

DENLOK™

VITRIFIED CLAY JACKING PIPES



INTRODUCTION

The DENLOK range of vitrified clay pipes has been specially developed to meet the requirements of installation by trenchless construction methods. DENLOK pipes are supplied to major projects throughout the world for installation by various techniques including:

- **MICROTUNNELLING**
- **AUGER BORING**
- **PIPE BURSTING**
- **PIPE EATING**
- **SLIP LINING**

PROPERTIES

The excellent long term performance of vitrified clay pipes is well known and they form an extremely durable structure, which combines high load bearing strength and excellent chemical and abrasion resistance.

DENLOK clay jacking pipes are characterised by a high axial strength, making them an ideal choice for installation by trenchless methods.

DENLOK pipes offer:

- High axial strengths to withstand jacking forces.
- Accurately machined ends to ensure directional stability during installation.
- Dimensional accuracy of pipes and joints, minimising frictional resistance during jacking.
- Push-fit joints with integral packing ring for easy assembly.
- Joints that meet the performance requirements imposed by trenchless installation.
- High resistance to imposed earth loads.
- High resistance to abrasion and corrosion.



Excellent long term performance to high pressure jetting and other cleaning methods.

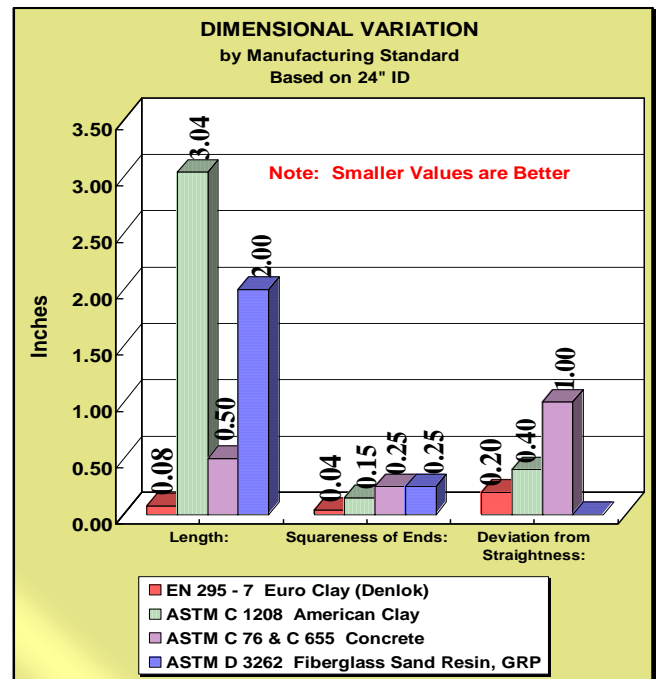
Denlok™ Performance Advantages

Municipal Advantages

- Minimum 100 year life guarantee
- Demonstrated results from centuries of vitrified clay pipe use
- Unsurpassed corrosion resistance that is unaffected by time
- Water/air tight joints
- Proven worldwide successes in 17 countries
- Highest abrasion resistance of all sewer materials
- Strength does not decrease with age as do pipes of resin or plastics *
- Excellent hydraulics for sanitary sewer use
- Lowest cost per allowable jacking force
- Economical installations
- Lowest ownership cost in the long run
- Exceeds European and ASTM standards for ceramic pipe

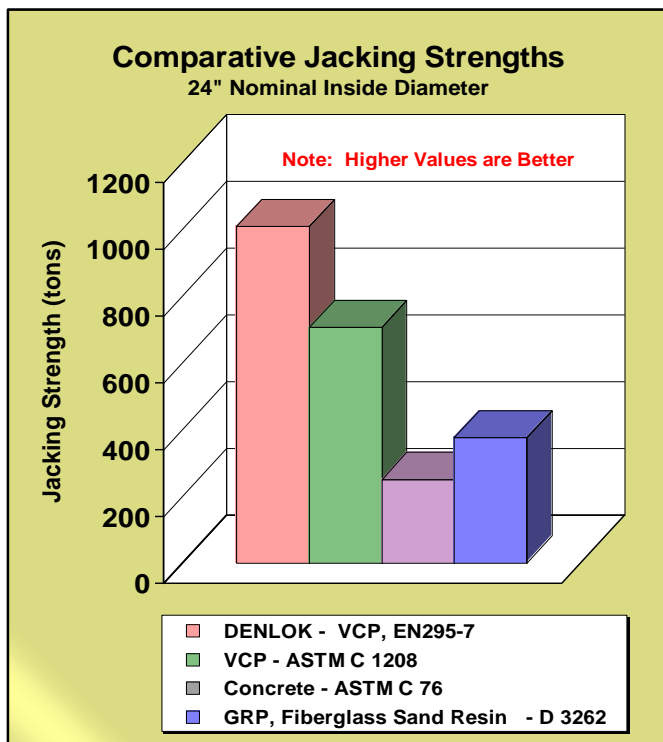
Contractor Advantages

- Precision diamond cut ends for less induced point loads
- High jacking strength compared to other products
- Rigid material eliminates “telescoping” of joints under jacking load
- Low external friction for lower jacking loads
- Factory made self centering packing / cushion rings reduce job site hassles
- Lengths to 10 feet available



More Advantages

- Premium material and premium performance without a premium cost
- Available from 6”(150mm) through 48”(1200mm) diameters
- Exceeds requirements of both European Standard, EN 295-7 and ASTM C1208



Important Elements of EN 295-7 Standard

- 10,875 psi minimum compression strength, for higher jacking strengths
- End squareness tolerance < 0.040”(1mm)
- Straightness tolerance < 0.2” (5mm)
- Stainless steel sleeves for long life and best structural performance

High Pressure Ratings Available

- External pressures proven to 60 ft head
- Greater pressure ratings, above standard, are available upon consultation.

* H 211.41A, Los Angeles 50 Year Tensile Strength & Modulus of Elasticity of Structural Plastics for Piping, 1997

Delivery and Site handling

Packaging

The pipes and joints are normally packaged for unloading by forklift or crane. If other arrangements are necessary, please contact the factory prior to placing the order.

Site Receiving and Storage

All pipes and joints should be inspected at delivery. Identification of any damage from transportation must be noted on receiving documentation.

Unloading and site handling should be done with caution. Installation of cushions, wood or other compressible materials, on the vertical portion of forks have proven effective aids. Impact damage of the pipes and joints should be prevented with good handling techniques and proper equipment.

Joint cushion / packing rings must be protected from moisture. The cushion material is of finely ground particle board which transmits jacking loads better than other materials, but is susceptible to continued saturation. Typically, the rings are shipped in a water resistant container. Protection should be maintained during storage.

Under normal conditions and typical project storage duration, Denlok™ pipes and joint components are resistant to heat, ozone and ultraviolet light.

Cushion / Packing Rings

Extreme caution should be exercised to ensure that rings are inserted between each pipe prior to jacking. The compressibility of the rings assists in distribution of the jacking loads between the ends of the pipe.

Do not install damaged rings. They are an essential element for successful installations.

Site Testing

Prior to installation all components should be visually inspected for signs of damage which could have occurred from transportation and handling. Do not use damaged pipes that could affect performance.

Additional Site Testing Techniques

Denlok™ jacking pipes are tested at the factory for structural integrity prior to shipping.

Two methods can be used on the site.

- Dye testing (preferred)
- Bladder testing

Dye Test

Dye testing uses a dye penetrant. Magnaflux brand Spotcheck® or equal has been found to provide good results to aid visual inspection of the pipe. It is often preferred over bladder testing because of the ease of use.

The recommended procedure includes testing of each end of the pipe immediately prior to placement in to the jacking frame. Additionally, follow the dye penetrant manufacture's use instructions. Detailed instructions are available.

Any pipes that have cracks through the barrel should not be used.

Bladder Test

Denlok™ test equipment is available from Can Clay for job site testing of the structural integrity of the pipe ends. Dye testing is now the preferred test

Test equipment consists of a bladder, connection, instructions and pump. Each size of pipe requires a specific bladder.

Procedure:

- Inspect the ends of the pipe for obvious damage.
- Clean the inside of each end of pipe to ensure that the test bladder assembly is not fouled during testing.
- Insert the bladder into the end of the pipe, ensuring it is centered.
- Slowly start to pump fluid into the bladder until it is firmly in place.
- Once the bladder is firmly in place, move away from the pipe a distance of 8 to 10 ft.
- Restart pumping using long slow strokes and until recommended pressure rating is reached, as marked on the testing bladder assembly.
- Test each end of all pipes.



Suggestions

It is recommended that pipes are installed with the spigot / un-sleeved end facing the tunneling head.

When jointing the pipes, care must be taken to avoid the sealing ring from becoming displaced.

Always follow prudent safety practices.

Inform all site personnel of these instructions.

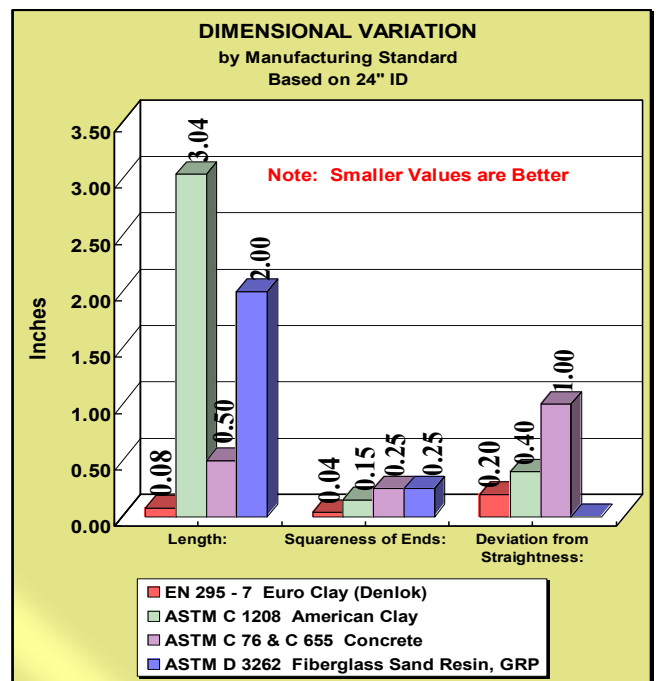
Denlok™ Performance Advantages

Municipal Advantages

- Minimum 100 year life guarantee
- Demonstrated results from centuries of vitrified clay pipe use
- Unsurpassed corrosion resistance that is unaffected by time
- Water/air tight joints
- Proven worldwide successes in 17 countries
- Highest abrasion resistance of all sewer materials
- Strength does not decrease with age as do pipes of resin or plastics *
- Excellent hydraulics for sanitary sewer use
- Lowest cost per allowable jacking force
- Economical installations
- Lowest ownership cost in the long run
- Exceeds European and ASTM standards for ceramic pipe

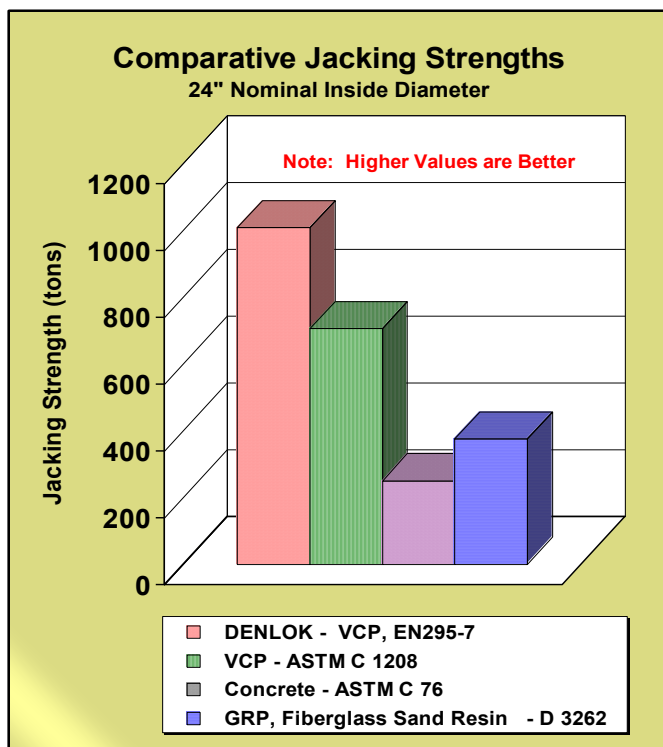
Contractor Advantages

- Precision diamond cut ends for less induced point loads
- High jacking strength compared to other products
- Rigid material eliminates “telescoping” of joints under jacking load
- Low external friction for lower jacking loads
- Factory made self centering packing / cushion rings reduce job site hassles
- Lengths to 10 feet available



More Advantages

- Premium material and premium performance without a premium cost
- Available from 6”(150mm) through 48”(1200mm) diameters
- Exceeds requirements of both European Standard, EN 295-7 and ASTM C1208



Important Elements of EN 295-7 Standard

- 10,875 psi minimum compression strength, for higher jacking strengths
- End squareness tolerance < 0.040”(1mm)
- Straightness tolerance < 0.2” (5mm)
- Stainless steel sleeves for long life and best structural performance

High Pressure Ratings Available

- External pressures proven to 60 ft head
- Greater pressure ratings, above standard, are available upon consultation.

* H 211.41A, Los Angeles 50 Year Tensile Strength & Modulus of Elasticity of Structural Plastics for Piping, 1997



Denlok® Jacking Pipe Ft. Lb. Dimensions

Can Clay Corporation • Phone: 812.547.3461/800.282.2529 • www.canclay.com

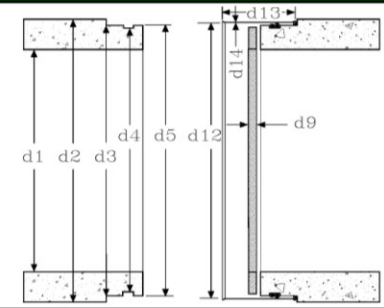
Revision Date:

Exceeds European EN-295 Part 7 and ASTM C 1208 Manufacturing Standards

6-Nov-11

Specifications subject to change without notice.

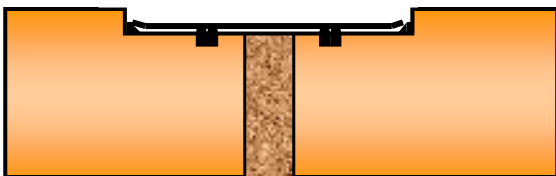
• polyurethane seal



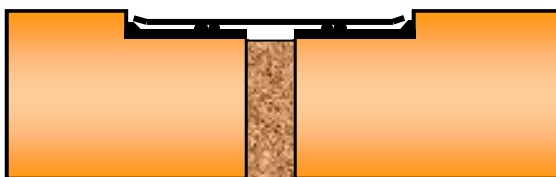
NOMINAL DIAMETER INCHES	PIPE DIMENSIONS IN INCHES					PACKING RING			SLEEVE						
	+d1	MAX d2	+d2	+d3	+d4	+d5	+d6	+d7	+d8	+d9	d10	d11	+d12	+d13	d14
	4" - 12" (DN100 - DN300) Tolerances					Polyurethane Joint									
	0.20	0.20	0.04			0.08				0.04	+0.08/-0.0	+0.08/-0.0	0.02	0.04	
	15" - 18" (DN375 - DN450) Tolerances														
	0.24	0.24	0.02	0.02	0.02	0.02	0.02	0.02		0.04	+0.08/-0.0	+0.08/-0.0	0.02	0.04	
	20" - 21" (DN500 - DN525) Tolerances														
	0.30	0.30	0.02	0.02	0.02	0.02	0.02	0.02		0.04	+0.08/-0.0	+0.08/-0.0	0.02	0.04	
	24" - 27" (DN600 - DN700) Tolerances														
	0.35	0.35	0.02	0.02	0.02	0.02	0.02	0.02		0.04	+0.08/-0.0	+0.08/-0.0	0.02	0.04	
	30" - 32" (DN750 - DN800) Tolerances														
	0.47	0.47	0.02	0.02	0.02	0.02	0.02	0.02		0.04	+0.08/-0.0	+0.08/-0.0	0.02	0.04	
	36" - 48" (DN900 - DN1200) Tolerances														
	0.59	0.59	0.02	0.02	0.02	0.02	0.02	0.02		0.04	+0.08/-0.0	+0.08/-0.0	0.02	0.04	
	ID d1	MAX OD d2	OD d2	d3	Seal ID d4	d5	Shoulder Width d6 d7 d8		Thick. d9	ID d10	OD d11	ID d12	Width d13	Thick d14	
4"*	4.016	7.64	7.441	6.402			1.73		0.51	3.94	6.48	7.030	3.66	0.06	
6"*	5.984	9.88	9.685	8.661			1.73		0.51	6.10	8.70	9.160	3.66	0.06	
8"*	7.874	11.89	11.693	10.669			1.73		0.51	7.99	10.71	11.280	3.66	0.06	
10"*	9.843	13.86	13.622	12.598			1.73		0.51	9.96	12.64	13.210	3.66	0.06	
12"*	11.929	16.06	15.827	14.803			1.73		0.51	12.05	14.84	15.390	3.66	0.06	
15"	15.157	19.37	19.134	18.445	18.051	18.366	0.98	0.71	0.51	0.75	15.31	18.11	18.700	4.72	0.06
16"	15.945	20.51	20.276	19.488	19.094	19.409	0.98	0.71	0.51	0.75	16.10	19.15	19.670	4.72	0.06
18"	17.953	22.72	22.480	21.811	21.417	21.732	0.98	0.71	0.51	0.75	18.11	21.48	21.990	4.72	0.06
20"	20.039	25.45	25.157	24.508	24.114	24.429	0.98	0.71	0.51	0.75	20.26	24.21	24.850	4.72	0.08
21"	20.866	25.73	25.433	24.705	24.311	24.626	0.98	0.71	0.51	0.75	21.08	24.41	24.840	4.72	0.08
24"	23.661	30.08	29.724	28.917	28.528	28.843	0.98	0.71	0.51	0.75	23.94	28.57	29.070	4.72	0.08
24"	23.937	30.32	29.961	29.154	28.760	29.075	0.98	0.71	0.51	0.75	24.21	28.80	29.300	4.72	0.08
27"	27.717	34.02	33.661	32.835	32.441	32.756	1.18	0.71	0.51	0.75	27.99	32.48	32.950	5.12	0.12
30"	29.213	35.87	35.394	34.409	34.016	34.331	1.18	0.71	0.51	0.75	29.61	33.94	34.590	5.12	0.12
30"	30.984	37.87	37.402	36.437	36.043	36.358	1.18	0.71	0.51	0.75	31.38	35.96	36.610	5.12	0.12
32"	31.181	37.87	37.402	36.437	36.043	36.358	1.18	0.71	0.51	0.75	31.57	35.96	36.610	5.12	0.12
32"	31.181	38.90	38.425	37.028	36.634	36.949	1.18	0.71	0.51	0.75	31.57	36.56	37.150	5.12	0.12
36"	35.157	43.27	42.677	41.339	40.819	41.291	1.65	0.71	0.51	0.75	35.67	40.78	41.650	6.06	0.12
36"	35.984	44.29	43.701	42.362	41.841	42.313	1.65	0.71	0.51	0.75	36.50	41.80	42.680	6.06	0.12
39"	39.724	48.27	47.677	46.260	45.740	46.213	1.65	0.71	0.51	0.75	40.24	45.70	46.530	6.06	0.12
42"	42.717	51.93	51.339	50.039	49.518	49.990	1.65	0.71	0.51	0.75	43.23	49.48	50.350	6.06	0.12
48"	48.031	57.56	56.969	55.472	54.951	55.423	1.65	0.71	0.51	0.75	48.54	54.91	55.790	6.06	0.12
48"	48.622	58.27	57.677	56.181	55.659	56.132	1.65	0.71	0.51	0.75	49.13	55.62	56.490	6.06	0.12

Approx. Weight per Foot Pounds	Jacking Strengths		
	Minimum Jacking Strength Safety Factor=1	Working Jacking Load Safety Factor=3	Working Jacking Load Safety Factor=4
	TONS	TONS	TONS
32	97	32	24
48	154	51	39
61	204	68	51
74	243	81	61
91	303	101	76
115	377	126	94
128	436	145	109
147	543	181	136
183	714	238	178
190	808	203	152
251	1008	336	252
251	1008	336	252
289	1124	375	281
305	1173	391	293
345	1316	439	329
341	1263	421	316
409	1447	482	362
457	1652	551	413
482	1757	586	439
538	1987	662	497
650	2454	818	614
727	2791	930	698
749	2879	960	720

Denlok EPDM / Stainless Steel Joint 15" through 48" Joint Configuration



Denlok Polyurethane / Stainless Steel Joint 6" through 12" Joint Configuration



Quality System

Since 1997 our manufacturing operations have been operated under ISO 9000 Quality System certification. In 2009 the system was recertified to ISO 9002:2008 standards.

Manufacturing consistency, procedural repeatability and design control are elements essential to quality products. Can Clay is the only VCP pipe manufacturer in the United States to have earned this certification.





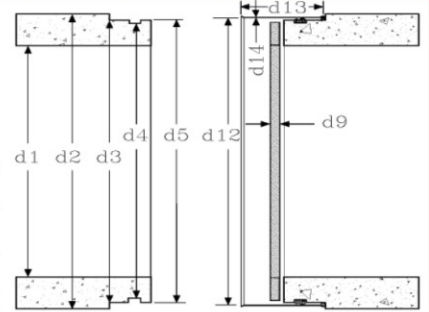
Denlok® Jacking Pipe Metric Dimensions

Can Clay Corporation • Phone: 812.547.3461/800.282.2529 • www.canclay.com

Revision Date:
6-Nov-11

Exceeds European EN-295 Part 7 and ASTM C 1208 Manufacturing Standards

Specifications subject to change without notice. -- polyurethane seal

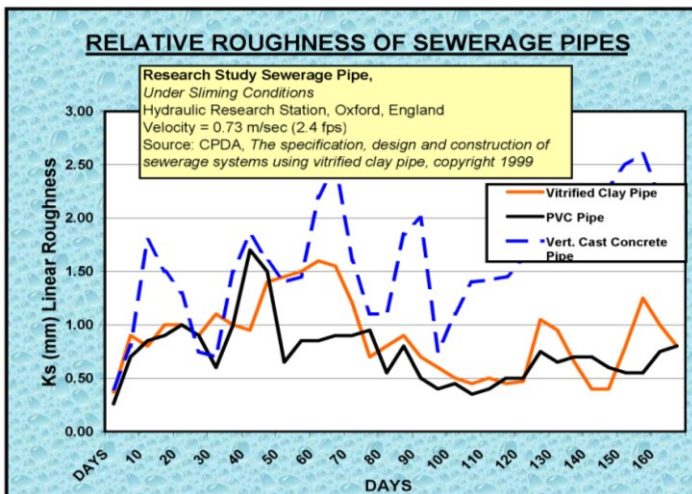
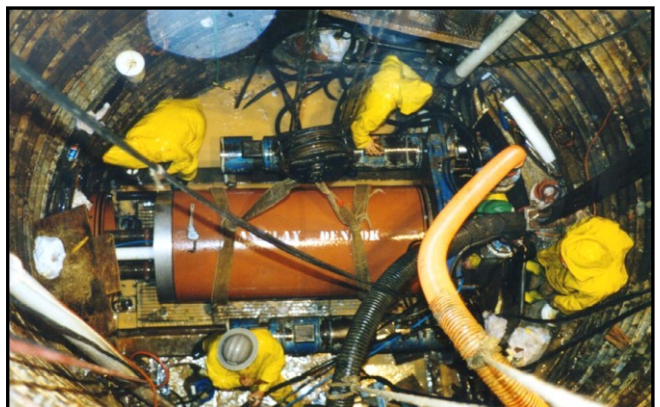


DN	PIPE DIMENSIONS in MILLIMETERS								PACKING RING			SLEEVE			
	+d1	MAX d2	+d2	+d3	+d4	+d5	+d6	+d7	+d8	+d9	d10	d11	+d12	+d13	d14
	* Polyurethane Joint														
	DN100 - DN300 Tolerances														
5.0	5.0			1.0				2.0		1.0	+2.0/-0.0	+2.0/-0.0	0.5	1.0	
	DN375 - DN450 Tolerances														
6.0	6.0	0.5	0.5	0.5	0.5			0.5	0.5	1.0	+2.0/-0.0	+2.0/-0.0	0.5	1.0	
	DN500 - DN525 Tolerances														
7.5	7.5	0.5	0.5	0.5	0.5			0.5	0.5	1.0	+2.0/-0.0	+2.0/-0.0	0.5	1.0	
	DN600 - DN700 Tolerances														
9.0	9.0	0.5	0.5	0.5	0.5			0.5	0.5	1.0	+2.0/-0.0	+2.0/-0.0	0.5	1.0	
	DN750 - DN800 Tolerances														
12.0	12.0	0.5	0.5	0.5	0.5			0.5	0.5	1.0	+2.0/-0.0	+2.0/-0.0	0.5	1.0	
	DN900 - DN1200 Tolerances														
15.0	15.0	0.5	0.5	0.5	0.5			0.5	0.5	1.0	+2.0/-0.0	+2.0/-0.0	0.5	1.0	
	ID	MAX OD	OD	Seal ID	Shoulder Width			Thick.	ID	OD	ID	Width	Thick		
	d1	Max d2	d2	d3	d4	d5	d6	d7	d8	d9	d10	d11	d12	d13	d14
100*	102.0	194.0	189.0		162.6			44.0		13.0	100.0	164.6	178.5	93.0	1.5
150*	152.0	251.0	246.0		220.0			44.0		13.0	155.0	221.0	232.7	93.0	1.5
200*	200.0	302.0	297.0		271.0			44.0		13.0	203.0	272.0	286.5	93.0	1.5
250*	250.0	351.0	346.0		320.0			44.0		13.0	253.0	321.0	335.5	93.0	1.5
300*	303.0	407.0	402.0		376.0			44.0		13.0	306.0	377.0	390.8	93.0	1.5
375	385.0	492.0	486.0	468.5	458.5	466.5	25.0	18.0	13.0	19.0	389.0	460.0	475.0	120.0	1.5
400	405.0	521.0	515.0	495.0	485.0	493.0	25.0	18.0	13.0	19.0	409.0	486.5	499.5	120.0	1.5
450	456.0	577.0	571.0	554.0	544.0	552.0	25.0	18.0	13.0	19.0	460.0	545.5	558.5	120.0	1.5
500	509.0	646.5	639.0	622.5	612.5	620.5	25.0	18.0	13.0	19.0	514.5	615.0	626.0	120.0	2.0
525	530.0	653.5	646.0	627.5	617.5	625.5	25.0	18.0	13.0	19.0	535.5	620.0	631.0	120.0	2.0
600	601.0	764.0	755.0	734.5	724.6	732.6	25.0	18.0	13.0	19.0	608.0	725.6	738.4	120.0	2.0
600	608.0	770.0	761.0	740.5	730.5	738.5	25.0	18.0	13.0	19.0	615.0	731.5	744.3	120.0	2.0
700	704.0	864.0	855.0	834.0	824.0	832.0	30.0	18.0	13.0	19.0	711.0	825.0	837.0	130.0	3.0
750	742.0	911.0	899.0	874.0	864.0	872.0	30.0	18.0	13.0	19.0	752.0	862.0	878.5	130.0	3.0
787	787.0	962.0	950.0	925.5	915.5	923.5	30.0	18.0	13.0	19.0	797.0	913.5	930.0	130.0	3.0
800	792.0	962.0	950.0	925.5	915.5	923.5	30.0	18.0	13.0	19.0	802.0	913.5	930.0	130.0	3.0
800	792.0	988.0	976.0	940.5	930.5	938.5	30.0	18.0	13.0	19.0	802.0	928.5	943.5	130.0	3.0
900	893.0	1099.0	1084.0	1050.0	1036.8	1048.8	42.0	18.0	13.0	19.0	906.0	1035.8	1058.0	154.0	3.0
920	914.0	1125.0	1110.0	1076.0	1062.8	1074.8	42.0	18.0	13.0	19.0	927.0	1061.8	1084.0	154.0	3.0
1000	1009.0	1226.0	1211.0	1175.0	1161.8	1173.8	42.0	18.0	13.0	19.0	1022.0	1160.8	1181.9	154.0	3.0
1100	1085.0	1319.0	1304.0	1271.0	1257.8	1269.8	42.0	18.0	13.0	19.0	1098.0	1256.8	1279.0	154.0	3.0
1200	1220.0	1462.0	1447.0	1409.0	1395.8	1407.8	42.0	18.0	13.0	19.0	1233.0	1394.8	1417.0	154.0	3.0
1200	1235.0	1480.0	1465.0	1427.0	1413.8	1425.8	42.0	18.0	13.0	19.0	1248.0	1412.8	1435.0	154.0	3.0

Approx. Weight per Metre	Jacking Strengths		
	Pursuant to EN 295 Part 7 = 75N/mm ² = 10,875 psi		
	Minimum Jacking Strength	Working Jacking Load	Working Jacking Load
Kgs	kN	kN	kN
47	864	288	216
71	1373	458	343
91	1819	606	455
110	2164	721	541
136	2696	899	674
171	3351	1117	838
191	3877	1292	969
219	4827	1609	1207
272	6348	2116	1587
282	5406	1802	1352
374	8967	2989	2242
374	8966	2989	2241
430	10001	3334	2500
454	10433	3478	2608
513	11712	3904	2928
508	11240	3747	2810
608	12870	4290	3217
680	14694	4898	3674
717	15629	5210	3907
800	17674	5891	4418
967	21835	7278	5459
1082	24828	8276	6207
1115	25610	8537	6403

Excellent Flow Characteristics

Experience has shown that the flow characteristics of all pipe materials must be adjusted for real world conditions. Sanitary sewer pipes build up sedimentation, obstructions and slime over time. Prudent designs recognize that roughness increases from idealized factory flow tests. Denlok™ in service roughness compares well to other materials.



Delivery and Site handling

Packaging

The pipes and joints are normally packaged for unloading by forklift or crane. If other arrangements are necessary, please contact the factory prior to placing the order.

Site Receiving and Storage

All pipes and joints should be inspected at delivery. Identification of any damage from transportation must be noted on receiving documentation.

Unloading and site handling should be done with caution. Installation of cushions, wood or other compressible materials, on the vertical portion of forks have proven effective aids. Impact damage of the pipes and joints should be prevented with good handling techniques and proper equipment.

Joint cushion / packing rings must be protected from moisture. The cushion material is of finely ground particle board which transmits jacking loads better than other materials, but is susceptible to continued saturation. Typically, the rings are shipped in a water resistant container. Protection should be maintained during storage.

Under normal conditions and typical project storage duration, Denlok™ pipes and joint components are resistant to heat, ozone and ultraviolet light.

Cushion / Packing Rings

Extreme caution should be exercised to ensure that rings are inserted between each pipe prior to jacking. The compressibility of the rings assists in distribution of the jacking loads between the ends of the pipe.

Do not install damaged rings. They are an essential element for successful installations.

Site Testing

Prior to installation all components should be visually inspected for signs of damage which could have occurred from transportation and handling. Do not use damaged pipes that could affect performance.

Additional Site Testing Techniques

Denlok™ jacking pipes are tested at the factory for structural integrity prior to shipping.

Two methods can be used on the site.

- Dye testing (preferred)
- Bladder testing

Dye Test

Dye testing uses a dye penetrant. Magnaflux brand Spotcheck® or equal has been found to provide good results to aid visual inspection of the pipe. It is often preferred over bladder testing because of the ease of use.

The recommended procedure includes testing of each end of the pipe immediately prior to placement in to the jacking frame. Additionally, follow the dye penetrant manufacture's use instructions. Detailed instructions are available.

Any pipes that have cracks through the barrel should not be used.

Bladder Test

Denlok™ test equipment is available from Can Clay for job site testing of the structural integrity of the pipe ends. Dye testing is now the preferred test

Test equipment consists of a bladder, connection, instructions and pump. Each size of pipe requires a specific bladder.

Procedure:

- Inspect the ends of the pipe for obvious damage.
- Clean the inside of each end of pipe to ensure that the test bladder assembly is not fouled during testing.
- Insert the bladder into the end of the pipe, ensuring it is centered.
- Slowly start to pump fluid into the bladder until it is firmly in place.
- Once the bladder is firmly in place, move away from the pipe a distance of 8 to 10 ft.
- Restart pumping using long slow strokes and until recommended pressure rating is reached, as marked on the testing bladder assembly.
- Test each end of all pipes.

Suggestions

It is recommended that pipes are installed with the spigot / un-sleeved end facing the tunneling head.

When jointing the pipes, care must be taken to avoid the sealing ring from becoming displaced.

Always follow prudent safety practices.

Inform all site personnel of these instructions.



INSTALLATION

It is important that pipes are handled with care when placing them in the jacking rig, with careful use of slings and avoiding excessive swinging, to prevent impact damage.

Can Clay strongly recommends the use of the Can Clay internal testing device immediately prior to insertion to ensure that the pipe ends have not been damaged during handling.

Pipes should be installed with the unsleeved end of the pipe facing the tunnelling head. Before installation, both ends of the joint should be thoroughly cleaned and Can Clay Joint Lubricant applied.



AVAILABILITY

Due to the increasing demand for DENLOK throughout the world, large stocks are maintained at the factory, to enable prompt delivery.



CONNECTIONS

In line connections to DENLOK pipes can easily be made using standard techniques and materials. Flexible couplings and epoxy saddle kits are available.



CAN CLAY CORPORATION
402 Washington St., Cannelton
Indiana 47520, USA
Tel: (812) 547 3461
Fax: (812) 547 6514

