# OVERVIEW OF THE NEW FEATURES OF CONVAL® 12

## SOFTWARE LEASE OPTION – CONVAL 365

- Direct availability of new functions that would otherwise only be rolled out with a release upgrade
- Update of the supported calculation standards to the most recent version
- Guarantee of compatibility with the latest Windows versions
- Continuous updates for quality assurance and bug fixing

## EXTENDED LICENSING MODELS

CONVAL supports different licensing variants:

- **Network licenses**, which are installed on any workstation or server in your company, and which manage the number of simultaneous users of CONVAL. The installation of the actual calculation software can be done locally on the client or on a network share.
- **Personal licenses**, which are provided by F.I.R.S.T. GmbH in the cloud and are bound to a named user. These licenses can be checked out temporarily so that work is still possible even without an Internet connection.

## THE NEW USER INTERFACE

- Clear, contrast-optimized calculation forms based on popular Office programs
- Input pane with variable width for optimum use of the screen width
- Dynamic fading in and out of parameter names in multi-column input mask when width is changed
- Improved scaling support for high-resolution screens

## ENHANCEMENTS AND IMPROVEMENTS AT RELEASE START

### GENERAL

- Revised help system
- Setting option for the font of tables for the printout
- User-defined fields
  - User-defined fields can be entered in multiple languages.
  - Drop-down lists with or without the option of free input are supported.
  - Notes can be added to all the user-defined fields.
- Templates
  - Extended options for creating and managing calculation templates
  - Improved support for export templates in Excel format

### CONTROL VALVES

- Minor improvements and fixes for stability issues
- CONVAL now also supports valves of the "Dilating Disk" type (valves with an iris shutter-like mechanism).
- Improved calculation of fluid conditions in the Vena Contracta of multi-stage valves
- More accurate sound calculation for multi-stage valves if the data of the last stage is not known
- Improved recommendation for the optimum Cv100 value when several operating points are given
- Display of flow velocities in the upstream and downstream pipe for all operating points
- When printing out calculations with diaphragm valves, the valve stroke is not displayed

## ACTUATED VALVES

- Adaptation to the recently issued version of ISO 5115 " Industrial valves - Part-turn valve actuation" (11/2023)

## DIFFERENTIAL PRESSURE FLOW ELEMENTS

- The calculation of differential pressure flow elements now supports the input of up to three operating points. The names of the operating points can be customized.
- For concentric orifices, in addition to the pressure tapping points defined in the standards, the distances between the pressure tapping points can optionally be entered freely.
- Improved design when using the calculation reference "C and ε with 2/3 sqm" by displaying both operating states
- Calculation of the permanent pressure loss $\Delta\varpi$ for Venturi tubes
- Improved support of the extended uncertainty calculation in tables and graphs
- Numerous other minor improvements

## RESTRICTION ORIFICES

- Minor improvements and correction of stability issues in multi-hole orifice calculation
- Table view of individual orifices in multi-stage arrangements with more detailed information
- Display of inlet and outlet flow velocities

## PRESSURE RELIEF VALVES

- Minor improvements and fixes for stability issues
- Calculation of the property data in the outlet of the safety valve, including the calculation of the mass vapor content for flashing liquids.
- Determination of the mass flow to be discharged in the event of thermal expansion in blocked heat exchangers, pipelines, and vessels (thermal relief valves)
- Determination of the maximum pressure of the blocked pipeline in the event of thermal expansion in pipelines
- Calculation of the banking-up pressure at the valve outlet with supercritical gas flow
- Calculation of the discharge function $\Psi$ and Discharge power $\Phi$ for compressible flow
- Graphic display of the corrections for the discharge coefficient for back pressure and lift stop
- Calculation of the steam pressure coefficient for steam according to ISO 4126-7
- Improved calculation of two-phase flow pressure relief valves
- Display of the maximum mass flow rate (maximum mass flow rate = certified mass flow rate / 0.9)
- Calculation of pipe data (pressure losses, reaction forces, etc.) optionally with the required mass flow rate instead of the maximum mass flow rate
- Improved support of temperature-dependent curves for the maximum set pressure
- Improved calculation of safety valves according to API 526 (08/2023)

## THERMOWELLS

- Thermowell calculation now supports input of up to three operating points. The names of the operating points can be customized.
- Pass/Fail analysis of dimensions, frequencies, and stress limits for up to three operating points
- Stress analysis can now show the dependence of stress limits on frequency ratio, flow velocity, and now flow rate.

## TANK DEPRESSURIZATION

- Minor improvements and fixes for stability issues
- Display of flow velocity at valve outlet

### RUPTURE DISCS

- Improved calculation of two-phase flow rupture discs

### SUBSTANCE DATABASE

- Numerous viscous oils have been added to the substance database.
- Improved calculation of mixtures of liquids and gases
- Calculation of isothermal compressibility χ for media from the Thermodynamics module

### LICENSE MANAGEMENT

- Temporary check-out and check-in of network and named user licenses so you can continue to work without a network connection.
- Optimized settings to make it easier to find available licenses

## OVERVIEW OF THE CONVAL® 11 SERVICE RELEASES

### CHANGES IN BUILD 11.5.0

### GENERAL

- Minor improvements and fixes for stability issues
- Improved appearance when scaling for high-resolution screens
- Extended update check: In addition to device and fluid data, export templates and templates for calculation information are also checked and updated if necessary.
- The function for sending calculations as e-mail attachments has been revised.
- Improvements to printing of calculations with notes and comments

### CONTROL VALVES

- Improved calculation of valve inlet pressure at operating conditions near the phase boundary
- Corrections in the calculation of the outlet conditions of valves with small pressure ratings
- Improved estimation of the valve characteristic value Fd and thus the sound prediction for low-noise valves for which no measured data are available
- When calculating the flow rate, the stroke position can now be specified as an alternative to the Cv/Kv value.
- The stroke in inch or mm can now be specified as an alternative when using lift stoppers for valves from the database.
- The dependence graphs of the parameters of the 2nd and 3rd working points partly gave no result.

### STEAM COOLING VALVES

- Small improvements in the verification of input parameters

### ACTUATOR FORCES OF CONTROL VALVES

- Support of leakage class IV-S1 according to IEC 60534-4

### DIFFERENTIAL PRESSURE FLOW ELEMENTS

- Minor improvements

### RESTRICTION ORIFICES

- Minor improvements and fixes for stability issues in the calculation of multi-stage structures

### PRESSURE RELIEF VALVE DATABASE

- Improvements in the import of valves with back pressure curve

### PRESSURE RELIEF VALVES

- Revised calculation of outlet conditions and outlet pipe for gases and vapors
- Improvements in checking the limits of use for valves with threaded or clamped connections

### FLUID DATABASE

- Correction of errors when editing solutions
- Minor improvements

### MATERIAL DATABASE

- Improvements in entering new materials with clipboard support

### COM-SERVER

- The SI-unit of parameters could not be changed by the setting the name of the unit.

## ACHANGES IN BUILD 11.4.1

### GENERAL

- Fixes for stability issues

### CONTROL VALVES

- The selection of valves from the database with different inlet and outlet size caused the program to crash in some cases.

### DIFFERENTIAL PRESSURE FLOW ELEMENTS

- The selection of flow meters from Rosemount with special design caused the program to crash in rare cases.
- When calculating humid gases, in some cases the mass flow rate qm was not displayed.

## CHANGES IN BUILD 11.4.0

### GENERAL

- Minor improvements and fixes for stability issues
- Revised help system
- New: Graphics can be copied directly to the clipboard
- New: Navigation in tables with the Enter key optionally horizontally instead of vertically

### ACTUATED VALVES

- Revised user interface and new data sheets according to ISO 5115 and WIB RP S 2812-X-19
- Support of electric actuators with torque brake
- Minor display issues in the selection dialog for electric actuators have been fixed.
- Revised check of the stall torque of electric actuators

### CONTROL VALVES

- Minor improvements and fixes for stability issues

- Improved sound prediction for valves with two phase flow at inlet
- Improved sound prediction for low-noise valves not provided with all measured valve factors
- New: Calculation of the flange internal diameters as a function of the pressure rating

## DIFFERENTIAL PRESSURE FLOW ELEMENTS

- Minor improvements
- The flow meter calculation according to ISO 5167 has been updated to the 2022 edition.
- The flow meter calculation according to ISO 9300 has been updated to the 2022 edition.
- New: Calculation of wet gas in orifices, Venturi tubes and cone meters according to:
  - ISO/TR 11583:2012 "Measurement of wet gas flow by means of pressure differential devices inserted in circular cross-section conduits".
  - ISO/TR 12748:2015 "Natural gas - Wet gas flow measurement in natural gas operations".
- New: It is now possible to enter the diameter ratio ß as an alternative to entering the throttle orifice d.
- New: Sound prediction for all orifice type meters based on IEC 60534-8-3 or IEC 60534-8-4
- New: Input option for carrier rings for orifice plates with corner pressure tapping
- Revised calculation of Rosemount 1595 multi-hole orifice plates and 1195 integral orifice plates
- The calculation of the expansion coefficient ε of wedge flowmeters according to R. W. Miller was erroneously performed according to ISO 5167-6.

## RESTRICTION ORIFICES

- Minor improvements and fixes for stability issues

## PIPE WALL THICKNESS

- Minor improvements
- Strength calculation according to API 521 has been updated to the 2020 edition.
- New: Suggestion of the matching schedule for the calculated wall thickness of ANSI pipelines

## PRESSURE RELIEF VALVES

- Minor improvements and fixes for stability issues
- Consideration of high viscosity media (small Reynolds numbers) with all calculation standards
- In addition to the sound power level, the sound pressure level is now calculated as well.
- New: Support of open discharge relief valves
- Revised pressure-temperature curves for cast iron according to EN 1092-2

## RUPTURE DISCS

- Minor improvements and fixes for stability issues
- Consideration of high viscosity media (small Reynolds numbers) with all calculation standards

## LEVEL CALIBRATION

- The density of the media in the legs was not always calculated.

## EXPORT FUNCTION

- An issue with exporting and sending calculations as PDF document has been fixed.

## COM SERVER

- Improved support of formulas in user-defined fields

### SUBSTANCE DATABASE

- A bug with copying solutions is fixed.

### RELIEF VALVE DATABASE

- Improved import of data in Excel format with extended plausibility check

### MATERIAL DATABASE

- Minor improvements and data maintenance

## CHANGES IN BUILD 11.3

### GENERAL

- Minor improvements and fixes for stability issues
- Revised management of formulas with access to parameters of calculation in user-defined fields
- Revised help system
- Improved window handling

### ACTUATED VALVES

- Minor improvements and fixes
- Support of breakaway torques in open and closed position
- Revision and extension of the databases for valves and actuators

### CONTROL VALVES

- Minor improvements and fixes for stability issues
- Option for safety-related application
- Revised user interface for valves with stroke or rotation angle limitation
- Improved handling of valves for liquids at flashing conditions or liquids with dissolved gases
- Improved support for rotary valves with low-noise trims
- Consideration of kinetic energy in the calculation of downstream resistances (only in combination with the thermodynamics module)

### STEAM COOLING VALVES

- Revised user interface
- Consideration of the pressure drop at the injection nozzle

### DIFFERENTIAL PRESSURE FLOW ELEMENTS

- Minor improvements in the calculation of the flow coefficient C for Venturi tubes for small and large Reynolds numbers
- Revised calculation of limits for pipe roughness
- Calculation for drain holes according to ISO/TR 15377:2018 for all types of orifice plates
- Strength calculation for orifice plates according to ISO/TR 9464, ASME B31.3 etc.
- Inclusion of GOST 8.586 (ISO 5167 mod) in the list of available calculation standards

### RESTRICTION ORIFICES

- Minor improvements and fixes for stability issues
- Consideration of kinetic energy in the calculation of multistage configurations (only in connection with the thermodynamics module)

### PIPE WALL THICKNESS

- Strength calculation according to API 521:2014 - A.3.5.4.4

### PRESSURE RELIEF VALVES AND RUPTURE DISCS

- Minor improvements and fixes for stability issues.
- Inclusion of ASME BPVC-XIII:2021 in the list of available calculation standards
- Calculation of two-phase flow by direct integration according to API 520 or ISO 4126-10
  If CONVAL provides thermodynamic equations of state for the selected medium, the calculation of the mass flow can be derived by integration from the inlet to the narrowest flow cross-section of the nozzle.

### SHELL-AND-TUBE HEAT EXCHANGER

- Corrected calculation of the minimum shell diameter for multiple pass heat exchangers

### EXPORT FUNCTION

- Minor improvements and fixes for stability issues
- Improved user interface for creating export templates with error checking and hints on possible issues
- The unit of parameters can be predefined in the export templates

### COM SERVER

- Selection of regional format for decimal separator, date, and time in CONVAL language settings
- Support of formulas in user-defined fields with access to parameters of the calculation

## CHANGES IN BUILD 11.2

### GENERAL

- Minor improvements and fixes for stability issues
- Minor adjustments for improved Windows 11 experience
- Improved appearance when scaling for high-resolution screens
- Revised help system
- NEW: Support of formulas in user-defined fields with access to parameters of the calculation
- Improved compatibility when loading old calculations from CONVAL versions 5 and 6
- Sporadic problems with the visualization of Chinese characters are solved
- Improved export of graphics to various image formats
- Selection of regional format for decimal separator, date, and time in CONVAL language settings
- Minor inconsistencies in the handling of mixtures are fixed.
- Import and export of mixtures according to AGA 8 and GERG 2008 standards
- Minor improvements in connection with export templates in Excel format
- Update of the licensing software. Problems with handling licenses for cloud licenses are fixed.

### ACTUATED VALVES

- Many improvements and fixes of stability problems
- NEW: Design and selection of electric actuators
- Revised actuator database for pneumatic actuators
- Support of a second breakaway angle for open position for automated valves
- Improved import function for Scotch-Yoke actuators specifying the angle for the running torque
- Improved import function for valve torques that already include a safety margin

- Extended export templates

### CONTROL VALVES

- Minor improvements and fixes to stability issues.
- Corrections in checking the maximum cavitation index recommended by the valve manufacturer
- Corrections in the evaluation of sound level corrections specified by the manufacturer
- Revised control valve database
- Revised export templates for calculations with two-phase flow

### DIFFERENTIAL PRESSURE FLOW ELEMENTS

- Minor improvements
- Corrections in the extended uncertainty calculation near the phase boundary
- Calculation of the position of the Vena Contracta for additional orifice types

### RESTRICTION ORIFICES

- Minor improvements and fixing of issues in the calculation of multistage configurations
- Improved ability to detect potential pipe damage with compressible flow
- Extension of the valid input range for the hole diameter d

### PRESSURE RELIEF VALVES

- Minor improvements and fixes of stability problems
- Correction of noise prediction according to ISO 4126-9 and API 521

### MATERIAL DATABASE

- Minor improvements and fixes of stability problems

### COM SERVER

- Timing issues when starting the COM server are fixed.
- General function "ModuleFunc" for ICalculation to call the public functions without parameters

## CHANGES IN BUILD 11.1

### GENERAL

- Display issues with scaling for high-resolution screens have been fixed.
- Exporting graphics and Excel templates to PDF format is now possible in many cases.
- Problems with opening multiple calculations via the Open dialog have been fixed.
- Searching of Chinese substance and material names is now supported.
- Improved handling when individual device databases are not stored in the default folder
- Extended option to control the printout of calculations by sections
- In the database programs, Excel data sheets with formulas are supported during import.
- Improved client setup at network installation fixes problems with accessing the help function
- Revised controlling of license search for network and cloud licenses
- Occasional issues when opening calculations with gas or liquid mixtures have been fixed.
- Improved print preview via Microsoft WebView2 instead of Internet Explorer with PDF plugin

### ACTUATED VALVES

- Minor improvements and fixes of stability problems
- Specifying multiple flanges for valves and actuators is supported by the database.
- When specifying valves in the database, an additional user-defined identifier can be assigned.
- The minimum air pressure required for the valve torques is displayed in the actuator selection.
- In addition to scotch yoke and rack and pinion actuators, diaphragm and vane actuators are supported.

### CONTROL VALVES

- Minor improvements and fixes of stability problems
- Display issues in the piping selection dialog have been fixed.

### DIFFERENTIAL PRESSURE FLOW ELEMENTS

- Minor improvements
- Revised uncertainty calculation for pitot tubes. The Uncertainty of the pipe diameter was not sufficiently considered in the overall uncertainty calculation.

### RESTRICTION ORIFICES

- Minor improvements and fixes of stability problems
- Revised calculation of multi-stage single-hole orifices at extremely high Mach numbers.

## OVERVIEW OF THE NEW FEATURES OF CONVAL® 11

### SOFTWARE MAINTENANCE OPTION

- Update of the supported calculation standards to the most recent version
- Guaranteed compatibility with the latest Windows versions

### ENHANCEMENTS AND IMPROVEMENTS AT RELEASE START

### GENERAL

- Revised user interface
- Advanced import and export functions
- Improved support for Windows display scaling

### SUBSTANCE DATABASE

- Measured values for enthalpy, entropy, surface tension
- Improved calculation of substance mixtures
  - Option to enter mass and molar percentage data
- Support of solutions, acids etc.
  - Concentration-dependent substance properties
- Support for substance names for additional languages besides German and English

### NEW: ACTUATED VALVES

- Sizing and selection of actuators for part-turn on/off valves
  - WIB RP S 2812-X-19
  - ISO-TC153-SC

- Graphical analysis of valve and actuator torques
- Database for actuators
- Database for on/off valves
- Favorites lists for device manufacturers in the valve and actuator selection

## CONTROL VALVES

- Improved calculation of downstream resistors
- Revised printout of characteristic curves
- Extended control valve database
- Improved valve selection with favorites list for valve manufacturers
- Calculation of steam cooling valves

## DIFFERENTIAL PRESSURE FLOW ELEMENTS

- Extended uncertainty calculation according to ISO 5168 with -Sensitivity coefficients
- Update of the calculation for nozzles according to ISO 5167-3
- Calculation of wedge flowmeters according to ISO 5167-6
- Support of GB/T 2624 standard
- Extended calculation of cone meters. Includes the calculation of the required straight inlet and outlet lengths
- Stress calculation for orifices (ASME B31.3, ISO/TR 9464, ISO 5167 etc.)

## RESTRICTION ORIFICES

- Calculation of multi-stage expansion (automatic and manual)
- Improved stress calculation (ASME B31.3, AD 2000, ISO 5167 etc.), especially for multi-hole orifice plates

## PRESSURE LOSS

- Pressure loss with NPSH calculation

## PRESSURE RELIEF VALVES

- Calculation of two-phase flow
  - ISO 4126-10
- Revised user interface with recommendations for the valve design
- Favorites lists for valve manufacturers and enhanced filter options in the valve selection

## RUPTURE DISCS

- Calculation of two-phase flow
  - API 520
  - ISO 4126-10

## THERMOWELLS

- Calculation of the maximum allowable working stress in a wider temperature range

## PIPE WALL THICKNESS

- Pipe wall thickness calculation according to ASME B31.3

## LEVEL CALIBRATION

- Media in the legs from database
  - Consideration of temperature changes affecting the density

- Improved uncertainty calculation
  - For example, to check the influence of the ambient temperature with tanks with two liquids

# OVERVIEW OF THE NEW FEATURES OF CONVAL® 10

## MISCELLANEOUS

- Defaults for calculation standard and pipe class in the program options
- Flange / tubing dimensions according to ASME B16.5 and EN-1092-1
- Extended material database with improved selection options
- Automatic online update of all device and material databases
- Revised online help system

## PROPERTY CALCULATION

The new thermodynamics package consists of three components:

### *FLUIDCAL*

FLUIDCAL is integrated in CONVAL to perform the calculation of thermodynamic properties from equations of state (fundamental equations in the form of the Helmholtz free energy). This program enables the user to calculate more than 25 thermodynamic properties of more than 70 substances. For a large number of substances, the most common transport properties can also be calculated.

### *NIST REFPROP*

REFPROP is an acronym for reference fluid properties describing a program which calculates the thermodynamic and transport properties of industrially important fluids and their mixtures. The program embeds pure substances and pre-defined or user defined fluid mixtures and represents the substance calculation with the highest accuracy in this context.

### *GERG 2008*

Calculation of mixtures according to GERG 2008. The GERG-2008 equation is valid in the gas phase, in the liquid phase, in the supercritical region and for the vapor-liquid equilibrium.

## CONTROL VALVE

- Extended calculation of resistance structures
  - Design (automatic)
    CONVAL calculates all intermediate pressures between the single resistances and optimizes them.
  - Design (specify pressures)
    Specification of the intermediate pressures and the subsequent calculation of the resistance structure
  - Recalculation (specify Cv/Kv)
    Recalculation of an existing single or multi-stage multi hole orifice plate configuration
  - Analysis of the resistances of all operating points
  - Improved sound prediction
- Noise calculation
  - Calculation according IEC 60534-8-4 (2015)
  - Calculation of the sound pressure level at each third octave frequency for all operating points
- Support of body materials with pressure and temperature curves
- Improved selection of valves with extended filter possibilities
- Support of liquids containing dissolved gas
- Improved calculation of super-critical fluids (isentropic exponent $\varkappa > 1{,}6$)
- Revised reliability forecast for multi-stage valves
- Optional input of the distinct mass flows of the liquid and vapor phase for two-phase flow

## STEAM CONDITIONING VALVE

- Beside water many other media from the new thermodynamics module can be computed.

## DIFFERENTIAL PRESSURE FLOW ELEMENT

- Revised selection of measuring devices and calculation standards
- Supported flow elements:
  - Orifices
  - Nozzles
  - Venturi
  - Averaging pitot tubes
  - Cone meter
  - Wedge flow meter
  - Integral flow orifice assembly
  - Manufacturer dependent special designs
- Supported calculation bases:
  - ISO 5167 (2003, 1998, 1995, 1980)
  - ISO 5167-5 (2016)
  - ISO/TR 15377 (2007)
  - ISO 9300 (2005)
  - ASME MFC-3Ma (2007)
  - ASME MFC-7 (2016, 1987-R2014)
  - ASME MFC-14M (2003)
  - ASME PTC 6 (2004)
  - ASME PTC 19.5 (2004)
  - AGA 3 / API MPMS 14.3 (2013, 2003)
  - VDI/VDE 2041 (1991)
  - R. W. Miller, Flow Measurement Engineering Handbook (1996)
- Clear summary of all limitations of use
- Stress calculation for orifices (ASME B31.3, AD 2000, ISO 5167 etc.)
- Clear arrangement of the required inlet and outlet sections
- Revised uncertainty calculation
- Calculation of segmental orifices with carrier rings

## RESTRICTION ORIFICE PLATE

- Improved calculation method considering the length of the cylindrical orifice
- Support for multi-hole orifices
- Revised forecast of choked-flow conditions
- Improved stress calculation (ASME B31.3, AD 2000, ISO 5167 etc.)
- Improved sound prediction
- Calculation of the Vena Contracta and outlet conditions
- Support of liquids containing dissolved gas

## THERMOWELLS

Supported calculation standards:

- DIN 43772 (2000) For standardized and variable forms with up to three sections
- ASME PTC 19.3 TW (2016) With graphical stress analysis

- ASME PTC 19.3 (1974)

## PRESSURE LOSS

- Support of two-phase flow conditions according to three different calculation methods:
  - L. Friedel: “Improved friction pressure drop correlation for horizontal and vertical two-phase pipe flows” European two-phase flow group meeting, Ispra, 5-8 June 1979
  - H. Müller-Steinhagen – K. Heck: „A Simple Friction Pressure Drop Correlation for Two-Phase Flow in Pipes” Chem. Eng. Process., 20 (1986) 291-308
  - Homogeneous flow model
- Enhanced flow resistance database according to I. E. ldel'chik “Handbook of Hydraulic Resistance “

## PRESSURE RELIEF VALVE

Supported calculation standards:

- ISO 4126-1 (2013)
- ISO 4126-7 AMD 1 (2016)
- ISO 4126-9 (2008)
- API 520 (2014)
- API 521 (2014)
- API 526 (2009)
- ASME Section VIII (2011)
- AD Specification A2 (2015)

## LEVEL CALIBRATION

- Calculation of the uncertainty of the relative level in dependence of the densities in the legs
- (For example, to check the influence of the ambient temperature with tanks with two liquids)