

DPCalc - Flow Element Sizing Software

- Designed for use with Windows® 95, 98, and NT
- Calculations to BS EN ISO 5167:1 and BS 1042 1.2
- Orifice Plates, Flow Nozzles and Venturis
- A.I.Ch.E. Fluid Property Data for over 70 common fluids
- ASME 1967 Steam Density Tables
- Solve for Orifice/Throat Diameter, Flow or Differential Pressure
- Comprehensive Selection of Units of Measurements

General Description

DPCalc is a true 32-bit Windows solution to differential pressure flow metering calculations. Based on the latest revision of BS EN ISO 5167:1, DPCalc allows the user to accurately calculate orifice diameter, flow rate or differential pressure.

Ease of use is enhanced by a built in database of fluid properties for over 80 common fluids, saving a great deal of time and effort in calculating or looking up values in tables. Internal pipe tables are included enabling internal diameter to be calculated from nominal bore and schedule. Calculation of expansion coefficients for many common pipe and flow element materials is also included.

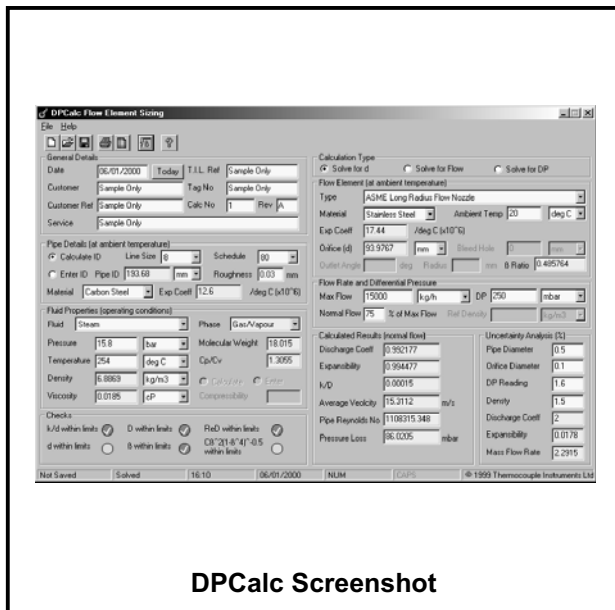
For each variable, an extensive list of metric and imperial units of measurement is available.

Calculated results include unrecovered pressure loss, an uncertainty analysis, and a series of checks to ensure conformance with the requirements of BS EN ISO 5167:1.

Results can be printed to any Windows printer, or saved to disk for future reference.

System Requirements

- PC with a 486/66 MHz or higher processor: Pentium Recommended
- Microsoft Windows 95 or later operating system or Microsoft Windows NT Workstation operating system version 4.0 or higher
- 16 MB RAM / 10 MB Hard Disk Space (Maximum)
- CD ROM Drive
- SVGA Monitor (800 x 600 resolution, 256 colours)
- Mouse or other pointing device



DPCalc Screenshot

Printing

Results may be printed on any Windows printer, on A4 paper. A sample of the printed page is shown below.

Thermocouple Instruments Limited		Flow Element Sizing Calculation	
		In accordance with BS EN ISO 5167-1 and BS 1042 1.2	
GENERAL DETAILS			
Date	08/01/2000	Thermocouple Ref	Sample Only
Customer Name	Sample Only	Calculation Number	1 Rev 0
Customer Ref	Sample Only	Tag Number	Sample Only
Service	Sample Only		
PIPE DETAILS (AT AMBIENT TEMPERATURE)			
Nominal Line Size	6	Exact Pipe ID	146.34 mm
Schedule	80	Surface Roughness	0.03 mm
Pipe Material	Chrome-Moly	Coefficient of Expansion	12.62 E-06 /deg C
FLOW ELEMENT DETAILS			
Element Type	ISA 1932 Flow Nozzle		
Element Material	Stainless Steel	Coefficient of Expansion	17.45 E-06 /deg C
Ambient Temperature	20 deg C	Bleed Hole Diameter	0 mm
B Ratio	0.589334	Orifice/Throat Diameter	86.1444 mm
Outlet Angle	N/A	Radius	N/A
FLOW RATE AND DIFFERENTIAL PRESSURE			
Meter Max Flow Rate	12500 kg/h	Normal Flow Rate	9375 kg/h
Differential Pressure	250 mbar	Reference Density	N/A
PROCESS CONDITIONS			
Fluid Name	Steam	Fluid State	Gas/Vapour
Operating Pressure	14.5 barg	Operating Temperature	258 deg C
Operating Density	6.6898 kg/m3	Operating Viscosity	0.0186 cP
Isentropic Exponent	1.305	Molecular Weight	18.015
Compressibility	N/A		
CALCULATED RESULTS (AT NORMAL FLOW RATE)			
Discharge Coefficient	0.963927	Expansibility Coefficient	0.993835
Relative Roughness	0.0002	Average Velocity	23.0056 m/s
Pipe Reynolds Number	1211844.377	Pressure Loss	66.6321 mbar
UNCERTAINTY ANALYSIS			
Pipe Diameter	0.5 %	Orifice Diameter	0.1 %
DP Reading	1.6 %	Density	1.5 %
Discharge Coefficient	0.8 %	Expansibility Coefficient	0.0181 %
Mass Flow Rate	1.3832 %		
ERROR MESSAGES			
No errors to report			
<small>Thermocouple Instruments Limited, Pentwyn, Cardiff, CF23 7XJ, U.K. Tel 029 20734121 Fax 029 20734049 E-mail thermocouple@thermocouple.co.uk Internet www.thermocouple.co.uk Calculation produced by DPCalc® Version 1.0.0. DPCalc® software is a product of Thermocouple Instruments Limited, Cardiff, UK</small>			

Supported Flow Elements

The following flow measuring primary elements are supported in DPCalc:-

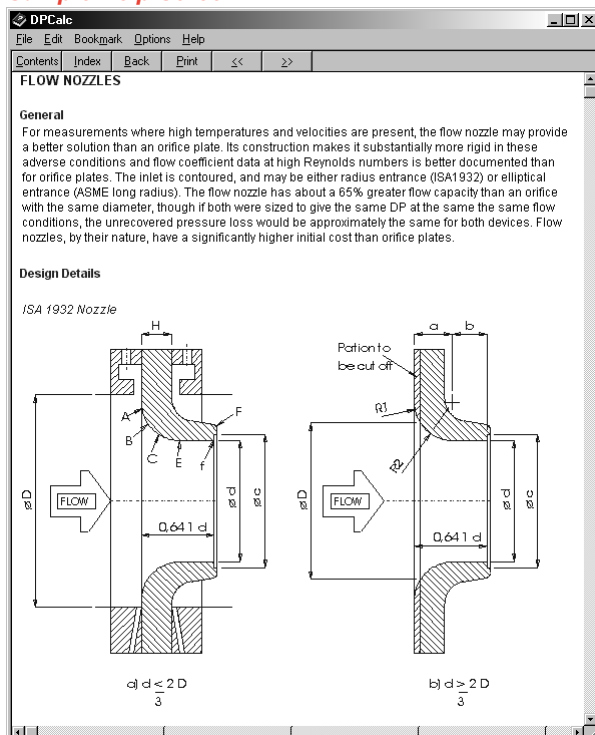
- Orifice Plate, Flange Tappings
- Orifice Plate, Corner Tappings
- Orifice Plate, D & D/2 Tappings
- ISA 1932 Flow Nozzle
- ASME Long Radius Flow Nozzle
- Venturi, Machined Convergent Section
- Venturi, As Cast Convergent Section
- Venturi, Fabricated Convergent Section
- Venturi Nozzle
- Quarter Circle Orifice Plate
- Conical Entrance Orifice Plate
- Eccentric Orifice Plate
- Orifice Plate, 25mm -50mm Lines

Note the Restriction Orifice Plates are not included (as the calculation method is not described by BS EN ISO 5167:1). Thermocouple Instruments Ltd offers a separate program for this, ROCalc (please refer to the relevant data sheet).

On-Line Help

On line help is extensive and informative, providing assistance both in the use of the software and in the selection of the correct flow element for the application.

Sample Help Screen



Fluid Property Data

For many common fluids the following fluid properties can be computed, given the operating temperature and pressure:-

- Density
- Viscosity
- Molecular Weight (gases/vapours only)
- Compressibility (gases/vapours only)
- Isentropic Exponent (gases/vapours only)

Values are computed in accordance with formulae presented by the A.I.Ch.E. (Note that steam density is calculated using the ASME 1967 formulation).

At pressures and temperatures where data cannot be calculated, DPCalc's comprehensive error handling facility informs the user of the problem, and suggests solutions where possible.

For fluids not in the database, 'Liquid' or 'Gas' can be selected, and values of fluid properties entered manually.

A list of the fluids included in the database is shown below.

Nitrogen(N₂), Oxygen(O₂), Hydrogen(H₂), Water(H₂O), Carbon Monoxide(CO), Carbon Dioxide(CO₂), Methane(CH₄), Air, Argon(Ar), Acetic Acid(C₂H₄O₂), Acetylene(C₂H₂), Ammonia(H₃N), Benzene(C₆H₆), Propane(C₃H₈), Acetone(C₃H₆O), Hydrogen Sulphide(H₂S), Sulphuric Acid(H₂SO₄), Silane(H₄Si), Helium(He), Iodine(I₂), Nitrogen Oxide(N₂O), Neon(Ne), Sulphur Dioxide(SO₂), Ozone(O₃), Xenon(Xe), Sodium Hydroxide(NaOH), Fluorine(F₂), Hydrogen Fluoride(HF), Chlorine(Cl₂), Hydrochloric Acid(HCl), Steam, Hexatriacontane(C₃₆H₇₄), Thionyl Chloride(SO₂Cl₂), Sulphur Chloride(S₂Cl₂), Trichlorosilane(C₃H₇Si), Nitric Acid(HNO₃), Krypton(Kr), Ethylene(C₂H₄), Ethane(C₂H₆), Propadiene(C₃H₄), Propylene(C₃H₆), 1,2-Butadiene(C₄H₆), Isobutene(C₄H₈), n-Butane(C₄H₁₀), Glycerol(C₃H₈O₃), Isopentane(C₅H₁₂), Neopentane(C₅H₁₂), n-Hexane(C₆H₁₄), n-Nonane(C₉H₂₀), n-Decane(C₁₀H₂₂), n-Undecane(C₁₁H₂₄), n-Dodecane(C₁₂H₂₆), n-Tricosane(C₂₃H₄₈), n-Octacosane(C₂₈H₅₈), 1-Butene(C₄H₈), 1-Pentene(C₅H₁₀), 1-Hexene(C₆H₁₂), 1-Heptene(C₇H₁₄), 1-Octene(C₈H₁₆), Toluene(C₇H₈), m-Xylene(C₈H₁₀), o-Xylene(C₈H₁₀), p-Xylene(C₈H₁₀), Styrene(C₈H₈), Cumene(C₉H₁₂), Acetic Anhydride(C₄H₆O₃), 3-Chloropropene(C₃H₅Cl), Benzoic Acid(C₇H₆O₂), Butyl Acetate(C₆H₁₂O₂), Carbon Disulphide(CS₂), Carbon Tetrachloride(CCl₄)

Thermocouple Instruments Limited

Pentwyn, Cardiff, CF23 7XJ, UK
 Tel: (+44) 029 20734121 Fax: (+44) 029 20734040
 Internet: <http://www.thermocouple.co.uk>
 E-mail: thermocouple@thermocouple.co.uk