
RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

03/29/2013

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.: NO. 931-6467 REVISION 3

SRP SECTION: 03.08.03 – Concrete and Steel Internal Structures of Steel or Concrete Containments

APPLICATION SECTION: 03.08.03

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QUESTION NO. 03.08.03-83

On page ii of MHI Technical Report (TR) MUAP-11020-P (R0), the subsection entitled Detailing of Connection Regions to Achieve Local Ductility states that the out-of-plane shear failure at the SC wall connection region is prevented by providing adequate shear strength ($f_v V_n$) greater than its flexural capacity divided by two times the section thickness ($M_n/2T$). Explain how the out-of-plane shear failure at the SC wall connection region can generically be prevented with $f_v V_n > M_n/2T$. As an example, for the case of the SC wall with fixed end condition at the connection to the basemat and simply supported at a higher elevation, with a span length equal to $4T$, the above approach does not appear to show that flexural failure occurs before out-of-plane shear failure.

ANSWER:

This answer revises and replaces the previous MHI answer that was transmitted by letter UAP-HF-12197 (ML12235A511).

Technical Report MUAP-11020, Rev. 1, Section 3.1, sub-part (iv), includes an additional requirement for the out-of-plane shear strength besides $M_n/2T$. The basis for this additional requirement and its influence on the design are addressed below.

Technical Report MUAP-11020, Rev. 1, Section 3.1, sub-part (iv), also explains why the $M_n/2T$ requirement has been placed on the out-of-plane shear strength of steel concrete (SC) wall connection regions. Technical Report MUAP-11020, Rev. 1, Section 3.2, summarizes the out-of-plane behavior and limit states for SC walls. This section also presents how the design approach used for SC wall connection regions provides ductile behavior and why a shear span ratio of 2.0 was selected.

Technical Report MUAP-11020, Rev. 1, Section 3.1, subpart (iv), indicates that the required out-of-plane shear strength (V_r^{out}) of the connection region will be the larger of two calculated values: (a) Shear force calculated in accordance with American Concrete Institute (ACI) 349-06, Section 21.3.4.1, and (b) Shear force required to develop flexural capacity over a shear span ratio of 2 (i.e., $M_r/2T$, where T is the wall thickness).

Figure 03.08.03-83-1. Design Shears for Girders and Columns of RC Frames (from ACI 349-06)

Impact on DCD

There is no impact on the DCD.

Impact on R-COLA

There is no impact on the R-COLA.

Impact on S-COLA

There is no impact on the S-COLA.

Impact on PRA

There is no impact on PRA.

Impact on Technical/Topical Report

There is no impact on the Technical/Topical Report.

This completes MHI's response to the NRC's question.