

Comparison between Roobuck Steel Wire Mesh Reinforced HDPE Pipe (Roobuck Pipe) and Normal PE Pipe

ONE: Performance Comparison

1. Wall Thickness/SDR

Normal PE pipes use DN to describe the pipe size, which is defined as Outside Diameter (OD) of the pipe. Roobuck pipes use Inside Diameter (ID) to describe the sizes of our pipes because of its special structure. So a conversion must be done to compare either OD or ID of both pipes. The following table indicates that Roobuck pipes are much tinner for most sizes and pressures.

Roobuck Pipe			Normal PE Pipe				Roobuck	Normal		
Inside Diameter	Wall Thickness	Outside Diameter	Outside Diameter	Wall Thickness			SDR	SDR		
	Any PN			PN20	PN16	PN10	Any PN	PN20	PN16	PN10
ID100	12.0	124	DN125	14.0	11.4	7.4	10.3	9.0	11.0	17.0
ID125	12.0	149	DN140	15.7	12.7	8.3	12.4	9.0	11.0	17.0
ID150	12.0	174	DN160	17.9	14.6	9.5	14.5	9.0	11.0	17.0
ID200	12.5	225	DN225	25.1	20.5	13.4	18.0	9.0	11.0	17.0
ID250	12.5	275	DN250	27.9	22.7	14.8	22.0	9.0	11.0	17.0
ID300	12.5	325	DN315	35.2	28.6	18.7	26.0	9.0	11.0	17.0
ID350	15.0	380	DN355	39.6	32.2	21.1	25.3	9.0	11.0	17.0
ID400	15.0	430	DN400	44.7	36.3	23.7	28.7	9.0	11.0	17.0
ID450	16.0	482	DN450	50.2	40.9	26.7	30.1	9.0	11.0	17.0
ID500	16.0	532	DN500	55.8	45.5	29.6	33.3	9.0	11.0	17.0
ID600	20.0	640	DN630	70.3	57.2	37.3	32.0	9.0	11.0	17.0

2. Weight

Roobuck Pipe			Normal PE Pipe (PN20/SDR9)		Comparison
Inside Diameter	Outside Diameter	Kg/m	Outside Diameter	Kg/m	
ID100	OD124	8	DN125	4.9	+63%
ID125	OD149	10	DN140	6.2	+61%
ID150	OD174	11	DN160	8.0	+38%
ID200	OD225	15	DN225	15.8	-5%
ID250	OD275	18	DN250	19.5	-8%
ID300	OD325	22	DN315	31.0	-29%
ID350	OD380	28	DN355	39.3	-29%
ID400	OD430	32	DN400	49.9	-36%
ID450	OD482	43	DN450	63.2	-32%
ID500	OD532	50	DN500	77.9	-36%
ID600	OD640		DN630		

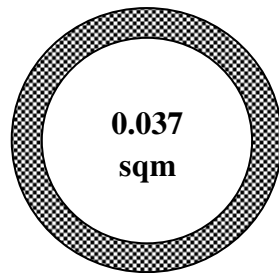
3. Sectional area

For a certain outside diameter, thinner wall leaves larger inside area of section. The following two PN20 pipe examples show how much area of section is increased.

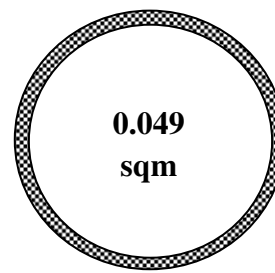
	PN20 Pipe Example 1 (mm)				PN20 Pipe Example 2 (mm)			
	Outside Diameter	Wall	Inside Diameter	Sectional Area	Outside Diameter	Wall	Inside Diameter	Sectional Area
Normal PE Pipe	280	31.3	217.4	37,101mm ²	500	55.8	388.4	0.118m ²
Roobuck Pipe	275	12.5	250.0	49,062 mm ²	482	16.0	450.0	0.159m ²
Compare	-5	-18.8 (60%)	+32.6 (15%)	11,961mm ² (32%)	-18	39.8 (71%)	+61.6 (16%)	0.041m ² (34%)

Roobuck pipes can increase area of section by 1/3 with the same or slightly thinner pipe. This represents significant increase of flowing capacity.

Example 1: Normal PE Pipe (Outside D= 280)



Roobuck Pipe (Outside D= 275)



4. High Pressure

The highest pressure in AS4130 standard is PN25, but Roobuck pipe can achieve PN40. Nominal pressures for different sizes are shown in the table.

	ID50	ID65	ID80	ID100	ID125	ID150	ID200	ID250	ID300	ID350	ID400	ID450	ID500	ID600
PN15	X	X	X	X	X	X	X	X	X	X	X	X	X	X
PN12.5	X	X	X	X	X	X	X	X	X	X	X	X	X	X
PN16	X	X	X	X	X	X	X	X	X	X	X	X	X	X
PN20	X	X	X	X	X	X	X	X	X	X	X	X	X	
PN25	X	X	X	X	X	X	X							
PN30	X	X	X	X	X									
PN35	X	X	X											
PN40	X	X				X								

5. Long-term hydrostatic strength

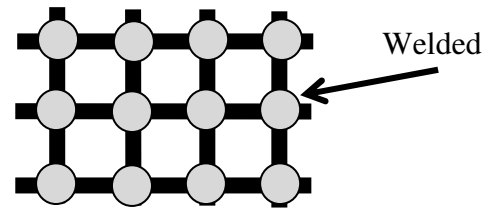
Most internal stress, mainly coming from pressure, is borne by steel mesh for Roobuck pipes so the PE itself is largely relieved from stress. So Roobuck pipe has much better creep resistance to avoid long term damage. The following table shows test results by *Tested by Broutman Laboratory, Chicago.*

	Loop Stress	Time
Normal PE Pipe	11.4 MPa	15041 Hour
Roobuck Pipe	31.0 MPa	22752 Hour

The pipe lifetime is mainly decided by three factors – stress, temperature and media. For a certain media and temperature, a higher long-term hydrolic strength means longer lifetime or higher pressure to withstand.

6. Rapid Crack Propagation Resistant and Environment Stress Crack Resistant Comparison

Every cross over of the steel mesh is welded. When such welded mesh is embedded in the PE, it will strongly hold the PE together. The following table shows the test result by *Belgian Research Centre for Pipes and Fittings*



	Inner Pressure	Crack Length	Outside Diameter
Roobuck Pipe	1	No crack	174 mm
Normal PE Pipe	0.89	95 mm	110 mm

Such superior performance of resistance to cracks, the possibility for cracks to happen is low. If a crack happens, the steel core will significantly reduce the crack propagation whatever the crack direction is.

7. Impact resistance and dimension stability

The elasticity modulus of steel is about 200 higher than that of the HDPE. Such a steel cored structure makes Roobuck pipe impact resistance and dimension stability far beyond than any types of plastic pipes including HDPE. The mesh steel core configuration also preserves flexibility in the axis direction. The superior performance in both rigidity and flexibility provides a strong resistance to vertical load created by earth movement or vibration from traffic. This feature also makes it suitable for situations where a pipeline in slow curve is required. It also makes it easy for transportation and installation.

8. Temperature

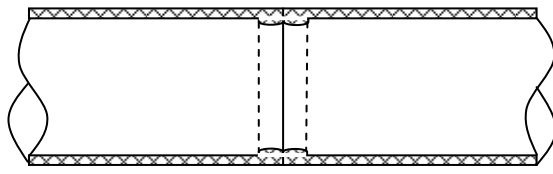
When temperature rises, PE strength is reduced quickly, but steel only changes very slightly in the range of 0-100°C. So the ability for Roobuck pipe to withstand pressure reduces slowly with temperature rises. The “Pressure Reduction Coefficient” for PE pipes is specified in 40°C as 0.73 in ISO4427-1. Roobuck pipe can achieve 0.9. PE pipes will be distorted in extreme environmental condition, such as high temperature. Roobuck pipe will be much less distorted in such a condition and will keep the pipeline straight

Therefore, Roobuck pipe is suitable for high temperature and even can be used in high temperature where Normal PE pipe cannot be used.

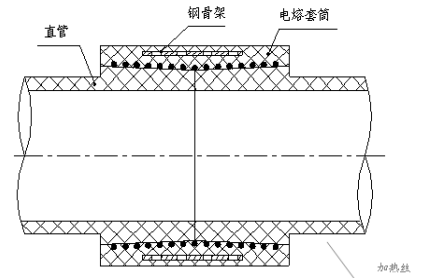
9. Smooth inner wall in low resistance

The hot plate welding of Normal PE pipe will inevitably form a bead in circle on the inner wall. These beads not only reduce the inner diameter, but also cause turbulence so generate a significant resistance to

the media transportation. Roobuck electrofusion technology welds an electrofusion coupler outside the pipe, so inner wall beads will not be generated.



Normal PE Pipe connection



Roobuck Pipe connection

10. Strong electrofusion connection

- Large welding area

Roobuck Electrofusion Coupling method provide a very large welding area, which is πDL . D is outside diameter and L is width of the Electrofusion Coupler. Take ID400 for example, the welding area is

$$3.14 \times 0.4\text{m} \times 0.3\text{m} = 0.38\text{m}^2.$$

A normal PE pipe only welds wall section area, which is πDW . W is wall thickness. For a DN400, we have

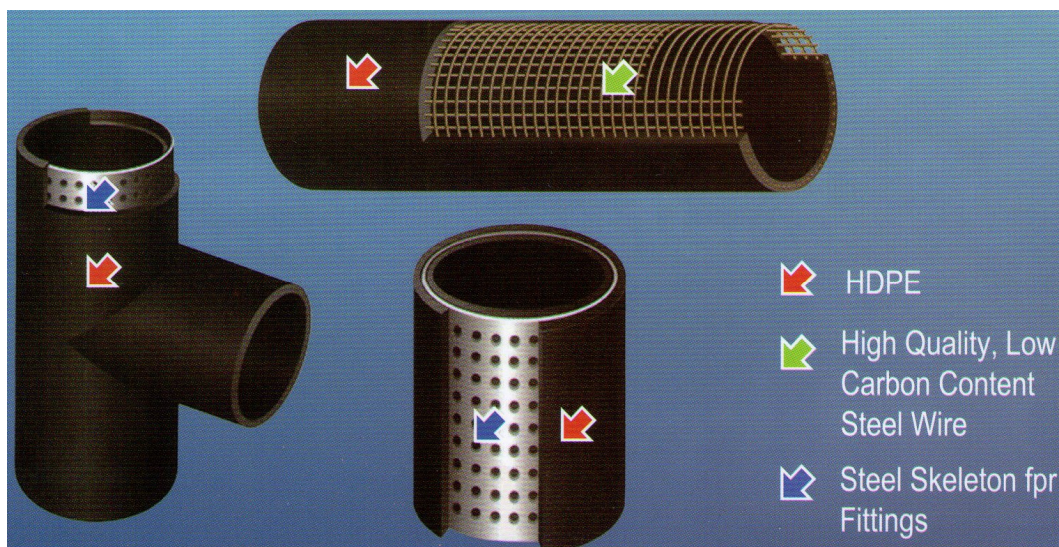
$$3.14 \times 0.4\text{m} \times 0.025\text{m} = 0.03 \text{ m}^2 \text{ for SDR 17}$$

$$3.14 \times 0.4\text{m} \times 0.037\text{m} = 0.05 \text{ m}^2 \text{ for SDR 11}$$

$$3.14 \times 0.4\text{m} \times 0.047\text{m} = 0.06 \text{ m}^2 \text{ for SDR 9}$$

- Steel skeleton fittings

The steel structure of fittings are solid steel skeleton, rather than steel mesh. This skeleton is much stronger than mesh, but it is not flexible.



- Double layer effect

The Electrofusion Coupler and the pipe form a double wall at the connection point.

Generally speaking, the connection point for a normal PE pipe will be 20% weaker than pipe body. However, for Roobuck pipes, the connection point is stronger than pipe body. During our extensive pressure tests, pipe always breaks in pipe body, rather than in connection point. This feature significantly reduces the possibility of leakage and damage to the environment.

TWO: Installation Comparison

1. Pipe weight

The weight is much less than Normal PE pipes. Most pipes can be moved by hand.

2. Weight of welding machine

Our electrofusion welding machine only weighs 20kg. It can be carried by one man, so it is much more convenient. A typical PE pipe welding machine will be many times heavier. A hydrolic station must be in place sometimes.

3. High rising installation

For normal PE pipes, the welding machine needs to be lifted up so installation is difficult. But for Roobuck pipe, the welding machine stays on the ground and you only need to connect electrical wires. This is important for chemical plant pipe or mining pipes.

4. Welding time

The welding time is 10-20 minutes for ID250. Total connecting time is about 30 minutes, generally less than half required for a Normal PE pipe.

For a large size PE pipe, you need a long time to preheat the pipe. For our pipe and welding, no preheat is needed at all.

5. Multi-joint operation

For Normal PE pipes, you can only connect pipes at one point, or maybe two sometimes. You have to wait for complete cooling of the welded joint before moving to the next point. With Roobuck, you only need to hold the welded connection using a simple holding bracket, because the coupler holds the two jointed pipes together. So once the joint is welded, you can immediately move to the next joint.

6. Welding machine operation

A normal PE pipe welding machine is complicated to operate. Too many human factors will affect the result.

Our welding machine is an intelligent machine. It automatically detects the pipe model and will configure to the best parameters. The machine does not have any contact with pipes. You only connect wires to the pipe. It is also easy to monitor the welding progress. The whole welding process is easy to operate.

7. Man power

Because of above features, significant man power is saved and quick installation can be achieved comparing to Normal PE pipes.

8. Fuel consumption

Roobuck pipe installation consumes less power in welding. It even save fuel consumption for generator and crane because there are no heavy jigs to move between butt welds.

9. Welding reliability

A normal PE pipe welding is significantly affected by environment, such as wind and rain. The effects of these factors are much less on our electrofusion welding.

THREE: Cost Comparison

Costs can be saved in almost all respects.

1. Pipe cost

For a project, the basic requirement is media transportation rate.

- You can use a smaller pipe with higher pressure to achieve the specified transportation.
- Even using the same pressure, you can also use a smaller pipe because inside diameter is large and section area is even larger.

2. Installation cost

Installation cost is much lower than normal pipes because of less man power, shorter time, easier transportation because of less weight, and less fuel consumption.

3. Maintenance cost

- Features described in Section One makes Roobuck pipes much more reliable, robust and longer lifetime.
- Steel core provide a good traceability. The pipe can be detected using a metal detector.
- The electrofusion welding is much easier than Normal PE pipe. This makes repairing a simple process.

Cost saving rate is different from project to project. However, savings are possible. Normally, the bigger diameter of the pipe, the more savings. Roobuck pipes are especially suitable for large pipes.