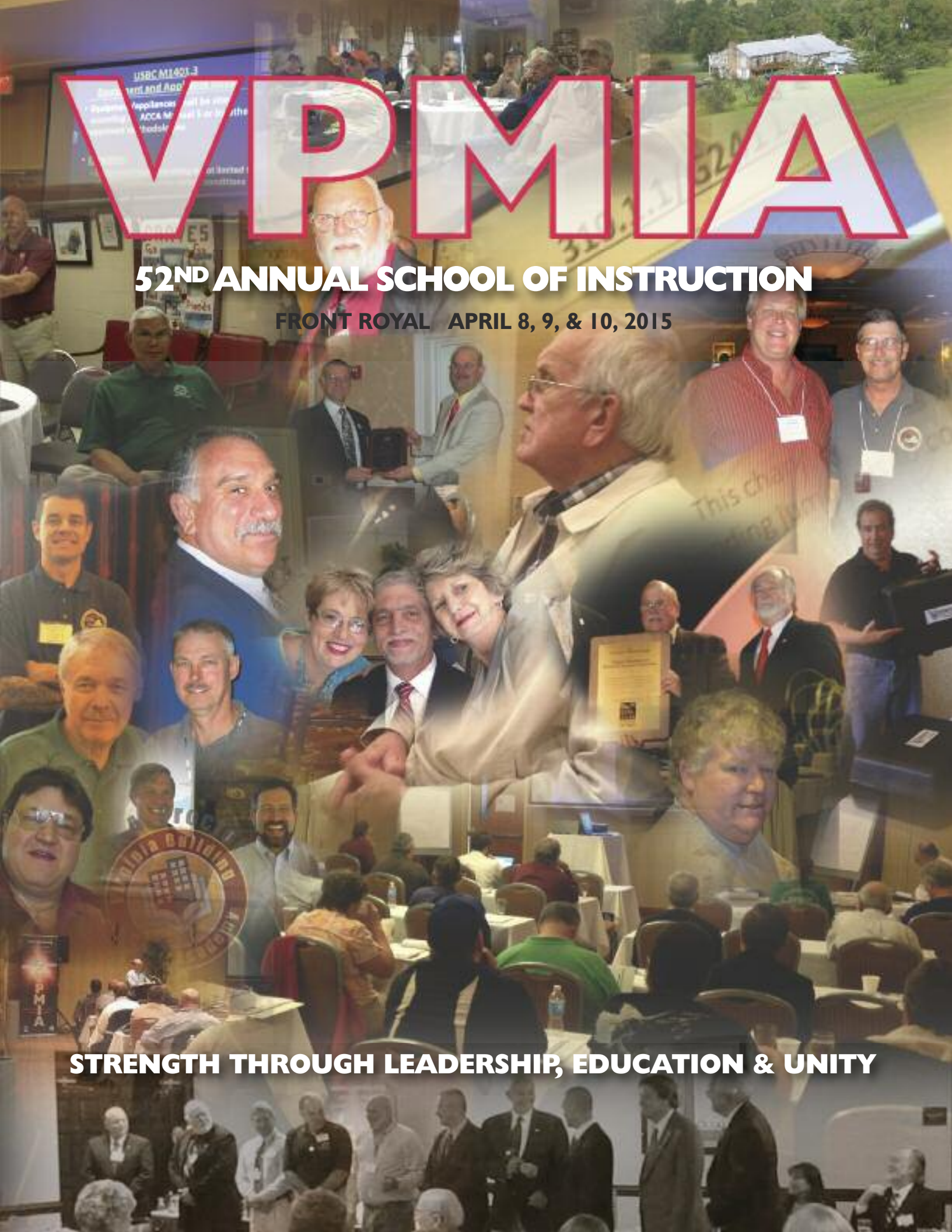


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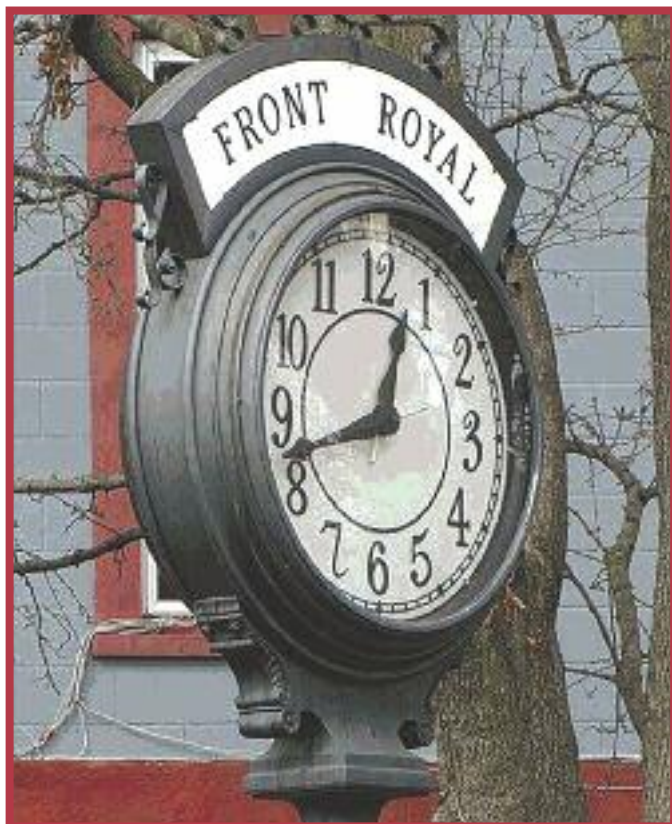
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# 52<sup>nd</sup> Annual School of Instruction



April 8, 9 & 10, 2015  
Front Royal, Virginia

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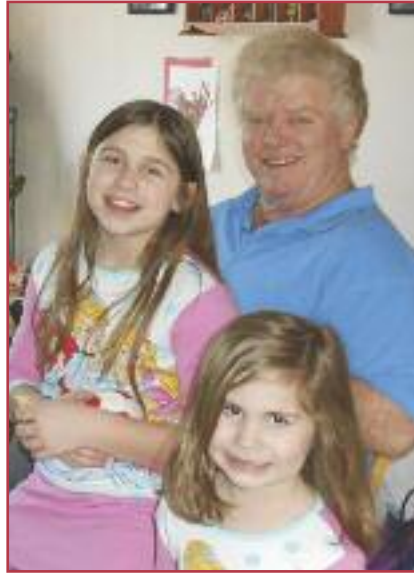
# The President's Corner

It's been an honor and a pleasure to serve as VPMIA's 50th President and it certainly has been a fun-filled year. Being President is only as simple as the people you serve wish to make it for you and, in this organization that equals simple!

Late last April, PMPV offered VPMIA a complimentary tabletop at their annual tradeshow in Northern Virginia. Within 2 days of my emailing the membership for volunteers, Past President Dennis McNaughton contacted me and offered to "man" the booth. Also in April, I was able to introduce Jim Ellwood, ICC HSTTP Consultant from the ICC High School Tech Program to Virginia Tech's Building Official, William Hinson, in hopes to "grow" this program in Virginia.

May is Building Safety Month and activities were happening all across the State—from the Demarree Brothers in Alexandria, Bill Aldridge in Christiansburg, over to Randy Pearce in Emporia, all points in between as well as at the beach!

In July, during our summer meeting at Graves Mountain Lodge, the General Membership unanimously approved the revised By-Laws that our very astute By-Laws Committee had worked on revamping for almost 2 years. With assistance from Jim Moore, Donald Mimms, and John Hudgins, the Certification/Training Committee was able to develop — and receive — DPOR approval for our 2012 PMG code update training.



Later in the year, Curt Campbell, Dustin McLehane, Donald Mimms, Jon Sargeant, James Anjam, and Richard Grace assisted in providing tradesman training in Chesterfield County as well as Chantilly.

In September, I attended the ICC Annual Conference where it was a pleasure to watch two-time, past VPMIA President, Guy Tomberlin, being sworn in as the incoming ICC President. In October, VPMIA had a tabletop for the first time at the Governor's Housing Conference along with folks from ICC, VBCOA, and

DHCD; this was a successful event in which we will continue to participate.

As we rolled into the New Year, all the planning ramped up for this, the 52nd Annual School of Instruction. The School of Instruction Committee, Awards Committee, Nominations Committee, and the Advertising & Yearbook Committee have been all very busy producing yet another successful SOI.

In closing, as I stated at the beginning of this letter, it is the people you serve that serve you — making all of this possible, and for that I am very grateful. A special thank you goes out to Jane Fitzgerald who works behind the scenes making this yearbook possible.

Respectfully,

Skip Harper  
President, VPMIA  
2014-2015



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# VPMIA 52<sup>nd</sup> Annual School of Instruction

## SCHEDULE

April 8, 9, and 10, 2015

Holiday Inn Front Royal 111 Hospitality Drive Front Royal, VA 22630 (540) 631-3050

### WEDNESDAY, APRIL 8

07:00 am - 08:15 am	Registration
08:30 am - 10:00 am	Propane Training Services— Changes to NFPA 58-11 and IFGC 2012 .....Dennis Cruise
10:00 am - 10:30 am	Break
10:30 am - 12:00 pm	Copper Alliance— Copper and Copper Alloy Installation Update .....Dale Powell
12:00 pm - 01:00 pm	Lunch (included with registration)
01:00 pm - 02:30 pm	New Age Casting—Common Corrosive Issues .....Pat McQuillan
02:30 pm - 03:00 pm	Break (sponsored by Otto Sales)
03:00 pm - 04:30 pm	Quantum Flow— Domestic Water Pressure Booster Systems.....Ed Ross
05:00 pm - 06:00 pm	President's Welcome
06:00 pm - 07:30 pm	Buffet Dinner (included with registration)

### THURSDAY, APRIL 9

08:30 am - 10:00 am	An Overview of VRF Heating and Cooling Systems (Part 1).....Lee Smith
10:00 am - 10:30 am	Break
10:30 am - 12:00 pm	An Overview of VRF Heating and Cooling Systems (Part 2).....Lee Smith
12:00 pm - 12:15 pm	VPMIA General Membership Meeting (Part 1)
12:00 pm - 01:00 pm	Lunch (included with registration)
01:00 pm - 02:30 pm	Charlotte Pipe-Laboratory Plumbing Design & Special Waste Piping Systems
02:30 pm - 03:00 pm	Break
03:00 pm - 04:30 pm	CDP Access.....Cindy Davis and Shawn Strausbaugh
06:30 pm - 10:00 pm	VPMIA Banquet with Awards (included with registration)

### FRIDAY, APRIL 10

8:00 am - 9:00 am	Breakfast Buffet (included with registration)
9:00 am - 12 noon	VPMIA General Membership Meeting (Part 2) Conference ends

Visit the website at [www.VPMIA.org](http://www.VPMIA.org)



# Congratulations

to Guy Tomberlin from VPMIA





# VPMIA's Foundation

## Vision Statement

VPMIA members are committed to providing code development leadership and continuous training that results in uniform application of the codes. We look for opportunities to partner with all who are impacted and strive to develop and deliver codes and standards that result in health, safety, and welfare protection for the public.

## Mission

VPMIA is an association of code professionals dedicated to promotion of uniform enforcement and development of the codes throughout the Commonwealth to assure the health, safety, and welfare of its citizens and any one who may live, work, or visit the state of Virginia. The pursuit of this endeavor is achieved through close, open, and equal working relationships with design professionals, builders, contractors, material manufacturer's and others involved in the construction industry. VPMIA supports the ICC, its goals and mission.

## Strategic Plan Mission

VPMIA's strategic plan is to advance our mission through training in order to promote better understanding of the benefits and efficiency of using model codes. The association promotes teamwork, while embracing fairness and respect to all involved parties, always maintaining open communications in every aspect to those who participate in the process.

# VPMIA's Strategic Plan

## GOAL # 1

### **Enhance and increase communications of VPMIA with the public**

(Communications)

#### **Initiative action:**

- Actively promote a positive image of code enforcement's role in the community.
- Advertisements in trade, industry, state DHCD, and community publications.
- Commitment to code development to achieve the superior level of health, safety, and welfare for our citizens.

## GOAL # 2

### **Increase and expand education**

(Training – Communications)

#### **Initiative action:**

- Encourage increased participation from all interested parties who interact with any and all aspects of code enforcement.
- Increase awareness of the educational benefits of the association.
- Promote credentialing programs provided by the state DHCD.

## GOAL # 3

### **Uphold the highest levels of professionalism**

(Leadership – Professionalism)

#### **Initiative action:**

- Instill and promote leadership values.
- Always display integrity.
- Adherence to code of ethics.
- Share knowledge at all levels.

- Maintain and promote certifications.
- Respect others.

## GOAL # 4

### **Promote relationships with industry and related professional organizations**

(Cooperation)

#### **Initiative action:**

- Participate in the code development process.
- Encourage cooperative working relationships with construction-industry professionals.
- Become involved as active or associate members to other professional organizations such as VBCOA, ICC, IAEL, and PMPV.
- Solicit speakers and provide speakers for these organizations to enhance communication.
- Continue to actively participate in DHCD towards uniform application and development of the model building codes and standards.

## GOAL # 5

### **Broaden and expand VPMIA Membership**

(Membership)

#### **Initiative action:**

- Develop information package of the organization benefits.
- Provide more member services.
- Develop a more wide spread advertisement program for membership, including associate members.

## GOAL # 6

### **Continue leadership and participation in code development process**

(Leadership – Code Development)

#### **Initiative action:**

- Enhance and develop strategies for participation in International Code Council Code developmental process.
- Encourage participation on state and national committees.
- Provide financial support towards member participation in these activities.

## GOAL # 7

### **Promote the adoption of the International Code Council family of model codes**

(Communications – Training)

#### **Initiative action:**

- Provide analysis and impact of benefits for industry, where necessary.
- Provide training for code enforcement officials and industry.
- Interact with DHCD to provide uniform enforcement of model codes.

## GOAL # 8

### **Ensuring financial viability of VPMIA**

(Financial)

#### **Initiative action:**

- Align financial resources to organizational outcomes.
- Achieve goal objectives.
- Operate within budgeted plan.





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## **Constitution and By-Laws**

### **ARTICLE I — Name, Seal, and Address**

**Section 1.** The name of this organization shall be the Virginia Plumbing and Mechanical Inspectors Association, herein referred to as the Association.

**Section 2.** The seal shall be approved by the Board of Directors, herein referred to as the Board.

**Section 3.** The address shall be that of the Executive Secretary, unless otherwise approved by the Board.

### **ARTICLE II — Mission and Objectives**

**Section 1.** The Association's mission shall be to promote and protect the health, safety and welfare of all Virginia citizens and of all others who may live, work, play and visit within the Commonwealth.

**Section 2.** The objectives of the Association shall be to:

- A. Promote uniform application of the Virginia Uniform Statewide Building Code.
- B. Actively participate in plumbing, mechanical and fuel gas code development at state and national levels.
- C. Provide opportunities for professional development by sponsoring or conducting training seminars.
- D. Partner with organizations that share the Association's mission and objectives.
- E. Encourage unity among code officials, governmental agencies and the private sector.
- F. Recognize members who make contributions that further the Association's mission and objectives.
- G. Maintain an organizational environment which promotes professionalism, mutual respect, mentoring, leadership and the pursuit of common goals.

### **ARTICLE III — Membership**

**Section 1.** Categories of Membership.

- A. Active Membership shall be open to governmental employees actively engaged in plumbing, mechanical and fuel gas code enforcement as prescribed in the Virginia Uniform Statewide Building Code.
- B. Associate Members shall be non-governmental employees interested or engaged in the building industry.
- C. Lifetime Membership is open to Active and Associate members in good standing who have made significant contributions that advanced or supported the Association's mission.
- D. Honorary Membership is open to individuals who are not currently members, but who have made significant contributions that advanced or supported the Association's mission.
- E. Retired membership is open to Active or Associate members who have retired.
- F. Student Membership is open to students actively engaged in the study of engineering, building design/construction and plumbing/mechanical apprenticeship/technical programs.

**Section 2.** Membership shall be granted as follows:

- A. Application for Active, Associate, Retired and Student membership shall be submitted to the Executive Secretary on the Association's membership application form. Each application shall be reviewed, approved or disapproved by the Executive Secretary.
- B. Honorary and special-offer type memberships shall be approved by the Board.
- C. Lifetime membership nomination forms shall be submitted to the Awards Committee Chair. The Awards Committee shall review and select the recipients.

**Section 3.** Dues.

- A. Active, Associate, Retired and Student members shall pay dues and such dues shall cover the period from January 1 through December 31 of each year. Dues remitted after December 31 shall only cover the period until December 31 of the current year. Members whose dues are current shall be considered in good standing.
- B. Lifetime and Honorary members shall not be required to remit dues.
- C. Dues shall be established by the Board and listed on the Association's membership application form.
- D. Where any Active, Associate, Retired or Student member does not remit dues for two (2) consecutive years, the membership shall have expired and the member's name shall be removed from the roster. Expired memberships may be renewed in accordance with Article III. Section 2.A. *(continued)*



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## **Constitution and By-Laws, page 2**

### **Section 4. Membership Meeting Voting.**

- A. Only Active members in good standing shall have the right to vote.
- B. All members shall have the right to make and second motions and to participate in discussion of any motion before the membership

### **Section 5. Conduct.**

A. All members shall be committed to the Association's mission and shall conduct themselves in accordance with the Association's Code of Ethics.

## **ARTICLE IV — Officers and Duties**

**Section 1.** Officers shall be Active members in good standing and comprised of a President, Vice President, Secretary and Treasurer.

**Section 2.** Officers shall be elected and installed at the Annual School of Instruction, herein referred to as the SOI.

**Section 3.** Officer's terms shall be one year and officers shall serve no more than two (2) consecutive terms in the same office. The terms of the Officers shall begin at the close of the SOI and end at the close of the SOI the following year.

## **ARTICLE V — Districts and Directors**

**Section 1.** District Directors shall be Active members in good standing and shall be comprised of one (1) director from each of the Association's four (4) districts as follows:

**District I:** Shall be the area, including all cities and towns that lie therein, created by the counties of Augusta, Arlington, Clark, Culpeper, Fairfax, Fauquier, Frederick, Greene, Highland, Loudoun, Madison, Orange, Page, Prince William, Rappahannock, Rockingham, Shenandoah, Spotsylvania, Stafford, and Warren.

**District II:** Shall be the area, including all cities and towns that lie therein, created by the counties of Alleghany, Amherst, Appomattox, Bath, Bedford, Bland, Botetourt, Buchanan, Campbell, Carroll, Craig, Dickenson, Floyd, Franklin, Giles, Grayson, Henry, Lee, Montgomery, Patrick, Pittsylvania, Pulaski, Roanoke, Rockbridge, Russell, Scott, Smyth, Tazewell, Washington, Wise, and Wythe.

**District III:** Shall be the area, including all cities and towns that lie therein, created by the counties of Albemarle, Amelia, Brunswick, Buckingham, Caroline, Charlotte, Chesterfield, Cumberland, Dinwiddie, Fluvanna, Goochland, Greensville, Halifax, Hanover, Henrico, King George, Louisa, Lunenburg, Mecklenburg, Nelson, Nottoway, Powhatan, Prince Edward, Prince George, Surry and Sussex.

**District IV:** Shall be the area, including all cities and towns that lie therein, created by the counties of Accomack, Charles City, Essex, Gloucester, Isle of Wight, James City, King and Queen, King William, Lancaster, Mathews, Middlesex, New Kent, Northampton, Northumberland, Richmond, Southampton, Suffolk, Westmoreland, and York.

**Section 2.** District Directors shall be elected and installed at the SOI. The terms of District Directors shall begin at the close of the SOI and end at the close of the SOI the following year.

## **ARTICLE VI — Board of Directors and Duties**

**Section 1.** A Board of Directors is hereby established to manage the policies, business, property and affairs of the Association.

**Section 2.** Voting members of the Board shall be Active members in good standing and comprised of the Officers, District Directors, Immediate Past President, Executive Secretary and Chair of each standing committee.

**Section 3.** Non-voting, ex-officio members of the Board shall be as follows:

- A. Any Association member from Virginia serving on the International Code Council Board of Directors.
- B. The VPMIA representative currently serving on the Executive Council of the International Code Council Region VII.
- C. The Deputy Director or his or her representative of the Division of Building and Fire Regulation at the Virginia Department of Housing and Community Development.
- D. The President, or his or her representative of the Virginia Building and Code Officials Association, Virginia Fire Prevention Association, and Virginia Chapter of the International Association of Electrical Inspectors.
- E. Any member of the Association, or of the Virginia Building and Code Officials Association serving as a Representative on the Board for Contractors of the Virginia Department of Professional and Occupational Regulation.

**Section 4.** The Board shall appoint an Executive Secretary for a maximum term of five (5) years, or as otherwise approved by the Board.

*(continued)*

### Constitution and By-Laws, page 3

**Section 5.** The Board shall require the Treasurer to be bonded. The amount, timeframe and terms of the bond shall be approved by the Board. The Association shall pay the bond premium and any other costs associated with the bond.

**Section 6.** The Board shall appoint members to fill unexpired terms or vacancies on the Board within forty-five days.

**Section 7.** An executive session of the Board shall be conducted at the request of any member of the board, when approved by a two-thirds majority of the Board's voting members present. Only voting members of the Board and those individuals deemed necessary by the President to the purpose of the meeting are permitted to attend the executive session.

**Section 8.** The Board is hereby authorized to conduct business through electronic messaging, teleconference or other remote participation methods provided the quorum and voting requirements specified herein are observed. A minimum of three (3) business days notice shall be provided by the President or their designated representative prior to the meeting.

**Section 9.** Board members shall, upon receipt of draft Board and Membership meeting minutes, review such minutes and advise the Secretary of any suggested modifications within five (5) business days.

**Section 10.** Duties and responsibilities of each Board member shall be as described in the Board of Directors Job Description Policy, approved by the Board.

### ARTICLE VII — Committees

**Section 1.** The standing committees are:  
Advertising/Yearbook, Auditing, Awards, Bylaws, Certification/Education, Finance, Legislative, Nominating, Plumbing /Mechanical/Fuel Gas, SOI, Time/Place, Membership and Information Technology.

**Section 2.** Standing Committee chairs shall be appointed by the President, unless otherwise specified in this article, within 30 days following the close of the SOI. Members of the committees shall be appointed by the chair unless otherwise specified in this article.


**Section 3.** The following standing committees shall be comprised of a minimum of three (3) members including the chair:

- A. Advertising and Yearbook
- B. Auditing
  - 1. The Treasurer shall not serve on this committee.
- C. Awards
- D. By-Laws
- E. Certification and Education
- F. Finance
  - 1. The Treasurer shall serve as the chair.
- G. Information Technology
  - 1. The webmaster shall serve as the chair.
- H. Membership
  - 1. The Executive Secretary shall serve as the chair.
- I. Nominating
  - 1. The Immediate Past President shall serve as the chair.
- J. Plumbing/Mechanical/Fuel Gas.
- K. Time and Place.
- L. School of Instruction
  - 1. The Executive Secretary shall serve on this committee.
  - 2. The chair of the time and place committee shall serve on this committee.

*(continued)*

**Participate**

Attend ANY of the Board of Directors meetings and THREE General Membership meetings throughout the year.



Check the VPMIA website, [www.vpmia.org](http://www.vpmia.org) for the most current meeting information.





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## Constitution and By-Laws, page 4

**Section 4.** Legislative Committee shall be comprised of the committee chair and any member willing to serve.

**Section 5.** Special Ad Hoc committees shall be appointed by the President when deemed necessary by the President or the Board. The committee shall be comprised of a minimum of three (3) members and shall operate at the discretion of the Board. The committee chair will not have Board voting rights.

### ARTICLE VIII — Meetings

**Section 1.** A minimum of two (2) membership meetings shall be held per year.

**Section 2.** First Membership Meeting shall be held at a time, Date and location approved by the Board. The meeting shall be for the purpose of receiving reports from the Officers, District Directors, committees and for any other business that may arise. A minimum of fifteen (15) Active members present shall constitute a quorum.

**Section 3.** The SOI shall be held at a time, Date and location approved by the Board. The date and location shall be approved a minimum of one (1) year in advance of the SOI. The SOI shall be for the purpose of conducting the Second Membership Meeting, providing educational programs, electing Officers, District Directors, receiving reports from Officers, District Directors, committees and for any other business that may arise. A minimum of fifteen (15) Active members present shall constitute a quorum.

**Section 4.** Meetings of the Board shall be held on the call of the President, but not less than three (3) times each year. A majority of the Board's voting members shall constitute a quorum.

**Section 5.** Special membership or Board meetings may be called by the President or the Board of Directors. Official notice of the meeting shall be sent by mail or electronically to the members a minimum of fourteen (14) days prior to the date thereof. The purpose of the meeting is to conduct business of the Association. A minimum of fifteen (15) active members present constitute a quorum for a special membership meeting or a majority of the Boards voting members for a Board meeting. Special meetings may be conducted using electronic messaging or teleconference.

### ARTICLE IX — Parliamentary Authority

*The current edition of Robert's Rules of Order Newly Revised* is the Associations final Authority on all questions of procedure and parliamentary law not covered by the Constitution and By-laws nor by any special rules of order adopted by the Association.

### ARTICLE X — Amendment of Bylaws

*These bylaws may be amended* during any membership meeting by a two-thirds majority of Active members present and voting, provided such amendment has been submitted in writing by any member to the Bylaws Chair not less than thirty (30) days in advance of a Board meeting for review and recommendation; and further provided such amendment has been posted on the Association's website not less than thirty (30) days prior to the membership meeting.

### ARTICLE XI — Code of Ethics

*We the members of the Association* acknowledge that our profession has a direct and vital impact on the quality of life of all Virginia citizens and of all others who may live, work, play, and visit within the Commonwealth. We the members are therefore dedicated to the highest standards of professionalism, integrity, and competence, and we do pledge to adhere to the following principles of ethical behavior:

- *Recognize that the health, safety, and welfare of the public are our top priorities and acknowledge that the primary function of government is to serve the best interests of the people.*
- *Consider our profession a distinct opportunity to serve society.*
- *Demonstrate honesty, integrity, and uniformity in the discharge of our duties.*
- *Treat all persons with courtesy and respect.*
- *Conduct ourselves in a manner which creates and maintains respect for the Association and the industry it represents.*
- *Refuse to leverage our positions to secure advantage or favor for ourselves, our family, or friends.*
- *Refrain from representing private interests in any business or affairs of the Association.*
- *Remain loyal to the Virginia Plumbing and Mechanical Inspectors Association and pursue its mission and objectives in a manner consistent with the public good.*

According to History, these By-laws were adopted November 1962. Amended April 1988, December 1990, December 1994, April 2006, April 2007, April 2008, October 2010, July 29th, 2011, and July 30, 2014.

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## Acknowledgments

**T**his Yearbook is funded with advertising from industry members and friends who support the mission of VPMIA. *Please join me in acknowledging each advertiser listed on page 3 for their contribution.* We are fortunate to have such strong support that advertisement income repeatedly covered all, or most of this publication's printing costs. *Please take time to visit and personally thank our Tabletop Exhibitors listed on page 35* (some of whom are advertisers as well).

I thank the following for their contributions to the 2015 Yearbook: **Contributing authors:** Lee Clifton of ICC and Luis Escobar of ACCA; **Active members:** Jesse Hurt, Paul Rimel; **Advertising and Yearbook Committee members:** John Seay, Ron Bladen, and Jane Fitzgerald, Fitzgerald Art & Design; and **Printing services:** Christiana Giel, Doyle Printing.

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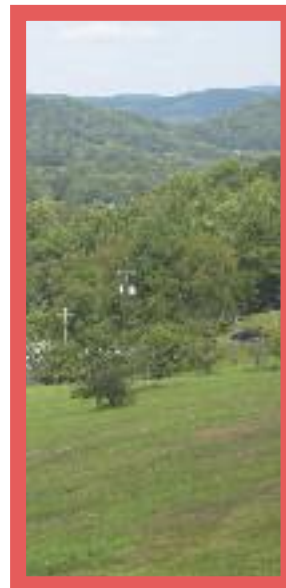


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Make a note:  
Information on this Summer's SOI will soon be posted on VPMIA's website [www.VPMIA.org](http://www.VPMIA.org)



# 2014



# 2015

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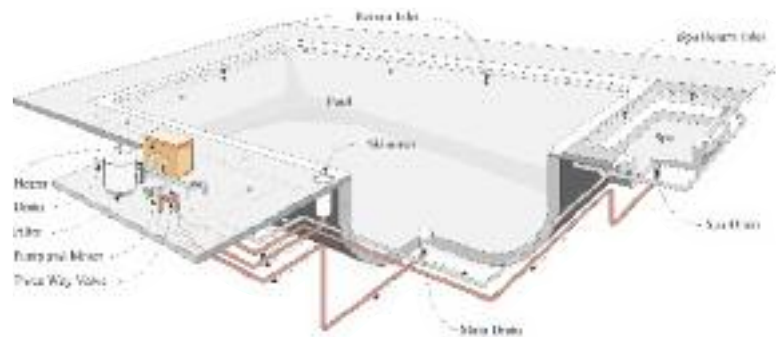
Typical Residential Pool with Spa

In this article we will take a close look at the circulation and piping requirements for pools and spas that are noted in the 2012 International Swimming Pool and Spa Code™ (ISPSCTM). It is important in the inspection of pool and spa installations to understand how pools and spas work. The pump is the heart of a circulation system, which keeps the water in constant motion through the pipes and support equipment, where it is filtered, heated and chemically treated. There are various valves, gauges and meters that direct the water-flow through the system.

### Operation

In a typical circulation system water is drawn from the pool or spa through the suction outlets to the pump. In the engineering of a pool and spa circulating system this is commonly referred to the *Suction* side of the system. The water is pushed out of the pump, through the filter system and back to the pool or spa. This is referred to as the *pressure* side of the system. This side of the system is where most pools and spas use a heating system and sanitizing equipment. Sanitizing equipment should be installed, in most cases, after the water has been filtered

and heated, so as not to damage equipment through direct contact with the sanitizers. Section 319 of the ISPSCTM requires the equipment to be capable of introducing the correct quantity of sanitizer necessary to maintain the appropriate levels under all conditions of its intended use. Chemical feed systems when installed shall be installed in accordance with the manufactures specifications. The chemical feed pump is required to be wired so that it cannot operate unless there is adequate return flow to disburse the chemical throughout the vessel as designed.



(Continued on next page)



AN ARTICLE BY LEE CLIFTON

Based on the 2012 International Swimming Pool and Spa Code™ (ISPSCTM)

## Design

A circulation system as stated in Section 311.2 consist of pumps, piping, return inlets and outlets, filters, and other necessary equipment are to be provided for the complete circulation of water. Wading pools and spas are to have a separate dedicated filtering system except for residential aquatic vessels.

## Turnover Rate

*Turnover rate* is the amount of time it takes to circulate the entire water volume through the circulation system once. Proper turnover is important, because, if water circulates too slowly, it is more likely to grow stagnant and breed algae, insects such as mosquitoes and disease causing germs. The minimum required turnover rate for a permanent in ground residential pool as required by Section 810.1 is 12 hours. The system shall be designed to give the proper turnover rate based on the manufactures specified maximum flow rate of the filter, with a clean media condition of the filter. Table 407.2 in Chapter 4 require that Class A, B, and C public pools turnover rate hours equal 1-1/2 times the average depth of the pool in feet not to exceed 6 hours. Wading pools are to be 1 hour. Once the turnover rate for the pool or spa and the total capacity in gallons (liters) has been determined, the flow rate can be calculated. Flow rate expressed in gallons per minute (gpm) or liters per minute (Lpm) is calculated by dividing the capacity (gallons/liters) by the turnover rate in minutes:  
Flow rate = capacity ÷ turnover rate [hours] x 60 [minute]

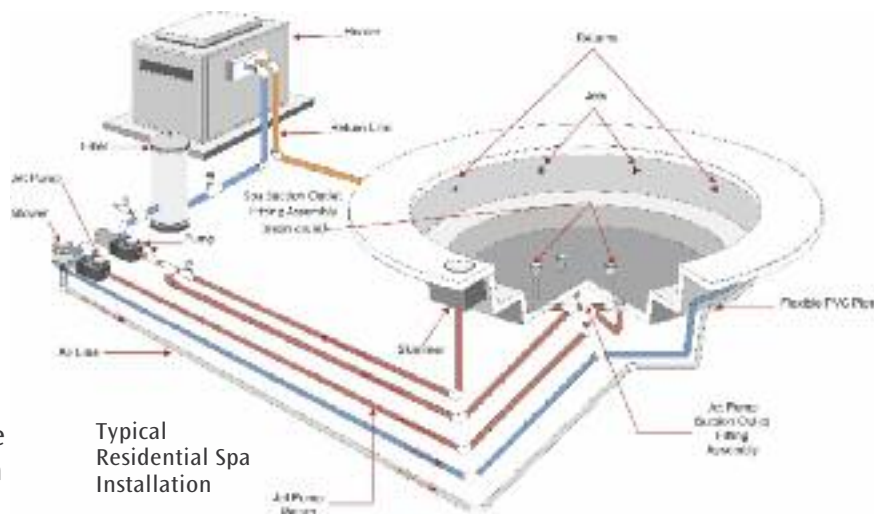
Example: It has been determined that a swimming pool with a capacity of 30,000 gallons must have a turnover rate of 12 hours. What flow rate will achieve a 12 hour turnover?  
Flow rate = capacity ÷ (turnover rate in hours x 60 minutes)  
Flow rate = 30,000 gallons ÷ (12 hours x 60 minutes.)  
Flow rate = 30,000 gallons ÷ 720 minutes = 42 gpm

The piping in the circulation system must be sized so that the water piping, at the calculated flow rate does not exceed the recommended velocity.

## Velocity and Friction Loss

The pipes and equipment in a circulation system must be large enough to handle the required flow rate, without pushing the water to fast. A good example would be to try and blow a cup full of milk through a straw in a minute or less. In a large straw the milk will travel more slowly than in a small straw. If you're the pump, the one minute is the required turnover, and the straw is the pipes and equipment. It is easy to see over time, the lower velocities cause less wear and tear on the pipes and equipment.

The term velocity refers to the speed of water, measured in feet or meters per second (fps or mps), through a pipe line or individual piece of equipment in the hydraulic



Typical Residential Spa Installation

system. Section 311.3 requires that the water velocity in return lines not exceed 8 feet per second and the water velocity in suction piping comply with the *APSP-7 Standard for Suction Entrapment*. Water flow should never exceed recommended maximum velocities through the circulation system for two reasons. First high velocities can contribute to suction entrapment incidents an, where a bather is trapped by the suction created by rapid water flow and turbulence around a drain or suction fitting. This is a particular danger for children, who are too small to break away. High velocities also put stress on the piping and circulation system. The *APSP-7 Standard for Suction Entrapment* requires the maximum water velocity in branch suction piping shall be limited to 6 feet per second (fps) (1.829 mps) when one of a pair is blocked. In normal operation then, the branch suction piping velocity is 3 fps (0.914 mps). All other suction piping velocities shall be 6 fps (1.829 mps) for public pools or 8 fps (2.438 mps) for residential pools. Sizing charts are available from manufacturers of PVC pipe, which illustrate flow rates in feet per second. In essence, the calculations are already done for you, which can streamline the process of checking your piping systems.

## Pump

A typical aquatic vessel circulation system will include a pump to provide for circulation of the pool water. The pump shall be capable of providing the flow required for filtering the pool water and filter cleaning, if applicable, against the total dynamic head developed by the complete system. The intake protection is ensured by Section 313.3 requiring that a cleanable strainer, skimmer basket, or screen be provided for public aquatic vessels, upstream or as an integral part of circulation pumps, to remove solids, debris, hair, and lint on all pressure filter systems.

Service and maintenance needs of equipment are an important part of this code. Section 313.4 requires the location of pumps and motors to be accessible for inspection and service in accordance with the manufactures instructions. Section 313.6 states that shutoff valves are required to be installed on the suction and discharge sides of pumps that are located below the waterline and shall be accessible.



## Return Inlets

Section 314.4 states that there shall be one return inlet for each 300 square feet (27.87 m<sup>2</sup>) of pool surface area, or fraction thereof with the exception of onground storable pools.

In the design of a return system, the general direction of the water flow should be toward the deep end and from the bottom towards the surface. Return inlets are sometime installed in the pool walls, floors, or both. Where skimmers are used, the return inlets should be located so

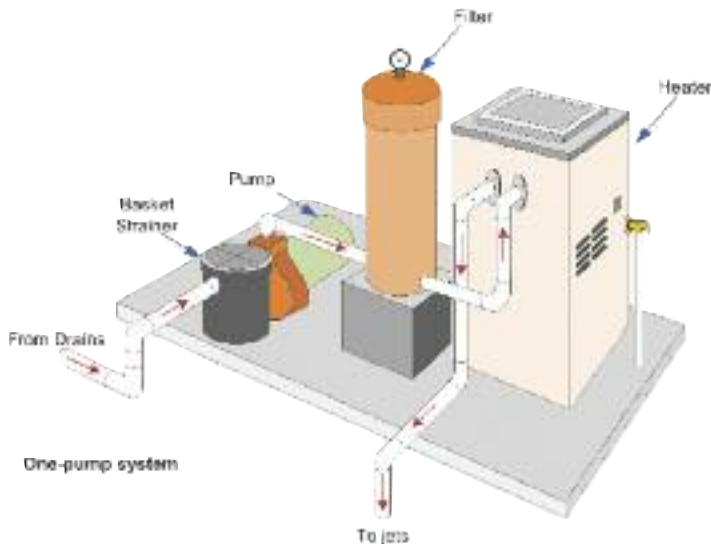


as to help bring floating particles within range of the skimmers. Compliance with ISPS Sections 314 will ensure the proper distribution of water flow and chemicals why not constituting a hazard to the bather.

## Skimmers

The provisions of Section 315 apply to skimmers for all aquatic vessels with the exception of portable residential spas and portable residential exercise spas. Removing surface water is important, because it contains the most contaminants. The water is moved from the surface of the pool and or spa through skimmers or overflow gutters by the circulation pump. Section 315.2 requires a surface skimming system be provided for public aquatic vessels. However there is an exception for Class D public pools designed in accordance with Chapter 6. This chapter covers public pools and water containment systems for aquatic recreation.

Section 315.2 requires that surface skimming systems be designed and constructed to skim the surface when the water level is maintained within its operational perimeters. Table 315.3 has been provided for the proper sizing of automatic surface skimmers where they are used



as the sole overflow system. At least one surface skimmer shall be provided for the square foot areas or fractions there-of, noted in Table 315.3.

Many large residential and public pools have a perimeter gutter system (a continuous trough running all around the pool) instead of a skimmer. The gutter opening, at the waterline catches a thin sheet of overflow water and which is routed from the gutter, through pipes to a surge tank and, from there back to the pump. Where a perimeter type surface skimming system is used as the sole surface skimming system, the system is to extend around not less than 50% of the aquatic vessel perimeter. These systems shall be connected to a circulation system with a system surge capacity of not less than 1 gallon for each square foot (40.7 liters per square meter) of water surface. The capacity of the perimeter overflow system and related piping is permitted to be considered as a portion of the surge capacity. A perimeter overflow system not commonly found in permanent inground residential pools is allowed by Section 315.2 in place of skimmers. Water level is critical when using gutters, to ensure proper skimming action. You will find that there are additional and sometime more restrictive requirements by state and local public health authorities and local jurisdiction for public pools.

## Heaters

The provisions of Section 316 apply to heaters of all aquatic vessels. Heaters are to be sized in accordance with manufactures instruction. The installation of these heaters, along with related piping and accessories are governed by the International Fuel Gas Code, International Mechanical Code, International Energy Conservation Code, NFPA 70 or the International Residential Code as applicable in accordance with Section 102.7.1. There are five basic types of pool/spa heaters: Gas or oiled-fired heaters; Heat pumps; Solar heaters; Radiant heat systems; and Electric.



Section 316.4.1 requires a means to monitor water temperature. We are not only concerned with the comfort of the bather and protection from scalding, but the water balance, evaporation, chlorination, and algae growth (warmer temperatures encourage growth).

This 2012 edition of the ISPS Code and Commentary is also available. It includes the complete ISPS with commentary after each section and also includes the APSP-7 Standard for Suction Entrapment Avoidance.

*Lee Clifton, Director of Plumbing, Mechanical, Fuel Gas Resources (PMG) for the International Code Council (ICC) has 40 years of experience in the Plumbing, Mechanical, and Fuel Gas Industry. His career began as a second generation plumber, working for his father at Clifton Plumbing Inc. in Tampa, Florida. He retired from the City of Los Angeles in 2007 as a Principal Inspector after 21 years of service.*

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# Implementing Manual S

In 2012, Virginia recognized ANSI/ACCA 3 Manual S for Residential HVAC Equipment Selection. Since going into effect state-wide (and nation-wide in the model codes), ACCA received feedback from all sectors of the industry to improve Manual S. So ACCA undertook a multi-year revision effort that culminated in the new version recognized by the American National Standards Institute in 2014. This article is an introduction to the contents of this updated, code-recognized standard.



## REVISION BASICS

One look at the new Manual S and you might be overwhelmed by the size difference. But the changes are predominately to layout, the equipment selection principles remain the same. The following is the basic information about the revised format:

- The book is split into two parts: the first part is normative and covers the requirements, while the second part is informative and is comprised of explanations / examples / appendices.

- The requirements in the normative part (only 22 pages) are now written in mandatory language for ease of enforcement by code officials; the sections of this normative part are:

- N1 – Definitions and General Requirements.
- N2 – Equipment Size Limits.
- N3 – OEM Verification Path.

- Glossaries for terms and acronyms have been added.

The revised Standard does have some non-formatting revisions that should be noted. Specifically:

- All oversize limits were reviewed and criteria expanded in recognition of new equipment capabilities.

- The new Standard explicitly addresses sizing requirements for multi/variable-speed equipment offerings.

- The rationale for the Normative Section N2 sizing limits is clearly presented in Appendix 20.

## EQUIPMENT SELECTION PROCEDURE

The equipment selection procedures have not changed since the previous version of the Standard. They are,

however, stated up front in Section N1, and apply to all equipment types. As a refresher, the steps for contractors are as follows:

### 1. Begin with the load calculation per ACCA Manual J.

There will be two loads: a peak heating load (Winter), and a peak cooling load (Summer).

### 2. Get original equipment manufacturer (OEM) performance data for the equipment they're interested in.

This data will contain specific values for how the equipment performs (e.g., total and sensible capacity, external static pressure, etc.) for various conditions (e.g., condenser entering air temperature, fan speed, etc.) and usually comes in table format.

### 3. Determine the blower Cfm values (for cooling and heating).

a. Using the home's sensible heat ratio (SHR), they'll calculate airflow value. Specifically, they'll use the equation  $CFM = \frac{BTUH_{sens}}{\Delta T \times 1.1 \times ACF}$  where CFM is the target airflow

in cubic feet per minute;  $BTUH_{sens}$  is the home's sensible cooling load;  $\Delta T$  is the temperature difference in the air between the inlet and outlet of the furnace or cooling coil; 1.1 is a physical constant; and ACF is the Altitude Correction Factor.

b. The actual blower Cfm will be determined from the OEM performance data.

### 4. Determine a target entering air condition (for cooling and heating).

This will include the dry-bulb and wet-bulb temperatures of the air entering the equipment from the conditioned space air; any changes caused by the return air duct (e.g., if they're located in unconditioned space); and any changes caused by bringing in outdoor air and mixing it with return air.

### 5. Extract capacity values from OEM performance data for the design conditions used to produce the load calculation.

a. The data presented by the OEM will usually not exactly match the conditions for the home (e.g., CFM, entering dry- and wet-bulb temperatures, etc.). This may require that the designer interpolate from the data provided by the OEM to find the actual capacity for the equipment at the design conditions.

b. Please see the caution below about using AHRI ratings for sizing the equipment.



**6. Select equipment that conforms to the sizing limits contained in Section N2 of Manual S.**

- a. The capacity value calculated in the previous step must fall within the acceptable range given for each equipment type.
- b. Manual S explicitly states that cooling equipment SHALL NOT be sized for load spikes due to occasional periods of unusually high loads (e.g., entertainment).

**7. Document the design.**

Manual S requires that the designer save copies of each step of the process; this documentation may be requested at the AHJ's discretion to verify compliance with the requirements.

If you'd like to see an example step-by-step equipment selection, please see *The New HVAC Equipment Sizing Code: An Introduction to ACCA Manual S*, by Wesley Davis in the 2009 VPMIA yearbook at [www.vpmia.org](http://www.vpmia.org).

Equipment Types Covered	
<ul style="list-style-type: none"> <li>• AHRI cooling-only equipment</li> <li>• AHRI-certified heat pump equipment (single-, two-, and variable-speed)</li> <li>• Electric heating coils</li> <li>• Fossil fuel furnaces</li> <li>• Water boilers</li> </ul>	<ul style="list-style-type: none"> <li>• Water heaters used for space heat</li> <li>• Dual fuel systems</li> <li>• Ancillary dehumidification equipment</li> <li>• Humidification equipment</li> <li>• AHAM appliances</li> <li>• Direct evaporative cooling equipment</li> </ul>

**CAUTION: USE OF AHRI RATINGS FOR SIZING**

AHRI-rated equipment is evaluated at air temperatures of 80°F db / 67°F wb entering the indoor unit, and 95°F entering the outdoor unit. This provides a standard testing point for equipment capacity and efficiency, but makes the AHRI rating value inappropriate for use in equipment sizing and selection. No one wants an 80°F indoor space temperature in the summer! And not every location will have a 95°F outdoor design temperature. So, interpolation of OEM expanded data is needed to obtain correct equipment performance.

**SIZING LIMITS SPECIFICS**

Table 1 (See next page) is an extract from Manual S that contains an overview of the new size limits for cooling-only, heat pump, electric heating coils, furnaces, and water boilers.

**HEAT PUMPS SIZING LIMITS**

You'll notice some differences for the sizing limits for heat pumps, an equipment type that is very common

across the state. The first difference is that the minimum sizing limit has been lowered from 0.95 to 0.90 x the Manual J cooling load. This allows for smaller equipment, which would run longer and thus be able to remove more moisture from the indoor environment. The revised Standard also has new maximum limits for multi- and variable-speed equipment: 1.30 and 1.35 x the cooling load, respectively. This allows greater application of this equipment, while still ensuring that proper humidity control is provided.

**FREE Resources for ICC Members**

ACCA has developed a wide variety of technical information to address the educational needs of code officials. In a special arrangement with the International Code Council, any ICC member can become a member of ACCA by visiting [http://www.iccsafe.org/MyICC/Documents/ACCA\\_Membership\\_Application.pdf](http://www.iccsafe.org/MyICC/Documents/ACCA_Membership_Application.pdf), thereby getting access to ACCA educational material.

By becoming an ACCA member, you'll have access to the full archive of ACCA Town Hall presentations. On 5 June 2014, ACCA held a presentation entitled, *What's New with ANSI/ACCA Manual S* (Residential

*(Continued on page 33)*



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Equipment Selection), which goes into detail about the content of the revised Standard.

Also available for free view on the ACCA codes page ([www.acca.org/standards/codes](http://www.acca.org/standards/codes)) is a three part video series entitled, **What Code Officials Need to Know About HVAC System Design**. This video series is targeted directly at code officials and covers load calculations (Manual J), equipment selection (Manual S), and duct sizing (Manual D). The three-part series runs slightly over two hours. •

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TABLE 1

Overview of Size Limits for Residential HVAC Equipment								
Equipment <sup>a</sup> Tested and Rated by the AHRI	Attributes of Local Climate Notes b, c	Issue	Minimum (deficient) and Maximum(excessive) Capacity Factors. <sup>d</sup>					
			Single-Speed Compressor			Multi- and Variable-Speed Compressor		
			Air-Air	GLHP <sup>e</sup>	GWHP <sup>f</sup>	Air-Air	GLHP <sup>e</sup>	GWHP <sup>f</sup>
Air-Air and Water-Air Cooling-Only & Heat Pump	Mild Winter or Has a Latent Cooling Load	Total	0.90 to 1.15		1.25	0.90 to 1.20 <sub>multi</sub> or 1.30 <sub>variable</sub>		1.30 <sub>m</sub> or 1.35 <sub>v</sub>
		Latent	Minimum = 1.00. Preferred maximum = 1.50 (may exceed 1.5 if no reasonable alternative).					
		Sensible	Minimum = 0.90. Maximum determined by total and latent capacities.					
Air-Air and Water-Air Heat Pump Only	Cold Winter and No Latent Cooling load	Total	Maximum capacity = <b>Manual J</b> total cooling load plus 15,000 Btuh; Minimum factor = 0.90					
		Latent	Latent capacity for summer cooling is not an issue.					
		Sensible	Not an issue (determined by the limits for total cooling capacity).					
a) Central ducted; ductless single-split; ductless multi-split equipment. AHRI: Air Conditioning, Heating and Refrigeration Institute. b) Mild winter: Heating degree days for base 65°F divided by cooling degree days for base 50°F less than 2.0. Cold winter = 2.0 or more. c) Latent cooling load: <b>Manual J</b> sensible load divided by <b>Manual J</b> total load less than 0.95. No latent load = 0.95 or more. d) Minimum and maximum capacity factors operate on the total, latent, and sensible capacity values produced by an accurate <b>Manual J</b> load calculation (per Section 2 of the Eighth Edition of <b>Manual J</b> , version 2.0 or later). Multiply a size factor by 100 to convert to a percentage. For example, 1.15 excess capacity = 115% excess capacity. e) GLHP: Ground loop heat pump (water in buried closed pipe loop). f) GWHP: Ground water heat pump (ground water from well, pond, lake, river, etc., flows through equipment and is discarded).								
Electric Heating Coils	Furnaces; Heat Pump supplement; emergency	Load (Btuh)	Maximum KW		Minimum Capacity Factor		Maximum Capacity Factor	
		≤ 15,000	5.0		Satisfy Load		See Maximum KW	
		> 15,000	See Min and Max		0.95		1.75	
Minimum and maximum capacity factors operate on the heating load produced by an accurate <b>Manual J</b> load calculation. Multiply a size factor by 100 to convert to a percentage.								
Natural Gas, Oil, Propane Furnaces	Duty	Minimum Output Capacity			Maximum Output Capacity			
	Heating-only	1.00			1.40			
	Heating-Cooling Preferred				2.00			
Minimum and maximum capacity factors operate on the heating load produced by an accurate <b>Manual J</b> load calculation. Multiply a size factor by 100 to convert to a percentage. For heating-cooling duty, blower performance must be compatible with the cooling equipment.								
Electric, and Fossil Fuel Water Boilers	Duty	Minimum Output Capacity			Maximum Output Capacity			
	Gravity or forced convection terminals in the space, water coil in duct or air-handler.	1.00			1.40			

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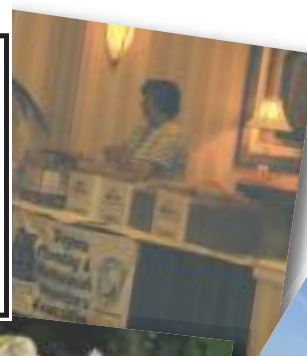
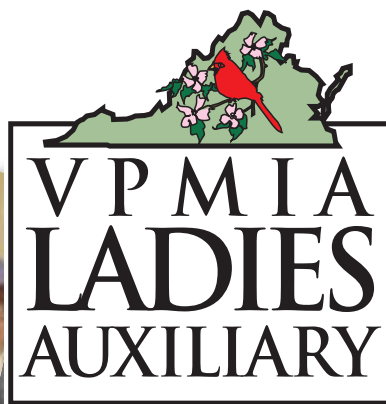
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## 2015 PROGRAM TBD

Join us this week to enjoy the local scene with our friendly group. As this Yearbook goes to press, activities for spouses are being planned for Wednesday, Thursday and Friday morning. Stop by the Registration desk for updated information on the plans.

Spouses attending the SOI may join in any of the activities as our guests.

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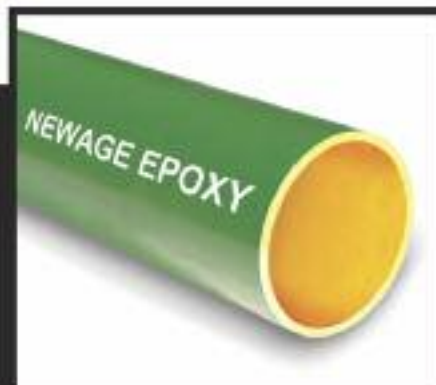
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**In the past ten years,** much was accomplished: **there were increased state-wide, training opportunities** – there were continuing partnerships with DPOR and DHCD – **the facilitation of mentoring programs** – VPMIA was named the ICC Chapter of the Year in 2011 – **named ICC Merit Chapter of the Year in 2005** – the establishment of an active website: [www.VPMIA.org](http://www.VPMIA.org) – **the promotion of Building Safety Month** – participation in VTEC – VPMIA celebrated its 50th Anniversary in 2012 – **its 50th School of Instruction in 2013** – participated in four Joint Conferences: 2005 in Hampton, 2008 in Wytheville, 2011 in Virginia Beach, and 2013 in Richmond – **Annual Schools of Instruction have taken place in Blacksburg, Charlottesville, Fredericksburg, Front Royal, Richmond, Staunton, Virginia Beach, and Winchester** – VPMIA members Steve Shapiro, Bill Dupler, and Guy Tomberlin have served as President of ICC. **We can do more.**





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FOR ADDITIONAL INFORMATION CONTACT:

**Shelton Cartwright, Jr.**

*WaterFurnace Virginia Territory Manager*

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**Residential Plans Examiner Review Form  
for HVAC System Design (Loads, Equipment, Ducts)**

County, Town, Municipality, Jurisdiction  
Header Information

Contractor: \_\_\_\_\_  
Mechanical Designer: \_\_\_\_\_  
Building Plan #: \_\_\_\_\_  
Home Address (Street or Lot#, Block, Subdivision): \_\_\_\_\_

REQUIRED ATTACHMENTS	ATTACHED
Manual J Form and supporting worksheets or HVAC Form J and supporting worksheets	Yes <input type="checkbox"/> No <input type="checkbox"/>
Manual S Form and supporting worksheets	Yes <input type="checkbox"/> No <input type="checkbox"/>
Manual D Form and supporting worksheets	Yes <input type="checkbox"/> No <input type="checkbox"/>
Manufacturer's literature	Yes <input type="checkbox"/> No <input type="checkbox"/>

**HVAC LOAD CALCULATION (ACC 414.1-1)**

**Design Conditions**

**Winter Design Conditions**

Outdoor Temperature \_\_\_\_\_ °F  
Indoor Temperature \_\_\_\_\_ °F  
Total Heat Loss \_\_\_\_\_

**Summer Design Conditions**

Outdoor Temperature \_\_\_\_\_ °F  
Indoor Temperature \_\_\_\_\_ °F  
Sensible Heat Gain \_\_\_\_\_ Btu/h  
Latent Heat Gain \_\_\_\_\_ Btu/h  
Total Heat Gain \_\_\_\_\_

**HVAC EQUIPMENT SELECTION (ACC 414.1-2)**

Heating Equipment Data	Cooling Equipment Data	System Data
Equipment Type _____ Manufacturer/Model _____	Equipment Type _____ Manufacturer/Model _____	Heating CFM _____ Cooling CFM _____
Heating output capacity _____ <small>(See manufacturer's literature)</small>	Total Cooling Capacity _____ Sensible Cooling Capacity _____ Latent Cooling Capacity _____	Static Pressure _____ <small>For recommended static pressure for design office</small>

**HVAC DUCT DISTRIBUTION SYSTEM DESIGN (ACC 414.1-3)**

Design Airflow \_\_\_\_\_ CFM  
Equipment Design CFM \_\_\_\_\_ HVAC  
Total Static Pressure Losses \_\_\_\_\_ HVAC  
Available Static Pressure (ASP) \_\_\_\_\_ HVAC

Longest supply duct \_\_\_\_\_ FT  
Longest return duct \_\_\_\_\_ FT  
Total Effective Length \_\_\_\_\_ FT  
Friction Rate \_\_\_\_\_ HVAC  
Source: ACC 414.1-3.1

Duct Materials (Use circles)  
Flex duct: Duct board, Flex, Sheet metal, Lined duct board, Other (specify) \_\_\_\_\_  
Branch/Duct: Duct board, Flex, Sheet metal, Lined duct board, Other (specify) \_\_\_\_\_

Before the load calculation, equipment selection, and duct system design were completed on the building plans listed above, I understand the claims made on these forms will be subject to review and verification.

Contractor's Printed Name \_\_\_\_\_ Date \_\_\_\_\_  
Contractor's Signature \_\_\_\_\_

Received for County, Town, Municipality, or Authority having jurisdiction use

Form published by ACCA Form Division Manager Editor: Don Rice

## Residential Plans Examiner's HVAC Review Form

The information you need for a quick and simple evaluation of the HVAC system's design, all in one place.

ACCA developed this form to facilitate the enforcement of the Virginia Residential Code by VPMIA members. The form can be customized with your department's logo and is available for free download at [www.acca.org/standards/codes/system-design-review-form](http://www.acca.org/standards/codes/system-design-review-form)

For free ACCA membership, please complete and submit the application found at [http://www.iccsafe.org/MyICC/Documents/ACCA\\_Membership\\_Application.pdf](http://www.iccsafe.org/MyICC/Documents/ACCA_Membership_Application.pdf).

Check out these other ACCA resources for code officials at [www.acca.org/codes](http://www.acca.org/codes):

- Brochures addressing the verification of ACCA Manuals J (load calculations), D (duct sizing), and S (equipment selection)
- Three part video series, *What Code Officials Need to Know About HVAC System Design*
- *Bob's House*, a residential HVAC design case study

For technical support  
contact: Luis Romeo Escobar  
Manager, Codes and Standards  
[luis\\_escobar@acca.org](mailto:luis_escobar@acca.org)

