Tutorial on Reduction of Support Loads with Cold Spring using CAEPIPE

General

Cold spring (cut short or cut long) is used to reduce thermal forces on equipment connected to the piping system. When lengths of pipes are cut short or extended by design, they are pulled together or pushed apart to join them during installation, giving rise to a “cold-sprung” system.

Such an installation process (cold condition) obviously introduces stresses, which are relieved when the system starts up (hot condition). Note however, that the piping codes do not allow credit for any reduction in stresses due to cold spring since the displacement range is unaffected (similar to self-springing). But, codes allow reduction in support loads due to cold spring (which can be helpful at the equipment).

This feature should be used only with a proper understanding of the implications.

The intent of this tutorial is to provide a guideline on reducing the operating load on equipment connections by using the Cold Springs.

Tutorial

Step 1:

Attached are two sample CAEPIPE stress models of a Cold Reheat Piping system connecting the PSV Header to the Turbine Nozzles with and without Cold Spring.

Model 1: ColdReheatPiping_without_ColdSpring.mod

For this model, let us note the following.

1. Nodes 10 and 470 connect to PSV Headers.
2. Nodes 400 and 870 connect to Turbine Nozzles.
3. No Cold Springs (Cut Pipes) are used in the piping connecting to the Turbine Nozzles.
Model 2: ColdReheatPiping_with_ColdSpring.mod

This model is same as Model 1 except that two Cold Springs are added in the piping connecting to the Turbine Nozzles as given below:

1. A Cut Pipe between Nodes 400 & 410 which is cut short by 6.65 inch
2. A Cut Pipe between Nodes 860 & 870 which is cut short by 6.639 inch.

Step 2:

Material, Section and Load properties of the two models are identical. They are given below for reference.
Step 3:

When the Cold Spring (Cut Pipe) is defined in the stress model, Cold Spring load cases will appear automatically in the Loads menu (under Load cases).

For analysis, select the desired Cold Spring load cases from those shown. Please note, the Hanger selection procedure does not consider the cold spring since the selection is based on the first Operating (W+P1+T1) load case. However, if Cold Spring is used, the hanger loads for the Cold Spring load cases [for example, Cold Spring (W+P1+T1)] will include the effect of the Cold Spring.

Once the required load cases are selected, perform Analyses of both the models using CAEPIPE.
Step 4:

From the Sorted Stresses and Cold Compliance results (shown above) obtained from the two models, it is noted that the stresses for Sustained and Expansion Load cases are identical between the two models. This confirms the statement that the piping codes do not allow credit for any reduction in stresses due to cold spring since the displacement range is unaffected.
Step 5:

Now from the Support Load Summary results obtained from the two models (shown above), it is to be noted that the Support Loads for Cold Spring 1 (= Operating 1 (W+P1+T1) + Cold Spring) for the model with Cold Springs are considerably low compared to the Support Loads for Operating 1 (W+P1+T1) for the model without Cold Springs.

This effectively confirms that the operating load on equipment connections can be reduced using the Cold Springs.