**checkSTRESS**

## EXAMPLE 4 - Locating Supports For Deadweight Analysis

This problem illustrates how to select and locate vertical supports to carry piping deadweight in the operating condition.

Fig. 4A shows a practical problem with 10" NB Standard schedule pipe from equipment nozzle at node 5 up to the reducer at node 30, 8" NB Standard schedule pipe from this reducer to the pump nozzle at node 40, and a 6" NB Standard schedule branch line from the welding tee at node 25 to the equipment nozzle at node 125.
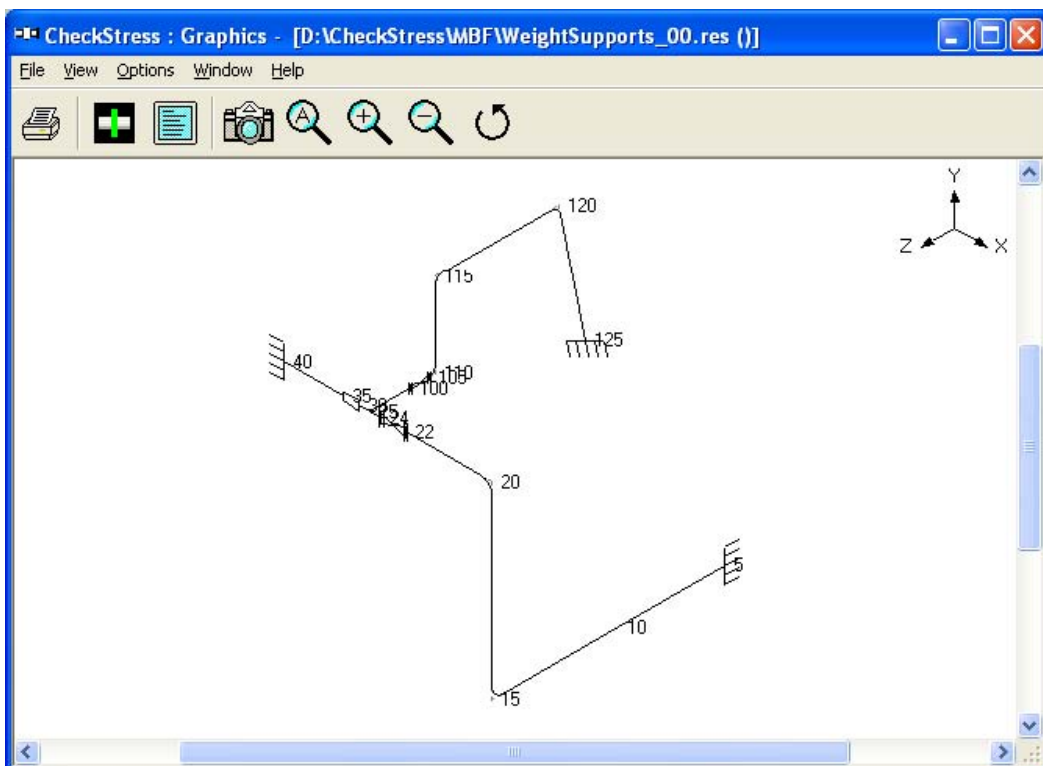


**Figure 4A - Layout with Node Numbers**

The thermal stress contour plot given in Fig. 4B confirms that the piping system is highly flexible and hence meets the code requirement for thermal load.
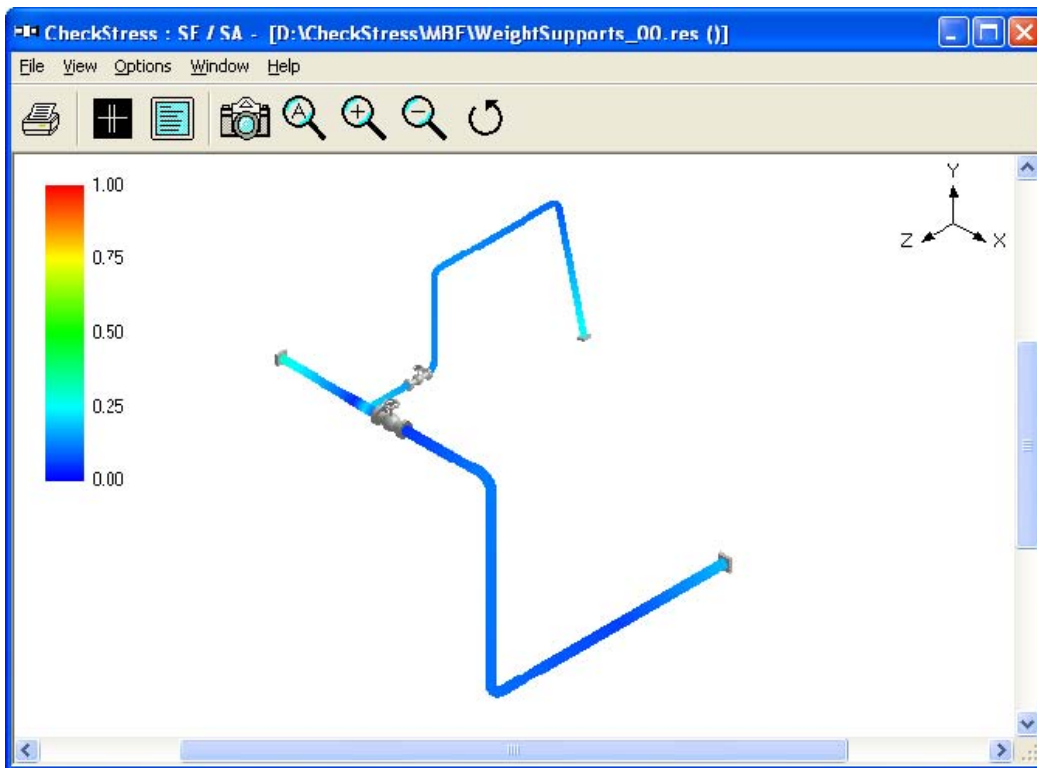
**Figure 4B - Thermal Stress Contour Plot**

Fig. 4C shows the deflected shape for sustained load (i.e., mainly deadweight). It is observed that the weight of (i) the horizontal line from node 5 to node 15 and (ii) a major portion of the vertical riser from node 15 to node 20 is carried by the equipment nozzle at node 5; on the other hand, the pump nozzle at node 40 carries the weight of (i) the horizontal line from node 20 to node 40, (ii) the valve portion of the branch line from node 25 to node 125 and (iii) a small portion of the vertical riser from node 15 to node 20.
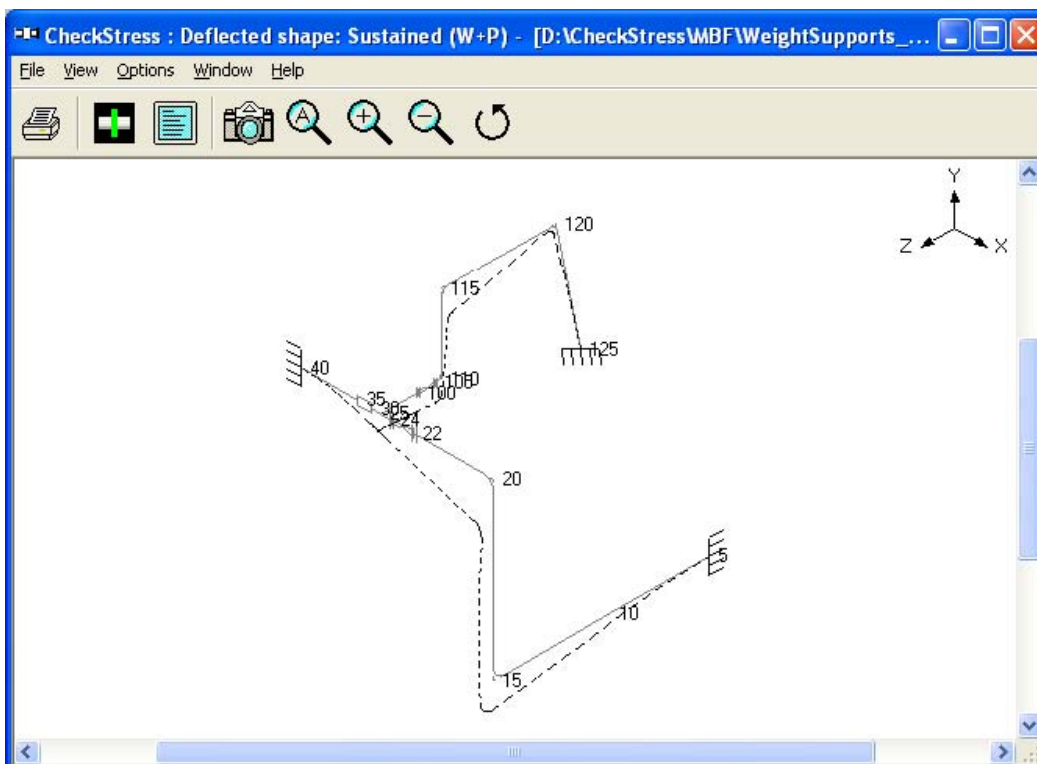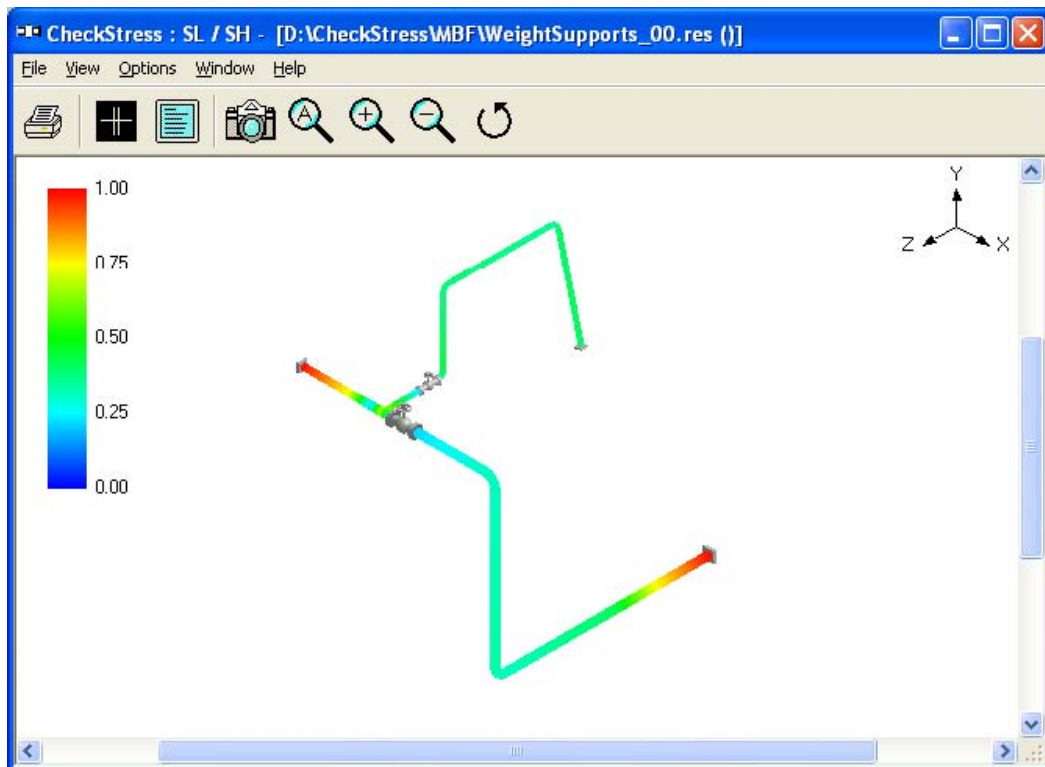


**Figure 4C - Sustained Load Deflected Shape**

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The deformation response for deadweight, in turn, generates large forces and moments and hence large sustained stresses at nozzle nodes 5 and 40 as shown in Fig. 4D for sustained stress contour plot.



**Figure 4D - Sustained Stress Contour Plot**

Fig. 4E shows the same layout with variable spring hangers at the bends at nodes 20 and 115, which carry piping deadweight and provide negligible restraint to thermal movement from cold to hot condition and vice versa.
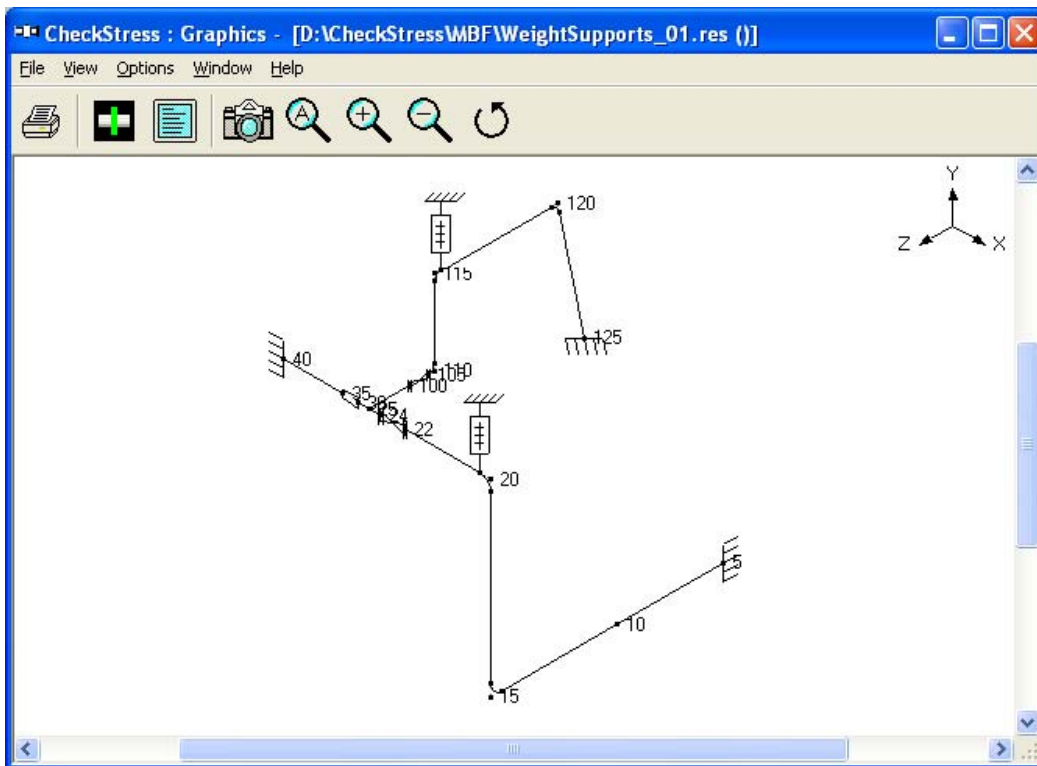
**Figure 4E - Layout with Hangers**

The thermal and sustained stress contour plots given in Fig. 4F and Fig. 4G confirm that the piping system with hangers is code-complaint for both sustained and thermal load cases.
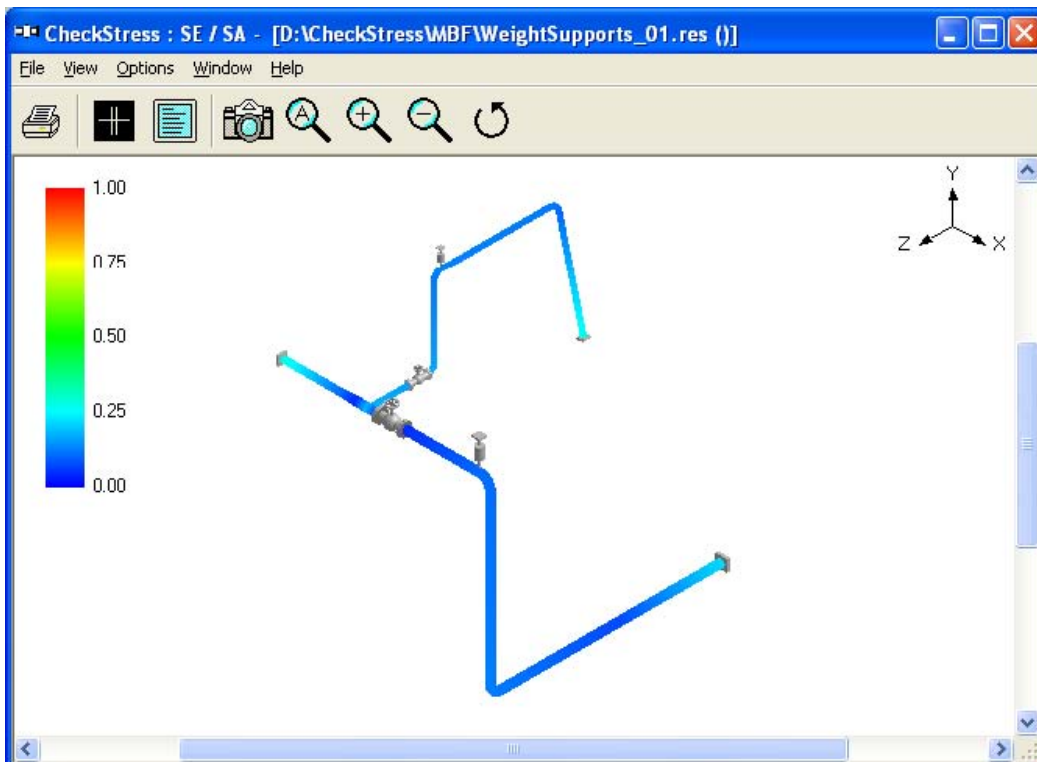


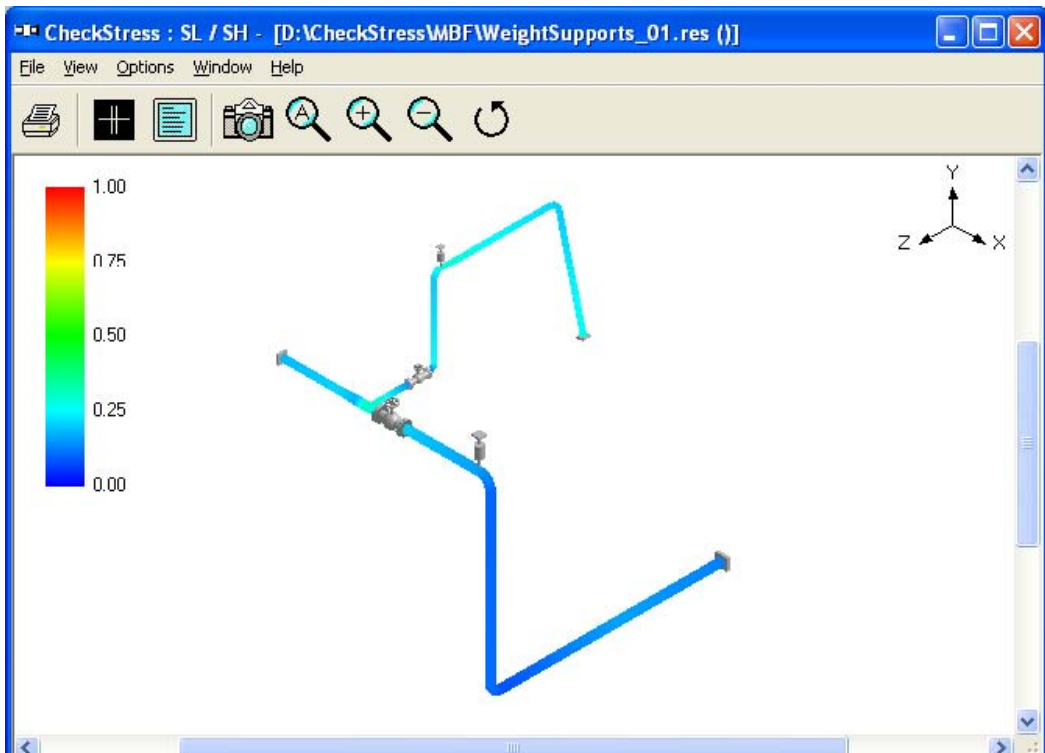**Figure 4F - Thermal Stress Contour Plot for Layout with Hangers**

**Figure 4G - Sustained Stress Contour Plot for Layout with Hangers**