DOWNLOAD PDF 2. GMAW PROCESS OPERATION AND SAFETY

Chapter 1 : Grounding and Arc Welding Safety

Complete statements concerning the advantage of the GMAW process by selecting the correct answers. Sample Question ______________ can be more quickly trained to weld with the GMAW process than with any other welding process.

More Topics Plasma Arc Cutting Hazards In his fourth article in the series, the author explains hazards unique to this and two types of arc welding. The central theme of these articles has been to emphasize that welding, if mastered and performed safely, is a rewarding profession, and that safety is an integral part of producing professional results. Previous discussions have addressed some of the safety concerns that are unique to shielded metal arc welding SMAW , oxy-fuel welding and cutting, and general fire prevention. Please refer to previous issues for information on these topics. By way of summary, the previous articles have presented the philosophy that welding is a profession and that the true professionals incorporate safety into all aspects of their work. Some of the hazards addressed thus far have been UV and IR light exposure, fume and particulate generation, thermal burns, occupational heat stress, exposure to electromagnetic fields, and electrocution. The effective use of eye protection is the only way to prevent injuries to the eye. Protective clothing is the key to preventing thermal burns. Designing the work process to allow for adequate cool-down breaks, staying properly hydrated, and keeping fit are the best preventive measures for avoiding heat stress. Periodic testing of the equipment being used is the only way to ensure overexposure to harmful EMFs has not been reached. Keeping the equipment in good repair, working in dry environments or using adequate rubber matting, and preventing contact with the circuitry including the work piece are ways to prevent electrocution. The welding processes described in this article carry the same hazards, and the injury prevention strategies are the same as for other types of welding and cutting. Some notes on safe practices proximate to robotic welders also are provided. The process works by conveying an electric arc through some form of gas mixture oxygen, nitrogen, argon, compressed air, etc. This process causes the gas temperature to increase to the point where it enters the fourth state of matter--plasma. Many PAC devices employ a pilot arc to ionize the gas and initiate the transference of the electric arc, in a manner similar to that of the high-frequency starter on a gas-tungsten welder. The rush of gas traveling through the restricted opening, heated by the arc, makes the cut. This process utilizes consumable carbon rods. A stream of compressed gas blows the arc for a short distance past the convergence of the carbon rods. There is some probability that plasma is generated in the carbon-arc process, but its effect is of limited consequence. The rush of gases past the point of work in the PAC and carbon-arc gouging processes generate noise levels above 85 db-A, thus requiring the use of an effective hearing protection program. Mechanized PAC systems and some hand-held units may employ a water table under the platen. This will lower the noise and reduce particulate emissions. However, most CAC processes employ hand-held torches, and thus the particulate and noise levels remain high. The GTAW process uses a tungsten alloy electrode to transmit the arc to the work piece and a shielding gas to minimize oxidation. The GTAW electrode used in stainless steel welding contains approximately 2 percent thorium--a radioactive element. Because the electrode must be occasionally ground to a fine point in order to produce the desired result, the welder may be exposed to thorium dust. The health risks associated with respirable thorium dust require the welder to take effective measures to prevent the inhalation of this dust. The two more common effective methods employ a wet grinding process and a dust collection system placed proximate to the grinding wheel. A hazardous waste is generated when thorium is ground and must be handled in accordance with environmental and occupational laws.

Chapter 2 : AWS Bookstore. SAFETY AND HEALTH - Results

Page 1 SECTION 1 âˆ' SAFETY PRECAUTIONS - READ BEFORE USING som âˆ'01 7 Protect yourself and others from injury â€" read, follow, and save these important safety precautions and operating instructions.

Receptacle circuit testers will easily check the continuity of the grounding conductor. Receptacle circuit testers for volt circuits are available at electrical supply or hardware stores; these inexpensive test devices plug into an electrical outlet. Indicator lights show whether the grounding circuit is available at the outlet, as well as other circuit tests. If the test device shows the absence of a ground connection or other circuit problem, call a qualified electrician for assistance. This is a simple test and should be done periodically. Consult with a qualified electrician to test circuits greater than volts. Workpiece Ground The welding circuit consists of all conductive material through which the welding current is intended to flow. Welding current flows through the welding machine terminals, welding cables, workpiece connection, gun, torch, electrode holder and workpiece. The welding circuit is not connected to ground within the welding machine, but is isolated from ground. How do we ground the welding circuit? We must connect the workpiece or work table to a suitable ground, such as a metal building frame. The ground connection should be independent or separate from the welding circuit connection. Grounding the workpiece has similar benefit to grounding the welding machine enclosure. When the workpiece is grounded, it is at the same potential as other grounded objects in the area. In the event of insulation failure in the arc welding machine or other equipment, the voltage between the workpiece and ground will be limited. Note that it is possible to have an ungrounded workpiece, but this requires the approval of a qualified person. The Workpiece Connection is not a Ground Clamp "Ground clamp" and "ground lead" are common terms used by many welders. The workpiece is connected to a welding cable typically by means of a spring loaded clamp or screw clamp. Unfortunately, a workpiece connection is often incorrectly called a "ground clamp" by many welders and the workpiece lead is incorrectly called "ground lead. The ground connection is separate from the workpiece connection. High Frequency Ground Some welding machines utilize starting and stabilizing circuits that contain a high frequency voltage. The high frequency voltage may have frequency components that extend into the megahertz region. In contrast, the welding voltage may be as low as 60 Hertz. High frequency signals have a tendency to radiate away from the welding area. These signals may cause interference with nearby radio and television reception or other electrical equipment. One method to minimize the radiation of high frequency signals is to ground the welding circuit. The welding machine instruction manual will have specific instructions on how to ground the welding circuit and components in the surrounding area to minimize the radiation effect. Portable and Vehicle Mounted Welding Generator Grounding Portable and vehicle mounted arc welding generators often have the capability to supply and volt auxiliary power. These generators are used in remote locations away from an electrical power distribution system. A convenient earth ground is not usually available for connection. Should the generator frame be grounded? The rules for grounding depend on the specific use and design of the auxiliary power generator. Most applications fall into one of the two categories summarized below: If all of these requirements are met, then it is not required to ground the generator frame: The generator is mounted to truck or trailer The auxiliary power is taken from receptacles on the generator using a cord and plug arrangement The receptacles have a grounding pin The frame of the generator is bonded, or electrically connected, to the truck or trailer frame 2. If either of these conditions are met, then the generator frame must be grounded: The generator is connected to a premises wiring system. For example, to supply power to a house during a blackout. The auxiliary power is hard wired into the generator without the use of cords and plugs. Extension Cord Grounds Extension cords should be periodically tested for ground continuity. Extension cords lead a rough life while lying on the ground; they are under foot and prone to damage. The use of a receptacle circuit tester will confirm that all of the connections are intact within the cord, plug and receptacle. Welding Circuit Shock Hazards Utilizing proper grounding in the welding environment is a good practice, but it does not remove all possibility of electrical shock. The welding circuit is energized by welding voltage. A person will receive a shock if they become the electrical path across the welding circuit. Precautions must be taken to insulate the welder from the welding circuit. Use dry insulating gloves and other insulating means. Also maintain insulation on weld cables, electrode holders, guns and torches to provide protection. Similarly, electric shock originating from the electrical supply system can be prevented. Proper maintenance of electrical equipment and extension cords will insulate the welder from electrical sources.

Chapter 3 : An Introduction to Pulsed GMAW | MillerWelds

Gas Metal Arc Welding (GMAW), or Metal Inert Gas (MIG) welding, is an arc welding process in which a thin wire electrode is continuously fed into the workpiece. An arc between the electrode and the workpiece melts both the base metal and the tip of.

Students learn the types and uses of personal protection equipment PPE and the techniques for handling and storing fuel and other gas cylinders. Students learn the safety and fire risks associated with electrical equipment and learn basic first-aid procedures. They also train on handling fire extinguishers. Principles of Welding Levels 1 and 2 â€" This program teaches basic welding principles, terms and processes. Students learn the metallurgy and preparation of materials for welding. They discover the importance of workpiece and body position during welding and learn to spot weld defects by visual and other means. Level 3 â€" This advanced program teaches students about welding as a commercial metal-joining process. They learn the operation of welding power supplies, how an electric arc generates heat for welding, welding polarities and the use of shielding gases. The program features the selection and use of the proper electrodes for different GMAW applications, as well as the AWS electrode classification system. Students also learn the use of personal protection equipment PPE and safety in the workplace. The program includes waveform identification and control. In addition to studying the equipment and shielding gases, students expand their GMAW experience to include aluminum and stainless steels. Students prepare a work area for welding, and perform the fit-up and tacking procedures. Students learn to visually identify weld discontinuities and defects. This program includes the welding of pipe. Students see how FCAW electrodes differ from those used in other processes. Important topics include electrode characteristics and classifications, the importance of arc length and safety. Students learn to identify weld defects and their causes. Level 3 â€" This advanced program covers electrode characteristics and classifications. Students perform welds by the FCAW method and learn the effects of gravity, polarities and arc length on them. Safe equipment set-up and operation is stressed. Students learn the use of FCAW to weld pipe. Given the composition of a base metal such as carbon steel, stainless steel or aluminum , students see how to adjust circuit polarity and other process variables. The selection of GTAW consumables and electrodes is an important part of the program. Students will learn how to safely operate a PAC power source and make a cut. In oxyfuel cutting, students learn the use of fuel gases, how to set up an oxyfuel cutting operation and the safe handling and storage of combustible-gas cylinders. Robotics 1 Level 2 â€" This program combines the principles of arc welding with robotics. Students learn to safely power-up, program and execute automated welding programs through lessons that incorporate lab activities. The creation and refining of robotic programs is a key topic, and students will program a robot to weld in square and circular paths. Level 3 â€" This is an advanced look at automated welding. Students learn to safely power-up, program and execute advanced automated projects. Advanced V-bead and weave bead applications are taught in detail and students learn to edit their robot welding programs. Lab activities are included within the lessons. CNC Plasma Cutting Level 2 â€" In this program, students learn the basics of Cartesian Coordinates and how this computer-controlled process operates within them. An important aspect of the program is the introduction to tool paths and the importing of G-code files into the Torchmate Driver Software Interface. Students use Torchmate CAD software to import images and learn the functions of the software. Manufacturing and Engineering Levels 2 and 3 â€" Students evaluate welds by visual inspection and learn about destructive and nondestructive testing techniques. They work with welding codes and learn their selection, use and documentation. Welding students learn how to test and qualify for specific welding procedures. Fabrication Lessons Level 1 â€" This program teaches students to read and create fabrication plans, drawings, cut lists and bills of material. These tools are ultimately used to estimate project costs. Students are also introduced to basic strength of materials concepts. Levels 2 and 3 â€" This program offers a detailed instruction on fabrication concepts. Students learn the principles of project design for basic structures. Strength and physical material properties are used to teach students the basics of material selection. Math in Welding Levels 2 and 3 â€" This program teaches the basic math skills required in a welding and cutting operation. Students learn how to work with fractions and convert them to decimals, as well as the conversion of units. Geometric concepts and the calculation of the areas, perimeters and volumes of different shapes are covered. Students learn the conversion of volumes to equivalent weights. Careers in Welding Levels 1, 2, and 3 â€” This program communicates the practical aspects of welding as a career and the role of welding in the economy. Students learn what it takes to become a Certified Welder or a Certified Welding Inspector and the benefits and costs of choosing those careers. Students are introduced to welding instruction as a career and are coached on how to effectively interview for welding positions.

Chapter 4 : Low Voltage Short Circuiting-GMAW

Gas metal arc welding (GMAW), sometimes referred to by its subtypes metal inert gas (MIG) welding or metal active gas (MAG) welding, is a welding process in which an electric arc forms between a consumable wire electrode and the workpiece metal(s), which heats the workpiece metal(s), causing them to melt and join.

The central theme of these articles has been to emphasize that welding, if mastered and performed safely, is a rewarding profession, and that safety is an integral part of producing professional results. Previous discussions have addressed some of the safety concerns that are unique to shielded metal arc welding SMAW , oxy-fuel welding and cutting, and general fire prevention. Please refer to previous issues for information on these topics. By way of summary, the previous articles have presented the philosophy that welding is a profession and that the true professionals incorporate safety into all aspects of their work. Some of the hazards addressed thus far have been UV and IR light exposure, fume and particulate generation, thermal burns, occupational heat stress, exposure to electromagnetic fields, and electrocution. The effective use of eye protection is the only way to prevent injuries to the eye. Protective clothing is the key to preventing thermal burns. Designing the work process to allow for adequate cool-down breaks, staying properly hydrated, and keeping fit are the best preventive measures for avoiding heat stress. Periodic testing of the equipment being used is the only way to ensure overexposure to harmful EMFs has not been reached. Keeping the equipment in good repair, working in dry environments or using adequate rubber matting, and preventing contact with the circuitry including the work piece are ways to prevent electrocution. The welding processes described in this article carry the same hazards, and the injury prevention strategies are the same as for other types of welding and cutting. Some notes on safe practices proximate to robotic welders also are provided. The process works by conveying an electric arc through some form of gas mixture oxygen, nitrogen, argon, compressed air, etc. This process causes the gas temperature to increase to the point where it enters the fourth state of matter--plasma. Many PAC devices employ a pilot arc to ionize the gas and initiate the transference of the electric arc, in a manner similar to that of the high-frequency starter on a gas-tungsten welder. The rush of gas traveling through the restricted opening, heated by the arc, makes the cut. This process utilizes consumable carbon rods. A stream of compressed gas blows the arc for a short distance past the convergence of the carbon rods. There is some probability that plasma is generated in the carbon-arc process, but its effect is of limited consequence. The rush of gases past the point of work in the PAC and carbon-arc gouging processes generate noise levels above 85 db-A, thus requiring the use of an effective hearing protection program. Mechanized PAC systems and some hand-held units may employ a water table under the platen. This will lower the noise and reduce particulate emissions. However, most CAC processes employ hand-held torches, and thus the particulate and noise levels remain high. The GTAW process uses a tungsten alloy electrode to transmit the arc to the work piece and a shielding gas to minimize oxidation. The GTAW electrode used in stainless steel welding contains approximately 2 percent thorium--a radioactive element. Because the electrode must be occasionally ground to a fine point in order to produce the desired result, the welder may be exposed to thorium dust. The health risks associated with respirable thorium dust require the welder to take effective measures to prevent the inhalation of this dust. The two more common effective methods employ a wet grinding process and a dust collection system placed proximate to the grinding wheel. A hazardous waste is generated when thorium is ground and must be handled in accordance with environmental and occupational laws.

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Chapter 5 : Welding Program < Northshore Technical Community College

GMAW (MIG) â˜' Welding â˜' (40 Hours Course) With technical assistance from: GERMAN DEVELOPMENT SERVICE August Dear Reader, I would like to comment this handout, because otherwise you might get a little confused while studying it.

In some cases, companies may be hesitant to adopt the process, but it can offer distinct advantages. Changing welding processes can improve operator training Companies are always looking for ways to become more productive, create higher quality parts and generate greater profitability. In some cases, reaching these goals is a matter of improving operator training, implementing lean practices or taking on other continuous improvement initiatives. Changing welding processes can make a significant difference. While not new to the industry, pulsed gas metal arc welding sometimes referred to as GMAW-P is still being adopted for the first time by many companies as a means to drive improvements in the welding operation. The process is an excellent alternative to constant voltage CV GMAW, and may be a good option for companies looking to boost their efficiencies, especially since it can help improve the quality of welds across varying welding operator skill levels. In some cases, companies have been slow to adopt pulsed GMAW in their operations and the reasons for that vary. It may be that companies are simply unfamiliar with the process, or that welding supervisors or operators are hesitant to change technologies since they fear extensive training may be involved. Some companies may be concerned that the cost will be significantly higher. Fortunately, the transition from a spray process to learning pulsed GMAW is not difficult. Changing from a standard GMAW or a short circuit transfer process requires operator training, but the learning curve is typically much shorter than expected. It is true, however, that the process produces a different sound, which may be unsettling or intimidating to some, and the technology often costs more. That said, the long-term benefits the process offers can produce a solid return on investment, and a bit of practice and knowledge can easily put common concerns to rest. The Deltaweld system is designed for easy setup and use, with the simplest interface on the market for pulsed MIG welding. Learn more at www. During this switch, the peak current pinches off a droplet of wire and propels it to the weld joint. This action differs from a traditional spray transfer process, which continuously transfers tiny droplets of molten metal into the weld joint. In a synergic pulsed GMAW system, the power level automatically adjusts to the wire speed as it changes. This is the most common method in welding equipment today, as it is the easiest for welding operators to set and achieve good welding parameters. For example, if the wire feed speed changes from inches per minute ipm to ipm, the arc length or power on the wire will remain the same relative to the power level that was on the ipm setting. On the other hand, using a non-synergic pulsed GMAW process requires the welding operator to adjust the power to match the wire feed speed. The advantages Consider these key benefits impacting productivity, quality and ease of use offered by the pulsed GMAW process: Exceptional directional control over the weld pool makes it easier for new welding operators to learn the pulsed GMAW process and create welds with good bead appearance. Improved control over arc starts and stops helps reduce weld defects and improve appearance. When the welding operator initiates the arc, the process delivers higher energy, which offers good fusion. It then reduces the amount of energy going into the weld to prevent burn-through and provide greater control over the weld bead appearance. When stopping the arc, a pulsed GMAW process with a crater function is ideal, as it allows the operator to ramp down to a cooler welding parameter to fill in the crater at the end. This helps eliminate the potential for termination cracking that can easily occur when welding materials such as aluminum. Faster wire feed and travel speeds can occur in many applications with pulsed GMAW. This helps increase productivity while simultaneously reducing heat input, to decrease residual stress and reduce the opportunity for distortion or burn-through. This material cannot handle too much heat or the welding operator may burn the chromium and nickel out of the base material. As a result, the weld metal and surrounding joint turn into mild steel, which lacks corrosion resistance and toughness. Pulsed GMAW is a good solution for welding this material and avoiding such pitfalls. Prevent over-welding and poor fusion. Some pulsed GMAW power sources allow welding operators to adjust the width of the arc cone, which helps them tailor the bead profile to the application. Reduced spatter generated during the pulsed GMAW process results in reduced time and money spent on associated grinding and post-weld cleanup. Easy setup of the process means the welding operator uses a single knob to set the wire feed speed. Since the arc length number or voltage automatically adjusts with pulsed GMAW, the arc becomes longer or shorter accordingly, for greater ease of use and productivity. The applications Applications that are prone to weld defects such as lack of fusion or porosity, or problems like burnthrough, spatter or warping are good candidates for pulsed GMAW. The lower heat input generated by the process offers similar advantages found when using a process like gas tungsten arc welding GTAW , along with the good penetration, deposition and fusion associated with a traditional spray transfer process. Pulsed GMAW can be used to weld thick or thin materials. On thicker sections, it helps minimize downtime for repositioning parts because it generates a cooler weld puddle than a traditional spray transfer process, which makes it usable in all positions. On thinner sections, it minimizes the opportunity for burn-through and reduces the risk of warping by controlling the heat input. It also allows the welding operator to put more weld metal in the joint in less time without the risk of adding excessive amounts of heat. Common mistakes Welding operators who are new to pulsed GMAW should be aware of a few pitfalls and common mistakes, the most common of which is assuming the arc length is the same as the voltage. In fact, on a pulsed GMAW power source, the arc length is a function of voltage, but the actual number is arbitrary. These power sources often have a zero to scale that is nominal If the welding operator wants less power, for example, he or she would adjust below 50 for less power or above 50 for more power. Taking a limited look at the possibilities of pulsed GMAW is another common pitfall. There are advanced pulsed GMAW processes available with multiple programs, each of which possesses different attributes. Welding operators should always check to make sure they have the right program for the job in order to achieve the best results. As always, companies should consult with a trusted welding distributor with questions about pulsed GMAW to determine the best power source for the application and to ensure they gain the best results.

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Chapter 6 : Gas metal arc welding - Wikipedia

the opportunity to optimize the operation of the GMAW process and all of its variants. Process Definition Gas Metal Arc Welding (GMAW), by definition, is an.

What are the requirements to register Prerequisites? In order to be successful in the Quick Careers program, students need to have good computer skills. If you are a beginner on the computer, you should take a course FIRST, to strengthen your computer skills before registering for a Quick Careers course. Contact the Quick Careers Office extension with questions. Individuals should also know that as a Quick Careers student, you will need to have access to a computer outside of class in order to complete required coursework. Computers used outside of class would need to be Internet connected and also have compatible software to what is used in class e. The below checklist provides information regarding the minimum computer skills needed in order to register for a Quick Careers course. Potential students should thoroughly evaluate their computer skills using this checklist. You should be able to turn a computer on and off Do you know the difference in an operating system versus an application software i. You may be eligible for scholarship money. Click on the link below to learn if you might meet the applicant requirements. Scholarship have time sensitive application deadlines. For more information call NCWorks Greensboro: How do I register for this class? You may register online: Register Or In person. When registering in person, completed the Continuing Education Registration Form and bring it with your payment check, cash, credit card, or money order , to one of the GTCC Campuses: Book and tools required: Students who successfully complete both of the Welder classes will receive an Award of Completion. Requirements for Successful Completion: Can I miss the first day of class Attendance Policy? If you enter after the 2nd day of class, you will not receive credit for taking the class. Additionally, time absent will be counted against you; students can only miss 18 hours of class total and pass the class. If I drop the class will I get a refund Refund policy? Also if the class is canceled or full, GTCC will make a full refund. The census date varies from class to class. Non-attendance is not a basis for a refund. You may be eligible for scholarships when taking this training program. Each scholarship has time sensitive application deadline. Once your application is received, you will be notified by email if it is granted and the amount provided.

DOWNLOAD PDF 2. GMAW PROCESS OPERATION AND SAFETY

Chapter 7 : GMAW Orientation And Safety - Obj. 1 - ProProfs Quiz

Match the GMAW terms with their definitions. An arc welding process that produces coalescence of metals by heating them with an arc between a continuous filler metal electrode and a workpiece; shielding comes entirely from an ecternally supplied gas.

Development[edit] The principles of gas metal arc welding began to be understood in the early 19th century, after Humphry Davy discovered the short pulsed electric arcs in At first, carbon electrodes were used in carbon arc welding. By , metal electrodes had been invented by Nikolay Slavyanov and C. Nobel of General Electric. It used direct current with a bare electrode wire and used arc voltage to regulate the feed rate. It did not use a shielding gas to protect the weld, as developments in welding atmospheres did not take place until later that decade. In another forerunner of GMAW was released, but it was not suitable for practical use. It used a smaller diameter electrode and a constant voltage power source developed by H. It offered a high deposition rate, but the high cost of inert gases limited its use to non-ferrous materials and prevented cost savings. In , the use of carbon dioxide as a welding atmosphere was developed, and it quickly gained popularity in GMAW, since it made welding steel more economical. In and , the short-arc variation of GMAW was released, which increased welding versatility and made the welding of thin materials possible while relying on smaller electrode wires and more advanced power supplies. It quickly became the most popular GMAW variation. The spray-arc transfer variation was developed in the early s, when experimenters added small amounts of oxygen to inert gases. More recently, pulsed current has been applied, giving rise to a new method called the pulsed spray-arc variation. There, the method is often used for arc spot welding , replacing riveting or resistance spot welding. It is also popular for automated welding , where robots handle the workpieces and the welding gun to accelerate manufacturing. The control switch, or trigger, when pressed by the operator, initiates the wire feed, electric power, and the shielding gas flow, causing an electric arc to be struck. The contact tip, normally made of copper and sometimes chemically treated to reduce spatter, is connected to the welding power source through the power cable and transmits the electrical energy to the electrode while directing it to the weld area. It must be firmly secured and properly sized, since it must allow the electrode to pass while maintaining electrical contact. On the way to the contact tip, the wire is protected and guided by the electrode conduit and liner, which help prevent buckling and maintain an uninterrupted wire feed. The gas nozzle directs the shielding gas evenly into the welding zone. Inconsistent flow may not adequately protect the weld area. Larger nozzles provide greater shielding gas flow, which is useful for high current welding operations that develop a larger molten weld pool. A gas hose from the tanks of shielding gas supplies the gas to the nozzle. Sometimes, a water hose is also built into the welding gun, cooling the gun in high heat operations. Most models provide the wire at a constant feed rate, but more advanced machines can vary the feed rate in response to the arc length and voltage. Some wire feeders can reach feed rates as high as Compressed air circulates through it to maintain moderate temperatures. It is used with lower current levels for welding lap or butt joints. The second most common type of electrode holder is semiautomatic water-cooled, where the only difference is that water takes the place of air. It uses higher current levels for welding T or corner joints. The third typical holder type is a water cooled automatic electrode holderâ€”which is typically used with automated equipment. As a result, any change in arc length which is directly related to voltage results in a large change in heat input and current. A shorter arc length causes a much greater heat input, which makes the wire electrode melt more quickly and thereby restore the original arc length. This helps operators keep the arc length consistent even when manually welding with hand-held welding guns. To achieve a similar effect, sometimes a constant current power source is used in combination with an arc voltage-controlled wire feed unit. In this case, a change in arc length makes the wire feed rate adjust to maintain a relatively constant arc length. In rare circumstances, a constant current power source and a constant wire feed rate unit might be coupled, especially for the welding of metals with high thermal conductivities, such as aluminum. This grants the operator additional control over the heat input into the weld, but requires significant skill to perform successfully. Since the anode tends to have a greater heat concentration, this results in faster melting of the feed wire, which increases weld penetration and welding speed. The polarity can be reversed only when special emissive-coated electrode wires are used, but since these are not popular, a negatively charged electrode is rarely employed. Electrode selection greatly influences the mechanical properties of the weld and is a key factor of weld quality. In general the finished weld metal should have mechanical properties similar to those of the base material with no defects such as discontinuities, entrained contaminants or porosity within the weld. To achieve these goals a wide variety of electrodes exist. All commercially available electrodes contain deoxidizing metals such as silicon , manganese , titanium and aluminum in small percentages to help prevent oxygen porosity. Some contain denitriding metals such as titanium and zirconium to avoid nitrogen porosity. The smallest electrodes, generally up to 1. Shielding gases are necessary for gas metal arc welding to protect the welding area from atmospheric gases such as nitrogen and oxygen , which can cause fusion defects, porosity, and weld metal embrittlement if they come in contact with the electrode, the arc, or the welding metal. This problem is common to all arc welding processes; for example, in the older Shielded-Metal Arc Welding process SMAW , the electrode is coated with a solid flux which evolves a protective cloud of carbon dioxide when melted by the arc. In GMAW, however, the electrode wire does not have a flux coating, and a separate shielding gas is employed to protect the weld. This eliminates slag, the hard residue from the flux that builds up after welding and must be chipped off to reveal the completed weld. Pure inert gases such as argon and helium are only used for nonferrous welding; with steel they do not provide adequate weld penetration argon or cause an erratic arc and encourage spatter with helium. Pure carbon dioxide , on the other hand, allows for deep penetration welds but encourages oxide formation, which adversely affects the mechanical properties of the weld. Generally, in short circuit GMAW, higher carbon dioxide content increases the weld heat and energy when all other weld parameters volts, current, electrode type and diameter are held the same. Excessive oxygen, especially when used in application for which it is not prescribed, can lead to brittleness in the heat affected zone. Argon-helium mixtures are extremely inert, and can be used on nonferrous materials. However, it should not be used on steel, aluminum or magnesium because it can cause porosity and hydrogen embrittlement. Mixtures of argon, carbon dioxide and oxygen are marketed for welding steels. Other mixtures add a small amount of helium to argon-oxygen combinations, these mixtures are claimed to allow higher arc voltages and welding speed. Helium also sometimes serves as the base gas, with small amounts of argon and carbon dioxide added. However, because it is less dense than air, helium is less effective at shielding the weld than argonâ€”which is denser than air. It also can lead to arc stability and penetration issues, and increased spatter, due to its much more energetic arc plasma. Helium is also substantially more expensive than other shielding gases. Other specialized and often proprietary gas mixtures claim even greater benefits for specific applications. Welding flat surfaces requires higher flow than welding grooved materials, since gas disperses more quickly. Faster welding speeds, in general, mean that more gas must be supplied to provide adequate coverage. Additionally, higher current requires greater flow, and generally, more helium is required to provide adequate coverage than if argon is used. The spray transfer variation normally requires more shielding-gas flow because of its higher heat input and thus larger weld pool. For most of its applications gas metal arc welding is a fairly simple welding process to learn requiring no more than a week or two to master basic welding technique. Even when welding is performed by well-trained operators weld quality can fluctuate since it depends on a number of external factors. All GMAW is dangerous, though perhaps less so than some other welding methods, such as shielded metal arc welding. As much of the process is automated, GMAW relieves the weldor operator of the burden of maintaining a precise arc length, as well as feeding filler metal into the weld puddle, coordinated operations that are required in other manual welding processes, such as shielded metal arc. Additional skill includes knowing how to adjust the welder so the voltage, wire feed rate and gas flow rate are correct for the materials being welded and the wire size being employed. Maintaining a relatively constant contact tip-to-work distance the stick-out distance is important. Excessive stick-out distance may cause the wire electrode to prematurely melt, causing a sputtering arc, and may also cause the shielding gas to rapidly disperse, degrading the quality of the weld. Stick-out distance varies for different GMAW weld processes and applications. It should be held so as to bisect the angle between the workpieces; that is, at 45 degrees for a fillet weld and 90 degrees for welding a flat surface. The travel angle, or lead angle, is the angle of the gun with respect to the direction of travel, and it should generally remain approximately vertical. In position welding, gravity tends to cause molten metal to run out of the puddle, resulting in cratering and undercutting, two conditions that produce a weak weld. Weaving constantly moves the fusion zone around so as to limit the amount of metal deposited at any one point. Surface tension then assists in keeping the molten metal in the puddle until it is able to solidify. Development of position welding skill takes some experience, but is usually soon mastered. If not controlled, they can lead to weaker, less ductile welds. Dross is an especially common problem in aluminium GMAW welds, normally coming from particles of aluminium oxide or aluminum nitride present in the electrode or base materials. Electrodes and workpieces must be brushed with a wire brush or chemically treated to remove oxides on the surface. Any oxygen in contact with the weld pool, whether from the atmosphere or the shielding gas, causes dross as well. As a result, sufficient flow of inert shielding gases is necessary, and welding in moving air should be avoided. The gas can come from impurities in the shielding gas or on the workpiece, as well as from an excessively long or violent arc. Generally, the amount of gas entrapped is directly related to the cooling rate of the weld pool. Because of its higher thermal conductivity , aluminum welds are especially susceptible to greater cooling rates and thus additional porosity. To reduce it, the workpiece and electrode should be clean, the welding speed diminished and the current set high enough to provide sufficient heat input and stable metal transfer but low enough that the arc remains steady. Preheating can also help reduce the cooling rate in some cases by reducing the temperature gradient between the weld area and the base metal. Since GMAW employs an electric arc, weldors must wear suitable protective clothing, including heavy gloves and protective long sleeve jackets, to minimize exposure to the arc itself, as well as intense heat, sparks and hot metal. Conventional welding helmets contain dark face plates to prevent this exposure. Newer helmet designs feature a liquid crystal -type face plate that self-darkens upon exposure to the arc. Transparent welding curtains, made of a polyvinyl chloride plastic film, are often used to shield nearby workers and bystanders from exposure to the arc. GMAW produces smoke containing particles of various types of oxides , and the size of the particles tends to influence the toxicity of the fumes. Smaller particles present greater danger. Concentrations of carbon dioxide and ozone can prove dangerous if ventilation is inadequate.

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Gas metal arc welding (GMAW), sometimes referred to by its subtypes as metal inert gas (MIG) welding or metal active gas (MAG) welding, is an electric arc welding process where the heat for welding is produced by an arc between a continuously fed, consumable filler metal electrode and the work.

Chapter 9 : Plasma Arc Cutting Hazards -- Occupational Health & Safety

Page 2 of 5. Plasma Arc Cutting Hazards. Mar 01, ; THIS is the fourth in the series of articles on welding safety. The central theme of these articles has been to emphasize that welding, if.