# Lower Spring Contact Extension Summary Report

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# LOWER SPRING CONTACT EXTENSION SUMMARY REPORT

## 1. *PURPOSE*

The purpose of this report is to describe the lower spring contact extension and to summarize the preliminary analysis and evaluations.

## 2. *SUMMARY AND CONCLUSIONS*

The lower spring contact against the shroud is modified to extend beyond the H6A weld. This modification restores the contact to its intended design condition. Extending the lower contact beyond the H6A weld provides an alternate load path for the horizontal seismic loads at the core support in the event separation occurs at the H6A weld.

The added extension piece is captured in all directions by features on the lower spring assembly and is held firmly in place by a spring loaded clamping force. The design, materials and fabrication of the added extension complies with the original design basis.

## 3. *BACKGROUND*

The lower springs on the NMP-1 shroud stabilizer assemblies are designed to limit core plate displacement during seismic events. The springs bear against the shroud at the core support ledge and portions of the spring contact were designed to extend beyond weld H6A. In the event there is crack separation at weld H6A, and the shear forces exceed the frictional resistance between the core plate assembly and the core support ledge, the shroud may be displaced laterally until contact is made with the extended spring contact. With this condition, the spring contact will limit shroud displacement and will carry a part of the lateral load on the core support. A steam line LOCA is the only event to cause possible crack separation at the H6A weld.

The lower contacts do not extend above the H6A weld as was intended to satisfy the design requirements described above. The Reactor Modification Drawing, 107E5679 Revision 6, shows the as-installed position of the lower contacts and the H6A weld. The situation resulted from insufficient margin in the lower contact design to account for the uncertainties in the as-built geometry of the shroud support cone.

This above deviation from the intended design condition is described and evaluated in FDDR EA1-0031. The evaluation showed the core plate bolts are sufficient to maintain

the core plate alignment without the lower contact extending above weld H6A. The evaluation considered the bolt clamping load and the elastic properties of the bolts to show allowable core plate displacement was not exceeded. Adding the extension piece provides additional design margin and assurance that the core plate alignment is maintained.

## 4. *DESCRIPTION*

The lower contact is modified to extend beyond the H6A weld by adding a U shaped extension piece. The extension piece fits over the existing lower contact with the legs of the U extending around the sides of the existing lower contact as shown in Figure 1. The steps at the ends of the legs fit under the lower contact to prevent axial movement. A tang at the top extension fits in the gap between the lower contact and the lower spring to restrict the horizontal movement. The added extension piece is captured in all directions on the existing lower contact. The legs of the extension are spring loaded to provide a 40 to 50 pound clamping force against the sides of the lower contact. This force is sufficient to prevent any free movement or vibrations. With this arrangement, the added extension piece is captured in all directions and is held secure by the spring loaded clamping force.

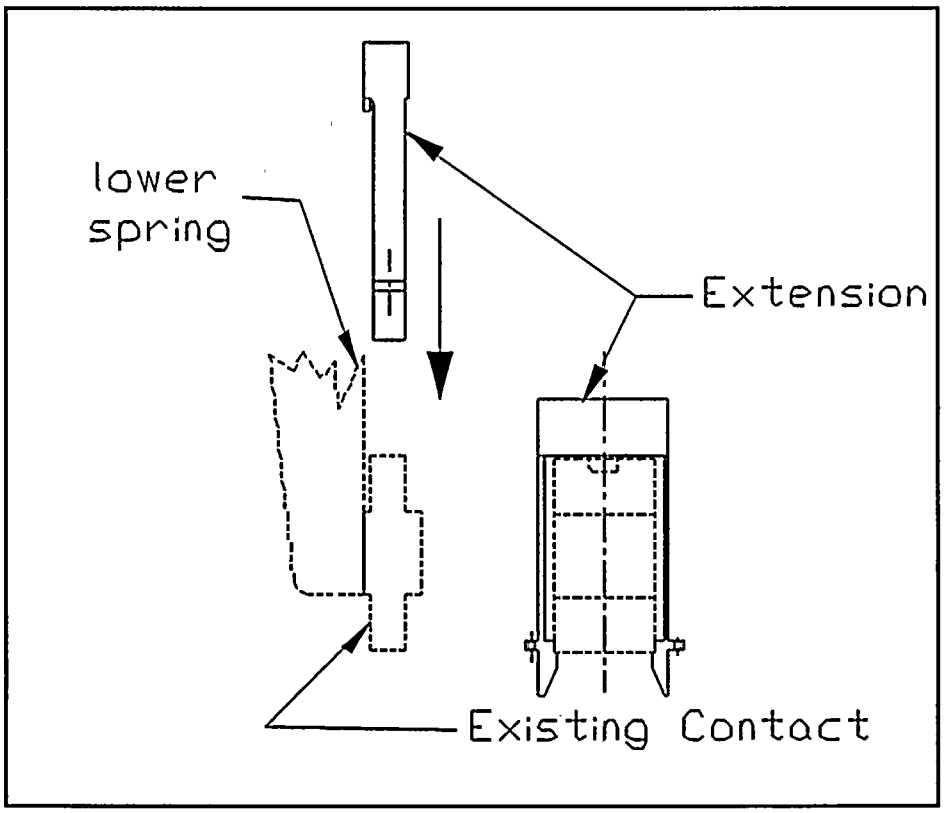


FIGURE 1

The added extension pieces are installed with a special tool for handling and to keep the legs sprung apart. The holes through the tabs at the lower end of the legs are used for this purpose. When seated in place, the tool releases the legs allowing them to clamp around the lower contact. This method allows the piece to be installed without sliding or having to apply excessive force. The same tool can be used to remove the extension piece if required.

## *5. FUNCTION*

The lower springs are designed to limit the core plate displacement during a seismic event. The lower spring bears against the shroud at the core support ledge and extends above the H6A weld and below the H6B weld. Core plate spacers were also installed during the last outage which fill the space between the core plate and the shroud at four locations. With the core plate spacers installed, a load on the core plate is carried by both the core support structure and by the shroud. The core plate cannot move laterally without loading the shroud and visa versa.

When the H6A weld remains in contact, whether its failed or otherwise, the joint acts as a hinge and is capable of carrying a shear load. The core plate displacement is determined by the compression of the lower spring. During a steam line LOCA, the $\Delta P$ load on the shroud head is sufficient to open a 360° through wall crack at the H6A location. In this event, the joint acts as a roller and is not capable of carrying a shear load. The shroud cylinder is restrained only by the core support bolts and friction between the core plate assembly and the core support ledge until contact is made with the contact extension. This lateral movement may be from 0.2 to 0.50 inches before contact is made with the contact extension piece. The free movement depends on the direction of movement.

With separation at H6A the lateral load on the core support during a seismic event is carried by the core support structure until the shroud makes contact with the lower contact extension. After shroud contact is made, the lateral load is distributed between the core support structure and the shroud. The maximum lateral dynamic displacement is the initial 0.5 inch movement plus the spring compression. (0.50 + 0.19 = 0.69 inches). The maximum permanent displacement is 0.50 inches. These displacements are less than the allowable dynamic (1.49) and permanent (0.67) displacements per the design specification for a faulted event. The shroud displacement is less than half the shroud thickness (0.75 in.) which is sufficient to maintain the flow partition requirement.

## *6. DESIGN BASIS*

Adding the contact extension restores the function of the lower spring to comply with the intended design arrangement. The lower contact extension is designed and

fabricated to the same requirements as the repair hardware. The added extension piece is captured in all directions by physical features on the stabilizer assembly and is secured by the spring clamping force. The part is made of Inconel X-750 as are the other spring members in the stabilizer assembly. The maximum bending stresses in the spring members providing the clamping force are below the material Sm value at operating temperature. With or without the spring force, the part is captured to prevent the possibility of a loose part. Special tooling is required for installation and removal. The extension piece design is consistent with the core shroud repair design criteria and design basis.

## *7. SAFETY CONSIDERATIONS*

The GE Core Shroud Repair Design Safety Evaluation, GE-NE-B13-01739-05, Rev. 1 has been reviewed for possible adverse consequences of adding the extension piece. The core plate displacements reported in B.2.1 require updating to address the possible separation at the H6A weld combined with a seismic event. The temporary core support displacement during this event may be 0.69 inches. This remains well below the 1.49 inch allowable temporary displacement for a faulted event. Adding the extension does not change the analysis of the other 16 criteria in Part B or the response to the 7 unreviewed safety questions in Part C.

## *8. DOCUMENTATION*

The documents listed below require revisions or supplements to address the addition of the contact extension pieces.

a. Reactor Modification Drawing and Parts List
107E5679, Rev. 6
PL107E5679, Rev. 4

b. Safety Evaluation, GE Core Shroud Repair Design
GE-NE B13-01739-05, Rev. 1

c. Stabilizer Installation
GE Specification 25A5585, Rev. 3

d. Nine Mile Point Unit 1 Shroud Repair Hardware
Stress Analysis, GE-NE-B13-01739-04, Rev. 0

e. Bottom Spring Spacer
148C6912 (new drawing)