

TRENCHLESS APPLICATIONS WITH DUCTILE IRON PIPE

4"–36" HDSS® Pipe:
Horizontal Directional
Drilling (HDD) and Pipe
Bursting



PIPE

FABRICATION

RESTRAINED JOINTS

FITTINGS

GASKETS

COATINGS & LININGS



U.S. PIPE

A QUIKRETE® COMPANY

TRENCHLESS APPLICATIONS WITH DUCTILE IRON PIPE

4"–36" HDSS® Pipe: Horizontal Directional Drilling (HDD) and Pipe Bursting

TRENCHLESS APPLICATIONS

People across the country are finding out that Ductile Iron pipe can be used for Horizontal Directional Drilling (HDD) and for Pipe Bursting.

The same great qualities of ruggedness, durability and dependability that make Ductile Iron pipe the choice for water systems across the nation are the same qualities that make it the right choice for Trenchless Technology. The proven and reliable HDSS® Restrained Joint, ensures quick and easy assembly with the great strength needed for the toughest trenchless jobs. Another benefit to our pipe is that the same standard restrained joint, with a nominal pipe length of 18-ft or 20-ft, can be used for either HDD or pipe bursting, no need for expensive special pipe with long lead times, standard restrained joint pipe is usually in stock. The nominal 18-ft or 20-ft lay lengths not only pull in quickly but also are convenient to use with the cartridge method when working in tight city streets or congested urban areas.

For trenchless sewer applications requiring a protective pipe lining, PROTECTO 401™ or CERAMAPURE™ PL90 is offered.

HORIZONTAL DIRECTIONAL DRILLING WITH DUCTILE-IRON

The HDD pipeline installation method is becoming more and more common in our industry. In certain unique situations, a trenchless installation may be the only way for a pipeline to be installed or replaced. But whether your project is a traditional open trench or trenchless installation, you want to install the best pipe material available – and that's Ductile Iron pipe from U.S. Pipe and Foundry Company.

U.S. Pipe's proven and reliable HDSS® Restrained Joint is approved for use in applications using Horizontal Directional Drilling. The great strength of Ductile Iron, combined with the renowned HDSS® Restrained Joint, make it the right choice for HDD. Providing ease of assembly and positive thrust restraint, the HDSS® Restrained Joint can easily withstand the unique rigors and demands of HDD.

We've developed several guidelines to assist you when you decide to use U.S. Pipe's HDSS® Restrained Joint in trenchless installations:

PULLING FORCE CAPABILITY

Today's HDD machines are capable of generating tremendous pulling forces when pulling the pipe into the borehole. The pipe joint must be capable of withstanding these forces. The pulling force for the HDSS® pipe joint is based on PC 350 pipe in a dead-end thrust condition of the working pressures. The pipe should be pulled only from a spigots first orientation to take advantage of the low-profile, streamlined bell. Table 1 (pg. 3) lists the recommended pull forces. If higher pulling forces are required please contact your U.S. Pipe Sales Representative.

LONG RADIUS PULLS

Long radius pulls should be designed to stay within the deflection capability of the joint to ensure that the joint is not over-deflected. Table 1 lists the industry standards for minimum radius for an 18-ft pipe and borehole diameters for straight or radius pulls. A tighter pull radius can be achieved with shorter lay length pipe. See the free HDD Radius Calculator at www.uspipe.com for planning an HDD creek, canal crossing or standard directional drill.

POLYETHYLENE ENCASEMENT OR V-BIO®

U.S. Pipe recommends that pipe used for HDD be polyethylene encased or wrapped in V-BIO® if the project area has a history of corrosive soil or soil survey determines the soil to be corrosive. The polyethylene must meet the material specifications of AWWA Standard ANSI/AWWA C105/A21.5 "Polyethylene Encasement for Ductile-Iron Pipe Systems". See assembly instructions on page 4 for a suggested procedure if the pipe is poly-wrapped.

PULLING HEADS

U.S. Pipe offers specially-designed pulling heads for purchase in 4" – 36" sizes. These pulling heads can also be used for pressure testing the line.

PIPE BURSTING WITH DUCTILE-IRON

The same HDSS® Restrained Joint that is used for HDD can also be used for pipe bursting. The great joint strength makes it ideal for the pulling process in pipe bursting for water or sewer applications. Most pipe bursting applications are from manhole to manhole and are for sewer system updates such as upsizing for current or future capacity requirements or for pipe replacement of existing leaking or collapsed piping systems in compliance to the EPA's Clean Water Act.

Ductile-Iron pipe can be installed and used to burst pipe materials such as Clay, Asbestos-Cement, PVC, HDPE, Steel, Concrete, and Ductile-Iron. Ductile-Iron pipe can also be used to burst Cast-Iron pipe as long as the soil resistivity (around the Cast-Iron pipe) is equal to/or greater than 2,000 ohm-cm.

PIPE BURSTING PULLING HEAD

A special pull head is not required for pipe bursting. The standard pull head for the ductile iron pipe should be connected so it is pulled behind the bursting head and expander cone of the pipe bursting equipment. A shroud or skirt from the expander should extend past the pipe pull head to keep debris from falling between the pipe pull head and expander rod. The expander head or cone diameter is typically 2-inches larger than the pipe bell diameter.

POLYETHYLENE ENCASEMENT

Polyethylene Encasement or V-Bio cannot be used because the bursting process leaves the previous pipe broken; the sharp edges will tear and shred the polyethylene.

PULL FORCE

See Table 1 for pull force. In pipe bursting most of the pulling force is concentrated at the expanding cone or head with the pipe behind being pulled in with very little force. Another factor in low pull back forces is that the bell is larger than the pipe barrel; and only contacts the host pipe in a small contact area at every pipe length unlike other materials that have a continuous uninterrupted outside diameter.

TRENCHLESS APPLICATIONS WITH DUCTILE IRON PIPE

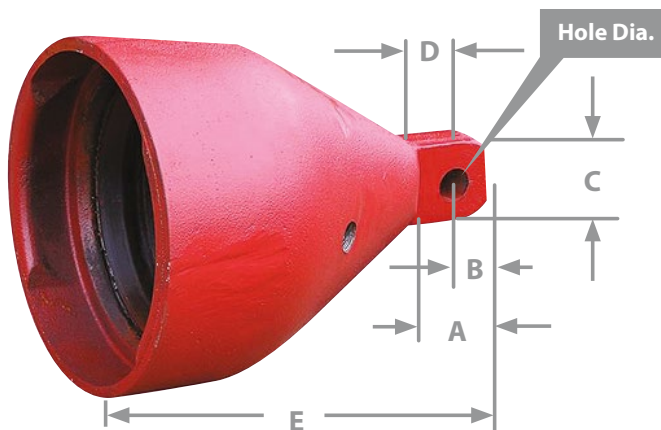
4"–36" HDSS® Pipe: Horizontal Directional Drilling (HDD) and Pipe Bursting

TABLE 1 – HORIZONTAL DIRECTIONAL DRILLING WITH HDSS® PIPE

SIZE INCHES	BELL O.D. INCHES	BOREHOLE DIA. @ 1.25 X BELL DIA. (ROUNDED) INCHES	BOREHOLE DIA. @ 1.5 X BELL DIA. (ROUNDED) INCHES	ALLOWABLE JT. DEFLECTION DEGREES	RADIUS @ 1/2 JT.- DEFLECT. – 18' PIPE FEET	RADIUS @ 1/2 JT.- DEFLECT. – 20' PIPE FEET	PULL FORCE PC-350 PIPE POUNDS	BUOYANCY (IN WATER) PIPE FULL OF AIR PC-350 PIPE (-) WILL NOT FLOAT POUNDS/FOOT
4	7.00	9	11	5	412	458	10,000	-5.5
6	9.27	12	14	5	412	458	20,000	-3.4
8	11.68	15	18	5	412	458	30,000	1.6
10	14.12	18	22	5	412	458	45,000	8.1
12	16.43	21	25	5	412	458	65,000	16.3
14	19.15	24	29	4	516	573	85,000	21.1
16	21.46	27	32	4	516	573	110,000	30.7
18	23.78	30	36	4	516	573	135,000	44.5
20	26.07	33	39	4	516	573	165,000	59.4
24	30.67	38	46	4	516	573	240,000	94.2
30	36.38	46	55	2.5	825	916	365,000	157.8
36	43.36	55	65	2	1031	–	520,000	241.3

TABLE 2 – PULLING HEAD DIMENSIONS

SIZE INCHES	HOLE DIA. INCHES	WEIGHT POUNDS	A INCHES	B INCHES	C INCHES	D INCHES	E INCHES
4	.812	23	2.24	1.22	1.88	1.12	10.81
6	1.06	41	2.70	1.38	2.25	1.25	13.13
8	1.187	70	3.61	1.9	3.00	1.5	15.81
10	1.437	97	4.63	2.06	3.63	1.5	18.47
12	1.437	142	4.42	2.09	3.63	1.56	20.60
14	1.812	177	5.42	2.72	5.44	1.94	20.50
16	2.406	239	7.00	3.5	9.00	2.5	21.50
18	2.406	291	7.00	3.5	9.00	2.5	22.75
20	2.940	368	8.50	4.5	10.00	3.62	25.25
24	3.340	508	9.25	4.75	10.00	3.62	28.50
30HPL	5.00	1400	13.30	8.00	16.25	6.50	43.28
36HPL	5.00	1800	13.63	8.00	16.25	6.50	46.00



NOTES:

- Radius is based on 1/2 of the joints deflection capability using 18 ft. lengths of pipe. A tighter radius can be achieved using shorter lengths of pipe. An industry rule of thumb for the bore radius is Nominal pipe Size x 100 i.e. – for a 12" pipe – 12 x 100 = 1200 ft. Final bore radius and bore hole diameter size is the responsibility of the project engineer. See Radius Calculator www.uspipe.com/trenchless.
- Industry Standards is 1.25 – 1.5 times bell Dia. For Straight Pulls and 1.5 or larger for Curved or Radius Pulls.
- Pull loads are based on PC-350 Pipe – Contact your U.S. Pipe Sales Representative for lower PC pipe or higher pull loads if needed.

TRENCHLESS APPLICATIONS WITH DUCTILE IRON PIPE

4"–36" HDSS® Pipe: Horizontal Directional Drilling (HDD) and Pipe Bursting

ASSEMBLY INSTRUCTIONS

STEP 1: Cut polyethylene tube, V-Bio or Sheet, to 2–3 foot longer than the pipe length to provide sufficient overlap. Slide the polyethylene onto the first pipe before assembling the pipe to the pulling head.

STEP 2: Clean and dry the pipe. Position the edge of the polyethylene to the second assembly stripe. Fold the polyethylene to take up the slack so that it lays flat against the pipe. Using the polyethylene tape, tightly tape over all leading edges of the polyethylene to prevent mud from flowing underneath (Fig. 1). Pulling the polyethylene tape very tight in a spiral winding motion, tape the first half of the pipe being sure not to leave a gap or space between the tape wraps before connecting to the pulling head.

STEP 3: Assemble the pipe to the pulling head per the assembly instructions in the U.S. Pipe's HDSS® Restrained Joint Ductile Iron Pipe and Fittings brochure.

STEP 4: Securing the HDSS locking segments: Trim the rubber retainer approximately ¼" longer than the gap between the locking segments when they are inserted into the segment cavity. Using a hammer or screwdriver, drive the rubber retainer to the back of the segment cavity (Fig. 2). The rubber is in compression and will hold the locking segments in place.

STEP 5: Sleeve the next pipe with polyethylene and assemble the joint per the instructions in Step 4. Slide the polyethylene from the second pipe forward over the bell of the first pipe and secure with a tight tape wrap. Pull the polyethylene of the first pipe over the bell creating an overlap with the direction of the pull and continue tightly taping the remainder of the first pipe over the bell and to the barrel of the second pipe. The gap or space between the tape wraps in this area of the pipe and for the remainder pipe should not be greater than 6 to 8-inches apart. All slack in the polyethylene encasement should be folded flat and against the pipe. Continue overlapping and tightly spiral winding the tape for the remainder of the pipe. (Fig. 3)

Field Weld Applied Rings: HDSS field weld rings can be used in the pulling or pull-back process. Field weldment rings, kits and instructions are available from U.S. Pipe. (See U.S. Pipe's brochure, "Field Cutting and Welding Procedure for HDSS® Pipe.")

Drilling Fluids: Various types of soils and soil formations require different drilling fluids and additives. It is recommended that HDD users follow the drilling fluid manufacturer's recommendations for the proper mud mix formulation and viscosity.

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