2011-2012

ASPE
PLUMBING
HANDBOOK

REGION 2:
GREAT LAKES

CLEVELAND
CHAPTER

www.clevelandaspe.org
CONTENTS

NATIONAL SOCIETY
Society Board of Directors........................................................... 5
Regional Directors........................................................................ 6
CPD Certification.......................................................................... 8
ASPE Research Foundation........................................................ 9
Aims of ASPE............................................................................. 11
Membership Information ............................................................ 12
ASPE Plumbing Engineering Design Handbooks...................... 16

CLEVELAND CHAPTER
Cleveland Board of Directors..................................................... 17
ASPE and Cleveland Chapter.................................................... 18
Cleveland Chapter Committees ................................................. 27
Cleveland Chapter Membership................................................ 28

ENGINEERING DATA
History of Plumbing.................................................................... 35
Evolution of Plumbing Codes..................................................... 51
Basic Principles of A40.8 ........................................................... 59
Water Facts................................................................................ 62
Conversion Factors..................................................................... 63

DETAILS
Floor Cleanout Detail ................................................................. 65
Wall Cleanout Detail................................................................. 66
Exposed Cleanout Detail ............................................................ 67
Kitchen Grease Interceptor Sizing Guide .................................... 68
Grease Interceptor Detail............................................................ 69
Grease Trap Piping Detail .......................................................... 70
Pipe Chase Clearances for Wall Hung Carrier Closets ............. 71
Water Heater Piping Diagram .................................................... 72
Water Heater Piping Diagram .................................................... 73
Instantaneous Electric Water Heater Detail............................... 74
Recirculating Hot Water Pump Detail ........................................ 75
Trap Primer Detail................................................................. 76
Vent Through Roof Detail ....................................................... 77
Roof Pipe Curb Detail ............................................................. 78
Roof Pipe Penetration Detail..................................................... 79
Interior Wall Pipe Penetration Detail ....................................... 80
Floor Sleeve Detail .................................................................. 81
Clevis Hanger Detail ............................................................ 82
A MESSAGE FROM THE PRESIDENT

The Cleveland Chapter of the American Society of Plumbing Engineers is proud to present the Eighth Edition of the ASPE Plumbing Handbook for your use.

This Handbook has once again been completely updated and includes a list of National and Cleveland Chapter Board Members including our Local Chapter Members. These lists include the latest mailing addresses, phone numbers, fax numbers and email addresses.

We have once again included numerous Plumbing Details in the Handbook for your use. Please feel free to use any of these details, but they should be used with caution and modified to comply with your particular project needs.

The Sources of Information, Local Code Officials, Plumbing Contractor and Sprinkler Contractor sections have been updated. These sections include the latest information possible and will help you in your day to day responsibilities.

As in previous editions of the Handbook, we could not provide the information within this book without the help and support of our Advertisers. I would like to thank them once again and ask that you support those who helped make this reference book a success.

I would also like to thank Dan Evans and Mike Drab for spending many hours of their free time putting together this latest edition. A lot of work goes into putting together a reference book of this magnitude and we could not have done it without their help.

In addition to this handbook, you can visit the Society website at www.aspe.org and the Cleveland Chapter website at www.clevelandaspe.org for additional information. These web sites are updated on a regular basis and will give you the latest news and information regarding our Society. Please give Mike Drab your ongoing support for a job well done in managing our web site and newsletter.

In closing, I hope that you find this Handbook useful and a valuable resource that will help you in your daily routines. Please be generous and share this reference book with your colleagues, they too will benefit from it. This publication is one more reason to be a member of ASPE and why keeping involved is so important for networking and for this organization.

Keith Bush, CPD, CSI
President
SOCIETY BOARD OF DIRECTORS

President
William F. Hughes Jr., CPD, LEED AP, FASPE
E-mail: aspepres@aspe.org

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William M. Smith
E-mail: aspeal@aspe.org

Appointed Technical Liaison
Bill Hughes
E-Mail: aspeatl@aspe.org
REGIONAL DIRECTORS

Region 1 (Northeast)

Region 1 Director
Paul Silvestre
(215) 639-3600
E:Mail: asper1director@aspe.org


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(724) 477-1254
E:Mail: asper2director@aspe.org

Central Indiana Central Ohio Cleveland Eastern Michigan Johnstown Kentucky Pittsburgh Rochester, NY Southwestern Ohio Buffalo-Niagara Western Michigan
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Alabama
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Memphis
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Raleigh
Columbia
Nashville
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North Florida
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Intermountain
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Northern California
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Phoenix
Portland
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San Francisco
Southern Nevada

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Central Illinois
Central Texas
Chicago
Dallas/Fort Worth
Houston
High Plains
Kansas City
Minnesota
Omaha
St. Louis
Wisconsin
Tulsa
CERTIFIED IN PLUMBING DESIGN

The American Society of Plumbing Engineers sponsors the Certified in Plumbing Design (CPD) program – The international certification program for engineers and designers of plumbing systems. Completion of the CPD program and examination confers upon the successful candidate the designation CPD “Certified in Plumbing Design”. The certification program provides the profession, the plumbing industry, and the general public with a single, comprehensive qualification of professional competence for engineers and designers of plumbing systems.

The CPD is the only international credential program in the plumbing engineering field. It sets the standards for leadership within the industry and provides formal recognition of outstanding professionals with advanced skills in the design and specification of plumbing systems. The CPD designation is designed to:

- Establish specific standards for professional competence in the field.
- Identify and recognize those individuals who successfully demonstrate their acquired knowledge and abilities.
- Encourage plumbing engineers to participate in a continuing program of professional development.
- Provide a standard for educational programs in plumbing engineering.
- Enhance the status of plumbing engineering as a unique discipline.

The CPD designation is achieved through successful completion of the comprehensive CPD examination and maintained through a biennial recertification program. The examination is typically held in the month of April of even-numbered years and eligibility requires a minimum of eight years experience (or equivalent). Created to provide a single, uniform national credential in the field of engineered plumbing systems, the CPD program is not in any way connected to any state-regulated Professional Engineer (P.E.) registration.
ASPE RESEARCH FOUNDATION

The Research Foundation of the American Society of Plumbing Engineers was established in 1976 to foster a continuing program of technical research in the field of plumbing design and engineering. With this research, it is hoped to significantly expand the body of scientific knowledge in the field, to the benefit of the profession and the general public.

FOCUS OF THE FOUNDATION

The Foundation is an organization that is not equipped to undertake major definitive research involving huge financial obligations and years of coordinated effort from geographically and professionally dispersed participants to the end that published results have no direct, timely or even foreseeable returns to individual ASPE members or Foundation coffers. However, the Foundation is equipped to take on basic research. All major definitive research has its basis in basic research conducted for the purpose of stimulating interest and obtaining funding for a specific topic of interest to the profession. Typically, basic research references existing literature and illustrates questions, contradictions and inconsistencies in a particular topic with the purpose of focusing further on resolving these issues by definitive research. Your ASPE Research Foundation is ideally suited to the generation of such basic research and subsequent funding pursuits. Expenditures for basic research with the purpose of generating larger externally funded research, then become a proportional investment in future royalties rather than a recurring unrecoverable expense.

Two basic research papers have recently been developed with future topics being reviewed. The two papers, which will be available to members for downloading from the Research Foundation’s website in the near future, are:

- Scalding Temperatures Relative to Age and Physical Condition of a Person
- Emergency Eyewash and Shower Equipment: A Comprehensive Literature Review and Comparison

FINANCIAL SUPPORT

Like all non-profit organizations, the ASPE Research Foundation, Inc. depends on voluntary contributions for the conduct of the research it supports. It receives contributions from ASPE members, chapters and regions as well as industry related organizations. The Foundation’s Board of Directors is very appreciative of all the contributions that are received from these sources. When definitive external research is
conducted on the basic research topics developed by the Foundation, the organization will experience royalties to assist in future basic research projects.

Because of its non-profit status, all donations to the ASPE Research Foundation, Inc. are fully tax deductible – private, individual contributions as well as corporate gifts.

CONTACT THE FOUNDATION

If anyone has any questions, comments or requests for information, they may contact the Foundation at their email address: asperf@aspe.org.
AIMS OF ASPE

The objects of the Society are:

- To further the interest of the members through the development of their technical expertise, and to enable them to better perform the responsibilities of their positions.

- To improve the profession of plumbing engineering and thereby benefit the general public.

- To assist in solving professional problems among the engineering community as such problems affect the profession and the general public.

- To promote research in the field of plumbing engineering, and to extend the body of professional knowledge and expertise.

- To facilitate the exchange of information throughout the professional practices and responsibility, statistical research, governmental regulations, standards and/or certifications, standardized methods of keeping book and records, and related topics of interest to others.

- To advance the general scientific interest and education of the plumbing engineering profession, to inculcate the desire for scientific advancement in the field among members of this Society, and to provide appropriate recognition of significant accomplishments in this area.

- To foster greater cooperation and understanding between the members of the Society and the plumbing officials and other related professionals with whom they interact.

- To encourage participation by members on such public interest bodies as Code Committees and Standards Committees.

- To establish, register and gain public acceptance of a Society certification mark indicating a specific degree of professional expertise.

- To sponsor an engineering course of study.
HOW ASPE SERVES ITS MEMBERS

ASPE is serving its members and the plumbing engineering profession in many important ways:

- TECHNICAL DATA on plumbing engineering and the presentation of technical reports.
- OPPORTUNITY TO SHARE information and experience with others in their field.
- PLUMBING ENGINEERING DESIGN HANDBOOKS - the only handbook of plumbing design of its kind.
- ADVANCED RESEARCH, sponsored and conducted through the ASPE Research Foundation, and the publication of advanced technical materials in the ASPE Journal.
- DEVELOPMENT OF CODES and standards, through involvement with national organizations.
- CHAPTER-SPONSORED COURSES in plumbing design for those in, and entering, the profession.
- REPRESENTATION OF THE PLUMBING ENGINEER through involvement with other organizations and creation of better communication within the construction industry.
- FELLOWSHIP among plumbing engineers and members of the plumbing industry.
MEMBERSHIP

MEMBERSHIP AND APPLICATION PROCEDURES

Today, more than 7000 members around the world are part of the ASPE family.

All members belong to ASPE nationally and, in those areas throughout the United States and Canada where local chapters exist, to those as well. There are currently (62) chapters.

Membership in ASPE is designed primarily for engineers and designers involved in the design and specification of plumbing systems. There are also categories for manufacturers and representatives, code officials and municipal inspectors, contractors, educators and students, and virtually all others who are interested in the plumbing industry.

Membership Categories:

1. **FULL MEMBER**: Eight (8) years of experience in plumbing engineering, a minimum of four (4) years of which must have been in a position of responsibility for the design of plumbing systems.

   A maximum of four (4) years of experience may be waived by the Society Vice President Membership for:

   a. Education: One half (½) year for each completed year in a curriculum related to plumbing engineering;
   b. Engineering Registration: Four (4) years for Professional Engineering registration in a field that includes plumbing engineering; and
   c. CPD Certification: Two (2) years.

2. **ASSOCIATE MEMBER**: Any individual involved in the design of plumbing systems or in plumbing engineering and not meeting the requirements for Full membership.

3. **AFFILIATE MEMBER**: Any individual involved in producing or marketing a plumbing product who does not meet the qualifications or requirements of membership in any other grade.

4. **PRESIDENTIAL MEMBER**: The outgoing President of the Society shall become a Presidential Member upon installation of a successor and shall retain all rights, privileges and responsibilities of a Full Member.
5. **GOVERNMENTAL MEMBER:** Anyone employed by municipal, state of federal government for one of the following reasons: (a) the checking and/or inspection of plumbing plans and installations; (b) the formulation of codes, rules requirements and regulations pertaining to the planning, designing and installation of plumbing systems, or any portion of a plumbing system; (c) the research and developing of plumbing systems and design criteria.

   Exception: Persons employed by municipal, state or federal government for the purpose of designing and/or specifying plumbing systems shall be eligible for membership as Full Members or Associate Members, provided they have fulfilled the experience requirement as outlined for each respective classification.

6. **SPECIAL MEMBER:** Anyone employed by or doing business as a contractor or having a special interest in plumbing design, who does not meet any of the qualifications for membership in any other grade.

   Exception: Persons employed by contractors or separate division of contractor for the exclusive purpose of designing and/or specifying plumbing systems shall be eligible for membership as Full Members or Associate Members, provided they have fulfilled the experience required as outlined for each respective classification.

7. **STUDENT MEMBER:** Any individual attending a recognized University or College full time (12 credit hours per term minimum) in curriculum related to plumbing design.

8. **RETIRED MEMBER:** Any retired member with ten (10) years of continuous membership in the Society who has reached the age of sixty (60) years and is no longer active in the profession.

9. **HONORARY MEMBER:** The Society’s board of Directors may recommend, upon its own initiative or when so requested by the two-thirds (2/3) majority vote of a chapter’s membership, Honorary Membership for anyone deemed worthy by action or contribution to the Society or the plumbing profession. Such recommendations shall be ratified by a two-thirds (2/3) majority vote of delegates at the Society’s convention. Proposed recommendations shall be presented to the delegates forty-five (45) days prior to the Society’s convention.

10. **LIFE MEMBER:** The Society’s board of Directors, after nomination by a Chapter Board of Directors, may grant upon verification of retirement, Life Membership status to any retired person who has been a Member in good standing continuously during the past ten (10) years and has demonstrated significant contributions to the Chapter and the Society. The Life Member shall also have reached the age of sixty (60) years and no longer be active in the profession.
MEMBERSHIP BENEFITS

Chapter meetings are held monthly, providing members with an opportunity to hear and question authorities within the plumbing engineering field.

The Plumbing Engineering Design Handbooks published by ASPE, incorporates design sections which are constantly being updated and revised, reflecting current advances in the science of Plumbing Engineering.

ASPE holds an Engineering Plumbing Exposition concurrently with its biennial Convention. This exposition brings together the leading manufacturers to enable them to display their new or improved products. Also, many new design concepts are displayed or presented at the many technical seminars.

Members receive “Plumbing Systems and Design Magazine”, the Society’s journal which is an authoritative periodical on engineering, research, development design and news in the field of plumbing.

ASPE PROJECTS

TECHNICAL

ASPE technical committees review plumbing engineering data and present technical reports. By sharing experience and knowledge and publishing the Plumbing Engineering Design Handbooks, ASPE assists its members in improving design methods.

CODES AND STANDARDS

ASPE is actively participating in the development of codes and standards.

Through membership on code and standard groups, ASPE works for improvement and uniformity of national codes and standards.

EDUCATION

ASPE sponsors courses of instruction in plumbing design. Courses are taught by experts and specialists in the field. Each course is under the auspices of the local ASPE Chapter.

INDUSTRY RELATION

ASPE has organized committees toward a better understanding among members of the construction industry in the solution of their common problems.
ASPE PLUMBING ENGINEERING
DESIGN HANDBOOKS

ASPE Data Book Volumes:

Volume 1 Fundamentals of Plumbing Engineering (2009-2010)
Volume 2 Plumbing Systems (2011)
Volume 4 Plumbing Components and Equipment (2008)

Please Visit the ASPE website @ www.aspe.org for additional publications.
CLEVELAND CHAPTER
AMERICAN SOCIETY OF PLUMBING ENGINEERS
P.O. Box 5962
Cleveland, Ohio 44101-0962

CLEVELAND CHAPTER BOARD OF DIRECTORS

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KEITH BUSH, CPD, CSI

V.P. Technical
JOHN VARGA

Administrative Secretary
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V.P. Legislative
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Corresponding Secretary
CRAIG McDOWELL

V.P. Membership
GREG TROMBOLD

Treasurer
KEVIN NOBLE, P.E., LEED AP

Past Presidents

Murray Herzog* April 1974 - May 1977
John Nagle* May 1977 - May 1978
Joseph Zaffuto May 1978 - May 1980
Murray Herzog* May 1980 - May 1981
Joseph Zaffuto May 1981 - May 1983
Richard Uszko* May 1983 - May 1985
Paul Sheridan May 1985 - May 1987
Andrew Kovesdi May 1987 - May 1989
Salvatore Traina* May 1989 - May 1991
John A. Serwatka May 1993 - May 1995
Ronald C. Hegadore May 1995 - May 1997
John A. Serwatka May 1997 - May 1999
Ronald C. Hegadore May 1999 - May 2000
Keith Bush May 2000 - May 2002
Michael D. Drab May 2007 - May 2010
Keith Bush May 2010 - Present

*Deceased
ASPE CLEVELAND CHAPTER GOALS FOR 2010-2012

1. Teach plumbing engineering to Engineers, Contractors and Representatives.
2. Increase the practical knowledge of plumbing selection, design and installation to the plumbing community.
3. Maintain interest in the American Society of Plumbing Engineers with our peer group.
4. As always, learn a little each day and have fun doing so.
AMERICAN SOCIETY OF PLUMBING ENGINEERS (ASPE)

ASPE was incorporated in 1964 as a non-profit organization, devoted exclusively to the interests and concerns of the plumbing engineer. Its membership includes Plumbing Engineers, Designers, Cad Operators, Specifiers, Governmental Authorities and Contractors.

ASPE members today enjoy the most extensive organization through which they can exchange data, knowledge and experience with others in their field.

HISTORY OF THE CLEVELAND CHAPTER

Interest in forming a chapter in Cleveland began in early 1973. Eventual interim officers and charter members met to plan the chapter.

A letter of intent to organize was sent to Marianna Frankel, Administrative Secretary of ASPE National. Her acknowledgment of that letter dated July 5, 1973 was received by a chief organizer, Murray Herzog.

On July 15, 1973, Donald Sampler, then National 3rd Vice President, sent a letter to organizers describing procedures and requirements needed to form a chapter. The key requirement was twenty people who qualified as full or associate members. Through the dedication and hard work of the future interim officers and charter members, success was achieved in March, 1974.

April 3, 1974 was selected as the date of the initial Chapter meeting. George Runkle, Jr. the President of ASPE National at that time was present and officiated. During this first meeting, interim officers were elected to head the new Cleveland Chapter.

The newly elected interim officers developed plans for funding the chapter and selected a meeting site, The Cleveland Engineering and Scientific Center on Chester Avenue. It was also decided that the Chapter meetings were to be held on the third Wednesday of each month. A loan was then provided by ASPE National on April 17, 1974 in the amount of one hundred dollars to help get the Chapter started.

ASPE bylaws also required a prospective Chapter to hold three meetings prior to petitioning for its charter. On May 15, 1974, a formal petition was sent to Marianna Frankel. On May 22, 1974 the first formal Chapter meeting took place during which election of the next years officers took place. The original organizers and interim officers were all elected to the permanent posts.

July 20, 1974 was chosen for celebrating the inception of the new Cleveland Chapter of the American Society of Plumbing Engineers. Dr. Alfred Steel, then treasurer of ASPE National made the presentation to the Chapter.
The Cleveland Chapter had the honor of hosting the 1995 ASPE symposium. Chapter President Ron Hegadore hosted the event that was held at the Marriott Hotel at Key Tower in downtown Cleveland. The event was well attended and included numerous seminars and a product show. In fact, it was the first time continuing education units were offered to those attending the seminars.

ASPE also offered tours of Jacobs Field, home of the Cleveland Indians, the Rock-n-Roll Hall of Fame, Moen headquarters and the Inventors Hall of Fame in Akron.

The first formal Cleveland Chapter meeting was held on May 22, 1974. On May 12, 2004 the Chapter celebrated its 30th Anniversary at the monthly meeting. The celebration was held at Harry’s Steakhouse in Independence and inaugural Board Members Craig McDowell, Joe Zaffuto and Region Two Chairman Dave Hudson were in attendance. Dave presented Chapter President Mitch Clemente with a plaque and emblem recognizing the milestone.

The 2004 National Plumbing Engineering Exposition and Convention was held in Cleveland and hosted by the Chapter. The Convention took place from October 23rd through October 27th and was held at Cleveland Public Hall. The Marriott Hotel at Key Tower served as the host hotel.

Convention Chairman and Chapter President Mitch Clemente along with Committee Members Kevin Noble, Greg Trombold, Keith Bush, Tom Porter, Matt Davis and a host of volunteers welcomed Society, Delegates and guests to the event. Besides all of the seminars, shows and meetings, Society also celebrated their 40th Anniversary in Cleveland and gave away a brand new red pick-up truck to a lucky attendee from Minnesota.
INITIAL CLEVELAND CHAPTER OFFICERS

MAY 1974 - MAY 1975

MURRAY HERZOG - PRESIDENT
FRED EHRENBEIT - TREASURER
THOMAS KING - FIRST VICE PRESIDENT
JOHN NAGLE - SECOND VICE PRESIDENT
RICHARD USZKO - THIRD VICE PRESIDENT
JOE ZAFFUTO - ADMINISTRATIVE SECRETARY
CRAIG MCDOWELL - CORRESPONDING SECRETARY

CHARTER MEMBERS

Robert Allison  Don Jirk  Ron Rupert
William Billik  Thomas King  Ken Sauvain
David Brese  Marcus Kiteisrud  D.E. Sheldon
James Browning  James Konwinski  Paul Sheridan
Michael Cheatham  Craig McDowell  Edward Sloan
Leslie Duguid  William McNally  William Story
Fred Ehrenbeit  John Nagle  Russel J. Subjinski
Ralph C. Frey  Fred Peschke  Richard Uszko
Albert Graser  John Pidwell  William Walker
Murray Herzog  Charles W. Pressler  Joseph Zaffuto
Robert W. Hoste

PROGRAM OF EVENTS

CHARTER DINNER COMMITTEE

John Nagle - Chairman  Craig McDowell

CHARTER PRESENTATION PROGRAM

Opening Remarks ......................... John Nagle, Chairman Dinner Committee
Introduction of Chapter President
Address of Welcome .............................................. Murray Herzog, President
Introduction of Officers of Cleveland Chapter
Introduction of Invited Guests
Introduction of National Society Treasurer, Dr. Alfred Steele

CHARTER PRESENTATION CEREMONY

Presentation ......................................................... Dr. Alfred Steele
Acceptance and Acknowledgment ................................ Murray Herzog, President
Closing Address ..................................................... Murray Herzog
Dancing Until 12:30 a.m. ......................................... Hal Lynn Orchestra
INITIAL CHARTER SPONSORS

The Cleveland Chapter of the American Society of Plumbing Engineers expresses its sincere gratitude for the financial participation by the following firms that helped sponsor the Chapter:

Allied Equipment Company  The Osborn Engineering Co.
Allied Pipe Products  Consulting Engineers
American Standard  The Paley Plumbing & Heating Co.
The Austin Company  Pfizenmaier & Jablonski
J.A. Bastl & Associates, Inc.  Pressler & Associates
Borosh Associates, Inc.  Reliance Mechanical Contractors
BWA Company  J.M. Roessler & Associates
DeMarco Inc. Mechanical Contractors  Sloan Valve Co., represented by Robert J. Wolf
Denk-Kish and Associates
A.E. Ehrke & Company  A.O. Smith Corporation
Ralph C. Frey & Associates, Inc.  The Smith & Oby Company
Manufacturers’ Representative  The Spohn Corporation
Graham’s Petroleum Equipment & Sales Co.  Story Equipment Sales
Kahn Plumbing & Heating Co.  Structural Fibers, Inc.
Lochinar Water Heater Corp.  Tomlinson Co., Inc.
Mack Industries, Inc.  Trombold Equipment Co.
Paul C. Menster & Associates  Trygve Hoff & Associates
Mussun Sales, Inc.  Woodhill Nipple & Supply, Inc.
Ohio Hydronics Company  Yager Plumbing Co., Inc.
Omar McDowell Co.  Youngstown Steel, Producers of Yoloy Pipe

MEMBERSHIP INFORMATION

Full Members  $30.00 Annually
Associate Members  $25.00 Annually
Junior Member  $10.00 Annually
Governmental Member  $25.00 Annually
Special Member  $35.00 Annually
Student Member  $10.00 Annually
Affiliate Members  $85.00 Annually for each membership card

Membership applications are available upon request of any officer.

On January 15, 1975, our chapter voted to co-sponsor with the American Society of Sanitary Engineering a manufacturers’ mini-show.

Our first roster was published in May, 1975. Enrollment had increased since then.
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<td>President</td>
<td>Murray Herzog</td>
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<td>John Nagle</td>
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<td>1st Vice President</td>
<td>Thomas King</td>
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<td>Joseph Zaffuto</td>
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<td>2nd Vice President</td>
<td>John Nagle</td>
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<td>Thomas Kamis</td>
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<td>3rd Vice President</td>
<td>Richard Uszko</td>
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<td>Paul Sheridan</td>
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<tr>
<td>Treasurer</td>
<td>Edward Sloan</td>
<td>Marcus Kittelsrud</td>
<td>M. Kittelsrud</td>
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<td>Administrative Sec.</td>
<td>Joseph Zaffuto</td>
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<td>Murray Herzog</td>
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<td>Corresponding Sec.</td>
<td>Robert Hoste</td>
<td>Craig McDowell</td>
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Membership has grown to 48.

A class in Plumbing Engineering is formed at Cuyahoga Community College. The instructor for the class is Murray Herzog.


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<td>Ralph Frey</td>
<td>James Porter</td>
<td>Geza Garnai</td>
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<td>Andrew Borosh</td>
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Membership is at 80.
Titles of board members change.

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<td>Ed Liggett</td>
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## BOARD OF DIRECTORS

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<thead>
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<tbody>
<tr>
<td>President</td>
<td>Richard Uszko</td>
<td>Paul Sheridan</td>
</tr>
<tr>
<td>V.P. Technical</td>
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<td>Ed Liggett</td>
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<td>Thomas Kamis</td>
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<td>Ed Liggett</td>
<td>Ralph Frey, Jr</td>
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<tr>
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<td>Andrew Kovesdi</td>
<td>Joseph Zaffuto</td>
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<td>Richard Uszko</td>
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<td>Judy Cefaratti</td>
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<tr>
<td>President</td>
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<td>Judy Cefaratti</td>
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<td>Carolyn Hager</td>
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## BOARD OF DIRECTORS

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<thead>
<tr>
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<tr>
<td>President</td>
<td>John Serwatka</td>
<td>John Serwatka</td>
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<td>V.P. Technical</td>
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<td>Treasurer</td>
<td>Joseph Zaffuto</td>
<td>Raymond Davis</td>
</tr>
<tr>
<td>Administrative Sec.</td>
<td>Mike Cassell</td>
<td>Robert Laneve</td>
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<tr>
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<td>Tim Campbell</td>
<td>Tim Campbell</td>
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<tr>
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<tr>
<td>1996-1997</td>
<td>President: Ronald Hegadore</td>
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<tr>
<td></td>
<td>V.P. Technical: William Fortman</td>
<td></td>
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<td>1997-1998</td>
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<td>1999-2000</td>
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<td>2007-2008</td>
<td>President: Michael D. Drab</td>
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### BOARD OF DIRECTORS

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<td>Craig McDowell</td>
<td>Craig McDowell</td>
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### CHAPTER MEMBERSHIP STANDING

As of September, 2010

- FULL: 55
- ASSOCIATE: 10
- AFFILIATE: 28
- GOVERNMENTAL: 0
- SPECIAL: 6
- STUDENT: 0
- LIFE: 3
- RETIRED: 4

**TOTAL**: 106

- CPD Registration: 10
- CPD and P.E. Registration: 2
- PE Registration: 25
# CLEVELAND CHAPTER COMMITTEES

<table>
<thead>
<tr>
<th>Committee</th>
<th>Chairman</th>
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<tbody>
<tr>
<td><strong>AFFILIATE LIAISON</strong></td>
<td>John Griffin - Chairman</td>
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<tr>
<td><strong>HANDBOOK</strong></td>
<td>Michael Drab - Chairman</td>
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<tr>
<td><strong>NEWSLETTER</strong></td>
<td>Michael Drab - Editor</td>
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<td><strong>GOLF OUTING</strong></td>
<td>Greg Trombold - Chairman</td>
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<td>Kevin Noble - Chairman</td>
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<td><strong>FUNDRAISING</strong></td>
<td>Michael Drab - Chairman</td>
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<tr>
<td><strong>HISTORIAN</strong></td>
<td>Mitch Clemente - Chairman</td>
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</table>

CLEVELAND CHAPTER MEMBERSHIP

ALAG, HARJIT S., P.E.
H2L1 Engineering, Inc.
1785 East 45th Street
Cleveland, OH 44103
(216) 361-2911

AUSTRIAN, DAN, P.E.
Austrian & Associates, Inc.
2530 Superior Ave., Suite 202
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(216) 621-6631

BAKER, DAVID L., CPD
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1022 Heyl Rd. P.O. Box 996
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5510 Wildwood CT.
Apartment B
Willoughby, OH 44094
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BANAS, MARK J., P.E.
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Parma, OH 44134
(216) 459-0828

BENTZEN III, LOUIS A.
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(330) 225-5091

BOGER, JOHN J. CPD
URS Grinner
1692 Hammum Dr.
Streetsboro, Ohio 44241
(330) 442-0887

BRIMACOMBE, DALE, P.E.
16476 Sheldon Road
Brook Park, OH 44142

BUDD, TERRENCE W., P.E., CPD
4517 Windfall Rd
Medina, OH 44256
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BUSH, KEITH D., CPD
Kent State U-Off. of Architect
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Kent, OH 44242
(330) 672-3880

CACOLICI, DOMINIC, P.E.
Karpinski Engineering
3135 Euclid Ave.
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(216) 391-3700

CAMPBELL, TIM
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Cuyahoga Hts, OH 44125
(216) 696-1155

CAMPBELL, THOMAS F.
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Cuyahoga Hts, OH 44125
(216) 696-1155

CHASE, STEPHEN J.
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Cleveland, OH 44145
(440) 871-2410
CHURCH, DONALD D., P.E.
3563 Saddleboro Drive
Uniontown, OH 44685
(330) 666-1127

CLEMENTE, MITCHELL J., CPD
Westlake Reed & Leskosky
640 CrystalBrooke Drive
Hinckley, OH 44233
(216) 522-1350

CONYNGHAM, KEVIN MICHAEL
US Consolidated
836 West Streetsboro
Hudson, OH 44236
(330) 655-9220

D’AMICO JR., ANTHONY T.
ADCO Sales
2933 Clayton Ave.
Wickliffe, OH 44092
(440) 944-7500

DIMACCHIA, JOSH
10299 Forestview Drive
Strongsville, OH 44136
(440) 268-9612

DRAB, MICHAEL D.
Thorson Baker & Associates, Inc.
3030 West Streetsboro Rd.
Richfield, OH 44286
(330) 659-6688

DREYER, TEDD
Gardiner-Trane
31200 Bainbridge Road
Solon, OH 44139
(440) 622-3440

DURST, MICHAEL
29205 Avo R
Murdock, NE 68407
(404) 867-2037

EVANS, DANIEL R., CPD, LEED AP
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1022 Heyl Road
Wooster, OH 44691
(330) 262-0042

FESZ, STEPHEN V.
SVF Sales Co.
4901 Brookpark Rd.
Parma, OH 44134
(216) 741-7000

FORESTA, TIMOTHY J.
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Cleveland, OH 44115
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FREY JR., RALPH C.
R.C. Frey & Associates
9263 Ravenna Rd. A-10
Twinsburg, OH 44087
(330) 425-2555

FRY, JAMES
Freeland Contracting Co.
2100 Integrity Drive
Columbus, OH 43209
(614) 443-2718

GALLAGHER MICHAEL J.
The J.F. Gallagher Plumbing Co.
36360 Lakeland Blvd.
Eastlake, OH 44095-5314
(216) 946-4256

GARRAMONE, GUY J., P.E., CPD
306 Game Drive
Monroe Falls, OH 44262-1706
(330) 928-4069

GODFREY, RUSSELL JACQUE
Tri-Tech Medical, Inc.
35401 Avon Commerce Pkwy
Avon, OH 44011
(440) 937-6244
GRIFFIN, JOHN E.
Libb Company
885 Knightsbridge Dr.
Ravenna, OH 44266
(330) 297-0757

GRIGORIU, JOHN M.
26101 Country Club Blvd. Apt 1828
North Olmsted, OH 44070
(440) 734-6538

HAAS, RICHARD C.
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HAGMAN, CHARLES, G.E.
J.M. Verostko Engineering
1216 Ameritech Blvd.
Youngstown, OH 44509
(330) 799-1339

HARTSOCK, ROBERT M.
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Youngstown, OH 44509
(330) 746-1360

HAUSMANN K. DIETER., P.E.
TES Engineering
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Cleveland, OH 44145
(440) 871-2410

HAYCOOK, KRISTOPHER WAYNE, G.E.
Westlake Reed & Leskosky
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Cleveland, OH 44115
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HERBERT, KEVIN, P.E.
Point One Design Ltd.
9941 York Theta Dr.
North Royalton, OH 44133-3512
(440) 230-1800

HERBERT, DEBORAH JEAN, CPD
Point One Design Ltd.
9941 York Theta Dr.
North Royalton, OH 44133-3512
(440) 230-1800

HESS, MATTHEW
Frederick, Frederick & Heller
Engineers, Inc.
672 E. Royalton Rd.
Broadview Heights, OH 44147
(440) 546-9688

HICKS, GUY R., P.E., LEED AP
Thorson Baker & Assoc., Inc.
3030 West Streetsboro Rd.
Richfield, OH 44286
(330) 659-6888

HINKEL JR., HARRY L., P.E.
Hinkel Engineering
1022 Heyl Rd. P.O. Box 996
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HOLLO, TIM
21270 Cromwell Avenue
Fairview Park, OH 44126
(440) 241-6944

HOMOLA, CHRISTOPHER A. P.E.
27001 Springside Lane
Olmsted Falls, OH 44138
(440) 823-2896

HUDAK, BRIAN
296 Willson Ave.
Tallmadge, OH 44278
(330) 633-5789

HUELSMAN, ANDREW, G.E.
431 East Main Street
St. Henry, OH 45883
(419) 628-4240
JACKSON, DANIEL L.  
TES Engineering Inc.  
25760 First Street  
Westlake, OH 44145  
(440) 871-2410

JASINSKI, JAIME K.  
TEC, Inc.  
33851 Curtis Blvd. Suite 216  
Eastlake, OH 44095  
(440) 953-8760

JIRKA, JOHN  
5289 Windchime Drive  
Medina, OH 44256  
(330) 722-1032

KERR, KENNETH J.  
Kerr Marketing Agency, Inc.  
2947 Nationwide Parkway  
Brunswick, OH 44212-2365  
(330) 225-1420

KINDBOM, KEVIN  
Bandwen William Kindbom  
3475 Forest Lake Suite 300  
Uniontown, OH 44685  
(330) 899-9633

KNICKERBOCKER, GERALD C., P.E.  
Electro Mech Engineering  
311 High Street NE  
Canal Fulton, OH 44614-1158  
(330) 854-0347

KOENIG, DREW  
Garmann/Miller  
38 S. Lincoln St.  
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THE HISTORY OF PLUMBING

· Learning From Past Experiences

We all learn from our mistakes and there have been plenty of events to learn from over the course of the history of plumbing systems. History provides us with knowledge and informative records of past plumbing performance and adverse experiences. Recognition of our past mistakes and learning from them provides us with the knowledge to move on and develop plumbing systems that will prevent illnesses and protect the health of the public. Society tends to react to plagues and epidemics by first asking why did this happen and what could have been done to prevent it from occurring again. The American Society of Sanitary Engineering carries this thought forward in their motto “Prevention Rather Than Cure”. We can learn from the past and prevent outbreaks and illnesses rather than cure the ill effects experienced by persons exposed to unsanitary or outdated plumbing systems.

Ancient Plumbing

· 4000-3000 BC: Indus River Valley, India

Plumbing has been around for a long time. The first known evidence of ancient plumbing was when Archaeologists unearthed copper water pipes in the Palace Ruins in the Indus River Valley. The water pipe was estimated to be 5,500 years old. The Palace site was excavated and found to have individual apartments. Each bedroom apparently had been provided with a bathroom with elaborate plumbing systems for the time. This establishes the earliest known plumbing systems almost 6,000 years ago.

· 2400-2150 BC: Babylon Between the Tigris and Euphrates Rivers

Greek writers wrote of ancient Babylonia where the science of hydraulic engineering seemed to have had it’s beginning. A network of canals, all skillfully planned and regulated, covered the area. They had large brick drainage sewers with access holes similar to today’s manholes.

· The First Building Code

The first reported building code came from Babylonia. It was called the Hammurabi Code, written by King Shulgi of the Ur Dynasty. This compilation of laws included special provisions for construction and maintenance of the canals that were very important to that desert region. One of the clauses in this code deals with construction of a building. The clause struck terror in the heart of unethical contractors. The clause said “Woe to the builder whose house falls and kills someone. That builder shall be sentenced to death.”
· 1000 BC: The Island of Crete

On the island of Crete, the remains of a plumbing system at least 3000 years old were unearthed in excavations on the site of an ancient palace of Knossos. Evidence was found of plumbing fixtures, a water supply system, a sanitary drainage system, and a heating system. One of the fixtures was a bathtub made of hard pottery and 5 feet in length. It was a floor standing model with an integral base, resembling in shape the cast iron bathtub on base widely installed in America in the latter part of the nineteenth century. Another fixture was a water closet, also of hard pottery. It showed evidence of having been equipped with a water closet seat and a flushing device. Found intact were long sections of clay drain pipe of the bell and spigot type. Pipe lengths were short, and branch fittings were provided with T and Y connections adjacent to the bells or hubs.

· 500 BC - 455 AD: The Roman Empire

Of all the ancient peoples, the Romans carried sanitation to the highest and broadest degree of development. From their language, Latin, have come such words as sanitation and plumber, the latter being derived from artifex plumbarius, meaning a worker in lead. Roman aqueducts still grace the Italian countryside and rank among the world’s engineering triumphs. Extensive underground sewer systems, public and private baths, lead and bronze water piping systems, and marble fixtures with gold and silver fittings have come to be symbolic of the civilization of Ancient Rome. An especially significant feature of progress may be cited by the fact that much of the underground public water supply system was constructed of standardized cast lead sections. It is interesting to note that the lead pipes that were so convenient to work with at the time made vast improvements in sanitary conditions. Today we are moving away from lead in piping systems for health reasons. One more lesson learned from our experiences.

· 500 BC - 455 AD: The Roman Baths

Public bathing colonies dotted the Roman Empire. One of them, the baths of Diocletian, reportedly accommodated 3200 bathers. Baths and bathing pools were lined with ceramic glazed tile. In residences, bathtubs often occupied an entire room and were supplied with both hot and cold water. Hot water was provided by means of lead or bronze piping which conveyed water across open fires. Bathtubs often were carved from solid marble or lined with ceramic glazed tile and equipped with gold or silver fittings.

· 455 AD - 1200 AD: The Dark Ages
After almost a thousand years of world rule, the empire of ancient Rome crumbled. In the fifth century, it was subjected to successive invasions by Goths and Vandals, barbaric tribes from the north of Europe. In 455, Vandals swept south through Rome, sacked it of all things of value including any metals that could be removed, and destroyed its public works. With the destruction of Rome, its civilization rapidly decayed, and sanitary standards regressed almost to the vanishing point. Surprisingly several major urban areas today are going through similar experiences on a smaller scale.

The following 10 centuries have been historically termed the Dark Ages. For many centuries, people in general paid little attention to personal cleanliness and other domestic sanitary needs involving the use of water. Bathing was frowned upon by persons of influence and not taken seriously even by members of the ruling class, many of whom preferred to use perfume. Plumbing fixtures fell into disuse, including water closets which had been developed and widely used during the fourth and fifth centuries in Rome. They were not used again until about the twelfth century, and even then their use was extremely limited.

1300 - 1400 AD: Plagues and Epidemics

During the fourteenth century, Europe was ravaged by disease. Bubonic plague swept the continent and England reportedly killing 25 million people. To improve sanitary conditions in Paris in 1395, the authorities ordered a stop to the practice of throwing sewage out of building windows and dumping sewage waste pots onto the streets below. But this was a common practice that continued unabated in other cities.

As late as the early part of the eighteenth century, European cities had not been equipped with sanitary sewage disposal facilities. The mortality rate in many cities exceeded the birth rate. When building owners were ordered to install domestic sewage vaults, considerable opposition was raised. It was not until the latter part of the eighteenth and early part of the nineteenth centuries that European cities started to provide public sewer systems beneath city streets. Slowly people began to use the convenient public sewer facilities for the disposal of sewage from buildings and to develop progressively higher sanitary standards.
Early American Sanitation Standards

- **1600: Early Settlements**
  Although America has become a symbol of high standards in plumbing and sanitation, these evolved from very primitive and rude beginnings. Along the Atlantic Coast, firmly established settlements developed local industries and conducted trade with Europe. Among the numerous early settlements were several which later became major port cities, such as Boston, New York, Philadelphia, and Baltimore. Each faced the same general sanitation problems and progressed in developing sanitary standards almost simultaneously. The following is an account of the historical records of early American plumbing history.

- **1626: New York Port Area Living Conditions**
  Available reports of the progressive development of sanitary standards in New York may be cited as typical. Following settlement of the port area in 1626, houses were built. None had within them any water supply or sewage disposal facilities. Drinking water was used sparingly as it had to be carried from springs or wells, or purchased by the bucket from water peddlers who traveled through the streets selling water from wooden barrels on horse drawn trucks. Outdoor earth pit privies were used as toilet facilities. Wastes from dish washing, clothes washing, and bathing were disposed of outdoors by dumping them onto the ground adjacent to buildings. Rainwater from roofs also was disposed of onto the ground. As the population of the settlement increased with the arrival of new immigrants, conditions deteriorated. Shallow wells became polluted by seepage from earth pit privies, areas around homes became excessively fouled from sewage and refuse dumped onto the ground, and streets were quagmires of mud long after rainstorms ended.

- **1675: New York Appoints The First Health Official in America**
  Health conditions became intolerable in time and forced organization of a Common Council in 1675. The council appointed a health officer in charge of sewage and refuse disposal and other health matters. Water tight privy vaults began to be installed instead of earth pit privies as toilet facilities. Scavenging regulations governing the disposal of privy vault wastes were put into effect in 1676. The scavengers lifted the wastes with buckets and hauled it away in barrels on carts pulled by horses or oxen. Scavengers were the predecessors to today’s modern septic tank pumping services.

- **1677: New York Builds the First Public Water Wells**
  The cities first public water wells were projected in 1677 and completed in 1686. People could draw water from these wells that were located in the populated areas. Later horse drawn carts would deliver water to the doorstep for a small fee.

- **1687: Muddy Streets Called for Gutters in New York City**
Streets were paved and gutters were installed in built up areas in 1687, and homeowners were ordered to pave sidewalks. This was all the result of storm water runoff causing muddy streets and sidewalks. Once again we learn from the past.

· 1700: New York Adopts a Sanitary Waste Ordinance

In 1700, a sanitary ordinance was adopted prohibiting the dumping of scavengers’ barrels of vault wastes into the street gutters. They were required to go far beyond the city to dump their smelly cargo.

· 1703: New York Builds Sewage Canals

An open ditch public sewer or sewage canal was constructed, and city surveyors were appointed to establish street and sewer grades.

· 1717: Open Sewers Drain Into New York Bay

Complaints arose about the unsanitary conditions created by the open ditch public sewer, and in 1717 the sewer was extended to empty into New York Bay.

· 1728: New York Installs the First Underground Sewer

The public began to complain about the smell of the open sewers and the health officials responded by installing the first sewer under the streets of New York.

· 1776: The First Water Reservoir Constructed for New York

The first water supply reservoir was constructed in 1776. It collected water from wells and ponds and distributed water through a supply system consisting of hollow wooden logs laid under principal streets.

· 1794 - 1797: Epidemics Caused Formation of More Health Boards

Epidemics of waterborne diseases occurred in New York, Philadelphia, Baltimore, and other population centers along the Atlantic Coast. Public pressure developed as complaints to authorities mounted regarding the unsanitary disposal of sewage and the lack of an adequate, available supply of safe drinking water. To improve conditions, boards of health were established in Philadelphia in 1794 and Boston in 1797. At this time they were not chlorinating the water to kill bacteria. Later we learned this simple process would save millions of lives from bacteria in the water.

· 1800s: The First Catch Basins

As a health protection measure, communities began to install all public sewers underground and to extend them to buildings, although many people considered the sewers merely as a means of eliminating unsightly conditions. These early underground sewers were constructed with flat stone tops and bottoms and brick masonry sidewalks. They were intended to serve just for storm water drainage from streets and buildings. But they soon became foul and odorous from sewage and garbage dumped into street gutters. In 1831, catch basin traps were installed in street gutters to intercept solids conveyed
by storm water draining into the public sewer. Later they would learn round or egg shaped sewers would carry away solids much more efficiently.

**1830: First Water Mains Installed Under New York Streets**
In 1830, after numerous fires had demonstrated the need for an adequate, available supply of water for fire fighting, New York City installed its first public waterworks. This consisted of a large above ground water storage tank into which water was pumped from shallow wells, and from which water was supplied through two 12 inch cast iron water mains to fire hydrants installed along several of the main streets where business buildings were located. But this system proved to be totally inadequate when a severe fire broke out on December 16, 1835. A total of 530 buildings were destroyed overnight.

**1835: The New York Fire**
The disastrous fire of 1835 in New York City stirred the people into action and led to developments of great significance and benefit. People became aware of the necessity for having an adequate pressurized water supply system readily and constantly available for fire fighting in built up areas. They also realized there was a great need, both as a sanitary measure and as a laborsaving convenience, for having an adequate pressurized water supply system from which safe drinking water could be piped directly to buildings. Soon after the fire, plans were projected for providing a large public water supply system which would satisfy both of these needs. The 1835 New York City fire taught us a lesson about sizing water mains that civil engineers still refer to today.

**1842: New Yorks Aqueduct Placed in Service**
In 1842 the original Croton Aqueduct System was placed in operation. In this system, water from the Croton River was collected in Croton Reservoir, 40 miles north of the city, and supplied from there through an underground piping system to two reservoirs in the city, one at 42nd Street and another in Central Park. From these reservoirs, water was distributed through a system of cast iron water mains installed underground in city streets, and fire hydrants were installed in sidewalks at appropriate locations along the curb. Building owners were permitted to have water service connections made to the public main, and water service piping extended from the main to supply faucets or hydrants in building cellars or yards. At that time the population of the city of New York was about 300,000.
Plumbing Systems Inside Buildings in America -
“Indoor Plumbing”

· 1842: New York City Installs Water Piping to Buildings

Upon completion of the Croton Aqueduct System and pressurized water services into building cellars and yards in New York City in 1842, a radical change in building construction took place — the installation of plumbing systems in buildings. Pressurized water supply systems made it possible to satisfy, at the turn of a faucet, the needs of building occupants for a safe and abundant supply of water for all domestic purposes and to eliminate the drudgery, labor and inconvenience of having to carry water from the source. No plumbing fixtures had been installed in buildings prior to this time, except for a few crude sink installations reportedly installed in kitchens that were provided with water supply by means of an adjacent hand pump that drew water from a shallow well.

· 1845 - 1850: Drainage Piping Installed in Buildings

As late as 1845, records indicate that buildings were not provided with interior drainage piping systems. Most buildings were equipped with exterior leaders which conveyed storm water from roofs to pavements and sidewalks from which the water ran into the street gutters. In some cases where branches had been installed from the public sewer to buildings, the exterior leaders discharged directly into such branches or building sewers. Before fixtures could be installed with water supply and drainage piping systems, building sewers had to be installed first so as to convey sewage away from the buildings to a suitable disposal terminal, such as a public sewer system. In 1845 New York City permitted sanitary building sewers to be connected to the existing public sewer system which had originally been provided for just storm water disposal. These building sewers, and the main drains installed underground in buildings at the time were constructed with flat stone tops and brick masonry bottoms and brick masonry sidewalls. They still had flat bottomed sewers. And when they allowed the connection of sanitary sewers to the storm sewers many solids started to settle out in the bottoms of the sewers.

· 1845 - 1850: Plumbing Fixtures Installed in NYC Buildings

By 1850, plumbing fixtures had been installed in a number of New York City homes. These were principally private residences owned by wealthy people who could afford to alter their buildings to accommodate such facilities. Provision had to be made to protect the fixtures and piping against frost damage by means of heating equipment, insulation or both. Earliest installations consisted of wooden and sheet metal sinks in kitchens, wooden washtubs in kitchens, cellars or basement laundry rooms, and sheet metal bathtubs in special bathrooms or closets.
For these early installations, water supply and drainage piping were attached to building walls and either left exposed in rooms or concealed in boxwork. A handmade trap was installed in the drain of each individual fixture to prevent escape of obnoxious odors and sewer gases from fixture waste outlets. However, these traps often lost their water seals because of siphonage and back pressure conditions in the drainage system, and this caused fouling of the atmosphere of rooms in which fixtures were placed. Check valves and many specially designed traps were installed in efforts to prevent the loss of trap seal, but such devices were found to be totally ineffective. At that time, the principle of venting fixture drains to protect trap seals was unknown.

Nevertheless, progress was made in the installation of plumbing systems in buildings. Fixtures were placed in locations where they would not be too objectionable. Sinks and washtubs were put in kitchens and basements. Lavatories and bathtubs were located on various floors and connected to separate stacks. Long hopper water closets, so named because of their funnel or long hopper shape, were installed in toilet rooms or compartments accessible only from outdoors, because it was considered hazardous to health for rooms which housed such odorous fixtures to be directly accessible from the interior of buildings. The hopper type water closet was installed so as to be relatively frost proof by placing the trap and water supply valve below the floor level. There was little or no consideration for backflow or cross connections in the early installations.

In the late 1850s, people became more and more aware of the need for improving sanitary standards in and adjacent to buildings. Recognition was given to the fact that plumbing systems in buildings could provide adequate safe water for drinking, cooking, bathing, and for flushing fixtures, and also could safely and efficiently dispose of sewage and other wastes from buildings. Extensions were built on many homes specifically to provide bathrooms at the upper stories of existing buildings. Lavatories, bathtubs, and water closets were installed in these extension bathrooms, many of which were also provided with heating equipment. Double doors were placed in passageways between extension bathrooms and the main building in order to prevent bathroom odors and sewer gases from entering the living quarters.
· 1860s: The First Multifamily Housing Built in East Coast Cities

Directly following the Civil War, immigration swelled the populations of industrial cities in the eastern part of the country. In many cities, rows of attached three and four tenement houses were built to take care of the additional population. These buildings were provided just with yard hydrants for drinking water supply, while toilet facilities consisted of rows of privies built above watertight privy vaults located in the backyards of the buildings. Extremely objectionable unsanitary conditions soon developed under such circumstances. Health authorities had to take stringent action to halt the spread of disease. To protect the health of building occupants, the public was alerted to the necessity of equipping buildings with adequate means for supplying safe drinking water for domestic purposes and with adequate facilities for sanitary disposal of sewage. Health authorities advocated the installation of plumbing systems in buildings, and as a result this became a subject of regulation in sanitary codes.

· 1870s: The First Water Heaters

In the early 1870s, water supplied kitchen sinks came into general use in private homes and other small buildings. Fireboxes of coal fired kitchen ranges were equipped with water jacketed backs and water jacketed fronts, and circulation piping was installed between these water heating units and hot water storage tanks so as to make pressurized hot water available in volume at fixtures. The use of outdoor privies and privy vaults for private homes was discontinued gradually as indoor water closets, directly connected to building drains, were installed in toilet rooms accessible from backyards.

· 1874: The Venting Theory Was Proven

A major stymie to more rapid introduction of plumbing systems in buildings was the fact that, as late as 1874, no method was known for preventing fixture trap seals from being lost because of siphonage and back pressure conditions in the drainage system. Where fixture trap seals were lost, objectionable odors and sewer gases escaped from the system at fixture outlets and fouled the atmosphere of rooms in buildings. A significant instance of this occurred when a plumbing system was installed in a large new private dwelling in New York City in 1874. Soon after occupying the building, the owner complained to the plumbing contractor that the stench of sewer gas from fixtures in the building was unbearable. After receiving this complaint, the plumbing contractor discussed it at a conference with other New York City master and journeymen plumbers. At this conference in 1874, the theory was that air pressure in the drain at the outlet of a fixture trap had to be in relatively exact balance with the atmospheric pressure at the inlet of the trap, and this balance could be maintained by means of a vent pipe connected to the drain at the trap outlet and extended to atmospheric pressure outdoors so that air could flow freely into or out of the drain in response to pressure variations in the drain.
This theory was tested by contractors and journeymen in the field on numerous installations, and it was proved to be correct. However, numerous details of vent piping installation and sizing had to be determined by further testing and field experience before continuous, satisfactory performance of vent piping was assured. Nevertheless, the principle of venting sanitary drainage systems by means of attendant vent pipes, to protect fixture trap seals against loss by siphonage and back pressure, was established. The way had been found to prevent objectionable odors and sewer gases from escaping at fixture waste outlets and fouling the atmosphere in buildings. To me this is one of the most important advances in modern plumbing history. Now, there could be “indoor plumbing”.

· The Venting Principle is Publicized

News of the development of the principle of venting sanitary drainage systems spread rapidly to all parts of the country. Detailed information on vent piping installation, test reports, and experience with systems in service were carried in trade publications, association reports, and newspapers at the time. A major breakthrough had been achieved in knowledge of the design of plumbing systems in buildings which made it possible to locate plumbing fixtures inside without fouling the atmosphere. Objections to installing plumbing systems in buildings rapidly vanished, and plumbing installation proceeded at a greatly accelerated rate.

Within a few years, kitchen sinks were installed in each dwelling unit in tenement houses. Owners of private homes began to have kitchen sinks put in, followed soon after by laundry trays, then bathtubs, and later lavatories placed in appropriate locations for convenient use. About 1880, the use of privies and privy vaults in the backyards of tenement houses was discontinued. In their place batteries of hopper type water closets, directly connected to building drains, were installed in either backyards or cellars. Similarly, at schools privies and privy vaults were removed. They were replaced by installation of trough type water closets, known as school sinks, directly connected to building drains. There fixtures were provided in separate schoolyard toilet buildings.

· 1881: Building Sewers Improve Living Conditions

By 1881, the health protection benefits of sanitary plumbing systems in buildings were clearly recognized by health officials in cities. Prior to this time, in New York City, 90 percent of all human wastes had to be disposed of by removing such wastes from privy vaults and transporting them through buildings, along city streets to docks, and then out to sea where they were dumped. This method of sewage disposal was a severe health hazard and had to be eliminated for this reason. Sanitary plumbing systems in buildings were the answer. People in cities knew this from hard experience. They began to rely upon plumbing facilities for improved sanitary conditions, and to reduce their daily work and increase their enjoyment of living.
For economy in installation, sinks and laundry trays were grouped together in kitchens and water closets, bathtubs, and lavatories were grouped together in bathrooms. This was possible to do in cities with public water supply and sewage disposal systems. But in rural areas, having no such public systems available for building connection, homes had no plumbing facilities. The only sanitary provisions for building occupants in such areas were an outdoor earth pit privy. Portable washtubs and bathtubs were used either indoors or under an outdoor shed in most areas.

- **1890s: The First Washdown Water Closet and Cast Iron Bathtub**
  
  In the 1890s, two important fixture developments, combined with newly available gas and electric public utility systems laid under city streets, aided in further expanding the use of plumbing systems in buildings. The first water closet design considered to be really sanitary was introduced about 1890 with the development of the washdown water closet. Almost simultaneously, the freestanding, white enameled cast iron bathtub appeared. They were hailed as important new sanitary advances, as they were reasonably priced, mass produced fixtures which home owners desired. The smooth surfaces of these fixtures did not harbor bacteria and were easy to clean. These new smooth finishes on these fixtures helped to reduce odors, spread of diseases and they improved sanitary conditions.

- **1890: The Manning Formula**
  
  In 1890, Robert Manning proposed a formula to calculate the flow in sloping drains. The Manning Formula is now the popular formula for determining flow in sloping drains.

- **1890s: New Gas Mains Allowed Installation of Gas Fired Water Heaters**
  
  Doctors and health authorities advocated the expanded use of hot water as a sanitary measure and proclaimed the health benefits of bathing. The ready availability of public utility gas supply systems, which had been newly laid under city streets, aided in expanding the use of hot water supply systems in buildings and the installation of gas fired water heaters. The availability of public utility systems for supplying electricity for light and power in buildings made possible the installation of efficient electric pumps for pumping water to plumbing fixtures at any height. It was at this time that skyscraper type office buildings were first erected in New York City, Chicago, Philadelphia and other major cities. These buildings were equipped with plumbing systems that performed satisfactorily and were unobjectionable, and suitable kinds and numbers of fixtures were provided in convenient locations for building occupants.
· 1900s: Minimum Requirements for Number of Fixtures

At the start of the twentieth century, laws had already been enacted in many areas of the country requiring the installation of plumbing systems in buildings and the provision of suitable kinds and numbers of fixtures in convenient locations for the use of building occupants. In general, such areas were large municipalities where public water supply and public sewer systems were available for building connections. In areas beyond the limits of public systems, it was deemed unreasonable to require installations of plumbing systems and fixtures. Nevertheless, people desired sanitary plumbing facilities and sought to equip their buildings with appropriate systems.

· 1900s: Key Developments in Water Heating

Hot water supply was especially desired as manufacturers publicized their new developments in water heater equipment. Coal and gas fired sidearm water heaters appeared on the scene. Automatic controls to eliminate the dangers associated with manual operation of water heaters were introduced, and range boiler manufacturers introduced tanks made of several different materials with greater durability.

· 1900’s: Unsanitary Conditions Caused Building Codes to be Updated

Many new tenements were erected in large industrial cities to house the swelling populations. These buildings had sinks and laundry trays in each dwelling unit, but water closets were provided in toilet compartments accessible from the public hallways on each floor. In many cases, more than one family used the toilet facilities. It was soon apparent that such arrangements were inadequate and objectionable and fostered unsanitary conditions. Health authorities put new regulations into effect requiring that water closets be installed in toilet rooms or bathrooms in each dwelling unit, and strenuous efforts were made to bring existing buildings up to existing standards.

· 1906: American Society of Sanitary Engineering Organized

The American Society of Sanitary Engineering grew out of a meeting held in Washington D.C. on January 29-31, 1906. Henry B. Davis, chief Plumbing Inspector for the District of Columbia, believed it was vital that the plumbing practice in the United States be standardized. Mr. Davis invited 25 inspectors from other American cities to organize an association of plumbing inspectors and sanitary engineers. The Fundamental Principle they decided to follow was “Prevention Rather Than Cure”. This principle still guides the society today. ASSE’s activities and programs were designed to educate the industry and the public on the importance of safe and correct plumbing installations.
· 1920s: Post WW I Building Boom

Following World War I and continuing through the early 1920s, the large industrial cities expanded tremendously. New housing developments were built on the fringes of cities, and public water supply, sewer, and utility systems were extended to serve the new buildings. All these were equipped with the most modern plumbing systems and fixtures of the day. Complete bathroom installations, consisting of a water closet, lavatory, and bathtub with an overhead shower were provided in each dwelling unit along with modern kitchen sinks and laundry trays. The growing importance of sanitary plumbing systems in buildings was shown by large scale plumbing installations in hotels, office buildings, factories, food processing plants, and dairy buildings. Most buildings were provided with more plumbing equipment than was required by law. Multistory residential buildings in great numbers were erected in the central parts of cities where land values were very high. They too were fully equipped with complete bathroom, kitchen, and laundry fixtures of modern and sanitary design. Many were equipped with colored plumbing fixtures which were introduced in the middle 1920s. But this tremendous new building construction wave reached its peak in 1929 and came to a sudden halt in 1930 when the severe business depression occurred.

· 1926: IAPMO Began as the Plumbing Inspectors Association of Southern California.

In 1926 forty-two plumbing inspectors banded together to bring about an improvement in the application of common sense codification and application of ordinances based on scientific knowledge. In 1932 they published the Standard Plumbing Code. The organization still writes codes, they publish the Uniform Plumbing Code and the Uniform Mechanical Code. Today they are known as the International Association of Plumbing and Mechanical Officials.

· 1930s: The Depression - Inadequate Systems Corrected

During the 1930s relatively few new buildings were erected until the latter part of the decade. This period was devoted principally to the correction and modernization of plumbing systems and equipment in existing buildings. Important corrections were made to the potable water supply systems of buildings to eliminate all water supply piping connections and fixture supply piping connections and fixture supply connections which were recognized as potential sources of contamination. This drive for correction of systems was led by health officials, water supply officials and building officials to avoid the repetition of the amoebic dysentery epidemic which occurred in the city of Chicago during it’s world fair in 1933. Other important improvements were made in the hot water supply systems in existing buildings. Many were equipped with modern automatically controlled hot water heaters designed for use with gas, oil, or electricity as a source of heat.
· 1935 - 1940: Electricity Extended to Rural Areas

During this period, the public utility systems around the country extended their electric supply lines into a great portion of the rural area. This provided a source of power for pumping water from wells and for supplying plumbing systems with all the water needed to maintain the sanitary standards that were enjoyed in the cities. Private sewage disposal systems were provided by means of underground septic tank and leaching field installations in appropriate locations. In this way, modern sanitary plumbing systems and fixtures became available even in the remote regions of the country.

· 1940s: ASSE and the Plumbing Industry Search for Cause of Polio

In the 1940s the American Society of Sanitary Engineering (ASSE) and the plumbing industry took on an extensive effort to prove that polio was a water borne disease. ASSE and the plumbing industry contended the viral disease was spread through polluted potable water. The theory was that many cases were caused by faulty plumbing practices such as cross connections which led to back siphonage and backflow. The ASSE campaign was of major importance in developing a greater consciousness of proper plumbing practices. Since that time the American Society of Sanitary Engineering has developed many Standards for Products that are components of plumbing systems. The standards have a heavy emphasis on backflow prevention and are being adopted by model codes throughout the country.

· 1944: The National Sanitation Foundation was Formed

The National Sanitation Foundation was formed by Walter Snyder, Henry Vaughan and Nathan Sinai. The Agency was devoted to scientific research in sanitation. They kept in contact with national, state and local governments for the purposes of promoting sound improvements in sanitation. NSF International develops standards for food & beverage equipment, components used in drinking water systems and plastic pipe and fittings.

· 1946 - 1970s: Post WW II Building Boom

In the latter 1940s, following World War II, and continuing through the 1950s, 1960s, and into the 1970s, there was a tremendous expansion of housing developments and industrial plant construction outside the central areas of cities in the United States. New buildings were erected along new principle highways, and public water, sewer, gas, and electric systems were provided for building service needs in most areas. Private systems were utilized in many areas where public systems were not available. All of the buildings built during these years were equipped with modern plumbing systems conforming to sanitary standards elevated to a higher level than ever before.
In the central areas of cities many old buildings were removed and in their places large skyscraper office buildings and apartment buildings were erected. They too were equipped with modern plumbing systems designed in accordance with the highest sanitary standards in history in order to serve the greatest occupancy loads of all time.

· 1950s: N.B.S. Published Report on Estimating Loads

In the 1950s, the National Bureau of Standards published report BMS 65, “Methods of Estimating Loads in Plumbing Systems,” prepared by Dr. Roy B. Hunter. The report gave tables of load producing characteristics (fixture unit weights) of commonly used fixtures along with probability curves which made it easy to apply to actual design problems. The curves are known as “Hunters Curves.”

· 1950s - 1960s: Skyscraper Construction Brings Changes in Design

Tower building construction accelerated in the late 1950s and early 1960s, and necessitated changes in design to meet changing conditions. Increased building heights and increased water usage, including water for air conditioning, required water supply tanks so large that they caused significant space problems and were uneconomical. To meet the changing conditions, design was changed to provide tankless, automatic constant pressure booster pump systems which required a minimum of valuable building space and which also provided a sealed in supply of potable water from the source of supply to the plumbing fixture outlet.

· 1966: The Development of Plastic Piping

In 1966, a critical shortage of copper occurred in the United States because of stoppage of shipments from foreign sources of supply. Inventories of copper drainage waste and vent (DWV) tube and fittings were rapidly exhausted. Large developments of single family residences were halted for most of 1966 because of the unavailability of copper DWV piping which originally had been planned to be installed. This urgent need was soon filled by nonmetallic, plastic DWV pipe and fittings, which were then introduced into use for building plumbing systems under carefully prescribed installation conditions.

· 1961 - 1992: Development of Plumbing for the Disabled

A most significant change in the design of buildings used by the public began in 1961. The object of the change was to make all buildings and facilities, including plumbing, used by the public accessible to, and functional for, the physically handicapped, without loss of function, space, or facility where the general public is concerned. The changes were originally set forth in the American National Standards Institute (ANSI) standard, “Specification for Making Buildings and Facilities Accessible to and Usable by Physically Handicapped People”, originally issued as A117.1-1961.
Updates were made in 1971 and 1980, and in 1992 government regulations went into effect known as the Americans with Disabilities Act (ADA). These regulations were enacted and mandated the necessary building design changes including many related to plumbing systems in buildings.

· 1974: Energy Efficiency in Plumbing Design

Since 1974, when the supply of foreign oil to the United States was interrupted and oil prices rose sharply, ways to conserve energy have been a constant concern. Some important conservation measures related to plumbing were: elimination of water waste, limitation of water use to a reasonable minimum, limitation of hot water supply temperature and rate of flow reductions for hot water faucets, insulation of water heater tanks and piping, and use of heat reclaiming systems and solar heating systems. These are just some of the conservation methods that have been applied to plumbing systems. Today water saving faucets and fixtures are becoming mandated by many municipalities from coast to coast due to water shortages in many water districts around the country.


Legislation was adopted as part of the Energy Efficiency Act in the 1980s to restrict the water flow rates in various plumbing fixtures. Later it was amended with the Energy Policy Act of 1992 to further reduce water usage in plumbing fixtures. As part of the Energy Policy Act of 1992 legislators determined 1.6 gallons per minute would be the maximum consumption allowed for water closets without any testing or research. Manufacturers have spent millions of dollars to redesign fixtures to flush with the lower flow rates and the jury is still out on this one. Can we learn a lesson from this? I think we have. Before legislation of this type is introduced in the future, there should be research done by an independent organization to conclude that the fixtures will work properly at a given flow rate.

· Conclusion

As you can see, there are a lot of significant events recorded in the history of plumbing. Each time something did not work properly, or someone became ill, there was an investigation of some scale to determine the cause of the failure or occurrence. We need to respect the things we have learned from history and continue teaching them to young engineers and apprentices. The code book may tell you not to do something but history tells you why you should not do something.


From an article by Ronald L. George, CIPE, which appeared in the July - September, 1997 issue of ASSE’s Plumbing Standards magazine.
THE EVOLUTION OF PLUMBING CODES

The plumbing industry in the United States has long held a fascination with the history of plumbing codes. Trivia experts debate who has the oldest plumbing code, but the age and beginning of plumbing codes are not as important as how plumbing codes have evolved.

The evolution of plumbing codes in the United States parallels the evolution of the country itself. The true emergence of this country came about in the years following the Civil War. Before the Civil War, the United States was a nation of loosely joined states. While the country had a strong resolve, it was, in fact, a weak union. In the early 1800s, nobody would have considered the United States a superpower, nor would they ever have guessed that they would accomplish such stature.

It was Abraham Lincoln that defined this country as one nation. When the Civil War was fought between 1861 and 1865, the fighting forces came from all of the different state militias. Even the great generals of the South fought because they always had a higher calling for their state (and home), not the federal government. Still, Lincoln’s plan took hold as states worked together to achieve a common goal.

When the troops from the different states fought side-by-side, they also conversed with one another. It was one of the first times in the history of this country that direct communication took place among common people of the different states. This was normally left to politicians and wealthy business owners.

The camaraderie that developed among the soldiers continued for a lifetime. They put their association to use after the war, trying to solve the many problems of the country. Many of these soldiers were future plumbers and sanitarians.

The Civil War era also highlighted the deplorable sanitary conditions in the country. With all of the troops in Washington, the Potomac River smelled of sewage and water quality was terrible. Most soldiers lost their lives in the Civil War not from wounds, but from poor sanitation and unclean water. Historians report that it was contaminated water in the White House that caused the death of Lincoln’s only son, Willy. Hence, Lincoln was directly affected by the poor quality of the water system and the unsanitary conditions of the time.

The Birth of Associations

Early plumbers and sanitarians started associations following the Civil War to collaborate in solving the problems of the poor sanitation. These associations started writing down precepts to prevent
contamination of drinking water. These precepts were passed around to different areas of the United States.

In the 1880s a national plumbing organization was formed to continue these efforts to share ideas and information. That association, originally the National Association of Master Plumbers, is the National Association of Plumbing, Heating, and Cooling Contractors.

The intention of these early plumbing association members was very noble. It was through their efforts that they were going to protect the health of the nation. They had figured out simple ways of protecting potable water from contamination. They also recognized the need to isolate waste from water source.

These recommended practices were gradually adopted by major cities, usually after some major outbreak of disease or other health crisis. The adopted rules became known as the Code of Practice for the plumbing industry. Unfortunately, there was no consistency in the code from one city to the next. The political leaders always thought that their problems were unique when compared to other cities, so they would tinker with the code of practice. Competition as to who had the better code for protecting sanitation began early among the different jurisdictions.

In 1906, a group of sanitary professionals got together under the direction of Henry Davis and formed an organization called The American Society of Sanitary Engineering. Davis envisioned a group that could exchange ideas and try to standardize the different sanitary codes throughout the country. Recognizing that codes, to date, had all been reactionary, ASSE developed a motto of “Prevention Rather Than Cure”. This philosophy was based upon predicting what would occur if certain conditions persisted. The plumbing profession was better equipped to solve a problem before the problem occurred, as opposed to having the medical profession cure the illness.

Building regulations were also being implemented throughout the country in response to major conflagrations. However, the building professionals and the sanitary professionals were not comparing notes. The first group to consider fire protection concerns was the National Fire Protection Association, which was formed in 1896. In 1915, a group of building inspectors got together in New York City to develop the Building Officials Conference of America (BOCA). This was the first group to concentrate on coordinating building code regulations on a national level. Two other major code organizations would follow: Southern Building Code Congress in the South and International Conference of Building Officials on the West Coast. The need for separate organizations was dictated by a lack of adequate transportation and immediate communication. A trip from New York to Los Angeles took from three to five days.
The Hoover Legacy

In 1921, President Warren Harding appointed prominent engineer Herbert Hoover to the position of Secretary of Commerce. Hoover, as an engineer, saw the United States as a vast land where proper planning could change the course of the nation. Remember that the 1920s were a time of prosperity in the United States. Hoover believed that with the emergence from World War I and with the wealth of the nation coming into prominence, the country could improve its quality of life by applying better engineering concepts.

Hoover wanted electricity and indoor plumbing in every home. At the time Hoover was Secretary of Commerce, less than one percent of the homes in the United States had indoor plumbing. In 1921, Hoover started the Building Material and Structures Division of the National Bureau of Standards. The person to head the plumbing section was Dr Roy B. Hunter. Hunter dedicated his talents to the research of plumbing in an effort to standardize regulations in the United States.

The work at the National Standards was a cornerstone in Hoover’s efforts to bring engineering to the forefront in the United States. Hoover believed that the Commerce Department should control the standardization effort since this would improve the ability for entrepreneurs to have easy access to the marketplace. It was only a few years earlier that Henry Ford promoted the idea of interchangeable parts.

Standards for products were emerging at the same time as plumbing codes. The Civil War also had an impact on the development of standards. Prior to the war, manufacturers were producing products to their own specifications. However, one manufacturer’s pipe could not be joined to another manufacturer’s pipe. It was during the war that the manufacturers developed one set of specifications so that their products could be used together. Hoover’s observation in regard to this effort was that it would help spur competition and lower prices for all Americans.

Hoover was a beloved man in our country because of his efforts as Secretary of Commerce. When the first plumbing code was developed in 1928, through the efforts of the National Bureau of Standards, it was nicknamed the Hoover Code. Not because of any effort put forth by Hoover, more to pay tribute to a man who saw the need to develop such a document.
Recognizing Building Demands

The Hoover Code of 1928 was revised in 1932, Hunter continued his research in the 1930s, developing new methods for estimating demands on a plumbing system. His work culminated in the publication of the BMS 66 Plumbing Manual in 1940. These three documents served as the basis for every up-to-date plumbing code of that time. The federal government did not see it as their job to mandate the national plumbing code. They offered it as a suggested document for jurisdictions to adopt. During this period, the federal government was still of the opinion that construction should be regulated at the local level. The plumbing code was only mandated for federal projects.

While the basic emphasis of the Hoover Code and BMS 66 was sanitation, the codes also made a concerted effort to emphasize low cost housing. In Hunter's paper, BMS 65, 1940, he wrote, “The purpose of this series of papers is to collect, in an organized form, the mass of information obtained by the author over a number of years, beginning with the investigation in 1921 of plumbing of small dwellings, and including the current research (1937-1940) on plumbing for low cost housing, together with the results of intervening experiments related to plumbing requirements, and to interpret the results of these investigations in a form suitable for direct and practical application. It is hoped that this series of papers will supply the logical answer to many of the controversial questions pertaining to pipe sizes and design of plumbing construction.”

BMS 66 followed a similar theme, writing, “In order to have good and economical plumbing, it is necessary that there should be some agreement on the rules governing its design and installation. Particular emphasis is placed upon its usefulness in connection with low cost housing, where there is special need to take advantage of all legitimate economies. The field of the manual, however, is not restricted to housing, since the same fundamental principles apply in any structure.”

The BMS 66 manual also stated that many innovations were added to the document to allow engineers to design, and builders to build based on the actual demands of the building. Users of the plumbing code were encouraged to offer comments on the content of the manual. There was an acknowledgment that the document would need to undergo changes to keep it abreast of new technology. However, the document did state that there are certain concepts in plumbing that would never change, only ways to achieve the goals of these concepts.
The Proliferation of Codes

During this time, other organizations were publishing plumbing codes to be adopted by local jurisdictions. The American Standards Association (ASA), later known as ANSI, developed an A40 Committee to prepare a national standard on plumbing. The National Association of Master Plumbers (later known as NAPHCC) published a code, and the Western Plumbing Officials (later known as IAPMO) published a code. All these documents used the work of the National Bureau of Standards as their basis.

The United States’ entry into World War II changed the way plumbing codes were viewed. The National Association of Plumbing Contractors (later NAPHCC) and the United Association (plumbers’ union) collaborated with various government agencies to develop the Emergency Plumbing Standard. This was the first nationally enacted plumbing code since it was made law as an emergency measure during the war.

Since the Emergency Plumbing Standard was considered successful, the National Association of Plumbing Contractors and the UA again joined with government agencies to establish a peacetime code. They first developed a plumbing code for housing in 1949. This was further developed into a plumbing code for all structures. The document, with many sponsoring organizations, was submitted to the American Standards Association for consideration as a National Standard. In 1955, the document was published as the ASA A40.8 National Plumbing Code. Included in the code was a list of basic principles for the development of the National Plumbing Code. (This list of basic principles was published in last month’s newsletter. - ed.)

The beauty of the Basic Principles was that they provided engineering guidelines regarding the intent of the plumbing code. In developing any newer technology or innovative method of plumbing, one only had to reference the intent of the Basic Principles to establish a protocol to follow.

Another feature of the code was the alternate material and methods requirements. This section established a means for the consideration of new or innovative materials or methods. A procedure was provided for gaining immediate acceptance.

The A40.8 was one of the most widely used plumbing codes in the United States. It was adopted by many states and local jurisdictions. The BOCA Basic Building Code referenced the A40.8 as the plumbing code.
ASA required all standards to be periodically updated. It was recognized that the A40.8 would need to be revised to stay current. Unfortunately, the revision committee was unable to achieve a consensus for updating the standard. The committee had many battles that could not be settled. ASA (ANSI) removed their accreditation of the A40.8 in 1963. Two of the member organizations of the revision committee decided to take the draft of the revised A40.8 and develop their own plumbing code. What emerged in 1967 was the first edition of the BOCA Basic Plumbing Code, and in 1971, the first edition of the NAPHCC National Standard Plumbing Code.

The Demise of the Code

What was the controversy that caused the demise of the A40.8? It was all based on recognition of plastic pipe for plumbing systems. The majority of the committee favored adding PVC and ABS plastic pipe as acceptable materials for drainage, waste, and vent systems. However, competing material interests saw plastic as a threat to their industry. The opponents were able to manipulate the consensus process to prevent the recognition of plastic pipe.

BOCA’s response to this dilemma was to prevent material interests from voting on any code matters. The only ones permitted to vote on changes to the BOCA Code would be inspectors that attended the annual meeting. NAPHCC solved the problem by putting the code in the hands of a committee appointed by the president of the association (which would not include material interests).

Not only did material interests use the consensus process to foster their positions, they also used the legal system. When BOCA published their first edition of the Basic Plumbing Code, the cast iron soil pipe industry immediately filed suit against BOCA. Of course, the problem was that the BOCA Code permitted use of plastic pipe for drainage, waste and vent systems. Some believe that NAPHCC waited to publish their version of the code until after the BOCA lawsuit was settled. The cast iron industry lost the lawsuit, but it did delay the adoption (by jurisdictions) of the code.

The demise of the A40.8 brought an end to the pure concepts of plumbing codes in the United States. Organizations and manufacturers recognized that plumbing codes could be used as legal tools to control the marketplace. Politicking, lobbying, and manipulation of the facts could be used to delay, or even restrict, the acceptance of new materials and methods.
There was a tremendous outgrowth of the special interests in the plumbing code profession. A new profession was started – code consultants.

The codes that remained a force were the BOCA Code, the NAPHCC Code, the SBCCI Standard Plumbing Code, and the IAPMO Uniform Plumbing Code. Each of these regional model code organizations knew that the special interests wanted to manage the code for their own benefit. Each organization established policies to prevent the special interests from controlling the free exchange of ideas and the recognition of new technology.

The model code groups developed slogans to guide them in promulgating their codes. The basic expression, still used today, is “The code provides the minimum level of protection against public health, safety and welfare.” Lost in these slogans was the concern for low cost housing. Also lost was a guideline for recognizing new technology. The model code organizations soon developed a policy of cost is not an object when it comes to protection of the public. In 1991, IAPMO dropped the expression of minimum requirements. It was considered inadequate just to have minimum requirements.

What has evolved are plumbing codes filled with niceties. Many changes were made in recent years because someone thought it was a good idea, or because that is how we do it in our part of the country. When technical data is required, it is not uncommon to find data manipulated to achieve the user’s end objective. Opinions garner more support than does pure science. When reports are issued by esteemed research facilities, including the National Bureau of Standards (now known as NIST), those opposed to the new concepts simply raise the red flag of “This may be good in the laboratory, but it does not duplicate what occurs in the field.” When that doesn’t work, the other red flag goes up, “This is good information, but is only a start. Additional testing is necessary.” Any time an opponent wants to stop progress, they merely have to say that more testing is required, when in fact, there will never be enough testing to satisfy them.

While the model code organizations have attempted to remain pure, they too have fallen into using the plumbing code for their own economic gains. The copyright of each code is protected so that only the model code group can generate revenues from the sale of the plumbing code. The plumbing codes also specify requirements for the listing of plumbing products. Some codes require every plumbing product to be listed by a third party agency. Conveniently, the model code organizations have listing services in order to list the plumbing products to meet these requirements in the code. These listings cost manufacturers millions of dollars each year and result in financial gains for the listing agencies. One only has to ask oneself, “Does a hose clamp really need to be listed?”
Consolidating Codes

The last evolution has been a consolidation of codes in the United States. BOCA, ICBO, and SBCCI have joined forces to promulgate the new International Plumbing Code. IAPMO, NAPHCC, and MCAA (Mechanical Contractors Association of America) have joined together to promulgate the A$) National Plumbing Code.

After 33 years, a new edition of the A40 was published in 1993. However, the Secretariat recognized that the document was out of date the day it was published. The IAPMO, NAPHCC, MCAA group intends to update the document to compete against the International Plumbing Code.

The International Plumbing Code had its first edition published in 1995. This joint effort by the code groups is intended to produce the most technically accurate plumbing code in the country. However, there are no rigid guidelines for determining technical accuracy. As a result, the code is still based largely upon opinions of committee members overseeing its development.

While the direction of plumbing codes may not appear to be very promising in the United States, in fact, the current state of plumbing codes is very good. The United States has always been known to adjust their methods to correct what is wrong. Other nations can learn from the wealth of experience the United States has in the area of plumbing codes. The points that other nations should follow in developing a good national plumbing code are as follows:

- Establish minimum performance guidelines.
- Consider the cost impact of any code regulation.
- Have the code specify minimum requirements.
- Establish guidelines for evaluating technical data.
- Permit direct input from any interested party.
- Have open proceedings for all code activity.
- Have an annual review of the code.
- Require all parties to disclose their biases.
- Expose all hidden agendas.
- Have voting rights on code matters established to be fair.
- Provide a quick and impartial appeals mechanism.
- Permit a legal challenge of all code regulations.

There are also things to avoid in promulgating a national plumbing code. They would be as follows:
- Don’t permit the copyright to be retained by one entity.
- Don’t permit the code writing organization to serve as a product listing agency.
- Don’t permit manufacturers to use the code to restrict progress.
- Don’t permit manufacturers or trade organizations to control the voting.
· Don’t permit unsubstantiated, biased (non-technical) data to be considered.
· Don’t permit personal opinions to override credible technical data.

It is most important for a plumbing code to remain a flexible document that allows for innovations and advances in technology. The engineering mind never stops trying to solve problems in slightly better ways.

Plumbing codes can be defined as good or bad. A plumbing code that is restrictive, takes years to evaluate new technology, and is not open to immediate change can easily be defined as a bad code. A good plumbing code is one that is open, fair, established on the latest available technology, and based on common sense. This is what the plumbing industry worldwide should be striving for — good plumbing codes.

From an article by Julius Ballanco, PE, which appeared in the November, 1996 issue of PM Engineer magazine.

BASIC PRINCIPLES OF A40.8

The A40.8 has been considered by many in this profession to be the last pure and innocent plumbing code in the United States. While it was neither pure nor innocent, the document followed the philosophy of the National Bureau of Standards. It had requirements based on the latest available technology, was concerned about low cost housing and provided the necessary protection of public health.

Included in the A40.8 was a list of Basic Principles. The Basic Principles were intended to be guidelines for the development of the National Plumbing Code. The Basic Principles from the 1955 edition of the ASA A40.8 National Plumbing Code were as follows:

Principle No. 1: All premises intended for human habitation, occupancy or use shall be provided with a supply of pure and wholesome water, neither connected with unsafe water supplies nor subject to the hazards of backflow or back siphonage.

Principle No. 2: Plumbing fixtures, devices and appurtenances shall be supplied with water in sufficient volume and at pressures adequate to enable them to function satisfactorily and without undue noise under all normal conditions of use.

Principle No. 3: Plumbing shall be designed and adjusted to use the minimum quantity of water consistent with proper performance and cleaning.
Principle No. 4: Devices for heating and storing water shall be so designed and installed as to prevent dangers from explosion through overheating.

Principle No. 5: Every building having plumbing fixtures installed and intended for human habitation, occupancy or use on premises abutting on a street, alley or easement in which there is a public sewer shall have a connection with the sewer.

Principle No. 6: Each family dwelling unit on premises abutting on a sewer or with a private sewage disposal system shall have at least one water closet and one kitchen type sink. It is further recommended that a lavatory and bathtub or shower be installed to meet the basic requirements of sanitation and personal hygiene.

All other structures for human occupancy or use on premises abutting on a sewer or with a private sewage disposal system shall have adequate sanitary facilities, but in no case less than one water closet and one other fixture for cleaning purposes.

Principle No. 7: Plumbing fixtures shall be made of smooth nonabsorbent material, shall be free from concealed fouling surfaces and shall be located in ventilated enclosures.

Principle No. 8: The drainage system shall be designed, constructed and maintained so as to guard against fouling, deposit of solids and clogging, and with adequate cleanouts so arranged that the pipes may be readily cleaned.

Principle No. 9: The piping of the plumbing system shall be of durable material, free from defective workmanship and so designed and constructed as to give satisfactory service for its reasonable expected life.

Principle No. 10: Each fixture directly connected to the drainage system shall be equipped with a water seal trap.

Principle No. 11: The drainage system shall be designed to provide an adequate circulation of air in all pipes with no danger of siphonage, aspiration or forcing of trap seals under conditions of ordinary use.

Principle No. 12: Each vent terminal shall extend to the outer air and be so installed as to minimize the possibilities of clogging and the return of foul air to the building.

Principle No. 13: The plumbing system shall be subjected to such tests as will effectively disclose all leaks and defects in the work.

Principle No. 14: No substance which will clog the pipes, produce explosive mixtures, destroy the pipes or their joints, or interfere unduly with the sewage disposal process shall be allowed to enter the building drainage system.
Principle No. 15: Proper protection shall be provided to prevent contamination of food, water, sterile goods and similar materials by backflow of sewage. When necessary, the fixture, device or appliance shall be connected indirectly with the building drainage system.

Principle No. 16: No water closet shall be located in a room or compartment which is not properly lighted and vented.

Principle No. 17: If water closets or other plumbing fixtures are installed in buildings where there is no sewer within a reasonable distance, suitable provision shall be made for disposing of the building sewage by some accepted method of sewage treatment and disposal.

Principle No. 18: Where a plumbing drainage system may be subjected to backflow of sewage, suitable provision shall be made to prevent its overflow into the building.

Principle No. 19: Plumbing systems shall be maintained in a sanitary and serviceable condition.

Principle No. 20: All plumbing fixtures shall be so installed with regard to spacing as to be reasonably accessible for their intended use.

Principle No. 21: Plumbing shall be installed with due regard to preservation of the strength of structural members and prevention of damage to walls and other surfaces through fixture usage.

Principle No. 22: Sewage or other waste from a plumbing system which may be deleterious to surface or subsurface waters shall not be discharged into the ground or into any waterway unless it has first been rendered innocuous through subjection to some acceptable form of treatment.

From an article by Julius Ballanco, PE, which appeared in the November, 1996 issue of PM Engineer magazine.
WATER FACTS

- One gallon of fresh water weighs 8.333 pounds.
- One cubic foot of water contains 7.48 gallons.
- One cubic foot of water weighs 62.428 pounds.
- One gallon of water occupies 231 cubic inches.
- The capacity of a cylinder in gallons is equal to the length in inches multiplied by the square of the diameter in inches x 0.0034.
- A water column 1 foot high exerts a pressure of 0.4333 pounds per square inch.
- Doubling the diameter of a pipe increases its capacity four times.
- Water expands 4.34% when heated from 40°F to 212°F.
## CONVERSION FACTORS

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<tr>
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FLOOR CLEANOUT DETAIL

NOTE:
NO-HUB INSTALLATION IS SIMILAR

SCALE: NONE
WALL CLEANOUT DETAIL

SCALE: NONE
**KITCHEN GREASE INTERCEPTOR SIZING GUIDE**

1. Determine the cubic content of all fixtures being drained.
   
   **Example:** A wash sink is 48" long x 24" wide x 12" deep.
   
   \[48 \times 24 \times 12 = 13,824 \text{ cubic inches}\]

2. Convert cubic inches into gallons by dividing by 231.
   
   **Example:** \[\frac{13,824 \text{ cubic inches}}{231} = 59.8 \text{ gallons}\]

3. Determine the **Actual Drainage Load**
   
   A fixture is usually filled to about 75% of capacity with waste water. The items being washed displace the remaining 25% of the fixture content.
   
   **Example:** Actual drainage load = 59.8 gallons \times 75\% = 44.9 Gallons

4. Determine the **Flow Rate** and the **Drainage Period.**
   
   Good practice dictates a (1) minute drainage period, however where conditions permit, a (2) minute drainage period may be used.
   
   The drainage period is the actual time required to completely drain the fixture.

   \[
   \text{Flow Rate} = \frac{\text{Actual Drainage Load}}{\text{Drainage Period}}
   \]
   
   **Example:** \[\frac{44.9 \text{ gallons}}{1 \text{ minute}} = 44.9 \text{ gallons per minute}\]

5. Plumbing and Drainage Institute G-101, (Certification Standard Flow rates and Grease Retention Capacity Ratings for Grease Interceptors) states that an interceptor must retain not less than 2.25 pounds of grease for each gallon per minute of average flow rate.

6. A cubic foot of grease at 100 degrees F weighs 56.5 pounds.

7. The fixture used in this example would require an interceptor that retains 101 pounds of grease as determined below:
   
   **Example:** \[44.9 \text{ GPM} \times 2.25 \text{ pounds of grease per GPM} = 101.03 \text{ pounds}\]
   
   Or, if you wish to use volume rather than pounds:
   
   \[101.03 \text{ pounds of grease} \div 56.5 \text{ pounds per cubic foot} = 1.788 \text{ cubic feet} \]
   
   capacity required.
Note:
1. All Dimensions Shown shall be Verified with Local Authority Having Jurisdiction
2. City of Cleveland requires 1000 gallon minimum size.
GENERAL NOTES:
1. CONTRACTOR SHALL VERIFY EXACT THERMOSTATIC MIXING VALVE PIPING ARRANGEMENT WITH MANUFACTURER.
2. PROVIDE VACUUM RELIEF VALVE ON BOTTOM FEED TANK ONLY.

WATER HEATER PIPING DIAGRAM
NO SCALE
GENERAL NOTES:
1. CONTRACTOR SHALL VERIFY EXACT THERMOSTATIC MIXING VALVE PIPING ARRANGEMENT WITH MANUFACTURER.
2. PROVIDE VACUUM RELIEF VALVE ON BOTTOM FEED TANKS ONLY.

WATER HEATER PIPING DIAGRAM
NO SCALE
INSTANTANEOUS ELECTRIC WATER HEATER DETAIL

SCALE: NONE
TRAP PRIMER DETAIL

SCALE: NONE
VENT THROUGH ROOF DETAIL

SCALE: NONE
HANGER ROD

HEAVY DUTY CLEVIS HANGER

LOCKING NUT
SUPPORT NUT

VAPOR BARRIER INSULATION

16 GAUGE ZINC COATED SHEET STEEL SADDLE AT LEAST 12" LONG.

SINGLE HORIZONTAL RUNS WITH VAPOR BARRIER INSULATION

CLEVIS HANGER
SCALE: NONE

82
TRAPEZE HANGER DETAIL

SCALE: NONE
GAS PIPE ROOF SUPPORT DETAIL

SCALE: NONE
Sump Pump Design Notes

Use Submersible when:
- Outdoors
- Indoors with Limited Headroom above Sump
- Sumps over 10'-0"
- Limited Maintenance
- Where Abrasives occur, i.e. Sand

Use Shaft type when:
- Desire to have motor above floor
- Long life of motor (20-30 years) with proper maintenance
- Explosion proof motor capability
- Economical up to 8 feet deep basin

Basin
- Minimum width of 48” — 60” for heavy flows
- 4'-0” minimum between inlet and bottom of basin

Power
- Alarms require 110 volt connection
- Power shall be 3 phase for pumps and control circuit

Selection Example
100 ft. x 100 ft. = 10,000 sq. ft.
10,000 sq. ft. X ¼ft. / hr. rainfall rate = 2500 cu. ft. / hour
2500 cu. ft. X 7.5 = 18,750 gal. / hour
18,750 gph ÷ 60 = 320 gpm.

Head Calculation Example

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Pump Selection
- Select non-overloading motor
- Normal rpm 1150
ELEVATOR PIT SUMP PUMP DETAIL

SCALE: NONE
HYDRAULIC ELEVATOR SUMP PUMP DETAIL

SCALE: NONE
CITY OF AKRON
DOMESTIC WATER PIPING ISOMETRIC

 SCALE: NONE

NOTE:
REFER TO FLOOR PLAN
FOR PIPE SIZES
REDUCED PRESSURE PRINCIPLE BACKFLOW PREVENTION ASSEMBLY
PER CITY OF AKRON PUBLIC UTILITIES BUREAU

1. ALL PIPING TO CONFORM TO AKRON WATER WORKS STANDARD CONSTRUCTION DRAWINGS AND SPECIFICATIONS.
2. BYPASSING OF THIS ASSEMBLY IS SPECIFICALLY PROHIBITED.
3. INSTALLATION OF THIS ASSEMBLY IN VAULT IS SPECIFICALLY PROHIBITED.
4. UNIONS PRIOR TO BACKFLOW PREVENTION ASSEMBLIES ARE PROHIBITED.
5. INSTALLED DIRECTLY AFTER THE METER SETTING AHEAD OF ANY OUTLETS.
6. INSTALLED SO AS TO BE READILY ACCESSIBLE FOR INSPECTION, TESTING AND MAINTENANCE.
7. PROVIDED WITH ADEQUATE SPACE FOR INSPECTION, TESTING, MAINTENANCE AND DISASSEMBLY.
8. PROTECTED FROM FREEZING BY INSTALLATION WITHIN A HEATED BUILDING.
9. MOUNTED IN A HORIZONTAL POSITION WITH ABUTTING SHUT-OFF VALVE, AS SUPPLIED WITH THE ASSEMBLY, THREE FEET ABOVE FINISHED FLOOR.
10. PROVIDED WITH ADEQUATE DRAINAGE.
11. INSTALLED SO THAT THERE IS A VISIBLE FREE DISCHARGE FROM THE RELIEF PORT WITH NO EXTENSION PIPING.
12. INSTALLED AS PER MANUFACTURER'S SPECIFICATIONS. WHERE MANUFACTURER'S SPECIFICATIONS CONFLICT WITH THESE GUIDELINES, THESE GUIDELINES SHALL GOVERN.
13. BECAUSE OF THEIR DESIGN, BACKFLOW PREVENTION ASSEMBLIES CREATE A CLOSED SYSTEM AND A DETECTABLE PRESSURE LOSS. BECAUSE OF THESE FACTS, THE INSTALLATION MAY ALTER THE HYDRAULICS OF THE INTERNAL PLUMBING SYSTEM. THE OWNER SHOULD CONTACT A MECHANICAL DESIGNER PRIOR TO INSTALLATION.
14. UPON INSTALLATION, ASSEMBLIES MUST BE TESTED BY A BACKFLOW PREVENTION ASSEMBLY TESTER, CERTIFIED BY THE OHIO DEPARTMENT OF COMMERCE. THE ASSEMBLY MUST BE DISMANTLED, INSPECTED INTERNALLY, CLEANED, AND REPAIRED, IF NECESSARY.

(*) ALL REQUIREMENTS MAY NOT APPLY TO THIS PROJECT)
ASME PRESSURE RELIEF VALVE, EXTEND DISCHARGE PIPING FULL SIZE TO OVER TOP OF NEAREST FLOOR DRAIN WITH AIR GAP

PRESSURE REDUCING VALVE

REduced PRESSURE BACKFLOW PREVENTER

FUNNEL

EXTEND DISCHARGE PIPING FULL SIZE TO OVER TOP OF NEAREST FLOOR DRAIN WITH AIR GAP

SHUT-OFF VALVE (TYP)

VALVED BYPASS AROUND PRESSURE REDUCING VALVE

UNION (TYP)

MAKE-UP WATER STATION

SCALE: NONE
ROUTE TEPID WATER IN WALL PLUMBING CONTRACTOR TO COORDINATE INSTALLATION OF PIPING WITH GENERAL CONTRACTOR

STAINLESS STEEL WALL ESCUTCHEON (TYPICAL)

ROUTE SANITARY PIPE TO FLOOR DRAIN THRU WALL (TERMINATE WITH 3" AIR GAP)

FROM TEPID WATER DISTRIBUTION SYSTEM

SHUT-OFF VALVE

EMERGENCY SHOWER / EYEWASH DETAIL

SCALE: NONE
Hose Bibb Detail
Scale: None
FROSTPROOF HOSE BIBB DETAIL

SCALE: NONE
FROSTPROOF YARD HYDRANT DETAIL

SCALE: NONE
SOURCES OF INFORMATION

City of Cleveland
Distribution Systems Engineering Services
Guy Singer-Supervisor
(216)-664-2444 x5555

Permit & Sales Unit
Submittal and processing of permits for service connections, inspection of service connection installations on owner’s side, hydrant permits, location of individual service lines.
   Greg McClain, Supervisor   (216) 664-2444 x5200
   Address: 1201 Lakeside Avenue, Cleveland, OH 44114

Plan Review Unit
Review of connection sizing and meter sizing of service connections (eventual approval process for plans in 1998)
   Tina Gosha   (216) 664-2444 x5526
   Address: 1201 Lakeside Avenue, Cleveland, OH 44114

Backflow Unit
Review of connections for backflow requirements, inspection and verification of backflow installations.
   John Corsi, Sr.   (216) 664-3944
   Address: 1825 Lakeside Ave. Cleveland, OH 44114

Flow Test Information
Static and Residual pressure readings
   Leondria Williams   (216) 664-2444 x5505

Mapping Unit
Location of water mains and copies of maps.
   Richard Smith   (216) 664-2444 x5558
Cleveland Water Pollution Control Department

Deputy Commissioner (216) 664-2754

Contact for Sewer Drawings and Information

Engineering
Rashid Zoghaib (216) 664-3785
12303 Kirby Avenue, Cleveland, Ohio 44108

City of Cleveland
Division of Building and Housing (216) 664-2910

Building Code Consultation
Timothy R. Wolosz, Commissioner (216) 664-2298

Zoning Code Consultation
Richard Riccardi, Assistant Commissioner (216) 664-3827

Structural Plan Review
Ramesh Patel, Chief Civil Engineer (216) 664-2923

HVAC, Plumbing Plan Review
Timothy Musser, Chief Mechanical Engineer (216) 664-2036

Electrical Plan Review
Kenneth Marriott, Electrical Engineer (216) 664-3635

Contractor Registration
Timothy Wolosz, Commissioner (216) 664-2298

Building Inspections
District 1 – Kevin Franklin (216) 664-4364
Chief Building Inspector
District 2 – George Lazarowski (216) 664-2032
Chief Building Inspector
District 3 – Pete Stewart (216) 664-2030
Chief Building Inspector
District 4 – Dwayne Ford (216) 664-4316
Chief Building Inspector

Vacant Properties Unit
Tom Ardito, Chief Building Inspector  (216) 664-3669

Electrical Inspections
Charlie Stroud, Chief Elect. Inspector  (216) 664-2616

HVAC, Refrigeration Inspections
Bill Cagney, Acting Chief HVAC/Refrigeration Inspector  (216) 664-2284

Plumbing Inspections
Bill Cagney, Chief Plumbing Inspector  (216) 664-2284

Elevator Inspections
Bill Cagney, Chief Elevator Inspector  (216) 664-2284
OTHER IMPORTANT SOURCES OF INFORMATION

Officials

Building Officials and Code Administrators International (BOCA)
1245 Sunbury Rd., Suite 100
Westerville, OH 43081
Bruce Larcorb - Senior Service Coordinator, Mid-East Regional Office: (614) 890-1064 or (614) 890-9712

Americans with Disabilities Act (ADA) Title III, Public Law 101-636
U.S. Department of Justice
Washington, D.C. 20530
Barbara S. Drake, Deputy Assistant Attorney General
Stewart B. Oneglia, Chief Coordination and Review Section
John Wodatch, Director
Information: (202) 514-0301 (Voice)
(202) 514-0381 (TDD)
(202) 514-0383 (TDD)
Copies of Act: (202) 514-0301 (Voice)
(202) 514-0381 (TDD)
Electronic Bulletin Board: (202) 514-6193

Cuyahoga County Sanitary Engineer
6100 West Canal
Valley View, Ohio 44125
Tom Atherton - Plan Review / County Grease Traps
(216) 443-8204

Cleveland Fire Prevention Bureau
1645 Superior Avenue
Cleveland, Ohio 44114-2984
Lt. Doug Veselsky - Sprinkler and Plan Review
(216) 664-6664

Cleveland Plumbing Industry Fund
981 Keynote Circle Suite #30
Brooklyn Hts., Ohio 44131
Thomas J. Wanner, Executive Director
(216) 459-0770, Fax: 216-459-1342
Utility Companies

Dominion East Ohio Gas Company
1201 East 55th Street
P.O. Box 5759
Cleveland, Ohio 44101-0759
(800) 362-7557

Columbia Gas Company
7080 Fry Road
Middleburg Heights, Ohio 44130
(800) 440-6111

The Illuminating Company
55 Public Square
P.O. Box 5000
Cleveland, Ohio 44101
Central Sales Region
(216) 622-9800

First Energy
6200 Oak Tree Boulevard
Independence, Ohio 44131
or
P.O. Box 94661
Cleveland, Ohio 44101-4661
(330) 315-6976

Cleveland Thermal Energy Resources
2274 Canal Road
Cleveland, Ohio 44113
(216) 241-3636

Lake County Water Department
Plan Review and Questions
(440) 639-4825
Flow Test and Water Quality
(440) 951-8410
Societies

Cleveland Engineering Society
3100 Chester Avenue
Cleveland, Ohio 44114-4683
Debra Mitchell, Executive Director
(216) 361-3100

Ohio Association of Consulting Engineers
Don Mader, Executive Director
(614) 487-8844

Cleveland ASHRAE
Billy Kodosky, President
(330) 342-9400

National Fire Protection Association
(800) 344-3555

American Society of Sanitary Engineering
Northern Ohio Chapter
Jason Shank, President
(216) 459-2900
## LOCAL CODE OFFICIALS

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<th>Address Details</th>
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<td>Bay Village</td>
<td>350 Dover Center Road, Bay Village, OH 44140</td>
<td>(440) 899-3402</td>
<td>(440) 899-3418</td>
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<tr>
<td>Brecksville</td>
<td>9069 Brecksville Road, Brecksville, OH 44141</td>
<td>(440) 526-2630</td>
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Chardon
470 Center Street Building 8
Chardon, Ohio 44024
(440) 285-2222
Fax: (440) 286-1290

Fairview Park
20777 Lorain Road
Fairview Park, Ohio 44126
(440) 356-4405
Fax: (440) 356-4404

Cleveland
601 Lakeside Avenue
Cleveland, Ohio 44114
(216) 664-2719
Fax: (216) 420-8419

Garfield Heights
5407 Turney Road
Garfield Heights, Ohio 44125
(216) 475-3835
Fax: (216) 475-1124

Cleveland Heights
40 Severance Circle Drive
Cleveland Heights, Ohio 44118
(216) 291-4955
Fax: (216) 291-4421

Highland Heights
5827 Highland Road
Highland Heights, Ohio 44143
(440) 442-7403
Fax: (440) 473-1994

Cuyahoga Heights
4863 East 71st Street
Cuyahoga Heights, Ohio 44125
(216) 524-6068
Fax: (216) 641-8485

Independence
6800 Brecksville Road
Independence, Ohio 44131
(216) 524-1019
Fax: (216) 573-1592

East Cleveland
13601 Euclid Avenue
East Cleveland, Ohio 44112
(216) 681-2106
Fax: (216) 681-2402

Jefferson
12 West Jefferson Street
Jefferson, Ohio 44047
(440) 576-6010
Fax: (440) 576-5527

Euclid
585 East 222nd Street
Euclid, Ohio 44123
(216) 289-8181
Fax: (216) 289-8184

Lakewood
12650 Detroit Road
Lakewood, Ohio 44107
(216) 529-6270
Fax: (216) 529-5936
Lyndhurst
5287 Mayfield Road
Lyndhurst, Ohio 44124
(440) 473-5108
Fax: (440) 442-7189

Middleburg Heights
15700 Bagley Road
Middleburg Heights, Ohio 44130
(440) 234-2218
Fax: (216) 234-9092

Macedonia
9691 Valley View Road
Macedonia, Ohio 44056
(330) 468-8360
Fax: (330) 468-8396

Moreland Hills
4350 SOM Center Road
Moreland Hills, Ohio 44022
(440) 248-1188
Fax: (440) 498-9591

Maple Heights
5353 Lee Road
Maple Heights, Ohio 44137
(216) 663-4094
Fax: (216) 587-9094

Newburg Heights
4000 Washington Park Blvd.
Newburg Heights, Ohio 44105
(216) 475-3562
Fax: (216) 641-2712

Mayfield Heights
6154 Mayfield Road
Mayfield Heights, Ohio 44124
(216) 442-2626
Fax: (216) 442-7662

North Olmsted
5200 Dover Center Road
North Olmsted, Ohio 44070
(440) 777-8000
Fax: (440) 777-5889

Medina
4800 Ledgewood Drive
Medina, Ohio 44256
(330) 723-9523
Fax: (330) 723-9659

North Randall
21937 N Miles Road
North Randall, Ohio 44128
(216) 662-0430
Fax: (216) 587-9280

Mentor
8500 Civic Center Blvd.
Mentor, Ohio 44060
(440) 974-5785
Fax: (440) 974-5708

North Royalton
11545 Royalton Road
North Royalton, Ohio 44133
(440) 582-3000
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South Euclid
1349 South Green Road
South Euclid, Ohio 44121
(216) 381-0400
Fax: (216) 291-4959

Willoughby Hills
35405 Chardon Road
Willoughby Hills, Ohio 44094
(440) 975-3550
Fax: (440) 918-8749

Strongsville
16099 Foltz Industrial Parkway
Strongsville, Ohio 44136
(440) 238-5720
Fax: (440) 238-3001

Willowick
31230 Vine Street
Willowick, Ohio 44095
(440) 516-3000
Fax: (440) 585-3776

University Heights
2300 Warrensville Center Road
University Heights, Ohio 44118
(216) 932-7800
Fax: (216) 932-5239

Westlake
27700 Hilliard Road
Westlake, Ohio 44145
(440) 871-3300
Fax: (440) 835-6447

Wickliffe
28730 Ridge Road
Wickliffe, Ohio 44092
(440) 943-7115
Fax: (440) 943-7162

Willoughby
One Public Square
Willoughby, Ohio 44094
(440) 951-2800
Fax: (440) 953-4167
CLEVELAND AREA ENGINEERS

Austin Company
6095 Parkland Blvd.
Cleveland, OH 44124
(440) 544-2600

Austrian and Associates
2530 Superior Avenue
Cleveland, OH 44114
(216) 621-6631

Bandwen, Williams, and Kindbom
3475 Forest Lake Suite 300
Union town, OH 44685
(330) 899-9633

Burgess & Niple, LTD.
100 West Erie Street
Painesville, Ohio 44077
(440) 951-7050

CEC Consultants
11699 Brookpark Road
Cleveland, OH 44130
(216) 749-2992

C.T. Consultants, Inc.
35000 Kaiser Court
Willoughby, Ohio 44124
(440) 951-9000

Denk Associates
503 East 200th Street
Cleveland, Ohio 44119
(216) 531-8880

Frederick Frederick and Heller
672 East Royalton Road
Broadview Heights, Ohio 44147
(440) 546-9696
H2L1 Engineering Inc.
1785 East 45th Street
Cleveland, OH 44103
(216) 361-2911

Hinkel Engineering
1022 Heyl Road
P.O. Box 996
Wooster, OH 44691
(330) 262-0042

Karpinski Engineering
3135 Euclid Avenue
Cleveland, OH 44115
(216) 391-3700

McHenry and Associates
25001 Emery Road, Suite 200
Warrensville Heights, OH 44128-5621
(216) 292-4696

Middough Associates
1901 East 13th Street
Cleveland, OH 44114
(216) 367-6000

Osborn Engineering
1300 East 9th Street
Cleveland, OH 44114
(216) 861-2020

Peters, Tschantz and Associates
275 Springside Drive, Suite 300
Akron, OH 44333
(330) 666-3702

Point One Design
9941 York Theta Drive
North Royalton, OH 44133
(440) 230-1800

Ralph Tyler Company
1120 Chester Ave. Suite 200
Cleveland, OH 44115
(216) 623-0808
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<td>216-252-9590</td>
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MANUFACTURER'S REPRESENTATIVES

HOBART 868-446-2278  www.hobartcorp.com
HOLEY VALVE COMPANY  440-786-8833  www.jmco.com
HOMA PUMP  216-663-8700  www.grinder-pumps.com
HONEYWELL  440-786-8883  www.honeywell.ca
HOTBOX  800-298-0401  www.hot-box.com
HOUZER  724-981-5500  www.houzersink.com
HUSKY  614-296-7906  www.anaco-husky.com
HYDRO SYSTEMS  216-449-2477  www.hydrosystems.com
INGERSOL RAND  216-447-9190  www.ingo.com
INSINKERATOR  216-366-9200  www.insinkerator.com
INSULTECT  216-741-7000  www.mygmeledproducts.com
INTERSAN  216-696-1155  www.intersan.us.com
IONPURE  978-614-7326  www.ionpure.com
IPx  800-298-0401  www.ipxnc.com
IPX CORPORATION  724-981-6500  www.ipxcorp.com
ISMET UTILITY CONTROLLERS  440-944-7500  www.ismet.com
JENNY SPRINKLER AIR COMPRESSORS  216-741-7000  www.steamjenny.com
J.R. SMITH  440-944-7500  www.sjsmth.com/ buzz
JADO / PORCHER  419-756-0233  www.jadoporcher.com
JASON WHIRLPOOL STUBS  440-871-2827  www.jasonint.com
JOHNSON CORPORATION  330-659-0200  www.liquimeyer.com
JONES STEPHENS CORP.  888-594-7468  www.phinbest.com
JOSAM  216-741-7000  www.josam.com
JOSAM (SOUTHERN OH)  740-927-6880  www.josam.com
JUST/EC  339-425-2555  www.justec.com
JUST/EC (SOUTHERN OH)  740-927-6880  www.justec.com
KELTECH TANKLESS WATER HEATERS  800-999-4320  www.keltech-nc.com
KINDRED STAINLESS STEEL SINKS  866-567-5045  www.kindred-sinkware.com
KINETICO  330-296-3978  www.kinetico.com
KOHLER  216-447-0050  www.us.kohler.com
LAARS HEATING SYSTEMS  330-659-0200  www.laars.com
LASCO BATHWARE  724-581-5500  www.lascobathware.com
LAWLER  216-696-1155  www.lawlervalve.com
## MANUFACTURER’S REPRESENTATIVES

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<td>LEGEND VALVE</td>
<td>PROMARC SALES INC.</td>
<td>888-584-7458</td>
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<td>LEONARD</td>
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<td>LIBERTY PUMPS</td>
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<td>LINDSAY CONCRETE PRODUCTS</td>
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<td>MAJESTIC FIREPLACE HANDBOOK</td>
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<td>MARLO</td>
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<td>MASON INDUSTRIES, INC.</td>
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<td>MCGUIRE MANUFACTURING</td>
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<td>MG CAST IRON COUPLINGS</td>
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<td>MICROPHOR, INC.</td>
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<td>MIFAB</td>
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<td>MILIPOR</td>
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<td>MUSTEE</td>
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<td>NATIONAL CHIMNEY LINER</td>
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<td>NELSON</td>
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<td>NEPTUNE</td>
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<td>NEOPERL</td>
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MANUFACTURER'S REPRESENTATIVES

NEW YORKER BOILERS
NOMACO PIPE INSULATION
NORITZ TANKLESS HEATERS
NORWALK CONCRETE IND.
NOVEON FLOWGUARD GOLD
OASIS
OATEY
OLSONITE
OMEXELL
ORION FITTINGS
PACO PUMPS
PEERLESS FAUCETS
P V I WATER HEATERS
PARKER BOILER COMPANY
PATTERSON - KELLEY BOILERS
PATTERSON FIRE PUMPS
PEERLESS FAUCETS
PEERLESS PUMP
PERFECTION CORP.
PETES PLUGS
PLUMBEREX SPECIALTY PRODUCTS
POLYCAST TRENCH DRAIN SYSTEMS
POLYDRAIN
POTTER ROEMER
POWERS
PRECISION BOILERS
PRECISION PLUMBING PRODUCTS
PROCEPTOR
PROVENT SYSTEMS
PURITAN BENNETT
QUANTUM FLO
RAYCHEM
RHI WATER HEATERS

STORY EQUIPMENT SALES
CURRAYN SALES, INC.
NORITZ TANKLESS HEATERS
NORWALK CONCRETE IND.
NOVEON, INC.
SAFPCO SALES
EWA CO.
MIWEST SPEC
REPRESENTATIVE
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BOILER SPECIALISTS, INC.
D. B. JOHNSON COMPANY
TROMBOLD EQUIP. CO.
LIBB CO. INC.
LIBB CO. INC.
NORTH SHORE PUMP CO.
PERFECTION CORP.
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REPRESENTATIVE
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ADCO SALES INC.
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440-786-1100
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740-251-5151
330-659-5295
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216-331-9333
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www.noritzamerica.com
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www.oasiscolors.com
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www.omexell.com
www.orionfittings.com
www.pacopumps.com
www.peerless.com
www.pvi.com
www.parkerboiler.com
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www.pattersonpumps.com
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www.perfectioncorporation.com
www.petesplug.com
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www.bubblemasterstems.com
www.abdrains.com
www.potterroemer.com
www.powersoniccontrols.com
www.precisionboilers.com
www.pppinc.com
www.proceptorm.com
www.proventsystems.com
www.puritanbennett.com
www.quantumflo.com
www.raychem.com
www.rhiwaterheaters.com
<table>
<thead>
<tr>
<th>MANUFACTURER’S REPRESENTATIVES</th>
</tr>
</thead>
<tbody>
<tr>
<td>RCF PLASTICS, INC.</td>
</tr>
<tr>
<td>RECO WATER HEATERS</td>
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<tr>
<td>REDGOAT</td>
</tr>
<tr>
<td>RED-WHITE VALVE CORPORATION</td>
</tr>
<tr>
<td>RHEEM/RUUD</td>
</tr>
<tr>
<td>RINNAI TANKLESS HEATERS</td>
</tr>
<tr>
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<td>ROOFTOP BLOX</td>
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<td>SANYMETAL TOILET PARTITIONS</td>
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<td>SHERWOOD PUMPS</td>
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<td>SPEARS MANUFACTURING</td>
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<td>STAR SOIL PIPE AND FITTINGS</td>
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<tr>
<td>STAR SPRINKLER COMPANY</td>
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<td>STATE WATER HEATERS</td>
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<td>STERN - WILLIAMS</td>
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<tr>
<td>SPECIFIED TECHNOLOGIES INC.</td>
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<td>STIEBEL ELTRON</td>
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not available
www.recousaheaters.com
www.redgoat.com
www.redwhitevalvesusa.com
www.rheem.com
www.foreverhotwater.com
www.rockfordseparators.com
www.rocktopbox.com
www.rovanco.com
www.rsce-heattrace.com
www.samsoncontrols.com
www.cranepumbing.com
www.scaleSAFE.com
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www.sqaare-cogswell.com
www.ssgcgo.com
www.starproducts.com
www.startsprinkler.com
www.statelind.com
www.stanwilliams.com
www.sfiresstop.com
www.stiebel-eltron-usa.com
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<th>MANUFACTURER'S REPRESENTATIVES</th>
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<td>STRAHMAN</td>
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<td>STUDOR, INC.</td>
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<td>TEKMAR CONTROL SYSTEMS</td>
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<td>THERMACOR</td>
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<td>THERMAL SOLUTIONS</td>
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<td>THERMON</td>
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<td>THRUSH COMPANY</td>
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<td>TIGERFLOW</td>
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<td>TOLCO PIPE SUPPORTS</td>
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<td>TOPP INDUSTRIES, INC.</td>
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<td>TOWN &amp; COUNTRY (T&amp;C)</td>
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<td>TRACETEK</td>
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<td>TRACPIPE (OMEGAFLex, INC.)</td>
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<td>TRASOR CORP.</td>
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<td>TRI - TECH MED.</td>
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<td>TRIAD PROCESS VALVES</td>
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<td>TRIANGLE TUBE - PHASE III</td>
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<td>TRUEBRO / IPS</td>
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<td>TYLER PIPE/WADE</td>
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<td>UNILUX</td>
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<td>UPONOR</td>
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<td>UV PURE TECHNOLOGIES</td>
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<td>Manufacturer's Representatives</td>
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<tr>
<td>VICTAULIC</td>
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<tr>
<td>VIEGA PLUMBING AND HEATING</td>
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<td>VIKING CORPORATION</td>
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<td>VITRA PLUMBING FIXTURES</td>
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<td>WARDFLEX</td>
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<td>WATER CONTROL CORPORATION</td>
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<td>WATER SPECIALITIES</td>
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<td>WATSON McDaniel</td>
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<td>WEBSTONE</td>
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<td>WEIL PUMP</td>
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<td>WHITMER COMPANY</td>
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<td>WILKINS</td>
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<td>WILLOUGHBY SECURITY FIXTS.</td>
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<tr>
<td>WOODFORD</td>
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<tr>
<td>WTW SYSTEMS, INC.</td>
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<td>ZOELLER PUMPS</td>
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<td>ZURN</td>
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Ultra-High Efficiency Commercial Water Heaters

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All models can vent vertically, horizontally and are also approved for unbalanced, direct-vent closed combustion applications.

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LAARS STORAGE TANKS
Laars now offers three styles of large volume, hot water storage tanks: Bare Style, Jacketed and Insulated Style and Rigid Polyurethane Foam with Acrylic Topcoat Style. They are the perfect addition to your high-demand water heating installations.

AERCO KC 1000
The first high-efficiency products available in the U.S. commercial market, their condensing design and unmatched 14:1 turndown ratio deliver the highest possible thermal efficiencies with precise temperature control.

Each 1 million BTU/hr. KC1000 unit can be equipped with a Low NOx burner that supports 11:1 turndown to preserve operation efficiency in environmentally friendly installations.

LAARS NEOTHERM
NeoTherm is a direct vent, sealed combustion, volume water heater with 95+% thermal efficiency that modulates with a 5 to 1 turndown.

Available for natural or propane gas with sizes ranging from 150,000 to 500,000 BTU/h.
Lakeside Supply Company was founded in 1933 as a wholesale vendor of plumbing, heating, and industrial supplies to the northern Ohio marketplace. Over the years we have endeavored to provide services and products of the highest quality to the contractor, industrial, and commercial marketplace. Our goal has always been to exceed customer requirements and expectations. Much has changed since our company's inception, but our commitment to service the needs of our customers has remained the same. This is our purpose and the reason for our continued success.

- Pipe & Tubing
- Valves & Controls
- Pipe Fittings
- Hangers/Fasteners
- Plumbing Fixtures
- Plumbing Specialties
- Fire Protection
- Steam & Hot Water
- Tools & Compounds

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The Line Card – April 2011

107 Cypress Street S.W.
Reynoldsburg, OH 43068
Phone: 740-927-8880 or 888-927-4244
Fax: 740-927-4545

Manufacturers' Representatives: Serving Plumbing, Mechanical, Electrical, Architectural, and Water Treatment Industries with Offices in Columbus, Cleveland, and Cincinnati
Representing the Following Product Lines:

<table>
<thead>
<tr>
<th>Company Name</th>
<th>Products</th>
</tr>
</thead>
<tbody>
<tr>
<td>A Better Idea, Inc.</td>
<td>E-Z Sleeper / Quick Block – Rooftop pipe support blocks</td>
</tr>
<tr>
<td>ABT – Polydrain</td>
<td>Pre-sloped polymer trench drains, French Drainer – pre-sloped trench drain systems.</td>
</tr>
<tr>
<td>American Plumber</td>
<td>Sediment cartridge filters, drinking water systems, water softeners, media filters, water filters, and specialty filters.</td>
</tr>
<tr>
<td>Aqua Glass</td>
<td>Acrylic and gelcoat fiberglass shower stalls, bathtubs, soaking tubs, whirlpools, multi-piece, special care, wall kits and laundry tubs for residential, commercial and institutional.</td>
</tr>
<tr>
<td>Bernard</td>
<td>Automatic control valves for: pressure reducing, fire protection control, pressure relief, pump control, float, check valves, flow and hydraulic systems.</td>
</tr>
<tr>
<td>Bosch Pro Tankless Water Heaters</td>
<td>Tankless instantaneous water heaters. Wall hung hydraulic boilers.</td>
</tr>
<tr>
<td>Boss Products</td>
<td>Adhesives, moisture barrier compounds, silicone sealants, polyurethane sealants, calcium, lubricants, aerosols, anti-static compounds, humidifiers and fire stop products.</td>
</tr>
<tr>
<td>Bradley Corporation</td>
<td>Washfountains, Expres and Frequency lavatory systems, Niteile technology, Navigator thermostatic mixing valves, showers, safety equipment, metering faucets, security fixtures, patient care units, Tereos solid surface products.</td>
</tr>
<tr>
<td>Creative Industries</td>
<td>Pre-cast terrazzo shower floors, mop basins, concrete laundry tubs and stalls or benches, terrazzo or concrete or glass counter tops and custom terrazzo products.</td>
</tr>
<tr>
<td>Eemax</td>
<td>Electric instantaneous water heaters, DNI and booster heaters, emergency shower eyewash heaters.</td>
</tr>
<tr>
<td>Just Manufacturing / EBC</td>
<td>Stainless steel commercial, institutional &amp; residential sinks. EBC stops/supplies, cast u-traps, cast &amp; tubular waste fittings.</td>
</tr>
<tr>
<td>Liberty Pumps</td>
<td>Sump, drain and condensate, effluent, sewage, grinder, macerating toilet and engineered pump system packages.</td>
</tr>
<tr>
<td>Marlo</td>
<td>Commercial &amp; industrial water softeners, media filters, reverse osmosis, deionizers and demineralization water treatment equipment.</td>
</tr>
<tr>
<td>Mifab</td>
<td>Cast iron floor drains, floor sinks, roof drains, cleanouts, carryovers, interceptors, hydrants, shock absorbers, trap primes, backwater valves, access doors, no-hub couplings, pipe markers, roof blocks, Proformance modular trench drain system, Beere backflow's and pre's.</td>
</tr>
<tr>
<td>Osco International</td>
<td>Osco International, headquartered in Columbus, Ohio, manufactures and distributes a wide range of water displacement products under the Osco and Samroc brands.</td>
</tr>
<tr>
<td>Pneumatrix</td>
<td>Pro-Extreme, Trap Gear, Handy Shield Maxx and Clear Shield laboratory trap and riser installation kits. Mushroom Flange and Floor Sink Carrier specialty products.</td>
</tr>
<tr>
<td>Preceptor / Green Turtle</td>
<td>Fiberglass oil, grease, and solid interceptors with 30-year bonded warranty, available as decontamination or storage tank, double wall, leak detection and level sensing. PPHX acid neutralization systems. Retrospout kitchen and Microporous coffee grinds interceptors.</td>
</tr>
<tr>
<td>Pro-Grill Products</td>
<td>Open Mesh Sand Cloth that is rugged, durable and will last longer than other abrasive products. Each 10 yard roll is 180 grit and comes in four highly visible fluorescent colors.</td>
</tr>
<tr>
<td>Raychem / Tyco Thermal Controls</td>
<td>HW-LT-Plus self-regulating heating cable system for domestic hot water, XL-Trace freeze protection cable, Prowater M1 and Elcoventur series and multi-circle cable, Insulation roof and gutter de-inicing cable, RaySol floor warming and freezer floor heating cable.</td>
</tr>
<tr>
<td>Schott Scientific Glass / Klinax</td>
<td>Glass piping for acid waste and containment piping systems. Bright-Ware acid neutralizing pumps.</td>
</tr>
<tr>
<td>Water Control Corporation</td>
<td>Rainwater Reclamation Systems with Ultraviolet or Ozonation purification, vortex downspout separators, storage tanks and complete controls for monument systems.</td>
</tr>
<tr>
<td>Waterless Company</td>
<td>Waterless &quot;No Flush&quot; toiletless chews and fiberglass urnals with EcoTuro and Blue Seal liquid. UTC Sentinel sensor flushing systems. Everytime floor drain trap primer liquid. Signature and Greenbloom chemicals.</td>
</tr>
</tbody>
</table>

**Additional Products Distributed:**

- Bathroom Partitions (solid plastic, baked enamel, stainless steel, laminate and phenolic)
- Bathroom Accessories, Lockers (solid plastic and metal), Water Treatment Products.
# Mastroianni & Associates, Inc.

**Manufacturer Representatives of Products for the Mechanical Trades**

<table>
<thead>
<tr>
<th>Product Line</th>
<th>Website</th>
</tr>
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<tbody>
<tr>
<td>PACO PUMPS</td>
<td><a href="http://www.paco-pumps.com">www.paco-pumps.com</a></td>
</tr>
<tr>
<td>- End Suction &amp; In-Line Centrifugal Pumps</td>
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<tr>
<td>- Horizontal Split Case</td>
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<tr>
<td>- Condensate Pumps LoNPSH Pumps</td>
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<tr>
<td>- Sump Pumps</td>
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<tr>
<td>- Sewage Ejectors</td>
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<tr>
<td>- Boiler Feed Pumps</td>
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<tr>
<td>RUNTAL</td>
<td><a href="http://www.runtalnorthamerica.com">www.runtalnorthamerica.com</a></td>
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<tr>
<td>- Architectural &amp; Custom Perimeter Heating</td>
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<tr>
<td>- Hot Water &amp; Steam Radiators</td>
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<tr>
<td>NEXUS</td>
<td><a href="http://www.nexusvalve.com">www.nexusvalve.com</a></td>
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<tr>
<td>- Combination Balance Valves</td>
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<tr>
<td>- Coil Piping Packages</td>
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<tr>
<td>PURE HUMIDIFIER</td>
<td><a href="http://www.purehumidifier.com">www.purehumidifier.com</a></td>
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<tr>
<td>- Steam &amp; Electric Self-Generating Humidifiers</td>
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<tr>
<td>- Gas Humidifiers</td>
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<tr>
<td>VIBRATION ELIMINATOR</td>
<td><a href="http://www.veco-ny.com">www.veco-ny.com</a></td>
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<tr>
<td>- Spring Isolators &amp; Rubber-in-Shear Isolators</td>
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<td>- SEISMIC</td>
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<tr>
<td>- Roof Curb Isolators, Rails &amp; Bases</td>
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<tr>
<td>- Neoprene Pads</td>
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<td>- Inertia Bases</td>
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<tr>
<td>- Floating Floors</td>
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<tr>
<td>HYSSPAN/BARCO</td>
<td><a href="http://www.hyspan.com">www.hyspan.com</a></td>
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<tr>
<td>- Ball Joints (For Pipe Expansion &amp; Movement)</td>
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<td>- Venturi Flow Measuring System</td>
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<tr>
<td>- Portable Read-out Meters</td>
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<tr>
<td>TIGERFLOW</td>
<td><a href="http://www.tigerflow.com">www.tigerflow.com</a></td>
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<tr>
<td>- Domestic Water Booster Packages</td>
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<td>- Heat Exchanger Packages</td>
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<tr>
<td>- Variable Flow Pump Packages</td>
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<tr>
<td>THRUSH</td>
<td><a href="http://www.thrushco.com">www.thrushco.com</a></td>
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<tr>
<td>- End Suction &amp; In-Line Pumps</td>
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<tr>
<td>- Heat Exchangers</td>
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<tr>
<td>MUELLER</td>
<td><a href="http://www.spxvalves.com">www.spxvalves.com</a></td>
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<tr>
<td>- Triple Duty Valves (Grooved)</td>
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<tr>
<td>- Suction Diffusers</td>
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<tr>
<td>POLARIS</td>
<td><a href="http://www.polarisphe.com">www.polarisphe.com</a></td>
</tr>
<tr>
<td>- Plate &amp; Frame Heat Exchangers</td>
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<tr>
<td>VALUE ENGINEERED PRODUCTS</td>
<td><a href="http://www.valueng.com">www.valueng.com</a></td>
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<tr>
<td>- Insulated Pipe Inserts</td>
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<tr>
<td>METRAFLEX</td>
<td><a href="http://www.metraflex.com">www.metraflex.com</a></td>
</tr>
<tr>
<td>- Flexible Connectors: Rubber, Stainless Steel &amp; Teflon</td>
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<tr>
<td>- Expansion Joints &amp; Compensators</td>
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<tr>
<td>- MetraLoops &amp; FireLoops</td>
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<tr>
<td>- MetraSeals &amp; FireSeals (pipe to wall seals)</td>
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<td>- Pipe Guides</td>
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<td>- Check Valves</td>
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<td>- Air Vents</td>
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<td>- Strainers</td>
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<tr>
<td>JOHN WOOD CO</td>
<td><a href="http://www.johnwood.com">www.johnwood.com</a></td>
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<tr>
<td>- Air Separator</td>
<td></td>
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<tr>
<td>- Expansion Tanks</td>
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<tr>
<td>Website:</td>
<td><a href="http://www.mastroiannahvac.com">www.mastroiannahvac.com</a></td>
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</table>

Please Contact: Frank Mastroianni

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- Water Heaters - Gas, Oil, Gas/Oil, Electric, Steam and Hot Water
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Armstrong Mixing Centers ([www.armstronginternational.com](http://www.armstronginternational.com))
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- Thermostatic Mixing Valves for Zoned Group Control, Heat Traced Systems, & Pump Recirculation Systems
- Tempering systems for emergency fixtures - Z358.1 compliant

Clamp-All Corp. ([www.clampall.com](http://www.clampall.com))
- Hubless Couplings for Cast Iron Pipe, Approved to Factory Mutual Standard 1680 Class I at 15 PSI. Sizes 1-1/2”-15”, Approved for transition between all materials and sizes.

Chromalox ([www.chromalox.com](http://www.chromalox.com))
- Heat Tracing Cable for Domestic Hot Water Temperature Maintenance, Freeze Protection, Snow & Ice Melting Systems

Elbi of America ([www.elbi.net](http://www.elbi.net))
- ASME Constructed Expansion Tanks for potable hot water, hydronic heating systems, pressurized potable water systems
- ASME Code Air Separator

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