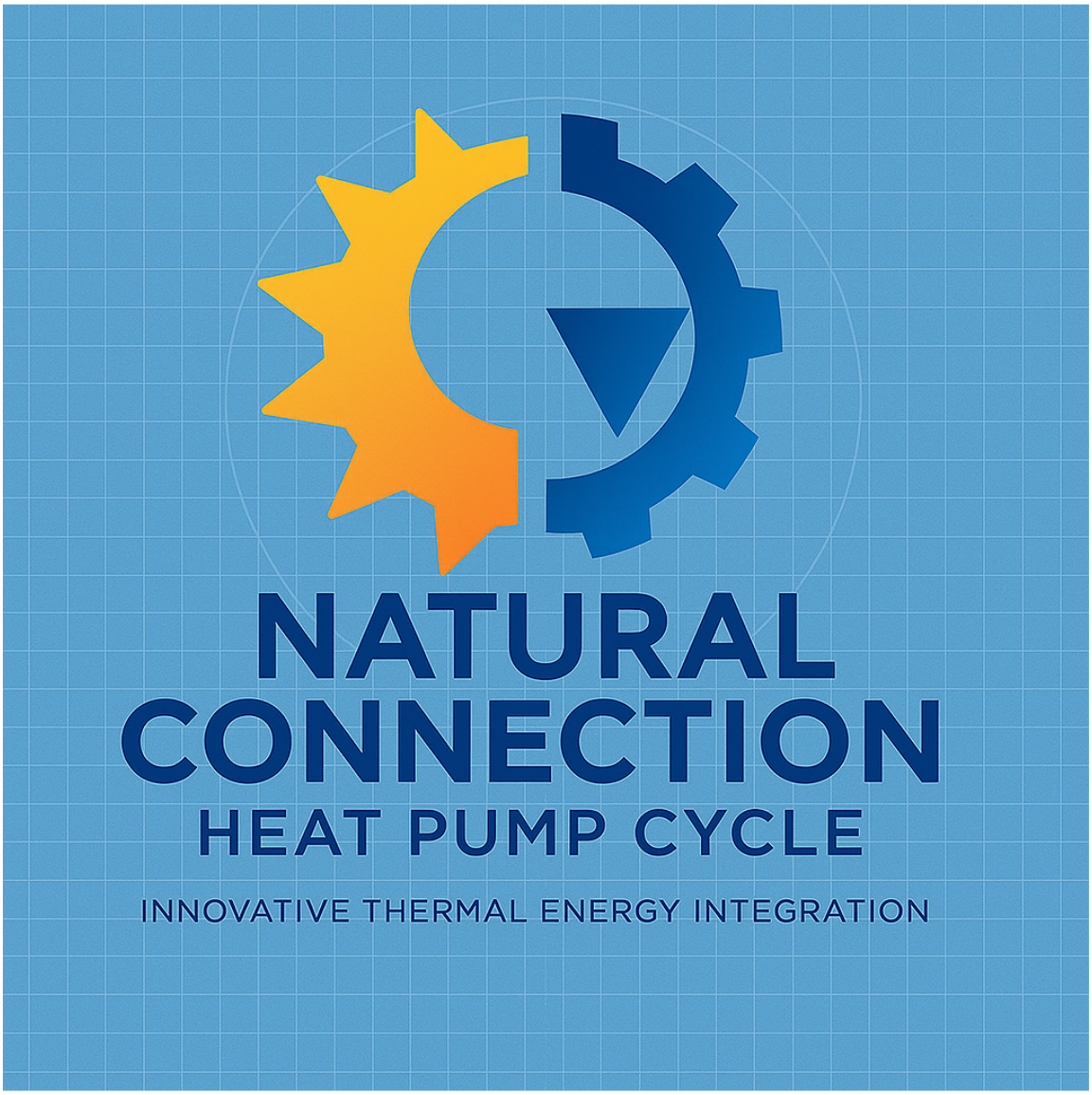

THE NATURAL CONNECTION HEAT PUMP CYCLE

Innovative Thermal Energy Integration

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Prepared and Authored by Wesley S. Bonafé, P.E., November 2025

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Executive Summary

The **Natural Connection Heat Pump Cycle** is an original HVAC concept integrating solar thermal energy, evaporative cooling, and thermal storage to dramatically increase heat pump efficiency while reducing electric resistance heating and mechanical cooling loads.

Developed by **Wesley S. Bonafé, P.E.**, a licensed mechanical engineer with over 50 years of experience in plumbing, HVAC design, and energy systems, this patent-ready technology represents a practical, scalable pathway to immediate energy savings using today's equipment.

After more than a decade of refinement, this system has reached the point where it can be modeled, tested, and commercialized by a qualified manufacturer or investor. It bridges current air-source heat pump technology with the next generation of hybrid and renewable HVAC systems.

Opportunity

Acquisition / Assignment: Full rights to the concept, documentation, and drawings are available **free** of charge. The *Natural Connection Heat Pump Cycle (NCHP)* integrates solar energy, evaporative cooling, and traditional heat pump technology to create an efficient, biomimetic approach to heating and cooling. It is offered freely in the hope that it accelerates sustainable HVAC innovation.

The *Natural Connection Heat Pump Cycle* delivers tangible technical and marketing advantages, including renewable-energy integration, reduced grid dependency, and alignment with modern energy-efficiency standards.

Why I Am Offering This Concept

After decades in the HVAC and plumbing industry, I have seen how true progress depends on collaboration between engineering innovation and commercial capability. The **Natural Connection Heat Pump Cycle** is ready to move from concept to development, and I am offering it for free so that its potential can be realized.

Reasons:

1. *Proven Potential:* Like Willis Haviland Carrier's invention of air conditioning, this concept has the capacity to redefine how we manage comfort and energy.
2. *Practical Implementation:* With the right manufacturing, testing, and marketing resources, this system can reach the marketplace quickly.
3. *Scalable Impact:* The concept applies across residential, commercial, and industrial markets, integrating naturally with renewables.

4. *Shared Success:* Rather than remain unused, this technology can benefit both society and the company that develops it.
5. *Sensible Economics:* It pays for itself, creates innovation pathways, and is structured for straightforward acquisition.

Heating Cycle

• Solar thermal panels capture heat from the sun.
• Heat is stored in a water storage tank.
• Heat is provided to the outdoor portion of a split-system heat pump via a hydronic coil.
• Cool water returns lower in the storage tank to promote stratification.

Cooling Cycle

• Prior to ambient air entering the heat pump outdoor unit, cooling is enhanced by an evaporative pad cooling air toward the wet-bulb temperature.
• During periods of cooling, the solar panels can give up heat to the sky at night or on cloudy days, cooling the tank water.
• Cool tank water further reduces the air temperature through the hydronic coil.
• Solar panels are off and shade much of the roof, reducing building heat load.

Additional Information

The system can be added to existing split-system heat pumps and is adaptable to both new construction and retrofits. It operates passively when not engaged, allowing standard heat pump operation without interference.

The Name – “The Natural Connection”

Chosen because the system represents a *human-created cycle connected to natural energy behavior*.
It also acts as a bridge to the next technology, potentially a hybrid of photovoltaic and nuclear, though this lies beyond my current design scope.

Patent Status

Not patented.

What I Want

Nothing. Because it's a good idea, society can benefit, & I leave a legacy.

Why This Idea Will Work

- Pays for itself.
- Adds to current technology without disruption.
- Works with existing systems.
- Can scale for commercial and residential use.
- Matches proven rules of thumb (e.g., 1 gallon storage per sq ft or 600 gal/ton).
- Provides clear energy savings and operational reliability.

What Remains to Be Done

- Evaluate possible tax credits.
- Build a model to confirm performance.
- Develop enclosure design to adapt to current heat pumps.
- Determine fan needs, power, and control requirements.
- Develop solar thermal pump and control strategies.
- Design evaporative cooling actuation.
- Establish manufacturer agreements for components.
- Design piping, flow rates, and installation instructions.
- Design coil and pad combinations for each system size.
- Develop solar panels capable of delivering 25,000 BTU/day at target cost.
- Explore new applications using existing product lines.

Potential

Based on estimated U.S. market data:

- 3-ton system = ~$10,000 installed cost, paying for itself within ~10 years. **Current pricing should be verified!**
- Assuming 10% market share of 26 million heat-pump homes, potential sales could reach **$26 billion**.

Pros and Cons

Pros:
• Tax deductible as R&D cost.
• Marketing and sustainability value.
• Can be owned outright.
• Less expensive than developing similar systems internally.
• Immediate innovation platform.

Cons:
• Requires capital investment.
• Performance must be verified through testing.
• Integration with multiple manufacturers may be required.

THE SYSTEM (Full Technical Detail)

Going through the system (Refer to Appendix A, drawing 4 of 4):

One (1):

1. FAN:

A. A fan in series with the existing heat pump outdoor unit fan enables movement of an equivalent air volume (CFM), Could be on/off, variable speed or stepped control.

Possible Control Inputs

1. Pressure
2. Air volume
3. Activation of existing fan.
4. MOTOR
5. ECM (Preferred for energy efficiency)
6. PSC
7. SP

B. If new equipment, Motor may be deleted because main fan can be used for the entire air flow requirement.

C. Freeze protection is not required at this location.

Two (2):

1. CABINET

A. Encloses and directs air flow.

B. The cabinet, among other things, will permit mounting of additional fan (if required), coil, three-way valve (if variable speed ECM motor is used on pump a two-way valve will be used), evaporator pad & controls, as well as a wiring /control enclosure.

C. It permits mounting of the evaporative pad, hydronic coil, and fan as well as provides for a control enclosure.

D. In most cases it will have to enclose three sides of the heat pump outdoor unit to take full advantage of the existing coil.

E. Material of construction may be:

1) Ferrous sheet metal (Preferred).

2) Non-ferrous sheet metal.

3) Plastic.

4) Wood.

5) Fiberglass.

6) Other ferrous or non-ferrous material.

7) Any combination thereof.

F. INSULATION

A. Should be same as already in use.

B. May or may not be required, however, is recommended to prevent energy loss.

C. Fiberglass board (Preferred for ease of installation but should be same as already in use.

D. Fiberglass batt.

E. Rubber.

F. Plastic.

G. Foam.

H. Expanded foam.

I. Expanded rubber.

J. Any other weather resistant material used to prevent the transfer of energy.

K. FREEZING: Freezing of the cabinet is not a risk, however the cabinet may function to assist in the prevention of freezing the hydronic coil.

Three (3):

1. HEATING COIL:

A. This component will operate to warm ambient air using water from the storage tank.

B. Water shall be removed from the tank at an upper elevation to take advantage of stratification to remove warmer water.

C. Water shall be returned to the tank at a lower elevation to promote stratification of cooler water at lower elevations in the tank.

D. FREEZING:

1) Freezing of the coil is probable due to its function of warming ambient air.

2) If the coil is permitted to freeze damage will result.

3) Antifreeze with a plate heat exchanger with a possible additional pump, or a plate heat exchanger located in the tank perhaps with no pump with refrigerant allowed to migrate due to its changing state (like a heat pipe) could be used, however this may increase cost & complexity.

4) Requiring drainage of the coil back to the storage tank to prevent freezing is the lowest cost option.

Four (4):

1. EVAPORATIVE COOLING PAD

A. The evaporative cooling pad is to be used to lower the ambient air temperature towards the wet bulb prior to use by the heat pump.

B. Water is expected to be potable, under pressure, requiring only a solenoid valve to activate its supply.

C. Water can be naturally obtained and condensates from the air conditioning process can be reused tofurther reduce environmental impact.

D. Freezing:

1) The evaporator pad shall be deactivated and the supply pipe drained prior to freezing conditions.

2) As long as the evaporator pad is deactivated and the supply pipe drained prior to freezing conditions freezing will not be an issue.

Five (5):

LOCATION FIVE:

1. Air leaving the evaporative cooling pad and hydronic coil enters the outdoor heat pump coil.

2. In the summer the ambient air will have cooled towards the wet bulb thus making the cooling cycle of the heat pump more efficient.

3. In the winter the ambient air will have been warmed hopefully eliminating operation of electric strip heat except under the most extreme conditions and making the heating cycle of the heat pump more efficient under other conditions.

4. Freezing is not an issue at this location.

Six (6):

1. SOLAR THERMAL PANEL

A. A typical Solar Rating and Certification Corporation (SRCC) approved panel can deliver 25000 BTU per day.

B. Provide roughly twenty-eight 25,000 BTU/Day panels (900 square feet of panel for an 1800 square foot residence.

C. The opportunity: Solar thermal panels must be delivered at $150.00 EACH. This is the hard part, but it can be done.

D. FREEZING:

1) Freezing of solar panels & piping will happen when the solar temperature falls below freezing.

2) Piping is at risk any time the ambient temperature is below freezing. Therefore, it shall be insulated.

3) Water flowing through the pipe at elevated temperatures along with the insulation will prevent freezing.

4) Solar thermal panels and piping shall be designed and installed to drain back to the storage tank. This shall happen whenever the water temperature returning to the storage tank is less than the water temperature in the tank or when the solar temperature is less than fifty degrees F.

Seven (7):

1. NON-POTABLE WATER STORAGE TANK:

A. A float valve, like one used in a cooling tower to control basin water level, is envisioned to control water level in the storage tank. Other electronic means may be used.

B. A readily available non-potable below grade water storage tank at 600 gallons per ton will be required.

C. A pre-insulated tank insulated with six inches of waterproof insulation will need to be developed. In the meantime, available storage tanks with 4" of field applied polyisocyanurate insulation can be used.

D. Storage required is one gallon per square foot with an anticipated temperature rise of approximately forty degrees F.

E. Freezing: Tank is buried below frost line making freezing a nonissue.

2. PUMPS:

A. The system will require two pumps. They will be fractional horsepower, and each will be powered by a 115 V., single phase circuit. They will operate at the same time.

B. SOLAR THERMAL PUMP: Pumps water from the storage tank to the solar thermal panels. Run pump when the solar temperature is greater than the fluid temperature at the bottom of the tank and the solar temperature is above fifty degrees F. If the solar temperature is above one hundred- and sixty-degrees F. (close to boiling) run the pump to prevent

panel steaming, if the storage tank temperature exceeds 190 degrees F.(very close to boiling) open the waste valve. This will require running the waste pump (a very efficient sump pump with an ECM motor mounted near the bottom of the tank. I am aware of none currently available.) It could be a very inexpensive in-line pump mounted outside the tank below the fill level in a watertight fiberglass box. This will require makeup introduction thus cooling the tank.

C. HEATING WATER COIL PUMP: Pumps water from the storage tank to the ambient air heating coil and associated valve. Run the pump when the outdoor fan is on and the heat pump is in heating mode. This should be a very efficient sump pump with an ECM motor mounted near the top of the tank.

Appendix A – Drawings

Figure 1 — System Layout (Sheet 1 of 4)

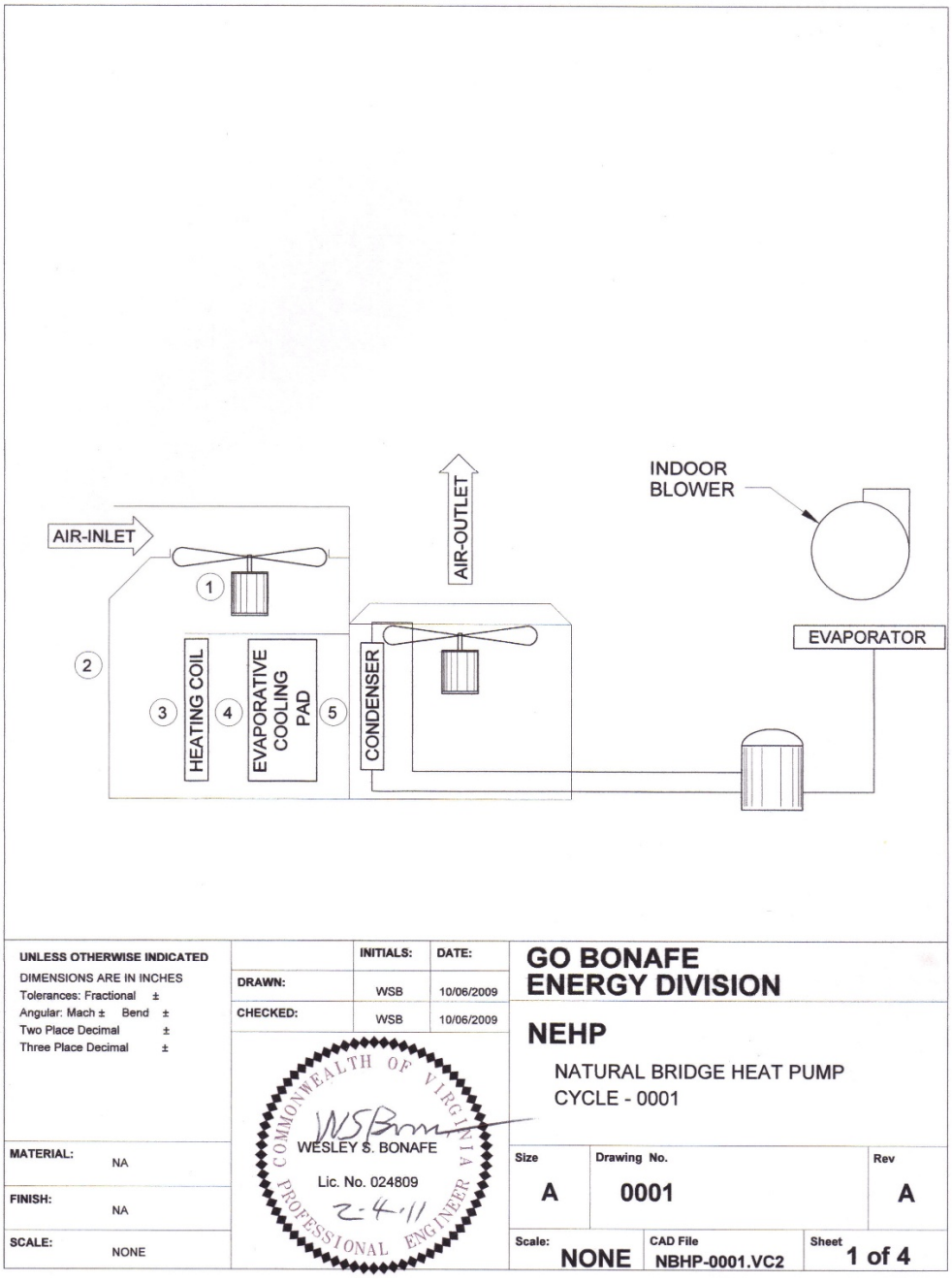


Figure 2 — System Hydronic Schematic (Sheet 2 of 4)

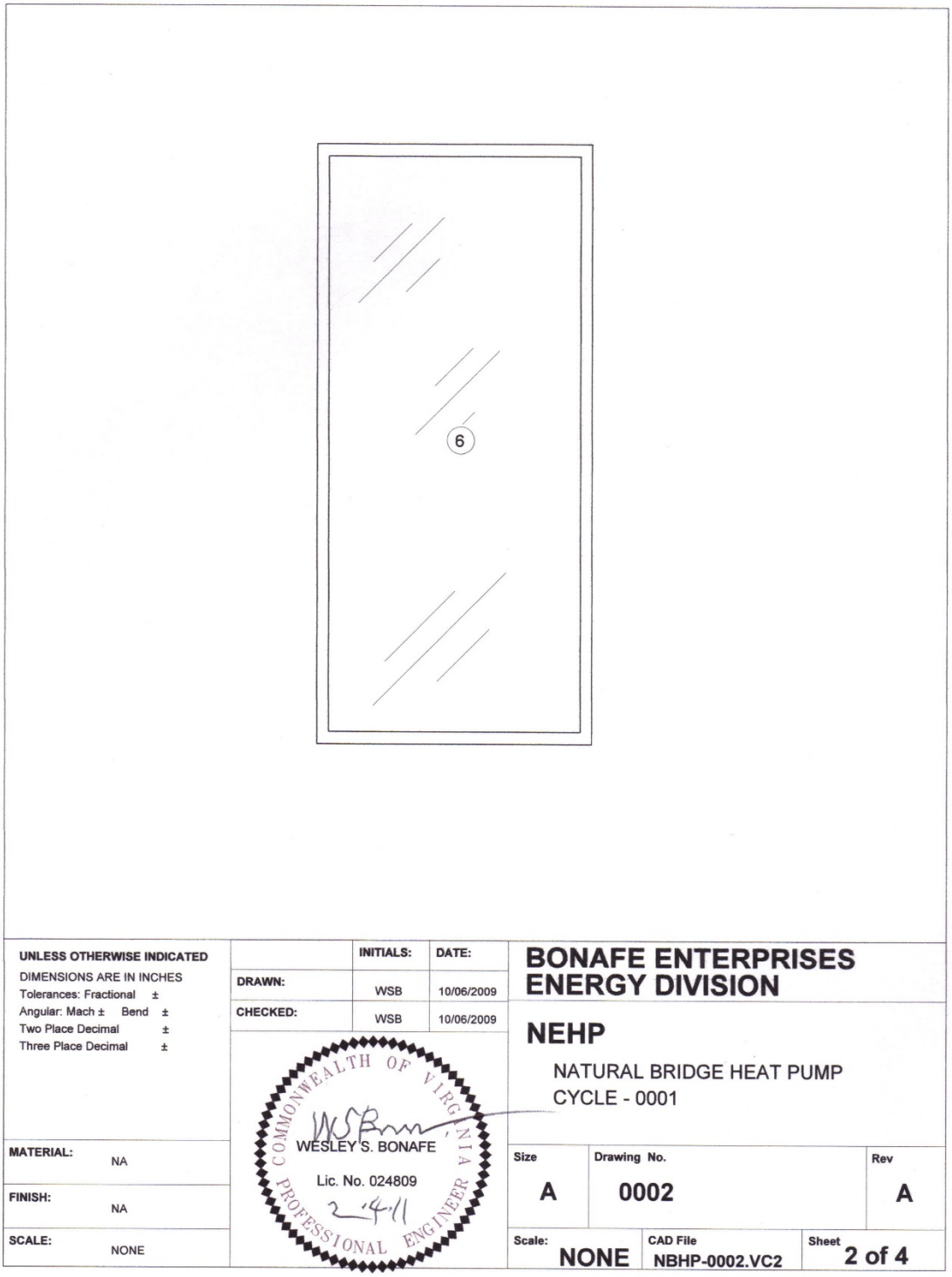


Figure 3 — Solar Thermal Integration (Sheet 3 of 4)

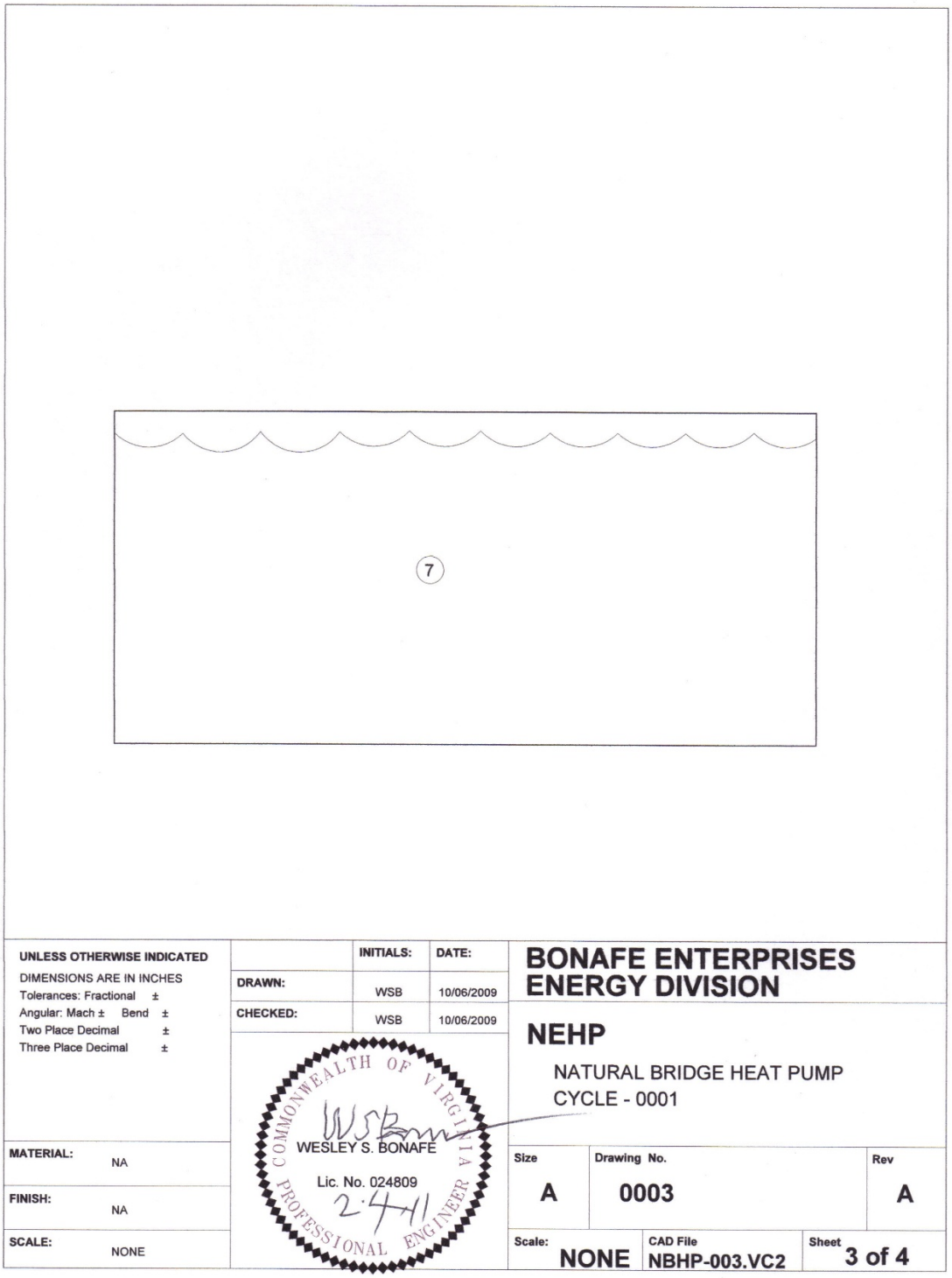
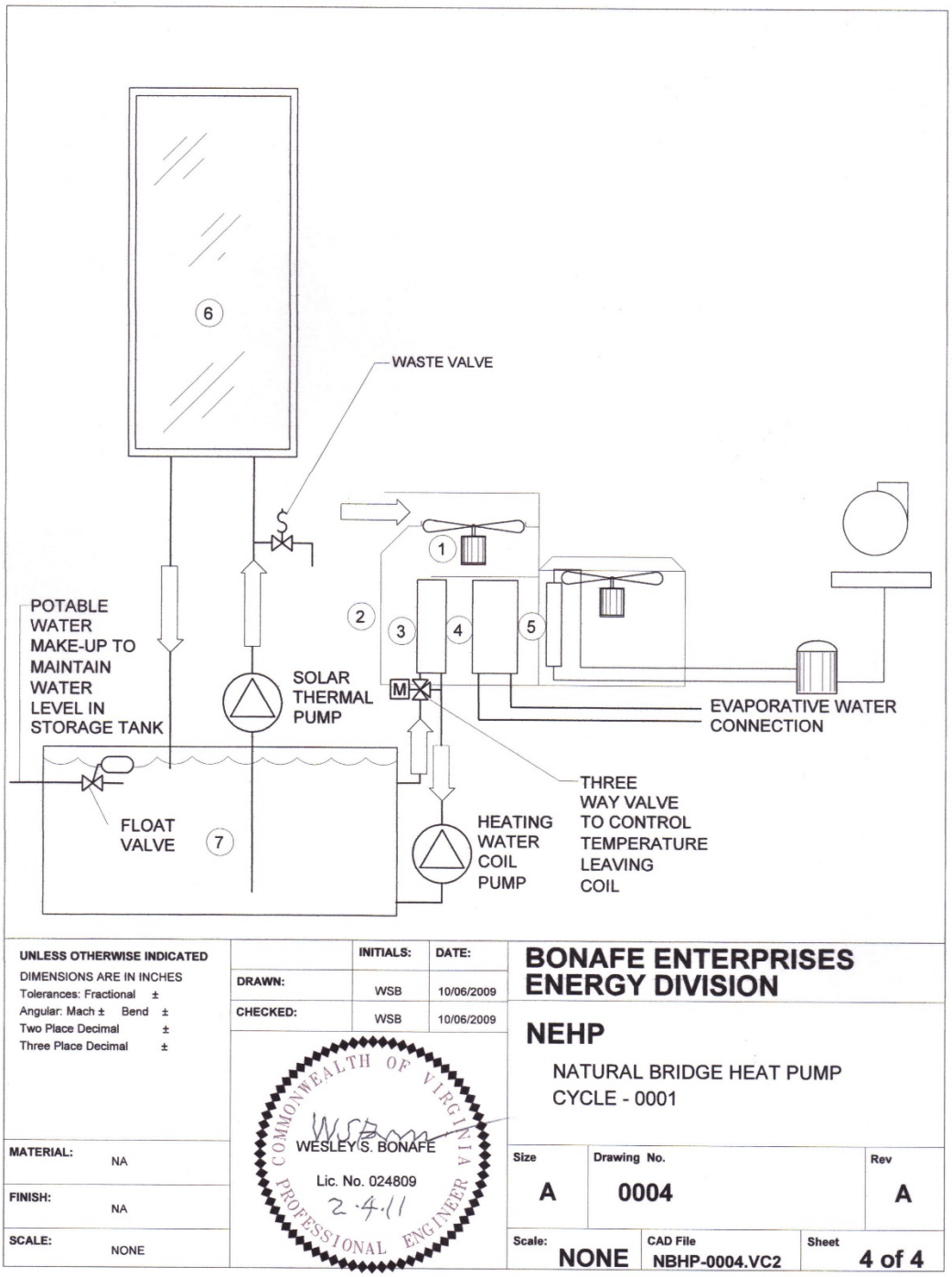


Figure 4 — Solar Thermal Integration (Sheet 4 of 4)

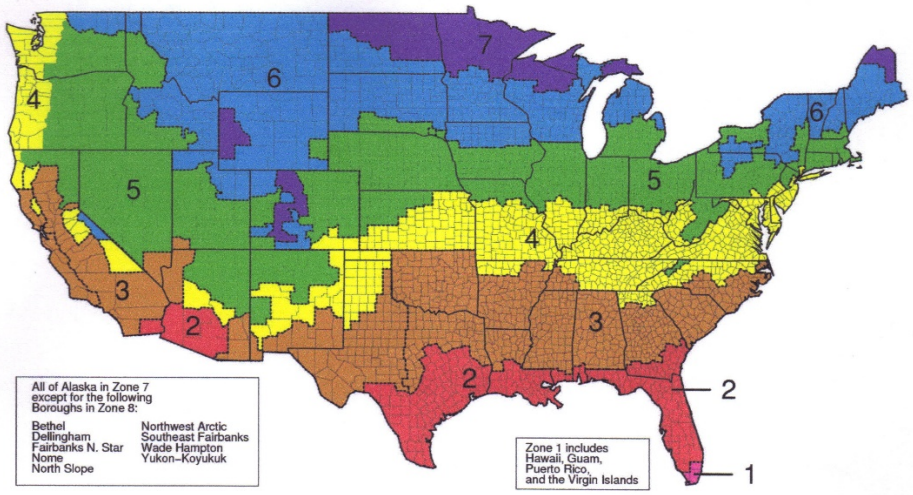


Appendix B – Energy Code Climate Zones

Figure 5 — U.S. Energy Code Reference Map (Page 1 of 2)

Building Energy Codes
RESOURCE CENTER

Energy Code Climate Zones



The 2004 IECC Supplement was the first model energy code to adopt a new set of climate zones. The older IECC zones had been based only on heating degree days, and did not account for cooling energy.

The older climate zones suffered from several shortcomings that the new zones remedy:

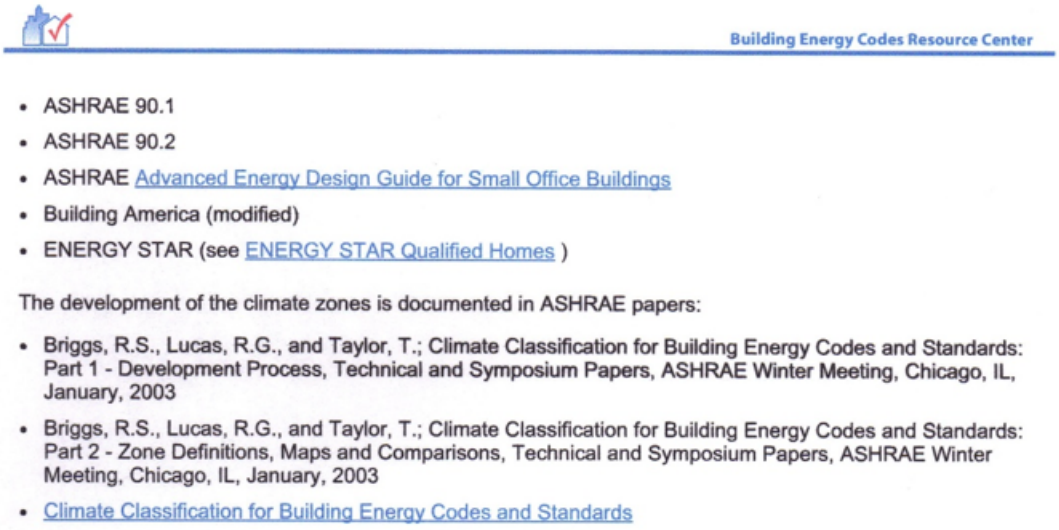
1. Too many zones within individual jurisdictions. Many code users have complained to DOE that the code"s requirements change too much within code jurisdictions. Reducing the number of zones by roughly half will mean that far fewer users will need to keep track of requirements that differ across the region in which they practice.
2. Poor representation of cooling issues. The older zones are based almost entirely on heating degree-days, which means they do a rather poor job of distinguishing climate factors that affect cooling loads. The new zones better reflect factors that impact cooling, such as cooling degree days, high wet bulb temperatures, and variations in solar radiation.
3. Inconsistent and sometimes conflicting information regarding climate in the code. For example, the pre-2004 IECC"s requirements are sometimes based on heating degree-days, sometimes map-based climate zones, and sometimes both. This could result in different requirements in the same location depending on which climate specification is used. The new climated zones consolidate the various code criteria around a single specification-the U.S. map of climate zones.

The new climate zones were developed based on analysis of the 4775 NOAA weather sites and statistical analysis of regional information. The new climate zones are entirely set by county boundaries.

The new climate zones have now been adopted by many other organizations including:

http://resourcecenter.pnl.gov/cocoon/morf/ResourceCenter Page 1 of 2

Figure 6 — U.S. Energy Code Reference Map (Page 2 of 2)



Notice

The Natural Connection Heat Pump Cycle is the original work of Wesley S. Bonafe, P.E. It is offered freely for use, development, and commercialization by any individual or organization with the resources to move it forward. Attribution is appreciated but not required.

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