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Details:

(FORM UPDATED: 08/11/2010)

## WISCONSIN STATE LEGISLATURE ...
## PUBLIC HEARING - COMMITTEE RECORDS

# 2007-08
(session year)

# Assembly
(Assembly, Senate or Joint)

# Committee on ... Housing
# (AC-Ho)

## COMMITTEE NOTICES ...

- Committee Reports ... **CR**
- Executive Sessions ... **ES**
- Public Hearings ... **PH**
- Record of Comm. Proceedings ... **RCP**

## INFORMATION COLLECTED BY COMMITTEE FOR AND AGAINST PROPOSAL

- Appointments ... **Appt**
- Clearinghouse Rules ... **CRule**
- Hearing Records ... bills and resolutions
  (**ab** = Assembly Bill) (**ar** = Assembly Resolution) (**ajr** = Assembly Joint Resolution)
  (**sb** = Senate Bill) (**sr** = Senate Resolution) (**sjr** = Senate Joint Resolution)
- Miscellaneous ... **Misc**

* Contents organized for archiving by: Mike Barman (LRB) (Aug/2010)

# Assembly

## Record of Committee Proceedings

## Committee on Housing

**Assembly Bill 231**

Relating to: rules requiring that certain buildings be superinsulated.

By Representatives Suder, Ballweg, Bies, Boyle, Gronemus, Hahn, Hines, Honadel, Hraychuck, Hubler, Jeskewitz, Lothian, Montgomery, Moulton, Mursau, Musser, Nerison, A. Ott, Owens, Petrowski, Rhoades, Townsend and Vruwink; cosponsored by Senators Kreitlow, Cowles, Grothman, Hansen, Harsdorf, Jauch, Lassa, Olsen, Roessler, Schultz, Plale and Vinehout.

April 05, 2007 Referred to Committee on Housing.

May 3, 2007 **PUBLIC HEARING HELD**

Present: (7) Representatives Wieckert, Roth, Townsend, Honadel, Hebl, Young and A. Williams.

Absent: (0) None.

Appearances For

- Ann Emerson , Madison — Rep. Scott Suder
- Matt Pagel , Madison — Senator Kreitlow
- Joleen Jensen , Turtle Lake — Steffes Corporation
- Shannon Clark , Soldiers Grove
- Martin Hillert , Friendship
- Greg Blum , Iola
- James Hathaway , Menomonie
- Jan Stranz , Abrams
- Robert Eddy , Eden Prairie — EP Sales Inc.
- Leo Udee, Fond du Lac — Wisconsin Geothernal Association
- Ron Blando , Ellsworth
- David Delkers , Arcadia
- David Jenkins , Madison — Wisconsin Federation of Cooperatives

Appearances Against

- None.

Appearances for Information Only

- None.

Registrations For

- Marvin Jensen , Turtle Lake

- Richard Cochran , Menomomie Falls — Radiant Electrical Heat
- Brad Boycks — Wisconsin Builders Association
- Luther Olsen , Madison — Senator , 14th Senate District

Registrations Against

- None.

January 24, 2008 **EXECUTIVE SESSION HELD**

Present: (7) Representatives Wieckert, Stone, Townsend, Honadel, Hebl, Young and A. Williams.
Absent: (0) None.

Moved by Representative Young, seconded by Representative Honadel that **Assembly Bill 231** be recommended for passage.

Ayes: (7) Representatives Wieckert, Stone, Townsend, Honadel, Hebl, Young and A. Williams.
Noes: (0) None.

PASSAGE RECOMMENDED, Ayes 7, Noes 0

Scott Becher
Committee Clerk


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## Vote Record
# Committee on Housing

Date: 1/24/08

Moved by: TOWNSEND Seconded by: YOUNG

AB 231 SB _____ Clearinghouse Rule _____

AJR _____ SJR _____ Appointment _____

AR _____ SR _____ Other _____

A/S Amdt _____

A/S Amdt _____ to A/S Amdt _____

A/S Sub Amdt _____

A/S Amdt _____ to A/S Sub Amdt _____

A/S Amdt _____ to A/S Amdt _____ to A/S Sub Amdt _____

Be recommended for:

☒ Passage ☐ Adoption ☐ Confirmation ☐ Concurrence ☐ Indefinite Postponement

☐ Introduction ☐ Rejection ☐ Tabling ☐ Nonconcurrence

| Committee Member | Aye | No | Absent | Not Voting |
|---|---|---|---|---|
| **Representative Steve Wieckert, Chair** | ☑ | ☐ | ☐ | ☐ |
| **Representative Jeff Stone** | ☑ | ☐ | ☐ | ☐ |
| **Representative John Townsend** | ☑ | ☐ | ☐ | ☐ |
| **Representative Mark Honadel** | ☑ | ☐ | ☐ | ☐ |
| **Representative Gary Hebl** | ☑ | ☐ | ☐ | ☐ |
| **Representative Leon Young** | ☑ | ☐ | ☐ | ☐ |
| **Representative Annette Polly Williams** | ☑ | ☐ | ☐ | ☐ |
| **Totals:** | 7 | 0 | ____ | ____ |

☑ Motion Carried ☐ Motion Failed


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GEN~SYS ENERGY

Jeffrey W. Springer, CEM
Manager, Technical Services Group

3200 East Avenue South • La Crosse WI 54601
Office (608) 787-1464 • Fax (608) 787-1221

TO: Wisconsin Assembly - Housing Committee

FROM: Jeff Springer

DATE: May 2, 2007

SUBJECT: Support for Assembly Bill 231

As an energy efficiency proponent and Certified Energy Manager with 20 years of experience, I would like to offer my support for Assembly Bill 231. As an energy professional, I support the repeal of superinsulation requirements because the fact is, these requirements, as implemented in the administrative code, are not in the best interests of Wisconsin consumers.

The current regulations impose impractical restrictions on new homes that have over 3kW (equal to two hair dryers) of electric heat. The current software used by most home inspectors to show code compliance can lead to unacceptable trade-offs in order to pass a home with electric heat. An example of this is the dramatic reduction in the number and size of windows needed for a home with electric heat to achieve a passing score while a house with 78% efficient gas furnace passes easily. In addition, the same electric home design passes the code requirements of every other state without the need to reduce windows.

Electric heating technologies have made dramatic advances in efficiency and economy since the original restrictions were put in place. Electrically powered ground source heat pumps now offer the highest efficiencies and lowest operating costs of any heating system available. Storage heat systems allow consumers to heat their homes using low off-peak electric rates and improve efficiency of power plants. Since electric heating can offer considerable savings over propane and fuel oil systems in the same home, there is no reason to impose special insulation requirements that discourage the use of the electric option.

Of all the fuel types available for home heating, only solar and electric have a renewable component. In fact, electric heating is often an appropriate choice to supplement a passive solar home. Recent attempts to build a zero energy home in Colorado incorporated electric heating in the design. The International Energy Conservation Code is fuel neutral in order to allow designers to select the best system for each individual application. Electric heat systems complement the use of renewable sources for energy.

In the last 25 years, standard insulation levels have increased substantially. Given the changes in electric heating technology, economics, and baseline building practices, the time is right for Assembly Bill 231 to repeal the superinsulation requirements for electric heat. This measure will provide an equal playing field for all fuel types so that architects, designers, and consumers can choose the system that best suits their needs.


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Testimony of David Jenkins
Electric Division Manager
Wisconsin Federation of Cooperatives

On AB 231

May3, 2007

Committee on Housing

Chairman Wieckert and Members:

Wisconsin's consumer-owned electric cooperatives serve nearly 10% of Wisconsin's electricity customers.

We thank the sponsors of AB 231 for supporting this legislation. It corrects a 1983 statute that requires homeowners building a new home to put more insulation in their homes if they use one type of heating system-electric heat.

Advances in building codes and electric heating and cooling technologies have rendered this 24 year-old provision obsolete.

My most important message to the members here today is that homeowners in consultation with their builders, are in the best position to choose what kind of heating and cooling systems to use in new construction. The state should not have artificial barriers to any kind of technology.

All heating systems should have the same rules applied to them. This legislation would ensure that.

Off peak electric heating systems save consumers money. That is what we are trying to promote.

It is vital that we move load off-peak to the greatest extent possible. No one wants to build more power plants than we need to. In fact the PSC recently urged utilities to step up their load management systems to reduce electric load during off-peak times.

We urge the committee to adopt this legislation.

Thank you very much.


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Electric Heating Bill (AB 231) Hearing
May 3, 2007

One of my roles at Pierce Pepin Cooperative Services, as the member service manager, is to provide information and advice to our members on energy efficiency and energy efficient products, including home heating. In addition, Pierce Pepin Propane Services is a wholly owned subsidiary of Pierce Pepin Cooperative Services, which provides a full line of propane services to the electric and non-electric members in the Pierce Pepin serving area.

Electric heating is a very viable and dependable source for Wisconsin homeowners. It has a very good track record of comfort and dependability. When used with off-peak or time-of-use meter pricing, it is a better value than LP, natural gas, or fuel oil.

> Some types of electric heating are; baseboard, plenum heaters, boilers, heat pumps, and electric thermal storage devices.

Technology today has been able to make many electric heating products even more efficient. Electric thermal storage equipment has the ability to communicate out-door temperature information to charge the brick core to proper levels. Electric boilers and plenum heaters are now able to modulate the elements for better comfort control and run time. Geo source and air-to-air heat pumps utilize variable speed compressors and fan controls which help increase energy efficiency.

I do not believe the current legislation is allowing our Wisconsin homeowners the choice to purchase the best solutions for their heating needs. One case in particular cites a new homeowner that was building a new home on the Pierce Pepin Cooperative system. He did not want a fossil fuel heating system for his new home. His architect that designed his home was from California and his electrician was from neighboring Minnesota. Both of these individuals expected the house plans to pass the permitting process without much discussion. However, his house plans did not pass the requirement for the Uniform Dwelling Code building permit in Wisconsin without giving up several windows and drastically changing his house design. Many personal and phone discussions ended in frustration with the builder, the owner, the building inspector, and myself. Ultimately he was not able to build the home he initially wanted. There have been several other homeowners that wanted to install electric boilers for off-peak hydronic floor heating along with a forced air gas furnace, but the home could not pass the 3 kW rule.

No other states have imposed restrictions similar to the restrictions the State of Wisconsin currently has as law or administrative rules. Superinsulation has not been properly defined and imposes improper restrictions on electrically heated homes, especially when you consider that 3 kW is equivalent to two hand held hair dryers.

Energy calculations, regardless of the fuel, should be calculated equally and without bias. Electric energy efficiency is calculated back to the source of a coal fired power plant. Other fossil fuels are calculated at the end user price and don't even consider the product

production costs or transportation costs. Today electric energy has a very diverse portfolio that includes renewable energy, therefore, electric energy calculations should also be considered from the end user price.

Passing this legislation will be good for Wisconsin energy users. Passing this legislation will put the heating decision making for their new and existing homes back into the homeowners control, without being forced to remove windows, increase wall size, or deviate from the original plans. Wisconsin homeowners have the right to choose the type of heating system that provides them with the best long term dependable product. Passing this legislation will allow them to make the best choice for them.

Ron Blado
Member Services Manager,
Pierce Pepin Cooperative Services
Ellsworth, WI

Ph. 715-273-2412


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Date ?

Benefits of Electric Heat

Good morning Mr. Chair and distinguished assemblypersons. My name is James R. Hathaway. I am the General Manager of the Dunn Energy Cooperative, headquartered in Menomonie, Wisconsin and I would like to testify in favor of AB 231.

Dunn Energy Cooperative is an electric distribution cooperative serving consumers in six Western Wisconsin counties. The cooperative purchases electric power for distribution from Dairyland Power Cooperative. We offer our members a variety of electric heating products to help them heat their homes, farms and businesses efficiently and economically. As with other technologies, electric heat has entered the 21st century with innovative products that can heat a room or a whole house, cleanly and efficiently. But the restrictions in the Uniform Dwelling Code limit our member's ability to choose these heating products,

We offer electric rates and programs that help our members reduce the cost of heating. Our off-peak heating program reduces the demand for electricity during times of peak demand and that helps reduce the cost of the electricity our cooperative buys from our power supplier. We pass those savings on to our members and our off-peak energy rate is about half of our standard electric rate. Natural gas is not available in most of the rural

territory that Dunn Energy serves and our off-peak electric rate is much less expensive than the cost of heating with propane. At Dunn Energy we sell propane as well as electricity so I'm not testifying in favor of AB 231 just so that the cooperative can make more money. Our members want to have the choice of heating their homes with electricity but because of the restrictions in the Uniform Dwelling Code, they are often prohibited from having that choice.

Changing the Uniform Dwelling Code as proposed in AB 231 will allow our members the freedom to choose how they heat their homes. Thank you.


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**Central Wisconsin Electric Cooperative**
150 Depot Street
P.O. Box 255
Iola, Wisconsin 54945
Phone: 715-445-2211

Date ?


Hello Thank you for taking the time to hear my comments on AB 231. I will give you my comments in writing after I read them to you.

My name is Greg Blum. I am the CEO of Central Wisconsin Electric Cooperative. We serve 8000 members in Shawano, Portage Marathon, and Waupaca Counties mainly in rural areas where natural gas is not available. I talk to my members who want choices in heating their homes for cost reasons and environmental reasons. In our area, Fuel oil is over $2.69 a gallon, propane is $1.69, and wood is a lot of work.

We install and maintain geo thermal Heat pumps, currently classified as electric space heat. These units are 300% efficient and are used by our membership at a heat controlled rate of around 5 cents per KWH. This translates into 41 cent propane on a 92 % efficient propane furnace and 48 cent fuel oil on a 70% efficient fuel oil furnace. Even resistance heat, with 100% efficiency rating, is a better bargain today translating to a propane cost of $1.23 and fuel oil of $1.44, well below today's prices.

When you talk about energy efficiency and environmental reasons to pass the bill, we operate these units at off peak times therefore taking advantage of capacity already built. This delays the need for costly future base load generation, which helps our environment.

As I have stated with real numbers, electric currently costs less, is more efficient, and can help our environmental if used with our load management programs. This is a win for our members and our environment.

Yes, there are ways around the current law, but they all cost our members **more** money to use a system that meets their needs better and helps the environment and this does not have to be nor should be. Without this bill, you either have to super-insulate or you have to have an engineer sign off which Focus on Energy will gladly do for $300; so in effect our members pay three times. Once for the Public Benefits charge, another time when they and us pay Focus on Energy for the analysis, and a third with more insulation than is required for a less efficient source of heat like propane or Fuel oil needs.

And to make matters, worse, if our members do not have the money up front for analysis or more insulation and have to buy a propane furnace, they get the honor of paying higher energy costs for the life of the system, based on prices today.

I urge you along with my members to create a balanced playing field so they can have the choices that suit their needs and pass Assembly Bill 231. Thank you for your attention.

Signed,
Greg W Blum
Greg Blum
CEO, Central Wisconsin Electric Cooperative
715-445-2211 E1684 Nelson Road, Iola WI 54945


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Date ?

**Testimony on AB 231**
**David R. Oelkers**

My name is David Oelkers. I am the General Manager of Riverland Energy Cooperative in Arcadia, Wisconsin. I live W26988 Mesa Lane, Arcadia, Wisconsin. Good afternoon Chairman Wieckert and committee members, I want to thank you for the opportunity to speak with you today regarding AB 231.

Simply put, the passage of AB 231 will provide the opportunity for the homeowner to make the decision on what type of heating system they would like to install in their home.

I strongly believe that the building code should not be based on a specific heating system. Subject to fair and appropriate insulation requirements, the heating system decision should be the sole decision of the property owner. This is especially true in the rural areas that our cooperatives serve because in most cases the availability of natural gas is quite limited. Our member's only options are electricity, propane, fuel oil, and wood.

Today's electric heating options are greatly improved over those of years ago. Today the plenum heaters, electric thermal storage units, and radiant heat units take the latest technology and provide safe, clean, reliable and low cost options for home heating. Geothermal heat pump systems provide not only heating, but also a low cost cooling option for the homeowner. As an example, I currently live in a home that was appropriately insulated, but it probably does not meet the superinsulation requirement because the home was constructed before enforcement of the rules. It is an all electric home and it is heated with a ground source heat pump. Over the past 12 months on our cooperative's dual fuel rate my wife and I have been able to heat and cool our 2,800 square foot home for a total cost of under $500. That is correct - less than $500.00 for the entire year with electricity as the only fuel source.

I am convinced that the consumer can heat their home equally as well and with greater efficiency using an electric heat option as they can heating with any other fuel. And I believe that it can be done at no more cost than other fuel options. To restrict the consumers home design based on the type of heating system is simply outdated and no longer a cost effective nor valid argument.

I want to remind the committee that electric power today is not only being generated by coal fired powered plants. Our power provider currently offers an ever-growing renewable portfolio from such sources as landfills, manure digesters and of course, wind.

As I see it, supporting this bill will make an appropriate adjustment to our state's current law thereby placing it in better harmony with our state's overall energy conservation initiative.

I encourage the committee to act favorably on this bill and I would encourage the full assembly to do likewise.

Thank you for your time this afternoon, I sincerely appreciate the opportunity.


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WECA Division of Wisconsin Federation of Cooperatives Legislative Brief 2007
For more information, please contact Beata Kalies 608/ 258-4406 or email Beata.Kalies@wfcmac.coop.

Date 7

# CONSUMER HEATING FAIRNESS ACT

Please support Representative Suder's LRB-1177 being circulated for co-sponsorship.

AB 231

- Current state law requires any one-and two-family dwelling which uses electricity for space heating to be superinsulated.
- The law does not define the requirements, but the building code has different and stricter standards for electrically heated systems.
- Because superinsulation is not defined, the term is rather vague. Does it mean more insulation than used in 1980 or current construction trends? Is it more insulation than used for natural gas or propane heat? New construction can be considered better insulated now than 20 years ago. The superinsulation requirements are unfair and outdated mandates.
- No other state has such requirements.

- In rural areas of the state, natural gas is often not available, electricity, propane, fuel oil or wood are the only choices.
- Co-ops serve many seasonal members and cabin owners in mostly rural areas of the state, which are all adversely affected by this specific code since it limits the benefits of electric heat systems
- In Wisconsin, based on a 2003 census, electricity is used for heating by 13 % of the population, compared to 76% for natural gas and 11% for other types like propane.

- The choice of a heating system should be up to the homeowner. 15 % increase in insulation levels equals $2 more per square foot. $4,000 for 2,000 sq ft house.
- The current building code has a huge impact on co-ops because it discourages construction, makes it more expensive and inconvenient to meet code and takes away our members' rights to choose their best heating option.

- We are not suggesting a reduction in code requirements, only fair and equal treatment of all heating sources. The building code should not be based on a specific heating system but be fuel neutral since fuel diversity and conservation measures need to be encouraged for all heating systems.

- Software used to show building code compliance is looking at total envelope so one can add a ridiculous amount of insulation in an area just to meet code but in reality not address efficiency or true weatherization.

- Homeowners have been able to get by the requirements by eliminating windows. Energy standards should require that one use energy efficient windows, not how many or how large the windows need to be.

- The code does not treat electric heat sources the same as other. For example, if use geothermal heat need to have a backup furnace but if you use natural gas furnace there is no such requirement.

- Since the enactment of the Federal Energy Act of 2005, there are many incentives and rebates offered for energy efficiency. The Department of Commerce is considering adopting the International Energy Conservation Code (IECC) as part of the Wisconsin code so that Wisconsin consumers can take advantage of those incentives and rebates. This action would be good for fuel neutrality because the IECC treats all heating sources the same.

- Wisconsin only state statute requiring superinsulation needs to be repealed and the building code needs to be modified to utilize all the benefits electric heat offers.

For more information, please contact Beata Kalies 608/ 258-4406 or email Beata.Kalies@wfcmac.coop.

## Why is the state law this way?

In 1983, an amendment to the budget bill authorized creation of a rule that required superinsulation for electrically heated dwellings.

- There was no public input and no legislative vote on the provision.
- The 1980's was a time of abundant and cheap natural gas.
- Intended as a consumer protection measure because landlords would put in baseboard electric heat and not weatherize or maintain the buildings properly leaving the tenants to foot the bill for utility costs.
  Problem with this is that the provision applies to one and two- family dwellings – not apartments.

Result is that electrically heated dwellings are treated unfairly under code.

## Key Points about the Bill:

- Repeals the superinsulation requirement in state statute.
- Prohibits Commerce from creating such rules or enforcing them.

In addition to this bill, we are working with Commerce on changes to the Administrative Code Ch. 22 to:

- Change the current definition of electrically heated which identifies a property as electrically heated if the home or addition has 3 kilowatts of electric heat; and
- Modify the department-approved worksheet and software used to show code compliance, since both fail to properly calculate the efficiency of electric heat systems. The worksheets also determine appliance credits.

For more information, please contact Beata Kalies 608/ 258-4406 or email Beata.Kalies@wfcmac.coop.

## Examples of Electric Heat:

- Geothermal heat pumps - extract heat from the ground. Provide cooling as well.
- Electric thermal storage - store heat during off-peak hours to be used later during peak use times.
- Radiant electric heat panels - heat objects instead of air and can be installed as cables in floors, heated by boiler or in-ground heat pump.
- Air source heat pumps - extract heat form air and transfer it form one place to another. Provide air conditioning too.
- Plenum heaters are installed within the ductwork of existing furnaces, and allow for switching between two fuels during peak and non-peak hours to maximize efficiency and minimize costs.

## Benefits of Electric Heat:

- Electric resistance heat is 100% efficient, heat pumps 200%, & ground source heat pumps are 350% efficient; all energy is converted to heat.
- Get warmth when and where you need it without cold spots, drafts, waiting for the system to warm up or wasting energy heating a full house when only small area is occupied.
- Technological improvements allow the same job to be done using less energy. Emission controls have dramatically reduced environmental impacts.
- Electric power can be generated from renewable sources such as methane gas from landfills or manure digesters.
- Great for seasonal use and cabins because can be plugged in when needed.
- Requires no outside storage or refills during the heating season.
- Electric heat sources can reduce energy use by utilizing load management to control load during peak demand.


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STEFFES CORPORATION

*"Commitment to Innovation"*


**Joleen Jensen**
Regional Sales Manager

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AB 231
?

I'm Joleen Jensen from Turtle Lake, Wisconsin. I am a resident of northwestern Wisconsin who had to meet the code when we built our home in 2003. I also work for Steffes Corporation. Steffes is a manufacturer of Electric Thermal Storage (ETS) heating equipment.

**Off-Peak heating with Electric Thermal Storage (ETS)**

Power companies offer off-peak or Time-of-Use rates to encourage consumers to shift usage to off-peak times. ETS systems use power at night and other off-peak times when the demand for electricity is low. The efficiency of power production, distribution and transmission is substantially better during off-peak times and the associated costs are lower. They also defer the need to build new generation, distribution and transmission facilities.

ETS systems use off-peak electricity – all of the electricity/heat is purchased during the off-peak times when power company rates are lower and when power plants operate more efficiently. The heat is stored in high-density ceramic bricks located inside the unit. Comfortable heating is provided 24 hours a day from the stored heat. Because all of the electricity is purchased at off-peak rates, consumers can save considerably on their energy bills, generally 40-70%.

In the handouts, you will find the Steffes product brochures. There are individual room units, the Comfort Plus Forced Air and the Comfort Plus Hydronic. They all use off-peak electricity and store the heat in bricks.

Generally the Comfort Plus systems are interfaced with an Air Source Heat Pump which provides even greater efficiency, substantially lower energy consumption and further reductions of homeowners operating cost.

Air Source Heat Pumps are known to be very efficient, even at very cool outdoor temperatures, however, as outdoor temperatures decrease, so does the heating ability of the heat pump.

When paired with a Comfort Plus System, the heat pump can operate to very cool temperatures and thereby the full efficiency of the system is utilized. We used to shut heat pumps off at around 30 degrees outside. When paired with our system we can run the heat pump down to about 5 degrees. It's still very efficient at the cooler temperatures, it just can't produce enough heat to heat the entire home.

There are also comfort issues with air source heat pumps. Consumers don't like the "cool" temperatures coming from the registers, which is typical of Air Source Heat Pumps when outdoor temperature is below 30-degrees. Often they replace the air source heat pump with a less efficient heating source to improve the comfort.

The Steffes Comfort Plus system monitors the discharge air temperature from the heat pump, as well as the outdoor temperature. It very precisely modulates the right amount of heat into the duct stream to ensure warm, comfortable air temperatures are delivered to the home at all times. This allows the heat pump to operate the majority of the heating season hours and captures the efficiency of the heat pump at even colder outdoor temperatures.

**Economic Information:**
ETS systems provide very attractive operating costs for consumers. Common power company off-peak rates are about half the standard rate. This sheet in your packet is a Space Heating Cost Comparison. We are comparing Electric Thermal Storage heating to other heating options. The two green bars are the Electric Thermal Storage options. We've got annual space heating costs in dollars and cents here and graph form at the bottom. The two green bars/lines are the Electric Thermal Storage options. The first bar is using room units or a central system by itself. The second green bar is using one of the Comfort Plus Systems with an air source heat pump. We get very good operating costs with both options.

When we built our home in 2003, to be able to meet the code, we had to put additional insulation in the walls on the main level, additional insulation in the basement walls and in the ceiling. We also eliminated a couple egress windows in the basement. We knew about the code as we were planning our home so we did what we needed to do to make it pass. We knew the heating system we wanted and did what was necessary to meet the code.

We're using the Comfort Plus Hydronic system with an air source heat pump. Our annual heating costs are around $500 a year. If we were using a 90% propane furnace at $1.30 a gallon the costs would have been about $1200 a year. If we were using a 90% efficient natural gas furnace at $1.05 a therm it would have been around $1000 a year.

As part of my job I work with people who are building homes. Many consumers building new homes in Wisconsin would also like to utilize this very efficient off-peak ETS heating option without having to superinsulate their homes, or build their homes with small or few windows. Consumers building new homes today don't object to building energy efficient homes. They want to see the electric heat treated the same as other available options.

We work with power companies throughout the US and WI is the only state we work in where consumers have to build differently if they are using electric heat.

When you're working with customers and telling them about an option that can help them reduce their energy costs in their new home, but you say, oh but if you use electric heat you have to insulate better, it makes it sound like we're promoting something that's bad...if the state tells them they have to insulate better with this system.

Consumers want to have choices when it comes to heating their homes. They are making the investment and ultimately will be paying the monthly energy bills. ETS systems offer an affordable, safe, comfortable and efficient option for them.

Electricity is the only one of the major fuel sources that have a renewable component. Electricity is derived from solar, wind, [illegible] manure digesters

Steffes

# ETS

## ELECTRIC THERMAL STORAGE ROOM UNITS

*A Low Cost Off-Peak Heating Solution for Optimum Comfort and Convenience*

## THE *ETS* CONCEPT

Electric Thermal Storage (ETS) heaters are designed to use low cost, off-peak electricity for heating a home or business 24 hours a day. Electric heating elements lie within high-density ceramic bricks capable of storing vast amounts of heat for extended periods of time. During off-peak hours, when electricity costs are lower, the heater will store electric energy as heat. This stored heat is used to satisfy immediate heating requirements and to provide total comfort during peak hours, when a power company's demand for electricity and associated costs are high. Power companies generally offer substantial discounts (up to 40% or even greater), for electricity used during the off-peak hours. With this rate discount, consumers can realize significant savings in their energy bills when compared to alternative heating options.

- SAFE, CLEAN, COMFORTABLE HEAT
- NO SMOKE, NO FUMES, NO MESS
- EASY TO OPERATE
- NO ROUTINE MAINTENANCE
- 100% EFFICIENT
- MANUFACTURED IN NORTH AMERICA
- 5-YEAR LIMITED MANUFACTURER'S WARRANTY

## HOW *ETS* WORKS

### Heat Storage Control

The amount of heat stored in the brick core is regulated manually by the user or automatically in relation to outdoor temperature (stores less in mild weather and more in colder weather). During a charging period (off-peak time), the heater stores the appropriate amount of heat needed to satisfy comfort requirements.

### Room Temperature Control

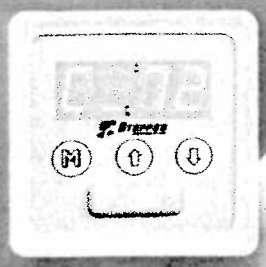
The desired comfort level is regulated by the heater's built-in room thermostat using a blend of radiant heat from the warm heater surface and convection heat from the fan as it circulates the stored heat into the room.

### Peak Control

Steffes ETS equipment interfaces with various on-peak and off-peak signaling devices to regulate energy usage by the consumer and the heating equipment. These include utility control switches, utility meters and time clocks. The power company generally provides a method of recording the off-peak energy usage to ensure you receive the energy savings offered by the off-peak rate.

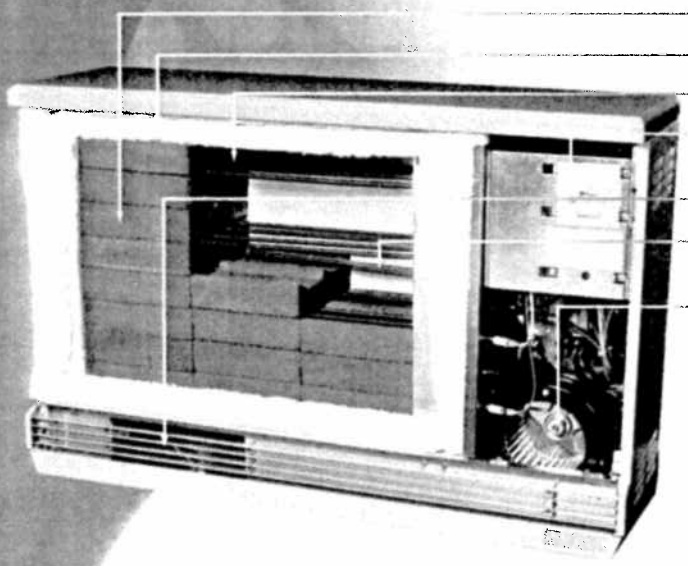
*Heat The Smart Way With Electric Thermal Storage*

ETS heating systems utilize low cost, off-peak, electric rates to provide owners excellent comfort and substantial savings on their heating bills. Steffes Corporation offers a full line of high quality storage heating products including room units, centrally ducted units, and hydronic units as well as the interfacing peak control devices to allow ETS to fit just about any application.



Display/Control Panel

# THE STEFFES 2100 SERIES ROOM UNIT OFFERS MANY UNIQUE FEATURES




- Microprocessor Technology
- Low Cost Automatic Charge Control
- Heater Operation Display Lights
- Integral Digital Room Temperature Thermostat
- Brick Core and Air Discharge Temperature Safety Controls
- Variable Speed Blower
- Built-in Controls to Reduce Installation Time & Costs
- Microprocessor Based Time Clock Module (Optional)

## Specifications

Standard voltage on all systems is 240VAC. Charging input voltages of 208 and 277 are also available.

| MODEL | Charging Inputs (kW) Available *(See Note 1)* | Approximate Installed Weight (lbs) | Dimensions (inches) | | |
|---|---|---|---|---|---|
| | | | Length | Height | Depth |
| 2102 *(See Note 2)* | 2.4, 3.0, 3.6 | 267 | 30 | 24.5 | 10.5 |
| 2103 | 3.6, 4.5, 5.4 | 376 | 37 | 24.5 | 10.5 |
| 2104 | 4.8, 6.0, 7.2 | 478 | 44 | 24.5 | 10.5 |
| 2105 | 6.0, 7.5, 9.0 | 585 | 51 | 24.5 | 10.5 |
| 2106 | 7.2, 9.0, 10.8 | 692 | 58 | 24.5 | 10.5 |

**NOTE 1:** kW input must be specified at time of order. The appropriate model and kW input for your application will depend on heat loss of the area intended to be heated and the number of power company off-peak hours available. Contact your local power company, a contractor or Steffes Corporation for assistance in selecting an appropriately sized system.

**NOTE 2:** Model 2102 also available in a 1.32kW input with a 120V plug-in cord.

**NOTE 3:** A clearance of 12" is recommended on the right side of heater to ensure accurate room temperature sensing and for servicing purposes. If less than 12" is available, an optional remote room temperature sensor is available.

| MINIMUM CLEARANCE REQUIREMENTS | |
|---|---|
| Top | 4" |
| Front | 15" |
| Sides *(See Note 3)* | 2" |
| Back | 1.5" |

## *ETS* ... Perfect for just about any application

(Whole House or Warm Room Heating)

- Electrically Heated Homes
- Fossil Fuel System Replacement
- Wood Stove Replacement
- Boiler Replacement

## Typical Installations

- Primary Residence
- Weekend Home or Cabin
- Manufactured Home
- Apartments or Condominiums
- Churches
- Hotels/Motels
- Schools/Offices
- Warehouses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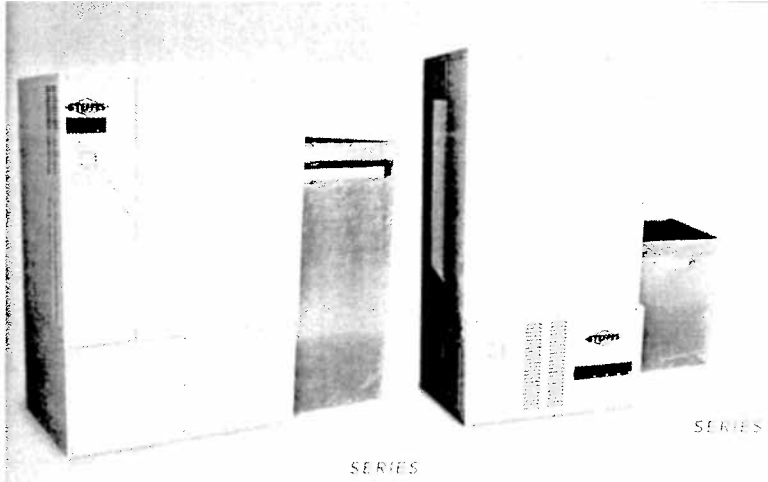



## Off-Peak Heating

The Steffes Comfort Plus Series heating systems are a type of Electric Thermal Storage (ETS) equipment which utilize low cost, off-peak electricity to provide economical and comfortable heating. ETS systems convert electricity to heat during off-peak hours and store that heat in specially designed ceramic bricks. Off-peak hours are those times during the day or night when electricity is plentiful and the electric power company can supply it at a lower cost. Power companies generally offer substantial discounts in rates (up to 40% or greater), for electricity used during off-peak hours. With this rate discount, consumers can realize significant savings in their energy bills when compared to alternative heating options.

## Applications

The versatility of Comfort Plus systems allow them to fit almost any application whether it be in new construction or as a direct replacement for an existing centrally ducted system (fossil fuel or electric furnace). They are designed for use as either the sole heating source ("stand alone" furnace) or as a supplement to ducted heating systems such as heat pumps.

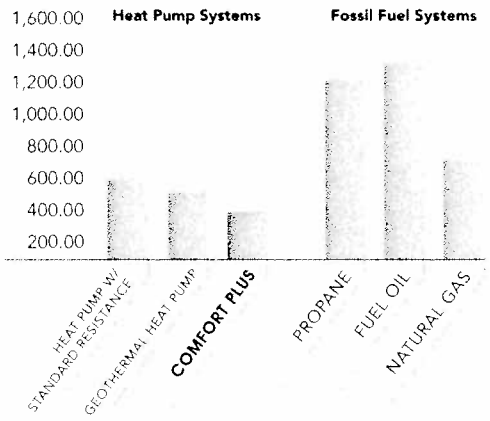
### *Heat Pump Booster*

Heat pumps are known for providing very efficient, low cost heating and cooling. However, during colder outdoor temperatures, traditional heat pumps often times do not deliver acceptable comfort. With the Steffes Comfort Plus unit, you can be assured good comfort while optimizing the heat pump's efficiency. As replacement to the electric resistance strip heat, which is typically used to supplement or back-up heat pump systems, the Comfort Plus unit adds the precise amount of off-peak, stored heat needed to ensure constant, even and comfortable air is being delivered 24 hours a day. During on-peak hours or when the demand for heat is at the point where the heat pump's capacity alone cannot satisfy the heating requirements, the Comfort Plus unit uses its stored, off-peak heat to supplement the heat pump output.

### Typical Annual Heating Costs Example

***(based on a 45,000 BTU/hr heat loss home)***

*Annual costs in your area will vary depending on climate, electric rates, heating fuel costs, etc.*




**The Comfort Plus/Heat Pump system offers many significant benefits:**

- Provides for a high efficiency, low cost heating and cooling system all in one.
- Optimizes system performance by allowing the heat pump's efficiency to be fully utilized.
- Eliminates cool and uncomfortable discharge air temperatures associated with heat pump systems during cool outdoor temperatures.

Utilizing a Comfort Plus unit with a heat pump, in conjunction with an off-peak electric rate, has proven to be one of the most economical heating and cooling systems available.

### *"Stand-Alone" Furnace*

The large storage capacity of the Comfort Plus unit allows this system to be used as the sole heating source for an entire heating application. The unit can easily accommodate most standard auxiliary devices such as an air conditioner, electronic air filter, central humidifying systems, etc.

As a stand-alone central furnace, the Comfort Plus unit provides low cost, off-peak, stored heat as needed to satisfy heating requirements 24 hours a day. Its many sensing devices monitor brick core and discharge air temperatures to ensure maximum safety, even heat distribution, and optimum comfort.

## Operation

Operation of the Comfort Plus is completely automatic. A sensor monitors outdoor temperature to regulate the amount of heat the system stores in its brick core. The wall thermostat, along with the duct sensor in the Comfort Plus, controls heat delivery to ensure a warm and comfortable room temperature 24 hours a day.

### *Optional Variable Speed Blower*

The variable speed ECM blower option provides extra comfort as well as cost savings. To ensure the system always delivers warm air, when it first starts-up there is a delay on the indoor blower until only warm air can be delivered. In addition, with variable speed, air is constantly pulled from all parts of the building, mixed and redistributed. The result is a more consistent, even temperature from floor-to-ceiling, room-to-room and floor-to-floor. In addition to providing a more comfortable environment, the variable speed option is much more efficient in operation. Because it consumes less energy, it will cost substantially less to operate than a typical, standard blower system.

With the variable speed blower option, you can enjoy more consistent temperatures, quieter operation, and money-saving energy efficiency all year long.

## Benefits

The Comfort Plus system allows heating requirements to be satisfied using off-peak electricity (if available from your power company); thus, significant savings in heating costs can be realized. In addition, it offers great safety and reliability with minimal maintenance. With off-peak heating, you will enjoy stable electric rates and superior comfort for many years to come.

# COMPONENTS OF A COMFORT PLUS

**1 Return Air Plenum**
3100: provided with unit
*(right side mounting only)*
4100: separately ordered or installer supplied
*(right or left side mounting)*

**2 Return Air Inlet**

**3 Air Conditioner or Heat Pump Indoor Coil**
*(installer supplied)*

**4 Air Filter**
*(Provided with return air plenum.)*

**5 Supply Air Outlet**
*(4100: bottom right or left side)*

**6 Insulation**
Super-insulated to ensure low surface temperatures along with a doublewall cabinet design to minimize static heating.

**7 Circuit Breakers**
Element and controls circuit breakers are built in to every system to eliminate the need for a separate service disconnect.

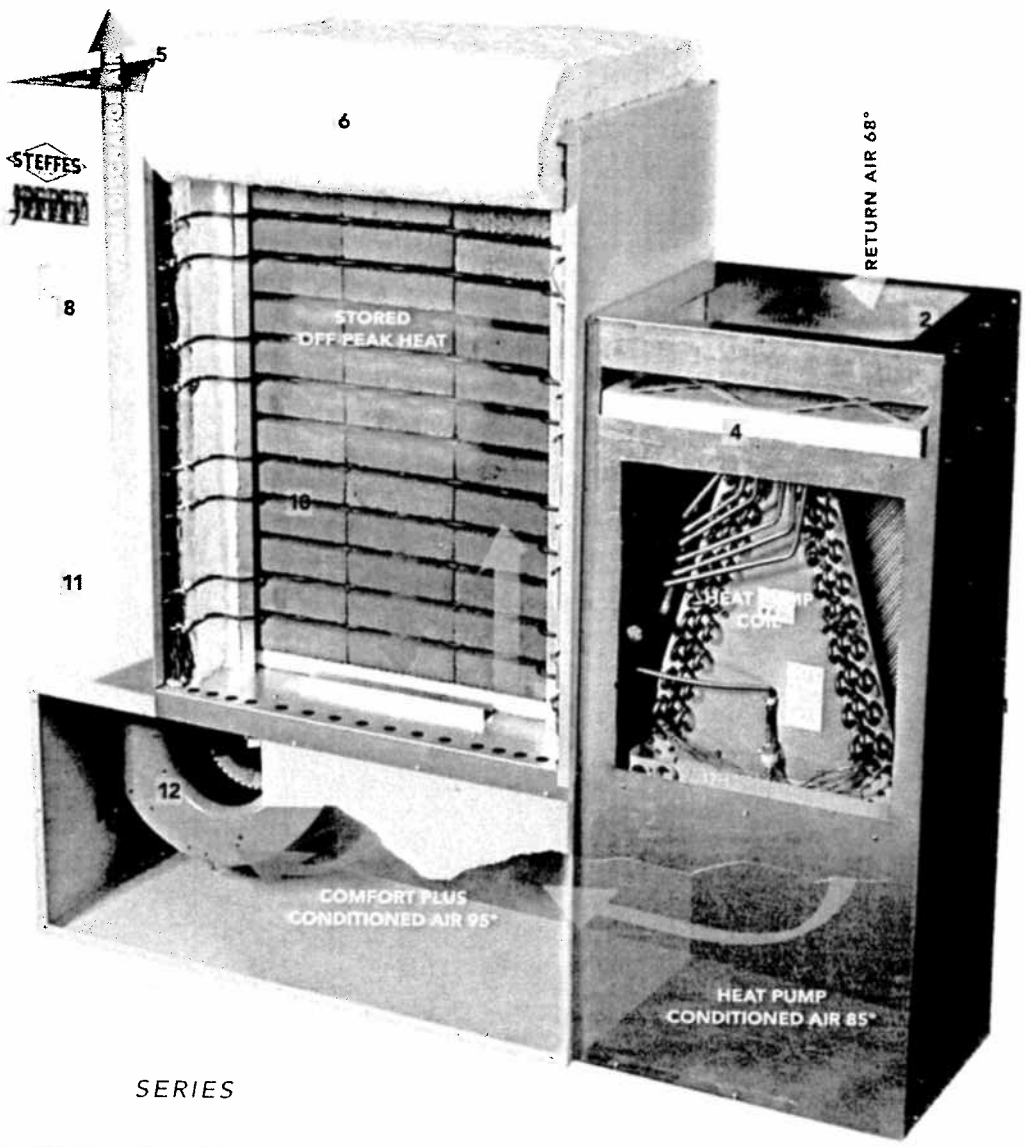
**8 Microprocessor Control Panel and Operating Display**
This state-of-the-art, intelligent control system provides complete programmability of the system to allow for customization to user and power company immediate and future needs, as well as diagnostic testing through the operating display panel.

**9 Heating Elements**
Incoloy sheathed, low-watt density for long life.

**10 Heat Storage Bricks**
Specially designed to store vast amounts of heat for use 24 hours a day.

**11 Electrical Compartment**

**12 Supply Air Blower**
PSC motor in standard configuration. High efficiency ECM variable speed option available for even greater comfort and cost savings.




*SERIES*

# OTHER FEATURES

- Built-in power line carrier receiver for wireless communication of information such as peak control signals and outdoor temperature for automatic brick core charge control.
- Selectable freeze protection and peak override temperature set points *(power company permitting)*.
- Adjustable charge delay allows the furnace to be staged ON at the end of a peak control period or power outage to minimize voltage fluctuations.
- Minimizes transformer overloading and reduces shoulder peaking situations by energizing only the minimum number of elements required to achieve core charging requirements.
- Built-in auxiliary load control capability for devices such as an air conditioner, water heater, etc.
- Time clock module for peak control signaling purposes *(optional)*.
- Completely automatic, making it extremely easy to operate.

# WARRANTY

**Steffes Corporation** proudly offers product warranties. The entire heating unit is covered by a five-year limited parts warranty. All Steffes accessory and external control devices interfaced to the unit are backed by a one-year limited warranty.

# SPECIFICATIONS for standard 240V units with standard blower

*208V, 277V, and 347V configurations also available. Contact factory for technical specifications.*

**1kW = 3412 BTU/hr 1kWh = 3412 BTU** **US Pat #5086493 • Canada Pat #2059158**

| MODEL | 3120 | | | 4120 | | 4130 | | 4140 | |
|---|---|---|---|---|---|---|---|---|---|
| Charging Input | 14.0 kW | 17.5 kW | 21.6 kW | 19.2 kW | 24.8 kW | 28.8 kW | 37.2 kW | 38.4 kW | 45.6 kW |
| Element Current Draw | 59 amps | 73 amps | 90 amps | 80 amps | 104 amps | 120 amps | 155 amps | 160 amps | 190 amps |
| Circuits Required | | | | | | | | | |
| Elements | 2-40 amps | 2-50 amps | 2-60 amps | 3-40 amps | 3-50 amps | 4-40 amps | 4-50 amps | 4-50 amps | 4-60 amps |
| Blowers/Control | 1-15 amp *(6 amps maximum load)* | | | 1-15 amp *(7 amps maximum load)* | | | | | |
| | Unit is factory-configured with multiple-line voltage, single-phase circuit connections. If single feed to the element and blowers/controls circuits is desired, an optional single-feed kit is available. Phase-balancing is recommended when making connections in 3-phase applications. | | | | | | | | |
| Storage Capacity | 86 kWh (293,432 BTU) | | | 125 kWh (426,500 BTU) | | 180 kWh (614,160 BTU) | | 240 kWh (818,880 BTU) | |
| | The size and heating ability of the system required for an application is dependent on the heat loss of the area and the power company's off-peak hours. Refer to the Maximum Maintainable Heat Loss for heating abilities in specific charge strategies. | | | | | | | | |
| Approximate Installed Weight | 1,562 lbs | | | 2,183 lbs | | 3,031 lbs | | 3,859 lbs | |
| | Contact a building contractor or architect if you have structural weight concerns of the installation surface selected. Adhere to all national and local electrical and building code placement requirements for electric heating appliances. | | | | | | | | |
| Unit Dimensions - W x D x H | | | | | | | | | |
| w/o Ducting | 41.6" x 27" x 60" | | | 29.2" x 44.7" x 46.6" | | 29.2" x 44.7" x 57.6" | | 29.2" x 44.7" x 68.6" | |
| w/ Factory-Built Ducting (1/3 HP or 1/2 HP) | 63" x 27" x 60" | | | 72.8" x 44.7" x 46.6" | | 72.8" x 44.7" x 57.6" | | 72.8" x 44.7" x 68.6" | |
| w/ Factory-Built Ducting (3/4 HP) | N/A | | | 77.3" x 44.7" x 46.6" | | 77.3" x 44.7" x 57.6" | | 77.3" x 44.7" x 68.6" | |
| | There are required installation clearances to account for. Contact the factory for this information. | | | | | | | | |
| Duct Openings | | | | | | | | | |
| Supply Air Outlet (1/3 HP or 1/2 HP) | 10.1" x 16" | | | 18" x 22.6" (in factory-built plenum) | | | | | |
| Supply Air Outlet (3/4 HP) | N/A | | | 22.5" x 22.6" (in factory-built plenum) | | | | | |
| Return Air Inlet | 21.4" x 21.4" (in factory-built plenum) | | | 10.5" x 22.3" (in unit) or 21.4" x 21.4" (if using a factory-built plenum) | | | | | |
| Maximum Coil Dimensions (W x D x H) | 21" x 21" x 24.25" | | | | | | | | |
| | The factory-built return air plenum is configured for housing an indoor coil. Dimensions listed are that of the inner coil area in this plenum. For larger coils, field provisions to the plenum are necessary or it will need to be supplied by the installer. | | | | | | | | |
| Supply Air Delivery (1/2 HP, PSC Motor) | LOW | | | LOW/MED | | MED/HIGH | | HIGH | |
| CFM @ .25 Static Pressure | 1205 | | | 1580 | | 1780 | | 1850 | |
| CFM @ .50 Static Pressure | N/A | | | 1420 | | 1470 | | 1560 | |
| | For applications requiring higher or lower air volumes, other blower options available. For specifications on the variable speed ECM blower option, contact the factory. | | | | | | | | |
| Heating Ability Based on Charge Time (BTU/hr) | | | | | | | | | |
| 8 Consecutive Charge Hours | 20,414 | 23,512 | 23,512 | 27,996 | 34,175 | 41,994 | 49,212 | 55,992 | 65,615 |
| 12 Consecutive Charge Hours | 30,621 | 31,350 | 31,350 | 41,994 | 45,566 | 62,991 | 65,615 | 83,988 | 87,487 |
| 6/4/6/8 Charge Strategy | 30,621 | 38,276 | 47,097 | 41,994 | 54,242 | 62,991 | 81,363 | 83,988 | 99,735 |
| | The size and heating ability of the system required for an application is dependent on the heat loss of the area and the power company's off-peak hours. If the unit is not installed within the heated area, heat lost statically must be taken into account. Contact your local power company, a contractor, or Steffes Corporation for assistance in selecting an appropriately sized system for your specific charge strategy. The 6/4/6/8 strategy listed is 8 hours off-peak at night plus 4 hours off-peak mid-day. (The Heating Ability figures listed have a heat use allowance factored in for sizing purposes. Average BTU delivery rate is the listed value multiplied by .78 heat use factor.) | | | | | | | | |

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# COMFORT PLUS HYDRONIC SYSTEM

*The Premier Off-Peak Hydronic Heating System for Radiant and Forced Air Heating*

- Low Cost Electric Heat (100% Efficient)
- Comfortable, Clean, Quiet, Even Heat
- Hydronic Heating with Electric Thermal Storage (ETS)
- Safe and Reliable
- Easy to Operate
- Five-Year Limited Manufacturer's Warranty

The Comfort Plus Hydronic system adds a new dimension to heating by blending hydronic heating with Electric Thermal Storage (ETS) Technology. During off-peak hours, when electricity costs and energy usage generally are substantially lower, the Comfort Plus Hydronic unit converts electricity into heat and stores that heat in specially designed high-density ceramic bricks located inside the unit. Through the use of a heat exchanger, this stored heat is transferred as needed from the storage media to a water or glycol solution, which is circulated to areas where the heat is needed. The Comfort Plus Hydronic system has the ability to utilize off-peak, time of day (or time of use), demand-based or other preferential electric rates to generate considerable savings for the consumer, while delivering the many benefits associated with hydronic heating.

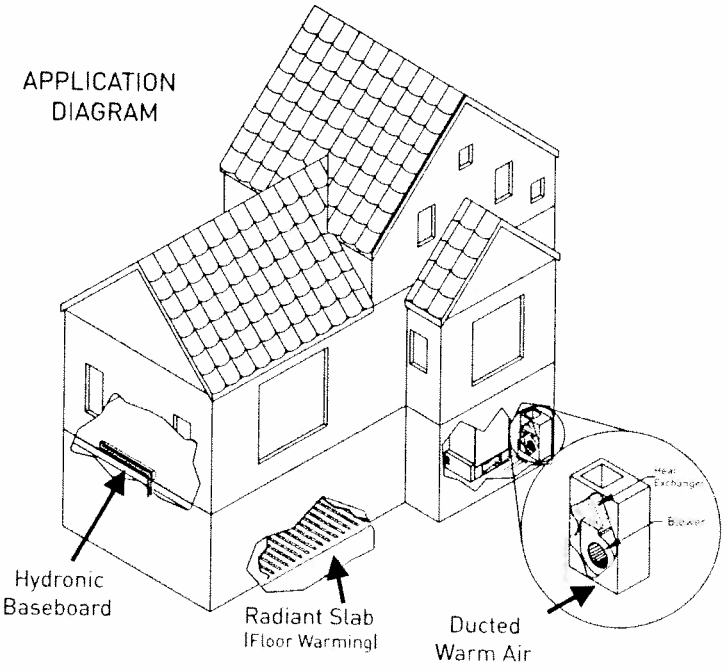
The system is extremely flexible and can handle multiple heating zones. Heat can be delivered via a radiant floor system, baseboard radiation, free standing radiators, a forced air system or almost any combination of zoned delivery systems. The Comfort Plus Hydronic System can also be used as a supplement to a single or multiple heat pump system installation. The built-in microprocessor provides the ability to easily adjust output water temperature, thereby reducing or eliminating the need for costly add-on controls.

The Comfort Plus Hydronic system is easy to operate. Just set the room thermostat to the desired comfort level and enjoy the safe, clean, reliable and economical heat this off-peak hydronic system provides.

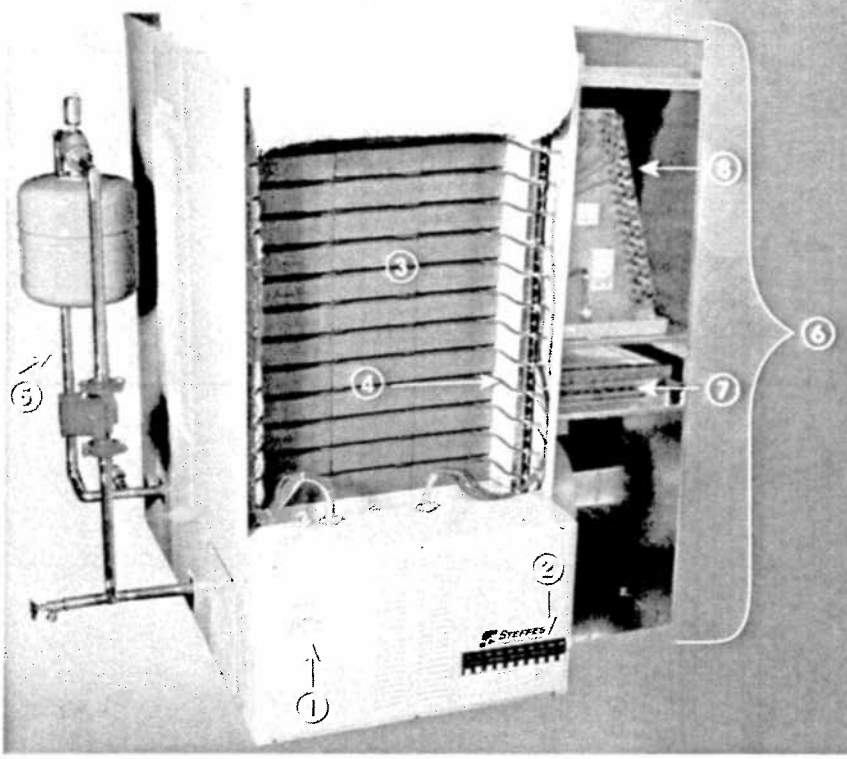
## Ideal for residential or commercial applications to include:

- **Radiant Floor Systems**
- **Hydronic Baseboards**
- **Free Standing Radiators**
- **Supplemental Heat for a Heat Pump**
- **Make-up Air Tempering and Demand Management**

APPLICATION DIAGRAM




With the optional air handler, you can enjoy forced air heating and/or cooling in addition to radiant hydronic heating.




# FEATURES

1. Programmable microprocessor-based control system allows for customization to user's and power company's immediate and future needs
2. Built-in circuit breakers/power disconnects
3. High density heat storage bricks
4. Electric heating elements
5. Primary water loop and accessories - Required (separately ordered or installer supplied)
6. Optional 1/2 HP or 3/4 HP air handler system for ducted heating and/or cooling (can accommodate most AC or heat pump coils up to 5-ton capacity)
7. Hydronic coil (provided with air handler)
8. AC or heat pump coil (installer supplied)

## ADDITIONAL FEATURES

- Water zone temperature can easily be set and adjusted by the installer or it can automatically adjust based on weather conditions
- Built-in controls allow for interfacing with heat pumps or air conditioners
- Digital display provides operation information
- Automatic core charging
- Optional time clock module available

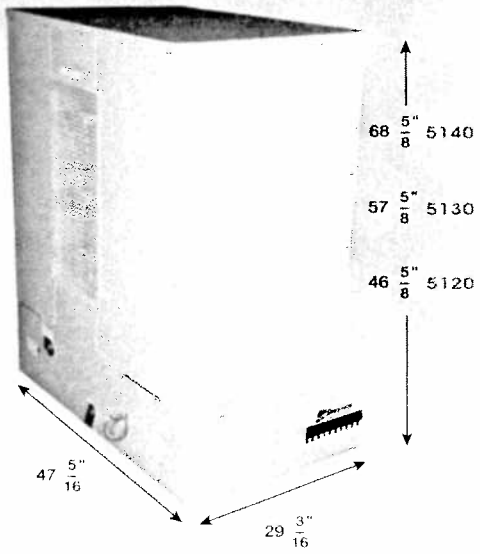
# SPECIFICATIONS *for standard 240V units*

*208V, 277V, and 347V configurations also available. Contact factory for technical specifications.*

***1kW = 3412 BTU/hr  1kWh = 3412 BTU***

| MODEL | 5120 | | 5130 | | 5140 | |
|---|---|---|---|---|---|---|
| Charging Input | 19.2 kW | 24.8 kW | 28.8 kW | 37.2 kW | 38.4 kW | 45.6 kW |
| Element Current Draw | 80 amps | 104 amps | 120 amps | 155 amps | 160 amps | 190 amps |
| Element Circuits Required (See Note 1) | (3) 40 amp | (3) 50 amp | (4) 40 amp | (4) 50 amp | (4) 50 amp | (4) 60 amp |
| Pump and Blowers/Controls Circuit Required (See Note 2) | 1 - 15 amp (10 amps maximum load) | | | | | |
| Storage Capacity (See Note 2) | 125 kWh (426,500 BTU) | | 180 kWh (614,160 BTU) | | 240 kWh (818,880 BTU) | |
| Approximate Installed Weight (See Note 3) | 2,218 lbs. | | 3,046 lbs. | | 3,894 lbs. | |
| Pipe Size – Water Inlet/Water Outlet | 1" | | | | | |
| Output Water Temperature Selection Range | 50°F to 185°F | | | | | |
| Maximum Working Pressure | 20 PSIG | | | | | |
| Minimum Flow Rate (primary loop) | 1 GPM per 10,000 BTU of required output at 20°F temperature rise (10 GPM maximum) | | | | | |
| Internal Pressure Drop (assuming 50% glycol mix) | .1 ft @ 2 GPM<br>.2 ft @ 4 GPM | | .4 ft @ 6 GPM<br>.7 ft @ 8 GPM | | 1.1 ft @ 10 GPM | |
| Heating Ability Based on Charge Time (See Note 2) | | | | | | |
| 8 Consecutive Charge Hours (BTU/hr) | 27,996 | 34,175 | 41,994 | 49,212 | 55,992 | 65,615 |
| 12 Consecutive Charge Hours (BTU/hr) | 41,994 | 45,566 | 62,991 | 65,615 | 83,988 | 87,487 |
| 6/4/6/8 Charge Strategy (BTU/hr) | 41,994 | 54,242 | 62,991 | 81,363 | 83,988 | 99,738 |

## UNIT DIMENSIONS




NOTE: There are required installation clearances. Contact the factory for this information.

Note 1 Unit is factory configured to be connected to multiple line voltage circuits. If single feed to the element and blowers/controls circuits is desired, an optional single feed kit is available. Phase balancing is recommended when making connections in 3-phase applications.

Note 2 The size and heating ability of the system required for an application is dependent on the heat loss of the area and the power company's off-peak hours. If the unit and piping are not installed within the heated area, heat lost statically must be taken into account. Contact your local power company, a contractor, or Steffes Corporation for assistance in selecting an appropriately sized system for your specific charge strategy. The 6/4/6/8 strategy listed is 8 hours off-peak at night plus 4 hours off-peak mid-day. (The Heating Ability figures listed have a heat use allowance factored in for sizing purposes. Average BTU delivery rate is the listed value multiplied by .78 heat use factor.)

Note 3 Contact a building contractor or architect if you have structural weight concerns of the installation surface selected. Adhere to all national and local electrical and building code placement requirements for electric heating appliances.

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## *Heating Cost Summary & Comparison*

# Example - Wisconsin Homeowner

## End User Cost of Operation Comparison

**Heatloss of home** 50,000 btu/h DL
**Outside Design Temp.** -25

**Heatpump** 3 Ton, 13 SEER, 8.3 HSPF maintaining a minimum of 90-degree duct temperature
**Heat Pump is allowed to operate during On-Peak Hours**

| Electric Rates: | Rate | U/M |
|---|---|---|
| Standard Electric | 0.085 | kWh |
| On-Peak | 0.085 | kWh |
| Off-Peak | 0.041 | kWh |

| Fossil Fuel costs: | Cost | U/M | Base Chg. | |
|---|---|---|---|---|
| Propane | 1.30 | Gallon | 0.00 | |
| Fuel Oil | 2.25 | Gallon | 0.00 | |
| Natural Gas | 1.05 | Therm | 5.00 | Monthly |

| Heat Pump with Comfort Plus | |
|---|---|
| HP kWh On-Peak | 454 |
| HP kWh Off-Peak | 5,653 |
| Comfort Plus (ETS) kWh | 6,718 |
| ***Total*** | ***12,825*** |
| **Annual COP** | **1.74** |

| Cost of Operation: | Efficiency or COP | Usage | U/M | Ext. Cost |
|---|---|---|---|---|
| Standard Electric | 100% | 22,330 | kWh's | **$1,898.05** |
| Off-peak Electric (ETS) | 100% | 22,330 | kWh's | $915.53 |
| Heatpump w/Std Resistance | 1.40 | 15,968 | kWh's | **$1,357.25** |
| Geothermal Heat Pump | 2.90 | 7,700 | kWh's | **$654.50** |
| Comfort Plus & Air Source Heat Pu | 1.74 | 12,825 | kWh's | $545.79 |
| Propane | 90% | 927 | Gallon's | **$1,250.36** |
| Fuel Oil | 80% | 687 | Gallon's | **$1,573.96** |
| Natural Gas | 90% | 847 | Therm's | **$1,014.99** |

## Estimated Annual Heating Cost Comparison