TANA
Drilling and Industries

PRODUCT CATALOGUE

www.tdiplc.com

A MESSAGE FROM THE OWNER AND GENERAL MANAGER

Hello and welcome to Tana Drilling and Industries PLC (TDI). Established in 2004 we are a family owned business which initially focused in Deep Well Drilling for rural, municipal and other communal water development projects. During this time, we have seen steady growth and have drilled over 500 deep wells around Ethiopia.

In 2015, after earning ourselves a sound reputation in the water construction industry we constructed 2 state of the art manufacturing plants producing HDPE and uPVC Pipes and have started producing HDPE Fabricated Fittings. Our Factory is located in the Akaki/Kality sub city region of Addis Ababa. Presently it has a combined production capacity of over 38,000 MT making it the largest manufacturing facility of its kind in Ethiopia, actually larger than all the existing pipe plants combined.

We are a certified ISO 9001:2015 company and manufacture all our products to international standards. We have installed state of the art testing laboratory equipment and conduct a rigorous testing regime focusing on every aspect of the production process from resin entering the factory to the end product being delivered to the customer. Please read on and explore to find out how we have spread our production and technology approach.

Always on the lookout for new ideas and progress through modernization, diversification and expansion, Tana Drilling and Industries Plc is now poised for a major leap in product innovation, technology transfer, and meeting customers' needs in the 21st century.

We are confident that our pipes are especially suited to the needs and environment of Ethiopia and the surrounding countries; and we are proud for contributing to the industrialization of Ethiopia by producing high quality pipes locally.

We, at Tana Drilling and Industries Plc, are committed to ensuring customer satisfaction by offering quality products through continuous upgrading of our technologies and systems, with the involvement of our customers, vendors and employees.

Warm Regards,

Etsegenet Berhe
General Manager

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COMPANY PROFILE

Tana Drilling and Industries PLC (TDI) is a family owned company and was established in 2004. Its primary business function was Deep Well drilling for rural, municipal and other communal water development projects. During this time the company has seen reputation and steady growth, and has drilled over 500 deep wells around Ethiopia.

TDI vision is focused on creating cost-effective high-quality products which will ensure a long-lasting infrastructure. To achieve this, we have installed state of the art manufacturing equipment from Germany and Italy, and we only use the highest quality pure grade resins for all our products. This combined with our highly skilled workforce ensures that only the highest quality pipes are produced.

In meeting Ethiopia's growing demand for HDPE and uPVC pipes, TDI constructed two state of the art manufacturing plants equipped with the latest manufacturing technologies producing HDPE and uPVC Pipes located in the Akaki/Kality sub city industrial area in 2015, with a combine production capacity of over 38,000 MT making it the largest manufacturing facility of its kind in Ethiopia, actually larger than all the existing large pipe plants combined.

TDI develops, produces, and markets a comprehensive range of piping systems in a variety of materials used worldwide to transport water and wastes at the highest quality, service and price range. TDI's HDPE and uPVC pipes are suitable for water distribution networks, drainage and sewerage systems, chemical, gas and water conveyance, sewer and water purification systems, Agriculture and Irrigation, and electrical and telecommunications distribution systems. TDI operates in three core segments: Building technology, Utility application, and Agriculture.

TDI is a certified ISO 9001:2015 company and manufactures all its products to international standards. It is equipped with a state of the art testing laboratory which conducts a rigorous testing administration focusing on every aspect of the production process from resin entering the factory to the end product being delivered to the customer. As a result of meticulous quality control approach and testing, product quality of Tana Drilling and Industries Plc is confirmed by its local and international quality certificates. TDI gives top priority to using the highest standard of technology to manufacture user-friendly products with the highest quality and service.

Finally, we hope you find this Product Catalogue helpful and should you require any further information or would like to come and visit our manufacturing facility for full discussions and to assure yourselves that our production and testing facilities are of the highest order, it would be a pleasure to host you.

VISION

To be the regional leader of water supply systems in the African continent by providing a full customer solution from design to commissioning in conjunction with the supply of high-quality cost effective pipes and deep well drilling services with a goal of being a major contributor in the drive for clean water access for all.

MISSION

Through its state of the art manufacturing facilities and extensive experience in the drilling and installation of water supply systems TDI will seek out and build partnerships with local and regional customers to produce innovative and cost-effective products and services.

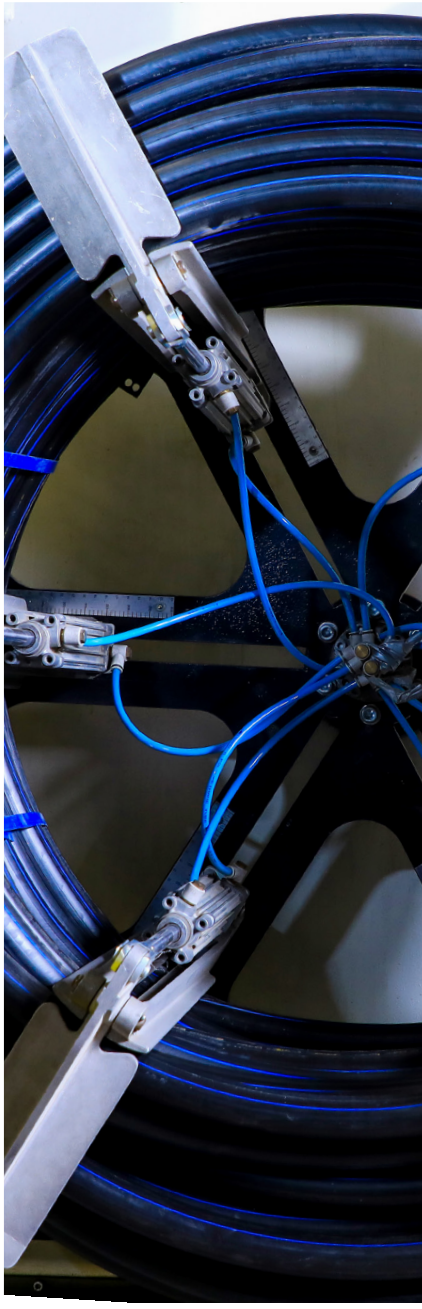
WHY CHOOSE TDI HDPE AND UPVC PIPES?

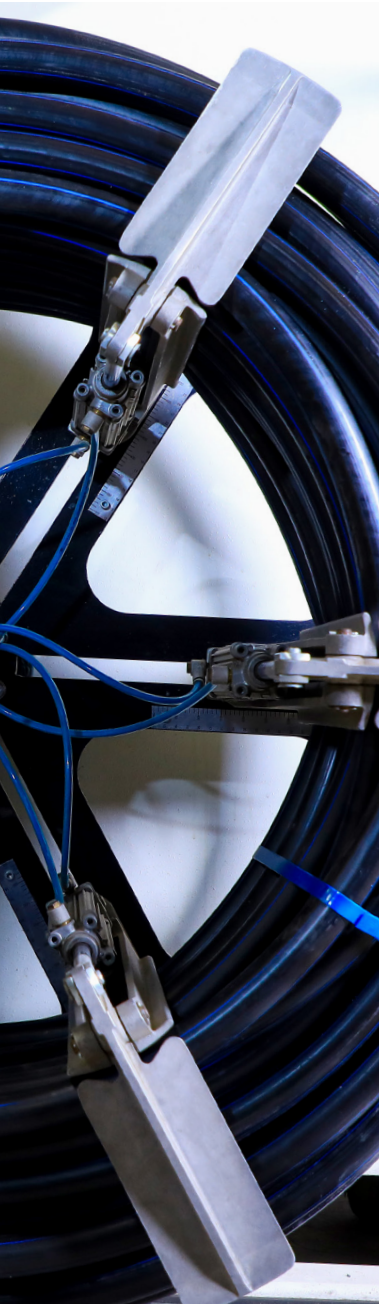
PRODUCT CONFIDENCE

TDI uses only the highest grades of resins and additives in the manufacture of all its pipes. No reprocessed plastic is used to reduce manufacturing costs. Our vision is to provide long-lasting infrastructure and to achieve this we will never compensate quality over cost by using substandard resins and reprocessed plastic waste. This means you can be 100% confident that when you purchase a TDI pipe it will perform as per the standard it has been manufactured to. A HDPE pipe will have a minimum lifespan of 100 years and uPVC will last a minimum of 100 years.

MANUFACTURING EXCELLENCE

TDI uses state of the art European manufacturing equipment for the production of all its products. Critical aspects of the production process are constantly monitored and controlled by various systems incorporated into the equipment. This in conjunction with our highly trained workforce ensure consistent quality for each and every pipe produced.



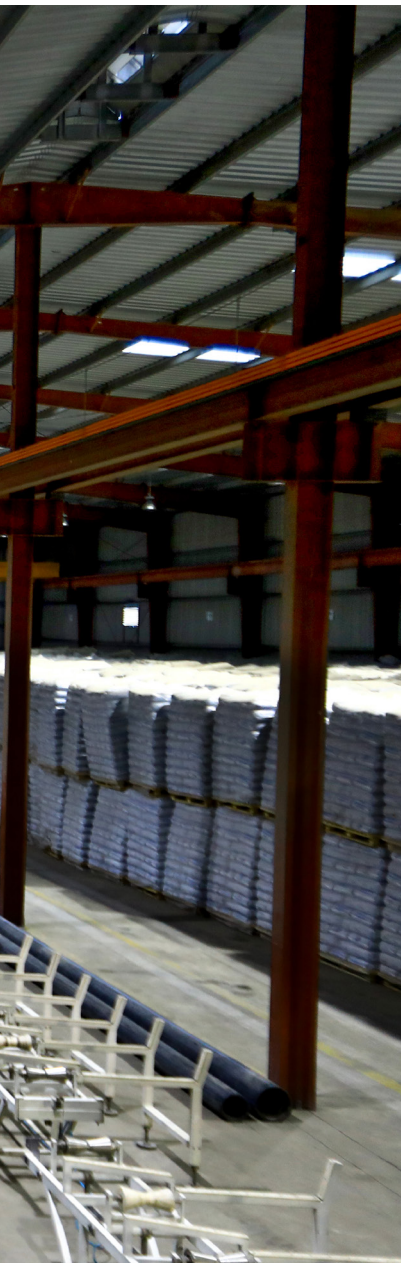


QUALITY CONTROL

TDI has been certified by the Ethiopian Conformity Assessment Enterprise to manufacture HDPE pipes to the ISO 4427and uPVC pipes to ISO 1452 which are the main international standards. All aspects of TDI's products are stringently tested following the ISO requirements from the resin entering the factory to delivery to the customer. All testing is conducted using sophisticated equipment from IPT, a major German global testing equipment supplier. TDI is equipped to test almost all pipe quality related parameters which ensures only the highest quality products reaches the customer. Additionally, TDI is certified to ISO 9001:2015 which is the latest Quality Management System which ensures Continuous Improvement to its products and services.

PROFESSIONAL EMPLOYEES

Our employees are at the heart of our business – everything we do, and our success, is dependent on them. Our employees are engaged, and have the skills and knowledge the industry demands to perform their roles. They have the ambition to grow, develop and feel fulfilled which is essential for satisfying our customers, and for TDI to prosper as a company.



HDPE PLANT

INTRODUCTION TO HIGH DENSITY POLYETHELYENE (HDPE)

High Density Polyethylene (HDPE) has been used extensively around the world since the 1950's. The material has been developed internationally from the first grade which was PE 63 to PE 100 which is used today. These developments have enabled a 30% reduction in wall thickness while still retaining the same strength. This not only saves costs but increases the performance of the pipe as the internal diameter is bigger enabling significant savings on pumping costs. This combined with the excellent flow characteristics of HDPE enables the pipes to be downsized while still performing within the defined parameters.

PROPERTIES OF TDI HDPE PIPES

HIGH STRENGTH AND FLEXIBILITY

HDPE Pipes have a high degree of impact resistance and are robust and ductile. Pipes are flexible and can bend easily saving in design as less critical joints are needed. Additionally, due to its characteristics HDPE pipes have the ability to absorb pressure surges which make the superior to other plastic materials.

HDPE pipes can be laid in narrow uneven trenches or across uneven surfaces, so trench preparation costs are reduced. Due HDPE's ductility and strength the pipes can be joined outside the trench and simply pushed into position which simplifies the installation process and saves costs.

DAMAGE/CHEMICAL RESISTANCE

HDPE Pipe is exceptionally resistant to corrosion, abrasion and biological attack. It offers better resistance to corrosive acids, bases and salts than most other piping materials and also has good resistance to many other organic substances such as fuels and solvents. This eliminates the need to corrosion inhibitors or chemical treatments thus reducing overall running costs of the pipeline.

VERSATILITY

HDPE pipe is used globally for the transportation of drinking water, mining slurries, chemicals, oil, gas and extremely hazardous waste materials. Installations have proven safe and leak proof both below and above the ground as well as underwater. The versatility of HDPE pipe means most installation methods can be adopted such as direct burial, slip lining, oversized lining and directional drilling.

SUPERIOR FLOW CHARACTERISTICS

HDPE has a very smooth internal surface which allows a greater flow capacity and minimal friction loss. It has less drag, lower tendency for turbulence at high velocity and its non-stick and chemical resistance properties eliminate scaling and pitting during the life of the pipe. These properties combined reduce the pumping costs and the pipeline with retain its flow capacity over its life unlike other material such as steel and concrete.

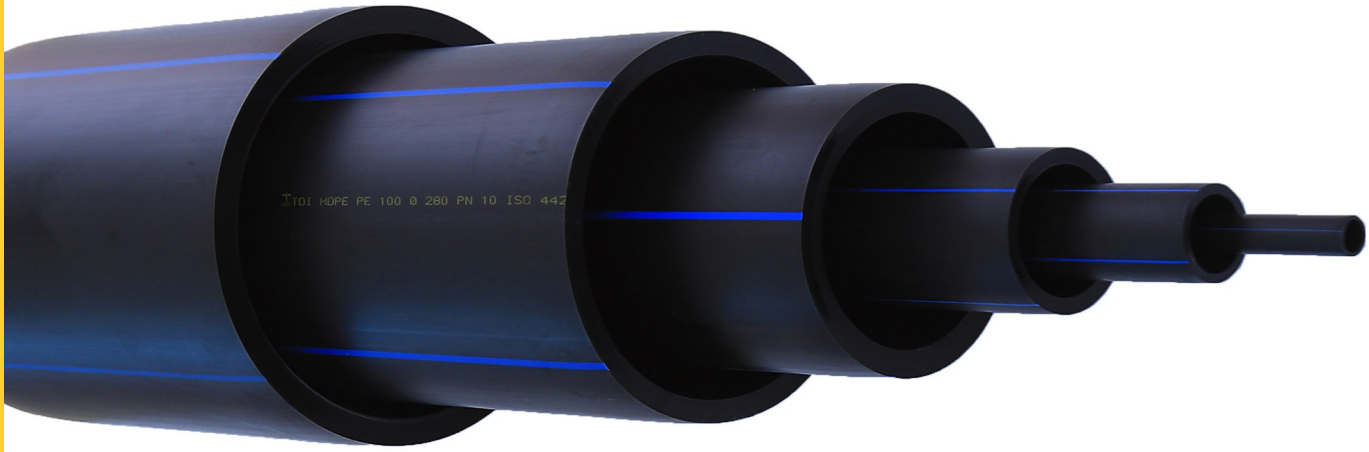
APPLICATIONS

All TDI pipes are manufactured to ISO 4427 and can be confidently used with the applications listed below,

INDUSTRIAL	Chemical, Gas and water conveyance. Sewer and water purification systems.
CIVIL ENGINEERING	Water mains and other water distribution networks.
BUILDING	Industrial and Residential water distribution networks.
MINING	Water/Slurry conveyance.

THE MAIN FEATURES OF TDI PRESSURE AND DRAINAGE PIPES ARE

- High flexibility which allows the network pipes for elbows to save cost
- Excellent traffic load resistance due to its structure which specified as visco-elestic material
- Excellent impact resistance
- Small pipe sizes is delivered in coils which reduce installation time and cost.
- High resistance for chemicals at different temperature
- Do not change the odor and taste of water, for that it is considered healthy.



SPECIFICATION	
Standards	ISO 4427
Material	PE100
Joints	Butt Fusion, Electro-fusion, and compression fittings
Temp Range	0˚C - 60˚C
Tensile Strength	elongation at break ≥350%
RAW MATERIAL	
The raw material is 100% virgin HDPE Grade PE100	
COLOR	
ES-ISO 4427: Black with blue strip or as per ISO standards	
LENGTH	
As per customers requirement	

TDI HDPE PRODUCT RANGE/ SPECIFICATION

PROPERTIES OF TDI HDPE

The physical characteristic of PE100 material as granules and in pipe form shall be in accordance with Tables 1 and 2 of ISO 4427-1 and Table 3&5 of ISO 4427-2, as summarized in Table 1 of this specification.

CHARACTERISTICS	STANDARD	REQUIRED VALUE
Compound density	ISO 1183-2	≥950kg/m^3
Carbon black content	ISO 6964	2 to 2.5% by mass
Carbon black dispersion	ISO 18553	≤3
Oxidation induction time(OIT)	ISO 11357-6	≥20 minutes at 200^{0}C
Water content	ISO15512	≤300mg/kg
Volatile content	EN 12099	≤350mg/kg
Melt mass-flow rate(MFR)	ISO 113 Condition T	0.2 to 1.4 g/10 minutes
Tensile strength for butt-fusion	ISO 13953	Ductile Failure
Slow crack growth (110mm SDR11 Pipe)	ISO13479	≥500 hours
Slow crack growth(110mm SDR11 pipe) - HSCR PE 100	ISO 113479	≥8,760 hours
Elongation at break	ISO 6259	≥350%
Hydrostatic strength at 80^{0}C	ISO 1167	≥165 hours at 5.4 MPa
Hydrostatic strength at 80^{0}C	ISO 1167	≥1000 hours at 5.0 MPa
Hydrostatic strength at 20^{0}C	ISO 1167	≥100 hours at 12.4 MPa
Longitudinal reversion	ISO2505	≤3%at110± 2^{0}C

The Nominal pressure of HDPE pipe is the working pressure of the pipe at 20^{0}C . If the operating temperature is in between 25-40^{0}C a supplementary derating factor should be applied according to the following table. The maximum working pressure is given by multiplying the nominal pressure by the derating factor.

OPERATING TEMPERATURE (^{0}C)	DERATING FACTOR
0< T < 20	1.0
20< T < 25	0.93
25< T < 30	0.87
30< T < 35	0.8
35< T < 40	0.74

TDI HDPE PRODUCT RANGE

The table below shows the current HDPE pipe sizes that TDI can provide

PRESSURE GRADE FROM PN 4 - 8 BAR

				PIPE SERIES													
				SDR21				SDR26				SDR 33				SDR 41			
				S10				S 12.5				S 16				S 20			
PE 100				PN 8				PN6				PN 5				PN 4			
NOMINAL SIZE(MM)	MEAN OUT-SIDE DIAME-TER (MM)		MAXIMUM OUT-OF-ROUND-NESS (MM)	WALL THICK-NESS (MM)		ID (MM)	WT/M	WALL THICK-NESS (MM)		ID (MM)	WT/M	WALL THICK-NESS (MM)		ID (MM)	WT/M	WALL THICK-NESS (MM)		ID (MM)	WT/M
	MIN.	MAX.		MIN.	MAX.			MIN.	MAX.			MIN.	MAX.			MIN.	MAX.		
16	16	16.3	1.2																
20	20	20.3	1.2																
25	25	25.3	1.2																
32	32	32.3	1.3																
40	40	40.4	1.4	2	2.3	35.70	0.2												
50	50	50.4	1.4	2.4	2.8	44.80	0.4	2	2.3	45.70	0.3								
63	63	63.4	1.5	3	3.4	56.60	0.6	2.5	2.9	57.60	0.5								
75	75	75.5	1.6	3.6	4.1	67.30	0.8	2.9	3.3	68.80	0.7								
90	90	90.6	1.8	4.3	4.9	80.80	1.2	3.5	4	82.50	1.0								
110	110	110.7	2.2	5.3	6	98.70	1.8	4.2	4.8	101.00	1.4								
125	125	125.8	2.5	6	6.7	112.30	2.3	4.8	5.4	114.80	1.8								
140	140	140.9	2.8	6.7	7.5	125.80	2.8	5.4	6.1	128.50	2.3								
160	160	161	3.2	7.7	8.6	143.70	3.7	6.2	7	146.80	3.1								
180	180	181.1	3.6	8.6	9.6	161.80	4.7	6.9	7.7	165.40	3.8								
200	200	201.2	4	9.6	10.7	179.70	5.8	7.7	8.6	183.70	4.7								
225	225	226.4	4.5	10.8	12	202.20	7.3	8.6	9.6	206.80	5.9								
250	250	251.5	5	11.9	13.2	224.90	9.0	9.6	10.7	229.70	7.3								
280	280	281.7	9.8	13.4	14.9	251.70	11.3	10.7	11.9	257.40	9.2								
315	315	316.9	11.1	15	16.6	283.40	14.2	12.1	13.5	289.40	11.7	9.7	10.8	294.50	9.42	7.7	8.6	298.70	7.54
355	355	357.2	12.5	16.9	18.7	319.40	18.1	13.6	15.1	326.30	14.7	10.9	12.1	332.00	11.91	8.7	9.7	336.60	9.59
400	400	402.4	14	19.1	21.2	359.70	23.1	15.3	17	367.70	18.7	12.3	13.7	374.00	15.16	9.8	10.9	379.30	12.16

PRESSURE GRADE FROM PN 10 - 25 BAR

				PIPE SERIES																			
				SDR7.4				SDR9				SDR 11				SDR 13.6				SDR 17			
				S3.2				S 4				S 5				S 6.3				S 8			
PE 100				PN 25				PN 20				PN 16				PN 12.5				PN 10			
NOMINAL SIZE (MM)	MEAN OUTSIDE DIAMETER (MM)		MAXIMUM OUT-OF-ROUND-NESS (MM)	WALL THICK-NESS (MM)		ID (MM)	WT/M	WALL THICK-NESS (MM)		ID(MM)	WT/M	WALL THICKNESS (MM)		ID (MM)	WT/M	WALL THICK-NESS (MM)		ID (MM)	WT/M	WALL THICK-NESS (MM)		ID (MM)	WT/M
	MIN.	MAX.		MIN.	MAX.			MIN.	MAX.			MIN.	MAX.			MIN.	MAX.			MIN.	MAX.		
16	16	16.3	1.2	2.3	2.7	11.00	0.1	2	2.3	11.70	0.1												
20	20	20.3	1.2	3	3.4	13.60	0.2	2.3	2.7	15.00	0.1	2	2.3	15.70	0.12								
25	25	25.3	1.2	3.5	4	17.50	0.2	3	3.4	18.60	0.2	2.3	2.7	20.00	0.17	2	2.3	20.70	0.15				
32	32	32.3	1.3	4.4	5	22.60	0.4	3.6	4.1	24.30	0.3	3	3.4	25.60	0.28	2.4	2.8	26.80	0.23	2	2.3	27.70	0.19
40	40	40.4	1.4	5.5	6.2	28.30	0.6	4.5	5.1	30.40	0.5	3.7	4.2	32.10	0.43	3	3.5	33.50	0.36	2.4	2.8	34.80	0.29
50	50	50.4	1.4	6.9	7.7	35.40	0.9	5.6	6.3	38.10	0.8	4.6	5.2	40.20	0.67	3.7	4.2	42.10	0.55	3	3.4	43.60	0.45
63	63	63.4	1.5	8.6	9.6	44.80	1.5	7.1	8	47.90	1.3	5.8	6.5	50.70	1.05	4.7	5.3	53.00	0.87	3.8	4.3	54.90	0.72
75	75	75.5	1.6	10.3	11.5	53.20	2.1	8.4	9.4	57.20	1.8	6.8	7.6	60.60	1.47	5.6	6.3	63.10	1.24	4.5	5.1	65.40	1.02
90	90	90.6	1.8	12.3	13.7	64.00	3.0	10.1	11.3	68.60	2.6	8.2	9.2	72.60	2.13	6.7	7.5	75.80	1.77	5.4	6.1	78.50	1.46
110	110	110.7	2.2	15.1	16.8	78.10	4.5	12.3	13.7	84.00	3.8	10	11.1	88.90	3.16	8.1	9.1	92.80	2.63	6.6	7.4	96.00	2.17
125	125	125.8	2.5	17.1	19	88.90	5.8	14	15.6	95.40	4.9	11.4	12.7	100.90	4.10	9.2	10.3	105.50	3.39	7.4	8.3	109.30	2.77
140	140	140.9	2.8	19.2	21.3	99.50	7.3	15.7	17.4	106.90	6.2	12.7	14.1	113.20	5.11	10.3	11.5	118.20	4.24	8.3	9.3	122.40	3.48
160	160	161	3.2	21.9	24.2	113.90	9.5	17.9	19.8	122.30	8.0	14.6	16.2	129.20	6.71	11.8	13.1	135.10	5.54	9.5	10.6	139.90	4.54
180	180	181.1	3.6	24.6	27.2	128.20	12.0	20.1	22.3	137.60	10.1	16.4	18.2	145.40	8.48	13.3	14.8	151.90	7.03	10.7	11.9	157.40	5.75
200	200	201.2	4	27.4	30.3	142.30	14.9	22.4	24.8	152.80	12.5	18.2	20.2	161.60	10.46	14.7	16.3	169.00	8.62	11.9	13.2	174.90	7.09
225	225	226.4	4.5	30.8	34	160.20	18.8	25.2	27.9	171.90	15.9	20.5	22.7	181.80	13.24	16.6	18.4	190.00	10.94	13.4	14.9	196.70	8.99
250	250	251.5	5	34.2	37.8	178.00	23.2	27.9	30.8	191.30	19.5	22.7	25.1	202.20	16.28	18.4	20.4	211.20	13.48	14.8	16.4	218.80	11.02
280	280	281.7	9.8	38.3	42.3	199.40	29.1	31.3	34.6	214.10	24.5	25.4	28.1	226.50	20.42	20.6	22.8	236.60	16.89	16.6	18.4	245.00	13.84
315	315	316.9	11.1	43.1	47.6	224.30	36.8	35.2	38.9	240.90	31.0	28.6	31.6	254.80	25.84	23.2	25.7	266.10	21.41	18.7	20.7	275.60	17.53
355	355	357.2	12.5	48.5	53.5	253.00	46.7	39.7	43.8	271.50	39.4	32.2	35.6	287.20	32.80	26.1	28.9	300.00	27.14	21.1	23.4	310.50	22.31
400	400	402.4	14	54.7	60.3	285.00	59.3	44.7	49.3	306.00	50.0	36.3	40.1	323.60	41.65	29.4	32.5	338.10	34.42	23.7	26.2	350.10	28.20

TDI HDPE PRODUCT RANGE

The TDI Plastic factory is equipped with both single and double winders that handle pipe diameters up to 110 mm in diameter.

The following table lists the coil sizes according to ISO 4427 for PE 100. TDI can also supply different length pipe based on the customer's requirement.

Nominal Outside Diameter (mm)	Nominal Wall Thickness							Inner Coil Diameter (mm)	Mass Length (Meter)
	STANDARD SIZE								
	SDR26	SDR21	SDR17	SDR 13.6	SDR11	SDR 9	SDR7.4		
	NOMINAL PRESSURE (BAR)								
	6	8	10	12.5	16	20	25		
	MM	MM	MM	MM	MM	MM	MM		
32			2.0	2.4	3.0	3.6	4.4	1200	600
40		2.0	2.4	3.0	3.7	4.5	5.5	1200	500
50	2.0	2.4	3.0	3.7	4.6	5.6	6.9	1200	350
63	2.5	3.0	3.8	4.7	5.8	7.1	8.6	1900	350
75	2.9	3.6	4.5	5.6	6.8	8.4	10.3	2250	300
90	3.5	4.3	5.4	6.7	8.2	10.1	12.3	2250	200
110	4.2	5.3	6.6	8.10	10.0	12.3	15.1	2250	200

DESIGN CRITERIA

Polyethylene material is identified by the MINIMUM REQUIRED STRENGTH (MRS) which is evaluated by conducting regression analysis test. The MRS value @ 20 ^{0}C for PE 100 and PE 80 materials is 10 and 8 Mpa respectively.

Pipe design stress, σs, which is used to determine the continuous pressure rating of a pipe is calculated by dividing the MRS value by overall service (design) coefficient C.

i.e., σs=MRS/C

In case of gas, value of C depends on appropriate design codes, national regulations, type of gas, etc. However, the minimum values of C for water and gas applications as per different standards are as follows:

For water applications (minimum)	ISO 4427		C=1.25		
For gas applications (minimum)	ISO 4427		C=2.0		
Design stress @ 20 ^{0}C as per value C					
For PE 100 water piping system	σs	=	10/1.25	=	8 Mpa
For PE 80 water piping system	σs	=	8/1.25	=	6.3 Mpa
For PE 100 gas piping system	σs	=	10/2	=	5 Mpa
For PE 100 gas piping system	σs	=	8/2	=	4 Mpa

Continuous pipe internal pressure rating in bars @ 20 ^{0}C

APPLICATION	SAFETY FACTOR	MATERIAL	SDR 9	SDR 11	SDR 17
Water	1.25	PE 100 PE 80	20 16	16 12.5	10 8
Gas	2.0	PE 100 PE 80	12.5 10	10 8	6 5

PRESSURE PIPE DIMENSIONING

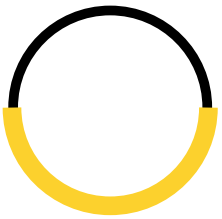
$PN = \frac{20 \times MRS}{(SDR-1) \times C}$

Where: MRS: Minimum Required Strength (Mpa) PN : Nominal Pressure (bar), OD: Outside Diameter (mm), SDR: Standard Dimensional Ratio (DN/e),

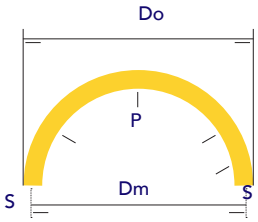
bore: Internal Diameter (mm), бs: Design Stress (Mpa)

SDR-STANDARD DIMENSION RATIO AND THE BASIC PRESSURE PIPE EQUATION

SDR 17

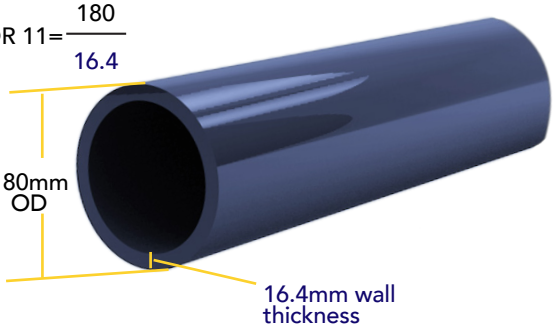


$SDR = \frac{\text{nominal (Minimum) outside diameter}}{\text{Minimum wall thickness}}$



Example:

$SDR\ 11 = \frac{180}{16.4}$



$$\sigma_s = \frac{p \times d_m}{2 \times s} = \frac{P}{10} \times \frac{d_o - s}{2 \times s}$$

σ_s = hoop stress (N/mm^2)

P = internal presure(bar)

dm = means pipe diameter(mm)

dO= outside pipe diameter(mm)

s = wall thicknes (mm)

DESIGN LIFE OF POLYETHYLENE PIPES

The burst pressure of PE pipes are time dependent and therefore it is necessary to define the strength of the material at a reference lifetime.

The time normally chosen for this reference value is 50 years, as the various safety factor that are incorporated into the design mean the actual lifetime will be many times greater. In order to generate the burst strength of the material at 50 years, a number of pipe samples are pressure tested to failure at lifetimes between 10 and 10,000 hours.

The results of these tests are graphically and numerically analyzed to obtain the minimum required strength (MRS) at 50 years. PE material is identified by their minimum required strength (MRS) which is evaluated by conducting regression analysis test. The MRS value @20 ^{0}C for PE 100 and PE 80 material is 10 and 8 Mpa respectively.

Within the ISO Standards it is recommended that the MRS value is based on the 97.5% lower confidence limit obtained by regression analysis.

Thus the minimum required strength (MRS) for the different polymers are listed below:

TYPE	MRS(Mpa)	DESIGN STRESS	
PE 80	8.0		6.3
PE 100	10.0		8.0

*1.25 ~Service co-efficent for water

TRANSPORTATION

- Vehicles transporting pipes should have a flat bed, which include supports that are free of sharp edges or projections;
- Pipes should be evenly supported over their full length and not overhanging the vehicle;
- Where different sizes of pipe are to be transported together larger diameter pipe should be loaded first with the vehicle having side supports at no larger than 1.5 meter intervals.

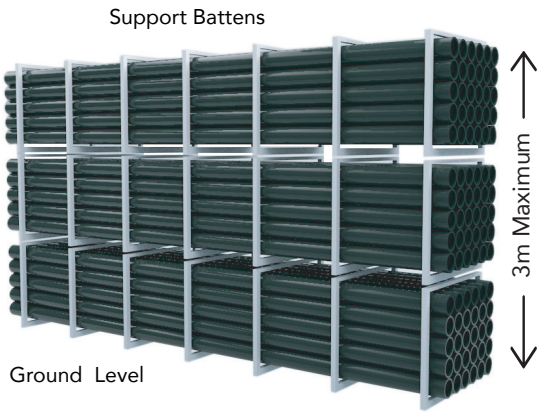
HANDLLING OF POLYETHYLENE PIPES

- Care and attention should always be applied when handling pipes. This should be done not only for the protection of the pipes but also for the safety of the handling personnel;
- Pipes should never be dropped onto hard or uneven surfaces;
- Pipes should never be thrown from vehicles;
- Pipes should never be dragged or rolled along the ground;
- Where possible, pipes should always be unloaded individually. In cases where pipes are already bundled into frames, proper lifting equipment (lift truck, etc.) should be used;
- Where pipe weights exceed practical personnel handling weight capability, rope or web slings should be used with mechanical lifting equipment;
- Metal chains, hooks or ropes should never be used.

SITE STORAGE

BUNDLE PIPES

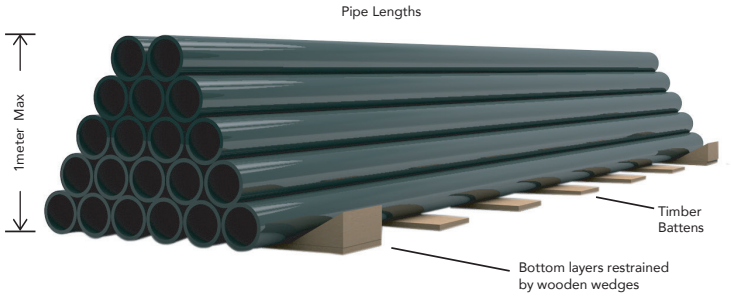
- Pipes supplied in factory bundles should be stored on flat even ground able to withstand weight of both pipes and lifting apparatus;



- Pipes should be kept away from sharp projections or other jagged crops;
- Bundle strapping should remain in position until such time that the pipe is to be used.
- Stack height should not exceed 1.5m and not more than three stacks should be bundled together.

LOOSE PIPES

- Pipes should be stored on flat even ground able to withstand weight of pipes and lifting equipment;
- Different sizes of pipes should be stored separately. Where this is not possible, larger and/or thicker walled pipes should be placed at the bottom of the stack;
- Pipes should not be stacked over a height of 1m so that the pipes do not disfigure;
- Pipes should be kept away from sharp projections, stones or other jagged cut crops;
- Never place pipes in contact with lubricating or hydraulic oils, gasoline or solvents;
- Keep pipes away from intense heat;



PROTECTION FROM ULTRA-VIOLET

- A first-in first-out stock rotation system of pipes and fittings usage should always be adopted;
- For hotter climates, it is recommended that pipes should be kept away from direct sunlight and be covered;
- Good ventilation at all times during storage is essential.

GENERAL POINTS ON TRENCHING, LAYING AND BACK FILING

TRENCHING AND BACK FILLING

Polyethylene pipe systems are designed to make installation quicker, easier and more cost-effective. Installation is as much part of the costing equation as ease of maintenance and the price of the pipe system itself.

Advantage of polyethylene in installation is its lightness and flexibility, coupled with its durability and totally secure jointing methods. For all modern pipe laying techniques, whether in rehabilitation work or the construction of new pipelines, polyethylene pipes usually provide the simplest and most economical solution.

When polyethylene pipe is laid it may suffer surface damage. Precautions should be taken to reduce this, although test work carried out has proved that scoring up to 10% of the pipe wall thickness will not affect the performance of the pipe.

Generally, a lengths of ground at least three pipe long should be excavated ahead of mains laying to expose obstructions which may necessitate deviation from the planned route.

GENERAL POINTS ON TRENCH EXCAVATION

Installation of polyethylene pipeline systems requires minimal trench width; therefore considerable saving can be made in terms both of reduced labor costs and less waste spoil to be removed from site. Additionally, reinstatement costs are cut and smaller quantities of imported backfill are needed.

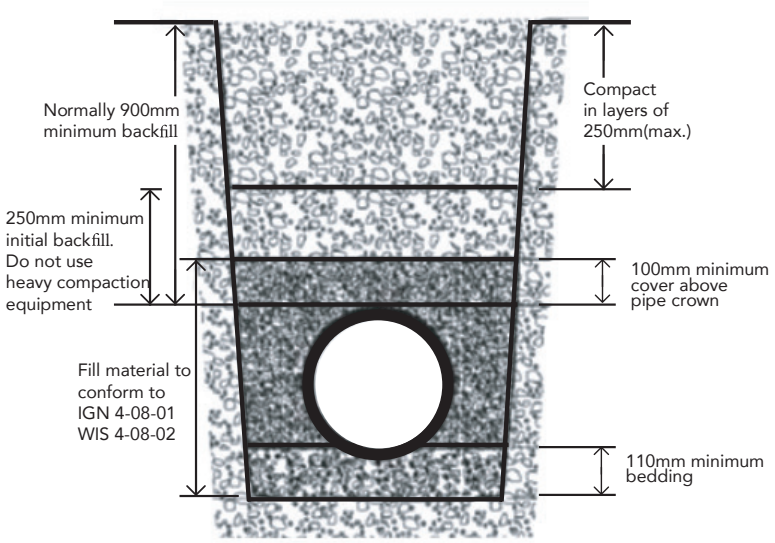
The dimensions of a trench line opening are normally governed by the pipe diameter, method of jointing and site conditions.

Normal minimum depth of cover for mains should be 900mm from ground level to the crown of the pipe. Trench width should be as narrow as possible, but never less than the outside diameter of the pipe plus 250mm to allow for correct compaction of side fill.

In some instances it may be acceptable to lay HDPE pipe directly on the bottom of the trench-but only where the soil is uniform, relatively soft and fine-grained without large flints, stones and other hard objects. The trench bottom should be brought to an even finish, providing consistent support for pipes and along their whole length.

In other cases, the trench should be cut to depth, which will allow for the necessary thickness of selected bedding material below the bottom of the pipe. If soil from the excavation is unsuitable, granular material should be imported. Gravel or broken stone graded between five and ten millimeters in size provides suitable bedding, since it needs little compaction. Coarse sand, a sand and gravel mix, or gravel smaller than 20mm are also all acceptable straight from the quarry.

Excavators with narrow buckets are best suited to conventional trenching methods. Pipes are located by being lifted into the correct position. After installation, the ground can be backfilled and consolidated.



BACKFILLING

Unless special procedures apply, such as local agreements for carriageway reinstatement, appropriate excavated material may be returned to the trench and compacted in layers of a thickness specified by the appropriate utility. Ensure the trenches should be compacted properly after the initial backfilling, to prevent lateral movement of pipes. Heavy compaction equipment should not be used until the fill over the crown of the pipe is at least 300mm.

HDPE PIPE JOINTING TECHNIQUES

TDI polyethylene pipes and fittings can be installed using the state of the art effortless techniques utilizing the Electro-Fusion and Butt Fusion technologies. Polyethylene pipes can also be joined by various other methods such as Compression, push-fit and flange.

Butt Fusion technique creates a permanent heat-fused bond, thus creating a leak-free system without the need of secondary fittings or bonding materials. The fusion bond area created is not only homogeneous with the material around it but also as strong as the original adjoining pipe structure.

Electro fusion provides a similar option to a fusion bond and is generally used for small diameter pipes, 160mm and below.

Compression, push-fit and flange is non-permanent type of joint which is used to connect different material.

ADVANTAGES OF BUTT FUSION AND ELECTRO-FUSION TECHNIQUES

Butt Fusion and Electro-Fusion techniques eliminate the potential for leakage points which could be incurred by spigot and socket type pipes connections.

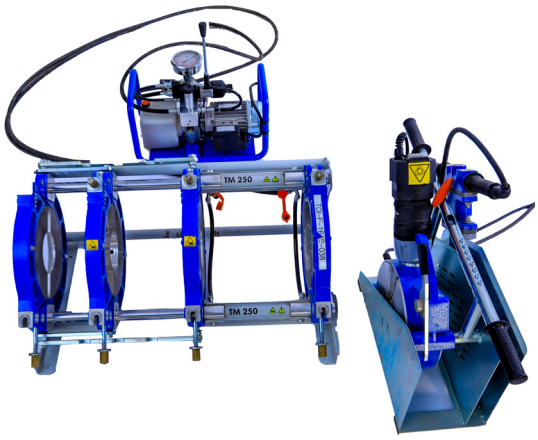
- The life cycle cost of polyethylene pipes differs from other pipe materials due to the zero leakage rate of a properly fused joint.
- Polyethylene pipe fused joints are self-restraining therefore eliminating costly thrust restraints or thrust blocks.
- Polyethylene pipes' fused joints eliminate infiltration and exfiltration problems, which can be experienced with alternate pipe joint systems.

JOINTING PROCEDURES

BUTT FUSION PROCESS

The following equipment and tools are required for the butt fusion process

- Automatic Butt Fusion Machine suitable for the pipe size;
- Power source compatible with the machine power;
- Bead gauge and bead remover;
- Pipe cutter;
- Pipe rollers.

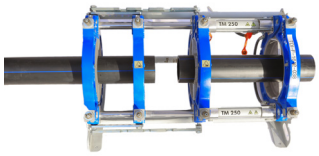


PREPARATIONS BEFORE STARTING THE BUTT FUSION PROCESS

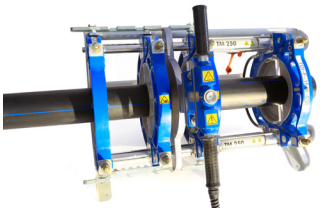
- The butt fusion machine should be placed on a flat, clean, and dry board in a suitable shelter for protection from contamination, chilled wind and direct sunlight;
- Make sure that all machine parts (Control box, heater, chassis, timer) are clean and free from dust, humidity or any other contaminations;
- Make sure that the machine has been serviced and calibrated regularly;
- Check the input power source and make sure that it is compatible with the power requirements of the machine.

JOINTING PROCEDURE

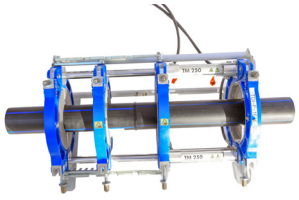
1. POSITIONING OF PIPE



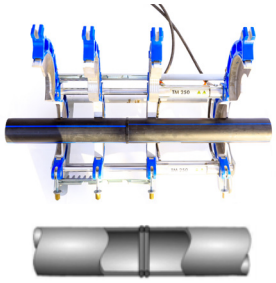
2. PEELING & HEATING



3. JOINTING, COOLING



4. CHECK THE JOINT



NOTE: THE INSTALLER SHOULD FOLLOW THE INSTRUCTIONS LISTED IN THE CATALOGUE OF THE MANUFACTURER OF THE BUTT WELDING MACHINE.

ELECTRO-FUSION PROCESS

The following equipment and tools are required for the electro fusion process:

- Automatic Electro Fusion Machine;
- Power source compatible with the machine power;
- Suitable pipe clamps;
- Pipe cutter;
- Electro fusion fittings with size similar to the pipe size;
- Scrubbing tools;
- Marker pen.

PREPARATIONS BEFORE STARTING THE ELECTRO FUSION PROCESS

- The electro fusion machine should be placed on a flat, clean, and dry board in a suitable shelter for protection from contamination, chilled wind and direct sunlight;
- Make sure that all machine parts (are clean and free from dust, humidity or any other contaminations;
- Check the input power source and make sure that it is compatible with the power requirements of the electro fusion machine.

JOINTING PROCEDURE

1. Ensure that the pipe is cut rectangular.
2. Align the pipe and fix the position.
3. Remove the oxidized layer of the pipe by using rotary peeler.
4. Clean the dust & grease by using proper cleaning material.
5. Weld the components together.

NOTE: THE INSTALLER SHOULD FOLLOW THE INSTRUCTIONS LISTED IN THE CATALOGUE OF THE MANUFACTURER OF THE ELECTRO FUSION MACHINE.

TDI FUSION SERVICES

As part of its services for the HDPE installations, TDI is imported HDPE butt welding and electro fusion machines up to 400 mm from George Fisher.

MIXING AND PVC PLANT

INTRODUCTION TO POLYVINYL CHLORIDE (PVC)

PVC is one of the oldest plastics resins. It was first discovered accidentally in 1826, patented in 1913 and eventually came into industrial use in the mid 1950's. Its globally the second most used resin below Ethylene.

Unlike all other resins the production of PVC is not totally reliant on non-renewable fossil fuels (oil) and because it contains 43% salt its environmental impact along with its durability and cost have given rise to its popularity. It was first used to make shoe heels and golf balls but now it is used in hundreds of different applications and is dominant in the construction and pipe industries.

Unlike HDPE PVC cannot be processed in its pure form and additives need to be added and then blended to increase its heat stability and other characteristics. It comes in two basic forms which are Rigid and Flexible, the properties are derived by adding a plasticiser during the blending process. PVC Pipes are made with rigid or un-plasticised PVC and so it's given the acronym uPVC. Because of its properties uPVC is an ideally suited to many pipe applications.

PROPERTIES OF TDI uPVC PIPE

LOAD BEARING PROPERTIES

TDI uPVC pipes are extremely flexible and can flex without breaking when loaded externally from soil weight and heavy-duty traffic. Rigid pipes, such as those made of concrete, clay or ceramic are unable to flex when loaded and will experience wall crushing and collapse when their load limit is reached. When a PVC pipe encounters external loading, its diameter will begin to deflect. If the pipe is buried in the right supportive soil conditions, the stiffness of the soil combined with the pipe stiffness will resist the deflection.

CORROSION RESISTANT AND SCALE BUILD-UP

The inert nature of uPVC piping systems provides complete corrosion resistance and build-up of scale. This eliminates the need for chemical treatments ensures that the pumping costs remain the same throughout the product life.

LIGHTWEIGHT

PVC pipes have a huge advantage in the weight department when compared with other piping materials. PVC pipes are significantly lightweight. The low weight facilitates easy and effortless installation, without the risk of getting injured or needing a large team of workers to carry it.

FLAME RESISTANCE

PVC pipes are extremely difficult to ignite. Unless there is a continuous presence of an external ignition source, PVC pipes will not continue to burn. This advantageous feature makes it extremely safe and secure to work with and to install for long-term purposes. The temperature that they need for any cases of spontaneous ignition is 450 degrees Celsius.

LONGER PRODUCT LIFE

TDI uPVC pipe formulation is blended with high quality ingredients in the correct amounts and complies with ISO 1452. This means that all uPVC pipes will last a minimum of 100 years and so it far outlasts other pipe materials.

CHEMICAL RESISTANCE AND UV STABILITY

TDI uPVC pipes exhibit excellent resistance to a wide range of chemical reagents and disinfectant chemicals. With low risk of materials eating through the pipe, PVC pipes are highly suitable for most water infrastructure projects as they can convey most strong acids, alkalis and aqueous solutions (except those which are strongly oxidising), aliphatic hydrocarbons, fluorides, photographic and plating solutions, brine, mineral oils, fats and alcohols. TDI uPVC pipes are also UV resistant so are suitable for outdoor installations.

HIGH FLOW RATES

TDI uPVC pipes are manufactured with extremely smooth bores and lack of internal projection and so give excellent hydraulic capacity over the total life of the pipework system. Unlike other piping materials such as steel and concrete there is no build up inside the pipe so the pumping costs remain the same throughout the lifespan of the piping system.

QUICKER INSTALLATION TIME

The results of a recent study conducted by The European Plastic Pipes and Fittings Association (TEPPFA) found that uPVC pipe installation was over 30% faster than the same size concrete pipe. This time saving is mainly attributed to the decrease in weight making the pipes easier to handle and also the ease of joining the pipes.

ENVIRONMENTAL IMPACT

TDI uPVC pipes have clear environmental advantages over traditional materials. As PVC is a low carbon plastic, PVC pipes require less energy and fewer resources to manufacture. Due to their low weight, less energy is used when transported. PVC pipes last long with a minimum of maintenance and they are easily recyclable. Moreover, the ultra-smooth surface of PVC pipes reduces pumping costs and energy use, and their leak-free fittings eliminate water loss. This is good for both the environment and the utility bill.

THE MAIN FEATURES OF TDI PRESSURE AND DRAINAGE PIPES ARE

- Strong and resistant to impact
- Easy to install
- Fully compliant to the ISO standards
- Resistant to a wide range of chemicals/fluids
- Smooth bore to give excellent flow characteristics

SPECIFICATION	
Standards	ISO 1452
Material	100% pure uPVC resin and additives
Joints	Solvent cement weld sockets & rubber ring seal joint
Temp Range	0°C - 60°C
Tensile Strength	Min. 80 N/mm2
COLOR	
Dark Grey, Light Grey, Orange…	
LENGTH	
Pipes are normally supplied in 6m overall length, and it can also be supplied in 5.8m overall length to fit inside containers.	

APPLICATIONS

All TDI pipes are manufactured to ISO 1452 and can be confidently used with the applications listed below,

WATER SUPPLY TDI uPVC pipes will not affect the taste color of smell of drinking water.

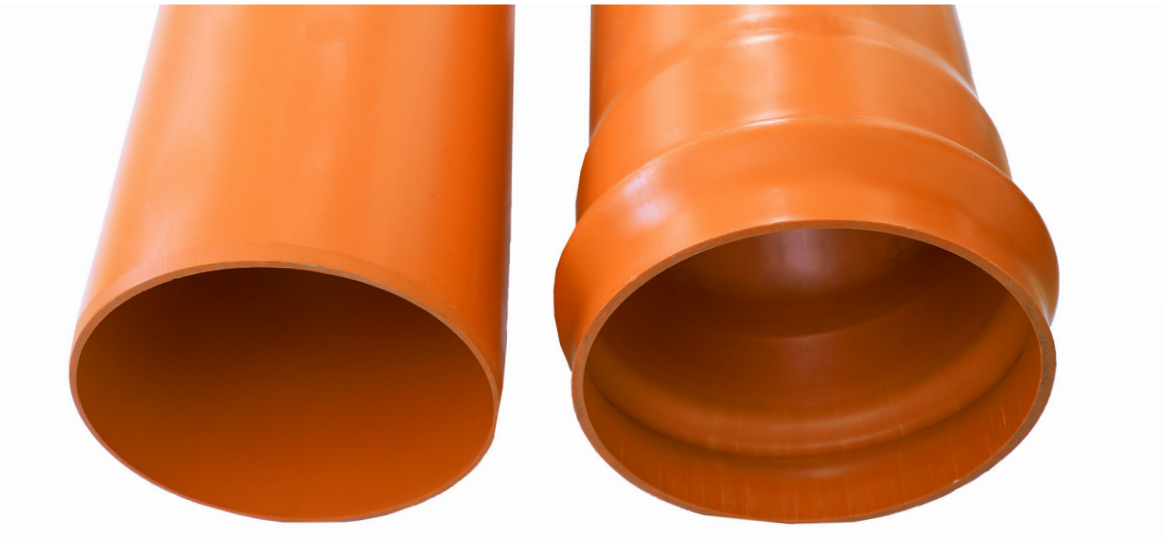
AGRICULTURE AND IRRIGATION TDI uPVC pipes are ideal for agricultural irrigation systems.

INDUSTRIAL TDI uPVC pipes are resistant to most chemicals so make an ideal choice in many industrial pipeline applications.

DRAINAGE AND SEWER SYSTEM

RAINWATER COLLECTION

ELECTRICAL AND TELECOMMUNICATIONS



TDI uPVC PIPE

TDI's uPVC pipes are available in sizes from 16mm to 630 mm and cover pressure classes from 4 to 25 bar. The standard length is 6 meters, but this can be varied to any length to suit the customer needs. The raw material ingredients used by TDI will ensure a finished product that gives maximum performance to service all municipal and industrial water needs. The pipes are available in dark gray and orange, but the pipes can be made in other colors to suit the customer needs.

PROPERTIES OF TDI uPVC PIPE

TDI uPVC pipes are expected to operate efficiently over long period of time without affecting water quality. Below are the unique properties and testing method.

CHARACTERISTICS	TYPICAL VALUE	TEST METHOD
General property		
Opacity	<0.2%	ES ISO 7686
Specific gravity	1.4	
Mechanical property		
Resistance to hydrostatic pressure	No breakage or leakage during test.	ES ISO 1167
Resistance to external blows @0 ^{0}C	TIR<10%	ES ISO 3127
Physical property		
Vicat softening point	>79 ^{0}C	ES ISO 2507
Longitudinal reversion	<5%@150^{0}C	ES ISO 2505
Resistance to dichloromethane	No attack at any part of the	ISO 9852

The Nominal pressure of uPVC pipe is the working pressure of the pipe at 20 ^{0}C. If the operating temperature is in between 25-45 ^{0}C a supplementary derating factor should be applied according to the following table. The maximum working pressure is given by multiplying the nominal pressure by the derating factor.

Operating temperature (^{0}C)	Derating factor
0< T < 20	1.0
20< T<30	0.9
30< T<40	0.7
40< T<50	0.5
50< T<60	0.3

uPVC PIPES OF OD 16-90MM ACCORDING TO ISO 1452

					PIPE SERIES																			
					SDR13.6				SDR17				SDR 21				SDR 26				SDR 33			
					S 6.3				S 8				S 10				S 12.5				S 16			
					PN 16				PN 12.5				PN 10				PN 8				PN 6			
NOMINAL SIZ(MM)	MEAN OUTSIDE DIAMETER (MM)		MAXIMUM OUT-OF-ROUNDNESS (MM)		WALL THICKNESS (MM)		ID (MM)	WT/M	WALL THICK-NESS (MM)		ID (MM)	WT/M	WALL THICK-NESS (MM)		ID (MM)	WT/M	WALL THICK-NESS (MM)		ID (MM)	WT/M	WALL THICK-NESS (MM)		ID (MM)	WT/M
	MIN.	MAX.	S16	S12.5- S5	MIN.	MAX.			MIN.	MAX.			MIN.	MAX.			MIN.	MAX.			MIN.	MAX.		
16	16	16.2	-	0.5	1.5	1.9	12.60	0.1																
19	19	19.2	-	0.5	1.5	1.9	15.60	0.1																
20	20	20.2	-	0.5	1.5	1.9	16.60	0.1																
21	21	21.2	-	0.5	1.5	1.9	17.60	0.2	1.2	1.6	18.20	0.1												
25	25	25.2	-	0.5	1.9	2.3	20.80	0.2	1.5	1.9	21.60	0.2												
32	32	32.2	-	0.5	2.4	2.9	26.70	0.3	1.9	2.3	27.80	0.3	1.6	2	28.40	0.24								
40	40	40.2	1.4	0.5	3	3.5	33.50	0.5	2.4	2.9	34.70	0.4	1.9	2.3	35.80	0.35	1.6	2	36.40	0.30	1.5	1.9	36.60	0.28
50	50	50.2	1.4	0.6	3.7	4.3	42.00	0.8	3	3.5	43.50	0.7	2.4	2.9	44.70	0.55	2	2.4	45.60	0.46	1.6	2	46.40	0.38
63	63	63.3	1.5	0.8	4.7	5.4	52.90	1.3	3.8	4.4	54.80	1.1	3	3.5	56.50	0.86	2.5	3	57.50	0.74	2	2.4	58.60	0.59
75	75	75.3	1.6	0.9	5.6	6.4	63.00	1.9	4.5	5.2	65.30	1.5	3.6	4.2	67.20	1.24	2.9	3.4	68.70	1.01	2.3	2.8	69.90	0.81
90	90	90.3	1.8	1.1	6.7	7.6	90.00	2.7	5.4	6.2	90.00	2.2	4.3	5	90.00	1.76	3.5	4.1	90.00	1.46	2.8	3.3	90.00	1.18

uPVC PIPES OF OD FROM 110-630MM ACCORDING TO ISO 1452

					PIPE SERIES																			
					SDR17				SDR21				SDR 26				SDR 33				SDR 41			
					S 8				S 10				S 12.5				S 16				S 20			
					PN 16				PN 12.5				PN 10				PN 8				PN 6			
NOMINAL SIZE (MM)	MEAN OUT-SIDE DIAME-TER (MM)		MAXIMUM OUT-OF-ROUNDNESS (MM)		WALL THICK-NESS (MM)		ID (MM)	WT/M	WALL THICK-NESS (MM)		ID (MM)	WT/M	WALL THICK-NESS (MM)		ID (MM)	WT/M	WALL THICK-NESS (MM)		ID (MM)	WT/M	WALL THICK-NESS (MM)		ID (MM)	WT/M
	MIN.	MAX.	S20-S16	S12.5-S8	MIN.	MAX.			MIN.	MAX.			MIN.	MAX.			MIN.	MAX.			MIN.	MAX.		
110	110	110.4	2.2	1.4	6.6	7.5	95.90	3.2	5.3	6.1	98.60	2.6	4.2	4.9	100.90	2.05	3.4	4	102.60	1.67	2.7	3.2	104.10	1.40
125	125	125.4	2.5	1.5	7.4	8	109.60	4.0	6.0	6.8	112.20	3.3	4.8	5.5	114.70	2.66	3.9	4.5	116.60	2.18	3.1	3.7	118.20	1.81
140	140	140.5	2.8	1.7	8.3	9.4	122.30	5.0	6.7	7.6	125.70	4.1	5.4	6.2	128.40	3.35	4.3	5	130.70	2.69	3.5	4.1	132.40	2.30
160	160	160.5	3.2	2	9.5	10.7	139.80	6.6	7.7	8.7	143.60	5.4	6.2	7.1	146.70	4.40	4.9	5.6	149.50	3.50	4.00	4.6	151.40	2.99
180	180	180.6	3.6	2.2	10.7	12	157.30	8.4	8.6	9.7	161.70	6.8	6.9	7.8	165.30	5.51	5.5	6.3	168.20	4.43	4.4	5.1	170.50	3.69
200	200	220.6	4	2.4	11.9	13.3	174.80	10.3	9.6	10.8	179.60	8.4	7.7	8.7	183.60	6.84	6.2	7.1	186.70	5.54	4.9	5.6	189.50	4.58
225	225	225.7	4.5	2.7	13.4	15	196.60	13.1	10.8	12.1	202.10	10.7	8.6	9.7	206.70	8.59	6.9	7.8	210.30	6.94	5.5	6.3	213.20	5.78
250	250	250.8	5	3	14.8	16.5	218.70	16.0	11.9	13.3	224.80	13.1	9.6	10.8	229.60	10.64	7.7	8.7	233.60	8.63	6.2	7.1	236.70	7.24
280	280	280.9	6.8	3.4	16.6	18.5	244.90	20.2	13.4	15	251.60	16.5	10.7	12	257.30	13.29	8.6	9.7	261.70	10.78	6.9	7.8	265.30	9.02
315	315	316	7.6	3.8	18.7	20.8	275.50	25.6	15.0	16.7	283.30	20.8	12.1	13.6	289.30	16.91	9.7	10.9	294.40	13.69	7.7	8.7	298.60	11.37
355	355	356.1	8.6	4.3	21.1	23.5	310.40	32.5	16.9	18.6	319.50	26.4	13.6	15.2	326.20	21.41	10.9	12.2	331.90	17.31	8.7	9.8	336.50	14.44
400	400	401.2	9.6	4.8	23.7	26.3	350.00	41.1	19.1	21.3	359.60	33.6	15.3	17.1	367.60	27.17	12.3	13.8	373.90	22.00	9.8	11	379.20	18.35
450	450	451.4	10.8	5.4	26.7	29.6	393.70	52.1	21.5	23.9	404.60	42.5	17.2	19.2	413.60	34.36	13.8	15.4	420.80	27.81	11	12.3	426.70	23.18
500	500	501.5	12	6	29.7	32.9	437.40	64.4	23.9	26.5	449.60	52.5	19.1	21.3	459.60	42.41	15.3	17.1	467.60	34.24	12.3	13.8	473.90	28.73
560	560	561.7	13.5	6.8					26.7	29.6	503.70	65.7	21.4	23.8	514.80	53.18	17.2	19.2	523.60	43.11	13.7	15.3	531.00	35.91
630	630	631.9	15.2	7.6					30	33.2	566.80	83.0	24.1	26.8	579.10	67.38	19.3	21.5	589.20	54.42	15.4	17.2	597.40	45.37

uPVC PIPES OF OD FROM 20-630MM ACCORDING TO DIN 8061/ES 1222

OD(mm)	PN4	PN6	PN10	PN16	PN20
			Nominal wall thickness e_n(mm)		
20					2.3
25			1.5	1.9	2.8
32			1.8	2.4	3.6
40		1.8	1.9	3.0	4.5
50		1.8	2.4	3.7	5.6
63		1.9	3	4.7	7.0
75	1.8	2.2	3.6	5.6	8.4
90	1.8	2.7	4.3	6.7	10.0
110	2.2	3.2	5.3	8.2	12.3
125	2.5	3.7	6	9.3	13.9
140	2.8	4.1	6.7	10.4	15.6
160	3.2	4.7	7.7	11.9	17.8
180	3.6	5.3	8.6	13.4	20.0
200	4	5.9	9.6	14.9	22.3
225	4.5	6.6	10.8	16.7	25.0
250	4.9	7.3	11.9	18.6	27.8
280	5.5	8.2	13.4	20.8	
315	6.2	9.2	15	23.4	
355	7	10.4	16.9	26.3	
400	7.9	11.7	19.1	29.7	
450	8.9	13.2	21.5		
500	9.8	14.8	23.9		
560	11.0	16.4	26.7		
630	12.4	18.4	30		

PIPE STORAGE, HANDLING & TRANSPORT INSTRUCTION

STORAGE

- uPVC pipes should be stacked on a reasonably flat surface free from sharp objects, stones or projections likely to deform or damage them.
- If the pipe is stored in racking it should be continuously supported along its length.
- When stacking Socket-End and Spigot-End pipes, the sockets shall be alternated within the stack and shall project sufficiently for the pipes to be correctly supported along their whole length.
- Place the pipes in a location where it is not possible for dirt to get into the pipes. Do not place in contact with pipes for fuels, solvents or paints.
- Do not over-stack the pipes as there is a risk of deformation of the pipes at the bottom of the stack. Also reduce the height of the stack if storing in a hot environment.
- To prevent UV attack never store uPVC pipe in direct sunlight.

HANDLING

- The pipe should be handled with reasonable care to avoid breakage or damage.
- Do not drag the pipes along the ground.
- When loading and unloading the pipes by hand and do not let them slip. If handling equipment is used, choose techniques which are not likely to damage the pipes. Direct contact with metal pipes, slings, hooks or chains.
- Do not throw the pipes onto a hard surface.
- If the pipes have been telescoped for transporting, always remove the inner pipes first and stack them separately.

TRANSPORT

- When transporting pipes, use flat bed vehicles, free from nails and other sharp objects which could cause damage. The pipes shall rest uniformly on the vehicle over their whole length.
- The vehicles shall have side supports appropriately spaced 2 meters apart, and the pipes shall be secured effectively during transport. All posts shall be flat with no sharp edges.
- When loading socket-end and spigot-end pipes, Stack the pipes so that the sockets do not take any load.
- Load the pipes onto the vehicle with an overhang not exceeding 1 m.
- Load the thicker pipes before the thinner ones.

GENERAL POINTS ON TRENCHING, LAYING AND BACKFILLING.

- Reasonable care shall be taken in the handling and laying of uPVC pipes.
- uPVC pipes do not fracture under load but can be liable to deformation. The extent of this deformation depends largely up on the compaction of the immediate surrounding fill. This fill should extend to the trench width in a normal situation.
- The external backfill and surcharge loads imposed on a pipe of rigid material (such as vitrified clay, concrete, asbestos, cement or cast iron) are supported mainly by the resistance of the pipe to circumferential deformation and rely partly on external support to resist deformation. Therefore it is primary importance for uPVC pipes that fill material, particularly the bedding and side fill should be properly compacted in order to prevent excessive deformation.
- It is desirable that vertical deformation should be limited to 5% on completion of the backfilling, which can only be achieved by proper composition and compaction of the backfill.
- It is essential to avoid high stress concentrations and sharp objects such as large stones or flints which should not be allowed to come into contact with the surface of the pipe.
- The flexible nature of uPVC pipe helps them to accommodate deformations resulting from ground movement or from other differential settlement under normal circumstances.
- When a vertical load is imposed on the uPVC pipes the resulting horizontal force is transmitted to the undisturbed trench wall by the side fill. Any deflection of the pipe will cease when the horizontal reaction of the side fill corresponds to the transmitted vertical load and a state of equilibrium is reached.
- Except in special condition, e.g. shallow cover depths or where it is necessary to safe-guard the foundations of existing structures, do not encase the pipes in concrete, which would transform the flexible pipe into a rigid bar with no flexural strength which would be likely to break during any movements of the earth.

EXCAVATION

The trench should not be opened too long in advance of pipe laying and should be back filled as soon as possible. It is essential to ensure that the side of the trenches are adequately supported.

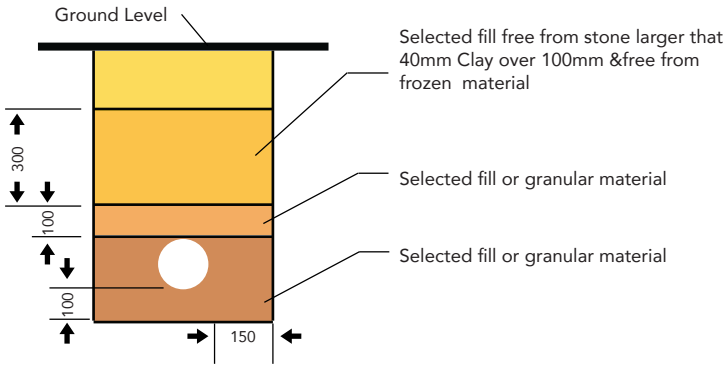
The width of the trench within any timbering should be as narrow as possible, but not less than the outside diameter of the pipe plus sufficient width (usually about 150mm) on each side of the pipe to provide access for making the joints, as well as placing and compacting side fill.

PIPE BEDDING & BACKFILLING

The base of the trench shall be carefully leveled and cleared of any sharp edges and stones. If this is not possible, apply a suitable material over a thickness of at least 100mm.

The material used for bedding & surrounding of the pipe should be selected granular material with a maximum particle size not exceed 20mm.

Secure the pipes along the side with suitable backfill material compacted into successive layers of 100mm maximum. The same material shall then be placed over the pipe to a height equal to two thirds the diameter but at least 100mm and not more than 300mm and thoroughly compacted. The recommended depth and width of trench is illustrated below.



PIPE LAYING

Lay the pipes on the prepared bed making allowances for thermal expansion, particularly if laying takes place in very hot weather. Leave the pipes to cool at the bottom of the trench before completing assembly and back filling.

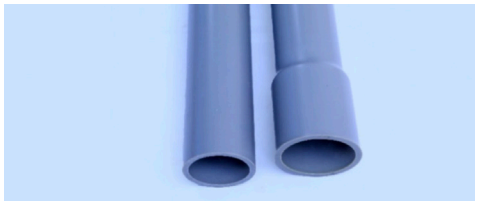
Normally pipe is laid in straight lines. However, in special circumstances, it may sometime be acceptable to spring the jointed pipes at a slight curve to avoid obstacle, or to follow the curvature of a street. If this is done and the joints are of rubber seal joint type, care has to be taken not to spring the pipe work too sharp. Otherwise, the curve or the joints may be over strained and cause a subsequent failure. Straining of the joints can be minimized by firmly backfilling a short length of the pipe.

The pipe should be anchored in this position by farther backfilling before the next joint is made and the process repeated as necessary. The trench may need to be widened on the curve to accommodate the pipe in straight position. It is essential that the jointing is always carried out in the straight position.

INSTALLATION METHOD

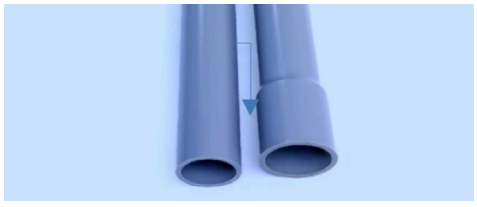
SOLVENT CEMENTED JOINTS: where adhesive is applied both to the spigot end of the pipe and in the socket.

1. Ensure the pipes are cut at 90 degrees.

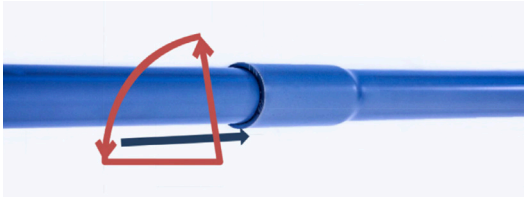


2. Clean the spigot and socket from dust, grit and grease and ensure the pipe is dry

3. Apply the adhesive in a longitudinal direction over the surface of both spigot and socket.

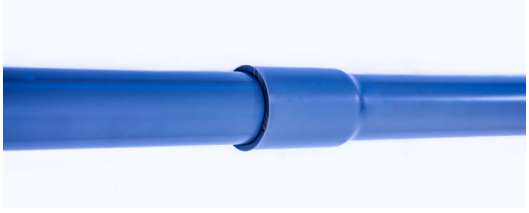


4. Insert the spigot end into socket with slight twisting action to full depth of the socket



5. Remove excess adhesive as soon as the joint has been made.

6. Once the joint is made leave to dry without disturbing for at least 5minutes.

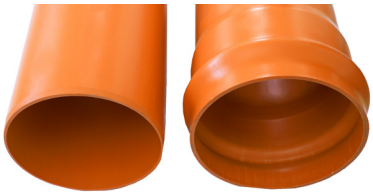


NOTE

- Adhesive can be inflammable and must not be stored or used near open flame.
- The adhesive should be applied in a well ventilated space.
- Close the cap of the adhesive tin when not in use.

AUTOMATIC JOINTS: where a rubber seal is automatically compressed and forms a sealed joint when the spigot end is inserted into the socket.

1. Make sure that the pipes are cut at 90 degrees and are chamfered properly.



2. Clean the spigot and socket from dust, grit and grease and ensure the pipe is dry.

3. Insert pipe in to the socket without seal ring in place and mark pipe when it's fully inserted.

4. Place the rubber seal in groove socket ensuring that the seal is oriented correctly.

5. By aligning correctly apply lubricant to the spigot side and rubber seal.

6. Once it's lubricated, the spigot end shall be inserted to socket up to reference mark.

Pipes may be re-cut on site but it must be cut at 90 degrees and chamfered correctly. The correct jointing procedure should be followed to avoid causes of leakage.

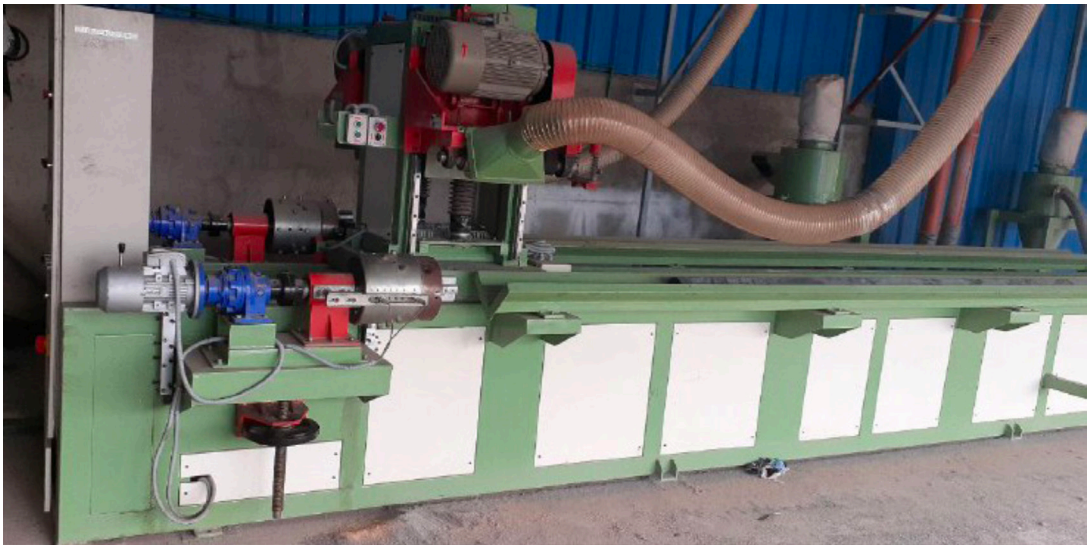
HYDROSTATIC PRESSURE TESTING

After completion of the laying operations, all the elements of the Pipeline shall be inspected and tested to ensure the safety and reliability of the network.

- The hydrostatic testing of a pipe shall be carried out at ambient temperature.
- The test pressure shall not exceed 1.5 times the rated pressure for the weakest part of the Pipeline.
- The test pressure shall be applied for at least one hour, but under no circumstances for more than 24 hours.
- Networks with cemented joints shall not be tested until a certain period has elapsed after the completion of the final joint & until the anchorage acquire their strength.
- The network should be flushed out with water to clean any undesired matter before the test.
- All intermediate control valves shall be open throughout the duration of the test. If a network is to be tested by-sections, the ends shall be temporarily closed by means of suitable joints.
- Manometers shall be calibrated according to the level at which they are placed. Air vents at high Points shall be open during the filling of the network.
- Slowly fill the pipes with water starting from the lowest Point, thus avoiding water hammer and removing all air.
- Once it has been completely filled with water, leave the Pipeline to rest for 24 hours. Close the air vents and carryout an initial inspection to check that all the joints are leak tight.
- Slowly increase the pressure, preferably using a hand Pump or motor pump for large diameter until the required pressure is obtained. A preliminary application of pressure for 15 minutes may be made before the test proper.
- Isolate the Pipeline from the test pump for at least 1 hour. The test is considered satisfactory if the quantity of the loss of water should not exceed one liter per hour, per linear meter, per meter of nominal diameter.
- An additional inspection of the complete System may be carried out at normal Service pressure, during which maneuverability of the valves and their correct operation can be checked.
- All defects revealed by the test shall be rectified and a new test carried out until a satisfactory result is obtained.

uPVC WELL CASING AND SCREEN PIPES

TDI manufactures and supplies Well Casing and Screen Pipes in a variety of Sizes in accordance with DIN 4925. TDI Screen and Casing pipes are less than one seventh the weight of conventional steel casing and screens. Additionally the lifespan of conventional steel casing is 10 years compared to 50 years for TDI Well and Screen Casing. When these two factors are taken into consideration it really does make sense to procure TDI PVC Casing and Screens instead of the steel alternatives.



- Casing with Machine

CHEMICAL RESISTANCE

The following chart rates the resistance to uPVC & PE to various chemicals at various concentration and temperatures. The chart is intended as applicable to all working conditions should there be any doubt about the behavior of the pipe under specific conditions please contact our technical team. Use the index below as a reference guide to the tables which follow.

ABREVATIONS	MATERIAL	REMARKS
uPVC	Unplasticized polyvinylchloride	Good resistance to most solutions of acids, alkailis and salts and to solvents miscible with water. Not resistant to aromatic and chlorinated hydrocarbons.
PE	Polyethylene (high density)	Good resistance to solutions of acids, alkalis and salts, as well as to large numbers of organic solvents. Unsuitable for concentrated oxidising acids.

CHEMICAL RESISTANCE TABLE

Medium	Concentration	°C	PVC-U	PE
Acetic acid, aqueous	Up to 25%	40	▼	▼
	Up to 25%	60	Ø	▼
	80%	40	Ø	Ø
	80%	100	-	-
	85%	80	-	-
	85%	100	-	-
Ammonia water	Warm saturated	40	▼	▼
	Warm saturated	60	Ø	▼
	Warm saturated	80	-	Ø
	Saturated	100	-	-
Battery acid		60	▼	▼
Benzene	Technically pure	20	-	-
Benzine (Petrol)	Technically pure	60	▼	▼
Butane gaseous	50 %	20	▼	▼
Carbon dioxide, dry	100%	60	▼	▼
	100%	80	-	Ø
Carbon monoxide	100%	60	▼	▼
Caustic soda solution	Up to 40%	60	▼	▼
	50 / 60%	60	▼	▼
Chlorine, gaseous, dry	100%	20	▼	Ø
Chlorine, liquid		20	-	-
Chlorine water	Saturated	20	Ø	-
Citric acid, aqueous	Up to 10%	40	▼	▼
	Up to 10%	60	Ø	▼
	Saturated	60	Ø	▼
Coconut oil	Technically pure	60	▼	Ø
Corn oil		20	Ø	▼
Cyclohexanol	Technically pure	20	-	▼
Diesel Oil		60	Ø	Ø
Ethyl alcohol, denatured (with 2% toluene)	95%	20	▼	Ø
Ethylene glycol	Technically pure	20	▼	▼
	Technically pure	60	Ø	▼
Fatty acids	Technically pure	60	▼	Ø
Formaldehyde, aqueous	Diluted	40	▼	▼
	Diluted	60	▼	▼
	40%	60	▼	▼
Fruit juices	Usual concentration	60	▼	▼
		100	-	Ø
Fuel oil		20	Ø	Ø
Hydrochloric acid, aqueous	Up to 30%	40	▼	▼
	Up to 30%	60	Ø	▼
	Over 30%	20	▼	▼
	Over 30%	60	▼	Ø

Hydrochloric acid, aqueous	Over 30 %	80	-	-
Hydrogen	100 %	60	▼	▼
	100 %	100	-	-
Linseed oil	Technically pure	80	Ø	Ø
	Technically pure	100	-	-
Lubricating oils	Technically pure	20	▼	-
Methyl alcohol	Technically pure	40	▼	▼
	Technically pure	60	Ø	▼
	Technically pure	65	-	Ø
Milk	Usual commercial	20	▼	▼
Mixed acids 1 (sulphuric acid/nitric acid/water)	48 / 49 / 3 %	20	▼	-
	48 / 49 / 3 %	40	Ø	-
	50 / 50 / 0 %	20	Ø	-
	50 / 50 / 0 %	40	-	-
	10 / 87 / 3 %	20	Ø	-
	50 / 31 / 19 %	30	▼	-
Motor oils	Usual commercial	60	Ø	Ø
Nitric acid, aqueous	Up to 30 %	50	▼	▼
	30 / 50 %	50	▼	Ø
	40 %	70	-	-
	40 %	90	-	-
	48 %	80	-	-
	70 %	20	▼	Ø
	70 %	60	Ø	-
	98 %	20	-	-
	98 %	60	-	-
Oleum	10 %	20	-	-
Oxygen	All	60	▼	▼
Palm oil		20	-	▼
		60	-	Ø
Paraffin		60	▼	Ø
Paraffin oil		60	▼	Ø
Petroleum	Technically pure	60	Ø	Ø
Sea water		40	▼	▼
		60	▼	▼
		100	-	-
Soap solution, aqueous	Concentrated	20	▼	▼
	Concentrated	60	▼	▼
Soda, aqueous	Diluted	40	▼	▼
	Diluted	60	▼	▼
	Saturated	60	▼	▼
Starch, aqueous	All	40	▼	▼
	All	60	▼	▼

Sulphuric acid, aqueous	Up to 40 %	40	▼	▼
	Up to 40 %	60	Ø	▼
	70 %	20	▼	▼
	70 %	60	Ø	Ø
	80 – 90 %	40	▼	Ø
	96 %	20	▼	Ø
	96 %	60	Ø	Ø
Toluene	Technically pure	20	-	-
Turpentine oil	Technically pure	60	Ø	Ø
Urine	Normal	40	▼	▼
	Normal	60	▼	▼
Vinegar (wine vinegar)	Usual commercial	40	▼	▼
	Usual commercial	100	-	-
Water, distilled		40	▼	▼
		100	-	Ø
Water, potable, chlorinated see Water distilled				

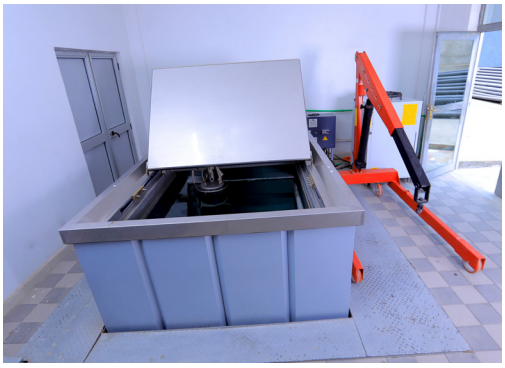
LABORATORY EQUIPMENT

The laboratory is equipped with modern and sophisticated high precision test equipment procured from IPT-Institut für Prüftechnik of Germany. The company is equipped to test almost all pipe quality related parameters start from pressure test to raw material quality.

HYDROSTATIC PRESSURE TEST

Determines the capability of the sample to withstand internal pressure for both long and short period of time.

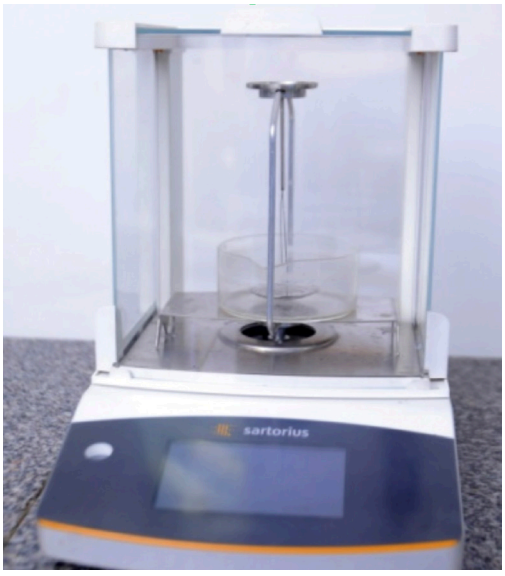
1. Test Reference: ISO 1167.
2. More than 1000 hours @ 60 ^{0}C on stress level: 2.5MPa 1Hours, @20 ^{0}C on stress level 42MPa 100hour, @20 ^{0}C on stress level 35 MPa



DENSITY/SPECIFIC GRAVITY

Determines the specific gravity and density to help in material identification.

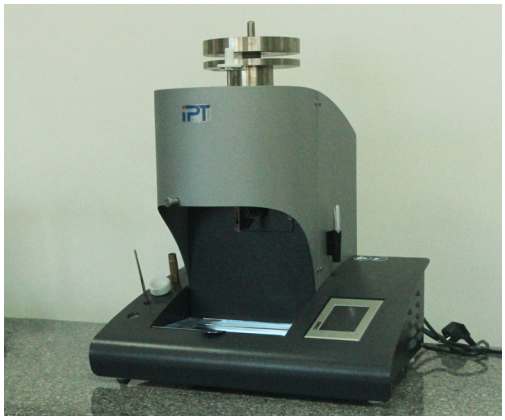
1. Test Reference: ISO 1183.
2. Value: specific gravity shall fall within PVC material range(=1.42)



MASS-FLOW RATE(MFR)

Measures the molten viscosity or the ease of the flow of the melt of a plastic material.

1. Test Reference: ISO 1133.
2. Value: 0.22 - 2.27 Chang e in MRF value caused by processing, between the measured value for material from the pipe and measured value for the compound, must not be greater than ±20%



LONGITUDINAL HEAT REVERSION TEST

Effects of Heating: Measures the change in length of the sample after exposure to high temperature and the ability to resist heat without showing delamination, cracks or blisters

1. Test Reference: ISO 2505
2. Value: Longitudinal Reversion(Shrinkage) shall be <5%

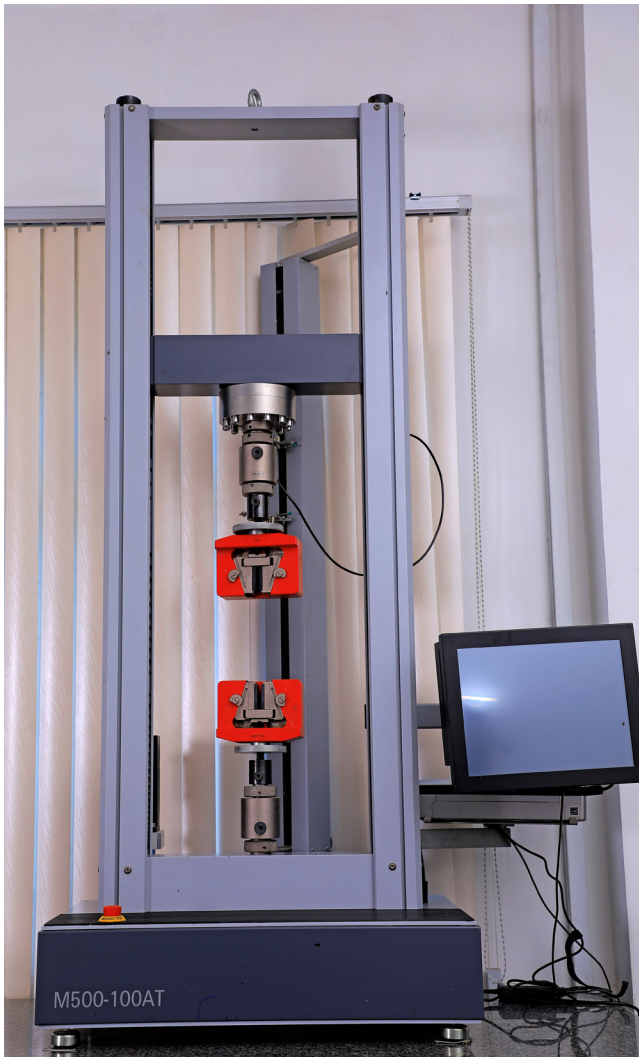
TENSILE, COMPRESSION & FLEXURAL TEST

Measures the strength of material (Resistance) being pulled apart

1. Test Reference: ISO 6259 1-3
2. Value: Elongation at break must be > 350%

Modulus of Elasticity:

- Measures the stiffness of material Elongation at break.
- Measures the extension length of the sample until it breaks.



HDPE BUTT WELD FITTINGS

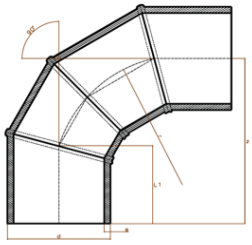
Tana Drilling and Industries Plc has started to manufacture and supply a complete range of HDPE butt weld fittings with for use exclusively with butt welding. These fittings are often a preferred option for butt weld contractors as they are compact, easily stacked for simplified transportation and storage, and excellent for prefabricated pipe works.

Butt fusion involves the simultaneous heating of the ends of two pipe/fitting components which are to be joined, until a molten state is attained on each contact surface. The two surfaces are then brought together under controlled pressure for a specific cooling time and a homogeneous fusion joint is formed. The resultant joint is fully resistant to end loads and has comparable performance under pressure to the pipe itself.

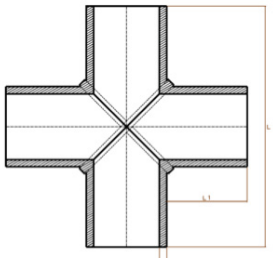
Butt welding is a very economical and reliable jointing technique for making permanent welded joints by way of a thermofusion process, requiring only butt-welding equipment. TDI supplies both fittings with short spigot ends and fittings with long spigot ends are suitable for butt welding.

Concentric and eccentric equal tees, 90° bends (elbows), cross tees, end caps, and Y-Branches are all part of the comprehensive range of butt weld fittings manufactured and supplied by TDI. We have Production Capacity in all size of HDPE butt-welded/ Segmented fittings up to Ø400 mm nominal diameter. The offered items are fabricated utilizing quality sanction PE-100 material and propelled manufacturing machinery, instruments, and dynamic innovation and technology.

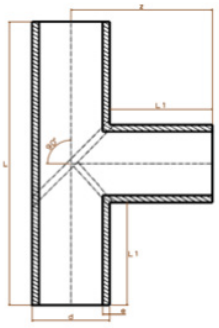
90°/450 BENDS (ELBOWS)
PE100: PN10 – PN25



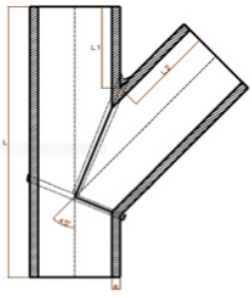
SEGMENTED CROSS TEE
PE100: PN10 – PN25



SEGMENTED EQUAL TEE
PE100: PN10 – PN25



SEGMENTED BRANCH TEE
PE100: PN10 – PN25



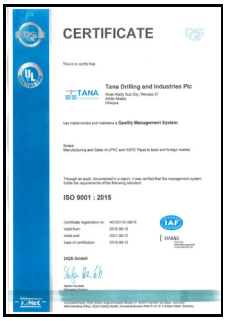
CERTIFICATES


THE INTERNATIONAL CERTIFICATION NETWORK

CERTIFICATE

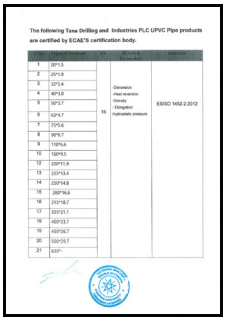
Tana Drilling and Industries Plc

ISO 9001 : 2015


CERTIFICATE

Tana Drilling and Industries Plc

ISO 9001 : 2015


The following Tana Drilling and Industries PLC UPVC Pipe products are certified by ECAE'S certification body.


License to use Ethiopian Standard (ES) Mark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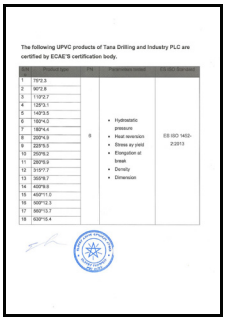
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The following Tana Drilling & Industries PLC, HDPE pipe products are certified by ECAE'S certification body.


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