

Technical Newsletter from
ADOR WELDING LIMITED
Formerly Advani - Oerlikon Ltd.

Product Update

CHAMPTIG 163
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SELECTION OF WELDING TORCHES FOR GTAW WELDING APPLICATIONS

INTRODUCTION

In the last article we highlighted the features of MIG welding torches and benefits of selecting the right torch for a specific application; in this article we will discuss features and benefits of selecting the right torches for TIG welding.

ARC WELDING APPLICATIONS

To recapitulate, arc welding machines can be classified as manual, semi-automatic and automatic, depending on their use in different applications.

The welding processes in each category are:

- **Manual:** Shielded Metal Arc Welding (SMAW), Gas Tungsten Arc Welding (GTAW)
- **Semi Automatic:** Gas Metal Arc Welding (GMAW)
- **Automatic:** Submerged Arc Welding (SAW)

GTAW and GMAW processes can also be used in automatic mode

PRODUCTIVITY OF DIFFERENT WELDING PROCESSES

SMAW and GTAW are manual welding processes, at around 35% duty cycle, dependency on the skill of welder is very high. This results in low productivity and higher cost. SAW process is



- High power and efficient AC/DC TIG Welder
- Advanced inverter technology optimized ARC performance

FILLER WIRES FOR TIG

generally fully automatic and yields high productivity with lower costs. However applications are limited for SAW process. GMAW process is semi automatic process and gives the advantage of higher productivity with relatively lower dependency on skill of welder.

Even though the process is slow, GTAW (Gas Tungsten Arc Welding) is one of the most preferred welding processes for best quality welding. This process is also known as TIG (Tungsten Inert Gas) welding process. Some of the benefits of TIG welding process are: superior quality of welds, precise control of welding variables (heat input), minimum spatter, low distortion and welds can be made with or without filler metal. The limitations are: lower deposit rates, welders require more skill for TIG welding applications, process is costly for welding thick sections and it is generally used for thin to medium sections.

THE GTAW EQUIPMENT

A typical GTAW welding machine consists of the following:

- **Power Source:** It delivers the required welding power for welding.(voltage and current)
- **High Frequency Unit:** This unit delivers the HF which helps to strike the arc without touching the non consumable Tungsten electrode to the work piece
- **Water Circulatory Unit:** For higher current application (Above 200 amps) water circulatory unit is provided for cooling of the torch
- **Welding Torch (Gun):** It actually does the job of welding by feeding both the shielding gas and the required welding current up to the welding groove. In this process the welding takes place due to the arc between non consumable Tungsten electrode and the work piece. Welder has to feed the filler wire separately to add the weld metal, on need basis

TYPE OF GTAW WELDING TORCHES (GUNS)

As is evident, the welding torch plays a very important role in ensuring a defect free welding joint in GTAW welding. In this



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article, we will highlight some important features of torches that will help select the right torch for GTAW welding applications.

Type of Cooling

The torches can be cooled either by shielding gas or by circulating water. Hence they are referred to as gas cooled or water cooled torches.

Gas Cooled Torches:

This type of torch is very popular. It has low maintenance and is light in weight. The cooling of the torch is done by the same gas used for the shielding of the arc. Generally gas cooled torches are used for applications up to current range of 200 amps.

Water Cooled Torches:

The heat generated at higher current (200 amps at 60 % duty cycle) is high. In this case, the gas is not able to cool the torch sufficiently. For such high current applications and for regular production jobs in every shift, one has to necessarily use water cooled torches. Hence water circulation is done at torch head to keep the torch cool. This results in torch becoming higher in weight and also in cost. The cost of maintenance also goes up. However, since the torches are cooler than gas cooled torches, the life of consumables is longer.

Current Range

Based on application and usage one has to select the right torch. Selecting right current and right duty cycle torch is very important. Using a 400 amps torch for applications that require 250 amps will unnecessarily increase fatigue of welder due to higher weight of torch. Generally torches for GTAW welding are designed for 60 % duty cycle. Lower duty cycle torches will again create welder fatigue due to overheating of torch. Torches are available in current range of 200, 300 and 500 amps.

Shape of Torch Head

The torch head can be designed with an angle or a straight head. The neck can be fixed, rotating or of different length.

Neck with an angle: This type of head is used for semi automatic applications; the head is bent at the end for easy accessibility and weld visibility to the welder.

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Straight Head: The design of the head is straight. These types of torches are mainly used for weld automation. The torches are mounted on automation systems.

Length of Torch

The torches are available in various lengths. The most commonly used is 4.5 meters. Apart from this, 8 meter length torch is also popular. The straight head machine mounted torches are available in lengths starting from one meter to eight meters. Unlike GMAW torch, in which torch is feeding the wire, GTAW torch has no limitation of length as it has to feed only current through the current cable and the gas through the hose. In other words, the length of the torch can be selected based on application.

Type of Torch Head

- **Fixed Type:** In this type of torch design, the torch head is fixed in the torch handle
- **Revolving Type:** In this type of design, the torch head can be revolved in 360 degrees. This feature is very important while welding jobs with difficult to access grooves

MAIN COMPONENTS OF WELDING TORCH

A high quality torch reduces operator fatigue, increases the service life of the torch, reduces replacement costs and ensures ease of changing components during replacement. The main components in a torch assembly are tungsten electrodes, collets, gas nozzles, insulators, caps, switches, torch bodies (air or water cooled), torch handles and cables and hoses. The tungsten electrodes, collets, gas nozzles and insulators are generally considered consumable since they tend to wear out due to the high heat input during welding. Features of some of the important components are described below.

Tungsten Electrodes:

Tungsten electrodes can be of pure tungsten (used mainly for AC welding), 2% Ceriated tungsten (preferred for DC welding) or 2% Thoriated tungsten (AC/DC welding).

Tungsten electrodes are available in various sizes such as 1.6mm, 2.0mm, 2.5mm, 3.2mm, 4.0mm etc. The size of electrode is

selected based on the welding current used or required for the application, depending on thickness of job to be welded.

Collets:

These are available in various sizes to suit the diameter of tungsten electrode to be used

Nozzle:

It ensures proper covering of shielding gas over the weld puddle. Nozzles are made out of alumina or ceramic and are available in different sizes depending upon the current range and application. A gas lens is sometimes fixed on the nozzle to eliminate turbulence of the gas stream, which tends to pull in air and cause weld contamination

Gas Insulator:

It insulates the nozzle from the collet

Cap with O Ring:

Caps are available in different lengths and their selection is done based on the length of Tungsten electrode used

Torch Switch:

With this switch, welder / operator can start or stop welding

SELECTION OF TORCH

Each type of torch has its advantages and limitations. Following are the important criteria for the selection of right torch for the particular application

- Amperage requirements
- Duty cycle
- Work site and frequent movement requirements
- Weight and flexibility of torch. This is very important for the comfort of welder
- Size of the job. This will help in deciding the length of the torch
- Manual operation or automatic usage. Based on this one can decide the torch head design

DECISION TO SELECT EITHER GAS COOLED OR WATER COOLED TORCH

Keeping the welding torch cool is necessary to protect power cable, torch head, and consumables like, nozzle, insulators from damage due to radiant heat of the arc and resistive heat from the current cable.

Cooling also protects operator from heat related injuries and provides more comfortable working conditions.

Welding amperage / current is an important factor while deciding between gas cooled or water cooled system. Generally gas cooled torches are recommended for low currents up to 200 amps and water cooled torches are suitable for higher amperage conditions i.e. above 200 amps.

Gas cooled torches are available up to 200 Amps. Water cooled torches are available from 300 Amps to 500 Amps capacity.

Water circulating units occupy space and are difficult to move around. Where space is a constraint and welding units are frequently moved around, it is preferable to use gas cooled torches.

Preventative maintenance for torch and torch consumables

- Check connections between power source, cable, torch, the neck and consumables on a daily basis to ensure they are tight and undamaged
- Use right capacity of torch for application to ensure there is no overheating
- Ensure maximum duty cycle of torch is 60% for semi automatic welding and 100% for automatic welding
- While welding, take care to keep torch at the right distance from job; too long a distance will give weld defects and too short distance will reduce the life of torch consumables
- Move the torch during welding at right speed; moving it too fast or slow will give weld defects such as undercut, incomplete fusion, (travel too fast), incomplete joint penetration(travel too slow)
- Change consumables like gas nozzles, Insulator, O ring, etc. at regular intervals

ADOR WELDING LTD. RANGE OF TORCHES FOR TIG WELDING

We have the entire range of GTAW torches. Kindly select torch for

specific application from the chart given below by clicking on the name of the torch

Torch Model	Type of End Connection	Length	Standard Torch Head Option	Option of Straight Head	Type of Torch Cooling	Selection Guideline
HI-Pro TIG 200-4/8	Standard ADOR end Connection	Four meter or Eight Meter	Neck with Angle	Yes	Gas	For light duty application, Welding thin sheets
HI-Pro TIG 201-4/8	Independent end connection	Four Meter or Eight Meter	Neck with Angle	Yes	Gas	For light duty application. Welding thin sheets
HI-Pro TIG 300-4/8	Standard ADOR end Connection	Four Meter Or Eight Meter	Neck with Angle	Yes	Water	For medium duty application. Continuous welding
HI-Pro TIG 301-4/8	Independent end connection	Four Meter or Eight meter	Neck with Angle	Yes	Water	For medium duty application. Continuous welding
BTW 30-5/8	Standard ADOR end Connection	Five Meter or Eight Meter	Neck with Angle	Yes	Water	For medium duty application. Continuous welding
BTW 50-5/8	Standard ADOR end Connection	Five Meter or Eight Meter	Swan Neck	Yes	Water	For heavy duty application. Continuous welding on thick plates

Please contact cmo@adorians.com for help in selecting the right torch for defect free, economical TIG welding applications.



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