

# AIR FORCE QUALIFICATION TRAINING PACKAGE (AFQTP)



FOR  
STRUCTURAL  
(3E3X1)  
MODULE 32  
OXYACETYLENE WELDING

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Career Field Education and Training Plan (CFETP) references from 1 August 2002 version.

OPR: HQ AFCESA/CEOF  
(SMSgt Dan Sacks)  
Supersedes AFQTP 3E3X1-31, 14 Jul 00

Certified by: HQ AFCESA/CEOF  
(CMSgt Myrl F. Kibbe)  
Pages: 18/Distribution F

**Notice.** This AFQTP is *NOT* intended to replace the applicable technical references nor is it intended to replace hands-on training. It is to be used in conjunction with these for training purposes only.

**AIR FORCE QUALIFICATION TRAINING PACKAGES**  
**FOR**  
**STRUCTURAL**  
**(3E3X1)**

**INTRODUCTION**

**Before starting this AFQTP**, refer to and read the “[AFQTP Trainer/Trainee Guide](#)”

**AFQTPs are mandatory and must be completed** to fulfill task knowledge requirements on core and diamond tasks for upgrade training. **It is important for the trainer and trainee to understand** that an AFQTP **does not** replace hands-on training, nor will completion of an AFQTP meet the requirement for core task certification. AFQTPs will be used in conjunction with applicable technical references and hands-on training.

**AFQTPs and Certification and Testing (CerTest) must be used as minimum upgrade requirements for Diamond tasks.**

**MANDATORY minimum upgrade requirements:**

**Core task:**

AFQTP completion  
Hands-on certification

**Diamond task:**

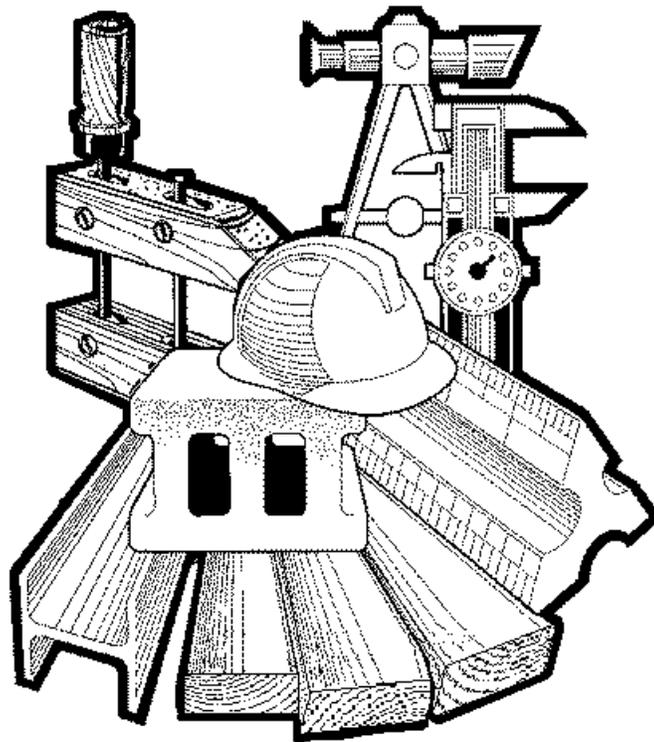
AFQTP completion  
CerTest completion (80% minimum to pass)

**Note:** Trainees will receive hands-on certification training for Diamond Tasks when equipment becomes available either at home station or at a TDY location.

**Put this package to use.** Subject matter experts under the direction and guidance of HQ AFCESA/CEOF revised this AFQTP. If you have any recommendations for improving this document, please contact the Career Field Manager at the address below.

HQ AFCESA/CEOF  
139 Barnes Dr. Suite 1  
Tyndall AFB, FL 32403-5319  
DSN: 523-6445, Comm: (850) 283-6445  
Fax: DSN 523-6488  
E-mail: [ceof.helpdesk@tyndall.af.mil](mailto:ceof.helpdesk@tyndall.af.mil)

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## OXYACETYLENE WELDING

MODULE 32

AFQTP UNIT 4

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### ASSEMBLE AND TEST OXYACETYLENE EQUIPMENT FOR GAS LEAKS (32.4.)

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**ASSEMBLE AND TEST OXYACETYLENE EQUIPMENT FOR GAS LEAKS**

***Task Training Guide***

<b>STS Reference Number/Title:</b>	32.4. - Assemble and test oxyacetylene equipment for gas leaks.
<b>Training References:</b>	<ol style="list-style-type: none"> <li>1. Career Development Course (CDC) Structural Journeyman 3E351B, Volume 3, Unit 1; <i>Oxyacetylene Welding Equipment</i>.</li> <li>2. Commercial Manual, <i>Welding Skills by R.T. Miller, 1994</i>.</li> <li>3. Commercial CD-ROM, Williams Learning Network Interactive Maintenance Training Program, <i>Oxy-Fuel Gas Welding</i>, Version 2.0.</li> </ol>
<b>Prerequisites:</b>	<ol style="list-style-type: none"> <li>1. <b>Possess as a minimum a 3E331 AFSC.</b></li> <li>2. <b>Review the following references:</b> <ol style="list-style-type: none"> <li>2.1. CDC Structural Journeyman 3E351B, Volume 3, Unit 1.</li> <li>2.2. Welding Skills, Oxyacetylene Welding, Chapter 6, <i>Setting-up and Operating</i>.</li> <li>2.3. CD-ROM Interactive Maintenance Training Program, <i>Oxy-Fuel Gas Welding</i>. (If available.)</li> </ol> </li> </ol>
<b>Equipment/Tools Required:</b>	<ol style="list-style-type: none"> <li>1. Torch wrench.</li> <li>2. Soapy water.</li> <li>3. Bucket of clear water.</li> <li>4. Oxyacetylene Rig.</li> </ol>
<b>Learning Objective:</b>	Individual should be able to test oxyacetylene equipment for leaks.
<b>Samples of Behavior:</b>	Trainee should know the safe way to test oxyacetylene equipment for gas leaks.
<b>Notes:</b>	
Trainer is encouraged to use Williams Learning Network CD-ROM program. See your Unit Training Manager for this program and any CerTest videos (630 - 636) related to this subject.	

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## ASSEMBLE AND TEST OXYACETYLENE EQUIPMENT FOR GAS LEAKS

**1. Background.** Oxyacetylene welding is a gas flame process that controls heat to join (weld) metal parts together. A torch is used to control the amount of acetylene and oxygen needed to produce the right flame needed for the particular welding job. Before any operations can be started, oxyacetylene equipment must be properly assembled and tested for gas leaks. As a structural journeyman, you must leak test the oxyacetylene equipment before each use. A leaky apparatus not only costs money due to lost gas, but it may result in a fire or explosion resulting in personnel injury and property damage.

**2. Procedures.** Follow these steps to assemble and test oxyacetylene equipment for gas leaks:

**Step 1. Gather all materials, safety gear, and required tools.**

**SAFETY:**

**DO NOT USE OIL ON HARD TO THREAD CONNECTIONS. OIL AND OXYGEN MIXED TOGETHER WILL COMBUST.**

**Step 2: Fasten the cylinders to a fixed object so that they cannot move.** Remove the protective cap and make sure that the outlet nipples (where the gas will flow through) are not damaged.

**Step 3: While standing to one side of the cylinders, open the valve on each cylinder for just an instant.** This process will blow out any dirt lodged in the outlet nipple. Then with a clean cloth, wipe out the connection seat (where the regulator is connected).

**HINT:**

Open and close the valve quickly to avoid wasting gas.

**Step 3: Connect the regulators to the correct bottle with a torch wrench.**

**NOTE:**

Remember, acetylene bottles have left-handed threads (outlet nipple) and oxygen bottles have right-handed threads.

**Step 4: Connect the hoses to the regulators (instrument that reads gas pressures), making sure the correct hoses are going to the correct regulators.**

**Step 5: Attach the torch body to the hoses and the appropriate tip you need to use.**

**Step 6: Testing for leaks.**

**6.1.** To test for leaks. With the torch body closed, open the oxygen valve slowly at first then fully open. Then open the acetylene valve slowly  $\frac{3}{4}$  to  $1\frac{1}{2}$  maximum turn.

**6.1.1.** Adjust the working pressure (pressure used for actual operation) to a low setting—3 pounds per square inch (psi) for both the oxygen and acetylene regulators. Apply soapy water to all the connections.

**6.1.2.** Inspect each connection carefully; use a torch wrench to tighten the connection if a leak is detected.

**6.1.3.** If the leak does not stop, shut off the respective gas and examine the threads where the leak is coming from.

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**6.2.** To check for leaks in the welding hoses, turn on the regulators to a low working pressure (3 psi) and submerge the hoses in clean water, looking for any bubbles. If there are any leaks in the hoses, replace the hoses.

**SAFETY:**

**IF ANY DISCREPANCIES ARE FOUND, MAKE CORRECTIONS IMMEDIATELY BEFORE ANY OXYACTYLENE WELDING OPERATIONS ARE PERFORMED.**

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**REVIEW QUESTIONS  
FOR  
ASSEMBLE AND TEST OXYACETYLENE EQUIPMENT FOR GAS LEAKS**

QUESTION	ANSWER
1. Welding equipment only needs to be checked for leaks once a month.	a. True. b. False.
2. Acetylene hoses have right-handed threads.	a. True. b. False.
3. Stand to one side of the cylinder when opening the valve.	a. True. b. False.
4. To test for leaks, open the _____ and acetylene tanks with the torch body closed.	a. oxygen b. needle c. oxide d. tank
5. Acetylene bottles have _____ handed threads and oxygen bottles have _____ handed threads.	a. left, right b. left, left c. right, left d. right, right

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## ASSEMBLE AND TEST OXYACETYLENE EQUIPMENT FOR GAS LEAKS

### PERFORMANCE CHECKLIST

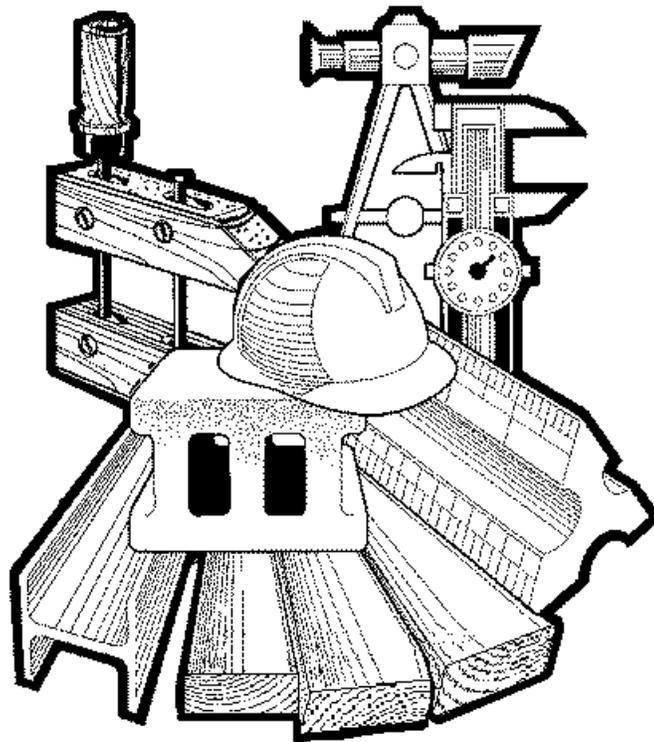
#### INSTRUCTIONS:

The trainee must satisfactorily perform all parts of the task without assistance. Evaluate the trainee's performance using this checklist.

DID THE TRAINEE....	YES	NO
1. fasten the cylinders to a fixed object?		
2. blow out the outlet nipples and wipe the connection seats?		
3. connect regulators correctly?		
4. connect the hoses to the regulators correctly?		
5. connect the torch body to the hoses correctly?		
6. attach the correct sized tip?		
7. use a torch wrench to tighten all connections?		
8. test all joints for leaks before using the equipment?		
9. test all hoses for leaks before using the equipment?		
10. comply with all safety requirements?		

**FEEDBACK:** Trainer/Certifier should provide both positive and/or negative feedback to the trainee immediately after the task is performed. This will ensure the issue is still fresh in the mind of both the trainee and trainer/certifier.

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## OXYACETYLENE WELDING

MODULE 32

AFQTP UNIT 10

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USE OXYACETYLENE EQUIPMENT TO CUT METAL (32.10.)

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**USE OXYACETYLENE EQUIPMENT TO CUT METAL**  
***Task Training Guide***

<b>STS Reference Number/Title:</b>	31.10. - Use oxyacetylene equipment to cut metal.
<b>Training References:</b>	<ol style="list-style-type: none"> <li>1. Career Development Course (CDC) Structural Journeyman 3E351B, Volume 3, Unit 4; <i>Oxyacetylene Cutting and Hard Surfacing</i>.</li> <li>2. Commercial Manual, <i>Welding Skills</i> by R.T. Miller, 1994.</li> <li>3. Commercial CD-ROM Williams Learning Network Interactive Maintenance Training Program, <i>Oxy-Fuel Gas Welding</i>, Version 2.0.</li> </ol>
<b>Prerequisites:</b>	<ol style="list-style-type: none"> <li>3. <b>Possess as a minimum a 3E331 AFSC.</b></li> <li>4. <b>Review the following references:</b> <ol style="list-style-type: none"> <li>2.1. CDC Structural Journeyman 3E351 B, Volume 3, Unit 4.</li> <li>2.2. Welding Skills, Special Welding Processes, Chapter 30, <i>Cutting Operations</i>.</li> <li>2.3. CD-ROM Interactive Maintenance Training Program, <i>Oxy-Fuel Gas Welding</i>. (If available.)</li> </ol> </li> </ol>
<b>Equipment/Tools Required:</b>	<ol style="list-style-type: none"> <li>1. Gloves.</li> <li>2. Cutting Goggles.</li> <li>3. Striker.</li> <li>4. Welding Jacket.</li> <li>5. Oxyacetylene Rig.</li> <li>6. Plate, ½" black iron, 4" x 12".</li> </ol>
<b>Learning Objective:</b>	Individual should be able to describe the procedures for cutting metal.
<b>Samples of Behavior:</b>	Trainee will be able to cut metal safety.
<b>Notes:</b>	
Trainer is encouraged to use the Williams Learning Network CD-ROM program. See your Unit Training Manager for this program as well as any CerTest videos related to this area.	

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## USE OXYACETYLENE EQUIPMENT TO CUT METAL

**1. Background.** Oxyacetylene cutting is a fast and economical way to cut steel. As a structural journeyman, you can use a cutting torch to make accurate cuts and prepare joint edges on the job without having to rely on time-consuming methods such as sawing or grinding. The cutting torch mixes oxygen and acetylene in different ratios. It burns the mixture in a preheating flame, which heats the work to begin cutting operations. The hand-cutting torch is similar to the welding torch, but is different in construction and method of control. In this unit, we will cover the proper steps to cut metal plate.

**SAFETY:**

**ALL SAFETY EQUIPMENT MUST BE WORN WHEN CUTTING OR WELDING**

**NOTE TO TRAINER/CERTIFIER:**

Have the trainee layout a square, triangle and circle onto a 4" x 12" plate ½" thick. The figures should be approximately 2" in size. Next, have the trainee cut out the shapes using the steps below.

**2. Procedures.** Follow these steps to use oxyacetylene equipment to cut metal:

**Step 1: Layout metal plate.**

- 1.1. Ensure metal is clean of any material that might hinder the cutting process.
- 1.2. Draw a square, triangle and circle approximately two-inches in size onto the metal plate using a soapstone or suitable marker.
- 1.3. Secure the plate to a metal table or vise and prepare for cutting operation.

**Step 2: Prepare oxyacetylene cutting torch.**

- 2.1. Set up oxyacetylene cutting torch using procedures in Unit 1.
- 2.2. Select the correct tip size and adjust the regulators to the correct pressure for the job. Figure 10-1 below shows various tip sizes and pressures required for different thicknesses of metal plate.

**NOTE:**

Be sure to use the correct pressure when oxyacetylene cutting.

**Figure 10-1. Recommended Working Pressures for Various Plate Thicknesses.**

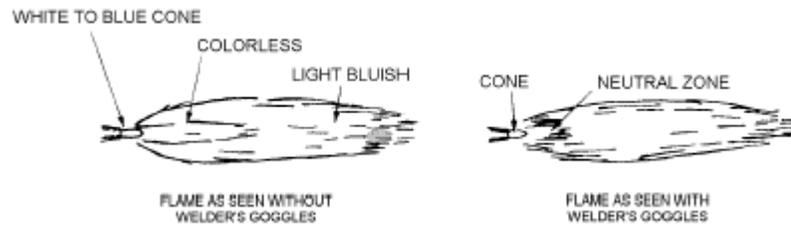
PLATE THICKNESS	TIP SIZE	ACETYLENE PRESSURE	OXYGEN PRESSURE
¼-inch	0	3	25 to 30
<sup>3</sup> / <sub>8</sub> - to ½-inch	1	3	30 to 40
<sup>3</sup> / <sub>4</sub> - to 1-inch	2	3	40 to 50
1 ½-inch	3	3	45 to 50
2-inch	4	3	50 to 55
3- to 4-inch	4	4	55 to 65
5- to 6-inch	6	5	55 to 65
8- to 10-inch	7	6	60 to 70
12-inch	8	6	70 to 80

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**Step 3: Light the torch.**

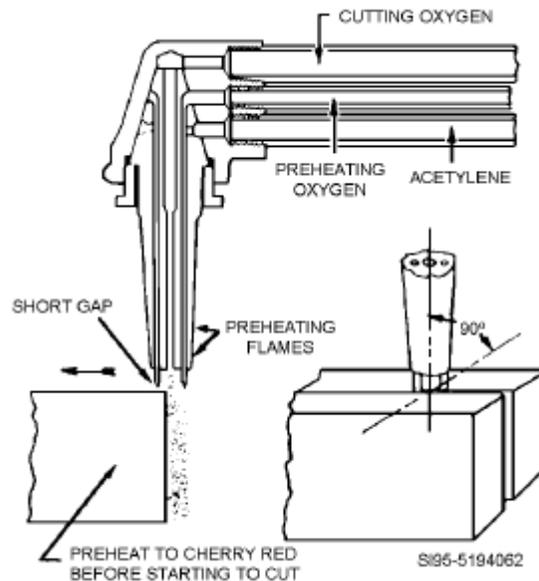
- 3.1. Ensure the torch tip is not directed towards any personnel or flammable equipment.
- 3.2. Turn the acetylene needle valve open 1/4 turn, light the torch with a striker, and adjust the oxygen needle valve to get a neutral flame (Figure 10-2).
- 3.3. Keep flame pointed away from any personnel or flammable material.

**Figure 10-2. Neutral Flame.**



**Step 4: Preheat the metal.** Hold the torch perpendicular (90°) to the work surface with the inner cones of the preheating flame slightly above the surface as shown in Figure 10-3.

**Figure 10-3. Torch Cutting.**



**Step 5: Cut the metal.**

- 5.1. Observe the plate's color. When the plate turns bright red to near orange it is at the correct heat.
- 5.2. Push the oxygen handle on the torch slowly at first, then fully open. Keep the torch between 1/8- to 1/4-inches above the metal.
- 5.3. Observe sparks. A shower of sparks falling from the opposite side indicates the correct cutting speed and pressure and that the cut has penetrated through the metal.
- 5.4. A correctly made cut will be clean and narrow and will compare to a saw cut.

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**REVIEW QUESTIONS  
FOR  
USE OXYACETYLENE EQUIPMENT TO CUT METAL**

QUESTION	ANSWER
1. How close should the torch be from the metal when cutting?	<ul style="list-style-type: none"> <li>a. 1-inch.</li> <li>b. 1/8- to 1/4-inches.</li> <li>c. Torch head touching the metal.</li> <li>d. Inner cone 3/4-inches away from the metal.</li> </ul>
2. What is the correct tip size to use to cut 3-inch metal?	<ul style="list-style-type: none"> <li>a. 3.</li> <li>b. 4.</li> <li>c. 5.</li> <li>d. 6.</li> </ul>
3. A shower of sparks falling from the opposite side of the metal will indicate that _____.	<ul style="list-style-type: none"> <li>a. the metal is binding.</li> <li>b. you are using the wrong striker.</li> <li>c. you're cutting speed is not fast enough.</li> <li>d. the cut has penetrated through the metal.</li> </ul>
4. The hand-cutting torch is similar to the welding torch, but is different in construction and method of control.	<ul style="list-style-type: none"> <li>a. True.</li> <li>b. False.</li> </ul>
5. The cutting torch mixes oxygen and acetylene in definite proportions; burns the mixture in a preheating flame, which heats the work.	<ul style="list-style-type: none"> <li>a. True.</li> <li>b. False.</li> </ul>
6. According to Table 1, if the plate thickness is 3- to 4-inches thick, use a size ____ tip, acetylene pressure of ____ and oxygen pressure of _____.	<ul style="list-style-type: none"> <li>a. 4, 4, 55 to 65.</li> <li>b. 4, 5, 55 to 60.</li> <li>c. 5, 4, 50 to 55.</li> <li>d. 5, 4, 50 to 60.</li> </ul>
7. To get a neutral flame, turn the acetylene needle valve open 1/4 turn, light the torch with a _____, and adjust the oxygen needle valve.	<ul style="list-style-type: none"> <li>a. striker</li> <li>b. match</li> <li>c. lighter</li> <li>d. plate torch</li> </ul>

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## USE OXYACETYLENE EQUIPMENT TO CUT METAL

### PERFORMANCE CHECKLIST

#### INSTRUCTIONS:

The trainee must satisfactorily perform all parts of the task without assistance. Evaluate the trainee's performance using this checklist.

DID THE TRAINEE....	YES	NO
1. ensure the metal was clean of any foreign matter?		
2. properly secure the plate to the table or vise?		
3. have on all his/her safety equipment?		
4. setup the oxyacetylene equipment correctly?		
5. select the correct tip size?		
6. adjust the regulators to the correct pressure?		
7. establish a neutral flame on the torch?		
8. preheat the metal plate properly before beginning the cut?		
9. control the torch while cutting?		
10. comply with all safety requirements?		

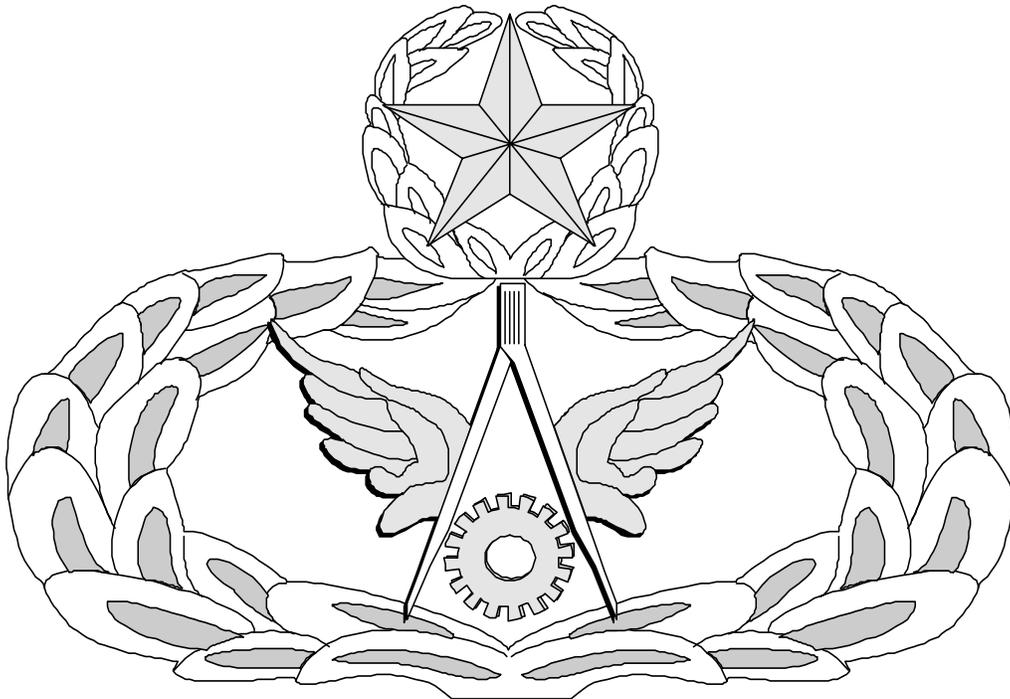
**FEEDBACK:** Trainer/Certifier should provide both positive and/or negative feedback to the trainee immediately after the task is performed. This will ensure the issue is still fresh in the mind of both the trainee and trainer/certifier.

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# Air Force Civil Engineer

## QUALIFICATION TRAINING PACKAGE (QTP)

### REVIEW ANSWER KEY



FOR  
**STRUCTURAL**  
(3E3X1)

**MODULE 32**  
**OXYACETYLENE WELDING**

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**Key-1**

**ASSEMBLE AND TEST OXYACETYLENE EQUIPMENT FOR GAS LEAKS  
(3E3X1-32.4.)**

QUESTION	ANSWER
1. Welding equipment only needs to be checked for leaks once a month.	b. False.
2. Acetylene hoses have right-handed threads.	b. False.
3. Stand to one side of the cylinder when cracking the valve.	a. True.
4. To test for leaks, open the _____ and acetylene tanks with the torch body closed.	a. oxygen
5. Acetylene bottles have _____ handed threads and oxygen bottles have _____ handed threads.	a. left, right

**USE OXYACETYLENE EQUIPMENT TO CUT METAL  
(3E3X1-32.10.)**

Question	Answer
1. How close should the torch be from the metal when cutting?	b. $\frac{1}{8}$ - to $\frac{1}{4}$ -inches.
2. What is the correct tip size to use to cut 3-inch metal?	b. 4.
3. A shower of sparks falling from the opposite side of the metal will indicate that _____.	d. the cut has penetrated through the metal.
4. The hand-cutting torch is similar to the welding torch, but is different in construction and method of control.	a. True.
5. The cutting torch mixes oxygen and acetylene in definite proportions; burns the mixture in a preheating flame, which heats the work.	a. True.
6. According to Table 1, if the plate thickness is 3- to 4-inches thick, use a size ____ tip, acetylene pressure of ____ and oxygen pressure of _____.	a. 4, 4, 55 to 65.
7. To get a neutral flame, turn the acetylene needle valve open $\frac{1}{4}$ turn, light the torch with a _____, and adjust the oxygen needle valve.	a. striker

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MEMORANDUM FOR HQ AFCESA/CEOF  
139 Barnes Drive Suite 1  
Tyndall AFB, FL 32403-5319

FROM:

SUBJECT: Qualification Training Package Improvement

1. Identify module.

Module # and title \_\_\_\_\_

2. Identify improvement/correction section(s):

<input type="checkbox"/> STS Task Reference	<input type="checkbox"/> Performance Checklist
<input type="checkbox"/> Training Reference	<input type="checkbox"/> Feedback
<input type="checkbox"/> Evaluation Instructions	<input type="checkbox"/> Format
<input type="checkbox"/> Performance Resources	<input type="checkbox"/> Other
<input type="checkbox"/> Steps in Task Performance	

3. Recommended changes--use a continuation sheet if necessary.

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4. You may choose to call in your recommendations to DSN 523-6445 or FAX DSN/Commercial 523-6488 or (850) 283-6488 or email [ceof.helpdesk@tyndall.af.mil](mailto:ceof.helpdesk@tyndall.af.mil).

5. Thank you for your time and interest.

YOUR NAME, RANK, USAF  
Title/Position