AIR FORCE
QUALIFICATION TRAINING PACKAGE
(AFQTP)

for

HVAC/REFRIGERATION

(3E1X1)

MODULE 20

STEAM AND HOT WATER GENERATING EQUIPMENT

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Career Field Education and Training Plan (CFETP) references from 1 Apr 97 version.

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INTRODUCTION

Before starting this AFQTP, refer to and read the "Trainee/Trainer Guide" located on the AFCESA Web site **http://www.afcesa.af.mil/**

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/CEOT, revised this AFQTP. If you have any recommendations for improving this document, please contact the HVAC/R Career Field Manager at the address below.

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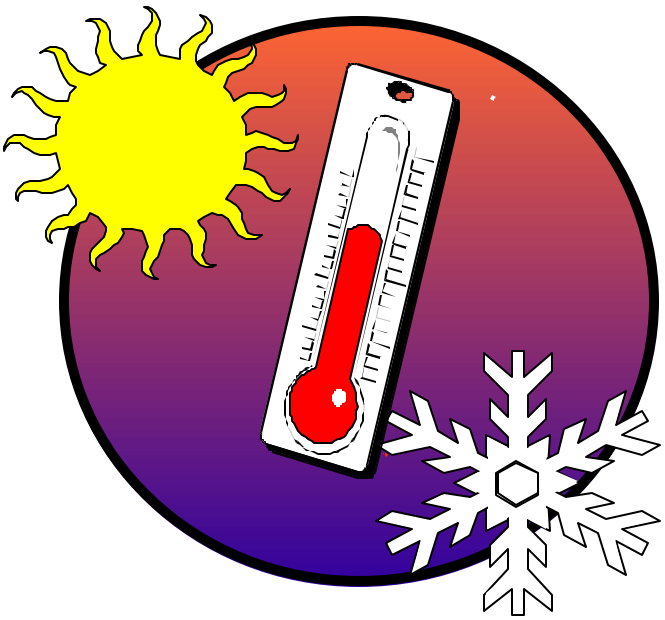

STEAM AND HOT WATER GENERATING EQUIPMENT

MODULE 20 **AFQTP UNIT 7**

TROUBLESHOOT (20.7.1.)

CORRECT MALFUNCTIONS (20.7.2.)

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TROUBLESHOOT

CORRECT MALFUNCTIONS

Task Training Guide

STS Reference Number/Title:	20.7.1. Troubleshoot 20.7.2. Correct malfunctions
Training References:	• ASHRAE Handbook, Equipment; Applications; ASME Boiler Pressure Vessel Code; Steam, it's Generation and Use
Prerequisites:	• Possess as a minimum a 3E131 AFSC.
Equipment/Tools Required:	• Personal Protective Equipment (PPE) • Standard HVAC tool bag
Learning Objective:	• Identify troubleshooting facts of steam and hot water generating equipment
Samples of Behavior:	• Isolate and correct malfunctions in steam and hot water generating equipment
Notes:	
• Any safety violation is an automatic failure.	

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TROUBLESHOOT

CORRECT MALFUNCTIONS

Background: The troubleshooting of a steam system can be very complicated, and as a HVAC/R systems technician you will be expected to accomplish troubleshooting tasks. As you progress in the HVAC/R career field, your troubleshooting experience will increase with having more contact with more varied types of equipment. In this section you will be provided with some procedures for troubleshooting steam systems. The most important thing to remember is to start with the simple and work towards the complex. The troubleshooting process, when approached logically, will be very helpful in locating problems. You can break the process into logical areas consisting of electrical, fuel supply, feedwater system, and burner controls when dealing with the boiler. For the distribution system, troubleshooting areas will be the piping and valves, consumers, traps, and condensate receivers.

Troubleshoot Boilers:

Electrical. One of the more common problems encountered are electrical malfunctions. If you have gone to a mechanical room and attempted a boiler light off, and cannot get the boiler to run at all, check all the circuit breakers and fuses that supply power to the boiler. Also, check to see that the main power switch of the boiler is on. Next, check to see if the fuel selector switch is turned for the proper fuel to be used.

Fuel Supply. In the event that the boiler has power, but fails to light off and an alarm sounds, allow the programmer to cycle through the post-purge. Then check the fuel selector switch for proper position. It should indicate the fuel you plan to use. Then check all the valves in that particular fuel delivery system, whether gas or oil, to be certain they are open. If gas is being used it is possible that the high/low pressure switch has tripped. Check and reset these switches. If oil is being used, check to see if the auxiliary fuel pump is operating. Check the fuel tank to make sure there is fuel available. If all the valves are open, the pump is on, and there is fuel, check the fuel oil strainer. It may need to be cleaned.

Attempt restart of the boiler. If everything else is in order, the boiler should now light.

Feedwater System. During the pre-operational inspection, you should have checked the boiler water level. It is possible that the level in the boiler is correct and the control could not have been reset. In this case, the alarm for low water would sound. If you are certain the level is correct, reset the control and restart the burner. If there is any doubt about the water level, prove it by accomplishing the preoperational level test procedure. Then check the valves in line from the pumps to the boiler. Also, check the feed water tank water level and the make-up line valve to be certain they are open. After this has been accomplished, check the electrical power to the feed water pumps. Test the pumps by turning the selector switch on the pump panel to the manual position and observe pump operation. Once you are certain the pump operates properly, turn the selector switch to the automatic position. The boiler should now be ready to light.

Flame Safeguard Controls. In the event the boiler does not light off and you are certain that the problem is not with the electrical, fuel, or feedwater system, check the flame safeguard system.

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To check the flame safeguard system you need to try a test run to see what happens. The first thing you need to do before anything else is to purge the combustion chamber of any vapors (and remove any excess fuel oil if burning oil). Then push the reset on the programmer and watch the programmer as the system goes through its cycle. Note at which point the boiler shuts down. Now that you have found the problem and remedied the situation, the burner should start. In the event the burner cycles on, but doesn't light, check the air flow switch to make certain it is operating. Make certain of your fuel supply again.

Next, check the flame sensor. It is possible that it has become dirty or has soot on the lens. Remove the scanner, clean it or replace it. If everything is in order the boiler should now light. It may seem as though there are a lot of things that may go wrong with a boiler. You should not encounter all of these problems at once, however, you may run across a situation where two or more of these problems may be present. In that case, following a logical sequence will make it possible to locate and correct all the problems you will encounter.

Troubleshoot Steam Distribution Systems: The distribution system, as you have found out, may be a small one building system or it may be half of the base or installation to which you are assigned. It would do no good to produce all the steam in the world if it goes nowhere. So, when you have a problem with the distribution system, you will need to correct it. The most obvious problems with the system would be leaks in the piping, or the possibility of valves that are not open. Other problems you may find involve consumers that do not deliver the heat required for some reason. This could be caused by faulty traps or condensate receiving equipment. Let's look at these problems in a logical order.

Piping/Valves. In most cases, when you have a piping leak, the only remedy is to replace that particular piece of pipe. When this is necessary, be aware that the pipe in the system could be very old and needs to be treated with respect. Always use a back-up wrench when loosening piping. This will help to avoid replacing large sections of piping that may be damaged by rough handling. When it is obvious that the steam is not traveling through the piping, the first thing that you should look for are closed valves. Make certain all the valves are open to the equipment you are using.

In some cases, the steam will be supplied to a pressure reducing station to lower it to the working pressure of the equipment in that system. In the event the pressure is not at the proper level, first check to see if all the valves except the bypass valves are open. When this is done, check the pressure gauges and make adjustments as necessary to the pressure reducing/regulating valves. Once the pressure in the system is correct, check to see that the consumers are working properly.

Consumers. It is possible that a consumer will have all the valves open and steam available but will not heat up. There are many reasons for this. The consumer may be plugged with sediments or scale and would need to be removed and cleaned. The consumer may also be blocked by air that will not allow steam to pass. Carefully vent the air by manually operating the air vent. It may be necessary to vent the air through the trap by removing the air vent plug. Do this carefully. Remember, the air will be followed by steam, so isolate the unit, remove the plug, then open the valves and allow the air to vent. As soon as steam begins to escape, close the steam valve and replace the vent plug. Then open the steam valve and check the operation of the consumer.

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Traps. Malfunctioning traps will also prevent proper system operation. This could occur in two ways; either the trap allows steam to pass straight through or it doesn't allow anything to pass. There are a couple of safe methods that will tell you if the traps are functioning properly. One method is to observe the condensate receiver. Normally, operating traps will allow hot condensate water into the receiver. If this is happening, a small amount of steam or vapor will rise out of the vent line. If the trap is not working and allowing steam to "blow by" the condensate receiver will be extremely hot and will be literally blowing steam out through the vent.

- **Thermal Chalk.** Another method of troubleshooting a trap is to use thermal chalk. Thermal chalk is a product that is used to detect traps that are blowing by. To do this, make a mark with the chalk on the piping just downstream of the suspected trap. If the chalk melts, the trap is defective and needs to be fixed.

- **Infrared.** The most accurate method of trap troubleshooting is to use an infrared thermometer. This instrument measures the surface temperature of an object and gives a reading relative to a reference temperature. To accomplish this test, aim the infrared thermometer at the inlet of the heat consumer and get the reading. Then, take a reading on the outlet of the steam trap. If it is working correctly, there should be a decrease in temperature reading through the meter.

If a trap is not allowing anything to pass, the consumer will not heat up. This could be caused by a sticking trap mechanism, air in the trap, or a water logged system. To correct a sticking trap, you must isolate the trap, remove it, repair it, and then return it to service. Air in the trap has already been discussed. A waterlogged system could be caused by a malfunctioning condensate receiver.

Condensate Receivers. When a system becomes waterlogged, it may be the fault of the condensate receiver. To check out this problem, first be certain all valves are open which need to be. Then check the operation of the pump by moving the float linkage until the pump energizes. In the event the pump does not run, check the power supply to the pump, that is, the circuit breakers and disconnects.

Troubleshooting LTHW Systems. LTHW systems may work well for many years, provided the seasonal overhaul is performed properly. But, it is not always possible to prevent the system from breaking down. Mechanical systems, no matter how well designed or maintained, will at some point in time fail to operate as designed for one reason or another.

When troubleshooting any system, remember to begin with the simplest thing that could cause a problem first, eliminate that cause then move on to more complex malfunctions. If you learn to quickly recognize and correct these problems, they can be eliminated quickly.

Hot Water Boilers. The following are common troubles, along with their causes and remedies that could be encountered during the operation of a low temperature hot water boiler. The main consideration when troubleshooting a boiler is to follow the recommendations and procedures furnished by the manufacturer of the boiler and boiler components.

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Boiler Pressure. The boiler and system are designed to deliver a certain amount of heat at a given pressure and temperature. In the event the pressure is not correct, it will be necessary to correct it before the boiler will deliver the proper heat to the space.

- **High Pressure.** If it becomes evident that the boiler pressure has risen above the design pressure it will be necessary to make some adjustments to return it to the proper level. High pressure, above the desired pressure, can be caused by a couple of different things. One of the simplest causes would be a PRV that has been poorly adjusted. Some other things that would cause high pressure could be the bypass valve was open or leaking by. Also, water entering the system would cause the boiler pressure to be too high. With any of these problems, after they have been corrected, drain a small amount of water from the system to lower the pressure then allow the system to automatically return to the desired pressure.

- **Low Pressure.** If low pressure is the problem, there are very few things that could cause this. The first thing to check would be to see if the make-up valves are open, if these valves are closed the pressure would not reach the desired point. Then check to see if the PRV is allowing water through, if it is then it must be adjusted too low. To raise the pressure simply turn the adjusting screw at the top clockwise to increase the pressure. Allow the system time to stabilize then check the pressure again. Continue this process until the desired pressure is obtained.

Expansion Tank. The expansion tank of an LTHW system could be a source of problems. The tank could become too full or waterlogged, or develop leaks, both above and below the water line.

When water level in the expansion tank gets too high the room needed for the water to expand as it is heated is not available. The result of the increased pressure on the system causes the PRV to lift wasting water to the drain. This high water could be caused by a few simple problems. A loss of the air cushion in the tank will allow the water to rise beyond the desired height. The air cushion could be lost through a leak in the tank, out through the sight glass valves or gaskets, or maybe through the airtrol valve.

On the other hand the water level could be too low. This problem, in most instances, would be accompanied by low pressure. Low water for the most part would be caused by the PRV valves in the make-up water line being adjusted wrong or closed altogether.

In the case of an improper water level, once the problem has been repaired it will be necessary to charge the expansion tank. Charging the tank consists of isolating it from the boiler and system, draining the water while allowing air to enter the tank. Once all the water is drained and air is no longer being drawn into the tank close the airtrol vent valve and the drain valve. Now open the boiler make-up valve and allow the boiler and expansion tank to fill. The water level should stop rising at approximately 1/2 of the sight glass. The tank is now charged.

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Improper Temperature. To deliver the proper amount of heat to the system, the boiler must be maintaining the proper temperature. If the temperature is too low, adjust the Aquastat to a higher setting. Allow the system to stabilize and check the temperature again. If the adjustment has no effect on the temperature replace the Aquastat. If the temperature is too high, adjust the Aquastat to a lower setting.

Another malfunction that could cause an improper water temperature would be a burner that is not operating properly. Since burners were covered earlier they will not be covered here. A dirty fireside will also cause the temperature to be lower than is required. Cleaning the boiler will help to obtain the proper temperature.

Hot Water Distribution Systems. At times the distribution system components do not operate properly. The following are common troubles, causes, and remedies that relate to the troubleshooting of hot water distribution system troubles. Always follow the recommendations and procedures furnished by the manufacturer of system components.

Consumers. When troubleshooting consumers remember that the majority of the malfunctions are caused by some very basic problems. If the problem seems to be that this consumer (or terminal unit) is not heating and you have already determined that the water at the boiler is hot and circulating, check the simple things first. Make sure the supply and return valves are open. Next, check to see if the unit is air locked; open (or loosen) the air vent to bleed off any air. In the event that the proper water flow is available but not flowing into the unit, remove the unit and see if it is plugged up. Finally, if everything else is OK, check to see if the water balancing valves are properly set by comparing the flow through the unit to the design flow.

Air Vents. Air vents are designed to eliminate air that may become trapped in the unit as the system is filled. Should this device leak at the threads, tighten it up. If the leak is from the vent part of the device, check to see if it has some debris holding the valve open. If the valve is clean, check the float for holes or a waterlogged condition. If the air vent proves to be defective replace it.

Flow Control. The flow control valve is designed to prevent the flow of water through the system after the circulating pump shuts off. In the event the system is still delivering heat even though the pump is off, check to see if this valve is in the manual or automatic position. In the auto position it should stop the flow. If water is still flowing, isolate the system and disassemble the valve and check the disc and seat. Repair or replace parts as necessary. On the other hand, if the valve was in the manual position (stem all the way up) simply return it to the auto position by turning the handle clockwise until it stops.

Circulating Pump. The circulating pump gets the water from the boiler to the terminal units. If it is not doing its job, make sure that all the proper valves are open. Once the valves have been checked and they are "OK," the first thing to suspect is the power supply. Check to see if the power is on to the control circuit and then make sure the thermostat is actually calling for heat. Another item that could be easily overlooked is the condition of the coupling on some types of pumps.

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If all of these things seem to be all right, and the pump motor is actually running, check to see if the motor is turning in the proper direction. Once the problem has been identified take the proper steps to correct it.

Indirect Heating Systems. Systems that gain heat from steam or high temperature water are referred to as indirect heating systems. These systems use a converter, temperature regulating valves, standard consumers, and piping to get heat to the desired spot. Indirect systems may be used to produce hot water for heating purposes or for domestic uses.

Troubleshooting Indirect Heating Systems. When troubleshooting an indirect heating system, begin by determining if the primary system is delivering the desired heating medium at the proper temperature. Contact the central steam or high temperature water plant to see if there are any malfunctions that would have an effect on your system. Always check for isolating valves to the facility. Check temperature, pressure and flow of source to system in question. After it has been determined that the primary heating supply is available, continue to search the secondary system for the malfunction. The following paragraphs will provide a few basic areas to look for problems.

Converters. Converters are used to bring the steam (or heating medium) into contact with a vessel that contains the water to be heated (or the heated medium). The normal piping arrangement of this type of an installation would be with the steam being piped into the top of the converter shell with the condensate being removed out through the trap in the condensate line at the bottom. The water to be heated is then circulated through a bundle of tubes that is installed in the shell and surrounded by the steam. In the event the trap fails in the closed position, the converter will become flooded and will no longer transfer heat to the water. One of the more obvious problems would be a leak in the converter or related piping. A problem that may not be so easy to spot would be a tube bundle that has sprung a leak. If the steam pressure is higher than the water pressure the secondary system may become filled with steam. On the other hand, if the water pressure is greater than the steam, it may be possible to fill the steam system with water. These are a few of the problems that might be encountered with a converter.

Temperature Regulating Valve (TRV). Temperature regulating valves are used to regulate the temperature of a secondary system by controlling the flow of the heating medium. The valve is installed in the heating medium supply line with its sensing device in the heated medium outlet line. The valve is operated by the sensing bulb putting pressure on the valve diaphragm to open it when the temperature of the water drops below the setting. If the diaphragm develops a hole the valve will not open. Another cause for the valve not opening would be the capillary tube from the sensing bulb being damaged or broken. In that case the valve would not open and again the water would not be heated. A closed valve is not the only problem that could cause a malfunction. The valve may fail in the open position. If that is the problem the temperature of the secondary system will become too hot. Failing in the open position is not common but it can happen when debris becomes lodged under the valve seat holding it open, or if the stem has scale build-up that prevents it from moving to respond to the sensor.

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System Components. The indirect heating systems have all of the components that are contained in the LTHW direct heating systems. With that in mind the troubleshooting of this type of system will be the same as was discussed in the LTHW section. The problems with components such as the circulating pump, consumers (or terminal units), or valves are no different for this type system than they are for the direct system.

Troubleshoot Domestic Hot Water Systems. Domestic hot water systems refer to systems that are used to produce hot water used for bathing, washing clothing, and other related tasks. These systems use similar components as the indirect heating systems. Since the system is not designed to heat a space, but to deliver hot water to a faucet it will not have any terminal devices. It will, however, have a converter, related piping, temperature control valve and circulating pumps. Since these items have already been covered they will not be covered again. When troubleshooting this type system apply the techniques brought out earlier.

LTHW Trouble Shooting Chart. You will encounter some of the following common troubles along with their causes and remedies during the operation of a low-temperature, hot water boiler. **The main consideration when troubleshooting a boiler is to follow the recommendations and procedures furnished by the manufacturer of the boiler and boiler components.**

	Trouble	Cause	Remedy
A.	Boiler pressure improper	1. Makeup water valve closed. 2. Bypass valve open 3. Pressure regulating valve out of adjustment. 4. Pressure regulating valve leaks or, cannot be adjusted properly	1. Open valve. 2. Close valve 3. Adjust to match system pressure requirements Repair or replace pressure regulating valve
B.	Water level too low in expansion tank	1. Makeup water valve closed. 2. Expansion tank valve closed. 3. Air-vent valve hollow tube clogged 4. Gauge glass shows improper water level	1. Open valve. 2. Open valve 3. Remove, clean, and reinstall valve 4. Open upper and lower gauge glass valves and charge expansion tank accordingly (observe system pressure).

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	Trouble	Cause	Remedy
C.	Water level too high in expansion tank.	1. Loss of air cushion.	1. Close makeup water valve. Open air-vent tank valve. Open expansion tank and drain entire tank. Leave air-vent valve open until it stops sucking air into tank, then close it. Close expansion tank drain valve. Open makeup water valve and fill tank to approximately one-half full. Observe pressure gauge and adjust pressure-regulating valve to meet system pressure needs.
D.	Improper water temperature.	1. Firing equipment working improperly 2. Boiler fireside dirty. 3. Boiler waterside clogged. 4. Aquastat operates improperly.	1. Check and adjust burner controls. 2. Clean boiler fireside 3. Drain and flush boiler. 4. Check adjustment and set properly. Check wiring.
E.	Safety relief valve popping.	1. Makeup water bypass valve open. 2. Boiler pressure too high.	1. Close valve. 2. Drain and charge expansion tank. Adjust pressure-regulating valve to meet system requirements.
F.	Safety relief valve leaking.	1. Scale or dirt deposits under valve seat.	3. Remove and clean pressure relief valve. Reinstall valve and check operation (if it still leaks, replace valve).

Summary. Troubleshooting the boiler and distribution system, if approached logically from the simple to the more complex, should be quick and simple. If done haphazardly, it could turn out to be a nightmare. Use the simple techniques you read about here to build on. Actual experience will eventually help you become an expert in the LTHW systems. Always remember to check with the manufacturers recommendations for troubleshooting their specific pieces of equipment. Troubleshooting indirect heating systems is very similar to the techniques used in checking out the direct systems. The big difference is the absence of a boiler. The lack of a boiler brings about the need for a converter; the converter has unique equipment that supports its operation. The converter itself has some possibilities for malfunctions such as leaks, failed traps, and ruptured tube bundles. The temperature-regulating valve supplies the heating medium to the converter; if it fails, the converter cannot supply the desired heat. This valve can fail in the open or closed position. In the closed position the system will be cold; in the open position, however, the system will be heated beyond the desired temperature and out of control.

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Review Questions
for
Troubleshoot
Correct Malfunctions

Question	Answer
1. What is NOT a possible cause of steam pressure higher than necessary on the low-pressure side of the pressure reducing station?	a. Boiler pressure is to high b. PRV adjusted improperly c. By pass is open d. PRV leaks by
2. What would cause steam to be exhausted from the vent pipe on the condensate receiver?	a. Trap passing vapor b. Vent pipe hand valve open c. Trap holding vapor d. Vent pipe hand valve closed
3. One cause of a consumer not delivering heat is _____.	a. Air locked b. Steam or hot water flow is sufficient c. T-stat calling for heat d. Steam pump inoperative
4. What should the Aquastat be checked for if the water temperature is improper?	a. Proper adjustment b. Make up water valve operation c. Tripped circuit breakers d. Proper alignment
5. Which item would not cause high pressure in the LTHW system?	a. Poorly adjusted PRV b. Make up water by pass valve is open c. Make up water by pass valve is closed
6. What would cause the water level to be too high in the expansion tank of the LTHW system?	a. Small air leak on top of the tank b. Drain line plugged c. Tank has expanded to its upper limit d. Sight glass not calibrated
7. What could be wrong if the proper valves are open and the circulating pump still does not seem to be delivering the proper amount of heat?	a. No power b. Pump coupling not connected c. Pump motor burned up d. All of the above

Instructions: Match the trouble in column A with its cause in column B. Each item in column B may be used only once

Column A	Column B
____(1) Safety relief valve leaking. ____(2) Improper water temperature. ____(3) Boiler pressure improper. ____(4) Safety relief valve popping. ____(5) Water level too low in expansion tank. ____(6) Water level too high in expansion tank.	a. Aqua stat operates improperly. b. Loss of air cushion. c. Scale or dirt deposit under valve seat. d. Boiler pressure too high. e. Air-vent valve hollow tube clogged. f. Pressure-regulating valve out of adjustment.

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Question	Answer

TROUBLESHOOT

CORRECT MALFUNCTIONS

Performance Checklist		
Step	**Yes**	**No**
1. Troubleshoot and Repair Steam Generator / Components:		
a. Electrical		
b. Fuel Supply		
c. Feedwater System		
d. Flame Safeguard Controls		
2. Troubleshoot and correct malfunctions to steam:		
a. Piping/Valves		
b. Consumers		
c. Traps		
d. Condensate Receivers		
3. Troubleshoot and correct malfunctions to LTHW Systems:		
a. Boiler Pressure		
b. Expansion Tank		
c. Improper Temperature		
4. Troubleshoot and correct malfunctions to Distribution Systems:		
a. Consumers		
b. Air Vents		
c. Flow Control		
d. Circulating Pump		

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

HVAC/REFRIGERATION

(3E1X1)

MODULE 20

STEAM AND HOT WATER GENERATING EQUIPMENT

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TROUBLESHOOT
(3E1X1-20.7.1.)

CORRECT MALFUNCTIONS
(3E1X1-20.7.2.)

Question	Answer
1. What is NOT a possible cause of steam pressure higher than necessary on the low-pressure side of the pressure reducing station?	a. Boiler pressure is to high
2. What would cause steam to be exhausted from the vent pipe on the condensate receiver?	a. Trap passing vapor
3. One cause of a consumer not delivering heat is _____.	a. Air locked
4. What should the Aqua stat be checked for if the water temperature is improper?	a. Proper adjustment
5. Which item would not cause high pressure in the LTHW system?	c. Make up water by pass valve is closed
6. What would cause the water level to be too high in the expansion tank of the LTHW system?	a. Small air leak on top of the tank
7. What could be wrong if the proper valves are open and the circulating pump still does not seem to be delivering the proper amount of heat?	d. All of the above

Instructions: Match the trouble in column A with its cause in column B. Each item in column B may be used only once

Column A	Column B
C (1) Safety relief valve leaking.	a. Aquastat operates improperly.
A (2) Improper water temperature.	b. Loss of air cushion.
F (3) Boiler pressure improper.	c. Scale or dirt deposit under valve seat.
D (4) Safety relief valve popping.	d. Boiler pressure too high.
E (5) Water level too low in expansion tank.	e. Air-vent valve hollow tube clogged.
B (6) Water level too high in expansion tank.	f. Pressure-regulating valve out of adjustment.

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.