

PIPESTRESS Version 4.0.0 Enhancements

The main enhancements included in PIPESTRESS Version 4.0.0 since the last released version (3.9.0) are outlined below followed by a description of compatibility with previously released versions.

1. New Code Editions

Code edition	IDEN card	TITL card
B31.1 Ed. 2016	CD=0	CV=17
ASME NB-3600 Ed. 2017	CD=1	CV=24
ASME NC-3600 Ed. 2017	CD=2	CV=25
ASME ND-3600 Ed. 2017	CD=3	
B31.3 Ed. 2016	CD=4	CV=14
CODET Ed. 2016	CD=5	CV=6
RCC-M Volume B Ed. 2016	CD=7	CV=8
RCC-M Volume B Ed. 2017		CV=9
RCC-M Volume C Ed. 2016	CD=8	CV=8
RCC-M Volume C Ed. 2017		CV=9
EN 13480-3 Ed. 2017	CD=F	CV=3
ASME Appendix XXVI Ed. 2017	CD=P	CV=3

2. New FDIS card (Force DIStributed)

This new card allows to apply uniform or trapezoidal loads to any member.

3. Time History Calculations with applied rotational movements (RACC analysis)

4. Improvements to stratification features

- New STRG card: this card is introduced for linear (or linear-equivalent) stratification in any direction defined by vector V (VX/VY/VZ). It applies to straight and bend elements.
- The STRX card now also applies to bend elements. A new field GV is introduced in addition to GU, which allows to define stratification parallel to the bend centerline.

5. Generation of soil springs along buried bends (BRAD)

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6. Improvements to nonlinear restraints NRST

- Allow RMVT cards.
- Consider friction effects.

7. Improvements to floor response spectrum analysis RCAS

- Implementation of Gupta and Lindley-Yow methods for both periodic and rigid modes. See LO=B and LO=C.
- Implementation of counterphase interlevel LV=6.

8. New program ASG (Amplified Spectrum Generator)

New QA program that allows to generate the amplified spectrum at the decoupling point between run piping and branch piping.
This generation is possible by reading the restart file generated by PIPESTRESS with addition of dynamic magnification factors.

9. Improvements to beam elements BEAM

- Nonprismatic beams.
- Calculation of section properties based on beam geometry (fields ME and TY).
- Automatic mass point generation is enabled for beams (see MP field in FREQ card).
- New PF field (definition of start point).

10. New NTSP and NRSP cards (nonlinear springs)

Nonlinear translational and rotational springs.

11. Implementation of new equations for functional capability and operability in RCC-M Class 1 and Class 2

New equations EQ=S, O and P when the RCC-M code is selected (IDEN CD=7 or CD=8).

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12. Additional information for multilevel floor response spectrum analysis (RCAS card)

The modal masses for each mode and each direction are now printed in the prd file.

13. New branch option BR in the TITL card

This new option governs how the flexibility of non-Class 1 branches is calculated:

- 0 = the imaginary element connecting the centerline with the surface of the run pipe has zero flexibility (default)
- 1 = the imaginary element connecting the centerline with the surface of the run pipe has the same section as the section of the branch pipe (same as BRAN TE=2)
- 2 = the flexibility is calculated according to the rules of Class 1 branch connections

14. Rigorous calculation of local accelerations of valves for floor response spectrum analysis RCAS/DCAS

New option AL=3 in the TITL card. In this case, the signed projections are applied to each elementary response A_{ijk} (level i, mode j, direction k). The total response is obtained by $A = \Sigma \Sigma \Sigma A_{ijk}$, where Σ means the selected combination method.

15. Implementation of Time History analysis with gapped restraints (ADAMOS): new analysis cards PCAS and PACC

Dynamic analysis of piping systems with gapped restraints is based upon a piecewise linear approach in which the total response is obtained as a summation of all the modal responses and a correction for the left-out modes (beyond the cut-off frequency of the system).

Piecewise linear means that at time of impact or release of a gapped restraint, the mode shapes and modal amplitudes are recomputed. Between impacts or releases the system behaves linearly.

This method, called "ADaptive MOdal Summation" (ADAMOS), can be used with applied force time-history loads at discrete points, or with floor motion at a number of support levels.

16. New option KE=1 in the TITL card for ASME Class 1 Piping (Code Case N-779)

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17. Correction of Errors and Implementation of Minor Enhancements

- Possibility to define more than 99 levels: the possible level ident codes for supports have been changed from I2 (integer from 1 to 99) to A2 (2 alphanumeric characters). This raises the available number of ident codes from 99 to 3843.
- Enhancements to INDI and INDB card.
- Possibility to consider the Bourdon effects IP=1 in the TITL card for Class 1 calculations.
- Possibility to select the range method ME=9 in the CCAS card for Class 1 calculations.

18. Correction of Errors and Implementation of Minor Enhancements to QA programs POSTR, FHFILE, THIST, COMPPS, SPECT

- **POSTR**: transfer of the options from the command file to the control file, enhancements to flange calculations (e.g. new summary for flange calculations) and minor corrections.
- **THIST**: rotational levels, implementation of dynamic analysis with gapped restraints (ADAMOS).
- **FHFILE**: rotational levels, integrate feature.
- **SPECT**: rotational levels.
- **COMPPS**: possibility to apply specific options to each comparison.

Note: the programs PLOTT and SPREAD_PLT have become obsolete and have been removed.

19. PIPESTRESS is now available in 32 bits and 64 bits version.

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Compatibility

PIPESTRESS Version 4.0.0 may generate different solutions than earlier versions due to the correction of the following errors in Version 3.9.0:

1. The stress indices used for the calculation of tees may be incorrect for a combination case (*see report R-5 in the prc file*) when all following conditions are met:
 - the output of the first combination case is improperly disabled with EQ=1 in place of OP=1
 - the calculation is performed according to the ASME Code Classes 2&3 Edition 2001 or earlier
 - the equation verified in the combination case is:
 - either EQ=F (Functional Capability)
 - or EQ=M, N, X or Z (Reversing Anchor Motions, starting Edition 1992+A94)

See Error Report No. 123.

2. The load duration for LCAS and NCAS cases is defined by means of field DU for polyethylene piping calculated according to ASME Code Case N-755.

If base load cases with different durations are defined and there is at least one dependent load case, the solution for some load cases may be calculated using the wrong duration. For example, the solution for a LCAS case with DU=0 (long duration) may be calculated using the mechanical properties and allowable stresses related to DU=1 (short duration).

See Error Report No. 124.

3. The left-out-force correction may be calculated incorrectly for GCAS cases if the rotational inertia option is used.

See Error Report No. 125.

4. RSEC cases may be calculated incorrectly when at least two levels are defined with a zero phase number (default value) and at least one level is defined with a nonzero phase number.

See Error Report No. 126.

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5. When more than one restraints acting on the same point are defined in POSTR input file (card SUPP), the results for those restraints may not be combined conservatively if all following conditions are met:

- At least one of those restraints is skew
- The forces and moments for those restraints are output in a single report (default) and in global coordinates (option GL=G)
- There is at least one group (card GROU) containing an unsigned case (+/-) or one group using a non-algebraic method (ME ≠ 0)

See Error Report No. 127.

6. If RACC cases are calculated together with RCAS and/or DCAS cases, and the number of modes used for the RACC cases is less than the number of extracted modes, the solution obtained for the RCAS and/or DCAS cases may be incorrect.

See Error Report No. 128.

7. For branch connections with reduced outlet calculated according to Code ASME III NC/ND starting from Ed. 80+W80 up to and including Ed. 2001, the section modulus $Z_b = \pi (r_m)^2 t_s$ is used by PIPESTRESS for the branch in all equations (except Eqs.(8) and (9) starting from Ed. 1983), where t_s is the effective branch wall thickness.

This does not conform to Figure NC/ND-3673.2(b)-1 which requires the section modulus $Z_b = \pi (r_m)^2 T_b$ be used, where T_b is the branch wall thickness.

See Error Report No. 129.

8. Environmental fatigue effects can be evaluated by PIPESTRESS for ASME III NB piping. The dissolved oxygen content in water (DO) is a key parameter that may be specified by means of the OPER card for pipes made of carbon steel or low alloy steel.

If several OPER cards are entered with different DO contents, the DO contents may be assigned to the load sets in the wrong order. Thus, the transformed DO levels O^* and the F_{en} factors may be incorrect.

See Error Report No. 130.

9. The results of primary floor response spectrum analysis (RCAS) may be incorrect when the N-411 composite damping option is used.

See Error Report No. 131.

10. No displacements are applied to NRST supports for RACC and RSEC cases.

See Error Report No. 132.

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11. For codes EN 13480-3 starting Edition 2012 and CODETI starting Edition 2013, if the pressure correction option is enabled, the design pressure is used to calculate the stress intensification factors and flexibility factors of bend elements.

The design pressure should be taken equal to 0 when no DESN card is entered in the model. However, if the model with no DESN card is executed by means of a command file after another model that contains a DESN card, then the design pressure entered in that DESN card is used instead of 0.

See Error Report No. 133.

12. For codes EN 13480-3 starting Edition 2012, CODETI starting Edition 2013, ASME B31.1 starting Edition 1995+A96 and ASME B31.3, when the Hot Modulus option is selected, the temperature of the reference case specified in the FREQ card should be used for modal extraction.

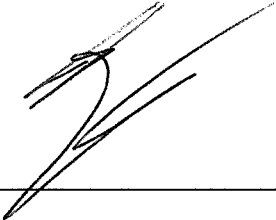

However, the design temperature is used instead if the material is defined by means of tables and the DESN card is placed after the OPER card of the FREQ/RF case and before the MATL card.

See Error Report No. 134.

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Some other modifications in PIPESTRESS Version 4.0.0 may also generate different solutions than earlier versions:

- The snow and wind loads are generated using the uniform model instead of lump model, for more precise calculations. Besides, the snow and wind loads apply to BELW card (bellow) but not to RIGD card (rigid element).
- The left-out-force correction for RCAS/DCAS/RACC cases is calculated taking into account the rotational inertia when the option TITL BL=7 or 8 is used. However, the impact on the solution is small and practically negligible in most cases.
- Correction of signs of support reactions when these signs are incoherent (e.g. negative value for unsigned cases).
- For anchors and restraints in local axes (LO>0), the direction is calculated more precisely when the coordinates DX and DZ of the connected element are very small.
- For EN13480 code: The pressure term can be calculated as $p_c \cdot d_i^2 / (d_o^2 - d_i^2) + 0.5 p_c$ instead of $p_c \cdot d_o / 4 / e_n$. The term $0.5 p_c$ is now considered when PR=2 in the TITL card.

I. Cornaton, QA Manager 	Date: 28-NOV-18
G. Catalano, President 	Date: 28-NOV-18