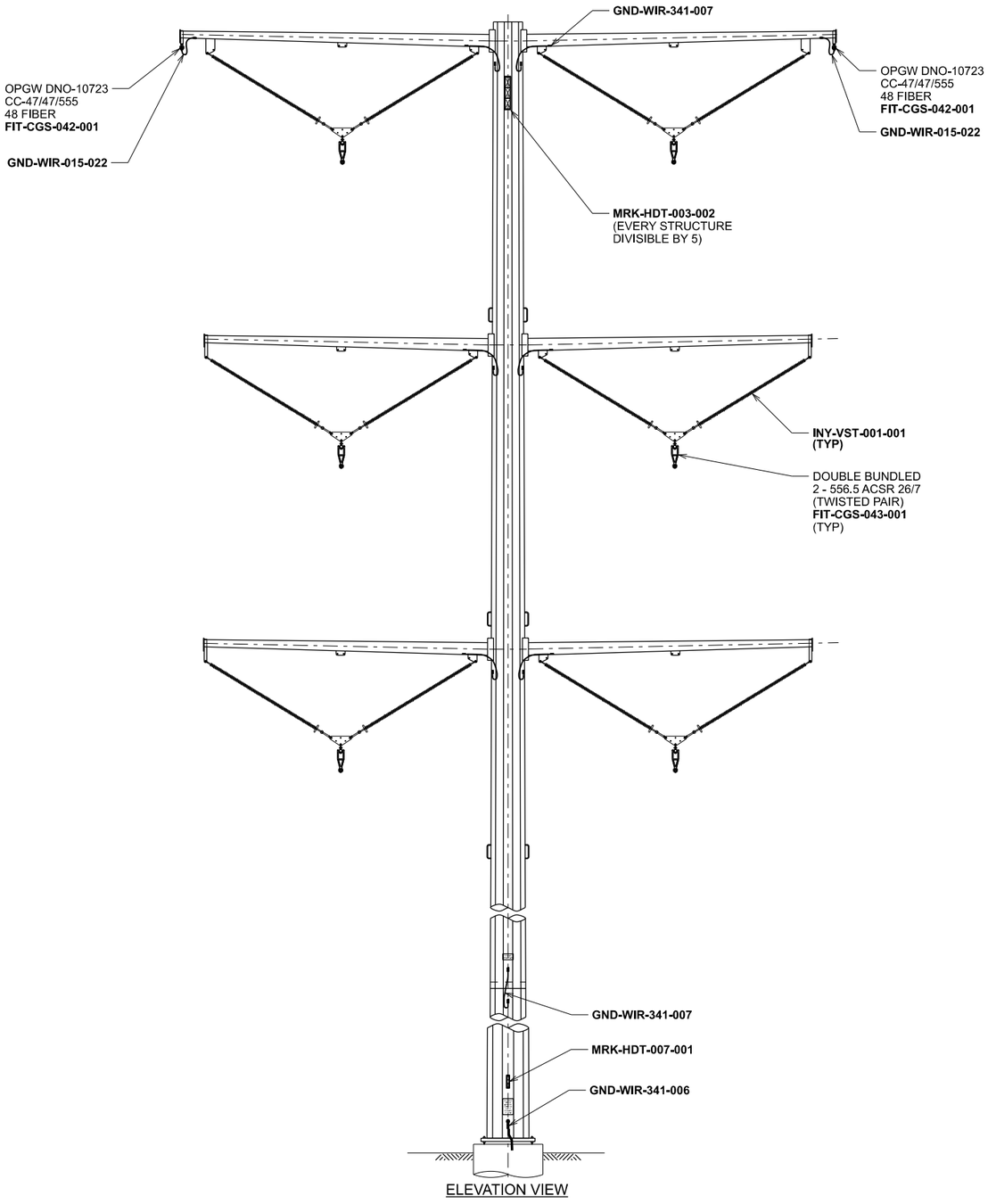
APPENDIX D

Typical Transmission Line Structure Design

Lyon County Generating Station Project
Combined Application
MPUC Docket Nos. E002/CN-25-145, G002/GS-25-154,
E002/TL-25-161 & G002/GP-25-163
May 2025



ELEVATION VIEW

NOTE:
SUB-ASSEMBLY FOR JOINT BONDS WILL BE ADDED TO EACH PLS POLE MODEL.

INSTALL BONDING GND-WIR-341-007 ACROSS ALL STEEL SHAFT SLIP JOINTS		
STRUCTURE XP#	POLE HEIGHT	TOTAL NUMBER OF SLIP JOINT BONDING REQUIRED
PST17159	125-0"	2
PST17160	130'-0"	2
PST17161	135'-0"	2
PST17162	140'-0"	2
PST17163	145'-0"	2
PST17164	150'-0"	2
PST17165	155'-0"	3
PST17166	160'-0"	3
PST17167	165'-0"	3

CONSTRUCTION NOTE:

WHEN INSTALLING ARMS TO SHAFT BONDS DO NOT CONTACT ANY PART OF THE POLYMER INSULATOR.

CONSTRUCTION NOTE:

IF CABLES ARE USED TO TIE DOWN ARMS PRIOR TO WIRE INSTALLATION, DO NOT ALLOW TIE DOWN CABLES TO CONTACT ANY PART OF THE POLYMER INSULATOR.

ASSEMBLY
STR ND-279464-1
FOR STEEL POLES
STL ND-279454-PST17159
STL ND-279454-PST17160
STL ND-279454-PST17161
STL ND-279454-PST17162
STL ND-279454-PST17163
STL ND-279454-PST17164
STL ND-279454-PST17165
STL ND-279454-PST17166
STL ND-279454-PST17167
LD ND-279418

QTY	SUBASSEMBLIES
2	FIT-CGS-042-001
3	FIT-CGS-043-001
2	GND-WIR-015-022
1	GND-WIR-341-006
6	GND-WIR-341-007
3	INY-VST-001-001
1	MRK-HDT-007-001

ASSEMBLY
STR ND-279464-2
FOR STEEL POLES
FOR SECOND CIRCUIT

QTY	SUBASSEMBLIES
3	FIT-CGS-043-001
3	INY-VST-001-001

REV	DATE	WBS 4	REVISION DESCRIPTION
0	09/25/2019	B.0000004.021.001.001	

DRAWING REFERENCE

PLAN & PROFILE _____ ND-279505
SUBASSEMBLY INDEX _____ NL-279504

THIS PE SEAL IS ONLY APPLICABLE TO THE CURRENT CONSTRUCTION REVISION

ISSUED BY ENGINEERING DEPT FOR: CONSTRUCTION

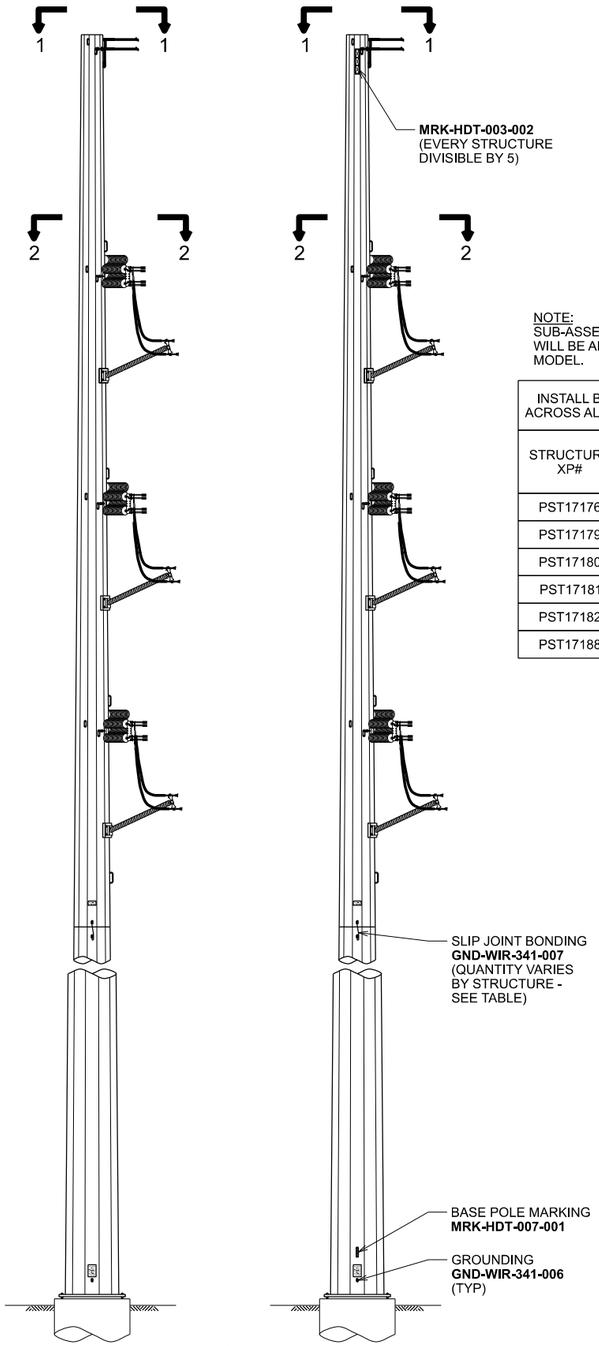
345 kV

STRUCTURE DRAWING - TANGENT - STEEL - D.C. - SINGLE POLE
TAN TO 2 DEGREE, DAVIT ARM, V-STRING

Xcel Energy® | ND-279464-1 | SCALE AS NOTED | REV 0

ND-279464-1.DGN

4/27/2020 8:03:50 AM



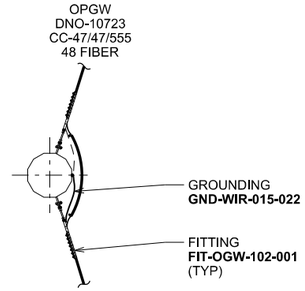
ELEVATION VIEW

STRUCTURE SHOWN IS RIGHT ANGLE CONFIGURATION - ROTATE 180° FOR LEFT ANGLE CONFIGURATION

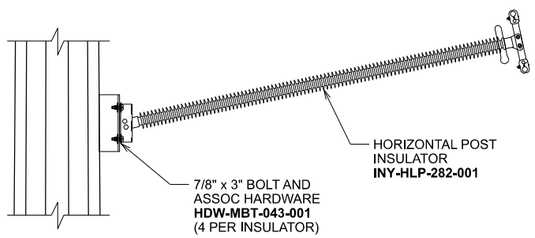
LINE ANGLE VARIES BY STRUCTURE

NOTE:
SUB-ASSEMBLY FOR JOINT BONDS WILL BE ADDED TO EACH PLS POLE MODEL.

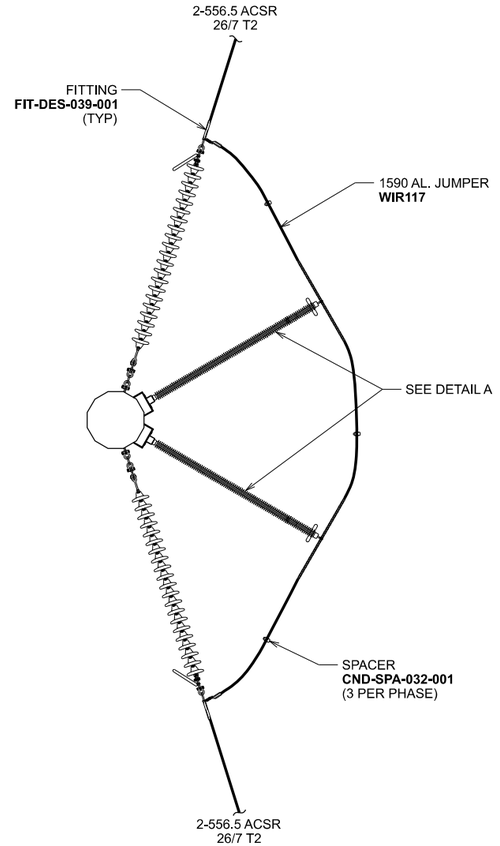
INSTALL BONDING **GND-WIR-341-007** ACROSS ALL STEEL SHAFT SLIP JOINTS		
STRUCTURE XP#	POLE HEIGHT	TOTAL NUMBER OF SLIP JOINT BONDING REQUIRED
PST17176	130'-0"	2
PST17179	155'-0"	3
PST17180	160'-0"	3
PST17181	165'-0"	3
PST17182	155'-0"	3
PST17188	145'-0"	3



SECTION 1-1
SHIELD WIRE
SCALE: NONE



DETAIL A
HORIZONTAL POST INSULATOR
SCALE: NONE



SECTION 2-2
PHASE
SCALE: NONE

ASSEMBLY
STR ND-279471-1
FOR STEEL POLES
LINE 0967

STL ND-279455-PST17176
STL ND-279455-PST17179
STL ND-279455-PST17180
STL ND-279455-PST17181
LD ND-279425

STL ND-279455-PST17182
LD ND-279426

STL ND-279455-PST17188
LD ND-279431

QTY	SUBASSEMBLIES
9	CND-SPA-032-001
2	FIB-OGW-102-001
6	FIT-DES-039-001
2	GND-WIR-015-022
2	GND-WIR-341-006
48	HDW-MBT-043-001
12	INY-HLP-282-001
1	MRK-HDT-007-001
330	WIR117 - 1590 AL

ASSEMBLY
STR ND-279471-2
FOR STEEL POLES
LINE 0982

QTY	SUBASSEMBLIES
9	CND-SPA-032-001
6	FIT-DES-039-001
330	WIR117 - 1590 AL.

REV	DATE	WBS 4	REVISION DESCRIPTION
0	01/13/2020	B.0000004.021.001.001	

DRAWING REFERENCE
PLAN & PROFILE _____ ND-279505
SUBASSEMBLY INDEX _____ NL-279504

THIS PE SEAL IS ONLY APPLICABLE TO THE CURRENT CONSTRUCTION REVISION

ISSUED BY ENGINEERING DEPT FOR: CONSTRUCTION

345 kV
STRUCTURE DRAWING - DEADEND - TERMINAL - STEEL - ANGLE
0 TO 95 DEGREE - DOUBLE CIRCUIT - 2-POLE, NO OPGW SPLICE

Xcel Energy®

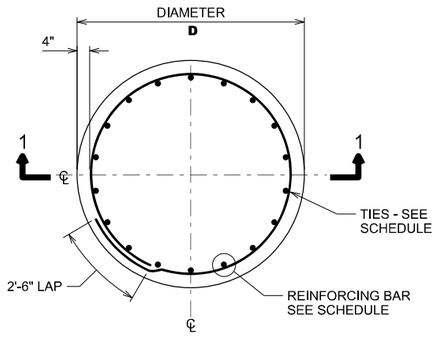
ND-279471-1

SCALE 1/16"=1'-0"

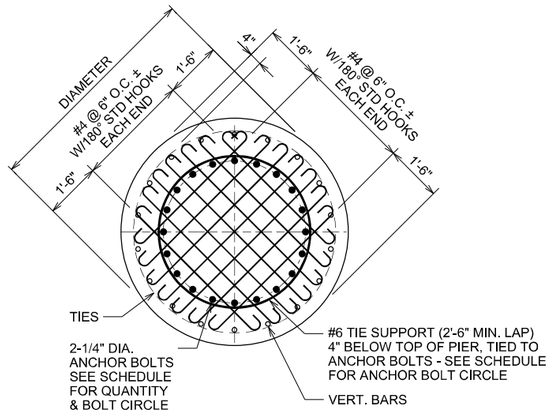
REV 0

ND-279471-1.DGN

7/20/2020 11:25:20 AM

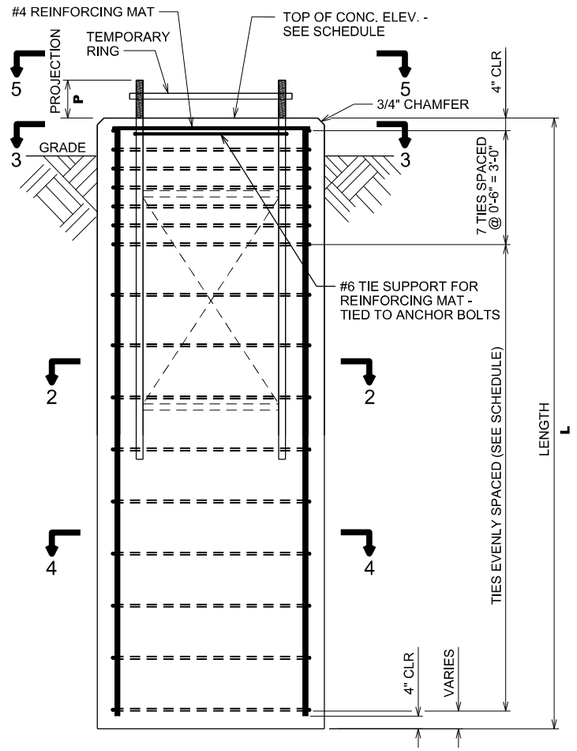


SECTION 2-2

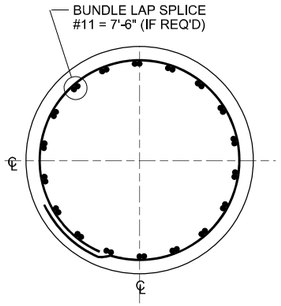


SECTION 3-3

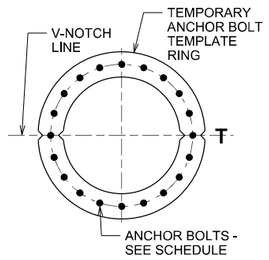
#4 REINFORCING MAT



SECTION 1-1

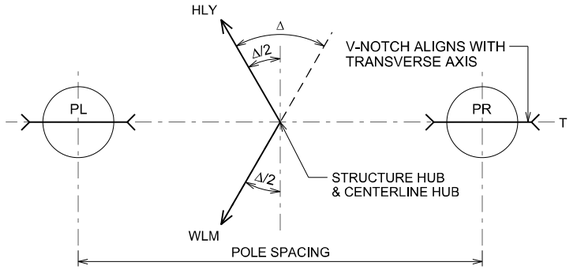


SECTION 4-4

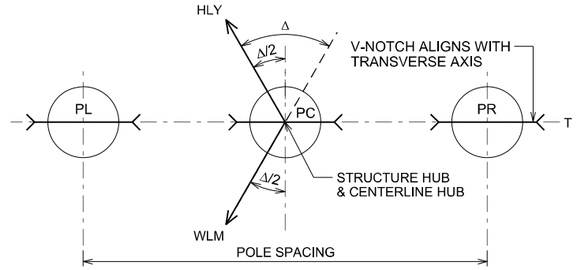


SECTION 5-5

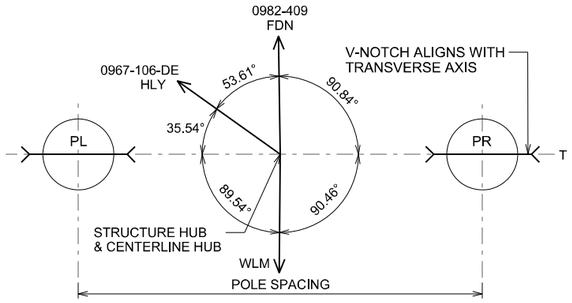
ANCHOR BOLT LAYOUT



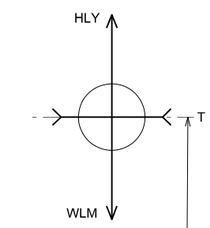
V-NOTCH ORIENTATION
TYPICAL 2-POLE DEAD END STRUCTURE



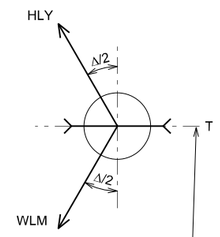
V-NOTCH ORIENTATION
TYPICAL 3-POLE DEAD END STRUCTURE



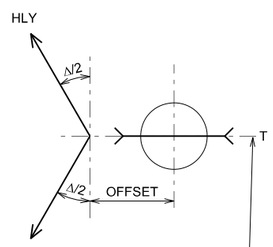
V-NOTCH ORIENTATION
STRUCTURE 0967-105-DE



V-NOTCH ORIENTATION
TYPICAL 1-POLE
TANGENT STRUCTURE



V-NOTCH ORIENTATION
TYPICAL 1-POLE DEAD END
STRUCTURE



V-NOTCH ORIENTATION
TYPICAL 1-POLE
RUNNING ANGLE STRUCTURE

GENERAL NOTES

1. REINFORCING STEEL SHALL CONFORM TO ASTM A-615 GRADE 75 FOR VERTICAL BARS. ALL OTHER STEEL SHALL BE GRADE 60. ALL CLEAR DIMENSIONS MEASURED FROM OUTSIDE EDGE OF REINFORCING STEEL.
2. CONCRETE: READY MIX CONCRETE SHALL CONFORM TO ASTM C-94. CEMENT SHALL BE ADDED PER ASTM C-260 TO PRODUCE FROM 6% +/- 1½% ENTRAINED AIR. NO CALCIUM CHLORIDE SOLUTION SHALL BE ADDED TO CONCRETE MIX.
   A) CONCRETE STRENGTH: (MINIMUM 28 DAY COMPRESSIVE STRENGTH) - 4500 P.S.I.
   B) AGGREGATE: SHALL CONFORM TO ASTM C-33. MAXIMUM AGGREGATE SIZE THROUGHOUT SHALL BE 3/4"
   C) SLUMP: SHALL BE 6-9 INCHES.
   D) VIBRATION OF CONCRETE: SHALL BE LIMITED TO THE TOP TEN FEET OF THE FOUNDATION.
3. SOIL OR ROCK CONDITIONS: WHERE SOIL DEPTHS, DEPTHS TO BEDROCK, OR THE CONDITIONS OF SOIL OR BEDROCK DIFFER FROM THAT SHOWN ON THE BORINGS, THE FOUNDATIONS ENGINEER SHALL BE CONTACTED.
4. ALL PIERS SHALL BE FORMED FROM TOP OF FOUNDATION TO ONE FOOT BELOW GRADE BEFORE CONCRETE IS PLACED TO COMPLETE THE PIER.

ADDITIONAL REINFORCING STEEL REQUIRED FOR PIERS - STRUCTURES 001-043 ONLY

1. LONGITUDINAL SUPPORT BARS: (4) #4 BARS 20 FEET LONG FOR PIER LENGTHS 20 FEET OR LESS, PLUS (6) #4 BARS 20 FEET LONG FOR EACH ADDITIONAL 0-10 FEET OF PIER LENGTH ABOVE 20 FEET.
2. CROSS BRACING BARS TO MAINTAIN SHAPE (DESIRED 8 FEET MAXIMUM SPOKE SPACING):
   A) FOR PIER DIAMETERS 4 FEET TO LESS THAN 7 FEET: (2) #8 BARS 20 FEET LONG FOR PIER LENGTHS 20 FEET OR LESS, PLUS (2) #8 BARS 20 FEET LONG FOR EACH ADDITIONAL 0-10 FEET OF PIER LENGTH ABOVE 20 FEET.
   B) FOR PIER DIAMETERS 7 FEET TO 10 FEET: (2) #11 BARS 20 FEET LONG FOR PIER LENGTHS 20 FEET OR LESS, PLUS (2) #11 BARS 20 FEET LONG FOR EACH ADDITIONAL 0-10 FEET OF PIER LENGTH ABOVE 20 FEET.
   C) FOR PIER DIAMETERS GREATER THAN 10 FEET: (4) #11 BARS 20 FEET LONG FOR PIER LENGTHS 20 FEET OR LESS, PLUS (2) #11 BARS 20 FEET LONG FOR EACH ADDITIONAL 0-10 FEET OF PIER LENGTH ABOVE 20 FEET.

DRAWING REFERENCE

ANCHOR BOLT DETAILS	ND-279512
FOUNDATION DESIGN CALCULATIONS	NX-279510
PLAN AND PROFILE	ND-279505
SOIL BORINGS	NX-279511
SUBASSEMBLY DRAWING INDEX	NL-279504
FOUNDATION SCHEDULE - WLM SUB TO 0967-020	ND-279509-2
FOUNDATION SCHEDULE - 0967-021 TO 0967-043	ND-279509-3
FOUNDATION SCHEDULE - 0967-044 TO 0967-069	ND-279509-4
FOUNDATION SCHEDULE - 0967-070 TO 0967-097	ND-279509-5
FOUNDATION SCHEDULE - 0967-098 TO 0967-125	ND-279509-6
FOUNDATION SCHEDULE - 0967-126 TO 0967-155	ND-279509-7
FOUNDATION SCHEDULE - 0967-156 TO 0967-185	ND-279509-8
FOUNDATION SCHEDULE - 0967-186 TO 0967-215	ND-279509-9
FOUNDATION SCHEDULE - 0967-216 TO 0967-245	ND-279509-10
FOUNDATION SCHEDULE - 0967-246 TO HLY SUB	ND-279509-11

THIS PE SEAL IS ONLY APPLICABLE TO THE CURRENT CONSTRUCTION REVISION

TRANSMISSION CONSTRUCTION

☐ BUILT AS DESIGNED
☐ REVISE PER MARK-UP

FOREMAN / INSPECTOR SIGNATURE

DATE:

I hereby certify that this plan, specification, or report was prepared by me or under my direct supervision and that I am a duly Licensed Professional Engineer under the laws of the state of Minnesota.

REV	DATE	WBS 4	REVISION DESCRIPTION

ISSUED BY ENGINEERING DEPT FOR: CONSTRUCTION

345 kV

Xcel Energy®

ND-279509-1

SCALE NONE

REV 6

ND-279509-1.DGN

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