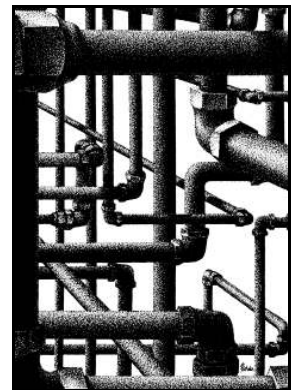


GASWorks™ *Product Description*

GASWorks has continued to evolve since our first quite simple but effective version of the software was released in 1991. Our latest release sports a very sophisticated map style graphic data interface, a quick solution routine, and provides support for a number of different model elements, including support for individual customer features. GASWorks provides an extensive set of network modeling tools designed to assist the User analyze and design distribution, transmission, gathering, fuel and plant piping systems conveying natural gas or other compressible fluids.

GASWorks may be used to create steady-state models of systems containing not only standard pipe type elements, but also supports regulator, compressor, valve, well, and fitting type elements. GASWorks calculates the estimated valve coefficient for regulators and the estimated power and fuel requirements for compressors. A pipe sizing routine is provided to assist in determining the required size for selected pipes in the model.



Solution Method

GASWorks uses a Newton-Nodal, iterative method of solution. It supports nineteen pipe flow equations - with an equation suitable for essentially all natural gas applications.

The solution routine provides efficient solution of virtually any sized model - tested to 250,000 node. Solution options allow flowing temperature to be calculated based on environmental heat loss and gain. Gas properties to be calculated at specific locations, including specific gravity, viscosity, ratio of specific heats, and heating value, based on the gas composition. Mixed gas properties throughout the system can be calculated based on the flow distribution. Compressibility can be calculated using one of several methods, including the latest revision of AGA 8.

Graphic Data Interface

The Graphic Data Interface (GDI) provides map style graphical access to the model data. The GDI allows the inclusion of Bitmap (BMP), Drawing Interchange Format (DXF), or Shapefiles (SHP) as a reference background. Using the GDI, the User can draw the model schematic using point-and-click mouse entry, coordinate value entry, or relative distance and angle entry. The GDI provides data screens for editing and viewing of the various pipe, node and customer data and analysis results.

The GDI includes a wide variety of tools for modifying the pipe, node, and customer model features including routines for adding, deleting and moving features - and the ability to undo (and redo) changes and deletions. Three independent display panels support various zoom commands including the ability to zoom in by a User specified window, zoom by a User specified scale, and zoom to a previous view allow the User to easily move around the model image. A robust set of color coding and tracing routines enhance the User's ability to graphically review the analysis results and the system's performance. The trace routines are complimented by the inclusion of what we refer to as "valve nodes". The valve node feature was developed to assist in the design and layout of emergency isolation areas. A complete set of annotation routines allows the User to include notes and references in the model graphics.

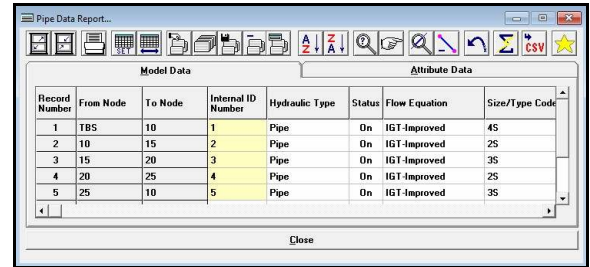


The GDI display can include: Two-point, polyline, and arc style pipe symbols • Node, customer, and pseudo service line symbols • Pipe, node, and customer data values as text • Piping symbols for non-pipe type elements • User defined annotation, graphic lines and shapes • Fitting symbols • Valve node symbols • Flow direction arrows • Marker Flags • And multiple background reference images. The User may customize the GDI's display properties by setting display colors, line and symbol types, display limit, and display size and width.

The GDI tools are accessed through descriptive tool icons contained on function based "fly-out" toolbars, through a command line and list interface, and through a tool palette which can be arranged to meet the User's preference.

Report Routines

The report routines provide spreadsheet style reporting of the model data, attribute data, and analysis results - including the ability to edit data directly from within the report by simply selecting the cell you wish to edit and making the desired change. The User may select the items to be included in the report by collapsing the columns associated with the unwanted items.



| Model Data | | | | Attribute Data | | | |
|---------------|-----------|---------|--------------------|----------------|--------|---------------|----------------|
| Record Number | From Node | To Node | Internal ID Number | Hydraulic Type | Status | Flow Equation | Size/Type Code |
| 1 | TBS | 10 | 1 | Pipe | On | IGT-Improved | 4S |
| 2 | 10 | 15 | 2 | Pipe | On | IGT-Improved | 2S |
| 3 | 15 | 20 | 3 | Pipe | On | IGT-Improved | 3S |
| 4 | 20 | 25 | 4 | Pipe | On | IGT-Improved | 2S |
| 5 | 25 | 10 | 5 | Pipe | On | IGT-Improved | 3S |

The pipe report provides a comprehensive collection of information including reporting of both size/type and internal diameter values, reporting of pipe inlet, outlet and average pressures, flow rates, velocities and volumes, and simultaneous reporting of linear and pressure drop per User specified length. Selection sets may be created from within the data reports, allowing unique reporting of User specified data groups. Hierarchical queries allow the creation of sub-sets from a previously created selection set.

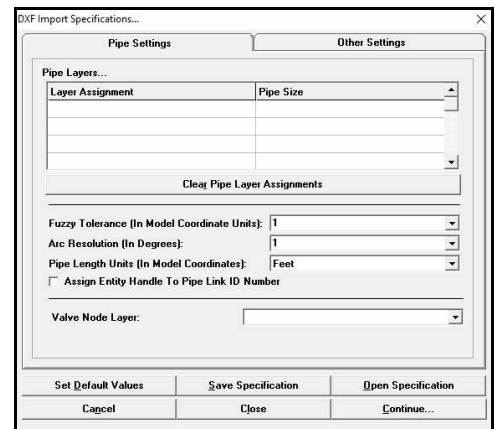
Reports may be printed onto any Windows supported device, allowing the selection of paper orientation, and font size and type. Pipe, node, and customer can be viewed using the "standard" spreadsheet style report - summary, data error, solution log and exception reports are also provided. Customer reports may be created by exporting the model data to a third party database, spreadsheet, or word processor application.

Other Features

Import & Export Routines: GASWorkS includes an extensive set of import and export routines allowing data to be exchanged between a variety of applications. Support is provided for ASCII, DBF, Microsoft Access and Excel data files, third party model data files, GIS shapefiles (SHP), and a robust DXF translator allowing both import and export of graphical data.

The DXF and SHP import routines allow the automated creation of a GASWorkS model from a CAD drawing or GIS data set. "Quick Export" routines are provided to allow export of complete model data with a single click.

Customer Features: Diversified load values for antenna or looped type network configurations can be automatically distributed using the Diversity handling features - based on the British IGE calculation standards. An external database may be attached to the GASWorkS customer data features. This is especially useful for connecting the billing file data to the model data.



The dialog box is titled 'DXF Import Specifications...'. It has two tabs: 'Pipe Settings' and 'Other Settings'. Under 'Pipe Settings', there is a section for 'Pipe Layers...' with a table for 'Layer Assignment' and 'Pipe Size'. Below this is a 'Clear Pipe Layer Assignments' button. Under 'Other Settings', there are several input fields: 'Fuzzy Tolerance (In Model Coordinate Units): 1', 'Arc Resolution (In Degrees): 1', 'Pipe Length Units (In Model Coordinates): Feet', and a checkbox for 'Assign Entity Handle To Pipe Link ID Number'. At the bottom, there are three buttons: 'Set Default Values', 'Save Specification', and 'Open Specification'. At the very bottom, there are three buttons: 'Cancel', 'Close', and 'Continue...'.

Main Attribute Features: An external database may be attached to the GASWorkS pipe data features. This is useful for maintaining the non-model attribute data such as address, pipe specification, and test pressure values.

User Interface: Each of the GASWorkS routines are accessed through a friendly and efficient point-and-click User interface. GASWorkS is fully menu-driven and provides logical access to data and results. Online help, including an extensive collection of how-to topics is just a click away.

GASWorkS will run on any personal computer configured to run on Windows XP or a newer operating system. Affordably priced and easy to learn and use - visit our website for more information or to download a *free* demonstration copy of the GASWorkS software.

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