XT™ -301

LIQUID COOLED PLASMA CUTTING TORCH

For Distributor Use With Merlin® 1000 Cutting Systems

Instruction Manual

Rev AC.01 Issue Date: December 20, 2006 Manual No. 0-4768

Operating Features:
- Duty Cycle: 100%
- 100 AMP
- DC
WARNINGS

Read and understand this entire Manual and your employer’s safety practices before installing, operating, or servicing the equipment.

While the information contained in this Manual represents the Manufacturer’s best judgement, the Manufacturer assumes no liability for its use.

Liquid Cooled Plasma Torch
Model XT™-301
for Distributor use with: Merlyn® 1000 Cutting System
Instruction Manual No. 0-4768 Rev AB.01.

Published by:
ThermaDyne Corporation
82 Benning Street
West Lebanon, New Hampshire, USA 03784
(603) 298-5711

www.thermal-dynamics.com

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Printed in the United States of America

Publication Date: July 31, 2006

Record the following information for Warranty purposes:

Where Purchased: ___________________________________

Purchase Date: ___________________________________

Equipment Serial #: ___________________________________
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<th>Shield ('Secondary') Gas</th>
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SECTION 1: GENERAL INFORMATION

1.01 Notes, Cautions and Warnings

Throughout this manual, notes, cautions, and warnings are used to highlight important information. These highlights are categorized as follows:

**NOTE**

An operation, procedure, or background information which requires additional emphasis or is helpful in efficient operation of the system.

**CAUTION**

A procedure which, if not properly followed, may cause damage to the equipment.

**WARNING**

A procedure which, if not properly followed, may cause injury to the operator or others in the operating area.

1.02 Important Safety Precautions

**WARNINGS**

OPERATION AND MAINTENANCE OF PLASMA ARC EQUIPMENT CAN BE DANGEROUS AND HAZARDOUS TO YOUR HEALTH.

Plasma arc cutting produces intense electric and magnetic emissions that may interfere with the proper function of cardiac pacemakers, hearing aids, or other electronic health equipment. Persons who work near plasma arc cutting applications should consult their medical health professional and the manufacturer of the health equipment to determine whether a hazard exists.

To prevent possible injury, read, understand and follow all warnings, safety precautions and instructions before using the equipment. Call 1-603-298-5711 or your local distributor if you have any questions.

**GASES AND FUMES**

Gases and fumes produced during the plasma cutting process can be dangerous and hazardous to your health.

- Keep all fumes and gases from the breathing area. Keep your head out of the welding fume plume.
- Use an air-supplied respirator if ventilation is not adequate to remove all fumes and gases.
- The kinds of fumes and gases from the plasma arc depend on the kind of metal being used, coatings on the metal, and the different processes. You must be very careful when cutting or welding any metals which may contain one or more of the following:
  - Antimony
  - Chromium
  - Mercury
  - Arsenic
  - Cobalt
  - Nickel
  - Barium
  - Copper
  - Selenium
  - Beryllium
  - Lead
  - Silver
  - Cadmium
  - Manganese
  - Vanadium
- Always read the Material Safety Data Sheets (MSDS) that should be supplied with the material you are using. These MSDSs will give you the information regarding the kind and amount of fumes and gases that may be dangerous to your health.
- For information on how to test for fumes and gases in your workplace, refer to item 1 in Subsection 1.03, Publications in this manual.
- Use special equipment, such as water or down draft cutting tables, to capture fumes and gases.
- Do not use the plasma torch in an area where combustible or explosive gases or materials are located.
- Phosgene, a toxic gas, is generated from the vapors of chlorinated solvents and cleansers. Remove all sources of these vapors.
- This product, when used for welding or cutting, produces fumes or gases which contain chemicals known to the State of California to cause birth defects and, in some cases, cancer. (California Health & Safety Code Sec. 25249.5 et seq.)

**ELECTRIC SHOCK**

Electric Shock can injure or kill. The plasma arc process uses and produces high voltage electrical energy. This electric energy can cause severe or fatal shock to the operator or others in the workplace.

- Never touch any parts that are electrically “live” or “hot.”
• Wear dry gloves and clothing. Insulate yourself from the work piece or other parts of the welding circuit.
• Repair or replace all worn or damaged parts.
• Extra care must be taken when the workplace is moist or damp.
• Install and maintain equipment according to NEC code, refer to item 9 in Subsection 1.03, Publications.
• Disconnect power source before performing any service or repairs.
• Read and follow all the instructions in the Operating Manual.

**FIRE AND EXPLOSION**

Fire and explosion can be caused by hot slag, sparks, or the plasma arc.

• Be sure there is no combustible or flammable material in the workplace. Any material that cannot be removed must be protected.
• Ventilate all flammable or explosive vapors from the workplace.
• Do not cut or weld on containers that may have held combustibles.
• Provide a fire watch when working in an area where fire hazards may exist.
• Hydrogen gas may be formed and trapped under aluminum workpieces when they are cut underwater or while using a water table. **DO NOT** cut aluminum alloys underwater or on a water table unless the hydrogen gas can be eliminated or dissipated. Trapped hydrogen gas that is ignited will cause an explosion.

**PLASMA ARC RAYS**

Plasma Arc Rays can injure your eyes and burn your skin. The plasma arc process produces very bright ultra violet and infra red light. These arc rays will damage your eyes and burn your skin if you are not properly protected.

• To protect your eyes, always wear a welding helmet or shield. Also always wear safety glasses with side shields, goggles or other protective eye wear.
• Wear welding gloves and suitable clothing to protect your skin from the arc rays and sparks.
• Keep helmet and safety glasses in good condition. Replace lenses when cracked, chipped or dirty.
• Protect others in the work area from the arc rays. Use protective booths, screens or shields.
• Use the shade of lens as suggested in the following per ANSI/ASC Z49.1:

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<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>Less Than 300*</td>
<td>8</td>
<td>9</td>
</tr>
<tr>
<td>300 - 400*</td>
<td>9</td>
<td>12</td>
</tr>
<tr>
<td>400 - 800*</td>
<td>10</td>
<td>14</td>
</tr>
</tbody>
</table>

*These values apply where the actual arc is clearly seen. Experience has shown that lighter filters may be used when the arc is hidden by the workpiece.

**NOISE**

Noise can cause permanent hearing loss. Plasma arc processes can cause noise levels to exceed safe limits. You must protect your ears from loud noise to prevent permanent loss of hearing.

• To protect your hearing from loud noise, wear protective ear plugs and/or ear muffs. Protect others in the workplace.
• Noise levels should be measured to be sure the decibels (sound) do not exceed safe levels.
• For information on how to test for noise, see item 1 in Subsection 1.03, Publications, in this manual.

**1.03 Publications**

Refer to the following standards or their latest revisions for more information:

2. **ANSI Standard Z49.1, SAFETY IN WELDING AND CUTTING**, obtainable from the American Welding Society, 550 N.W. LeJeune Rd, Miami, FL 33126
5. **ANSI Standard Z41.1, STANDARD FOR MEN’S SAFETY-TOE FOOTWEAR**, obtainable from the American National Standards Institute, 1430 Broadway, New York, NY 10018
6. ANSI Standard Z49.2, FIRE PREVENTION IN THE USE OF CUTTING AND WELDING PROCESSES, obtainable from American National Standards Institute, 1430 Broadway, New York, NY 10018

7. AWS Standard A6.0, WELDING AND CUTTING CONTAINERS WHICH HAVE HELD COMBUSTIBLES, obtainable from American Welding Society, 550 N.W. Lejeune Rd, Miami, FL 33126

8. NFPA Standard 51, OXYGEN-FUEL GAS SYSTEMS FOR WELDING, CUTTING AND ALLIED PROCESSES, obtainable from the National Fire Protection Association, Batterymarch Park, Quincy, MA 02269

9. NFPA Standard 70, NATIONAL ELECTRICAL CODE, obtainable from the National Fire Protection Association, Batterymarch Park, Quincy, MA 02269

10. NFPA Standard 51B, CUTTING AND WELDING PROCESSES, obtainable from the National Fire Protection Association, Batterymarch Park, Quincy, MA 02269

11. CGA Pamphlet P-1, SAFE HANDLING OF COMPRESSED GASES IN CYLINDERS, obtainable from the Compressed Gas Association, 1235 Jefferson Davis Highway, Suite 501, Arlington, VA 22202

12. CSA Standard W117.2, CODE FOR SAFETY IN WELDING AND CUTTING, obtainable from the Canadian Standards Association, Standards Sales, 178 Rexdale Boulevard, Rexdale, Ontario, Canada M9W 1R3

13. NWSA booklet, WELDING SAFETY BIBLIOGRAPHY obtainable from the National Welding Supply Association, 1900 Arch Street, Philadelphia, PA 19103


15. ANSI Standard Z88.2, PRACTICE FOR RESPIRATORY PROTECTION, obtainable from American National Standards Institute, 1430 Broadway, New York, NY 10018

1.04 Note, Attention et Avertissement

Dans ce manuel, les mots “note,” “attention,” et “avertissement” sont utilisés pour mettre en relief des informations à caractère important. Ces mises en relief sont classifiées comme suit:

**NOTE**
Toute opération, procédure ou renseignement général sur lequel il importe d’insister davantage ou qui contribue à l’efficacité de fonctionnement du système.

**ATTENTION**
Toute procédure pouvant résulter l’endommagement du matériel en cas de non-respect de la procédure en question.

**AVERTISSEMENT**
Toute procédure pouvant provoquer des blessures de l’opérateur ou des autres personnes se trouvant dans la zone de travail en cas de non-respect de la procédure en question.
1.05 Precautions De Securite
Importantes

**AVERTISSEMENTS**

L’OPÉRATION ET LA MAINTENANCE DU
MATÉRIEL DE SOUDAGE À L’ARC AU JET
DE PLASMA PEUVENT PRÉSENTER DES
RISQUES ET DES DANGERS DE SANTÉ.

Couplant à l’arc au jet de plasma produit de l’énergie électrique haute tension et des émissions magnétique qui peuvent interférer la fonction propre d’un “pacemaker” cardiaque, les appareils auditif, ou autre matériel de santé électronique. Ceux qui travail près d’une application à l’arc au jet de plasma devrait consulter leur membre professionnel de médication et le manufacturier de matériel de santé pour déterminer s’il existe des risques de santé.

Il faut communiquer aux opérateurs et au personnel TOUS les dangers possibles. Afin d’éviter les blessures possibles, lisez, comprenez et suivez tous les avertissements, toutes les précautions de sécurité et toutes les consignes avant d’utiliser le matériel. Composez le + 603-298-5711 ou votre distributeur local si vous avez des questions.

**FUMÉE et GAZ**

La fumée et les gaz produits par le procédé de jet de plasma peuvent présenter des risques et des dangers de santé.

- Eloignez toute fumée et gaz de votre zone de respiration. Gardez votre tête hors de la plume de fumée provenant du chalumeau.
- Utilisez un appareil respiratoire à alimentation en air si l’aération fournie ne permet pas d’éliminer la fumée et les gaz.
- Les sortes de gaz et de fumée provenant de l’arc de plasma dépendent du genre de métal utilisé, des revêtements se trouvant sur le métal et des différents procédés. Vous devez prendre soin lorsque vous coupez ou soudez tout métal pouvant contenir un ou plusieurs des éléments suivants:
  - antimoine
  - argent
  - arsenic
  - baryum
  - beryllium
  - cadmium
  - chrome
  - cobalt
  - cuivre
  - manganèse
  - mercure
  - nickel
  - plomb
  - sélénium
  - vanadium

- Lisez toujours les fiches de données sur la sécurité des matières (sigle américain “MSDS”); celles-ci devraient être fournies avec le matériel que vous utilisez. Les MSDS contiennent des renseignements quant à la quantité et la nature de la fumée et des gaz pouvant poser des dangers de santé.
- Pour des informations sur la manière de tester la fumée et les gaz de votre lieu de travail, consultez l’article 1 et les documents cités à la page 5.
- Utilisez un équipement spécial tel que des tables de coupe à débit d’eau ou à courant descendant pour capter la fumée et les gaz.
- N’utilisez pas le chalumeau au jet de plasma dans une zone où se trouvent des matières ou des gaz combustibles ou explosifs.
- Le phosgène, un gaz toxique, est généré par la fumée provenant des solvants et des produits de nettoyage chlorés. Eliminez toute source de telle fumée.
- Ce produit, dans le procédé de soudage et de coupe, produit de la fumée ou des gaz pouvant contenir des éléments reconnu dans L’état de la Californie, qui peuvent causer des défauts de naissance et le cancer. (La sécurité de santé en Californie et la code sécurité Sec. 25249.5 et seq.)

**CHOC ELECTRIQUE**


- Ne touchez jamais une pièce “sous tension” ou “vive”; portez des gants et des vêtements secs. Isolez-vous de la pièce de travail ou des autres parties du circuit de soudage.
- Réparez ou remplacez toute pièce usée ou endommagée.
- Prenez des soins particuliers lorsque la zone de travail est humide ou moite.
- Montez et maintenez le matériel conformément au Code électrique national des Etats-Unis. (Voir la page 5, article 9.)
- Débranchez l’alimentation électrique avant tout travail d’entretien ou de réparation.
- Lisez et respectez toutes les consignes du Manuel de consignes.
INCENDIE ET EXPLOSION

Les incendies et les explosions peuvent résulter des scories chaudes, des étincelles ou de l’arc de plasma. Le procédé à l’arc de plasma produit du métal, des étincelles, des scories chaudes pouvant mettre le feu aux matières combustibles ou provoquer l’explosion de fumées inflammables.

- Soyez certain qu’aucune matière combustible ou inflammable ne se trouve sur le lieu de travail. Protégez toute telle matière qu’il est impossible de retirer de la zone de travail.
- Procurez une bonne aération de toutes les fumées inflammables ou explosives.
- Ne coupez pas et ne soudez pas les conteneurs ayant pu renfermer des matières combustibles.
- Prévoyez une veille d’incendie lors de tout travail dans une zone présentant des dangers d’incendie.
- Le gas hydrogène peut se former ou s’accumuler sous les pièces de travail en aluminium lorsqu’elles sont coupées sous l’eau ou sur une table d’eau. NE PAS couper les alliages en aluminium sous l’eau ou sur une table d’eau à moins que le gas hydrogène peut s’échapper ou se dissiper. Le gas hydrogène accumulé explosera si enflammé.

RAYONS D’ARC DE PLASMA

Les rayons provenant de l’arc de plasma peuvent blesser vos yeux et brûler votre peau. Le procédé à l’arc de plasma produit une lumière infra-rouge et des rayons ultra-violets très forts. Ces rayons d’arc nuiront à vos yeux et brûleront votre peau si vous ne vous protégez pas correctement.

- Pour protéger vos yeux, portez toujours un casque ou un écran de soudeur. Portez toujours des lunettes de sécurité munies de parois latérales ou des lunettes de protection ou une autre sorte de protection oculaire.
- Portez des gants de soudeur et un vêtement protecteur approprié pour protéger votre peau contre les étincelles et les rayons de l’arc.
- Maintenez votre casque et vos lunettes de protection en bon état. Remplacez toute lentille sale ou comportant fissure ou rongure.
- Protégez les autres personnes se trouvant sur la zone de travail contre les rayons de l’arc en fournissant des cabines ou des écrans de protection.

BRUIT


- Pour protéger votre ouïe contre les bruits forts, portez des tampons protecteurs et/ou des protections auriculaires. Protégez également les autres personnes se trouvant sur le lieu de travail.
- Il faut mesurer les niveaux sonores afin d’assurer que les décibels (le bruit) ne dépassent pas les niveaux sûrs.
- Pour des renseignements sur la manière de tester le bruit, consultez l’article 1, page 5.

Utilisez la nuance de lentille qui est suggérée dans le recommendation qui suivent ANSI/ASC Z49.1:

<table>
<thead>
<tr>
<th>Courant Arc</th>
<th>Nuance Minimum</th>
<th>Nuance Suggerée</th>
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</thead>
<tbody>
<tr>
<td>Moins de 300*</td>
<td>8</td>
<td>9</td>
</tr>
<tr>
<td>300 - 400*</td>
<td>9</td>
<td>12</td>
</tr>
<tr>
<td>400 - 800*</td>
<td>10</td>
<td>14</td>
</tr>
</tbody>
</table>

*Ces valeurs s’appliquent ou l’arc actuel est observé clairement. L’expérience a démontré que les filtres moins foncés peuvent être utilisés quand l’arc est caché par moiseau de travail.
1.06 Documents De Reference

Consultez les normes suivantes ou les révisions les plus récentes ayant été faites à celles-ci pour de plus amples renseignements :


5. Norme ANSI Z41.1, NORMES POUR LES CHAUSSURES PROTECTRICES, disponible auprès de l’American National Standards Institute, 1430 Broadway, New York, NY 10018


8. Norme 51 de l’Association Américaine pour la Protection contre les Incendies (NFPA), LES SYSTEMES À GAZ AVEC ALIMENTATION EN OXYGÈNE POUR LE SOUDAGE, LA COUPE ET LES PROCÉDÉS ASSOCIÉS, disponible auprès de la National Fire Protection Association, Battery mound Park, Quincy, MA 02269

9. Norme 70 de la NFPA, CODE ELECTRIQUE NATIONAL, disponible auprès de la National Fire Protection Association, Battery mound Park, Quincy, MA 02269

10. Norme 51B de la NFPA, LES PROCÉDÉS DE COUPE ET DE SOUDAGE, disponible auprès de la National Fire Protection Association, Battery mound Park, Quincy, MA 02269


13. Livret NWSA, BIBLIOGRAPHIE SUR LA SÉCURITÉ DU SOUDAGE, disponible auprès de l’Association Nationale de Fournitures de Soudage (National Welding Supply Association), 1900 Arch Street, Philadelphia, PA 19103


1.07 Declaration of Conformity

Manufacturer: Thermal Dynamics Corporation
Address: 82 Benning Street
          West Lebanon, New Hampshire 03784
          USA


The equipment described in this manual conforms to all applicable aspects and regulations of the "EMC Directive" (European Council Directive 89/336/EEC) and to the National legislation for the enforcement of this Directive.

Serial numbers are unique with each individual piece of equipment and details description, parts used to manufacture a unit and date of manufacture.

National Standard and Technical Specifications

The product is designed and manufactured to a number of standards and technical requirements. Among them are:

* CSA (Canadian Standards Association) standard C22.2 number 60 for Arc welding equipment.

* UL (Underwriters Laboratory) rating 94VO flammability testing for all printed-circuit boards used.

* ISO/IEC 60974-1 (BS 638-PT10) (EN 60 974-1) (EN50192) (EN50078) applicable to plasma cutting equipment and associated accessories.

* Extensive product design verification is conducted at the manufacturing facility as part of the routine design and manufacturing process. This is to ensure the product is safe, when used according to instructions in this manual and related industry standards, and performs as specified. Rigorous testing is incorporated into the manufacturing process to ensure the manufactured product meets or exceeds all design specifications.

Thermal Dynamics has been manufacturing products for more than 30 years, and will continue to achieve excellence in our area of manufacture.

Manufacturers responsible representative: Steve Ward
Operations Director
Thermadyne Europe
Europa Building
Chorley N Industrial Park
Chorley, Lancashire,
England PR6 7BX
1.08 Statement of Warranty

LIMITED WARRANTY: Thermal Dynamics® Corporation (hereinafter “Thermal”) warrants that its products will be free of defects in workmanship or material. Should any failure to conform to this warranty appear within the time period applicable to the Thermal products as stated below, Thermal shall, upon notification thereof and substantiation that the product has been stored, installed, operated, and maintained in accordance with Thermal’s specifications, instructions, recommendations and recognized standard industry practice, and not subject to misuse, repair, neglect, alteration, or accident, correct such defects by suitable repair or replacement, at Thermal’s sole option, of any components or parts of the product determined by Thermal to be defective.

THIS WARRANTY IS EXCLUSIVE AND IS IN LIEU OF ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

LIMITATION OF LIABILITY: Thermal shall not under any circumstances be liable for special or consequential damages, such as, but not limited to, damage or loss of purchased or replacement goods, or claims of customers of distributor (hereinafter “Purchaser”) for service interruption. The remedies of the Purchaser set forth herein are exclusive and the liability of Thermal with respect to any contract, or anything done in connection therewith such as the performance or breach thereof, or from the manufacture, sale, delivery, resale, or use of any goods covered by or furnished by Thermal whether arising out of contract, negligence, strict tort, or under any warranty, or otherwise, shall not, except as expressly provided herein, exceed the price of the goods upon which such liability is based.

THIS WARRANTY BECOMES INVALID IF REPLACEMENT PARTS OR ACCESSORIES ARE USED WHICH MAY IMPAIR THE SAFETY OR PERFORMANCE OF ANY THERMAL PRODUCT.

THIS Warranty is INVALID IF THE PRODUCT IS SOLD BY NON-AUTHORIZED PERSONS.

The limited warranty periods for Thermal products shall be as follows

<table>
<thead>
<tr>
<th>Parts</th>
<th>Labor</th>
</tr>
</thead>
<tbody>
<tr>
<td>XT™-301 Torch (excluding consumable parts, O-Rings, and Water Tube)</td>
<td>1 Year</td>
</tr>
<tr>
<td>Repair/Replacement Parts (excluding consumable parts and O-Rings)</td>
<td>90 Days</td>
</tr>
</tbody>
</table>

Warranty repairs or replacement claims under this limited warranty must be submitted by an authorized Thermal Dynamics® repair facility within thirty (30) days of the repair. No transportation costs of any kind will be paid under this warranty. Transportation charges to send products to an authorized warranty repair facility shall be the responsibility of the customer. All returned goods shall be at the customer’s risk and expense. This warranty supersedes all previous Thermal warranties.

Effective: August 29, 2005
SECTION 2: INTRODUCTION

2.01 Scope of Manual

This manual contains descriptions, operating instructions and maintenance procedures for the XT™-301 Torch. Service of this equipment is restricted to properly trained personnel; unqualified personnel are strictly cautioned against attempting repairs or adjustments not covered in this manual, at the risk of voiding the Warranty.

Read this manual thoroughly. A complete understanding of the characteristics and capabilities of this equipment will assure the dependable operation for which it was designed.

2.02 General Description and Applications

The XT™-301 Torch is a direct replacement for the Maximizer™ torch on Merlin™ 1000 cutting systems. The XT-301 Torch can be connected to Maximizer torch leads up to 25' / 7.6 m long. Use only XT-301 Torch leads for installations requiring leads longer than 25 ft / 7.6 m.

The XT-301 Torch is available in a 180° configuration.

The XT-301 Torch is a liquid cooled torch. Two torch leads provide plasma and secondary (‘shield’) gas to the torch head. The leads also provide a closed loop for the liquid coolant flow from the Power Supply.
2.03 Torch Kit Contents

Torch operation requires these additional parts:

- Shield Cup
- Shield Cap
- Tip
- Electrode
- Cartridge
- Shield Gas Distributor
- Plasma Gas Distributor

Mounting Tube Hardware Kit

Art # A-07043

Lead Packages, Lengths > 25 ft / 7.6 m
2.04 Specifications & Design Features

1. XT™-301 Torch Configuration and Dimensions

![Torch Configuration Diagram]

2. Torch Ratings and Gas Specifications

<table>
<thead>
<tr>
<th>XT™-301 Torch Ratings</th>
<th>When Used with Merlin 1000 Power Supply</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ambient Temperature</td>
<td>104° F 40° C</td>
</tr>
<tr>
<td>Duty Cycle</td>
<td>100% @ 100 Amps</td>
</tr>
<tr>
<td>Maximum Current</td>
<td>100 Amps</td>
</tr>
<tr>
<td>Voltage (V&lt;sub&gt;peak&lt;/sub&gt;)</td>
<td>500V</td>
</tr>
<tr>
<td>Arc Striking Voltage</td>
<td>10kV</td>
</tr>
<tr>
<td>Current</td>
<td>Up to 100 Amps, DC, Straight Polarity (See Note)</td>
</tr>
<tr>
<td>Minimum Coolant Flow Requirements</td>
<td>0.9 gpm (3.4 lpm)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>XT™-301 Torch Gas Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plasma Gases:</td>
</tr>
<tr>
<td>Compressed Air, Oxygen, Argon/Hydrogen (H35)</td>
</tr>
<tr>
<td>Shield Gases:</td>
</tr>
<tr>
<td>Compressed Air, Nitrogen (N2)</td>
</tr>
<tr>
<td>Operating Pressure</td>
</tr>
<tr>
<td>90 psi ± 5 psi</td>
</tr>
<tr>
<td>6.2 bar ± 0.4 bar</td>
</tr>
<tr>
<td>Maximum Input Pressure</td>
</tr>
<tr>
<td>135 psi / 9.3 bar</td>
</tr>
<tr>
<td>Gas flow</td>
</tr>
<tr>
<td>10 - 300 scfh</td>
</tr>
<tr>
<td>Power supply used with:</td>
</tr>
<tr>
<td>Merlin 1000</td>
</tr>
</tbody>
</table>
3. Cutting Range
Most materials up to 1 inch (25.4 mm)
Up to 1/2 inch (12.7 mm) for production speed cutting

4. Pierce Rating
1/2 inch (12.7 mm)

5. Transfer Distance
1/8 - 1/4 inch (3-6 mm)

6. Torch Parts
Shield Cup, Shield Cap, Secondary ('Shield') Gas Distributor, Tip, Plasma Gas Distributor, Electrode, Cartridge

7. Gas Requirements

<table>
<thead>
<tr>
<th>Gas</th>
<th>Quality</th>
<th>Minimum Pressure</th>
<th>Flow</th>
</tr>
</thead>
<tbody>
<tr>
<td>O2 (Oxygen)</td>
<td>99.5% Purity (Liquid recommended)</td>
<td>90 psi</td>
<td>83 scfh (2350 l/h)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6.2 bar / 620 kPa</td>
<td></td>
</tr>
<tr>
<td>N2 (Nitrogen)</td>
<td>99.5% Purity (&lt;1000 ppm O2, &lt;32 ppm H2O)</td>
<td>90 psi</td>
<td>278 scfh (7872 l/h)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6.2 bar / 620 kPa</td>
<td></td>
</tr>
<tr>
<td>Compressed or Bottled Air</td>
<td>Clean, Dry, Free of Oil (see Note 1)</td>
<td>90 psi</td>
<td>82 scfh (2313 l/h)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6.2 bar / 620 kPa</td>
<td></td>
</tr>
<tr>
<td>H35 (Argon-Hydrogen)</td>
<td>99.995% Purity (gas liquid recommended)</td>
<td>90 psi</td>
<td>77 scfh (2180 l/h)</td>
</tr>
<tr>
<td>H35 = 35% Hydrogen, 65% Argon</td>
<td></td>
<td>6.2 bar / 620 kPa</td>
<td></td>
</tr>
<tr>
<td>H2O (Water)</td>
<td>See Note 2</td>
<td>50 psi (3.5 bar)</td>
<td>3 - 9 gph (13 - 40 lph)</td>
</tr>
</tbody>
</table>

**Note 1:** The air source must be adequately filtered to remove all oil or grease. Oil or grease contamination from compressed or bottled air can cause fires in conjunction with oxygen.

**Note 2:** The tap water source does not need to be deionized, but in water systems with extremely high mineral content a water softener is recommended. Tap water with high levels of particulate matter must be filtered.

8. Parts - In - Place (PIP)
The torch is designed for use with a power supply which senses coolant return flow to confirm that torch parts are in place. If coolant return flow to the power supply is absent or insufficient the power supply will not provide power to the torch. Coolant leakage from the torch also indicates that torch parts are absent or installed improperly.

9. Type of Cooling
Combination of gas stream through torch and liquid cooling.
3.01 Kit Contents

These kit configurations are available:
3.02 Kit Applications:

NOTE: Installations with Remote Arc Starter require installer to reverse coolant lead connections at power supply bulkhead. Refer to installation instructions for details.

Merlin 1000 Power Supply

< 25' / 7.6m: Use XT-301 Torch Head and Maximizer Torch Leads
> 25' / 7.6m: Use XT-301 Torch Head and XT-301 Torch Leads

3.03 Unpacking

The product is packaged and protected to prevent damage during shipping.

1. Unpack each item and remove all packing material.
2. Locate the packing list(s) and use the list to identify and account for each item.
3. Inspect each item for possible shipping damage. If damage is evident, contact your distributor and/or shipping company before proceeding with installation.
3.04 XT-301 Torch Head Installation on Maximizer™ Leads (up to 25' long)

The XT-301 torch head can be connected to Maximizer leads up to 25' / 7.6 m long. For applications with longer leads, replace the Maximizer torch leads with XT-301 leads. Connect the Torch head to existing Maximizer leads as follows:

**WARNING**

Disconnect primary power at the source before disassembling the torch or torch leads.

A. Remove Maximizer Torch and Mounting Assembly

1. Remove the torch, positioning tube, and pinion assembly from its support.
2. Locate the shrink-on tubing at the back end of the torch positioning tube. Remove the shrink-on tubing from the torch lead sleeving being careful not to damage the lead assembly underneath.
3. Under the shrink-on tubing remove the tape from the torch lead sleeving and slide the sleeving back (see NOTE).

**NOTE**

The positioning tube will not slide over the torch lead sleeving.

4. Unscrew the positioning tube and the torch adaptor from the torch head assembly. Slide the positioning tube, torch adapter, and pinion assembly back over the leads to expose the four gas and coolant connectors.
5. Disconnect the plasma (+), secondary, coolant supply (-), and coolant return connectors to allow removal of the torch head.

6. Slide the torch adapter, positioning tube, bushing, and end cap off the torch leads.
7. Set the Maximizer torch and mounting equipment aside in a secure location.
B. Install XT-301 Torch

NOTE

Handle the torch head carefully to avoid damage. The installer may choose to follow Section 3.07, Installing Consumable Parts, before installing the torch head. This will provide additional protection to the coolant tube on the torch head during installation.

1. Install the torch clamp assembly included in this kit, in place of the pinion removed previously.
2. Slide the end cap up onto the torch leads.
3. Remove and discard the protective end caps from the Mounting Tube.
4. Install the O-ring included in this kit in the groove at the upper end of the Mounting Tube.
5. Slide the positioning tube up onto the torch leads, far enough to allow access to the lead connection fittings.
6. Connect the XT-301 torch head to the Maximizer leads as shown.
7. Press the Torch Head Assembly upward to connect to the positioning tube. Pull the leads back as needed to ensure a proper fit through the positioning tube. Hold the Torch Head Assembly stationary; rotate the positioning tube to thread it onto the Torch Head. Install set screws from the hardware kit in any two of the threaded holes at the bottom of the positioning tube, to fasten the head assembly to the positioning tube.

**CAUTION**

Ensure that the leads do not twist within the positioning tube. Leads must lie as shown in the installation sketch.

8. Press the end cap downward on the positioning tube to cover and engage the O-Ring at the top of the positioning tube.

9. Secure the positioning tube to the torch clamp.

10. Secure the torch clamp to its mounting device. If not done previously, refer to Section 3.07 for details on installing torch consumable parts.
3.05 Connecting XT-301 Torch and Torch Leads (over 25' long) to Merlin 1000

This section details connecting the XT-301 Torch and XT-301 Torch leads directly to the Merlin 1000 Power supply. Refer to Section 3.06 for connections to the optional Merlin Remote Arc Starter.

A. Remove Maximizer Torch and Leads

1. Remove the torch and pinion assembly (with torch leads) from its support. Set the assembly aside in a secure location.

2. On the power supply, turn the two latch screws fastening the Control / Access Panel to the power supply.

3. Open the Access Panel.

4. Disconnect the torch leads, including the control cable connector and shield leads, from the power supply bulkhead panel. The first illustration shows leads with single shielding; the second illustration shows leads with double shielding.

---

Single-shielded Leads Connections
5. Carefully remove the torch leads through the rubber boot on the power supply front panel. Feed the control cable connector through the boot last, as there will not be enough room for it to pass through the boot if the other leads are in the boot.
B. Connect XT-301 Leads to Merlin 1000 Power Supply

**WARNING**

Disconnect primary power at the source before disassembling the torch or torch leads.

---

1. Feed the connector on the end of the CNC Control Cable through the rubber boot on the front panel of the Power Supply (see NOTE).

---

**NOTE**

Feed the Control Cable through the rubber boot first as there will not be enough space inside the rubber boot for the connector if the Coolant and Gas Leads have been fed through the rubber boot first.

2. Connect the CNC Control Cable connector to the Control Cable connector on the Torch Bulkhead Panel.

3. Feed the ends of the Torch Leads through the rubber boot.

4. Refer to the illustration. The Leads Assembly includes two leads shields; each shield includes two ring-tongue connectors. Connect the Torch Leads Shield Wires as follows:
   a. Remove one nut and star washer from the torch leads shield stud on the Torch Bulkhead Panel.
   b. Place the ring lugs from the inner (RED) Torch Leads Shield Wires over the shield stud on the Torch Bulkhead Panel.
   c. Secure the wires with the nut and star washer.
   d. Place the ring lugs from the outer (GREEN / YELLOW) Torch Leads Shield Wires over the shield stud on the power supply chassis.
   e. Use the nut and star washer previously removed from the torch leads assembly to secure the wires to the shield stud on the power supply chassis.

5. Connect torch coolant and gas leads to connectors on the Torch Bulkhead Panel.

6. Close the Access Panel and turn the two latching screws.
Torch Leads Connections to Merlin 1000
B. Connect XT-301 Torch Head to XT-301 Torch Leads

**NOTE**

Handle the torch head carefully to avoid damage. The installer may choose to follow Section 3.07, Installing Consumable Parts, before installing the torch head. This will provide additional protection to the coolant tube on the torch head during installation.

1. Install the torch clamp assembly included in this kit, in place of the pinion removed previously.
2. Slide the end cap up onto the torch leads.
3. Remove and discard the protective end caps from the Mounting Tube.
4. Install the O-ring included in this kit in the groove at the upper end of the Mounting Tube.
5. Slide the positioning tube up onto the torch leads, far enough to allow access to the lead connection fittings.
6. Connect the XT-301 torch head to the Maximizer leads as shown.
7. Press the Torch Head Assembly upward to connect to the positioning tube. Pull the leads back as needed to ensure a proper fit through the positioning tube. Hold the Torch Head Assembly stationary; rotate the positioning tube to thread it onto the Torch Head. Install set screws from the hardware kit in any two of the threaded holes at the bottom of the positioning tube, to fasten the head assembly to the positioning tube.

**CAUTION**

Ensure that the leads do not twist within the positioning tube. Leads must lie as shown in the installation sketch.

8. Press the end cap downward on the positioning tube to cover and engage the O-Ring at the top of the positioning tube.

9. Secure the positioning tube to the torch clamp.

10. Secure the torch clamp to its mounting device. If not done previously, refer to Section 3.07 for details on installing torch consumable parts.
3.06 Connecting XT-301 Torch and Torch Leads to Remote Arc Starter

The Torch Leads connect to a bulkhead inside the Remote Arc Starter. In installations with torch leads less than 25 feet / 7.6 m long, connect the XT-301 Torch Head to Maximizer leads as in Section 3.04-B. In installations with torch leads longer than 25 feet / 7.6 m, remove the Maximizer torch leads. Connect the XT-301 Torch Leads to the Remote Arc Starter as follows:

**WARNING**

*Disconnect primary power at the source before disassembling the torch or torch leads.*

A. Disconnect Maximizer Torch from Remote Arc Starter

1. Remove the cover from the Remote Arc Starter.

---

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2. Disconnect the torch leads from the bulkhead panel inside the remote arc starter. The left illustration shows single-shielded leads connections; the right illustration shows double-shielded leads connections.

3. Carefully remove the torch leads through the boot on the Remote Arc Starter.
B. Connect XT-301 Torch Leads to Remote Arc Starter

1. Connect the torch leads connectors to the bulkhead connections per the following figure.

**CAUTION**

*If the Arc Starter Box does not include a drilled hole in the front panel as shown below for the outer (GREEN / YELLOW) torch lead shields, perform the following steps:*

- Drill a hole in the area shown.
- Scrape both sides of the front panel down to bare metal around the hole (to a diameter of ± 3/4” / 19 mm).
- Provide hardware as shown to secure the outer (GREEN / YELLOW) torch shield leads to the Arc Starter Box.
- Use the same hardware to connect a customer-supplied external ground from the Arc Starter Box to an earth ground.

2. Connect the inner shield leads with red wires and ring terminals to the mounting stud on the bulkhead panel.

3. Remove the nut and bolt mounted to the Remote Arc Starter front panel. Connect the outer shield leads with green/yellow wires and ring terminals to the mounting stud on the inside of the front panel. Secure the stud to the front panel with a hex nut. Connect a customer-supplied external ground wire to the stud, outside the front panel, and secure with a hex nut. Connect the other end of this ground wire to a properly-installed earth ground.
C. Reverse Coolant Leads at the Power Supply

1. Remove the power supply left side panel.

2. On the torch bulkhead panel, disconnect and reverse the coolant leads.

3. Re-install the power supply left side panel.
D. Install XT-301 Torch

NOTE

Handle the torch head carefully to avoid damage. The installer may choose to follow Section 3.07, Installing Consumable Parts, before installing the torch head. This will provide additional protection to the coolant tube on the torch head during installation.

1. Remove the Maximizer torch and pinion assembly from its support. Set the assembly aside in a secure location.

2. Install the torch clamp assembly included in this kit, on the torch positioning tube.

3. Slide the XT-301 end cap up onto the torch leads.

4. Remove and discard the protective end caps from the Mounting Tube.

5. Install the O-ring included in this kit in the groove at the upper end of the Mounting Tube.

6. Slide the positioning tube up onto the torch leads, far enough to allow access to the lead connection fittings.

7. Connect the XT-301 torch head to the XT-301 leads as shown.

8. Press the Torch Head Assembly upward to connect to the positioning tube. Pull the leads back as needed to ensure a proper fit through the positioning tube. Hold the Torch Head Assembly stationary; rotate the positioning tube to thread it onto the Torch Head. Use hardware provided to fasten the head assembly to the positioning tube.

CAUTION

Ensure that the leads do not twist within the positioning tube. Leads must lie as shown in the installation sketch.

9. Press the end cap downward on the positioning tube to cover and engage the O-Ring at the top of the positioning tube.
10. The lower end of the Mounting Tube includes four threaded holes. Install an Allen set screw from the hardware kit in any of the threaded holes to secure the Torch Head Assembly to the Mounting Tube.

11. Fasten the positioning tube into the torch clamp. Slide the leads end cap down onto the torch positioning tube. Ensure that the end cap engages the O-ring at the top of the positioning tube.

12. Install the shield cup, and cartridge assembly (including consumables) onto the torch head.
3.07 Install Consumable Torch Parts (All Applications)

1. Check the appropriate cut chart for the right combination of parts for the cutting application.

2. Install the consumable parts as follows to ensure proper operation. These steps will help ensure that parts are seated correctly.

3. Stack the consumable parts together.

4. Insert the stack of consumable parts into the cartridge. Ensure that the large O-ring on the torch tip fits completely into the cartridge. If any part of the O-ring protrudes from the cartridge, the parts are not seated properly.
5. Use the removal tool to hold the cartridge assembly, while turning the shield cup onto the cartridge assembly. When this group is fully assembled, the shield should protrude from the front of the shield cup 0.063" to 0.083" (1.6 - 2.1 mm). Without this protrusion the shield cup is not properly tightened onto the cartridge assembly.

6. Take the removal tool off the cartridge. Fit the cartridge assembly onto the torch head. The cartridge should seal to the large O-ring on the torch body as shown. If the cartridge does not seal on the O-ring, the cartridge is not fully tightened.

**CAUTION**

*Do not force the cartridge if it will not fully tighten. Remove the cartridge and gently clean the threads on the torch head body with a wire brush. Apply oxygen-compatible lubricant (supplied with the torch) to the threads.*
7. Connect the wire lead from the height finder to the ohmic clip if using ohmic torch height sensing.

**NOTE**

*Ohmic sensing is not recommended with water shield (secondary). Water on the plate interferes electrically with the ohmic sensing system.*

8. Confirm proper parts assembly as shown.

9. Slide the ohmic clip over the shield cup if using ohmic torch height sensing.

10. Connect the wire lead from the height finder to the ohmic clip.
SECTION 4: OPERATION

4.01 Introduction
This Section provides a description of the XT™-301 Torch followed by operating procedures.

4.02 Functional Overview
The Torch operates with the Merlin® 1000 Power Supply to provide a plasma cutting system which can cut most metals from gauge thickness up to 1 inch (25.4 mm).

4.03 Getting Started
Follow this procedure at the start of each shift:

---

**WARNING**
Disconnect primary power at the source before assembling or disassembling stacked modules, individual modules, torch parts, or torch and leads assemblies.

---

A. Torch Parts
Check the torch for proper assembly. Install proper torch parts for the desired application (refer to Section 6.05, Torch Parts Selection).

B. Input Power
1. Check the power source for proper input voltage.
2. Make sure that the Power Supply in the system is set for the proper voltage (refer to Power Supply Operating Manual for connections or adjustments).
3. Close main disconnect switch or plug unit in to supply primary power to the system.

C. Work Cable
Check for a solid work cable connection to the workpiece.

D. Gas Supplies
Select desired gas supplies. Make sure gas sources meet requirements (refer to Section 2.03, Specifications & Design Features). See the Appendix for gas selection guidance. Check connections and turn gas supplies on.

---

E. Purge System
On the Power Supply place the ON/OFF switch to the ON position. An automatic gas purge (pre-flow) will remove any condensation that may have accumulated in the torch and leads while the system was shut down. The torch cannot be activated during the purge cycle (pre-flow). After the purge is complete, if the RUN/SET switch is in SET position, gas will flow. If the switch is the in RUN position there will be no gas flow.

F. Current Output Level
Set the desired current output level on the Power Supply for the desired operation.

---

**NOTE**
DO NOT exceed the amperage rating of the Torch Parts (consumables).

---

G. Pressure And Flow Settings
Make the pressure and flow settings at the Gas Control Panel on the Plasma Power Supply.

---

**NOTES**
Refer to appropriate Plasma Power Supply Operating Manual for instructions on setting gas flows.

Refer to Cutting Speed Charts in the Appendix for recommended gas pressures and flows for the material being cut.

H. Ready for Operation
Return the RUN/SET switch to RUN position. The system is now ready for operation.

---

**NOTE**
Refer to Appendix 1 for a detailed block diagram of the Sequence Of Operation.
4.04 Torch Parts Selection

The metal to be cut and the plasma and secondary (shield) gases determine the torch parts to be used.

Torch parts:

Shield Cup, Shield Cap, Secondary (Shield) Gas Distributor, Tip, Plasma Gas Distributor, Electrode, Cartridge

---

CAUTION

Do not interchange parts. Make sure all parts in the torch correspond with the plasma and secondary in use.
4.05 Torch Maintenance

A. Consumable Removal

1. Use the removal tool to hold the Shield Cup & Cartridge Assembly stationary. Turn the Shield Cup to remove it from the Cartridge Assembly.

2. Take the Removal Tool off the back of the Cartridge Assembly. Use the removal tool to push the consumable parts out of the Cartridge.
B. O-Ring Lubrication

Lubricate all three O-Rings on the Cartridge Assembly and all three O-Rings on the Torch Head periodically with Thermal Dynamics No. 9-4893 O-Ring Lubricant. Remove the snap ring on the cartridge assembly and slide the locking ring downward for access to the O-Ring under the locking ring.

**CAUTION**

*Use only Thermal Dynamics No. 9-4893 O-Ring Lubricant (Christo Lube MCG-129) with this torch part. Use of other lubricants may cause irreparable damage to the torch.*
C. Parts Wear

Replace the Gas Distributor if it is charred or cracked.
Replace the Gas Distributor if the flange is damaged in any way.
Replace the tip and/or electrode if they are worn.
**D. Torch Consumables Installation**

---

**WARNINGS**

*Do not install consumables into the Cartridge while the Cartridge is attached to the Torch Head. Keep foreign materials out of the consumables and Cartridge. Handle all parts carefully to avoid damage, which may affect torch performance.*

---

1. Install the consumables as follows:

   1. Stack Parts
   2. Press Cartridge onto Stacked Parts
   3. Thread Shield Cup onto Cartridge
   4. Check Shield Cap Protrusion

   - **Electrode**
   - **Plasma Gas Distributor**
   - **Tip**
   - **Shield Gas Distributor**
   - **Shield Cap**
   - **O-Ring on Tip**
   - **Cartridge Covers O-Ring on Torch Tip**
   - **No Gaps Between Parts**
   - **Shield Cap Protrudes 0.063-0.083" (1.6 - 2.1 mm)**

---
2. Remove the Removal Tool from the Cartridge and install the assembled Cartridge onto the Torch Head.

**CAUTION**

The cartridge assembly must cover the O-Ring on the torch head.

Do not force the cartridge if it will not tighten fully. Remove the cartridge assembly and gently clean the threads on the torch head with a wire brush. Apply oxygen-compatible lubricant (supplied with the torch) to the threads.

---

3. Slide the ohmic clip over the shield cup if using ohmic torch height control sensing.

**NOTE**

Ohmic height sensing is not recommended with water secondary (‘shield’). Water on the plate interferes electrically with the ohmic sensing circuit.

4. Connect the wire lead from the height finder to the ohmic clip.
E. Coolant Leak Trouble-Shooting

Never operate the system if coolant leaks from the torch. A steady drip indicates that torch parts are damaged or installed improperly. Operating the system in this condition can damage the torch head. Refer to the following chart for guidance on coolant leakage from the torch head.

<table>
<thead>
<tr>
<th>Amperage</th>
<th>Plasma Gas</th>
<th>Recommended Wear Depth for Replacement</th>
</tr>
</thead>
<tbody>
<tr>
<td>55</td>
<td>O2</td>
<td>0.04</td>
</tr>
<tr>
<td></td>
<td>Air</td>
<td>0.08</td>
</tr>
<tr>
<td>100</td>
<td>O2</td>
<td>0.04</td>
</tr>
<tr>
<td></td>
<td>H35</td>
<td>0.08</td>
</tr>
</tbody>
</table>

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4.06 Cut Quality

NOTE

Cut quality depends heavily on set-up and parameters such as torch standoff, alignment with the workpiece, cutting speed, gas pressures, and operator ability.

Cut quality requirements differ depending on application. For instance, nitride build-up and bevel angle may be major factors when the surface will be welded after cutting. Dross-free cutting is important when finish cut quality is desired to avoid a secondary cleaning operation. Cut quality characteristics are illustrated in the following figure:

Cut Quality Characteristics

A. Cut Surface
   The desired or specified condition (smooth or rough) of the face of the cut.

B. Nitride Build-Up
   Nitride deposits can be left on the surface of the cut when nitrogen is present in the plasma gas stream. These buildups may create difficulties if the material is to be welded after the cutting process.

C. Bevel Angle
   The angle between the surface of the cut edge and a plane perpendicular to the surface of the plate. A perfectly perpendicular cut would result in a 0° bevel angle.

D. Top-Edge Rounding
   Rounding on the top edge of a cut due to wearing from the initial contact of the plasma arc on the workpiece.

E. Bottom Dross Build-up
   Molten material which is not blown out of the cut area and re-solidifies on the plate. Excessive dross may require secondary clean-up operations after cutting.

F. Kerf Width
   The width of the cut (or the width of material removed during the cut).

G. Top Spatter (Dross)
   Top Spatter or dross on the top of the cut caused by slow travel speed, excess cutting height, or cutting tip whose orifice has become elongated.
H. Cut Quality on Various Materials and Thicknesses

The chart defines the typical cut quality on various materials and thicknesses:

<table>
<thead>
<tr>
<th>Gases</th>
<th>Thickness</th>
<th>Material</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Carbon Steel</td>
</tr>
<tr>
<td>Plasma</td>
<td>Secondary ('Shield')</td>
<td>0 - 1 inch 0 - 25.4 mm</td>
</tr>
<tr>
<td>Air</td>
<td></td>
<td>1/4 - 1/2 inch 6.4 - 12.7 mm</td>
</tr>
<tr>
<td>H35 (Ar/H2)</td>
<td>N2</td>
<td>1/2 - 1 inch 12.7 - 25.4 mm</td>
</tr>
<tr>
<td>O2</td>
<td></td>
<td>0 - 3/8 inch 0 - 9.5 mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3/8 - 1 inch 9.5 - 25.4 mm</td>
</tr>
</tbody>
</table>

Description of Cut Characteristics:

**Excellent** - Minimum bevel (0 - 4°), minimum kerf (2 x tip orifice diameter), little or no dross, smooth cut surface.

**Good** - Slight bevel (0 - 10°), slightly wider kerf (2-1/2 x tip orifice diameter), some dross (easily removed), medium-smooth cut surface, slight top edge rounding.

**Fair** - Excessive bevel (over 10°), wide kerf (over 2-1/2 x tip orifice diameter), medium to heavy dross, rough cut surface, top edge rounding.

**NR** - Not Recommended.

**NOTE**

Cut quality depends heavily on set-up and parameters such as torch standoff, alignment with the workpiece, cutting speed, gas pressures, and operator ability.
4.07 Operating the System

**WARNINGS**

Disconnect primary power at the source before disassembling the power supply, torch, or torch leads.

Frequently review the Important Safety Precautions at the front of this manual. Be sure the operator is equipped with proper gloves, clothing, eye and ear protection. Make sure no part of the operator’s body comes into contact with the workpiece while the torch is activated.

Sparks from the cutting process can cause damage to coated, painted, and other surfaces such as glass, plastic and metal. Handle torch leads with care and protect them from damage.

A. Piloting

Piloting is harder on parts life than actual cutting because the pilot arc is directed from the electrode to the tip rather than to a workpiece. Whenever possible, avoid excessive pilot arc time to improve parts life.

B. Torch Standoff

Improper standoff (the distance between the torch tip and workpiece) can adversely affect tip life as well as shield cup life. Standoff may also significantly affect the bevel angle. Reducing standoff will generally result in a reduced bevel angle.

C. Edge Starting

**NOTE**

Edge starting is not recommended for machine type operations as most of the operations use the standoff method of starting and finishing on the work piece.

For edge starts, hold the torch perpendicular to the workpiece with the front of the tip near (not touching) the edge of the workpiece at the point where the cut is to start. When starting at the edge of the plate, do not pause at the edge and force the arc to "reach" for the edge of the metal. This effect will cause reduced tip life. Establish the cutting arc as quickly as possible.

D. Direction of Cut

In the Liquid Cooled Torch, the plasma gas stream swirls as it leaves the torch to maintain a smooth column of gas. This swirl effect results in one side of a cut being more square than the other. Viewed along the direction of travel, the right side of the cut is more square than the left. To make a square-edged cut along an inside diameter of a circle, the torch should move counterclockwise around the circle. To keep the square edge along an outside diameter cut, the torch should travel in a clockwise direction.

![Side Characteristics Of Cut](image-url)
E. Dross

When dross is present on carbon steel, it is commonly referred to as either “high speed, slow speed, or top dross”. Dross present on top of the plate is normally caused by too great a torch to plate distance. "Top dross" is normally very easy to remove and can often be wiped off with a welding glove. "Slow speed dross" is normally present on the bottom edge of the plate. It can vary from a light to heavy bead, but does not adhere tightly to the cut edge, and can be easily scraped off. "High speed dross" usually forms a narrow bead along the bottom of the cut edge and is very difficult to remove. When cutting a troublesome steel, it is sometimes useful to reduce the cutting speed to produce "slow speed dross". Any resultant cleanup can be accomplished by scraping, not grinding.

4.07 Torch Operation

A. Cutting With Torch

1. Use a square to check that the torch is perpendicular to the workpiece to obtain a clean, vertical cut.

2. To start a cut at the plate edge, position the center of the torch along the edge of the plate.

3. The torch can be activated by the remote operator control panel, remote control pendant, or by remote interface device such as CNC. After a two second gas purge, the pilot arc will start. The pilot arc will stay on as long as the torch is activated or until main arc starts.

4. With the pilot arc on, the main cutting arc will be established when the torch is brought within 1/16 - 1/4 in (1.6 - 6.4 mm) of the workpiece. If the cutting arc is interrupted and the torch is still activated, as when cutting expanded metal, the pilot arc will automatically restart (see NOTE). Deactivating the torch will shut off either the pilot or main arc, depending on the mode of operation.

NOTE

Refer to High/Low Speed Auto-Restart Function in the Plasma Power Supply Operating Manual.

5. Cut with a standoff of 1/16 - 1/4 in (1.6 - 6.4 mm) from the work. The torch should be held perpendicular to the workpiece while cutting. Start cutting slowly and adjust cutting speed for optimum cutting performance. Refer to the Appendix pages for typical cutting speeds for various materials and material thicknesses.
B. Travel Speed

Proper travel speed is indicated by the trail of the arc which is seen below the plate. The arc can be one of the following:

1. **Straight Arc**
   - A straight arc is perpendicular to the workpiece surface. This arc is generally recommended for the best cut using air plasma on stainless or aluminum.

2. **Leading Arc**
   - The leading arc is directed in the same direction as torch travel. A five degree leading arc is generally recommended for air plasma on mild steel.

3. **Trailing Arc**
   - The trailing arc is directed in the opposite direction as torch travel.

For optimum smooth surface quality, the travel speed should be adjusted so that only the leading edge of the arc column produces the cut. If the travel speed is too slow, a rough cut will be produced as the arc moves from side to side in search of metal for transfer.

Travel speed also affects the bevel angle of a cut. When cutting in a circle or around a corner, slow down the travel speed to achieve a squarer cut. The power source output should be reduced also.

C. Piercing With Torch

To pierce with the torch, start the arc with the torch positioned as high as possible above the plate while allowing the arc to transfer and pierce. This standoff helps avoid having molten metal blow back onto the front end of the torch.

When operating with a cutting machine, a pierce or dwell time is required. Torch travel should not be enabled until the arc penetrates the bottom of the plate. As motion begins, torch standoff should be reduced to the recommended distance for optimum speed and cut quality.

Piercing the plate is not recommended on plates thicker than 1/2 inch (12.7 mm). Blowback from the piercing operation can shorten the life of torch parts. All piercing should therefore be done as quickly as possible and at maximum amperage and maximum standoff.

Pierce off the cutting line and then continue the cut as needed. Clean spatter and scale from the shield cup and the shield cap as soon as possible. Spraying or dipping the shield cup and cap in anti-spatter compound will minimize the amount of scale which adheres to it. This can significantly increase parts life.

4.08 Recommended Cutting Speeds

Cutting speed depends on material, thickness, and input voltage. These other factors may affect system performance:

- Torch parts wear
- Air quality
- Operator experience
- Torch standoff height
- Proper work cable connection
- Alloy content of material

**NOTE**

This information represents realistic expectations using recommended practices and well-maintained systems. Actual speeds may vary from those shown in the charts depending on the alloy content of the selected material.

See the Appendix pages for complete cutting data.
4.08 Gas Selection

A. Plasma Gases

1. Air Plasma
   • Most often used on ferrous or carbon base materials for good quality at faster cutting speeds.
   • Air plasma is normally used with air secondary.
   • Only clean, dry air is recommended for use as plasma gas. Any oil or moisture in the air supply will substantially reduce torch parts life.
   • Provides satisfactory results on nonferrous materials.

2. Argon/Hydrogen (H35) Plasma
   • Recommended for use on 3/4 in (19 mm) and thicker stainless steel. Recommended for 1/2 inch (12 mm) and thicker nonferrous materials. Ar/H2 is not normally used for thinner nonferrous materials because less expensive gases can achieve similar cut quality.
   • Poor cut quality on ferrous materials.
   • Provides faster cutting speeds and high cut quality on thicker materials to offset the higher cost.
   • A 65% argon / 35% hydrogen mixture should be used.

3. Oxygen (O2) Plasma
   • Oxygen is recommended for cutting ferrous materials.
   • Provides faster cutting speeds.
   • Provides very smooth finishes and minimizes nitride build-up on cut surface (nitride build-up can cause difficulties in producing high quality welds if not removed).

4. Nitrogen (N2) Plasma
   • Provides better cut quality on nonferrous materials such as stainless steel and aluminum.
   • Can be used in place of air plasma with air secondary or carbon dioxide (CO2).
   • Provides much better parts life than air.
   • A good clean welding grade nitrogen should be used.

B. Secondary (“Shield”) Gases

1. Compressed Air Secondary
   • Air secondary is normally used when operating with air plasma.
   • Improves cut quality on some ferrous materials.
   • Inexpensive - reduces operating costs.

2. Nitrogen (N2) Secondary
   • Nitrogen secondary is used with Ar/H2 (H35) plasma.
   • Provides smooth finishes on nonferrous materials.
   • May reduce smoke when used with Ar/H2 plasma.
SECTION 5: SERVICE

5.01 Introduction

This Section describes basic maintenance procedures. No other adjustments or repairs are to be attempted by other than properly trained personnel.

WARNINGs

Disconnect primary power at the source before disassembling the torch or torch leads.

Frequently review the Important Safety Precautions in Section 1. Be sure the operator is equipped with proper gloves, clothing, eye and ear protection. Make sure no part of the operator's body comes into contact with the workpiece while the torch is activated.

Sparks from the cutting process can cause damage to coated, painted, and other surfaces such as glass, plastic and metal.

Handle torch leads with care and protect them from damage.

A. Torch O-ring Lubrication

O-rings on the torch head require lubrication on a scheduled basis. This will allow the o-rings to remain pliable and provide a proper seal. The o-rings will dry out, becoming hard and cracked, if the o-ring lubricant is not used regularly. This can lead to potential leaks internally and externally. Failure of o-rings can cause severe contamination. Contaminants can destroy or shorten the parts life of tips, electrodes, and internal torch parts.

Apply a very light film of o-ring lubricant, Catalog Number 9-4893, to all the o-rings on a weekly basis.

CAUTION

Use only Thermal Dynamics No. 9-4893 O-Ring Lubricant (Christo Lube MCG-129) with this torch part. Use of other lubricants may cause irreparable damage to the torch.

NOTE

DO NOT use other lubricants or grease, they may not be designed to operate within high temperatures or may contain "unknown elements" that may react with the atmosphere. This reaction can leave contaminants inside the torch. Either of these conditions can lead to inconsistent performance or poor parts life.

5.02 Common Operating Faults

The following are the more common cutting faults and possible causes:

1. Insufficient Penetration
   a. Cutting speed too fast
   b. Torch tilted too much
   c. Metal too thick
   d. Worn torch parts
   e. Cutting current too low
   f. Non-Genuine Thermal Dynamics Parts

2. Main Arc Extinguishes
   a. Cutting speed too slow
   b. Torch standoff too high from workpiece
   c. Cutting current too high
   d. Work cable disconnected
   e. Worn torch parts
   f. Non-Genuine Thermal Dynamics Parts
3. Excessive Dross Formation
   a. Cutting speed too slow
   b. Torch standoff too high from workpiece
   c. Worn torch parts
   d. Improper cutting current
   e. Non-Genuine Thermal Dynamics Parts

4. Short Torch Parts Life
   a. Oil or moisture in air source
   b. Exceeding system capability (material too thick)
   c. Excessive pilot arc time
   d. Air flow too low (incorrect pressure)
   e. Improperly assembled torch
   f. Output current too high
   g. Torch tip contacting workpiece
   h. Damaged or loose torch head components
   i. Non-Genuine Thermal Dynamics Parts
   j. Restricted coolant flow (over heating)

5. Poor Pilot Starting
   a. Non-Genuine Thermal Dynamics Parts
   b. High coolant conductivity (refer to Power Supply Manual)

5.03 General Maintenance

A. O-Ring Lubrication

Lubricate all three O-Rings on the Cartridge Assembly and all three O-Rings on the Torch Head periodically with O-Ring Lubricant supplied. Remove the snap ring on the cartridge assembly and slide the locking ring downward for access to the O-Ring under the locking ring.

**CAUTION**

Use only Thermal Dynamics No. 9-4893 O-Ring Lubricant (Christo Lube MCG-129) with this torch part. Use of other lubricants may cause irreparable damage to the torch.

Art # A-04071

Art # A-04066
B Consumable Removal

1. Use the removal tool to hold the Shield Cup & Cartridge Assembly stationary. Turn the Shield Cup to remove it from the Cartridge Assembly.

2. Take the Removal Tool off the back of the Cartridge Assembly. Use the removal tool to push the consumable parts out of the Shield Cup.
C. Gas Distributor Inspection

Replace the Gas Distributor if it is charred or cracked.

Replace the Gas Distributor if flange is damaged in any way.

D. Electrode Inspection

Replace the Electrode when the insert has become worn per the chart.

<table>
<thead>
<tr>
<th>Amperage</th>
<th>Plasma Gas</th>
<th>Recommended Wear Depth for Replacement</th>
</tr>
</thead>
<tbody>
<tr>
<td>55</td>
<td>O₂</td>
<td>0.04 Inch, 1 mm</td>
</tr>
<tr>
<td>55</td>
<td>Air</td>
<td>0.08 Inch, 2 mm</td>
</tr>
<tr>
<td>100</td>
<td>O₂</td>
<td>0.04 Inch, 1 mm</td>
</tr>
<tr>
<td>100</td>
<td>H35</td>
<td>0.08 Inch, 2 mm</td>
</tr>
</tbody>
</table>
5.04 Torch Consumables Installation

**WARNINGS**

*Do not install consumables into the Cartridge while the Cartridge is attached to the Torch Head. Keep foreign materials out of the consumables and Cartridge. Handle all parts carefully to avoid damage, which may affect torch performance.*

1. Install the parts as follows for proper operation. Note that properly assembled parts will turn within one another without substantial binding.

---

1: Stack Parts

- Electrode
- Plasma Gas Distributor
- Tip
- Shield Gas Distributor
- Shield Cap

2: Press Cartridge onto Stacked Parts

- Upper O-Ring on Tip
- No Gaps Between Parts
- Cartridge Covers Upper O-Ring on Torch Tip

3: Thread Shield Cup onto Cartridge

- Shield Cup

4: Check Shield Cap Protrusion

- Shield Cap Protrudes 0.063-0.083" (1.6 - 2.1 mm)
2. Remove the Removal Tool from the Cartridge and install the assembled Cartridge onto the Torch Head. Confirm proper parts installation as shown.

4. Slide the ohmic clip over the shield cup if using ohmic torch height sensing.

5. Connect the wire lead from the height finder to the ohmic clip if using ohmic torch height sensing.

**NOTE:**

*Ohmic height sensing is not recommended with water shield. Water on the plate interferes electrically with the ohmic sensing circuit.*

6. Purge coolant from the torch before firing the torch. Ensure there are no leaks before use. If leaks are evident, consult the coolant leak trouble-shooting guide in the maintenance section of this manual.
5.05 Troubleshooting Guide

A. Troubleshooting

This Sub-Section covers troubleshooting that requires disassembly and electronic measurements. It is helpful for solving many of the common problems that can arise with this torch assembly.

B. How to use this Guide

The following information is a guide to help determine the most likely causes for various symptoms.

This guide is set up as follows:

X. Symptom (Bold Type)

Any Special Instructions (Text Type)

1. Cause (Italic Type)
   
a. Check/Remedy (Text Type)

Locate your symptom, check the causes (easiest listed first) then remedies. Repair as needed, being sure to verify that the unit is fully operational after any repairs.
A. Torch will not pilot when torch switch is activated

1. Power Supply RUN/SET switch in SET position
   a. Place RUN/SET switch to RUN position.
2. Torch switch activated during power on purge
   a. Release torch switch and wait at least 20 seconds before activating switch again.
3. Faulty torch parts
   a. Inspect torch parts and replace if necessary. Refer to Section 5.04.
4. Gas pressure too high
   a. Set pressure per the speed charts in the Appendix.
5. Faulty components in torch and leads assembly
   a. Inspect torch assemblies and replace if necessary. Refer to Section 5.07, Torch and Leads Troubleshooting.
6. Faulty components in power supply system components
   a. Return for repair or have qualified technician repair per Service Manual.

B. No cutting output

1. Torch not properly connected to power supply
   a. Check that torch leads are properly attached to power supply.
2. Faulty components in torch and leads assembly
   a. Inspect torch assemblies and replace if necessary. Refer to Section 5.07, Torch and Leads Troubleshooting.
3. Faulty components in power supply system components
   a. Return for repair or have qualified technician repair per Service Manual.

C. Low cutting output with no control

1. Incorrect setting of AMPERAGE control on power supply
   a. Check and adjust to proper setting.
2. Torch tip contacting workpiece
   a. Increase standoff distance.
3. Faulty components in torch and leads assembly
   a. Inspect torch assemblies and replace if necessary. Refer to Section 5.07, Torch and Leads Troubleshooting.
4. Faulty components in power supply system components
   a. Return for repair or have qualified technician repair per Service Manual.

D. Limited output with no control

1. Poor input or output connections to power supply
   a. Check all input and output connections.
2. Incorrect setting of CURRENT control on power supply
   a. Check and adjust to proper setting.
3. Faulty components in torch and leads assembly
   a. Inspect torch assemblies and replace if necessary. Refer to Section 5.07, Torch and Leads Troubleshooting.
4. Faulty components in power supply system components
   a. Return for repair or have qualified technician repair per Service Manual.

E. Erratic or improper cutting output

1. Poor input or output connections to power supply
   a. Check all input and output connections.
2. Current set too low at power supply
   a. Increase current setting.
3. Torch is being moved too fast across workpiece
   a. Reduce cutting speed (refer to Cutting Speed Charts in the Appendix).
4. Excessive oil or moisture in torch
   a. Hold torch 1/8 inch (3 mm) from clean surface while purging and observe oil or moisture buildup (do not activate torch).
F. No gas flow
1. Gas not connected or pressure too low
   a. Check source for proper input pressure.
2. Faulty components in torch and leads assembly
   a. Inspect torch assemblies and replace if necessary. Refer to Section 5.07, Torch and Leads Troubleshooting.
3. Faulty components in power supply system components
   a. Return for repair or have qualified technician repair per Service Manual.

G. Torch cuts but not adequately
1. Current set too low at power supply
   a. Increase current setting
2. Torch is being moved too fast across workpiece
   a. Reduce cutting speed (refer to Cutting Speed Charts in the Appendix).
3. Excessive oil or moisture in torch
   a. Hold torch 1/8 inch (3 mm) from clean surface while purging and observe oil or moisture buildup (do not activate torch)
4. Torch tip contacting workpiece
   a. Increase standoff distance
5. Torch tip worn
   a. Replace tip
6. Wrong gas pressure
   a. Set correct gas pressure

5.06 Servicing Torch Components

WARNINGS
Disconnect primary power to the system before disassembling the torch or torch leads.

DO NOT touch any internal torch parts while the AC indicator light on the front panel of the Power Supply is ON.

A. Removing Torch Head
1. Remove the shield cup, cartridge, and consumables from the torch head.
2. Locate the shrink-on tubing at the back end of the torch positioning tube. Remove the shrink-on tubing from the torch lead sleeving being careful not to damage the lead assembly underneath.
3. Under the shrink-on tubing remove the tape from the torch lead sleeving and slide the sleeving back (see NOTE).

NOTE
The positioning tube will not slide over the torch lead sleeving.

4. Unscrew the positioning tube from the torch head assembly and slide the positioning tube back over the leads to expose the plasma (+), secondary (shield), coolant supply (-), and coolant return connectors.

CAUTION
Hold the torch head stationary and unscrew the positioning tube. Do not unscrew the torch head. Do not let the torch leads or connectors twist.

5. Disconnect the plasma (+), secondary (shield), coolant supply (-), and coolant return connectors to allow removal of the torch head. Note the location of the torch leads insulator between the negative and positive leads.
B. Reassembling Torch Assembly

1. Slide the replacement shrink-on tubing onto the torch leads assembly.
2. Connect the plasma (+), secondary (shield), coolant supply (-), and coolant return connectors.
3. Secure leads and tubing with single layer of electrical tape.
4. Slide the positioning tube down over the leads and thread it onto the torch head assembly.

*CAUTION*

Hold the torch head stationary. Thread the positioning tube onto the torch head. Do not twist or rotate the torch head or torch leads.

5. Apply tape to the torch leads sleeving at the back end of the positioning tube.
6. Position the shrink-on tubing over the taped area and shrink into place.
7. Use set screws in the lowest holes in the positioning tube to secure the torch head to the tube.
8. Install the front end torch parts.
5.07 Torch And Leads Troubleshooting

A. General Information

Failures in the Torch and Leads can be isolated to the Torch Head or Torch Lead components. Isolating a failed part requires the use of an ohmmeter and a Hi-Pot Tester.

**WARNING**

The use of a Hi-Pot Tester should be performed only by a qualified electronic technician.

In the Torch Head the center insulator separates the negative and positive charged sections of the torch. If the center insulator does not provide adequate resistance, current which is intended for the pilot arc may be dissipated into the torch head, resulting in torch failure.

In the Torch Leads the negative and positive leads are isolated from each other. If there is not adequate resistance between the leads then torch failure may occur.

B. Quick Check Procedure

This quick check will identify major isolation failures in the Torch Head or Torch Lead components using an ohmmeter. The actual assembly and consumables may vary for different torches but the basic procedure is the same for all torches. Make the quick check on the Torch Head and Leads as follows:

**WARNINGS**

Disconnect primary power to the system before disassembling the torch or torch leads.

DO NOT touch any internal torch parts while the AC indicator light of the Power Supply is ON.

1. Remove the consumables from the torch.
2. Disconnect the torch leads from the power supply to isolate the torch from power supply circuits.
3. Using an ohmmeter (set to 10K or higher), check for continuity between the positive and negative torch fittings.
   - If there is continuity between the two torch fittings proceed to Step 4.
   - If no continuity (infinite resistance) is found between the two torch fittings proceed to paragraph C.
4. Remove the torch head from the leads (refer to the proper Section on servicing the Torch Components).
5. With the torch head disconnected from the leads, measure the resistance between negative fitting or cathode body of the torch head and the positive fitting or anode body of the torch head.
   No continuity (infinite resistance) should be measured between negative and positive sections of the torch head.
   - If there is continuity, torch head must be replaced.
   - If no continuity (infinite resistance) is found proceed to Step 6.
6. Check the torch leads by measuring the resistance between the positive pilot lead connector and the negative lead fitting.
   - If there is continuity, torch leads must be replaced.
   - If no continuity (infinite resistance) is found proceed to paragraph ‘C’ (see NOTE).

**NOTE**

*It is possible that the Torch Head and Torch Leads will test properly with an ohmmeter. The Torch Head and Torch Leads should be tested further for insulation breakdown if no other fault can be found.*

**C. Checking Proper Isolation Resistance Procedure**

The Torch Head and Torch Leads should be tested further for insulation breakdown if no other fault has been found. This procedure requires the use of a Hi-Pot Tester.

**WARNING**

*This procedure should be performed only by a qualified electronic technician.*

1. Test the Torch Head center insulator for insulation breakdown as follows:
   a. Remove the Torch Head Assembly from the Torch Leads if not already done.
   b. Remove the consumables from the Torch Head Assembly if not already done.
   c. Connect a Hi-Pot Tester capable of producing 2500 VAC between the positive pilot lead and the negative lead fittings.
   d. Increase the output of the Hi-Pot Tester to a maximum of 2500 VAC.
      - If the voltage drops to 0 V AC or leakage current is detected, then the Torch Head center insulator is breaking down and the Torch Head must be replaced.
      - If the Torch Head center insulator passes the test, then proceed to Step 2.

2. To test the Torch Leads for insulation breakdown use the following procedure:
   a. Connect the Hi-Pot Tester between the positive pilot lead and the negative lead fittings. The fitting on the other end of the Torch Leads must be separated (isolated) from each other.
   b. Increase the output of the Hi-Pot Tester to a maximum of 2500 VAC.
      - If the voltage drops to 0 VAC or leakage current is detected, then the insulation between the Torch Leads is breaking down and the Torch Leads must be replaced.
      - If the Torch Leads passes the test, then proceed to Step 3.

3. Visually check that the torch switch wires, pilot lead connection, and negative lead connections are properly connected and in good condition (no shorts or arcing).
   - If problems are evident, repair or replace as required.
   - If there are no visual problems, then proceed to Step 4.
4. Check the pilot lead, negative lead and switch control wires for opens from one end of the torch leads to the other.
   • If open, replace leads or open component of the Torch Leads Assembly.
   • If not open, then proceed to Step 5.

5. Check the pilot and switch control wires for shorts to other components in the Torch Leads.
   • If shorted, then replace Torch Leads.
   • If not shorted, then proceed to Step 6.

6. Carefully reassemble the components and recheck the completed assembly per paragraph ‘B’, Step 3 to confirm that the components have been properly assembled.

This completes the checks for the proper operation of the Torch Head and Torch Leads.
SECTION 6: PARTS LISTS

6.01 Introduction

A. Parts List Breakdown

The parts list provides a breakdown of all replaceable components. Torch Assemblies are field serviceable, so a complete breakdown of parts is provided. The parts lists are arranged as follows:

- Section 6.03: Replacement 180° Torch Parts
- Section 6.04: Replacement Rack & Pinion Parts
- Section 6.05: Torch Consumables

**NOTE**

Parts listed without item numbers are not illustrated, but may be ordered by the catalog numbers shown.

B. Returns

If a product must be returned for service, contact your authorized distributor. Materials returned without proper authorization will not be accepted.

6.02 Ordering Information

Order replacement parts by catalog number and complete description of the part or assembly, as listed in the description column of the Parts List. Also include the model and serial number of the torch. Address all inquiries to your authorized distributor.
## 6.03 Replacement Torch Parts and Kits

<table>
<thead>
<tr>
<th>Item #</th>
<th>Qty</th>
<th>Description</th>
<th>Catalog #</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>XT-301 Torch Head Assembly (Only)</td>
<td>35-1002</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>XT-301 Torch Kit</td>
<td>9-4970</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>XT-301 Torch Lead Assembly (Only)</td>
<td></td>
</tr>
<tr>
<td></td>
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<td>O-Ring Lubricant (Cristo-Lube MCG-129) *</td>
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*NOTE:
Use only this lubricant with this torch. Use of other lubricants may cause irreparable damage to the torch.
O-Rings
Cat. No. 9-9041
Cat. No. 8-0539
Cat. No. 8-0534
Cat. No. 8-0530

Coolant Tube Kit
Cat. No. 9-9429

Cartridge Assembly
O-Ring, Cat. No. 8-0544
O-Ring, Cat. No. 8-0540
Inner O-Ring (Cat. No. 8-0545)
Location (Under Locking Ring)

Cartridge Retaining Ring 9-9489
Snap Ring

Lead Packages, Lengths > 25 ft / 7.6 m
6.05 O-Rings for Torch Consumables

Shield Cap

35-1034
O-Ring 9-9039

Tip

35-1051
O-Ring 9-9038
O-Ring 9-9060

35-1053
O-Ring 9-9038
O-Ring 9-9060

35-1055
O-Ring 8-5525
O-Ring 9-9060

35-1056
O-Ring 8-5525
O-Ring 9-9060

35-1060
O-Ring 9-9038
O-Ring 9-9060

35-1062
O-Ring 9-9038
O-Ring 9-9060

Electrode

35-1069
O-Ring 9-9035

35-1071
O-Ring 9-9035

35-1078
O-Ring 9-9035

35-1080
O-Ring 9-9035

35-1085
O-Ring 9-9035

35-1086
O-Ring 9-9035
This page is blank intentionally.
**Sequence of Operation Diagram**

**ACTION**
Close external disconnect switch

**RESULT**
- Power to system

**ACTION**
Enable ON ON/OFF switch to ON

**RESULT**
- AC indicator ON
- TEMP Indicator ON
- GAS indicator ON
- Fan and pump ON
- 20 second auto-purge

**ACTION**
RUN/SET switch to SET

**RESULT**
- Gas solenoids open, gases flow to set pressures
- GAS indicator ON

**RESULT**

**ACTION**
Run/SET switch to RUN

**RESULT**
- Gas flow stops
- Power circuit ready
- GAS indicator OFF

**ACTION**
Protect eyes and activate torch

**RESULT**
- Gas indicator ON
- Gas pre-flow
- Main contactor closes
- DC indicator ON
- Pilot contactor closes
- Pilot arc established

**ACTION**
Torch de-activated by torch switch released or remote device

**RESULT**
- Main arc stops
- Main contactor opens
- DC indicator OFF

**NOTE** - If torch is activated during post-flow the pilot arc will immediately restart. If within range of work, main arc will transfer.

After post-flow:
- Gas solenoids close, gas flow stops
- GAS indicator OFF

**ACTION**
ON/OFF switch to OFF

**RESULT**
- AC indicator OFF
- TEMP Indicator OFF
- Fan and pump OFF

**ACTION**
Open external disconnect

**RESULT**
- No power to system

**ACTION**
Torch removed from work

**RESULT**
- Main arc stops
- Pilot arc auto-restart

**ACTION**
Torch moved to within 1/8 - 3/8 inch of work

**RESULT**
- Main arc transfer
- Pilot arc OFF

**ACTION**
Torch moved to within 1/8 - 3/8 inch of work

**RESULT**
- Main arc transfer
- Pilot arc OFF

**ACTION**
Torch removed from work

**RESULT**
- Main arc stops
- Pilot arc auto-restart

**ACTION**
ON/OFF switch to OFF

**RESULT**
- AC indicator OFF
- TEMP Indicator OFF
- Fan and pump OFF

**ACTION**
Open external disconnect

**RESULT**
- No power to system
Mild Steel

55A

Air Plasma / Air Secondary

---

<table>
<thead>
<tr>
<th>Material Thickness</th>
<th>Cut Flow Rates / Pressures</th>
<th>** Arc Voltage</th>
<th>Torch Working Height</th>
<th>Travel Speed</th>
<th>Initial Piercing Height</th>
<th>Pierce Delay</th>
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**Bold type** indicates maximum piercing parameters.
# Mild Steel

## 55A

**O2 Plasma / Air Secondary**

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### Cut Flow Rates / Pressures

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**Bold type** indicates maximum piercing parameters.
**Mild Steel**

**100A**

**Air Plasma / Air Secondary**

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<td>psi</td>
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*Bold Italic indicates edge starts only.*
## Mild Steel

### 100A

**O2 Plasma / Air Secondary**

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**Bold type** indicates maximum piercing parameters. **Bold Italic** indicates edge starts only.
## Stainless Steel
### 55A
#### Air Plasma / Air Secondary


### 55A Aluminum (Air/Air)

<table>
<thead>
<tr>
<th>Material Thickness</th>
<th>Cut Flow Rates / Pressures</th>
<th>** Arc Voltage</th>
<th>Torch Working Height</th>
<th>Travel Speed</th>
<th>Initial Piercing Height</th>
<th>Pierce Delay</th>
</tr>
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<tbody>
<tr>
<td>(ga) (in) (in)</td>
<td>Plasma (Air) Shield (Air)</td>
<td>(volts)</td>
<td>(in)</td>
<td>(ipm)</td>
<td>(in)</td>
<td>(sec)</td>
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<td>23 0.031 30 90 50</td>
<td>130 0.063 600 0.130 0.0</td>
<td>16 0.064 30 90 50</td>
<td>125 0.063 400 0.250 0.0</td>
<td>3/16 0.188 30 90 50</td>
<td>135 0.125 100 0.250 0.0</td>
<td>1/4 0.250 30 90 50</td>
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### 55A Aluminum (mm/mm)

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<th>Cut Flow Rates / Pressures</th>
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<th>Travel Speed</th>
<th>Initial Piercing Height</th>
<th>Pierce Delay</th>
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<td>(mm)</td>
<td>(sec)</td>
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**Bold type** indicates maximum piercing parameters.
## Stainless Steel

### 100A

#### Air Plasma / Air Secondary

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<td>0.625</td>
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<th>Pierce Delay</th>
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**Bold type** indicates maximum piercing parameters. **Bold Italic** indicates edge starts only.
**Stainless Steel**

**100A**

**H35 Plasma / N2 Secondary**

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<th>Cut Flow Rates / Pressures</th>
<th><strong>Arc Voltage</strong></th>
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<th>Pierce Delay</th>
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<td>(ipm)</td>
<td>(in)</td>
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<td>(in)</td>
<td>(in)</td>
<td>Ball</td>
<td>psi</td>
<td>psi</td>
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<td>142</td>
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<td>90</td>
<td>35</td>
<td>145</td>
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</tr>
<tr>
<td>5/8</td>
<td>0.625</td>
<td>45</td>
<td>90</td>
<td>35</td>
<td>153</td>
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<td>90</td>
<td>35</td>
<td>155</td>
<td>0.160</td>
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<td>45</td>
<td>90</td>
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<td>165</td>
<td>0.160</td>
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<th>Travel Speed</th>
<th>Initial Piercing Height</th>
<th>Pierce Delay</th>
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<td>(mm/min)</td>
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<td>2.4</td>
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*Bold Italic* type indicates edge starts only.
## Stainless Steel
### 100A
#### N2 Plasma / H2O Secondary

### 100A SS (N2/H2O)

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<th>Torch Working Height</th>
<th>Travel Speed</th>
<th>Initial Piercing Height</th>
<th>Pierce Delay</th>
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</thead>
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<td>Shield (H2O)</td>
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<td>(in)±0.005</td>
<td>(ipm)</td>
<td>(in)</td>
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<td>0.188</td>
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<td>167</td>
<td>0.188</td>
<td>100</td>
<td>0.300</td>
</tr>
<tr>
<td>1/4 0.250</td>
<td>45 90</td>
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<td>166</td>
<td>0.188</td>
<td>60</td>
<td>0.300</td>
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<tr>
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<td>45 90</td>
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<td>169</td>
<td>0.188</td>
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<td>0.188</td>
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<th>Torch Working Height</th>
<th>Travel Speed</th>
<th>Initial Piercing Height</th>
<th>Pierce Delay</th>
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</table>

* Ball setting for shield water is set using a line pressure of 55 PSI / 3.8 Bar

**Bold type** indicates maximum piercing parameters.

---

**NOTE**

Ohmic sensing is not recommended with water shield. Water on the plate interferes electrically with the ohmic sensing system.
**Aluminum**

**55A Air Plasma / Air Secondary**

<table>
<thead>
<tr>
<th>Material Thickness</th>
<th>Cut Flow Rates / Pressures</th>
<th><strong>Arc Voltage</strong></th>
<th>Torch Working Height</th>
<th>Travel Speed</th>
<th>Initial Piercing Height</th>
<th>Pierce Delay</th>
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<tbody>
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</tr>
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<tr>
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**Material Thickness**

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<th>Travel Speed</th>
<th>Initial Piercing Height</th>
<th>Pierce Delay</th>
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**Bold type** indicates maximum piercing parameters.
# Aluminum

## 100A

### Air Plasma / Air Secondary

<table>
<thead>
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<th>Cut Flow Rates / Pressures</th>
<th>** Arc Voltage</th>
<th>Torch Working Height</th>
<th>Travel Speed</th>
<th>Initial Piercing Height</th>
<th>Pierce Delay</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Plasma (Air)</td>
<td>Shield (Air)</td>
<td>(volts)</td>
<td>(in)±0.005</td>
<td>(ipm)</td>
<td>(in)</td>
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<td>16 (in)</td>
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<td>90</td>
<td>25</td>
<td>150</td>
<td>0.130</td>
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<td>10 (in)</td>
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<td>90</td>
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**Bold type** indicates maximum piercing parameters.
**Aluminum**

**100A**

**N2 Plasma / H2O Secondary**

**NOTE**

Ohmic sensing is not recommended with water shield. Water on the plate interferes electrically with the ohmic sensing system.

---

### 100A Al (N2/H2O)

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### Material Thickness

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* Ball setting for shield water is set using a line pressure of 55 PSI / 3.8 bar

**Bold type** indicates maximum piercing parameters.
## Aluminum
### 100A
#### H35 Plasma / N2 Secondary


### 100A Al (H35/N2)

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**Bold type** indicates maximum piercing parameters.  **Bold Italic** indicates edge starts only.
## XT™-301 Plasma Cutting Torch Patents

The following parts are covered under U.S. and Foreign Patents as follows:

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**XT™-301 Plasma Cutting Torch Patents**

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**NOTE**

This manual may refer to some or all of the parts listed.
# Publication History

## Manual No. 0-4768

<table>
<thead>
<tr>
<th>Cover Date</th>
<th>Rev</th>
<th>Change(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>8/29/05</td>
<td></td>
<td>First issue.</td>
</tr>
<tr>
<td>9/10/05</td>
<td></td>
<td>Corrected metric measurements in speed charts.</td>
</tr>
<tr>
<td>10/17/05</td>
<td></td>
<td>Fixed catalog number error on p. 6-2 – changed 9-4336 to 9-9336. Updated speed chart style and fixed parts selection error (55-A MS, Air-air).</td>
</tr>
<tr>
<td>11/7/05</td>
<td></td>
<td>Updated parts selection art on Pg 6-4, dropped consumables catalog numbers from speed charts.</td>
</tr>
<tr>
<td>1/9/06</td>
<td></td>
<td>Expanded application info and installation details. Added installation detail for connecting leads to Remote Arc Starter. Added Torch &amp; Lead assembly catalog numbers. Added minimum coolant flow requirements. Updated cutting data charts; changed plasma gas pressure to 90 psi / 6.2 bar. Added cautions against using ohmic height sensing with water shield.</td>
</tr>
<tr>
<td>3/31/06</td>
<td>AA</td>
<td>Updated catalog numbers for Nitrogen-water electrodes per ECO B-051. Added notes on maximum piercing &amp; edge starts. Updated sketch for checking shield cup installation on cartridge.</td>
</tr>
<tr>
<td>7/31/06</td>
<td>AB.01</td>
<td>Updated part numbers, removing 35-1042 Plasma Gas Distributor from art work on pgs. 4-3, 6-4, A-9 and A-12. Updated art adding 35-1089 electrode to pages 4-3 and 6-4.</td>
</tr>
<tr>
<td>12/20/06</td>
<td>AC.01</td>
<td>Added patent information pages and updated Torch Head part number from 35-2001 to 35-2002. Updated revision.</td>
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</tbody>
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