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HDPE Safe Pulling Strenth
a technical note

Smooth wall HDPE conduit has become the economic material of choice for protection of fiber optic and copper cable lines because of its strength, toughness, flexibility, and long lengths without joints. HDPE conduit can be installed in a variety of methods, including open trench, plowing, and Horizontal Directional Drilling (HDD).

During installation, conduit is subject to a number of construction stresses, including tensile, bending, crushing and impact which need to be considered and accounted for. Although there will be some tensile forces on the HDPE conduit in plowed installations, HDD typically will involve the greatest stresses in the axial (along the length) direction of the pipe (1).

HDPE is a viscoelastic material. Its molecular structure has the ability to relax and relieve stress. The material's tensil yield is a time dependant property whose value changes over time, so HDPE will exhibit a high resistance in the short term which may decrease over time. Unloading HDPE conduit may alternatively cause a rebound and gain in stiffness of the pipe. Furthermore, the rate of loading affects the tensile yield of the material. The pull strength of a conduit can be determined by multiplying the tensile strength of the material (HDPE) by the area of the pipe section. However, a safety factor reflecting the time dependant characteristics of the material is recommended by the Plastic Pipe Institute (PPI) (2) for HDD applications.

The standard tensile strength of HDPE resin used in the manufacture of conduit is 3,000-3,500 psi. PPI recommends using a tensile strength of 1,300 psi for short duration bores (30 minutes) and 1,100 psi for long duration bores (24 hours). You can see the recommended "safe pull strength" is about 30% of the laboratory yield strength of the material. The tables below calculate the safe pull strength at three yield strength conditions for the more popular sizes of HDPE conduit used in HDD applications.

1. Handbook of Polyethylene Pipe, The Plastic Pipe Institute, Chapter 14, pg 475: Installation Method vs. Short-Term and Long-Term Stresses.
2. Handbook of Polyethylene Pipe, The Plastic Pipe Institute, Chapter 12, pg 427: Performance Limits of HDD Pipe.

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Laboratory / Safe Pull Strength

Diameter SDR 11	Pull Strength @ Yield 3,250 psi	Duration / Stress 30 minutes / 1,300 psi	Duration / Stress 24 hours / 1,100 psi
1″	1,590	635	540
1.25″	2,435	975	825
1.5″	3,215	1,285	1,090
2″	5,005	2,000	1,695
3″	10,890	4,350	3,685
4″	17,970	7,190	6,080
5″	27,525	11,010	9,315
6″	39,030	15,615	13,210

Diameter SDR 13.5	Pull Strength @ Yield 3,250 psi	Duration / Stress 30 minutes / 1,300 psi	Duration / Stress 24 hours / 1,100 psi
1″	1,330	530	450
1.25″	2,045	815	695
1.5″	2,700	1,075	910
2″	4,160	1,665	1,410
3″	9,050	3,615	3,060
4″	14,915	5,970	5,050
5″	22,850	9,140	7,730
6″	32,400	12,960	10,970

Diameter SCH 40	Pull Strength @ Yield 3,250 psi	Duration / Stress 30 minutes / 1,300 psi	Duration / Stress 24 hours / 1,100 psi
1″	1,720	690	585
1.25″	2,310	925	780
1.5″	2,760	1,105	935
2″	3,705	1,480	1,255
3″	7,760	3,490	2,695

Diameter SCH 80	Pull Strength @ Yield 3,250 psi	Duration / Stress 30 minutes / 1,300 psi	Duration / Stress 24 hours / 1,100 psi
3″	10,335	4,135	3,500
4″	15,110	6,050	5,115
5″	20,930	8,375	7,085
6″	28,825	11,530	9,760

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