APPENDIX D
FLORIDA STANDARDS

FLORIDA STANDARD NO. 1 (FL-1)
FLORIDA REGULATORY MODIFICATIONS TO AIR-CONDITIONING & REFRIGERATION INSTITUTE (ARI) STANDARD 470-80
Effective April 1, 1986

The following regulatory modifications made to the Air-Conditioning and Refrigeration Institute (ARI) Standard 470-80 shall constitute Florida Standard FL-1 and shall be accounted for in results testing performed on heat recovery units for which credit is claimed under Section 405 Chapter 13-6 of the *Florida Energy Code*, *Energy Conservationfor Building Construction*. All other criteria and conditions of ARI Standard 470-80 remain in effect. Testing to the Florida regulatory modifications shall not constitute testing to ARI Standard 470-80. ARI Standard 470-80 is hereby incorporated by reference.

SECTION 1
PURPOSE

1.1.1 This standard is suggested as a guide for to be used by the industry, including manufacturers, distributors, contractors, consulting engineers, and users of desuperheater/water heaters.

SECTION 2
SCOPE

2.1 Scope. This standard applies to desuperheater/water heaters supplied as separate components, as defined in Section 3.1 for residential potable water heating.
2.2 Exclusion. This standard does not apply to desupereater/water heaters supplied as components of factory assembled refrigeration or air conditioning units.

SECTION 3
DEFINITIONS

3.1 Desuperheater/water heater. A factory-made assembly of elements by which the flows of refrigerant vapor and water are maintained in such heat transfer relationship that the refrigerant vapor is desuper-heated and the water is heated. A water circulating pump may be included as part of the assembly.
3.2 Total useful heat exchange effect.
3.3 Total Heat Exchange Effect. The total heat removed from the refrigerant in the heat exchanger. This is the sum of the useful heat exchange effect and the heat loss through the external surfaces of the heat exchanger to the ambient air. Total system hot gas superheat. The total heat removal required to completely desuperheat the refrigerant discharge vapor. This value is the product of the mass flow of refrigerant and the difference in enthalpy between the refrigerant vapor entering the desuperheater and the vapor at saturation leaving the desuperheater.

SECTION 4

STANDARD EQUIPMENT AND ACCESSORIES

4.1 The following items shall be required as standard equipment:

6. Installation manual, including owners' operating and maintenance instructions.

SECTION 5
TESTING AND RATING REQUIREMENTS

5.1.1 Published ratings shall state all the pertinent operating conditions and shall include the following:

d. Total useful heat exchanger effect, Btuh(W)

i. Fouling factor (water side)

Net useful heat exchange effect expressed as percent of total hot gas superheat.

j. Total system hot gas superheat.

j. [j. becomes k.]

k. [k. Becomes l.]

Note 1: If a water circulating pump is included as part of the desuperheater assembly, as value of 2545 Btu/h (746 W) per rated horsepower shall be deducted from the useful heat exchange effect (d) to arrive at actual net useful heat exchange effect, Btu/h (W). If the pump motor is rated in watts (s), such value shall be used to determine Btu/h to be deducted. For systems with no water circulating pump, the net useful heat exchange effect is equal to the total useful heat exchange effect.

5.1.2 Published ratings may also include a nominal refrigerating system capacity. The nominal system capacity in tons shall be based upon a total heat transfer effect in the desuperheater/water heater of 2000 Btuh (588 W) per ton of total system capacity at the 75 F(23.9°C) entering water temperature, air cooled conditions shown in Table 1. on a refrigerant 22 mass flow rate of 180 pounds per hour (.02268 Kg/s) per ton, and shall be given for at least one of the standard rating groups shown in Table 1. It shall be identified as to air cooled or water cooled rating.

5.2 Standard ratings. Published ratings shall include the standard rating, given for at least one of the standard rating groups shown in Table 1 and properly identified as the standard rating. Standard ratings shall include an allowance for fouling of the water side surface of 0.002 sq ft · hr · F/Btu (0.0036 $m^2 \cdot °C/W$) for steel tubes or 0.001 sq ft · hr · F/Btu (0.00018$m^2 \cdot °C/W$) for non ferrous tubes. Regrigerant side fouling is assumed to be 0.0000. Standards ratings shall be cleaned ratings per 5.4.1.

5.3 Application ratings. Application ratings give performance data under operating conditions other than those shown in Table 1. At least on set of application ratings shall use the fouling factor as shown in 5.2. Application ratings shall contain all information shown in Section 5.1.1, and such ratings shall be subject to the tolerances of this standard. The publication of application ratings is optional.

5.3.1 Published application ratings may also include ratings with other fouling factors or means for determining ratings with other fouling factors. If a manufacturer elects to publish application ratings with other fouling factors, these ratings shall be determined in accordance with methods described in Section 5.4.2 and 5.4.3 below. Fouling factors shall be specified.

5.3.2 Reserved. The manufacturer shall provide published information as to the maximum recommended flow rate to minimize erosion.

SECTION 7

MARKING

7.1 Each desuperheater/water heater shall have the following minimum information shown in a conspicuous place:

e. Water pump h.p. (watts), volts, amps

SECTION 8
Voluntary CONFORMANCE

8.1 Conformance. While conformance with this standard is completely voluntary, All equipment represented as being in accordance with this standard shall conform to all of the provisions thereof.

Table 1. STANDARD RATING CONDITIONS
APPENDIX A. METHOD OF TESTING
DESUPERHEATER/WATER HEATERS

SECTION A2
SCOPE

A2.1 Scope. This appendix applies to desuperheater/water heaters supplied as a separate component. for residential potable water heating.

SECTION A3
DEFINITIONS

A3.1 Desuperheater/water heater. A factory-made assembly of elements by which the flows of refrigerant vapor and water are maintained in such a heat transfer relationship that the refrigerant vapor is desuperheated and the water is heated. A water circulating pump may be included as part of the assembly.

A3.2 Useful heat exchanger effect. The useful heat transferred shall be the product of the mass flow of water, the specific heat and the temperature difference between water entering and leaving water entering and leaving the desuperheater assembly.

A3.3 Total heat exchange effect. The total heat removed from the refrigerant in the heat exchanger. This is the sum of the useful heat exchange effect and the heat loss through the external surfaces of the heat exchanger to the ambient air.

A3.4 Total system hot gas superheat. The total heat removal required to completely desuperheat the refrigerant discharge vapor. This value is the product of the mass flow of the refrigerant and the difference in enthalpy between the refrigerant vapor entering the desuperheater and the vapor at saturation leaving the desuperheater.

SECTION A4
EXPRESSION OF TEST RESULTS

A4.1.1 Test results shall be expressed in the following terms.:

j. Refrigerant designation - R22

k. Useful heat exchange effect, percent of total system hot gas superheat, %.

l. Total system hot gas superheat, Btu/h.

SECTION A5
TEST METHODS

A5.1.1 Test shall consist of measurement of the following at specified conditions:
i. Water pump watts
j. Total system hot gas superheat, Btu/h
A5.1.2 The total useful heat transfer effect shall be determined by:
a. Multiplying the mass flow rate of water by the specific heat and temperature difference between entering and leaving water (total useful heat transfer effect) and adding to this the heat lost by the refrigerant vapor though the external surfaces of the heat exchanger (see A5.1.6).
b. Multiplying the mass flow rate of refrigerant by the enthalpy difference between entering and leaving refrigerant and adding to this the heat effect of the pump if included as part of the assembly (see NOTE 1, para. 5.1.1).
A5.1.6 Reserved. The heat lost through the external surfaces of the heat exchanger to the ambient air shall be determined by:

$$Q = \frac{A \quad t_m}{R}$$

Where:
Q = heat loss though external surfaces, Btuh (W)
A = external surface area, sq ft (m^2)
t_m = log mean temperature difference, F(°C) calculated between entering and leaving refrigerant temperature and the average ambient air temperature)
$R = \frac{x}{k} + \frac{1}{hs}$, hr ft^2 F/Btu ($m^2 \cdot °C/W$)
Where:
x = insulation thickness, ft (m)
k = thermal conductivity of insulation, Btu/hr ft F (W/m · °C)

[4378]

FLORIDA STANDARD NO. 12 (FL-12)
FLORIDA REGULATORY REQUIREMENTS FOR ENERGY EFFICIENCY FOR RESIDENTIAL INGROUND SWIMMING POOLS & SPAS

The following regulatory requirements shall constitute Florida Standard FL-12 and will provide compliance criteria for section 403.9 of the *Florida Building Code, Energy Conservation Code*. These requirements follow an Association of Pool & Spa Professional (APSP) a draft national standard for energy efficiency for residential in-ground swimming pools and spas.

SECTION 1
SCOPE

1.1. Energy efficiency requirement for permanently installed residential aboveground/onground and inground swimming pool filtration and permanently installed swimming pool and spa heating systems used for bathing and are operated by an owner. This standard is intended to cover certain aspects of the swimming pool filtration and heating system design, equipment, installation, and operation for the purpose of consuming less energy while maintaining water quality and temperature.

1.2. This standard does not cover swimming pool safety requirements, including, but not limited to, suction entrapment, structural, thermal, or electrical hazards.

1.3. This standard does not cover Portable Electric Spas, which are covered by FL-2, APSP-14 Standard for Portable Electric Spa Energy Efficiency.

1.4 This standard provides specifications for energy efficient filtration systems, but does not specify sanitizer, daily turnover flow rates, or pool-cleaning technologies needed to establish and maintain swimming pool water quality.

1.5 1.2. This standard provides specifications for energy efficient, permanently installed residential aboveground/onground and inground swimming pool and spa heating systems.

1.6 1.5. Other standards are referenced in this standard for items not covered.

SECTION 2

NORMATIVE REFERENCES

AHRI 1160, *Standard For Performance Rating of Heat Pump Pool Heaters*
APSP-4, *Standard For Aboveground/Onground Residential Swimming Pools.* ***[1]***
APSP-5, *Standard For Residential Inground Swimming Pools.*[1]
APSP-7, *Standard for Suction Entrapment Avoidance in Swimming Pools, Wading Pools, Spas, Hot Tubs, and Catch Basins.*[1]
HI 1.6, *Centrifugal Pump Test.* ***[2]***
IEEE 114-2001, *Standard Test Procedure for Single-Phase Induction Motors.* ***[3]***
NFPA 70, *National electrical code, Article 680, Swimming pools, fountains, and similar installations.*[4]
NSF 50, *Equipment for Swimming Pools, Spas, Hot Tubs and Other Recreational Water Facilities.*[5]

SECTION 3

DEFINITIONS

Auxiliary Pool Loads. Features, functions, or devices that need higher head and flow rates than that required for pool filtration, including, but not limited to, solar pool heating systems, filter backwashing, pool cleaners, waterfalls, fountains, and spas.

Backwash Valve. A diverter valve designed to reverse the flow of water through a filter. The valve is located between the circulation pump and the filter, including, but not limited to, slide, push-pull, multi-port, and full-flow valves.

Brake Horsepower. A term historically used in the pool, spa, and whirlpool bath industries, a term which conflicts with Total Horsepower and Service Factor Horsepower, and if used would not conform to this standard.

Capacity of the Motor. The Total Horsepower, or product of the rated horsepower and the service factor of a motor used on a pool pump (also known as SFHP) based on the maximum continuous duty motor power output rating allowable for nameplate ambient rating and motor insulation class.

Elbow (fittings). Also called ell, el. a plumbing pipe or pipe connection having a right-angled bend.
Energy Factor. The measure of overall pool filter pump efficiency in units of gallons per watt-hour, as determined using the applicable test method in Section 4.1.2. Energy Factor is analogous to other energy factors such as Miles Per Gallon. Energy Factor (EF) is calculated as:

EF (gal/Wh) = Flow (gpm) x 60 / Power (watts)

Filtration Flow Rate**.** A flow rate that will turn over the pool water volume in six hours or more (must be equal to or less than the maximum filtration flow rate).

Flow Rate. Flow rate is the volume of water flowing through the filtration system in a given time, usually measured in gallons per minute (gpm).

Full-Rated. A term used to describe pool pump motors with a Service Factor greater than 1.25 (typically). The term is generally used for marketing purposes and is not used within the scope this standard.

Head. The water pressure necessary to move fluid through pipes and inlets, push water through filters, ~~and~~ heaters, and other equipment and project it through fountains and jets.

Maximum Filtration Flow Rate. The flow rate needed to turn over the pool water volume in six hours or 36 gpm, whichever is greater.

Maximum Flow Rate. The flow rate for the auxiliary pool loads or the filtration flow rate, whichever is greater.

Max-Rated. A term used to describe pool pump motors with a Service Factor between 1.0 and 1.25 (typically). The term is generally used for marketing purposes and is not within the scope this standard.

Multi-Speed. A pump motor capable of operating at two (2) or more speeds and includes two-speed, three-speed and variable-speed ~~pumps~~.

Nameplate Horsepower. The ~~nameplate power is the~~ motor horsepower listed on the pump ~~nameplate~~ and the horsepower by which a pump is typically sold (also known as rated horsepower).

NSF/ANSI 50 is the NSF International ~~(formerly National Sanitation Foundation)~~ Standard and American National Standards Institute document entitled "Circulation System Components and Related Materials for Swimming Pools, Spas/Hot Tubs"

Peak Horsepower. A term historically used in the pool, spa, and whirlpool bath industries, a term which conflicts with Total Horsepower and Service Factor Horsepower, and if used would not conform to this standard.

Permanently Installed Swimming Pool. A pool constructed in such a manner that it cannot be disassembled for storage.

Pipe and Pipe Fittings. The PVC pipe and fittings intended for use in the transport of swimming pool filtration water. Fittings include elbows, tees, and flow control valves. Pipe and fittings do not include backwash valves, which are addressed separately, and equipment connections, or internal equipment piping.

Pool Pump Motor Capacity. See Total Horsepower.

Pumps. Pool and spa pumps usually come with a leaf strainer before the impeller. The pumps contain an impeller to accelerate the water through the housing. The motors for residential pumps are included in the pump purchase but can be replaced separately. The pumps increase the "head" and "flow" of the water.

Rated Horsepower. The motor power output designed by the manufacturer for a rated RPM, voltage and frequency. May be less than Total Horsepower where the Service Factor is > 1.0, or equal to Total Horsepower where the Service Factor = 1.0

Residential Swimming Pools. Permanently installed residential inground and aboveground/onground swimming pools intended for use by a single-family home for noncommercial purposes and with dimensions as defined in ANSI/NSPI-5, Standard for Residential Inground Swimming Pools and ANSI/APSP-4 Standard for Aboveground/Onground Residential Swimming Pools.

Return. The return refers to the water in the filtration system returning to the pool. The return lines or return side, relative to the pump, can also be defined as the pressure lines or the pressure side of the pump. Water in the returns is delivered back to the pool at the pool inlets.

Service Factor. A multiplier applied to rated horsepower of a motor to indicate the percent above nameplate horsepower at which a pump motor may operate continuously without exceeding its allowable insulation class temperature limit, provided the other design parameters such a rated voltage, frequency and ambient temperature are within limits. ~~Full-rated pool motor service factors can be as high as 1.65~~. A 1.5 hp pump with a 1.65 service factor produces 2.475 hp (total horsepower) at the maximum service factor point.

Service Factor Horsepower (SFHP). The maximum continuous duty motor power output rating allowable for nameplate ambient rating and motor insulation class. Commonly, service factor horsepower = rated horsepower x service factor (also known as total horsepower).

Special Horsepower. A term historically used in the pool, spa, and whirlpool bath industries, a term which may conflict with Rated Horsepower, Total Horsepower and Service Factor Horsepower, and if used would not conform to this standard.

Suction. Suction created by the pump is how the pool water gets from the skimmers and suction outlets to the filtration system. The suction side and suction lines refer to the vacuum side of the pump. It is at negative atmospheric pressure relative to the pool surface.

System Curve. A graphical representation of the relationship between Flow Rate and Total Dynamic Head, where TDH increases proportional to the square of the flow and plotting the relationship results in a parabolic shape. Each system will have a unique curve with the starting point, (zero flow) being the same for all systems. The generic expression for a system curve is $H = C \times F^2$, where H = Total Dynamic Head, C = is a coefficient based on the resistance of the system, and F = flow rate. As TDH increases, for example, as the filter collects debris and system pressure increases, coefficient C will also increase.

Sweep Elbow. Sweep elbows or ~~are~~ a type of elbow that has a pressure drop less than the pressure drop of straight pipe with a length of 30 pipe diameters. For example, a 2 inch elbow must have a pressure drop less than a 5-foot length of 2 inch straight pipe.

Total Dynamic Head. Total dynamic head, or TDH, refers to the sum of all the friction losses and pressure drops in the filtration system from the pool's suction outlets and skimmers to the returns. It is a measure of the system's total pressure drop and is given in units of either psi or feet of water column (sometimes referred to as "feet", ~~or~~ "feet of head" or "head").

Total Horsepower. The product of the rated horsepower nameplate power and the service factor of a motor used on a pool pump (also known as SFHP) based on the maximum continuous duty motor power output rating allowable for nameplate ambient rating and motor insulation class.
Total Horsepower = Rated Horsepower x Service Factor.

Turnover. A turnover is the act of filtering one volume of water in the pool.

Turnover Time (also called Turnover Rate). The time required to circulate the entire volume of water in the pool or spa through the filter. e.g. A turnover time of 6-hours means an entire volume of water equal to that of the pool will be passed through a filter system in six hours.

Turnover Time = Volume of the pool / Flow rate

Up-Rated. A term used to describe pool pump motors with a Service Factor between 1.0 and 1.25 (typically). The term is generally used for marketing purposes and is not within the scope this standard.

SECTION 4

APPLIANCES

4.1 Pool filter pumps

4.1.1 Motors

4.1.1.1 Motor efficiency

Pool filter pump motors shall not be split-phase, shaded-pole, or capacitor start – induction run type.

EXCEPTION: Pool pump motors that are powered exclusively from on-site renewable generation. For example: solar photovoltaic and wind generation. Grid-tied generation systems are not exempt since the pump is powered from the traditional utility grid when the alternate power source is not available.

4.1.1.2 Two-speed, multi-speed, or variable-speed capability

Pool filter pump motors with a capacity of 1.0 total horsepower or greater shall have the capability of operating at two or more speeds with a low speed having a rotation rate that is no more than one-half of the motor's maximum rotation rate.

4.1.1.3 Test methods for pool filter pump motors

4.1.1.3.1 Reported motor efficiency shall be verifiable by test method IEEE 114-2001 (corrected), or most recent version.

NOTE- Section 5.2.4.2.1 of IEEE 114-2001 lists formula for dynamometer correction factor. Formula inadvertently omits a component of the equation. Section 5.2.1.3.2 of the 1982 version of the standard lists formula correctly. Therefore, "corrected" shall mean using the 1982 version of the formula within the 2001 standard

4.1.2 Pumps

4.1.2.1 Test methods for pool pumps

4.1.2.1.1 ANSI/HI 1.6-2000 shall be used for the measurement of pump performance and efficiency.

4.1.2.1.2 ~~4.1.2.1.1~~ Tests shall be conducted using unmodified, manufactured and fully assembled pump, including strainer baskets when applicable.

4.1.2.1.3 ~~4.1.2.1.2~~ Three system curves shall be calculated:

Curve A: $H = 0.0167 \times F^2$ (approximately ~~Curve~~ 2.0" pipe)

Curve B: $H = 0.050 \times F^2$ (approximately ~~Curve~~ 1.5" pipe)

Curve C: $H = 0.0082 \times F^2$ (approximately ~~Curve~~ 2.5" pipe)

Where:

H is the total system head in feet of water.

F is the flow rate in gallons per minute (gpm).

4.1.2.1.4. ~~4.1.2.1.3~~ For each curve (A, B, and ~~or~~ C), the pump head shall be adjusted until the flow and head lie on the curve. The following shall be tested and reported for the intersect point of the pump performance curve with each system curve.:

1. Motor nominal speed (RPM)
2. Flow (gallons per minute)
3. Power (watts)
4. Energy Factor (gallons per watt hour)

Where the Energy Factor (EF) is calculated as:
EF = Flow (gpm) x 60 / Power (watts)

4.1.2.1.5 ~~4.1.2.1.4~~. For two-speed, three-speed, or other multi-speed pumps with fixed, non-adjustable speeds, test and report the intersect point of the pump performance curve with each system curve. Intersect data required in Section 4.1.2.1.4 shall be reported for each ~~at both high and low~~ speed~~s~~ and each system curve ~~s~~.

4.1.2.1.6 For variable-speed pumps, test and report the intersect point of the pump performance curve with each system curve. Intersect data required in Section 4.1.2.1.4 shall be reported for the highest, lowest, and the best efficiency speed~~s~~ as determined by the manufacturer.

4.1.3 Labeling

4.1.3.1 Motors

Each pool filter pump motor shall be marked, permanently and legibly on an accessible and conspicuous place on the unit, in characters no less than ¼", the ~~capacity~~ Total Horsepower of the motor.

4.1.3.2 Pumps

Each pool filter pump shall be marked, permanently and legibly on an accessible and conspicuous place on the unit, in characters no less than ¼", the N~~n~~ameplate H~~h~~orsepower of the pump.

4.1.3.3 Two-speed, multi-speed, or variable-speed pool filter pumps shall be marked permanently and legibly on an accessible and conspicuous place on the unit, in characters no less than ¼", "This pump, when used as a filter pump, must be installed with a two-, multi-, or variable-speed pump motor controller."

EXCEPTION: Pool filter pumps with integrated and/or included timer and motor control without which the motor will not run and which comply with Section 4.2.1.

4.2 Pump controllers

4.2.1 Pool pump motor controls for use with a two-speed, multi-speed, or variable-speed pumps shall have the capability of operating the pool pump at least at two speeds. The control's default filtration speed setting shall be no more than one-half of the motor's maximum rotation rate. Any high-speed override capability shall be for a temporary period not to exceed one 24-hour cycle without resetting to default settings.

4.3 Heaters

4.3.1 Energy design

4.3.1.1 Gas-fired pool heaters shall not be equipped with constant burning pilots.

4.3.1.2 All pool heaters shall have a readily accessible on-off switch that is mounted on the outside of the heater and that allows shutting off the heater without adjusting the thermostat setting.

4.3.1.3 Electric resistance hearing is prohibited.

4.3.2 Heater efficiency

4.3.2.1 Gas-fired pool heaters and oil-fired pool heaters shall have a thermal efficiency of not less than 78 percent for heaters manufactured before April 16, 2013 and not less than 82 percent for heaters manufactured on or after April 16, 2013.

4.3.2.2 There is no energy efficiency standard for electric resistance pool heaters.

4.3.2.3 Electric heat pump pool heaters shall have a coefficient of performance (COP) of not less than 4.0 at the low temperature conditions when tested in accordance with AHRI Standard 1160.

4.3.3 Test methods

4.3.3.1 ANSI Z21.56 – 1994 shall be used for the measurement of gas-fired and oil-fired pool heater efficiency.

4.3.3.2 ANSI/ASHRAE 146-1998 shall be used for the measurement of electric resistance pool heater efficiency.

4.3.3.3 AHRI 1160 - 2008, Table 2, Standard Rating Conditions – Low Air Temperature, shall be used for the measurement of heat pump pool heater efficiency.

AHRI 1160 – 2008: Table 2. Standard Rating Conditions

	Air Temperature Surrounding Unit		Water Temperature Entering Unit	Water Flow Rate (or Less if Specified by the Manufacturer)	
	Dry-bulb °F [°C]	Wet-bulb °F [°C]	°F [°C]	GPM	L/s
High Air Temperature -Mid Humidity (62% RH)	80.6 [27.0]	70.7 [21.5]	80.0 [26.7]	0.450 per 1000 Btu/h	0.028 per 293.1 Watts
Low Air Temperature -Mid Humidity (63% RH)	50.0 [10.0]	44.2 [6.78]	80.0 [26.7]	Same flow rate as established in High Air Temperature - Mid Humidity (62% RH)	

To comply with this standard, measured test results for Heating Capacity and Coefficient of Performance shall not be less than 95% of Published Ratings

SECTION 5

POOL SYSTEMS

5.1 General

5.1.1 All filter pumps and filter pump motors installed shall be listed in the California Energy Commission's Appliance Efficiency Database for Residential Pool Pumps, or the APSP Appliance Efficiency Pool Pump Database and shall comply with Section 4.1.

5.1.2 For maximum energy efficiency, pool filtration should be operated at the lowest possible flow rate for a time period that provides sufficient water turnover for clarity and sanitation.

5.1.3 For maximum hydraulic efficiency, sweep elbows or elbow-type fittings that have a pressure drop of less than the pressure drop of straight pipe with a length of 30 pipe diameters are recommended.

5.1.4 Auxiliary pool loads that require high flow rates such as spas, pool cleaners, and water features, should be operated separately from the filtration system to allow the maximum filtration flow rate to be kept to a minimum.

5.1.5 Pool controls are a critical element of energy efficient pool design. Modern pool controls allow for auxiliary loads such as cleaning systems, solar heating, and temporary water features without compromising energy savings.

5.2 Maximum filtration flow rate

5.2.1 Depending on the size (volume) of the pool, the pool filtration flow rate may not be greater than the rate needed to turn over the pool water volume in six hours or 36 gpm, whichever is greater. This means that for pools of less than 13,000 gallons the pump must be sized to have a flow rate of 36 gpm or less and for pools of greater than 13,000 gallons, the pump must be sized using the following equation:

Maximum Filtration Flow Rate (gpm) = Pool Volume (gallons) / 360

5.2.2 These are maximum flow rates. Lower filtration flow rates and longer filtration times are encouraged and will result in added energy savings.

5.2.3 Pools with auxiliary pool loads must use either a multi-speed pump or a separate pump for each auxiliary pool load. For example, if a spa shares the pool filtration system, either a multi-speed pump must be used or a separate pump must be provided to operate the spa. If the pool system can be served by one pump of less than 1.0 total horsepower in capacity, the pump may be single speed.

5.3 Pool filter pump sizing, flow rate, and filter pump control.

5.3.1 Filtration pump motors with a capacity of 1.0 total horsepower or more shall be multi-speed.

5.3.2. Select a pool filtration pump from the California Energy Commission's Appliance Efficiency Database for Residential Pool Pumps, or the APSP Appliance Efficiency Pool Pump Database.

5.3.2.1. For pools equal to or less than 17,000 gallons, a filter pump shall be chosen such that the flow rate listed for Curve A is less than the maximum filtration flow rate calculated according to Section 5.2.1 (six-hour turnover rate). For multi-speed and variable-speed filter pumps, at least one speed shall have the flow listed for Curve A that is less than the maximum filtration flow rate calculated according to Section 5.2.1 (six-hour turnover rate).

5.3.2.2 ~~**5.3.3**~~ For pools greater than 17,000 gallons, a filter pump shall ~~must~~ be chosen such that the listed flow rate at Curve C is less than the maximum filtration flow rate calculated according to Section 5.2.1 (six-hour turnover rate). For multi-speed and variable-speed filter pumps, at least one speed shall have the flow listed for Curve C that is less than the maximum filtration flow rate calculated according to Section 5.2.1 (six-hour turnover rate).

5.3.3 ~~**5.3.2.**~~**.** The maximum filter pump performance limits in Sections 5.3.2.1 and 5.3.2.2 are calculated based on pool gallons, where the filter pump performance increases proportional to the size of the pool. In the same way, pipe, filter and backwash valve (when used) will increase in size proportional to pool volume.

5.3.4. ~~**5.3.3.1**~~ System equation used by pool filter pump manufacturers: ~~The pool filter pump head and flow rate shall be calculated using the following system equation:~~

$H = C \times F^2$

Where:

H is the total system head in feet of water.

F is the Maximum Filtration Flow Rate in gallons per minute (gpm) calculated according to Section 5.2.1 (six-hour turnover rate).

C is a coefficient based on the volume of the pool:

C = 0.0167 for pools less than or equal to 17,000 gallons.

C = 0.0082 for pools greater than 17,000 gallons.

~~and;~~

~~5.3.4 Filtration pumps shall be sized, or if programmable, shall be programmed, so that the filtration flow rate is not greater than the rate needed to turn over the pool water volume in 6 hours or 36 gpm, whichever is greater; and~~

~~5.3.5 Pump motors used for filtration with a capacity of 1 total horsepower or more shall be multi-speed; and~~

~~5.3.6 Each auxiliary pool load shall be served by either separate pumps or the system shall be served by a multi-speed pump; and~~

~~**EXCEPTION:** Filter pumps if less than 1 total horsepower may be single speed.~~

5.3.5 ~~5.3.7~~ Multi-speed pumps must have controls that default to the filtration flow rate when no auxiliary pool loads are operating. The controls must also default to the filtration flow rate setting within 24 hours and must have a temporary override capability for servicing.

5.3.6 ~~5.3.8~~ A time switch or similar control mechanism must be installed as part of the pool water filtration control system that will allow all pumps to be set or programmed to run only during the off-peak electric demand period and for the minimum time necessary to maintain the water in the condition required by applicable public health standards.

EXCEPTION: Pool filter pumps with integrated and/or included timer and motor control without which the motor will not run and which comply with Section 4.2.1.

5.4 System equipment

5.4.1 Filters sizing.

Filters shall be at least the size specified in NSF/ANSI 50 for public pool intended applications based on the maximum flow rate through the filter.

5.4.1.1 The filter factors that must be used are ~~(in ft^2/gpm)~~:

- Cartridge 0.375 (gpm/ft^2)
- Sand 15 (gpm/ft^2)
- Diatomaceous Earth 2 (gpm/ft^2)

5.4.2 Backwash valves.

Minimum diameter of backwash valves shall be 2 inches or the diameter of the return pipe, whichever is greater.

5.5 System piping and circulation.

5.5.1 Pool piping and pipe fittings shall be sized so that the velocity of the water at the maximum flow rate does not exceed 8 feet per second in the return line and 6 feet per second in the suction line. Velocity calculations for branch piping flow shall allow variations in pipe sizes.

EXCEPTION: Equipment connections and internal piping, including, but not limited to, suction safety systems, pumps, heaters, and sanitizing devices.

5.5.1.1. Velocity calculations for branch piping flow shall allow variations in pipe sizes provided there are no valves capable of isolating flow through one branch. Branch piping is shown as the thin line in Figure 1.

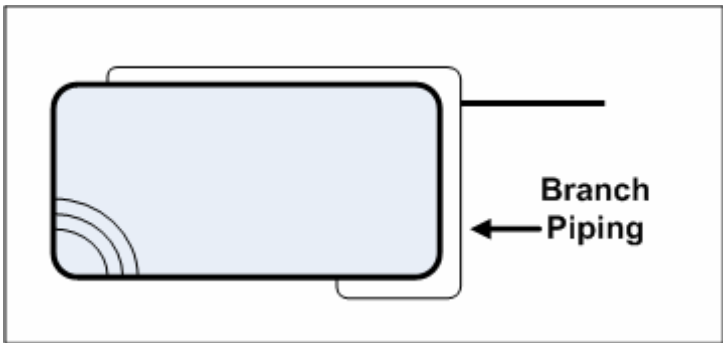

Figure 1

5.5.2 ~~5.5.1.~~ For pool filtration pumps without an integrated strainer basket, a length of straight pipe that is at least 4 pipe diameters shall be installed before the pump.

5.5.3 ~~5.5.2~~ Solar heating. At least 18 inches of horizontal or vertical pipe shall be installed between the filter and the heater or dedicated suction and return lines, or built-in or built-up connections shall be installed to allow for the future addition of solar heating equipment.

5.6 Directional inlets.

The pool shall have directional inlets that adequately mix the pool water.

[1] Association of Pool and Spa Professionals (APSP) [formerly National Spa and Pool Institute (NSPI)], 2111 Eisenhower Avenue, Alexandria, VA 22314
[2] Hydraulic Institute, 6 Campus Drive, First Floor North, Parsippany NJ, 07054-4406, (973) 267-9700, *www.pumps.org*
[3] IEEE Corporate Office, 3 dark Avenue, 17th Floor, New York, NY 10016-5997, (212) 419-7900, *www.ieee.org*
[4] National Fire Protection Association (NFPA) 1 Batterymarch Park, Quincy, MA 02169-7471, (617) 770-3000, *www.nfpa.org*
[5] NSF International, 789 Dixboro Road, Ann Arbor, MI 48113-0140, (734) 769-8010, *www.nsf.org*

[4072]

FLORIDA STANDARD NO. 2 ~~3~~ (FL-2 ~~3~~)

FLORIDA REGULATORY REQUIREMENTS FOR PORTABLE ELECTRIC SPA ENERGY EFFICIENCY

The following regulatory requirements shall constitute Florida Standard FL-**2** ~~**3**~~ and provide compliance criteria for section 403.9.5 of the *Florida Building Code, Energy Conservation Code*. These requirements follow an Association of Pool & Spa Professional (APSP) ~~a draft~~ national standard for portable electric spa energy efficiency that is currently obtaining ANSI approval.

SECTION 1.
SCOPE

1.1 These requirements apply to factory built residential portable electric spas that are used for bathing and are operated by a private ~~an~~ owner.

1.2 This standard is meant to establish minimum energy efficiency requirements for portable electric spas. This standard shall be met notwithstanding certain variations in equipment, materials, and design (Refer to ANSI/NSPI-6).

1.3 These requirements do not apply to public spas, permanently installed ~~residential~~ spas or other spas, such as those operated for medical treatment, physical therapy or other purposes. Swim-spas and portions of combination spas/swim-spas are included in this standard.

1.4 Other standards are referenced in this standard for items not covered.

SECTION 2.
NORMATIVE REFERENCES

APSP-6 Standard for Portable Spas[1]

ISO/IEC 17025General Requirements for the Competence of Calibration and Testing Laboratories

ISO/IEC Guide 65 General Requirements for Bodies Operating Product Certification Systems

SECTION 3.
DEFINITIONS

AMBIENT TEMPERATURE – Air temperature inside testing chamber.

ANCILLARY EQUIPMENT – Additional components used in the construction of the

spa beyond pumps, heaters and control systems.

CERTIFICATION BODY (CB) – An independent third party that operates a product, process or service certification system.

CHAMBER – A controlled environment suitable for conducting energy efficient testing ~~Climate controlled test room~~.

COVER, SPECIFIED – The cover that is provided or specified by the spa manufacturer.

ENERGY EFFICIENCY STANDARD – A performance standard expressed in numerical form, such as energy factor, EER, or thermal efficiency. ~~Using less energy to provide the same level of energy service.~~

FILL VOLUME - The halfway point between the bottom of the skimmer opening and the overflow level ~~top~~ of the spa. In the absence of a ~~If there is no~~ wall skimmer, the fill volume is six inches below the overflow level of the spa. ~~the spa shall be filled with water to six inches below the top of the spa.~~

FILTER CYCLE - The period when the control system activates a pump intended to move water through a filter media.

GALLON – Means U.S. liquid gallon

HEATING CYCLE – The period when the temperature regulating system activates the heating component for the purpose of increasing the water temperature.

HOT TUB – See Spa

INGROUND SPA - Non-portable, non-self-contained spa (Refer to ANSI/NSPI -3 Permanent Inground Spas)

NORMALIZE – Calculation of power consumption to eliminate temperature bias.

~~NRTL – Nationally Recognized Test Laboratory~~

POWER FACTOR – The ratio of watts to volt-amperes of an AC circuit.

PURGE CYCLE - The period when the control system activates a pump intended to rapidly move water throughout the spa.

SKIMMER, VENTED – A suction opening intended to remove floating debris from the water surface and to be installed where part of the water intake opening is open to atmospheric pressure.

SPA – A product intended for the immersion of persons in heated water circulated in a

closed system, and not intended to be drained and filled with each use. A spa usually includes a filter, a heater (electric, solar, or gas), a pump or pumps, and a control, and may also include other equipment, such as lights, blowers, and water sanitizing equipment.

Permanent Residential Spa- A spa in which the water heating and water circulating equipment is not an integral part of the product. The spa shall be intended as a permanent plumbing fixture and shall not be intended to be moved. (Refer to ANSI/NSPI-3 1999 Standard For Permanently Installed Residential Spas.)

Public Spa - Any spa other than a permanent residential spa or residential portable spa which is intended to be used for bathing and is operated by an owner, licensee, concessionaire, regardless of whether a fee is charged for use. (Refer to ANSI/NSPI-2 1999 Standard for Public Spas.)

Residential Portable Spa - Either Self-Contained or Non-Self-Contained (Refer to ANSI/NSPI-6 1999 Standard For Residential Portable Spas.):

Self Contained Spa - A factory built spa in which all control, water heating and water circulating equipment is an integral part of the product. Self-contained spas may be permanently wired or cord connected.

Non-Self-Contained Spa - A factory built spa in which the water heating and circulating equipment is not an integral part of the product. Non-self-contained spas may employ separate components such as an individual filter, pump, heater and controls, or they may employ assembled combinations of various components.

~~STANDARD COVER – The cover that is provided or specified by the spa manufacturer.~~

STANDBY MODE - All settings at default as shipped by the manufacturer, except water temperature which may be adjusted to meet the test conditions. No manual operations are enabled.

~~SWIMSPA – Variant of a Residential Portable Spa which consists of a large unobstructed volume of water primarily designed for, and constructed with specific equipment required to produce a water flow intended to allow recreational physical activity including, but not limited to, swimming in place.~~

~~Swim spas may include peripheral jetted seats intended for water therapy, heater, circulation and filtration system, or may be a separate distinct portion of a combination spa/swim spa with separate controls.~~

SWIM SPA - Variant of a factory built residential portable spa consisting ~~which consists~~ of a large unobstructed volume of water that allows the 99% male~~/female~~ population to swim. The design and construction of a swim spa includes specific features and equipment ~~utilizing swim jets for a treadmill-like workout, primarily designed for, and~~

~~constructed with specific equipment required~~ to produce a water flow intended to allow recreational physical activity including, but not limited to, swimming in place.

Swim spas may include peripheral jetted seats intended for water therapy, heater, circulation and filtration system, or may be a separate distinct portion of a combination spa/swim spa and may have ~~with~~ separate controls.

~~WATT HOUR – Energy consumed over a period of one hour.~~

SECTION 4
QUALIFICATION OF TESTING LABORATORIES AND CERTIFICATION BODIES

4.1 All Certification Bodies (CB) shall be accredited by a member of IAF (International Accreditation Forum) using ISO/IEC Guide 65, General Requirements for Bodies Operating Product Certification Systems.

4.2 All testing laboratories shall be qualified by a CB.

4.2.1 The CB shall assess the testing laboratory's quality system to determine that it satisfies applicable requirements of ISO/IEC 17025.

NOTE: Different parts of ISO/IEC 17025 are applicable to first-party, second-party and third-party laboratories.

4.2.2 Where a laboratory is accredited to ISO/IEC 17025 by a member of ILAC (International Laboratory Accreditation Council) the CB is permitted to accept such accreditation as evidence of conformity to ISO/IEC 17025, in whole or in part.

4.2.3 The CB shall additionally assess the laboratory's facilities, test equipment, testing personnel and test procedures, to establish that the laboratory is competent to perform the tests in this standard.

4.2.4 The CB shall provide a copy of the assessment report to the testing laboratory, and retain a record of the assessment. Any discrepancies identified in the assessment report shall be cleared before the laboratory is deemed qualified.

4.3 Testing laboratories shall demonstrate qualification on a continuing basis.

4.3.1 The CB shall audit the testing laboratory for ISO/IEC 17025 compliance and testing competence on a regular basis.

4.3.1.1 Laboratories accredited by an ILAC member shall be audited at intervals not exceeding three (3) years.

4.3.1.2 Non-accredited laboratories shall be audited annually by the CB.

4.3.2 The CB shall provide a copy of the audit report to the testing laboratory, and retain a record of the audit. Any discrepancies identified in the audit report shall be cleared before the laboratory is deemed re-qualified.

SECTION 5 4.
TEST METHOD

54.1 Purpose: To measure the energy consumption of a portable electric spa in standby mode, using a repeatable and reproducible test procedure. The results will be used to calculate the standby power demand.

5.2 The test facility and equipment will be audited as indicated in 4.3 of this standard to confirm they meet the requirements of this standard. Documentation showing facility and test equipment compliance to this standard from the CB will be maintained on side by the test facility and made available as required (See Appendix B).

5.3 All equipment shall be calibrated at intervals not to exceed eighteen months, and traceable to NIST or other national standard.

5.4 ~~4.2~~ Test Equipment

~~Note: All equipment shall be calibrated and traceable to the National Institute of Standards and Technology (NIST). The test facility and equipment will be evaluated by a NRTL to confirm they meet the requirements of this standard. Documentation showing facility and test equipment compliance to this standard from the NRTL will be maintained on site by the test facility and made available as required.~~

5.4.1.~~4.2.1~~ Recording Watt Hour meter – Accuracy: Class-2 or better.

5.4.2.~~4.2.2~~ Temperature measurement system - Accuracy: +/- 1°F

5.4.3.~~4.2.3~~ Water meter to measure fill water in gallons – Accuracy: +/- 1.5%

5.5.~~4.3~~ Test Conditions

The test method for portable electric spas is as follows:

5.5.1.~~4.3.1~~ Minimum continuous testing time shall be 72 hours.

5.5.2.~~4.3.2~~ The spa shall be filled with water to the halfway point between the bottom of the skimmer opening and the top of the spa. In the absence of a ~~If there is no~~ wall skimmer, the fill volume is six inches below the overflow level ~~spa shall be filled with water to six inches below the top~~ of the spa.

5.5.2.1 ~~4.3.2.1~~ Measure and record fill volume (V) ~~while filling according to 4.3.2.~~

5.5.3.~~4.3.3~~ The water temperature of the spa or spa portion of a combination swim spa shall be a minimum of 100°F, for the duration of the test. The water temperature of the swim spa or swim portion of a combination swim spa shall be a minimum of 85°F, for the duration of the test.

5.5.4.~~4.3.4~~ The ambient air temperature shall be a maximum of 63°F for the duration of the test.

5.5.5.~~4.3.5~~ The manufacturer's specified ~~standard~~ cover ~~that comes with the unit~~ shall be used during the test.

5.6 ~~4.4~~ **Test Procedure**

5.6.1 ~~4.4.1~~ The test shall start when the water temperature has been at 102°F, ±2°F, (at 87°F, ± 2°F for swim spas) for at least a four hour stabilizing period.

5.6.2 ~~4.4.2~~ Record water temperature.

5.6.2.1 ~~4.4.2.1~~ The thermocouple shall be located three to five inches below the water level and centrally located relative to the shape of the spa.

5.6.3 ~~4.4.3~~ Record ambient air temperature at one point located twelve to eighteen inches ~~a maximum of one to one and a half feet~~ above spa cover level and six to eight inches from the chamber wall . The temperature probe will be positioned and out of direct airflow from the ~~chamber temperature control system and/or~~ circulation fan.

5.6.4 ~~4.4.4~~ **Data Recording**

5.6.4.1 ~~4.4.4.1~~ Record temperatures at a maximum interval of 5 ~~4~~ minutes.

5.6.4.2 ~~4.4.4.2~~ Measure voltage, current, and power factor (OPTIONAL) at a maximum interval of 5 ~~4~~ minutes.

5.6.4.3 ~~4.4.4.3~~ Record watt-hours, voltage and current used during entire Test Period.

5.6.4.4 ~~4.4.4.4~~ Record elapsed time during Test Record.

5.6.5 ~~4.4.5~~ Record the total energy use for the period of test, starting at the end of the first heating cycle after the stabilization period and finishing at the end of the first heating cycle after 72 hours has elapsed.

Exception: For spas without heaters, substitute heating cycle with filter or purge cycle.

5.6.6 ~~4.4.6~~ The unit shall remain covered and in the default operation mode during the

test. Energy-conserving circulation functions, if present, must not be enabled if not appropriate for continuous, long-term use. The minimum filtration rate shall be 12 water turns within a 24 hour period. Ancillary equipment including, but not limited to lights, audio systems, and water treatment devices, shall remain connected to the mains but may be turned off during the test if their controls are user accessible.

SECTION 6 ~~5~~
FORMULAS

6.1 ~~5.1~~ The measured standby power (P_{meas}) shall be determined by E/t:

$P_{meas} = E/t$

Where:

E = total energy use during the test (Wh)

t = length of test (hr)

6.2 ~~5.2~~ The measured standby power (P_{meas}) shall be normalized (P_{norm}) to a temperature difference of 37°F using the equation:

$P_{norm} = P_{meas} (\Delta T_{ideal} / \Delta T_{meas})$

Where:

$\Delta T_{ideal} = 37°F$

$\Delta T_{meas} = T_{water\ avg} - T_{air\ avg}$

$T_{water\ avg}$ = Average water temperature during test

$T_{air\ avg}$ = Average air temperature during test.

6.3 ~~5.3~~ The normalized standby power (P_{norm}) shall not be greater than maximum standby power (P_{max}):

$P_{max} = 5(V^{2/3})$

Where:

V = fill volume in gallons

SECTION 7 ~~6.~~
LABEL REQUIREMENTS

7.1 ~~**6.1**~~ The manufacturer shall include either on or in close proximity to the spa's product label the standby watts rating.

7.2 ~~**6.2**~~ Wording to be in the following format:

Per ANSI-14 Measured Standby Power Consumption XXXX watts~~/hr~~ (Maximum Allowable Standby Power Consumption XXXX watts~~/hr~~)

APPENDIX A (Informative)

This appendix is not part of the American National Standard and is included for information only.

Minimum Chamber Requirements

Chamber internal dimensions:

Minimum 7 feet high

Minimum 1 foot from spa to chamber wall or other internal barrier.

Air flow: If air circulation from the air temperature control equipment is intermittent, install 1 fan in one corner of the chamber, 6 feet from the floor. Direct toward the center of the floor. The fan should move at least 80 CFM of air, and not more than 100 CFM. If the air temperature control equipment continuously circulates air in the chamber, no fan is required.

Chamber Insulation: Walls shall be insulated adequately to maintain proper ambient temperatures.

Chamber Floor: The floor may be insulated with 2" thick R-13 polisocyanurate with radiant barrier on both sides. This insulation shall be laid directly on a level concrete floor or slab or other firm, level surface created for it. The insulating layer shall be sheeted with minimum 1/2" thick plywood to protect the insulation layer and provide a smooth surface to properly position the spas to be tested.

APPENDIX B (Informative)

This appendix is not part of the American National Standard and is included for information only.

Procedure for Establishing Test Facility and Equipment Compliance

This section provides an evaluation procedure to qualify a test facility for the sole purpose of testing to the requirements outlined in **ANSI/APSP 14 Portable Spa Energy Efficiency Standard.**

All evaluations are to be conducted by a CB as defined in Section 3 of this standard. Any testing performed, data and results obtained, or facility and equipment used prior to the adoption of ANSI/APSP 14 is exempt from the requirements of Appendix B.

1. Test Chamber

1.1 The test chamber will be evaluated to establish compliance with the construction requirements outlined in Appendix A.
1.2 The test chamber must demonstrate the capability to maintain the test environment(s) called for in Section 4 of this standard.
1.2.1 The test chamber will be evaluated operating at the test parameters for a minimum of three hours.

2. Data Measuring and Recording Equipment

2.1. The operator of the test facility will provide proof of calibration traceable to NIST or other national standard for all equipment used to measure and collect data as outlined in Section 4 of this standard. 2.2 The maximum period before equipment recalibration is required will be eighteen months from its previous calibration date.
2.2.1 If the test equipment comes from the manufacturer with a Certificate of Calibration, the time frame for recalibration will be a maximum of eighteen months from date of purchase.
2.3 Calibration records (electronic or hard copy), will be kept by the test facility and made available upon request by the evaluating CB.

3. Training of Personnel

3.1 The test facility will designate the person, and alternates, responsible for training other employees in the requirements of performing the ANSI 14 Portable Spa Energy Efficiency Testing.
3.1.1 Training records will include:

- The person(s) doing the training
- Date(s) the training took place
- Facility and chamber used

3.2 The test facility will keep employee training records and provide them to the CB upon request.

4. Record Maintenance

4.1 Upon request of the CB, the test facility will provide a copy of all forms used, (electronic or hard copy), to record the required test data.

4.2 The CB may review previous testing performed for compliance to this standard.

5. Documentation of Test Facility Compliance

5.1 If the test facility successfully completes the evaluation, the CB will issue the appropriate document(s) indicating compliance with Appendix B of this standard.

5.2 If found non-conforming, the CB will issue a report of corrective actions the test facility must address to be compliant.

5.2.1 A second site visit to verify the corrective actions will be at the discretion of the CB.

5.3 Upon the test facility addressing and providing the necessary documentation, the CB will issue the appropriate document(s) indicating compliance with Appendix B of this standard.

---

[1] Association of Pool & Spa Professionals (APSP) (formerly National Spa and Pool Institute (NSPI), 2111 Eisenhower Avenue, Alexandria, VA 22314

[4077]