Fact Sheet

PSV*Plus*™ is a software designed to help Process Engineers to calculate, design and prepare the Specification Sheet of Pressure Relief Valves.

Typical users are Process Engineers involved in the Design of Chemical / Petrochemical plants, Gas Plants, Refinery and similar industrial applications.

Calculation Codes

Pressure Safety Valves calculations are carried out in full accordance with APT RP 520, 521 and 526. Good engineering practice criteria are also available to assist the process engineer in the proper Relief valve parameters and type selection and calculation.

PSV*Plus*™ provides a set of routines for the Gas, Liquid, Steam and Two-Phase relieving scenarios. The Two-Phase code provides four different calculation routines in accordance with Appendix D of API 520 latest edition.

Simultaneous Process Data Sheet, Summary Calculation Sheet and Relief Load Summary preparation

Based on actual working specific requirement, the calculation modules can be linked to an Access™ (*) database for preparation of the following documents, while performing the orifice and in / out lines design:

- **Process Specification Sheets (i.e. the data sheets normally prepared by the Process Engineer used by the Instrumentation Dept as basic information to purchase the PSV's);**
- **Summary Calculation sheet for PSV: the calculation sheet that summarizes all the scenario's considered for each PSV sizing, along with the most relevant data. This document is normally required by end users, authorities and certifying entities to ensure that all applicable emergency scenario's have been duly taken into consideration;**
- **Relief Load Summary: table normally used to show in a consistent format all the relieving rates and characteristics for plant general emergencies. Required for sizing and design of flare headers.**

All the above reports will be generated automatically starting from the PSV calculation stage. and can be exported to MS Excel.

The MS Access database has also been designed to be fully compatible with Smart Plant Instrumentation (ex-INTools™)(*) for automatic data download, if required.

Fluid Physical Properties

PSV*Plus*™ uses *FluidProp™(**)* software for the calculation of single-components and mixture properties as defined by the user. More than 150 components and five different thermodynamic models are available to estimate fluid properties at relieving conditions.

Determination of Relieving Rates, according to the applicable Emergency Scenario

The rate to be discharged from a PSV is normally to be calculated assuming all the applicable emergency scenario's. This is a time consuming task that requires experience and often heavy hand calculations. PSV Plus provides a set of routines to quickly guide the user towards the proper determination of this relieving rate, by suggesting typical parameters and procedures to be considered, in addition to calculation methods:

1. Fire Load calculations

PSV*Plus*™ eliminates the need to perform any fire load related calculation. The options available will allow to calculate fire loads for both ***Wetted*** and ***Unwetted*** vessel surface cases. Up to three vessels can be included to compute the total fire load. Each vessel can be described in terms of its geometry, dimensions and contained fluid.

2. Control Valve Failure

A detailed calculation form is available to rigorously calculate the consequences of the complete opening of a control valve. Calculation routines take into account control valve CV calculation, if not already available, and will cover also the gas blow-by scenario, that is one of the most frequent scenarios encountered.

3. Fan Failure

In case of failure of one or more fans the loss of cooling or condensing may lead to pressure increase in the system and subsequent opening of Pressure Safety Valve. Determination of the relief load is then achieved through typical parameters.

4. Reflux Failure

Failure of a column top or side reflux causes pressure increase in the system as higher vapor rate than normal will be present into the column. Relieving rate determination is achieved through typical parameters.

5. Exchanger Tube Rupture (Single and Mixed Phases)

When the differential pressure between the two sides of a S&T heat exchanger is high, the tube rupture contingency is a main concern since, should it occur, the low pressure side may be affected by pressure higher than design one. Determination of relieving load for this case is accomplished through complex calculation routines, which are available in PSV*Plus*™.

6. Thermal Expansion

Should a liquid filled portion of piping or equipment be blocked-in under solar radiation or any other heat source, this will cause pressurization due to specific volume change of the liquid. Calculation of relieving rate can be easily calculated through PSV*Plus*™ routines.

7. General Power Failure, Cooling Water Failure, Fire, Blocked Outlet, etc…

The other emergency scenario's can be selected from a comprehensive list. However no standard calculation method exists for them and the Process Engineer will have to calculate on his / her own. PSV*Plus*™ provides facilities to record all the considerations made to achieve the relieving rate figure, for later use or documenting purposes.

Seamless Integration between PSV Plus calculation module and MS Access(*) Database and Open Source Database Design

MS Access(*) database environment can be accessed directly from within PSV Plus calculation engine.

MS Access(*) database is distributed in the open Source form, allowing the user to customize reports, adding Company logo's and performing any kind of modification that is needed.

All the PSV's emergency scenario's calculations are handled in PSV*Plus*™ calculation modules. Immediately the required reports are available in the database provided application.

Inlet and Outlet line Sizing

Inlet and outlet lines sizing routines for both single and two-phase fluids are also available to the user for proper piping design, following safety relief valve orifice calculation and selection. PSV*Plus*™ will automatically check that the specified back pressure of the valve is consistent with the one calculated across the outlet line and will alert the operator in case of improper valve selection, based on the back pressure to upstream pressure ratio criteria.

Inlet and outlet lines sizing is also checked against the pressure drop and velocity criteria commonly used. The option of sizing the outlet line for chocked flow is also provided.

A calculation form is provided for easy and quick calculation of inlet / outlet piping equivalent length, in case a detailed calculation is required by the user.

Global Settings and Calculation Parameters

Common calculation and parameters settings for all PSV's included in a database application can be easily entered in once by the User to have data and calculation's consistency throughout the Project.

Pressure Safety Valves back-pressures settings and line sizing velocity and pressure losses design criteria can be manipulated to have full control over the performed sizing for PSV's and associated inlet / outlet lines.

On-line Guide and Quick Start

PSV*Plus*™ is provided with an online help and a comprehensive quick start section that will guide the user through main software capabilities. One-hour self-training, using this tutorial will be sufficient to an experienced professional for proper use of the software.

Technical reference and background is also provided in the manual.

Man-hours saving and Quality Improvement

PSV*Plus*™ has proven to be effective in saving man-hours up to 70% for the pressure safety valves calculation and process specification activities. Better quality is also provided by the standardization of calculation codes and data consistency among the various reports generated.

(*) ACCESS™ is a registered trademark by Microsoft Corp. SPI and INTOOLS™ is a registered trademark by Intergraph Corp.

(**) **P.Colonna, T.P. van der Stelt, 2004, *FluidProp: a program for the estimation of thermo physical properties of fluids,* Energy Technology Section, Delft University of Technology, The Netherlands.**