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# Appendix A

## Support Materials

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# Print Resources

Blankenbaker, E. Keith, Modern Plumbing, The Goodheart-Willcox Company, Inc.,2005

Feirer, Mark, D. & Feirer, John, L., Carpentry & Building Construction, Glencoe/McGraw-Hill, 2004

Mullin, Ray C., Miller, Gary & Stephenson, Paul, Electrical Wiring Residential, Thomson Nelson, 2003

Wagner, Willis H. & Smith, Howard Bud, Modern Carpentry, The Goodheart-Willcox Company, Inc.,2003

Creative Homeowner - Smart Guide Series

Roofing

Plumbing

Wiring

Ceramic Tile

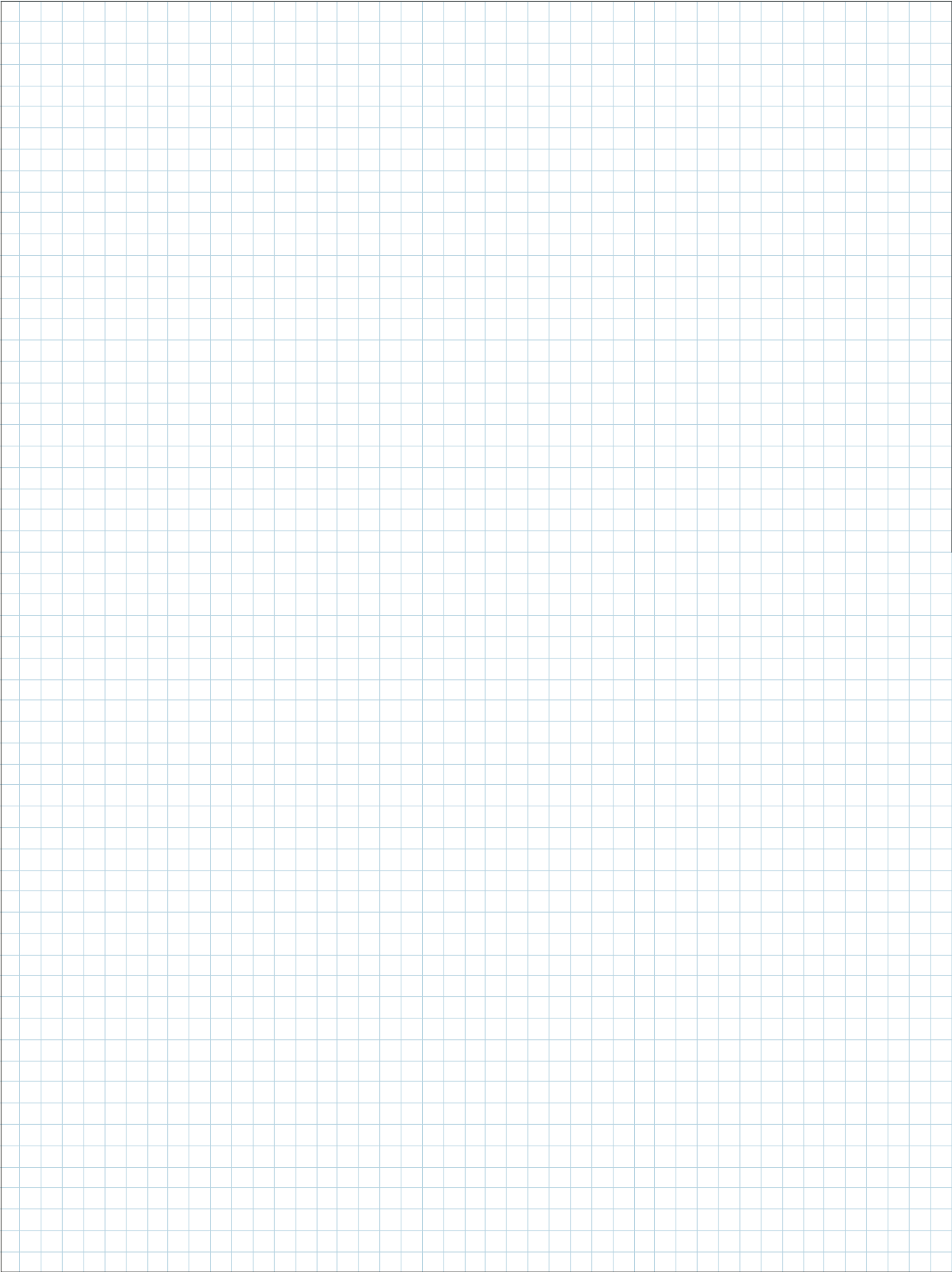
Stairs and Railings



# Drawings

These drawings are produced for use with the activities in the course. The first two, Orthographic and Isometric grids, are for duplication for use by students in a number of different activities. The others are specific to activities.



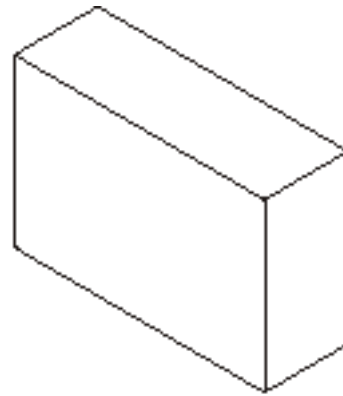
	

Title: \_\_\_\_\_

Title: \_\_\_\_\_



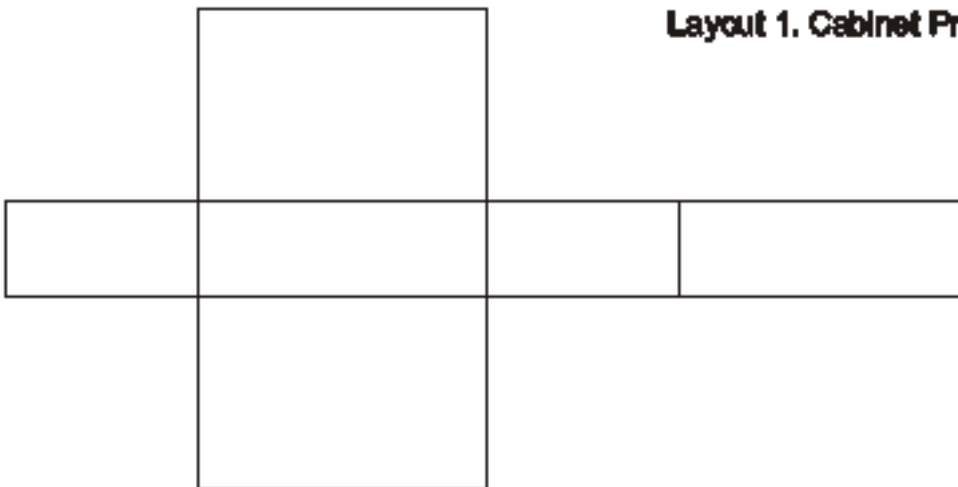
**Layout 1. Orthographic**



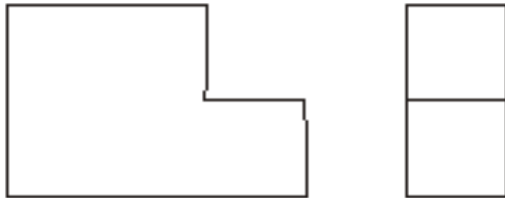
**Layout 1 Isometric**



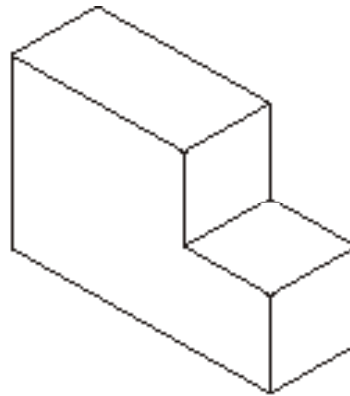
**Layout 1. Cabinet Projection**



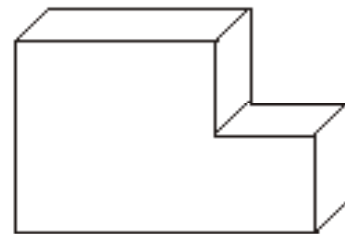
**Layout 1. Pattern**



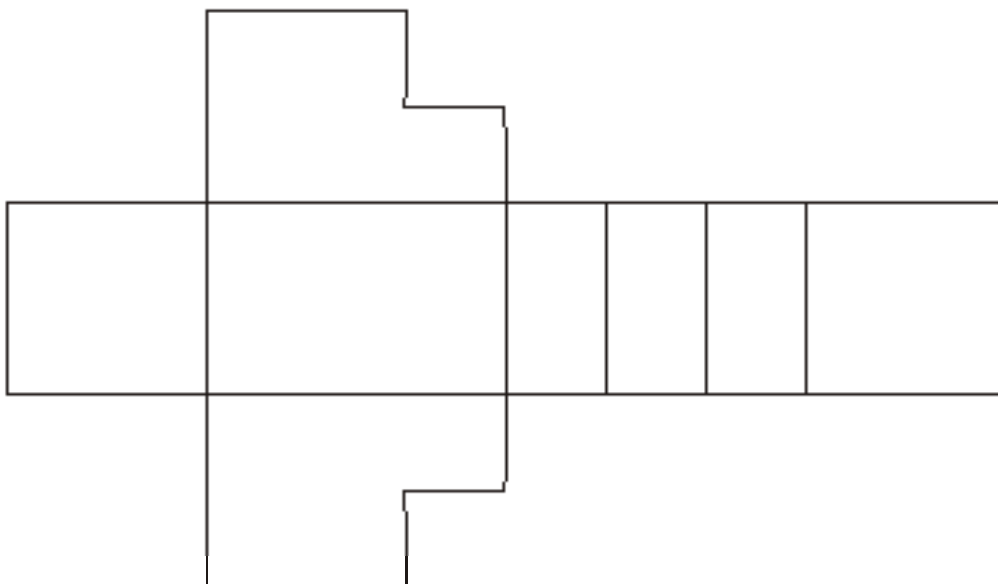
**Layout 2. Orthographic**



**Layout 2. Isometric**



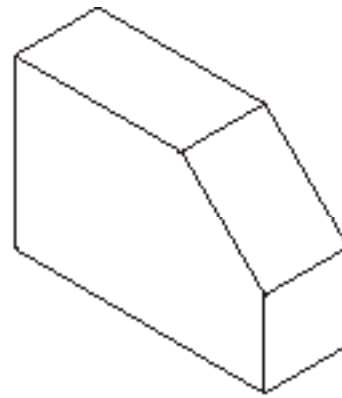
**Layout 2. Cabinet Projection**



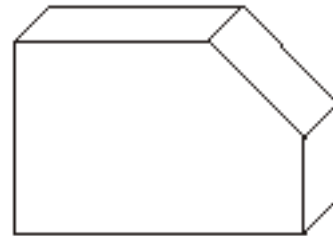
**Layout 2. Pattern**



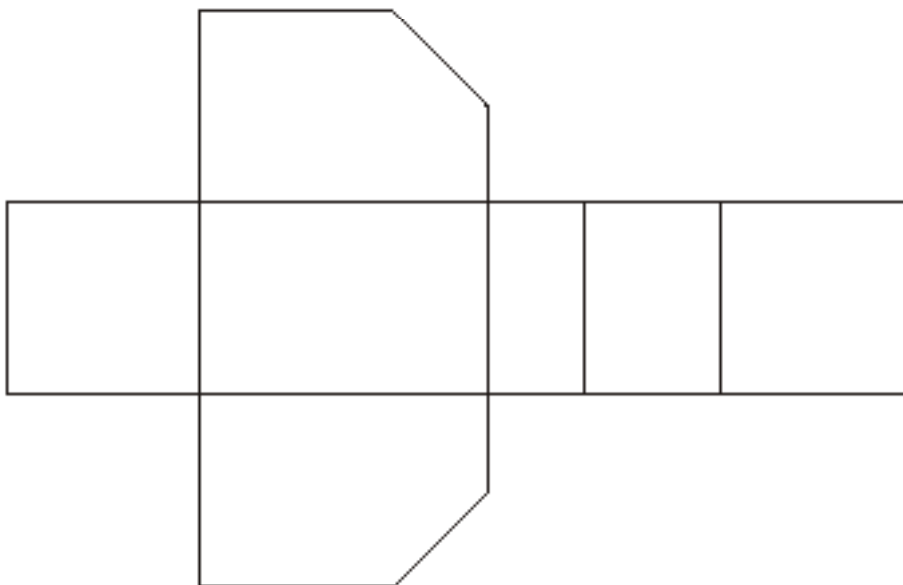
**Layout 3. Orthographic**



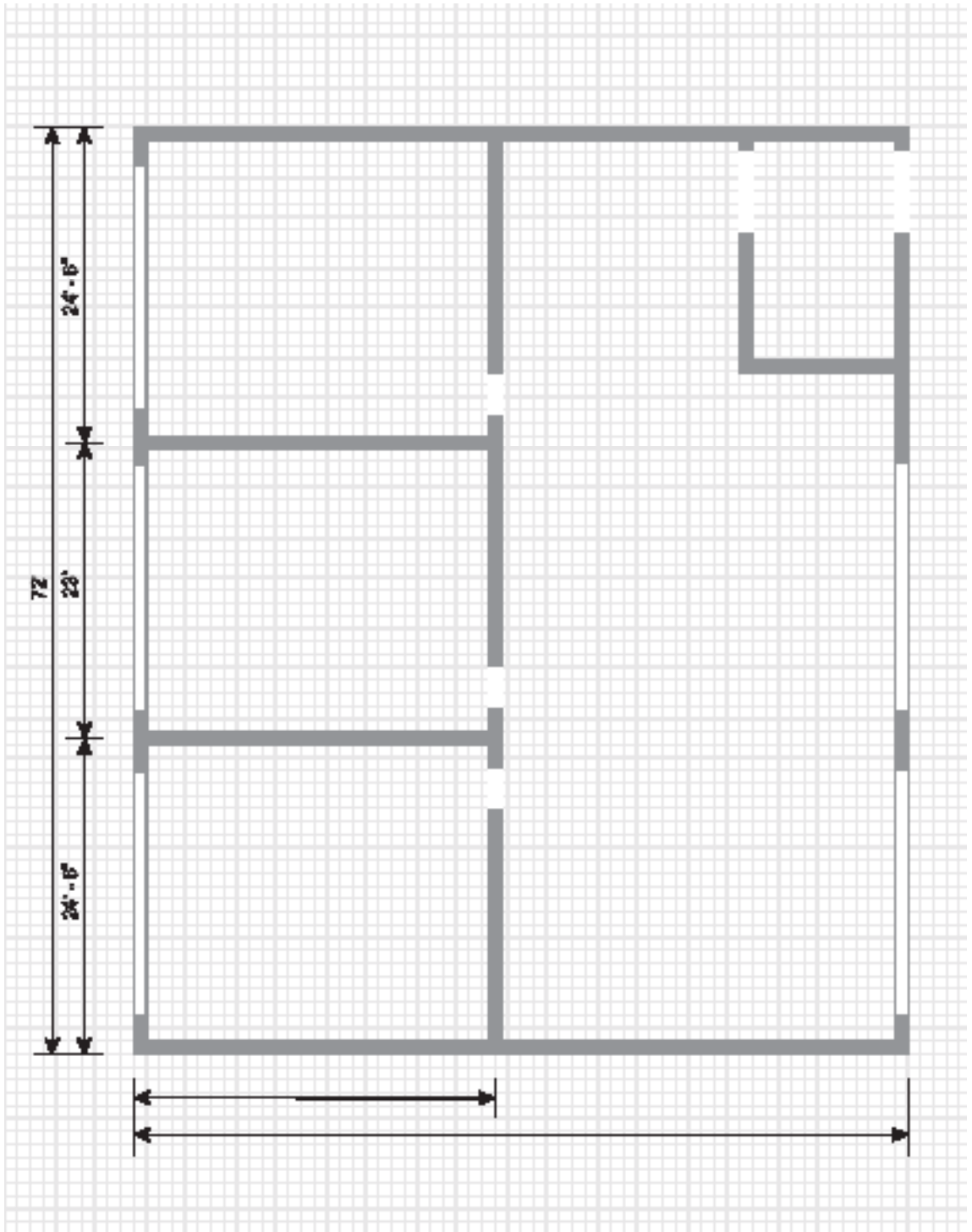
**Layout 3. Isometric**



**Layout 3 Cabinet Projection**

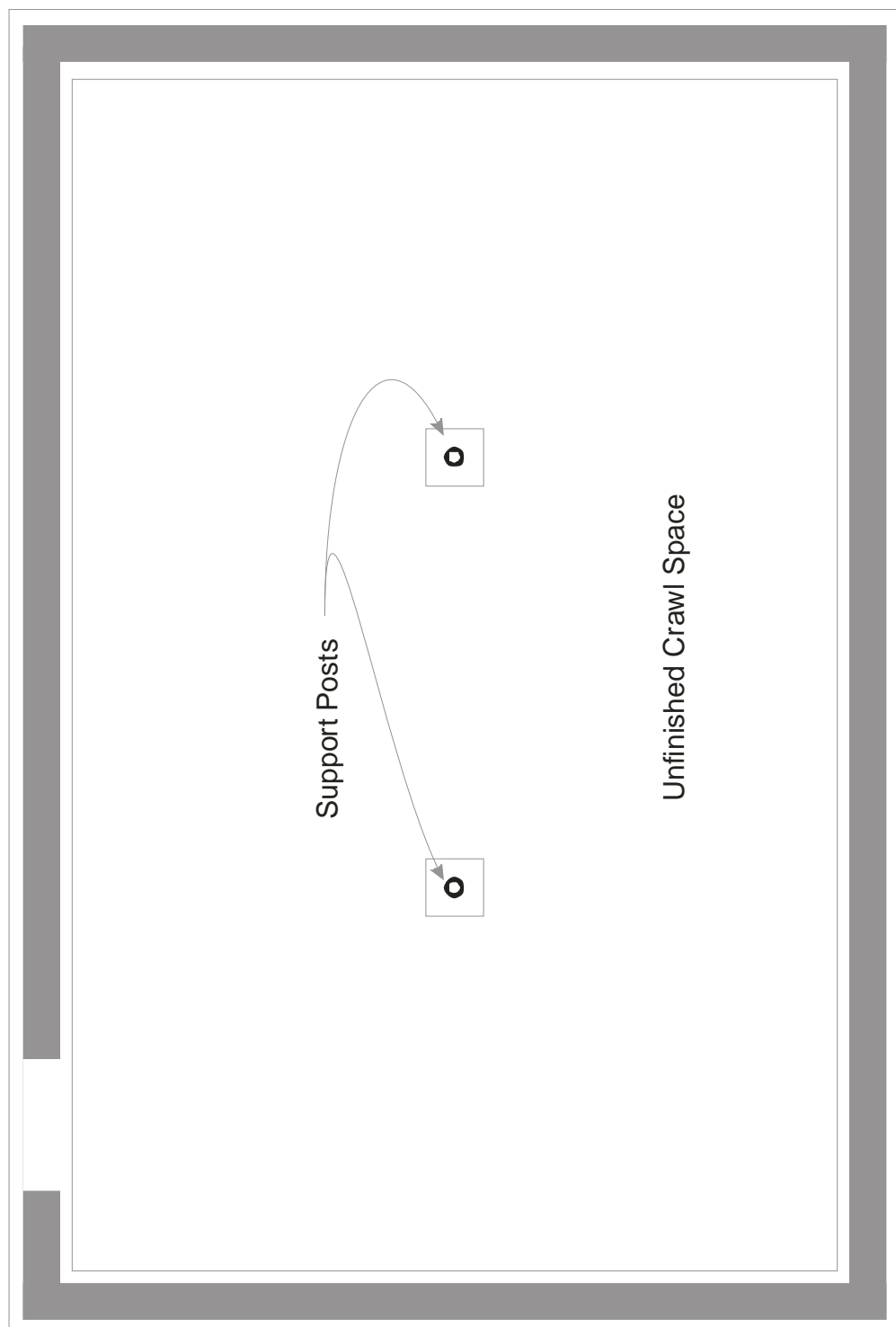


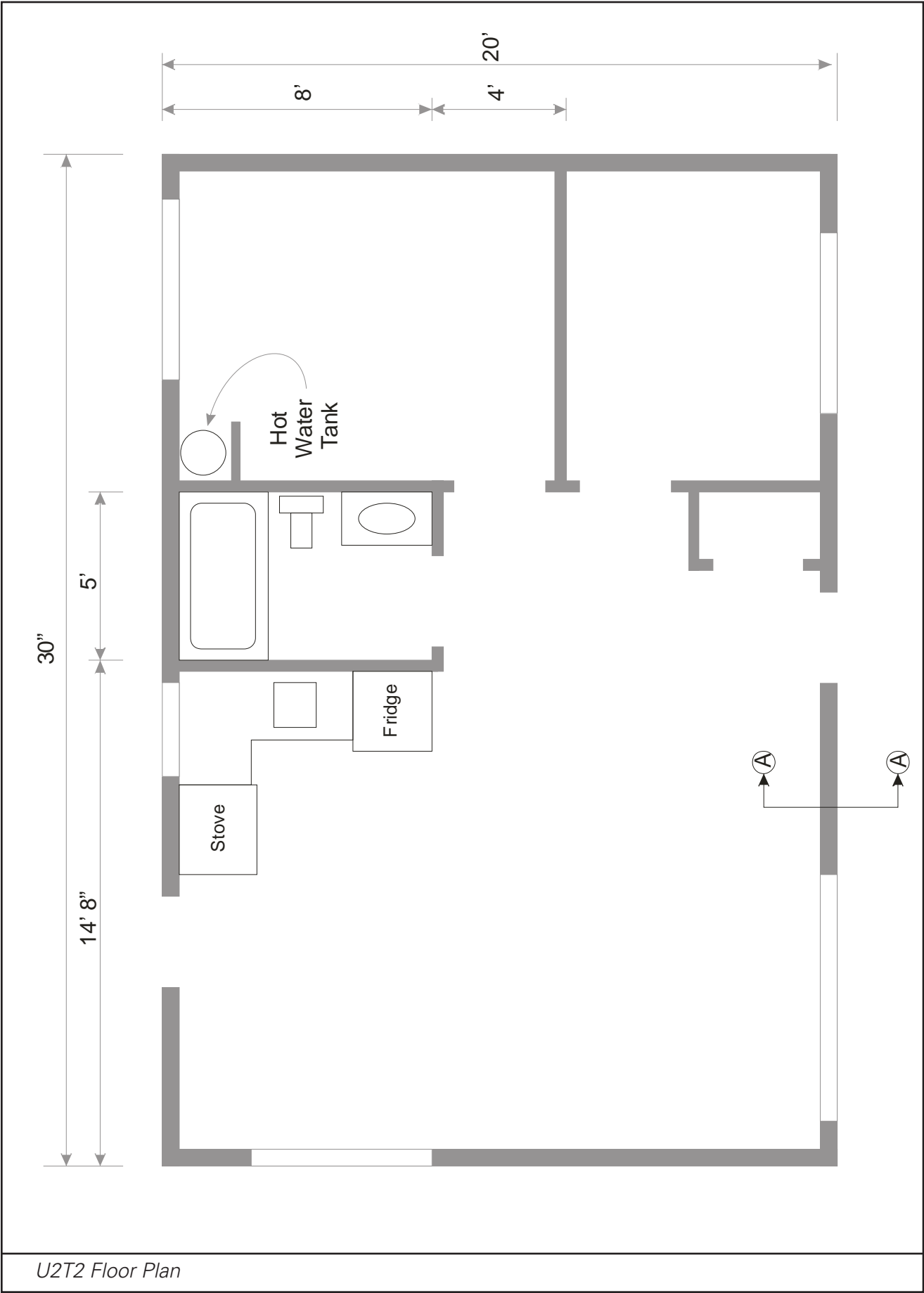
**Layout 3. Pattern**



U2T2 Scale

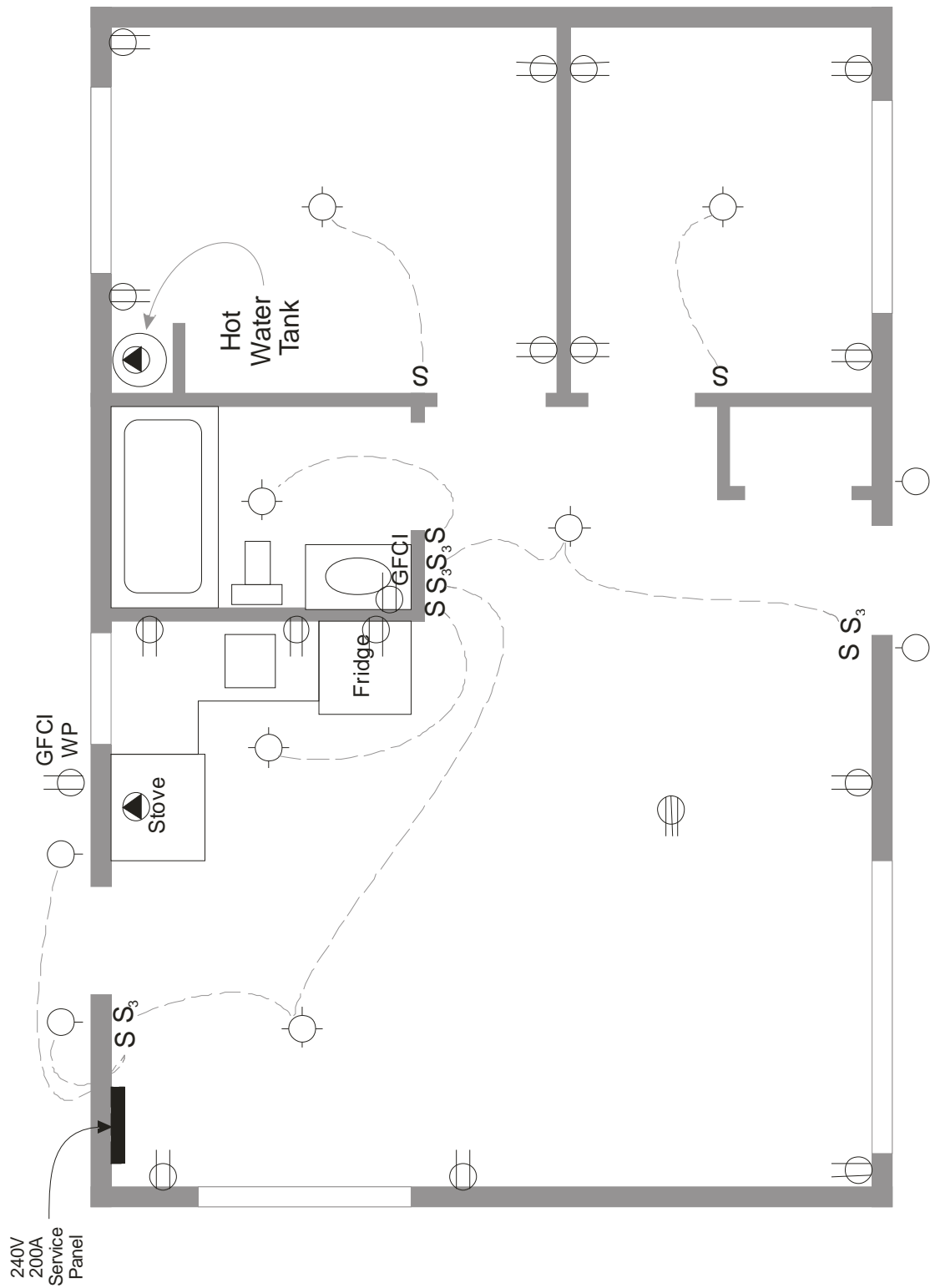
Scale: 1 square = 1 Foot



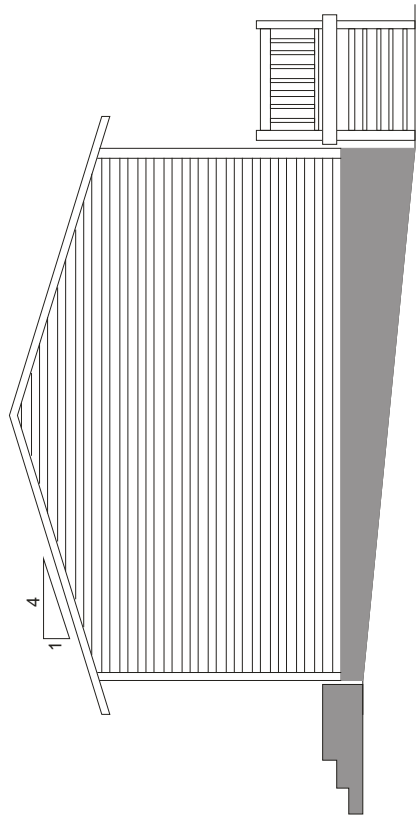


U2T2 Floor Plan

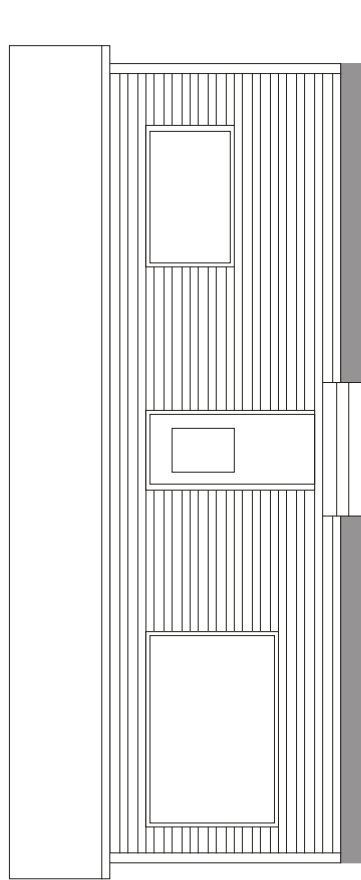




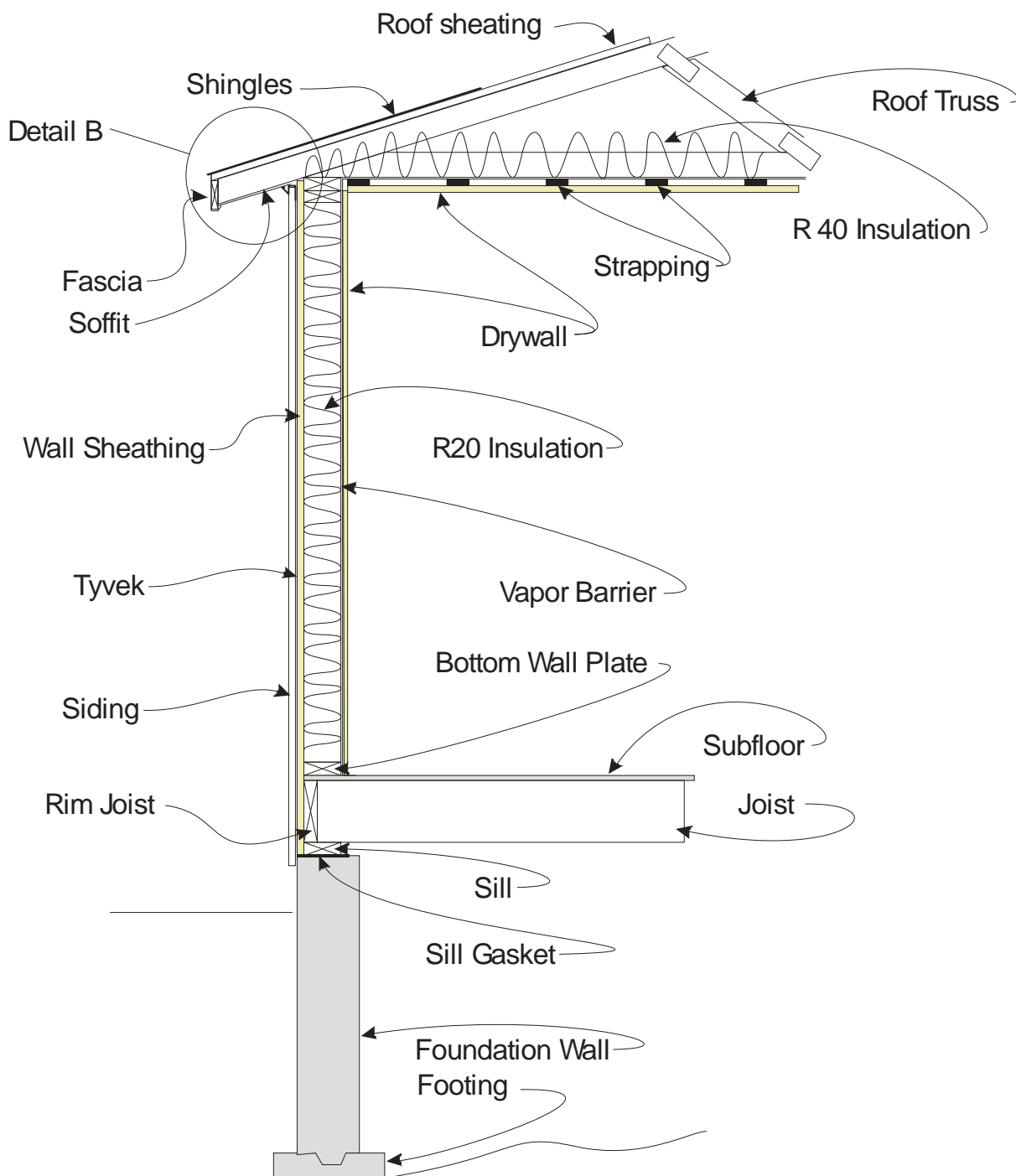
U2T2 Electrical Plan



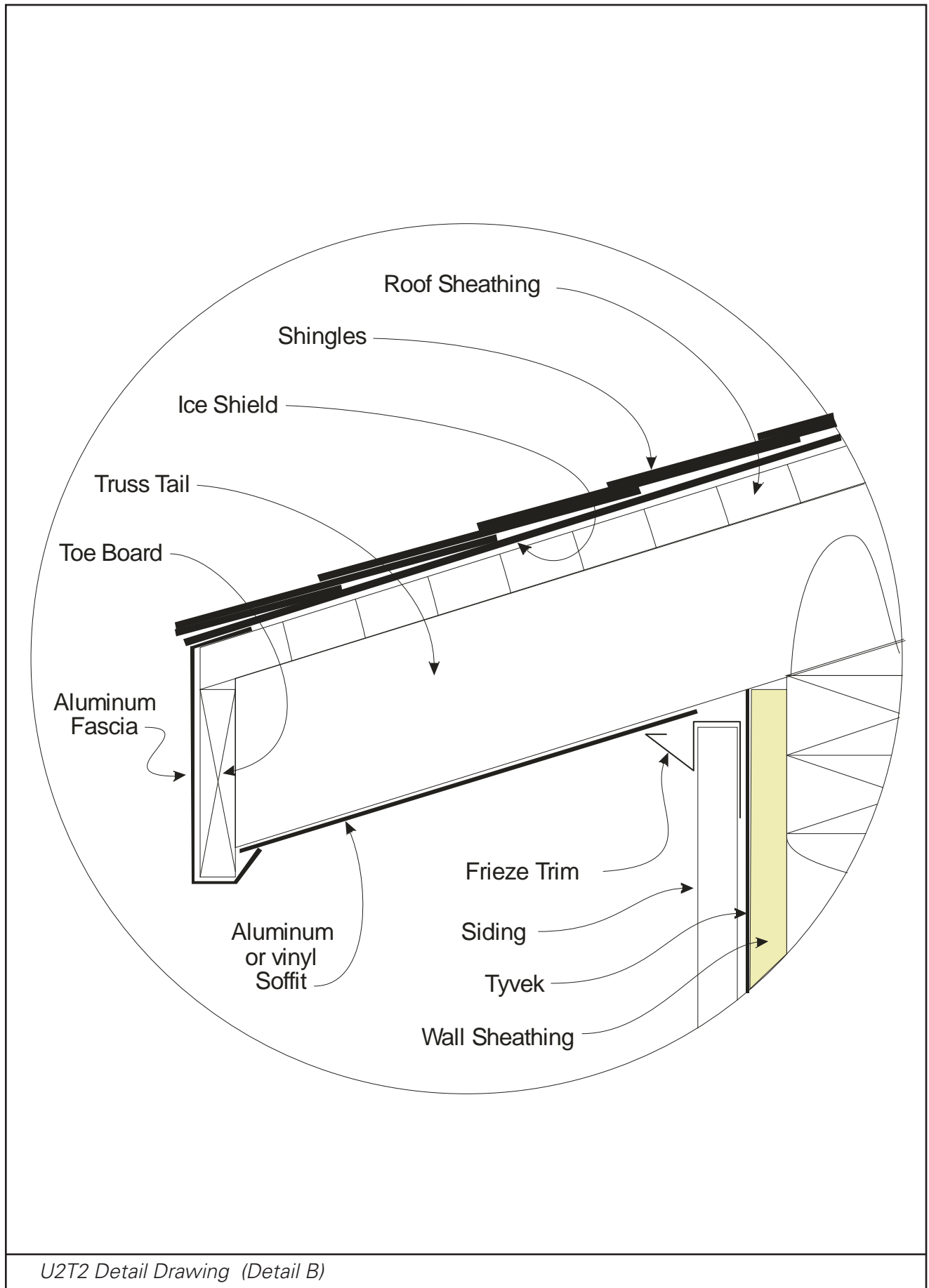
Right Side elevation

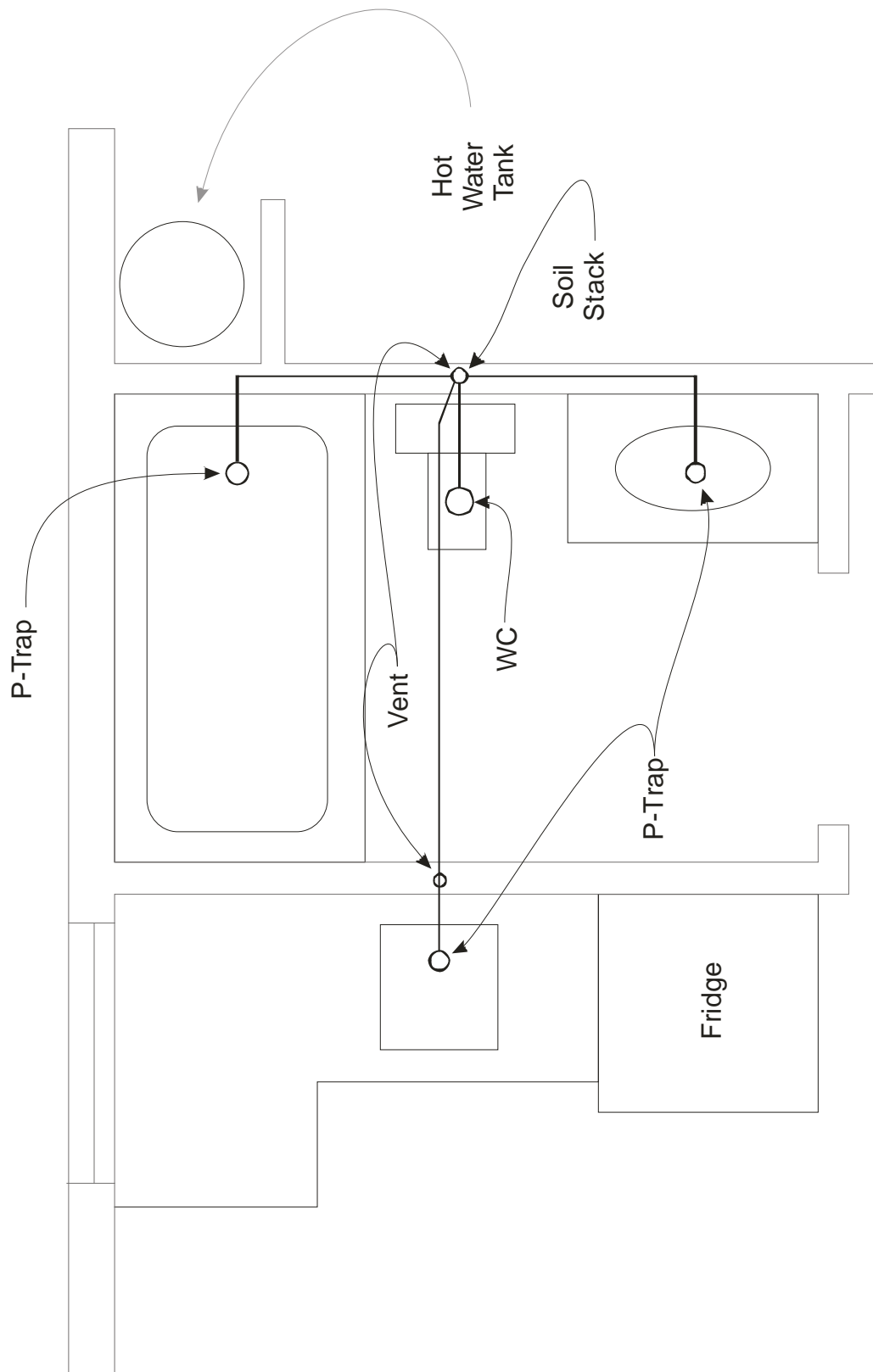


Front Elevation

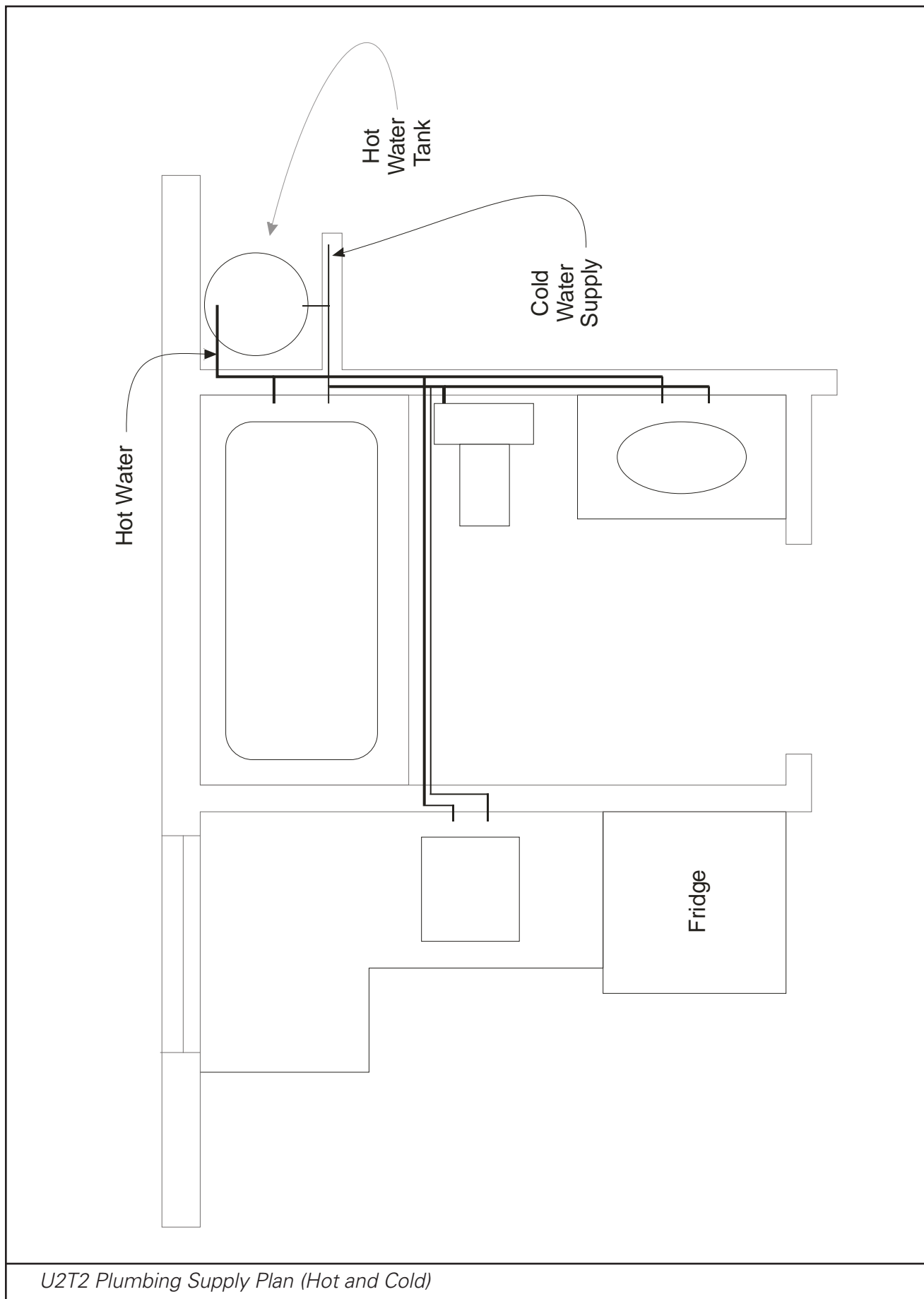


*U2T2 Section Drawing (Section "A-A")*

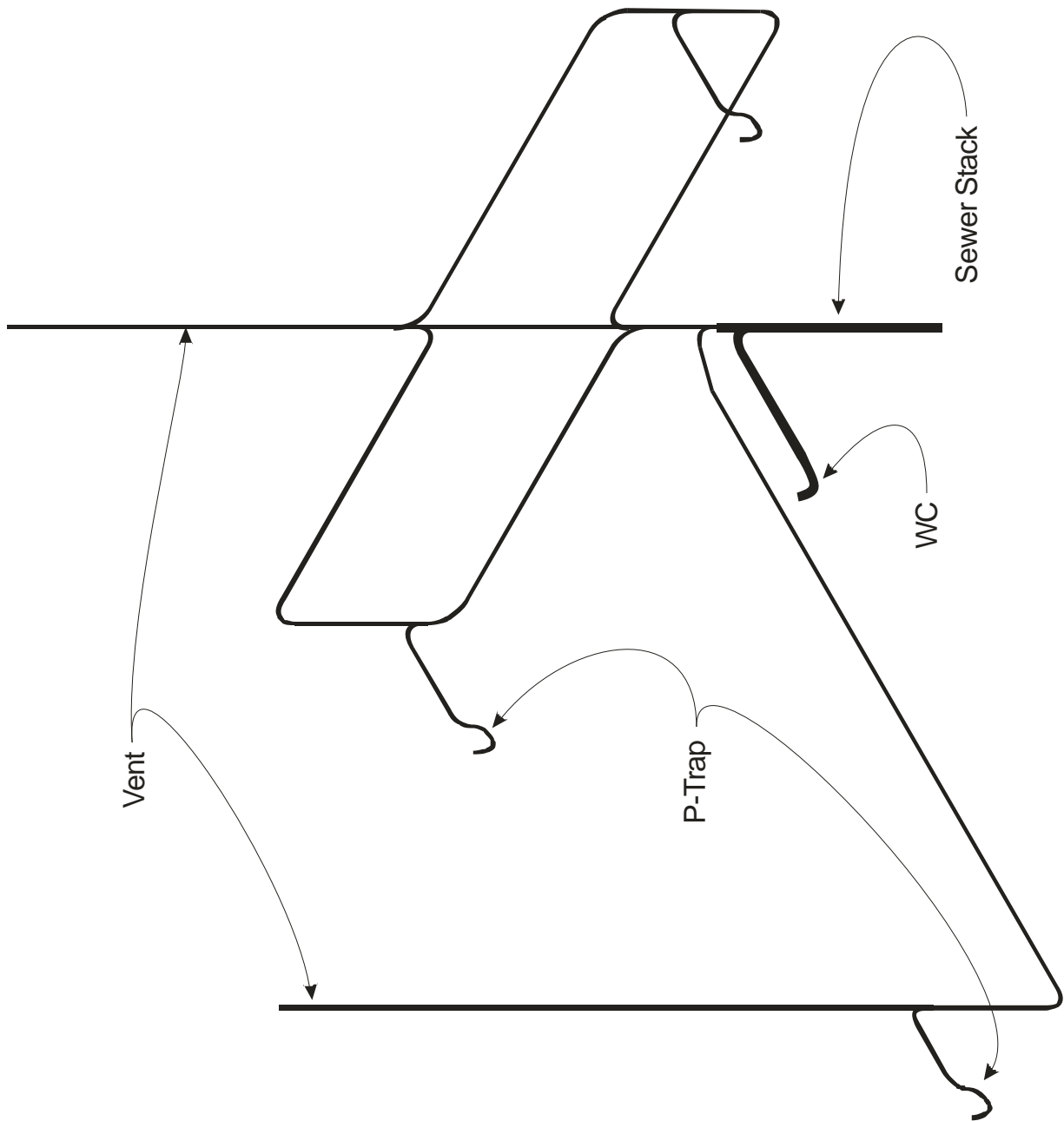




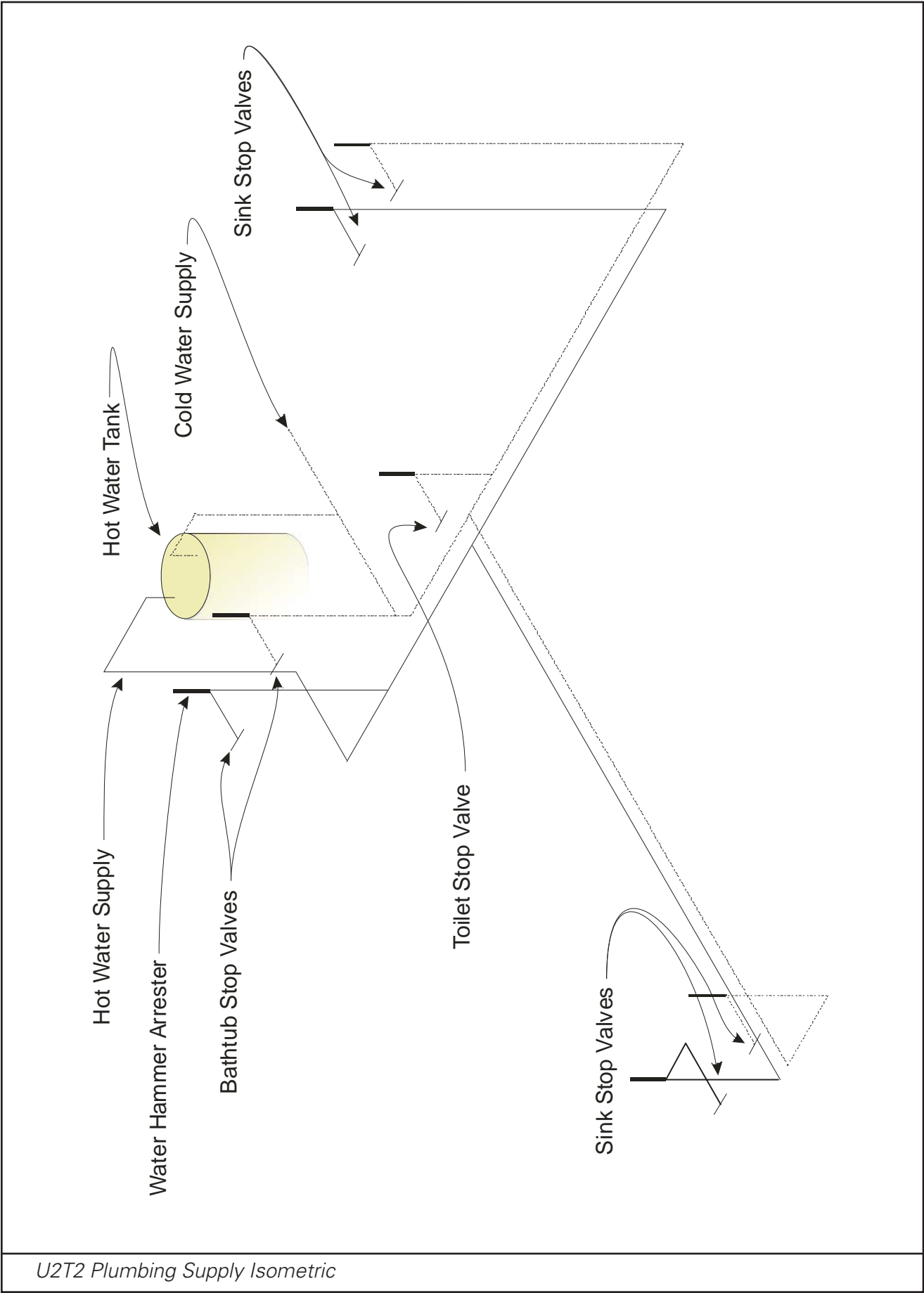
U2T2 Plumbing Waste Water Plan (DWV)



*U2T2 Plumbing Supply Plan (Hot and Cold)*

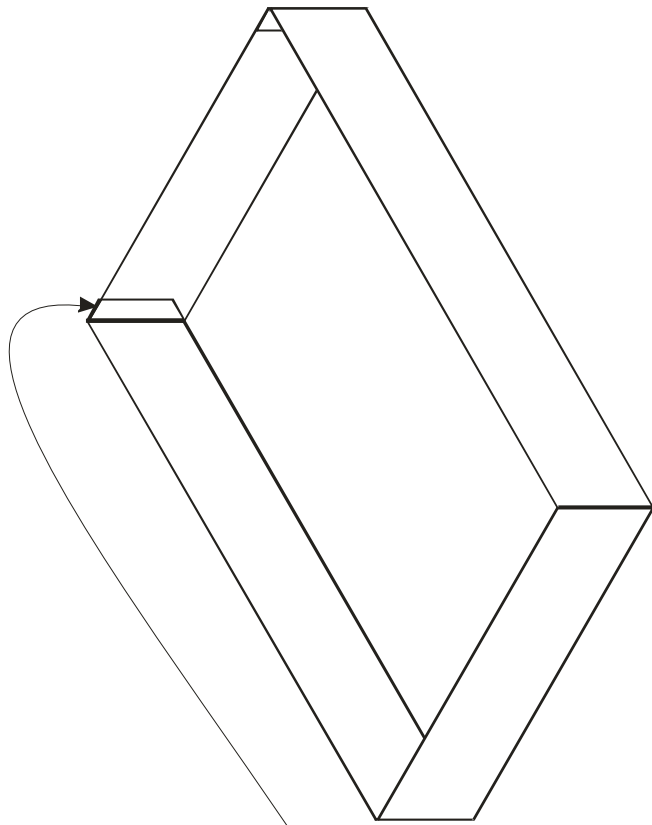


*U2T2 Plumbing Waste Isometric*

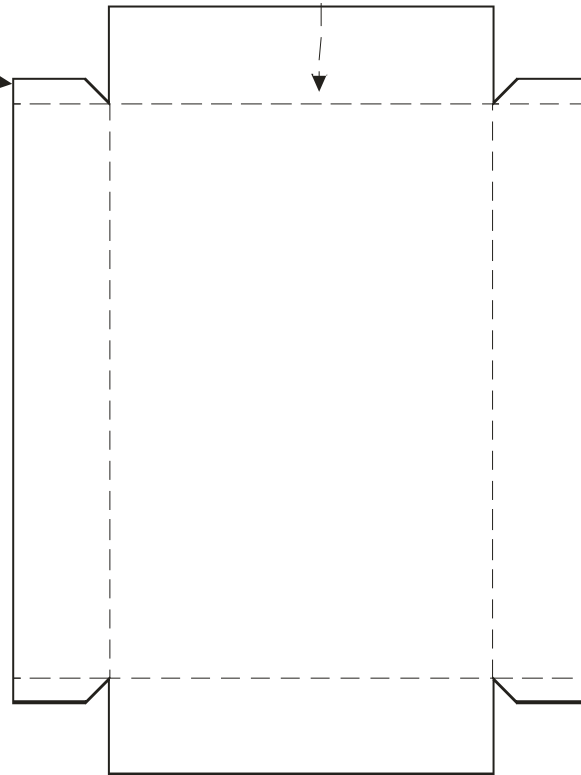


U2T2 Plumbing Supply Isometric



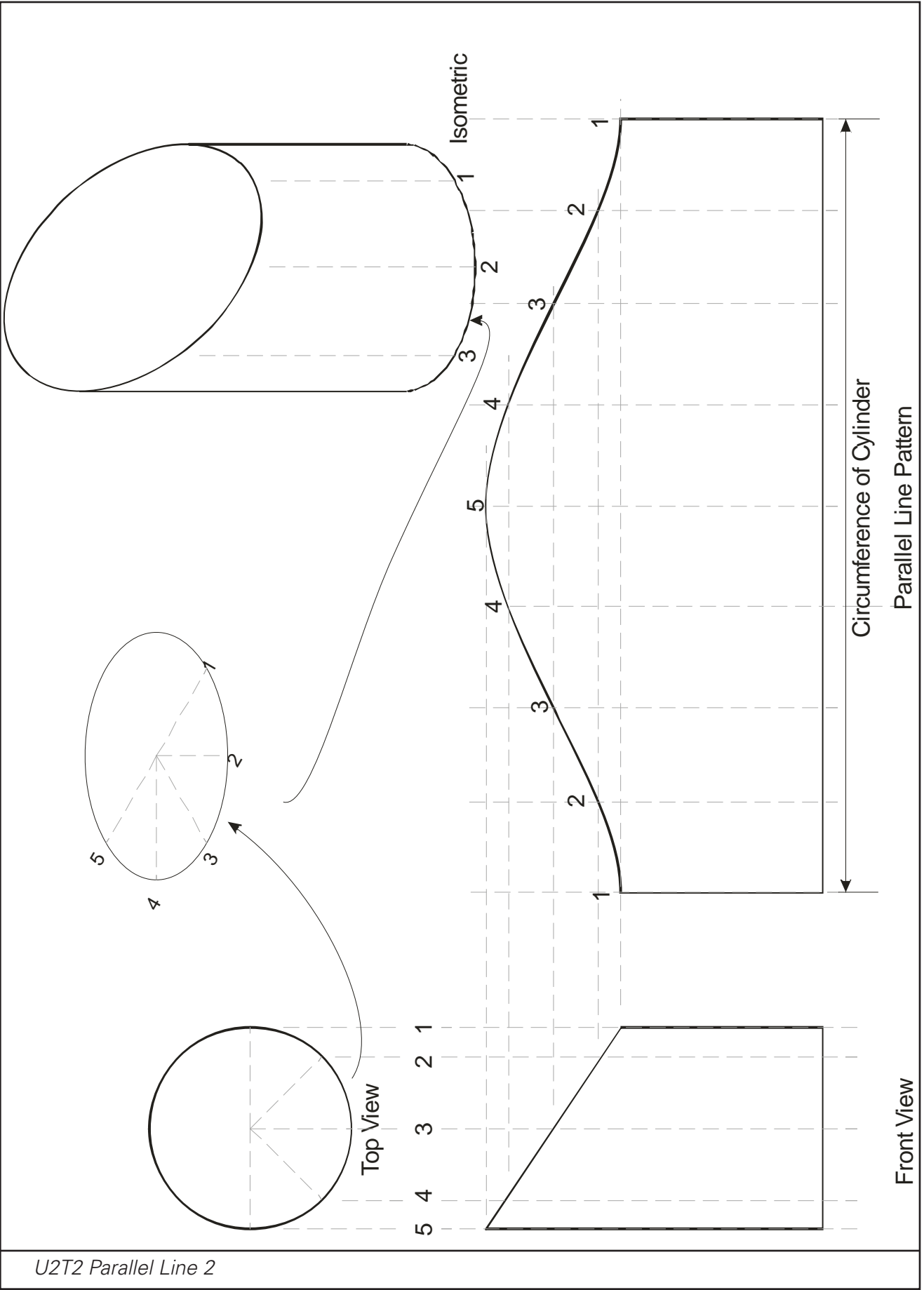


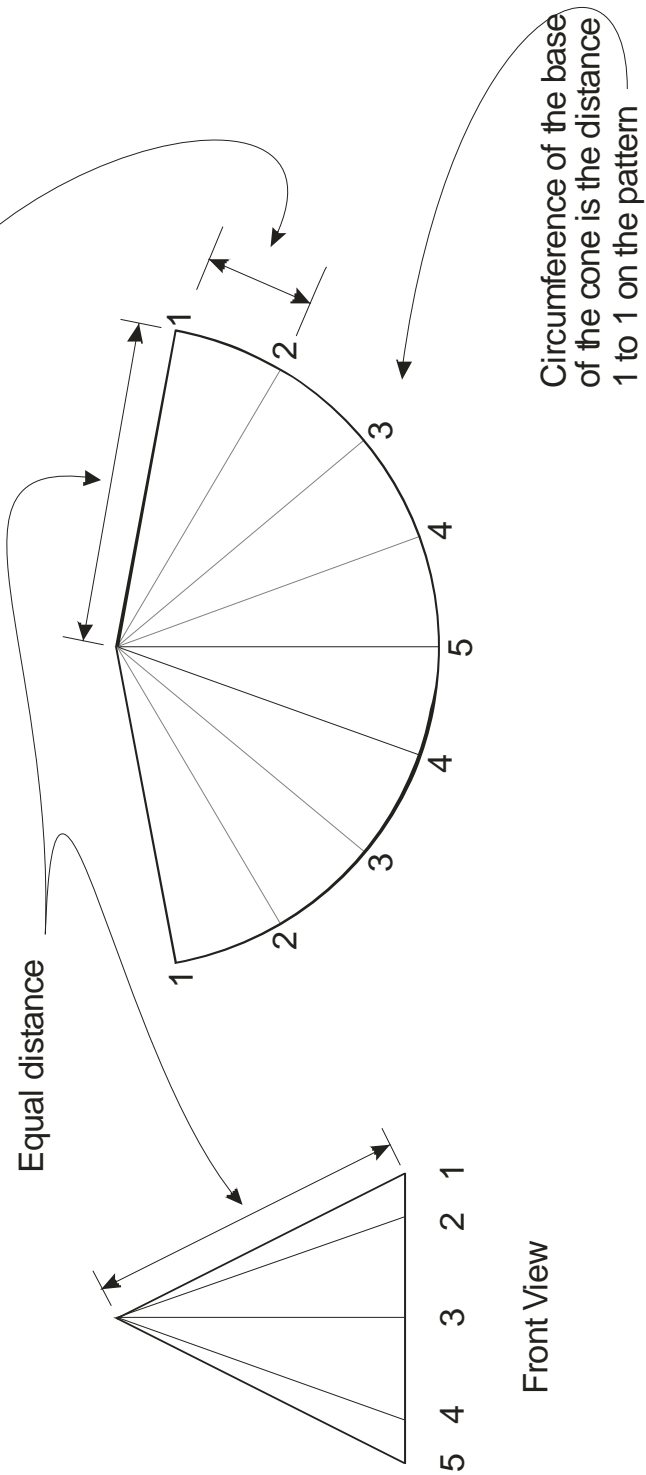
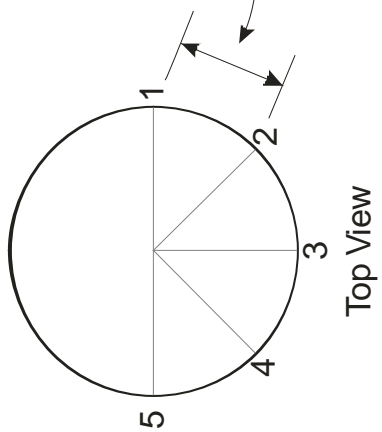
Parallel Line Layout 1 Isometric

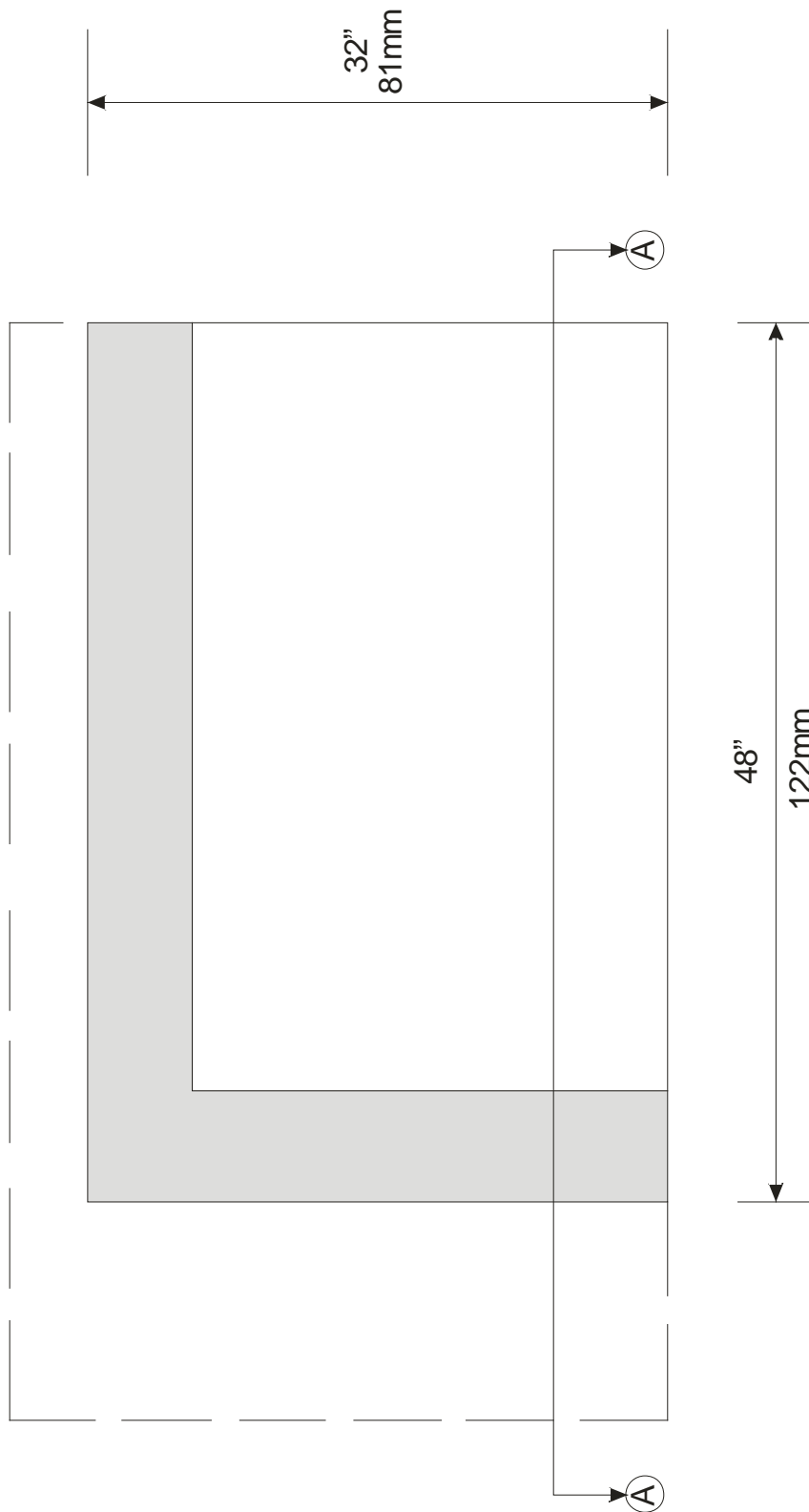


Folding (Bending) Lines

Parallel Line Layout 1 Pattern View





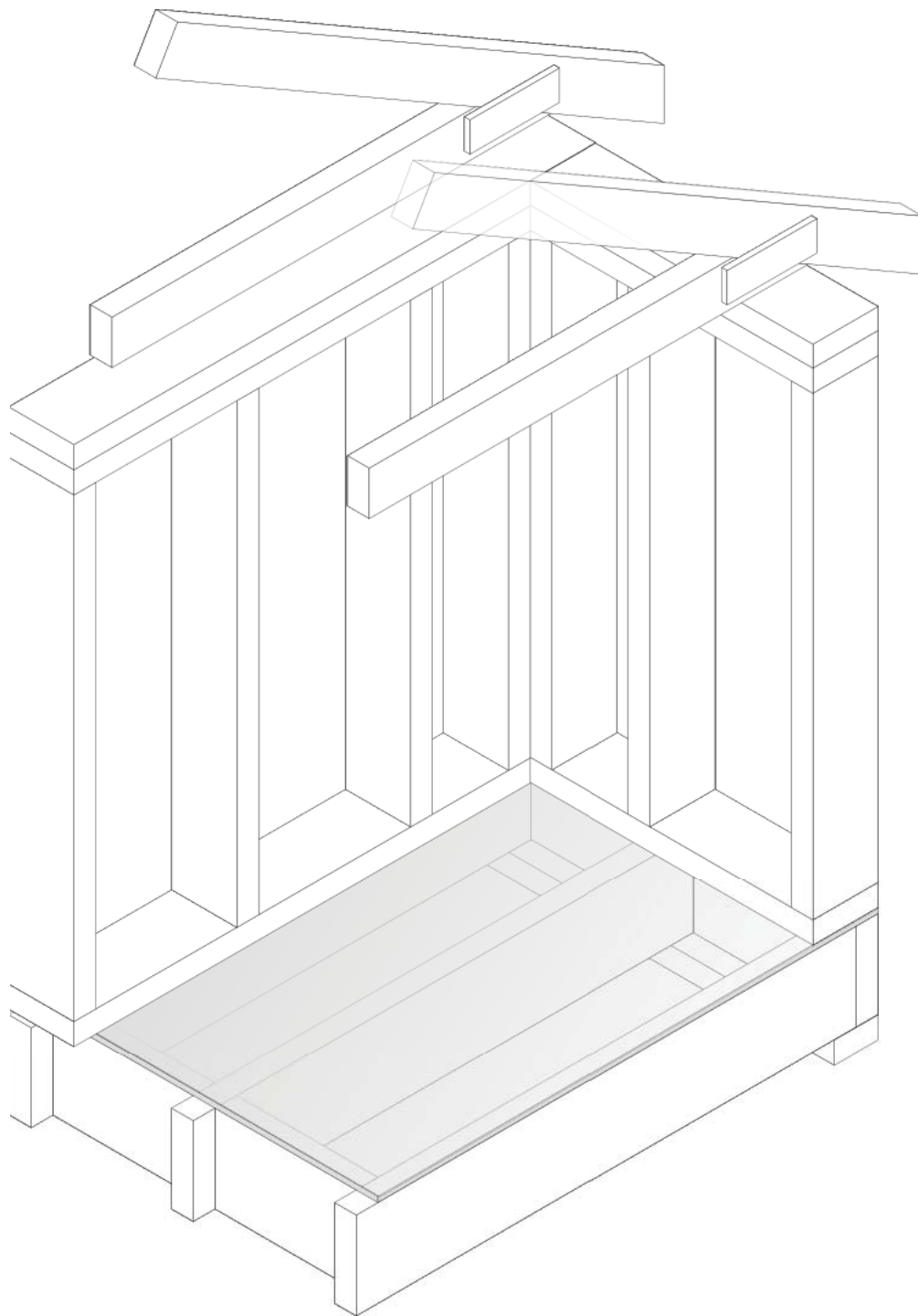


### Design Option 1 Floor Plan

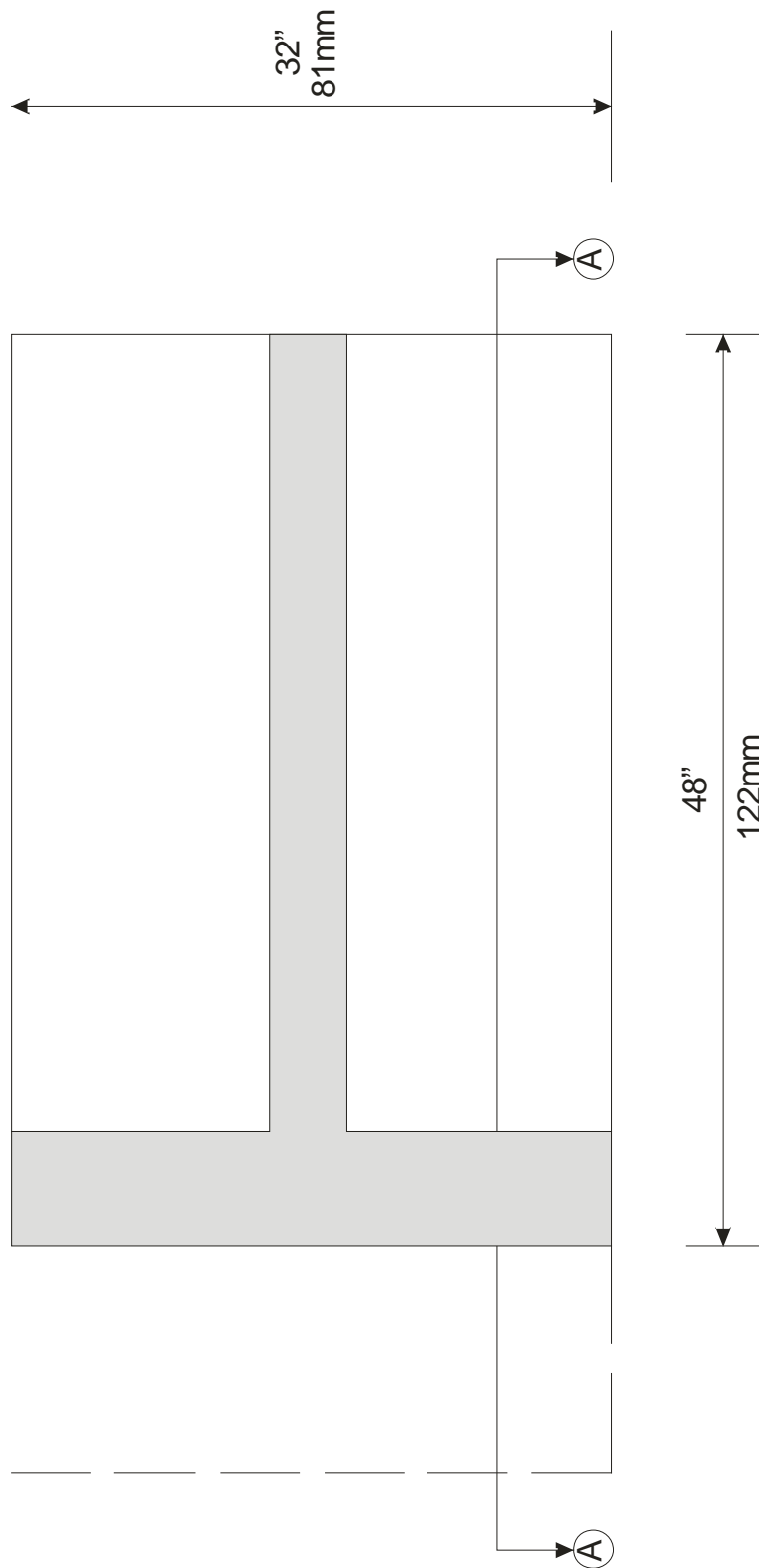
Corner layout with two exterior walls.

Walls at 4 feet or 122 mm high.

Roof section with 1 foot eave overhang and 6 inch extension over gable

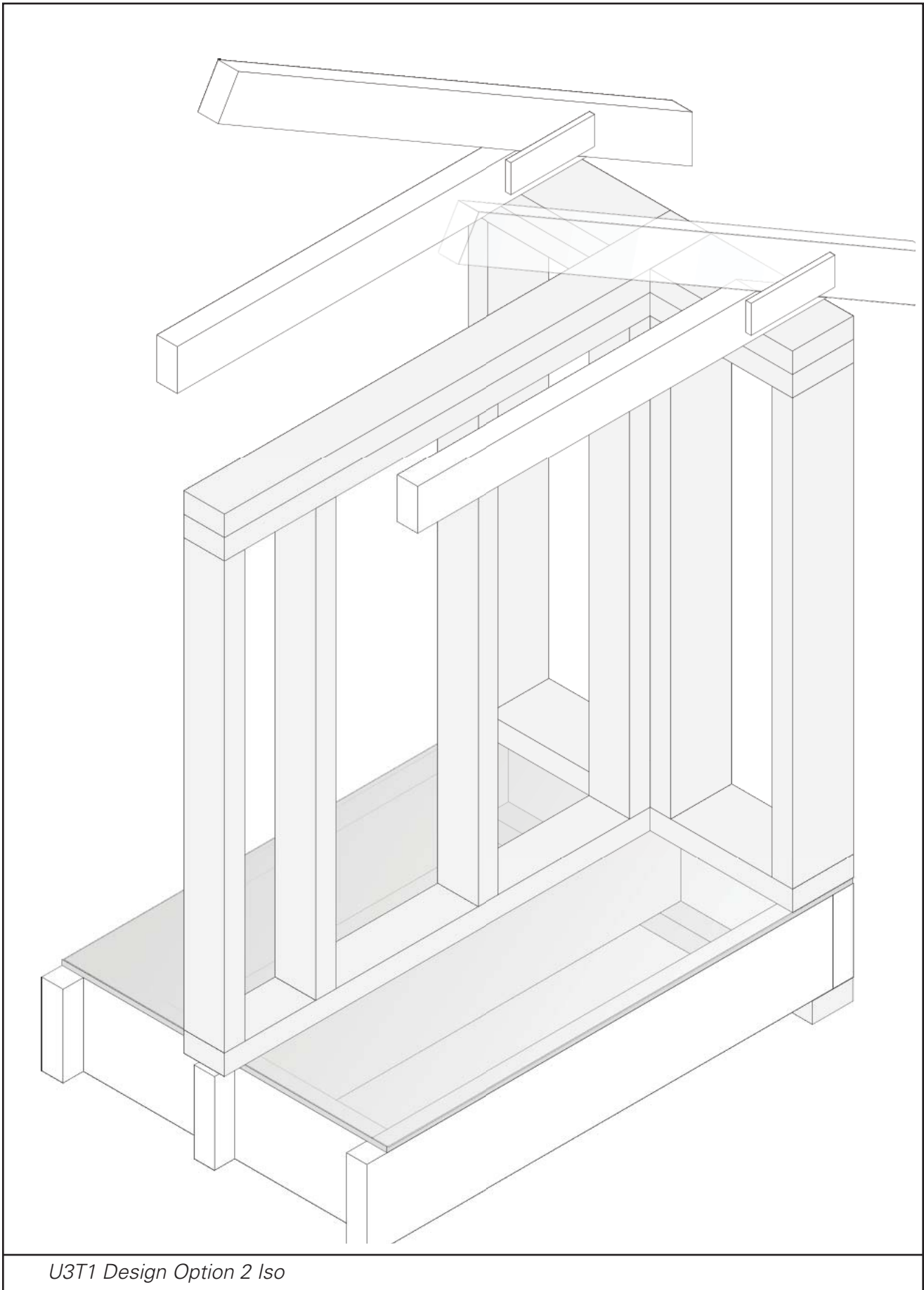


*U3T1 Design Option 1 Isometric*

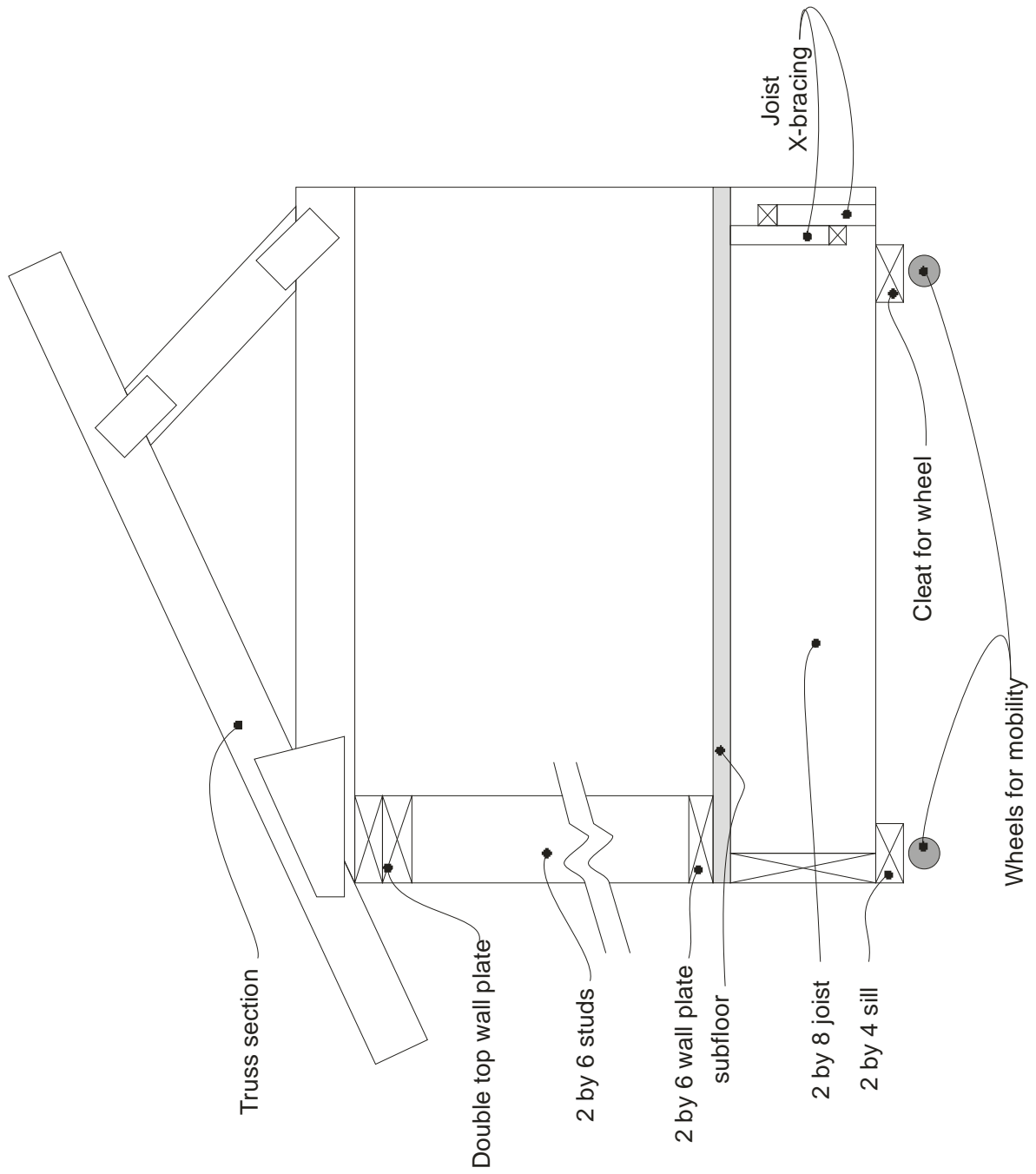


### Design Option 2 Floor Plan

Layout with one exterior and one interior wall.  
 Walls at 4 feet or 122 mm high.  
 Roof section with 1 foot eave overhang

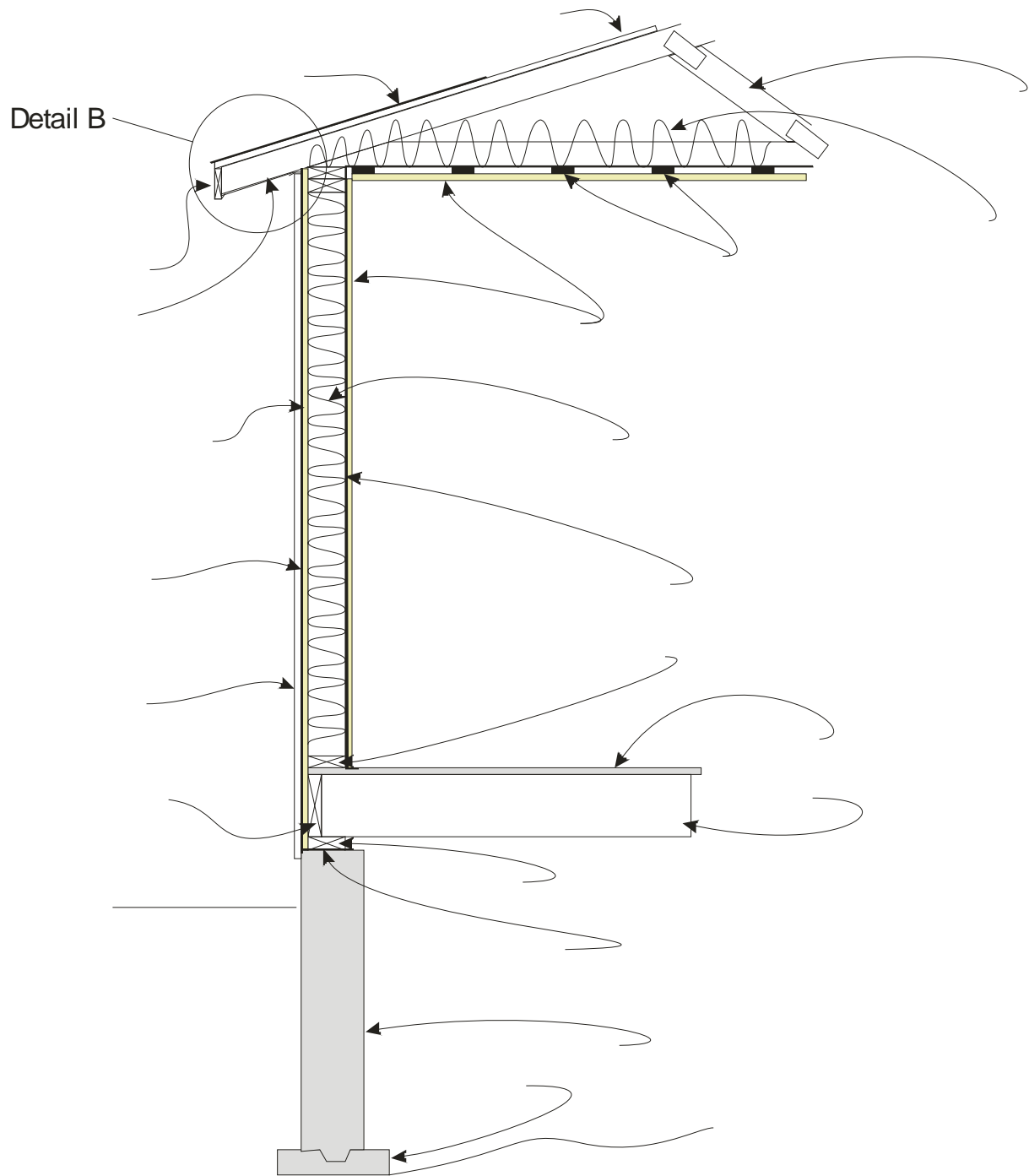


*U3T1 Design Option 2 Iso*

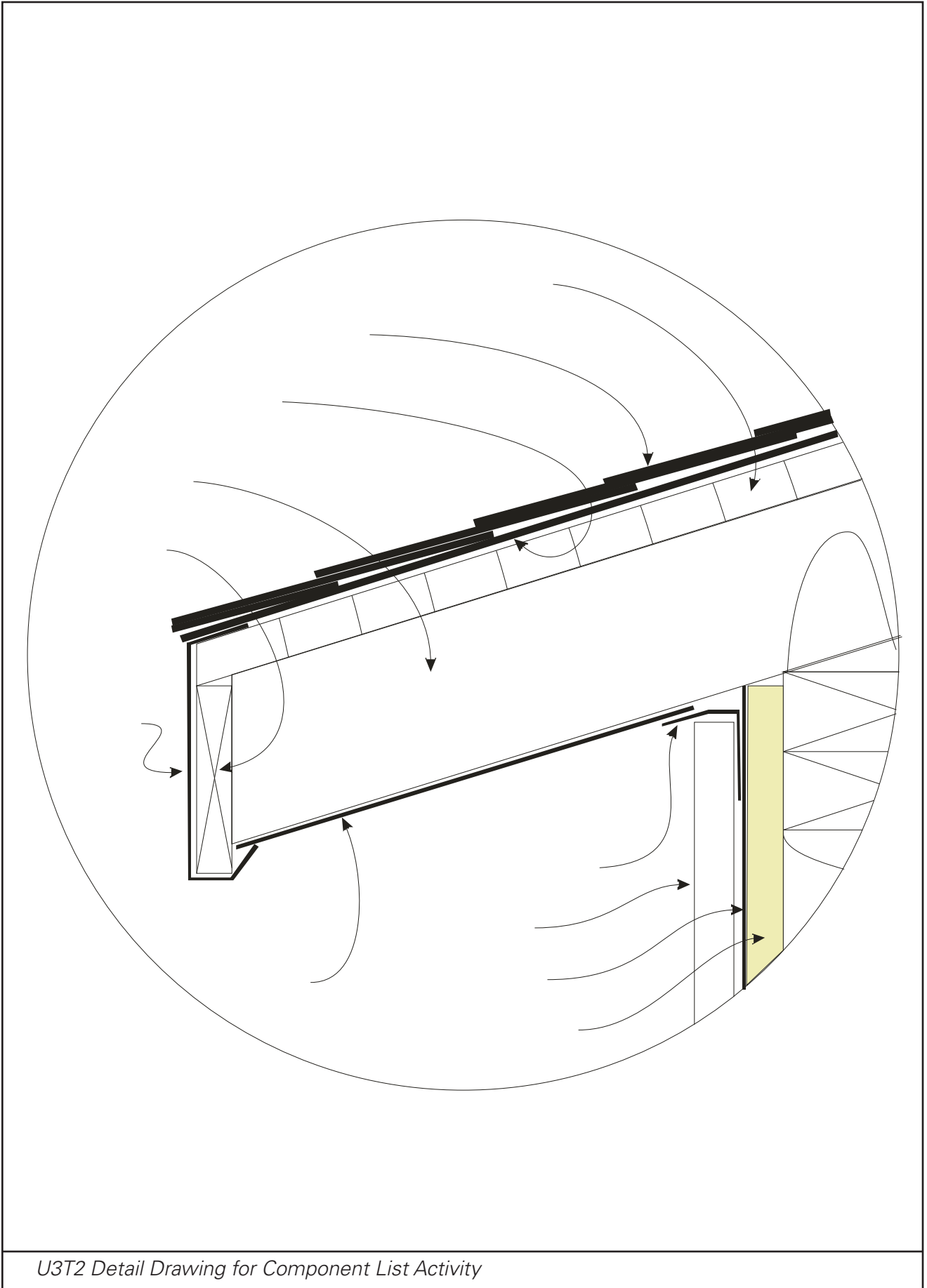


U3T1 Design Section "A-A" (Options 1 and 2)

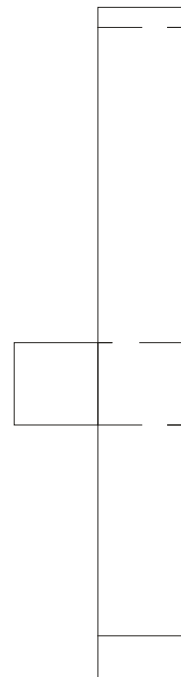
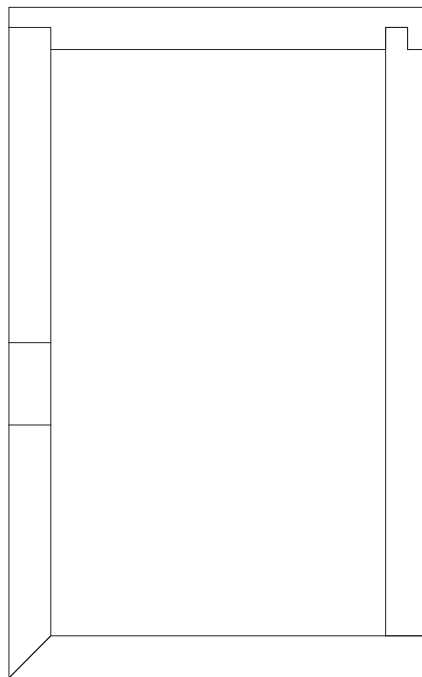
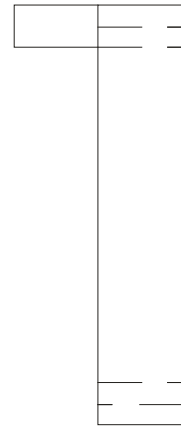
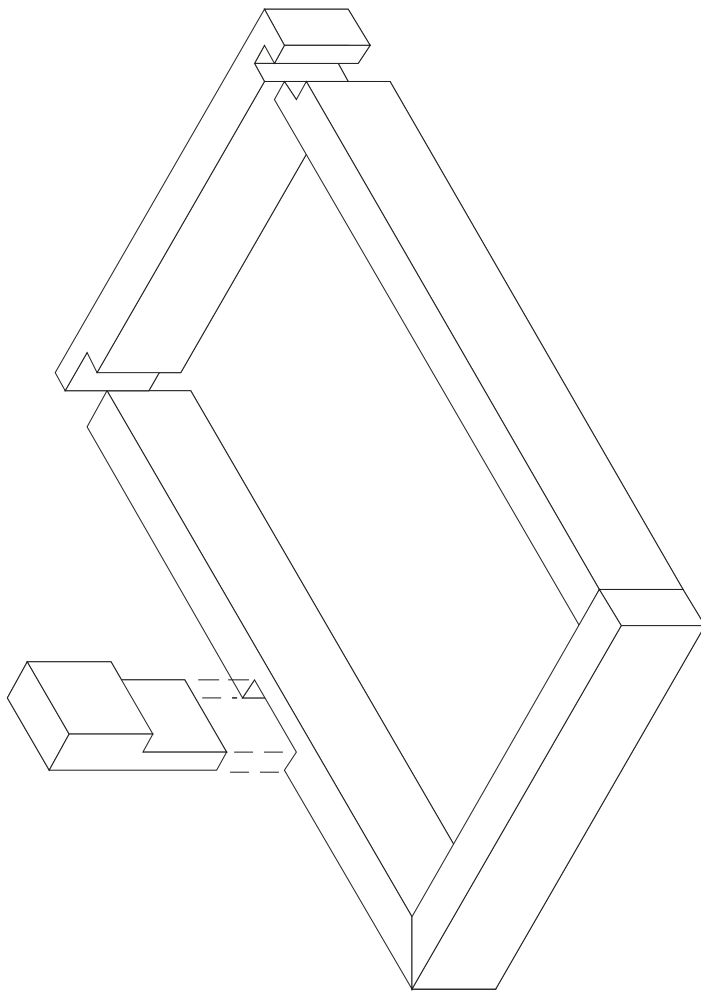




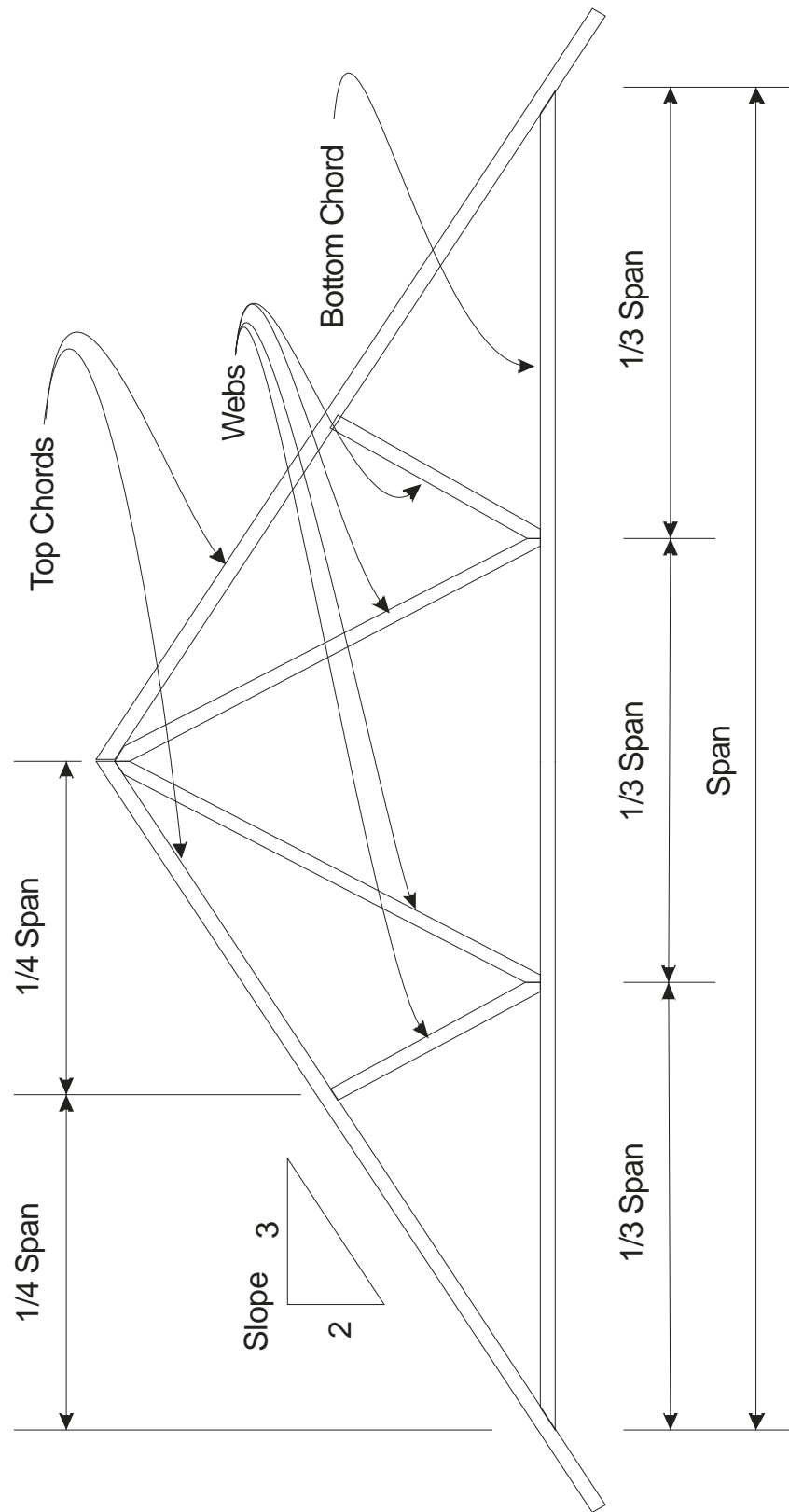
*U3T2 Section Drawing for Component List Activity*



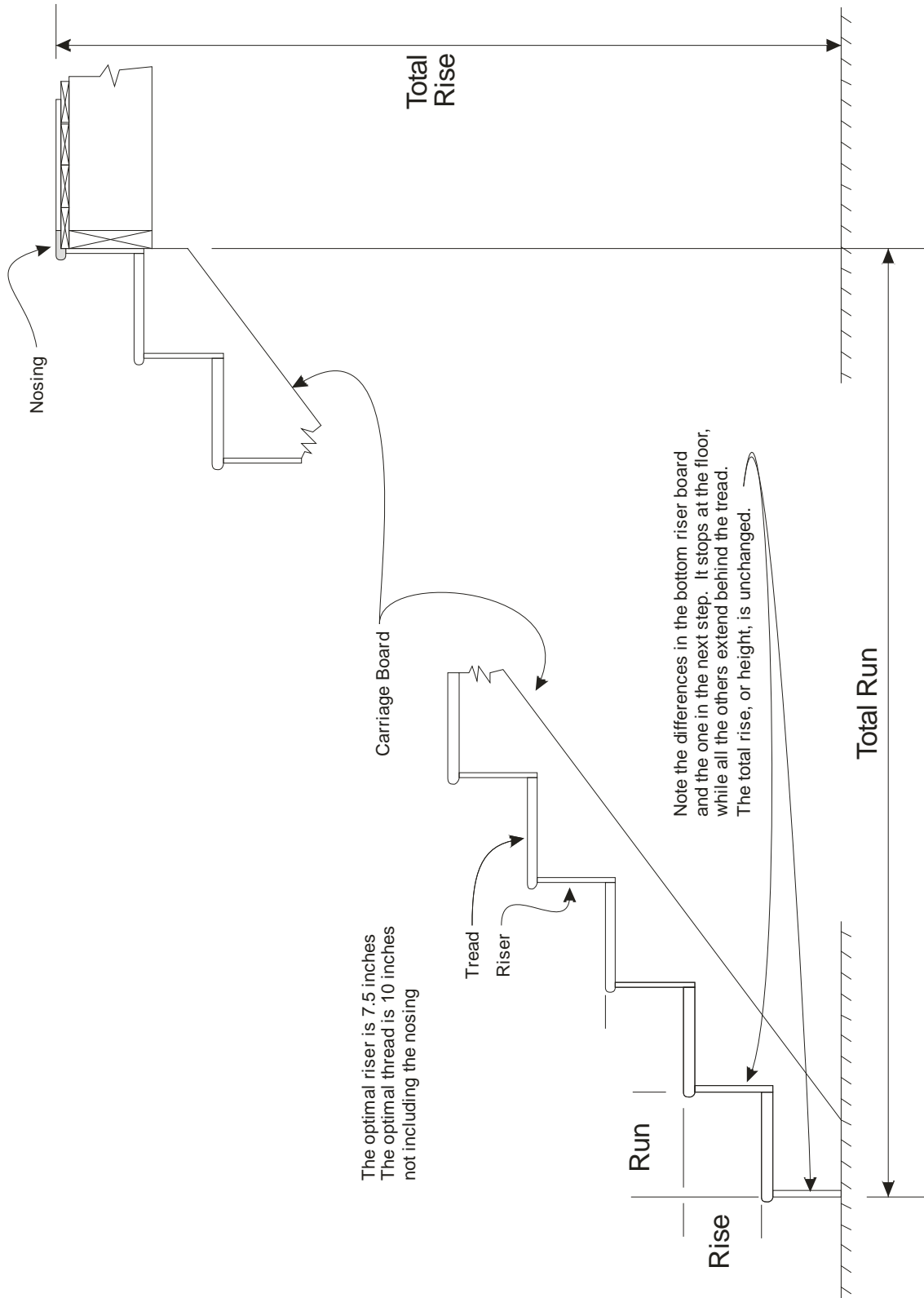
*U3T2 Detail Drawing for Component List Activity*



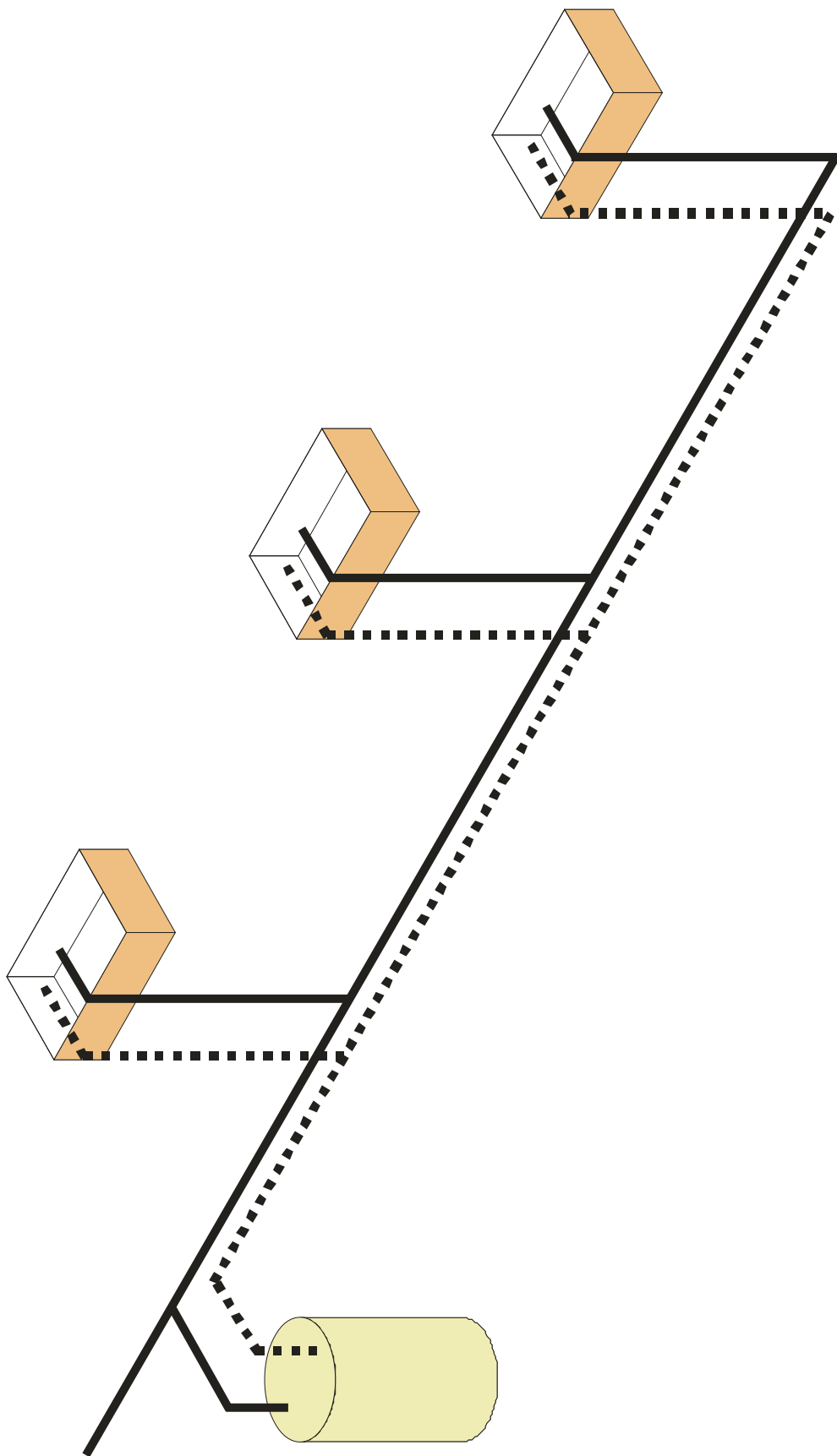
*U3T2 Cutting Plan Drawing*



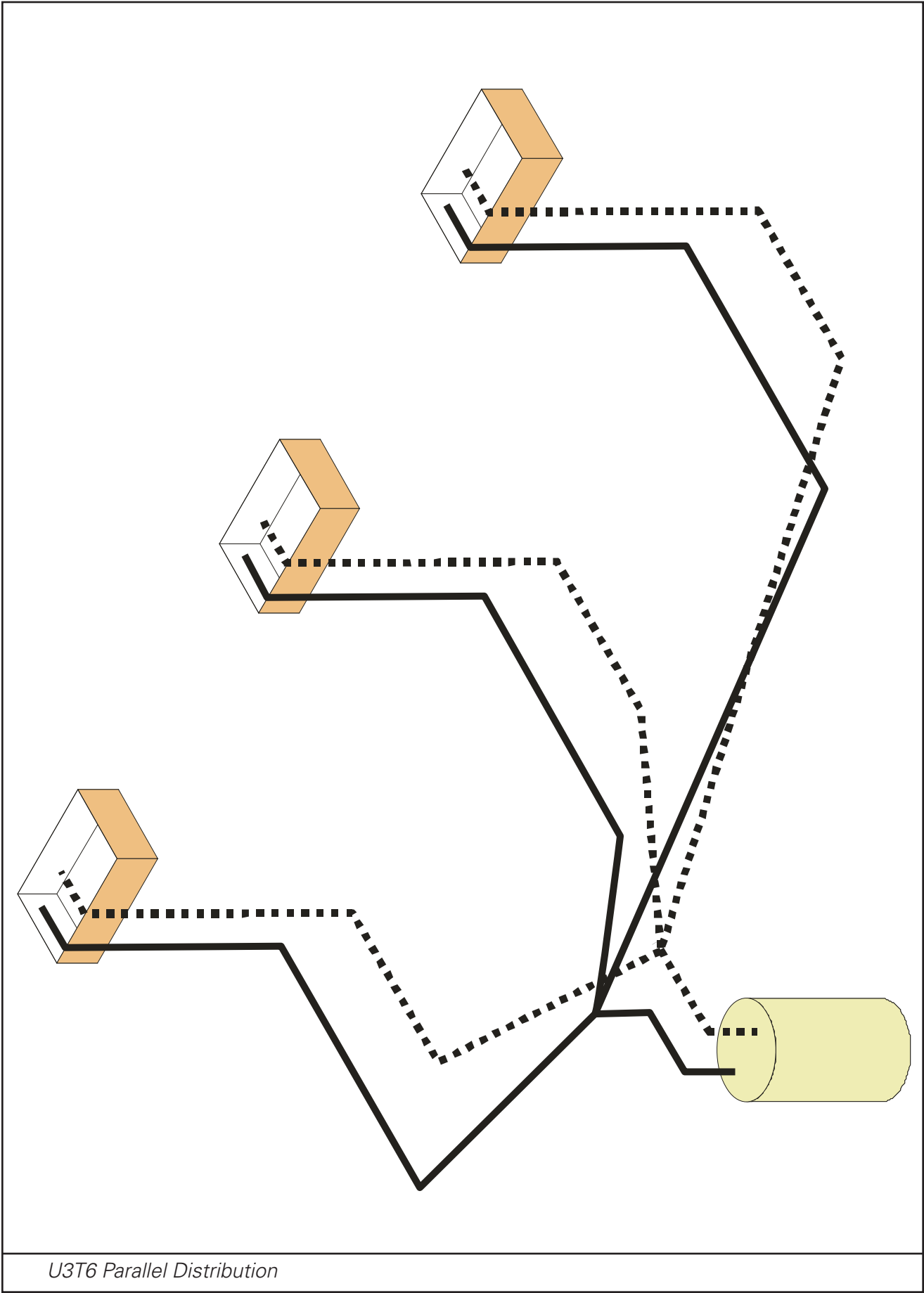
*U3T2 Standard (Fink) Truss*



U3T2 Stair Drawing



*U3T6 Series Distribution*







# Design and Planning

Design is a problem solving strategy that is employed in all technology education courses. It is based on standard practice in industry and commerce. It provides a standardized methodology for developing technological solutions to problems. Design, as used in this course has these components

- Project identification/selection
- Development of a design brief
- Planning each of the major components of the project
- Fabricating each of the major components of the project

The following are included in this section

- Design Brief: Information for developing a brief
- Design Brief Template
- Planning Guide

# Design Brief

## Information for Developing a Brief

### Project Description

The workplace for the construction trades can be emulated by fabricating a model structure in the school shop, complete with electrical, plumbing and other components.

### Task Statement

Design and fabricate a construction simulation that includes elements of these trades

- Carpenter
- Electrician
- Plumber
- Lather
- Painter-decorator
- Sheet metal worker

### Project Includes

The project needs to include these components from each of the trades

- Carpenter
  - Rough framing (floor, walls, roof, ceiling strapping)
  - Exterior (siding, roof covering)
  - Interior (trim)
- Electrician
  - Electrical rough-in (1 receptacle, 1 split receptacle with 1 half switched, 1 3-way switched overhead light, one outdoor GFI receptacle, and wiring)
  - Installation of receptacles, switches, and lights
- Plumber
  - Plumbing waste water rough-in (drainage system with toilet flange, sink trap, and vents for both)
  - Plumbing hot and cold supply rough-in (toilet supply, tap supply, with appropriate stops)

- Insulation and vapour barrier
- Lather
  - Drywall installation
  - Drywall plaster
- Painter-Decorator
  - Painting prep
  - Painting
- Sheet Metal Worker
  - Forming of soffit, fascia, rain gutter
  - Installation of soffit, fascia, rain gutter

### Conditions Affecting the Project

Conditions affecting the project are availability of resources, including time, space, materials, tools, and information. Other conditions are codes and regulations from the various trades that are addressed in the project.

### What the Solution must Do

The solution needs to emulate, as much as possible a job site setting. It needs to illustrate practices and techniques, and complete work according to accepted standards in each of the trades. It is not expected that students will attain the level of knowledge, skill and precision of a trades person. Accepted standards will be a sliding scale that the teacher has to judge.

# Design Brief Template

Date \_\_\_\_\_

Name \_\_\_\_\_

Group \_\_\_\_\_

Project Description

Task Statement

Project Includes

Conditions Affecting the Project

What the Solution must Do

# Planning Guide

## Information for Fabrication Planning

The major project for the course is based on development of a solution to a design problem. The solution is developed using a six stage process, with one stage for each of the six trades

- Carpenter
- Residential Electrician
- Plumber
- Lather
- Painter-Decorator
- Sheet Metal Worker

Each stage has two separate components

- Planning
- Fabrication

### Planning

Planning is a method of identifying the tasks that need to be done, the resources and tools required to do them, and putting it all into a logical sequence of actions.

Planning allows you to, for example

- Identify potential problems and develop ways to deal with them
- Determine best use of resources and time
- Be more productive and get better results
- Share work equitably among team members
- Identify skills you need to acquire

Planning, in this course, begins with the design brief. The brief sets the overall conditions, and identifies what needs to be done. The brief says nothing about how to actually develop the solution, only what the solution must accomplish. The brief in this course is a bit more specific than in many cases in that it identifies the general parameters of the solution.

Since the solution will be implemented in six stages, one for each trade, planning will need to be

done six times, once for each trade. The trades are sequenced in the order that they first need to be implemented. Carpentry will not be completed until the initial work from electrical, plumbing, and lather is done. Electrical will not be completed until initial work from plumbing, lather and painter-decorator is done.

### Planning Sequence

For all 6 of the trades, the following planning sequence is recommended. It is recommended that you chance with the teacher as work progresses to determine if things are missing and to keep the teacher informed of your plans.

- Review the design brief to identify what is required
- Identify all the systems, subsystems and components required to construct them
- Create sketches to ensure that you understand the systems, how they are built and how they work and interconnect with one another.
- Create a materials list
  - Identify each type of material or component
  - Identify the different dimensions or sizes of each
  - Make a list that sorts them by type, size and quantity of each size
- Make a list of ways that each of the materials or components need to be processed (modified). Processing will fall under these categories
  - Layout (measuring and marking for further processing)
  - Separated (modified by removing materials such as cutting, sawing, planing, sanding, filing)
  - Shaped/formed (modified without removing material such as bending, twisting, compressing, stretching)

- Combined (joining together by mechanical [nails, screws, overlapping joints], adhesive [glues, soldering], or cohesive [welding, solvents] means
- Finished (covering with a protective layer)
- Make a list of the fabrication sequence.
  - Determine the logical sequence. What needs to be done first? What needs to be done last? What are the steps to get from first to last task? Are there some tasks that need to be done before others can be done?
  - Write up the list of steps. Rearrange them as necessary as you review and think about the logic of the sequence.
- Make a list of tools and equipment needed to do the fabrication.
  - Materials processing can only be done with tools and equipment. After making a materials list and planning a fabrication sequence, you should have a good idea of the processes that need to be applied to the materials
  - Look at each step in the sequence, identify the processes that need to be applied to the materials and identify the tools and equipment needed to perform the tasks
- Identify training and certification needed to use the tools
  - Have you used this tool? Don't assume that you know how to use it effectively just because it may be a familiar tool. Safe use is not always obvious. Efficient use (best results for least effort) is seldom obvious even for simple tools. Sometimes the two are synonymous, sometimes they are not. Safe, efficient use is the goal
  - From the list of required tools and equipment, identify who in the group will be using which ones.
  - Make a three column list that has name, tool, training/certification. Indicate for each name, which tool and if training/certification is needed.
- When the plan is complete, do a review to determine if you understand everything
- Have the plan reviewed by your teacher for authorization to move to fabrication



# Student Safety

Student safety is a multi-level issue. It requires

- Clearly stated rules of conduct
- Clearly stated operating procedures for use of any tools, equipment and materials
- Obvious, effective, and consistent modeling of safe procedures by the teacher
- Rigorous teaching and assessment of student knowledge and performance with respect to safety and safe operation of tools, equipment and materials
- Consistent enforcement of safe practices
- Consistent and appropriate use of safety protection such as safety glasses and hearing protectors.

## References

In addition to the references in the guide, these sites offer excellent information on shop and tool safety

- Workshop safety rules at <http://www.technologystudent.com/health1/safetyr1.htm>
- Safety in mechanical workshops at <http://www.shef.ac.uk/safety/mech/mech1.html>
- Safety PDF links at <http://www.leeds.ac.uk/safety/library/mach.htm>
- Workplace safety toolkit (checklists) at <http://www.nonprofitrisk.org/ws-ps/topics/popt/toolschk2-ps.htm>

# Safety Instructions for the Tech Ed Lab

1. All activities must be approved by your instructor before work proceeds on any project.
2. You must be evaluated and score 100% pass before you are allowed to use any tool or machinery.
3. Report all injuries to the instructor regardless of how small or slight.
4. Wear eye and ear protection around all machinery and whenever using any tool.
5. Tie/fasten hair back in such a fashion that it doesn't block your vision, and it is not a hazard for entanglement in machinery.
6. Wear suitable clothing in the lab. Long or loose sleeves, sweaters and coats are not permitted around machinery. Remove any loose item that might present a hazard, such as, necklaces, pendants, watches, rings etc.
7. Obey the operating instructions of the machinery that you are using.
8. Notify the instructor if people are exhibiting unsafe behavior.
9. Bring any faulty or improperly operating equipment to the attention of the instructor.
10. Maintain a safe working area around machinery.
11. Keep tools and materials from projecting over the edge of benches.
12. Immediately clean up and dispose of chips, dust, and waste generated from projects.
13. Keep the floor clear of dust, scraps, litter and debris.
14. Immediately wipe up or clean spilled liquid materials.
15. Place oily rags and other combustible materials into approved disposal containers.



# Safety Rules For Using Power Equipment

1. Do not operate any machinery until you have received proper instruction and certification on that machine, and have been approved by the instructor to use it. Be sure to obtain permission each time you use the machine.
2. Wear proper eye and hearing protection at all times.
3. Have the instructor check your work setup before starting any activity.
4. Check and make all adjustments to your machinery before turning on the power.
5. Make sure that all persons are outside the work zone for the machine before starting or beginning work.
6. Guards must be in place and functioning properly. NEVER disable a guard on a piece of machinery.
7. Only one person should be using a piece of machinery unless the process requires a helper. Helpers should operate in the designated safe location. The operator should control the workpiece at all times
8. Start and stop your own machinery and never leave the machinery until it comes to a full stop.
9. Do not leave a piece of machinery running unattended.
10. Disconnect all power sources before performing any type of cleaning or maintenance.
11. Keep your hands, fingers, and limbs a safe distance from moving parts, as designated by the regulations for that machine.
12. Keep machinery clear of all tools and other items. The machinery should not be used as a storage surface.
13. Keep the floor around the machinery clear of all liquids, dust, or scraps to prevent slipping.
14. Keep your attention on the task at hand. Don't talk or become distracted while operating machinery. Do not distract or interrupt anyone operating machinery.
15. Notify the instructor of any malfunctioning machinery or tool.

# Student Safety Pledge Form

## Safety Pledge

I, \_\_\_\_\_, am enrolled in ST1201. I pledge to follow all safety instructions and rules and regulations for operating tools and equipment. In particular, I will:

1. Follow all safety rules for the lab.
2. Never use or operate a machine without first having:
  - a. permission from the instructor,
  - b. proper instruction and training in the operation of that machinery.
  - c. earned a 100% pass on the machine operation and safety test.
3. Immediately report all injuries or accident to the instructor.
4. Not engage in behaviors that endanger my own, or others, personal safety in the technology lab.

This safety pledge for students is based on:

1. The student having received proper instruction from the instructor.
2. The student assuming responsibility for following prescribed safety rules and procedures.
3. Written permission from the students parents/guardians.

Date: \_\_\_\_\_ Student's Signature: \_\_\_\_\_

I hereby give my consent to allow my son/daughter to operate all machinery and equipment necessary to the requirements of the ST1201 course in which he is enrolled.

Date: \_\_\_\_\_ Parent's Signature: \_\_\_\_\_

Parents are invited to visit the shop to inspect the machines and to see them in operation.

# Tools Listed by Trade

The following should be noted about these tool lists

- These lists include some of the tools employed in the trade. They are not lists of required tools for the course.
- The lists are not intended to be complete or comprehensive, rather as an indication of the range of tools that trades persons use.
- All of these tools require instruction before students use them. Even the simplest tools have best practices which increase effectiveness and decrease risk
- All tools have levels of risk associated with their use. Risk is managed with proper instruction and workshop management.
- Some of these tools require safety tests before students can use them. Where such tests are required a 100% pass is required on verbal and written components and on performance tests.
- Tool safety sheets are provided in Appendix B for many of the tools that require safety testing before use.

# Carpentry Tools

## Job Site Tools

- Hand saw (crosscut)
- Hand plane (block, smooth)
- Utility knives
- Wood chisels (1/4, 3/8, 1/2, 3/4) and wooden mallet
- 12 ounce and 16 ounce claw hammers
- Nail set
- Try, mitre and framing squares
- Metric and imperial measuring tapes & rules
- 2 foot and 4 foot levels
- Laser level
- Plumb bob
- Chalk line and chalk
- Small pry bar
- Rechargeable electric drills
- 1/2 inch electric drill
- Sets countersinks, twist drills, spade bits and auger bits for power drills
- Set Vixx bits for center boring screw holes in hinges
- Hole saw with assorted sizes (also used for plumbing)
- Countersink
- Pneumatic brad nailer (3/4 to 2 inch)
- Pneumatic framing nailer
- 1-2 hp portable compressor (also needed for sheet metal)
- Power miterbox (laser line would improve safety)
- Rotary orbital action sander with dust collection port

## Shop tools

- Stationary drill press
- Band saw
- Table saw
- 6" jointer
- 12 inch or larger planer
- Oscillating spindle sander
- Lathe

# Electrical Tools

- Wire T-stripper
- Fibreglass handled hammer
- Heavy duty side-cutting pliers
- Heavy duty needle-nose pliers
- Heavy duty diagonal cutting pliers
- Soldering gun and soldering iron
- 1000V insulated flat, Robertson and Phillips screwdrivers in standard sizes (or a reasonable facsimile)
- Electricians locking knife
- Locking tape measure
- Multi-meter
- Non-contact continuity tester
- Safety glasses
- Wire cutters
- Wire strippers
- Circuit tester
- Drills
- Saws

# Plumbing Tools

- Pipe and soil pipe cutters
- Tapes, rules, and squares
- Reaming and deburring tools
- Pipe, chain, and bench vise
- Soapstone
- Cutting tools (hacksaw, hole saw, jab saw, back saw)
- Pliers (groove joint, slip joint, locking)
- Snips (left, right, straight)
- Chisels (cold, punch)
- Propane torch, flame shield, solder, flux (You must be tested and score a 100% pass on the knowledge and practical use of the tool. You may not use the tool until you have been tested)
- Emery cloth
- Safety glasses
- Adjustable wrenches, 6 and 10 inch sizes
- Basin, pipe, strap, monkey, spud, and chain wrenches
- Builder, laser, water, line and torpedo levels

# Lather Tools

- Wall board lifter
- Drywall tape reeler
- Hand sander
- Drywall saw
- Stud finder
- Drywall square
- Level
- Drywall corner tool
- Plaster hawk
- Pole sander
- Drywall hammer
- Outside corner tool
- Utility saw
- Utility knife
- Stilts
- Taping knives
- Putty knife
- Finishing knife
- Plastering trowels

# Painter Tools

- Paint roller handles for 4 and 10 inch rollers
- Paint trays
- Drop cloths
- Wallpaper tray

# Sheet Metal Tools

## Hand Tools

- Machinist try square
- 3 head machinist square
- Steel safety straight edge
- Adjustable bevel
- Scribes
- Automatic centre punch
- Compass
- Left, right, and straight aviation snips
- Pop riveter
- Clamps
- Heavy duty locking utility knife
- Hand operated nibbling tool
- Deburrer
- Hand seaming tool
- Electric drill

## Pneumatic Tools

- Pneumatic nibbling tool
- Pneumatic shear (straight or pistol grip)
- Pneumatic punch and flanging tool

## Machines

- 30 inch 3-in-1 sheet metal machine (shear, brake, roll former)
- Small air compressor (1-2 hp)
- Drill press

# Appendix B

## Rubrics and Safety Tests

Rubrics	56
Tool Safety Sheets	64





# Rubrics

Two general and 4 design rubrics are supplied

- Knowledge
  - Where multiple concepts are assessed, expand the “Understanding of Content” section accordingly
- Skills
  - Where multiple skills are assessed, add each one to the “Ability to Apply Skills” section
- Design Part 1: Opportunity Selection
- Design Part 1: Design Brief
- Design Part 2: Planning
- Design Part 2: Fabrication

## References

In addition to references in the guide,

- Holistic rubrics at <http://pals.sri.com/pals/tasks/5-8/ME122/rubric.html>
- Performance assessment at <http://fcit.usf.edu/assessment/performance/assessb.html>
- Rules for writing rubrics at <http://pals.sri.com/guide/scoringdetail.html>

# Knowledge Building Rubric

## Rating Scale

4. Exceeds Defined Outcomes	3. Meets Defined Outcomes	2. Meets Defined Outcomes	1. Meets Defined Outcomes	0. Has not Completed Defined Outcomes
Exceptional quality and attention to detail. Consistently performs above the standard	Above average quality. Consistently performs to the standard	Average quality. Meets the standard better than 50% of the time	Below average. Meets standards with assistance	Unacceptable. Does not meet the outcome

## Scoring Grid

Planning and Management	Score
Identifies what is being asked	
Set goals and plans a sequence of steps to achieve each goal	
Prioritizes tasks and manages time wisely	
<b>Planning and Management Score</b>	

Research	Score
Uses multiple sources	
Uses a variety of information gathering techniques	
Determines relevance of information in an effective and timely manner	
References sources appropriately	
<b>Research Score</b>	

Understanding of Content	Score
Identifies what is being asked	
Can accurately explain the major concepts or ideas	
Can accurately explain the more subtle details of a concept	
Can make appropriate decisions and take appropriate actions based on understanding of the content	
<b>Understanding of Content Score</b>	

Presentation and Reporting	Score
Identifies what is being asked	
Sequences content in a logical manner	
Creates accurate information	
Creates information that is appropriately detailed	
Presents material in a syntactically correct manner	
<b>Presentation and Reporting Score</b>	

Work Practices and Teamwork	Score
Effectively troubleshoots common problems and devises ways to overcome them	
Collaborates effectively in work groups and teams	
Takes on leadership and other team roles	
Correctly and consistently documents work in the work log	
<b>Work Practices and Teamwork Score</b>	

# Skill Building Rubric

## Rating Scale

4. Exceeds Defined Outcomes	3. Meets Defined Outcomes	2. Meets Defined Outcomes	1. Meets Defined Outcomes	0. Has not Completed Defined Outcomes
Exceptional quality and attention to detail. Consistently performs above the standard	Above average quality. Consistently performs to the standard	Average quality. Meets the standard better than 50% of the time	Below average. Meets standards with assistance	Unacceptable. Does not meet the outcome

## Scoring Grid

Planning and Management	Score
Identifies what is being asked	
Set goals and plans a sequence of steps to achieve each goal	
Prioritizes tasks and manages time wisely	
Organizes and works in an orderly manner	
<b>Planning and Management Score</b>	

Tools and Equipment	Score
Gets permission to use equipment	
Selects and uses appropriate tools	
Recognizes and controls health and safety hazards, for example loose clothes, dust control and proper guards	
Uses proper protective equipment	
Use appropriate aids to manage the workpiece, for example a mitre gauge on the table saw or clamping the workpiece for portable tools	
<b>Tools and Equipment Score</b>	

Ability to Apply Skills	Score
With appropriate instruction and practice acquires and uses specific skill 1	
“ skill 2	
<b>Ability to Apply Skills Score</b>	

Materials	Score
Selects materials appropriate to the task	
Uses materials in a manner that minimizes waste	
Uses tools and techniques appropriate to the properties of the material	
<b>Materials Score</b>	

Work Practices and Teamwork	Score
Effectively troubleshoots common problems and devises ways to overcome them	
Collaborates effectively in work groups and teams	
Takes on leadership and other team roles	
Correctly and consistently documents work in the work log	
Communications ideas and information effectively	
<b>Work Practices and Teamwork Score</b>	

# Design Part 1: Opportunity Selection Rubric

## Rating Scale

4. Exceeds Defined Outcomes	3. Meets Defined Outcomes	2. Meets Defined Outcomes	1. Meets Defined Outcomes	0. Has not Completed Defined Outcomes
Exceptional quality and attention to detail. Consistently performs above the standard	Above average quality. Consistently performs to the standard	Average quality. Meets the standard better than 50% of the time	Below average. Meets standards with assistance	Unacceptable. Does not meet the outcome

## Scoring Grid

Planning and Management	Score
Identifies what is being asked	
Set goals and plans a sequence of steps to achieve each goal	
Prioritizes tasks and manages time wisely	
Organizes and works in an orderly manner	
<b>Planning and Management Score</b>	

Project Selection	Score
Assesses opportunities for a design project related to the trades	
<b>Establishes assessment criteria</b>	
<b>Rate the options using their assessment criteria</b>	
Selects an option for a design project related to the trades	
<b>Using the results of their assessment, selects an option</b>	
<b>Gives a rationale for their selection</b>	
<b>Project Selection Score</b>	

Work Practices and Teamwork	Score
Effectively troubleshoots common problems and devises ways to overcome them	
Collaborates effectively in work groups and teams	
Takes on leadership and other team roles	
Communications ideas and information effectively	
Correctly and consistently documents work in the work log	
<b>Work Practices and Teamwork Score</b>	

# Design Part 1: Design Brief Rubric

## Rating Scale

4. Exceeds Defined Outcomes	3. Meets Defined Outcomes	2. Meets Defined Outcomes	1. Meets Defined Outcomes	0. Has not Completed Defined Outcomes
Exceptional quality and attention to detail. Consistently performs above the standard	Above average quality. Consistently performs to the standard	Average quality. Meets the standard better than 50% of the time	Below average. Meets standards with assistance	Unacceptable. Does not meet the outcome

## Scoring Grid

Planning and Management	Score
Identifies what is being asked	
Set goals and plans a sequence of steps to achieve each goal	
Prioritizes tasks and manages time wisely	
Organizes and works in an orderly manner	
<b>Planning and Management Score</b>	

The Design Brief	Score
Project Description	
Task Statement	
Project Includes	
Conditions Affecting the Project	
What the Solution Must Do	
<b>The Design Brief Score</b>	

Work Practices and Teamwork	Score
Effectively troubleshoots common problems and devises ways to overcome them	
Collaborates effectively in work groups and teams	
Takes on leadership and other team roles	
Communications ideas and information effectively	
Correctly and consistently documents work in the work log	
<b>Work Practices and Teamwork Score</b>	

# Design Part 2: Planning Rubric

## Rating Scale

4. Exceeds Defined Outcomes	3. Meets Defined Outcomes	2. Meets Defined Outcomes	1. Meets Defined Outcomes	0. Has not Completed Defined Outcomes
Exceptional quality and attention to detail. Consistently performs above the standard	Above average quality. Consistently performs to the standard	Average quality. Meets the standard better than 50% of the time	Below average. Meets standards with assistance	Unacceptable. Does not meet the outcome

## Scoring Grid

Planning and Management	Score
Identifies the subsystems for the fabrication task	
Uses the trade-specific symbols to make sketches	
Produces properly structured orthographic and/or isometric sketches that convey ideas for additions, modifications or changes to the plan	
Creates a list of required materials sorted by type, dimensions or other appropriate characteristic	
<b>Planning and Management Score</b>	

Tools and Equipment	Score
Identifies a list of tools and equipment required for the process, including for layout, separating, shaping, combining, and finishing	
Identifies tools that they are qualified / not qualified to use and makes arrangements for those they need certification on	
<b>Tools and Equipment Score</b>	

Fabrication Sequence	Score
Identifies the sequence of tasks for this part of the project	
Identifies the tasks from this project in the overall sequence for the total project	
<b>Ability to Apply Skills Score</b>	

Work Practices and Teamwork	Score
Effectively troubleshoots common problems and devises ways to overcome them	
Collaborates effectively in work groups and teams	
Takes on leadership and other team roles	
Communications ideas and information effectively	
Correctly and consistently documents work in the work log	
<b>Work Practices and Teamwork Score</b>	

# Design Part 2: Fabrication Rubric

## Rating Scale

4. Exceeds Defined Outcomes	3. Meets Defined Outcomes	2. Meets Defined Outcomes	1. Meets Defined Outcomes	0. Has not Completed Defined Outcomes
Exceptional quality and attention to detail. Consistently performs above the standard	Above average quality. Consistently performs to the standard	Average quality. Meets the standard better than 50% of the time	Below average. Meets standards with assistance	Unacceptable. Does not meet the outcome

## Scoring Grid

Planning and Management	Score
Organizes fabrications tasks according to the plan	
Implements tasks in the planned order	
Modifies the plan as needed to meet changing work conditions	
<b>Planning and Management Score</b>	

Use of Materials	Score
Makes effective use of the material list	
Selects materials as specified by the codes or regulations for each trade	
Uses tools and techniques appropriate to the properties of the material	
Uses materials in a manner that minimizes waste	
<b>Use of Materials Score</b>	

Tools and Equipment	Score
Gets permission to use equipment	
Selects and uses appropriate tools	
Adjusts tools properly before use	
Uses appropriate techniques to layout, and separate/shape/combine materials	
Recognizes and controls health and safety hazards, for example loose clothes, dust control and proper guards	
Uses proper protective equipment	
Use appropriate aids to manage the workpiece, for example a mitre gauge on the table saw or clamping the workpiece for portable tools	
<b>Tools and Equipment Score</b>	

Fabrication Sequence	Score
Effectively troubleshoots the fabrication process and makes modifications to the work plan as needed	
Using the work plan as reference, correctly lays out the cutting pattern on materials	
Using the work plan as reference, correctly separates materials to complete each of the subsystems, for example cuts joists with a power mitre saw	
Using the work plan as reference, correctly shapes materials to complete each of the subsystems, for example folds sheet metal to make a fascia	
Using the work plan as reference, correctly combines materials to complete each of the subsystems, for example fastens with construction adhesive or nails	
<b>Fabrication Sequence Score</b>	

Work Practices and Teamwork	Score
Takes appropriate measures to minimize risk for themselves and others by	
<b>Engaging in safe practices as designated by standard shop safety rules</b>	
<b>Using tools and materials only when authorized and certified</b>	
<b>Handling materials in a safe and proper fashion</b>	
<b>Adjusting tools and equipment for the material and task being performed</b>	
<b>Keeping the work place clean and tidy</b>	
Effectively troubleshoots common problems and devises ways to overcome them	
Collaborates effectively in work groups and teams	
Takes on leadership and other team roles	
Correctly and consistently documents work in the work log	
<b>Work Practices and Teamwork Score</b>	



# Tool Safety Sheets

## Tools

Safety sheets are supplied for the following tools

- Table Saw
- Radial Arm Saw
- Drill Press
- Jointer
- Planer
- Band Saw
- Power Mitre Saw
- Scroll Saw
- Electric Drill
- Jig Saw
- Lathe
- Router
- Oscillating Spindle Sander
- Bench Grinder
- Chisel
- Hand Plane

## References

### Text References

- Wagner & Smith, unit 4, page 75-100
- Koel, chapter 9- 17, page 68-122
- Ummstattd & Davis,
  - chapter 18, page 267-280
  - chapter 21-28, page 305-480
  - chapter 31, page 523-540,

### Website references

- Machine Safety at [http://ncsdesign.org/PDFs/tool\\_book.pdf](http://ncsdesign.org/PDFs/tool_book.pdf)
- Texas Technical University Shop Rules at <http://www.arch.ttu.edu/resources/shop/ShopManual.asp>
- Assessing the Quality of a Product at <http://www.orinda.k12.ca.us/ois/teachers/AllensInformation.htm>
- Lab Safety Manual and Hazardous Materials Guide at <http://www.fbe.unsw.edu.au/staff/mariano.ramirez/IDLabManual2003.pdf>
- University of Louisiana at Lafayette—Lab Safety at <http://arts.louisiana.edu:16080/resources/safety.pdf>
- MTEA Safety Resource—Checklist and Tests at <http://www.mtea.net/PDF%20Files/3-Construction%20Tech.pdf>
- Pennsylvania Safety Manual at <http://www.mtea.net/PDF%20Files/Pennsylvaniasafety.pdf> (Page 131, Machine Tool Tests)

# Table Saw

## Adjustments

- Blade height
- Blade angle
- Rip fence
- Mitre Gauge

Operations that can only be performed with the guard removed

- Dadoing
- Rabbeting

Standard operations with guards in place

- Ripping
- Crosscutting

## Safety Checklist

Setup	Operation	Shut down
<p>Requests permission to use equipment</p> <p>Removes or secures loose clothes and jewelry and confines long hair</p> <p>Wears the proper personal protective equipment</p> <p>Does not change blades without teacher supervision</p> <p>Sets blade to proper height—3 mm or 1/8" above the work piece</p> <p>Adjusts and properly locks fence or mitre gauge</p> <p>Checks to see that all guards and other safety devices are in place and functioning.</p>	<p>Only uses the saw if all guards are in place</p> <p>Always uses rip fence for ripping and mitre gauge for crosscutting. Never uses both simultaneously</p> <p>Always uses a push stick for ripping to prevent hands from coming within 150 mm or 6" of the blade</p> <p>Stands to one side of the blade when performing any operation</p> <p>Measures off the blade only after it has come to a complete stop</p> <p>Allows the blade to come to a complete stop before waste stock is removed from the table</p> <p>When a helper is assisting with long and/or wide stock, the operator controls the work piece</p> <p>Keeps floor and machine surfaces free from scrap materials.</p>	<p>Makes sure the machine has come to a complete stop prior to cleaning</p> <p>Returns tools and accessories to their proper location</p> <p>Cleans up equipment and work area</p> <p>Lowers blade and returns the mitre gauge and blade to 90°.</p>

# Radial Arm Saw

## Adjustments

- Blade height
- Blade angle
- Motor rotation
- Arm angle

## Standard operations with guards in place

- Crosscutting
- Mitre cuts

- Compound mitre cuts
- Dadoing
- Ripping (not recommended as it is a dangerous operation)
- Rabbeting (not recommended as it is a dangerous operation)

## Operations that can only be performed with the guard removed

- None

## Safety Checklist

Setup	Operation	Shut down
<p>Requests permission to use equipment</p> <p>Removes or secures loose clothes and jewelry and confines long hair</p> <p>Wears the proper personal protective equipment</p> <p>Does not change blades without teacher supervision</p> <p>Sets blade to proper height</p> <p>Adjusts and properly locks</p> <ul style="list-style-type: none"> <li>• main arm</li> <li>• motor carriage slide</li> <li>• motor mount rotation</li> <li>• blade angle</li> </ul> <p>Checks to see that all guards and other safety devices are in place and functioning.</p>	<p>Only uses the saw for cross cutting and dadoing operations. Never uses the saw for ripping or rabbeting operations.</p> <p>For cross cutting and dadoing operations, controls the feed speed to prevent climb-cutting</p> <p>Keeps hands at least eight to ten inches from the cut</p> <p>Stands to one side of the blade when performing any operation</p> <p>Measures off the blade only after it has come to a complete stop</p> <p>Allows the blade to come to a complete stop before waste stock is removed from the table</p> <p>Keeps floor and machine surfaces free from scrap materials.</p>	<p>Makes sure the machine has come to a complete stop prior to cleaning</p> <p>Returns tools and accessories to their proper location</p> <p>Cleans up equipment and work area</p> <p>Returns saw to standard setup for 90 degree crosscut</p>

# Drill Press

## Adjustments

- Table height
- Table angle
- Chuck
- Chuck speeds (belt and pulley adjustments)

## Required auxiliary supports

- Clamps and/or hold downs for all workpieces
- Guide fences or support blocks for non-rectangular workpieces

## Standard operations (No Guards)

- Drilling using a wide variety of cutters
- Sanding
- Morticing

## Safety Checklist

Setup	Operation	Shut down
Requests permission to use equipment	Does not hold workpiece by hand for drilling	Makes sure the machine has come to a complete stop prior to cleaning
Removes or secures loose clothes and jewelry and confines long hair	Only drills properly clamped and braced workpieces	Returns tools and accessories to their proper location
Wears the proper personal protective equipment	Turns off power if the drill gets caught in a work piece	Cleans up equipment and work area
Selects and mounts the proper drill bit or accessory	Applies even pressure when drilling	Returns equipment to original state
Removes the key from the chuck	Raises the drill bit occasionally to clear cuttings	
Adjusts the machine to the correct speed	Uses cutting/lubricating fluids if necessary	
Checks the condition and position of pulley guards	Drills a pilot hole for larger holes	
Mounts the work securely in the proper vise or clamp	Removes cuttings with a brush	
Adjusts the depth stop to the correct depth	Keeps floor free from scrap materials.	
Centres punches metal parts prior to drilling		
Checks drill bit for straightness		
Adjusts table height and angle		
Checks drill bit alignment and depth of cut		
Uses a V-block to hold round stock		

# Jointer

## Adjustments

- Infeed table height (depth of cut)
- Outfeed table height (to align with cutter, only done on installation of cutters)
- Fence
  - width of cut (amount of cutter exposed)
  - angle of cut

## Standard operations with guards in place

- Jointing a surface
- Jointing an edge

## Operations that can only be performed with the guard removed

- Cutting a rabbet (not recommended for student operation)

## Safety Checklist

Setup	Operation	Shut down
<p>Requests permission to use equipment</p> <p>Removes or secures loose clothes and jewelry and confines long hair</p> <p>Wears the proper personal protective equipment</p> <p>Never adjusts the out-feed table.</p> <p>Checks and makes all adjustments and with power off</p> <p>Checks condition and operation of guards</p> <p>Identifies grain direction in the wood in order to joint in the proper direction</p> <p>Adjusts depth of cut to a maximum of 3 mm or 1/8".</p>	<p>Uses jointer only with the guard in place</p> <p>Joints in direction of grain</p> <p>Makes several multiple thin cuts rather than one heavy cut</p> <p>Only joints material with an absolute minimum length of twice the size of the knives</p> <ul style="list-style-type: none"> <li>• 6" (15 cm) - 12" (30 cm) length</li> <li>• 8" (20 cm) - 16" (40 cm) length</li> </ul> <p>Only joints stock greater than 12 mm or 1/2" in thickness</p> <p>Uses push block for flat work</p> <p>Does not pass hand directly over the top of the cutter head</p> <p>Keeps area clean and floor free of scrap materials.</p>	<p>Makes sure the machine has come to a complete stop prior to cleaning</p> <p>Returns tools and accessories to their proper location</p> <p>Cleans up equipment and work area</p> <p>Returns adjustments to original state</p>

# Planer

## Adjustments

- Depth of cut

## Standard operations with guards in place

- Surfacing a workpiece

## Operations that can only be performed with the guard removed

- None

## Safety Checklist

Setup	Operation	Shut down
<p>Requests permission to use equipment</p> <p>Removes or secures loose clothes and jewelry and confines long hair</p> <p>Wears the proper personal protective equipment</p> <p>Ensures feed area is clear of debris</p> <p>Sees that the work piece is free of loose knots, nails, dirt and finish materials</p> <p>Determines grain and feed direction</p> <p>Adjusts depth of cut, normal 2mm or 1/16"</p>	<p>Planes in the direction of the grain</p> <p>Never looks directly into the front or rear opening of the planer when it is in operation</p> <p>Does not plane stock less than 300 mm or 12" long, or less than 6 mm or 1/4" thick.</p> <p>Uses a follower stick if required for short stock</p> <p>Keeps hands clear of infeed and outfeed rollers in lower table</p> <p>Stands to one side of the stock when planing</p> <p>When a helper is assisting with long stock, the operator controls the work piece</p> <p>Shuts power off before attempting to remove</p> <p>Stock that has become stuck</p> <p>Keeps area around equipment free of scrap.</p>	<p>Makes sure the machine has come to a complete stop prior to cleaning</p> <p>Returns tools and accessories to their proper location</p> <p>Cleans up equipment and work area</p> <p>Returns adjustments to original state</p>

# Band Saw

## Adjustments

- Blade guard
- Upper and lower blade thrust bearings and guide bushings/bearings
- Table tilt
- Mitre gauge
- Rip fence

## Standard operations with guards in place

- Ripping and resawing
- Crosscutting (90, and any angle mitre and compound cuts)
- Freehand sawing

## Operations that can only be performed with the guard removed

- None

## Safety Checklist

Setup	Operation	Shut down
Requests permission to use equipment	Guides the work slowly; does not force the work	Makes sure the machine has come to a complete stop prior to cleaning
Removes or secures loose clothes and jewelry and confines long hair	Avoids backing out from cuts other than making relief cuts	Returns tools and accessories to their proper location
Wears the proper personal protective equipment	Does not attempt to cut smaller radius than the	Cleans up equipment and work area
Checks the condition of the blade and blade guides	Blade will allow	Returns adjustments to original state
Adjusts blade guides to the correct height—3 mm or 1/8"—above the workpiece	Uses V block to cut cylindrical stock	
	Does not place fingers or hands in line with the blade	
	Uses a push stick where necessary	
	Allows the machine to come to a complete stop when removing the work piece, cleaning or making adjustments	
	Maintains a 100 mm margin of safety between fingers and blade.	

# Power Mitre Saw

## Adjustments

- Storage position lock
- Horizontal angle of cut (mitre)
- Vertical angle of cut (compound mitre)
- Fence adjustment (some models)
- Hold downs (some models)
- Stops for repeat work (some models)
- Horizontal slide (some models)

## Standard operations with guards in place

- Standard mitre cuts (90, 45, 22.5 degrees)
- Compound mitre cuts (horizontal and vertical angle adjustment)
- Repeat cuts using a stop to reproduce exact length

## Operations that can only be performed with the guard removed

- None

## Safety Checklist

Setup	Operation	Shut down
Requests permission to use equipment	Ensures that long workpieces are properly supported before cutting	Makes sure the machine has come to a complete stop prior to cleaning
Removes or secures loose clothes and jewelry and confines long hair	Clamps or holds the work securely against the fence	Returns tools and accessories to their proper location
Wears the proper personal protective equipment	Cuts in a smooth continuous motion	Cleans up equipment and work area
Notifies teacher if blade needs to be changed	Keeps hands 6 inches (15 cm) away from the blade	Returns adjustments to original state
Sets horizontal or vertical angle as needed	Waits until saw comes to a complete stop before removing workpiece	
Gets teacher to check setup before using		



# Stationary Scroll Saw

## Adjustments

- Blade removal and replacement
- Height of the hold-down / guard
- Table tilt
- 

## Standard operations with guards in place

- Cutting wood along a line, any direction

## Operations that can only be performed with the guard removed

- Not recommended, as the guard also aids cutting by keeping the wood from lifting with the blade (a hold-down)

## Safety Checklist

Setup	Operation	Shut down
<p>Requests permission to use equipment</p> <p>Removes or secures loose clothes and jewelry and confines long hair</p> <p>Wears the proper personal protective equipment</p> <p>Make all adjustments with the power off, then rotate the motor by hand as a final check</p> <p>Make sure all guards are in place and operating correctly</p> <p>Makes sure that hold down is pressing lightly on the work piece</p> <p>Chooses the correct blade and correct speed for the material to be cut, and for the smallest radius required</p> <p>Ensures the blade is held firmly in the chucks, and the chucks are properly mounted in the holders</p> <p>Sets the table angle for the required cut</p>	<p>Uses the saw only with the guard/ hold-down in place</p> <p>Guides the material slowly through the machine with both hands, keeping fingers away from the cut line.</p>	<p>Makes sure the machine has come to a complete stop prior to cleaning</p> <p>Returns tools and accessories to their proper location</p> <p>Cleans up equipment and work area</p> <p>Returns adjustments to original state</p>

# Electric Drill

## Adjustments

- Chuck

## Standard operations (No guards)

- Drilling
- Countersinking

Operations that can only be performed with the guard removed

- Not applicable

## Safety Checklist

Setup	Operation	Shut down
<p>Requests permission to use equipment</p> <p>Removes or secures loose clothes and jewelry and confines long hair</p> <p>Wears the proper personal protective equipment</p> <p>Selects correct bit and size for the material being drilled</p> <p>Ensures that bit is properly mounted in the chuck and the chuck is securely tightened</p> <p>Ensures workpiece is properly secured or clamped</p>	<p>Center-punches holes before drilling</p> <p>Holds drill securely, usually using the second hand to steady and guide it</p> <p>Withdraws the bit frequently to clear the hole</p> <p>Uses the proper lubricant when drilling metals</p> <p>Uses a guide such as a square or adjustable bevel for visual alignment to ensure the hole is at the correct angle</p>	<p>Makes sure the machine has come to a complete stop prior to cleaning</p> <p>Returns tools and accessories to their proper location</p> <p>Cleans up equipment and work area</p> <p>Returns adjustments to original state</p>

# Lathe

## Adjustments

- Rotational speed
- Tail stock
- Tool rest
- Centers (drive, center, live)
- Faceplates
- Assorted internal and external clamping chucks

Standard operations with guards in place (guards only on some models)

- Spindle turning
- Faceplate turning

Operations that can only be performed with the guard removed

- Sanding
- French polishing
- Spindle turning
- Faceplate turning

## Safety Checklist

Setup	Operation	Shut down
Requests permission to use equipment	Rotates spindle by hand to check clearance before starting	Makes sure the machine has come to a complete stop prior to cleaning
Removes or secures loose clothes and jewelry and confines long hair	Stands to one side when starting the lathe	Returns tools and accessories to their proper location
Wears the proper personal protective equipment	Selects the appropriate cutting tools	Cleans up equipment and work area
Checks stock for balance and soundness	Holds the cutting tools securely and at the proper angles to the work	Returns adjustments to original state
Securely mounts work between centres or to the face plate	Frequently readjusts tool rest to maintain distance to work piece	
Adjusts tool rest to the correct height and distance from the work piece	Adjust tool speed as needed dependant upon the progress in the turning	
Makes sure cutting tools are sharp. If not, notify the teacher to have them sharpened	Allows work piece to fully stop before adjusting the tool rest or measuring the work piece	
Adjusts lathe to operate at the correct speed	Removes tool rest before sanding	
Sets guard to correct distance where one is provided		

# Router (Hand held use)

## Adjustments

- Fixed base
  - bit changes
  - depth of cut
- Plunge base
  - bit changes
  - depth of plunge cut
- Router fence
  - offset from fence to bit

## Standard operations with guards in place

- Pattern routing with upper or lower bearing bit
- Edge routing with router fence
- Through dado or rabbet routing with guides
- Plunge base routing
  - stopped routing with templates

## Operations that can only be performed with the guard removed

- None

## Safety Checklist

Setup	Operation	Shut down
Requests permission to use equipment	Routes only with the aid of a template, fence or guide.	Makes sure the machine has come to a complete stop prior to cleaning
Removes or secures loose clothes and jewelry and confines long hair	Starts the router with the bit away from the wood	Returns tools and accessories to their proper location
Wears the proper personal protective equipment	Grips the router carefully with both hands to counteract against starting torque	Cleans up equipment and work area
Checks bit for suitability to task	Feeds the router at a constant speed, not slow enough to burn the wood or so fast as to cause bogging down in the cut	Adjusts router so that the bit is inside the base
Gets teacher to install appropriate bit	Cuts in multiple passes, removing about 6 mm of wood at a time	
Adjusts depth of cut or plunge distance, to take 1/4 inch (6mm) deep or less cuts	Cuts in the direction against the bit rotation to prevent climb cutting	
Sets up router fence or clamps guides in place or sets up a template for routing	Allows the router to come to a complete stop before laying it down	
	Places the router on its side or top when done	

# Oscillating Spindle Sander

## Adjustments

- Changing spindles size
- Changing sanding drums on the spindle
- On some machines, adjusting the angle of the table

## Standard operations (No guards)

- Edge sanding different sizes and shapes of wood or plastic

Operations that can only be performed with the guard removed

- Not applicable

## Safety Checklist

Setup	Operation	Shut down
Requests permission to use equipment Removes or secures loose clothes and jewelry and confines long hair Wears the proper personal protective equipment Ensures that spindle is properly mounted and tightened	Ensures that workpiece is not in contact with spindle when starting the machine Feeds material into the spindle against the rotation of the spindle Applies consistent even pressure and rate of feed to prevent gouging of the workpiece or motor stalling Keeps fingers 6 inches (15 cm) away from the spindle	Makes sure the machine has come to a complete stop prior to cleaning Returns tools and accessories to their proper location Cleans up equipment and work area Returns adjustments to original state

# Bench Grinder

## Adjustments

- Guards
- Tool rest

Standard operations with the guard in place

- Grinding
- Sharpening

Operations that can only be performed with the guard removed

- Buffing, with the addition of a buffing wheel and compound

## Safety Checklist

Setup	Operation	Shut down
Requests permission to use equipment Removes or secures loose clothes and jewelry and confines long hair Wears the proper personal protective equipment Notifies the teacher if grinding or buffing wheels need to be changed Ensures that guards are in place and properly adjusted before grinding or sharpening Ensures that tool rests are in place and properly adjusted before grinding or sharpening	Waits until the grinder has reached full rotational speed before placing the workpiece against the wheel Uses correct techniques, depending on the nature of the workpiece Frequently cools the workpiece to prevent changes to the temper of the metal	Makes sure the machine has come to a complete stop prior to cleaning Returns tools and accessories to their proper location Cleans up equipment and work area Returns adjustments to original state

# Chisel

## Adjustments

- None

## Standard operations

- Free hand chiselling
- Chiselling with a striking tool such as a mallet

## Safety Checklist

Setup	Operation	Shut down
Requests permission to use equipment Removes or secures loose clothes and jewelry and confines long hair Wears the proper personal protective equipment Clamps the workpiece securely Carries the chisel with the blade down and away from the body Passes a chisel to another person handle first	Operates the chisel so that it cuts away from the body, especially the hands When free hand chiselling, holds the chisel with both hands When using a mallet, Hold the chisel securely against the workpiece before striking it on the handle tip	Returns tools and accessories to their proper location Cleans up equipment and work area Returns adjustments to original state

# Hand Plane

## Adjustments

- Basic
  - Plane Iron
    - Depth of cut
    - Angle of iron
  - Mouth opening (some models)
- Advanced
  - Frog
  - Plane Iron Cap
  - Lever Cap

## Standard operations

- Planing edge or face grain
- Planing end grain

## Safety Checklist

Setup	Operation	Shut down
Requests permission to use equipment Removes or secures loose clothes and jewelry and confines long hair Wears the proper personal protective equipment Places plane on its side on the bench when not in use Determines wood grain direction to identify best planing direction Adjusts the depth and angle of cut to suit the workpiece Clamps the workpiece securely before planing	Applies marks to the workpiece to identify areas to be planed and limits of the planing operation Planes in a smooth continuous stroke Applies proper pressure to the correct end of the plane on starting, planning, and ending phases of the stroke Observes results and modifies techniques to prevent tear out and to ensure the workpiece is flattened to a true plane	Returns tools and accessories to their proper location Cleans up equipment and work area Returns adjustments to original state