# AIR FORCE
# QUALIFICATION TRAINING PACKAGE (AFQTP)

FOR

## UTILITIES SYSTEMS
## (3E4X1)

## MODULE 23

## FIXTURES AND RELATED COMPONENTS

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## FIXTURES AND RELATED COMPONENTS

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

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Supersedes AFQTP 3E4X1-22, 1 Oct 1999

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**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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# FIXTURES AND RELATED COMPONENTS

## REPLACE

**MODULE 23** **AFQTP UNIT 2**

## LAVATORIES (23.2.1.)

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## REPLACE LAVATORIES

## *Task Training Guide*

| | |
|---|---|
| **STS Reference Number/Title:** | 23.2.1., Replace lavatories. |
| **Training References:** | 1. Manufacturers Instruction.<br>2. Uniform Plumbing Code.<br>3. Career Development Course (CDC) 3E451, *Utilities Systems*. |
| **Prerequisites:** | 1. **Possess as a minimum a 3E431 AFSC.**<br>2. **Review the following references:**<br>2.1. Uniformed Plumbing Code.<br>2.2. CDC 3E451.<br>2.3. Manufacturers Instructions. |
| **Equipment/Tools Required:** | 1. Replacement lavatory w/appurtenances.<br>2. Basic plumbing tool kit.<br>3. Bucket.<br>4. Rags.<br>5. Plumber's putty.<br>6. Larger pipe cutter with pipe reamer.<br>7. Small pipe cutter. |
| **Learning Objective:** | Replacing lavatory using manufacturers instructions furnished with the fixture. |
| **Samples of Behavior:** | Trainee will be able to replace a lavatory. |
| **Notes:** | |
| 1. Steps will be followed in sequence as needed.<br>2. Any safety violation is an automatic failure. | |

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## REPLACE LAVATORIES

**1. Background:** Lavatories are available in different shapes and sizes. The four basic types are wall hung, countertop, trough, and pedestal. The installation of the different types of lavatories will vary according to the manufacturer's specifications. However, the minimum diameter for the lavatory drain is 1 ¼ inch.

**SAFETY:**

**WHEN REPLACING THESE FIXTURES IT IS NECESSARY TO WEAR PROTECTIVE EQUIPMENT SUCH AS EYE PROTECTION AND GLOVES. IN ADDITION, HELP MAY BE NEEDED TO LIFT THE LAVATORY OFF/ON TO THE MOUNTING BRACKETS. REMEMBER TO REFER TO THE MANUFACTURER'S SPECIFICATIONS PRIOR TO THE INSTALLATION FOR ANY OTHER SAFETY RECOMMENDATIONS.**

**1.1.** The **wall-hung** lavatory is used extensively. A wall-hung lavatory may be enclosed in a cabinet to give a vanity effect and add storage to the bathroom. A wall-hung lavatory will contain a wall mount or special hanging brackets to secure the fixture to the wall. Brass screws fasten the hanger to a 2 x 6-inch board nailed securely between two studs at a height recommended by the manufacturer. The lip height of a lavatory is usually 31 inches from the finished floor, unless otherwise specified by the manufacturer.

**1.2.** The **countertop** lavatory (also called flat rim) is widely used in hotels and private homes. The most popular trend in lavatories is the built-in or vanity design. This type of lavatory may come as a complete unit or installed in a vanity or cabinet. The lavatory is secured in place by retaining clips. Make sure manufacturer's recommendations are followed.

**1.3.** The **trough** and **pedestal** lavatories are not as popular as the flat-rim and wall-hung. The trough lavatory is mainly for industrial or commercial use. Pedestal lavatories are bolted or cemented to the floor. The drain for pedestal lavatories passes through the floor instead of the wall. Pedestal type lavatories are being replaced, because of the S-traps used with this fixture.

**NOTE:**

Remember to refer to the manufacturer's specifications for assistance prior to installation.

**2. <u>Replacement Of Lavatories</u>.**

**2.1.** ***To perform this task, follow these steps:***

**Step 1: Gather required tools and materials to replace lavatory.**

**Step 2: Turn off hot and cold water at the supply valves.**

**Step 3: Turn on faucet(s) to drain the pipes.**

**Step 4: With an adjustable wrench, loosen the coupling nuts that hold the riser tubes to the valves.** Place bucket underneath the valves to catch any water that left in the lines.

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**Step 5: With a Smooth Jaw adjustable wrench or Ford (Monkey) wrench loosen the coupling nuts on the P-trap.** Again, place the bucket underneath the P-trap to catch the water from the pipe.

**Step 6: Loosen the screws on the hanger (if wall-hung) or remove the retaining clips (if it a countertop), then lift the lavatory from the bracket or countertop and place it on the floor.**

**SAFETY:**
**ACCORDING TO THE TYPE/SIZE OF THE LAVATORY, YOU MAY NEED HELP IN REMOVING IT FROM THE BRACKET OR COUNTERTOP.**

**Step 7: Remove the water supply lines, faucet and drain tailpipe from the old sink, and clean off the plumbers putty with a putty knife and rag.** (If the replacement sink has new hardware, you can skip this step.)

**Step 8: Install drain tailpiece on the fixture.**

**8.1.** Use plumber's putty and hand tools.

**8.2.** Apply plumbers putty to the underside of the tailpiece flange.

**8.3.** Insert tailpiece into the lavatory opening.

**8.4.** Place a cone washer on the tailpiece and install a locknut.

**Step 9: Install faucet on the fixture.**

**9.1.** Place the rubber gasket on the underside of the faucet.

**9.2.** Place the faucet on the top of the lavatory and insert it through the lavatory opening.

**9.3.** Secure the faucet to the lavatory using lock washers and lock nuts.

**Step 10: Reinstall lavatory on to the hanger bracket or on top of the countertop. Retighten screws or reinstall retaining clips.**

**10.1.** Bracket Mount: Ensure that the lavatory is centered and you have the right lip height.

**10.2.** Countertop: Ensure that the lavatory is centered.

**SAFETY:**
**ACCORDING TO THE TYPE/SIZE OF THE LAVATORY, YOU MAY NEED HELP IN SETTING IT ON THE BRACKET OR COUNTERTOP.**

**Step 11: Reinstall P-trap to complete the fixture drain.**

**11.1.** Use a Ford (Monkey) wrench or

**11.2.** Smooth Jaw adjustable wrench

**Step 12: Reinstall water supply lines.**

**12.1.** Use wrenches and a basin wrench to tighten the compression joints.

**Step 13: Turn on water supply.**

**Step 14: Perform visual inspection of water supply lines and drain for leaks.**

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**Step 15: Tighten fittings if leaks are found.**

**Step 16: Remove aerator to remove dirt, rust, and debris if required.**

**Step 17: Reinstall aerator.**

**Step 18: Clean work area.**

**Step 19: If it a countertop lavatory, caulk around it to prevent water from leaking under the lavatory.**

**Step 20: Put up equipment and supplies.**

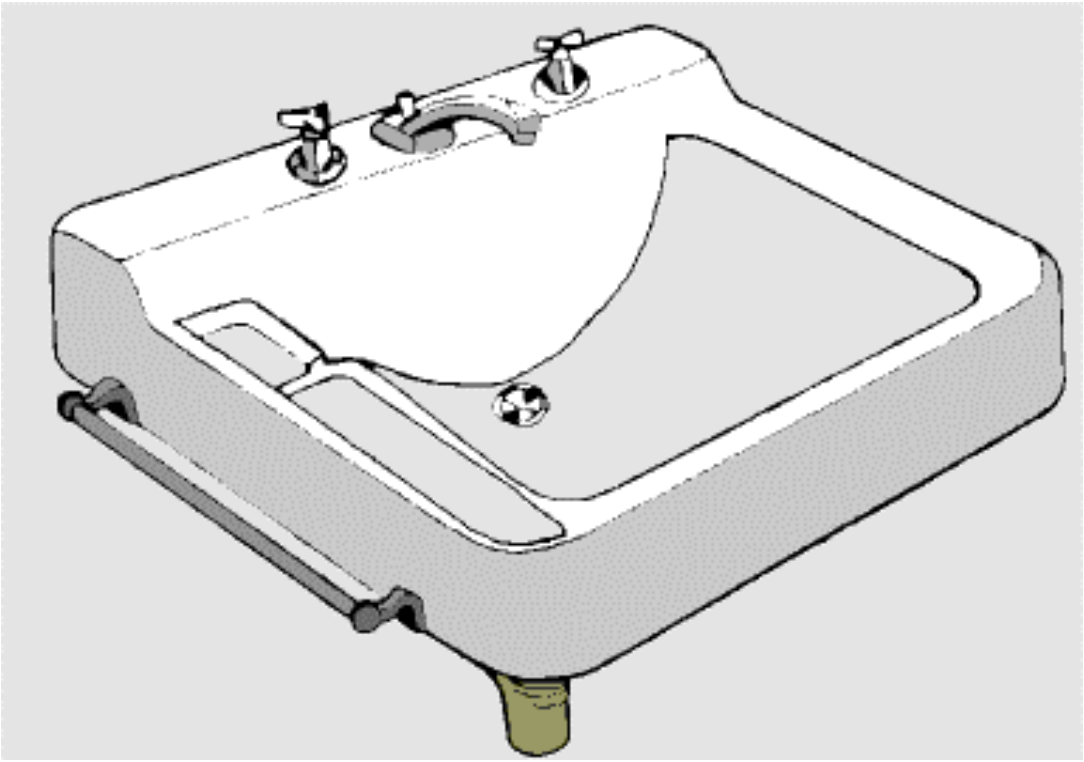

**Figure 1. Example of a Wall-hung Lavatory**

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# REVIEW QUESTIONS
# FOR
# REPLACE LAVATORIES

| QUESTION | ANSWER |
|---|---|
| 1. What should you follow before replacing a lavatory? | a. CDCs.<br>b. Manufacturer's Surveys.<br>c. Manufacturer's Specifications.<br>d. All of the above. |
| 2. Which lavatory is secured by retaining clips? | a. Countertop.<br>b. Pedestal.<br>c. Trough.<br>d. All of the above. |
| 3. 1 ½ inch is the minimum size for a lavatory drain. | a. True.<br>b. False. |
| 4. Which lavatory contains an "S"-trap? | a. Countertop.<br>b. Pedestal.<br>c. Trough. |
| 5. What is the minimum height of a wall hung lavatory? | a. 28 inches.<br>b. 30 inches.<br>c. 31 inches.<br>d. 33 inches. |

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## REPLACE LAVATORIES

## 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 all the material needed for the job | | |
| 2. Take proper safety precautions | | |
| 3. Turn off the water supply lines | | |
| 4. Turn on the faucet(s) to drain lines | | |
| 5. Uninstall/reinstall water supply lines correctly | | |
| 6. Correctly uninstall/reinstall P-trap to complete the fixture drain | | |
| 7. Remove/replace the lavatory safely | | |
| 8. Remove/install faucet correctly | | |
| 9. Visual inspection supply lines and drain for leaks | | |
| 10. Tighten fittings if leaks were found | | |
| 11. Remove and reinstall aerator | | |
| 12. Clean up tools and work area | | |
| 13. Complete all the questions in AFQTP:<br>13.1. Score 80% or higher<br>13.2. Trainer review and explain all missed questions | | |

**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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# FIXTURES AND RELATED COMPONENTS

## REPLACE

**MODULE 23** **AFQTP UNIT 2**

## WATER CLOSETS (23.2.2.)

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## REPLACE WATER CLOSETS

## *Task Training Guide*

| | |
|---|---|
| **STS Reference Number/Title:** | 23.2.2., Replace water closets. |
| **Training References:** | 1. Manufacturers Instruction.<br>2. Uniform Plumbing Code.<br>3. Career Development Course (CDC) 3E451, *Utilities Systems*. |
| **Prerequisites:** | 1. **Possess as a minimum a 3E431 AFSC.**<br>2. **Review the following references:**<br>2.1. Uniformed Plumbing Code.<br>2.2. CDC 3E451.<br>2.3. Manufacturers Instructions. |
| **Equipment/Tools Required:** | 1. Water closet.<br>2. Basic plumbing tool kit.<br>3. Water closet components.<br>4. Wax ring(s).<br>5. Flexible supply.<br>6. Toilet Paper.<br>7. Bucket.<br>8. Rags. |
| **Learning Objective:** | Replacing water closet using manufacturers instructions furnished with the fixture. |
| **Samples of Behavior:** | Trainee will be able to replace/install a water closet. |
| **Notes:** | |
| 1. Steps will be followed in sequence.<br>2. Any safety violation is an automatic failure. | |

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## REPLACE WATER CLOSETS

**1. Background:** There are two basic styles of water closets commonly used on Air Force installations, the wall-hung and the floor mounted. Two different flushing devices are also associated with the water closet. The first one is the flushometer type flush valve and the second is the tank type. The tank type is used in residences because it is not as noisy as a flushometer and does not require a larger supply line. To support the wall-hung water closet, either a horizontal or vertical chair carrier is used. This adjustable combined fitting and chair carrier permits each wall-hung closet to be set at a uniform height from the floor when installed in a battery of similar fixtures. Although wall-hung water closets are used, the most commonly used by the Air Force is the floor mounted.

**NOTE:**
Due to the many different makes and models of water closets, always refer to the manufacturer's instructions and specifications furnished with the fixture.

**SAFETY:**
**ALL PERSONNEL WILL WEAR PROTECTIVE EQUIPMENT DURING THE INSTALLATION OF THE WATER CLOSET. IF YOU ARE TO LEAVE THE AREA FOR AN EXTENDED PERIOD OF TIME YOU NEED TO SEAL OFF THE OPENING TO THE DRAIN LINE WITH A RAG OR WAD OF TOILET PAPER, THIS WILL PREVENT HARMFUL SEWER GASES FROM ESCAPING INTO THE WORK AREA.**

**2. Replacement Of Water Closet.**

**2.1.** ***To perform this task, follow these steps:***

**Step 1: Gather needed parts and proper hand tools.**

**Step 2: Turn off water at the supply valve.**

**Step 3: Push and hold down the trip lever to drain the tank.**

**Step 4: With an adjustable wrench, loosen the coupling nuts that hold the riser tube to the ballcock.** Place bucket underneath the ballcock to catch any water that left in the tank.

**Step 5: With a Smooth Jaw adjustable wrench or Ford (Monkey) wrench remove the nuts on the closets bolts. Then lift the water closet off the bolts and place a rag in the horn (outlet) opening.**

**SAFETY:**
**YOU MAY NEED HELP IN REMOVING THE WATER CLOSET FROM THE BOLTS.**

**Step 6: Remove the old wax ring/wax and closet bolts from the closet flange.**

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**Step 7: Check floor to insure that it is level.**

**7.1.** If the floor is not level or if the floor has been raised above the top of the closet flange, use two wax rings.

**Step 8: To prevent scratching the bowl, invert it and place it on a piece of wood or paper.**

**8.1.** Do not drop the bowl, as it is *FRAGILE.*

**Step 9: Firmly place the wax ring around the horn (outlet) of the water closet.**

**Step 10: Secure closet bolts provided to the flange.**

**Step 11: Turn bowl over and carefully line up the holes in the bowl with the closet bolts.**

**11.1.** Carefully set bowl into place.

**Step 12: Rock bowl gently to seal bowl onto flange.**

**12.1.** This will ensure that the wax ring seals to the bowl and to the flange.

**HINT:**

Do not over tighten any parts on the bowl or tank, they will crack or break easily. It is better to fix a leak than buy a new commode and tank.

**Step 13: Slowly tighten the nuts alternately but do not over-tighten.**

**13.1.** Over-tightening the nuts will crack the bowl.

**13.2.** You are now ready to attach tank or flushometer to water closet bowl.

**NOTE:**

If water closet is a flushometer kind refer to the manufacturer instructions for flushometers and perform Steps 9, 17, and 20. If water closet is a tank type water closet, go to Step 10.

**Step 14: Install the flush valve.**

**14.1.** Place the cone washer on the bottom of the valve.

**14.2.** Insert the valve through the tank and secure with the locknut.

**HINT:**

Flush valves differ from manufacturer; see specifications sheets for proper installation procedures.

**Step 15: Install ballcock assembly into tank.**

**15.1.** Install a cone washer on the bottom of the ballcock.

**15.2.** Insert the ballcock through the tank and secure to the tank with the lock nut.

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**HINT:**
Ball cock valves will differ from manufacturer to manufacturer. See specification sheets for proper installation procedures.

**Step 16: Ensure the hush tub is installed.**

**Step 17: Screw the float rod and ball into the top of the ballcock.**

**Step 18: Connect water supply to the ballcock.**

**Step 19: Install the trip handle.**

**19.1.** Remember that it has reverse threads.

**Step 20: Connect lift arm to the flapper with a chain.**

**Step 21: Make sure the tank gasket (doughnut gasket) fits the opening of the bowl.**

**21.1.** The doughnut gasket should be placed on the flush valve protruding through the bottom of the tank.

**Step 22: Attach tank to bowl with tank bolts provided, inserting them through the holes in the tank.**

**22.1.** The bolts should come with rubber seals to seal the interior and exterior openings on the tank.

**Step 23: Alternate the tightening of nuts to insure that the tank will be level.**

**Step 24: Turn on water supply and test for leaks and proper operation.**

**Step 25: Caulk around the base of the closet bowl to prevent water from leaking under the bowl.**

**Step 26: Remove old water closet and clean up area.**

**Step 27: Put away equipment.**

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## REVIEW QUESTIONS
## FOR
## REPLACE WATER CLOSETS

| QUESTION | ANSWER |
|---|---|
| 1. What two kinds of water closets are there? | a. Wall-hung and floor mounted.<br>b. Floor-hung and wall mounted.<br>c. Corner mounted.<br>d. None of the above. |
| 2. Which is the most commonly used water closet on Air Force installations? | a. Floor mounted.<br>b. Floor-hung.<br>c. Wall mounted.<br>d. Wall-hung. |
| 3. What should you always refer to when installing a water closet? | a. Self-help literature.<br>b. Manufacturers brochures.<br>c. Manufacturers specifications.<br>d. Any of the above. |
| 4. What may be needed if the floor has been raised above the top of the closet flange? | a. The first wax ring.<br>b. A second wax ring.<br>c. A third wax ring.<br>d. A fourth wax ring. |
| 5. How do you seal the wax ring to the flange? | a. Rock closet bowl gently.<br>b. Rock closet bowl firmly.<br>c. Use a rubber mallet.<br>d. Use a 5lb. ball-peen hammer. |
| 6. Why should you never over tighten nuts on a bowl? | a. The nut will strip.<br>b. The bolt will strip.<br>c. The water closet will crack.<br>d. You can never over tighten bowl nuts. |
| 7. Where do you hook up the water supply? | a. To the bowl.<br>b. To the ballcock assembly.<br>c. To the effluent valve.<br>d. To the influent valve. |

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## REPLACE WATER CLOSETS

## 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 which type of water closet to replace | | |
| 2. Identify all the equipment needed for the job:<br>2.1. Closet bowl.<br>2.2. Closet tank.<br>2.3. Ballcock assembly.<br>2.4. Doughnut gasket.<br>2.5. Flush valve.<br>2.6. Toilet Paper.<br>2.7. Wax ring.<br>2.8. Lift arm. | | |
| 3. Take proper safety precautions | | |
| 4. Know the different types of flushing devices | | |
| 5. Complete job with no leaks:<br>5.1. Gather needed parts and proper hand tools.<br>5.2. Check floor to insure that it is level.<br>5.3. Firmly place the wax ring around the horn of the water closet.<br>5.4. Secure closet bolts provided to the flange.<br>5.5. Turn bowl over line up the holes in the bowl with the closet bolts.<br>5.6. Rock bowl gently to seal bowl onto flange.<br>5.7. Tighten the nuts alternately but do not over-tighten.<br>5.8. Install the flush valve.<br>5.9. Install ballcock assembly into tank.<br>5.10. Connect water supply to the ballcock.<br>5.11. Install trip lever.<br>5.12. Connect lift arm to flush valve assembly.<br>5.13. Make sure the doughnut gasket aligns with the opening of the bowl.<br>5.14. Attach tank to bowl with tank bolts provided.<br>5.15. Alternate the tightening of nuts to insure that the tank will be level.<br>5.16. Turn on water supply and test for leaks and proper operation.<br>5.17. Clean up area.<br>5.18. Put away equipment. | | |
| 6. Complete all the questions in AFQTP:<br>6.1. Score 80% or higher.<br>6.2. Trainer review and explain all missed questions | | |

**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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# FIXTURES AND RELATED COMPONENTS

## REPAIR

**MODULE 23** **AFQTP UNIT 3**

## WATER CLOSETS COMPONENTS (23.3.1.)

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## REPAIR WATER CLOSET COMPONENTS

### *Task Training Guide*

| | |
|---|---|
| **STS Reference Number/Title:** | 23.3.1., Repair water closet components. |
| **Training References:** | 1. Manufacturers Instruction.<br>2. Uniform Plumbing Code and Illustration.<br>3. Career Development Course (CDC) 3E451, *Utilities Systems*. |
| **Prerequisites:** | 1. **Possess as a minimum a 3E431 AFSC.**<br>2. **Review the following references:**<br>2.1. Uniformed Plumbing Code.<br>2.2. CDC 3E451.<br>2.3. Manufacturers Instructions. |
| **Equipment/Tools Required:** | 1. General plumbing hand tools.<br>2. Water closet components. |
| **Learning Objective:** | Repairing/replacing water closet components. |
| **Samples of Behavior:** | Trainee will understand the procedures for repairing/replacing water closet components. |
| **Notes:** | |
| 1. Steps will be followed in sequence as needed.<br>2. Any safety violation is an automatic failure. | |

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## REPAIR WATER CLOSET COMPONENTS

**1. Background:** There are many types of float-controlled valves, but most of them work on the same principle as the one used in a water closet tank to automatically control the water. Float-controlled valves are often called float valves (See Figure 1). There are many different float controlled valves used today one type is the flush-ball valve, which may be called a Douglas valve. Another type is the traditional plunger-valve. There are also float cup ballcocks (also know as a Fluidmaster); and floatless ballcocks.

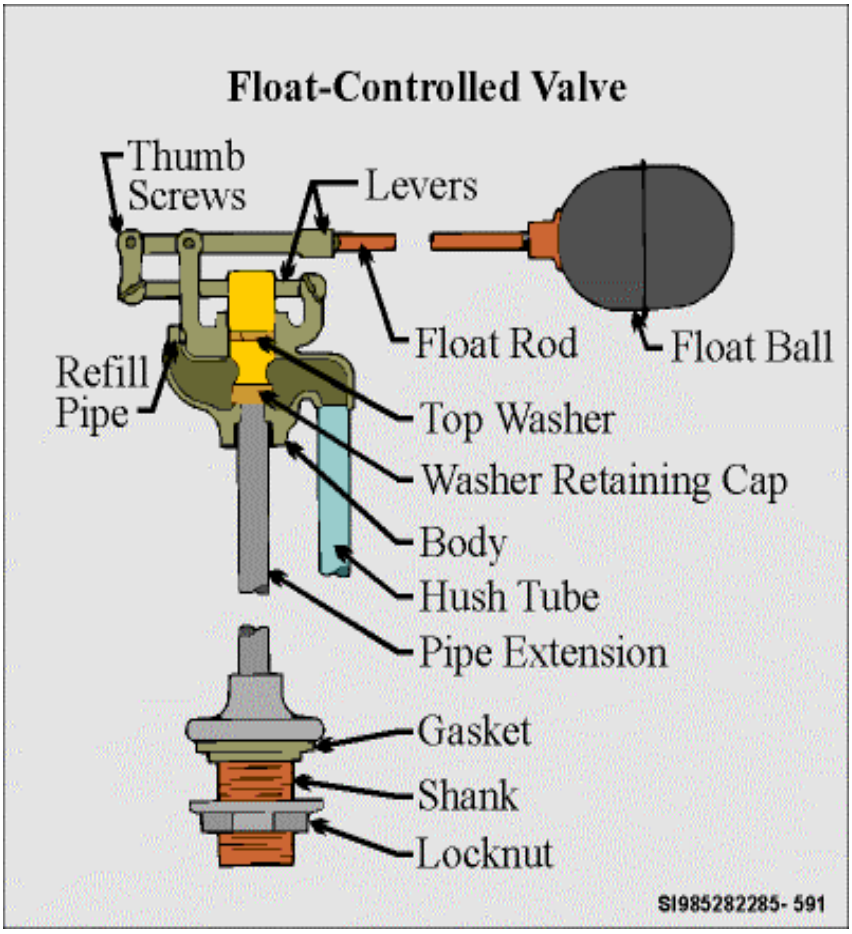


**Figure 1. Float Controlled Valve**

> **NOTE:**
> Douglas Valve and Fluidmaster are two popular manufacturer name brands

**1.1.** No matter what type of valve is used in a water closet, all will have a handle, trip lever, valve seat, and an overflow tube. You will experience similar and dissimilar problems associated with different types of water closet valves, such as loose handles, lever adjustments, worn washers, and cracked or broken float balls, and worn out flappers.

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**HINT:**
Remember to follow manufacturer's recommendations or specification.

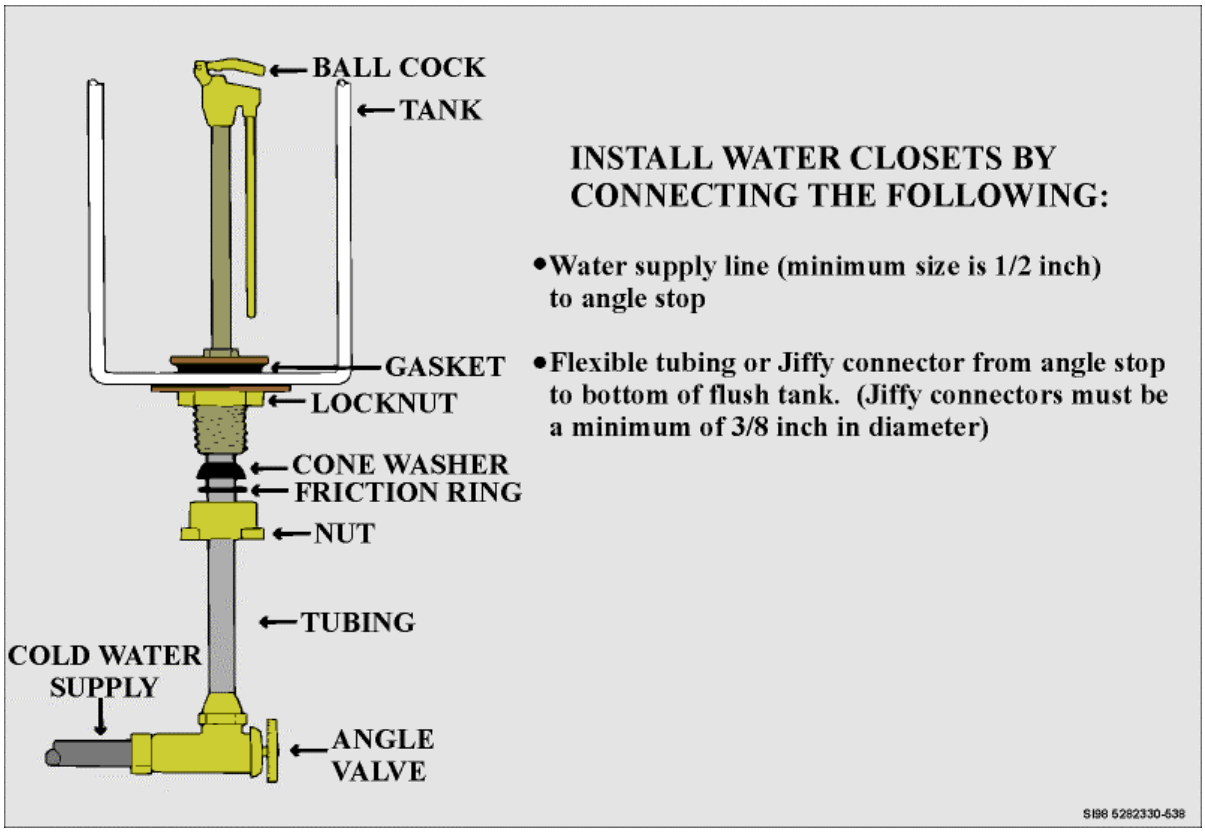


**Figure 2. Ball Cock Assembly**

**2. <u>Repair Of Water Closet Components</u>.** (See Figure 2.)

**2.1. Traditional Plunger-Valve and Diaphragm Ballcocks.** The water flow is controlled by a plunger attached to the float arm and ball. To lower the water level, bend the float arm down slightly. Raise the water level by bending the float arm up.

**2.2. Float cup Ballcocks.** These are made of plastic. Lower and raise the water level by pinching the spring clip on the pull down rod and move it upward or downward.

**2.3. Floatless Ballcocks.** These are controlled by a pressure-sensing device. Lower and raise the level by adjusting the plastic screw clockwise or counter- clockwise.

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**HINT:**

To save precious man-hours it may be feasible to replace water components (i.e. float valves, overflow tubes, lever assemblies, etc.) rather than trying to repair these components.

**2.4. Loose or Broken Handles.** Clean and adjust the handle so that it operates smoothly. If satisfactory results are not met, replace the handle.

**NOTE:**

Water continuously running could be caused by the chain being improperly adjusted, a worn flapper valve, debris lodged in the float valve, or the ballcock assembly top washer or plunger being worn out. (See Figure 3.)

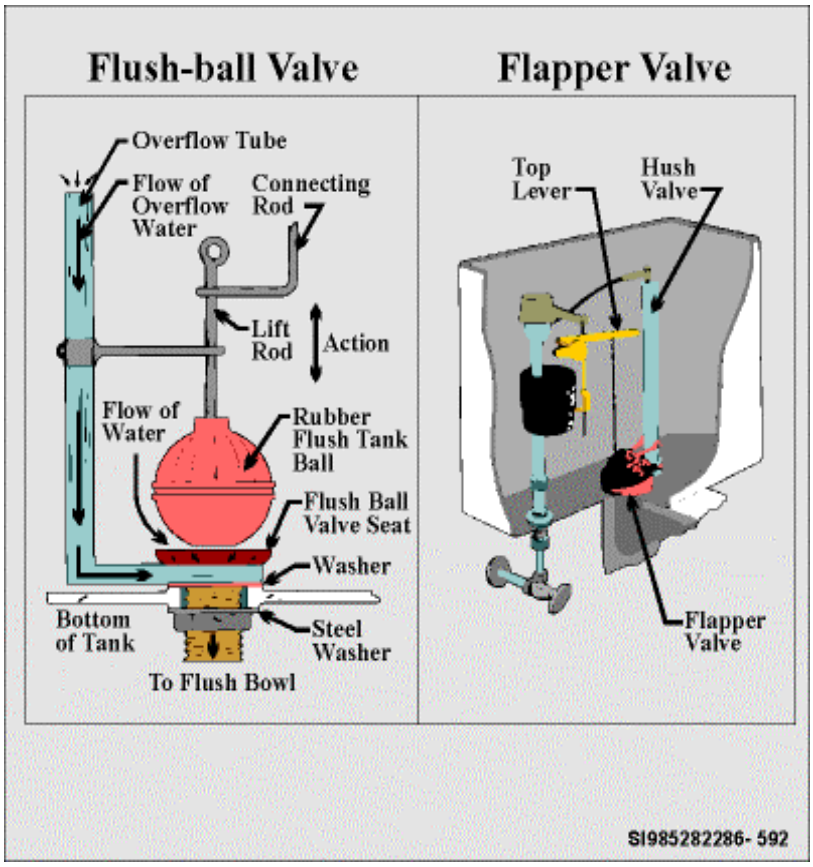


**Figure 3. Sample of Water Closet Components**

**3. Adjusting Lift Chain.**

**3.1.** ***To perform this task, follow these steps:***

**Step 1: Adjust the lift chain so it hangs straight from the handle lever with about ½ inch of slack.**

**Step 2: Remove excess slack in the chain by hooking it in a different hole in the handle lever or by removing links.**

**Step 3: Adjust so the tank float operates smoothly.**

**Step 4: Inspect for proper operation.**

**Step 5: Clean up area and tools.**

**4. Replacing The Flapper Valve.**

**4.1.** ***To perform this task, follow these steps:***

**Step 1: Shut off the water supply.**

**Step 2: Drain water from the tank of the water closet.**

**Step 3: Remove the flapper valve. (Use manufacturer's instructions.)**

**Step 4: Install new flapper valve. (Use manufacturer's instructions.)**

**Step 5: Turn on supply and let the closet tank fill.**

**Step 6: Check for leaks and proper operation.**

**Step 7: Clean up area and tools.**

**5. Removing Debris In The Ballcock Assembly.**

**5.1.** ***To perform this task, follow these steps:***

**Step 1: Shut off supply.**

**Step 2: Remove float ball and float rod from the ballcock assembly.**

**Step 3: Remove the top cover of the ballcock assembly.**

**3.1.** Remove screws and lift the cover off.

**Step 4: Remove the top washer and plunger.**

**Step 5: Crack open angle valve to flush out debris.**

**Step 6: Reinstall top washer and cover.**

**Step 7: Reinstall float rod and float ball.**

**Step 8: Turn on supply and check for proper operation.**

**Step 9: Clean up area and tools.**

**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.

**6. Replacing Ballcock Assembly Washer And Plunger.**

> **NOTE:**
> Always follow the manufacturer's instructions and use replacement parts from the manufacturer of the components you are working on.

**6.1.** ***To perform this task, follow these steps:***

**Step 1: Shut off supply.**

**Step 2: Remove float ball and float rod from the ballcock assembly.**

**Step 3: Remove the top cover of the ballcock assembly.**

**3.1.** Remove screws and lift the cover off.

**Step 4: Remove top washer and plunger.**

**Step 5: Inspect for wear or tears in the top washer.**

**Step 6: Inspect the plunger for deterioration.**

**Step 7: Replace with washer or plunger from the manufacturer's repair kit.**

**Step 8: Reinstall cover.**

**Step 9: Reinstall float rod and float ball.**

**Step 10: Turn o n supply and check for proper operation.**

> **NOTE:**
> The water level should be approximately 1-inch below the top of the overflow tube.

**Step 11: Clean up area and tools.**

**7. Replacing Cone Washers.**

> **HINT:**
> Worn cone washes normally cause leaks, which occur at the exterior of the tank. The two areas where worn cone washes may be found are at the exterior of the tank at the base of the ballcock assembly. Run your fingers along the washer's material and if any of the washer comes apart on your fingertips, the washer needs to be replaced.

**7.1.** ***To perform this task, follow these steps:***

**Step 1: Shut off supply.**

**Step 2: Drain the closet tank.**

**Step 3: Remove supply line from ballcock assembly.**

**Step 4: Remove lock nut using a smooth jaw adjustable wrench.**

**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.

**Step 5: Remove ball-cock assembly.**

**Step 6: Remove and replace the cone washer.**

**6.1.** Use replacement washer from manufacturer's repair kit.

**Step 7: Reinstall lock nut.**

**Step 8: Reinstall supply line to ballcock assembly.**

**Step 9: Check for leaks and proper operation.**

**Step 10: Clean up area and tools.**

**8. Replacing Doughnut Gasket/Cone Washer On The Flush Valve.**

> **HINT:**
> Water leaking on the underside of the tank between the tank and the closet bowl could be caused by one of two things. The first is a worn doughnut gasket, and the second is a worn cone washer on the flush valve.

**8.1.** ***To perform this task, follow these steps:***

**Step 1: Drain the closet tank.**

**Step 2: Remove tank bolts.**

**Step 3: Remove tank from closet bowl.**

**Step 4: Remove doughnut gasket and inspect for wear.**

**4.1.** If it is worn replace with gasket from manufacturers repair kit.

**Step 5: Remove lock nut from flush valve.**

**Step 6: Remove flush valve.**

**Step 7: Inspect flush valve cone washer.**

**7.1.** If it is worn replace with cone washer from manufacturer's repair kit.

**Step 8: Reassemble components in reverse order.**

**Step 9: Turn on supply.**

**Step 10: Check for leaks and proper operation.**

**Step 11: Clean up area and tools.**

**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.

## REVIEW QUESTIONS
## FOR
## REPLACE WATER CLOSET COMPONENTS

| QUESTION | ANSWER |
|---|---|
| 1. What other name(s) is a float-controlled valve known by? | a. Ballcock.<br>b. Check/Gate.<br>c. Pressure/lift.<br>d. All of the above. |
| 2. What must you follow when repairing water closet components? | a. Plumber's Journal.<br>b. Common sense.<br>c. Manufacturer's instructions.<br>d. All of the Above. |
| 3. What closet tank component could cause a leak between the closet tank and the bowl? | a. Doughnut gasket.<br>b. Seal.<br>c. Cone washer.<br>d. Both a and c. |
| 4. How much slack should be left on the lift chain? | a. ¼".<br>b. ½".<br>c. ¾".<br>d. 1". |

**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.

## REPLACE WATER CLOSET COMPONENTS

## 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. Correctly identify all water closet components | | |
| 2. Adjust flushing levers, and chain levers following the steps in the AFQTP:<br>2.1. Adjust the lift chain so it hangs straight from the handle lever with about ½ inch of slack<br>2.2. Remove excess slack in the chain by hooking it in a different hole in the handle lever or by removing links<br>2.3. Adjust so the tank float operates smoothly<br>2.4. Inspect for proper operation<br>2.5. Clean up area and tools | | |
| 3. Replace the flapper valve following the steps in the AFQTP:<br>3.1. Shut off the water supply<br>3.2. Drain water from the tank of the water closet<br>3.3. Remove the flapper valve<br>3.4. Install new flapper valve<br>3.5. Turn on supply and let the closet tank fill<br>3.6. Check for leaks and proper operation<br>3.7. Clean up area and tools | | |
| 4. Remove debris in the ballcock assembly following the steps in the AFQTP:<br>4.1. Shut off supply<br>4.2. Remove float ball and float rod from the ballcock assembly<br>4.3. Remove the top cover of the ballcock assembly<br>4.4. Remove the top washer and plunger<br>4.5. Crack open angle valve to flush out debris<br>4.6. Reinstall top washer and cover<br>4.7. Reinstall float rod and float ball<br>4.8. Turn on supply and check for proper operation<br>4.9. Clean up area and tools | | |
| 5. Replace the ballcock assembly washer and plunger following the steps in the AFQTP:<br>5.1. Shut off supply.<br>5.2. Remove float ball and float rod from the ballcock assembly.<br>5.3. Remove the top cover of the ballcock assembly.<br>5.4. Remove top washer and plunger.<br>5.5. Inspect for wear or tears in the top washer.<br>5.6. Inspect the plunger for deterioration.<br>5.7. Replace with washer or plunger from the manufacturer's repair kit.<br>5.8. Reinstall cover.<br>5.9. Reinstall float rod and float ball.<br>5.10. Turn on supply and check for proper operation.<br>5.11. Clean up area and tools. | | |

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**PERFORMANCE CHECKLIST (Continued)**

| DID THE TRAINEE….? | YES | NO |
|---|---|---|
| 6. Replace the cone washer following the steps in the AFQTP:<br>6.1. Shut off supply<br>6.2. Drain the closet tank<br>6.3. Remove supply line from ballcock assembly<br>6.4. Remove lock nut using a smooth jaw wrench<br>6.5. Remove ballcock assembly<br>6.6. Remove and replace the cone washer<br>6.7. Reinstall lock nut<br>6.8. Reinstall supply line to ballcock assembly<br>6.9. Check for leaks and proper operation<br>6.10. Clean up area and tools | | |
| 7. Replace the doughnut gasket and cone washer following the steps in the AFQTP:<br>7.1. Clean up area and tools<br>7.2. Drain the closet tank<br>7.3. Remove tank bolts<br>7.4. Remove tank from closet bowl<br>7.5. Remove doughnut gasket and inspect for wear<br>7.6. Remove lock nut from flush valve<br>7.7. Remove flush valve<br>7.8. Inspect flush valve cone washer<br>7.9. Reassemble components in reverse order<br>7.10. Turn on supply<br>7.11. Check for leaks and proper operation<br>7.12. Clean up area and tools | | |

**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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# FIXTURES AND RELATED COMPONENTS

## REPAIR

**MODULE 23** **AFQTP UNIT 3**

## TRAPS (23.3.2.)

**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.

## REPAIR TRAPS

## *Task Training Guide*

| | |
|---|---|
| **STS Reference Number/Title:** | 23.3.2., Repair traps. |
| **Training References:** | 1. Manufacture's Specifications.<br>2. Air Force Instruction (AFI) 32-1066, *Plumbing Systems*.<br>3. Uniform Plumbing Code.<br>4. Career Development Course (CDC) 3E451, *Utilities Systems*. |
| **Prerequisites:** | 1. **Possess as a minimum a 3E431 AFSC.**<br>2. **Review the following references:**<br>2.1. Uniform Plumbing Code.<br>2.2. CDC 3E451.<br>2.3. Manufacture's Specifications.<br>2.4. AFI 32-1066. |
| **Equipment/Tools Required:** | 1. General plumbing hand tools.<br>2. P-trap.<br>3. Slip nuts.<br>4. Slip joint washers. |
| **Learning Objective:** | Trainee will learn how to repair traps. |
| **Samples of Behavior:** | Trainee will be able to repair traps. |
| **Notes:** | |
| 1. Steps will be followed in sequence as needed.<br>2. Any safety violation is an automatic failure. | |

**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.

## REPAIR TRAPS

**1. Background:** One of the basic principles of plumbing is that every plumbing fixture must have a trap. The trap is a fitting designed to provide a liquid seal. This liquid seal will prevent sewer gases from entering the building.

**2.1.** Some types of traps are the P-trap, the S-trap, the drum trap, bell traps, bottle traps and bag traps. The most commonly used trap is the P-trap. The material used to construct these traps will vary, from plastic to cast-iron. **We will discuss the repair and replacement of the most common used trap, the P-trap.**

**2.2. P-Trap.** There are two different types of P-traps: the common seal and the deep seal (*which holds twice the column of water, or 4 or more inches than the common seal*). Both types of P-traps require the same type of repairs. (See Figure 1.)

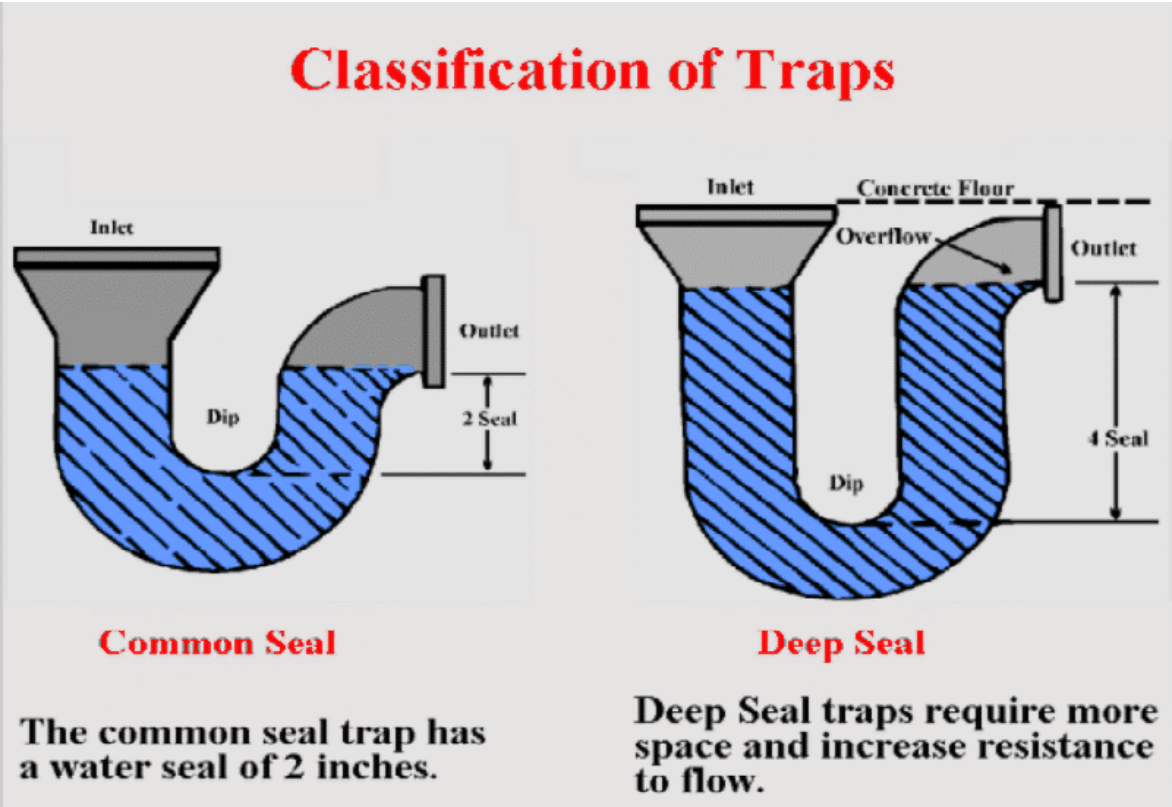


**Figure 1. Classification of Traps**

> **HINT:**
> If the trap is under a lavatory, a small pail or some type of receptacle should be used to catch the remaining water when disassembling.

**2. *To perform this task, follow these steps:***

**Step 1: Gather required tools.**

**Step 2: Disassemble the slip joints on the trap.**

**2.1.** Most P-traps are made with a chrome finish.

**2.2.** Use a Ford (monkey) Wrench to tighten or loosen the slip nut.

**Step 3: Inspect slip nut and slip joint washer.**

**3.1.** If threads are damaged, replace it.

**3.2.** If the slip joint washer is damaged replace it.

**Step 4: Inspect the P-trap threads.**

**4.1.** If the threads are damaged, replace it.

**Step 5: Inspect trap for cracks and obstructions.**

**5.1.** Remove obstructions or replace trap if cracked or damaged.

**Step 6: Reinstall slip joint washers and slip nuts.**

**HINT:**
Most slip joints must be hand tightened only!

**Step 7: Turn on supply to fixture.**

**Step 8: Inspect for leaks:**

2.1. If there is a leak, tighten the coupling until it stops. If this fails, check the tapered washer and the threads on the P-trap.

**Step 9: Clean work area and put tools back in their proper place.**

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## REVIEW QUESTIONS
## FOR
## REPAIR TRAPS

| Question | Answer |
|---|---|
| 1. What must every plumbing fixture with a drain have? | a. A valve.<br>b. A stopper.<br>c. A trap.<br>d. All of the above. |
| 2. What is the basic function of a trap? | a. Create a smooth flow of solid waste.<br>b. Prevent sewer gases from entering building.<br>c. Catch items that fall down the drain.<br>d. Collect hair and other debris. |
| 3. Another function of a trap is to catch or retain items that may fall into a fixture. | a. True.<br>b. False. |
| 4. A trap is a fitting or device so designed and constructed as to provide, when properly vented, a liquid seal, which prevents sewer gases from entering the building. | a. True.<br>b. False. |

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## REPAIR TRAPS

## 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 all the equipment needed for the job | | |
| 2. Repair trap(s):<br>2.1. Gather required tools<br>2.2. Disassemble the Slip joints<br>2.3. Inspect slip nut and slip joint washers<br>2.4. Inspect P-trap threads<br>2.5. Inspect trap for cracks and obstructions<br>2.6. Reinstall slip nut and slip joint washers<br>2.7. Turn on supply to fixture<br>2.8. Inspect for leaks<br>2.9. Clean work area and put tools back in their proper place | | |
| 3. Understand the procedures to repair traps | | |
| 4. Complete all the questions in the AFQTP:<br>4.1. Score 80% or higher<br>4.2. Trainer review and explain all missed questions | | |

**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.

**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.

# FIXTURES AND RELATED COMPONENTS

## REPAIR

**MODULE 23** **AFQTP UNIT 3**

## FAUCETS (23.3.3.)

**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.

## REPAIR FAUCETS

## *Task Training Guide*

| | |
|---|---|
| **STS Reference Number/Title:** | 23.3.3., Repair faucets. |
| **Training References:** | 1. Manufacture's Specifications.<br>2. Air Force Instruction (AFI) 32-1066, *Plumbing Systems.*<br>3. Career Development Course (CDC) 3E451, *Utilities Systems*.<br>4. Uniform Plumbing Code.<br>5. Illustrated Manuel. |
| **Prerequisites:** | 1. **Possess as a minimum a 3E431 AFSC.**<br>2. **Review the following references:**<br>2.1. Manufacture's Specifications.<br>2.2. CDC 3E451.<br>2.3. Uniform Plumbing Code.<br>2.4. Illustrated Manual.<br>2.5. AFI 32-1066. |
| **Equipment/Tools Required:** | 1. Repair kit.<br>2. Basic plumbers toolbox.<br>3. Seat wrench.<br>4. Seat kit.<br>5. Washer kit.<br>6. O-ring kit. |
| **Learning Objective:** | Trainee will learn to repair water faucet. |
| **Samples of Behavior:** | Trainee will be able to repair water faucet to include check for leaks and proper operation. |
| **Notes:** | |
| 1. Steps will be followed in sequence as needed.<br>2. Any safety violation is an automatic failure. | |

**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.

## REPAIR FAUCETS

**1. Background:** There are generally two categories of faucets: **single** and **combination**. Those that have a common spout are called mixing faucets. A basic type of faucet has the seat and a washer (disc), which is located at the end of the stem. The stem packing is held into place by a packing nut. Most faucets today have a stem assembly allowing the stem to turn inside a replaceable threaded sleeve. By using this type of faucet, you eliminate stem wear on the body of the valve. Leakage from the spout when the water is turned off is an indicator that either the washer or seat is bad. If water is leaking around the stem of the faucet this is an indicator that the packing nut needs to be tightened.

> **NOTE:**
> Always read the manufacturer's specifications regarding the repair of the faucet you will be working on.

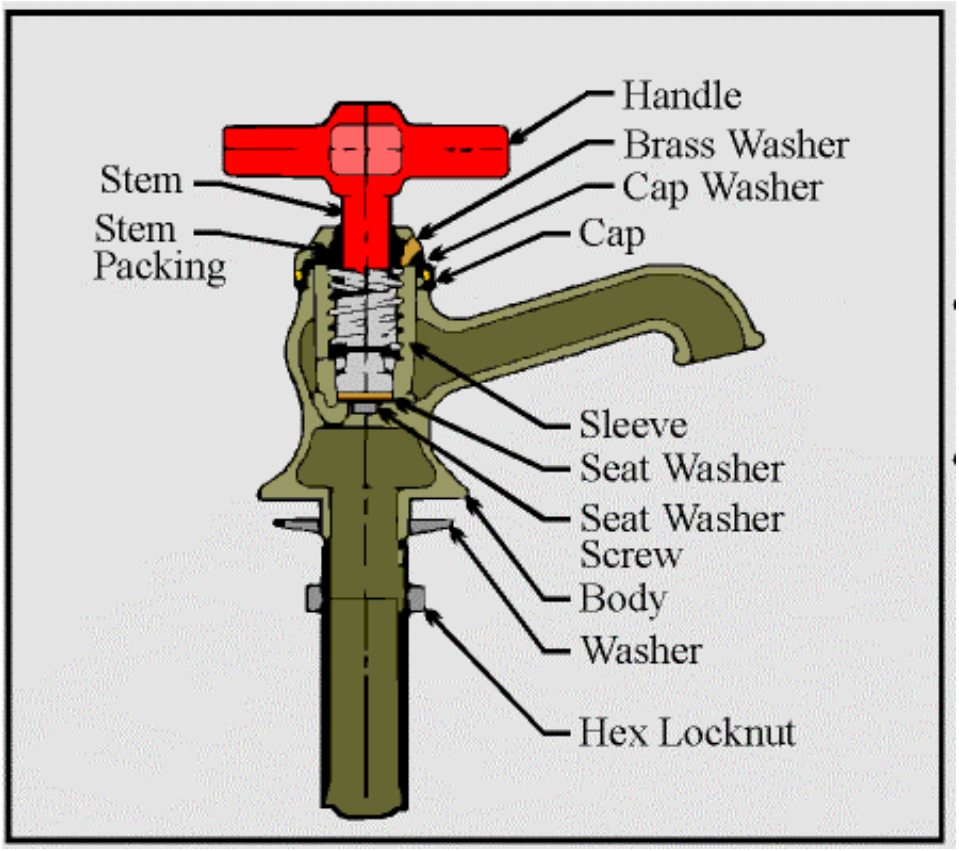


**Figure 1. Faucet Components**

**2. Repairing Faucets.**

**2.1.** ***To perform the repairs, follow these steps.***

**Step 1: Turn off supply at the angle stop.**

**1.1.** Open the faucet one-quarter turn.

**Step 2: Remove the cap from top of faucet handle and remove the screw.**

**Step 3: Remove handle.**

**3.1.** A handle puller may be necessary to remove handle if it is hard to remove.

**Step 4: Unscrew the stem assembly from the body of faucet using an adjustable jaw wrench.**

**Step 5: Inspect the valve seat in faucet body for wear.**

**HINT:**
Some seats are **not** removable; in this case you would need to use a reseating tool. (See Figure 2.)

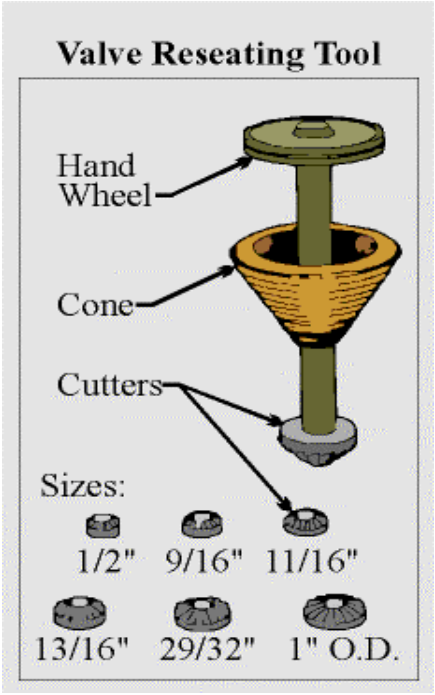


**Figure 2. Reseating Tool**

**Step 6: To replace the seat insert proper seat wrench into the seat, and turn it counter-clockwise to remove seat.**

**NOTE:**
If a replacement seat is not on hand, you can smooth seat by sanding. Sanding may only last for a short time, remember to replace seat later when new seat comes in.

**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.

**Step 7: Install replacement seat.**

**7.1.** Ensure the replacement seat is an accurate match.

**Step 8: Inspect the stem washer (disc).**

**Step 9: Remove the screw from the stem assembly.**

**Step 10: Remove the worn stem washer (disc).**

> **HINT:**
> You may be able to turn the washer (disc) over once and reuse it as a temporary measure.

**Step 11: Install replacement stem washer (disc).**

**Step 12: Unscrew the stem from the threaded sleeve.**

**Step 13: Inspect the O-ring and ensure it is in good repair.**

**Step 14: If the O-ring is bad remove it and replace with same size O-ring.**

**Step 15: Reassemble the faucet in reverse order.**

**Step 16: Turn on water supply and check for proper operation.**

**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.

## REVIEW QUESTIONS
## FOR
## REPAIR FAUCETS

| QUESTION | ANSWER |
|---|---|
| 1. Which of the following is not a category of faucet? | a. Single.<br>b. Mixing.<br>c. Combination.<br>d. Fixed. |
| 2. You don't really need to inspect the valve seat in the faucet body. | a. True.<br>b. False. |
| 3. What may be needed to pull off the faucet handle? | a. Handle puller.<br>b. Packing puller.<br>c. Strap wrench.<br>d. Pliers. |
| 4. If seat is worn and can't be removed what should you do? | a. Resurface seat with a reseating tool.<br>b. Resurface seat with a rasp file.<br>c. Resurface seat with wire brush.<br>d. Replace the entire unit. |
| 5. When replacing a seat or O-ring what should you ensure? | a. Try a rubber band this time.<br>b. Use correct replacement part.<br>c. You never replace an O-ring.<br>d. None of the above. |

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## REPAIR FAUCETS

## 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 all the equipment needed for the job:<br>1.1. Seat Wrench<br>1.2. Reseating Tool<br>1.3. Replacement parts<br>1.4. Tools | | |
| 2. Take proper safety precautions | | |
| 3. Repair the faucet following the AFQTP and using manufacturer's specifications:<br>3.1. Turn off supply at the angle stop<br>3.2. Remove the cap from top of faucet handle and remove the screw<br>3.3. Remove handle<br>3.4. Unscrew the stem assembly from the body of faucet<br>3.5. Inspect the valve seat<br>3.6. Remove seat<br>3.7. Replace the seat<br>3.8. Inspect stem washer (disc)<br>3.9. Remove screw<br>3.10. Remove and replace stem washer (disc)<br>3.11. Unscrew the stem from the threaded sleeve<br>3.12. Inspect O-ring<br>3.13. Replace O-ring<br>3.14. Reassemble faucet in reverse order<br>3.15. Turn on supply and check for proper operation | | |
| 4. Use exact duplicate parts | | |
| 5. Check for leaks and proper operation | | |
| 6. Complete all the questions in AFQTP:<br>6.1. Score 80% or higher<br>6.2. Trainer review and explain all missed questions | | |

**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.

**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.

# FIXTURES AND RELATED COMPONENTS

## REPAIR

**MODULE 23** **AFQTP UNIT 3**

## MIXING VALVES (23.3.4.)

**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.

## REPAIR MIXING VALVES

## *Task Training Guide*

| | |
|---|---|
| **STS Reference Number/Title:** | 23.3.4., Repair mixing valves. |
| **Training References:** | 1. Career Development Course (CDC) 3E451, *Utilities Systems*.<br>2. Air Force Joint Manual (AFJMAN) 32-1070, *Plumbing.*<br>3. Uniform Plumbing Code. |
| **Prerequisites:** | 1. **Possess as a minimum a 3E431 AFSC.**<br>2. **Review the following references:**<br>2.1. CDC 3E451.<br>2.2. Uniform Plumbing Code.<br>2.3. AFJMAN 32-1070. |
| **Equipment/Tools Required:** | 1. Basic plumbing tool kit.<br>2. Handle puller.<br>3. Shower stem socket wrench.<br>4. Seat wrench.<br>5. Seat kit.<br>6. Washer kit.<br>7. O-ring kit. |
| **Learning Objective:** | Trainee will learn to repair mixing valves. |
| **Samples of Behavior:** | Trainee will be able to repair mixing valves. |
| **Notes:** | |
| 1. Steps will be followed in sequence as needed.<br>2. Any safety violation is an automatic failure. | |

**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.

## REPAIR MIXING VALVES

**1. Background:** There are three basic types of mixing valves used in showers and tub and shower combinations. The first type is the manual mixing valve, it consists of two hand-operated valves in one valve body. The manual mixing valve does not give any protection against sudden changes in temperature caused by varying temperature or supply pressure fluctuations. The second type of mixing valve is the pressure controlled mixing valve. This type of mixing valve has one handle that controls both hot and cold water and protects against pressure changes in the system. The last type of valve is the thermostatic mixing valve. This type of mixing valve protects against varying water temperatures and supply pressure fluctuations.

**1.1.** There are many types of repair kits available, be sure to use a repair kit that is made by the manufacturer of the mixing valve you are working on. Also be sure to follow the manufacturer's instructions.

**2. Repairing A Mixing Valve.**

**2.1.** ***To perform this task, follow these steps:***

**Step 1: Identify the type of mixing valve you will be repairing.**

**Step 2: Get manufacturer's instructions and parts breakdown for the type of mixing valve you will be repairing.**

**Step 3: Get proper repair kits.**

**3.1.** O-ring, washer, and seat kits.

**Step 4: Shut off supply.**

**Step 5: Remove screw on the handle.**

**Step 6: Pull handle off.**

**6.1.** If the handle is hard to remove use a handle puller.

**Step 7: Remove the escutcheon.**

**7.1.** Some escutcheons are threaded on and have to be unthreaded to remove.

**Step 8: Remove Stem assembly.**

**8.1.** Use a shower stem socket wrench and turn it counterclockwise until the stem comes out.

**Step 9: Inspect the stem washer (disc) if it is worn replace it.**

**9.1.** To replace the discs remove the screw and pull the disc off.

**Step 10: Inspect the seat inside the valve assembly if pitted replace it.**

**10.1.** If the valve has a removable seat extract it (use a seat wrench).

**10.2.** Replace the seat with a new one from the seat kit (use seat wrench).

**Step 11: Reassemble the valve in reverse order.**

**Step 12: Install the escutcheons.**

**Step 13: Install handles.**

**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.

**Step 14: Turn on water supply.**

**Step 15: Check for leaks.**

**Step 16: Clean up the area and put up tools.**

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## REVIEW QUESTIONS
## FOR
## REPAIR MIXING VALVES

| QUESTION | ANSWER |
|---|---|
| 1. What must you refer prior to repairing a mixing valve? | a. Manufacturer's instructions.<br>b. CDCs.<br>c. Plumber's Journal.<br>d. Any of the above. |
| 2. Why should you refer to the manufacturer's instructions when repairing a mixing valve? | a. It's the law.<br>b. For safety reasons.<br>c. Different manufacturers.<br>d. None of the above. |
| 3. What is the last thing you do when all repairs have been made? | a. Check for leaks and proper operation.<br>b. Turn on water and watch for filings.<br>c. Turn on water and taste for palatability.<br>d. Check for filings and taste. |
| 4. Which of the following is not a type of mixing valve? | a. Thermostatic.<br>b. Fixed.<br>c. Manual.<br>d. Pressure. |

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## REPAIR MIXING VALVES

## 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 all the equipment needed for the job:<br>1.1. Basic plumbing tool kit<br>1.2. Handle puller shower stem socket wrench<br>1.3. Shower stem socket wrench<br>1.4. Seat wrench<br>1.5. Seat kit<br>1.6. Washer kit<br>1.7. O-ring kit | | |
| 2. Take proper safety precautions | | |
| 3. Repair the mixing valve following the AFQTP and using manufacturer's specifications:<br>3.1. Identify the type of mixing valve you will be repairing<br>3.2. Get manufacturer's instructions and parts breakdown<br>3.3. Get proper repair kits (O-ring, washer, and seat kits)<br>3.4. Shut off supply<br>3.5. Remove screw on the handle<br>3.6. Pull handle off<br>3.7. Remove the escutcheon<br>3.8. Remove Stem assembly<br>3.9. Inspect the stem washer (disc) if it is worn replace it<br>3.10. Inspect the seat inside the valve assembly if pitted replace it<br>3.11. Reassemble the valve in reverse order<br>3.12. Install the escutcheons<br>3.13. Install handles<br>3.14. Turn on water supply<br>3.15. Check for leaks<br>3.16. Clean up the area and put up tools | | |
| 4. Complete all the questions in AFQTP:<br>4.1. Score 80% or higher<br>4.2. Trainer review and explain all missed questions | | |

**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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# FIXTURES AND RELATED COMPONENTS

## REPAIR

**MODULE 23** **AFQTP UNIT 3**

## FLUSHOMETERS (23.3.5.)

**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.

## REPAIR FLUSHOMETERS

## *Task Training Guide*

| | |
|---|---|
| **STS Reference Number/Title:** | 23.3.5., Repair flushometers. |
| **Training References:** | 1. Career Development Course (CDC) 3E451, *Utilities Systems*.<br>2. Air Force Joint Manual (AFJMAN) 32-1070, *Plumbing*.<br>3. Uniform Plumbing Code. |
| **Prerequisites:** | 1. **Possess as a minimum a 3E431 AFSC.**<br>2. **Review the following references:**<br>2.1. CDC 3E451.<br>2.2. Uniform Plumbing Code.<br>2.3. AFJMAN 32-1070. |
| **Equipment/Tools Required:** | 1. Repair kits.<br>2. Plumbing tool kit.<br>3. Flushometer. |
| **Learning Objective:** | Trainee will learn to repair/replace a flushometer. |
| **Samples of Behavior:** | Trainee will be able to repair a flushometer. |
| **Notes:** | |
| 1. Steps will be followed in sequence as needed.<br>2. Any safety violation is an automatic failure. | |

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## REPAIR FLUSHOMETERS

**1. Background:** Depending on the make of a urinal or water closet, flushometers will vary in type and size, but rarely in the principle of operation. There are two types of flushometers, the piston type and the diaphragm type. The two types of fixtures that flushometers serve are closet bowls and urinals.

**1.1.** The **piston** type flushometer has a hollow piston that separates the water in the dashpot chamber from the lower chamber. When the handle is activated the water is discharged from the dashpot chamber. The difference in pressure between the dashpot and the lower chambers forces the piston assembly upward allowing the water to enter the fixture. The dashpot chamber is filled through a bypass in the piston. The bypass is connected to the water supply. When the water pressure equalizes on both sides of the piston, the piston will seat, closing off the water supply. (See Figure 1.)

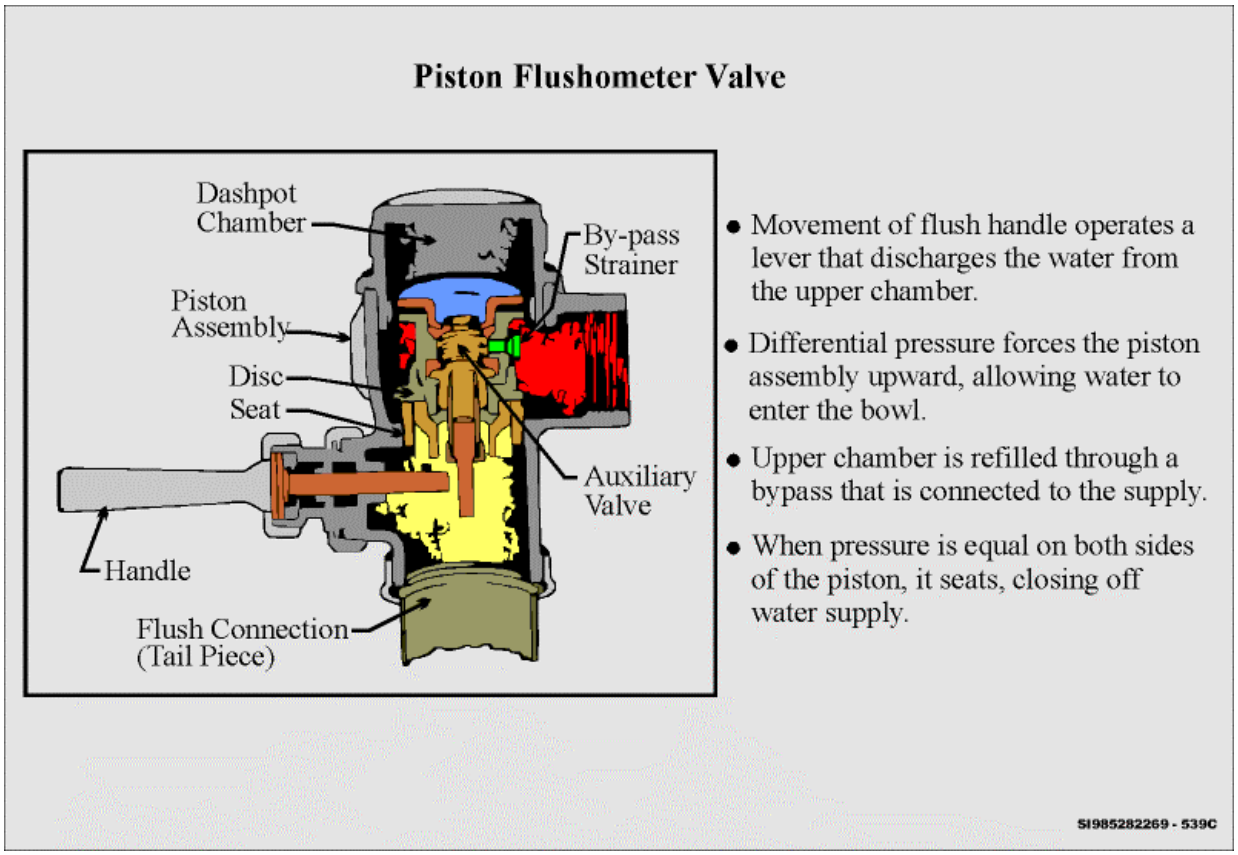


**Figure 1. Piston Type Flushometer**

**1.2.** The diaphragm type flushometer uses a flat rubber diaphragm. It has an upper and a lower chamber, which is separated by a relief valve mounted on the diaphragm. The upper chamber is connected to the lower chamber by a bypass. The lower chamber is connected to a ¾ inch angle valve on the supply line. When the handle is activated the relief valve is moved to the open position discharging the water from the upper chamber. The difference in pressure between the upper and lower chambers forces the diaphragm to lift off its seat admitting water from the supply into the fixture. Water then fills the upper chamber through the bypass line. When the pressure equalizes the diaphragm will seat closing off the water flow. (See Figure 2.)

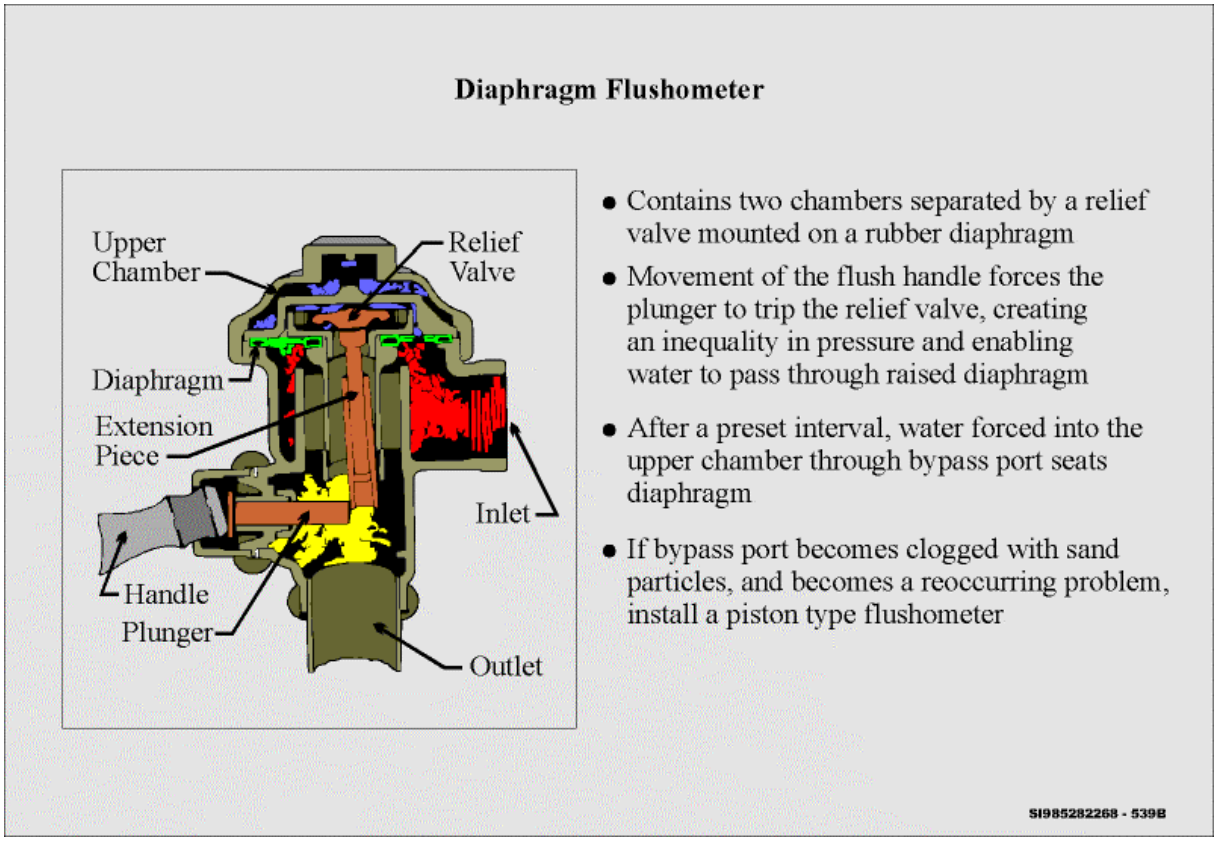


**Figure 2. Diaphragm Type Flushometer**

**NOTE:**

If available, the manufacturer's instructions must be followed for the flushometer you're working on.

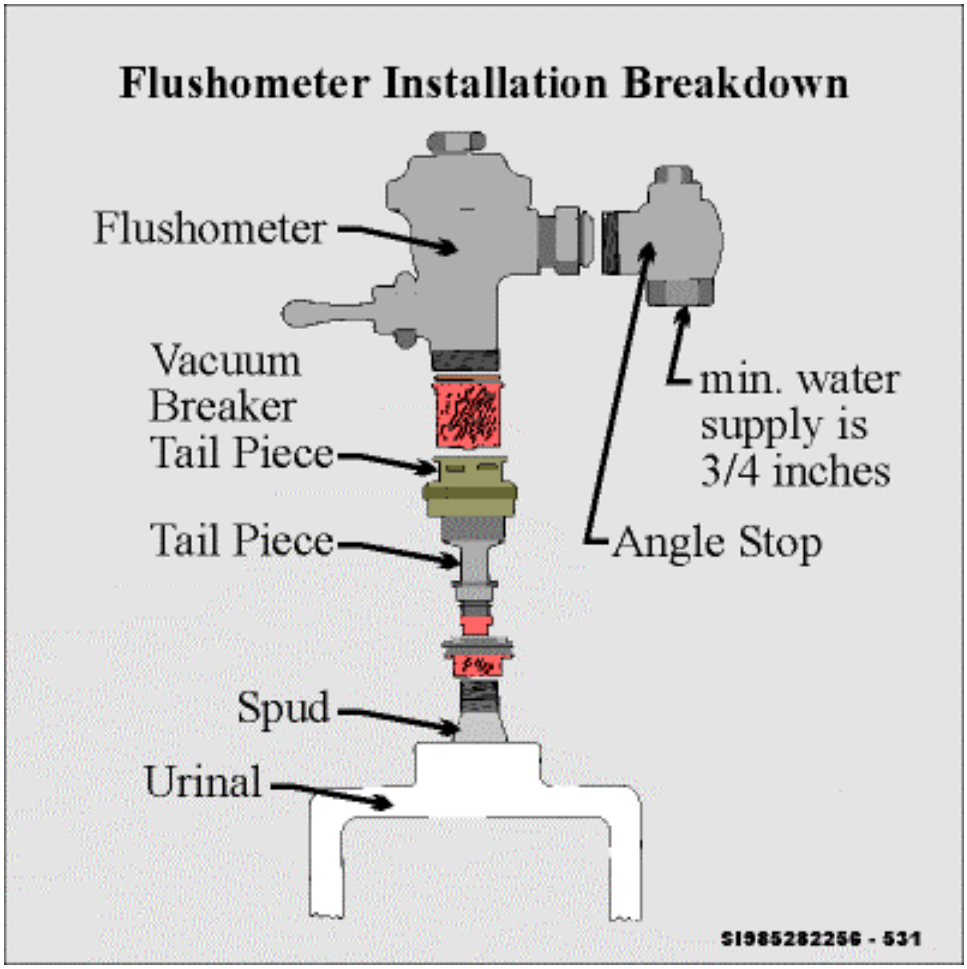


**Figure 3. Flushometer Breakdown.**

**2. <u>Repairing A Flushometer.</u>**

**2.1.** ***To perform this task, follow these steps:***

**Step 1: Identify the type of flushometer you will be replacing.**

**Step 2: Obtain manufacturer's instructions and parts breakdown.**

**Step 3: Shut off the water supply.**

**3.1.** Usually at the angle valve.

**Step 4: Remove the lid or cover of the flushometer.**

**Step 5: Inspect the diaphragm/piston bypass line to ensure it's not restricted.**

**5.1.** If it is restricted use a piece of wire to remove the obstruction.

**Step 6: Inspect seating surfaces and clean any debris.**

**Notice.** This AFQTP is *<u>NOT</u>* 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.

**NOTE:**
Debris can cause flushometer to malfunction or become inoperable. The flushometer should be cleaned thoroughly when disassembled.

**Step 7: Inspect for worn parts and replace if needed.**

**Step 8: Inspect the handle of the flushometer for wear and replace if necessary.**

**Step 9: Remove the tailpiece slip nut.**

**Step 10: Remove the tailpiece from the flushometer.**

**Step 11: Inspect vacuum breaker for wear. Remove and replace if necessary.**

**Step 12: Inspect o-ring in the flushometer for wear. Remove and replace if necessary.**

**Step 13: Reassemble flushometer in reverse order.**

**Step 14: Turn on supply at angle valve.**

**Step 15: Check for leaks and proper operation.**

**Step 16: Clean up area and put up tools.**

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## REVIEW QUESTIONS
## FOR
## REPAIR FLUSHOMETERS

| QUESTION | ANSWER |
|---|---|
| 1. If available what must you refer to in the repairs of a flushometer? | a. Manufacturer's instructions.<br>b. CDCs.<br>c. Plumber's Journal.<br>d. Any of the above. |
| 2. Where do you normally turn off the water supply going to a flushometer? | a. At the globe valve.<br>b. At the gate valve.<br>c. At the angle valve.<br>d. At the building main. |
| 3. What is the last thing you do when all repairs have been made? | a. Check for leaks and proper operation.<br>b. Turn on water check for floating debris.<br>c. Tighten an extra turn to prevent leakage.<br>d. All of the above. |
| 4. How does water enter the dashpot chamber on the piston type flushometer? | a. Control line.<br>b. Sensing line.<br>c. Bypass line.<br>d. Tail line. |

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## REPAIR FLUSHOMETERS

## 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 all the equipment needed for the job | | |
| 2. Take proper safety precautions | | |
| 3. Repair the flushometer following the steps using the AFQTP and referring to the manufacturer's instructions:<br>3.1. Identify the type of flushometer you will be replacing<br>3.2. Obtain manufacturer's instructions and parts breakdown<br>3.3. Shut off the water supply<br>3.4. Remove the lid<br>3.5. Inspect the diaphragm/piston bypass line<br>3.6. Inspect for worn parts and replace if needed<br>3.7. Inspect the handle of the flushometer<br>3.8. Remove the tailpiece slip nut<br>3.9. Remove the tailpiece from the flushometer<br>3.10. Inspect vacuum breaker for wear<br>3.11. Inspect o-ring in the flushometer for wear<br>3.12. Reassemble flushometer in reverse order<br>3.13. Turn on supply at angle valve<br>3.14. Check for leaks and proper operation<br>3.15. Clean up area and put up tools | | |
| 4. Use manufacturer's instructions if available | | |
| 5. Complete all the questions in AFQTP:<br>5.1. Score 80% or higher<br>5.2. trainer review and explain all missed questions | | |

**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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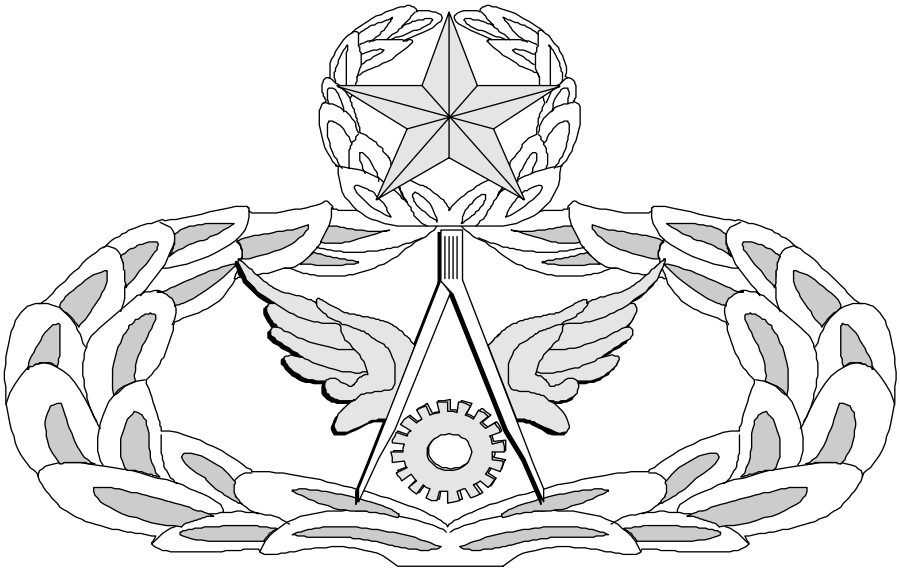
# Air Force Civil Engineer

## QUALIFICATION TRAINING PACKAGE (QTP)

## REVIEW ANSWER KEY



**FOR**

**UTILITIES SYSTEMS**

**(3E4X1)**

## MODULE 23

## FIXTURES AND RELATED COMPONENTS

**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.

## REPLACE LAVATORIES
**(3E4X1-23.2.1.)**

| QUESTION | ANSWER |
|---|---|
| 1. What should you follow when before installing a lavatory? | c. Manufacturer's Specifications. |
| 2. Which lavatory is secured by retaining clips? | a. Countertop. |
| 3. 1 ½ inch is the minimum size for a lavatory drain. | a. True. |
| 4. Which lavatory contains an "S"-trap? | b. Pedestal. |
| 5. What is the minimum height of a wall hung lavatory? | a. 31 inches. |

## REPLACE WATER CLOSETS
**(3E4X1-23.2.2.)**

| QUESTION | ANSWER |
|---|---|
| 1. What two kinds of water closets are there? | a. Wall-hung and floor mounted. |
| 2. Which is the most commonly used water closet on Air Force installations? | a. Floor mounted. |
| 3. What should you always refer to when installing a water closet? | c. Manufactures specifications. |
| 4. What may be needed if the floor has been raised above the top of the closet flange? | b. A second wax ring. |
| 5. How do you seal the wax ring to the flange? | a. Rock closet bowl gently. |
| 6. Why should you never over tighten nuts on a bowl? | c. The water closet will crack. |
| 7. Where do you hook up the water supply? | c. To the ballcock assembly. |

## REPAIR WATER CLOSET COMPONENTS
**(3E4X1-23.3.1.)**

| QUESTION | ANSWER |
|---|---|
| 1. What other name(s) is a float-controlled valve known by? | a. Ball cock. |
| 2. What must you follow when repairing water closet components? | c. Manufacturer's instructions. |
| 3. What closet tank component could cause a leak between the closet tank and the bowl? | d. Both a and c. |
| 4. How much slack should be left on the lift chain? | b. ½". |

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## REPAIR TRAPS
**(3E4X1-23.2.2.)**

| QUESTION | ANSWER |
|---|---|
| 1. What must every plumbing fixture with a drain have? | c. A trap. |
| 2. What is the basic function of a trap? | b. Prevent sewer gases from entering building. |
| 3. Another function of a trap is to catch or retain items that may fall into a fixture. | b. False. |
| 4. A trap is a fitting or device so designed and constructed as to provide, when properly vented, a liquid seal, which prevents sewer gases from entering the building. | a. True. |

## REPAIR FAUCETS
**(3E4X1-23.3.3.)**

| QUESTION | ANSWER |
|---|---|
| 1. Which of the following is not a category of faucet? | d. Fixed. |
| 2. You don't really need to inspect the valve seat in the faucet body. | b. False. |
| 3. What may be needed to pull off the faucet handle? | a. Handle puller. |
| 4. If seat is worn and can't be removed what should you do? | a. Resurface seat with a reseating tool. |
| 5. When replacing a seat or O-ring what should you ensure? | b. Use correct replacement part. |

## REPAIR MIXING VALVES
**(3E4X1-23.3.4.)**

| QUESTION | ANSWER |
|---|---|
| 1. What must you refer to in the repairs of a mixing valve? | a. Manufacturer's instructions. |
| 2. Why should you refer to the manufacturer's instructions when repairing a mixing valve? | c. Different manufacturers. |
| 3. What is the last thing you do when all repairs have been made? | a. Check for leaks and proper operation. |
| 4. Which of the following is not a type of mixing valve. | b. Fixed. |

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## REPAIR FLUSHOMETERS
**(3E4X1-23.3.5.)**

| QUESTION | ANSWER |
|---|---|
| 1. If available what must you refer to in the repairs of a flushometer? | a. Manufacturer's instructions. |
| 2. Where do you normally turn off the water supply going to a flushometer? | c. At the angle valve. |
| 3. What is the last thing you do when all repairs have been made? | a. Check for leaks and proper operation. |
| 4. How does water enter the dashpot chamber on the piston type flushometer? | c. Bypass line. |

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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):

   _____ STS Task Reference
   _____ Training Reference
   _____ Evaluation Instructions
   _____ Performance Resources
   _____ Steps in Task Performance
   _____ Performance Checklist
   _____ Feedback
   _____ Format
   _____ Other

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

   _____
   _____
   _____
   _____
   _____
   _____
   _____
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   _____

4. You may choose to call in your recommendations to DSN 523-6380 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