



Calc. For Thermal Expansion Values	
for Condenser 1CDΦ1A	
<input checked="" type="checkbox"/> Safety-Related	<input type="checkbox"/> Non-Safety-Related

Calc. No. L-000203	
Rev. 0	Date
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Client	ComEd
Project	Lasalle County, unit 1
Proj. No. 9066-272	Equip. No. 1CDΦ1A

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Reviewed by		Date
Approved by		Date

PURPOSE / OBJECTIVE

The purpose of this calculation is to determine the thermal expansion values of the condenser in the longitudinal and lateral directions for use in the design of seismic restraints for the condenser.

METHODOLOGY AND ACCEPTANCE CRITERIA

Determine the thermal expansion values based on the maximum temperature values per Ref. 1 NDIT and considering that when recirculation pumps are not working, condenser is at ambient equilibrium at about 70°F. This is acceptable since the installation of seismic restraints will take place under this condition.

ASSUMPTIONS

Minor assumptions are stated within the calculation with proper justification.

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DESIGN INPUT

Maximum Temperature (Ref. 1)

- Condenser bottom : 153°F
- Condenser Wall (above water level) : 199°F

Material specification (Ref. 3)

- Condenser shell plate : A-285, Gr. C (carbon steel)
- Tube support plates : A-285, Gr. C (carbon steel)
- Pipe used for internal or external supporting & reinforcing members } : A-106, Gr. A or B (carbon steel)

Coefficient of Thermal Expansion (Ref. 4, Table I-5.0)

$$\begin{aligned}\alpha &= 6.57 \times 10^{-6} \text{ in/in/}^\circ\text{F} \quad \text{Mean coefficient going from } 70^\circ\text{F to } 150^\circ\text{F} \\ &= 6.67 \times 10^{-6} \text{ in/in/}^\circ\text{F} \quad \text{Mean coefficient going from } 70^\circ\text{F to } 200^\circ\text{F}\end{aligned}$$

REFERENCES

1. NDIT No. LS-NDIT-0113, dated 02-07-96
2. Westinghouse Drawings 736J240, sheets 1 thru 4, Rev. 4
3. Spec. J-2515
4. 1986 ASME Section III, Appendices
5. Westinghouse Drawing 731J390, sheet 1, Rev. 5
6. S & L Drawing S-414, Rev. P

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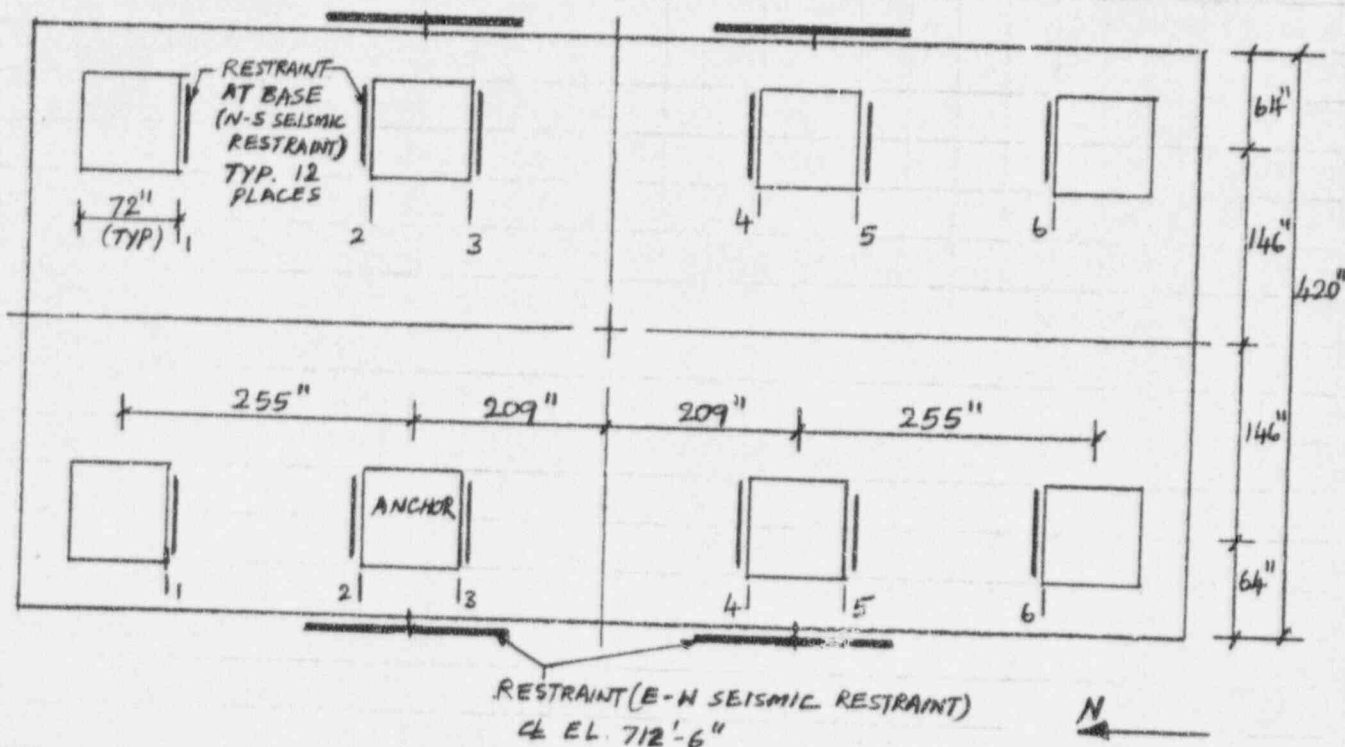
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CALCULATIONS

Thermal Expansion Along N-S direction (Longitudinal Direction)



$$\text{Thermal Expansion} = \alpha \cdot \Delta t \cdot L$$

α = Coefficient of thermal expansion

$$= 6.57 \times 10^{-6} \text{ in/in/}^{\circ}\text{F}$$

Δt = Increase in temperature

$$= 153 - 70 = 83^{\circ}\text{F}$$

L = Length

Note: 70°F temperature is the temperature of the condenser at ambient equilibrium when the recirculation pumps are not operating. This is acceptable since the installation of seismic restraints will take place under this condition.



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$$\alpha = 6.57 \times 10^{-6} \text{ in/in/}^{\circ}\text{F}, \Delta t = 83^{\circ}\text{F}$$

Location	Length (in)	Thermal Expansion (in)
1	219	0.12 ($\pm 1/8"$)
2	36	0.02 ($\pm 1/32"$)
3	36	0.02 ($\pm 1/32"$)
4	382	0.21 ($\pm 1/4"$)
5	454	0.25 ($1/4"$)
6	637	0.35 ($\pm 3/8"$)

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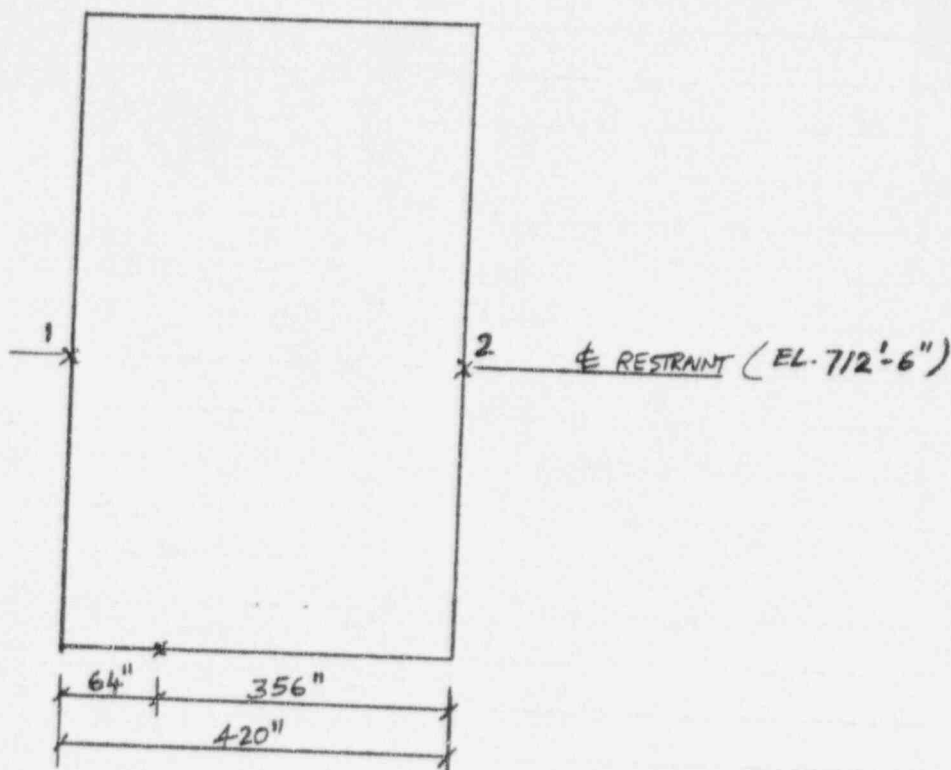
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Thermal Expansion along E-W Direction (Lateral Direction)



$$\text{Thermal Expansion } (\Delta L) = \alpha \cdot \Delta t \cdot L, \quad \alpha = 6.67 \times 10^{-6} \text{ in/in/}^{\circ}\text{F}$$

$$\Delta t = 199 - 70 = 129^{\circ}\text{F}$$

$$\text{Location 1: } \Delta L = 6.67 \times 10^{-6} \times 129 \times 64 = 0.055 \text{ in}$$

conservatively use $\frac{1}{8}"$ (about 30% of total thermal growth)
i.e. $0.3[6.67 \times 10^{-6} \times 129 \times 420 = 0.11 \text{ in}]$

$$\text{Location 2: } \Delta L = 6.67 \times 10^{-6} \times 129 \times 356 = 0.31 \text{ in } (\approx 5/16")$$

Conclusion: The thermal expansion values for Condenser 1CD01A determined based on the maximum temperature values per Ref. 1 NDI7 and 70°F ambient temperature are summarized on the following page.

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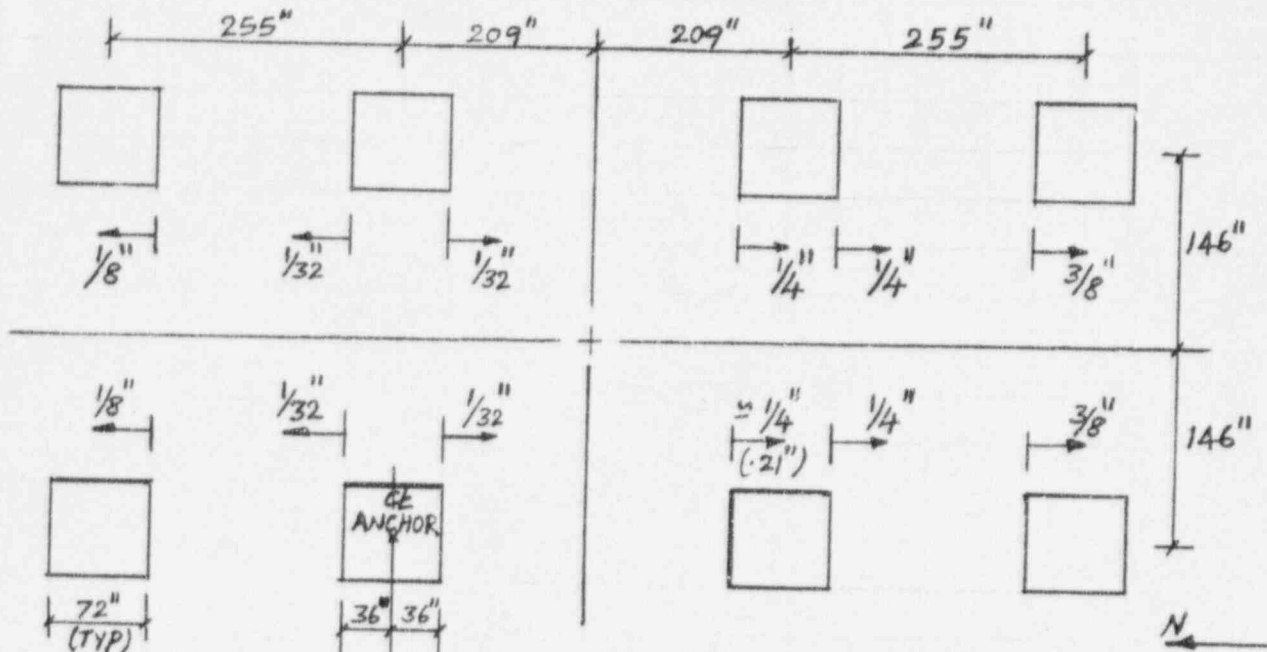
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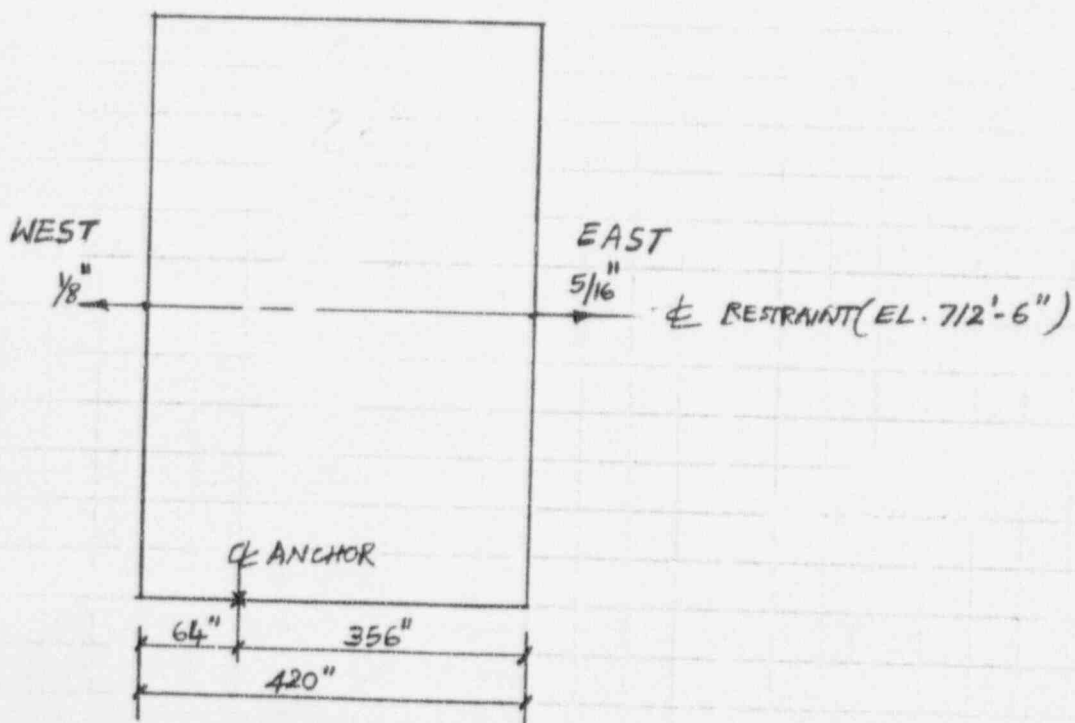
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THERMAL EXPANSION ALONG N-S DIRECTION



THERMAL EXPANSION ALONG E-W DIRECTION