MITSUBISHI HEAVY INDUSTRIES, LTD.
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TOKYO, JAPAN

April 12, 2011

Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Attention: Mr. Jeffrey A. Ciocco

Docket No. 52-021
MHI Ref: UAP-HF-11101

Subject: Amended MHI's Response to US-APWR DCD RAI No. 491-3733 REVISION 0 (SRP 03.08.03)

Reference: 1) "Request for Additional Information No. 491-3733 Revision 0, SRP Section: 03.08.03 – Concrete and Steel Internal Structures of Steel or Concrete Containments, Application Section: 3.8.3", dated November 23, 2009.
2) "MHI's Response to US-APWR DCD RAI No. 491-3733 Revision 0", UAP-HF-10062, dated March 3, 2010.

With this letter, Mitsubishi Heavy Industries, Ltd. ("MHI") transmits to the U.S. Nuclear Regulatory Commission ("NRC") a document entitled "Amended MHI's Response to Request for Additional Information No. 491-3733 Revision 0."

Enclosed is the response to the RAI contained within Reference 1.

In the amended responses to Question No.03.08.03-17, the answer is provided in Enclosure 2, this submittal contains additional information about SG support configuration to previously provided in Reference 2. MHI considers these are proprietary, and therefore should be withheld from public disclosure pursuant to 10 C.F.R. § 2.390 (a)(4) as trade secrets and commercial or financial information which is privileged or confidential. The proprietary information is bracketed by the designation "[ ]".

This letter includes a copy of the proprietary amended answer (Enclosure 2) and the Affidavit of Yoshiki Ogata (Enclosure 1) which identifies the reasons MHI respectfully requests that all materials designated as "Proprietary" in Enclosure 2 be withheld from public disclosure pursuant to 10 C.F.R. § 2.390 (a)(4).

Please contact Dr. C. Keith Paulson, Senior Technical Manager, Mitsubishi Nuclear Energy Systems, Inc. if the NRC has questions concerning any aspect of the submittals. His contact information is below.

Sincerely,

Y. Ogata

Yoshiki Ogata
General Manager- APWR Promoting Department
Mitsubishi Heavy Industries, LTD.

DOS!
NRO

Enclosures:

1. Affidavit of Yoshiki Ogata

2. Amended Answer to QUSTION 03.08.03-17 of Request for Additional Information No. 491-3733 Revision 0 (Proprietary Version)

3. Amended Answer to QUSTION 03.08.03-17 of Request for Additional Information No. 491-3733 Revision 0 (Non Proprietary Version)

CC: J. A. Ciocco
C. K. Paulson

Contact Information
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ENCLOSURE 1

Docket No.52-021
MHI Ref: UAP-HF-11101

MITSUBISHI HEAVY INDUSTRIES, LTD.

AFFIDAVIT

I, Yoshiki Ogata, state as follows:

1. I am General Manager, APWR Promoting Department, of Mitsubishi Heavy Industries, LTD ("MHI"), and have been delegated the function of reviewing MHI's US-APWR documentation to determine whether it contains information that should be withheld from public disclosure pursuant to 10 C.F.R. § 2.390 (a)(4) as trade secrets and commercial or financial information which is privileged or confidential.

2. In accordance with my responsibilities, I have reviewed the enclosed document entitled "Amended MHI's Response to US-APWR DCD RAI No. 491-3733 REVISION 0", and have determined that portions of the document contain proprietary information that should be withheld from public disclosure. Those pages containing proprietary information are identified with the label "Proprietary" on the top of the page and the proprietary information has been bracketed with an open and closed bracket as shown here "[ ]". The first page of the document indicates that all information identified as "Proprietary" should be withheld from public disclosure pursuant to 10 C.F.R. § 2.390 (a)(4).

3. The information identified as proprietary in the enclosed document has in the past been, and will continue to be, held in confidence by MHI and its disclosure outside the company is limited to regulatory bodies, customers and potential customers, and their agents, suppliers, and licensees, and others with a legitimate need for the information, and is always subject to suitable measures to protect it from unauthorized use or disclosure.

4. The basis for holding the referenced information confidential is that it includes the output of design calculations used by mathematical method, based on detail SG supports columns dimension of US-APWR. The information is not available in public sources and could not gathered readily from other publicly available information.

5. The referenced information is being furnished to the Nuclear Regulatory Commission ("NRC") in confidence and solely for the purpose of information to the NRC staff.

6. The referenced information is not available in public sources and could not be gathered readily from other publicly available information. Other than through the provisions in paragraph 3 above, MHI knows of no way the information could be lawfully acquired by organizations or individuals outside of MHI.

7. Public disclosure of the referenced information would assist competitors of MHI in their design of new nuclear power plants without incurring the costs or risks associated with the design of the subject systems. Therefore, disclosure of the information contained in the referenced document would have the following negative impacts on the competitive position of MHI in the U.S. nuclear plant market:

A. Loss of competitive advantage due to the costs associated with development of the welding material procurement specifications for the Reactor Coolant Pressure Boundary of the US-APWR. Providing public access to such information permits competitors to duplicate or mimic the methodology without incurring the associated costs.

B. Loss of competitive advantage of the US-APWR created by benefits of enhanced plant safety, and reduced operation and maintenance costs associated with the Reactor Coolant Pressure Boundary.

I declare under penalty of perjury that the foregoing affidavit and the matters stated therein are true and correct to the best of my knowledge, information and belief.

Executed on this 12th day of April, 2011.

Y. Ogata

Yoshiki Ogata,
General Manager- APWR Promoting Department
Mitsubishi Heavy Industries, LTD.

Docket No. 52-021
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Enclosure 3

UAP-HF-11101
Docket Number 52-021

Amended Answers to QUESTION 03.08.03-17 of
RAI No.491-3733 REVISION 0

(Non Proprietary)

April 2011

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

4/12/2011

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.:	**NO. 491-3733 REVISION 0**
SRP SECTION:	**03.08.03 – Concrete and Steel Internal Structures of Steel or Concrete Containment**
APPLICATION SECTION:	**03.08.03**
DATE OF RAI ISSUE:	**11/23/2009**

QUESTION NO. : 03.08.03-17

In its response to Question 3.8.3-3, MHI states that in order to reduce the seismic effects of the US-APWR steam generators (SG) they chose to use a three level lateral support system. This three level support system is described in the response. The response also includes a sketch that shows how the pin-joint detail used for the SG support columns provides for thermal movement.

In Part (a) of their response, MHI states that "This three level support system has increased ... This response is described in details in Subsection 3.7.2.4". The staff was not able to find any description on this support system in Subsection 3.7.2.4. The applicant is requested to provide a description of the response, cited above, in the DCD.

For Part (b) of their response, the information provided by MHI is acceptable in general. However, the figure provided in the answer causes another concern. It appears that the pins at the hinge joints would be subjected to a large force from the heavy steam generator (SG). The applicant is requested to provide a free-body diagram (sketch) of the SG showing the weight of SG and the reaction forces from the supports. Also, MHI is requested to provide the design calculations for the pins at the hinge joints and the details of the connection of the support columns to the supporting concrete.

Reference: MHI response to RAI 322-1999, dated 9/17/2009, MHI Ref: UAP-HF-09449, ML092670583.

ANSWER

Part (a)
Unchanged. (Refer to MHI's letter UAP-HF-10062, dated on March 3, 2010)

Part (b)
A free-body diagram of the SG showing the weight of the SG and the reaction forces from the supports is shown in Figure 1. W indicates the weight of the SG that is supported in the vertical direction by the four support columns. The pin-jointed columns are designed to allow lateral movement, and therefore relieve horizontal reactions. Therefore, the acting force on each SG support column is nominally W/4 per support column. More information about the design calculations for the pins at the hinge joints are provided in Attachment A. The connection for the support columns to the supporting concrete is provided by the anchor bolts. Anchor bolts are buried in the concrete structure, and tightened with support column base plate by nuts.

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 the PRA.

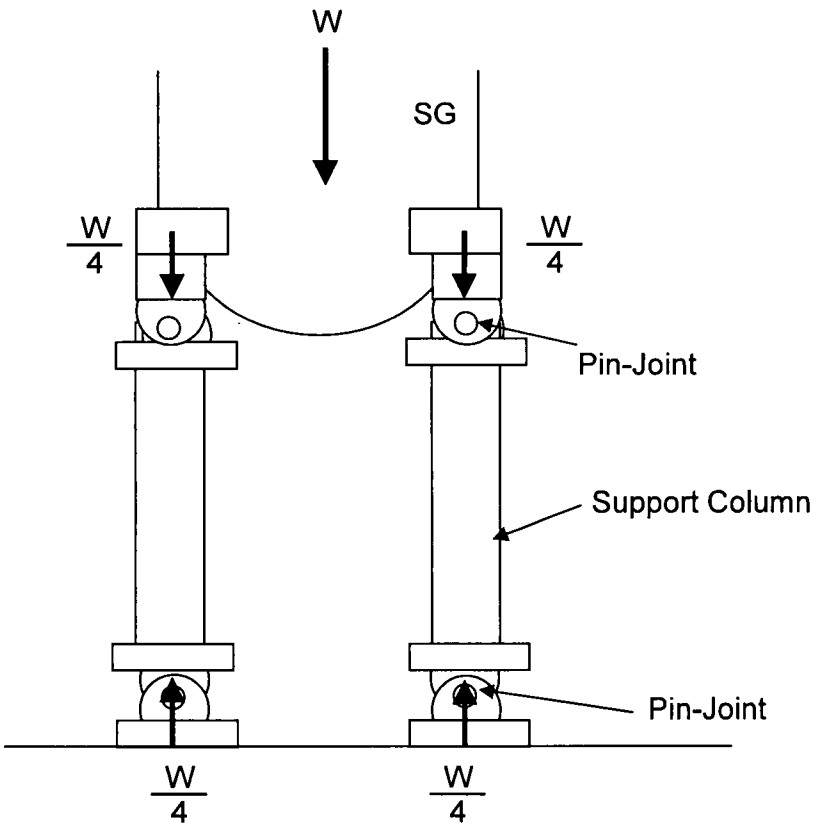

Figure 1 Free-body Diagram of the SG weight

ATTACHMENT A

SG COLUMNS STRESS CALCULATION

CONTENTS

1.0 ALLOWABLE STRENGTHS OF MATERIALS

1.1 Structural Steel and Bolt

Allowable stress design shall be adopted for the structural design for steel works in accordance with ASME Section III and AISC/ADS (9th edition)

1.1.1 Tensile Strength Values and Yield Strength Values

Tabulated values of ultimate tensile strength of material at temperature (Su) and Yield strength at temperature (Sy) for materials listed below shall be;

(Unit: ksi)

SPECIFICATION	TEMPERATURE (°F)																	
	-20	100	150	200	250	300	400	500	600	650	700	750	800	850	900	950	1000

1.2 Allowable Stresses in Service Level D for Structural Steel

1.2.1 Allowable Tensile Stresses as per Appendix F-1334 of ASME Section III on the effective net sectional area

Ft = Min. (1.20Sy, 0.70Su)

1.2.2 Allowable Shear Stress as per Appendix F-1334 of ASME Section III

Fv = Min. (0.72Sy, 0.42Su)

1.2.3 Allowable bearing stress on the projected area as per Appendix F-1336 of ASME Section III

Fp = 2.10Su

1.3 Allowable Stresses in Service Level D for Bolts and Pins

1.3.1 Allowable Tensile Stresses as per Appendix F-1334 of ASME Section III Average tensile stress area

Ft = Min. (Sy, 0.70Su)

1.3.2 Allowable Shear Stress as per Appendix F-1334 of ASME Section III Average shear stress area

Fv = Min. (0.60Sy, 0.42Su)

1.4 Allowable Stresses on Design of Members

1.4.1 Columns

(Ksi)

No.	Member Name	Material	Temp. Condition*	Allowable Stresses for Service Level D			
			°F	Ft*	Fa*	Fv*	Fp*
1	Support Pipe Side Hinge						
2	Bracket Side Hinge						
3	Base Plate Side Hinge						
4	Upper Side Support Pin						
5	Lower Side Support Pin						

*Material temperature at normal operation

2.0 STRESS CALCULATION

2.1 General

The stress calculation shall be in accordance with the allowable stress design for steel structures as specified in ASME codes.

2.2 Loads

2.2.1 Design Loads for Columns

(Unit:kips)

Node	LOOP A, D		LOOP B, C	
	+Z	-Z	+Z	-Z
125				
126				
127				
128				

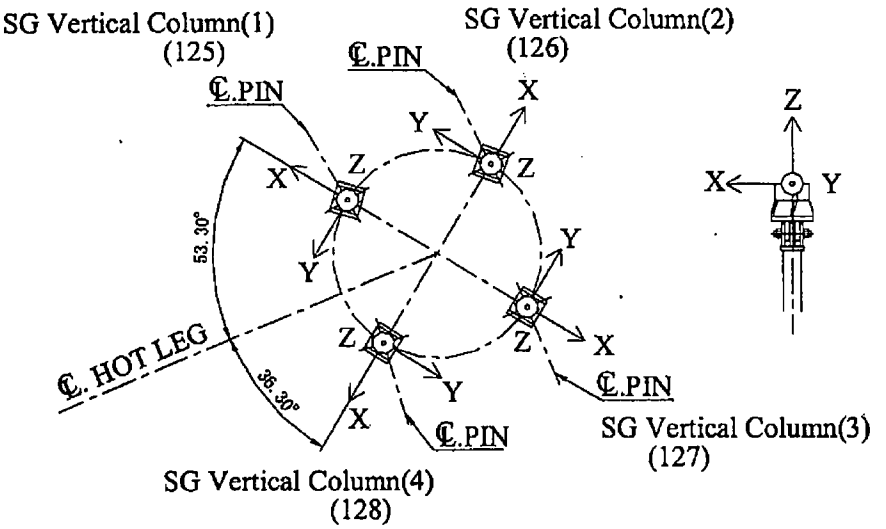

Figure 2-1 Support Model

2.3 Stress Calculation

Support Location*	Support Name	Vertical Design Load Z	Area of Member A	Tensile Stress σt	Shear Stress τ	Bearing Stress σp	Allowable Stress			Actual-Allowable Stress Ratio	Within Allowance (Y/N)
							Ft	Fv	Fp		
1	Upper & Lower Support Pipe Side Hinge										
2											
3	Upper & Lower Support Pipe Side Hinge Bearing										
4	Bracket Side Hinge										
5											
6	Bracket Side Hinge Bearing										
7	Base Plate Side Hinge										
8											
9	Base Plate Side Hinge Bearing										
10	Upper Side Support Pin										
11	Lower Side Support Pin										

*Support Location outlined in Section 3.0, *Outline of SG Columns*
Stress Unit = kips/in^2

2.3.1 Support Pipe Side Hinge (Upper Side Hinge & Lower Side Hinge)

$$\sigma t1 = \frac{Z}{At1} = \left[\quad\right]$$

$$\text{Ratio} = \frac{\sigma t1}{Ft} = \left[\quad\right]$$

Where area of tension member At1 = [ ] in^2

$$\tau 2 = \frac{Z}{Av2} = \left[\quad\right]$$

$$\text{Ratio} = \frac{\tau 2}{Fv} = \left[\quad\right]$$

Where area of shear member Av2 = [ ] in^2

$$\sigma p3 = \frac{Z}{Ap3} = \left[\quad\right]$$

$$\text{Ratio} = \frac{\sigma p3}{Fp} = \left[\quad\right]$$

Area of bearing member Ap3 = [ ] in^2

2.3.2 Bracket Side Hinge

$$\sigma t4 = \frac{Z}{At4} = \left[\quad \right]$$

$$\text{Ratio} = \frac{\sigma t4}{Ft} = \left[\quad \right]$$

Where area of tension member At4 = [ ] in^2

$$\tau 5 = \frac{Z}{Av5} = \left[\quad \right]$$

$$\text{Ratio} = \frac{\tau 5}{Fv} = \left[\quad \right]$$

Where area of shear member Av5 = [ ] in^2

$$\sigma p6 = \frac{Z}{Ap6} = \left[\quad \right]$$

$$\text{Ratio} = \frac{\sigma p6}{Fp} = \left[\quad \right]$$

Where area of bearing member Ap6 = [ ] in^2

2.3.3 Base Plate Side Hinge

$$\sigma t7 = \frac{Z}{At7} = \left[\quad \right]$$

$$\text{Ratio} = \frac{\sigma t7}{Ft} = \left[\quad \right]$$

Where area of tension member At7 = [ ] in^2

$$\tau 8 = \frac{Z}{Av8} = \left[\quad \right]$$

$$\text{Ratio} = \frac{\tau 8}{Fv} = \left[\quad \right]$$

Where area of shear member Av8 = [ ] in^2

$$\sigma p9 = \frac{Z}{Ap9} = \left[\quad \right]$$

$$\text{Ratio} = \frac{\sigma p9}{Fp} = \left[\quad \right]$$

Where area of bearing member Ap7 = [ ] in^2

2.3.4 Upper Side Support Pin

$$\tau 10 = \frac{Z}{Av10} = \left[\quad \right]$$

$$\text{Ratio} = \frac{\tau 10}{Fv} = \left[\quad \right]$$

Where area of shear member: Av10 = [ ] in^2

2.3.5 Lower Side Support Pin

$$\tau 11 = \frac{Z}{Av11} = \left[\quad \right]$$

$$\text{Ratio} = \frac{\tau 11}{Fv} = \left[\quad \right]$$

Where area of shear member Av11 = [ ] in^2

3.0 OUTLINE OF SG COLUMNS

3.1 Evaluated Points

Refer to attached drawings hereinafter.

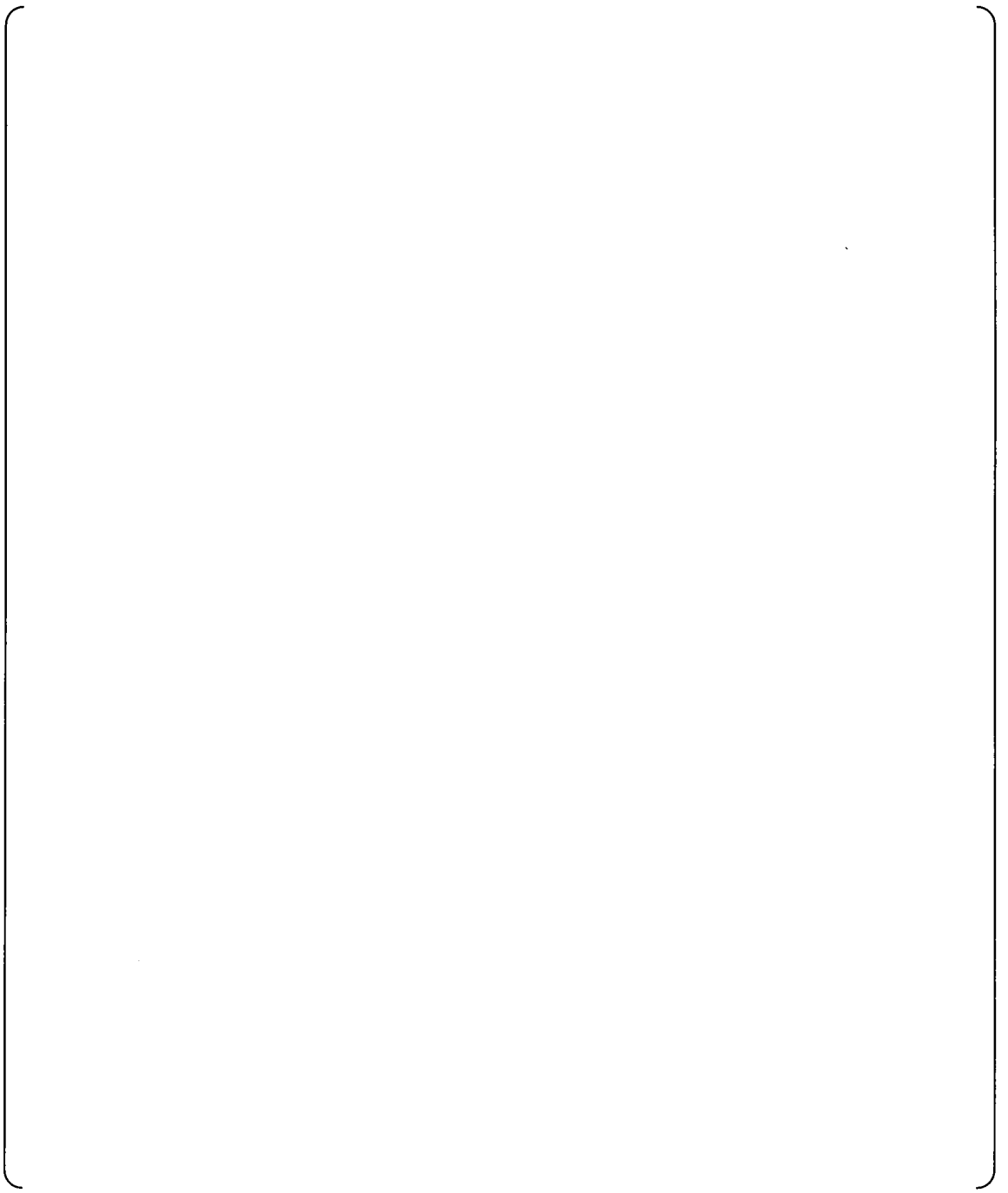

Figure 3-1 Column Assembly

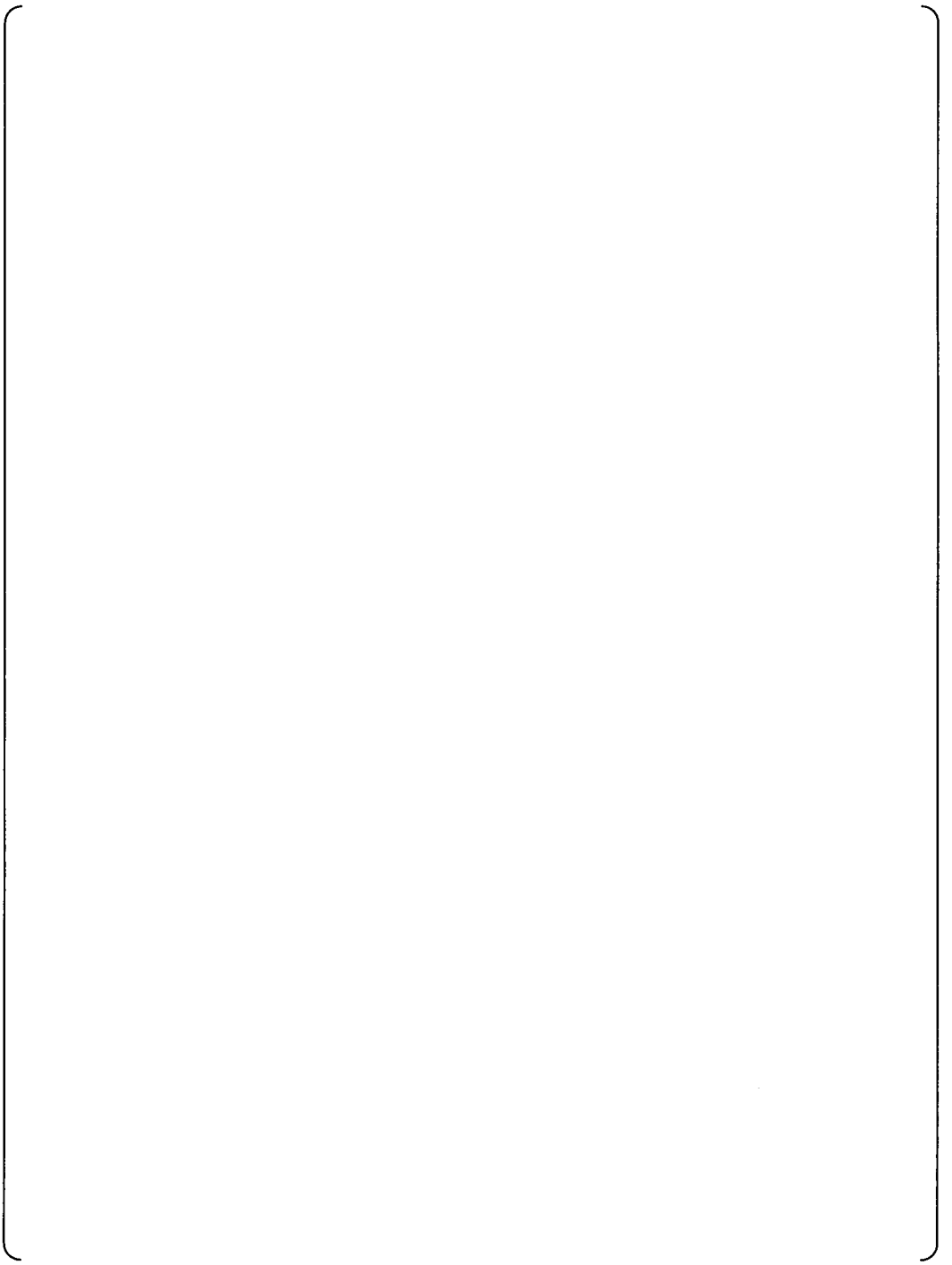

Figure 3-2 Support Pipe Upper Side Hinge & Lower Side Hinge

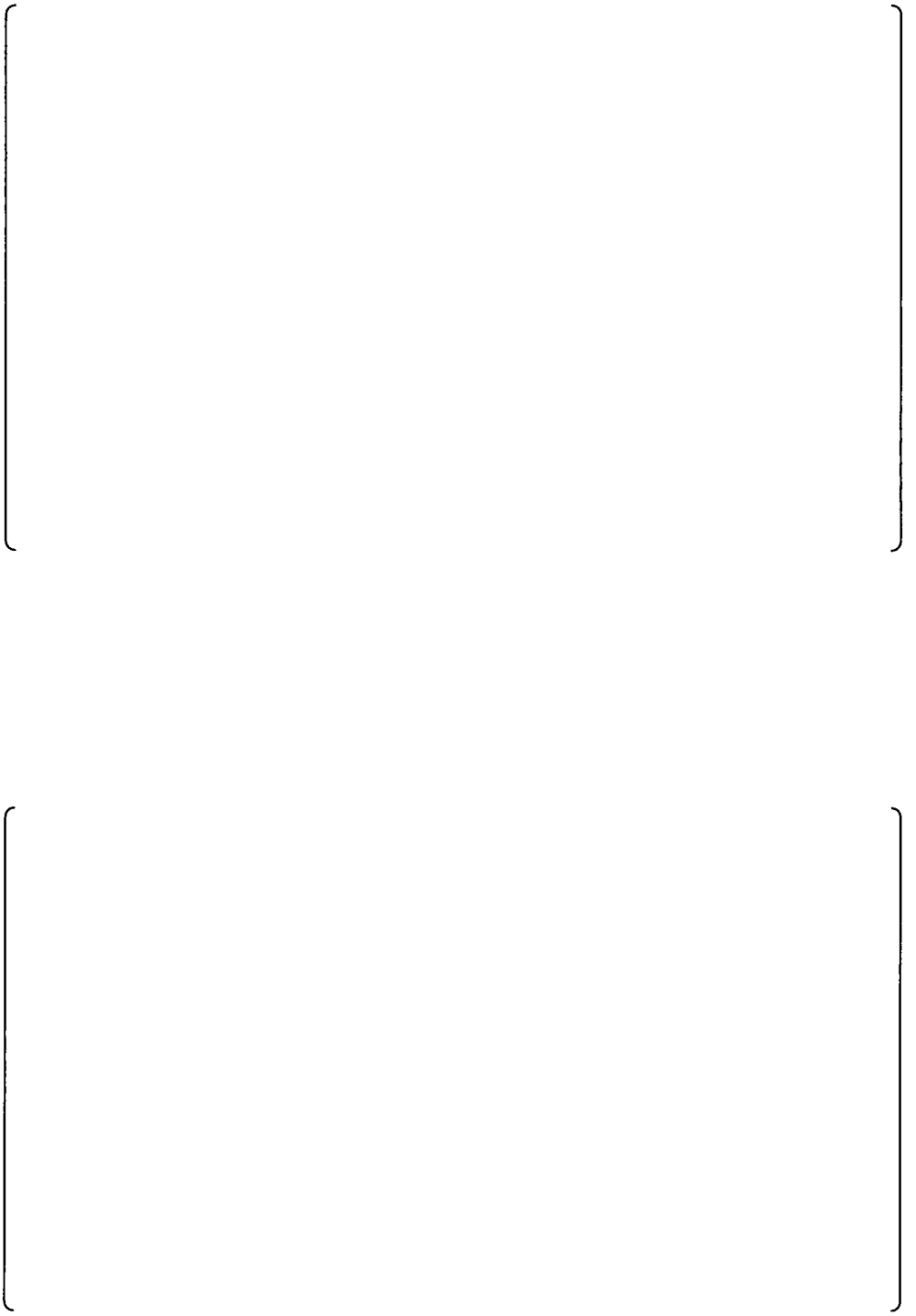

Figure 3-3 Bracket Side Hinge and Base Plate Side Hinge

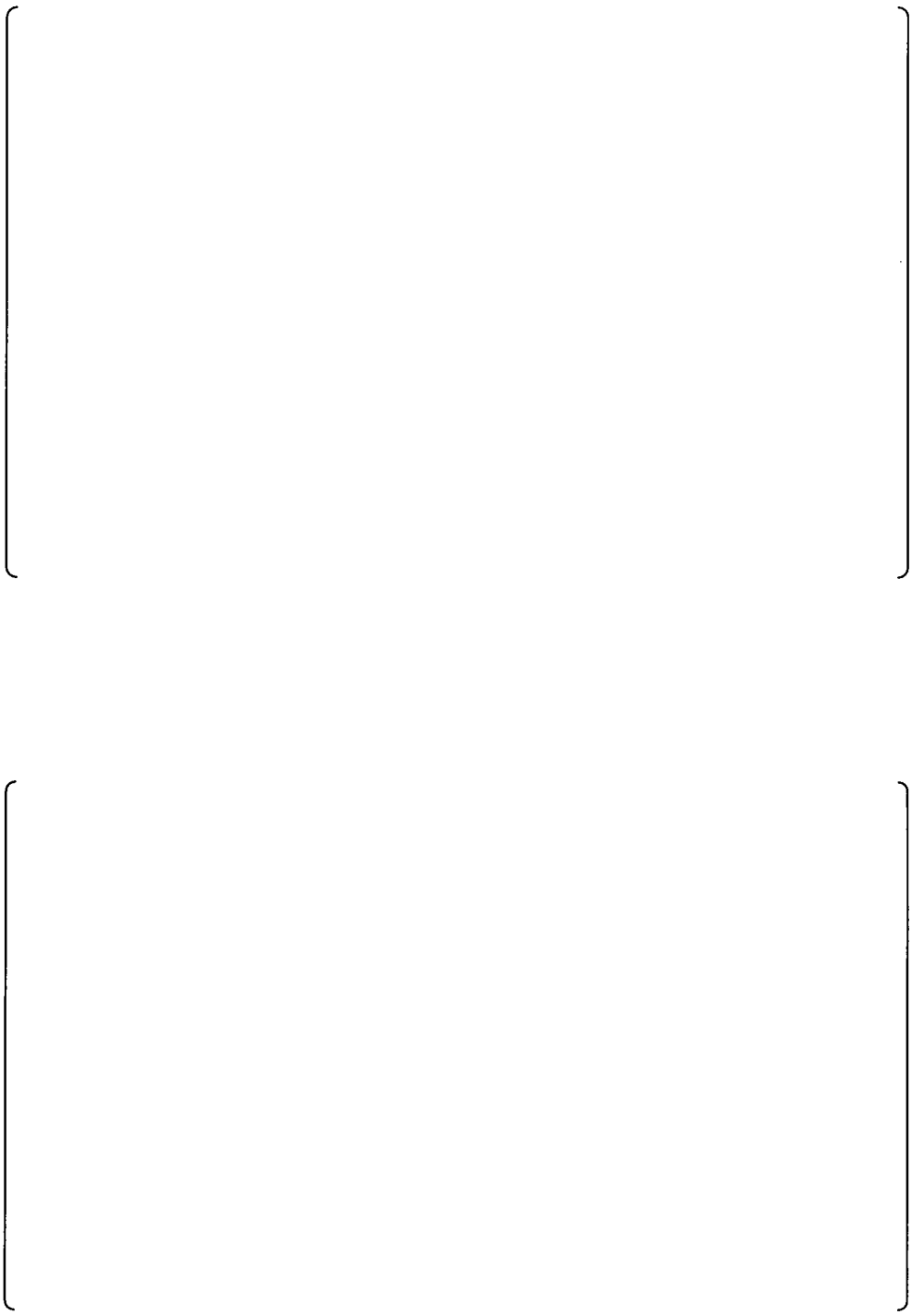

Figure 3-4 Upper Side Support Pin and Lower Side Support Pin