# Franklin County School District

# School Closure Packet

## Week Four: April 14-17

## 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 13th – April 17th

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

1) Stages of Pregnancy – *CC*
- ❖ Stages of Pregnancy – Signs of Pregnancy & Prenatal Care – Student Notes and Assessment I
- ❖ Stages of Pregnancy – The First Trimester – Student Notes and Assessment II
- ❖ Stages of Pregnancy – The Second Trimester – Student Notes and Assessment III
- ❖ Stages of Pregnancy – The Third Trimester – Student Notes and Assessment IV
- ❖ Stages of Pregnancy – Labor – Student Notes and Assessment V
- ❖ Stages of Pregnancy – Vocabulary and Assessment IV

2) ****FEMALES ONLY** Human Development: The Adolescent Female – *CC*
- ❖ The Adolescent Female – Cognitive, Emotional & Social Development – Student Notes & Assessment I
- ❖ The Adolescent Female – Female Anatomy – Student Notes & Assessment II
- ❖ The Adolescent Female – Puberty – Student Notes & Assessment III
- ❖ The Adolescent Female – Reproduction – Student Notes & Assessment IV
- ❖ The Adolescent Female – Common Female Diseases – Student Notes & Assessment V
- ❖ The Adolescent Female – Vocabulary & Anatomy Identification
- ❖ The Adolescent Female – Assessment VI

3) ****MALES ONLY** Human Development: The Adolescent Male – *CC*
- ❖ The Adolescent Male – Cognitive, Emotional & Social Development – Student Notes & Assessment I
- ❖ The Adolescent Male – Male Anatomy – Student Notes & Assessment II
- ❖ The Adolescent Male – Puberty – Student Notes & Assessment III
- ❖ The Adolescent Male – Reproduction – Student Notes & Assessment IV
- ❖ The Adolescent Male – Common Male Diseases – Student Notes & Assessment V
- ❖ The Adolescent Male – Vocabulary & Anatomy Identification
- ❖ The Adolescent Male – Assessment VI

**Resource Management 1st, 2nd, and 3rd Periods**

Week of April 13th – April 17th

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

1) Avoiding Financial Schemes & Fraud – *CC*
- ❖ Avoiding Financial Schemes & Fraud – Schemes – Student Notes and Assessment I
- ❖ Avoiding Financial Schemes & Fraud - Frauds – Student Notes and Assessment II
- ❖ Avoiding Financial Schemes & Fraud - Scams – Student Notes and Assessment III
- ❖ Avoiding Financial Schemes & Fraud – Vocabulary and Assessment IV

2) Financial Literacy: Retirement & Estate Planning – *CC*
- ❖ Financial Literacy: Retirement & Estate Planning – Vocabulary
- ❖ Fin. Lit.: Retirement & Estate Planning – Worksheet & Assessment I
- ❖ Document Definition
- ❖ Financial Literacy: Retirement & Estate Planning Assessment II

## Intro to Ag, ANR I, & ANR II

All work for Ag was sent out in packet 2; we apologize for any inconvenience this may cause.

### Health Science 1 Assignments for Week 4 April 13th through April 17th

1. Go to aeseducation.com and choose anatomy and physiology. Then choose Unit 6 sensory system. Watch PowerPoints for lessons 1 through 5. Then complete the quiz for the sensory 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
3. Remember you will receive credit for your work.

### Health Science 2 Assignments for Week 4 April 13th through April 17th

1. Go to aeseducaiton.com and choose Wellness and Nutrition. Then choose Unit 2 Nutrition and watch lesson 1, 2, and 3. 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
3. Remember you will receive credit for your work.

Robotics and Engineering Year I and II
Civil Engineering

Look over the following terms to get an understanding of different aspects of Civil Engineering.

**Aqueducts**: a system of bridges and canals, used to redirect and supply cities with safe water

**Construction Engineering**: directs building of bridges, tunnels, dams, and super structures

**Water Resources**: refers to rivers, irrigation, water supply, and sewage disposal

**Environmental Engineer**: directs preservation and cleanup of water and the natural landscape

**Transportation Engineer**: directs highway and railroad building and repair, and traffic control projects

**Geotechnical Engineer**: directs earthwork, soil mechanics, and foundation projects

**BS**: Bachelor's Degree in Science

**B Eng**: Bachelor's Degree in Civil Engineering (a four-year college degree)

**Structural design**: A process of applying engineering mechanics to create a functional, economic, and safe structure for the public

**Retaining wall**: a structure that holds back earth materials

**Structural analysis:** set of physical laws and mathematics required to study and predict the behavior of structures

**Hydraulic Engineering**: the field of engineering concerned with the flow and conveyance of fluids, principally water.

**Structural Engineering**: a subfield of civil engineering that deals with the design of any structural systems whose purpose is to support and resist various loads

Robotics and Engineering Year I and II
Civil Engineering

Review the Civil Engineering career under on the Engineering Your Future Web site "What is Engineering?" (top left tab) page at http://www.futuresinengineering.org. Answer the following question based on the material on that page.

1) What is a civil engineer?

2) What would you study to become a civil engineer?

3) What types of projects do civil engineers work on?

4) Do civil engineers work primarily alone or in teams with other specialists?

5) What courses in high school will be important for a future in civil engineering?

6) Can you name any projects in your community that would have been developed by a civil engineer?

7) What math and science disciplines do engineers rely on?

8) Is college necessary for a career in civil engineering?

Robotics and Engineering Year I and II
Civil Engineering

# Research Road Map

1. The Channel Tunnel – Braxton and Treshun
2. The CN Tower – Mason and Gabriel
3. The Empire State Building – Joshua and Christopher
4. The Golden Gate Bridge – Sa'Myria and Hayden
5. Itaipu Damn – Ronald and Briana
6. Netherlands North Sea Protection Works – James and Everett
7. The Panama Canal – Nathan and Parker

https://www.theworldwonders.com/modernwonders.html

Directions: Answer the following questions to help research the modern wonder of the world your group was assigned. Use the link above.

1) What kind of structure is it?

2) When was it built?

3) Where is it located?

4) What is the purpose of the structure?

5) How is the structure innovative?

6) What makes the structure a "wonder" of the modern world?

7) There are several specialties within the field of civil engineering, for example:

· **Construction and structural** · **Water resources** · **Transportation engineering**

· **Environmental engineering** · **Geotechnical engineering**

Which specialists were likely required to collaborate on the design and construction of the structure your group researched? Explain your conclusions.

# Mrs. Larkin's Teacher Academy I & II Class
## April 13th – 17th

**A NOTE FOR THE TEACHER:** Hello my babies! Can I just tell you how bad I miss you! TERRIBLY! My daughter and I have repainted and redone sooooo much stuff and I have been working on grad school stuff too, but even with all of this going on, I still miss my students! I hope that you have taken this opportunity to spend time with family and challenge yourself to do something productive. One of my challenges has been to read a book, not a book that I HAVE to read, but instead read something just for me. I hope you find something enriching too!

**Monday**

I am considering doing a lot of my testing and such through a computer platform. I know that many of you have experience with Google Classroom through the high school and I believe that some students may have some experience with Canvas through Technology Foundations. I would like you to tell me what you think some of the benefits and drawbacks of these platforms are. I really want your insight! I value it!

**Tuesday**

This is the time of the year that I begin thinking about what changes could make our course better for the students that are to come. We are technically required to keep a portfolio in my program. Because of lack of space and such, I have never had my students keep a binder with all of their work in it. I am considering doing an online portfolio. Basically, each student would have an online portfolio and when they did a project they would simply take a picture of it and import it into their portfolio. The same thing with reflections etc. What are your thoughts on this?

**Wednesday**

I know last year I spent time painting and such, but that is simply decorations and making the classroom look nicer. What supplies are changes could I make to the Teacher Academy classroom that would make it better? Remember, I am not offended by constructive criticism as long as you say it in a nice way. You are welcome to mention any of the rooms that we have access to.

**Thursday**

I have noticed that many of my Teacher Academy friends/teachers are utilizing a lot of apps in their classrooms. What are some apps that you have used or heard of that you think might be beneficial for Teacher Academy?

**Friday**

We currently have the Glitzy Glam formal closet and the clothing and hygiene closet that I am very proud of. What are some ideas for letting students know what we have available to them. Remember that it is important for students to never be embarrassed. ALSO, is there another community service project that we might could do that actually takes us out into the community? I am open for ideas!

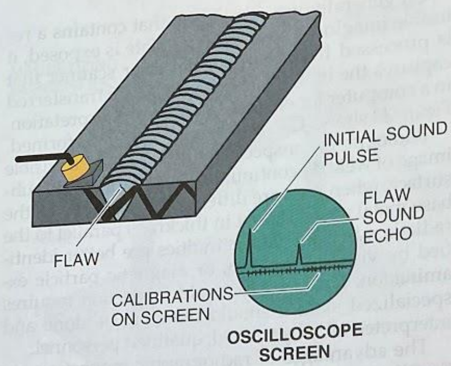


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*Figure 24* Portable ultrasonic device.

The term *ultrasonic* indicates frequencies above those heard by the human ear. Ultrasonic devices operate very much like depth sounders or fish finders. The key element is a **transducer** that is passed over the weld to be tested. The transducer converts electrical energy into mechanical energy that is emitted as high-frequency vibrations.

Ultrasonic examination can be used to detect and locate cracks, **laminations**, shrinkage cavities, pores, slag inclusions, incomplete fusion, and incomplete joint penetration, as well as other discontinuities in the weld. A qualified inspector can interpret the signal on a screen to determine the approximate position, depth, and size of the discontinuity.

Ultrasonic beams can deeply penetrate weld material with high sensitivity and accuracy. The output is readily digitized, and operation of the monitor is entirely nonhazardous. Some of the different types of ultrasonic techniques are the following:

## Self-Propelled NDT

This ultrasonic test instrument is often used to inspect pipe and tanks. Its magnetic wheels allow it to cling to the surface as it moves along, controlled by a joystick mechanism.

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- Pulse-echo
- Pulse-transmission
- Ultrasonic attenuation
- Continuous wave resonance
- Ultrasonic spectroscopy
- Phased array

*Figure 25* shows the effects of moving an angle-beam transducer back and forth across a weld. *Figure 26* shows the effects of moving an angle-beam transducer in an arc around a weld.

Ultrasonic monitors are very portable, but they require experienced technicians to monitor the equipment. Reading an ultrasonic flaw detector requires some practice because the screen image shows the peaks of back reflection.

In traditional UT, a single-element probe is physically moved around the weldment by the inspector to create a cross-section of the joint being tested. In contrast, the newer phased array (PA) ultrasonic testing method (*Figure 27*) uses a probe containing an array of ultrasonic transducers. The beam created by these transducers is electronically steered. The data from the individual elements is combined electronically to create a cross-section of the weld.

Among the advantages of ultrasonic inspection are that it can find defects throughout the material being examined; it can be used to check materials that cannot be radiographed; it is nonhazardous to personnel and equipment; and it can detect even small defects from one side of the material.

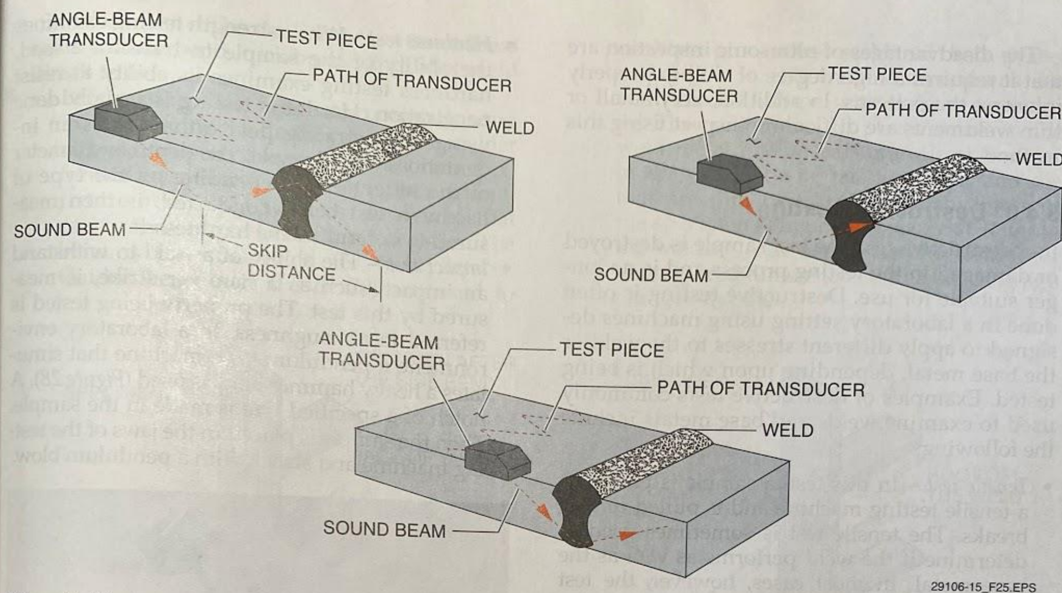


*Figure 25* Moving a transducer back and forth.

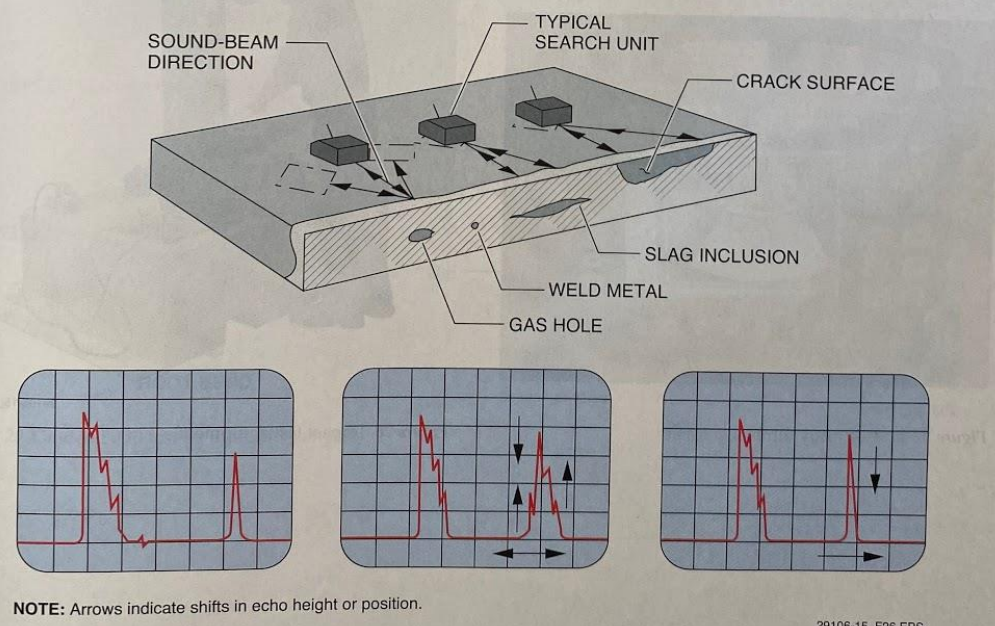


*Figure 26* Moving a transducer in an arc.

The disadvantages of ultrasonic inspection are that it requires a high degree of skill to properly interpret the patterns. In addition, very small or thin weldments are difficult to inspect using this method.

### 3.4.0 Destructive Testing

In a destructive test, the test sample is destroyed or damaged in the testing process and is no longer suitable for use. Destructive testing is often done in a laboratory setting using machines designed to apply different stresses to the weld or the base metal, depending upon which is being tested. Examples of destructive tests commonly used to examine welds and base metals include the following:

- *Tensile test* – In this test, a sample is placed in a tensile testing machine and is pulled until it breaks. The tensile test is sometimes used to determine if the weld performs as well as the base metal. In most cases, however, the test is performed to determine specific properties of the weldment, such as strength and ductility (the amount the sample will stretch before breaking).
- *Hardness test* – While strength testing examines the ability of the sample to transmit a load, hardness testing examines its ability to resist penetration. Hardness testing is usually done using a penetrating device that leaves an indentation in the sample. The depth or diameter of the indentation, depending on the type of hardness test being conducted, is then measured to determine the hardness.
- *Impact test* – The ability of a weld to withstand an impact, such as a hammer strike, is measured by this test. The property being tested is referred to as toughness. In a laboratory environment, a pendulum-type machine that simulates a heavy hammer blow is used (*Figure 28*). A notch of a specified size is made in the sample. Then the sample is placed in the jaws of the testing machine and struck with a pendulum blow.

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*Figure 27* Phased array ultrasonic tester.


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*Figure 28* Impact test equipment.

- *Soundness test* – The three types of soundness tests include bend, nick-break, and fillet weld break tests.
  - Bend testing is the test most commonly used in determining the qualifications of a welder or welding procedures. Bend tests are performed by placing the sample in a special fixture and applying stress in a way that causes the sample to bend 180 degrees. The bend is then inspected for weld defects. Guided bend tests (*Figure 29*) are used to evaluate groove test welds on both plates and pipes. In this method, specimens are bent into a U-shape with a device called a jig. The bending action places stress on the weld metal and reveals any discontinuities in the weld. The jig has a plunger and die that are dimensioned for the thickness of the specimen being bent (*Figure 30*). Refer to the welding code being used for testing for the required dimensions of the bending jig's plunger and die.

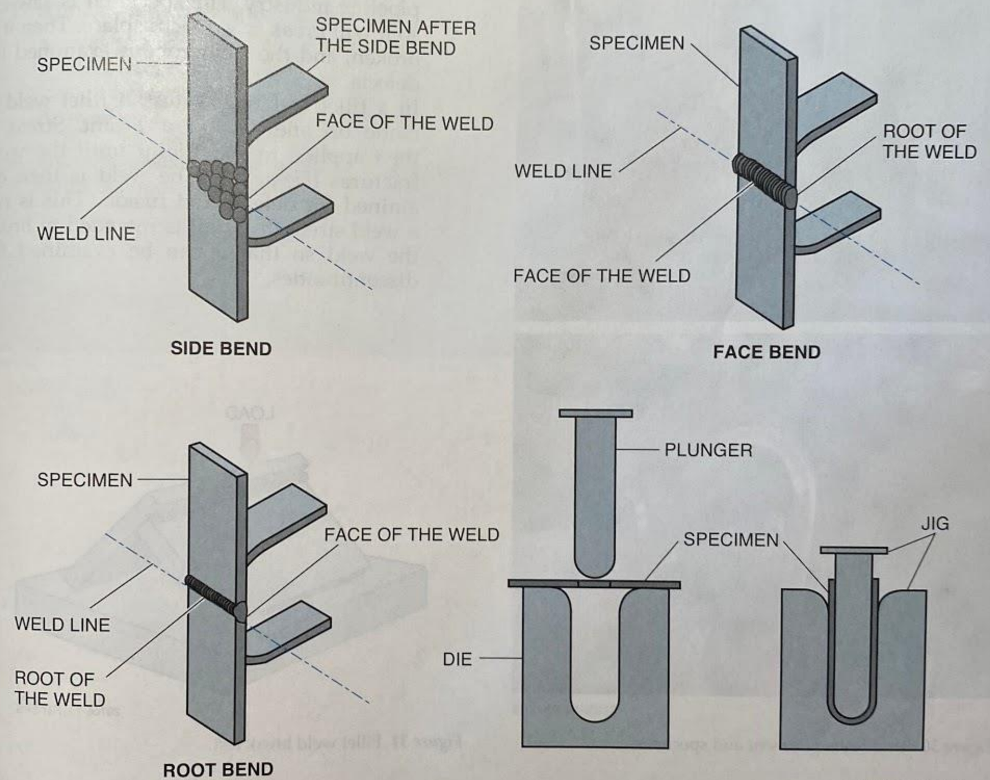


*Figure* 29 Guided bend test method and samples.

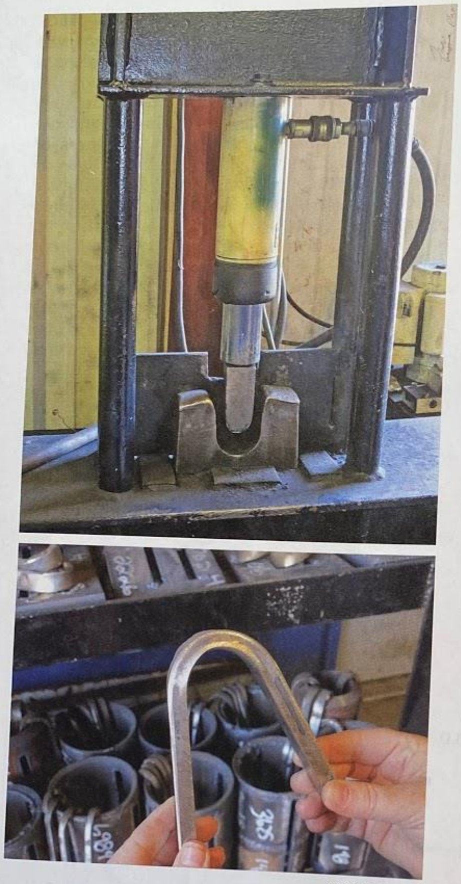

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*Figure 30* Bend test equipment and specimen.

- The three types of tests performed on the jig are root bends, face bends, and side bends. These bends test for penetration and fusion throughout the root joint. They also test for porosity, inclusions, and other defects, as well as the quality of the fusion to the side walls and the face of the weld joint. Face and root bend tests are used for materials up to ⅜" (≈10 mm metric plate) thick. For materials thicker than this, side bend testing may be used.
- Nick-break testing is used primarily in the pipeline industry. The specimen is saw-cut so it will break in a specific place. Then it is broken, and the weld zone is examined for defects.
- In a fillet weld break test, a fillet weld is made on one side of a T-joint. Stress is then applied to the T-joint until the weld fractures (*Figure 31*). The weld is then examined for defects and fusion. This is not a weld strength test; it is intended to break the weld so that it can be examined for discontinuities.

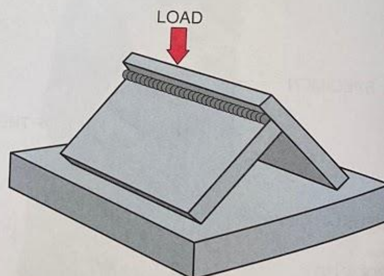


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*Figure 31* Fillet weld break test.

## Additional Resources

*Visual Inspection Workshop Reference Manual, AWS VIW-M-2008.* Miami, FL: American Welding Society.

*Certification Manual for Welding Inspectors.* Miami, FL: American Welding Society.

*Welding Inspection Technology.* Miami, FL: American Welding Society.

*B1.10M/B1.10:2009 Guide for the Nondestructive Examination of Welds.* Miami, FL: American Welding Society.

## 3.0.0 Section Review

1. A bridge cam gauge is used to measure ______.
   a. undercut
   b. fillet weld depth
   c. butt weld reinforcement
   d. overlap

2. Electromagnetic inspection can be used to test welds in non-ferrous metals.
   a. True
   b. False

3. Which of these test methods uses an imaging plate placed in a cassette?
   a. Ultrasonic
   b. Phased array UT
   c. Computed radiography
   d. Digital radiography

4. A tensile test is one in which the test coupon is ______.
   a. bent
   b. pulled
   c. struck
   d. compressed

## Module 29106-15 Weld Quality   Week of April 13, 2020

*You may need to use the last two weeks of Section Three to answer questions also to save page space please answer your questions on back or on notebook paper.…*

1. Undercut________________________Cause:_______________________

2. Incomplete Joint Penetration__________Cause:___________________

3. Porosity_________________Cause: ________________________________

4. Incomplete Fusion____________________Cause:______________

5. Inclusions______________________Cause: __________________________

Continued from previous week:

13. _________ is a relatively low-cost nondestructive examination method that uses sound wave vibrations to find surface and subsurface defects in the weld material. The ultrasonic waves pass through the material being tested and are reflected back by any density change caused by a defect. The reflected signal is then ___________________________________________.

14. List the five advantages of ultrasonic inspection: (Number them 1-5)

15. In _________________the sample or specimen is destroyed in the testing process.

16. List four common destructive examination methods: (Number them 1-4)

17. _______ is the test most commonly used to determine the qualifications of a welder.

18. List the three types of bend examinations. (Number them 1-3)

Also, answer questions in green section 3.0.0 review!

We hope you are all well and safe! WE MISS YOU!!!

- *Rare earth electrodes (EW)* – These electrodes are used as non-radioactive substitutes for 2-percent thoriated electrodes. They start and re-ignite well and have very good service life for applications in which welding cycles of at least 15 minutes are used.
- *Cryogenically treated thoriated tungsten electrodes* – These electrodes are used as non-radioactive substitutes for 2-percent thoriated electrodes. The cryogenically treated electrodes are easier to ignite and have longer tip life, longer overall electrode life, and higher amperage tolerance than non-treated 2-percent thoriated tungsten.

Select the size of electrode rated for the amperage to be used. *Table 6* lists examples of electrode current ranges by electrode size and type when used with argon shielding gas under various GTAW modes.

### 3.3.1 Preparing the Electrode

The different types of GTAW welding current require different-shaped electrode tips. For manual DCEN welding, a taper-ground and truncated point is the best shape. For manual DCEP welding, a rounded end is the best shape. For manual AC welding, a tapered and balled end is the best shape. *Figure 33* shows GTAW electrode end shapes.

Electrode tips must be formed on all new electrodes and on used electrodes that have damaged or contaminated tips. The contaminated section must be reshaped. Do not prepare the end of the electrode that contains the color-code band; otherwise you will not be able to identify the electrode's type in the future.

The degree of taper on an electrode tip affects weld penetration and bead width. A long, narrow taper (small angle, more pointed) produces a wide bead with shallow penetration. A short, wide taper (large angle, less pointed) produces a narrow bead and deep penetration. During any particular welding operation, it is important to maintain the same taper on the electrode during sharpening or replacement so that the bead characteristics remain the same.

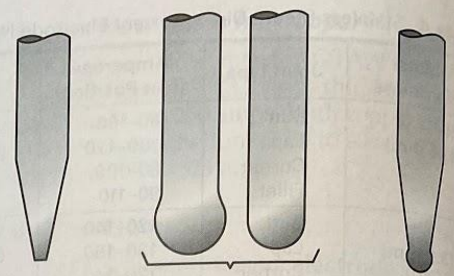



*Figure 33* GTAW electrode end shapes for different current types.

### 3.3.2 Pointing the Electrode Tip

For DCEN welding, electrodes can be made pointed by dipping the red-hot end into a special chemical powder, or they can be tapered by grinding or sanding.

Perform the following steps to use a chemical powder to sharpen a tungsten electrode:

*Step 1* Place the tungsten electrode in the torch so that it extends about 1 inch (≈25 mm) from the gas nozzle.

**Table 6** Electrode Current Ranges

| Electrode Diameter | GTAW Modes | | | |
|---|---|---|---|---|
| | AC* | | Pure Tungsten, Rare Earth, or Thoriated Tungsten Electrodes | |
| | Pure Tungsten | Thoriated or Rare Earth Electrodes** | DCEN | DCEP |
| 0.020" (0.5 mm) | 5–15 | 8–20 | 8–20 | – |
| 0.040" (1.0 mm) | 10–60 | 15–80 | 15–80 | – |
| 1/16" (1.6 mm) | 50–100 | 70–150 | 70–150 | 10–20 |
| 3/32" (2.4 mm) | 100–160 | 140–235 | 150–250 | 15–30 |
| 1/8" (3.2 mm) | 150–210 | 225–325 | 250–400 | 25–40 |
| 5/32" (4.0 mm) | 200–275 | 300–425 | 400–500 | 40–55 |
| 3/16" (4.8 mm) | 250–350 | 400–525 | 500–800 | 55–80 |
| 1/4" (6.4 mm) | 325–475 | 500–700 | 800–1,000 | 80–125 |

* Maximum values shown have been determined using an unbalanced AC power source. If a balanced AC power source is used, either reduce these values by about 30 percent or use the next size electrode. This is necessary because of the higher heat input to the electrode in a balanced AC setup.
** Balled electrode tip ends can best be sustained at these current levels.

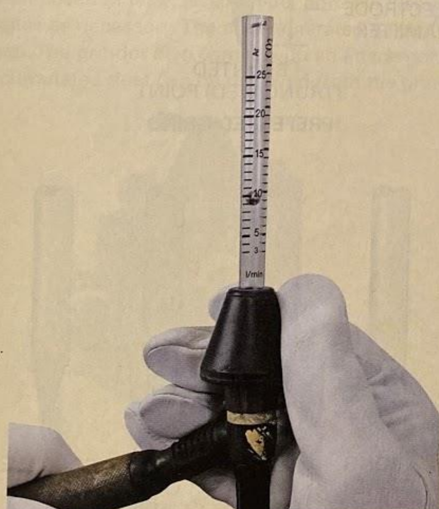
**Step 2** Heat the tungsten electrode by shorting it on a copper plate or by striking an arc. Be sure shielding gas is flowing to protect the tungsten electrode.

**Step 3** When the tip of the tungsten electrode is cherry-red for a distance of about four times the electrode diameter, place the end of the electrode in the chemical powder. For example, if the electrode diameter is ⅛" (3.2 mm), about ½" (13 mm) of the length should be cherry-red.

**Step 4** Hold the end of the tungsten electrode in the powder for the time recommended on the container for the diameter of the electrode being pointed. The chemical powder will dissolve the tungsten electrode and form a sharp point at the proper angle. For an un-tapered (new or broken off) tungsten, the procedure may have to be repeated a number of times to obtain the desired shape.

## Reading Torch Flow Rate

Welders must maintain accurate and consistent torch flow rates to create consistent welds and adhere to a WPS. The device shown here can be used to quickly measure shielding gas flow directly at the torch tip. This simple peashooter style is durable and convenient. Digital models offer a bit more sophistication. They can also be mounted on the gas line, providing a constant digital display of flow rate.



## There Is No Universal Electrode Size

Contrary to some popular beliefs, the 3/32" (2.4 mm) electrode is not a universal size that can be used for everything. Always use the electrode size recommended for the amperage required. Using an electrode that's too big will result in arc starting and stability problems. Using an electrode that is too small can result in tungsten spitting (tungsten melting and migration into the weld).

*Figure 34* shows the chemical powder used for sharpening.

**CAUTION**

Always wear clean gloves when handling tungsten electrodes to avoid contaminating the electrode.

More often, tungsten electrodes are sharpened by grinding or sanding. Since tungsten electrodes are very hard, they are best ground with diamond-impregnated silicon carbide or alumina oxide grinding wheels or sanding belts. Use 80 grit for fast shaping and 120 grit for finishing.

**WARNING!**

Observe proper respiratory, hazard, and environmental contamination procedures when using a grinder. Dust from tungsten electrode grinding can be hazardous and may contain radioactive elements. Refer to the manufacturer's SDS/MSDS to determine any specific hazards. Safety glasses must be worn when using a grinder.


*Figure 34* Tungsten sharpening powder.

Follow these steps to point the end of a tungsten electrode using a grinder:

CAUTION

Use a grinding wheel designated only for tungsten. Be careful to never use the grinding wheel for any other material, or contaminants will be deposited on the tungsten electrode and the grinding wheel will have to be discarded. Always wear safety glasses when using a grinder.

*Step 1* With the color band end held farthest from the grinder, hold the tungsten electrode against the grinder so that the tungsten electrode is in the plane of the wheel and makes an angle of about 30 degrees with the wheel or belt surface (*Figure 35*).

*Step 2* Slowly rotate the tungsten electrode as it is ground to keep the point on the center line of the axis. Orient the grind marks toward the point along the long dimension of the tungsten electrode, not around the point. For DCEN electrodes, the length of the taper should be between two and three times the electrode diameter. The point should be truncated to the approximate tip diameter shown in *Table 7*.

*Step 3* Check the ground end to make sure the tapered length is correct and that the point is in the center of the tungsten electrode and not toward one side. Correct the shape if necessary.

*Figure 36* shows preferred and incorrect grinds for prepared pointed electrode ends.

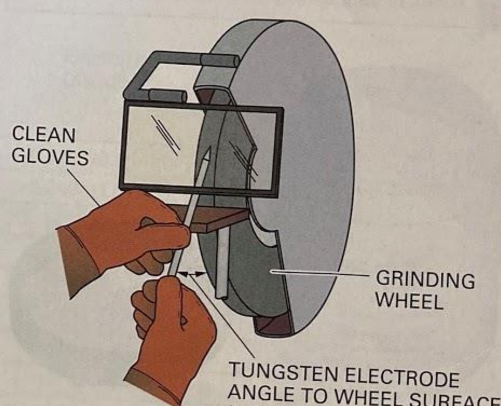



*Figure 35* Proper grinding angle and tungsten electrode orientation.

**Table 7** Tip Diameters

| Electrode Diameter | Diameter at Tip |
|---|---|
| 0.040" (1.0 mm) | 0.005" (0.13 mm) |
| 0.040" (1.0 mm) | 0.010" (0.25 mm) |
| 0.062" (1.6 mm) | 0.020" (0.51 mm) |
| 0.062" (1.6 mm) | 0.030" (0.76 mm) |
| 0.093" (2.4 mm) | 0.030" (0.76 mm) |
| 0.093" (2.4 mm) | 0.045" (1.14 mm) |
| 0.125" (3.2 mm) | 0.045" (1.14 mm) |
| 0.125" (3.2 mm) | 0.060" (1.52 mm) |

### 3.3.3 Balling the Electrode Tip

Only pure tungsten (EWP) or zirconiated tungsten (EWZr) can be balled, or spherical. The thorium in thoriated tungstens or other rare earth (except cerium) tungstens inhibits the formation of a ball. If welders attempt to ball most rare earth tungstens, the tungsten forms a number of small protrusions at the tip instead of a ball. These protrusions cause the arc to be unstable.

If the electrode is to be used for lower-amperage DCEP welding, the electrode end should be tapered about two diameters in length and be quite blunt. A ball will form on the blunt end when welding.

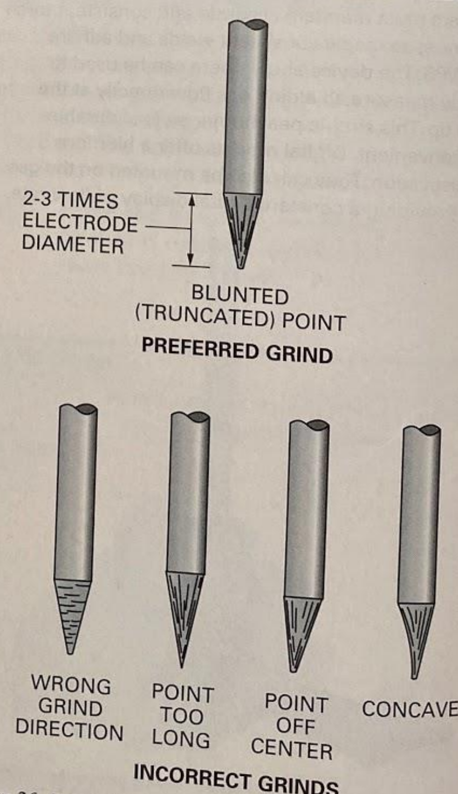



*Figure 36* Properly and improperly prepared pointed electrode ends.

For AC welding, the end is balled with or without tapering. Balling is done by arcing the electrode over clean copper or another clean metal. Do not arc over carbon, because it will contaminate the electrode.

AC or DCEP can be used to ball an electrode. When balling an electrode, start off with a low current and gradually increase it until the end of the electrode starts to melt and form a hemispherical (half-round) end or slight ball. The ball should be no more than 1½ times the electrode diameter. Using DCEP will cause a ball to form at a much lower amperage setting than it will be formed using AC current. Using DCEP, only about 35 to 45 amps of welding current will be required to ball 3⁄32" (2.4 mm) to 1⁄8" (3.2 mm) diameter electrodes. *Figure 37* shows ideal, acceptable, and unacceptable prepared balled electrode ends.

**CAUTION**

Using excess amperage will cause the ball to melt and drop off the electrode. Be especially careful when using DCEP as it will generate much more heat on the electrode than the same AC setting.

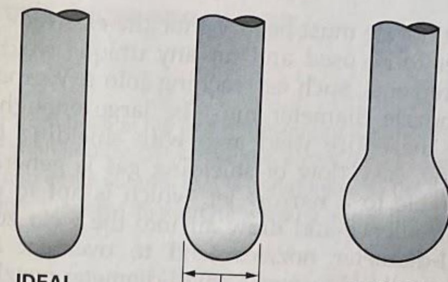



*Figure 37* Properly and improperly prepared balled, non-tapered electrode ends for AC welding.

### 3.4.0 Selecting and Installing the Nozzle

Typically, a range of nozzle sizes and styles is available for a given torch in order to accommodate different electrode sizes and welding applications. Nozzles are made for close clearances, for long reaches, for reaching deep into narrow places, and for covering wide beads. Discard nozzles with chips, cracks, or metal buildup on the end because they can affect the gas flow pattern and produce weld defects.

## Diamond-Wheel Grinders

Diamond wheel grinders are used to prepare tungsten electrodes. Both stationary and handheld, portable grinders are available. A stationary water-bath diamond-wheel grinder (*A*) can be set to different electrode grind angles as necessary. A water bath captures the tungsten dust that is generated during grinding so the dust can be disposed of later. A handheld, portable diamond-wheel grinder (*B*), can also be set to different electrode grind angles as necessary. The dust generated during grinding is captured inside the grinder's fully enclosed grind head. The grinder also comes with an attachment that allows the grinder to be connected to a shop vacuum so accumulated dust can be removed from the grinding chamber.


(A) STATIONARY GRINDER

(B) HANDHELD GRINDER

The nozzle must be sized for the electrode diameter to be used and for any unique welding requirements, such as reaching into a V-groove. The nozzle diameter must be large enough to cover the entire weld area with shielding gas. A wide, easy flow of shielding gas is generally preferable to a narrow jet, which is apt to create turbulence and draw air into the weld zone. Small-diameter nozzles tend to overheat and break easily. However, a small-diameter nozzle is useful for steadying the torch and arc for the root pass in a V-groove weld.

To select the proper size and shape nozzle, always refer to the manufacturer's nozzle recommendations for the torch being used. In general, the nozzle's inside diameter should be about three times the diameter of the electrode being used.

### 3.4.1 Installing the Electrode

The electrode is usually installed after the nozzle because the electrode stickout (ESO) is measured from the end of the nozzle. The electrode is clamped in place in the torch body by the collet assembly. The collet is a cylindrical clamp that tightens as it is pulled or pushed (depending on the torch design) into a tapered holder as the threaded electrode cap is screwed on and tightened. To adjust the electrode stickout or to remove the electrode, loosen the cap assembly. Collet designs vary with torch manufacturers (*Figure 38*).

**CAUTION**

Handle tungsten electrodes with clean gloves to avoid contamination of the electrode.

Follow these steps to install the electrode:

*Step 1* Remove the electrode cap from the rear of the torch.

*Step 2* Check the collet size and collet body. If it is not the correct size for the electrode to be installed, remove and replace it with the correct size.

*Step 3* Replace the electrode cap, but do not tighten it. Screw the cap only about one turn to leave the collet clamp loose.

*Step 4* Insert the electrode into the collet from the nozzle end of the torch, and adjust it so that it extends from the nozzle about 1 to 1½ times the electrode diameter. Insert the color-coded end first to prevent destroying the electrode markings.

**CAUTION**

If the electrode cap is overtightened, the threads will be damaged as the torch heats with use. If the cap is too loose, the collet and electrode will overheat and damage the torch.

*Step 5* Handtighten the electrode cap to lock the electrode in place.

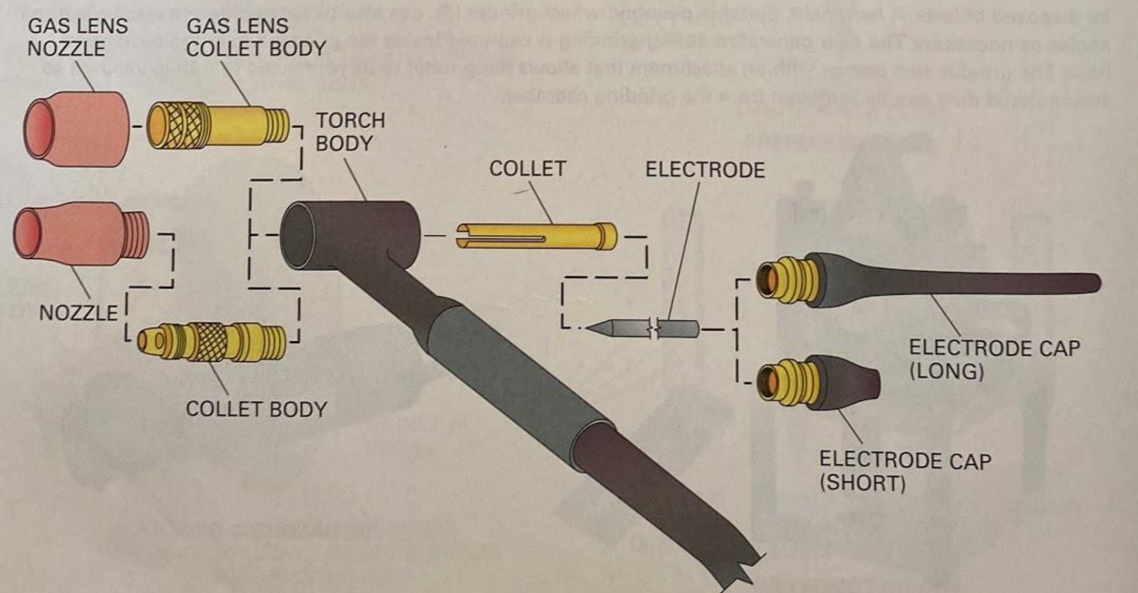



*Figure 38* Collet assembly of a typical GTAW torch.

## Electrode Stickout

Various manufacturers recommend stickout distances that differ from flush at the end of the cup to distances equal to the inside diameter of the cup, depending on the application and task. For instance, a root pass in a deep, narrow groove can be accomplished more easily with a narrow cup and a stickout that is about equal to the inside diameter of the cup. However, the use of a gas lens allows a longer tungsten stickout for welding under the same circumstances.

## Additional Resources


*AWS B1.10, Guide for the Nondestructive Examination of Welds.* Miami, FL: American Welding Society.

*AWS B1.11, Guide for the Visual Examination of Welds.* Miami, FL: American Welding Society.

*AWS D3.5, Guide for Steel Hull Welding.* Miami, FL: American Welding Society.

*AWS D3.7, Guide for Aluminum Hull Welding.* Miami, FL: American Welding Society.

Lincoln Electric website: **http://www.lincolnelectric.com**

*Modern Welding Technology.* 6th Edition. Howard B. Cary. Englewood Cliffs, NJ: Prentice Hall, Inc.

*OSHA 1910.269,* Appendix *C, Protection from Step and Touch Potentials.* Current Edition. Washington, DC: Occupational Safety and Health Administration (OSHA).

*OSHA 19260.351, Arc Welding and Cutting.* Current Edition. Washington, DC: Occupational Safety and Health Administration (OSHA).

*Welding Handbook. Vol. 1. Welding Science & Technology.* 9th Edition. Miami, FL: American Welding Society, 2001.

*Welding Handbook. Vol. 2, Part 1: Welding Processes.* Miami, FL: American Welding Society, 2004.


## 3.0.0 Section Review

1. Before plugging a welding machine into an electrical outlet, be sure to identify the location of the _____.
   a. supplemental oxygen source
   b. backup generator
   c. alternator back cap
   d. electrical disconnect

2. When connecting the shielding gas for GTAW, 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 _____.
   a. welding machine's gas solenoid
   b. gas cylinder's regulator/flowmeter
   c. gas cylinder's protective cap
   d. remote control foot pedal

3. Welders should select the size of GTAW electrode rated for the _____.
   a. amperage to be used
   b. voltage of the welding machine
   c. temperature at the work site
   d. required type of shielding gas

4. In general, the inside diameter of the nozzle should be about how many times the diameter of the GTAW electrode that is being used?
   a. One
   b. Two
   c. Three
   d. Four

**Module 29207-15  GTAW Equipment and Filler Metals            Week of April 13, 2020**

**To save space use back of paper or notebook paper to answer questions.  You may need to look back at the last two weeks to find the rest of the section for answers.**

*Read Section 3.3.0 – 3.4.1 and answer the following questions.*

1. The GTAW electrode must be selected and properly prepared before it is installed.  Correct preparation of the GTAW electrode is essential.  If the tip is not properly prepared it will not produce the required ____________________ and characteristics. 3.3.0

2. What type of electrode  is used for aluminum and magnesium? ____________ 3.3.0

3. When selecting an electrode choose the type recommended for the welding current required by the base metal. The type of electrode will be specified in the ___ or the site quality standards.

4. Do not prepare the end of the electrode with the _______________________________ because you will not be able to identify it in the future. 3.3.1

5. How does the degree of the taper on an electrode tip affect weld penetration and bead width? 3.3.1

6. Place the tungsten electrode in the torch so that it extends about  ___from the gas nozzle. 3.3.2

7. With the color band end held farthest from the grinder hold the tungsten electrode against the grinder so that the tungsten electrode is in the plane of the grinder wheel and makes an angle of about __________ degrees with the wheel. 3.3.2

8. For DCEN electrodes the taper should be ___ times the electrode diameter in length and be blunted or ______________________________. 3.3.2

9. Only pure tungsten or zircroniated tungsten can be ____ or rounded. 3.3.3

10. The thorium in thoriated tungstens or other rare earth tungsten, except cerium, inhibits the formation of a ___________________. Most rare earth tungsten will instead form a number of protrusions causing arc instability.

ANSWER SECTION 3 Review questions page 41.

We miss you guys and hope you are staying safe!