Franklin County School District

School Closure Packet

Week Three: April 6-10

Career & Technical Center

Please find the pages that are for your program.

Name:

____

Career-Tech Teacher:

____

Contemporary Health 4th and 5th Periods
Week of April 6th – April 10th

Log into your ICEV account and complete the following assignments as you watch the video or Powerpoint:

1) Conflict Management – CC
   - Conflict Management – Vocabulary
   - Conflict Management – Worksheet
   - Conflict Management - Assessment I
   - Conflict Management - Assessment II
   - Conflict Management - Assessment III
   - Conflict Management – Assessment IV
   - Conflict Management – Assessment V
   - Conflict Management – Assessment VI
2) Family Relationships & Management – CC
   - Family Relationships & Management – Vocabulary
   - Family Relationships & Management – Personal Growth & Development Worksheet and Assessment I
   - Family Relationships & Management – Developing Positive Relationships Worksheet & Assessment II
   - Family Relationships & Management – The Family Unit Worksheet & Assessment III
   - Family Relationships & Management – Technology & Resource Management Worksheet & Assessment IV
   - Family Relationships & Management – Managing Difficult Situations & Crises Worksheet & Assessment V
   - Family Relationships & Management – Assessment VI

Resource Management 1st, 2nd, and 3rd Periods
Week of April 6th – April 10th

Log into your ICEV account and complete the following assignments as you watch the video or Powerpoint:

1) What is Social Security? – CC
   - What is Social Security? – Vocabulary
   - What is Social Security? – History of Social Security – Student Notes and Assessment I
   - What is Social Security? – Benefits & Eligibility – Student Notes and Assessment II
   - What is Social Security? – Future of Social Security – Student Notes and Assessment III
   - What is Social Security? – Assessment IV
2) Financial Literacy: Taxes & Paychecks – CC
   - Financial Literacy: Taxes & Paychecks – Vocabulary
   - Financial Literacy: Taxes & Paychecks – Worksheet and Assessments I & II
   - Summer Job Earning
   - Pay Stub
   - Tax Matching
   - Financial Literacy: Taxes & Paychecks - Assessment III

Intro to Ag, ANR I, & ANR II

Please continue the work from last week.

Health Science 1 Assignments for Week 3 April 6th through April 9th

1. Go to aeseducation.com and choose anatomy and physiology. Then choose Unit 5 nervous system. Watch PowerPoints for lesson 1 and 2. Then complete the quiz for the nervous system. I will be able to see when completed and your score.
2. Contact me if you have any questions through remind or email at akent@fcsd.k12.ms.us

Health Science 2 Assignments for Week 3 April 6th through April 9th

1. Go to aeseducaiton.com and choose Wellness and Nutrition. Then choose Unit 1 Wellness and watch PowerPoints 1 and 2. Take the quiz at the end of that lesson. I will be able to see when completed and your score.
2. Contact me if you have any questions through remind or email at akent@fcsd.k12.ms.us

Robotics and Engineering Year I and II

In this lesson you will research the different types of simple machines, complete the provided worksheet, and complete the scavenger hunt worksheet.

1

Introduction to

Simple Machines

2

What are they?

Simple machines are machines with few or no moving parts that are used to make work easier

3

Wedge

- Pushes materials apart, cuts things
- Examples: axe, doorstop, chisel, nail, saw, jackhammer, bulldozer, snow plow, horse plow, zipper, scissors, airplane wing, knife, fork, bow of a boat or ship

4

Wheel and Axle

- Makes it easy to move things by rolling them, and reducing friction
- Examples: car, bicycle, office chair, wheel barrow, shopping cart, hand truck, roller skates

5

Lever

- Makes lifting weight easier by using a fulcrum to redirect force over a longer distance
- Examples: see-saw, dump truck, broom, crane arm, hammer claw, crow bar, fishing pole, screwdriver, bottle opener

6

Inclined Plane

- Makes it easier to move objects upward, but you have to go further horizontally
- Examples: highway or sidewalk ramp, stairs, inclined conveyor belts, switchback roads or trails

7

Screw

- Turns rotation into lengthwise movement, takes many twists to go a short distance, and holds things together
- Examples: screws, bolts, clamps, jar lids, car jack, spinning stools, spiral staircases

8

Pulley

- Makes lifting things with a rope easier by redirecting force and the addition of additional pulleys
- Examples: flag pole, elevator, sails, fishing nets, clothes lines, cranes, window shades and blinds, rock climbing

9

Complex Machines

- Combining two or more simple machines to work together
- Examples:
  - –Crane or tow truck combines lever and pulley
  - –Wheel barrow combines wheel and axle with a lever

Simple Machines Worksheet

1. Match the simple machine with its correct definition by writing the corresponding number in the answer column.

Simple Machines	Answer
Lever =	
Inclined plane =	
Wedge =	
Screw =	
Wheel and axle =	
Pulley =	

Definitions
1. Something that reduces the friction of moving something.
2. Something that can hold things together or lift an object.
3. A ramp.
4. Something that uses a rope and can change the direction of a force
5. Something similar to a see-saw that can lift an object.
6. Something that can split an object apart.

2. On the line by each picture, write the type of simple machine.

____

____

____

and

____

____

____

____

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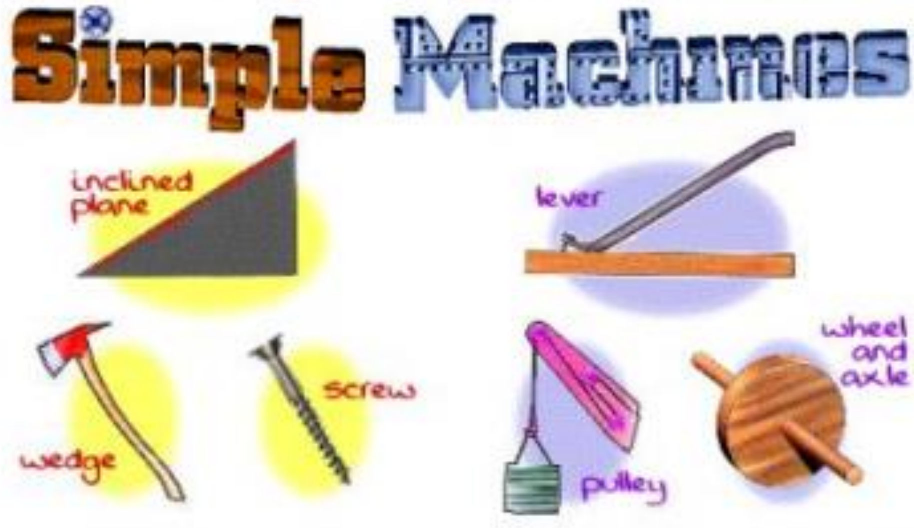
Look around your home, neighborhood, etc. to see if you can find examples of these simple machines. Try to find at least two examples of each machine.



When you find a simple machine, write it down in the correct category in the table below. If you find a compound machine (one that combines more than one simple machine), record it in the compound machine row.

Simple Machine Type	Examples
Inclined plane	
Pulley	
Wedge	
Lever	
Screw	
Wheel and axle	
Compound machine	

Sign-up for the Robotics Remind

Enter this number
81010 (?)

Text this message
@roboticsa (?)

Teacher Academy I & II
April 6th – 10th

A note from your teacher: Hello everyone! I hope these lessons find you safe and healthy! I am so missing seeing your faces daily! Please make sure that you are saving your work from the lesson plans you have been given. You will have the opportunity to turn them in for points, details to follow. We are also going to be having one ZOOM meeting a week together. Everyone that joins in the ZOOM class will also receive credit. I have been thinking about our current situation. So many times, we count the days and minutes until weekends, holidays, and the summer. It is times like these that we truly realize that there is no substitution for seeing one another face-to-face. It is food for the soul and truly how we thrive! Please take care babies. Spend time with your families, stay focused on school as much as possible, and do things that feed your soul……Mrs. Larkin

Monday

We are in unprecedented times right now with the pandemic. As a teacher, we are tasked with trying to continue offering educational opportunities regardless of obstacles. I would like you to find an educational website for elementary age children. Write down the address and explain what the website has to offer students and what skills it teaches.

Tuesday

Explain what has already been offered to students through the high school for distance education. How as it been effective? What are the drawbacks? Explain

Wednesday

Find an art activity that can be done with students using only items that can be found in the home or in nature. If you are adventurous, make the art activity and take a picture of it. If you prefer not to, write down the steps to the activity.

Thursday

As you know from Teacher Academy, there have been many movies that we have watched that we can relate to our course. I want you to think of a cartoon or children's movie that could be used to teach a lesson with students. This cannot be a movie or show that we have already used. Write down the name of the cartoon or movie and explain how it could be used to relate to/teach a lesson.

Friday

Pretend that you are a teacher in today's situation. You need to teach a Science lesson and can only use the camera in your phone. Explain how you could teach a Science lesson only using the camera in your phone.

SECTION THREE

3.0.0 WELD EXAMINATION PRACTICES

Objective

Describe various nondestructive and destructive weld examination practices.

a. Describe basic visual inspection methods including measuring devices and liquid penetrants.
b. Describe magnetic particle and electromagnetic inspection processes.
c. Describe the radiographic and ultrasonic inspection processes.
d. Describe destructive testing processes.

Performance Task

1. Perform a visual inspection (VT) on a fillet and/or groove weld and complete an inspection report.

Trade Terms

Laminations: Cracks in the base metal formed when layers separate.

Radiographic: Describes images made by passing X-rays or gamma rays through an object and recording the variations in density on photographic film.

Transducer: A device that converts one form of energy into another.

Nondestructive examination (NDE), sometimes referred to as nondestructive testing (NDT) or nondestructive inspection, is a term used for those inspection methods that allow materials to be examined without changing or destroying them. NDE methods can usually detect the discontinuities and defects previously described.

Nondestructive examination is usually performed by the site quality group as part of the site quality program. Inspectors trained in the proper test methods conduct the examinations.

The welder should be familiar with the following basic nondestructive examination practices:

- Visual inspection (VT)
- Liquid penetrant inspection (PT)
- Magnetic particle inspection (MT)
- **Radiographic** inspection (RT)
- Ultrasonic inspection (UT)
- Electromagnetic (eddy current) inspection (ET)
- Leak testing (LT)

There is considerable overlap in the application of nondestructive and destructive tests. Destructive tests, which destroy the weld, are frequently used on several sample weldments to supplement, confirm, or establish the limits of nondestructive tests. Destructive testing is also used to provide supporting information. Once this information has been established, nondestructive examinations can be made on similar welds to locate all discontinuities above the critical defect size that was determined by the destructive tests.

3.1.0 Visual Inspection

In visual inspection, the surface of the weld and the base metal are observed for visual imperfections. Certain tools and gauges may be used during the inspection. Visual inspection is the examination method most commonly used by welders and inspectors. It is the fastest and most inexpensive method for examining a weld. However, it is limited to what can be detected by the naked eye or through a magnifying glass.

Properly done before, during, and after welding, visual inspection can detect more than 75 percent of discontinuities before they are found by more expensive and time-consuming nondestructive examination methods.

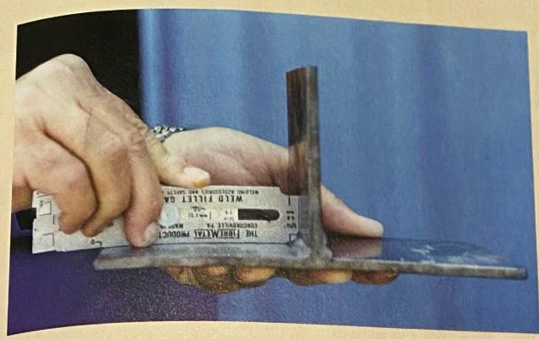
Prior to welding, the base metal should be examined for conditions that may cause weld defects. The required dimensions of the material, including edge preparations, should also be confirmed by measurements. If problems or potential problems are found, corrections should be made before proceeding any further.

After the parts are assembled for welding, the weld joint should be visually checked for a proper root opening and any other aspects that might affect the quality of the weld. Visually check for the following conditions:

- Proper cleaning
- Joint preparation and dimensions
- Clearance dimensions for backing strips, rings, or consumable inserts
- Alignment and fit-up of the pieces being welded
- Welding procedures and machine settings
- Specified preheat temperature (if applicable)
- Tack-weld quality

Fixed Weld Fillet Gauge

This fixed weld fillet gauge can be used to measure 11 fillet weld sizes in fractions or decimals. Metric versions are also available.



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During the welding process, visual inspection is the primary method for controlling quality. Some of the aspects that should be visually examined include the following:

- Quality of the root pass and the succeeding weld layers
- Sequence of weld passes
- Interpass cleaning
- Root preparation prior to welding a second side
- Conformance to the applicable procedure

After the weld has been completed, the weld surface should be thoroughly cleaned. A complete visual examination may disclose weld surface defects such as cracks, shrinkage cavities, undercuts, incomplete penetration, incomplete fusion, overlap, and crater deficiencies before they are discovered using other nondestructive inspection methods.

An important aspect of visual examination is checking the dimensional accuracy of the weld after it has been completed. Dimensional accuracy is determined by the use of measuring gauges. The purpose of using the gauges is to determine if the weld is within allowable limits as defined by the applicable codes and specifications.

Some of the more common welding gauges are the following:

- Undercut gauge
- Butt weld reinforcement gauge
- Fillet weld blade gauge set

3.1.1 Undercut Gauge

An undercut gauge is used to measure the amount of undercut on the base metal. Typically, codes allow for undercut to be between 0.01" and 0.031" deep. These gauges have a pointed end that is pushed into the undercut. The reverse side of the gauge indicates the measurement in either inches or millimeters. Two types of undercut gauges currently used are the bridge cam gauge and the V-WAC gauge (*Figure 15*). These gauges can be used for measuring undercut and for many other measurements.

3.1.2 Butt Weld Reinforcement Gauge

The butt weld reinforcement gauge has a sliding pointer calibrated to several different scales that are used to measure the size of a fillet weld or the reinforcement of a butt weld. To use the gauge for a fillet weld, position it as shown in *Figure 16*, and then slide the pointer to contact the base metal or weld metal. Be sure to read the correct scale for the measurement being taken. The other end of the gauge is used for butt welds.

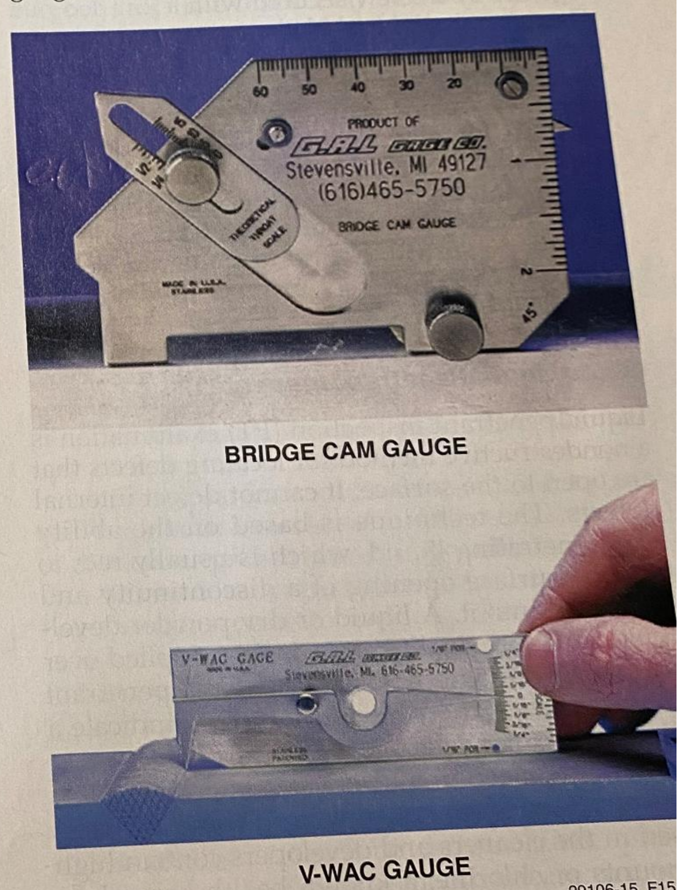

Figure 15 Undercut gauges.

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Figure 16 Automatic weld size gauge (AWS).

3.1.3 Fillet Weld Blade Gauge Set

The fillet weld blade gauge set has seven individual blade gauges for measuring convex and concave fillet welds. The individual gauges are held together by a screw secured with a knurled nut. The seven individual blade gauges can measure eleven concave and convex fillet weld sizes: 1/8", 3/16", 1/4", 5/16", 3/8", 7/16", 1/2", 5/8", 3/4", 7/8", and 1" as well as their metric equivalents.

To use the fillet weld blade gauge set, identify the type of fillet weld to be measured (concave or convex) and the size. Select the appropriate blade and position it. Be sure the gauge blade is flush to the base metal with the tip touching the vertical member. *Figure 17* shows an application of a fillet weld blade gauge.

3.1.4 Liquid Penetrant Inspection

Liquid penetrant inspection (PT) examination is a nondestructive method for locating defects that are open to the surface. It cannot detect internal defects. The technique is based on the ability of a penetrating liquid, which is usually red, to wet the surface opening of a discontinuity and be drawn into it. A liquid or dry powder developer, which is usually white, is then applied over the metal. If the flaw is significant, red penetrant bleeds through the white developer to indicate a discontinuity or defect.

The dye, cleaner, and developer are available in spray cans for convenience. Some solvents used in the cleaners and developers contain high amounts of chlorine, a known health hazard, to make the liquids nonflammable.

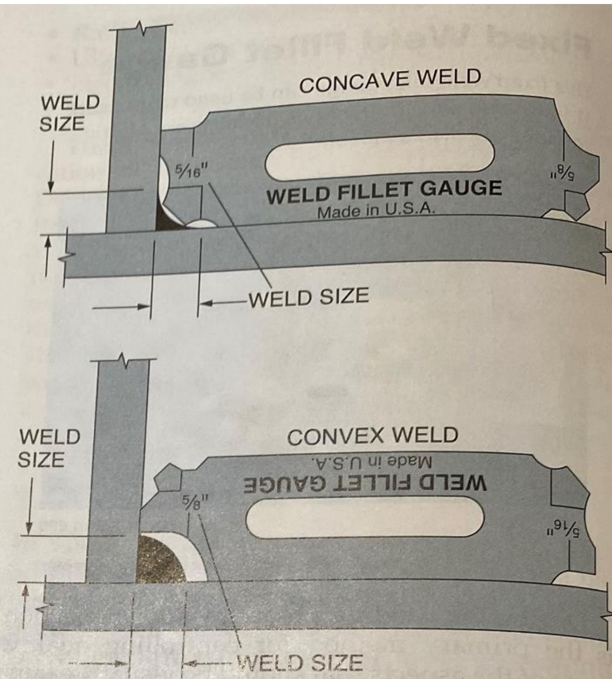

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Figure 17 Fillet weld blade gauge.

WARNING! Refer to the safety data sheet (SDS/MSDS) for hazards associated with the liquid penetrant solvent.

The most common defects found using this process are surface cracks. Most cracks exhibit an irregular shape. The width of the bleed-out (the red dye bleeding through the white developer) is a relative measure of the depth of a crack.

Surface porosity, metallic oxides, and slag will also hold penetrant and cause bleed-out. These indications are usually more circular and have less width than a crack. *Figure 18* shows liquid penetrant materials and an example of the results of liquid penetrant inspection.

The advantages of liquid penetrant inspection are that it can find small defects not visible to the naked eye; it can be used on most types of metals; it is inexpensive; and it is fairly easy to use and interpret. PT is most useful in examining welds that are susceptible to surface cracks. Except for visual inspection, it is perhaps the most commonly used nondestructive examination method for surface inspection.

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Figure 18 Liquid penetrant materials and inspection example.

The disadvantages of liquid penetrant inspection are that it takes more time to use than visual inspection, and it can only find surface defects. The presence of weld bead ripples and other irregularities can also hinder the interpretation of indicators. Because chemicals are used, care must be taken when performing the inspection. When testing rough, irregular surfaces, the presence of irrelevant indicators may also make interpretation difficult.

3.1.5 Leak Testing

Leak testing (*Figure 19*) is used to determine the ability of a pipe or vessel to contain a gas or liquid under pressure. Testing methods vary depending on the application of the weldment. In some cases, the vessel is pressurized and tested by immersing it in water or by applying a soap bubble solution to the weld. An open tank can be tested using water that contains fluorescein, which can be detected by ultraviolet light.

A method called the vacuum box test is used to test a vessel when only one side of the weld is accessible. The base of a storage tank is an example. The vacuum box is a transparent box with a soft rubber seal. A vacuum pump is used to extract all the air from the box. A leak is indicated by the presence of bubbles.

In the helium spectrometer leak test, helium is used as a tracer gas. Because of the small size of helium atoms, they can pass through an opening so small that it might not be detectable by other test methods. Sensitive instruments are used to detect the presence of helium.

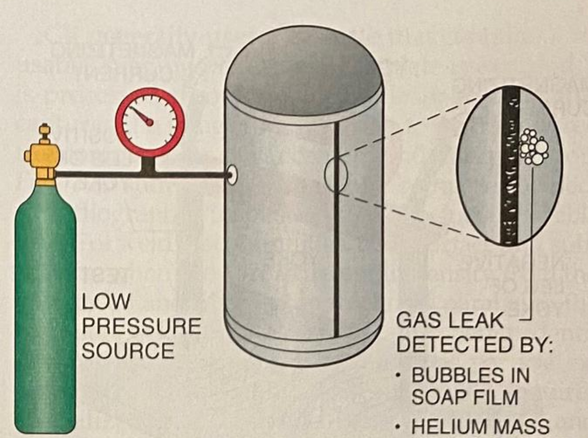

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Figure 19 Example of a leak test.

3.2.0 Magnetic Particle and Electromagnetic Inspection

These non-destructive methods make use of electromagnetism to perform weld examination. Magnetic particle inspection methods are only effective when used with ferrous metals. Electromagnetic inspection can be used with non-ferrous metals as well as ferrous metals.

3.2.1 Magnetic Particle Inspection

Magnetic particle inspection (MT) is a nondestructive examination method that uses electricity to magnetize the weld that will be examined (*Figure 20*). After the metal has been magnetized, metal particles are sprinkled onto the weld surface. If there are defects in the surface or just below it, the metal particles will be grouped into a pattern around the defect. The defect can be identified by the shape, width, and height of the particle pattern.

Magnetic particle inspection is used to test welds for such defects as surface cracks, incomplete fusion, porosity, and slag inclusion. It can also be used to inspect plate edges for surface imperfections prior to welding. Defects can be detected only at or near the surface of the weld. Defects much deeper than this are not likely to be found. Certain discontinuities exhibit characteristic powder patterns that can be identified by a skilled inspector.

For magnetic particle examination, the part to be inspected must be ferromagnetic (made of steel or a steel alloy), smooth, clean, dry, and

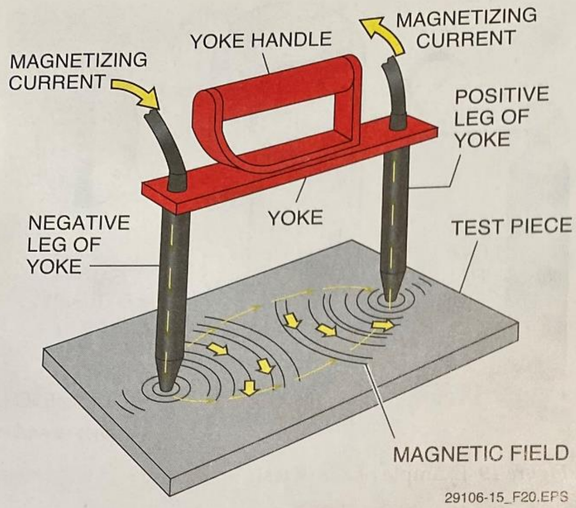

Figure 20 Magnetic particle examination with electromagnetic yokes.

free from oil, water, and excess slag. The part is magnetized by using an electric current to set up a magnetic field within the material. The magnetized surface is covered with a thin layer of magnetic powder. If there is a defect, the powder is held to the surface at the defect because of the powerful magnetic field.

When this examination method is used, there is normally a code or standard that governs both the method and the acceptance/rejection criteria of indications.

The advantages of magnetic particle inspection are that it can find small defects not visible to the naked eye, and it is faster than liquid penetrant inspection.

Disadvantages of magnetic particle inspection are that the materials must be capable of being magnetized; the inspector must be skilled in interpreting indications; rough surfaces can interfere with the results; the method requires an electrical power source; and it cannot identify internal discontinuities located deep in the weld.

3.2.2 Electromagnetic (Eddy Current) Inspection

Like magnetic particle testing, electromagnetic, or eddy current inspection (ET) uses electromagnetic energy to detect defects in the joint. A coil, which produces a magnetic field, is placed on or around the part being tested. After being calibrated, the coil is moved over the part to be inspected. The coil produces a current in the metal through induction. The induced current is called

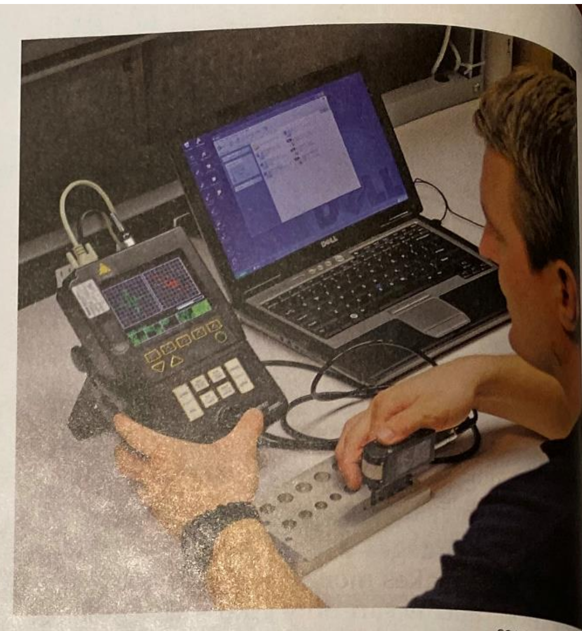

Figure 21 Eddy current test.

an eddy current. If a discontinuity is present in the test part, it will interrupt the flow of the eddy currents. This change can be observed on the oscilloscope display.

Eddy currents only detect discontinuities near the surface of the part. This method is suitable for both ferrous and nonferrous materials, and it is used in testing welded tubing and pipe. It can determine the physical characteristics of a material and the wall thickness in tubing. It can also check for porosity, pinholes, slag inclusions, internal and external cracks, and incomplete fusion.

The advantage of eddy current inspection is that it can detect surface and near-surface weld defects. It is particularly useful in inspecting circular parts like pipes and tubing.

The disadvantage of eddy current inspection is that eddy currents decrease with depth, so defects farther from the surface may go undetected. The accuracy of the examination depends in large part on the calibration of the instrument and the ability of the inspector. *Figure 21* shows an eddy current test being conducted.

3.3.0 Radiographic and Ultrasonic Inspection

These non-destructive inspection methods rely on technology that is commonly used in medical diagnostics. The ability to apply these methods and to correctly interpret the results requires extensive training and experience.

3.3.1 Radiographic Inspection

Radiography (RT) is a nondestructive examination method that uses radiation (X-rays or gamma rays) to penetrate the weld and produce an image. Like medical X-rays, this weld inspection technology originally worked by exposing treated film to the X-rays. In traditional RT work, X-ray film is placed against the weld and exposed (*Figure 22*). When a joint is radiographed, the radiation source is placed on one side of the weld and the film on the other. The joint is then exposed to the radiation source. The radiation penetrates the metal and produces an image on the film. The film is called a radiograph and provides a permanent record of the weld quality.

Modern RT offers two additional options: digital detector array (DDA) and computed radiography (CR). DDA radiography, also referred to as digital radiography, uses a semiconductor array instead of silver-based film to capture the image. Like film radiography, digital radiography is considered a form of direct radiography. Once the DDA is exposed, the image it captures can be transferred directly to a computer and enhanced for viewing. DDA radiography uses the same type of X-ray source as film radiography.

CR generally uses a cassette that contains a reusable imaging plate. Once the plate is exposed, it is processed through a special laser scanner that captures the image and allows it to be transferred to a computer for enhancement and interpretation. *Figure 23* shows CR radiography being performed.

Radiographic inspection can produce a visible image of weld discontinuities, both surface and subsurface, when they are different in density from the base metal and different in thickness parallel to the radiation. Surface discontinuities are better identified by visual, penetrant, or magnetic particle examination. Radiographic weld inspection requires specialized skill. It should therefore be done and interpreted only by trained, qualified personnel.

The advantages of radiographic inspection are that it provides a permanent record of the weld quality, stored either on film or as a computer image. Through radiography, the entire thickness can be examined, and it can be used on all types of metals.

The disadvantages of radiographic inspection are that it is a slow and expensive method for inspecting welds; some joints are inaccessible to radiography; and excessive exposure to radiation of any type is very hazardous to humans. Cracks can frequently be missed if they are very small or are not aligned with the radiation beam.

3.3.2 Ultrasonic Inspection

Ultrasonic inspection (UT) is a relatively low-cost, nondestructive examination method that uses sound wave vibrations to find surface and subsurface defects in the weld material. Ultrasonic waves are passed through the material being tested and are reflected back by any density change caused by a defect. The reflected signal is shown on the screen display of the instrument (*Figure 24*).

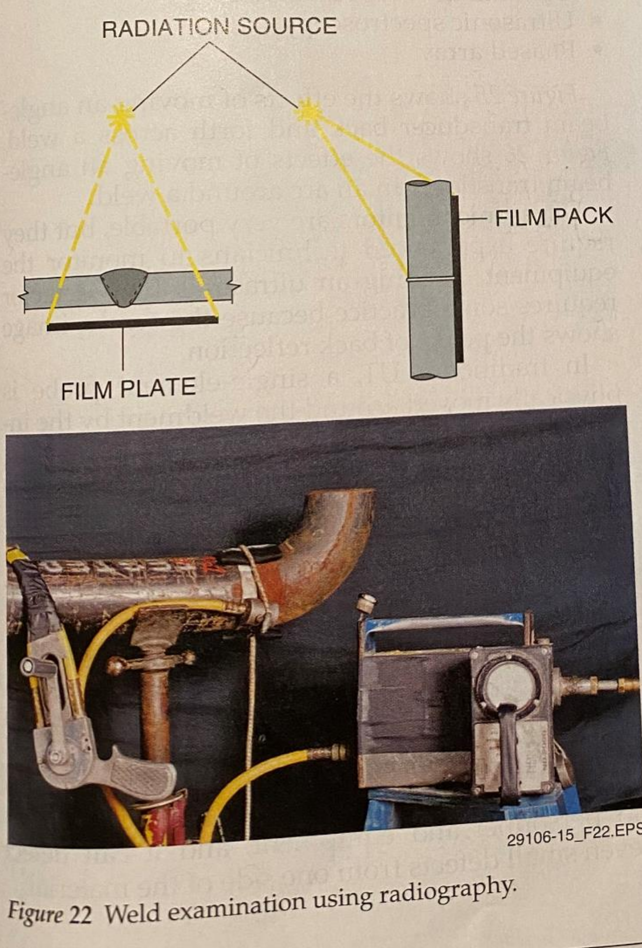

Figure 22 Weld examination using radiography.

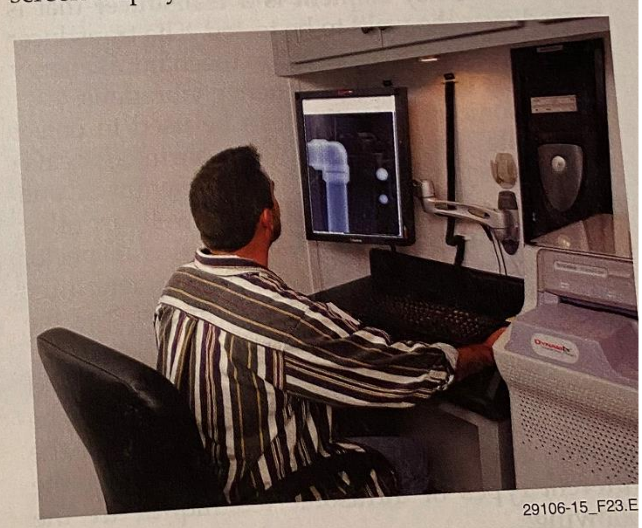

Figure 23 Computed radiography (CR) testing in process.

Module29106-15   Weld Quality Lesson 3 Section 3

Name ______________________________________   Date ____________   Class Period _______

Hello guys! We have been asked to shorten the number of pages of our assignments, so we will do half a section at a time! We hope you are all well and staying safe! We miss you and hope we can get back to normal soon!

Read section 3.0.0-3.3.1 and answer the following questions. Complete by Friday.

1. Weld inspection methods that allow materials to be examined without changing or destroying them is called ____.

2. List seven methods of weld examination that are nondestructive. 1. ___________________ 2. ______________ 3. ___________________ 4. __________________ 5. _________________ 6. ________________ 7. ____________

3. In ____ the surface of the weld and base metal are observed for visual imperfections.

4. Visual inspection is limited but properly done, before, during and after visual inspection can detect what percent of defects? ____________

5. An important aspect of visual examination is dimensional accuracy determined by using measuring gauges. List three of the most common welding gauges and what they are used for.

1)____

2)____

3)____

6. How many individual blade gauges does a set of fillet welds have? _____________

7. The use of a fillet weld gauge set, identifies the ____ _______________________________________ and the _________________________________.

8. A nondestructive examination for locating defects that are open to the surface such as a crack is called ____ and uses a cleaner, a liquid penetrant, usually red and a dry powder developer which are all available in convenient spay cans.

9. _______________________________ is used to determine the ability of a pipe or pressure vessel to contain a gas or liquid under pressure.

10. ____ is a nondestructive examination method that use electricity to magnetize the weld that will be examined. After the weld has been magnetized metal particles are sprinkled onto the weld surface which group into a pattern around a defect.

11. The _____________________________________ is a method that uses electromagnetic energy to detect defects in a joint. A coil produces current in the metal through induction. The induced current is called eddy current. If a discontinuity is present in the test part it will ____ _________________________________.

12. A nondestructive method of inspection that uses radiation (x-rays or gamma rays) to penetrate the weld and produce an image is ____.

SECTION THREE

3.0.0 WELDING EQUIPMENT SETUP

Objective

Explain how to set up for GTAW welding.

a. Explain how to select and position the welding machine.
b. Explain how to connect and set up the shielding gas flow rate.
c. Explain how to select and prepare the tungsten electrode.
d. Explain how to select and install the nozzle along with the tungsten electrode.

Performance Tasks

3. Connect the shielding gas and set the flow rate.
4. Select and prepare the tungsten electrode.
5. Break down and reassemble a GTAW torch.

To weld safely and efficiently, all the necessary welding equipment must be properly set up. The following sections explain how to properly set up GTAW equipment.

3.1.0 The GTAW Welding Machine

Select the welding machine and current type for the base metal to be welded, considering the following factors:

- GTAW requires a constant-current power source. SMAW power sources and welding machines are commonly used for GTAW.
- Consider the welding current type required, AC or DC; generally, carbon steels, stainless steels, and alloy steels are welded with DC, while aluminum and magnesium are welded with AC at high frequency.
- Determine the maximum amperage required.
- Determine if there is an electrical power source and appropriate receptacles in which to plug a welding machine. Otherwise, an engine-driven welding machine is needed.

Because of the limited length of GTAW torch cables, the shielding gas supply must be located reasonably close to the welding site. The welding machine can be some distance away, but unless remote controls are installed, it will not be convenient to operate.

Select a site where the GTAW equipment will not be in the way but will be protected from welding, grinding, or cutting sparks. There should be good air circulation to keep the welding machine cool. The environment should be free from explosive or corrosive fumes and as free as possible from dust and dirt. Welding machines have internal cooling fans that will pull these particles into the machines if they are present. The site should also be free of standing water or water leaks. If an engine-driven generator is used, locate it so that it can be easily refueled and serviced. Also, make sure that the area around the generator is well ventilated.

There should be easy access to the site so that the equipment can be started, stopped, or adjusted as needed. If the machine will be plugged into an outlet, be sure that the outlet has been properly installed and properly grounded by a licensed electrician. Also, be sure to identify the location of the electrical power disconnect switch or circuit breaker before plugging the welding machine into the outlet.

3.2.0 The Shielding Gas

The hose from the shielding gas regulator and flowmeter connects to the welding machine gas solenoid if the welding machine is designed for GTAW. If a standard welding machine is used, the shielding gas hose connects to the torch cable. To connect the shielding gas, perform the following steps:

Step 1 Identify the shielding gas required by referring to the WPS or site quality standard.

Step 2 Locate a cylinder of the correct gas or mixture, and secure it nearby.

> **WARNING!**
> Be sure to secure the gas cylinder first so it cannot fall over. Do not remove the cylinder cap until the cylinder is secured.

Step 3 Remove the cylinder's protective cap, momentarily crack open the cylinder valve to blow out any dirt, and then close it again.

Step 4 Using a regulator or combination regulator/flowmeter with the correct CGA connection for the cylinder, mount the regulator on the cylinder.

Step 5 Connect the gas hose to the flowmeter and to the gas solenoid on the welding machine or to the end of the torch cable.

NOTE

If the gas hose is connected to the torch cable and the torch does not contain a gas shutoff valve, install a valve in the line between the torch cable and the regulator/flowmeter.

Step 6 Check to be sure the flowmeter adjusting valve is closed.

Step 7 Very slowly open the cylinder valve slightly. After the pressure gauge indicates the cylinder pressure and is stable, open the valve completely.

Figure 31 shows how to connect the shielding gas.

3.2.1 Setting the Shielding Gas Flow Rate

Gas flow rate is measured in cubic feet per hour (ft^3/hr or cfh) or liters per minute (L/min), which represents the volume of gas flowing from the torch nozzle. Flow rate is important because it affects the quality and the cost of a weld. A flow rate that is too low will not shield the weld zone adequately and will result in a poor-quality weld. An excessively high gas flow rate wastes expensive gas and can generate turbulence in the gas column above the weld. This turbulence can pull air into the weld zone and cause oxidation and weld contamination. The nozzle must be large enough to gently flood the weld pool with inert gas. As a general rule, larger nozzles require higher flow rates. Welding specifications contain nozzle sizes and shielding gas flow rates.

Factors that may affect the shielding gas flow rate include the following:

- *Drafts* – The flow rate must be increased in a drafty location to maintain the gas shield around the weld zone.
- *Specific gas used* – For example, helium usually requires a higher flow rate than argon because helium rises much faster because of its low density.
- *Welding current* – High welding currents require higher flow rates.
- *Nozzle size (exit opening)* – Larger nozzles require higher flow rates.
- *Weld joint type* – Welds on flat surfaces require higher flow rates than welds in deep grooves or fillets.
- *Welding speed* – Fast advance speeds require higher flow rates than slower advance speeds.
- *Weld position* – Vertical- and horizontal-position welds require higher flow rates than flat or overhead welds.

Adjust the flow for the type and thickness of the base metal being welded, or per applicable WPS. To set the shielding gas flow rate, perform the following steps.

Step 1 Start the gas flow by depressing the remote control foot pedal or hand-operated switch to open the gas solenoid on the welder, or manually open the hand valve on the torch.

CAUTION

Some flowmeters are preset for a specific gas. These flowmeters do not require any adjustment, but they can only be used with the specific shield gases indicated on the flowmeter. Due to density differences in the various shielding gases, using this type of flowmeter with the wrong gas will result in incorrect flow rate readings.

Step 2 Set the gas flow by turning the flowmetering adjustment knob out until the ball inside the glass tube rises to the desired flow rate (*Figure 32*). The flow rate is usually read from the top of the floating ball. However, always check the manufacturer's instructions to determine the correct adjustment method.

Step 3 When the proper gas flow has been achieved, release the remote foot pedal or hand switch, or manually close the valve on the torch to stop the gas flow.

NOTE

Some flowmeters are equipped with several scales of different calibrations around the same sight tube for monitoring the flows of different types (densities) of gases. Be sure to rotate the scales or read the correct side for the gas type being used.

Step 4 Check for leaks before starting to weld.

The following sections provide general recommendations for flow rates for various types of base metals. Note that these flow rates can vary; always check the WPS for the appropriate flow rate.

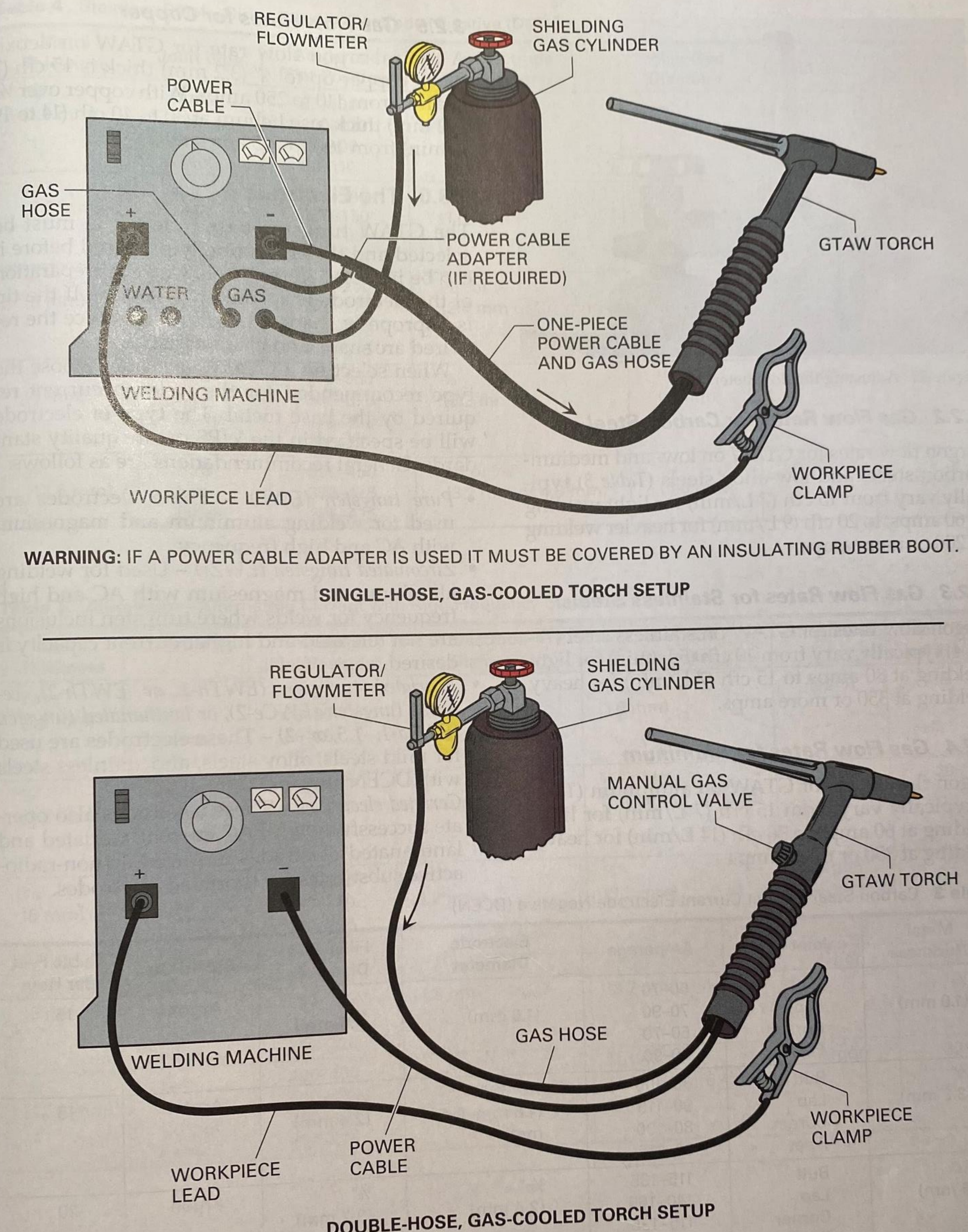

Figure 31 Connecting the shielding gas.

Figure 32 Adjusting the flowmeter.

3.2.2 Gas Flow Rates for Carbon Steel

Argon flow rates for GTAW on low- and medium-carbon steels and low-alloy steels (*Table 3*) typically vary from 15 cfh (7 L/min) for light welding at 60 amps, to 20 cfh (9 L/min) for heavier welding at 200 or more amps.

3.2.3 Gas Flow Rates for Stainless Steel

Argon flow rates for GTAW on stainless steel (*Table 4*) typically vary from 10 cfh (5 L/min) for light welding at 80 amps to 15 cfh (7 L/min) for heavy welding at 350 or more amps.

3.2.4 Gas Flow Rates for Aluminum

Argon flow rates for GTAW on aluminum (*Table 5*) typically vary from 15 cfh (7 L/min) for light welding at 60 amps to 30 cfh (14 L/min) for heavy welding at 350 or more amps.

3.2.5 Gas Flow Rates for Copper

A typical argon flow rate for GTAW on deoxidized copper up to ⅛" (3.2 mm) thick is 15 cfh (7 L/min) from 110 to 250 amps. With copper over ⅛" (3.2 mm) thick, use helium at 30 to 40 cfh (14 to 19 L/min) from 190 to 525 amps.

3.3.0 The Electrode

The GTAW tungsten-based electrode must be selected and the end properly prepared before it can be installed in the torch. Correct preparation of the electrode is absolutely essential. If the tip is improperly shaped, it will not produce the required arc shape and characteristics.

When selecting a GTAW electrode, choose the type recommended for the welding current required by the base metal. The type of electrode will be specified in the WPS or site quality standards. General recommendations are as follows:

- *Pure tungsten (EWP)* – These electrodes are used for welding aluminum and magnesium with AC and high frequency.
- *Zirconiated tungsten (EWZr)* – Used for welding aluminum and magnesium with AC and high frequency for welds where tungsten inclusions are not tolerated and higher current capacity is desired.
- *Thoriated tungsten (EWTh-1 or EWTh-2), ceriated tungsten (EWCe-2), or lanthanated tungsten (EWLa-1, -1.5, or -2)* – These electrodes are used for mild steels, alloy steels, and stainless steels with DCEN current.
- *Ceriated electrodes* – These electrodes also operate successfully with AC current. Ceriated and lanthanated electrodes are used as non-radioactive substitutes for thoriated electrodes.

Table 3 Carbon Steel—Direct Current Electrode Negative (DCEN)

Metal Thickness	Joint Type	Amperage	Electrode Diameter	Filler Rod Diameter	Shield Gas	Cubic Feet per Hour
1⁄16" (1.6 mm)	Butt Lap Corner Fillet	60–70 70–90 60–70 70–90	1⁄16" (1.6 mm)	1⁄16" (1.6 mm)	Argon	15
⅛" (3.2 mm)	Butt Lap Corner Fillet	80–100 90–115 80–100 90–115	1⁄16"–3⁄32" (1.6 mm–2.4 mm)	3⁄32" (2.4 mm)	Argon	15
3⁄16" (5 mm)	Butt Lap Corner Fillet	115–135 140–165 115–135 140–170	3⁄32" (2.4 mm)	⅛" (3.2 mm)	Argon	20
¼" (6 mm)	Butt Lap Corner Fillet	160–175 170–200 160–175 175–210	⅛" (3.2 mm)	5⁄32" (4 mm)	Argon	20

Table 4 Stainless Steel—Direct Current Electrode Negative (DCEN)

Metal Thickness	Joint Type	Amperage (Flat Position)	Electrode Diameter	Filler Rod Diameter	Shield Gas	Cubic Feet per Hour
1/16" (1.6 mm)	Butt Lap Corner Fillet	80–100 100–120 80–100 90–110	1/16" (1.6 mm)	1/16" (1.6 mm)	Argon	10
1/8" (3.2 mm)	Butt Lap Corner Fillet	120–140 130–150 120–140 130–150	1/16" (1.6 mm)	3/32" (2.4 mm)	Argon	10
3/16" (5 mm)	Butt Lap Corner Fillet	200–250 225–275 200–250 225–275	3/32" or 1/8" (2.4 mm or 3.2 mm)	1/8" (3.2 mm)	Argon	15
1/4" (6 mm)	Butt Lap Corner Fillet	275–350 300–375 275–350 300–375	1/8" (3.2 mm)	5/32" (4 mm)	Argon	15
1/2" (12.5 mm)	Butt Lap Fillet	350–450 375–475 375–475	1/8" or 3/16" (3.2 mm or 4.8 mm)	3/16" (4.8 mm)	Argon	15

Table 5 Aluminum—Alternating Current with High Frequency Stabilization

Metal Thickness	Joint Type	Amperage (Flat Position)	Electrode Diameter	Filler Rod Diameter	Shield Gas	Cubic Feet per Hour
1/16" (1.6 mm)	Butt Lap Corner Fillet	60–85 70–90 60–85 75–100	1/16" (1.6 mm)	1/16" (1.6 mm)	Argon	15
1/8" (3.2 mm)	Butt Lap Corner Fillet	125–150 130–160 120–140 130–160	3/32" (2.4 mm)	3/32" or 1/8" (2.4 mm or 3.2 mm)	Argon	20
3/16" (5 mm)	Butt Lap Corner Fillet	180–225 190–240 180–225 190–240	1/8" (3.2 mm)	1/8" (3.2 mm)	Argon	20
1/4" (6 mm)	Butt Lap Corner Fillet	240–280 250–320 240–280 250–320	3/16" (4.8 mm)	1/8" or 3/16" (3.2 mm or 4 mm)	Argon	25
1/2" (12.5 mm)	Butt Lap Corner Fillet	400–450 400–450 400–450 420–470	3/16" or 1/4" (4.8 mm or 6.4 mm)	3/16" or 1/4" (4.8 mm or 6.4 mm)	Argon	30

Module 29207-15 GTAW Equipment and filler metals Section 3 Part 1 Week of April 6 Welding 2

Name ____ Date ________________

Read sections 3.0.0-3.2.5 and answer the following questions. (At your own pace for the week)

1. GTAW equipment must be ____________________________________ in order to weld safely and efficiently. 3.0.0

2. A ______________________________________ power source is required for GTAW. 3.1.0

3. The hose from the shielding gas flowmeter connects to the ______________________________ on a welding machine designed for GTAW. 3.2.0

4. As a general rule larger nozzles require higher ____. 3.2.1

5. List 7 factors that affect shielding gas flow rate.

1.________________________________

2. ________________________________

3. ________________________________

4. ________________________________

5. _________________________________

6. _________________________________

7. _________________________________

6. Gas flow rate is measured in __________________________ per hour or ____________________ per minute which represents the volume of gas flowing from the torch nozzle. 3.2.1

7. On the flowmeter the flow rate is usually read from
____ ________________________. 3.2.1

8. More gas flow rate is not always better because too much flow can deflect off the work piece and cause turbulence that will ____ which creates contamination and causes pin holes. 3.2.1

9. Argon flow rates for GTAW on low and medium carbon steel and low-alloy steels typically vary from ______ cubic feet per hour (cfh) for light welding at 60 amps to _________ cfh for heavier welding at 200 or more ampres. 3.2.2