AUXILIARY BUILDING

CRACK MAPPING EVALUATIONS

FOR

GRILLAGE 8 INITIAL JACKING & REJACKING

AUXILIARY BUILDING CRACK MOVEMENT

PURPOSE

The purpose of this report is to evaluate the changes in cracks in critical Auxiliary Building walls and slabs between when the soil was removed beneath the East and West Electrical Penetration Areas (EPA), and when initial jacking load was transferred to both East and West 8 Grillage Beams. The crackmapping in these critical walls and slabs is required per the design specifications.

The changes in widths for selected cracks were also evaluated after rejacking. The cracks considered for this evaluation were those which were reported to have changed in width after initial jacking of Grillage 8.

An overall plan and elevation of the Auxiliary Building are given in Attachment A. The location of Grillage 8 is also shown on these sketches. Attachment B shows the dates of crackmapping, initial jacking of Grillage 8 and re-jacking of Grillage 8.

METHOD OF ANALYSIS

1. Each critical wall and slab was divided into several areas with unique area numbers, (e.g. ⟨18⟩).

2. All cracks which were reported to have increased or decreased in width and all reported new cracks were reviewed after initial jacking. These crack changes are shown in Attachment C.

3. All the cracks which changed in width and all new cracks found after initial jacking, were again measured after re-jackings of Grillage 8. Observed changes in the width of these cracks are given in Attachment D.

4. Crack width measurements at a given location have an estimated tolerance of ± .0025 inches. Therefore, readings taken at two different times for the same crack could easily differ by .005 inches.

5. The location, width and direction of cracks which changed were compared qualitatively with expected structural behavior during excavation, initial jacking and re-jackings.

6. The evaluation of cracks after the initial jacking event and the selected cracks after rejacking is tabulated in Attachment E.

7. Dr. Mete Sozen of the University of Illinois and Dr. A. E. Fiorato of Construction Technology Laboratory inspected cracks which in their opinion warranted field inspection. They also reviewed this report and concurred with the conclusions which follow.

CONCLUSION

A. For Grillage 8 Jacking

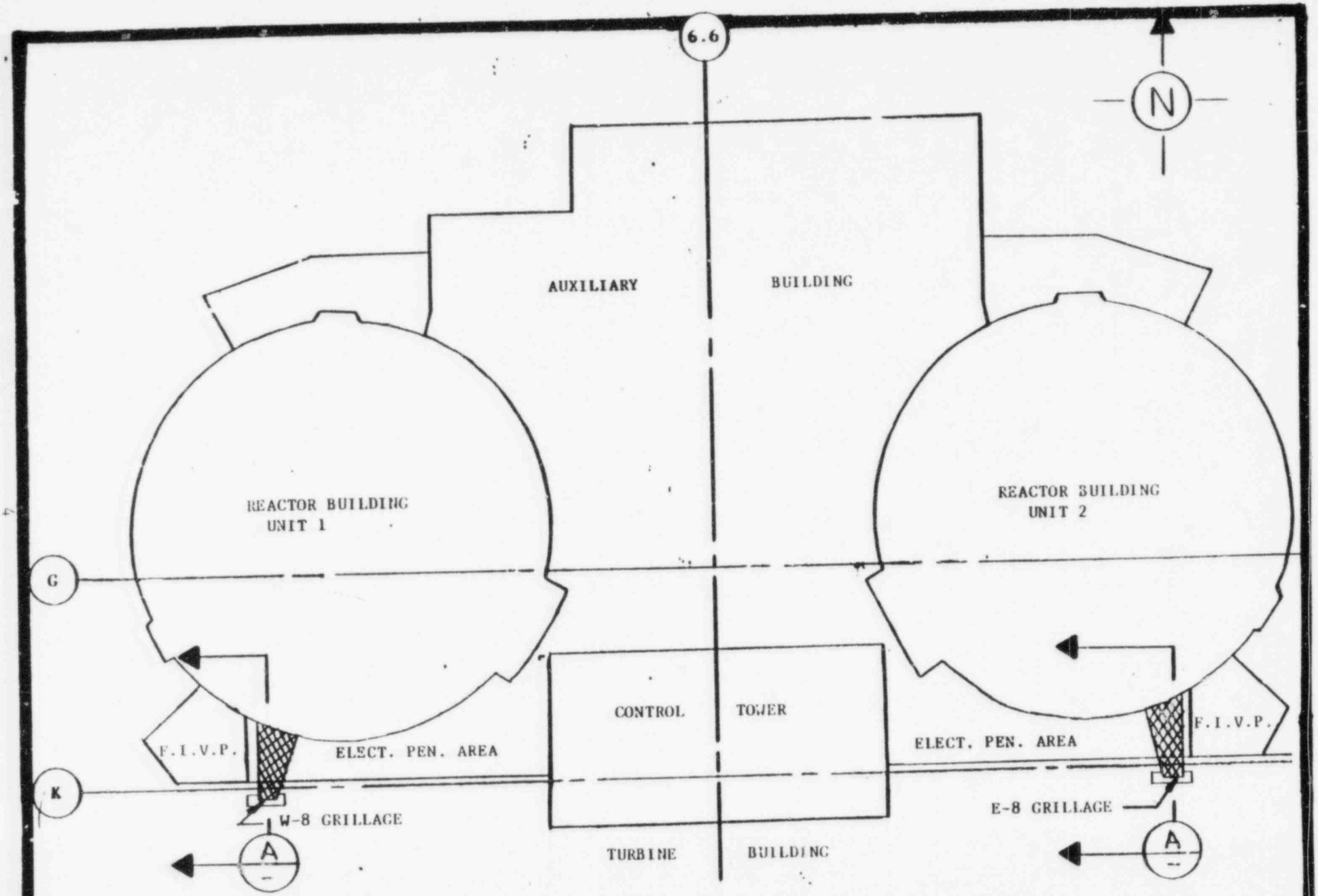
There are approximately 2,000 cracks which were monitored in the Auxiliary Building after initial Grillage 8 jacking. Evaluation of the crackmapping data has shown that only twenty-three (23) of these cracks changed in width (approximately 1%) while only twenty-one (21) new cracks were found (approximately 1% increase). The width changes which occurred were .005 inches or less except for two cases. In both of these cases the observed cracks were in the floor topping. After physical observation, it was judged that in these two cases, width changes were attributable to measurement dispersion. See Attachment E for summary of crack changes and evaluation of these changes. No alert or action level cracks were found during mapping.

It should be noted that crackmapping is intended to be used to identify a need for evaluation of the building. Alert and action levels for the crack widths are set forth to trigger this evaluation. The primary monitoring device is the building movement instrumentation. The strain instrumentation, is the secondary monitoring device.

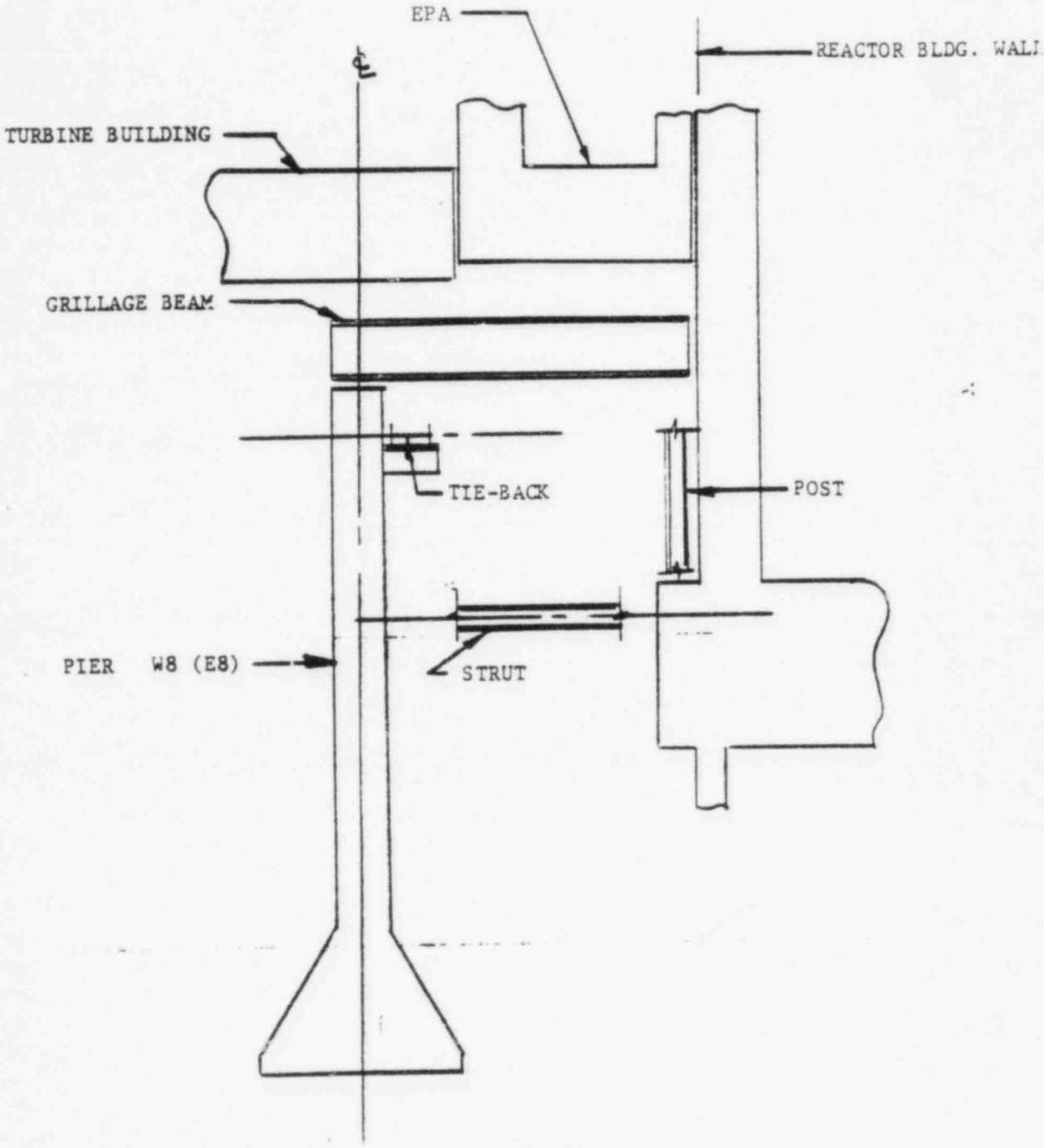
The observed changes in crack patterns and widths are in general consistent with previous patterns that indicate volume change movements. The width changes are within the estimated tolerance limits of measurements. All of the crack widths are well below the alert limits, therefore need for special evaluation is not warranted.

B. For Grillage 8 Re-jacking

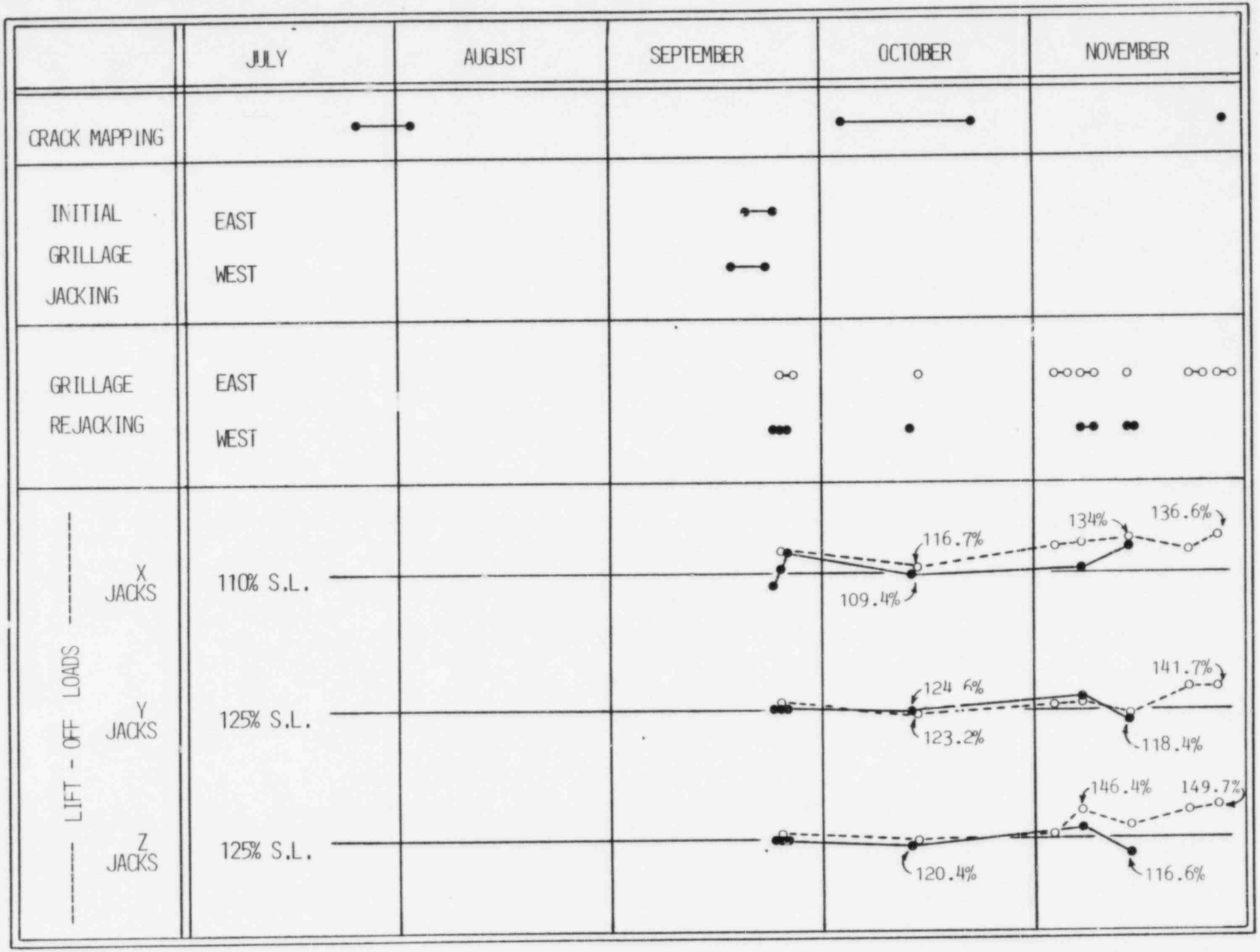
Width of cracks which had been observed to have changed during initial jacking, were measured after re-jacking. Evaluation of this data, indicates that all measured crack width changes are within the estimated tolerance of .005 inches. None of these cracks reached alert level.

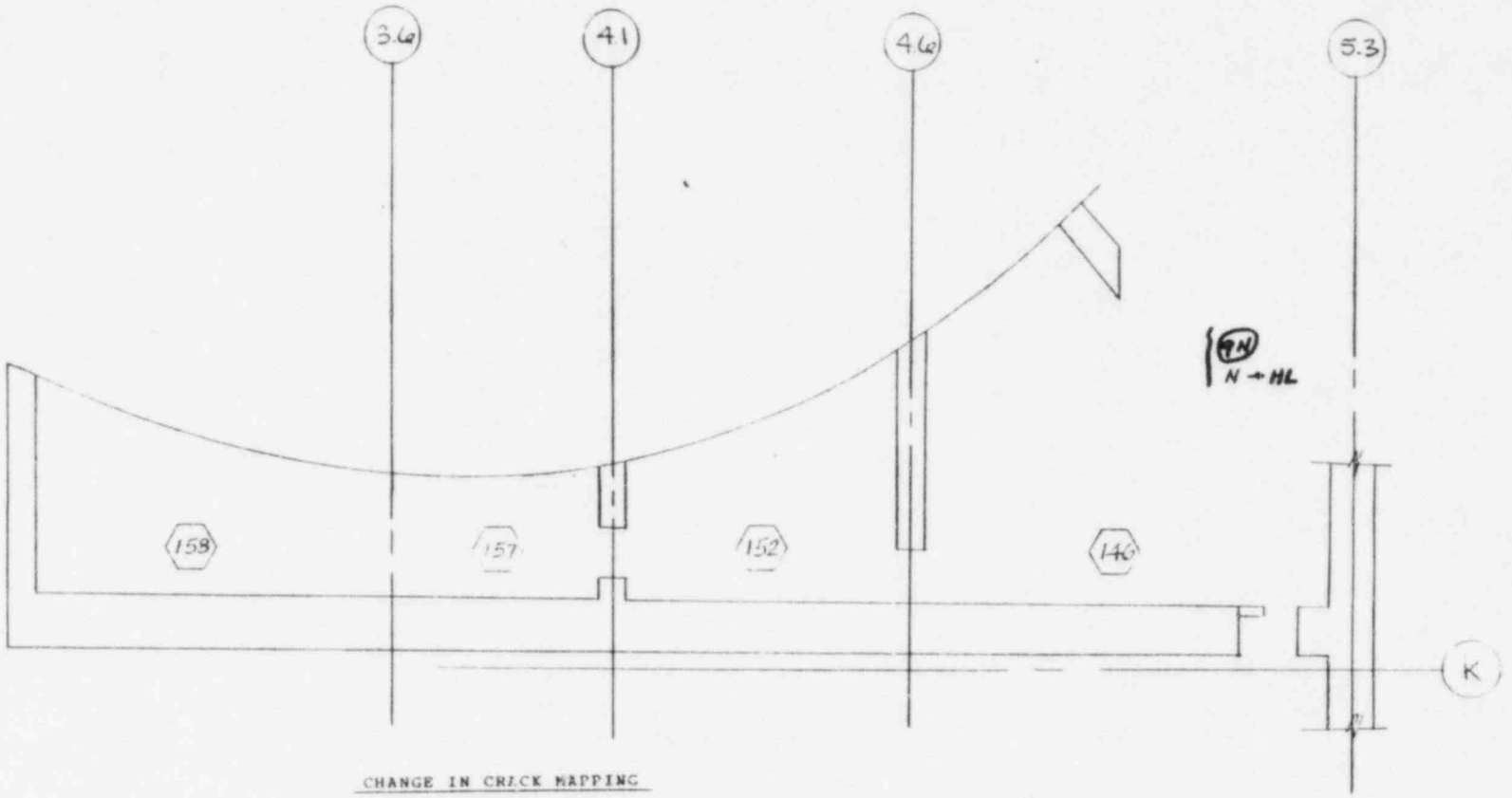


PLAN VIEW: LOCATION- EAST 8 AND WEST 8 TEMPORARY GRILLAGE BEAMS


EPA
REACTOR BLDG. WALL
TURBINE BUILDING
GRILLAGE BEAM
TIE-BACK
POST
PIER W8 (E8)
STRUT

SECTION A-A


JULY
AUGUST
SEPTEMBER
OCTOBER
NOVEMBER
CRACK MAPPING
INITIAL GRILLAGE JACKING
EAST
WEST
GRILLAGE REJACKING
EAST
WEST
LIFT - OFF LOADS
X JACKS
110% S.L.
116.7%
109.4%
134%
136.6%
Y JACKS
125% S.L.
124.6%
123.2%
141.7%
118.4%
Z JACKS
125% S.L.
120.4%
146.4%
149.7%
116.6%



CHANGE IN CRACK MAPPING

AUXILIARY BUILDING - WEST ELECTRICAL PENETRATION AREA AT ELEVATION 628'-6"

LEGEND:

N = New crack

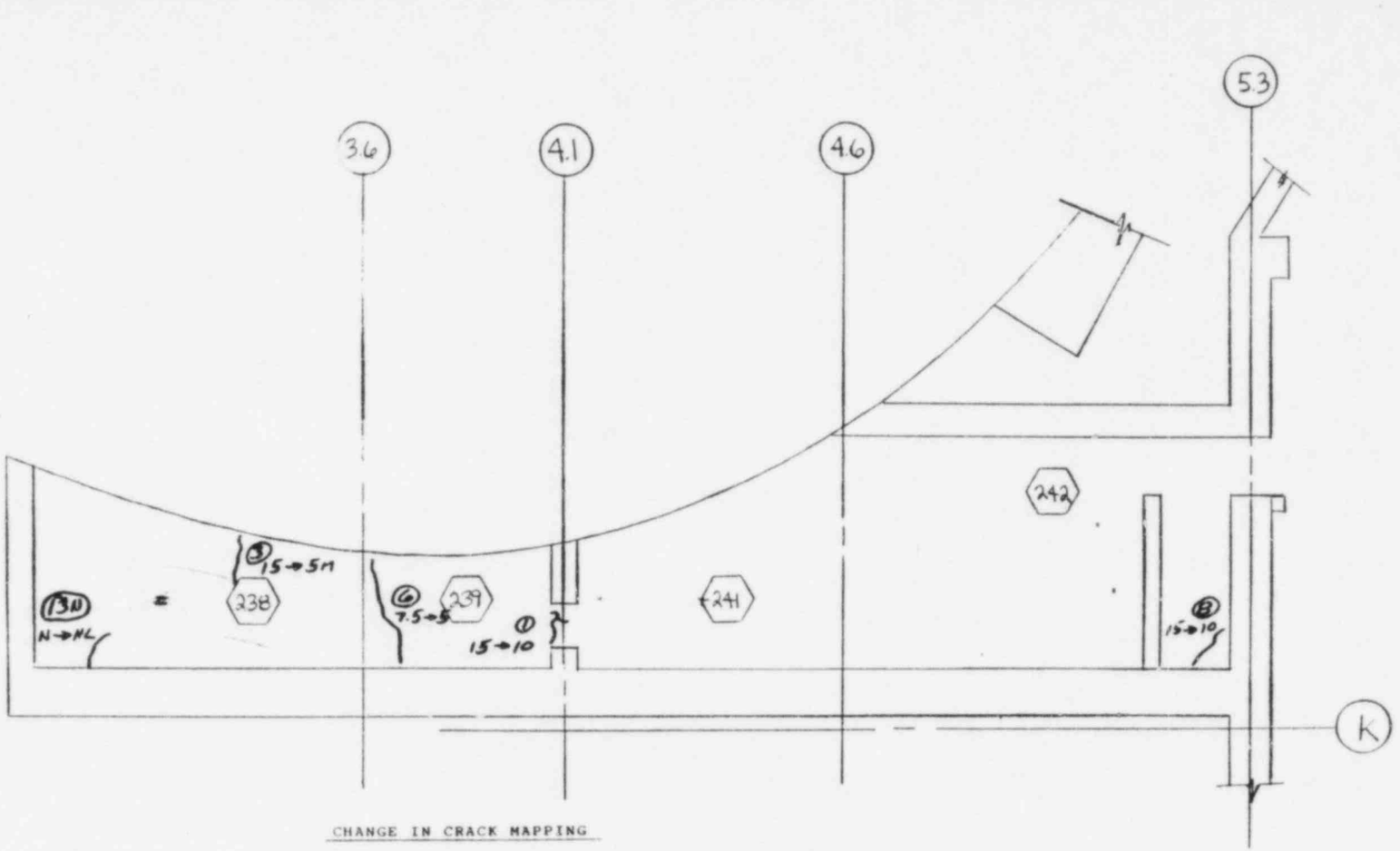
HL = Hair-line

M = mil (.00, in.)

DATES MAPPED: 7/27/83 and 10/6/83

DATE GRILLAGE JACKED: 9/10/83 to 9/24/83

AFTER INITIAL JACKING AT E/W 8 GRILLAGES



CHANGE IN CRACK MAPPING

AUXILIARY BUILDING - WEST ELECTRICAL PENETRATION AREA AT ELEVATION 659'-0"

LEGEND:

N = New crack

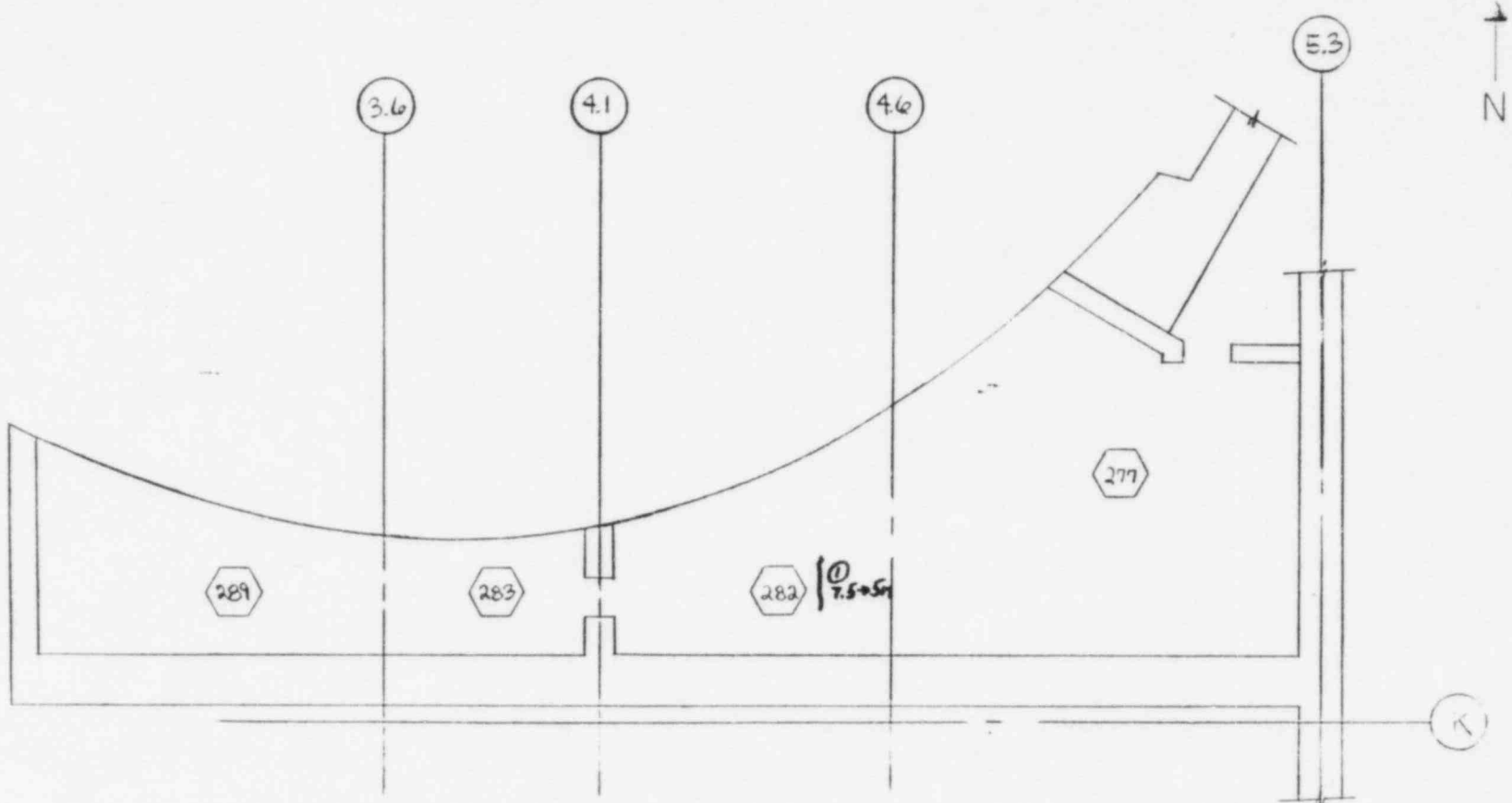
HL = Hair-line

M = mil (.001 in.)

DATES MAPPED: 7/27/83 and 10/7/83

DATE GRILLAGE JACKED: 9/18/83 to 9/24/83

AFTER INITIAL JACKING AT E/W 8 GRILLAGES



CHANGE IN CRACK MAPPING

AUXILIARY BUILDING - WEST ELECTRICAL PENETRATION AREA AT ELEVATION 674'-6"

LEGEND:

N = New crack

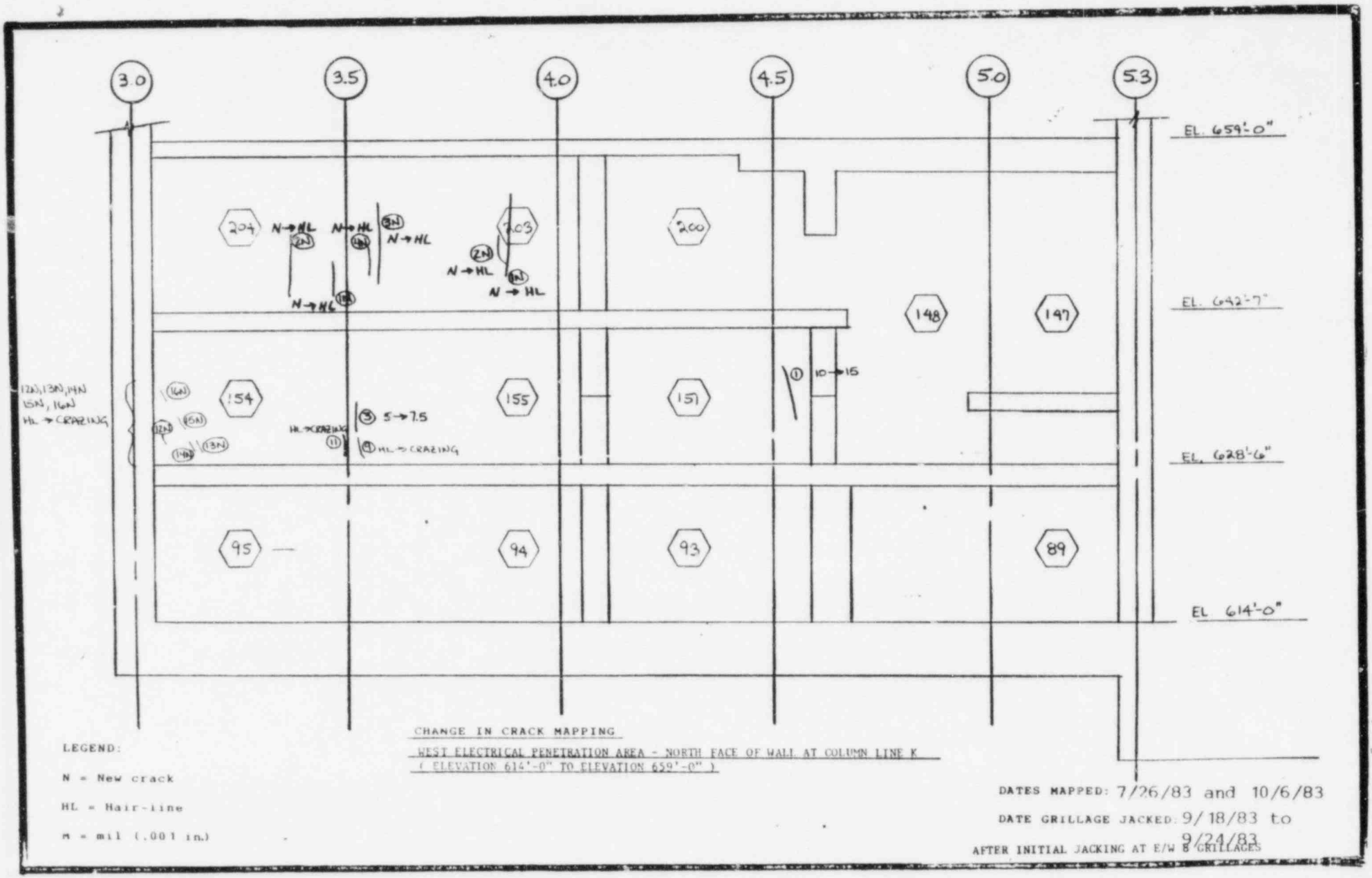
HL = Hair-line

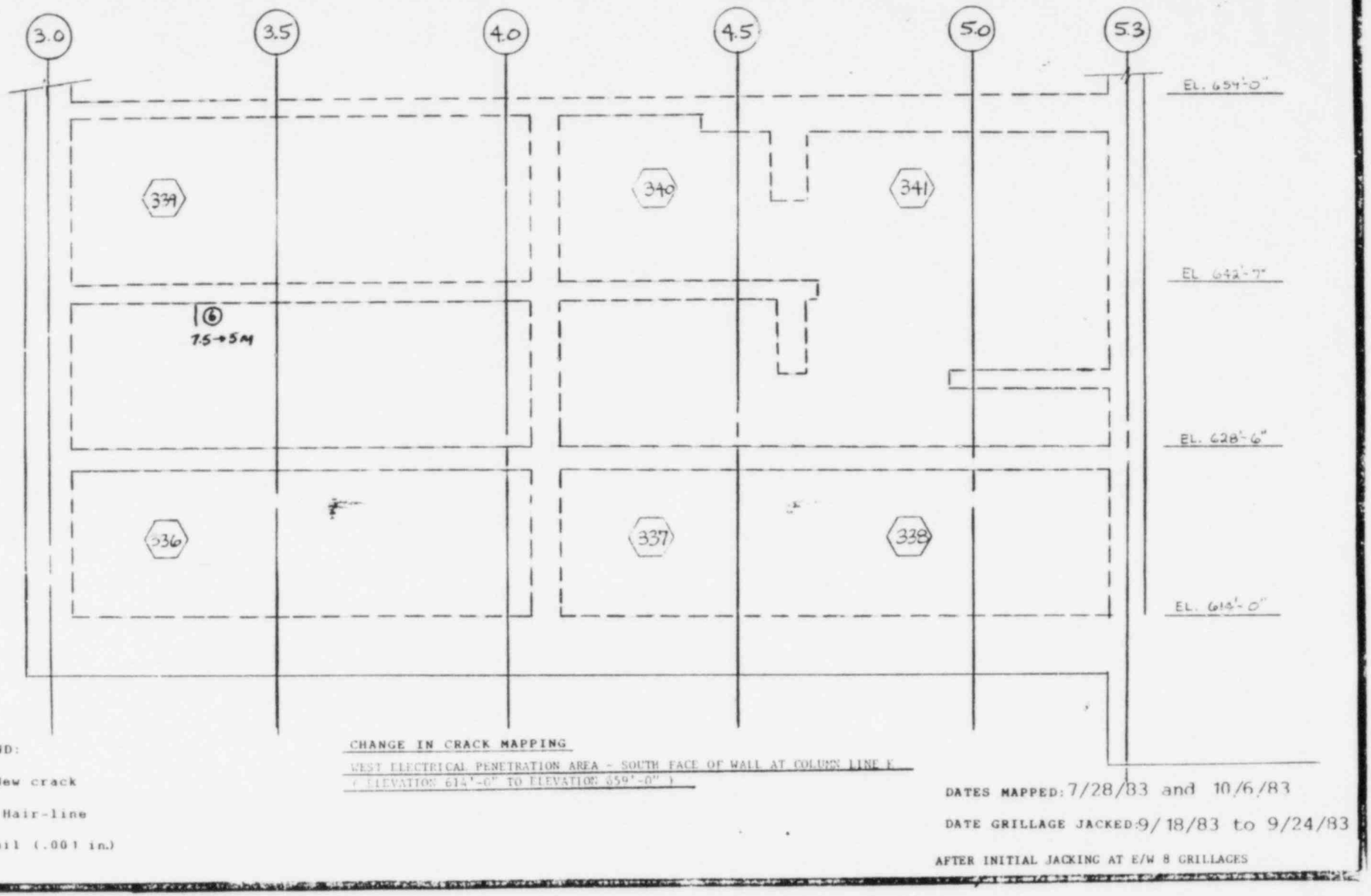
M = mil (.001 in.)

DATES MAPPED: 7/27/83 and 10/7/83

DATE GRILLAGE JACKED: 9/18/83 to 9/24/83

AFTER INITIAL JACKING AT E/W 8 GRILLAGES


3.0
3.5
4.0
4.5
5.0
5.3
EL. 659'-0"
EL. 642'-7"
EL. 628'-6"
EL 614'-0"
204
203
200
148
147
154
155
151
95
94
93
89
N → HL
5 → 7.5
HL → CRAZING
10 → 15
LEGEND:
N = New crack
HL = Hair-line
m = mil (.001 in.)
CHANGE IN CRACK MAPPING
WEST ELECTRICAL PENETRATION AREA - NORTH FACE OF WALL AT COLUMN LINE K
(ELEVATION 614'-0" TO ELEVATION 659'-0")
DATES MAPPED: 7/26/83 and 10/6/83
DATE GRILLAGE JACKED: 9/18/83 to 9/24/83
AFTER INITIAL JACKING AT E/W 8 GRILLAGES



LEGEND:

N = New crack

HL = Hair-line

M = mil (.001 in.)

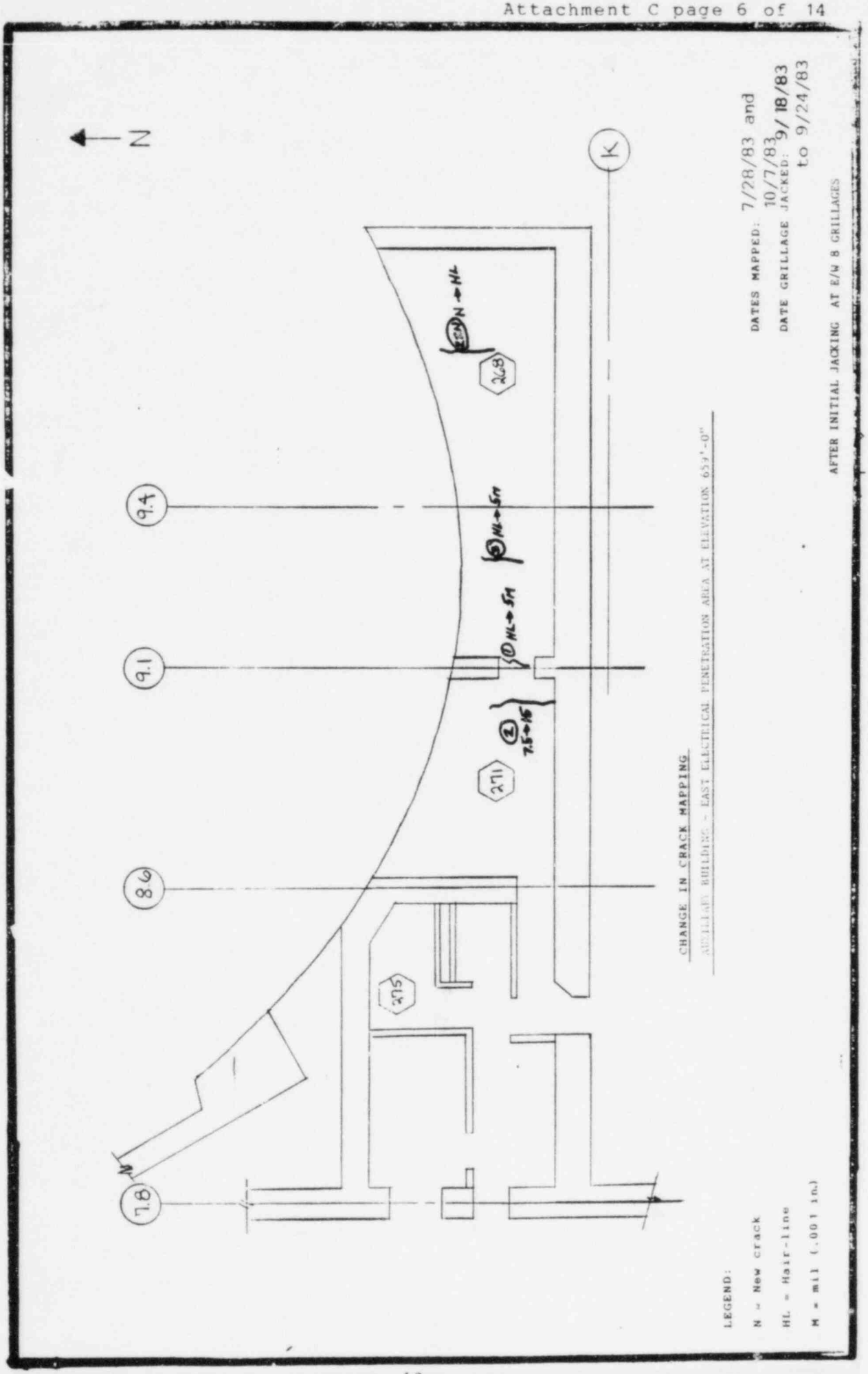
CHANGE IN CRACK MAPPING

WEST ELECTRICAL PENETRATION AREA - SOUTH FACE OF WALL AT COLUMN LINE K
(ELEVATION 614'-0" TO ELEVATION 659'-0")

DATES MAPPED: 7/28/83 and 10/6/83

DATE GRILLAGE JACKED: 9/18/83 to 9/24/83

AFTER INITIAL JACKING AT E/W 8 GRILLAGES



CHANGE IN CRACK MAPPING

ANCILLARY BUILDING - EAST ELECTRICAL PENETRATION AREA AT ELEVATION 654'-0"

DATES MAPPED: 7/28/83 and 10/7/83

DATE GRILLAGE JACKED: 9/18/83 to 9/24/83

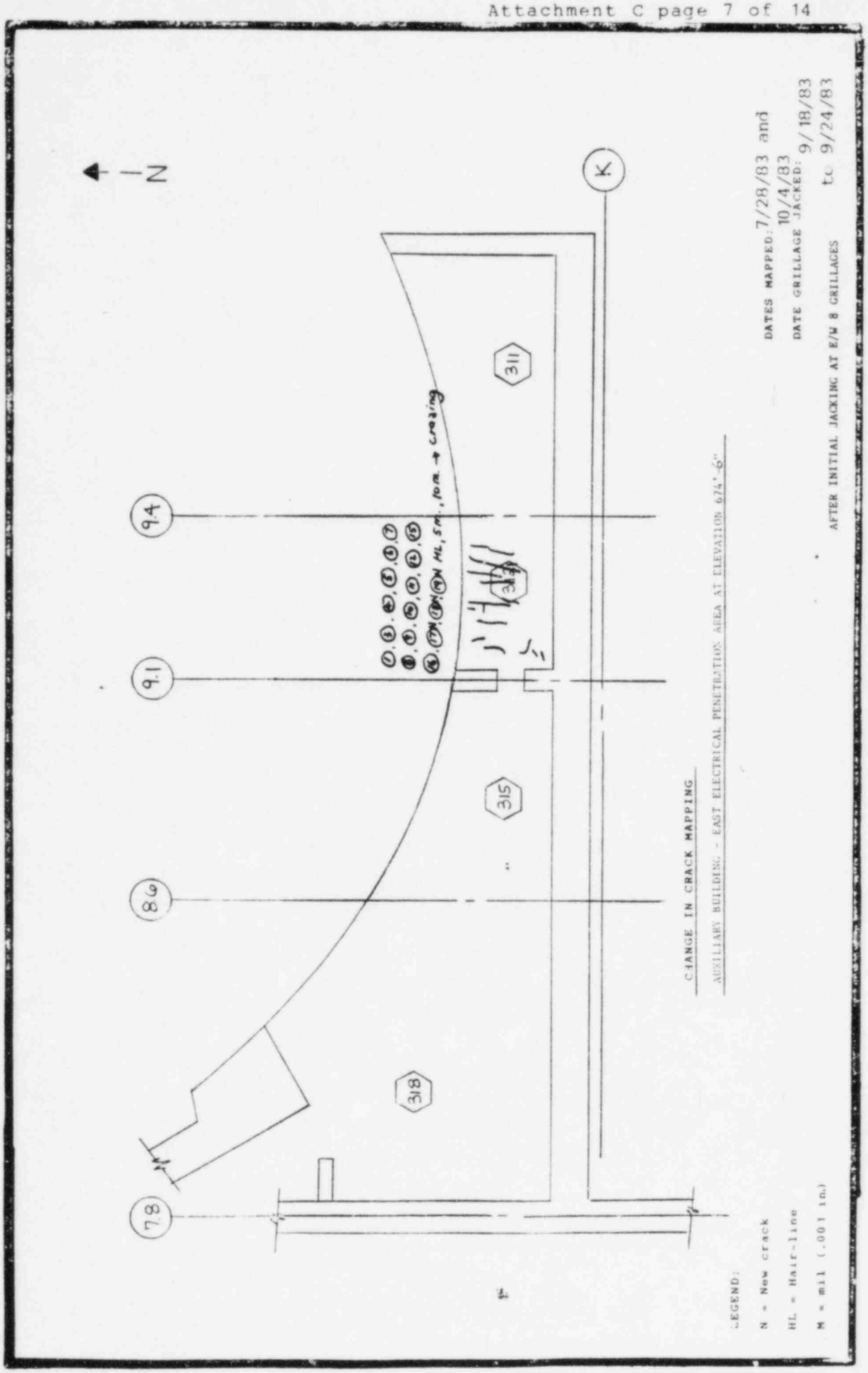
AFTER INITIAL JACKING AT E/W 8 GRILLAGES

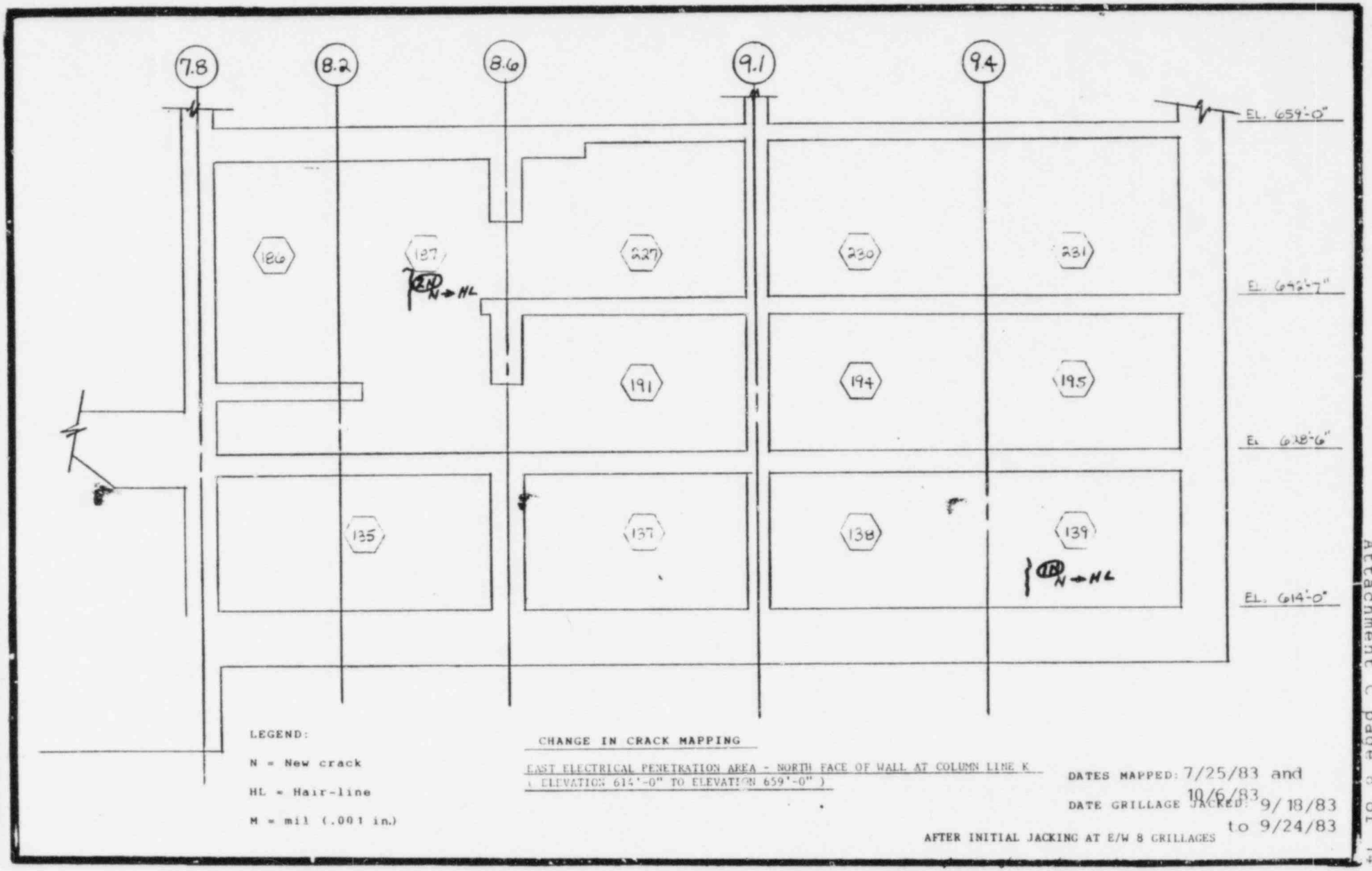
LEGEND:

N - New crack

HL - Hair-line

M - mil (.001 in.)


N
K
9.4
9.1
8.0
7.8
311
315
318
CHANGE IN CRACK MAPPING
AUXILIARY BUILDING - EAST ELECTRICAL PENETRATION AREA AT ELEVATION 674'-6"
DATES MAPPED: 7/28/83 and 10/4/83
DATE GRILLAGE JACKED: 9/18/83 to 9/24/83
AFTER INITIAL JACKING AT E/W 8 GRILLAGES
LEGEND:
N = New crack
HL = Hair-line
M = mil (.001 in.)



LEGEND:

N = New crack

HL = Hair-line

M = mil (.001 in.)

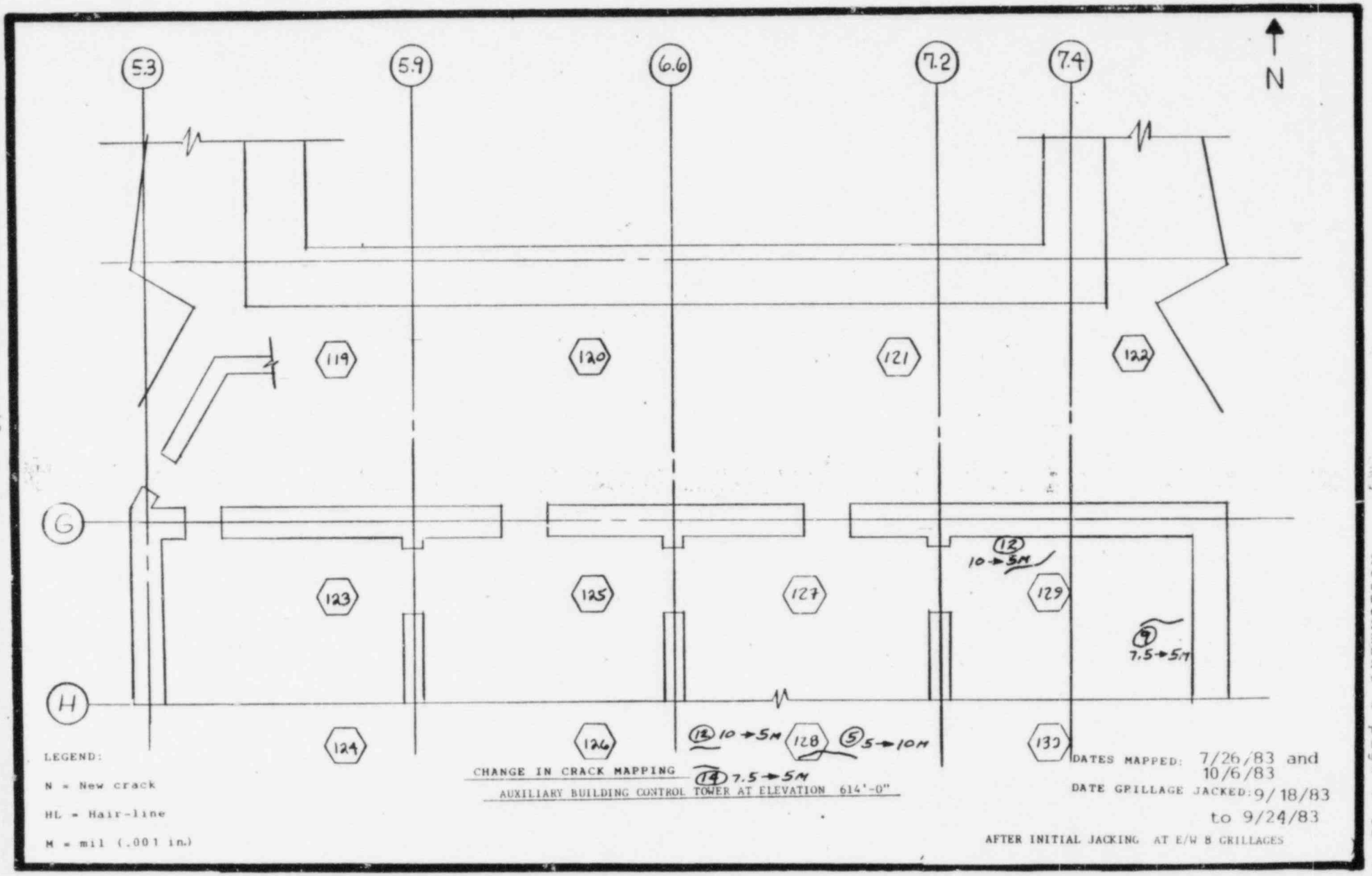
CHANGE IN CRACK MAPPING

EAST ELECTRICAL PENETRATION AREA - NORTH FACE OF WALL AT COLUMN LINE K
(ELEVATION 614'-0" TO ELEVATION 659'-0")

DATES MAPPED: 7/25/83 and 10/6/83

DATE GRILLAGE JACKED: 9/18/83 to 9/24/83

AFTER INITIAL JACKING AT E/W 8 GRILLAGES



CHANGE IN CRACK MAPPING
AUXILIARY BUILDING CONTROL TOWER AT ELEVATION 614'-0"

LEGEND:

N = New crack

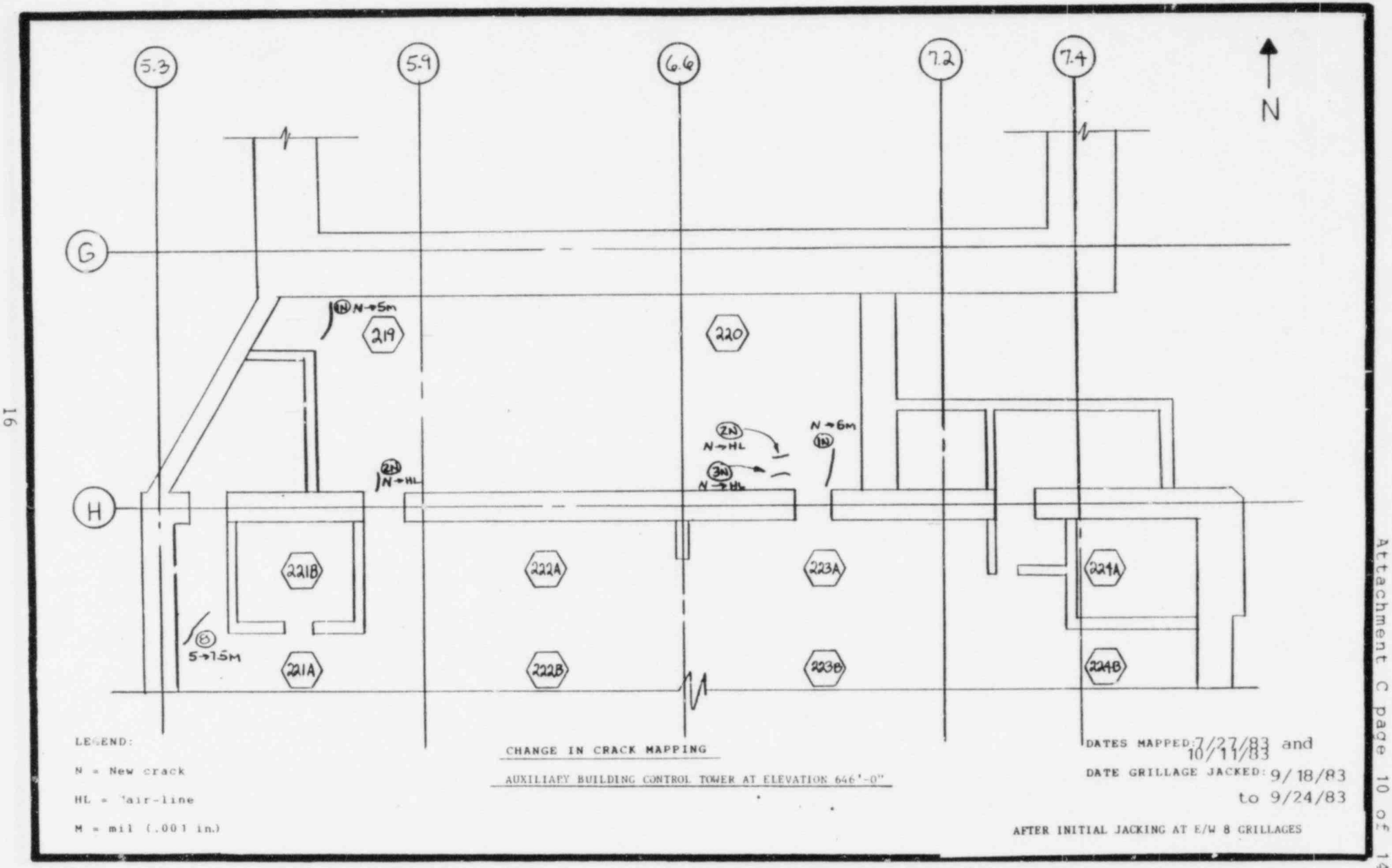
HL = Hair-line

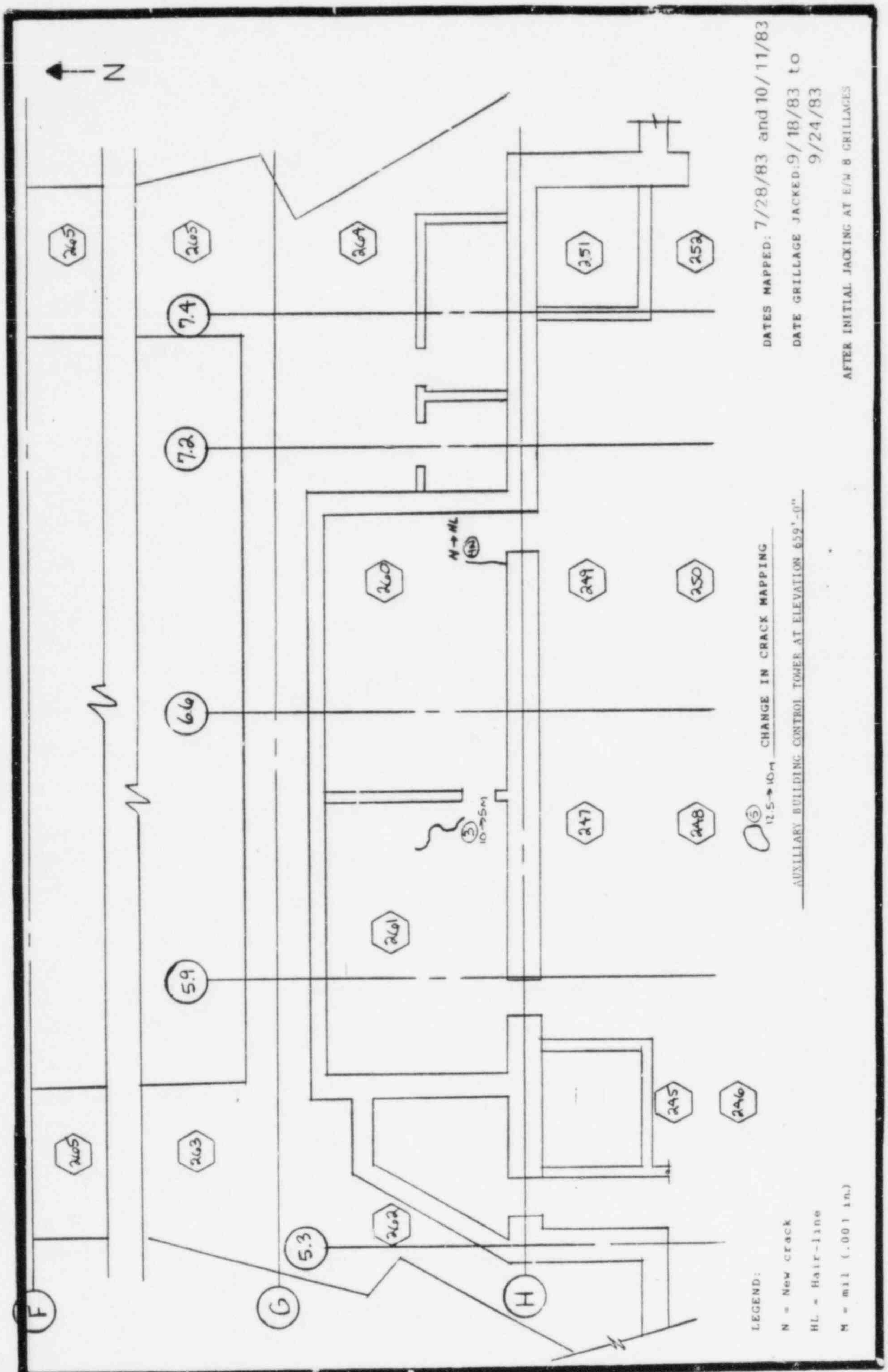
M = mil (.001 in.)

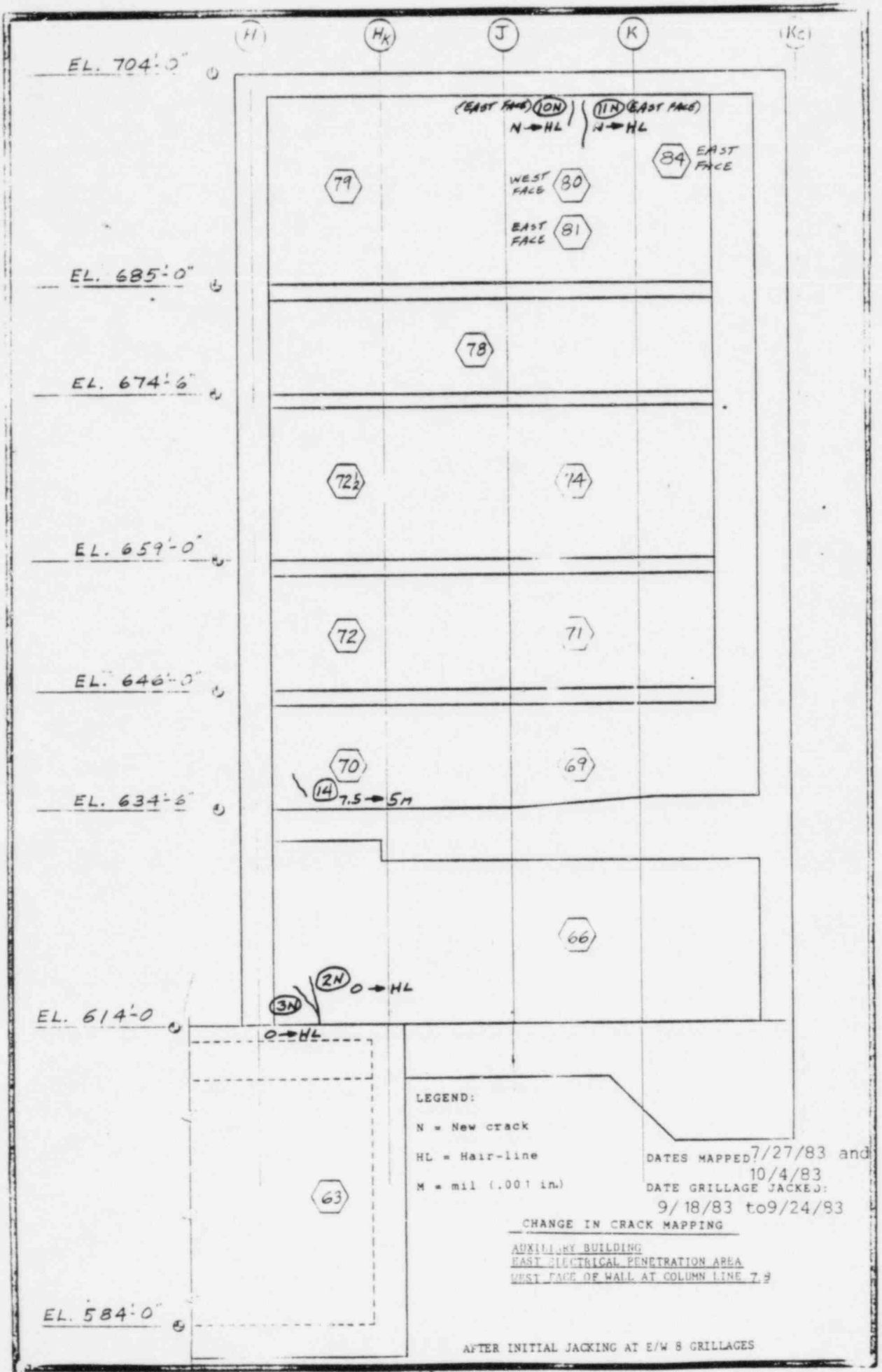
DATES MAPPED: 7/26/83 and 10/6/83

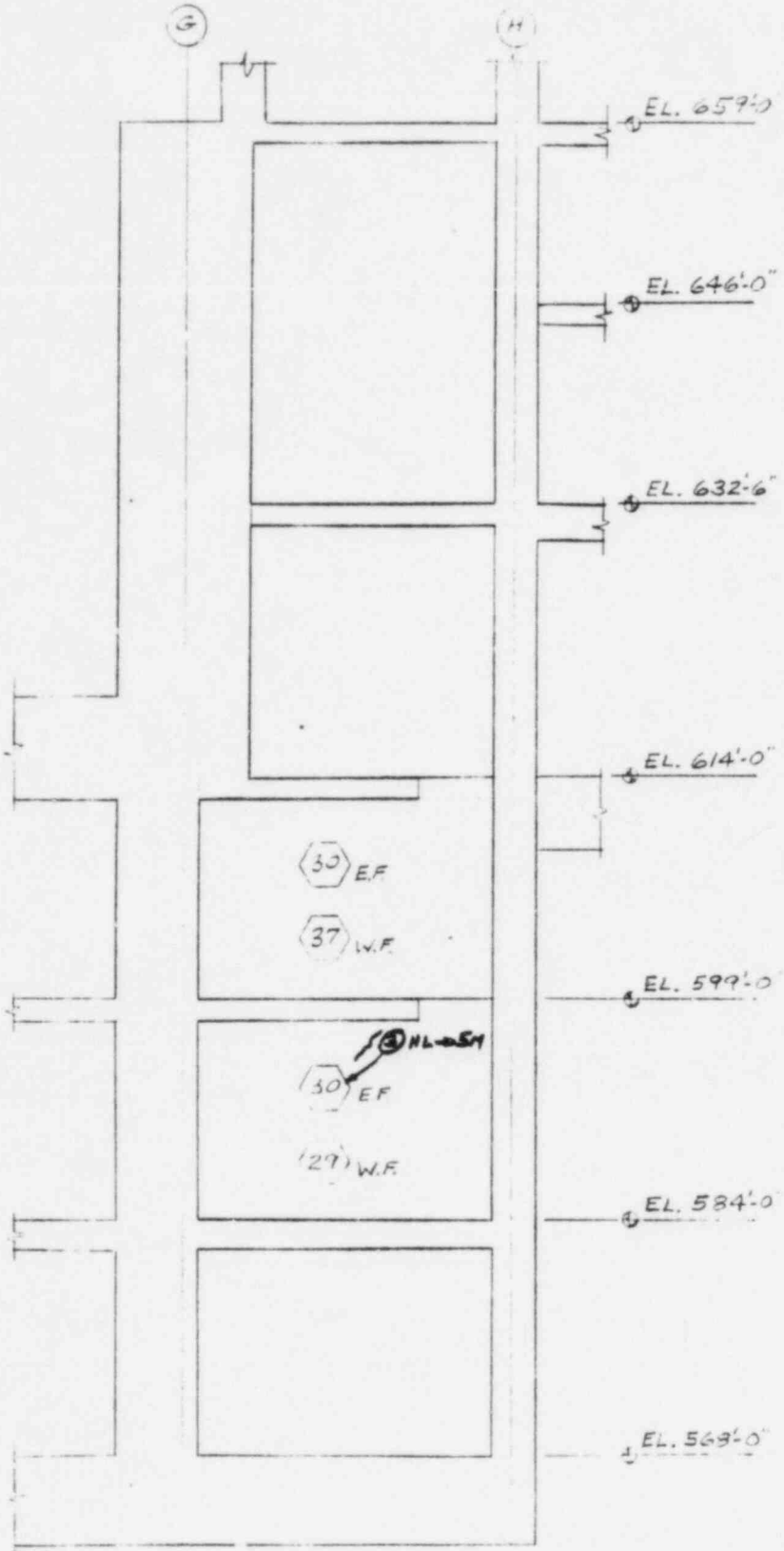
DATE GRILLAGE JACKED: 9/18/83 to 9/24/83

AFTER INITIAL JACKING AT E/W 8 GRILLAGES


5.3
5.9
6.6
7.2
7.4
N
G
H
1N N→5M
219
220
2N N→HL
2N N→HL
3N N→HL
N→6M
1N
221B
222A
223A
224A
221A
222B
223B
224B
5→7.5M
LEGEND:
N = New crack
HL = Hair-line
M = mil (.001 in.)
CHANGE IN CRACK MAPPING
AUXILIARY BUILDING CONTROL TOWER AT ELEVATION 646'-0"
DATES MAPPED: 7/27/83 and 10/11/83
DATE GRILLAGE JACKED: 9/18/83 to 9/24/83
AFTER INITIAL JACKING AT E/W 8 GRILLAGES


N
F
G
H
5.3
5.9
6.6
7.2
7.4
265
265
265
263
264
262
260
261
251
252
249
250
247
248
245
246
N → HL
3
10 → 5M
5
12.5 → 10M
CHANGE IN CRACK MAPPING
AUXILIARY BUILDING CONTROL TOWER AT ELEVATION 659'-0"
DATES MAPPED: 7/28/83 and 10/11/83
DATE GRILLAGE JACKED: 9/18/83 to 9/24/83
AFTER INITIAL JACKING AT E/W 8 GRILLAGES
LEGEND:
N - New crack
HL - Hair-line
M - mil (.001 in.)


H
HK
J
K
KC
EL. 704'-0"
EL. 685'-0"
EL. 674'-6"
EL. 659'-0"
EL. 646'-0"
EL. 634'-6"
EL. 614'-0
EL. 584'-0"
(EAST FACE) 10N N→HL
11N (EAST FACE) N→HL
84 EAST FACE
79
WEST FACE 80
EAST FACE 81
78
72½
74
72
71
70
69
14 7.5→5M
66
2N 0→HL
3N 0→HL
63
LEGEND:
N = New crack
HL = Hair-line
M = mil (.001 in.)
DATES MAPPED 7/27/83 and 10/4/83
DATE GRILLAGE JACKED: 9/18/83 to 9/24/83
CHANGE IN CRACK MAPPING
AUXILIARY BUILDING
EAST ELECTRICAL PENETRATION AREA
WEST FACE OF WALL AT COLUMN LINE 7.9
AFTER INITIAL JACKING AT E/W 8 GRILLAGES



LEGEND:

N = New crack

HL = Hair-line

M = mil (.001 in.)

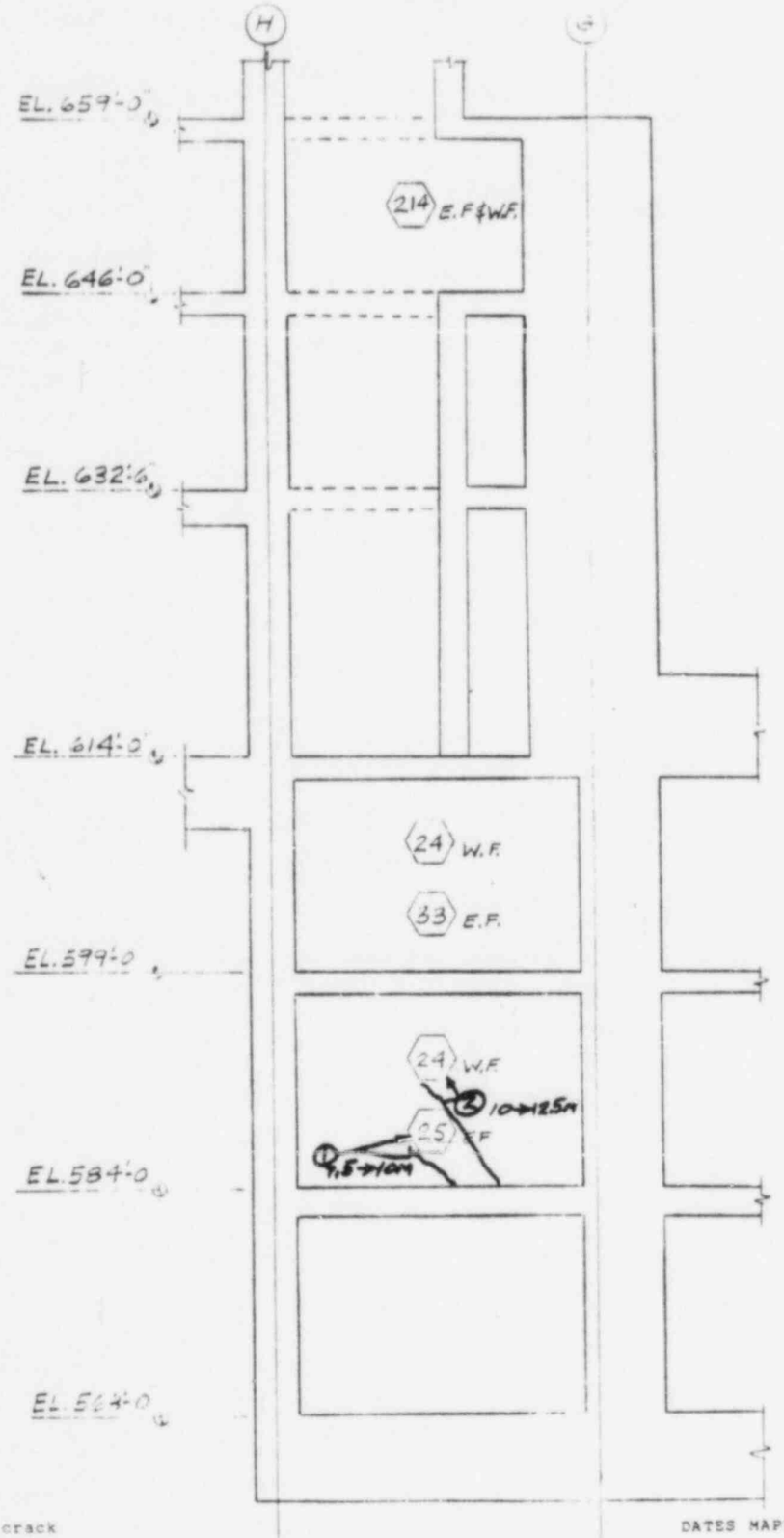
CHANGE IN CRACK MAPPING

WALL AT COLUMN LINE 7.4 AND 7.8

DATES MAPPED: 7/25/83 and 10/3/83

DATE GRILLAGE JACKED: 9/18/83 to 9/24/83

AFTER INITIAL JACKING AT E/W 8 GRILLAGES



LEGEND:

N = New crack

HL = Hair-line

M = mil (.001 in.)

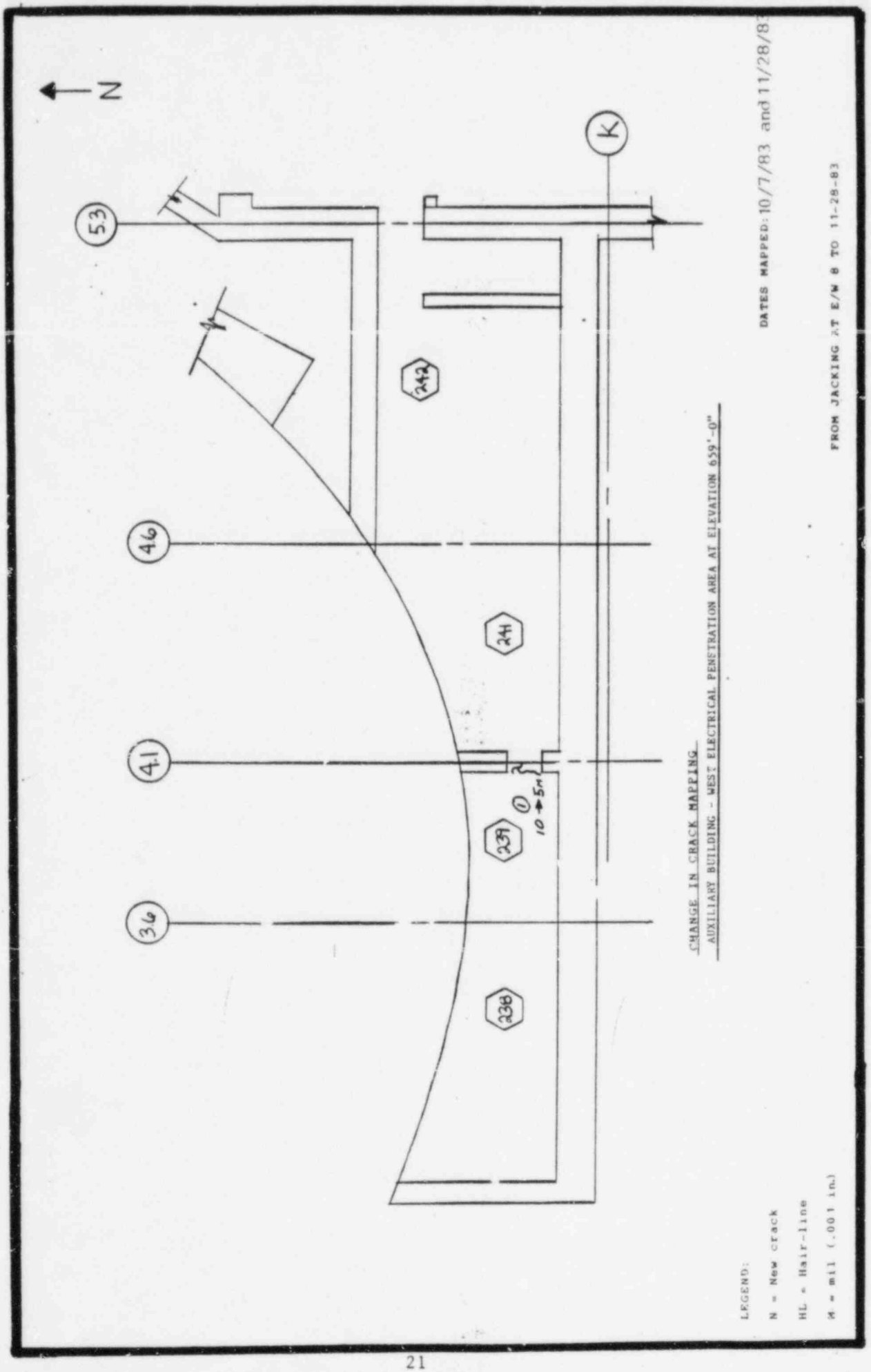
DATES MAPPED: 7/25/83 and 10/3/83

DATE GRILLAGE JACKED: 9/18/83 to 9/24/83

CHANGE IN CRACK MAPPING

WALL AT COLUMN LINE 5.3 AND 5.6

AFTER INITIAL JACKING AT E/W 8 GRILLAGES

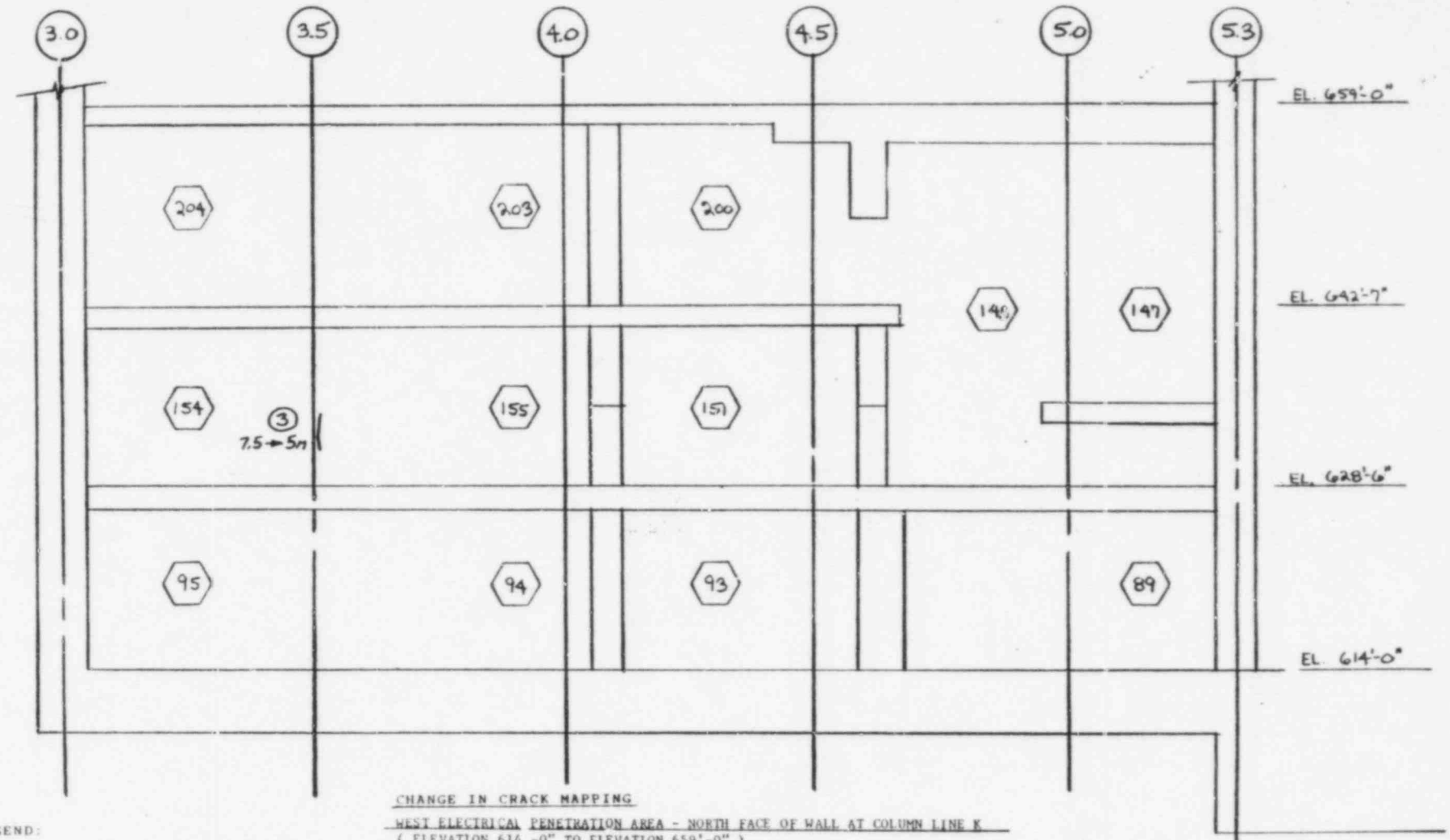


CHANGE IN CRACK MAPPING
AUXILIARY BUILDING - WEST ELECTRICAL PENETRATION AREA AT ELEVATION 659'-0"

DATES MAPPED: 10/7/83 and 11/28/83

FROM JACKING AT E/W 8 TO 11-28-83

LEGEND:
N = New crack
HL = Hair-line
M = mil (.001 in.)



CHANGE IN CRACK MAPPING

WEST ELECTRICAL PENETRATION AREA - NORTH FACE OF WALL AT COLUMN LINE K
(ELEVATION 614 -0" TO ELEVATION 659'-0")

LEGEND:

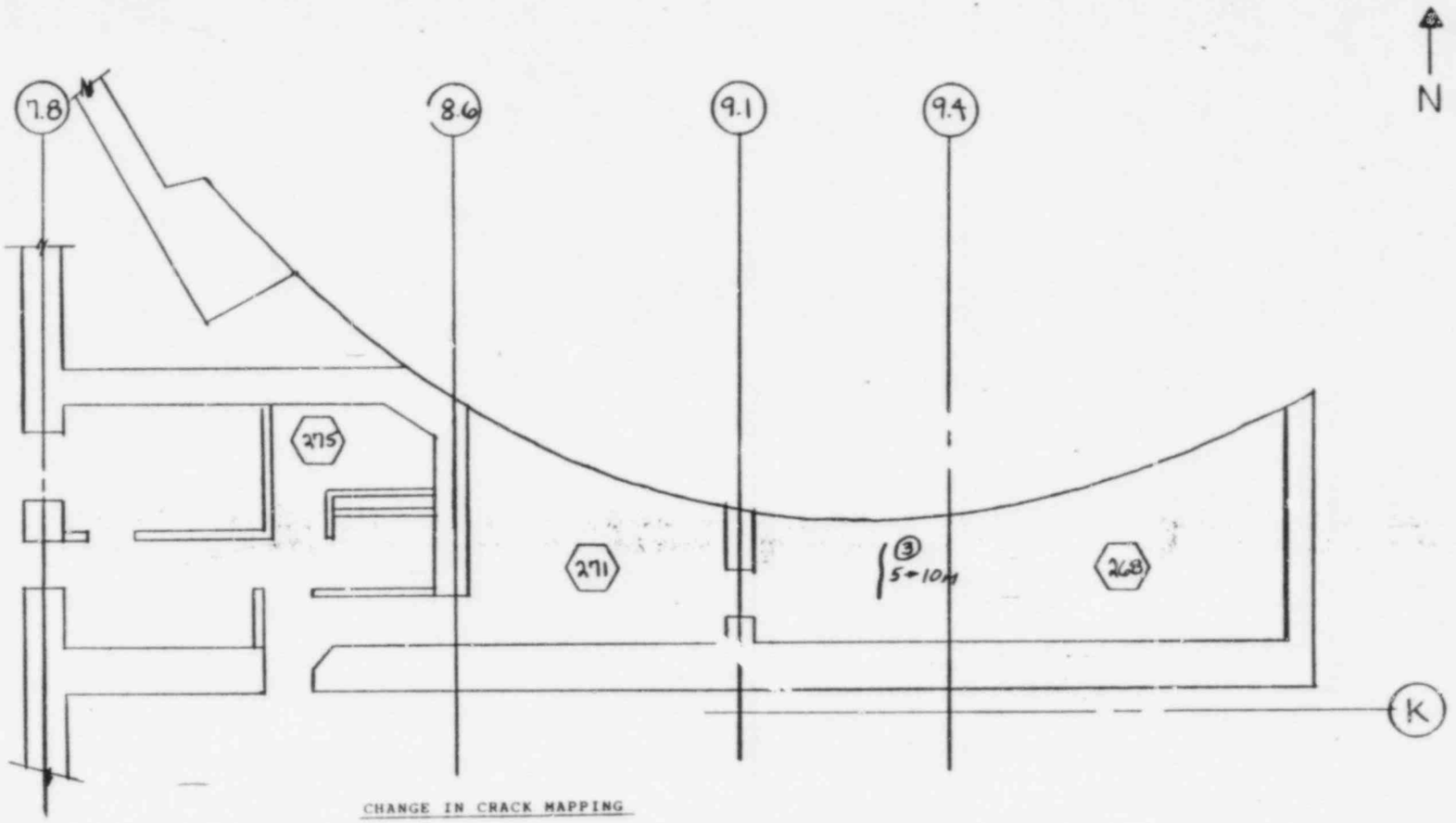
N = New crack

HL = Hair-line

M = mil (.001 in.)

DATES MAPPED: 10/6/83 and 11/28/83

FROM JACKING AT E/W 8 TO 11-28-83



CHANGE IN CRACK MAPPING

AUXILIARY BUILDING - EAST ELECTRICAL PENETRATION AREA AT ELEVATION 659'-0"

LEGEND:

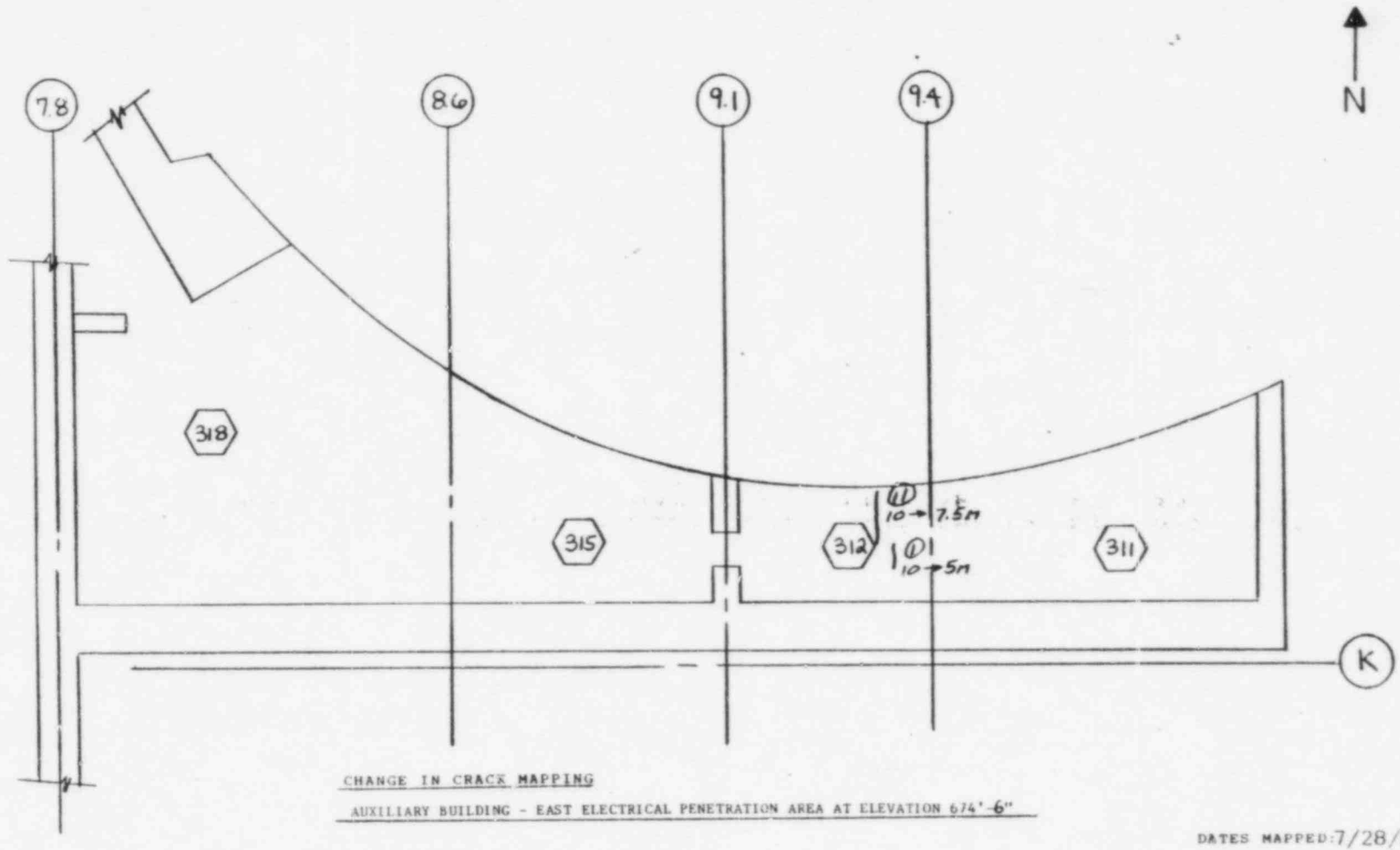
N = New crack

HL = Hair-line

M = mil (.001 in.)

DATES MAPPED: 10/7/83 and 11/28/83

FROM JACKING AT E/W B TO 11-28-83



CHANGE IN CRACK MAPPING

AUXILIARY BUILDING - EAST ELECTRICAL PENETRATION AREA AT ELEVATION 674'-6"

LEGEND:

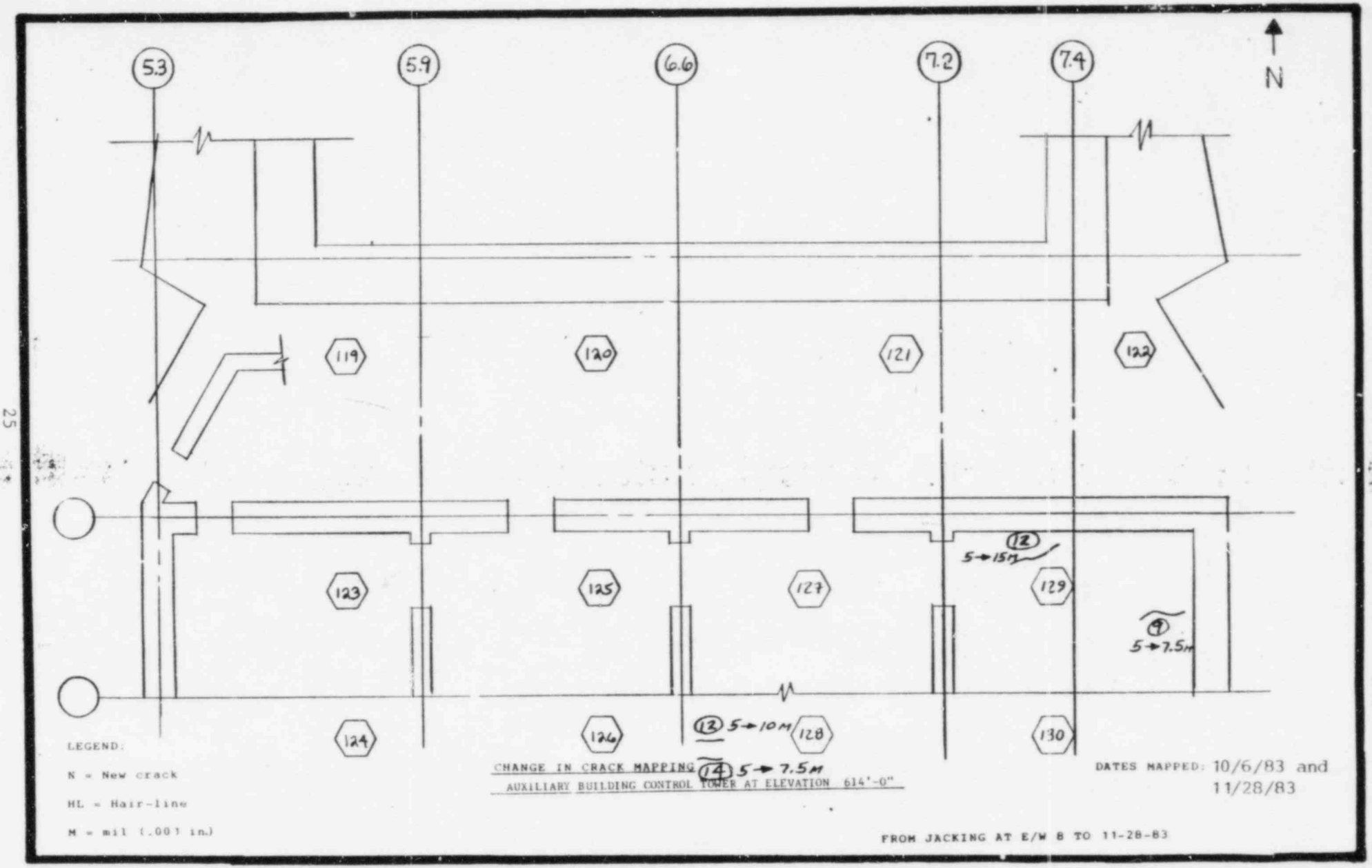
N = New crack

HL = Hair-line

M = mil (.001 in.)

DATES MAPPED: 7/28/83 and 11/28/83

FROM JACKING AT E/W 8 TO 11-28-83



LEGEND:

N = New crack

HL = Hair-line

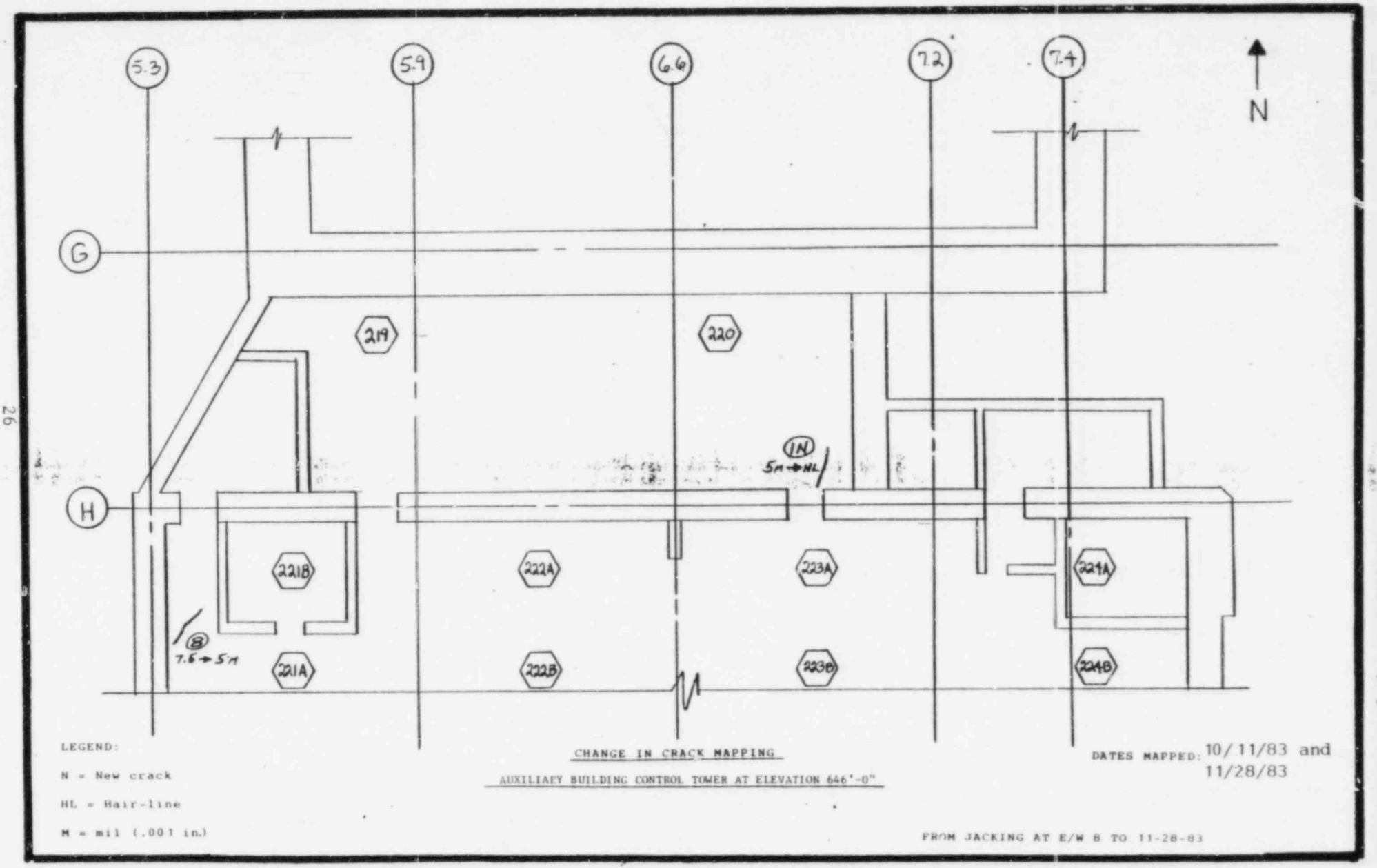
M = mil (.001 in.)

CHANGE IN CRACK MAPPING

AUXILIARY BUILDING CONTROL TOWER AT ELEVATION 614'-0"

DATES MAPPED: 10/6/83 and 11/28/83

FROM JACKING AT E/W B TO 11-28-83



LEGEND:

N = New crack

HL = Hair-line

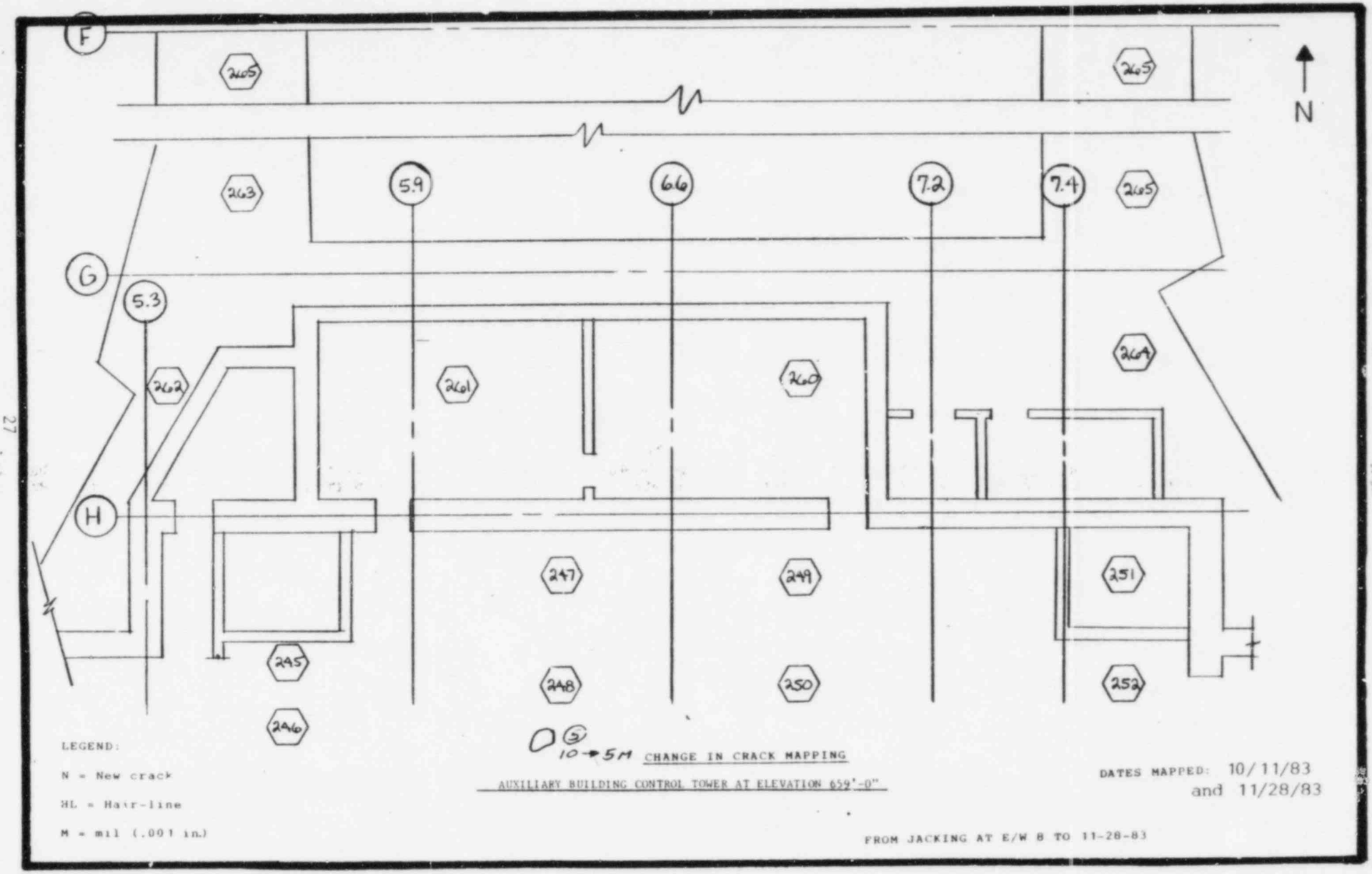
M = mil (.001 in.)

CHANGE IN CRACK MAPPING

AUXILIARY BUILDING CONTROL TOWER AT ELEVATION 646'-0"

DATES MAPPED: 10/11/83 and 11/28/83

FROM JACKING AT E/W 8 TO 11-28-83



LEGEND:

N = New crack

HL = Hair-line

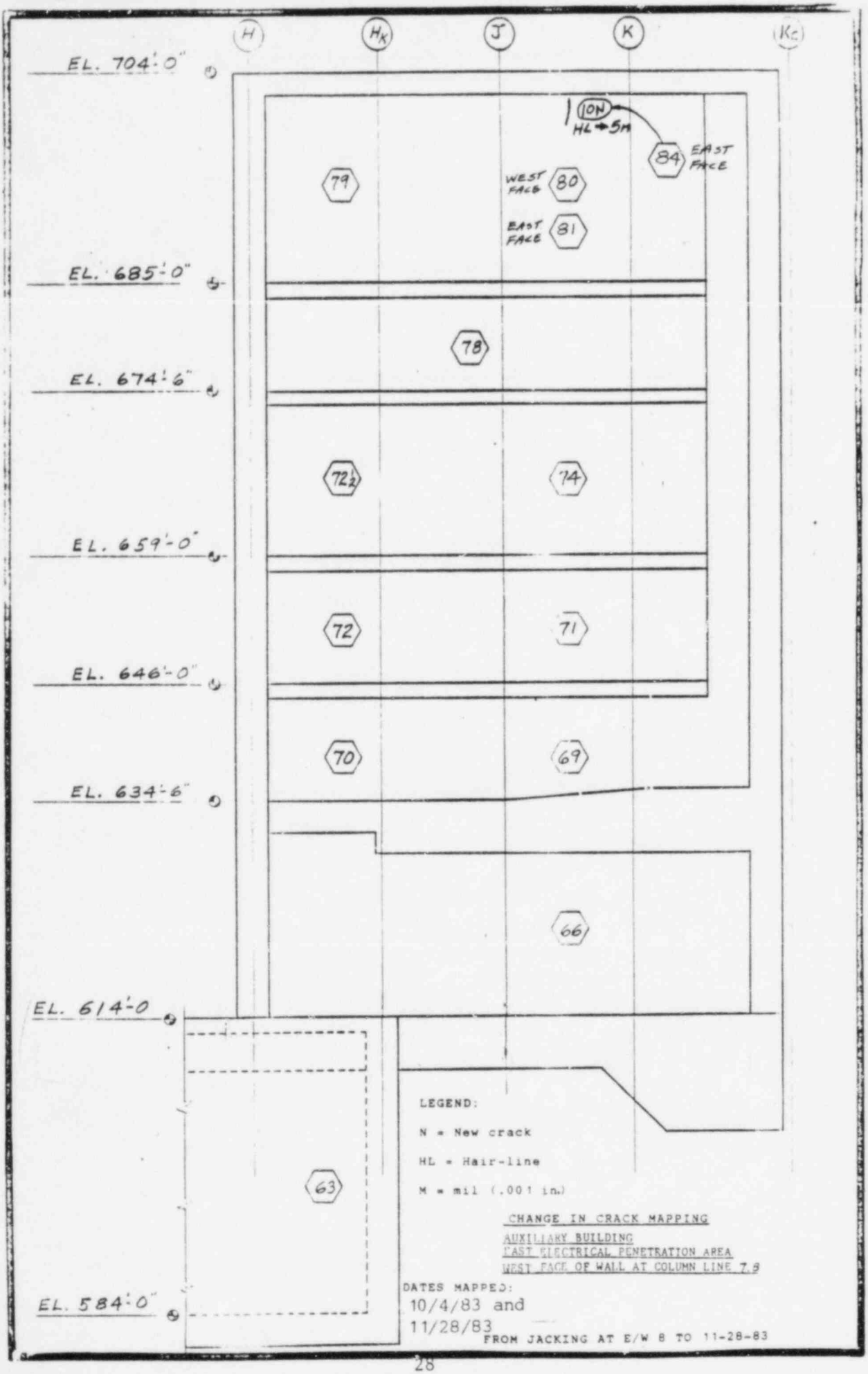
M = mil (.001 in.)

CHANGE IN CRACK MAPPING

AUXILIARY BUILDING CONTROL TOWER AT ELEVATION 659'-0"

DATES MAPPED: 10/11/83 and 11/28/83

FROM JACKING AT E/W B TO 11-28-83


H
HK
J
K
KL
EL. 704'-0"
EL. 685'-0"
EL. 674'-6"
EL. 659'-0"
EL. 646'-0"
EL. 634'-6"
EL. 614'-0
EL. 584'-0"
10N
HL → 5M
84
EAST FACE
79
WEST FACE
80
EAST FACE
81
78
72½
74
72
71
70
69
66
63
LEGEND:
N = New crack
HL = Hair-line
M = mil (.001 in.)
CHANGE IN CRACK MAPPING
AUXILIARY BUILDING
EAST ELECTRICAL PENETRATION AREA
WEST FACE OF WALL AT COLUMN LINE 7.9
DATES MAPPED:
10/4/83 and
11/28/83
FROM JACKING AT E/W 8 TO 11-28-83

LOCATION	AREA	CRACK I.D. NO	CRACK MEASURMENTS (1 MIL=.001 in.)						EVALUATION
			WIDTH CHANGE AFTER INITIAL JACKING (MILS)			WIDTH CHANGE AFTER REJACKING (MILS)			
			FROM	TO	> 5 MILS	FROM	TO	> 5 MILS	
West EPA Slab @ 628' 6"	146	9N	N	HL	No				Within Tolerance.
West EPA slab @ 659' 0"	238	*3	15	5	Yes				Crack #3 in area 238 is in floor topping with poorly defined worn off edges which could have lead to measurement dispersion. All other cracks within tolerance.
	238	*13N	N	HL	No				
	239	*1	15	10	No	10	5	No	
	239	*6	7.5	5	No				
	242	*8	15	10	No				
West EPA Slab @ 674' 6"	282	1	7.5	5	No				Within Tolerance.
West EPA North face of wall @ Col. Line K 614'-0" to 659'-0"	151	1	10	15	No				Both cracks within tolerance.
	154	3	5	7.5	No	7.5	5	No	
	203	*1N	N	HL	No				Cracks were reexamined and traces of paint within the crack indicated that it had formed before underpinning operation.
	203	*2N	N	HL	No				
	203	*3N	N	HL	No				
	203	*4N	N	HL	No				
	204	*1N	N	HL	No				
	204	*2N	N	HL	No				
South face of wall.	339	6	7.5	5	No				Within Tolerance.
East EPA Slab @659'-0"	268	*1	HL	5	No				Crack #2 in area 271 is in floor topping with poorly defined worn off edges which could have lead to measurement dispersion. All other cracks within tolerance.
		*3	HL	5	No	5	10	No	
		*22N	N	HL	No				
	271	*2	7.5	15	Yes				
East EPA Slab @674'6"	312	1	10	Crazing	N/A	10	5	No	Cracks were noted as crazing when mapped after initial jacking. Valves from 7/28/83 to 11/28/83 were within tolerance.
		11	10	Crazing	N/A	10	7.5	No	
East EPA North face of wall @ Col. Line K 614'-0" to 659'-0"	187	2N	N	HL	No				Both cracks within tolerance.
	139	1N	N	HL	No				
Control Tower West face of wall @ Col. Line 7.8	66	2N	N	HL	No				All cracks within tolerance.
		3N	N	HL	No				
	70	14	7.5	5	No				

SUMMARY OF AUXILIARY BUILDING CRACK CHANGES

LOCATION	AREA	CRACK I.D. NO.	CRACK MEASUREMENTS (1 MIL=.001 in)						EVALUATION
			WIDTH CHANGE AFTER INITIAL JACKING (MILS)			WIDTH CHANGE AFTER REJACKING (MILS)			
			FROM	TO	5 MILS	FROM	TO	5 MILS	
Control Tower East face of Wall @ Col. Line 7.8	84	10N ~~+1~~1N	N N	HL HL	No No	HL	5	No	Both cracks within tolerance.
Control Tower Slab @614'-0"	128	5	5	10	No				Crack #12 in area 129 is in floor topping with poorly defined worn off edges which could have lead to measurement dispersion. All other cracks within tolerance.
		12	10	5	No	5	10	No	
		14	7.5	5	No	5	7.5	No	
	129	9	7.5	5	No	5	7.5	No	
		12	10	5	No	5	15	Yes	
Control tower Slab @646'-0"	221A	8	5	7.5	No	7.5	5	No	Within Tolerance.
Control tower Slab @659'-0"	248	5	12.5	10	No	10	5	No	Within Tolerance.
Aux. Bldg. Slab @646'-0"	219	1N	N	HL	No				All cracks within tolerance.
		2N	N	HL	No				
	220	1N	N	5	No	5	HL	No	
		2N	N	HL	No				
		3N	N	HL	No				
Aux. Bldg. Slab @659'-0"	260	4N	N	HL	No				Both cracks within tolerance.
	261	3	10	5	No				
Aux. Bldg. Wall @Col. Line 7.4 & 7.8	30	3	N	5	No				Within Tolerance.
Aux. Bldg. Wall @Col. Line 5.3 & 5.6	25	*1	7.5	10	No				Both cracks within tolerance.
	24	*2	10	12.5	No				
* Inspected by Dr. A. E. Fiorato (CTL) and Dr. Mete Sozen (Univ. of Ill)									

SUMMARY OF CRACK CHANGES FOR

INITIAL JACKING AT E/W 8 GRILLAGE

DESCRIPTION	NEW	INCREASED	DECREASED
Total number of cracks.	21	10	13
Number of cracks greater than 0.005" change.	0	1	1

As shown above, relatively few cracks were observed to have changed in width during the introduction of the initial jacking loads for the Grillages. Of the reported twenty-one (21) new cracks after initial jacking, eight (8) were determined to have existed before start of underpinning based on subsequent inspection.

SUMMARY OF SELECTED CRACK CHANGES FOR REJACKING AT E/W 8 GRILLAGE

	INCREASED	DECREASED
Total number of crack changes.	6	7
Number of cracks greater than 0.005" change.	1	0