An Approach to Best Welding Practice : Part – V

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"AN APPROACH TO BEST WELDING PRACTICE. Part – V." is the Fifth Detail Part of **"AN APPROACH TO BEST WELDING PRACTICE"** which was written as a General and Overall approach to the subject matter.

AN APPROACH TO BEST WELDING PRACTICE. Part – V is particularly focused on the setting up of the equipment and accessories especially for Gas Metal Arc Welding (GMAW) to obtain the best results in shop floor operation.

All over the world, Gas Metal Arc Welding (GMAW) is mostly and widely used welding process in all types of small, medium and large scale fabrication and manufacturing industries covering a wide range of products – inter continent pipe lines, bridges, ships, buildings, rolling stocks, automobiles. Gas Metal Arc Welding (GMAW) has simplified the process of welding in comparison to other welding processes as less skill is required and easiest to learn and perform. The main reason is because the power source does virtually all the work as it adjusts welding parameters to handle differing conditions.

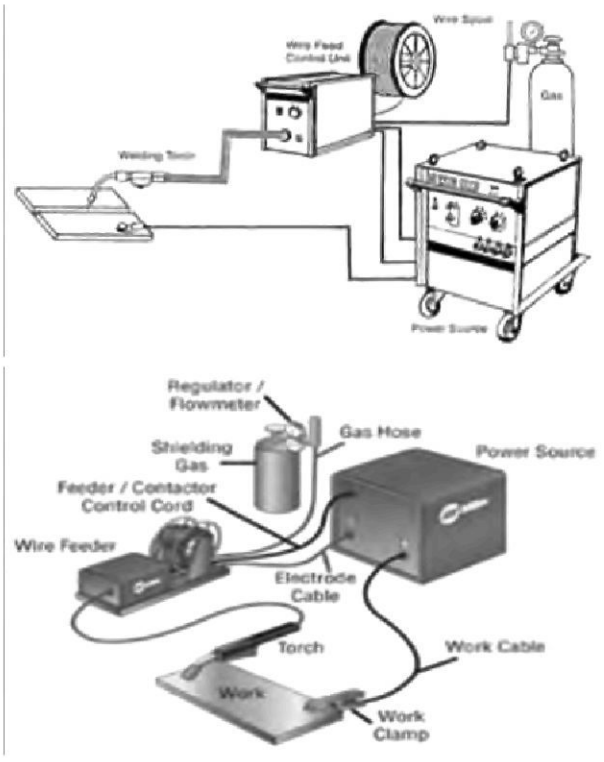
In GMAW, the main Equipment used are :

- DC Output Power Source and Welding Control unit
- Wire feed unit
- Welding Torch
- Shielding gas supply
- Work return welding lead and Cable Connections

In order to get the best out of GMAW process for optimum production and productivity a systematic approach on the setting up of the equipment especially the Power Source, the Wire Feeder Unit and the Welding Torch is necessary. It is obvious to look at the essential setting up and maintenance requirement of the Power Source first.

THE POWER SOURCE

The location of the power source should be carefully selected to ensure satisfactory and dependable service. A proper



location is relatively close to a source of electrical power supply line with proper fuse / miniature circuit breakers. Location must be clean, easily approachable, well covered, protected from rain and accumulation of floor water.

The machine components are maintained at proper operating temperature by forced air which is drawn through the cabinet by the fan unit. For this reason, the location must be well ventilated but free from draughts where air can circulate freely at front and rear openings.

The setting up of the Power Source may be done as per the following guidelines :

a. The area must be free from moisture and dust.

b. Ambient temperature should preferably be between 0°C (32°F) to 40°C (104°F).





c. The area must be free from oil, steam and corrosive gases.

d. The area must not be subjected to abnormal vibration or shock.

e. The area must not be exposed to direct sunlight or rain.

f. The Power Source should be placed at a distance of 1 foot or more from walls for unrestricted natural air flow for cooling.

g. The power source must be located on a suitable horizontal surface in the upright position to prevent toppling over when in use.

h. An assessment of potential electromagnetic problems in the surrounding area should be made before installing the Power Source. The following points must be taken into account.

   i. Other power supply cables, control cables, signaling and telephone cables; above, below and adjacent to the welding equipment to be installed.

   ii. Radio and television transmitters and receivers in the close proximity.

   iii. Computer and other control equipment in use nearby.

   iv. Guarding of industrial equipment and other Safety critical equipment.

   v. The use of pace- makers and hearing aids of people around.

   vi. Equipment used for calibration and measurement.

Mains Supply

- Welding equipment should be connected to the mains supply according to the manufacturer's recommendations.
- If interference occurs, it may be necessary to take additional precautions such as filtering of the mains supply.
- Consideration should be given to shielding the supply

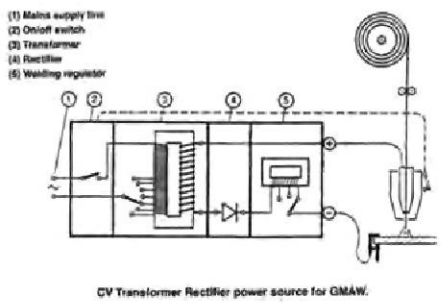
cable of permanently installed welding equipment in metallic conduit or equivalent. Shielding should be electrically continuous throughout its length. The shielding should be connected to the Welding Power Source so that good electrical contact is maintained between the conduit and the Welding Power Source enclosure.

- Mains Supply Voltage Requirements should be within ± 15% of the rated Mains supply voltage. Too low a supply voltage may cause poor welding performance or wire feeder malfunction. Too high a supply voltage will cause components to overheat and possibly fail.

Input Power Cable

- It must be ensured before installing the power cable that at the main power panel there must be line (wall) disconnect switch with fuses or circuit breakers of proper ratings.
- The normal supply of the factory-installed input power cable (No. 8 AWG, 4/c, type SO (90 °C), 12 ft (3.7 m) length) with the Power source may be used, otherwise it must be made sure that only insulated copper conductors are used as the power cable. In case of two (single phase) or three (three-phase) power leads and one ground wire the wires may be heavy rubber covered cable or may be run in a solid or flexible conduit.
- It must be made sure that the ground lead is at least twice as long as the input power leads on the inside of the power source and is securely tightened. If these conditions are not met, the power source chassis may become electrically "hot" if excessive stress is placed on the input power cable.
- If it is necessary to move the power source after it has been connected to primary power, it has to be ensured that the power source is turned OFF, and that an adequate amount of "slack" is maintained in the input power cable. If single-phase input power is used and the factory-installed power cable, the ON-OFF switch cable connections from three-phase to single-phase configuration to be changed.
- Particular attention should be paid to the electrical resistance in the welding circuit; especially, the work and work cable and when using a water-cooled torch.
- High resistance in the welding circuit can cause performance deterioration (loss of "heat" input, popping of weld puddle, bushy arcs, etc.).
- It is recommended that the power source/wire feeder and work piece be placed as close together as possible to limit this resistance.
- It is to ensure that the work cable (ground) is large enough, kept as short as possible, properly insulated, securely connected to the workpiece, and that all connections are clean and tightly secured.
- If the work circuit includes mechanical fixtures, ship structure, robot fixtures, etc., it must be made sure that the circuit is secure and presents a low resistance path to the flow of weld current.
- The power cable on a water-cooled torch is normally subject to gradual deterioration and increasing resistance due to corrosion which leads to the poor performance. To assure good torch performance, the water-cooled power cable should be replaced periodical.

Power Source Maintenance



CV Transformer Rectifier power source for GMAW.

Maintenance of Power Source is equally if not more important than the setting up of the same. Faulty or improperly maintained equipment will cause interruption in production and may cause injury or death. It is advisable therefore:

- All electrical installation, troubleshooting, and maintenance work must be performed by qualified electricians.
- The power source must be disconnected from the incoming electrical power before performing any maintenance work inside a power source,
- Power supply cables, grounding wire, connections, power cord must be maintained in safe and good working order. No equipment should be allowed to operate in faulty condition.
- All the equipment should be kept away from heat sources such as furnaces and wet conditions such as water puddles, oil or grease, corrosive atmospheres and inclement weather.
- All safety devices and cabinet covers must be in their positions in clean and well maintained condition.
- Equipment to be used only for its intended purpose. No modifications should be done in any manner.

SOME MORE POINTS TO NOTE

Heat Causes Damage

Excessive heat, which is both a source and a result of electrical resistance Among is most damaging to welding components Heat generated is directly proportional to the Resistance of the circuit. When heat builds up as a result of this excessive resistance, it creates more resistance, which in turn generates more heat. This cycle can significantly shorten equipment life in addition to causing poor welding performance. For these reasons, it is critical to use cables that are appropriately sized for welding application.

Symptoms of Poor Conductivity

Common symptoms of poor conductivity/excessive resistance are

a. an erratic, sputtering arc;

b. a gradual need to increase voltage at the power source;

c. discoloration of copper cable strands or the liner;

d. increased contact tip burn backs;

e. inconsistent weld appearance.

Causes and Remedies of Poor Conductivity

- Increased electrical resistance can develop and create performance problems in several places along the welding circuit.
- Mechanical connections at the power source, cable connections, clamps etc. are the most common sources of decreased conductivity and typically are the easiest places along the circuit to check for failure.
- Visually inspection of the connections between the cables, the power source, and the wire feeder usually will reveal reasons of conductivity problems.
- Solutions range from cleaning and tightening connections to completely replacing clamps, guns and cables.
- The work lead and the workpiece connection can be problematic . The work lead should be in good mechanical condition and clamped to clean, unpainted metal, as close to the work area as practically possible.
- To ensure optimum conductivity for rotating work leads, such as turntables and tube positioners a conductive grease may be used.
- Conductivity problems also can be caused by damaged copper stranding within the cables. The internal wire strands - particularly in the gun cable - can fray and break with repeated use. The area just below the gun handle is especially prone to frayed and broken wires in guns without a strain relief.
- In many cases, the gun can be repaired by shortening and re-terminating the cable to remove the damaged area.
- The fittings between the cable and the gun can cause conductivity problems. Different types of fittings, including compression, set screw, and crimping are used. In general, compression fittings offer the best combination of conductivity and repairability.
- Set screw fittings are typical and easy to repair, but they are more susceptible to loosening and increased resistance.
- Crimped fittings usually have good conductivity, especially when new, but are generally more susceptible to overheating with repeated use when the fitting gets loose.

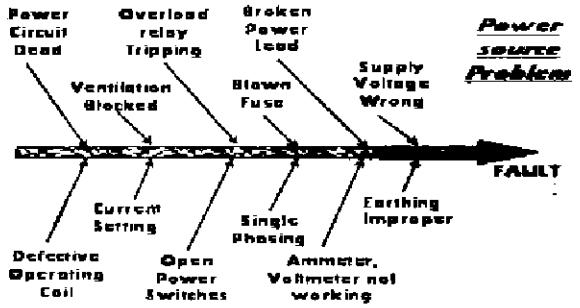
- Loose fittings at the neck, a diffuser that is too small for the application, or a worn contact tip all can cause increased resistance in the circuit. All the components should be tightened, cleaned, or replaced as soon as they begin to create problems.
- Potential locations of poor conductivity and excessive resistance lie along the welding circuit, they usually are easy to identify and the makeup of the equipment often requires replacing the problem areas only.

Recommended Input Conductors and Fuse Sizes

Rated Load (3 phase input) Volts	Amps	Input & Ground Conductor* (CU/AWG (mm)	Time-Delay Fuse Size
208	40	8 (10)	60
230	38	8 (10)	60
460	21	10 (6)	30
575	17	10 (6)	30

Routine Checks

SL NO	CHECK POINTS	PERIODICITY
1	Check the cleanliness of the Power Source from dust, dirt, grease, oil etc. and clean.	Daily
2	Check and clean inside of the Power Source using a Vacuum Cleaner / Blower.	Weekly
3	Check Incoming Connections and tighten any slackness of connectors.	Daily
4	Check Miniature Circuit Breakers in the Mains.	Daily
5	Check all the output terminals and connectors for any slackness and tighten if any.	Daily
6	Check the Ground / Earthing of the Power Source and the Workpiece.	Daily
7	Check all output cable connections, joints, clamps, connectors.	Daily
8	Check the working of the Ammeter and the Voltmeter.	Weekly
9	Check the output Voltages and Current.	Weekly
10	Check Workload and Duty Cycle specified	Monthly



FAULT ANALYSIS

Power Source problems may arise from time to time. It is suggested to take help of a FISH BONE DIAGRAM or CAUSE AND EFFECT DIAGRAM for an analytical and systematic approach to locate and identify the cause for remedial measure. The Base Diagram is shown here.

CONCLUSION

A Power Source is the primary equipment to supply stipulated energy to produce an arc, melt the electrode and the parent metal at an adjustable predetermined rate continuously to produce a welded joint. The health and the functioning of such a Power Source is critical for productivity and quality of weldment. In this article, this point is stressed and the path to achieve is elaborated.