105 Decker Court, Suite 825
Irving, TX, 75062
http://plasticpipe.org
Email: MID@plasticpipe.org

PACE

Pipeline Analysis & Calculation Environment

Pipe Selection

PE Pipe Type:	PE4710 DIPS 10" DR17
DI Pipe Type:	DI DIPS 10" Thickness = 0.26"
PVC Pipe Type:	PVC12454-B CIOD 10" DR18

Input Summary

Pipeline Length	1000 ft
Design Velocity for Recurring Surge	4 ft/s
Design Velocity for Occasional Surge	8 ft/s
Anticipated Recurring Surges	55 per day
Temperature	57 degrees Fahrenheit
Working Pressure	70 psi
Minimum Design Life	100 years

Calculated Results

Standard	AWWA-C906		AWWA-C151		AWWA-C900	
Resin	PE4710		DI		PVC12454-B	
Pipe Rating at 57°F	125		350		235	
Working Pressure (no surge) Check	OK		OK		OK	
Nominal OD [in]	DIPS 10		DIPS 10		CIOD 10	
Dimension Ratio / Thickness	17		0.26		18	
Average Inside Diameter [in]	9.72		10.46		9.79	
	Recur.	Occas.	Recur.	Occas.	Recur.	Occas.
Flow Rate [gpm]	924	1,849	1,070	2,140	939	1,878
Head Loss [psi]	2.0	7.4	2.1	7.7	2.0	7.3
Surge Pressure [psi]	45	90	204	408	70	139
Total Pressure [psi]	115	160	274	478	140	209
Allow. Total Press. (with surge) [psi]	188	250	450	450	235	376
Surge Pressure Check	OK	OK	OK	x	OK	OK
Number of Cycles To Failure	9.2×10^8		N/A		2.3×10^6	
Design Fatigue Life [years; SF = 2]	>100		N/A		58	
Design Fatigue Life Check	OK		N/A		x	

Additional Design Parameters

Dynamic Elastic Modulus [psi]:	150,000	24,000,000	400,000
Hydrostatic Design Stress [psi]:	1,000	N/A	2,000
Temperature Derating Factor:	1	1	1
Hazen-Williams Factor:	150	140	150

Copyright 2015 eTrenchless Group Inc.
Printed from http://ppipace.com on September 16, 2026, 11:06 pm

105 Decker Court, Suite 825
Irving, TX, 75062
http://plasticpipe.org
Email: MID@plasticpipe.org

Calculation Procedures

- PPI-PACE is an online tool developed by eTrenchless Group Inc. that follows the design procedures in well-established and accepted water standards (ANSI/AWWA C150/151, ANSI/AWWA C900, ANSI/AWWA C901, ANSI/AWWA C905, ANSI/AWWA C906, ANSI/ASTM D2241).
- Per ANSI/AWWA C906, "Matching the ID of other pipe materials to the ID of HDPE for flow and PC will yield incorrect results. Use PPIPACE.com to evaluate flow capacity and PC of HDPE to other materials."
- Per ANSI/AWWA C906, "For PE4710, the PC calculations include a safety factor greater than 2 relative to the allowed operating stress..."
- Per ANSI/AWWA C906, "For PE4710, the SF for occasional surge pressure is pressure is greater than 2..."
- Per the AWWA and ANSI approvals of AWWA C906, the Hydrostatic Design Stress (HDS) of PE4710 is 1000 psi.
- Users can change the default values per project requirements.
- For Recurring Surge, PPI-PACE defaults to a minimum 4 fps flow velocity per AWWA M55; the software allows for a 4-8 fps range.
- For Occasional Surge, PPI-PACE defaults to a minimum 8 fps flow velocity per AWWA M55; the software allows for a 5-15 fps range.
- Average Flow Velocities: 6.7 fps (for Recurring Surge) and 11.6 fps (for Occasional Surge) per AWWA M55.
- For Working Pressure, PPI-PACE defaults to 70 psi - which is the average working pressure in the US. The minimum allowable value in PPI-PACE is 40 psi.
- For Anticipated Recurring Surges, PPI-PACE defaults to 55 cycles per day per AWWA C900-07 and AWWA C905-10 (Appendix B/Design Example); this results in about 1 million cycles for a 50-year design life and about 2 million cycles for a 100-year design life. It was recommended by one consultant to design for 3.5 million cycles or 96 cycles per day at a 100-year design life. The minimum allowable value in PPI-PACE is the default 55 cycles/day.
- For Temperature, PPI-PACE defaults to 57°F which is the average water temperature in the US; the software allows 40-100°F; consult the manufacturer for other temperatures.
- For Minimum Design Life, PPI-PACE defaults to 100 years; the software allows a minimum recommended design life of 50 years.
- For Help, refer to Resistance of PE4710 Piping to Pressure Surge Events in Force Main Applications, PP XVI, Barcelona, 2012, UK Water Industry IGN 4-37-02 Design Against Surge and Fatigue Conditions for Thermoplastic Pipes, and EPA Water Research Foundation: Durability and Reliability of Large Diameter HDPE Pipe for Water Main Applications
- The definition of pressure rating and pressure class differ between the implemented standards (AWWA C900, AWWA C905, AWWA C906, ASTM F714, ASTM D2241). The calculations on this site, provided by eTrenchless Inc., provide an unbiased interpretation of these standards so that an equivalent comparison of pipe materials can be conducted.
- Temperature derating factors for PE pipe in AWWA-M55 are limited to 100°F with a reference to manufacturers literature for temperatures greater than 100°F. ASTM F714 (PE) and AWWA-M23 (PVC) publishes temperature derating factors up to 140°F but these higher temperatures are not included in this tool.
- The design fatigue life for PVC is determined using the calculation method stated in AWWA C900 and C905 Appendix B using a 2:1 design factor. Data from tests with PE 4710 pipe are consistent with the UKWIR and Marshall/Brogden reports; see above reference and link to PP XVI Barcelona, 2012. For PE the design fatigue life is determined using fatigue curves provided in *Marshall, G.P., Brogden, S: Final report of Pipeline Innovation Contract to UKWIR, 1997* using a 2:1 design factor. For additional information on fatigure life and flow velocies see the Jana Laboratories report here. The design fatigue life of Ductile Iron (DI) pipe is not shown in PPI-PACE since these calculations are not available or referenced in the DI AWWA Standards or Manuals.
- Pressure rating should be reduced for systems operating under special or unusual conditions or where the pipe transports fluids that are known to have some degrading effect on the properties of polyethylene or where specified in Codes or Regulations or by the authority having jurisdiction. Water is the assumed transport fluid on PPI-PACE.
- Occasional transients caused by emergency pump and valve operations are usually severe. The system should be designed to withstand positive and negative pressures caused by these emergency operations. Water column

Copyright 2015 eTrenchless Group Inc.
Printed from http://ppipace.com on September 16, 2026, 11:06 pm

105 Decker Court, Suite 825
Irving, TX, 75062
http://plasticpipe.org
Email: MID@plasticpipe.org

separation may occur if the negative pressure is reduced to the vapor pressure of the liquid. Rejoining of the separated water column typically results in a large pressure rise, which will possibly damage the pipe system. Whenever possible, water column separation should be avoided

- These are preliminary calculations for product comparison only, not for final design. Qualified professionals should be contracted to consider all aspects of the design for pressure pipe design.

For more information contact support@ppipace.com

Copyright 2015 eTrenchless Group Inc.
Printed from http://ppipace.com on September 16, 2026, 11:06 pm

105 Decker Court, Suite 825
Irving, TX, 75062
http://plasticpipe.org
Email: MID@plasticpipe.org

TERMS OF USE

This website is constructed to assist water distribution professionals in the selection of their product pipe by providing a pressure pipe design tool that is consistent with the existing standards. For polyethylene pipe, AWWA-M55 "PE Pipe - Design and Installation", ASTM F714-10 "Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter", AWWA C901-08 "AWWA Standard for Polyethylene (PE) Pressure Pipe and Tubing, ½ In. (13 mm) through 3 In. (76 mm), for Water Service", and AWWA C906-15 "AWWA Standard for Polyethylene (PE) Pressure Pipe and Fittings, 4 In. Through 65 In. (100 mm Through 1,650 mm), for Waterworks" are the applicable documents. For polyvinyl-chloride pipe (PVC), AWWA-M23 "PVC Pipe - Design and Installation", ANSI/AWWA C900-07 "AWWA Standard for Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. Through 12 In. (100 mm Through 300 mm), for Water Transmission and Distribution", AWWA C905-10 "AWWA Standard for Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14 In. Through 48 In. (350 mm Through 1,200 mm)", and ASTM D2241-05 "Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)" are the applicable documents. For ductile iron pipe (DI), AWWA-C150-14 "Thickness of Ductile Iron Pipe" and AWWA C151-09 "Ductile-Iron Pipe, Centrifugally Cast" are the applicable documents

This website is developed by eTrenchless Group Inc and PPI with technical input from PPI members.

The information provided on this website is offered in good faith and believed to be accurate at the time of its preparation, but is offered "as is" without any express or implied warranty, including WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. Information is offered to the user only for consideration and all users must fulfill their own compliance when using this information from this website. PPI and eTrenchless Group Inc. assumes no responsibility for regulatory compliance or compliance data.

PPI and eTrenchless will improve and revise this website based on users comments and industry developments. Please send user comments to {mailto address="support@ppipace.com"}. Information on other publications can be obtained by contacting ASTM, AWWA, PPI or eTrenchless directly or visiting the web site.

PPI and its members develop quality products by assisting independent standards-making and user organizations in the development of standards, and also by developing reports on an industry-wide basis to help engineers, code officials, specifying groups, and users.

The Plastics Pipe Institute, Inc.

http://www.plasticpipe.org

eTrenchless Group Inc.

http://www.etrenchless.com

Email: {mailto address="info@etrenchless.com"}

Last Updated: May 15, 2015

YOUR ACCESS TO THIS WEBSITE IS SUBJECT TO LEGALLY BINDING TERMS AND CONDITIONS. PLEASE CAREFULLY READ THE FOLLOWING TERMS AND CONDITIONS BEFORE PROCEEDING.

1. Agreement between You and eTrenchless Group Inc. and its affiliates, and their successors and assigns (collectively referred to as "eTrenchless"), is a company that sells design tools for preliminary engineering purposes. The purpose of this website (the "Site") is to provide information on pressure pipe design for PE and PVC pipe following the existing published standards. The terms, conditions and notices contained herein, constitute an agreement between you and eTrenchless (the "Agreement") regarding your use of the Site. eTrenchless has made reasonable efforts to make the Agreement available to you either through the Site and/or other means of communication. By accessing the Site, you accept the Agreement. If you do not accept the Agreement, in its entirety, you must not access or use the Site.

2. Modification of the Agreement

eTrenchless reserves the right to modify this Agreement from time to time, for any reason. When such changes occur, you will see the word "Updated" next to the link to this Agreement on the introductory page of the Site for a period of at least thirty (30) days from such update. Additionally, the date when this Agreement was last updated will also appear at or near the top of any page within the Site on which this Agreement is displayed. Please review this Agreement from time to time so you will be apprised of any changes. After any change to this Agreement, eTrenchless may, but is not obliged to, ask you to actively confirm your agreement with the revised Agreement. If eTrenchless does not do so, but you continue to use the Site after the changes come into effect, you will be deemed to have agreed to abide by the revised Agreement. If you do not agree with the revised Agreement without qualification, you must discontinue using the Site and, if applicable, instruct eTrenchless to disable any usernames and passwords assigned to you.

3. Contracting Party with Authority

For the purposes of this Agreement, you shall be deemed to have capacity and authority or apparent capacity and authority to accept the Agreement. You accept responsibility for any fraudulent activity resulting from an impersonator or an unauthorized person without capacity and authority to accept the Agreement.

4. Use of eTrenchless Product-Related Information

Copyright 2015 eTrenchless Group Inc.
Printed from http://ppipace.com on September 16, 2026, 11:06 pm

105 Decker Court, Suite 825
Irving, TX, 75062
http://plasticpipe.org
Email: MID@plasticpipe.org

eTrenchless offers product-related information which may include information provided by a third party. The inclusion of any information or hyperlink does not imply that eTrenchless endorses any of the content including news, opinions, advice, statements and advertisements of the third party website. These sites are not under the control of eTrenchless, and by accessing them, you do so at your own risk. eTrenchless is not responsible for webstreaming or any other form of transmission received from any third party site, nor is eTrenchless responsible if the third party site is not working appropriately. Any transactions that take place between you and the third party, are directly with the third party, and eTrenchless cannot be held responsible for any loss or damage you may incur as a consequence thereof.

5. Intellectual Property

You acknowledge that any and all information, content, links, reports, data, databases, e-mails, code, photographs, pictures, video, files, graphics, interfaces, web pages, text, files, software, product names, company names, trade-marks, logos, trade names, or other materials contained on the Site (collectively the "Content") including the manner in which the Content is presented or appears and all information relating thereto, are the property of their respective owners as indicated, eTrenchless or its licensors, as the case may be. Except as expressly provided, you are not granted any rights in or to the Content available on or via the Site. All such rights remain with their respective owners.

To the extent that any jurisdiction applicable to this Agreement has a notice and take-down scheme like the one set out in the United States Digital Millennium Copyright Act ("DMCA"), upon receipt of any notice alleging infringement that complies with such a scheme, eTrenchless will act expeditiously to remove or disable access to any material claimed to be infringing or claimed to be the subject of infringing activity and will act expeditiously to remove or disable access to any reference or link to material or activity that is claimed to be infringing. eTrenchless may attempt to contact the person who has posted such material in order to give that person an opportunity to respond to the notification, although eTrenchless makes no promise to do so. Any and all counter notifications submitted by that person will be furnished to the complaining party. In all circumstances, eTrenchless will give the complaining party an opportunity to seek judicial relief in accordance with any applicable laws before eTrenchless replaces or restores access to any material as a result of any counter notification.

Notices of claimed infringement should be directed to:

eTrenchless Group Inc.
442 Tamarack Drive
Waterloo, Ontario
Canada N2L 4H1
Fax: 519-746-6556
Email: {mailto address="info@etrenchless.com"}

Please put "Notice of Infringement" in the subject line of all such notifications, and include in each such notice a reasonable description of the materials alleged to be infringing and the proprietary rights alleged to have been or being infringed.

6. WARRANTY DISCLAIMER

CONTENTS ON THE SITE ARE PROVIDED ON AN "AS IS" AND "AS AVAILABLE" BASIS WITH NO WARRANTIES OR CONDITIONS WHATSOEVER. ETRENCHLESS EXPRESSLY DISCLAIMS ALL WARRANTIES OF ANY KIND, WHETHER EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND NON-INFRINGEMENT. ETRENCHLESS MAKES NO WARRANTY THAT (A) THE SITE WILL MEET YOUR REQUIREMENTS; (B) THE SITE WILL BE AVAILABLE ON AN UNINTERRUPTED, TIMELY, SECURE, OR ERROR-FREE BASIS; (C) THE RESULTS THAT MAY BE OBTAINED FROM THE USE OF THE SITE OR ANY SERVICES OFFERED THROUGH THE SITE WILL BE ACCURATE AND RELIABLE; OR (D) THE QUALITY OF ANY PRODUCTS, SERVICES, INFORMATION, OR OTHER MATERIALS PURCHASED OR OBTAINED BY YOU THROUGH THE SITE WILL MEET YOUR EXPECTATIONS.

ETRENCHLESS IS NOT RESPONSIBLE FOR ANY DAMAGE TO YOUR COMPUTER SYSTEM OR LOSS OF DATA THAT RESULTS FROM THE DOWNLOAD OF ANY CONTENT, MATERIALS, INFORMATION OR SOFTWARE FROM THE SITE.

7. LIMITATION OF LIABILITY

THE USE OF THIS SITE AND THE CONTENT IS AT YOUR OWN RISK AND ETRENCHLESS, ITS LICENSORS, SUPPLIERS, AND ANY RESPECTIVE DIRECTORS, OFFICERS, EMPLOYEES OR AGENTS ASSUMES NO LIABILITY OR RESPONSIBILITY PERTAINING TO THE CONTENT OR YOUR USE OF THE SITE. IN NO EVENT SHALL ETRENCHLESS, ITS LICENSORS, SUPPLIERS, AND ANY RESPECTIVE DIRECTORS, OFFICERS, EMPLOYEES OR AGENTS BE LIABLE FOR ANY SPECIAL, INCIDENTAL, CONSEQUENTIAL, EXEMPLARY OR INDIRECT DAMAGES RESULTING FROM OR ARISING IN CONNECTION WITH THE SITE, THE CONTENT, THE PRIVACY POLICY OR THIS AGREEMENT, INCLUDING WITHOUT LIMITATION LOSS OF REVENUES, LOSS OF USE, THE INCAPACITY TO REACH ANY OBJECTIVE, OR THE LOSS OF DATA OR OF COMPUTER TIME USE, EVEN IF THEY HAVE BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES BY YOU OR ANY OTHER PERSON.

IN NO EVENT SHALL ETRENCHLESS, ITS LICENSORS, SUPPLIERS, AND ANY RESPECTIVE DIRECTORS, OFFICERS, EMPLOYEES OR AGENTS BE LIABLE TO YOU OR ANY PERSON ON ACCOUNT OF YOUR OR THAT PERSON’S USE OR MISUSE OF AND RELIANCE ON THE CONTENT OR OTHER MATERIALS ACCESSIBLE ON OR VIA THE SITE.

IN NO EVENT SHALL ETRENCHLESS, ITS LICENSORS, SUPPLIERS, AND ANY RESPECTIVE DIRECTORS, OFFICERS, EMPLOYEES OR AGENTS BE LIABLE TO YOU OR ANY PERSON WITH RESPECT TO DAMAGES INCURRED BY REASON OF ANY SERVICES OR GOODS

Copyright 2015 eTrenchless Group Inc.
Printed from http://ppipace.com on September 16, 2026, 11:06 pm

105 Decker Court, Suite 825
Irving, TX, 75062
http://plasticpipe.org
Email: MID@plasticpipe.org

RECEIVED THROUGH OR ADVERTISED ON THE SITE OR RECEIVED THROUGH ANY LINKS PROVIDED IN THE SITE.

ETRENCHLESS, ITS LICENSORS, SUPPLIERS, AND ANY RESPECTIVE DIRECTORS, OFFICERS, EMPLOYEES OR AGENTS WILL NOT BE RESPONSIBLE FOR ANY DAMAGES YOU OR ANY THIRD PARTY MAY SUFFER AS A RESULT OF THE TRANSMISSION, STORAGE OR RECEIPT OF CONFIDENTIAL, PERSONAL OR PROPRIETARY INFORMATION THAT YOU MAKE OR THAT YOU EXPRESSLY OR IMPLICITLY AUTHORIZE ETRENCHLESS TO MAKE, OR FOR ANY ERRORS OR ANY CHANGES MADE TO ANY TRANSMITTED, STORED OR RECEIVED INFORMATION.

ETRENCHLESS ASSUMES NO OBLIGATION TO UPDATE THE CONTENT ON THE SITE. THE CONTENT ON THE SITE MAY BE CHANGED WITHOUT NOTICE TO YOU. ETRENCHLESS, ITS LICENSORS, SUPPLIERS, AND ANY RESPECTIVE DIRECTORS, OFFICERS, EMPLOYEES OR AGENTS ARE NOT RESPONSIBLE FOR ANY CONTENT OR INFORMATION THAT YOU MAY FIND UNDESIRABLE OR OBJECTIONABLE. ETRENCHLESS, ITS LICENSORS, SUPPLIERS, AND ANY RESPECTIVE DIRECTORS, OFFICERS, EMPLOYEES OR AGENTS DISCLAIM ANY LIABILITY FOR UNAUTHORIZED USE OR REPRODUCTION OF ANY PORTION OF THE SITE. ACCESSING THE SITE OR THE CONTENT FROM TERRITORIES WHERE IT MAY BE ILLEGAL IS PROHIBITED.

The limitations specified above shall apply regardless of the causes or circumstances giving rise to the claim, even if such claim is based on breach of contract, negligence or other tort, and shall survive a fundamental breach or failure of essential purpose of any limited remedy or this Agreement.

You acknowledge and agree that, regardless of any statute or law to the contrary, any claim or cause of action you may have arising out of, or relating to, your use of the Site must be filed within one (1) year after such claim or cause of action arises, or it will be permanently barred.

YOU AGREE TO WAIVE ANY RIGHTS YOU MAY HAVE: (1) TO PARTICIPATE IN ANY CLASS ACTION LAW SUITS AND (2) TO A TRIAL BY JURY.

8. Indemnification

You agree at all times to indemnify, defend and hold harmless eTrenchless and its licensors, suppliers, and any respective directors, officers or employees against all actions, proceedings, costs, claims, damages, demands, liabilities and expenses whatsoever (including legal and other fees and disbursements) sustained, incurred or paid by eTrenchless directly or indirectly in respect of (i) any information or other content you provide on or through the Site or by e-mail or other correspondence; or (ii) your use or misuse of the Content or the Site, including without limitation infringement claims.

9. Privacy Policy

eTrenchless is concerned about your privacy and has developed a policy to address privacy concerns. (the "Privacy Policy"). You can find the current Privacy Policy at www.eTrenchless.com/privacy-policy/

10. Applicable Laws

The Site is controlled by eTrenchless in Waterloo, Ontario, Canada. By accessing the Site, you agree that any legal matter that may arise between you and eTrenchless relating to the Contents of the Site shall be governed by the laws of the Province of Ontario, Canada and exclusively by its courts without reference to the conflict of laws provision. The parties agree to attorn to the jurisdiction of the courts of the Province of Ontario for the conduct of any legal proceedings under, or related to, this Agreement. eTrenchless makes no promise that anything on the Site is appropriate or available for use in locations outside Canada. The Site and its Contents are intended for use only in jurisdictions where they may lawfully be offered for use.

11. Severability

If a court of competent jurisdiction deems any provision unenforceable, that provision will be enforced to the maximum extent permissible, and the remaining provisions will remain in full force and effect.

12. Assignment

eTrenchless may assign this Agreement, in whole, or in part, at any time, with or without notice to you. You may not assign your rights or delegate your duties under this Agreement, either in whole or in part, without the prior written consent of eTrenchless.

13. Copyright Notice and Trademark Information

Unless otherwise indicated, information contained in this site is Copyright 2012, eTrenchless Group Inc. All rights reserved.

Other names appearing on the Site may be trademarks of their respective owners.

14. Contact Information

If you have any questions regarding this Agreement, please contact eTrenchless Group Inc. at

eTrenchless Group Inc.

Copyright 2015 eTrenchless Group Inc.
Printed from http://ppipace.com on September 16, 2026, 11:06 pm

Fax: 519-746-6556
Email: {mailto address="info@etrenchless.com"}

15. English Language

The parties confirm that it is their wish that this Agreement as well as all other documents relating to this Agreement, including notices, be drawn up in English only. Les parties aux présentes confirment que cest leur volonté que la présente convention du même que tous les documents, y compris les avis, sy rattachant, soient redigés en anglais seulement.

Copyright 2015 eTrenchless Group Inc.
Printed from http://ppipace.com on September 16, 2026, 11:06 pm