SARGENT & LUNDY ENGINEERS

DESIGN ASSESSMENT FOR
SEISMIC RE-ANALYSIS
PAGE 1

PROJECT NAME FERMI
PROJECT NO. 6139-38 UNIT NO. 2
CLIENT DETROIT EDISON CO.
CALC. NO. SDD-DECO-004

☒ SAFETY RELATED ☐ NON SAFETY RELATED

SIGNATURE & DATE FOR REV. 0			
PREPARER	Dau T. Le 5-5-81	Sections I, II, III, IV & V	
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APPROVER	8106150329	REVIEW METHOD	

IDENTIFICATION OF PAGES PREPARED/REVISED/VOIDED & REVIEW METHOD

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SECTION I

INTRODUCTION & METHODOLOGY

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① INTRODUCTION -

The purpose of this calculation is to asses the structural adequacy of the following components of the Nuclear Power Plant FERMI-2 for the revised 7% damping site spectra, SSE condition:

- The Reactor Pedestal
- The Stabilizer Trust
- The sacrificial shield
- The drywell shield walls (Biological shield)

② - Assumptions

The structural components are being assessed for the following load

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combinations:

A : DL + T_o

B : DL + T_o + SSE

C : DL + SSE

where:

DL : represents dead load plus any applicable live load (From previous calculations*)

T_o : represents thermal load due to operating temperature

SSE : represents loads due to Safe shutdown earthquake including horizontal and vertical excitations. The horizontal SSE are as reported in the S&L report SDD-DECO-003 dated 4-18-1981 and the vertical effects are calculated by using

(*) See References.

the DBE vertical response spectra given in the S&L report SL-2682 dated Sept 27, 1974 with a multiplication factor of 2.0

(3). METHOD OF ASSESSMENT.

- For the following reinforced concrete structural components:
  - the reactor pedestal
  - the dry well shield wall

various design sections are selected and their capacities are represented by the interaction diagrams plotted by computer program COLID according to the ACI-1977 code.

The strength adequacy of these sections are assessed by plotting

on the interaction diagram the load point represented by the most critical load combination.

. For the structural steel components, the stabilizer truss and the sacrificial shield, the principal stresses from the most critical combination are compared with the allowable stresses.

④ Conclusion -

Based on the above assumptions and methodology, it could be concluded that the assessed structural components have adequate strength to accomodate the load combinations considered in paragraph 2.

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(5) REFERENCES

1. S&L Report SDD-DECO-003 dated April 18, 1981 - "Seismic Re-Analysis for 7% damping site spectra, Reactor Auxiliary Building".

2. Calculation book No. NØ-01 / FERMI project No. 5285 - "Assessment of pedestal and stabilizer trust for safe-and break".

3. Calculation books No. NØ-02 and NØ-03 / FERMI project NO 5285, "Sacrificial shield analysis for Annulus Pressurization".

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References -

4- S&L report SL-2682 dated Sept. 27, 1974, "Seismic Analysis of the Reactor-Auxiliary building Complex - ENRICO FERMI Atomic power plant unit 2."

5. S&L Inter-office memo from A.K. Singh to R.A. Wiff, dated May 1, 1981, "Vertical SSE spectra".

6- Calculation book No. 5-04-12/FERMI job No. 3988, "Load Combinations and TEMCO input for Dry well shell" (Computer output).

7- Calculation book 5.04.01/FERMI project No. 3988, "DESIGN OF DRYWELL SHIELD & Penetration Analysis".

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SECTION II

ASSESSMENT OF REACTOR PEDESTAL

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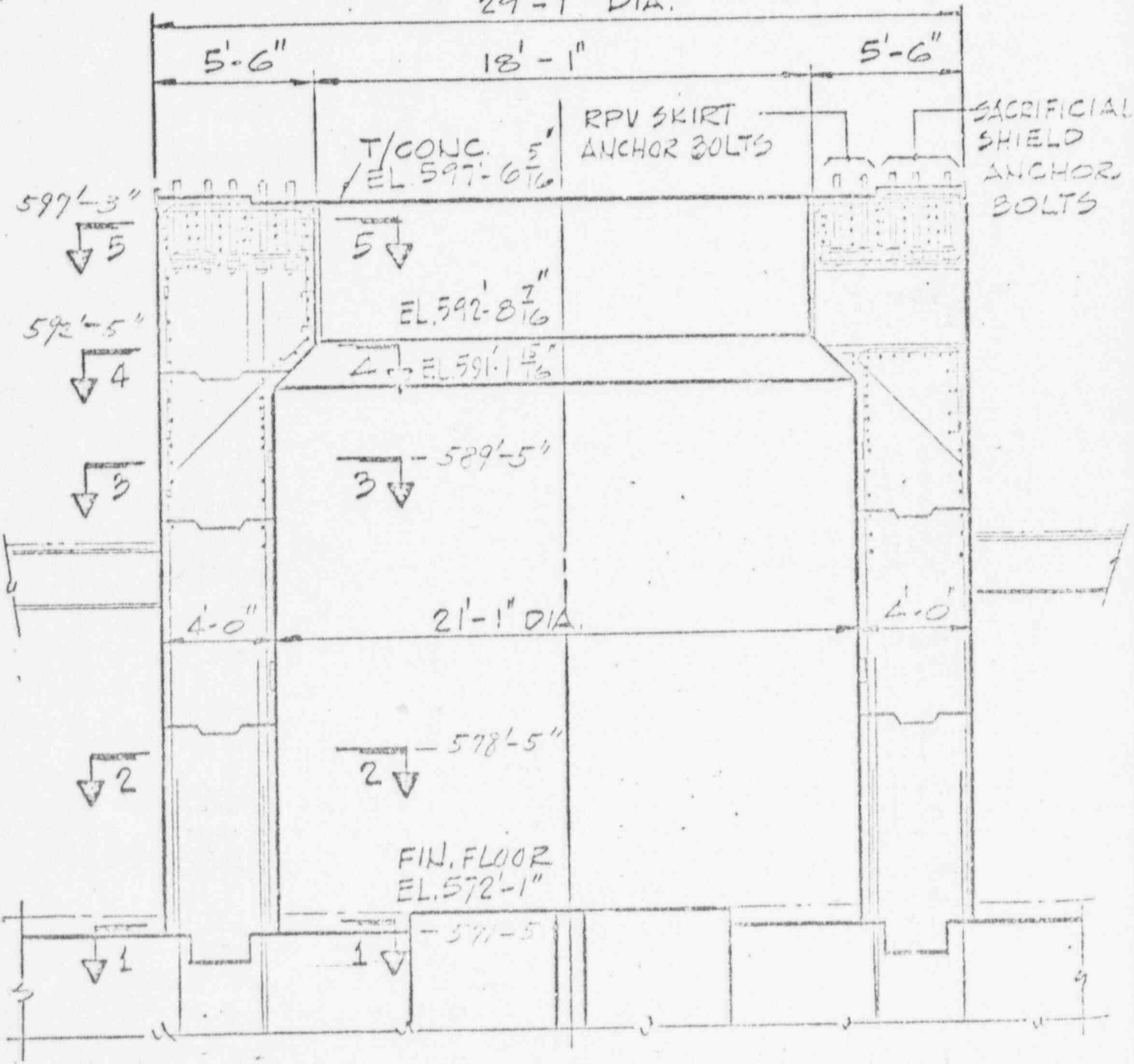

REACTOR PEDESTAL SECTION

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Design Section for Pedestal Assessment

Section	Elevation	DYNAS Model Elem/Node
1	572'-0"	17 / 12
2	578'-5"	17 / -
3	589'-5"	99/95
4	592'-5"	18/-
5	597'-3"	18/29

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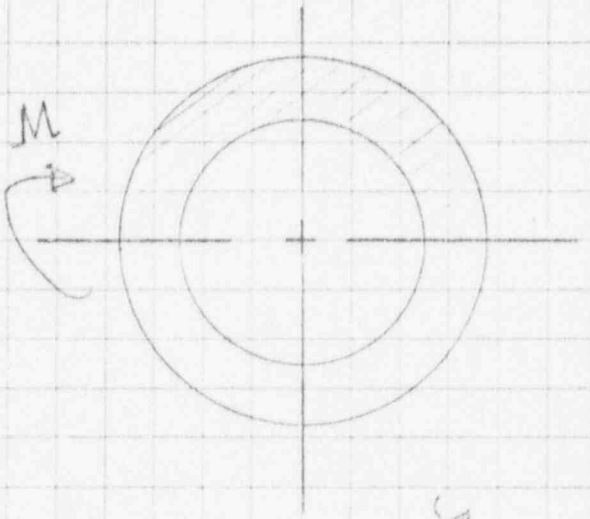
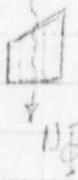
Conversion of Beam forces to shell element forces.

① - N_ϕ due to Moment -



$$\sigma = \frac{Mc}{I} = \frac{Mc}{\frac{\pi}{4}(R_o^4 - R_i^4)} = \frac{4Mc}{\pi(R_o^4 - R_i^4)}$$

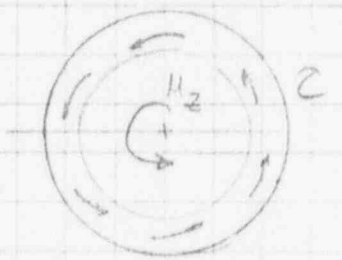
$$N_\phi = \sigma_{average}(R_o - R_i) = \frac{4M\frac{(R_o+R_i)}{2}}{\pi(R_o^4 - R_i^4)}(R_o - R_i)$$



$$\boxed{N_\phi^M = \frac{2M}{\pi(R_o^2 + R_i^2)}} \quad (1)$$

② - Calculation of Shear

a - Due to Torsion - (Q_τ)



$$\tau = \frac{M_z c}{\frac{\pi}{2}(R_o^4 - R_i^4)} = \frac{2M_z c}{\pi(R_o^4 - R_i^4)}$$

$$Q_\tau = \tau_{average}(R_o - R_i) = \frac{2M_z\left(\frac{R_o+R_i}{2}\right)}{\pi(R_o^4 - R_i^4)}(R_o - R_i)$$

$$Q_C = \frac{M_Z}{\pi(R_o^2 + R_i^2)} \qquad (2)$$

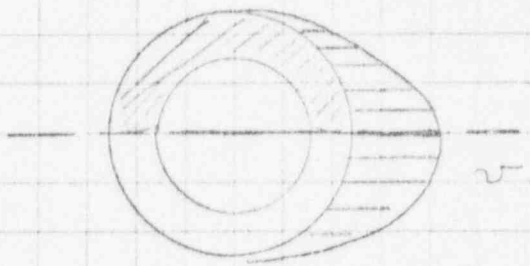
b. Due to Transverse Shear V: (Q_T)

$$v = \frac{VQ}{It^*}$$

$$Q = \frac{2}{3}(R_o^3 - R_i^3)$$

$$I = \frac{\pi}{4}(R_o^4 - R_i^4)$$

$$t^* = 2(R_o - R_i)$$



$$v = \frac{V \cdot \frac{2}{3}(R_o^3 - R_i^3)}{\frac{\pi}{4}(R_o^4 - R_i^4) \cdot 2 \cdot (R_o - R_i)}$$

$$= \frac{4}{3} \frac{V(R_o^2 + R_o R_i + R_i^2)}{\pi(R_o^4 - R_i^4)}$$

$$Q_T = v(R_o - R_i) =$$

$$Q_T = \frac{4}{3} \frac{V(R_o^2 + R_o R_i + R_i^2)}{\pi(R_o^2 + R_i^2)(R_o + R_i)} \qquad (3)$$

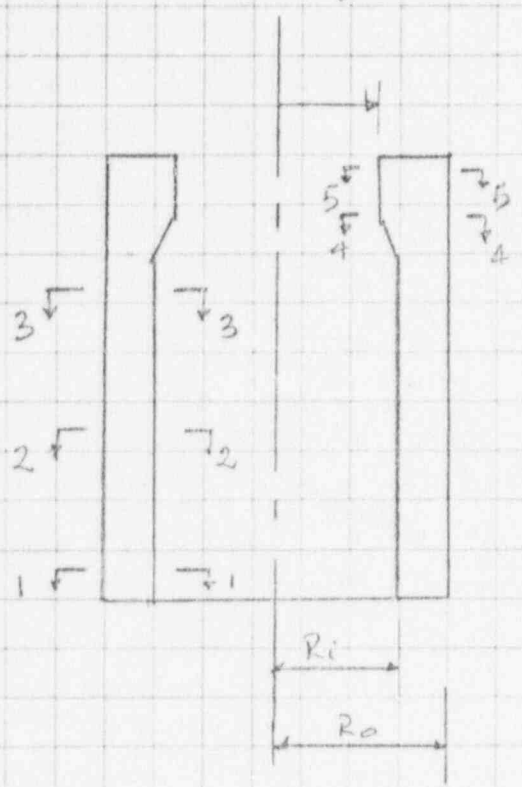
(3) - N_ϕ due to Vertical forces:

$$\sigma_z = \frac{P}{\pi(R_o^2 - R_i^2)}$$

$$N_\phi^z = \sigma (R_o - R_i)$$

$$\boxed{N_\phi^z = \frac{P}{\pi(R_o + R_i)}}$$

Numerical applications.



Pedestal : Sections: 1, 2 & 3

$$\begin{cases} R_o = 14.542' \\ R_i = 10.542' \end{cases}$$

$$N_\phi^M = \frac{2M}{\pi(R_o^2+R_i^2)} = \frac{2M}{\pi(14.542^2+10.542^2)} = \underline{0.001973\,M}$$

$$Q_z = \frac{M_z}{\pi(R_o^2+R_i^2)} = \frac{M_z}{\pi(14.542^2+10.542^2)} = \underline{0.000937\,M_z}$$

$$Q_T = \frac{4}{3}\frac{V(R_o^2+R_oR_i+R_i^2)}{\pi(R_o^2+R_i^2)(R_o+R_i)}$$

$$Q_T = \frac{4}{3}\frac{(14.542^2+14.542\times10.542+10.542^2)\,V}{\pi(14.542^2+10.542^2)(14.542+10.542)} = \underline{0.0250\,V}$$

$$N_\phi^z = \frac{P}{\pi(R_o+R_i)} = \frac{P}{\pi(14.542+10.542)} = \underline{0.0127\,P}$$

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Pedestal : Sections: 4 , 5

$$\begin{cases} R_o = 14.542' \\ R_i = 9.042' \end{cases}$$

$$N_\phi^M = \frac{2M}{\pi(R_o^2+R_i^2)} = \frac{2M}{\pi(14.542^2+9.042^2)} = \underline{0.00108\,M}$$

$$Q_Z = \frac{M_Z}{\pi(R_o^2+R_i^2)} = \frac{M_Z}{\pi(14.542^2+9.042^2)} = \underline{0.000543\,M_Z}$$

$$Q_T = \frac{4}{3}\frac{V(R_o^2+R_oR_i+R_i^2)}{\pi(R_o^2+R_i^2)(R_o+R_i)}$$

$$Q_T = \frac{4}{3}\frac{(14.542^2+14.542\cdot 9.042+9.042^2)}{\pi(14.542^2+9.042^2)(14.542+9.042)}V = \underline{0.0261\,V}$$

$$N_\phi^2 = \frac{P}{\pi(R_o+R_i)} = \frac{P}{\pi(14.542+9.042)} = \underline{0.0135\,P}$$

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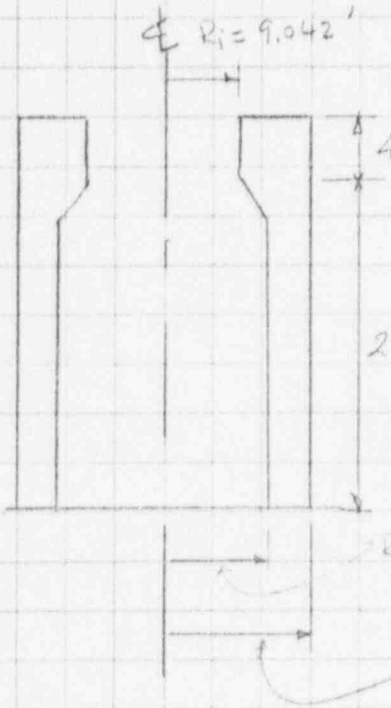
Seismic forces (SSE - VERTICAL)



Volume of pedestal

$$V = \Sigma \pi (R_o^2 - R_i^2) h$$

$$= \pi \left\{ (\overline{14.542}^2 - \overline{10.542}^2) \times 21.286 + (\overline{14.542}^2 - \overline{9.042}^2) \times 4.823 \right\}$$

$$= \underline{8675.05} \text{ ft}^3$$

$$W = 0.150 * 8675.05$$

$$= \underline{1301.26} \text{ kips}$$

$$F = m a_v \quad *$$

$$= 1301.26 * 0.30$$

$$= \underline{390.4} \text{ kips}$$

(*) Acceleration from Vertical SSE @ Elevation 583'-6" (Ref. SL-2682), Fig. C-15 with a multiplying-factor equal to 2.0

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Member Forces from SSE - (DYNAS Model)

DESIGN SECTION	V_{MAX}	M_2	M_{MAX}	P_2
1	919.3	62.8	45980.	390.4
2	919.3	62.8	34760.	
3	872.8	39.9	29740.	
4	866.6	35.8	29780.	
5	866.6	35.8	22550.	390.4

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EQUIVALENT MEMBRANE FORCES - SSE-Horizontal

DESIGN SECTION	Q_T	Q_Z	N_ϕ''	N_ϕ^2	ΣQ	ΣN
1	23.0	0.06	90.7	5.0	23.1	95.7
2	23.0	0.06	68.6	5.0	23.1	73.6
3	21.8	0.04	58.7	5.0	21.8	63.7
4	22.6	0.02	32.2	5.3	22.6	37.5
5	22.6	0.02	24.4	5.3	22.6	29.7

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Note on member forces for operating Thermal.

Ref: (Calc. NΦ-1, 5285 / Page 29 – 33)

Analysis was performed for Accident temperature T_a ($\Delta T = 145°F$) - For operating temperature T_o ($\Delta T = 40°F$), member forces will be proportionally by ratio: $\frac{40}{145} = 0.276$

	SECT	MΦ	MΔ	NΦ	NΔ	QeΦ
T_a	1	-8.1	-1.4	0.0	-0.05	-0.6
	2	-8.9	-1.5	0.0	-15.0	2.0
	3	49.1	25.3	-0.06	-0.5	27.5
	4	223.8	-10.5	7.5	117.9	15.5
	5	72.6	12.3	-0.03	544.5	-61.4
T_o	1	-2.24	-0.39	0.0	-0.01	-0.16
	2	-2.46	-0.4	0.0	-4.14	0.55
	3	41.2	6.98	0.02	0.14	7.6
	4	61.8	-2.9	2.1	32.5	4.3
	5	20.0	3.4	-0.01	150.3	-16.9

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Calcs. For Reactor Assembly

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Approved by Date

DESIGN MEMBER FORCES

SECTION: 1

LOAD COMBINATIONS:

DL values: Ref. 2.

$A = DL + T_o$

$B = DL + T_o + SSE$

$C = DL + SSE$

FORCES	DL	T_o	SSE	A	B	C
M_ϕ	10.7	-2.2	-	8.5	8.5	10.7
M_θ	1.8	-0.4	-	1.4	1.4	1.8
N_ϕ	-61.2	0.0	95.7	-61.2	34.5	34.5
N_θ	-10.3	-0.01	-	-10.3	-10.3	-10.3
$Q_{R\phi}$	-3.7	-0.2	-	-3.9	3.9	-3.7
$Q_{R\theta}$	-	-	-	-	-	-
Q_T	-	-	23.1	-	23.1	23.1

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DESIGN MEMBER FORCES

SECTION: 2

LOAD COMBINATIONS:

$A = DL + T_o$

$B = DL + T_o + SSE$

$C = DL + SSE$

FORCES	DL	T_o	SSE	A	B	C
M_ϕ	0.2	-2.5	–	-2.3	-2.3	0.2
M_θ	0.04	-0.4	–	-0.4	-0.4	0.04
N_ϕ	-61.2	0.0	73.6	-61.2	12.4	12.4
N_θ	-1.1	-4.2	–	-5.3	-5.3	-1.1
$Q_{R\phi}$	-0.2	0.6	–	0.4	0.4	-0.2
$Q_{R\theta}$	–	–	–	–	–	–
Q_T	–	–	23.1	–	23.1	23.1

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Calcs. For Pedestal Assessments

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Reviewed by M. Valetta Date 5-4-91

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DESIGN MEMBER FORCES

SECTION: 3

LOAD COMBINATIONS:

$A = DL + T_o$

$B = DL + T_o + SSE$

$C = DL + SSE$

FORCES	DL	T_o	SSE	A	B	C
M_ϕ	-24.0	41.2	—	17.2	17.2	-24.0
M_θ	-4.1	7.0	—	2.9	2.9	-4.1
N_ϕ	-61.2	-0.02	6.7	-61.2	2.5	2.5
N_θ	8.7	-0.1	—	8.6	8.6	8.7
$Q_{R\phi}$	-6.0	7.6	—	1.6	1.6	-6.0
$Q_{R\theta}$	—	—	—	—	—	—
Q_T	—	—	21.8	—	21.8	21.8

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DESIGN MEMBER FORCES

SECTION: 4

LOAD COMBINATIONS:

$A = DL + T_o$

$B = DL + T_o + SSE$

$C = DL + SSE$

FORCES	DL	T_o	SSE	A	B	C
M_ϕ	-7.6	61.8	—	54.2	54.2	-7.6
M_θ	4.5	-2.9	—	1.6	1.6	4.5
N_ϕ	-60.9	2.1	37.5	-58.8	-21.3	-23.4
N_θ	2.5	32.5	—	35.0	35.0	2.5
$Q_{R\phi}$	21.2	4.3	—	16.9	16.9	21.2
$Q_{R\theta}$	—	—	—	—	—	—
Q_T	—	—	22.6	—	22.6	22.6

Form GQ.3.08.1 Rev. 2

SARGENT & LUNDY ENGINEERS CHICAGO

Calcs. For Pedestal Assessments

Calc. No. SDD-DECO-004

Rev. 0 | Date

☑ Safety-Related | ☐ Non-Safety-Related

Page 2-17 of

Client DECO

Project FERMI-2

Proj. No. 6139-38 Equip. No.

Prepared by Dau Le | Date 4-30-81

Reviewed by M. Valette | Date 5-4-81

Approved by | Date

DESIGN MEMBER FORCES

SECTION: 5

LOAD COMBINATIONS:

$A = DL + T_o$

$B = DL + T_o + SSE$

$C = DL + SSE$

FORCES	DL	T_o	SSE	A	B	C
M_ϕ	-23.9	20.0	—	-3.9	-3.9	-23.9
M_θ	-4.1	3.4	—	-0.7	-0.7	-4.1
N_ϕ	-65.1	-0.01	29.7	-65.1	-35.4	-35.4
N_θ	-35.8	150.3	—	114.5	114.5	-35.8
$Q_{R\phi}$	-2.0	-16.9	—	-18.9	-18.9	-2.0
$Q_{R\theta}$	—	—	—	—	—	—
Q_T	—	—	22.6	—	22.6	22.6

Form GO-3.03.1 Rev. 2

SARGENT & LUNDY ENGINEERS CHICAGO

Calcs. For Pedestal Assessment		Calc. No. SDD-DECO-CC-1
		Rev. 0 Date
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Client DECC	Prepared by Dau Le	Date 5-4-81
Project FERMI-2	Reviewed by M. Walthers	Date 5-5-81
Proj. No. 6139.38 Equip. No.	Approved by	Date

CRITICAL COMBINATIONS FOR INTERACTION DIAGRAM

SECTION 1 :

Meridional : $\begin{cases} M\phi = 10.7 \\ N\phi = 57.6 \end{cases}$

Hoop : $\begin{cases} M\theta = 1.8 \\ N\theta = 12.8 \end{cases}$

SECTION 2 :

Meridional : $\begin{cases} M\phi = -2.3 \\ N\phi = 35.5 \end{cases}$

Hoop : $\begin{cases} M\theta = -0.4 \\ N\theta = 17.8 \end{cases}$

SECTION 3 :

Meridional : $\begin{cases} M\phi = -24.0 \\ N\phi = 24.3 \end{cases}$

Hoop : $\begin{cases} M\theta = -4.1 \\ N\theta = 30.5 \end{cases}$

SARGENT & LUNDY ENGINEERS CHICAGO

Calcs. For Pedestal Assessment		Calc. No. SDD-DECO-004
		Rev. 0 Date
X Safety-Related	Non-Safety-Related	Page 2-19 of

Client DECO	Prepared by Daule		Date [illegible]
Project FERMI-2	Reviewed by M. Valletta		Date 5-5-[illegible]
Proj. No. 6139-38 Equip. No.	Approved by		Date

SECTION 4:

Meridional: $\begin{cases} M_\phi = 54.2 \\ N_\phi = 1.3 \end{cases}$

Hoop: $\begin{cases} M_t = 4.5 \\ N_t = 57.6 \end{cases}$

SECTION 5:

Meridional: $\begin{cases} M_\phi = -23.9 \\ N_\phi = -12.8 \end{cases}$

Hoop: $\begin{cases} M_t = -4.1 \\ N_t = 137.1 \end{cases}$

SARGENT & LUNDY ENGINEERS CHICAGO

Calcs. for Pedestal Assessments			Calc. No. SDD-DECO-004
			Rev. 0 Date
X	Safety-Related		Non-Safety-Related Page 2-20 of

Client DECO		Prepared by Duu Le	Date 4-25-91
Project FERMI-2		Reviewed by M. Valath	Date 5-5-91
Proj. No. 6139-38	Equip. No.	Approved by	Date

Material Properties

Concrete: $\gamma_w = 150$ pcf
$f'_c = 4000$ psi

Steel Reinforcement: $f_y = 60$ ksi
$E_s = 29 \times 10^3$ ksi

Reinforcement Data -

SECTION: 1, 2 & 3 - Thickness: 48"

LAYER	MERIDIAN		HOOP	
	DISTANCE	A_s	Distance	A_s
1	2.205"	3.12 □"	3.615	2.08
2	45.795	3.12	44.385	2.08

SECTION: 4 - THICKNESS: 63.06"

LAYER	MERIDIAN		HOOP	
	DISTANCE	A_s	DISTANCE	A_s
1	3.615"	3.12 □"	2.205"	2.08 □"
2	60.858"	3.12 □"	59.448"	2.08

Form GO-3.08.1 Rev. 2

SARGENT & LUNDY ENGINEERS CHICAGO

Calcs. For Pedestal Treatment		Calc. No. SDD-DECO-004
		Rev. 0 Date
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Client DECO	Prepared by Dau Le	Date 4.30.91
Project FERMI-2	Reviewed by M. Vaidhyanathan	Date 5-2-91
Proj. No. 6139.38 Equip. No.	Approved by	Date

Reinforcement Data -

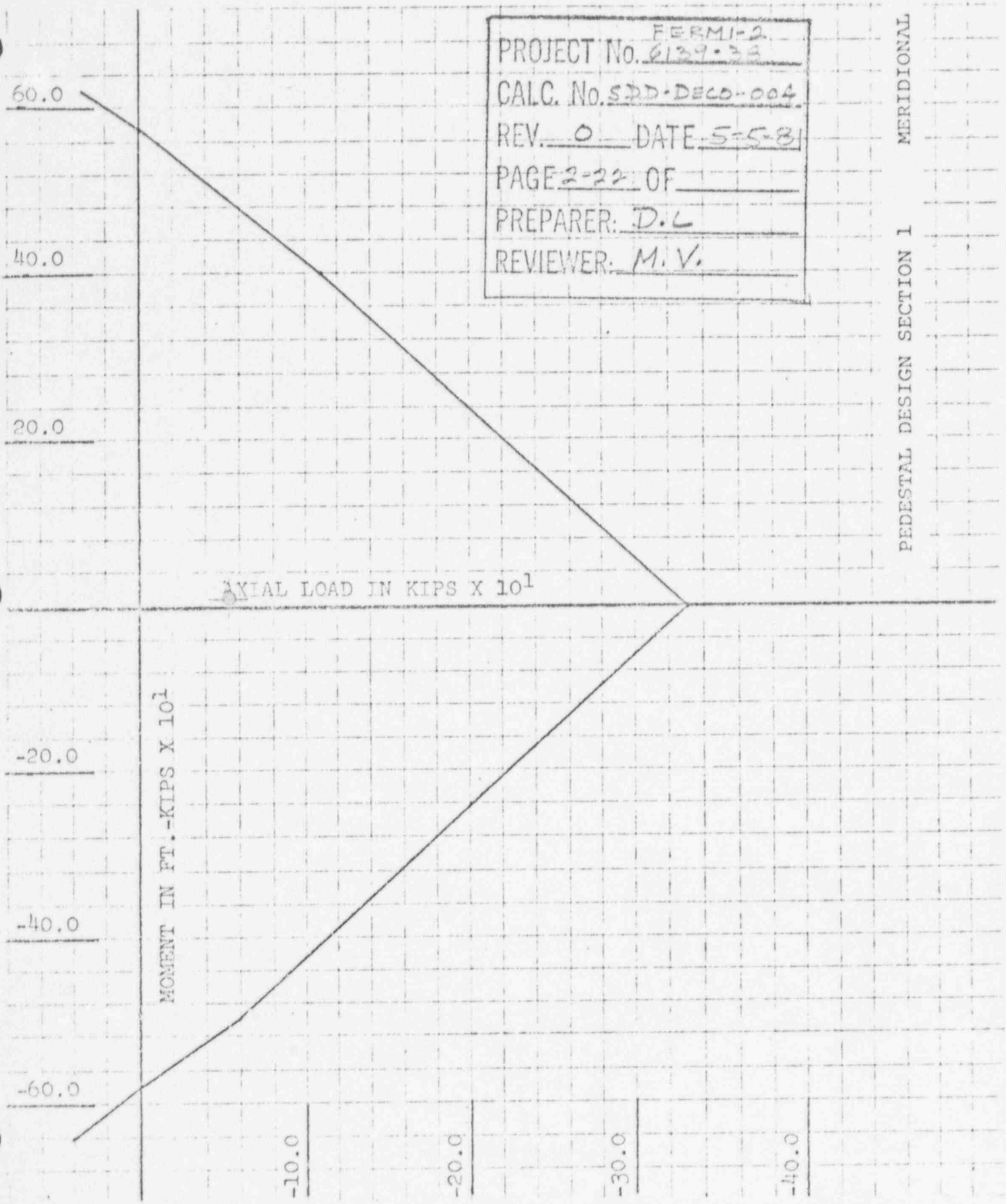
SECTION : 5 , Thickness : 66"

LAYER	MERIDIAN		HOOP	
	Distance	Area	Distance	Area
1	3.615"	3.12 □"	2.205"	2.08 □"
2	65.795"	3.12	16.0	3.9
3	—	—	27.0	3.12
4	—	—	29.82	3.9
5	—	—	40.0	3.9
6	—	—	51.0	3.9
7	—	—	54.0	3.9
8	—	—	62.355	2.08

SARGENT & LUNDY
ENGINEERS
CHICAGO

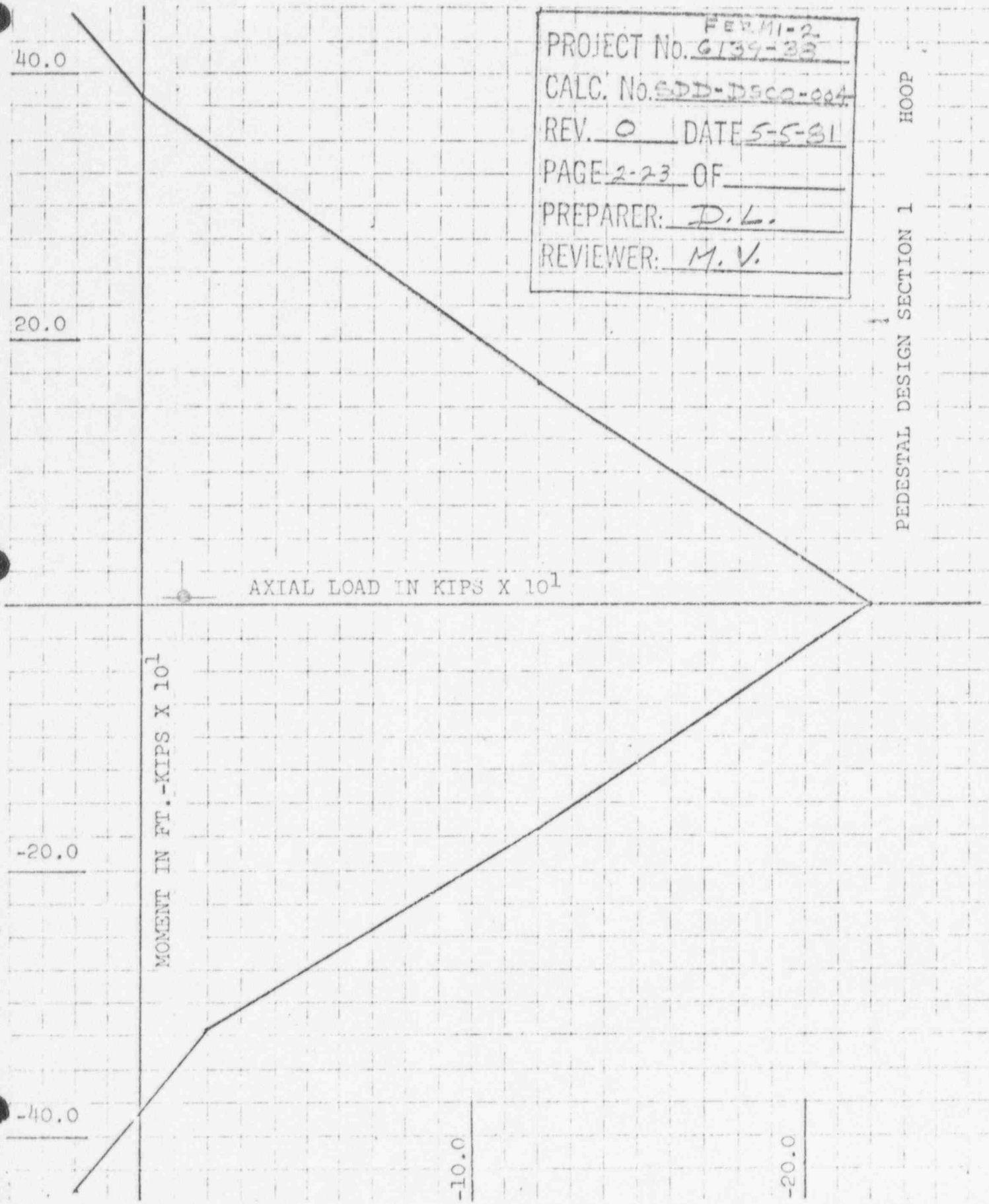
PROJECT No. FERMI-2 6139-38
CALC. No. SDD-DECO-004
REV. 0 DATE 5-5-81
PAGE 2-22 OF
PREPARER: D.L
REVIEWER: M.V.

PEDESTAL DESIGN SECTION 1 MERIDIONAL



SARGENT & LUNDY
ENGINEERS
CHICAGO

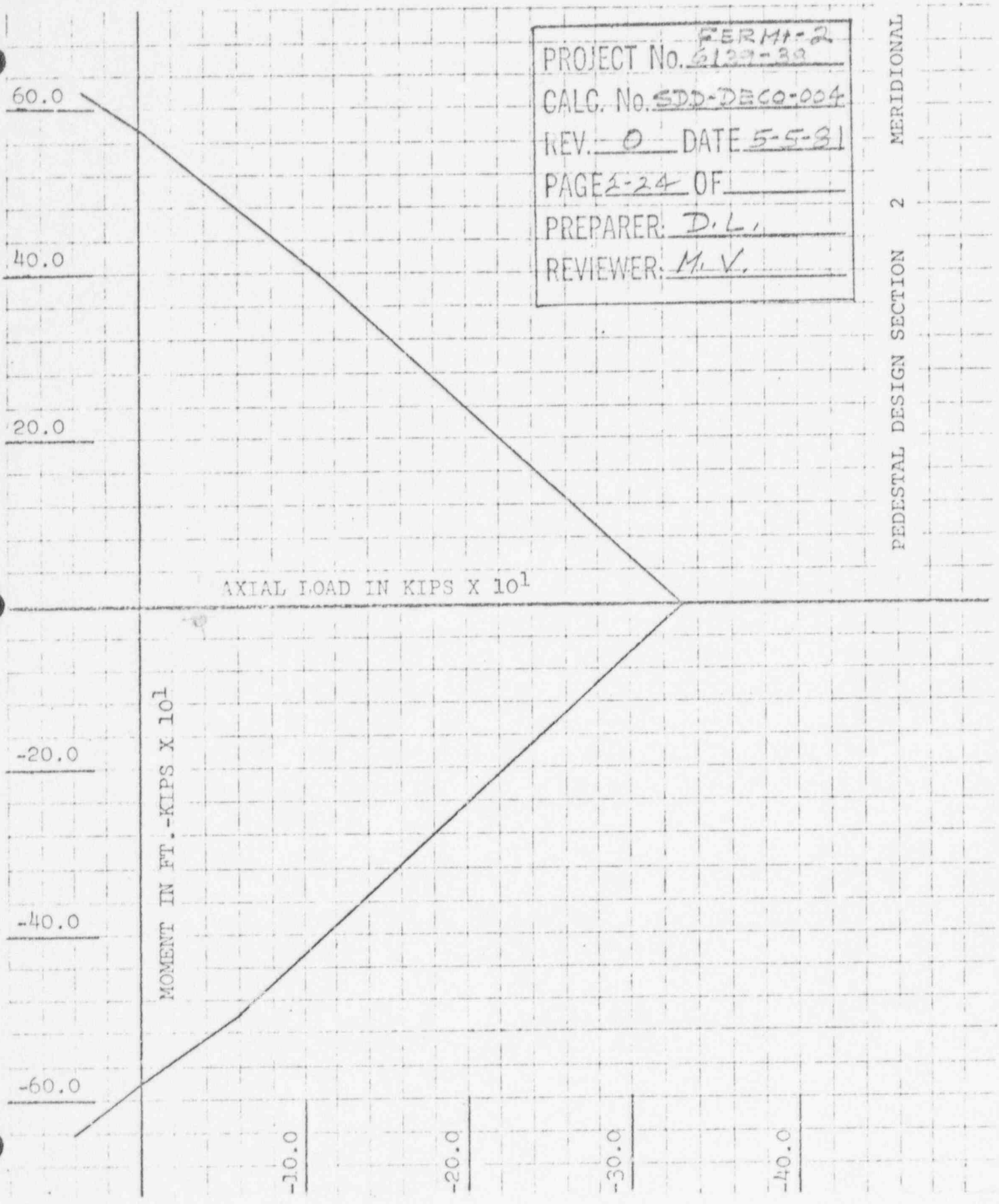
PROJECT No. 6139-38 FERMI-2
CALC. No. SDD-DSC0-004
REV. 0 DATE 5-5-81
PAGE 2-23 OF
PREPARER: D.L.
REVIEWER: M.V.



SARGENT & LUNDY
ENGINEERS
CHICAGO

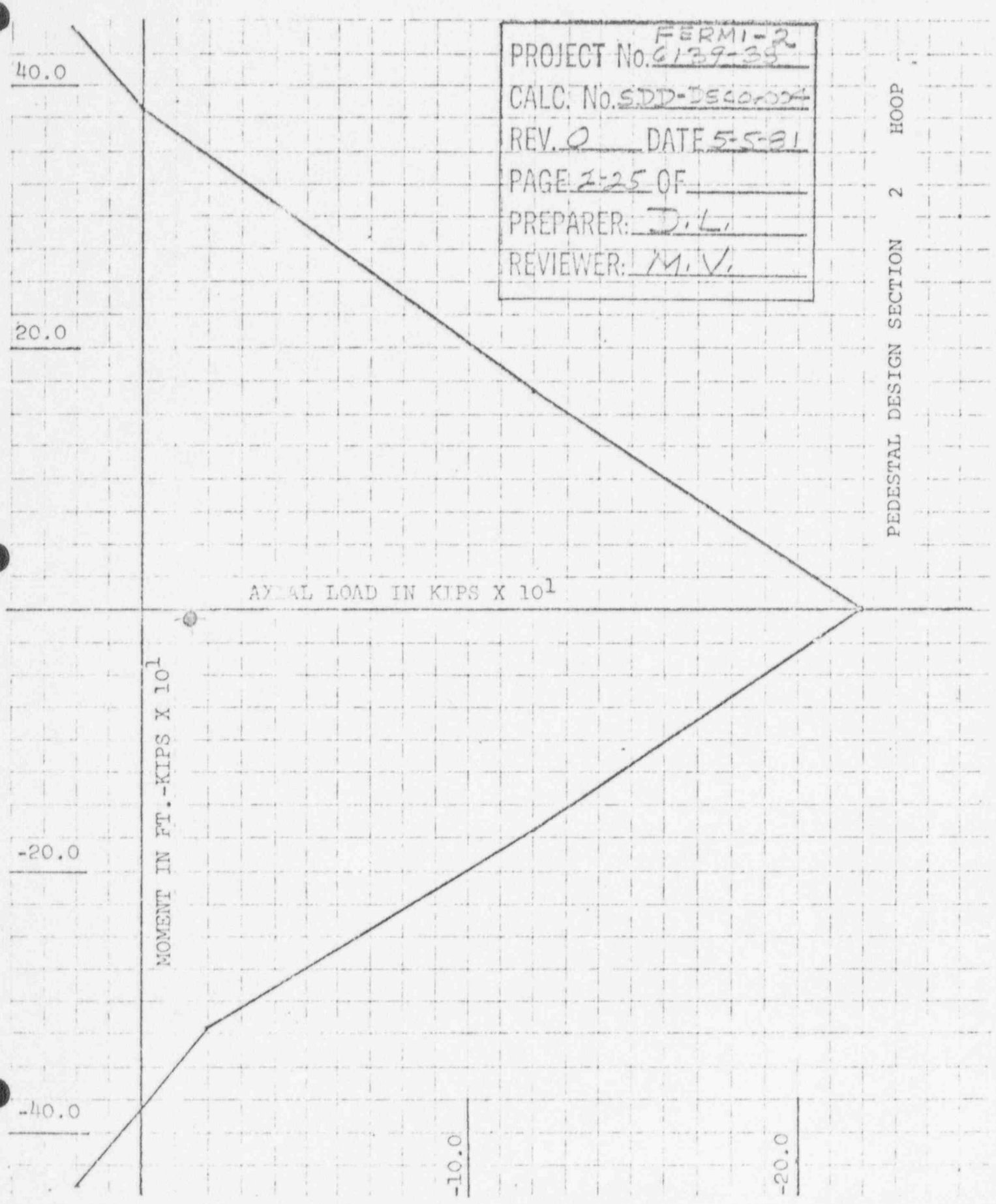
FERMI-2
PROJECT No. 6139-39
CALC. No. SDD-DECO-004
REV. 0 DATE 5-5-81
PAGE 2-24 OF
PREPARER: D.L.
REVIEWER: M.V.

PEDESTAL DESIGN SECTION 2 MERIDIONAL



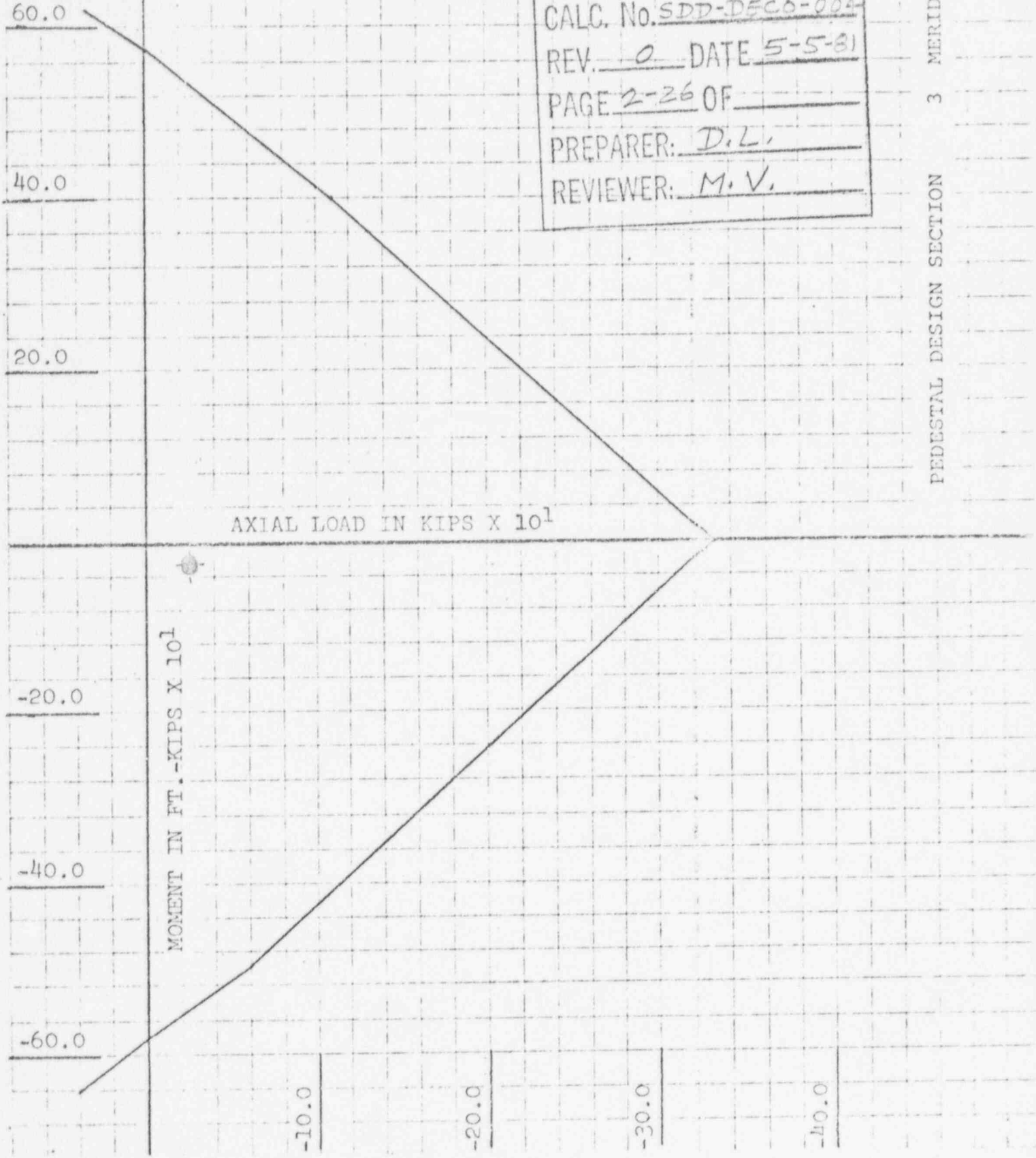
SARGENT & LUNDY
ENGINEERS
CHICAGO

PROJECT No. FERMI-2 6139-39
CALC. No. SDD-DSC0-004
REV. 0 DATE 5-5-81
PAGE 2-25 OF
PREPARER: D.L.
REVIEWER: M.V.



PROJECT No. FERMI-2 6139-38
CALC. No. SDD-DECO-004
REV. 0 DATE 5-5-81
PAGE 2-26 OF
PREPARER: D.L.
REVIEWER: M.V.

PEDESTAL DESIGN SECTION 3 MERIDIONAL



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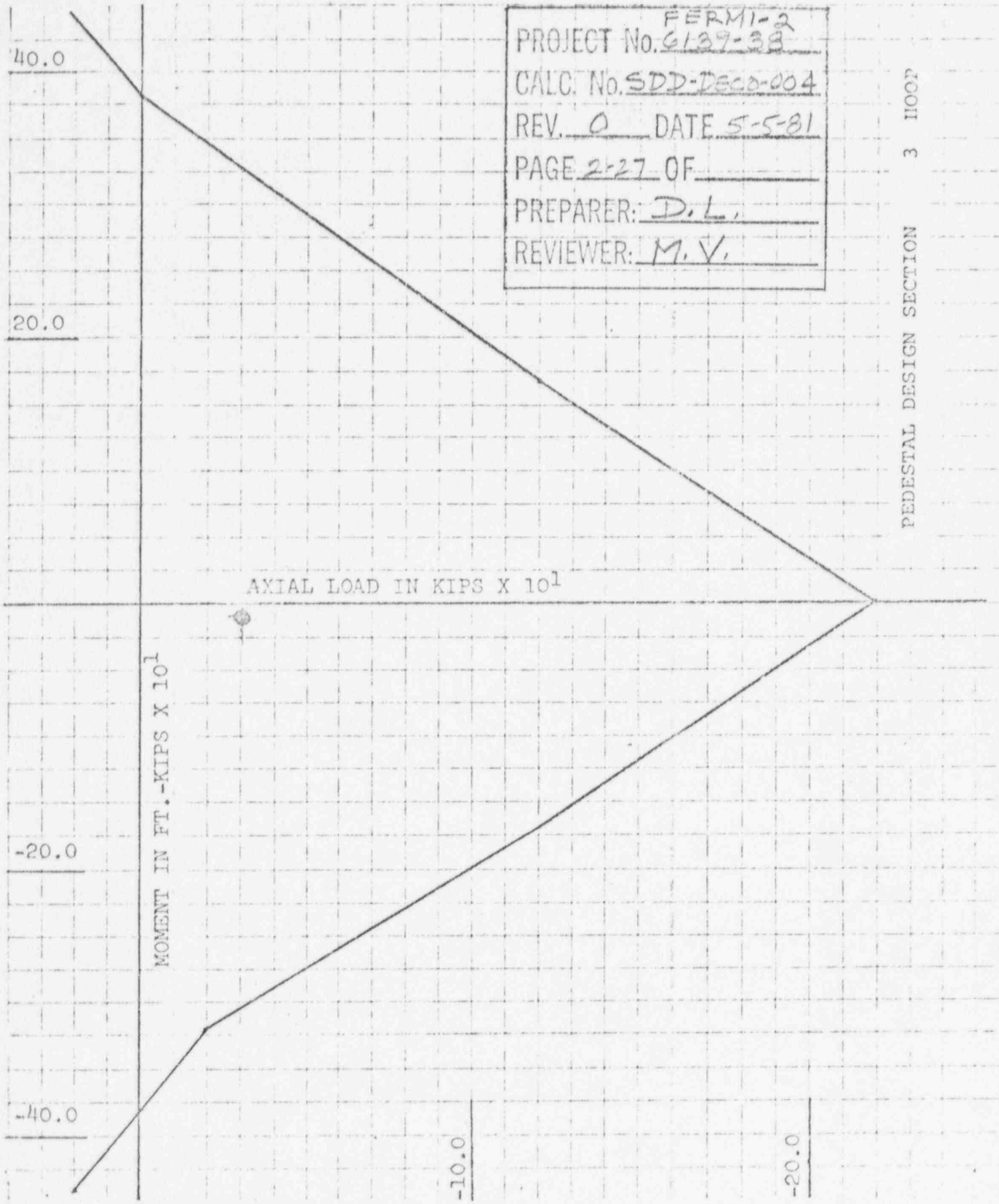
FERMI-2
PROJECT No. 6137-33
CALC. No. SDD-DECO-004
REV. 0 DATE 5-5-81
PAGE 2-27 OF
PREPARER: D. L.
REVIEWER: M. V.

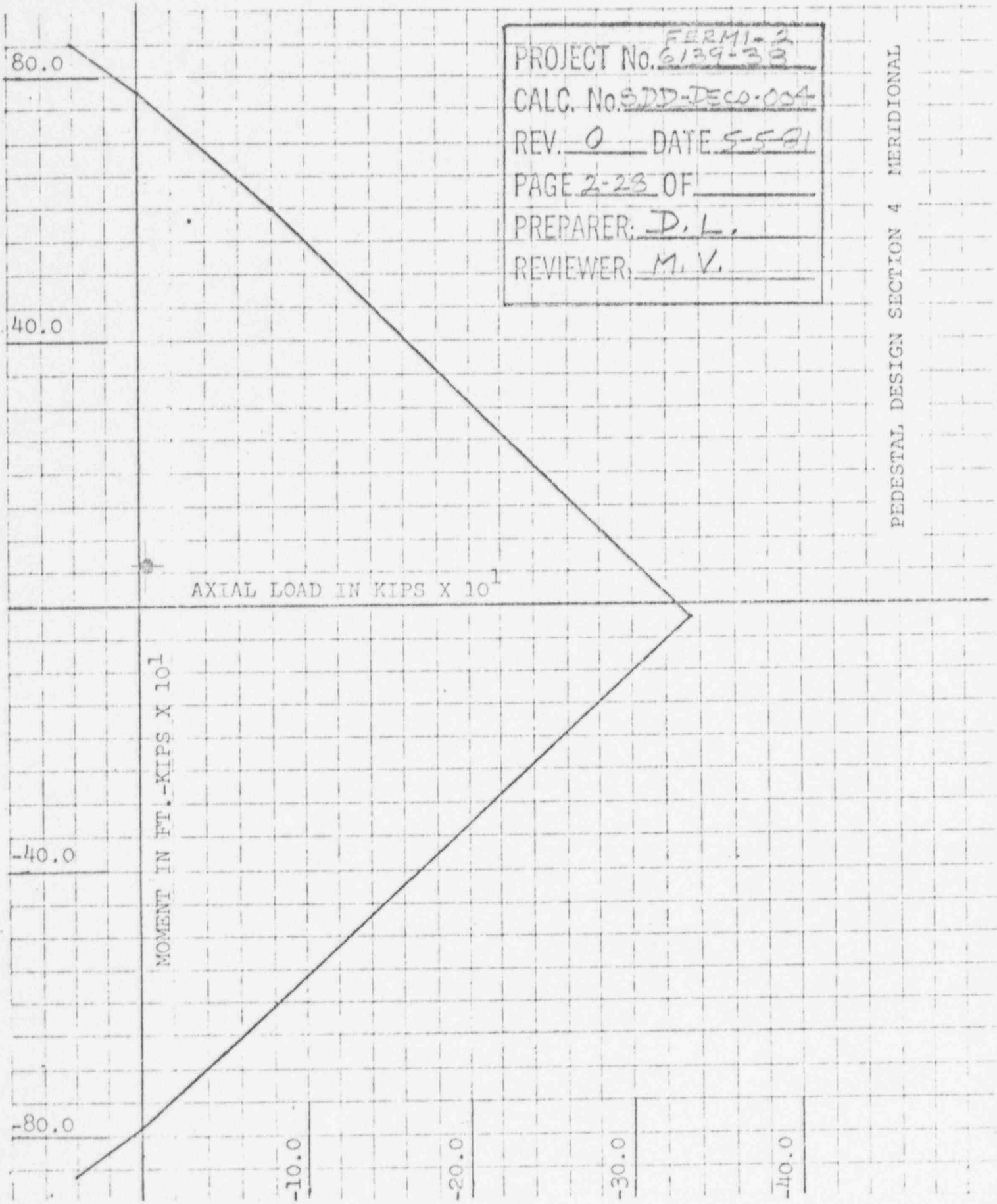
PEDESTAL DESIGN SECTION 3 HOOP



SARGENT & LUNDY
ENGINEERS
CHICAGO

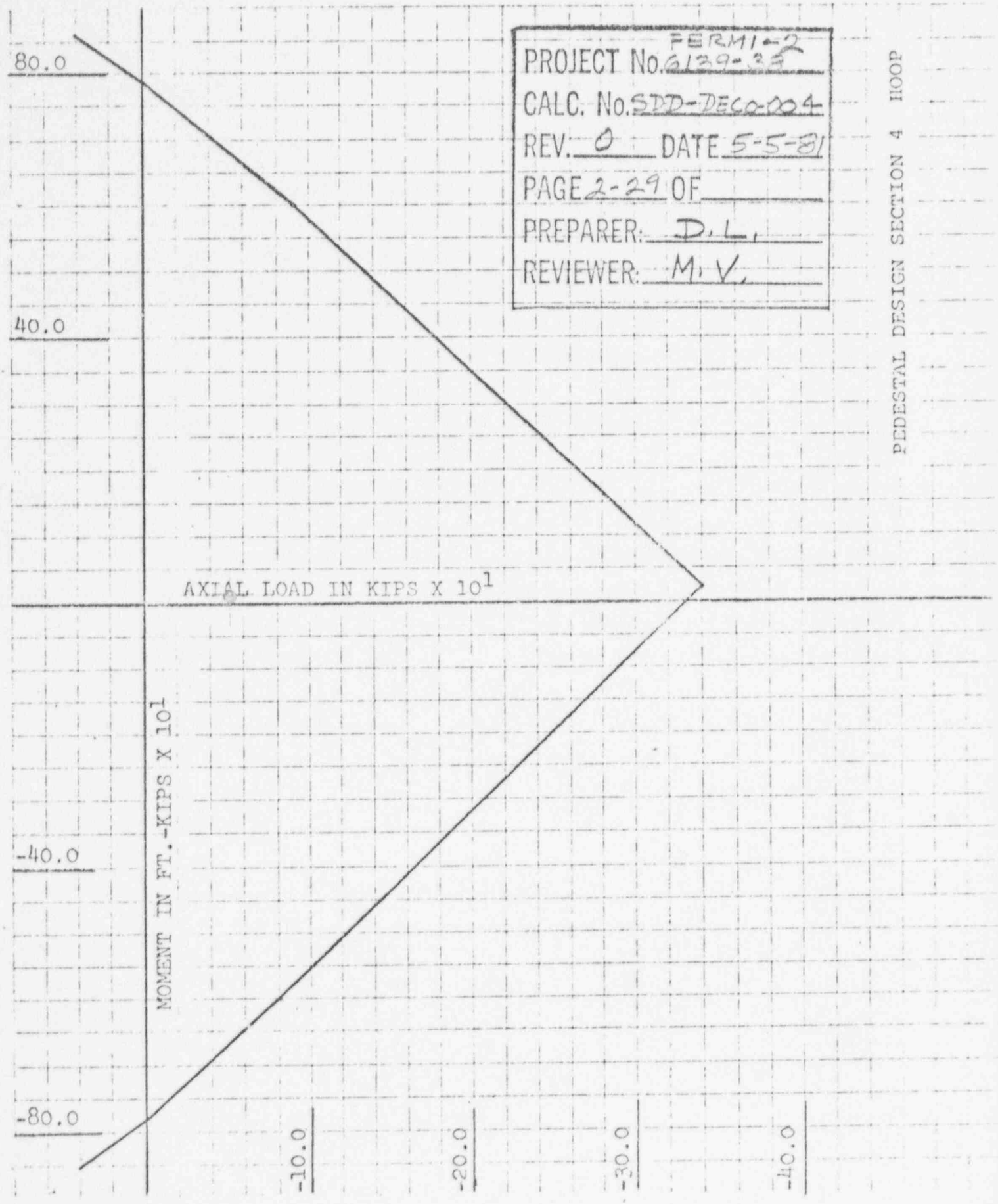
PROJECT No. FERMI-2 6139-3
CALC. No. SDD-DECO-004
REV. 0 DATE 5-5-01
PAGE 2-23 OF
PREPARER: D. L.
REVIEWER: M. V.

PEDESTAL DESIGN SECTION 4 MERIDIONAL



PROJECT No. FERMI-2 6129-23
CALC. No. SDD-DECO-004
REV. 0 DATE 5-5-81
PAGE 2-29 OF
PREPARER: D.L.
REVIEWER: M.V.

PEDESTAL DESIGN SECTION 4 HOOP



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ENGINEERS
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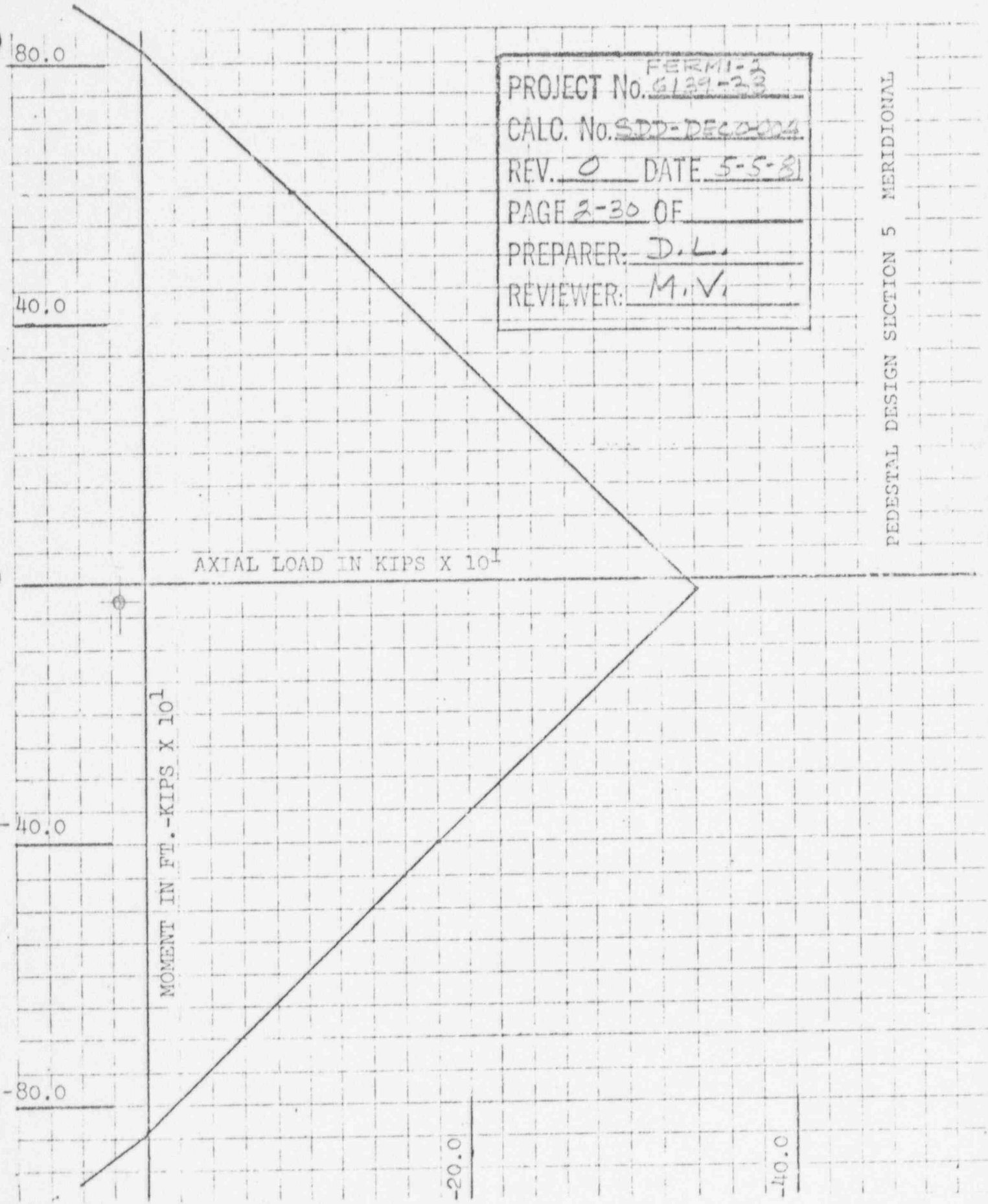
PROJECT No. FERMI-1 6129-23
CALC. No. SDD-DEC-004
REV. 0 DATE 5-5-81
PAGE 2-30 OF
PREPARER: D.L.
REVIEWER: M.V.

PEDESTAL DESIGN SECTION 5 MERIDIONAL



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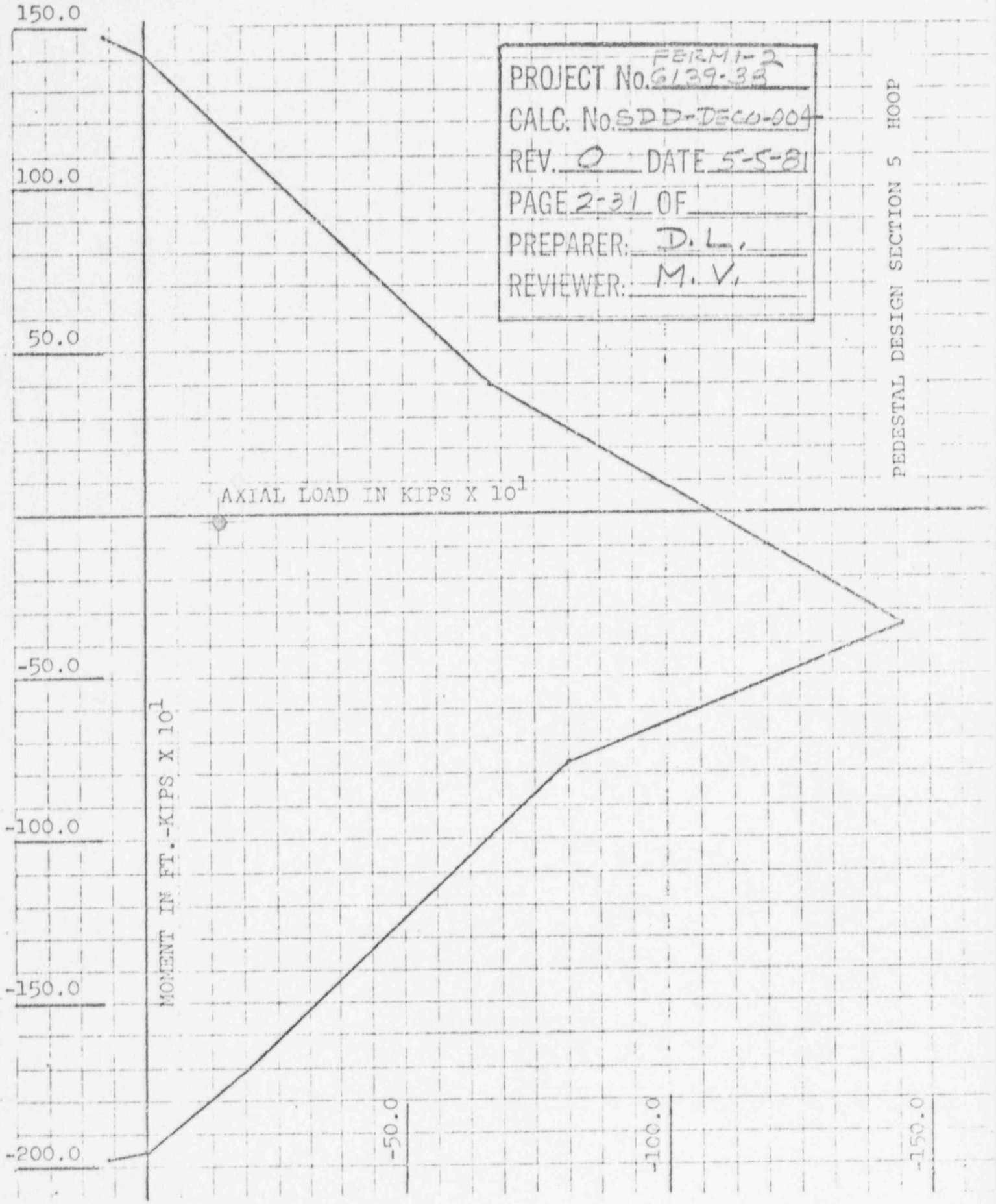
CHICAGO

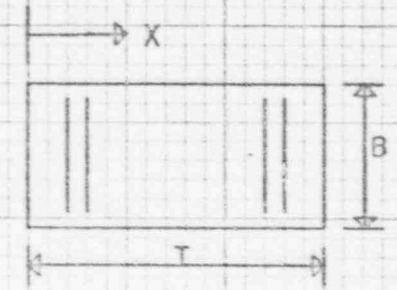
PROJECT No. FERMI-2 6139-33
CALC. No. SDD-DEC0-004
REV. 0 DATE 5-5-81
PAGE 2-31 OF
PREPARER: D. L.
REVIEWER: M. V.



FY = 60.0 KSI
F'C = 4.00 KSI
B = 12.00 IN
T = 48.00 IN

X (IN) AS (IN2)

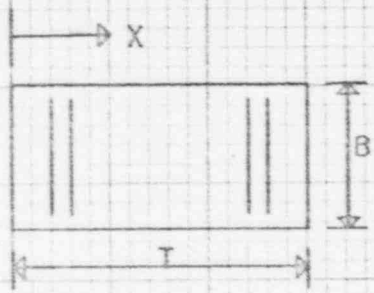
2.21 3.12
45.79 3.12



PEDESTAL DESIGN SECTION 1.2.3 MERIDIONAL

FY = 60.0 KSI
F'C = 4.00 KSI
B = 12.00 IN
T = 48.00 IN

X (IN)	AS (IN2)
3.62	2.08
44.38	2.08



PROJECT No. 4139-33
CALC. No. SDP-2200-004
REV. 2 DATE 6-6-94
PAGE 2-23 OF
PREPARER: D.L.
REVIEWER: M.Y.

PEDESTAL DESIGN SECTION 1.2.3 HOOP

PROJECT No. FERMI-2 6132-35

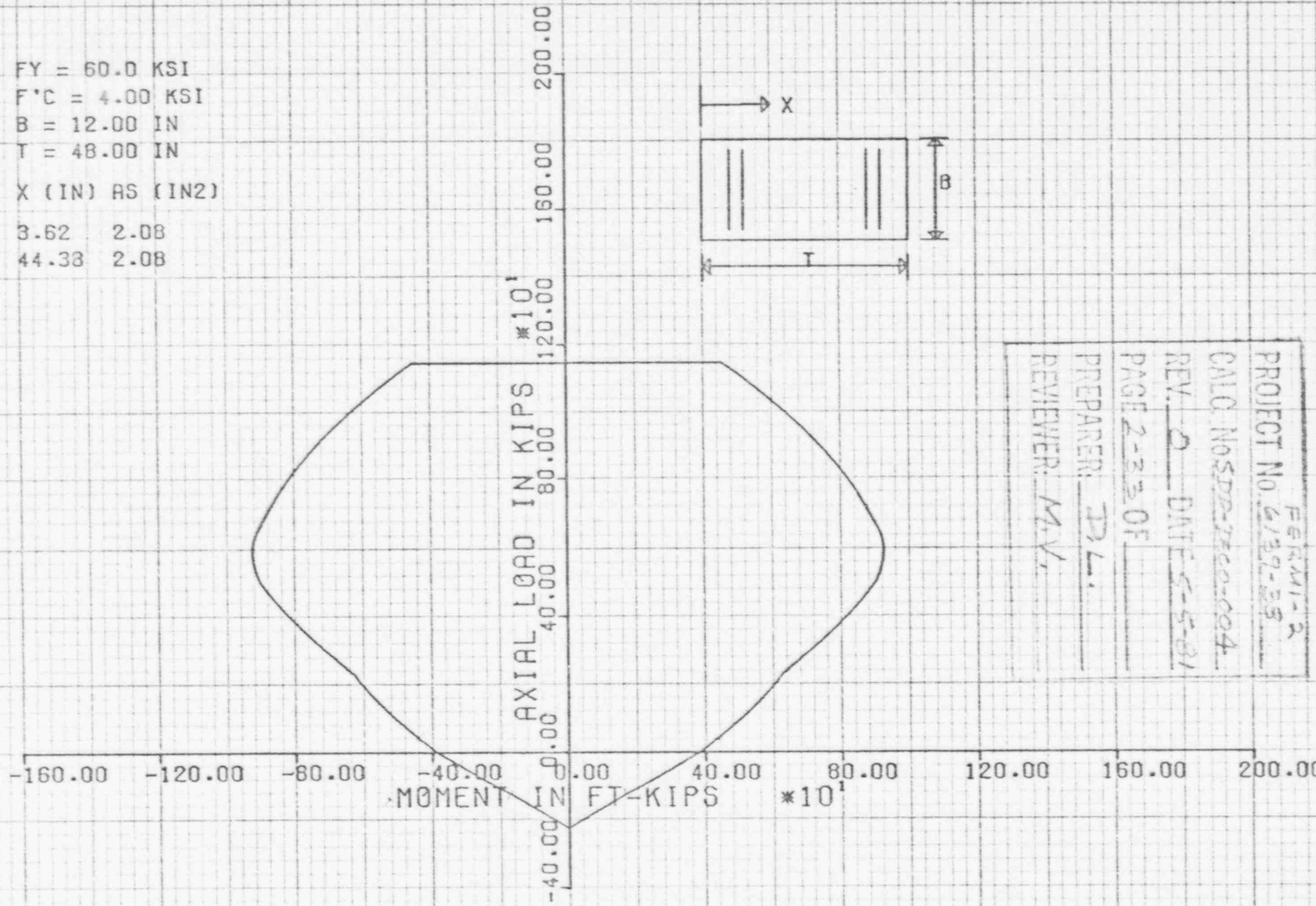
CALC. No. SDP-JECO-004

REV. 0 DATE 5-5-81

PAGE 2-33 OF

PREPARER: D.L.

REVIEWER: M.V.

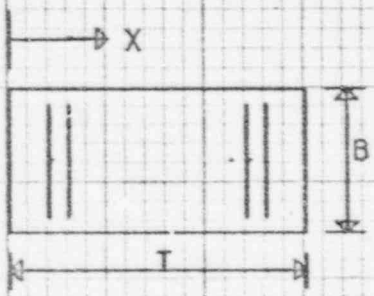


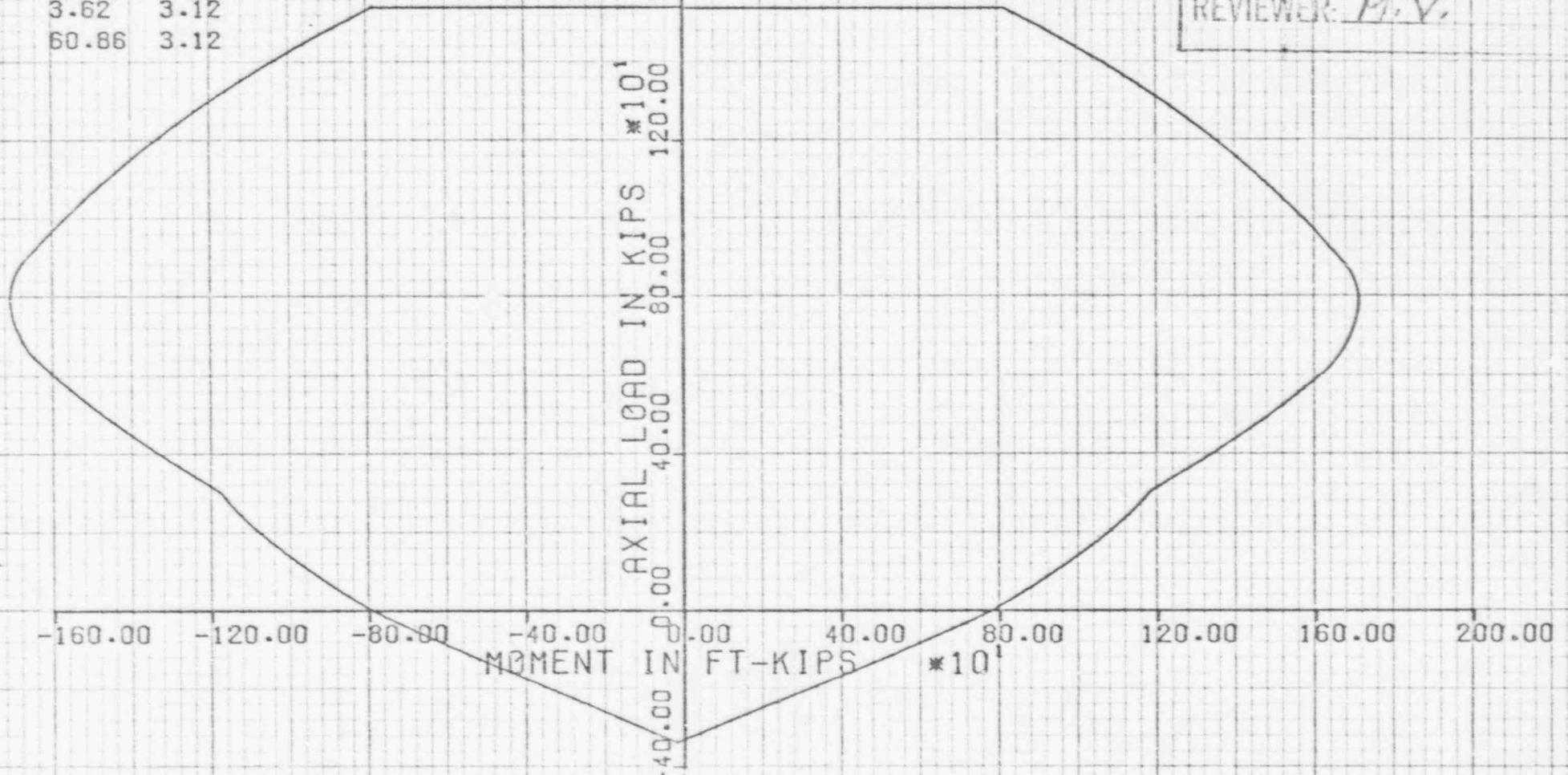
PEDESTAL DESIGN SECTION 1.2.3 HOOP

FERMI-2
PROJECT No. C13?-?3
CALC. No. SDD-DEC0-004
REV. 0 DATE 5-?-?
PAGE 2-34 OF ___
PREPARER: D.L.
REVIEWER: M.V.

FY = 60.0 KSI
F'C = 4.00 KSI
B = 12.00 IN
T = 63.06 IN

X (IN)	AS (IN2)
3.62	3.12
60.86	3.12





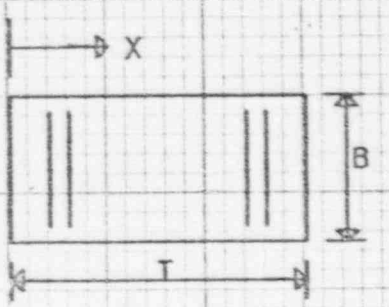
PEDESTAL DESIGN SECTION 4 MERIDIONAL

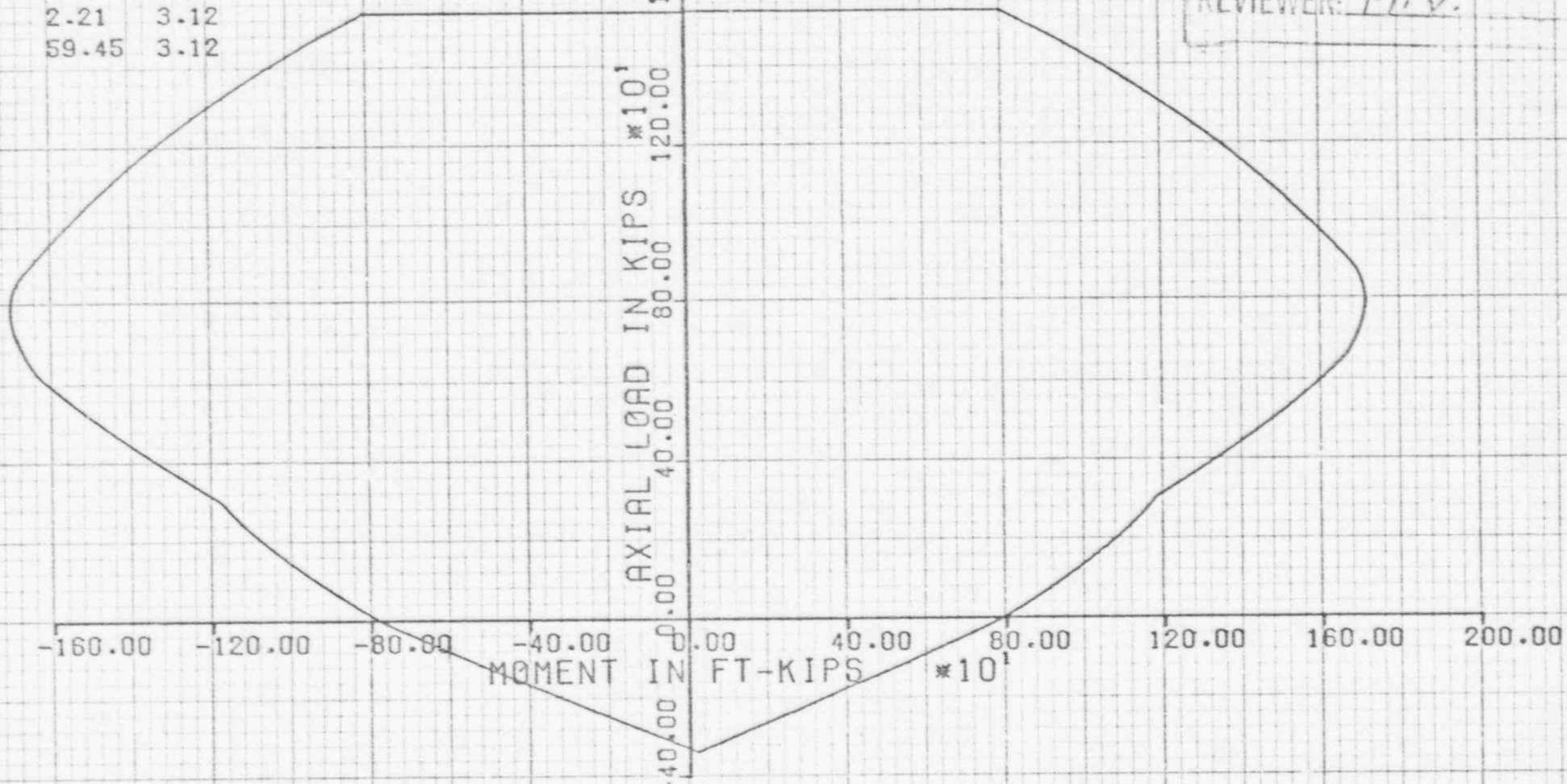
FERMI-2
PROJECT No. 6139-38
CALC. No. SDD-DESC-004
REV. 0 DATE 5-5-81
PAGE 2+35 OF
PREPARER: D.L.
REVIEWER: M.V.

FY = 60.0 KSI
F'C = 4.00 KSI
B = 12.00 IN
T = 63.06 IN

X (IN) AS (IN2)

2.21 3.12
59.45 3.12





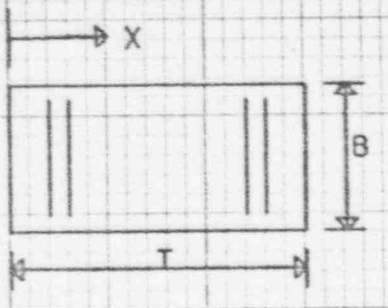
PEDESTAL DESIGN SECTION 4 HOOP

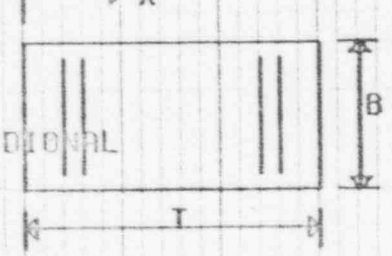
PROJECT No. FERMI-2 C439-39
CALC. No. SDD-DEG0-004
REV. 0 DATE 5-5-92
PAGE 2-36 OF
PREPARER: D.L.
REVIEWER: M.V.

FY = 60.0 KSI
F'C = 4.00 KSI
B = 12.00 IN
T = 66.00 IN

X (IN) AS (IN2)

3.62 3.12
63.79 3.12



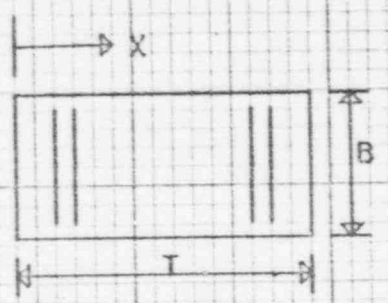


PEDESTAL DESIGN SECTION 5 MERIDIONAL

FERMI-2
PROJECT No. 6139-38
CALC. No. SDD-DC-0014
REV. 0 DATE 5-5-81
PAGE 2-37 OF
PREPARER: D.L.
REVIEWER: M.V.

FY = 60.0 KSI
F'C = 4.00 KSI
B = 12.00 IN
T = 66.00 IN

X (IN)	AS (IN2)
2.21	2.08
16.00	3.90
27.00	3.12
29.82	3.90
40.00	3.90
51.00	3.90
54.00	3.90
62.39	2.08



PEDESTAL DESIGN SECTION 5 HOOP

SARGENT & LUNDY ENGINEERS CHICAGO

Calcs. For Assessment for Seismic Re-Analysis		Calc. No. SDD-DECO-004
		Rev. 0 Date
X Safety-Related	Non-Safety-Related	Page 3-1 of

Client DECO	Prepared by Daulc	Date 5-5-81
Project FERMI-2	Reviewed by M. Valathur	Date 5-5-81
Proj. No. 6139.38 Equip. No.	Approved by	Date

SECTION III -

ASSESSMENT OF STABILIZER TRUSS

SARGENT & LUNDY ENGINEERS CHICAGO

Calcs. For STabilizer Truss

Calc. No. SDD-DECO-00-

X Safety-Related | Non-Safety-Related

Rev. 0 | Date

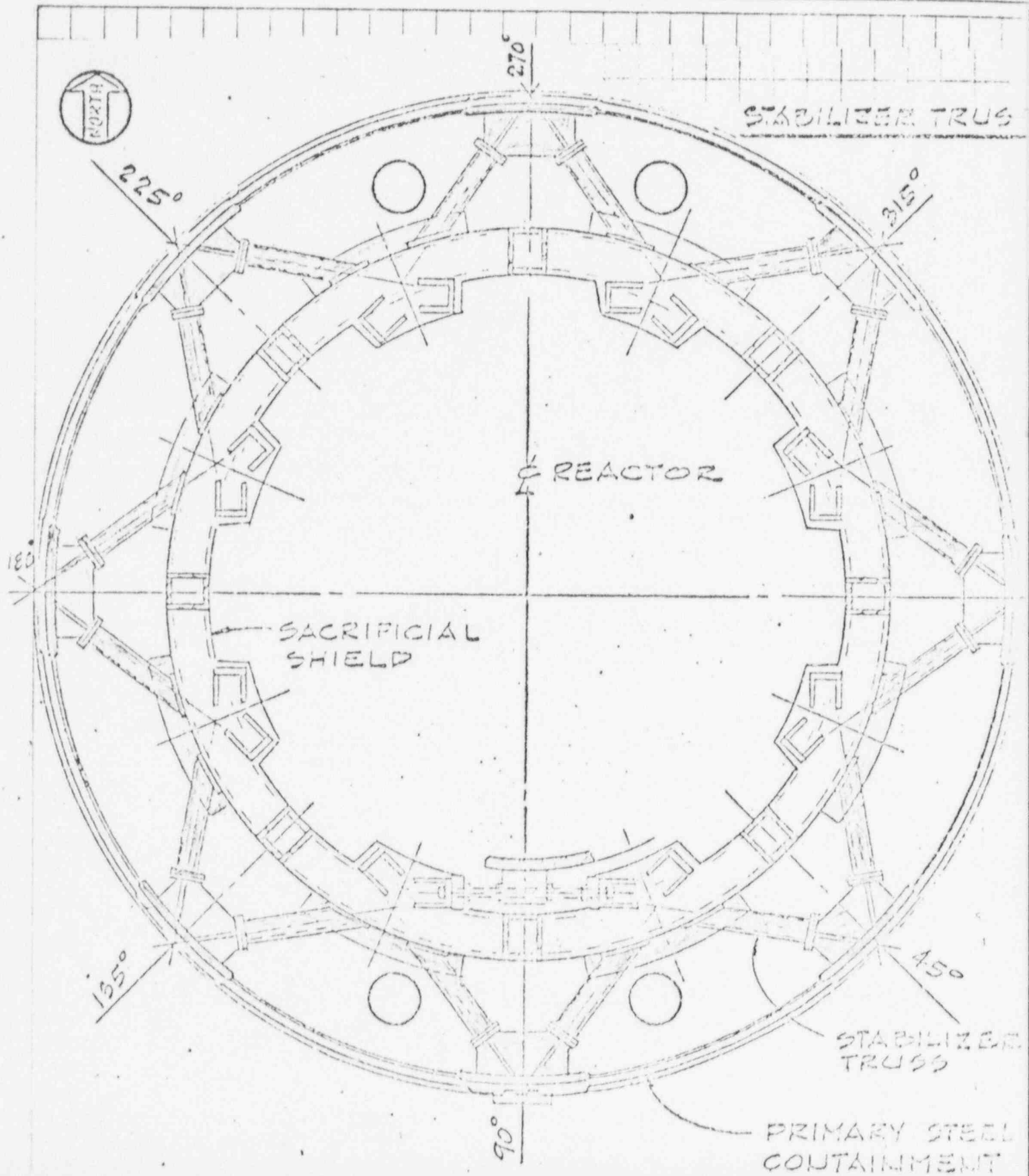
Page 3-2 of

Client	DECO	Prepared by	Dau Le
Project	FERMI-2	Reviewed by	M. Valath
Proj. No.	6139-38 Equip. No.	Approved by	

Date 4-24-8

Date 4-30-8

Date



Form GQ-3.08.1 Rev. 2

SARGENT LUNDY ENGINEERS CHICAGO

Calcs. For Stabilizer Truss

Calc. No SDD-DECO-00-

X Safety-Related | Non-Safety-Related

Rev. 0 | Date

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Client DECO

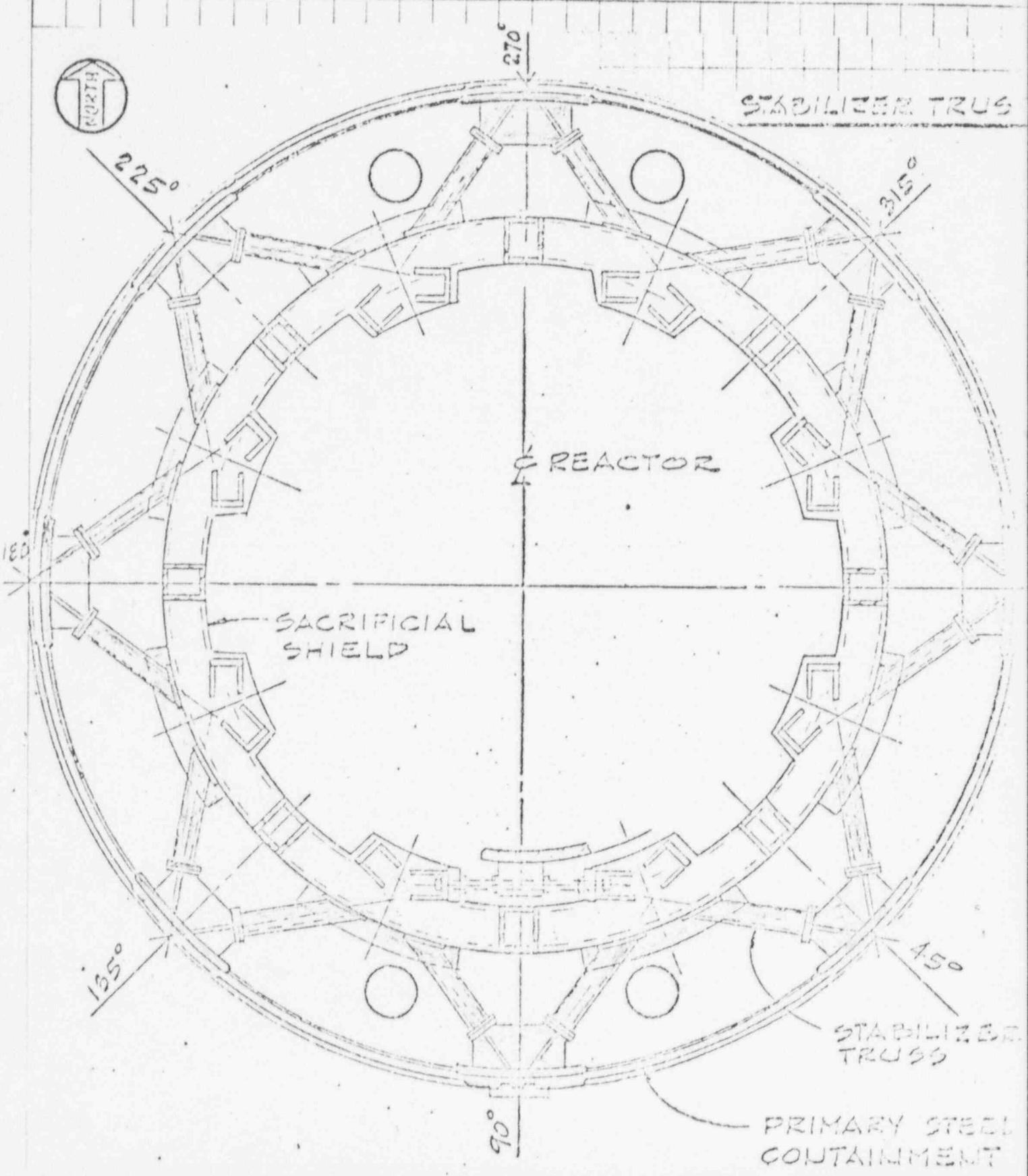
Project FERMI-2

Proj. No. 6139-38 Equip. No.

Prepared by Dau Le | Date 4-24-8

Reviewed by M. Valaitis | Date 4-30-8

Approved by | Date



Form GO-3.08.1 Rev. 2

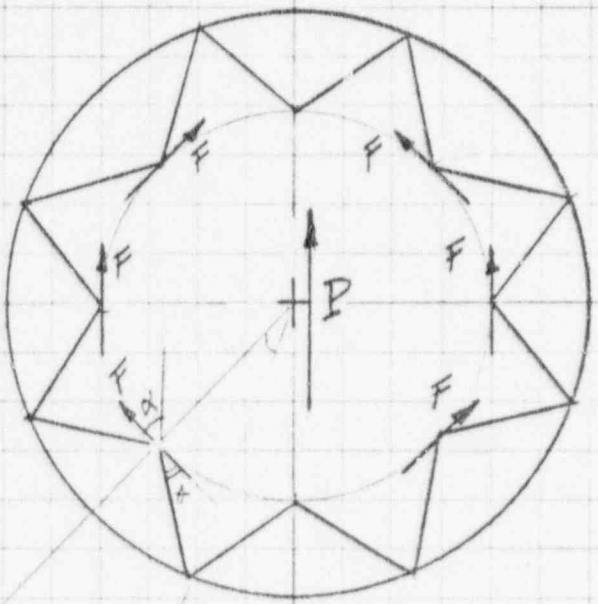
SARGENT & LUNDY ENGINEERS CHICAGO

Calcs. For Assessment of Stabilizer Trust		Calc. No. SDD-DECO-04
		Rev. 0 Date
X Safety-Related	Non-Safety-Related	Page 3.3 of

Client DECO	Prepared by Dau Le	Date 4-25-91
Project FERMI-2	Reviewed by M. Valathur	Date 4-30-91
Proj. No. 6139-38 Equip. No.	Approved by	Date

SEISMIC Load:

SSE, P = 549.2 kips



(Ref: DWG B-144)

$\alpha = 45°$

$\phi =$

$$2F + 4F\cos\alpha = P$$

$$F = \frac{P}{2+4\cos\alpha} = 0.2071\,P$$

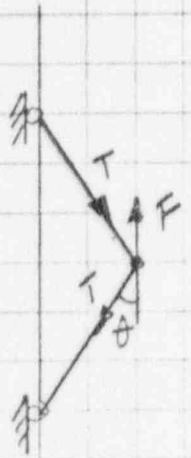
$$= 0.2071 \times 549.2 = \underline{113.7}\ \text{kips}$$

Form GQ-3.08.1 Rev. 2

SARGENT & LUNDY ENGINEERS CHICAGO

Calcs. For	Assessment of Stabilizer Truss
	X Safety-Related ; Non-Safety-Related
Calc. No.	SDD-DECO-004
Rev.	0 Date
Page	3-4 of

Client	DECO	Prepared by	Daule Date 4.25-91
Project	FERMI-2	Reviewed by	M. Valai Date 5-4-91
Proj. No.	6139-38 Equip. No.	Approved by	Date



$$F = 2T\cos\theta$$

$$T = \frac{F}{2\cos\theta} = \frac{113.7}{2\cos(32.59^\circ)}$$

$$T = \underline{67.5}\ \text{kips}$$

$\theta = 32.59^\circ$.

- Assessment of Truss pipe column:

ASTM A53 Grade B steel

10" ϕ XX Strong pipe. (Sch. No 160)

$l = \underline{4.5'}$

$A = 34.01\ in^2$

$I = 399.42\ in^4$

$r = 3.43\ in$

$$\frac{kl}{r} = \frac{4.5 \times 12}{3.43} = 15.74$$

$F_{all} = \underline{20.85}$ ksi (AISC Table)

$$f_a = \frac{67.5}{34.01} = \underline{1.98}\ \text{ksi} \ll 20.85\ \text{ksi}$$

O.K

Form GQ-3.08.1 Rev. 2

SARGENT & LUNDY ENGINEERS CHICAGO

Calcs. For	Assessment for Seismic Re-Analysis
	X Safety-Related ; Non-Safety-Related
Calc. No.	SDD-DECO-004
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Date	
Page	4-1 of

Client	DECO	Prepared by	Daulc
Project	FERMI-2	Reviewed by	M. Valentin
Proj. No.	6139.38 Equip. No.	Approved by	
		Date	5-5-81
		Date	5-5-81
		Date	

SECTION IV

ASSESSMENT OF SACRIFICIAL SHIELD

Form GO-3.08.1 Rev. 2

SARGENT & LUNDY ENGINEERS CHICAGO

Calcs. For Sacrificial Shield Alignments		Calc. No. SDD-DECO-004
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Client DECO	Prepared by Dau Le	Date 4-30-91
Project FERMI-2	Reviewed by M. Valentin	Date 4-30-91
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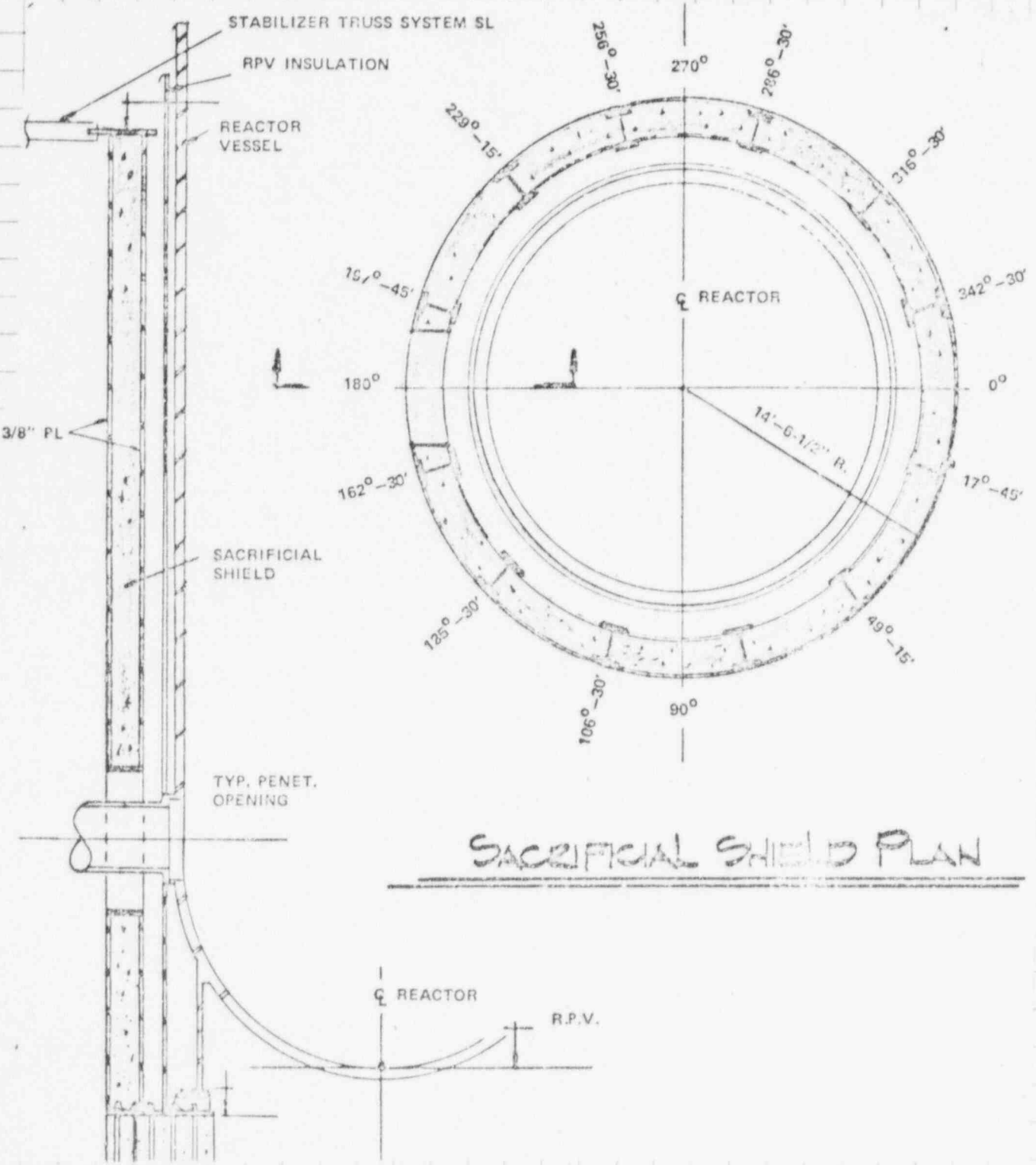

SACRIFICIAL SHIELD PLAN

Form GO-3.08.1 Rev. 2

SARGENT & LUNDY ENGINEERS CHICAGO

Calcs. For Sacrificial Shield Assessment		Calc. No. SDD-DECO-004
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Client DECO	Prepared by Dan Le	Date 4-30-91
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Proj. No. 6139-38 Equip. No.	Approved by	Date

DESIGN SECTIONS FOR ASSESSMENT

SECTION	ELEVATION	SLSAP Model (member)	DYNAS Model (Node)
1	597'-10 9/16"	9	29
2	606'-0"	15	30
3	627'-11"	21	31
4	650'-7 11/16"	31	32

SARGENT & LUNDY ENGINEERS CHICAGO

Calcs. For Sacrificial Shield Assessments		Calc. No. SDD-DECO-C24
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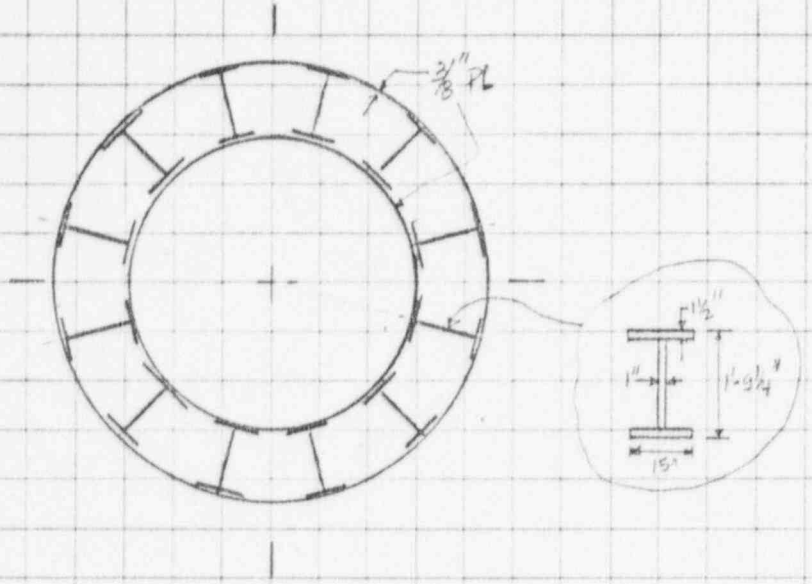
Client DECO	Prepared by Dan Le	Date 5-4-8
Project FERMI-2	Reviewed by M. Valath	Date 5-4-8
Proj. No. 6139-33 Equip. No.	Approved by	Date

SACRIFICIAL SHIELD PROPERTIES



$R_o = 174.5''$

$R_i = 153.5''$

$L = 49'$

$A_I = (2 \times 15 \times 1.5) + (1 \times 18.25)$
$= 63.25\ in^2$

Area :

Column : $63.25 \times 12 = 759\ in^2$

3/8" plate : $\frac{3}{8} \times 2\pi (174.5 + 153.5) = 772.8\ in^2$ } 1531.8

Area Total : $\pi (\overline{174.5}^2 - \overline{153.5}^2) = 21639.3\ in^2$

Area Concrete : $21639.3 - 1531.8 = 20107.5\ in^2$

Total Weight $= \left\{ 0.49 \times 1531.8 \times \frac{1}{144} + 0.150 \times 20107.5 \times \frac{1}{144} \right\} 49.0$

$W = 1281.7\ kips$

Form GQ-3.08.1 Rev. 2

SARGENT & LUNDY ENGINEERS CHICAGO

Calcs. For Sacrificial Shield Assessments		Calc. No. SDD-DECO-004
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Client DECO	Prepared by Dau Le	Date 5-4-91
Project FERMI-2	Reviewed by M. Vakatin	Date 5-4-91
Proj. No. 6139-38 Equip. No.	Approved by	Date

Membrane Strest calculation

Assumptions:

Tension force: Taken by steel only

Compressive force: Taken by steel and concrete

Shear = Taken by steel & Concrete.

Equivalent area per circumference ft length:

Steel:

$$A_s = \frac{1531.8}{2\pi R_{mean}}$$

$$= \frac{1531.8}{2\pi \times 13.67} = \underline{17.83}\ in^2/ft$$

$$= \underline{0.124}\ ft^2/ft$$

Concrete:

$$A_c = \frac{20107.5}{2\pi \times 13.67} = \underline{234}\ in^2/ft$$

$$= \underline{1.625}\ ft^2/ft$$

Form GQ-3.08.1 Rev. 2

SARGENT & LUNDY ENGINEERS CHICAGO

Calcs. For Sacrificial Shield Attachment cuts		Calc. No. SDD-DECO-024
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Client DECO	Prepared by Dan Le	Date 5-4-5
Project FERMI-2	Reviewed by M. Valatt	Date 5-6-5
Proj. No. 6139-38 Equip. No.	Approved by	Date

Stress on steel.

Tensile:

$$N\phi = A_s \sigma_s \rightarrow \sigma_s = \frac{N\phi}{A_s}$$

$$= \frac{N\phi}{0.124} = \underline{8.06\ N\phi}$$

Compressive:

$$N\phi = A_c \sigma_c + A_s \sigma_s$$

$$= A_c \frac{\sigma_s}{n} + A_s \sigma_s = \sigma_s \left(A_s + \frac{A_c}{n}\right)$$

$$= \sigma_s \left(0.124 + \frac{1.625}{7}\right) = 0.356\, \sigma_s$$

$$\sigma_s = \frac{N\phi}{0.356} = \underline{2.81\ N\phi}$$

Shear:

$$Q = A_s \tau \rightarrow \tau = \frac{Q}{A_s} = \frac{Q}{0.124} = \underline{\underline{8.06}}\ Q$$

Stress in Concrete: Compressive only:

$$\sigma_c = \frac{\sigma_s}{n} = \frac{\overset{2.81}{\cancel{8.06}}\ N\phi}{7} = \underline{\underline{\overset{0.40}{\cancel{1.15}}\ N\phi}}$$

SARGENT & LUNDY ENGINEERS CHICAGO

Calcs. For Sacrificial Shield Attachments		Calc. No. SDD-DECO-004
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Client DECO	Prepared by Dau Le	Date 5-4-91
Project FERMI-2	Reviewed by M. Vasan	Date 5-4-91
Proj. No. 6139-38 Equip. No.	Approved by	Date

SEISMIC FORCES

VERTICAL SEISMIC SSE

$$F = m a_v$$

$$= \frac{W}{g} a_v$$

$$= 1281.7 * (0.26)$$ *

$$= 333.2 \text{ kips}$$

$$N\phi = \frac{F}{2\pi R} = \frac{333.2}{2\pi \cdot 13.67} = \underline{3.88} \text{ kip/ft}$$

* Acceleration from Vertical SSE (Report SL-2682) Fig C-12 with a multiplying factor equal to 2.0

SARGENT & LUNDY ENGINEERS CHICAGO

Calcs. For Sacrificial Shield Assessments		Calc. No. SDD-DECO-C04
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Client DECO	Prepared by Dau Le	Date 4-23-91
Project FERMI-2	Reviewed by M. Vaidhyanathan	Date 4-23-91
Proj. No. 6139-38 Equip. No.	Approved by	Date

SEISMIC FORCE -

HORIZONTAL SSE -

Equivalent Forces from beam model -

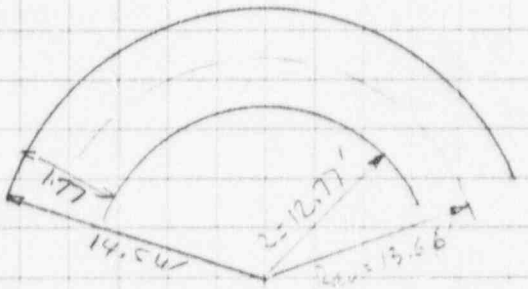
From Dynas model :

$A = 8.2\ ft^2$

$A_{shear} = \frac{8.2}{2} = 4.1\ ft^2$

$I_x = I_y = 766.0\ ft^4$

$J = 1532.0\ ft^4$



$$\sigma_{aw} = \frac{Mc}{I} = \frac{M \times 13.66}{766.0} = 0.0178\,M$$

$$N\phi = \sigma \times t = 0.0178 \times 1.77\,M = \underline{0.0315\,M}$$

$$v_{aw} = \frac{V}{A_s} = \frac{V}{4.1} = 0.2439\,V$$

$$Q_T = v \times t = 0.2439 \times 1.77\,V = \underline{0.432\,V}$$

$$\tau = \frac{M_z c}{J} = \frac{M_z \times 13.66}{1532} = 0.00892\,M_z$$

$$Q_\tau = \tau t = 0.00892 \times 1.77\,M_z = \underline{0.0158\,M_z}$$

Form GQ-3.08.1 Rev. 2

SARGENT & LUNDY ENGINEERS CHICAGO

Calcs. For Sacrificial Shield Assessment		Calc. No. SDD-DECO-004
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Client DECO		Prepared by Dan Le	Date 5-4-31
Project FERMI-2		Reviewed by M. Blatz	Date 5-4-31
Proj. No. 6139.38	Equip. No.	Approved by	Date

Member Forces @ Design Sections (SSE)

DESIGN SECTION	V_{max}	M_z	M_{max}	P_z
1	207.7	37.5	7957.0	3.9
2	207.7	37.5	6518.0	3.9
3	178.8	9.5	2457.0	3.9
4	122.2	9.5	81.5	3.9

EQUIVALENT SHELL FORCES

DESIGN SECTION	Q_T	Q_z	N_ϕ^m	N_ϕ^z	ΣQ	ΣN
1	89.7	0.59	250.6	3.9	90.3	254.5
2	89.7	0.59	205.3	3.9	90.3	209.2
3	77.2	0.15	77.4	3.9	77.4	81.3
4	52.8	0.15	2.6	3.9	53.0	6.5

Form GO-3.08.1 Rev. 2

SARGENT & LUNDY ENGINEERS CHICAGO

Calcs. For Sacrificial Shield Assessment

X Safety-Related | Non-Safety-Related

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Client DECO | Project FERMI-2 | Proj. No. 6139-38 Equip. No.

Prepared by Dan Le Date 5-5-91 | Reviewed by M. Valath Date 5-6-91 | Approved by Date

Membrane stresses – SSE

DESIGN SECTION	σ_{11} (KSF) TENSILE	σ_{11} (KSF) COMPRESSIVE	σ_{12} (KSF)	$\sigma_{concrete}$ (KSF)
1	2051.3	715.1	727.8	102.2
2	1688.2	587.8	727.8	84.0
3	655.3	228.4	623.8	32.6
4	52.4	18.3	427.2	2.6

DESIGN SECTION	σ_{11} (KSI) TENSILE	σ_{11} (KSI) COMPRESSIVE	σ_{12} (KSI)	σ_c (KSI)
1	14.25	4.97	5.05	0.71
2	11.71	4.08	5.05	0.58
3	4.55	1.59	4.33	0.23
4	0.36	0.13	2.97	0.02

Form GO-3.08.1 Rev. 2

SARGENT & LUNDY ENGINEERS CHICAGO

Calcs. For Sacrificial Shield Attachments		Calc. No. SDD-DECO-004
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Project FERMI-2	Reviewed by M. Valath	Date 5-5-91
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STRESSES @ DESIGN SECTIONS

SECTION : 1

Notes:
DL & To : ref. 3.

LOAD COMBINATION :

A = DL + To

B = DL + To + SSE

C = DL + SSE

Stressed		DL	To	SSE	A	B	C
σ_{11}	Tensile	–	1.35	14.25	1.35	15.60	14.25
	Compressive	-0.004	-1.97	-4.97	-1.97	-6.94	-4.97
σ_{22}	Tensile	–	–	–	–	–	–
	Compressive	–	-3.50	–	-3.50	-3.50	–
σ_{12}		–	0.57	5.05	0.57	5.62	5.05

$$\bar{\sigma} = \frac{1}{2}(\sigma_{11}+\sigma_{22}) + \sqrt{\frac{1}{2}(\sigma_{11}+\sigma_{22})^2 + \sigma_{12}^2}$$

$$= \frac{1}{2}(15.6-3.5) + \sqrt{\frac{1}{2}(15.6+3.5)^2 + 5.62^2} = \underline{20.68 \text{ ksi}} < \underline{50 \text{ ksi}}$$

O.K.

Form GQ.3.08.1 Rev. 2

SARGENT & LUNDY ENGINEERS CHICAGO

Calcs. For Sacrificial Shield Attachments		Calc. No. SDD-DECO-004
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Client DECO	Prepared by Dan Le	Date 5-5-81
Project FERMI-2	Reviewed by M. Valatta	Date 5-5-81
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STRESSES @ DESIGN SECTIONS

SECTION : 2

LOAD COMBINATION :

A = DL + T_o

B = DL + T_o + SSE

C = DL + SSE

Stress		DL	T_o	SSE	A	B	C
σ_{11}	Tensile	—	1.35	11.71	1.35	12.06	11.71
	Compressive	-0.004	-1.97	-4.97	-1.97	-6.94	-4.97
σ_{22}	Tensile	—	—	—	—	—	—
	Compressive	—	-3.50	—	-3.50	-3.50	—
σ_{12}		—	0.57	5.05	0.57	5.62	5.05

$$\bar{\sigma} = \frac{1}{2}(\sigma_{11}+\sigma_{22}) + \sqrt{\frac{1}{2}(\sigma_{11}-\sigma_{22})^2 + \sigma_{12}^2}$$

$$= \frac{1}{2}(12.06-3.5) + \sqrt{\frac{1}{2}(12.06+3.5)^2 + 5.62^2} = 16.63 \text{ ksi} < \frac{50.0 \text{ ksi}}{0.K}$$

Form GO-3.08.1 Rev. 2

SARGENT & LUNDY ENGINEERS CHICAGO

Calcs. For Sacrificial Shield Attachments		Calc. No. SDD-DECO-024
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Client DECO	Prepared by Dan Le	Date 5-5-81
Project FERMI-2	Reviewed by M. Valath	Date 5-5-81
Proj. No. 6139-38 Equip. No.	Approved by	Date

STRESSES @ DESIGN SECTIONS

SECTION : 3

LOAD COMBINATION :

A = DL + T_o

B = DL + T_o + SSE

C = DL + SSE

Stresses		DL	T_o	SSE	A	B	C
σ_{11}	Tensile	–	0.006	4.55	0.006	4.55	4.55
	Compressive	-0.002	-0.01	-1.59	-0.01	-1.60	-1.59
σ_{22}	Tensile	–	–	–	–	–	–
	Compressive	–	-0.009	–	-0.009	-0.009	–
σ_{12}		–	0.007	4.33	0.007	4.34	4.33

$$\bar{\sigma} = \frac{1}{2}(\sigma_{11}+\sigma_{22}) + \sqrt{\frac{1}{2}(\sigma_{11}-\sigma_{22})^2 + \sigma_{12}^2}$$

$$= \frac{1}{2}(4.55-0.01) + \sqrt{\frac{1}{2}(4.55+0.01)^2 + 4.34^2} = 7.68 \text{ ksi} < 50.0 \text{ ksi}$$

O.K.

Form GQ.3.08.1 Rev. 2

SARGENT & LUNDY ENGINEERS CHICAGO

Calcs. For Sacrificial Shield Attachment

[x] Safety-Related [ ] Non-Safety-Related

Calc. No. SDD-DECO-004 Rev. 0 Date

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Client DECO

Project FERMI-2

Proj. No. 6139-32 Equip. No.

Prepared by Dan Le Date 5-5-81

Reviewed by M Valette Date 5-6-81

Approved by Date

STRESSES @ DESIGN SECTIONS

SECTION : 4

LOAD COMBINATION :

A = DL + To

B = DL + To + SSE

C = DL + SSE

Stress		DL	To	SSE	A	B	C
σ_{11}	Tensile	—	0.004	0.36	0.004	0.36	0.36
	Compressive	-0.003	-0.003	-0.13	-0.003	-0.13	-0.13
σ_{22}	Tensile	—	0.004	—	0.004	0.004	—
	Compressive	—	-0.002	—	-0.002	-0.002	—
σ_{12}		—	0.001	2.97	0.001	2.97	2.97

$$\bar{\sigma} = \frac{1}{2}(\sigma_{11}+\sigma_{22}) + \sqrt{\frac{1}{2}(\sigma_{11}-\sigma_{22})+\sigma_{12}^2}$$

$$= \frac{1}{2}(0.36+0.004) + \sqrt{\frac{1}{2}(0.36-0.04)^2 + 2.97^2} = 3.16 \text{ ksi} < 50.0 \text{ ksi}$$

O.K.

Form GO-3.06.1 Rev. 2

SARGENT & LUNDY ENGINEERS CHICAGO

Calcs. For Assessment for Seismic Re-Analysis		Calc. No. SDD-DECO-004
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Client DECO	Prepared by Dau Le	Date 5-5-11
Project FERMI-2	Reviewed by M Valaitis	Date 5-5-11
Proj. No. 6139-38 Equip. No.	Approved by	Date

SECTION V

ASSESSMENT OF DRYWELL SHIELD WALL

SARGENT & LUNDY ENGINEERS CHICAGO

Calcs. For DRYWELL SHIELD WALL ASSESSMENT		Calc. No. SDD-DECO-004
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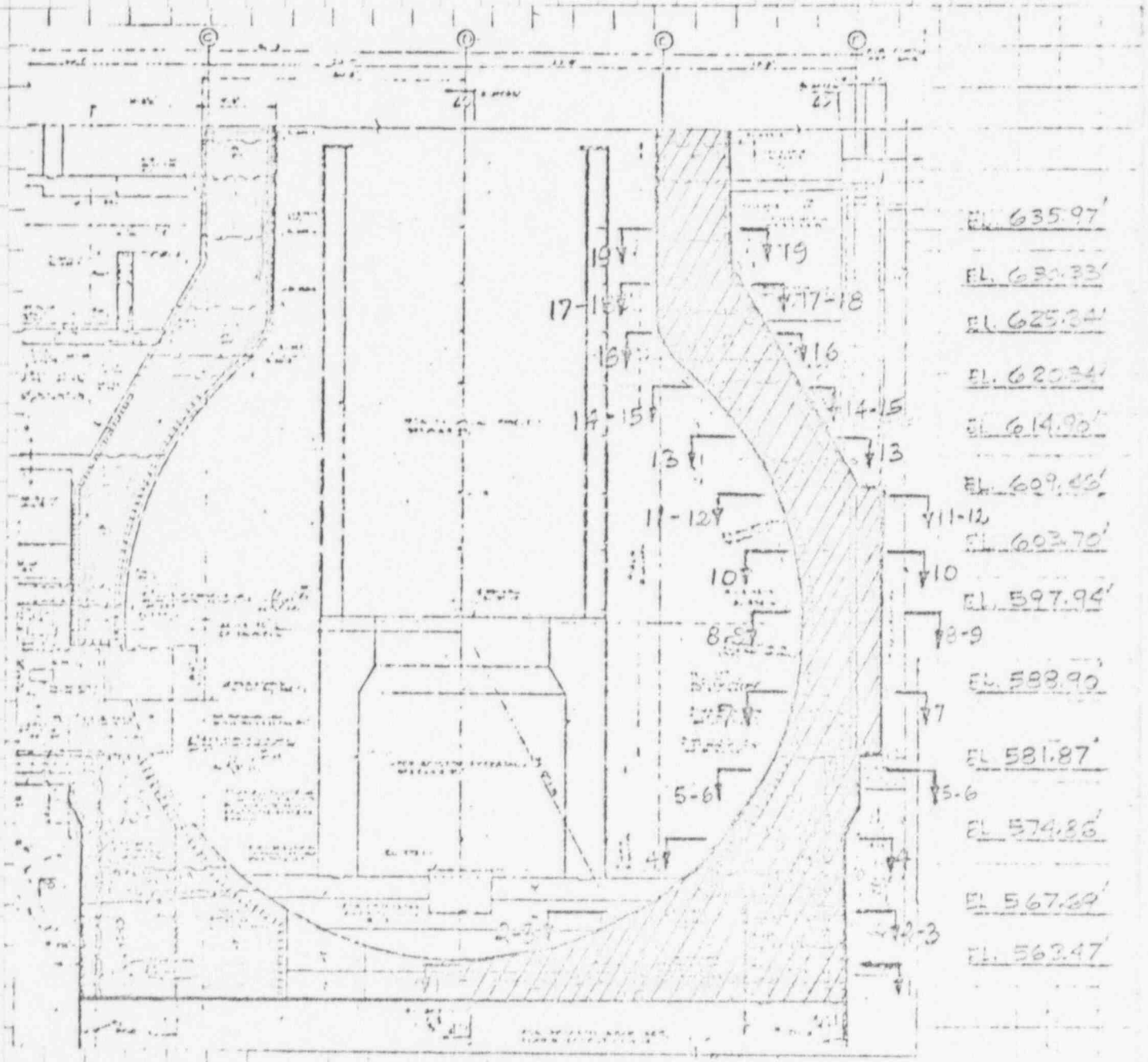
Client DECO	Prepared by Dau Le	Date 5-5-5
Project FERMI-2	Reviewed by M. Valeta	Date 5-5-5
Proj. No. 6139-38 Equip. No.	Approved by	Date

DESIGN SECTIONS FOR ASSESSMENT-

(Ref: 7)



Form GO-3.08.1 Rev. 2

SARGENT & LUNDY ENGINEERS CHICAGO

Calcs. For DRYWELL SHIELD WALL ASSESSMENT		Calc. No. SDD-DECO-004
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Client DECO		Prepared by Dan Le	Date 5-2-81
Project FERMI-2		Reviewed by M. Valletta	Date 5-5-81
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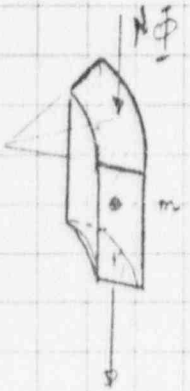
VERTICAL SEISMIC EQUIVALENT SHELL FORCES



$$\overline{N\phi}^{v} = m a_v$$

$$= \left\{ \frac{\rho \pi (R_o^2 - R_i^2)}{2\pi R_{av}} \cdot h \right\} a_v$$

$$\overline{N\phi_v} = \rho (R_o - R_i) h \cdot a_v$$

ρ = mass density

a_v = vertical acceleration

or

ρ' = weight density

a_v' = vertical acceleration in G. (**)

h = 1' unit length

$$\overline{N\phi} = 0.150 \cdot (R_o - R_i) a_v'$$

(**) Acceleration from Vertical SSE, Report SL-2698 with Spectrum Values multiplied by a factor of 2.0

Form GO-3.08.1 Rev. 2

SARGENT & LUNDY ENGINEERS CHICAGO

Calcs. For DRYWELL SHIELD WALL ASSESSMENT

Calc. No. SDD-DECO-0004

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x Safety-Related | Non-Safety-Related

Client DECO

Project FERMI-2

Proj. No. 6139-38 Equip. No.

Prepared by Dan Lc Date 5-5-81

Reviewed by M. Valatin Date 5-5-81

Approved by Date

VERTICAL SEISMIC FORCE (SSE)

$$\overline{N\phi_V} = 0.150 \times (R_o - R_i) \times a_V \quad (\text{Kips})$$

DESIGN SECTION	Elevation	R_o	R_i	a_V	$\overline{N\phi_V}$	Spectrum curve from SL-26[illegible]
1	562.47'	39.0	0.0	0.26	1.52	C-12
2&3	567.69		17.25		0.85	
4	574.86		25.84		0.51	
5&6	581.87		30.46		0.33	
7	589.90		33.25		0.22	
8&9	597.14		33.99		0.19	
10	603.70		33.33		0.22	
11&12	609.46	39.0	31.62		0.29	
13	614.10	37.51	28.91	0.26	0.33	
14&15	620.34	34.37	24.7	0.32	0.46	C-13
16	625.34	31.45	20.0		0.55	
17&18	630.33	28.6	20.0		0.41	
19	635.17	27.4	20.0	0.32	0.35	

Form GQ 3.08.1 Rev. 2

Client	DECO	Prepared by	Dan Le
Project	FERMI-2	Reviewed by	U. Valathur
Proj. No.	6139-38 Equip. No.	Approved by	

Date 4-23-81

Date 5-5-81

Date

Conversion of Beam forces to shell element forces

(1) - N_ϕ due to Moment

$$\sigma = \frac{Mc}{I}$$

$$= \frac{Mc}{\frac{\pi}{4}(R_o^4 - R_i^4)} = \frac{4Mc}{\pi(R_o^4 - R_i^4)}$$

$$N_\phi = \sigma_{average}(R_o - R_i)$$

$$= \frac{4M\frac{(R_o+R_i)}{2}}{\pi(R_o^4 - R_i^4)}(R_o - R_i)$$

$$\boxed{N_\phi = \frac{2M}{\pi(R_o^2 + R_i^2)}} \quad (1)$$

(2) - Calculation of Shear

a - Due to Torsion - (Q_θ)

$$\tau = \frac{M_z c}{\frac{\pi}{2}(R_o^4 - R_i^4)} = \frac{2M_z c}{\pi(R_o^4 - R_i^4)}$$

$$Q_\theta = \tau_{average}(R_o - R_i) = \frac{2M_z\left(\frac{R_o+R_i}{2}\right)}{\pi(R_o^4 - R_i^4)}(R_o - R_i)$$

SARGENT & LUNDY ENGINEERS CHICAGO

Calcs. For Assessment for Revised Seismic / SSE

X Safety-Related | Non-Safety-Related

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Client DECO

Project FERMI-2

Proj. No. 6139-38 Equip. No.

Prepared by Dan Le Date 4-28-81

Reviewed by M. Valathur Date 5-5-81

Approved by Date

$$Q_C = \frac{M_z}{\pi (R_o^2 + R_i^2)} \qquad (2)$$

b. Due to Transverse Shear V: (Q_T)

$$v = \frac{VQ}{It^*}$$

$$Q = \frac{2}{3}(R_o^3 - R_i^3)$$

$$I = \frac{\pi}{4}(R_o^4 - R_i^4)$$

$$t^* = 2(R_o - R_i)$$

$$v = \frac{V \cdot \frac{2}{3}(R_o^3 - R_i^3)}{\frac{\pi}{4}(R_o^4 - R_i^4) \cdot 2 \cdot (R_o - R_i)}$$

$$= \frac{4}{3} \frac{V(R_o^2 + R_o R_i + R_i^2)}{\pi (R_o^4 - R_i^4)}$$

$$Q_T = v(R_o - R_i) =$$

$$Q_T = \frac{4}{3} \frac{V(R_o^2 + R_o R_i + R_i^2)}{\pi (R_o^2 + R_i^2)(R_o + R_i)} \qquad (3)$$

SARGENT & LUNDY ENGINEERS CHICAGO

Calcs. For Assessment for Revised Seismic/SSE

X Safety-Related | Non-Safety-Related

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Client DECO

Project FERMI-2

Proj. No. 6139-38 Equip. No.

Prepared by Dan Le | Date 4-23-81

Reviewed by M. Valath | Date 5-5-81

Approved by | Date

(3) - N_ϕ due to Vertical forces:

$$\sigma_z = \frac{P}{\pi (R_o^2 - R_i^2)}$$

$$N_{\phi_z} = \sigma (R_o - R_i)$$

$$\boxed{N_\phi^z = \frac{P}{\pi (R_o + R_i)}}$$

Form GO-3.08.1 Rev. 2

SARGENT & LUNDY ENGINEERS CHICAGO

Calcs. For DRYWELL SHIELD WALL ASSESSMENT		Calc. No. SD-DECO-024
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Project FERMI-2	Reviewed by M. Valentin	Date 5-5-81
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Numerical Application -

SECTION : 1

$$\begin{cases} R_o = 39.0 \\ R_i = 0.0 \end{cases}$$

$$N\phi = \frac{2M}{\pi(R_o^2+R_i^2)} = \underline{0.00042\,M}$$

$$Q_Z = \frac{M_Z}{\pi(R_o^2+R_i^2)} = \underline{0.00021\,M_Z}$$

$$Q_T = \frac{1}{3}\,\frac{V(R_o^2+R_oR_i+R_i^2)}{\pi(R_o^2+R_i^2)(R_o+R_i)} = \underline{0.01088\,V}$$

SECTION : 223

$$\begin{cases} R_o = 39.0 \\ R_i = 17.25 \end{cases}$$

$$N\phi = \underline{0.00035\,M}$$

$$Q_Z = \underline{0.000175\,M_Z}$$

$$Q_T = \underline{0.01034\,V}$$

SARGENT & LUNDY ENGINEERS CHICAGO

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SECTION : 4

$R_o = 39.0$
$R_i = 25.84$

$N\phi = 0.00029\ M$

$Q_L = 0.000145\ M_z$

$Q_T = 0.009559\ V$

SECTION : 5 & 6

$R_o = 39.0$
$R_i = 30.46$

$N\phi = 0.00026\ M$

$Q_L = 0.00013\ M_z$

$Q_T = 0.009074\ V$

SECTION : 7

$R_o = 39.0$
$R_i = 33.25$

$N\phi = 0.000242\ M$

$Q_L = 0.000121\ M_z$

$Q_T = 0.008774\ V$

Form GQ-3.08.1 Rev. 2

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SECTION : 829

$R_o = 39.0$
$R_i = 33.99$

$N\phi = 0.000238\ M$

$Q_C = 0.000119\ M_Z$

$Q_T = 0.00895\ V$

SECTION : 10

$R_o = 39.0$
$R_i = 33.33$

$N\phi = 0.000242\ M$

$Q_C = 0.000121\ M_Z$

$Q_T = 0.008766\ V$

SECTION : 11 & 12

$R_o = 39.0$
$R_i = 31.62$

$N\phi = 0.000253\ M$

$Q_C = 0.000126\ M_Z$

$Q_T = 0.00895\ V$

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SECTION : 13

$R_o = 37.51$
$R_i = 28.91$

$N\phi = 0.000284\ M$
$Q_C = 0.000142\ M_Z$
$Q_T = 0.00947\ V$

SECTION 14 & 15

$R_o = 34.37$
$R_i = 24.70$

$N\phi = 0.000355\ M$
$Q_C = 0.000178\ M_Z$
$Q_T = 0.01059\ V$

SECTION : 16

$R_o = 31.45$
$R_i = 20.0$

$N\phi = 0.000458\ M$
$Q_C = 0.000229\ M_Z$
$Q_T = 0.01198\ V$

Form GQ-3.08.1 Rev. 2

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SECTION : 17 & 18

$$\begin{cases} R_o = 28.60 \\ R_i = 20.0 \end{cases}$$

$N\phi = 0.000523\ M_L$

$Q_C = 0.000261\ M_Z$

$Q_T = 0.012837\ V$

SECTION : 19

$$\begin{cases} R_o = 27.25 \\ R_i = 20.0 \end{cases}$$

$N\phi = 0.000557\ M$

$Q_C = 0.000279\ M_Z$

$Q_T = 0.01327\ V$

Form GQ-3.08.1 Rev. 2

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SEISMIC MEMBER FORCES – SSE

DESIGN SECTION	ELEVATION	DYNAS MODEL ELEMENT/NODE	V_{max}	M_z	M_{2max}
1	562.47'	1/-	20750.0	105300.0	919250.0
2 & 3	567.69'	1/12	20750.0	105300.0	919250.0
4	574.86'	2/12	18700.0	103800.0	820750.0
5 & 6	581.87'	2/13	18700.0	103800.0	606900.0
7	589.90'	3/13	16070.0	96680.0	603250.0
8 & 9	597.94'	3/-	16070.0	96680.0	367500.0
10	603.70'	3/14	16070.0	96680.0	190750.0
11 & 12	609.46'	3/14	16070.0	96680.0	190750.0
13	614.90'	4/14	4652.0	28350.0	187000.0
14 & 15	620.34'	4/-	4652.0	28350.0	149000.0
16	625.34'	4/15	4652.0	28350.0	111000.0
17 & 18	630.33'	-/15	4652.0	28350.0	111000.0
19	635.97'	5/-	4331.0	28070.0	73190.0

SARGENT & LUNDY ENGINEERS CHICAGO

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Prepared by N. L. Le Date 5-5-91

Reviewed by A. Valentin Date 5-5-91

Approved by Date

MEMBRANE FORCES ON DESIGN SECTION - (SSE)

DESIGN SECTION	Q_T	Q_α	N_ϕ^{ne}	N_ϕ^v	ΣQ	ΣN
1	225.8	22.1	386.1	1.52	247.9	387.6
2 & 3	214.6	18.4	321.7	0.85	233.0	322.5
4	178.7	15.1	237.9	0.51	193.8	238.4
5 & 6	169.7	13.5	157.8	0.33	183.2	158.1
7	141.0	11.7	146.0	0.22	152.7	146.2
8 & 9	139.7	11.5	87.5	0.19	151.2	87.7
10	140.9	11.7	46.1	0.22	152.6	46.3
11 & 12	143.8	12.2	48.2	0.29	156.0	48.5
13	44.1	4.0	53.1	0.33	48.1	53.4
14 & 15	49.3	5.1	52.9	0.46	54.4	53.4
16	55.7	6.5	50.8	0.55	62.2	51.4
17 & 18	59.7	7.4	58.1	0.41	67.1	58.5
19	59.5	7.8	40.8	0.35	65.3	41.1

Form GQ.3.08.1 Rev. 2

SARGENT & LUNDY ENGINEERS CHICAGO

Calcs. For DRYWELL SHIELD WALL ASSESSMENT

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Project FERMI-2

Proj. No. 6139-33 Equip. No.

Prepared by Dau Le Date 5-5-91

Reviewed by M. Valtierra Date 5-5-91

Approved by Date

DESIGN MEMBER FORCES

SECTION: 1

LOAD COMBINATIONS:

DL & T_o: Ref. 6

$A = DL + T_o$

$B = DL + T_o + SSE$

$C = DL + SSE$

FORCES	DL	T_o	SSE	A	B	C
M_ϕ	-1197.7	-259.4	—	-1457.1	-1457.1	-1197.7
M_θ	-208.6	-355.6	—	-564.2	-564.2	-208.6
N_ϕ	-438.9	—	337.6	-438.9	-51.3	-51.3
N_θ	-75.4	—	—	-75.4	-75.4	-75.4
Q_T	16.4	—	247.9	16.4	264.3	264.3

Form GO-3.08.1 Rev. 2

SARGENT LUNDY ENGINEERS CHICAGO

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DESIGN MEMBER FORCES

SECTION: 2

LOAD COMBINATIONS:

$A = DL + T_o$

$B = DL + T_o + SSE$

$C = DL + SSE$

FORCES	DL	T_o	SSE	A	B	C
M_ϕ	-1151.1	-250.4	-	-1410.5	-1410.5	-1151.1
M_θ	-261.7	-355.6	-	-617.3	-617.3	-261.7
N_ϕ	-417.4	-	322.5	-417.4	-94.9	-94.9
N_θ	-39.6	-	-	-39.6	-39.6	-39.6
Q_T	23.5	-	233.0	23.5	256.5	256.5

Form GQ.3.08.1 Rev. 2

SARGENT LUNDY ENGINEERS CHICAGO

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DESIGN MEMBER FORCES

SECTION: 3

LOAD COMBINATIONS:

$A = DL + T_o$

$B = DL + T_o + SSE$

$C = DL + SSE$

FORCES	DL	T_o	SSE	A	B	C
M_ϕ	-1151.1	-259.4	—	-1410.5	-1410.5	-1151.1
M_θ	-441.0	-355.6	—	-796.6	-796.6	-441.0
N_ϕ	-405.0	—	322.5	-405.0	-82.5	-82.5
N_θ	-37.3	—	—	-37.3	-37.3	-37.3
Q_T	23.5	—	233.0	23.5	256.5	256.5

Form GQ-3.08.1 Rev. 2

SARGENT & LUNDY ENGINEERS CHICAGO

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Prepared by Dau Le Date 5-5-21

Reviewed by M. Valdez Date 5-5-21

Approved by Date

DESIGN MEMBER FORCES

SECTION: 4

LOAD COMBINATIONS:

$A = DL + T_o$

$B = DL + T_o + SSE$

$C = DL + SSE$

FORCES	DL	T_o	SSE	A	B	C
M_ϕ	-422.6	-213.4	-	-636.0	-636.0	-422.6
M_θ	-176.7	-412.3	-	-589.0	-589.0	-176.7
N_ϕ	-329.4	-	238.4	-329.4	-91.0	-91.0
N_θ	21.2	-	-	21.2	21.2	21.2
Q_T	30.0	-	193.8	30.0	223.8	223.8

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SARGENT LUNDY ENGINEERS CHICAGO

Calcs. For DRYWELL SHIELD WALL ASSESSMENT

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DESIGN MEMBER FORCES

SECTION: 5

LOAD COMBINATIONS:

$A = DL + T_o$

$B = DL + T_o + SSE$

$C = DL + SSE$

FORCES	DL	T_o	SSE	A	B	C
M_ϕ	104.1	109.2	—	213.3	213.3	104.1
M_θ	-21.4	-241.5	—	-262.9	-262.9	-21.4
N_ϕ	-289.6	—	158.1	-289.6	-131.5	-131.5
N_θ	44.2	—	—	44.2	44.2	44.2
Q_T	31.2	—	183.2	31.2	214.4	214.4

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SARGENT & LUNDY ENGINEERS CHICAGO

Calcs. For DRYWELL SHIELD WALL ASSESSMENT

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Reviewed by [illegible] Date 5-5-81

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DESIGN MEMBER FORCES

SECTION: 6

LOAD COMBINATIONS:

$A = DL + T_o$

$B = DL + T_o + SSE$

$C = DL + SSE$

FORCES	DL	T_o	SSE	A	B	C
M_ϕ	103.4	109.2	–	212.6	212.6	103.4
M_θ	10.1	241.5	–	251.6	251.6	10.1
N_ϕ	-260.6	–	158.1	-260.6	-102.5	-102.5
N_θ	49.1	–	–	49.1	49.1	49.1
Q_T	31.8	–	183.2	31.8	215.0	215.0

Form GQ-3.08.1 Rev. 2

SARGENT & LUNDY ENGINEERS CHICAGO

Calcs. For DRYWELL SHIELD WALL ASSESSMENT

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DESIGN MEMBER FORCES

SECTION: 7

LOAD COMBINATIONS:

$A = DL + T_o$

$B = DL + T_o + SSE$

$C = DL + SSE$

FORCES	DL	T_o	SSE	A	B	C
M_ϕ	+42.0	75.2	—	117.2	117.2	42.0
M_θ	+ 3.4	188.4	—	191.8	191.8	3.4
N_ϕ	-240.8	—	+146.2	-240.8	-94.6	-94.6
N_θ	99.0	—	—	99.0	99.0	99.0
Q_T	34.0	—	152.7	34.0	186.7	186.7

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Prepared by Dau Le | Date 5-5-9

Reviewed by M. Valathu | Date 5-5-9

Approved by | Date

DESIGN MEMBER FORCES

SECTION: 8

LOAD COMBINATIONS:

$A = DL + T_o$

$B = DL + T_o + SSE$

$C = DL + SSE$

FORCES	DL	T_o	SSE	A	B	C
M_ϕ	142.0	53.5	—	195.5	195.5	142.0
M_θ	23.2	130.9	—	154.1	154.1	23.2
N_ϕ	-222.0	—	87.7	-222.0	-134.3	-134.3
N_θ	99.4	—	—	99.4	99.4	99.4
Q_T	30.7	—	151.2	30.7	181.9	181.9

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DESIGN MEMBER FORCES

SECTION: 9

LOAD COMBINATIONS:

$A = DL + T_o$

$B = DL + T_o + SSE$

$C = DL + SSE$

FORCES	DL	T_o	SSE	A	B	C
M_ϕ	141.3	53.5	—	194.8	194.8	141.3
M_θ	24.4	130.9	—	155.3	155.3	24.4
N_ϕ	-222.7	—	87.7	-222.7	-135.0	-135.0
N_θ	99.2	—	—	99.2	99.2	99.2
Q_T	30.7	—	151.2	30.7	181.9	181.9

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Calcs. For DRYWELL SHIELD WALL ASSESSMENT

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DESIGN MEMBER FORCES

SECTION: 10

LOAD COMBINATIONS:

$A = DL + T_o$

$B = DL + T_o + SSE$

$C = DL + SSE$

FORCES	DL	T_o	SSE	A	B	C
M_ϕ	105.3	66.7	—	172.0	172.0	105.3
M_θ	16.5	165.8	—	182.3	182.3	16.5
N_ϕ	-218.4	—	46.3	-218.4	-172.1	-172.1
N_θ	122.8	—	—	122.8	122.8	122.8
Q_T	27.1	—	152.6	27.1	179.7	179.7

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DESIGN MEMBER FORCES

SECTION: 11

LOAD COMBINATIONS:

$A = DL + T_o$

$B = DL + T_o + SSE$

$C = DL + SSE$

FORCES	DL	T_o	SSE	A	B	C
M_Φ	186.8	84.7	—	271.5	271.5	186.8
M_ϕ	25.9	198.9	—	224.8	224.8	25.9
N_Φ	-213.7	—	48.5	-213.7	-164.2	-164.2
N_ϕ	112.3	—	—	112.3	112.3	112.3
Q_T	21.0	—	156.0	21.0	177.0	177.0

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SARGENT LUNDY ENGINEERS CHICAGO

Calcs. For DRYWELL SHIELD WALL ASSESSMENT

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Proj. No. 6139-33 Equip. No.

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DESIGN MEMBER FORCES

SECTION: 12

LOAD COMBINATIONS:

$A = DL + T_o$

$B = DL + T_o + SSE$

$C = DL + SSE$

FORCES	DL	T_o	SSE	A	B	C
M_ϕ	188.1	84.7	—	272.8	272.8	188.1
M_ϕ	9.6	198.9	—	208.5	208.5	9.6
N_ϕ	-198.9	—	48.5	-198.9	-150.4	-150.4
N_ϕ	114.8	—	—	114.8	114.8	114.8
Q_T	13.6	—	156.0	13.6	189.6	189.6

Form GQ 3.08.1 Rev. 2

SARGENT & LUNDY ENGINEERS CHICAGO

Calcs. For DRYWELL SHIELD WALL ASSESSMENT

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Approved by Date

DESIGN MEMBER FORCES

SECTION: 13

LOAD COMBINATIONS:

$A = DL + T_o$

$B = DL + T_o + SSE$

$C = DL + SSE$

FORCES	DL	T_o	SSE	A	B	C
M_ϕ	46.2	89.2	—	135.4	135.4	46.2
M_θ	-28.1	-189.2	—	-217.3	-217.3	-28.1
N_ϕ	-214.2	—	53.4	-214.2	-160.8	-160.8
N_θ	65.4	—	—	65.4	65.4	65.4
Q_T	9.0	—	48.1	9.0	57.1	57.1

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SARGENT & LUNDY ENGINEERS CHICAGO

Calcs. For DRYWELL SHIELD WALL ASSESSMENT

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Proj. No. 6139-38 Equip. No.

Prepared by Dau Le Date 5-5-91

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Approved by Date

DESIGN MEMBER FORCES

SECTION: 14

LOAD COMBINATIONS:

$A = DL + T_o$

$B = DL + T_o + SSE$

$C = DL + SSE$

FORCES	DL	T_o	SSE	A	B	C
M_ϕ	-21.8	-52.9	—	-74.7	-74.7	-21.8
M_θ	-47.0	-56.8	—	-103.8	-103.8	-47.0
N_ϕ	-225.2	—	52.4	-225.2	-171.8	-171.8
N_θ	-6.9	—	—	-6.8	-6.8	-6.8
Q_T	4.6	—	54.4	4.6	59.0	59.0

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SARGENT & LUNDY ENGINEERS CHICAGO

Calcs. For DRYWELL SHIELD WALL ASSESSMENT		Calc. No. SDT-DECO-CC-1
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Client DECO	Prepared by Dau Le	Date 5-5-91
Project FERMI-2	Reviewed by M. Vasilkov	Date 5-5-91
Proj. No. 6139-38 Equip. No.	Approved by	Date

DESIGN MEMBER FORCES

SECTION: 15

LOAD COMBINATIONS:

$A = DL + T_o$

$B = DL + T_o + SSE$

$C = DL + SSE$

FORCES	DL	T_o	SSE	A	B	C
M_ϕ	-21.6	-52.9	—	-74.7	-74.7	-21.8
M_θ	-51.1	-56.8	—	-107.9	-107.9	-51.1
N_ϕ	-223.7	—	53.4	-223.7	-170.3	-170.3
N_θ	- 6.5	—	—	-6.5	-6.5	-6.5
Q_T	4.6	—	54.4	4.6	59.0	59.0

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Calcs. For DRYWELL SHIELD WALL ASSESSMENT

Calc. No. SDD-DECO-[illegible]

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Client DECO

Project FERMI-2

Proj. No. 6139-38 Equip. No.

Prepared by Dau Le Date 5-5-91

Reviewed by M. Kabbani Date 5-5-91

Approved by Date

DESIGN MEMBER FORCES

SECTION: 16

LOAD COMBINATIONS:

$A = DL + T_o$

$B = DL + T_o + SSE$

$C = DL + SSE$

FORCES	DL	T_o	SSE	A	B	C
M_ϕ	-193.5	-64.6	-	-258.1	-258.1	-193.5
M_θ	-103.2	-56.5	-	-159.7	-159.7	-103.2
N_ϕ	-230.2	-	51.4	-230.2	-178.8	-178.8
N_θ	-80.6	-	-	-80.6	-80.6	-80.6
Q_T	1.3	-	62.2	1.3	63.5	63.5

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Calcs. For DRYWELL SHIELD WALL ASSESSMENT

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Client DECO

Project FERMI-2

Proj. No. 6139-38 Equip. No.

Prepared by Dau Le Date 5-5-91

Reviewed by U Valluri Date 5-5-91

Approved by Date

DESIGN MEMBER FORCES

SECTION: 17

LOAD COMBINATIONS:

$A = DL + T_o$

$B = DL + T_o + SSE$

$C = DL + SSE$

FORCES	DL	T_o	SSE	A	B	C
M_ϕ	-485.2	-68.6	—	-553.8	-553.8	-485.2
M_θ	-150.0	-56.2	—	-206.2	-206.2	-150.0
N_ϕ	-227.6	—	58.5	-227.6	-169.1	-169.1
N_θ	-148.8	—	—	-148.8	-148.8	-148.8
Q_T	1.5	—	67.1	1.5	68.6	68.6

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Calcs. For DRYWELL SHIELD WALL ASSESSMENT

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Client DECO

Project FERMI-2

Proj. No. 6139-33 Equip. No.

Prepared by Dau Le Date 5-5-91

Reviewed by M. Vlatkovich Date 5-5-91

Approved by Date

DESIGN MEMBER FORCES

SECTION: 18

LOAD COMBINATIONS:

$A = DL + T_o$

$B = DL + T_o + SSE$

$C = DL + SSE$

FORCES	DL	T_o	SSE	A	B	C
M_ϕ	-485.2	-68.6	–	-553.8	-553.8	-485.2
M_θ	-106.6	-56.2	–	-162.8	-162.8	-106.6
N_ϕ	-223.0	–	58.5	-223.0	-164.5	-164.5
N_θ	-127.0	–	–	-127.0	-127.0	-127.0
Q_T	1.5	–	67.1	1.5	68.6	68.6

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Calcs. For DRYWELL SHIELD WALL ASSESSMENT

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Client DECO

Project FERMI-2

Proj. No. 6139-33 Equip. No.

Prepared by Dau Le Date 5-5-2

Reviewed by M. Valatt Date 5-5-2

Approved by Date

DESIGN MEMBER FORCES

SECTION: 19

LOAD COMBINATIONS:

$A = DL + T_o$

$B = DL + T_o + SSE$

$C = DL + SSE$

FORCES	DL	T_o	SSE	A	B	C
M_ϕ	-150.9	-68.6	—	-219.5	-219.5	-150.9
M_θ	-52.3	-56.2	—	-108.5	-108.5	-52.3
N_ϕ	-206.7	—	41.1	-206.7	-165.6	-165.6
N_θ	-128.8	—	—	-128.8	-128.8	-128.8
Q_T	2.1	—	65.3	2.1	67.4	67.4

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Client C.G.&E.	Prepared by Dau Le	Date 5-5-81
Project FERMI-2	Reviewed by U. Klallam	Date 5-5-81
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CRITICAL COMBINATIONS FOR INTERACTION DIAGRAM.

SECTION 1 -

Meridional: $\begin{cases} M_\phi = -1457.1 \\ N_\phi = 213.0 \end{cases}$

Hoop: $\begin{cases} M_\theta = -564.2 \\ N_\theta = 188.9 \end{cases}$

SECTION 2 -

Meridional: $\begin{cases} M_\phi = -1410.5 \\ N_\phi = 161.6 \end{cases}$

Hoop: $\begin{cases} M_\theta = -617.3 \\ N_\theta = 216.9 \end{cases}$

SECTION 3 -

Meridional: $\begin{cases} M_\phi = -1410.5 \\ N_\phi = 174.0 \end{cases}$

Hoop: $\begin{cases} M_\theta = -796.6 \\ N_\theta = 219.2 \end{cases}$

SECTION 4 :

Meridional : $\begin{cases} M\phi = -436.0 \\ N\phi = 132.8 \end{cases}$

Hoop : $\begin{cases} M\theta = -589.0 \\ N\theta = 245.0 \end{cases}$

SECTION 5 :

Meridional : $\begin{cases} M\phi = 213.3 \\ N\phi = 82.9 \end{cases}$

Hoop : $\begin{cases} M\theta = -262.9 \\ N\theta = 258.6 \end{cases}$

SECTION 6 :

Meridional : $\begin{cases} M\phi = 212.6 \\ N\phi = 112.5 \end{cases}$

Hoop : $\begin{cases} M\theta = 251.6 \\ N\theta = 264.1 \end{cases}$

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SECTION 7:

Meridional: $\begin{cases} M\phi = 117.2 \\ N\phi = 92.1 \end{cases}$

Hoop: $\begin{cases} M\theta = 191.8 \\ N\theta = 285.7 \end{cases}$

SECTION 8:

Meridional: $\begin{cases} M\phi = 195.5 \\ N\phi = 47.6 \end{cases}$

Hoop: $\begin{cases} M\theta = 154.1 \\ N\theta = 281.3 \end{cases}$

SECTION 9:

Meridional: $\begin{cases} M\phi = 194.8 \\ N\phi = 46.9 \end{cases}$

Hoop: $\begin{cases} M\theta = 155.3 \\ N\theta = 281.1 \end{cases}$

SECTION 10 :

Meridional : $\begin{cases} M\phi = 172.0 \\ N\phi = 2.5 \end{cases}$

Hoop : $\begin{cases} M\theta = 182.3 \\ N\theta = 302.5 \end{cases}$

SECTION 11 :

Meridional : $\begin{cases} M\phi = 271.5 \\ N\phi = 12.8 \end{cases}$

Hoop : $\begin{cases} M\theta = 224.8 \\ N\theta = 289.3 \end{cases}$

SECTION 12 :

Meridional : $\begin{cases} M\phi = 272.3 \\ N\phi = 39.2 \end{cases}$

Hoop : $\begin{cases} M\theta = 208.5 \\ N\theta = 304.4 \end{cases}$

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Calcs. For DRYWELL SHIELD WALL ASSESSMENT		Calc. No. SDP-ECA-204
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SECTION 13 :

Meridional : $\begin{cases} M\phi = 135.4 \\ N\phi = -103.7 \end{cases}$

Hoop : $\begin{cases} M\theta = -217.3 \\ N\theta = 122.5 \end{cases}$

SECTION 14 :

Meridional : $\begin{cases} M\phi = -74.7 \\ N\phi = -112.8 \end{cases}$

Hoop : $\begin{cases} M\theta = -103.8 \\ N\theta = 52.2 \end{cases}$

SECTION 15 :

Meridional : $\begin{cases} M\phi = -74.7 \\ N\phi = -111.3 \end{cases}$

Hoop : $\begin{cases} M\theta = -107.9 \\ N\theta = 52.5 \end{cases}$

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Client DECO	Prepared by [signature]	Date 5-5-81
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SECTION 16 :

Meridional : $\begin{cases} M_\phi = -258.1 \\ N_\phi = -115.3 \end{cases}$

Hoop : $\begin{cases} M_\phi = -159.7 \\ N_\phi = -17.1 \end{cases}$

SECTION 17 :

Meridional : $\begin{cases} M_\phi = -553.8 \\ N_\phi = -100.5 \end{cases}$

Hoop : $\begin{cases} M_\phi = -206.2 \\ N_\phi = -80.2 \end{cases}$

SECTION 18 :

Meridional : $\begin{cases} M_\phi = -553.8 \\ N_\phi = -95.9 \end{cases}$

Hoop : $\begin{cases} M_\phi = -162.8 \\ N_\phi = -58.4 \end{cases}$

Form GO.3.08.1 Rev. 2

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SECTION 19 :

Meridional : $\begin{cases} M_\phi = -219.5 \\ N_\phi = -98.2 \end{cases}$

Hoop : $\begin{cases} M_\theta = -108.5 \\ N_\theta = -61.4 \end{cases}$

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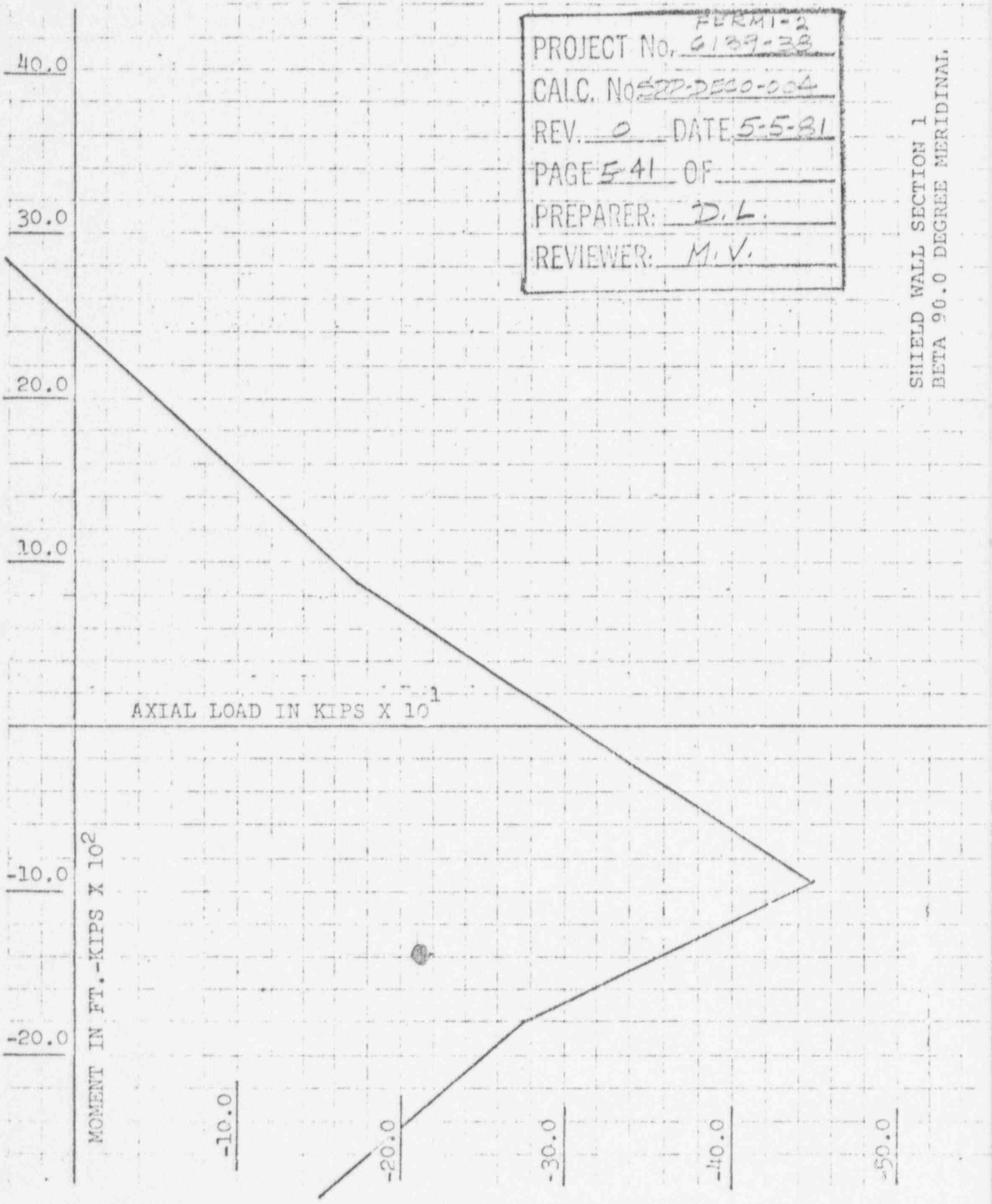
PREPARER: D.L.
REVIEWER: M.V.

SHIELD WALL SECTION 1
BETA 90.0 DEGREE MERIDINAL



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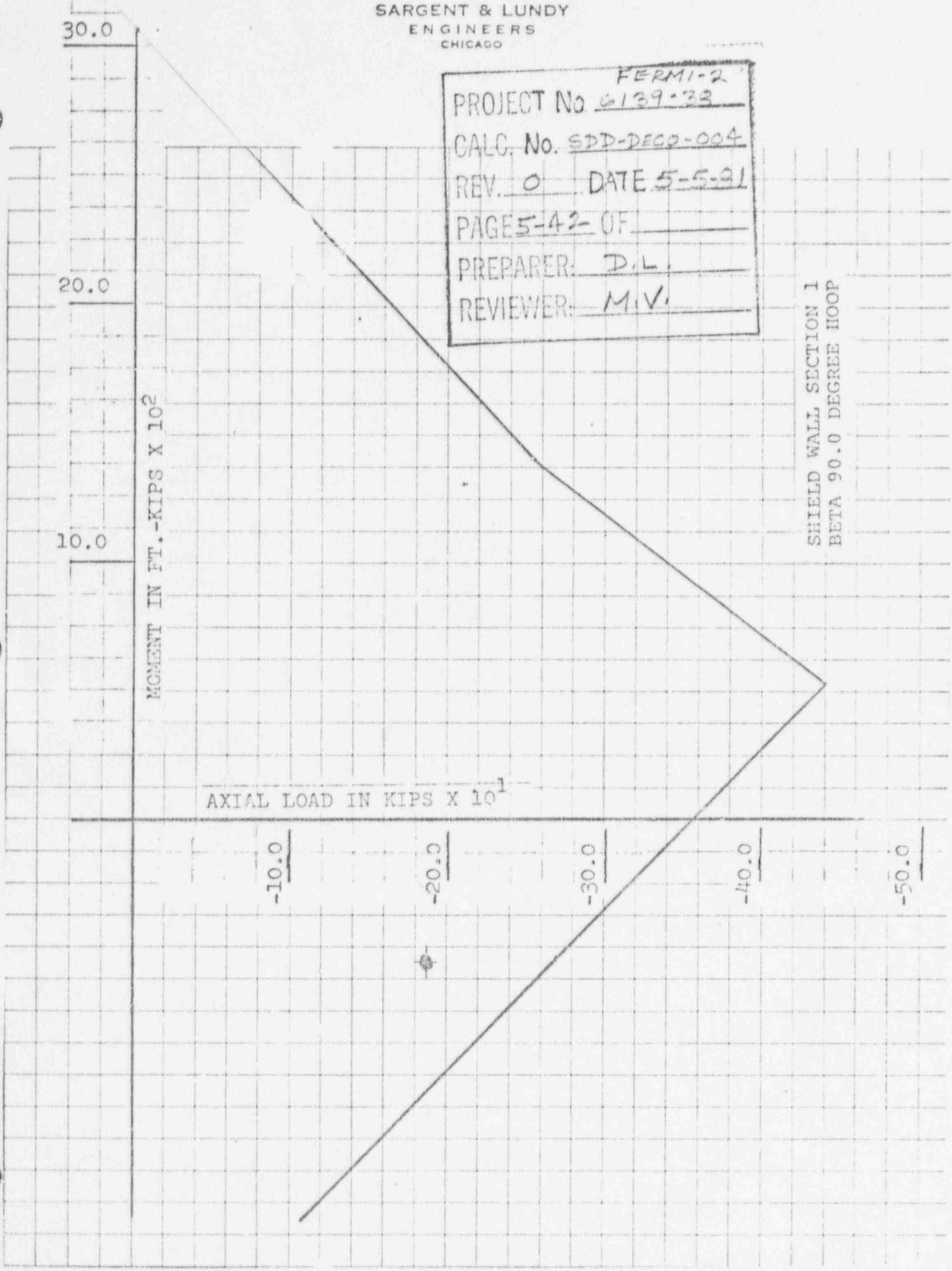
PREPARER: D.L.
REVIEWER: M.V.



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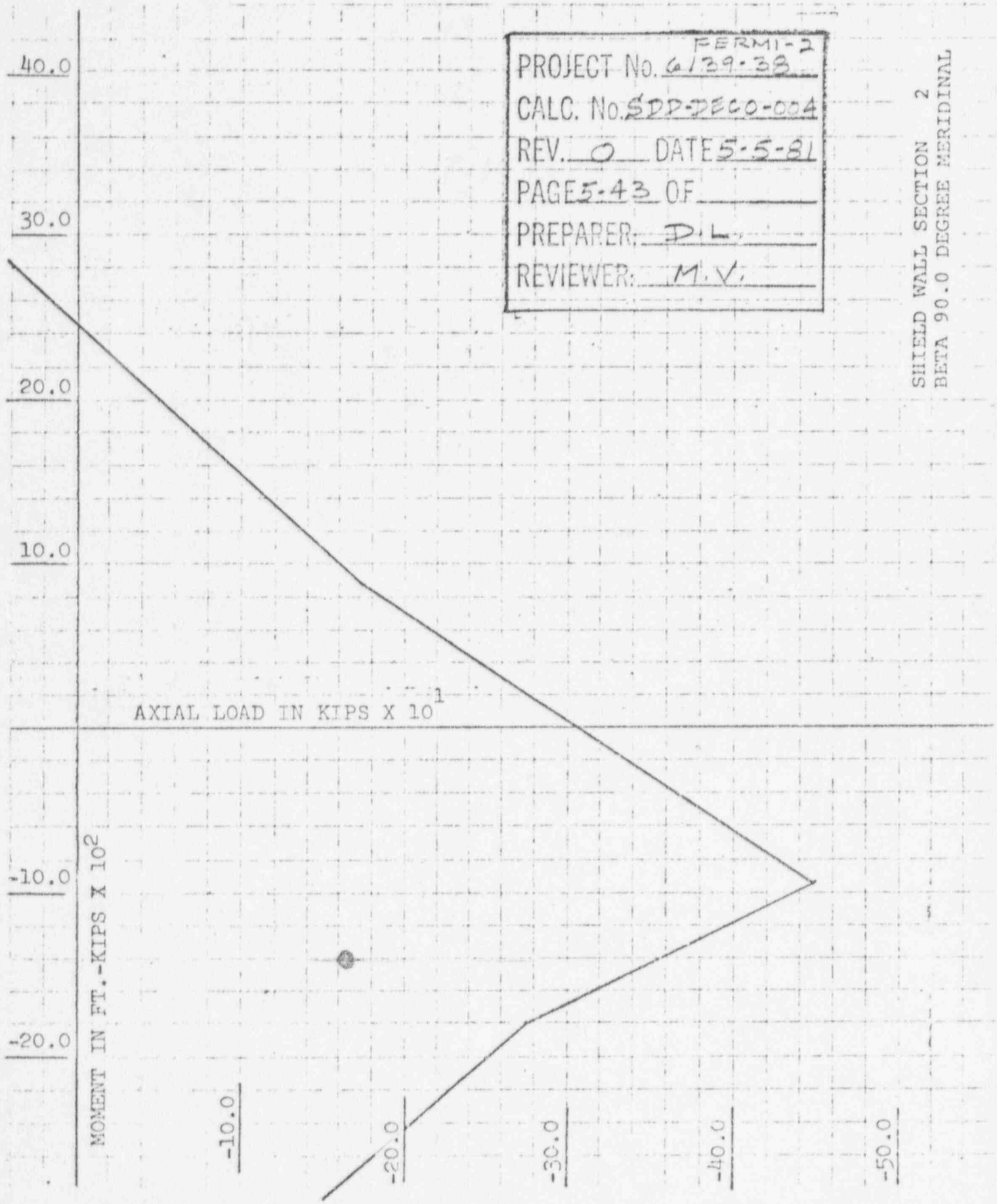
REVIEWER: M.V.

SHIELD WALL SECTION 2
BETA 90.0 DEGREE MERIDINAL



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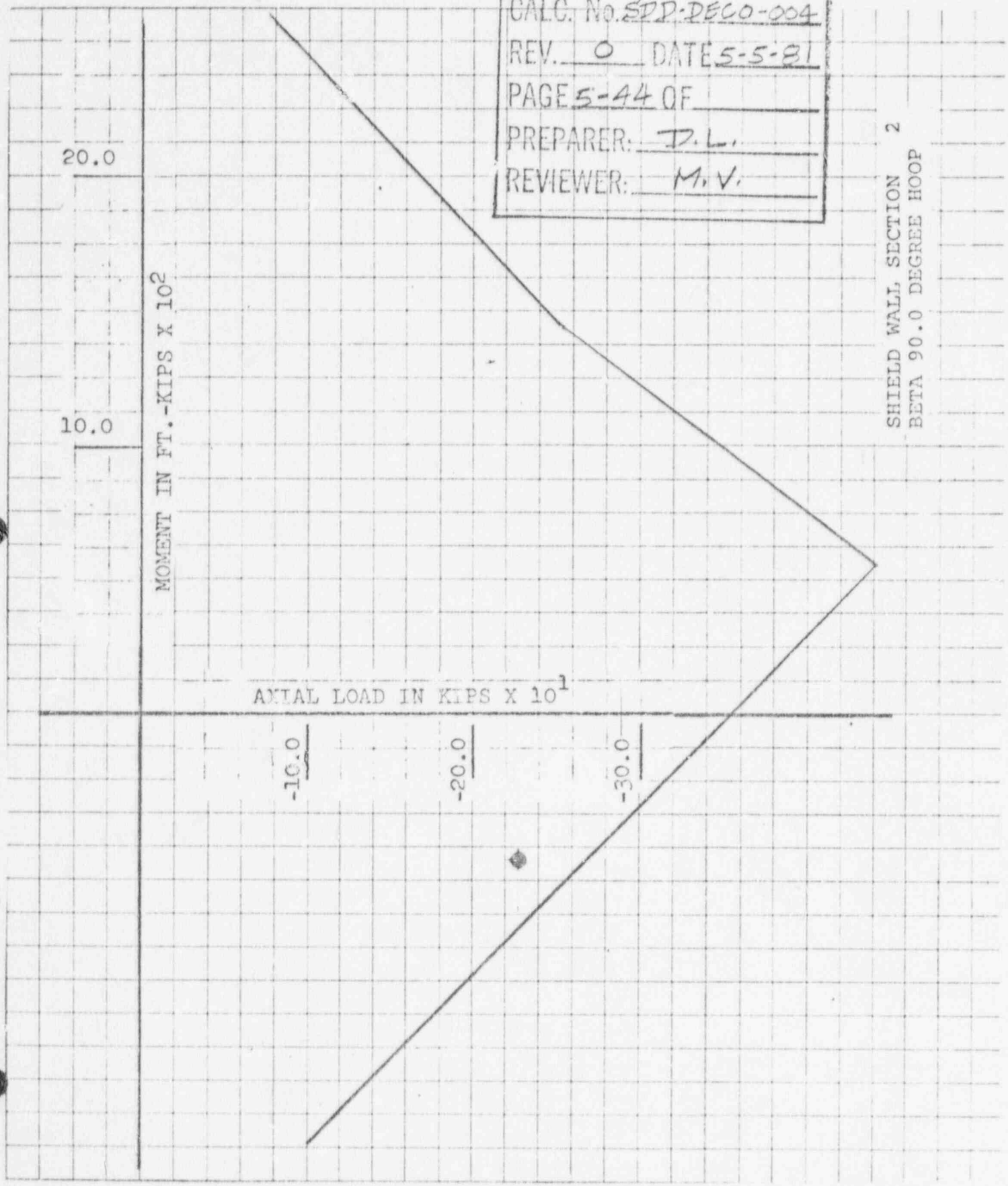
PREPARER: D.L.
REVIEWER: M.V.



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PROJECT No. FERMI-2 C139-39
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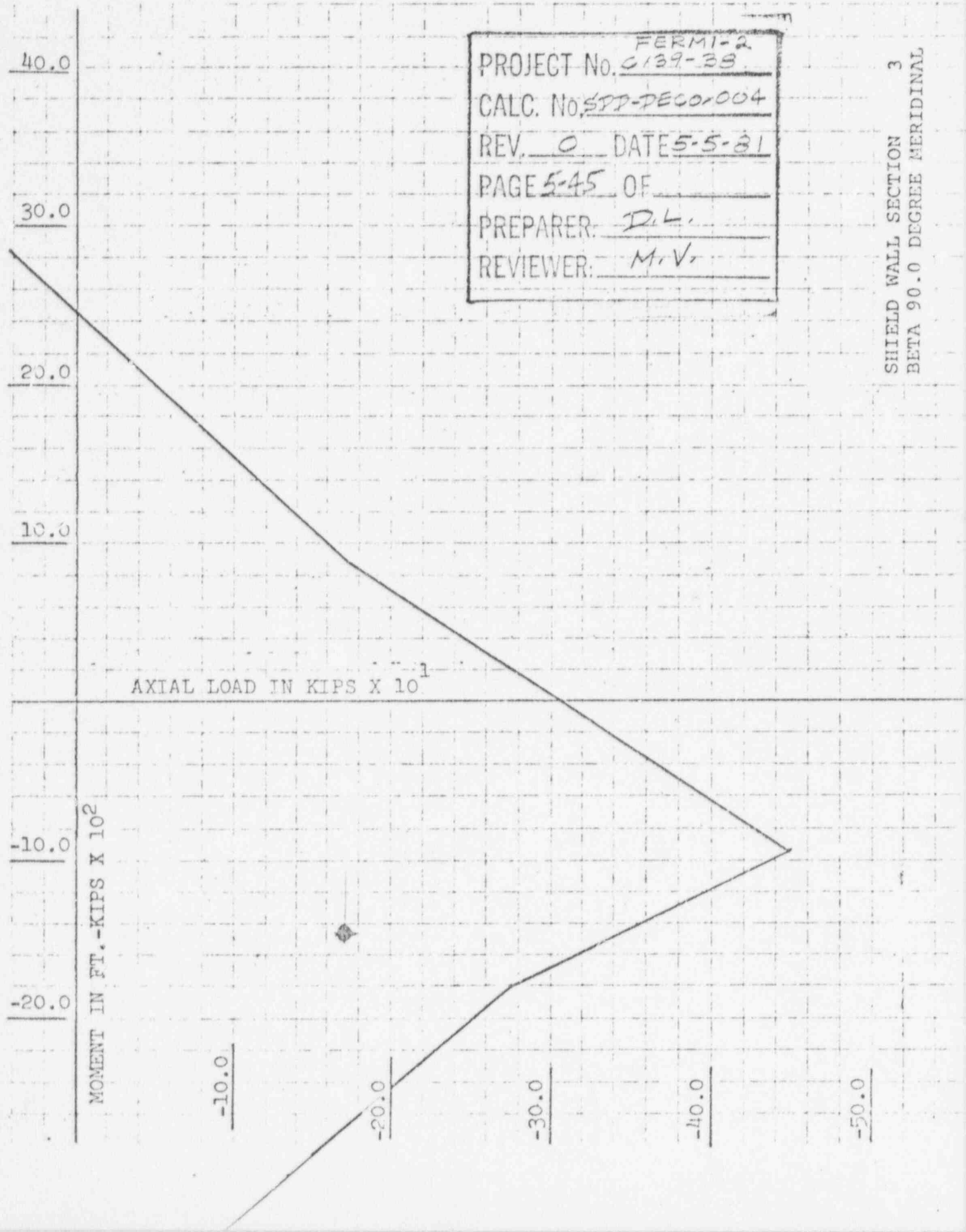
PREPARER: D.L.
REVIEWER: M.V.

SHIELD WALL SECTION 3
BETA 90.0 DEGREE MERIDINAL



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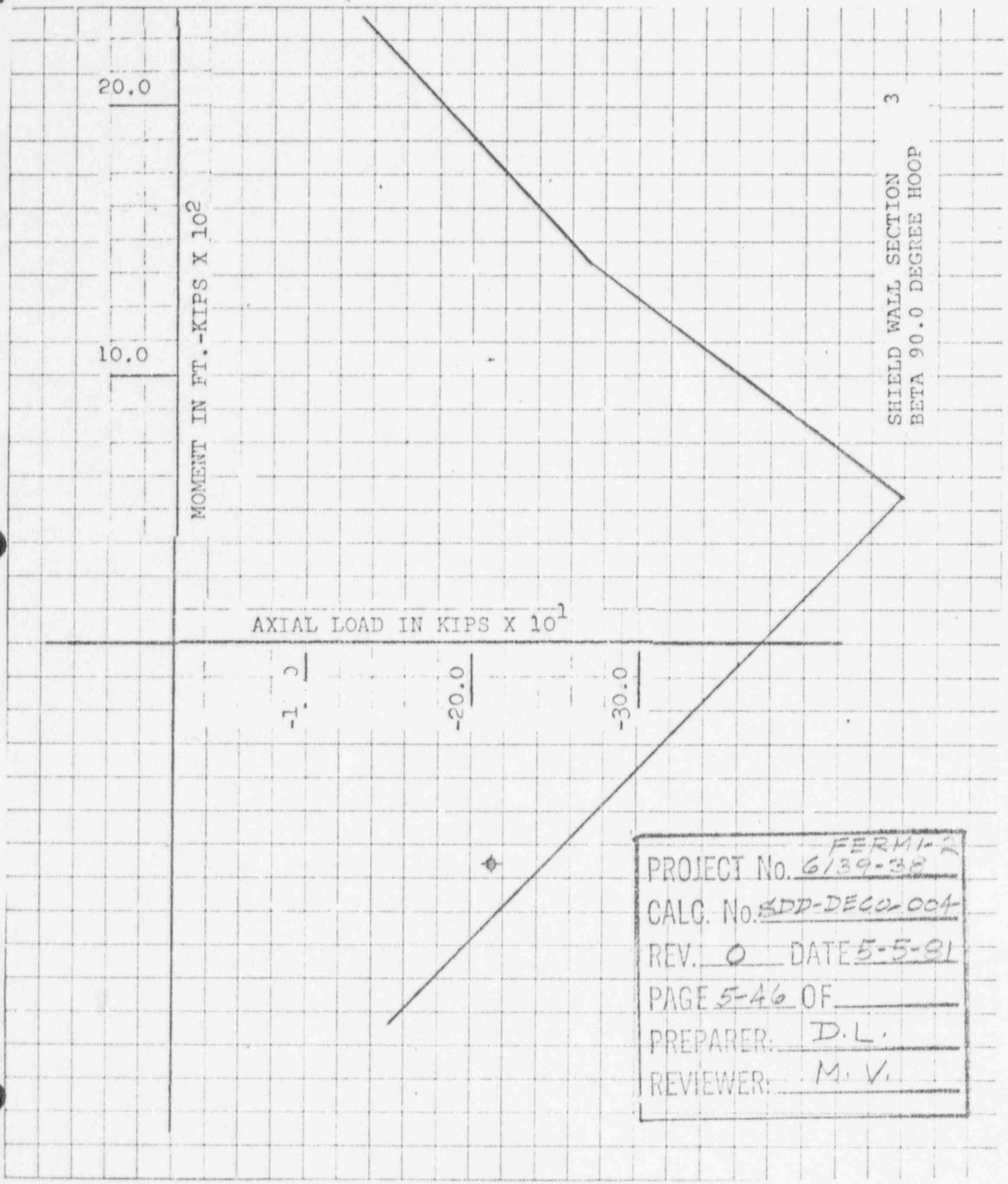

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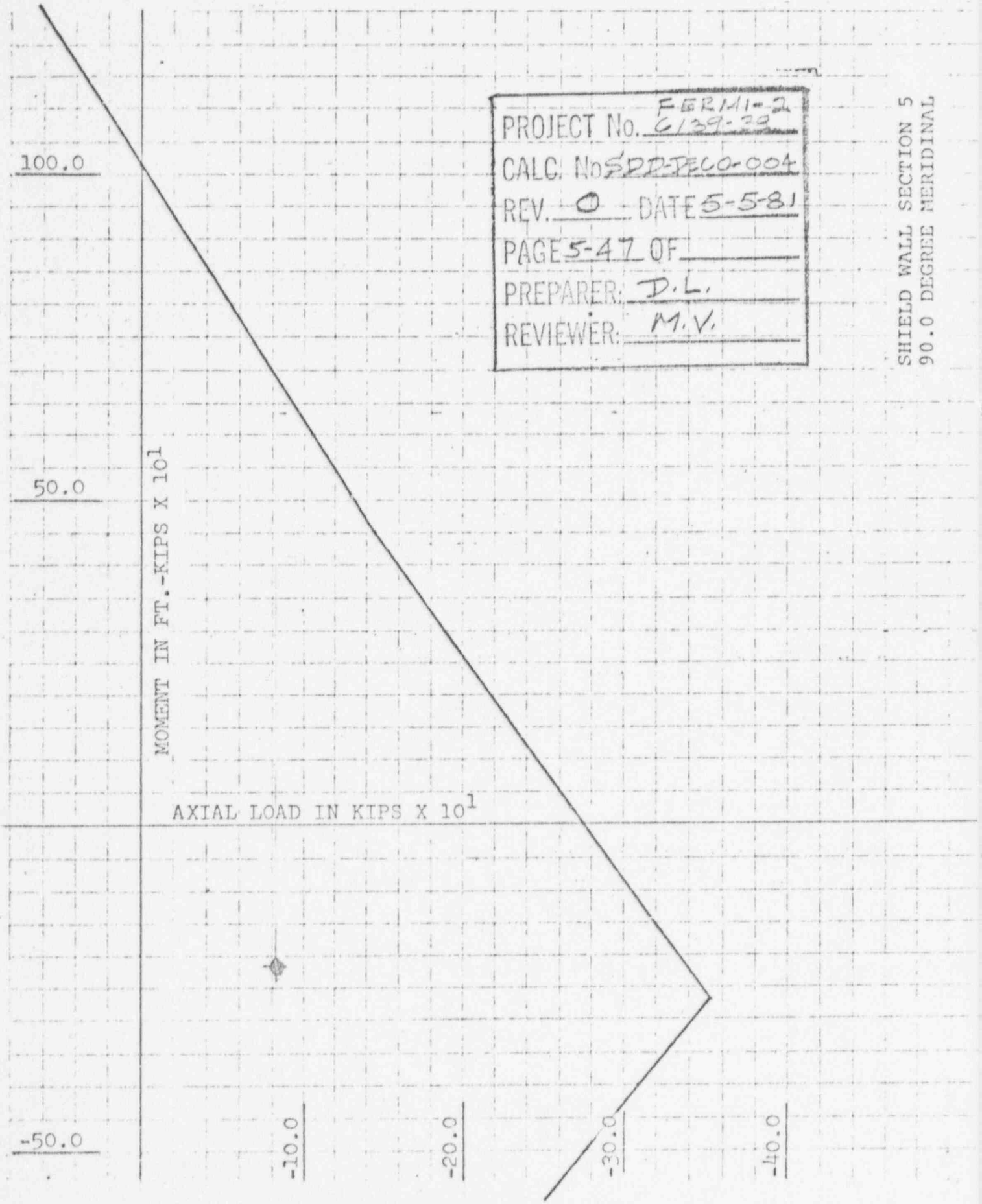
PREPARER: D.L.
REVIEWER: M.V.

SHIELD WALL SECTION 5
90.0 DEGREE MERIDINAL



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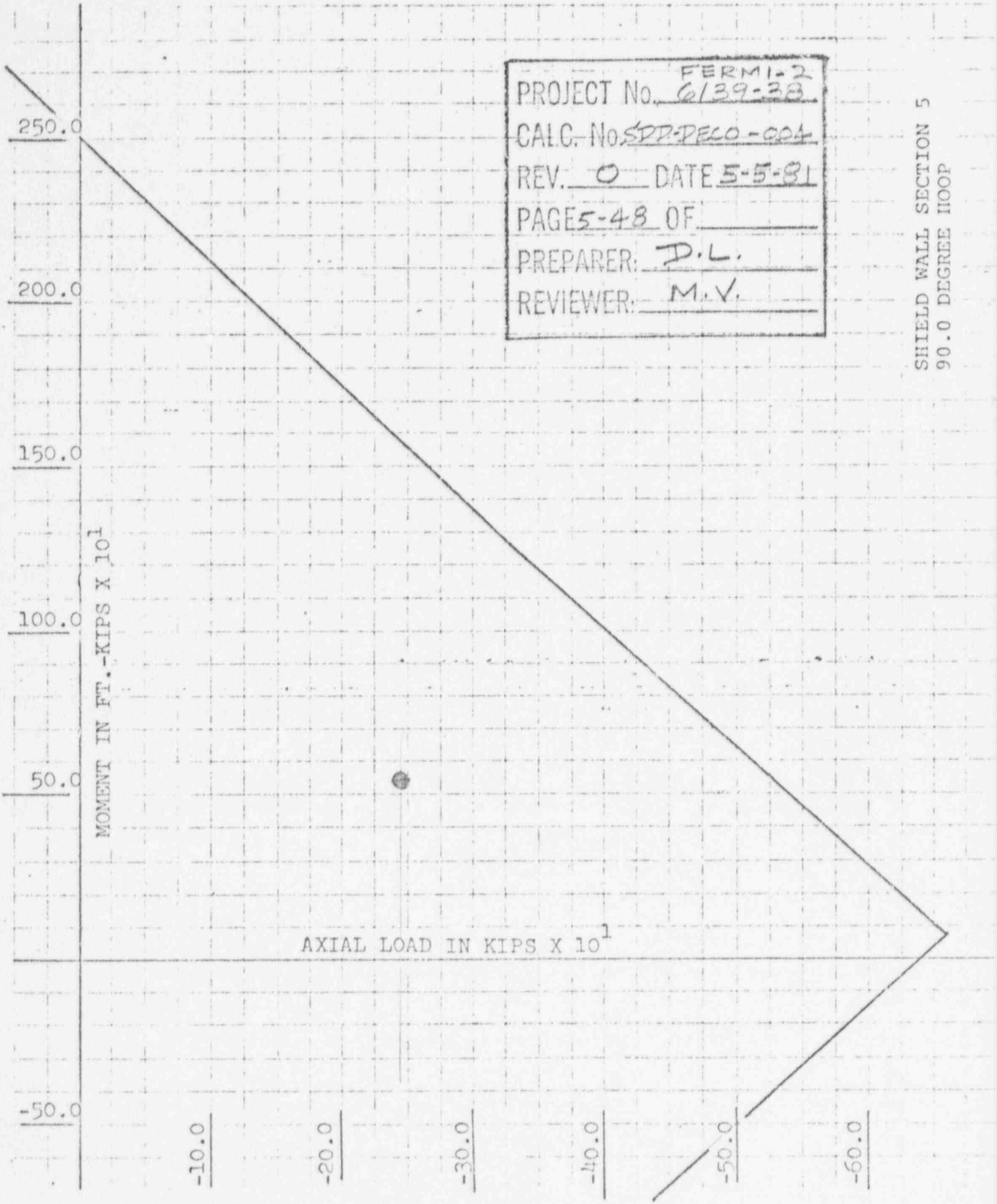
PREPARER: D.L.
REVIEWER: M.V.

SHIELD WALL SECTION 5
90.0 DEGREE HOOP



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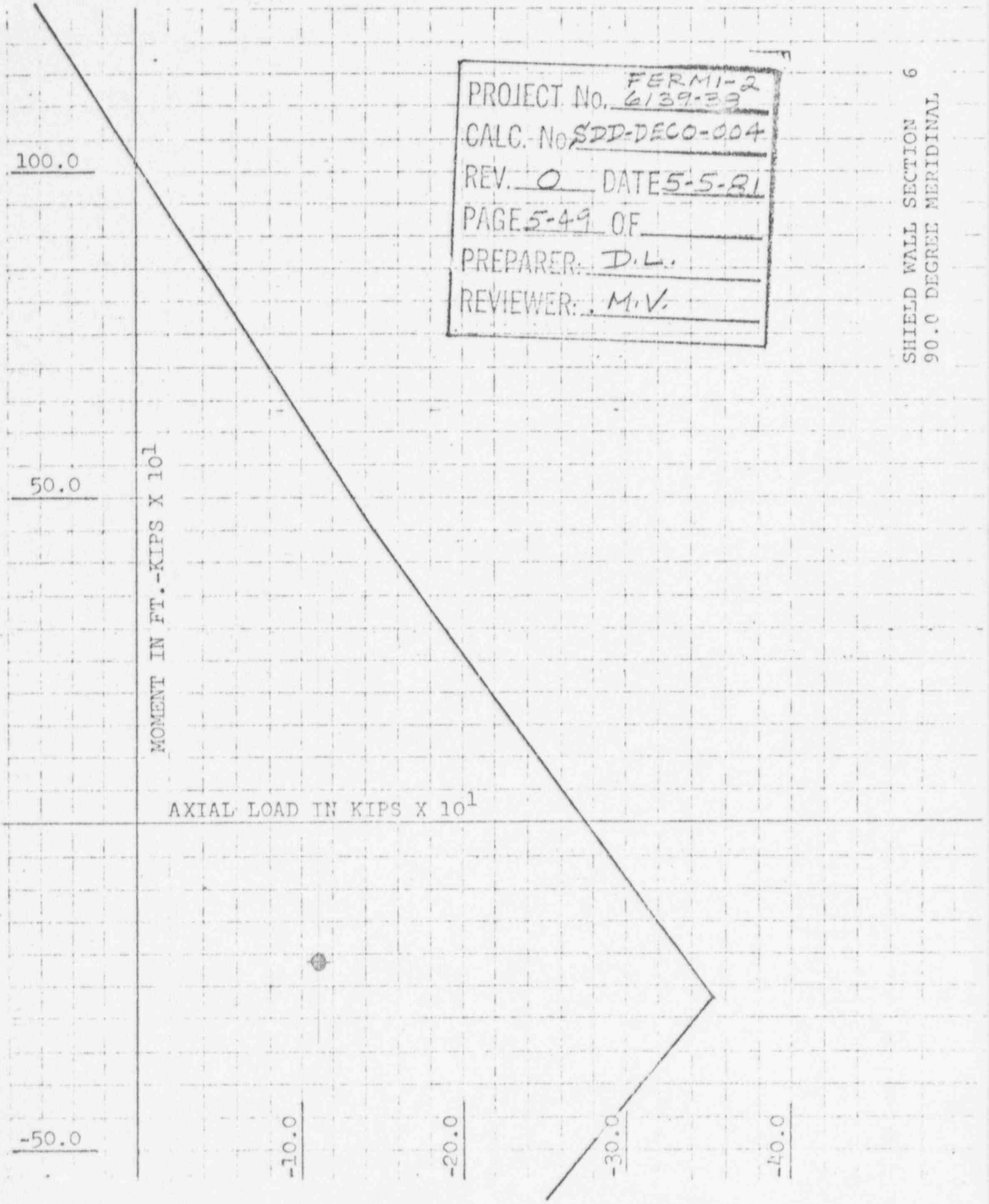
REVIEWER: M.V.

SHIELD WALL SECTION 6
90.0 DEGREE MERIDINAL



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PREPARER: D.L.
REVIEWER: M.V.

SHIELD WALL SECTION 6
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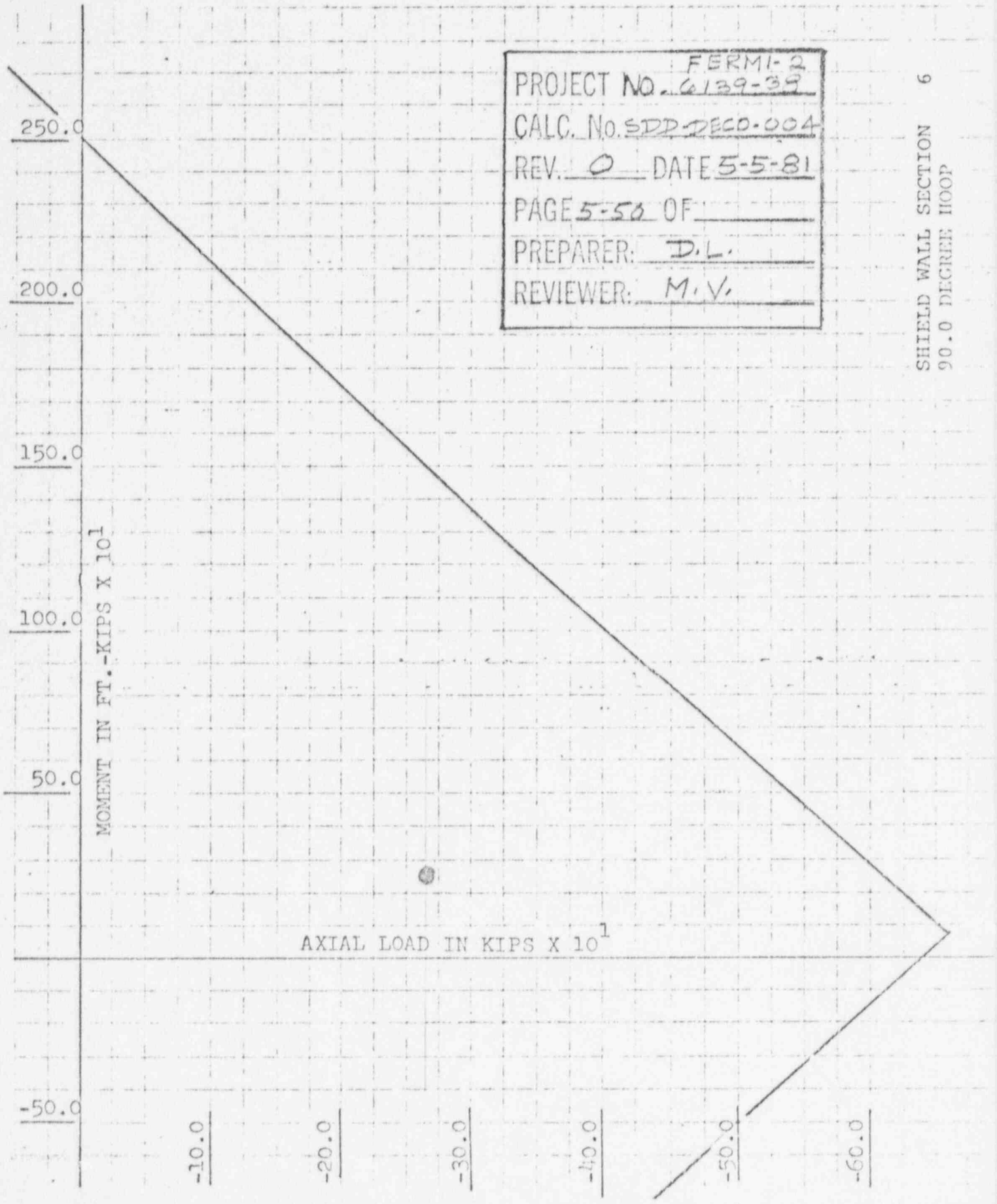

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PROJECT No. 6139-32 (FERMI-2)
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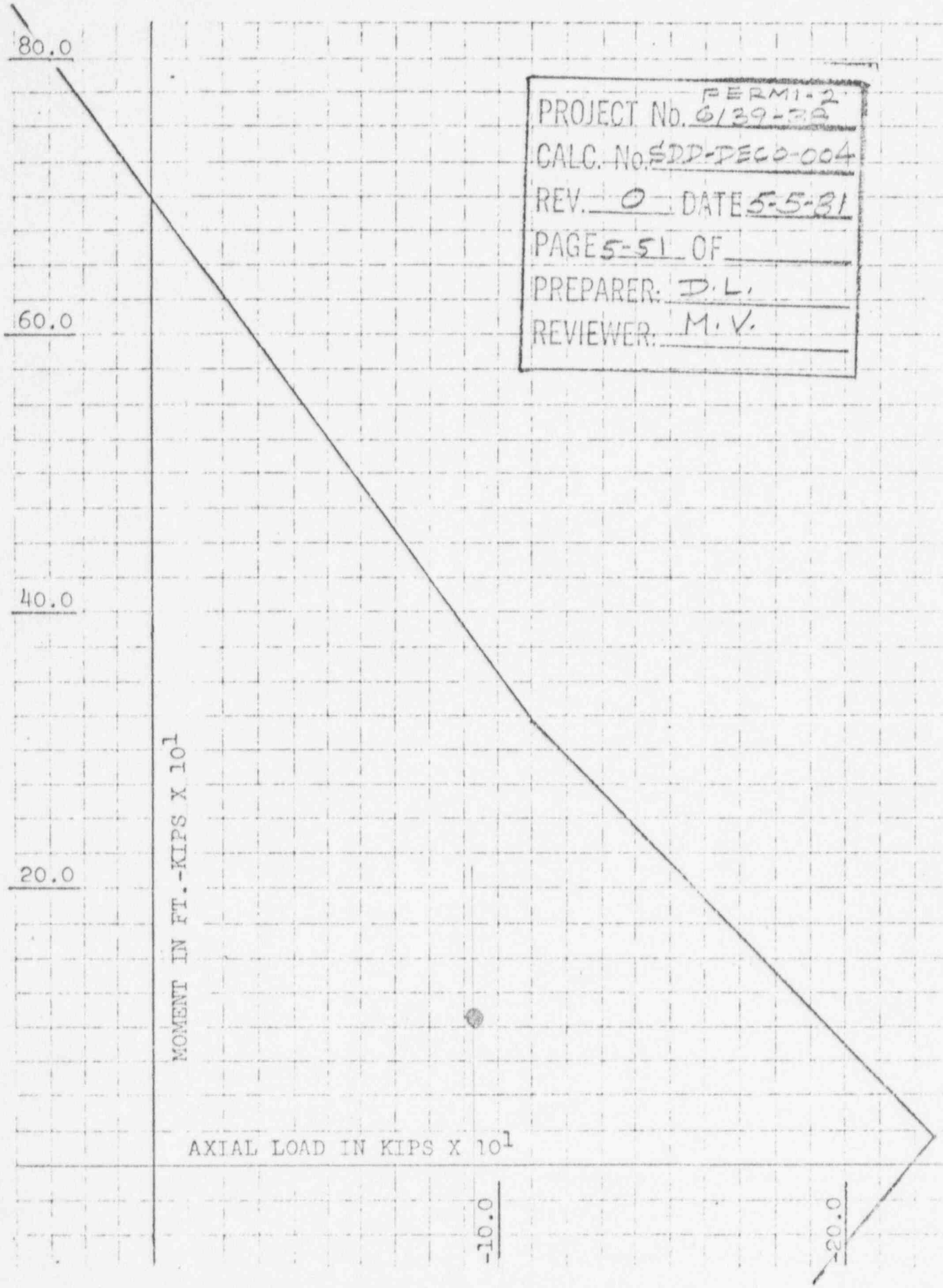
PREPARER: D.L.
REVIEWER: M.V.



SHIELD WALL SECTION 7
90.0 DEGREE MERIDINAL

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PROJECT No. FERMI-2 6159-22
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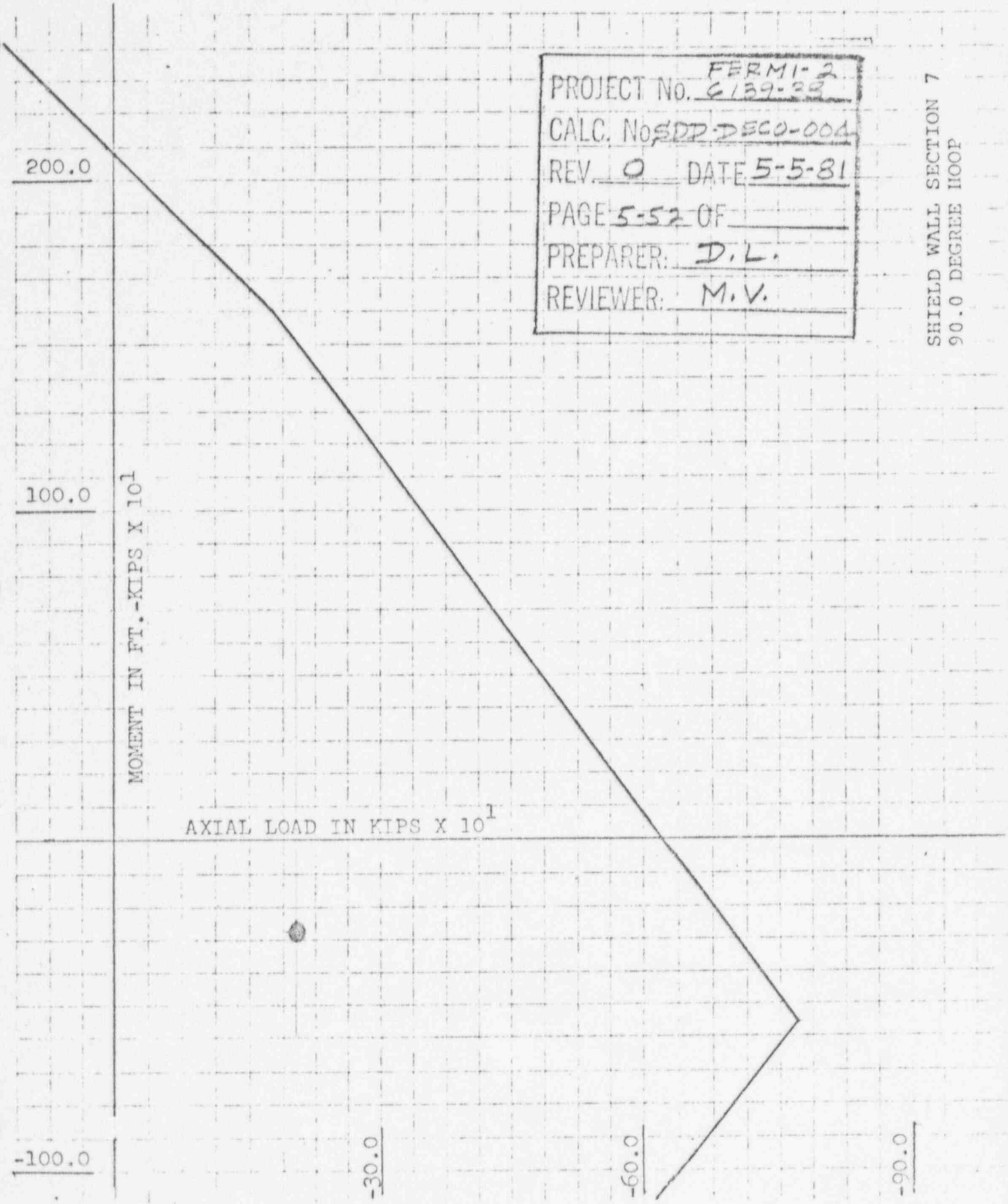
PREPARER: D.L.
REVIEWER: M.V.

SHIELD WALL SECTION 7
90.0 DEGREE HOOP



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PROJECT NO. FERMI-2 6129-28
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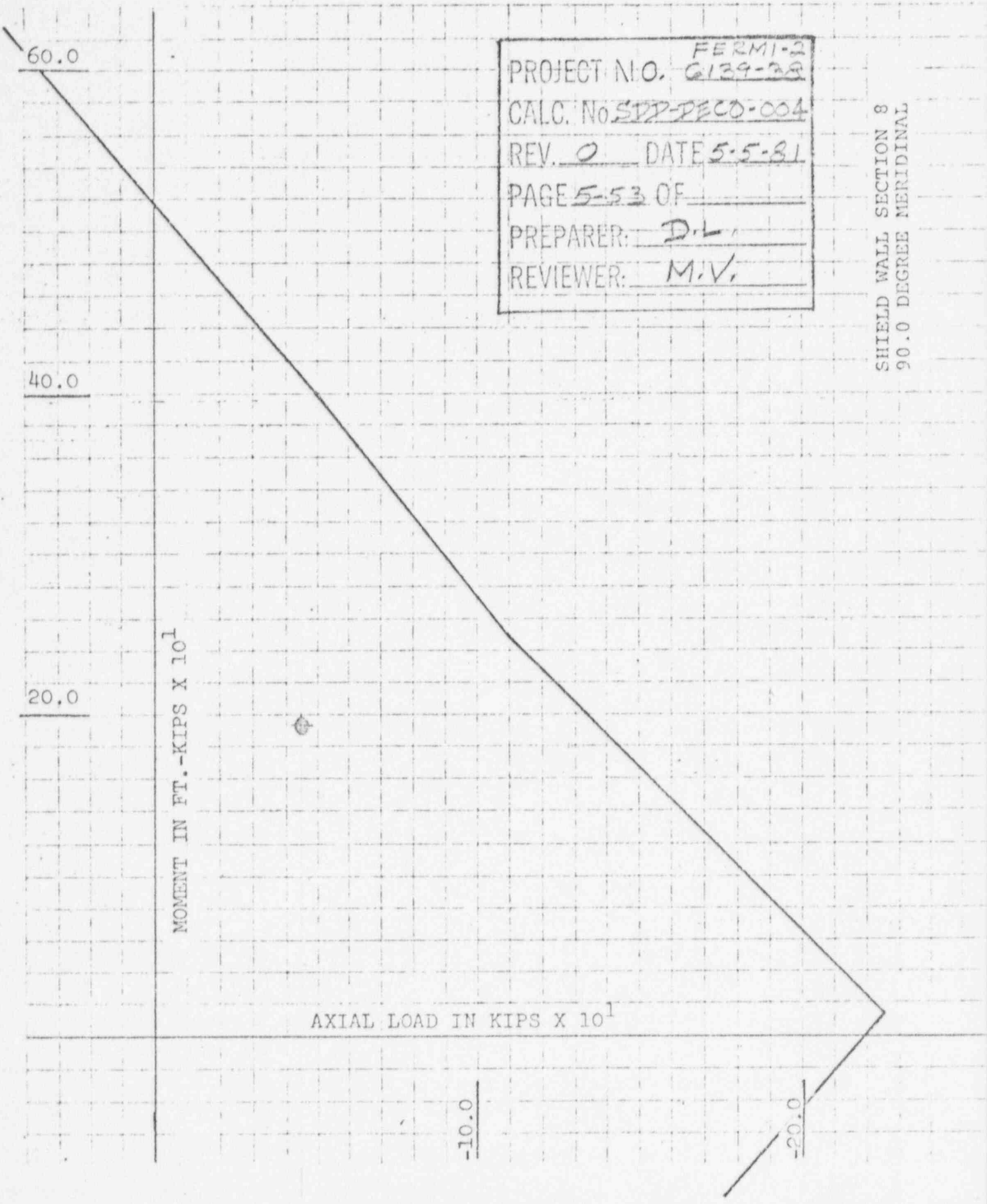
REVIEWER: M.V.

SHIELD WALL SECTION 8
90.0 DEGREE MERIDINAL



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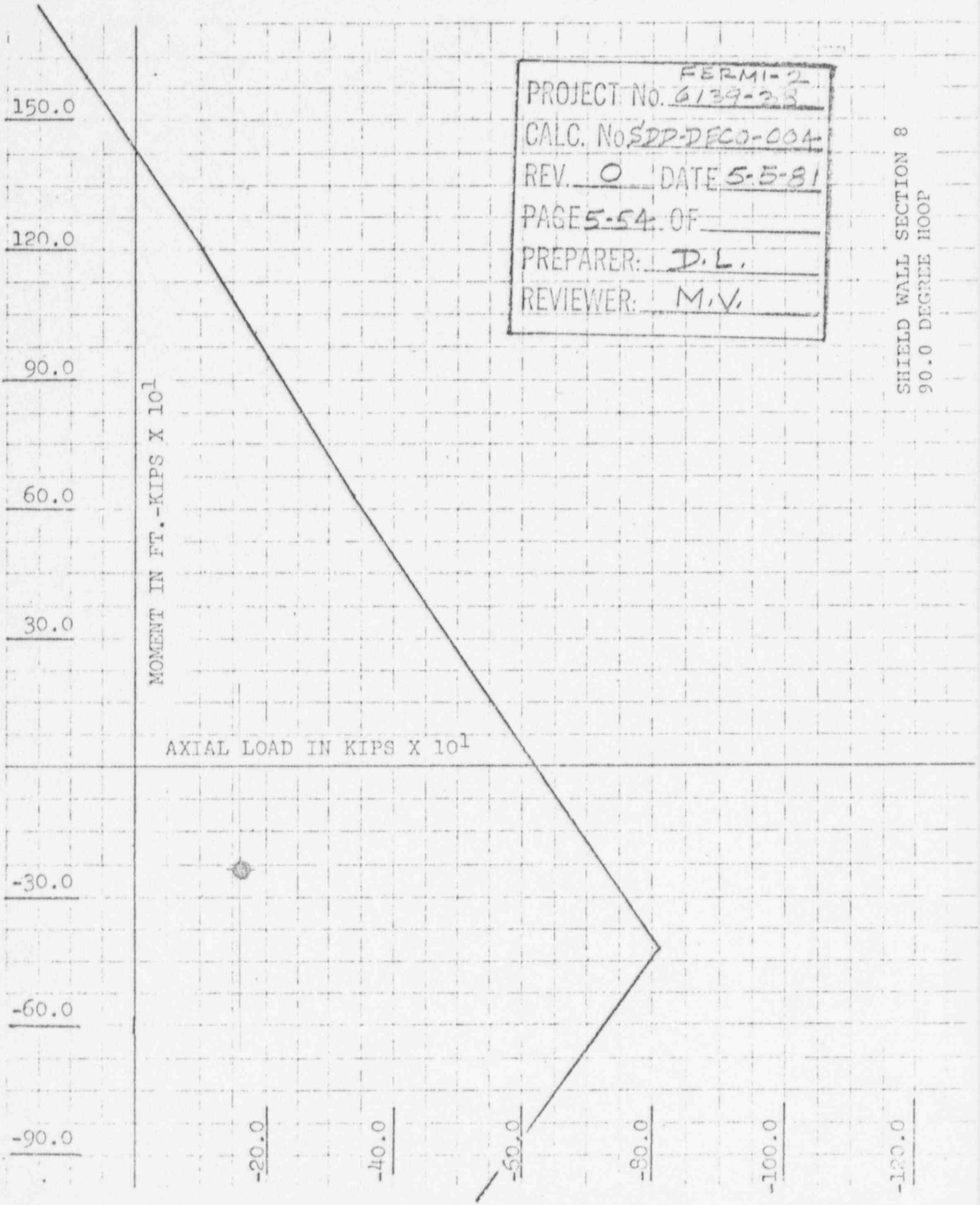
REVIEWER: M.V.

SHIELD WALL SECTION 8
90.0 DEGREE HOOP



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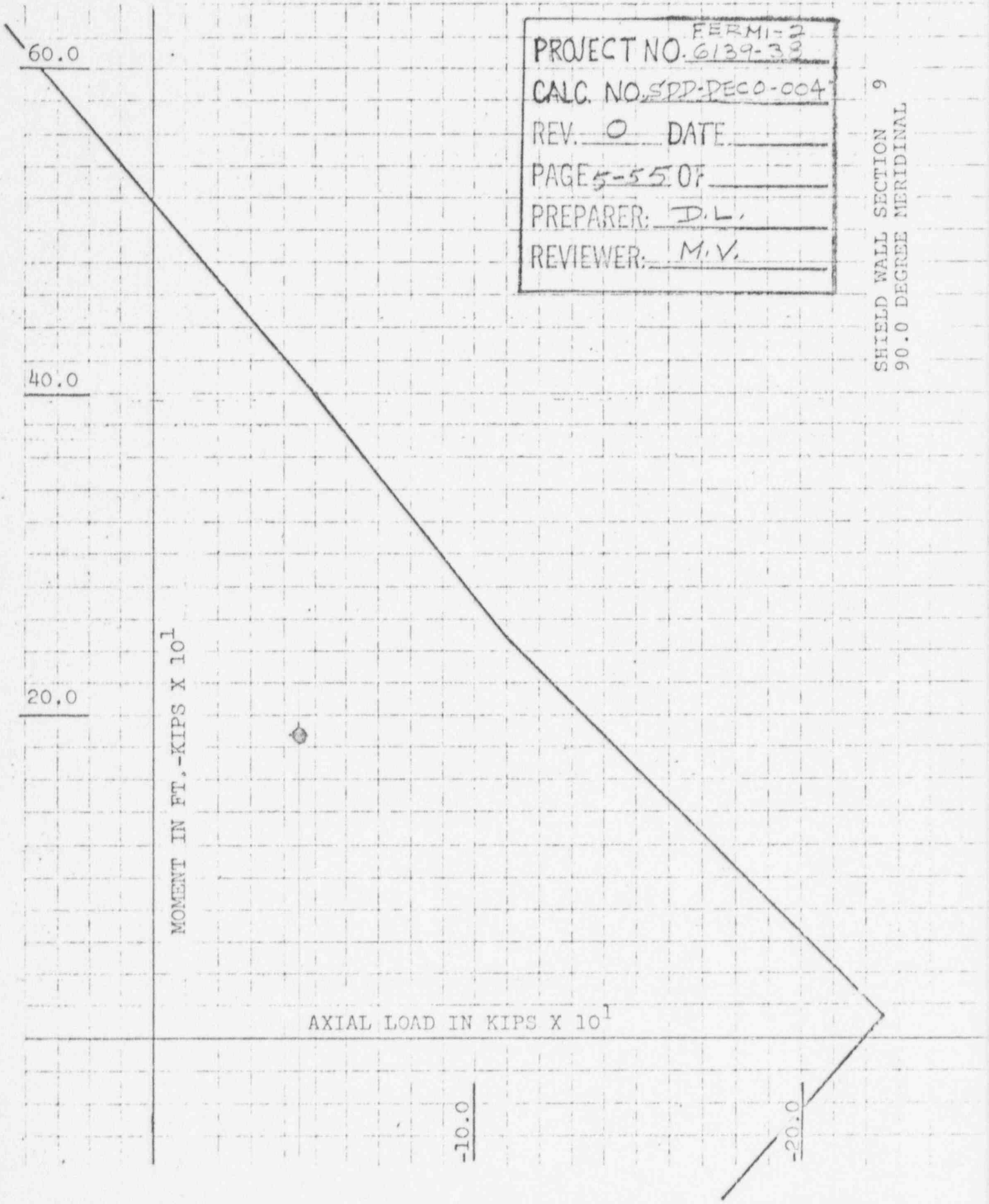
PREPARER: D.L.
REVIEWER: M.V.

SHIELD WALL SECTION 9
90.0 DEGREE MERIDINAL



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PROJECT NO. FERMI-2 6132-39
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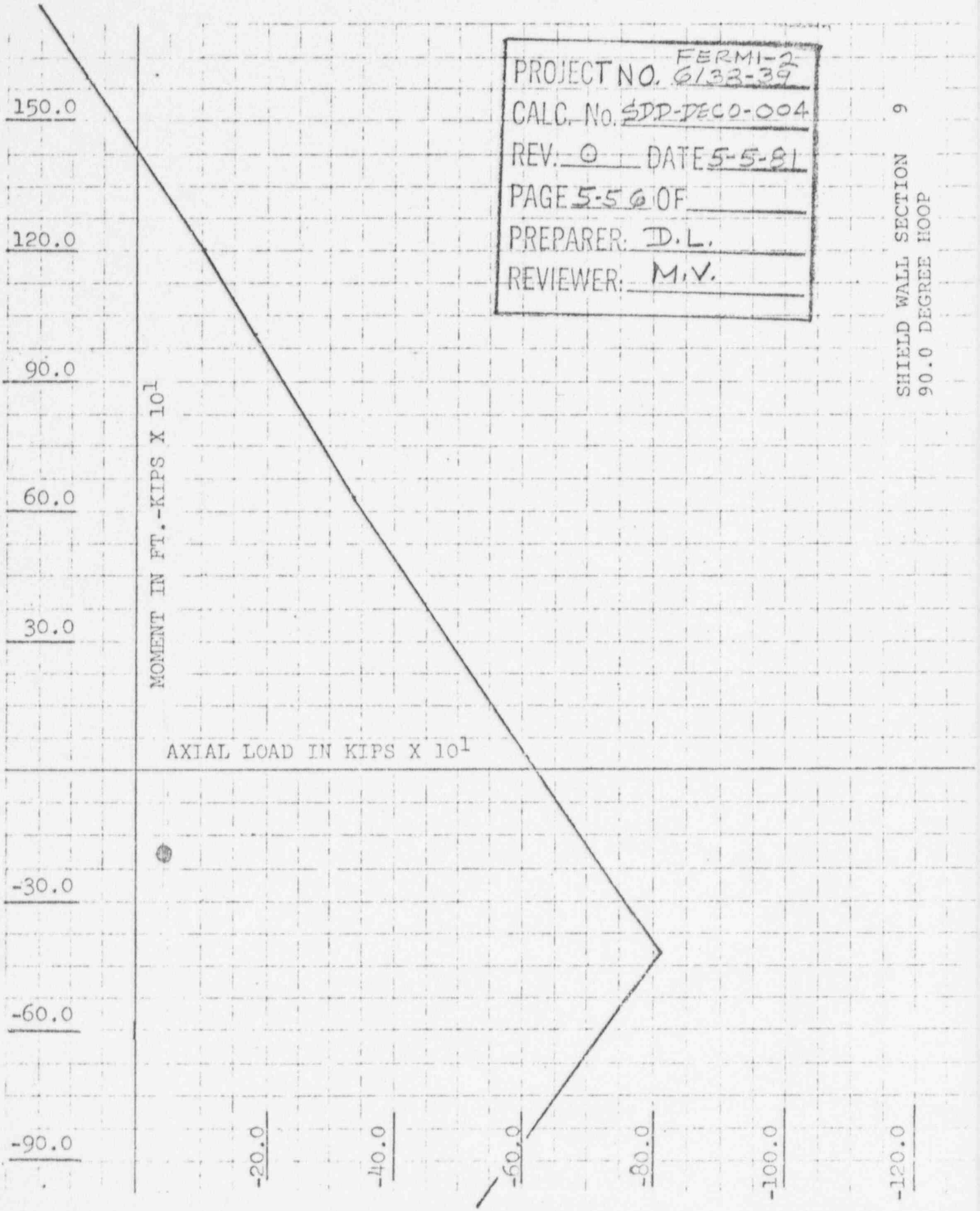
SHIELD WALL SECTION 9
90.0 DEGREE HOOP



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PROJECT NO. FERMI-2 6139-38
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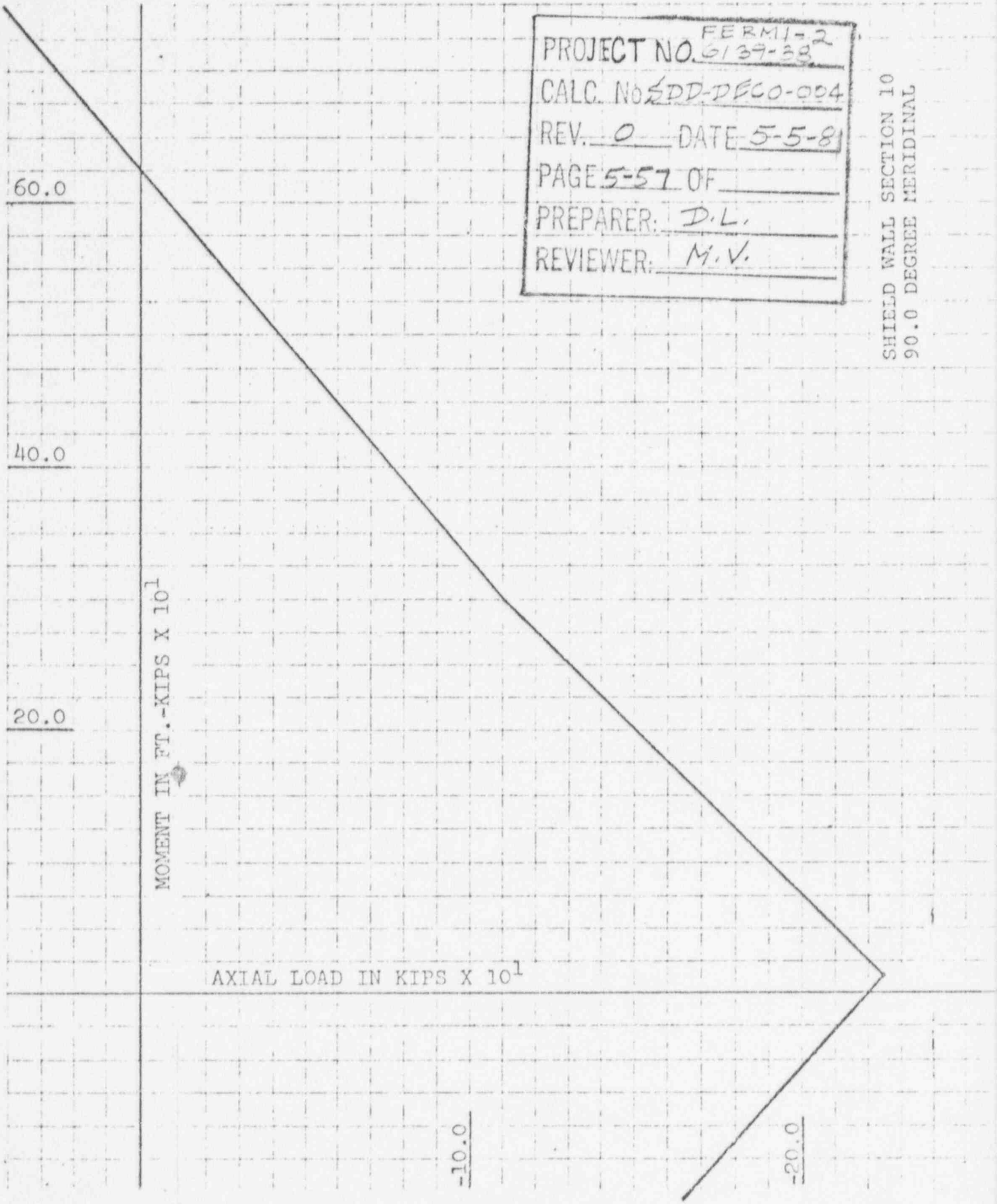
PREPARER: D.L.
REVIEWER: M.V.

SHIELD WALL SECTION 10
90.0 DEGREE MERIDINAL



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PROJECT No. FERMI-2 6139-33
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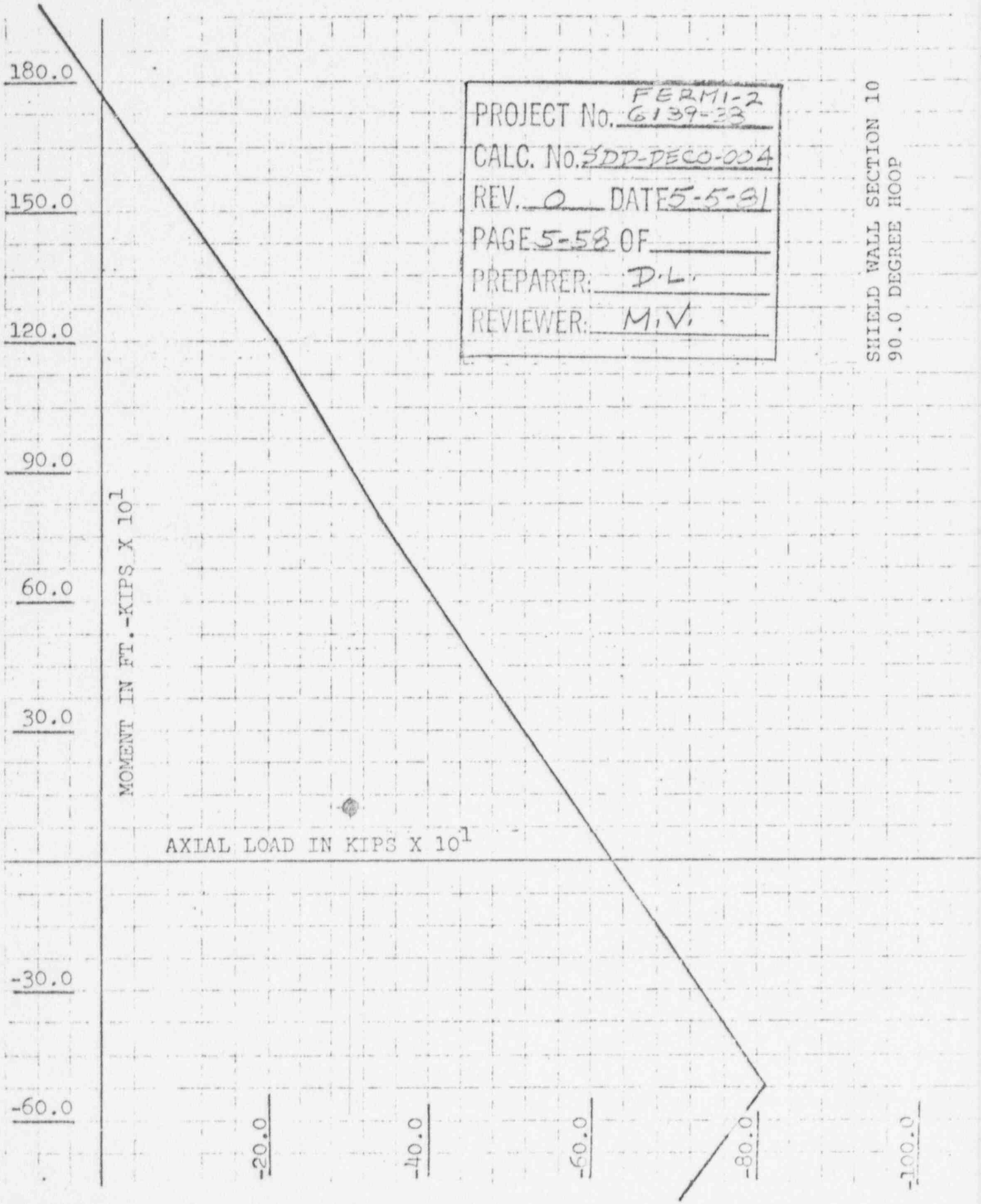
PREPARER: D.L.
REVIEWER: M.V.

SHIELD WALL SECTION 10
90.0 DEGREE HOOP



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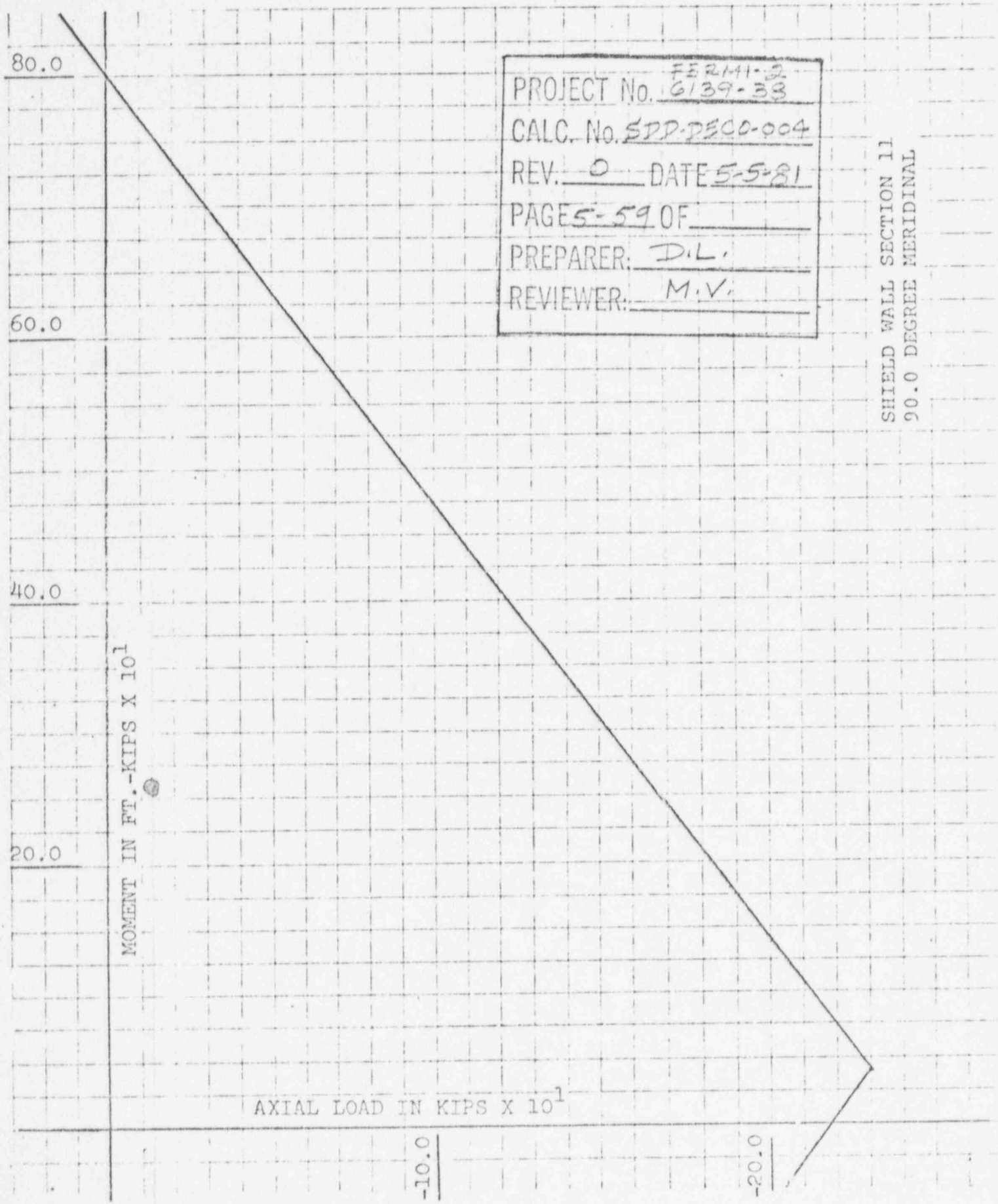
CHICAGO

PROJECT No. FERMI-2 6139-33
CALC. No. SDD-DECO-004
REV. 0 DATE 5-5-81
PAGE 5-59 OF
PREPARER: D.L.
REVIEWER: M.V.



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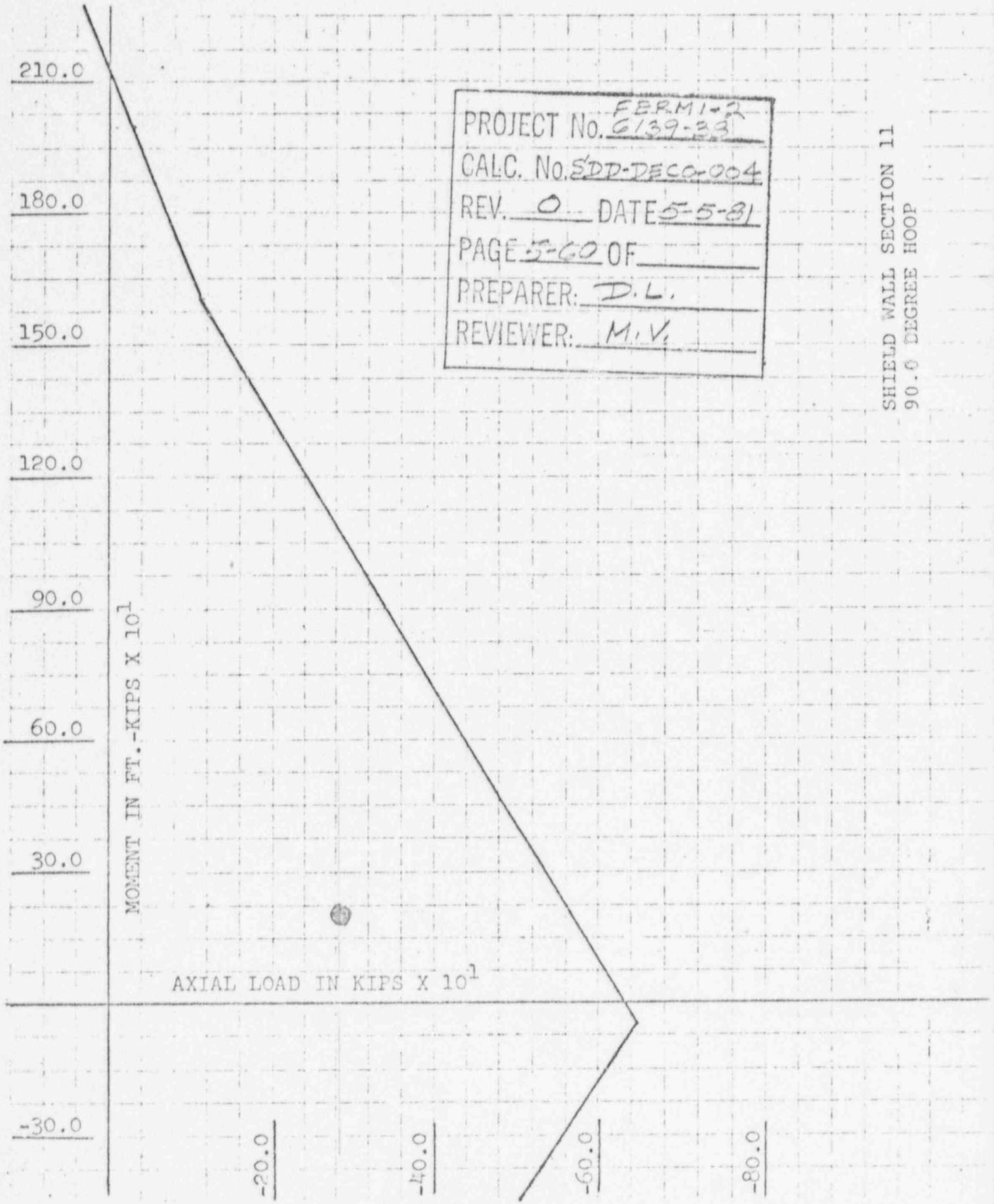
ENGINEERS
CHICAGO

PROJECT No. FERMI-2 6139-331
CALC. No. SDD-DECO-004
REV. 0 DATE 5-5-81
PAGE 5-60 OF
PREPARER: D.L.
REVIEWER: M.V.

SHIELD WALL SECTION 11
90.0 DEGREE HOOP



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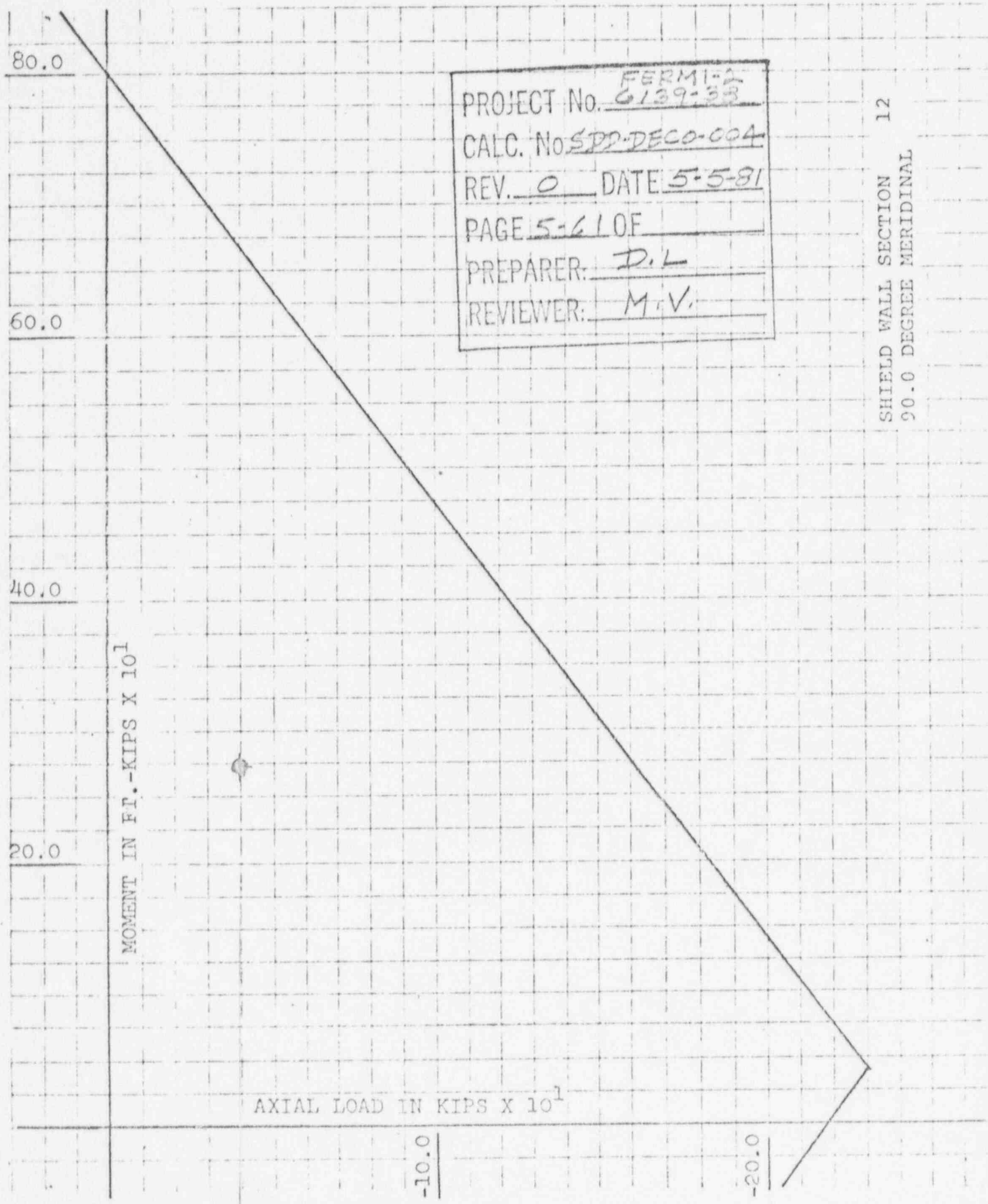
CHICAGO

PROJECT No. FERMI-2 6139-33
CALC. No. SDD-DECO-004
REV. 0 DATE 5-5-81
PAGE 5-61 OF
PREPARER: D.L
REVIEWER: M.V.



SHIELD WALL SECTION 12
90.0 DEGREE MERIDINAL

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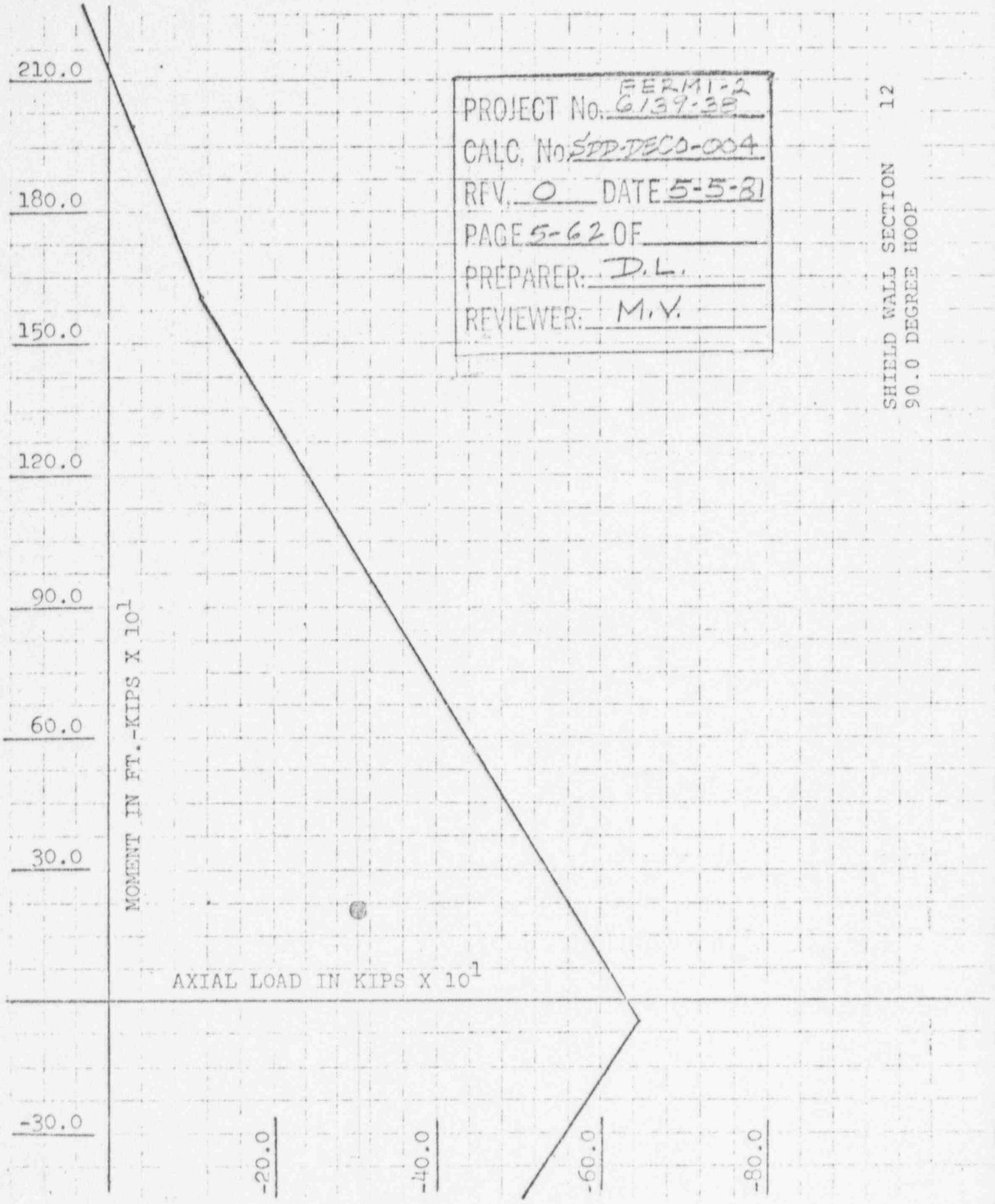
ENGINEERS
CHICAGO

PROJECT No: FERMI-2 6139-38
CALC. No: SDD-DECO-004
REV. 0 DATE 5-5-81
PAGE 5-62 OF
PREPARER: D.L.
REVIEWER: M.Y.

SHIELD WALL SECTION 12
90.0 DEGREE HOOP



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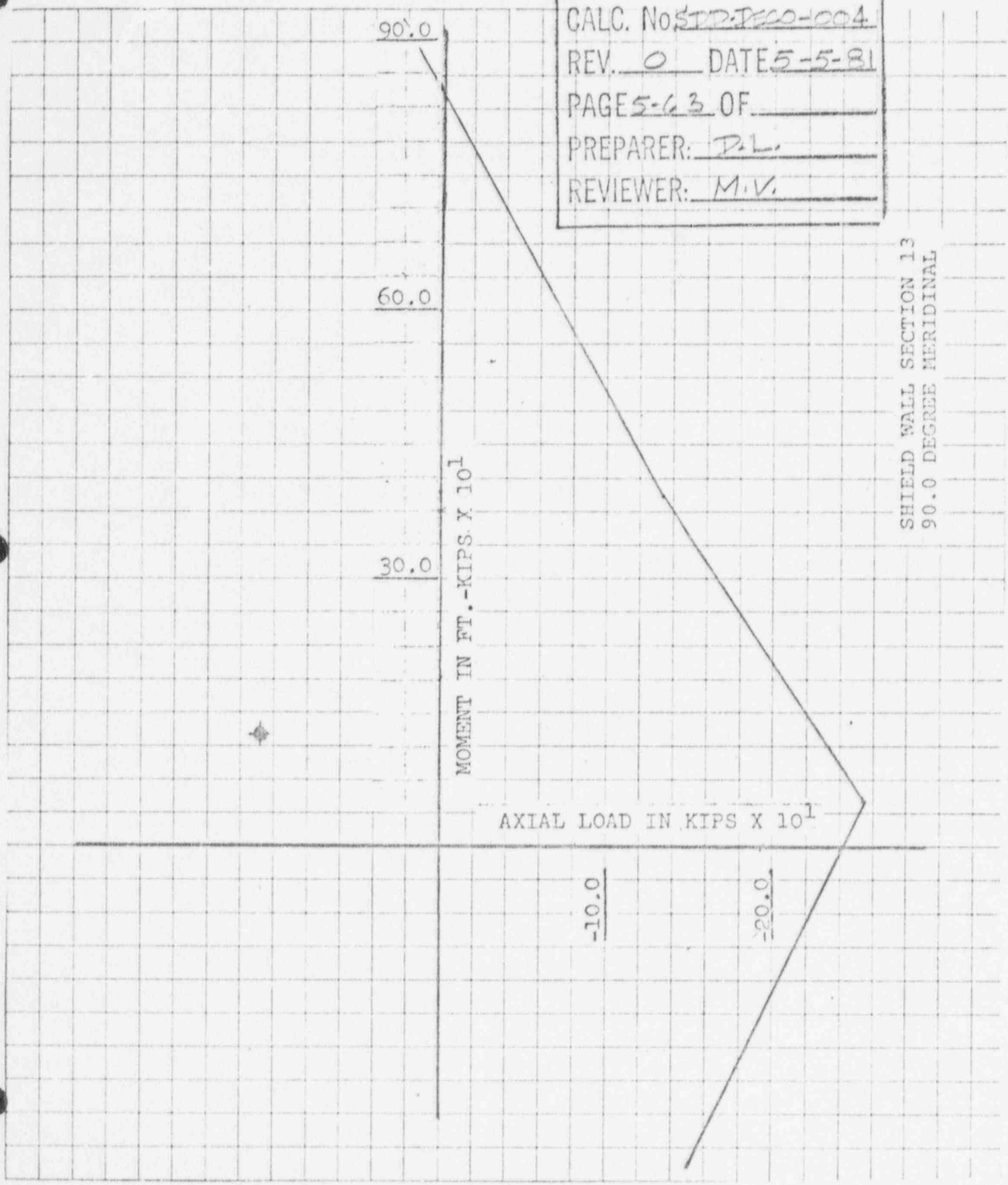
PROJECT No. FERMI-2 6139-39
CALC. No. SID-DEC0-004
REV. 0 DATE 5-5-81
PAGE 5-63 OF
PREPARER: D.L.
REVIEWER: M.V.



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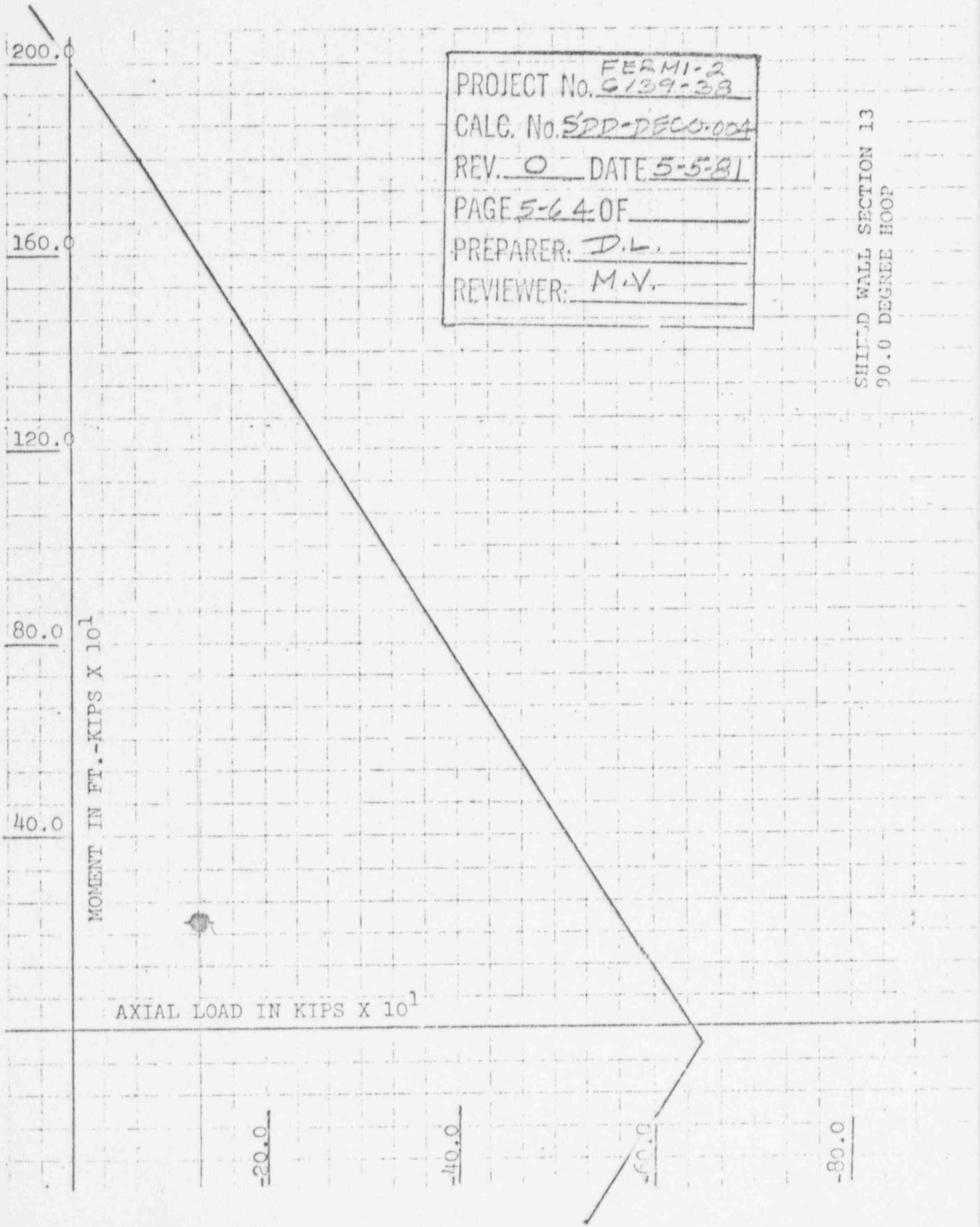
ENGINEERS
CHICAGO

PROJECT No. FERMI-2 6139-38
CALC. No. SDD-DECO-004
REV. 0 DATE 5-5-81
PAGE 5-64 OF
PREPARER: D.L.
REVIEWER: M.V.



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ENGINEERS
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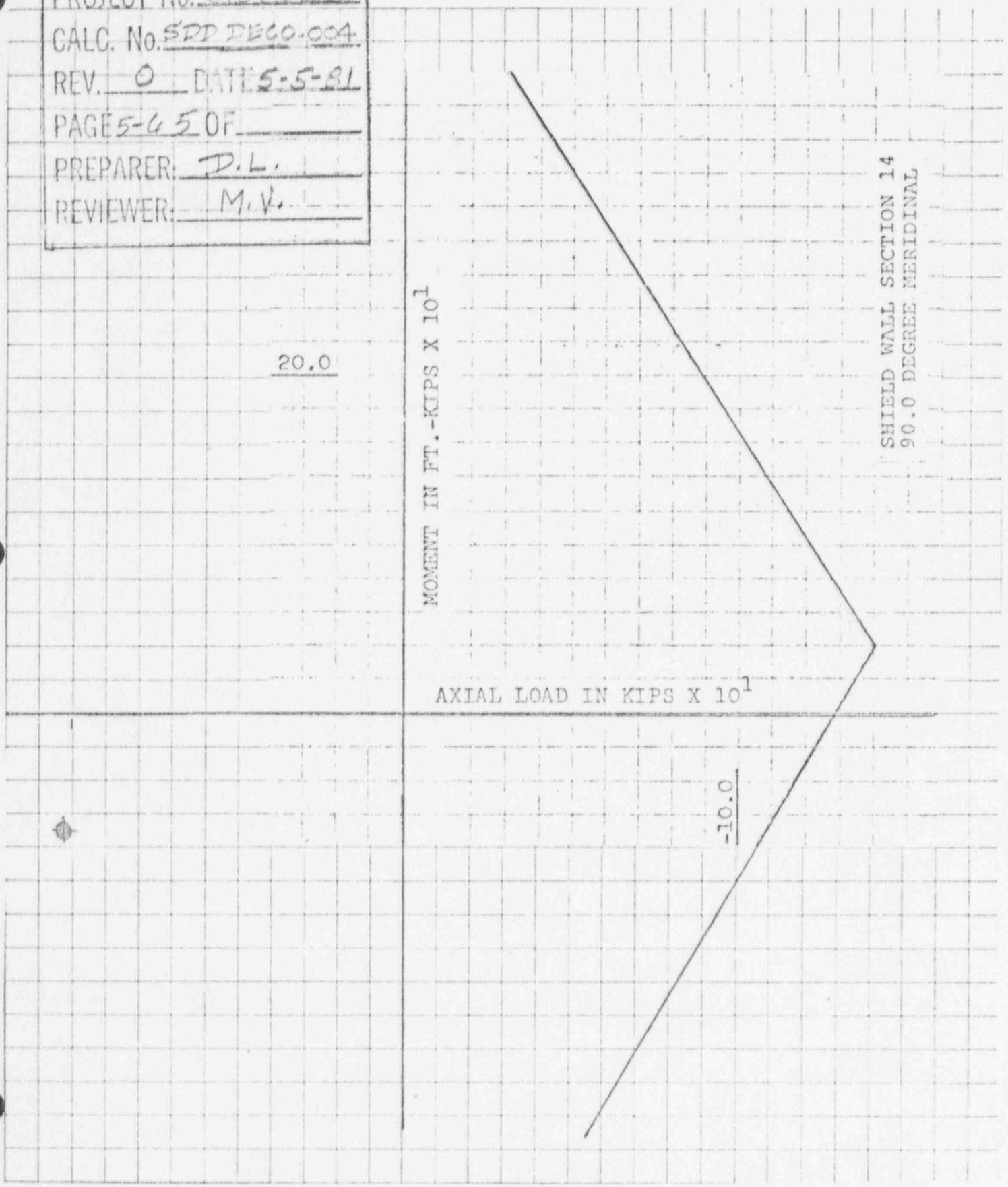
PROJECT No. FERMI-2 6139-38
CALC. No. SDD DECO-004
REV. 0 DATE 5-5-81
PAGE 5-45 OF
PREPARER: D.L.
REVIEWER: M.V.



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ENGINEERS
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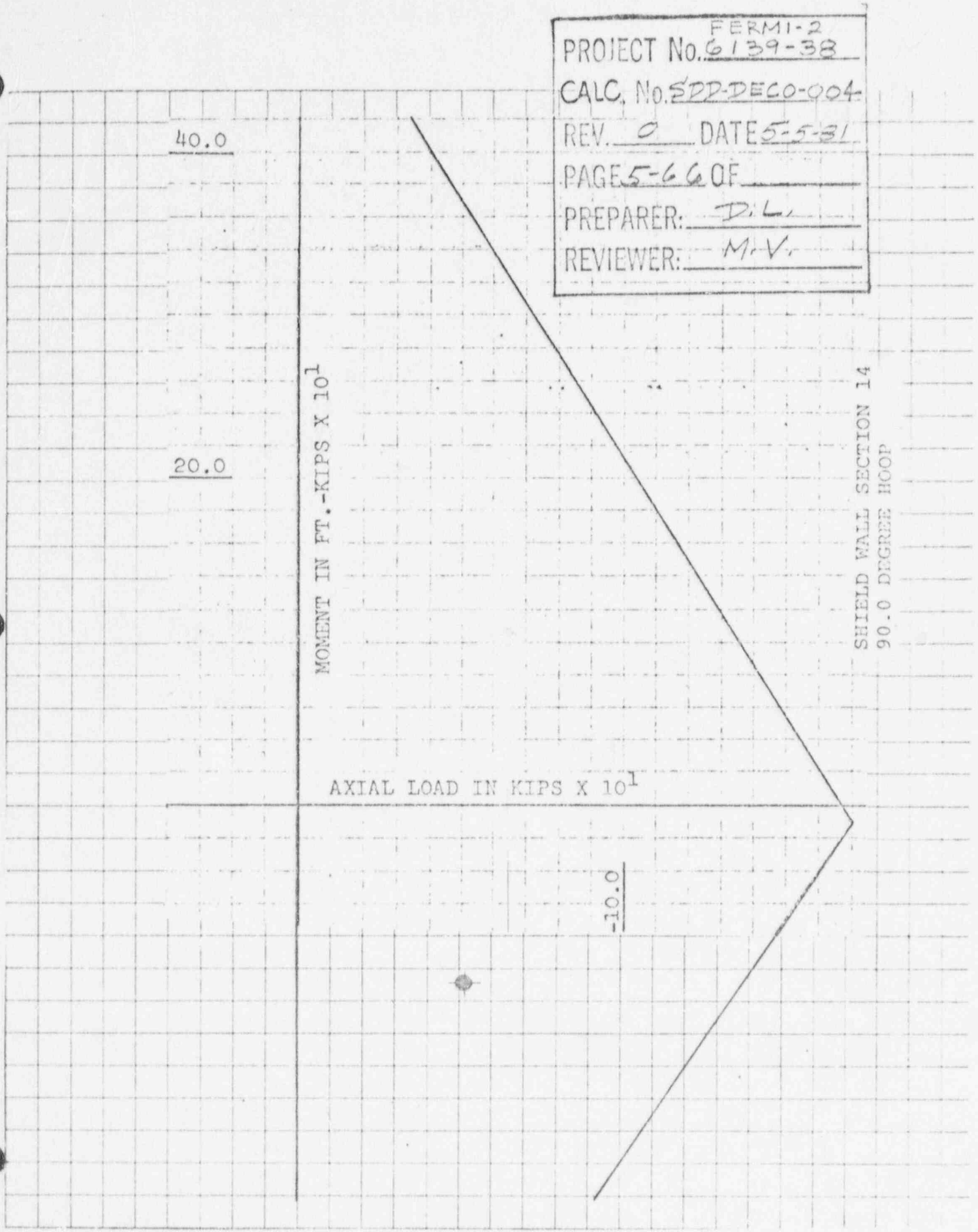
PROJECT No. FERMI-2 6139-38
CALC. No. SDD-DECO-004
REV. 0 DATE 5-5-81
PAGE 5-66 OF
PREPARER: D.L.
REVIEWER: M.V.



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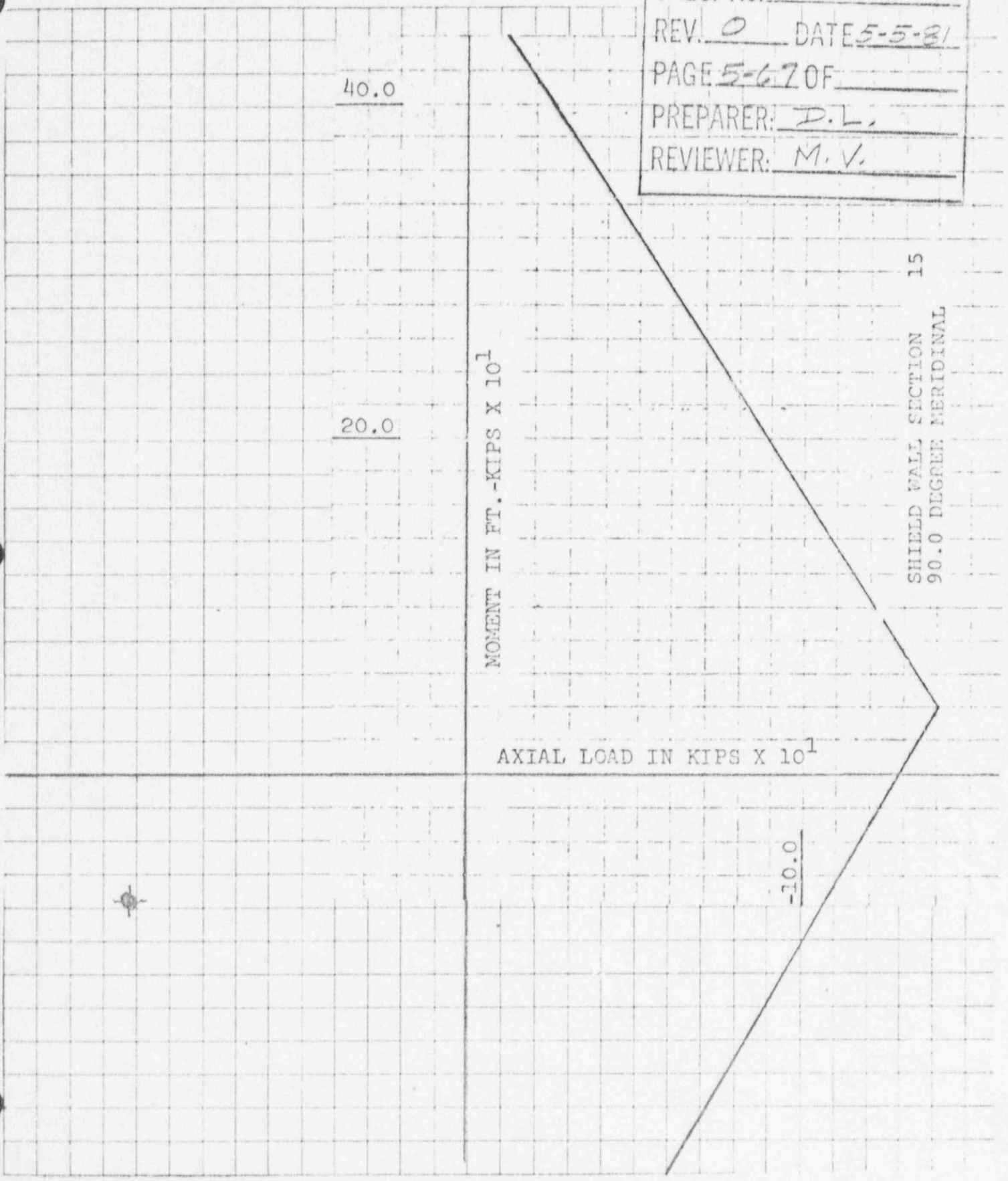
PROJECT No. FERMI-2 6139-38
CALC. No. SDD-DECO-004
REV. 0 DATE 5-5-81
PAGE 5-67 OF
PREPARER: D.L.
REVIEWER: M.V.



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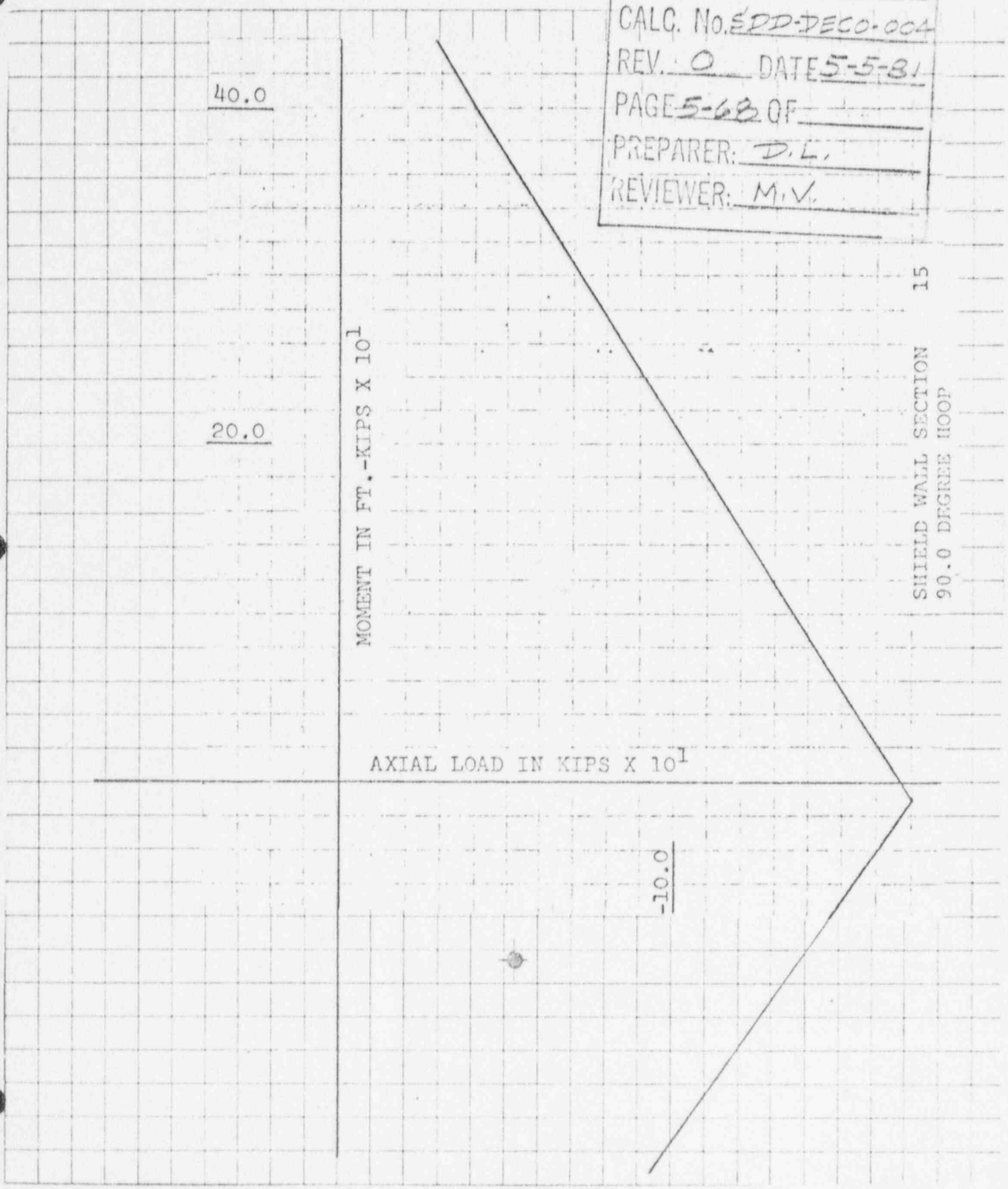
ENGINEERS
CHICAGO

PROJECT No. FERMI-2 6139-39
CALC. No. EDD-DECO-004
REV. 0 DATE 5-5-81
PAGE 5-68 OF
PREPARER: D.L.
REVIEWER: M.V.



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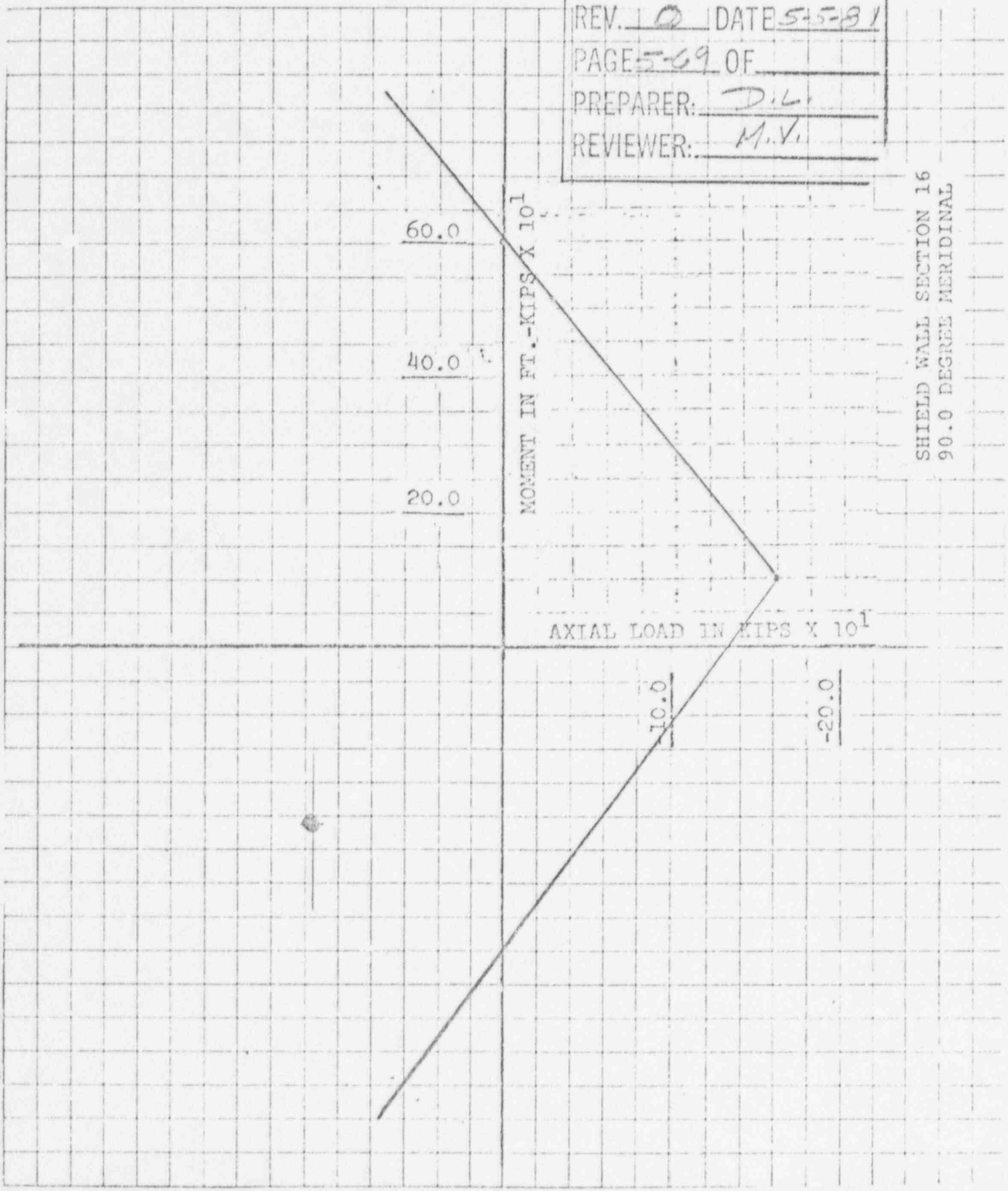
PROJECT No. FERMI-2 6139-38
CALC. No. SDD-DECO-004
REV. 0 DATE 5-5-81
PAGE 5-69 OF
PREPARER: D.L.
REVIEWER: M.V.



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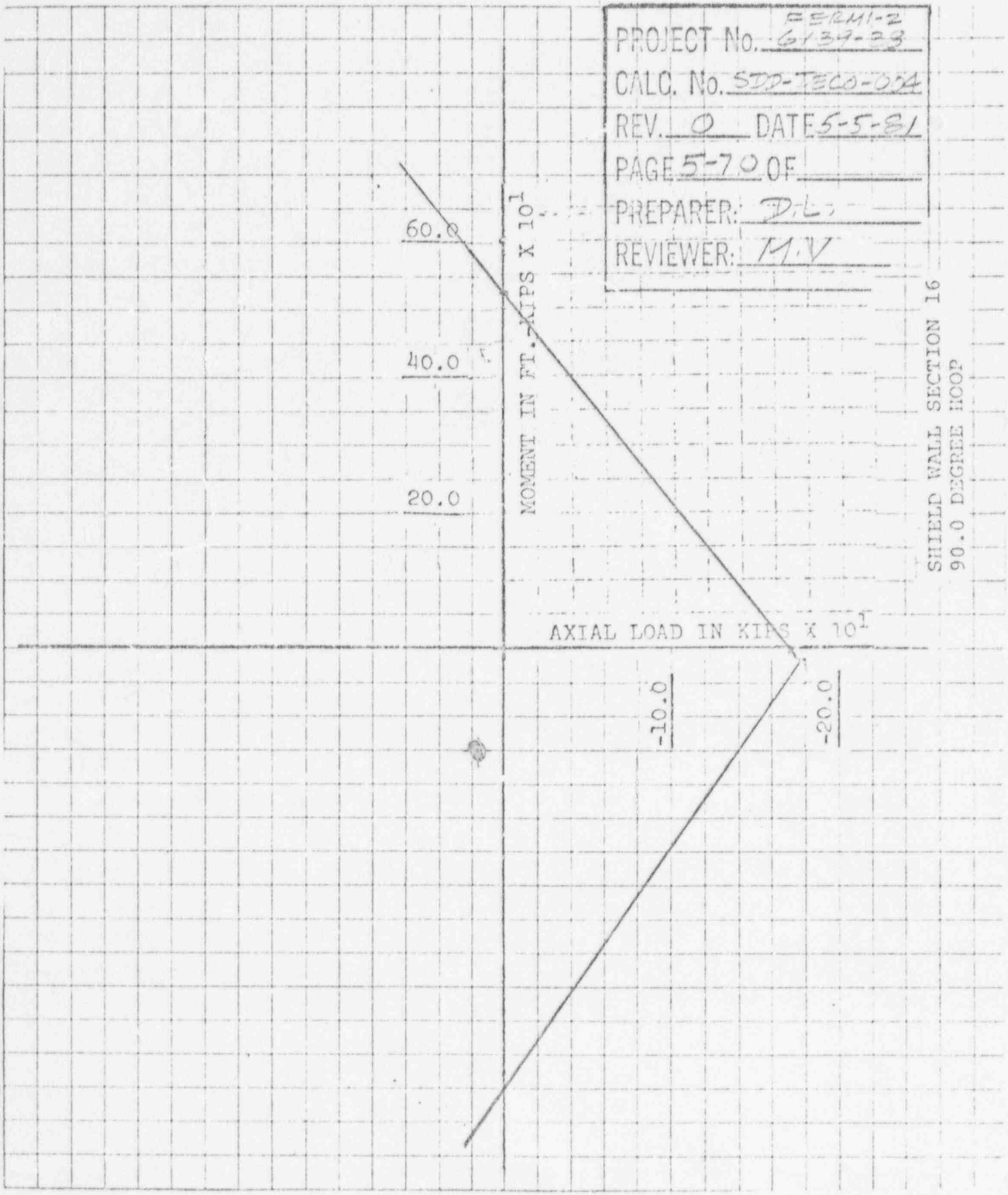
CHICAGO

PROJECT No. SESM1-2 6134-23
CALC. No. SID-IECO-004
REV. 0 DATE 5-5-81
PAGE 5-70 OF
PREPARER: D.L.
REVIEWER: M.V



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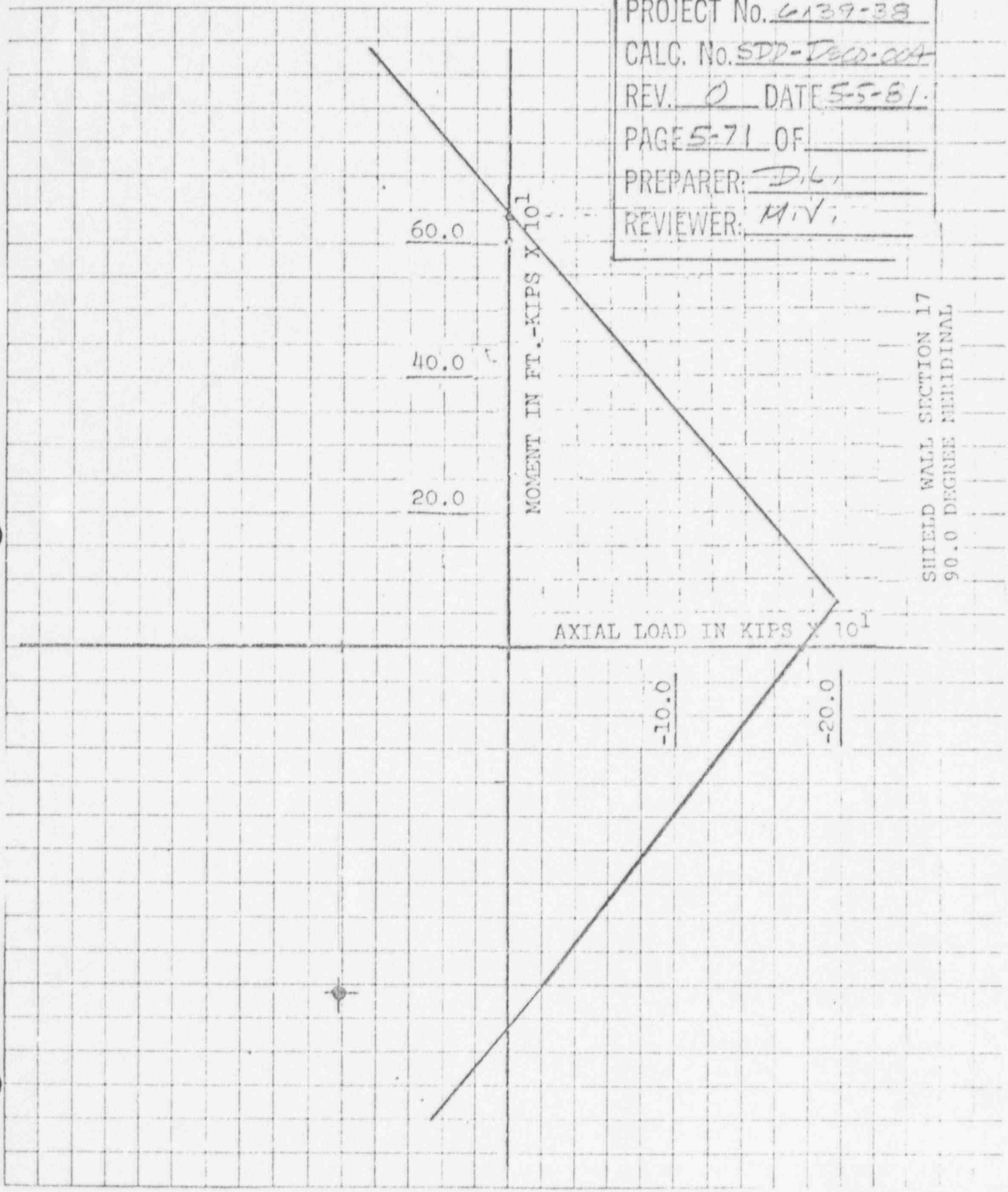
PROJECT No. 6139-38 FERM-2
CALC. No. SDP-Decd-004
REV. 0 DATE 5-5-81
PAGE 5-71 OF
PREPARER: D.L.
REVIEWER: M.V.



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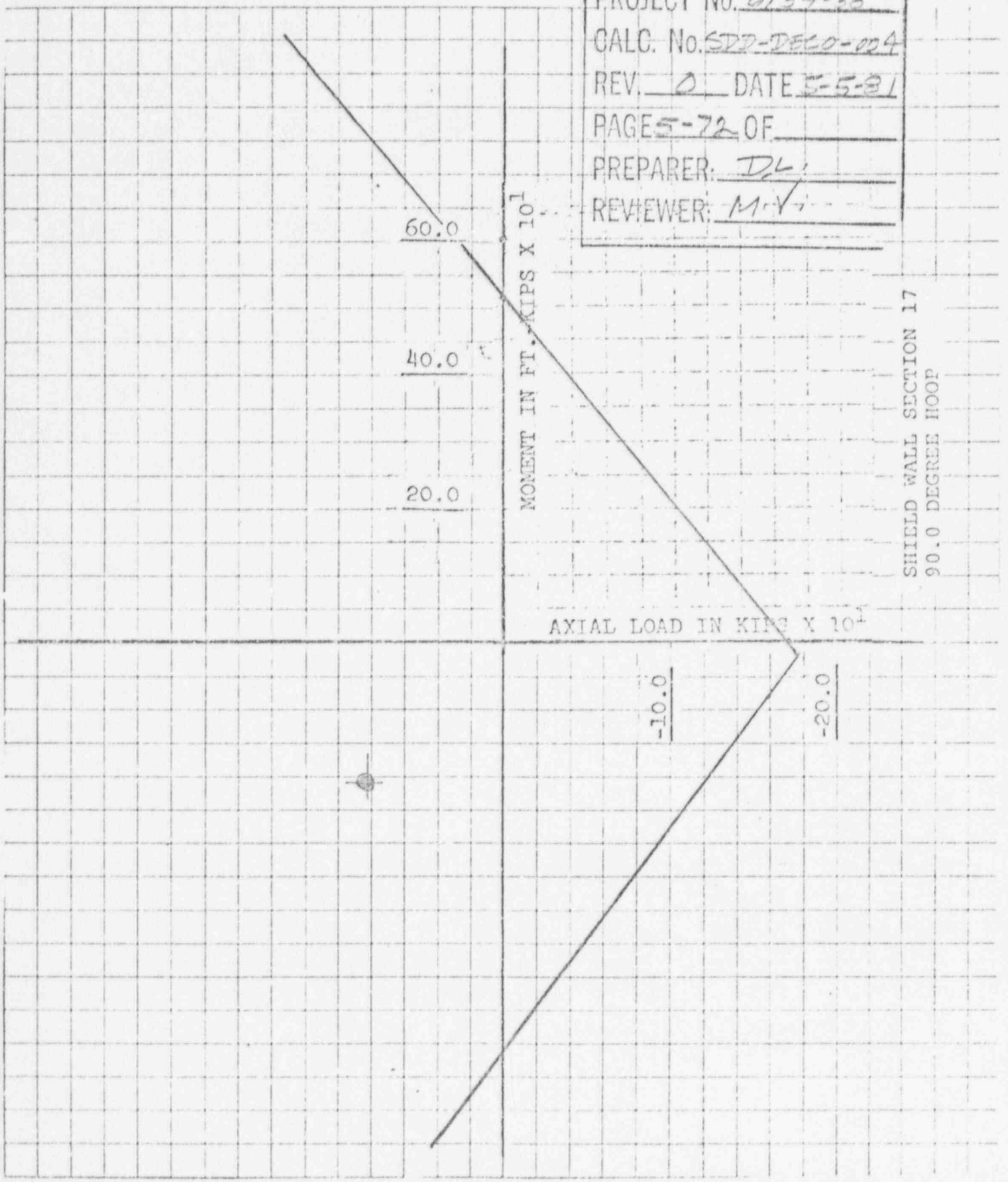
PROJECT No. FERMI-2 6139-38
CALC. No. SDD-DELO-024
REV. 0 DATE 5-5-91
PAGE 5-72 OF
PREPARER: DL
REVIEWER: M.V.



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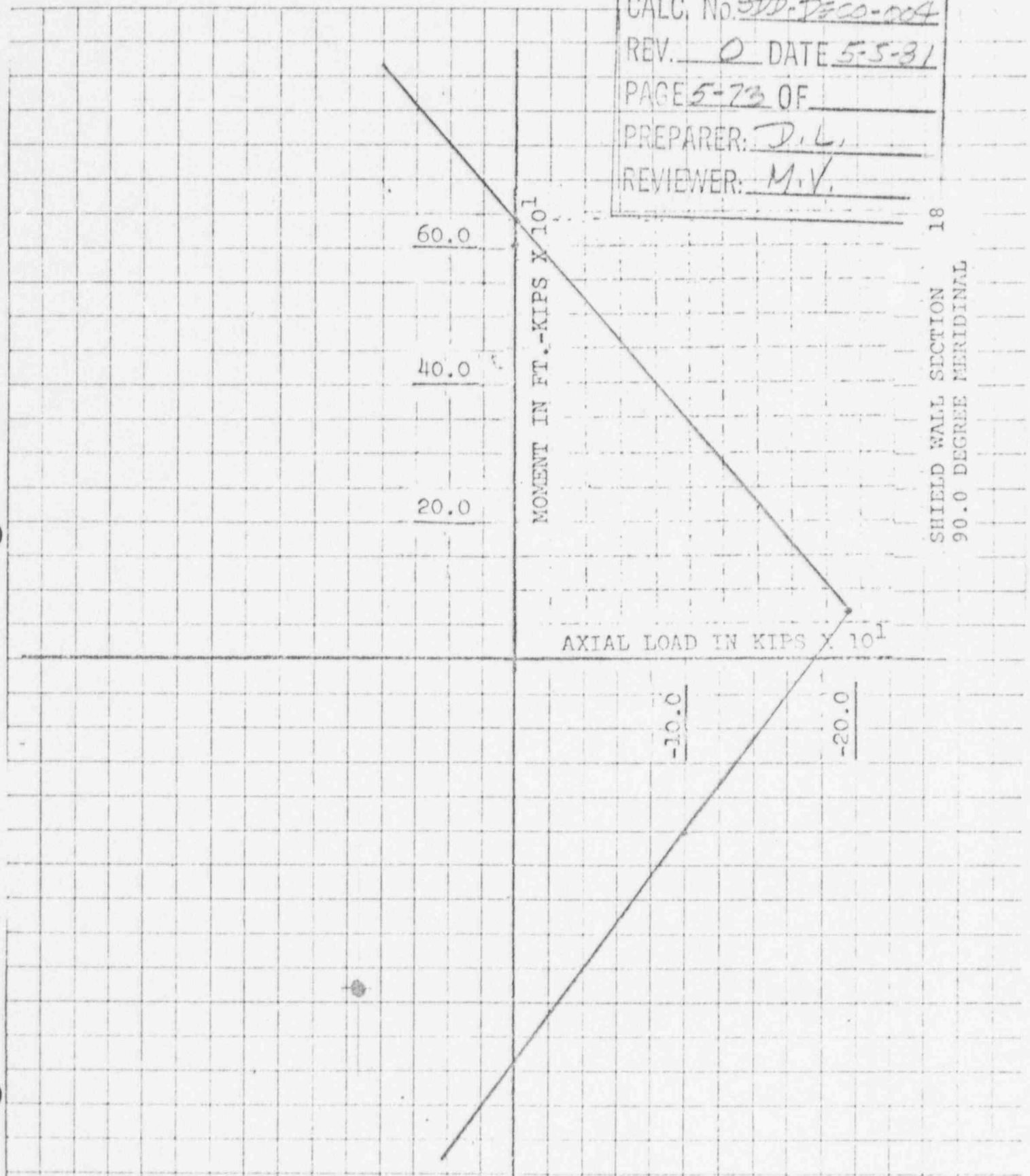
PROJECT No. FERM-1 6139-33
CALC. No. SDD-DFCO-004
REV. 0 DATE 5-5-31
PAGE 5-73 OF
PREPARER: D.L.
REVIEWER: M.V.



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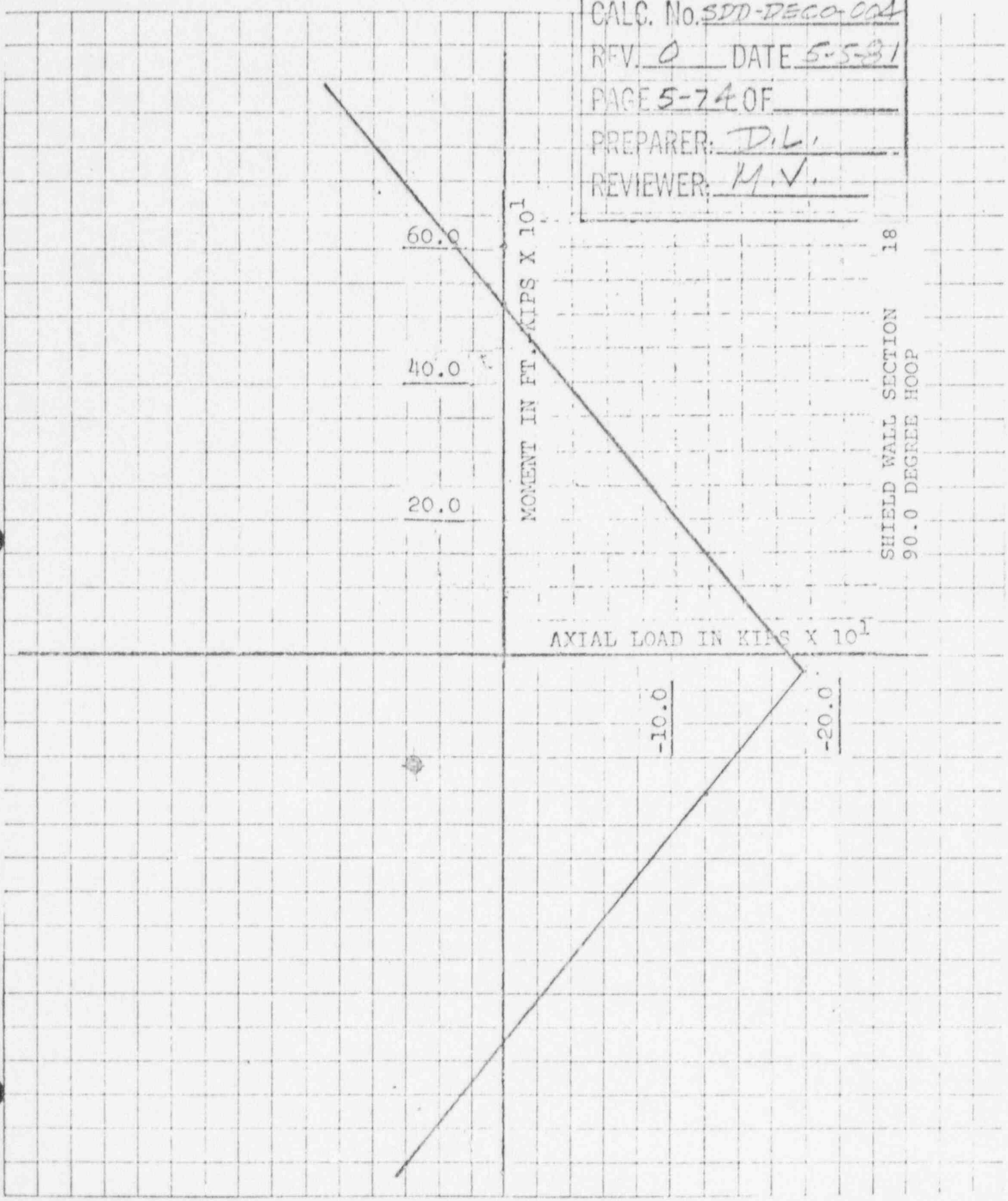
ENGINEERS
CHICAGO

FORM-2

PROJECT No. 6139-38
CALC. No. SDD-DEGO-004
REV. 0 DATE 5-5-81
PAGE 5-74 OF
PREPARER: D.L.
REVIEWER: M.V.



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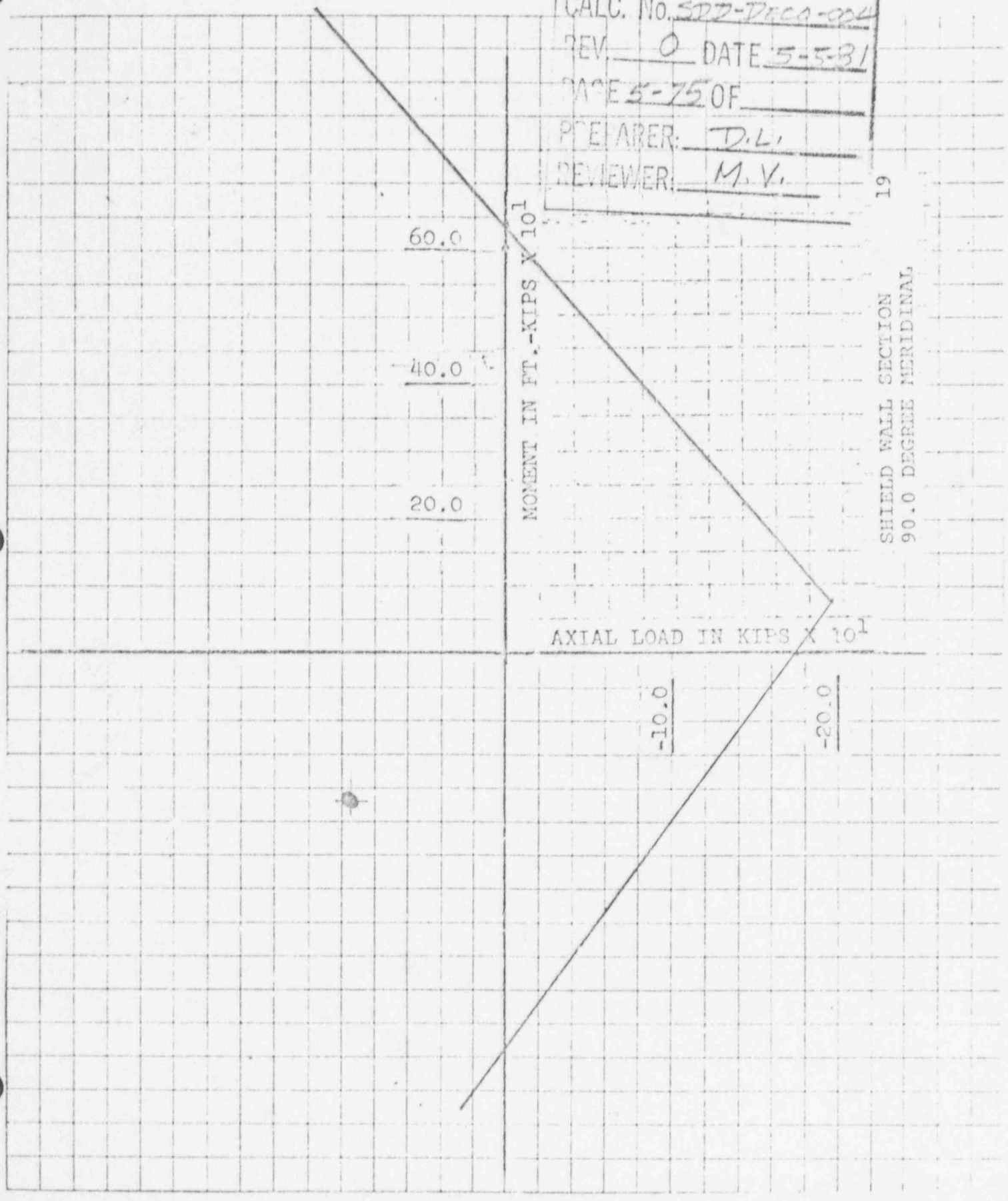
PROJECT No. FERMI-2 6139-33
CALC. No. SDD-DEC1-024
REV. 0 DATE 5-5-81
SHEET 5-75 OF
PREPARER: D.L.
REVIEWER: M.V.



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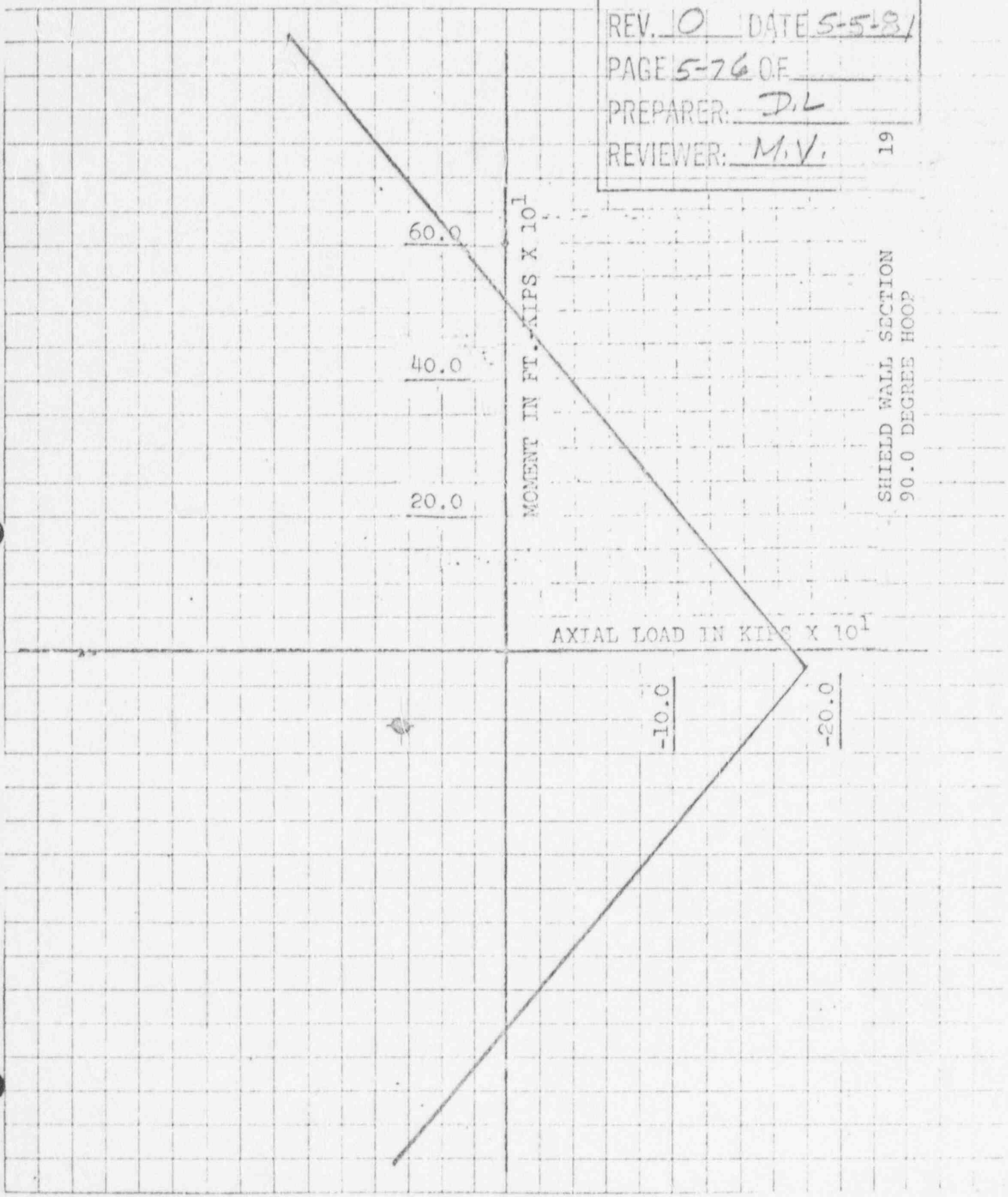
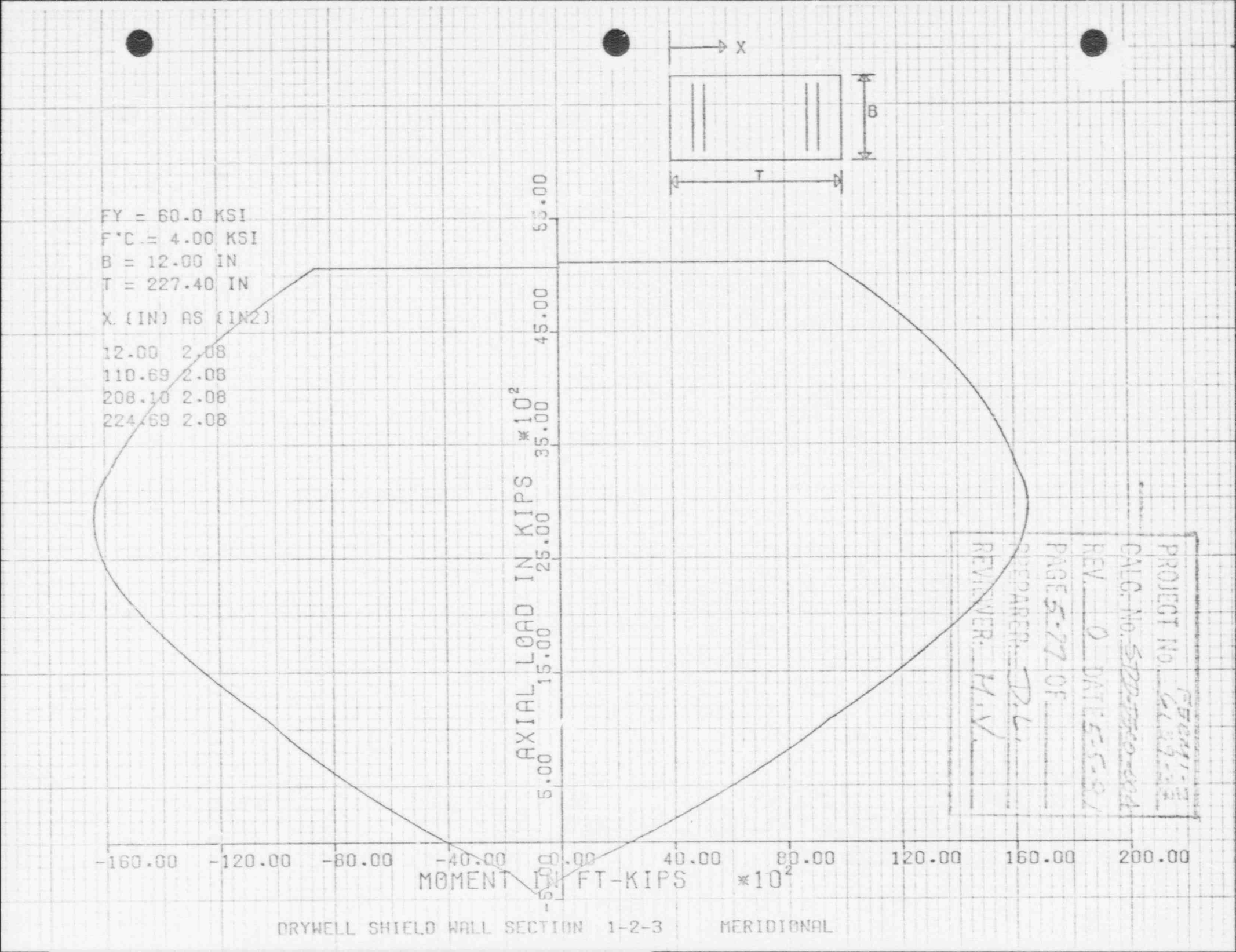
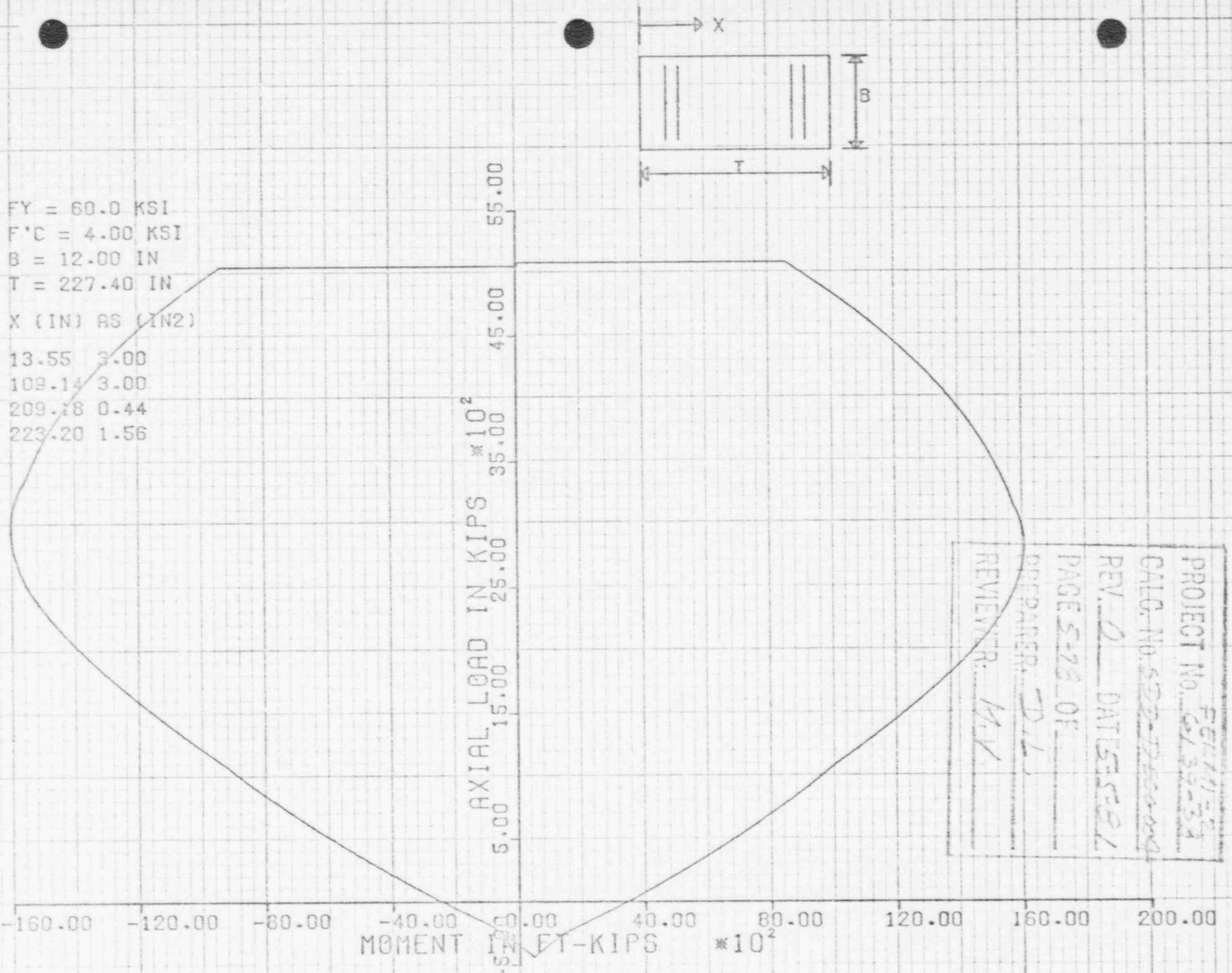
ENGINEERS
CHICAGO

PROJECT No. FERMI-2 6139-39
CALC. No. SDD-DEC0-014
REV. 0 DATE 5-5-81
PAGE 5-26 OF
PREPARER: D.L
REVIEWER: M.V.





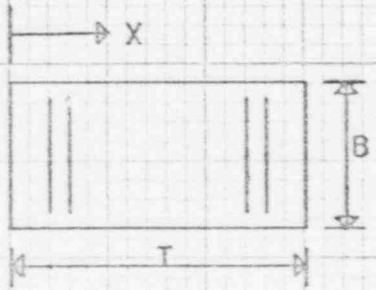
DRYWELL SHIELD WALL SECTION 1-2-3 MERIDIONAL



DRYWELL SHIELD WALL SECTION 1-2-3 HOOP

FY = 60.0 KSI
F'C = 4.00 KSI
B = 12.00 IN
T = 167.76 IN

X (IN)	AS (IN2)
2.70	1.39
5.80	1.39
148.46	2.08
165.05	2.08

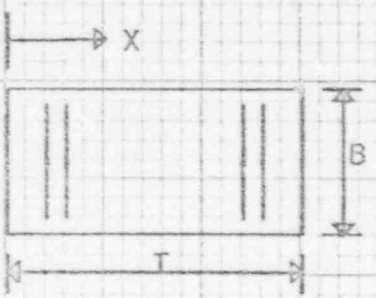


PROJECT NO. [illegible]
CALC. NO. [illegible]
REV. 0 DATE 5-6-91
PAGE 5-71 OF
PREPARER: PL
REVIEWER: MV

DRYWELL SHIELD WALL SECTION 4 MERIDIONAL

FY = 60.0 KSI
F'C = 4.00 KSI
B = 12.00 IN
T = 167.76 IN

X (IN)	AS (IN2)
4.25	3.00
7.35	3.00
149.54	0.44
163.64	1.56

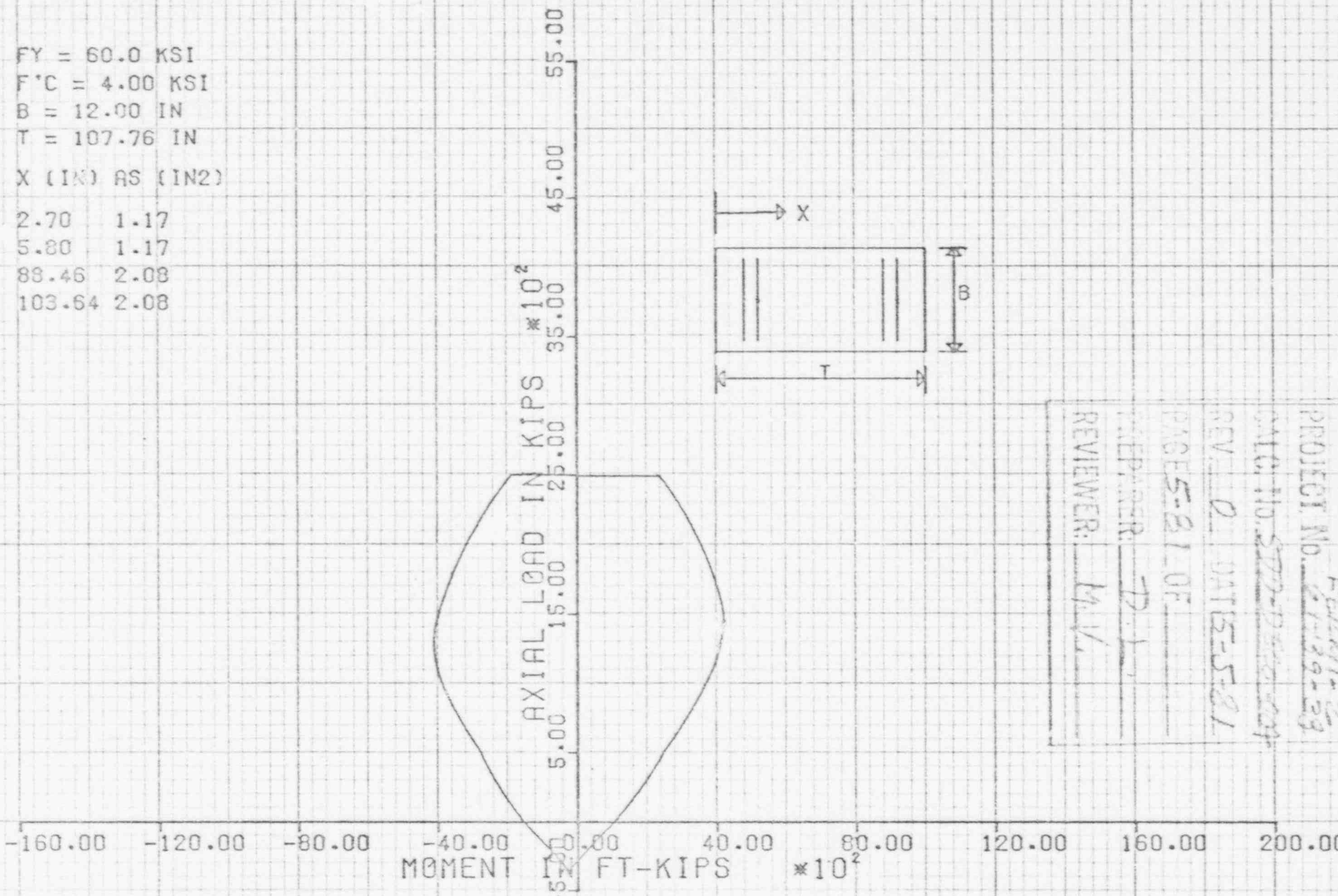


DRYWELL SHIELD WALL SECTION 4 HOOP

PROJECT No. 4132.32
REV 0 DATE 5-5-92
PAGE 55 OF
PREPARER: DVA
REVIEWER:

FY = 60.0 KSI
F'C = 4.00 KSI
B = 12.00 IN
T = 107.76 IN

X (IN)	AS (IN2)
2.70	1.17
5.80	1.17
88.46	2.08
103.64	2.08

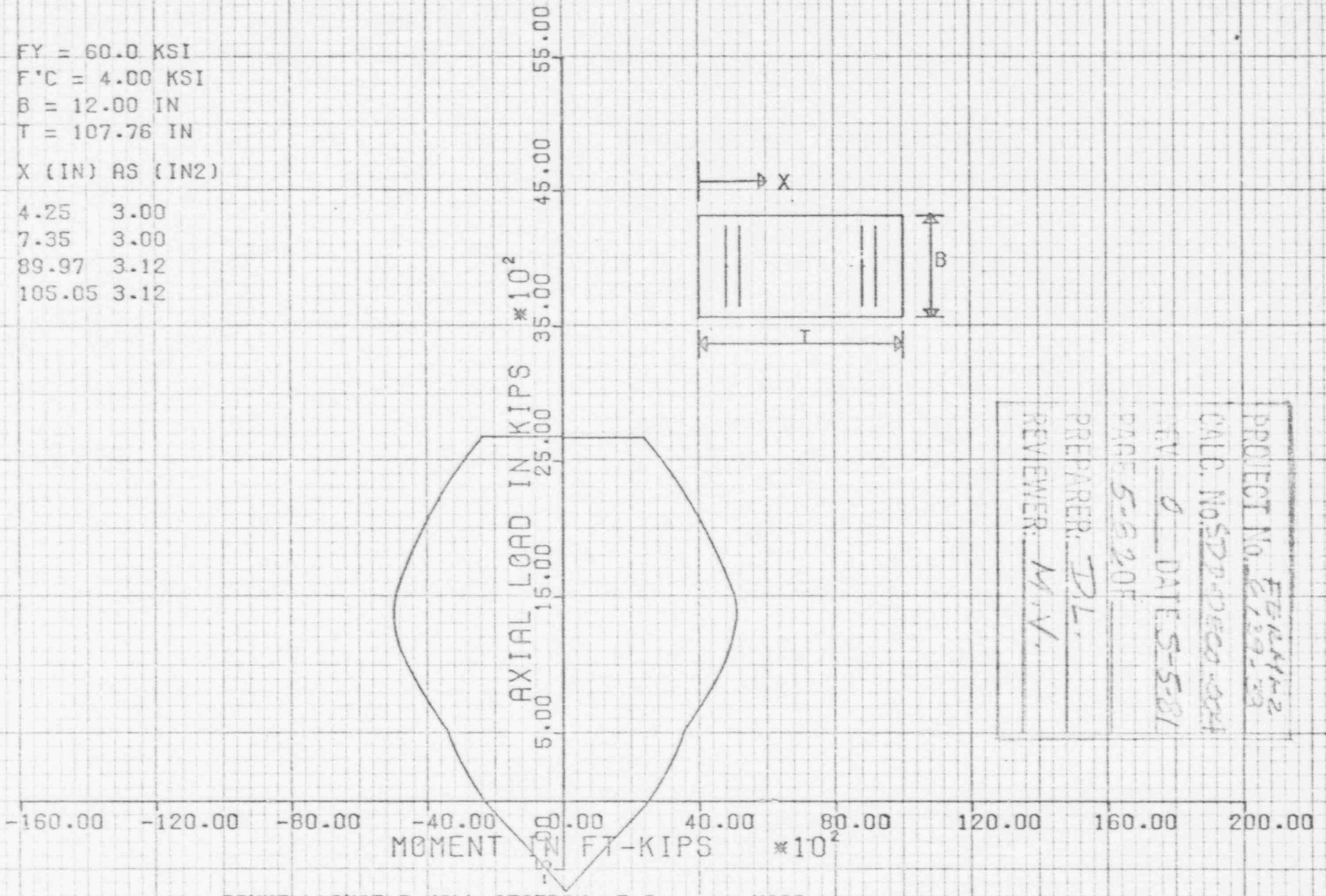


DRYWELL SHIELD WALL SECTION 5-6 MERIDIONAL

PROJECT No. FERMI-2 21-129-23
CALC. No. ST2-D5C-004
REV. 0 DATE 5-5-81
PAGE 5-81 OF
PREPARER: D.L.
REVIEWER: M.V.

FY = 60.0 KSI
F'C = 4.00 KSI
B = 12.00 IN
T = 107.76 IN

X (IN)	AS (IN2)
4.25	3.00
7.35	3.00
89.97	3.12
105.05	3.12

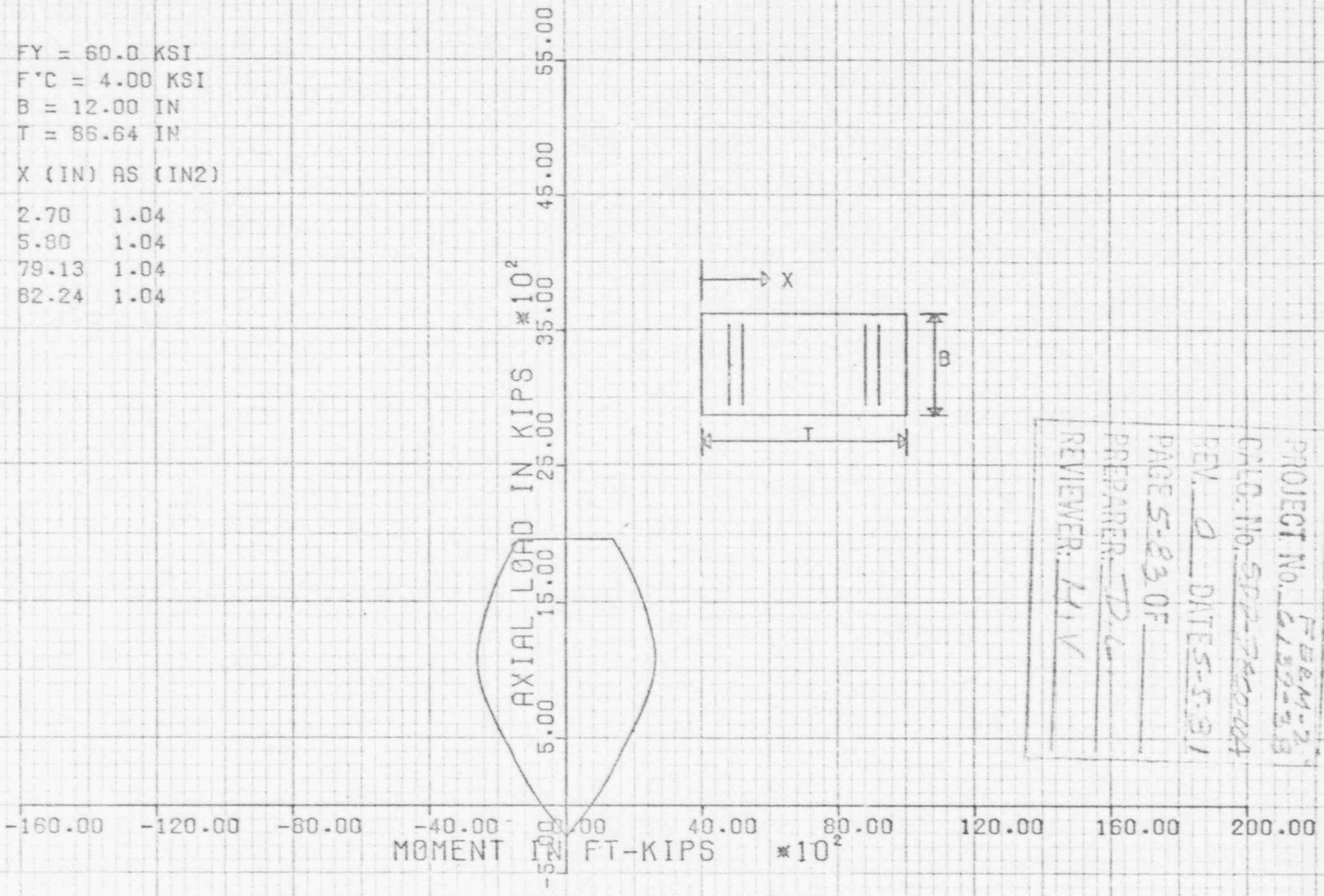


PROJECT No. EC-NNPP-2
CALC. No. SD-DRSW-0004
REV. 0 DATE 5-5-81
PAGE 5-62 OF
PREPARER: DL.
REVIEWER: M.V.

DRYWELL SHIELD WALL SECTION 5-6 HOOP

FY = 60.0 KSI
F'C = 4.00 KSI
B = 12.00 IN
T = 86.64 IN

X (IN)	AS (IN2)
2.70	1.04
5.80	1.04
79.13	1.04
82.24	1.04

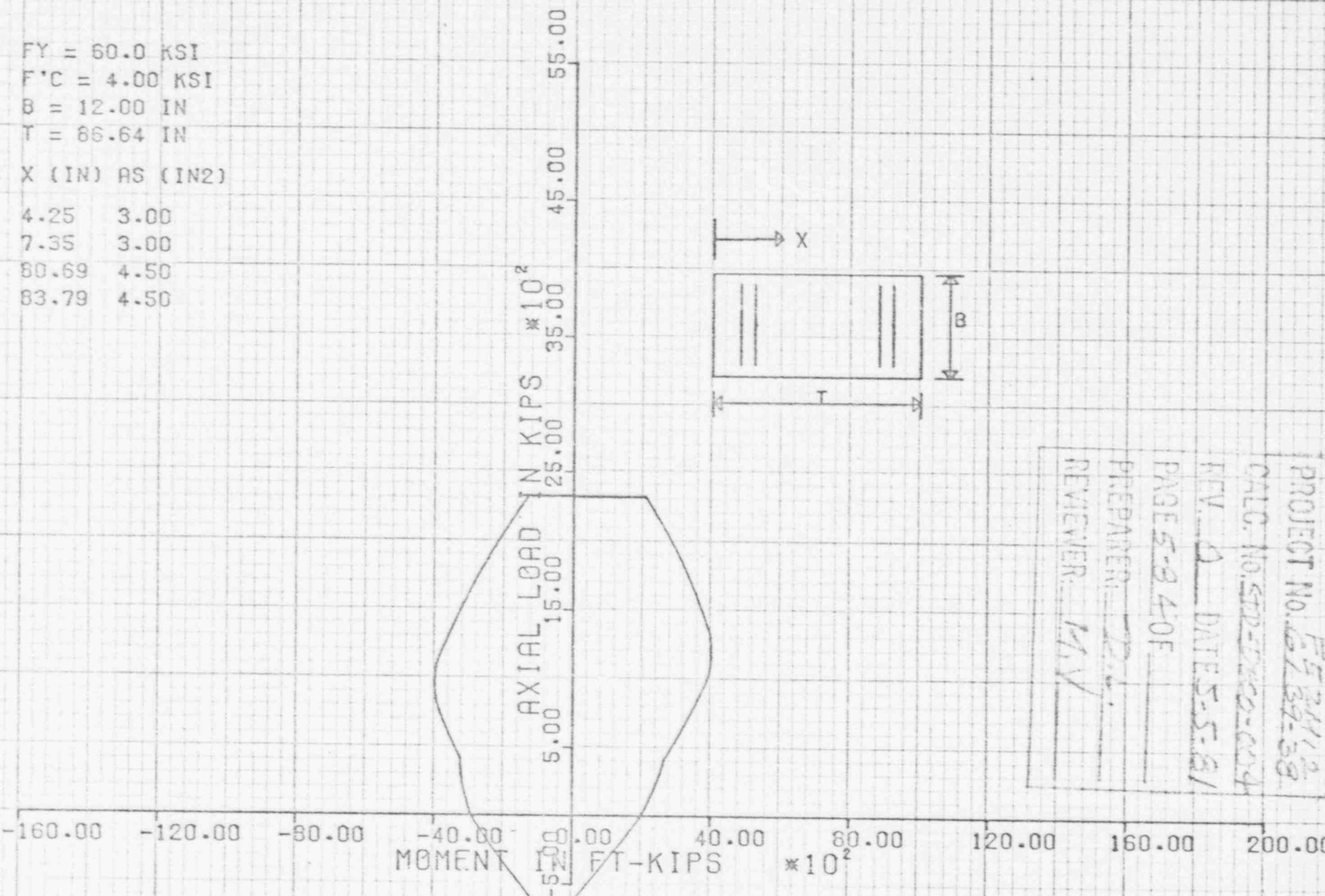


PROJECT NO. [illegible]
CALC. NO. [illegible]
REV. 0 DATE 5-3-91
PAGE 5-23 OF
PREPARER: [illegible]
REVIEWER: [illegible]

DRYWELL SHIELD WALL SECTION 7 MERIDIONAL

FY = 60.0 KSI
F'C = 4.00 KSI
B = 12.00 IN
T = 86.64 IN

X (IN)	AS (IN2)
4.25	3.00
7.35	3.00
80.69	4.50
83.79	4.50

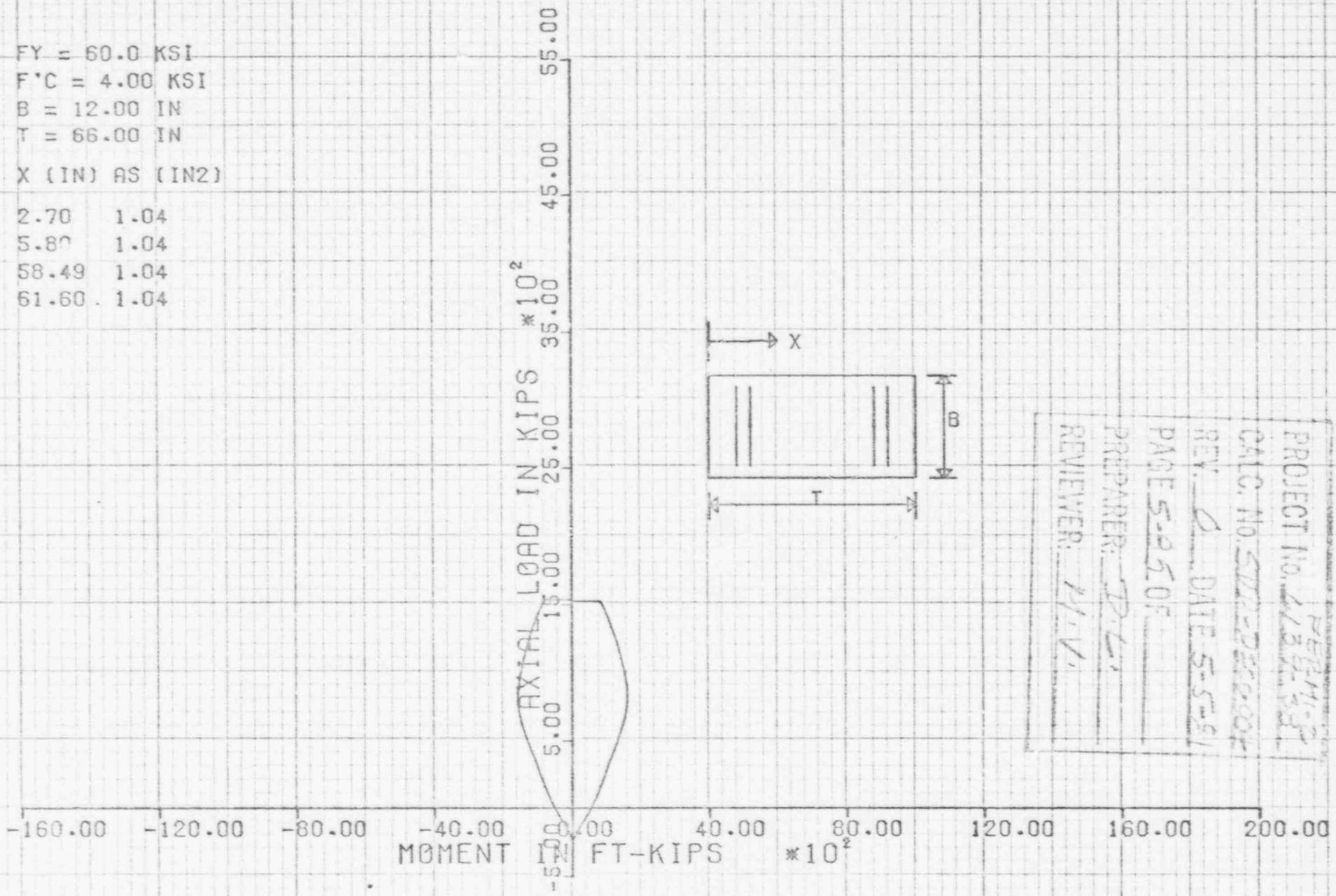


DRYWELL SHIELD WALL SECTION 7 HOOP

PROJECT No. 5734-38
CALC. No. STP-DSCO-004
REV. 0 DATE 5-5-81
PAGE 5-84 OF
PREPARER: D.L.
REVIEWER: M.V.

FY = 60.0 KSI
F'C = 4.00 KSI
B = 12.00 IN
T = 66.00 IN

X (IN)	AS (IN2)
2.70	1.04
5.80	1.04
58.49	1.04
61.60	1.04

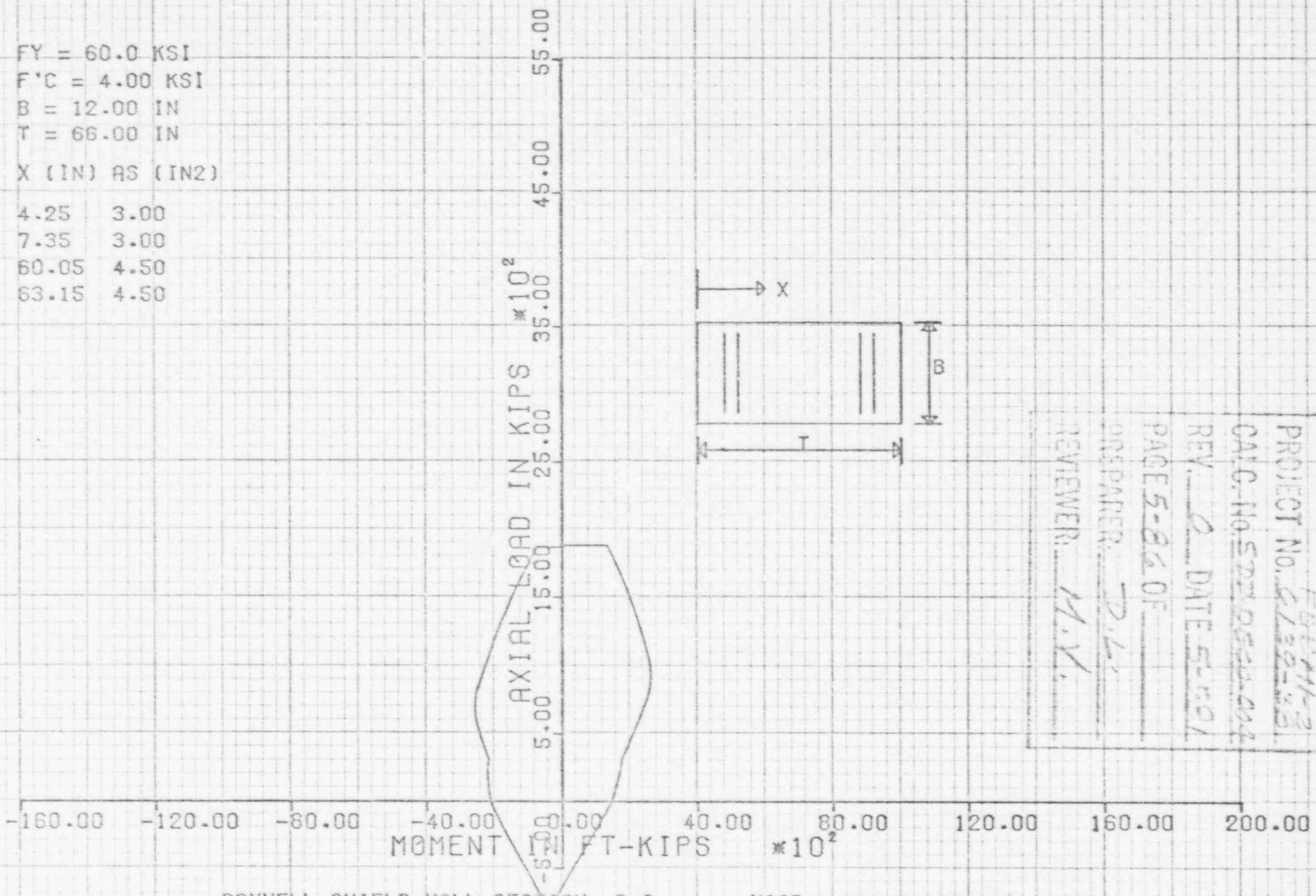


PROJECT NO. [illegible]
CALC. NO. [illegible]
REV. 0 DATE 5-5-91
PAGE 5-95 OF [illegible]
PREPARER: [illegible]
REVIEWER: [illegible]

DRYWELL SHIELD WALL SECTION 8-9 MERIDIONAL

FY = 60.0 KSI
F'C = 4.00 KSI
B = 12.00 IN
T = 66.00 IN

X (IN)	AS (IN2)
4.25	3.00
7.35	3.00
60.05	4.50
63.15	4.50

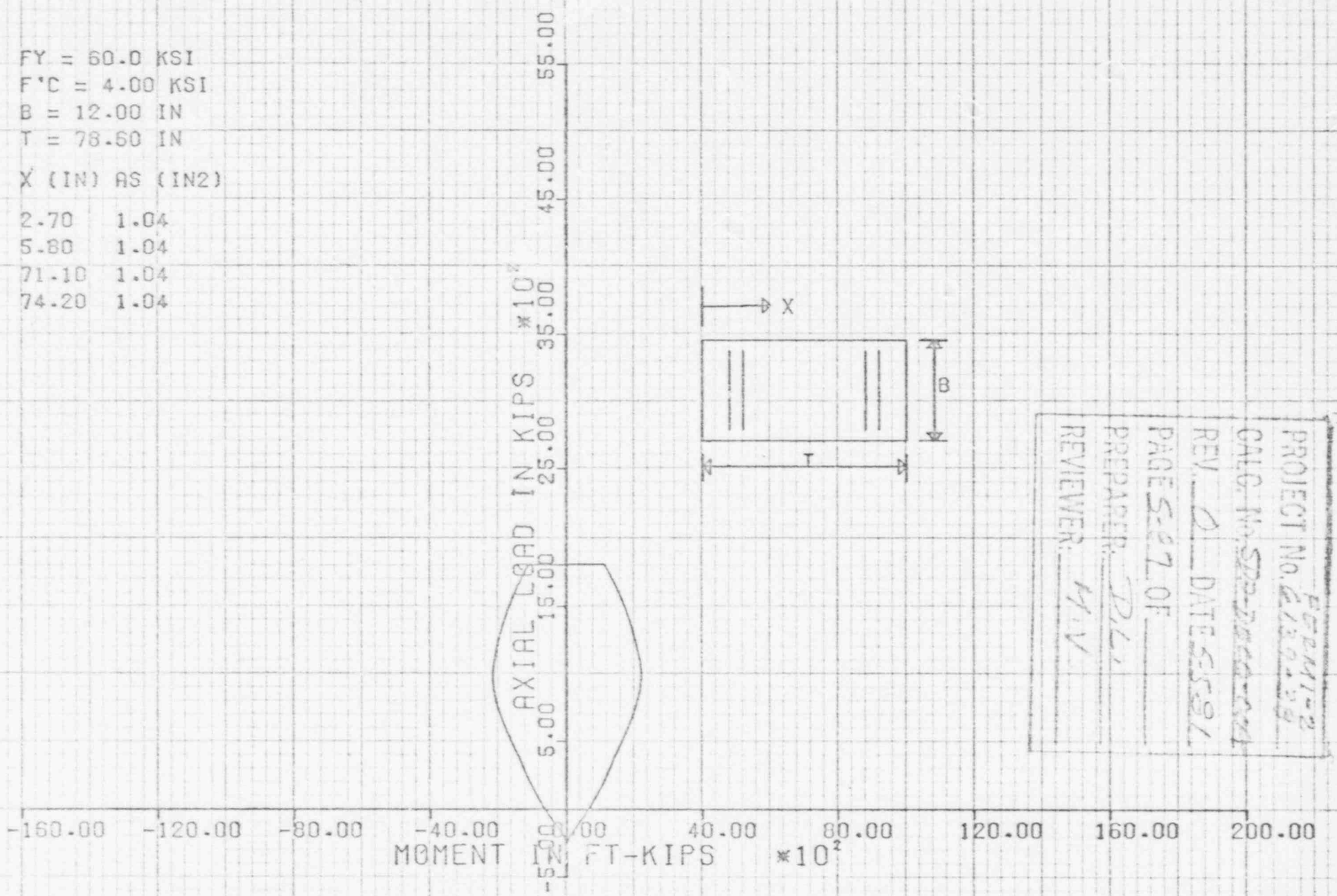


PROJECT No. [illegible]
CALC. No. [illegible]
REV. 2 DATE 5/89
PAGE 5-86 OF
PREPARER: D.L.
REVIEWER: M.Y.

DRYWELL SHIELD WALL SECTION 8-9 HOOP

FY = 60.0 KSI
F'C = 4.00 KSI
B = 12.00 IN
T = 78.60 IN

X (IN)	AS (IN2)
2.70	1.04
5.80	1.04
71.10	1.04
74.20	1.04



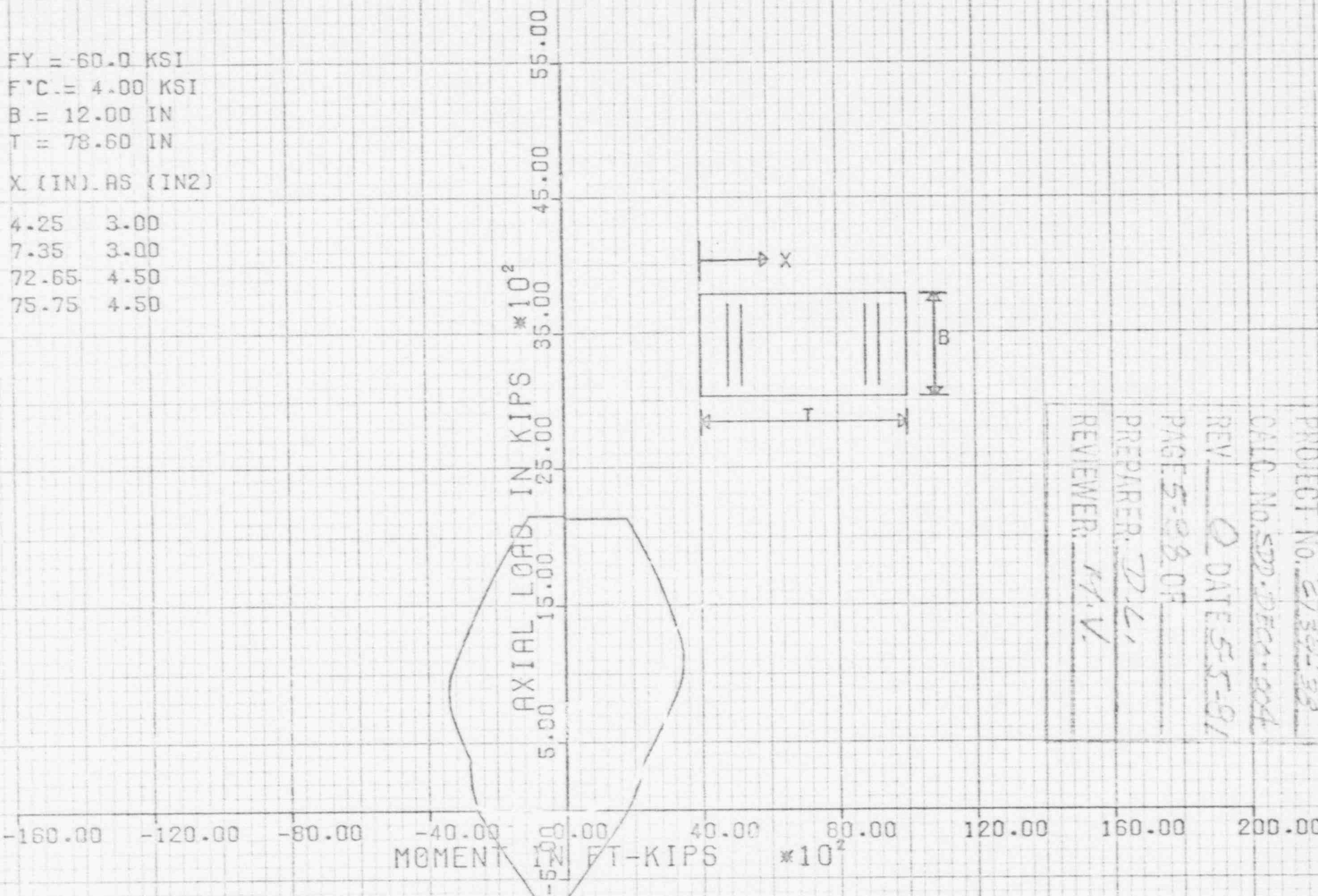
PROJECT No. EC-PMP-2
CALC. No. SDP-DW-SW-001
REV. 0 DATE 5/5/94
PAGE 5-27 OF
PREPARER: D.L.
REVIEWER: M.V.

DRYWELL SHIELD WALL SECTION 10 MERIDIONAL

PROJECT No. EEBH-33
CALC. No. SDD-DECC-004
REV 0 DATE 5-5-91
PAGE 5-88 OF
PREPARER: D.L.
REVIEWER: M.V.

FY = 60.0 KSI
F'C = 4.00 KSI
B = 12.00 IN
T = 78.60 IN

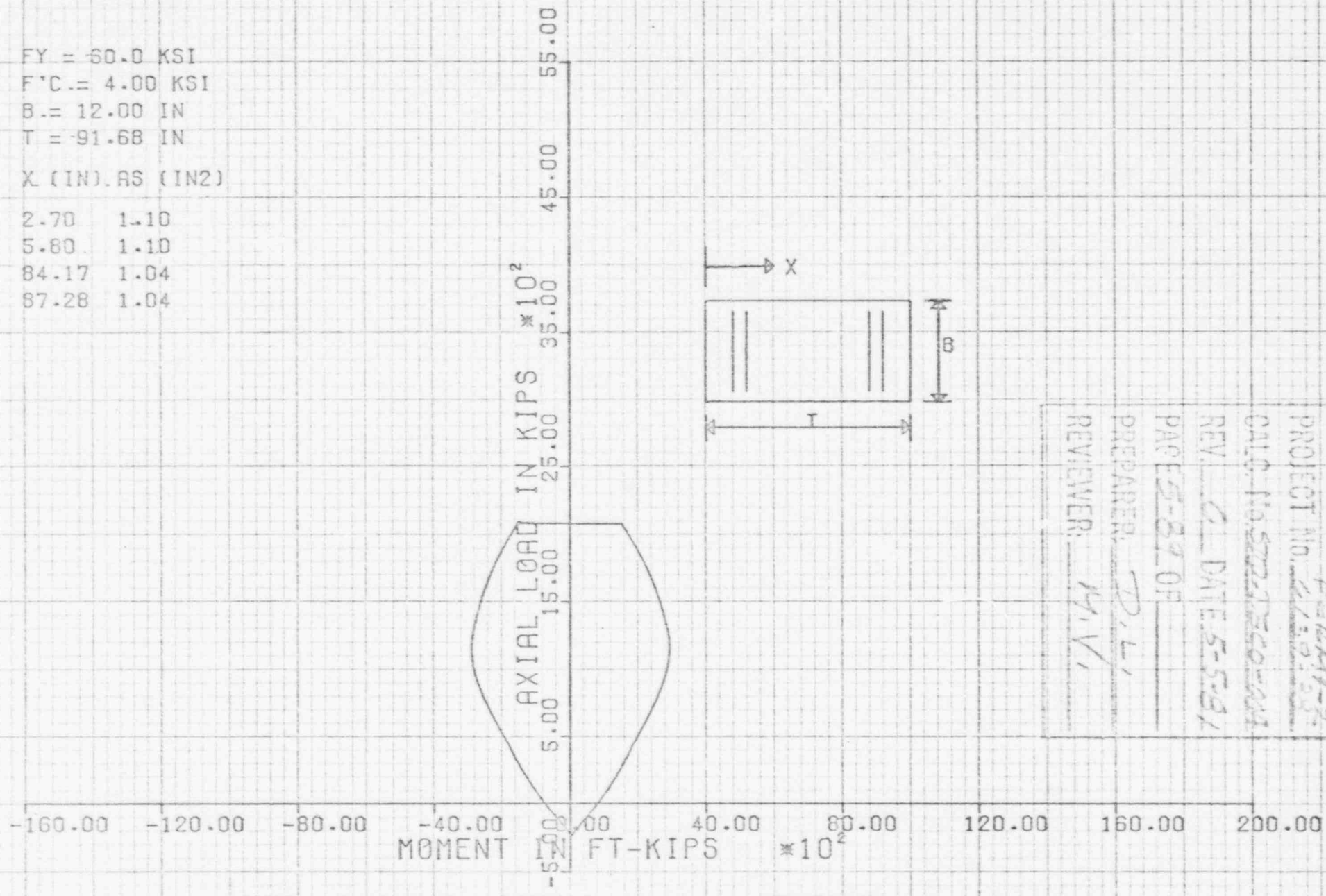
X (IN)	AS (IN2)
4.25	3.00
7.35	3.00
72.65	4.50
75.75	4.50



DRYWELL SHIELD WALL SECTION 10 HOOP

FY = 60.0 KSI
F'C = 4.00 KSI
B = 12.00 IN
T = 91.68 IN

X (IN)	AS (IN2)
2.70	1.10
5.80	1.10
84.17	1.04
87.28	1.04

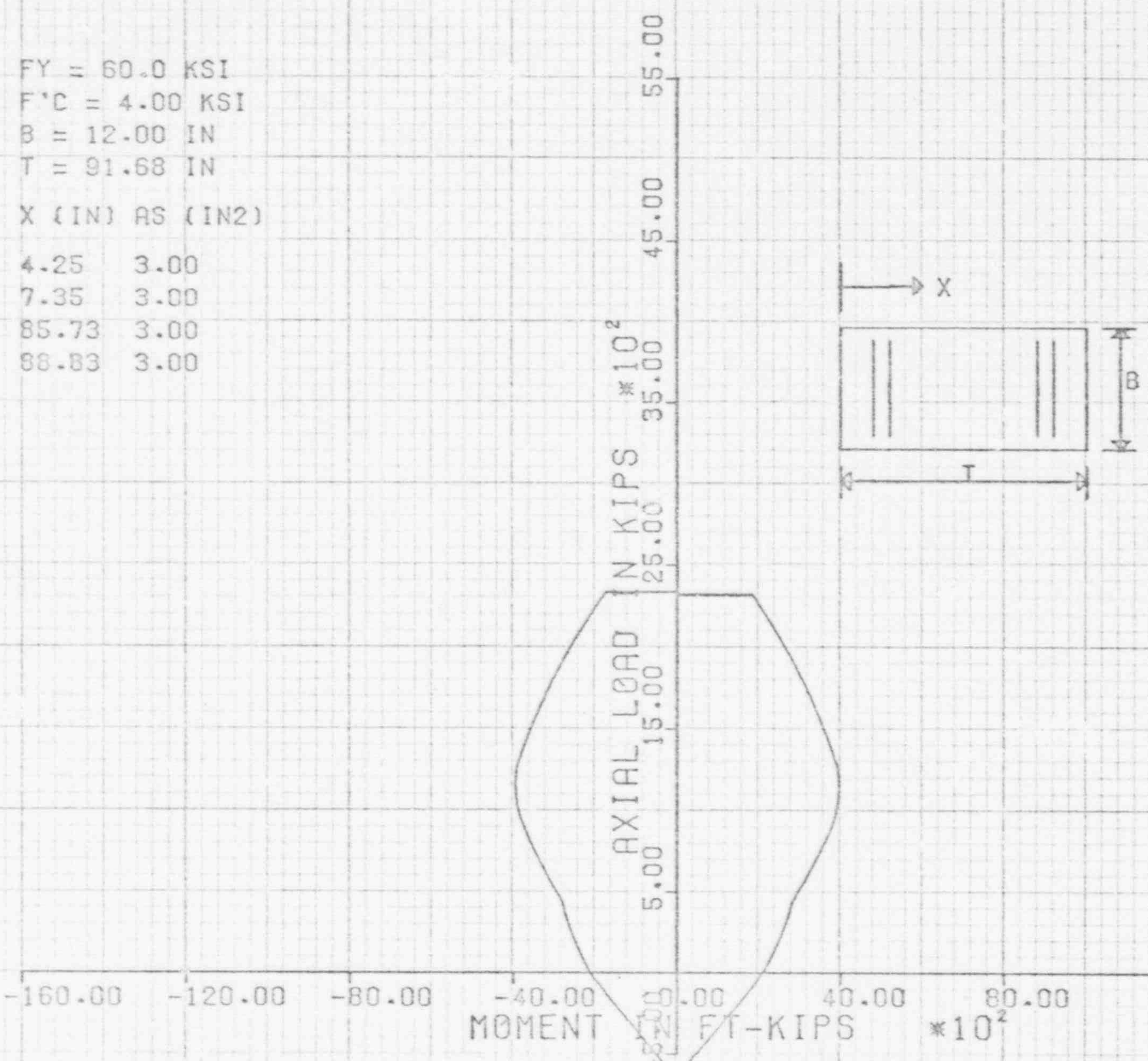


PROJECT NO. [illegible]
CALC. NO. [illegible]
REV. 0 DATE 5-5-94
PAGE 23 OF ___
PREPARER: D. L.
REVIEWER: M. V.

DRYWELL SHIELD WALL SECTION 11-12 MERIDIONAL

FY = 60.0 KSI
F'C = 4.00 KSI
B = 12.00 IN
T = 91.68 IN

X (IN)	AS (IN2)
4.25	3.00
7.35	3.00
85.73	3.00
88.83	3.00

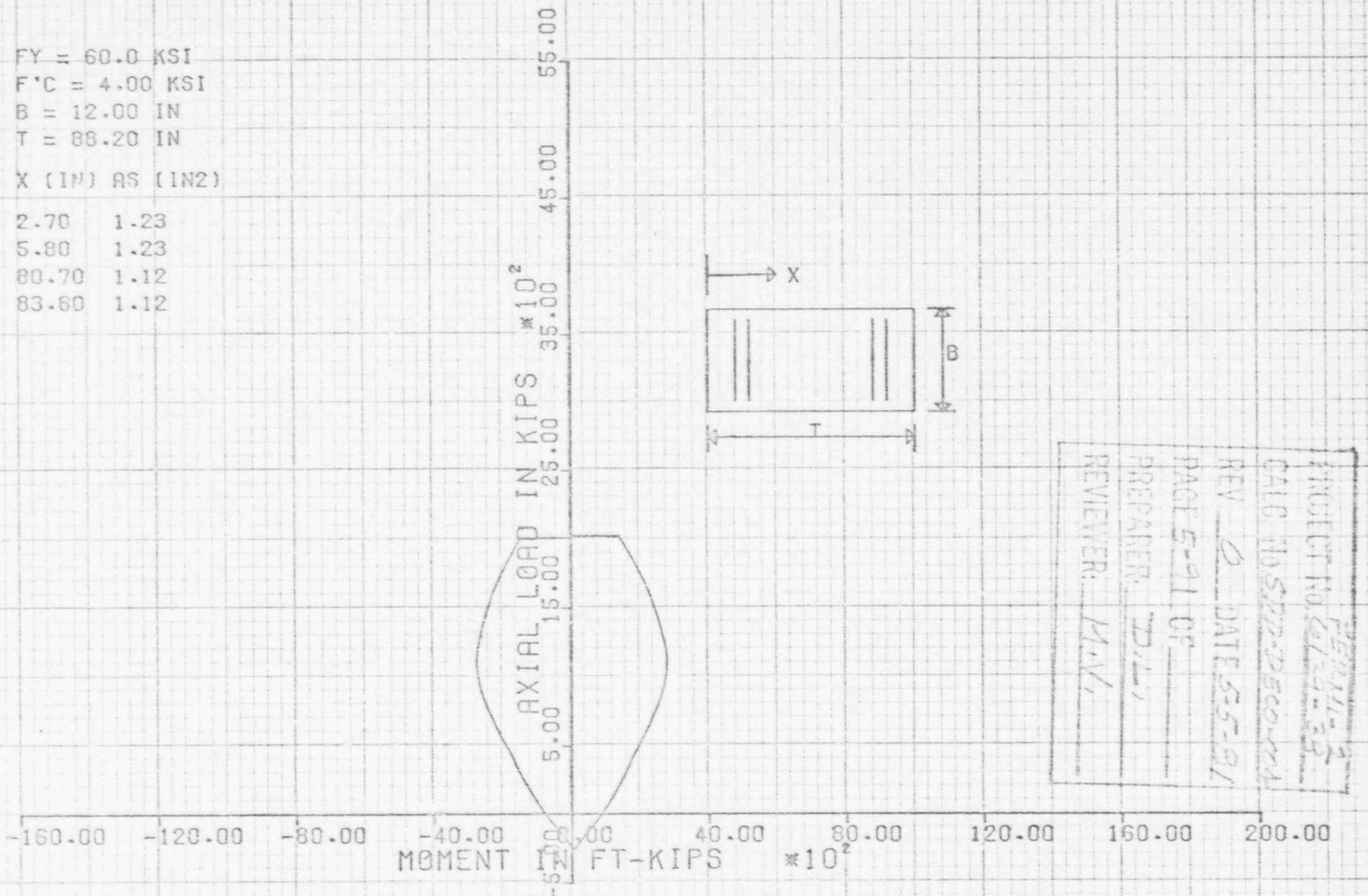


DRYWELL SHIELD WALL SECTION 11-12 HOOP

PROJECT No. FERMI-2 6729-38
CALC. No. EDD-D300-004
REV. 0 DATE 5-5-91
PAGE 5-10 OF
PREPARER: D.L.
REVIEWER: M.V.

FY = 60.0 KSI
F'C = 4.00 KSI
B = 12.00 IN
T = 88.20 IN

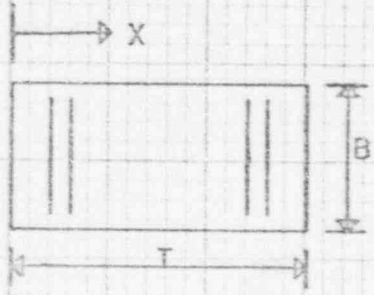
X (IN)	AS (IN2)
2.70	1.23
5.80	1.23
80.70	1.12
83.80	1.12



DRYWELL SHIELD WALL SECTION 13 MERIDIONAL

FY = 60.0 KSI
F'C = 4.00 KSI
B = 12.00 IN
T = 88.20 IN

X (IN)	AS (IN2)
4.25	3.00
7.35	3.00
82.25	3.00
85.35	3.00

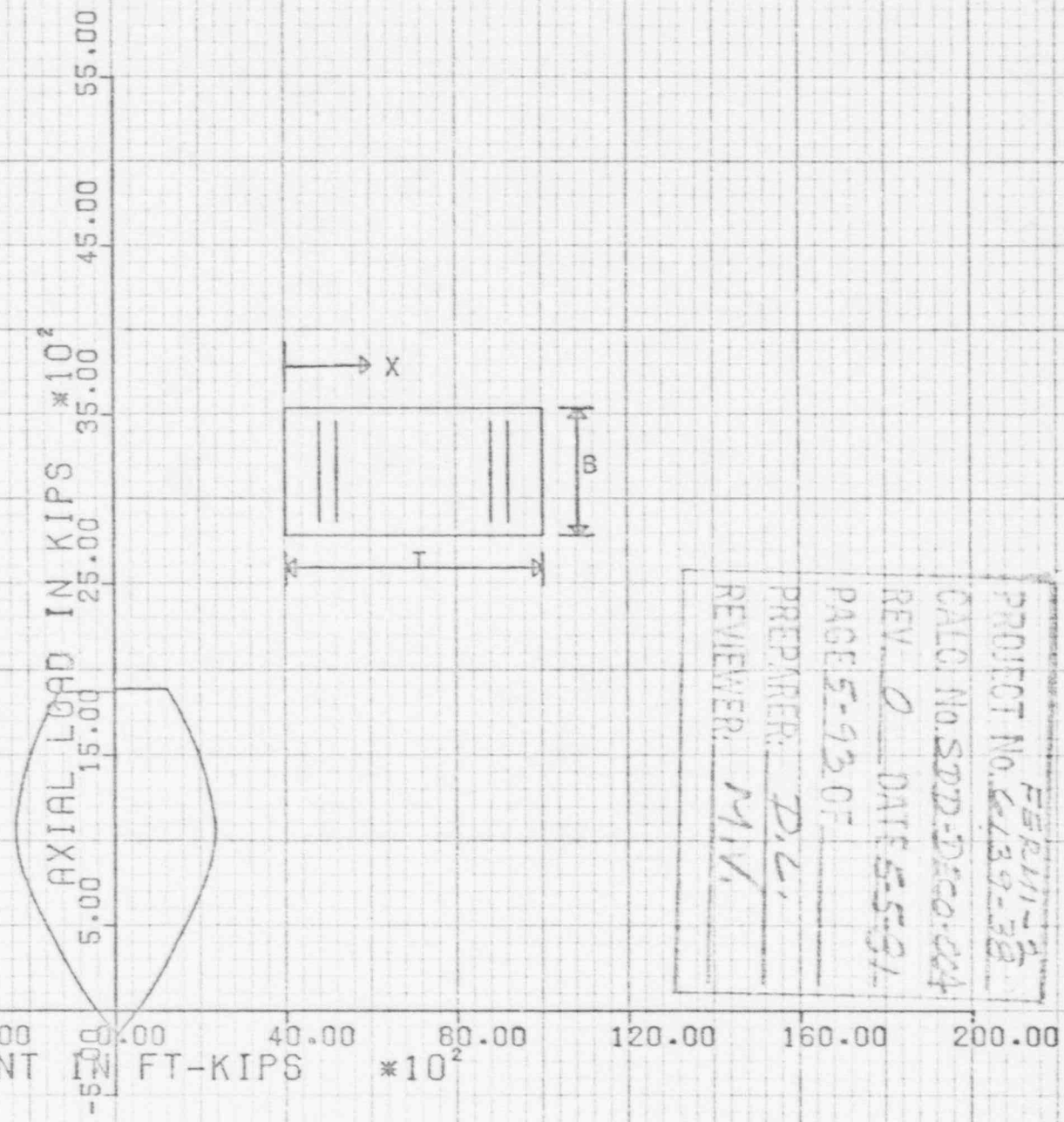


PROJECT NO. 6129-38
CALC NO. SDP-CC-0001
REV. 0 DATE 5-5-97
PAGE 5-42 OF
PREPARER D.L.
REVIEWER M.V.

DRYWELL SHIELD WALL SECTION 13 HOOP

FY = 60.0 KSI
F'C = 4.00 KSI
B = 12.00 IN
T = 84.72 IN

X (IN)	AS (IN2)
2.70	1.39
80.32	1.22



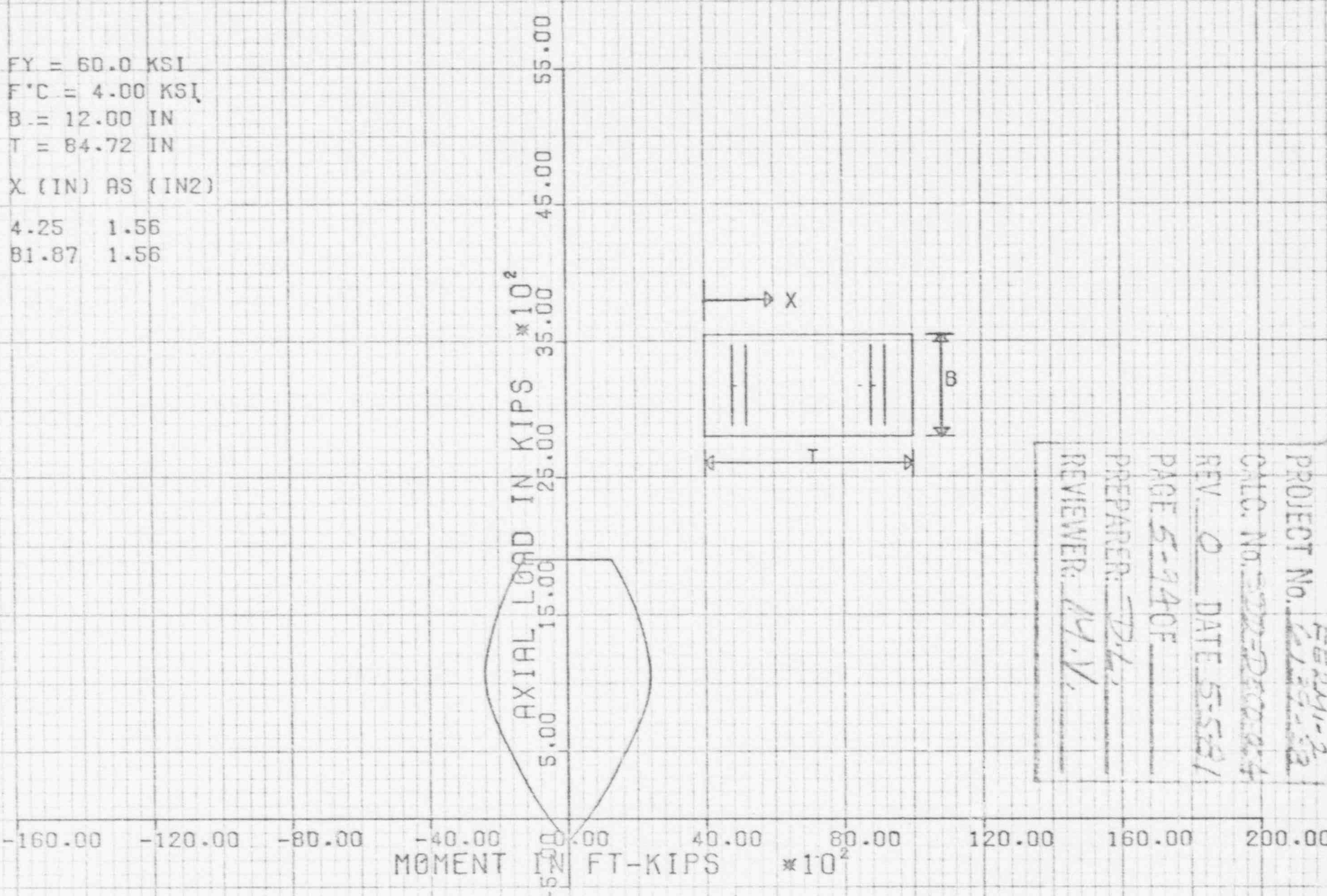
PROJECT No. 6239-28
CALC No. SDD-DESC-004
REV. 0 DATE 5-5-94
PAGE 5-93 OF
PREPARER: D.C.
REVIEWER: M.V.

DRYWELL SHIELD WALL SECTION 14-15 MERIDIONAL

PROJECT No. FE2M1-2
CALC. No. SDD-DECO-2-4
REV. 0 DATE 5-5-81
PAGE 5-34 OF
PREPARER: D.L.
REVIEWER: M.V.

FY = 60.0 KSI
F'C = 4.00 KSI
B = 12.00 IN
T = 84.72 IN

X (IN)	AS (IN2)
4.25	1.56
81.87	1.56



DRYWELL SHIELD WALL SECTION 14-15 HOOP

FY = 60.0 KSI
F'C = 4.00 KSI
B = 12.00 IN
T = 84.36 IN

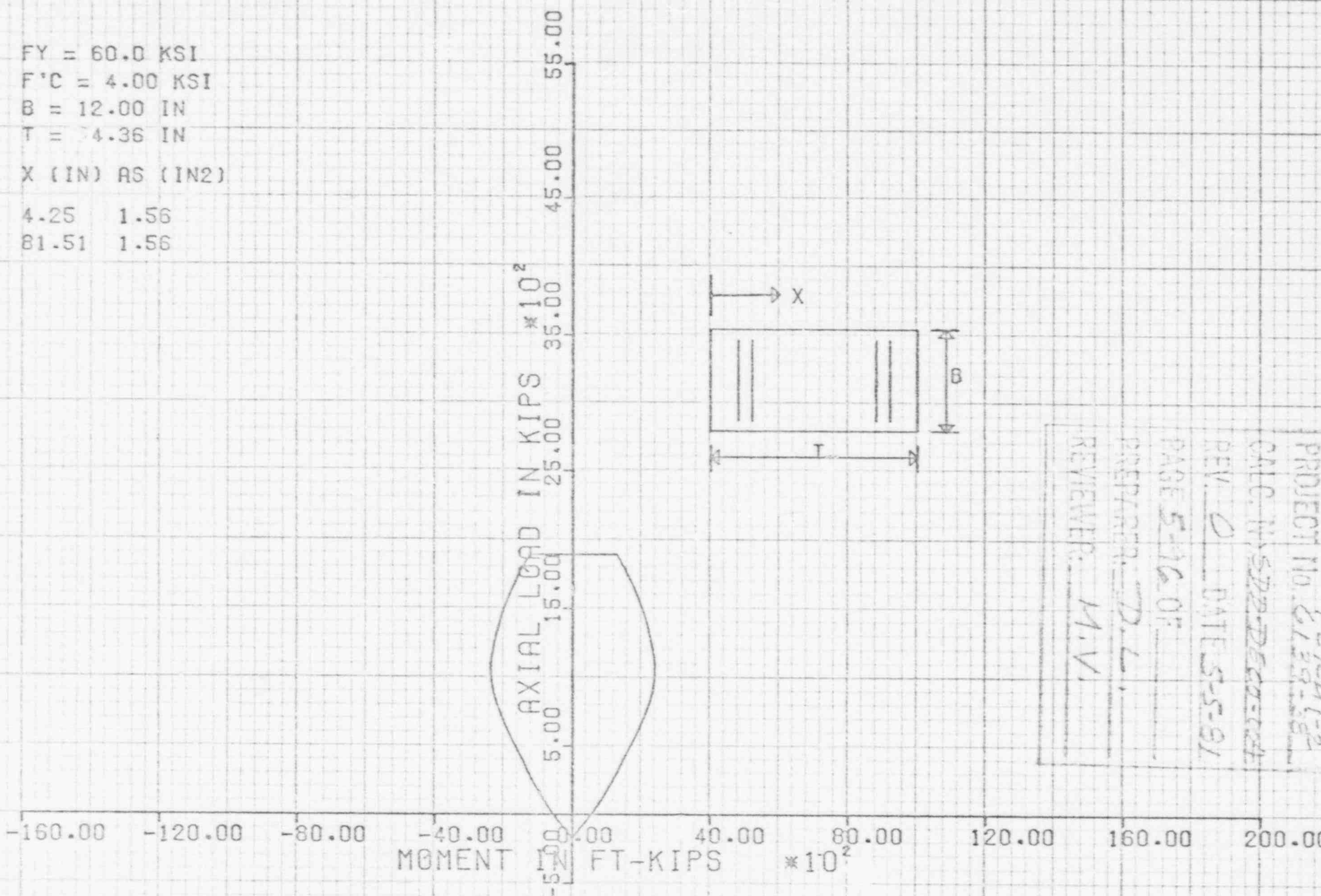
X (IN)	AS (IN2)
2.70	1.74
79.96	1.34

DRYWELL SHIELD WALL SECTION 16. MERIDIONAL

PROJECT No. FERMI-2 6179-44
CALC. No. SDD-DECO-604
REV. 0 DATE 5-5-81
PAGE 5-95 OF
PREPARER. D.L.
REVIEWER. M.V.

FY = 60.0 KSI
F'C = 4.00 KSI
B = 12.00 IN
T = [illegible]4.36 IN

X (IN)	AS (IN2)
4.25	1.56
81.51	1.56

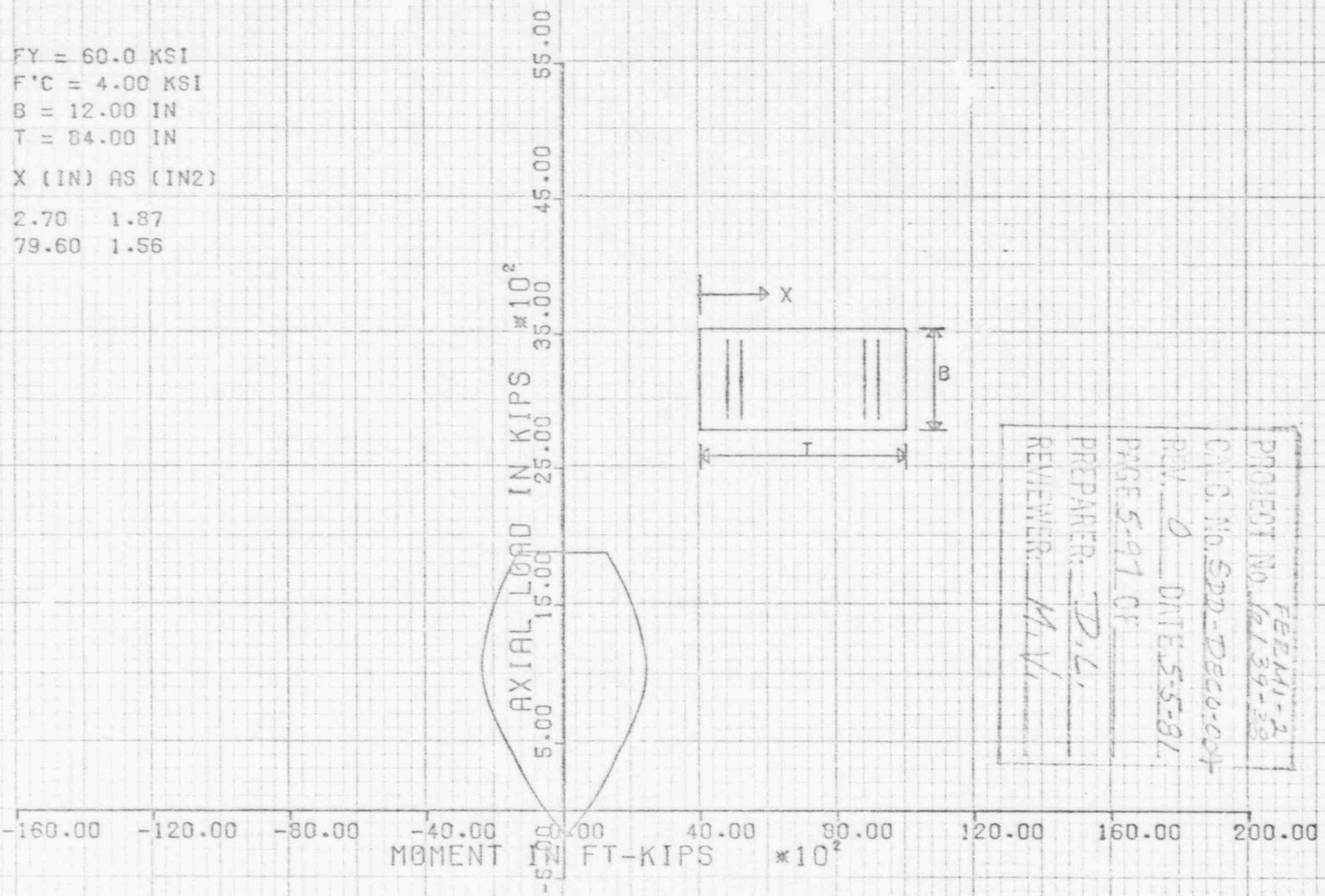


DRYWELL SHIELD WALL SECTION 16 HOOP

PROJECT No. FERMI-2 6139-58
CALC. No. SD2-DE00-04
REV. 0 DATE 5-5-91
PAGE 5-96 OF
PREPARER: D.L.
REVIEWER: M.V.

FY = 60.0 KSI
F'C = 4.00 KSI
B = 12.00 IN
T = 84.00 IN

X (IN)	AS (IN2)
2.70	1.87
79.60	1.56

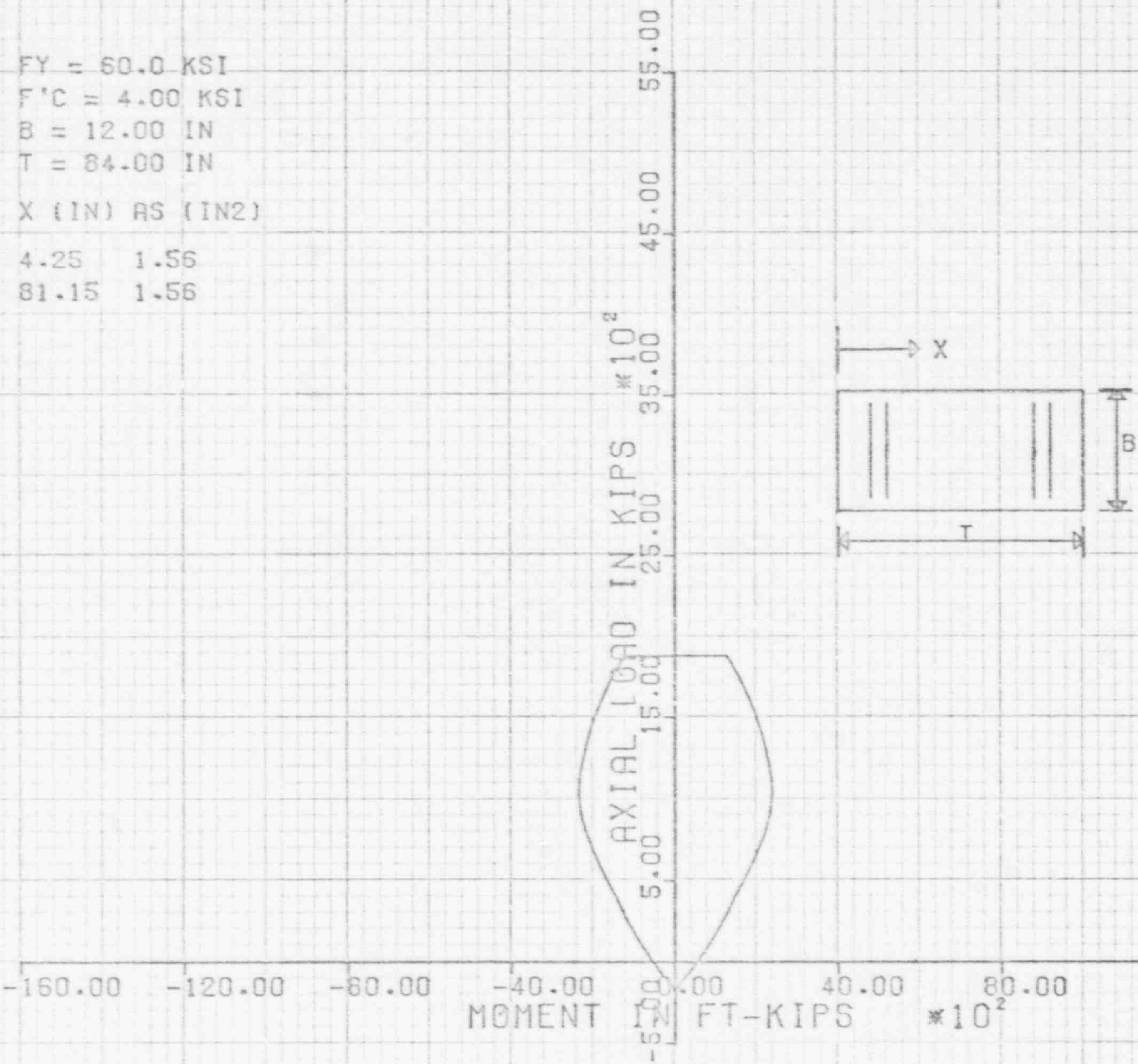


PROJECT NO. Kal 89-38
CALC. NO. S22-D660-004
REV. 0 DATE 5-5-89
PAGE 5-91 OF
PREPARER: D.L.
REVIEWER: M.W.

DRYWELL SHIELD WALL SECTION 17-18-19 MERIDIONAL

FY = 60.0 KSI
F'C = 4.00 KSI
B = 12.00 IN
T = 84.00 IN

X (IN)	AS (IN2)
4.25	1.56
81.15	1.56



DRYWELL SHIELD WALL SECTION 17-18-19 HOOP

PROJECT No. FERMI-2 6139-38
CALC. No. STD-DEGO-004
REV. 0 DATE 5-5-81
PAGE 5.98 OF
PREPARER: D.G.
REVIEWER: M.V.

SARGENT & LUNDY ENGINEERS CHICAGO

Calcs. For: Assessment for Seismic Re-Analysis

[X] Safety-Related [ ] Non-Safety-Related

Calc. No. SDD-DE60-004

Rev. 0 Date

Page 6.1 of

Client: DECO

Project: FERMI-2

Proj. No. 6139-383 Equip. No.

Prepared by: Dan Le Date 5-15-81

Reviewed by: M. Vlasta Date 5-15-81

Approved by: Date

SECTION VI

Assessment of Spent Fuel Pool

Form GO-3.08.1 Rev. 2

SARGENT & LUNDY ENGINEERS CHICAGO

Calcs. For Spent Fuel Pool Assessment		Calc. No. SDD-DECO-004
		Rev. 0 Date
X Safety-Related	Non-Safety-Related	Page 6-2 of

Client DECO	Prepared by Dau Le	Date 5-15-81
Project FERMI-2	Reviewed by M. Blatz	Date 5-15-81
Proj. No. 6139-38 Equip. No.	Approved by	Date

A. Assumptions

(1) The spent fuel pool has been assessed in 1974 for original seismic loads with mechanical load of 2000 psf. The design forces at various design sections have been calculated as shown in table on page 6-25.

(2) With the revised seismic (1981) and with new mechanical load of 1663 psf, a new set of design forces is calculated and is compared with the original design forces mentioned in paragraph (1) for the assessment of the spent fuel pool.

SARGENT & LUNDY ENGINEERS CHICAGO

Calcs. For Spent Fuel Pool Assessment		Calc. No. SDD-DECO-004
		Rev. 0 Date
X Safety-Related	Non-Safety-Related	Page 6-3 of

Client DECO	Prepared by Dau Le	Date 5-15-91
Project FERMI-2	Reviewed by M. Valath	Date 5-15-91
Proj. No. 6139-38 Equip. No.	Approved by	Date

B. CONCLUSION -

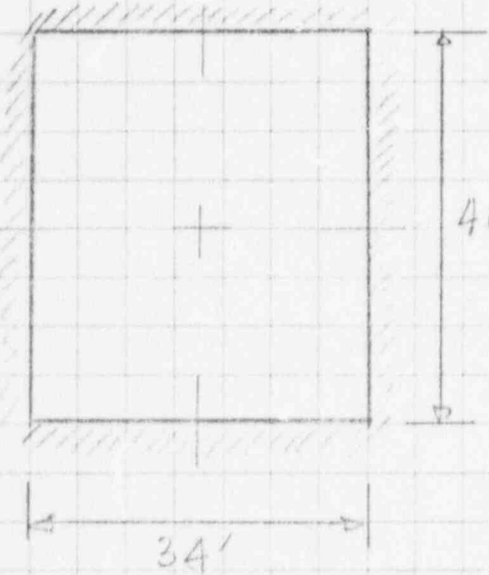
The comparison shows that the ratio between the new set of design forces (ML = 1663 psf with revised seismic) and the original set of design forces is 1.03.

SARGENT & LUNDY ENGINEERS CHICAGO

Calcs. For Spent Fuel Pool Assessment		Calc. No. SDD-DE10-C04
		Rev. 0 Date
X Safety-Related	Non-Safety-Related	Page 6-4 of

Client DECO	Prepared by Dau Le	Date 5-14-91
Project FERMI-2	Reviewed by M. Valatka	Date 5-14-91
Proj. No. 6139-38 Equip. No.	Approved by	Date

Fixed End Moment & shear on slab -



For $w = \underline{1.0}$ ksf

$\frac{a}{b} = 0.85 \approx \frac{7}{8}$

From Moody Table:
(Moments & Reactions for Rect. Plate Engineering Monograph. No. 27)

$M_{x_1} = 0.0592 \times wa^2 \simeq \underline{69.0}$

$M_{x_2} = -0.0267 \times wa^2 \simeq \underline{31.0}$

$M_{y_1} = 0.053 \times wa^2 = \underline{61.3}$

$M_{y_2} = 0.0209 \times wa^2 = \underline{24.1}$

$R_x = 0.4629 \cdot wa \approx \underline{16.0}$

$R_y = 0.473 \times wa \approx 17.0$

Form GQ.3.08.1 Rev. 2

SARGENT & LUNDY ENGINEERS CHICAGO

Calcs. For Spent Fuel Pool Assessment		Calc. No. SDD-DE10-004
		Rev. 0 Date
✓ Safety-Related	Non-Safety-Related	Page 6-5 of

Client DECO	Prepared by Dau Le	Date 5-14-91
Project FERMI-2	Reviewed by M Valentin	Date 5-14-91
Proj. No. 6139-38 Equip. No.	Approved by	Date

Weight Calculations

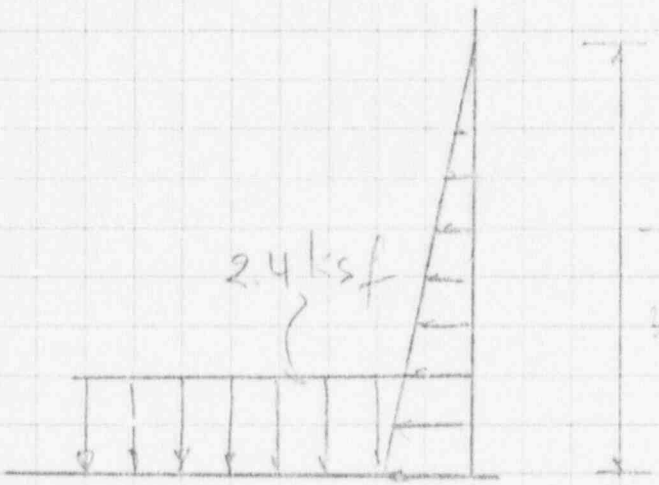
Slab:

$0.150 \times 6.0' = \underline{0.9}$ ksf

Hydrostatic.

38.5 ft of water.

$38.5 \times 62.5 = \underline{2.4}$ ksf



Mechanical load:

Case 1) - 2.0 ksf

Case 2) - 1.663 ksf

Form GO-3.08.1 Rev. 2

SARGENT & LUNDY ENGINEERS CHICAGO

Calcs. For Hydrodynamic Forces on Spent Fuel Pool		Calc. No. SD-DECO-003
		Rev. 0 Date
✓ Safety-Related	Non-Safety-Related	Page 6 - 6 of

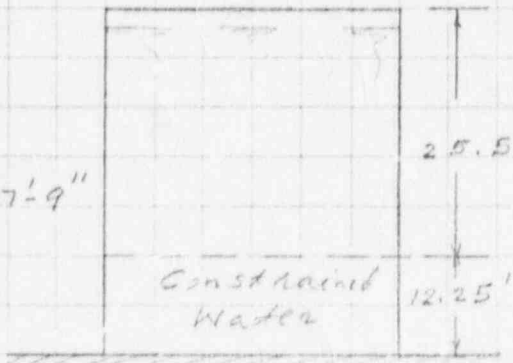
Client DECO	Prepared by M. Vasatka	Date 4-23-91
Project Fermi - 2	Reviewed by Dan Le	Date 5-5-91
Proj. No. 6139-38 Equip. No.	Approved by	Date

Consider Unit strip

$\frac{h}{l} = \frac{37.75}{17.0} = 2.22$

Hence deep container

Constrained height $\} 37.75 - (1.5 \times 17) = 12.25'$



Impulsive forces :

$$W = 25.5 \times 34 \times 1 \times \frac{62.4}{1000} = 54^{K}$$

$$\frac{W_0}{W_1} = \frac{\tanh \sqrt{3}\,\frac{l}{h}}{\sqrt{3}\,\frac{l}{h}} = \frac{0.821}{1.16} = 0.708$$

$$\therefore W_0 = 0.708 \times 54 = 38.2^{K}$$

$h_0 = \frac{3}{8} h = \underline{9.6'}$ for EBP

Using NS Component Horizontal Floor Resp. spectra @ Elevation 641'-6" (spectra B33 of SD-DECO-003)

$\ddot{u}_0 = 0.35g$ (OLD DBE value 0.25g)

$P_0' = 0.35 \times 38.2 = \underline{13.37^{K}}$

Constrained Water weight $= 12.25 \times 34 \times 1 \times \frac{62.4}{1000} = 26^{K}$

$P_0'' = 0.35 \times 26 = \underline{9.1^{K}}$

$h'' = \frac{12.25}{2} = \underline{6.125'}$

Form GQ-3.08.1 Rev. 2

SARGENT & LUNDY ENGINEERS CHICAGO

Calcs. For Hydrodynamic Forces on Spent Fuel pool	Calc. No. SDD-DEC0-022-1
✓ Safety-Related / Non-Safety-Related	Rev. 0 / Date
	Page 6-7 of

Client DECO	Prepared by N.N. Vakharia / Date 4-27-81
Project Fermi-2	Reviewed by Dau Le / Date 5-5-81
Proj. No. 6139-38 Equip. No.	Approved by / Date

Convective Forces: $h = 37.75'$; $l = 1.7'$ $\quad \frac{l}{h} = 0.045$

$$W = 37.75 \times 34 \times 1 \times \frac{62.4}{1000} = 80^{K}$$

$$\frac{W_1}{W} = 0.527 \frac{l}{h} \tanh\left(1.58 \frac{h}{l}\right) = 0.23$$

$$\therefore W_1 = 0.23 \times 80 = 18.4^{K}$$

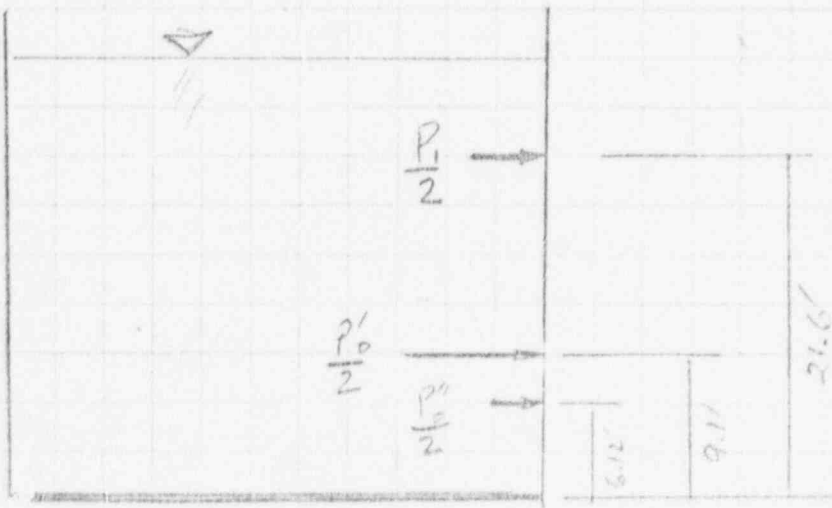
$$\frac{h_1}{h} = 1 - \frac{\cosh\left(1.58 \frac{h}{l}\right) - 1}{1.58 \frac{h}{l} \sinh\left(1.58 \frac{h}{l}\right)} = 0.72$$

$$\therefore h_1 = 30 \times 0.72 = \underline{21.6'}$$

$$\omega^2 = \frac{1.58 g}{l} \tanh\left(\frac{h}{l}\right) = 1.89 \quad \therefore \omega = 1.38$$

$$\therefore f = \frac{\omega}{2\pi} = 0.22 \text{ cps} \qquad \beta_a = 0.025$$

$$\therefore P_1 = 18.4 \times 0.02 = \underline{0.37^{K}/'}$$



Form GQ 3.08.1 Rev. 2

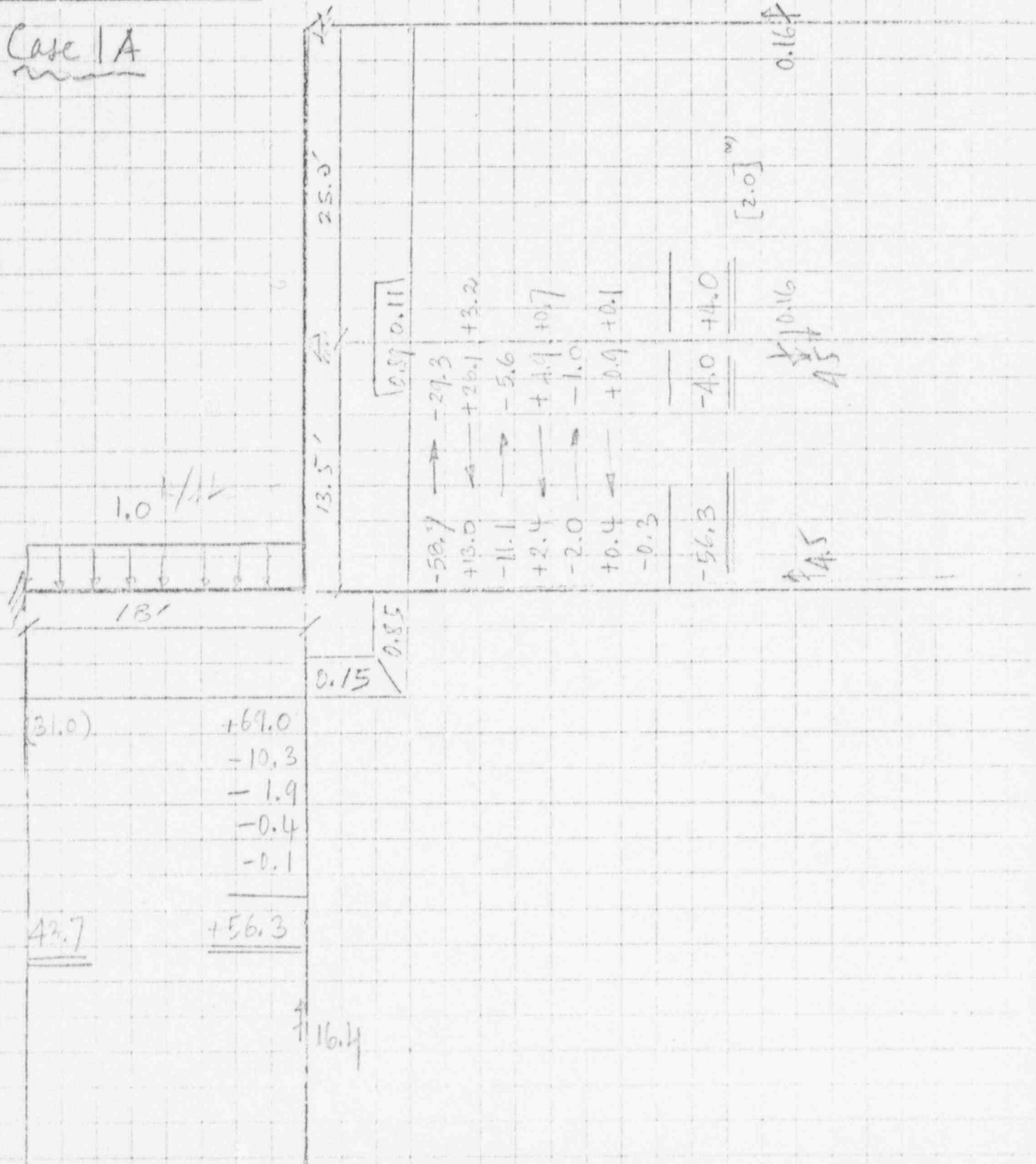
SARGENT & LUNDY ENGINEERS CHICAGO

Calcs. For Spent fuel Pool Addition		Calc. No. SDD-DFE-0004
		Rev. 0 Date
✓ Safety-Related	Non-Safety-Related	Page 6.8 of

Client DECO		Prepared by Dou Le	Date 5-11-81
Project FERMI-2		Reviewed by M Valetta	Date 5-13-81
Proj. No. 6139-33	Equip. No.	Approved by	Date

NORTH WALL

Case 1A



Form GO-3.08.1 Rev. 2

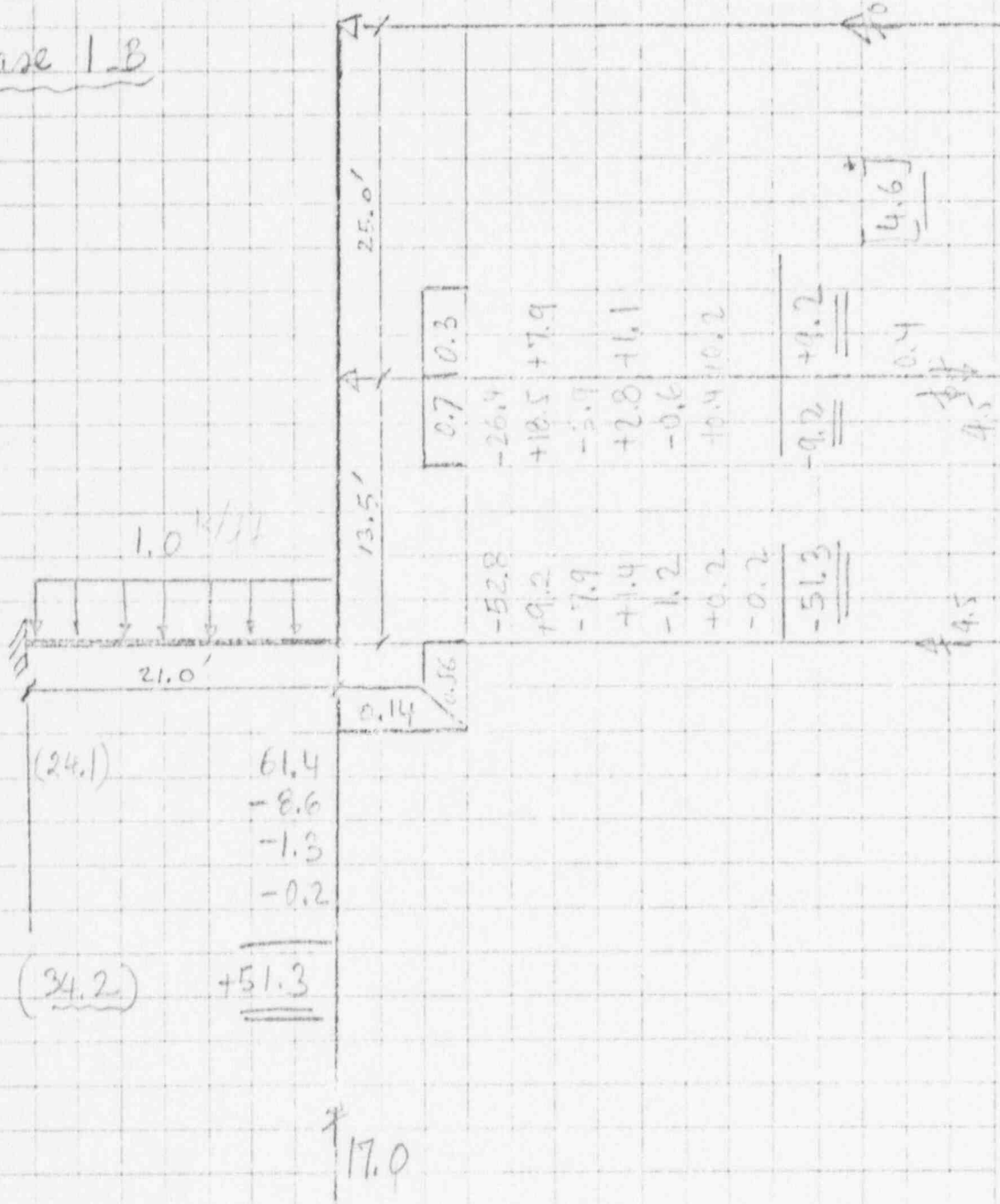
SARGENT & LUNDY ENGINEERS CHICAGO

Calcs. For SPT + Fuel Pool Assessment		Calc. No. SDD-DECO-004
		Rev. 0 Date
✓ Safety-Related	Non-Safety-Related	Page 6.9 of

Client DECO	Prepared by Dan Lo	Date 5-14-91
Project FERMI-2	Reviewed by M Blatz	Date 5-13-91
Proj. No. 6139-38 Equip. No.	Approved by	Date

WEST WALL

Case 1B



Form GQ-3.08.1 Rev. 2

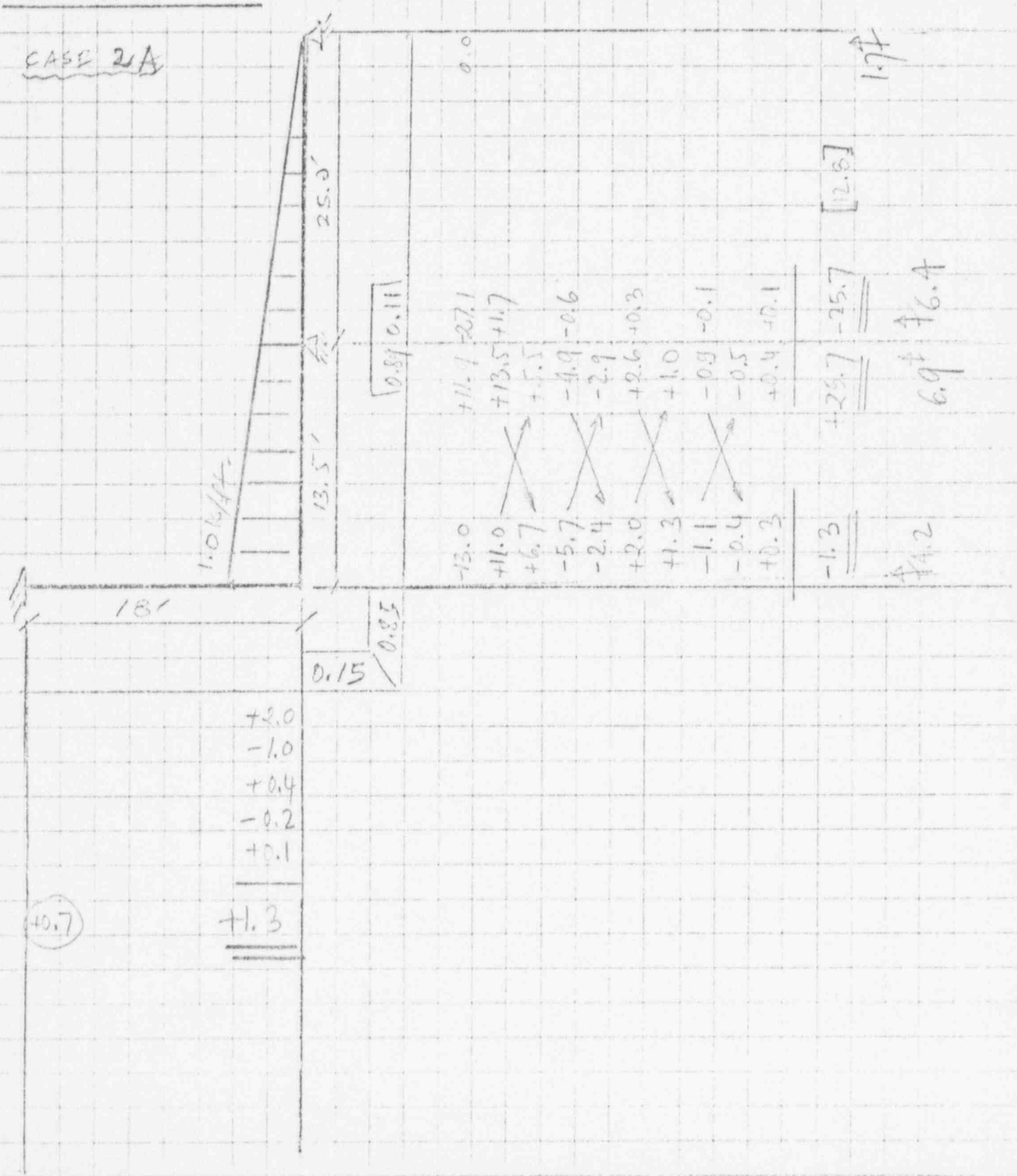
SARGENT & LUNDY ENGINEERS CHICAGO

Calcs. For Spent Fuel Pool Addition		Calc. No. SDD-DF10-004
		Rev. 0 Date
L Safety-Related	Non-Safety-Related	Page 6.10 of

Client DECO	Prepared by DLL	Date 5-11-91
Project FERMI-2	Reviewed by M. Valath	Date 5-13-91
Proj. No. 6139.33 Equip. No.	Approved by	Date

NORTH WALL

CASE 2A



Form GO-3.08.1 Rev. 2

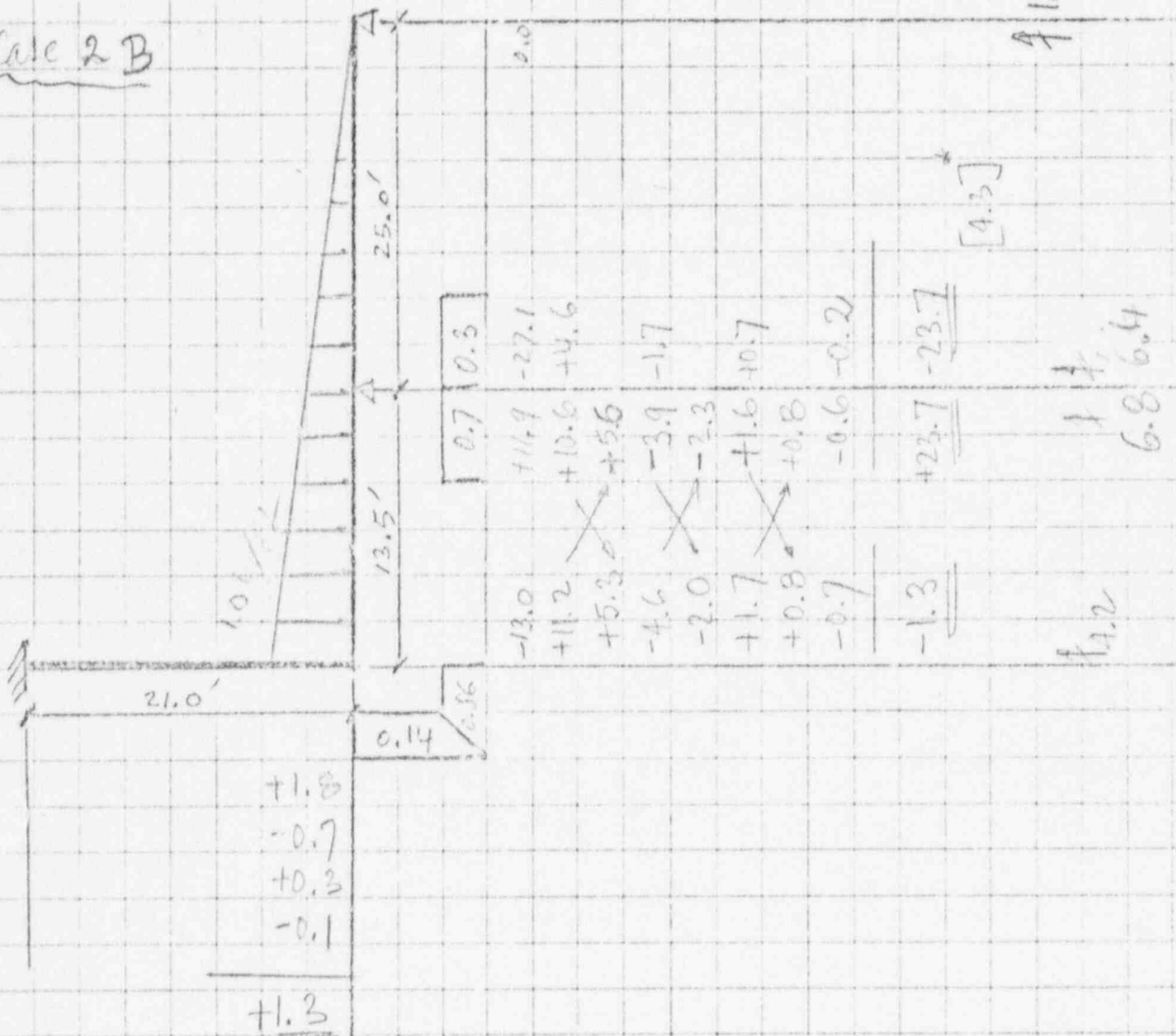
SARGENT & LUNDY ENGINEERS CHICAGO

Calcs. For Spent fuel Pool Assessment		Calc. No. SDD-DECO-304
		Rev. 0 Date
✓ Safety-Related	Non-Safety-Related	Page 6.1 of

Client DECO	Prepared by Dauto	Date 5-17-91
Project FER.III-2	Reviewed by M. Valata	Date 5-17-91
Proj. No. 6139-38 Equip. No.	Approved by	Date

WEST WALL

Calc 2B



+1.8
-0.7
+0.3
-0.1

+1.3

Form CQ-3.00.1 Rev. 2

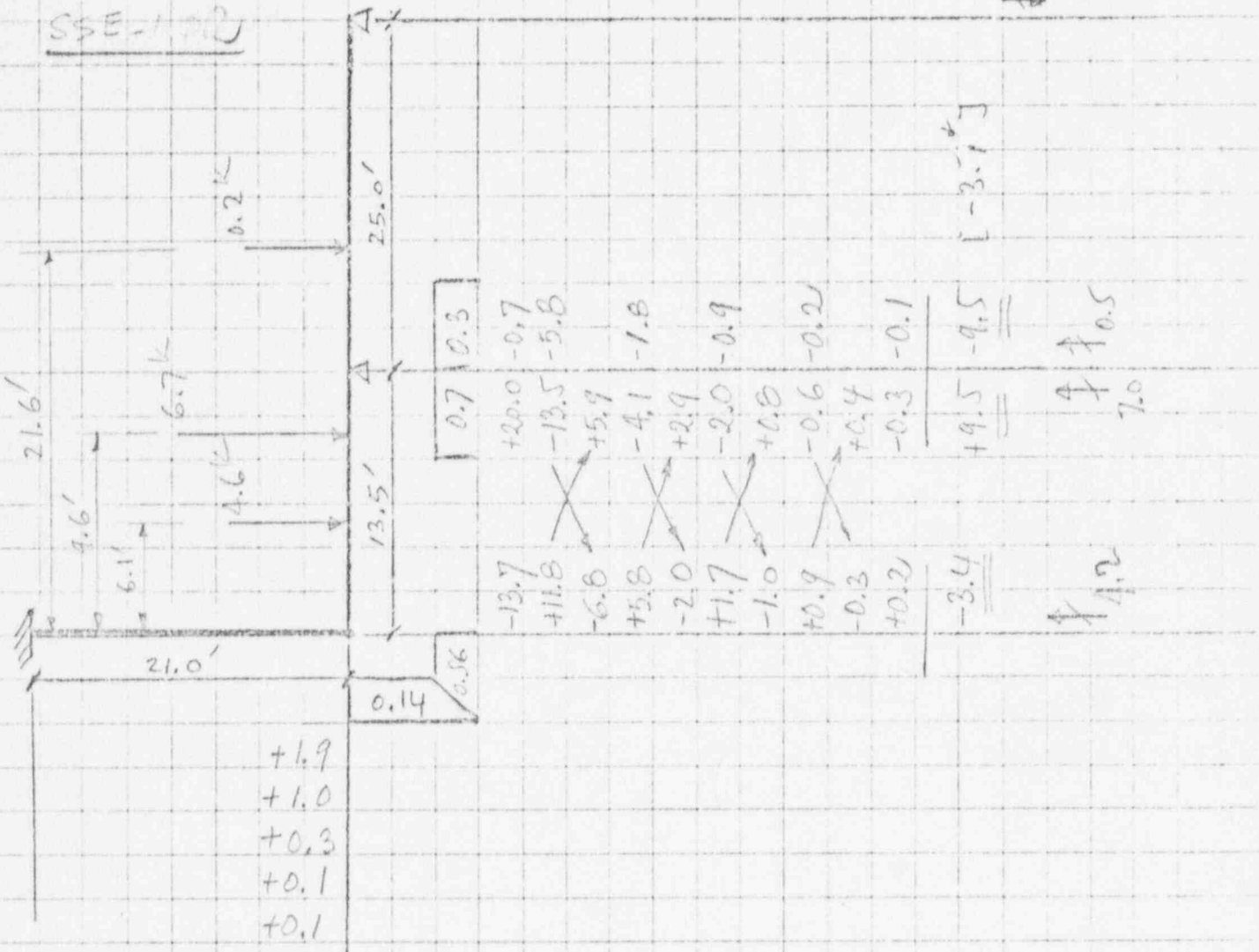
SARGENT & LUNDY ENGINEERS CHICAGO

Calcs. For SPR + fuel Pool Assessment		Calc. No. SDD-2510-004
		Rev. 0 Date
X Safety-Related	Non-Safety-Related	Page 6.12 of

Client DECO	Prepared by Dan L.	Date 5-14-81
Project FERMI-2	Reviewed by M. Palatta	Date 5-14-81
Proj. No. 6139-38 Equip. No.	Approved by	Date

WEST WALL EH1 (Ref: page 6.7)

SSE-1 + 2



+1.9
+1.0
+0.3
+0.1
+0.1
3.4

Form GO-3.08.1 Rev. 2

SARGENT & LUNDY ENGINEERS CHICAGO

Calcs. For Spent Fuel Pool Attachment

Calc. No. SDA-DEC0-0004

Rev. 0 Date

Page 6.13 of

1 Safety-Related | Non-Safety-Related

Client DECO

Project FERMI-2

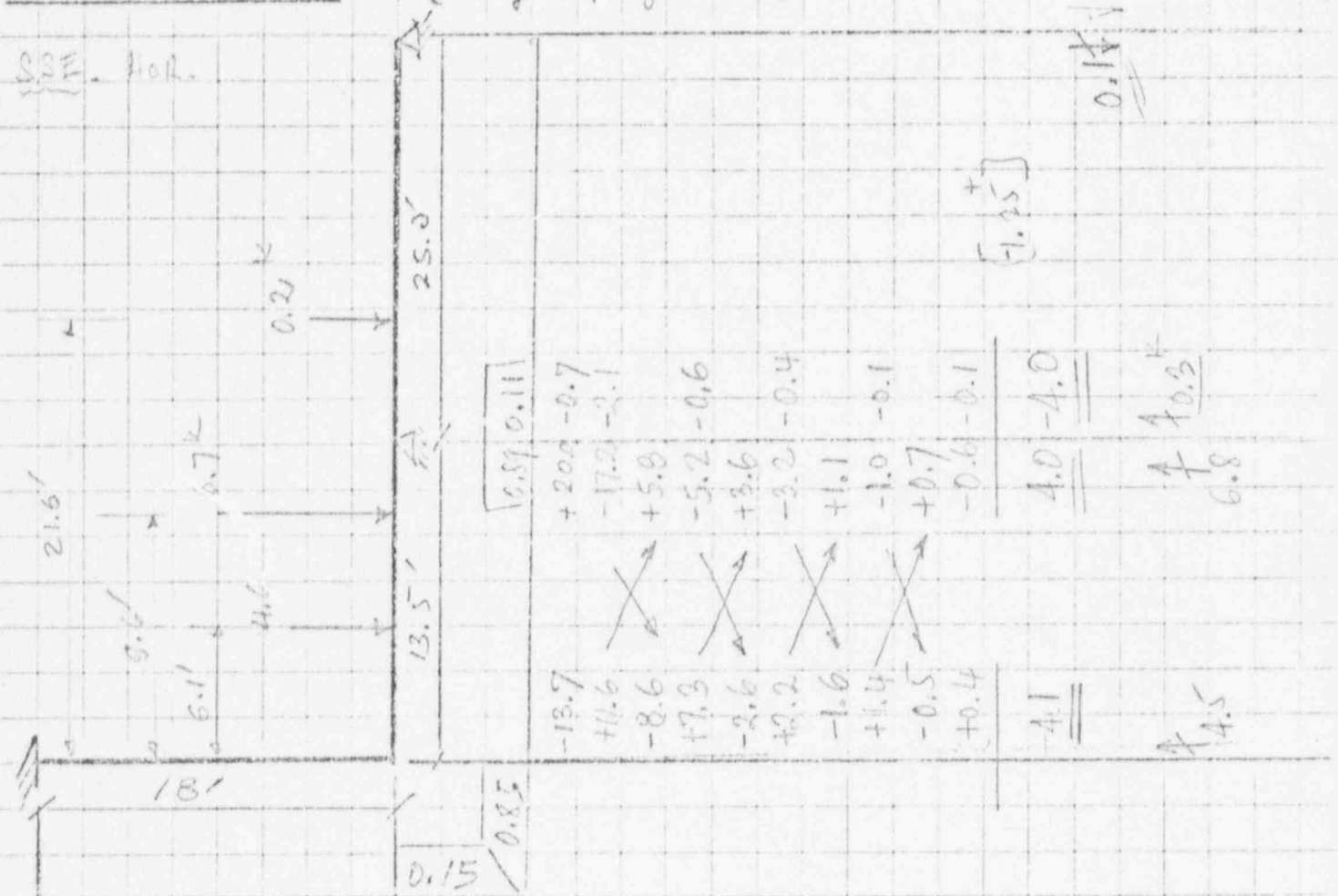
Proj. No. 6139.33 Equip. No.

Prepared by Dan Le Date 5-14-81

Reviewed by M. Valetta Date 5-14-81

Approved by Date

NORTH WALL (Ref: page 6.7)



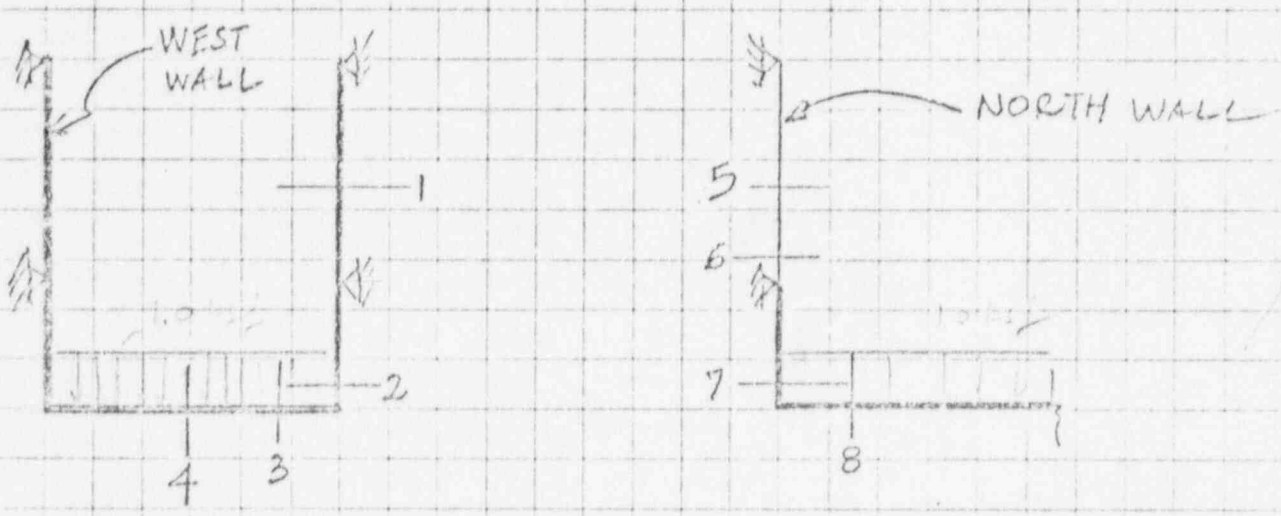
Form GQ-3.08.1 Rev 2

SARGENT & LUNDY ENGINEERS CHICAGO

Calcs. For Spent Fuel Pool Assessment		Calc. No. SDD-DF10-C054
		Rev. 0 Date
X Safety-Related	Non-Safety-Related	Page 6.14 of

Client DECO	Prepared by Dan Le	Date 5-12-91
Project FERMI-2	Reviewed by M. Vasak	Date 5-14-91
Proj. No. 6139-38 Equip. No.	Approved by	Date

CASE 1 (Ref: page 6.82 6.91)



LOAD		SECTION 1	2	3	4	5	6	7	8
	M	-4.6	-51.3	-51.3	34.2	+2.0	+4.0	-56.3	-56.3
	P	17.0	17.0	4.5	4.5	16.4	16.4	16.4	4.5
	V	0.4	4.5	17.0	—	0.2	-0.2	4.5	16.4

Form GQ-3.08.1 Rev. 2

SARGENT & LUNDY ENGINEERS CHICAGO

Calcs. For Spent Fuel Pool Assessment

Calc. No. SPD-DEC-[illegible]

Rev. 0 Date

[x] Safety-Related [ ] Non-Safety-Related

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Client DECO

Project FERMI-2

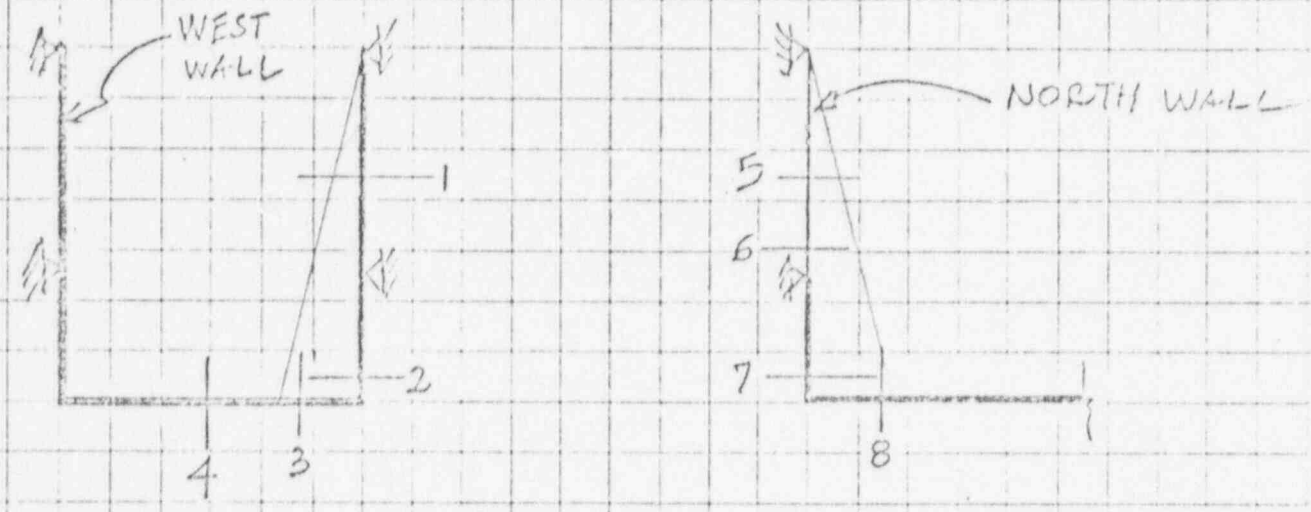
Proj. No. 6139-38 Equip. No.

Prepared by Dan Le Date 5-12-[illegible]

Reviewed by M. Valatka Date 5-14-[illegible]

Approved by Date

Case 2: (Ref: page 6.10 & 6.11)



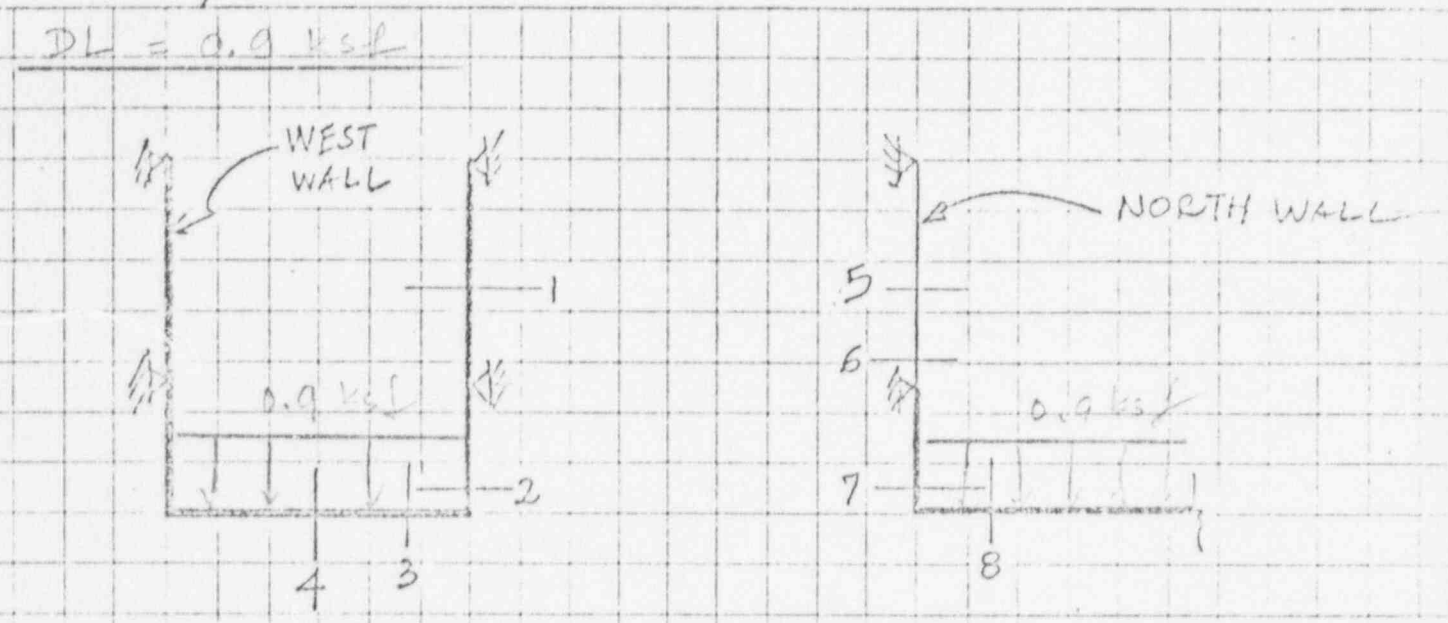
LOAD		SECTION 1	2	3	4	5	6	7	8
	M	4.3	-1.3	-1.3	—	12.8	-25.7	-1.3	-1.3
	P	—	—	4.2	4.2	—	—	—	4.2
	V	1.8	4.2	—	—	1.7	6.4	4.2	—

Form GC-3.08.1 Rev. 2

SARGENT & LUNDY ENGINEERS CHICAGO

Calcs. For Spent Fuel Pool Assessment		Calc. No. 600-DECO-0004
		Rev. 0 Date
X Safety-Related	Non-Safety-Related	Page 6.16 of

Client DECO	Prepared by Dan Le	Date 5-12-9
Project FERMI-2	Reviewed by M. Blatz	Date 5-14-9
Proj No. 6139-38 Equip. No.	Approved by	Date



LOAD		SECTION 1	2	3	4	5	6	7	8
	M	4.1	-46.2	-46.2	38.8	1.8	3.6	-50.7	-50.7
	P	15.3	15.3	4.0	4.0	14.8	14.8	14.8	4.0
	V	0.4	4.0	15.3	—	0.2	-0.2	4.0	14.8

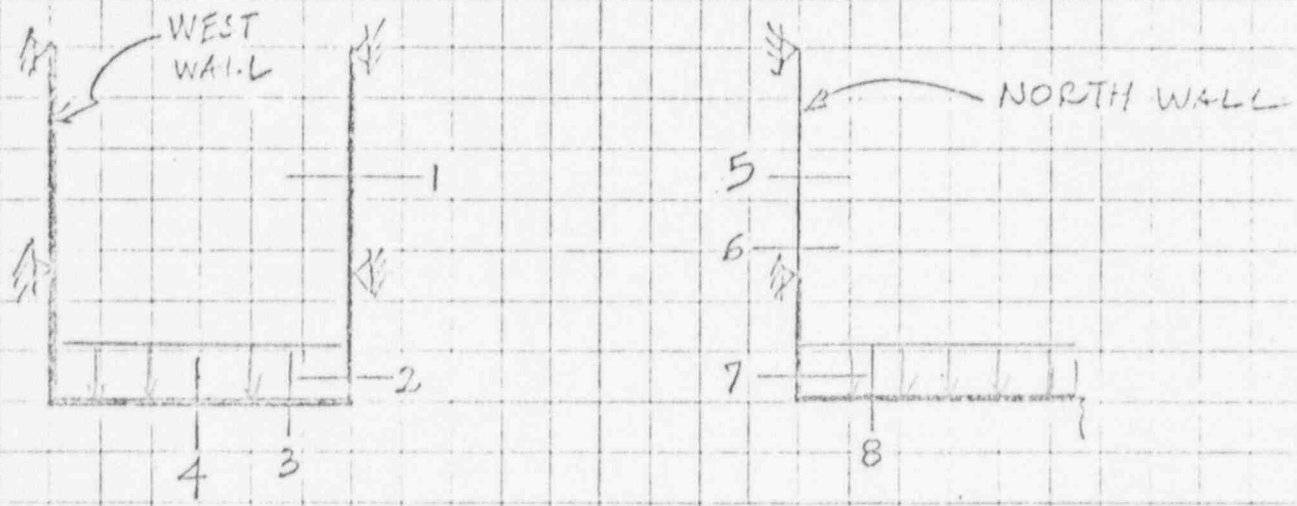
Form GO-3.08.1 Rev. 2

SARGENT & LUNDY ENGINEERS CHICAGO

Calcs. For Spent Fuel Pool Assessment		Calc. No. SDD-DECO-002
		Rev. 0 Date
X Safety-Related	Non-Safety-Related	Page 6.17 of

Client DECO	Prepared by Dan Le	Date 5-12-91
Project FERMI-2	Reviewed by M Valathur	Date 5-14-91
Proj. No. 6139-32 Equip. No.	Approved by	Date

MECHANICAL LOAD : 1.663 Kip



LOAD		SECTION 1	2	3	4	5	6	7	8
	M	7.6	-85.3	-85.3	56.9	3.3	6.6	-93.6	-93.6
	P	28.3	28.3	7.5	7.5	27.3	27.3	27.3	7.5
	V	0.7	7.5	28.3	—	0.3	-0.3	7.5	27.3

Form GQ-3.08.1 Rev. 2

SARGENT & LUNDY ENGINEERS CHICAGO

Calcs. For Spent Fuel Pool Assessment

Calc. No. SDD-DEC-004

Rev. 0 Date

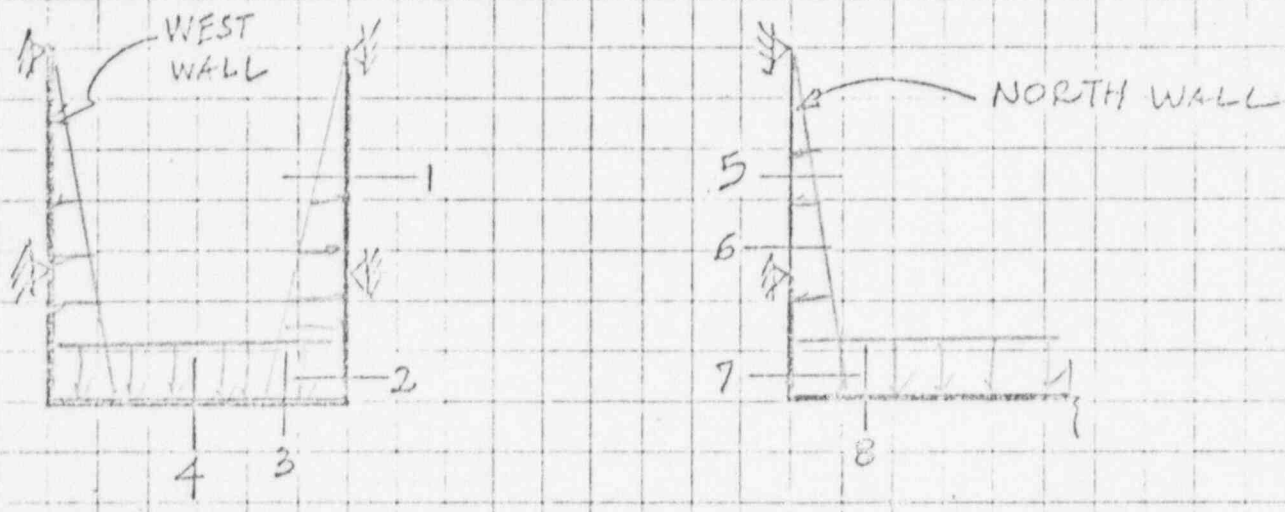
Page 6.18 of

[x] Safety-Related [ ] Non-Safety-Related

Client	DECO	Prepared by	Dan Le
Project	FERMI-2	Reviewed by	M. Valathur
Proj. No.	6134-32 Equip. No.	Approved by	

Date 5-12-91 | Date 5-14-91 | Date

HS - Hydrostatic 2.4 ksf - (Ref: pages 6.5, 6.14 & 6.15)



LOAD		SECTION 1	2	3	4	5	6	7	8
	M	21.4	-126.2	-126.2	82.1	35.5	-52.1	-138.2	-138.2
	P	40.8	40.8	20.9	20.9	39.4	39.4	39.4	20.9
	V	5.3	20.9	40.8	—	4.6	14.9	20.9	39.4

Form GO-3.08.1 Rev. 2

SARGENT & LUNDY ENGINEERS CHICAGO

Calcs. For Spent Fuel Pool Assessment

Safety-Related | Non-Safety-Related

Calc. No. SDD-DF40-004

Rev. 2 Date

Page 6.19 of

Client DELO

Project FERMI-2

Proj. No. 6139-38 Equip. No.

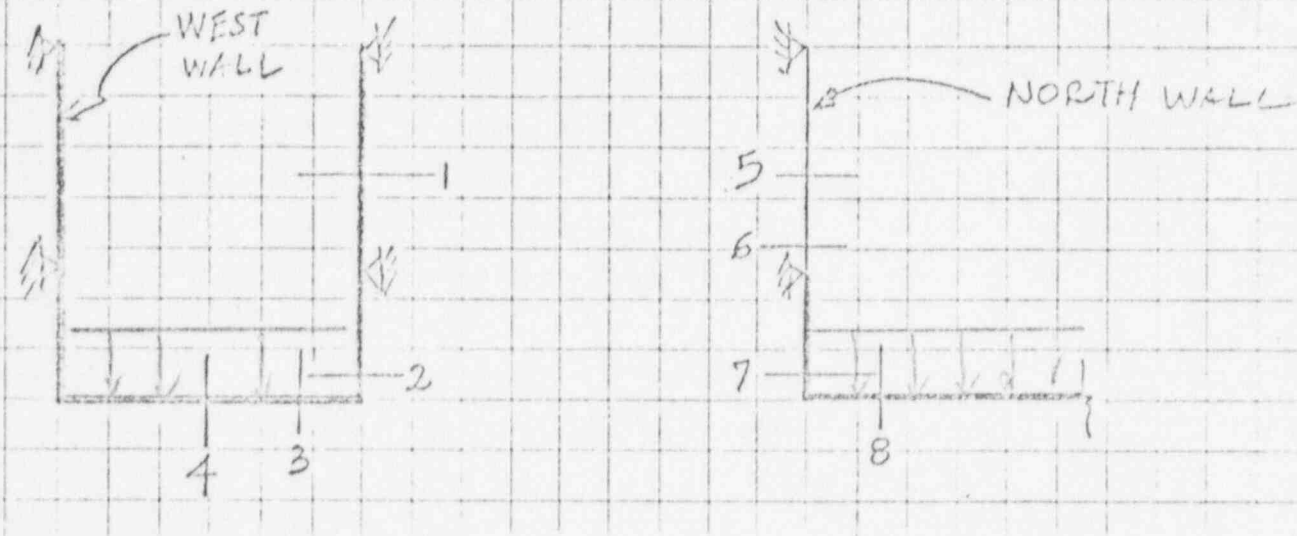
Prepared by Dau Le Date 5-12-81

Reviewed by M. Valath Date 5-14-81

Approved by Date

EV = 0.4 G = 1.9852 ksf

SSI - Vertical



LOAD		SECTION 1	2	3	4	5	6	7	8
	M	9.1	-101.8	-101.8	67.9	4.0	7.9	-111.8	-111.8
	P	33.7	33.7	8.9	8.9	32.5	32.5	32.5	8.9
	V	0.8	8.9	33.7	—	0.4	-0.4	8.9	32.5

VERTICAL SEISMIC:

EV = 0.4 G (DL + ML + Hydrostatic)

= 0.4 (0.9 + 1.663 + 2.4) = 1.9852 ksf

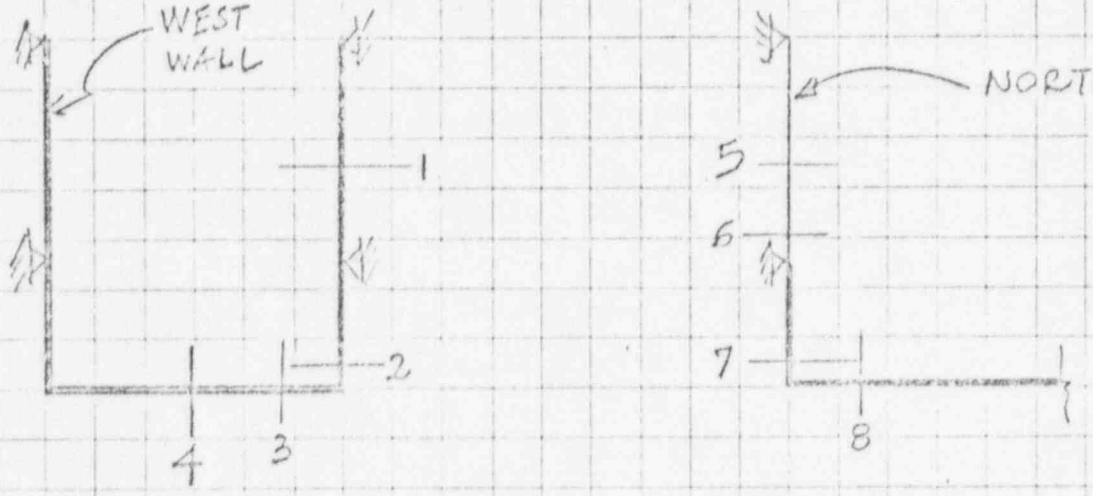
Form 00-3.08.1 Rev. 2

SARGENT & LUNDY ENGINEERS CHICAGO

Calcs. For Spent Fuel Pool Assessment		Calc. No. SDJ-DECo-004
		Rev. 0 Date
☒ Safety-Related	☐ Non-Safety-Related	Page 6.20 of

Client DECO	Prepared by Dan Le	Date 5/14/91
Project FERMI-2	Reviewed by M. Rahimian	Date 5-14-91
Proj. No. 6139-38 Equip. No.	Approved by	Date

Horizontal Seismic SSE - EH (Ref: pags 6.12 & 6.13)



LOAD		SECTION 1	2	3	4	5	6	7	8
	M	-3.7	-3.3	-3.3	-	-1.3	-4.1	-4.0	-4.0
	P	-	-	4.2	4.2	-	-	-	4.5
	V	0.3	4.2	-	-	0.1	0.3	4.5	-

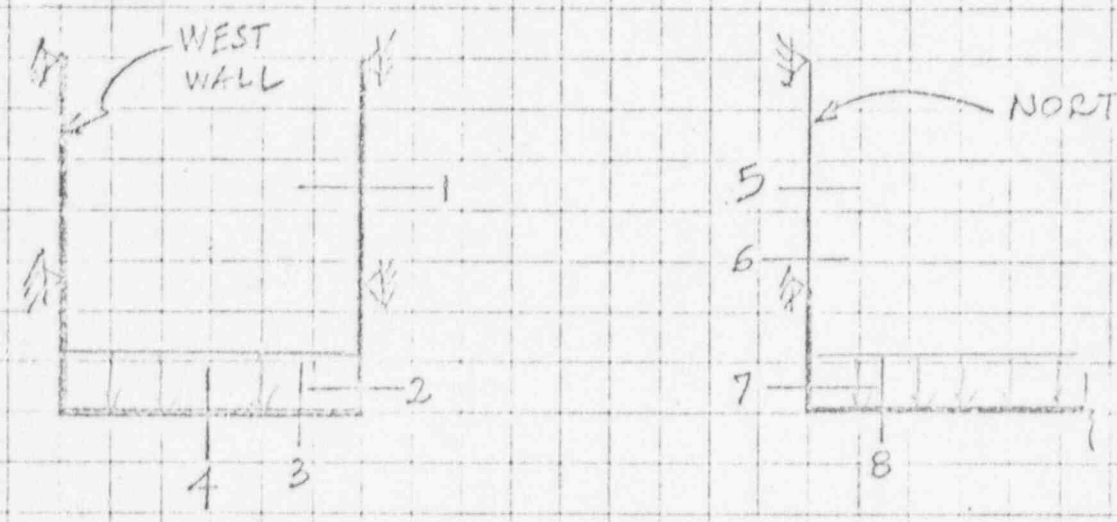
Form GO-3.08.1 Rev. 2

SARGENT & LUNDY ENGINEERS CHICAGO

Calcs. For Spent Fuel Pool Assessment		Calc. No. SQD-DEC-034
		Rev. 0 Date
✓ Safety-Related	Non-Safety-Related	Page 6.21 of

Client DECO	Prepared by Dan Le		Date 5-12-8
Project FERMI-2	Reviewed by M. Voeth		Date 5-14-8
Proj. No. 6139-32 Equip. No.	Approved by		Date

$EV(x) = 2.12$ ksf [Revised seismic with ML = 2000 psf



LOAD		SECTION 1	2	3	4	5	6	7	8
	M	9.7	-108.8	-108.8	72.5	4.2	9.5	-119.4	-119.4
	P	36.0	36.0	9.5	9.5	34.8	34.8	34.8	9.5
	V	0.8	9.5	36.0	—	0.4	-0.4	9.5	34.8

$EV_2 = 0.4 G (DL + ML^* + HS)$

$= 0.4 (0.9 + 2.0 + 2.4) = 2.12$ ksf

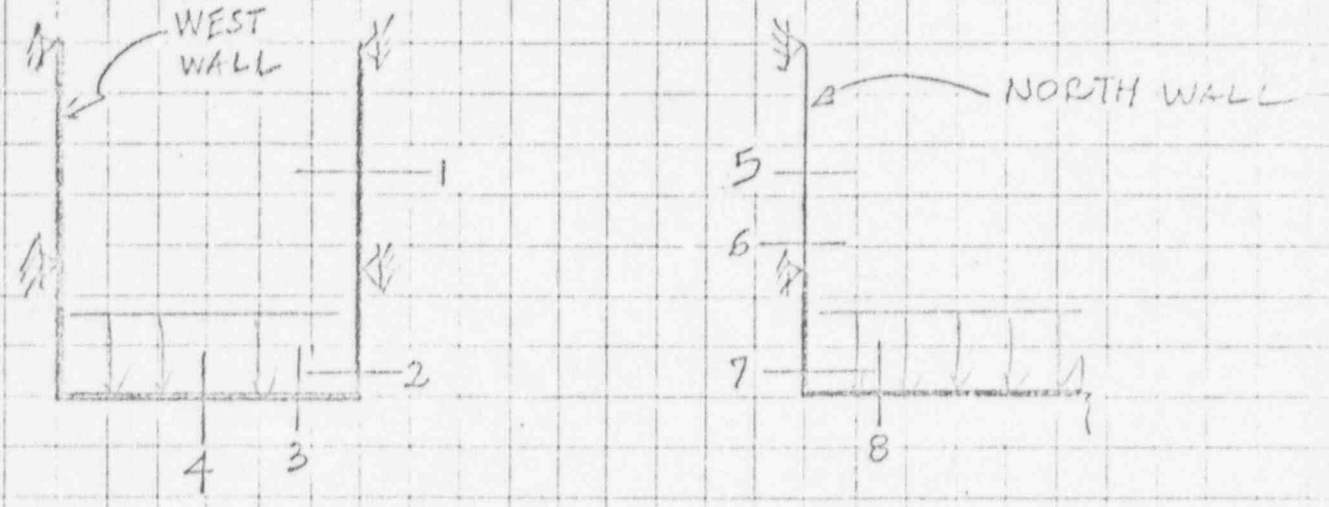
Form GQ-3.08.1 Rev. 2

SARGENT & LUNDY ENGINEERS CHICAGO

Calcs. For Spent Fuel Pool Assessment		Calc. No. SDD-DC0-004
		Rev. 0 Date
X Safety-Related	Non-Safety-Related	Page 6.22 of

Client DECO	Prepared by Dan Le	Date 5-12-8
Project FERMI-2	Reviewed by M. Wrathall	Date 5-14-8
Proj. No. 6139-38 Equip. No.	Approved by	Date

ML = 20 Kips (K)



LOAD		SECTION 1	2	3	4	5	6	7	8
	M	9.2	-102.6	-102.6	68.4	4.0	8.0	-112.6	-112.6
	P	34.0	34.0	9.0	9.0	32.8	32.8	32.8	9.0
	V	0.8	9.0	34.0	—	0.4	-0.4	9.0	32.8

Form GO-3.08.1 Rev. 2

SARGENT & LUNDY ENGINEERS CHICAGO

Calcs. For Spent Fuel Pool Assessment

Calc. No. SD-DFSC-[illegible]

Rev. 0 Date

Page 6, 23 of

[X] Safety-Related [ ] Non-Safety-Related

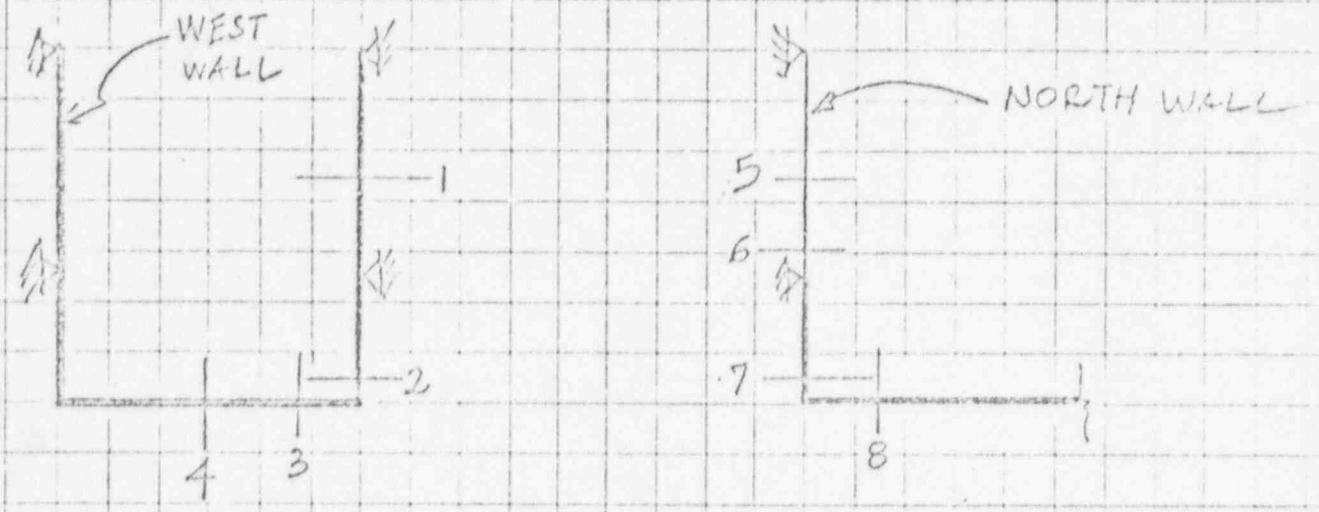
Client	DECO	Prepared by	Dau Le
Project	FERMI-2	Reviewed by	M. Palaia
Proj. No.	6139-38 Equip. No.	Approved by	

Date 5-14-[illegible]

Date 5-14-[illegible]

Date

COMBINATION A & SSE (with ML = 1663.0 psf).



LOAD		SECTION 1	2	3	4	5	6	7	8
	M	38.5	-362.8	-262.8	245.7	43.3	-38.1	-348.3	-[illegible]
	P	118.1	118.1	45.5	45.5	113.9	113.9	113.9	45.[illegible]
	V	7.5	45.5	118.1	—	5.6	16.1	45.8	113.[illegible]

Form GQ-3.08.1 Rev. 2

SARGENT & LUNDY ENGINEERS CHICAGO

Calcs. For Spent Fuel Pool Assessment

Calc. No. SDA-0054

Rev. 0 Date

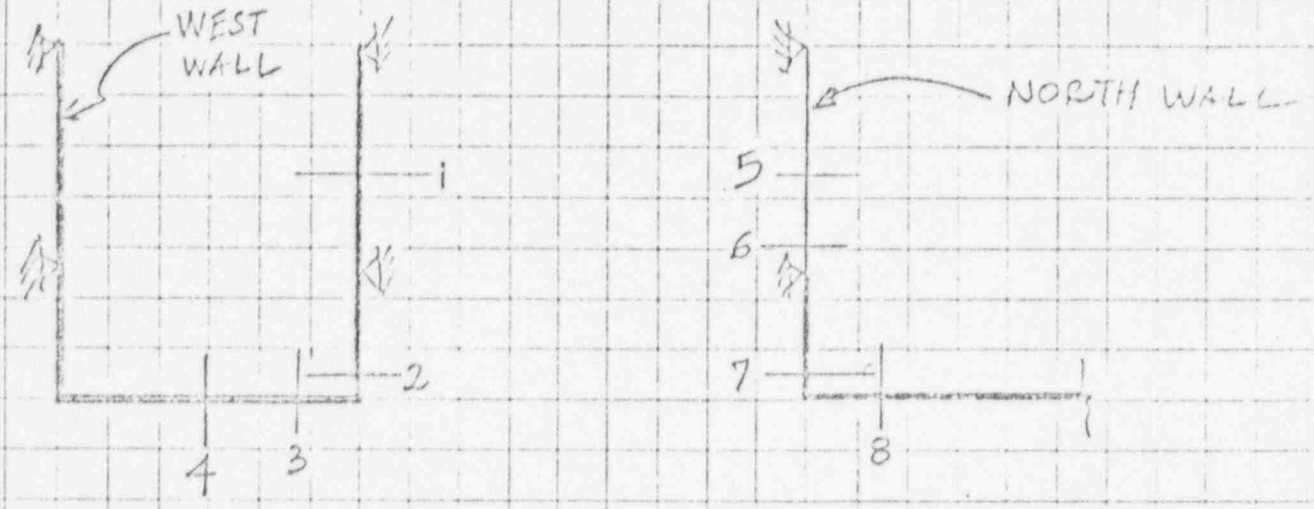
☒ Safety-Related ☐ Non-Safety-Related

Page 6.24 of

Client	DECO	Prepared by	Dan Le
Project	FERMI-2	Reviewed by	M. Valastro
Proj. No.	6134-33 Equip. No.	Approved by	

Date 5-14-91 | Date 5-14-91 | Date

COMBINATION B: SSE (w/ ML = 2000 psf)



LOAD		SECTION 1	2	3	4	5	6	7	8
	M	40.7	-387.1	-387.1	261.8	44.2	-36.1	-424.9	-424.
	P	126.1	126.1	47.6	47.6	121.8	121.8	121.8	47.6
	V	10.3	47.6	126.1	—	6.6	22.5	47.9	121.5

Form GO-3.08.1 Rev. 2

SARGENT LUNDY ENGINEERS CHICAGO

Calcs. For Spent Fuel Pool Assessment

Calc. No. SFP-M10-004

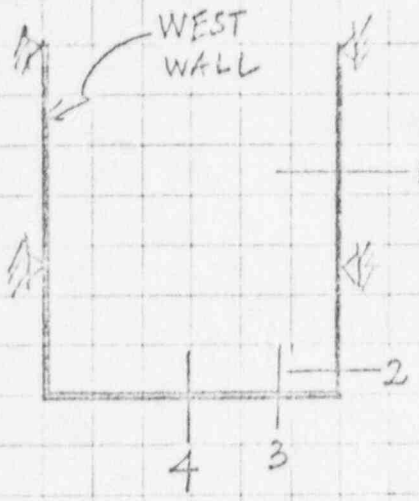
Rev. 0 Date

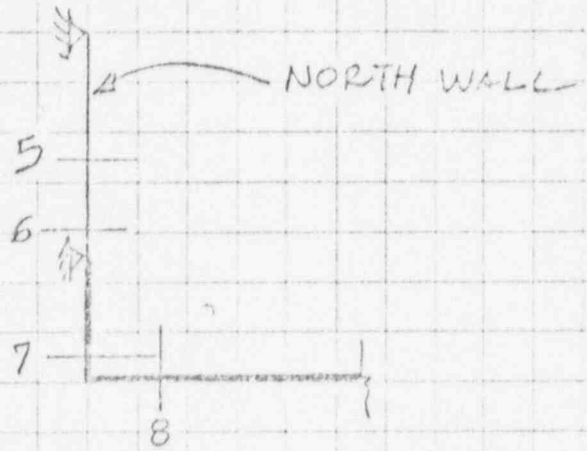
[x] Safety-Related [ ] Non-Safety-Related

Client	DECO	Prepared by	Dan Le
Project	FERMI-2	Reviewed by	M. Valai
Proj. No.	6139-38 Equip. No.	Approved by	

Date 5-14-91 | Date 5-14-91 | Date

COMBINATION C - 1974 Analysis with M = 2000 psf





LOAD		SECTION 1	2	3	4	5	6	7	8
	M	85.6	-355.9	-355.9	280.0	37.7	-110.33	-357.6	-357.6
	P	108.7	108.7	44.0	44.0	110.8	110.8	110.5	44.0
	V	—	44.0	108.7	—	—	—	44.0	110.8

SARGENT & LUNDY ENGINEERS CHICAGO

Calcs. For Spent Fuel pool Assessment		Calc. No. SPD-DECO-104
		Rev. 0 Date
X Safety-Related	Non-Safety-Related	Page 6.26 of

Client DECO	Prepared by Dau Le	Date 5-14-81
Project FERMI-2	Reviewed by M. Vakalkar	Date 5-14-81
Proj. No. 6139-38 Equip. No.	Approved by	Date

COMPARISON OF RESULTING FORCES.

		SSE 1981 ML = 2000 psf	SSE 1981 ML = 1663 psf	SSE 1974 ML = 1530 psf	SSE 1981 ML = 1530 psf
WEST WALL	M	-387.1	-362.8	-355.9	-353.1
(SECTION 2)	P	126.1	118.1	108.7	104.9
	V	47.6	45.5	44.0	44.7
NORTH WALL (*)	M	-424.9	-398.3	-387.6	-387.8
(SECTION 7)	P	121.8	113.9	110.8	110.8
	V	47.9	45.8	44.0	44.9
SLAB	M	-387.1	-362.8	-355.9	353.1
(SECTION 3)	P	47.6	45.5	44.0	44.7
	V	108.1	101.2	108.7	98.5
SLAB (*)	M	-424.9	-398.3	-387.6	387.8
(SECTION 8)	P	47.9	45.8	44.0	44.9
	V	101.5	94.9	110.8	98.5

(*) GOVERNING SECTIONS.

Form GO-3.08.1 Rev. 2

SARGENT & LUNDY ENGINEERS CHICAGO

Calcs. For SPENT FUEL POOL ASSESSMENT		Calc. No. SDD-DECO-005
✓ Safety-Related	Non-Safety-Related	Rev. / Date
		Page 6.27 of

Client DECO	Prepared by Dewlc	Date 5-14-81
Project FERMI-2	Reviewed by M. Valentine	Date 5-14-81
Proj. No. 6139-38 Equip. No.	Approved by	Date

COMPARISON OF RESULTING FORCES (SPENT FUEL POOL)

STRUCTURE		SSE 1974 ML = 2000 psf	SSE 1981 ML = 1663 psf	REMARKS
WEST WALL	M	-355.9	-362.8	
	P	108.7	118.1	
	V	44.0	45.5	
NORTH WALL	M	-387.6	-398.3	(*) GOVERNING SECTION
	P	110.8	113.9	
	V	44.0	45.8	
SLAB N.S DIRECTION	M	-355.9	-362.8	
	P	44.0	45.5	
	V	108.7	101.2	
SLAB	M	-387.6	-398.3	(x) GOVERNING SECTION
E.W Direction	P	44.0	45.8	
	V	110.8	94.9	

Form GQ 3.08.1 Rev. 2

SARGENT LUNDY ENGINEERS CHICAGO

Calcs. For Assessment of Dryer-Seperator pool for revised seismic load		Calc. No. SDD-DECO-004
		Rev. 0 / Date
1 Safety-Related	Non-Safety-Related	Page 7-1 of

Client DECO		Prepared by M Valathur	Date 5-15-91
Project Fermi-2		Reviewed by Dan Lo	Date 5-15-91
Proj. No. 6139-38	Equip. No.	Approved by	Date

SECTION VII

ASSESSMENT OF DRYER-SEPERATOR POOL

SARGENT & LUNDY ENGINEERS CHICAGO

Calcs. For Assessment of Dryer-Seperator Pool for Revised Seismic Load	Calc. No. SDD-DECO-034
✓ Safety-Related / Non-Safety-Related	Rev. 0 / Date
	Page 7-2 of

Client DECO	Prepared by M. V. Bhatt / Date 5-15-81
Project Fermi-2	Reviewed by Dau Le / Date 5-15-81
Proj. No. 6139-38 Equip. No.	Approved by / Date

Introduction:

The purpose of this calculation is to assess the structural adequacy of the dryer-seperator pool base slab and walls for the revised 7% damping site spectra, SSE condition. For this purpose, the capacities of the wall sections and slab sections are computed using the computer program COLID and are plotted as section capacity interaction diagrams. The strength adequacy of these sections are assessed by plotting on the interaction diagram the load point represented for the most critical load combination.

Conclusion:

From the interaction diagrams given on pages 7-13 through 7-15, it is concluded that the dryer-seperator pool can accomodate the revised forces.

SARGENT & LUNDY ENGINEERS CHICAGO

Calcs. For Hydrodynamic Forces on Diesel-Separator Storage Pool		Calc. No. SDD-DECO-004
		Rev. 0 Date
✓ Safety-Related	Non-Safety-Related	Page 7-3 of

Client DECO	Prepared by I.A. Vakilian	Date 4-29-81
Project Fermi-2	Reviewed by Dale Le	Date 5-5-81
Proj. No. 6137-38 Equip. No.	Approved by	Date

Reference 1: "Dynamic Pressure on Fluid Containers", Structural Design and Drafting Report SDDD A2D No. 134, July 1974.

Consider one-foot strip

$\frac{h}{l} = \frac{24.0}{26.5} = 0.905$

Hence shallow Conta

Assuming the pool to be free standing, the hydrodyn forces are computed as per the procedure outlined in Reference 1.

weight of water $W = 24 \times 53 \times 1 \times \frac{62.4}{1000} = 79.2^{K}$

$$W_0 = W \frac{\tanh\left(\sqrt{3}\,\frac{l}{h}\right)}{\sqrt{3}\,\frac{l}{h}} = \frac{0.957}{1.91} \times 79.2 = 39.6^{K}$$

$h_0 = \frac{3}{8} h = \frac{3}{8} \times 24 = 9'$ for EBP

$h_0 = \frac{h}{8}\left[\frac{4\sqrt{3}\,\frac{l}{h}}{\tanh\left(\sqrt{3}\,\frac{l}{h}\right)} - 1\right] = \frac{24}{8}\left[\frac{4}{0.5} - 1\right] = 21'$ for IBP

$\frac{W_1}{W} = 0.527\,\frac{l}{h}\tanh\left(1.58\,\frac{h}{l}\right)$

$= 0.527 \times 1.104 \times 0.892 = 0.52$

$\therefore W_1 = 0.52 \times 79.2 = 41.2^{K}$

Form GO-3.08.1 Rev. 2

SARGENT & LUNDY ENGINEERS CHICAGO

Calcs. For Hydrodynamic forces on Damper-separator storage pool	Calc. No. SDD-DECO-002
✓ Safety-Related / Non-Safety-Related	Rev. 0 / Date
	Page 7-4 of

Client DECO	Prepared by M Valdata	Date 4-28-81
Project Fermi-2	Reviewed by Dau Le	Date 5-5-81
Proj. No. 6139-38 Equip. No.	Approved by	Date

$$\frac{h_1}{h} = 1 - \frac{\cosh\left(1.58\,\frac{h}{2}\right) - 1}{1.58\,\frac{h}{2}\sinh\left(1.58\,\frac{h}{2}\right)}$$

$$= 1 - \frac{2.209 - 1}{1.43 \times 1.97} = 0.571$$

$$\therefore h_1 = 0.571 \times 24 = 13.7' \text{ for EBP}$$

$$\frac{h_1}{h} = 1 - \frac{\cosh\left(1.58\,\frac{h}{2}\right) - 2}{1.58\,\frac{h}{2}\sinh\left(1.58\,\frac{h}{2}\right)}$$

$$= 1 - \frac{2.209 - 2}{1.43 \times 1.97} = 0.926$$

$$\therefore h_1 = 0.926 \times 24 = 22.2' \text{ for IBP}$$

$$\omega^2 = \frac{1.58g}{h}\tanh\left(1.58\,\frac{h}{2}\right)$$

$$= \frac{1.58 \times 32.2}{26.5} \times 0.892 = 1.71$$

$$\therefore \omega = \sqrt{1.71} = 1.31 \qquad f = \frac{\omega}{2\pi} = 0.208 \text{ cps}$$

Using N-S Comp of Horizontal Floor Resp. Spectra

@ Elevation 659'-6" (Spectra B35 of SDD-DECO-002)

$a_o = 0.4g$ (& DBE value : 0.28g)

$\therefore P_o = 0.4 \times 39.6 = 15.84^K$

Form GO-3.08.1 Rev. 2

for $f = 0.208$, spectral acceleration, $S_a \approx 0.02g$

$$\therefore \frac{g}{h} = 1.58 \frac{S_a}{\omega^2} \cdot \frac{1}{\ell} \tanh\left(1.58 \frac{h}{\ell}\right) = \frac{S_a}{g} = 0.02$$

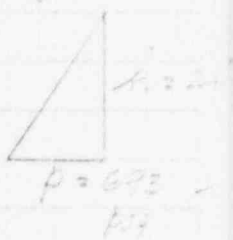
$$\therefore P_1 = W_1 S_a = 41.2 \times 0.02 = 0.8^K$$

$$\therefore \text{Max. shear on each wall} = \frac{1}{2}\{P_0 + P_1\} = \frac{1}{2}\{16.84 + 0.8\} = 8.32^K$$

Assuming the pressure to be distributed linearly,

pressure at the base $p = \frac{2 \times 8.32}{24} \times 1000$

$= 693\ psf$



SARGENT & LUNDY ENGINEERS CHICAGO

Calcs. For Design of Diesel - separation storage pool walls		Calc. No. SD-DEC0-004
		Rev. 0 Date
✓ Safety-Related	Non-Safety-Related	Page 7-6 of

Client DECO		Prepared by M. Wright	Date 4-24-81
Project Fermi-2		Reviewed by Daube	Date 5-5-81
Proj. No. 6179-38	Equip. No.	Approved by	Date

East-West Walls

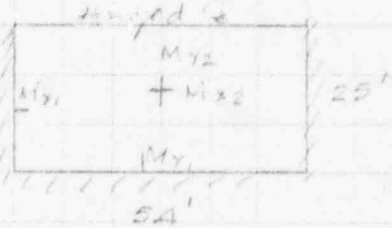
Due to hydrostatic load (from calc. No. 7.01.00 - Fermi 2)
pressure = 1560 lbs/ft²

M_{x1} = +28.114 ft kip

M_{y1} = +57.817 ft kip

M_{x2} = -9.56 ft-kip

M_{y2} = -25.252 ft-kip



Max. Reaction = 0.3988 × 1.56 × 25 = 15.55 kips

Bottom slab shear = 34.2 K which becomes axial load for the wall (from page 8)

Due to operation thermal load moment = -20.2 ft-kips

Due to hydrodynamic loads

Max. Reaction = $15.55 \times \frac{693}{1560} = 6.91$ kips

$M_{x1} = +\frac{693}{1500} \times 28.114 = +12.52$ ft-kip $M_{y1} = +\frac{693}{1560} \times (57.817) = +25.634$ ft-k

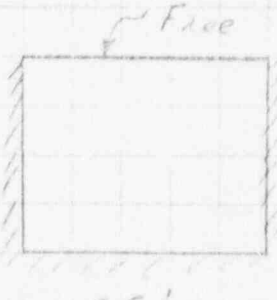
$M_{x2} = -\frac{693}{1500} \times 9.56 = -4.246$ ft-kip $M_{y2} = -\frac{693}{1560} \times 25.252 = -11.218$ ft-k

Final forces: Axial = 34.2 K (resistive); $M_- = -56.67$ ft-kips; $M_+ = +63.5$ ft-k

South Wall

Due to hydrostatic load (from calc No. 7.01.00 Fermi)
Pressure = 1560 lbs/ft²

Max. Moment mid-span of free end
= -9.5 ft-kip



Max. + Moment at bottom of wall mid span = 31.6 ft kips

Max. Reaction = 0.3236 × 1.56 × 25 = 12.62 kips

Due to oper. thermal, Moment = -20.2 ft-kips

Due to hydro dynamic load

Max. Reaction = $12.62 \times \frac{693}{1560} = 5.61$ kips

$M_- = -\frac{693}{1560} \times 9.5 = -4.22$ ft-kip $M_+ = +\frac{693}{1560} \times 31.6 = +14.04$ ft-kip

Final forces: Axial force = 0.0, $M_- = -33.9$ ft-kips; $M_+ = +25.5$ ft-k

Form GQ-3.08.1 Rev. 2

SARGENT LUNDY ENGINEERS CHICAGO

Calcs. For Design of Diesel-separator Pool Walls

Calc. No. [illegible]

Rev. 2 Date

Page 6-9 of

1 Safety-Related | Non-Safety-Related

Client DECO

Project Fermi-2

Proj. No. 6139-38 Equip. No.

Prepared by M. Wirth Date [illegible]

Reviewed by Dau Le Date 5-1-81

Approved by Date

Diesel-separator Pool

Summary of Loads for East-West Walls & South Wall

Load	East-West Walls			South Wall		
	M_+ (ft-kips)	M_- (ft-kips)	V (kips)	M_+ (ft-kips)	M_- (ft-kips)	V (kips)
Dead load + Mech. Load + Hyd. Static	+57.82	-25.25	15.55	+31.60	-9.5	12.62
seismic - SSE	+25.68	-11.22	6.91	+14.04	-4.22	5.61
oper. thermal (*)	-20.20	-20.20	—	-20.20	-20.20	—
Final Total	+63.30	-56.67	22.46	+25.5	-33.9	18.23

Axial load on the walls = 34.2 kips (tension)

(*) Refer to Computer output 357 DL, Dated May 8, 1981.

SARGENT & LUNDY ENGINEERS CHICAGO

Calcs. For Design of Dryer-Separator pool Slab

✓ Safety-Related | Non-Safety-Related

Calc. No. S&L-DEC-[illegible]

Rev. 0 | Date

Page 7-8 of

Client DECO

Project Fermi-2

Proj. No. 6139-38 Equip. No.

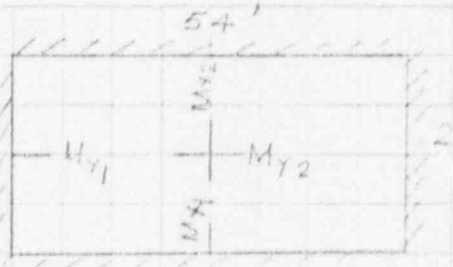
Prepared by M. Bakhtiar | Date 5-2-81

Reviewed by Dan Le | Date 5-5-81

Approved by | Date

Dryer-Separator Pool - Bottom Slab

From calc. No. 7.01.00-Fermi-2, moments and shears due to Dead, Mech & Hydro static loads are:



Load	M_{X_1} (K-ft)	M_{X_2} (K-ft)	M_{Y_1} (K-ft)	M_{Y_2} (K-ft)	V_X (Kips)	V_Y Kips
Dead Load + Mech. Load + Hyd. Static	+88.2	-45.4	+55.0	-15.5	+24.4	+22.3
Vert Seismic - SSE*	+35.3	-18.2	+22.0	-6.2	+9.8	+8.9
Oper. Thermal ⊛	-48.1	-48.1	-48.1	-48.1	—	—
Final Total	+75.4	-111.7	+28.9	-69.8	+34.2	+31.2

Axial load on the slab = 22.46 K (tensile)

*From the new spectra curve No. C-171R dated 5-2-81, Vertical response spectra for slab @ GA 1'-6", 659'-6" & 654'-6" the rigid acceleration = 0.4g

⊛ Refer to Computer output 557 DL, Dated May 4, 1981.

Form GQ-3.08.1 Rev. 2

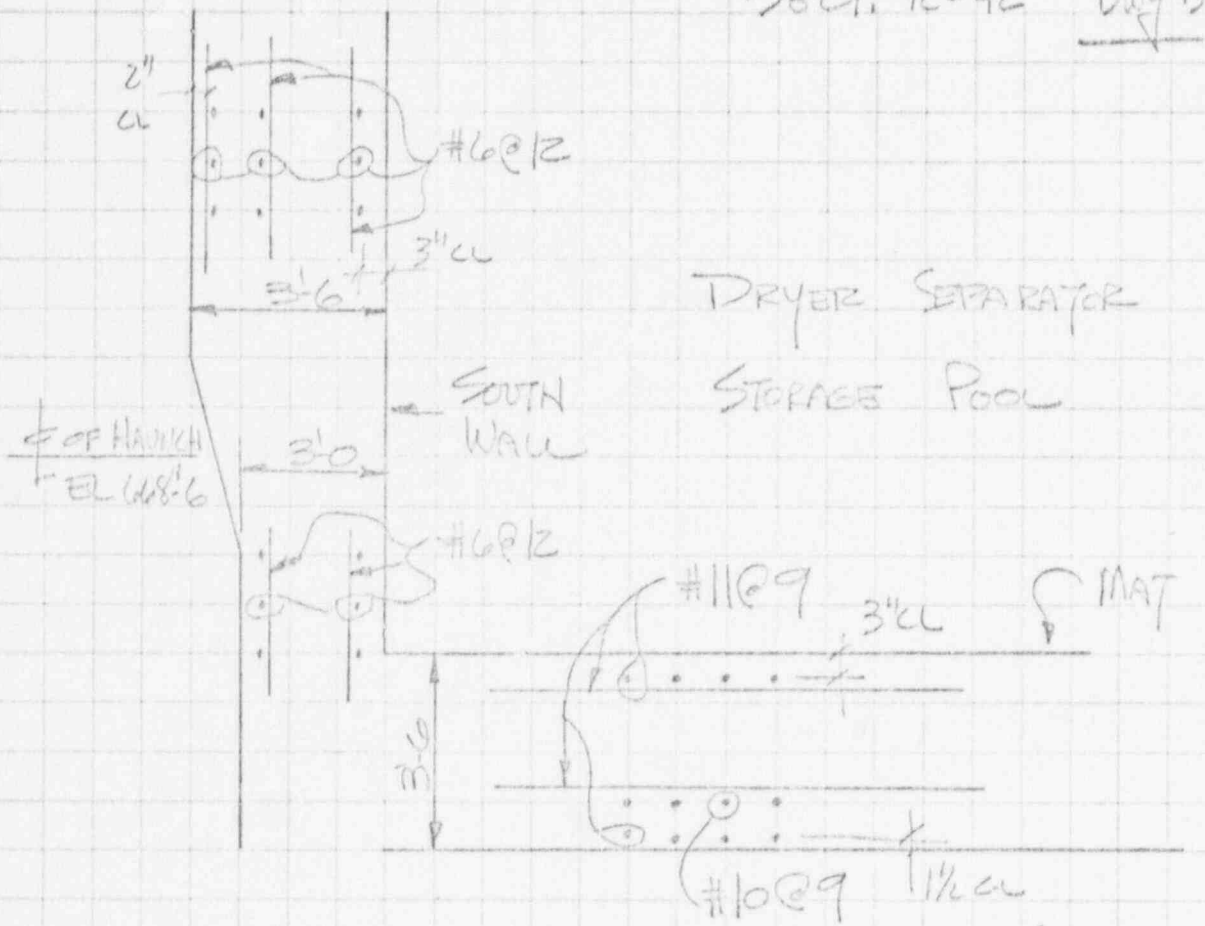
SARGENT & LUNDY ENGINEERS CHICAGO

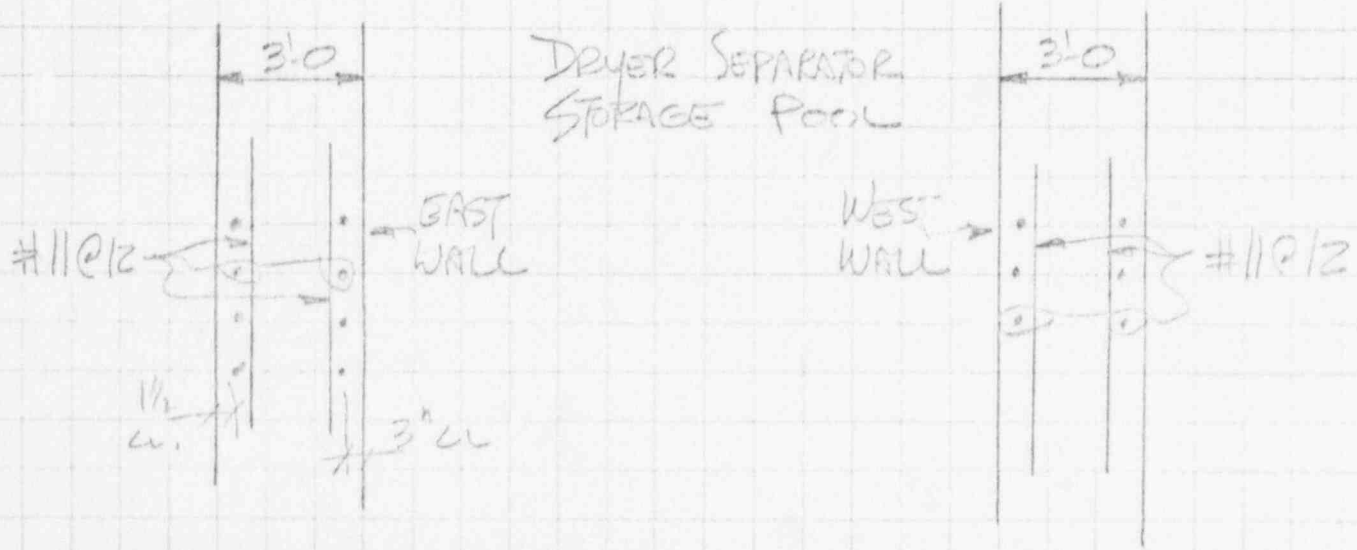
Calcs. For DRYER SEPARATOR STORAGE POOL REINF.		Calc. No. STD-DFCC-0044
X Safety-Related	Non-Safety-Related	Rev. / Date
		Page 7-9 of

Client DETROIT EDISON	Prepared by [illegible]	Date 5-11-91
Project ENRICO FERMI-2	Reviewed by M. Valentine	Date 5-13-91
Proj. No. 6159.39 Equip. No.	Approved by	Date

SECT. 40-40 Dwg B-63 Rev I

SECT. 42-42 Dwg B-72 Rev M





Form GQ-3.08.1 Rev. 2

SARGENT & LUNDY ENGINEERS CHICAGO

Calcs. For DRYER SEPARATOR STORAGE POOL RIDGE.		Calc. No. STD-DSC0-004
		Rev. 0 Date
X Safety-Related	Non-Safety-Related	Page 7-10 of

Client DETROIT EDISON	Prepared by [illegible]	Date 5-1-81
Project ENRICO FERMI-2	Reviewed by M. Blevins	Date 5-14-81
Proj. No. 6139-38 Equip. No.	Approved by	Date

MAT: PER FT. 3'-6 THICK

TOP REINF. = 56.4 SQ. IN.

BOTTOM REINF. = 81.8 SQ. IN.

EAST OR WEST WALL: PER FT. 3'-0 THICK

INSIDE REINF. = 33.8 SQ. IN.

OUTSIDE REINF. = 33.8 SQ. IN.

SOUTH WALL BELOW EL 668'-6

PER FT. 3'-0 THICK

INSIDE REINF. = 18 SQ. IN.

OUTSIDE REINF. = 18 SQ. IN.

SOUTH WALL ABOVE EL 668'-6

PER FT. 3'-6 THICK

INSIDE REINF. = 18 SQ. IN.

OUTSIDE REINF. = 36 SQ. IN.

Form GQ-3.08.1 Rev. 2

SARGENT & LUNDY ENGINEERS CHICAGO

Calcs. For Section Capacity for dryer separator pool slab & walls		Calc. No. SDD-DEC0-[illegible]
		Rev. 0 / Date
✓ Safety-Related	Non-Safety-Related	Page 7-11 of

Client DEC0	Prepared by M. Valotta	Date 1-25-91
Project Fermi-2	Reviewed by Daula	Date 2-26-91
Proj. No. 6139-38 Equip. No.	Approved by	Date

Material Properties:

Unit weight of Concrete = 150 pcf

Compressive strength of Concrete = 4000 psi

Yield strength of steel = 60 ksi

Young's Modulus of steel = 29×10^3 ksi

East, West & South Walls

Thickness = 36"

Width = 12"

Reinforcement Data	Layer #	1	2
	Distance (inch)	3	33
	Area (inch²)	1.56	1.56

Form GO-3.08.1 Rev. 2

SARGENT & LUNDY ENGINEERS CHICAGO

Calcs. For Design of Dryer-Separator pool slab & walls

Calc. No. SDD-DEC-002

Rev. 0 Date

Page 7-12 of

✓ Safety-Related | Non-Safety-Related

Client DECO

Project Fermi-2

Proj. No. 6139-38 Equip. No.

Prepared by M. V. Dalton Date 5-1-81

Reviewed by Dau (c Date 5-2-81

Approved by Date

Slab:

Thickness = 42"

Width = 12"

Reinforcement Data	Layer #	1	2	3
	Distance (ind.)	3	36	39
	Area (inch²)	2.0	1.69	2.03

Form GO-3.08.1 Rev. 2

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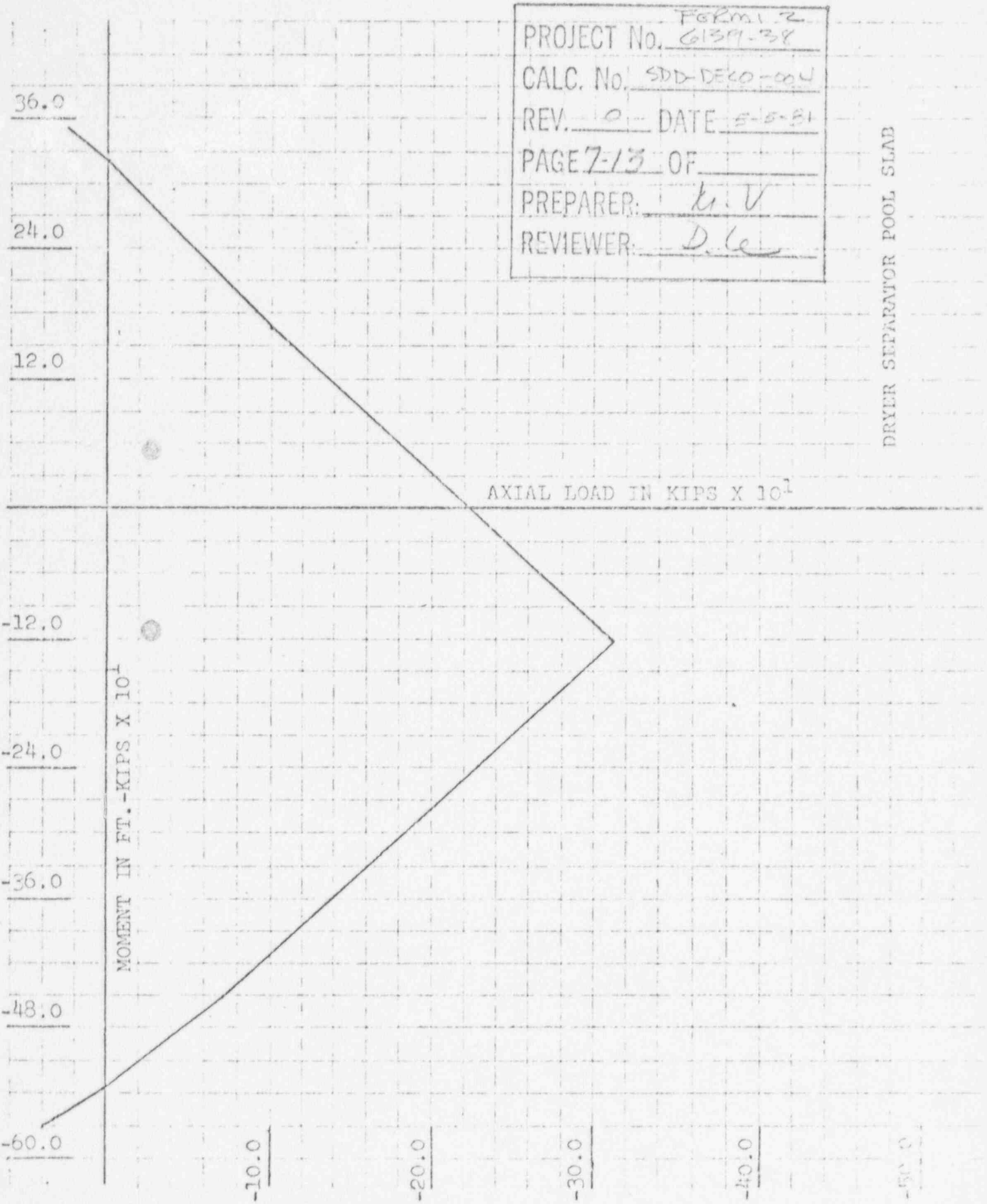
CHICAGO

FORM 1.2

PROJECT No. 6139-38
CALC. No. SDD-DEC0-001
REV. 0 DATE 5-5-81
PAGE 7-13 OF
PREPARER: L. V
REVIEWER: D. C

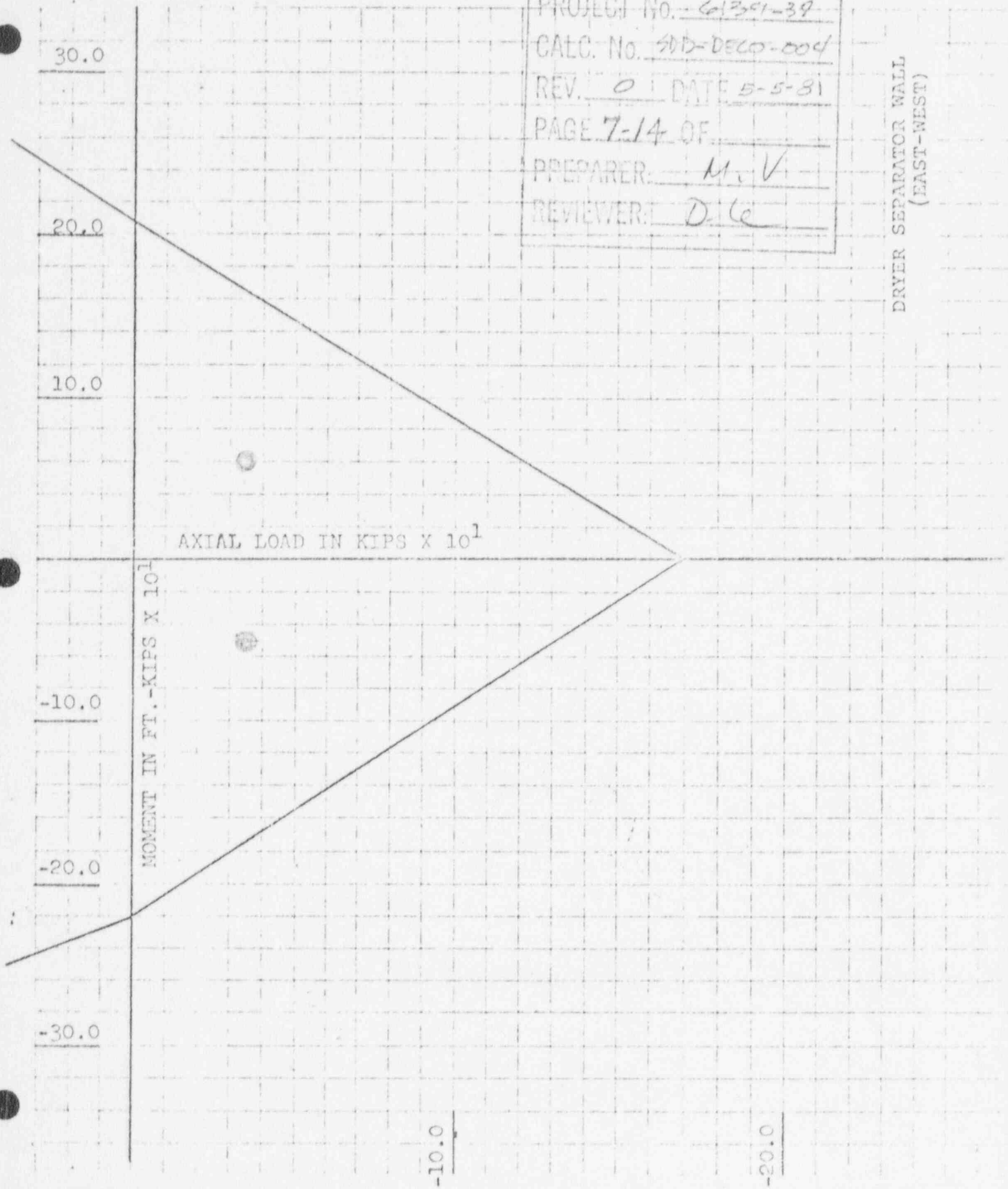
DRYER SEPARATOR POOL SLAB



SARGENT & LUNDY
ENGINEERS
CHICAGO

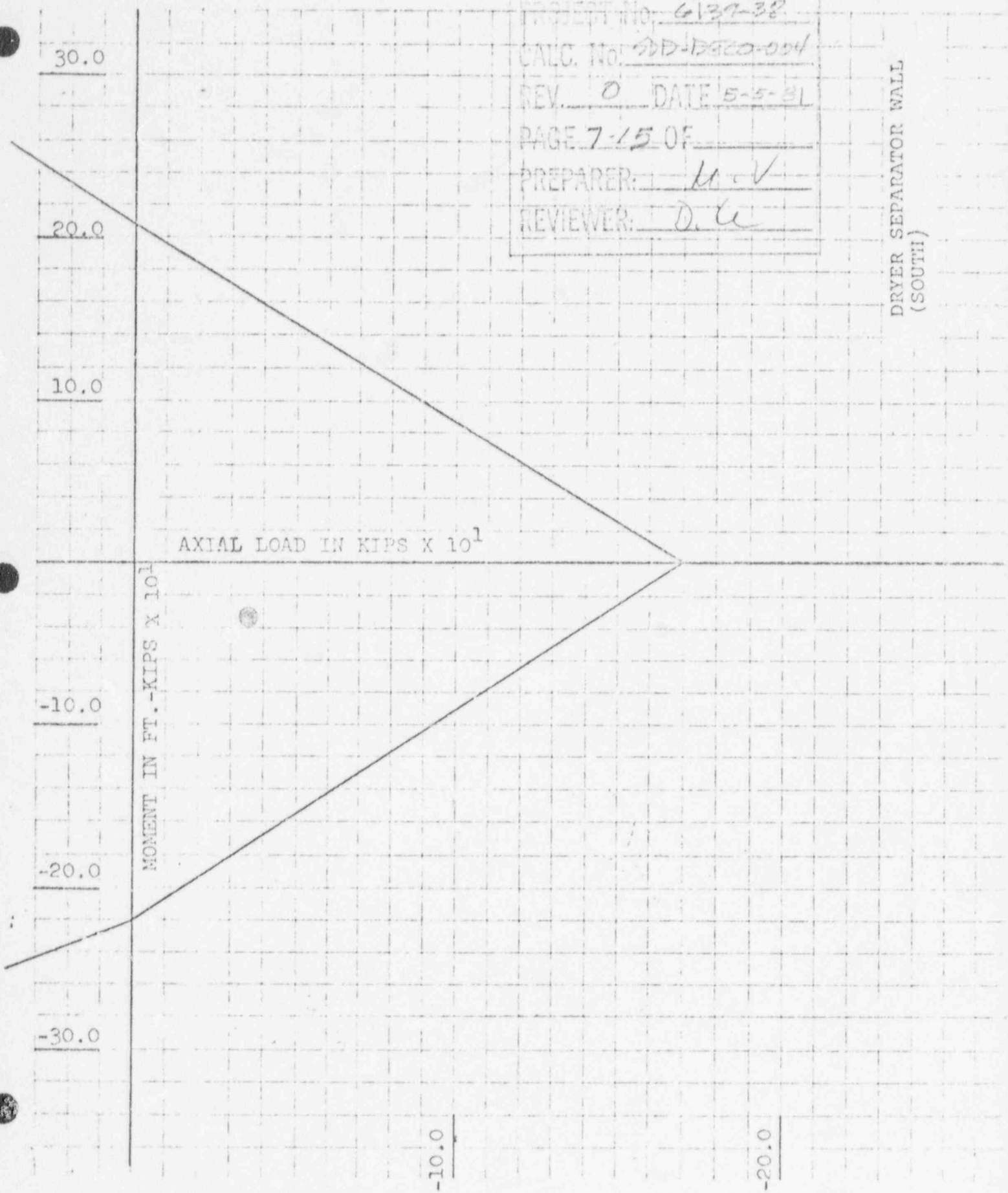
PROJECT No. Fermi 2 6135-39
CALC. No. 50D-DECO-004
REV. 0 DATE 5-5-81
PAGE 7-14 OF
PREPARER: M. V
REVIEWER: D. C

DRYER SEPARATOR WALL
(EAST-WEST)



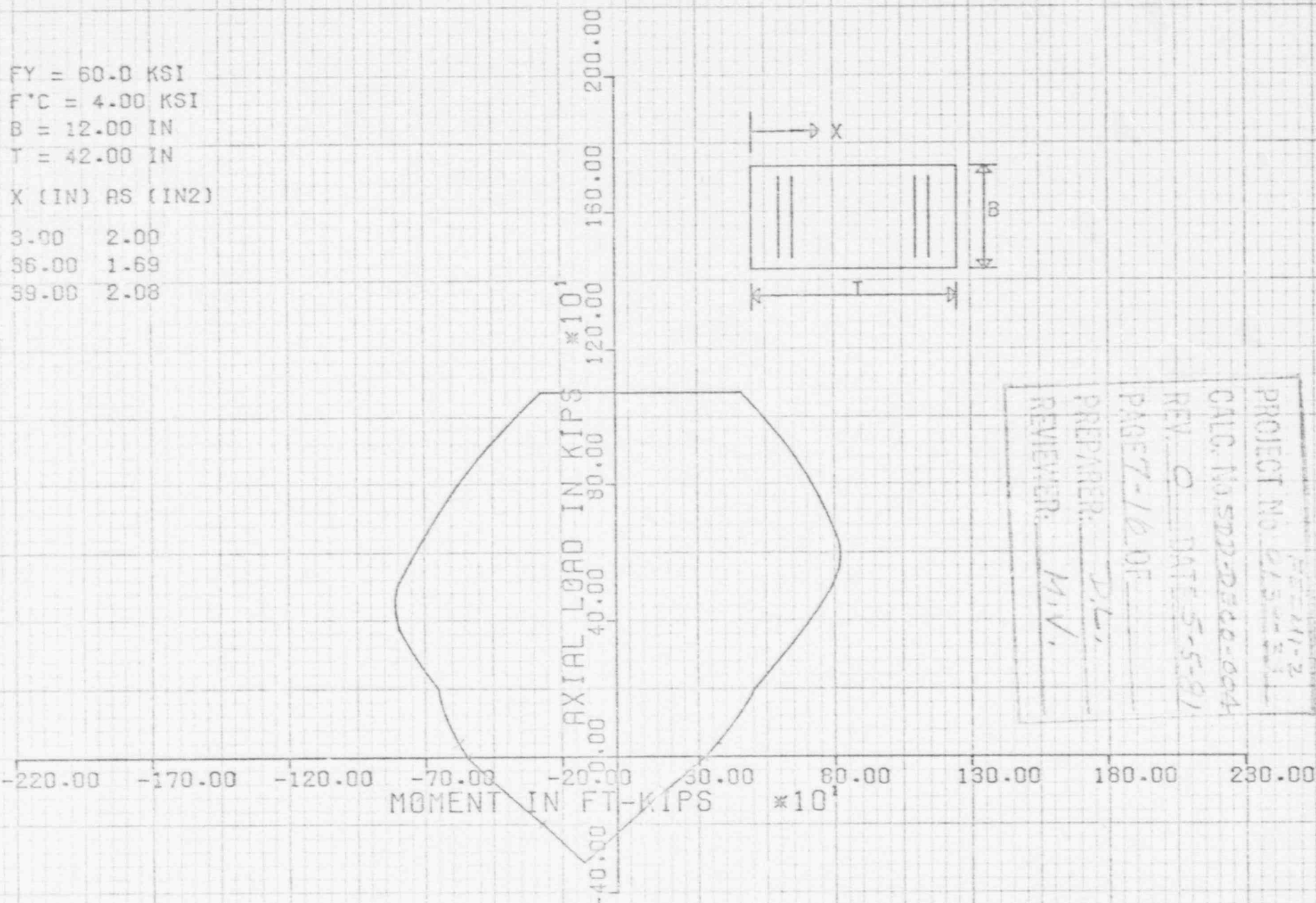
SARGENT & LUNDY
ENGINEERS
CHICAGO

PROJECT No: Fermi 2 6137-38
CALC. No: DD-D&CO-004
REV. 0 DATE 5-5-81
PAGE 7-15 OF
PREPARER: M. V
REVIEWER: D. C



FY = 60.0 KSI
F'C = 4.00 KSI
B = 12.00 IN
T = 42.00 IN

X (IN)	AS (IN2)
3.00	2.00
36.00	1.69
39.00	2.08

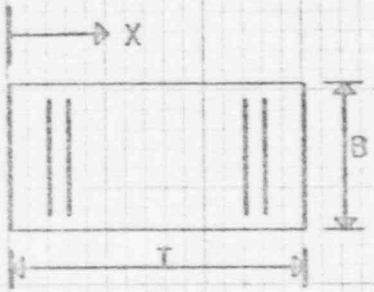


PROJECT NO. [illegible]
CALC. NO. SD2-2222-004
REV. 0 DATE 5-5-01
PAGE 7-10 OF [illegible]
PREPARER: D.C.
REVIEWER: M.V.

DRYER SEPARATOR POOL SLAB

FY = 50.0 KSI
F'C = 4.50 KSI
B = 12.00 IN
T = 36.00 IN

X (IN)	AS (IN2)
3.00	1.56
33.00	1.56



DRYER SEPARATOR WALL

SARGENT & LUNDY ENGINEERS CHICAGO

Calcs. For Notes on LOCA calculations		Calc. No. SDD-DECO-CC
		Rev. 0 / Date
✓ Safety-Related	Non-Safety-Related	Page A-1 of

Client DECO	Prepared by M. Vakkilainen	Date 5-21-81
Project Fermi-2	Reviewed by Dan Lee	Date 5-21-81
Proj. No. 6139-38 Equip. No.	Approved by	Date

APPENDIX

NOTES ON LOCA CALCULATIONS

SARGENT & LUNDY ENGINEERS CHICAGO

Calcs. For Notes on LOCA calculations		Calc. No. SDD-DECO-004
		Rev. 0 / Date
✓ Safety-Related	Non-Safety-Related	Page A-2 of

Client DECO	Prepared by M. Valathur	Date 5-21-81
Project FERMI-2	Reviewed by Dan Le	Date 5-21-81
Proj. No. 6139-38 Equip. No.	Approved by	Date

Notes on LOCA calculations

In this section, the results of the Analysis* for LOCA condition are summarized for the following components:

Reactor Pedestal

Stabilizer Truss

Sacrificial shield

The load Combinations considered in the assessment are tabulated on page A-3 and the results of the assessment are summarized on the following pages A-4 through A-6 for the critical LOCA load Combination.

* From References 2 and 3 given on page 1-6 of this calculation book.

SARGENT LUNDY ENGINEERS CHICAGO

Calcs. For Notes on LOCA calculation		Calc. No. SDD-DECO-00.4
		Rev. 0 Date
✓ Safety-Related	Non-Safety-Related	Page A-3 of

Client DECO	Prepared by M Blatt	Date 5-21-81
Project Fermi-2	Reviewed by Daulc	Date 5-21-81
Proj. No. 6139-38 Equip. No.	Approved by	Date

LOADING COMBINATION TABLE

LOAD TYPES / LOAD COMBINATIONS	1	2	3	4	5	6	7	8	9	10	11	12
	DEAD LOAD	ACCIDENT TEMP.	OBE		SSE		PRESSURE DUE TO ANNULUS PRESSURIZATION				PIPE REACTIONS	
	D	TA	EOP	EON	ESP	ESN	PAPP	PAPN	PANP	PANN	YRP	YRN
1	1.0	1.0	1.25				1.0					
2	1.0	1.0		1.25				1.0				
3	1.0	1.0	1.25						1.0			
4	1.0	1.0		1.25						1.0		
5	1.0		1.25								1.0	
6	1.0			1.25								1.0
7	1.0	1.0			1.0		1.0					
8	1.0	1.0				1.0		1.0				
9	1.0	1.0			1.0				1.0			
10	1.0	1.0				1.0				1.0		
11	1.0				1.0						1.0	
12	1.0					1.0						1.0

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SARGENT & LUNDY ENGINEERS CHICAGO

Calcs. For Notes on Load calculations

Calc. No. SDD-DECO-[illegible]

Rev. 0 | Date

Page A-3 of

✓ Safety-Related | Non-Safety-Related

Client DECO

Project Fermi-2

Proj. No. 6139-38 Equip. No.

Prepared by M Vblatha | Date 5-21-81

Reviewed by Davis | Date 5-21-81

Approved by | Date

LOADING COMBINATION TABLE

LOAD TYPES / LOAD COMBINATIONS	1	2	3	4	5	6	7	8	9	10	11	12
	DEAD LOAD	ASSUMED TEMP.	OBE		SSE		PRESSURE DUE TO ANNULUS PRESSURIZATION				PIPE REACTIONS	
	D	TA	EOP	EON	ESP	ESN	PAPP	PAPN	PANP	PANN	YRP	YRN
1	1.0	1.0	1.25				1.0					
2	1.0	1.0		1.25				1.0				
3	1.0	1.0	1.25						1.0			
4	1.0	1.0		1.25						1.0		
5	1.0		1.25								1.0	
6	1.0			1.25								1.0
7	1.0	1.0			1.0		1.0					
8	1.0	1.0				1.0		1.0				
9	1.0	1.0			1.0				1.0			
10	1.0	1.0				1.0				1.0		
11	1.0				1.0						1.0	
12	1.0					1.0						1.0

Form GO-3.08.1 Rev. 2

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Calcs. For Summary of stresses for Reactor Pedestal		Calc. No. SDD-DEC4-004
		Rev. 0 Date
/ Safety-Related	Non-Safety-Related	Page A-4 of

Client DECO	Prepared by M. Valatka	Date 5-21-81
Project Fermi-2	Reviewed by Dan Le	Date 5-21-81
Proj. No. 6139-38 Equip. No.	Approved by	Date

Summary of stresses - Reactor Pedestal

DESIGN SECTION	ACTUAL VALUES			ALLOWABLE VALUES		
	Reinforcing (ksi)	Concrete (ksi)	Shear (kips)	Reinforcing (ksi)	Concrete (ksi)	Shear (kips)
MERIDIONAL						
1	33.6	0.7	55.7	54	3.4	58.9
2	26.1	0.5	52.2	54	3.4	58.9
3	18.1	0.5	46.0	54	3.4	58.9
4	16.9	0.5	52.2	54	3.4	78.2
5	3.4	0.3	68.6	54	3.4	82.0
HOOP						
1	32.0	0.2	1.1	54	3.4	57.0
2	34.0	0.3	0.3	54	3.4	57.0
3	33.4	0.4	1.6	54	3.4	57.0
4	42.2	0.3	2.6	54	3.4	76.4
5	28.4	0.5	3.7	54	3.4	80.2

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Calcs. For Summary of Stresses - Stabilizer Truss		Calc. No. SDD-DECO-604
		Rev. 0 Date
✓ Safety-Related	Non-Safety-Related	Page A-5 of

Client DECO	Prepared by M. Bhatia	Date 5-21-81
Project Fermi-2	Reviewed by Dau Le	Date 5-21-81
Proj. No. 6139-38 Equip. No.	Approved by	Date

Summary of stresses - Stabilizer Truss

critical load Combinations and the forces considered are:

Feed water line reaction load

$$1.0 E_s + 1.0 P_a + 1.0 Y_r = 1.0(346) + 1.0(1579) + 1.0(145)$$

$$= 2,070 \text{ kips}$$

Recirculation line reaction load

$$1.0 E_s + 1.0 Y_r = 1.0(346) + 1.0(700)$$

$$= 1046 \text{ kips}$$

∴ Design load = 2,070 kips

Load on Truss pipe column member = 254 kips
(As per procedure given on page 3-4 of this calc. book)

Maximum stress in the member = f_a = 7.47 ksi

and allowable stress = F_a = 20.85 ksi (As per AISC)

Form GO-3.08.1 Rev. 2

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Calcs. For Summary of Stresses for Sacrificial Shield		Calc. No. CDD-DFC-004
		Rev. 0 Date
✓ Safety-Related	Non-Safety-Related	Page A-6 of Final

Client DFCO	Prepared by M. Palatta	Date 5-21-81
Project Fermi-2	Reviewed by Daule	Date 5-24-81
Proj. No. 6134-38 Equip. No.	Approved by	Date

Summary of Stresses - Sacrificial Shield

Maximum stresses in the plates

Design section	Positive stresses (KSI)			Negative stresses (KSI)		
	σ_{11}	σ_{22}	σ_{12}	σ_{11}	σ_{22}	σ_{12}
1	11.89	1.69	3.92	-12.73	-18.00	-5.37
2	12.62	16.18	7.71	-7.07	-8.77	-8.67
3	7.51	6.20	1.22	-6.62	-2.59	-1.80
4	7.24	5.35	6.55	-1.24	-0.24	-0.85

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