

# Expansion joints

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Latest update: 24 apr 2020

## Expansion joints

24 Mar, 2020

- [Support](#)

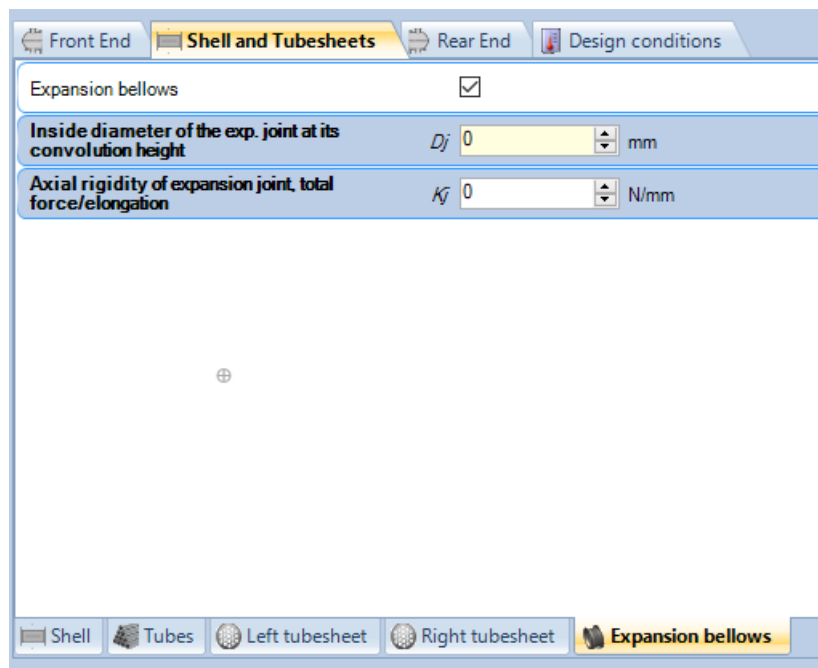
[Sergio Lidonnici](#)

The expansion joints (or bellows) are used in fixed plate heat exchangers to reduce thermal stress in case of high temperature differences between the two sides.

The program offers three different methods for considering the joint in the calculation of the tubesheets:

### 1. Entering only the properties of the joint, without creating the model

When calculating tubesheets, normally only two properties of the joint are required, namely the maximum internal diameter and the axial stiffness. These values are supplied directly by the manufacturer. It is therefore possible to insert only these two properties without having to add the expansion bellow as a component for the code verification. In the wizard, simply enable the appropriate option and enter the two values, as shown in the figure.

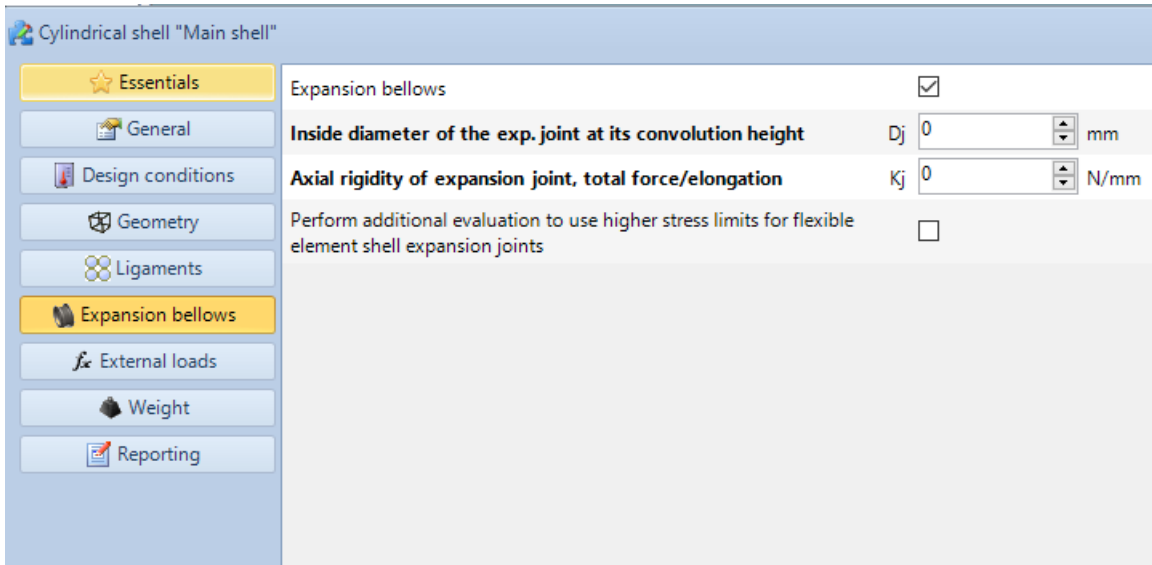


The screenshot shows a software interface with a top navigation bar containing 'Front End', 'Shell and Tubesheets' (highlighted), 'Rear End', and 'Design conditions'. Below this is a form with the following fields:

- Expansion bellows
- Inside diameter of the exp. joint at its convolution height:  $D_j$  0 mm
- Axial rigidity of expansion joint, total force/elongation:  $K_j$  0 N/mm

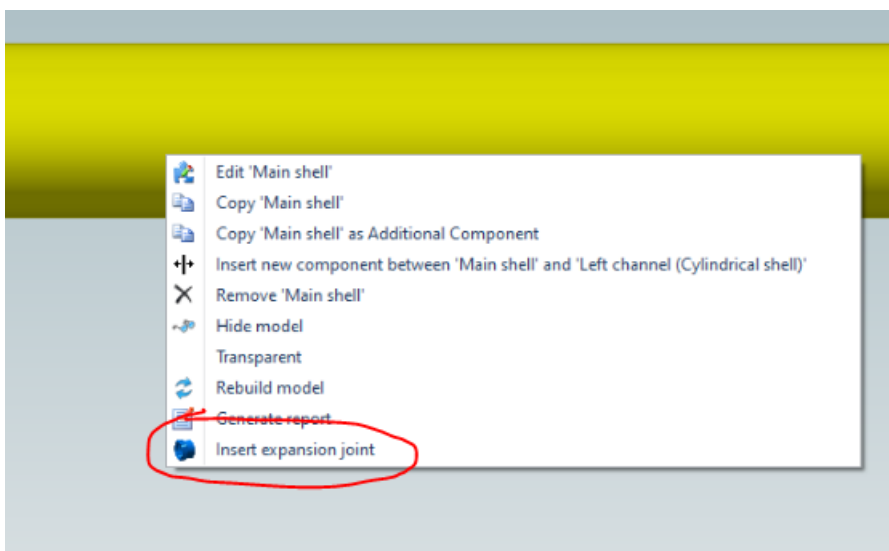
At the bottom, there is a tabbed interface with 'Shell', 'Tubes', 'Left tubesheet', 'Right tubesheet', and 'Expansion bellows' (highlighted).

After running the wizard and creating the exchanger, the properties of the joint will be visible in the shell tab. It is also possible to add them directly to the shell after running the wizard, if they have not already been entered previously.

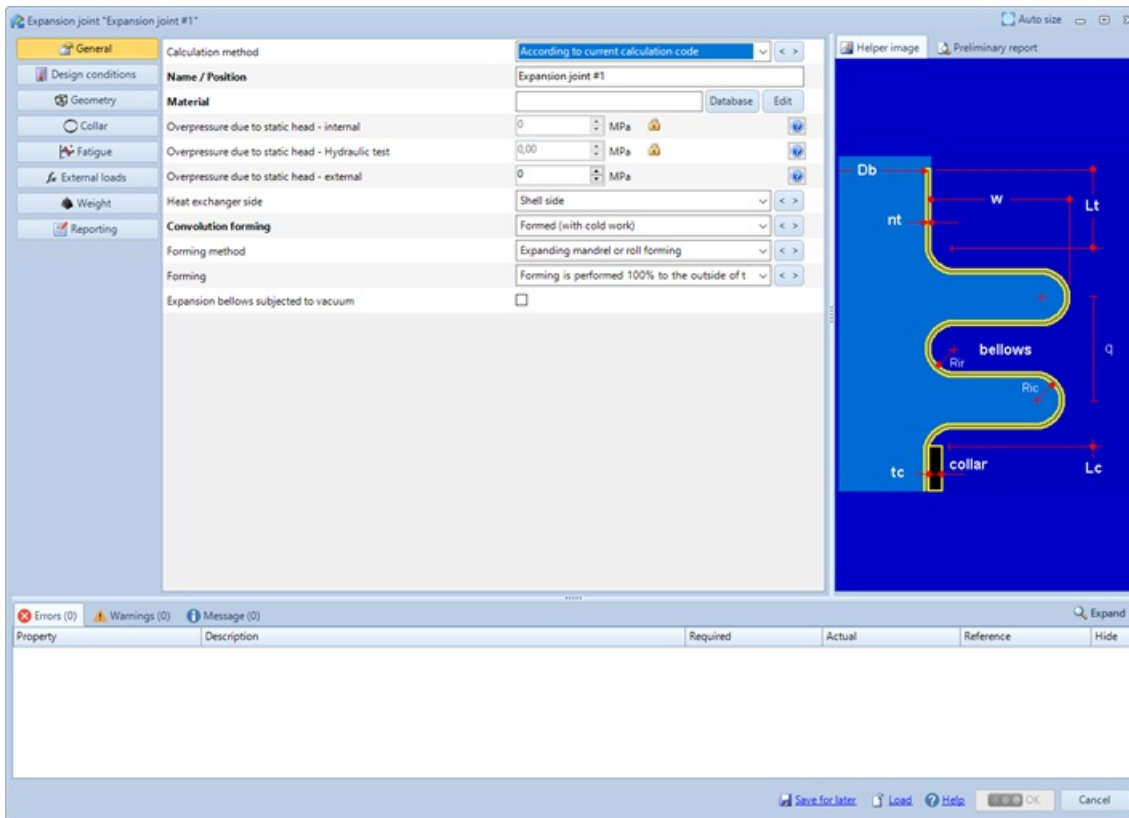


## 2. Adding the expansion joint as a 3D component

If it is also necessary to perform or check the calculation of the joint, it is possible to insert it as a physical component to the model of the exchanger, after the wizard has been executed. To do this, simply right-click on the shell and select the appropriate "Insert expansion joint" option:

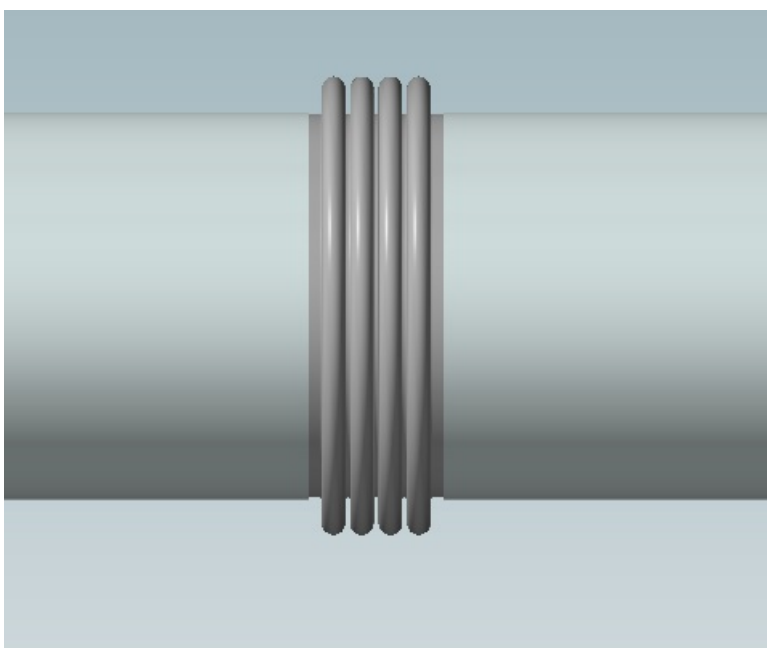


The input window of the properties of the joint as a component will open, you can enter all the data here as for the other components.



It is possible to perform the joint calculation according to the method provided by the selected calculation code, e.g. Appendix 26 for ASME VIII Div. 1, Chapter 4.19 for ASME VIII Div. 2, Clause 14 for EN 13445-3, etc., or according to EJMA 10th, if the calculation module is present in your license. Selection of the method is possible in the first property "Calculation method". The program provides for the verification of "Unreinforced U-shaped bellows" type bellows and does not support the verification of toroidal or ring-reinforced joints. It should also be noted that the verification of the expansion joint may require, depending on the calculation method selected, values that can only be calculated through a fatigue calculation of the vessel.

At the end of the insertion the joint will be inserted in the center of the shell, which will be thus divided into two cylindrical courses.



**NOTE:** The tube plates calculation module will automatically consider the presence of the joint, whether it has been inserted according to point 1, or that it has been inserted as a component according to point 2.

Note that the insertion of the properties to the shell (method 1) takes precedence over creating the model as a physical component (method 2). If method 1 has already been used, it is therefore necessary to remove the properties of the joint from the shell if you want to use the results obtained from the joint calculation directly.

### 3. Adding the expansion joint as an additional component

If you only need to check the joint or if you do not wish to add it as a physical component to the exchanger, you can add it as an additional component. In this case the properties of the joint resulting from the calculation will have to be added manual