



PASS/START-PROF

Online Training Course Agenda

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This course created by experienced piping stress analysis specialists covers all features of onshore above ground and underground piping and pipeline analysis. The course is based on PASS/START-PROF software applying, though it will be valuable for users of any other pipe stress analysis tools as it contains a lot of theoretical information.

The course consists of pre-recorded video lectures, quizzes, examples and handout materials. After finishing the course, you will receive a Certificate of Completion from the Learning Platform as well as the Certificate from PASS. All trainees will be granted access to the full version of PASS/START-PROF software for 30 days.

PASS/START-PROF provides comprehensive pipe stress analysis with related sizing calculations according to the most requested international codes and standards. First introduced in 1965, PASS/START-PROF combines a highly efficient solver, powerful analysis features, friendly and easy to use GUI, an intuitive 3D graphical pre/post-processor, a detailed help system with embedded intelligence from generations of piping design experts.

PASS Team offers a complete solution for engineering of Piping Systems and related equipment including engineering consulting and the PASS Software. By bringing its experience from many engineering projects into the PASS software tools and combining this embedded intelligence with powerful capabilities and unsurpassed usability, PASS makes piping and equipment analysis practical for every engineer and designer while reducing the time, effort, and cost to perform the analysis.



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Introduction

In the introduction video, you will learn general information about the course:

- General course overview: purposes, structure, duration
- How to download and install a PASS/START-PROF trial license
- Where to get additional information about the software
- How to obtain your Certificate of Completion

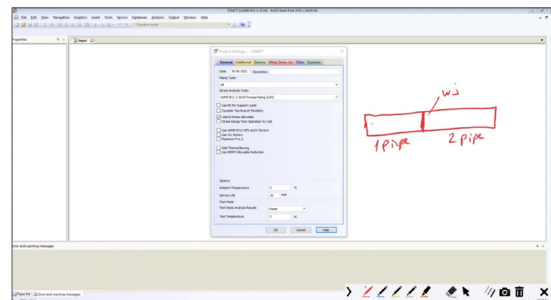
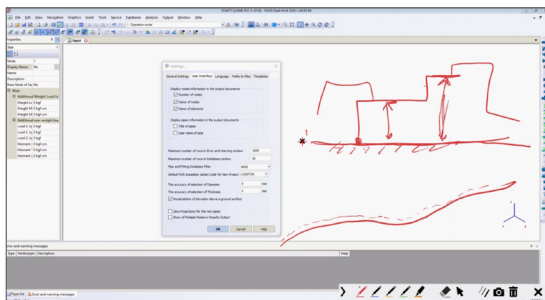
Section 1. Working with PASS/START-PROF User Interface

LECTURE 1. DEFAULT SETTINGS, CREATING A NEW PROJECT, WHAT IS AMBIENT TEMPERATURE, GENERAL SETTINGS, OVERVIEW OF PIPING COMPONENTS TOOLBAR, ADJUSTING THE USER INTERFACE (VIDEO 1)

Duration: 54 minutes

In this lecture you will learn:

- How to set up Default Settings for a new project
- How to Create a New Project
- What the Ambient Temperature of a piping system is
- Description overview of General Settings
- Overview of the Piping Components Toolbar
- Adjusting the User Interface (toolbars, dockable windows, save layout)

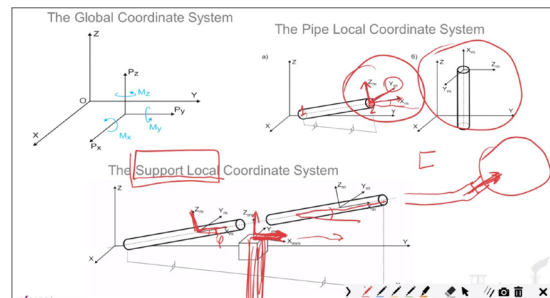
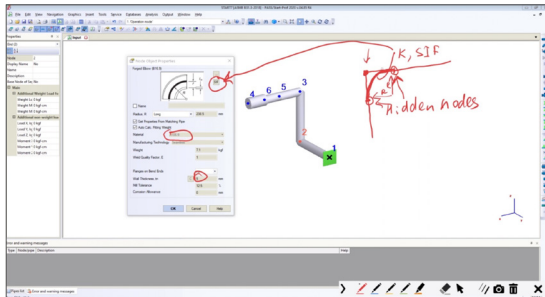


LECTURE 2. CREATING A SIMPLE PIPING MODEL, VIEWING OF DEFLECTED SHAPE, STRESSES, RESTRAINT LOADS, DISPLACEMENTS, COORDINATE SYSTEMS (VIDEO 2)

Duration: 44 minutes

In this lecture you will learn:

- How to Create a Piping Model from scratch
- View the Deflected Shape of a piping system
- Check Stresses, Restraint Loads, Displacements
- Learn about available Coordinate Systems

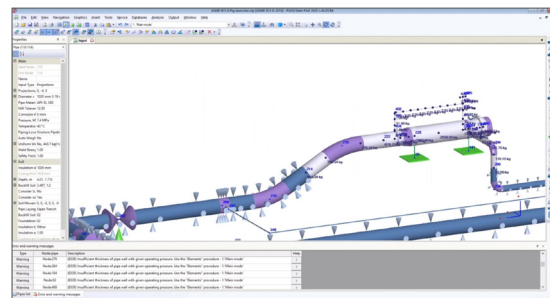
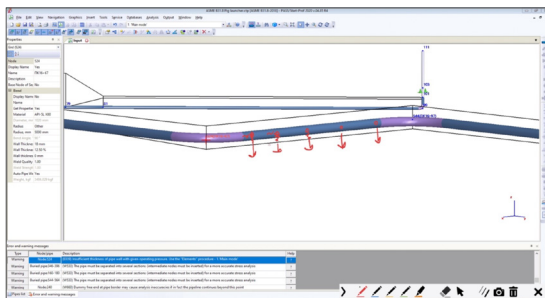


LECTURE 3. 3D NAVIGATION (SCALING, PANNING, ROTATING, VIEW SELECTION, 3D, TRANSPARENT), FIND FUNCTION, CUSTOMIZE GRAPHICS, NODE AND ELEMENT NAMES, VIEWING RESULTS IN DOCKABLE WINDOWS, SORTING, PIPE ELEMENT LIST WINDOW (VIDEO 4)

Duration: 23 minutes

In this lecture you will learn:

- 3D Navigation (Scaling, Panning, Rotating, View Selection, 3D, Transparent)
- Find Function
- Customize Graphics
- Node and Element Names
- Viewing Results in Dockable Windows
- Sorting
- Pipe Element List Window

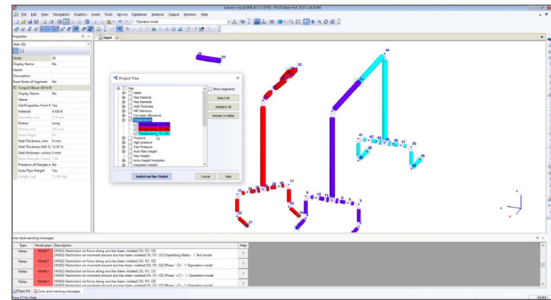
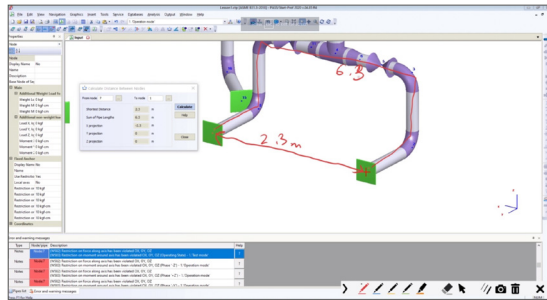


LECTURE 4. COPY, ROTATE, MOVE, CHANGE OF PROPERTIES, INDEPENDENT PIPING SEGMENTS, GLOBAL COORDINATES, ADDING OF NODES INTO OBJECTS. PROJECT TREE, MEASURE DISTANCE AND ANGLE (VIDEO 5)

Duration: 41 minutes

In this lecture you will learn:

- How to Copy piping segments
- How to Rotate piping
- How to Move piping
- How to Change properties for several objects simultaneously
- How to create several Independent Piping Segments
- What is global coordinates
- How to add node into bend, valve, tee
- How to use a Project Tree
- How to Measure Distance and Angle



LECTURE 5. UNITS CHANGING, BUILT-IN CALCULATOR, NODES RENUMBERING, REMOVING UNNECESSARY NODES, LIST OF PIPING COMPONENTS (VIDEO 6-1)

Duration: 10 minutes

In this lecture you will learn:

- How to change units
- Using a built-in smart calculator
- Nodes renumbering
- Unnecessary nodes removing
- List of piping components

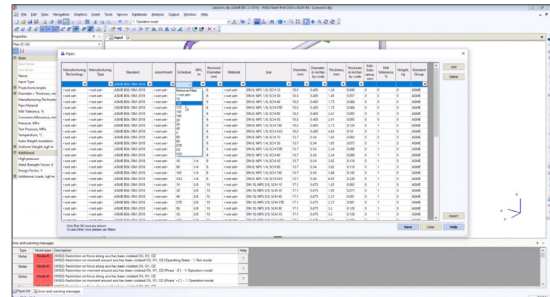
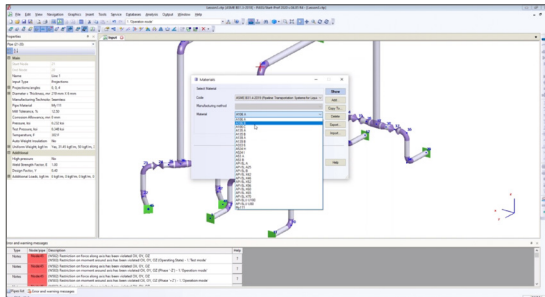


LECTURE 6. MATERIAL, INSULATION, PIPE COMPONENTS, INSULATION JACKET DATABASES (VIDEO 8)

Duration: 27 minutes

In this lecture you will learn:

- Material database
- Insulation database
- Pipe, bend, tee, reducer databases
- Insulation Jacket Database

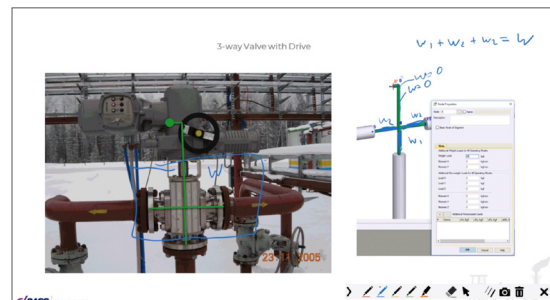
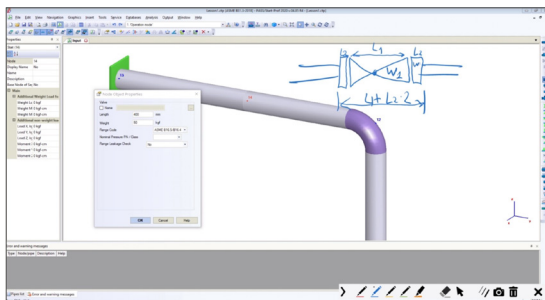


LECTURE 7. 2-, 3-, 4-WAY VALVE MODELING, VALVE WITH HEAVY DRIVE, FLANGE LEAKAGE CHECK (VIDEO 11)

Duration: 21 minutes

In this lecture you will learn:

- Modeling of 2-way valve, 3-way valve, 4-way Valve
- Valve modeling with a heavy drive
- Check the flange leakage

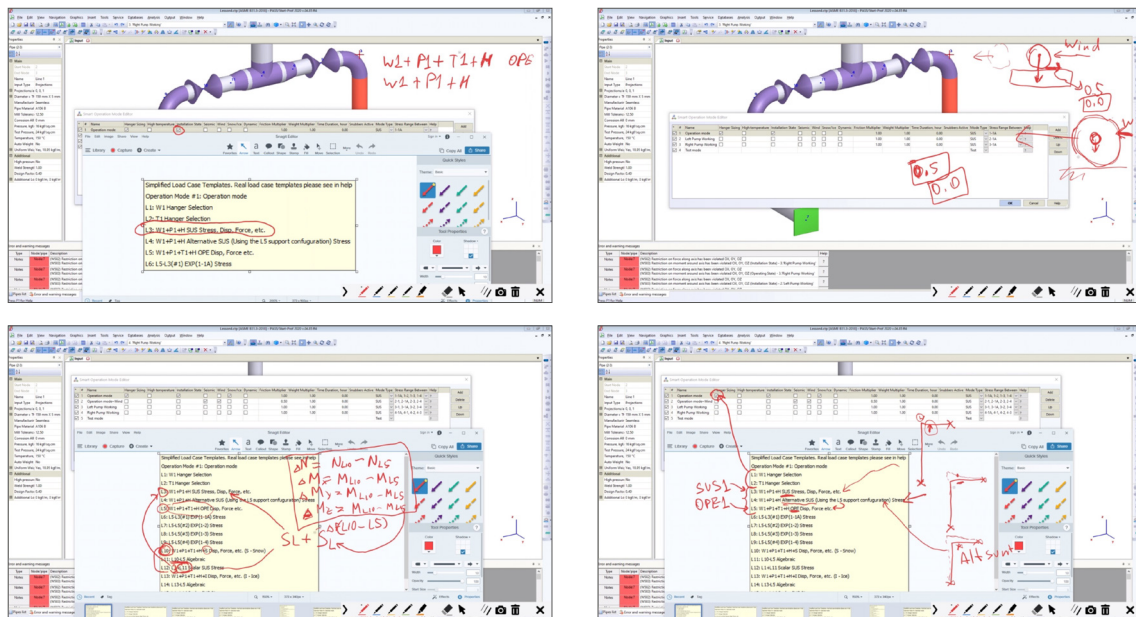


LECTURE 8. OPERATION MODE EDITOR. WIND, ICE AND SNOW LOADS. ADDITIONAL FORCE LOADS (VIDEO 12)

Duration: 55 minutes

In this lecture you will learn:

- Use operation mode editor. Load cases description
- Specify several pressures, temperatures and support movements
- Add wind, ice, snow loads
- Add seismic loads
- Add additional force loads



LECTURE 9. LOAD CASE TEMPLATES. ADDITIONAL CONCENTRATED AND UNIFORM LOADS. SUPPORT MOVEMENTS. HOG AND SAG (VIDEO 15)

Duration: 64 minutes

In this lecture you will learn:

- Which load cases are created for each operating mode
- Concentrated forces, uniform loads, support movements
- When to add several ambient temperatures
- Detailed overview of load cases which you get in result tables: stress, support loads, displacements, etc.



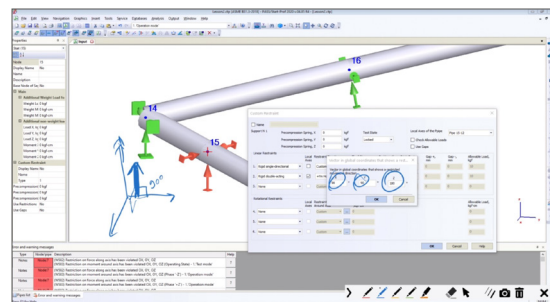
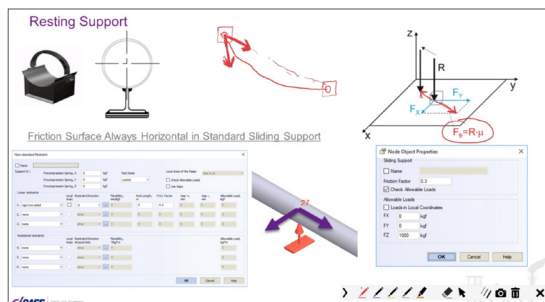
Section 2. Piping Supports

LECTURE 10. RESTRAINT TYPES, STANDARD RESTRAINS, CUSTOM RESTRAINT, ADDING MULTIPLE SUPPORTS (VIDEO 3)

Duration: 39 minutes

In this lecture you will learn:

- Restraint Types
- Standard Restraints
- Custom Restraint
- Adding Multiple Support Types

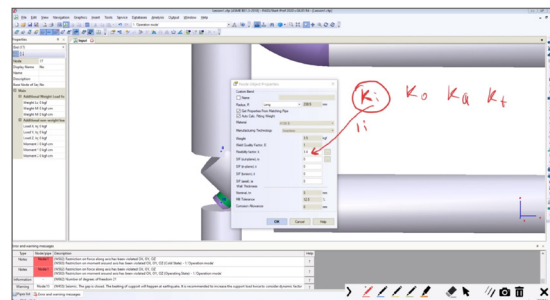
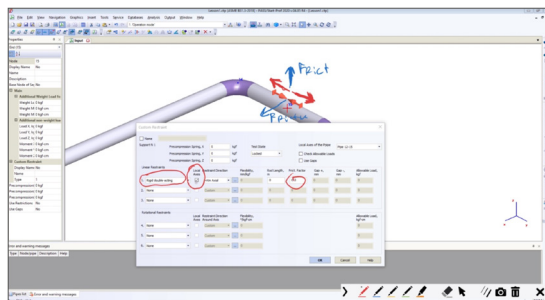


LECTURE 11. LIMIT STOP, TRUNNION ON THE BEND (VIDEO 9)

Duration: 24 minutes

In this lecture you will learn:

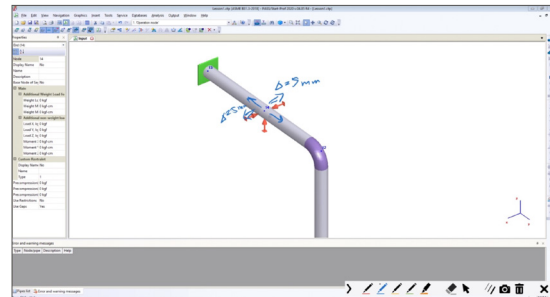
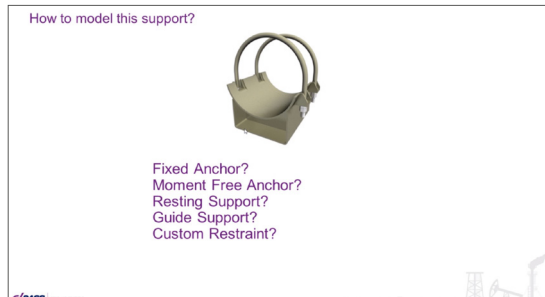
- Limit stop
- Trunnion on the Bend



LECTURE 12. RESTRAINT CHOOSING PHILOSOPHY, ROLLERS SUPPORT (VIDEO 10)

Duration: 13 minutes

You will learn how to choose the right type of a restraint and how to model the roller support.



LECTURE 13. SPRING SELECTION (VIDEO 13)

Duration: 62 minutes

In this lecture you will learn:

- Cases when spring hangers are needed
- The spring selection algorithm
- How to tune springs manually
- How to perform equipment alignment
- Difference between cold and hot state selection
- Possible error messages
- Constant Spring Selection
- How to remove the weight load from equipment nozzles
- What is a spring locking in hydro test

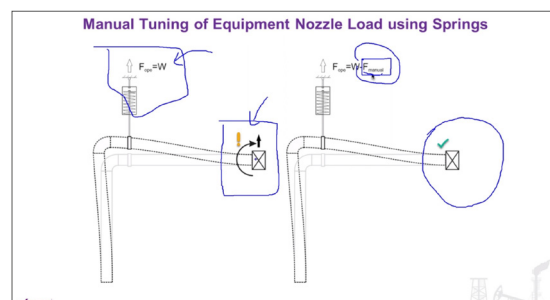
Spring Selection Algorithm

We need to reduce the difference between operation and cold load using the more flexible springs (reduce "k")

$$F_{OPE} = W$$

$$F_{Inst} = W + k\Delta$$

This reduces the large piping deformations in cold state that spoil the drain slope, reduces stress range, simplifies the spring installation and makes the spring load within allowable limits (max and min load).
Maximum load variation by most of spring manufacturers is 25%

$$\text{Load Variation} = \frac{|F_{OPE} - F_{Inst}|}{F_{OPE}} = \frac{|k\Delta|}{F_{OPE}} \leq 25\%$$


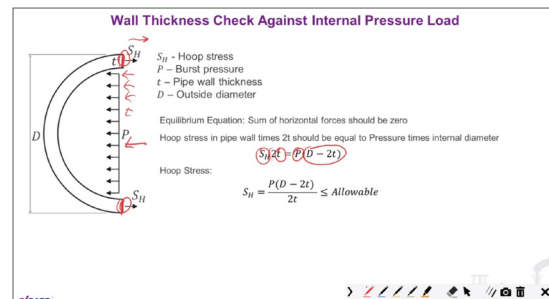
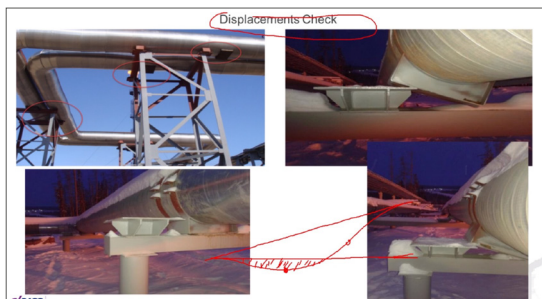
Section 3. Stress Analysis Theory and Results Evaluation

LECTURE 14. STRESS ANALYSIS RESULTS. SUPPORT LOADS, DISPLACEMENTS, WALL THICKNESS CALCULATION PER ASME B31 AND EN CODES (VIDEO 14-1)

Duration: 55 minutes

In this lecture you will learn:

- What we should check after analysis besides stresses?
- Support load table settings
- Load coordinate systems
- Displacement table settings
- Deflected shape of the piping analysis, stress color diagram
- Wall thickness calculation check against internal pressure
- E, W, y factors
- Allowable stress calculation procedure
- Wall thickness calculation per ASME B31.3 including Chapter IX
- Wall thickness calculation per ASME B31.1, B31.9, B31.5, B31.12, B31.4, B31.8, EN 13480
- Bend and Miter bend wall thickness calculation



LECTURE 15. LOAD CLASSIFICATIONS. STRESS TYPES. PRIMARY AND EQUIVALENT STRESSES. ASME B31.3 STRENGTH CRITERIA (VIDEO 14-2)

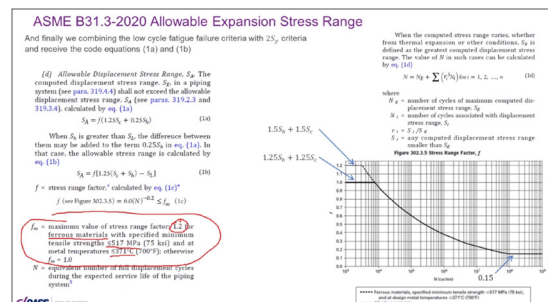
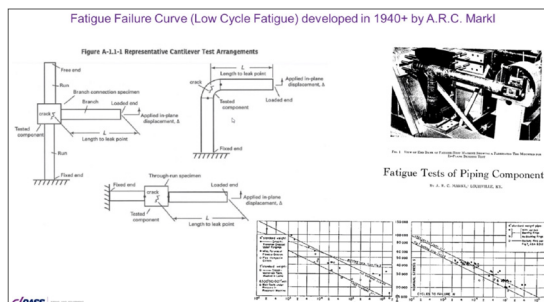
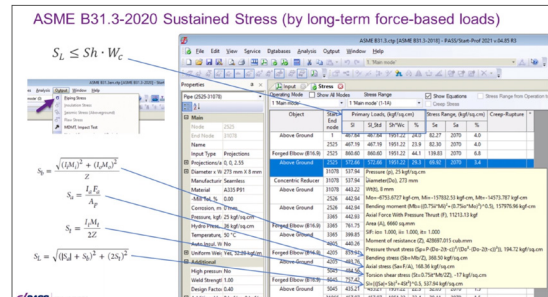
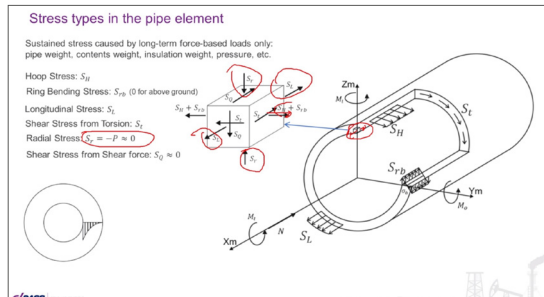
Duration: 67 minutes

In this lecture you will learn:

- Load classification (primary, secondary, sustained, occasional)
- Pipe stress types. Principal stresses. Equivalent stresses
- Sustained, occasional, expansion stress check per ASME B31.3



- Specific features of stress calculation in nonlinear systems. Alternative sustained stress
- Support friction effects on stresses in piping systems
- Low cycle fatigue evaluation

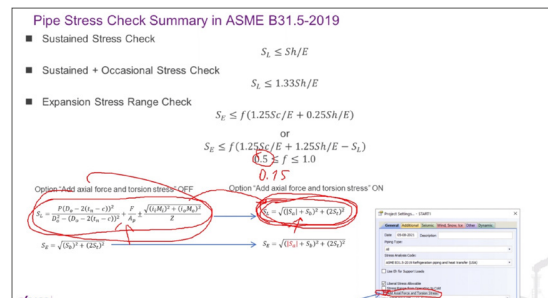
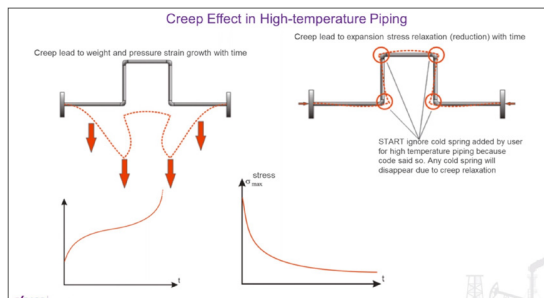


LECTURE 16. APPENDIX V: CREEP-RUPTURE USAGE FACTOR, CREEP EFFECT IN HIGH TEMPERATURE PIPING. PIPE STRESS CHECK SUMMARY PER ASME B31.3, B31.1, B31.9, B31.5 (VIDEO 14-3)

Duration: 24 minutes

In this lecture you will learn:

- Appendix V: Creep-Rupture Usage Factor calculation and evaluation
- Creep Effect in High Temperature Piping. How it affects stresses and support loads
- Creep self-springing effect
- Check Summary per ASME B31.3, B31.1, B31.9, B31.5



LECTURE 17. BOURDON EFFECT. RESTRAINED AND UNRESTRAINED PIPES. PIPE- LINE STRENGTH CRITERIA PER ASME B31.4 AND B31.8 (VIDEO 14-4)

Duration: 66 minutes

In this lecture you will learn:

- Pressure Bourdon effect in piping systems
- Restrained and unrestrained pipe calculation and strength criteria
- Restrained and unrestrained zones in pipelines
- Virtual anchor length
- Effective axial force, upheaval buckling
- “Start Smart Check” criteria and how it simplifies the pipeline stress analysis
- Pipeline Strength Criteria per ASME B31.4 and B31.8

Bourdon Effect

• Final Conclusion. Unrestrained, Restrained, Partially Restrained

	Unrestrained pipe $k = 0$	Restrained pipe $k = \infty$	Partially restrained pipe with flexible spring k
(Effective Axial Force) → Support Load	$R = 0$	$R = \frac{P(D-2t)^2}{4E} + \frac{P(D-2t)^2}{4E} = \frac{P(D-2t)^2}{2E}$	$R = \frac{P(D-2t)^2}{4E} + \frac{P(D-2t)^2}{4E} = \frac{P(D-2t)^2}{2E}$
(True Axial Force) → Axial Force	$F = \frac{P(D-2t)^2}{4E} + \frac{P(D-2t)^2}{4E} = \frac{P(D-2t)^2}{2E}$	$F = \frac{P(D-2t)^2}{4E} + \frac{P(D-2t)^2}{4E} = \frac{P(D-2t)^2}{2E}$	$F = \frac{P(D-2t)^2}{4E} + \frac{P(D-2t)^2}{4E} = \frac{P(D-2t)^2}{2E}$
Axial Stress	$S_x = \frac{P(D-2t)^2}{4E} + \frac{P(D-2t)^2}{4E} = \frac{P(D-2t)^2}{2E}$	$S_x = \frac{P(D-2t)^2}{4E} + \frac{P(D-2t)^2}{4E} = \frac{P(D-2t)^2}{2E}$	$S_x = \frac{P(D-2t)^2}{4E} + \frac{P(D-2t)^2}{4E} = \frac{P(D-2t)^2}{2E}$
Elongation	$\Delta L = \frac{P(D-2t)^2}{4E} + \frac{P(D-2t)^2}{4E} = \frac{P(D-2t)^2}{2E}$	$\Delta L = 0$	$\Delta L = \frac{P(D-2t)^2}{4E} + \frac{P(D-2t)^2}{4E} = \frac{P(D-2t)^2}{2E}$

Pipe Stress Check in ASME B31.4, B31.8, B31.12PL

ASME B31.4 and B31.8 codes divide pipes into restrained and unrestrained. Which part of pipe is restrained and which is not? Many engineers have a misconception about this.

Unrestrained Pipe

- B31.4, B31.8, B31.12PL
 - $S_x = \frac{P(D-2t)^2}{4E} + \frac{P(D-2t)^2}{4E} = \frac{P(D-2t)^2}{2E}$
 - $S_y = \frac{P(D-2t)^2}{4E} + \frac{P(D-2t)^2}{4E} = \frac{P(D-2t)^2}{2E}$
 - $S_z = \frac{P(D-2t)^2}{4E} + \frac{P(D-2t)^2}{4E} = \frac{P(D-2t)^2}{2E}$
- B31.4, B31.8, B31.12PL
 - $S_x = \frac{P(D-2t)^2}{4E} + \frac{P(D-2t)^2}{4E} = \frac{P(D-2t)^2}{2E}$
 - $S_y = \frac{P(D-2t)^2}{4E} + \frac{P(D-2t)^2}{4E} = \frac{P(D-2t)^2}{2E}$
 - $S_z = \frac{P(D-2t)^2}{4E} + \frac{P(D-2t)^2}{4E} = \frac{P(D-2t)^2}{2E}$

Restrained Pipe

- B31.4, B31.8, B31.12PL
 - $S_x = \frac{P(D-2t)^2}{4E} + \frac{P(D-2t)^2}{4E} = \frac{P(D-2t)^2}{2E}$
 - $S_y = \frac{P(D-2t)^2}{4E} + \frac{P(D-2t)^2}{4E} = \frac{P(D-2t)^2}{2E}$
 - $S_z = \frac{P(D-2t)^2}{4E} + \frac{P(D-2t)^2}{4E} = \frac{P(D-2t)^2}{2E}$
- B31.4, B31.8, B31.12PL
 - $S_x = \frac{P(D-2t)^2}{4E} + \frac{P(D-2t)^2}{4E} = \frac{P(D-2t)^2}{2E}$
 - $S_y = \frac{P(D-2t)^2}{4E} + \frac{P(D-2t)^2}{4E} = \frac{P(D-2t)^2}{2E}$
 - $S_z = \frac{P(D-2t)^2}{4E} + \frac{P(D-2t)^2}{4E} = \frac{P(D-2t)^2}{2E}$

LECTURE 18. STRESS INTENSIFICATION FACTORS. ASME B31J, FEA. TEE MODEL. TRUNNION ON THE PIPE AND BEND, LATERAL TEE (VIDEO 14-5)

Duration: 20 minutes

In this lecture you will learn:

- Stress intensification (SIF) factors
- ASME B31J code and its limitations
- How to calculate SIF using finite element method
- SIF and k-factor calculation for lateral tees, trunnions, etc.
- Second layer model of the tee object in PASS/START-PROF
- Second layer model of the trunnion objects in START-PROF
- Brief overview of PASS/NOZZLE-FEM software applying for SIF and k-factor calculation



Bourdon Effect

• Final Conclusion. Unrestrained, Restrained, Partially Restrained

	Unrestrained pipe $k = 0$	Restrained pipe $k = \infty$	Partially restrained pipe with flexible spring k
(Effective Axial Force) → Support Load	$R = 0$	$R = \frac{P(D-2t)^2}{4(D^2-2Dt+2t^2)}$	$R = \frac{P(D-2t)^2}{4(D^2-2Dt+2t^2)} \cdot \frac{1}{1 + \frac{E}{kD}}$
(True Axial Force) → Axial Force	$R = 0$	$R = \frac{P(D-2t)^2}{4(D^2-2Dt+2t^2)}$	$R = \frac{P(D-2t)^2}{4(D^2-2Dt+2t^2)} \cdot \frac{1}{1 + \frac{E}{kD}}$
Axial Stress	$S_x = \frac{P(D-2t)^2}{4(D^2-2Dt+2t^2)}$	$S_x = \frac{P(D-2t)^2}{4(D^2-2Dt+2t^2)}$	$S_x = \frac{P(D-2t)^2}{4(D^2-2Dt+2t^2)} \cdot \frac{1}{1 + \frac{E}{kD}}$
Elongation	$\Delta L = \frac{P(D-2t)^2}{4(D^2-2Dt+2t^2)} \cdot \frac{L}{E}$	$\Delta L = 0$	$\Delta L = \frac{P(D-2t)^2}{4(D^2-2Dt+2t^2)} \cdot \frac{L}{E} \cdot \frac{1}{1 + \frac{E}{kD}}$

Pipe Stress Check in ASME B31.4, B31.8, B31.12PL

ASME B31.4 and B31.8 codes divide pipes into restrained and unrestrained. Which part of pipe is restrained and which is not? Many engineers have a misconception about this.

Unrestrained Pipe

- B31.4, B31.8, B31.12PL: $S_x = 0.5S_y \pm S_z \leq 0.75S_y$
- B31.4, B31.8, B31.12PL: $S_y = \sqrt{\frac{(0.75M_x)^2 + (0.75M_z)^2}{I}}$
- B31.4, B31.8, B31.12PL: $S_z = \frac{PD}{4t}$

Restrained Pipe

- B31.4, B31.8, B31.12PL: $S_x = S_y + vS_z \pm S_z \leq 0.9S_y$
- B31.4, B31.8, B31.12PL: $S_y = \sqrt{\frac{(0.75M_x)^2 + (0.75M_z)^2}{I}}$
- B31.4, B31.8, B31.12PL: $S_z = \frac{PD}{4t}$

ASME B31.4 and B31.8 codes divide pipes into restrained and unrestrained. Which part of pipe is restrained and which is not? Many engineers have a misconception about this.

LECTURE 19. MINIMUM DESIGN METAL TEMPERATURE CALCULATION MDMT (VIDEO 14-6)

Duration: 5 minutes

In this lecture you will learn:

- What is the minimum design metal temperature?
- MDMT reduction depending on the stress ratio

Minimum Design metal Temperature (MDMT) Check per ASME B31.3-2020

PASS/START-PROF calculates the MDMT according to figure 323.2.2A for carbon steels. If "use MDMT allowable reduction" option is activated, then MDMT is reduced using the figure 323.2.2B depending on the calculated stress ratio, taking into account the code requirements 323.2.2 (g), (h), (i), but not less than -48° C. If stress ratio less than 0.3, then MDMT can be reduced to -104° C.

After analysis the output report table is provided. For each pipe START-PROF show if the impact test is needed or not.

Minimum Design metal Temperature (MDMT) Check per ASME B31.3-2020

Minimum Design Metal Temperature or MDMT is the lowest temperature that a piping system with specified material and thickness can withstand. While designing piping systems (equipment) in cold regions where environment temperature falls drastically or piping systems carrying cryogenic temperature fluid, MDMT is a critical factor. Considering the metal's resistance to brittle failure, MDMT is the lowest permissible metal temperature for that thickness.

Minimum Design Metal Temperature (MDMT) calculated according to 323.2.2 (a), (b), (d), (e), (f), (h), (i), (j) of ASME B31.3-2020.

Material database contains all needed data.



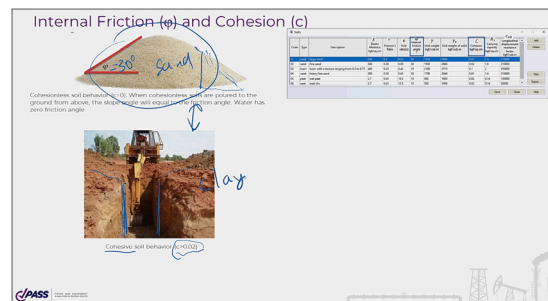
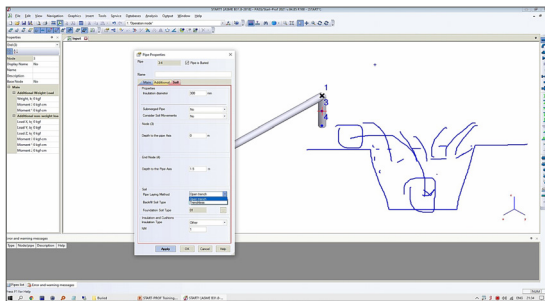
Section 4. Underground Pipe Modeling

LECTURE 20. BURIED PIPELINES MODELING. SOIL PROPERTIES (VIDEO 16-1)

Duration: 47 minutes

In this lecture you will learn:

- Overview of additional strength criteria for buried pipelines
- Cylindrical coordinate system for pipelines
- Creating a buried piping system. Buried pipes attributes
- Soil database. Detailed overview of all required soil properties: void ratio, unit weight, particle unit weight, internal friction angle, cohesion, etc.

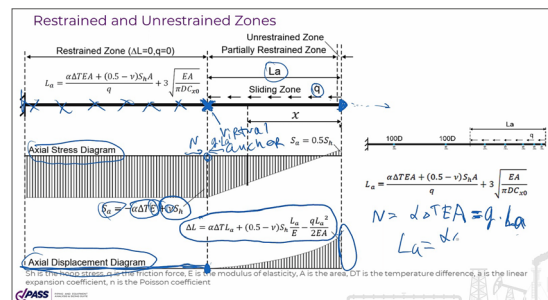
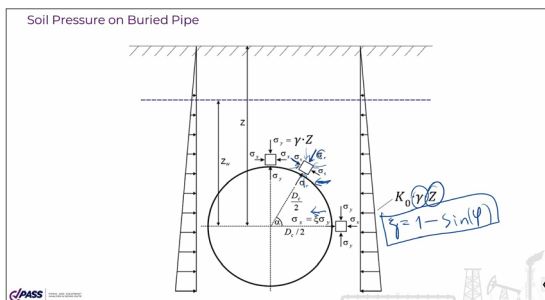


LECTURE 21. PIPE-SOIL INTERACTION MODEL. BENDING, SLIDING, AND RESTRAINED ZONES (VIDEO 16-2)

Duration: 50 minutes

In this lecture you will learn:

- Pipe-soil interaction model. Expansion pad and polyurethane foam insulation flexibility
- Longitudinal, lateral, and vertical soil spring properties. Soil pressure arch effect
- Soil properties for inclined and vertical pipes
- Soil spring placement algorithm for dry soil. Restrained, sliding and bending zones

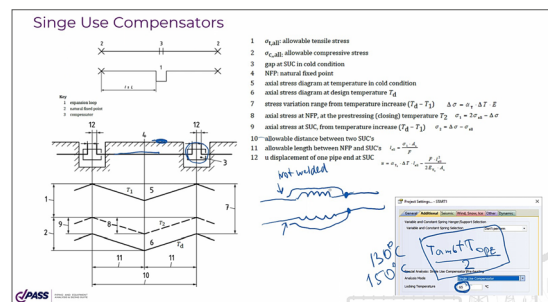
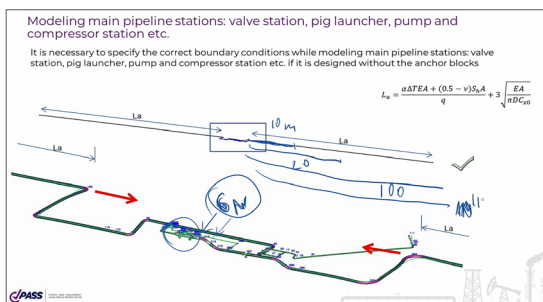


LECTURE 22. SPECIFIC BEHAVIOR OF BURIED PIPELINES. METHODS OF THERMAL EXPANSION COMPENSATION. SUBMERGED PIPELINES. BALLASTING WEIGHTS. SINGLE USE COMPENSATORS. PRE-HEATING (VIDEO 16-3)

Duration: 59 minutes

In this lecture you will learn:

- Specific behavior features of the buried pipeline in contrast to the above ground pipelines. Virtual anchor length
- Dealing with huge axial elongations for cross country pipelines
- Effect of placing supports on buried piping
- Soil model for submerged pipes. Ballasting weights, buoyancy force
- Methods of thermal expansion compensation
- Single use compensators
- Pre-heating



LECTURE 23. RING BENDING STRESS. STRESS IN INSULATION. STRESS FROM SURFACE LOAD. LONG RADIUS BENDS MODELING OF LAYING, TRENCHING, LIFTING, SUBSIDENCE, FROST HEAVING, FAULT CROSSING. STRAIN LIMIT CHECK (VIDEO 16-4)

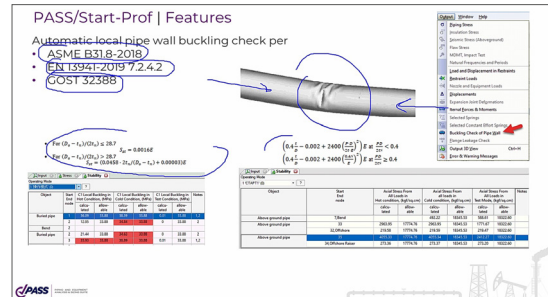
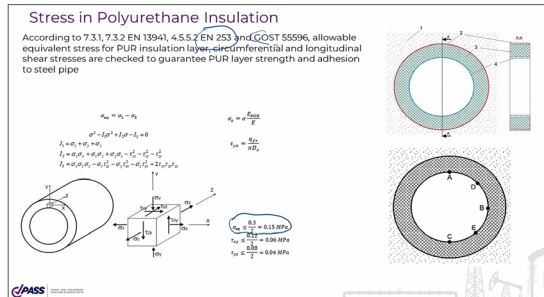
Duration: 54 minutes

In this lecture you will learn:

- Ring bending stress from soil pressure
- Checking stresses in polyurethane insulation
- Pipe stresses from live loads on ground surface
- Very long radius bends. Restressed long radius bends
- Modeling a pipeline laying over a terrain profile
- Modeling pipeline trenching
- Modeling pipeline lifting for repair



- Modeling of soil subsidence, frost heaving, fault crossing with example
- Strain limit check per ASCE 2001 (ALA)

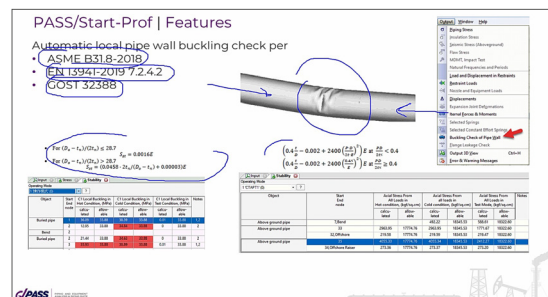
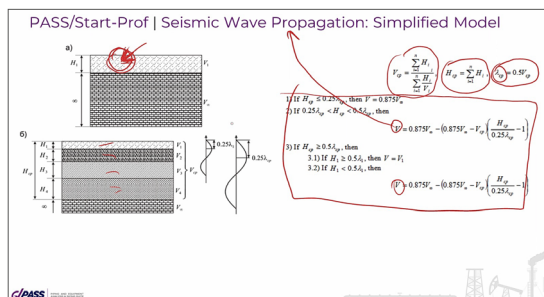


LECTURE 24. LANDSLIDE. SEISMIC WAVE PROPAGATION. PIPE WALL BUCKLING, UPHEAVAL BUCKLING. MODELING OF PIPE IN CHAMBER, IN CASING WITH SPACERS. ELECTRICAL INSULATION KIT (VIDEO 16-5)

Duration: 39 minutes

In this lecture you will learn:

- Landslide modeling
- Seismic wave propagation analysis with example. Strain check per ASCE 2001 (ALA)
- Example of accurate seismic P,S,R-waves modeling
- Example showing why pipe branches and pipe turns fail during seismic wave propagation
- Pipe wall buckling check
- Modeling of an underground chamber
- Modeling of a pipeline in casing with spacers
- Checking Stress in an insulation joint (electrical insulation kit)
- Upheaval buckling analysis
- Lateral buckling for above ground pipelines



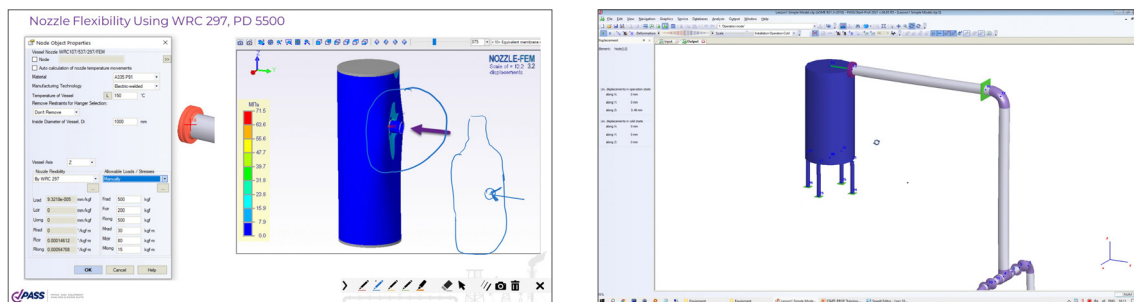
Section 5. Static and Rotating Equipment Modeling and Evaluation

LECTURE 25. CONNECTION TO PRESSURE VESSELS (VIDEO 17-1)

Duration: 58 minutes

In this lecture you will learn:

- Methods of connection to pressure vessels modeling
- Thermal expansions of equipment modeling
- Local nozzle flexibility modelling per WRC 297 and PD 5500. “Nozzle” object
- Ways of global vessel flexibility modeling. “Cylindrical shell” and “rigid element” objects



LECTURE 26. STRESS AND FLEXIBILITY CALCULATION PER WRC 297/107/537/ PD 5500/FINITE ELEMENT METHOD (VIDEO 17-2)

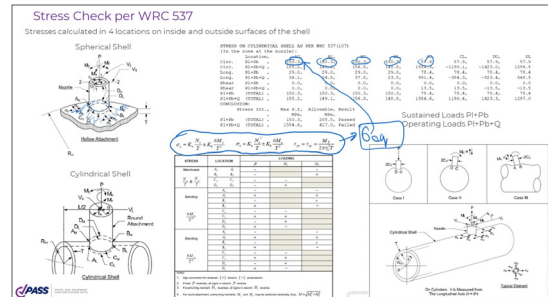
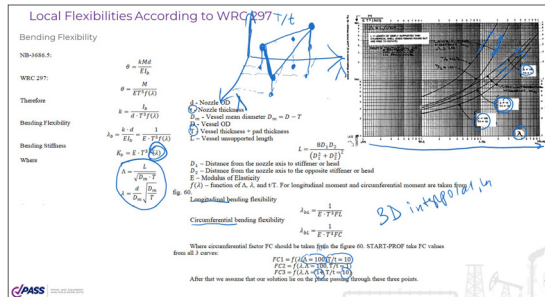
Duration: 49 minutes

In this lecture you will learn:

- Calculation of nozzle flexibilities per WRC 297 for cylindrical shell
- Calculation of nozzle flexibilities per PD 5500 for cylindrical shell
- Calculation of nozzle flexibilities per PD 5500 for spherical head
- Stress check per WRC 537/WRC 297. Difference and application limitations



- Calculation of nozzle flexibilities and stresses with finite element method (FEM) using PASS/Nozzle-FEM software. Stress extrapolation, effect of mesh size tuning

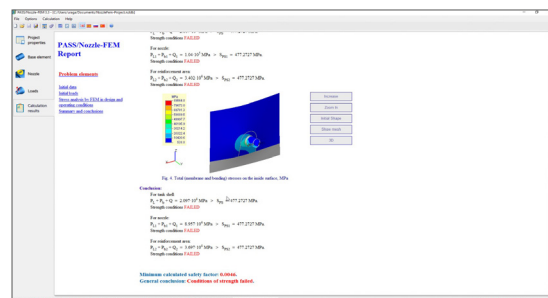
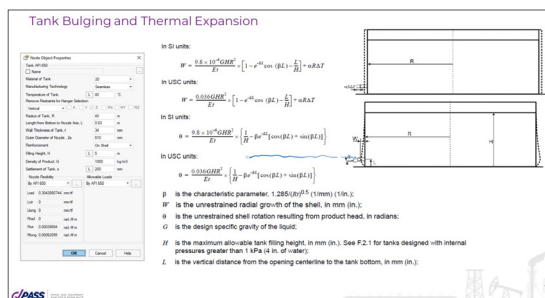


LECTURE 27. CONNECTION TO HORIZONTAL VESSELS AND COLUMNS. CONNECTION TO A STORAGE TANK, API 650 (VIDEO 17-3)

Duration: 60 minutes

In this lecture you will learn:

- Modeling of horizontal pressure vessels
- Modeling of columns
- Modeling of a connection to a storage tank. "Storage tank" object
- Modeling of a tank settlement
- Modeling of a tank bulging and thermal expansion
- Modeling of a tank nozzle flexibility per API 650 and using finite element method
- Checking tank nozzle allowable loads using API 650 method and finite element method
- Different techniques of nozzle to tank connection modeling
- Modelling of spring hangers to compensate a tank settlement

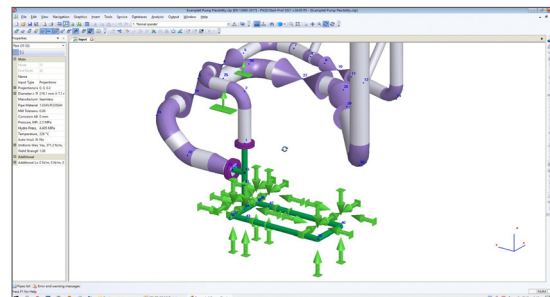
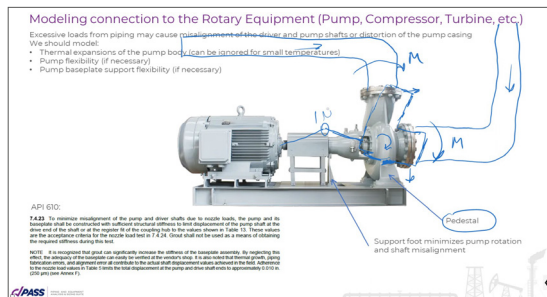
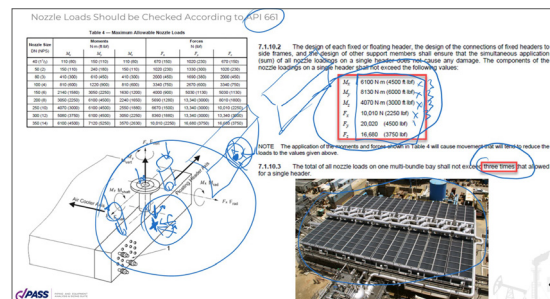
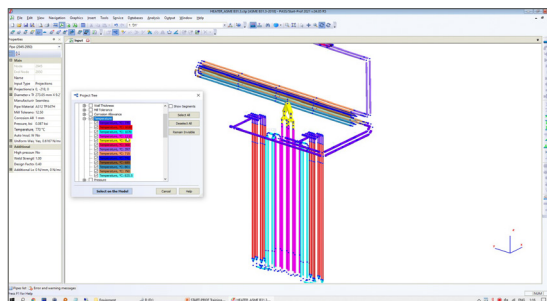


LECTURE 28. CONNECTION TO A FIRED HEATER, API 560, API 530. AIR COOLED HEAT EXCHANGER, API 661. PUMP, COMPRESSOR, TURBINE API 610, API 617, NEMA SM23 (VIDEO 17-4)

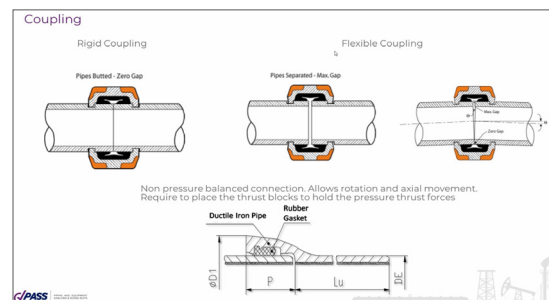
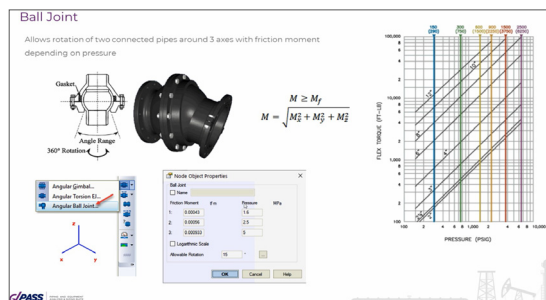
Duration: 77 minutes

In this lecture you will learn:

- Two different methods of fired heater modeling and checking. API 560. “Fired heater” object
- Fired heater radiant coil analysis, API 530
- Methods of air cooled heat exchanger modeling. “Air cooler” object
- Allowable loads on air cooled heat exchanger checking per API 661
- Methods of modeling a connection to a pump. Pump thermal expansions.
- “Pump” object
 - Modeling of a pump and pump baseplate flexibility
 - Loads checking per API 610
 - Modeling of in-line pumps and allowable loads checking per API 610. “In-line” pump object
 - Modeling of filters and allowable loads checking
 - “Custom pump” object
- Modelling of a compressor and a turbine. Allowable loads checking per API 617 and NEMA SM 23. “Compressor” and “Turbine” objects
- Modular design. Modeling of a connection to the module



- Rubber expansion joint features
- Flexible hoses modeling and checking
- Slip joint
- Torsion Joint
- Ball joint
- Weight of expansion joints
- Coupling types and modeling
- Expansion joint database



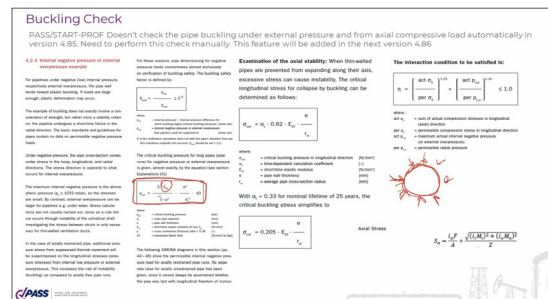
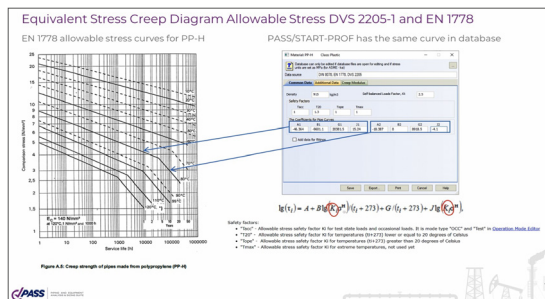
Section 7. Non-Metallic Piping Stress Analysis

LECTURE 31. HDPE, PVC, PP THERMOPLASTIC PIPING STRESS ANALYSIS

Duration: 49 minutes

In this lecture you will learn:

- Main differences of thermoplastic piping behavior comparing to the steel piping
- Thermoplastic piping failure examples
- DVS 2205-1 / DVS 2210-1 / EN 1778 code requirements
- Creep Modulus, Thermal Expansion Factor
- Allowable Stress Calculation, Material Database
- Buckling Analysis
- Examples, comparison with SIMONA engineering guide



LECTURE 32. FRP/GRP/GRE PIPING STRESS ANALYSIS

Duration: 50 minutes

In this lecture you will learn:

- Main Differences of FRP/GRP/GRE piping behavior comparing to steel piping
- FRP/GRP/GRE Material Database
- Pipe pressure elongation
- Piping failure criteria according to ISO 14692
- Ring bending stress calculation



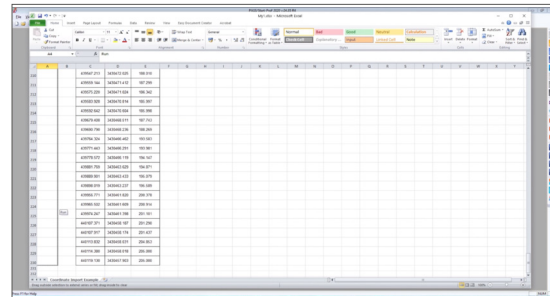
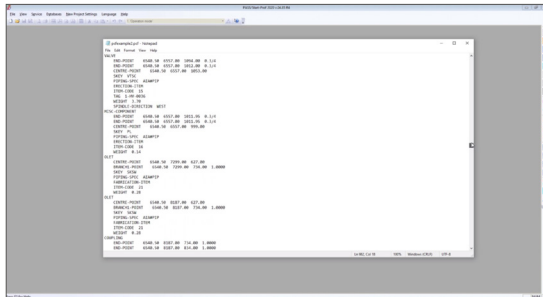
Section 8. External Interfaces

LECTURE 33. IMPORT FROM PCF, IMPORT FROM EXCEL, API APPLICATION PROGRAMMING INTERFACE. EXAMPLE PROGRAMS ON C# AND VBA IN EXCEL (VIDEO 7)

Duration: 13 minutes

In this lecture you will learn:

- How to Import from PCF format file (piping component file)
- How to Import a model from Excel
- What is PASS/START-PROF API Interface. Using C# and VBA in Excel with PASS/START-PROF



LECTURE 34. COPYING A MODEL INTO MS WORD, EXPORT INTO NEUTRAL FILE, CREATING A REPORT IN MS WORD, EXPORT TO AUTOCAD, EXPORT TO BMP, JPG, EXPORT TO PCF FORMAT, EXPORT TO CAESAR II, IMPORT FROM CAESAR II (VIDEO 6-2)

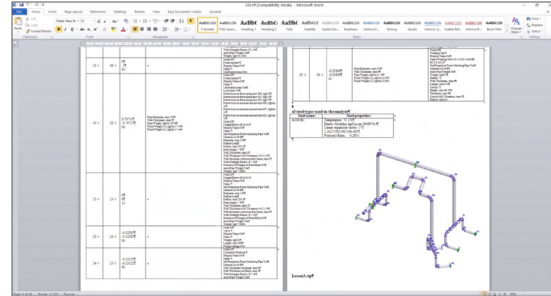
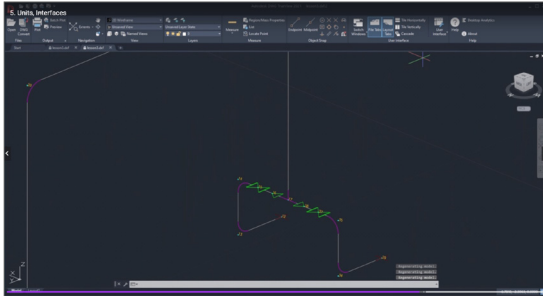
Duration: 13 minutes

In this lecture you will learn:

- Copy a model into MS Word
- Export a model into a neutral file
- Create a report in MS Word
- Export to Autodesk AutoCAD



- Export to BMP, JPG, etc.
- Export to PCF format
- Export to CAESAR II, Import from CAESAR II

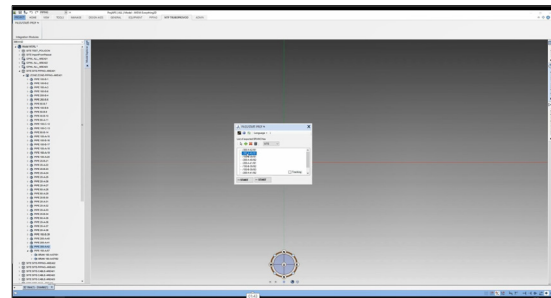
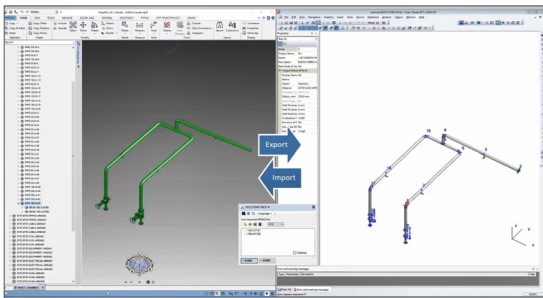


LECTURE 35. IMPORT FROM AVEVA PDMS, E3D, MARINE INTO PASS/START-PROF AND BACKWARD

Duration: 4 minutes

In this lecture you will learn:

- Installing of a START-AVEVA module
- Import a model from AVEVA into PASS/START-PROF
- Export a model from PASS/START-PROF into AVEVA



LECTURE 36. IMPORT FROM AUTODESK REVIT INTO PASS/START-PROF

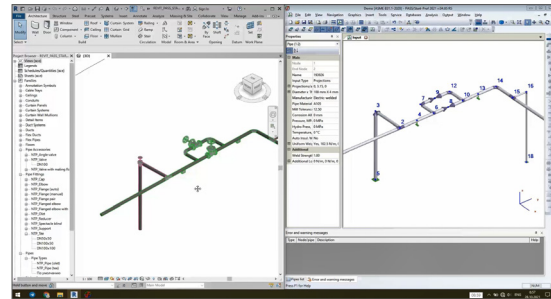
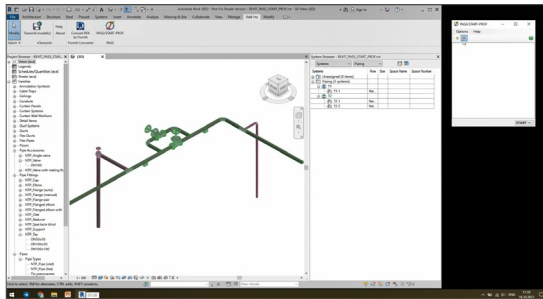
Duration: 10 minutes

In this lecture you will learn:

- Installing of a START-REVIT module
- Customize Settings of Revit Integration module



- Export setup methods
- Export procedure

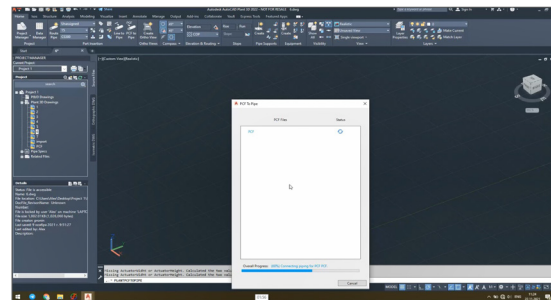
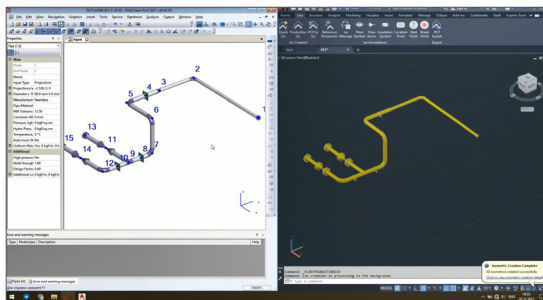


LECTURE 37. EXPORT AND IMPORT FROM PCF INTO PASS/START-PROF

Duration: 4 minutes

In this lecture you will learn:

- Import from PCF file
- Export to PCF file
- PCF file import customization file



LECTURE 38. NORMAL MODES ANALYSIS

Duration: 30 minutes

In this lecture you will learn:

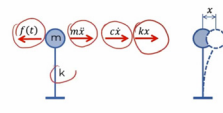
- Normal Modes Calculation Theory. Example of one mass and two mass systems
- Settings for dynamic analysis in PASS/START-PROF
- Example of two mass and distributed mass systems in PASS/START-PROF
- Automatic mass distribution method
- Natural frequencies view and mode shapes



- Normal modes analysis of nonlinear systems with gaps, single-directional restraints, friction and rotating rods
- Code requirements for natural frequencies and common practice
- Common methods of piping system tuning to avoid vibration with an example
- Problem of a friction effect on vibration and its' solution
- How to increase the accuracy of calculated natural frequencies

PASS/START-PROF | Dynamic: Modal Analysis

System with one degree of freedom



Sum of the forces acting on the mass

$$m\ddot{x} + c\dot{x} + kx = f(t)$$

m – mass
 c – damping
 k – stiffness
 $f(t)$ – external force as function of time
 $x(t)$ – displacement as function of time
 $\dot{x}(t)$ – velocity as function of time
 $\ddot{x}(t)$ – acceleration as function of time

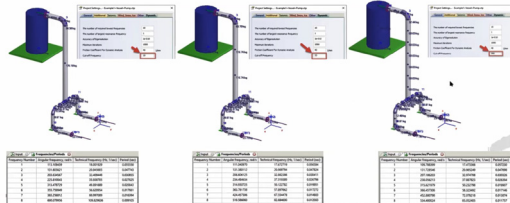
Let's assume that

- $c = 0$ no damping
- $f(t) = 0$ no external forces
- $x = A \cdot \sin(\omega t)$
- $\dot{x} = -\omega^2 \cdot A \cdot \sin(\omega t) = -\omega^2 x$
- $-\omega^2 x + kx = 0$

PASS PIPELINE ANALYSIS SOFTWARE

PASS/START-PROF | Dynamic: Modal Analysis

The greater cut-off frequency, the more accurate results you receive, but slower



PASS PIPELINE ANALYSIS SOFTWARE

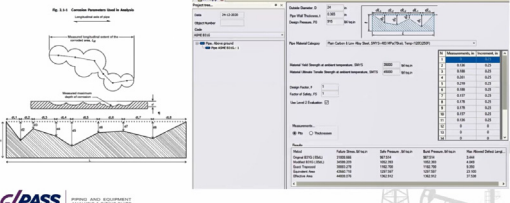
LECTURE 39. ASME B31G REMAINING STRENGTH OF CORRODED PIPELINE CALCULATION

Duration: 4 minutes

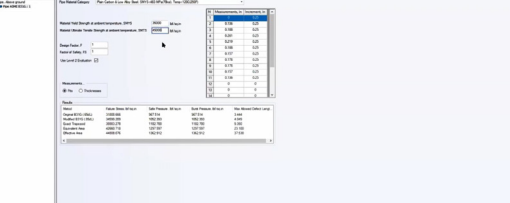
In this lecture you will get an overview of Original B31G, Modified B31G, Effective Area methods.

PASS/START-PROF | ASME B31G

ASME B31G Remaining Strength of Corroded Pipeline



PASS PIPELINE ANALYSIS SOFTWARE



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