Design Analysis Title Page

Title: Seismic Qualification of Hot Leg RTD, Hot Leg PDT and Hot Leg Sampling MNSA Hardware

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1. **Approval of Completed Analysis**

This Design Analysis is complete and verified. Management authorizes the use of its results.

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Record of Revisions

No.	Date	Pages Involved	Prepared By	Approved By
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1.0 Objective

The scope of this calculation is to analyze the overturning moments in the Bottom Pressurizer MNSA, the Hot Leg PDT MNSA, and the Hot Leg Sampling MNSA, resulting from a 1 G seismic loading applied to each design. The calculated values for the Bottom Pressurizer MNSA will be compared to the two new design's values.

NOTE: The Hot Leg RTD nozzle MNSA is not evaluated here. It is identical to the fully qualified Southern California Edison, San Onofre Units 2 & 3's RTD MNSA clamp (See reference 3.2).

Under seismic conditions the increase in load reacts against the preload in the Hex Head Bolts, which would result in a loss of sealing pressure, or anti-ejection capability. By showing that the overturning moment of the Bottom Pressurizer MNSA, subjected to the seismic load, is equal or greater than either the overturning moment values of the Hot Leg PDT, or Hot Leg Sampling MNSA, we can conclude that seismically testing the two new MNSA assemblies is unnecessary because the loadings in the two new designs will be less than the loadings the Bottom Pressurizer MNSA was subjected to during qualification testing (Reference 3.1)

2.0 Analytical Techniques (Method)

The method used to calculate the overturning moments is hand calculations, utilizing the principles of mechanical design. Further calculations will be performed to determine the force acting to offset the Preload in the four Hex Head Bolts, created by the overturning moments, Hot Leg PDT, and Hot Leg Sampling MNSA's. The unloading force values for the Bottom Pressurizer MNSA will be compared to both the Hot Leg PDT MNSA and Hot Leg Sampling MNSA values, since there geometry and bolt circles are different.

Definitions used in this calculation are as follows:

RTD - Resistor Temperature Detector.
PDT - Pressure Differential Transmitter.
MNSA - Mechanical Nozzle Seal Assembly.
BP - Bottom Pressurizer.
SG - Steam Generator.

3.0 References

3.1 ABB Report No. TR-PENG-033, Rev. 00, "Test Report, Seismic Qualification of the San Onofre Units 2 & 3 MNSA Clamps for Pressurizer Instrument Nozzles and RTD Hot Leg Nozzles".

3.2 ABB Calculation No. S2-NOME-CALC-085, "Seismic Qualification of the Steam Generator PDT, Hot Leg PDT, and Hot Leg Sampling MNSA Hardware."

3.3 ABB CENO Drawing No. E-MNSA-228-001, Rev. 02, "Bottom Pressurizer Mechanical Nozzle Seal Assembly".

3.4 ABB CENO Drawing No. E-WFDMNSA-228-002, Rev. 01, "Hot Leg PDT MNSA".

3.5 ABB CENO Drawing No. E- WFDMNSA -228-003, Rev. 01, "Hot Leg Sampling MNSA".

3.6 ABB CENO Drawing No. E-MNSA-228-004, Rev. 05, "Mechanical Nozzle Seal Assembly Details".

4.0 CALCULATION OF BOTTOM PRESSURIZER (BP) MNSA OVERTURNING MOMENT

- THE WEIGHT OF THE ENTIRE BP MNSA IS TABULATED AND CALCULATED IN TABLE 1.
- FOR CALCULATION PURPOSES, THE ASSEMBLY WILL BE SPLIT INTO TWO PARTS; 1.) THE UPPER ASSY, AND 2.) THE LOWER ASSY.

4.1 THE UPPER ASSY PARTS & WEIGHTS ARE: (FROM TABLE 1)

DESCRIPTION	QTY	TOTAL WEIGHT (LBS)
a.) TOP PLATE	1	3.63
b.) TIE RODS	4	1.56
c.) HEX NUTS	12	0.27
d.) 7/8" RETAINER WASHERS.	12	+ 0.22

W_{BAP} = UPPER ASSY WEIGHT = $\boxed{5.68 \text{ LBS}}$

4.2 OVERTURNING MOMENT OF BP MNSA UPPER ASSY – MOMENTS ABOUT PIVOT POINT, FIGURE 2

4.2.1 OVERTURNING MOMENT DUE TO TOP PLATE –
⊛ ASSUMING A 1g SEISMIC LOAD.

$$M_{BPTP} = W_{BPTP}(D)$$

$$M_{BPTP} = 3.63 \text{ LBS} (.375 \text{ in} + 0.037 \text{ in} + 12.28 \text{ in} - 0.63 \text{ in})$$

$$M_{BPTP} = 3.63 \text{ LBS} (14.322 \text{ in}) = \boxed{52 \text{ IN-LBS}}$$ ⊛

4.2.2 OVERTURNING MOMENT DUE TO REMAINDER OF UPPER ASSY –

- WEIGHT (TIE RODS) : $W_{BPTR} = W_{BPUP} - W_{BP_{TP}}$

$$W_{BP_{TR}} = 5.68 \text{ LBS} - 3.63 \text{ LBS} = \underline{\underline{2.05 \text{ LBS}}}$$

- FORCE ACTS THROUGH THE CG OF THE TIE RODS;

– LOCATION (DIMENSIONS FROM FIGURE 1)

$$CG_{BP} = \left[\frac{(.630 + 13.28 + .037) - (.700 + .500 + .282 + 2.035)}{2}\right] + (.700 + .500 + .282 + 2.035)$$

$$CG_{BP} = \left[\frac{(13.947) - (3.517)}{2}\right] + 3.517 = \underline{8.732 \text{ IN}}$$

4.2.3 MOMENT – * ASSUMING + 1g SEISMIC LOAD

$$M_{BPTR} = W_{BP_{TR}} (CG_{BP})$$

$$M_{BPTR} = 2.05 \text{ LBS} (8.732 \text{ IN})$$

$$M_{BPTR} = \boxed{17.9 \text{ IN-LBS}} \; *$$

4.3 THE LOWER ASSY PARTS & WEIGHTS ARE: (FROM TABLE 1)

DESCRIPTION	QTY	TOTAL WEIGHT (LBS)
a.) LOWER FLANGE	1	24.64
b.) SEAL RETAINER	1	0.74
c.) COMPRESSION COLLAR	1	0.82
d.) UPPER FLANGE (BOTTOM)	1	7.10
e.) UPPER FLANGE (TOP)	1	6.96
f.) HEX BOLT (SHORT)	2	0.44
g.) HEX BOLT (LONG)	2	0.72
h.) 1/2" RETAINER WASHER	4	+ 0.11

W_{BPLW} = LOWER ASSY WEIGHT = $\boxed{41.53 \text{ LBS}}$

4.3.1 FOR CALCULATION PURPOSES, THE BP MNSA LOWER ASSY IS DIVIDED INTO TWO SECTIONS:

- SECTION 1; WITH A TRIANGULAR CROSS-SECTION
- SECTION 2; WITH A SQUARE CROSS-SECTION

THE ASSUMPTION IS MADE THAT 1/2 OF THE LOWER ASSY WEIGHT IS ACCOUNTED FOR BY SECTION 1, & THE REMAINING HALF BY SECTION 2.

$\Rightarrow$ OR $41.53 \text{ LBS}/2 = \boxed{20.765 \text{ LBS}}$ EA. SECTION

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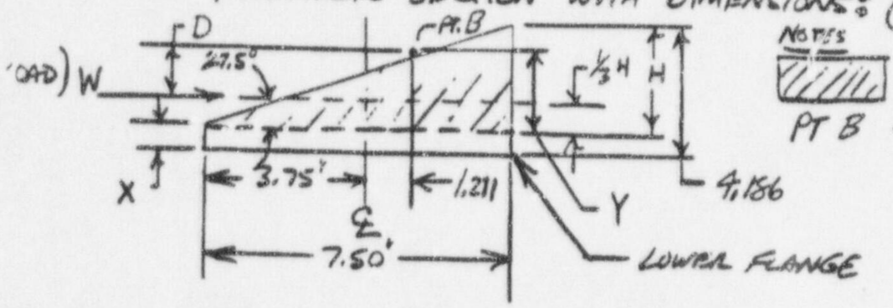
4.4 OVERTURNING MOMENT OF 3P MNSA LOWER ASSY

4.4.1 MOMENT ARM OF LOWER ASSY, SECTION (1) –

TRIANGULAR SECTION WITH DIMENSIONS: (FROM REF 3.7)



• DETERMINE "H" – $\tan(27.5°) = \frac{H}{7.50"}$

$\Rightarrow H = \tan(27.5°)[7.50"]$

$H = \underline{3.904"}$

• DETERMINE "X" – $X = 4.186" - H$

$X = 4.186" - 3.904"$

$\underline{X = 0.282}$

• DETERMINE "1/3H" – $\frac{1}{3}H = 0.333(3.904")$

$\underline{\frac{1}{3}H = 1.301}$

4.4.1 (CON.)

- DETERMINE "Y" — $\tan(27.5°) = \frac{Y}{(3.75" + 1.211")}$

  $Y = \tan(27.5°)[4.961"]$

  $\underline{Y = 2.583"}$

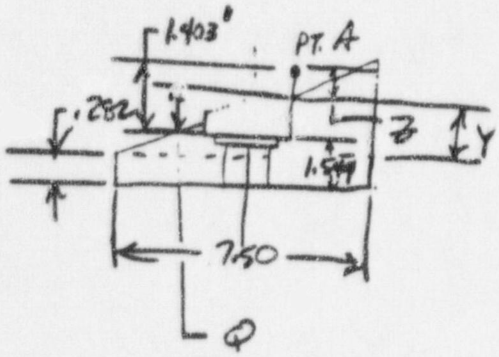
- DETERMINE "D" — $D = Y - \frac{1}{3}H$

  $D = 2.583" - 1.301"$

  $\underline{D = 1.282"}$

- ADDITIONAL STICKOUT OF SEAL RETAINER BELOW LOWER FLANGE "Z"

  NOTE: - PT A IS PIVOT POINT FOR OVERTURNING MOMENT.



- DETERMINE "Q" —

  $Q = Y - [1.544" - .282"]$

  $Q = 2.583" - [1.262"]$

  $\underline{Q = 1.321"}$

- FINALLY "Z" — $Z = 1.403" - Q$

  $Z = 1.403" - 1.321"$

  $\underline{Z = 0.082"}$

4.4.1 (CON.)

⇒ MOMENT ARM: $D' = D + Z$

$D' = 1.282'' + 0.082''$

$\boxed{D' = \underline{1.364}''}$

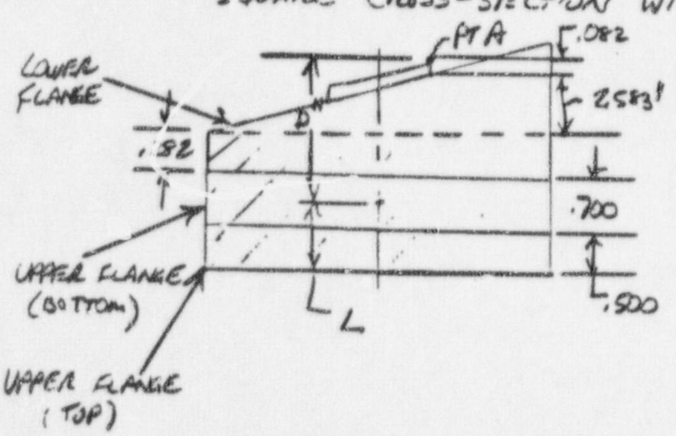
4.4.2 SECTION ① MOMENT — ⊛ ASSUMING A 1g SEISMIC LOAD

$M_{BPLW①} = 20.765\ \text{LBS}\ (1.364\ \text{IN})$

$M_{BPLW①} = \boxed{28.3\ \text{IN-LBS}}$ ⊛

4.4.3 MOMENT OF LOWER ASSY, SECTION ② –

SQUARE CROSS-SECTION WITH DIMENSIONS: (FROM REF 3.7 & FIG. 1



– SECTION ②

• DETERMINE L –

$L = \dfrac{(.282 + .700 + .500)}{2}$

$\underline{L = 0.741\ \text{IN}}$

⇒ MOMENT ARM: $D'' = [.082'' + 2.583'' + .282'' + .700 + .500] - L$

$\boxed{D'' = [4.147''] - 0.741\ \text{IN} = \underline{3.406\ \text{IN}}}$

4.4.4 SECTION (2) MOMENT – (*) ASSUMING A 1g SEISMIC LOAD.

$$M_{BPLW(2)} = 20.765\ \text{LBS}\ (3.406\ \text{in})$$

$$M_{BPLW(2)} = \boxed{70.7\ \text{IN-LBS}}\ (*)$$

4.5 <u>TOTAL OVERTURNING MOMENT (BP)</u>:

$$M_{BP} = M_{BPTP} + M_{BPTB} + M_{BPLW(1)} + M_{BPLW(2)}$$

$$M_{BP} = 52\ \text{in-lbs} + 17.9\ \text{in-lbs} + 28.3\ \text{in-lbs} + 70.7\ \text{in-lbs}$$

$$\boxed{M_{BP} = 168.9\ \text{In-Lbs} \quad \text{OR} \quad 14.1\ \text{FT-LBS}}$$

5.0 CALCULATION OF HOT LEG POT (HLP) MNSA OVERTURNING MOMENT

- THE WEIGHT OF THE ENTIRE HLP MNSA IS TABULATED & CALCULATED IN TABLE 2.
- FOR CALCULATION PURPOSES, THE ASSEMBLY WILL BE SPLIT INTO TWO PARTS; 1) THE UPPER ASSY, AND 2.) THE LOWER ASSY.

5.1 THE UPPER ASSY PARTS & WEIGHTS ARE: (FROM TABLE 2)

DESCRIPTION	QTY	TOTAL WEIGHT (LBS)
a.) TOP PLATE	1	3.59
b.) TIE RODS	4	1.81
c.) HEX NUTS	12	0.27
d.) 3/8" RETAINER WASHERS	8	+ 0.15

$W_{HLP_{UP}}$ = UPPER ASSY WEIGHT = $\boxed{5.82 \text{ Lbs}}$

5.2 OVERTURNING MOMENT OF HLP MNSA UPPER ASSY. - MOMENTS ABOUT PIVOT PT. FIGURE 2

5.2.1 OVERTURNING MOMENT DUE TO TOP PLATE - (*) ASSUMING A 1g SEISMIC LOAD.

$$M_{HLP_{TP}} = W_{HLP_{TP}} \left(D_{HLP_{TP}} \right)$$

$$M_{HLP_{TP}} = 3.59 \text{ LBS} \left(12.88" - 0.080" - 0.375" \right)$$

$$M_{HLP_{TP}} = 3.59 \text{ LBS} \left(12.645 \right) = \boxed{45.4 \text{ IN-LBS}} \ (*)$$

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5.2.2 OVERTURNING MOMENT DUE TO REMAINDER OF UPPER ASSY -

- WEIGHT (TIE RODS) : $W_{HLP_{TR}} = W_{HLP_{HP}} - W_{HLP_{TP}}$

$$W_{HLP_{TR}} = 5.82 \text{ LBS} - 3.59 \text{ LBS} = \underline{\underline{2.23 \text{ LBS}}}$$

- FORCE ACTS THROUGH THE CG OF THE TIE RODS;

- LOCATION (DIMENSIONS FROM FIGURE 3)

$$CG_{HLP} = \left[\frac{(12.2 + .020) - (1.500 + .135 + .380)}{2}\right] + (1.500 + .135 + .380)$$

$$CG_{HLP} = \left[\frac{(12.2) - (2.015)}{2}\right] + (2.015) = \underline{7.143 \text{ IN}}$$

6.2.3 MOMENT - (*) ASSUMING A 1g SEISMIC LOAD

$$M_{HLP_{TR}} = W_{HLP_{TR}}\left(CG_{HLP}\right)$$

$$M_{HLP_{TR}} = 2.23 \text{ LBS}\left(7.143 \text{ in}\right)$$

$$M_{HLP_{TR}} = \boxed{\underline{15.93 \text{ IN-LBS}}} \; (*)$$

5.3 THE LOWER ASSY PARTS ; WEIGHTS ARE: (FROM TABLE 2)

DESCRIPTION	QTY	TOTAL WEIGHT (LBS)
a.) LOWER FLANGE	1	2.68
b.) SEAL RETAINER	1	0.18
c.) COMPRESSION COLLAR	1	0.45
d.) UPPER FLANGE (BOTTOM)	1	3.66
e.) UPPER FLANGE (TOP)	1	4.24
f.) HEX BOLT	4	0.79
g.) RETAINER PLATES	4	+ 0.06

W_{HLPLW} = LOWER ASSY WEIGHT = $\boxed{12.06 \text{ Lbs}}$

5.4 OVERTURNING MOMENT OF HL MNSA LOWER ASSY.

HLP MNSA LOWER ASSY. MOMENT; MOMENTS ABOUT PIVOT PT ON FIGURE 2 :

→ ① ASSUMING A 1g SEISMIC COND.

$$M_{HLPLW} = W_{HLPLW}(CG_{HLPLW})$$

$$M_{HLPLW} = 12.06 \text{ Lbs} \left(0.135'' + \frac{0.380''+1.50''}{2}\right)$$

$$M_{HLPLW} = 12.06 \text{ Lbs} \left(1.008_{IN}\right)$$ ①

$$M_{HLPLW} = \boxed{12.2 \text{ IN-LBS}}$$

5.5 TOTAL OVERTURNING MOMENT (HLP):

$$M_{HLP} = M_{HLP_{TP}} + M_{HLP_{TR}} + M_{HLP_{LW}}$$

M_{HLP} = 45.4 In-Lbs. + 15.93 In-Lbs. + 12.2 In-Lbs

$\boxed{M_{HLP} = \text{73.53 In-Lbs. Or 6.13 Ft-Lbs.}}$

6.0 CALCULATION OF HOT LEG SAMPLING (HLS) MNSA OVERTURNING MOMENT

- THE WEIGHT OF THE ENTIRE HLS MNSA IS TABULATED AND CALCULATED IN TABLE 3.
- FOR CALCULATION PURPOSES, THE ASSEMBLY WILL BE SPLIT INTO TWO PARTS; 1.) THE UPPER ASSY, AND 2.) THE LOWER ASSY.

6.1 THE UPPER ASSY PARTS & WEIGHTS ARE: (FROM TABLE 3)

	DESCRIPTION	QTY	TOTAL WEIGHT (LBS)
a)	TOP PLATE	1	4.93
b.)	TIE RODS	4	2.06
c)	HEX NUTS	12	0.27
d.)	7/8" RETAINER WASHERS	8	+ 0.15

$W_{HLS_{UP}}$ = UPPER ASSY WEIGHT = $\boxed{7.41 \text{ Lbs.}}$

6.2 OVERTURNING MOMENT OF HLS MNSA UPPER ASSY. – MOMENT ABOUT PIVOT PT., FIGURE 3

6.2.1 OVERTURNING MOMENT DUE TO TOP PLATE – (A) ASSUMING A 1g SEISMIC LOAD.

$$M_{HLS_{TP}} = W_{HLS_{TP}} \left(D_{HLS_{TP}} \right)$$

$$M_{HLS_{TP}} = 4.93 \text{ LBS} \left(.375'' + 15.3'' \right)$$

$$M_{HLS_{TP}} = 4.93 \text{ LBS} \left(15.675 \text{In} \right) = \boxed{77.3 \text{ IN-LBS}}$$ (B)

6.2.2 OVERTURNING MOMENT DUE TO REMAINDER OF UPPER ASSY -

- WEIGHT (TIE RODS): $W_{HLS_{TR}} = W_{HLS_{UA}} - W_{HLS_{P}}$

$$W_{HLS_{TR}} = \underline{7.41}\ LBS - 4.93\ LBS$$

$$W_{HLS_{TR}} = \underline{\underline{2.48\ LBS}}$$

- FORCE ACTS THROUGH THE CG OF THE TIE RODS;
  - LOCATION (DIMENSIONS FROM FIGURE 4)

$$CG_{HLS} = \left[\frac{(15.3) - (1.500 + .135 + .380)}{2}\right] + (1.500 + .135 + .380)$$

$$CG_{HLS} = \left[\frac{(15.3) - (2.015)}{2}\right] + (2.015) = \underline{8.66\ In.}$$

6.2.3 MOMENT - * ASSUMING A 1g SEISMIC LOAD

$$M_{HLS_{TR}} = W_{HLS_{TR}} (CG_{HLS})$$

$$M_{HLS_{TR}} = \underline{2.48\ LBS} (8.66\ In)$$

$$M_{HLS_{TR}} = \boxed{21.48\ In\text{-}Lbs} \ *$$

6.3 THE LOWER ASSY. PARTS & WEIGHTS ARE: (FROM TABLE 3)

DESCRIPTION	QTY	TOTAL WEIGHT (LBS)
a.) LOWER FLANGE	1	2.68
b.) SEAL RETAINER	1	0.18
c.) COMPRESSION COLLAR	1	0.45
d.) UPPER FLANGE (BOTTOM)	1	3.66
e.) UPPER FLANGE (TOP)	1	4.24
f.) HEX BOLT	4	0.79
g.) RETAINER PLATES	4	+ 0.06

$W_{HLS_{LW}}$ = LOWER ASSY. WEIGHT = $\boxed{12.06 \text{ Lbs.}}$

6.4 OVERTURNING MOMENT OF HLS ~~MNSA~~ LOWER ASSY.

HLS MNSA LOWER ASSY MOMENT; MOMENTS ABOUT PIVOT PT. ON FIGURE 3: ⊕ ASSUMING A 1g SEISMIC LOAD.

$$M_{HLS_{LW}} = W_{HLS_{LW}} \cdot (D_{HLS_{LW}})$$

$$M_{HLS_{LW}} = 12.06 \text{ Lbs.} \cdot (0.135" + 0.380" + 1.500")$$

$$M_{HLS_{LW}} = 12.06 \text{ Lbs.} \cdot (2.015 \text{ IN})$$

$$M_{HLS_{LW}} = \boxed{24.3 \text{ IN-LBS}} \oplus$$

6.5 TOTAL OVERTURNING MOMENT (HLS):

$$M_{HLS} = M_{HLS_{TD}} + M_{HLS_{TR}} + M_{HLS_{LW}}$$

$$M_{HLS} = 77.3 \text{ In-Lbs} + 21.48 \text{ In-Lbs} + 24.3 \text{ In-Lbs}$$

$$\boxed{M_{HLS} = 123.1 \text{ In-Lbs. Or } 10.3 \text{ Ft-Lbs}}$$

7.0 COMPARISON OF BP MNSA TO HLP MNSA

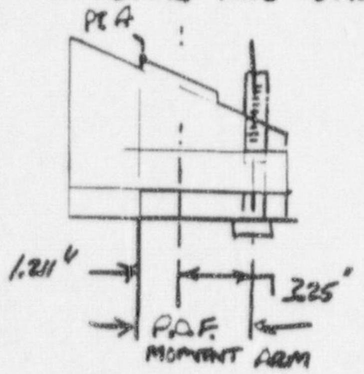
- THE DESIGNS OF THE BP MNSA & HLP MNSA HAVE DIFFERENCES, SO THAT A ONE-FOR-ONE COMPARISON CANNOT BE MADE (AS WAS DONE FOR THE SG MNSA). IN ORDER TO COMPARE THE TWO DESIGNS, WE MUST LOOK AT THE LOAD CREATED BY THAT OVERTURNING MOMENT THAT WOULD TEND TO OFFSET THE HEX BOLTS PRELOAD.

- THEREFORE, THE PRELOAD OFFSETTING FORCE (P.O.F.) WILL BE CALCULATED FOR EACH DESIGN. IF THE P.O.F. FOR THE HLP MNSA IS LESS THAN OR EQUAL TO THAT FOR THE BP MNSA, THE HLP MNSA WILL BE CONSIDERED SEISMICALLY QUALIFIED TO WITHST SEISMIC CONDITIONS FOR THE BP MNSA (REF. 3.1).

7.1 P.O.F. FOR BP MNSA

- OVERTURNING MOMENT (FROM 4.5) = 168.8 IN-LBS

- WORST CASE IS THAT ONLY ONE BOLT WILL BE RESISTING THIS OVERTURNING MOMENT



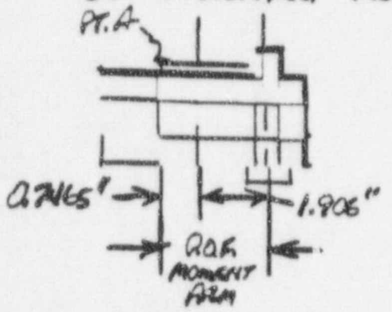
$$P.O.F._{BP} = \frac{M_{BP}}{\text{MOMENT ARM}_{P.O.F.}}$$

$$P.O.F._{BP} = \frac{168.8 \text{ IN-LBS}}{(1.211" + 3.25")} = \frac{168.8 \text{ in}}{4.461 \text{ in}}$$

$$\boxed{P.O.F._{BP} = 37.8 \text{ LBS}}$$

7.2 P.O.F. FOR HLP MNSA

- OVERTURNING MOMENT (From 5.5) = 73.53 In-Lbs.
- WORST CASE IS FOR ONE BOLT RESISTING THE ENTIRE OVERTURNING MOMENT.



$$P.O.F._{HLP} = \frac{M_{HLP}}{\text{MOMENT ARM}_{P.O.F.}}$$

$$P.O.F._{HLP} = \frac{73.53 \text{ in-lbs}}{(1.906" + 0.7465")} = \frac{73.53 \text{ In Lbs}}{(2.6525 \text{ in})}$$

$$\boxed{P.O.F._{HLP} = 27.72 \text{ LBS}}$$

7.3 COMPARISON OF BP TO HLP

- COMPARE P.O.F.'s OF TWO DESIGNS:

IS THIS TRUE? $P.O.F._{HLP} \leq P.O.F._{BP}$

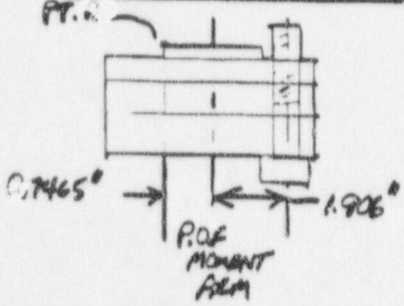
$$\boxed{(\text{From } 9.2)\ 27.72 \text{ LBS} \leq (\text{From } 7.1)\ 37.8 \text{ LBS}}$$ ✓

THE STATEMENT IS TRUE & THEREFORE THE HLP IS SEISMICALLY QUALIFIED.

8.0 COMPARISON OF BP MNSA TO HLS MNSA

- THE DESIGNS OF THE BP MNSA AND HLS MNSA HAVE EVEN GREATER GEOMETRICAL DIFFERENCES. THEREFORE, AS IS SECTION 7.0 THE ONLY MEANINGFUL COMPARISON IS TO COMPARE THE PRELOAD OFFSETTING FORCE (P.O.F.) FOR EACH DESIGN. IF THE P.O.F. FOR THE HLS MNSA IS LESS THAN OR EQUAL TO THAT OF THE BP MNSA, THE HLS MNSA IS CONSIDERED SEISMICALLY QUALIFIED.

8.1 P.O.F. FOR HLS MNSA



- OVERTURNING MOMENT (FROM 6.5)

$$M_{HLS} = 123.08 \text{ IN-LBS}$$

- WORST CASE IS FOR ONE BOLT RESISTING THE ENTIRE OVERTURNING MOMENT.

$$P.O.F._{HLS} = \frac{M_{HLS}}{\text{MOMENT ARM}_{P.O.F.}} = \frac{123.08 \text{ IN-LBS}}{(2.6525 \text{ in})}$$

$$\boxed{P.O.F._{HLS} = 46.4 \text{ LBS}}$$ (*)

8.2 COMPARISON OF BP TO HLS

- COMPARE P.O.F.s OF TWO DESIGNS:

IS THIS TRUE? $P.O.F._{HLS} \leq P.O.F._{BP}$

$\boxed{\text{(FROM 10.1) } 46.4 \geq \text{(FROM 7.1) } 37.8 \text{ LBS}}$

9.0 CONCLUSION

Under a representative 1G load, the offseting loads created in, Hot Leg PDT MNSA's is less than the loads created in the BP MNSA. Therefore the statement can be made that the Hot Leg PDT MNSA designs is "seismicaly qulified" since it would be tested to the same response specturm as the BP MNSA in Reference 3.1

The Preload Offseting Force calculated above are sumarised in the below table

Clamp	P.O.F.	Section
BP MNSA	37.8 Lbs.	Section 7.1
H.L.P. MNSA	27.7 Lbs.	Section 7.2
HLS MNSA	46.4 Lbs.	Section 8.1

The offseting load calculated for the Waterford Sampling Nozzle MNSA is greater than the offseting load calculated for the Bottom Pressurizer MNSA that was tested. Therefore the Waterford response spectra will be compared to the test spectra. Then the ratio of the two calculated moments will be used to establish a "g" loading to demonstrate that the test conditions envelope the Waterford design conditions. This will be done in ABB Report No. C-NOME-ER-0120, "Design Evaluation of MNSA for Various Applications at Waterford Unit 3".

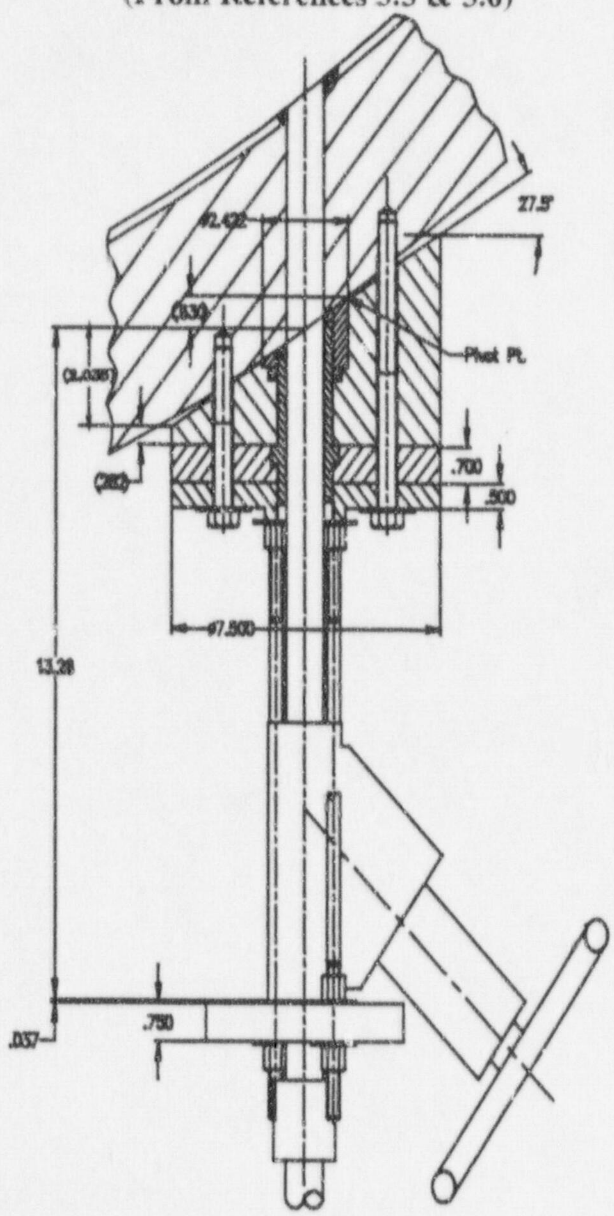
10.0 ASSESMENT OF SIGNIFICANT DESIGN CHANGES

This calculation evaluates the MNSA design for Waterford and is based on previous designs of MNSA clamps for San Onofre Units 2 & 3. The only significant design change is the length of the tie rods. This calculation incorporates the new lengths of the tie rods.

11.0 Design Input

This calculation uses the references of Section #3 as design inputs.

FIGURE 1
Bottom Pressurizer Mechanical Nozzle Seal Assembly
(From References 3.3 & 3.6)



Note: Reference Dimensions (W/ "()" are calculated values based on a 27.5° Angle.

FIGURE 2

Hot Leg PDT Mechanical Nozzle Seal Assembly

(From References 3.4, 3.6 & 3.7)

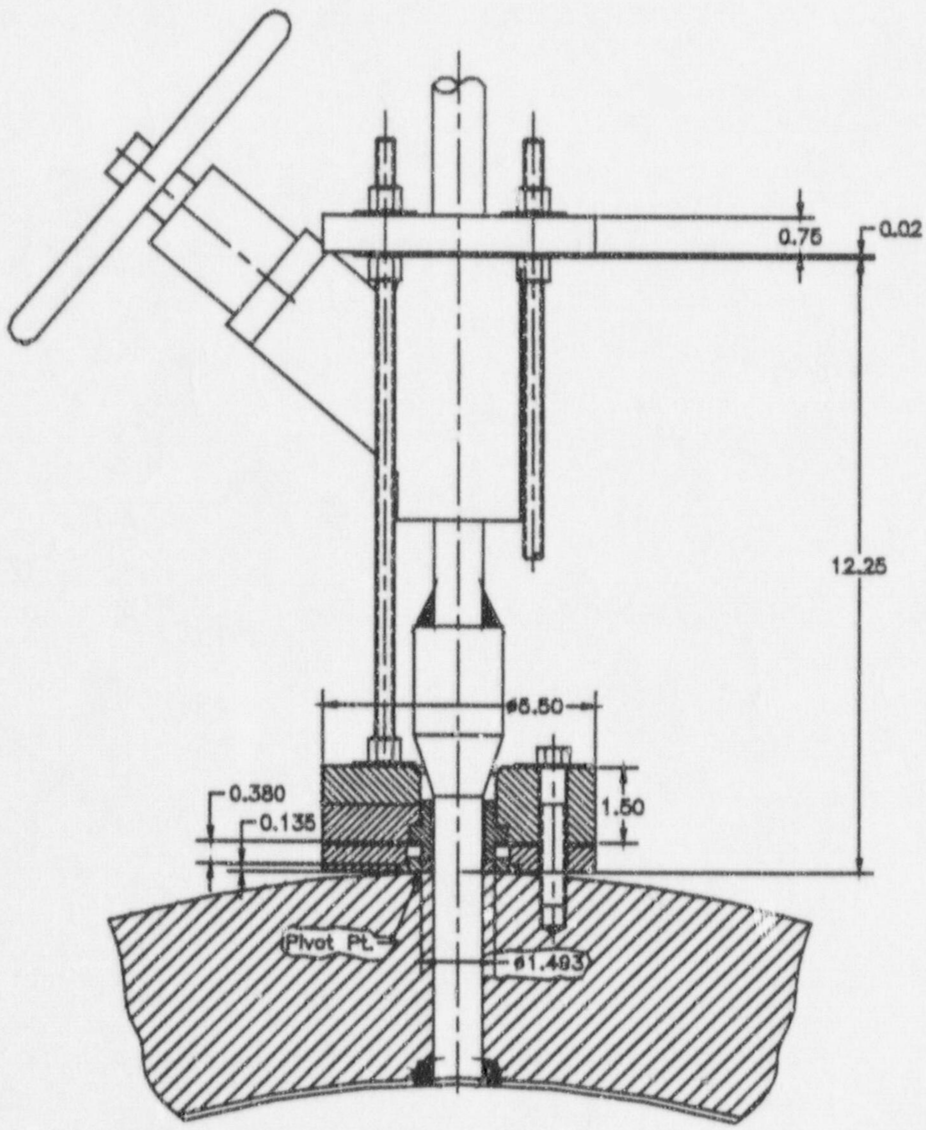


FIGURE 3
Hot Leg Sampling Mechanical Nozzle Seal Assembly
(From References 3.5, 3.6 &3.7)

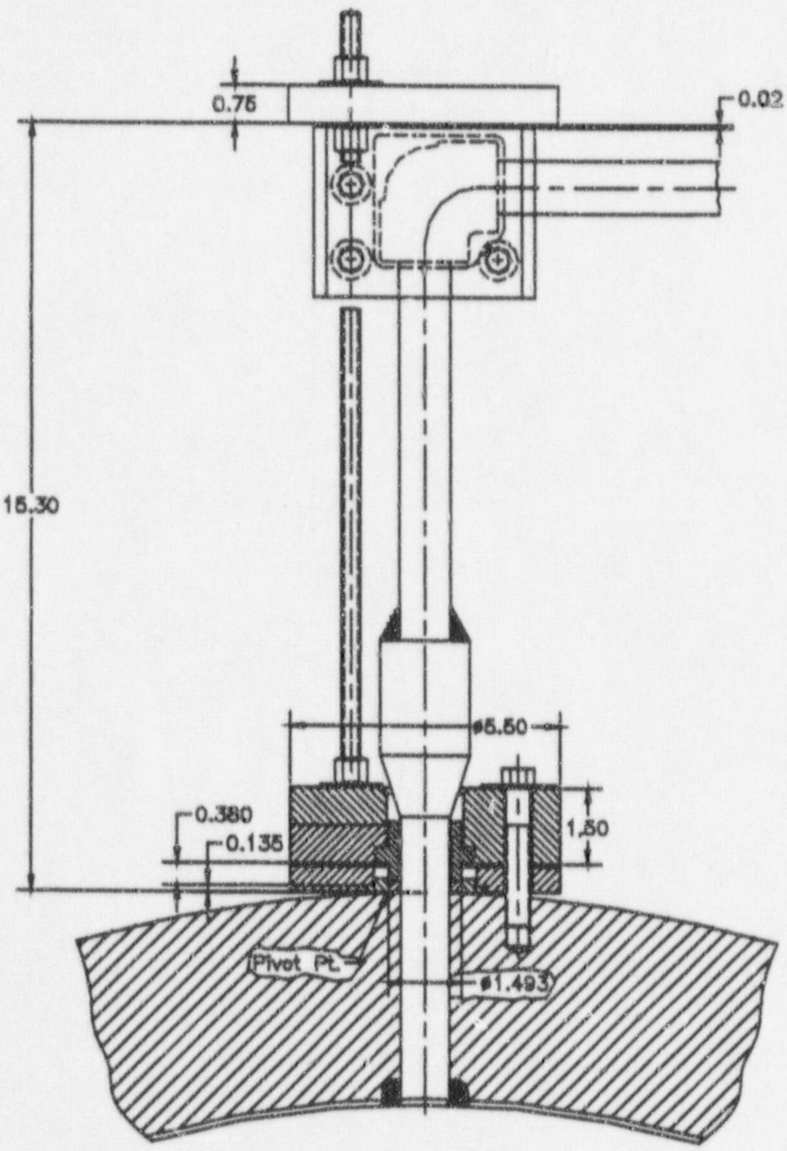


TABLE 1

Bottom Pressurizer MNSA (E-MNSA-228-001-1, Assembly) Weight

Name	Detail Part No.	Volume (cu.in.)	Density (lb/cu.in.)	Weight/Piece (lbs)	Quantity	Total Weight (lbs)
Lower Flange	E-MNSA-228-004-1	87.057	0.283	24.64	1	24.64
Seal Retainer	-004-2	2.614	0.283	0.74	1	0.74
Compression Collar	-004-3	2.899	0.283	0.82	1	0.82
Upper Flange (Bottom)	-004-29	25.100	0.283	7.10	1	7.10
Upper Flange (Top)	-004-5	24.593	0.283	6.96	1	6.96
Top Plate	-004-6	12.826	0.283	3.63	1	3.63
Hex Bolt (Short)	-004-25	0.773	0.283	0.22	2	0.44
Hex Bolt (Long)	-004-24	1.266	0.283	0.36	2	0.72
Tie Rod	-004-15	1.381	0.283	0.39	4	1.56
Hex Nut	-004-27	0.081	0.283	0.02	12	0.27
1/2" Retainer Washer	-004-22	0.093	0.283	0.03	4	0.11
3/8" Retainer Washer	-004-21	0.066	0.283	0.02	12	0.22
					Total:	***47.21***

Notes:

1. Weight of Grafoil Seal is negligible.
2. All calculations are based on dimensions from referenced drawings.

TALBE 2

Hot Leg PDT MNSA (E-MNSAWFD-228-002-1, Assembly) Weight

Name	Detail Part No.	Volume (cu.in.)	Density (lb/cu.in.)	Weight/Piece (lbs)	Quantity	Total Weight (lbs)
Lower Flange	E-MNSA-228-013-13	9.477	0.283	2.68	1	2.68
Seal Retainer	-004-32	0.628	0.283	0.18	1	0.18
Compression Collar	E-MNSAWFD-228-003-06	1.603	0.283	0.45	1	0.45
Upper Flange (Bottom)	-013-12	12.925	0.283	3.66	1	3.66
Upper Flange (Top)	-013-24	14.973	0.283	4.24	1	4.24
Top Plate	-013-06	12.670	0.283	3.59	1	3.59
Hex Bolt	-013-21	0.701	0.283	0.20	4	0.79
Tie Rod	-013-27	1.601	0.283	0.45	4	1.81
Hex Nut	-004-27	0.081	0.283	0.02	12	0.27
Retainer Plate	-013-20	0.054	0.283	0.02	4	0.06
3/8" Retainer Washer	-004-21	0.066	0.283	0.02	8	0.15
					Total:	***17.88***

Notes:

1. Weight of Grafoil Seal is negligible.
2. All calculations are based on dimensions from referenced drawings.

TABLE 3

Hot Leg Sampling MNSAWFD (E-MNSA-228-003-1, Assembly) Weight

Name	Detail Part No.	Volume (cu.in.)	Density (lb/cu.in.)	Weight/Piece (lbs)	Quantity	Total Weight (lbs)
Lower Flange	E-MNSA-228-013-13	9.477	0.283	2.68	1	2.68
Seal Retainer	-004-32	0.628	0.283	0.18	1	0.18
Compression Collar	E-MNSAWFD-228-003-06	1.603	0.283	0.45	1	0.45
Upper Flange (Bottom)	-013-12	12.925	0.283	3.66	1	3.66
Upper Flange (Top)	-013-24	14.973	0.283	4.24	1	4.24
Top Plate	-013-15	17.430	0.283	4.93	1	4.93
Hex Bolt	-013-21	0.701	0.283	0.20	4	0.79
Tie Rod	-013-25	1.822	0.283	0.52	4	2.06
Hex Nut	-004-27	0.081	0.283	0.02	12	0.27
Retainer Plate	-013-20	0.054	0.283	0.02	4	0.06
3/8" Retainer Washer	-004-21	0.066	0.283	0.02	8	0.15
					Total:	***19.48***

Notes:

1. Weight of Grafoil Seal is negligible.
2. Seismic effect of the weight of Clamp (Detail -013-22), Hex Hd Bolts (Detail -016-15), and 1/2" Retainer Washers (Detail -004-22) is addressed in the Design Report, **Ref. 3.2**
3. All calculations are based on dimensions from referenced drawings.