

*Tankless Water Heater
Technology, the Green
Solution*

Presented For:

Connecticut Design & Building Conference

By:

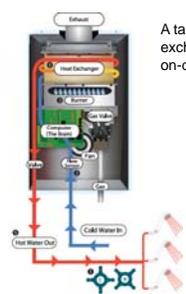
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Roger Stoltling from EDOS Manufacturers' Reps

March 15, 2011

Presentation Overview

- The following information is of a general nature and there are exceptions, added requirements and variations with different manufacturers and their varying models.
- When considering any product to be used one should always refer to the manufacturers' specifications, installation and maintenance requirements.
- These products are of a higher technical nature and it is recommended that someone properly licensed and trained install, service and repair these products.
- Our industry is continuously developing and improving. Old Limitations are being overcome on a regular basis.

What is a Tankless Water Heater?



A tankless water heater uses a burner and heat exchanger to produce an endless supply of hot water on-demand.

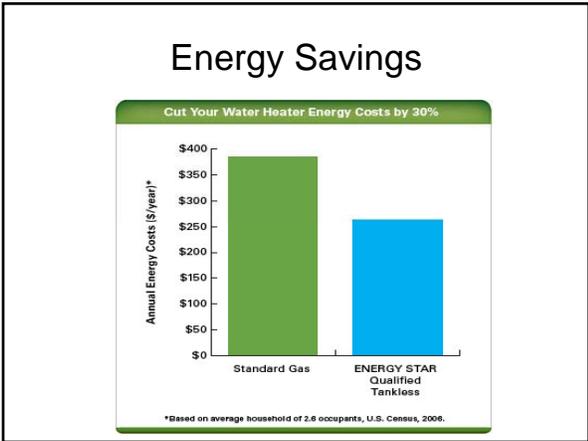
Step by Step Operation:

- 1) A hot water fixture is opened
- 2) The tankless unit detects the hot water demand
- 3) The gas burner is ignited
- 4) The unit's heat exchanger heats the water to the set temperature
- 5) Hot water exits the tankless unit

3



Benefits of Tankless Technology





The US Department of Energy estimates that 6.5% of stored capacity is lost every hour in commercial jobs to standby losses.¹

Ex.
 $250 \text{ [gallons storage]} \times 8.34 \text{ [lb H}_2\text{O/gallon]} \times 100 \text{ [F]} = 208500 \text{ [BTU heat storage]}$
 $208500 \text{ [BTU heat storage]} \times 0.065 \text{ [%/hr]} = 13552 \text{ [BTU/hr]}$

$13552 \text{ [BTU/hr]} \times 24 \text{ [hr/day]} \times 365 \text{ [days/yr]} = 118,715,520 \text{ [BTU/year]} \text{ lost}$

¹Source: US DOE website. http://www1.eere.energy.gov/buildings/commercial/water_heating.html

Tank vs. Tankless



- ✓ Limited water supply
- ✓ Low thermal efficiency (~60%)
- ✓ Water is continually re-heated
- ✓ Dirty Water
- ✓ 8-10 Year Lifespan
- ✓ Takes up large amount of space
- ✓ Heavy and difficult to install



7

Tank vs. Tankless



- ✓ Endless Hot Water
- ✓ High Thermal Efficiencies (84%-93%)
- ✓ No water stored in rusty tank
- ✓ Energy savings because water is heated On-Demand
- ✓ Longer Lifespan Backed By Superior Warranty
- ✓ Small size and weight
- ✓ Wall hung to save floor space



8

Environmentally Friendly



Tankless units are drastically smaller than storage tanks. The main components of tankless water heaters are recyclable and Typically parts are replaceable. Thereby significantly reduces the amount of waste material that ends up in landfills every year.

Space Saving

REPLACEMENT IN SAME LOCATION



PROS
Easier installation & minimal installation cost:
Using the existing lines at the current location can significantly decrease the re-piping necessary to install the tankless unit, saving you on installation costs.

CONS
Unit may not be near fixtures:
If the current location of the heater is furthest away from the frequently used hot water fixtures (i.e. Bath tub/Shower), it will still take time for the hot water to reach those fixtures.

Garage Install (Before) Garage Install (After)

Location Flexibility

RELOCATION

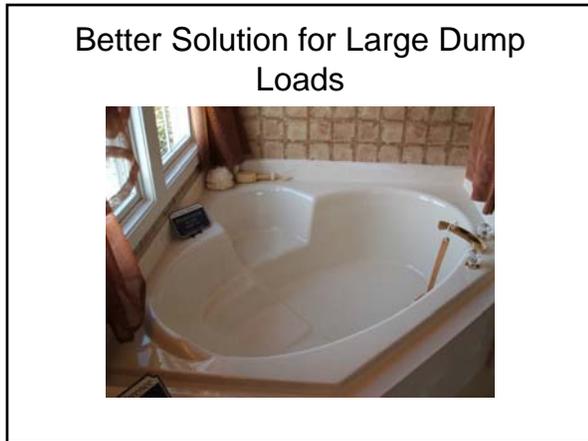


PROS
Regain valuable floor space & install unit closer to hot water fixtures:
The compact design and flexible options of a Noritz tankless water heater, allows for the unit to be installed virtually anywhere. The space once occupied by a bulky tank water heater is no more. With the flexible installation options of a Noritz unit, you can choose a location that is central to all the major hot water fixtures in your home, shortening the distance the hot water needs to travel to reach the fixture and saving valuable water.

CONS
Higher installation costs:
Since you will be relocating the unit to a new location, the costs for re-piping the gas and water lines may increase the cost of installation.

Garage Install (Before) Relocate to Attic (After)

Better Solution for Large Dump Loads



Quick Replacement if Needed



- Light weight, one person typically can replace
- Adjustable and easy to disassemble vent components
- Isolation valves & unions
- Very small water quantity in units to drain

- Large Commercial and Institutional Savings
- Multiple Unit connectability, with huge space savings
- Redundancy with multiple units
- Low cost Computerized Staging Control

Before



After



Versatility: Installation

Tankless water heaters can be installed in many different configurations.



- Indoor, inside wall
- Indoor, outside wall
- Outdoor, wall mount
- Rooftops
- Rack mount



Redundancy: An Example

- The hotel still has hot water!
- Noritz units are designed to handle partial failure cases.



Unit Staging and Load Balancing

Example:

1. Zero Demand. All Heaters Off.
2. Demand Equivalent to 50% of one heater is added.
3. Capacity equal >100% of one heater is opened
4. Second unit comes on, each unit splits the demand.
5. More demand is added, 2 units attempt to satisfy.
6. Demand grows too large, third unit fires, units split demand.

Noritz Unit Rotation

Example:

1. One unit is designated as the primary unit. Water is shut off to all other units by default.
2. After 8 hours of burn time, the units rotate. The previous 2nd unit becomes the main unit.
3. After 8 more hours of burn time, the units will rotate again.
4. Cycle will continue for each unit in the system.

Special Considerations

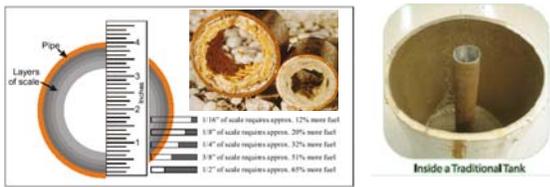
Tankless Gas Heaters

- Minimum water flow requirements typically
- Most will not work with out electric power
- Requires larger gas supply
- Sized by flow rate
- Cold Water Sandwich possibilities

- Requires more technical expertise
- May have an initial higher cost investment
- Special venting requirements
- Water quality considerations
- Routine maintenance required

More things to consider...

- Affects unit performance
- Can damage unit, water lines, and fixtures over time
- Especially important for commercial jobs
- Recommend water treatment based on hardness



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History and Industry Developments

Gas Tankless

- Gas Tankless technology has been around since the early 1900's
- Current gas tankless has been largely developed in Asia and Europe with its beginnings starting late 1940's
- Fuel & Space costs being the driving force



- Initial tankless technology was considerably bulkier, mostly floor mounted
- Technology with better controls and computers have made for direction into wall mount applications
- Tankless as we know it started to show it's presents in the USA in the early 90's
- Originally heaters were not well received, and had their problems

- Original units had issues with reliability, high minimum flow rates, unstable delivery temperatures & had limited output capabilities
- Installers were not familiar with technology & applications
- Over the last few years with major technological advances plus with contractor familiarity this has been largely overcome

- Minimum flow rates have been reduced considerably, down to .5 gpm and less
- Equipment has become very reliable
- Temperatures fluctuations have been brought to closer tolerances due to sensor quality, computer speed and additional control devices.
- Equipment also has more safety features than in the past

- We now have units with the capability to deliver 9.6 gal./min. with a 65 degree temp rise using 380,000 btus
- In our Case, up to 24 units can be combined to deliver as much as 230 gpm with a 65 degree temp rise from one controler
- Many manufacturers can interconnect 2 or more units together with a simple cable

- Concentric flue piping for manufacturers continues to expand its presents for the non condensing & condensing products
- Condensing technology also continues to grow within the industry
- We will continue to see improvements and application expansion as we move forward



Major Manufacturers

Gas Tankless Heaters

- Bosch
- Eternal
- Navien
- Noritz
- Quietside
- Rheem/ Ruud/ Poloma
- Rinnai/ GE
- Takagi/ A.O.Smith/ State
- Others



How They Work

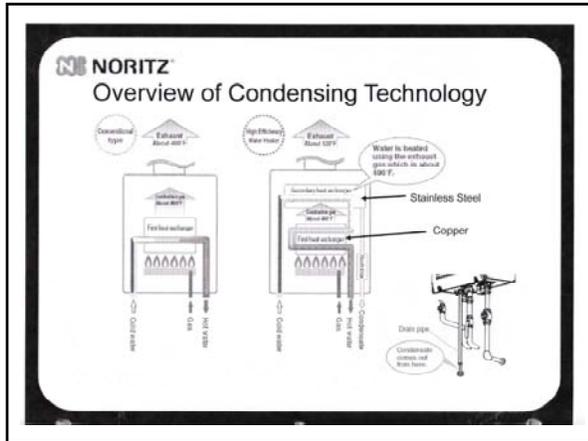
Tankless Gas

- Flow sensor sends info back to computer along with temp sensor info from inlet and outlet
- Start-up is initiated, fan purges combustion chamber & proves, ignition sequence started and proved
- Most units use spark ignition, many use a series of gas solenoid valves and a modulating gas valve to deliver just the right amount of gas
- Many units also have bypass valves controlled by computer to provide more precise control of outlet temperature

- All this takes place with-in a few seconds to deliver the desired temperature at the units outlet
- A number of safeties verifying operating parameters are feed back to computer
- When water stops flowing through unit gas burner shuts down and fan purges combustion chamber

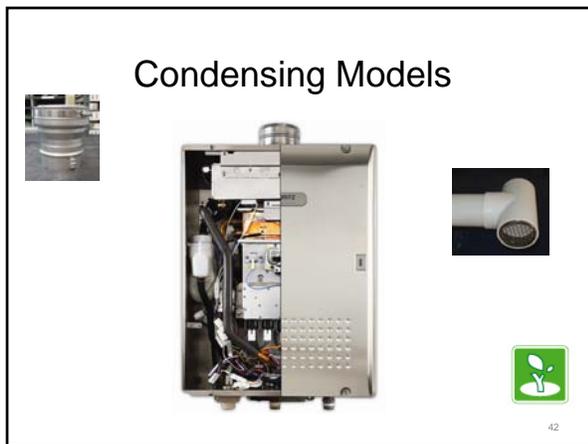
- When multiple units are interconnected they are either connected by a simple cable and the individual computers communicate or are connected to an external control module
- When this is done the units stage on relative to flow and temperature requirements
- Some systems have built in control features to work with re-circ systems

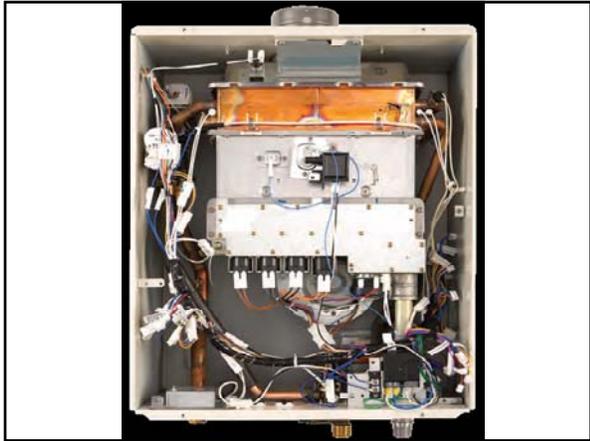
- Many units have built in freeze protection
- Temperature control varies by manufacturer and models
- Condensing units typically have secondary heat exchanger which can handle condensate run back from flue piping
- UPS battery back-up systems can often be used as power source during limited power outages
- Most manufacturers offer remote temperature control





Noritz Heli-coil Stainless Steel Condensing Heat Exchanger





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Applications

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What factors into product selection?

- ASME – yes or no?
- Residential vs. Commercial Units
- Which model heater?
- Installation environment
- Building layout
- Sizing

Boiler or water heater?

- The technology behind a boiler and a water heaters is very similar. The only real distinction is not in the generation of heat, but the purpose for which the heat is used.
- With the way the code is written, the differentiation between the two is very ambiguous.
- As a result, the difference is left up to interpretation. Due to the issue of public safety, many states have adopted the policy of treating water heaters as boilers.
- For boilers/water heaters, the ASME certification is generally marked by one of two insignias. The "H" stamp is for boilers to be used with non-potable water, while the "HLW" stamp is for boilers that can be used with potable water.



Which is which? One is the Noritz NH150-DV, the other a Noritz NC250-DV-ASME. The two units look almost identical!

- Residential
- Commercial
- Institutional
- Industrial
- Domestic Hot Water
- Hydronic Heating
- Snow Melt
- Process Applications

Sizing Requirements

Sizing

- The sizing of the application also plays a role in product selection.
- Sizing is one of the most important aspect of utilizing water heating systems.



Introducing the “FAST” Four Factors

ixture count

pplication type

pecial usage fixtures

emperature rise

50

ixture count
What fixtures
require hot
water?

*An accurate count on
the type and quantity of
fixtures is required for
accurate sizing.*



51

Application type

What type of application is it?

Different job types will have drastically different hot water usage requirements and load profiles.



52

Application Type Explained

- Sizing is based on peak demand
- Peak demand is determined by simultaneous fixture use
- Each type of job has different water usage requirements



53

Examining Simultaneous Peak Usage

- Hunter curve developed a diversity model
- Diversity model to estimate probability that any given number of fixtures run simultaneously
- Noritz water heating systems are sized based on these principles as well



54

pecial usage fixtures

What are the special usage fixtures on a job site?

Special usage fixtures are fixtures with either abnormal or metered flow requirements.



Special Usage Fixtures Explained

Why does it matter?

- *Fixtures may not function properly without the correct amount of water.*
- *Can cause damage to the fixtures.*
- *Can cause pressure/temperature issues.*

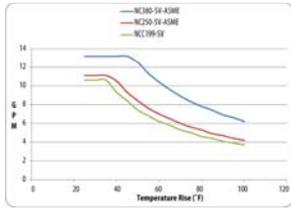
56

Temperature rise explained

- Heater set point temperature is the HIGHEST required.
- Ground water temperature should be based on the COLDEST time of the year.
- Temperature rise is the difference between the two.

57

Temperature Rise vs. Flow Rate



Temp Rise (°F)	NC380 Series	NC250 Series	NC199 Series	NC199 Series
30	13.2	11.1	11.1	9.8
35	13.2	11.1	10.6	9.2
40	13.2	10.5	9.3	8.4
45	13.2	9.3	8.4	7.5
50	12.5	8.4	7.4	6.7
55	11.8	7.6	6.8	6.1
60	10.4	7.8	6.2	5.6
65	9.6	6.5	5.8	5.2
70	8.9	6.0	5.3	4.8
75	8.3	5.6	5.0	4.5
80	7.8	5.3	4.6	4.2
85	7.9	4.9	4.4	4.0
90	6.9	4.7	4.1	3.7
95	5.6	4.4	3.9	3.5
100	6.2	4.2	3.7	3.4

58

Site Evaluation

- Customers budget
- Customer's expectations
- Hot Water requirements
- Fuel Supply or power supply
- Determine water quality

- Determine unit location
- Resolve heater(s) ventilation and combustion air requirements
- Requirements for equipment that old heater may have been vented with
- Review other pertinent information as required by heater manufacturer and/or code

Sealed Combustion Applications (DV or DVC)



- Hairspray
- Lint
- Grease
- Bad or Insufficient Combustion Air



Installations

- Permit Process
- Follow Manufacturers installation guidelines
- Plan heater vent installation
- Prepare and install heater
- Properly install water piping, isolation valves, relief valve, etc.
- Provide appropriate grounded power supply

- Properly install exhaust and combustion vent piping as required**
- Avoid condensate run back to heat exchanger(s) not designed to take it
 - Use proper vent piping materials
 - Maintain proper clearance to combustibles
 - Don't over extend maximum run lengths published by manufacturer
 - Install terminations in proper locations with adequate clearances as per installation instructions and code requirements



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Venting Materials

Non-Condensing High Temp Category 3 Exhaust Venting

- Unless specified otherwise by manufacturer exhaust piping should be Stainless Steel AL29-4C vent piping with associated fittings and terminations.
- Concentric vent piping should be also AL29-4C unless special piping is listed and approved by equipment manufacturer
- B-Vent, galvanized piping, ABS, PVC is not an approved product





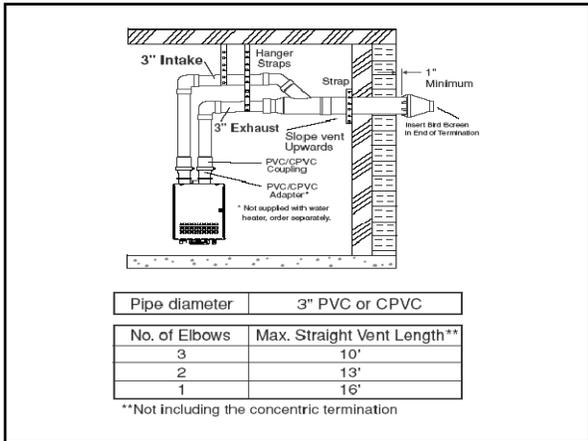
Condensing Low Temp Category 4 Exhaust Venting

- Solid core PVC is usually permitted
- Schedule 80 CPVC is sometimes called out for portion of piping
- Some manufacturers require specific terminations only provided by them and rodent/bird screens only provided manufacturer

NORITZ N-0841MC ONLY
PVC Installation- Adapter and Bird Screen

- Push screen in termination as far as it will go
- Tabs secure screen in termination
- Adapter "snaps" onto heater
- Insert PVC coupling or "smooth" side of elbow fully into adapter and secure with band clamp

Pipe Material	PVC or CPVC	
	Max. Straight Vent Length	
No. of Elbows	4" Pipe	3" Pipe
3	15'	7'
2	27'	10'
1	39'	13'



- Some require PVC cements and primers to be of the same manufacturer
- Vent piping hanger spacing often at maximum 3' intervals not your typical 4' as in drainage piping

Gas Piping

Gas Line Sizing

Maximum Natural Gas Delivery Capacity in Cubic Feet per Hour (0.66 Specific Gravity, 0.5" WC Pressure Drop)

Pipe Size	Length in Feet									
	50'	100'	150'	200'	250'	300'	350'	400'	450'	500'
1/2"	172	170	168	167	166	165	164	163	162	161
3/4"	343	340	337	334	331	328	325	322	319	316
1"	686	680	673	666	659	652	645	638	631	624
1 1/4"	1408	1393	1378	1363	1348	1333	1318	1303	1288	1273
1 1/2"	2112	2092	2072	2052	2032	2012	1992	1972	1952	1932
2"	4224	4184	4144	4104	4064	4024	3984	3944	3904	3864
2 1/2"	6336	6272	6208	6144	6080	6016	5952	5888	5824	5760
3"	8448	8368	8288	8208	8128	8048	7968	7888	7808	7728
3 1/2"	10560	10464	10368	10272	10176	10080	9984	9888	9792	9696
4"	12672	12568	12464	12360	12256	12152	12048	11944	11840	11736

Maximum Natural Gas Delivery Capacity (cfh) for Gas Line Connectors (0.66 Specific Gravity, 0.5" WC Pressure Drop)

Pipe Size	Length in inches				
	36"	48"	60"	72"	84"
1/2"	18	18	18	18	18
3/4"	36	36	36	36	36
1"	72	72	72	72	72
1 1/4"	144	144	144	144	144
1 1/2"	216	216	216	216	216
2"	432	432	432	432	432
2 1/2"	648	648	648	648	648
3"	864	864	864	864	864
3 1/2"	1080	1080	1080	1080	1080
4"	1296	1296	1296	1296	1296

- 3/4" Minimum Inner Diameter
- Consider Gas Draw From Other Appliances
- Distance From Meter Determines Line Size
- Pay Special Attention to Flex Connectors
- Always Size for Maximum btu

79

1. Check gas pressure. NGA 5-10.5 "H₂O measure during high fire LPG 10-14 "H₂O
2. Check gas type
3. Check gas line size
4. Check gas meter or regulator
5. Check for full port gas valves
6. Check type of gas line (hard pipe, CSST, flex lines)

80

CHECKING GAS PRESSURE

- Check static and dynamic gas pressure
- Gas draw from other appliances (e.g. furnaces)
- 11/12/59/90 Error Codes



81



Maintenance

- ## Yearly Maintenance
- ✓ Water Filter
 - ✓ Front cover for dust or debris
 - ✓ Abnormal sounds during combustion
 - ✓ Fan for dust or debris
 - ✓ Pressure relief valve for proper operation
 - ✓ Water leaks from piping
 - ✓ Dust and soot in exhaust vent/terminal
 - ✓ Venting for damage/leaks
 - ✓ Blow unit out with compressed air
 - ✓ Do a descale
- 83

- ## Parts Maintenance or Replacement
- Remove flame rod
 - Clean with Scotch-Brite Pad or replace if damaged
 - Replace if corroded or damaged
 - Remove flow sensor
 - Clean out debris
 - Replace if damaged
 - Remove water filter
 - Clean with brush and water
 - Replace if damaged
- 84



Future of Tankless

- More Concentric options
- Further improvements on temperature stabilization
- More units with higher flow rates
- More condensing technology
- More termination flexibility
- Common venting

Scale Prevention

New Development In Scale Prevention

Scale Prevention for Tankless Technology



COMMERCIAL H2FLOW

Water Softening Alternative

The No Salt, Non Chemical, Non Backwashing, Zero-Discharge alternative to softening and chemical feed systems for scale control



H2FLOW – A DEFINITION

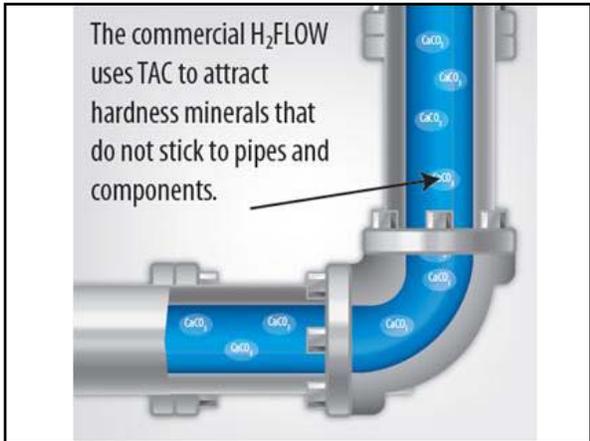
TAC Technology

A recent scientific development, Template Assisted Crystallization (TAC) offers the first effective *and* consistent chemical-free scale prevention method.

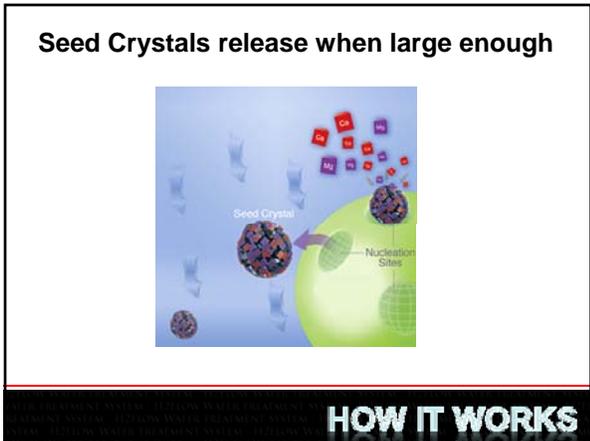
H2Flow technology converts hardness minerals into harmless, inactive microscopic crystals.



TECHNOLOGY BREAKTHROUGH



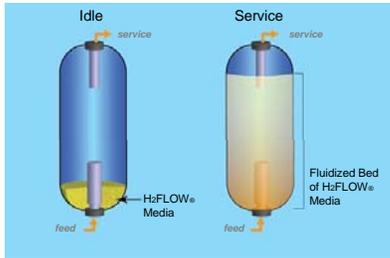




Huge Advantages

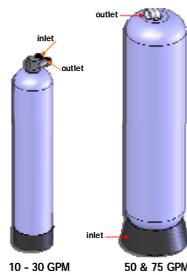
- Eliminates scale prevention chemicals
- Other chemical costs can be reduced
- Reduced space requirements
- Reduced maintenance and downtime
- Increased design/operating efficiencies
- Longer life expectancy for capital equipment
- Easy to install and virtually no maintenance
- Economical, simple and permanent solution to hard water scale problems

COMMERCIAL ADVANTAGES



SYSTEM CUTAWAY

Model	Service Flow
CH2F-10	10 GPM
CH2F-12	12 GPM
CH2F-16	16 GPM
CH2F-20	20 GPM
CH2F-30	30 GPM
CH2F-50	50 GPM
CH2F-75	75 GPM



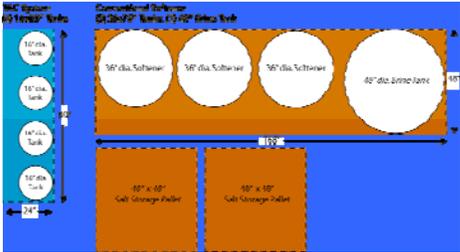
H2FLOW® TANK-STYLE POE SYSTEMS

Model	Service Flow
2 x CH2F-50	100 GPM
2 x CH2F-75	150 GPM
3 x CH2F-75	225 GPM
5 x CH2F-50	250 GPM
4 x CH2F-75	300 GPM
5 x CH2F-75	375 GPM
6 x CH2F-75	450 GPM



H₂FLOW® HIGH FLOW POE SYSTEMS

Space Requirements



H₂FLOW® VS. CONVENTIONAL SOFTENING

Water Treatment Applications

- Piping Systems
- Mixing Valves
- Boilers
- Tankless Water Heaters
- Solar Heating Systems
- Steam Generating Equipment
- Distiller Heating Chambers
- Irrigation System Spray Heads
- Humidifiers / Evaporators
- Misting Systems

COMMERCIAL, HOSPITALITY AND AGRICULTURAL POE

NORITZ **H₂FLOW**



- Economical
- No salt or chemicals
- No energy usage
- No discharge
- Virtually no maintenance
- Compact
- Green Building Friendly
- LEED credits

THE GREEN SOLUTION

NORITZ **H₂FLOW**

Maintenance

On the residential H2Flow, the media cartridge recommended change out is 2 years. As for the commercial H2Flow, the replacement media recommended change out is 3 years.

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Questions & Answers
