Gas Module

Steady-state hydraulic analysis of compressible gas and vapor flow: pressure and temperature profiles, flow distribution, local gas properties, velocity, Mach number and equipment duties across a connected network.

1 FUNCTIONAL DESCRIPTION

The module solves gas properties and pipe pressure drop as one coupled calculation. Each pipe is divided into increments so that wall friction and momentum flux are evaluated at local conditions rather than at an averaged state.

2 CALCULATION BASIS

Analysis	Steady-state
Fluid	Compressible gas and vapor, single phase
Pressure drop	Duxbury method; wall friction and momentum flux at every pipe increment
Properties	Real-gas behavior, from selectable equations of state and corresponding-states methods applied at local conditions
Conduit	Cylindrical pipes; rectangular ducts; annular passages
Pipe condition	Can model clean and aged pipes
Networks	Series, parallel and branching
Compressibility	Mach number reported; sonic (choked) flow identified

3 MODELING ELEMENTS

Categories	Pipes and ducts; boundaries; boosters; valves; controllers; check valves; general resistances; size changes; relief devices; heat exchangers
Database	Performance and pressure-loss characteristics held in the database, so definitions can be reused and shared
Defaults	Default values applied on placement and customizable
Non-standard	General Resistances model non-standard piping equipment

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4 MODEL INPUTS

Boundaries	Fluid, temperature, and pressure or flow defined at source; pressure or flow defined at destination or outlet boundaries
Pipes and ducts	Length, friction-loss model, surface roughness and scaling; size defined directly or from standard dimensions available in the database
Nodes and equipment	Elevation, applicable modeling correlation, and autosizing status, required parameters or manufacturer data
Note	*Simultaneous input definition across selected elements; default input data can be customized*

5 MODELING WORKFLOW

- Open a new flowsheet (File menu or CTRL+N).
- Place boundary nodes and define their conditions.
- Place equipment from the Component Palette and connect with the selected pipe or duct.
- Define pipe, node and equipment data in the Input Editor.
- Run the calculation (toolbar or CTRL+F8).
- Review results and messages in the Data Palette.
- View component charts in the Data Palette, or create component and flowsheet charts as required; charts can be placed on the flowsheet.

6 STANDARDS APPLIED

Control valves	Sizing and assessment per ISA 75.01.01-2007
Orifices and nozzles	Thin orifice and in-line nozzle sizing per ISO 5167
Relief valves	Pressure relief valve sizing per API RP 520
Flare systems	API Mach-number limits applied to relief, vent and flare piping
Affinity laws	Applied to fans for variable-speed operation

7 DESIGN CHECKS AND WARNINGS

Flagged	Sonic (choked) flow; Mach-number limits
Convergence	Messages tab reports convergence issues, data warnings and engineering hints
On flowsheet	Flow-direction arrows; red markers on warnings and errors

8 OUTPUTS AND REPORTING

Results	Per-component results in the Data Palette Results tab, or on the flowsheet
Charts	Compressor, blower fan and system curves from the Chart tab; component, flowsheet and composite charts
Messages	Convergence issues, data warnings and engineering hints

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9 APPLICATIONS

- Natural gas transmission and distribution: real-gas profiles, compressor duty and sonic capacity limits
- Compressed air and ducted-air systems: compressor, fan and blower networks with flow distribution and operating points
- Steam and vapor networks: vapor flow with pressure, temperature, heat-transfer and choked-flow results
- Chemical and process plant gases: nitrogen, oxygen, fuel gas, process gas and flue gas through pipes and ducts
- Relief, vent and flare networks: PSV and piping adequacy, backpressure and inlet-piping checks

10 DEPENDENCIES AND LICENSING

Required by	Two-Phase Module
Scripting	Included at no additional cost

11 CAPABILITIES

- Size pipes and equipment — size gas pipes and ducts, compressors, valves and restrictions.
- Solve pressure drop rigorously — wall friction and momentum flux at every pipe increment.
- Model real-gas properties — selectable equations of state and corresponding-states methods.
- Model duct geometry and condition — cylindrical, rectangular and annular; roughness and scaling.
- Evaluate compressors, fans and blowers — test manufacturer curves against your system, with affinity laws.
- Assess control valves — check valve pressure drop and control range in gas service.
- Find the sonic capacity limit — calculate achievable flow and locate sonic choke points.
- Test debottlenecking strategies — confirm whether a change clears the choke point or moves it.

12 SCOPE AND EXCLUSIONS

General compressible gas and vapor systems. Where liquid and gas are present together, continue with the Two-Phase Module, for which the Gas Module is a prerequisite.

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