

**AIR FORCE  
QUALIFICATION TRAINING PACKAGE (AFQTP)**



**FOR  
STRUCTURAL  
(3E3X1)**

**MODULE 13  
AFS SPECIFIC SAFETY**

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**AFS SPECIFIC SAFETY**

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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 3E3X1-12, 14 Jul 00

Certified by: HQ AFCESA/CEOF  
(CMSgt Myrl F. Kibbe)  
Pages: 15/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:**

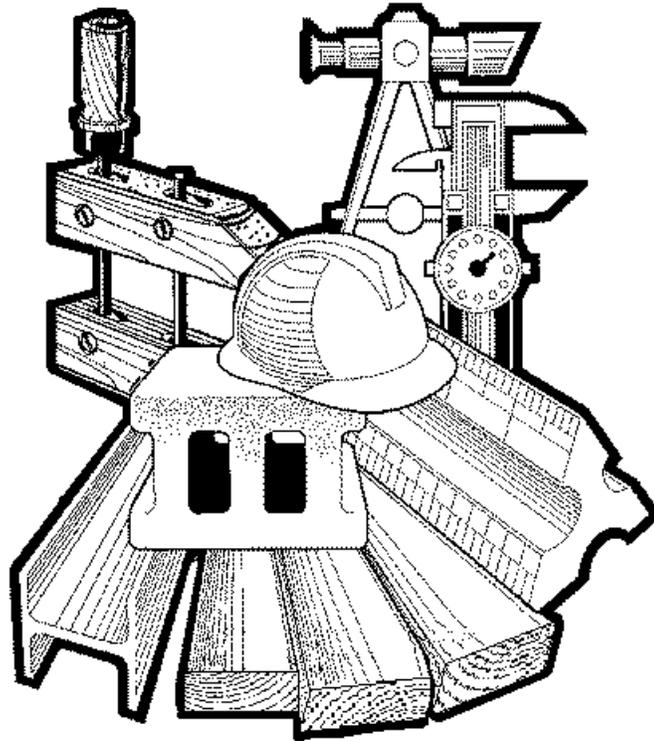
AFQTP completion  
CerTest completion (80% minimum to pass)

**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  
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## EXERCISE SAFETY PRECAUTIONS WHEN:

MODULE 13

AFQTP UNIT 3

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HANDLING COMPRESSED GAS CONTAINERS (13.3.5.)

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**HANDLING COMPRESSED GAS CONTAINERS**  
***Task Training Guide***

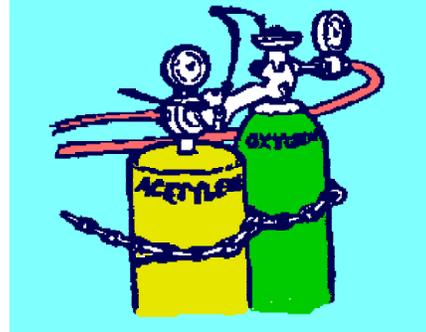
<b>STS Reference Number/Title:</b>	13.3.5. - Exercise safety precautions when handling compressed gas containers.
<b>Training References:</b>	<ol style="list-style-type: none"> <li>1. Career Development Course (CDC) Structural Journeyman 3E351B, Volume 3, Unit 1, Section 1-1, Lesson 401; <i>Oxyacetylene Welding Equipment</i>.</li> <li>2. Commercial Manual, <i>Welding Skills</i> by R.T. Miller, 1994.</li> <li>3. <a href="#">Air Force Occupational Safety and Health Standard (AFOSHSTD) 91-5, Welding, Cutting, and Brazing.</a></li> <li>4. <a href="#">Technical Order (TO) 34W4-1-5, Welding Theory and Application.</a></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 1, Unit 1, Section 1-1, Lesson 401.</li> <li>2.2. AFOSHSTD 91-5.</li> </ol> </li> </ol>
<b>Equipment/Tools Required:</b>	<ol style="list-style-type: none"> <li>1. Gloves.</li> <li>2. Steel toed boots.</li> <li>3. Compressed gas container.</li> <li>4. Eye protection.</li> </ol>
<b>Learning Objective:</b>	Individual should be able to handle and transport compressed gas containers without supervision.
<b>Samples of Behavior:</b>	Trainee will be able to successfully and safely move gas containers.
<b>Notes:</b>	<ol style="list-style-type: none"> <li>1. Any safety violation will result in a failure.</li> <li>2. This AFQTP should be used in conjunction with Module 32.</li> <li>3. Trainer must develop an exercise scenario based on handling and transporting compressed gas containers to validate ability of trainee to meet learning objective and samples of behavior.</li> </ol>

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## HANDLING COMPRESSED GAS CONTAINERS

**1. Background.** Many Air Force operations require the use of compressed gases for a variety of different welding operations. Compressed gases present a unique hazard. Depending on the particular gas, there is a potential for simultaneous exposure to both mechanical and chemical hazards. Gases may be:

- 1.1. Flammable or combustible.
- 1.2. Explosive.
- 1.3. Corrosive.
- 1.4. Poisonous.
- 1.5. Inert.
- 1.6. Or a combination of hazards.



**2. Hazards.** If the gas is flammable, flash points lower than room temperature compounded by high rates of diffusion present a danger of fire or explosion. Additional hazards of reactivity and toxicity of the gas, as well as asphyxiation, can be caused by high concentrations of even "harmless" gases such as nitrogen. Since the gases are contained in heavy, highly pressurized metal containers, the large amount of potential energy resulting from compression of the gas makes the cylinder a potential rocket or fragmentation bomb. Careful procedures are necessary for handling the various compressed gases, the cylinders containing the compressed gases, regulators or valves used to control gas flow, and the piping used to confine gases during flow.

### 3. Identification.

**3.1.** The contents of any compressed gas cylinder must be clearly identified. Such identification should be stenciled or stamped on the cylinder or a label. Commercially available three-part tag systems may also be used for identification and inventory.

**3.2.** No compressed gas cylinder should be accepted for use that does not legibly identify its contents by name. If the labeling on a cylinder becomes unclear or an attached tag is defaced to the point the contents cannot be identified, the cylinder should be marked "contents unknown" and returned directly to the manufacturer or supplier.



**Always read the label!!**

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**3.3.** Never rely on the color of the cylinder for identification. Color-coding is not reliable because cylinder colors may vary with each supplier. Additionally, labels on caps have little value since caps can be easily interchanged.

**3.3.1.** The labels should be color coded to distinguish hazardous gases, such as non-flammable, flammable gas, or oxygen.



**3.3.2.** Signs identifying the substances and appropriate precautions (e.g., ACETYLENE - FLAMMABLE GAS - NO SMOKING - NO OPEN FLAMES) should be conspicuously posted in areas where flammable compressed gases are stored.

#### 4. Handling and Use.

**4.1.** Cylinders may be secured to a workbench, individually to a wall, post, placed in a holding cage, or other secure anchorage to prevent them being knocked or pulled over. Securing is accomplished by using chains or sturdy straps.

**4.2.** In the event of a minor leak, move the cylinder to a well-ventilated area and notify the Fire Department. If the leak is major, evacuate the area and then notify the Fire Department immediately.

#### NOTE:

Under no circumstances should any attempt be made to repair a cylinder or valve.

**4.3.** Standard cylinder-valve outlet connections have been devised by the Compressed Gas Association (CGA) to prevent mixing of incompatible gases. The outlet threads used vary in diameter; some are internal or external, and they may be right- or left-handed. In general, right-handed threads are used for non-fuel and water-pumped gases, while left-handed threads are used for fuel and oil-pump gases. To minimize undesirable connections, only CGA standard combinations of valves and fittings should be used in compressed gas installations; the assembly of miscellaneous parts should be avoided. The threads on cylinder valves, regulators, and other fittings should be examined to ensure they correspond and are undamaged.

**4.4.** Cylinders should be placed with the valve accessible at all times. Always keep the cylinder valve closed when the tank is not in use. This is necessary not only for safety when the cylinder is under pressure, but also to prevent the corrosion and contamination resulting from diffusion of air and moisture into the cylinder after it has been emptied.

**4.5.** Cylinders are equipped with either a hand wheel or stem valve. For cylinders equipped with a stem valve, the valve spindle key should remain on the stem while the cylinder is in service. Only wrenches or tools provided by the cylinder supplier should be used to open or close a valve. At no time should pliers be used to operate cylinder valves. Some valves may require washers; this should be checked before the regulator is fitted.

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**4.6.** Open cylinder valves slowly. Most cylinder valves should only be opened  $\frac{1}{4}$  turn. Oxygen cylinder valves should be opened all the way.

**4.7.** When opening the valve on a cylinder containing an irritating or toxic gas, the user should position the cylinder with the valve pointing away from him or herself, don personal protective equipment, open the valve in a well ventilated area, and warn those working nearby.

**SAFETY:**

**DO NOT STAND FACING CYLINDER VALVE OUTLETS OF OXYGEN, ACETYLENE, OR ANY OTHER COMPRESSED GASES WHEN OPENING THE VALVE.**



**4.8.** Cylinders containing flammable gases such as acetylene must not be stored in close proximity to open flames, areas where electrical sparks are generated, high heat, or where other sources of ignition may be present.

**NOTE:**

Never store cylinders containing acetylene on their side.

**4.9.** An open flame shall never be used to detect leaks of flammable gases. to do so will ignite the gas leading to an explosion. All cylinders containing flammable gases should be stored in a well-ventilated area away from heat or ignition sources.

**4.10.** Oxygen cylinders, full or empty, shall not be stored in the same vicinity as flammable gases. The proper storage for oxygen cylinders requires that a minimum of 20 feet be maintained between flammable gas cylinders and oxygen cylinders or the storage areas be separated, at a minimum, by a fire wall five feet high with a fire rating of 0.5 hours.

**SAFETY:**

**GREASY AND OILY MATERIALS SHALL NEVER BE STORED AROUND OXYGEN, NOR SHOULD GREASE OR OIL BE APPLIED TO FITTINGS.**

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**Regulators are gas specific and not necessarily interchangeable!**

**Always make sure the regulator and valve fittings are compatible.**



**4.11.** Check with your supervisor if there is any question as to the suitability of a regulator for a particular gas. Before attaching the regulator “crack” the cylinder valve by opening slightly for an instant to blow out any dirt or foreign matter that may have accumulated during shipment or storage. After the regulator is attached, the cylinder valve should be opened just enough to indicate pressure on the regulator gauge (no more than one full turn) and all the connections checked with a soap solution for leaks. Never use oil or grease on the regulator of a cylinder valve.

**4.12.** The following rules should always be followed in regards to piping:

**4.12.1.** Copper piping shall not be used for acetylene.

**4.12.2.** Plastic piping shall not be used for any portion of a high-pressure system.

**4.12.3.** Do not use cast iron pipe for chlorine.

**4.12.4.** Do not conceal distribution lines where a high concentration of a leaking hazardous gas can build up and cause an explosion.

**4.12.5.** Distribution lines and their outlets should be clearly labeled as to the type of gas contained.

**4.12.6.** Piping systems should be inspected for leaks on a regular basis.

**4.12.7.** Special attention should be given to fittings as well as possible cracks that may have developed.

**4.13.** A cylinder should never be emptied to a pressure lower than 172 kPa (25 psi/in<sup>2</sup>) as the residual contents may become contaminated if the valve is left open. When work involving a compressed gas is completed, the cylinder must be turned off, and if possible, the lines bled.

**4.14.** When the cylinder needs to be removed or is empty, all valves shall be closed, the system bled, and the regulator removed. The valve cap shall be replaced, the cylinder **clearly marked as "empty" or "MT,"** and returned to the approved storage area and secured to wait for pickup by the supplier.



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4.15. Empty and full cylinders should be stored in separate areas.

4.16. Liquid bulk cylinders may be used in laboratories where a high volume of gas is needed. These cylinders usually have a number of valves on the top of the cylinder. All valves should be clearly marked as to their function. These cylinders will also vent their contents when a preset internal pressure is reached, therefore, they should be stored or placed in service where there is adequate ventilation.

**SAFETY:**

**ALWAYS USE SAFETY GLASSES (PREFERABLY A FACE SHIELD) WHEN HANDLING AND USING COMPRESSED GASSES, ESPECIALLY WHEN CONNECTING AND DISCONNECTING COMPRESSED GAS REGULATORS AND LINES.**



4.17. All compressed gas cylinders must be returned to the supplier when empty or no longer in use.

**5. Transportation of Cylinders.** The cylinders that contain compressed gases are primarily shipping containers and should not be subjected to rough handling or abuse. Such misuse can seriously weaken the cylinder and render it unfit for further use or transform it into a rocket having sufficient thrust to drive it through masonry walls.

5.1. To protect the valve during transportation, the cover cap should be screwed on hand tight and remain on until the cylinder is in place and ready for use.

5.2. Cylinders should never be rolled on its sides or dragged.

5.3. When moving large cylinders, they should be strapped to a properly designed wheeled cart to ensure stability.

5.4. Only one cylinder should be handled (moved) at a time.

**6. Procedures:** Follow these steps to safely handle compressed gas container:

**Step 1: Close the valves, safely bleed the system, and remove the regulator (if required).**

**Step 2: Screw on the cover cap (hand tight).**

**Step 3: Clearly mark/tag the cylinder “empty” or “MT”.**

**Step 4: Remove the safety chain/strap.**

**Step 5: Place empty cylinder on a wheeled cart and secure it.**

**Step 6: Move the cylinder to the correct storage area and secure the cylinder.**

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**REVIEW QUESTIONS  
FOR  
HANDLING COMPRESSED GAS CONTAINERS**

QUESTION	ANSWER
1. If the regulator to an oxygen cylinder is difficult to thread, you should:	<ul style="list-style-type: none"> <li>a. oil the threads.</li> <li>b. try using the acetylene regulator.</li> <li>c. use an adjustable wrench to tighten it.</li> <li>d. return the cylinder or regulator to the supplier.</li> </ul>
2. If you find a compressed gas cylinder not properly labeled, you should:	<ul style="list-style-type: none"> <li>a. attach a regulator and test the contents.</li> <li>b. make a guess as to its contents based on cylinder color.</li> <li>c. mark cylinder as “unknown” and return to supplier.</li> <li>d. store in a separate location until identification can be made.</li> </ul>
3. It is safe to conduct minor repairs on Argon or Oxygen cylinder valves.	<ul style="list-style-type: none"> <li>a. True.</li> <li>b. False.</li> </ul>
4. Compressed gas cylinders may be secured safely by using:	<ul style="list-style-type: none"> <li>a. chains.</li> <li>b. duct tape.</li> <li>c. bracing between two immoveable objects.</li> <li>d. All of the above.</li> </ul>
5. When the equipment is not in use, the cylinder valves should always be closed.	<ul style="list-style-type: none"> <li>a. True.</li> <li>b. False.</li> </ul>
6. Oxygen cylinder valves are always opened all the way when in use.	<ul style="list-style-type: none"> <li>a. True.</li> <li>b. False.</li> </ul>
7. Which type of gas cylinder should <b>NEVER</b> be stored on its side?	<ul style="list-style-type: none"> <li>a. Argon.</li> <li>b. Helium.</li> <li>c. Oxygen.</li> <li>d. Acetylene.</li> </ul>
8. Cylinders containing flammable gas will <b>NOT</b> be stored near:	<ul style="list-style-type: none"> <li>a. Pilot lights.</li> <li>b. Bunsen burners.</li> <li>c. Areas generating electrical sparks.</li> <li>d. All of the above.</li> </ul>
9. It is okay to use plastic piping for a high-pressure gas system.	<ul style="list-style-type: none"> <li>a. True.</li> <li>b. False.</li> </ul>
10. Compressed gas cylinders should <b>NEVER</b> be rolled on its sides or dragged.	<ul style="list-style-type: none"> <li>a. True.</li> <li>b. False.</li> </ul>

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## HANDLING COMPRESSED GAS CONTAINERS

### 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. recognize the type of compressed gas being handled?		
2. follow the proper shut down and hose bleeding procedures? (If required.)		
3. use the proper tools for removing pressure gages from the gas container? (If required.)		
4. properly mark/tag the empty container?		
5. correctly replace the appropriate cover cap on the container to be handled?		
6. safely move the container in a manner that avoided rolling or dragging?		
7. ensure all tanks were never left unattended until properly secured?		

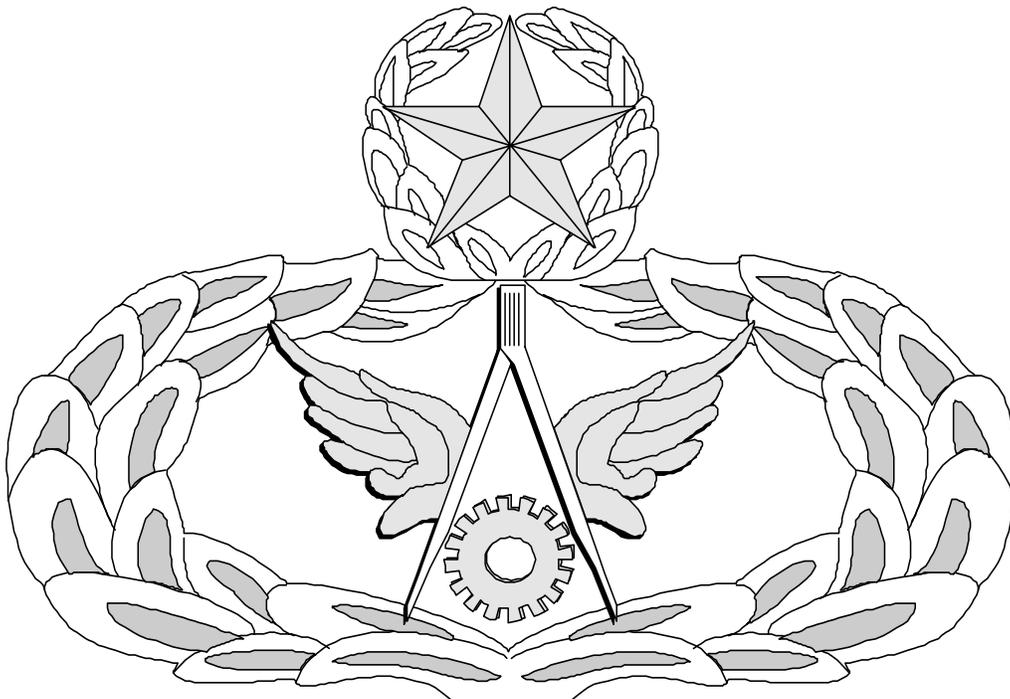
**FEEDBACK:** Trainer/Certifier should provide both positive and/or negative feedback to the trainee immediately after the task is performed. This will ensure the issue is still fresh in the mind of both the trainee and trainer/certifier.

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# Air Force Civil Engineer

## QUALIFICATION TRAINING PACKAGE (QTP)

### REVIEW ANSWER KEY



FOR  
**STRUCTURAL**  
(3E3X1)

**MODULE 13**  
**AFS SPECIFIC SAFETY**

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**Key-1**

**HANDLING COMPRESSED GAS CONTAINERS  
(3E3X1-13.3.5.)**

QUESTION	ANSWER
1. If the regulator to an oxygen cylinder is difficult to thread, you should:	d. return the cylinder or regulator to the supplier.
2. If you find a compressed gas cylinder not properly labeled, you should:	c. mark cylinder as “unknown” and return to supplier.
3. It is safe to conduct minor repairs on Argon or Oxygen cylinder valves.	b. False.
4. Compressed gas cylinders may be secured safely by using:	a. chains.
5. When the equipment is not in use, the cylinder valves should always be closed.	a. True.
6. Oxygen cylinder valves are always opened all the way when in use.	a. True.
7. Which type of gas cylinder should <b>NEVER</b> be stored on its side?	d. Acetylene.
8. Cylinders containing flammable gas will <b>NOT</b> be stored near:	d. All of the above.
9. It is okay to use plastic piping for a high-pressure gas system.	b. False.
10. Compressed gas cylinders should <b>NEVER</b> be rolled on its sides or dragged.	a. True.

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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