CAEPIPE 3D+
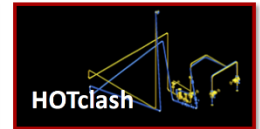
CAEPIPE 3D+ is a bundled package consisting of CAEPIPE and three plugin modules checkSTRESS, HOTclash and dataTRANSLATORS.

It is common practice worldwide that piping layout designers route pipes in 3D Plant Design systems with consideration given mainly to space constraints, process and flow constraints (such as pressure drop) and other requirements arising from constructability, operability and reparability. Most often, while routing piping systems, pipe stress requirements are not sufficiently considered.

To meet pipe stress requirements, pipe stress engineers have felt the following needs.

Need 1: Instead of creating pipe stress models by manually entering layout, pipe sizes and materials, supports, loads etc. in pipe stress software such as CAEPIPE, such stress models should be generated directly from 3D Plant Design systems.

Need 2: The layouts of the stress models so generated from 3D Plant Design systems should have already gone through first-level stress compliance checks performed by 3D piping designers, so that the piping layouts received by pipe stress engineers are already flexible enough to absorb expansion/contraction of pipes due to thermal loads.

A Comprehensive Software Enabling Seamless Design of Piping from 3D Plant Design to Stress Compliance

Need 3: In addition to the traditional "clash checks" carried out on 3D plant model, piping designers should be able to check for "interference" when piping is deformed under "hot operating condition".

Need 4: Immediate visualization of the 3D plant model while performing detailed analyses would immensely help pipe stress engineers to identify (a) all possible locations for pipe supports and (b) vacant space available in case re-routing of pipes is required.

Need 5: Piping designers should be able to import any layout changes made by stress engineers to 3D plant model as "reference geometry" for re-routing, and update pipe supports in 3D plant model by referring to finalized stress models.

The disruptive product CAEPIPE 3D+ fulfils all 5 Needs of pipe stress engineers as outlined in the respective features below.

Feature 1:

Data Translators in CAEPIPE 3D+ meets <u>Need 1</u> by generating pipe stress models directly from 3D Plant Design systems such as E3D/PDMS, SmartPlant, AutoCAD Plant 3D, AutoPlant, CADMATIC, CATIA, etc. This feature is incorporated into CAEPIPE 3D+ by including all data translators for CAEPIPE listed at the link https://www.sstusa.com/data-translators.php.
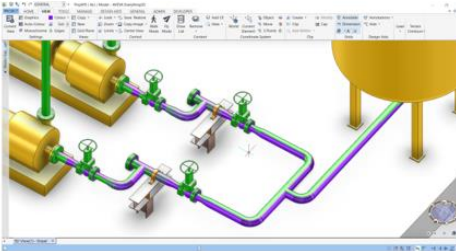
Feature 2:

Integration with 3D systems
Import model from 3D systems
Preliminary stress check by designers

Need 2 is met by first having 3D piping designers use checkSTRESS in CAEPIPE 3D+ as first-level piping flexibility check software. In other words, while pipe routing, 3D piping designers use CAEPIPE 3D+ to perform a few basic stress compliance checks, specifically to make sure the layouts are flexible enough to absorb thermal expansion/contraction of pipes. This feature is made possible in CAEPIPE 3D+ by incorporating in CAEPIPE 3D+ the checkSTRESS modules for the 3D Plant Design systems listed at the link https://www.sstusa.com/check-stress.php.

Feature 3:

Once 3D piping designers finalize the layouts after performing first-level piping flexibility checks, they can meet Need 3 by using HOTclash in CAEPIPE 3D+ to check for interference between the "deformed" layouts of piping under "hot operating condition" and adjacent objects. This feature is available only on CAEPIPE 3D+ for E3D/PDMS and CADMATIC. To avoid any interference under hot conditions, designers can make minor layout changes.   By including the HOTclash product in CAEPIPE 3D+, this feature of CAEPIPE 3D+ is made available to the users of E3D/PDMS and CADMATIC. For details on HOTclash, visit the link https://www.sstusa.com/hot-clash.php.

Clash free piping design

Feature 4:

The "thermal stress-compliant" and "hot-clash-free" CAEPIPE 3D+ models resulting from Features 2 and 3 are transferred to pipe stress engineers (a) to carry out detailed analyses for loads such as deadweight, thermal, wind, seismic and dynamic loads, (b) to arrive at proper support scheme to meet all aspects of pipe stress requirements, and (c) to generate detailed stress reports.

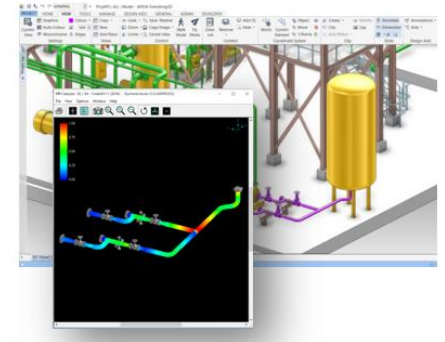CAEPIPE 3D+ meets Need 4 of pipe stress engineers by providing immediate visualization of the 3D plant model while performing analyses. Such instant visualization helps (a) to identify all possible locations for pipe supports, and (b) to identify vacant space available in case re-routing of pipes is required. The pipe stress software CAEPIPE is built into CAEPIPE 3D+; hence, the immediate visualization of the 3D plant model by pipe stress engineers (either online or off-line) while performing analyses is available to the CAEPIPE 3D+ users.

Code complaint piping design
Comprehensive stress analysis and output for support and structure design

Feature 5:

Once stress models are finalized by pipe stress engineers, CAEPIPE 3D+ meets Need 5 by allowing piping designers to import all layout changes made by stress engineers into 3D plant model as "reference geometry", over which designers would re-route pipes. Designers would then update pipe supports in 3D plant model by referring to finalized stress models. The "Export to" feature built into CAEPIPE that exports updated stress layouts from CAEPIPE to PDMS/E3D, CADMATIC and PCF file formats provides this feature in CAEPIPE 3D+.
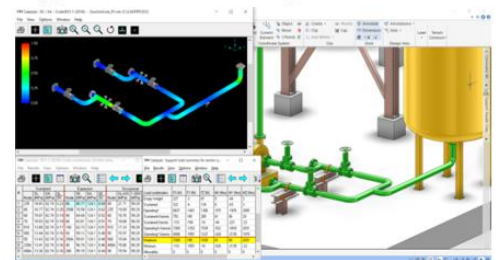
Overview of CAEPIPE 3D+

Pipe stress software CAEPIPE 3D+ has four (4) parts built-in as listed below.

Part 1 generates pipe stress models in CAEPIPE 3D+ format using dataTranslators from:
- Plant database of 3D Plant Design software E3D/PDMS and CADMATIC, and
- "PCF" files generated from plant database of 3D Plant Design software such as SmartPlant, AutoCAD Plant 3D, AutoPlant, CATIA, CADWORX, etc.

by reading the following from the plant database / PCF files of the above 3D Plant Design software:
- Piping geometry, pipe sections and material properties,
- Temperature, pressure and weight of pipe fittings,
- Thermal anchor movements at equipment nozzles,
- Allowable loads at equipment nozzles, and
- Pipe support details to create the corresponding hangers, guides, etc. in CAEPIPE 3D+.

Part 2 of CAEPIPE 3D+ contains the checkSTRESS modules for the 3D Plant Design systems listed under Part 1 above.

Part 3 of CAEPIPE 3D+ contains the HOTclash module only for the 3D Plant Design systems E3D/PDMS and CADMATIC.

Part 4 of CAEPIPE 3D+ is the same as the worldwide used pipe stress software CAEPIPE, which reads the stress models generated through Part 1. For modeling and analysis features of CAEPIPE, review CAEPIPE User's Manual, Technical Reference Manual and Code Compliance Manual available at the link www.sstusa.com/caepipe-docs.php.

Flexible Usage of CAEPIPE 3D+

Each licensed seat of CAEPIPE 3D+ currently allows the use of the following 4 modules, with the only restriction being only one module can be used at any point in time. As listed below, CAEPIPE 3D+ can be used as a stand-alone CAEPIPE in case 3D plant database or PCF files are not available to work with.

3D Plant Design System	Module Name	Status
E3D/PDMS*	CAEPIPE 3D+ for E3D/PDMS	Available
CADMATIC*	CAEPIPE 3D+ for CADMATIC	Available
3D Plant Design System that produces PCF files (such as SmartPlant, AutoCAD Plant 3D, AutoPlant, CATIA, CADWORX etc.)	CAEPIPE 3D+ for PCF	Available
Nil	CAEPIPE (stand-alone)	Available
CAEPIPE 3D+ runs as an on-line, add-on module to E3D/PDMS/CADMATIC, whereby a 3D piping designer transfers piping layouts and all available data from E3D/PDMS/CADMATIC to CAEPIPE 3D+ directly and performs first-level stress compliance checks without exiting E3D/PDMS/CADMATIC. Similarly, a pipe stress engineer performs detailed analyses of stress models received from the 3D piping designer without exiting E3D/PDMS/CADMATIC.		

In short, all four modules are available for use by a licensed CAEPIPE 3D+ seat, but only one module can be used at any point in time.

Advantages of CAEPIPE 3D+

1. The same full-fledged pipe stress software CAEPIPE 3D+ is used with many 3D Plant Design systems or as a stand-alone stress software, based on the requirements of projects.

2. CAEPIPE 3D+ input files can be generated directly from 3D Plant Design systems, thereby saving time and avoiding errors in re-creating stress models manually.

3. CAEPIPE 3D+ can be used first by 3D piping designers as a first-level piping flexibility check software. This step substantially reduces the number of design iterations between the piping layout and stress departments, resulting in huge time saving during design.

4. Using CAEPIPE 3D+ module for E3D/PDMS/CADMATIC, 3D piping designers can check for interference between "piping deformed under hot operating condition" and adjacent objects.

5. 3D plant model can be instantly viewed by piping designers during their first-level stress checks and by pipe stress engineers during detailed analyses.

6. Stress analysts can identify all possible locations for pipe supports on 3D plant model, as it contains all supporting objects such as steel and concrete structures adjacent to the concerned piping systems. These possible pipe support locations, once marked in the 3D plant model, are automatically transferred as "nodes" in the CAEPIPE 3D+ input files.

7. Piping designers can import layout changes made by stress engineers into 3D plant model and update pipe supports by viewing final stress models, resulting in significant time saving during design.

In summary, CAEPIPE 3D+ helps 3D piping designers and stress engineers to arrive at substantially better piping layouts that also meet all stress requirements, thereby saving costs associated with design, materials, construction, operation and maintenance.

CAEPIPE 3D+, the Most Disruptive Pipe Stress Software!

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