

AIR FORCE QUALIFICATION TRAINING PACKAGE (AFQTP)



FOR
UTILITIES SYSTEMS
(3E4X1)

MODULE 17
WASTEWATER SYSTEMS

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<p>Career Field Education and Training Plan (CFETP) references from 1 Jul 02 version.</p>

OPR: HQ AFCESA/CEOF
 (SMSgt James B. Lucas)
 Supersedes AFQTP 3E4X1-15, 1 Oct 1999

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 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
UTILITIES SYSTEMS
(3E4X1)**

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:

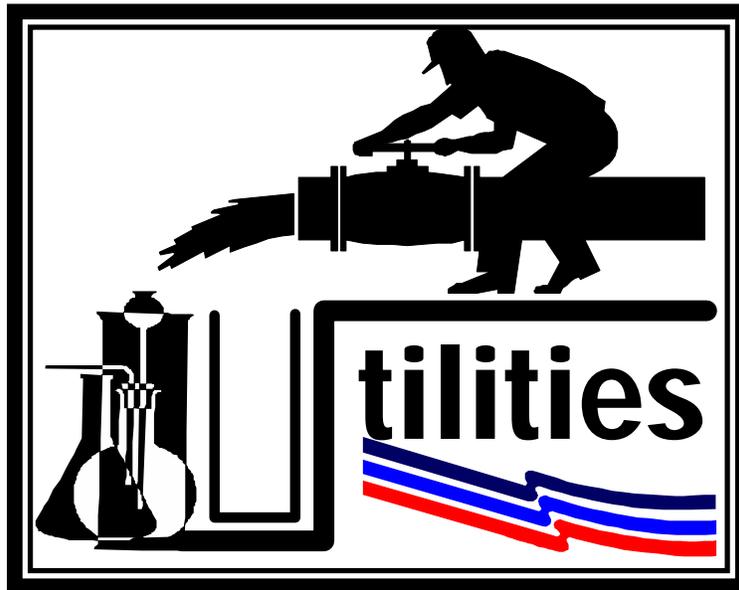
AFQTP completion
CerTest completion (80% minimum to pass)

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.

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WASTEWATER SYSTEMS

ESTABLISH TRENCH GRADE & PIPELINE SLOPE

MODULE 17

AFQTP UNIT 4/5

ESTABLISH TRENCH GRADE (17.4.)

ESTABLISH PIPELINE SLOPE (17.5.)

ESTABLISH TRENCH GRADE/PIPELINE SLOPE

Task Training Guide

STS Reference Number/Title:	17.4., Establish trench grade. 17.5., Establish pipeline slope.
Training References:	<ol style="list-style-type: none"> 1. CD-ROM Air Force Qualification Training Package (AFQTP) 3E4X1 Utilities, Version 1.0, Feb 00: <i>The Repair of Water & Wastewater Piping Systems</i>. 2. Uniformed Plumbing Code. 3. Air Force Instruction (AFI) 32-1067, Water Systems. 4. Air Force Joint Manual (AFJMAN) 32-1070, Plumbing. 5. Unified Facilities Criteria (UFC) 3-420-01FA, Design: Plumbing 6. MOP-11.
Prerequisites:	<ol style="list-style-type: none"> 1. Possess as a minimum a 3E431 AFSC. 2. Review the following references: <ol style="list-style-type: none"> 2.1. Uniformed Plumbing Code. 2.2. AFI 32-1067, <i>Water Systems</i>. 2.3. AFJMAN 32-1070, <i>Plumbing</i>. 3. Complete the CD-ROM AFQTP 3E4X1 Utilities, Version 1.0, Feb 00: <i>The Repair of Water & Wastewater Piping Systems</i>.
Equipment/Tools Required:	<ol style="list-style-type: none"> 1. Carpenter's level, string, string level, and common hand tools. 2. Computer to support AFQTP CD-ROM. 3. General Plumbing Hand Tools. 4. Carpenter's Level. 5. String. 6. String Level. 7. Pieces of piping
Learning Objective:	<ol style="list-style-type: none"> 1. The trainee will know the steps required to establish a trench grade and pipeline slope. 2. The trainee will understand theory behind establishing a trench grade and pipeline slope.
Samples of Behavior:	Trainee will be able to complete required steps in establishing a trench grade and pipeline slope.
Notes:	<ol style="list-style-type: none"> 1. To successfully complete this element, the steps must be followed exactly--no exceptions. 2. Any safety violation is an automatic failure.

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ESTABLISH TRENCH GRADE/PIPELINE SLOPE

1. Background: Trenches are graded to ensure that wastewater flows through the pipe at the correct velocity. When properly grading a trench for wastewater pipe installation it is necessary to keep one end of the pipe lower than the other so wastewater will flow freely (gravity flow). Slanting of the sewer pipe is referred to as fall. Slope of the waste pipe should be designed to transport wastewater at a rate that ensures solids are carried with the water through the piping system. If the flow is too fast, the water flows faster than the solids, which leaves the solids sitting in the pipe to create stoppage. If the water flows too slow, solids settle out and are left in the pipe to create stoppages. For this reason a velocity of two feet per second must be maintained. Velocities greater than ten feet per second can cause solids to separate from the wastewater, creating stoppages, causing excessive turbulence at manholes, and eventually eroding the sewer line. Building sewers that are three inches in diameter must have a fall of not less than $\frac{1}{4}$ inch per foot. Sewers larger than three inch in diameter must have a fall of not less than $\frac{1}{8}$ inch per foot. Establishing a grade line and then digging the trench to exactly this line ensures the proper fall.

2. Complete the CD-ROM AFQTP 3E4X1 Utilities, Version 1.0, Feb 00: *The Repair of Water & Wastewater Piping Systems*, for detailed instruction on how to establish trench grade & pipeline slope. ***Upon completion of the above-mentioned CD-ROM, properly establish a trench grade and a pipeline slope using the step-by-step procedures listed below.***

NOTE:

The review questions for this material are contained in the above-mentioned CD-ROM.

SAFETY:

PRIOR TO ANY EXCAVATION, YOU MUST OBTAIN CLEARANCE TO PREVENT INJURY OR DAMAGE TO ANY UNDERGROUND UTILITIES. COMPLETE AF FORM 103, BASE CIVIL ENGINEERING WORK CLEARANCE REQUEST, TO OBTAIN CLEARANCE.

SAFETY:

1. IN EXCAVATIONS OF TRENCHES, YOU NEED TO FOLLOW THESE SAFETY REQUIREMENTS:

1.1. BRACE AND SHORE OR STEP-OUT THE SIDES OF A TRENCH IN:

1.1.1. STABLE SOIL 5-FEET OR MORE IN DEPTH.

1.1.2. LOOSE SOIL 4-FEET OR MORE IN DEPTH.

1.2. PROVIDE ACCESS LADDERS THAT EXTEND AT LEAST 3-FEET ABOVE THE TRENCH SIDES AND NO MORE THAN 25-FEET APART.

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3. Fixed Beam Laser or Engineer's Transit. The best method used to grade/slope a trench/pipe is surveying with engineers' transit or fixed beam laser. An Engineering Journeyman will have to assist you when these methods are used. You provide the information on how much slope is required, and then the transit or fixed laser beam is used to shoot the correct grade. This method is more appropriate for larger projects, such as a long sewer main installation. For this reason we will focus this QTP on the two methods that is used in the field for repairs:

3.1. String line and line level.

3.2. Carpenter's level.

4. String Line and Line Level. The string line and line level method is commonly used because it is a relatively quick, simple, and inexpensive way to check for proper grade. The process involves stretching and leveling a string between stakes positioned along a trench. The discharge end is then lowered to the amount of grade required.

4.1. To perform this task, follow these steps:

Step 1: Drive stakes on each end of trench.

Step 2: Attach the string to both stakes and mark the location of the leveled string on the stakes at each end of the trench. Be sure to leave enough room between the line and the ground so that discharge end of the string can be lowered to the proper height.

Step 3: Measure the distance of the string between the two stakes, then multiply that distance by the proper pipe slope. For example, if the distance between the stakes is 50 feet, and the grade wanted is $\frac{1}{4}$ inch per foot, drop the lower end of the string $12\frac{1}{2}$ inches ($\frac{1}{4}$ inch x 50 = $12\frac{1}{2}$ inches).

NOTE:

Make every effort to prevent the string from moving out of position once it has been established.

Step 4: Mark the outlet end stake with the distance that was obtained on previous step. For example, if the distance was $12\frac{1}{2}$ inches, place a mark $12\frac{1}{2}$ inches below the level mark on the outlet stake.

Step 5: Determine what the required depth of the trench is and mark it on a grade stick.

NOTE:

The required depth of the trench must be below the frost line.

Step 6: Dig the trench using the grade stick as a standard for the depth. This is accomplished by matching the mark on the grade stick (or tape measure if used) with the sloped string along the trench. You will know that the trench is at the proper depth and slope when the grade stick is placed at any point in the trench and the mark always matches the established string slope.

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5. Carpenter's Level. Because of the time consuming nature of this method, it is best used on relatively shorter pipe runs. This method involves placement of the Carpenter's Level on the pipe at the high end; place a block of wood, corresponding in thickness to the grade required, under the low end of the level. When the air bubble is centered between the marks on the level, the pipe has the proper grade. To determine the proper slope of the pipe, the length of the level and the size of the pipe must be considered.

5.1. To perform this task, follow these steps:

Step 1: Start at the drain or inlet side of pipe. Smooth the bottom of the trench and lay down the pipe.

NOTE:

If using pipe that has bell and spigot type joints, dig holes beneath each hub so that the pipe lies flat and is supported only on its main body by the trench bed. This prevents stress on the joints.

Step 2: Attach a block of wood (with its thickness corresponding to the desired grade) under the low end of level. The block of wood may be secured with a **thin** piece of masking tape (or some other suitable adhesive) that will not significantly change its height. Place the level on the pipe at the high end and adjust the soil under the pipe until the air bubble on the level is centered. For example, if the level is 2 feet long and the pipe is 3 inches in diameter, the proper thickness of the block is 2 feet x $\frac{1}{4}$ inch, or $\frac{1}{2}$ inch.

NOTE:

This leveling procedure is done at random points along the pipeline.

ESTABLISH TRENCH GRADE/PIPELINE SLOPE

PERFORMANCE CHECKLIST

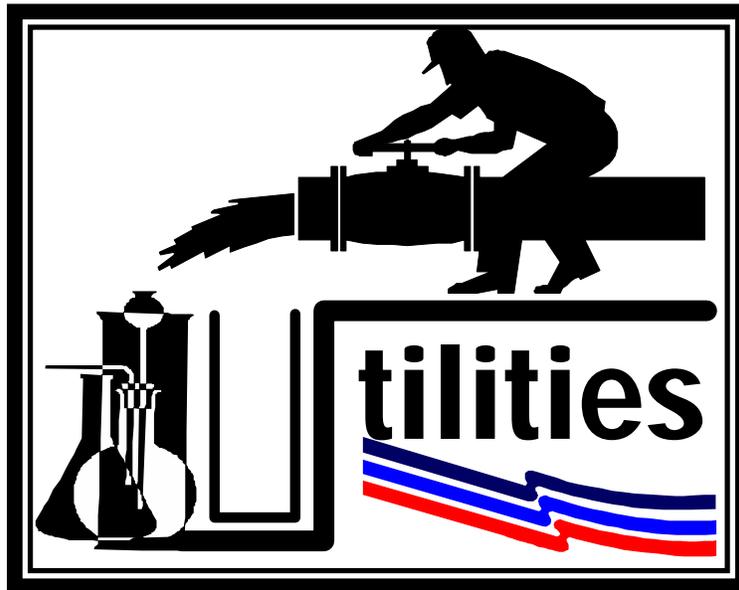
INSTRUCTIONS:

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. Identify methods to establish a trench grade/pipeline slope: 1.1. Engineers' transit or a fixed-beam laser 1.2. String line and line level 1.3. Carpenter's level		
2. Take proper safety precautions: 2.1. Obtained an approved AF Form 103 2.2. Shored /stepped-out trench 2.3. Provided access ladder		
3. Complete steps of establishing a trench grade/pipeline slope using the string line and line level: 3.1. Drove stakes on each end of trench 3.2. Attached the string to both stakes and marked the location of the leveled string on the stakes at each end 3.3. Measured the distance of the string between the two stakes, then multiplied that distance by the proper pipe slope 3.4. Determined what the required depth of the trench is and marked it on a grade stick 3.5. Excavated trench using the grade stick as standard for the depth 3.6. If using pipe that has bell and spigot type joints, did the trainee dig holes beneath each hub so that the pipe lies flat and is supported only on its main body by the trench bed		
4. Complete steps of establishing a trench grade and pipeline slope using the Carpenter's level: 4.1. Started at the drain or inlet side of pipe 4.2. Attached a block of wood (with its thickness corresponding to the desired grade) under the low end of level 4.3. Randomly check point on pipeline for proper grade 4.4. If using pipe that has bell and spigot type joints, did the trainee dig holes beneath each hub so that the pipe lies flat and is supported only on its main body by the trench bed		
5. Understand the theory of the five classes of bedding: 5.1. Class A-1 5.2. Class B 5.3. Class C-1 5.4. Class C 5.5. Class D		

FEEDBACK: Trainer 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.

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WASTEWATER SYSTEMS

MAINTAIN WASTEWATER SYSTEMS

MODULE 17

AFQTP UNIT 9

USE POWER AUGERS (17.9.1.1.3.)

USE POWER AUGERS
Task Training Guide

STS Reference Number/Title:	17.9.1.1.3., Open clogged or restricted drainage systems using power augers.
Training References:	1. Career Development Course (CDC) 3E451. 2. Manufacturers' Manuals.
Prerequisites:	1. Possess as a minimum a 3E431 AFSC. 2. Review the following references: 2.1. Manufacturer Manual. 2.2. CDC 3E451.
Equipment/Tools Required:	1. Power auger. 2. Working gloves. 3. Safety goggles.
Learning Objective:	Trainee will understand the operating procedures of a power auger.
Samples of Behavior:	Trainee will properly unclog restrictions using the power auger.
Notes:	
Any safety violation is an automatic failure.	

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USE POWER AUGERS

1. Background: The purpose of using power augers is to open exterior or relatively larger wastewater drain systems. There are many types of augers available to you as a Utilities Systems Journeyman. One type that you will often use in the field will be a power auger, used to unstop large waste lines. Each manufacturer will have specific guidelines on how to use their augers; however, here are some general steps for a basic power auger:

SAFETY:

1. YOU SHOULD ALWAYS:

- 1.1. USE GLOVES WHEN OPERATING A POWER AUGER.
- 1.2. CHECK ELECTRICAL CORD FOR DAMAGE BEFORE PLUGGING AUGER INTO AN OUTLET.
- 1.3. REMOVE ALL JEWELRY BEFORE OPERATING POWER AUGER.
- 1.4. WATCH FOR EXCESS SLACK IN CABLE WHILE OPERATING POWER AUGER.

NOTE TO SUPERVISOR/TRAINER:

The following steps **WILL NOT** supersede the manufacture's operating instructions for your power auger. Insert the manufacture instructions as needed. The following steps serves only to complete the core task "open clogged or restricted drainage systems using power augers."

2. *To clear wastewater drains using power augers follow these steps:*

Step 1: Gather required equipment (power auger, goggles, gloves, and steel toe boots).

Step 2: Plug auger into approved power source (check the cord and plug for damages).

Step 3: Loosen cable release.

Step 4: Remove cable from auger.

Step 5: Insert cable from auger into the opening of clogged or restricted drain.

Step 6: Tighten the automatic feed on auger. The automatic feed is used to feed and reverse the cable.

Step 7: Step on foot pedal and move feed lever to the forward position to allow auger cable to feed to open restriction.

Step 8: Once drain becomes free of the obstruction, put feed lever into the neutral position, then remove your foot from the pedal. Allow the auger to come to a complete stop.

Step 9: Move the feed lever to reverse position.

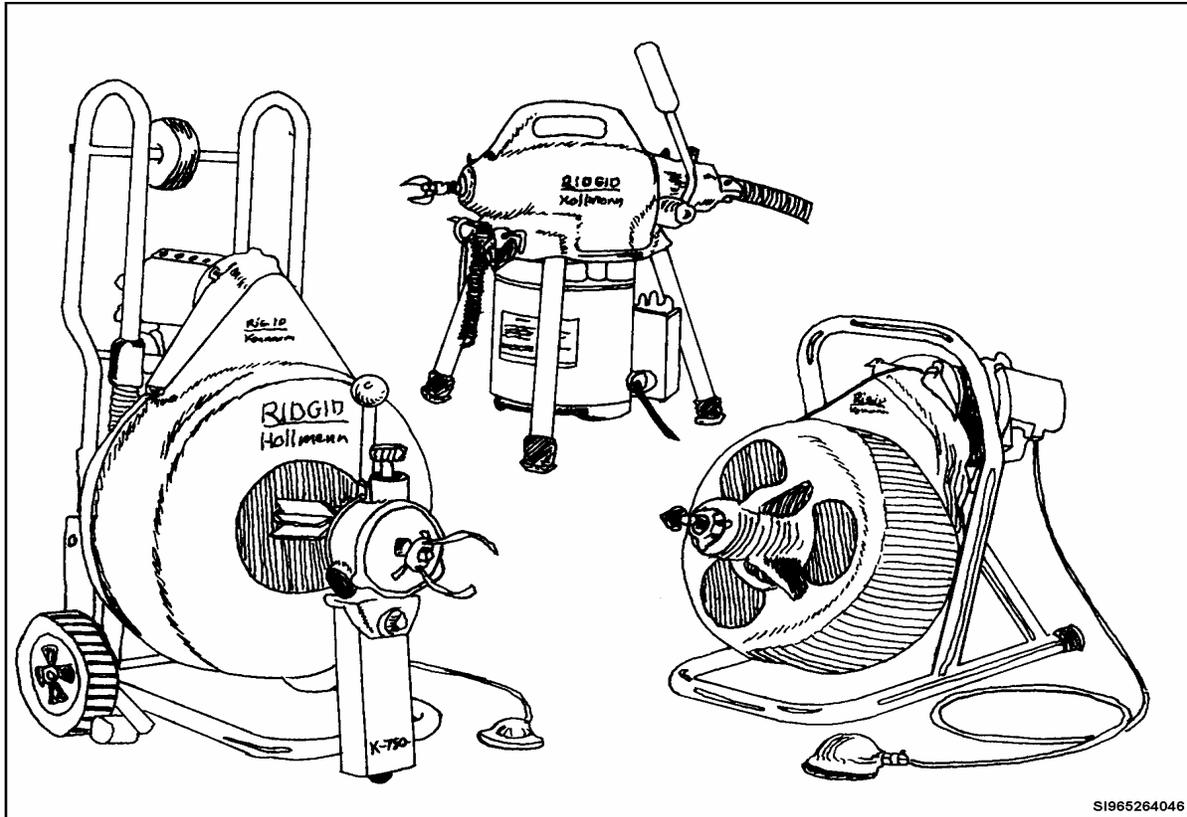
Step 10: Step on the foot pedal, this will retract cable from drain line.

Step 11: Flush line with water to ensure drain is free of obstruction.

Step 12: Cleanup work area and all equipment.

Step 13: Return equipment to Shop tool room.

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Figure 1. Types of Power Augers

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**REVIEW QUESTIONS
FOR
USE POWER AUGERS**

QUESTION	ANSWER
1. Power augers are used on what kind of clogged lines?	a. Large water lines. b. Exterior and larger waste lines. c. Small water lines. d. Small waste lines.
2. What is the feed lever used for?	a. To automatically feed the cable. b. To manually feed the cable. c. To automatically feed and reverse the cable. d. None of the above.
3. Before feeding the cable, what must you do first?	a. Tighten down automatic feed knob on auger. b. Tighten down manual feed knob on auger. c. Loosen the automatic feed knob on auger. d. Loosen the manual feed knob on auger.
4. Why do you want to keep excess cable to a minimum?	a. It may damage the cable and/or cause it to kink. b. Augers work better with a short cable. c. Excess cable extraction will prolong the augers life. d. None of the above.

USE POWER AUGERS

PERFORMANCE CHECKLIST

INSTRUCTIONS:

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

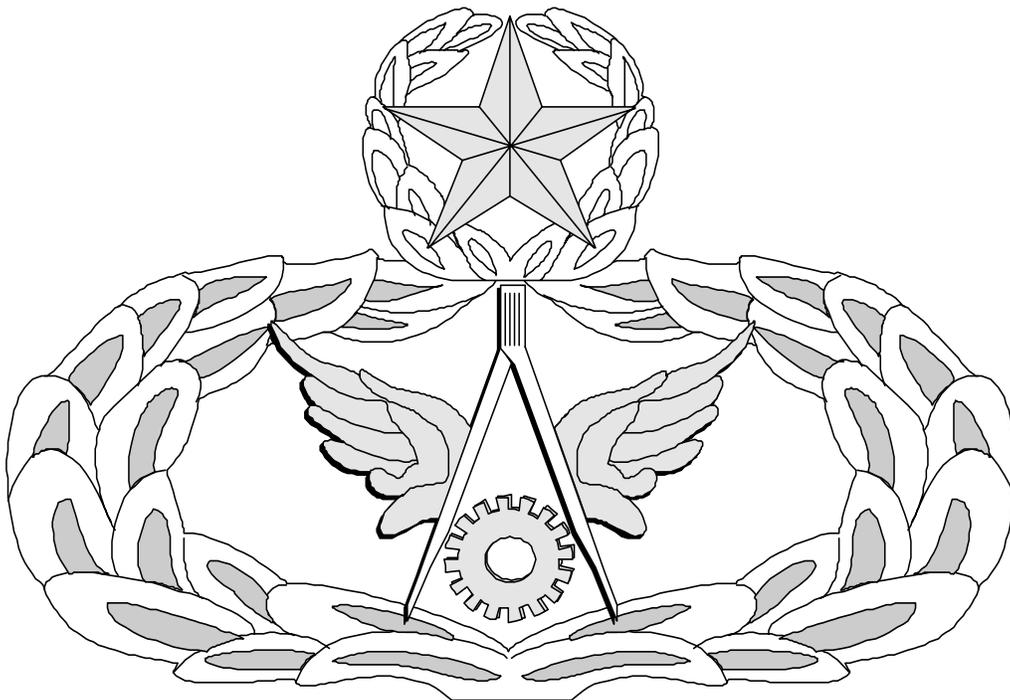
DID THE TRAINEE....?	YES	NO
1. Identify the usage for a power auger: 1.1. Unstop large waste lines		
2. Take proper safety precautions: 2.1. Don safety goggles. 2.2. Used gloves while operating power auger. 2.3. Checked electrical cord for damage. 2.4. Removed all jewelry before operating power auger. 2.5. Watched for excess cable while operating power auger.		
3. Operate the power auger correctly and open the clogged or restricted line: 3.1. Gathered required equipment (power auger, goggles, gloves, and steel toe boots). 3.2. Plugged auger into approved power source. 3.3. Loosened cable release. 3.4. Inserted cable from auger into the drain. 3.5. Started power auger by depression the foot pump. 3.6. Applied minimum force to feed cable. Avoided excessive force that would have damaged the cable and/or cause it to kink. 3.7. Stopped power auger once the obstruction was cleared. Ensured drain was clear, removed cable and stored away properly. 3.8. Flushed line with water to ensure drain is free of obstruction. 3.9. Cleaned-up work area and stored equipment.		

FEEDBACK: Trainer 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.

Air Force Civil Engineer

QUALIFICATION TRAINING PACKAGE (QTP)

REVIEW ANSWER KEY



FOR
UTILITIES SYSTEMS
(3E4X1)

MODULE 17
WASTEWATER SYSTEMS

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Key-1

**USE POWER AUGERS
(3E4X1-17.9.1.1.3.)**

QUESTION	ANSWER
1. Power augers are used on what kind of clogged lines?	b. Exterior or larger waste lines.
2. What is the feed lever used for?	c. To automatically feed and reverse the cable.
3. Before feeding the cable, what must you do first?	a. Tighten down automatic feed knob on auger.
4. Why do you want to keep excess cable to a minimum?	a. It may damage the cable and/or cause it to kink.

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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.

4. You may choose to call in your recommendations to DSN 523-6392 or FAX DSN/Commercial 523-6488 or (850) 283-6488 or email ceof.helpdesk@tyndall.af.mil.
5. Thank you for your time and interest.

YOUR NAME, RANK, USAF
Title/Position