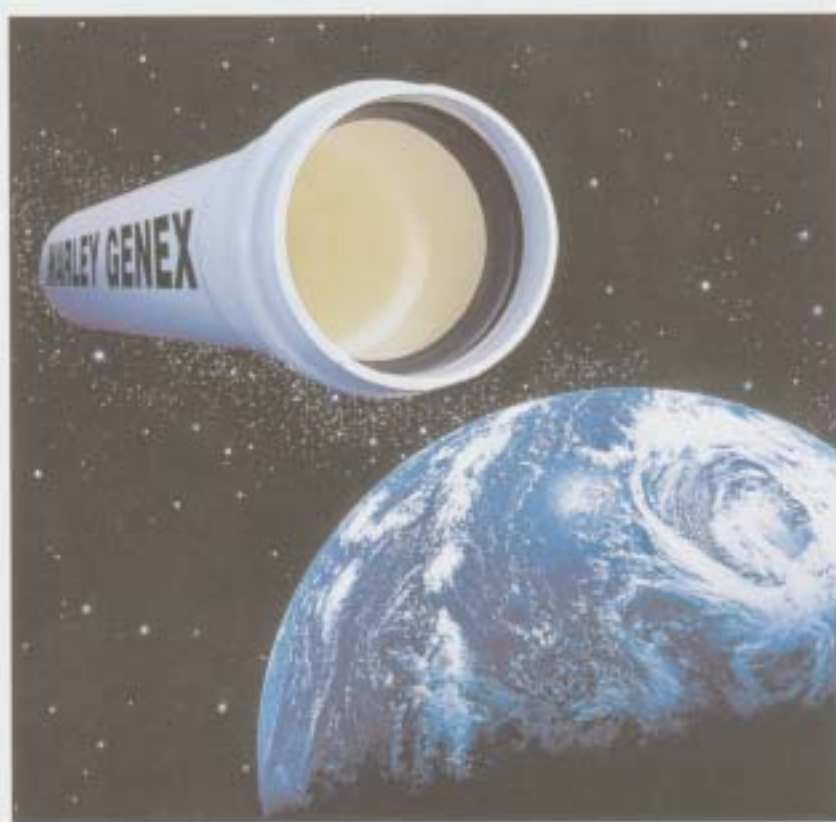


MARLEY **GENEX**

NEXT GENERATION PRESSURE PIPE



MARLEY

Introduction

Marley New Zealand Limited have designed and developed a new pressure pipe specifically for use in water reticulation applications.

This new pipe is an alloy of specially selected grades of polyvinyl chloride (PVC) and modifiers to provide a pipe with the strength of uPVC and the toughness of Polyethylene. This pipe has been named Marley Genex **mPVC** and is categorised as Modified PVC (**mPVC**).

Marley Genex **mPVC** has been developed to produce a pipe that has highly ductile fracture characteristics to provide the specifier with a product that has a superior level of performance.

Modified PVC pipes have been in use for a number of years overseas, specifically in Britain, USA and South Africa. They were initially used in the mining industry to provide a rugged piping system that was safe to use in confined spaces where failure could result in fatalities. The use of **mPVC** in water supply applications is a logical progression to supply a cost effective product that can withstand the rigours of the water industry.

Marley have utilised the latest extrusion technology to produce Marley Genex **mPVC** with specialised die heads to eliminate the weld lines that run through the wall of traditional uPVC pipes. This provides a greater design stress than is possible with conventional tooling.

Benefits

- Increased Flow Ratesrefer 2.1
- Greater Ductilityrefer 2.2
- High Impact Strengthrefer 2.5
- High Corrosion Resistancerefer 2.8
- Crack Propagation Resistancerefer 2.9
- Lightweight
- The Marley Guarantee of Quality and Performance

Product Data

1.1 GENEX WHITE

- to suit AS/NZS 1477 Series 1 dimensioned pipes: Effective 6m length

NOMINAL PIPE SIZE DN	MEAN OD		WALL THICKNESS							
			PN.6		PN.9		PN.12		PN.15	
			T _{min}	T _{max}	T _{min}	T _{max}	T _{min}	T _{max}	T _{min}	T _{max}
100	114.1	114.5	2.0	2.3	2.9	3.2	3.8	4.2	4.7	5.2
125	125.0	125.2	2.4	2.7	3.6	4.0	4.8	5.3	5.8	6.4
150	160.0	160.5	2.7	3.0	4.0	4.4	5.3	5.9	6.6	7.2
175	200.0	200.5	3.4	3.8	5.0	5.6	6.7	7.3	8.3	9.1
200	225.0	225.6	3.8	4.2	5.7	6.3	7.5	8.2	9.3	10.2
225	250.0	250.7	4.2	4.7	6.3	6.9	8.3	9.2	10.3	11.3
250	280.0	280.4	4.7	5.3	7.0	7.8	9.3	10.3	11.5	12.6
300	315.0	315.9	5.3	5.9	7.9	8.7	10.5	11.5	13.0	14.3
375	400.0	401.1	6.8	7.5	10.1	11.1	13.3	14.7	16.5	18.2

1.2 GENEX BLUE

- to suit AS/NZS 1477 Series 2 dimensioned pipes: Effective 6m length

NOMINAL PIPE SIZE OD	MEAN OD		WALL THICKNESS					
			PN.12		PN.15*		PN.20*	
			T _{min}	T _{max}	T _{min}	T _{max}	T _{min}	T _{max}
100	121.7	122.1	4.1	4.6	5.4	6.0	6.6	7.3
150	177.1	177.6	5.9	6.5	7.8	8.6	9.6	10.6
200	231.9	232.6	7.7	8.5	10.2	11.3	12.6	13.9

*Non stock item, minimum order quantities apply.

1.3 PIPE PRESSURE CLASS

The specified hydrostatic working pressure at 20°C of the various pressure classes of pipe is as follows:

CLASS	WORKING PRESSURE	WITNESS MARK COLOUR
PN 6	600kPa, 60m head 87 psi	Red
PN 9	900kPa, 90m head 129 psi	Blue
PN 12	1200 kPa, 120m head 173 psi	Green
PN 15	1500 kPa, 150m head 217 psi	Brown
PN 20	2000 kPa, 200m head 288 psi	Yellow

Performance

2.1 FLOW RATES

Marley Genex **mPVC** provides better hydraulic performance than standard uPVC pipes because of its higher SDR (SDR is the ratio of wall thickness to O.D. of pipe). This means that greater flow rates can be achieved with Marley Genex **mPVC** compared with the equivalent size and Class in standard uPVC due to increased clear bore.

The use of new die head technology provides a pipe with a smoother bore resulting in less turbulence and better flow.

A flow chart is provided on page 7 to assist the designer in selecting the most appropriate diameter pipe for the application.

These charts have been formulated using the mean bore of the pipes across the full range of sizes and classes with the pipes running full at a temperature of 13°C

2.2 TOUGHNESS

Marley Genex **mPVC** pipe shows very high levels of toughness. Point loading from notches or bedding is distributed by the ductile nature of the alloy, spreading the load and minimising concentrated local stresses. This is demonstrated by point loading the pipe with a rock. The pipe adopts the contour of the rock spreading the load and minimising any localised stress.



A fracture toughness test is carried out on a C-fling with a notch cut into it. This ring is then loaded until it breaks at the notch and the break is examined. In all instances Marley Genex **mPVC** will exhibit hinging and shears in a tough ductile manner.



The toughness is also clearly demonstrated with the tensile test where notched samples are loaded until failure. A large plastic zone is generated and causes the initial crack to become blunt preventing any further embrittlement.



Performance

2.3 HOOP STRENGTH

Marley New Zealand Limited has been able to develop an alloy that provides an **mPVC** pipe with a hydrostatic design strength similar to that of uPVC whilst significantly improving the toughness.

This strength provides the pressure resistance and the excellent impact and notch resistance.

2.4 PRESSURE TESTING

An extensive pressure testing programme has been undertaken in order to confirm the long term pressure resistance of Marley Genex **mPVC**. This programme ensures that the pipe material is subjected to a full range of hydrostatic stresses so that the long term working life of the pipe can be assured. One of the requirements is that, when testing Marley Genex **mPVC** pipe to destruction, it will always exhibit swelling/bulging prior to leaking demonstrating its ductility.

This pressure testing has been carried out to ensure the HDS is as Marley engineers had designed and the pipe performance was totally predictable.

The use of the new die technology has resulted in a significant 4.5% improvement in the 50 year design stress of the piping system when compared to product run using conventional die technology.

2.5 IMPACT STRENGTH

Marley Genex **mPVC** pipe shows extraordinary impact resistance when tested with a falling mass which is the standard method for testing uPVC pipes. Marley Genex **mPVC** pipe will not shatter when a minimum mass of 15kg is dropped from 20 metres subjecting the pipe to an impact force of at least 3000 joules. The impact striker merely penetrates the top surface of the pipe confirming the pipe's great toughness and ductility.

Conventional uPVC pipes are tested by dropping a mass with a 25mm diameter striker from a height of 2 metres. The mass varies according to the diameter of the pipe and ranges from a force of 54 joules to 147 joules which is 20 times less than that used for Marley Genex **mPVC** pipe.



Performance

2.6 TEMPERATURE

Marley Genex **mPVC** pipe behaves in a similar manner to other plastic piping systems when subjected to different temperatures. It is suitable for use at low temperatures and at temperatures up to 50°C. When used at temperatures above 20°C it should be derated in accordance with standard industry practice i.e. for each 10°C rise in temperature the next highest pressure Class should be used. For example for a line with a working pressure of 6 bar running at 30°C a Class 9 pipe should be selected.

2.7 FATIGUE

The high ductility alloy used in the manufacture of Marley Genex **mPVC** means that the pipe system will more readily withstand fluctuations in pressure, in the form of surges from valve shut off, demand usage and highway loads induced by heavy vehicles, than standard uPVC pipe.

2.8 CHEMICAL RESISTANCE

Marley Genex **mPVC** is designed for use in the conveyance of potable water and most industrial pumping applications. It has excellent resistance to naturally occurring aggressive environments and can be used in any situation where uPVC is deemed to be acceptable.

Marley Genex **mPVC** is non-metallic and is resistant to all forms of metallic corrosion and is resistant to almost all types of chemical or electro-chemical corrosion. Aggressive waters including low hardness waters and those resulting from high sulphate soils will not effect Marley Genex **mPVC**.

For more detailed information contact Marley New Zealand Ltd.

2.9 NOTCH SENSITIVITY

The reduced notch sensitivity of Marley Genex **mPVC** is one of its major advantages over standard uPVC pipe. The inclusion of modifiers changes the basic material characteristic from being one of a strong brittle material to an alloy which is both strong and ductile. This ductility dramatically reduces the notch sensitivity of the material so that any induced failure is always in a ductile mode.

One of the main advantages is that the pipe is less susceptible to failure when subjected to notching or scratching due to poor handling, installation or poor service control in applying varying pressures.

2.10 STANDARDS

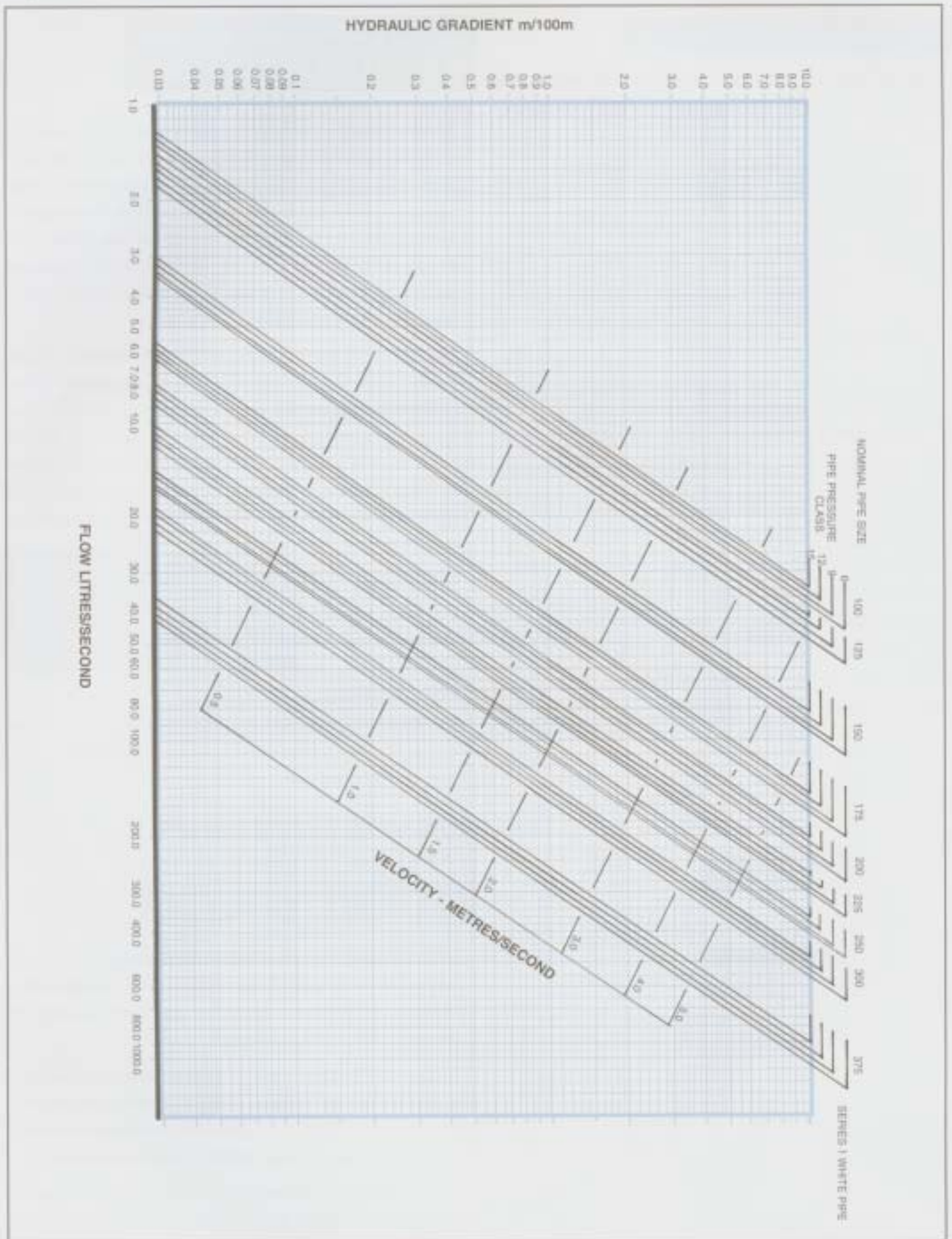
Marley Genex **mPVC** is manufactured to comply with the following Standards:

- PINZ Industry mPVC Pressure Pipe Product Standard
- North West Water Specification No. NWW 1.1 mPVC Pipes
- SABS mPVC Draft Standard mPVC Pipes

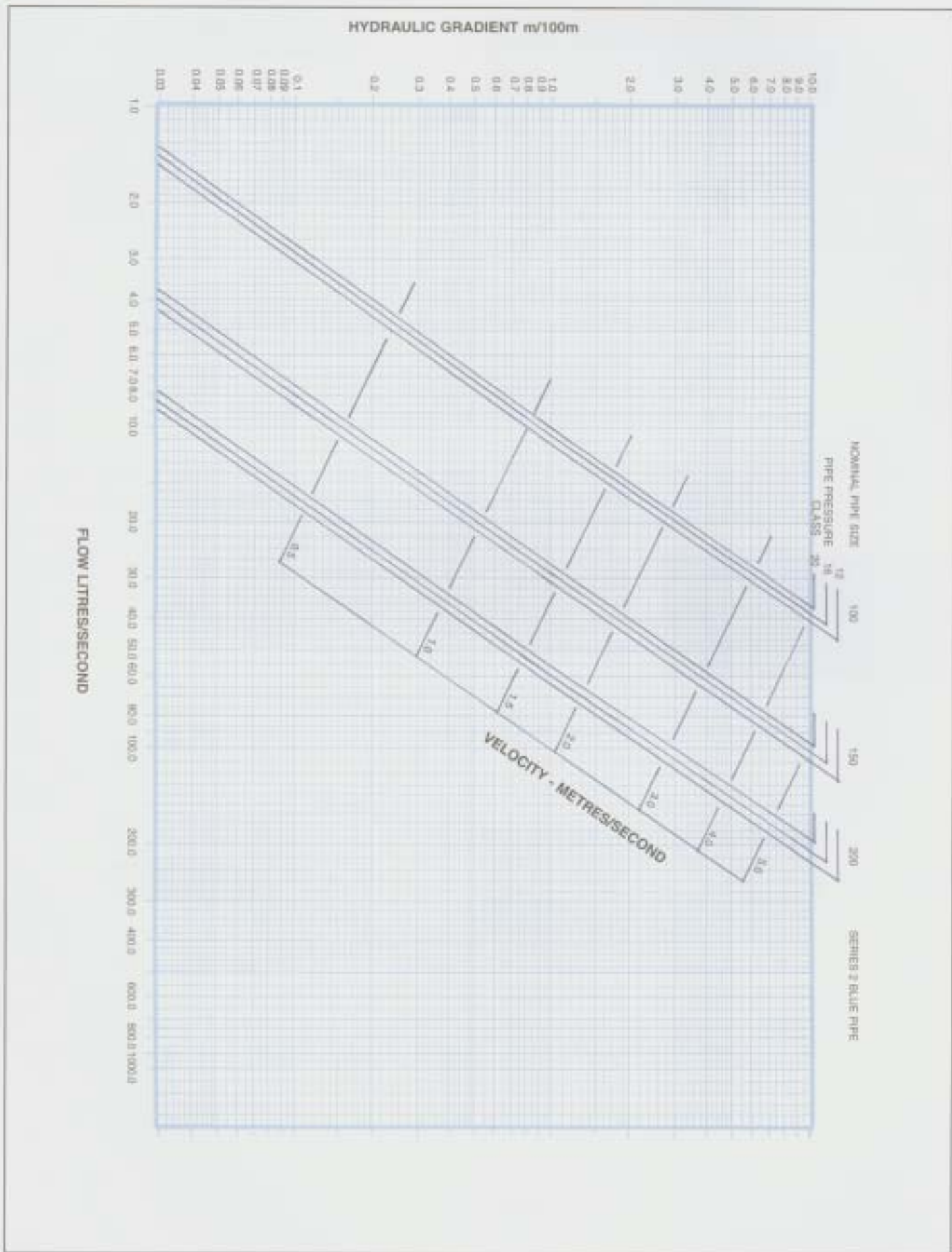
The PINZ Industry Product Standard has been developed by James Hardie Pipelines and Marley New Zealand Limited and is based on the NWW and SABS standards. It has been developed to ensure consistency in quality and performance of the pipe and will be submitted to Standards New Zealand for adoption as a joint AS/NZS Standard.

Marley New Zealand are a Registered Supplier (No 638) to ISO9002 under the Telarc Registered Supplier Scheme and also operate a Telarc Registered Testing Laboratory Reg No. 92.

Flow Chart



Flow Chart



Installation

3.1 STORAGE

Pipes are supplied in timber crates. Pipes should be stored in these crates until ready for use. Maximum height of stack for crated pipes is 2m.

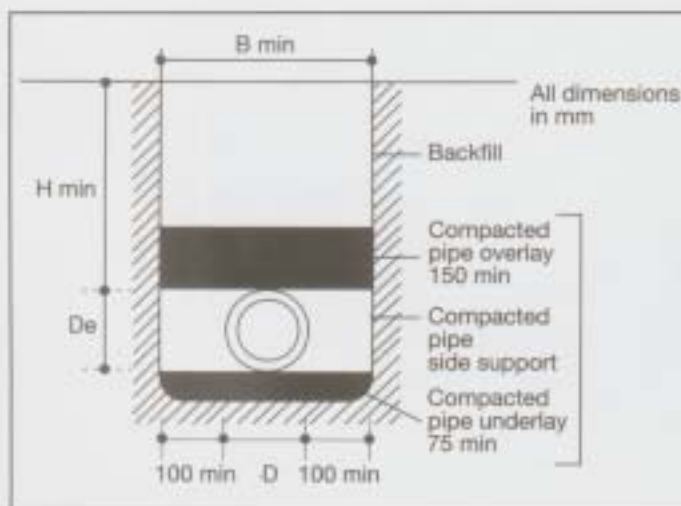
NOMINAL DIAMETER	PIPES/PACK
100	36
125	22
150	18
175	18
200	10
250	8
300	6
375	4

Decrated or loose pipes stacked on site should be as follows:

Horizontal supports of about 75mm wide should be spaced not more than 1.5m centre to centre beneath the pipes to provide even support.

Vertical side support should also be provided at intervals of 3m along rectangular pipe stacks.

If it is planned to store pipes in direct sunlight for a period in excess of 6 months, then the pipes should be covered with material such as hessian. Coverings such as black plastics must not be used as these can greatly increase temperatures within the stack.



3.2 TRENCH EXCAVATION AND BED PREPARATION

The trench should not be excavated too far in advance of pipelaying and should be backfilled as soon as possible. The width of the trench will be governed by the installation compaction requirements and the standard excavator bucket size should be no wider than needed to meet NZS 7643. The bed width should not be less than 200mm wider than the outside diameter of the pipe. The trench should be excavated deep enough to allow for the specified grade, the required depth of underlay and the minimum cover.

The pipe underlay should be placed and graded to invert level, but not compacted other than by foot pressure. The underlay forms a cushion into which the pipe can bed, and aids effective haunch support. If the natural material of the trench is not suitable for this purpose, then the trench should be excavated to 75mm below pipe invert level to allow for the pipe underlay. In conditions where the trench bottom is wet, soft or irregular, it may be necessary to first stabilise, fill and level, and compact the base.

MINIMUM COVER OVER PIPE (DIMENSION H)

- Not subject to vehicular loading 300mm
- Subject to vehicular loading
 - Not in roadways, driveways or similar 450mm
- Under sealed roadways 600mm
- Under unsealed roadways 750mm
- Pipes in embankment conditions or subject to construction equipment loading 750mm

3.3 PLACEMENT OF PIPE SIDE SUPPORT AND OVERLAY

This procedure requires provision be made for testing the integrity of the pipe and fittings system. The pipe side support and overlay material should be just sufficient to restrain the pipes. Joints should be left uncovered for inspection and testing.

The pipe sidefill material should be placed evenly on both sides of the pipeline to two thirds the height of the pipe diameter and compacted by hand tamping. Sidefill material should be worked under the sides of the pipe to minimise voids and provide maximum pipe haunching.

The pipe overlay material should be levelled and compacted in layers, to a minimum height of 150mm above the crown of the pipe, or as specified.

Installation con't

Backfill material should be placed on the pipe overlay and compacted as specified but generally not in layers in excess of 300mm. Complete backfilling operation to finished surface levels.

3.4 NOTES ON JOINTING

- Marley Genex **mPVC** is available with a rubber ring joint in all sizes and solvent cement joint in sizes DN100 - DN200.
- The rubber rings used in Marley Genex **mPVC** "Blue" DICI compatible pressure pipe are identical to that used in Marley Super Blue.
- Pipes may be jointed out of the trench but it is preferable that connections be made in the trench to prevent possible "pulling" of the joint.
- Always joint the pipe in a straight line and then lay to a curve if required.
- If a pipe is homed too far, it may be withdrawn immediately, but once the lubricant is dry (which takes only a few minutes in hot weather) mechanical aids are required to pull the joint apart. If excessive force is required to make a joint, this may mean that the rubber ring has been displaced. To check the placement of the ring without having to dismantle the joint a feeler gauge can be inserted between the socket and pipe to check even placement of the ring. Marley Genex **mPVC** pipe can be inserted into the standard socket of a Ductile Iron pipe. Ductile Iron pipe spigot should not be inserted into a Marley Genex **mPVC** pipe socket. Ductile Iron and Marley Genex **mPVC** pipes are manufactured to different tolerances. The wider tolerance of Ductile Iron pipes may adversely affect the joint integrity if a Marley Genex **mPVC** socket is damaged by a dimensionally incompatible Ductile Iron pipe spigot. Restrain the socket end of the line so that previously jointed pipes are prevented from closing up.

Important: Pipe joints must not be pushed home to the bottom of the socket. They must go no further than the witness mark. This is to allow for possible expansion of the pipe. Inspect each joint to ensure that the witness mark is just visible at the face of each socket.

3.5 JOINTING SEQUENCE

(a) Marley Genex **mPVC** pipes are supplied with the rubber ring inserted. Before laying, remove rubber ring. Clean the socket especially the ring groove. Do not use a rag with lubricant on it.



Check the spigot end, if cut in the field, has a chamfer of approximately 12° to 15°. When pipe is cut, a witness mark should be pencilled in and care should be taken to mark the correct position to allow for 10mm expansion.

(b) Insert the rubber ring into the groove with the flap on the ring facing inward. The rubber ring is correctly fitted when the thickest cross section of the ring is positioned towards the outside of the socket and the groove in the rubber ring is positioned inside the socket. Run your finger around the lead-in angle of the rubber ring to check that it is correctly seated, not twisted and that it is evenly distributed around the ring groove.



(c) Apply the lubricant to the spigot and keep the rubber ring and ring groove free of jointing lubricant until the joint is actually being made.



(d) Align the spigot with the socket and apply a firm even thrust to push the spigot into the socket. It is possible to join 100mm and 150mm diameter pipes by hand, larger sizes will require a crowbar and a block of wood.



Installation con't

3.6 CUTTING

During manufacture pipes are cut to standard length by cut-off saws. These saws have carbide-tipped circular blades which produce a neat cut without burrs.

Pipes may be cut on site with a variety of cutting tools. These are:

1. Propriety cutting tools. These tools can cut, deburr and chamfer the pipe in one operation. They are the best tools for cutting pipe.
2. A portable electric circular saw with cut-off wheel. This is quick and easy to use and produces a neat clean cut requiring little deburring. It does, however require a power supply and the operator has to be skilled in using it to produce a square cut.
3. A hand saw and mitre box. This saw produces a square cut but requires more deburring. It takes comparatively more time and effort and requires a stand.

The use of roller cutters is not recommended.

Note: If the cut pipe end is not square, uneven pressure on the ring may cause difficulty in jointing.

3.7 CHAMFERING

As Marley Genex mPVC pipes are only available in rubber ring joint, a chamfer is required.

Special chamfering tools are available for this purpose, but in the absence of this equipment a body file can be used provided it does not leave any sharp edges which may cut the rubber ring. Do not make an excessively sharp edge at the rim of the bore and do not chip or break this edge. The chamfer angle should be 12° to 15° and a witness mark should be drawn at the appropriate distance from the end of the spigot.

3.8 JOINTING FITTINGS

Marley Genex mPVC "blue" may be jointed to cast iron fittings to Australian Standard AS 2280 (DICI) and AS 2544 (Cast Iron). In the event the appropriate sealing ring and jointing procedure recommended by the manufacturer of the fitting should be used.

Pipes must be inserted the full depth of engagement available on the cast iron fitting socket. To ensure full insertion, check the depth of the fitting socket and mark this length on the spigot of the pipe with an indelible marking pen.

3.9 JOINTING LUBRICATION

Marley jointing lubricant can be supplied with the pipe and is an especially formulated organic preparation for easy jointing of Marley Genex mPVC.

The use of petroleum based greases or other substitutes may affect the ring or potability of the water supply and cannot be recommended.

The approximate number of joints that may be jointed with one litre is as follows:

NOMINAL SIZE mm	NUMBER OF JOINTS/LITRE
100	100
125	80
150	60
175	55
200	50
225	45
250	40
300	30
375	25

Installation con't

3.10 INSTALLING PIPES ON A CURVE

Marley Genex **mPVC** pipes are sufficiently flexible to allow bending around a curve alignment or around obstacles. The same property enables the pipes to absorb subsidence and other earth movements.

Significant bending moments should not be exerted on the joints, since the spigot and socket that may be detrimental to long term performance. To avoid this, the joints in curved lines must be thoroughly supported by compacted soil, with the bending occurring primarily at the centre of each pipe.

When installing pipes on a curve, the pipe should be jointed straight and then laid to a curve. The minimum bending radius of Marley Genex **mPVC** is 300 times the diameter.

NOMINAL SIZE mm	MINIMUM RADIUS (m)
100	30
125	37.5
150	45
175	52.5
200	60
225	67
250	75
300	90
375	112
450	135

3.11 TAPPING

Only tapping saddles designed for use with **uPVC** pipe should be used. These saddles should:

- be contoured to fit around the pipe and not have lugs or sharp edges that dig in.
- have a positive stop to avoid overtightening of the saddle around the pipe.

The maximum hole size that should be drilled in a **uPVC** pipe for tapping purposes is 50mm or 1/3 the pipe diameter, whichever is smaller.

This does not prevent the connection of larger branch lines via tapping saddles, provided the hydraulic loss through the restricted hole size is acceptable.

For larger branches, generally a tee is preferred.

Holes should not be drilled into **mPVC** pipe:

- Less than 300mm from end of spigot end
- Closer than 450mm to another hole on a common parallel line
- Holes should be drilled using a hole cutting saw or twist bit, a flat spade bit is not suitable for drilling through Marley Genex **mPVC**.

3.12 FLUSHING

For newly installed water mains, no special flushing is required. Marley Genex **mPVC** pipes comply with Australian Standards for health authority requirements for extractable substances in drinking water.

3.13 TESTING AND COMMISSIONING

All new lines should be tested in accordance with Marley testing procedures. For general guidance pipelines may be tested as a whole or in sections, depending on the diameter and length of the pipe, the spacing between sectioning valves or blank ends and the availability of water.

Pipelines should be bedded and backfilled, but with the joints left uncovered for inspection before and after testing.

All thrust supports for fittings and valves must be finished and the concrete properly cured (the minimum time is seven days). Blank ends installed temporarily should be adequately supported to take the pressure thrust.

Fill the pipeline with water and remove air from the system as far as possible. Pressurise the system. Additional water will be required to bring the line up to pressure because the pipe expands slightly.

For example, to reach 1.2 times working pressure requires about 1% additional volume. After reaching test pressure, note the drop in pressure over time. It is normal for a pressure drop to occur as the remaining air goes into solution, and some further expansion of the pipe (around 0.1%) will also occur.

The expansion due to a temperature rise of 1°C will decrease the pressure by about 3.4 KPa. Re-pressurise and again note the drop in pressure over the same time period. A reduction in the Pressure test indicates a satisfactory test. A similar pressure drop may indicate a satisfactory test or a leak. It may be necessary to repeat the procedure several times to be sure.

NZS 7643 recommends that the test pressure should be held for a minimum period of 15 minutes.

THE MARLEY GUARANTEE OF QUALITY AND PERFORMANCE

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