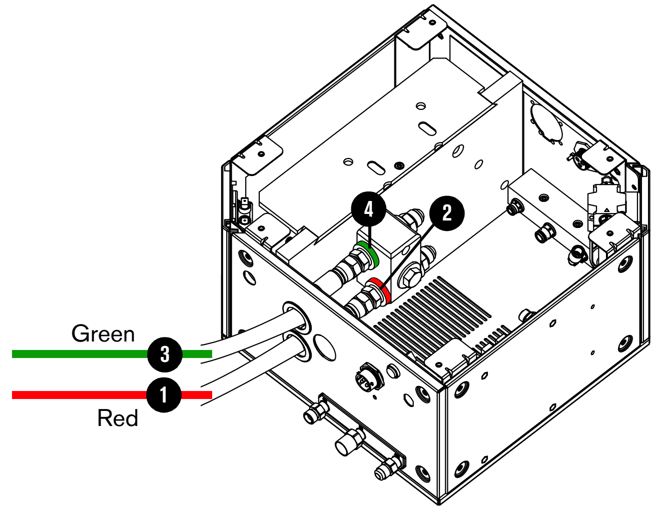
   If your cutting system previously used the XPR short torch, make sure to interchange the coolant hoses prior to standard-torch operation. Refer to the *XPR Short Torch Instruction Manual* (810640) for information about how to do this.



2. Connect the coolant hose set to the gas connect console:

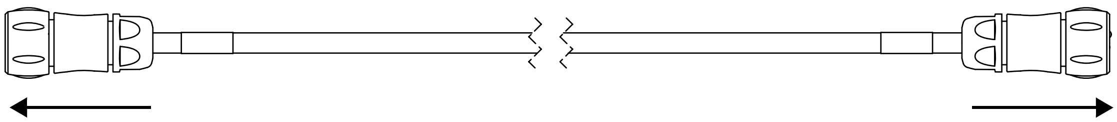
   a. Connect the coolant return hose (red) ❶ to the coolant return fitting (red, bottom) ❷.

   b. Connect the coolant supply hose (green) ❸ to the coolant supply fitting (green, top) ❹.



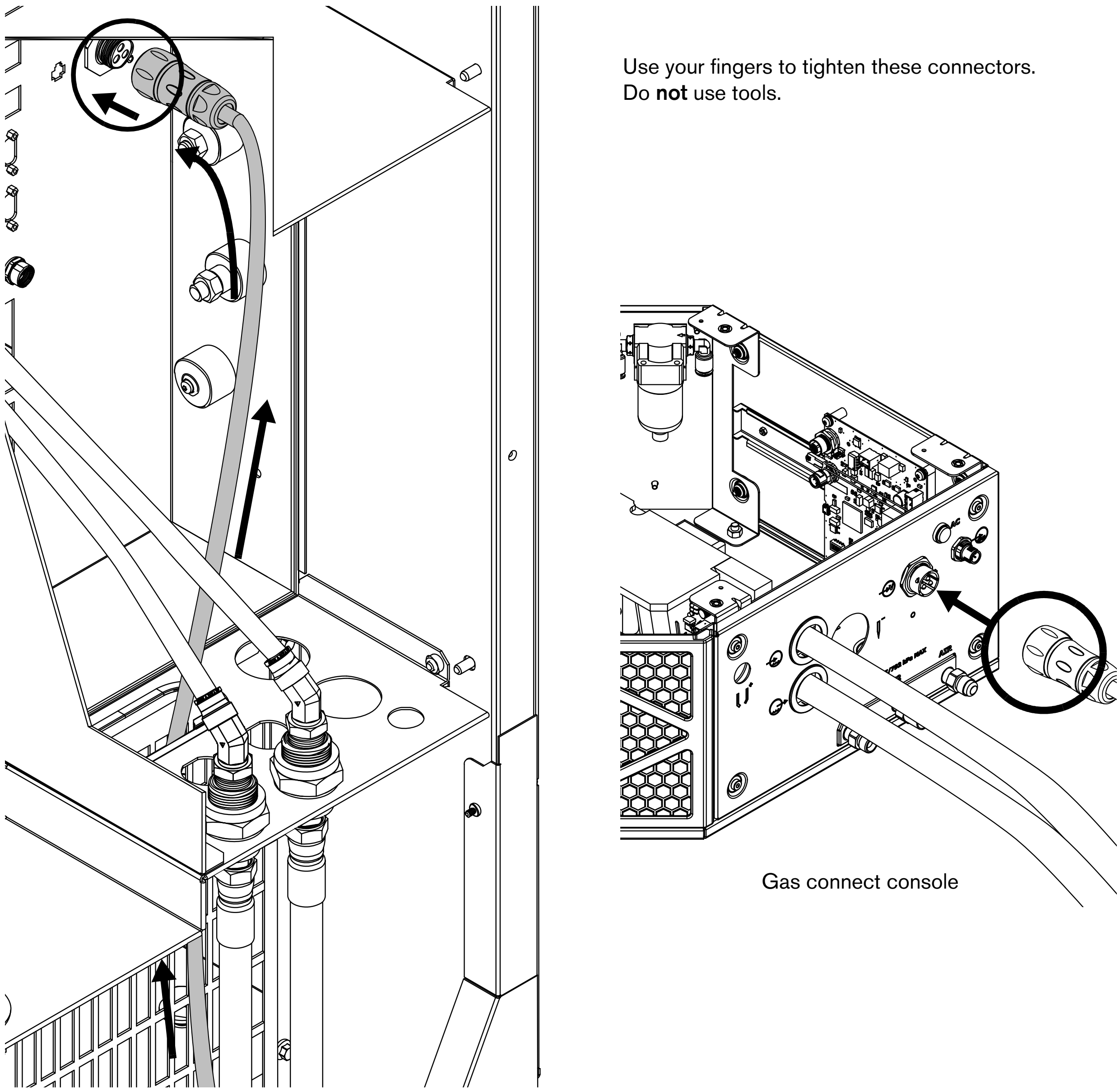
Connect the power cable

Figure 14 – Power cable



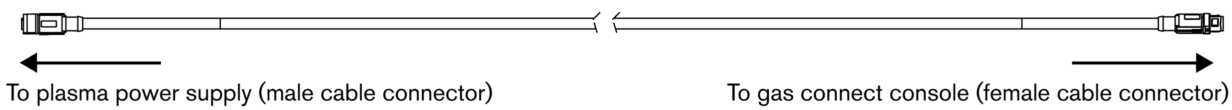
For lengths, refer to Power cable on page 401 of the Parts List.

Figure 15 – Connect the power cable



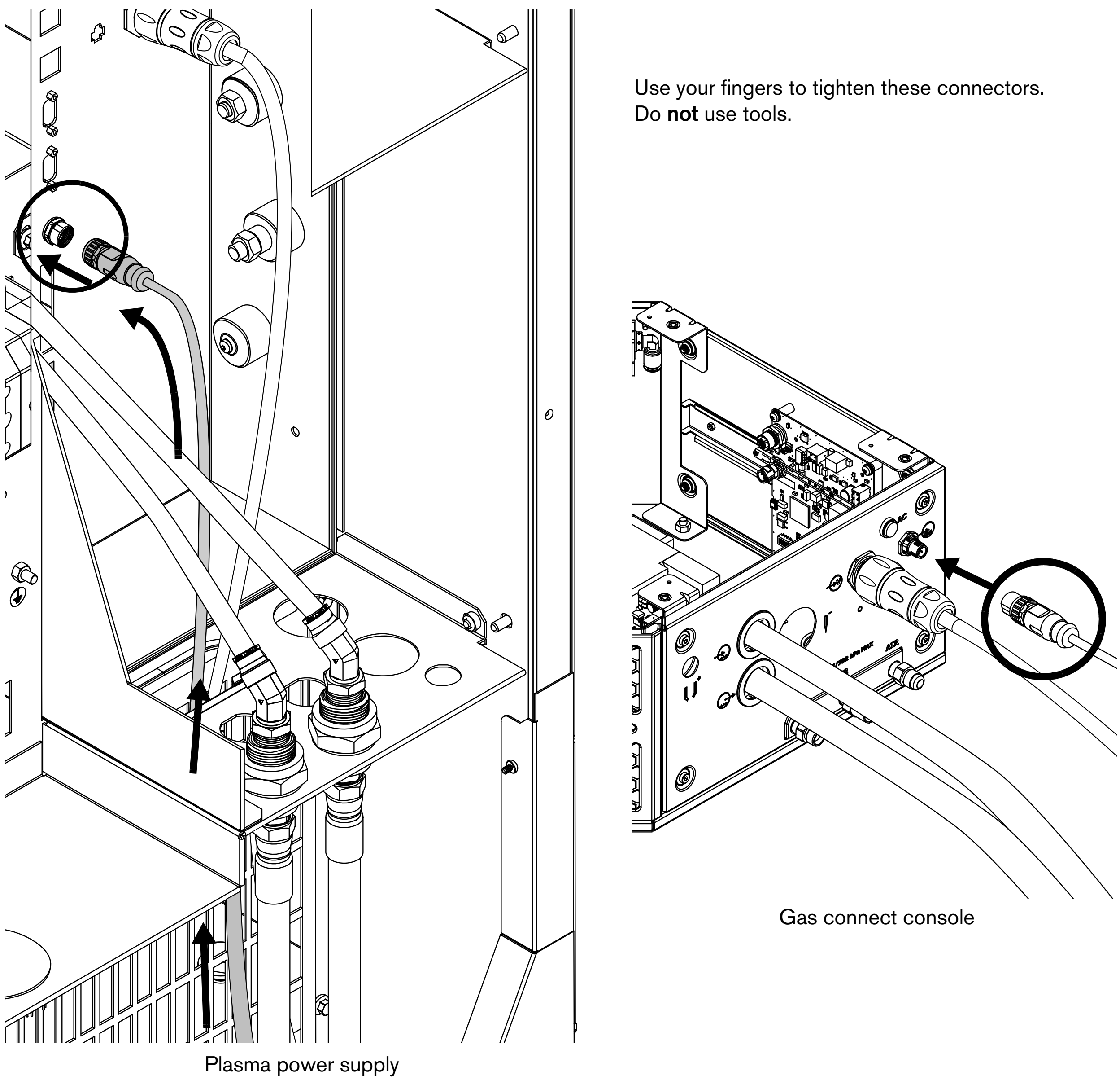
Connect the CAN cable

Figure 16 – CAN cable



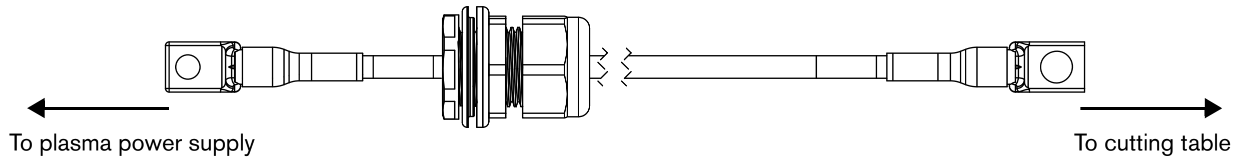
For lengths, refer to CAN cable on page 402 of the Parts List.

Figure 17 – Connect the CAN cable



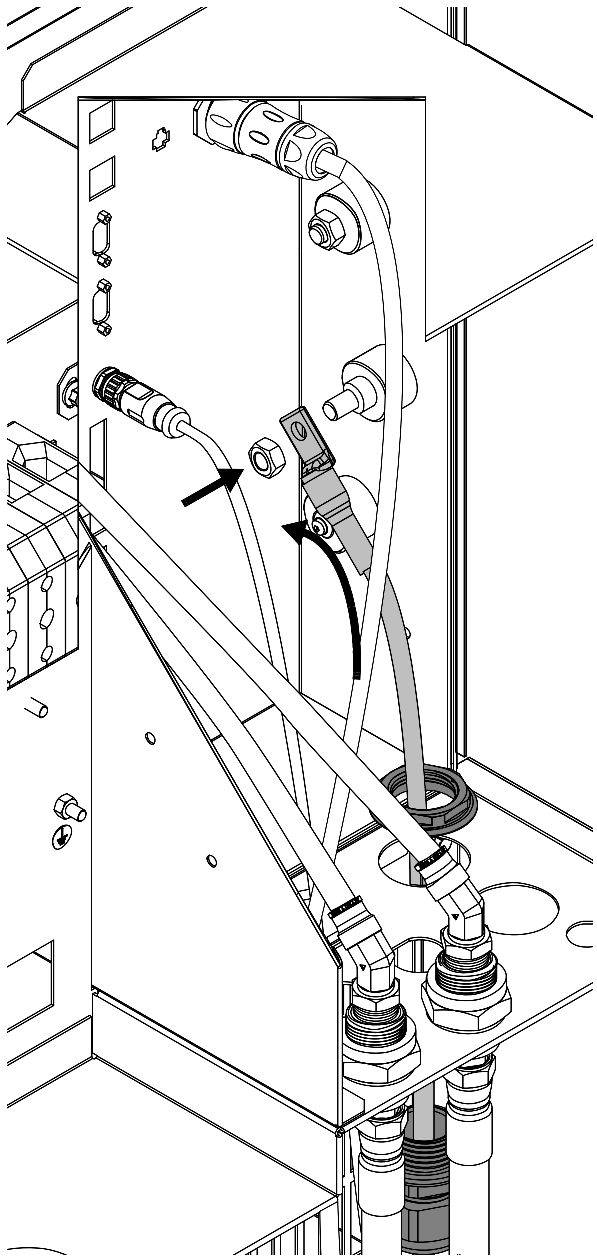
Connect the work lead to the plasma power supply and cutting table

Figure 18 – Work lead



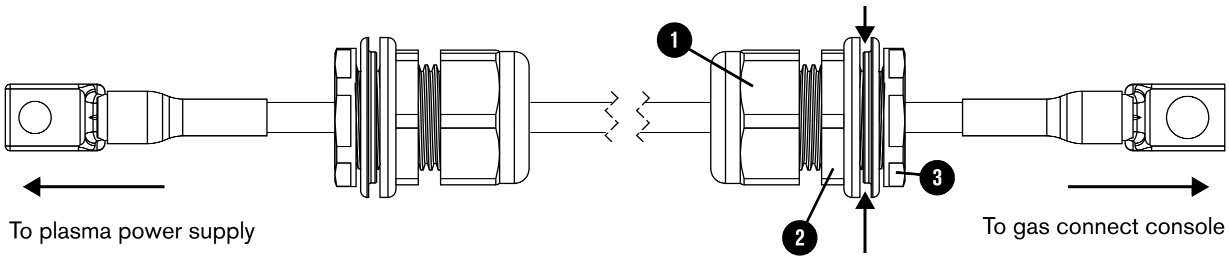
For lengths, refer to Work lead on page 405 of the Parts List.

Figure 19 – Connect the work lead to the plasma power supply (shown) and cutting table (not shown)



Connect the negative lead with strain relief

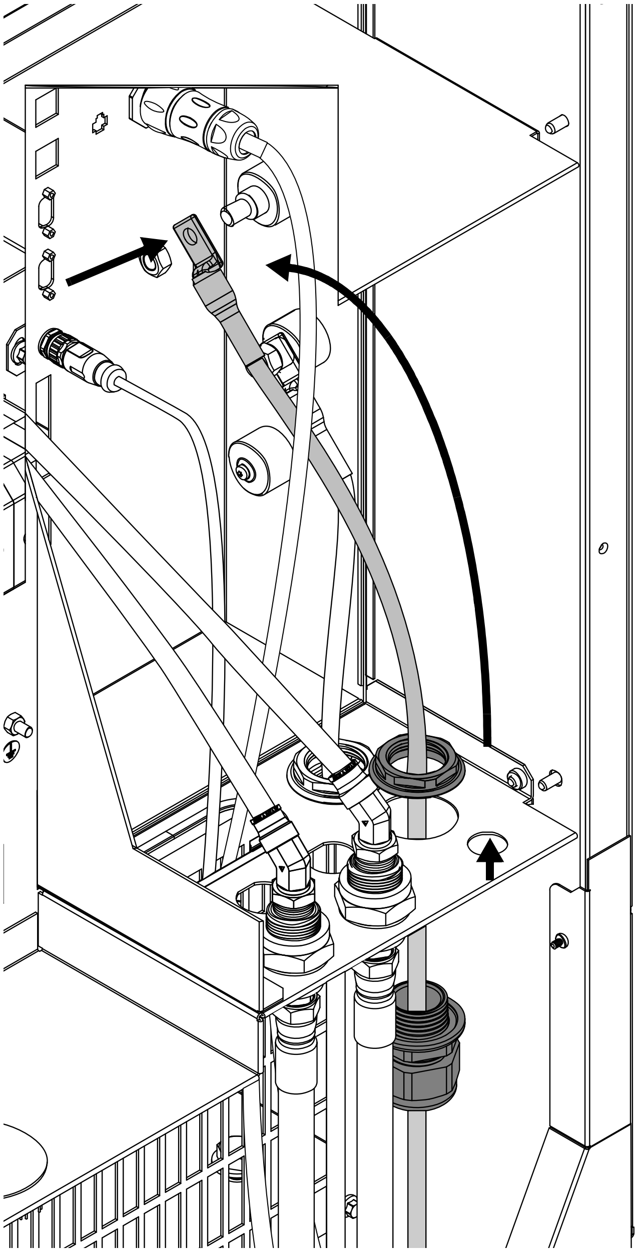
Figure 20 – Negative lead with strain relief



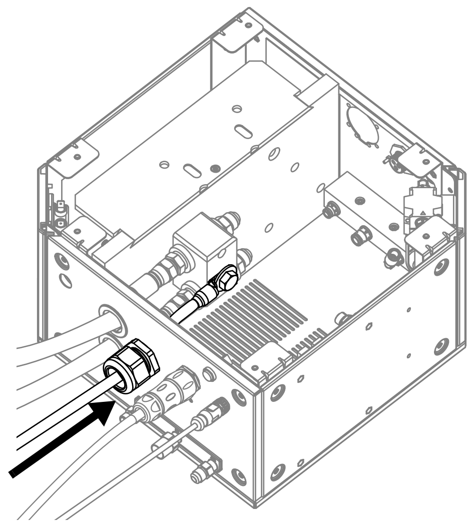
For lengths, refer to Negative lead with strain relief on page 400 of the Parts List.

1. Put the outer nut ❶ and strain relief nut ❷ onto the negative lead.
2. Put the negative lead and strain relief nut through the hole in the gas connect console or plasma power supply.
3. Put the inner nut ❸ over the end of the lead.
4. Connect the gas connect console end of the lead to the coolant block, or connect the plasma power supply end of the lead to the negative (-) connector.
5. Tighten the inner nut ❸ onto the strain relief nut ❷.

Figure 21 – Connect the negative lead with strain relief



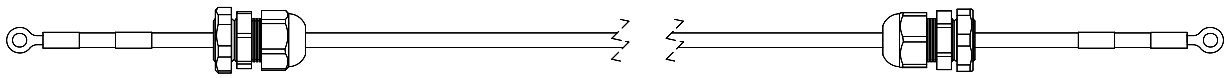
Plasma power supply



Gas connect console

Connect the pilot arc lead with strain relief

Figure 22 – Pilot arc lead with strain relief



For lengths, refer to Pilot arc lead with strain relief on page 400 of the Parts List.

Figure 23 – Connect the pilot arc lead with strain relief to the plasma power supply

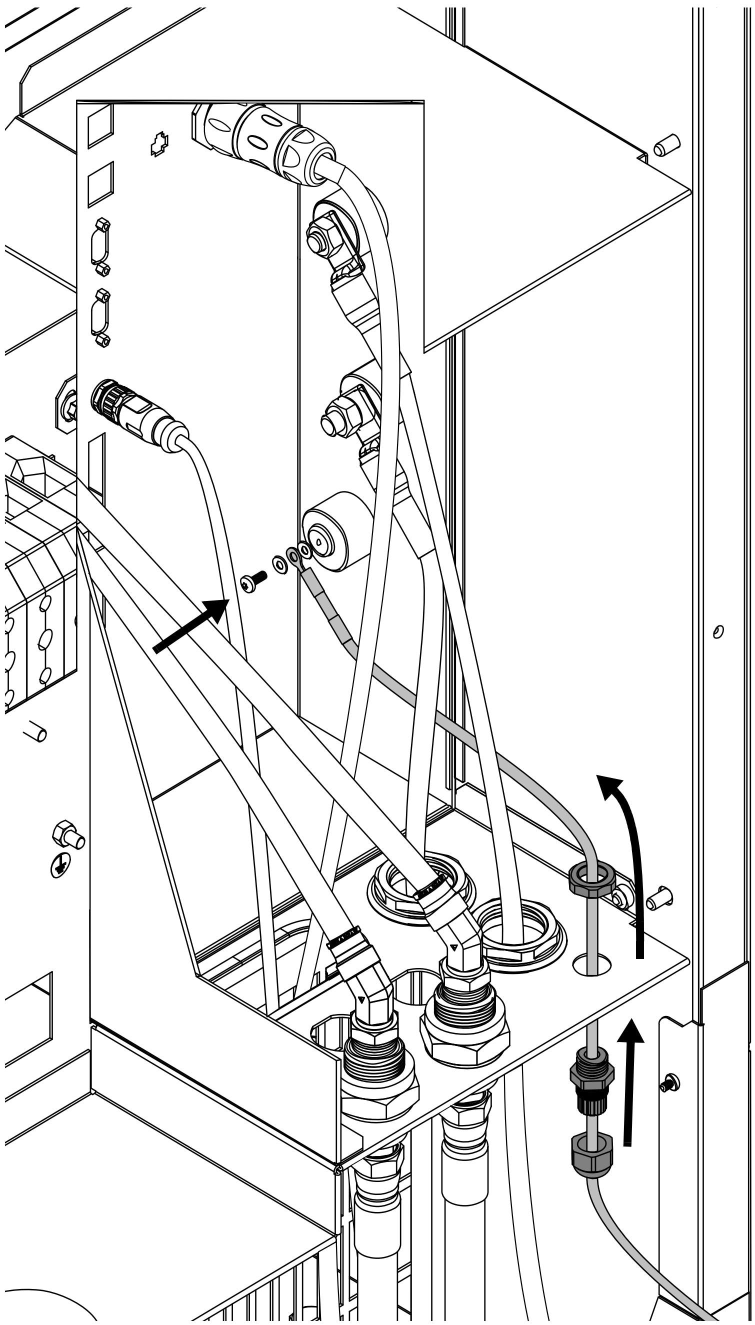
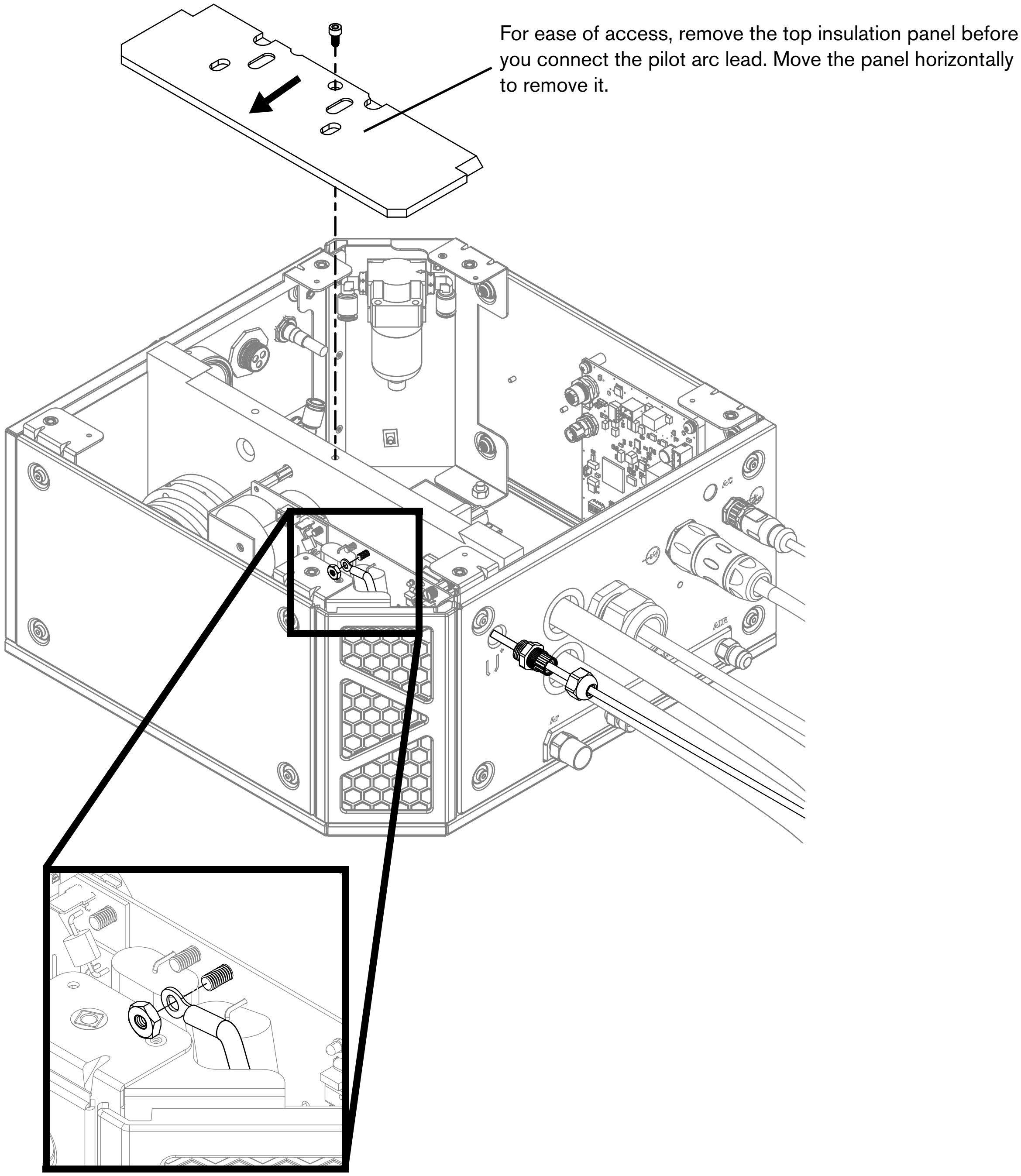


Figure 24 – Connect the pilot arc lead with strain relief to the gas connect console (Core, CorePlus, VWI, or OptiMix)



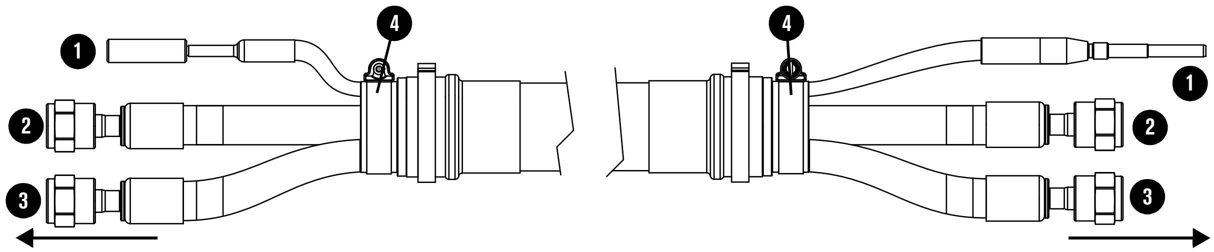
You do not need the strain relief nut. Remove the nut from the lead and tighten the strain relief into the panel on the gas connect console.

Connect the gas connect console (Core or CorePlus) to the TorchConnect console

- The following installation steps are for the **Core** or **CorePlus** gas connect console.
- If you have a VWI or OptiMix gas connect console, refer to Connect the gas connect console (VWI or OptiMix) to the TorchConnect console on page 115.

Connect the pilot arc and coolant hose set assembly (Core or CorePlus)

Figure 25 – Pilot arc and coolant hose set assembly



1 Pilot arc lead (yellow)

2 Coolant return hose (red band)

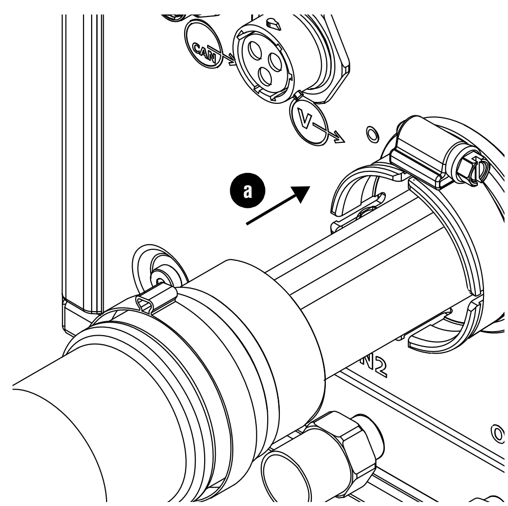
3 Coolant supply hose (green band)

4 Lead coupler

The 18 meter (59.1 feet) assembly is compatible only with the 2 meter (6.6 feet) or 2.5 meter (8.2 feet) torch lead. For lengths, refer to Pilot arc and coolant hose set assembly (Core or CorePlus) on page 402 of the Parts List.

1. Connect the lead assembly to the gas connect console:

   a. Put the hoses and lead through the hole in the gas connect console.

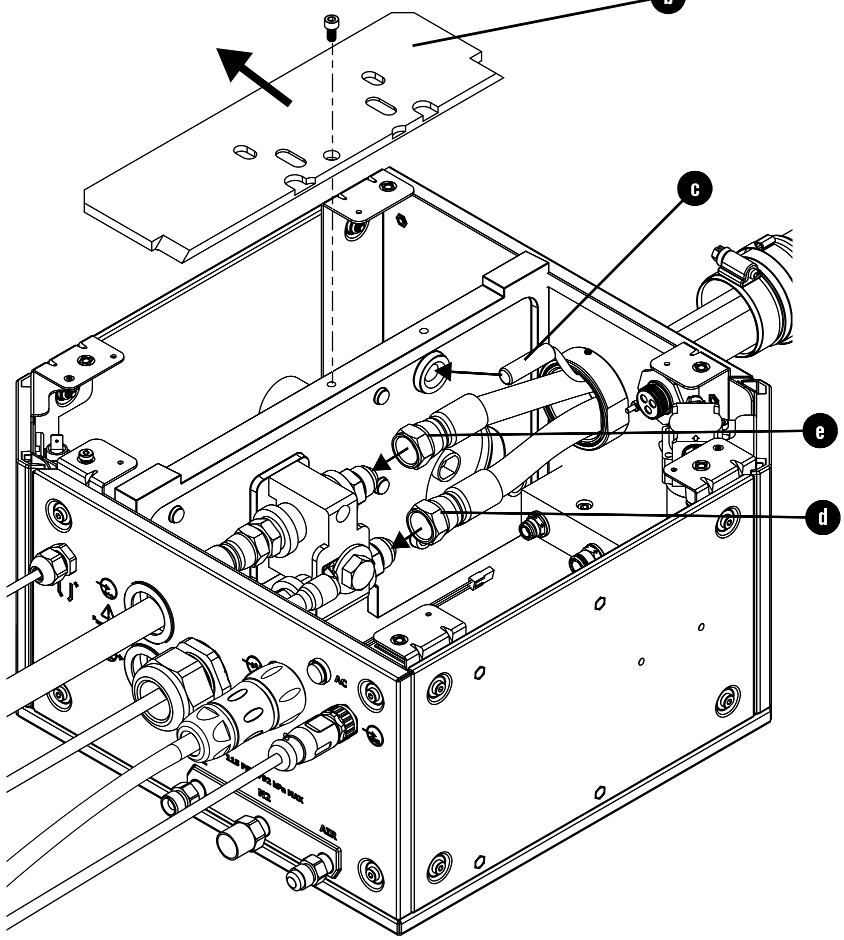


b. Remove the insulator panel. Move the panel horizontally to remove it.

c. Connect the pilot arc lead.

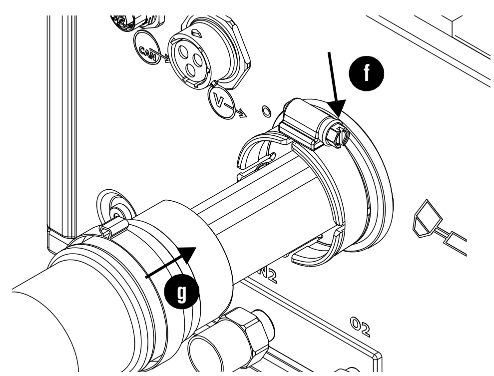
d. Connect the coolant return hose (red) to the coolant return fitting (red).

e. Connect the coolant supply hose (green) to the coolant supply fitting (green).



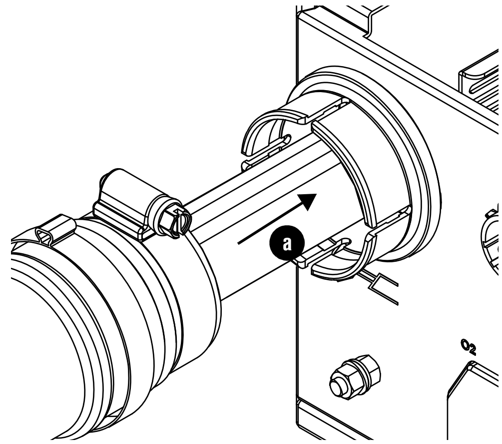
f. Remove the hose clamp from the lead and put it into the groove on the console collar.

g. Push the coupler into the console collar and tighten the clamp.



2. Connect the console-to-console coolant lead to the TorchConnect console:

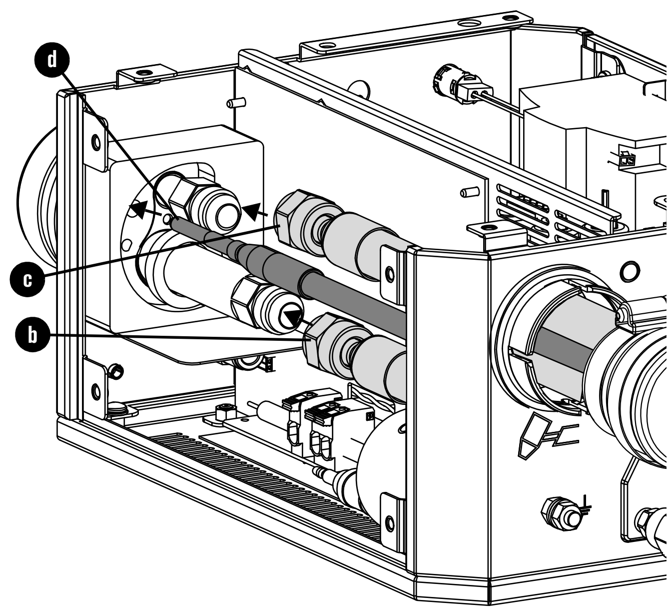
a. Put the hoses and lead through the hole in the TorchConnect console.



b. Connect the coolant return hose (red) to the coolant return fitting (red).

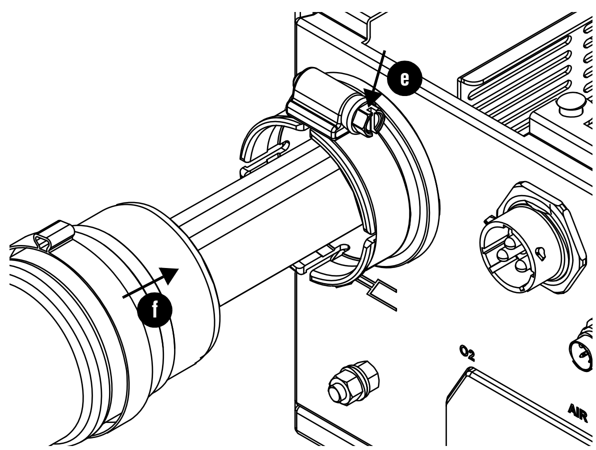
c. Connect the coolant supply hose (green) to the coolant supply fitting (green).

d. Connect the pilot arc lead.



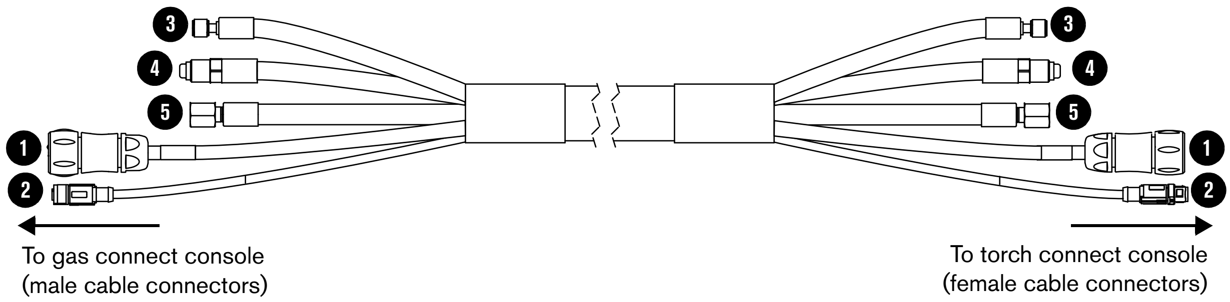
e. Remove the hose clamp from the lead and put it into the groove on the console collar.

f. Push the coupler into the console collar and tighten the clamp.



Connect the power, CAN, and 3-gas assembly (Core)

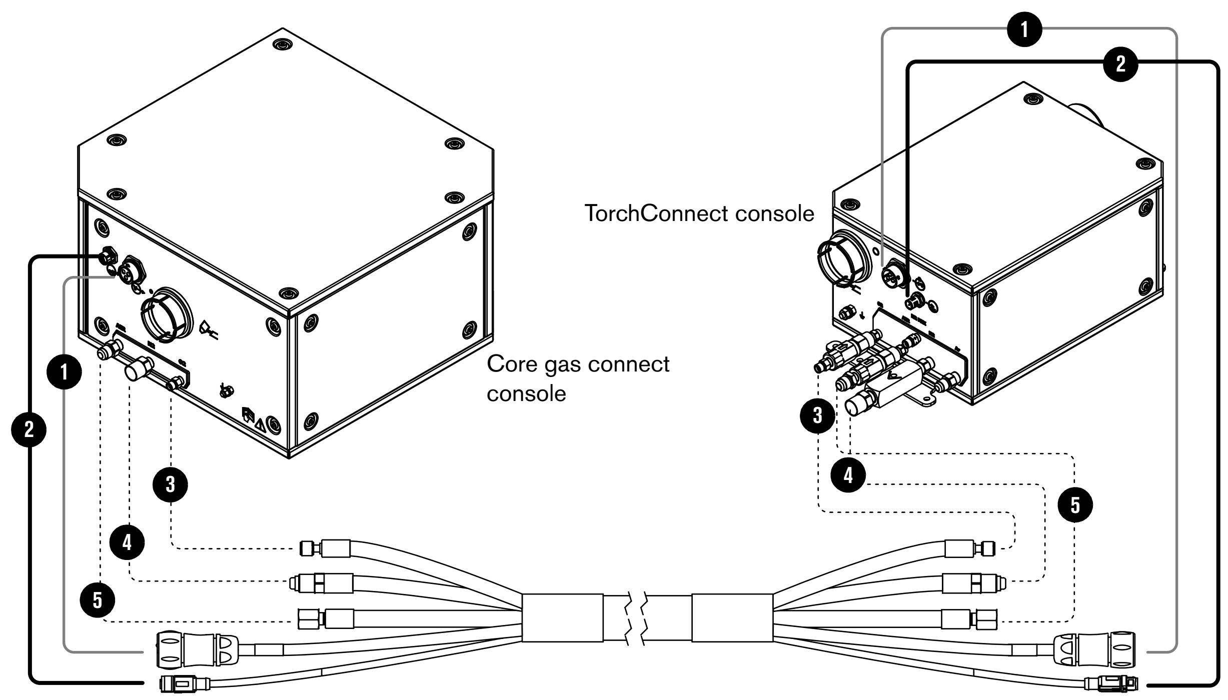
Figure 26 – Power cable, CAN cable, and 3-gas hose assembly



1 Power cable
2 CAN cable
3 Oxygen hose (blue)
4 Nitrogen hose (black)
5 Air hose (black)

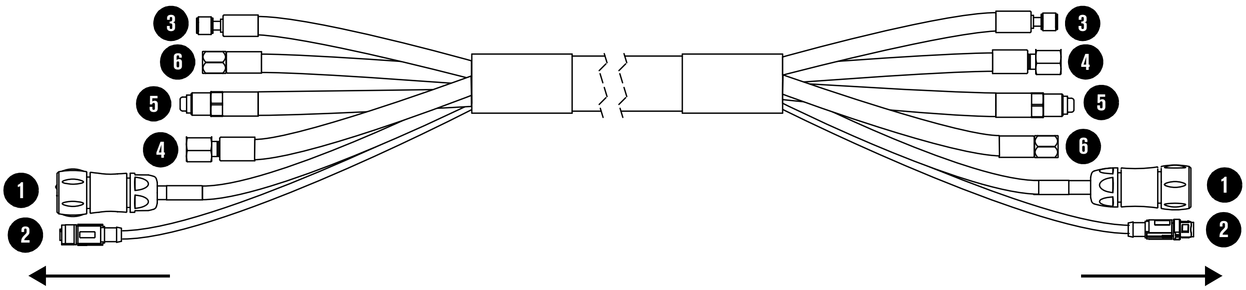
The 18 meter (59.1 feet) assembly is compatible only with the 2 meter (6.6 feet) or 2.5 meter (8.2 feet) torch lead. For lengths, refer to Power, CAN, and 3-gas assembly (Core) on page 402 of the Parts List.

Figure 27



Connect the power, CAN, and 4-gas assembly (CorePlus)

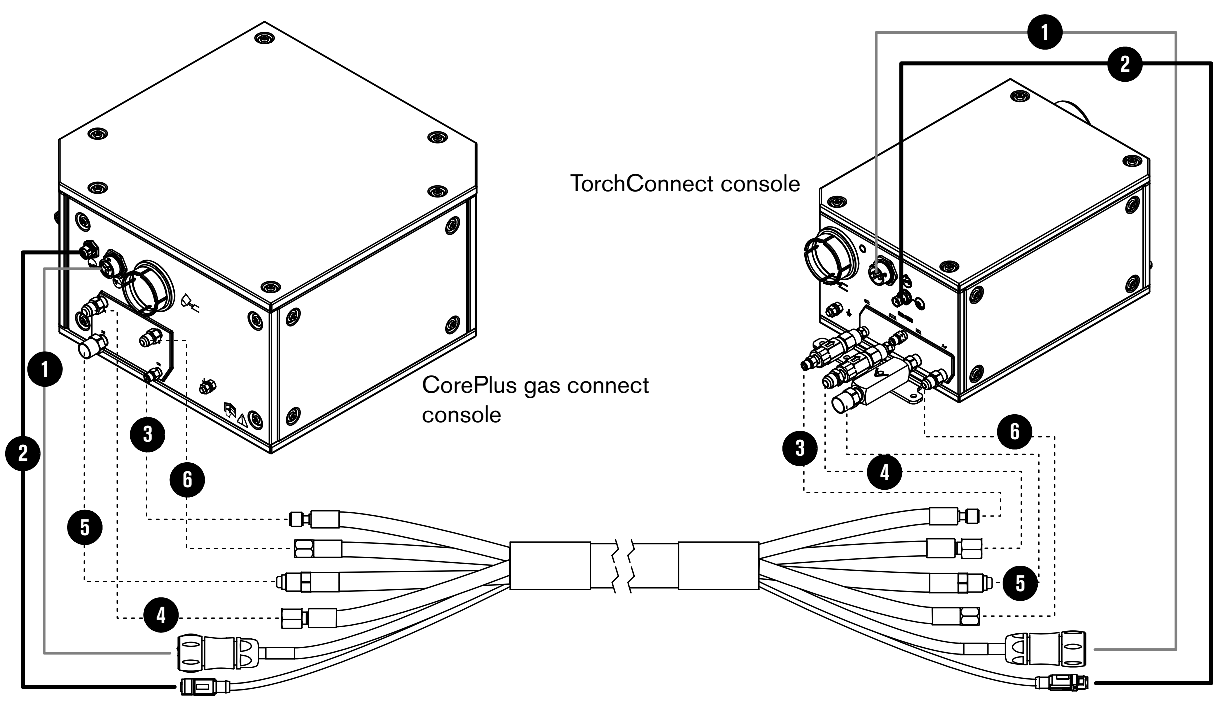
Figure 28 – Power cable, CAN cable, and 4-gas hose assembly



1 Power cable
2 CAN cable
3 Oxygen hose (blue)
4 Air hose (black)
5 Nitrogen hose (black)
6 Argon hose (black)

The 18 meter (59.1 feet) assembly is compatible only with the 2 meter (6.6 feet) or 2.5 meter (8.2 feet) torch lead. For lengths, refer to Power, CAN, and 4-gas assembly (CorePlus) on page 403 of the Parts List.

Figure 29

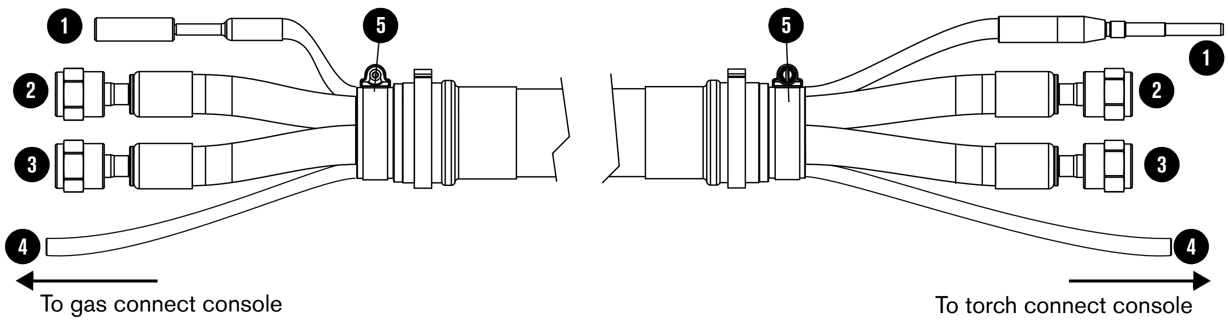


Connect the gas connect console (VWI or OptiMix) to the TorchConnect console

- The following installation steps are for the **VWI or OptiMix** gas connect console.
- If you have a Core or CorePlus gas connect console, refer to Connect the gas connect console (Core or CorePlus) to the TorchConnect console on page 110.

Connect the pilot arc, coolant hose set, and shield water assembly (VWI or OptiMix)

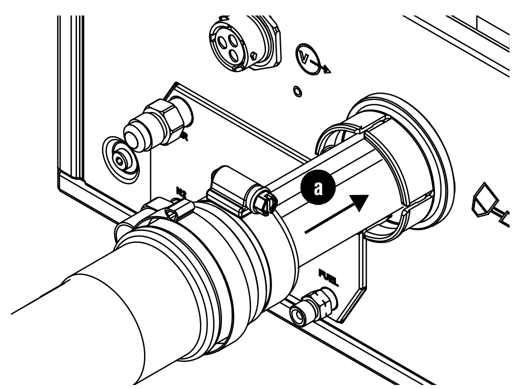
Figure 30 – Pilot arc, coolant hose set, and shield water assembly



1 Pilot arc lead (yellow)
2 Coolant return hose (red band)
3 Coolant supply hose (green band)
4 Shield water hose
5 Lead coupler

The 18 meter (59.1 feet) assembly is compatible only with the 2 meter (6.6 feet) or 2.5 meter (8.2 feet) torch lead. For lengths, refer to Power, CAN, and 5-gas assembly (VWI or OptiMix) on page 403 of the Parts List.

1. Connect the lead assembly to the gas connect console:
   a. Put the hoses and lead through the hole in the gas connect console.



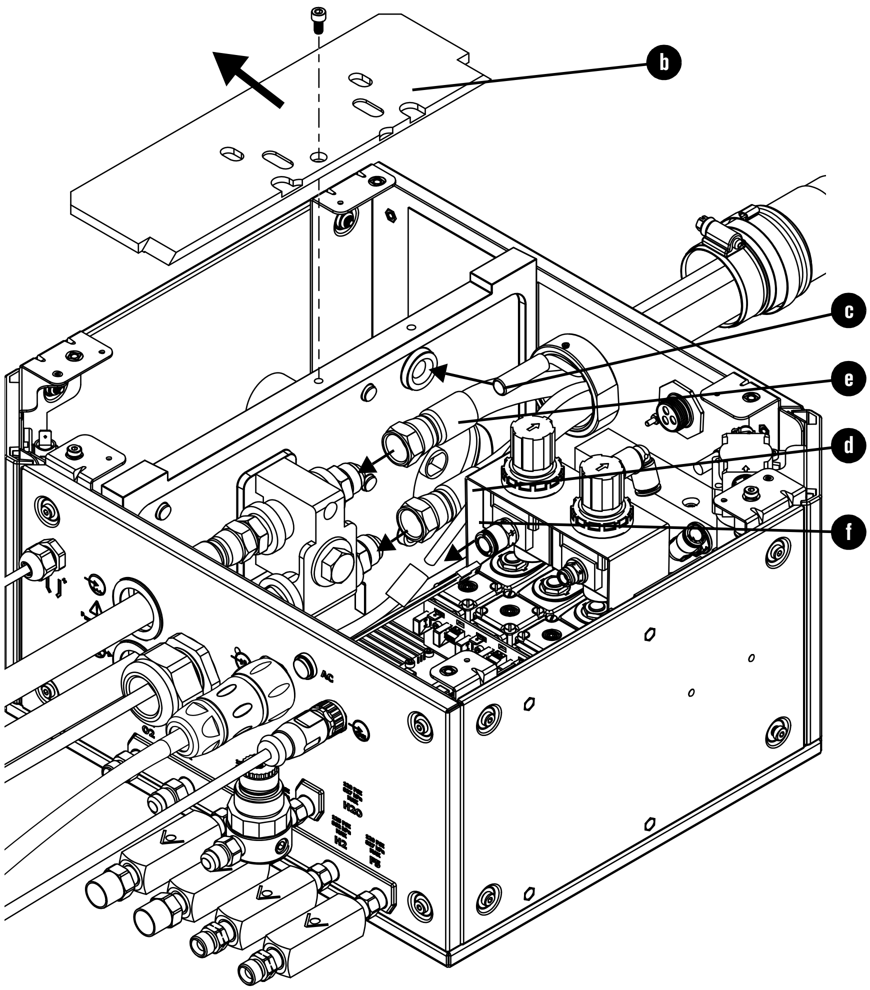
b. Remove the insulator panel. Move the panel horizontally to remove it.

c. Connect the pilot arc lead.

d. Connect the coolant return hose (red) to the coolant return fitting (red).

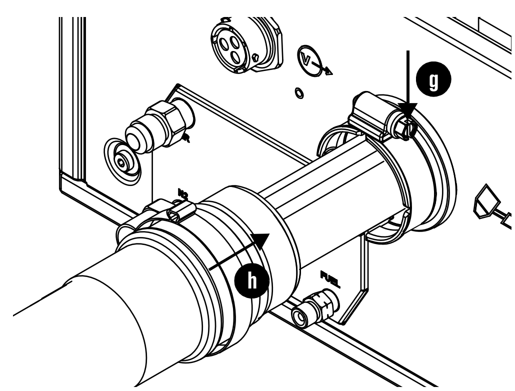
e. Connect the coolant supply hose (green) to the coolant supply fitting (green).

f. Connect the water hose inside of the VWI or OptiMix console.



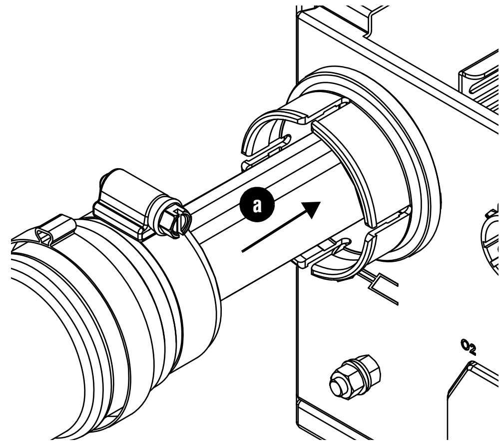
g. Remove the hose clamp from the lead and put it into the groove on the console collar.

h. Push the coupler into the console collar and tighten the clamp.



2. Connect the lead assembly to the TorchConnect console:

a. Put the hoses and lead through the hole in the TorchConnect console.

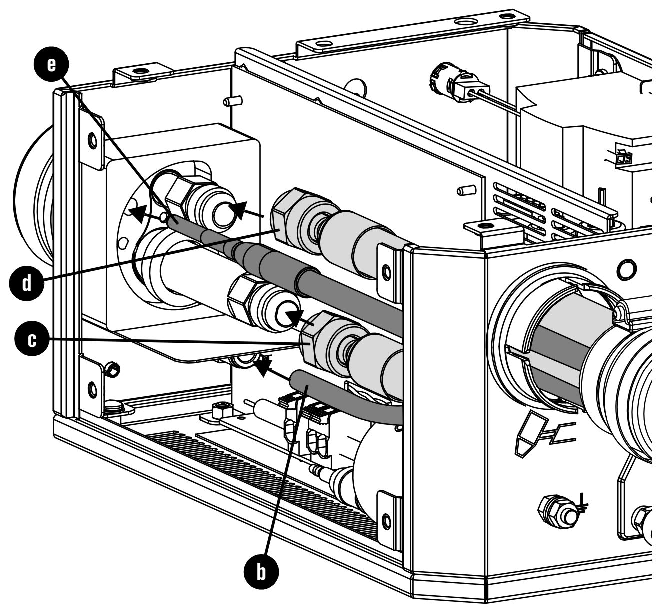


b. Push the water hose into the connector until it stops, approximately 13 mm (0.5 inch).

c. Connect the coolant return hose (red) to the coolant return fitting (red).

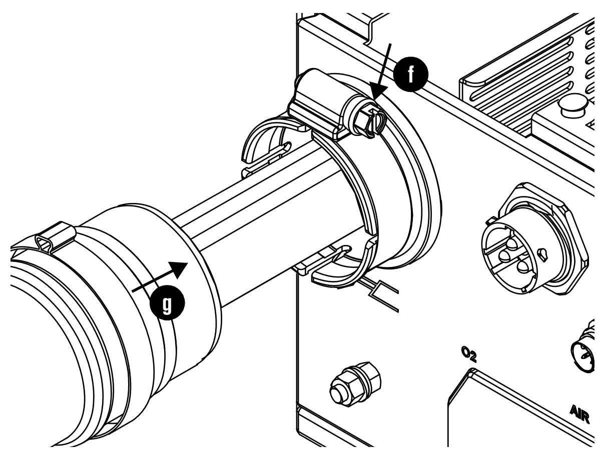
d. Connect the coolant supply hose (green) to the coolant supply fitting (green).

e. Connect the pilot arc lead.



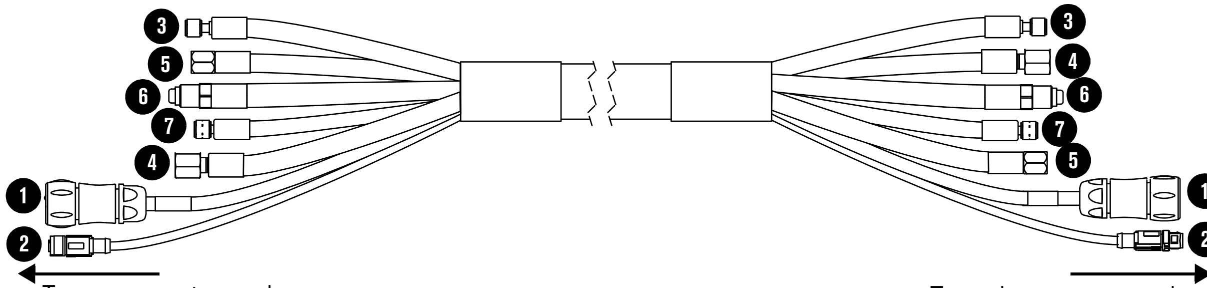
f. Remove the hose clamp from the lead and put it into the groove on the console collar.

g. Push the coupler into the console collar and tighten the clamp.



Connect the power, CAN, and 5-gas assembly (VWI or OptiMix)

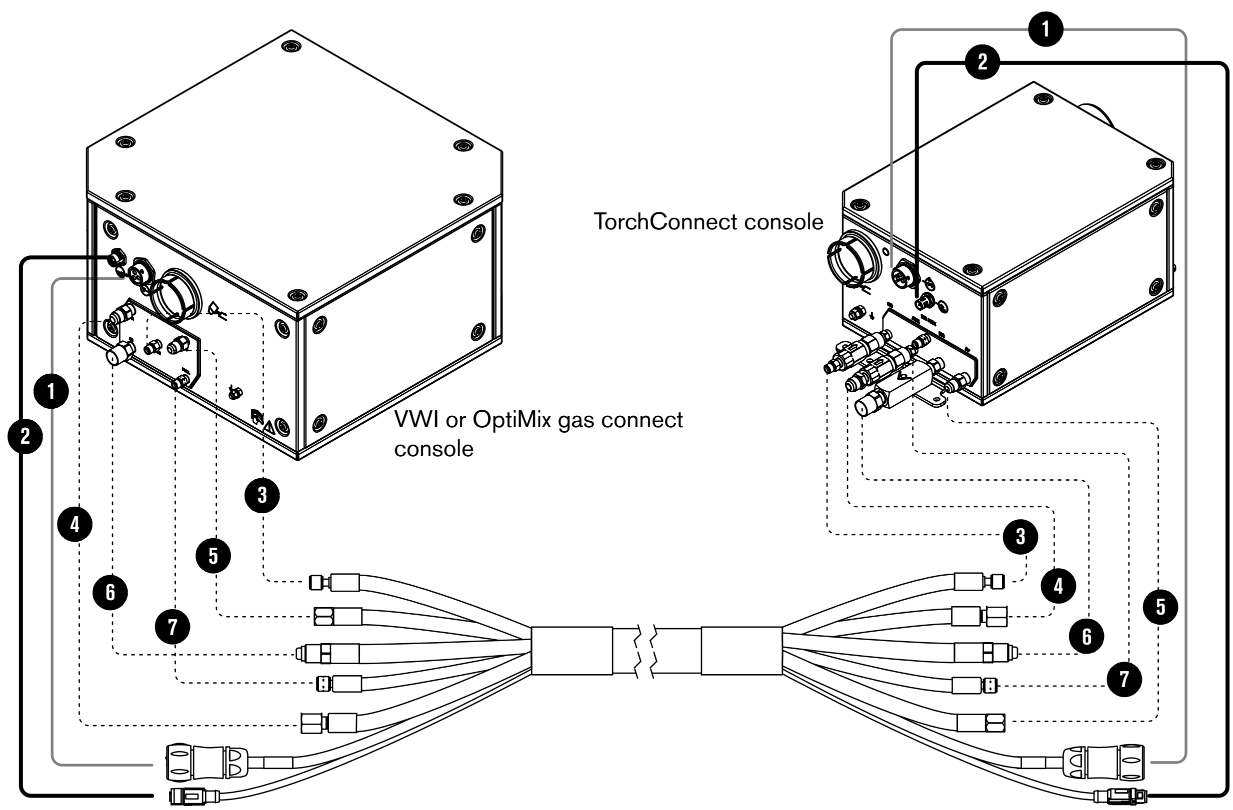
Figure 31 – Power cable, CAN cable, and 5-gas hose assembly



1 Power cable
2 CAN cable
3 Oxygen hose (blue)
4 Air hose (black)
5 Argon hose (black)
6 Nitrogen hose (black)
7 H_2-mix or F5 hose (red)

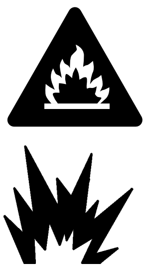
The 18 meter (59.1 feet) assembly is compatible only with the 2 meter (6.6 feet) or 2.5 meter (8.2 feet) torch lead. For lengths, refer to Power, CAN, and 5-gas assembly (VWI or OptiMix) on page 403 of the Parts List.

Figure 32



Install and connect the supply gases

WARNING



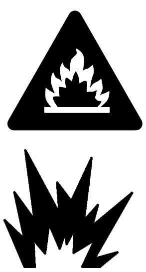
OXYGEN GAS CAN CAUSE A FIRE HAZARD

If you use oxygen as the plasma gas for cutting, it can cause a potential fire hazard due to the oxygen-enriched atmosphere that collects.

Hypertherm recommends that you install an exhaust ventilation system to remove the oxygen-enriched atmosphere that can collect when oxygen is used as the plasma gas for cutting. A fire can occur if oxygen is not removed.

Flashback arrestors are REQUIRED to stop the spread of fire to the supply gases (unless a flashback arrestor is not available for a specific gas or pressure).

As an installer or user, you must supply the exhaust ventilation and flashback arrestors for your cutting system. You can get them from your cutting machine supplier.



HYDROGEN GAS CAN CAUSE AN EXPLOSION OR FIRE

Hydrogen is a flammable gas that can cause an explosion or fire. Keep flames away from cylinders and hoses that contain hydrogen. Keep flames and sparks away from the torch when using hydrogen as a plasma gas.

Consult your local safety, fire, and building code requirements for the storage and use of hydrogen.

Hypertherm recommends that you install an exhaust ventilation system to remove the hydrogen-enriched atmosphere that can collect when hydrogen is used as the plasma gas for cutting. An explosion or fire can occur if hydrogen is not removed.

Flashback arrestors are REQUIRED to stop the spread of fire to the supply gases (unless a flashback arrestor is not available for a specific gas or pressure).

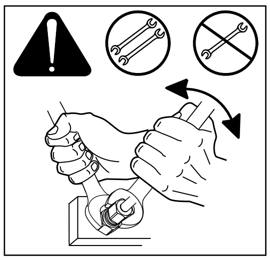
As an installer or user, you must supply the exhaust ventilation and flashback arrestors for your cutting system. You can get them from your cutting machine supplier.

As an installer or user, you must supply the following items for your cutting system:

- High-quality gas regulators
- Supply gas plumbing
- Supply gases

The items you supply must meet all minimum requirements and be installed by a qualified person. Refer to Process gas requirements (Core, CorePlus, VWI, and OptiMix gas connect consoles) on page 44 and Qualifications of service personnel on page 39.

Table 19 – Torque specifications

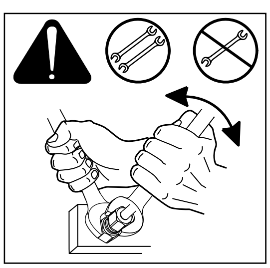
	Torque Specifications			
	**Gas or water hose size**	**N·m**	**in·lbf**	**ft·lbf**
	Up to 10 mm (3/8 inch)	8.5 – 9.5	75 – 84	6.25 – 7
	12 mm (1/2 inch)	16.3 – 19.0	144 – 168	12 – 14
	25 mm (1 inch)	54.2 – 88.1	480 – 780	40 – 65

Install gas regulators

For gas regulator installation, make sure to complete the following steps:

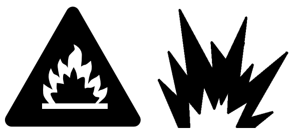
- Install the gas regulators **before** the supply gas plumbing. For installation steps, refer to the instruction manual that came with the gas regulator.
- Position a gas regulator within 3 meters (10 feet) of the gas connect console or take actions to adjust inlet gas pressures to tolerances specified in the process gas requirements. Refer to Process gas requirements (Core, CorePlus, VWI, and OptiMix gas connect consoles) on page 44.
- Pressurize the entire system and look for gas leaks after installation is complete. Your system installer or a licensed plumber can do this for you.
- Verify that all gas fittings are tightened to the torque specifications in Table 20.

Table 20 – Torque specifications

	Torque Specifications			
	**Gas or water hose size**	**N·m**	**in·lbf**	**ft·lbf**
	Up to 10 mm (3/8 inch)	8.5 – 9.5	75 – 84	6.25 – 7
	12 mm (1/2 inch)	16.3 – 19.0	144 – 168	12 – 14
	25 mm (1 inch)	54.2 – 88.1	480 – 780	40 – 65

Connect supply gases to the gas connect console (Core or CorePlus)

WARNING



MISSING CHECK VALVES CAN CAUSE AN EXPLOSION OR FIRE

Never remove a check valve.

An explosion or fire can occur if the cutting system is operated without check valves.

NOTICE

PTFE TAPE CAN CAUSE CLOGGED VALVES, REGULATORS, AND TORCHES

Never use PTFE tape on any joint preparation. Use only a liquid or paste thread sealant on male thread ends.

CAUTION

INCORRECT HOSES, CONNECTIONS, OR FITTINGS CAN CAUSE DAMAGE AND BAD PERFORMANCE

All hoses, hose connections, and hose fittings used for supply-gas plumbing must be designed for use with the appropriate gas and pressure rating. Incorrect hoses, hose connections, or hose fittings can crack or leak.

NEVER connect a supply gas to a hose, connection, or fitting that is not designed for that gas type or pressure.

A replacement hose, connection, or fitting must meet all applicable regulations and codes.

Non-compliant hoses, hose connections, or hose fittings can crack or leak. The wrong fittings can cause malfunctions with the internal valves because contaminants can enter the valves through damaged or loose fittings.

CAUTION

INCORRECT SUPPLY-GAS FITTINGS CAN CAUSE VALVES TO MALFUNCTION

Do not change or replace the supply-gas fittings on the gas connect console.

If you alter or replace the fittings, it can cause the internal valves to malfunction if particulates get inside.

NOTICE

INCORRECT SUPPLY-GAS CONNECTIONS CAN CAUSE CUTTING SYSTEM DAMAGE

NEVER connect a supply gas to a hose, connection, or fitting that is not designed for that gas type or pressure.

Incorrect connections can reduce the life of consumables and damage the torch head, torch receptacle, torch leads, and torch connect console.

CAUTION

INCORRECT SUPPLY-GAS CONNECTIONS CAN CAUSE BAD PERFORMANCE

Cutting system performance can be bad if a supply-gas hose is connected to the wrong port on a gas connect console.

NEVER connect a supply gas to a hose, connection, or fitting that is not designed for that gas type or pressure.

NOTICE

PTFE TAPE CAN CAUSE CLOGGED VALVES, REGULATORS, AND TORCHES

Never use PTFE tape on any joint preparation. Use only a liquid or paste thread sealant on male thread ends.

NOTICE

DIRTY, OILY AIR CAN CAUSE DAMAGE TO THE AIR FILTER BOWL

Some air compressors use synthetic lubricants that contain esters. Esters can damage the polycarbonates in the air filter bowl. Add additional gas filtration if necessary.

NOTICE

INCORRECT GAS PRESSURES CAN CAUSE BAD PERFORMANCE

Gas leaks or pressure and flow rates that are outside of recommended ranges can:

- Cause problems with system performance
- Result in bad cut quality
- Shorten the life of consumables

If the quality of the gas is bad or if the pressure setting is incorrect, it can decrease:

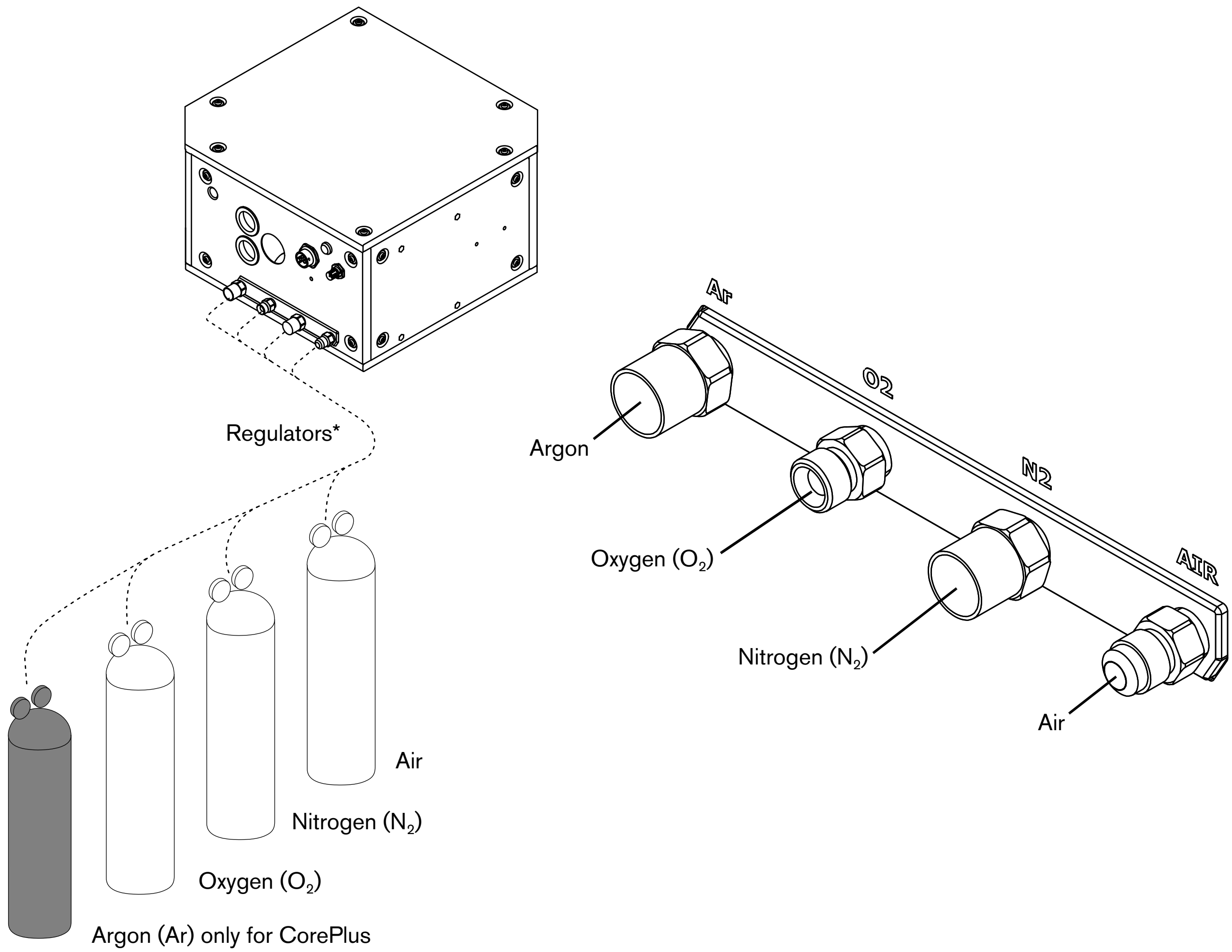
- Cut quality
- Cut speed
- Cut thickness capabilities

- The following installation steps are for the **Core** or **CorePlus** gas connect console.
- If you have a VWI or OptiMix gas connect console, refer to Connect supply gases and shield water to the gas connect console (VWI or OptiMix) on page 125.

Table 21 – Recommended sizes for gas fittings

Fitting type	Size
N_2 / Ar	5/8 inch – 18 RH, internal (inert gas) “B”
Air	9/16 inch – 19, JIC #6
F5 / H_2	9/16 inch – 18, LH (fuel gas) “B”
O_2	9/16 inch – RH (oxygen)

Figure 33 – Connect the supply gas plumbing and gases to the Core or CorePlus gas connect console



* For the best results, make sure that the cutting system is ready for use and the gases are flowing when you select gas regulator settings, similar to testing gas preflow and cutflow.

1. Make sure that you have the correct supply gas hoses before you connect them. Hypertherm recommends an internal diameter of at least 10 mm (0.375 inch) for supply-gas hoses that are 76 m (250 feet) or less.

2. Tighten all fittings to the torque specifications in Table 20 on page 120.

3. After installation is complete, pressurize the entire system and look for gas leaks. A licensed plumber can do this for you.

NOTICE

INCORRECT SUPPLY-GAS CONNECTIONS CAN CAUSE CUTTING SYSTEM DAMAGE

NEVER connect a supply gas to a hose, connection, or fitting that is not designed for that gas type or pressure.

Incorrect connections can reduce the life of consumables and damage the torch head, torch receptacle, torch leads, and torch connect console.

CAUTION

INCORRECT SUPPLY-GAS CONNECTIONS CAN CAUSE BAD PERFORMANCE

Cutting system performance can be bad if a supply-gas hose is connected to the wrong port on a gas connect console.

NEVER connect a supply gas to a hose, connection, or fitting that is not designed for that gas type or pressure.

Connect supply gases and shield water to the gas connect console (VWI or OptiMix)

WARNING

MISSING CHECK VALVES CAN CAUSE AN EXPLOSION OR FIRE

Never remove a check valve.

An explosion or fire can occur if the cutting system is operated without check valves.

WARNING

INCORRECT SUPPLY-GAS CONNECTIONS CAN CAUSE AN EXPLOSION OR FIRE

An explosion or fire can occur if a supply-gas hose is connected to the wrong port on a gas connect console.

NEVER connect a supply gas to a hose, connection, or fitting that is not designed for that gas type or pressure.

NOTICE

PTFE TAPE CAN CAUSE CLOGGED VALVES, REGULATORS, AND TORCHES

Never use PTFE tape on any joint preparation. Use only a liquid or paste thread sealant on male thread ends.

CAUTION

INCORRECT HOSES, CONNECTIONS, OR FITTINGS CAN CAUSE DAMAGE AND BAD PERFORMANCE

All hoses, hose connections, and hose fittings used for supply-gas plumbing must be designed for use with the appropriate gas and pressure rating. Incorrect hoses, hose connections, or hose fittings can crack or leak.

NEVER connect a supply gas to a hose, connection, or fitting that is not designed for that gas type or pressure.

A replacement hose, connection, or fitting must meet all applicable regulations and codes.

Non-compliant hoses, hose connections, or hose fittings can crack or leak. The wrong fittings can cause malfunctions with the internal valves because contaminants can enter the valves through damaged or loose fittings.

CAUTION

INCORRECT SUPPLY-GAS FITTINGS CAN CAUSE VALVES TO MALFUNCTION

Do not change or replace the supply-gas fittings on the gas connect console.

If you alter or replace the fittings, it can cause the internal valves to malfunction if particulates get inside.

NOTICE

INCORRECT SUPPLY-GAS CONNECTIONS CAN CAUSE CUTTING SYSTEM DAMAGE

NEVER connect a supply gas to a hose, connection, or fitting that is not designed for that gas type or pressure.

Incorrect connections can reduce the life of consumables and damage the torch head, torch receptacle, torch leads, and torch connect console.

⚠ CAUTION

INCORRECT SUPPLY-GAS CONNECTIONS CAN CAUSE BAD PERFORMANCE

Cutting system performance can be bad if a supply-gas hose is connected to the wrong port on a gas connect console.

NEVER connect a supply gas to a hose, connection, or fitting that is not designed for that gas type or pressure.

⚠ NOTICE

DIRTY, OILY AIR CAN CAUSE DAMAGE TO THE AIR FILTER BOWL

Some air compressors use synthetic lubricants that contain esters. Esters can damage the polycarbonates in the air filter bowl. Add additional gas filtration if necessary.

⚠ NOTICE

INCORRECT GAS PRESSURES CAN CAUSE BAD PERFORMANCE

Gas leaks or pressure and flow rates that are outside of recommended ranges can:

- Cause problems with system performance
- Result in bad cut quality
- Shorten the life of consumables

If the quality of the gas is bad or if the pressure setting is incorrect, it can decrease:

- Cut quality
- Cut speed
- Cut thickness capabilities

NOTICE

PTFE TAPE CAN CAUSE CLOGGED VALVES, REGULATORS, AND TORCHES

Never use PTFE tape on any joint preparation. Use only a liquid or paste thread sealant on male thread ends.

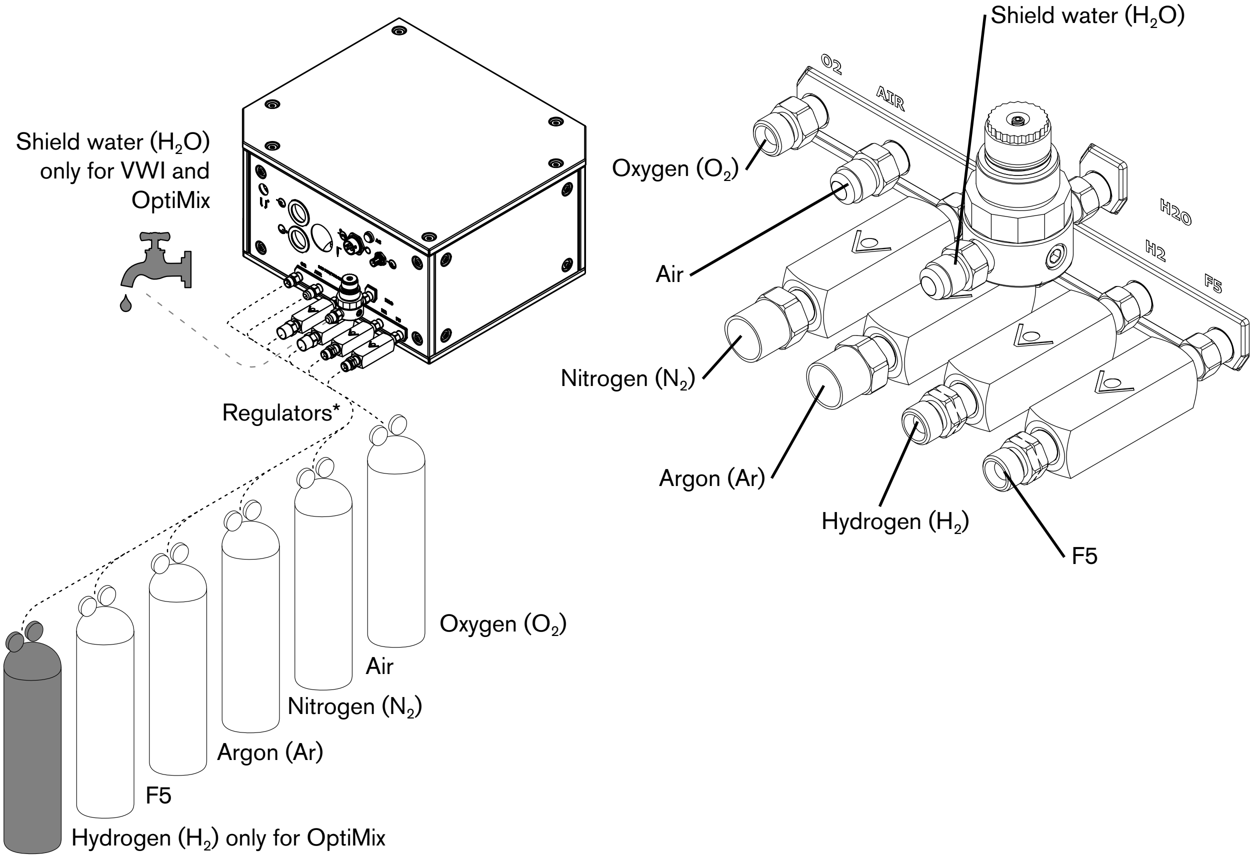
- The following installation steps are for the **VWI or OptiMix** gas connect console.
- If you have a Core or CorePlus gas connect console, refer to Connect supply gases to the gas connect console (Core or CorePlus) on page 121 or Connect supply gases and shield water to the gas connect console (VWI or OptiMix) on page 125.

Connect the supply gases

Table 22 – Recommended sizes for gas fittings

Fitting type	Size
N_2 / Ar	5/8 inch – 18 RH, internal (inert gas) “B”
Air	9/16 inch – 19, JIC #6
F5 / H_2	9/16 inch – 18, LH (fuel gas) “B”
O_2	9/16 inch – RH (oxygen)

Figure 34 – Connect the supply gas plumbing, gases, and optional shield water to the VWI or OptiMix gas connect console



* For the best results, make sure that the cutting system is ready for use and the gases are flowing when you select gas regulator settings, similar to testing gas preflow and cutflow.

1. Make sure that you have the correct supply gas hoses before you connect them. Hypertherm recommends an internal diameter of at least 10 mm (0.375 inch) for supply-gas hoses that are 76 m (250 feet) or less.

2. Tighten all fittings to the torque specifications in Table 20 on page 120.

3. After installation is complete, pressurize the entire system and look for gas leaks. A licensed plumber can do this for you.

NOTICE

INCORRECT SUPPLY-GAS CONNECTIONS CAN CAUSE CUTTING SYSTEM DAMAGE

NEVER connect a supply gas to a hose, connection, or fitting that is not designed for that gas type or pressure.

Incorrect connections can reduce the life of consumables and damage the torch head, torch receptacle, torch leads, and torch connect console.

CAUTION

INCORRECT SUPPLY-GAS CONNECTIONS CAN CAUSE BAD PERFORMANCE

Cutting system performance can be bad if a supply-gas hose is connected to the wrong port on a gas connect console.

NEVER connect a supply gas to a hose, connection, or fitting that is not designed for that gas type or pressure.

Connect optional shield water to the gas connect console (VWI or OptiMix)

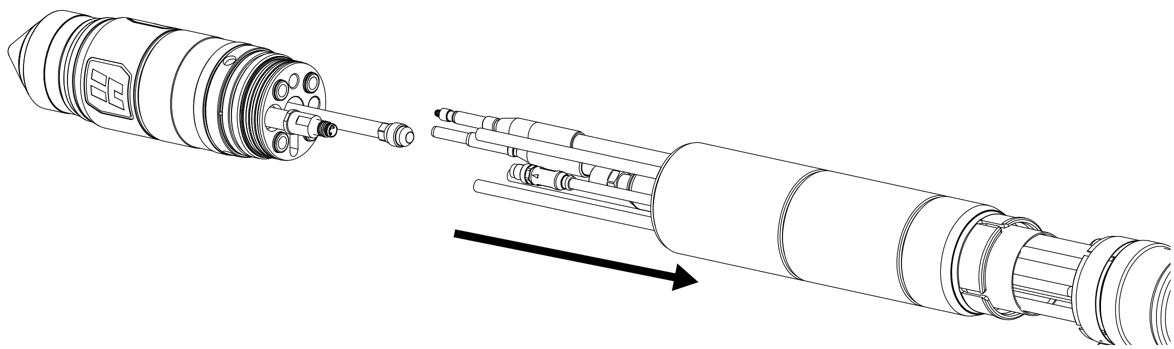
Shield water is available with the **VWI or OptiMix** gas connect console.

- If you have a Core or CorePlus gas connect console, refer to Connect supply gases to the gas connect console (Core or CorePlus) on page 121 or Connect supply gases and shield water to the gas connect console (VWI or OptiMix) on page 125 for installation steps.
- If you have a VWI or OptiMix gas connect console, but choose to **not** use shield water, you can ignore this installation step.
- If you plan to use shield water, make sure to follow Shield water requirements (VWI and OptiMix) on page 50. Also remember that the temperature range for cutting system operation with shield water is reduced to above 0°C to 40°C (32°F to 104°F).

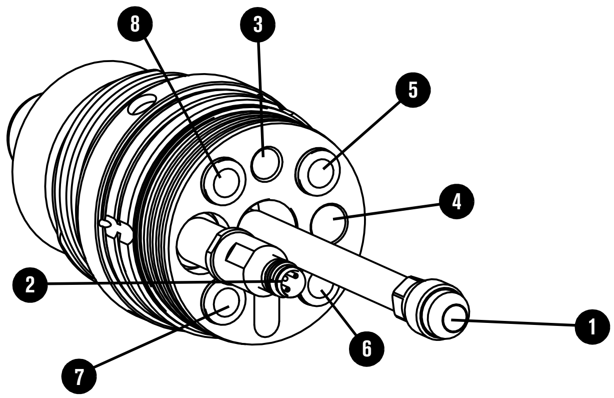
Connect the torch receptacle to the TorchConnect console

1. Uncoil approximately 2 meters (6.5 feet) of the torch-end of the torch lead assembly.
2. Put the torch collar onto the connector-end of the torch.

3. Put the torch mounting sleeve onto the torch-end of the torch lead assembly. Adjust the mounting sleeve so that you can access the connector ends of the torch lead.



4. Align the color-coded leads in the torch lead assembly with the corresponding connectors in the torch receptacle.

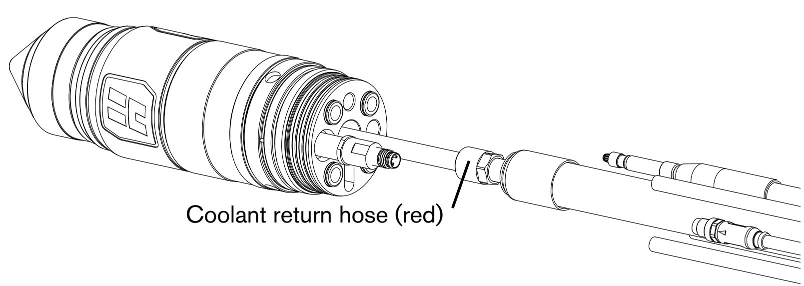


1	Coolant return (red)	**5**	Coolant supply (green)
2	Plasma valve	**6**	Shield gas (blue)
3	Pilot arc (yellow)	**7**	Plasma gas 2 (yellow)
4	Ohmic (orange)	**8**	Plasma gas 1 (black)

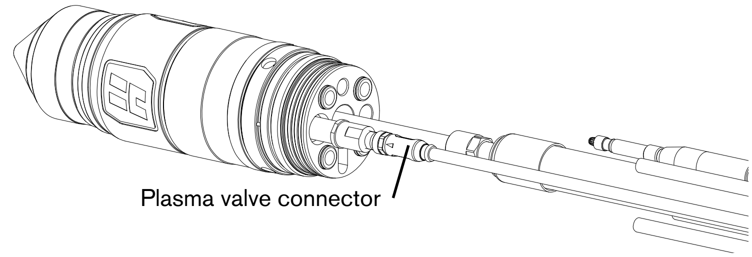
Good alignment minimizes twisted leads. Twisted leads can cause gas or coolant restrictions that shorten the life of consumables or result in bad cut quality.

5. Connect the torch leads and connectors in the following order:

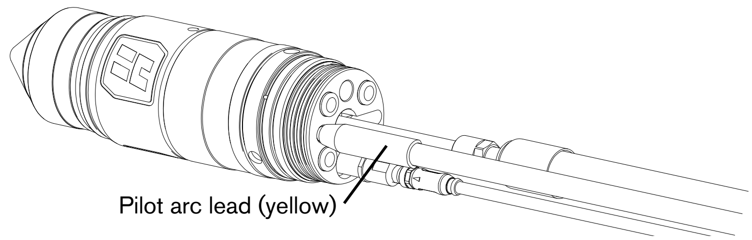
   a. Use 2 wrenches to install the coolant return hose (red) onto the coolant return fitting (red) and tighten to 16.3 N·m – 19.0 N·m (144 in·lbf – 168 in·lbf).



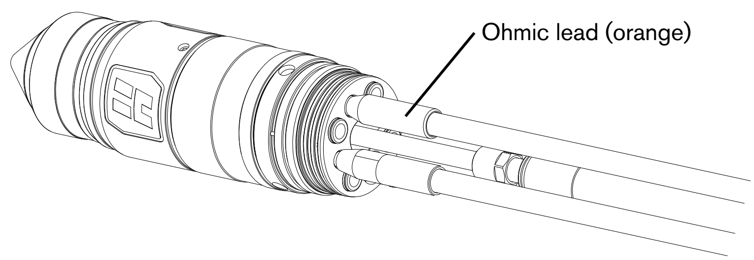
b. Insert the plasma valve connector. Use your fingers to tighten the connection. Do **not** use tools.



c. Connect the pilot arc lead (yellow). Use your fingers to tighten the connection. Do **not** use tools.

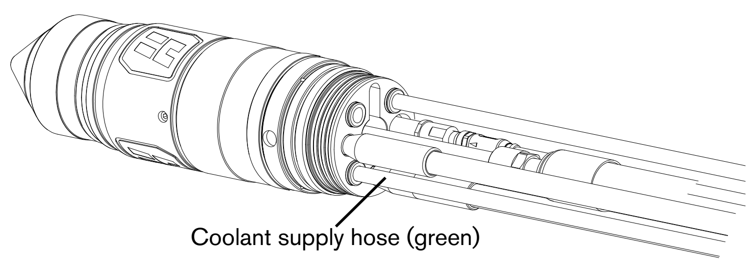


d. Connect the ohmic lead (orange). Use your fingers to tighten the connection. Do **not** use tools.



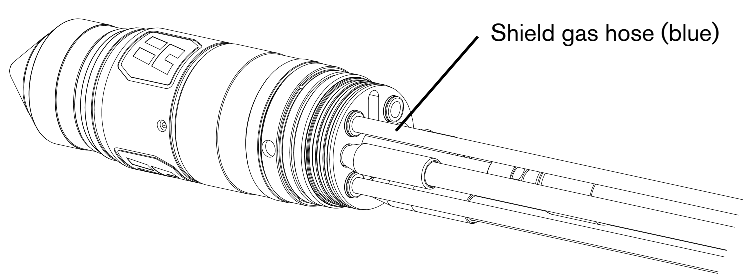
e. Connect the coolant supply hose (green). Push the hose into the connector until it stops, approximately 13 mm (0.5 inch).

This is a push-to-connect fitting.



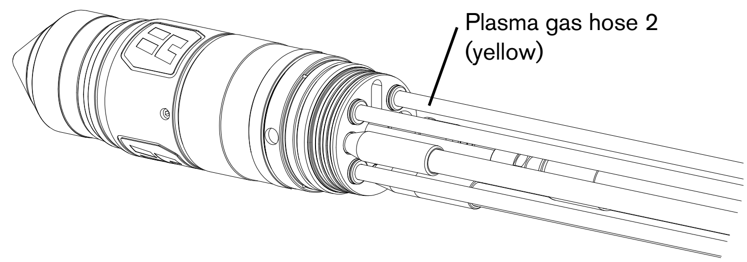
f. Connect the shield gas hose (blue). Push the hose into the connector until it stops, approximately 13 mm (0.5 inch).

This is a push-to-connect fitting.



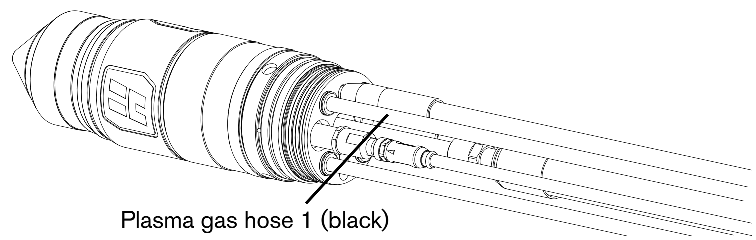
g. Connect plasma gas hose 2 (yellow). Push the hose into the connector until it stops, approximately 13 mm (0.5 inch).

This is a push-to-connect fitting.



h. Connect plasma gas hose 1 (black). Push the hose into the connector until it stops, approximately 13 mm (0.5 inch).

This is a push-to-connect fitting.

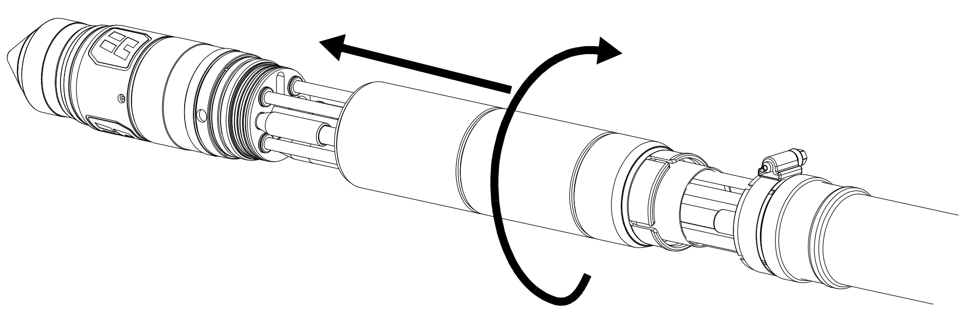


6. Install the torch mounting sleeve:

   a. Move the torch mounting sleeve in the direction of the torch.

   b. Use your hands to tighten the torch mounting sleeve connection.

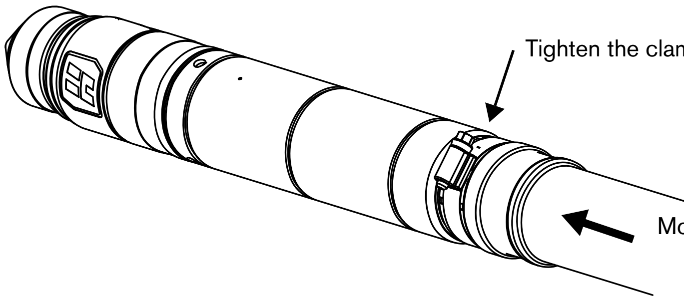
A spanner wrench (104879) comes with all 4 of the consumable parts kits (428616, 428617, 428618, 428619). Do **not** over tighten the torch mounting sleeve if you use the spanner wrench to stabilize the torch during mounting sleeve installation.



7. Reposition the collar on the torch-end of the torch lead:

   a. Move the collar in the direction of the torch-end of the torch lead assembly.

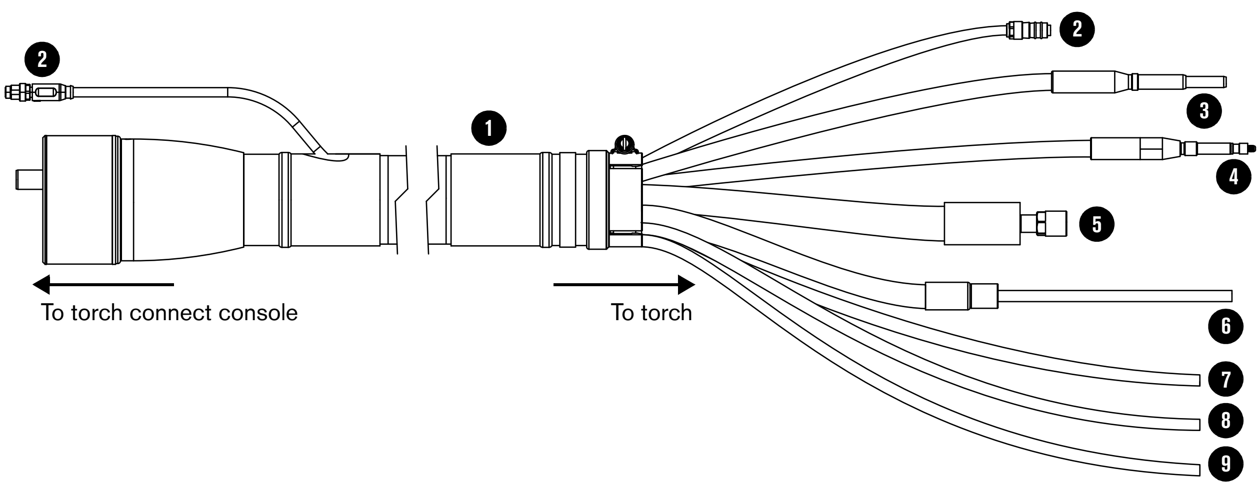
b. Tighten the hose clamp that holds the collar in position.



Connect the EasyConnect™ torch lead assembly to the TorchConnect console

> **NOTICE**
>
> **FOR THE BEST CUT QUALITY AND CONSUMABLE LIFE USE THE CORRECT LEAD LENGTHS**
>
> The manufactured lengths of torch and console leads are critical for system performance.
>
> Never change the lengths of leads. Cut quality and the lifespan of consumables will be decreased if you change the lead lengths.

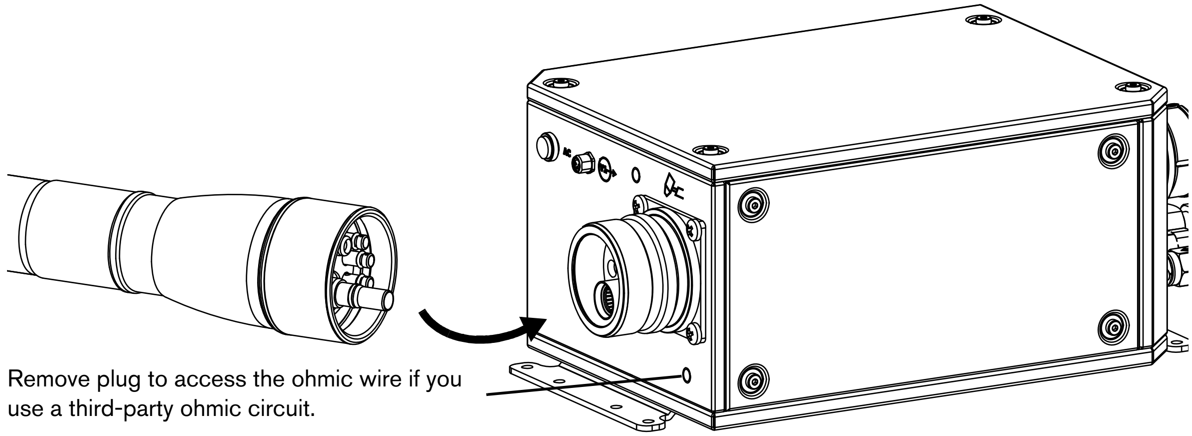
Figure 35 – Torch lead assembly



1	Protective sleeve	**6**	Coolant supply hose (green)
2	Plasma valve cable	**7**	Shield gas hose
3	Ohmic lead	**8**	Plasma gas hose A
4	Pilot arc lead	**9**	Plasma gas hose B
5	Coolant return hose (red)		

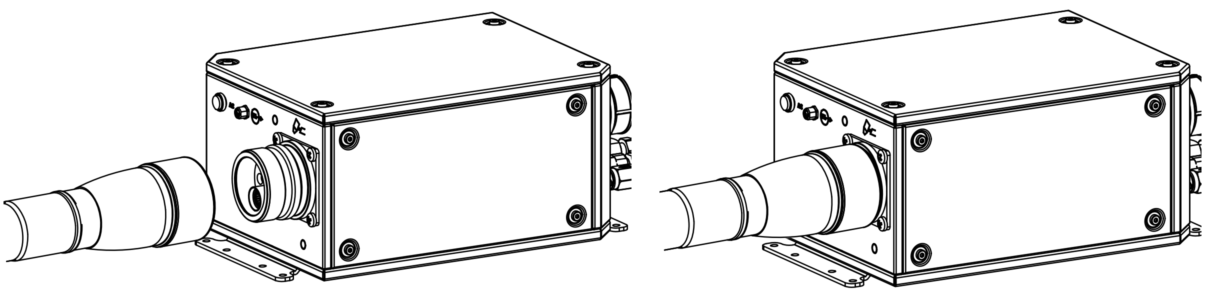
The 6 meter (20 feet) lead is compatible only with gas assemblies that are 7.5 meters (24.6 feet) or less. For lengths, refer to Torch lead on page 406 of the Parts List.

1. Adjust the torch lead assembly so that the connectors in the torch lead assembly are aligned with the corresponding receptacles in the TorchConnect console.

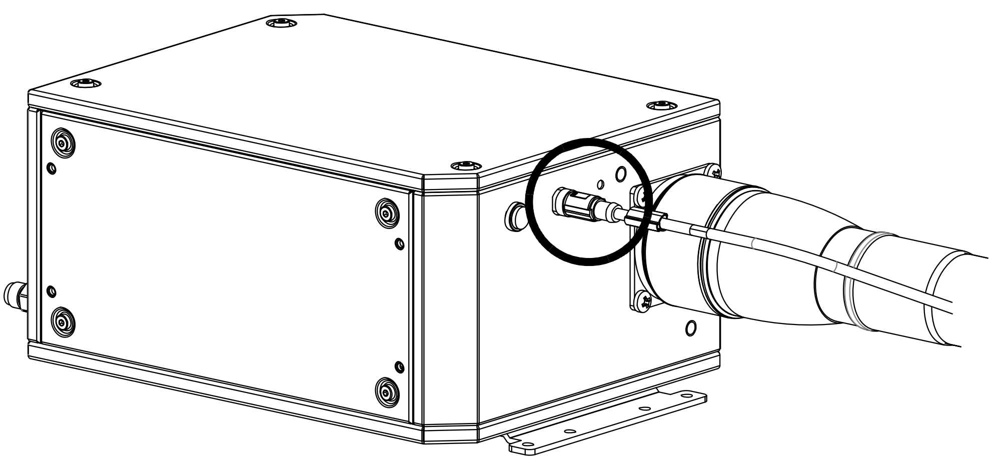


2. Connect the torch lead assembly to the TorchConnect console:

   Use your hands to tighten the coupler on the torch lead assembly.
   Do **not** use tools.



   Connect the plasma valve cable to its connector. Use your fingers to tighten this connection. Do **not** use tools.



Install the torch in the torch mounting bracket

Before you can install the torch in the torch mounting bracket, you must connect the torch lead assembly to the torch receptacle. Refer to Install the torch into the torch receptacle on page 138.

As the installer or user, you must supply the torch mounting bracket for your cutting system. Choose one that meets the requirements in Torch mounting bracket requirements on page 64. Mounting brackets are available from Hypertherm. Refer to Torch bracket on page 394 of the Parts List.

The XPR torch mounting sleeve is larger than the HPR torch mounting sleeve. Modification or replacement of an HPR mounting sleeve is necessary prior to XPR torch installation.

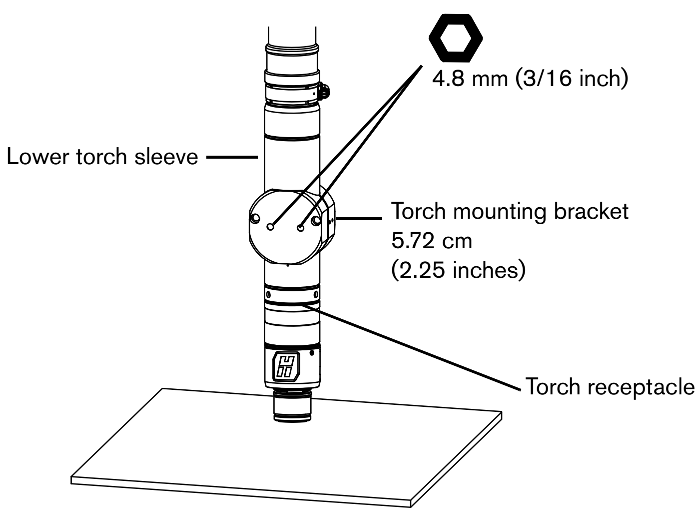
1. Remove the power from the cutting system:
   a. Set the line-disconnect switch to the OFF position.
   b. Make sure that the power-indicator LED is **not** illuminated on the plasma power supply, gas connect console, and TorchConnect console.

2. Install the torch mounting bracket onto the torch lifter.

   Refer to the instruction manual that came with the torch lifter for information about how to install the torch mounting bracket in the torch lifter.

3. Insert the torch (with attached torch lead assembly) into the torch mounting bracket, as shown in Figure 36.

Figure 36 – Torch assembly in mounting bracket



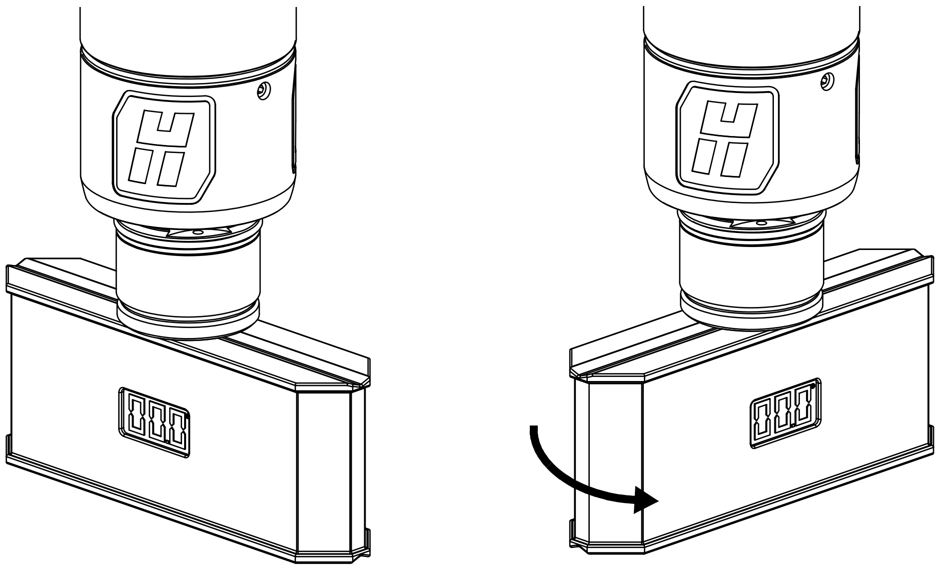
4. Move the torch assembly if necessary, so that the torch mounting bracket is around the lower part of the torch sleeve and does not touch the torch receptacle. Make sure that the torch mounting bracket is as low as possible on the torch sleeve, without touching the torch receptacle. This position can minimize vibration at the torch tip.

5. Make sure that the torch is level (at a 0° angle) in all directions, as shown in Figure 37. You can use a digital level to measure alignment for standard-position cutting, marking, and piercing.

   During bevel cutting, the torch is at an angle (not perpendicular) to the workpiece. The torch position for XPR torches can range from 0° – 52°. For information on bevel cutting, refer to Bevel cutting on page 222.

6. Remove the consumables, including the water tube, from the torch.

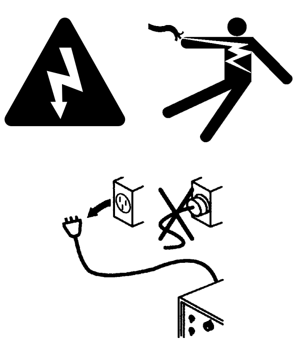
Figure 37 – Level the torch



7. Tighten the screws on the torch mounting bracket.

Install the consumables

WARNING



ELECTRIC SHOCK CAN KILL

Disconnect electric power before doing installation or maintenance.

The line-disconnect switch must REMAIN in the OFF position until all of the installation or maintenance steps are complete.

Refer to the *Safety and Compliance Manual* (80669C) for more safety information.

NOTICE

A LOOSE OR OVERTIGHTENED ELECTRODE CAN DAMAGE THE TORCH

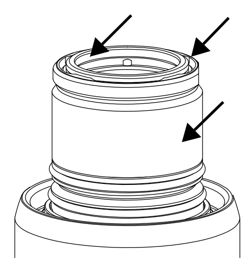
A tool is necessary to correctly install and tighten the torch electrode. Do **not** use your hands. Hypertherm recommends tightening the electrode to between 2.3 N∙m – 2.8 N∙m (20 in∙lbf – 25 in∙lbf) torque. If you fail to correctly install and tighten the electrode, torch damage can occur.

The torch head that comes with the XPR torch assembly kit (428488) has 300 A mild steel consumable parts pre-installed.

For guidance about how to choose consumables for your cutting or marking needs, refer to the *XPR Cut Charts Instruction Manual* (809830).

1. Remove the power from the cutting system:
   - **a.** Set the line-disconnect switch to the OFF position.
   - **b.** Make sure that the power-indicator LED is **not** illuminated on the plasma power supply, gas connect console, and TorchConnect console.
2. Choose the best consumables for your cutting or marking needs.
3. Apply a thin film of silicone lubricant (027055) to each O-ring on every consumable.

   The O-rings should look shiny. Too much lubricant can prevent gas flow. Remove excess lubricant if found.



4. Use a clean, lint-free cloth to wipe the internal and external surfaces of the torch.
5. Install the consumables on the torch as shown in Figure 38:
   - **a.** Install the water tube. Make sure that the water tube is installed prior to electrode installation.
   - **b.** Install the electrode.
   - **c.** Use either 1 of the 2 available tools (104119 or 429013) to tighten the electrode. A tool is necessary to correctly install and tighten the electrode. Do **not** use your hands. If you fail to correctly install or tighten the electrode, torch damage can occur. Hypertherm recommends tightening the electrode to between 2.3 N∙m – 2.8 N∙m (20 in∙lbf – 25 in∙lbf) torque.

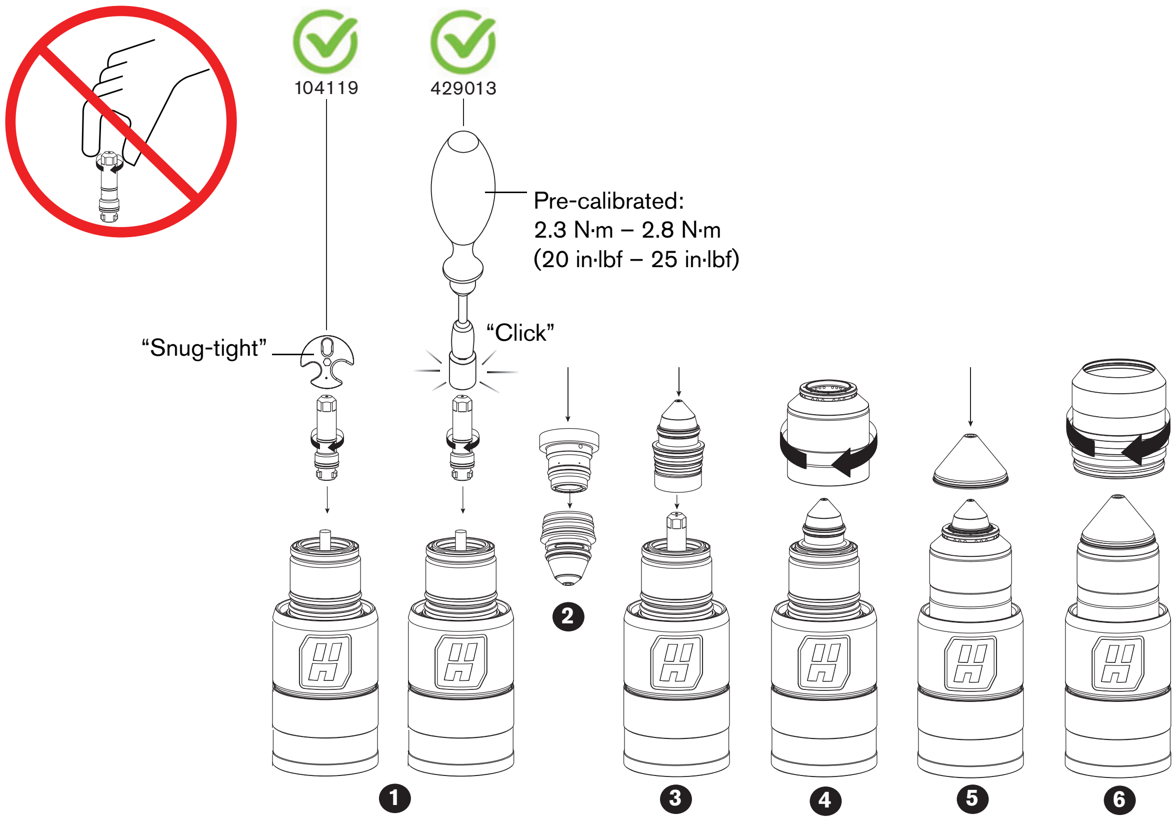
     Hypertherm offers 2 tools for tightening XPR torch components (104119 or 429013). The electrode torque tool (429013) is pre-calibrated at 2.5 N∙m (22.1 in∙lbf).

   - **d.** Install the swirl ring into the nozzle.
   - **e.** Install the nozzle and swirl ring assembly.
   - **f.** Install the nozzle retaining cap.

g. Install the shield.

h. Install the shield cap.

Figure 38 – Install the consumables on the torch



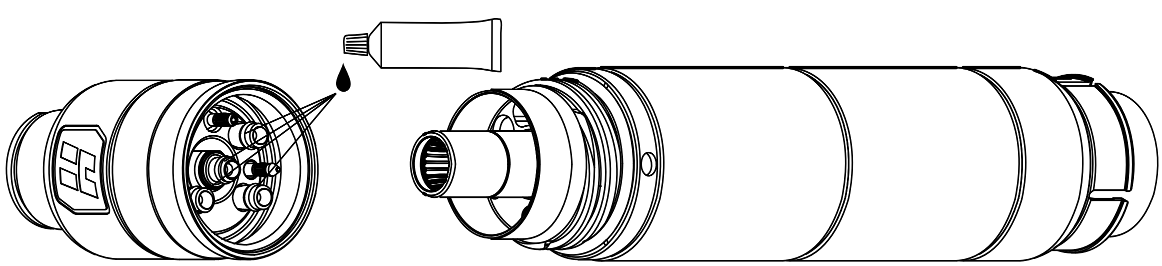
6. Install the torch in the torch receptacle. Refer to Install the torch into the torch receptacle on page 138.

7. Install the torch and attached receptacle in the torch mounting bracket. Refer to Install the torch in the torch mounting bracket on page 135.

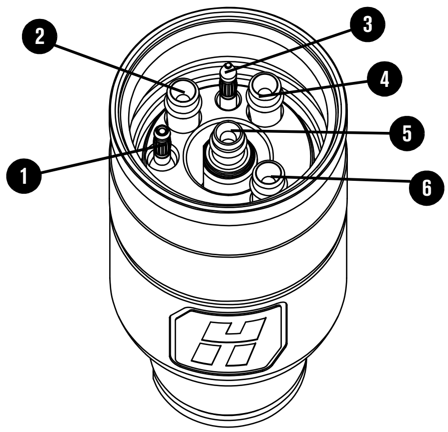
Install the torch into the torch receptacle

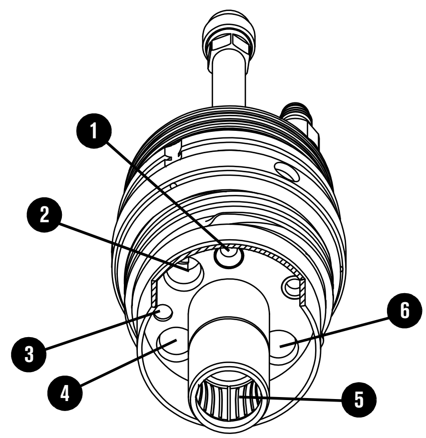
1. Apply a thin film of silicone lubricant (027055) to each of the 4 O-rings inside of the torch body.

   Do **not** apply silicone to the brass electrical connectors.



The O-rings should look shiny. Too much lubricant can prevent gas flow. Remove excess lubricant if found.





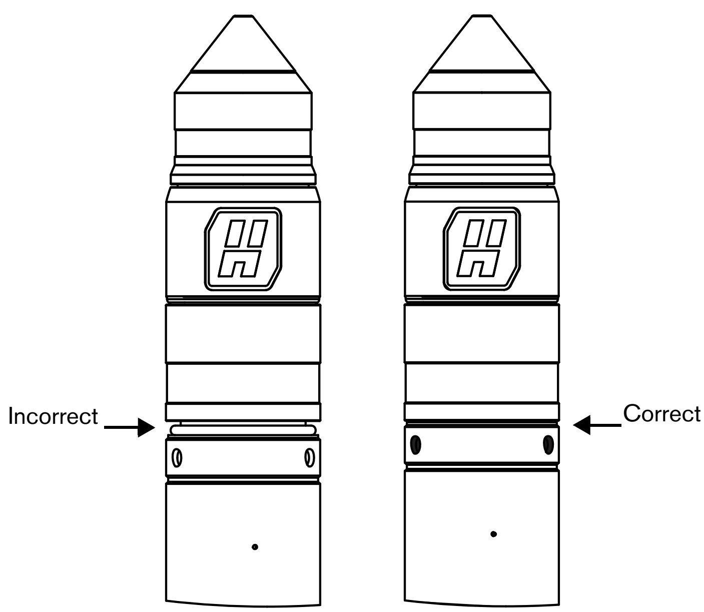
1 Pilot arc
2 Coolant return
3 Ohmic
4 Shield gas
5 Coolant supply
6 Plasma gas

2. Install the torch in the torch receptacle:

a. Turn the torch body with slight upward force until you feel it engage into position in the receptacle.

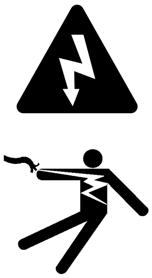
Use your hands to tighten the torch-coupler nut until the coupler nut no longer rotates. Do **not** use tools.

3. Make sure that the torch body is fully inserted into the torch receptacle. There should be no space between the torch body and torch receptacle.



Connect electric power to the cutting system

⚠ WARNING



ELECTRIC SHOCK CAN KILL

The line-disconnect switch must be in the OFF position before you connect the power cord to the cutting system. It must REMAIN in the OFF position until all installation steps are complete.

If the line-disconnect switch is not in the OFF position you can get a serious electric shock. Electric shock can seriously injure or kill you.

In the United States, use a “lock out/tag out” procedure until installation is complete. In other countries, follow the appropriate national and local safety procedures.

You must supply the main power cord for your cutting system. Choose one that meets local codes and all regulations and input power requirements. Refer to Input power requirements on page 40. The distance of the receptacle from the main box also can have an effect on size requirements for the main power cord. For information about the codes in your location and the requirements for your site, speak with a licensed electrician.

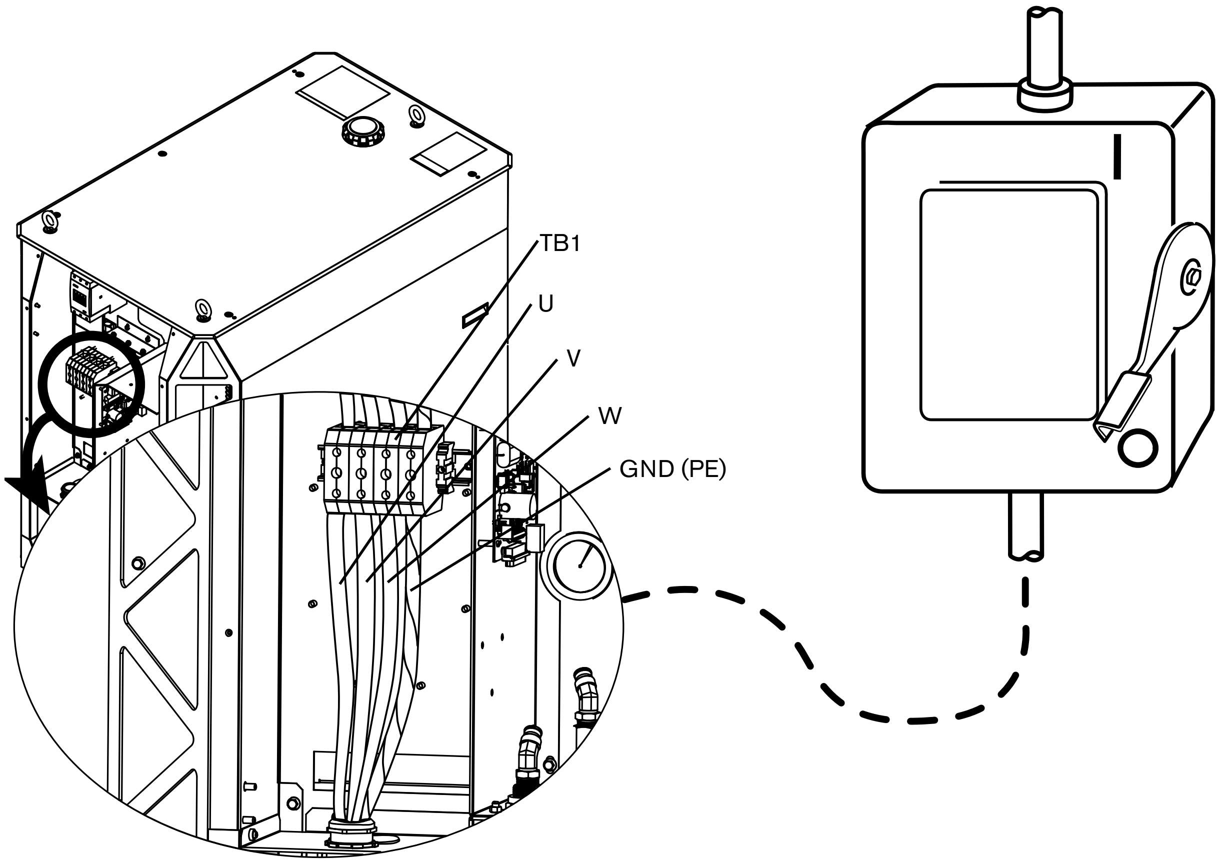
1. Make sure that the line-disconnect switch is in the OFF position and remains in the OFF position until all installation steps are complete.

2. Connect the main power cord to the plasma power supply, as shown in Figure 39:

   a. Connect the ground lead (PE) from the main power cord to the ground terminal (⏚) of TB1.

   b. Connect the W, V, and U leads from the main power cord to the corresponding TB1 terminals.

Figure 39 – Connect the main power cord to the plasma power supply



3. Follow national and local electrical codes to connect the W, V, and U power leads from the main power cord to the line-disconnect switch (Table 23).

Table 23 – Color codes for main power cord wires

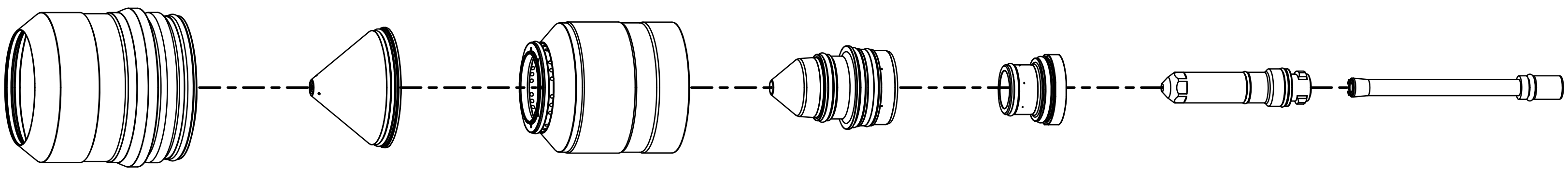
Wire color codes for North America	Wire color codes for Europe, Asia, and most locations outside of North America
U = Black	U = Black
V = White	V = Blue
W = Red	W = Brown
PE (earth ground) = Green/yellow	PE (earth ground) = Green/yellow

Example configurations for consumables

Worn or damaged consumables can have a negative effect on cut quality. Examine the installed consumables at least once daily, **before** system operation. For information about how to do this, refer to Examine the consumable parts on page 247 in the Maintenance section of this manual.

Ferrous (mild steel) example configurations

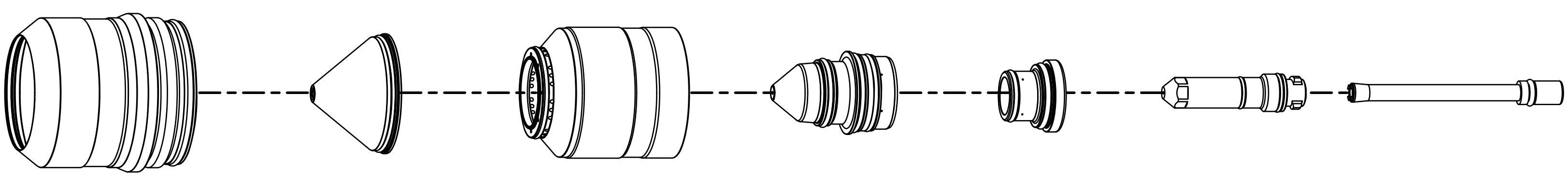
Mild steel – 30 A – O_2/O_2



Shield retaining cap	Shield	Nozzle retaining cap	Nozzle	Swirl ring	Electrode	Water tube
420200	**420228** 420619*	**420365**	**420225**	**420407** 420620*	**420222**	**420368**

* Consumables for mirror cutting only.

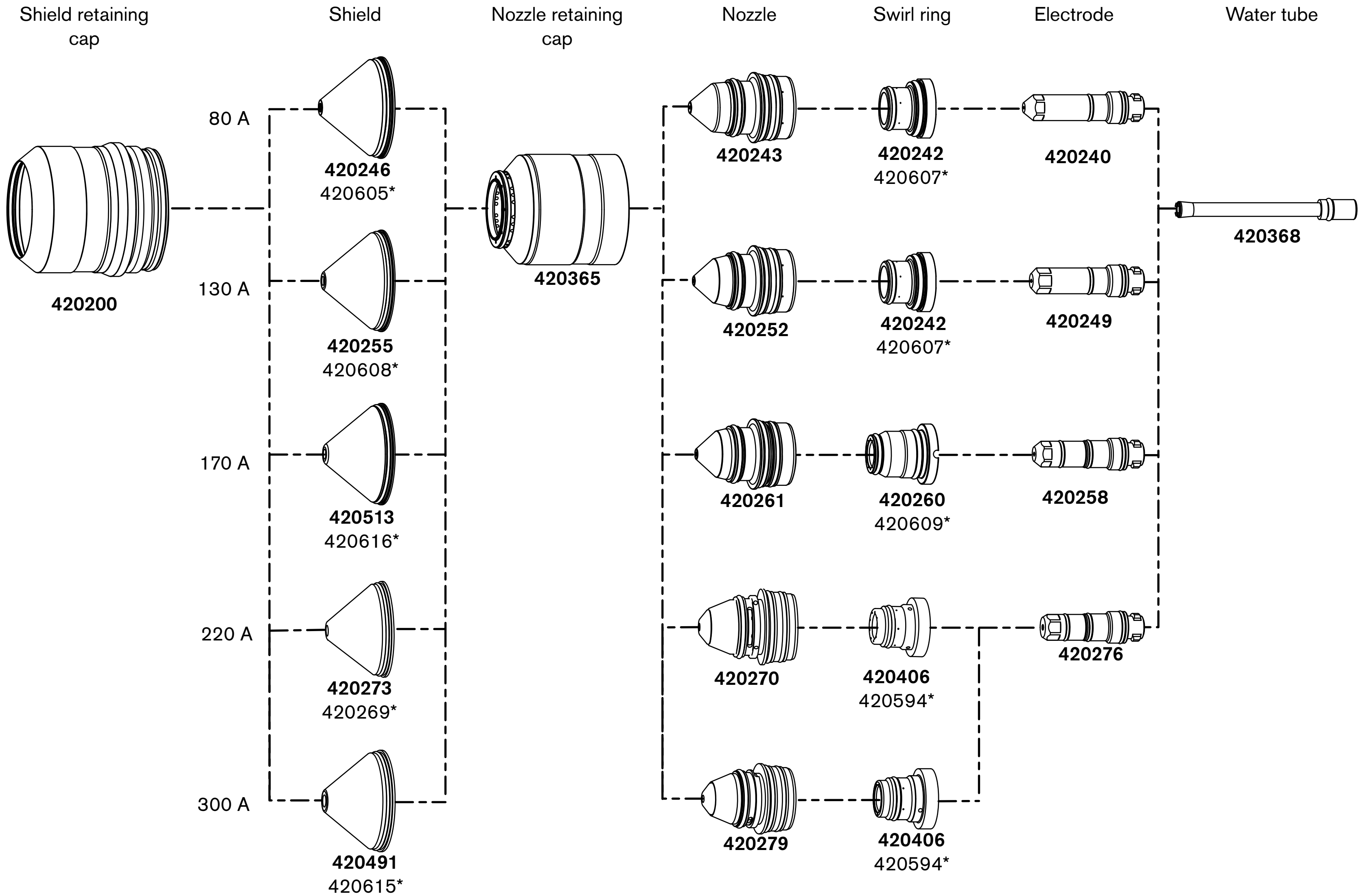
Mild steel – 50 A – O_2/Air



Shield retaining cap	Shield	Nozzle retaining cap	Nozzle	Swirl ring	Electrode	Water tube
420200	**420237** 420767*	**420365**	**420234**	**420233** 420768*	**420231**	**420368**

* Consumables for mirror cutting only.

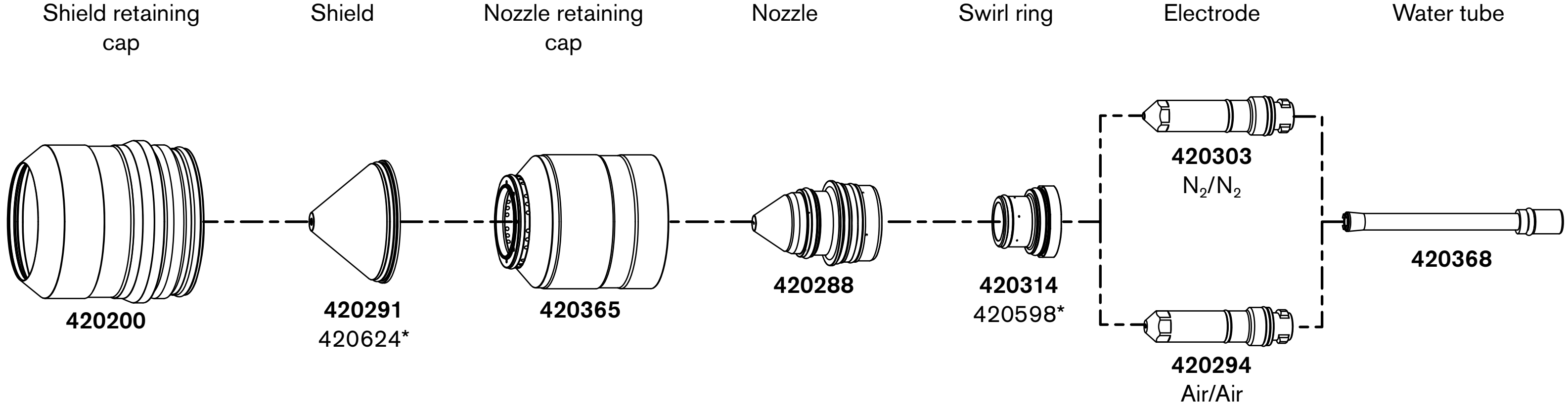
Mild steel – 80 A, 130 A, 170 A, 220 A, and 300 A – O_2/Air



* Consumables for mirror cutting only.

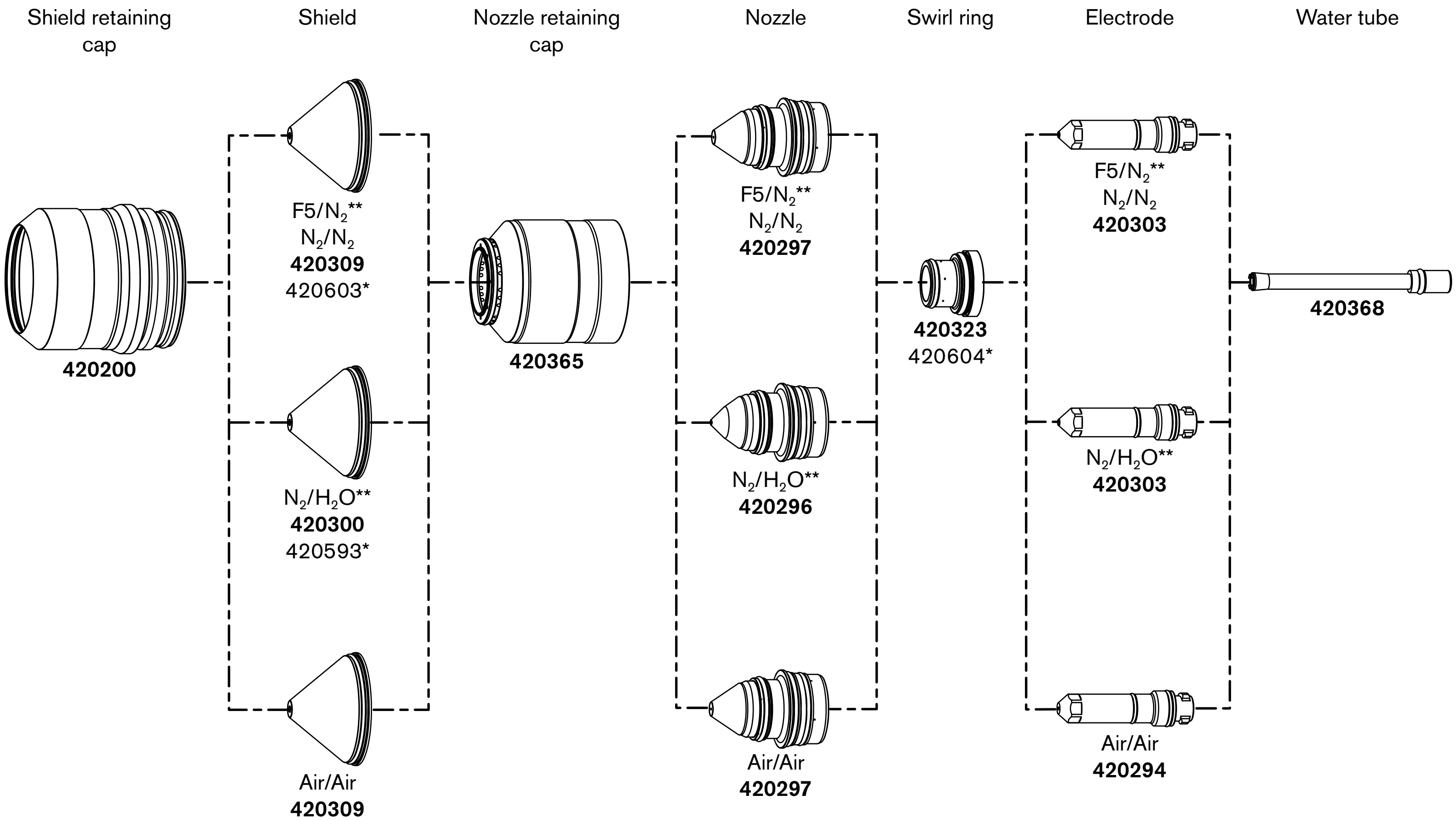
Non-ferrous (stainless steel and aluminum) example configurations

Non-ferrous – 40 A – N_2/N_2 and Air/Air



* Consumables for mirror cutting only.

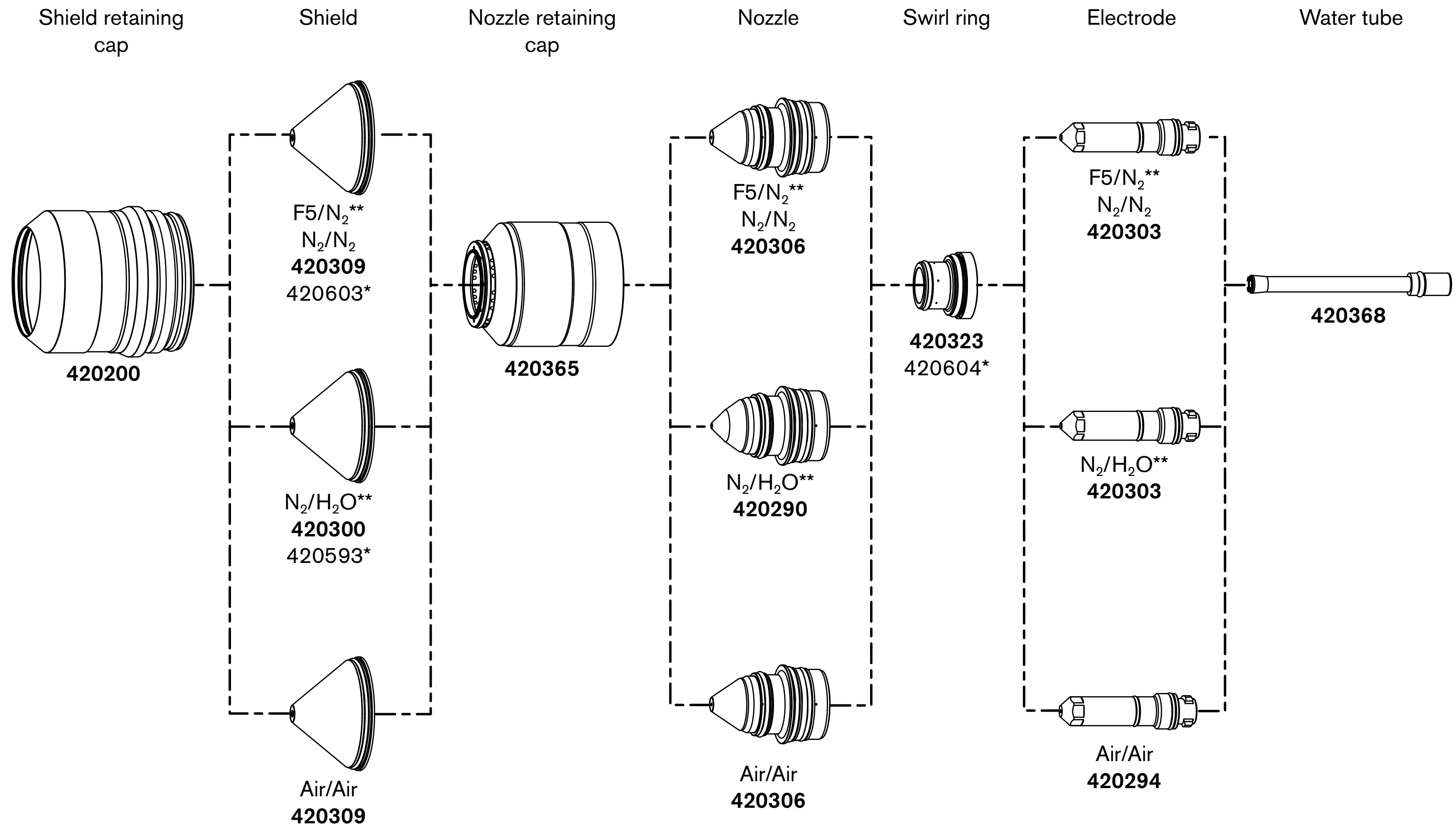
Non-ferrous – 60 A – $F5/N_2$**, N_2/N_2, N_2/H_2O**, and Air/Air



* Consumables for mirror cutting only.

** $F5/N_2$ and N_2/H_2O can only be used with VWI or OptiMix consoles.

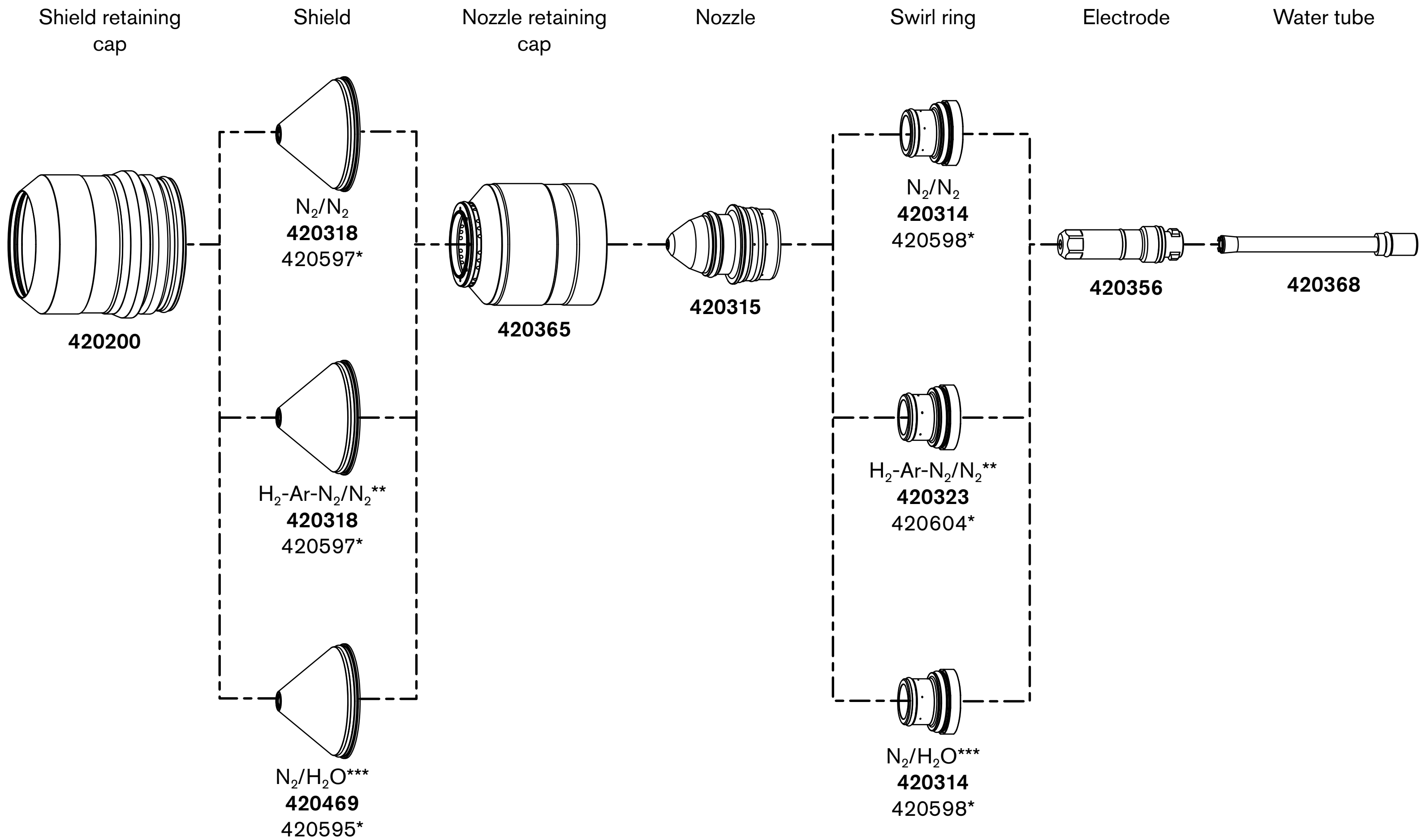
Non-ferrous – 80 A – $F5/N_2$**, N_2/N_2, N_2/H_2O**, Air/Air



* Consumables for mirror cutting only.

** $F5/N_2$ and N_2/H_2O can only be used with VWI or OptiMix consoles.

Non-ferrous – 130 A – N_2/N_2, H_2-Ar-N_2/N_2**, N_2/H_2O***

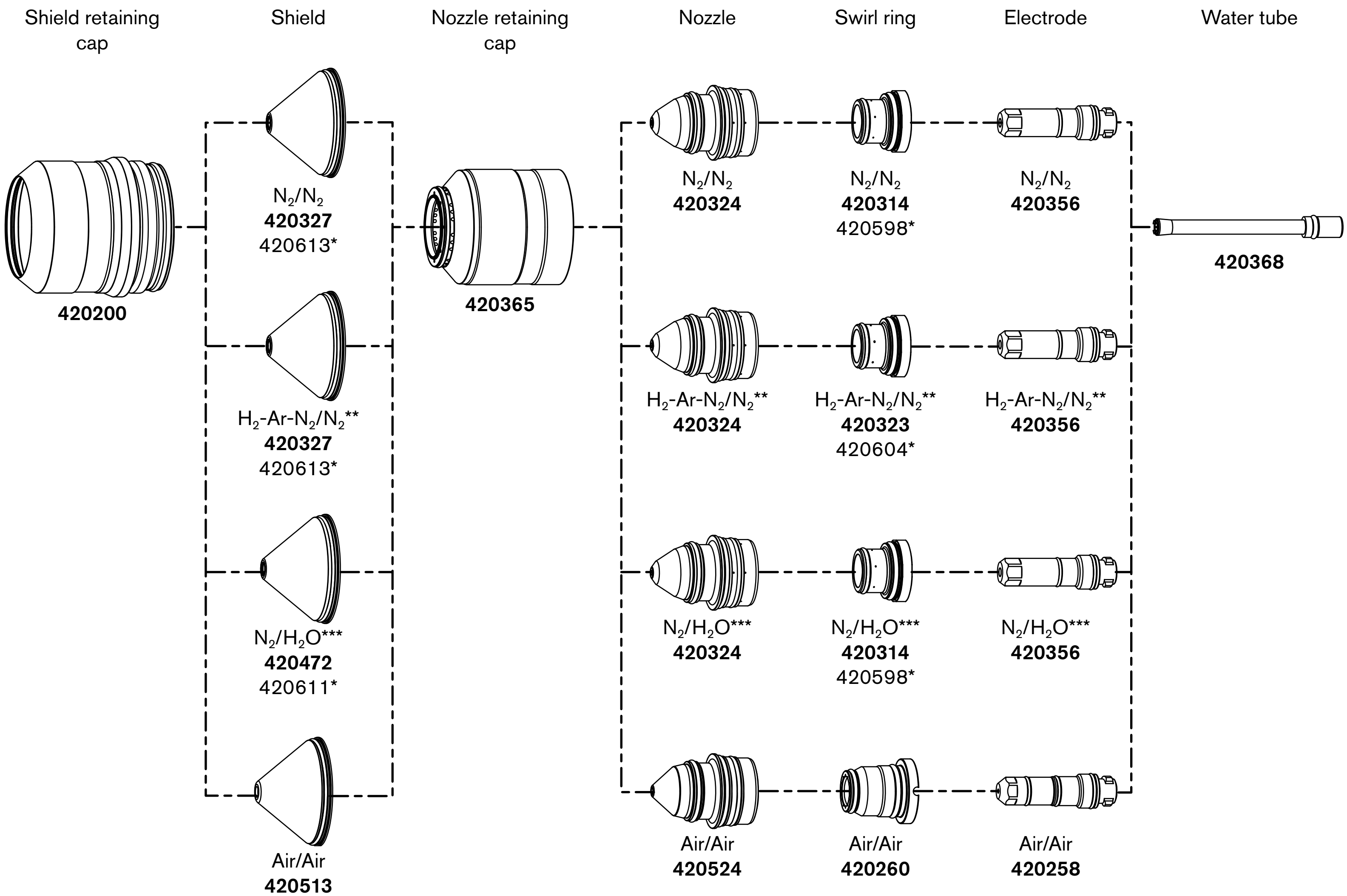


* Consumables for mirror cutting only.

** H_2-Ar-N_2/N_2 and N_2/H_2O can be used with OptiMix consoles.

*** N_2/H_2O can be used with VWI or OptiMix consoles.

Non-ferrous – 170 A – N_2/N_2, H_2-Ar-N_2/N_2**, N_2/H_2O***, Air/Air

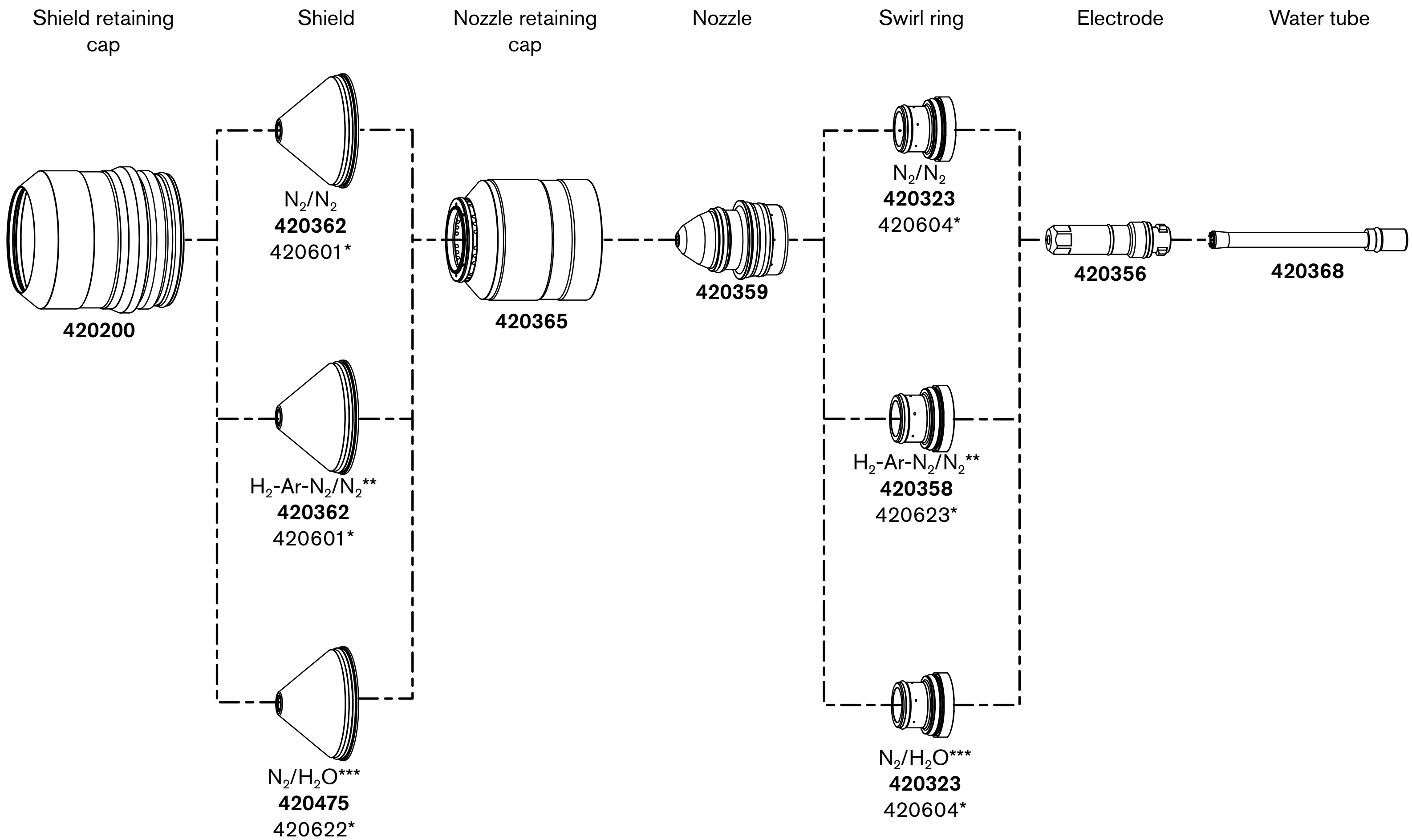


* Consumables for mirror cutting only.

** H_2-Ar-N_2/N_2 can be used with OptiMix consoles.

*** N_2/H_2O can be used with VWI or OptiMix consoles

Non-ferrous – 300 A – N_2/N_2, H_2-Ar-N_2/N_2**, N_2/H_2O***



* Consumables for mirror cutting only.

** H_2-Ar-N_2/N_2 and N_2/H_2O can be used on OptiMix consoles.

*** N_2/H_2O can be used with VWI or OptiMix consoles.

4 Connect for Communication

Choose the communication method that is best for your cutting system. There are 3 communication methods to fully operate the cutting system:

- **EtherCAT** – Use this method with an EtherCAT-compatible controller. Refer to How to connect to the plasma power supply with EtherCAT on page 153.

  If you use EtherCAT, remote on-off must be wired discretely by the cutting system manufacturer. Refer to Table 24 on page 152.

- **Serial RS-422 and discrete –** Use this method with a serial RS-422 and discrete-compatible controller.
  - Refer to How to connect to the plasma power supply with serial RS-422 on page 155.
  - Refer to How to connect to the plasma power supply with discrete on page 158.

  If you use serial RS-422, you must also use discrete to fully operate the cutting system. Refer to Table 24 on page 152.

- **Wireless (XPR Web Interface) and discrete** – Use this method with a wireless-enabled device and discrete-compatible controller.
  - Refer to How to connect to the plasma power supply with the XPR web interface on page 170.
  - Refer to How to connect to the plasma power supply with discrete on page 158.

  If you use wireless, you must also use discrete to fully operate the cutting system. Refer to Table 24 on page 152.

For information on signals and protocols, refer to the *CNC Communication Protocol for the XPR Cutting System* (809810).

Table 24 – Communication requirements and options

Set process with…*	To fully operate the cutting system…	Monitor with…		
	Discrete	EtherCAT	XPR web interface	RS-422
EtherCAT	Required for remote on-off**	Preferred	Alternative	Alternative
XPR web interface	Required	Alternative	Preferred	Alternative
RS-422	Required	Alternative	Alternative	Preferred

* **The device that first sets a process controls the plasma power supply.** For information on how to change the device that has control of the plasma power supply, refer to How to change the device that has control on page 196.

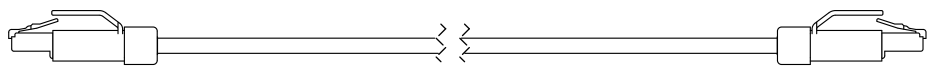
** Discrete inputs are ignored when a process ID is set over EtherCAT to a cutting system that uses the factory-default configuration. Contact your cutting machine supplier or Hypertherm Technical Service team with questions.

Example: If you use EtherCAT to set the process, the preferred method to monitor is EtherCAT. However, you can use RS-422 or the XPR web interface to monitor.

How to connect to the plasma power supply with EtherCAT

- For an example of a system diagram, refer to EtherCAT multi-drop (multi-system) interface (Sheet 16 of 22) on page 438.
- For information on signals and protocols, refer to *EtherCAT communications* and *Serial RS-422 and EtherCAT commands* in the *CNC Communication Protocol for the XPR Cutting System* (809810).

Figure 40 – EtherCAT cable



Hypertherm sells EtherCAT cables that have been tested with our cutting system. Refer to EtherCAT CNC interface cable on page 404 in the Parts List.

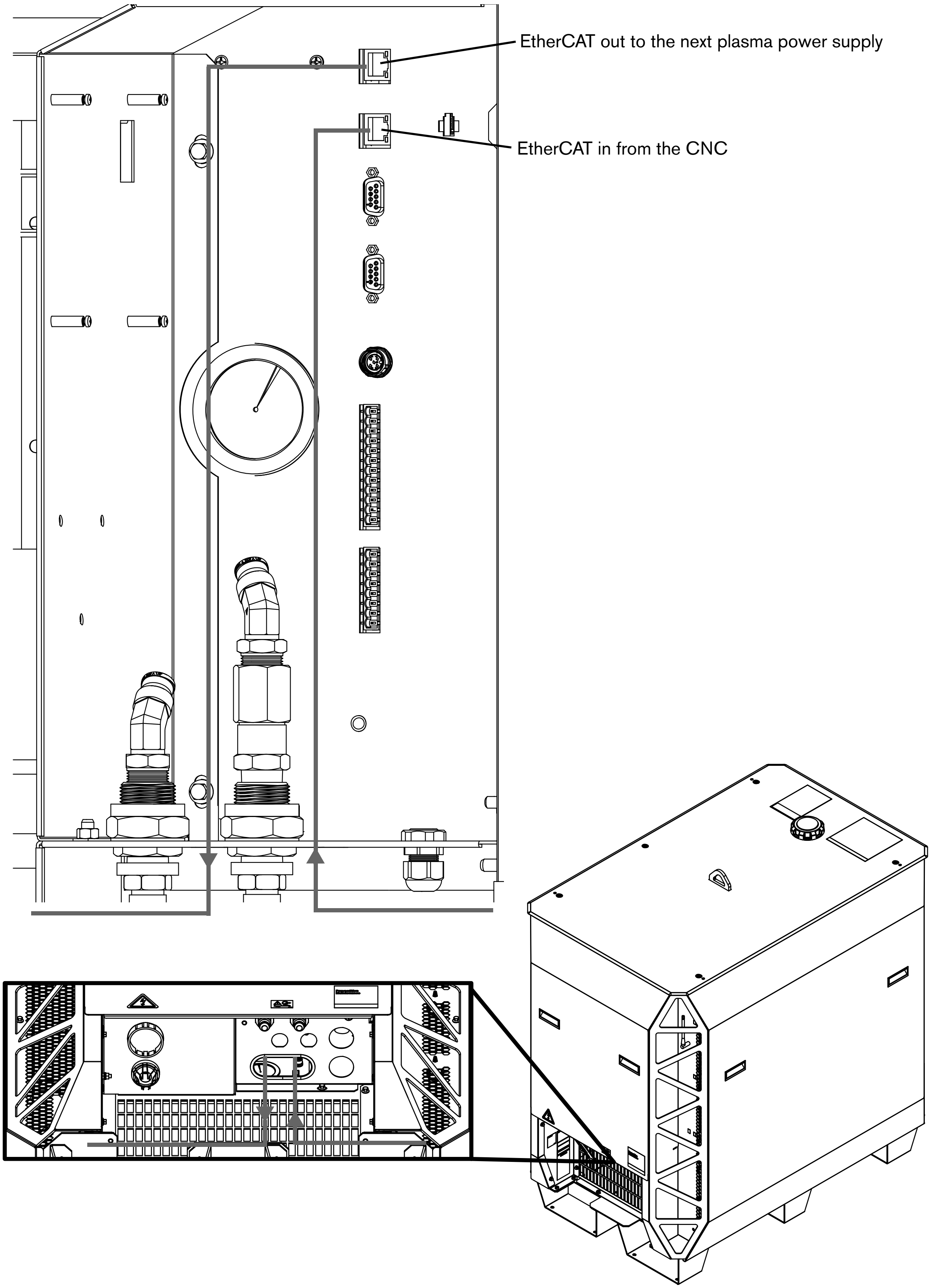
If you supply your own cables, choose EtherCAT cables that follow the Beckhoff® specification.

Type	Cat5e, 2-pair, 4-wire, double-shielded (overall foil and braid shield)
Wire	Construction: Stranded tinned wire Diameter: 0.75 mm (7 X 0.25 mm), 22 AWG Insulation: Polyethylene, 1.5 mm (0.06 inch) diameter
Core	Construction: Filler as central element Layer 1: 4 wires, 2 pair in star-quad configuration Sequence of colors: White, yellow, blue, orange Layer 2: Plastic tape overlapped Inner jacket: Thermoplastic copolymer, 3.9 mm (0.04 inch) diameter Aluminum laminated foil overlapped Shield: Braided, tinned copper wires, 0.13 mm (0.005 inch) diameter, coverage about 85%, 4.7 mm (0.19 inch) diameter
Jacket	Material: Polyurethane Wall thickness: 0.9 mm (0.04 inch) Outer diameter: 6.5 mm (0.26 inch) ± 0.2 mm (0.008 inch)
Maximum length	61 m (200 ft)

Use the following recommendations to avoid electromagnetic interference (EMI) problems with your cutting system:

- Separate the EtherCAT cable from the pilot arc lead, negative lead, or any power cables that have a voltage higher than 120 VAC. Refer to Distance requirements between high-frequency leads and control cables on page 62.
- Do not put the EtherCAT cable near the gas connect console.

Figure 41 – Connect EtherCAT cables to plasma power supply



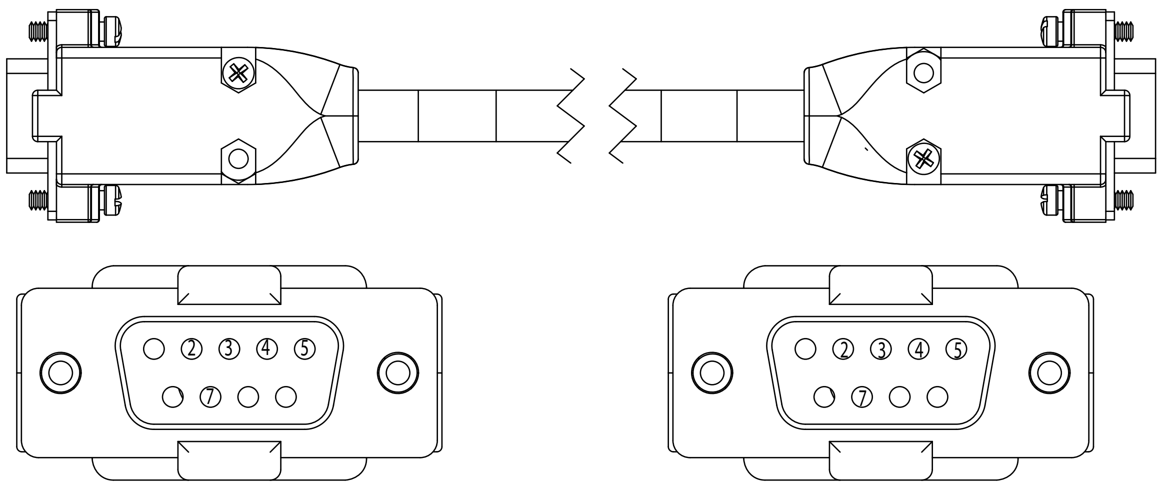
How to connect to the plasma power supply with serial RS-422

- For an example of a system diagram, refer to Serial RS-422 and discrete multi-drop (multi-system) interface (Sheet 17 of 22) on page 439.
- For serial RS-422 multi-drop (multi-system) addressing, refer to *XPR serial RS-422 multi-drop (multi-system) addressing* in the *CNC Communication Protocol for the XPR Cutting System* (809810).
- For information on signals and protocols, refer to *XPR serial RS-422 communications* and *Serial RS-422 and EtherCAT commands* in the *CNC Communication Protocol for the XPR Cutting System* (809810).

> To use arc voltage control (AVC) with a serial RS-422 cutting system, you must install an additional PCB inside the plasma power supply. For information about how to install this board, refer to VDC3 board installation (for AVC with RS-422 and discrete-only) on page 162.

1. Remove the rear panel of the plasma power supply. Refer to Remove the external panels from the system components on page 92.
2. Put End A (Figure 42) of the serial RS-422 cable through the hole in the bottom of the rear compartment in the plasma power supply. Refer to Figure 43 on page 157.
3. Connect End A of the serial RS-422 cable to the correct connector on the control board in the plasma power supply:
   - For systems with multiple plasma power supplies, use the top connector (J12) for the CNC. Use the bottom connector (J13) to connect to the next plasma power supply.
   - For systems with only one plasma power supply, you can use either connector to connect to the CNC.
4. Connect the End B (Figure 42) of the cable to the CNC.
5. If you are only monitoring with RS-422 serial, you are done. If you want to operate the cutting system, go to step 6.
6. You must connect to the plasma power supply with discrete. Refer to How to connect to the plasma power supply with discrete on page 158.

Figure 42 – Serial RS-422 cable



End A
To the plasma power supply (top serial connector, J12)

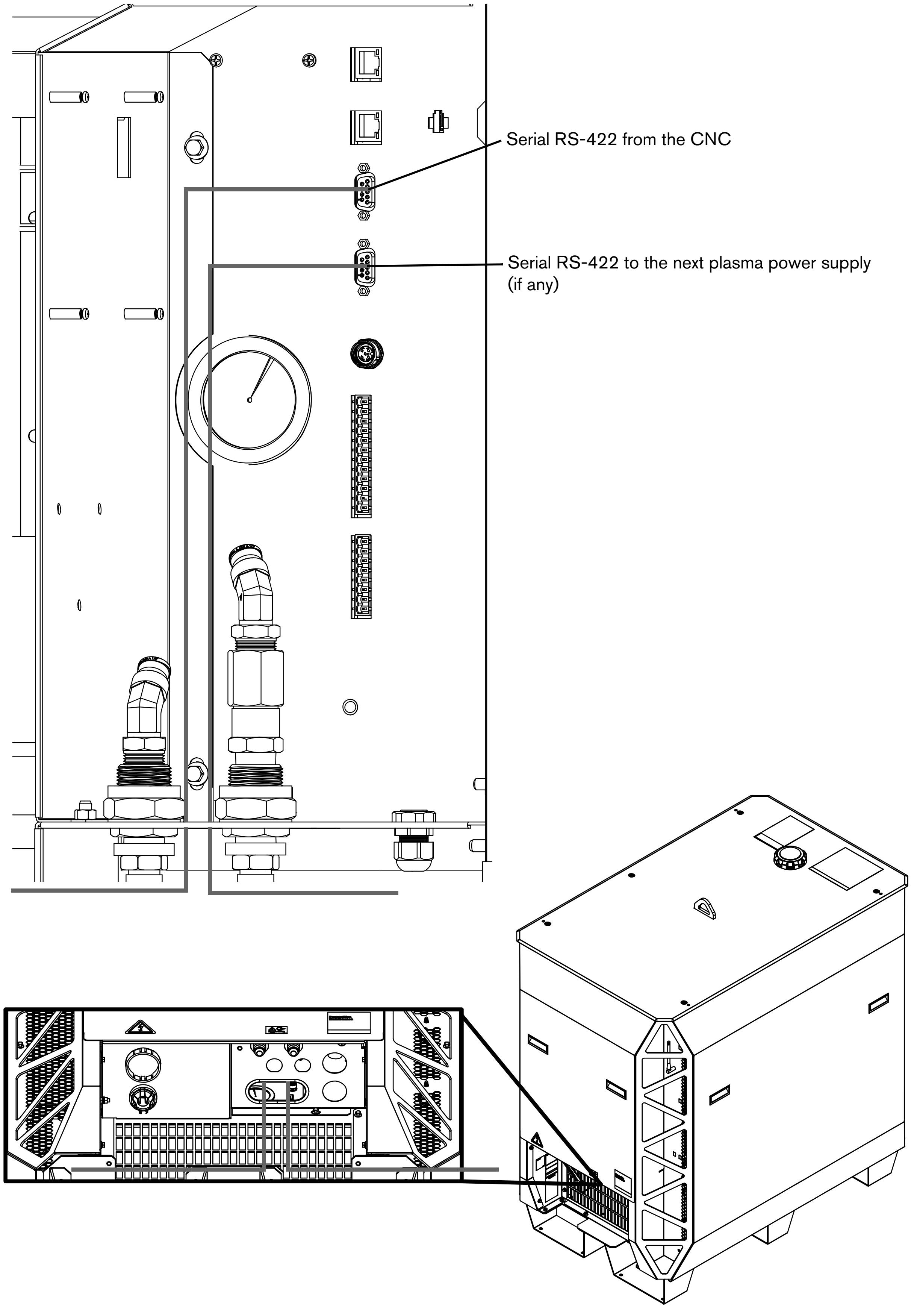
End B
To the CNC

For lengths, refer to Serial CNC interface cable on page 405 in the Parts List.

Table 25 – Pinout for serial RS-422 interface cable

End A		Wire color	End B		Wire type
Signal	**Pin number**		**Pin number**	**Signal**	
TxD +	4	Red	7	RxD +	Pair
TxD -	2	Black	3	RxD -	
RxD +	7	White	4	TxD +	Pair
RxD -	3	Black	2	TxD -	
GND	5	Green	5	GND	Pair
–	Cut	Black	Cut	–	

Figure 43 – Connect the serial RS-422 cable to the plasma power supply



How to connect to the plasma power supply with discrete

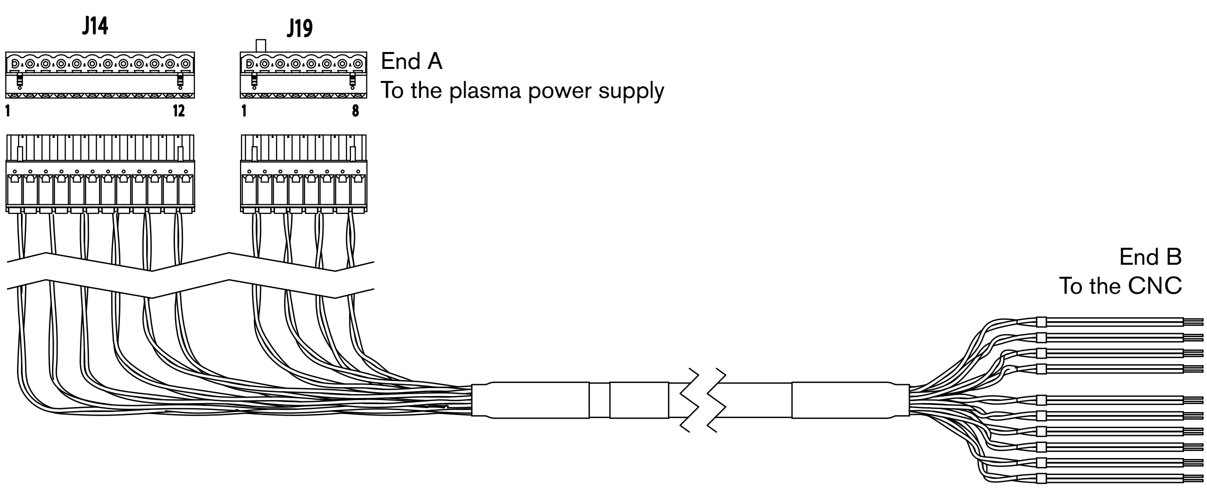
You must use serial RS-422 or the XPR Web Interface with discrete to operate the cutting system. If you use EtherCAT, remote on-off must be wired discretely by the cutting system manufacturer.

To use arc voltage control (AVC) with a discrete cutting system, you must install an additional PCB inside the plasma power supply. For information about how to install this board, refer to VDC3 board installation (for AVC with RS-422 and discrete-only) on page 162

- For an example of a system diagram, refer to Discrete multi-drop (multi-system) interface (Sheet 18 of 22) on page 440.
- For information on signals and protocols, refer to *XPR discrete communication* in the *CNC Communication Protocol for the XPR Cutting System* (809810).

1. Remove the rear panel of the plasma power supply. Refer to Remove the external panels from the system components on page 92.
2. Put End A (Figure 44) of the discrete cable through the hole in the bottom of the rear compartment in the plasma power supply. Refer to Figure 45 on page 161.
3. Connect J14 and J19 to their respective connectors on the control board in the plasma power supply.
4. Connect the End B (Figure 44) of the cable to the CNC. Refer to Table 26 on page 159 and Table 27 on page 160 for pinouts.

Figure 44 – Discrete cable



For lengths, refer to Discrete CNC interface cable on page 404 in the Parts List.

Table 26 – Pinout for J14 on the discrete cable

End A (Figure 44 on page 158)				
J14 pin	**Input/ Output**	**Signal**	**Function**	**Wire color**
1	Input[1]	Remote on/off +	When the input is closed, the plasma power supply is enabled. When open, the power to the consoles and the contactors is disabled.	Red
2		Remote on/off -		Black
3	Input[2]	Plasma start +	The CNC initiates preflow. If the hold input is not active, the CNC continues with the plasma arc. The plasma power supply stays in preflow as long as the hold input remains active.	White
4		Plasma start -		Black
5	Output[2]	Motion +	Notifies the CNC that an arc transfer has occurred and to begin machine motion once the CNC's pierce delay time elapses.	Green
6		Motion -		Black
7	Input[1, 3]	Hold +	The CNC delays plasma arc initiation. This signal is normally used in combination with the Start signals to synchronize multiple torches. Activate this signal at the same time as the Plasma Start signal. Deactivate this signal to fire the torch.	Blue
8		Hold -		Black
9	Input[1]	Shield pierceflow +	The CNC notifies the plasma system to maintain the shield preflow until the CNC releases the signal. Activate this signal at the same time as the Plasma Start signal. Deactivate this signal when the pierce time is complete.	Yellow
10		Shield pierceflow -		Black
11	Output[4]	F+24V CNC	Available 24 VDC (200 mA maximum)	Brown
12		F PWRGND	Ground	Black

1 Inputs are optically isolated. They require 24 VDC at 12.5 mA or dry-contact closure at 8 mA.

2 Outputs are optically isolated, open-collector transistors. The maximum rating is 24 VDC at 10 mA.

3 Although the plasma power supply has output capability, it is normally used solely as an input.

4 CNC +24 VDC provides 24 VDC at 200 mA maximum. A jumper is required on J17 to use 24 V power.

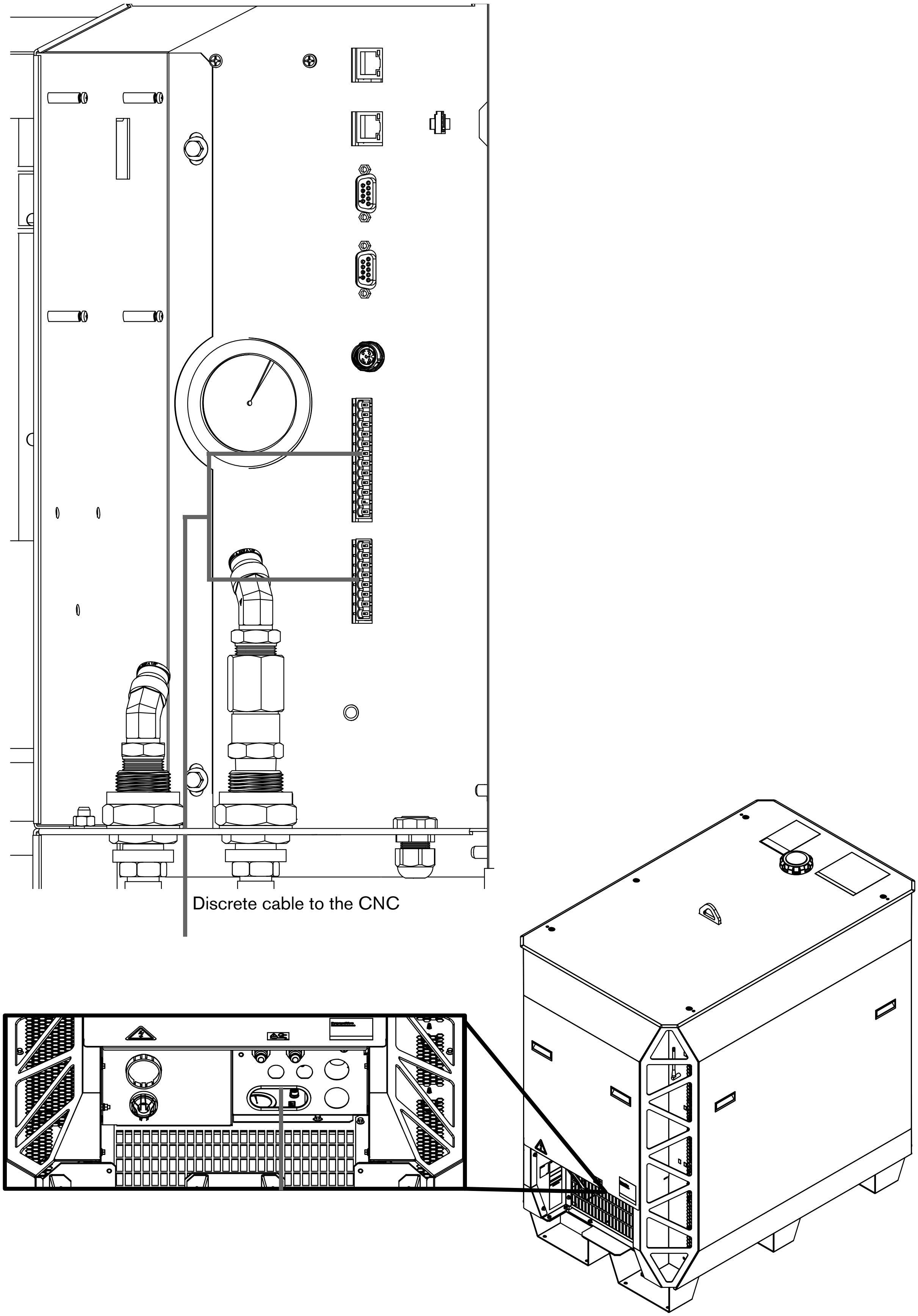
Table 27 – Pinout for J19 on the discrete cable

<table>
<tr><th colspan="2">End A (Figure 44 on page 158)</th><th colspan="3"></th></tr>
<tr><th>J19 pin</th><th>Input/ Output</th><th>Signal</th><th>Function</th><th>Wire color</th></tr>
<tr><td>1</td><td rowspan="2">Output[1]</td><td>Error +</td><td rowspan="2">Notifies the CNC that an alert, error, or failure has occurred. This signal is not intended to be used to stop table motion.</td><td>Orange</td></tr>
<tr><td>2</td><td>Error -</td><td>Black</td></tr>
<tr><td>3</td><td rowspan="2">Output[1]</td><td>Ready for start +</td><td rowspan="2">Notifies the CNC that the plasma power supply is ready for the plasma start.</td><td>White</td></tr>
<tr><td>4</td><td>Ready for start -</td><td>Red</td></tr>
<tr><td>7</td><td rowspan="2">Output[2]</td><td>Shield ohmic contact +</td><td rowspan="2">Refer to notes below for further info.</td><td>Blue</td></tr>
<tr><td>8</td><td>Shield ohmic contact -</td><td>Red</td></tr>
</table>

1 Outputs are optically isolated, open-collector transistors. The maximum rating is 24 VDC at 10 mA.

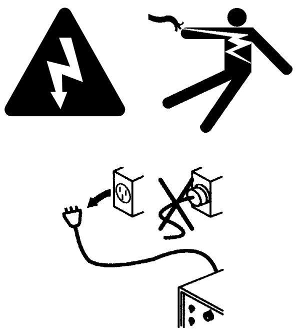
2 Shield ohmic contact is used to interface to plasma interface boards that have their own ohmic contact circuit. Refer to How to use ohmic contact sense on page 197.

Figure 45 – Connect the discrete cable to the plasma power supply



VDC3 board installation (for AVC with RS-422 and discrete-only)

WARNING



ELECTRIC SHOCK CAN KILL

Disconnect electric power before doing installation or maintenance. You can get a serious electric shock if electric power is not disconnected. Electric shock can seriously injure or kill you.

All work that requires removal of the plasma power supply outer cover or panels must be done by a qualified technician.

Refer to the *Safety and Compliance Manual* (80669C) for more safety information.

CAUTION

STATIC ELECTRICITY CAN DAMAGE PRINTED CIRCUIT BOARDS

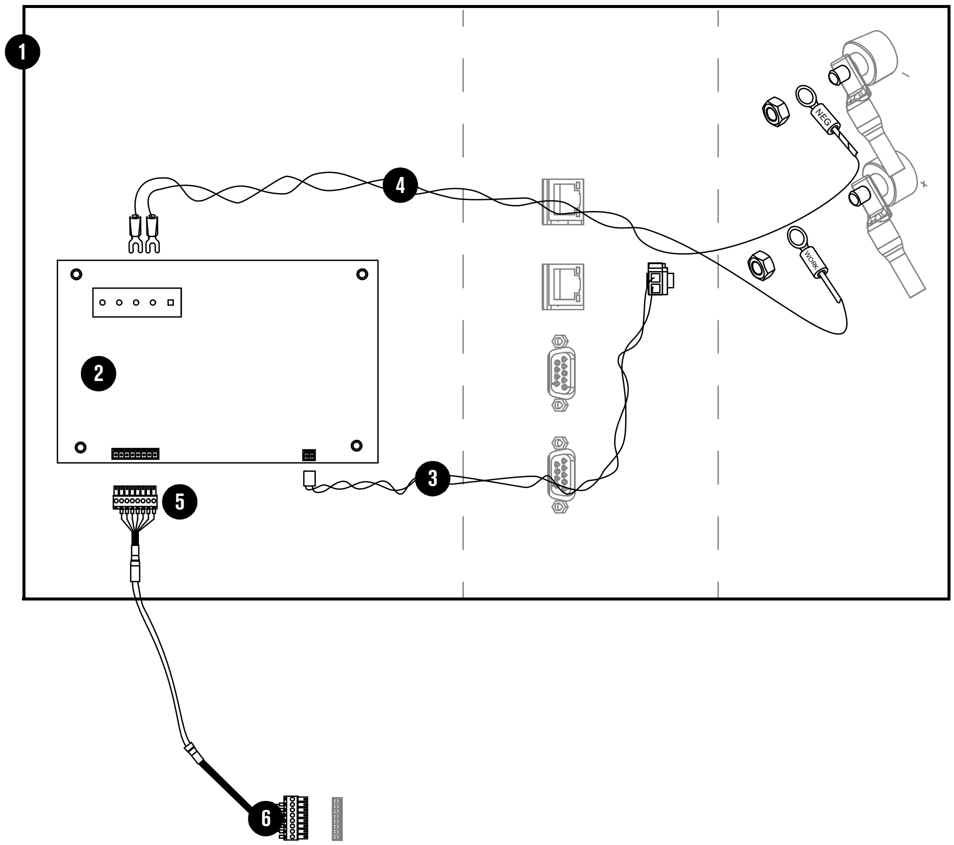
Use precautions when handling printed circuit boards (PCBs) to protect them from static electricity. Correct PCB handling includes the following steps:

- Store PCBs in anti-static containers.
- Wear a grounded wrist strap when handling PCBs.

Diagram of board, cable, and wire connections

Refer to Figure 46 for an overview of the board, cable, and wire connections inside the plasma power supply.

Figure 46 – Connections inside the plasma power supply



1. Plasma power supply
2. Board: VDC3 (141511)

   Wire harness in the plasma power supply

   3. Wires: VDC3 board 120 VAC
   4. Wires: Arc voltage

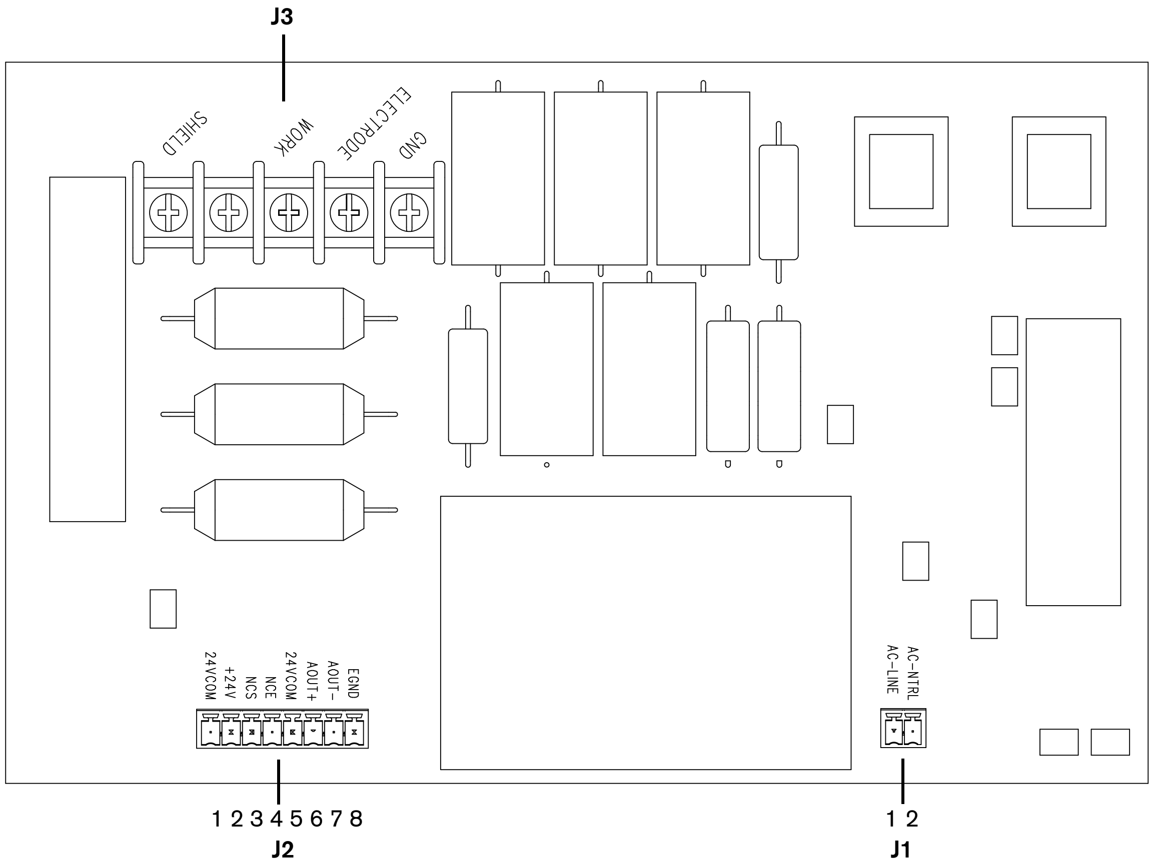
5. Male connector to VDC3 board (pre-installed on the VDC3 board)
6. Cable and connector to the computer numerical controller (CNC) (customer supplied)

Part numbers are shown for parts included in the kit.

The wire harness to connect the VDC3 board is located in a clip inside of the plasma power supply. The wiring harness includes the arc voltage wires and the power wires.

How to install the VDC3 board (141511)

Figure 47 – VDC3 board



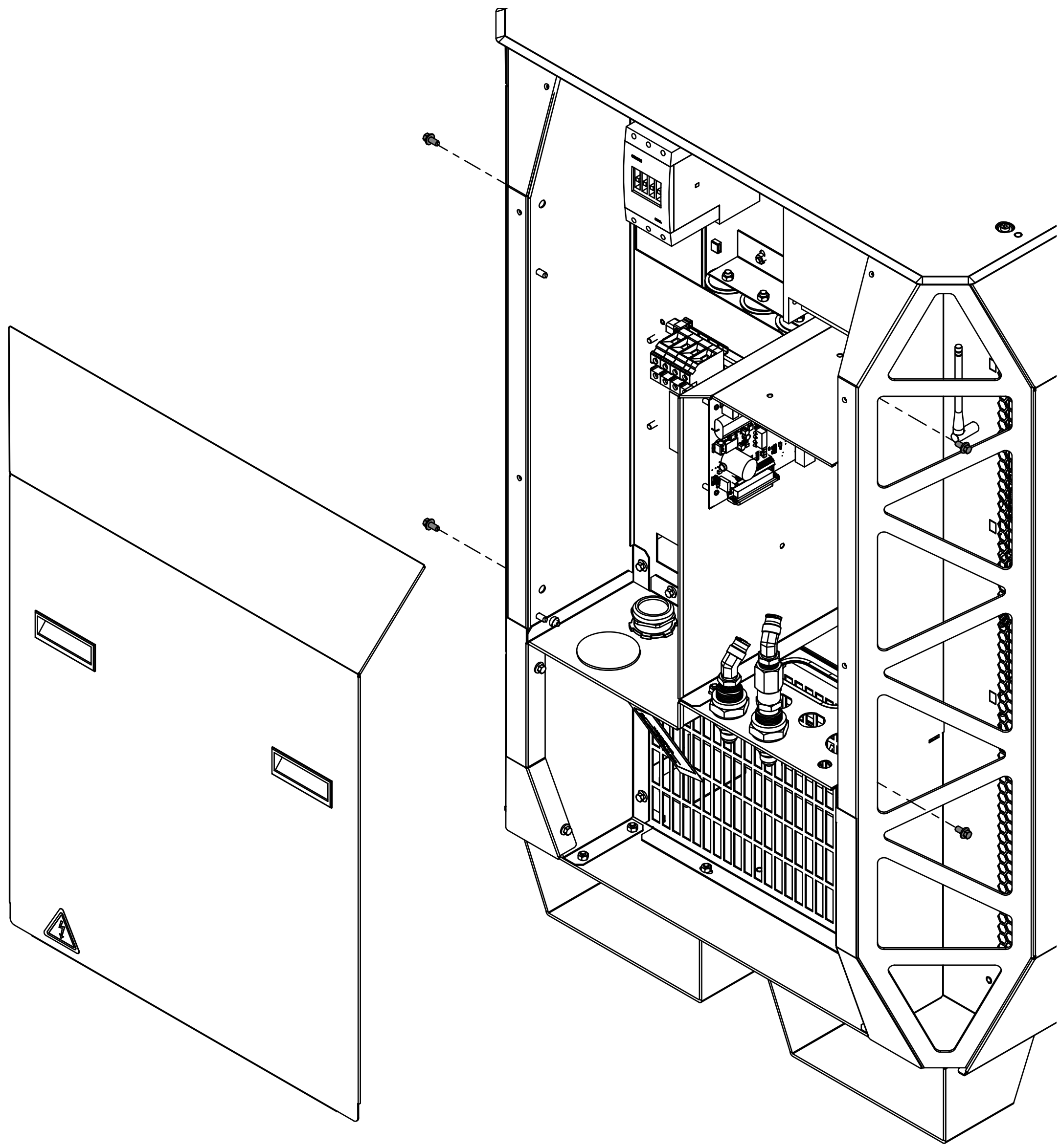
J1 120 VAC wires connector

J2 VDC3 board cable connector

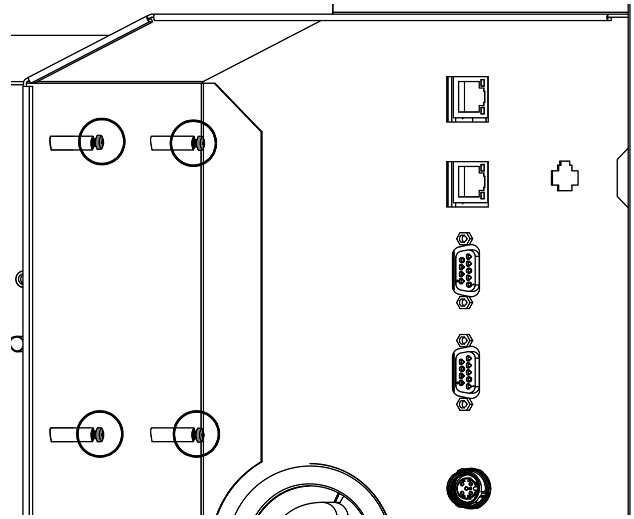
J3 Arc voltage wires connector

1. Use a 10 mm hex socket wrench or nut driver to remove the rear panel of the plasma power supply.

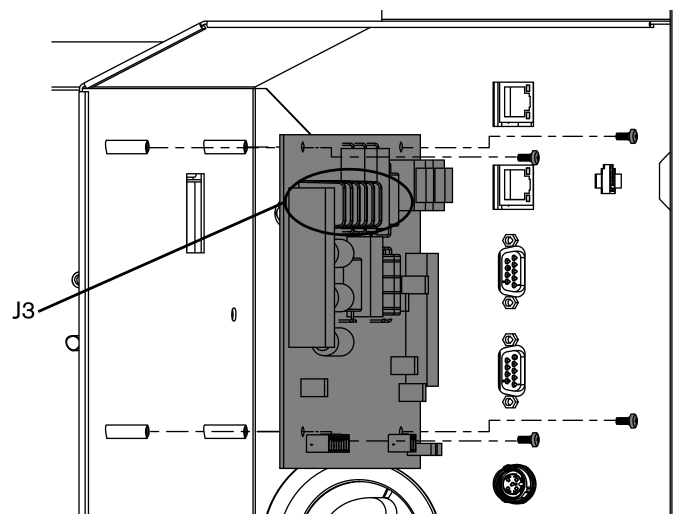
Figure 48



2. Use a #2 Phillips screwdriver to remove the 4 screws from the studs.

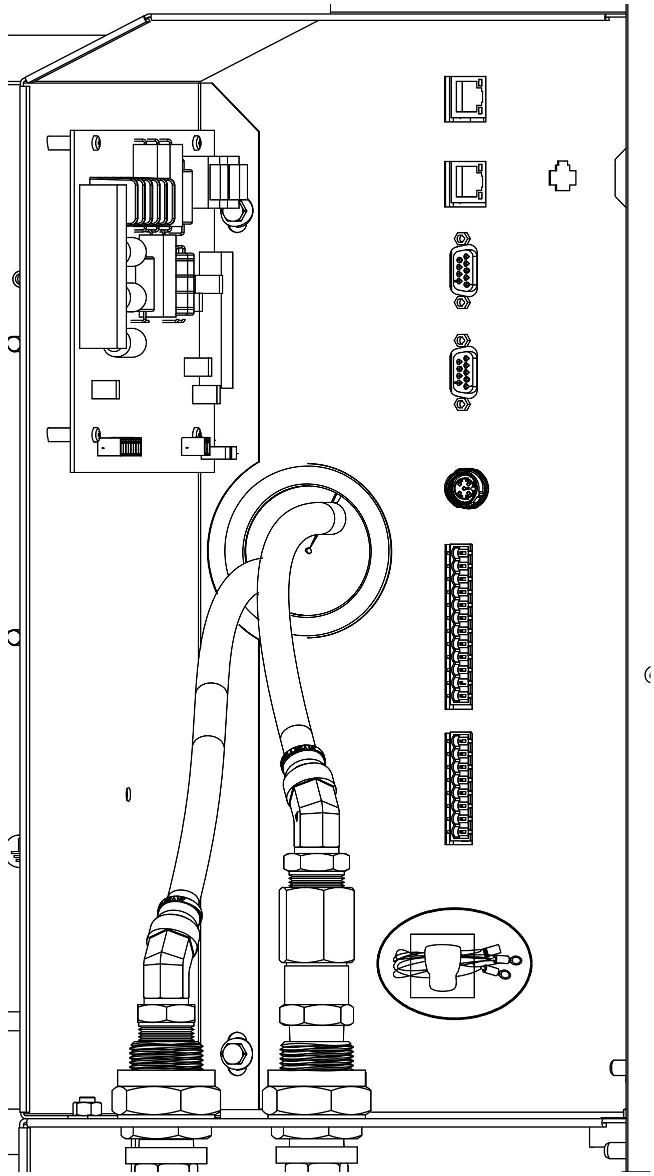


3. With J3 on top, use the 4 screws to install the board on the studs. Tighten the screws to 9.2 kg·cm (8.0 in·lb).



How to connect the VDC3 board (141511)

1. Remove the wire bundle from the wire clip in the plasma power supply.

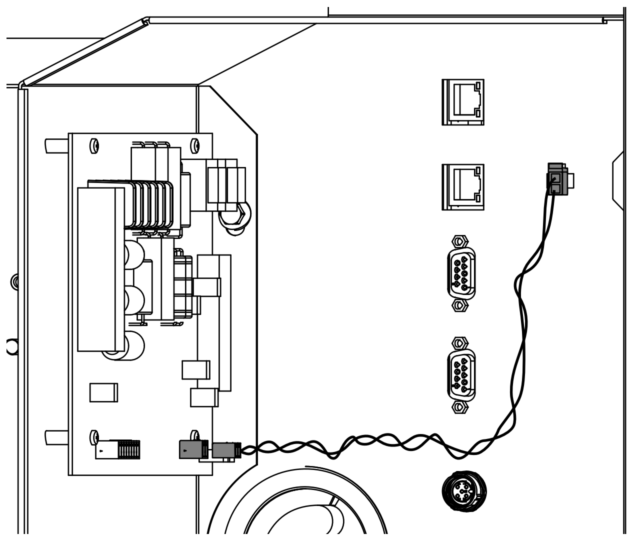


The wire bundle is included in the plasma power supply. The bundle includes the arc voltage wires and power wires.

2. Connect one end of the VDC3 120 VAC harness to J1 of the VDC3 board with the tab on top, as shown in Figure 49.

3. Connect the other end of the VDC3 120 VAC harness to the 120 VAC connector.

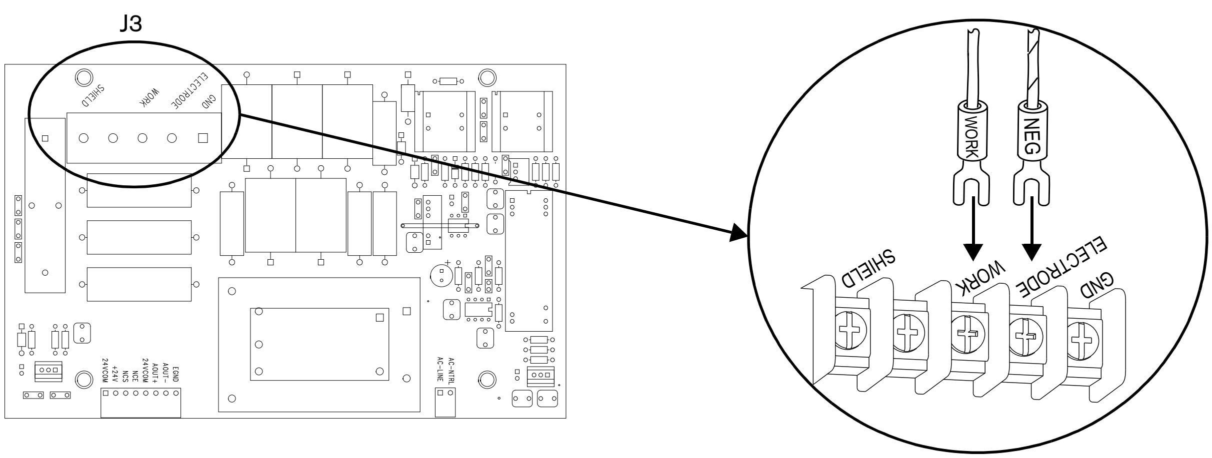
Figure 49



4. Attach the spade connector of the yellow wire (WORK) to the J3-WORK terminal, as shown in Figure 50.

5. Attach the spade connector of the yellow/black wire (NEG) to the J3-ELECTRODE terminal.

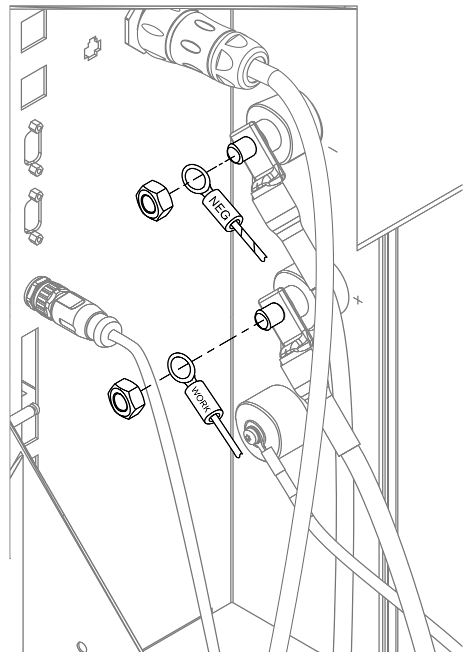
Figure 50



6. Attach the ring connector on the yellow wire (WORK) to the work bolt in the plasma power supply.Tighten the nut to 20 N·m (15 ft·lb).

7. Attach the ring connector on the yellow/black wire (NEG) to the negative bolt in the plasma power supply. Tighten the nut to 20 N·m (15 ft·lb).

   Other wires are already attached to the bolts in the plasma power supply. Attach the arc voltage wires on top of the existing wires.



8. Use NCS (pin 3), NCE (pin 4), Aout+ (pin 6), and Aout- (pin 7) to connect to the CNC. Refer to Figure 47 on page 164 for the locations of the pins. Refer to Table 28 for the pinout.

   Use the interface requirements of your CNC for additional connection requirements.

Table 28 – Pinout for J2 on the VDC3 board

J2 on the VDC3 board	
Pin number	**Signal**
1	Not connected
2	+24 VDC (out)
3	Nozzle contact sense (output)
4	Nozzle contact enable (input)
5	24 VDC common
6	+ Analog out (40:1)
7	- Analog out (analog common)
8	EMI chassis ground (cable shield)

9. Install the rear panel of the plasma power supply.

How to connect to the plasma power supply with the XPR web interface

CAUTION

WEAK NETWORK SECURITY INCREASES THE RISK FOR UNAUTHORIZED CUTTING SYSTEM OPERATION OR MISUSE

If you use a wireless (Wi-Fi™) network to communicate with your cutting system, Hypertherm recommends the use of a secure Wi-Fi network to minimize the risk of unauthorized cutting system operation or misuse.

Unauthorized access or misuse of the Wi-Fi network can result in incorrect settings or commands. Bad settings and commands can cause an uncontrollable or unusable system. A negative effect on system performance, shortened consumable life, and torch damage is also possible.

Minimum security features can include, but are not limited to, the following:

- Password protection
- WPA2 security for the plasma power supply
- A hidden SSID for the Wi-Fi network

Operator training about network security

You must use discrete with the XPR web interface to operate the cutting system.

If you go out of range with the device, you cannot communicate with the cutting system. The cutting system continues to operate. For more information on distances for wireless, refer to Distance requirements for communications on page 63.

You can use one of the following options to connect to the XPR web interface:

- Access point (AP) mode. Refer to Use AP mode to connect on page 171.
  - You connect to the plasma power supply's network.
  - AP mode is the default connection option. You connect to a single plasma power supply.
- Network mode. Refer to Use network mode to connect on page 173.
  - You connect the plasma power supply to your network.
  - The advantage of network mode is that you can connect to one network and access multiple plasma power supplies.

Web interface support information

- If you have a problem connecting and you suspect a problem with your device, router, or local network, contact your system administrator.
- If you have a problem connecting and you suspect a problem with the plasma power supply, contact your cutting machine supplier or Hypertherm Technical Service.

Use AP mode to connect

In AP mode, each plasma power supply has its own connection. You can only connect to and control one plasma power supply at a time. You must have a computer-based device with a screen, web browser that supports the latest web standards, and wireless access.

1. Supply power to the cutting system:
   a. Set the line-disconnect switch to the ON position.
   b. Make sure that the power-indicator LED is illuminated on the plasma power supply.
   c. Make sure that the remote on-off switch is set to ON.

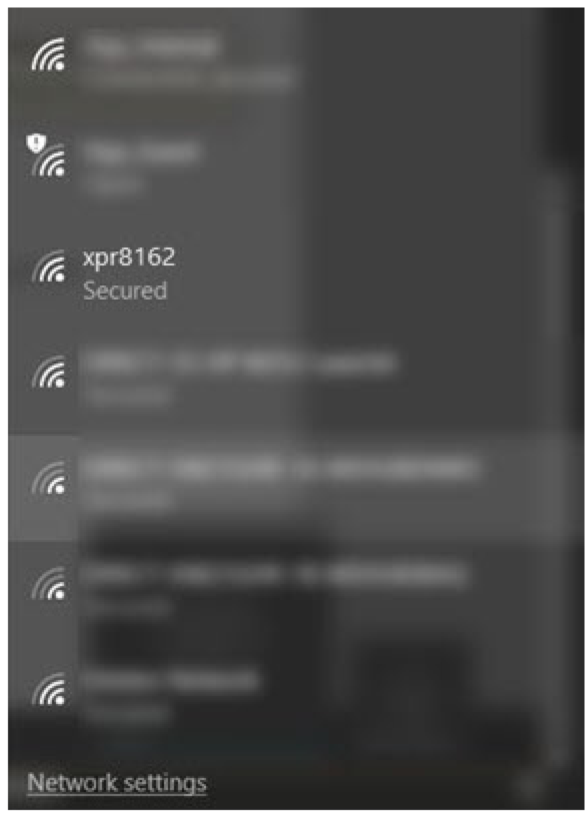
2. On your device, go to the wireless connections menu.

   This menu can be different on different devices.

3. Choose the XPR connection.

   The default connection name is "xpr" + the System ID. The System ID is the last 4 digits of the Media Access Control (MAC) address. For more information on the System ID and MAC address, refer to Web interface screen information on page 188.

   If you want to change the connection name, refer to Configure on page 195.



4. Enter the password, "hypertherm".

   If you want to change your password, refer to Configure on page 195.

5. Open an Internet browser.

6. Go to http://192.168.1.1/index.html.

- The plasma power supply is now connected.
- The information about your plasma power supply and connection are located in the upperleft of the XPR web interface.

- If the Client ID and the Operator ID are the same on your device, you are in control of the plasma power supply and can set a process.
- Refer to Web interface screen information on page 188 for more information on the interface menus.

7. To fully operate the cutting system, you must also use discrete. Refer to How to connect to the plasma power supply with discrete on page 158.

Use network mode to connect

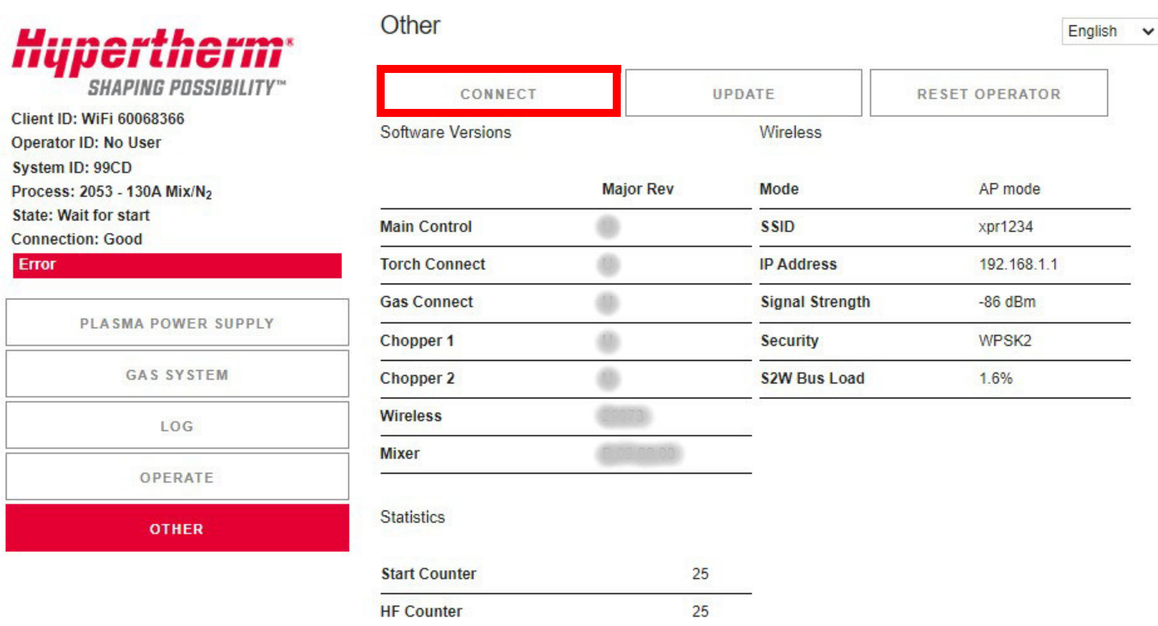
In network mode, multiple plasma power supplies can be connected to a network. You can connect to and control multiple plasma power supplies at the same time.You must have a computer-based device with a screen, web browser that supports the latest web standards, and wireless access.

Before you begin:

- You must set up a router with a local network to access. Follow the router's instructions to do this. If you have problems setting up your router, contact your system administrator.
- You must know the SSID and passphrase for the router.

1. Follow the procedure in Use AP mode to connect on page 171 to connect the wireless set-up device to the plasma power supply.

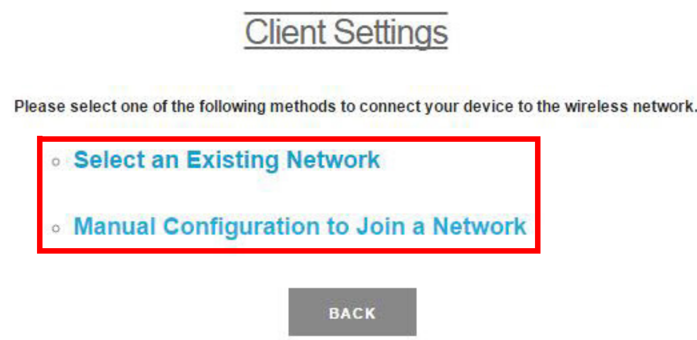
2. Choose **Connect** on the **Other** screen to open the Device Setup page.



The XPR web interface shows different fields for different XPR models.
The screen shown is for reference only.

3. Choose **Client Settings**.

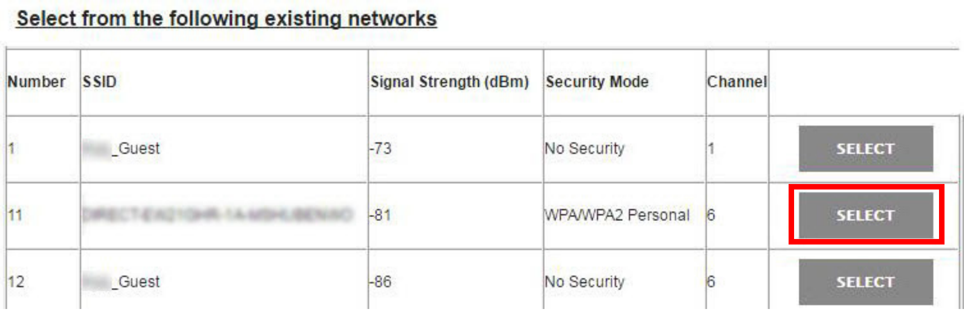
4. Choose an option to connect to wireless networks:
   - Select an existing network on page 175.
   - Set up manually on page 178.



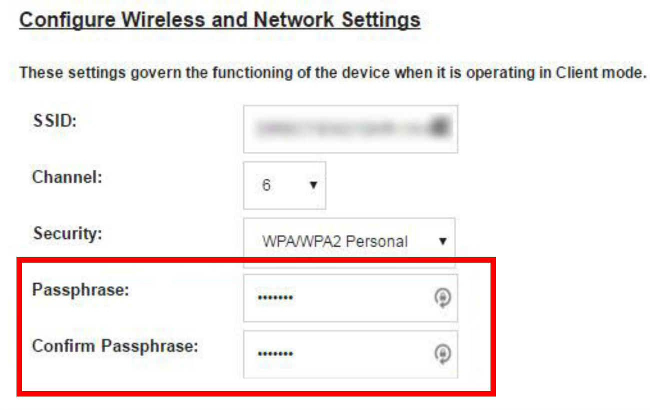
Select an existing network

When you choose this option, the plasma power supply scans for and shows the available access points.

1. Choose **Select** to connect to your router.

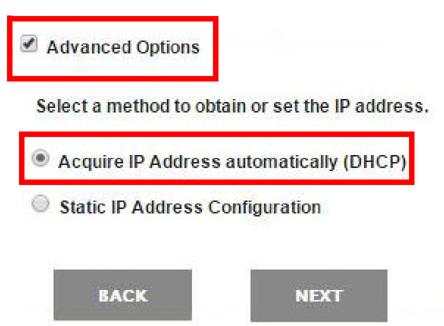


2. Type the required credentials for the router in **Passphrase**.

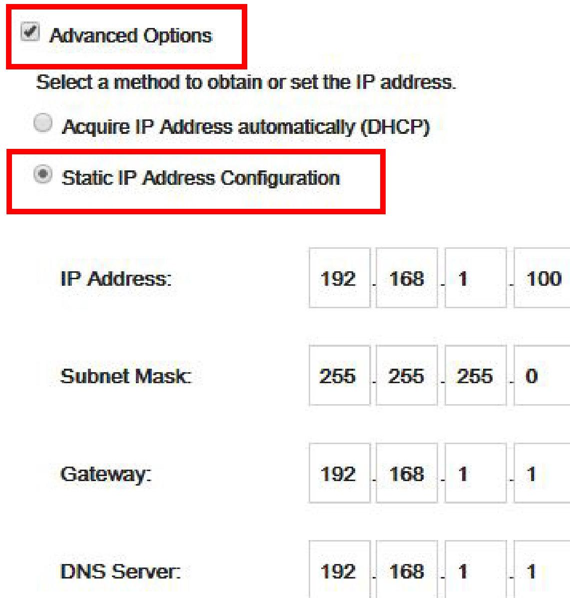


3. If needed, select the **Advanced Options** check box and select a method to get the IP address. If not, go to step 4.

   a. Dynamic Host Configuration Protocol (DHCP)

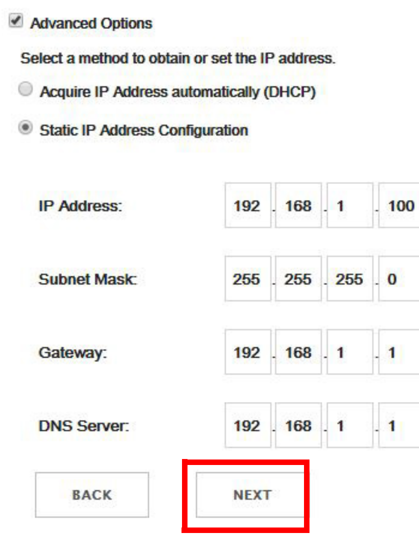


b. Static IP (advanced users only.)



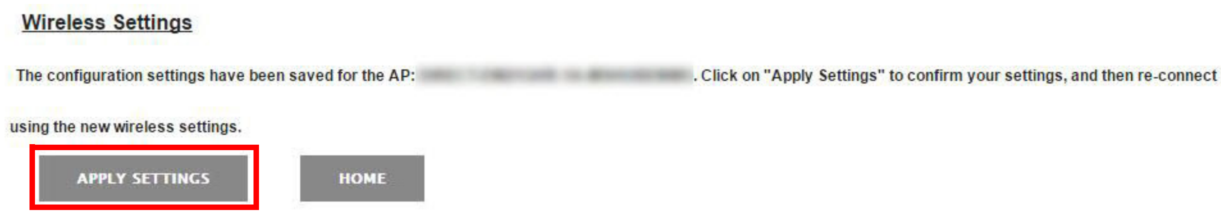
4. Choose **Next** to go to the Wireless Configuration Summary screen.

This page shows information about the **SSID**, **Channel**, and **Security** type.



5. Choose **Save**.

6. This page provides the option to apply the settings. Choose **Apply Settings**.



> The selected wireless settings are applied to connect the plasma power supply to the new network. The plasma power supply now resets and connects to the new network.

> To access the web interface after setup, refer to Access the XPR web interface after setup in network mode on page 181.

7. If you are only monitoring with the XPR web interface, you are done. If you want to operate the cutting system, go to step 8.

8. You must connect to the plasma power supply with discrete. Refer to How to connect to the plasma power supply with discrete on page 158.

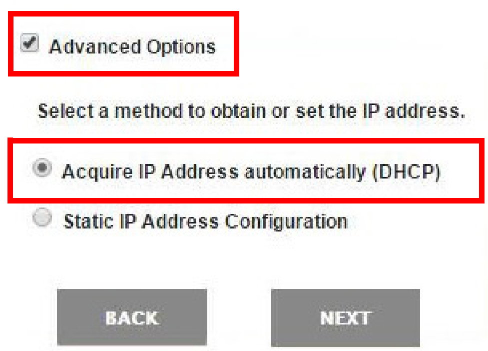
Set up manually

When you choose this option, you manually set up the wireless network.

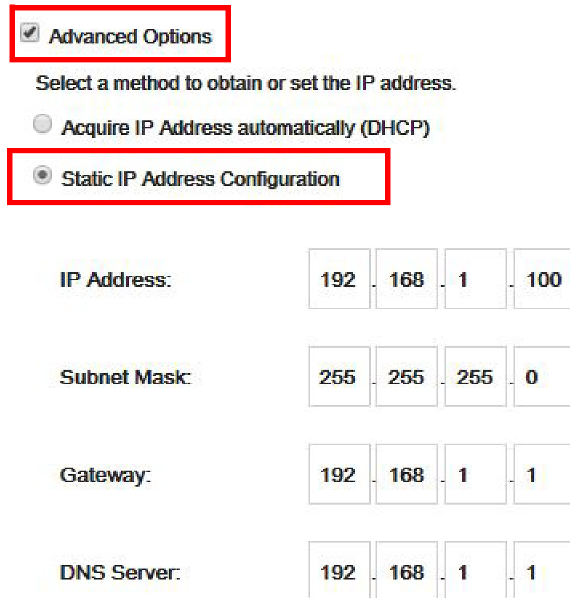
1. Select or type the wireless related settings such as **SSID**, **Channel**, **Security**, and **Passphrase**.

2. If needed, select the **Advanced Options** check box and select a method to get the IP address. If not, go to step 3.

   a. Dynamic Host Configuration Protocol (DHCP)



b. Static IP (advanced users only.)

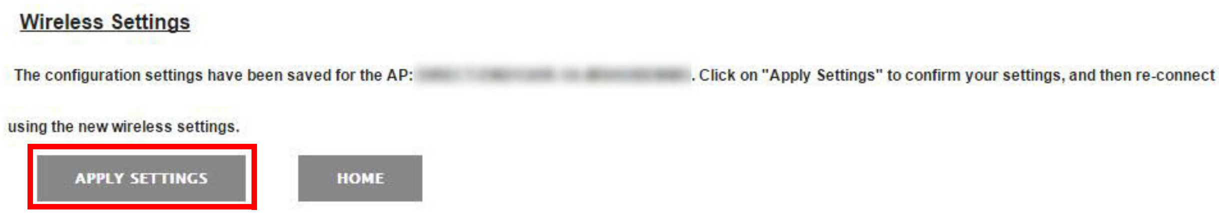


3. Choose **Next** to go to the Wireless Configuration Summary screen.

This page shows information about the **SSID**, **Channel**, **Security** type, **IP Address**, **Subnet Mask**, **Gateway**, and **DNS Server**.

4. Choose **Save**.

5. This page provides an option to apply the settings. Choose **Apply Settings**.



The selected wireless settings are applied to connect the plasma power supply to the new network. The plasma power supply now resets and connects to the new network.

To access the web interface after setup, refer to Access the XPR web interface after setup in network mode on page 181.

6. If you are only monitoring with the XPR web interface, you are done. If you want to operate the cutting system, go to step 7.

7. You must connect to the plasma power supply with discrete. Refer to How to connect to the plasma power supply with discrete on page 158.

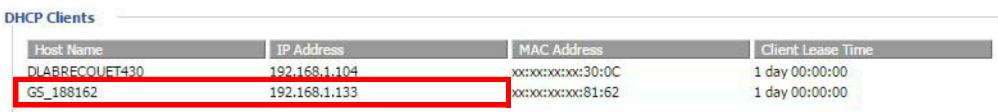
Access the XPR web interface after setup in network mode

Use the IP address of the plasma power supply.

> Hypertherm recommends that you use DHCP reservation if it is available on your router. This allows the plasma power supply to keep the same IP address through power cycles without having to set up the wireless module with the static IP address.

1. Use your router’s web interface to find the DHCP client table. Refer to Figure 51 for an example.

Figure 51 – Example DHCP client table


DHCP Clients

Host Name	IP Address	MAC Address	Client Lease Time
DLABRECQUET430	192.168.1.104	xx:xx:xx:xx:30:0C	1 day 00:00:00
GS_188162	192.168.1.133	xx:xx:xx:xx:81:62	1 day 00:00:00

2. Find the IP address of the plasma power supply.

> Your plasma power supply name shows as “GS_” + the last 6 digits of the MAC address.

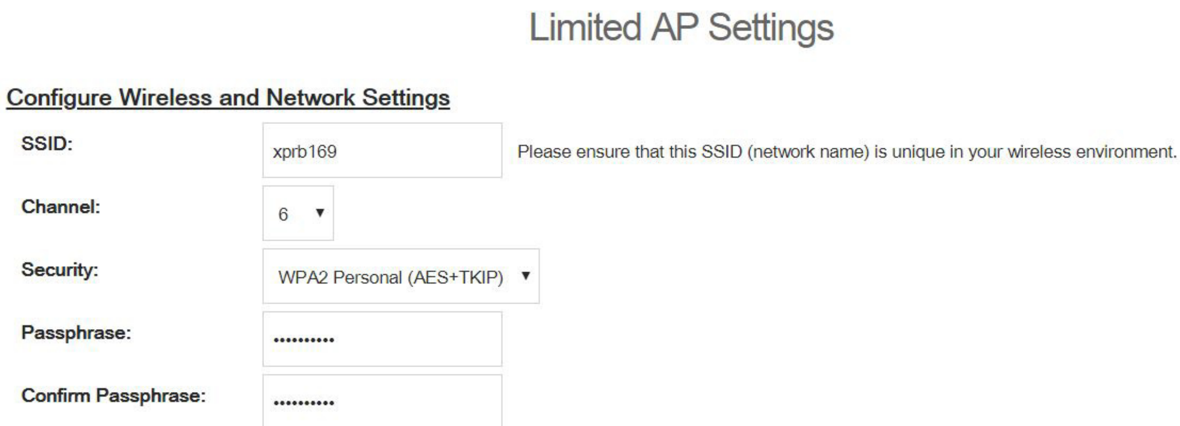
3. Open a web browser.

4. Use the assigned IP address to access the XPR web interface. In the example in Figure 51 you navigate to http://192.168.1.133/index.html.

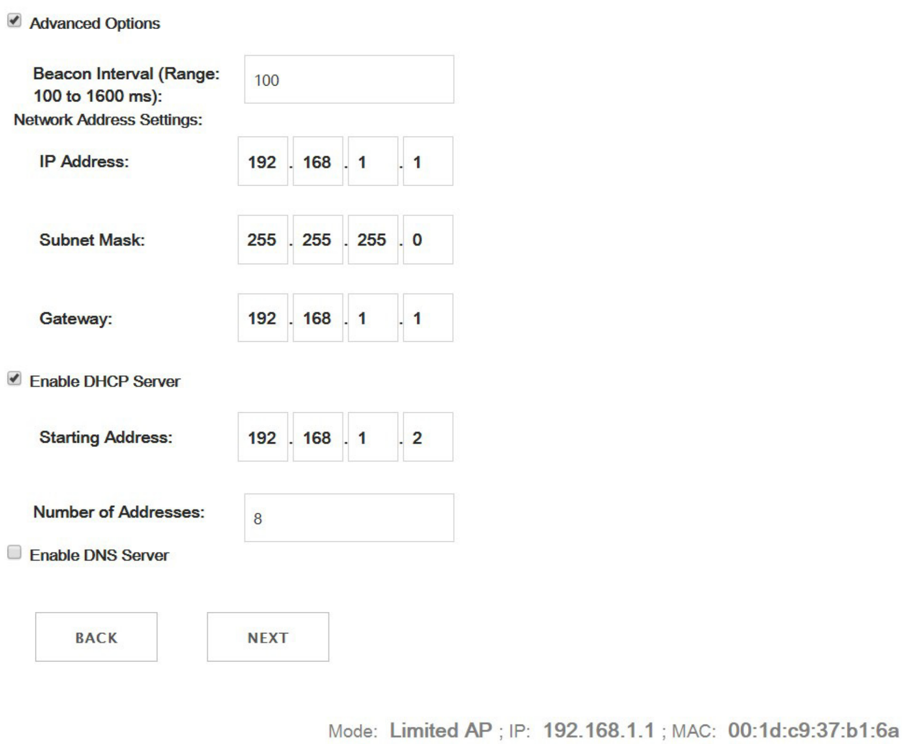
Change the limited AP settings

You can change the limited AP SSID, channel, network address, and DHCP settings in the Connect screen.

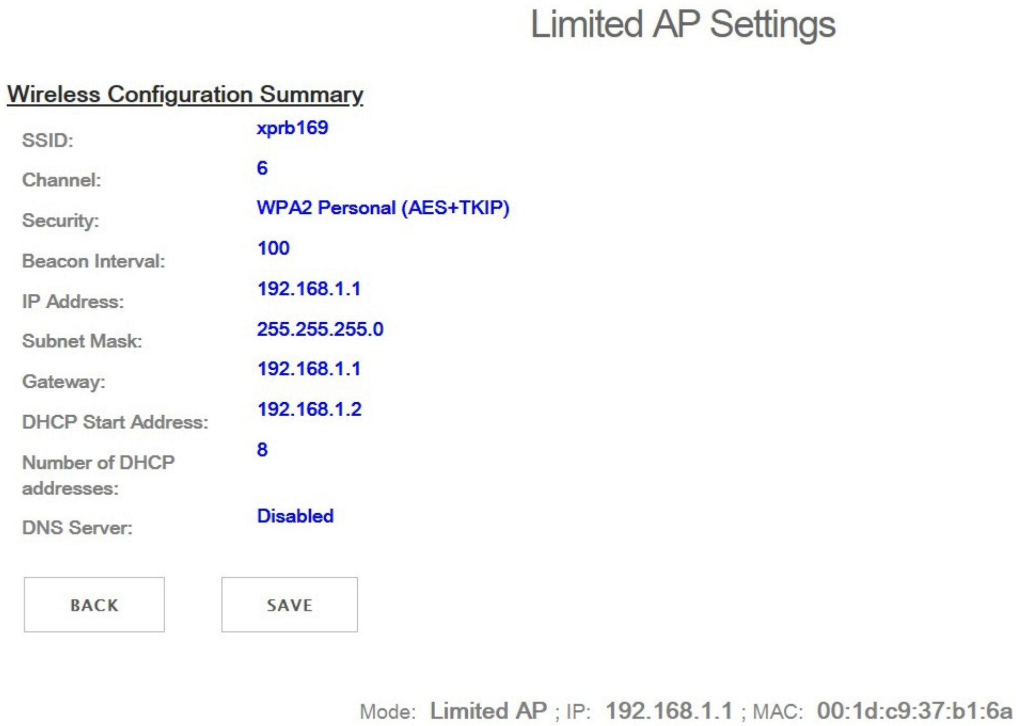
1. Choose **Other** > **Connect** > **Limited AP Settings**.
2. On the Limited AP Settings screen, select the AP mode settings



3. Choose **Advance Options**, then **Next**.



4. Verify that the settings are correct. Adjust if necessary, otherwise, choose **Save**.



5. Choose **Apply Settings**.

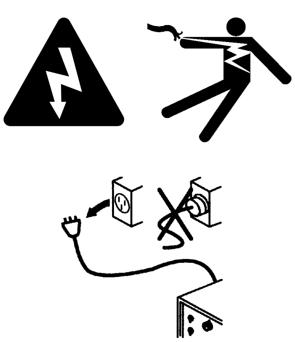
The change takes effect after you cycle the power.

6. Cycle the power to the plasma power supply.

Reset the wireless module

It is possible to make mistakes when you set up the wireless module. Use this procedure to reset your wireless module to its default settings.

WARNING



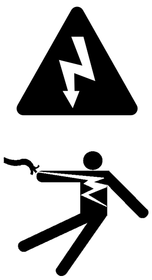
ELECTRIC SHOCK CAN KILL

Disconnect electric power before doing installation or maintenance. You can get a serious electric shock if electric power is not disconnected. Electric shock can seriously injure or kill you.

All work that requires removal of the plasma power supply outer cover or panels must be done by a qualified technician.

Refer to the *Safety and Compliance Manual* (80669C) for more safety information.

WARNING



ELECTRIC SHOCK CAN KILL

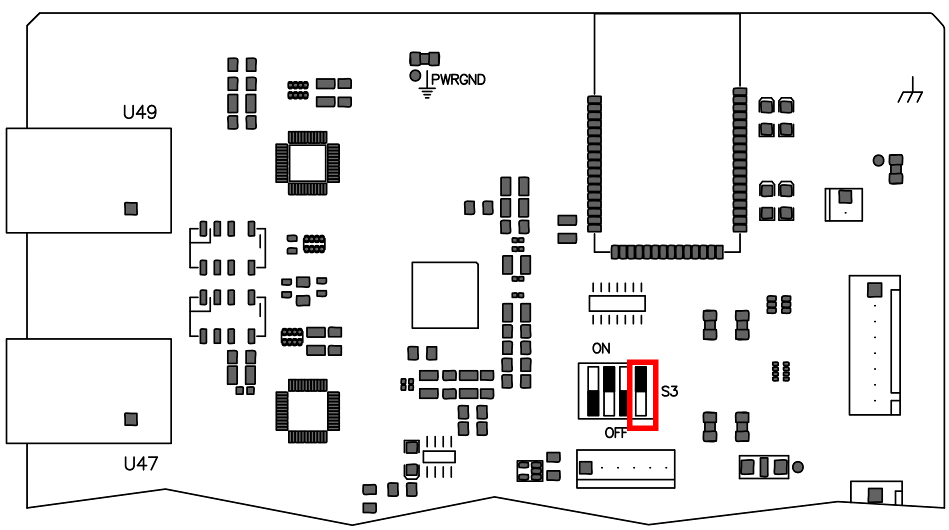
The plasma power supply contains dangerous electric voltages that can seriously injure or kill you.

Even if the plasma power supply is turned OFF, you can still get a serious electric shock if the plasma power supply remains connected to an electric power source.

Use extreme caution if you do diagnosis or maintenance tasks when the plasma power supply remains connected to an electric power source and the outer cover or panels are removed.

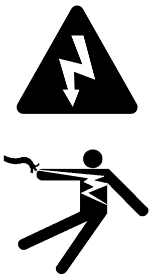
1. Remove the power from the cutting system:
   a. Set the line-disconnect switch to the OFF position.
   b. Make sure that the power-indicator LED on the plasma power supply is not illuminated.
2. Remove the control-side panel of the plasma power supply.
3. On the main control PCB, set position 4 on DIP switch S3 to the ON position.

   This disables the wireless connection.



4. Supply power to the cutting system:
   a. Set the line-disconnect switch to the ON position.
   b. Make sure that the power-indicator LED on the plasma power supply is illuminated.

WARNING



ELECTRIC SHOCK CAN KILL

The plasma power supply contains dangerous electric voltages that can seriously injure or kill you.

Use extreme caution if you do service or maintenance work on a plasma power supply when it is connected to an electric power source and the outer cover or panels are removed.

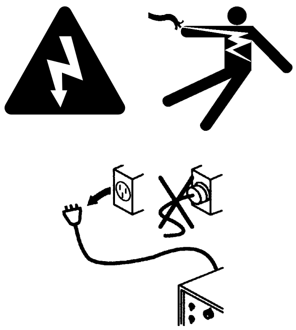
5. Wait 30 seconds.
6. Remove the power from the cutting system:
   a. Set the line-disconnect switch to the OFF position.
   b. Make sure that the power-indicator LED on the plasma power supply is not illuminated.
7. Set position 4 on DIP switch S3, located on the main control PCB, to the OFF position. This enables the wireless connection.
8. Install the control-side panel of the plasma power supply.
9. Supply power to the cutting system:
   a. Set the line-disconnect switch to the ON position.
   b. Make sure that the power-indicator LED on the plasma power supply is illuminated.
10. Wait 30 seconds.

    The wireless module is now reset to the factory default settings.

How to disable the wireless connection

If you want to completely disable the wireless connection, use this procedure.

WARNING



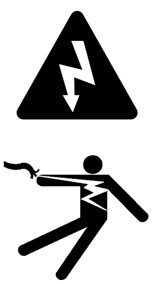
ELECTRIC SHOCK CAN KILL

Disconnect electric power before doing installation or maintenance. You can get a serious electric shock if electric power is not disconnected. Electric shock can seriously injure or kill you.

All work that requires removal of the plasma power supply outer cover or panels must be done by a qualified technician.

Refer to the *Safety and Compliance Manual* (80669C) for more safety information.

WARNING



ELECTRIC SHOCK CAN KILL

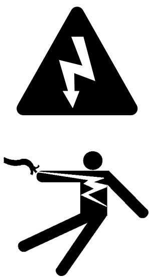
The plasma power supply contains dangerous electric voltages that can seriously injure or kill you.

Even if the plasma power supply is turned OFF, you can still get a serious electric shock if the plasma power supply remains connected to an electric power source.

Use extreme caution if you do diagnosis or maintenance tasks when the plasma power supply remains connected to an electric power source and the outer cover or panels are removed.

1. Remove the power from the cutting system:
   a. Set the line-disconnect switch to the OFF position.
   b. Make sure that the power-indicator LED is not illuminated on the plasma power supply.
2. Remove the side panel of the plasma power supply.

⚠ WARNING



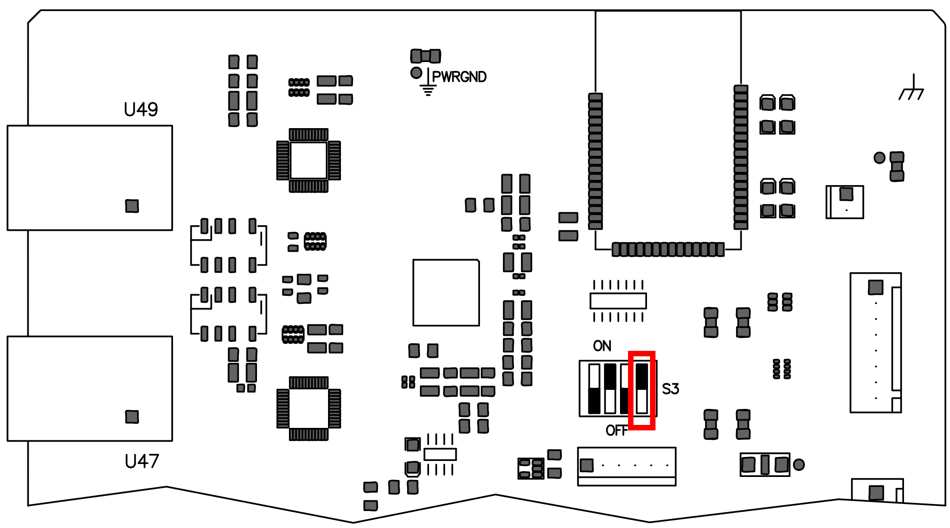
ELECTRIC SHOCK CAN KILL

The plasma power supply contains dangerous electric voltages that can seriously injure or kill you.

Use extreme caution if you do service or maintenance work on a plasma power supply when it is connected to an electric power source and the outer cover or panels are removed.

3. On the main control board, set position 4 on DIP switch S3 to the ON position. This disables the wireless.

Figure 52 – Main control board (note DIP switch S3 location).



4. Install the side panel of the plasma power supply.

5. Supply power to the cutting system:

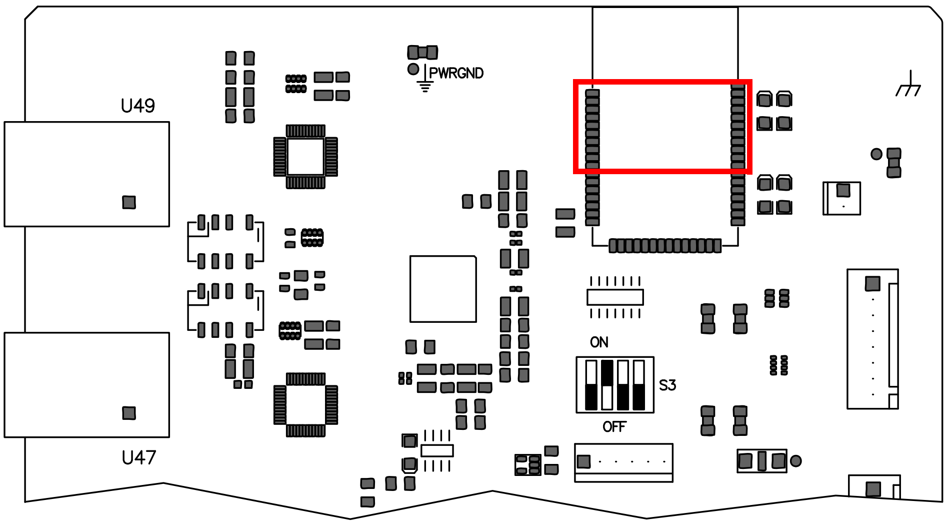
   a. Set the line-disconnect switch to the ON position.

   b. Make sure that the power-indicator LED is illuminated on the plasma power supply.

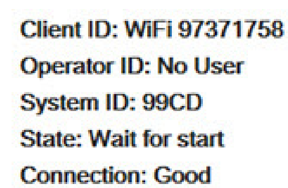
Web interface screen information

If you replace the control PCB, the information stored on the PCB changes. This includes the MAC address, System ID, passwords, and network information.

- **System ID** – This is the identifier for the plasma power supply. It is the last 4 digits of the MAC address. The MAC address is printed on the wireless module on the control PCB.



- **Operator ID** – This is the identifier for the device or client that has control of the plasma power supply. The first part of the Operator ID shows the type of connection that sent a process, **WiFi** for wireless, **Uart 422** for serial RS-422, or **EtherCAT** for EtherCAT.


Client ID: WiFi 97371758
Operator ID: No User
System ID: 99CD
State: Wait for start
Connection: Good

> To change which device has control of the plasma power supply, refer to How to change the device that has control on page 196.

- **Client ID** – This is the identifier for a device that communicates with the plasma power supply. This ID uses the UTC time stamp and is saved in a browser cookie.

> If the Client ID and the Operator ID are the same on your device, you are in control of the plasma power supply.

- **Connection** – This is the status of the communication between the device and the plasma power supply. (Good or Error.)

Plasma power supply

On this screen you can monitor the status of the plasma power supply. This screen also lists inputs and outputs. When highlighted red or gray, that input or output is active.

Status

Type	XPR OptiMix
State	Wait for start
Log	0
Process	2053 - 130A Mix/N_2
Arc Time	0d 0h 20min 51s
(+) DC	300 A
Coolant Flow	7.96 lpm (2.1 gpm)
Coolant Level	Low

IO

Inputs	Outputs
On Switch	Main Contactor
Start	Coolant Pump
Hold	Coolant Solenoid
Pierce	Magnetics Fans
	Heat Exchanger Fans
	Ready for Start
	Ohmic Contact
	Motion
	Hold
	Error

Fan Speed

Heat Exchanger 1	2950 rpm
Heat Exchanger 2	2951 rpm
Magnetics 1	2952 rpm
Magnetics 2	2953 rpm
Control Side 1	6150 rpm
Control Side 2	6250 rpm

Temperature

Coolant	24.9 °C (77 °F)
Transformer	26 °C (79 °F)
Inductor 1	25.1 °C (77 °F)
Inductor 2	25.2 °C (77 °F)
Inductor 3	25.3 °C (78 °F)
Inductor 4	25.4 °C (78 °F)

Chopper

	Setpoint	DC	Temperature
Chopper 1	150 A	151 A	69 °C (156 °F)
Chopper 2	150 A	149 A	70 °C (158 °F)

Arc Voltage	126 V
Bus Voltage	325.8 V

The XPR web interface shows different fields for different XPR models.
The screen shown is for reference only.

Gas system

On this screen you can monitor the status of the torch connect console and the gas connect console. You can also see which valves are active when the gas is flowing. Active valves have gray highlights. There are 2 view options for this screen.

1. **Text view** – Refer to Figure 53 on page 191 for an example text-view screen. In text view, text describes real-time gas pressures and currently-active valve states.

   Both bar and psi units of measure are visible in this screen.

2. **Diagram view** – Refer to Figure 54 on page 192 for an example diagram-view screen. In diagram view a diagram shows:

   - Real-time gas pressures and currently-active valve states.
   - Pressurized volumes and energized valves with color-coded highlights that illuminate when active.
   - Pressure measurements and setpoints near the proportional valves and duty cycle (PWM) sensors represented by the diagram.

   This screen gives you the option to display either bar or psi units of measure.

You can do 4 tests from this screen: Test Preflow, Test Cutflow, Test Pierceflow, and Gas Leak Test. The gas leak test can be done with all gas connect consoles. Refer to How to do a gas leak test on page 342.

The test starts when you choose the button. The button becomes active, indicated with a red highlight. The active valves are indicated with a gray highlight. The gases shown on Line A, Line B, and shield are different depending on the process ID that you selected. The gases flow for 60 seconds unless you choose the same button or choose another button that interrupts the test.

Figure 53 – Example text-view screen that describes the gas system status

TEST PREFLOW	TEST PIERCEFLOW
TEST CUTFLOW	GAS LEAK TEST

DIAGRAM VIEW

Torch Connect

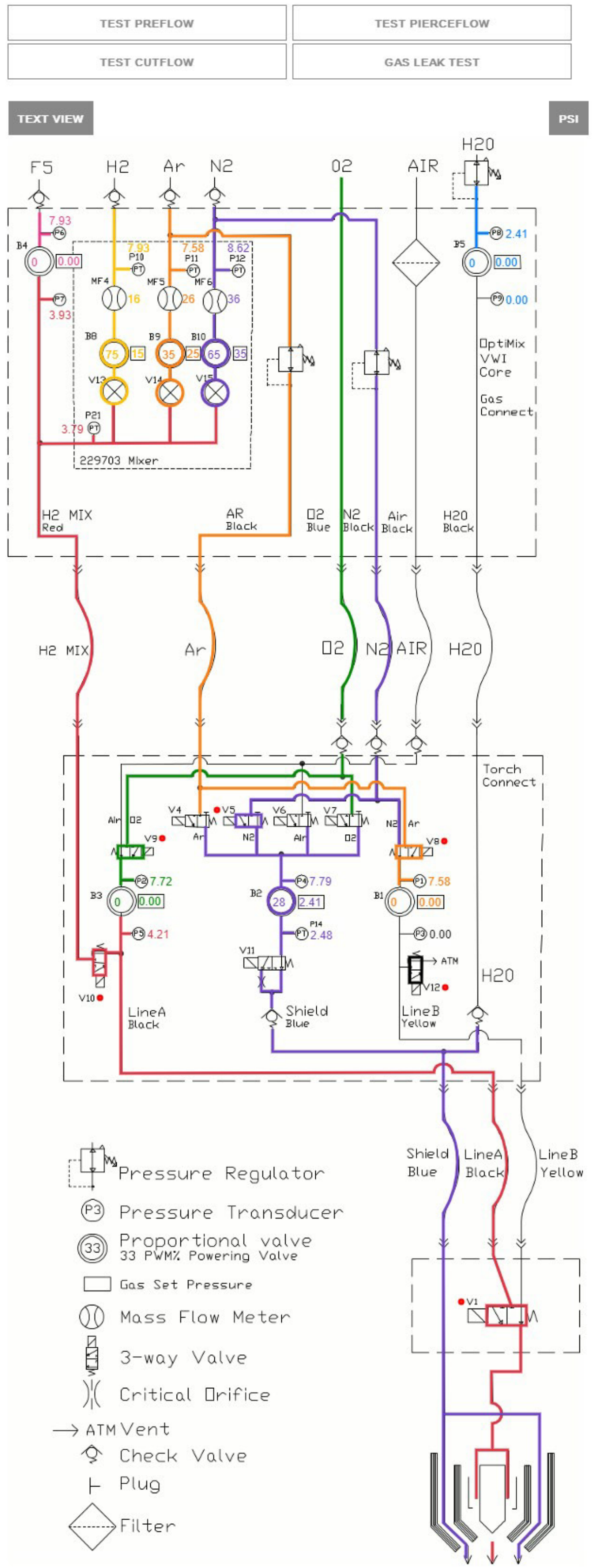
	Type	Setpoint	Output		Inlet		PWM	
Line A	Mix	0.00 bar (0 psi)	P5	4.21 bar (61 psi)	P2	7.72 bar (112 psi)	B3	0%
Line B	N_2	0.00 bar (0 psi)	P3	0.00 bar (0 psi)	P1	7.58 bar (110 psi)	B1	0%
Shield	Air	2.41 bar (35 psi)	P14	2.48 bar (36 psi)	P4	7.79 bar (113 psi)	B2	28%

Valve States V1 V4 V5 V6 V7 V8 V9 V10 V11 V12

OptiMix

	Setpoint	Output		Inlet		PWM	
H_2O	0.00 bar (0 psi)	P9	0.00 bar (0 psi)	P8	2.41 bar (35 psi)	B5	0%
F5	0.00 bar (0 psi)	P7	0.00 bar (0 psi)	P6	7.93 bar (115 psi)	B4	0%
H_2	25 slpm	MF4	26 slpm	P10	7.93 bar (115 psi)	B8	75%
Ar	15 slpm	MF5	16 slpm	P11	7.58 bar (110 psi)	B9	35%
N_2	35 slpm	MF6	36 slpm	P12	8.62 bar (125 psi)	B10	65%

Figure 54 – Example diagram-view screen that shows the gas system status



Log

On this screen you can monitor active diagnostic codes and view diagnostic code history. There are 4 categories of codes: information, alert, error, and failure. Refer to Table 37 on page 273 for definitions.

Active

Class	ID	On Time	Description	Details
Failure	513	0d 15h 39min 4s	Main->TCC CAN t/o	N/A
Failure	503	0d 15h 38min 35s	TCC->Main CAN t/o	hf:49677ms
Alert	531	0d 15h 38min 17s	Low psi-Line B	pres:38psi ref:53psi
Alert	770	0d 15h 37min 50s	Gas Inlet - N_2 Line B	p1:79psi ref:80psi
Error	691	0d 15h 37min 7s	Node reset	id:1 rcc:0x2e hf:27999ms
Error	691		Node reset	

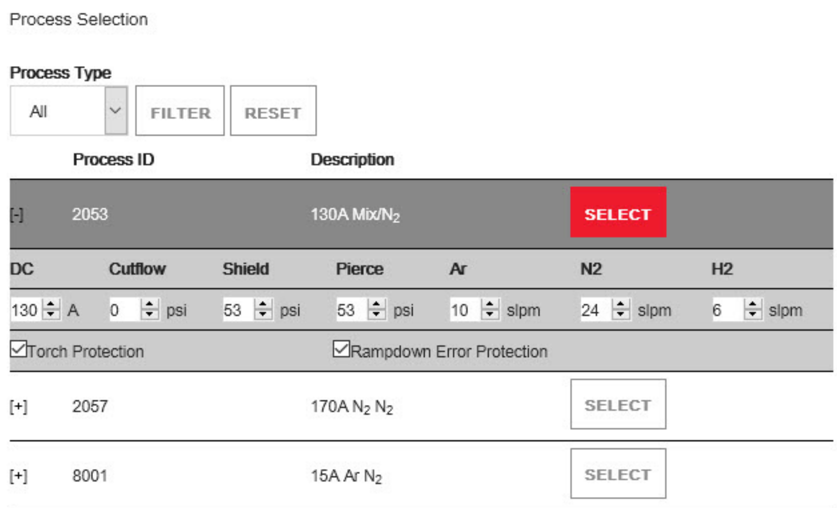
History

Class	ID	On Time	Description	Details
Info	647	0d 15h 37min 7s	Process selected	id:1001
Info	643	0d 15h 36min 43s	No process loaded	N/A
Info	642	0d 15h 36min 41s	System powered	N/A
Error	691	0d 15h 36min 40s	Node reset	id:1 rcc:0x2e hf:999ms

Operate

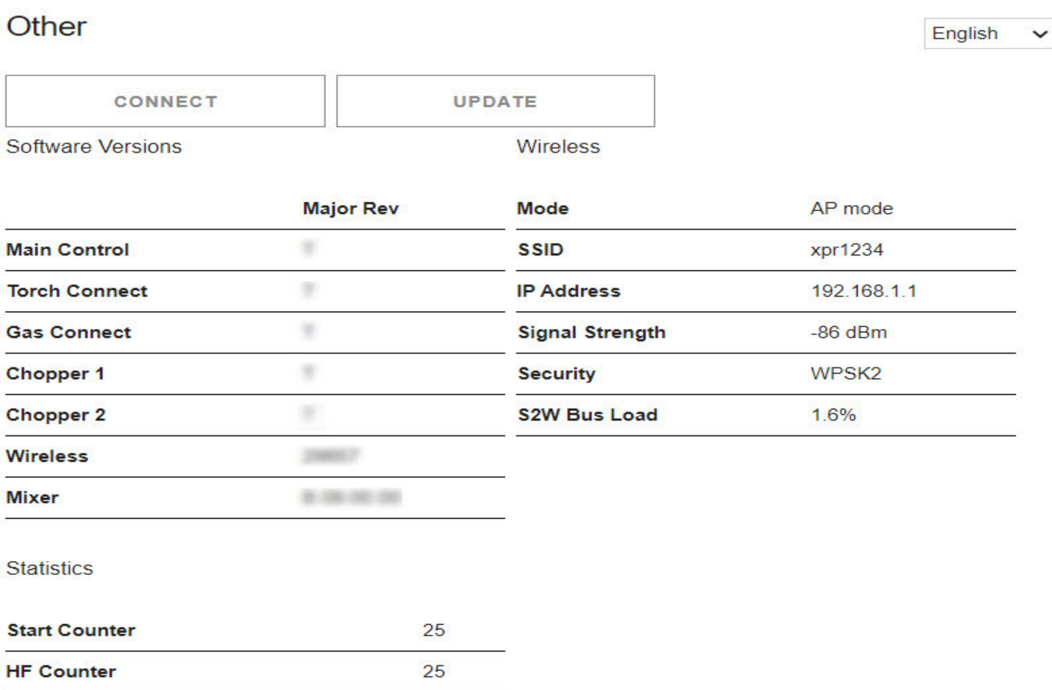
On this screen, if you have the device that is in control of the plasma power supply, you can select a process ID based on material, thickness, and process type.

You can customize some parameters by choosing the + to open the menu. The plasma power supply keeps this customization until the remote on-off switch is set to OFF or the power is removed from the plasma power supply. The customization is also reset when you select a new process.



Other

On this screen you can view the software versions and monitor the status of the wireless connection. From this screen, you can also access the **Configure**, **Connect**, and **Update** commands.



The XPR web interface shows different fields for different XPR models. The screen shown is for reference only.

Configure – On this screen you can change the connection name, limited AP password, limited AP IP address, or the setup password.

- You cannot use special characters in any of the fields on this screen.
- The connection name must be less than 32 characters long.
- Passwords must be between 8 and 20 characters long.
- Passwords are case sensitive.

Connect – On this screen you can change your client settings and connect to other networks. For more information on how to do this, refer to Use network mode to connect on page 173.

Update – On this screen you can update the web interface and firmware.

How to change the device that has control

The device that first sets a process controls the plasma power supply. For example, if the CNC sets the process, all other devices that connect to the plasma power supply after the CNC sets the process can only monitor the data.

If the **Client ID** and the **Operator ID** in the XPR web interface are the same on your device, you are in control of the plasma power supply.

To change the device that has control of the plasma power supply:

1. Remove the power from the cutting system:
   - **a.** Set the line-disconnect switch to the OFF position.
   - **b.** Make sure that the power-indicator LED is not illuminated on the plasma power supply.
2. Supply power to the cutting system:
   - **a.** Set the line-disconnect switch to the ON position.
   - **b.** Make sure that the power-indicator LED is illuminated on the plasma power supply.

How to use ohmic contact sense

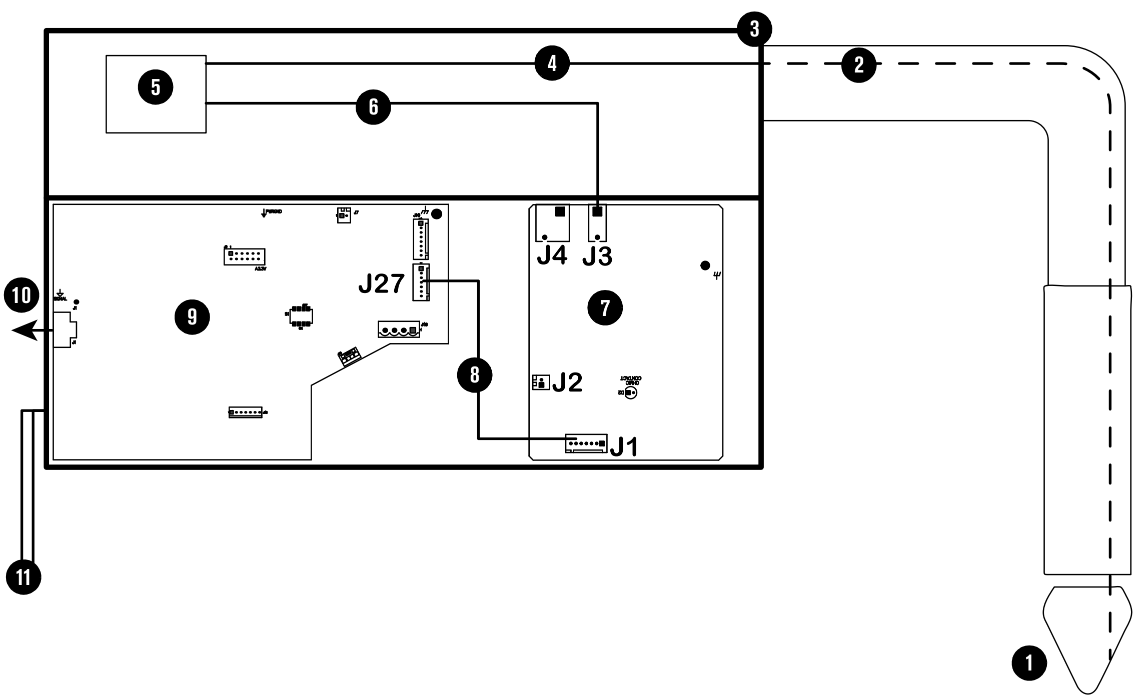
Ohmic relay overview

- The relay is normally open when not powered.
- The relay is closed during operation, except during ignition or cutting with water processes.
- Ohmic contact is disabled when cutting with a water process.
- Ohmic contact is disabled when the remote on-off switch is in the OFF position.

Internal ohmic contact sense

This is the default installation for the torch and torch connect console. No action is required.

Figure 55 – Internal ohmic diagram



1	Torch	**7**	Ohmic PCB
2	Ohmic wire, inside torch and torch lead	**8**	J1 to J27 wires
3	Torch connect console	**9**	Control PCB
4	Ohmic wire, torch receptacle to ohmic relay	**10**	CAN connection
5	Ohmic relay	**11**	2 ground connections (required)
6	Ohmic wire, ohmic relay to J3		

External ohmic contact sense

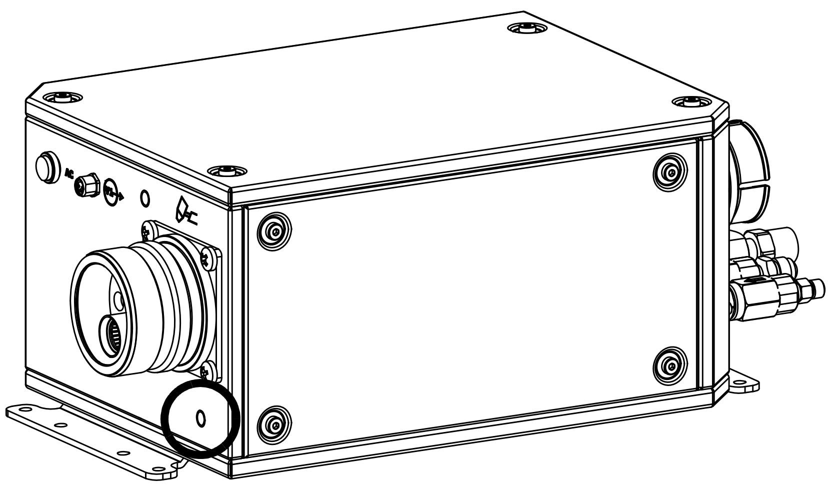
If you plan to use external ohmic contact sense, make the following modification to the ohmic wiring inside of the torch connect console.

The relay is still used to help isolate the ohmic circuit from high voltage.

1. Remove the power from the cutting system:
   a. Set the line-disconnect switch to the OFF position.
   b. Make sure that the power-indicator LED is not illuminated on the torch connect console.
2. Disconnect the ohmic wire from J3 on the ohmic PCB in the torch connect console.
3. Connect the ohmic wire that you removed from J3 to J4 pin1.
4. If you have a third-party ohmic circuit, remove the plug from the sheet metal on the torch connect console to access the ohmic wire inside. Otherwise, skip to step 5.

The plug is located below the torch lead connection (Figure 56).

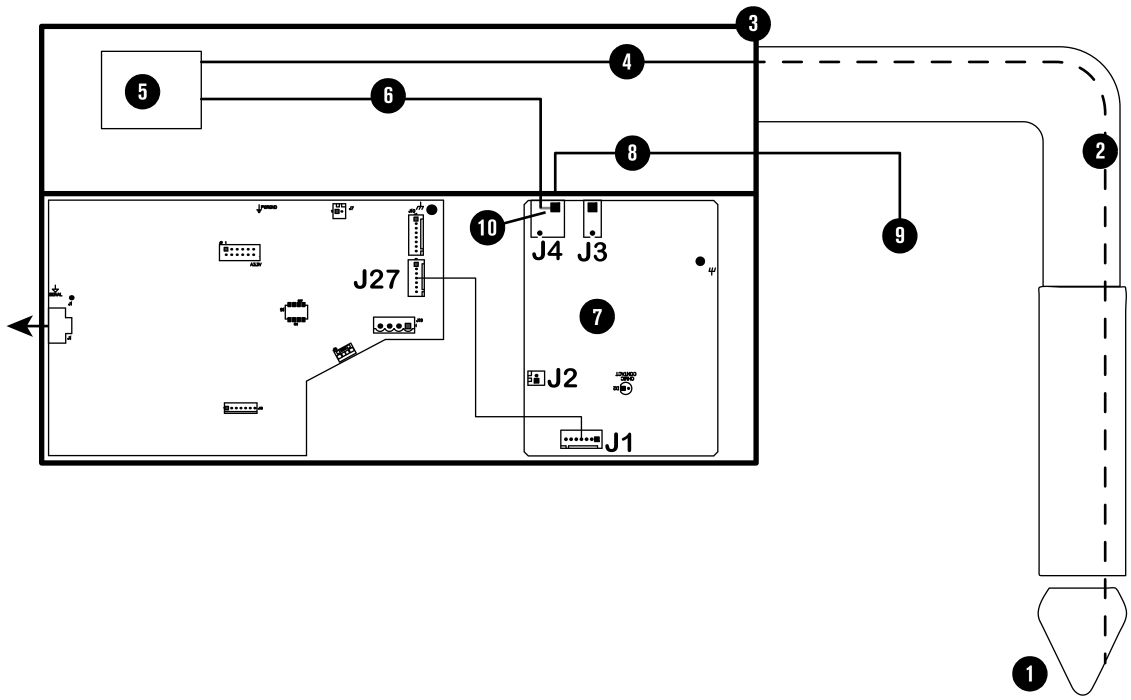
Figure 56 – Remove plug to access the ohmic wire if you use a third-party ohmic circuit



5. Connect the ohmic wire 6 from the ohmic relay to J4 pin 2 on the ohmic PCB in the torch connect console.

6. Connect the ohmic wire 9 to the PCB connection for ohmic inside the lifter.

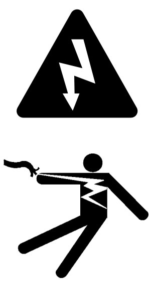
Figure 57 – Example external ohmic diagram



- **1** Torch
- **2** Ohmic wire, inside torch and torch lead
- **3** Torch connect console
- **4** Ohmic wire, torch receptacle to ohmic relay
- **5** Ohmic relay
- **6** Ohmic wire, ohmic relay to J4
- **7** Ohmic PCB
- **8** Ohmic wire, J4 to lifter or third party ohmic circuit
- **9** Torch lifter or third party ohmic circuit
- **10** Pin 1 and pin 2 on J4 are connected in the ohmic PCB

How to install a remote on-off switch

⚠ WARNING



ELECTRIC SHOCK CAN KILL

The plasma power supply contains dangerous electric voltages that can seriously injure or kill you.

Even if the plasma power supply is turned OFF, you can still get a serious electric shock if the plasma power supply remains connected to an electric power source. When the remote on-off switch is in the OFF position, electric **power remains active** to the following components in the system:

- Control board
- Control transformer input and output
- 48 V power supply
- 24 V power supply
- 120 VAC and 220 VAC on the power distribution board
- Input side of the contactors
- Input side of the pump relay
- Power-indicator LED on the front of the plasma power supply

Use extreme caution if you do diagnosis or maintenance tasks when the plasma power supply remains connected to an electric power source and the outer cover or panels are removed. All work that requires removal of the plasma power supply outer cover or panels must be done by a qualified technician.

Refer to the *Safety and Compliance Manual* (80669C) for more safety information.

If you want to use the remote on-off feature, remove the jumper from pin 1 and pin 2 of the J14 connector and install your own interface.

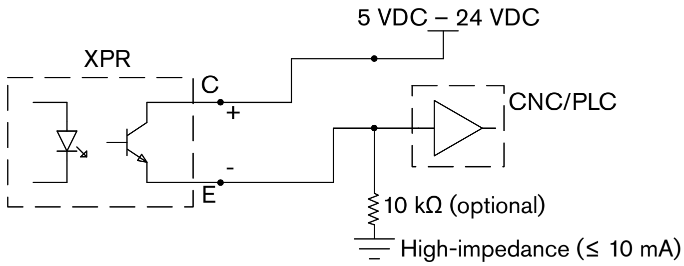
- For the pinout of J14, refer to Table 26 on page 159.
- Use the examples in Examples of output circuits on page 201 and Examples of input circuits on page 202 to design your circuit.

When the remote on-off switch is set to OFF (disabled), power is removed from the following parts:

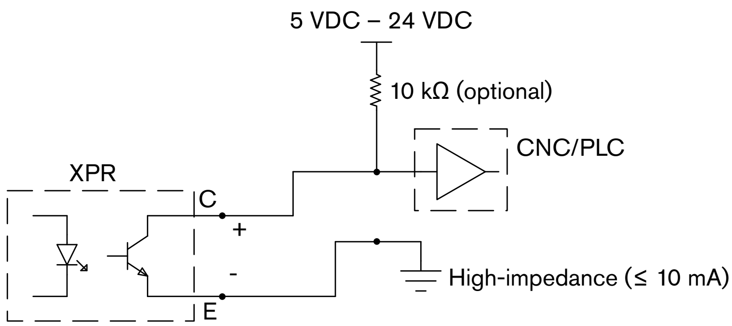
- Gas connect console
- Torch connect console
- Contactor enable
- Pump relay enable
- Fan enable
- CNC outputs

Examples of output circuits

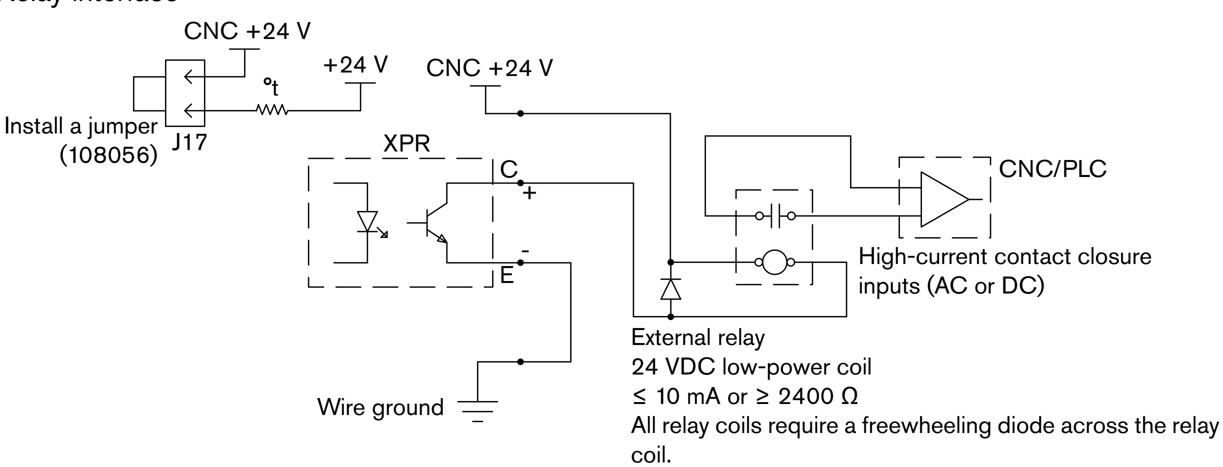
Logic interface, active high



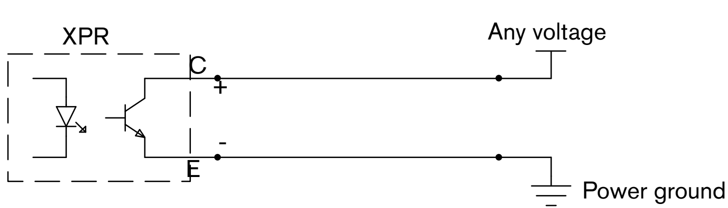
Logic interface, active low



Relay interface

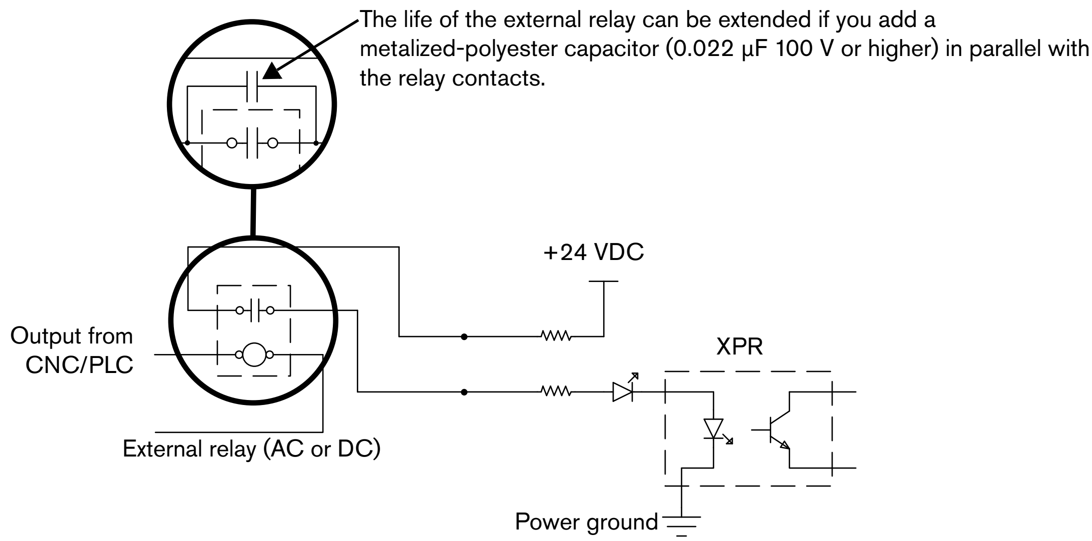


This circuit **VOIDS the warranty**. Do **NOT** use.

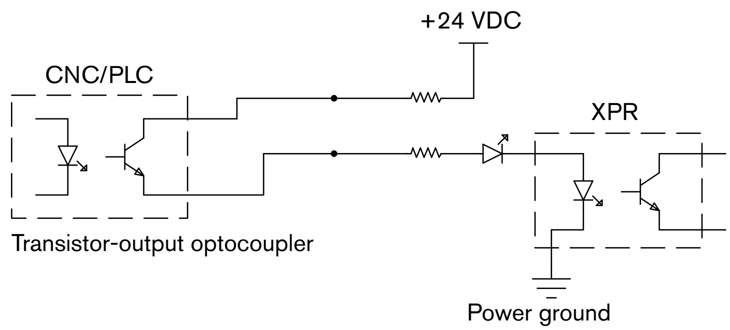


Examples of input circuits

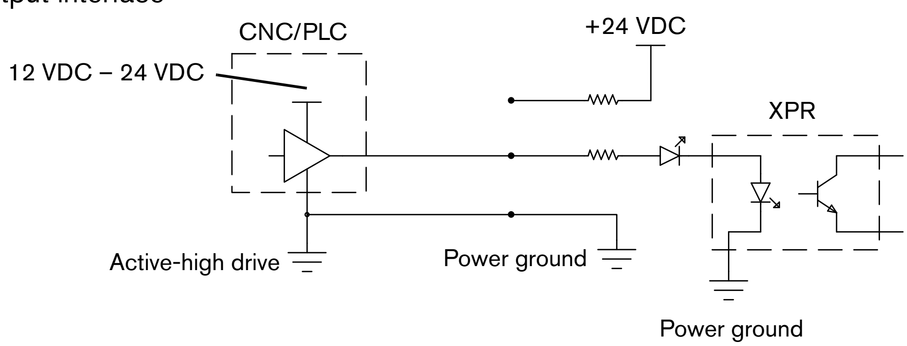
Relay interface



Optocoupler interface



Amplified-output interface



5 Coolant Installation

Overview

The cutting system ships **without** coolant in the reservoir. Before you operate the cutting system, you must fill it with coolant. The coolant capacity for the XPR cutting system is between 22.7 liters – 45.4 liters (6 US gallons – 12 US gallons).

A cutting system with long leads requires more coolant than a cutting system with short leads.

Contact your cutting machine supplier to reorder coolant. For information about how to calculate the approximate total volume of coolant for your cutting system, refer to Estimate the total coolant volume for your cutting system on page 258.

The plasma power supply ships with the coolant filter (027005) and coolant pump screen (127559) installed. Additional coolant filters and screens are available from Hypertherm. Refer to Coolant system on page 370.

For information about how to install a replacement coolant filter or coolant pump screen, refer to the *XPR Preventative Maintenance Program (PMP) Instruction Manual* (809490).

How to fill the cutting system with coolant

> **⚠ NOTICE**
>
> **LOW COOLANT LEVELS CAN DAMAGE THE CUTTING SYSTEM AND COOLANT PUMP**
>
> Never operate the cutting system if you get a low coolant level notice. There is a risk of serious damage to the cutting system and to the coolant pump if you operate the cutting system with no coolant or with low coolant.
>
> If your coolant pump is damaged, pump replacement can be necessary.

> **⚠ NOTICE**
>
> **AUTOMOTIVE ANTIFREEZE CAN DAMAGE THE TORCH COOLANT SYSTEM**
>
> Never use automotive antifreeze in place of Hypertherm coolant. Antifreeze contains chemicals that can damage the torch coolant system.

> **⚠ NOTICE**
>
> If you use the wrong coolant, it can cause damage to the cutting system. Refer to Coolant requirements on page 53.

1. Get the correct coolant mixture for your cutting system.

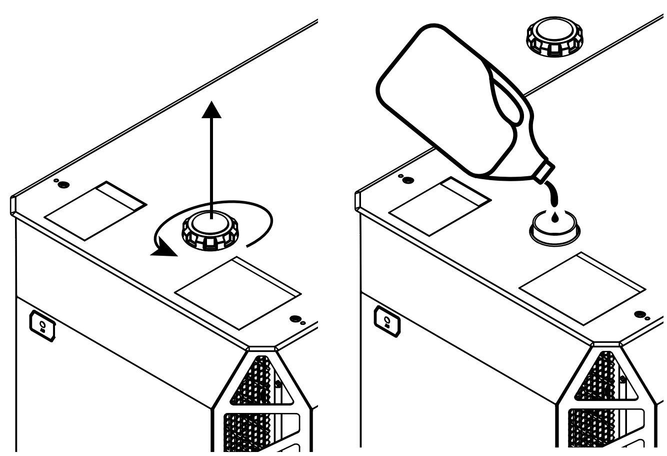
   Refer to Coolant requirements on page 53 to determine what percentage of propylene glycol to add in the premixed Hypertherm coolant (028872).

2. Remove the cap from the reservoir fill port inlet that is located on top of the plasma power supply.

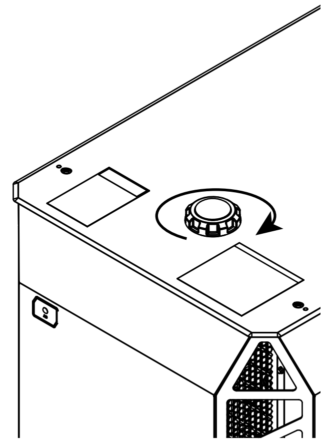
3. Look into the fill port inlet to see into the coolant reservoir.

4. Pour the coolant into the reservoir until the coolant level gets to the base of the fill spout.

   You can see the coolant level from the fill port inlet as you pour the coolant.



5. Install the cap onto the coolant reservoir.

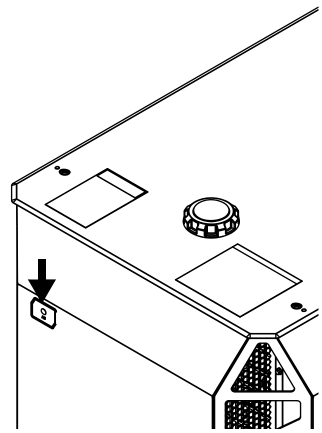


6. Supply the power to the cutting system:

   a. Set the line-disconnect switch to the ON position.

   b. Make sure that the remote on-off switch is enabled.

   c. Make sure that the green power-indicator LED is illuminated on the plasma power supply.



7. Use the CNC or XPR web interface to send a process to the plasma power supply and start the coolant pump.

> When you send a process, the gases start to flow and after a few seconds the coolant pump starts. If the pump stops, it is necessary to purge the air out of the coolant loop. Use the remote on-off switch to start and stop the coolant pump until the pump continues to run.

8. If necessary, add more coolant to fill the reservoir to the base of the fill spout.

WARNING

WET FLOOR

The floor near the plasma power supply can become slippery when wet.

If you put too much coolant in the reservoir, coolant flows out of the front of the plasma power supply onto the floor.

9. After installation of the coolant, use the CNC or XPR web interface to deselect the process.

6 Operation

Overview

This section of the manual describes the following items that relate to cutting system operation:

- Controls and indicators on page 208
- Sequence of operation on page 211
- How to choose the torch positions and process settings you need on page 221
- Process selection on page 229
- How to use cut charts on page 231
- How to select consumables on page 234
- Factors of cut quality on page 234

If you have questions about how to operate your cutting system, contact your cutting machine supplier or regional Hypertherm Technical Service team. You can find contact information for each regional office at www.hypertherm.com on the "Contact us" page.

Controls and indicators

Controls

CNC

A computerized numeric control (CNC) controls cutting system operation. The CNC has the following functions:

- Executes part programs from computer-aided design (CAD) and computer-aided manufacturing (CAM) software.
- Sends commands to the cutting system through a CNC interface cable (or wireless connection) between the CNC (or wireless device) and the plasma power supply.
- Reacts to feedback signals it receives from the cutting system and (or) operator.

Multiple cutting system commands, settings, and displays are visible and controllable from different CNC screens.

CNC screens can include the following:

- Main (control) screen
- Process setup screen
- Diagnostic screen
- Test screen
- Cut chart screen

See the instruction manual that came with your CNC for descriptions of CNC screens.

For information about how to use the Hypertherm CNC to control cutting system operation, see:

- The instruction manual that came with your CNC
- *CNC Communication Protocol for the XPR Cutting System* (809810)

Wireless device

A wireless device can be used to setup and monitor the XPR cutting system. A wireless device with the XPR web interface sends commands to the XPR cutting system through a wireless connection between the wireless device and the plasma power supply.

Multiple cutting system commands, settings, and displays are visible and controllable from different XPR web interface screens. For information on these screens, refer to Web interface screen information on page 188.

For information about how to set up a wireless device with the XPR web interface, refer to How to connect to the plasma power supply with the XPR web interface on page 170.

Indicators

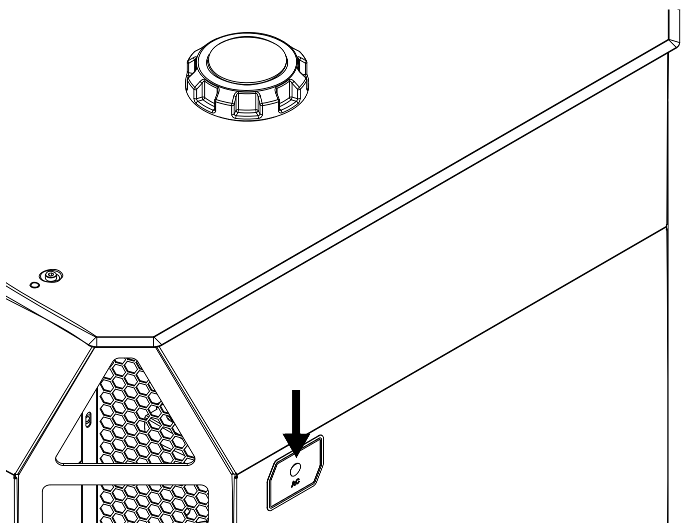
Power-indicator LEDs

Light emitting diodes (LEDs) illuminate to indicate power status.

The power-indicator LED on the plasma power supply (Figure 58) uses 2 colors to indicate power status:

- The LED illuminates amber when the plasma power supply is receiving electric power and the remote on-off switch is in the OFF position.
- The LED illuminates green when the plasma power supply is receiving electric power and the remote on-off switch is in the ON position.
- The plasma power supply that came with early XPR300 cutting systems has a green-only power-indicator. A power-indicator LED upgrade kit (428893) is available from Hypertherm if you want a 2-color LED for your plasma power supply.

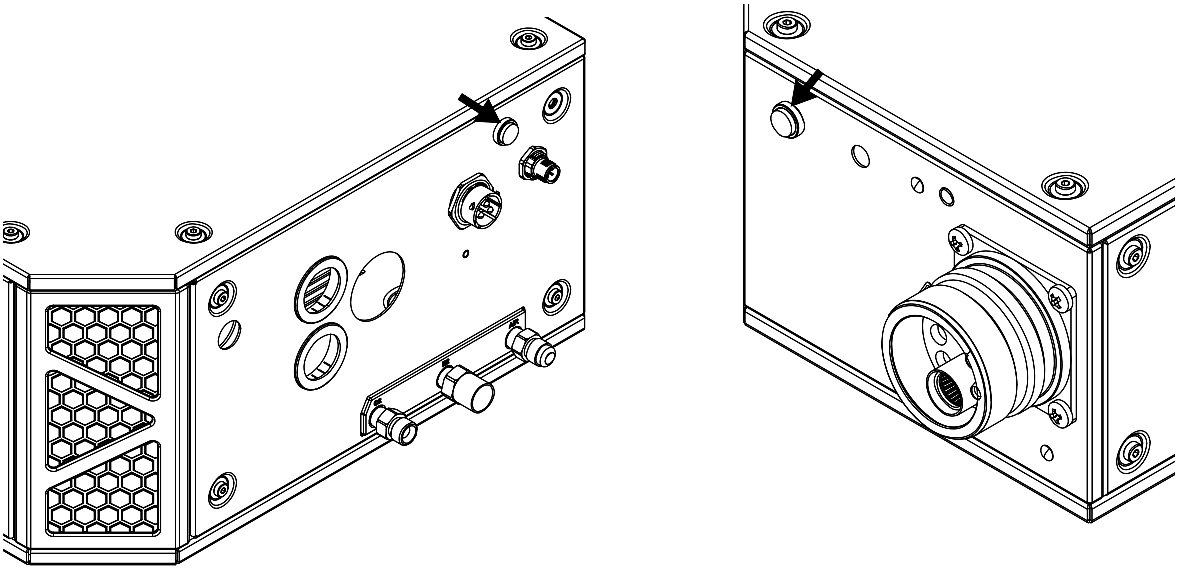
Figure 58 – Power-indicator LED on the plasma power supply



When illuminated, the green power-indicator LED on the gas connect console (Figure 59 on page 210) and torch connect console (Figure 59 on page 210) indicate that:

- Power is supplied to the XPR cutting system.
- The line-disconnect switch or breaker for the unit is set to the ON (I) position.
- The unit is ready for use.

Figure 59 – Power-indicator LED on the gas connect console (left) and on the torch connect console (right)



CNC display

Except for the power-indicator LEDs that show power status, all other visual indications of cutting system performance appear on the CNC or XPR web interface.

For CNC screen descriptions, see the instruction manual that came with your CNC.

Sequence of operation

The flowcharts on the following pages show the sequence of operation for the XPR cutting system.

States of operation for the XPR cutting system

Each state of operation is assigned a unique name and number for identification purposes. The type of name you see (name or number) depends on your cutting system settings.

Powerup State (1)

The operator supplies power to the cutting system to start the Powerup State (1).

Power is supplied to the cutting system.
Cutting system operation STARTS.

↓

Make sure that signals are OFF for the following:
- Main contactor
- Coolant pump
- Cooling fans

↓

Establish CAN communication.

↓

Wait for RS-422 serial, EtherCAT, or wireless communication between the plasma power supply and CNC or wireless device.

↓

Determine system configuration (number of choppers and number and type of consoles).

↓

Is Powerup State (1) complete and successful?

No → Diagnose and troubleshoot the problem. Refer to Diagnostics and Troubleshooting on page 263. Then, start the Powerup State (1) again.

Yes ↓

Continue to Initial checks State (2) on page 212

Initial checks State (2)

Search for diagnostic codes.

Is there a diagnostic code?

Yes

Diagnose and troubleshoot the problem. Refer to Diagnostics and Troubleshooting on page 263. Then, start Initial checks State (2) again.

No

Measure the following:

- Temperatures (main transformers, choppers, coolant)
- Inlet pressures (gas connect console, torch connect console)

Are the measurements within the acceptable range?

No

Diagnose and troubleshoot the problem. Refer to Diagnostics and Troubleshooting on page 263.

Yes

Wait for process selection by the operator.

Select a process ID.

Continue to Gas purge/pump on State (3) on page 213.

Gas purge/pump on State (3)

Is a specialty purge necessary?*

Yes → Do a specialty purge.

No ↓

Stage 1: Operate preflow gases.**

↓

Turn ON the coolant pump and start coolant flow.

↓

Stage 2: Operate cutflow gases.**

↓

Measure the coolant flow rate.

↓

Is the coolant flow within the acceptable range?

No → Diagnose and troubleshoot the problem. Refer to Diagnostics and Troubleshooting on page 263. Then, measure the coolant flow again.

Yes ↓

Continue to Wait for start State (5) on page 214.

* A specialty purge (with either N_2 or air) occurs automatically if the process changes from a non mixed-fuel gas to a mixed-fuel gas or F5 process (or the reverse). If the previous process was a water (H_2O) process, then a water purge is added to the gas purge. Refer to Automatic purges on page 219. If the previous process was not H_2O, or mixed-fuel gas, or F5, skip to the usual 2-stage gas purge.

** The length of time necessary to complete a purge is based on: 1) the type of operator-selected process that the CNC or wireless device sends to the cutting system, 2) if this is the first process sent after the Powerup State (1) starts, and 3) the type of previous operator-selected process.

Wait for start State (5)

Wait for the CNC to send the Plasma Start command to the cutting system.

Wait for a command: select a new process or "Plasma Start" (there is no limit to how long the system waits for input).

↓

Is a new process selected or "Plasma Start" selected?

No → return to "Wait for a command"

Yes ↓

For new process selection, continue to Initial checks State (2) on page 212.

OR

For a "Plasma Start" command, continue to Preflow/charge DC State (7) on page 214.

Preflow/charge DC State (7)

Start preflow gas flow.

↓

Turn ON the inrush contactor and then the main contactor.

↓

Turn ON the chopper.

↓

Turn ON the fans (if not already on).*

↓

Turn ON the coolant pump (if not already on).*

↓

Measure gas pressure.

↓

Make sure that Hold Ignition signal is OFF.

↓

Is the Preflow State complete and successful?

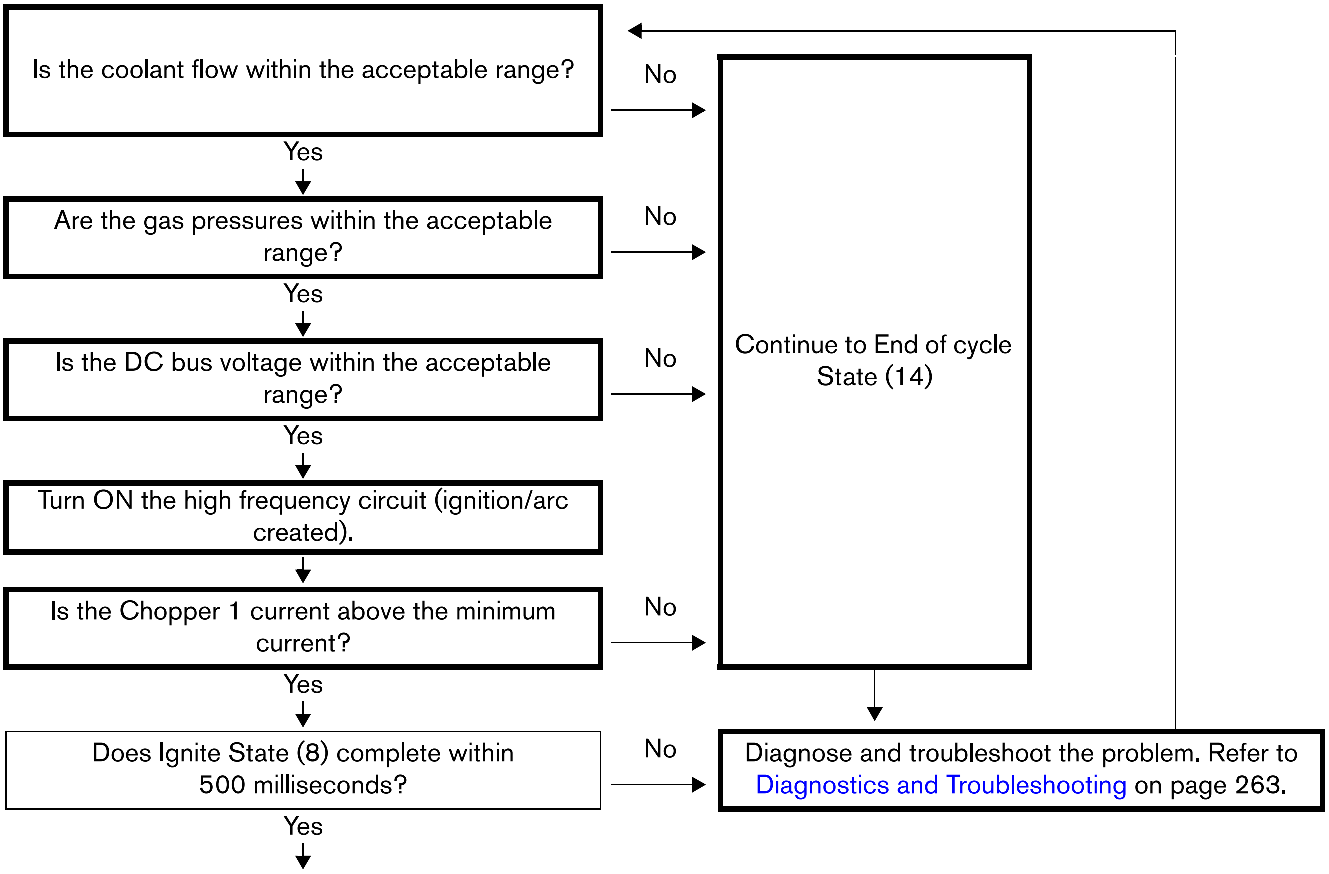
No → Diagnose and troubleshoot the problem. Refer to Diagnostics and Troubleshooting on page 263. Then, start Preflow/charge DC State (7) again.

Yes ↓

Continue to Ignite State (8) on page 215.

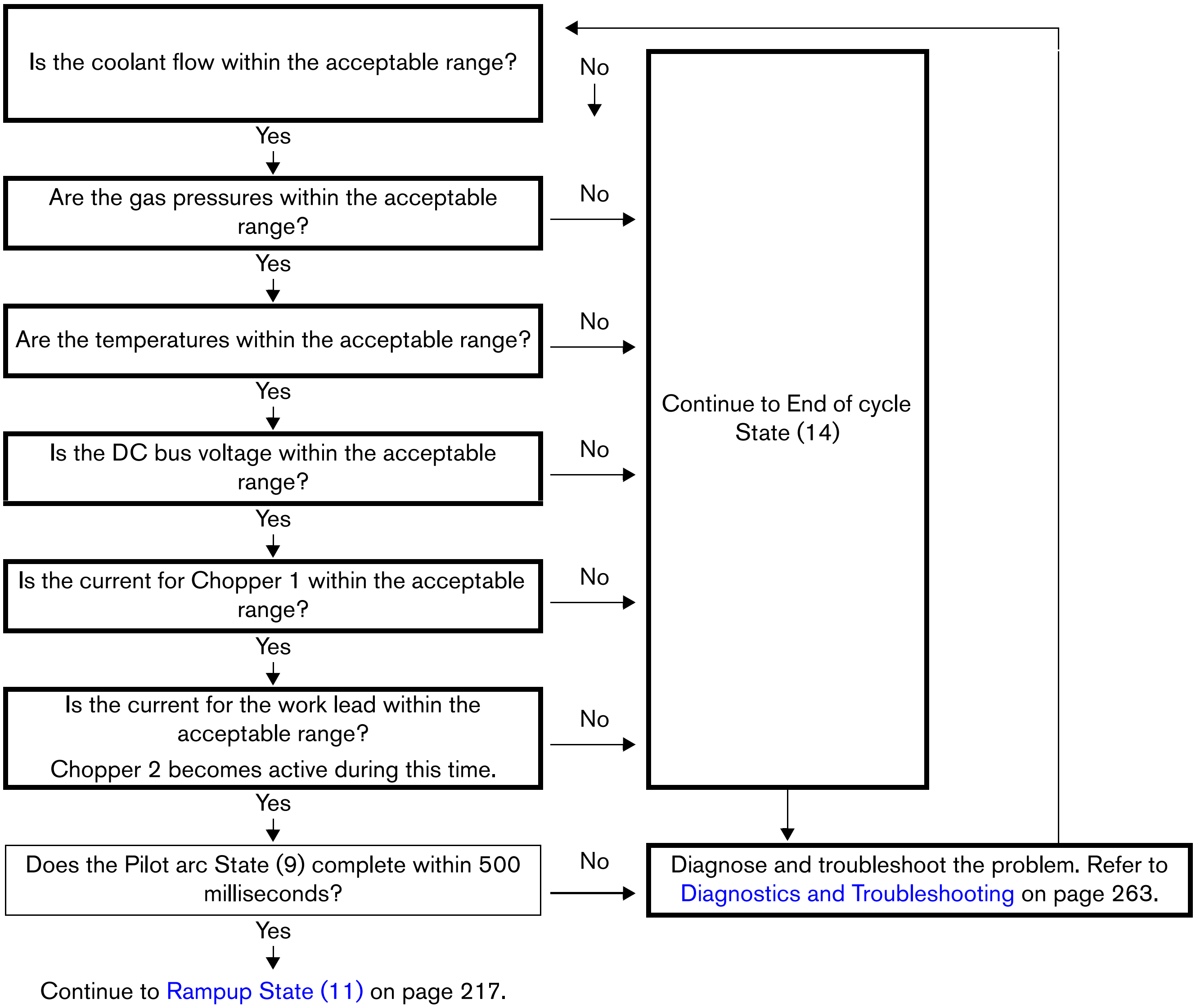
* To conserve energy, the coolant pump and fans stop after the time limit expires without a command.

Ignite State (8)



Continue to Pilot arc State (9) on page 216.

Pilot arc State (9)



Rampup State (11)

Increase current and gas flow to the setpoints for this process.

Is the Rampup State (11) complete and successful?

No → Diagnose and troubleshoot the problem. Refer to Diagnostics and Troubleshooting on page 263.

Yes

Continue to Steady State (12) on page 217.

Steady State (12)

During the Steady State (12), the sent process (piercing, marking, or cutting) is active.

Does the coolant flow rate remain within the acceptable range?

No

Yes

Do the gas pressures remain within the acceptable range?

No

Yes

Do the temperatures remain within the acceptable range?

No

Yes

Does the current for Chopper 1 and Chopper 2 remain within the acceptable range? (If the process is less than or equal to 30 A, only Chopper 1 is active).

Note: If the operator-selected process is equal to or greater than 30 A, monitor both choppers.

No

Diagnose and troubleshoot the problem. Refer to Diagnostics and Troubleshooting on page 263.

Yes

Is the Plasma Start signal removed?

Yes

Continue to Rampdown State (13) on page 218.

Rampdown State (13)

Rampdown State (13) begins when the CNC removes the Plasma Start command.

Decrease current to the final setpoint.

↓

Decrease gas flow to the final setpoint.

↓

Is Rampdown State (13) complete and successful?

No → Diagnose and troubleshoot the problem. Refer to Diagnostics and Troubleshooting on page 263.

Yes

↓

Continue to End of cycle State (14) on page 218.

End of cycle State (14)

Turn OFF Chopper 1 and Chopper 2.

↓

Turn OFF gas.

↓

Start post-flow gas flow.

↓

Start timer to turn OFF the contactor.

↓

Start timer to stop the fans.

↓

Start timer to stop the coolant pump.

↓

Cycle ends. Continue to Wait for start State (5) on page 214.*

* After the successful completion of an operator-selected process, the cutting system returns to the Wait for start State (5) on page 214 to wait for the next command.

High-voltage relay stages (closed or opened) in the ohmic circuit

During a wet process (specifically, N_2/H_2O), water can act as a current path for the ohmic-sense circuit. To prevent any passage of current to the ohmic board, the cutting system automatically opens the high-voltage relay and disables the ohmic-sense circuit.

Ohmic sensing for the N_2/H_2O process is available in cutting systems with firmware that is revision L or later. Stall force is required when the N_2/H_2O process is used underwater.

During a dry process, the cutting system closes the high-voltage relay and enables the ohmic-sense circuit (except during high-frequency starts).

Automatic purges

XPR cutting system purges are automatic. The type of purge is based on the currently-selected process, the previously-selected process, and on the type of gas connect console (OptiMix, VWI, CorePlus, or Core).

- OptiMix and VWI XPR cutting systems do both gas-change and process-setup purges. Refer to Gas-change purges for OptiMix or VWI XPR cutting systems on page 219 and Process-setup purges for all XPR cutting systems on page 220.
- CorePlus and Core XPR cutting systems do only process-setup purges. Refer to Process-setup purges for all XPR cutting systems on page 220.

> The length of time necessary to complete a purge is based on the type of operator-selected process and if the active process is the first process sent after the Powerup State (1). Refer to Sequence of operation on page 211.

Gas-change purges for OptiMix or VWI XPR cutting systems

If you have an XPR cutting system equipped with an OptiMix or VWI gas connect console, a plasma-gas purge occurs automatically when the cutting system changes from a **non** mixed-fuel gas process to a mixed-fuel gas (H_2-mix) or F5 process or from a mixed-fuel gas (H_2-mix) or F5 to a **non** mixed-fuel gas process.

> Core and CorePlus XPR cutting systems skip gas-change purges.

The type of plasma gas used for the purge is based on the type of cutting system configuration (OptiMix or VWI):

- OptiMix XPR cutting systems use a 2-phase gas-change purge that includes N_2.
- VWI XPR cutting systems use a 2-phase gas-change purge that includes air.

Plasma-gas purge

The following steps occur automatically for a plasma-gas purge:

1. Mixed-fuel gas (H_2-mix) or F5 drains from the XPR cutting system through the torch.
2. If you have an OptiMix XPR cutting system, N_2 purges any residual mixed-fuel gas.
3. If you have a VWI XPR cutting system, air purges any residual F5 gas from the torch lead.

Shield-gas/shield-fluid purge

If a process changes from a wet process to a dry process, a shield-fluid purge is used. During a shield-fluid purge, N_2 purges residual water from the shield gas/fluid hose.

> A wet process uses water as a shield fluid. A dry process does not use water as a shield fluid.

Core and CorePlus XPR cutting systems skip the gas-change purge.
Core and CorePlus XPR cutting systems use only process-setup purges.
Refer to Process-setup purges for all XPR cutting systems on page 220.

Process-setup purges for all XPR cutting systems

If you have a cutting system equipped with an OptiMix or VWI gas connect console, a process-setup purge automatically follows the gas-change purge, and includes preflow and cutflow purges.

If you have a CorePlus or Core XPR cutting system, the gas-change purge is skipped, and only the process-setup purge occurs.

The type of process gas used for a process-setup purge is based on the operator-selected process.

How to choose the torch positions and process settings you need

Perpendicular-position cutting, marking, and piercing

During perpendicular-position cutting, marking, and piercing, the torch remains perpendicular (at a 90° angle) to the workpiece. Many cutting processes and all piercing and marking processes use a perpendicular torch position.

Cutting

Cutting processes use a plasma arc that goes through the full thickness of the metal to create a desired shape. The length and shape of a cut part is based on the path and duration of torch movement.

Marking

Marking processes use argon (Ar) or nitrogen (N_2) to make marks on metal, without piercing or cutting through it. A typical use for marking is to mark a workpiece for secondary operations (such as bending or drilling) or for alpha-numeric part identification.

When you use argon marking, the type of metal, its thickness, and its surface finish have an effect on marking quality. Torch speeds and current levels also have an effect:

- Slower torch speeds and higher currents make deeper marks.
- Faster torch speeds and lower currents make shallower marks.

Make sure to mark and cut individual parts when you use the argon-marking processes. Marking the entire nest prior to cutting can reduce the life of consumables. For better results, alternate cuts and marks.

Poor quality marking or burn-through can occur with metal that is less than 1.5 mm (0.06 in. or 16 gauge).

Piercing

Piercing processes penetrate the full thickness of the metal. Piercing is also the first action involved in cutting a part.

Use edge starts when piercing is not possible.

If the torch moves too soon, the plasma arc cannot penetrate the metal. If the movement delays too long, the pierce-hole size can increase, which can result in the loss of the transferred arc. If the torch is too close to the workpiece during piercing, damage can occur to the consumables and the torch.

You can minimize unwanted results, increase the number of pierces, and maximize the life of consumable parts when you use the piercing settings that Hypertherm recommends.

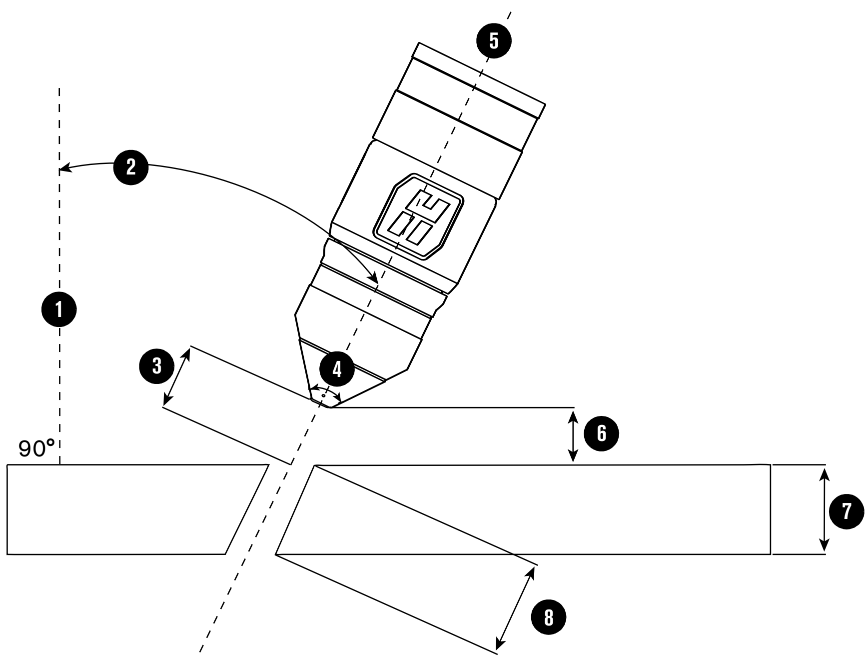
For information about how to get the best piercing results, refer to Recommendations for piercing processes on page 236.

Bevel cutting

During bevel cutting, the torch is at an angle (**not** perpendicular) to the workpiece. The angle of the torch (relative to the workpiece) has an effect on the bevel cut angle of the metal.

The torch and consumable parts are designed so that the torch position can range from 0° – 52° so that the torch tip remains the closest point to the workpiece. If you need an angle greater than 52°, you can raise the torch to increase the clearance.

Figure 60 – Example orientation of a torch during bevel cutting



1 **Perpendicular line**: The imaginary line that is perpendicular (at a 90° angle) to the workpiece.

2 **Bevel angle**: The angle between the center line of the torch and an imaginary line that is perpendicular to the workpiece.

3 **Cut height**: The linear distance from the center of the torch to the workpiece surface along the torch center-line. For optimal results, select a cut height that is based on an “effective thickness” value in the cut charts.

If a specific cut height is inconsistent with a clearance requirement, select a slightly higher cut height to prevent torch collisions.

4 **Cone angle**: All XPR torches have a 76° cone angle that makes it possible to tilt or position the torch up to 52°. If you need an angle greater than 52°, you can raise the torch to increase the clearance.

5 **Torch center line**: The imaginary line along the central axis of the torch.

6 **Clearance**: The vertical distance from the lowest point of the torch to the surface of the workpiece. Make sure that the distance is at least 2 mm – 3 mm (0.080 in. – 0.120 in.) to minimize torch contact with any slag on top of the plate.

7 **Nominal thickness**: The vertical thickness of a workpiece. This is the thickness of the metal that the plasma arc cuts, marks, or pierces.

8 **Effective thickness**: The distance that the plasma arc travels through the metal while cutting. This value is equal to the nominal thickness, divided by the cosine of the bevel angle.

Arc voltage settings for bevel cutting depend on the torch position, metal thickness, cut speed, and effective cut height. For this reason, cut charts only include arc voltages for perpendicular-position cutting.

Bevel compensation tables

Hypertherm's TrueBevel™ software has specialized cut charts known as "bevel compensation tables." They can help you get the best results on mild steel with minimal operator intervention.

For information about how to access and use the bevel compensation tables, refer to the instruction manual that came with your Hypertherm CAM software.

Hypertherm's ProNest™ software includes bevel-compensation tables.

For information about CNC compatibility requirements and how to use bevel compensation tables with non-Hypertherm CNCs, contact your cutting machine supplier or regional Hypertherm Technical Service team.

Ferrous (mild steel) processes

Ferrous (mild steel) processes are developed for cutting A36 mild steel. All mild steel processes are available with all 4 XPR gas connect consoles (OptiMix, VWI, CorePlus, and Core). Mild steel processes use O_2/Air in most cases, except for the following:

- Lower-current cutting processes on thinner metals, True Hole, and internal-feature cutting use O_2/O_2.
- The 300 A processes, on some thicknesses, use O_2/N_2.
- Argon-assist technology uses argon (Ar) in the shield to increase pierce capacity.

Refer to the *XPR Cut Charts Instruction Manual* (809830) for information about the gases used for plasma gas and shield gas during different processes.

All mild steel processes use Hypertherm's enhanced LongLife® technology that works together with Arc Response Technology™ to extend the life of consumables by detecting and reacting to rampdown errors before they occur.

HyDefinition vented processes	The XPR300 cutting system offers HyDefinition vented consumables for 30 A – 170 A processes. The processes enable the operator to achieve the following results: ▪ High-quality cuts ▪ Dross-free cutting (metal dependent) ▪ Fast cut speeds
HyDefinition 220 A and 300 A processes	The 220 A and 300 A processes are non-vented and deliver the following cutting options: ▪ High-quality cuts ▪ Excellent consumable part life ▪ Dross-free cutting with most thicknesses (metal dependent) ▪ Consistent cut quality over the lifetime of the consumable parts

The consumable parts for 300 A processes are non-vented and use a liquid-cooled nozzle (in place of a vented, air-cooled nozzle).

Non-ferrous (stainless steel and aluminum) processes

Non-ferrous (stainless steel and aluminum) processes that appear in the XPR cut charts were developed using the following metals:

- 304L and 316L stainless steel
- 6061 aluminum

It is possible, however, to cut other types of stainless steel and aluminum.

Non-ferrous process availability is based on the type of gas connect console that you have (Core, CorePlus, VWI, or OptiMix).

Table 29 – Available non-ferrous processes by gas connect console type and gas type.

Gas connect console	Available stainless steel processes	Available aluminum processes
Core	N_2/N_2	N_2/N_2, Air/Air
CorePlus	N_2/N_2	N_2/N_2, Air/Air
VWI	N_2/N_2, N_2/H_2O, F5/N_2	N_2/N_2, N_2/H_2O, Air/Air
OptiMix	N_2/N_2, N_2/H_2O, H_2-mix/N_2, F5/N_2	N_2/N_2, N_2/H_2O, H_2-mix/N_2, Air/Air

Table 30 – Process recommendations for cut quality, based on metal thickness and type

<table>
<tr><th colspan="2">Metal thickness</th><th colspan="2">Metal type</th></tr>
<tr><th>Metric (mm)</th><th>English (in)</th><th>Stainless steel</th><th>Aluminum</th></tr>
<tr><td>1</td><td>0.036</td><td rowspan="2">40 A N_2/N_2</td><td rowspan="2">40 A Air/Air</td></tr>
<tr><td>3</td><td>0.105</td></tr>
<tr><td>3.5</td><td>0.125</td><td rowspan="2">60 A N_2/N_2</td><td>60 A Air/Air</td></tr>
<tr><td>5</td><td>0.188</td><td>60 A N_2/N_2</td></tr>
<tr><td>6</td><td>0.250</td><td rowspan="2">80 A F5/N_2</td><td rowspan="2">80 A N_2/H_2O</td></tr>
<tr><td>10</td><td>0.375</td></tr>
<tr><td>12</td><td>0.500</td><td>130 A H_2-mix/N_2</td><td>130 A N_2/H_2O</td></tr>
<tr><td>16</td><td>0.625</td><td>170 A H_2-mix/N_2</td><td rowspan="2">170 A N_2/H_2O</td></tr>
<tr><td>20</td><td>0.750</td><td rowspan="4">300 A H_2-mix/N_2</td></tr>
<tr><td>25</td><td>1.000</td><td rowspan="2">300 A N_2/H_2O</td></tr>
<tr><td>50</td><td>2.000</td></tr>
<tr><td>75</td><td>3.000</td><td>–</td></tr>
</table>

Stainless steel

HyDefinition (HDi) vented processes	The XPR300 cutting system offers HDi vented cutting for all processes that cut stainless steel (up to170 A). HyDefinition vented processes produce high-quality cuts with minimal dross and can be used with either N_2, F5, or mixed-fuel gases. Specifically, HyDefinition vented processes can produce: ▪ A sharp top edge of the cut ▪ A smooth, shiny, or gray cut edge ▪ Excellent cut-edge angularity ▪ Fast cut speed
HyDefinition vented mixed-fuel gas processes	OptiMix-equipped systems let operators use mixed-fuel gas processes for stainless steel cutting. The OptiMix gas connect console has a 3-gas mixer that mixes H_2, Ar, and N_2 so that the operator can tune the cut edge color and angle with a wide variety of gas mixtures. The cutting system chooses an optimized combination of 3 gases or 2 gases (H_2, Ar) based on the thickness of the metal to be cut.
HyDefinition vented water injection processes	VWI processes use a low flow rate of water through the shield line (instead of shield gas). A process that uses water as a shield fluid is sometimes known as a “wet” process. Wet processes deliver an overall good cut quality with low operating cost and a decreased heat-affected zone. Wet processes produce a slightly rougher edge than “dry” processes.
HyDefinition non-vented processes	The 300 A processes (N_2/N_2, mixed-fuel gas/N_2, and N_2/H_2O) are non-vented and deliver the following cutting options: ▪ Dark-colored cut edges with N_2/N_2. ▪ Yellow-orange cut edges with mixed-fuel gas/N_2 on metals with 15 mm – 25 mm (0.59 in. – 1 in.) thicknesses. ▪ Dark, blue-hued cut edges with mixed-fuel gas/N_2 on metals with thicknesses that are greater than 25 mm (1 in.). ▪ Gray cut edges with small heat-affected zone with N_2/H_2O.

Aluminum

HyDefinition (HDi) vented processes	In addition to high-quality stainless steel cuts (refer to Stainless steel on page 225), the N_2 and mixed-fuel gas HyDefinition consumables can be used to produce high quality cuts on aluminum.
HyDefinition mixed-fuel gas processes	OptiMix-equipped systems let operators use mixed-fuel gas processes for aluminum cutting. The OptiMix gas connect console has a 3-gas mixer that mixes H_2, Ar, N_2. The cutting system chooses an optimized combination of 3 gases or 2 gases (H_2, Ar) based on the thickness of the metal to be cut.
HyDefinition vented water injection processes	VWI processes use a low flow rate of water through the shield line (instead of shield gas). A process that uses water as a shield fluid is sometimes known as a “wet” process. For aluminum, wet processes generally produce a smoother edge than “dry” processes. Additionally, VWI lets operators get: ▪ A sharp top edge of the cut ▪ A smooth cut edge ▪ Excellent cut-edge angularity
HyDefinition non-vented processes	The 300 A processes (N_2/N_2, mixed-fuel/N_2, and N_2/H_2O) are non-vented and deliver good cut quality at fast cutting speeds.

Processes for special applications

Underwater cutting

WARNING

UNDERWATER CUTTING CAN CAUSE AN EXPLOSION

Underwater cutting with fuel gases or underwater cutting of non-ferrous alloys can cause an explosion.

- Do NOT cut under water with fuel gases (H_2-mix) or F5.
- Do NOT cut non-ferrous alloys under water or on a water table, unless you can prevent the accumulation of hydrogen gas.

Failure to remove accumulated hydrogen gas can result in an explosion during cutting system operation.

Underwater cutting can suppress the acoustical noise, smoke, and glare that plasma cutting produces. Underwater cutting also decreases the heat-affected zone on the workpiece. On mild steel, it also decreases cutting speeds and produces a rougher cut edge with increased dross.

> You can expect the acoustical noise levels to average less than 70 decibels for many processes during underwater cutting of metals that are up to 75 mm (3 inches) below the water surface.

Make sure to satisfy the following conditions before you do underwater cutting:

- Do **not** cut under water with fuel gases (H_2-mix) or F5. An explosion can occur.
- Do **not** cut non-ferrous alloys under water or on a water table, unless you have installed the correct safety equipment from your table manufacturer or cutting machine supplier.
- Consult with your cutting machine supplier, the table manufacturer, and other experts prior to cutting non-ferrous alloys to implement a risk assessment and mitigation plan that eliminates the risk of detonation by preventing hydrogen accumulation.
- Do **not** cut a workpiece that is more than 75 mm (3 inches) below the surface of the water. It can negatively affect cutting system performance.
- Do **not** use True Hole® processes underwater. True Hole processes are not compatible with underwater cutting.

> True Hole cutting on a water table is possible only if the surface of the water is lowered to at least 25 mm (1 inch) **below the bottom surface** of the workpiece. For information about True Hole processes, contact your cutting machine supplier or regional Hypertherm Technical Service team.

- Make sure that the torch is perpendicular (at a 90° angle) to the workpiece.

- Make sure that preflow is turned ON during initial height sense (IHS) for all underwater cutting.

  Use the CNC or XPR web interface to activate the IHS. For information about how to do this, see the instruction manual that came with your CNC.

- Make sure that ohmic contact is disabled for all underwater cutting.

  For information about how to disable ohmic contact, see the instruction manual that came with your CNC.

Underwater cut charts are listed by amperage. They appear with the ferrous and stainless steel cut charts. Refer to the *XPR Cut Charts Instruction Manual* (809830).

Underwater cut chart settings are provided for:

- Ferrous processes 80 A and above
- Non-fuel gas stainless steel processes 80 A and above

Mirror cutting

Consumable parts for mirror cutting are available for all processes. They include a special swirl ring and shield that causes the gases to swirl in the opposite direction. The opposite-direction gas swirl makes the "good side" of the cut on the left side, relative to torch motion.

Mirror-cutting consumables are commonly used to cut a "left-handed" version of a "right-handed" part. Mirror-cutting consumables use the same settings as standard consumables.

For part numbers for mirror-cutting consumables, refer to Example configurations for consumables on page 142.

Process selection

All of the XPR cutting processes have a unique identification number (process ID). Each process ID aligns with a specific set of pre-programmed values in the cut chart database in the plasma power supply control board.

Processes in the database can be selected by:

- Metal type and thickness
- Cutting current
- Plasma and shield gas types
- Process category (Refer to Process categories on page 231.)

When you select a process ID from the CNC or the Operate screen in the XPR web interface, the cutting system automatically activates the pre-programmed settings for that process based on the values in the database.

On-screen options let you select, monitor, and control processes directly from the CNC or the Operate screen in the XPR web interface.

Manual selection of settings is not necessary in most cases. However, you can adjust some pre-programmed settings with override or offset commands, within limits. Refer to Process ID offsets / overrides on page 230.

How to use process IDs to access optimal settings

When you select a process ID from the CNC or XPR web interface, you automatically get the optimized settings that Hypertherm recommends for that process.

The pre-programmed settings come from Hypertherm's extensive laboratory tests. Because of differences in cutting systems, metals, and consumables, it is sometimes necessary to adjust the settings. However, in most cases, you can expect the best results when you use the default settings that come with a process ID.

To automatically get recommended settings, select the process ID for the process that aligns with your needs:

1. Go to the process selection screen on the CNC or the Operate screen on the XPR web interface.

2. Select the process ID:

   a. Examine the list of available processes.

   b. Identify the process that best aligns with your needs. For example, choose process ID 1153 to activate the settings for 170 A, 12 mm (0.5 inch), mild steel, O_2/Air.

      Process selection must occur during the Initial checks State (2) of operation. Refer to States of operation for the XPR cutting system on page 211.

3. If none of the processes are satisfactory:
   a. Select the closest available process.
   b. Send the necessary offset command or commands to adjust the setting or settings as necessary. Refer to Process ID offsets / overrides on page 230.

If you have an unusual process requirement, contact your cutting machine supplier or regional Hypertherm Technical Service team for guidance.

Process ID offsets / overrides

You can adjust some pre-programmed settings with an offset or override command. An offset/override command is a type of serial RS-422 or EtherCAT signal that lets you change the default value of a setting, within an allowable limit.

For example, if a pre-programmed plasma pressure value is 65, and you want to change it to 70, send an offset command of 5 (65 + 5 = 70). You can also use the web interface to send the desired plasma pressure value (70). Refer to Web interface screen information on page 188.

Offset settings remain active until you send a new process ID to the cutting system, or until power is removed from the cutting system.

For descriptions of offset commands and the allowable limits for each adjustable setting, refer to the *CNC Communication Protocol for the XPR Cutting System* (809810).

How to use cut charts

Electronic cut charts are available on the cut chart screen of your CNC or XPR web interface.

For information about how to find electronic cut charts, refer to the instruction manual that came with your CNC.

Cut charts are available in the *XPR Cut Charts Instruction Manual* (809830).

The cut charts are for reference purposes. Always use the electronic cut charts that appear on your CNC or XPR web interface for the most complete and accurate process-selection information.

Use the cut charts for guidance about process selection, especially if the default process ID settings are not satisfactory for your application.

The pre-programmed settings that come with a process ID are designed to give the best balance between quality and productivity with consumables that are in average condition.

The results that you want from a process can influence process selection. In some cases, cut quality is important. In other cases, speed is important. Often, the best choice balances these requirements.

Process core thickness (PCT)

The cut chart for every cutting process contains a range of possible thicknesses. Process engineers work to optimize a range of thicknesses (process category 1 for XPR). This optimized range is known as the process core thickness (PCT). Thicknesses greater and less than the PCT can have varied results relative to cut quality, cut speed, and piercing capability.

Process categories

The XPR cut charts have up to 5 process categories. Each category has a unique process category number (1 – 5) that correlates to the performance that you can expect when you select this process. The process category number for the process that you choose changes the quality-speed balance.

For best results, Hypertherm recommends that you select process category number 1 whenever possible. Category 1 represents an optimized thickness (or PCT) for that cut process with the overall best balance of cut quality and cut speed.

Table 31 on page 232 and Table 32 on page 233 describe the results that you can expect with different process category numbers.

Table 31 – Process category options and expected quality-speed results for ferrous (mild steel) processes

Process category number	Process category condition	Category description	Quality	Speed
Category 1	Process Core Thickness (PCT)	▪ Best overall balance of productivity and cut quality. ▪ The process is optimized for this thickness. ▪ Expect cut speeds that range from 2,030 mm/min – 3,810 mm/min (80 in/min – 150 in/min). ▪ Dross free, in most cases.	Very good	Very good
Category 2	Thicker than PCT	▪ Good choice when edge quality is more important than speed. ▪ Expect cut speeds that are slower than 2,030 mm/min (80 in/min). ▪ Expect some low-speed dross.	Very good – excellent	Lower
Category 3	Thinner than PCT	▪ Good choice when speed is more important than edge quality. ▪ Expect cut speeds that are faster than 3,810 mm/min (150 in/min). ▪ Dross-free results in most cases.	Lower	Higher
Category 4	Edge Start for most processes	▪ Edge start is required, with the exception of argon-assist processes. ▪ Thick, low-speed dross is likely.	Good	Low
Category 5	Severance	▪ This is the maximum thickness for these processes. ▪ Edge start is required. ▪ Expect cut speeds that are slower than 250 mm/min (10 in/min). ▪ Cut-edge quality can be rough. ▪ Expect significant dross.	Very low	Very low

In general, Hypertherm recommends lower amperage processes for the best cut-edge quality, and higher amperage processes for the best dross-free cutting. When speed is more important than quality, you can use a higher-amperage process. For guidance about process selection, refer to Table 30 – Process recommendations for cut quality, based on metal thickness and type on page 224 and the *XPR Cut Charts Instruction Manual* (809830).

Table 32 – Process category options and expected quality-speed results for non-ferrous processes

Process category number	Process category condition	Category description	Quality	Speed
Category 1	Process Core Thickness (PCT)	▪ Whenever possible, select Category 1 for optimal edge quality and speed, with minimal dross. ▪ The process is optimized for this thickness. ▪ Expect cut speeds that range from 1,016 mm/min – 3,048 mm/min (40 in/min – 120 in/min). ▪ Dross free, in most cases.	Very good – excellent	Very good
Category 2	Thicker than PCT	▪ In most situations, you can expect square cut edges with sharp top edges. ▪ Darker edge color is possible with stainless steel. ▪ Expect cut speeds that are slower than 1,016 mm/min (40 in/min). ▪ Expect some dross.	Good – very good	Lower
Category 3	Thinner than PCT	▪ Select Category 3 when speed is more important than edge quality. ▪ Expect cut speeds that are faster than 3,048 mm/min (120 in/min). ▪ Expect some dross.	Lower	Higher
Category 4	Edge Start Only	▪ Edge start is required. ▪ Darker edge color is possible with stainless steel. ▪ Thick dross is likely.	Good	Low
Category 5	Severance	▪ This is the maximum thickness for these processes. ▪ Edge start is required. ▪ Expect cut speeds that are slower than 250 mm/min (10 in/min). ▪ Cut-edge quality can be rough. ▪ Expect significant dross. ▪ Thick-metal cutting techniques can be necessary.	Very low	Very low

In general, Hypertherm recommends dross-free processes. Non-ferrous dross is very difficult to remove. Depending on the gas-connect console, the XPR300 cutting system offers the following non-ferrous cutting processes: Air/Air, N_2/N_2, N_2/H_2O, F5/N_2 and mixed-fuel gas/N_2. For guidance about process selection, refer to Table 30 – Process recommendations for cut quality, based on metal thickness and type on page 224 and the *XPR Cut Charts Instruction Manual* (809830).

How to select consumables

The XPR cutting system uses the same consumable parts for perpendicular-position (90° angle) and bevel-cutting processes. This eliminates the need to change consumables when you switch from a perpendicular-position process to bevel cutting or from bevel cutting to a perpendicular-position process. This also eliminates the need to inventory two different sets of consumables (perpendicular and bevel).

For guidance on how to select consumables (including part numbers) by process type and metal and how to install the consumables, see the following:

- *XPR Cut Charts Instruction Manual* (809830)
- Install the consumables on page 136

Factors of cut quality

Dross

- Dross is more likely to occur on a hot workpiece. The first cut in a series often produces the least dross. You can expect more dross with more cuts.
- Changes in shield flow can dramatically influence dross formation on non-ferrous metals.

Problem	Cause*	Solution
On mild steel, low-speed dross is heavier, but easy to remove.	The plasma arc can move ahead of the torch when the torch speed is too slow.	Increase the torch speed.
On mild steel, high-speed dross is finer, but difficult to remove.	The plasma arc can lag behind the torch when the torch speed is too fast.	Decrease the torch speed.

* Worn or damaged consumables can produce intermittent dross.

How to get the results you want

This section of the manual gives general recommendations for how to get the best results for many processes.

For instructions on how to troubleshoot specific performance problems, refer to Diagnostics and Troubleshooting on page 263.

General recommendations for all processes

- Always start with the default settings for the process that you want to use. In most cases, you can expect the best results when you use the default settings that come with a process ID.
- If you decide that it is necessary to adjust a default setting, use offset or override commands to make incremental changes to the original value (values), within limits. Refer to Process ID offsets / overrides on page 230.
- Do not allow the torch to touch the workpiece during cutting system operation. Contact with the workpiece can damage the torch nozzle and shield. It can also damage the surface of the workpiece.
- Make sure that the torch is perpendicular (at a 90° angle) to the workpiece for perpendicular-position processes.
- Unsteady drive system and rail movement can make torch motion unsteady, which can cause irregular cut patterns. Make sure to do routine service and maintenance to the drive system and rails.

  See the instruction manual that came with your cutting machine or table for information on how to do this.

- Do all cutting system maintenance tasks as scheduled. Refer to Maintenance on page 241.

Recommendations for perpendicular-position cutting processes

- Always start with the default settings for piercing the thickness of the metal that you want to cut.
- Avoid firing the torch into the air.

  It is acceptable to begin a cut at the edge of the workpiece.

- Avoid lead-outs that move away from the workpiece and stretch the plasma arc.
- Do the following steps to avoid the loss of a transferred plasma arc:
  - End every cut with the plasma arc still attached to the workpiece. Refer to Automatic rampdown error protection on page 239.
  - Decrease the cutting speed when the end of the cut is near.
  - Stop the plasma arc before the part is completely cut (allow completion of the cut during rampdown).
  - Program the path of the torch into the scrap area for rampdown.

Recommendations for piercing processes

For the best piercing outcomes follow these recommendations:

- Always start with the default settings for piercing the thickness of metal that you want to pierce.
- Allow a lead-in distance that is approximately the same thickness as the metal to be pierced. For example, for 50 mm (2 inch) metal, use a 50 mm (2 inch) lead-in.
- Keep the torch above cut height until it passes over the puddle of molten metal created by the pierce. Puddle avoidance minimizes shield damage.
- Make sure to follow transfer height and pierce height recommendations during piercing processes. Refer to the *XPR Cut Charts Instruction Manual* (809830).
- If it is difficult to pierce the workpiece (because of metal type or thickness):
  - Increase the shield pierce flow (if this function is available with your CNC).

    For this to work, the shield pierce signal must be activated. For information about how to activate the shield pierce signal, see the instruction manual that came with your CNC.

  - Use a “moving” or “flying” pierce technique, but only if you are an experienced operator.

    With a “moving” or “flying” pierce technique, torch motion starts immediately after arc transfer and during piercing. **Do not attempt this technique unless you are an experienced operator.** Damage to the torch, lifter, or other system components is possible.

  - Choose an argon-assist process to pierce thicker than 45 mm (1.75 inch) for mild steel.

    Argon-assist processes are available on CorePlus, VWI, and OptiMix gas connect consoles.

Hypertherm's pierce control and assist technology can minimize timing and torch height issues that can have a negative effect on piercing processes.

Pierce control* and assist technology	
Pierce delay settings	▪ The operator selects the time (in seconds) necessary to pierce through the full thickness of the metal. ▪ The operator enters this setting from the CNC or XPR web interface. ▪ For recommendations on how to choose the best pierce-delay setting, refer to the *XPR Cut Charts Instruction Manual* (809830).
Shield pierce gas signal	▪ This signal enables the shield pierce flow function. ▪ This signal must be activated with the Plasma Start command. Refer to Wait for start State (5) on page 214. For information about commands and signals, refer to the *CNC Communication Protocol for the XPR Cutting System* (809810).
Shield pierce flow setting	▪ The shield pierce gas setting is used during pierce operation. ▪ The shield pierce gas setting is active until pierce delay expires. ▪ The shield pierce gas setting can be offset or overridden.

* Also known as "shield pierceflow."

Recommendations for marking processes

- Alternate between marking and cutting processes. Marking without intermittent cutting can shorten the life of consumables.

Recommendations for bevel-cutting processes

- When possible, pierce with the torch perpendicular to the workpiece and then tilt the torch.
- Limit tilt rotation speed if necessary.
- Maintain 2 mm – 3 mm (0.08 inch – 0.12 inch) of clearance between the torch and the workpiece.
- Use the effective thickness of the workpiece you are cutting to select cut speed.

With True Bevel™ technology, Hypertherm provides you with flexible and adjustable bevel compensation cut charts, or process parameter tables, that automatically compensate key settings such as torch height and cut speed.

How to maximize the life of consumable parts

- LongLife process settings can minimize erosion on the emitter surface of the electrodes. The following steps occur automatically with LongLife electrode protection:
  - Gas and current flow automatically ramp-up at the start of a cut
  - Gas and current flow automatically ramp-down at the end of a cut
- To achieve the full benefits of Hypertherm's LongLife and Arc Response Technology, avoid firing the torch into the air. Refer to Arc Response Technology on page 238.

  It is acceptable to start a cut at the edge of the workpiece.

- Use the pierce settings in the cut chart database. Refer to Piercing on page 221.
- To achieve the full benefits of Hypertherm's automatic rampdown error protection, (refer to Automatic rampdown error protection on page 239), select processes that have cut speeds of 3,560 mm/min (140 in/min) or less.
- To minimize the risk of catastrophic failure of a consumable part when cutting speeds are greater than 3,560 mm/min (140 in/min), always take the following steps when cutting:
  - Decrease the cutting speed when the end of the cut is near.
  - Program torch movement into the scrap area of the workpiece.

  If possible, use a chain cut so that the path of torch movement leads directly from one cut part into the next. This will minimize multiple plasma arc starts and stops for multi-part cutting that damage electrodes.

Arc Response Technology

The plasma power supply is equipped with choppers that monitor the current and arc voltage load once every 33 microseconds (30 kilohertz), letting the system detect and react nearly instantaneously to events happening at the torch during cutting.

Arc Response Technology lets the XPR cutting system react to certain events at the torch that can lead to decreased consumable life or possible torch damage.

Automatic torch protection

When consumables fail catastrophically (blow out) at high current settings, torch damage can occur. This damage can occur either through arcing damage or from molten copper and/or brass that gets into the coolant paths of the torch.

If catastrophic consumable failure occurs, the choppers can detect the event at the onset through the electromagnetic interference (EMI) or noise signature of the current being delivered to the torch. The choppers respond quickly to stop the cutting system and prevent damage to the torch. The electrode will still blow out and other consumables can also be affected, but catastrophic damage to the torch will not occur.

Automatic rampdown error protection

LongLife technology requires a controlled stop of the current and gas pressure to preserve electrode life for mild steel cut processes. A failure to complete the cut on the workpiece causes most uncontrolled stops (rampdown errors). Failure to complete the cut on the workpiece causes the arc to stretch and then snap out in a rampdown error, which can drastically decrease consumable life. Common causes for a rampdown error are:

- Incorrect hole lead outs
- Running off the edge of the workpiece

The cutting system can detect a rampdown error before the arc snaps out and can respond quickly to do a controlled stop of the current and gas pressure. This can significantly increase the electrode life, especially when cut speeds are less than 3,560 mm/min (140 in/min).

7 Maintenance

Overview

Hypertherm cutting systems can operate in harsh conditions for many years. To maintain cutting system performance, minimize operating costs, and lengthen cutting system life, it is important to follow all maintenance procedures and schedules.

If you have questions about how to maintain your cutting system, contact your cutting machine supplier or regional Hypertherm Technical Service team. You can find contact information for your regional office at www.hypertherm.com on the "Contact us" page.

This section of the manual describes maintenance steps that you **must do daily, before system operation.**

- For instructions about preventive maintenance (such as weekly, monthly, and yearly tasks) refer to the *XPR Preventative Maintenance Program (PMP) Instruction Manual* (809490).
- For recommendations about how to diagnose and troubleshoot performance issues, refer to Diagnostics and Troubleshooting on page 263.
- For printed circuit board (PCB) drawings and LED locations, refer to PCB information on page 356.

Refer to Table 33 on page 242 for a list of preventive maintenance steps. The *XPR Preventative Maintenance Program (PMP) Instruction Manual* (809490) explains how to do them.

Usually, operators can do the daily, weekly, and bi-monthly tasks. Usually qualified maintenance personnel are needed for monthly, every-6-month, and yearly tasks.

Table 33 – Inspection, preventive maintenance, and cleaning tasks

Maintenance task or activity	Daily	Weekly	Monthly	Every 6 months
Do a test of the inlet pressures	X			
Examine all of the air filters	X			
Do a check of the coolant level and condition	X			
Examine and lubricate O-rings	X			
Examine the water tube and torch	X			
Examine hoses, cables, and leads		X		
Do tests for gas leaks		X		
Do a check of the coolant flow		X		
Clean inside the plasma power supply			X	
Examine the contactors			X	
Examine the pilot arc relay			X	
Examine the coolant system			X	
Do the coolant flow test			X	
Examine the gas line connections			X	
Examine the hoses			X	
Examine the cables			X	
Examine the ground connections			X	
Examine the table-to-workpiece connection			X	
Replace the coolant and coolant filter, and clean and examine the pump screen and coolant check valve				X

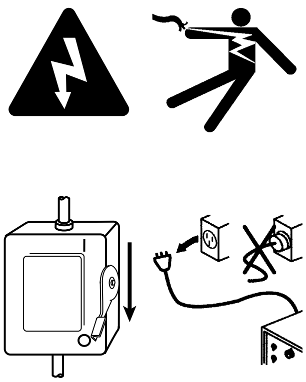
How to do daily inspections

Always do the following at least once daily, **before** system operation:

- Examine the gas regulators on page 245
- Examine the shield water regulator (if applicable) on page 245
- Examine the connections and fittings on page 245
- Examine the consumable parts, torch, and torch receptacle on page 246
- Examine the torch lead on page 251

Remove the power from the cutting system

WARNING



ELECTRIC SHOCK CAN KILL

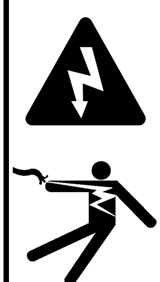
Disconnect electrical power before doing installation or maintenance.

The line-disconnect switch must REMAIN in the OFF position until all installation or maintenance steps are complete.

In the United States, use a "lock out/tag out" procedure until installation or maintenance is complete. In other countries, follow the appropriate national and local safety procedures.

Refer to the *Safety and Compliance Manual* (80669C) for more safety information.

WARNING



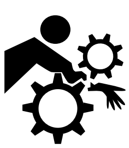
ELECTRIC SHOCK CAN KILL

The plasma power supply contains dangerous electric voltages that can seriously injure or kill you.

Even if the plasma power supply is turned OFF, you can still get a serious electric shock if the plasma power supply remains connected to an electric power source.

Use extreme caution if you do diagnosis or maintenance tasks when the plasma power supply remains connected to an electric power source and the outer cover or panels are removed.

WARNING



MACHINE MOTION CAN CAUSE INJURY

The end-use customer and the cutting machine supplier are responsible for providing protection against the hazardous moving parts of this cutting system.

Read and follow the instruction manual provided by the cutting machine supplier.

See the *Safety and Compliance Manual* (80669C) for more safety information.

Many procedures in this section require you to remove the power from the cutting system. To do this safely, use the following procedure.

> Before you remove the power from the cutting system, it can be helpful to move the torch to the edge of the cutting table and raise the torch lifter to its highest point. This provides easier access to the torch and consumable parts.

1. Set the line-disconnect switch to the OFF position.

2. If the cutting system is not hard wired, disconnect the main power from the electric power. If the cutting system is hard wired, you cannot disconnect the main power from the electric power.

   > Even if you remove the power from the cutting system, you can still get a serious electric shock if the plasma power supply remains connected to an electric power source. Use extreme care during service and maintenance when the cutting system is connect to electricity.

3. Make sure that the power-indicator LED is not illuminated on the plasma power supply, gas connect console, or torch connect console.

Examine the gas regulators

Before you start cutting system operation, examine the regulator (regulators) for the supply gases. Make sure that the supply gas pressures and flow rates are within the recommended range. Refer to Table 8 on page 44. Adjust the regulator (regulators) if necessary.

Examine the shield water regulator (if applicable)

If your cutting system uses water as a shield fluid, examine the shield water settings before you start cutting system operation. Make sure that the water pressure and flow rate is within the recommended range. Refer to Table 10 on page 50. The regulator on the gas connect console cannot be adjusted. If you have a regulator on the water supply, adjust that regulator if necessary.

Examine the connections and fittings

1. Remove the power from the cutting system. Refer to Remove the power from the cutting system on page 244.

2. Examine all of the hoses, cables, and leads that connect system components. Look for:
   - Kinks
   - Cracks
   - Cuts
   - Frays
   - Bulges or bubbles

3. Replace any hose, cable, or lead if you find damage or excessive wear.

   Refer to Installation on page 71 for information about how to do this.

4. Examine all of the fittings that connect the hoses, cables, and leads:

   a. Tighten loose connections if found, but do not make the connections too tight.

      Refer to Table 12 on page 51 for torque specifications.

   b. Order a replacement hose, cable, or lead set if you find its fitting has damage or excess wear. Replacement sets are available from Hypertherm.

      Individual fittings for external hoses, cables, and leads are **not** replaceable. If you find a problem with an external fitting, you must order a replacement hose, cable, or lead set (with integrated fitting).

      Some hose fittings **inside** of the plasma power supply are replaceable. For part numbers and specifications, refer to the Parts List on page 367.

5. Make sure that the hoses, cables, and leads do not twist or kink during torch movement and system operation. Adjust them if needed.

6. Before you supply power to the cutting system, always complete all inspection and maintenance tasks.

Examine the consumable parts, torch, and torch receptacle

Remove the torch and consumable parts

1. Remove the power from the cutting system. Refer to Remove the power from the cutting system on page 244.

2. Loosen the torch coupler nut to release the torch from the torch receptacle.

   The torch and consumables can be hot. Wear gloves to protect your hands.

3. Put the torch and torch receptacle on a surface that is:

   - Clean
   - Dry
   - Oil-free

4. Turn the shield cap counter-clockwise to release and remove the shield.

5. Turn the nozzle retaining cap counter-clockwise to release and remove the nozzle and swirl ring.

6. Use the consumable tool (104119) or the electrode torque tool (429013) to turn the electrode counter-clockwise. Remove the electrode.

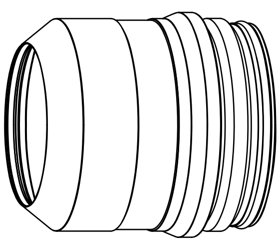
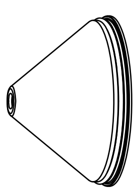
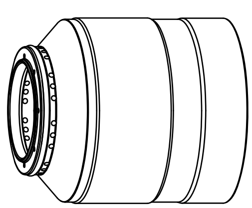
7. Put the used consumables on a surface that is:
   - Clean
   - Dry
   - Oil-free

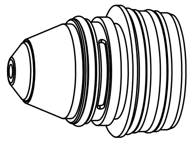
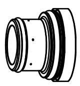
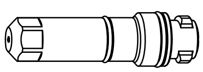
Examine the consumable parts

1. Complete the following procedures before continuing:
   a. Remove the power from the cutting system on page 244
   b. Remove the torch and consumable parts on page 246

2. Examine the consumable parts for damage and excess wear. Refer to Table 34 on page 247 for a list of inspection tasks.

Table 34 – Inspection tasks for consumables

Inspect	Look for	Action if found
Shield cap 	Erosion or missing material Cracks Melted, eroded, or missing material Damaged O-rings	Replace the shield cap.
	Molten material attached	If there is no damage to the shield cap, you can remove the molten material. If there is damage, replace the shield cap.
	Dry O-rings	Apply a thin film of silicone lubricant (027055) to O-rings that appear dry.
Shield 	A center hole that is not circular Damaged O-rings	Replace the shield.
	Over-lubricated O-rings	Use a clean, lint-free cloth to remove excess lubricant.
	Dry O-rings	Apply a thin film of silicone lubricant (027055) to O-rings that appear dry.
Nozzle retaining cap 	Damage Poor cut quality after replacing other consumables Damaged O-rings	Replace the nozzle retaining cap.
	Dry O-rings	Apply a thin film of silicone lubricant (027055) to O-rings that appear dry.

Inspect	Look for	Action if found
Nozzle 	Erosion or missing material Blocked gas holes A center hole that is not circular Damaged O-rings	Replace the nozzle.
	Over-lubricated O-rings	Use a clean, lint-free cloth to remove excess silicone lubricant.
	Dry O-rings	Apply a thin film of silicone lubricant (027055) to O-rings that appear dry.
Swirl ring 	Chips or cracks Blocked gas holes Damaged O-rings	Replace the swirl ring.
	Dirt or debris	Use compressed air to remove dirt or debris. Replace the swirl ring if you find damage.
	Over-lubricated O-rings	Use a clean, lint-free cloth to remove excess silicone lubricant.
	Dry O-rings	Apply a thin film of silicone lubricant (027055) to O-rings that appear dry.
Electrode 	Damaged O-rings	Replace the electrode. Use the electrode torque tool (429013) to correctly tighten the electrode.
	Over-lubricated O-rings	Use a clean, lint-free cloth to remove excess lubricant.
	Dry O-rings	Apply a thin film of silicone lubricant (027055) to O-rings that appear dry.
	Emitter wear For guidance about how to identify emitter wear, refer to How to identify emitter wear on page 253.	Replace the electrode and nozzle. Use the electrode torque tool (429013) to correctly tighten the electrode.

If an electrode needs replacement because of emitter wear, always replace the nozzle at the same time as the electrode.

3. If any consumable part needs replacement, refer to Install the consumables on page 136 for the installation steps.

4. Clean the consumable parts that do not need replacement:

   a. Use a clean, lint-free cloth to wipe the internal and external surfaces.

   b. Use compressed air to remove debris from internal and external surfaces.

   The nozzle retaining cap can retain debris. Make sure to clean it thoroughly.

c. Use **clean water** if you choose to wash consumables parts in water. Use water from the faucet to soak or rinse them. **Never use the water from a cutting table** to wash consumable parts. Cutting table water has contaminants that will damage consumable parts.

d. Apply a thin film of silicone lubricant (027055) to any O-ring that looks dry.

> The O-rings should look shiny. Too much lubricant can prevent gas flow. Remove excess lubricant if found.

5. Before you supply power to the cutting system, install the following components:
   - Consumables in the torch. Refer to Install the consumables on page 136.
   - Torch in the torch receptacle. Refer to Install the torch into the torch receptacle on page 138.

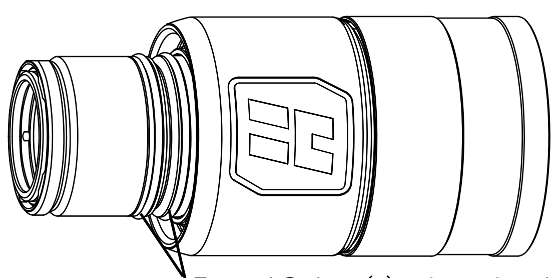
Examine the torch

1. Complete the following procedures before continuing:

   a. Remove the power from the cutting system on page 244

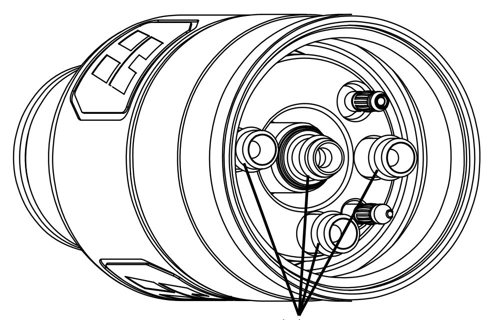
   b. Remove the torch and consumable parts on page 246

2. Examine the torch for:
   - Damage or excess wear on the external O-rings that are on the front of the torch



External O-rings (2) at front of torch

   - Damage or excess wear on the internal O-rings that are on the rear of the torch
   - Dry O-rings
   - Over-lubricated O-rings
   - Cracks in the torch main body
   - Cracks in the torch insulator



Internal O-rings (4) at rear of torch

3. Replace any O-rings that have damage or excess wear.

> Torch rebuild kits are available from Hypertherm.
> Refer to Preventive maintenance kits on page 408 of the Parts List.

4. If you find cracks in the torch main body or torch insulator, replace the entire torch main body. Refer to Install the torch into the torch receptacle on page 138.

5. Replace the torch water tube if you find pitting or bends. Refer to How to replace the water tube on page 252.

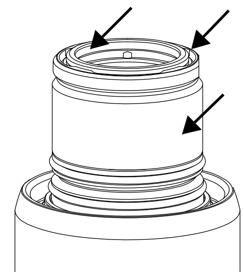
6. Clean and lubricate the torch if it does not need replacement:

   a. Use a clean, lint-free cloth to wipe the internal and external surfaces. Refer to Figure 61.

   b. Use compressed air to remove debris from the internal and external surfaces.

      A cotton swab can be used for internal surfaces that are difficult to reach. Do not leave cotton fibers inside of the torch.

Figure 61 – Wipe the internal and external surfaces of the torch



   c. Apply a thin film of silicone lubricant (027055) to any O-ring that does not need replacement and that looks dry.

      The O-rings should look shiny. Too much lubricant can prevent gas flow. Remove excess lubricant if found.

7. Before you supply power to the cutting system, install the following components:

   - Consumables in the torch. Refer to Install the consumables on page 136.
   - Torch in the torch receptacle. Refer to Install the torch into the torch receptacle on page 138.

Examine the torch receptacle

1. Complete the following procedure before continuing:

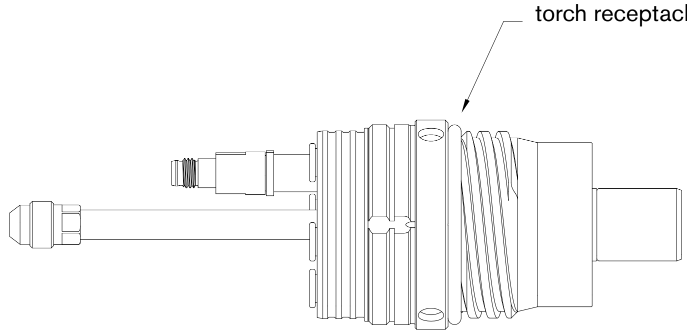
   a. Remove the power from the cutting system on page 244

2. Examine the torch receptacle. Look for:

   - Cuts, nicks, damage or excess wear on the O-ring on the torch receptacle

     The O-ring on the torch receptacle does not require lubricant. The O-ring is for dust protection only.

   - Cracks in the torch receptacle body



3. Replace the O-ring if it has damage or excess wear.

   Torch rebuild kits are available from Hypertherm. Refer to Preventive maintenance kits on page 408 of the Parts List.

4. If you find cracks in the torch main body or torch insulator, replace the entire torch receptacle. Refer to Install the torch into the torch receptacle on page 138.

5. Clean the torch receptacle if it does not need replacement:

   a. Use a clean, lint-free cloth to wipe the internal and external surfaces.

   b. Use compressed air to remove debris from the internal and external surfaces.

      A cotton swab can be used for internal surfaces that are difficult to reach.
      Do not leave cotton fibers inside the torch receptacle.

6. Before you supply power to the cutting system, make sure that the following components are installed:

   - Consumables in the torch. Refer to Install the consumables on page 136.
   - Torch in the torch receptacle. Refer to Install the torch into the torch receptacle on page 138.)

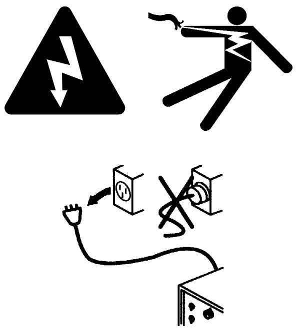
Examine the torch lead

Before cutting system operation, examine the torch lead. Look for damage or wear.

- Look for kinks, cracks, cuts, or excess wear. Replace the torch lead if you find these conditions.
- Make sure that all connections between the torch and torch lead are tight. Tighten loose connections if found, but do not make the connections too tight. Do **not** use tools to tighten these connections.
- If you have a power track that supports hoses, cables, and leads, examine their position on the track. Look for evidence that the hoses, cables, and leads are exceeding bend radius requirements during cutting system operation. Refer to Bend radius requirements for hoses, cables, and leads on page 61.
- Make adjustments if you find evidence of kinking, bending, or twisting.

How to replace the water tube

WARNING



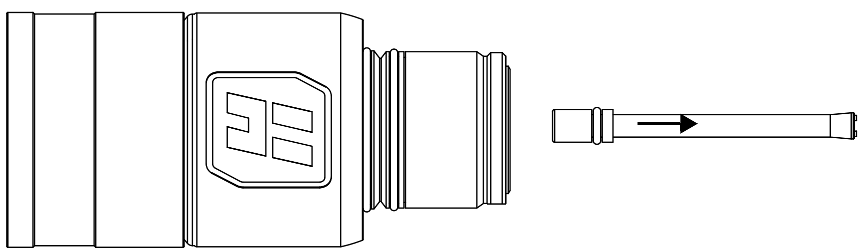
ELECTRIC SHOCK CAN KILL

Disconnect electric power before doing installation or maintenance.

The line-disconnect switch must REMAIN in the OFF position until all of the installation or maintenance steps are complete.

Refer to the *Safety and Compliance Manual* (80669C) for more safety information.

1. Complete the following procedures before continuing:
   - **a.** Remove the power from the cutting system on page 244
   - **b.** Remove the torch and consumable parts on page 246
2. Remove the water tube from the torch.



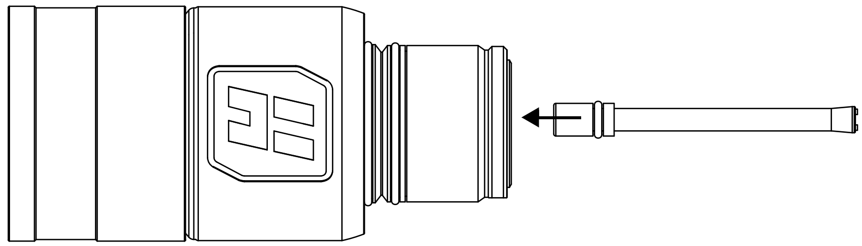
3. Examine the O-ring on the end of the water tube:
   - **a.** Replace the O-ring if you find damage or excess wear.

     Torch rebuild kits are available from Hypertherm. Refer to Preventive maintenance kits on page 408 of the Parts List.

   - **b.** Apply a thin film of silicone lubricant (027055) if the O-ring is dry.

     The O-ring should look shiny. Too much lubricant can restrict water tube motion. Remove excess lubricant if found.

4. Install a water tube in the torch.



When correctly installed, the water tube can seem loose. Any side-to-side looseness will disappear after electrode installation.

5. Before you supply power to the cutting system, install the following components:

- Consumables in the torch. Refer to Install the consumables on page 136.
- Torch in the torch receptacle. Refer to Install the torch into the torch receptacle on page 138.

How to identify emitter wear

Emitter wear can indicate when to replace the electrode. Emitter wear can be described by the width, depth, and appearance of the electrode pit. The number of starts and the arc-on time can have an effect on emitter wear.

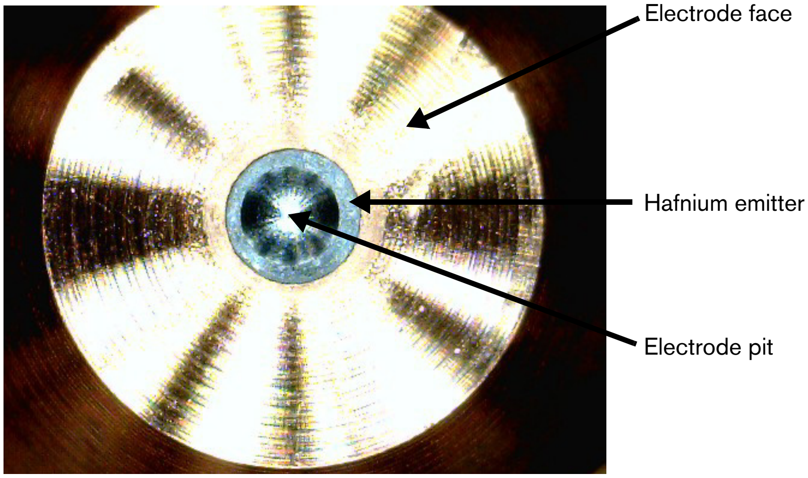
Emitter wear can cause the cut quality to degrade. Your cut quality requirements will indicate when to replace the electrode.

If an electrode needs replacement because of emitter wear, always replace the nozzle at the same time as the electrode. Use the electrode torque tool (429013) to correctly tighten the electrode.

The following guidelines for how to evaluate emitter wear apply to hafnium-emitter electrodes.

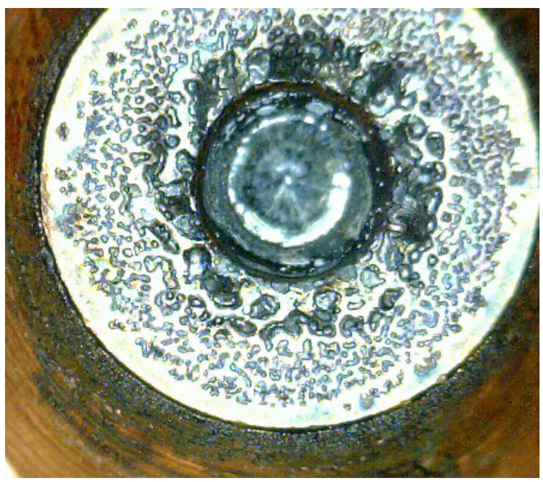
The face of a new electrode looks shiny and smooth (Figure 62).

Figure 62 – Face of a new electrode (note hafnium emitter and electrode pit)



If the electrode pit diameter extends beyond the hafnium (Figure 63), replace the electrode and nozzle.

Figure 63 – Wide electrode pit that extends beyond the hafnium



In general, if the electrode pit depth exceeds the guidelines below, replace the electrode and nozzle.

Electrode amperage	Replacement pit depth*	Description
< 130 A	≥ 1 mm (0.04 in)	In general, for electrodes less than 130 A, replace the electrode when the pit depth is 1 mm (0.04 in) or greater.
≥ 130 A and < 220 A	≥ 1.25 mm (0.05 in)	In general, for electrodes greater than or equal to 130 A and less than 220 A, replace the electrode when the pit depth is 1.25 mm (0.05 in) or greater.
≥ 220 A	≥ 1.5 mm (0.06 in)	In general, for electrodes greater than or equal to 220 A, replace the electrode when the pit depth is 1.5 mm (0.06 in) or greater.

* Based on your cut-quality requirements, it can be necessary to replace your electrode at a pit depth that is shallower or deeper than the guidelines above.

For information about how to measure electrode pit depth, refer to How to measure the pit depth of an electrode on page 256.

If you see a non-symmetrical, rough-edged pit and rough-surfaced electrode face (Figure 64), replace the electrode and nozzle.

Figure 64 – Non-symmetrical, rough-edged pit and rough-surfaced electrode face

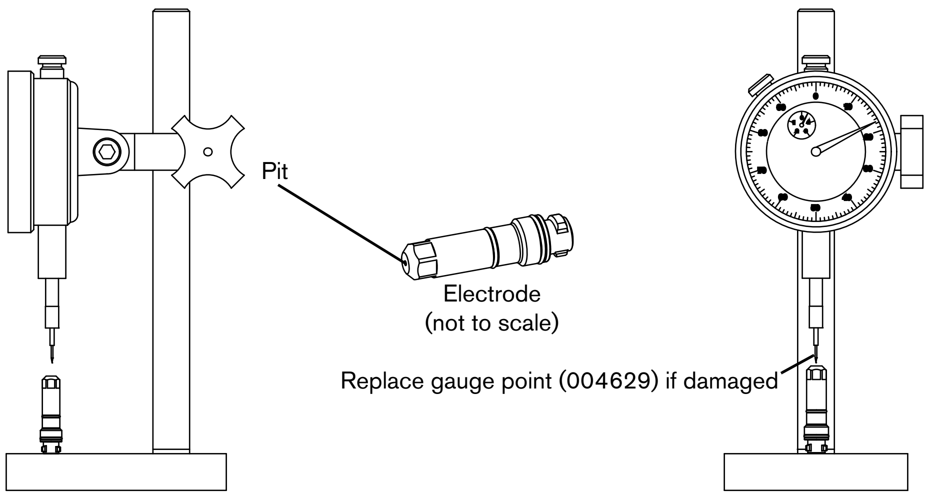
If an electrode needs replacement because of emitter wear, always replace the nozzle at the same time as the electrode.

How to measure the pit depth of an electrode

1. Complete the following procedures before continuing:
   a. Remove the power from the cutting system on page 244
   b. Remove the torch and consumable parts on page 246
2. Use an electrode pit-depth gauge to measure the pit depth on the electrode. Refer to Figure 65 on page 256.

   A pit-depth gauge (004630) is available from Hypertherm. Refer to Other consumable and torch parts on page 399 of the Parts List.

Figure 65 – Use an electrode pit-depth gauge to measure pit depth



How to do coolant maintenance

If the CNC alerts you that the coolant level is low (refer to Low coolant flow codes (540 – 542) on page 323), remove the power from the cutting system and refill the coolant reservoir **immediately.**

WARNING

COOLANT CAN BE IRRITATING TO SKIN AND EYES AND HARMFUL OR FATAL IF SWALLOWED

Propylene glycol and benzotriazole are irritating to skin and eyes, and harmful or fatal if swallowed. When you come into contact, flush skin or eyes with water. If swallowed, seek immediate medical attention.

NOTICE

LOW COOLANT LEVELS CAN DAMAGE THE CUTTING SYSTEM AND COOLANT PUMP

Never operate the cutting system if you get a low coolant level notice. There is a risk of serious damage to the cutting system and to the coolant pump if you operate the cutting system with no coolant or with low coolant.

If your coolant pump is damaged, pump replacement can be necessary.

NOTICE

AUTOMOTIVE ANTIFREEZE CAN DAMAGE THE TORCH COOLANT SYSTEM

Never use automotive antifreeze in place of Hypertherm coolant. Antifreeze contains chemicals that can damage the torch coolant system.

NOTICE

INCORRECT COOLANT CAN DAMAGE THE CUTTING SYSTEM

Incorrect coolant can damage the cutting system. Refer to Coolant requirements on page 53.

Estimate the total coolant volume for your cutting system

The capacity of the coolant reservoir for the XPR cutting system is 22.7 liters to 45 liters (6 US gallons to 12 US gallons).

A cutting system with long leads requires more coolant than a cutting system with short leads.

To calculate the estimated total coolant volume necessary for your cutting system, use the calculations below:

For total estimated volume in liters:

26	+	0.2534	X	Length of leads (**in meters**) between the plasma power supply and gas connect console for your cutting system	=	Total estimated volume (in liters)

For total estimated volume in US gallons:

6.8	+	0.0204	X	Length of leads (i**n feet**) between the plasma power supply and gas connect console for your cutting system	=	Total estimated volume (in US gallons)

Refer to Coolant Installation on page 203.

Replace all of the coolant

The use of old coolant can decrease coolant flow, which can cause higher torch temperatures that shorten the life of consumable parts.

Hypertherm recommends that you replace all of the coolant at least once every 6 months, as part of routine preventive maintenance. More frequent replacement can be necessary because of environmental conditions including but not limited to contaminants in your coolant or diagnostic codes that indicate coolant problems.

For instructions about preventive maintenance (such as weekly, monthly, and yearly tasks) refer to the *XPR Preventative Maintenance Program (PMP) Instruction Manual* (809490).

Adding new coolant to the reservoir when the coolant level is low is **not** the same as replacing all of the coolant. **All** of the coolant must be removed in order to flush the coolant system.

The steps below describe how to remove all of the old coolant. Refill the cutting system with new coolant only after you remove all of the old coolant.

For coolant installation steps, refer to Coolant Installation on page 203.

Remove old coolant from the coolant system

1. Remove the power from the cutting system. Refer to Remove the power from the cutting system on page 244.

2. Remove the right external panel from the plasma power supply (this is the panel on the right when you look at the front of the unit).

   M6 (10 mm hex) screws hold the panel in position.

3. Remove old coolant from the coolant reservoir:

   a. Connect a 3/8-inch inner diameter tube to the outlet of the valve on the bottom of the reservoir.

   b. Put the other end of the tube into an empty container.

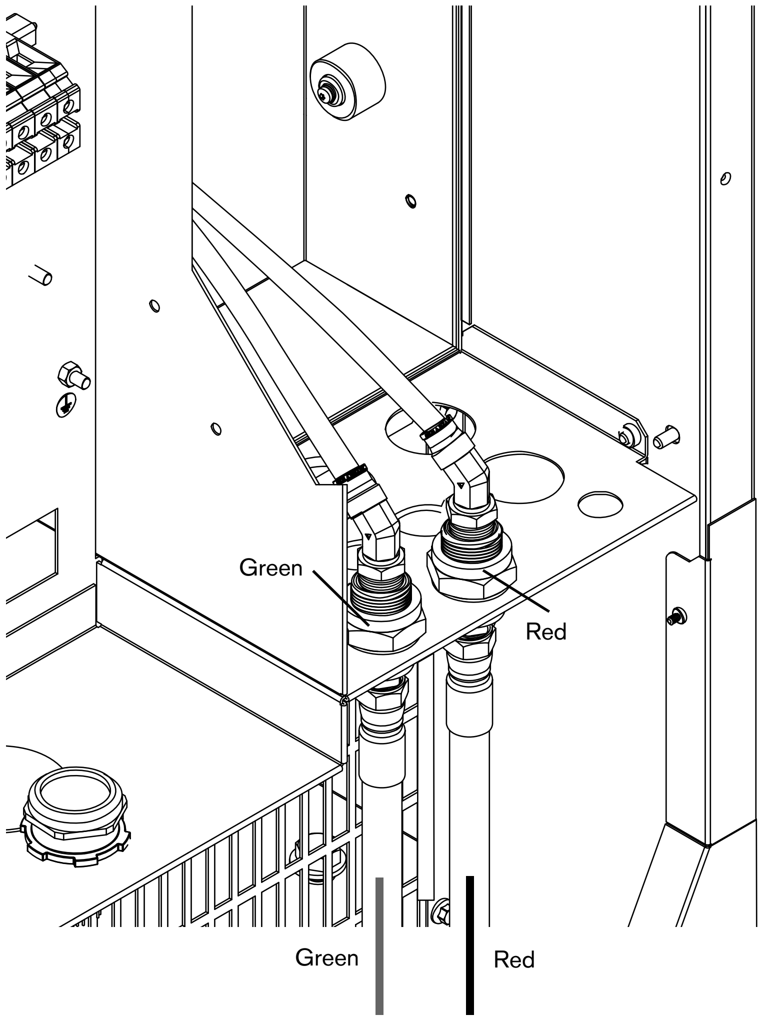
   Use a container that holds the approximate total coolant volume for your cutting system.

   c. Open the valve located on the bottom of the reservoir.

   d. Remove the cap on the reservoir inlet to allow the coolant to flow out of the reservoir.

4. Remove old coolant from the heat exchanger:

a. Keep the 3/8-inch inner diameter tube connected to the outlet of the valve on the bottom of the reservoir on one end and the other end in the container.



b. Remove the coolant return hose (red band) from the rear of the plasma power supply.

c. Attach compressed air (no more than 6.89 bar/100 psi) to the coolant return hose fitting on the rear of the plasma power supply where the return coolant hose (red band) was previously connected.

d. For no more than 30 seconds, use the compressed air to blow all of the coolant back into to the reservoir and filter housing.

System components need the coolant to lubricate rotating surfaces. If air flows through the cutting system for longer than 30 seconds, it can eliminate the coolant necessary for lubrication.

e. Close the valve at the bottom of the reservoir and remove the 3/8-inch inner diameter tubing from the outlet.

Do not store the 3/8-inch diameter tubing inside of the plasma power supply.

f. Leave the coolant return hose (red band) disconnected from the rear of the plasma power supply.

g. Put a container under the pump plug.

h. Remove the plug and coolant pump screen and set them aside.

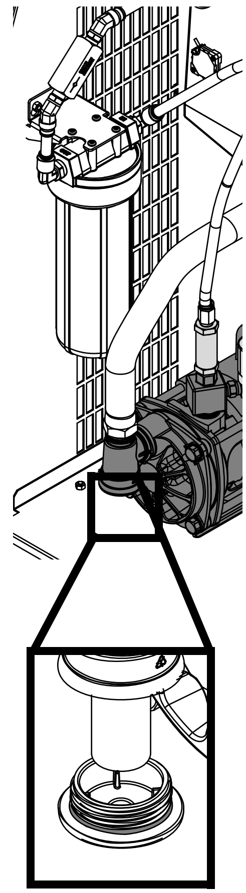
i. Remove the coolant supply hose (green band) from the rear of the plasma power supply.

j. Attach compressed air (no more than 3.45 bar/50 psi) to the coolant supply hose fitting on the rear of the plasma power supply where the coolant supply hose (green band) was previously connected.

k. For no more than 30 seconds, use the compressed air to blow all of the coolant into the container.

l. Leave the coolant supply hose (green band) disconnected.

System components need the coolant to lubricate rotating surfaces. If air flows through the cutting system for longer than 30 seconds, it can eliminate the coolant necessary for lubrication.



5. Clean and, if needed, replace the coolant pump screen:

a. Clean the coolant pump screen. Rinse it with water if you find debris.

b. Examine the coolant pump screen.

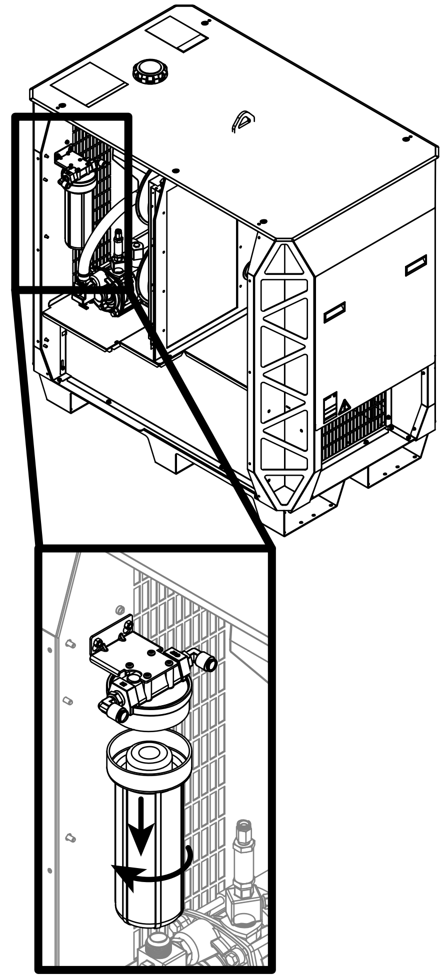
c. If you find damage on the coolant pump screen, replace it (127559).

d. Install the coolant pump screen.

e. Wipe the O-ring on the plug. Make sure that the O-ring is free of debris, cracks, and nicks.

f. Install the plug on the coolant pump housing.

6. Remove old coolant from the filter housing and replace the coolant filter:
   a. Remove the filter housing from inside of the plasma power supply.
   b. Discard all of the coolant from inside of the filter housing.
   c. Remove and discard the coolant filter.
   d. Examine the filter housing for debris. Rinse the filter housing to remove any debris, if found.
   e. Install a new coolant filter (027005).
   f. Install the filter housing.



7. Remove old coolant from hoses and leads:

   Cutting system hoses and leads can hold a large volume of coolant.

   Make sure to remove all of the old coolant from the hoses and leads. If you do not, the new coolant will mix with the old coolant. This will cause the new coolant to degrade faster.

   a. Put the disconnected end of the coolant return hose into an empty container.

      Use a container that holds the approximate total coolant volume for your cutting system.

   b. Attach compressed air (no more than 6.89 bar/100 psi) to the disconnected end of the coolant supply hose (green band).
   c. For approximately 3 minutes, inject compressed air into the coolant supply hose fitting to force coolant out of the coolant return hose (red band) into an empty container.
   d. After 3 minutes, look for coolant flow out of the coolant return hose (red band). Repeat this process until coolant flow from the coolant return hose (red band) stops.
   e. When coolant flow from coolant return hose (red band) stops, connect both hoses to the rear of the plasma power supply.

8 Diagnostics and Troubleshooting

Overview

This section of the manual includes information about how to diagnose and troubleshoot performance issues. It includes the following:

- A list of diagnostic codes and steps to troubleshoot them.
- Drawings for PCBs.

For information about daily inspections and preventive maintenance, see the following:

- How to do daily inspections on page 243 of this manual.
- *XPR Preventative Maintenance Program (PMP) Instruction Manual* (809490).

If you have questions about how to care for your cutting system, contact your cutting machine supplier or regional Hypertherm Technical Service team. You can find contact information for each regional office at www.hypertherm.com on the “Contact us” page.

The cutting system software generates a diagnostic code for most conditions that decrease cutting system performance. Some conditions have multiple diagnostic codes.

Diagnostic codes appear on the XPR web interface and can be queried by the CNC.

For information about how to view diagnostic codes on your CNC, see the instruction manual that came with your CNC. Codes show on the Log screen of the XPR web interface. Refer to Log on page 193.

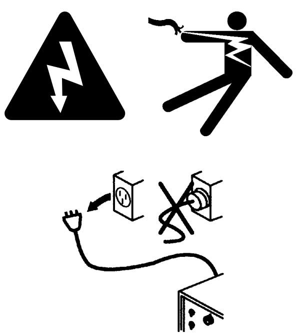
Safety considerations

For maximum safety, follow these safety guidelines when you diagnose or troubleshoot performance issues:

- Before you attempt to diagnose or troubleshoot a problem, make sure to read, understand, and follow all of the safety instructions (in this manual and on the cutting system).
- Unless the instructions tell you otherwise, always remove the power from the cutting system before you attempt to diagnose or troubleshoot a performance issue.
- Use a licensed electrician to install, modify, inspect, or repair any electrical equipment or electrical systems.
- Use a licensed plumber to install, modify, inspect, or repair any plumbing equipment or plumbing systems.

For more information, refer to Qualifications of service personnel on page 39 and the *Safety and Compliance Manual* (80669C).

WARNING



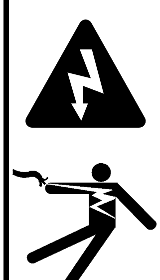
ELECTRIC SHOCK CAN KILL

Disconnect electrical power before doing troubleshooting or diagnostic work.

All work requiring removal of the plasma power supply outer cover or panels must be done by a qualified technician.

Refer to the *Safety and Compliance Manual* (80669C) for more safety information.

WARNING



ELECTRIC SHOCK CAN KILL

The plasma power supply contains dangerous electric voltages that can seriously injure or kill you.

Even if the plasma power supply is turned OFF, you can still get a serious electric shock if the plasma power supply remains connected to an electric power source.

Use extreme caution if you do diagnosis or maintenance tasks when the plasma power supply remains connected to an electric power source and the outer cover or panels are removed.

Initial inspection steps

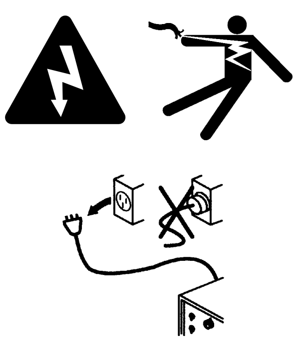
Some conditions do not give a diagnostic code. For example, there are no diagnostic codes (and the cutting system does not work) if electric power is removed from the cutting system.

Before you attempt to find or resolve a performance issue that does not result in a diagnostic code, make sure to first look for obvious problems or damage. Always start with the following inspection steps:

- Make sure that the cutting system is connected to electric power. Refer to Connect electric power to the cutting system on page 140.
- Make sure that the line-disconnect switch is set to ON. Refer to Line-disconnect switch requirements on page 41.
- Examine the PCBs. Refer to page 267.
- Use a licensed electrician to measure the line voltage between the terminals that are inside of the plasma power supply. Refer to page 269.

Remove the power from the cutting system

WARNING



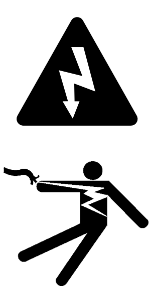
ELECTRIC SHOCK CAN KILL

Disconnect electrical power before doing troubleshooting or diagnostic work.

All work requiring removal of the plasma power supply outer cover or panels must be done by a qualified technician.

Refer to the *Safety and Compliance Manual* (80669C) for more safety information.

WARNING



ELECTRIC SHOCK CAN KILL

The line-disconnect switch must be in the OFF position before you connect the power cord to the cutting system. It must REMAIN in the OFF position until all installation steps are complete.

If the line-disconnect switch is not in the OFF position you can get a serious electric shock. Electric shock can seriously injure or kill you.

In the United States, use a “lock out/tag out” procedure until installation is complete. In other countries, follow the appropriate national and local safety procedures.

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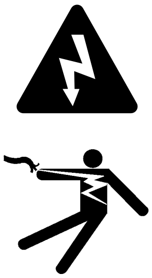


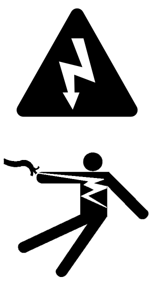
ELECTRIC SHOCK CAN KILL

When the line-disconnect switch is in the ON position, there is line voltage throughout the cutting system.

Voltages in the cutting system can cause serious electric shock. Electric shock can seriously injure or kill you.

Use extreme caution if you do diagnosis or maintenance tasks when the line-disconnect switch is in the ON position.

WARNING



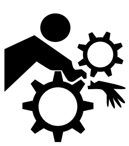
ELECTRIC SHOCK CAN KILL

The plasma power supply contains dangerous electric voltages that can seriously injure or kill you.

Even if the plasma power supply is turned OFF, you can still get a serious electric shock if the plasma power supply remains connected to an electric power source.

Use extreme caution if you do diagnosis or maintenance tasks when the plasma power supply remains connected to an electric power source and the outer cover or panels are removed.

WARNING



MACHINE MOTION CAN CAUSE INJURY

The end-use customer and the cutting machine supplier are responsible for providing protection against the hazardous moving parts of this cutting system.

Read and follow the instruction manual provided by the cutting machine supplier.

See the *Safety and Compliance Manual* (80669C) for more safety information.

Many procedures in this section require you to remove the power from the cutting system. To do this safely, use the following procedure.

Even if you use the remote on-off switch to turn OFF the cutting system, electricity remains inside the cutting system. You can still get a serious electric shock when the cutting system is connected to an electric power source.

Before you remove the power from the cutting system, it can be helpful to move the torch to the edge of the cutting table and raise the torch lifter to its highest point. This provides easier access to the torch and consumable parts.

1. Set the line-disconnect switch to the OFF position.

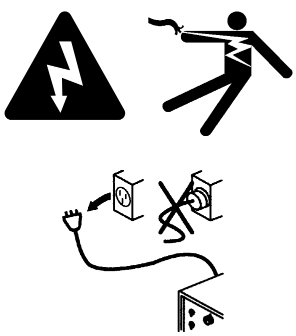
2. If the cutting system is not hard wired, disconnect the main power cord from the electric power. If the cutting system is hard wired, you cannot disconnect the main power cord from the electric power.

   Even if you remove the power from the cutting system, you can still get a serious electric shock if the plasma power supply remains connected to an electric power source. Use extreme care during service and maintenance when the cutting system is connected to electricity.

3. Make sure that the power-indicator LED is not illuminated on the plasma power supply, gas connect console, or torch connect console.

Examine the PCBs

WARNING



ELECTRIC SHOCK CAN KILL

Disconnect electrical power before doing troubleshooting or diagnostic work.

All work requiring removal of the plasma power supply outer cover or panels must be done by a qualified technician.

Refer to the *Safety and Compliance Manual* (80669C) for more safety information.

1. Remove the power from the cutting system. Refer to Remove the power from the cutting system on page 265.

2. Remove the external panel or panels from the system component that has the PCB that you want to examine. Refer to Table 35.

Table 35 – PCB names and locations

PCB name	Location	See the following drawings to PCB location page
Power distribution PCB	Plasma power supply	Refer to Control side – view 1 on page 374.
Control PCB	Plasma power supply	Refer to Control side – view 2 on page 375.
Chopper assembly PCB	Plasma power supply	Refer to Control side – view 2 on page 375.
Start-circuit assembly PCB	Plasma power supply	Refer to Control side – view 1 on page 374.
I/O PCB	Plasma power supply	Refer to Control side – view 2 on page 375.
Fan power distribution PCB	Plasma power supply	Refer to Fans on page 369.
Control PCB	Gas connect console	Refer to Gas connect console manifold side parts on page 379.
High-frequency, high-voltage ignition PCB	Gas connect console	Refer to Gas connect console high-voltage side parts on page 378.
Ohmic contact PCB	Torch connect console	Refer to Torch connect console manifold side – view 1 on page 390.
Control PCB	Torch connect console	Refer to Torch connect console manifold side – view 1 on page 390.

3. Examine the PCB. Look for:
   - Loose or disconnected PCB connectors
   - Loose or disconnected PCBs
   - Discoloration
   - Damage
4. If you find a PCB that is loose, reconnect it if possible.
5. If you find a PCB that has damage or discoloration, replace it.

   See Parts List on page 367 for part numbers and reorder information.

6. If all PCBs are in good condition, measure the line voltage between the terminals inside of the plasma power supply. Refer to Measure the line voltage between the terminals inside the plasma power supply on page 269.
7. If you cannot find or resolve the problem with these corrective actions, contact your cutting machine supplier or regional Hypertherm Technical Service team.

Measure the line voltage between the terminals inside the plasma power supply

WARNING

ELECTRIC SHOCK CAN KILL

The plasma power supply contains dangerous electric voltages that can seriously injure or kill you.

Even if the plasma power supply is turned OFF, you can still get a serious electric shock if the plasma power supply remains connected to an electric power source.

Use extreme caution if you do diagnosis or maintenance tasks when the plasma power supply remains connected to an electric power source and the outer cover or panels are removed.

WARNING

ELECTRIC SHOCK CAN KILL

Voltages at the terminal block and contactors can cause injury or death.

When the line-disconnect switch is in the ON position, there is line voltage at the contactor and the power distribution PCB.

Use extreme caution when you measure the primary power in these areas.

It is necessary for the cutting system to have electric power to measure line voltage. Use extreme caution if you do diagnosis or maintenance tasks when the plasma power supply remains plugged in and the panels on the plasma power supply are removed.

1. Measure the line voltage between the terminals (Figure 66 on page 270) in the following order:
   - ❑ U to V
   - ❑ U to W
   - ❑ V to W

   Verify each line to ground.

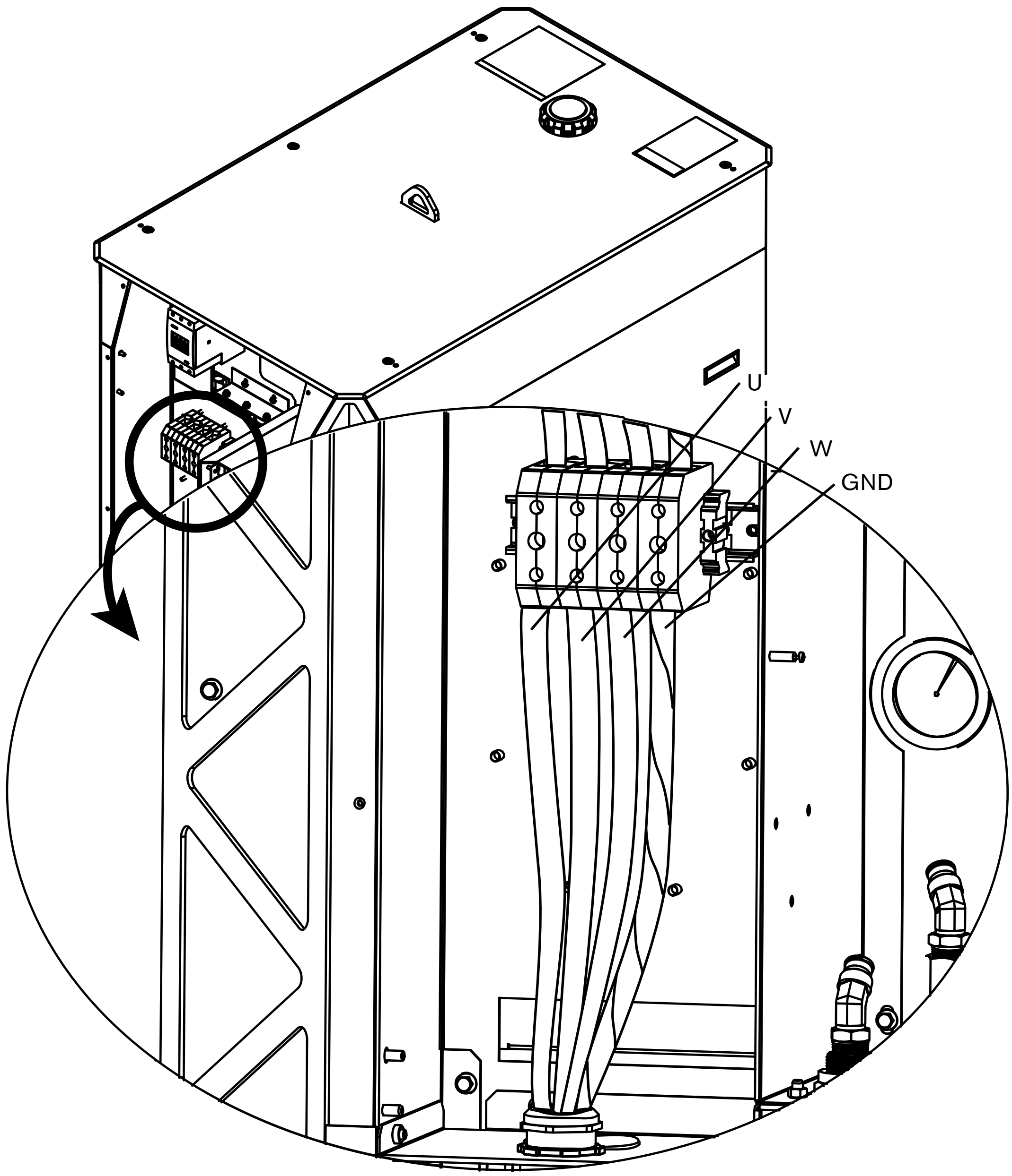
2. Determine if the voltage between any 2 of the 3 lines is equal to the supply voltage.

3. If any 1 line is equal to or 10% greater than the other 2 lines, examine with the incoming electric supply lines.

   If the incoming electric supply lines are good, contact a licensed electrician or the electric company that supplies electricity for more information.

4. If the voltage between any 2 of the 3 lines is less than the supply voltage:
   a. Remove the power from the cutting system. Refer to Remove the power from the cutting system on page 265.
   b. Examine the power cord for damage.
   c. Examine the fuses at the line-disconnect switch. Look for continuity.
   d. Repair or replace any damaged or defective parts if found.
5. Repeat these steps until the line voltage between any 2 of the 3 lines is equal to the supply voltage.

Figure 66



Diagnostic codes

How to diagnose and troubleshoot diagnostic codes

Use the Corrective action column of Table 37 on page 273 to respond to the diagnostic codes that show on the CNC or XPR web interface.

Diagnostic codes can include the following abbreviations:

GCC – Gas connect console

CAN – Controller area network

TCC – Torch connect console

t/o – Time out

HF – High frequency

IGBT – Insulated-gate bipolar transistor

Ch1 – Chopper

Ch2 – Chopper 2

DC – Direct current, current

Ind – Inductor

MAGFAN – Magnetics fan

HXFAN – Heat exchanger fan

Table 36 – Diagnostic codes in the web interface

Type	Description
Information	These codes contain information about the current conditions. In many cases, operator action is not necessary for Information codes. If action is necessary, the steps are usually simple.
Alert	These codes describe conditions that can reduce productivity or quality. Resolve an Alert code as soon as possible.
Error	These codes describe conditions that usually reduce productivity or quality, or cause damage to cutting system components. Resolve an Error code as soon as possible.
Failure	These codes describe conditions where you cannot start the arc until the condition is resolved. Failure mode protects the cutting system and system components from permanent damage.

Certain codes can occur if the cutting system has old firmware. Make sure that you have the most recent XPR firmware. Log into the Xnet at www.hypertherm.com to download it.

If you cannot find or resolve the problem with the corrective actions in Table 37, contact your cutting machine supplier or regional Hypertherm Technical Service team listed in the front of this manual.

Table 37 – Diagnostic codes

Diagnostic code number and category	Diagnostic code name	Description	Corrective action	XPR action	Code cancels with
500 Failure	GCC->Main CAN t/o	The gas connect console (Core, CorePlus, VWI, or OptiMix) cannot receive communications (at least once-per-second) from the main control PCB though the CAN.	Refer to CAN codes (500 – 503, 510 – 513 for gas connect console, 504 – 505, 514 – 515 for CAN cable and jumper block, 507 – 508 for CAN network and bus, 600 – 602 for no CAN communication) on page 315.	Shut down	Remote on-off
501 Failure	Mix->Main CAN t/o	The gas connect console (Core, CorePlus, VWI, or OptiMix) cannot receive communications (at least once-per-second) from the main control PCB through the CAN.		Shut down	Remote on-off
503 Failure	TCC->Main CAN t/o	The torch connect console cannot receive communications (at least once-per-second) from the main control PCB through the CAN.		Shut down	Remote on-off
504 Failure	Ch1->Main CAN t/o	Chopper 1 cannot receive communications (at least once-per-second) from the main control PCB through the CAN.		Shut down	Remote on-off
505 Failure	Ch2->Main CAN t/o	Chopper 2 cannot receive communications (at least once-per-second) from the main control PCB through the CAN.	Refer to CAN codes (500 – 503, 510 – 513 for gas connect console, 504 – 505, 514 – 515 for CAN cable and jumper block, 507 – 508 for CAN network and bus, 600 – 602 for no CAN communication) on page 315.	Shut down	Remote on-off

Diagnostic code number and category	Diagnostic code name	Description	Corrective action	XPR action	Code cancels with
507 Failure	Main no CAN	There is a problem with the CAN network when power is supplied to the cutting system.	Refer to CAN codes (500 – 503, 510 – 513 for gas connect console, 504 – 505, 514 – 515 for CAN cable and jumper block, 507 – 508 for CAN network and bus, 600 – 602 for no CAN communication) on page 315.	None	Remote on-off
508 Error	CAN Busy	The CAN bus is overloaded (for 10 milliseconds or more).		None	Remote on-off
510 Failure	Main->GCC CAN t/o	The main control PCB cannot receive communications (at least once-per-second) from the gas connect console (Core, CorePlus, VWI, or OptiMix) through the CAN.	Refer to CAN codes (500 – 503, 510 – 513 for gas connect console, 504 – 505, 514 – 515 for CAN cable and jumper block, 507 – 508 for CAN network and bus, 600 – 602 for no CAN communication) on page 315.	Ramp down	Remote on-off
511 Failure	Main->Mix CAN t/o	The main control PCB cannot receive communications (at least once-per-second) from the gas connect console's mix module through the CAN.		Ramp down	Remote on-off
513 Failure	Main->TCC CAN t/o	The main control PCB cannot receive communications (at least once-per-second) from the torch connect console through the CAN.		Ramp down	Remote on-off
514 Failure	Main->Ch1 CAN t/o	The main control PCB cannot receive communications (at least once-per-second) from Chopper 1 through the CAN.		None	Remote on-off

Diagnostic code number and category	Diagnostic code name	Description	Corrective action	XPR action	Code cancels with
515 Failure	Main->Ch2 CAN t/o	The main control PCB cannot receive communications (at least once-per-second) from Chopper 2 through the CAN.	Refer to CAN codes (500 – 503, 510 – 513 for gas connect console, 504 – 505, 514 – 515 for CAN cable and jumper block, 507 – 508 for CAN network and bus, 600 – 602 for no CAN communication) on page 315.	None	Remote on-off
520 Alert	Ignite t/o (no pilot arc)	The sensor in Chopper 1 did not measure current during the 600-millisecond ignite period because no current path completes between the nozzle and the electrode.	**1.** Make sure that the transfer height is correct and that the torch is not in contact with the workpiece. **2.** Examine the consumables. Replace the consumables that have damage or excess wear. **3.** If applicable, make sure that the spark gap PCB (141595) is correctly connected to the ignition PCB (141563). Refer to Gas connect console high-voltage side parts on page 378. Make sure that the spark gaps illuminate brightly. If they do not, replace only the spark gap PCB (141595). **4.** Inspect the main contactor: ▪ Look for black or rough surfaces that are difficult to remove. ▪ Make sure that the contactor closes immediately after the Start command is applied. **5.** If the contactor is bad, replace it. **6.** Examine the pilot arc relay. Make sure that it closes. **7.** Examine the wiring. Make sure that the coil receives 24 VDC. **8.** Inspect the Start circuit/Pilot board. If the Start circuit/Pilot board is bad, replace it. **9.** Do a torch lead test. Refer to How to test continuity between the nozzle and workpiece on page 347.	End of cycle	Start or set process; remote on-off

Diagnostic code number and category	Diagnostic code name	Description	Corrective action	XPR action	Code cancels with
521 Alert	Pilot arc t/o (no arc transfer)	No current detected on the work lead for 500 milliseconds after the pilot arc current is established. For a minimum of 3 milliseconds, the sensor in the work lead is unable to measure current greater than the transfer reference value.	**1.** Make sure that the transfer height is correct. **2.** Examine the consumables. Replace the consumables that have damage or excess wear. **3.** Do a torch lead test. Refer to How to test continuity between the nozzle and workpiece on page 347.	End of cycle	Start or set process; remote on-off
522 Alert	Preflow t/o	The cutting system cannot complete the preflow routine within 30 seconds.	**1.** Review the diagnostic code history for previous gas-related codes. Previous codes can indicate where to look for flow or pressure problems. **2.** Examine the consumables, valves, and inlet hoses. Make sure that they are correct. Replace them if you find damage or excess wear.	End of cycle	Start or set process; remote on-off
523 Error	Preflow purge t/o	The preflow purge cannnot get to the setpoint within 45 seconds.		None	Set process; remote on-off
524 Error	Cutflow purge t/o	The cutflow purge cannnot get to the setpoint within 45 seconds.		None	Set process; remote on-off
525 Error	Inert gas purge t/o	The XPR cutting system is unable to complete the N_2 purge within 45 seconds. The process did not get selected.		None	Set process; remote on-off

Diagnostic code number and category	Diagnostic code name	Description	Corrective action	XPR action	Code cancels with
530 Alert	Low psi-Line A	▪ The Line A pressure (P5) is less than 75% of the setpoint for 200 milliseconds, for any process; or ▪ P5 is less than 75% of the P21 sensor reading for 4 seconds, for a mixed-fuel gas process; or ▪ P5 is less than 75% of the P7 setpoint for 4 seconds, for a F5 process.	**1.** Review the diagnostic code history for previous pressure-related codes. Previous codes can indicate where to look for flow or pressure problems. **2.** Make sure that the inlet gas pressure for Line A (P2) or Line B (P1) are in the correct range. **3.** If the measurement is too high or too low, use the regulators to adjust the pressure for the Line A/Line B gas or F5 gas to the correct range. **4.** Examine the consumables: ▪ Make sure that the correct consumables are installed. ▪ Make sure that there is no damage or excess wear. **5.** Replace incorrect consumables or consumables that have damage or excess wear. **6.** Use the gas volume monitors located near the pressure transducers to look for gas leaks.	Ramp down	Set process; remote on-off

Diagnostic code number and category	Diagnostic code name	Description	Corrective action	XPR action	Code cancels with
531 Alert	Low psi-Line B	For a minimum of 200 milliseconds, Line B pressure is less than 75% of setpoint.	**1.** Review the diagnostic code history for previous pressure-related codes. Previous codes can indicate where to look for flow or pressure problems. **2.** Make sure that the inlet gas pressure for Line A (P2) or Line B (P1) are in the correct range. **3.** If the measurement is too high or too low, use the regulators to adjust the pressure for the Line A/Line B gas or F5 gas to the correct range. **4.** Examine the consumables: ▪ Make sure that the correct consumables are installed. ▪ Make sure that there is no damage or excess wear. **5.** Replace incorrect consumables or consumables that have damage or excess wear. **6.** Use the gas volume monitors located near the pressure transducers to look for gas leaks.	Ramp down	Set process; remote on-off
532 Alert	Low psi-H_2O	For a minimum of 200 milliseconds, the shield water pressure (P9) is less than 50% of the setpoint (2.7 bar/39 psi) and the setpoint is greater than 0.	Refer to Low shield water pressure code (532) on page 321.	Ramp down	Set process; remote on-off

Diagnostic code number and category	Diagnostic code name	Description	Corrective action	XPR action	Code cancels with
533 Alert	Low psi-F5	For a minimum of 200 milliseconds, the F5 pressure sensor (P7) is less than 75% of setpoint.	**1.** Review the diagnostic code history for previous pressure-related codes. Previous codes can indicate where to look for flow or pressure problems. **2.** Make sure that the inlet gas pressure for Line A (P2) or Line B (P1) are in the correct range. **3.** If the measurement is too high or too low, use the regulators to adjust the pressure for the Line A/Line B gas or F5 gas to the correct range. **4.** Examine the consumables: ▪ Make sure that the correct consumables are installed. ▪ Make sure that there is no damage or excess wear. **5.** Replace the incorrect consumables or consumables that have damage or excess wear. **6.** Use the gas volume monitors located near the pressure transducers to look for gas leaks.	Ramp down	Set process; remote on-off
534 Alert	Low psi-Shield	For a minimum of 600 milliseconds, the shield gas pressure is less than 75% of the setpoint, and the setpoint is more than 0.	Refer to Low shield gas pressure code (534) on page 322.	Ramp down	Set process; remote on-off
540 Error	Low flow 1-Coolant	For a minimum of 40 seconds after the Plasma Start switch is turned ON, the coolant flow rate is less than 1.9 L/min (0.5 gal/min).	Refer to Low coolant flow codes (540 – 542) on page 323.	Shut down	Remote on-off

Diagnostic code number and category	Diagnostic code name	Description	Corrective action	XPR action	Code cancels with
541 Error	Low flow 2-Coolant	For a minimum of 10 seconds after the coolant flow rate gets to 1.9 L/min (0.5 gal/min), the flow rate stays less than 3.03 L/min (0.8 gal/min).	Refer to Low coolant flow codes (540 – 542) on page 323.	Shut down	Remote on-off
542 Failure	Low flow-Coolant	For a minimum of 1 second, the coolant flow rate is less than 3.79 L/min (1 gal/min).		Shut down	Remote on-off
543 Error	High flow 1-Coolant	For a minimum of 5 seconds after the coolant pump stops, the coolant flow rate is more than 3.03 L/min (0.8 gal/min).	Refer to High coolant flow codes (543 – 544) on page 325.	Shut down	Set process; remote on-off
544 Failure	High flow-Coolant	For a minimum of 1 second, the coolant flow rate is more than 11.36 L/min (3.0 gal/min). This code can also occur when air is in the line or when there is a torch blow out.		Shut down	Remote on-off

Diagnostic code number and category	Diagnostic code name	Description	Corrective action	XPR action	Code cancels with
550 Alert	No plasma arc	For a minimum of 10 milliseconds during a Steady State, the total current decreases 50% below the current setpoint, and the setpoint is more than the setpoint for that process (setpoints vary by process type).	**1.** Examine the consumables. Replace the consumables that have damage or excess wear. **2.** Do a test for gas leaks. Replace the leaking components if found. **3.** Examine the J6 connector on the XPR control PCB. Look for loose or bad connections. Tighten loose connections if found. **4.** Examine contactors. Replace the damaged components if found. **5.** Look for DC bus errors. **6.** Exchange the choppers. Make sure the code follows the change. ▪ If yes, it confirms the bad chopper. Replace it. ▪ If no, go to step 7. **7.** Examine the following components: ▪ Choppers ▪ Inductors **8.** Replace the damaged choppers or inductors if found. **9.** Make sure that the arc remains on the workpiece during cutting. **10.** Make sure to use the correct techniques and rampdown settings, especially for cutting holes in simple shapes on aluminum or stainless steel. Otherwise, diagnostic codes 552 and 553 can replace the diagnostic code for rampdown errors (620) when the arc distance between the torch and the workpiece increases rapidly. **11.** If the code continues, contact your cutting machine supplier or regional Hypertherm Technical Service team.	End of cycle	Start or set process; remote on-off
552 Alert	DC below limit-Ch1	The Chopper 1 current decreases below 50% of the setpoint for 50 milliseconds and the setpoint is more than 10 A.		End of cycle	Set process; remote on-off

Diagnostic code number and category	Diagnostic code name	Description	Corrective action	XPR action	Code cancels with
553 Alert	DC below limit-Ch2	The Chopper 2 current decreases below 50% of the setpoint for 50 milliseconds and the setpoint is more than 10 A.	**1.** Examine the consumables. Replace the consumables that have damage or excess wear. **2.** Do a test for gas leaks. Replace the leaking components if found. **3.** Examine the J6 connector on the XPR control PCB. Look for loose or bad connections. Tighten loose connections if found. **4.** Examine contactors. Replace the damaged components if found. **5.** Look for DC bus errors. **6.** Exchange the choppers. Make sure the code follows the change. ▪ If yes, it confirms the bad chopper. Replace it. ▪ If no, go to step 7. **7.** Examine the following components: ▪ Choppers ▪ Inductors **8.** Replace the damaged choppers or inductors if found. **9.** Make sure that the arc remains on the workpiece during cutting. **10.** Make sure to use the correct techniques and rampdown settings, especially for cutting holes in simple shapes on aluminum or stainless steel. Otherwise, diagnostic codes 552 and 553 can replace the diagnostic code for rampdown errors (620) when the arc distance between the torch and the workpiece increases rapidly. **11.** If the code continues, contact your cutting machine supplier or regional Hypertherm Technical Service team.	End of cycle	Set process; remote on-off

Diagnostic code number and category	Diagnostic code name	Description	Corrective action	XPR action	Code cancels with
555 Failure	DC exceeds limit-Ch1	For a minimum of 10 milliseconds, the electric current for Chopper 1 is more than 170 A.	**1.** Examine the consumables. Replace the consumables that have damage or excess wear. **2.** Do a test for gas leaks. Replace the leaking components if found. **3.** Examine contactors. Replace the damaged components if found. **4.** Look for DC bus errors. **5.** Exchange the choppers. Make sure the code follows the change. ▪ If yes, it confirms the bad chopper. Replace it. ▪ If no, go to step 6. **6.** Examine the following components: ▪ Choppers ▪ Inductors **7.** Replace the damaged choppers or inductors if found. **8.** Make sure that the arc remains on the workpiece during cutting. **9.** If the code continues, contact your cutting machine supplier or regional Hypertherm Technical Service team.	Shut down	Remote on-off

Diagnostic code number and category	Diagnostic code name	Description	Corrective action	XPR action	Code cancels with
556 Failure	DC exceeds limit-Ch2	For a minimum of 10 milliseconds, the current for Chopper 2 is more than 170 A.	**1.** Examine the consumables. Replace the consumables that have damage or excess wear. **2.** Do a test for gas leaks. Replace the leaking components if found. **3.** Examine contactors. Replace the damaged components if found. **4.** Look for DC bus errors. **5.** Exchange the choppers. Make sure the code follows the change. ▪ If yes, it confirms the bad chopper. Replace it. ▪ If no, go to step 6. **6.** Examine the following components: ▪ Choppers ▪ Inductors **7.** Replace the damaged choppers or inductors if found. **8.** Make sure that the arc remains on the workpiece during cutting . **9.** If the code continues, contact your cutting machine supplier or regional Hypertherm Technical Service team.	Shut down	Remote on-off
560 Error	Over temp-Ch1	The insulated-gate bipolar transistor (IGBT) temperature for Chopper 1 is more than 75°C (167°F).	Refer to Over temp diagnostic codes – Choppers (560 – 561) and Coolant (587) on page 326.	Ramp down	–
561 Error	Over temp-Ch2	The insulated-gate bipolar transistor (IGBT) temperature for Chopper 2 is more than 75°C (167°F).	Refer to Over temp diagnostic codes – Choppers (560 – 561) and Coolant (587) on page 326.	Ramp down	–

Diagnostic code number and category	Diagnostic code name	Description	Corrective action	XPR action	Code cancels with
570 Alert	Start on Powerup	The Plasma Start switch is in the ON position before the cutting systems goes into Powerup State.	Refer to Start switch diagnostic codes (570 – 577) on page 329.	None	Start or set process; remote on-off
571 Alert	Start on wait-start	The Plasma Start switch is in the ON position before the cutting system goes into Wait-for-Start State.		None	Start or set process; remote on-off
574 Info	Start removed preflow	The Plasma Start switch is in the OFF position during Preflow State.	Refer to Start switch diagnostic codes (570 – 577) on page 329.	End of cycle	Start or set process; remote on-off
575 Info	Start removed ignite	The Plasma Start switch is in the OFF position during Ignite State.		End of cycle	Start or set process; remote on-off
576 Info	Start removed pilot	The Plasma Start switch is in the OFF position during Pilot arc State.		End of cycle	Start or set process; remote on-off
577 Info	Start removed rampup	The Plasma Start switch is in the OFF position during a Ramp-Up State.		End of cycle	Start or set process; remote on-off

Diagnostic code number and category	Diagnostic code name	Description	Corrective action	XPR action	Code cancels with
580 Error	Over temp-Ind1	The temperature of Inductor 1 (1A) or 2 (1B) is more than 160°C (320°F). When conditions are normal, it takes approximately 10 minutes for the XPR cutting system to cool. Over-temp codes can occur when cooling takes more than 10 minutes. A high ambient temperature can have an effect on cooling time.	Refer to Over temp diagnostic codes – Inductors (580 – 583), Transformers (586) on page 331.	Ramp down	—
581 Error	Over temp-Ind2			Ramp down	—
582 Error	Over temp-Ind3	The temperature of Inductor 3 (2A) or 4 (2B) is more than 160°C (320°F). When conditions are normal, it takes approximately 10 minutes for the XPR cutting system to cool. Over-temp codes can occur when cooling takes more than 10 minutes. A high ambient temperature can have an effect on cooling time.	Refer to Over temp diagnostic codes – Inductors (580 – 583), Transformers (586) on page 331.	Ramp down	—
583 Error	Over temp-Ind4			Ramp down	—
586 Error	Over temp-Xfmr	For a minimum of 5 seconds, the temperature of the transformer is more than 160°C (320°F).	Refer to Over temp diagnostic codes – Inductors (580 – 583), Transformers (586) on page 331.	Ramp down	—
587 Error	Over temp-Coolant	The coolant temperature is more than 85°C (185°F).	Refer to Over temp diagnostic codes – Choppers (560 – 561) and Coolant (587) on page 326.	Ramp down	—

Diagnostic code number and category	Diagnostic code name	Description	Corrective action	XPR action	Code cancels with
588 Failure	Fan timeout	Fan timeout codes can occur when cooling takes more than 1 hour. A high ambient temperature can have an effect on cooling time.	**1.** Identify the over-temp diagnostic codes that appear on the XPR web interface. **2.** Follow the troubleshooting steps for the codes.	Shut down	—
600 Error	No TCC found	For a minimum of 30 seconds after power is supplied to the cutting system, the torch connect console does not identify itself to the main control PCB through the CAN.	Refer to CAN codes (500 – 503, 510 – 513 for gas connect console, 504 – 505, 514 – 515 for CAN cable and jumper block, 507 – 508 for CAN network and bus, 600 – 602 for no CAN communication) on page 315.	Shut down	Remote on-off
601 Error	No chopper found	For a minimum of 30 seconds after power is supplied to the cutting system, Chopper 1 does not identify itself to the main control PCB through the CAN.	**1.** Confirm that the chopper ID connector is connected to J8. **2.** Connect the connectors if necessary. **3.** If connected, refer to CAN codes (500 – 503, 510 – 513 for gas connect console, 504 – 505, 514 – 515 for CAN cable and jumper block, 507 – 508 for CAN network and bus, 600 – 602 for no CAN communication) on page 315.	Shut down	Remote on-off
602 Error	No GCC found	For a minimum of 30 seconds after power is supplied to the cutting system, the gas connect console (Core, CorePlus, VWI, or, OptiMix) does not identify itself to the main control PCB.	Refer to CAN codes (500 – 503, 510 – 513 for gas connect console, 504 – 505, 514 – 515 for CAN cable and jumper block, 507 – 508 for CAN network and bus, 600 – 602 for no CAN communication) on page 315.	Shut down	Remote on-off

Diagnostic code number and category	Diagnostic code name	Description	Corrective action	XPR action	Code cancels with
604 Alert	No Chopper 2 found	The inductor thermocouples for Chopper 2 were detected, but Chopper 2 was not detected.	**1.** Make sure that the connector (J8) on Chopper 2 is fully engaged. **2.** Make sure that the connector (J2) on Chopper 2 is fully engaged. **3.** If connected, refer to CAN codes (500 – 503, 510 – 513 for gas connect console, 504 – 505, 514 – 515 for CAN cable and jumper block, 507 – 508 for CAN network and bus, 600 – 602 for no CAN communication) on page 315.	None	Start or set process; remote on-off
610 Failure	Ch1 Torch Protect ChA	A catastrophic failure of a consumable part is found on the Channel A Chopper 1 current signature.	**1.** Inspect the consumable parts for damage and excess wear. **2.** If any consumable part needs replacement, refer to Install the consumables on page 136.	Ramp down	Remote on-off
611 Failure	Ch1 Torch Protect ChB	A catastrophic failure of a consumable part is found on the Channel B Chopper 1 current signature.		Ramp down	Remote on-off
612 Failure	Ch2 Torch Protect ChA	A catastrophic failure of a consumable part is found on the Channel A Chopper 2 current signature.	**1.** Inspect the consumable parts for damage and excess wear. **2.** If any consumable part needs replacement, refer to Install the consumables on page 136,	Ramp down	Remote on-off
613 Failure	Ch2 Torch Protect ChB	A catastrophic failure of a consumable part is found on the Channel B Chopper 2 current signature.		Ramp down	Remote on-off

Diagnostic code number and category	Diagnostic code name	Description	Corrective action	XPR action	Code cancels with
620 Alert	Rampdown error (arc stretch) detected	The chopper duty cycle exceeds the programmed limit. A rampdown error can be the cause. During a ramp-down error, the arc distance between the torch and workpiece increases rapidly. Rampdown errors can decrease consumable life. The XPR cutting system can detect and react to rampdown errors. This helps extend the life of consumable parts. Refer to Automatic rampdown error protection on page 239.	Make sure that you are following correct cutting techniques: ▪ Use a workpiece that is large enough for the selected parts or nesting program. ▪ Use the correct parts or nesting program. Rampdown errors can occur when crossing large kerfs or cutting at incorrect heights. ▪ End every cut with the plasma arc still attached to the workpiece. ▪ Decrease the cutting speed when the end of the cut is near. ▪ Stop the plasma arc before the part is completely cut (allow completion of the cut during rampdown). ▪ Program the path of the torch into the scrap area for rampdown.	Ramp down	Start or set process; remote on-off
621 Failure	Over voltage-DC bus	The DC bus voltage is more than 414 V.	**1.** Confirm the input-line voltage is within+/-14% of nominal. Refer to Input power requirements on page 40. **2.** If the code continues, contact your cutting machine supplier or regional Hypertherm Technical Service team.	Shut down	Remote on-off

Diagnostic code number and category	Diagnostic code name	Description	Corrective action	XPR action	Code cancels with
622 Failure	Under voltage-DC bus	The DC bus voltage is less than 280 V.	**1.** Confirm the input-line voltage is within+/-14% of nominal. Refer to Input power requirements on page 40. **2.** Remove the power from the cutting system. **3.** Remove the cover from the contactor. **4.** Inspect the contacts for excess wear. Replace the contactor, if excess wear is found. **5.** Inspect the following contactor components for loose connections: ▪ Contactor ▪ Input to chopper ▪ Power cord **6.** Tighten loose connections if found. **7.** Examine the connections from the control PCB on J6. Look for loose or bad connections on pins 5 and 6. Tighten loose connections or replace bad connections. **8.** Make sure that LED D1 on the power distribution board (141425) is illuminated. **9.** If not illuminated, examine the power distribution board. Look for: ▪ 120 VAC at the input (J1 pins 5 – 6) ▪ Continuity on fuse FH2 (with power OFF) ▪ 120 VAC at the output (J5 pins 7 – 8 and pins 9 – 10) **10.** If 120 VAC is not present on the J5 contactor output pins, inspect J4 and K1 relay connections for damage. **11.** If K1 is bad, replace either the power distribution board (141425) or the K1 relay (003257). **12.** If the code continues, contact your cutting machine supplier or regional Hypertherm Technical Service team.	Shut down	Remote on-off

Diagnostic code number and category	Diagnostic code name	Description	Corrective action	XPR action	Code cancels with
623 Error	Ch1 DC at Idle	Chopper 1 is in idle state and the chopper current is more than 10 A.	**1.** Look for 24 VDC from the power sources (J2 pins 1 – 3). **2.** If you find 24 VDC from the power sources, the chopper is bad. **3.** Replace the chopper if necessary.	None	Remote on-off
624 Error	Ch2 DC at Idle	Chopper 2 is in idle state and the chopper current is more than 10 A.	**1.** Look for 24 VDC from the power sources (J2 pins 1 – 3). **2.** If you find 24 VDC from the power sources, the chopper is bad. **3.** Replace the chopper if necessary.	None	Remote on-off
626 Alert	No DC output-Ch1	For a minimum of 250 milliseconds after Arc-On State starts, Chopper 1 does not make current. This code is applicable only for processes that start with argon (Ar) gas.	**1.** Inspect the consumable parts for damage and excess wear. **2.** If any consumable part needs replacement, refer to Install the consumables on page 136. **3.** If the code continues, contact your cutting machine supplier or regional Hypertherm Technical Service team.	End of cycle	Remote on-off
627 Error	No DC output-Ch2	No current produced within 250 milliseconds after Arc-On State starts	**1.** Inspect the consumable parts for damage and excess wear. **2.** If any consumable part needs replacement, refer to Install the consumables on page 136. **3.** If the code continues, contact your cutting machine supplier or regional Hypertherm Technical Service team.	End of cycle	Remote on-off
631 Failure	DC at wait-start	The current in the work lead is more than 5 A while the XPR cutting system is in the Wait-for-Start State.	Refer to Current sensor diagnostic codes (631) on page 334.	Shut down	Remote on-off

Diagnostic code number and category	Diagnostic code name	Description	Corrective action	XPR action	Code cancels with
640 Info	No error	There are no active faults.	No operator action necessary.	None	—
642 Info	System powered	Power is supplied to the XPR cutting system and the customer-supplied, remote on-off switch is in the ON position (enabled).		None	Start or set process; remote on-off
643 Info	No process loaded	Power is supplied to the XPR cutting system and no process is selected.	Select a process to end the Initial checks (2) State of operation and start the Gas purge State (there is no limit for how long the system waits for input). Refer to Sequence of operation on page 211.	None	Start or set process; remote on-off
645 Info	System is off	Power is supplied to the cutting system and the customer-supplied, remote on-off switch is in the OFF position (disabled).	No operator action necessary. XPR cutting system operation continues when the remote on-off switch is set to the ON position. Refer to Sequence of operation on page 211.	None	Start or set process; remote on-off
646 Info	System turned off	Power is removed from the XPR cutting system.		Shut down	Start or set process; remote on-off
647 Info	Process selected	Shows the operator-selected process.	No operator action necessary.	None	Start or set process; remote on-off
654 Alert	CH1ArcOnTimeout	During Ignite State, Chopper 1 does not enter Arc-On State for at least 100 milliseconds.	**1.** Remove the power from the cutting system. **2.** Restore electrical power to the cutting system. **3.** Send a process command to the cutting system. **4.** If the code continues, contact your cutting system supplier or regional Hypertherm Technical Service team.	End of cycle	Remote on-off

Diagnostic code number and category	Diagnostic code name	Description	Corrective action	XPR action	Code cancels with
655 Alert	Current (DC) preflow	During Preflow State, a chopper finds current.	**1.** Inspect the consumable parts for damage and excess wear. **2.** If any consumable part needs replacement, refer to Install the consumables on page 136. **3.** Examine the torch lead. Look for a short or open line condition.	Shut down	Start or set process; remote on-off
660 Error	Thermistor Fault-Ind 1	The main control PCB finds a shorted temperature sensor in Inductor 1A.	Use a digital multimeter to measure the resistance from the thermistor. Refer to How to measure resistance from thermistors on page 350.	Shut down	Remote on-off
661 Error	Thermistor Fault-Ind 2	The main control PCB finds a shorted temperature sensor in Inductor 1B.		Shut down	Remote on-off
662 Error	Thermistor Fault-Ind 3	The main control PCB finds a shorted temperature sensor in Inductor 2A.	Use a digital multimeter to measure the resistance from the thermistor. Refer to How to measure resistance from thermistors on page 350.	Shut down	Remote on-off
663 Error	Thermistor Fault-Ind 4	The main control PCB finds a shorted temperature sensor in Inductor 2B.		Shut down	Remote on-off
666 Error	Thermistor Fault-Xfmr	The main control PCB finds a shorted temperature sensor in the transformer.	Use a digital multimeter to measure the resistance from the thermistor. Refer to How to measure resistance from thermistors on page 350.	Shut down	Remote on-off
667 Error	Thermistor Fault-Ch1	Chopper 1 finds a shorted temperature sensor near the insulated-gate bipolar transistor (IGBT).		Ramp down	Remote on-off
668 Error	Thermistor Fault-Ch2	Chopper 2 finds a shorted temperature sensor near the IGBT.	Use a digital multimeter to measure the resistance from the thermistor. Refer to How to measure resistance from thermistors on page 350.	Ramp down	Remote on-off

Diagnostic code number and category	Diagnostic code name	Description	Corrective action	XPR action	Code cancels with
670 Error	Thermistor Fault-Coolant	The main control PCB finds a shorted coolant temperature sensor.	Use a digital multimeter to measure the resistance from the thermistor. Refer to How to measure resistance from thermistors on page 350.	Shut down	Remote on-off
671 Error	No Thermistor-Ind 1	The main control PCB finds an open circuit in Inductor 1 (1A).		Shut down	Remote on-off
672 Error	No Thermistor-Ind 2	The main control PCB finds an open circuit in Inductor 2 (1B).		Shut down	Remote on-off
673 Error	No Thermistor-Ind 3	The main control PCB finds an open circuit in Inductor 3 (2A).	Use a digital multimeter to measure the resistance from the thermistor. Refer to How to measure resistance from thermistors on page 350.	Shut down	Remote on-off
674 Error	No Thermistor-Ind 4	The main control PCB finds an open circuit in Inductor 4 (2B).	Use a digital multimeter to measure the resistance from the thermistor. Refer to How to measure resistance from thermistors on page 350.	Shut down	Remote on-off
677 Error	No Thermistor-Xfmr	The main control PCB finds an open circuit in the transformer.	Use a digital multimeter to measure the resistance from the thermistor. Refer to How to measure resistance from thermistors on page 350.	Shut down	Remote on-off
678 Error	No Thermistor-Ch1	The XPR cutting system cannot detect the temperature sensor for Chopper 1.	**1.** Make sure that the 2 wires for J9 are fully engaged. **2.** Use a digital multimeter to measure the resistance from the thermistor. Refer to How to measure resistance from thermistors on page 350.	Ramp down	Remote on-off
679 Error	No Thermistor-Ch2	The XPR cutting system cannot detect the temperature sensor for Chopper 2.	**1.** Make sure that the 2 wires for J9 are fully engaged. **2.** Use a digital multimeter to measure the resistance from the thermistor. Refer to How to measure resistance from thermistors on page 350.	Ramp down	Remote on-off

Diagnostic code number and category	Diagnostic code name	Description	Corrective action	XPR action	Code cancels with
681 Error	No Thermistor-Coolant	The main control PCB detects an open circuit in the coolant sensor.	Use a digital multimeter to measure the resistance from the thermistor. Refer to How to measure resistance from thermistors on page 350.	Shut down	Remote on-off
691 Error	Node reset	The main control PCB receives a “console reset” message after power is supplied to the XPR cutting system.	**1.** Inspect the grounding for the cutting system. High frequency electromagnetic interference (also known as noise) can reset the CAN node. **2.** Make sure that the green (power-indicator) LED on the gas connect console and torch connect console is illuminated. **3.** If the LEDs are not illuminated, examine the power distribution board (141425). Look for: ▪ Loose and poorly-connected connectors and CAN cables. ▪ Evidence of 120 V (D1 illuminated). **4.** If D1 is illuminated, examine the plasma power supply control PCB (141322). Make sure that the remote on-off switch is in the ON position (enabled) (D89 illuminated). Re-set the switch if necessary. **5.** Contact your cutting machine supplier or regional Hypertherm Technical Service team. Make sure that you have the Record ID associated with the error.	Shut down	Set process; remote on-off

Diagnostic code number and category	Diagnostic code name	Description	Corrective action	XPR action	Code cancels with
695 Alert (OptiMix only)	Low Inlet H_2-Mix	The hydrogen (H_2) inlet pressure (P10) for the mixing module in the gas connect console (only for OptiMix) is less than 8.3 bar ± 0.4 (120 psi ± 5).	Refer to Low inlet pressure for H_2, Ar, N_2, and H_2O diagnostic codes (695 – 697, 700, 701) on page 335.	None	Set process; remote on-off
696 Alert (OptiMix only)	Low Inlet Ar-Mix	The argon (Ar) inlet pressure (P11) for the mixing module in the gas connect console is less than 8.3 bar ± 0.4 (120 psi ± 5).			
697 Alert (OptiMix only)	Low Inlet N_2-Mix	The nitrogen (N_2) inlet pressure (P12) for the mixing module in the gas connect console is less than 8.3 bar ± 0.4 (120 psi ± 5).		None	Set process; remote on-off
699 Error (OptiMix only)	Mix Fault	The main control PCB finds a mixing-module fault in the gas connect console.	No operator action necessary.	Ramp down	Set process; remote on-off
700 Alert (VWI or OptiMix only)	Gas Inlet F5-GCC	The F5 inlet pressure (P6) in the gas connect console is less than 5.52 bar (80 psi) or more than 8.61 bar (105 psi).	Refer to Low inlet pressure for H_2, Ar, N_2, and H_2O diagnostic codes (695 – 697, 700, 701) on page 335.	None	Set process; remote on-off
701 Alert (VWI and OptiMix only)	Low Inlet H_2O GCC	The water (H_2O) inlet pressure (P8) in the gas connect console is less than 2.07 bar (30 psi).		None	Set process; remote on-off

Diagnostic code number and category	Diagnostic code name	Description	Corrective action	XPR action	Code cancels with
702 Alert	Shield Gas Inlet N_2 TCC	For a minimum of 200 milliseconds, the nitrogen (N_2) inlet pressure (P4) in the torch connect console is less than 5.52 bar (80 psi) or more than 8.61 bar (125 psi).	If you have a cutting system equipped with a Core, CorePlus, or VWI gas connect console, refer to Gas inlet pressure codes (768 – 771) on page 341. If you have a cutting system equipped with a OptiMix gas connect console, refer to Process-gas inlet pressure in the torch connect console diagnostic codes (702, 705, 769, 770) for OptiMix-equipped cutting systems on page 338.	None	Set process; remote on-off
703 Alert	Shield Gas Inlet O_2 TCC	For a minimum of 200 milliseconds, the oxygen (O_2) inlet gas pressure (P4) in the torch connect console is less than 5.52 bar (80 psi) or more than 8.61 bar (125 psi).		None	Set process; remote on-off
704 Alert	Shield Gas Inlet Air TCC	For a minimum of 200 milliseconds, the air inlet pressure (P4) in the torch connect console is less than 5.52 bar (80 psi) or more than 8.61 bar (125 psi).		None	Set process; remote on-off
705 Alert	Shield Gas Inlet Ar-TCC	For a minimum of 200 milliseconds, the argon (Ar) inlet pressure (P4) in the torch connect console is less than 5.52 bar (80 psi) or more than 8.61 bar (125 psi).		None	Set process; remote on-off
706 Error	No sensor P1-TCC	The P1 pressure sensor in the torch connect console is not detected.	Refer to Pressure transducer diagnostic codes (706 – 715) on page 340.	Ramp down	Set process; remote on-off

Diagnostic code number and category	Diagnostic code name	Description	Corrective action	XPR action	Code cancels with
707 Error	No sensor P2-TCC	The P2 pressure sensor in the torch connect console is not detected.	Refer to Pressure transducer diagnostic codes (706 – 715) on page 340.	Ramp down	Set process; remote on-off
708 Error	No sensor P3-TCC	The P3 pressure sensor in the torch connect console is not detected.		Ramp down	Set process; remote on-off
709 Error	No sensor P4-TCC	The P4 pressure sensor in the torch connect console is not detected.		Ramp down	Set process; remote on-off
710 Error	No sensor P5-TCC	The P5 pressure sensor in the torch connect console is not detected.		Ramp down	Set process; remote on-off
711 Error	No sensor P14-TCC	The P14 pressure sensor in the torch connect console is not detected.		Ramp down	Set process; remote on-off
712 Error (VWI and OptiMix only)	No sensor P6-GCC	The P6 pressure sensor in the gas connect console is not detected.		Ramp down	Set process; remote on-off
713 Error (VWI and OptiMix only)	No sensor P7-GCC	The P7 pressure sensor in the gas connect console is not detected.		Ramp down	Set process; remote on-off
714 Error (VWI and OptiMix only)	No sensor P8-GCC	The P8 pressure sensor in the gas connect console is not detected.		Ramp down	Set process; remote on-off
715 Error	No sensor P9-GCC	The P9 pressure sensor in the gas connect console is not detected.		Ramp down	Set process; remote on-off

Diagnostic code number and category	Diagnostic code name	Description	Corrective action	XPR action	Code cancels with
716 Error	Process Invalid	The operator-selected process is not supported by this XPR cutting system. **Smart-fault data values**:	Refer to the smart-fault data value (number) that accompanies the diagnostic code in the XPR web interface to identify the unsupported process and best corrective action for each:	None	Set process; remote on-off
		1: invalid id Process ID = 0	Refer to the *XPR Cut Charts Instruction Manual* (809830) for guidance about how to select the process ID for a supported process.	None	Set process; remote on-off
		2: invalid user Another interface has control of the cutting system. Only 1 communication method (Serial, EtherCAT or Wireless) at a time can send a process ID to the XPR cutting system.	Refer to the Connect for Communication on page 151 and How to change the device that has control on page 196 for guidance about how to select or change the interface that controls the cutting system. If the CNC has control and you change control to another device using the RESET OPERATOR button in the XPR web interface, you can get a 716 diagnostic code if you try to send a process from the CNC. Select RESET OPERATOR again on the same device as before. This gives control back to the CNC. The RESET OPERATOR button was added to the web interface in XPR firmware revision U.	None	Set process; remote on-off; in some conditions it can be necessary to set the line-disconnect switch OFF and then back ON
		3: invalid user source Another interface has control of the cutting system. Only 1 wireless interface at a time can send a process ID to the XPR cutting system.		None	Set process; remote on-off; in some conditions it can be necessary to set the line-disconnect switch OFF and then back ON
		4: invalid process Incorrect process ID was sent.	Refer to the *XPR Cut Charts Instruction Manual* (809830) for guidance about how to select the process ID for a supported process.	None	Set process; remote on-off

Diagnostic code number and category	Diagnostic code name	Description	Corrective action	XPR action	Code cancels with
716 Error	Process Invalid	**5: not allowed or system not ready** The cutting system is not ready for a new process ID. It can only accept a process ID during the following states: “Initial Checks (2),” “Inert Gas Purge (4),” “Wait for Start (5),” “Manual Leak Test (20)” or “End of Cycle (14)” states.	Wait until gas purge or cutting is complete. The cutting system cannot accept a new process ID during gas purge or cutting. If the code continues, contact your cutting machine supplier or regional Hypertherm Technical Service Team.	None	Set process; remote on-off
		6: not supported The 4 XPR gas connect consoles (OptiMix, VWI, CorePlus, Core) can have different capabilities. For example, argon assist and argon marking for mild steel are available for cutting systems equipped with OptiMix, VWI, or CorePlus gas connect consoles, but not with Core.	Refer to How to choose the torch positions and process settings you need on page 221 for information about different process capabilities.	None	Set process; remote on-off
717 Alert (OptiMix only)	Low voltage-mix	The supply voltage for the gas mixer in the gas connect console is less than 21 V.	Confirm the output voltage of the 24 VDC power source in the gas connect console. The output voltage should be 24 VDC.	Ramp down	Set process; remote on-off
718 Alert	High voltage-mix	The supply voltage for the gas mixer in the gas connect console is more than 27 V.		Ramp down	Set process; remote on-off

Diagnostic code number and category	Diagnostic code name	Description	Corrective action	XPR action	Code cancels with
719 Alert	Mix pwm 100%	100% duty is reached on H_2, Ar, or N_2 proportional valve supply voltage. Total flow is decreased to keep the mix percentage of the other gases accurate. Because the mixer tries to deliver a flow, the outlet pressure can continue to rise.	**1.** Make sure that the consumables are correct. **2.** Make sure that the inlet pressures for N_2, Ar, and H_2 are consistently within acceptable range. **3.** Make sure that you have the most recent XPR firmware. You can log into the Xnet at www.hypertherm.com to download it.	None	Start or set process; remote on-off
720 Alert	Mix Pout>Pin	Pressure out (P21) is more than one of the pressures on the inlet side of the mixer (P10 – P12) by at least 0.069 bar (1 psi). When this occurs, the mixer reduces flow to prevent backflow, which can affect cut quality.	**1.** Make sure that the consumables are correct. **2.** Increase N_2, Ar, and H_2 pressure during test cutflow within acceptable range. **3.** Make sure that you have the most recent XPR firmware. You can log into the Xnet at www.hypertherm.com to download it.	None	Start or set process; remote on-off
721 Error	Mix param checksum	There was a failure of the mixing parameter checksum.	**1.** Use the remote on-off switch to turn OFF and then turn ON the cutting system. **2.** If the code continues, replace the gas connect console.	Ramp down	Set process; remote on-off
722 Error	Mix flow cal	There was a failure of the mixing flow calibration.		Ramp down	Set process; remote on-off
723 Error	Mix pressure cal	There was a failure of the mixing pressure calibration.		Ramp down	Set process; remote on-off

Diagnostic code number and category	Diagnostic code name	Description	Corrective action	XPR action	Code cancels with
724 Error	Mix I2C1	There is a mixing communication error on I2C1.	**1.** Examine the cable used to ground the gas connect console. Connect a disconnected cable or repair a damaged cable if found. **2.** Make sure that all external panels for all system components are correctly installed. Install loose or missing panels if found. **3.** Make sure that all hardware that holds the external panels is in position and is tight. Tighten loose connections if found.	Ramp down	Set process; remote on-off
725 Error	Mix I2C2	There is a mixing communication error on I2C2.		Ramp down	Set process; remote on-off
726 Error	Mix system clock	There is a problem with the mixing system clock.	**1.** Use the remote on-off switch to turn OFF and then turn ON the cutting system. **2.** If the code continues, replace the gas connect console.	Ramp down	Set process; remote on-off
730 Alert	Solenoid error V1	There is an over-current condition for receptacle valve V1 at the PCB in the torch connect console.	**1.** Inspect the valve driver cable connections for the valve receptacle in the torch connect console. **2.** Replace the torch V1 valve if you find damage or excess wear. **3.** If the code continues, examine the leads. Make sure the continuity in the leads is good. **4.** If the continuity is good and the code continues, replace the control PCB in the torch connect console.	Ramp down	Set process; remote on-off

<table>
<tr><th>Diagnostic code number and category</th><th>Diagnostic code name</th><th>Description</th><th>Corrective action</th><th>XPR action</th><th>Code cancels with</th></tr>
<tr><td>733
Alert</td><td>Solenoid error V4</td><td>There is an over-current condition for valve V4 at the PCB in the torch connect console.</td><td rowspan="6">1. Examine the wiring for the valve.
2. Connect the valve wire to another valve. If the error goes away, the valve is bad.
3. Replace the bad valve.
4. If the code continues, examine the leads. Make sure the continuity in the leads is good.
5. If the continuity is good and the code continues, replace the control PCB in the torch connect console.</td><td>Ramp down</td><td>Set process; remote on-off</td></tr>
<tr><td>734
Alert</td><td>Solenoid error V5</td><td>There is an over-current condition for valve V5 at the PCB in the torch connect console.</td><td>Ramp down</td><td>Set process; remote on-off</td></tr>
<tr><td>735
Alert</td><td>Solenoid error V6</td><td>There is an over-current condition for valve V6 at the PCB in the torch connect console.</td><td>Ramp down</td><td>Set process; remote on-off</td></tr>
<tr><td>736
Alert</td><td>Solenoid error V7</td><td>There is an over-current condition for valve V7 at the PCB in the torch connect console.</td><td>Ramp down</td><td>Set process; remote on-off</td></tr>
<tr><td>737
Alert</td><td>Solenoid error V8</td><td>There is an over-current condition for valve V8 at the PCB in the torch connect console.</td><td>Ramp down</td><td>Set process; remote on-off</td></tr>
<tr><td>738
Alert</td><td>Solenoid error V9</td><td>There is an over-current condition for valve V9 at the PCB in the torch connect console.</td><td>Ramp down</td><td>Set process; remote on-off</td></tr>
</table>

Diagnostic code number and category	Diagnostic code name	Description	Corrective action	XPR action	Code cancels with
739 Alert	Solenoid error V10	There is an over-current condition for valve V10 at the PCB in the torch connect console.	1. Examine the wiring for the valve. 2. Connect the valve wire to another valve. If the error goes away, the valve is bad. 3. Replace the bad valve. 4. If the code continues, examine the leads. Make sure the continuity in the leads is good. 5. If the continuity is good and the code continues, replace the control PCB in the torch connect console.	Ramp down	Set process; remote on-off
740 Alert	Solenoid error V11	There is an over-current condition for valve V11 at the PCB in the torch connect console.		Ramp down	Set process; remote on-off
741 Alert	Solenoid error V12	There is an over-current condition for valve V12 at the PCB in the torch connect console.		Ramp down	Set process; remote on-off
742 Alert	Mix I2C1 Alert	There is a mixing alert for I2C1.	1. Examine the cable used to ground the gas connect console. Connect any disconnected cable or repair a damaged cable if found. 2. Make sure that all external panels for all system components are correctly installed. Install loose or missing panels if found. 3. Make sure that all hardware that holds the external panels is in position and is tight.	None	Set process; remote on-off
743 Alert	Mix I2C2 Alert	There is a mixing alert for I2C2.		None	Set process; remote on-off
744 Alert	Low Speed-MAGFAN 1	The fan tachometer feedback is below the minimum.	1. Examine the fan. Refer to Identify fan diagnostic codes on page 355. Make sure that the following fan connections are good and tighten loose connections if found: ▪ The fan connector ▪ The wiring to J2 and J5 on the fan power distribution PCB ▪ The wiring to J7 on the control PCB 1 2. Examine the 48 VDC power source output. If not correct, replace the 48 VDC power source. 3. If you do not find any loose connections and the 48 VDC power source is good, replace the fan.	None	Set process; remote on-off

Diagnostic code number and category	Diagnostic code name	Description	Corrective action	XPR action	Code cancels with
745 Alert	Low Speed-MAGFAN 2	The fan tachometer feedback is below the minimum.	**1.** Examine the fan. Refer to Identify fan diagnostic codes on page 355. Make sure that the following fan connections are good and tighten loose connections if found: ▪ The fan connector ▪ The wiring to J2 and J5 on the fan power distribution PCB ▪ The wiring to J7 on the control PCB 1 **2.** Examine the 48 VDC power source output. If not correct, replace the 48 VDC power source. **3.** If the 48 VDC power source is good and no loose connections are found, replace the fan.	None	Set process; remote on-off
748 Alert	Low Speed-HXFAN 1	The fan tachometer feedback is below the minimum.	**1.** Examine the fan. Refer to Identify fan diagnostic codes on page 355. Make sure that the following fan connections are good and tighten loose connections if found: ▪ The fan connector ▪ The wiring to J2 and J5 on the fan power distribution PCB ▪ The wiring to J7 on the control PCB 1 **2.** Examine the 48 VDC power source output. If not correct, replace the 48 VDC power source. **3.** If you do not find any loose connections and the 48 VDC power source is good, replace the fan.	None	Set process; remote on-off

Diagnostic code number and category	Diagnostic code name	Description	Corrective action	XPR action	Code cancels with
749 Alert	Low Speed-HXFAN 2	The fan tachometer feedback is below the minimum.	**1.** Examine the fan. Refer to Identify fan diagnostic codes on page 355. Make sure that the following fan connections are good: ▪ The fan connector. ▪ The wiring to J2 and J3 (HxFan1) and to J4 (HXFAN 2) on the fan power distribution PCB. ▪ The wiring to J7 on the control PCB 1. **2.** Tighten loose connections if found. **3.** Examine the 48 VDC power source output. If not correct, replace the 48 VDC power source. **4.** If you do not find any loose connections and the 48 VDC power source is good, replace the fan.	None	Set process; remote on-off
750 Alert	Low speed CAB FAN 1 (Control Side)	Fan speed is below the minimum acceptable RPM value.	**1.** Examine the fan. Refer to Identify fan diagnostic codes on page 355. Make sure that the following fan connections are good: ▪ The fan connector. ▪ The wiring to J7 Low speed CAB FAN 1 (control side) on the fan power distribution PCB. ▪ The wiring to J7 on the control PCB 1. **2.** Tighten loose connections if found. **3.** Examine the 48 VDC power source output. If not correct, replace the 48 VDC power source. **4.** If you do not find any loose connections and the 48 VDC power source is good, replace the fan.	None	Set process; remote on-off

Diagnostic code number and category	Diagnostic code name	Description	Corrective action	XPR action	Code cancels with
751 Alert	Low speed CAB FAN 2 (Control Side)	Fan speed is below the minimum acceptable RPM value.	**1.** Examine the fan. Refer to Identify fan diagnostic codes on page 355. Make sure that the following fan connections are good: ▪ The fan connector. ▪ The wiring to J8 Low speed CAB FAN 2 (control side) on the fan power distribution PCB. ▪ The wiring to J7 on the control PCB 1. **2.** Tighten loose connections if found. **3.** Examine the 48 VDC power source output. If not correct, replace the 48 VDC power source. **4.** If you do not find any loose connections and the 48 VDC power source is good, replace the fan..	None	Set process; remote on-off
752 Error	Phase Fault Ch1	There is a 3-phase error in Chopper 1.	**1.** Confirm the input-line voltage is within+/-14% of nominal. Refer to Input power requirements on page 40. **2.** Remove the power from the cutting system. **3.** Remove the cover from the contactor. **4.** Inspect the contacts for excess wear. Replace the contactor, if excess wear is found. Otherwise, continue with the following steps. **5.** Inspect the following contactor components for loose connections: ▪ Contactor ▪ Input to chopper ▪ Power cord **6.** Tighten loose connections if found. Otherwise, continue with the following steps. **7.** If the code continues, contact your cutting machine supplier or regional Hypertherm Technical Service team.	Shut down	Remote on-off

Diagnostic code number and category	Diagnostic code name	Description	Corrective action	XPR action	Code cancels with
753 Error	Phase Fault Ch2	There is a 3-phase error in Chopper 2.	**1.** Confirm the input-line voltage is within+/-14% of nominal. Refer to Input power requirements on page 40. **2.** Remove the power from the cutting system. **3.** Remove the cover from the contactor. **4.** Inspect the contacts for excess wear. Replace the contactor, if excess wear is found. Otherwise, continue with the following steps. **5.** Inspect the following contactor components for loose connections: ▪ Contactor ▪ Input to chopper ▪ Power cord **6.** Tighten loose connections if found. Otherwise, continue with the following steps. **7.** If the code continues, contact your cutting machine supplier or regional Hypertherm Technical Service team.	Shut down	Remote on-off
755 Alert	Low level-Coolant	The coolant level is low.	Fill the coolant reservoir with coolant. Refer to Coolant Installation on page 203.	None	Set process; remote on-off

Diagnostic code number and category	Diagnostic code name	Description	Corrective action	XPR action	Code cancels with
756 Info	Leak test results	Reports the result of a gas leak test: 0: leak in v1 v12 or hose 1: leak in b1 2: leak in v1 or b1 3: leak in v1 Vv0 or hose 4: leak in b3); break; 5: leak in v10 or b3 6: manual leak test failed 7: manual leak test passed 8: leak in v4 v5 v6 or v7 9: leak in b2 10: leak in v10 or hose 11: no n2 inlet or v5 12: leak in p7 volume 13: leak in line A or v1 14: auto leak test failed 15: auto leak test passed 16: timeout	Refer to How to do a gas leak test on page 342.	None	Start or set process; remote on-off
757 Error	DC work exceeds limits	The work lead current exceeds the setpoint by 5 A.	Make sure that you have the most recent XPR firmware. You can log into the Xnet at www.hypertherm.com to download it. If the code continues, contact your cutting machine supplier or regional Hypertherm Technical Service team.	End of cycle	Remote on-off
758 Alert	Main 24 V dip	The 24 V DC bus decreases to less than 20 V on the main control PCB.		None	Set process; remote on-off
759 Alert	Main 24 V bus low	The 24 V bus decreases to less than 20 V on the gas connect console.		Ramp down	Set process; remote on-off

Diagnostic code number and category	Diagnostic code name	Description	Corrective action	XPR action	Code cancels with
763 Alert	Coolant solenoid fault	The coolant solenoid driver finds an over-current condition.	**1.** Inspect the coolant solenoid and wiring. Replace them if you find damage or excess wear. **2.** Make sure that you have the most recent XPR firmware. You can log in into the Xnet at www.hypertherm.com to download it. **3.** If the code continues, contact your cutting machine supplier or regional Hypertherm Technical Service team.	None	Set process; remote on-off
764 Alert	Main contactor fault	The main contactor driver finds an over-current condition.	**1.** Inspect the main contactor and wiring. Replace them if you find damage or excess wear. **2.** Make sure that you have the most recent XPR firmware. You can log into the Xnet at www.hypertherm.com to download it. **3.** If the code continues, contact your cutting machine supplier or regional Hypertherm Technical Service team.	None	Set process; remote on-off
765 Alert	Inrush contactor fault	The inrush contactor driver finds an over-current condition.	**1.** Inspect the inrush contactor, inrush contactor relay, and wiring for damage. Replace them if you find damage or excess wear. **2.** Make sure that you have the most recent XPR firmware. You can log into the Xnet at www.hypertherm.com to download it. **3.** If the code continues, contact your cutting machine supplier or regional Hypertherm Technical Service team.	None	Set process; remove on-off

Diagnostic code number and category	Diagnostic code name	Description	Corrective action	XPR action	Code cancels with
766 Alert	Pump enable fault	The pump enable driver finds an over-current condition.	**1.** Inspect the pump solid state relay for damage. Replace them if you find damage or excess wear. **2.** Make sure that you have the most recent XPR firmware. You can log into the Xnet at www.hypertherm.com to download it. **3.** If the code continues, contact your cutting machine supplier or regional Hypertherm Technical Service team.	None	Set process; remote on-off
767 Alert	Remote relay fault	The remote on-off relay driver finds an over-current condition.	**1.** Inspect the pump solid state relay for damage. Replace them if you find damage or excess wear. **2.** Make sure that you have the most recent XPR firmware. You can log into the Xnet at www.hypertherm.com to download it. **3.** If the code continues, contact your cutting machine supplier or regional Hypertherm Technical Service team	None	Set process; remote on-off
768 Alert	Gas inlet – O_2 Line A	Line A O_2 inlet pressure (P2) is below 5.52 bar (80 psi) or above 8.62 bar (125 psi).	Refer to Gas inlet pressure codes (768 – 771) on page 341.	None	Set process; remote on-off
769 Alert	Gas Inlet – Argon Line B	Line B Argon inlet pressure (P1) is below 5.52 bar (80 psi) or above 8.62 bar (125 psi).	If you have a cutting system equipped with a Core, CorePlus, or VWI gas connect console, refer to Gas inlet pressure codes (768 – 771) on page 341. If you have a cutting system equipped with a OptiMix gas connect console, refer to Process-gas inlet pressure in the torch connect console diagnostic codes (702, 705, 769, 770) for OptiMix-equipped cutting systems on page 338.	None	Set process; remote on-off
770 Alert	Gas Inlet – N_2 Line B	Line B N_2 inlet pressure (P1) is below 5.52 bar (80 psi) or above 8.62 bar (125 psi).		None	Set process; remote on-off
771 Alert	Gas Inlet – Air Line A	Line A Air inlet pressure (P2) is below 5.52 bar (80 psi) or above 8.62 bar (125 psi).	Refer to Gas inlet pressure codes (768 – 771) on page 341.	None	Set process; remote on-off

Diagnostic code number and category	Diagnostic code name	Description	Corrective action	XPR action	Code cancels with
772 Alert	High Inlet – Line A	Line A inlet pressure (P2) is more than 9.99 bar (145 psi).	Lower the air or O_2 inlet pressure.	Ramp down	Set process; remote on-off
774 Alert	P5 >=P2	Line A (H_2-mix) outlet pressure (P5) exceeds air inlet pressure (P2) and Line A type is “mix.” The system will automatically stop cutting system operation.	Increase air inlet pressure.	Ramp down	Set process; remote on-off
775 Alert	Node update	Informs the status of the node update. The alert occurs when the PCB updates via wireless connection.	Refer to the *XPR Firmware Updates Field Service Bulletin* (809820).	None	Start or set process; remote on-off
776 Alert	Wifi reset	The GS2011 wireless module has been reset.	Reduce wireless connections to the XPR cutting system.	None	Start or set process; remote on-off
777 Alert	Pilot relay fault	The pilot relay driver detects an over current condition.	**1.** Remove the power for the XPR cutting system. **2.** Remove the control-side panel from the plasma power supply. **3.** Examine the control PCB (PCB 1). **4.** Remove J6 from the control PCB. **5.** Remove the cover from the pilot arc relay. **6.** Use an ohmmeter to measure the coil resistance across wires 21 and 22. You can expect a resistance of approximately 280 ohms. **7.** If the ohms value is more than 10% above or below 280 ohms, replace the pilot arc relay. **8.** If the ohms value is within acceptable range, make sure that you have the most recent XPR firmware. You can log into the Xnet at www.hypertherm.com to download it.	None	Set process; remote on-off

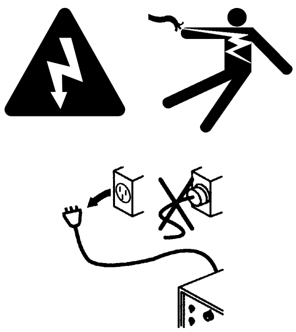
Diagnostic code number and category	Diagnostic code name	Description	Corrective action	XPR action	Code cancels with
778 Alert This code occurs only with cutting systems that have firmware at Rev J or earlier	Hv relay fault	The high-voltage relay driver detects an over current condition.	**1.** Remove the power for the XPR cutting system. **2.** Remove the top and side panels from the torch connect console. **3.** Examine the ohmic PCB inside the torch connect console. **4.** Remove J2 from the ohmic PCB. **5.** Use an ohmmeter and needle probes to measure the coil resistance across the 2 sockets (J2, 2 female connector). You can expect a resistance of approximately 126 ohms. **6.** If the ohms value is more than 10% above or below 126 ohms, replace the ohmic relay (Hv relay). **7.** If the ohms value is within acceptable range, make sure that you have the most recent XPR firmware. Log into the Xnet at www.hypertherm.com to download it.	None	Set process; remote on-off
779 Alert	Ch1 15V bus	The Chopper 1 15 V bus is out of range (below 13 V or above 17 V).	**1.** Examine the 24 VDC on the connector J2, pins 1 and 2 on the Chopper 1 assembly. **2.** If the 24 VDC is absent, examine the wiring on J2 of Chopper 1. Look for loose connections. **3.** If you measure 24 VDC, replace the Chopper 1 assembly.	None	Set process; remote on-off
780 Alert	Ch2 15V bus	The Chopper 2 15 V bus is out of range (below 13 V or above 17 V).	**1.** Examine the 24 VDC on the connector J2, pins 1 and 2 on the Chopper 1 assembly. **2.** If the 24 VDC is absent, examine the wiring on J2 of Chopper 2. Look for loose connections. **3.** If you measure 24 VDC, replace the Chopper 2 assembly.	None	Start or set process; remote on-off

Diagnostic code number and category	Diagnostic code name	Description	Corrective action	XPR action	Code cancels with
782 Alert (OptiMix only)	Mix low psi-P2	The Air inlet pressure (P2) in the torch connect console is less than 7.58 bar (110 psi) during a mix gas process.	Increase air pressure.	None	Start or set process; remote on-off
784 Error	Main 24 V high	The 24 VDC bus is above 28 volts.	**1.** Remove the control-side panel from the plasma power supply to access the 24 VDC power supply inside. **2.** Use a digital multimeter to find the presence of 24 VDC (+/- 2 VDC) across the Positive (+) and Negative (-) terminals of the power source. **3.** If the voltage is outside of the +/- 2 VDC limit, replace the 24 VDC power supply. **4.** If 24 VDC (+/- 2 VDC) is found across the Positive (+) and Negative (-) terminals of the power supply and the 784 diagnostic code continues, look for 24 VDC (+/- 2 VDC) on the control board (J1 pins 1 and 3). **5.** If voltage on J1 pins 1 and 3 is absent, examine the red and white wires. If the wiring is good, replace the control board.	Ramp down	None

Refer to Sequence of operation on page 211 for descriptions of XPR cutting system operations.

CAN codes (500 – 503, 510 – 513 for gas connect console, 504 – 505, 514 – 515 for CAN cable and jumper block, 507 – 508 for CAN network and bus, 600 – 602 for no CAN communication)

WARNING



ELECTRIC SHOCK CAN KILL

Disconnect electrical power before doing troubleshooting or diagnostic work.

All work requiring removal of the plasma power supply outer cover or panels must be done by a qualified technician.

Refer to the *Safety and Compliance Manual* (80669C) for more safety information.

Multiple codes at the same time can indicate a problem with the CAN cable. If there is only one code, the problem is more likely to be caused by what the code says (not the CAN cable).

1. Remove the power from the cutting system. Refer to Remove the power from the cutting system on page 244.

2. For **chopper-related codes**, make sure that the chopper ID cable connector is fully engaged in J8 on Chopper 1 and Chopper 2. If the chopper ID cable connection is good, continue with the following steps:

   a. For code 504 alone:

      - Examine the CAN cable connection between Chopper 1 and Chopper 2. Look for loose connections, bent pins, and bent sockets.
      - Tighten loose connections if found.
      - If you find bent sockets, order a new cable.
      - If you find a bent pin, try to straighten it. If this does not work, order a new cable.

   b. For code 503 and 504 together:

      - Examine the CAN cable connection between Chopper 2 and the control board (PCB 1) on the plasma power supply. Look for loose connections, bent pins, and bent sockets.
      - Tighten loose connections if found.
      - If you find bent sockets, order a new cable.
      - If you find a bent pin, try to straighten it. If this does not work, order a new cable.

   c. If the CAN cable connections are good, examine the PCB for Chopper 1/PCB 2 and Chopper 2/PCB 3. Make sure that the following green LEDS are illuminated on each PCB:

      - D22 (+18/-5 VDC)
      - D14 (+5 VDC)
      - D21 (+3.3 VDC)

These LEDs indicate power to the chopper control boards (PCB 2 and PCB 3).

d. If any LEDs are not illuminated, continue with the following steps:

- ❑ If **all** of the LEDs are **not** illuminated, make sure that the power connector for J2 is fully engaged.
  - If the connector for J2 is fully engaged, make sure that the wiring to the connector is good.
  - Check for 24 V DC, Chopper 1 J2, Pins 1 and 3, and Chopper 2, Pins 2 and 4.
  - If the wiring is good and the code continues, contact your cutting machine supplier or regional Hypertherm Technical Service team.
- ❑ If **only** 1 or 2 LEDs are **not** illuminated, PCB replacement can be necessary. Contact your cutting machine supplier or regional Hypertherm Technical Service team.

e. If the green LEDs on both boards are illuminated, examine the PCB 2 and PCB 3 chopper boards:

- ❑ Make sure that LED D3 and D4 on PCB 2 and PCB 3 are blinking once-per-second (indicates the microprocessor on the control board is functional).
- ❑ Make sure that the DIP switches on S2 are in the following positions:
  - 1 – OFF
  - 2 – OFF
  - 3 – OFF
  - 4 – OFF
- ❑ Make sure that the CAN cable connector is fully engaged in J7.

f. If the LEDs are **not** functioning as described above, contact your cutting machine supplier or regional Hypertherm Technical Service team.

g. If LEDs are functioning as described above, examine LEDs D33 and D34. Flickering indicates the communications on the CAN cable is functional.

h. If LED D33 and D34 are not flickering, contact your cutting machine supplier or regional Hypertherm Technical Service team.

i. If the CAN cable connectors and microprocessor are good and the LEDs appear functional, but the code continues, contact your cutting machine supplier or regional Hypertherm Technical Service team.

3. If the code is for the **Core, CorePlus, or VWI** gas connect console (GCC), go to step 6.

4. If the code is for the **OptiMix** GCC, go to step 7.

5. If the code is for the torch connect console (TCC), go to step 8.

6. **For Core, CorePlus, and VWI GCC codes**, examine the CAN cable connections between the plasma power supply and gas connect console:

a. Look for loose connections. Tighten loose connections if found.

b. If the connections are good, make sure that the control board inside of the gas connect console is tightly mounted to the chassis. Tighten loose connections if found.

c. Examine control board (141375) inside of the gas connect console. Make sure that the following LEDs are illuminated:

- D16 (+5 VDC)
- D18 (+3.3 VDC)

These LEDs indicate power to the PCB. Refer to PCB information on page 356.

d. If the LEDs are illuminated, examine LEDs D30 and D31. Look for once-per-second blinking (indicates the microprocessor on the PCB is functional).

e. If LED D30 and D31 are blinking once-per-second, examine LEDs D24 and D25. Flickering indicates the microprocessor on the PCB is functional.

f. If LED D24 and D25 are flickering and you have codes 600 and 602, make sure that the connection between the main power supply and gas connect console is good:

- ❑ Make sure that the CAN cable between the plasma power supply and gas connect console is connected.
- ❑ Disconnect the CAN cable connection between the gas connect console and torch connect console.

g. If D24 and D25 stop flickering, one of the following conditions can be the problem:

- ❑ There is a bad connection between the plasma power supply and the gas connect console. Reconnect or replace the CAN cable if necessary.
- ❑ There is a bad connection between the small CAN jumper cable for the gas connect console control board (141375) and the sheet metal (located inside of the gas connect console). Reconnect or replace the CAN cable if necessary.

h. If the control board is functional and the code continues, there is a problem with either the CAN cable between the gas connect console and torch connect console or with the small CAN jumper cable for the gas connect console control board (141375) and the sheet metal (located inside of the gas connect console). Continue with the following steps to identify the problem cable:

- ❑ Disconnect and examine each cable. Look for look loose connections, bent pins, and bent sockets.
- ❑ Tighten loose connections if found.
- ❑ If you find bent sockets, order a new cable.
- ❑ If you find a bent pin, try to straighten it. If this does not work, order a new cable.

i. If D24 and D25 are not illuminated and not flickering, the CAN cable to the plasma power supply is disconnected. Reconnect the CAN cable if necessary.

j. If D24 is not illuminated and D25 is flickering, examine the control board for shorts. Look for a shorting block across pins 1 and 2 of J16.

k. If there is a shorting block, remove it and restart the cutting system.

l. If J16 is open, replace the control board (141375).

7. **For OptiMix GCC codes**, examine the CAN cable connections between the plasma power supply and gas connect console:

   a. Look for loose connections. Tighten loose connections if found.

   b. Make sure that the control board (141375) inside of the gas connect console is tightly mounted to the chassis. Tighten loose connections if found.

   c. Examine the control board inside of the gas connect console. Make sure that the following LEDs are illuminated on the control board:

      - D16 (+5 VDC)
      - D18 (+3.3 VDC)

   These LEDs indicate power to the PCB. Refer to PCB information on page 356.

   d. If the LEDs are illuminated, examine LEDs D30 and D31. Look for once-per-second blinking (indicates the microprocessor on the PCB is functional).

   e. If LED D30 and D31 are blinking once-per-second, examine LEDs D24 and D25. Flickering indicates the microprocessor on the PCB is functional.

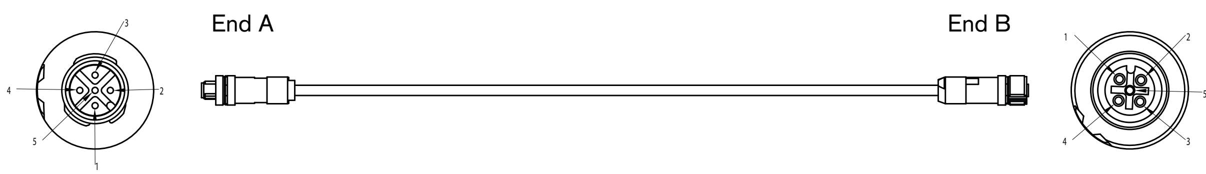
   f. If LED D24 and D25 are flickering and you have codes 600 and 602, make sure that the connection between the main power supply and gas connect console is good:

      - ❑ Make sure that the CAN cable between the plasma power supply and gas connect console is connected.
      - ❑ Disconnect the CAN cable connection between the gas connect control board (141375) and the mixer in the same console.

   The gas connect console, mixer, and torch connect consoles *can appear* to communicate, even when the CAN cable between them is disconnected.

   g. If D24 and D25 stop flickering, the CAN cable is bad. One of the following conditions can be the problem:

      - ❑ The CAN cable is damaged. Use a Ohm meter to verify the continuity at the end of each connector of the CAN cable. Verify pin-by-pin and in the same order as the CAN connectors. For example, Pin_1 on End A corresponds to Pin_1 on End B of the cable. Replace the cable if no continuity is found.



      - ❑ There is a bad connection between the plasma power supply and the gas connect console. Reconnect or replace the CAN cable if necessary.
      - ❑ There is a bad connection between the small CAN jumper cable for the gas connect console control board (141375) and the sheet metal (located inside of the gas connect console). Reconnect or replace the CAN cable if necessary.

h. If the control board is functional and the code continues, continue with the following steps:
   - Replace the CAN cable between the control board (141375) and the mixer.
   - Disconnect the CAN cable between the gas connect console and torch connect console.
   - Make sure that the green LEDs on the mixer are functional, and that the XPR web interface or CNC screen indicates that the cutting system is equipped with a OptiMix gas connect console.

i. If D24 and D25 are not illuminated and not flickering, the CAN cable to the plasma power supply is disconnected. Reconnect the CAN cable if necessary.

j. If D24 is not illuminated and D25 is flickering, examine the control board for shorts. Look for a shorting block across pins 1 and 2 of J16.

k. If there is a shorting block, remove it and restart the cutting system.

l. Look for CAN problems with the mixer inside of the OptiMix gas connect console. There are 3 LEDs located side-by-side. Look for the green LED. Examine the green LED on the board of the mixer:
   - If the green LED is blinking once-per-second and the yellow LED is flickering, the CAN cable is good and the cutting system is ready for use.
   - If the green LED is blinking once-per-second and the yellow LED is **not** illuminated, a CAN communication failure can be the problem. Examine the CAN cable between the control board (141375) and the mixer. Look for a loose connection or bent pins.
   - If the green LED is blinking once-per-second and the red LED is illuminated (steady, no flickering), the mixer in the gas connect console can be the problem. Contact your cutting machine supplier or regional Hypertherm Technical Service team. Technical Service can help you decide if it is necessary to replace the gas connect console.

8. **For TCC codes**, examine the CAN cable connections between the gas connect console and the torch connect console:

   a. Look for loose connections. Tighten loose connections if found.

   b. Examine the control board (141334) inside of the torch connect console. Make sure that the following LEDs are illuminated on the control board:
      - D43 (+5 VDC)
      - D46 (+3.3 VDC)

   c. If D43 and D46 are not illuminated, use a digital volt meter to measure the power output for PS1.
      - If there is no 24 VDC output, examine the 120 VAC input to PS1. If there is no 120 VAC, examine the power cable connection to the torch connect console and the 120 VAC-out connection from the gas connect console. Tighten loose connections if found.

   d. If D43 and D46 are illuminated, make sure that 120 VAC-out from the gas connect console is connected, then verify that the Activity LED (D88) and Status LED (D87) are blinking. Look for once-per-second blinking (indicates the microprocessor on the PCB is functional).

- If the LEDs are **not** blinking once-per-second, replace the control board. If replacement is necessary, contact your cutting machine supplier or Hypertherm Technical Service team.

e. If the power LEDs are good, examine CAN TX LED (D35) and RX LED (D34). Flickering indicates the microprocessor on the PCB is functional.

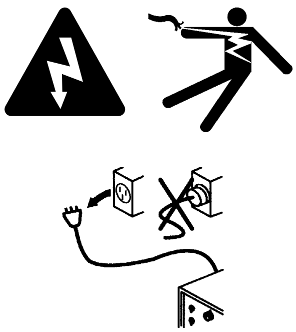
f. If the RX LED (D34) is **not** flickering, the CAN cable between the gas connect console and torch connect console is disconnected. Reconnect the CAN cable, if necessary.

g. If the RX LED is flickering and the CAN TX LED (D35) is **not** flickering, replace the control board (141334) inside of the torch connect console. If replacement is necessary, contact your cutting machine supplier or regional Hypertherm Technical Service team.

9. If you cannot find or resolve the problem with these corrective actions, contact your cutting machine supplier or regional Hypertherm Technical Service team.

Low shield water pressure code (532)

WARNING



ELECTRIC SHOCK CAN KILL

Disconnect electrical power before doing troubleshooting or diagnostic work.

All work requiring removal of the plasma power supply outer cover or panels must be done by a qualified technician.

Refer to the *Safety and Compliance Manual* (80669C) for more safety information.

1. Make sure that the shield water pressure supplied to the cutting system is between 2.76 bar – 7.93 bar (40 psi – 115 psi).

   If the pressure is less than 2.76 bar (40 psi), then a “booster” water pump can be necessary to avoid system shut down or bad cut quality. Refer to Shield water requirements (VWI and OptiMix) on page 50.

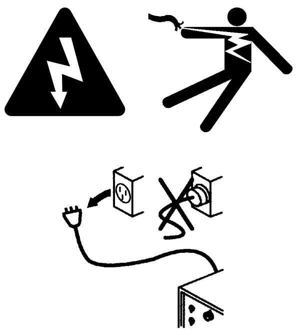
2. Examine all water hoses and water hose inlet fittings. Look for:
   - Damage or kinks that can restrict flow.
   - Leaks that can decrease pressure.
3. Replace any hoses with damage or kinks.
4. Reposition the hoses if you find fixable kinks.
5. Replace any fitting that has damage.
6. Tighten loose connections if found.
7. Examine water regulators. Look for debris that can block the flow path.
8. Adjust the inlet water pressures to at least 2.77 bar (40 psi) when cutting, if necessary.

   The Hypertherm-supplied regulator that is connected to the gas connect console is pre-set at the factory. Do **not** adjust this regulator.

9. If you cannot find or fix the problem with these corrective actions, contact your cutting machine supplier or regional Hypertherm Technical Service team.

Low shield gas pressure code (534)

WARNING



ELECTRIC SHOCK CAN KILL

Disconnect electrical power before doing troubleshooting or diagnostic work.

All work requiring removal of the plasma power supply outer cover or panels must be done by a qualified technician.

Refer to the *Safety and Compliance Manual* (80669C) for more safety information.

1. Make sure that the consumables are correct for the operator-selected process.
2. Examine gas hoses and fittings. Look for:
   - Damage and kinks that can restrict flow.
   - Leaks that can decrease pressure.
3. If the hoses and fittings are good, look at the CNC or XPR web interface to identify the shield gas pressure.

   For information about the recommended shield gas pressure by process type, refer to the *XPR Cut Charts Instruction Manual* (809830).

4. Send a command to test preflow. Make sure that the pressure is within the correct range for the active process.

   For information about how to do this, refer to the instruction manual that came with your CNC.

5. Send a command to test cutflow and continue with the following steps:

   Make sure that the pressure on P14 is achieved. An error occurs only if the value is less than 75% of the setpoint for at least 600 milliseconds.

   a. If the pressure is too high or too low, use the optional external shield gas regulator to decrease or increase the pressure.
   b. Examine voltage going to J21.1 and J21.2 for B2 and J7 for V11. Refer to Valve states during operation on page 416 to identify if V11 is enabled. Look for voltage between 5 VDC –24 VDC.
   c. If B2 and V11 do not have the correct voltage, examine the connections between the control board (141334) and the valves. Make sure that the connections are fully engaged.

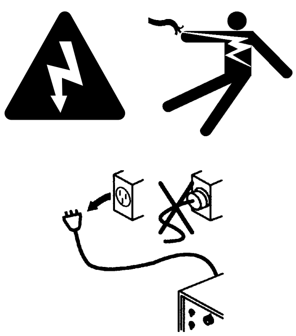
If the connections are fully engaged but the code continues, replace the control board.

6. If you cannot get the recommended pressure, or if pressure is within range but the code continues, exchange B2 with B1 or B3, or exchange P14 with a different transducer, to see if the code follows the exchange. If yes, replace B2 or P14, as needed.

7. If you cannot find or resolve the problem with these corrective actions, contact your cutting machine supplier or regional Hypertherm Technical Service team.

Low coolant flow codes (540 – 542)

WARNING



ELECTRIC SHOCK CAN KILL

Disconnect electrical power before doing troubleshooting or diagnostic work.

All work requiring removal of the plasma power supply outer cover or panels must be done by a qualified technician.

Refer to the *Safety and Compliance Manual* (80669C) for more safety information.

1. Make sure that the coolant level in the coolant reservoir is acceptable.

   You can see the coolant level from the fill port inlet located on the top of the plasma power supply. You also can see coolant levels on the CNC screen or XPR web interface.

2. If the coolant reservoir is not full, fill it with coolant. Refer to Coolant Installation on page 203.

3. If the coolant reservoir level is acceptable, but the code continues:
   a. Make sure that the coolant pump is ON and the gauge is spinning.
   b. Make sure that the bypass is working.
   c. Examine the coolant hoses. Look for restrictions or blockages.
   d. Examine the consumables. Make sure they are correct for the operator-selected process.
   e. Examine the coolant filter. Replace it if necessary. Refer to Table 33 – Inspection, preventive maintenance, and cleaning tasks on page 242.
   f. Examine the coolant pump screen. Replace it if you find damage. Clean it if you find debris.

4. If coolant filter or coolant pump screen replacement is not necessary, do a coolant flow test to identify the source of a coolant leak or obstruction. Refer to How to measure coolant flow on page 345.

5. Send a process command to start the coolant pump.

   The coolant pump starts automatically any time a process command is sent. Refer to Sequence of operation on page 211.

6. If the coolant flow test value (refer to step 4) is equal to or greater than 3.78 L/min (1.0 gal/min), but the XPR web interface shows a lower value, complete the following steps:

   a. Examine the control PCB. Look for +15 VDC on J8 pin 1 and pin 2.

      If there is no voltage on J8 pin 1 and pin 2, examine the wiring harness that connects to J8. Look for a short. If no short is found, replace the control PCB.

   b. If the voltage on J8 pin 1 and pin 2 is +15 VDC, examine the flow sensor output (in frequency) at the control PCB. Measure the frequency on J8 pin 3 (pulse) and pin 2 (ground).

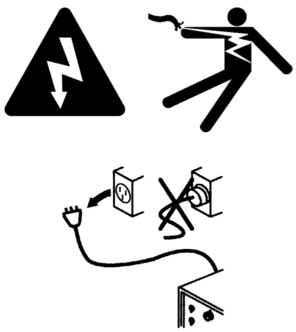
Flow rate		Frequency (Hz)
Liters per minute (L/min)	**US gallons per minute (gal/min)**	
1.89 L/min	0.5 gal/min	15 Hz
3.78 L/min	1.0 gal/min	34 Hz
5.67 L/min	1.5 gal/min	54 Hz

      If the value differs more than 0.8 L/min (0.2 gal/min), or if there are no pulses (0 Hz), replace the flow sensor.

7. If you cannot find or resolve the problem with these corrective actions, contact your cutting machine supplier or regional Hypertherm Technical Service team.

High coolant flow codes (543 – 544)

⚠ WARNING



ELECTRIC SHOCK CAN KILL

Disconnect electrical power before doing troubleshooting or diagnostic work.

All work requiring removal of the plasma power supply outer cover or panels must be done by a qualified technician.

Refer to the *Safety and Compliance Manual* (80669C) for more safety information.

A failed coolant pump can cause a high coolant flow diagnostic code (543). To make sure that the coolant pump is operational:

1. Look at the CNC or XPR web interface to make sure that the coolant pump is operational.
2. For diagnostic code **543**, examine the coolant hoses. Make sure that you have Hypertherm-supplied coolant hoses. Replace the bad hoses with Hypertherm-supplied coolant hoses, if necessary.
3. For diagnostic code **544**, do the following steps to re-set the cutting system:
   a. Set the line-disconnect switch to the OFF position.
   b. Examine the torch. Missing or severely damaged consumables can cause the flow meter to give a higher flow value.

      A missing water tube can have an effect on coolant flow.

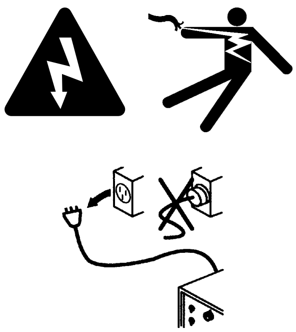
   c. Set the line-disconnect switch to the ON position.
   d. Use the CNC or XPR web interface to send a process command to the cutting system.

      The coolant pump starts automatically any time a process command is sent.

   e. If the code continues:
      - ❑ Examine the flow meter. Look for air bubbles in the sight glass. Air bubbles can cause the flow meter to give a higher flow value.
      - ❑ Make sure the coolant level is slightly above the level switch.
      - ❑ Examine the hoses and hose fittings. Look for damage or loose connections.
4. If you cannot find or resolve the problem with these corrective actions, contact your cutting machine supplier or regional Hypertherm Technical Service team.

Over temp diagnostic codes – Choppers (560 – 561) and Coolant (587)

WARNING



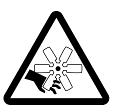
ELECTRIC SHOCK CAN KILL

Disconnect electrical power before doing troubleshooting or diagnostic work.

All work requiring removal of the plasma power supply outer cover or panels must be done by a qualified technician.

Refer to the *Safety and Compliance Manual* (80669C) for more safety information.

CAUTION



MOVING BLADES CAN CAUSE INJURY

Keep your hands away from moving parts.

1. Make sure that the clearance around the plasma power supply is adequate.

   For adequate ventilation, Hypertherm recommends a minimum separation distance of 1 meter (3.3 feet) between the plasma power supply and any other objects or equipment.

2. Make sure that the ambient temperature where the plasma power supply is located is within the acceptable temperature range for cutting system operation Refer to Table 1.

   If the temperature where your plasma power supply is located is above the temperature limit, you can see reduced performance and over-temp diagnostic codes.

3. While all of the fans continue to operate, allow the cutting system to cool.

4. Reference the XPR web interface. Make sure that the heat-exchanger fan speed is within the acceptable range (heat-exchanger fan 1; heat-exchanger fan 2).

Fan type	Acceptable range of speed
Large fans (254 mm / 10 inch)	2,800 RPM – 3,400 RPM
Small fans (120 mm / 4.7 inch)	5,600 RPM – 6,400 RPM

5. If the fan speed is within acceptable range, remove the power from the cutting system. Refer to Remove the power from the cutting system on page 244.

6. Remove the pump-side and front panels of the plasma power supply.

7. If you find obstructions, debris, or dust, use compressed air to remove the obstruction, debris, or dust from the fans and heat-exchanger area.

   The heat-exchanger area can retain large amounts of dust or debris. Multiple uses of compressed air is often necessary to clear this area. Consider the use of personal protective equipment to protect yourself from airborne particulates and debris.

   Make sure to minimize fan rotation during compressed air use. You can use a gloved hand to hold a fan in position, if necessary.

8. Make sure that the heat-exchanger fans have no obvious obstruction, dust, or debris:

   a. Disconnect the connector for the choppers or remove the coolant thermistor wires from the connector. This makes it easier to measure only the resistance for the thermistors.

   b. Use a digital multimeter to measure the resistance from each thermistor wire, based on the following codes and connector-pin locations:

Diagnostic code	Thermistor location	Location of thermistor wires / connector	Pins	
587, 670, 681	Heat exchanger, top	PCB 1	J1.2 pin 7	J1.2 pin 8
560, 667, 678	Chopper 1 (cold plate)	PCB 2	J9 pin 1	J9 pin 2
561, 668, 679	Chopper 2 (cold plate)	PCB 3	J9 pin 1	J9 pin 2

   c. Look for a resistance value that is outside of the minimum or maximum in Table 38:

85	750	1250
95	600	1000
105	400	800
115	300	600
125	200	500
135	150	400
145	150	250
155	125	225
165	100	175

Table 38 – Minimum and maximum ohmic resistance values for thermistors

Thermistor temperature	Minimum resistance (Ohms)	Maximum resistance (Ohms)
25°C (77°F)	9,000	11,000
35°C (95°F)	5,000	7,000
45°C (113°F)	3,900	4,900
55°C (131°F)	2,500	3,500
65°C (149°F)	1,500	2,500
75°C (167°F)	1,000	2,000
85°C (185°F)	750	1,250
95°C (203°F)	600	1,000
105°C (221°F)	400	800
115°C (239°F)	300	600
125°C (257°F)	200	500
135°C (275°F)	150	400
145°C (293°F)	150	250
155°C (311°F)	125	225
165°C (329°F)	100	175

At approximately 25°C (77°F), you can expect a resistance of approximately 10,000 ohms.

d. If the resistance value is outside the minimum or maximum value in Table 38 on page 328, contact your cutting machine supplier or regional Hypertherm Technical Service team. They can help you to decide if there is a wiring fault or if thermistor replacement is necessary.

e. If the resistance value is at or very near 0 ohms:

- Inspect the wiring between each thermistor and its connector pins.
- Look for shorts between wires or to the ground.

f. If the resistance value is above 100 ohms and below the minimum:

- Remove the electrical power from the cutting system. Refer to Remove the power from the cutting system on page 244.
- Allow the coolant to reach 85°C (185°F) or below.

It can take a long time for the coolant to reach 85°C (185°F) if the ambient temperature is high. Contact your cutting machine supplier or regional Hypertherm Technical Service team for guidance about how to cool the cutting system, if necessary.

- Restore electrical power to the cutting system.
- Repeat step 8.

g. If the resistance remains below the minimum ohmic value or does not change after you allow the coolant to reach 85°C (185°F) or below, do one or more of the following steps, based on the diagnostic code(s):

- Replace chopper 1 (PCB 2) for error code 560 (over temp-Ch1).
- Replace chopper 2 (PCB 3) for error code 561 (over temp-Ch2).
- Replace copper pipe thermistor assembly for error code 587 (Over temp-Coolant).

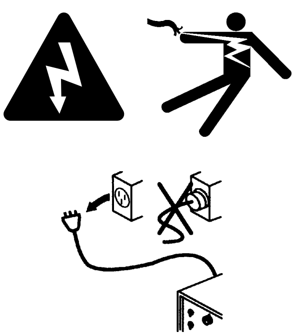
h. If the resistance is within range, continue cutting system operation.

i. If the thermistor resistance is within range when the thermistor is disconnected from the control PCB and the code continues when the thermistor is reconnected to the control PCB, contact your cutting machine supplier or regional Hypertherm Technical Service team. They can help you decide if control PCB replacement is necessary. Refer to Plasma power supply control PCB (141322) on page 357 or Plasma power supply chopper PCB (141319) on page 360.

9. If the code continues, or if you cannot find or resolve the problem with these corrective actions, contact your cutting machine supplier or regional Hypertherm Technical Service team.

Start switch diagnostic codes (570 – 577)

WARNING



ELECTRIC SHOCK CAN KILL

Disconnect electrical power before doing troubleshooting or diagnostic work.

All work requiring removal of the plasma power supply outer cover or panels must be done by a qualified technician.

Refer to the *Safety and Compliance Manual* (80669C) for more safety information.

1. Use the CNC or XPR web interface to verify the status of the cutting system. Make sure that a cutting sequence is **not** active.

2. Remove the power from the cutting system. Refer to Remove the power from the cutting system on page 244.

3. Remove the control-side panel from the plasma power supply.

4. Supply power to the cutting system.

5. If the code continues after you supply power to the cutting system, examine LED D50 on PCB 1. Look for illumination.

6. If the LED is not illuminated, there is a CNC problem.

Refer to the instruction manual that came with your CNC for troubleshooting recommendations.

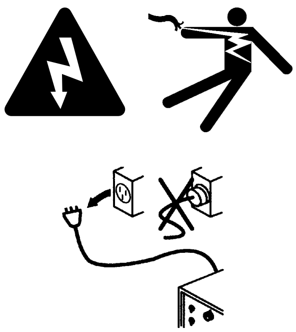
7. If LED D50 is illuminated:
   a. Remove the power from the cutting system. Refer to Remove the power from the cutting system on page 244.
   b. Remove the connector from J14 on the rear of the plasma power supply.
   c. Supply power to the cutting system.
   d. Examine the LED D50 on PCB 1. Look for illumination.
8. If LED D50 is illuminated (when the discrete cable remains disconnected), examine the PCB for dust or other contaminants. Use compressed air to remove any dust, debris, or obstruction if found.
9. If LED D50 is still illuminated after the wire is removed, there is a problem with the board. Contact your cutting machine supplier.
10. If the LED is not illuminated, skip to step 12.
11. If the code stops and LED D50 is not illuminated with the discrete cable still disconnected, examine the discrete cable for damage. Look for:
    - Shorts across the line
    - Damaged cable
    - Bad relays
    - Loose connections

    Replace the discrete cable if you find damage. Refer to Discrete CNC interface cable on page 404 in Parts List.
12. If you do not find visible damage to the discrete cable, remove the discrete cable from PCB 1. Look for an open circuit between pins 3 and 4 of J14.
13. If the cable is good, make sure that the CNC output is set to OFF.
14. If there is a short circuit, make sure that the discrete cable is not shorted and that the CNC start signal output is set to OFF.

    A closed circuit can indicate that the CNC sent a plasma-start signal or damage on the discrete cable.
15. If you cannot find or resolve the issue with these corrective actions, contact your cutting machine supplier or regional Hypertherm Technical Service team.

Over temp diagnostic codes – Inductors (580 – 583), Transformers (586)

WARNING



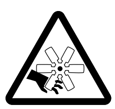
ELECTRIC SHOCK CAN KILL

Disconnect electrical power before doing troubleshooting or diagnostic work.

All work requiring removal of the plasma power supply outer cover or panels must be done by a qualified technician.

Refer to the *Safety and Compliance Manual* (80669C) for more safety information.

CAUTION



MOVING BLADES CAN CAUSE INJURY

Keep your hands away from moving parts.

1. Make sure that the clearance around the plasma power supply is adequate.

   For adequate ventilation, Hypertherm recommends a minimum separation distance of 1 meter (3.3 feet) between the plasma power supply and any other objects or equipment.

   Make sure that the ambient temperature where the plasma power supply is located is within the acceptable temperature range for cutting system operation. Refer to Table 1 on page 28. If the temperature where your plasma power supply is located is above the temperature limit, you can experience reduced performance and over-temp diagnostic codes.

2. While all of the fans continue to operate, allow the cutting system to cool.

   Before you continue with the next step, make sure that the magnetics reach a temperature of 160°C (320°F) or below.

3. **Without removing the external side panel** on the plasma power supply, look through the ventilation trusses on the plasma power supply to examine both magnetic fans inside.

   Look through the ventilation trusses on the front of the plasma power supply to locate the 2 magnetic (254 mm / 10 inch) fans inside. It is **not** necessary to remove the external panels to view the magnetics fans. Magnetic fans are near the front and bottom.

4. Examine the XPR web interface. Make sure that the speed for each magnetics fan is within the acceptable range (magnetics fan 1; magnetics fan 2).

Fan type	Acceptable range of speed
Large fans (254 mm / 10 inches)	2,800 RPM – 3,400 RPM
Small fans (120 mm / 4.7 inches)	5,600 RPM – 6,400 RPM

During normal operation, it is usually difficult to see individual blades because of the fast speed of the fan rotation). If you can easily see individual blades without the use of a strobe lamp, the rotation speed is probably too slow.

5. If the speed of the fans is below the acceptable range (refer to table above), remove the electrical power from the cutting system. Refer to Remove the power from the cutting system on page 244.

6. Remove the front panel of the plasma power supply.

7. If you find obstructions, debris, or dust, use compressed air to remove the obstruction, debris, or dust from the fans and magnetics area.

The magnetics area can retain large amounts of dust or debris. Multiple uses of compressed air is often necessary to clear this area. Consider the use of personal protective equipment to protect yourself from airborne particulates and debris.

Make sure to minimize fan rotation during compressed air use. You can use a gloved hand to hold a fan in position, if necessary.

8. If both magnetics fans have no obvious obstruction, dust, or debris:
   a. Disconnect the connector from the control board PCB 1 (for the magnetics).
   b. Use a digital multimeter to measure the resistance from each thermistor wire, based on the following connector-pin locations:

Diagnostic code	Thermistor location	Location of thermistor wires/connector	1st connector pin	2nd connector pin
580, 660, 671	Inductor 1A	PCB 1	J1.4 pin 3	J1.4 pin 4
581, 661, 672	Inductor 1B	PCB 1	J1.4 pin 5	J1.4 pin 6
582, 662, 673	Inductor 2A	PCB 1	J1.4 pin 7	J1.4 pin 8
583, 663, 674	Inductor 2B	PCB 1	J1.2 pin 1	J1.2 pin 2
586, 666, 677	Transformer	PCB 1	J1.4 pin 1	J1.4 pin 2

Thermistors are located on the magnetics.

c. Look for a resistance value from each thermistor wire that is outside of the minimum or maximum in Table 39:

Table 39 – Minimum and maximum ohmic resistance values for thermistors

Thermistor temperature	Minimum resistance (Ohms)	Maximum resistance (Ohms)
25°C (77°F)	9,000	11,000
35°C (95°F)	5,000	7,000
45°C (113°F)	3,900	4,900
55°C (131°F)	2,500	3,500
65°C (149°F)	1,500	2,500
75°C (167°F)	1,000	2,000
85°C (185°F)	750	1,250
95°C (203°F)	600	1,000
105°C (221°F)	400	800
115°C (239°F)	300	600
125°C (257°F)	200	500
135°C (275°F)	150	400
145°C (293°F)	150	250
155°C (311°F)	125	225
165°C (329°F)	100	175

At approximately 25°C (77°F), you can expect a resistance of approximately 10,000 ohms.

d. If the ohmic resistance is outside of the minimum or maximum value in Table 39 on page 333, contact your cutting machine supplier or regional Hypertherm Technical Service team. They can help you to decide if there is a wiring fault or if thermistor replacement is necessary.

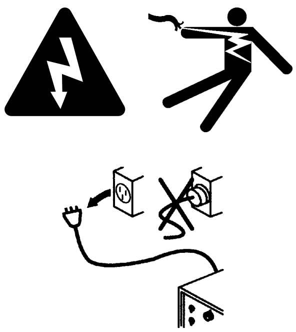
e. If the resistance is at or very near 0 ohms:

- Inspect the wiring between each thermistor and its connector pins.
- Look for shorts between wires or to the ground.

9. If the thermistor resistance is within range when the thermistor is disconnected from the control PCB and the code continues when the thermistor is reconnected to the control PCB, contact your cutting machine supplier or regional Hypertherm Technical Service team. They can help you decide if control PCB replacement is necessary. Refer to Plasma power supply control PCB (141322) on page 357.

Current sensor diagnostic codes (631)

WARNING



ELECTRIC SHOCK CAN KILL

Disconnect electrical power before doing troubleshooting or diagnostic work.

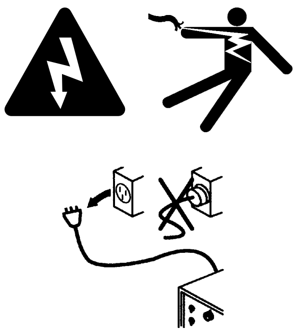
All work requiring removal of the plasma power supply outer cover or panels must be done by a qualified technician.

Refer to the *Safety and Compliance Manual* (80669C) for more safety information.

1. Remove the power from the cutting system. Refer to Remove the power from the cutting system on page 244.
2. Examine J1.8 on PCB 1 (control PCB) and the work lead sensor located on the I/O panel on PCB5 (I/O PCB).
3. Look for:
   - Damage
   - Loose connections
4. If the connections are good and the code continues, replace PCB5 (I/O PCB).
5. If you cannot find or resolve the problem with these corrective actions, contact your cutting machine supplier or regional Hypertherm Technical Service team.

Low inlet pressure for H_2, Ar, N_2, and H_2O diagnostic codes (695 – 697, 700, 701)

WARNING



ELECTRIC SHOCK CAN KILL

Disconnect electrical power before doing troubleshooting or diagnostic work.

All work requiring removal of the plasma power supply outer cover or panels must be done by a qualified technician.

Refer to the *Safety and Compliance Manual* (80669C) for more safety information.

1. During test cutflow and test preflow, look at the CNC or XPR web interface to identify the gas or water inlet pressure in the mixing module inside the gas connect console. Look at:
   - The H_2 inlet pressure (P10) for code 695.
   - The Ar inlet pressure (P11) for code 696.
   - The N_2 inlet pressure (P12) for code 697.
   - The H_2O inlet pressure (P8) for code 701.

2. If you have a Core, CorePlus, VWI, or OptiMix gas connect console, make sure that the gas inlet pressures inside the gas connect console are acceptable:

Gas connect console	Acceptable gas inlet pressures in the gas connect console		
	H_2	N_2	Ar
Core	–	7.5 bar ± 0.4 (110 psi ± 5)	–
CorePlus	–	7.5 bar ± 0.4 (110 psi ± 5)	7.5 bar ± 0.4 (110 psi ± 5)
VWI	–	7.5 bar ± 0.4 (110 psi ± 5)	7.5 bar ± 0.4 (110 psi ± 5)
OptiMix	8.3 bar ± 0.4 (120 psi ± 5)	8.3 bar ± 0.4 (120 psi ± 5)	8.3 bar ± 0.4 (120 psi ± 5)

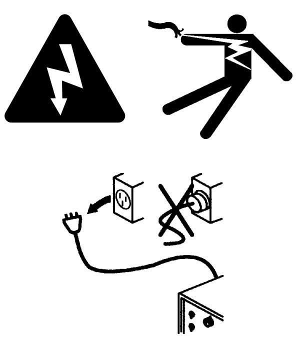
3. If you have a VWI or OptiMix gas connect console, make sure that the water inlet pressure is at least 2.07 bar (40 psi).

4. When gas flow is less than the pressure range, use the regulators to increase the pressure, if necessary. Do **not** exceed the recommended pressures.

5. If the pressure remains too low, examine the gas hoses and gas inlet fittings. Look for:
   - Damage or kinks that can restrict flow.
   - Leaks that can decrease pressure.
6. Replace the hoses if you find damage or kinks.
7. Reposition the hoses if you find fixable kinks.
8. Replace any fitting that has damage.
9. Tighten loose connections if found.
10. If you have an XPR cutting system equipped with a VWI or OptiMix gas connect console, make sure that the shield water quality is good. Refer to Shield water requirements (VWI and OptiMix) on page 50. Bad quality can have a negative effect on the shield water regulator. This can cause diagnostic codes for low inlet pressure.
11. If you cannot find or resolve the problem with these corrective actions, contact your cutting machine supplier or regional Hypertherm Technical Service team.

Shield gas inlet pressure in the torch connect console diagnostic codes (702 – 705)

⚠ WARNING



ELECTRIC SHOCK CAN KILL

Disconnect electrical power before doing troubleshooting or diagnostic work.

All work requiring removal of the plasma power supply outer cover or panels must be done by a qualified technician.

Refer to the *Safety and Compliance Manual* (80669C) for more safety information.

1. Look at the CNC screen or XPR web interface to identify the inlet pressure inside the torch connect console. Look at:
   - The N_2 inlet pressure (P4) for code 702.
   - The O_2 inlet pressure (P4) for code 703.
   - The air inlet pressure (P4) for code 704.
   - The Ar inlet pressure (P4) for code 705.

2. Make sure that the gas inlet pressures inside the torch connect console are acceptable:

Gas connect console	Acceptable gas inlet pressures in the torch connect console			
	N_2	O_2	Air	Ar
Core	7.5 bar ± 0.4 (110 psi ± 5)	7.5 bar ± 0.4 (110 psi ± 5)	7.5 bar ± 0.4 (110 psi ± 5)	–
CorePlus	7.5 bar ± 0.4 (110 psi ± 5)	7.5 bar ± 0.4 (110 psi ± 5)	7.5 bar ± 0.4 (110 psi ± 5)	7.5 bar ± 0.4 (110 psi ± 5)
VWI	7.5 bar ± 0.4 (110 psi ± 5)	7.5 bar ± 0.4 (110 psi ± 5)	7.5 bar ± 0.4 (110 psi ± 5)	7.5 bar ± 0.4 (110 psi ± 5)
OptiMix	8.3 bar ± 0.4 (100 psi ± 5)	8.3 bar ± 0.4 (115 psi ± 5)	7.9 bar ± 0.4 (115 psi ± 5)	8.3 bar ± 0.4 (100 psi ± 5)

3. Use the regulators to increase or decrease the inlet pressure.

4. If the pressure remains too low, examine gas hoses and gas inlet fittings. Look for:
   - Damage or kinks that can restrict flow.
   - Leaks that can decrease pressure.

5. Replace the hoses if you find damage or kinks.

6. Reposition the hoses if you find fixable kinks.

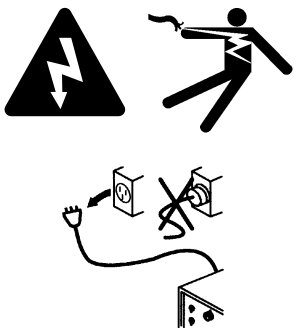
7. Replace any fitting that has damage.

8. Tighten loose connections if found.

9. If you cannot find or resolve the problem with these corrective actions, contact your cutting machine supplier or regional Hypertherm Technical Service team.

Process-gas inlet pressure in the torch connect console diagnostic codes (702, 705, 769, 770) for OptiMix-equipped cutting systems

WARNING



ELECTRIC SHOCK CAN KILL

Disconnect electrical power before doing troubleshooting or diagnostic work.

All work requiring removal of the plasma power supply outer cover or panels must be done by a qualified technician.

Refer to the *Safety and Compliance Manual* (80669C) for more safety information.

The N_2 and Ar gas regulators inside the OptiMix gas connect console (078633) are set at Hypertherm. They are set when the process gas is flowing with 7.9 bar – 8.6 bar (115 psi – 125 psi) pressure on the gas inlet and 6.9 bar (100 psi) on the gas outlet. A downstream 1.6 mm (0.063 inch) orifice is part of both regulator configurations.

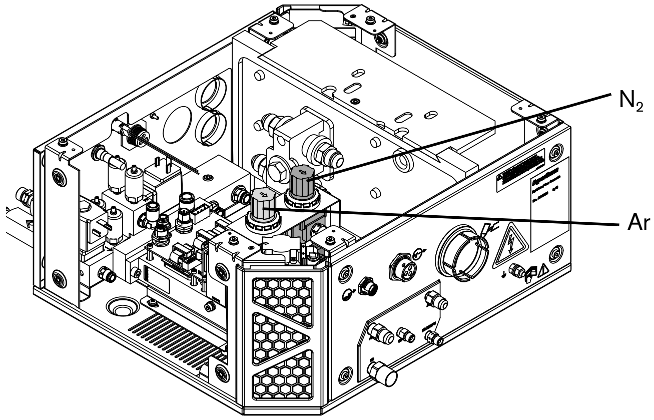
It can be necessary to adjust the regulators, if the following conditions occur:

- N_2 shield inlet (P4) pressure is above 7.5 bar (110 psi) or below 6.2 bar (90 psi)
- Ar shield inlet (P4) pressure is above 7.5 bar (110 psi) or below 6.2 bar (90 psi)

Follow these steps to adjust the N_2 regulator

1. Install 1 of the following sets of consumables:
   - 300 A O_2/Air
   - 300 A N_2/N_2
   - 300 A Mix/N_2
   - 170 A O_2/Air
   - 170 A N_2/N_2
   - 170 A Mix/N_2
2. Use the XPR web interface to choose 1 of the following processes:
   - 2100 for 300 A N_2/N_2 aluminum or stainless steel
   - 2057 for 170 A N_2/N_2 aluminum or stainless steel
3. Remove the cover from OptiMix gas connect console.

4. Pull up the N_2 regulator knob so the orange indicator is visible.



5. Go to **Gas System** in the XPR web interface.

6. Choose **TEST PREFLOW**.

7. While the gas flows, adjust the regulator until the shield inlet sensor (P4) on the XPR web interface is 6.9 bar (100 psi).

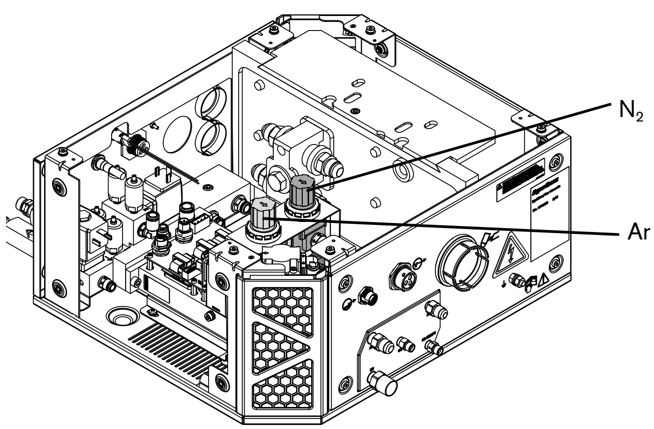
Follow these steps to adjust the Ar regulator

1. Install 1 of the following sets of consumables:
   - 300 A O_2/Air
   - 170 A O_2/Air

2. Use the XPR web interface to choose 1 of the following processes:
   - 1205 for O_2/N_2 mild steel
   - 1157 for O_2/Air (Ar pierce assist) mild steel

3. Remove the cover for OptiMix gas connect console.

4. Pull up the Ar regulator knob so the orange indicator is visible.



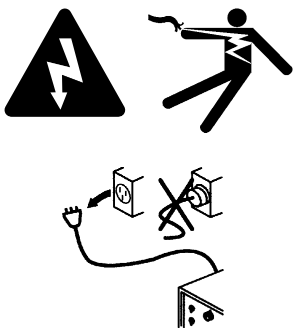
5. Go to **Gas System** in the XPR web interface.

6. Choose **TEST PIERCEFLOW**.

7. While the gas flows, adjust the regulator until the shield inlet sensor (P4) on the web interface is 6.9 bar (100 psi).

Pressure transducer diagnostic codes (706 – 715)

WARNING



ELECTRIC SHOCK CAN KILL

Disconnect electrical power before doing troubleshooting or diagnostic work.

All work requiring removal of the plasma power supply outer cover or panels must be done by a qualified technician.

Refer to the *Safety and Compliance Manual* (80669C) for more safety information.

1. Remove the power from the cutting system. Refer to Remove the power from the cutting system on page 244.

2. Examine the pressure transducer that is referenced in the diagnostic code. For example, if the code references “P1-TCC,” examine the P1 pressure transducer for the torch connect console, or if the code references “P6-GCC,” examine the P6 pressure transducer for the gas connect console.

3. Make sure that the pressure transducer is plugged in correctly on the following PCBs:
   - Torch connect console control PCB
   - Gas connect console control PCB

4. Re-install the pressure transducer if any incorrect connections are found.

5. If you find damage, replace the damaged control PCB.

6. Replace the pressure transducer.

7. If you cannot find or resolve the problem with these corrective actions, contact your cutting machine supplier or regional Hypertherm Technical Service team.

Gas inlet pressure codes (768 – 771)

WARNING

ELECTRIC SHOCK CAN KILL

The plasma power supply contains dangerous electric voltages that can seriously injure or kill you.

Even if the plasma power supply is turned OFF, you can still get a serious electric shock if the plasma power supply remains connected to an electric power source.

Use extreme caution if you do diagnosis or maintenance tasks when the plasma power supply remains connected to an electric power source and the outer cover or panels are removed.

WARNING

ELECTRIC SHOCK CAN KILL

Voltages at the terminal block and contactors can cause injury or death.

When the line-disconnect switch is in the ON position, there is line voltage at the contactor and the power distribution PCB.

Use extreme caution when you measure the primary power in these areas.

It is necessary for the cutting system to have electric power to verify gas inlet pressures. **Use extreme caution if you do diagnosis or maintenance tasks when the plasma power supply remains connected to electricity and the panels on the plasma power supply are removed.**

Gas pressure drops are more likely to occur if the supply gas hoses are long. Refer to Configuration with Core gas connect console on page 81, Configuration with CorePlus gas connect console on page 82, and Configuration with VWI or OptiMix gas connect console on page 83.

1. Use the CNC or XPR web interface to select Test Cutflow to start the gas flow.

2. Make sure that the gas inlet pressures are within the acceptable range. Refer to Process gas requirements (Core, CorePlus, VWI, and OptiMix gas connect consoles) on page 44.

3. If the gas inlet pressure is not within the acceptable range, adjust it

   a. Use a 2-stage regulator that can delivery the necessary gas flow and can maintain consistent gas pressure with high-pressure gas cylinders.

   b. Review the diagnostic code history for previous pressure-related codes that can indicate where to look for flow or pressure problems.

c. If you identify a code for a pressure transducer (P1 or P2), exchange the transducers. See if the code follows the transducer change. Replace the bad transducer if necessary. For instructions, refer to “Replace a pressure transducer” in the *XPR Replacement Parts Procedures Field Service Bulletin* (809970).

4. If you have a cutting system equipped with a OptiMix gas connect console, refer to Process-gas inlet pressure in the torch connect console diagnostic codes (702, 705, 769, 770) for OptiMix-equipped cutting systems on page 338.

5. If you have a Core, CorePlus, or VWI gas connect console, or if the code continues, or if you cannot find or resolve the problem with these corrective actions, contact your cutting machine supplier or regional Hypertherm Technical Service team.

NOTICE

RUST IN GAS CYLINDERS CAN GET INTO THE GAS LINE

Rust can collect at the bottom of gas cylinders. If the rust mixes with the gas, it can get into the gas line and decrease cut quality and performance.

When you move gas cylinders, make sure that you do not put them on their side, roll, or shake them.

How to do a gas leak test

NOTICE

INCORRECT GAS PRESSURES CAN CAUSE BAD PERFORMANCE

Gas leaks or pressure and flow rates that are outside of recommended ranges can:

- Cause problems with system performance
- Result in bad cut quality
- Shorten the life of consumables

If the quality of the gas is bad or if the pressure setting is incorrect, it can decrease:

- Cut quality
- Cut speed
- Cut thickness capabilities

WARNING

OXYGEN GAS CAN CAUSE A FIRE HAZARD

If you use oxygen as the plasma gas for cutting, it can cause a potential fire hazard due to the oxygen-enriched atmosphere that collects.

Hypertherm recommends that you install an exhaust ventilation system to remove the oxygen-enriched atmosphere that can collect when oxygen is used as the plasma gas for cutting. A fire can occur if oxygen is not removed.

Flashback arrestors are REQUIRED to stop the spread of fire to the supply gases (unless a flashback arrestor is not available for a specific gas or pressure).

As an installer or user, you must supply the exhaust ventilation and flashback arrestors for your cutting system. You can get them from your cutting machine supplier.

HYDROGEN GAS CAN CAUSE AN EXPLOSION OR FIRE

Hydrogen is a flammable gas that can cause an explosion or fire. Keep flames away from cylinders and hoses that contain hydrogen. Keep flames and sparks away from the torch when using hydrogen as a plasma gas.

Consult your local safety, fire, and building code requirements for the storage and use of hydrogen.

Hypertherm recommends that you install an exhaust ventilation system to remove the hydrogen-enriched atmosphere that can collect when hydrogen is used as the plasma gas for cutting. An explosion or fire can occur if hydrogen is not removed.

Flashback arrestors are REQUIRED to stop the spread of fire to the supply gases (unless a flashback arrestor is not available for a specific gas or pressure).

As an installer or user, you must supply the exhaust ventilation and flashback arrestors for your cutting system. You can get them from your cutting machine supplier.

With revision U (or later) of the XPR firmware, you can do a gas leak test with all gas connect consoles, including Core and CorePlus. With a firmware version before revision U, you can do gas leak tests only with VWI and OptiMix consoles.

Refer to Table 8 on page 44 for the recommended pressure and flow rates.

If you suspect a cutting system gas leak:

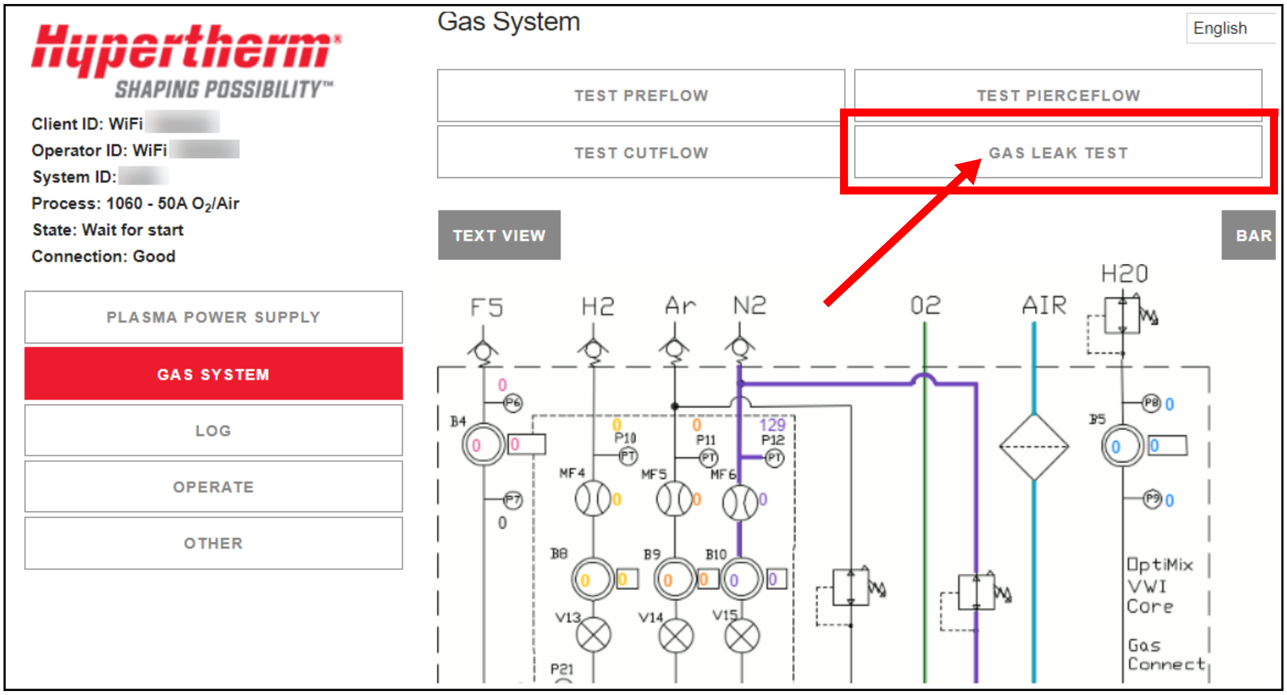
1. Use the CNC screen or XPR web interface to select the command to do an automated gas leak test. Test results and information will appear in the error log.

   For information about how to do this, see the instruction manual that came with your CNC.

2. See the error log for information and guidance about how to diagnose or troubleshoot a possible gas leak.

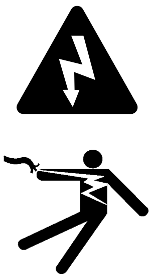
In the XPR web interface, select **GAS LEAK TEST** to start the test. Refer Figure 67. The button becomes active, indicated with a red highlight. The active valves are indicated with a gray highlight. The gases shown on Line A, Line B, and shield are different depending on the process ID that you selected. The gases flow for 60 seconds unless you choose the same button or choose another button that interrupts the test.

Figure 67 – GAS LEAK TEST in the XPR web interface



How to measure coolant flow

⚠ WARNING



ELECTRIC SHOCK CAN KILL

The plasma power supply contains dangerous electric voltages that can seriously injure or kill you.

Even if the plasma power supply is turned OFF, you can still get a serious electric shock if the plasma power supply remains connected to an electric power source.

Use extreme caution if you do diagnosis or maintenance tasks when the plasma power supply remains connected to an electric power source and the outer cover or panels are removed.

It is necessary for power to be supplied to the cutting system to measure coolant flow. **Use extreme caution if you do diagnosis or maintenance tasks when the plasma power supply remains connected to electric power.**

Use the CNC or XPR web interface

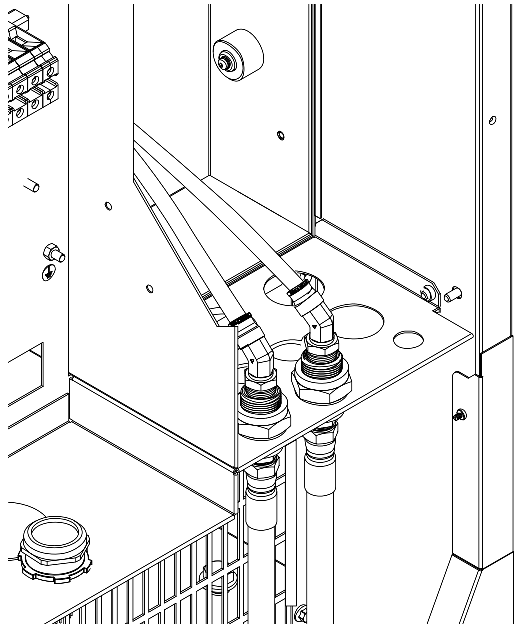
1. Look at the CNC or XPR web interface to identify the coolant flow rate.
2. Make sure that the coolant flow rate is above 3.79 L/min (1 gal/min).

   If the flow rate is outside of the correct range, an internal obstruction or leak can be the cause.

Do a container test

1. Obtain an empty container that has a capacity of at least 3.79 liters (1 US gallon) and volume measurements, if possible.
2. Remove the power from the cutting system. Refer to Remove the power from the cutting system on page 244.

3. Disconnect the coolant return hose (red) from the coolant return fitting (red) inside the rear of the plasma power supply. Use the container to catch coolant leaks if needed, but empty it before you start the test



4. Put the end of the coolant return hose into the container.

5. Restore electrical power to the cutting system.

6. Send a process to the cutting system.

7. When you hear the coolant pump turn ON, begin a 30-second count while coolant flows into the container.

8. After 30 seconds look at the amount of coolant in the container. It should be at least 1.89 liters (0.5 US gallon).

9. If the flow rate is outside of the correct range, an internal obstruction or leak can be the cause.

10. If you find obstructions, remove them. Replace damaged parts if found.

11. If coolant flow remains slow, and it has been more than 6 months since the last coolant replacement, replace the coolant. Refer to Replace all of the coolant on page 258.

    Hypertherm recommends coolant replacement every 6 months. For complete preventive maintenance information, refer to the *XPR Preventive Maintenance Program (PMP) Instruction Manual* (809490).

12. If coolant flow remains slow after replacement, verify that the following function and components are good:

    - Bypass is working
    - Coolant pump motor

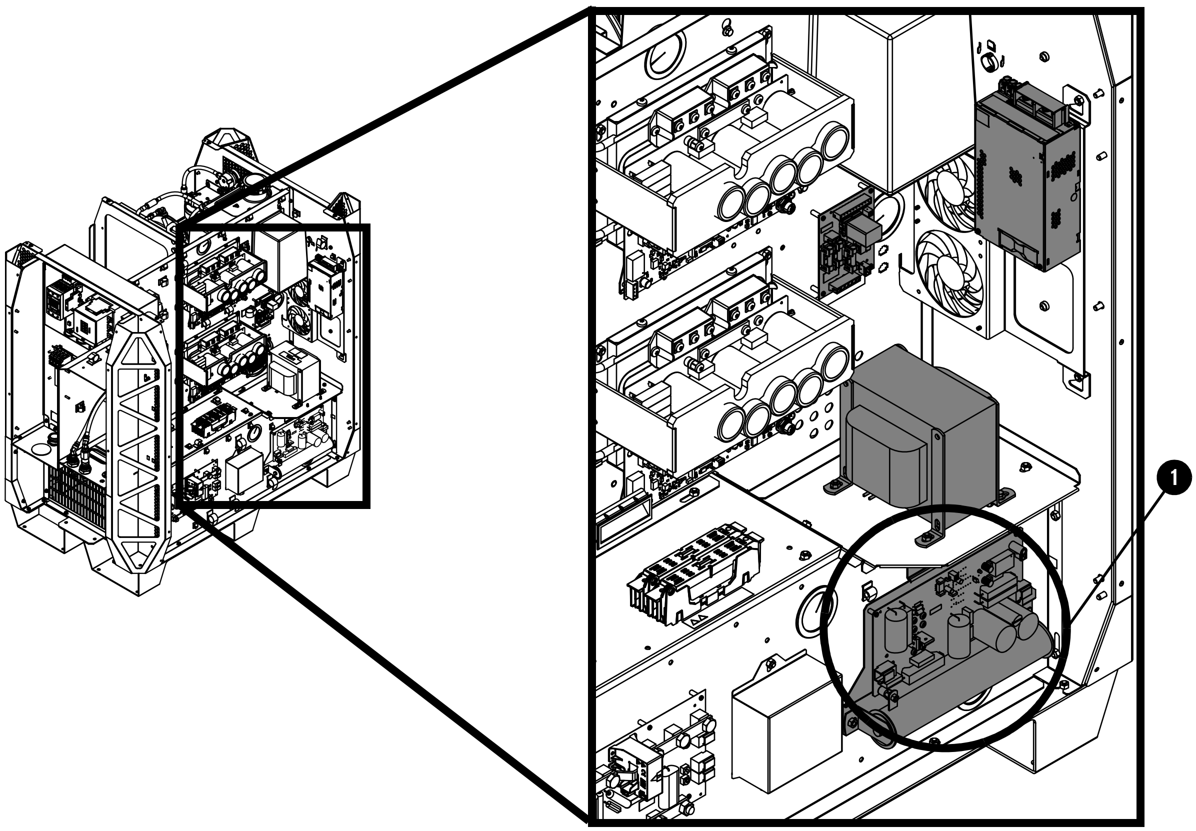
- Consumables and torch
- Coolant check valve

13. If you cannot find or resolve the problem with these corrective actions, contact your cutting machine supplier or regional Hypertherm Technical Service team.

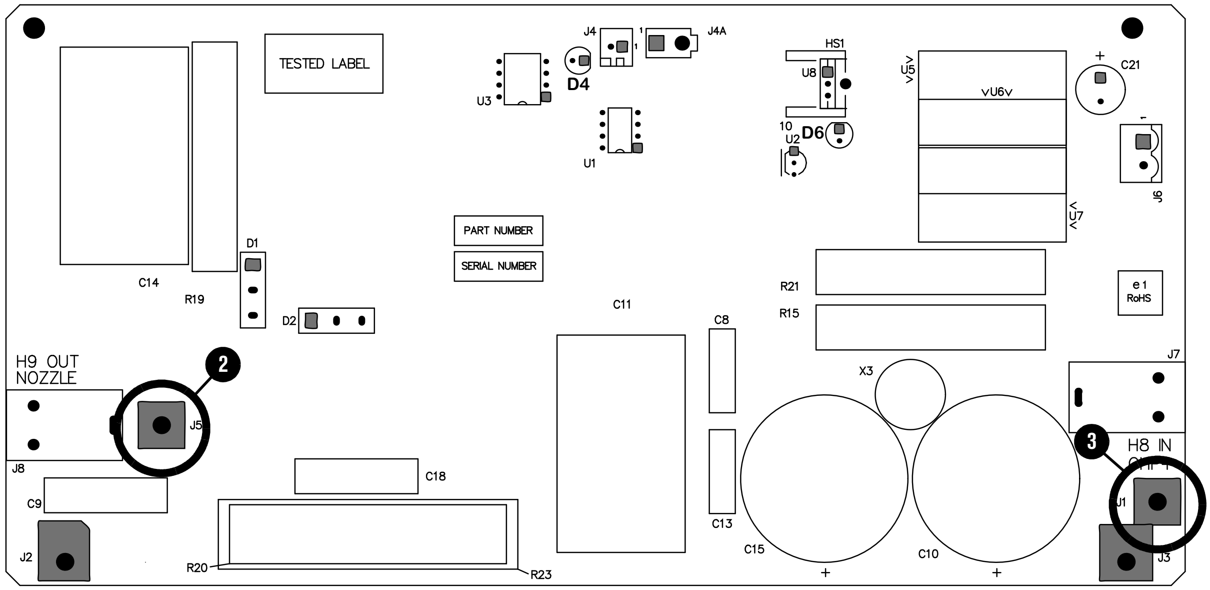
How to test continuity between the nozzle and workpiece

1. Remove the power from the cutting system. Refer to Remove the power from the cutting system on page 244.

2. Locate the start-circuit assembly PCB 4 ❶.



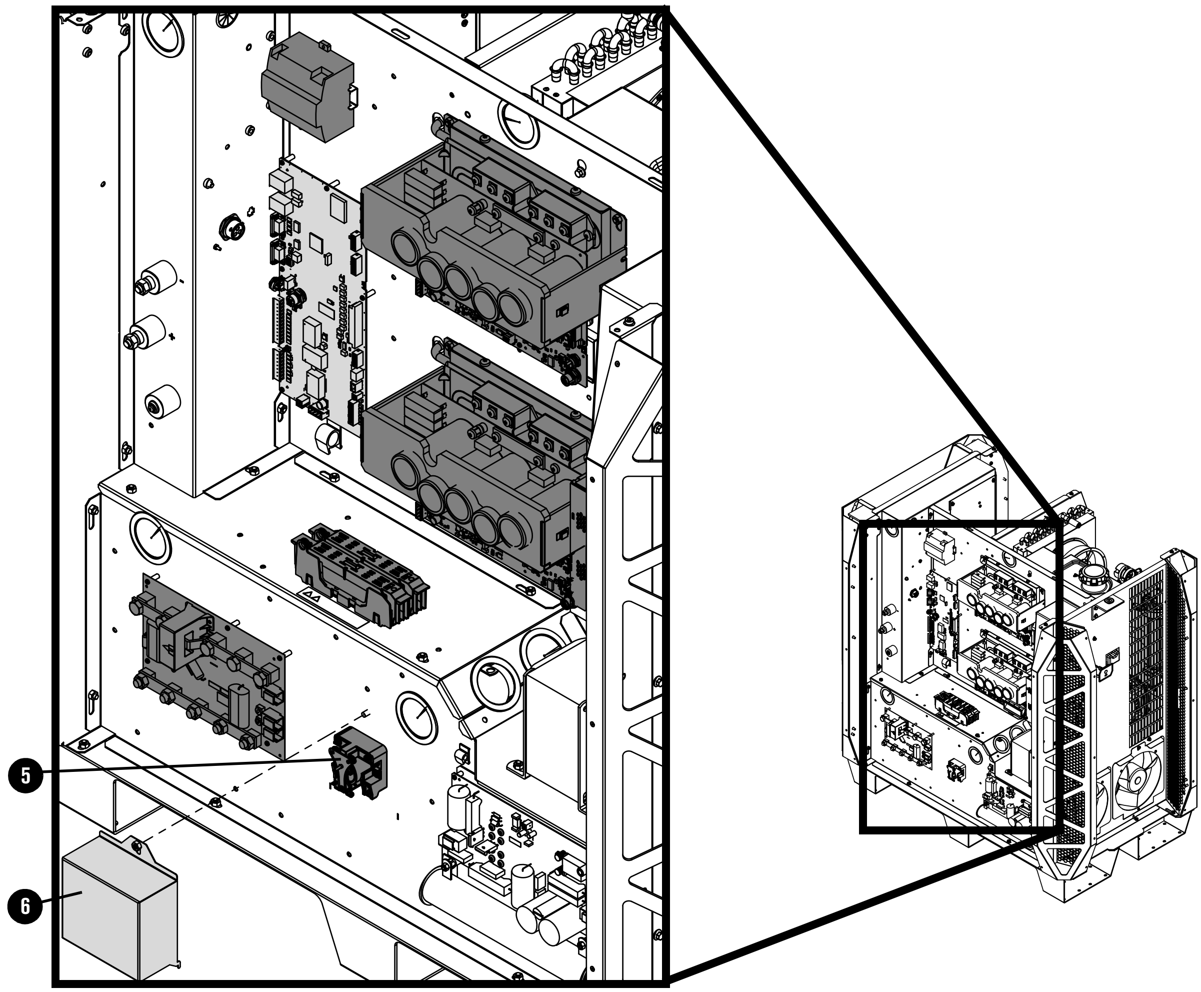
3. Install a temporary jumper wire between J5 (nozzle) 2 and J1 (work) 3 on the start circuit PCB 4 (141360).



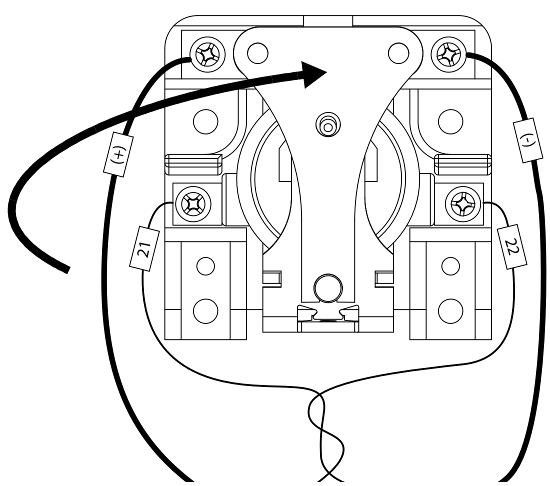
NOTICE

Never fire an arc when a temporary jumper wire is installed on the PCB. Sparking and damage to the PCB can occur.

4. Locate the pilot arc relay (CR 1) ❹ and remove the dust cover ❺.



5. Have a second person close (push in) the contact on the pilot arc relay.



6. Measure the ohms between the nozzle and the workpiece. Less than 3 ohms is good. A value greater than 3 ohms indicates a faulty connection between the torch and ignition console, or between the ignition console and the power supply, or between the power supply work lead and workpiece.

7. Examine the work lead. Replace it if you find damage or excess wear.

8. Examine the pilot arc circuit (plasma power supply to gas connect console, to torch connect console, to torch receptacle).

   a. If the pilot arc wire is damaged, replace the damaged item.

   b. If the pilot arc wire is not damaged, replace the torch and receptacle.

9. Release the pilot arc relay and measure the ohms between the nozzle and workpiece. The acceptable range is 9,000 – 11,000 ohms. If the ohms value is low (approximately 5,000 ohms or less), examine the pilot arc circuit (power supply to gas connect console, to torch connect console, to torch receptacle). Look for insulation damage and short circuits to ground.

How to measure resistance from thermistors

1. Use a digital multimeter to measure the resistance from each thermistor wire, based on the following connector-pin locations:

Thermistor location	Location of thermistor wires/connector	1st connector pin	2nd connector pin
Inductor 1A	PCB 1	J1.4 pin 3	J1.4 pin 4
Inductor 1B	PCB 1	J1.4 pin 5	J1.4 pin 6
Inductor 2A	PCB 1	J1.4 pin 7	J1.4 pin 8
Inductor 2B	PCB 1	J1.2 pin 1	J1.2 pin 2
Transformer	PCB 1	J1.4 pin 1	J1.4 pin 2
Chopper 1	PCB 2	J9 pin 1	J9 pin 2
Chopper 2	PCB 3	J9 pin 1	J9 pin 2
Coolant temperature	PCB 1	J1.2 pin 7	J1.2 pin 8

2. Look for a resistance value that is outside of the minimum or maximum in Table 40:

Table 40 – Minimum and maximum ohmic resistance values for thermistors

Thermistor temperature	Minimum resistance (Ohms)	Maximum resistance (Ohms)
25°C (77°F)	9,000	11,000
35°C (95°F)	5,000	7,000
45°C (113°F)	3,900	4,900
55°C (131°F)	2,500	3,500
65°C (149°F)	1,500	2,500
75°C (167°F)	1,000	2,000
85°C (185°F)	750	1,250
95°C (203°F)	600	1,000
105°C (221°F)	400	800
115°C (239°F)	300	600
125°C (257°F)	200	500
135°C (275°F)	150	400
145°C (293°F)	150	250
155°C (311°F)	125	225
165°C (329°F)	100	175

At approximately 25°C (77°F), you can expect a resistance of approximately 10,000 ohms.

3. If the resistance is above the maximum value, contact your cutting machine supplier or regional Hypertherm Technical Service team. They can help you to decide if there is a wiring fault or if thermistor replacement is necessary.

4. If the resistance is at or near 0 ohms:

   a. Inspect the wiring between each thermistor and its connector pins.

   b. Look for shorts between wires or to the ground.

5. If the resistance is within range, continue cutting system operation.

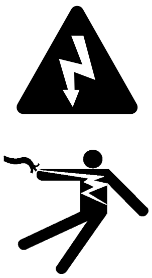
6. If the resistance remains below the minimum ohmic value or does not change after you allow the coolant to reach 85°C (185°F) or below, contact your cutting machine supplier or Hypertherm Technical Service team.

7. If the thermistor resistance is within range when the thermistor is disconnected from the control PCB and the code continues when the thermistor is reconnected to the control PCB, contact your cutting machine supplier or regional Hypertherm Technical Service team. They can help you decide if control PCB replacement is necessary. Refer to Plasma power supply control PCB (141322) on page 357.

8. If the code continues, or if you cannot find or resolve the problem with these corrective actions, contact your cutting machine supplier or regional Hypertherm Technical Service team.

How to do an ohmic-contact test

WARNING



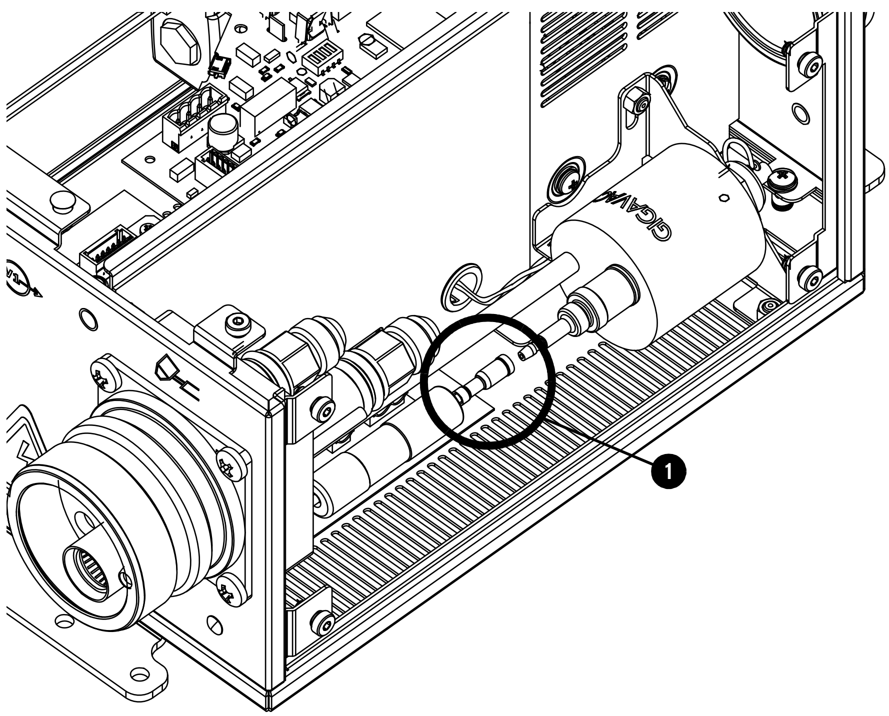
ELECTRIC SHOCK CAN KILL

When the line-disconnect switch is in the ON position, there is line voltage throughout the cutting system.

Voltages in the cutting system can cause serious electric shock. Electric shock can seriously injure or kill you.

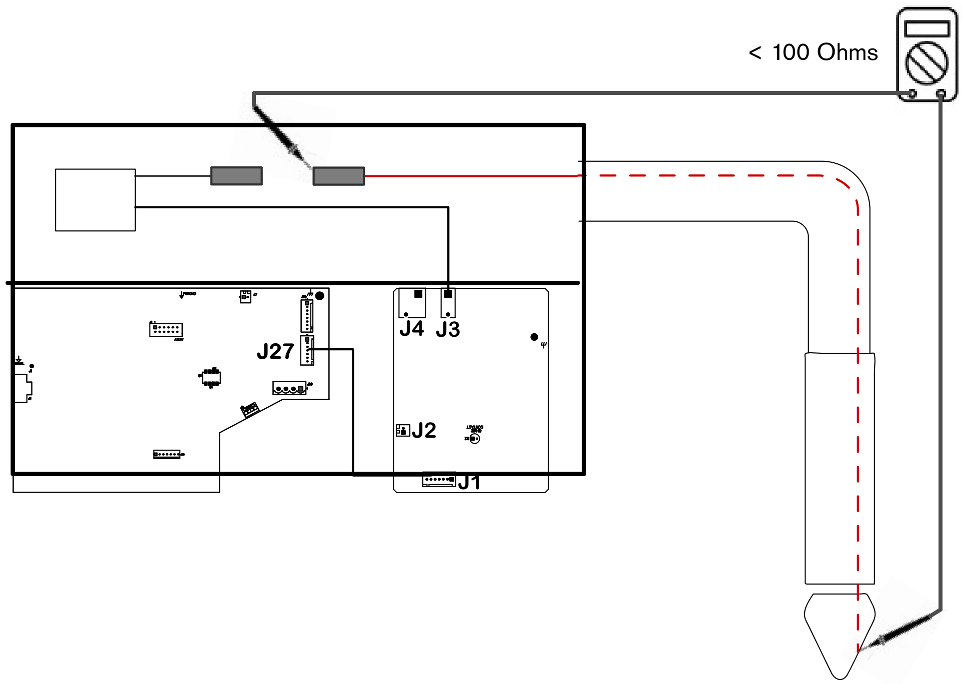
Use extreme caution if you do diagnosis or maintenance tasks when the line-disconnect switch is in the ON position.

1. Remove the power from the cutting system. Refer to Remove the power from the cutting system on page 244.
2. Examine the J2 connector on the ohmic contact PCB. Make sure that the ohmic relay coil is connected. Reconnect or tighten the ohmic relay coil if needed.
3. Disconnect the ohmic relay connector to access the bullet connector 1 on the torch receptacle block-side located inside the torch connect console.



4. Use a digital multimeter to measure the resistance from the torch tip to the ohmic relay. Refer to Figure 68 on page 353.

Figure 68 – Measure the resistance from the torch tip to the ohmic relay



   a. If the resistance is infinite (open), replace the torch lead.

   b. If the resistance is less than 100 Ohms, continue with step 5.

5. Reconnect the ohmic relay connector.

6. Examine the ohmic contact PCB. Refer to Torch connect console ohmic PCB (141368) on page 365.

   a. If configured for internal ohmic, make sure that the ohmic wire from the ohmic relay is connected to J3.

   b. If configured for external ohmic, make sure that the ohmic wire from the ohmic relay is connected to J4 pin 2 and that the ohmic wire from the lifter is connected to J4 pin 1.

   c. Adjust or tighten connections, if needed, then continue with step 7.

7. Supply electrical power to the cutting system.

8. Make sure that the torch is **not** touching the workpiece.

9. Use a digital multimeter to look for 24 VDC between the workpiece, or chassis ground, and the torch tip (J3 or J4).

10. If there is no 24 VDC, examine the wiring to the ohmic PCB (141368). Make sure that the J3 or J4 connector is not clamped onto the wire insulation and that the connection between the J2 or J2A connector and the relay coil is good.

    If the connections are good but there is no 24 VDC, contact your cutting machine supplier or regional Hypertherm Technical Service Team.

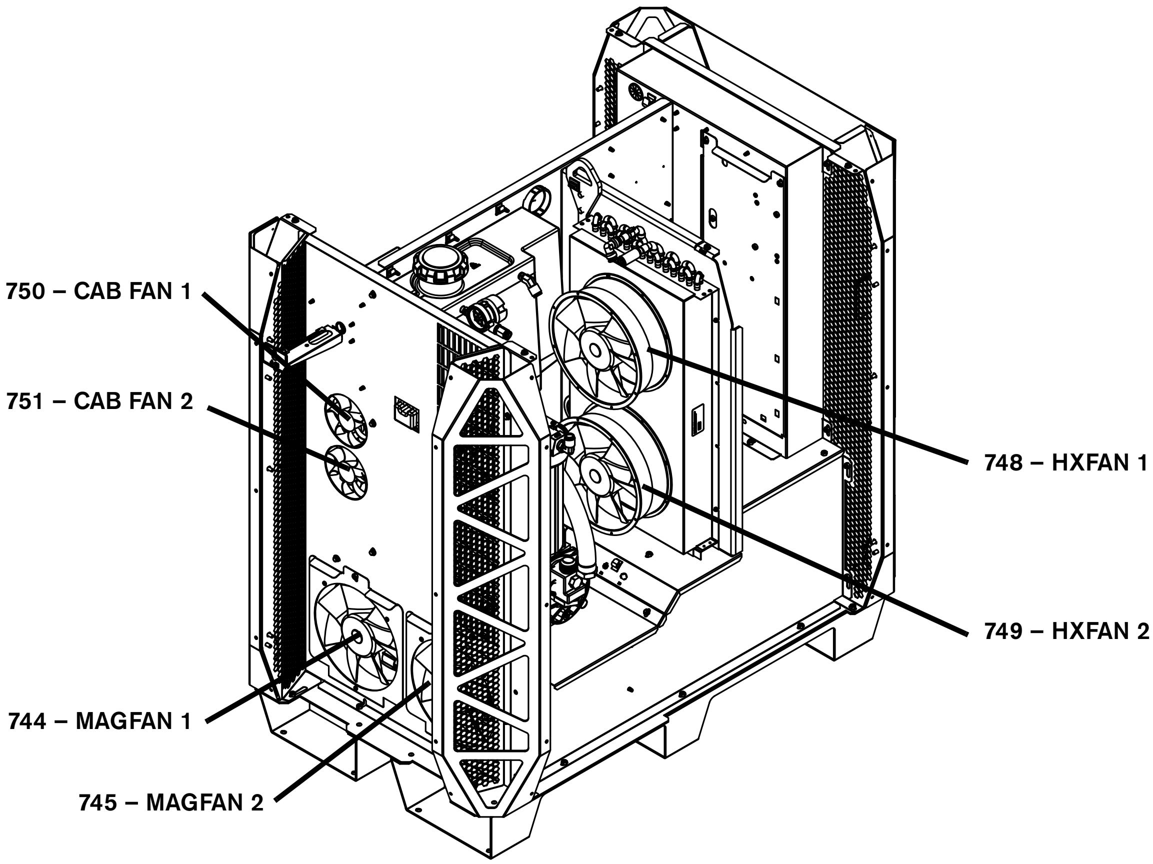
11. If you find 24 VDC, continue with the following steps:
    a. Make sure that both the workpiece and the torch connect console are grounded in the same location.
    b. Touch the torch tip to the workpiece or attach a jumper wire between the torch tip and the chassis ground.
    c. Examine LED D2 on the ohmic contact PCB. Refer to Torch connect console ohmic PCB (141368) on page 365.
    d. Examine LED D15 on the control PCB. Refer to Torch connect console control PCB (141334) on page 366.
    e. Make sure that LED D2 and D15 both illuminate.
    f. If both LEDs illuminate, make sure that the CNC is receiving ohmic contact signals from the cutting system or torch height controller.

       If receiving ohmic contact signals, refer to the instruction manual that came with your CNC for troubleshooting recommendations.

    g. If LED D2 is not illuminated, replace the ohmic contact board (141368).
    h. If LED D2 is illuminated and D15 is not, examine the wiring harness between both boards. Look for loose wiring.
12. If the code continues, contact your cutting machine supplier or regional Hypertherm Technical Service Team.

Identify fan diagnostic codes

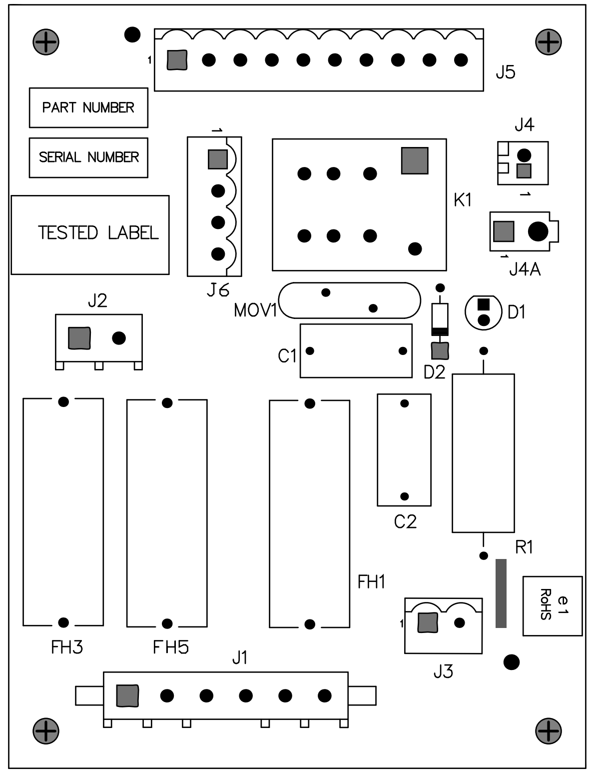
Figure 69 – Diagnostic code for each fan



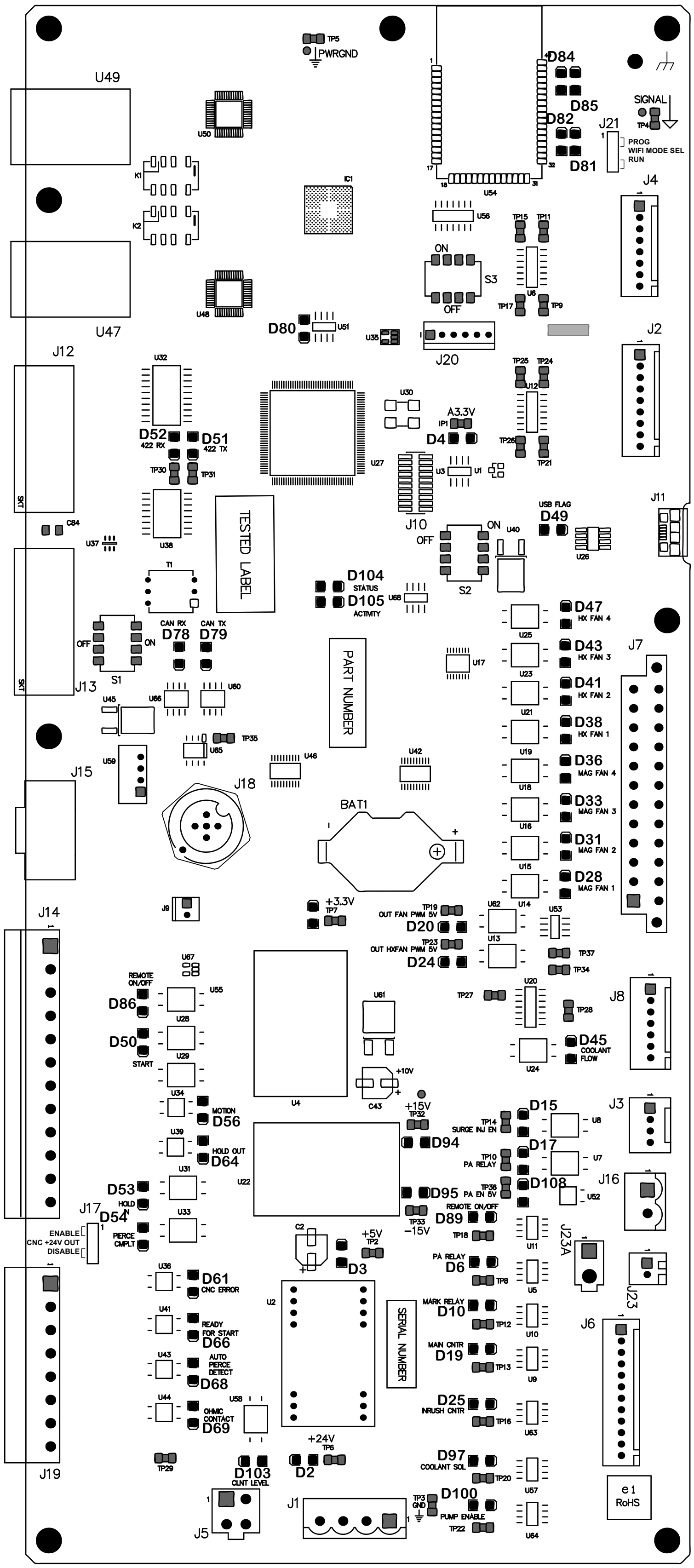
PCB information

Plasma power supply power distribution PCB (141425)

LED	Signal
D1	120 VAC



Plasma power supply control PCB (141322)



LED	Signal
D84	WiFi LED 1
D85	WiFi LED 2
D82	WiFi RX
D81	WiFi TX
D80	EtherCAT EEProm
D52	RS-422 RX
D51	RS-422 TX
D4	A3.3 V
D49	USB FLAG
D104	STATUS
D105	ACTIVITY
D78	CAN RX
D79	CAN TX
D47	CONTROL-SIDE FAN 2 FEEDBACK
D43	CONTROL-SIDE FAN 1 FEEDBACK
D41	HXFAN 2 FEEDBACK
D38	HXFAN 1 FEEDBACK
D31	MAGFAN 2 FEEDBACK
D28	MAGFAN 1 FEEDBACK
D5	+3.3 V
D20	MAGNETIC FANS ENABLE
D24	HEAT EXCHANGER FAN ENABLE
D45	COOLANT FLOW
D86	REMOTE ON-OFF

LED	Signal
D50	PLASMA START
D56	MOTION
D64	HOLD OUT
D53	HOLD IN
D54	PIERCE COMPLETE (shield pierceflow)
D61	CNC ERROR
D66	READY FOR START
D68	AUTO PIERCE DETECT
D69	OHMIC CONTACT OUTPUT
D15	SURGE INJ EN (UNUSED IN THIS SYSTEM)
D108	PILOT ARC ENABLE
D89	REMOTE ON-OFF RELAY ENABLE
D6	PILOT ARC RELAY
D10	MARK RELAY
D19	MAIN CONTACTOR
D25	INRUSH CONTACTOR
D97	COOLANT SOLENOID
D100	PUMP ENABLE
D94	+15 V
D95	-15 V
D3	+5 V
D2	+24 V
D103	COOLANT LEVEL

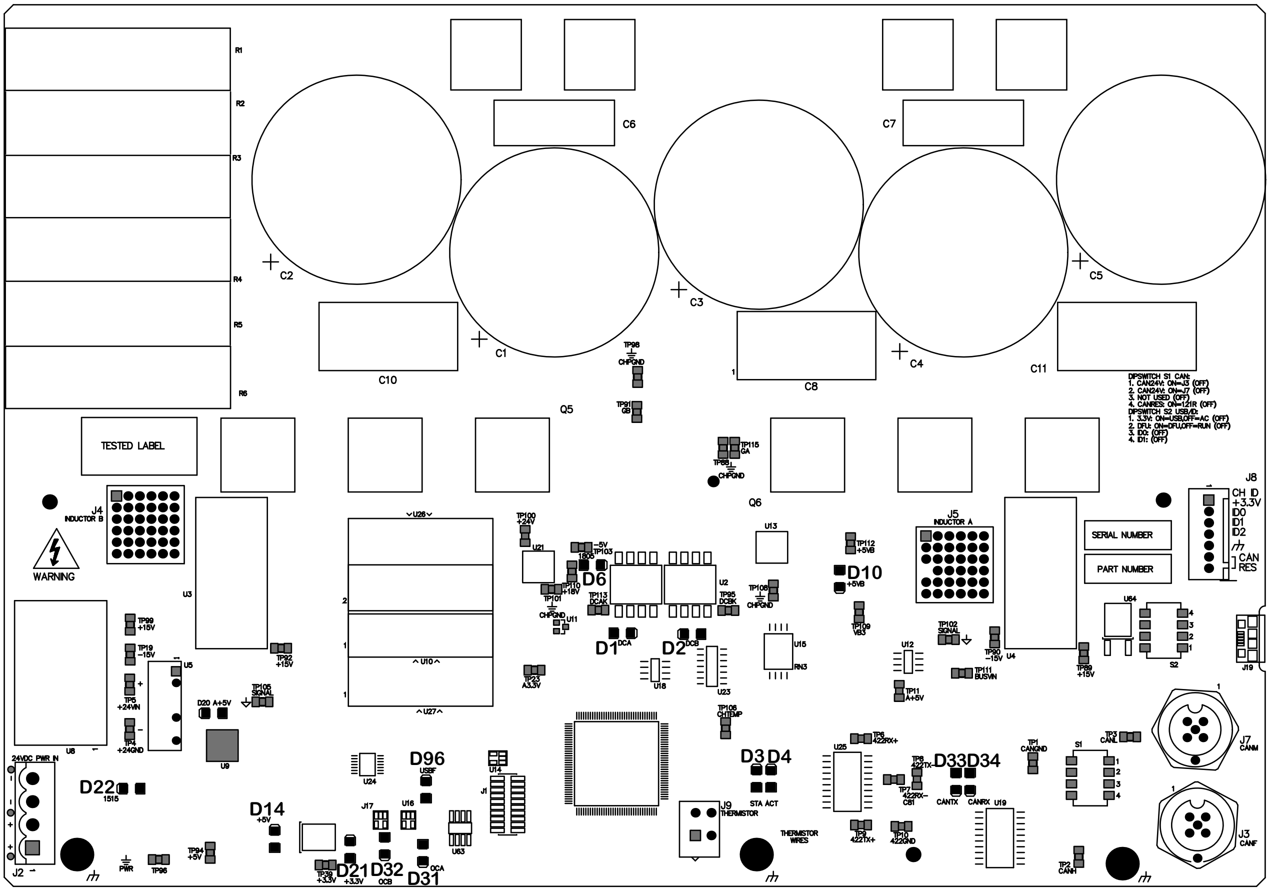
DIP switch positions

DIP switch 1 positions			
1	RS-422 RX termination	–	Default is ON
2	RS-422 TX termination	–	Default is OFF
3	Not used	–	Default is ON
4	CAN termination resistor	ON = 121 Ohms OFF = Open	Default is ON

DIP switch 2 positions			
1	Micro-controller DFU programming mode	ON = DFU OFF = Run	Default is OFF
2	3.3V logic power	ON = USB OTG OFF = Internal power supply	Default is OFF
3	RS-422 Serial ID0	–	Default is OFF
4	RS-422 Serial ID1	–	Default is OFF

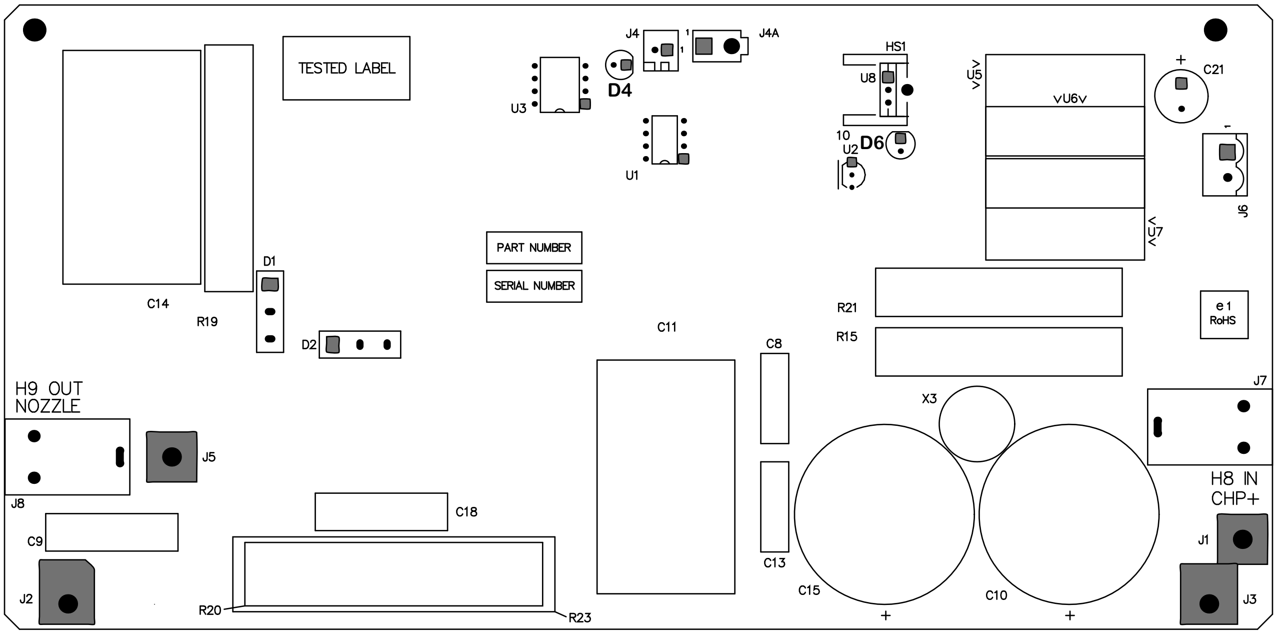
DIP switch 3 positions			
1	Wireless module programming	ON = Enabled OFF = Disabled	Default is OFF
2	Wireless module transmit:	ON = From micro-controller OFF = Disabled	Default is ON
3	Wireless module transmit	ON = From J20 programming connector OFF = Disabled	Default is OFF
4	Wireless enable	ON = Wireless disabled OFF = Wireless enabled	Default is OFF

Plasma power supply chopper PCB (141319)



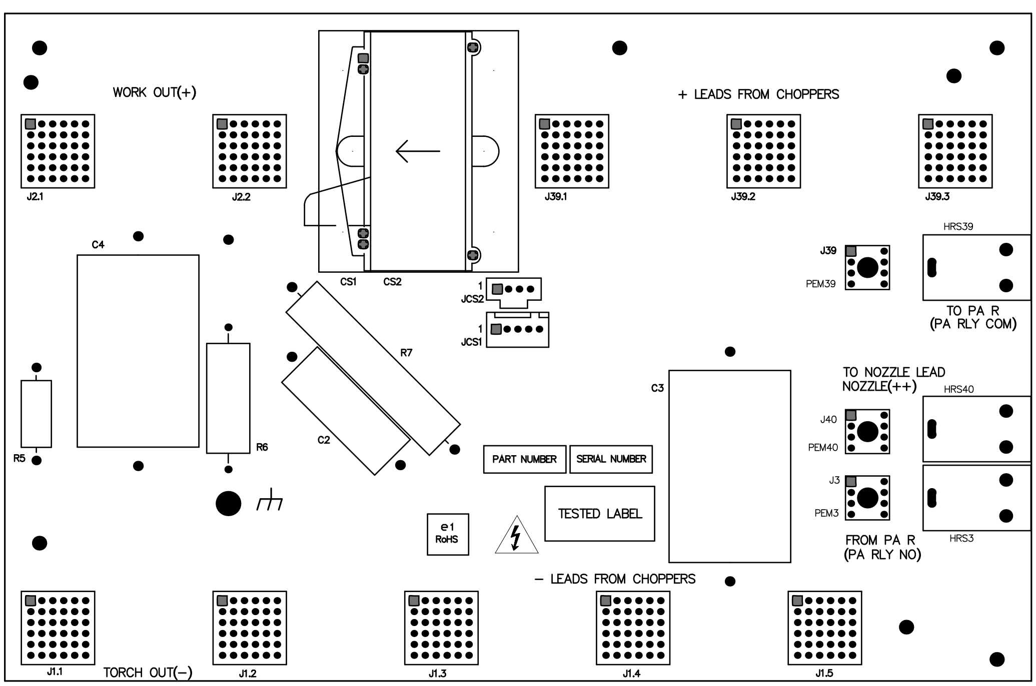
LED	Signal	LED	Signal
D22	+15V AND -15V POWER	D1	DCA
D14	+5 V	D2	DCB
D21	+3.3 V	D3	STATUS
D32	OVER CURRENT CHANNEL B	D4	ACTIVITY
D31	OVER CURRENT CHANNEL A	D10	+5VB
D96	USBFLAG	D33	CAN TX
D6	+18V AND -5V POWER	D34	CAN RX

Plasma power supply start circuit PCB (141360)

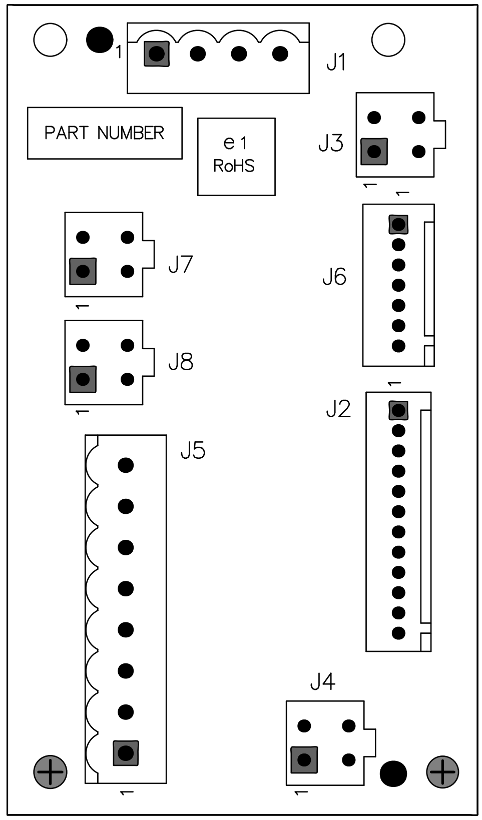


LED	Signal	LED	Signal
D4	PILOT ARC ENABLE	D6	+18V AND -5V POWER

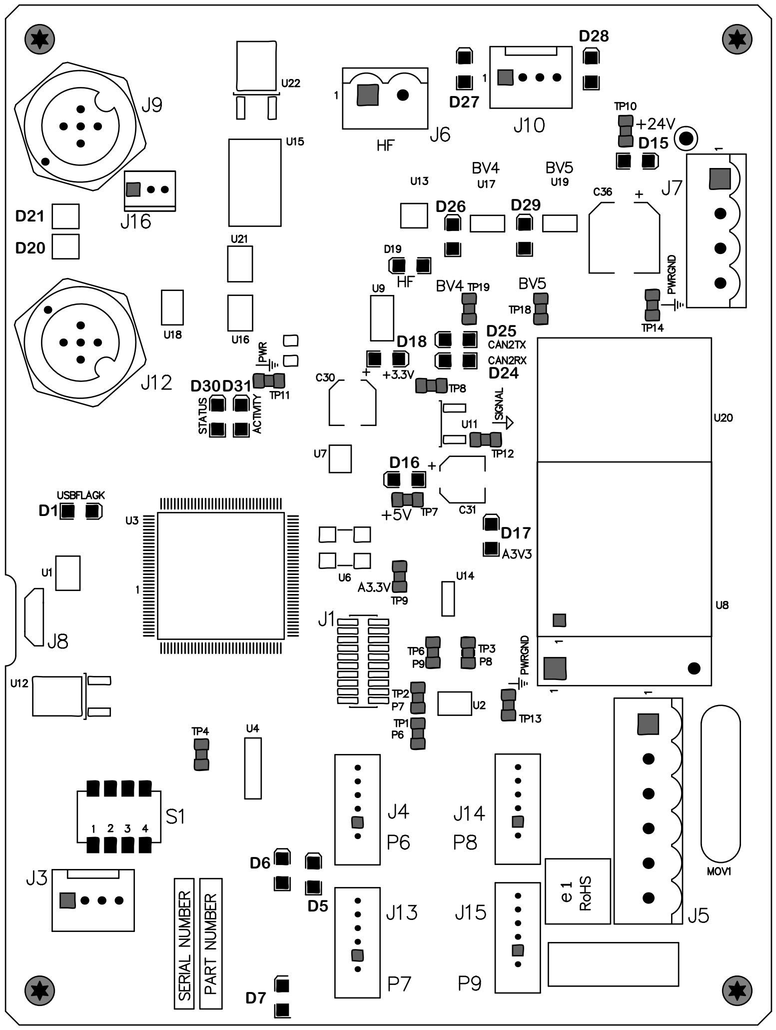
Plasma power supply I/O PCB (141371)



Plasma power supply fan power distribution PCB (141384)

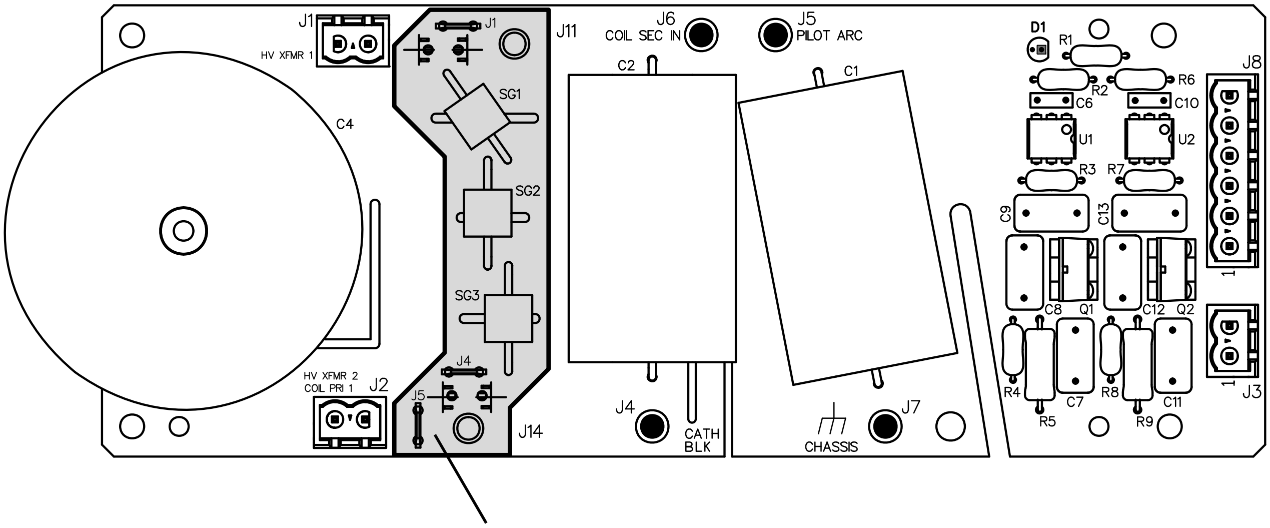


Gas connect console control PCB (141375)



LED	Signal	LED	Signal
D15	+24 V	D24	CAN RX
D29	B5	D30	Status
D26	B4	D31	Activity
D19	HF	D1	USBFLAG
D18	+3.3 V	D16	+5 V
D25	CAN TX	D17	A3.3

Gas connect console high frequency PCB (141563)

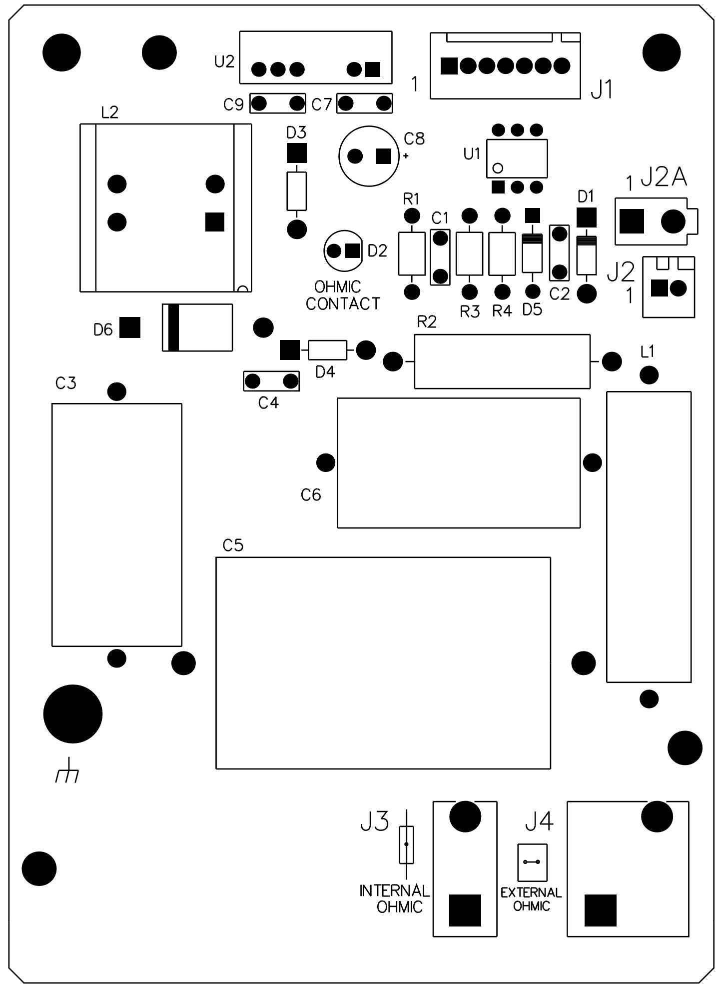


141595 – replaceable spark gap PCB

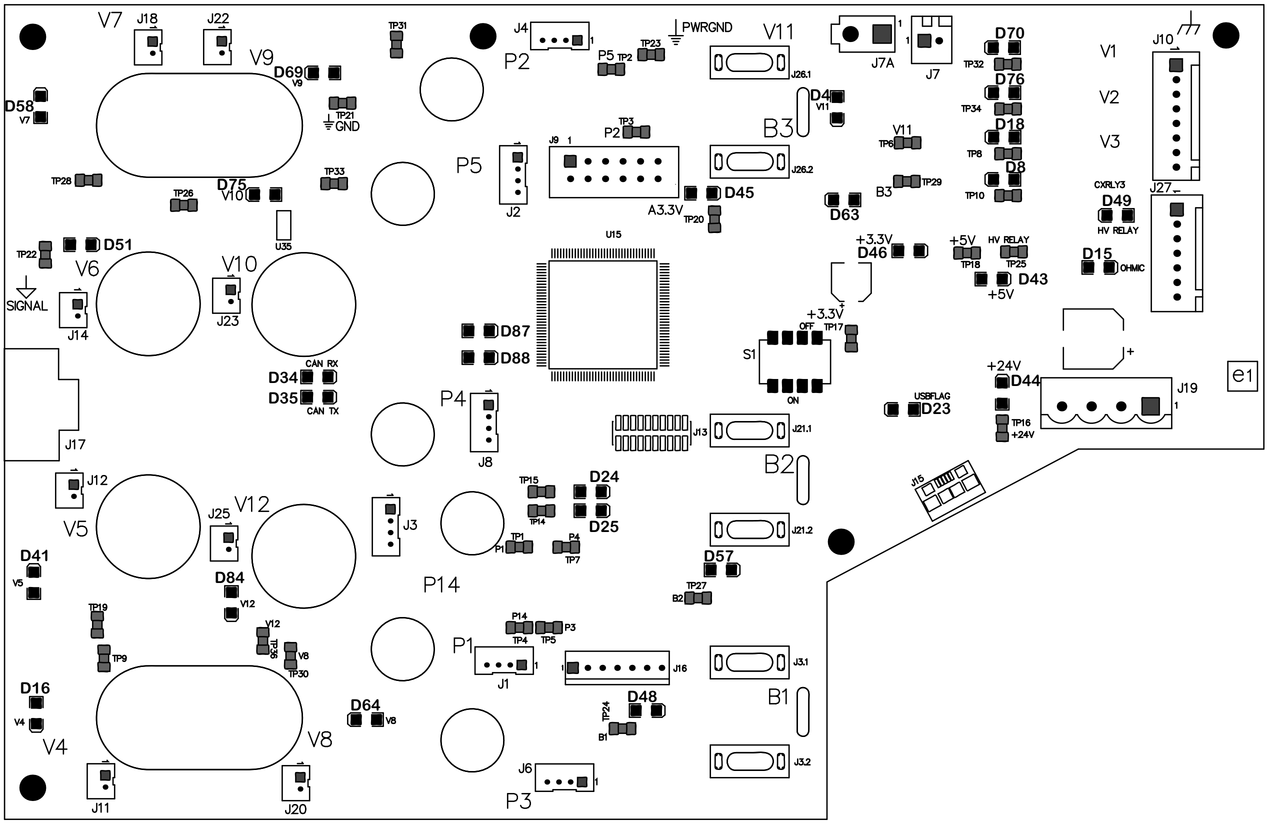
LED	Signal
D1	HIGH FREQUENCY ENABLE

Torch connect console ohmic PCB (141368)

LED	Signal
D2	Ohmic contact



Torch connect console control PCB (141334)

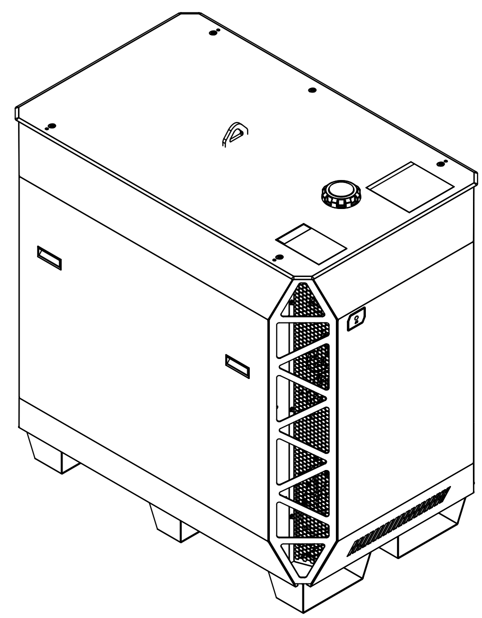


LED	Signal	LED	Signal
D58	V7	D87	STATUS LED
D69	V9	D88	ACTIVITY LED
D75	V10	D45	A3.3 V
D51	V6	D4	V11
D41	V5	D63	B3
D84	V12	D46	+3.3 V
D16	V4	D23	USB FLAG
D64	V8	D43	+5 V
D34	CAN RX	D44	+24 V
D35	CAN TX	D70	V1 TORCH VALVE
D48	B1	D76	V2 (NOT USED IN THIS SYSTEM)
D57	B2	D18	V3 (NOT USED IN THIS SYSTEM)
D49	HV RELAY	D8	(NOT USED IN THIS SYSTEM)
D15	OHMIC CONTACT		

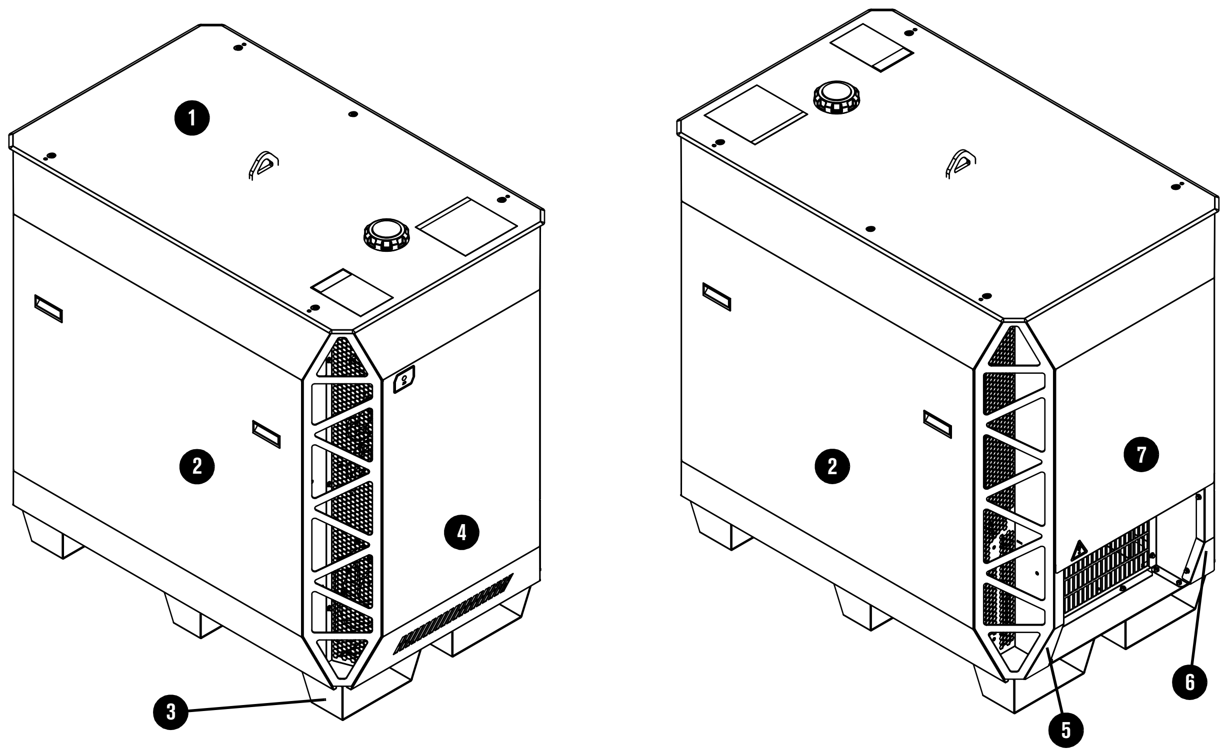
9 Parts List

Plasma power supply

Part number	Voltage (AC)
078620	200
078621	208
078622	220
078623	240
078624	380
078625	400
078626	415
078627	440
078628	480
078629	600

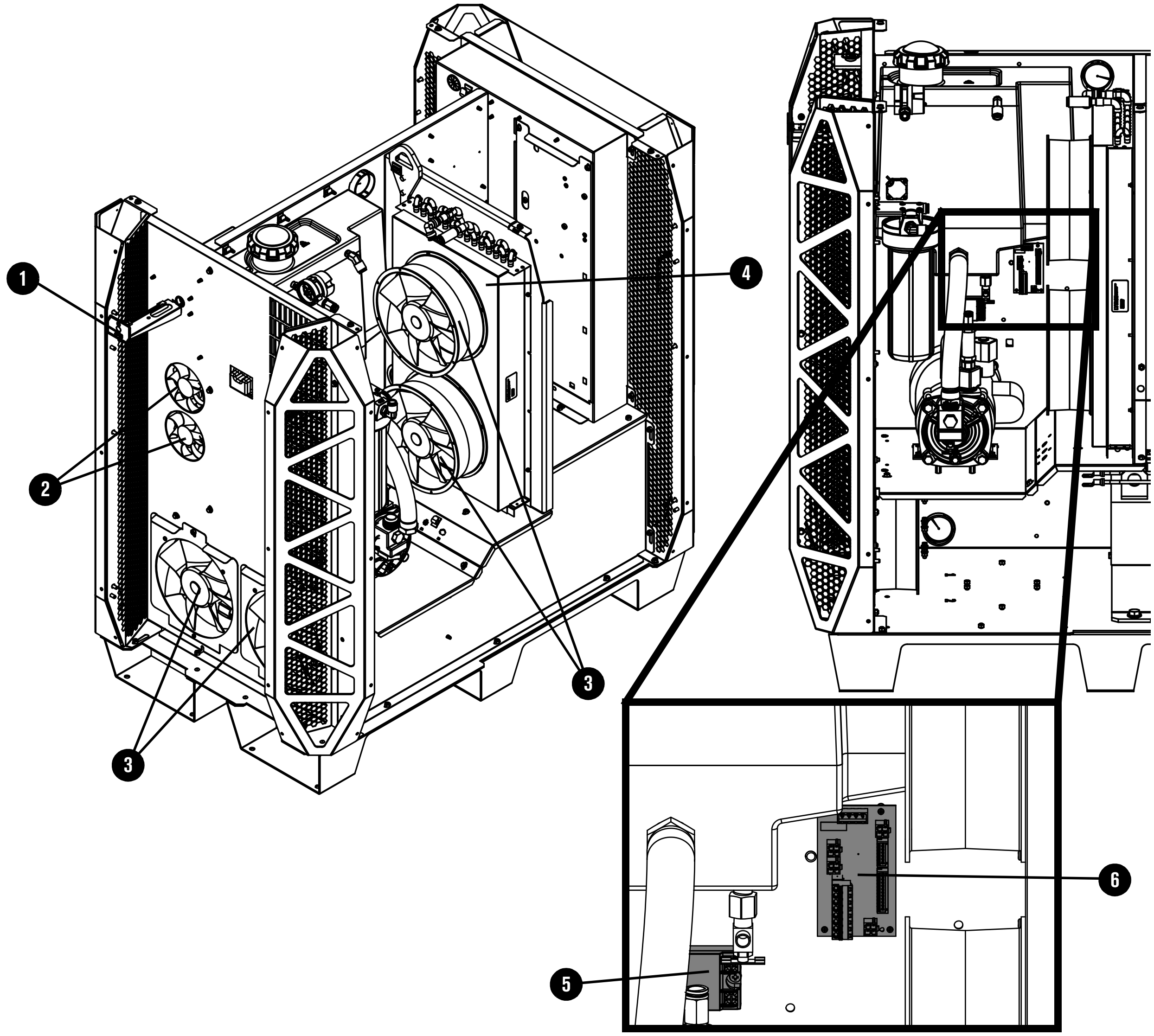


Outer panels



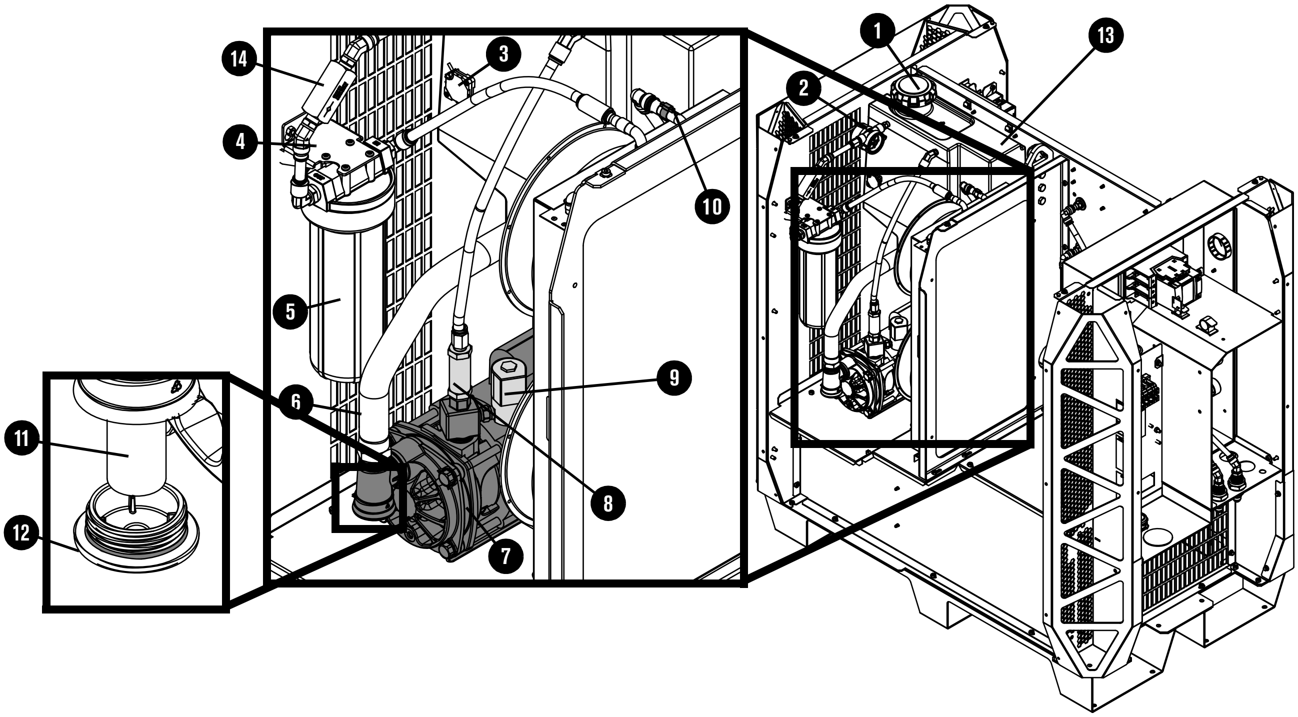
	Part number	Description	Quantity
1	428728	Top panel with labels	1
2	428727	Side panel with labels and handles	2
3	101300	Base	1
4	428725	Front panel with “H” (not shown) and power-indicator LED label	1
5	101314	Lower right (liquid-cooling) rear corner panel	1
6	101307	Lower left (control) rear corner panel	1
7	428726	Rear panel with label and handles	1

Fans



	Part number	Description	Designator	Quantity
1	429002	Power-indicator LED	–	1
2	229821	Fan: 292 cfm, 48 VDC,120 mm (4.7 inch) diameter	CAB FAN 1, CAB FAN 2	2
3	229822	Fan: 890 cfm, 48 VDC, 254 mm (10 inch) diameter	HXFAN 1, HXFAN 2, MAGFAN 1, MAGFAN 2	4
4	229717	Heat-exchanger only	–	1
5	003266	Solid state relay	–	1
6	141384	Fan power distribution PCB	PCB6	1

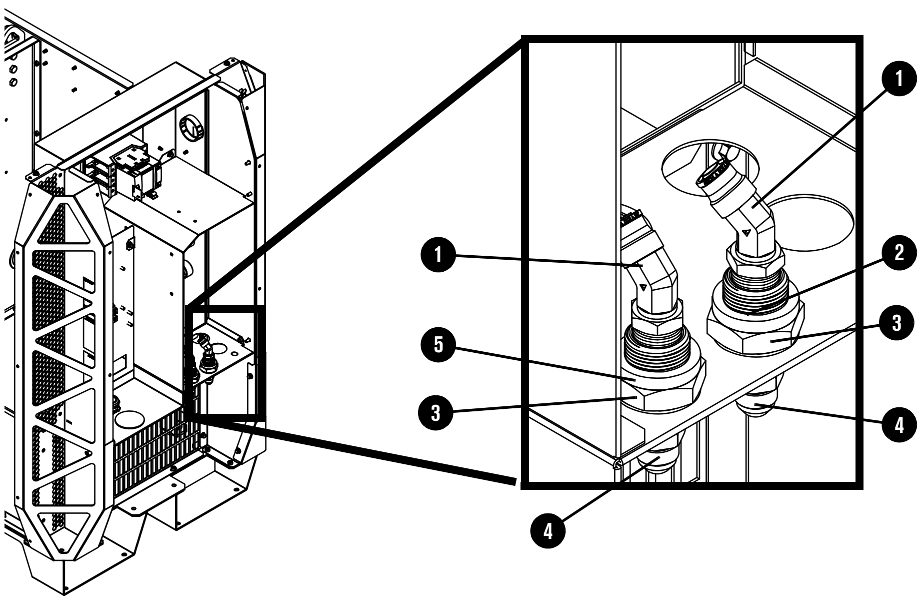
Coolant system



	Part number	Description	Quantity
1	127014	Coolant reservoir cap	1
2	229741	Coolant flow meter	1
3	229775	Coolant level sensor	1
4	101281	Coolant filter bracket	1
5	127344	Coolant filter housing	1
	027005	Coolant filter (fine)	1
	044554	O-ring, coolant filter housing	1
6	229777	Coolant hose (1 inch)	1
7	428729	Coolant pump and motor assembly: Adapter: 1-5/8 inch X 1 inch NPT X #16 JIC Plug with O-ring Coolant pump screen (coarse) Pump and motor Adapter: 1 inch MNPT X 1 inch MNPT hexagonal collar Adapter: 1 inch MNPT X 3/8 inch FNPT X 1/4 inch FNPT Adapter: 3/8 inch hexagonal Coolant solenoid valve assembly	1
8	006132	Coolant bypass check valve	1
9	229721	Coolant solenoid valve assembly	1
10	229654	Thermistor: Copper pipe clip with electrical connector	1

	Part number	Description	Quantity
11	127559	Coolant pump screen (coarse)	1
12	229843	Plug and O-ring	1
13	002561	Coolant reservoir	1
14	006113	Coolant check valve	1
	428330	Kit: Tubing (1 inch hose not included)	1

Coolant adapters in the rear compartment

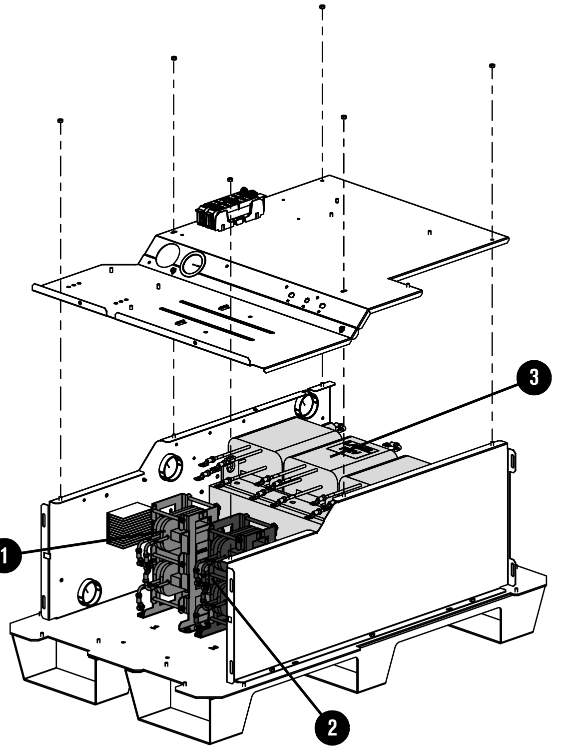


	Part number	Description	Quantity
1	015889	Elbow adapter: 1/2 inch NPT X 1/2 inch tube, 45° swivel	2
2	015903	Red ring: 1.13 inches inner diameter	1
3	015888	Adapter: 1/2 inch FNPT X 1-1/2 inch length bulkhead	2
	015899	Red ring: 0.87 inch inner diameter (not shown)	1
4	015029	Adapter: 1/2 inch NPT X #8 male	2
	015898	Green ring: 0.87 inch inner diameter (not shown)	1
5	015902	Green ring: 1.13 inch inner diameter	1

Other adapters not shown

Part number	Description	Location	Quantity
015669	Male adapter: 3/8 inch NPT X 1/2 inch tube	in coolant solenoid valve	1
006099	Coolant drain valve: 1/4 inch NPT X 3/8 inch tube	in the bottom of the coolant reservoir	1
015073	Adapter: 1/4 inch NPT X 1/4 FPT	in the bottom of the coolant reservoir	1
015738	Elbow adapter: 1/4 inch NPT X 1/2 inch tube, 45° swivel	in the top of the coolant reservoir	1
015510	Adapter: 1/4 inch X hexagonal collar	between the flow meter and coolant reservoir	1
015663	Adapter: 1/4 inch NPT X 1/2 inch tube	in the flow meter and coolant bypass check valve	2
015668	Elbow adapter: 1/2 inch NPT X 1/2 inch tube, 90°	in the coolant filter (fine) assembly	2
104807	Nut for chopper fitting	on the back of choppers	4
015815	Elbow fitting: 1/2 inch tube X 1/2 inch tube, 90°	on the back of the choppers (4) and the heat-exchanger inlet (1)	5
015820	Fitting: 1/2 inch tube X 1/2 inch tube	heat-exchanger outlet	1

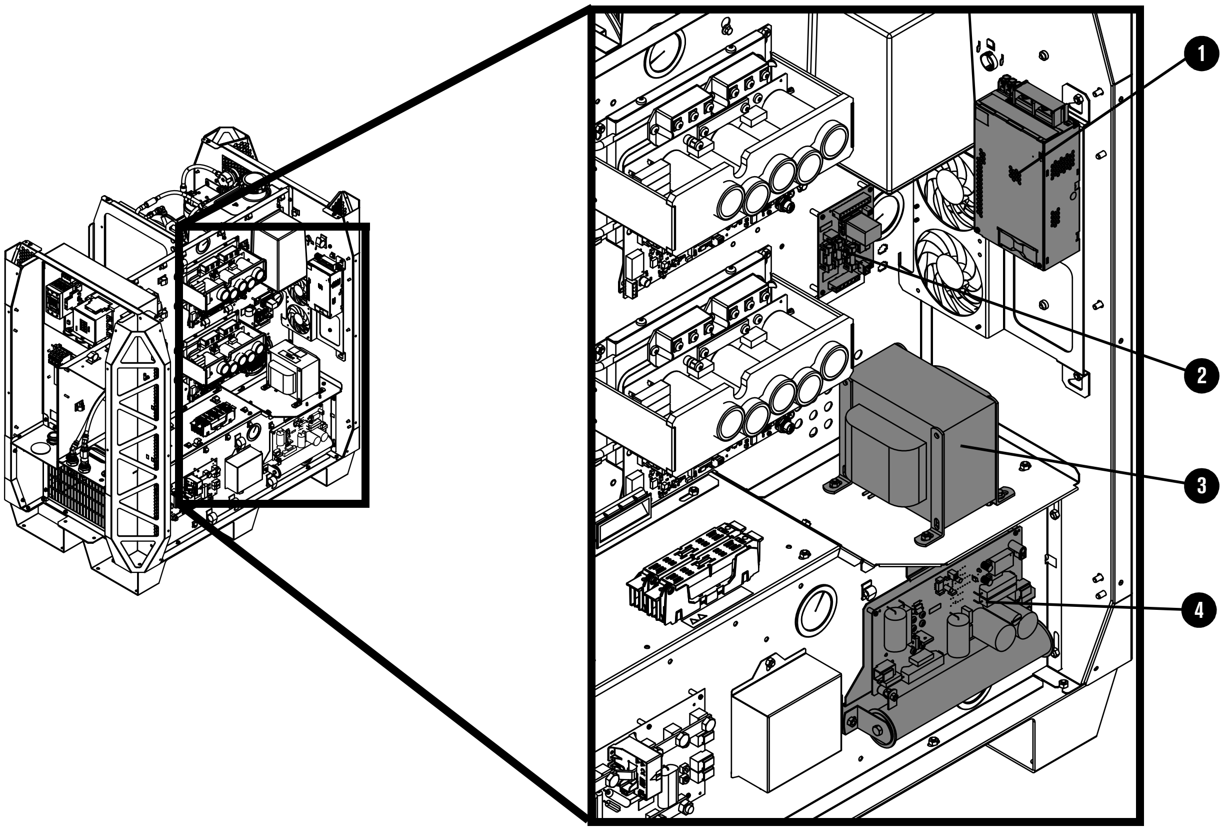
Transformers and inductors



<table>
<tr><th></th><th>Part number</th><th>Description</th><th>Designator</th><th>Quantity</th></tr>
<tr><td>1</td><td>428844</td><td>Kit: Inductor 1A (top)/1B (bottom)</td><td>L1</td><td>1</td></tr>
<tr><td>2</td><td>428845</td><td>Kit: Inductor 2A (top)/2B (bottom)</td><td>L2</td><td>1</td></tr>
<tr><td rowspan="11">3</td><td colspan="4">Transformer, horizontal, 66.5 kW, 3-phase*</td></tr>
<tr><td>–</td><td>200 V, 50 Hz – 60 Hz</td><td rowspan="10">T2</td><td rowspan="10">1</td></tr>
<tr><td>–</td><td>208 V, 60 Hz</td></tr>
<tr><td>–</td><td>220 V, 50 Hz – 60 Hz</td></tr>
<tr><td>–</td><td>240 V, 60 Hz</td></tr>
<tr><td>–</td><td>380 V, 50 Hz – 60 Hz</td></tr>
<tr><td>–</td><td>400 V, 50 Hz</td></tr>
<tr><td>–</td><td>415 V, 50 Hz</td></tr>
<tr><td>–</td><td>440 V, 50 Hz – 60 Hz</td></tr>
<tr><td>–</td><td>480 V, 60 Hz</td></tr>
<tr><td>–</td><td>600 V, 60 Hz</td></tr>
</table>

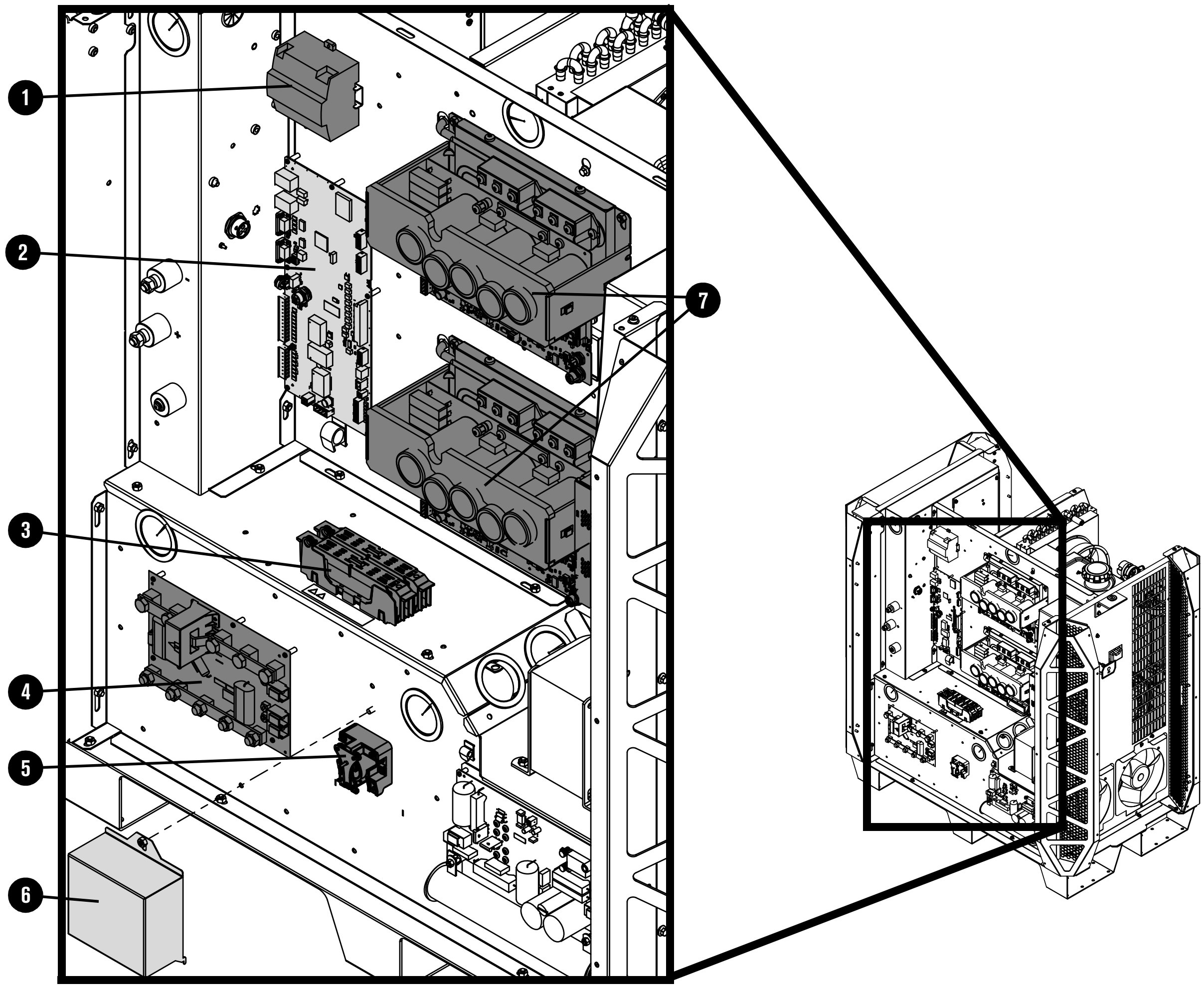
* You cannot purchase this part. Shown for reference only.

Control side – view 1



	Part number	Description	Designator	Quantity
1	229671	Power source: 88 VAC – 264 VAC to 48 VDC, 600 W	PS2	1
2	141425	Power distribution PCB	PCB7	1
	108709	Fuse: 10 A, 250 VAC, time delay (on PCB7)	F3, F4, F5	3
3	**Control transformer assembly, 3 kVA**			
	229809	200 V, 50 Hz – 60 Hz	T1	1
	229810	208 V, 60 Hz, 3 kVA		
	229811	220 V, 50 Hz – 60 Hz		
	229812	240 V, 60 Hz		
	229813	380 V, 50 Hz		
	229814	400 V, 50 Hz		
	229815	415 V, 50 Hz		
	229816	440 V, 50 Hz – 60 Hz		
	229794	480 V, 60 Hz		
	229817	600 V, 60 Hz		
4	229678	Start circuit assembly	PCB4	1

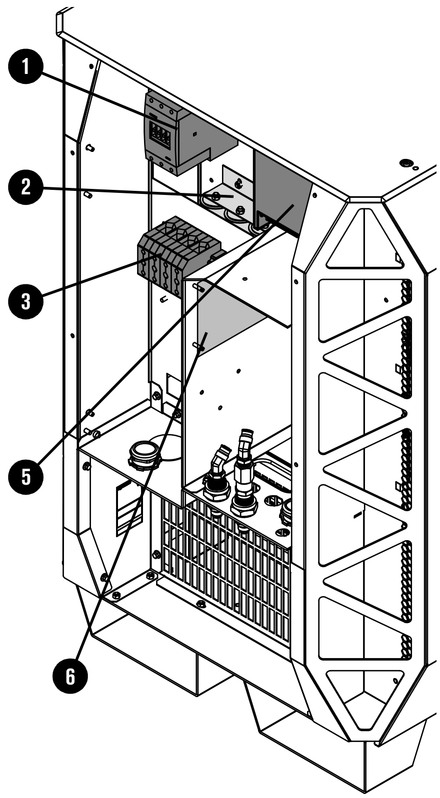
Control side – view 2



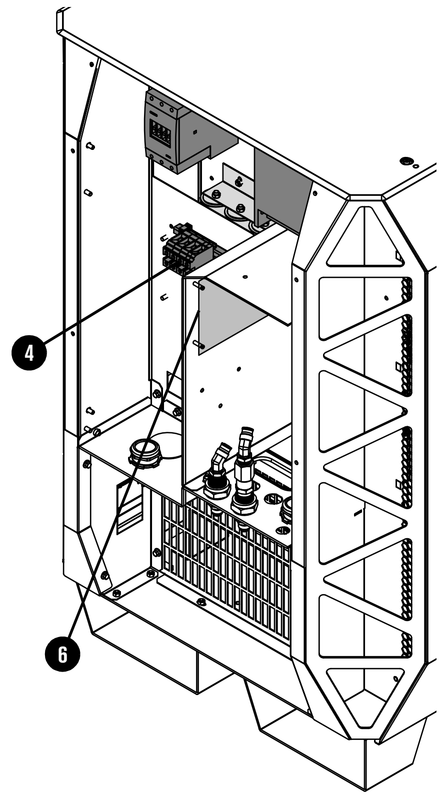
	Part number	Description	Designator	Quantity
1	229640	Power source: 88 VAC – 264 VAC to 24 VDC	PS1	1
2	428750	Control PCB	PCB1	1
3	208394	Fuse holder: 2P, 30 A, 600 V	–	1
	208395	Fuse: 8 A, 600 V, Class R (used in 380 V, 400 V, 415 V, 440 V, 480 V, 600 V)	F1, F2	2
	208397	Fuse: 15 A, 600 V, Class R (used in 200 V, 208 V, 220 V, 240 V)		
4	141371	I/O PCB	PCB5	1
5	003277	Pilot arc relay: 24 VDC, coil, 60 A 28 VDC contacts	CR1	1
6	101316	Pilot arc relay cover	–	1
7	229679	Chopper assembly	Chopper 1, Chopper 2	2

	Part number	Description	Designator	Quantity
	229711	XPR300 wire harness	–	1
	223399	CAN cable 0.5 m (1.6 ft) (not shown) Located between the control PCB and Chopper 2.	–	1
	223400	CAN cable 1 m (3.3 ft) (not shown) Located between Chopper 2 and Chopper 1.	–	1

Rear compartment of the plasma power supply



200 V, 208 V, 220 V, 240 V plasma power supplies

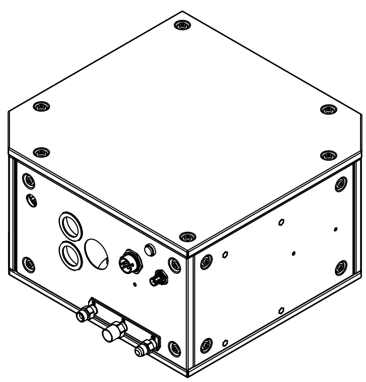


380 V, 400 V, 415 V, 440 V, 480 V, 600 V plasma power supplies

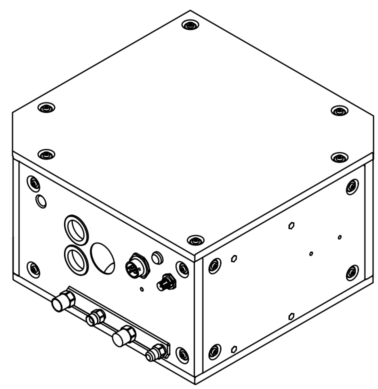
	Part number	Description	Designator	Quantity
1	229697	Inrush contactor assembly: 80 A, IEC AC-3, 3-phase, 120 VAC	IR_CON	1
2	209274	Inrush resistor assembly, 2 Ω X 3	–	1
3	229033	Terminal block 600 V, 200 A (200 V, 208 V, 220 V, 240 V, 380 V, 400 V, 415 V)	TB1	1
4	029316	Terminal block 600 V, 140 A (380 V, 440 V, 480 V, 600 V)		

	Part number	Description	Designator	Quantity
5	003276	Main contactor (200 V, 208 V, 220 V, 240 V)	M_CON	1
	429060	Main contactor assembly (380 V, 400 V, 415 V, 440 V, 480 V, 600 V)		
6	141511	VDC3 PCB (Optional, for use with RS-422 and discrete cutting systems)	–	1

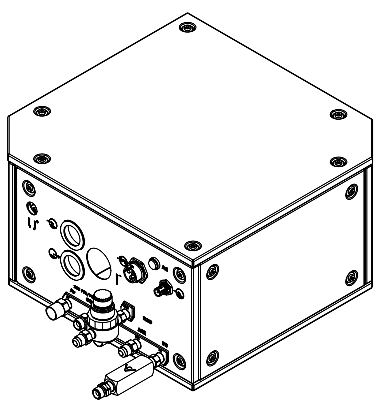
Gas connect consoles



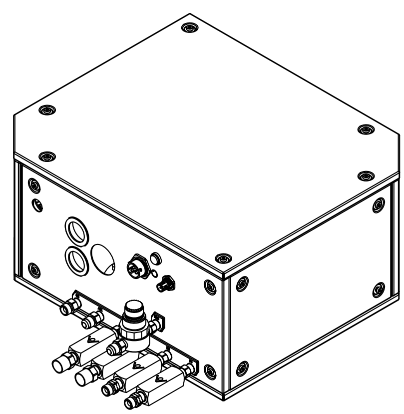
Core



CorePlus



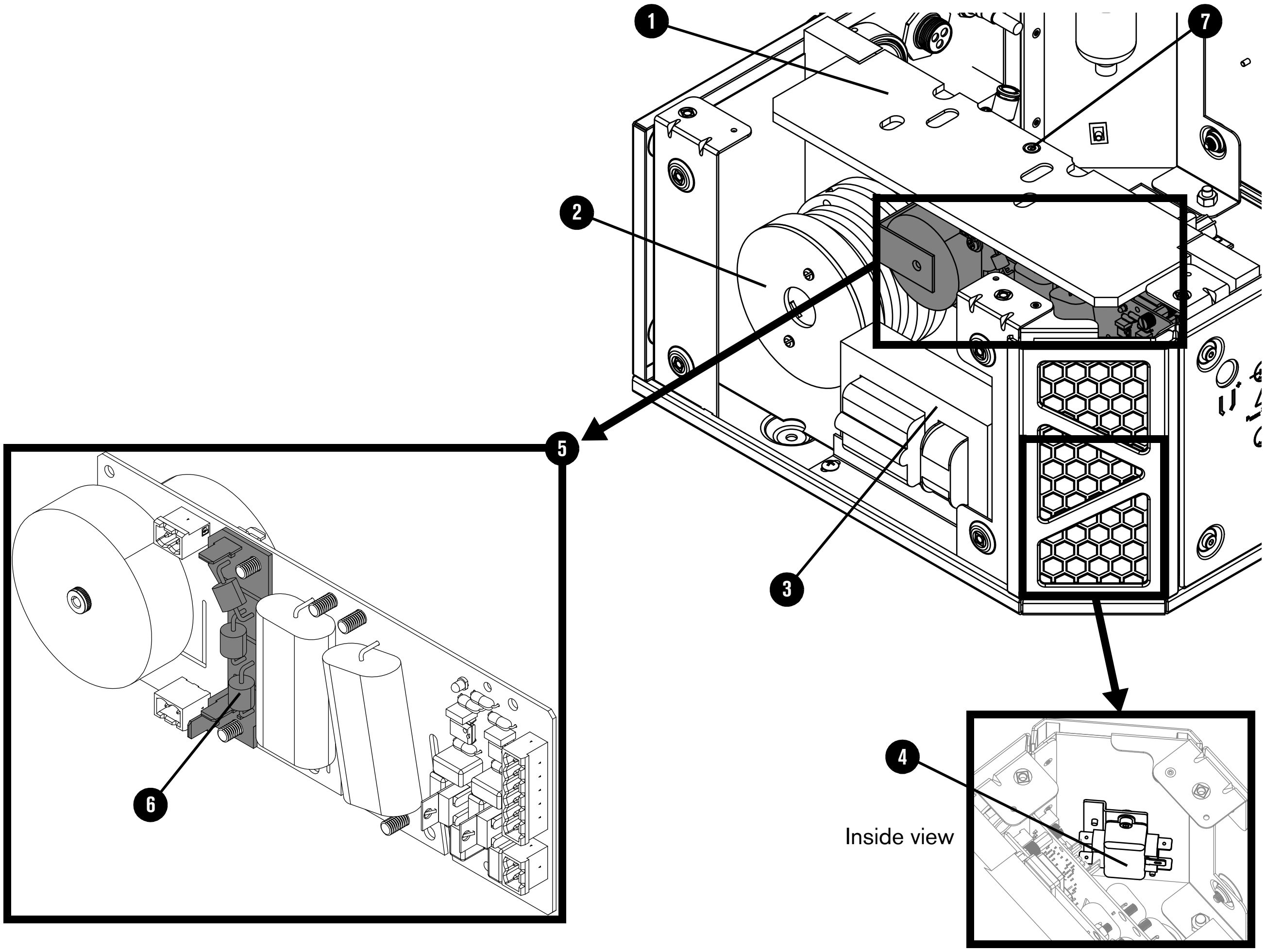
VWI



OptiMix

Part number	Description
078631	Core gas connect console
078662	CorePlus gas connect console
078632	VWI gas connect console
078633	OptiMix gas connect console

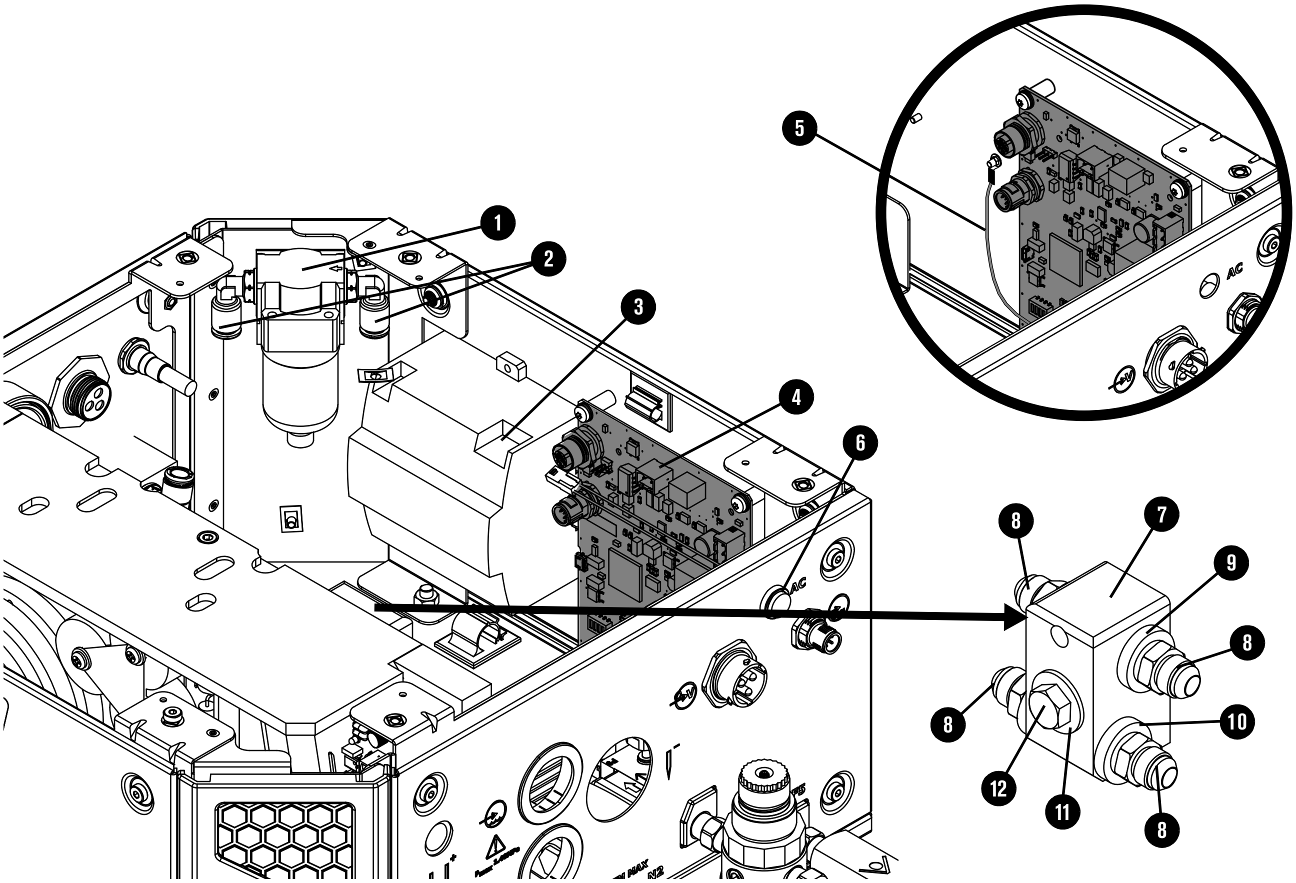
Gas connect console high-voltage side parts



	Part number	Description	Console	Designator	Quantity
1	002570	Insulator	Core, CorePlus, VWI, OptiMix	–	1
2	10079807	Coil assembly	Core, CorePlus, VWI, OptiMix	T2	1
3	229838	High-frequency, high-voltage transformer	Core, CorePlus, VWI, OptiMix	T1	1
4	009045	EMI filter	Core, CorePlus, VWI, OptiMix	–	1
5	141563	High-frequency, high-voltage ignition PCB	Core, CorePlus, VWI, OptiMix	PCB2	1
6	141595	Spark gap PCB	Core, CorePlus, VWI, OptiMix	–	1
7	075678	Socket head cap screw: M5 – 0.8 X 10 mm hexagonal	Core, CorePlus, VWI, OptiMix	–	1

Gas connect console manifold side parts

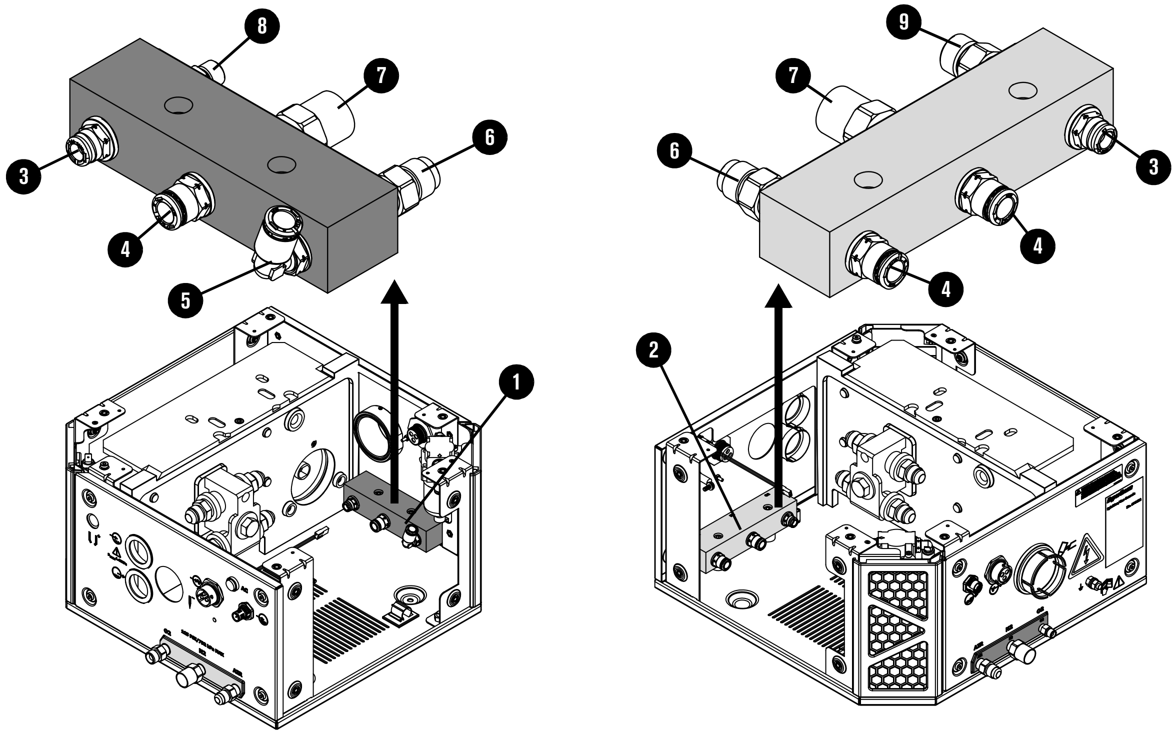
Core, CorePlus, VWI, and OptiMix gas connect console manifold side



	Part number	Description	Console	Designator	Quantity
1	011151	Air filter assembly	Core, CorePlus, VWI, OptiMix	–	1
	011110	Air filter element	Core, CorePlus, VWI, OptiMix	–	1
2	015853	Male elbow adapter: 1/4 inch NPT X 5/16 inch tube	Core, CorePlus, VWI, OptiMix	–	2
3	229640	Power source: 88 VAC – 264 VAC to 24 VDC	VWI, OptiMix only	–	1
4	141375	Control PCB	Core, CorePlus, VWI, OptiMix	PCB1	1
5	429205	Wire harness for control PCB This is not a ground wire, and it is not included with the 141375 control PCB.	CorePlus only	–	1

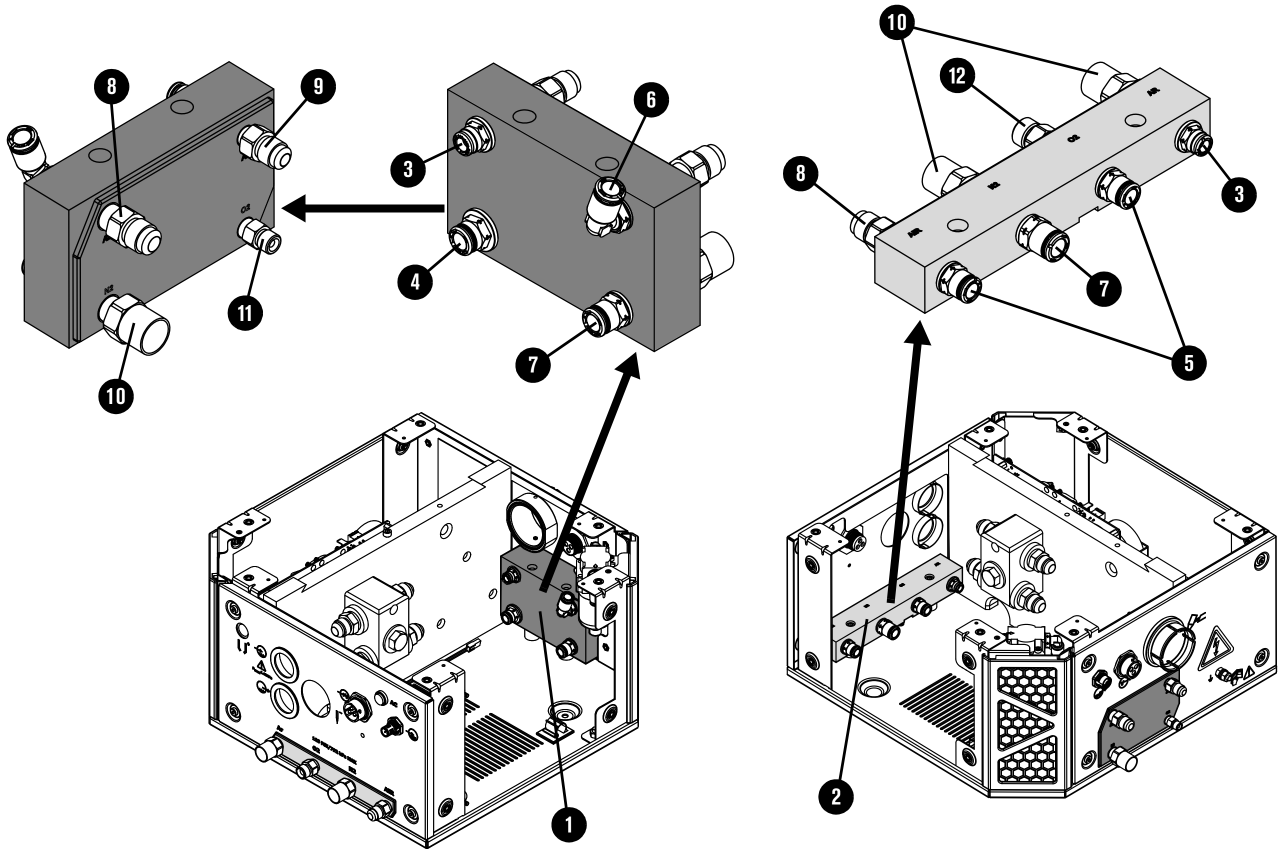
	Part number	Description	Console	Designator	Quantity
6	229825	Green power-indicator LED assembly	Core, CorePlus, VWI, OptiMix	–	1
7	104757	Coolant manifold	Core, CorePlus, VWI, OptiMix	–	1
8	015029	Adapter: 1/2 inch NPT X #8 male	Core, CorePlus, VWI, OptiMix	–	4
9	015898	Green ring: 0.87 inches inner diameter	Core, CorePlus, VWI, OptiMix	–	2
10	015899	Red ring: 0.87 inches inner diameter	Core, CorePlus, VWI, OptiMix	–	2
11	075218	Washer	Core, CorePlus, VWI, OptiMix	–	1
12	075140	Bolt	Core, CorePlus, VWI, OptiMix	–	1

Core gas connect console manifolds and adapters



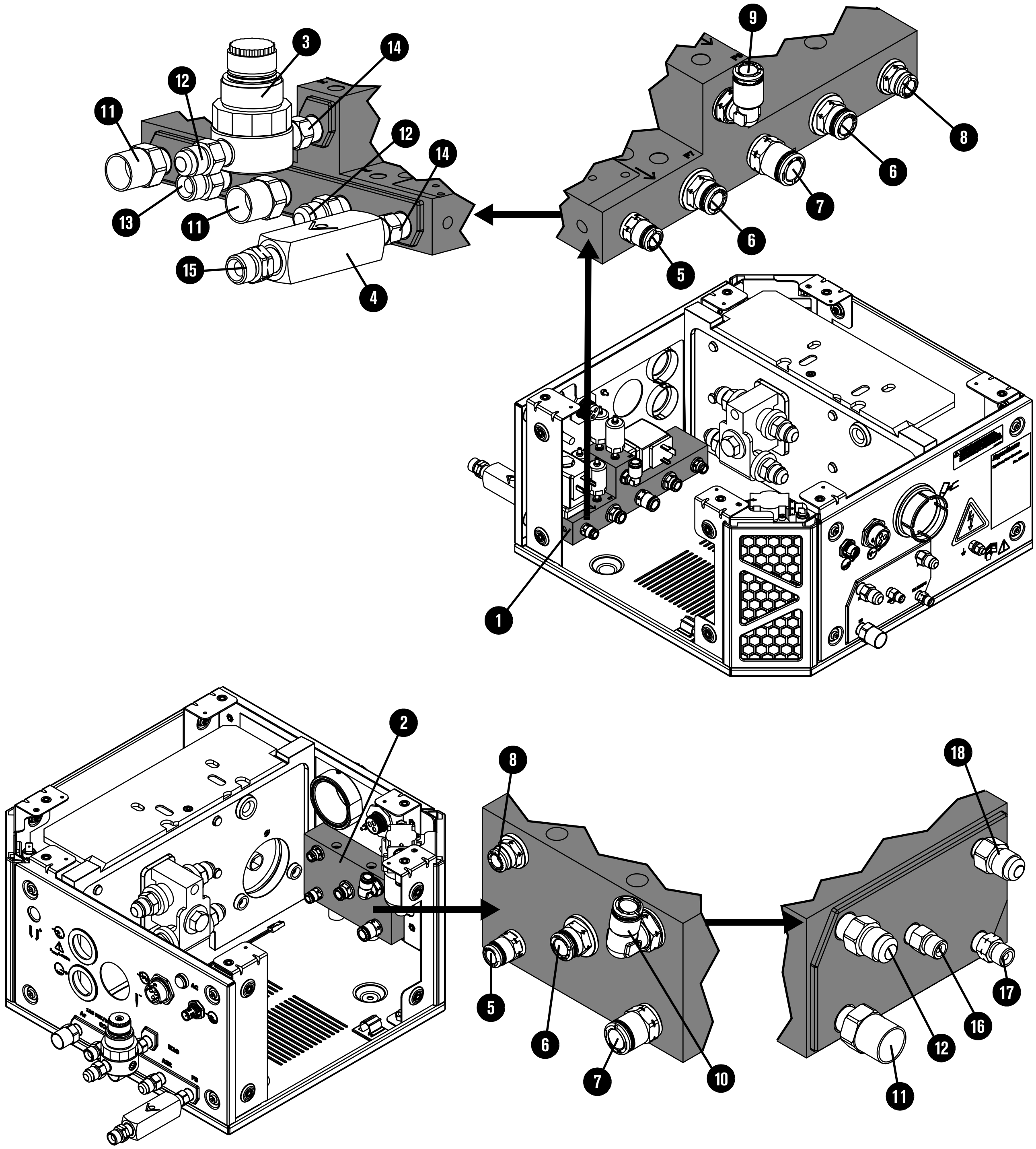
	Part number	Description	Quantity
1	104806	Manifold: Gas output (no adapters)	1
2	104802	Manifold: Gas input (no adapters)	1
	Push-to-connect adapters		
3	015876	1/4 inch NPT X 1/4 inch tube	2
4	015811	1/4 inch NPT X 8 mm tube	3
5	015853	Male elbow: 1/4 inch NPT X 5/16 inch tube	1
	Threaded adapters with thread sealant applied		
6	015012	1/4 inch NPT X #6 male (air output and input)	2
7	015103	1/4 inch NPT X RH ‘B’ inert female (nitrogen output and input)	2
8	015116	1/8 inch NPT X RH ‘A’ male (oxygen output)	1
9	015009	1/4 inch NPT X RH ‘B’ male (oxygen input)	1

CorePlus gas connect console manifolds and adapters



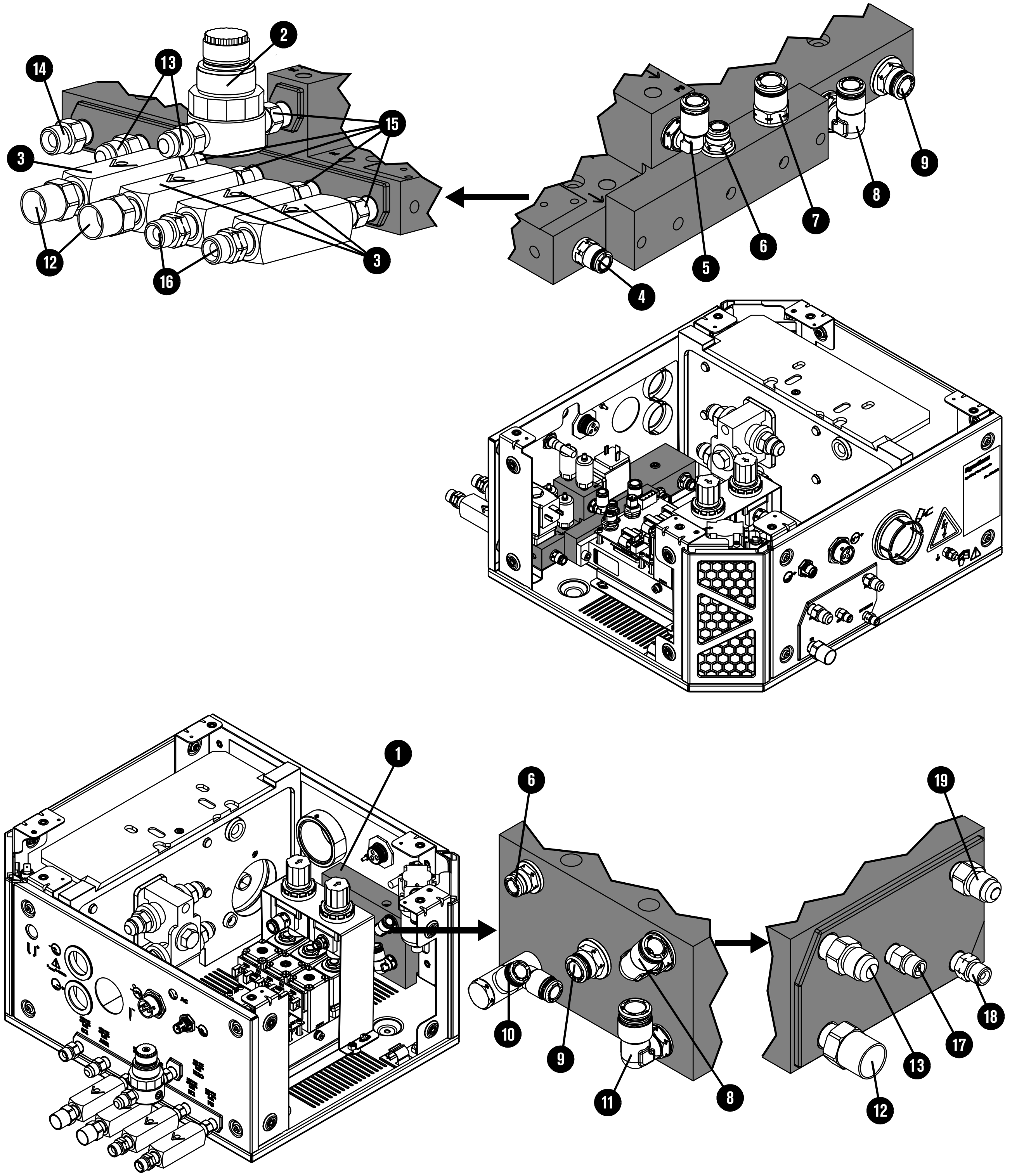
	Part number	Description	Quantity
1	10078917	Manifold: Gas output (no adapters)	1
2	10078916	Manifold: Gas input (no adapters)	1
	Push-to-connect adapters		
3	015876	1/4 inch NPT X 1/4 inch tube	2
4	015910	3/8 inch NPT X 5/16 inch tube	1
5	015811	1/4 inch NPT X 8 mm tube	3
6	015909	Male elbow: 1/4 inch NPT X 5/16 inch tube	1
7	015907	1/4 inch NPT X 3/8 inch tube	1
	Threaded adapters with thread sealant applied		
8	015012	1/4 inch NPT X #6 male (air output and input)	2
9	015197	Adapter: 1/8 inch NPT X #5 male (argon outlet)	1
10	015103	1/4 inch NPT X RH ‘B’ inert female (nitrogen output and input)	3
11	015116	1/8 inch NPT X RH ‘A’ male (oxygen output)	1
12	015009	1/4 inch NPT X RH ‘B’ male (oxygen input)	1

VWI gas connect console input and output manifolds and adapters



	Part number	Description	Quantity
1	229898	Manifold: Gas input (with adapters)	1
2	104843	Manifold: Gas output (no adapters)	1
3	229844	Water regulator	1
4	006157	Check valve	1
	Push-to-connect adapters		
5	015905	1/8 inch NPT X 1/4 inch tube	2
6	015910	3/8 inch NPT X 5/16 inch tube	2
7	015907	1/4 inch NPT X 3/8 inch tube	1
8	015876	1/4 inch NPT X 1/4 inch tube	1
9	015853	Elbow: 1/4 inch NPT X 5/16 inch tube, 90°	1
10	015909	Elbow: 3/8 inch NPT X 5/16 inch tube, 90°	–
	Threaded adapters with thread sealant applied		
11	015103	1/4 inch NPT X RH ‘B’ inert female	3
12	015012	1/4 inch NPT X #6 male	3
13	015009	1/4 inch NPT X RH ‘B’ male	1
14	015922	1/4 inch X hexagonal collar	2
15	015230	1/4 inch NPT X LH ‘B’	1
16	015116	Adapter: 1/8 inch NPT X RH ‘A’ (oxygen outlet)	1
17	015210	Adapter: 1/8 inch NPT X LH ‘A’ male (hydrogen mix outlet)	1
18	015197	Adapter: 1/8 inch NPT X #5 male (argon outlet)	1

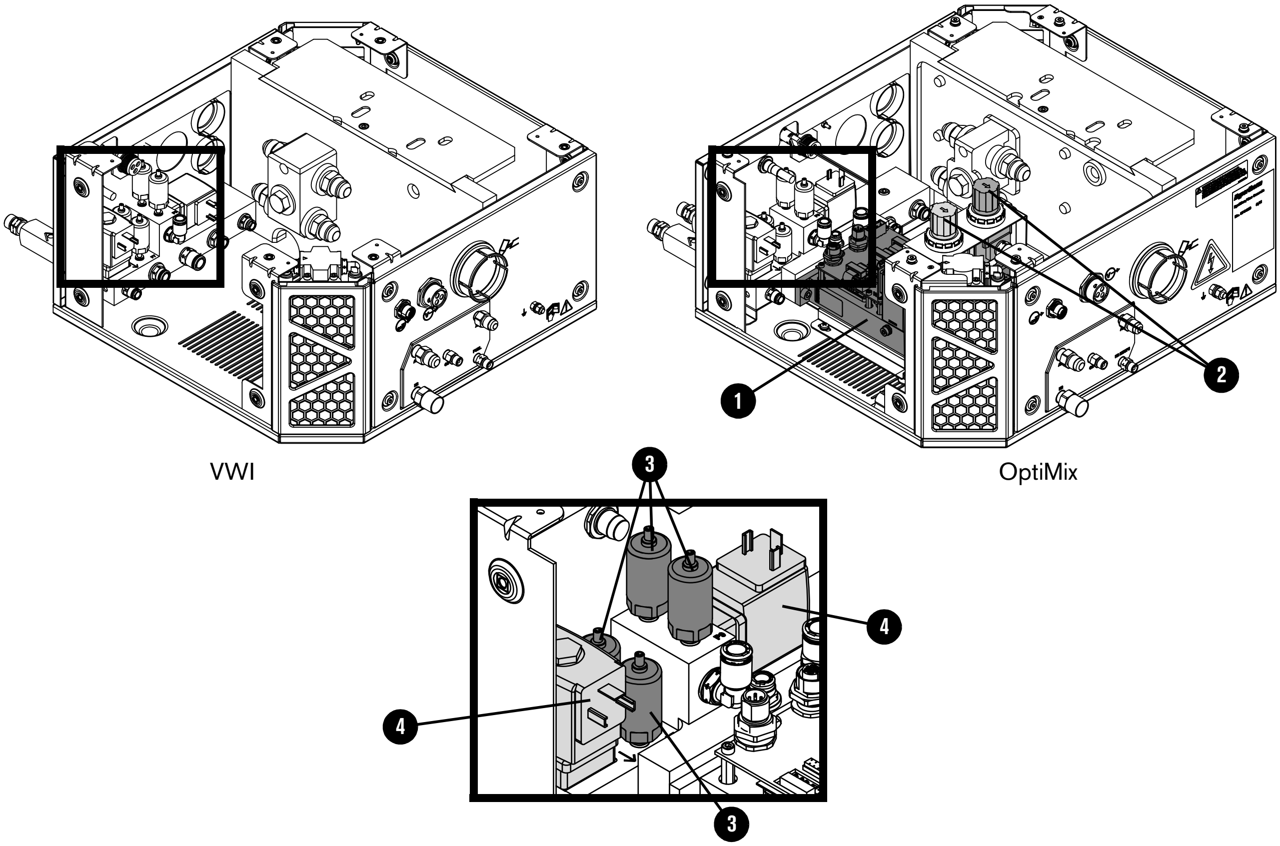
OptiMix gas connect console input and output manifolds and adapters



	Part number	Description	Quantity
1	104843	Manifold: Gas output (no adapters)	1
2	229844	Water regulator	1
3	006157	Check valve	4
	Push-to-connect adapters		
4	015905	1/8 inch NPT X 1/4 inch tube	1
5	015853	Elbow: 1/4 inch NPT X 5/16 inch tube	1
6	015876	1/4 inch NPT X 1/4 inch tube	1
7	015907	1/4 inch NPT X 3/8 inch tube	1
8	015909	Elbow: 3/8 inch NPT X 5/16 inch tube	1
9	015910	3/8 inch NPT X 5/16 inch tube	1
10	015906	Dual connection: 1/8 inch NPT X 1/4 inch tube	1
11	015908	Elbow: 1/4 inch NPT X 3/8 inch tube	1
	Threaded adapters with thread sealant applied		
12	015103	1/4 inch NPT X RH ‘B’ inert female	3
13	015012	1/4 inch NPT X #6 male	3
14	015009	1/4 inch NPT X RH ‘B’ male	1
15	015922	1/4 inch X hexagonal collar	5
16	015230	1/4 inch NPT X LH ‘B’	1
17	015116	1/8 inch NPT X RH ‘A’	1
18	015210	1/8 inch NPT X LH ‘A’	1
19	015197	1/8 inch NPT X #5	1

To replace the gas input manifold with adapters in an OptiMix gas connect console, contact your cutting machine supplier or regional Hypertherm Customer Service representative.

VWI and OptiMix gas connect console mixer, transducers, and valves

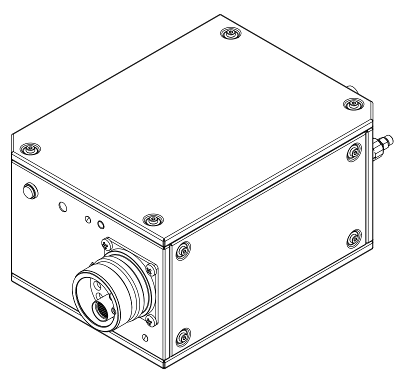


	Part number	Description	Console	Designator	Quantity
1	229703	Mixer module	OptiMix	–	1
	528057	Kit: Mixer module and cable ties	OptiMix	–	1
2	011101	Regulator	OptiMix	–	2
3	223398	Pressure transducer	VWI and OptiMix	P6 – P9	4
4	006167	Solenoid valve	VWI and OptiMix	B4, B5	2

Gas connect console wire harness, hose kit, and CAN cables

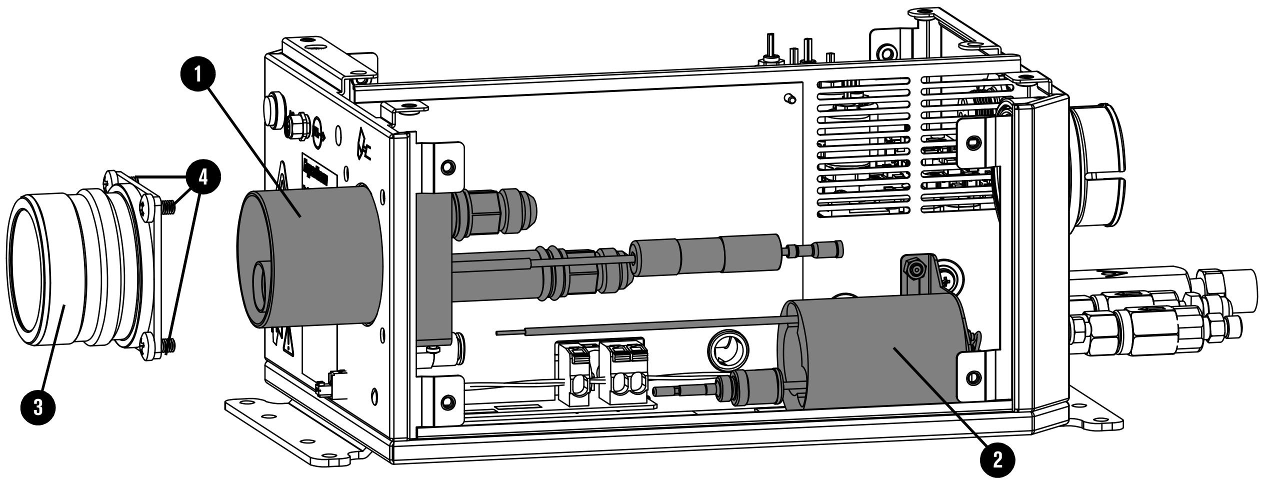
Part number	Description	Console	Quantity
229718	Wire harness	Core, CorePlus	1
429205	Wire harness for control PCB	CorePlus	
229719	Wire harness	VWI	
229720	Wire harness	OptiMix	
428490	Kit: Tubing	Core	1
10078918	Kit: Tubing	CorePlus	
428491	Kit: Tubing	VWI	
428492	Kit: Tubing	OptiMix	
223709	CAN cable 0.38 m (1.2 ft) to external connector	Core, CorePlus, VWI, OptiMix	1
223710	CAN cable 0.48 m (1.6 ft) male-female	Core, CorePlus, VWI	1
223711	CAN cable 0.5 m (1.6 ft) male-female	OptiMix	1
223712	CAN cable 0.39 m (1.3 ft) male-female	OptiMix	1

Torch connect console



Part number	Description
078618	Torch connect console

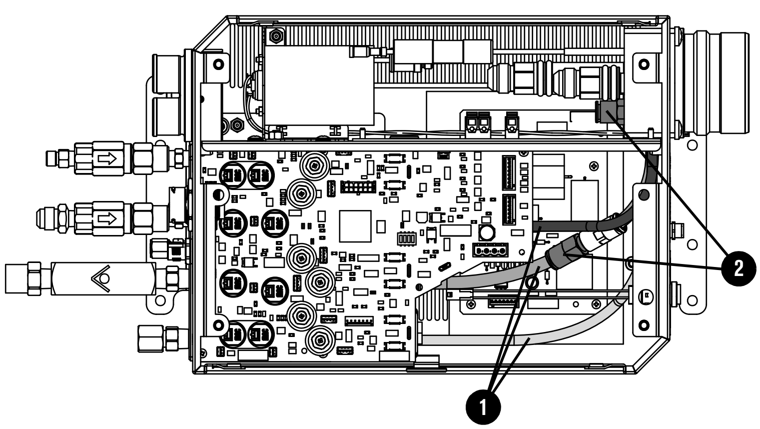
Torch connect console Easy Connect side



	Part number	Description	Designator	Quantity
1	428730	Torch receptacle block	–	1
2	229882*	Ohmic relay and bracket	–	1
3	420376	Torch lead connector	–	1
4	075544	Machine screw: M6 X 10 mm Phillips, pan head	–	4 (3 shown)

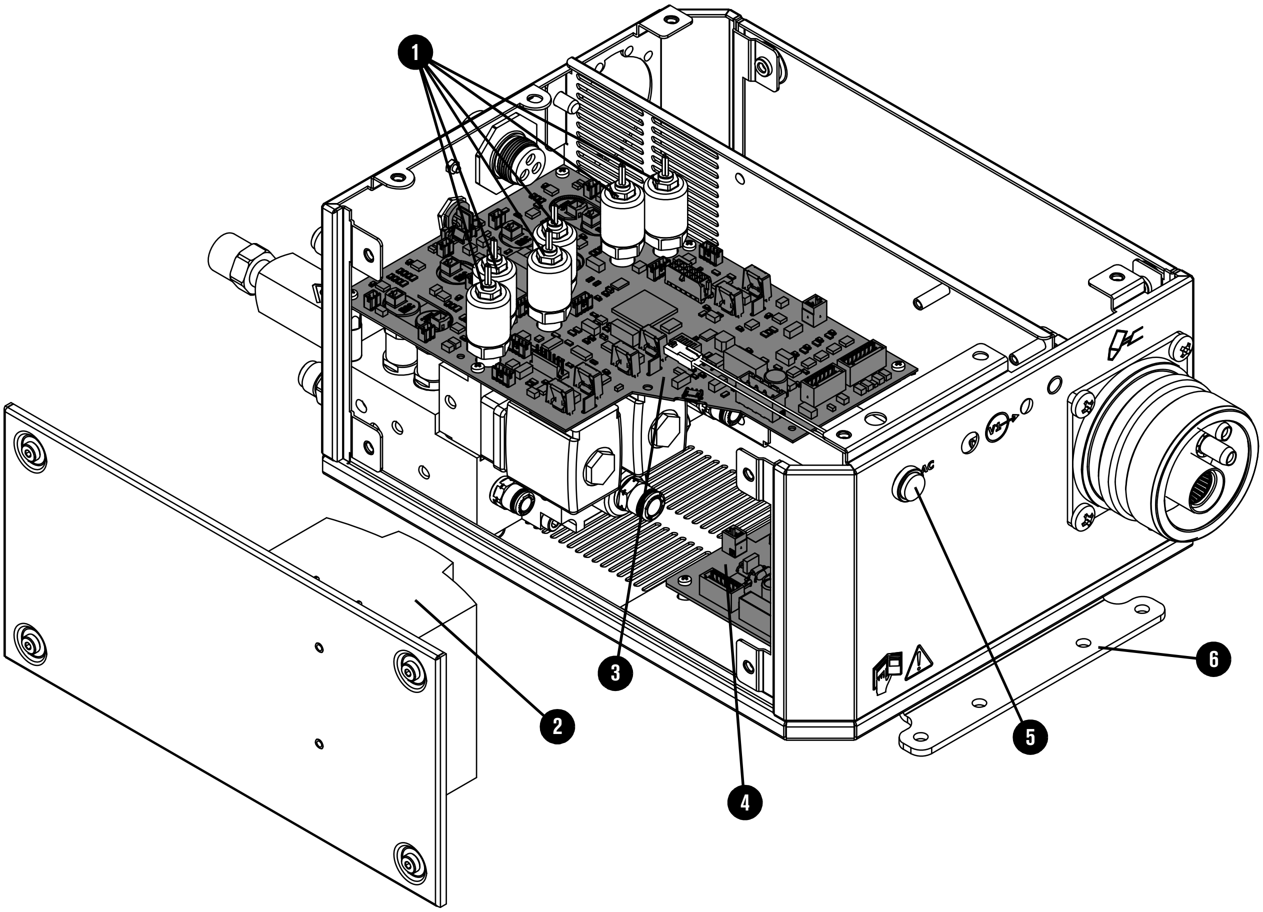
* Includes the ohmic contact PCB (141368).

Torch connect console – top



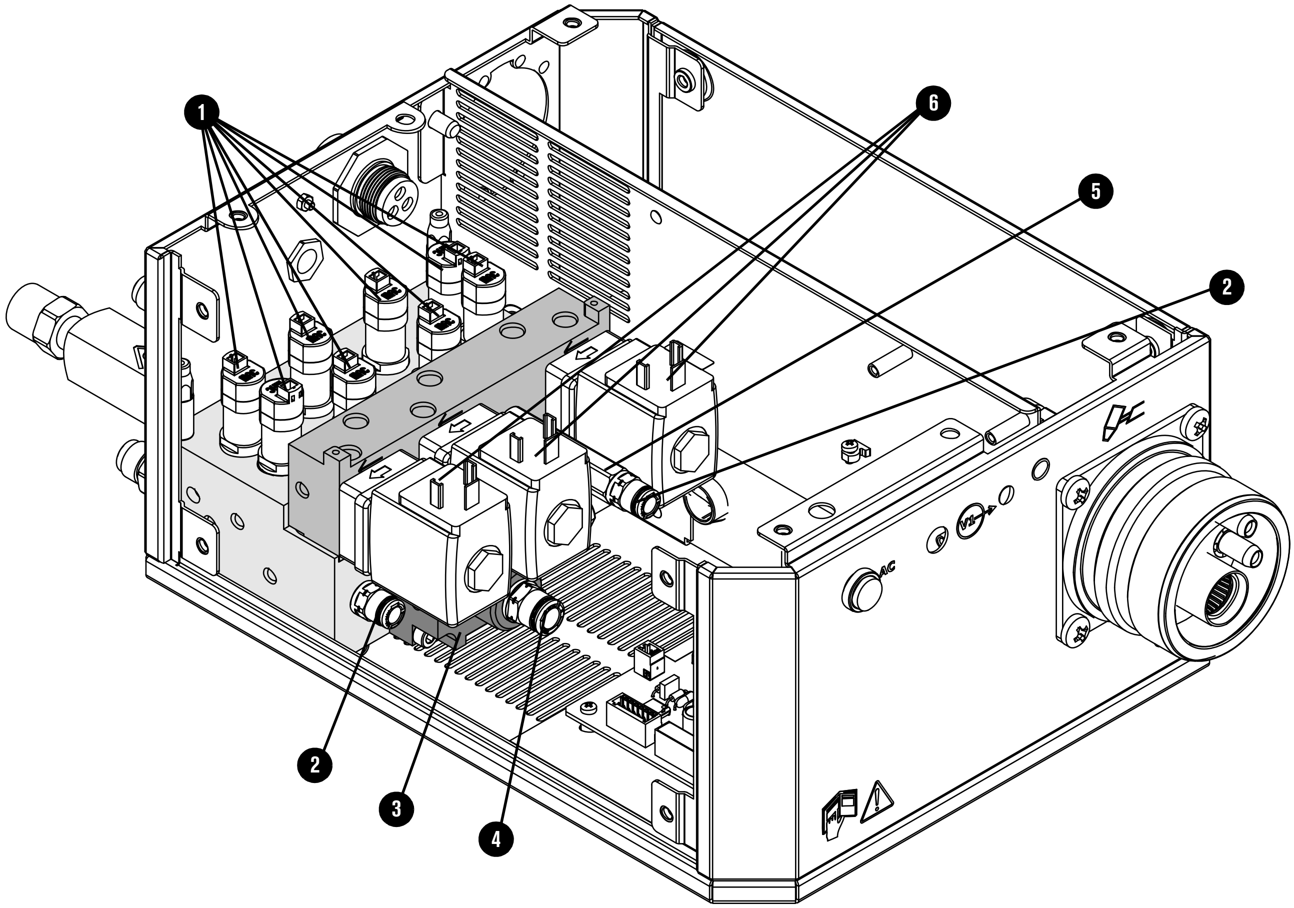
	Part number	Description	Designator	Quantity
1	428338	Kit: Tubing	–	1
2	006152	Check valve	–	2

Torch connect console manifold side – view 1



	Part number	Description	Designator	Quantity
1	223477	Pressure transducer with wire and connector	P1 – P5, P14	6
2	229640	Power source: 88 VAC – 264 VAC to 24 VDC	PS1	1
3	141334	Control PCB	PCB1	1
4	141368	Ohmic contact PCB	PCB2	1
5	229825	Green power-indicator LED assembly	–	1
6	101366	Bracket	–	2 (1 shown)
	229780	Valve cable 40 mm (1.6 inches)	–	8
	229800	Valve cable 279.4 mm (11 inches)	–	1
	229655	Wire harness	–	1

Torch connect console manifold side – view 2

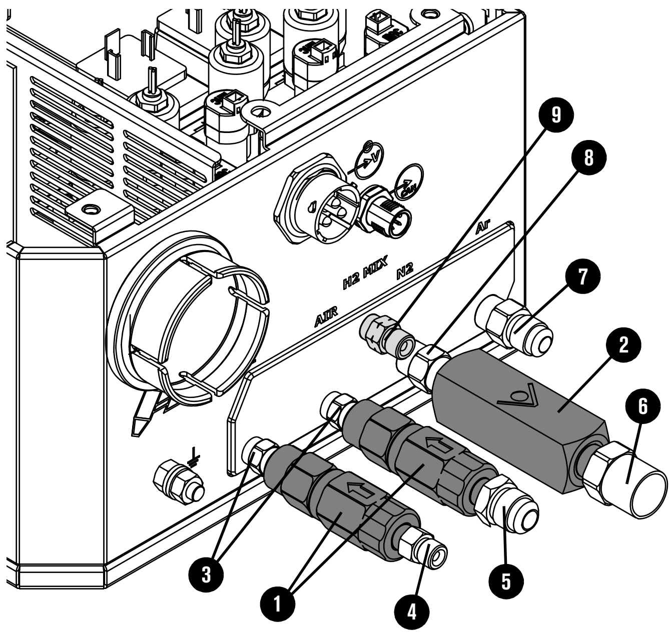


	Part number	Description	Designator	Quantity
	229895	Manifold assembly: ▪ Solenoid valves ▪ Proportional valves ▪ All manifolds ▪ All fittings	–	1
1	229965	Solenoid valve	V4 – V12	9 (8 shown)
	229917	Solenoid valve (229965) tool*	–	
2	015905	Adapter: 1/8 inch NPT O-ring seal X 1/4 inch tube	–	2
3	428756	Bottom manifold assembly: ▪ Bottom manifold ▪ Adapter ▪ Critical orifice ▪ Solenoid valve	–	1
4	015811	Adapter: 1/4 inch NPT O-ring seal X 8 mm tube	–	1

	Part number	Description	Designator	Quantity
5	104406	Adapter: 1/8 inch FPT X1/8 inch NPT X1-5/8 inch	–	1
6	006167	Proportional valve	B1 – B3	3
	044508	O-ring		7

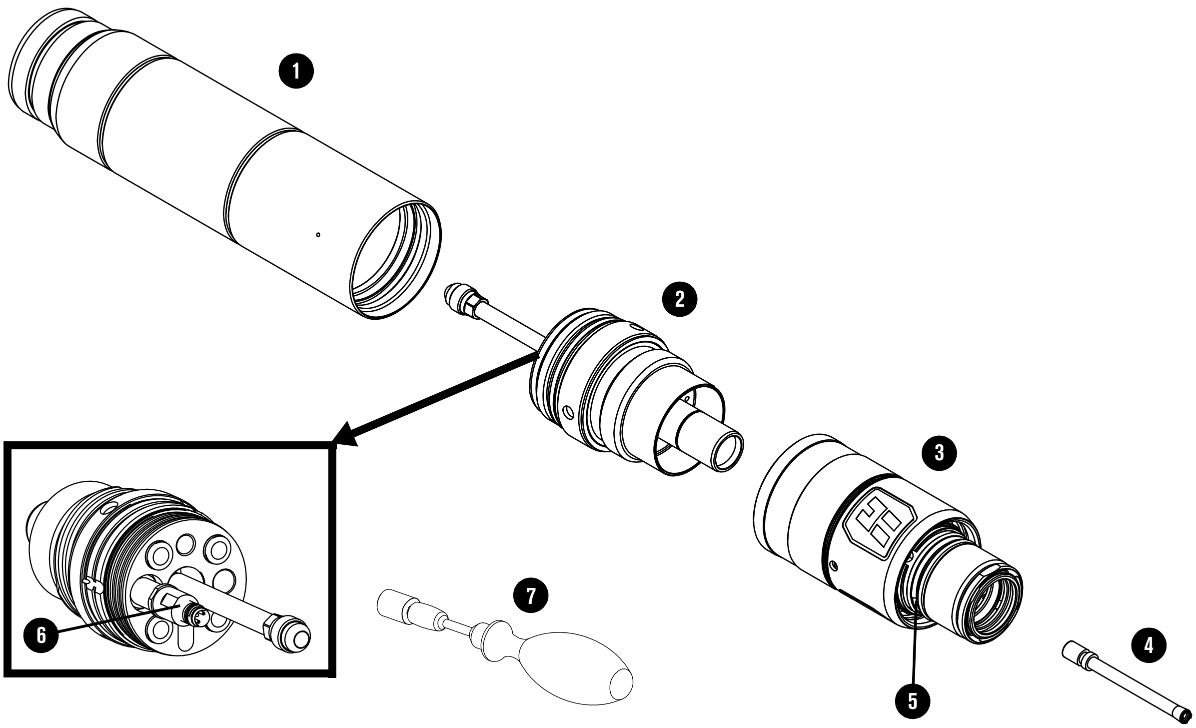
* Use this tool to remove the solenoid valve without removing the control PCB or the pressure transducers. For more information, refer to *XPR170 Replacement Part Procedures* (810410) or *XPR300 Replacement Part Procedures* (809970).

Front adapters and valves



	Part number	Description	Designator	Quantity
1	006077	Check valve: 1/8 inch FPT	–	2
2	006157	Check valve: 1/4 inch NPT female	–	1
	Threaded adapters with thread sealant applied			
3	015517	1/8 inch hexagonal collar	–	2
4	015116	1/8 inch NPT X RH ‘A’	–	1
5	015226	1/8 inch NPT X #6 male	–	1
6	015103	1/4 inch NPT X RH ‘B’ inert female	–	1
7	015007	1/4 inch NPT X #5 male	–	1
8	015922	1/4 inch hexagonal collar	–	1
9	015210	1/8 inch NPT X LH ‘A’ male	–	1

Torch assembly



	Part number	Description
1	420500	Torch mount sleeve assembly: Standard
	420501	Torch mount sleeve assembly: Short
	420502	Torch mount sleeve assembly: Extended
2	420220	Quick-disconnect/torch receptacle
3	420221	Quick-disconnect torch
4	420368	Water tube
5	044028	O-ring for quick-disconnect torch (Refer to Preventive maintenance kits on page 408.)
6	006155	Torch solenoid valve (V1)
7	229918	Torch solenoid valve (V1) tool
	006169	Torch solenoid valve connector
	428488	Torch assembly, 300 A mild steel consumables
	104879	2.25 inch spanner wrench

Torch bracket

Part number	Description
428646	Torch lifter bracket: 2.25 inch diameter sleeve

Consumable starter kits

Refer to Example configurations for consumables on page 142 or the *XPR Cut Charts Instruction Manual* (809830) for specific applications.

Mild steel consumable starter kit (428616)

Part number	Description	Quantity
420231	Electrode: 50 A	1
420234	Nozzle: 50 A	1
420237	Shield: 50 A	1
420233	Swirl ring: 50 A	1
420240	Electrode: 80 A	2
420243	Nozzle: 80 A	2
420246	Shield: 80 A	2
420242	Swirl ring: 80 A – 130 A	2
420249	Electrode: 130 A	3
420252	Nozzle: 130 A	3
420255	Shield: 130 A	2
420261	Nozzle: 170 A	3
420258	Electrode: 170 A	3
420513	Shield: 170 A	2
420260	Swirl ring: 170 A	1
420276	Electrode: 220 A / 300 A	4
420270	Nozzle: 220 A	1
420273	Shield: 220 A	1
420406	Swirl ring: 220 A / 300 A	2
420279	Nozzle: 300 A	3
420491	Shield: 300 A	2
420368	Water tube	1
420200	Shield retaining cap	1
420365	Nozzle retaining cap	1
104879	2.25 inch spanner wrench	1
104119	Consumable tool	1
027055	Silicone lubricant, 1/4 ounce	1

Stainless steel and aluminum consumable starter kit (428617)

Part number	Description	Quantity
420288	Nozzle: 40 A	3
420291	Shield: 40 A	2
420297	Nozzle: 60 A	1
420296	Nozzle: 60 A H_2O	1
420306	Nozzle: 80 A	2
420290	Nozzle: 80 A H_2O	2
420469	Shield: 130 A H_2O	1
420356	Electrode: 130 A – 300 A	4
420315	Nozzle: 130 A	2
420318	Shield: 130 A	1
420472	Shield: 170 A H_2O	1
420324	Nozzle: 170 A	3
420327	Shield: 170 A	1
420358	Swirl ring: 300 A fuel	1
420475	Shield: 300 A H_2O	1
420359	Nozzle: 300 A	2
420362	Shield: 300 A	2
420303	Electrode: 40 A – 80 A	3
420309	Shield: 60 A – 80 A	2
420294	Electrode: 40 A – 80 A aluminum air/air	1
420300	Shield: 60 A – 80 A H_2O	1
420314	Swirl ring: 40 A – 170 A multiple processes	1
420323	Swirl ring: 60 A – 300 A multiple processes	1
420368	Water tube	1
420200	Shield retaining cap	1
420365	Nozzle retaining cap	1
104879	2.25 inch spanner wrench	1
104119	Consumable tool	1
027055	Silicone lubricant, 1/4 ounce	1

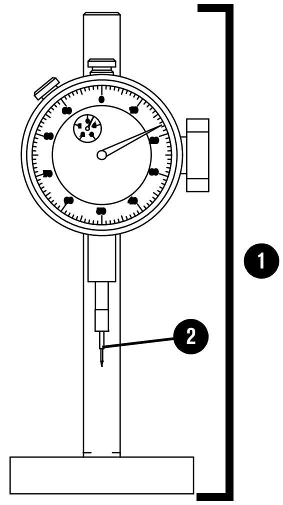
Mild steel consumable starter kit with torch (428618)

Part number	Description	Quantity
420221	Quick-disconnect torch head	1
420231	Electrode: 50 A	1
420234	Nozzle: 50 A	1
420237	Shield: 50 A	1
420233	Swirl ring: 50 A	1
420240	Electrode: 80 A	2
420243	Nozzle: 80 A	2
420246	Shield: 80 A	2
420242	Swirl ring: 80 A – 130 A	2
420249	Electrode: 130 A	3
420252	Nozzle: 130 A	3
420255	Shield: 130 A	2
420261	Nozzle: 170 A	3
420258	Electrode: 170 A	3
420513	Shield: 170 A	2
420260	Swirl ring: 170 A	1
420276	Electrode: 220 A / 300 A	4
420270	Nozzle: 220 A	1
420273	Shield: 220 A	1
420279	Nozzle: 300 A	3
420491	Shield: 300 A	2
420406	Swirl ring: 220 A / 300 A	2
420368	Water tube	2
420200	Shield retaining cap	2
420365	Nozzle retaining cap	2
104879	2.25 inch spanner wrench	1
104119	Consumable tool	1
027055	Silicone lubricant, 1/4 ounce	1

Stainless steel and aluminum consumable starter kit with torch (428619)

Part number	Description	Quantity
420221	Quick-disconnect torch head	1
420288	Nozzle: 40 A	3
420291	Shield: 40 A	2
420297	Nozzle: 60 A	1
420296	Nozzle: 60 A H_2O	1
420306	Nozzle: 80 A	2
420290	Nozzle: 80 A H_2O	2
420469	Shield: 130 A H_2O	1
420356	Electrode: 130 A – 300 A	4
420315	Nozzle: 130 A	2
420318	Shield: 130 A	1
420472	Shield: 170 A H_2O	1
420324	Nozzle: 170 A	3
420327	Shield: 170 A	1
420358	Swirl ring: 300 A fuel	1
420475	Shield: 300 A H_2O	1
420359	Nozzle: 300 A	2
420362	Shield: 300 A	2
420303	Electrode: 40 A – 80 A	3
420309	Shield: 60 A – 80 A	2
420294	Electrode: 40 A – 80 A aluminum air/air	1
420300	Shield: 60 A – 80 A H_2O	1
420314	Swirl ring: 40 A – 170 A multiple processes	1
420323	Swirl ring: 60 A – 300 A multiple processes	1
420368	Water tube	2
420200	Shield retaining cap	2
420365	Nozzle retaining cap	2
104879	2.25 inch spanner wrench	1
104119	Consumable tool	1
027055	Silicone lubricant, 1/4 ounce	1

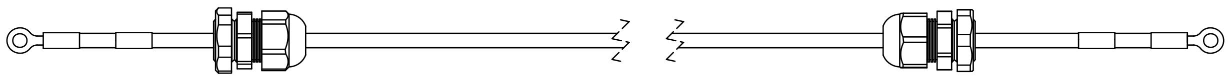
Other consumable and torch parts



	Part number	Description
1	004630	Pit depth gauge
2	004629	Gauge point
	027055	Silicone lubricant, 1/4 ounce
	104119	Consumable tool
	428764	XPR robotic torch teach accessory
	429013	XPR electrode torque tool

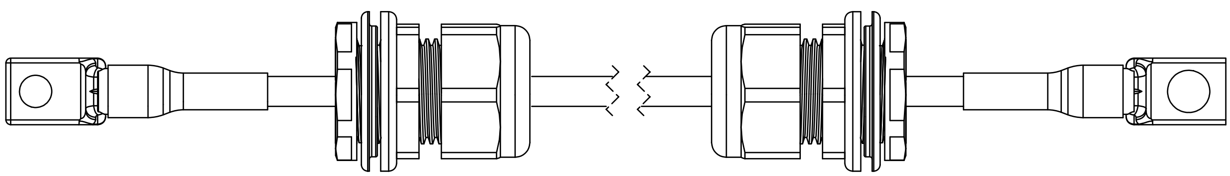
Plasma power supply to gas connect console connections

Pilot arc lead with strain relief



Part number	Length	Part number	Length
223529	3 m (9.8 feet)	223535	25 m (82 feet)
223530	4.5 m (14.8 feet)	223536	35 m (114.8 feet)
223531	7.5 m (24.6 feet)	223537	45 m (147.6 feet)
223532	10 m (32.8 feet)	223538	60 m (196.9 feet)
223533	15 m (49.2 feet)	223539	75 m (246.1 feet)
223534	20 m (65.6 feet)	–	–

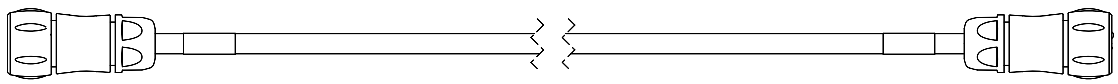
Negative lead with strain relief



Part number	Type	Length	Part number	Type	Length
223573	2/0	3 m (9.8 feet)	223527	4/0	60 m (196.9 feet)
223574	2/0	4.5 m (14.8 feet)	223528	4/0	75 m (246.1 feet)
223575	2/0	7.5 m (24.6 feet)	223551*	2/0	3 m (9.8 feet)
223576	2/0	10 m (32.8 feet)	223552*	2/0	4.5 m (14.8 feet)
223577	2/0	15 m (49.2 feet)	223553*	2/0	7.5 m (24.6 feet)
223578	2/0	20 m (65.6 feet)	223554*	2/0	10 m (32.8 feet)
223579	2/0	25 m (82 feet)	223555*	2/0	15 m (49.2 feet)
223525	4/0	35 m (114.8 feet)	223556*	2/0	20 m (65.6 feet)
223526	4/0	45 m (147.6 feet)	223557*	2/0	25 m (82 feet)

* Leads labeled with CCC mark only. CCC is defined in Symbols and marks on page 34.

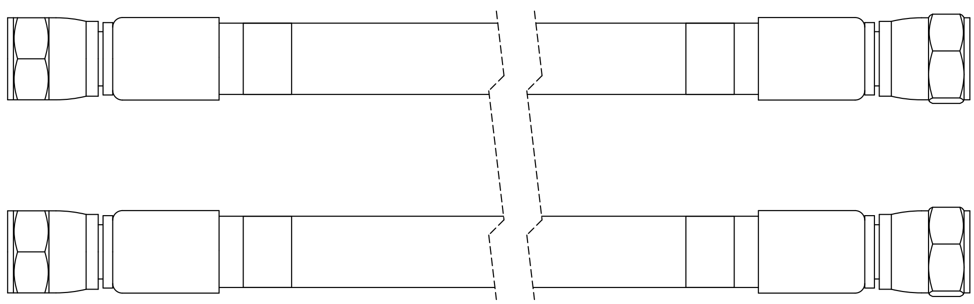
Power cable



Description: 3-position, male-female

Part number	Length	Part number	Length
223436	3 m (9.8 feet)	223446	25 m (82 feet)
223437	4.5 m (14.8 feet)	223447	35 m (114.8 feet)
223439	7.5 m (24.6 feet)	223448	45 m (147.6 feet)
223441	10 m (32.8 feet)	223449	60 m (196.9 feet)
223444	15 m (49.2 feet)	223450	75 m (246.1 feet)
223445	20 m (65.6 feet)	–	–

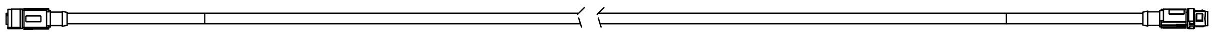
Coolant hose set



Description: 1.27 cm (0.50 inch) internal diameter

Part number	Length	Part number	Length
428475	3 m (9.8 feet)	428481	25 m (82 feet)
428476	4.5 m (14.8 feet)	428482	35 m (114.8 feet)
428477	7.5 m (24.6 feet)	428483	45 m (147.6 feet)
428478	10 m (32.8 feet)	428484	60 m (196.9 feet)
428479	15 m (49.2 feet)	428485	75 m (246.1 feet)
428480	20 m (65.6 feet)	–	–

CAN cable

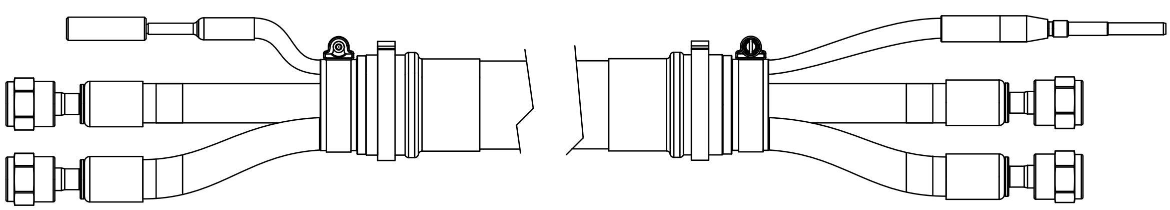


Description: 5-position, male-female

Part number	Length	Part number	Length
223417	3 m (9.8 feet)	223427	25 m (82 feet)
223418	4.5 m (14.8 feet)	223428	35 m (114.8 feet)
223420	7.5 m (24.6 feet)	223429	45 m (147.6 feet)
223422	10 m (32.8 feet)	223430	60 m (196.9 feet)
223425	15 m (49.2 feet)	223431	75 m (246.1 feet)
223426	20 m (65.6 feet)	–	–

Gas connect console to torch connect console connections

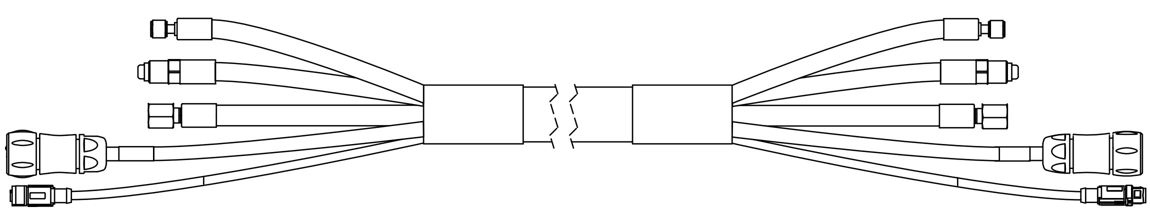
Pilot arc and coolant hose set assembly (Core or CorePlus)



Part number	Length	Part number	Length
428454	3 m (9.8 feet)	428458	10 m (32.8 feet)
428455	4.5 m (14.8 feet)	428459	15 m (49.2 feet)
428456	6 m (19.7 feet)	428982	18 m (59.1 feet)*
428457	7.5 m (24.6 feet)	–	–

* The 18 meter (59.1 feet) assembly is compatible only with the 2 meter (6.6 feet) or 2.5 meter (8.2 feet) torch lead.

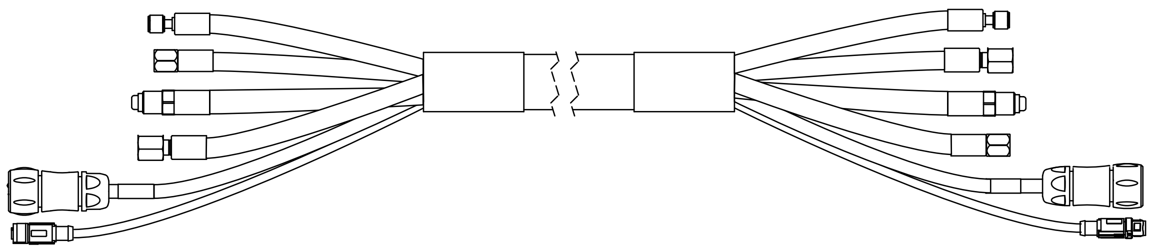
Power, CAN, and 3-gas assembly (Core)



Part number	Length	Part number	Length
428464	3 m (9.8 feet)	428468	10 m (32.8 feet)
428465	4.5 m (14.8 feet)	428469	15 m (49.2 feet)
428466	6 m (19.7 feet)	428983	18 m (59.1 feet)*
428467	7.5 m (24.6 feet)	–	–

* The 18 meter (59.1 feet) assembly is compatible only with the 2 meter (6.6 feet) or 2.5 meter (8.2 feet) torch lead.

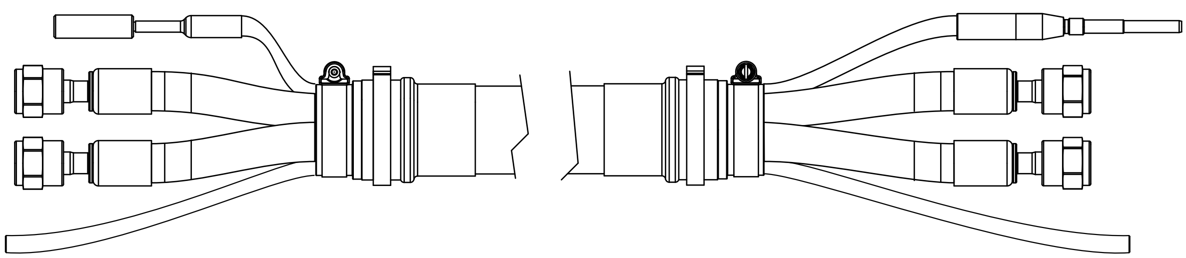
Power, CAN, and 4-gas assembly (CorePlus)



Part number	Length	Part number	Length
10079381	3 m (9.8 feet)	10079385	10 m (32.8 feet)
10079382	4.5 m (14.8 feet)	10079386	15 m (49.2 feet)
10079383	6 m (19.7 feet)	10079387	18 m (59.1 feet)*
10079384	7.5 m (24.6 feet)	–	–

* The 18 meter (59.1 feet) assembly is compatible only with the 2 meter (6.6 feet) or 2.5 meter (8.2 feet) torch lead.

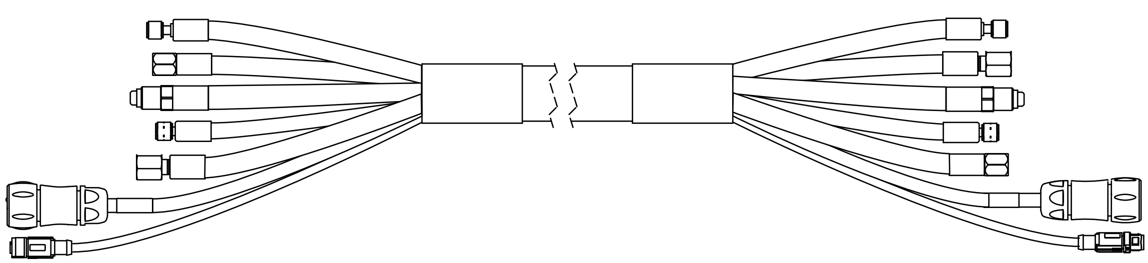
Pilot arc, coolant hose set, and shield water assembly (VWI or OptiMix)



Part number	Length	Part number	Length
428353	3 m (9.8 feet)	428357	10 m (32.8 feet)
428354	4.5 m (14.8 feet)	428358	15 m (49.2 feet)
428355	6 m (19.7 feet)	428981	18 m (59.1 feet)*
428356	7.5 m (24.6 feet)	–	–

* The 18 meter (59.1 feet) assembly is compatible only with the 2 meter (6.6 feet) or 2.5 meter (8.2 feet) torch lead.

Power, CAN, and 5-gas assembly (VWI or OptiMix)

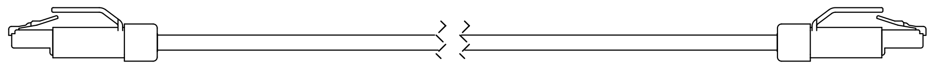


Part number	Length	Part number	Length
428363	3 m (9.8 feet)	428367	10 m (32.8 feet)
428364	4.5 m (14.8 feet)	428368	15 m (49.2 feet)
428365	6 m (19.7 feet)	428980	18 m (59.1 feet)*
428366	7.5 m (24.6 feet)	–	–

* The 18 meter (59.1 feet) assembly is compatible only with the 2 meter (6.6 feet) or 2.5 meter (8.2 feet) torch lead.

Plasma power supply to CNC connections

EtherCAT CNC interface cable

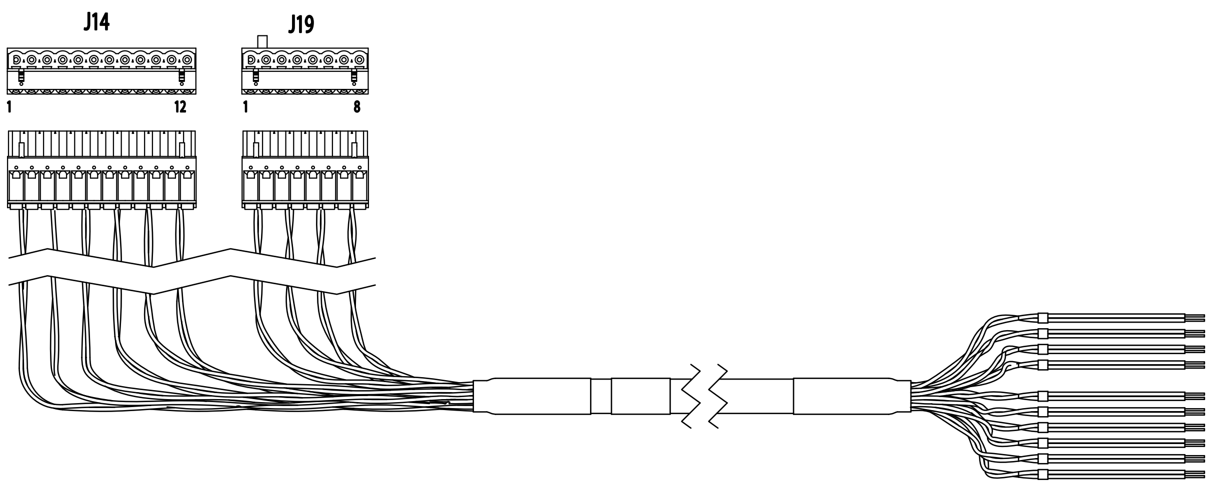


Description: RJ-45 connector, male-male, SF/UTP shield, 2 twisted pairs, 22 AWG

For more information on EtherCAT cable specifications, refer to How to connect to the plasma power supply with EtherCAT on page 153.

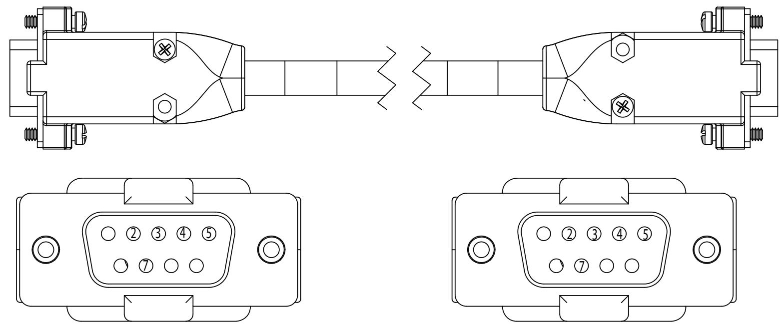
Part number	Length	Part number	Length
223506	0.3 m (1 foot)	223512	10 m (32.8 feet)
223507	0.6 m (2 feet)	223513	15 m (49.2 feet)
223508	1.5 m (4.9 feet)	223514	22.5 m (73.8 feet)
223672	2.5 m (8.2 feet)	223515	30 m (98.4 feet)
223509	3 m (9.8 feet)	223516	45 m (147.6 feet)
223510	6 m (19.7 feet)	223517	60 m (196.9 feet)
223511	7.5 m (24.6 feet)	223714	75 m (246.1 feet)

Discrete CNC interface cable



Part number	Length	Part number	Length
223691	3 m (9.8 feet)	223700	20 m (65.6 feet)
223692	4.5 m (14.8 feet)	223701	22.5 m (73.8 feet)
223693	6 m (19.7 feet)	223702	25 m (82 feet)
223694	7.5 m (24.6 feet)	223703	30 m (98.4 feet)
223695	10 m (32.8 feet)	223704	35 m (114.8 feet)
223696	12 m (39.4 feet)	223705	37.5 m (123 feet)
223697	13.5 m (44.3 feet)	223706	45 m (147.6 feet)
223698	15 m (49.2 feet)	223707	60 m (196.9 feet)
223699	16.5 m (54.1 feet)	223708	75 m (246.1 feet)

Serial CNC interface cable

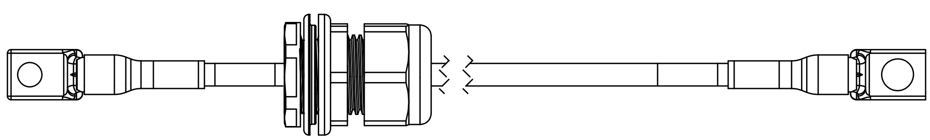


Description: 9-position, D-subminiature (D-sub) connector, male-male, RS-422

Part number	Length	Part number	Length
223673	3 m (9.8 feet)	223682	20 m (65.6 feet)
223674	4.5 m (14.8 feet)	223683	22.5 m (73.8 feet)
223675	6 m (19.7 feet)	223684	25 m (82.0 feet)
223676	7.5 m (24.6 feet)	223685	30 m (98.4 feet)
223677	10 m (32.8 feet)	223686	35 m (114.8 feet)
223678	12 m (39.4 feet)	223687	37.5 m (123 feet)
223679	13.5 m (44.3 feet)	223688	45 m (147.6 feet)
223680	15 m (49.2 feet)	223689	60 m (196.9 feet)
223681	16.5 m (54.1 feet)	223690	75 m (246.1 feet)

Plasma power supply to cutting table connection

Work lead

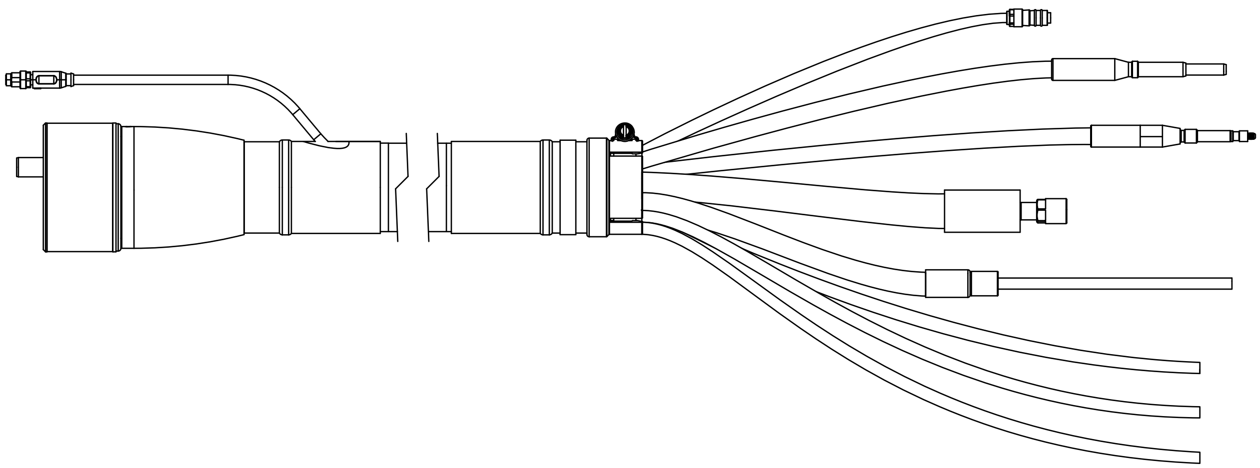


Part number	Type	Length	Part number	Type	Length
223628	2/0	3 m (9.8 feet)	223648	4/0	60 m (196.9 feet)
223629	2/0	4.5 m (14.8 feet)	223649	4/0	75 m (246.1 feet)
223630	2/0	7.5 m (24.6 feet)	223661*	2/0	3 m (9.8 feet)
223631	2/0	10 m (32.8 feet)	223662*	2/0	4.5 m (14.8 feet)
223632	2/0	15 m (49.2 feet)	223663*	2/0	7.5 m (24.6 feet)
223633	2/0	20 m (65.6 feet)	223664*	2/0	10 m (32.8 feet)
223634	2/0	25 m (82 feet)	223665*	2/0	15 m (49.2 feet)
223646	4/0	35 m (114.8 feet)	223666*	2/0	20 m (65.6 feet)
223647	4/0	45 m (147.6 feet)	223667*	2/0	25 m (82 feet)

* Leads labeled with CCC mark only. CCC is defined in Symbols and marks on page 34.

Torch connect console to torch receptacle connection

Torch lead



Part number	Length	Part number	Length
428383	2 m (6.6 feet)	428386	3.5 m (11.5 feet)
428384	2.5 m (8.2 feet)	428824	4 m (13.1 feet)
428385	3 m (9.8 feet)	428387	4.5 m (14.8 feet)

Bevel torch lead

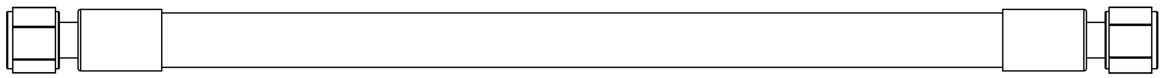
<table>
<tr><th>Part number</th><th>Lead length</th><th>Strain relief length</th><th>Part number</th><th>Lead length</th><th>Strain relief length</th></tr>
<tr><td>428825</td><td>2 m (6.6 feet)</td><td rowspan="7">0.5 m (20 inches)</td><td>428831</td><td>2 m (6.6 feet)</td><td rowspan="7">1.2 m (48 inches)</td></tr>
<tr><td>428826</td><td>2.5 m (8.2 feet)</td><td>428832</td><td>2.5 m (8.2 feet)</td></tr>
<tr><td>428827</td><td>3 m (9.8 feet)</td><td>428833</td><td>3 m (9.8 feet)</td></tr>
<tr><td>428828</td><td>3.5 m (11.5 feet)</td><td>428834</td><td>3.5 m (11.5 feet)</td></tr>
<tr><td>428829</td><td>4 m (13.1 feet)</td><td>428835</td><td>4 m (13.1 feet)</td></tr>
<tr><td>428830</td><td>4.5 m (14.8 feet)</td><td>428836</td><td>4.5 m (14.8 feet)</td></tr>
<tr><td>428978</td><td>6 m (20 feet)*</td><td>428979</td><td>6 m (20 feet)*</td></tr>
</table>

* The 6 meter (20 feet) lead is compatible only with gas assemblies that are 7.5 meters (24.6 feet) or less.

Supply hoses

Oxygen hose (blue)

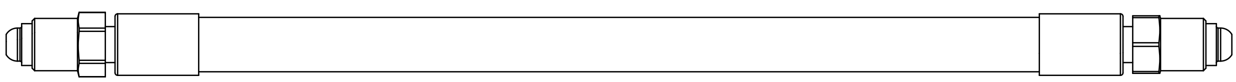
Fittings: RH type “B” female



Part number	Length	Part number	Length
124003	3 m (9.8 feet)	124009	25 m (82 feet)
124004	4.5 m (14.8 feet)	124107	30 m (98.4 feet)
124005	7.5 m (24.6 feet)	124010	35 m (114.8 feet)
124006	10 m (32.8 feet)	124011	45 m (147.6 feet)
124007	15 m (49.2 feet)	124012	60 m (196.9 feet)
124008	20 m (65.6 feet)	124013	75 m (246.1 feet)

Nitrogen or Argon hose (black)

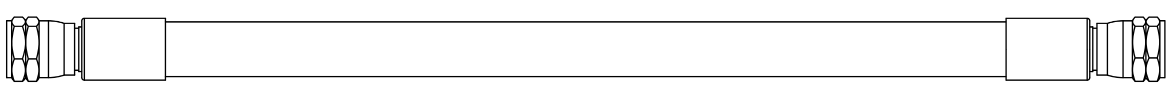
Fittings: RH type “B” male



Part number	Length	Part number	Length
124014	3 m (9.8 feet)	124020	25 m (82 feet)
124015	4.5 m (14.8 feet)	124108	30 m (98.4 feet)
124016	7.5 m (24.6 feet)	124021	35 m (114.8 feet)
124017	10 m (32.8 feet)	124022	45 m (147.6 feet)
124018	15 m (49.2 feet)	124023	60 m (196.9 feet)
124019	20 m (65.6 feet)	124024	75 m (246.1 feet)

Air hose (black)

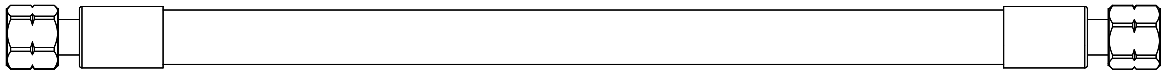
Fittings: JIC-6 female



Part number	Length	Part number	Length
124025	3 m (9.8 feet)	124031	25 m (82 feet)
124026	4.5 m (14.8 feet)	124109	30 m (98.4 feet)
124027	7.5 m (24.6 feet)	124032	35 m (114.8 feet)
124028	10 m (32.8 feet)	124033	45 m (147.6 feet)
124029	15 m (49.2 feet)	124034	60 m (196.9 feet)
124030	20 m (65.6 feet)	124035	75 m (246.1 feet)

Hydrogen or nitrogen-hydrogen (F5) (red)

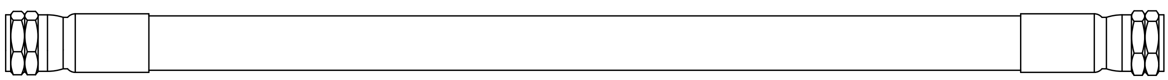
Fittings: LH type “B” female



Part number	Length	Part number	Length
124036	3 m (9.8 feet)	124042	25 m (82 feet)
124037	4.5 m (14.8 feet)	124110	30 m (98.4 feet)
124038	7.5 m (24.6 feet)	124043	35 m (114.8 feet)
124039	10 m (32.8 feet)	124044	45 m (147.6 feet)
124040	15 m (49.2 feet)	124045	60 m (196.9 feet)
124041	20 m (65.6 feet)	124046	75 m (246.1 feet)

Water (optional shield fluid) (blue)

Fittings: JIC-6 female



Part number	Length	Part number	Length
124047	3 m (9.8 feet)	124053	25 m (82 feet)
124048	4.5 m (14.8 feet)	124111	30 m (98.4 feet)
124049	7.5 m (24.6 feet)	124054	35 m (114.8 feet)
124050	10 m (32.8 feet)	124055	45 m (147.6 feet)
124051	15 m (49.2 feet)	124056	60 m (196.9 feet)
124052	20 m (65.6 feet)	124057	75 m (246.1 feet)

Preventive maintenance kits

Part number	Description
428639	Kit: Filter, torch rebuild without coolant
428640	Kit: Filter, torch rebuild with coolant
428920	Kit: Shield-fluid treatment
428641	Kit: Electronics (200 V – 240 V)
428642	Kit: Electronics (380 V – 600 V)

Tools

Part number	Description
229917	Torch connect console solenoid valve tool
229918	Torch solenoid valve tool
104879	2.25 inch spanner wrench
004630	Pit depth gauge
004629	Gauge point
104119	Consumable tool
429013	XPR electrode torque tool
1-13897 (Hypertherm Waterjet part number)	TDS meter

Recommended spare parts

Plasma power supply – recommended spare parts

Part number	Description	Designator	Quantity
428810	Shield-fluid treatment filter	–	1
027005	Coolant filter (fine)	–	1
006113	Coolant check valve	–	1
229640	Power source: 88 VAC – 264 VAC to 24 VDC	PS1	1
229671	Power source: 88 VAC – 264 VAC to 48 VDC, 600 W	PS2	1
229679	Chopper assembly	Chopper 1	1
428750	Control PCB	PCB1	1
141371	I/O PCB	PCB5	1
141384	Fan power distribution PCB	PCB6	1
141425	Power distribution PCB	PCB7	1
108709	Fuse:10 A, 250 VAC, time delay (on PCB7)	F3, F4, F5	2
208397*	Fuse: 15 A, 600 V, Class R (used in 200 V, 208 V, 220 V, 240 V)	F1, F2	2
208395*	Fuse: 8 A, 600 V, Class R (used in 380 V, 400 V, 415 V, 440 V, 480 V, 600 V)		2
003277	Pilot arc relay	CR1	1
229697	Inrush contactor assembly: 80 A, IEC AC-3, 3-phase, 120 VAC	IR_CON	1

Part number	Description	Designator	Quantity
003276*	Main contactor (200 V, 208 V, 220 V, 240 V)	M_CON	1
429060*	Main contactor assembly (380 V, 400 V, 415 V, 440 V, 480 V, 600 V)		1

* Voltage dependent - Select accordingly

Gas connect consoles – recommended spare parts

Part number	Description	Designator	Quantity
011110	Air filter element	–	1
223398	Pressure transducer (VWI and OptiMix only)	P6 – P9	1
006167	Solenoid valve (VWI and OptiMix only)	B4 – B5	1
141563	High-frequency, high-voltage ignition PCB	PCB2	1
141595	Spark gap PCB for ignition PCB	–	1

Torch connect console – recommended spare parts

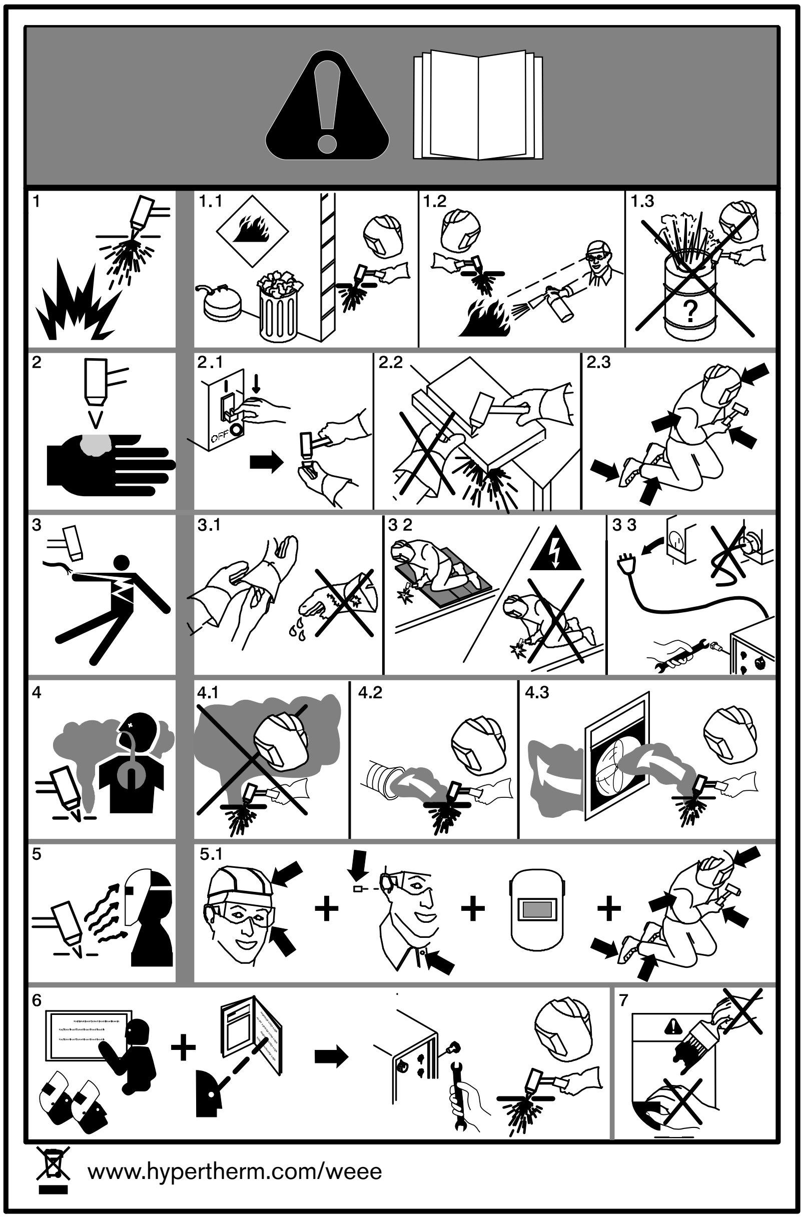
Part number	Description	Designator	Quantity
141368	Ohmic contact PCB	PCB2	1
223477	Pressure transducer with wire and connector	P1 – P5, P14	1
006167	Solenoid valve	B1 – B3	1
229965	Solenoid valve	V4 – V12	1

Torch – recommended spare parts

Part number	Description	Designator	Quantity
420220	Quick-disconnect/torch receptacle	–	1
420221	Quick-disconnect torch	–	1
420368	Water tube	–	1
006155	Torch solenoid valve	–	1

Descriptions of warning label icons

This warning label is affixed to some power supplies. It is important that the operator and maintenance technician understand the intent of these warning symbols as described. The numbered text corresponds to the numbered boxes on the label.



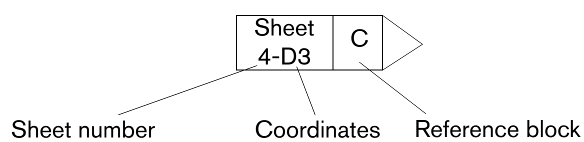
1. Cutting sparks can cause explosion or fire.
1.1 Do not cut near flammables.
1.2 Have a fire extinguisher nearby and ready to use.
1.3 Do not use a drum or other closed container as a cutting table.
2. Plasma arc can injure and burn; point the nozzle away from yourself. Arc starts instantly when triggered.
2.1 Turn off power before disassembling torch.
2.2 Do not grip the workpiece near the cutting path.
2.3 Wear complete body protection.
3. Hazardous voltage. Risk of electric shock or burn.
3.1 Wear insulating gloves. Replace gloves when wet or damaged.
3.2 Protect from shock by insulating yourself from work and ground.
3.3 Disconnect power before servicing. Do not touch live parts.
4. Plasma fumes can be hazardous.
4.1 Do not inhale fumes.
4.2 Use forced ventilation or local exhaust to remove the fumes.
4.3 Do not operate in closed spaces. Remove fumes with ventilation.
5. Arc rays can burn eyes and injure skin.
5.1 Wear correct and appropriate protective equipment to protect head, eyes, ears, hands, and body. Button shirt collar. Protect ears from noise. Use welding helmet with the correct shade of filter.
6. Become trained. Only qualified personnel should operate this equipment. Use torches specified in the manual. Keep non-qualified personnel and children away.
7. Do not remove, destroy, or cover this label. Replace if it is missing, damaged, or worn.

10

Wiring Diagrams

This section contains the wiring diagrams for the system. When you trace a signal path, or reference the *Parts List* or *Troubleshooting* sections, the following conventions will help you understand the organization of the wiring diagrams:

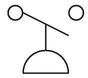
- Sheet numbers are located in the lower, right-hand corner of each page.
- References to other pages use the following connection symbol:



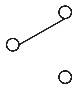
Use the sheet number to find the reference sheet. Line up the coordinates A–D on the Y axis and numbers 1–4 on the X axis of each sheet to find the reference blocks (similar to a road map).

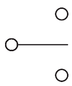
Wiring diagram symbols

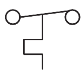
Battery	Ground clamp	Receptacle
Cap, polarized	Ground, chassis	Relay, coil
Cap, not polarized	Ground, earth	Relay, normally closed
Cap, feed-through	IGBT	Relay, normally open
Circuit breaker	Inductor	Relay, solid state, AC
Coax shield	LED	Relay, solid state, DC
Current sensor	Lamp	Relay, solid state
Current sensor	MOV	Resistor
DC supply	Pin	SCR
Diode	Socket	Shield
Door interlock	Plug	Shunt
Fan	PNP transistor	Spark gap
Feed-through LC	Potentiometer	Switch, flow
Filter, AC	Push button, normally closed	Switch, level, normally closed
Fuse	Push button, normally open	Switch, pressure, normally closed

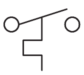
 Switch, pressure, normally open

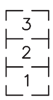
 Switch, 1 pole, 1 throw

 Switch, 1 pole, 2 throw

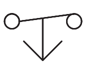
 Switch, 1 pole, 2 throw, center off

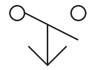
 Switch, temperature, normally closed

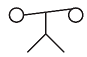
 Switch, temperature, normally open

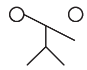


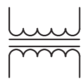
Terminal block

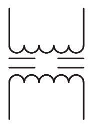
 Time delay closed, NC/off

 Time delay open, NO/off

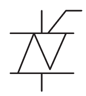
 Time delay open, NC/on

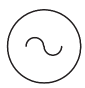
 Time delay closed, NO/off

 Transformer

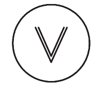
 Transformer, air core

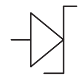
 Transformer, coil

 Triac

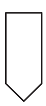
 VAC source

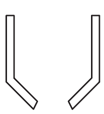
 Valve, solenoid

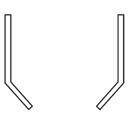
 Voltage source

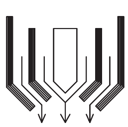
 Zener diode

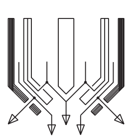
Torch symbols

 Electrode

 Nozzle

 Shield

 Torch

 Torch, HyDefinition®

Valve states during operation

During each stage of cutting system operation, different valves are active (ON) or inactive (OFF). The type of gas connect console and the type and timing of the active process changes the valves that are active or inactive.

Refer to the CNC or XPR web interface to see the most current information about the state (ON-OFF) of each valve.

- For information about how to view valve states on the CNC, refer to the instruction manual that came with your CNC.
- The following steps describe how to view valve states on the XPR web interface:
  - Use the XPR web interface to select the process you want to view.
  - Go to the Gas System screen. Refer to Gas system on page 190.

    On this screen you can see which valves are active when the gas is flowing. Active valves are indicated with a gray highlight.

  - On the Gas System screen, enable the desired mode (Test Preflow, Test Pierceflow, or Test Cutflow) for the process you want to view.

    Active valves are indicated with a gray highlight.

Valve states by process ID

Process IDs: 1001, 1002, 1003, 1152, 1153, 1155, 1004, 1005, 1151, 1156											
Block type	**Gas**	**V1**	**V4**	**V5**	**V6**	**V7**	**V8**	**V9**	**V10**	**V11**	**V12**
Preflow	N_2/Air	Off	Off	Off	**On**	Off	Off	**On**	Off	Off	Off
Cutflow	O_2/Air	**On**	Off	Off	**On**	Off	Off	**On**	Off	**On**	**On**
Piercing	O_2/Air	**On**	Off	Off	**On**	Off	Off	**On**	Off	Off	**On**

Process IDs: 7001, 7004, 7005, 7007, 7008, 7009, 7010, 7011, 7012, 7013, 7018											
Block type	**Gas**	**V1**	**V4**	**V5**	**V6**	**V7**	**V8**	**V9**	**V10**	**V11**	**V12**
Preflow	N_2/Air	Off	Off	Off	**On**	Off	Off	**On**	Off	Off	Off
Cutflow	O_2/O_2	**On**	Off	Off	Off	**On**	Off	**On**	Off	**On**	**On**
Piercing	O_2/Air	**On**	Off	Off	**On**	Off	Off	**On**	Off	Off	**On**

Process ID: 8001											
Block type	**Gas**	**V1**	**V4**	**V5**	**V6**	**V7**	**V8**	**V9**	**V10**	**V11**	**V12**
Preflow	N_2/N_2	Off	Off	**On**	Off	Off	Off	**On**	Off	Off	Off
Cutflow	N_2/N_2	Off	Off	**On**	Off	Off	Off	**On**	Off	**On**	Off
Piercing	N_2/N_2	Off	Off	**On**	Off	Off	Off	**On**	Off	Off	Off

Process IDs: 9001, 9010, 9018											
Block type	**Gas**	**V1**	**V4**	**V5**	**V6**	**V7**	**V8**	**V9**	**V10**	**V11**	**V12**
Preflow	Ar/Air	Off	Off	Off	**On**	Off	**On**	Off	Off	**On**	Off
Cutflow	Ar/Air	Off	Off	Off	**On**	Off	**On**	Off	Off	**On**	Off
Piercing	Ar/Air	Off	Off	Off	**On**	Off	**On**	Off	Off	**On**	Off

Process IDs: 2051, 2054, 2057, 2100, 8004, 8005, 8006											
Block type	**Gas**	**V1**	**V4**	**V5**	**V6**	**V7**	**V8**	**V9**	**V10**	**V11**	**V12**
Preflow	N_2/N_2	Off	Off	**On**	Off	Off	Off	Off	Off	Off	Off
Cutflow	N_2/N_2	Off	Off	**On**	Off	Off	Off	Off	Off	Off	Off
Piercing	N_2/N_2	Off	Off	**On**	Off	Off	Off	Off	Off	Off	Off

Process IDs: 2010, 2011, 2028, 2029, 2052, 2055, 2058											
Block type	**Gas**	**V1**	**V4**	**V5**	**V6**	**V7**	**V8**	**V9**	**V10**	**V11**	**V12**
Preflow	N_2/H_2O	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off
Cutflow	N_2/H_2O	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off
Piercing	N_2/H_2O	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off

Process IDs: 2053, 2056, 2059, 2060, 2061, 2062, 2063, 2064, 2065, 2066											
Block type	**Gas**	**V1**	**V4**	**V5**	**V6**	**V7**	**V8**	**V9**	**V10**	**V11**	**V12**
Preflow	N_2/N_2	Off	Off	**On**	Off	Off	Off	Off	Off	Off	Off
Cutflow	Mix/N_2	**On**	Off	**On**	Off	Off	Off	Off	**On**	Off	Off
Piercing	Mix/N_2	**On**	Off	**On**	Off	Off	Off	Off	**On**	Off	Off

Process IDs: 1201, 1203, 1206, 1251, 1252, 1253, 1254, 1255											
Block type	**Gas**	**V1**	**V4**	**V5**	**V6**	**V7**	**V8**	**V9**	**V10**	**V11**	**V12**
Preflow	N_2/Air	Off	Off	Off	**On**	Off	Off	**On**	Off	Off	Off
Cutflow	O_2/Air	**On**	Off	Off	**On**	Off	Off	**On**	Off	Off	**On**
Piercing	O_2/Air	**On**	Off	Off	**On**	Off	Off	**On**	Off	Off	**On**

Process IDs: 1051, 7014, 7015											
Block type	**Gas**	**V1**	**V4**	**V5**	**V6**	**V7**	**V8**	**V9**	**V10**	**V11**	**V12**
Preflow	N_2/O_2	Off	Off	Off	Off	**On**	Off	**On**	Off	Off	Off
Cutflow	O_2/O_2	**On**	Off	Off	Off	**On**	Off	**On**	Off	**On**	**On**
Piercing	O_2/O_2	**On**	Off	Off	Off	**On**	Off	**On**	Off	Off	**On**

Process IDs: 1102, 1101											
Block type	**Gas**	**V1**	**V4**	**V5**	**V6**	**V7**	**V8**	**V9**	**V10**	**V11**	**V12**
Preflow	N_2/Air	Off	Off	Off	**On**	Off	Off	**On**	Off	Off	Off
Cutflow	O_2/Air	**On**	Off	Off	**On**	Off	Off	**On**	Off	**On**	Off
Piercing	O_2/Air	**On**	Off	Off	**On**	Off	Off	**On**	Off	Off	Off

Process IDs: 1103, 1104, 1105, 1106, 1107											
Block type	**Gas**	**V1**	**V4**	**V5**	**V6**	**V7**	**V8**	**V9**	**V10**	**V11**	**V12**
Preflow	N_2/Air	Off	Off	Off	**On**	Off	Off	**On**	Off	Off	Off
Cutflow	O_2/Air	**On**	Off	Off	**On**	Off	Off	**On**	Off	**On**	Off
Piercing	O_2/Air	**On**	Off	Off	**On**	Off	Off	**On**	Off	Off	Off

Process IDs: 1207											
Block type	**Gas**	**V1**	**V4**	**V5**	**V6**	**V7**	**V8**	**V9**	**V10**	**V11**	**V12**
Preflow	N_2/Air	Off	Off	Off	**On**	Off	Off	**On**	Off	Off	Off
Cutflow	O_2/Air	**On**	Off	Off	**On**	Off	Off	**On**	Off	Off	**On**
Piercing	O_2/N_2	**On**	Off	On	**Off**	Off	Off	**On**	Off	Off	**On**

Process IDs: 7002, 7003, 7006											
Block type	**Gas**	**V1**	**V4**	**V5**	**V6**	**V7**	**V8**	**V9**	**V10**	**V11**	**V12**
Preflow	N_2/Air	Off	Off	Off	**On**	Off	Off	**On**	Off	Off	Off
Cutflow	O_2/O_2	**On**	Off	Off	Off	**On**	Off	**On**	Off	**On**	Off
Piercing	O_2/Air	**On**	Off	Off	**On**	Off	Off	**On**	Off	Off	Off

Process IDs: 7019											
Block type	**Gas**	**V1**	**V4**	**V5**	**V6**	**V7**	**V8**	**V9**	**V10**	**V11**	**V12**
Preflow	N_2/O_2	Off	Off	Off	**Off**	On	Off	**On**	Off	On	Off
Cutflow	O_2/O_2	**On**	Off	Off	**Off**	On	Off	**On**	Off	On	**On**
Piercing	O_2/Air	**On**	Off	Off	**On**	Off	Off	**On**	Off	Off	**On**

Process IDs: 2001, 2002, 2003, 2004, 2005											
Block type	**Gas**	**V1**	**V4**	**V5**	**V6**	**V7**	**V8**	**V9**	**V10**	**V11**	**V12**
Preflow	N_2/N_2	Off	Off	**On**	Off	Off	Off	Off	**On**	Off	Off
Cutflow	F5/N_2	**On**	Off	**On**	Off	Off	Off	Off	**On**	**On**	Off
Piercing	F5/N_2	**On**	Off	**On**	Off	Off	Off	Off	**On**	**On**	Off

Process IDs: 2006, 2007, 2012, 2013, 2014, 2015, 2024, 2025, 2026											
Block type	**Gas**	**V1**	**V4**	**V5**	**V6**	**V7**	**V8**	**V9**	**V10**	**V11**	**V12**
Preflow	N_2/N_2	Off	Off	**On**	Off	Off	Off	Off	Off	Off	Off
Cutflow	N_2/N_2	Off	Off	**On**	Off	Off	Off	Off	Off	**On**	Off
Piercing	N_2/N_2	Off	Off	**On**	Off	Off	Off	Off	Off	**On**	Off

Process IDs: 2008, 2009

Block type	Gas	V1	V4	V5	V6	V7	V8	V9	V10	V11	V12
Preflow	N_2/Air	Off	Of	Off	**On**	Off	Off	Off	Off	Off	Off
Cutflow	Air/Air	**On**	Off	Off	**On**	Off	Off	Off	Off	**On**	Off
Piercing	Air/N_2	**On**	Off	**On**	Off	Off	Off	Off	Off	**On**	Off

Process IDs: 2016, 2017, 2018, 2019

Block type	Gas	V1	V4	V5	V6	V7	V8	V9	V10	V11	V12
Preflow	N_2/Air	Off	Off	Off	**On**	Off	Off	Off	Off	Off	Off
Cutflow	Air/Air	**On**	Off	Off	**On**	Off	Off	Off	Off	**On**	Off
Piercing	Air/Air	**On**	Off	Off	**On**	Off	Off	Off	Off	**On**	Off

Process IDs: 2020, 2021, 2022, 2023

Block type	Gas	V1	V4	V5	V6	V7	V8	V9	V10	V11	V12
Preflow	N_2/N_2	Off	Off	**On**	Off	Off	Off	Off	**On**	Off	Off
Cutflow	F5/N_2	**On**	Off	**On**	Off	Off	Off	Off	**On**	Off	Off
Piercing	F5/N_2	**On**	Off	**On**	Off	Off	Off	Off	**On**	Off	Off

Process IDs: 9004, 9005, 9006, 9014, 9015, 9016, 9017

Block type	Gas	V1	V4	V5	V6	V7	V8	V9	V10	V11	V12
Preflow	Ar/N_2	Off	Off	**On**	Off	Off	**On**	Off	Off	Off	Off
Cutflow	Ar/N_2	Off	Off	**On**	Off	Off	**On**	Off	Off	Off	Off
Piercing	Ar/N_2	Off	Off	**On**	Off	Off	**On**	Off	Off	Off	Off

Process ID: 8007

Block type	Gas	V1	V4	V5	V6	V7	V8	V9	V10	V11	V12
Preflow	N_2/Air	Off	Off	Off	**On**	Off	Off	**On**	Off	Off	Off
Cutflow	N_2/Air	Off	Off	Off	**On**	Off	Off	**On**	Off	Off	Off
Piercing	N_2/Air	Off	Off	Off	**On**	Off	Off	**On**	Off	Off	Off

Process ID: 9007											
Block type	**Gas**	**V1**	**V4**	**V5**	**V6**	**V7**	**V8**	**V9**	**V10**	**V11**	**V12**
Preflow	Ar/Air	Off	Off	Off	**On**	Off	**On**	**On**	Off	**On**	Off
Cutflow	Ar/Air	Off	Off	Off	**On**	Off	**On**	**On**	Off	**On**	Off
Piercing	Ar/Air	Off	Off	Off	**On**	Off	**On**	**On**	Off	**On**	Off

Process ID: 9008											
Block type	**Gas**	**V1**	**V4**	**V5**	**V6**	**V7**	**V8**	**V9**	**V10**	**V11**	**V12**
Preflow	Ar/Air	Off	Off	Off	**On**	Off	**On**	Off	Off	Off	Off
Cutflow	Ar/Air	Off	Off	Off	**On**	Off	**On**	Off	Off	Off	Off
Piercing	Ar/N_2	Off	Off	**On**	Off	Off	**On**	Off	Off	Off	Off

Process IDs: 9002, 9003, 9009											
Block type	**Gas**	**V1**	**V4**	**V5**	**V6**	**V7**	**V8**	**V9**	**V10**	**V11**	**V12**
Preflow	Ar/N_2	Off	Off	**On**	Off	Off	**On**	Off	Off	**On**	Off
Cutflow	Ar/N_2	Off	Off	**On**	Off	Off	**On**	Off	Off	**On**	Off
Piercing	Ar/N_2	Off	Off	**On**	Off	Off	**On**	Off	Off	**On**	Off

Process IDs: 1202, 1204, 1207											
Block type	**Gas**	**V1**	**V4**	**V5**	**V6**	**V7**	**V8**	**V9**	**V10**	**V11**	**V12**
Preflow	N_2/N_2	Off	Off	**On**	Off	Off	Off	**On**	Off	Off	Off
Cutflow	O_2/N_2	**On**	Off	**On**	Off	Off	Off	**On**	Off	Off	**On**
Piercing	O_2/N_2	**On**	Off	**On**	Off	Off	Off	**On**	Off	Off	**On**

Process IDs: 2027, 2101											
Block type	**Gas**	**V1**	**V4**	**V5**	**V6**	**V7**	**V8**	**V9**	**V10**	**V11**	**V12**
Preflow	N_2/Air	Off	Off	Off	**On**	Off	Off	Off	Off	Off	Off
Cutflow	Air/Air	**On**	Off	Off	**On**	Off	Off	Off	Off	**On**	Off
Piercing	Air/Air	**On**	Off	Off	**On**	Off	Off	Off	Off	Off	Off

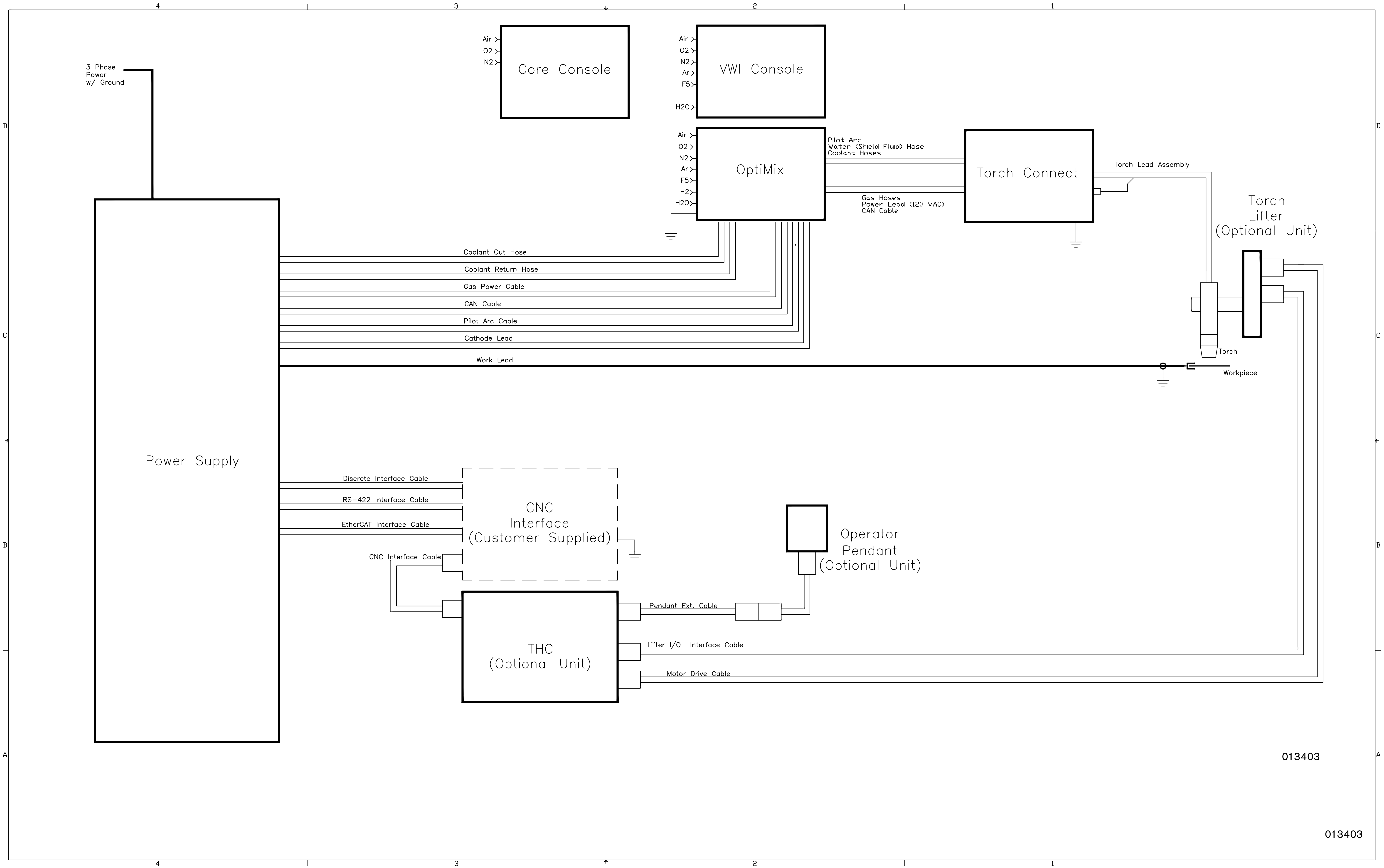
Process ID: 8002											
Block type	**Gas**	**V1**	**V4**	**V5**	**V6**	**V7**	**V8**	**V9**	**V10**	**V11**	**V12**
Preflow	N_2/N_2	Off	Off	**On**	Off	Off	Off	Off	Off	**On**	Off
Cutflow	N_2/N_2	Off	Off	**On**	Off	Off	Off	Off	Off	**On**	Off
Piercing	N_2/N_2	Off	Off	**On**	Off	Off	Off	Off	Off	**On**	Off

Process ID: 1205											
Block type	**Gas**	**V1**	**V4**	**V5**	**V6**	**V7**	**V8**	**V9**	**V10**	**V11**	**V12**
Preflow	N_2/N_2	Off	Off	**On**	Off	Off	Off	**On**	Off	Off	Off
Cutflow	O_2/N_2	**On**	Off	**On**	Off	Off	Off	**On**	Off	Off	**On**
Piercing	O_2/Ar	**On**	**On**	Off	Off	Off	Off	**On**	Off	Off	**On**

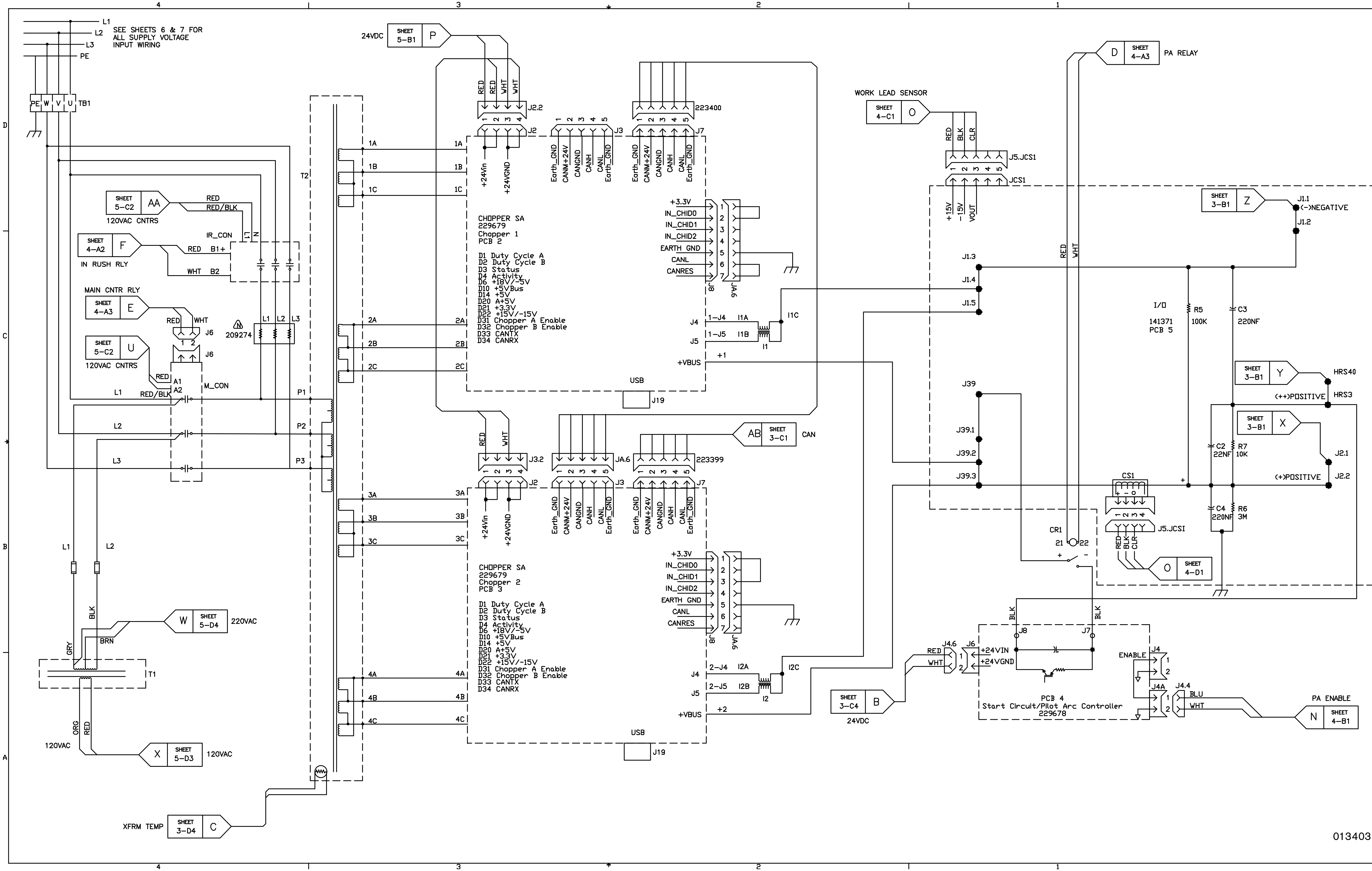
Process IDs: 9011, 9012, 9013											
Block type	**Gas**	**V1**	**V4**	**V5**	**V6**	**V7**	**V8**	**V9**	**V10**	**V11**	**V12**
Preflow	Ar/N_2	Off	On	**On**	Off	Off	**On**	Off	Off	**On**	Off
Cutflow	Ar/N_2	Off	On	**On**	Off	Off	**On**	Off	Off	Off	Off
Piercing	Ar/N_2	Off	On	**On**	Off	Off	**On**	Off	Off	Off	Off

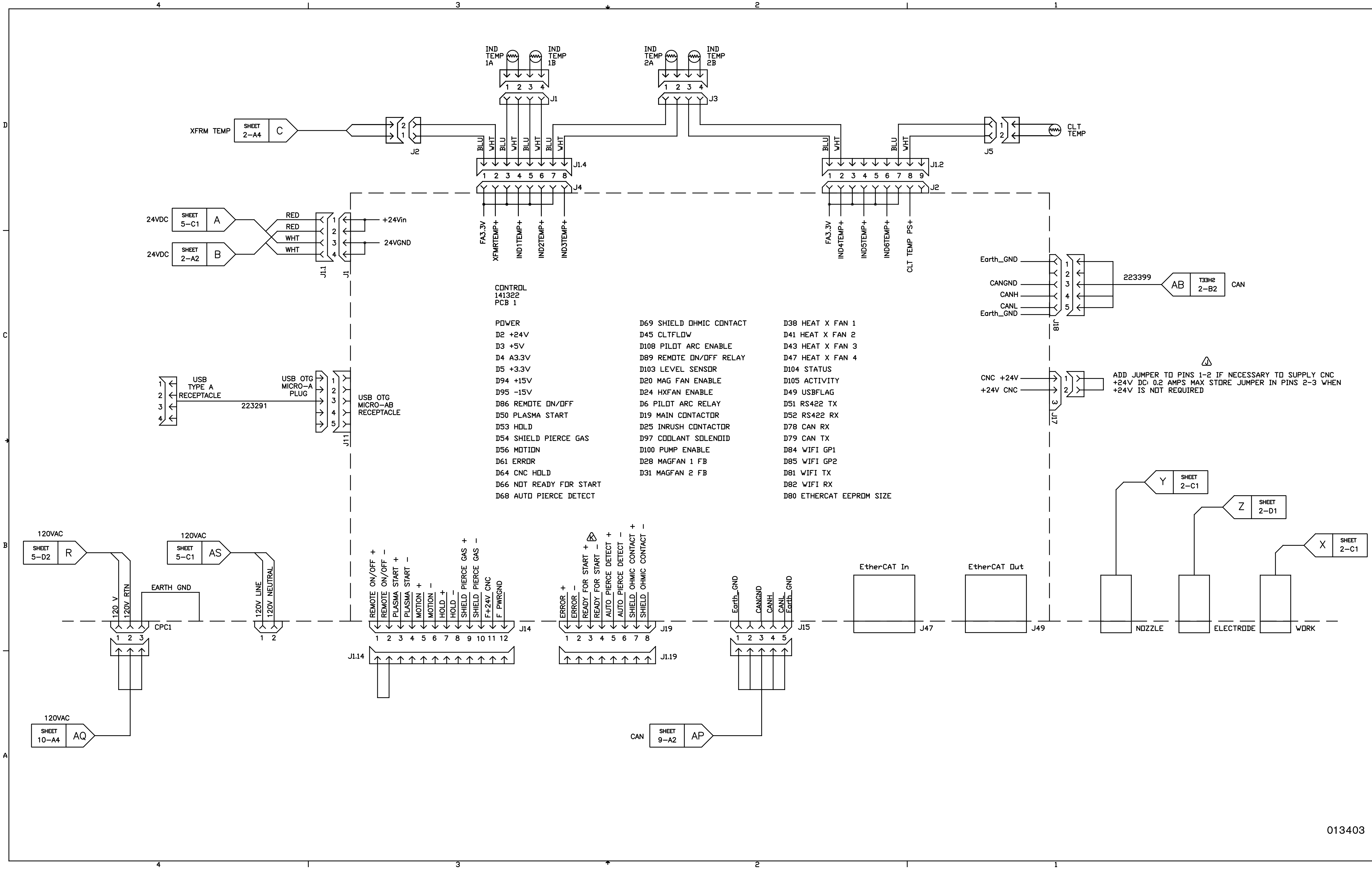
Process IDs: 1060, 1061, 7016, 7017											
Block type	**Gas**	**V1**	**V4**	**V5**	**V6**	**V7**	**V8**	**V9**	**V10**	**V11**	**V12**
Preflow	N_2/Air	Off	Off	Off	**On**	Off	Off	**On**	Off	**On**	Off
Cutflow	O_2/Air	**On**	Off	Off	**On**	Off	Off	**On**	Off	**On**	**On**
Piercing	O_2/Air	**On**	Off	Off	**On**	Off	Off	**On**	Off	**On**	**On**

Process ID: 1157											
Block type	**Gas**	**V1**	**V4**	**V5**	**V6**	**V7**	**V8**	**V9**	**V10**	**V11**	**V12**
Preflow	N_2/Air	Off	Off	Off	**On**	Off	Off	**On**	Off	Off	Off
Cutflow	O_2/Air	**On**	Off	Off	**On**	Off	Off	**On**	Off	**On**	**On**
Piercing	O_2/Ar	**On**	**On**	Off	Off	Off	Off	**On**	Off	Off	**On**

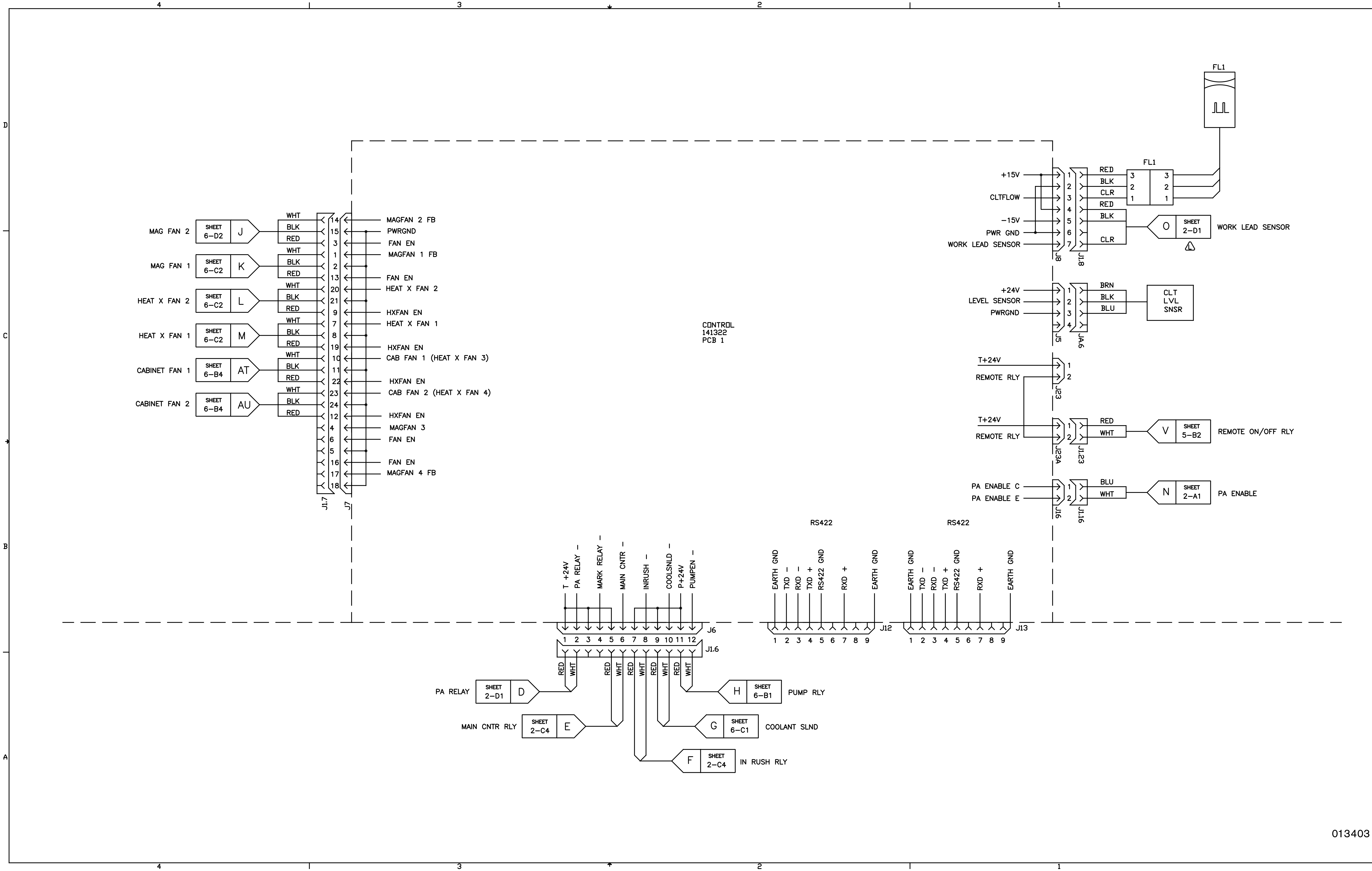


Core Console
Air
O2
N2
VWI Console
Air
O2
N2
Ar
F5
H2O
3 Phase Power w/ Ground
OptiMix
Air
O2
N2
Ar
F5
H2
H2O
Pilot Arc
Water (Shield Fluid) Hose
Coolant Hoses
Gas Hoses
Power Lead (120 VAC)
CAN Cable
Torch Connect
Torch Lead Assembly
Torch Lifter (Optional Unit)
Torch
Workpiece
Power Supply
Coolant Out Hose
Coolant Return Hose
Gas Power Cable
CAN Cable
Pilot Arc Cable
Cathode Lead
Work Lead
Discrete Interface Cable
RS-422 Interface Cable
EtherCAT Interface Cable
CNC Interface Cable
CNC Interface (Customer Supplied)
Operator Pendant (Optional Unit)
THC (Optional Unit)
Pendant Ext. Cable
Lifter I/O Interface Cable
Motor Drive Cable
013403
013403

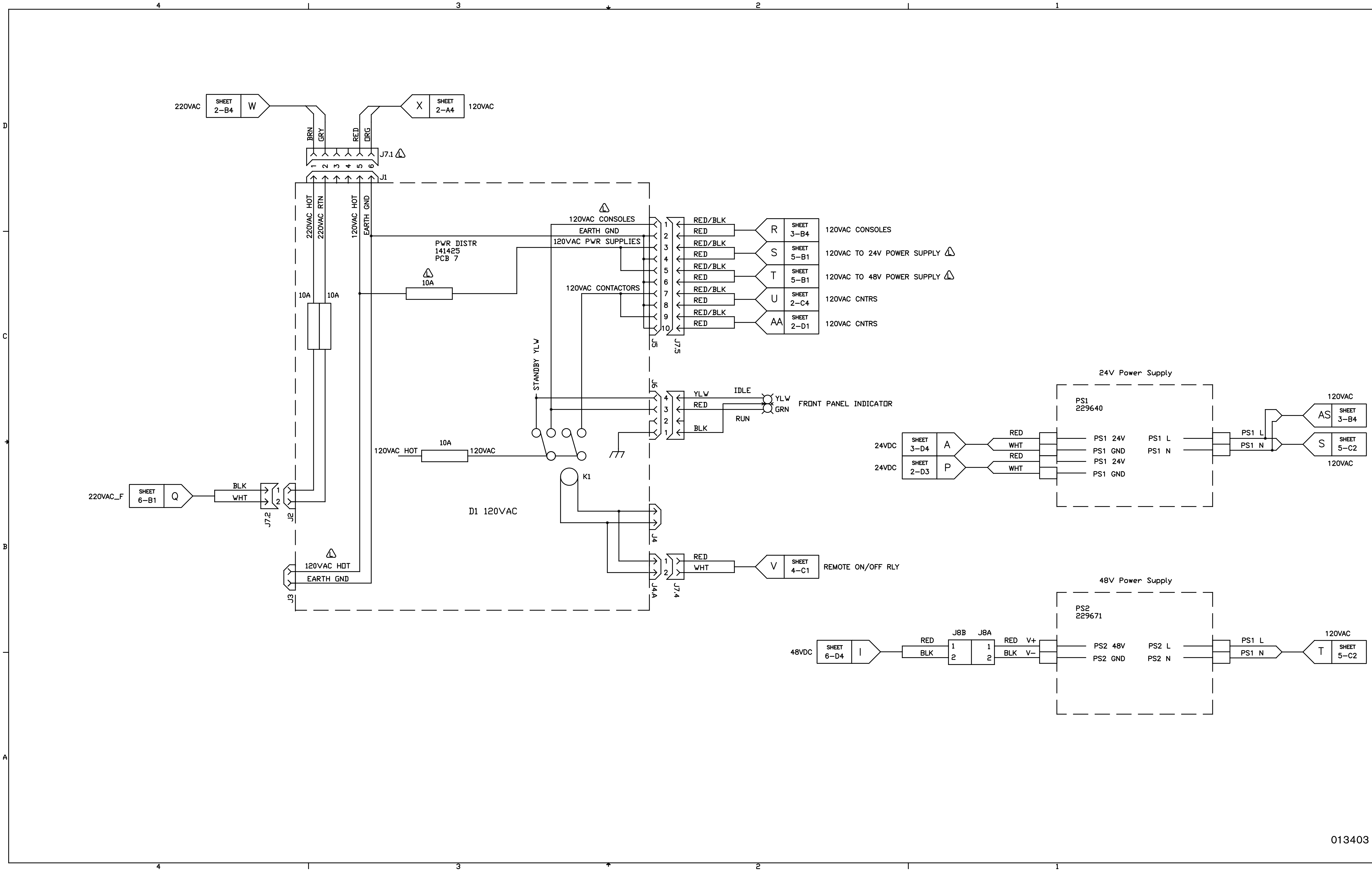

SEE SHEETS 6 & 7 FOR ALL SUPPLY VOLTAGE INPUT WIRING
TB1
120VAC CNTRS
IN RUSH RLY
MAIN CNTR RLY
120VAC CNTRS
M_CON
T2
CHOPPER SA
229679
Chopper 1
PCB 2
D1 Duty Cycle A
D2 Duty Cycle B
D3 Status
D4 Activity
D6 +18V/-5V
D10 +5VBus
D14 +5V
D20 A+5V
D21 +3.3V
D22 +15V/-15V
D31 Chopper A Enable
D32 Chopper B Enable
D33 CANTX
D34 CANRX
CHOPPER SA
229679
Chopper 2
PCB 3
WORK LEAD SENSOR
PA RELAY
I/O
141371
PCB 5
(−)NEGATIVE
(++)POSITIVE
(+)POSITIVE
PCB 4
Start Circuit/Pilot Arc Controller
229678
PA ENABLE
220VAC
120VAC
XFRM TEMP
24VDC
CAN
T1
013403



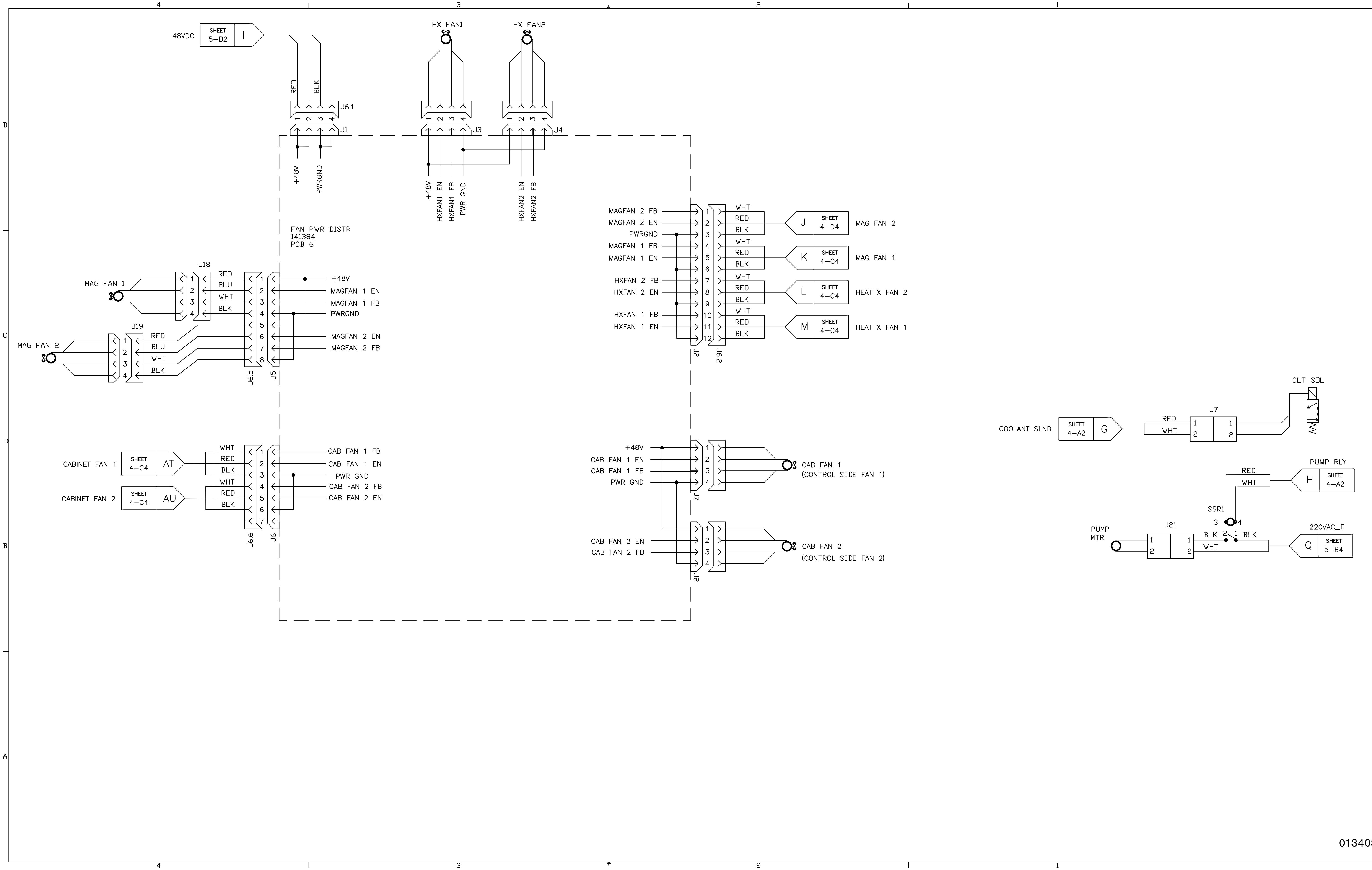
XFRM TEMP
SHEET 2-A4
C
J2
IND TEMP 1A
IND TEMP 1B
IND TEMP 2A
IND TEMP 2B
J1
J3
J1.4
J4
J1.2
J5
CLT TEMP
24VDC
SHEET 5-C1
A
24VDC
SHEET 2-A2
B
RED
RED
WHT
WHT
J1.1
J1
+24Vin
24VGND
FA3.3V
XFMRTEMP+
IND1TEMP+
IND2TEMP+
IND3TEMP+
FA3.3V
IND4TEMP+
IND5TEMP+
IND6TEMP+
CLT TEMP PS+
Earth_GND
CANGND
CANH
CANL
Earth_GND
J18
223399
AB
T33H2 2-B2
CAN
CONTROL
141322
PCB 1
POWER
D2 +24V
D3 +5V
D4 A3.3V
D5 +3.3V
D94 +15V
D95 -15V
D86 REMOTE ON/OFF
D50 PLASMA START
D53 HOLD
D54 SHIELD PIERCE GAS
D56 MOTION
D61 ERROR
D64 CNC HOLD
D66 NOT READY FOR START
D68 AUTO PIERCE DETECT
D69 SHIELD OHMIC CONTACT
D45 CLTFLOW
D108 PILOT ARC ENABLE
D89 REMOTE ON/OFF RELAY
D103 LEVEL SENSOR
D20 MAG FAN ENABLE
D24 HXFAN ENABLE
D6 PILOT ARC RELAY
D19 MAIN CONTACTOR
D25 INRUSH CONTACTOR
D97 COOLANT SOLENOID
D100 PUMP ENABLE
D28 MAGFAN 1 FB
D31 MAGFAN 2 FB
D38 HEAT X FAN 1
D41 HEAT X FAN 2
D43 HEAT X FAN 3
D47 HEAT X FAN 4
D104 STATUS
D105 ACTIVITY
D49 USBFLAG
D51 RS422 TX
D52 RS422 RX
D78 CAN RX
D79 CAN TX
D84 WIFI GP1
D85 WIFI GP2
D81 WIFI TX
D82 WIFI RX
D80 ETHERCAT EEPROM SIZE
USB TYPE A RECEPTACLE
223291
USB OTG MICRO-A PLUG
USB OTG MICRO-AB RECEPTACLE
J11
CNC +24V
+24V CNC
J17
ADD JUMPER TO PINS 1-2 IF NECESSARY TO SUPPLY CNC +24V DC: 0.2 AMPS MAX STORE JUMPER IN PINS 2-3 WHEN +24V IS NOT REQUIRED
120VAC
SHEET 5-D2
R
120VAC
SHEET 5-C1
AS
120 V
120V RTN
EARTH GND
CPC1
120V LINE
120V NEUTRAL
REMOTE ON/OFF +
REMOTE ON/OFF -
PLASMA START +
PLASMA START -
MOTION +
MOTION -
HOLD +
HOLD -
SHIELD PIERCE GAS +
SHIELD PIERCE GAS -
F+24V CNC
F PWRGND
J14
J1.14
ERROR +
ERROR -
READY FOR START +
READY FOR START -
AUTO PIERCE DETECT +
AUTO PIERCE DETECT -
SHIELD OHMIC CONTACT +
SHIELD OHMIC CONTACT -
J19
J1.19
Earth_GND
CANGND
CANH
CANL
Earth_GND
J15
EtherCAT In
J47
EtherCAT Out
J49
Y
SHEET 2-C1
Z
SHEET 2-D1
X
SHEET 2-C1
NOZZLE
ELECTRODE
WORK
120VAC
SHEET 10-A4
AQ
CAN
SHEET 9-A2
AP
013403

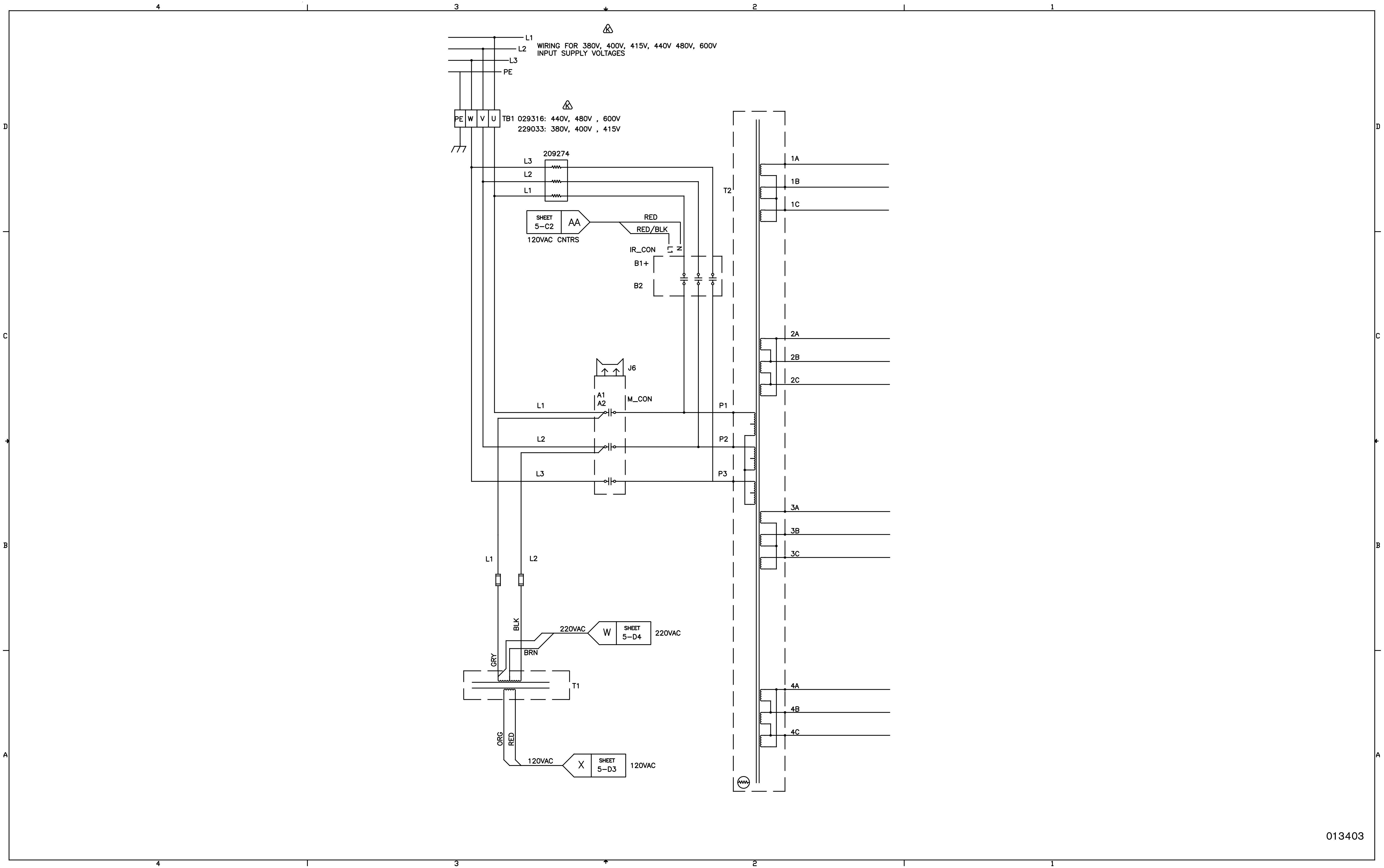

CONTROL
141322
PCB 1
MAG FAN 2
MAG FAN 1
HEAT X FAN 2
HEAT X FAN 1
CABINET FAN 1
CABINET FAN 2
MAGFAN 2 FB
PWRGND
FAN EN
MAGFAN 1 FB
HEAT X FAN 2
HXFAN EN
HEAT X FAN 1
CAB FAN 1 (HEAT X FAN 3)
CAB FAN 2 (HEAT X FAN 4)
MAGFAN 3
MAGFAN 4 FB
+15V
CLTFLOW
-15V
PWR GND
WORK LEAD SENSOR
+24V
LEVEL SENSOR
PWRGND
CLT LVL SNSR
T+24V
REMOTE RLY
REMOTE ON/OFF RLY
PA ENABLE C
PA ENABLE E
PA ENABLE
FL1
RS422
EARTH GND
TXD -
RXD -
TXD +
RS422 GND
RXD +
T +24V
PA RELAY -
MARK RELAY -
MAIN CNTR -
INRUSH -
COOLSNLD -
P+24V
PUMPEN -
PA RELAY
MAIN CNTR RLY
IN RUSH RLY
COOLANT SLND
PUMP RLY
013403

Plasma power supply 4 (Sheet 5 of 22)

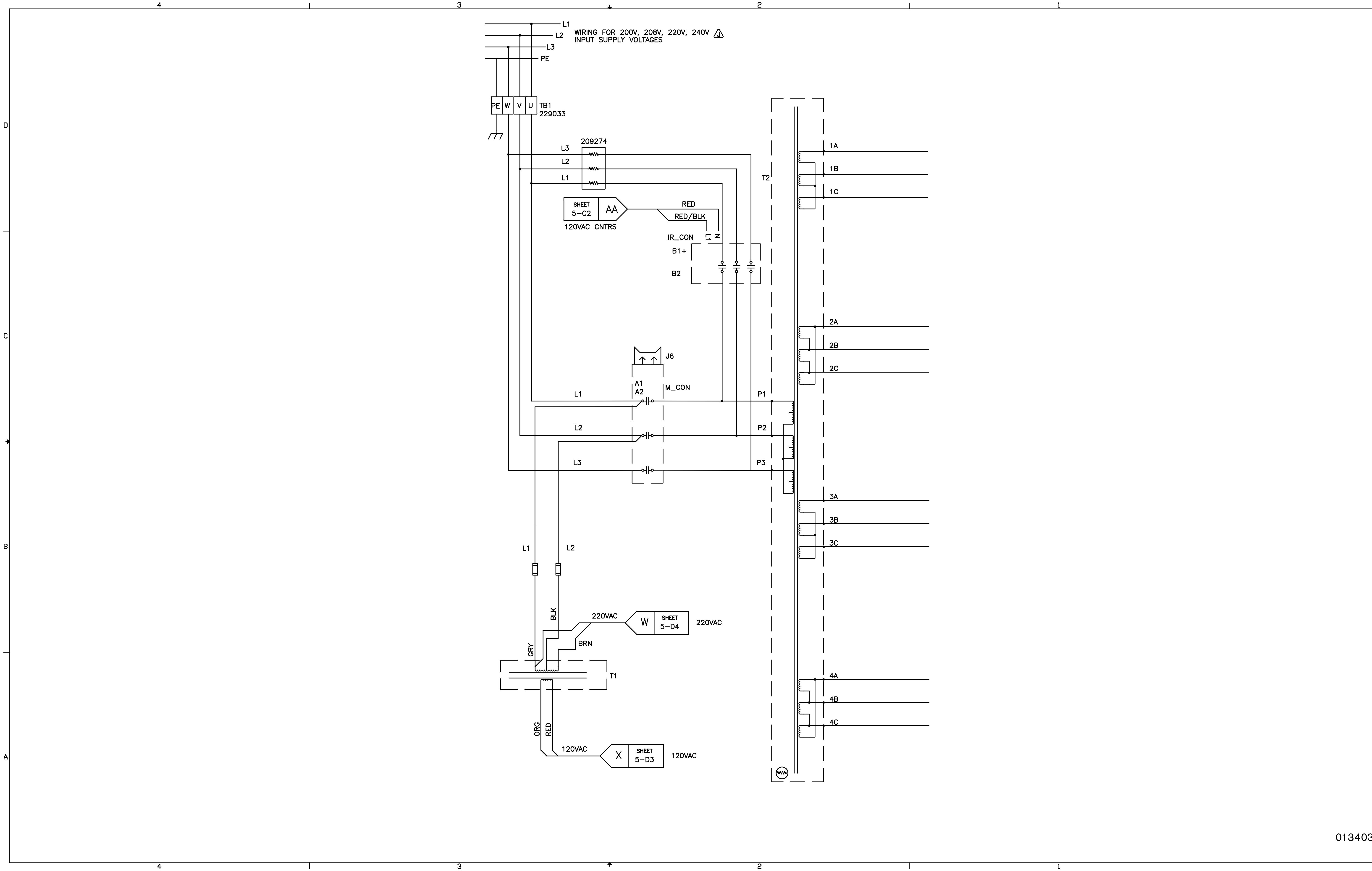


Plasma power supply 5 (Sheet 6 of 22)



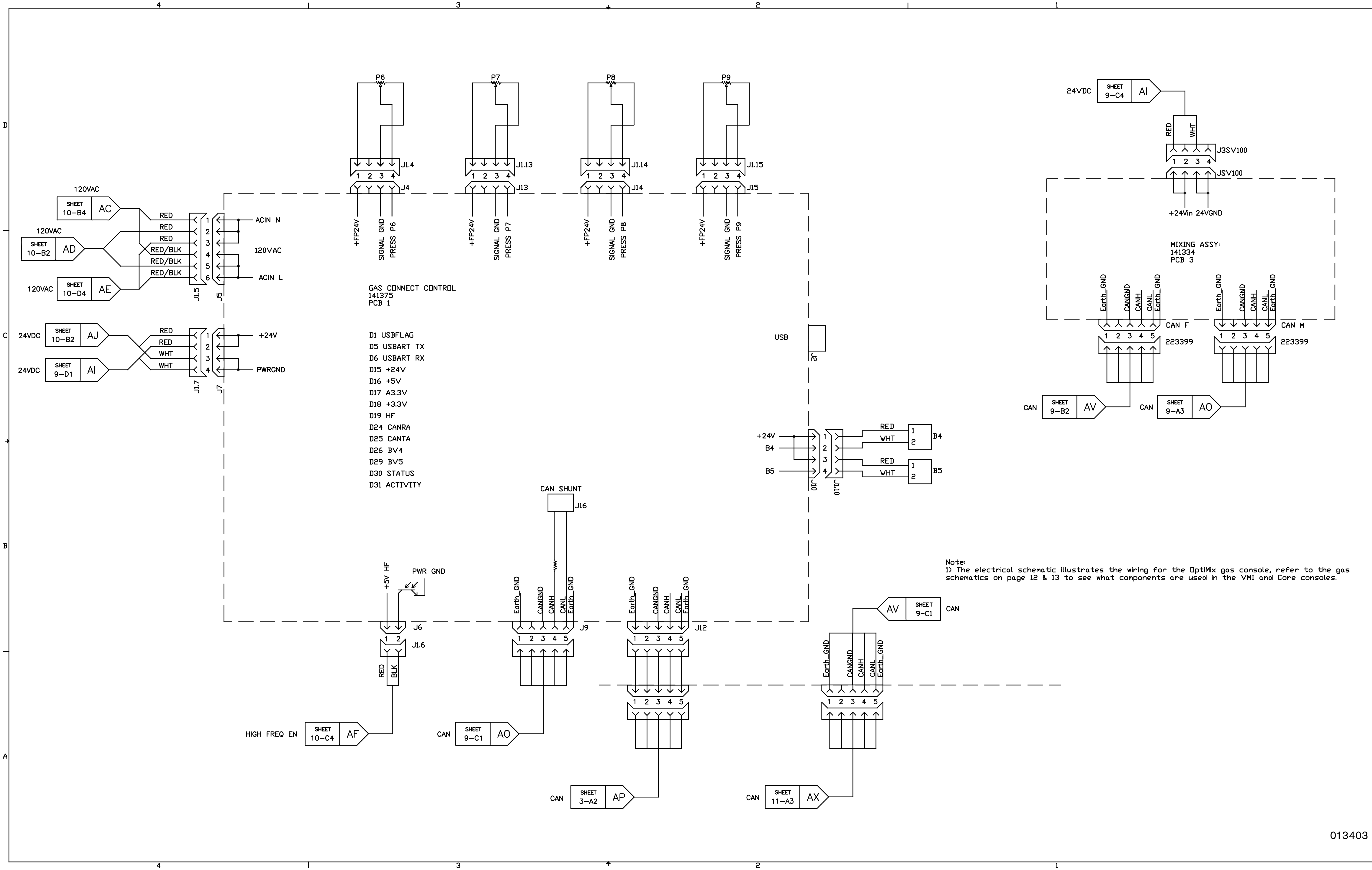


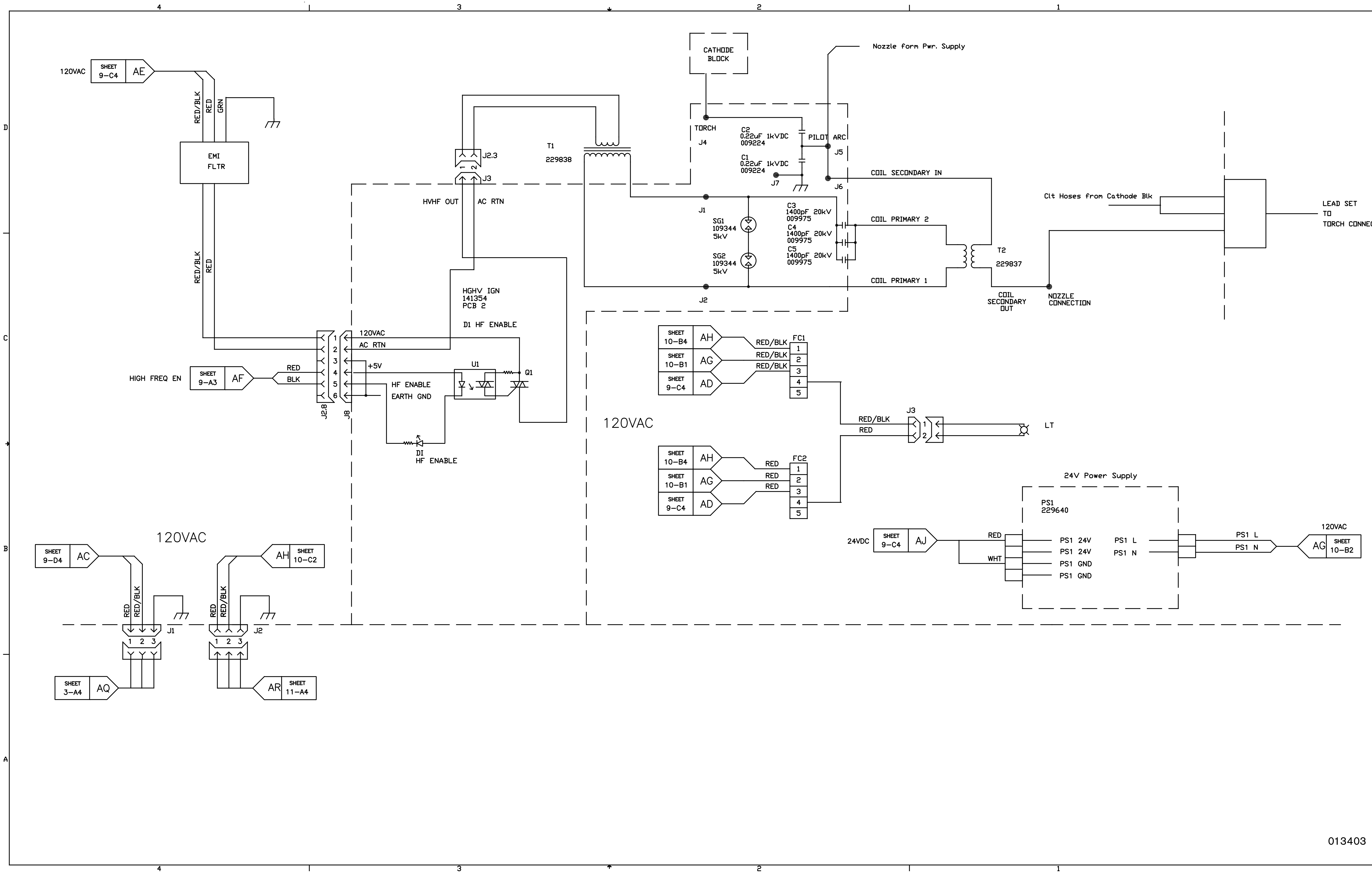
L1
L2
L3
PE
WIRING FOR 380V, 400V, 415V, 440V 480V, 600V INPUT SUPPLY VOLTAGES
PE W V U
TB1 029316: 440V, 480V , 600V
229033: 380V, 400V , 415V
209274
SHEET 5-C2
AA
120VAC CNTRS
RED
RED/BLK
IR_CON
B1+
B2
T2
1A
1B
1C
2A
2B
2C
J6
A1
A2
M_CON
P1
P2
P3
3A
3B
3C
220VAC
W
SHEET 5-D4
BLK
GRY
BRN
T1
4A
4B
4C
ORG
RED
120VAC
X
SHEET 5-D3
013403



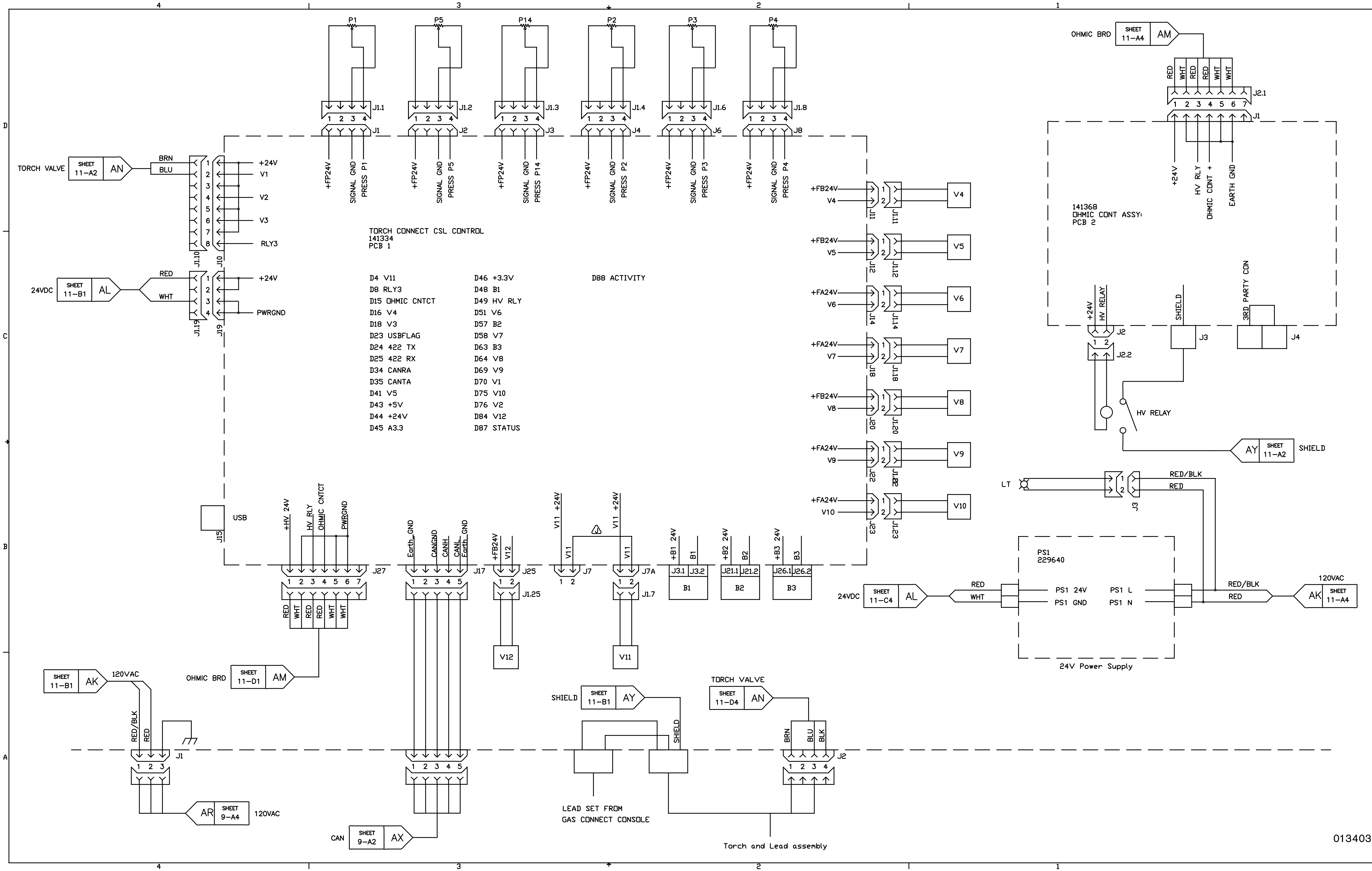
WIRING FOR 200V, 208V, 220V, 240V INPUT SUPPLY VOLTAGES
L1
L2
L3
PE
PE W V U
TB1
229033
209274
SHEET 5-C2
AA
120VAC CNTRS
RED
RED/BLK
IR_CON
L1 N
B1+
B2
T2
1A
1B
1C
2A
2B
2C
3A
3B
3C
4A
4B
4C
J6
A1
A2
M_CON
P1
P2
P3
BLK
GRY
220VAC
BRN
W
SHEET 5-D4
T1
ORG
RED
120VAC
X
SHEET 5-D3
013403

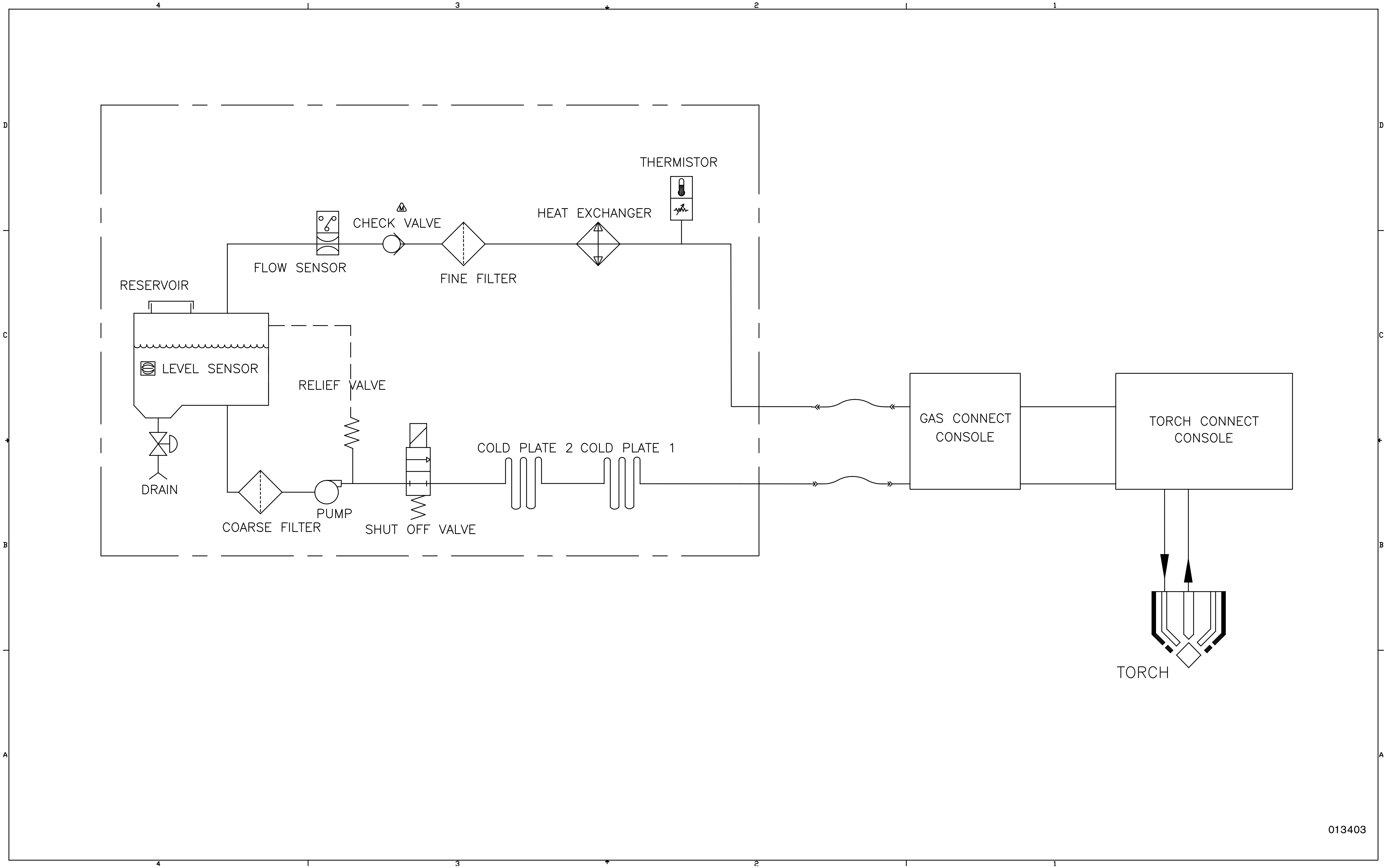
Gas connect console 1 (Sheet 9 of 22)

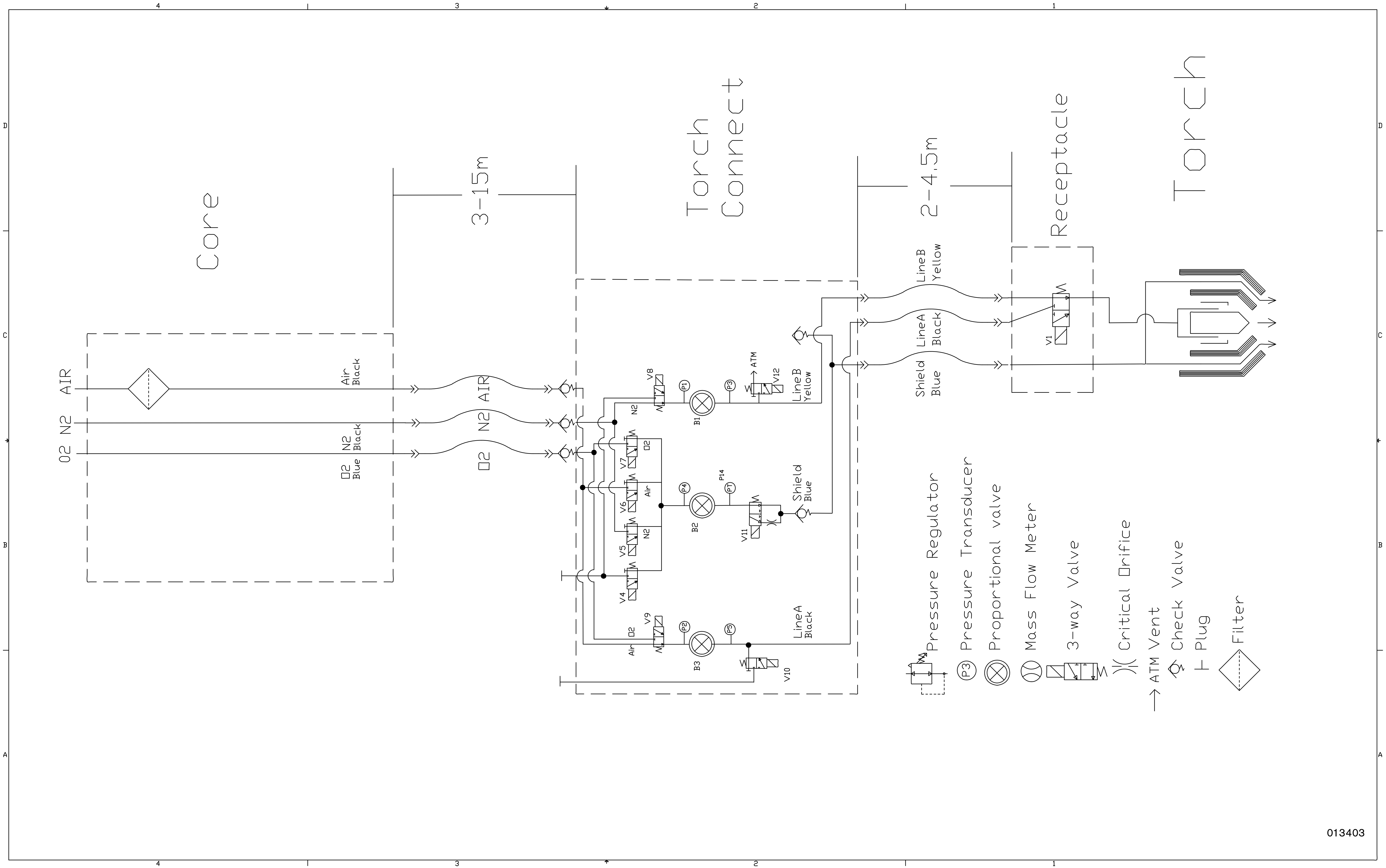



120VAC
SHEET 9-C4
AE
RED/BLK
RED
GRN
EMI FLTR
J2.3
J3
HVHF OUT
AC RTN
T1
229838
CATHODE BLOCK
TORCH
J4
C2 0.22uF 1kVDC 009224
C1 0.22uF 1kVDC 009224
J7
PILOT ARC
J5
J6
Nozzle form Pwr. Supply
COIL SECONDARY IN
J1
SG1 109344 5kV
SG2 109344 5kV
C3 1400pF 20kV 009975
C4 1400pF 20kV 009975
C5 1400pF 20kV 009975
COIL PRIMARY 2
COIL PRIMARY 1
J2
T2
229837
COIL SECONDARY OUT
NOZZLE CONNECTION
Clt Hoses from Cathode Blk
LEAD SET TO TORCH CONNECT
HGHV IGN 141354 PCB 2
D1 HF ENABLE
120VAC
AC RTN
+5V
HF ENABLE
EARTH GND
U1
Q1
HIGH FREQ EN
SHEET 9-A3
AF
RED
BLK
J2.8
J8
DI HF ENABLE
120VAC
SHEET 10-B4
AH
SHEET 10-B1
AG
SHEET 9-C4
AD
RED/BLK
FC1
RED/BLK
RED
J3
LT
RED
FC2
24V Power Supply
PS1 229640
24VDC
SHEET 9-C4
AJ
RED
WHT
PS1 24V
PS1 GND
PS1 L
PS1 N
120VAC
AG
SHEET 10-B2
SHEET 9-D4
AC
AH
SHEET 10-C2
J1
J2
SHEET 3-A4
AQ
AR
SHEET 11-A4
013403

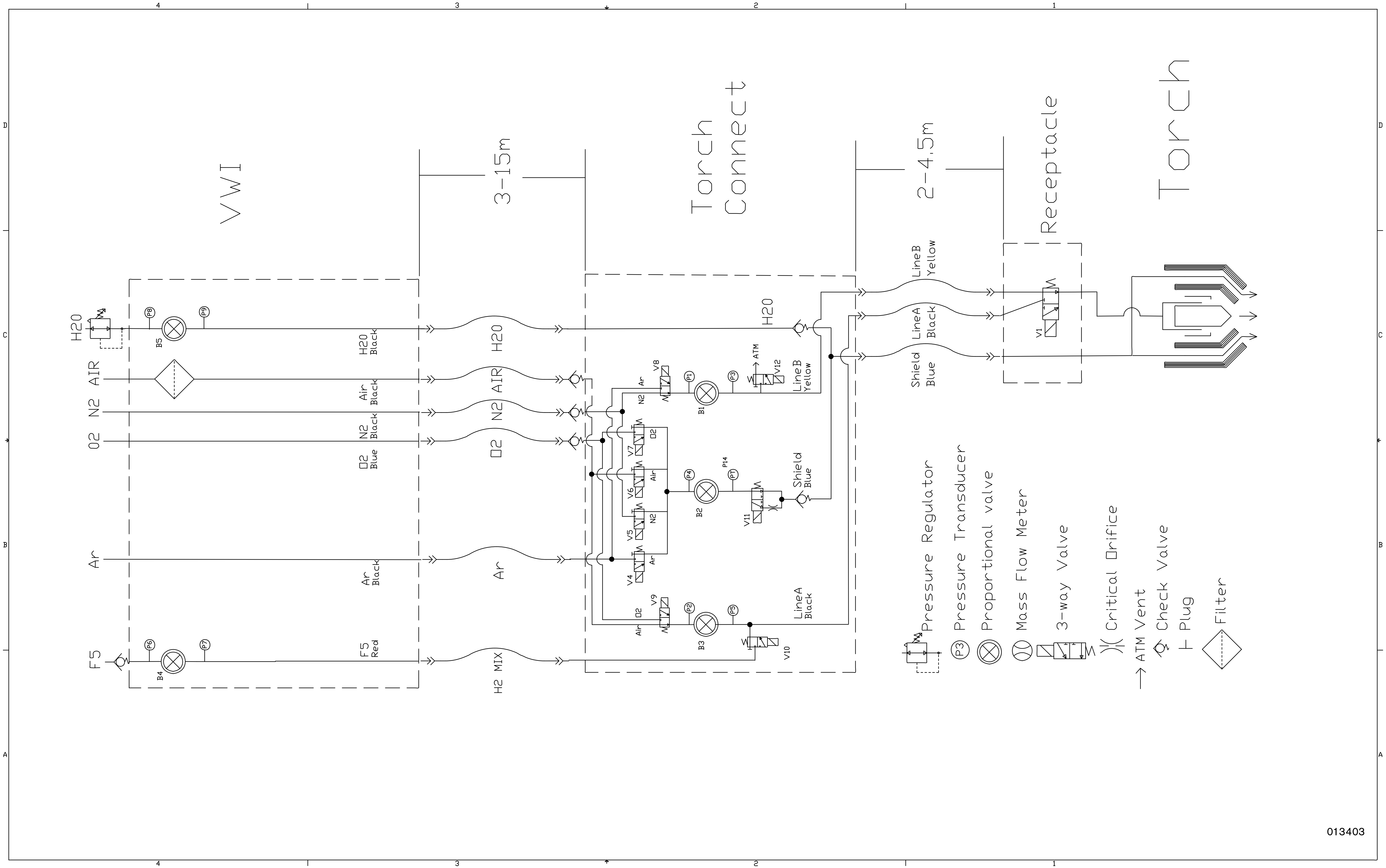
Torch connect console (Sheet 11 of 22)

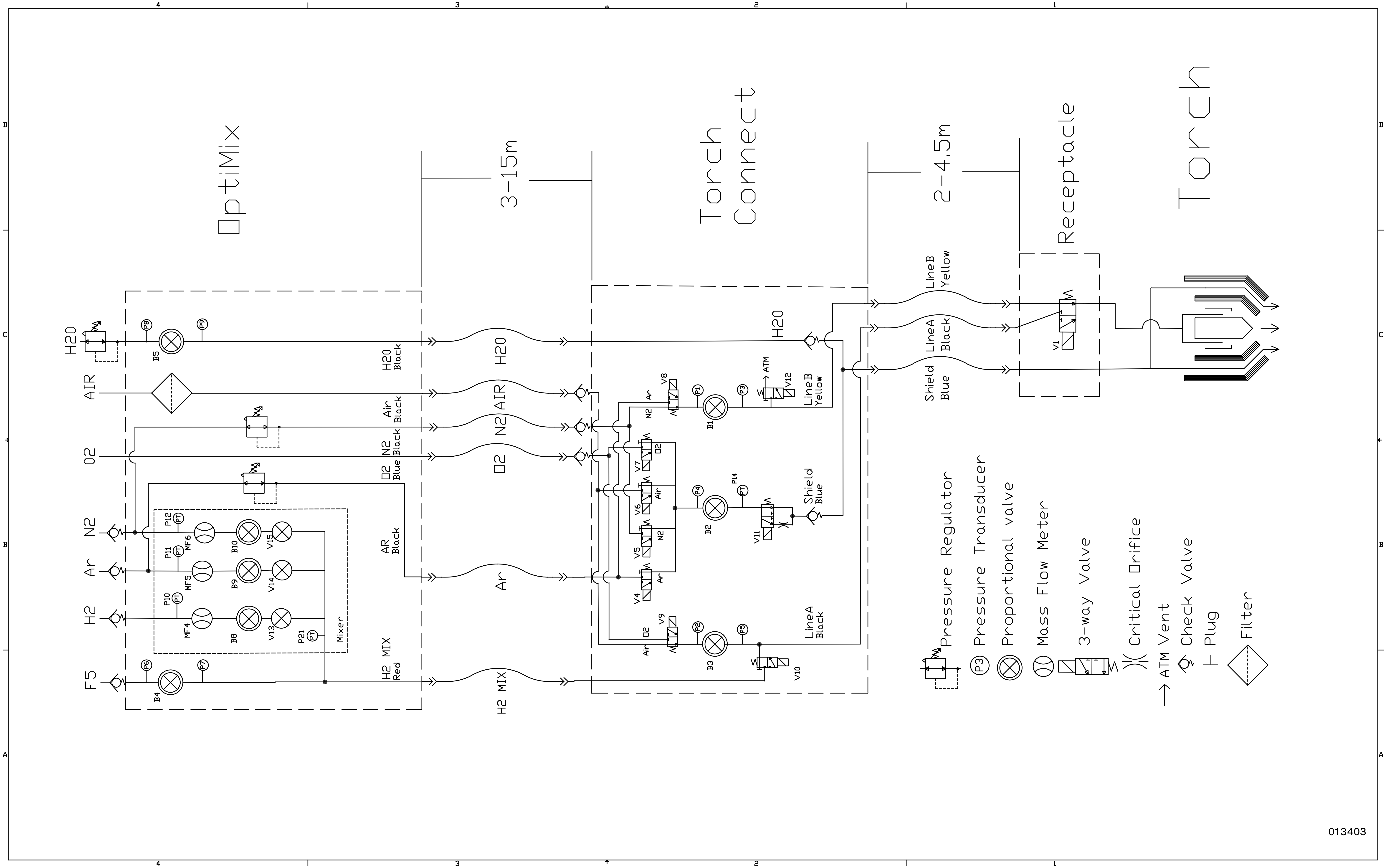



THERMISTOR
CHECK VALVE
HEAT EXCHANGER
FLOW SENSOR
FINE FILTER
RESERVOIR
LEVEL SENSOR
RELIEF VALVE
COLD PLATE 2
COLD PLATE 1
GAS CONNECT CONSOLE
TORCH CONNECT CONSOLE
DRAIN
PUMP
COARSE FILTER
SHUT OFF VALVE
TORCH
013403

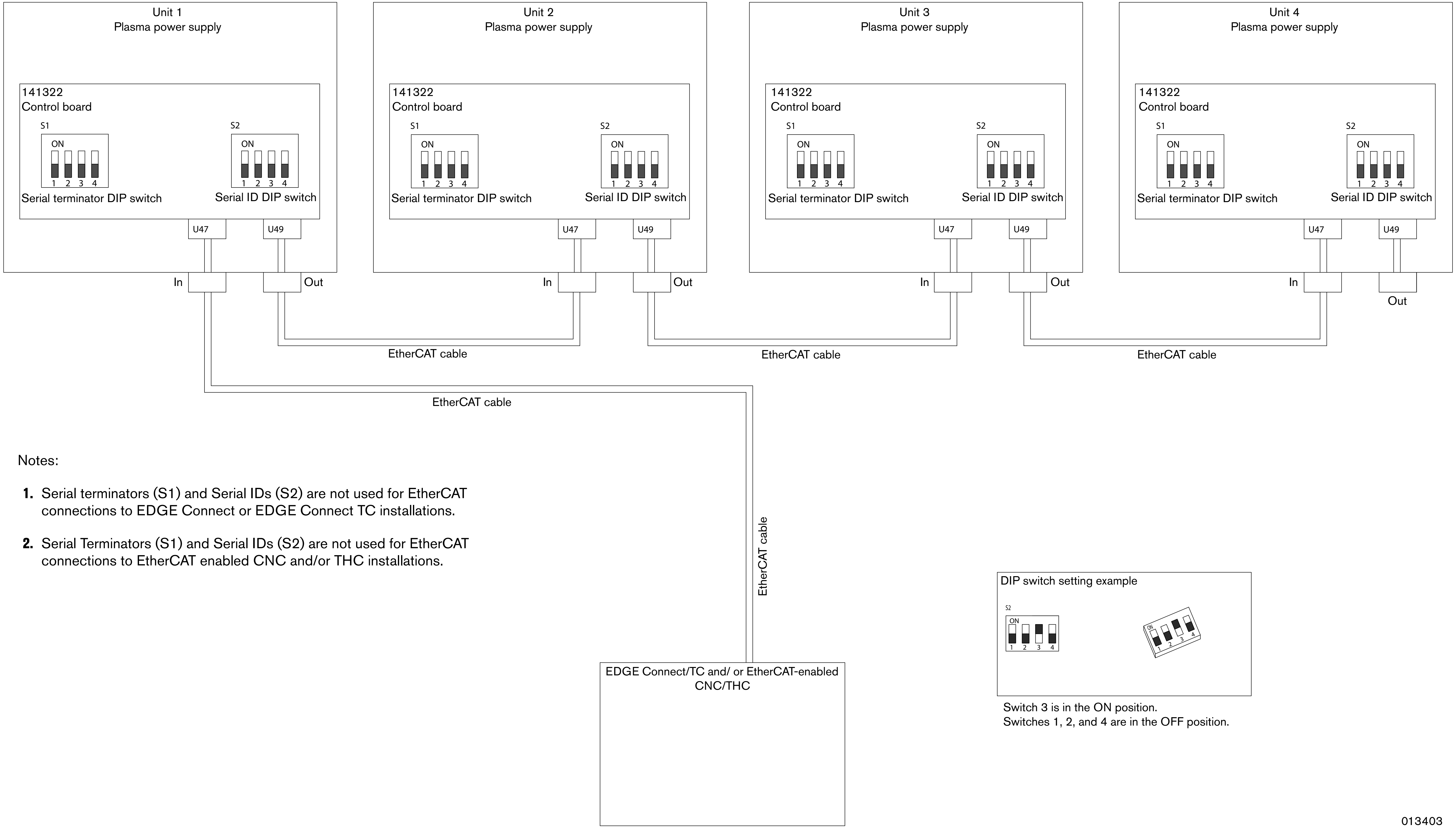

Core
3-15m
Torch Connect
2-4.5m
Receptacle
Torch
AIR
N2
O2
Air Black
N2 Black
O2 Blue
LineB Yellow
LineA Black
Shield Blue
V1
V4
V5
V6
V7
V8
V9
V10
V11
V12
P1
P2
P3
P4
P5
P14
B1
B2
B3
ATM
Pressure Regulator
Pressure Transducer
Proportional valve
Mass Flow Meter
3-way Valve
Critical Orifice
ATM Vent
Check Valve
Plug
Filter
013403

Gas system 2 (Sheet 14 of 22)




OptiMix
3-15m
Torch Connect
2-4.5m
Receptacle
Torch
H2O
AIR
O2
N2
Ar
H2
F5
H2 MIX
LineB Yellow
LineA Black
Shield Blue
Mixer
Pressure Regulator
Pressure Transducer
Proportional valve
Mass Flow Meter
3-way Valve
Critical Orifice
ATM Vent
Check Valve
Plug
Filter
013403

EtherCAT multi-drop (multi-system) interface (Sheet 16 of 22)

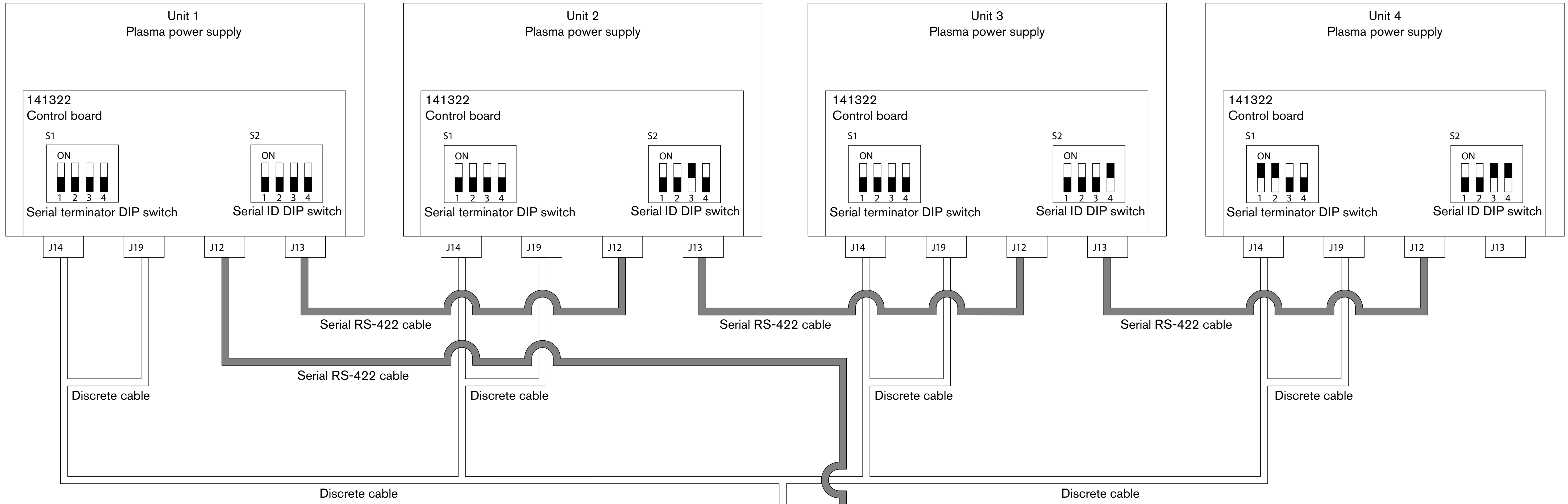


Notes:

1. Serial terminators (S1) and Serial IDs (S2) are not used for EtherCAT connections to EDGE Connect or EDGE Connect TC installations.

2. Serial Terminators (S1) and Serial IDs (S2) are not used for EtherCAT connections to EtherCAT enabled CNC and/or THC installations.

Serial RS-422 and discrete multi-drop (multi-system) interface (Sheet 17 of 22)



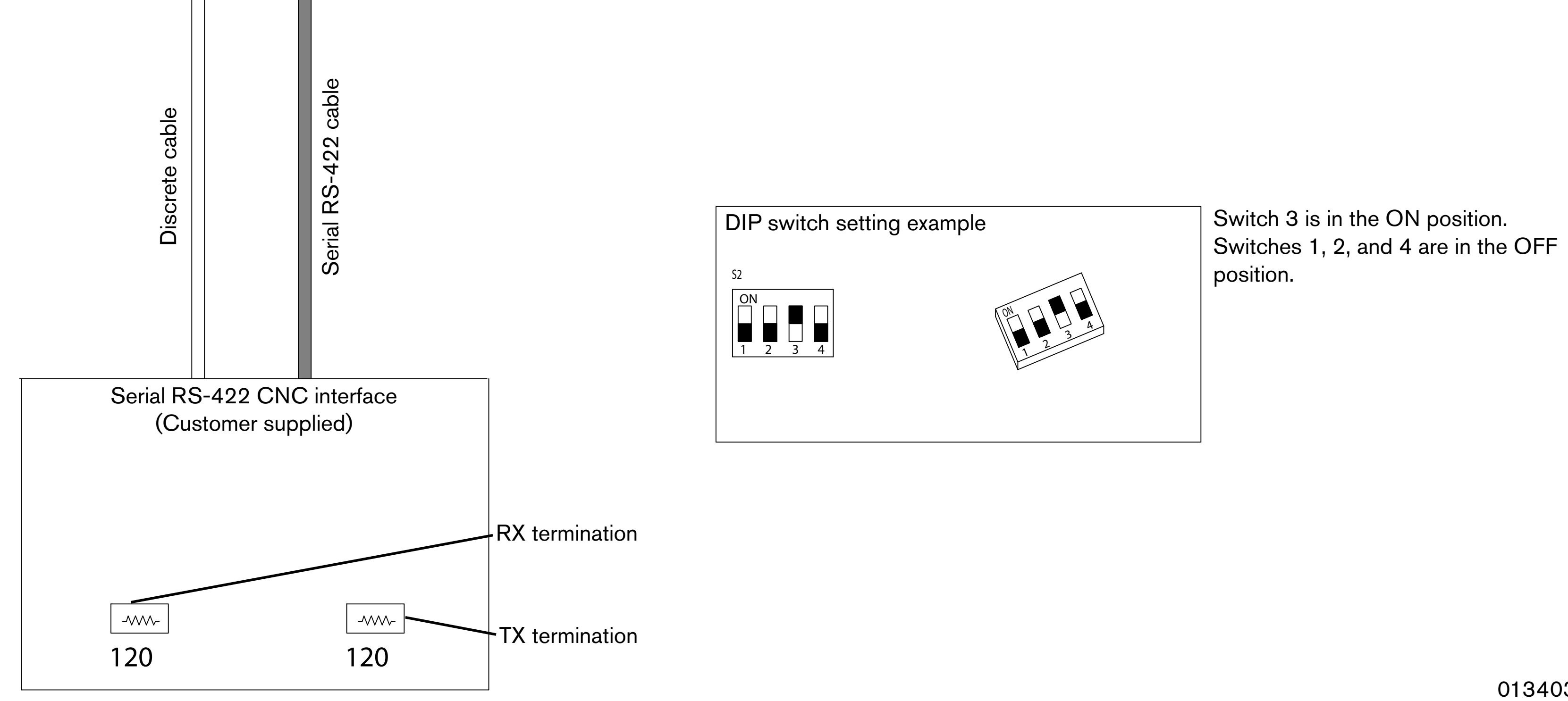
Notes:

1. For single plasma power supply installations, set Serial terminators (S1) as shown in Unit 4 and Serial IDs (S2) as shown in Unit 1.

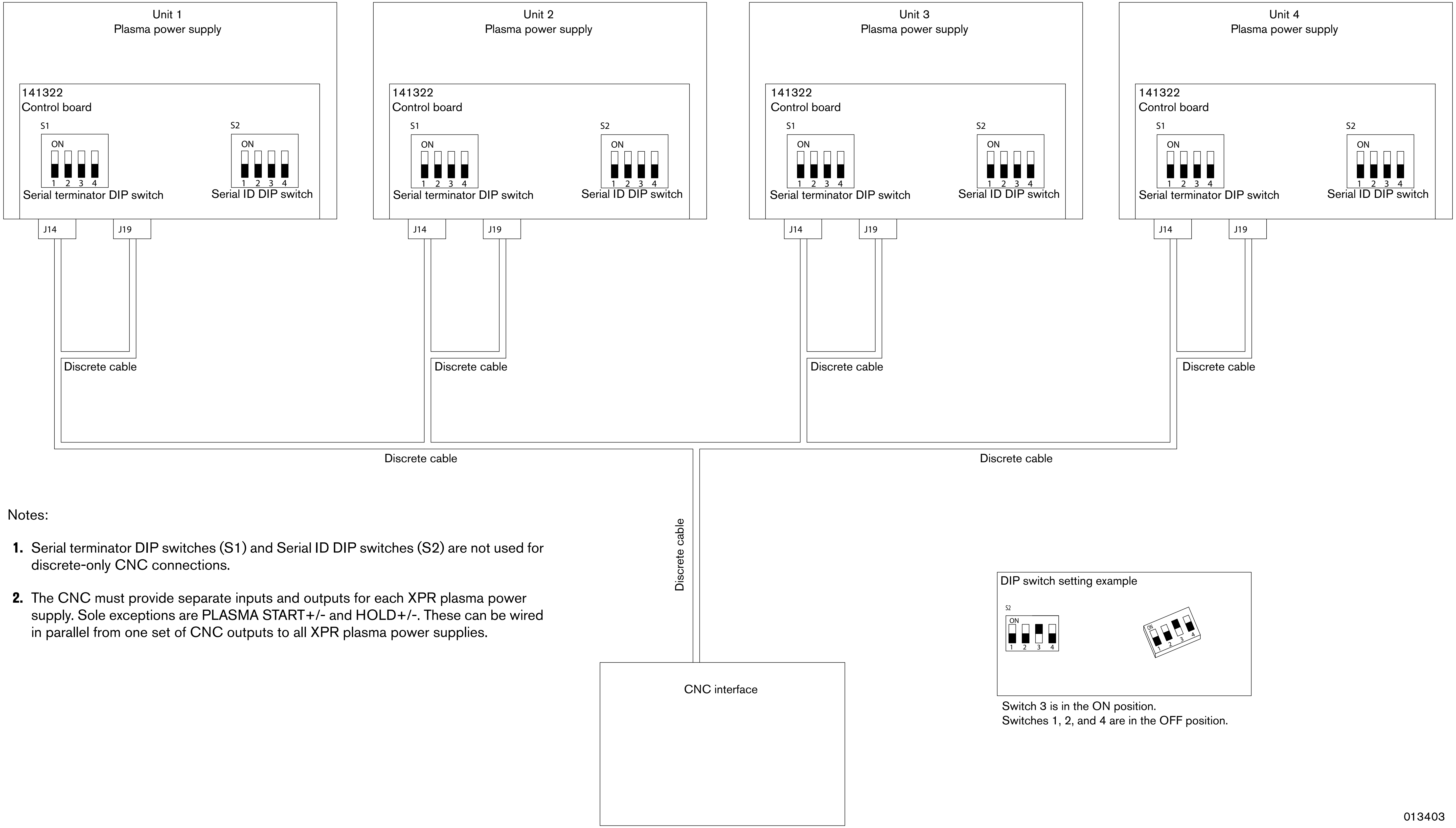
2. On multi-plasma power supply installations see the illustration. Switch S1 position 1 and 2 are OFF in all plasma power supplies except for the last one where they are set to ON.

   Termination resistors (120 Ω) or termination jumpers must be installed and set at the CNC for each of the RS-422 RX and TX signal pairs.

3. If a Hypertherm CNC is used and there are intermittent communication failures (PS Link Failure), try reversing switch S1 position 1 and position 2 on the control board, and the termination jumper (J6 or J8) on the serial isolation board in the controller. Only remove the termination jumper on the serial isolation board that is connected to the plasma power supply.



Discrete multi-drop (multi-system) interface (Sheet 18 of 22)

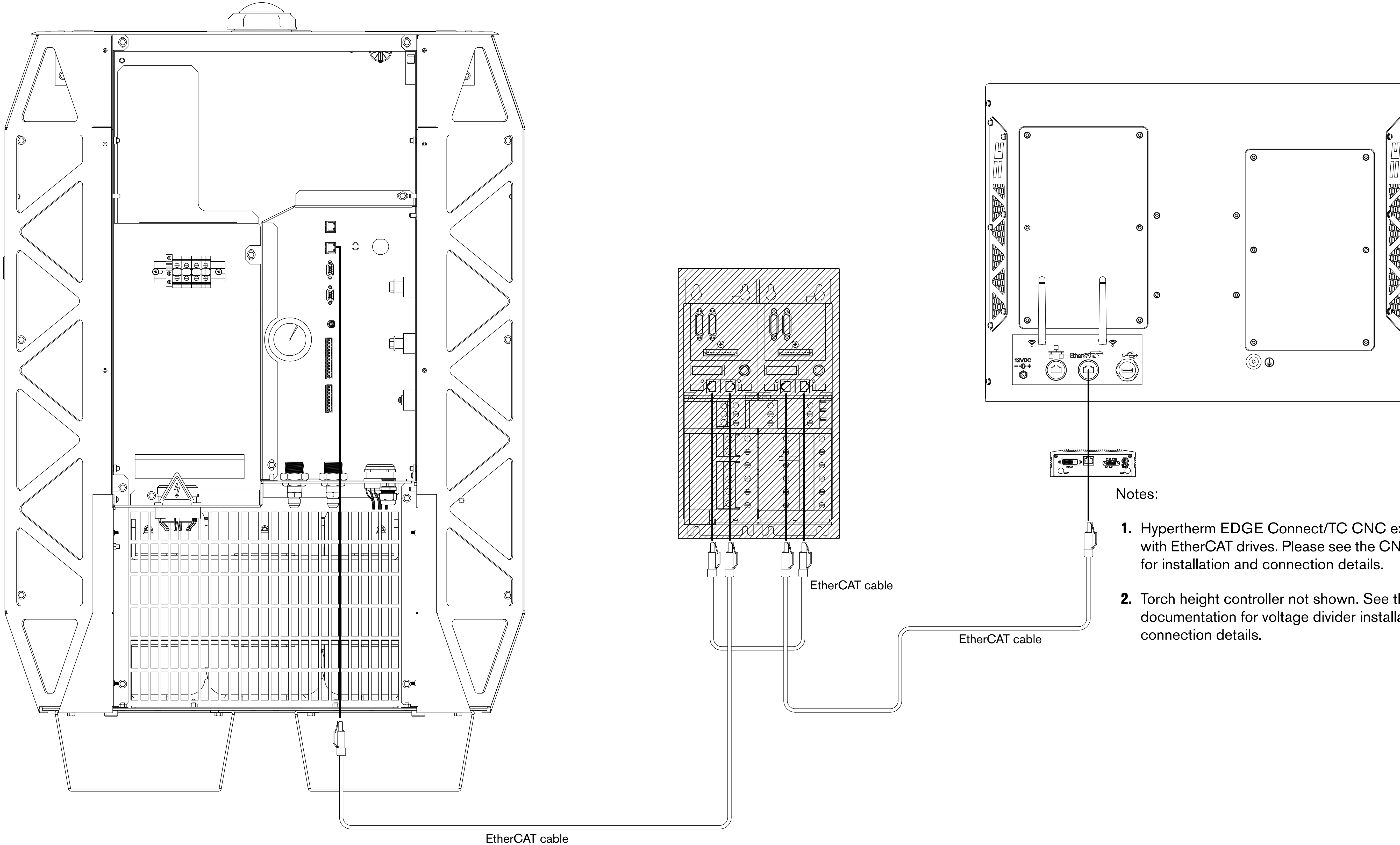


Switch 3 is in the ON position.
Switches 1, 2, and 4 are in the OFF position.

Notes:

1. Serial terminator DIP switches (S1) and Serial ID DIP switches (S2) are not used for discrete-only CNC connections.
2. The CNC must provide separate inputs and outputs for each XPR plasma power supply. Sole exceptions are PLASMA START+/- and HOLD+/-. These can be wired in parallel from one set of CNC outputs to all XPR plasma power supplies.

EtherCAT connection to EDGE Connect/TC (Sheet 19 of 22)



Notes:

1. Hypertherm EDGE Connect/TC CNC examples shown with EtherCAT drives. Please see the CNC documentation for installation and connection details.

2. Torch height controller not shown. See the THC documentation for voltage divider installation and connection details.

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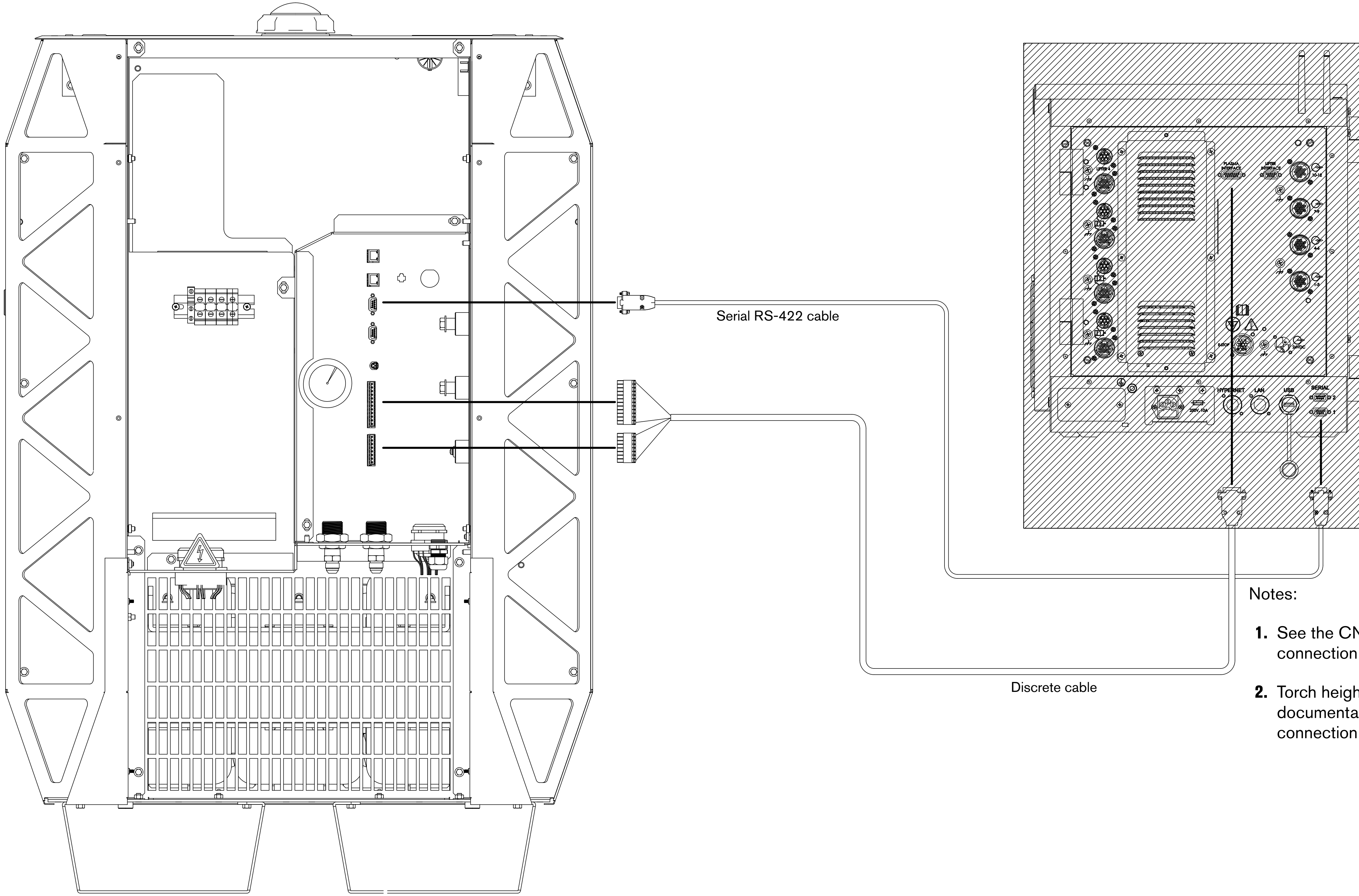
Discrete and serial RS-422 CNC connections (Sheet 20 of 22)



Notes:

1. See the CNC documentation for installation and connection details.
2. Torch height controller not shown. See the THC documentation for voltage divider installation and connection details.

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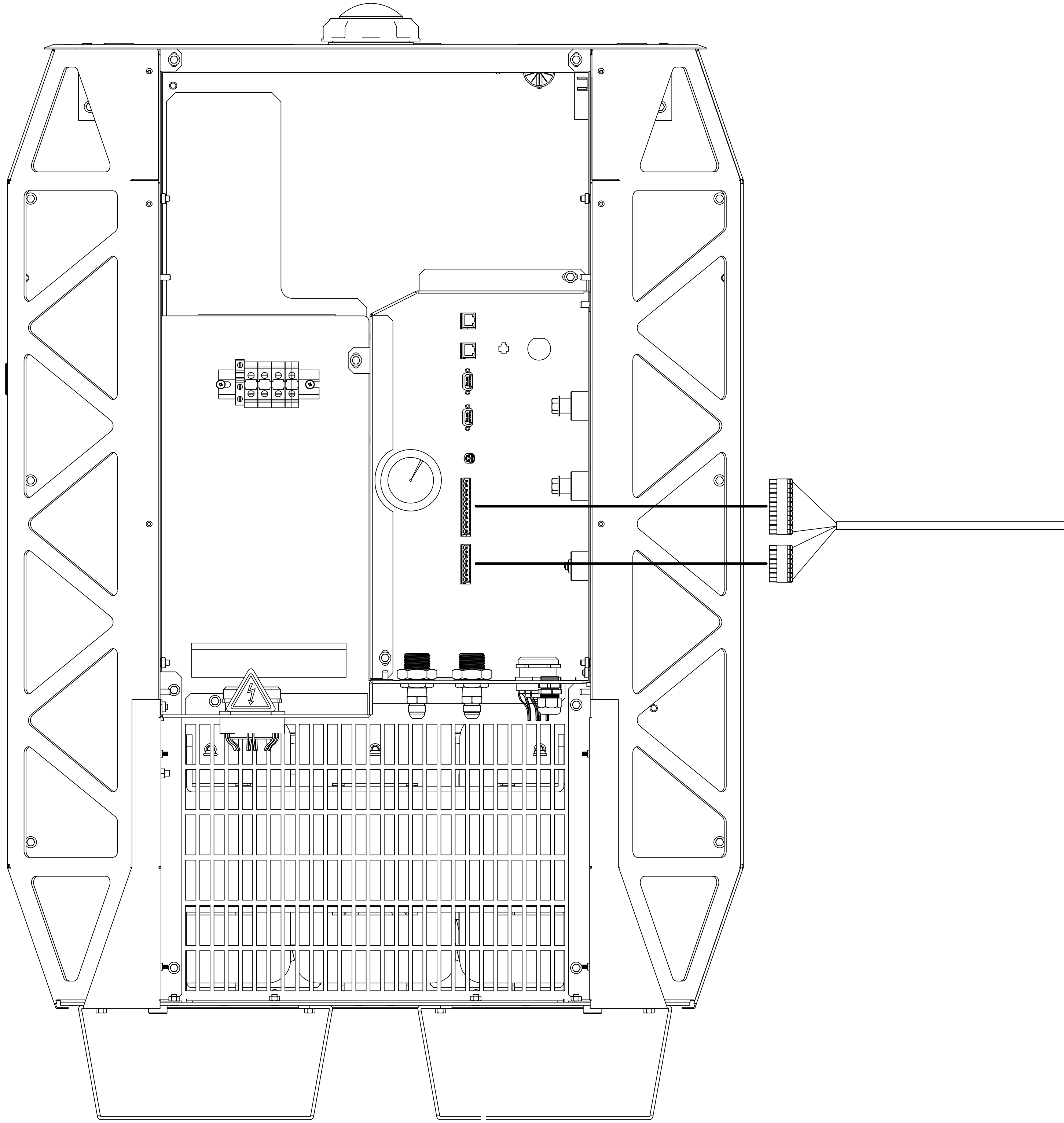
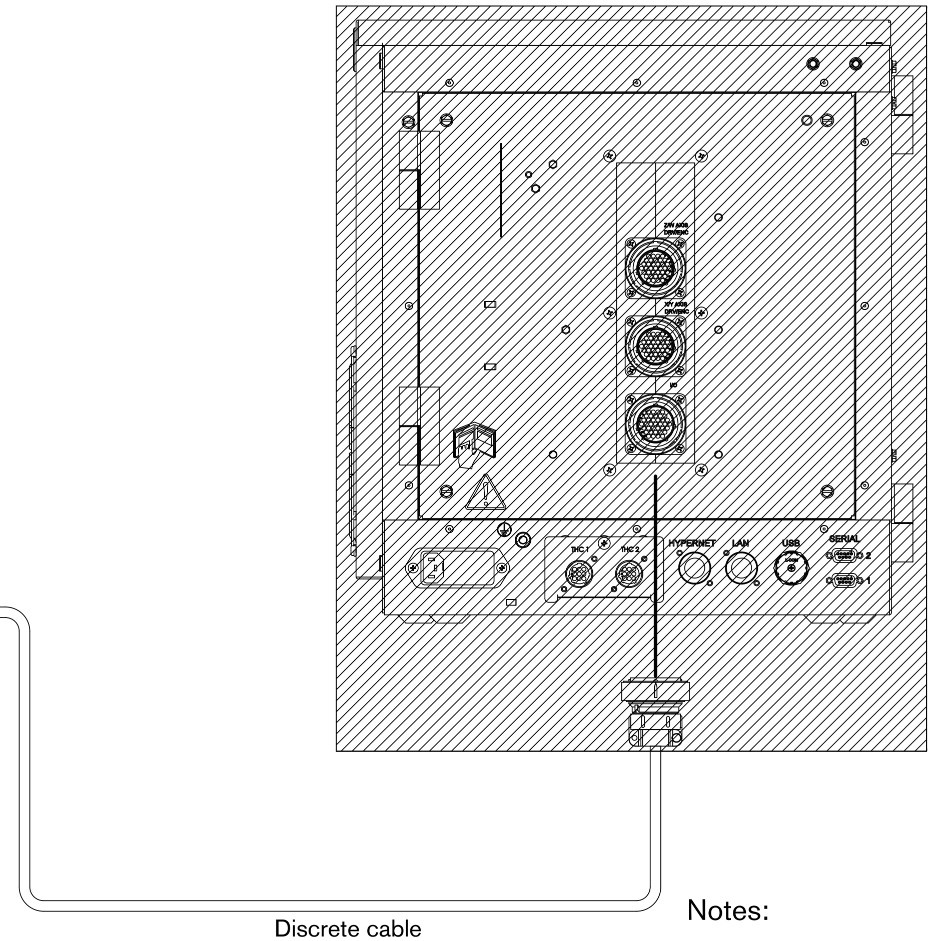
Discrete CNC connections (Sheet 21 of 22)





Notes:

1. See the CNC documentation for installation and connection details.

2. Torch height controller not shown. See the THC documentation for voltage divider installation and connection details.

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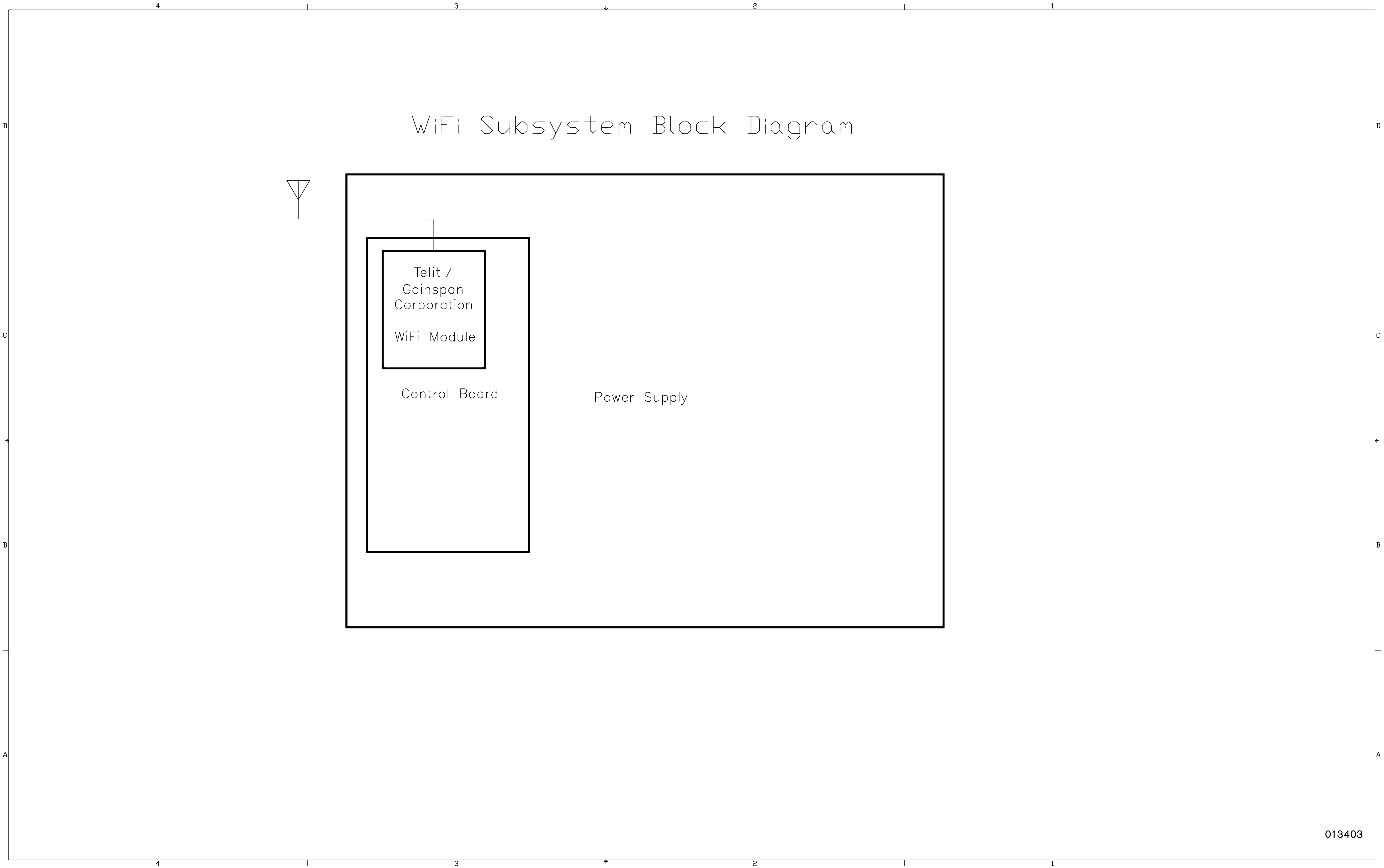
WiFi Subsystem Block Diagram
Telit /
Gainspan
Corporation
WiFi Module
Control Board
Power Supply
013403