What’s new in 4.84 version

Pipe Stress Analysis And Sizing
PASS/START-PROF

Quick Pipe Stress Analysis & Optimal Sizing

Presenter:

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About one year has passed since our last version of PASS/START-PROF Software release.

We worked hard during this time.

Check out that we have prepared for our customers!
PASS/Start-Prof | External Interfaces

- Added export & import from AVEVA E3D version 3.1
- Added export & import from AVEVA MARINE version 12.1SP4 and 12.1SP5
- Added AVEVA MDS Support
- Added import from Autodesk Revit to PASS/START-PROF
PASS/Start-Prof | Codes Updates

- Updated code ASME B31.9-2017 Building Services Piping (USA)
- Updated code ASME B31.4-2019 Pipeline Transportation Systems for Liquids and Slurries (USA)
Ring bending stress is calculated using finite element method with geometrical nonlinearity and consider stiffening effect of the pressure.

### 7.8 Allowable stresses

The sum of the hoop stresses shall be defined by the following formulae:

\[
\sigma_{h\text{um}} = \sigma_{b\text{p}} + \sigma_{b\text{h}}
\]

\[
\sigma_{b\text{p}} = \frac{P \times D_{\text{rmin}}}{2 \times t_{\text{rmin}}}
\]

\[
\sigma_{b\text{h}} = t_{\text{r}} \times D_{\text{h}} \times E_{\text{th}} \times \frac{\Delta y}{D_{\text{min}}} \times \frac{t_{\text{rmin}}}{D_{\text{rmin}}}
\]

where:

- \( P \) is the internal pressure, expressed in MPa;
- \( t_{\text{r,min}} \) is the minimum reinforced pipe wall thickness, expressed in mm;
- \( D_{\text{r,min}} \) is the mean diameter of the minimum reinforced pipe wall, expressed in mm;
- \( t_1 \) is the internal liner thickness of the pipe wall, expressed in mm;
- \( r_c \) is the rerounding coefficient, for \( P \leq 3 \) then \( r_c = 1 - P / 3 \), for \( P > 3 \) then \( r_c = 0 \);
- \( D_{1} \) is the shape factor, see AWWA Manual M45 (second edition), Table 1;
- \( \Delta y/D_{\text{r,min}} \) is the predicted vertical pipe deflection [see Formula (9)];
- \( E_{\text{th}} \) is the hoop bending modulus, expressed in MPa.
PASS/Start-Prof | New Codes

- ASME B31.12-2014 Hydrogen Piping and Pipelines (USA)
- BS PD 8010-1:2015 Pipeline systems – Part 1: Steel pipelines on land (UK)
- BS PD 8010-2:2015 Pipeline systems – Part 2: Subsea pipelines (UK)
- CSA Z662 + Ch.11 Oil and gas pipeline systems (Canada)
- GOST R 55989-2014 Gas and Oil Transmission Pipelines for Pressure Greater 10 MPa
- GOST R 55990-2014 Field pipelines (Russia)
- SP 284.1325800.2016 Field pipelines (Russia)
- SP 33.13330.2012 Steel Pipelines (Russia)
- Individual databases was created and filled with Material properties for all new codes
EN 13941-2019 District heating pipes - Design and installation of thermal insulated bonded single and twin pipe systems for directly buried hot water networks
Calculate And Check Stresses In Polyurethane Insulation (EN 13941 7.3.1, 7.3.2, EN 253). Check Stresses from Surface Vehicle Loads
PASS/Start-Prof | New Codes

- START-PROF has everything that is needed for district heating networks analysis and widely used for it since 1998.
- Pre-heating analysis
- Single use compensators analysis + Database + Distance Calculation
- Added LOGSTOR, POWERPIPE, +GF+ Urecon Polyurethane Pre-insulated Pipe Jacket Sizes Database for district heating and district cooling networks
- Now it is allowed to add expansion cushions on the vertical pipes
PASS/Start-Prof | Code Updates

Updated material database EN 13480/EN 13941.
Added automatic material properties selection depending on wall thickness and seamless/welding option.
Added Minimum Design Metal Temperature (MDMT) calculation according to 323.2.2 (a), (b), (d), (e), (f), (g), (h), (i), (j) of ASME B31.3-2018. Added into material database. START-PROF calculates the MDMT according to figure 323.2.2A and figure 323.2.2B depending on the calculated stress ratio if user select appropriate option in project settings, taking into account the code requirements 323.2.2 (g), (h), (i).
After analysis the output report table is provided. For each pipe START-PROF show if the impact test is needed or not.
Updated material library, weld reduction factors for ASME B31.3-2018. Added occasional allowable calculation for elevated temperature fluid service 302.3.6 (2) ASME B31.3-2018, added appendix V. Added "Time duration", "Alternative Occasional" options to operating mode editor. Added Larson-Miller constant "C" into ASME B31.3 material database.
Added automatic creep-rupture usage factor calculation according to ASME B31.3-2018 Appendix V (V303.1-V303.3)

**V303.2 Determine Creep-Rupture Usage Factor**

The usage factor, \( u \), is the summation of individual usage factors, \( t_i / t_m \), for all service conditions considered in para. V303.1. See eq. (V4).

\[
 u = \sum \left( \frac{t_i}{t_m} \right) \quad (V4)
\]

where
- \( i \) = as a subscript, 1 for the prevalent operating condition, \( i = 2, 3, \) etc., for each of the other service conditions considered
- \( t_i \) = total duration, h, associated with any service condition, \( i \), at pressure, \( P_i \), and temperature, \( T_i \)
- \( t_m \) = as defined in para. V303.1.4

**V303.3 Evaluation**

The calculated value of \( u \) indicates the nominal amount of creep-rupture life expended during the service life of the piping system. If \( u \leq 1.0 \), the usage factor is acceptable including excursions. If \( u > 1.0 \), the designer shall either increase the design conditions (selecting piping system components of a higher allowable working pressure if necessary) or reduce the number and/or severity of excursions until the usage factor is acceptable.
PASS/Start-Prof | New Features


All pipes and fitting wall thicknesses are automatically checked before every run of the pipe stress analysis according to the selected code.
PASS/Start-Prof | New Features

Added ability to enter the custom hanger allowable rotation angle for different types of hangers. PASS/START-PROF automatically check the hanger rotation angle and show the note message after analysis if restriction is violated.
- Added automatic local pipe wall buckling check per ASME B31.8-2018
- EN 13941-2019 7.2.4.2

\[
S_{st} = 0.0016E \\
S_{st} = (0.0458 \cdot 2t_n/(D_o - t_n) + 0.00003)E
\]
PASS/Start-Prof | New Features

Added built-in calculator in some input fields
PASS/Start-Prof | New Features

- Updated database ASME B36.10M-2018
- Added more than 140 new standards into pipes, tees, bends, and reducers database, including ASME B16.9 and lot of Russian GOST, OST, RD, TU codes
Added polypropylene "PP-B" into material database. Data taken from DVS 2205, EN 1778, and DIN 8078.
PASS/Start-Prof | New Features

Added seismic wave propagation analysis for underground pipelines. START-PROF calculate stress and strain in buried pipeline caused by seismic wave propagation and check the stress and strain limits according to:

- ASCE 2001 Guidelines for the Design of Buried Steel Pipe (American Lifelines Alliance). Improved by START-PROF authors, added shear wave effect
- GB 50032 (China)
- GB 50470 (China)
- SNiP 2.05.06-85 (Russia)
- SP 36.13330.2012 (Russia)
- GOST R 55989-2014 (Russia)
- GOST R 55990-2014 (Russia)
- SP 284.1325800.2016 (Russia)
- SP 33.13330.2012 (Russia)
PASS/Start-Prof | New Features
PASS/Start-Prof | New Features

Every pipe branch, turn or anchor cause great axial and bending stresses.
Axial seismic strain due to wave propagation is calculated using equation:

\[ \varepsilon = \pm \max \left( \min \left( \varepsilon_p, \varepsilon_s, \varepsilon_r \right) \right) \rho_{\text{max}} \cos \omega \]

Actually, pipe curvature can cause only bending moments, but we convert it into equivalent axial strain to simplify the stress analysis procedure in START-PROF software.

- \( \omega \) - Inclined angle of the pipe. 0 for horizontal pipe, 90 for vertical pipe
- \( D \) - Pipe diameter, m
- \( \varepsilon_p \) - Maximum axial strain from P-, S-, R-waves

\[ \varepsilon_p = \max \left( \frac{V_p}{C_p}, \frac{V_s}{2C_s}, \frac{V_r}{C_r} \right) \]

Maximum strain from P-wave friction forces is

\[ \gamma = \frac{\lambda}{4EA} \]

So maximum strain caused by friction from P-, S-, R-waves is

\[ \varepsilon_f = \max \left( 0.5C_p \gamma, 0.5C_s \gamma, 0.5C_r \gamma \right) \]

\( \rho_{\text{max}} \) - Maximum curvature from P-, S-, R-waves

\[ \rho_{\text{max}} = \max \left( 0.3854 \left( \frac{C_p}{C_p} \right)^2 + \frac{A_p}{C_p}, 0.3854 \left( \frac{C_s}{C_s} \right)^2 + \frac{A_s}{C_s}, 0.3854 \left( \frac{C_r}{C_r} \right)^2 + \frac{A_r}{C_r} \right) \]

- \( V_p \) - Peak ground velocity, m/s. Specified by user in pipe properties
- \( A_p \) - Peak ground acceleration, m/s². Specified by user in pipe properties
- \( A \) - Pipe cross-section area, m²
- \( T_u \) - Peak friction force, kN

\[ T_u = \tan(\pi n \cdot \phi) \left[ \frac{2\pi D_v}{\cos \theta - K_2 \cos \phi - K_6 \sin \phi} \right] + \pi D_v \rho_{\text{w}} \]

- \( \rho_{\text{w}} \) - Soil cohesion
- \( C_p \) - Apparent P-wave propagation velocity, m/s. Specified by user in START-PROF pipe properties. Default value 2 km/s
- \( C_s \) - Apparent S-wave propagation velocity, m/s. Specified by user in START-PROF pipe properties. Default value 1 km/s
- \( C_R \) - Apparent R-wave propagation velocity, m/s

Rayleigh wave velocity is equal to \( C_R = kC_p \), where \( k \) is obtained from the equation

\[ \frac{1 - k^4}{4} - \frac{k^4}{4} + \frac{1}{k^2} - \frac{1}{y} = 0 \]

Depending on Poisson’s ratio values the \( k \) values are within 0.92 < \( k < 0.95 \) We approximately assume that \( k = 0.92 \)

\[ C_R = 0.92C_p \]
Added strain check according to ASCE 2001 Guidelines for the Design of Buried Steel Pipe (American Lifelines Alliance), SNiP, SP, GOST, GB Codes
Landslide, Soil subsidence, frost heaving, Permanent ground deformation (seismic fault crossing) can also be modeled. The pipeline strain check is made according to ASCE 2001 (ALA) and GB 50470.
The pipeline strain check is made according to ASCE 2001 (ALA) and GB 50470.
PASS/Start-Prof | New Features

- Added ability to specify different seismic anchor movement values for the same phase group. It is used to define various restraint movement on several floors of the same building.
- Added new functions to Operation Mode Editor: Disable overload factors, add a factor to weight loads.
Added Insulation Joint (Insulation Kit) stress analysis. The axial stress and stress from torsion moment is checked automatically.
• Added new object "Cylindrical Shell", that is used for modelling of boilers, pressure vessels, columns, horizontal vessels,
• Added new object "Nozzle", allows to automatically model nozzles of boiler and pressure vessels, and columns. Automatically model shell flexibilities using WRC 297/PD 5500, custom values or FEM method, movements due to thermal expansion of the vessel, checks allowable loads, automatically checks stresses using WRC 107/537/297
PASS/Start-Prof | New Features
Added new object "Tank Nozzle API 650", allows to automatically model the storage tank nozzles. Automatically model flexibilities using API 650, thermal movements of the nozzle, movements and rotation due to tank bulging effect using API 650, tank settlement, automatically checks allowable loads using API 650 and STO-SA 03-002-2009.
• Added new object "Pump API 610/ISO 13709", allows to automatically model the pumps, consider thermal movements of the nozzles, checks allowable loads using API 610 and ISO 13709
• Added new object "Pump ISO 9905"
• Added new object "Pump ISO 5199"
Added new object "In-line Pump", allows to automatically model the vertical in-line pumps, consider thermal movements of the nozzles, checks allowable loads using API 610 and ISO 13709.
Added new object "Compressor API 617/API 619/ISO 10439", allows to automatically model the compressors, consider thermal movements of the nozzles, checks allowable loads using API 617 and ISO 10439
Added new object "Turbine NEMA SM23/API 611/API 612", allows to automatically model the steam turbines, consider thermal movements of the nozzles, checks allowable loads using NEMA SM23, API 611, API 612, ISO 10437
Added new object "Other Pump", allows to automatically model the pumps, consider thermal movements of the nozzles, checks allowable loads.
 Added new object "Fired Heater API 560/ISO 13705", allows to automatically model the fired heaters, consider thermal movements of the nozzles, checks allowable loads using API 560 and ISO 13705.

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Added new object "Air cooled Heat Exchanger API 661/ISO 13706", allows to automatically model the air cooled heat exchangers, consider thermal movements of the nozzles, checks allowable loads using API 661 and ISO 13706.
PASS/Start-Prof | New Features

Added new object Untied Expansion Joint and database of Untied Expansion Joints, allows to specify the axial, rotational, shear and torsion flexibility and automatically checks the individual and combined allowable deformations. No need to manually model it using nonstandard expansion joint any more.

\[ \frac{\lambda_P}{\lambda_p} + \frac{\lambda_D}{\lambda_D} + \frac{\lambda_A}{\lambda_A} \leq 1. \]
Added new object Torsion Expansion Joint and database of torsion expansion joints, automatically model torsion friction (friction moment) and checks allowable rotation angle.
PASS/Start-Prof | New Features

Added new fitness-for-service abilities: “Plane Flaw” object and “Volumetric Flaw” object, allows to model the plain flaw on the pipe, bend, tee and check the stresses in the flaws.
Added ability to specify insulation, cladding, and liner layers density and thickness in pipe properties. The ability to choose an insulation weight from the database still exist.
PASS/Start-Prof | New Features

Added thumbnails for windows explorer. Now you can preview all piping models right in the explorer before opening the file.
PASS/Start-Prof | New Features

Added function "Copy Whole Model". Allows to copy whole piping model as an object into clipboard. After that you can insert this interactive model into any other software like MS WORD, EXCEL etc. You can rotate, pan zoom the model right inside MS WORD.

You can add interactive into report in MS Word and send for your customer for review.
PASS/Start-Prof | New Features

- Added export to EHS pipe support sizing software. START-PROF can create cad8.dat file
- Added function that save backup copy of the file before each run with date and time stamp. It is available in general settings
- Added automatic compression of START-PROF piping model files (.ctp). Now files become 10 times smaller
- Significantly increased the speed of opening and saving big piping models into file
- Added new topics into Application Guide
PASS/Start-Prof | Reliability

Full Verification and Validation manual. Added a lot of verification examples, compared to manual calculations and other software.
Each new PASS/START-PROF release is:

- Automatically verified on more than 300 examples with previous versions (quality assurance system)
- Checked manually with group of pipe stress experts (testers)
- Each release pass through 1-3 pipe stress trainings with 10-20 students before official release
- After release, all bugs reported by +2 000 companies of our active users are quickly fixed and new release is provided
- Software is trusted and reliable!
Subscribe our YouTube channel, you will find a lot of PASS/START-PROF training videos

www.youtube.com/passuite
PASS/Start-Prof | Licensing

Configurations/Pricing Options

- **Permanent License at Affordable Price** (+1 year maintenance for free!)
- **Maintenance Renew 1 Year**: 25%
- **Annual License**: 40%
- **Semi-Annual License**: 25%

### Configurations Comparison

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