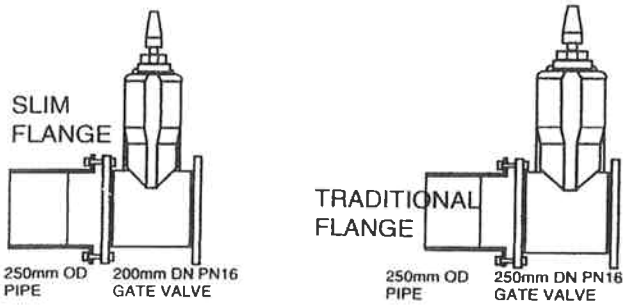
Flanged Joints

With **flanged** joints a problem can sometimes arise when joining PE pipe to iron fittings, as the iron is sized according to its bore, DN, whereas the PE is sized according to its outside diameter, d.

To overcome this problem Plastic Systems offer a ***SlimFlange*** adaptor for use on the PE pipe. This unique design, incorporates a stainless steel reinforcing ring in the PE flange face, allowing the flange shoulder height to be reduced. Thus eliminating the need to upsize an iron valve to fit the PE pipe.



Other ways of achieving a parity in nominal bore include:

- incorporating a PE reducer
- incorporating an iron taper
- using a steel flange adaptor
- using a mechanical flange adaptor

Installation of Flanged Joints

Wherever possible, flange joints should be made before other joints are completed. This helps ensure the flange mating surfaces are in alignment and butted squarely to each other with a maximum separation of 5mm between the flange faces prior to bolting up.

Flanged joints should be made using a single rubber gasket of the correct size. Mating surfaces must be clean and free from contamination and damage. **A jointing compound should not be used**.

The gasket must be centred properly between the two flanges before tightening commences.

Only clean, undamaged nuts and bolts of the correct size should be used, with flat washers at either end, also of the correct size.

Nuts and bolts must be tightened as uniformly as possible in diagonally opposite sequence progressively from a finger tight start, using a torque wrench.

Ideally, final torquing up should be repeated after the assembly has been allowed to relax for an hour or so.

Evenness of tightening is as important as final torque values. The torques shown in the table below are for SDR11 and SDR17.6 pipe, in both PE 80 and PE 100.

Typical bolting torques for standard flanges (PE to Iron)

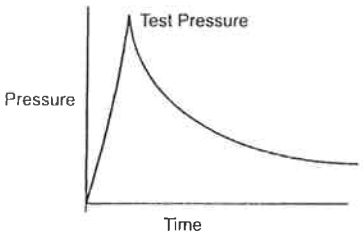
	Standard Flanges			Slim Flanges		
Nominal PE size (mm)	Nominal Iron size (mm)	Bolt Size	Torque (Nm) ±10%	Nominal Iron size (mm)	Bolt Size	Torque (Nm) ± 10%
63	50	M16x4	35		n/a	
90	80	M16x8	35		n/a	
125	100	M16x8	35		n/a	
180	150	M20x8	60		n/a	
200	200	M24x12	80		n/a	
225	200	M24x12	80		n/a	
250	250	M24x12	100	200	M20x12	70
280	250	M24x12	100		n/a	
315	300	M24x12	120	250	*M20x12	70
355	350	M24x16	150	300	M24x12	120
400	400	M27x16	200	350	M24x16	150
450	450	M27x20	250	400	M27x16	200
500	500	M30x20	300	450	M27x20	250
560	600	M33x20		500	M30x20	250

* non standard bolt size

Pressure Testing Water mains

Traditional testing procedures are not suitable for polyethylene pipe systems due to material creep and relaxation properties.

When a polyethylene pipeline is pressured a reduction in pressure occurs (pressure decay) EVEN in a leak free system.



Typical pressure decay curve for an unrestrained PE pipeline

With this in mind, a pressure test procedure has been developed by the UK WRc is described in the next section. This caters for and enables interpretation of the creep and stress relaxation effects.

PE pipe lines may be pressured up to 1.5 times the rated pressure of the pipe, depending on the SDR. In practice, it may only be necessary to test up to 1.5 times the working pressure of the system.

Pressure Test Method

Satisfied of minimal air entrapment, the time taken to reach test pressure is recorded (t_1) and used as a reference.

The pipeline is then isolated and the pressure allowed to decay. The pressure decay readings at predetermined times (multiples of t_1) are recorded.

A correction of t_1 is then used to calculated ratios (N), the values of which indfcate whether or no there is a leak in the system.

As the pressure decay is of exponential form the use of logarithms is necessary when comparing readings but a pocket calculator is all that is required for 'on site' calculations.

PE pipes should be tested in reasonable lengths appropriate to the pipe diameter and site conditions. Pipelines longer then 1000 metres require testing in sections. The pipeline should not be in service when testing, as this may affect the result. Polyethylene pipelines must not be pressure tested unless the wall temperature is kept to below 30°C; this includes open trench situations.

To enable a precise analysis of the pressure test data, pressure transducers with a logging process facility and display should be used.

The following detailed procedure is a slight modification of the one outlined in the WRc Manual for Polyethylene Pipe Systems for Water Supply, dated 1986.

Take a first reading of pressure P_1 at t_1, where t_1 is equal to the pressure loading time t_L.

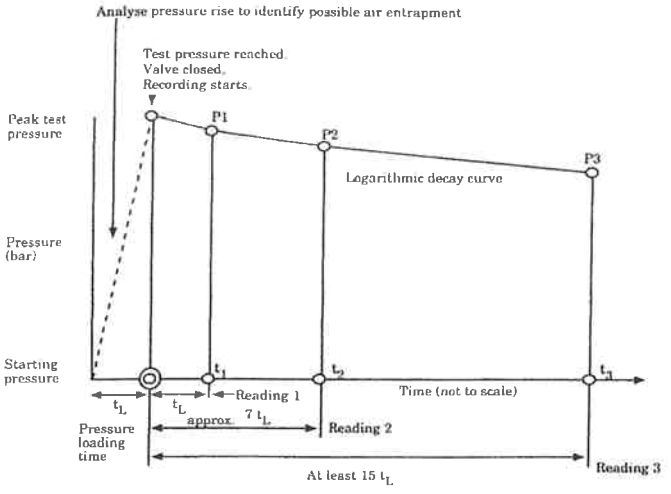
The pipeline begins to relax within the period of pressurisation and so a correction factor has to be applied to allow for this.

Note $t_{1C} = t_1$ corrected $= t_1 + 0.4t_L$

Take a second reading of pressure P_2, at a decay time of approximately $7t_L$ this is time t_2.

Note $t_{2C} = t_2$ corrected $= t_2 + 0.4_{tL}$

$$\textbf{Calculate } N_1 = \frac{\log P_1 - \log P_2}{\log t_{2C} - \log t_{1C}}$$



For a sound main this ratio N_1 should be:

a) 0.08 to 0.10 for pipes without constraint (eg. Sliplined for backfilled)

b) 0.04 to 0.05 for pipes with compacted backfill.

If the values are significantly less than the minimum identified, then there is too great a volume of air in the pipework. This air must be removed before a satisfactory test can be performed.

Retesting of a PE line is significantly more difficult to carry out because the pipe has already stretch due to creep from the pressure originally applied.

It is therefore extremely important to ensure that air is removed prior to testing.

Take a further reading of pressure P_3 at a decay time not less than $15t_L$. Let this time be t_3.

Note $t_{3C} = t_3$ corrected $= t_3 + 0.4_{tL}$

$$\textbf{Calculate } N_2 = \frac{\log P_2 - \log P_3}{\log t_{3C} - \log t_{2C}}$$

The ratio for N_2 should be

a) 0.08 to 0.10 for pipes without soil constraint

b) 0.04 to 0.05 for pipes without compacted backfill.

The sensitivity of the test can be increased by extending the value of t_3.

If at any stage during a pressure test a leak is indicated, check all mechanical fittings before visually inspecting the welded joints. Any leaks should be rectified and the test repeated.

On completion of a test sequence the pressure should be released slowly until the pipeline is under its pre-test conditions.

If a further test is required on the pipeline, this should **NOT** be attempted before sufficient time has elapsed for the pipeline to recover. This recovery time will depend upon individual circumstance but a period equivalent to 5 times the previous test period may be taken as a guide.

Commissioning

The commissioning of new or repaired supply mains is normally carried out in the following sequence:

- Cleaning and/or swabbing of the main
- Filling and sterilisation
- Flushing and/or neutralisation
- Refilling the main and Bacteriological sampling
- Acceptance certification
- Introduction of the main into service

The sequence for PE should include these basic procedures but may be adapted to meet particular conditions (eg. Pre-chlorination of sliplined mains). In all cases the procedures must comply with the requirement of the local Water Undertaking.