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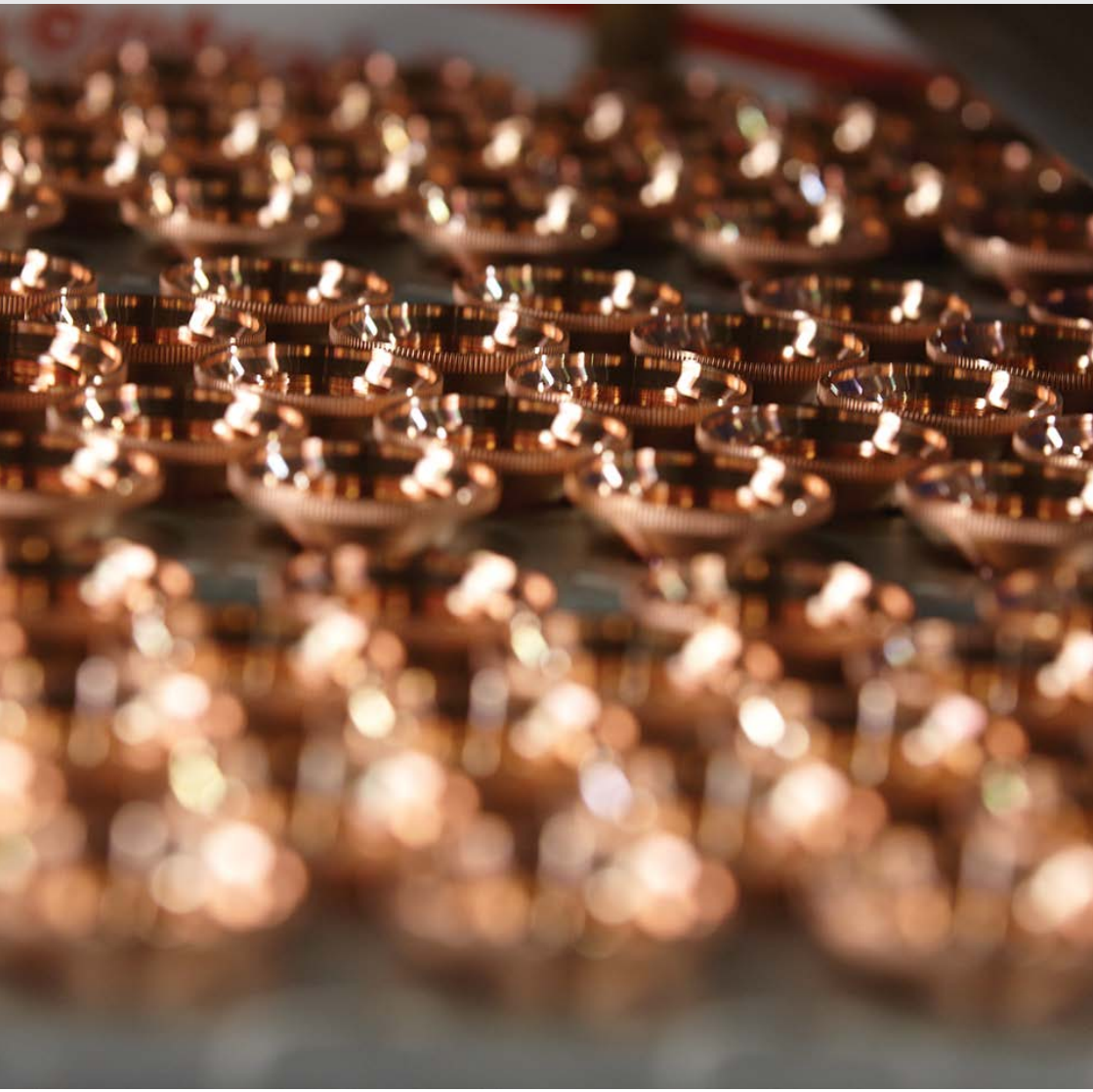
Consumable care guide



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Overview

A plasma system is only as good as the consumable parts in the torch. While changing consumables frequently will ensure exceptional cut quality, changing consumables before the end of their life is costly. That's why understanding how consumables work is a necessary first step to optimizing their performance.

This guide will help you:

- Identify different consumable types, their features, and identify consumable wear
- Find all of the relevant consumable information to properly assemble any Hypertherm torch
- Establish common practices and daily maintenance routines and accurately evaluate and track consumable performance

Water tube
The water tube is crucial for effective electrode cooling.

Electrode
The primary function of the electrode is to provide power to the plasma arc. It is the starting point and electrical contact point of the plasma arc.

Swirl ring
The main function of the swirl ring is to control the swirling action of the plasma gas flow around the electrode in order to center the cutting arc on the electrode and through the nozzle, and to constrict the cutting arc for faster cut speeds and thicker cut capability.

Nozzle
The primary function of the nozzle is to shape, direct, and constrict the plasma arc.

Nozzle cap
The inner retaining cap's primary function is to hold the nozzle and swirl ring in place while directing coolant flow to the exterior of the nozzle.

Shield
The main function of the shield is to protect and cool the other consumables, especially the nozzle from molten splatter. In some cases, the shield also contributes to the swirling action of the plasma gas.

Shield cap
The outer retaining cap holds the shield in place over the nozzle (or inner retaining cap, if applicable) and directs secondary gas or shield gas to the shield.

The torch body

The base of your consumable stack-up is the torch body. The torch body is a precision manufactured device that serves as the working end of the plasma cutting system. Among other things, the torch body:

- Holds the consumable parts in perfect alignment
- Provides pre-flow, plasma gas, and shield gas to the consumables
- Delivers the cutting current to the electrode

The key to long torch body life is cleanliness. Dirt and/or grease on the inner parts of the torch can eventually cause internal arcing, misfires, and possible torch failure. Use a clean cloth to clean the inside of the torch and use compressed air at a low pressure to blow debris off the threads.

You will want to inspect the o-rings found in your torch for any cracks or tears and replace if needed. When re-installing or replacing the o-rings, you may find it helpful to use a silicone lubricant. Put a small amount on your index finger and then rub it together with your thumb. Now apply the thin film to all the o-rings. You want the o-ring to look wet or shiny. If you can see a physical build-up of silicone left behind, you have applied too much. Silicone can clog or plug ports and for that reason you need to be especially careful with its application around the swirl ring so that the gas flow will work properly. Silicone lubricant, part number 027055, is available through the network of partners through Hypertherm Associates. It is not recommended to use substitutes, like petroleum-based lubricants, as they can cause fires within the torch.

If you have a liquid cooled torch you will find a removable cylindrical component called a water tube. The water tube is crucial for effective electrode cooling. It is an important component that should be checked during regularly scheduled maintenance. If your water tube is damaged and needs to be replaced, remember to lubricate the small o-ring found on the base of the tube.

The electrode

The primary function of the electrode in any plasma cutting torch is to provide power to the plasma arc.
It is the starting point and electrical contact point of the plasma arc.

One of the main features of the electrode is the plasma arc attachment point. The attachment point is a small cylindrical insert in the tip of the electrode made of an element with a very high melting point such as tungsten or hafnium. This insert must withstand the extreme heat of the plasma arc.

Normal electrode wear can be observed by examining the insert. As electrodes are used, the insert will slowly erode, forming a small pit on the top of the electrode. For most of our systems, our recommendation is to change out your electrode when the pit depth gets to 1 mm (0.040") if using a standard copper electrode and twice that, to 2 mm (0.080"), if using a silver electrode. Still, since every plasma system is different, it is important to read your owner's manual for recommended pit depth measurements. For example, if you are using an XPR® system you can go to 1.25 mm (0.050") if cutting between 130 and 300 amps, and to 1.5 mm (0.060") if cutting at 300 amps.

Electrode pit depth can simply and accurately be measured using a dial indicator. Regularly checking pit depth will help you maximize the useful life of your electrodes.

Excessive electrode wear reduces cut quality and increases the risk of catastrophic electrode failure that may damage other consumables and/or the torch.

Normal wear Excessive wear

Premature electrode wear is commonly caused by:

- Mismatching torch parts
- Incorrect gas flow settings
- Insufficient coolant flow (if using a liquid-cooled torch)
- Gas leaks or restrictions, such as kinked or split hoses
- Build-up of moisture and contaminates in the plasma gas

  To avoid build up of contaminates, always make sure that the pressurized gas or shop air you are using is clean and dry.

The nozzle

A new nozzle has a perfectly round orifice with sharp inside and outside edges, ensuring excellent cut quality. The most common issue affecting nozzle performance is the incorrect match-up of consumables. Nozzles can also be damaged by the following:

- Piercing and cutting too close to the work piece
- Piercing metal thicker than the maximum recommended thickness
- Incorrect gas settings
- Amperage or current that is too high
- Using the electrode beyond its life
- A pierce delay that is too short or long when mechanized cutting

To ensure the best cut quality, operators should replace the nozzle if the orifice:

- Is nicked or notched
- Is out-of-round or oval
- Has rounded edges

We recommend changing the nozzle an trode as a set to ensure the best cut quality.

The swirl ring

The main function of the swirl ring is to control the swirling action of the plasma gas flow around the electrode. It does this in order to:

- Center the cutting arc on the electrode and through the nozzle
- Constrict the cutting arc for faster cut speeds and thicker cut capability

The swirl ring has small angled holes and, on certain models, one or more o-ring seals typically made of ceramic or thermoplastic.

Ceramic swirl rings are fragile. Accidentally dropping one on the floor may cause a chip or crack, requiring replacement.

During each consumable change, check the swirl ring holes to ensure they are clear of dirt and o-ring lubricant. Clogged swirl holes will decrease cut quality and shorten electrode and nozzle life.

When treated properly, swirl rings will last through several electrode and nozzle changes.

The shield

The shield has several important functions:

- The shield protects the other consumables, especially the nozzle from molten splatter
- It helps cool the nozzle
- It contributes to good cut quality and fast cut speeds
- When using a hand torch, the shield enables drag-cutting

The shield has a main orifice that aligns with the nozzle orifice and may have additional vent holes around the center. The most common issues associated with the shield are damage to the main orifice or clogging of the vent holes. Both issues can cause performance problems.

The shield may be wearing when you spot signs of dross around the orifice. This indicates that the workpiece may have been pierced with the torch too close to the plate. Sometimes you can easily pick or brush the dross off the shield with a wire brush. If the orifice is still perfectly round then the shield can still be used. If not, the shield should be replaced.

Inner retaining cap

Some larger plasma systems, such as HyPerformance® and X-Definition® plasma systems, use an inner retainingcap in the consumable stack-up. The inner retaining cap's primary function is to hold the nozzle and swirl ring in place while directing coolant flow to the exterior of the nozzle.

The most common feature of the inner retaining cap are the vent holes.

It is essential to keep the threads clean. Dirt or grease on the ring can burn the cap. Dirt will damage threads over time, requiring the cap to be replaced prematurely.

When treated with care, the inner retaining cap can last through several electrode and nozzle changeouts.

Outer retaining cap

The outer retaining cap holds the shield in place over the nozzle (or inner retaining cap, if applicable) and directs secondary gas or shield gas to the shield.

The outer retaining cap should be inspected where the shield seals to ensure that the threads and o-rings are in good shape. Make sure threads are free of dirt to prevent thread damage. The outer retaining cap can last through several sets of electrode and nozzle replacements.

Consumable installation

Using the correct consumables and matching them together appropriately is critical to achieving optimal cutting performance. Proper installation of your consumables involves:

- Using the correct consumable part numbers
- Making sure parts are not over-tightened
- Using o-ring lubricant on the consumable and torch o-rings
- Keeping all consumable surfaces clean of dust and dirt

Consumables are specific to amperage, the material you are cutting, and application. People commonly use the wrong consumables so be sure to confirm that the consumables you are installing match the part numbers shown in your owner's manual. Each consumable is laser marked with its part number to make this easy to do. Make sure you install consumables in the right order. Your owner's manual is a great resource.

If you've lost your manual, you can download a new one at *www.hypertherm.com.* You can also download a catalog with torch and consumable part numbers. Choose the *About consumables section* underneath the *Products* tab.

Tracking and evaluating performance

Tracking and evaluating performance is an important and critical process that helps you determine if you are getting the life your consumables are designed to deliver.

Consumable life is driven by many factors, including:

- Cut speeds
- Metal thickness
- Duration of each cut
- Amperage settings

We recommend tracking the number of starts and arc-on time for each consumable change to gauge consumable life over time. For a true comparison, try to compare similar jobs in which you are cutting the same metal thickness at the same amperage for the same cut duration. Hypertherm Associates provides plasma cut data collection sheets to assist you with tracking performance.

Tracking consumable life will allow you to measure how efficiently you are using your consumables so they don't prematurely end up in the scrap bucket.

Plasma cut data collection

Company location		Part numbers of consumables used	
Operator		Electrode	
Machine install date:		Swirl ring	
Plasma system model		Nozzle	
CNC		Inner retaining cap	
Number of torches		Shield	
Plasma gas setting		Outer retaining cap	
Secondary gas setting			

Test number	Metal type	Metal thickness	Torch speed	Cutting amps	Pierce height	Cutting height	Number of starts	Arc-on time	Reasons for change-out (cut quality, starting, failure, etc.)

Comments (general impressions, notes on parameters or test procedures, etc.)

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