

Modified PVC Pressure Pipes

Continuous effort into the research of the properties of PVC pipe has led to the development of Modified PVC-M pipe, which achieve the optimum combination of strength and ductility.

WHAT IS MODIFIED PVC?

Modified PVC pipe is similar in composition to the traditional PVC pressure pipe that has been used in Australia for over thirty years.

The difference is that an impact modifier has been added to alter the fracture mechanism, so the material behaves in a more predictable, ductile manner. In addition, the processing conditions are optimised so that the full benefit of the modifier is achieved.

The important aspect of PVC-M pipes is the formulation and processing conditions are such that the optimum combination of strength and ductility is achieved.

HISTORY

The first impact modifiers for PVC were developed in the 1950's and have generally been used where their effect on toughness is the prime concern.

That is, where sacrifice in strength has been acceptable in order to achieve a high level of toughness. Such applications include house siding and window frames. There have also been a number of pipe applications including gas pipes in Australian and Holland, and mining pipes in Sough Africa. In these applications extreme levels of toughness are required and some reduction in strength has been tolerated.

More recently, it was recognised in the UK and Sough Africa, that a combination of high strength and enhanced toughness could be achieved by optimising the processing conditions and the addition of the modifier.

Pipes manufactured on this basis were introduced to the UK water industry about 10 years ago and to Sough Africa shortly after. PVC-M pipes were first produced in New Zealand in 1996 and have been used in Australia since 1997.

CHARACTERISTICS OF PVC-M PIPES

As mentioned above, the important aspect of PVC-M pipes is to achieve a combination of high strength and toughness. The strength is measured primarily by pressure testing short lengths of pipe. The toughness is assessed by several methods.

Firstly, pipes are routinely subjected to a high velocity impact by dropping masses onto the pipe from a height of 20m. Satisfactory pipe will suffer a ductile puncture under impact, whilst unsatisfactory pipe will fail in a brittle manner.

Secondly, pipe samples are pressure tested with sharp, longitudinal notches cut in to the outside surface. Tough pipes will only suffer a reduction in strength due to the removal of wall thickness, not to the geometry of the notch. That is, the pipes have to show no sign of notch sensitivity.

Finally, there is a test to assess both the strength and ductility at the same time. This is a notched C-ring test that provides a measure of the yield strength and absence of notch sensitivity.

INCREASED HYDRALIC CAPACITY

PVC-M pipes are manufactured with a thinner wall than traditional PVC because of their enhanced toughness and predictability. This means the bore is larger and flow rate is enhanced. Depending on the pipe class an increase of up to 15% is possible.

PUBLISHED SPECIFICATIONS

PVC-M pipes were first supplied in the UK to a North West Water Specification. More recently, the British Standards Institute published a Product Appraisal Specification.

In South Africa, the first specification was published under the Joint Acceptance Scheme for Water Installation Components. This has been followed by a national Standard published by the South African Bureau of Standards

AUSTRALIAN STANDARDS

The Australian New Zealand Standard AS/NZS Int for modified PVC (PVC-M) for pressure applications has just been published. The Standard covers pipes in sizes DN100 to DN600 in series 1 and series 2 dimensions. The Standard has been in preparation for over two years and is similar in many respects to specifications published in the United Kingdom and South Africa.

The modified PVC Standard is similar to the PVC pipe Standard AS/NZS 1477 in both format and many of the requirements. However, PVC-M pipes are subjected to a range of additional tests aimed at proving their toughness.

More information about performance and availability of PVC-M pipes can be obtained from PIPA members.

PIPA wishes to acknowledge and thank all our Technical Committee members and Industry Consultants for their contribution, expertise, and assistance in the development of this technical document.

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