

LESSON PLAN

SOLAR THERMAL

DAY 1

TRADE SUBJECT: Solar Thermal

LESSON ORDER: Certification 1

LESSON OBJECTIVES:

By the end of this lesson given handout sheets, lecture and films students will be able to:

1. Correctly answer questions relating to the fundamentals of solar energy and the history of solar thermal systems and applications.
2. Correctly answer questions relating to Solar thermal collector classification, certification, construction, and lab vs. applied efficiency's.
3. Correctly answer questions relating to Solar Thermal piping mounting of equipment and the installation according to manufacturer.
4. Correctly answer questions relating to Solar Thermal piping, systems and equipment installation, operation and maintenance and the use of proper codes and standards.
5. Correctly answer questions relating to the application of building permits and local codes applicable for selected roof mounting attachments and the connection of the collectors to the piping including ICS and thermo-siphon systems, due to the extra weight.
6. Correctly answer questions relating to Site assessment, tracking systems and time of day, also why some installs are impractical.
7. Identify the components of active direct and active indirect Solar Systems, location and system layout and configuration.
8. Identify the components of a passive direct and passive indirect Solar Systems.
9. Correctly answer questions relating to Solar Thermal piping installation with water tanks heater tanks and storage tanks per manufacturer recommendations.
10. Correctly answer questions relating to the determination of a plumbing retrofit method to be used if a conventional water heater tank is used as a buffer tanks and conventional auxiliary tanks.
11. Correctly answer questions about flow rates and Delta "T".

INTRODUCTION:

In order to become certified with a “Solar Thermal” classification in the state of Connecticut an individual must have a good understanding of solar thermal systems. Time of day for optimal usage, tracking, site assessment, practical and impractical installations, Identify the components of active direct and active indirect Solar Systems Identify the components of a passive direct and passive indirect Solar Systems will be covered. How their various parts work, a technician should be able to, understand and explain the basic premise of hot water storage, the use of a buffer tank, conventional auxiliary tanks.

RESOURCES:

1. Code book: International Plumbing Code.
2. IMC (International Mechanical Codes).
3. OSHA - 29 CFR – 1926, Manual on Personal and Job Site Safety.
4. Blackboard with dry erase markers, eraser, etc.
5. Lecture and class reading.
6. Instructor demonstration.
7. Handouts.

INSTRUCTOR RESOURCES:

1. Code book: International Plumbing Code.
2. Reference Code book: Code of federal Regulations – 29 CFR part 1926.
3. Day Plan: Day 1.
4. Handouts.
5. 40 Question Test.

TOOLS AND EQUIPMENT:

1. Notebook pen and pencil.

PRESENTATION / DEMONSTATION:

The instructor will give a lecture relating to Solar Thermal piping installation, where and how they work best. Time of day for optimal usage, tracking, site assessment, practical and impractical installations will be covered. How Delta “T” is used to help determine flow rates based on readings from the course textbooks, code books and personal experience in the field followed by a period of questions and answers (class review) to determine the students understanding of the lesson. Next the instructor will demonstrate how water is used for domestic hot water. The instructor will then test the students in a written test to determine understanding. A brief lecture on safety will then be given.

CLOSURE:

The instructor will end the lesson by reviewing the lesson objectives to see if they have been met. The instructor will then review the highlights of the lesson. Reading from the text book students may then be given for a homework assignment.

EVALUATION INSTRUMENTS:

1. Question and answers (Class review).
2. Assignments on blackboard.
3. 20 Question test.

LESSON PLAN

SOLAR THERMAL

DAY 2

TRADE SUBJECT: Solar Thermal

LESSON ORDER: Certification 1

LESSON OBJECTIVES:

By the end of this lesson given handout sheets, lecture and films students will be able to:

1. Correctly answer questions relation to equipment certification, components, codes, licenses.
2. Correctly answer questions relation to. Solar tool definition, system sizing and software use.
3. Correctly answer questions relating to Solar Thermal piping installation
4. Correctly answer questions relating to Solar Thermal water heating for domestic hot water.
5. Correctly answer questions involving basic system piping design valves and other components required.
6. Correctly determine the locations, and installation of a heat exchanger, heat exchanger fluids and pumps. According to the manufacturer's installation manuals and schematics.

INTRODUCTION:

In order to become Certified with a "Solar Thermal" classification in the state of Connecticut an individual must have a good understanding of domestic solar thermal systems and how their various parts work, a technician should be able to, understand and explain the basic premise of hot water heating. System piping design valves and other components required will be explained also valves, air vents, check, drain, auto drain down , expansion, expansion tanks, flow control, isolation, diverting, solenoids, mixing valves, anti-scold devises, pressure relief, temperature pressure relief, balancing, freeze as well as monitoring components, such as flow meter, temperature gauge, pressure gauge, etc... the location of plumbing valves and other components.

RESOURCES:

1. Code book: International Plumbing Code.
2. Blackboard with dry erase markers, eraser, etc.
3. Lecture and class reading.
4. Instructor demonstration.
5. Handouts.

INSTRUCTOR RESOURCES:

1. Code book: International Plumbing Code.
2. Reference Code book: Code of federal Regulations – 29 CFR part 1926.
3. Day Plan: Day 2.
4. Handouts.
5. 20 Question Test.

TOOLS AND EQUIPMENT:

1. Notebook pen and pencil.

PRESENTATION / DEMONSTATION:

The instructor will give a lecture on solar thermo water heating of domestic water based on readings from the course textbooks, code books and personal experience in the field followed by a period of questions and answers (class review) to determine the students understanding of the lesson. Next the instructor will demonstrate how water is used for domestic hot water, and what is done with excess relieved water, or how it can be used for other purposes. The students can verbally answer questions and/or board written examples using the code book. The instructor will then test the students in a written test to determine understanding. A brief lecture on safety will then be given.

CLOSURE:

The instructor will end the lesson by reviewing the lesson objectives to see if they have been met. The instructor will then review the highlights of the lesson. Reading from the text book and students may then be given for a homework assignment.

EVALUATION INSTRUMENTS:

1. Question and answers (Class review).
2. Assignments on blackboard.
3. 20 Question test on: Water heating piping to tanks and pools.

LESSON PLAN

SOLAR THERMAL

DAY 3

TRADE SUBJECT: Solar Thermal

LESSON ORDER: Certification 1

LESSON OBJECTIVES:

By the end of this lesson given handout sheets, lecture and films students will be able to:

1. Correctly answer questions relating to system design, and sizing.
2. Correctly answer questions relating to, proper roofs, ground, mechanical room work, collector attachments, piping runs, designs, electrical, and safety. Including commissioning, inspecting, servicing incorrect and improper systems.
3. Correctly answer questions relating to Rebates, tax credits, economics and sales help with complete scripts and methods.
4. Correctly answer questions relating to Solar Thermal wiring installation and location of the controller, differential controller, sensors, photovoltaic module controller, pump and timer controller.
5. Correctly answer questions on how to test the operation of the controller.
6. Correctly answer questions on how to determine that a system installation has structural integrity and is weather sealed, electrically installed correctly, plumbing is correct, verify a systems start up and shut down functionality is correct.
7. Correctly identify any deficiencies in materials, workmanship, function, or appearance by visual inspection of the entire system.
8. Demonstrate a proficiency I tool usage and materials for maintenance, troubleshooting, reading manuals, wire diagrams, drawing, specifications, maintenance, repair work, and how do determine what repairs and modifications are needed.
9. Demonstrate how to identify causes and evaluations of systems, calibrations, of sensors, etc.

INTRODUCTION:

In order to become Certified with a “Solar Thermal” classification in the state of Connecticut an individual must have a good understanding of domestic solar thermal systems and how their various parts work, Solar Thermal wiring installation and location of the controller, differential controller, sensors, photovoltaic module controller, pump and timer controller, and all other components to determine everything is structurally and visually sound or if there are defects on any part of the entire installation. A technician should be able to, understand and explain the basic premise of hot water storage and use including the concept and application of Solar Thermal home heating. Tool usage, safety and evaluation of causes will be covered.

RESOURCES:

1. Code book: International Plumbing Code.
2. Blackboard with dry erase markers, eraser, etc.
3. Lecture and class reading.
4. Instructor demonstration.
5. Handouts.

INSTRUCTOR RESOURCES:

1. Code book: International Plumbing Code.
2. Reference Code book: Code of federal Regulations – 29 CFR part 1926.
3. Day Plan: Day 3.
4. Handouts.
5. 20 Question Test.

TOOLS AND EQUIPMENT:

1. Notebook pen and pencil.

PRESENTATION / DEMONSTATION:

The instructor will give a lecture relating to Solar Thermal wiring for Valves, Relays switches, tanks, limits and the use of the controller based on readings from the course textbooks, code books and personal experience in the field followed by a period of questions and answers (class review) to determine the students understanding of the lesson. The students can verbally answer questions and/or board written examples using the code book. The instructor will then test the students in a written test to determine understanding. A brief lecture on safety will then be given.

CLOSURE:

The instructor will end the lesson by reviewing the lesson objectives to see if they have been met. The instructor will then review the highlights of the lesson. Reading from the text book and students may then be given for a homework assignment.

EVALUATION INSTRUMENTS:

1. Question and answers (Class review).
2. Assignments on blackboard.
3. 20 Question test

SYLLABUS for Solar Thermal

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|---------------------------|-------------------------|
| I. Program course- | 3 Days |
| II. Clock hours per week- | 24 hours |
| III. Length of course- | 3 days |
| IV. Class size maximum- | 24 students |
| V. Required text books- | 1. (Unknown at present) |

VI. Course description:

Solar Thermal Certification course covers Solar Theory, Solar energy fundamentals, energy wave forms, heat transfer, insulation values and how they are effected by location, season and climate, Redbook and tracking data. Solar Thermal applications in all markets, SRCC, collector losses, and efficiency curves, the history of solar thermal energy, Sizing and design theory, practical real world results vs. computer simulation. Roofing standards, project planning and audit reporting, solar fraction miscalculation, components, applications, and highlights different types of water heating appliances connected to the systems, including various types of panel and rod installation. The theory of how to correctly measure and size a solar system and make a site assessment will be covered. How to check for defects in materials and components will be covered. Demonstrations will be conducted on how to replace and clean and service inside and outside components including storage tanks will be covered, including how to detect and repair an improper installed existing systems. How indirect tanks differ from one manufacturer to another and what affect they have on heat transfer will be shown. How to determine the Delta T of a system and why it is so important. System piping, pool heaters, water relief, and other uses for Solar heated water will be discussed. Correct procedures, tools and equipment usage will be emphasized. National codes relating to Solar heating systems and piping will be reviewed. The Identification of the components of active direct and active indirect Solar Systems, passive direct and passive indirect Solar Systems, Solar Thermal wiring installation and location of the controller, differential controller, sensors, photovoltaic module controller, pump and timer controller. Tools Equipment, sales and job safety will be reviewed. A technician must be able to determine if everything is structurally and visually sound or if there are defects on any part of the entire installation Students must supply all tools.

VII. Course organization:

Content and scope of course

- Day 1** **Solar Thermal panels (rooftop setup), includes Site assessment, tracking and Safety Identification. The components of active direct and active indirect Solar Systems Identifying the components of passive direct and passive indirect Solar Systems, flow rates + Delta “T” and the location of Plumbing valves and other components.**
- Day 2** **Water heating, and piping to tanks and the use of diagrams and schematics.**
- Day 3** **Wiring hot water valves relays and circulators System Piping design valves and other components required.**

VIII. Course Objectives:

By the end of this course students will be able to:

- 1. Correctly answer questions relating to Piping of Solar systems.**
- 2. Correctly identify tools, equipment and materials related to Solar units.**
- 3. Correctly answer questions relating to tanks, flow rates and wiring.**
- 4. Correctly identify parts of a Solar system. Determine everything is structurally and visually sound or if there are defects on any part of the entire installation. Worksite safety must be shown.**

IX. Basis for Evaluation - 3 Exams = 100%

X. Prerequisite - Specific S and P licensing prior experience is required for this Class.