

WM. H. ZIMMER POWER STATIONINSTRUCTIONS FOR UPDATING YOUR DAR

Changes to the MARK II DAR are identified by a vertical line in the right margin of the page. To update your copy of the ZPS-1 DAR, remove and destroy the following pages and figures and insert pages and figures as indicated.

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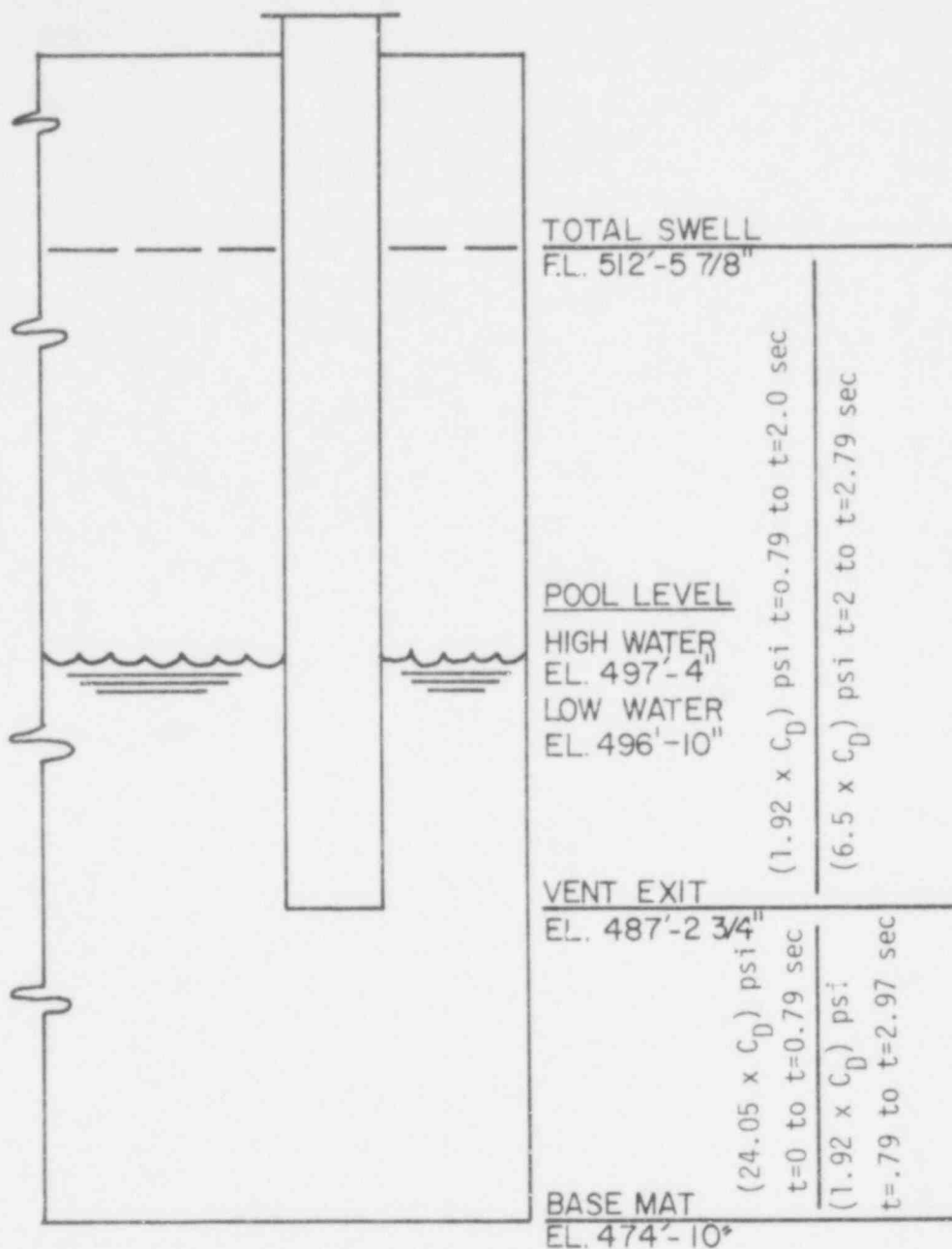
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1.  $F_t$  AND  $F_r$  ARE ORTHOGONAL COMPONENTS, ie., TANGENTIAL AND RADIAL. VECTORS INDICATE POSITIVE COORDINATE DIRECTIONS.

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FIGURE 3.2-18  
DOWNCOMER VENT GEOMETRY



NOTE:

1. THE DRAG LOAD APPLIES IN EITHER HORIZONTAL OR VERTICAL DIRECTION.

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FIGURE 3.3-8

DRAG LOAD DUE TO POOL SWELL AND  
FALLBACK PHENOMENA

APPENDIX F

CONTAINMENT STRUCTURE ASSESSMENT FOR

LOCA JET IMPINGEMENT AND POOL SWELL LOADS

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F.1.0 INTRODUCTION

This report presents an assessment of the containment structure for the LOCA jet and pool swell loads on the pool boundary defined in the "Lead Plant Program Load Evaluation Report," NUREG-0487 dated October 1978.

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The adequacy of the containment structure at key design sections is demonstrated with the aid of interaction diagrams.

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## F.2.0 LOADS

A conservative definition of the LOCA jet load and pool swell load is given in NUREG-0487 dated October 1978.

### F.2.1 LOCA Jet Load

Figure F.2-1 shows the spatial distribution of the LOCA jet load on the wetted surface of the suppression pool. The magnitude of the load is 33 psig below vent exit and attenuates linearly to zero at the pool surface.

### F.2.2 Pool Swell Load

The containment structure is analyzed for two load cases for the LOCA pool swell phenomenon; the symmetric and the asymmetric loads.

#### F.2.2.1 Symmetric Pool Swell Load

For the symmetric load, the loading is applied over the entire 360° of the containment wall. The pressure history of the drywell and wetwell air space is given in Figure F.2-2. Curve A of this figure applies to the drywell and curve B applies to that portion of the wetwell wall which is above the pool water surface. The LOCA-pool swell portion of these curves ends at time 2.97 seconds.

The peak wetwell air space pressure during this event is 23 psig, while the peak drywell pressure is 21 psig.

For the portion of the wetwell walls which are below the water surface, the load definition is given in Figure F.2-3. This load is 22 psig at the basemat level which decreases linearly to 16 psig at the elevation of the vent exit, and then increases linearly to 23 psig at the maximum pool swell elevation.

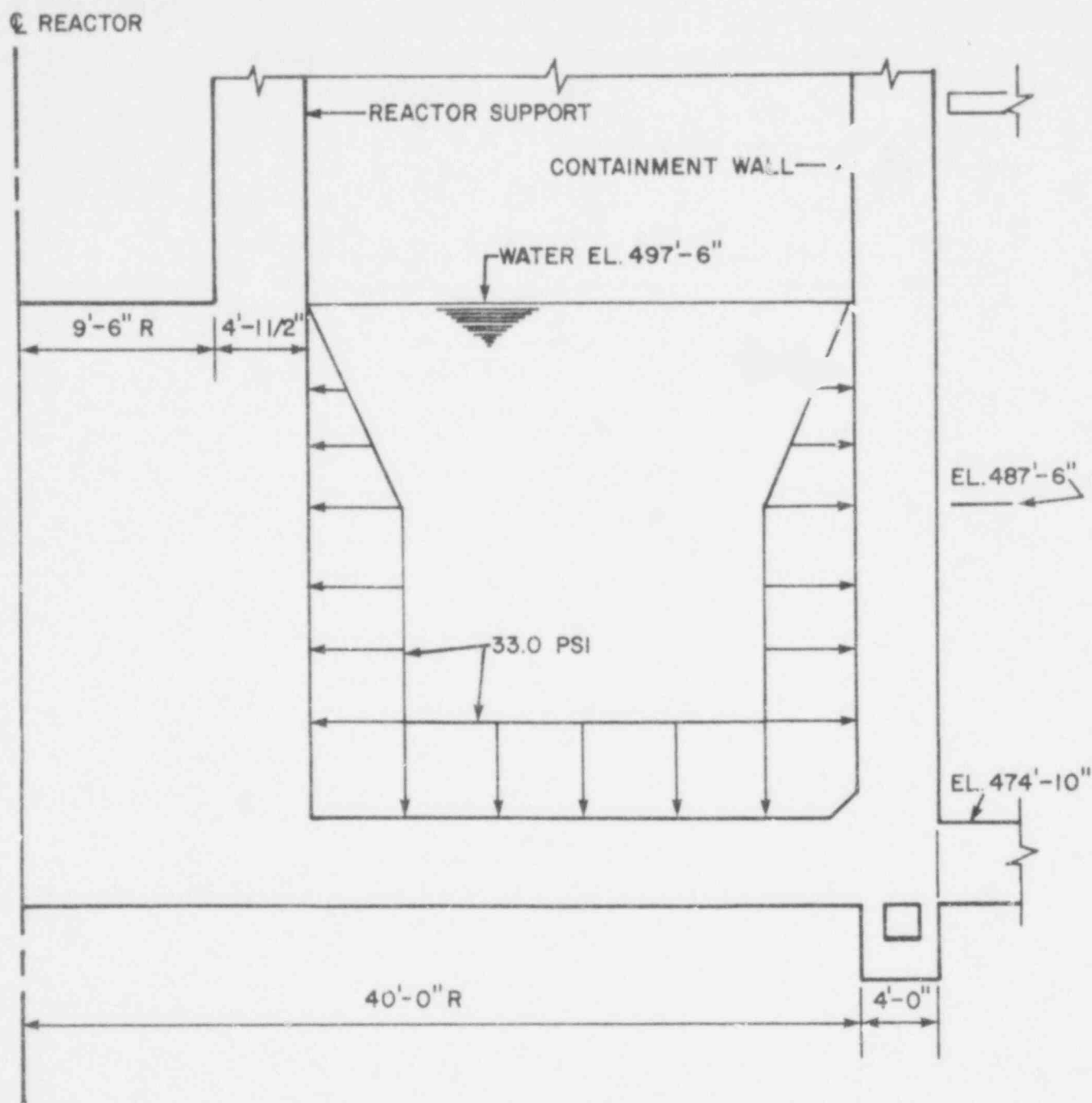
#### F.2.2.2 Asymmetric Pool Swell Load

The peak drywell pressure during this event is applied uniformly over the entire drywell.

Figure F.2-4 shows the pressure distribution of the pool swell asymmetric load for the wetwell.

The asymmetric pool swell load of 23 psig is applied over a sector of 180°, in addition to the hydrostatic load.

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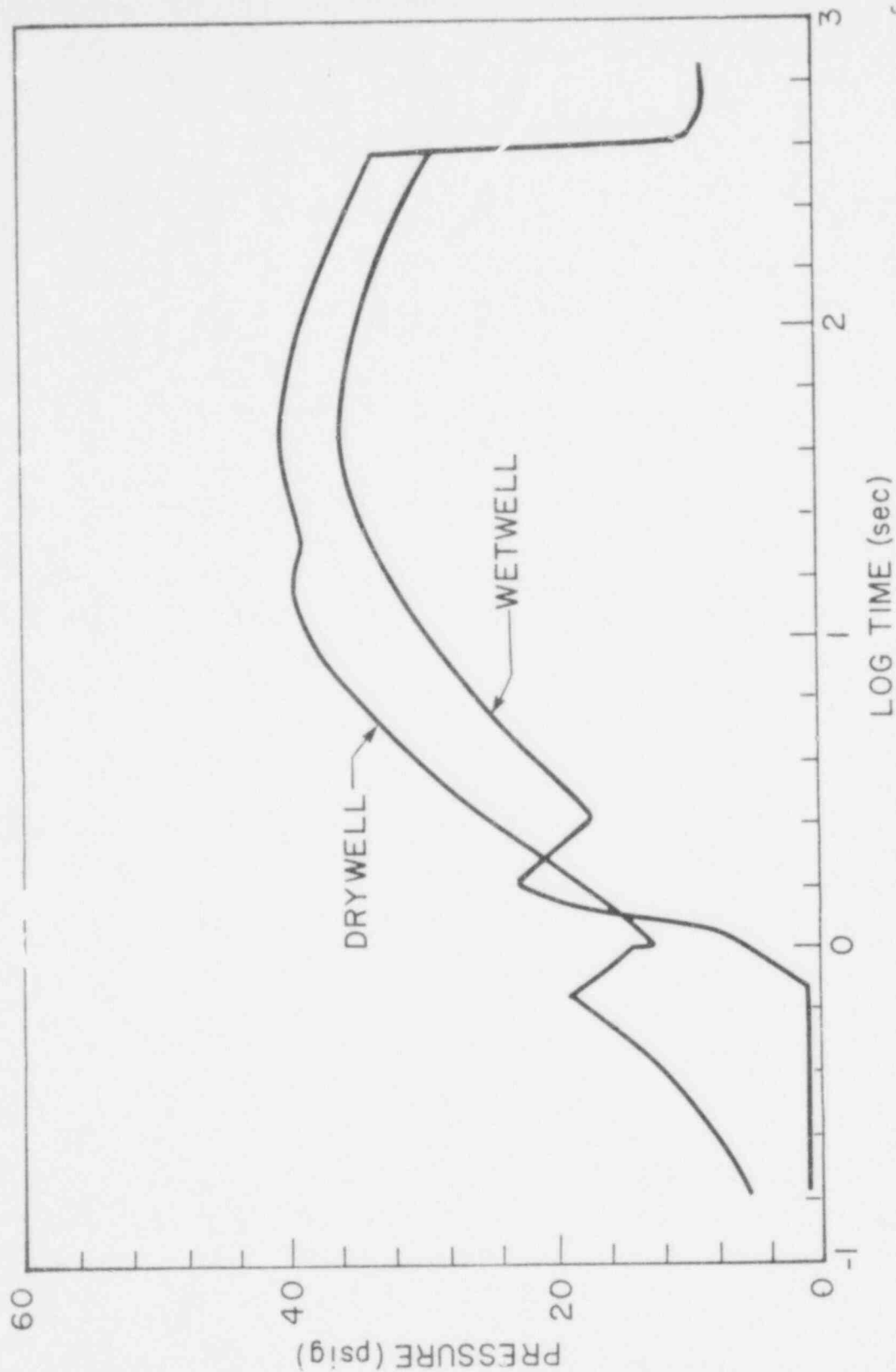
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FIGURE F.2-1

LOCA JET IMPINGEMENT PRESSURE  
DISTRIBUTION



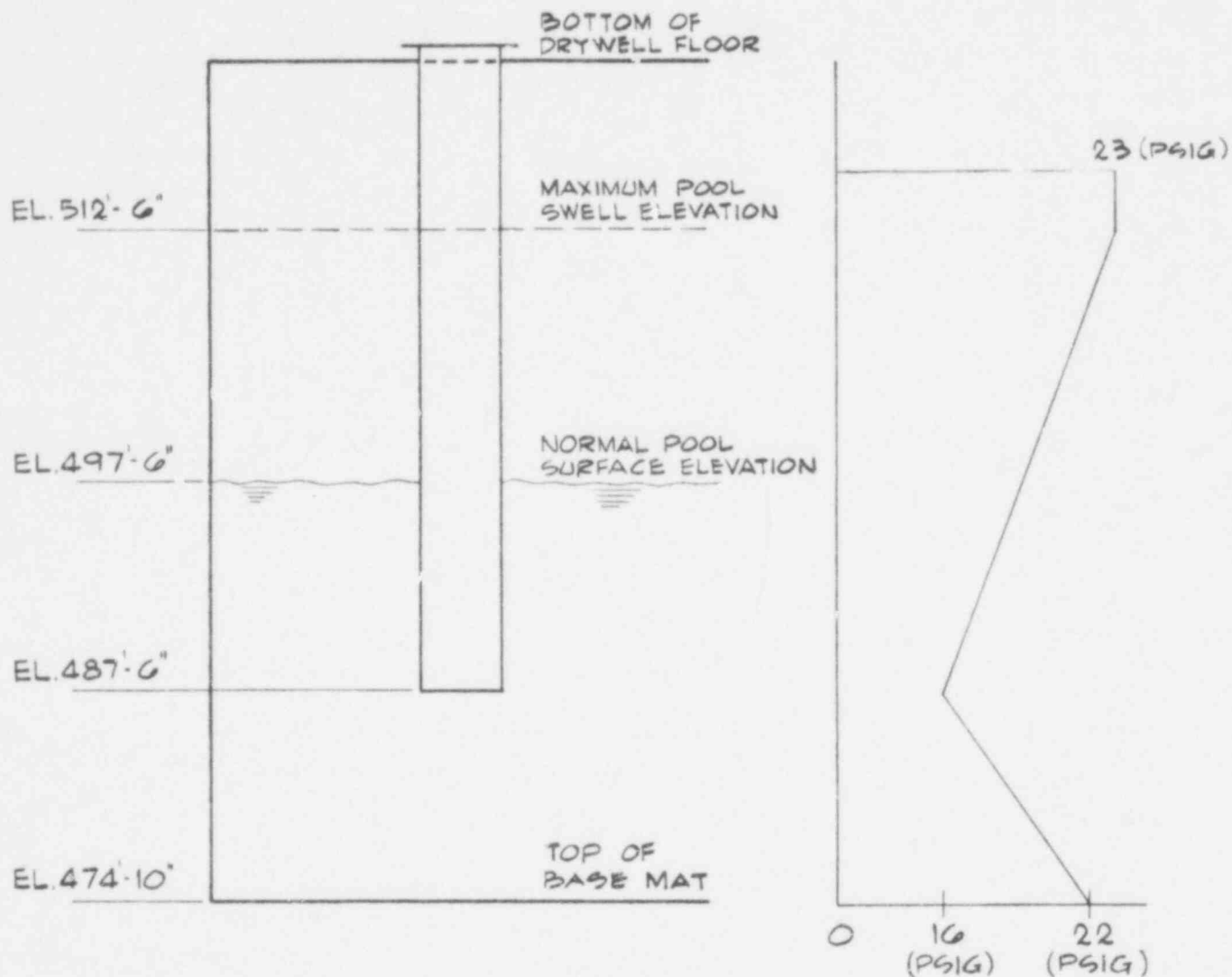
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FIGURE F.2-2

DRYWELL/WETWELL PRESSURE HISTORY FOR  
MAIN STEAMLINE BREAK

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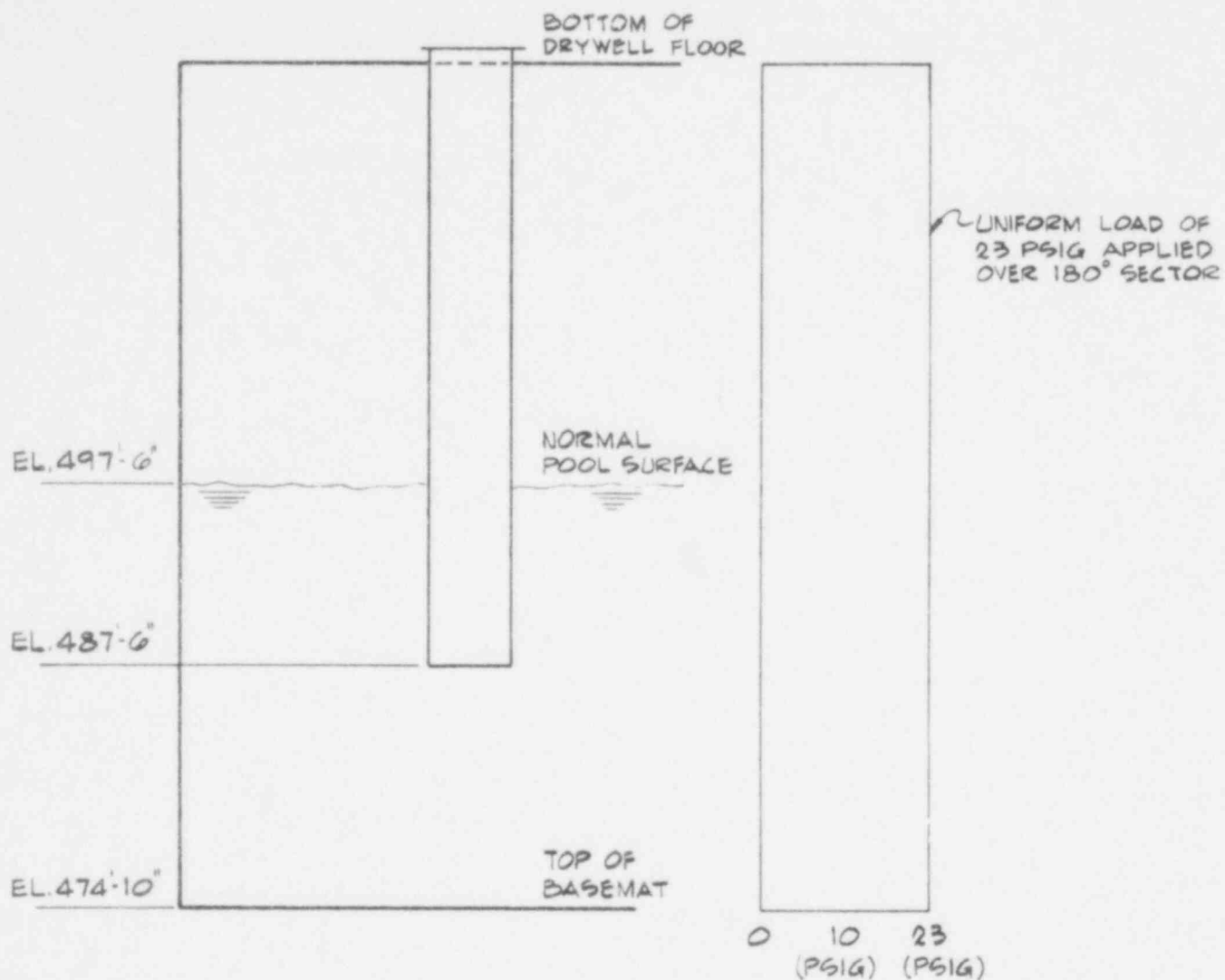


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FIGURE F.2-3

POOL SWELL SYMMETRIC LOAD



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FIGURE F.2-4

POOL SWELL ASYMMETRIC LOAD

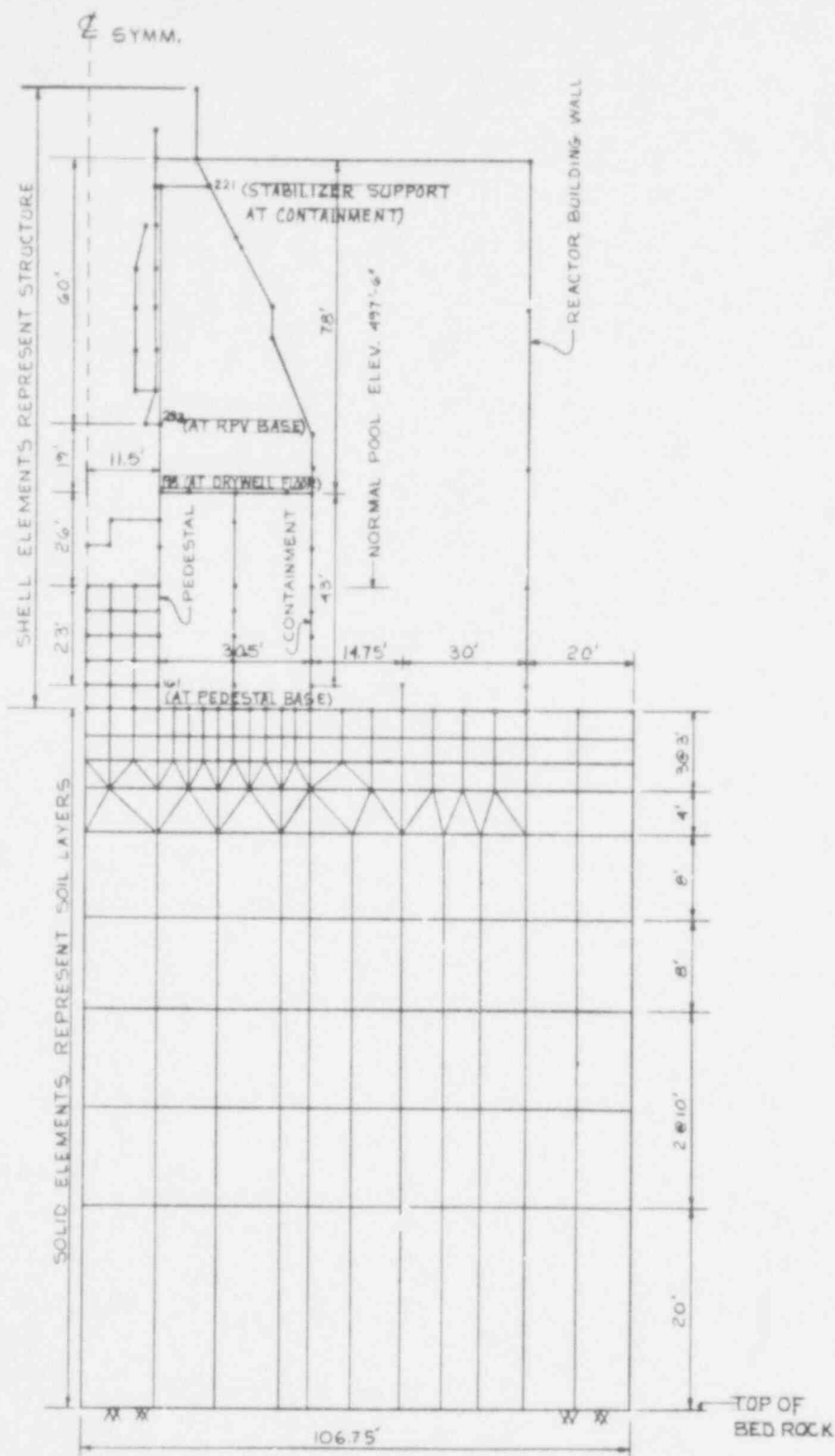
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F.3.0 STRUCTURAL ANALYSIS MODEL

The containment is modeled as an axisymmetric structure by finite shell elements as shown in Figure F.3-1. The structural model includes the basemat, primary containment, reactor pedestal, drywell floor, and reactor pressure vessel (RPV). The soil is modeled by axisymmetric solid finite elements in nine horizontal layers down to the bedrock level.

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FIGURE F.3-1

STRUCTURAL MODEL INCLUDING SOIL

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F.4.0 METHOD OF ANALYSIS AND RESULTS

The containment structure, described in Section F.3.0, is analyzed by the Sargent & Lundy version of the finite element program DYNAX which is capable of analyzing axisymmetric structures subjected to symmetric and asymmetric static or dynamic loads. The LOCA jet impingement and pool-swell loads are applied as Fourier sine and/or cosine harmonics for each case in this analysis.

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### F.5.0 DESIGN ASSESSMENT

The following key design sections in the containment structure, shown in Figure F.5-1, are selected for this assessment:

- a. basemat Section 2 near the junction between the basemat and reactor support,
- b. basemat Section 3 near the junction between the basemat and the containment wall,
- c. containment Section 1 in the wetwell near the junction between the basemat and the cylindrical wall,
- d. containment Section 4 in the drywell wall near the junction between the drywell floor slab and the cylindrical wall, and
- e. containment Section 11 in the conical drywell wall.

A breakdown of the effects of the LOCA jet impingement and pool swell and other individual loads on these critical design sections is given in Tables F.5-1 through F.5-5.

The design forces and moments on the key sections are obtained by combining the various individual loads in accordance with the load combinations specified in Table F.5-6.

The adequacy of the containment structure is verified by plotting the design force-moment combinations on the interaction diagrams for the various design sections. As can be seen from Figures F.5-3 through F.5-12, all points plot within the boundary of the respective interaction diagrams. This demonstrates that the containment structure can safely accommodate the effects of the conservative LOCA jet impingement and pool-swell loads defined in NUREG-0487 dated October 1978.

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TABLE F.5-1

## FORCES ON CONTAINMENT SECTION 1 FOR INDIVIDUAL LOADS

| LOAD DESCRIPTION           | $M_\phi$<br>(kip-ft/ft) | $M_\theta$<br>(kip-ft/ft) | $N_\phi$<br>(kip/ft) | $N_\theta$<br>(kip/ft) | $Q_{R\phi}$<br>(kip/ft) | $Q_{R\theta}$<br>(kip/ft) | $Q_T$<br>(kip/ft) |
|----------------------------|-------------------------|---------------------------|----------------------|------------------------|-------------------------|---------------------------|-------------------|
| PERMANENT LOADS            | -226.95                 | -45.20                    | -430.74              | -113.00                | 66.65                   | 0                         | 0                 |
| OPERATING TEMPERATURE      | -73.99                  | -32.83                    | 6.91                 | 3.64                   | 3.34                    | 0                         | 0                 |
| OPERATING BASIS EARTHQUAKE | 0                       | 0                         | 118.28               | 0                      | 0                       | 0                         | 60.95             |
| SAFE SHUTDOWN EARTHQUAKE   | 0                       | 0                         | 162.40               | 0                      | 0                       | 0                         | 88.46             |
| +SRV ALL                   | 121.34                  | 3.14                      | 16.17                | 4.69                   | 13.96                   | 2.82                      | 19.44             |
| -SRV ALL                   | -47.74                  | -1.10                     | -14.96               | -4.63                  | -26.24                  | -2.82                     | -19.44            |
| +SRV ASYMMETRICAL          | 66.52                   | 4.42                      | 11.06                | 4.64                   | 5.44                    | 1.77                      | 6.00              |
| -SRV ASYMMETRICAL          | -19.58                  | -1.35                     | -8.19                | -2.95                  | -17.85                  | -1.77                     | -6.01             |
| +SRV ADS                   | 95.98                   | 2.38                      | 11.34                | 2.80                   | 9.44                    | 3.68                      | 12.54             |
| -SRV ADS                   | -36.46                  | -0.66                     | -7.70                | -2.73                  | -21.27                  | -3.29                     | -13.33            |
| ASYMMETRICAL CHUGGING      | 152.59                  | 4.49                      | 9.60                 | 5.21                   | 27.13                   | 0                         | 0                 |
| +SRV SINGLE                | 64.56                   | 1.45                      | 7.03                 | 2.07                   | 4.76                    | 0.65                      | 3.23              |
| -SRV SINGLE                | -16.59                  | -0.38                     | -2.43                | -0.79                  | -14.82                  | -1.31                     | -3.15             |
| SBA & IBA PRESSURE LOADS   | 169.50                  | 28.80                     | 98.95                | 8.97                   | -30.95                  | 0                         | 0                 |
| DBA PRESSURE LOADS         | 199.42                  | 33.90                     | 116.20               | 10.57                  | -36.43                  | 0                         | 0                 |
| SYMMETRIC POOL SWELL       | 144.55                  | 4.54                      | 47.07                | 5.00                   | -26.22                  | 0                         | 0                 |
| ASYMMETRIC POOL SWELL      | 306.69                  | 10.72                     | 47.43                | -5.74                  | -52.07                  | +17.81                    | +62.87            |
| JET IMPINGEMENT            | 307.3                   | 9.21                      | 18.30                | -1.97                  | -57.19                  | 0                         | 0                 |

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F.5-2

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TABLE F.5-2

FORCES ON CONTAINMENT SECTION 4 FOR INDIVIDUAL LOADS

| <u>LOAD DESCRIPTION</u>    | $M_\phi$<br>(kip-ft/ft) | $M_\theta$<br>(kip-ft/ft) | $N_\phi$<br>(kip/ft) | $N_\theta$<br>(kip/ft) | $Q_{R\phi}$<br>(kip/ft) | $Q_{R\theta}$<br>(kip/ft) | $Q_T$<br>(kip/ft) |
|----------------------------|-------------------------|---------------------------|----------------------|------------------------|-------------------------|---------------------------|-------------------|
| PERMANENT LOSS             | 42.74                   | 7.34                      | -401.05              | -514.53                | -6.21                   | 0                         | 0                 |
| OPERATING TEMPERATURE      | -198.71                 | -53.95                    | 9.45                 | 289.91                 | -49.29                  | 0                         | 0                 |
| OPERATING BASIS EARTHQUAKE | 0                       | 0                         | 76.56                | 0                      | 0                       | 0                         | 58.06             |
| SAFE SHUTDOWN EARTHQUAKE   | 0                       | 0                         | 98.20                | 0                      | 0                       | 0                         | 83.62             |
| +SRV ALL                   | 10.43                   | 1.92                      | 13.83                | 5.11                   | 1.14                    | 0                         | 7.46              |
| -SRV ALL                   | -6.17                   | -1.16                     | 10.73                | -5.75                  | -2.03                   | 0                         | -7.46             |
| +SRV ASYMMETRICAL          | 5.56                    | 0.74                      | 7.41                 | 2.3                    | 1.45                    | 0.07                      | 3.58              |
| -SRV ASYMMETRICAL          | -2.64                   | -0.67                     | -9.08                | -3.69                  | -1.46                   | -0.07                     | -3.48             |
| +SRV ADS                   | 6.28                    | 1.43                      | 10.50                | 4.07                   | 1.91                    | 0                         | 5.20              |
| -SRV ADS                   | -4.00                   | -1.17                     | -7.71                | -4.07                  | -1.60                   | 0                         | -5.69             |
| ASYMMETRICAL CHUGGING      | 11.37                   | 5.12                      | 10.85                | 10.12                  | 4.03                    | 0                         | 0                 |
| +SRV SINGLE                | 3.48                    | 0.43                      | 4.89                 | 1.53                   | 1.0                     | 0                         | 2.40              |
| -SRV SINGLE                | -1.68                   | 0                         | -2.66                | -2.58                  | 0                       | 0                         | -1.19             |
| SBA & IBA PRESSURE LOADS   | 58.04                   | 9.87                      | 78.63                | 66.84                  | 19.76                   | 0                         | 0                 |
| DBA PRESSURE LOADS         | 68.28                   | 11.61                     | 92.51                | 78.63                  | 23.25                   | 0                         | 0                 |
| SYMMETRIC POOL SWELL       | 47.90                   | 8.14                      | 47.67                | 60.05                  | -2.45                   | 0                         | 0                 |
| ASYMMETRIC POOL SWELL      | 62.03                   | 10.52                     | 63.83                | 54.36                  | -9.87                   | 0                         | +7.93             |
| JET IMPINGEMENT            | 21.05                   | 3.36                      | 21.16                | 2.39                   | -1.15                   | 0                         | 0                 |

TABLE F.5-3

FORCES ON CONTAINMENT SECTION 11 FOR INDIVIDUAL LOADS

| <u>LOAD DESCRIPTION</u>    | $M_\phi$<br>(kip-ft/ft) | $M_\theta$<br>(kip-ft/ft) | $N_\phi$<br>(kip/ft) | $N_\theta$<br>(kip/ft) | $Q_{R\phi}$<br>(kip/ft) | $Q_{R\theta}$<br>(kip/ft) | $Q_T$<br>(kip/ft) |
|----------------------------|-------------------------|---------------------------|----------------------|------------------------|-------------------------|---------------------------|-------------------|
| PERMANENT LOADS            | 152.81                  | 23.93                     | -295.76              | -280.19                | -7.22                   | 0                         | 0                 |
| OPERATING TEMPERATURE      | -484.37                 | -206.28                   | 41.12                | -26.00                 | -20.43                  | 0                         | 0                 |
| OPERATING BASIS EARTHQUAKE | 0                       | 0                         | 182.08               | 0                      | 0                       | 0                         | 59.93             |
| SAFE SHUTDOWN EARTHQUAKE   | 0                       | 0                         | 255.85               | 0                      | 0                       | 0                         | 87.23             |
| +SRV ALL                   | 12.69                   | 2.13                      | 10.93                | 5.87                   | 1.92                    | 0                         | 9.20              |
| -SRV ALL                   | -11.59                  | -2.23                     | -6.06                | -5.63                  | -2.08                   | 0                         | -9.20             |
| +SRV ASYMMETRICAL          | 0.89                    | 0.77                      | 10.80                | 1.57                   | 0.20                    | 0.06                      | 7.38              |
| -SRV ASYMMETRICAL          | -1.28                   | -0.78                     | -10.06               | -1.76                  | -0.24                   | -0.06                     | -7.36             |
| +SRV ADS                   | 1.15                    | 1.20                      | 10.26                | 2.18                   | 0                       | 0                         | 7.85              |
| -SRV ADS                   | -1.63                   | -1.25                     | -9.10                | -1.91                  | 0                       | 0                         | -8.00             |
| ASYMMETRICAL CHUGGING      | 1.97                    | 7.44                      | 10.26                | 2.60                   | 0.48                    | 0                         | 0                 |
| +SRV SINGLE                | 0.48                    | 0.74                      | 4.03                 | 0.72                   | 0                       | 0                         | 1.77              |
| -SRV SINGLE                | -0.77                   | -0.62                     | -3.99                | -1.14                  | 0                       | 0                         | -1.46             |
| SBA & IBA PRESSURE LOADS   | 3.09                    | 2.65                      | 42.45                | 71.90                  | 9.86                    | 0                         | 0                 |
| DBA PRESSURE LOADS         | 3.62                    | 3.11                      | 49.89                | 84.35                  | 11.59                   | 0                         | 0                 |
| SYMMETRIC POOL SWELL       | 6.79                    | 4.03                      | 7.38                 | 43.93                  | 2.66                    | 0                         | 0                 |
| ASYMMETRIC POOL SWELL      | -3.16                   | 1.49                      | 17.64                | 48.99                  | 0.32                    | 0                         | +6.44             |
| JET IMPINGEMENT            | -24.51                  | -4.63                     | 26.13                | 15.83                  | -5.45                   | 0                         | 0                 |

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TABLE F.5-4

## FORCES ON BASEMAT SECTION 2 FOR INDIVIDUAL LOADS

| Load Description           | $M_{\phi}$<br>(kip-ft/ft) | $M_{\theta}$<br>(kip-ft/ft) | $N_{\phi}$<br>(kip/ft) | $N_{\theta}$<br>(kip/ft) | $Q_{R\phi}$<br>(kip/ft) | $Q_{R\theta}$<br>(kip/ft) | $Q_T$<br>(kip/ft) |
|----------------------------|---------------------------|-----------------------------|------------------------|--------------------------|-------------------------|---------------------------|-------------------|
| PERMANENT LOADS            | 105.24                    | 3.60                        | 0                      | 0                        | 26.67                   | 0                         | 0                 |
| OPERATING TEMPERATURE      | -426.00                   | -460.00                     | 0                      | 0                        | -10.40                  | 0                         | 0                 |
| OPERATING BASIS EARTHQUAKE | -134.00                   | -116.00                     | 0                      | 0                        | 32.00                   | 32.00                     | 0                 |
| SAFE SHUTDOWN EARTHQUAKE   | -195.00                   | -167.00                     | 0                      | 0                        | 45.00                   | 45.00                     | 0                 |
| +SRV ALL                   | 125.20                    | 45.40                       | 31.90                  | 8.90                     | 22.00                   | 7.00                      | 9.50              |
| -SRV ALL                   | -148.10                   | -56.80                      | -16.40                 | -2.30                    | -27.00                  | -7.00                     | -9.50             |
| +SRV ASYMMETRICAL          | 59.38                     | 27.15                       | 22.43                  | 4.32                     | 11.75                   | 2.13                      | 3.60              |
| -SRV ASYMMETRICAL          | -42.93                    | -22.13                      | -9.74                  | -2.73                    | -27.58                  | -2.17                     | -3.72             |
| +SRV ADS                   | 112.50                    | 39.30                       | 22.40                  | 5.90                     | 12.90                   | 5.60                      | 5.90              |
| -SRV ADS                   | -79.50                    | -31.80                      | -9.90                  | -3.10                    | -25.00                  | -4.80                     | -5.10             |
| ASYMMETRICAL CHUGGING      | 117.90                    | 30.80                       | 23.90                  | 9.20                     | 22.00                   | 0                         | 0                 |
| +SRV SINGLE                | 72.80                     | 24.70                       | 14.70                  | 1.80                     | 5.50                    | 1.00                      | 1.10              |
| -SRV SINGLE                | -29.60                    | -11.50                      | -4.50                  | -1.40                    | -16.90                  | -2.00                     | -2.90             |
| SBA AND IBA PRESSURE LOADS | -222.00                   | -257.00                     | 0                      | 0                        | -11.65                  | 0                         | 0                 |
| DBA PRESSURE LOADS         | -261.12                   | -301.90                     | 0                      | 0                        | -13.70                  | 0                         | 0                 |
| SYMMETRIC POOL SWELL       | -66.75                    | -26.75                      | 26.86                  | 14.77                    | -3.25                   | 0                         | 0                 |
| ASYMMETRIC POOL SWELL      | -212.40                   | -92.82                      | 122.60<br>-69.19       | 44.78                    | 7.60<br>-1.77           | 0                         | +67.09            |
| JET IMPINGEMENT            | -192.46                   | -90.84                      | 51.5                   | 45.8                     | 2.50                    | 0                         | 0                 |

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TABLE F.5-5

## FORCES ON BASEMAT SECTION 3 FOR INDIVIDUAL LOADS

| Load Description           | $M_\phi$<br>(kip-ft/ft) | $M_\theta$<br>(kip-ft/ft) | $N_\phi$<br>(kip/ft) | $N_\theta$<br>(kip/ft) | $Q_{R\phi}$<br>(kip/ft) | $Q_{R\theta}$<br>(kip/ft) | $Q_T$<br>(kip/ft) |
|----------------------------|-------------------------|---------------------------|----------------------|------------------------|-------------------------|---------------------------|-------------------|
| PERMANENT LOADS            | -575.84                 | -150.65                   | 0                    | 0                      | -75.92                  | 0                         | 0                 |
| OPERATING TEMPERATURE      | -318.80                 | -385.50                   | 0                    | 0                      | 5.00                    | 0                         | 0                 |
| OPERATING BASIS EARTHQUAKE | -327.00                 | -113.00                   | 0                    | 0                      | -29.00                  | -29.00                    | 0                 |
| SAFE SHUTDOWN EARTHQUAKE   | -470.00                 | -164.00                   | 0                    | 0                      | -42.00                  | -42.00                    | 0                 |
| +SRV ALL                   | 119.10                  | 14.10                     | 18.30                | 13.90                  | 14.60                   | 1.60                      | 1.80              |
| -SRV ALL                   | -73.70                  | -15.00                    | -6.90                | -7.20                  | -10.10                  | -1.60                     | -1.80             |
| +SRV ASYMMETRICAL          | 45.04                   | 5.24                      | 15.25                | 6.52                   | 16.70                   | 0.72                      | 2.19              |
| -SRV ASYMMETRICAL          | -19.66                  | -6.06                     | -4.20                | -2.87                  | -5.21                   | -0.64                     | -2.03             |
| +SRV ADS                   | 19.30                   | 7.00                      | 13.30                | 10.30                  | 10.70                   | 1.40                      | 3.50              |
| -SRV ADS                   | -33.40                  | -8.50                     | -6.50                | -4.20                  | -4.40                   | -1.20                     | -3.80             |
| ASYMMETRICAL CHUGGING      | 89.30                   | 10.90                     | 20.70                | 7.00                   | 0                       | 0                         | 0                 |
| +SRV SINGLE                | 55.00                   | 6.90                      | 8.30                 | 4.40                   | 7.80                    | 0                         | 0                 |
| -SRV SINGLE                | -17.80                  | -2.70                     | -2.80                | -2.60                  | -2.60                   | -1.00                     | -1.00             |
| SBA AND IBA PRESSURE LOADS | -438.00                 | -15.16                    | 0                    | 0                      | -60.00                  | 0                         | 0                 |
| DBA PRESSURE LOADS         | -515.44                 | -17.82                    | 0                    | 0                      | -70.58                  | 0                         | 0                 |
| SYMMETRIC POOL SWELL       | 222.30                  | 18.41                     | 22.84                | 20.82                  | 25.05                   | 0                         | 0                 |
| ASYMMETRIC POOL SWELL      | 297.50                  | 13.15<br>-6.46            | 86.32<br>-24.84      | 44.36                  | 34.59                   | 0                         | +26.89            |
| JET IMPINGEMENT            | 236.9                   | -11.7                     | 50.9                 | 48.3                   | 29.5                    | 0                         | 0                 |

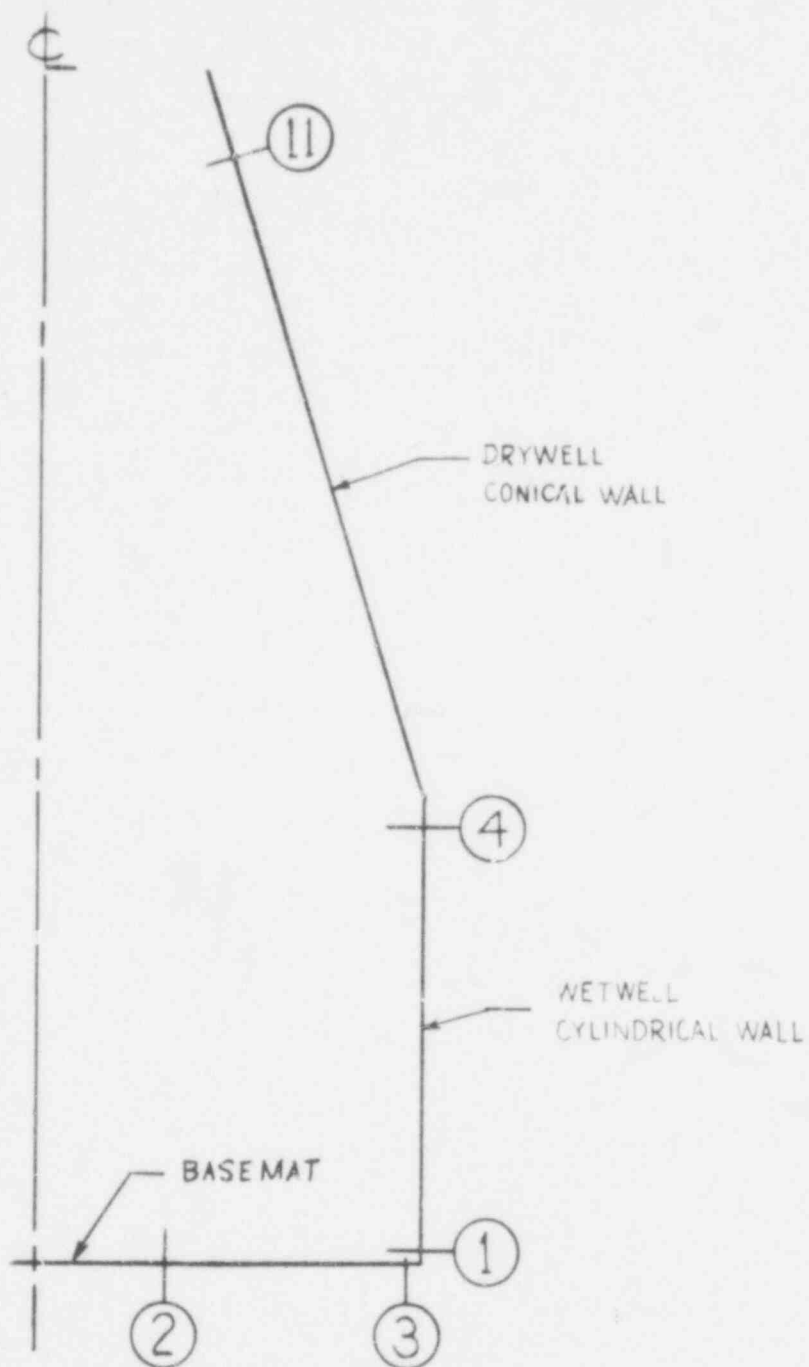
TABLE F.5-6

## DESIGN LOAD COMBINATIONS

| EQN | LOAD COND          | D   | L   | F   | P <sub>Q</sub> | T <sub>Q</sub> | R <sub>Q</sub> | E <sub>Q</sub> | E <sub>SS</sub> | P <sub>R</sub> | P <sub>A</sub> | T <sub>A</sub> | R <sub>A</sub> | R <sub>R</sub> | SRV  | ADS | ASSTMET- |       |
|-----|--------------------|-----|-----|-----|----------------|----------------|----------------|----------------|-----------------|----------------|----------------|----------------|----------------|----------------|------|-----|----------|-------|
|     |                    |     |     |     |                |                |                |                |                 |                |                |                |                |                |      |     | ALL      | RICAL |
| 1   | Normal w/o Temp    | 1.4 | 1.7 | 1.0 | 1.0            | -              | -              | -              | -               | -              | -              | -              | -              | -              | 1.5  | 0   | X        | X     |
| 2   | Normal w/Temp      | 1.0 | 1.3 | 1.0 | 1.0            | 1.0            | 1.0            | -              | -               | -              | -              | -              | -              | -              | 1.3  | 0   | X        | X     |
| 3   | Normal Sev. Env.   | 1.0 | 1.0 | 1.0 | 1.0            | 1.0            | 1.0            | 1.25           | -               | -              | -              | -              | -              | -              | 1.25 | 0   | X        | X     |
| 4   | Abnormal           | 1.0 | 1.0 | 1.0 | -              | -              | -              | -              | -               | 1.25           | -              | 1.0            | 1.0            | -              | 1.25 | X   | 0        | X     |
| 4a  |                    | 1.0 | 1.0 | 1.0 | -              | -              | -              | -              | -               | -              | 1.25           | 1.0            | 1.0            | -              | 1.0  | 0   | 0        | X     |
| 5   | Abnormal Sev. Env. | 1.0 | 1.0 | 1.0 | -              | -              | -              | 1.1            | -               | 1.1            | -              | 1.0            | 1.0            | -              | 1.1  | X   | 0        | X     |
| 5a  |                    | 1.0 | 1.0 | 1.0 | -              | -              | -              | 1.1            | -               | -              | 1.1            | 1.0            | 1.0            | -              | 1.0  | 0   | 0        | X     |
| 6   | Normal Ext. Env.   | 1.0 | 1.0 | 1.0 | 1.0            | 1.0            | 1.0            | -              | 1.0             | -              | -              | -              | -              | -              | 1.0  | 0   | X        | X     |
| 7   | Abnormal Ext. Env. | 1.0 | 1.0 | 1.0 | -              | -              | -              | -              | 1.0             | 1.0            | -              | 1.0            | 1.0            | 1.0            | 1.0  | X   | 0        | X     |
| 7a  |                    | 1.0 | 1.0 | 1.0 | -              | -              | -              | -              | 1.0             | -              | 1.0            | 1.0            | 1.0            | 1.0            | 1.0  | 0   | 0        | X     |

## LOAD DESCRIPTION

|                |   |                             |                 |   |                                                               |
|----------------|---|-----------------------------|-----------------|---|---------------------------------------------------------------|
| D              | = | Dead Loads                  | E <sub>SS</sub> | = | Safe Shutdown Earthquake                                      |
| L              | = | Live Loads                  | P <sub>R</sub>  | = | SBA and IBA Pressure Load                                     |
| F              | = | Prestressing Loads          | T <sub>A</sub>  | = | Pipe Break Temperature Load                                   |
| T <sub>Q</sub> | = | Operating Temperature Loads | R <sub>A</sub>  | = | Pipe Break Temperature Reactions Load                         |
| R <sub>Q</sub> | = | Operating Pipe Reactions    | P <sub>A</sub>  | = | DEA Pressure Loads (including all pool hydrodynamic loadings) |
| P <sub>Q</sub> | = | Operating Pressure Loads    | R <sub>R</sub>  | = | Reactions arising due to Pipe Break                           |
| SRV            | = | Safety/Relief Valve Loads   | IBA             | = | Intermediate Break Accident                                   |
| E <sub>Q</sub> | = | Operating Basis Earthquake  |                 |   |                                                               |
| SBA            | = | Small Break Accident        |                 |   |                                                               |



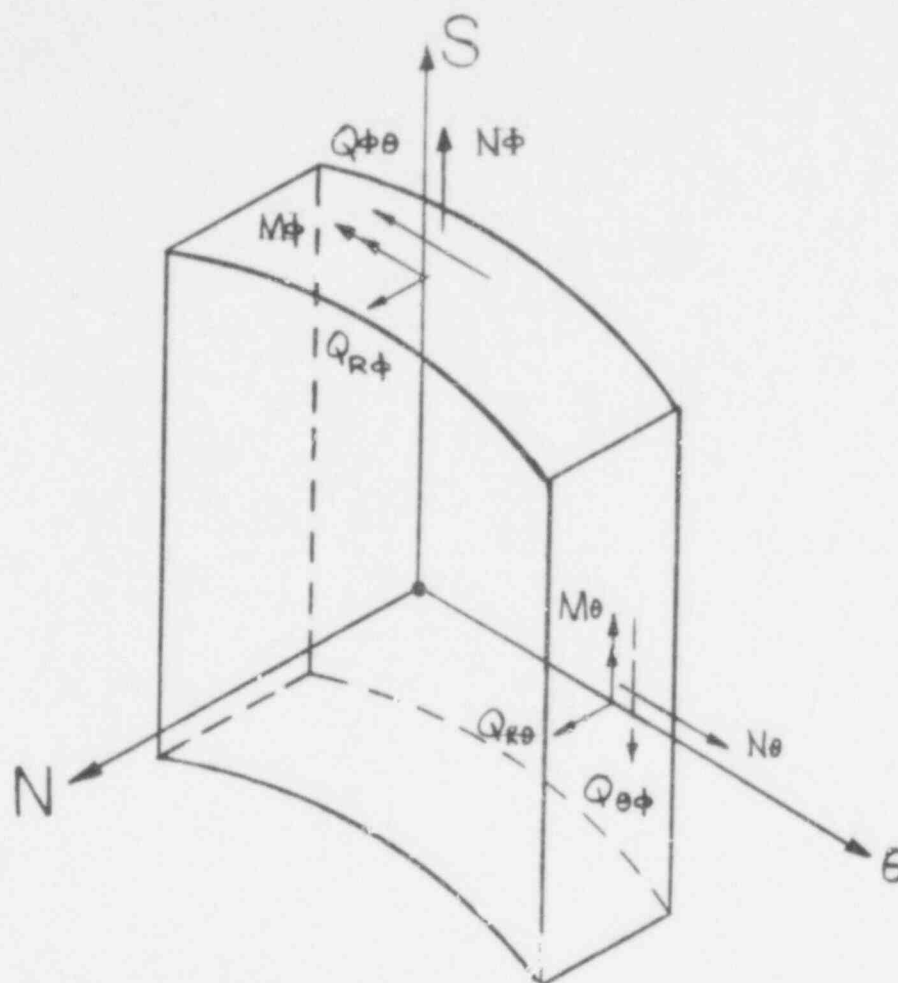
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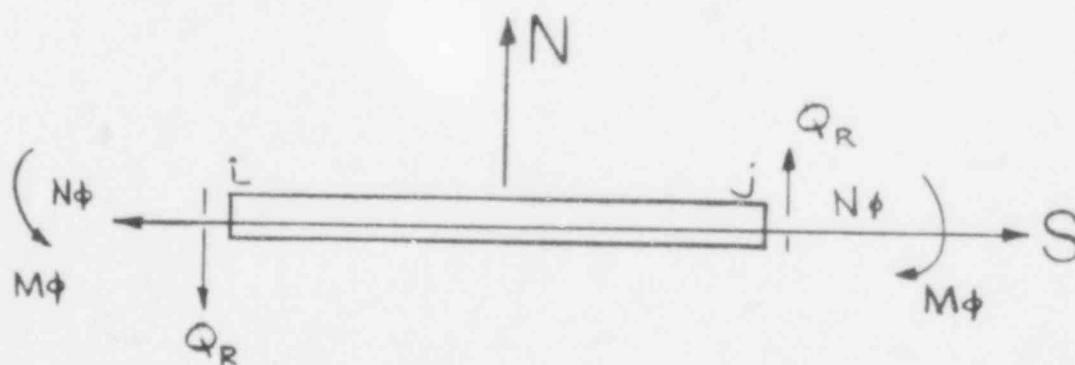
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FIGURE F.5-1

KEY CONTAINMENT DESIGN SECTIONS



CONTAINMENT AND PEDESTAL WALL



BASEMAT

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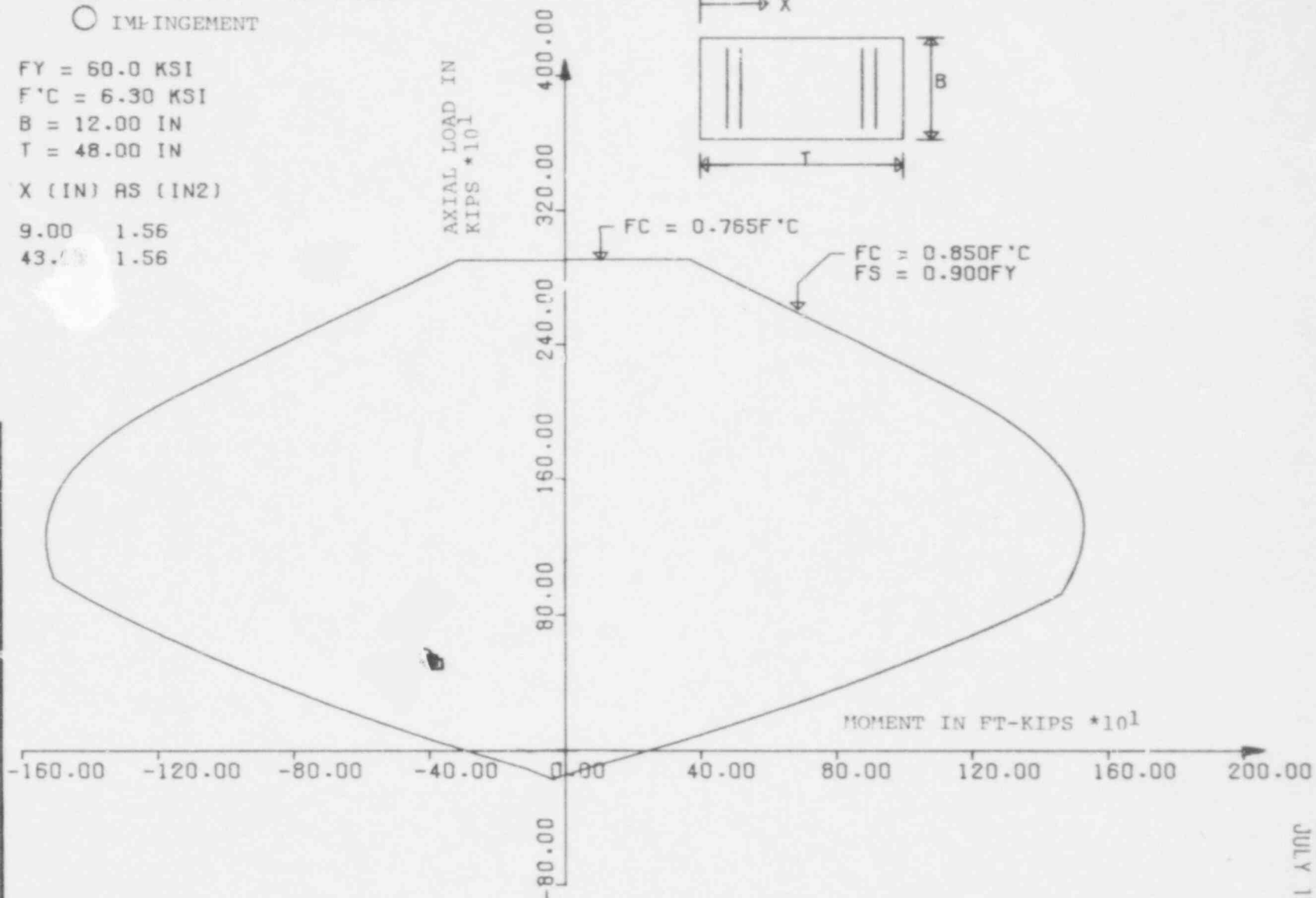
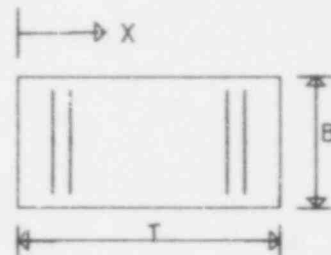
FIGURE F.5-2

NOTATIONS AND SIGN CONVENTIONS FOR  
FORCES AND MOMENTS

# NOTATION

- SYMMETRIC POOL SWELL
- ASYMMETRIC POOL SWELL
- IMPINGEMENT

$FY = 60.0 \text{ KSI}$   
 $F'C = 6.30 \text{ KSI}$   
 $B = 12.00 \text{ IN}$   
 $T = 48.00 \text{ IN}$   
 $X \text{ (IN)} \quad AS \text{ (IN}^2\text{)}$   
 $9.00 \quad 1.56$   
 $43.1 \quad 1.56$



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FIGURE F.5-3

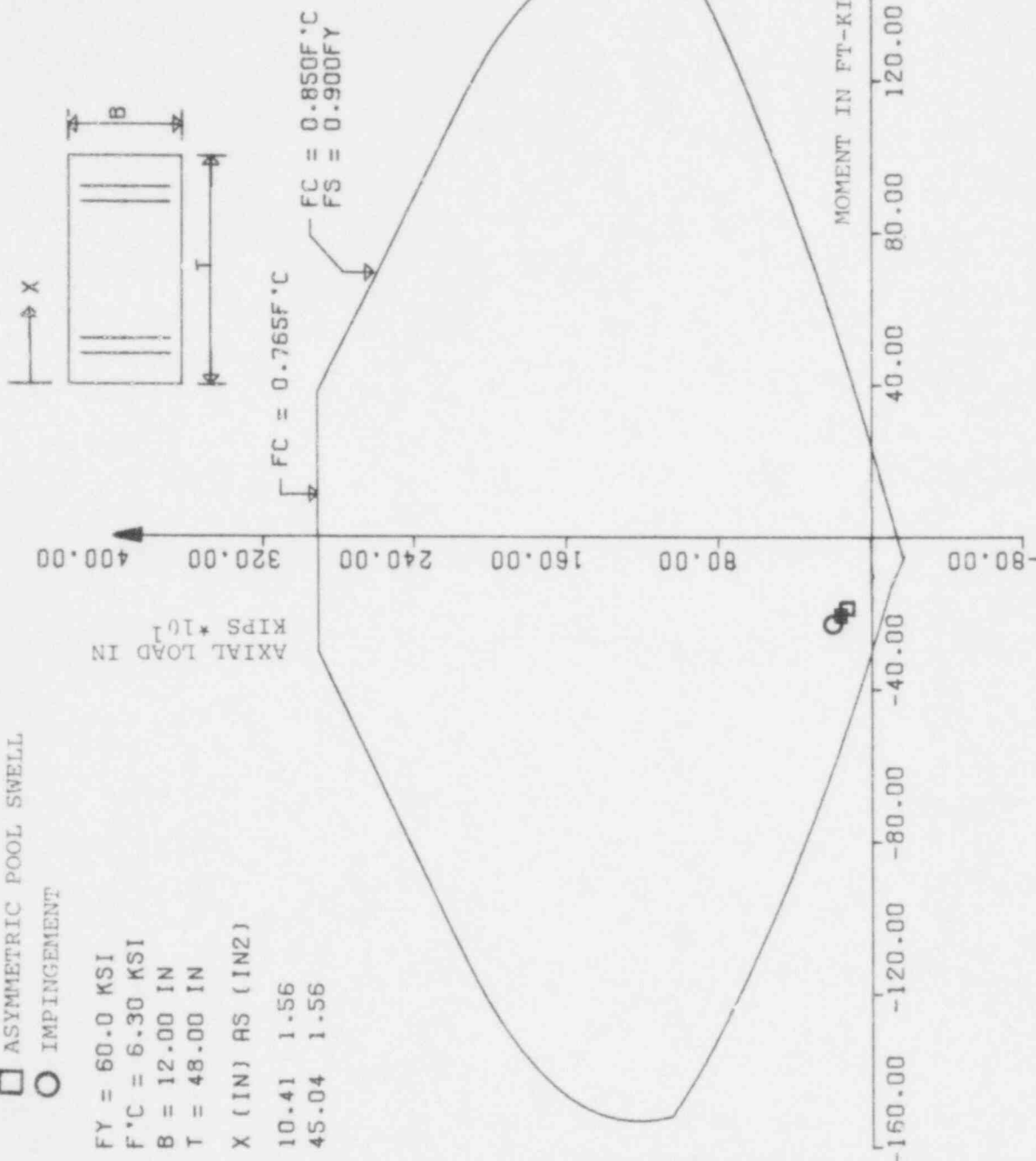
INTERACTION DIAGRAM FOR CONTAINMENT  
SECTION 1 - MECHANICAL FORCES

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NOTATION

- SYMMETRIC POOL SWELL
- ASYMMETRIC POOL SWELL
- IMPINGEMENT

$F_Y = 60.0 \text{ KSI}$   
 $F'C = 6.30 \text{ KSI}$   
 $B = 12.00 \text{ IN}$   
 $T = 48.00 \text{ IN}$   
 $X \text{ (IN) AS (IN2)}$   
 $10.41 \quad 1.56$   
 $45.04 \quad 1.56$



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FIGURE F.5-4

INTERACTION DIAGRAM FOR CONTAINMENT  
SECTION 1 - HOOP FORCES

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NOTATION

- SYMMETRIC POOL SWELL
- ASYMMETRIC POOL SWELL
- IMPINGEMENT

FY = 60.0 KSI

F'C = 6.30 KSI

B = 12.00 IN

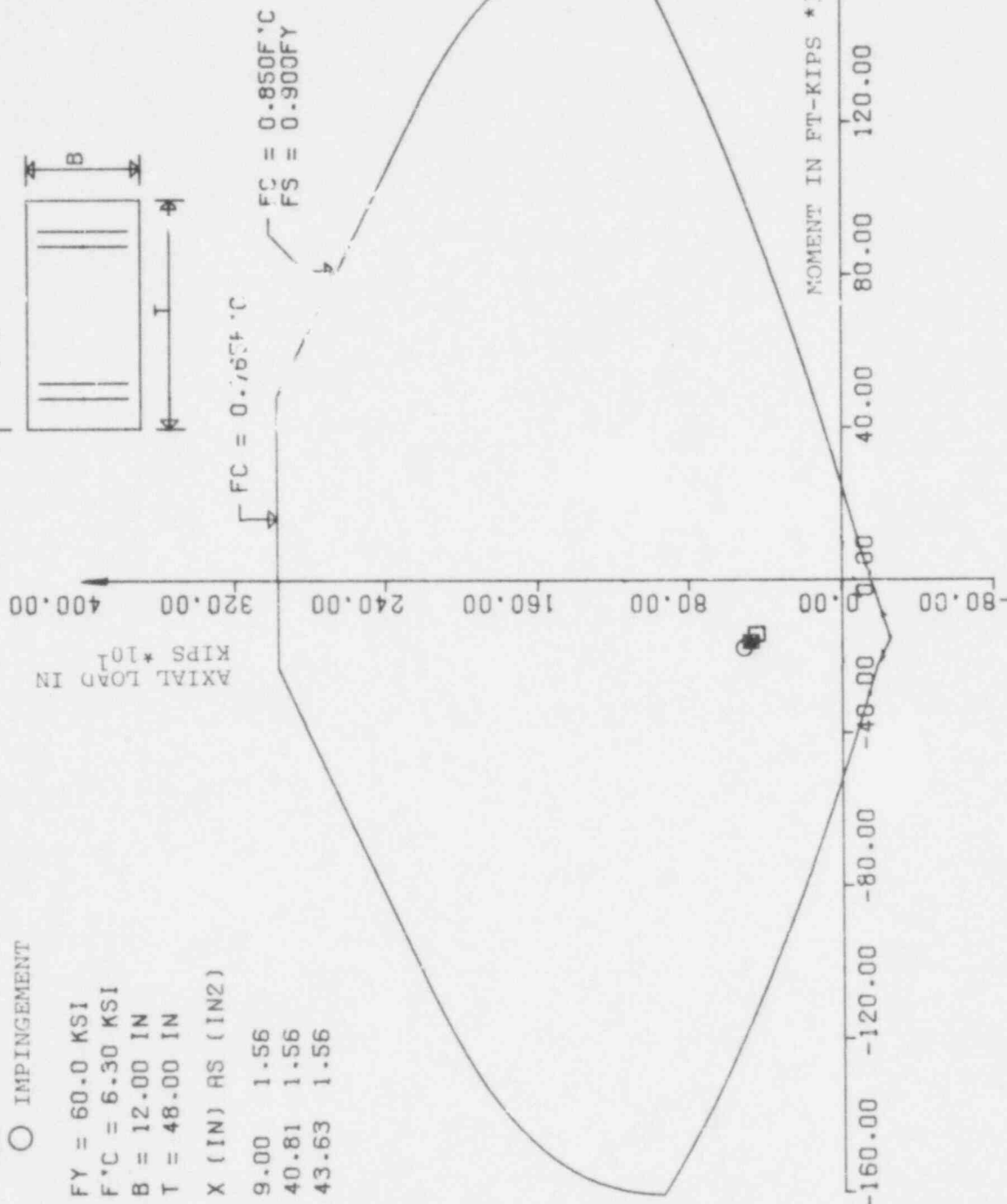
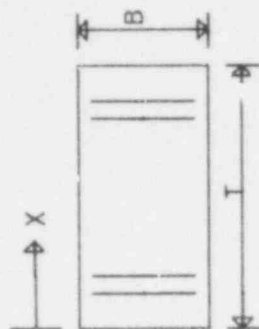
T = 48.00 IN

X (IN) RS (IN2)

9.00 1.56

40.81 1.56

43.63 1.56



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FIGURE F.5-5

INTERACTION DIAGRAM FOR CONTAINMENT  
SECTION 4 - MERIDIONAL FORCES

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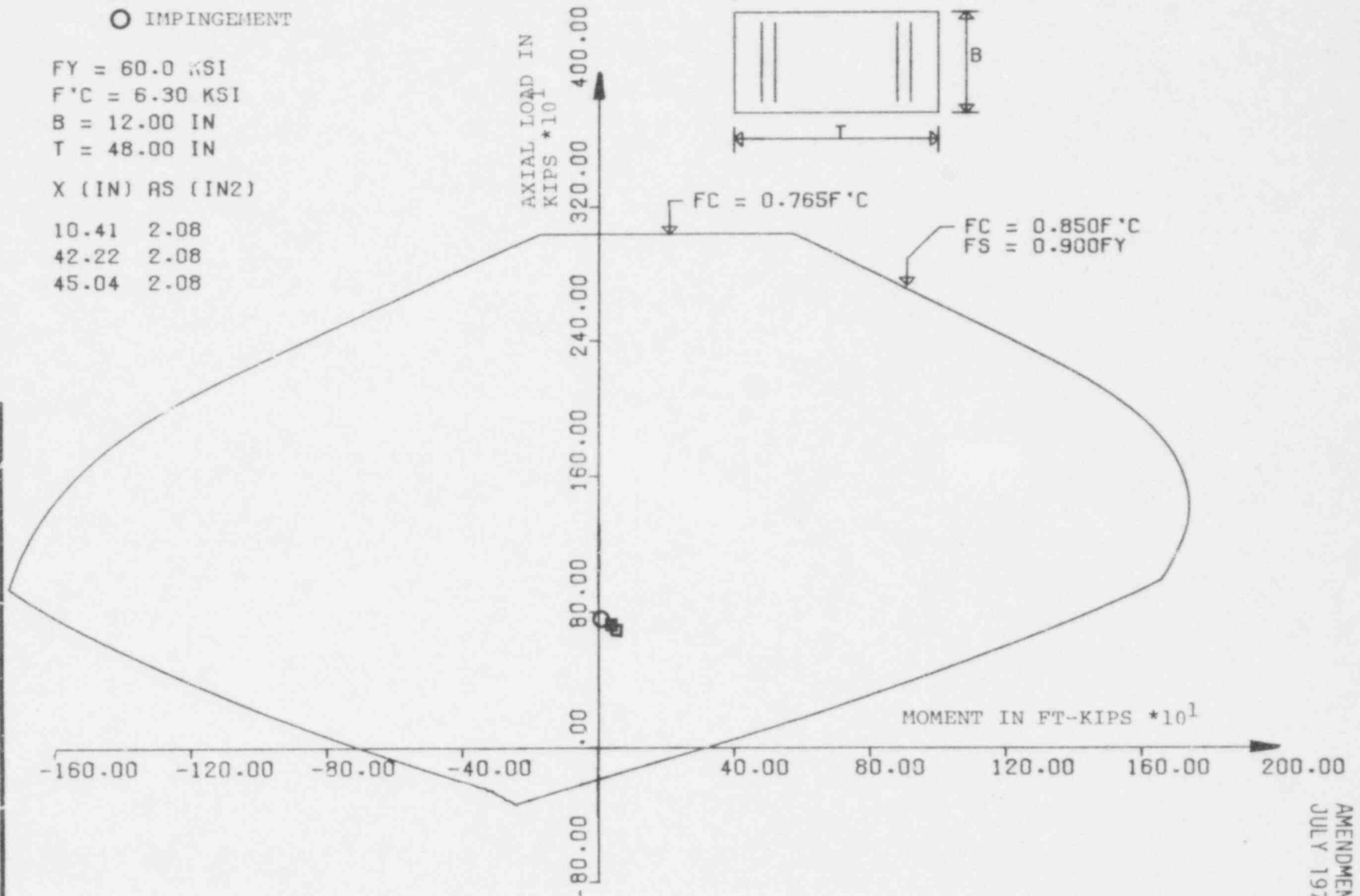
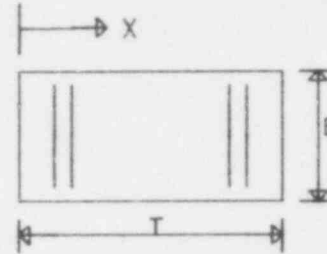
# NOTATION

- SYMMETRIC POOL SWELL
- ASYMMETRIC POOL SWELL
- IMPINGEMENT

FY = 60.0 KSI  
 F'C = 6.30 KSI  
 B = 12.00 IN  
 T = 48.00 IN

X (IN) AS (IN<sup>2</sup>)

10.41 2.08  
 42.22 2.08  
 45.04 2.08



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FIGURE F.5-6

INTERACTION DIAGRAM FOR CONTAINMENT  
 SECTION 4 - HOOP FORCES

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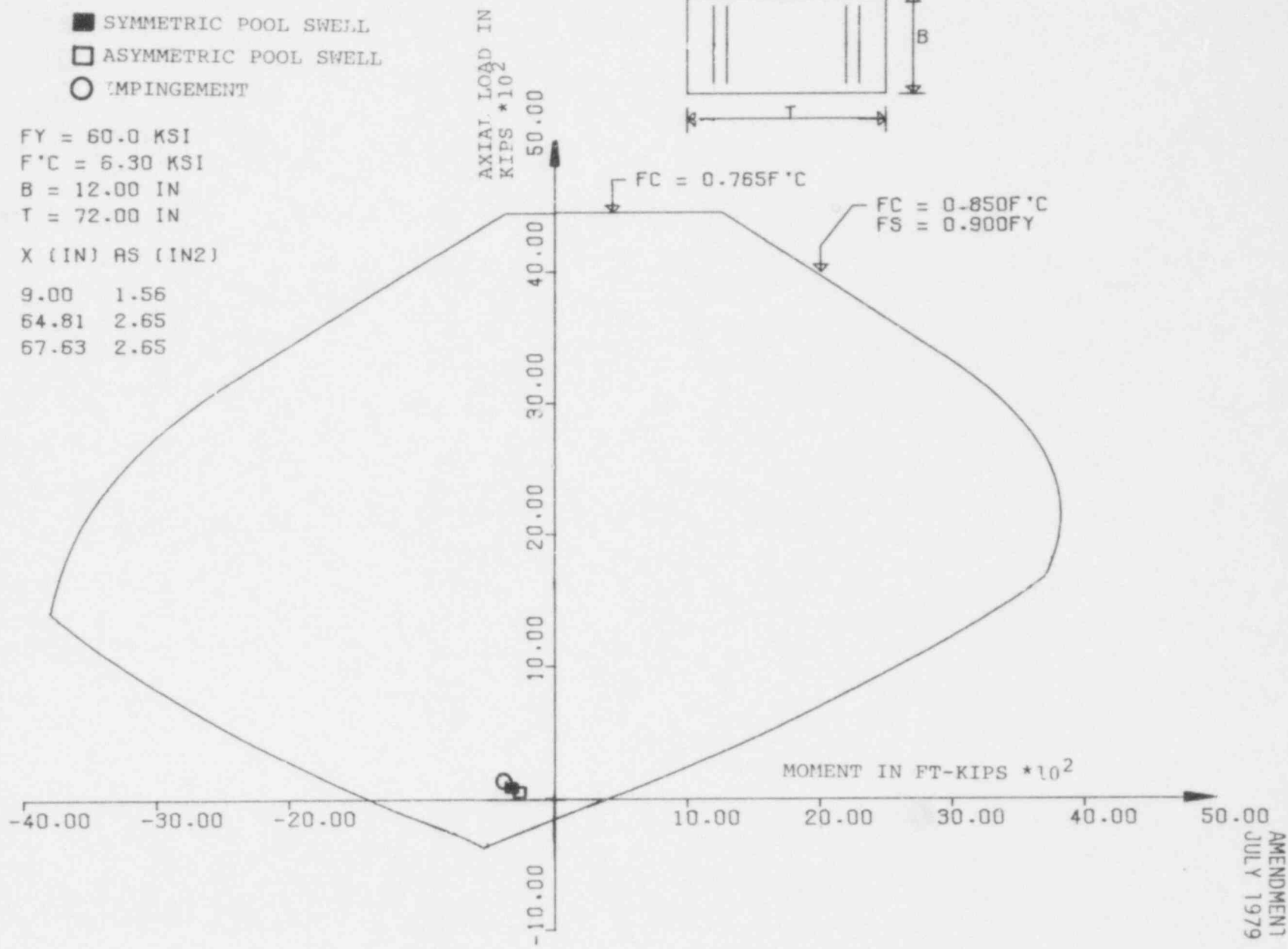
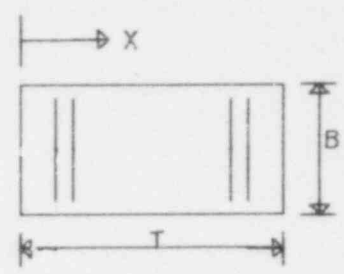
FIGURE F.5-7

INTERACTION DIAGRAM FOR CONTAINMENT  
SECTION 11 - MERIDIONAL FORCES

NOTATION

- SYMMETRIC POOL SWELL
- ASYMMETRIC POOL SWELL
- IMPINGEMENT

FY = 60.0 KSI  
 F'C = 6.30 KSI  
 B = 12.00 IN  
 T = 72.00 IN  
 X (IN) AS (IN2)  
 9.00 1.56  
 64.81 2.65  
 67.63 2.65



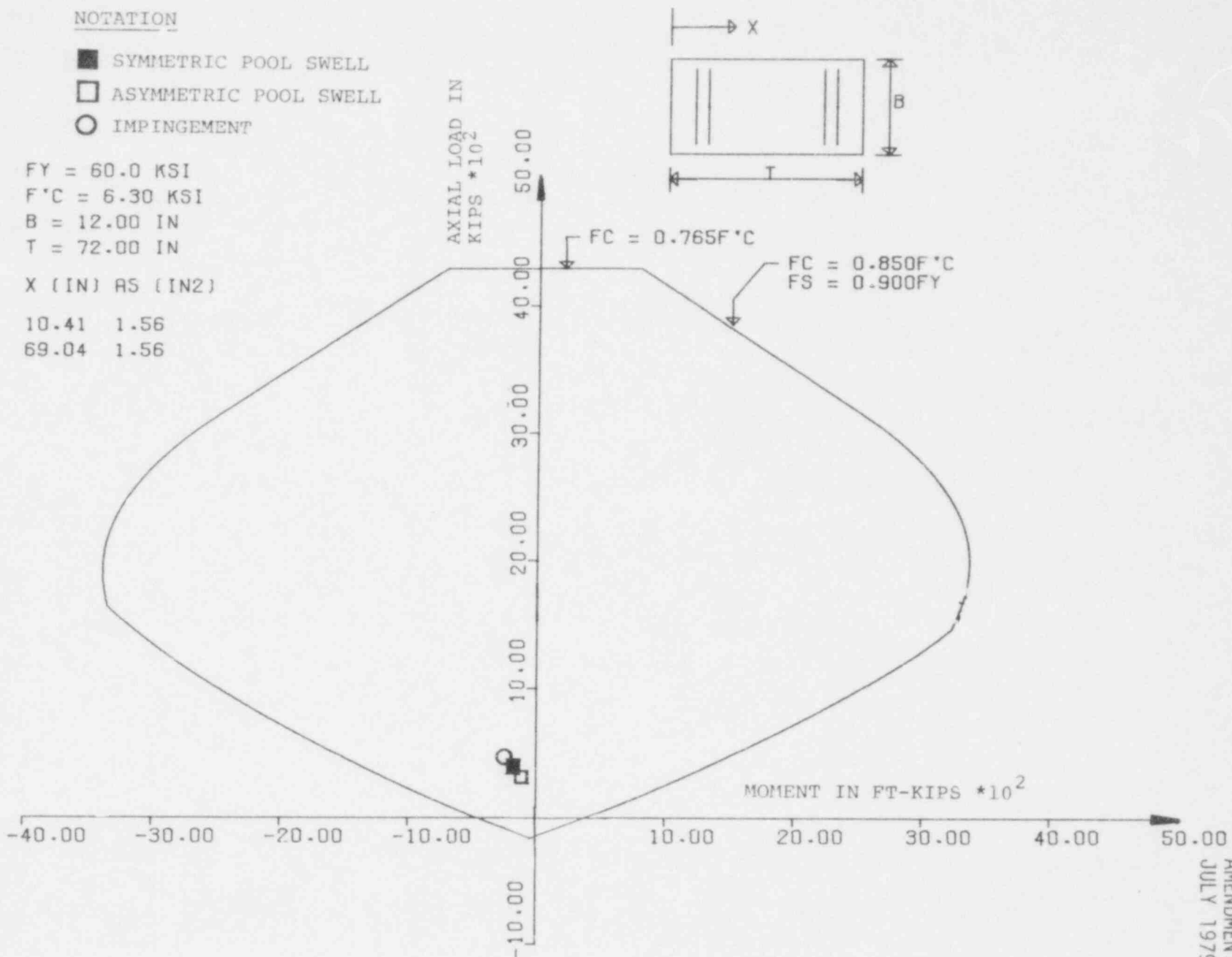
NOTATION

- SYMMETRIC POOL SWELL
- ASYMMETRIC POOL SWELL
- IMPINGEMENT

FY = 60.0 KSI  
F'C = 6.30 KSI  
B = 12.00 IN  
T = 72.00 IN

X (IN) RS (IN2)

10.41 1.56  
69.04 1.56



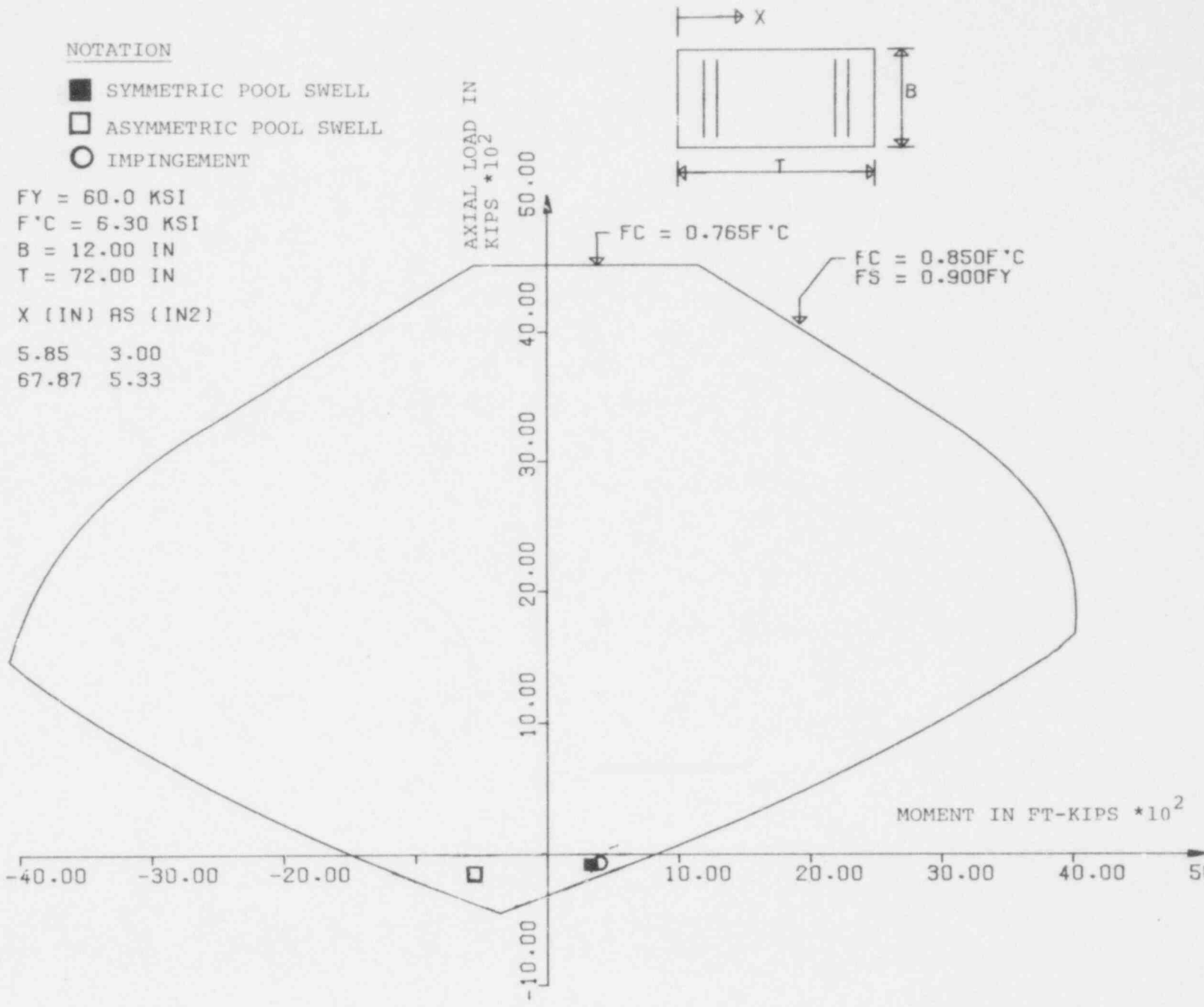
488 229

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FIGURE F.5-8

INTERACTION DIAGRAM FOR CONTAINMENT  
SECTION 11 - HOOP FORCES



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FIGURE F.5-9

INTERACTION DIAGRAM FOR BASE MAT  
SECTION 2 - MERIDIONAL FORCES

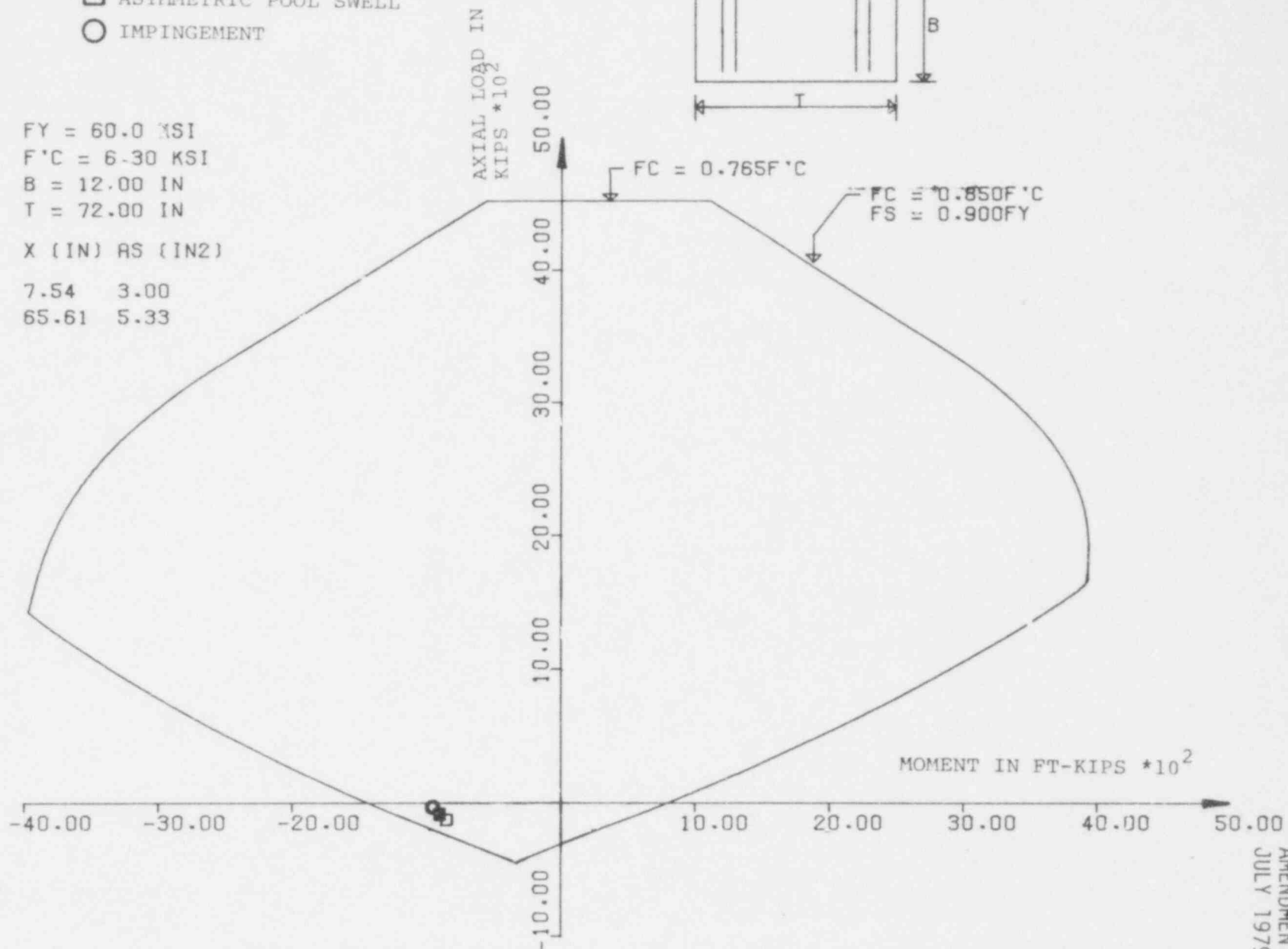
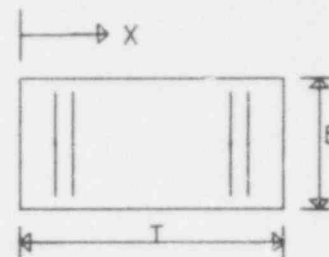
NOTATION

- SYMMETRIC POOL SWELL
- ASYMMETRIC POOL SWELL
- IMPINGEMENT

FY = 60.0 KSI  
F'C = 6.30 KSI  
B = 12.00 IN  
T = 72.00 IN

X (IN) AS (IN)

7.54 3.00  
65.61 5.33



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FIGURE F.5-10

INTERACTION DIAGRAM FOR BASE MAT  
SECTION 2 - HOOP FORCES

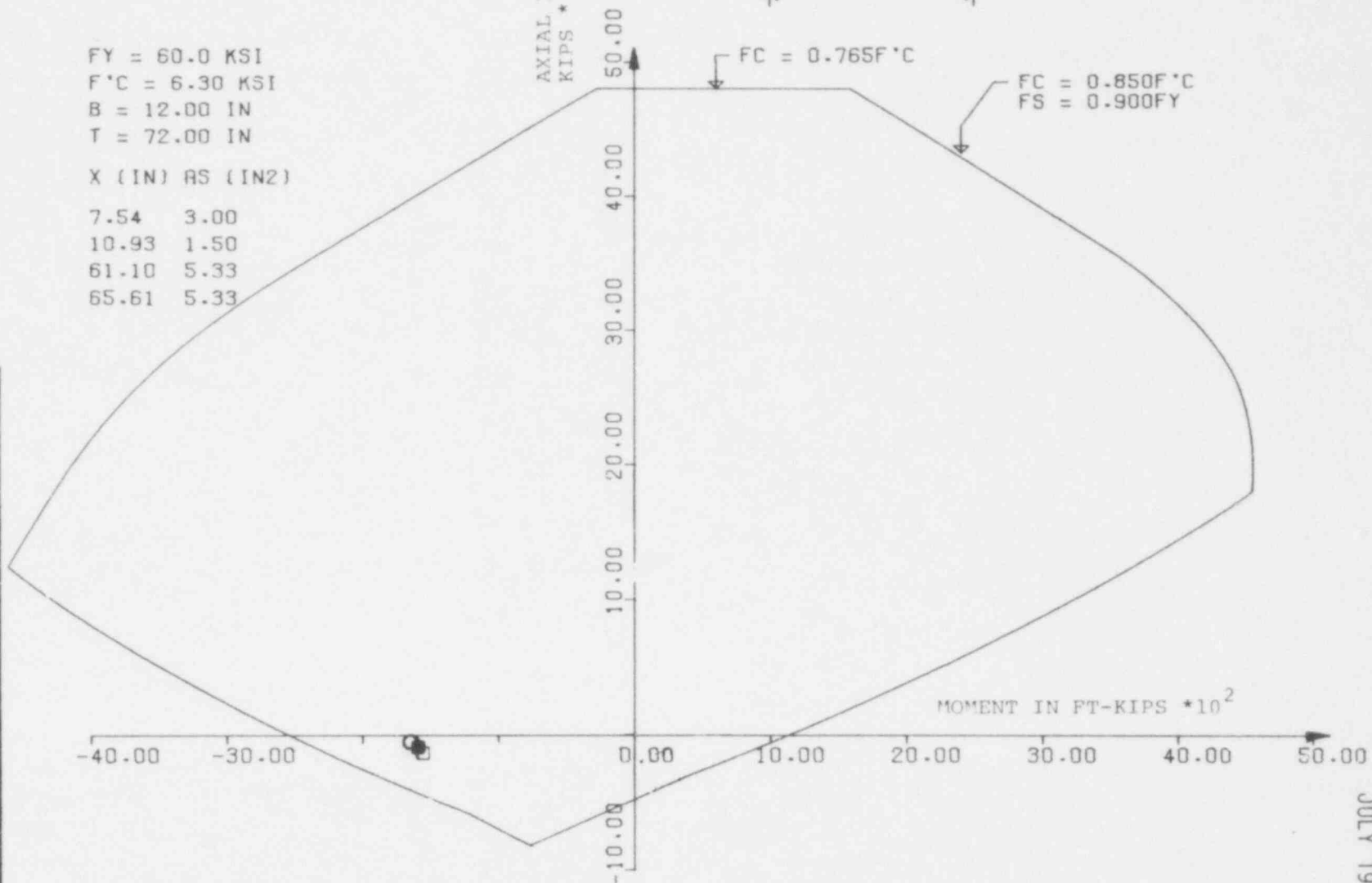
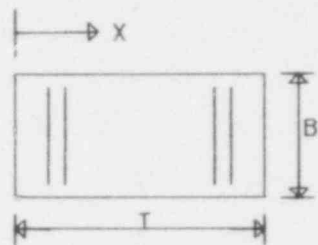
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NOTATION

- SYMMETRIC POOL SWELL
- ASYMMETRIC POOL SWELL
- IMPINGEMENT

FY = 60.0 KSI  
F'C = 6.30 KSI  
B = 12.00 IN  
T = 72.00 IN

X (IN) RS (IN2)  
7.54 3.00  
10.93 1.50  
61.10 5.33  
65.61 5.33



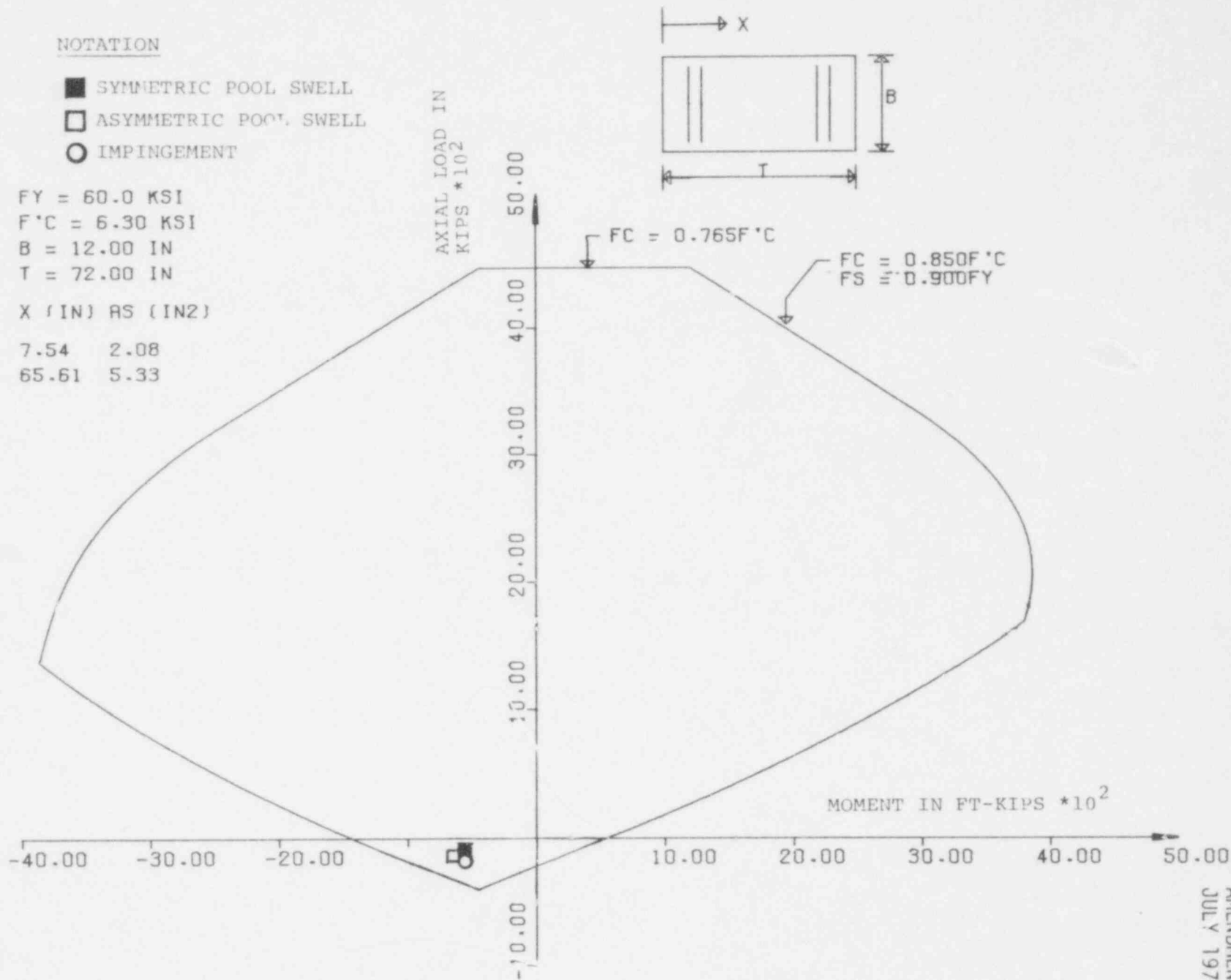
WM. H. ZIMMER NUCLEAR POWER STATION, UNIT 1

MARK II DESIGN ASSESSMENT REPORT

FIGURE F.5-11

INTERACTION DIAGRAM FOR BASE MAT  
SECTION 3 - MERIDIONAL FORCES

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FIGURE F.5-12

INTERACTION DIAGRAM FOR BASE MAT  
SECTION 3 - HOOPE FORCES

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