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Participant Handbook

Sector
Iron & Steel

Sub-Sector
Mechanical Maintenance

Occupation
Welding

Reference ID: **ISC/Q0911, Version 1.0**
NSQF Level 4

Tungsten Inert Gas Welder (GTAW)

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Disclaimer

"Skilling is building a better India. If we have to move India towards development then Skill Development should be our mission."

Shri Narendra Modi
Prime Minister of India

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Certificate

COMPLIANCE TO
QUALIFICATION PACK – NATIONAL OCCUPATIONAL STANDARDS

is hereby issued by the

Indian Iron & Steel Sector Skill Council

for

SKILLING CONTENT : PARTICIPANT HANDBOOK

Complying to National Occupational Standards of
Job Role/ Qualification Pack: **'GTA/TIG Welder'** QP No. **'ISC/Q0911, NSQF Level 4'**

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About this book

This Participant Handbook is designed to enable training for the specific Qualification Pack(QP). Each National Occupational (NOS) is covered across Unit/s.

This job is all about performing manual TIG welding for a range of standard welding requirements. This is for a skilled welder who can weld different materials in various positions and prepare various joints including corner, butt, fillet and tee. Set up and prepare for operations interpreting the right information from the WPS.

Key Learning Objectives for the specific NOS mark the beginning of the Unit/s for that NOS. The symbols used in this book are described below.

Symbols Used


Key Learning Outcomes


Steps


Exercise


Tips


Notes


Unit Objectives

Table of Contents

Unit Objectives

At the end of this unit, you will be able to:

1. Discuss about weld types
2. Perform different welding positions
3. Know about position naming standards

4.4.1 Weld types

Fillet Welds

A fillet weld joins two surfaces to each other. There are a few sorts of filet weld:

- In full fillet weld, span of the weld is same and thickness of the thinner part is combined.
- An irregular fillet weld, two discontinuous lines of weld made on the joint. It is like TEE joint where the fillet increases and in contrast with the other line.

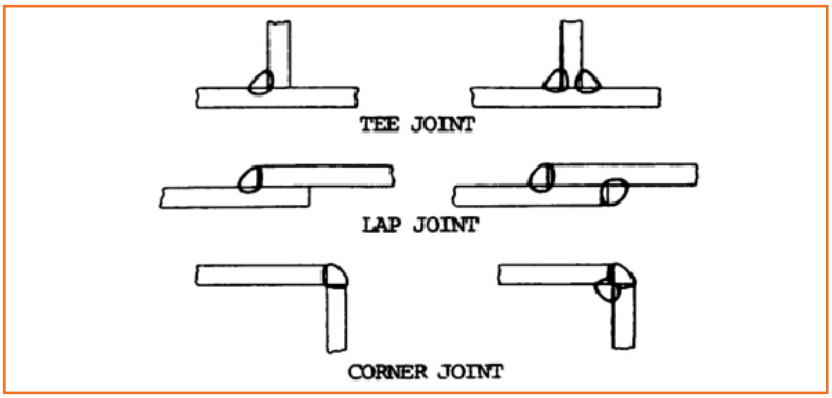

Fig 4.4.1 Application of fillet welds

Groove Welds

Groove welds are the second most used welds. Groove welds are of seven types. The depression weld alludes to dabs that are kept in a notch between two individuals to be joined.

Plug Weld

Plug welds are circular welds made through one member of a lap or tee joint joining that member to the other. The weld may or may not be made through a hole in the first member; if a hole is used, the

walls may or may not be parallel and the hole may be partially or completely filled with weld metal.

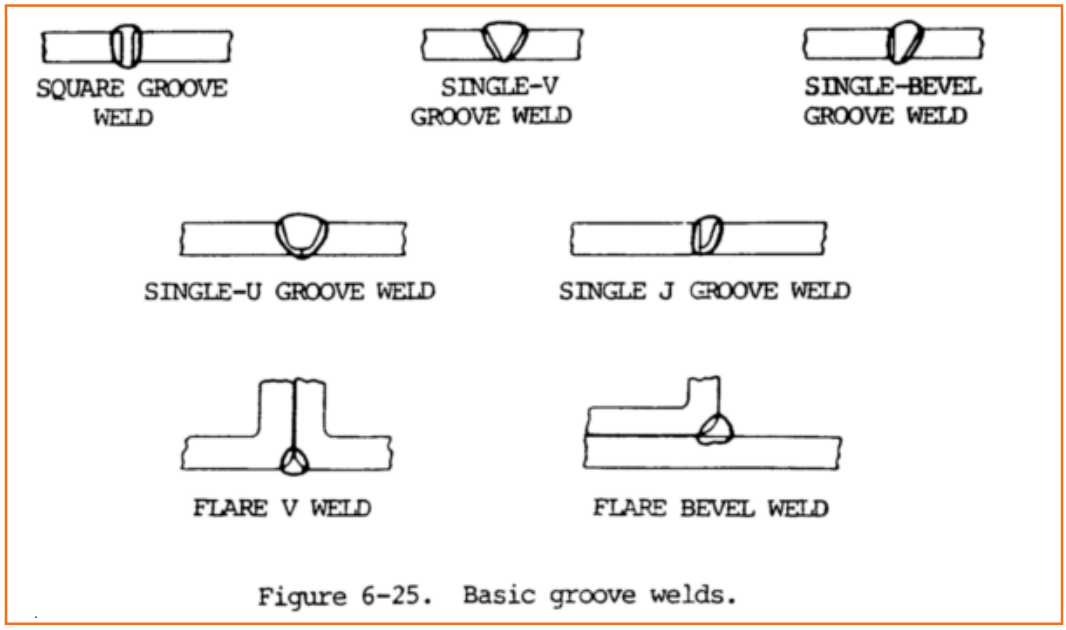

Fig 4.4.2 Groove welds

Slot Weld

Slot welds are made in an extended hole by a lap or tee joint by joining the uncovered surface through the gap. This gap might be open toward one side and might be halfway or totally loaded with weld metal.

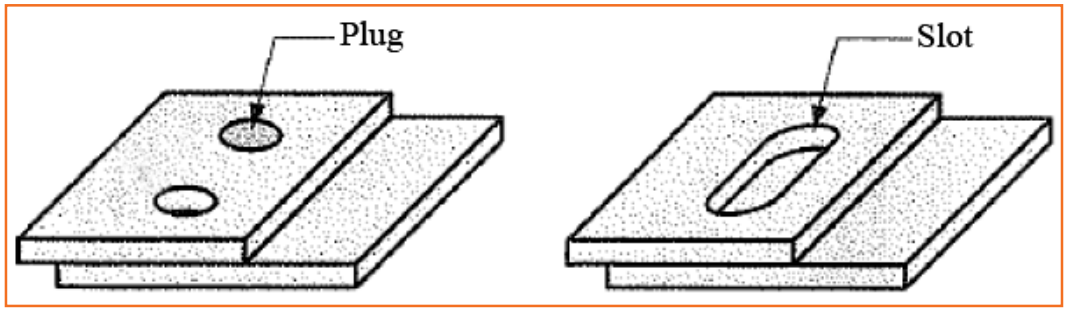

Fig 4.4.3 Plug and slot weld

4.4.2 Welding positions

All welding is done in one of four positions:

1. Down hand / Flat
2. parallel
3. perpendicular
4. Overhead

Welding positions naming as per the ISO 6947 standard

PA parallel welding of butt weld and fillet weld in flat location

PB parallel welding of fillet weld (downhand place)

PC Transverse place

PD Horizontal overhead place

PE Overhead place

PF straight up place

PG straight down place

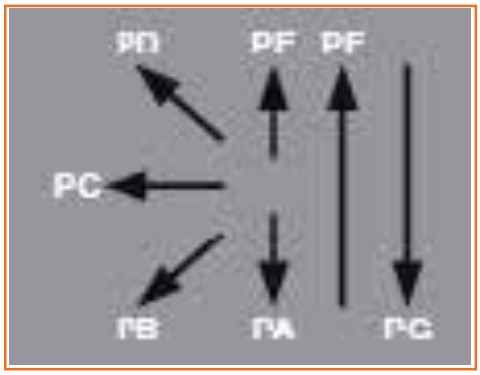

Fig 4.4.4 Welding positions

Welding positions naming as per the American Welding Society (AWS)

A digit is used to describe the place and an F for Fillet or G for groove refers to the sort of weld.

- 1.refers to a flat spot, either 1F or 1G
- 2.refers to a horizontal spot, either 2F or 2G
- 3..is a vertical spot, either 3F or 3G
- 4.is an overhead spot, either 4F or 4G

1. **Downhand / Flat Position Welding:** In downhand position, the welding is done on the upper side of the joint. Level welding is the favored term; in any case, a similar position is at times called downhand.
2. **Horizontal Position Welding:** In this position, the weld axis is a line passing through the length of the weld, which is opposite to the cross segment at its focal point of gravity.
3. **Vertical Position Welding**

   a) In this position, the weld axis is vertical.

   b) In vertical position pipe welding, the pipe axis is vertical and welding is done in even position.
4. **Overhead Position Welding: t**In this position, the welding is done underside of a joint.

5. **Pipe Welding Positions:** Pipe welds are made under various prerequisites and in various welding circumstances. The welding position is managed by the occupation. When all is said in done, the position is settled, yet now and again can be moved for level position work.

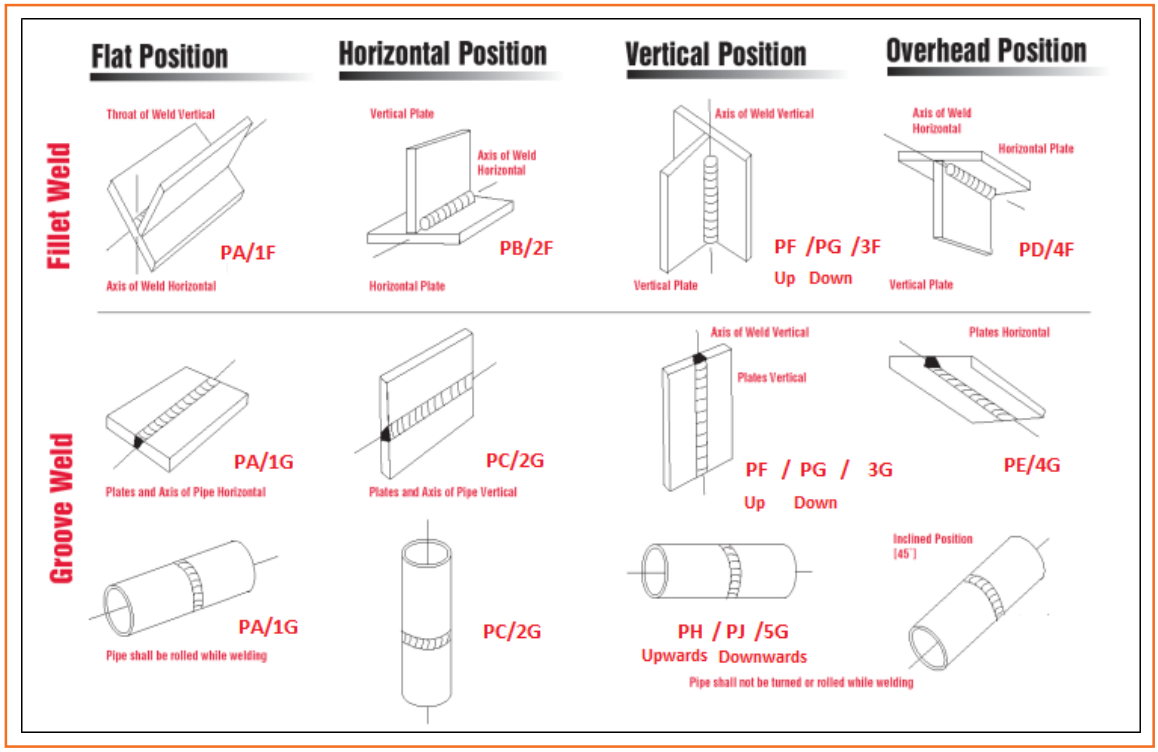

Fig 4.4.5 Welding positions

In groove weld, dimensions are mentioned in two measurements and like the fillet weld; they are showing on left side of the weld drawing. The first measurement is used to set up the edges of workpiece. The second size is the real weld estimate and is encased in enclosures to recognize it from the groove size.

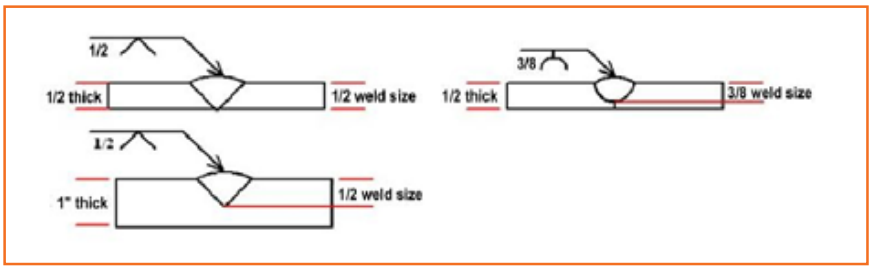

Fig 4.5.18 Groove weld example

Finishing symbols

After the weld has been made, there might be a completing procedure required. A portion of the more typical completing procedures are appeared above.

Fig 4.5.19 Finishing symbols

Commonly used welding power supplies are:

- **Transformers:** A transformer type power supply changes over the moderate voltage and current from utility mains (ordinarily 115 or 230 VAC) into low voltage between 17 to 45 (open-circuit) volts and high current 55 to 590 amperes supply.
- **Generator and alternator:** These power supplies changes mechanical energy into electrical energy. In this setup the utility power is changed over first into mechanical energy at that point and then again into electrical energy to accomplish the progression down impact like a transformer. Since the output of the generator can be direct current, or high frequency AC current.
- **Inverter:** Amperage range of inverter welding machines is much smaller than other types of machines. This smaller size of machine makes it portable and increases the energy efficiency. The use of electronics in the inverter-type welder allows it to produce any desired type of welding power. Before the invention of this machine, each type of welding required a separate machine. Now a solo welding machine can create the precise type of current required for shielded metal arc welding, gas tungsten arc welding, gas metal arc welding and plasma arc cutting.

Fig 5.1.6 Power Sources

- **Rectifiers:** Alternating welding current can be changed over to direct current by utilizing a progression of rectifiers. A rectifier enables current to stream in one direction only. Rectifiers wind up noticeably hot as they change AC to DC. They should be joined to a warmth sink and cooled by having air blown over them. The warmth delivered by a rectifier diminishes the power proficiency of the welding machine..

5.1.1.2 Tungsten electrode

In TIG welding, only tungsten is used as electrode. Because of its excellent properties, it is an outstanding non-consumable electrode. Properties of tungsten can be also improved by adding materials like thorium, lanthanum, cerium or zirconium:

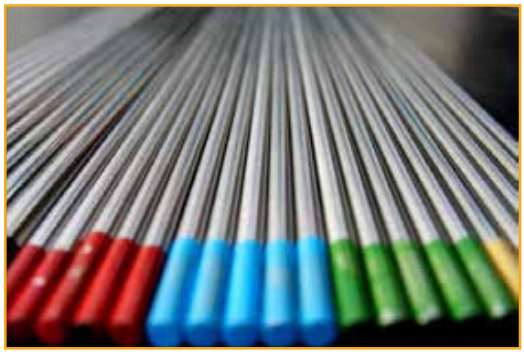

Fig 5.1.7 Tungsten electrodes

- Zirconiated;
- Ceriated;
- Thoriated;
- Tungsten;
- Lanthanated

Addition of above materials make sure better and stable arc striking.

- For DC welding, thoriated tungsten electrodes are utilized.
- For AC welding, zirconiated tungsten electrodes are utilized.

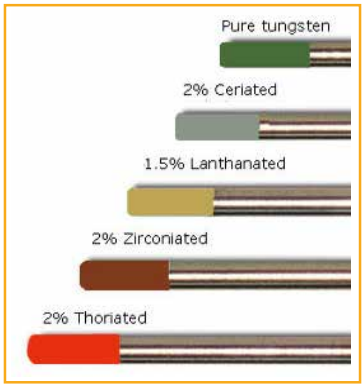

Fig 5.1.8 Tungsten electrodes colour code

Tungsten electrodes are identified in some countries by coloured rings or the ends being painted according to their alloy content. These colour codes are often country specific.

Electrode Type	Nominal Composition	Colour Code*
Pure Tungsten	99.8 %	Green
Thoriated	0.5 % ThO_2	Blue
Thoriated	1 % ThO_2	Yellow
Thoriated	2 % ThO_2	Red
Thoriated	3 % ThO_2	Violet
Thoriated	4 % ThO_2	Orange
Zirconiated	2 % ZrO_2	Brown
Zirconiated	0.80 % ZrO_2	White
Lanthanated	1 % LaO_2	Black
Ceriated	2 % CeO_2	Grey

Table 5.1.1 Tungsten Electrode Compositions and Colour Code as per European Standard EN 26848, 1991

Tungsten electrodes comes in many diameters which ranges from 0.5mm to 8 mm. Generally used electrode dimensions are 1.6 mm, 2.4 mm, 3.2 mm and 4 mm.

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