AS 2200—1978

Australian Standard®

Design charts for water supply and sewerage

The following scientific, industrial and governmental organizations and departments were officially represented on the committee entrusted with the preparation of this standard:

City Councils
Commission of Public Health, Victoria
Confederation of Australian Industry
Consulting Engineers
Department of Construction
Department of Local Government, Qld
Department of Public Works, N.S.W.
Institute of Plumbing Australia
Institution of Engineers, Australia
Master Plumbers and Sanitary Engineers Association
Royal Australian Institute of Architects
SAA Plastics Standards Board
University of New South Wales
Victorian Railways
Water Supply, Sewerage and Drainage Authorities

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PREFACE

This standard was prepared by the Water Supply Sewerage and Drainage Standards Board following discussion between representatives of the Metric Conversion Board and of the Standards Association of Australia.

The Department of Construction gathered, coordinated and edited material submitted by major water supply and sewerage authorities in Australia and prepared all committee drafts leading up to publication of this standard.

The Association acknowledges with gratitude the work done by the Department of Construction and by the many Australian authorities which provided material for consideration and inclusion in this standard.

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FOREWORD

The pipe-flow charts in this standard are based on the Manning formula, the Hazen and Williams formula, or the Colebrook-White formula. These three formulas were chosen as they represent those most commonly used for pipeline design in Australia. Designers will need to make their own choice as to which formula they wish to adopt.

The three formulas are as follows:

(a) *Manning:*

$$V = \frac{1}{n} R^{0.67} S^{0.5}$$

(b) *Hazen and Williams:*

$$V = 0.849\ C\ R^{0.63} S^{0.54}$$

(c) *Colebrook-White:*

$$V = -\sqrt{32gRS \log\left[\frac{k}{14.8R} + \frac{1.255\nu}{R\sqrt{32gRS}}\right]}$$

where

n = Manning roughness coefficient

C = Hazen and Williams roughness coefficient

k = Colebrook-White roughness coefficient, in metres

V = velocity

R = hydraulic radius, in metres

S = slope, in metres per metre

g = gravitational acceleration, in metres per second squared

ν = kinematic viscosity of water, in square metres per second.

It is intended that the charts will give designers a reasonably accurate basis for design of pipe systems. However, it must be realized that the formulas on which they are based may have limitations on the range of velocities, diameters and roughness coefficients to be used. They may be inaccurate where the parameters used are outside the conditions upon which the formulas were originally based. A guide to roughness coefficients for various pipe materials is given in Table 1.

Some hydraulic text books report that the Hazen and Williams formula may not be entirely suitable for diameters less than 50 mm or velocities greater than 3 m/s. It is also stated that the formula is not entirely accurate for values of C substantially less than 100.

The Manning formula applies to about the same flow range as the Hazen and Williams formula. It may be more useful than the Hazen and Williams formula in cases where the value of C is well below 100. However, its use is now diminishing in favour of the more reliable Hazen and Williams and Colebrook-White formulas.

The most recent formula to be devised is that by Colebrook-White which has only lately been presented in graphical form. It is regarded by many hydraulicians throughout the world as the most accurate basis for hydraulic design. It has had ample experimentation confirmation over wide conditions of flow.

The Colebrook-White charts have been drawn for a water temperature of 20°C. Although the temperature of water and sewage varies between seasons and also between localities, 20°C is considered to be a suitable mean value for Australian conditions. A temperature correction table has not been included because the increase or decrease in discharge due to temperature variations is small. In fact an increase or decrease in temperature of 10°C will vary the discharge by only about 3 percent.

Diameters given on the various charts represent internal diameters of pipes. Designers should therefore ensure that, when using the charts, actual internal diameters are applied, and not the ‘nominal size’ from the various Australian standards for pipes.

Examples in the use of the Colebrook-White formula charts are given in Appendix A, and an example in the use of Chart 19, Guide to Resistance Coefficients of Valves and Fittings for Fluid Flows, is given in Appendix B. For some other charts, an example is given below the chart.