

TECHNICAL BULLETIN

USING CERTA-LOK® PIPE FOR HORIZONTAL  
DIRECTIONAL DRILLING (HDD)

WHAT IS HORIZONTAL DIRECTIONAL DRILLING (HDD)?

HDD is a minimal impact trenchless method of installing underground utilities such as pipe, conduit, or cables in a relatively shallow arc or radius along a prescribed underground path using a surface-launched drilling rig. A guided pilot bore first establishes the trajectory and alignment then a bore is reamed to a larger bore diameter in one or more passes. The Certa-Lok® PVC pipe is then pulled through the prepared bore path. Drilling fluid is used to transport cuttings, stabilize the bore wall and cool the cutting tools. Please refer to our “Resources and References” Section for more information regarding the HDD installation process.

WHY USE CERTA-LOK® FOR HDD INSTALLATIONS?

Westlake Pipe & Fittings Certa-Lok PVC Pipe is designed for pulling multiple lengths of pipe underground. Certa-Lok segmented PVC Pipe reduces the size of the jobsite staging area and reduces the need for traffic control which minimizes community disruption. Further, the Certa-Lok joint design allows for quick and easy assembly without interrupting the pulling process. Lastly, Certa-Lok products use non-metallic parts, eliminating the risk of corrosion.

The following guidelines should be followed when using Westlake Pipe & Fittings Certa-Lok PVC Pipe for HDD installations. See below for the table of contents:

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PIPE DEFLECTION ALONG THE BORE PATH

The bore path design should respect the allowable longitudinal deflection of Certa-Lok Pipe. Changing Direction in an HDD bore using Certa-Lok restrained joint PVC pipe is achieved via longitudinal bending the pipe barrel. A properly designed bore path ensures that the designed bend radius of the bore path is not tighter than the allowable minimum bend radius of Certa-Lok pipe, refer to Table 1 below.



Figure 1 – Longitudinal bending of the pipe barrel requires proper restraint of the pipe joint.  
Certa-Lok® restrained joint pipe systems address these requirements.

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| TABLE 1: CERTA-LOK® LONGITUDINAL BENDING ALLOWANCES |                    |                  |   |
|---|--------------------|------------------|---|
| Product   | Nominal Size (in.) | Bend Radius (ft) | % Slope Change per 20ft Length (Figure 2) |
| AquaSpring™<br>C900 Certa-Lok®                      | 6                  | 144              | 7.00                                      |
|   | 8                  | 188              | 5.25                                      |
|   | 10                 | 232              | 4.38                                      |
|   | 12                 | 275              | 3.68                                      |
|   | 14                 | 319              | 3.15                                      |
|   | 16                 | 363              | 2.80                                      |
|   | 18                 | 406              | 2.45                                      |
|   | 20                 | 450              | 2.28                                      |
|   | 24                 | 538              | 1.93                                      |
| ASTM D2241<br>Certa-Lok®<br>Certa-Flo®              | 4                  | 75               | 13.30                                     |
|   | 6                  | 110              | 9.10                                      |
|   | 8                  | 144              | 7.00                                      |
|   | 10                 | 179              | 5.60                                      |
|   | 12                 | 213              | 4.73                                      |
|   | 14                 | 233              | 4.38                                      |
|   | 16                 | 267              | 3.68                                      |
| Certa-Com®  | 3, 4, 5, & 6       | 65               | 15.40                                     |
|   | 8                  | 72               | 14.00                                     |

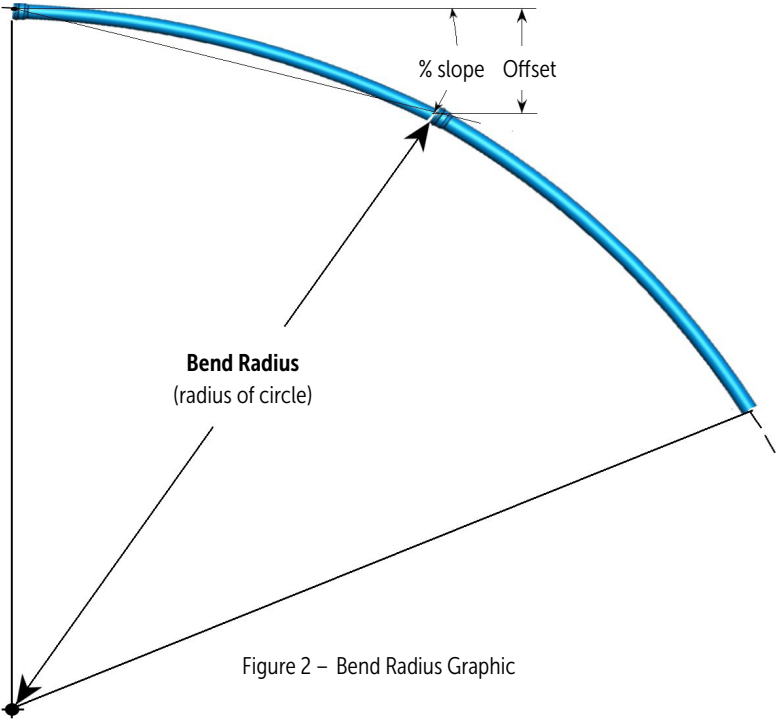


Figure 2 – Bend Radius Graphic

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## EXIT AND ENTRY ANGLES

Ground surface penetration angles are measured from horizontal. Penetration angles are limited by equipment capabilities; therefore, the design engineer should check constructability of the design. The below recommended entry and exit angles are according to ASCE Manuals and Reports on Engineering Practice No. 108: *Pipeline Design for Installation by Horizontal Direction Drilling*.

Entry angles: The recommended pipe entry angles are limited by equipment capabilities and should generally be designed between 8° and 20°.

Exit angles: The recommended pipe exit angles should generally range from 5° to 12°.

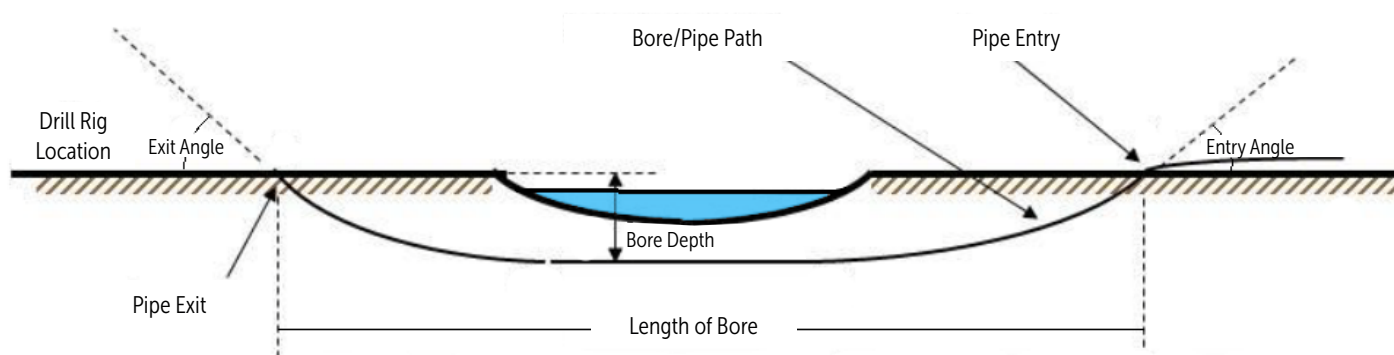


Figure 3 – Example of an HDD Bore Path

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PIT DIMENSIONS

In scenarios where Certa-Lok pipe is laid out and then pulled through the bore hole, it is critical that all pit dimensions are correct to ensure the minimum bend radius of the pipe is not exceeded. The table below provides the necessary pit lengths for each size and depth of Certa-Lok pipe. Also, refer to Figure 4 for further pit dimension guidance.

| TABLE 2: PERFORMANCE INFORMATION AND ENTRY PIT LENGTHS FOR WESTLAKE PIPE & FITTINGS CERTA-LOK® PVC PIPE |                    |                  |   |     |     |     |     |     |     |     |     |
|---|--------------------|------------------|---|-----|-----|-----|-----|-----|-----|-----|-----|
| Product   | Nominal Size (in.) | Bend Radius (ft) | Pit Length (L) for Entry Depth (D) [ft] |     |     |     |     |     |     |     |     |
|   |                    |                  | 4                                       | 5   | 6   | 7   | 8   | 9   | 10  | 11  | 12  |
| AquaSpring™<br>C900 Certa-Lok®  | 6                  | 144              | 48                                      | 54  | 59  | 64  | 68  | 72  | 76  | 79  | 83  |
|   | 8                  | 188              | 55                                      | 62  | 67  | 73  | 78  | 82  | 87  | 91  | 95  |
|   | 10                 | 232              | 61                                      | 68  | 75  | 81  | 86  | 91  | 96  | 101 | 105 |
|   | 12                 | 275              | 67                                      | 74  | 82  | 88  | 94  | 100 | 105 | 110 | 115 |
|   | 14                 | 319              | 72                                      | 80  | 88  | 95  | 101 | 107 | 113 | 118 | 124 |
|   | 16                 | 363              | 77                                      | 86  | 94  | 101 | 108 | 114 | 121 | 126 | 132 |
|   | 18                 | 406              | 81                                      | 90  | 99  | 107 | 114 | 121 | 128 | 134 | 140 |
|   | 20                 | 450              | 85                                      | 95  | 104 | 113 | 120 | 127 | 134 | 141 | 147 |
|   | 24                 | 538              | 93                                      | 104 | 114 | 123 | 131 | 139 | 147 | 154 | 161 |
| ASTM D2241<br>Certa-Lok®<br>Certa-Flo®  | 4                  | 75               | 35                                      | 39  | 42  | 46  | 49  | 52  | 54  | 57  | 59  |
|   | 6                  | 110              | 42                                      | 47  | 52  | 56  | 59  | 63  | 66  | 69  | 72  |
|   | 8                  | 144              | 48                                      | 54  | 59  | 64  | 68  | 72  | 76  | 79  | 83  |
|   | 10                 | 179              | 54                                      | 60  | 66  | 71  | 76  | 80  | 85  | 89  | 92  |
|   | 12                 | 213              | 59                                      | 66  | 72  | 77  | 83  | 88  | 92  | 97  | 101 |
|   | 14                 | 233              | 61                                      | 69  | 75  | 81  | 86  | 92  | 97  | 101 | 106 |
|   | 16                 | 267              | 66                                      | 73  | 80  | 87  | 93  | 98  | 103 | 108 | 113 |
| Certa-Com®  | 3, 4, 5, & 6       | 65               | 32                                      | 36  | 40  | 43  | 45  | 48  | 50  | 53  | 55  |
|   | 8                  | 72               | 34                                      | 38  | 42  | 45  | 48  | 51  | 53  | 56  | 58  |

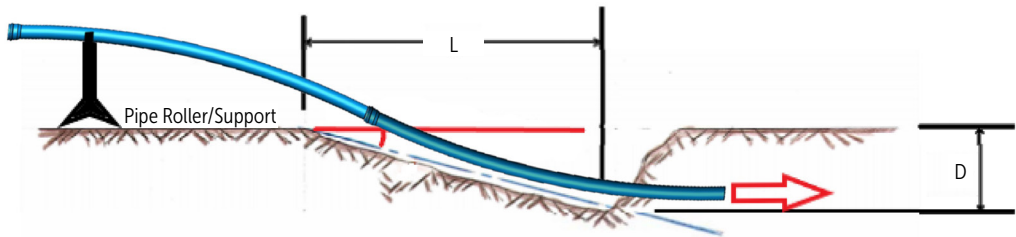


Figure 4 – Pit Dimensions

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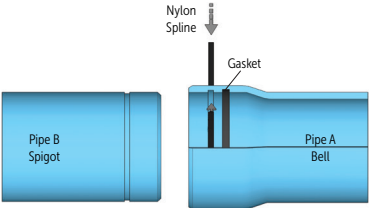
PIT DIMENSIONS (Cont'd)

One advantage of Certa-Lok pipe is the entire pipe string does not need to be assembled prior to pulling. Certa-Lok pipe can be installed using a cartridge style method, where one pipe length is installed then partially pulled enough so another pipe length can be assembled. In cartridge style installations, the pit dimensions are determined by the clearances required by the pipe and any associated HDD equipment.

PULL LENGTH / MAXIMUM PULL FORCE

In general, Certa-Lok is often capable of being pulled hundreds, if not thousands of feet, in a single pull. As there are many factors (e.g., length and depth of bore, drilling fluid consistency, soil type, severity of pipe bending, etc.) which influence the pullback force required to complete an installation, it is not possible to establish a single figure for maximum allowable pull length. Westlake Pipe & Fittings publishes safe maximum pull forces for all of our Certa-Lok products, which include a factor of safety. These safe pulling loads may be cross referenced against the expected pull load before and during the installation to help ensure the pipe is not exceeded. The most up to date figures for safe maximum pull loads for Certa-Lok products may be found on the product specification sheet for the particular product used. All Westlake Pipe & Fittings Product Technical Specifications are available on our website: <https://www.westlakepipe.com>. The Technical Product Specification sheet is typically included in the project submittal documents as well.

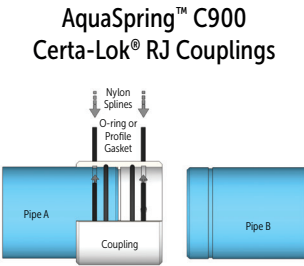
Also, see below (Tables 3 thru 6) for the maximum allowable pullback forces for all of our Certa-Lok products.

| TABLE 3: AQUASPRING™ C900 CERTA-LOK® RESTRAINED JOINT INTEGRAL BELL (RJIB)<br>MAXIMUM ALLOWABLE PULLBACK FORCES                           |                    |    |  |
|---|--------------------|----|--|
| Product   | Nominal Size (in.) | DR | Maximum Allowable Pullback Force (lbf) |
| <div><p>AquaSpring™ C900<br/>Certa-Lok® RJIB</p></div> | 6                  | 18 | 20,100                                 |
|   |                    | 14 | 22,300                                 |
|   | 8                  | 18 | 27,500                                 |
|   |                    | 14 | 31,000                                 |
|   | 10                 | 18 | 49,500                                 |
|   |                    | 14 | 52,600                                 |
|   | 12                 | 18 | 60,000                                 |
|   |                    | 14 | 60,000                                 |
|   | 16                 | 25 | 68,500                                 |
|   |                    | 18 | 72,000                                 |
|   | 18                 | 25 | 81,500                                 |
|   |                    | 18 | 101,000                                |
|   | 20                 | 25 | 102,400                                |
|   |                    | 18 | 117,500                                |
|   | 24                 | 25 | 125,000                                |
|   |                    | 18 | 126,000                                |

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PULL LENGTH / MAXIMUM PULL FORCE (Cont'd)

| TABLE 4: AQUASPRING™ C900 CERTA-LOK® RESTRAINED JOINT COUPLING MAXIMUM ALLOWABLE PULL FORCES |                    |    |  |
|--|--------------------|----|--|
| Product Standard   | Nominal Size (in.) | DR | Maximum Allowable Pullback Force (lbf) |
|            | 4                  | 18 | 7,800                                  |
|  |                    | 14 | 9,800                                  |
|  | 6                  | 18 | 16,000                                 |
|  |                    | 14 | 18,900                                 |
|  | 8                  | 18 | 23,100                                 |
|  |                    | 14 | 24,300                                 |
|  | 10                 | 18 | 40,500                                 |
|  |                    | 14 | 48,700                                 |
|  | 12                 | 18 | 50,500                                 |
|  |                    | 14 | 53,800                                 |
|  | 14                 | 25 | 52,500                                 |
|  |                    | 21 | 57,000                                 |
|  |                    | 18 | 61,500                                 |
|  | 16                 | 25 | 68,500                                 |
|  |                    | 21 | 68,500                                 |
|  |                    | 18 | 68,500                                 |
|  |                    | 14 | 68,500                                 |
|  | 18                 | 25 | 97,000                                 |
|  |                    | 21 | 105,000                                |
|  |                    | 18 | 113,000                                |
|  | 20                 | 25 | 107,500                                |
|  |                    | 21 | 112,500                                |
|  |                    | 18 | 117,500                                |
|  | 24                 | 25 | 120,000                                |
|  |                    | 21 | 132,500                                |
|  |                    | 18 | 145,000                                |

Note 1 – RJIB PVC Products  
Note 2 – PVC RJ Coupling  
Note 3 – Composite RJ Coupling

| TABLE 5: ASTM D2241 CERTA-FLO® RJIB MAXIMUM ALLOWABLE PULL FORCES |                    |    |  |
|---|--------------------|----|--|
| Product Standard  | Nominal Size (in.) | DR | Maximum Allowable Pullback Force (lbf) |
| ASTM D2241<br>Certa-Flo®  | 4                  | 21 | 6,500                                  |
|   | 6                  | 21 | 8,200                                  |
|   | 8                  | 21 | 15,500                                 |
|   | 10                 | 26 | 18,500                                 |
|   | 12                 | 26 | 22,000                                 |

| TABLE 6: ASTM D2241 CERTA-LOK® YELOMINE® MAXIMUM PULLBACK FORCES |                    |     |      |  |
|--|--------------------|-----|------|--|
| Product Standard   | Nominal Size (in.) | SDR | Note | Maximum Allowable Pullback Force (lbf) |
| ASTM D2241<br>Certa-Lok®<br>Yelomine®                            | 2                  | 17  | 2    | 1,400                                  |
|  | 3                  | 17  | 2    | 3,800                                  |
|  | 4                  | 21  | 1    | 6,500                                  |
|  |                    | 17  | 1    | 6,800                                  |
|  |                    | 21  | 2    | 5,200                                  |
|  |                    | 17  | 2    | 5,200                                  |
|  | 6                  | 21  | 1    | 8,200                                  |
|  |                    | 17  | 1    | 11,300                                 |
|  |                    | 26  | 2    | 6,200                                  |
|  |                    | 21  | 2    | 6,900                                  |
|  |                    | 17  | 2    | 7,100                                  |
|  | 8                  | 21  | 1    | 15,500                                 |
|  |                    | 26  | 2    | 10,900                                 |
|  |                    | 21  | 2    | 13,000                                 |
|  |                    | 17  | 2    | 13,000                                 |
|  | 10                 | 26  | 2    | 17,700                                 |
|  |                    | 21  | 2    | 20,000                                 |
|  | 12                 | 26  | 2    | 20,600                                 |
|  |                    | 21  | 2    | 23,300                                 |
|  | 14                 | 26  | 2    | 21,400                                 |
|  | 16                 | 26  | 2    | 20,000                                 |
|  |                    | 26  | 3    | 62,000                                 |
|  |                    | 21  | 3    | 62,000                                 |

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PULL LENGTH / MAXIMUM PULL FORCE (Cont'd)

| TABLE 7: CERTA-COM®<br>MAXIMUM ALLOWABLE PULLBACK FORCES |                    |         |  |
|--|--------------------|---------|--|
| Product Standard   | Nominal Size (in.) | Class   | Maximum Allowable Pullback Force (lbf) |
| Certa-Com®   | 3                  | Sch. 40 | 10,200                                 |
|  | 4                  | Sch. 40 | 12,700                                 |
|  | 5                  | Sch. 40 | 13,900                                 |
|  | 6                  | Sch. 40 | 16,700                                 |
|  | 8                  | Sch. 40 | 30,000                                 |

Bore Hole Diameter

The appropriate bore hole diameter is critical to provide clearance between the pipe outside diameter (OD) and bore hole, allow for adequate flow of drilling fluid, and reduce the required loads during the pullback operation.

NASTT recommends a final bore hole diameter that is the smaller of 1.5 times the actual outside diameter (OD) or 12 inches (300 mm) larger than the actual OD of the product pipe. It may be advisable to use a bore hole diameter less than 1.5 times the product OD in collapsing soil formations. Also, it may be necessary to increase the final bore hole diameter by 25% if substantial swelling of the soil is expected to occur. The recommended relationship of bore hole diameter to largest product diameter (typically Bell or Coupling OD) are presented below.

| TABLE 7: RECOMMENDED RELATIONSHIP BETWEEN<br>PRODUCT DIAMETER AND BOREHOLE DIAMETER |   |
|---|---|
| Product Diameter <sup>1</sup>   | Bore Hole Diameter                      |
| <8 inches (<200 mm)   | Diameter of product + 4 inches (100 mm) |
| 8-24 inches (200 - 600 mm)  | Diameter of product x1.5                |
| >24 inches (600 mm)   | Diameter of product +12 inches (300 mm) |

<sup>1</sup>Product diameter is the largest diameter of the product, such as the bell OD or coupling OD.

MINIMUM DEPTH OF COVER

Depth of cover may be prescribed by an owner agency or permitting agency. Alternatively, the minimum depth of cover may be determined by the engineer using a scour analysis, hydro-fracture risk evaluation and/or a settlement risk evaluation. Refer to PPI's TR-46: *Guidelines for Use of Mini-Horizontal Directional Drilling for Placement of High Density Polyethylene Pipe*, and ASTM F1962 for further guidance.

PULLER HEADS

Use Puller heads that are appropriately sized for your Certa-Lok PVC Pipe. Contact your local representative for information regarding rental of a puller head. Please click [HERE](#) to contact a representative in your area.

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### NEED A BORE PATH ANALYSIS?

Please reach out to a Westlake Pipe & Fittings Specification Engineer, who can facilitate a review of your bore path design to ensure that our Certa-Lok products' performance requirements are sufficient for a successful installation. If the bore path plan drawings are not available to send to Westlake Pipe & Fittings, then below is a list of the required items needed for us to review your design:

1. Total pull length of project
2. Entry & exit pit depths
3. Entry & exit pit elevations
4. Entry & exit angles
5. Maximum depth of bore path
6. Product information
  - a. Pipe Type
  - b. Pipe size (Nominal Pipe Size and Dimension Ratio [DR])

### SOURCES & REFERENCES

1. Dr. Slavin, L. (2009). TR-46: *Guidelines for Use of Mini-Horizontal Directional Drilling for Placement of High Density Polyethylene Pipe*. Plastic Pipe Institute.
2. North American Society for Trenchless Technology. (2017). *NASTT's Horizontal Directional Drilling (HDD) Good Practices Guidelines, 4th Ed.*
3. American Society of Civil Engineers (ASCE). (2014). *ASCE Manuals and Reports on Engineering Practice No. 108 – Pipelines Design for Installation by Horizontal Directional Drilling, 2nd Ed.*
4. ASTM F1962-20 – *Standard Guide for Use of Maxi-Horizontal Directional Drilling for Placement of Polyethylene Pipe or Conduit Under Obstacles, Including River Crossings.*

### EXAMPLES OF HDD INSTALLATIONS USING CERTA-LOK

Certa-Lok pre-strung and entering HDD pit. Using ground as support for pipe string.





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### EXAMPLES OF HDD INSTALLATIONS USING CERTA-LOK *(Cont'd)*

Certa-Lok pre-strung and support by pipe rollers before entering HDD pit.



Certa-Lok installed via cartridge method – each length of pipe is installed individually before being pulled in bore hole.



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