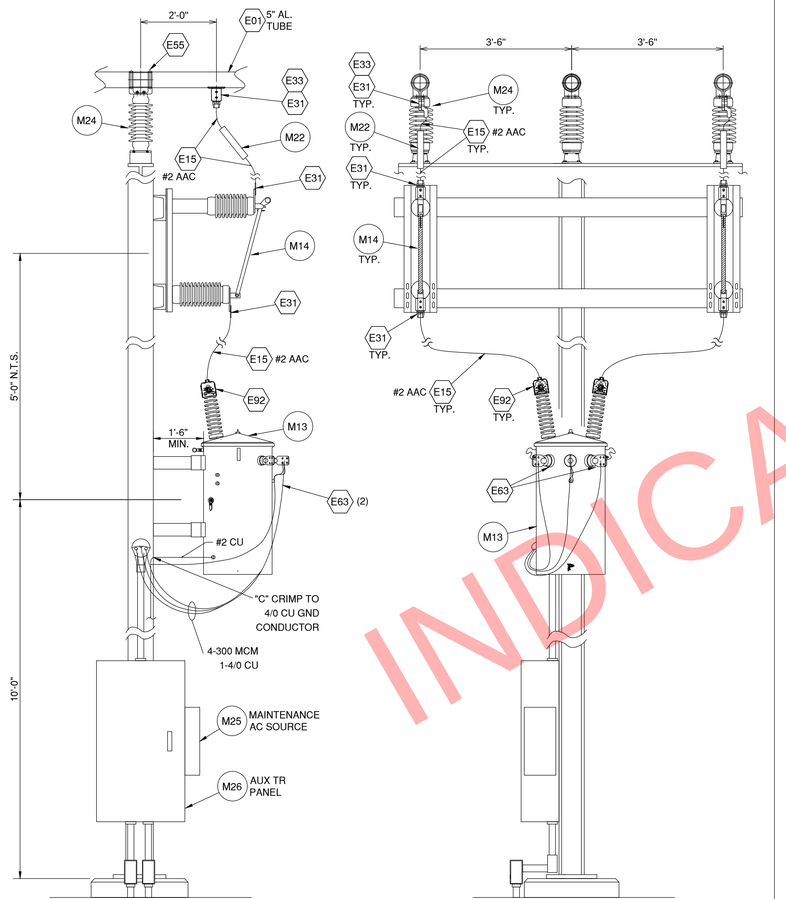
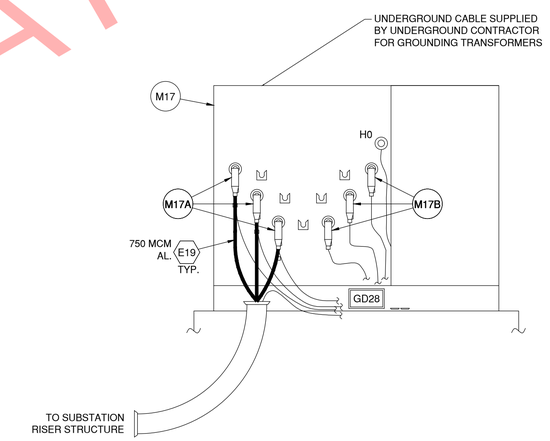
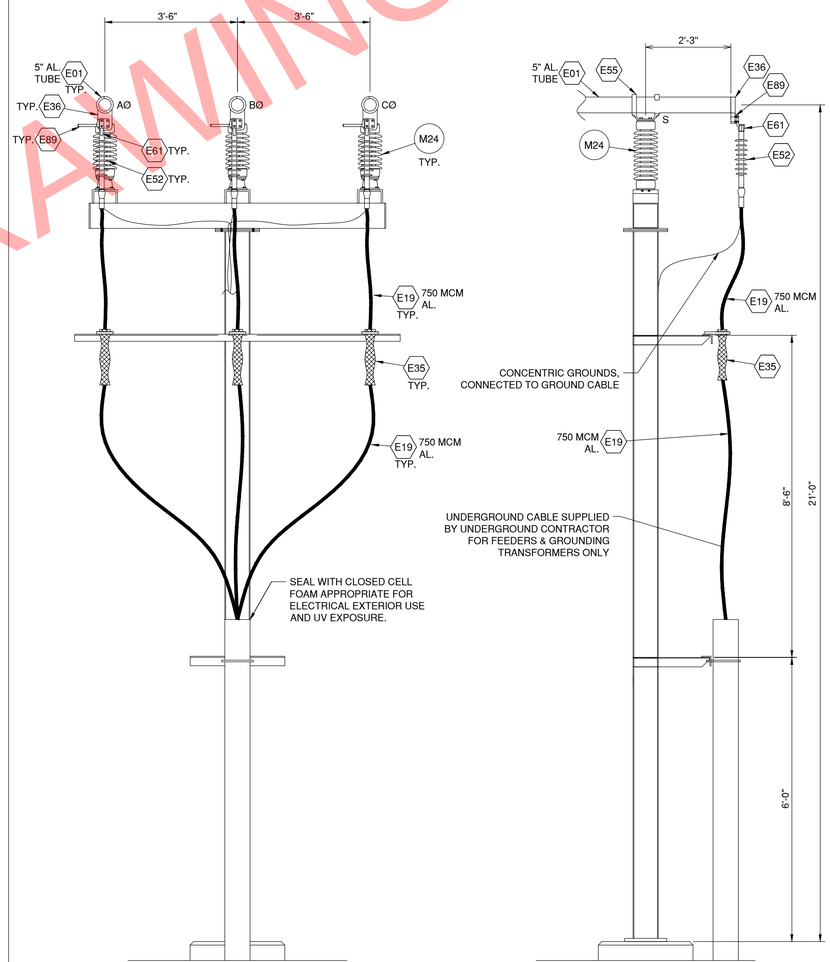
NOTE:
EMER STA AUX TRANSFORMERS TO BE CONNECTED TO A & C PHASES



DETAIL D20
STATION SERVICE TRANSFORMER



DETAIL D21
GROUNDING TRANSFORMER



DETAIL D22
GROUNDING TRANSFORMER RISER STRUCTURE

LEGEND:

F	FIXED FITTING
S	SLIP FITTING
E	EXPANSION FITTING
N.S.	NEAR SIDE
F.S.	FAR SIDE
M#	MAJOR MATERIAL SEE NH-XXXXX-X
E#	MINOR MATERIAL SEE NH-XXXXX-X
D#	DETAIL, SEE DWG. NH-XXXXX-X THRU XXXXX-X

NO	REVISION	ZONE	DATE	BY	CHK	ENG
	REV. A - ISSUED FOR REVIEW: 8-9-21					

NO	REVISION	ZONE	DATE	BY	CHK	ENG

REFERENCE DRAWINGS

DWG NO.	MANUFACTURER	DESCRIPTION

Xcel Energy®
NORTHERN STATES POWER COMPANY
XXXXXXX WIND FARM
XXXXXXX COUNTY, MINNESOTA

DWN:	DATE:	CHK:	DATE:
ENG:	DATE:	CHK:	DATE:
PM:	DATE:	PROJ. NO:	
APVD:	DATE:	SCALE: NONE	

ENERGY SUPPLY
ENGINEERING & CONSTRUCTION

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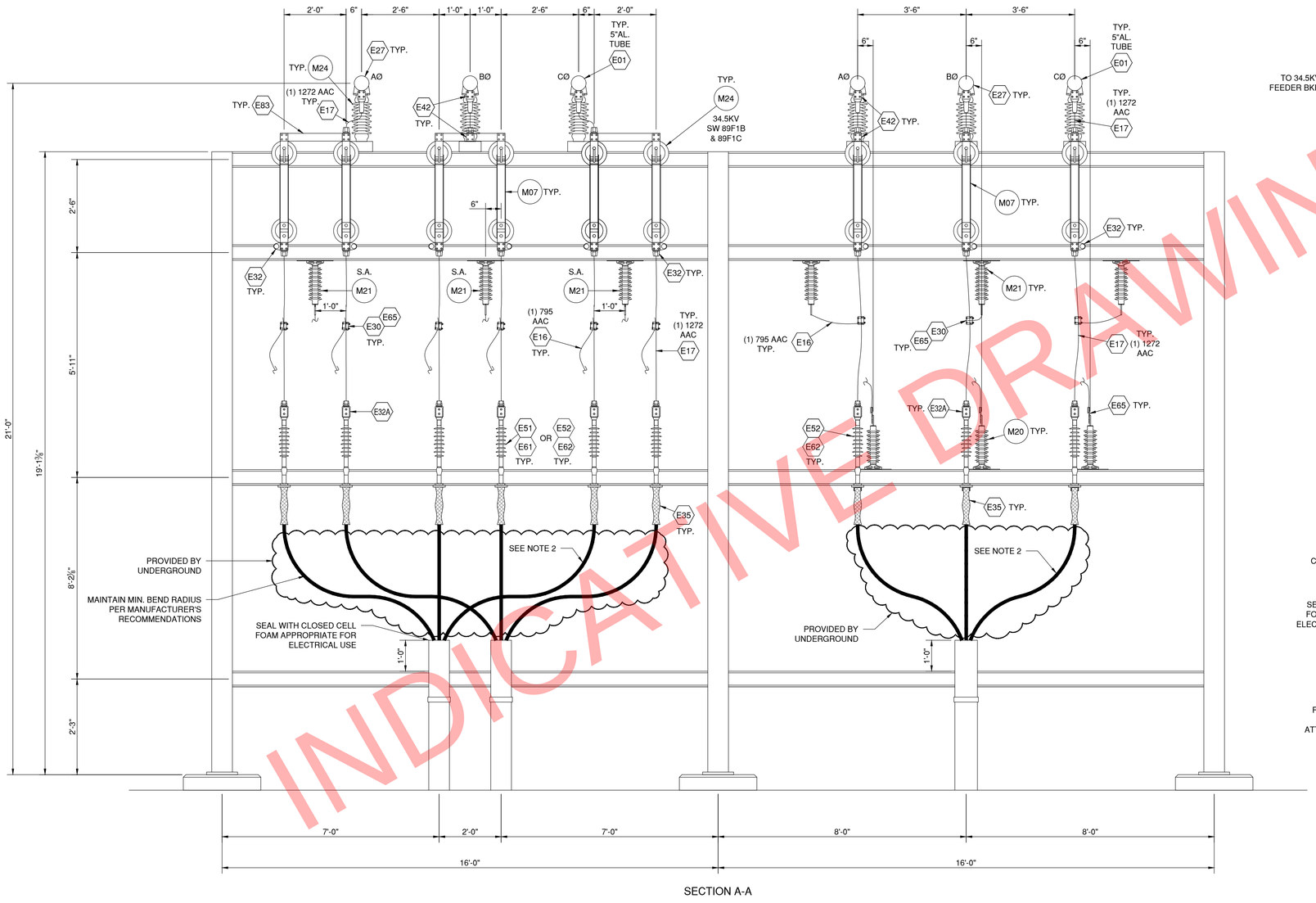
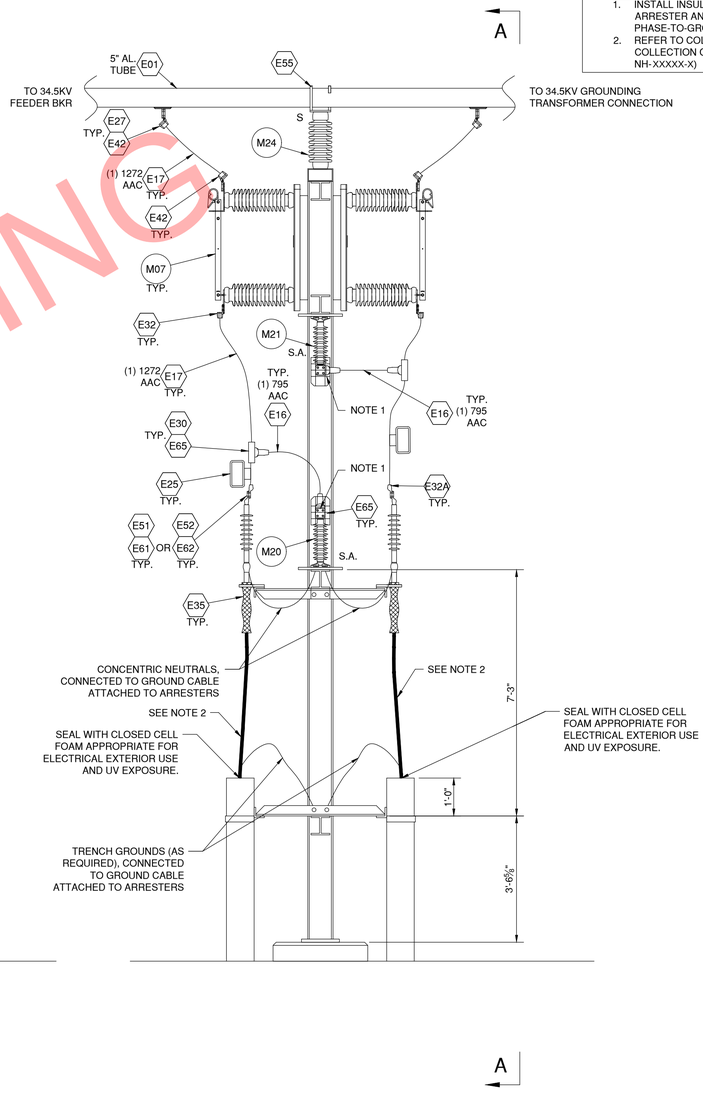
UNIT 0
COLLECTOR SUBSTATION PHYSICAL ELECTRICAL DETAILS

NH-XXXXX-X

REV



SECTION A-A



DETAIL D26

FEEDER RISER

LEGEND:

F	FIXED FITTING
S	SLIP FITTING
E	EXPANSION FITTING
N.S.	NEAR SIDE
F.S.	FAR SIDE
M#	MAJOR MATERIAL SEE NH-XXXXX-X
E#	MINOR MATERIAL SEE NH-XXXXX-X
D#	DETAIL, SEE DWG. NH-XXXXX-X THRU XXXXX-X

NOTE:

1. INSTALL INSULATION SO THAT THE TOP OF THE ARRESTER AND LEAD PROVIDE A PHASE-TO-GROUND SPACING OF 18".
2. REFER TO COLLECTION ONE LINES FOR COLLECTION CABLE SIZING (NH-XXXXX-X AND NH-XXXXX-X)

NO	REVISION	ZONE	DATE	BY	CHK	ENG
	REV. A - ISSUED FOR REVIEW: 8-9-21					

REFERENCE DRAWINGS		
DWG NO.	MANUFACTURER	DESCRIPTION

Xcel Energy®

NORTHERN STATES POWER COMPANY

XXXXXXX WIND FARM

XXXXXXX COUNTY, MINNESOTA

DWN:	DATE:	CHK:	DATE:
ENG:	DATE:	CHK:	DATE:
PM:	DATE:	PROJ. NO:	
APVD:	DATE:	SCALE: NONE	

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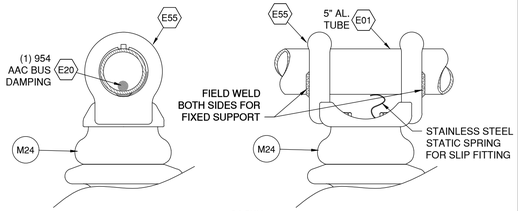
ENERGY SUPPLY
ENGINEERING & CONSTRUCTION

UNIT 0

COLLECTOR SUBSTATION PHYSICAL ELECTRICAL DETAILS

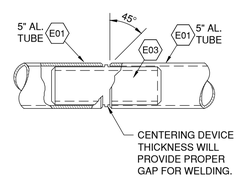
NH-XXXXX-X

REV

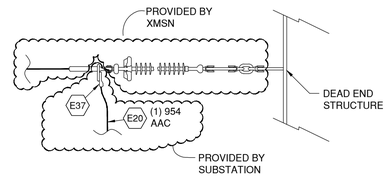


NOTES:
1. SEE GENERAL ARRANGEMENT & SECTIONS FOR FIXED OR SLIPPED SUPPORT TYPE.

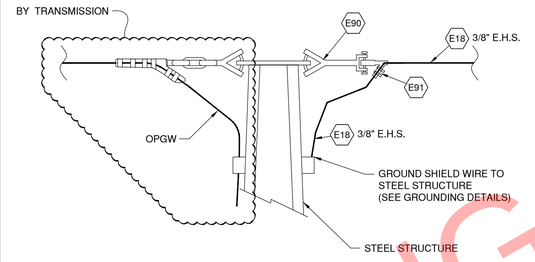
DETAIL D1
FIXED/SLIP BUS SUPPORT



DETAIL D2
BUS COUPLER

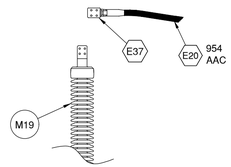


DETAIL D3
TRANSMISSION LINE TERMINATION

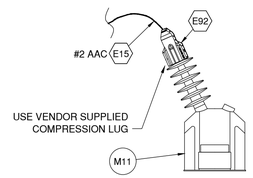


DETAIL D4
SHIELD WIRE TERMINATION

NOTE:
TO PREVENT TORQUE ON SURGE ARRESTER DO NOT APPLY TENSION TO JUMPER.

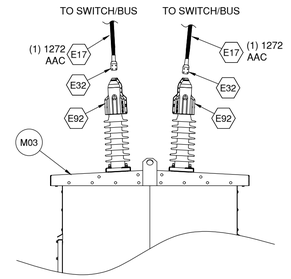


DETAIL D5
161KV UPRIGHT SURGE ARRESTER



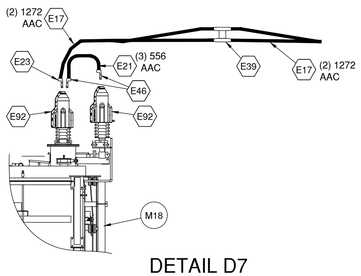
DETAIL D6
34.5KV VOLTAGE XFMR

NOTES:
1. INSTALL BUSHING COVERS ON EACH OF THE BREAKER BUSHINGS. NEVER COVER MORE THAN THE FIRST BUSHING SKIRT.
2. INSTALL 18" OF CABLE INSULATION FROM THE BUSHING COVER UP THE CABLE.

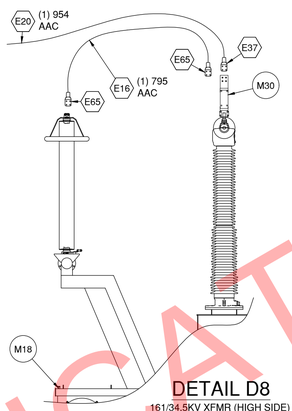


DETAIL D11
34.5KV FEEDER/VAR BREAKER

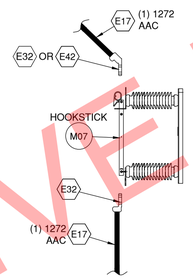
NOTES:
1. INSTALL BUSHING COVER TO ALLOW FOR OIL INDICATORS TO BE VIEWED FROM THE GROUND.
2. INSTALL INSULATION FROM THE BUSHING COVER TO PROVIDE 18" PHASE-TO-GROUND SPACING.



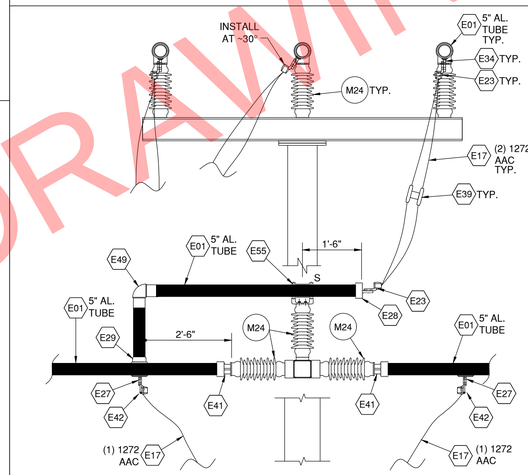
DETAIL D7
161/34.5KV XFMR (LOW SIDE)



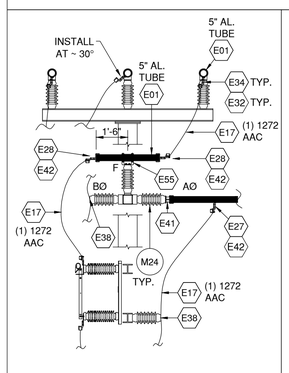
DETAIL D8
161/34.5KV XFMR (HIGH SIDE)



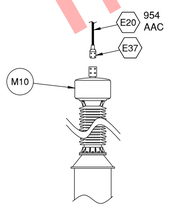
DETAIL D9
34.5KV SWITCH



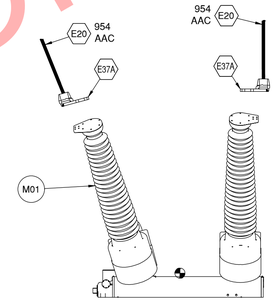
DETAIL D10
FEEDER BREAKER TO XFMR



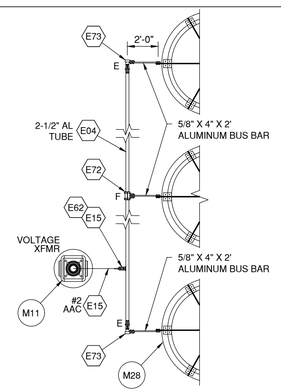
DETAIL D12
FEEDER BREAKER



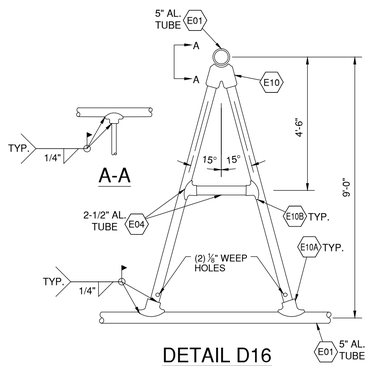
DETAIL D13
161KV CCVT



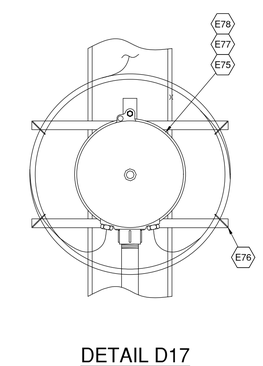
DETAIL D14
161KV POWER CIRCUIT BREAKER



DETAIL D15
REACTOR NEUTRAL BUS



DETAIL D16
161KV A-FRAME BUS SUPPORT



DETAIL D17
OPGW SPLICE BOX

LEGEND:

F	FIXED FITTING
S	SLIP FITTING
E	EXPANSION FITTING
N.S.	NEAR SIDE
F.S.	FAR SIDE
M#	MAJOR MATERIAL SEE NH-XXXXX-X
E#	MINOR MATERIAL SEE NH-XXXXX-X
D#	DETAIL, SEE DWG. NH-XXXXX-X THRU XXXXX-X

NO	REVISION	ZONE	DATE	BY	CHK	ENG
	REV. A - ISSUED FOR REVIEW: 8-9-21					

NO	REVISION	ZONE	DATE	BY	CHK	ENG

REFERENCE DRAWINGS

DWG NO.	MANUFACTURER	DESCRIPTION

Xcel Energy®
NORTHERN STATES POWER COMPANY
XXXXXXX WIND FARM
XXXXXXX COUNTY, MINNESOTA

DWN:	DATE:	CHK:	DATE:
ENG:	DATE:	CHK:	DATE:
PM:	DATE:	PROJ. NO:	
APVD:	DATE:	SCALE: NONE	

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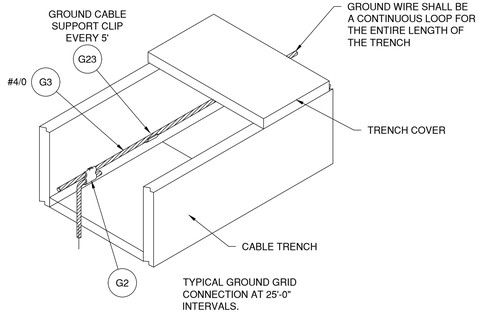
ENERGY SUPPLY
ENGINEERING & CONSTRUCTION

UNIT 0
COLLECTOR SUBSTATION PHYSICAL ELECTRICAL DETAILS

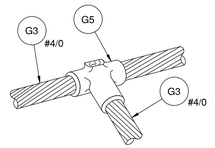
NH-XXXXX-X

REV



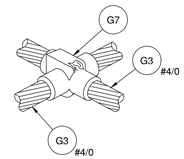
CABLE TRENCH CONNECTION

DETAIL N.T.S. GD1



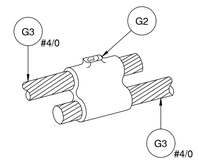
#4/0 RUN TO #4/0 TAP TEE CONNECTION

DETAIL N.T.S. GD2



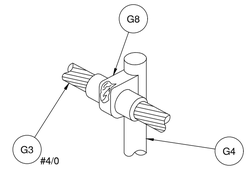
#4/0 RUN TO #4/0 TAP CROSS CONNECTION

DETAIL N.T.S. GD3



#4/0 TO #4/0 SPLICE CONNECTION

DETAIL N.T.S. GD4



CABLE TO GROUND ROD CONNECTION

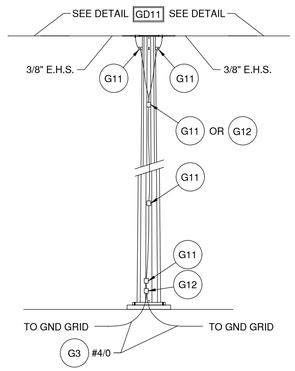
DETAIL N.T.S. GD5

LEGEND

(XX) GROUNDING MATERIAL, SEE NH-XXXXX-X

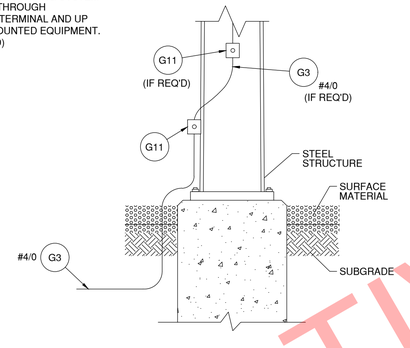
NOTES:

1. REFERENCE GROUNDING PLAN DRAWING NH-XXXXX-X FOR LOCATIONS OF GROUNDED EQUIPMENT.
2. REFERENCE GENERAL ARRANGEMENT DRAWING NH-XXXXX-X FOR FURTHER EQUIPMENT DETAILS.
3. REFERENCE SECTION VIEW DRAWINGS NH-XXXXX-X THRU X FOR FURTHER EQUIPMENT DETAILS.



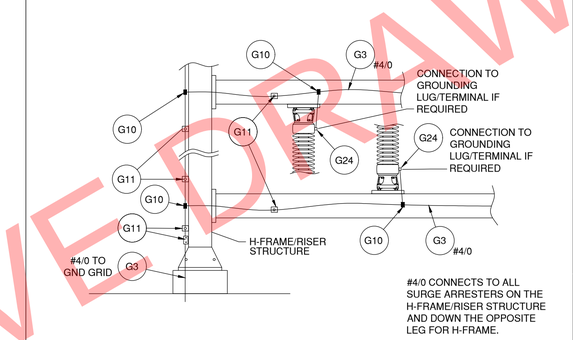
LIGHTNING MAST/H-FRAME

DETAIL N.T.S. GD6



FLAT STEEL

DETAIL N.T.S. GD7

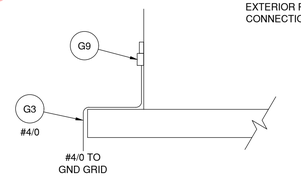


#4/0 CONNECTS TO ALL SURGE ARRESTERS ON THE H-FRAME/RISER STRUCTURE AND DOWN THE OPPOSITE LEG FOR H-FRAME.

SURGE ARRESTER

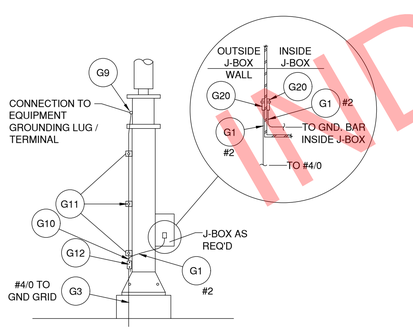
DETAIL N.T.S. GD8

FIELD TO REMOVE COLD STORAGE EXTERIOR PAINT WHERE GROUND CONNECTIONS ARE BEING MADE.



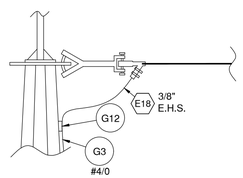
ELECTRICAL EQUIPMENT ENCLOSURE AND COLD STORAGE ENCLOSURE

DETAIL N.T.S. GD9



INSTRUMENT TRANSFORMER

DETAIL N.T.S. GD10

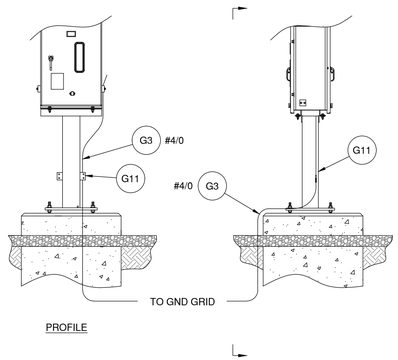


SHIELD WIRE

DETAIL N.T.S. GD11

(NOT USED)

DETAIL N.T.S. GD12



34.5KV CAP/REACTOR SWITCHER

DETAIL N.T.S. GD13

NO	REVISION	ZONE	DATE	BY	CHK	ENG
	REV. A - ISSUED FOR REVIEW: 8-9-21					

NO	REVISION	ZONE	DATE	BY	CHK	ENG

REFERENCE DRAWINGS		
DWG NO.	MANUFACTURER	DESCRIPTION

Xcel Energy®

NORTHERN STATES POWER COMPANY

XXXXXXX WIND FARM

XXXXXXX COUNTY, MINNESOTA

DWN: BRR	DATE: 12-22-20	CHK:	DATE:
ENG: RCS	DATE: 12-22-20	CHK:	DATE:
PM: BMD	DATE: 12-22-20	PROJ. NO: 22586	
APVD: BKC	DATE: 12-22-20	SCALE: NONE	

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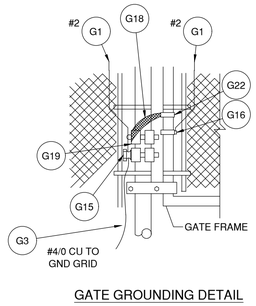
ENERGY SUPPLY
ENGINEERING & CONSTRUCTION

UNIT 0

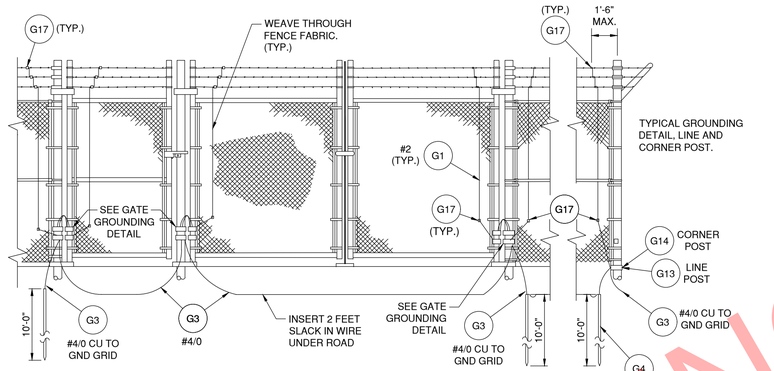
COLLECTOR SUBSTATION PHYSICAL GROUNDING DETAILS

NH-XXXXX-X

REV

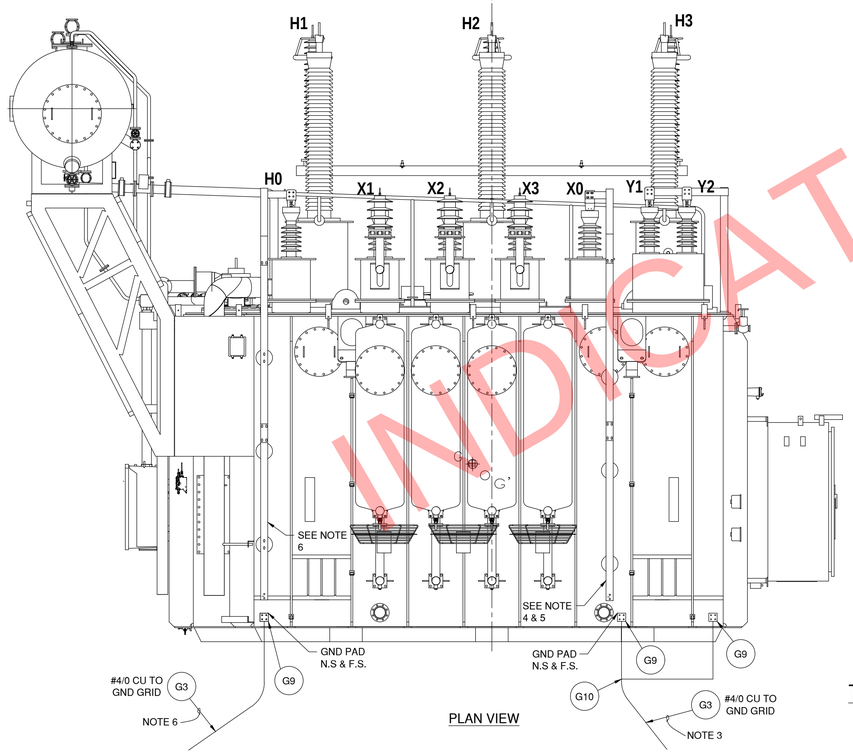


GATE GROUNDING DETAIL



FENCE POST, PEDESTRIAN GATE, AND DOUBLE-SWING GATE

DETAIL GD14
N.T.S.



PLAN VIEW

TRANSFORMER

DETAIL GD15
N.T.S.

TOP VIEW

NOTES:

1. CONTRACTOR TO SECURELY FASTEN GROUND CABLE TO TRANSFORMER USING APPROPRIATE MECHANICAL HARDWARE.
2. ARRESTER GROUNDING CONNECTIONS PROVIDED BY THE TRANSFORMER MANUFACTURER.
3. ARRESTER GROUNDING CONNECTION TO ATTACH TO GRID BY TRAVERSING THROUGH CAST IN CONCRETE CONDUITS.
4. REMOVE X0 TO GROUND CONNECTION SINCE NGR IS INCLUDED IN DESIGN.
5. FIELD TO REMOVE GROUND CONNECTION TO X0 BUSHING ONCE NGR IS INSTALLED AND CONNECTED TO GROUND GRID.
6. CONNECT H0 BUSHING TO GROUND.

LEGEND

- (XX) GROUNDING MATERIAL, SEE NH-XXXXX-X
- [GDX] DETAIL CALLOUT, SEE NH-XXXXX-X THRU X

NOTES:

1. REFERENCE GROUNDING PLAN DRAWING NH-XXXXX-X FOR LOCATIONS OF GROUNDED EQUIPMENT.
2. REFERENCE GENERAL ARRANGEMENT DRAWING NH-XXXXX-X FOR FURTHER EQUIPMENT DETAILS.
3. REFERENCE SECTION VIEW DRAWINGS NH-XXXXX-X THRU X FOR FURTHER EQUIPMENT DETAILS.

NO	REVISION	ZONE	DATE	BY	CHK	ENG
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DWG NO.	MANUFACTURER	DESCRIPTION

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NORTHERN STATES POWER COMPANY
XXXXXXX WIND FARM
XXXXXXX COUNTY, MINNESOTA

DWN:	DATE:	CHK:	DATE:
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PM:	DATE:	PROJ. NO:	
APVD:	DATE:	SCALE: NONE	

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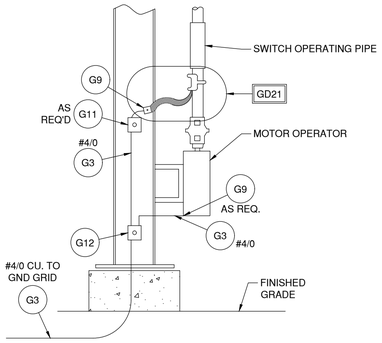
ENERGY SUPPLY
ENGINEERING & CONSTRUCTION

UNIT 0
COLLECTOR SUBSTATION PHYSICAL GROUNDING DETAILS

NH-XXXXX-X

REV

MOTOR OPERATED DISCONNECT SWITCH

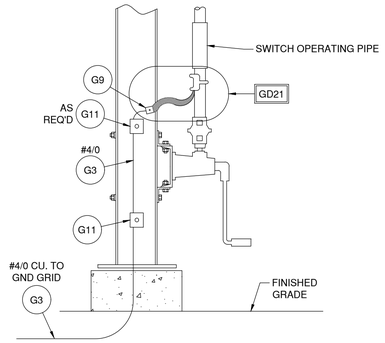


DETAIL N.T.S. GD16

MANUAL OPERATED DISCONNECT SWITCH

NOTES:

1. OPERATOR TYPE HANDLE IS TYPICAL, ACTUAL MAY VARY.

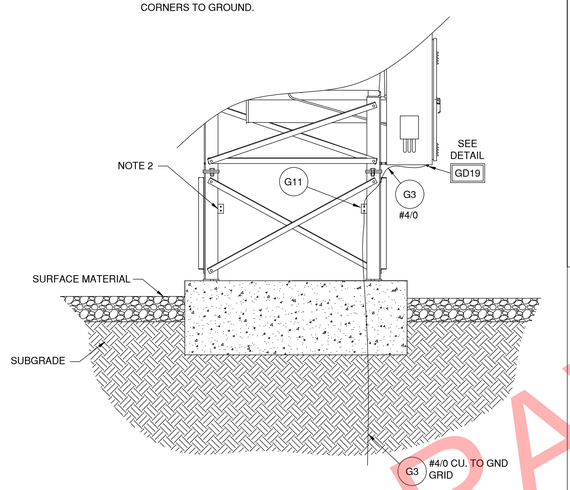


DETAIL N.T.S. GD17

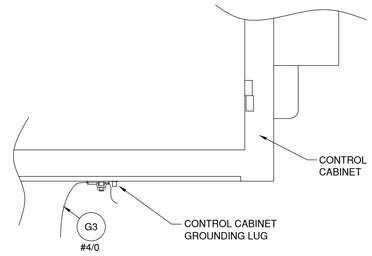
POWER CIRCUIT BREAKER

NOTES:

1. GROUND EACH POLE, IF SEPARATE STANDS.
2. CONNECT 2 LEGS OF THE BREAKER STAND IN OPPOSITE CORNERS TO GROUND.



DETAIL N.T.S. GD18



CONTROL CABINET

DETAIL N.T.S. GD19

(NOT USED)

DETAIL N.T.S. GD20

LEGEND

XX — GROUNDING MATERIAL, SEE NH-XXXXX-X

GDX — DETAIL CALLOUT, SEE NH-XXXXX-X THRU X

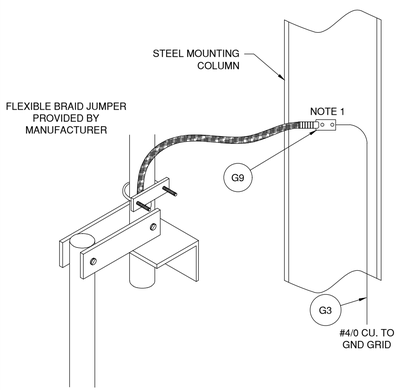
NOTES:

1. REFERENCE GROUNDING PLAN DRAWING NH-XXXXX-X FOR LOCATIONS OF GROUNDED EQUIPMENT.
2. REFERENCE GENERAL ARRANGEMENT DRAWING NH-XXXXX-X FOR FURTHER EQUIPMENT DETAILS.
3. REFERENCE SECTION VIEW DRAWINGS NH-XXXXX-X THRU X FOR FURTHER EQUIPMENT DETAILS.

DISCONNECT SWITCH HANDLE

NOTES:

1. FIELD TO DRILL MOUNTING HOLES IN STEEL AND MOUNT THE FLEXIBLE BRAID AND G9 CONNECTION BACK TO BACK.

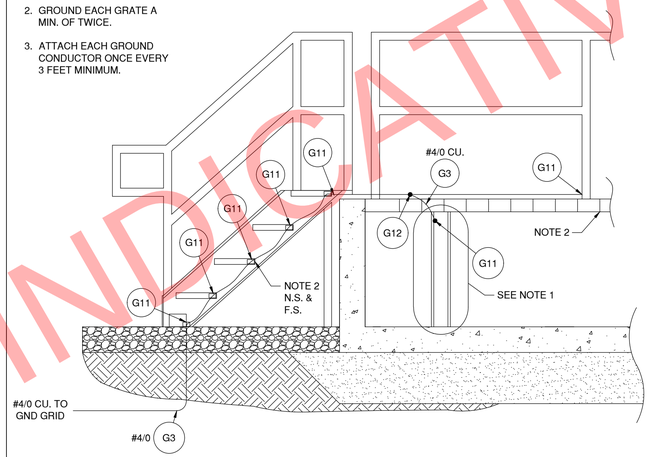


DETAIL N.T.S. GD21

OIL CONTAINMENT STAIRS

NOTES:

1. GROUND EACH LEG.
2. GROUND EACH GRATE A MIN. OF TWICE.
3. ATTACH EACH GROUND CONDUCTOR ONCE EVERY 3 FEET MINIMUM.

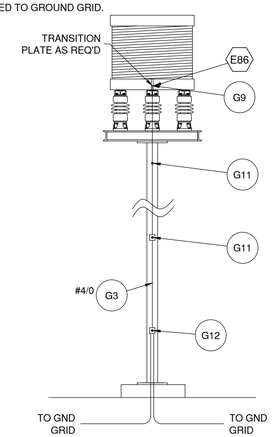


DETAIL N.T.S. GD22

NEUTRAL GROUNDING REACTOR CONNECTION

NOTE:

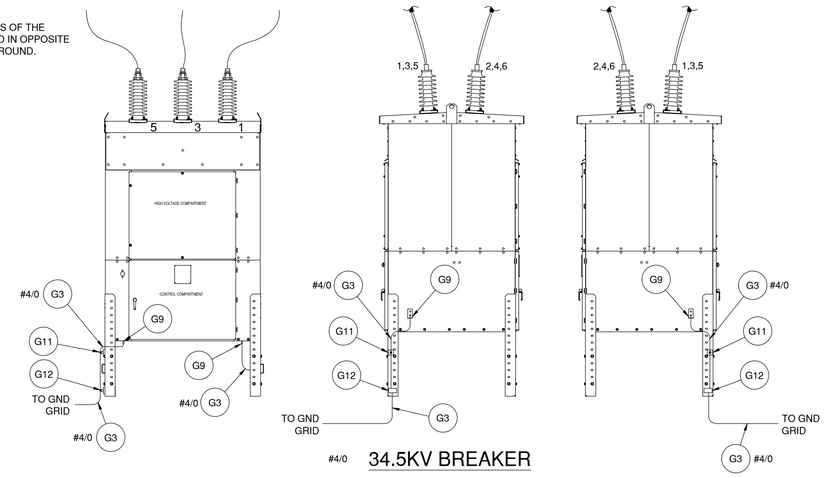
1. FIELD TO REMOVE GROUND CONNECTION TO XO BUSHING ONCE NGR IS INSTALLED AND CONNECTED TO GROUND GRID.



DETAIL N.T.S. GD23

NOTE:

1. CONNECT 2 LEGS OF THE BREAKER STAND IN OPPOSITE CORNERS TO GROUND.



34.5KV BREAKER

DETAIL N.T.S. GD24

NO	REVISION	ZONE	DATE	BY	CHK	ENG
	REV. A - ISSUED FOR REVIEW: 8-9-21					

NO	REVISION	ZONE	DATE	BY	CHK	ENG

REFERENCE DRAWINGS

DWG NO.	MANUFACTURER	DESCRIPTION

Xcel Energy®

NORTHERN STATES POWER COMPANY

XXXXXXX WIND FARM

XXXXXXX COUNTY, MINNESOTA

DWN:	DATE:	CHK:	DATE:
ENG:	DATE:	CHK:	DATE:
PM:	DATE:	PROJ. NO:	
APVD:	DATE:	SCALE: NONE	

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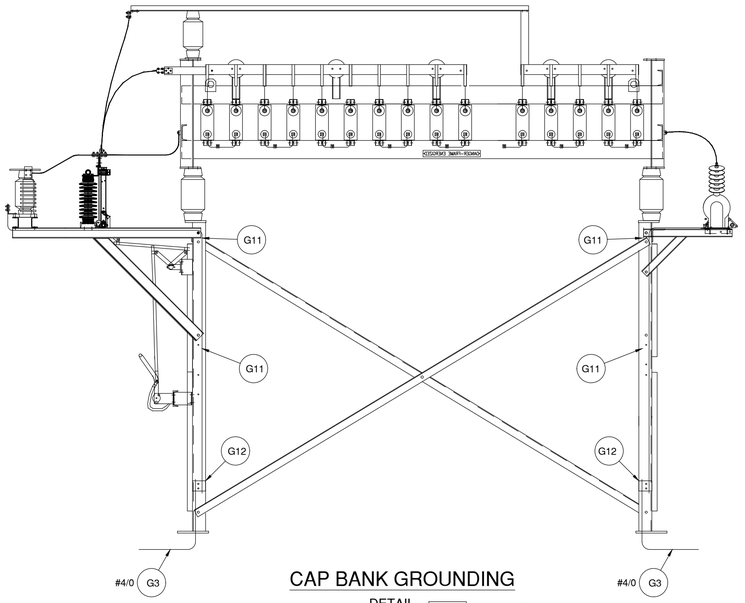
ENERGY SUPPLY
ENGINEERING & CONSTRUCTION

UNIT 0

COLLECTOR SUBSTATION PHYSICAL GROUNDING DETAILS

NH-XXXXX-X

REV

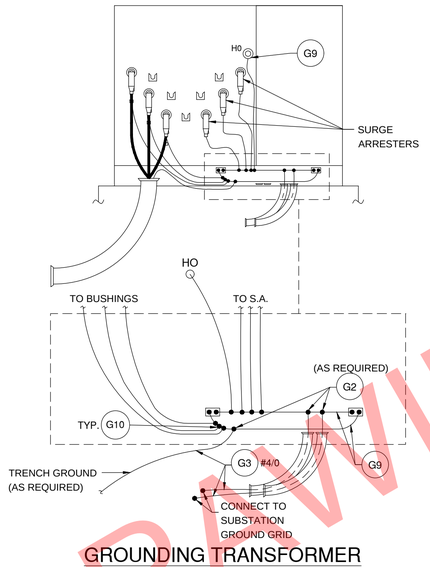


CAP BANK GROUNDING

DETAIL GD25 N.T.S.

#4/0 CU. TO GND GRID

NOTE:
CONNECT 2 LEGS OF THE STAND IN OPPOSITE CORNERS TO GROUND.



GROUNDING TRANSFORMER

DETAIL GD28 N.T.S.

NOTES:
1. CONCENTRIC GROUNDS CONNECTED TO SURGE ARRESTER GROUND CABLE.
2. BARE COPPER TRENCH GROUND CONNECTED TO VERTICAL GROUND CABLE TRAVERSING UP STEEL COLUMN.

LEGEND

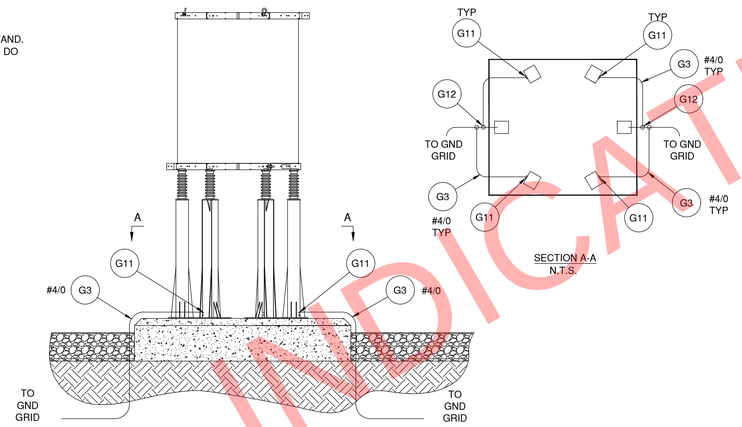
XX — GROUNDING MATERIAL, SEE NH-XXXXX-X

GDX — DETAIL CALLOUT, SEE NH-XXXXX-X THRU X

NOTES:

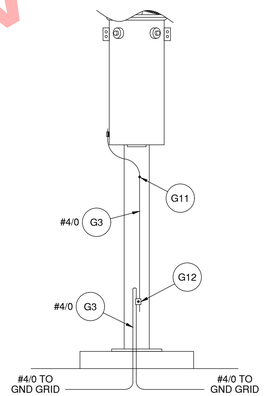
1. REFERENCE GROUNDING PLAN DRAWING NH-XXXXX-X FOR LOCATIONS OF GROUNDED EQUIPMENT.
2. REFERENCE GENERAL ARRANGEMENT DRAWING NH-XXXXX-X FOR FURTHER EQUIPMENT DETAILS.
3. REFERENCE SECTION VIEW DRAWINGS NH-XXXXX-X THRU X FOR FURTHER EQUIPMENT DETAILS.
4. 35KV CAP BANK SINGLE POINT CONNECTION NOT SHOWN FOR CLARITY. REFERENCE GROUNDING PLAN NH-XXXXX-X FOR LOCATION OF SECOND SINGLE POINT CONNECTION ON CAP BANK.

NOTE:
GROUND CONNECTIONS TO BE MADE TO EACH LEG OR THE STAND. STANDS TO BE FIELD DRILLED. DO NOT CONNECT ALL 6 LEGS IN A LOOP.



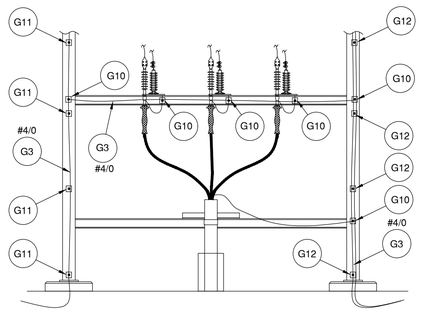
SHUNT REACTOR CONNECTION

DETAIL GD26 N.T.S.



STATION SERVICE XFMR (TYP.)

DETAIL GD29 N.T.S.



FEEDER CABLE & GROUND DETAIL

DETAIL GD31 N.T.S.

NO	REVISION	ZONE	DATE	BY	CHK	ENG
	REV. A - ISSUED FOR REVIEW: 8-9-21					

NO	REVISION	ZONE	DATE	BY	CHK	ENG

REFERENCE DRAWINGS

DWG NO.	MANUFACTURER	DESCRIPTION

Xcel Energy®

NORTHERN STATES POWER COMPANY

XXXXXXX WIND FARM

XXXXXXX COUNTY, MINNESOTA

DWN:	DATE:	CHK:	DATE:
ENG:	DATE:	CHK:	DATE:
PM:	DATE:	PROJ. NO:	
APVD:	DATE:	SCALE: NONE	

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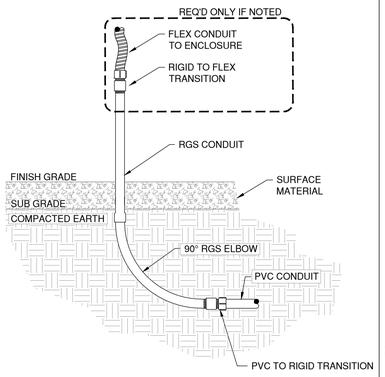
ENERGY SUPPLY
ENGINEERING & CONSTRUCTION

UNIT 0

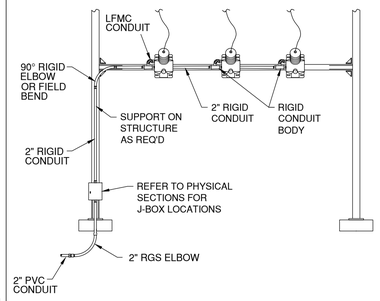
COLLECTOR SUBSTATION PHYSICAL GROUNDING DETAILS

NH-XXXXX-X

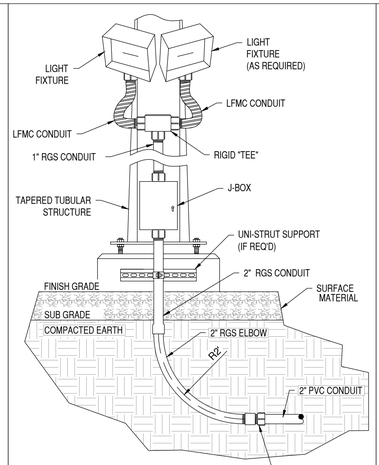
REV



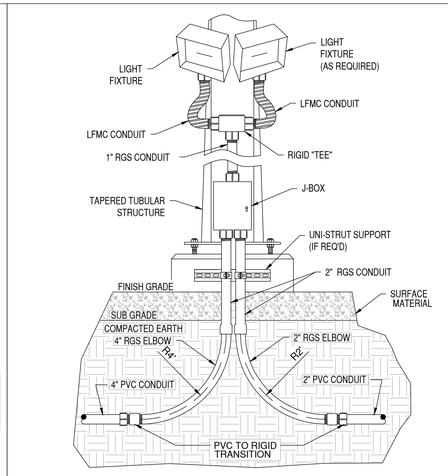
DETAIL CC1
TYPICAL CONDUIT RISER



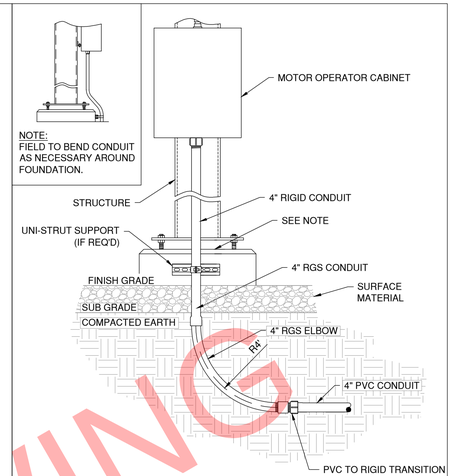
DETAIL CC2
34.5KV PT'S
THREE PHASE



DETAIL CC3
SUBSTATION LIGHTING



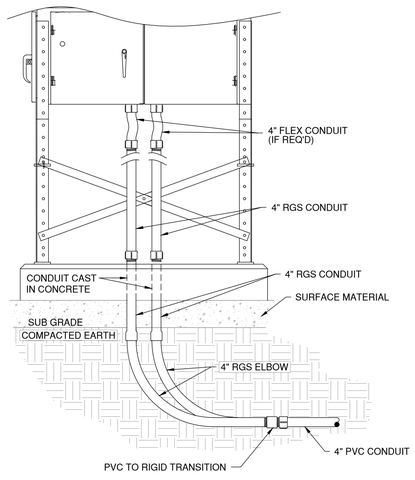
DETAIL CC3A
SUBSTATION LIGHTING



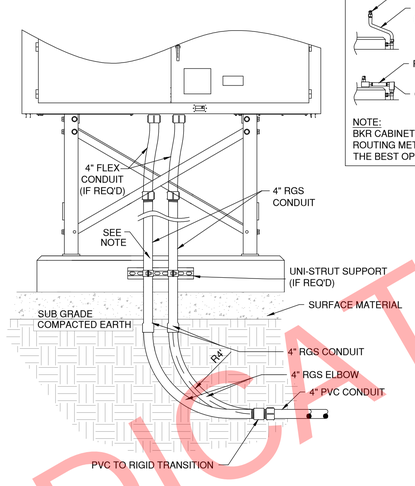
DETAIL CC4
SWITCH MOTOR OPERATOR

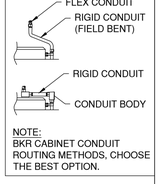
NOTES:

1. MYERS HUB TO BE USED FOR ALL CONDUITS ENTERING CABINETS.
2. FOR CONDUIT PLAN, SEE DRAWING NH- XXXXX-X. FOR ELECTRICAL SECTIONS, SEE DRAWINGS NH- XXXXX-X THRU X.



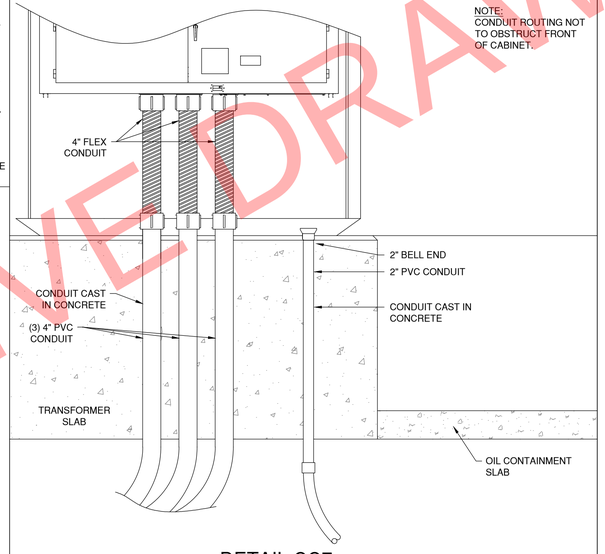
DETAIL CC5
34.5KV BREAKER





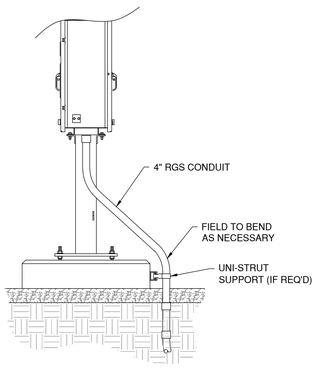
NOTE:
BKR CABINET CONDUIT ROUTING METHODS, CHOOSE THE BEST OPTION.

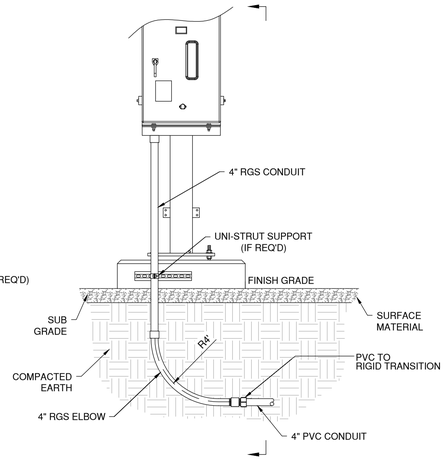
DETAIL CC6
161KV BREAKER



NOTE:
CONDUIT ROUTING NOT TO OBSTRUCT FRONT OF CABINET.

DETAIL CC7
TRANSFORMER





DETAIL CC8
CAPACITOR/REACTOR SWITCHER

NO	REVISION	ZONE	DATE	BY	CHK	ENG
0	ISSUED FOR CONSTRUCTION		04-10-20	RCS	BKC	BKC
1	ISSUED FOR RECORD		12-22-20	RCS	BKC	BKC
	REV. A - ISSUED FOR REVIEW: 8-9-21					

NO	REVISION	ZONE	DATE	BY	CHK	ENG

REFERENCE DRAWINGS		
DWG NO.	MANUFACTURER	DESCRIPTION

Xcel Energy®
NORTHERN STATES POWER COMPANY
XXXXXXX WIND FARM
XXXXXXX COUNTY, MINNESOTA

DWN:	DATE:	CHK:	DATE:
ENG:	DATE:	CHK:	DATE:
PM:	DATE:	PROJ. NO:	
APVD:	DATE:	SCALE: NONE	

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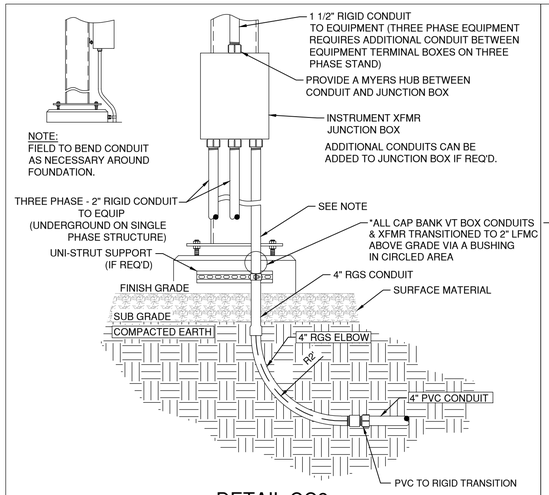
ENERGY SUPPLY
ENGINEERING & CONSTRUCTION

UNIT 0
COLLECTOR SUBSTATION PHYSICAL CONDUIT DETAILS

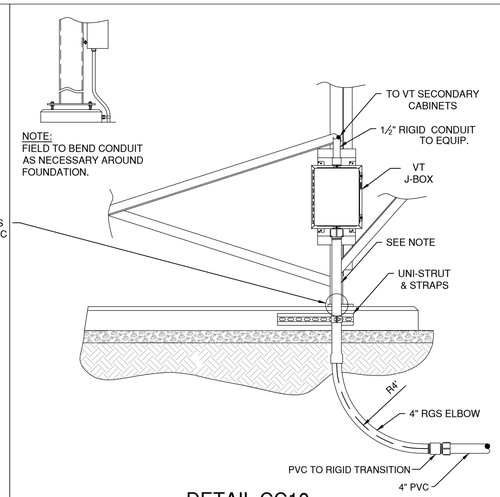
NH-XXXXX-X

REV



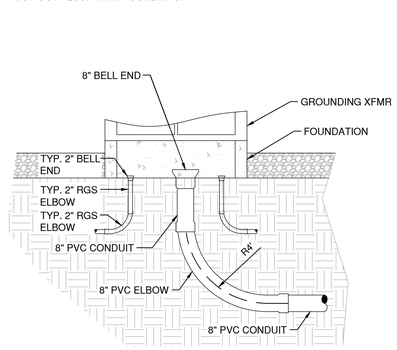
DETAIL CC9

INSTRUMENT TRANSFORMER - SINGLE AND THREE PHASE



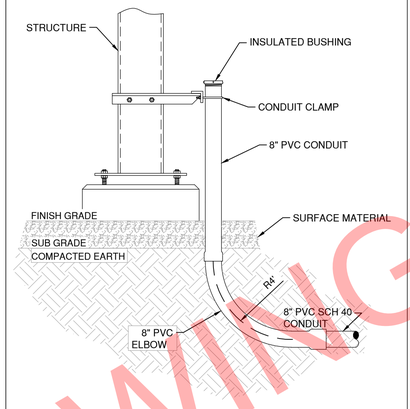
DETAIL CC10

34.5KV CAP BANK VT J-BOX



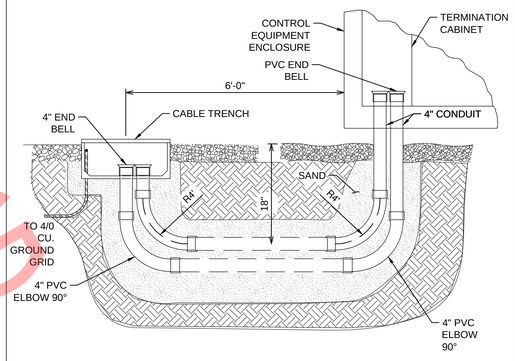
DETAIL CC11

GROUNDING XFMR



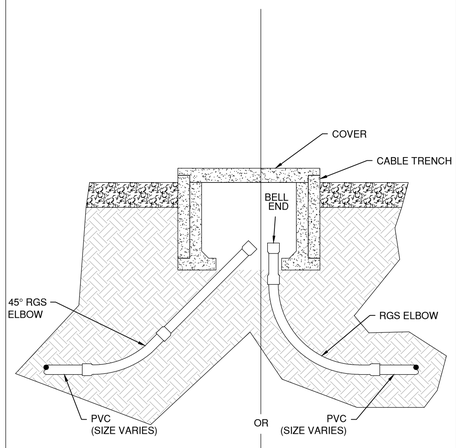
DETAIL CC12

GROUNDING XFMR CONDUIT RISER



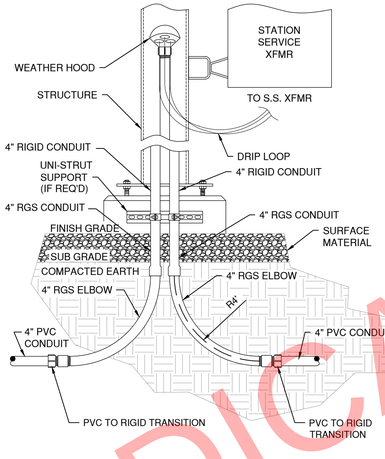
DETAIL CC13

EQUIPMENT ENCLOSURE



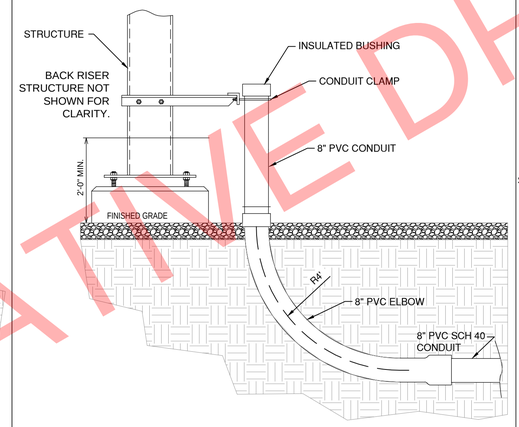
DETAIL CC14

CABLE TRENCH EXIT/ENTRANCE



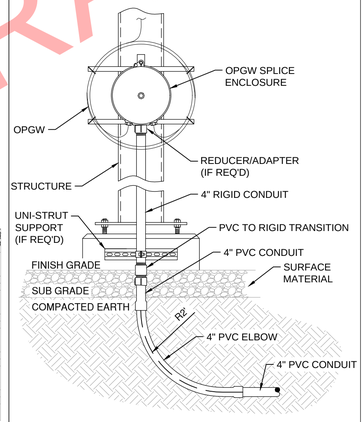
DETAIL CC15

STATION SERVICE XFMR



DETAIL CC16

FEEDER CONDUIT RISER



DETAIL CC17

OPGW SPLICE BOX

NOTES:

1. MYERS HUB TO BE USED FOR ALL CONDUITS ENTERING CABINETS.
2. FOR CONDUIT PLAN, SEE DRAWING NH-XXXXX-X. FOR ELECTRICAL ELEVATIONS, SEE DRAWINGS NH-XXXXX-X THRU X.
3. EQUIPMENT ENCLOSURE TRANSITION BOX SHALL BE WEATHER AND ANIMAL PROOF.

NO	REVISION	ZONE	DATE	BY	CHK	ENG
	REV. A - ISSUED FOR REVIEW: 8-9-21					

NO	REVISION	ZONE	DATE	BY	CHK	ENG

REFERENCE DRAWINGS

DWG NO.	MANUFACTURER	DESCRIPTION

Xcel Energy®

NORTHERN STATES POWER COMPANY

XXXXXXX WIND FARM

XXXXXXX COUNTY, MINNESOTA

DWN:	DATE:	CHK:	DATE:
ENG:	DATE:	CHK:	DATE:
PM:	DATE:	PROJ. NO:	
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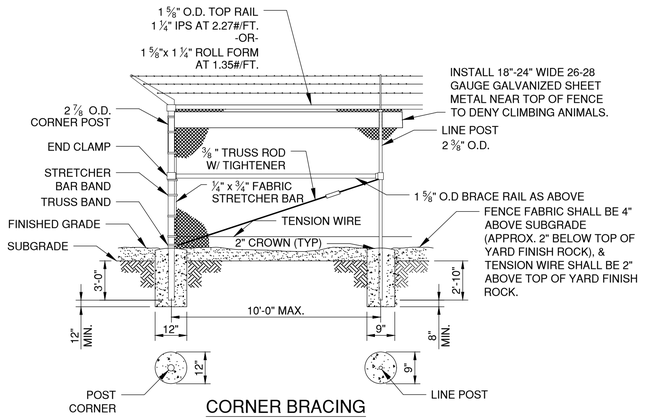
ENERGY SUPPLY
ENGINEERING & CONSTRUCTION

UNIT 0

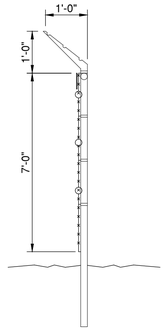
COLLECTOR SUBSTATION PHYSICAL CONDUIT DETAILS

NH-XXXXX-X

REV

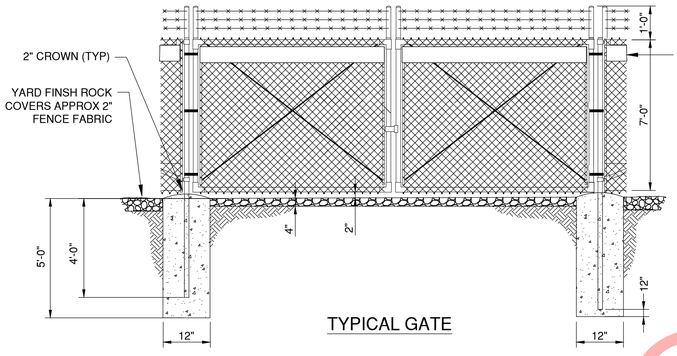


CORNER BRACING



LINE POST

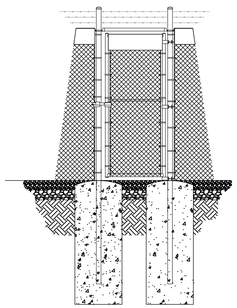
TABLE A FENCE POSTS FOR 8ft FENCE		
USE	TYPE	MINIMUM SIZE
LINE POSTS	ROUND	2 ⅜" OD; t = .154in.
END, CORNER, PULL POSTS	ROUND	2 ⅞" OD; t = .203in.
GATE POSTS	ROUND	4" OD; t = .226 in.



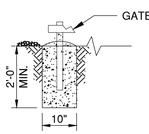
TYPICAL GATE

SECURITY SIGNS

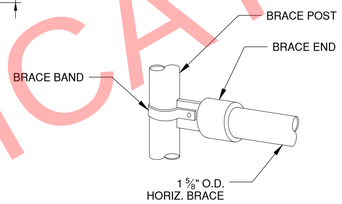
SEE CONSTRUCTION SPECIFICATION FOR COMPLETE LIST OF SECURITY SIGNS.



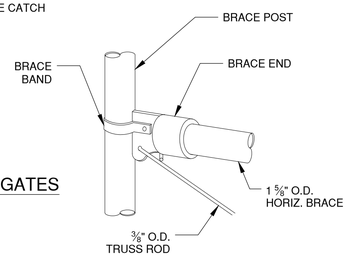
WALK GATE



ROADWAY AND PERSONNEL GATES



BRACE ATTACHMENT



BRACE AND TRUSS ATTACHMENT

FENCE MATERIALS AND ERECTION MATERIAL

1. FABRIC

THE FENCE SHALL BE A MINIMUM OF 7 FT. HIGH. IT SHALL CONSIST OF A MINIMUM NO. 9 USWG STEEL WIRE, WOVEN INTO A 2 IN. DIAMOND MESH. THE MINIMUM BREAKING STRENGTH OF WIRE SHALL BE 1200 LBS. THE SIDES OF THE MESH PATTERN SHALL BE APPROXIMATELY 45° TO A VERTICAL LINE.

THE FABRIC SHALL BE GALVANIZED IN ACCORDANCE WITH ASTM A392, CLASS II.

2. LINE, END, CORNER, PULL AND GATE POSTS

ALL POST SHALL BE STEEL AND CONFORM TO THE SIZES AS LISTED IN TABLE A, (BELOW), FOR THE SPECIFIC TYPE OF APPLICATION. STRENGTH AND PROTECTIVE COATINGS OF ALL FENCE FRAMEWORK SHALL CONFORM TO ASTM F1043.

TUBULAR MATERIAL SHOULD CONFORM TO ASTM A53 GRADE B, FOR ROUND SHAPES AND ASTM A500 GRADE B OR ASTM A501 FOR SQUARE SHAPES. ROLL-FORMED SECTIONS SHALL MEET THE YIELD STRESS REQUIREMENTS OF ASTM A36 AS A MINIMUM.

LINE POSTS SHALL BE OF SUFFICIENT HEIGHT TO; (A) ACCOMMODATE A 7 FT FABRIC; (B) ACCOMMODATE EXTENSION ARMS, AND (C) BE EMBEDDED 34 IN INTO THE CONCRETE FOOTING.

END, CORNER AND PULL POST SHALL BE OF SUFFICIENT HEIGHT TO (A) ACCOMMODATE A 7 FT FABRIC; (B) ACCOMMODATE EXTENSION ARMS OR EXTEND 1 FT EXTRA, AND (C) BE EMBEDDED 36 IN INTO THE CONCRETE FOOTING.

GATE POSTS SHALL BE OF SUFFICIENT HEIGHT TO; (A) ACCOMMODATE A 7 FT FABRIC; (B) ACCOMMODATE EXTENSION ARMS, AND (C) BE EMBEDDED 48 IN INTO THE CONCRETE FOOTING.

ALL TUBULAR POSTS SHALL BE GALVANIZED IN ACCORDANCE WITH ASTM A53. ROLL FORMED SECTIONS SHALL BE GALVANIZED IN ACCORDANCE WITH ASTM A123.

3. TOP RAIL

TOP RAILS SHALL BE ROUND STEEL PIPE OR TUBING. THE MINIMUM SIZE SHALL NOT BE LESS THAN 1 ⅝" OD NOR HAVE A MINIMUM WALL THICKNESS LESS THAN .138 IN. COUPLINGS SHALL BE THE OUTSIDE SLEEVE TYPE, SPACED ABOUT 20 FT APART AND AT LEAST 6 IN LONG, WITH PROVISIONS FOR EXPANSION AND CONTRACTION. THE TOP RAIL SHALL PASS THROUGH THE BASE OF THE EXTENSION ARM AND BE SECURELY FASTENED TO THE END, GATE AND PULL POSTS.

TOP RAILS SHALL BE GALVANIZED IN ACCORDANCE WITH ASTM A53.

4. BARBED WIRE

BARBED WIRE SHALL CONSIST OF TWO STRANDS OF 12 ½" USWG STEEL WIRE WITH 4-POINT BARBS AT A MAXIMUM SPACING OF 5 IN APART. THE WIRE SHALL BE GALVANIZED AFTER WEAVING IN ACCORDANCE WITH ASTM A121, CLASS 3, OR ALUMINUM COATED PER ASTM A-585, CLASS 2.

THREE LINES OF BARBED WIRE SHALL BE PROVIDED.

5. EXTENSION ARMS

THE EXTENSION ARMS SHALL EXTEND UPWARD AND OUTWARD FROM THE FENCE AT AN ANGLE OF 45°. THERE SHALL BE PROVISIONS FOR THREE EQUALLY SPACED LINES OF BARBED WIRE ON THE EXTENDED ARMS. THE UPPERMOST WIRE SHALL BE APPROXIMATELY 1 FT VERTICALLY ABOVE THE FABRIC AND 1 FT HORIZONTALLY OUTSIDE THE FENCE LINE.

THE EXTENSION ARM SHALL BE MADE OF PRESSED STEEL OR MALLEABLE IRON AND SHOULD BE DESIGNED FOR A 300 LBS MINIMUM PULL DOWN LOAD BEING APPLIED AT ARMS TIP.

THE EXTENSION ARM SHALL BE GALVANIZED IN ACCORDANCE WITH ASTM A153, CLASS B1.

6. STRETCHER BAR

STRETCHER BARS SHALL BE GALVANIZED STEEL BARS NOT LESS THAN ¼"x ¾". THEY SHALL BE APPROXIMATELY 1 IN LESS THAN THE FABRIC HEIGHT.

THE STRETCHER BAR SHALL BE USED FOR SECURING THE FABRIC TO ALL TERMINAL POSTS. ONE BAR IS REQUIRED FOR EACH GATE AND END POST. TWO ARE REQUIRED FOR EACH CORNER AND PULL POST.

7. POST BRACES

POST BRACES ARE REQUIRED AT EACH GATE, CORNER, PULL AND END POST. IT SHALL CONSIST OF A STRUT, WHICH SHALL NOT BE LESS IN SIZE THAN THE TOP RAIL, AND A TRUSS ROD WITH TURNBUCKLE. THE ROD SHALL BE STEEL AND HAVE A MINIMUM DIAMETER OF ⅜".

THE TRUSS SHALL BE SECURED NEAR THE BASE OF THE CORNER GATE, PULL OR END POST. THE SECOND END SHALL BE SECURED AT APPROXIMATELY MID-HEIGHT ON THE ADJACENT LINE POST.

BRACING MEMBERS SHALL ALL BE HOT-DIP GALVANIZED PER ASTM 153.

8. TENSION WIRE

TENSION WIRE SHALL BE NO. 6 GAUGE COIL SPRING STEEL WIRE. ONE TENSION WIRE SHALL BE LOCATED AT THE BOTTOM OF THE FABRIC AND ATTACHED WITH HOG RINGS TO THE FABRIC ON 24" CENTERS.

9. GATE FRAMES

GATE FRAMES SHALL BE CONSTRUCTED OF TUBULAR STEEL MEMBERS WHICH SHALL BE WELDED AT THE JOINTS. ADDITIONAL HORIZONTAL AND VERTICAL STRUTS MAY BE REQUIRED TO PROVIDE FOR A RIGID GATE PANEL ALLOWING FOR NO VISIBLE SAG OR TWIST. GATE FRAMES SHALL BE MADE TO HAVE APPROXIMATELY 3" CLEARANCE ABOVE THE ROAD.

FABRIC FOR THE GATE PANELS SHALL BE THE SAME AS THE FENCE.

GATE FRAME AND BRACING MEMBERS SHALL NOT BE LESS THAN THE STRUCTURAL EQUIVALENT OF 2 ⅜" OD STANDARD PIPE. STEEL TENSION RODS AND TURNBUCKLES MAY ALSO BE UTILIZED. GATE FRAME SHALL HAVE PROVISIONS FOR THREE LINES OF BARBED WIRE ABOVE FABRIC. ALL GATE FRAME MATERIAL SHALL BE HOT-DIP GALVANIZED PER ASTM A-120.

10. HARDWARE

HINGES SHALL BE HEAVY DUTY AND ALLOW 180° SWING OF ALL GATE LEAVES. THE HINGES SHALL NOT TWIST OR TURN UNDER THE ACTION OF THE GATE AND SHALL PROVIDE EASE OF OPERATION.

LATCHES, STOPS AND KEEPERS SHALL ALL BE HEAVY DUTY CONSTRUCTION OF GALVANIZED STEEL OR MALLEABLE IRON AND SHALL CONFORM TO ASTM A-48 SPECS FOR GRAY IRON CASTING, ASTM 1-47 SPECS FOR MALLEABLE IRON CASTING AND 2SAE-1025 SPECS FOR ROLLED PRESSED AND FOR STEEL. FORK LATCHES SHALL HAVE A HEAVY DUTY DROP BAR. THE CENTER STOP SHALL BE A SPRING OPERATED LATCHING TYPE MADE TO BE CAST IN CONCRETE AND ENGAGE THE DROP BAR. A KEEPER SHALL BE PROVIDED WHICH WILL SECURE THE FREE END OF THE GATE IN THE OPEN POSITION.

HARDWARE SHALL ALLOW FOR GATE OPERATION FROM EITHER SIDE WITH PROVISIONS FOR SECURING WITH PADLOCK.

ALUMINUM TIES AND BANDS SHALL BE OF ALUMINUM WIRE PER ASTM B-211, OR ALUMINUM STRIP PER ASTM B-209. STEEL TIES AND BANDS SHALL BE OF STEEL WIRE WITH 0.8 OZ. OF ZINC COATING PER SQUARE FT OF SURFACE, NO. 6 GAUGE WIRE FOR FASTENING FABRIC TO LINE POST, NO. 9 GAUGE WIRE FOR FASTENING TO TOP RAIL, ⅛" x 1" FOR BANDS, AND ¼" x ¾" STEEL FOR STRETCHER BARS. THE SPACING SHALL BE EVERY 24" ON THE TOP RAIL FOR THE TIES AND EVERY 14" ON THE POSTS FOR THE BAND.

11. ERECTION

THE FABRIC SHALL BE PLACED ON THE OUTSIDE OF THE POSTS, STRETCHED TAUT AND SECURED TO THE POSTS, TOP RAIL AND TENSION WIRE. THE FABRIC SHALL BE SECURED TO THE LINE POSTS WITH WIRE TIES OR METAL BANDS AT MAXIMUM INTERVALS OF 14". THE TOP AND BOTTOM EDGES SHALL BE SECURED, RESPECTIVELY, TO THE TOP RAIL AND TENSION WIRE WITH TIE WIRES NOT EXCEEDING INTERVALS OF 24". THE FABRIC SHALL BE SECURED TO TERMINAL POSTS BY MEANS OF THE STRETCHER BAR WHICH IS PASSED THROUGH THE END LOOPS OF FABRIC AND IS SECURED TO THE TERMINAL POSTS BY METAL BANDS SPACED AT A MAXIMUM INTERVAL OF 14".

FABRIC FOR FENCING SHALL ALL BE EITHER A LEFT-HAND OR RIGHT-HAND WEAVE. ROLLS OF FABRIC SHALL BE JOINED TOGETHER BY WEAVING A SINGLE STRAND INTO THE END OF THE ROLL TO FORM A CONTINUOUS PIECE.

THE SPACING OF LINE POSTS (10' MAX) SHALL IN GENERAL BE MEASURED PARALLEL TO THE GROUND. ALL POSTS SHALL BE PLACED IN A VERTICAL POSITION EXCEPT AS MAY BE SPECIFICALLY DESIGNATED OTHERWISE, WITH THE STRONG AXIS PARALLEL TO THE FABRIC. ALL POSTS SHALL BE SET IN HOLES AND BACKFILLED WITH CONCRETE. CONCRETE SHALL HAVE A MAXIMUM COMPRESSIVE STRENGTH OF 2500 PSI AT 28 DAYS WITH A MAXIMUM SIZE OF AGGREGATE OF ¾". THE CONCRETE SHALL BE WELL WORKED (RODDED) IN THE HOLE. THE TOP OF THE FOOTING SHALL BE CROWNED TO SHED WATER.

THE MINIMUM DIAMETER OF HOLES FOR LINE POSTS SHALL BE 9" AND 12" FOR TERMINAL POSTS.

THE MINIMUM DEPTH OF THE FOOTING HOLES SHALL BE 42".

NO	REVISION	ZONE	DATE	BY	CHK	ENG
	REV. A - ISSUED FOR REVIEW: 8-9-21					

NO	REVISION	ZONE	DATE	BY	CHK	ENG

REFERENCE DRAWINGS		
DWG NO.	MANUFACTURER	DESCRIPTION

Xcel Energy®
NORTHERN STATES POWER COMPANY
XXXXXXX WIND FARM
XXXXXXX COUNTY, MINNESOTA

DWN:	DATE:	CHK:	DATE:
ENG:	DATE:	CHK:	DATE:
PM:	DATE:	PROJ. NO:	
APVD:	DATE:	SCALE: NONE	

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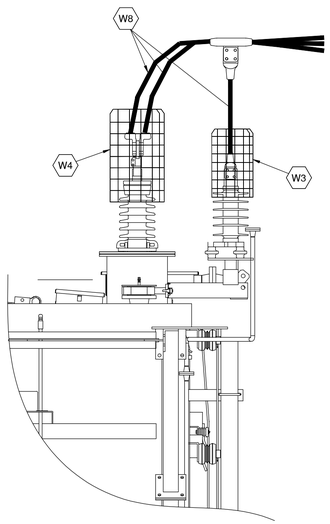
ENERGY SUPPLY
ENGINEERING & CONSTRUCTION

UNIT 0
COLLECTOR SUBSTATION PHYSICAL
161KV-34.5KV
FENCE DETAILS

NH-XXXXX-X

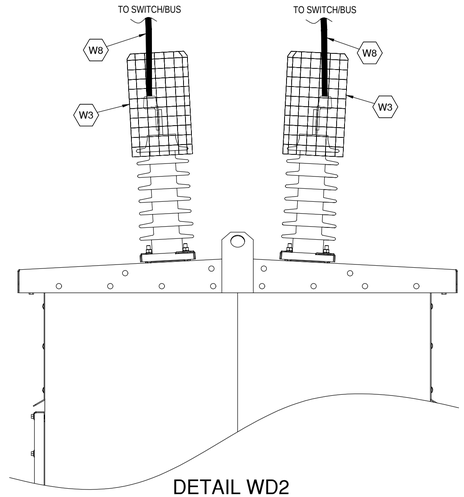
REV

NOTE:
EXTEND CABLE INSULATION 3'
FROM XFMR BUSHING.



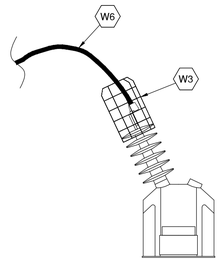
DETAIL WD1
XFMR (LOW SIDE)

NOTES:
1. INSTALL BUSHING COVERS ON EACH OF THE BREAKER BUSHINGS.
2. INSTALL 18" OF CABLE INSULATION FROM THE BUSHING COVER UP THE CABLE.
3. FOR INSULATING THE BARREL OF THE TERMINAL LUG, USE ONE SIZE LARGER THAN THE SIZE RECOMMENDED FOR CONDUCTOR SIZE.



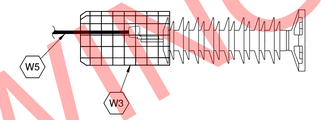
DETAIL WD2
34.5KV BREAKER

NOTES:
1. THE ENERGIZED TERMINALS AND LEADS SHOULD BE INSULATED FROM THE BUSHING COVER UP THE CABLE AT LEAST 18 INCHES.
2. FOR INSULATING THE BARREL OF THE TERMINAL LUG, USE ONE SIZE LARGER THAN THE SIZE RECOMMENDED FOR CONDUCTOR SIZE.



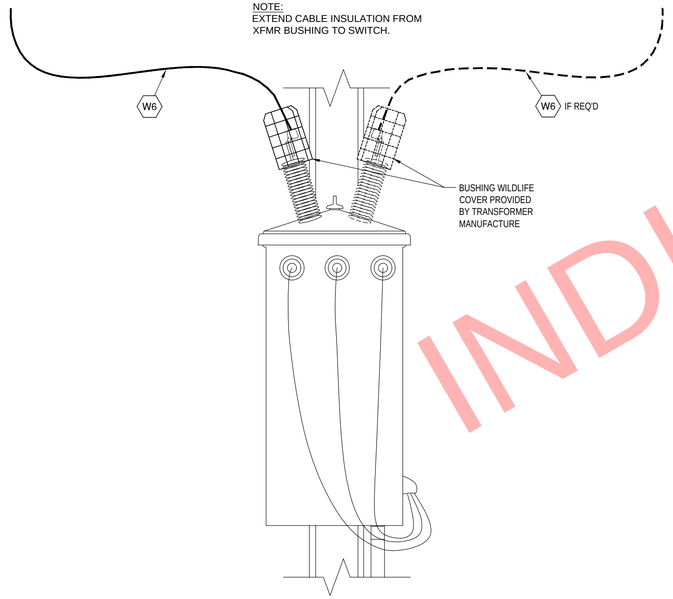
DETAIL WD3
34.5KV VOLTAGE XFMR

NOTES:
1. THE ENERGIZED TERMINALS AND LEADS SHOULD BE INSULATED FROM THE BUSHING COVER UP THE CABLE AT LEAST 18 INCHES.
2. FOR INSULATING THE BARREL OF THE TERMINAL LUG, USE ONE SIZE LARGER THAN THE SIZE RECOMMENDED FOR CONDUCTOR SIZE.



DETAIL WD4
34.5KV SURGE ARRESTER

NOTE:
EXTEND CABLE INSULATION FROM
XFMR BUSHING TO SWITCH.



DETAIL WD5
STATION SERVICE TRANSFORMER

LEGEND:

W# - MINOR MATERIALS, THIS SHEET

NOTES:
1. NEVER COVER MORE THAN THE FIRST BUSHING SKIRT.
2. ACCEPTABLE TO MAKE FIELD MODIFICATION TO BUSHING COVERS TO BETTER ALIGN WITH DESIGN.
3. USE OF FUSING TAPE AND PLASTIC CONNECTORS ACCEPTABLE FOR MODIFYING BUSHING COVERS.

WILDLIFE MITIGATION

Item #	QUANTITY	DESCRIPTION	MANUFACTURER	CATALOG #	SUPPLIER
W1	NOT REQ'D	BUSHING WILDLIFE COVER, MESH TYPE, 4.8" DIA X 9" HIGH, SMALL	THERM-A-GUARD*	TGB-50007	CONTRACTOR
W2	NOT REQ'D	BUSHING WILDLIFE COVER, MESH TYPE, 6.7" DIA X 10.6" HIGH, MEDIUM	THERM-A-GUARD*	TGB-65010	CONTRACTOR
W3	100	BUSHING WILDLIFE COVER, MESH TYPE, 6.8"-8.4" DIA X 14" HIGH, LARGE (4 SPARES)	THERM-A-GUARD*	TGB-82512	CONTRACTOR
W4	8	BUSHING WILDLIFE COVER, MESH TYPE, 8.9"-10.5" DIA X 19" HIGH, EXTRA LARGE	THERM-A-GUARD*	TGB-10517	CONTRACTOR
W5	100'	CONDUCTOR WILDLIFE COVER, SPLIT SILICONE RUBBER TUBING FOR 35KV CONDUCTORS 0.8063" - 1.00" DIA, GREY	MIDSUN GROUP*	E/INS-100-G	CONTRACTOR
W6	100'	CONDUCTOR WILDLIFE COVER, SPLIT SILICONE RUBBER TUBING FOR 35KV CONDUCTORS 0.25"-0.447" DIA, GREY	MIDSUN GROUP*	E/INS-50-G	CONTRACTOR
W7	NOT REQ'D	CONDUCTOR WILDLIFE COVER, SPLIT SILICONE RUBBER TUBING FOR 35KV CONDUCTORS 1.00"-1.196" DIA, GREY	MIDSUN GROUP*	E/INS-125-G	CONTRACTOR
W8	450'	CONDUCTOR WILDLIFE COVER, SPLIT SILICONE RUBBER TUBING FOR 35KV CONDUCTORS 1.25"-1.427" DIA, GREY	MIDSUN GROUP*	E/INS-150-G	CONTRACTOR
W9	NOT REQ'D	CONDUCTOR WILDLIFE COVER, SPLIT SILICONE RUBBER TUBING FOR 35KV CONDUCTORS 1.504"-1.735" DIA, GREY	MIDSUN GROUP*	E/INS-175-G	CONTRACTOR
W10	AS REQ'D	FUSING TAPE, 2.5" x 36" 30 MIL - GRAY	MIDSUN GROUP*	E/FTP-250G	CONTRACTOR

NO	REVISION	ZONE	DATE	BY	CHK	ENG
	REV. A - ISSUED FOR REVIEW: 8-9-21					

NO	REVISION	ZONE	DATE	BY	CHK	ENG

REFERENCE DRAWINGS

DWG NO.	MANUFACTURER	DESCRIPTION

Xcel Energy®
NORTHERN STATES POWER COMPANY
XXXXXXX WIND FARM
XXXXXXX COUNTY, MINNESOTA

DWN:	DATE:	CHK:	DATE:
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ENERGY SUPPLY
ENGINEERING & CONSTRUCTION

UNIT 0
COLLECTOR SUBSTATION PHYSICAL
34.5 KV WILDLIFE PROTECTION
DETAILS

NH-XXXXX-X

REV