PMENGINEER

Pipe Joining Methods Study

bnp market research

December 2007

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Study Overview

BACKGROUND

In an effort to examine the use of pipe joining methods, a market research study was commissioned by *PM Engineer*. The study results will be the basis of an editorial article, scheduled to appear in the February 2008 issue of *PM Engineer* magazine.

PURPOSE AND OBJECTIVES

The overall purpose of the study is to gain a better understanding of the use of pipe joining methods.

Specifically, this research seeks to identify:

- What standard do plumbing engineers specify joint selection for water pipes?
- What material pipe is specified most often by plumbing engineers?
- How do plumbing engineers determine joining methods?
- What specific materials is specified most often for plastic pipes?
- Is a manifold system or a straight pipe system preferred when installing a flexible plastic pipe system?

Study Overview

STUDY DETAILS

Target Audience: 1,600 active, qualified *PM Engineer* subscribers who work for a consulting engineering, architectural/design, or mechanical contracting firm who does plumbing or pipe/valves/fittings work and have a job title of engineering management or engineer and who specify, design, recommend or purchase plumbing, piping, hydronic heating, and/or fire protection products.

Sample Selection Method: Systematic sample from the domestic circulation (on an Nth name basis)

Survey Method: Mail

Incentive: a quarter (25¢)

Fielding Dates: October 26 – November 29, 2007

Completed Returns Summary:

Number Mailed	Undeliverable/ Unusable	Usable Base	Usable Returns	Response Rate
1,600	12	1,588	368	23%

DATA TABULATION AND PRESENTATION

Upon receipt at BNP Media, the questionnaires are coded and entered into a computer database. Tabulations are generated using SPSS, a statistical software package.

The data produced by SPSS is presented in graphical and tabular format with the number of respondents who answered that particular question. This number will change throughout the report since some respondents may skip or incorrectly answer a question.

Some questions in this survey requested respondents to write in a response. Other than minor editing for readability, these responses are presented as written by the respondent.

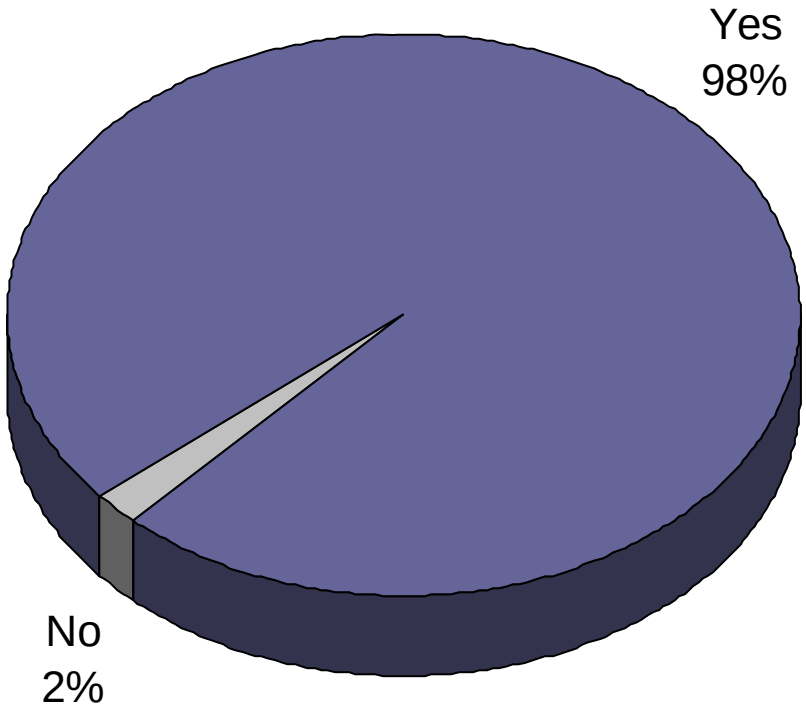
The questionnaire can be found in Appendix A. The glossary of statistical terms can be found in Appendix B.

The methods used in this research study were conducted in accordance with BNP Media's Market Research Code of Ethics. A copy of the Code is available upon request.

Study Results

Joining Methods Specified for Interior Water Pipes When Designing Water Distribution Systems

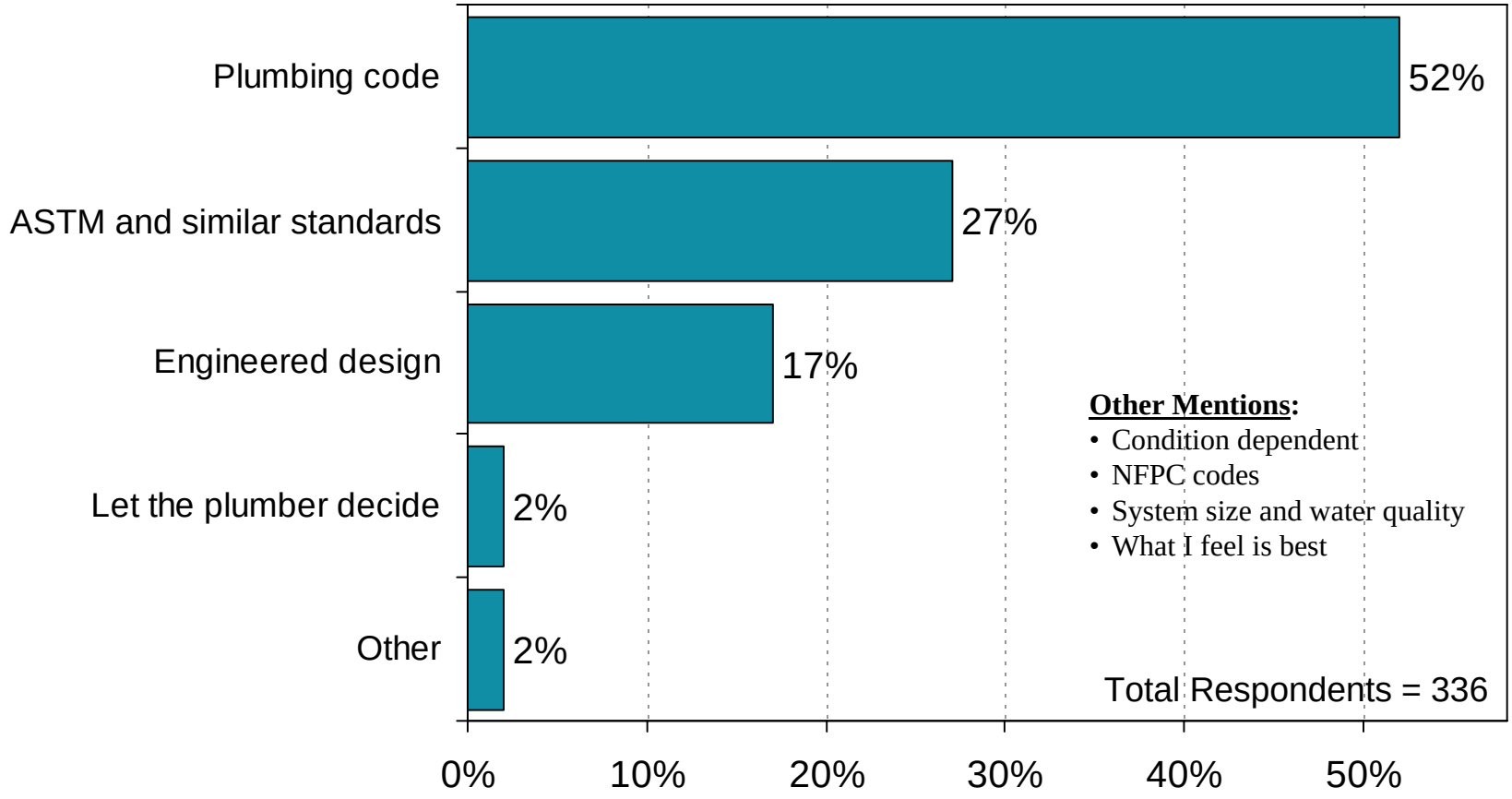
1. When designing a water distribution system, do you specify joining methods for interior water pipes?



Total Respondents = 368

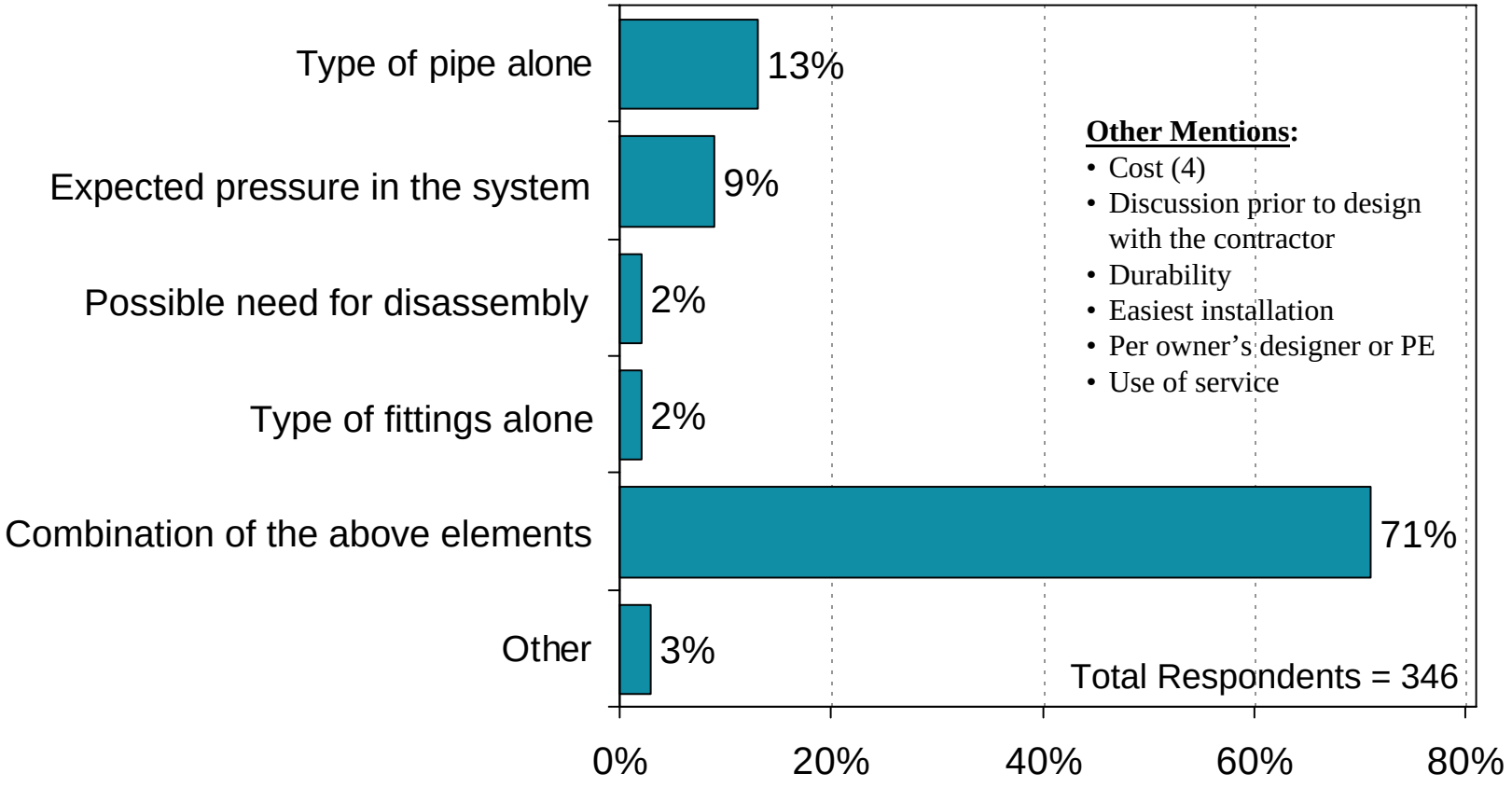
Standard Used to Specify Joint Selection

2. To which standard do you specify joint selection for water pipes?



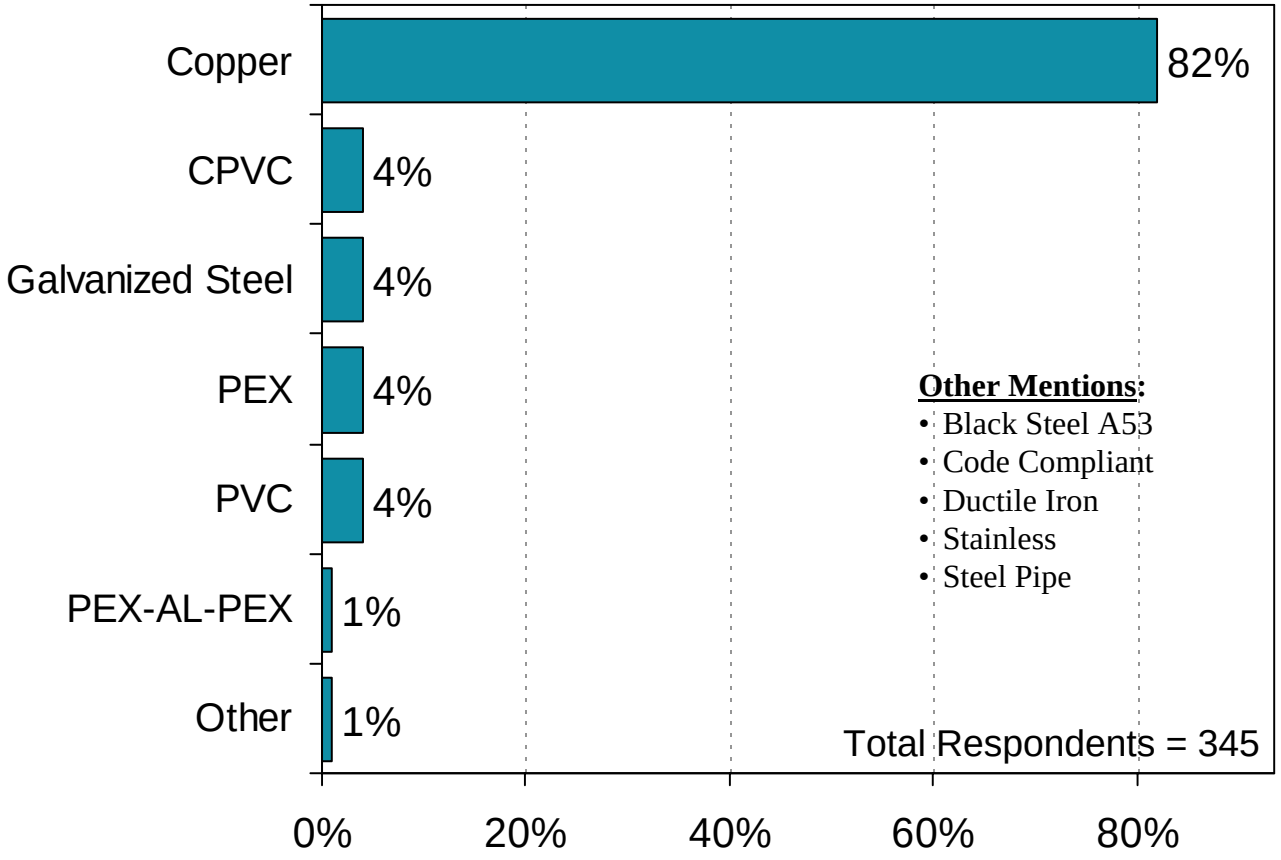
Joining Methods Determined When More Than One Method is Allowed

3. Generally speaking, how do you determine joining methods, if more than one acceptable method is allowed?



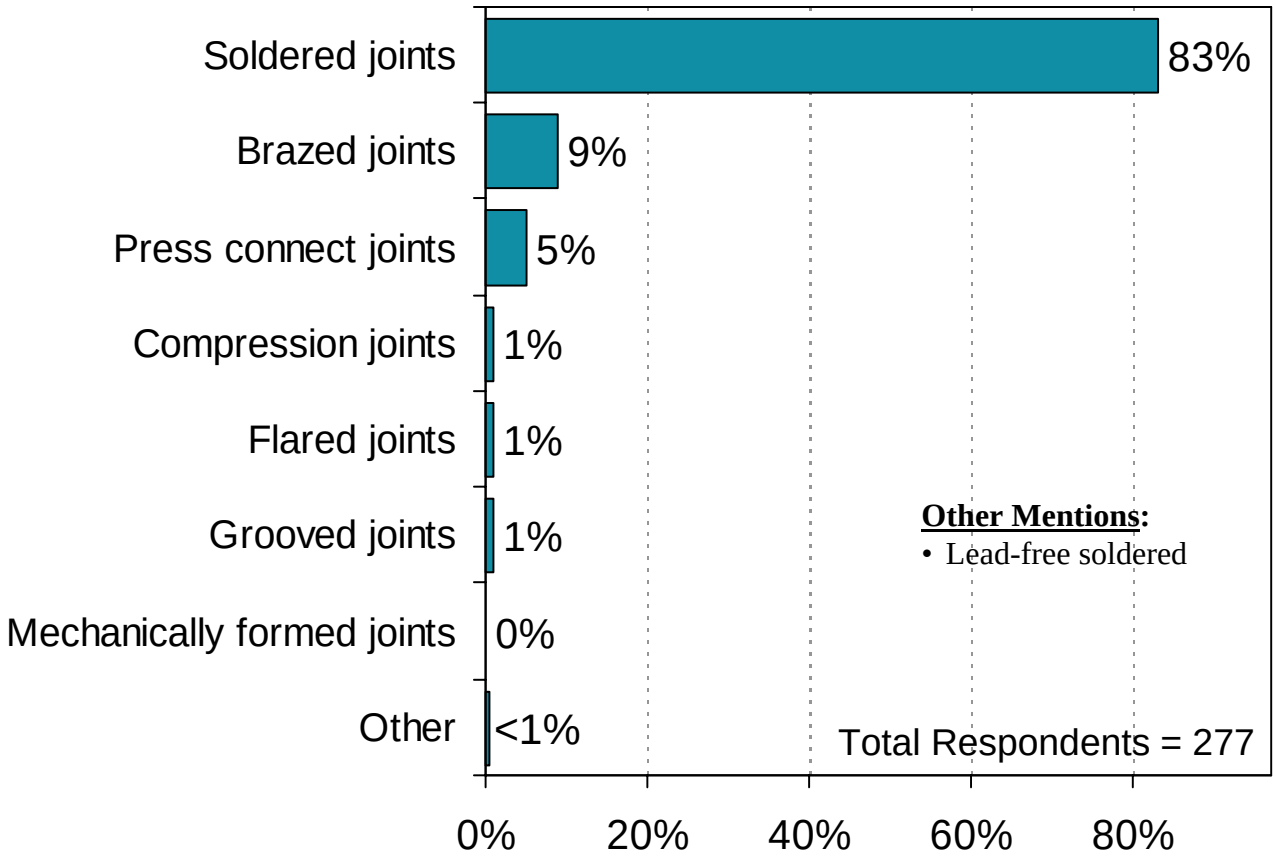
Material Pipe Specified Most Often

4a. Which material pipe do you specify most often?



Jointing Method Specified Most Often for Copper Pipe

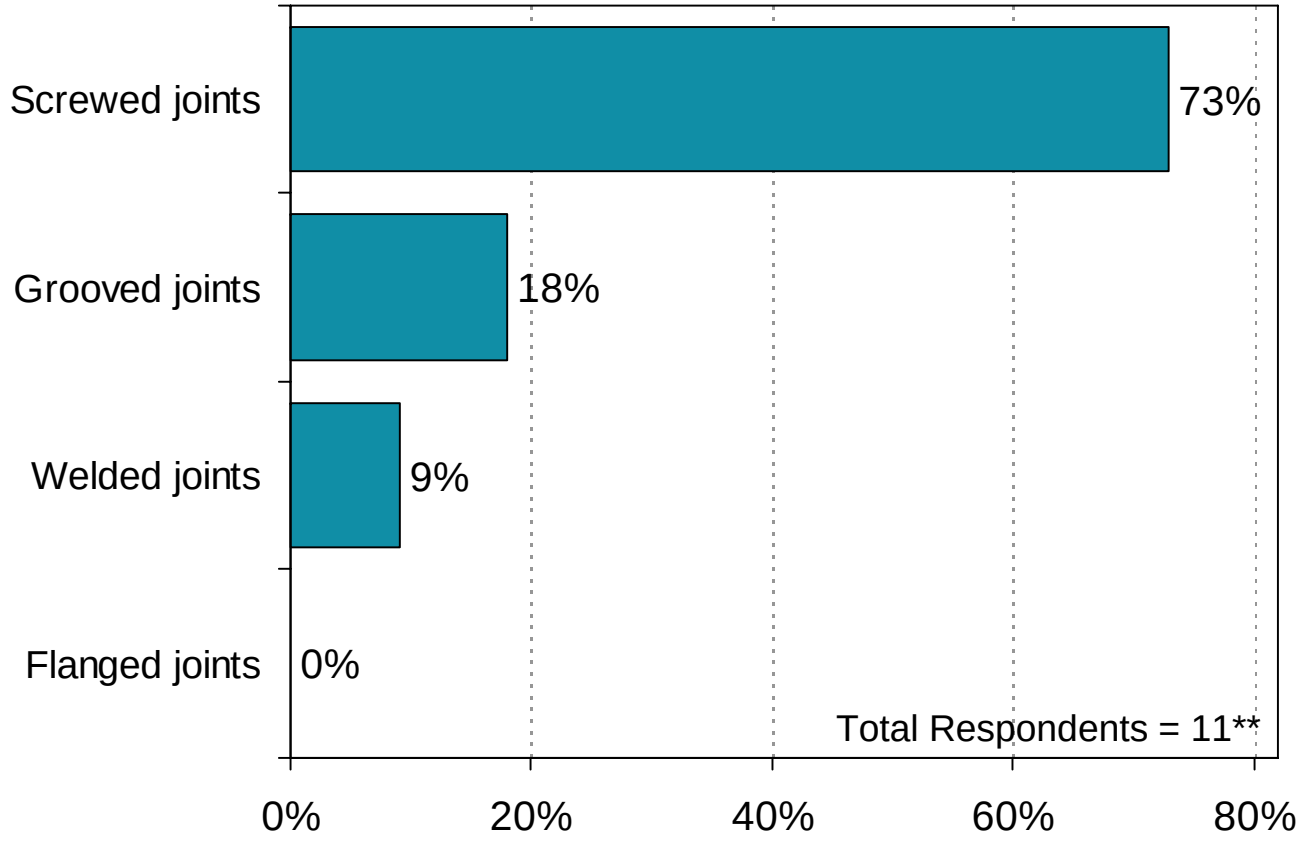
4b. If copper pipe, which jointing method do you specify most often?*



***Question 4b is based on those who answered copper pipe in question 4a.**

Jointing Method Specified Most Often for Galvanized Steel Pipe

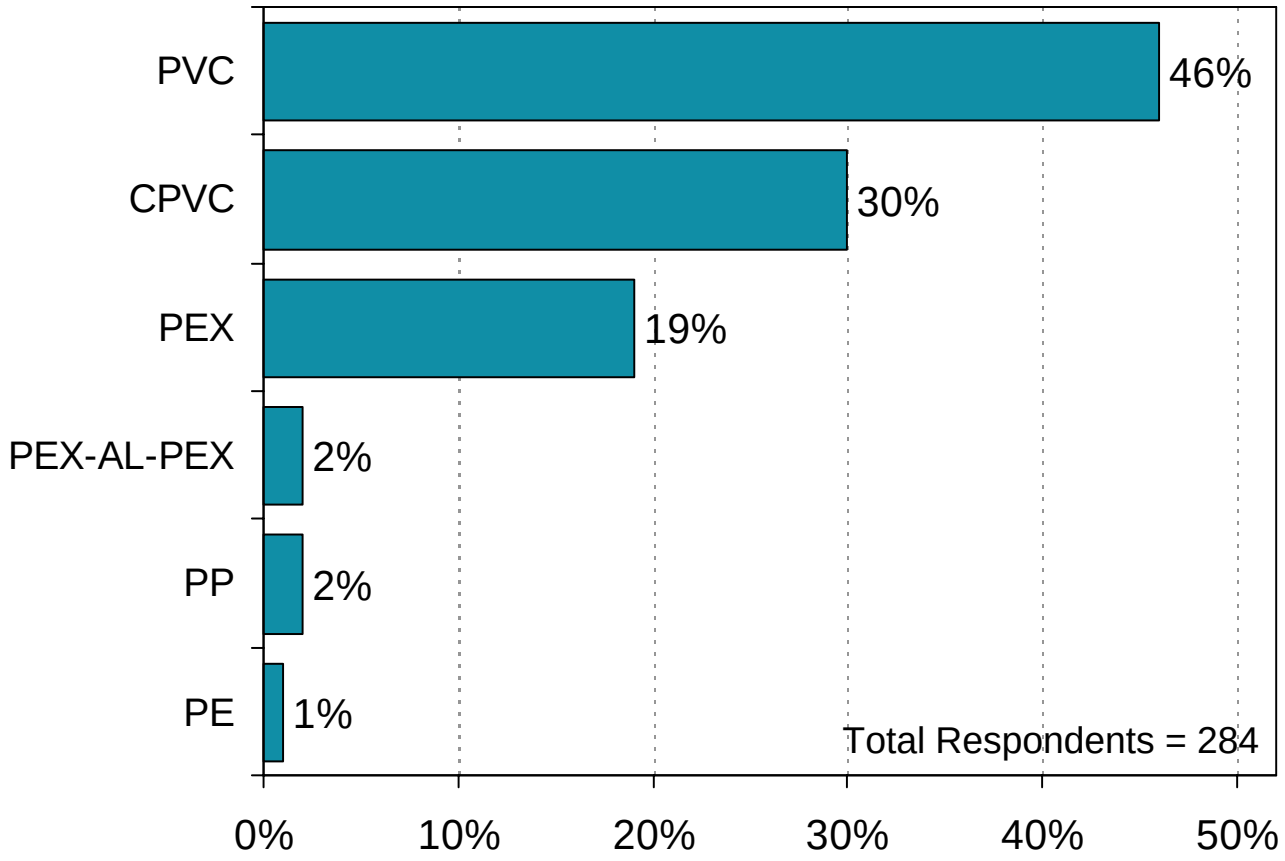
4c. If galvanized steel pipe, which jointing method do you specify most often?*



Question 4c is based on those who answered galvanized steel pipe in question 4a.
****Interpret with caution due to the low sample base, which increases the margin of error.***

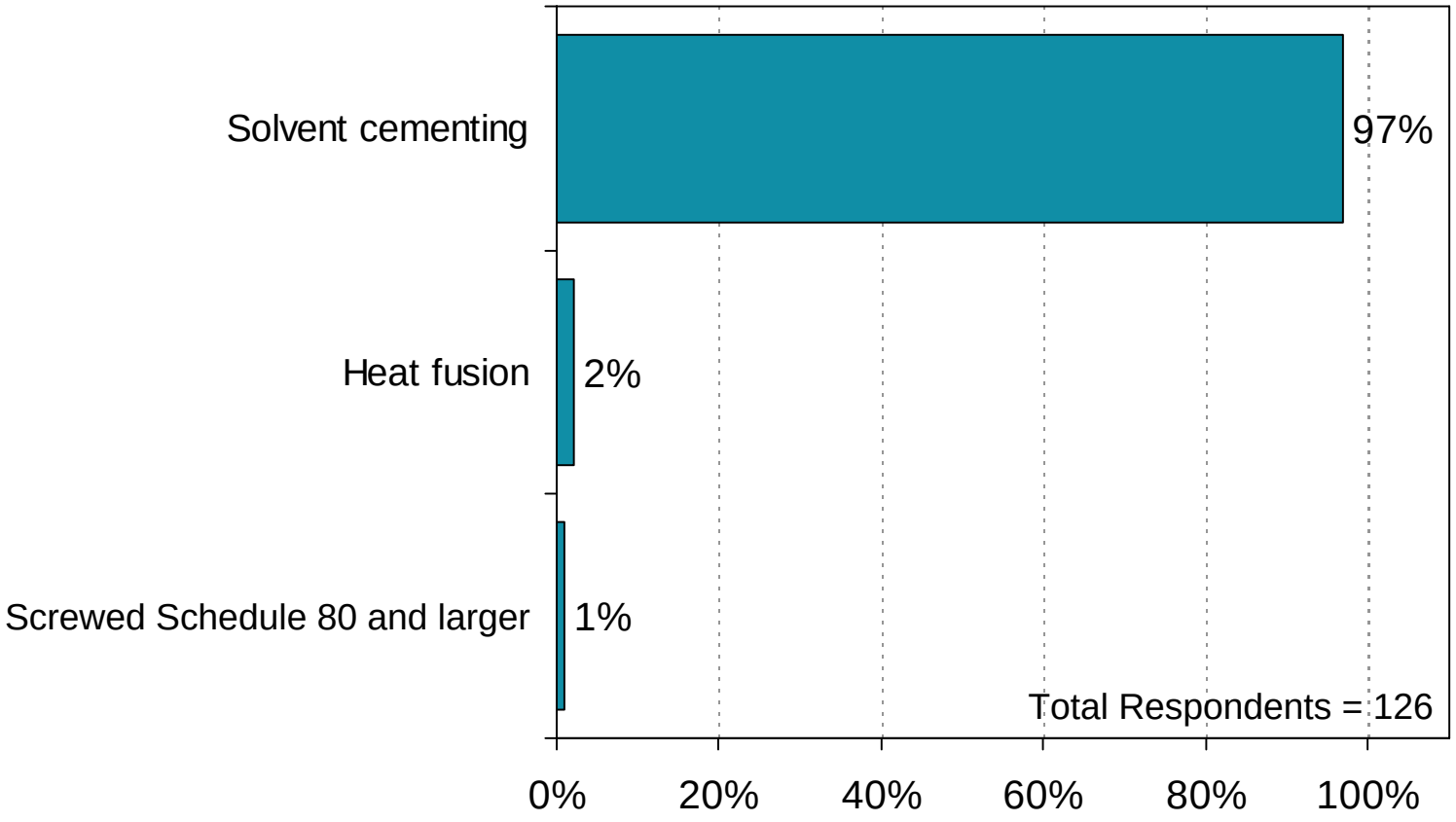
Plastic Pipe Material Specified Most Often

5a. If plastic pipe, which specific material do you specify most often?



Joining Method Specified Most Often for PVC Pipe

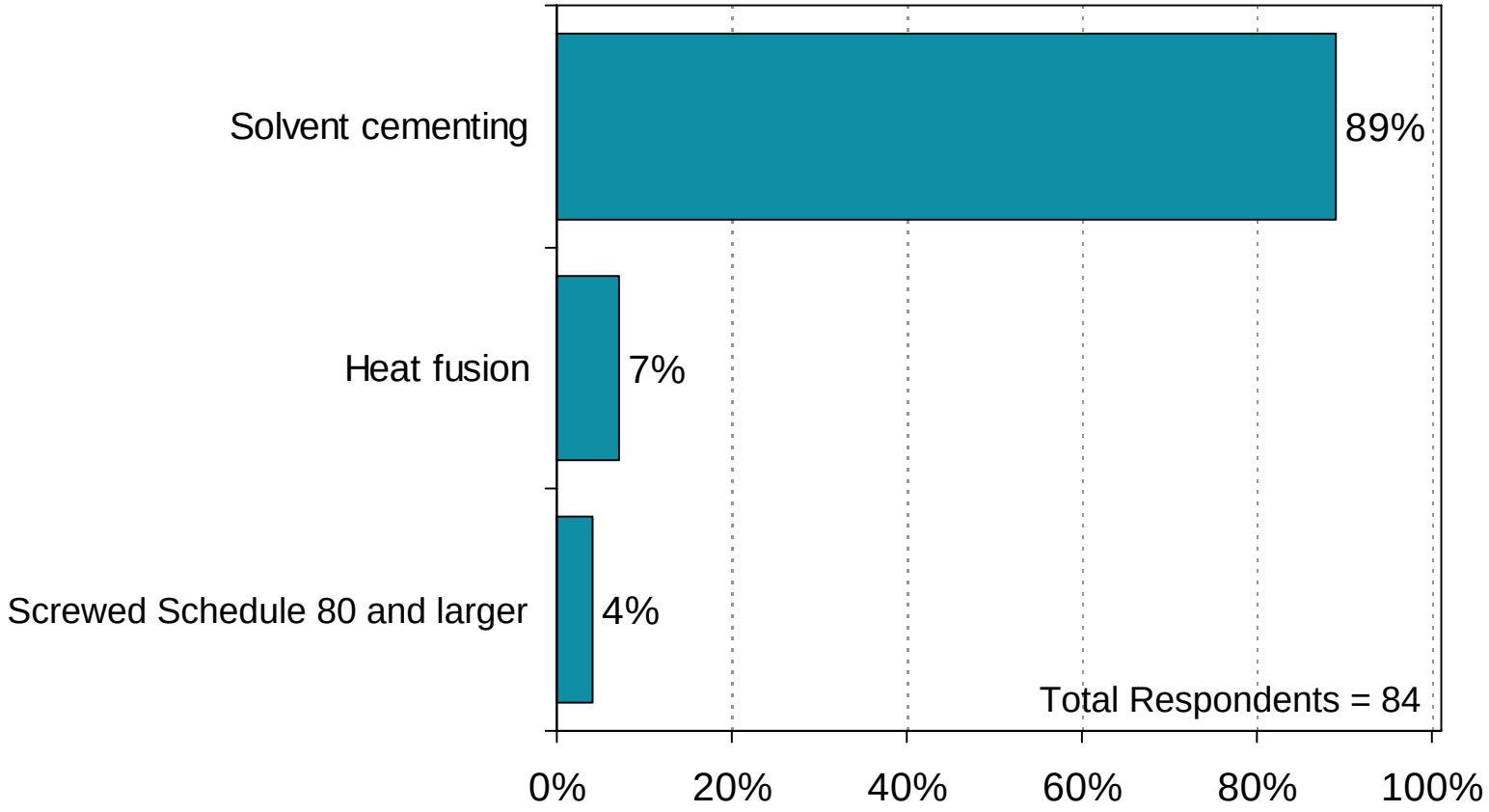
5b. If PVC pipe, which joining method do you specify most often?*



Question 5b is based on those who answered PVC in question 5a.

Joining Method Specified Most Often for CPVC Pipe

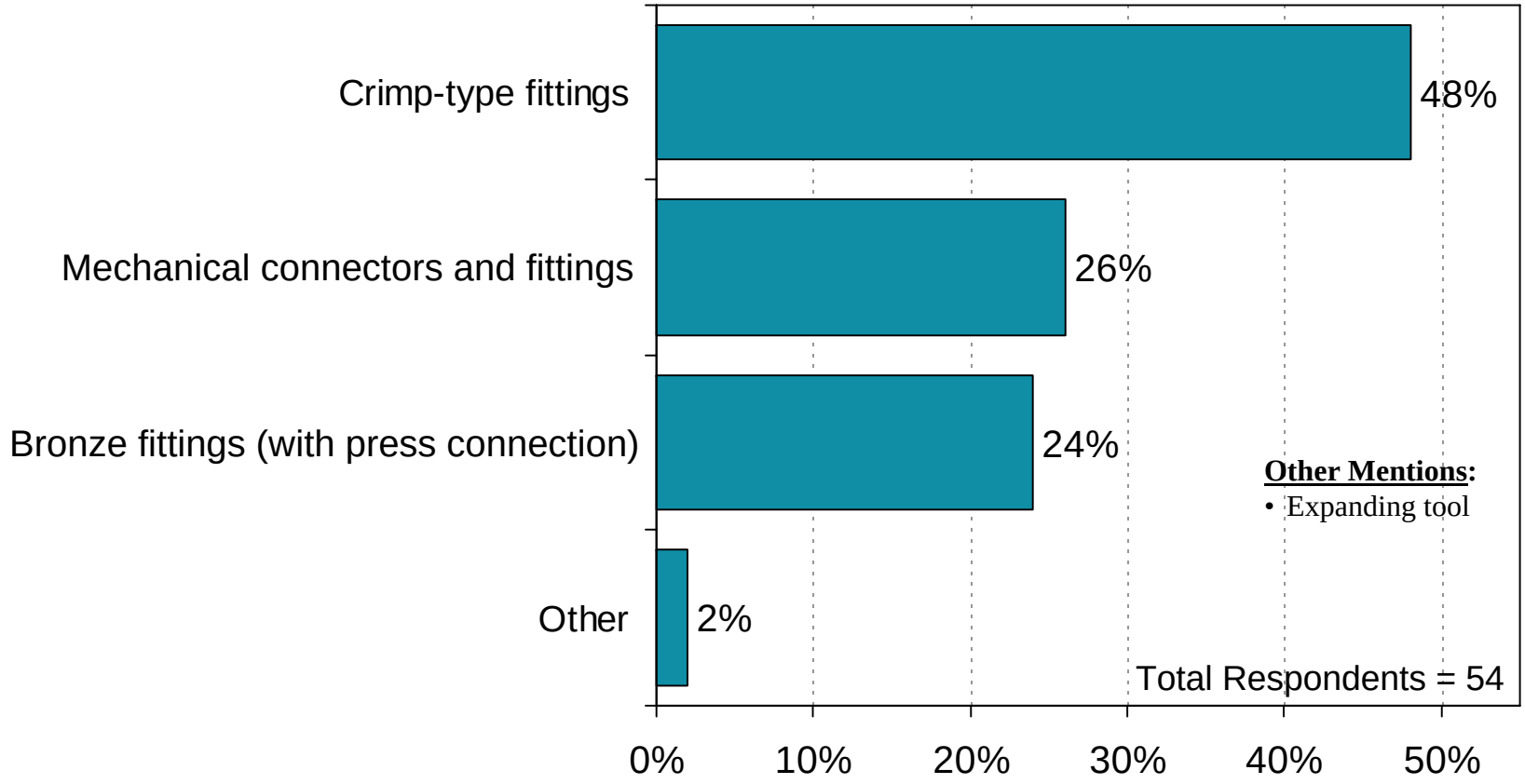
5c. IF <u>CPVC pipe</u>, which joining method do you specify most often?*



Question 5c is based on those who answered CPVC in question 5a.

Joining Method Specified Most Often for PEX Pipe

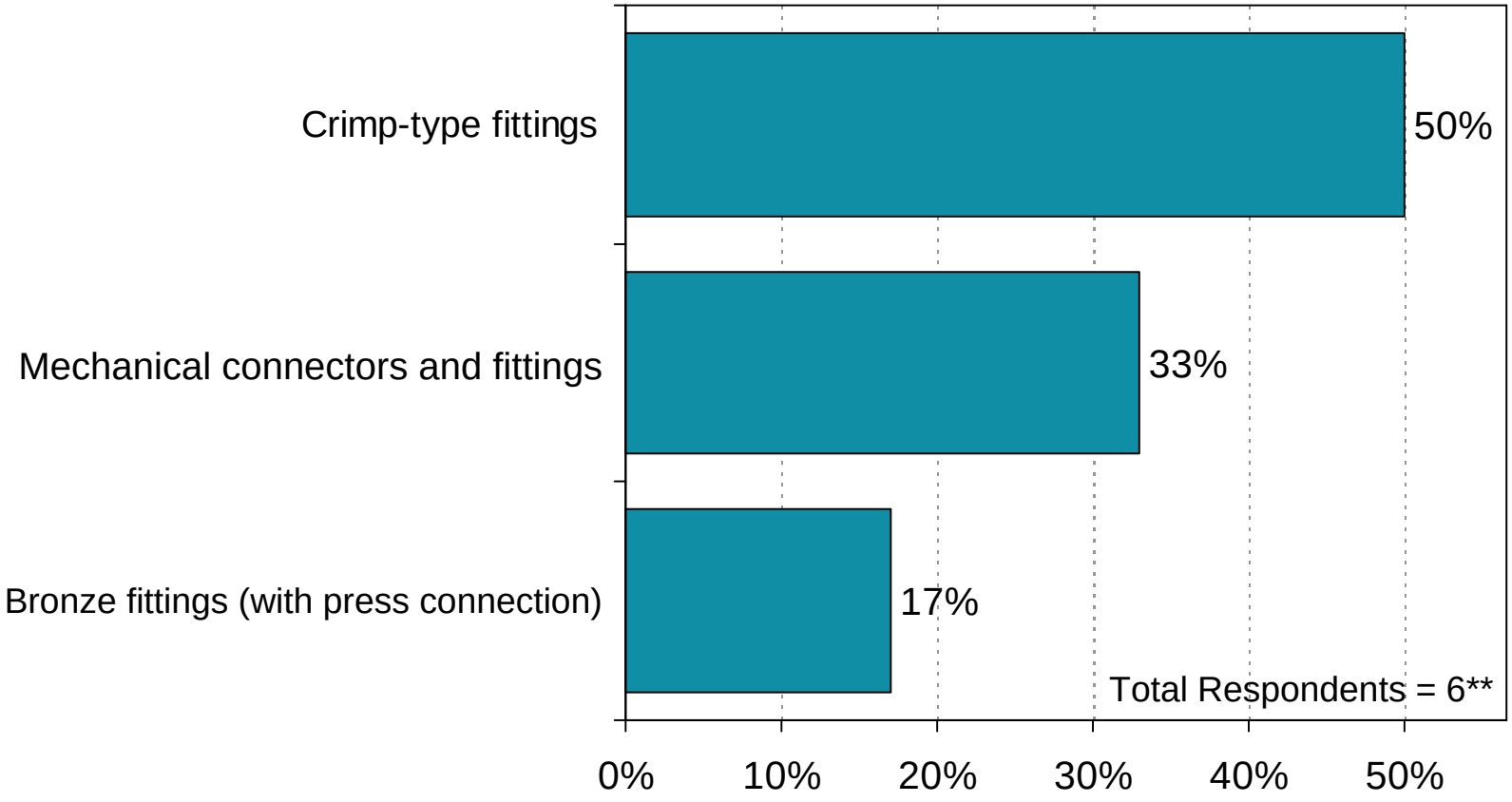
5d. If <u>PEX pipe</u>, which joining method do you specify most often?*



Question 5d is based on those who answered PEX in question 5a.

Joining Method Specified Most Often for PEX-AL-PEX Pipe

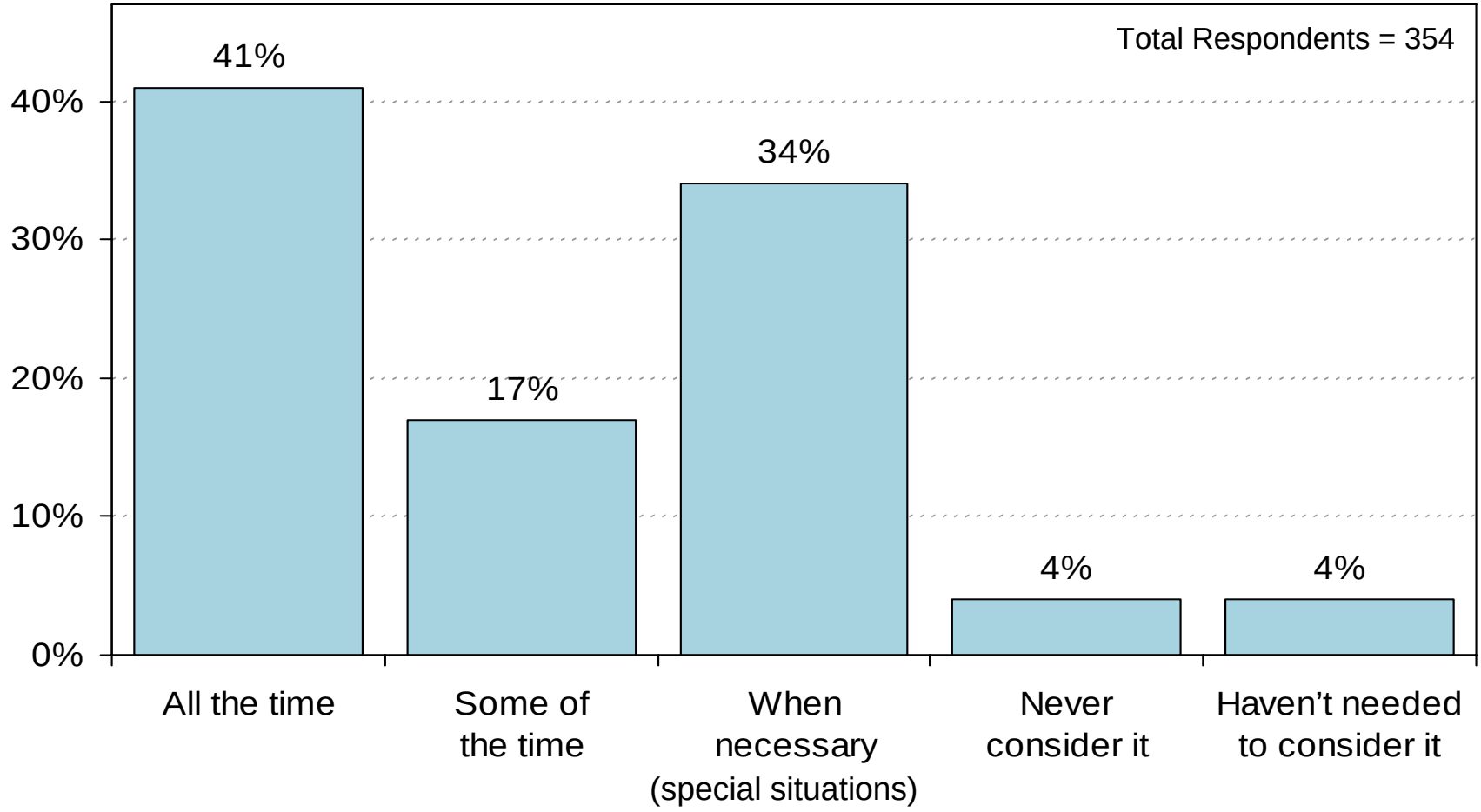
5e. IF <u>PEX-AL-PEX pipe</u>, which joining method do you specify most often?*



Question 5e is based on those who answered PEX-AL-PEX in question 5a.
****Interpret with caution due to the low sample base, which increases the margin of error.***

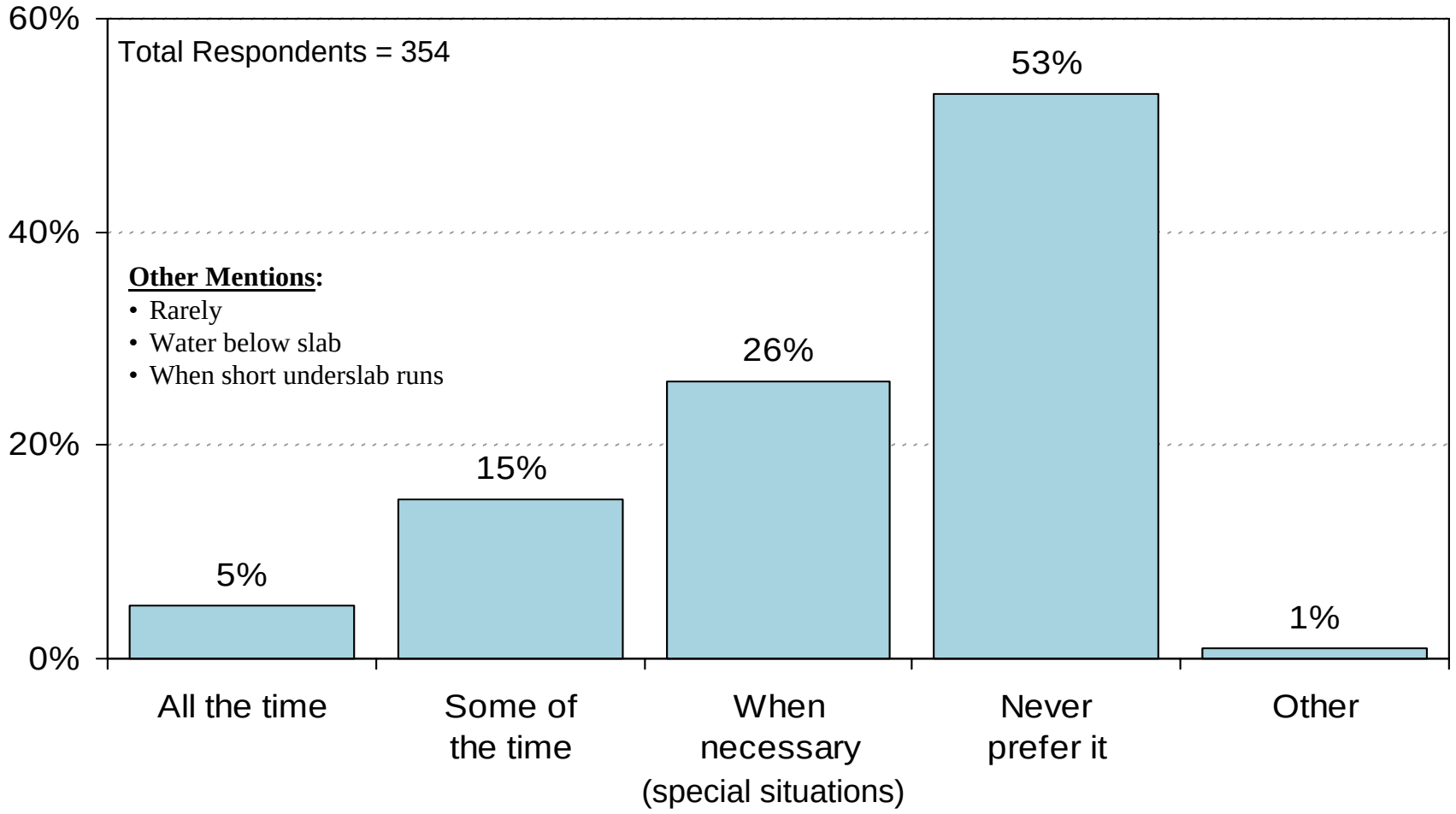
Frequency of Factoring in Piping Expansion and Contraction When Determining the Proper Joining Method

6. How often do you factor in piping expansion and contraction when determining the proper joining method?



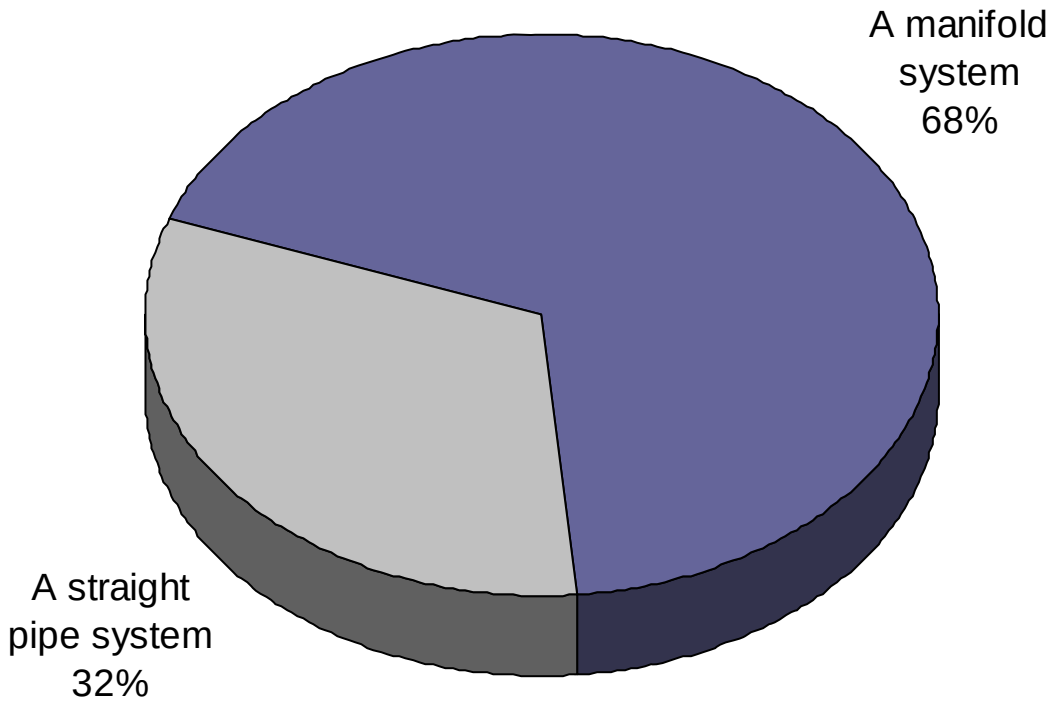
Frequency of Bending Metal Pipe as a Way to Reduce Number of Joints in the System

7. How often do you prefer bending metal pipe as a way to reduce the number of joints in the system?



Flexible Plastic Pipe System Preference

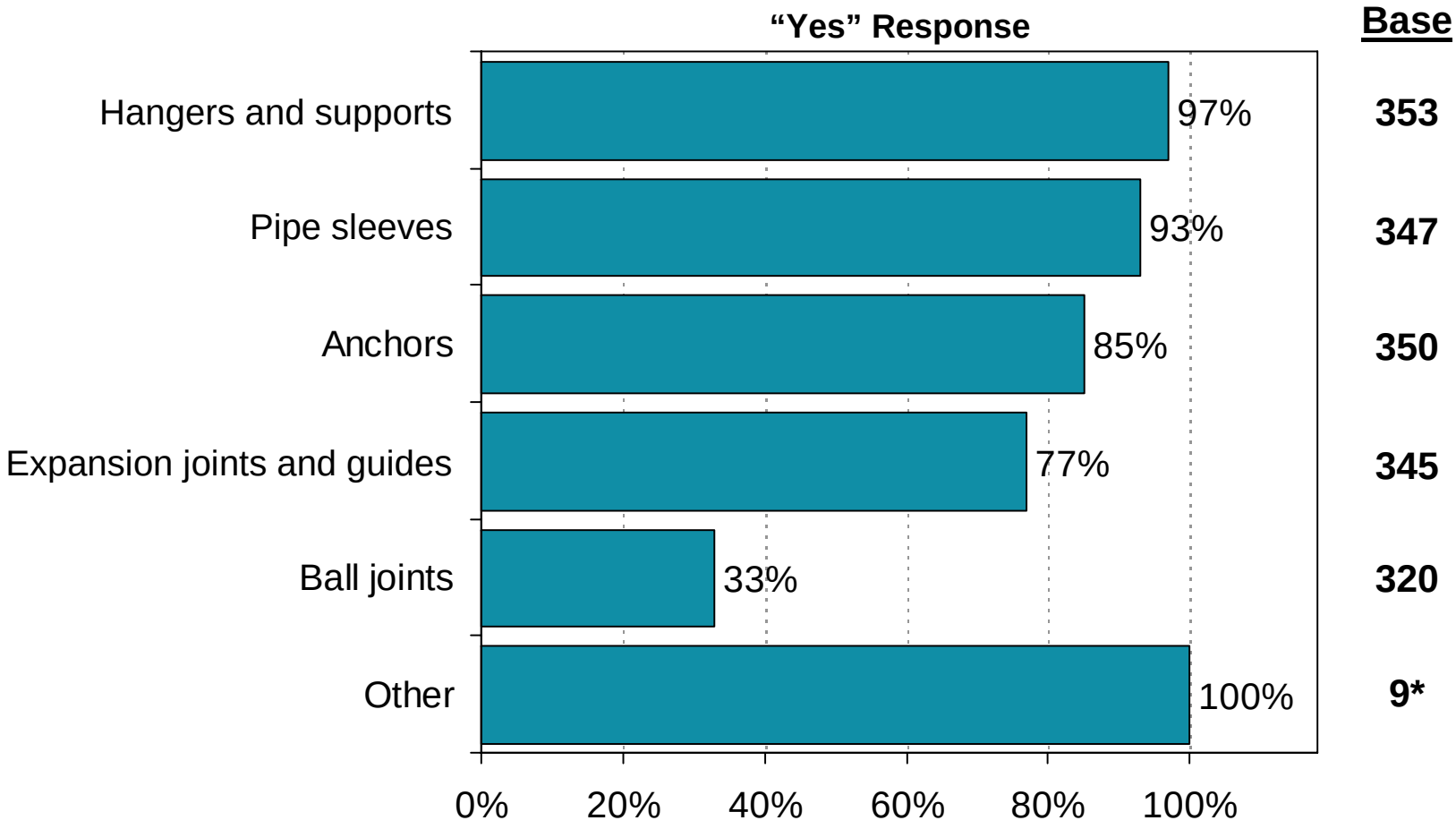
8. When installing a flexible plastic pipe system, which do you prefer?



Total Respondents = 308

Items Included in Specifications

9. Do you always include the following items in your specifications?



Interpret with caution due to the low sample base, which increases the margin of error.

Continued on next page…

Items Included in Specifications

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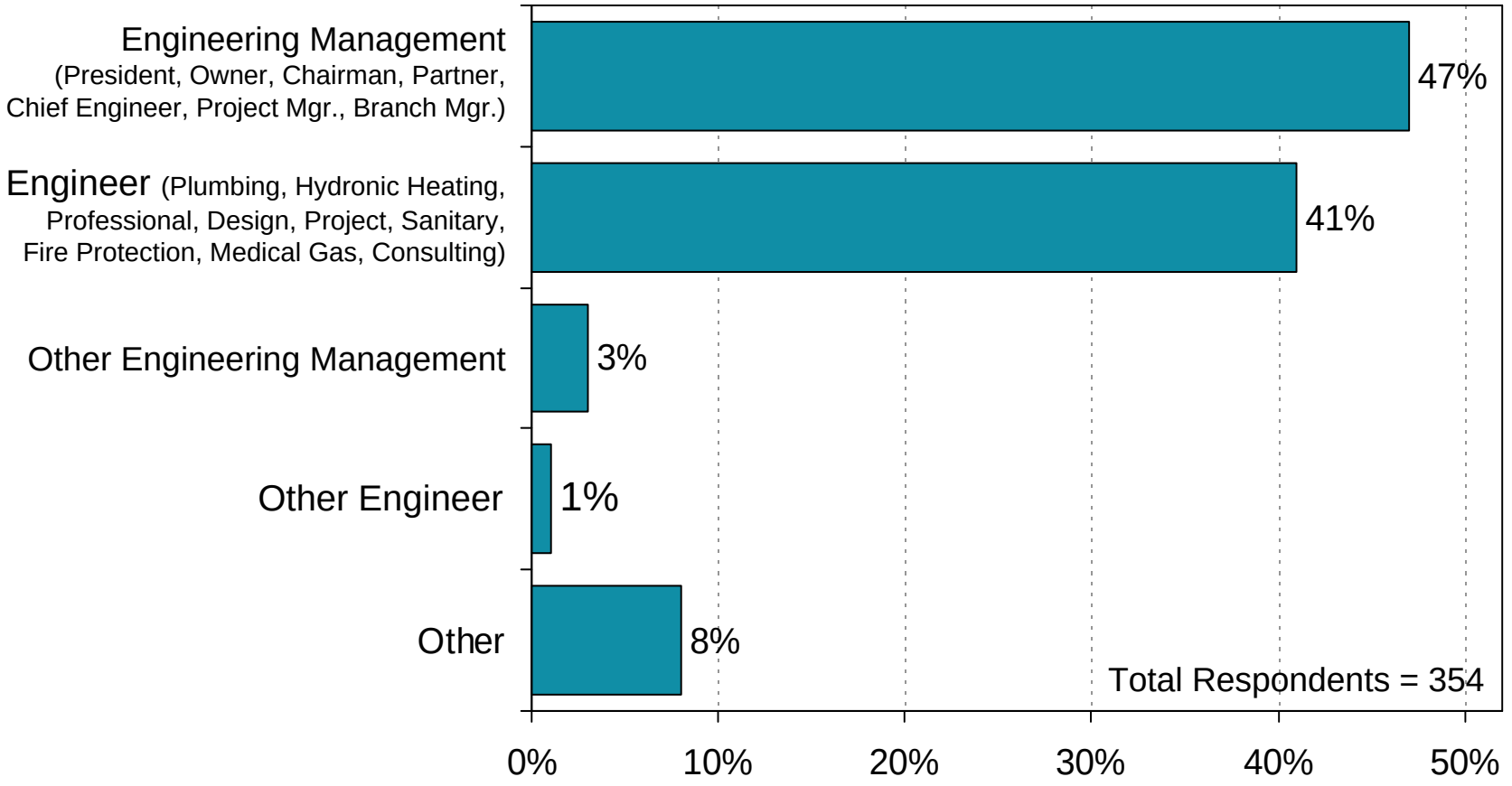
Other Mentions:

- Flex connectors
- Hardware
- Insulation
- Insulation and finishes
- Jointing methods
- Joints
- Seismic
- Seismic restraints
- Valves

Job Title or Classification

10. What is your current job title, or classification?



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Job Title or Classification

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Other Mentions:

- Architect (4)
- Contractor (2)
- Engineering Technician (2)
- Mechanical Designer (2)
- Project Manager (2)
- Design Assistant Contractor
- Design Technician
- Design/Build Hydronic Contactor
- Director Plumbing Operations & Commercial Sales
- Engineering Intern
- Mechanical Contractor
- Plumber
- Plumbing Department Head
- Plumbing Designer
- Plumbing Inspection/Consolidation
- Plumbing/Piping Designer III
- Senior Designer
- Senior Plumbing Designer
- Service Department Manager
- Service Technician
- Specifier
- Vice President

Respondents by U.S. Region

Midwest (Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, Ohio, North Dakota, South Dakota, Wisconsin)	31%
Northeast (Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont)	23%
South (Alabama, Arkansas, Delaware, District of Columbia, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, West Virginia)	21%
West (Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, Wyoming)	18%
Unknown	7%
Total Respondents	**368**

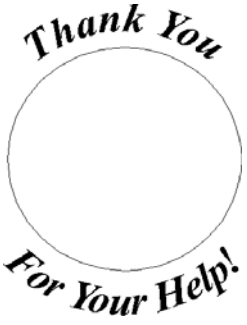
States have been grouped into the regions listed above.

Appendix A

Questionnaire

PM ENGINEER

Dear Reader:



We are conducting an important survey and we need your help. The editors of *PM Engineer* have asked us to examine the use of pipe joining methods. By completing the following questionnaire, you will be helping them serve your needs more effectively.

Since the study is being sent to a small select group of decision-makers, your reply is essential to the accuracy of the study. Please take a few minutes to fill out this **CONFIDENTIAL** questionnaire and return it in the enclosed envelope. Please reply by **November 29, 2007** so that we may include your response in the study. Look for the results in the February 2008 issue of *PM Engineer*. Thanks for your help!

Sincerely,

Michelle Maki

Michelle Maki
Sr. Project Manager

PS: Please accept the attached quarter as a token of our appreciation. Although not meant to compensate you for your time, it is a way of thanking you for completing this survey.

Questionnaire

1. When designing a water distribution system, do you specify joining methods for interior water pipes?

❑ Yes ❑ No* **If "No," please pass this survey on to the individual who specifies joining methods for interior water pipes. Thank you!*

2. To which standard do you specify joint selection for water pipes? *(Please check <u>one</u> only.)*

❑ Engineered design
❑ Plumbing code
❑ ASTM and similar standards
❑ Let the plumber decide
❑ Other *(Please specify)*:_____

3. Generally speaking, how do you determine joining methods, if more than one acceptable method is allowed? *(Please check <u>one</u> only.)*

❑ Type of pipe alone
❑ Type of fittings alone
❑ Expected pressure in the system
❑ Possible need for disassembly
❑ Combination of the above elements
❑ Other *(Please specify)*:_____

4a. Which material pipe do you specify most often? *(Please check <u>one</u> only.)*

❑ Copper
❑ Galvanized Steel
❑ PVC
❑ CPVC
❑ PEX
❑ PEX-AL-PEX
❑ Other *(Please specify)*:_____

4b. If <u>copper pipe</u>, which jointing method do you specify most often? *(Please check <u>one</u> only.)*

❑ Soldered joints
❑ Brazed joints
❑ Flared joints
❑ Grooved joints
❑ Compression joints
❑ Mechanically formed joints
❑ Press connect joints
❑ Other *(Please specify)*:_____

4c. If <u>galvanized steel pipe</u>, which jointing method do you specify most often? *(Please check <u>one</u> only.)*

❑ Screwed joints
❑ Grooved joints
❑ Welded joints
❑ Flanged joints
❑ Other *(Please specify)*:_____

Over, please...

5a. If plastic pipe, which specific material do you specify most often? *(Please check one only.)*

- ❑ PVC
- ❑ CPVC
- ❑ PEX
- ❑ PEX-AL-PEX
- ❑ PE
- ❑ PP
- ❑ Other *(Please specify)*:_____

5b. IF PVC pipe, which joining method do you specify most often? *(Please check one only.)*

- ❑ Solvent cementing
- ❑ Heat fusion
- ❑ Screwed Schedule 80 and larger
- ❑ Other *(Please specify)*:_____

5c. IF CPVC pipe, which joining method do you specify most often? *(Please check one only.)*

- ❑ Solvent cementing
- ❑ Heat fusion
- ❑ Screwed Schedule 80 and larger
- ❑ Other *(Please specify)*:_____

5d. IF PEX pipe, which joining method do you specify most often? *(Please check one only.)*

- ❑ Mechanical connectors and fittings
- ❑ Crimp-type fittings
- ❑ Bronze fittings (with press connection)
- ❑ Other *(Please specify)*:_____

5e. IF PEX-AL-PEX pipe, which joining method do you specify most often? *(Please check one only.)*

- ❑ Mechanical connectors and fittings
- ❑ Crimp-type fittings
- ❑ Bronze fittings (with press connection)
- ❑ Other *(Please specify)*:_____

6. How often do you factor in piping expansion and contraction when determining the proper joining method? *(Please check one only.)*

- ❑ All the time
- ❑ Some of the time
- ❑ When necessary (special situations)
- ❑ Never consider it
- ❑ Haven't needed to consider it

7. How often do you prefer bending metal pipe as a way to reduce the number of joints in the system? *(Please check one only.)*

- ❑ All the time
- ❑ Some of the time
- ❑ When necessary (special situations)
- ❑ Never prefer it
- ❑ Other *(Please specify)*:_____

8. When installing a flexible plastic pipe system, which do you prefer? *(Please check one only.)*

- ❑ A manifold system
- ❑ A straight pipe system

9. Do you always include the following items in your specifications? *(Please check one for each item.)*

	Yes	No
Anchors	❑	❑
Expansion joints and guides	❑	❑
Ball joints	❑	❑
Hangers and supports	❑	❑
Pipe sleeves	❑	❑
Other *(Please specify)*:_____	❑	❑

10. What is your current job title, or classification? *(Please check one only)*

- ❑ Engineering Management *(President, Owner, Chairman, Partner, Chief Engineer, Project Mgr., Branch Mgr.)*
- ❑ Other Engineering Management
- ❑ Other *(Please specify)*:_____
- ❑ Engineer *(Plumbing, Hydronic Heating, Professional, Design, Project, Sanitary, Fire Protection, Medical Gas, Consulting)*
- ❑ Other Engineer

Thank you for your participation!

Appendix B

Glossary of Statistical Terms

Glossary of Statistical Terms

Descriptive/Summary Statistics
Mean - The arithmetic average; the sum divided by the number of cases.
Median - The middle value in an ordered list of responses, with 50% of the values above it and 50% of the values below it.
Mode - The most frequently occurring value. If several values share the greatest frequency of occurrence, each of them is a mode.

Linear Regression is a statistical technique used to explain or predict the variation of one variable (an outcome) by the variation of one or more other variables (or predictors) by fitting a straight line to the data. For example, regression can be used to predict or explain an outcome we want to influence such as sales, by the variation in product ratings, satisfaction, demographics, or other variables which may be associated with sales. The results are often referred to as a "model." The variables associated with the outcome are typically referred to as "key drivers." If the objective of the regression analysis is to predict an outcome, a formula is shown with the regression results.

Commonly used terms with regression analysis:

Correlation Coefficient (r) – A measure of association between two variables. Values of the correlation coefficient range from -1 to +1. The sign of the coefficient indicates the direction of the relationship, and its absolute value indicates the strength, with larger absolute values indicating stronger relationships.
Dependent, or Outcome variable – The variable of interest being predicted or explained by one or more independent variables.
Independent, or Predictor variable – One or more variables selected as predictors and potential explanatory variables of the dependent or outcome variable.
Linear – Refers to a relationship, that when graphed, is a straight line.
R Squared (R^2) - Goodness-of-fit measure of a linear model, sometimes called the coefficient of determination. It is the proportion of variation in the dependent, or outcome variable explained by the regression model. It ranges in value from 0 to 1. Small values indicate that the model does not fit the data well.
Standard Error of the Estimate - A measure in the variation of the predicted value derived from a regression model.
Significance – The probability that the relationship or result is true and representative of the population. In a regression model, significance measures the likelihood that the observed relationship among two or more variables in the model is not due to chance. Typically a value of at least 95% is considered significant.
Unstandardized Coefficients (B) - Coefficients of the predictor variables used to create the regression equation. The values are stated in the original data scale and indicate the amount of change in the outcome variable, given a one-unit change in the predictor variable.
Standardized Coefficients, or **Beta** - Beta coefficients, sometimes called standardized regression coefficients, are the regression coefficients when all variables are expressed in standardized form and show the relative importance of the predictor variables. Transforming the predictor variables to standardized form makes the coefficients more comparable when they have different units of measure.

Factor Analysis is a statistical technique used to analyze interrelationships among a large number of variables and to explain these variables in terms of their "common" underlying dimensions (factors). Ultimately it allows a large number of original variables in a data set to be "condensed" into a smaller set of variates (factors) – for ease of interpretation.