Wisconsin Electric POWER COMPANY

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August 25, 1994

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U.S. NUCLEAR REGULATORY COMMISSION
Mail Station P1-137
Washington, D.C. 20555

Gentlemen:

DOCKETS 50-266 AND 50-301
REVISION OF THE DIESEL GENERATOR ADDITION PROJECT DESIGN SUMMARY
POINT BEACH NUCLEAR PLANT, UNITS 1 AND 2

On September 24, 1993, we submitted the "Diesel Generator Addition Project Design Summary." The Design Summary was provided in support of Technical Specification Change Request 166, which was subsequently submitted on May 26, 1994. This letter provides clarification of the design codes and methods used to design steel embedments described in the Design Summary.

In telephone conversations with the NRC staff, during the weeks of August 15 and August 22, 1994, it was determined that note (p) in Appendix A, page 27, of the "Diesel Generator Addition Project Design Summary," should be revised to further explain the methods used to design steel embedments for this project.

Appendix A of the "Diesel Generator Addition Project Design Summary" provides information about the design codes used for this project. Note (p) is one of the items in the comparison of ACI 318-89 and ACI 349-90. It currently states that steel embedments in the diesel generator building are designed in accordance with Appendix B in ACI 349-90, "Steel Embedments." This note is being revised, as follows, to clarify the methods used to design steel embedments:

p) Appendix B, "Steel Embedments," is included in ACI 349-90. Expansion anchors were designed such that the IE Bulletin 79-02, "Pipe Support Base Plate Designs Using Concrete Expansion Anchor Bolts," requirements are met. The design of Nelson™ studs and Unistrut™ anchorages are based on the manufacturers test data for capacities, with appropriate safety factors applied. Some equipment anchorages and supports designs were based on Seismic Qualification Utility Group methodologies. The remaining anchorages and supports





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were designed based on a 45° shear cone, which is in accordance with the original design for Point Beach.

As requested, part of an original anchorage loading calculation is attached to this letter that shows the calculational method used for steel embedments in the original Point Beach design was based on a 45° shear cone. This method is the original design basis for Point Beach.

This change in the Design Summary is a clarification of the design codes and methods used. This change does not alter any other previously submitted technical information, or conclusions thereof, for Technical Specification Change Request 166.

Please feel free to contact us if you have any questions.

Sincerely,

TG Marianowski for

G. M. Krieser
Manager
Industry and Regulatory Services

Attachments

cc: NRC Regional Administrator
NRC Resident Inspector
Public Service Commission of Wisconsin

17) Comparison of ACI-318-89 and ACI 349-90

a) ACI 349-90 requires a Quality Assurance Program covering nuclear safety related structures while ACI 318-89 does not. PBNP has a Quality Assurance Program in place according to Section 1.8 of the FSAR.

b) ACI 349-90 requires testing admixtures for concrete and has stricter requirements for material storage. No testing of admixtures is planned for the DGB. The material will be purchased from a vendor with a quality assurance program. Adequate requirements for control of the quality of concrete are provided in the Ready-Mix Concrete Specification 6704.001-SP-S-026.

c) Lightweight concrete is not permitted by ACI 349-90 and is not being used in the Diesel Generator Building.

d) Aluminum pipe is not permitted in ACI 349 to convey concrete. Also a method of temperature control in hot weather concreting is required to be specified in construction specification according to ACI 349. The Cast-In-Place Concrete Specification 6704.001-SP-S-025 for the DGB is consistent with those requirements. ACI 305R-91, "Hot Weather Concreting", provides methods for temperature control and is being referred to in the Concrete Specification.

e) ACI 349 requires that forms and form release agents be compatible with coating systems. Diesel Generator Concrete Specification complies with this requirement. ACI 349 also requires that pressure pipes embedded in concrete be tested before concreting. There are no pressure pipes embedded in concrete in the Diesel Generator Building.

f) Relocation of reinforcement requires Engineer approval according to ACI 349. The Concrete Specification for the Diesel Generator Building provides provision for control of any deviations from the drawing requirements.

g) Minimum reinforcing requirements for walls and slabs in ACI 349-90 are more stringent than ACI 318-89. The reinforcing bars provided in the Diesel Generator Building are more than the minimum reinforcing bars required by ACI 349-90.

h) The load combinations in ACI 349-90 are broadly expanded to include severe, extreme and abnormal loads. The load combinations considered for the design of the Diesel Generator Building are in conformance with the SRP 3.8.4 and thus satisfy the requirements of ACI 349-90.

i) The minimum slab thickness requirements in ACI 349-90 are higher than what is required in ACI 318-89. The 2' thick slab used in the Diesel Generator Building satisfies the ACI 349-90 criteria.

j) The walls which are subjected to transverse loads must satisfy strength and deflection requirements given in ACI 349-90. The 2' thick wall of the Diesel Generator Building is in compliance with the requirements.

k) Crack control requirements in ACI 349-90 are less conservative than ACI 318-89.

l) Membrane stresses should be considered in calculating punching shear capacity according to ACI 349-90. The membrane stresses are negligible in the Diesel Generator Building since loads that induce high membrane stresses (internal pressures, etc.) are not postulated for the building.

m) There are additional requirements for mechanical splices and splices of "tension tie members" in ACI 349-90. Mechanical splices and tension tie members are not used in the Diesel Generator Building.

n) The requirements for calculation of development of deformed bars in tension are less conservative in ACI 349-90, but the requirements for calculation of the length of lap splices of these bars are more conservative. Overall for #6 and #7 reinforcing bars used in the Diesel Generator Building, the length of lap splices calculated based on ACI 318-90 is more conservative than ACI 349-90.

o) Appendix A, "Thermal Considerations", is included in ACI 349-90. The Diesel Generator Building is not subjected to high temperature variation. The reinforcing provided is sufficient for the normal temperature changes and shrinkage of concrete. 4

p) Appendix B, "Steel Embedments", is included in ACI 349-90. Expansion anchors were designed such that the IE Bulletin 79-02, "Pipe Support Base Plate Designs Using Concrete Expansion Anchor Bolts," requirements are met. The design of Nelson™ studs and Unistrut™ anchorages are based on the manufacturers test data for capacities, with appropriate safety factors applied. Some equipment anchorages and supports designs were based on Seismic Qualification Utility Group methodologies. The remaining anchorages and supports were designed based on a 45° shear cone, which is in accordance with the original design for Point Beach.

q) Appendix C, "Special provision for Impulsive and Impactive Effects", is included in ACI 349-90. The requirements of this Appendix and of Position 10 of Regulatory Guide 1.142 are invoked to design the walls and slabs of the DGB fc. ;he effect of the tornado-generated missiles.

18) Comparison of AISC 6th and 9th Edition

a) Limiting width-thickness ratio for compression elements for compact section is higher in 9th Edition. Some steel profiles that were not considered to be compact in the 6th Ed. meet the requirements of compact section in 9th Ed.

b) The requirements for design of tension members are more conservative in the 9th Edition. Allowables are the same, or are more conservative in the 9th Edition (Reference Section 1.5.1.1, 6th Edition and Chapter D, 9th Edition).

c) The design procedure for slender compressive members (single angles, struts, etc.) is completely different and more conservative in 9th Edition. It requires consideration of eccentricity of loads, the flexural-torsional buckling, etc. in design of such members. (Reference Appendix B of 9th Edition).

d) The requirements for compact and non compact flexural members with unbraced length greater than $L_c$ is changed in 9th Edition. There are more requirements to be met but Equation F1-6 of the 9th Edition, which gives the allowable compressive stress, may be less conservative than the Formula 4 of the 6th Edition for certain cases.

e) There are more requirements for compact rectangular and circular tubes in the 9th Edition (Reference Section F3 9th Edition).

f) Allowable bearing stresses on concrete are less conservative in the 9th Edition. (Reference Section 1.5.5 of 6th Edition and J9 of 9th Edition).

g) Minimum size of fillet welds are lower in 9th Edition for certain part thicknesses.

h) The allowable stress in welds are higher in 9th Edition. (Reference 1.5.3 6th Edition and Table J2.5 9th Edition). However, there are more requirements for welded connection in 9th Edition.

i) The allowable stresses in the rivets and bolts are higher in the 9th Edition. (Reference Table 1.5.2.1 6th Edition, Table J3.2 of the 9th Edition).

j) The method of combining shear and tension in rivets and bolts is different in the two codes. The allowable tension stress calculated using equations given in Table J3.3 of the 9th Edition is higher than those in the 6th Edition. (Reference Section 1.6.3 6th Edition and Table J3.3 9th Edition).

k) The section dealing with fatigue is greatly expanded in the 9th Edition. (Reference Section 1.7 of 6th Edition and Appendix K of 9th Edition).

l) The limiting slenderness ratios are more liberal in the 9th Edition. (Reference Section 1.8 6th Edition and Chapter B 9th Edition).

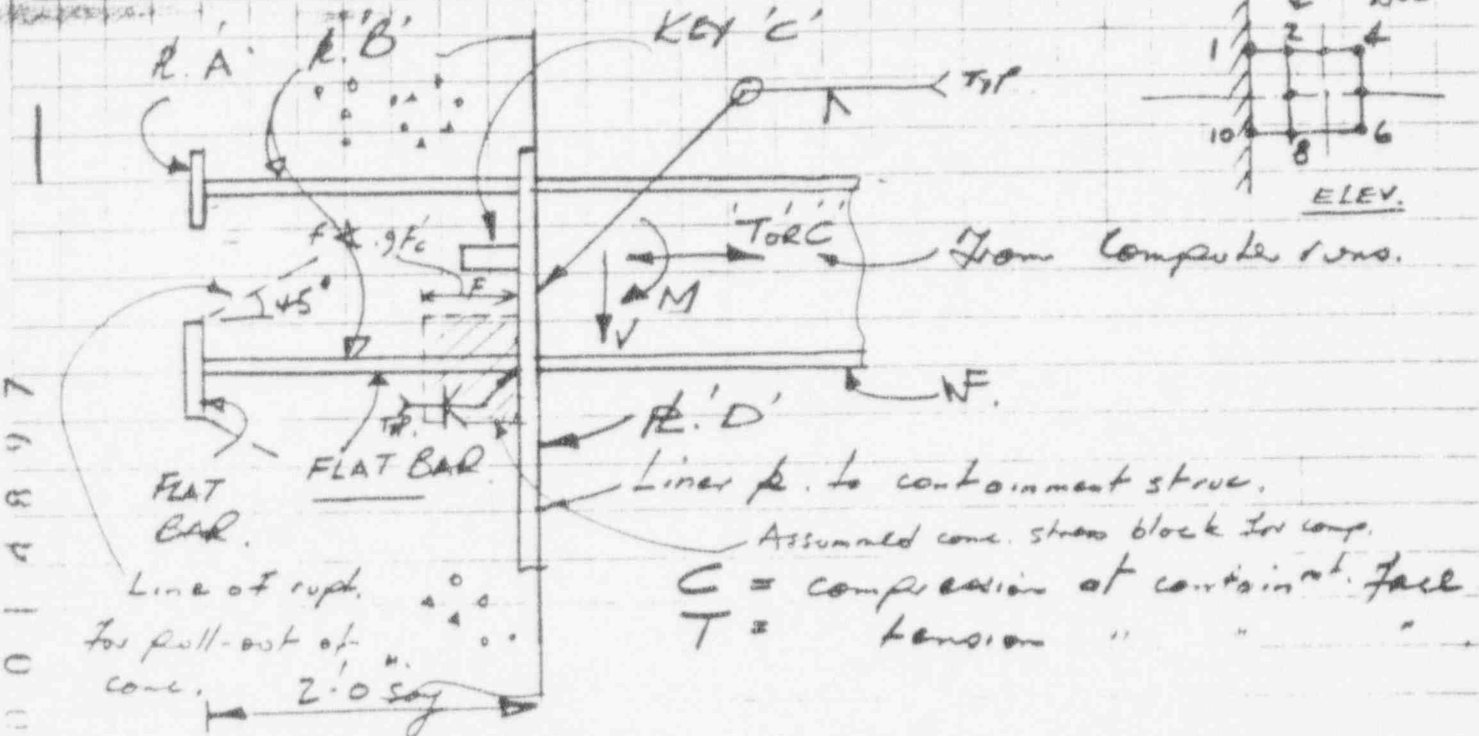
CALCULATION SHEET

SIGNATURE FWJ. DATE 5.20.68

TITLE NUCLEAR PLANT - WISCONSIN - UNIT #1 JOB NO. 6118

SUBJECT MAIN STEAM PIPE SUPPTS. SHEET NO. 22

DESIGN OF INSERTS FOR BRACKETS 2, 4, 5, 6 & 7.




C = compression at containm't. face

T = tension " " "

| BRACKET | T or C | | V | M | Joint | Load'g |
|---|---|---|---|---|---|---|
| 2, 4 | 42 | C | -255 | -527 | 1 | 1 |
| | 42 | T | 83 | -289 | 10 | " |
| | -169 | T | 22 | 14 | 1 | 2 |
| | 169 | T | 22 | -14 | 10 | " |
| | 30 | C | -181 | -372 | 1 | 4 |
| | 30 | T | 58 | -204 | 10 | " |
| | -149 | T | 74 | 212 | 1 | 5 |
| | 90 | T | -165 | 362 | 10 | " |
| 5 | 103 | C | -181 | -468 | 1 | 1 |
| | 103 | T | 158 | -312 | 10 | " |
| | -169 | T | 4 | 10 | 1 | 2 |
| | +169 | T | 4 | -10 | 10 | " |
| | 168 | C | -14 | 114 | 1 | 3 |
| | -169 | C | -14 | -114 | 10 | " |
| | 192 | C | -137 | -249 | 1 | 4 |
| | -47 | C | 101 | -301 | 10 | " |
| | -192 | T | 114 | 226 | 1 | 5 |
| | 46 | T | -124 | 322 | 10 | 5 |

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FORM 5-07 1000

# CALCULATION SHEET

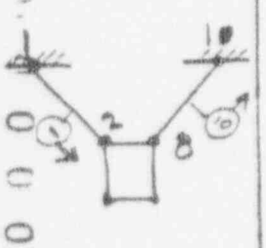
SIGNATURE FWJ　　　　DATE 6.1.68

TITLE NUCLEAR PLANT - WISCONSIN - UNIT #1　　　　JOB NO. 6118

SUBJECT MAIN STEAM PIPE SUPPTS.　　　　SHEET NO. 23

INSERTS FOR BRACKETS 2, 4, 5 6 + 7 CONTD.

| BRACKET. | T or P | V | M | Joint | Loadg. |
|---|---|---|---|---|---|
| 6 | 220 C* | 200 | 780* | 1 | 1 |
| | 220 T | 200 | 724 | 10 | " |
| | 200 C | 15.6 | -24 | 1 | 2 |
| | -200 C | 16 | 24 | 10 | " |
| | -200 T | -2 | -2 | 1 | 3 |
| | -200 C | -2 | +2 | 10 | " |
| | 300 C | 153 | 534 | 1 | 4 |
| | 14 T | -131 | 530 | 10 | " |
| | -298 T | -144 | -514 | 1 | 5 |
| | -14 T | 140 | -550 | 10 | " |
| 7 | 295 C | -5 | 152 | 1 | 1 |
| | 298 T | 2 | 90 | 10 | " |
| | 335 C | -33 | -179 | 1 | 2 |
| | -335 C | -33 | 179 | 10 | " |
| | -315 T | 49 | 163 | 1 | 3 |
| | -315 T | 49 | -163 | 10 | " |
| | 446 C | -27 | -20 | 1 | 4 |
| | -27 C | -21 | 190 | 10 | " |
| | -434 T | 36 | 52 | 1 | 5 |
| | 15 T | 31 | -222 | 10 | " |



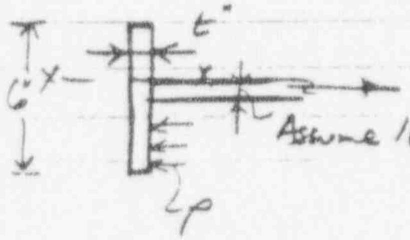
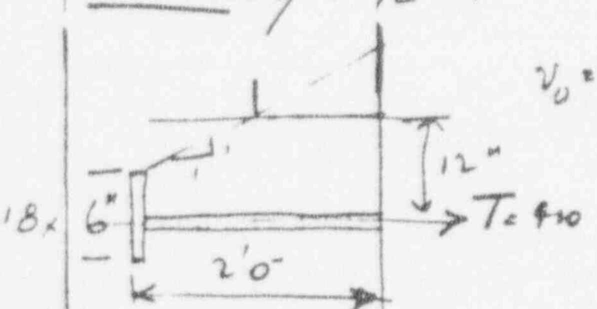
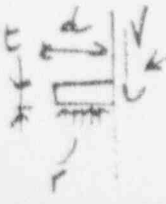

0000014R98

# CALCULATION SHEET

SIGNATURE: FWT. DATE: 6.1.68

TITLE: NUCLEAR PLANT - WISCONSIN - UNIT #1 JOB NO. 6118

SUBJECT: MAIN STEAM PIPE SUPPTS. SHEET NO. 24

| BRACKET NO. | CALCULATION | USE. |
|---|---|---|
| INSERTS FOR BRACKETS 2 & 4 & 5. | WF = 14 WF193; d = 15.50; Flanges 15.71" x 1.438" <br> Flange force say = $-\frac{527 \times 12}{15.50} \pm \frac{42}{2} = 431^k C$, $389\ T.$ | |
| | **Design Pl. 'A'** <br> Area = $\frac{389}{4.25}$ = 91.5 □"; Use 18" x 6" Pl. <br> $P_{act.} = \frac{389}{(18 \times 6) - 16} = 4.24^{k/□"}$ <br>  <br> Assume 16" x 1" <br> $M_{xx} = 4.24 \times \frac{2.5^2}{2} = 13.25^{k''}$ <br> $t = \sqrt{\frac{6 \times 13.25}{32.40}} = 1.57''$ | Pl. 'A' 6 x 1 5/8 x 18" Lg. |
| | **Pl. 'B'** <br> Force in Pl. say = $\frac{527 \times 12}{15.50} = 410^k$ <br> Assume b = 16"; $t = \frac{410}{16 \times 32.4} = .79$ - Use 1" | |
| | **Punching - Pl. 'A'** <br>  <br> $v_u = \frac{410}{2(42+30) \times 24} = 119 < 198$ ∴ o.k. | |
|  | **Pl. 'D'** - Use 1 5/8 Pl. x 1'-9 x 1'-9"; $f = \frac{431}{6_{say} \times 21} = 3.34 < 4.5$ ∴ o.k. <br> **Key 'C'** $V_{max} = 255^k$; b = 21" <br> $d = \frac{255}{4.25 \times 21} = 2.85$; Use 3"; $p = \frac{255}{3 \times 21} = 4.04^{k/□"}$; $t = \sqrt{\frac{6 \times 4.04 \times 3^2}{2 \times 32.40}} = 1.83''$ Use 2" | Key 'C' thick 3 x 2" x 1'-9 |