

STANDARD DRAWINGS: PART 2

TRANSMISSION LINES ASSEMBLIES, STRUCTURE DETAILS, SIGNS, LANDS, AND GROUNDING



LIST OF DRAWINGS:

Conductor Insulator Assemblies:

- 1. 41 1020-1– Transmission Line Standards Suspension Insulator Assemblies Single String, Porcelain or Glass Types SI- and SIA1-
- 2. 41 1020-2– Transmission Line Standards Suspension Insulator Assemblies Single String, Composite Types SI- and SIA1-
- 3. 41 1021 Rev. D – Transmission Line Standards Suspension Insulator Assemblies Double String, Porcelain, Glass or Composite Types SIA2-
- 4. 41 1022 Rev. E – Transmission Line Standards Tension Insulator Assemblies Single String, Porcelain or Glass Types T11- and T12-
- 5. 41 1023-1 Rev. A – Transmission Line Standards Tension Insulator Assemblies Double String, Porcelain or Glass Types T21- and T22- A Through D (Sheet 1 of 4)
- 6. 41 1023-2 Rev. A – Transmission Line Standards Tension Insulator Assemblies Double String, Porcelain or Glass Types T21- and T22- E Through G (Sheet 2 of 4)
- 7. 41 1023-3 Rev. A – Transmission Line Standards Tension Insulator Assemblies Double String, Composite Types T21- and T22- A Through D (Sheet 3 of 4)
- 8. 41 1023-4 Rev. A – Transmission Line Standards Tension Insulator Assemblies Double String, Composite Types T21- and T22- E Through G (Sheet 4 of 4)
- 9. 41 1024 Rev. B – Transmission Line Standards Horizontal Post Insulator Assemblies
- 10. 41 1025 Rev. C – Transmission Line Standards Suspension Insulator Assemblies Vee String, Single String
- 11. 41 1033 Rev. E – Transmission Line Standards Station Post Jumper Insulator Assemblies

Overhead Ground Wire Assemblies:

- 12. 41 1017 Rev. C – Transmission Line Standards Steel Towers Overhead Ground Wire Assembly
- 13. 41 1018 Rev. C – Transmission Line Standards Steel and Concrete Pole Structures Overhead Ground Wire Assembly
- 14. 41 1019 Rev. D – Transmission Line Standards Wood Pole Structures Overhead Ground Wire Assembly

Fiber Optic & Optical Ground Wire:

- 15. 41 1027 Rev. F – Transmission Line Standards Lattice Steel Structures Fiber Optic Cable Mounting
- 16. 41 1028 Rev. F – Transmission Line Standards Steel and Concrete Pole Structures Fiber Optic Cable Mounting
- 17. 41 1029 Rev. I – Transmission Line Standards Wood Pole Structures Fiber Optic Cable Mounting
- 18. 41 1030 Rev. F – Transmission Line Standards Fiber Optic Cable Mounting Downlead Clamps and Bands
- 19. 41 1031 Rev. G – Transmission Line Standards Optical Ground Wire Assemblies
- 20. 41 1035 – Transmission Line Standards Fiber Optic Cable Overhead to Underground Transition

- 21. 41 1036 Rev. A – Transmission Line Standards All Dielectric Self Supporting (ADSS) Fiber Optic Cable Assemblies

Structure Details:

- 22. 41 2001 Rev. D – Transmission Line Standards Tower Bolts
- 23. 41 2071 Rev. B –Transmission Line Standards Steel Pole Structures and Lattice Towers Fall Protection Anchorage Plates
- 24. 41 2701 Rev. D – Transmission Line Standards Steel Pole Structures Fall Protection Anchorage Plates
- 25. 43 2203 Rev. C – Transmission Line Structure Standards Steel Pole Structures Maintenance Provisions Work Ring
- 26. 43 2206 Rev. I – Transmission Line Structure Standards Steel Pole Structures Maintenance Provisions Outlines
- 27. 43 2207 Rev. H – Transmission Line Structure Standards Steel Pole Structures Maintenance Provisions Outlines
- 28. 43 2208 Rev. I – Transmission Line Structure Standards Steel Pole Structures Maintenance Provisions Outlines
- 29. 43 2209 Rev. H – Transmission Line Structure Standards Steel Pole Structures Maintenance Provisions Outlines
- 30. 43 2210 Rev. J – Transmission Line Structure Standards Steel Pole Structures Maintenance Provisions Details
- 31. 43 2213 Rev. A – Transmission Line Structure Standards Steel Pole Structures Anti Perch Provisions
- 32. 43 2214 Rev. B – Transmission Line Structure Standards Steel Pole Structures Maintenance Provisions – Outlines
- 33. 43 2218 – Transmission Line Structure Standards light Duty Steel Pole Structures Maintenance Provisions - Outlines
- 34. 43 2219 – Transmission Line Structure Standards light Duty Steel Pole Structures Maintenance Provisions - Outlines
- 35. 43 2220 – Transmission Line Structure Standards light Duty Steel Pole Structures Maintenance Provisions – Details
- 36. 41 9012 Rev. A – Standard Designs Transmission Lines Inspection and Treatment of Wood Pole Structures Plans-Elevations-Details
- 37. 41 9013 Rev. D – Standard Designs Transmission Lines Inspection and Treatment of Wood Poles-Details
- 38. 41 9014 Rev. A –Transmission Line Standard CMP-Type Casing for Setting Wood Poles
- 39. 41 9016 Rev. B – Transmission Line Standards Right of Way Encroachment Warning Sign Details and Location
- 40. 41 9017 Rev. A – Transmission Line Standards Pile-Type Foundations for Wood Poles
- 41. 41 9018 Rev. B – Standard Drawings Transmission Lines Pole Band Channel for Pile-Type Foundations
- 42. 41 9019 Rev. C – Transmission Line Standards Wood Pole Structures Bog Shoe and Bog Anchor

Signs:

- 43. 41 9004 Rev. E – Transmission Line Standards Wood Pole Structures Aerial Patrol Mile Marker and Number Signs

- 44. 41 9005 Rev. D – Transmission Line Standards Lattice Steel Towers Aerial Patrol Number and Warning Signs
- 45. 41 9006 Rev. C – Transmission Line Standards A-Type Tubular Steel Structure Location of Structure Signs
- 46. 41 9007 Rev. F – Transmission Line Standards Structure Number Signs Details and Location
- 47. 41 9008 Rev. F – Transmission Line Standards Lattice Towers Danger Signs Details and Locations
- 48. 41 9026 Rev. C – Transmission Line Standards Wood Pole Structures Aerial Patrol Warning Signs Details and Locations
- 49. 41 9027-1 Rev. A – Transmission Line Standards Steel Pole Structures Aerial Patrol Mile Marker and Number Signs (SH. 1 of 3)
- 50. 41 9027-2 Rev. C – Transmission Line Standards Steel Pole Structures Aerial Patrol Mile Marker and Number Signs (SH. 2 of 3)
- 51. 41 9027-3 Rev. B – Transmission Line Standards Steel Pole Structures Aerial Patrol Mile Marker and Number Signs (SH. 3 of 3)
- 52. 41 9028 Rev. E – Transmission Line Standards Steel Pole Structures Aerial Patrol Warning Signs Details and Locations
- 53. 41 9029 Rev. C – Transmission Line Standards Aerial Patrol Warning Signs and Marker Ball Marking Diagrams
- 54. 41 9030 – Transmission Line Standards Light Duty Steel Pole H-Frames Structure Signs Details and Locations

Lands and Earthwork:

- 55. 41 1026 Rev. A – Standard Designs Transmission Lines Right-of-Way Clearing Details
- 56. 41 2017 Rev. D – Transmission Line Standards Special Earthwork
- 57. 41 2020 Rev. A – Transmission Line Erosion Control Typical Section Tower Foundation
- 58. 41 2021 Rev. A – Transmission Line Erosion Control Typical Section Surface Erosion
- 59. 41 2022 Rev. A – Transmission Line Erosion Control Typical Section Surface Erosion & Roadway
- 60. 41 2023 Rev. A – Transmission Line Erosion Control Typical Section Roadway Ruts
- 61. 41 2024 Rev. A – Transmission Line Erosion Control Typical Section 2” to 4” Roadway Surfacing
- 62. 41 2025 Rev. A – Transmission Line Erosion Control Typical Section 6” to 12” Roadway Surfacing
- 63. 41 2026 Rev. A – Transmission Line Erosion Control Typical Section Earth Fill
- 64. 41 2027 Rev. A – Transmission Line Erosion Control Typical Section Rock Fill
- 65. 41 2028 Rev. A – Transmission Line Erosion Control Typical Section Road Structures
- 66. 41 2033 – Transmission Line Erosion Control Typical Roadway Cut and V-Shape Ditch Sections
- 67. 41 2035 Rev. A – Transmission Line Standards Access Roads General Requirement
- 68. 41 9002 Rev. N – Transmission Line Standards Barbed Wire Gate For Right-of-Way Fences
- 69. 41 9003 Rev. C – Transmission Line Standards Electric Barbed Wire Gate For Right-of-Way Fences

- 70. 41 9020 Rev. A – Transmission Line Standards Barbed Wire Gate for Off Right-of-Way Access Fences
- 71. 41 9021 Rev. A – Transmission Line Standards Access Road Rehabilitation Water Bar Construction
- 72. 41 9023 Rev. A – Standard Designs Transmission Lines Steel Access Gate
- 73. 41 9024 Rev. D – Transmission Line Standards Prefabricated Tubular Steel Gate

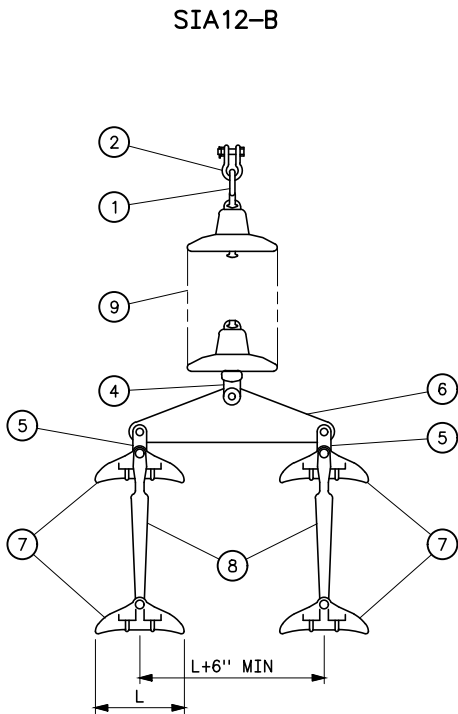
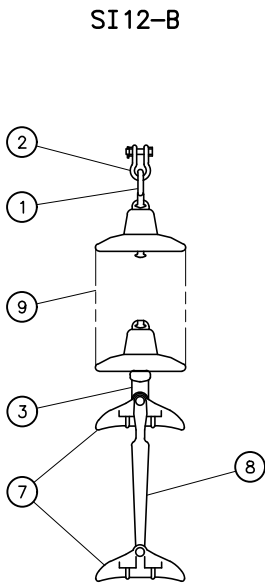
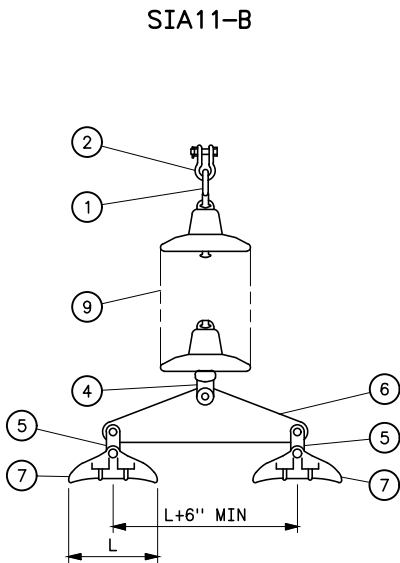
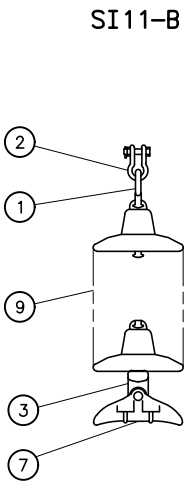
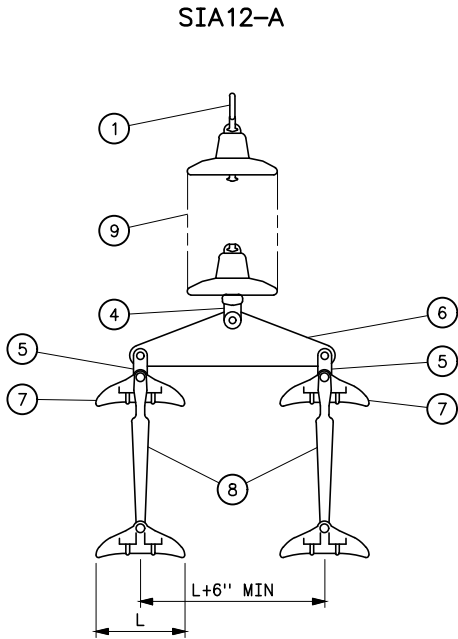
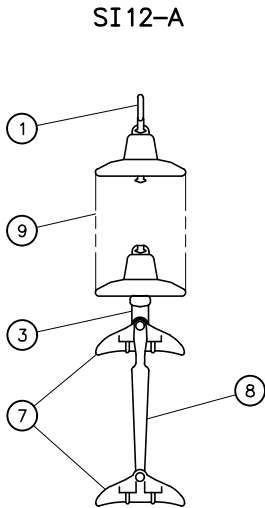
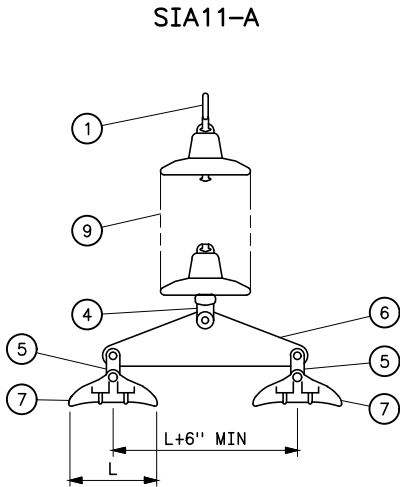
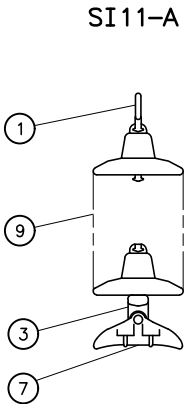
Grounding:

- 74. 41 1011 Rev. C – Transmission Line Standards Transmission Lines Fence Grounding Hardware
- 75. 41 1012 Rev. C – Transmission Line Standards Wood Pole Structures Grounding Details
- 76. 41 1013 Rev. B – Standard Designs Transmission Lines Tower Grounding Details
- 77. 41 1015 Rev. K – Transmission Line Standards Weathering Steel and Concrete Pole Structures Grounding Details
- 78. 41 1032 – Transmission Line Standards Wood Pole Structures Grounding Details
- 79. 41 1034 – Transmission Line Structure 115kV Tap Switch Structure Grounding Details
- 80. 41 2034 Rev. A – Transmission Line Standards Lattice Steel Towers Structure Grounding

Historical:

- 81. 41 1000 Rev. C FIO – Standard Design Transmission Lines Wood Pole Structures Suspension Assemblies (For Information Only)
- 82. 41 1001 Rev. D FIO – Standard Design Transmission Lines Insulator Assembly Details for Steel Towers (For Information Only)
- 83. 41 1002 Rev. C FIO – Standard Design Transmission Lines Wood Pole Structures Tension Insulator Assemblies (For Information Only)
- 84. 41 1003 Rev. B FIO – Transmission Line Standards Wood Pole Lines Insulator Hardware Details (For Information Only)
- 85. 41 1004 Rev. C FIO – Standard Design Transmission Lines Strain Yokes and Yoke Assemblies (For Information Only)
- 86. 41 1005 Rev. C FIO – Transmission Line Standards Steel Tower Lines Conductor and Overhead Ground Wire Hardware Details (For Information Only)
- 87. 41 1006 Rev. F FIO – Standard Design Transmission Lines Steel Tower Overhead & Ground Wire Attachment Detail (For Information Only)
- 88. 41 1007 Rev. C FIO – Transmission Line Standards Suspension, Tension, and Vee String Insulator Assemblies (For Information Only)
- 89. 41 1008 Rev. B FIO – Standard Designs Transmission Lines Cylindrical Hold Down Weight (For Information Only)
- 90. 41 1009 Rev. B FIO – Standard Designs Transmission Lines Suspension Insulator Hold Down Weight (For Information Only)

91. 41 1010 Rev. C FIO – Standard Design Transmission Lines Suspension Insulator Holddown Weight Shackle (For Information Only)
92. 41 1014 Rev. B FIO – Standard Designs Transmission Lines Details for Single String Insulator Assembly with Yoke (For Information Only)
93. 41 1016 Rev. B FIO – Standard Designs 69kV Transmission Lines Post Insulator Jumper Assembly (For Information Only)
94. 41 2000 Rev. C FIO – Standard Designs Transmission Lines Survey Layout for Footings (For Information Only)
95. 41 2018 Rev. A FIO – Standard Designs Transmission Lines Pole Structures-Climbing Facilities (For Information Only)
96. 41 2019 Rev. C FIO – Standard Designs Transmission Lines Footing Test Frame (For Information Only)
97. 41 9000 Rev. C FIO – Transmission Like Standards Prefabricated Steel Gates for Right-of-Way Fences (For Information Only)
98. 41 9001 Rev. B FIO – Transmission Line Standards Prefabricated Panel Gate for Right-of-Way Fences (For Information Only)
99. 41 9009 Rev. C FIO – Standard Designs Transmission Lines Location of Danger Signs on Steel Tower (For Information Only)
100. 41 9010 Rev. B FIO – Standard Designs Transmission Lines Wood-Pole Structures, Typical In-Line, Angle, & Dead End Structures (For Information Only)
101. 41 9011 Rev. A FIO – Standard Designs Transmission Lines Wood-Pole Structures Typical Branch Line Structures (For Information Only)
102. 41 9015 Rev. A FIO – Standard Design Transmission Lines Wood-Pole Structures, Typical Strain, Transposition, and Switch Structures (For Information Only)
103. 41 9025 FIO – Standard Designs Transmission Lines Prefabricated Wire-Filled Steel Gate (For Information Only)
104. 43 2211 Rev. B FIO – Light Duty Transmission Line Steel Pole Structures Climbing Provisions (For Information Only)
105. 43 2215 FIO – Transmission Line Structure Standards Steel Pole Structures Maintenance Provisions – Details (For Information Only)
106. 43 2216 Rev. A FIO – Transmission Line Structure Standards Steel Pole Structures Maintenance Provisions Permanent Fall Protection – Details (For Information Only)



SINGLE STRING, PORCELAIN OR GLASS
SUSPENSION INSULATOR ASSEMBLIES

ULTIMATE INSULATOR ASSEMBLY STRENGTH AS SPECIFIED

(NOTE 2)

MATERIALS LIST

ITEM NO.	DESCRIPTION
1	OVAL EYE BALL
2	ANCHOR SHACKLE, BNK
3	SOCKET EYE
4	SOCKET CLEVIS, BNK
5	CLEVIS EYE, BNK
6	YOKE PLATE
7	SUSPENSION CLAMP, BNK
8	VERTICAL BUNDLE YOKE, 18" SPACING
9	INSULATOR STRING, PORCELAIN OR GLASS UNITS

NOTES

1. BNK INDICATES BOLT, NUT AND STAINLESS STEEL COTTER KEY REQUIRED.
2. STRENGTH OF HARDWARE COMPONENTS SHALL BE EQUAL TO OR GREATER THAN THE INSULATOR ASSEMBLY ULTIMATE STRENGTH, EXCEPT THAT PARALLEL COMPONENTS IN INSULATOR ASSEMBLIES SIA11 AND SIA12 MAY HAVE 50% OF ASSEMBLY ULTIMATE STRENGTH.

PORCELAIN OR GLASS UNITS

VOLTAGE (KV)	UNIT QUANTITY PER ASSEMBLY			
	SI11 AND SI12		SIA11 AND SIA12	
	WOOD STRUCTURES	STEEL STRUCTURES	WOOD STRUCTURES	STEEL STRUCTURES
69	4	6	6	6
115	7	9	9	9
138	8	10	10	10
161	10	11	11	11
230	12	14	13	14

INSULATOR ASSEMBLY TYPE DESIGNATOR

TYPE OF STRUCTURE ATTACHMENT
HARDWARE

EXAMPLE: SIA11 - B

- ONE (1) OR TWO (2) SUBCONDUCTORS
- SINGLE (1) OR DOUBLE (2) INSULATOR STRING
- RUNNING ANGLE APPLICATION
15° - 60° LINE ANGLE
- "I-STRING"
- SUSPENSION ASSEMBLY

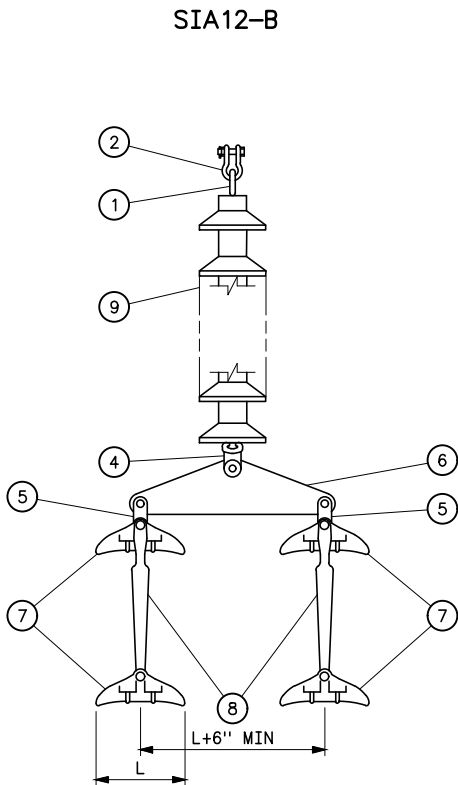
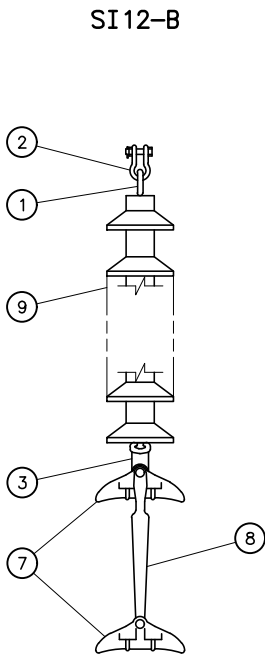
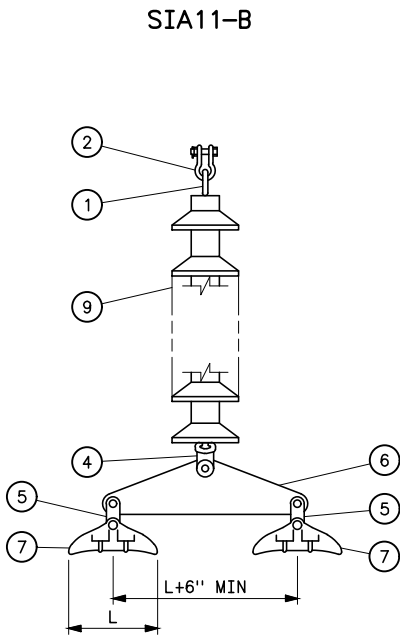
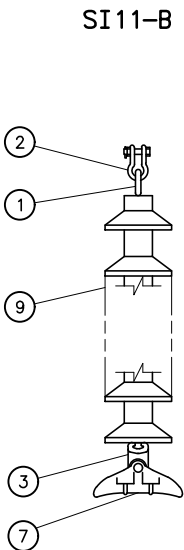
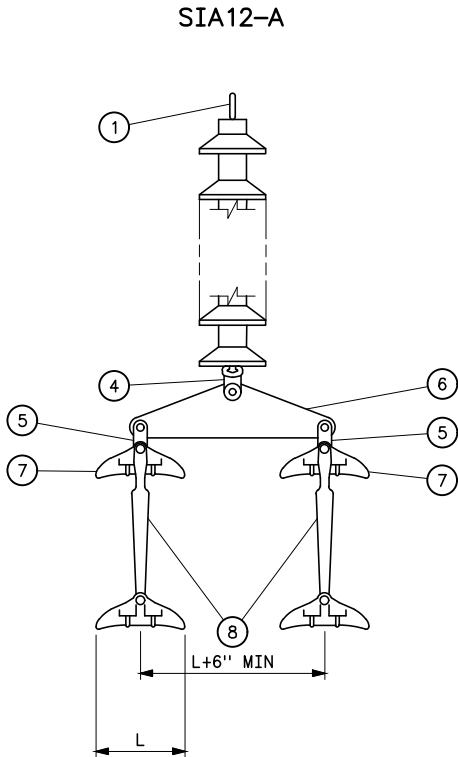
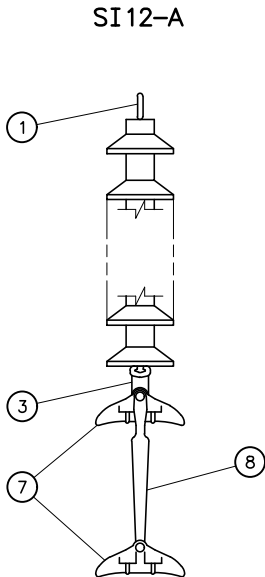
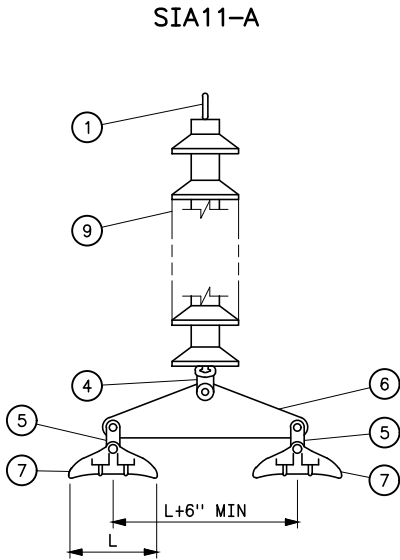
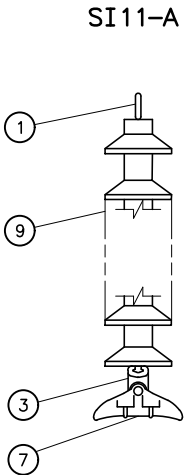
SUPERSEDES DWG NO. 41-1020

UNITED STATES DEPARTMENT OF ENERGY
WESTERN AREA POWER ADMINISTRATION
HEADQUARTERS - LAKEWOOD, COLORADO

TRANSMISSION LINE STANDARDS
SUSPENSION INSULATOR ASSEMBLIES
SINGLE STRING, PORCELAIN OR GLASS
TYPES SI- AND SIA1-

DESIGNED ALLEN TURNER APPROVED KYLE VAUGHN
ELECTRICAL ENGINEERING MANAGER

AUGUST 21, 2025 41 1020-1



MATERIALS LIST	
ITEM NO.	DESCRIPTION
1	OVAL EYE BALL
2	ANCHOR SHACKLE, BNK
3	SOCKET EYE
4	SOCKET CLEVIS, BNK
5	CLEVIS EYE, BNK
6	YOKE PLATE
7	SUSPENSION CLAMP, BNK
8	VERTICAL BUNDLE YOKE, 18" SPACING
9	INSULATOR, COMPOSITE, OVAL EYE-BALL (RATINGS AS SPECIFIED)

NOTES

1. BNK INDICATES BOLT, NUT AND STAINLESS STEEL COTTER KEY REQUIRED.
2. STRENGTH OF HARDWARE COMPONENTS SHALL BE EQUAL TO OR GREATER THAN THE INSULATOR ASSEMBLY ULTIMATE STRENGTH, EXCEPT THAT PARALLEL COMPONENTS IN INSULATOR ASSEMBLIES SIA11 AND SIA12 MAY HAVE 50% OF ASSEMBLY ULTIMATE STRENGTH.

INSULATOR ASSEMBLY TYPE DESIGNATOR

TYPE OF STRUCTURE ATTACHMENT
HARDWARE

EXAMPLE: SIA11 - B

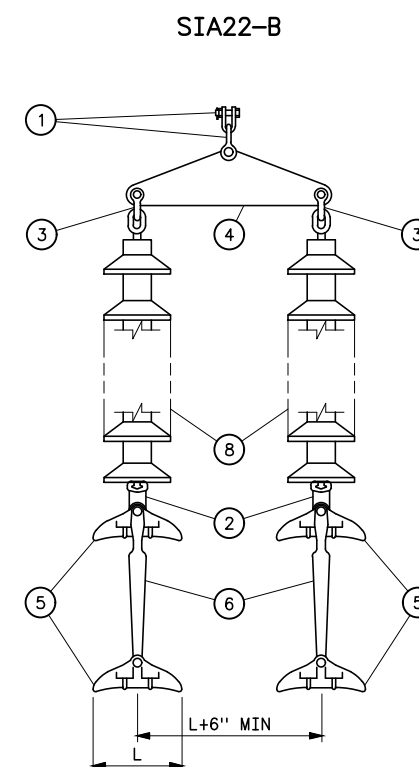
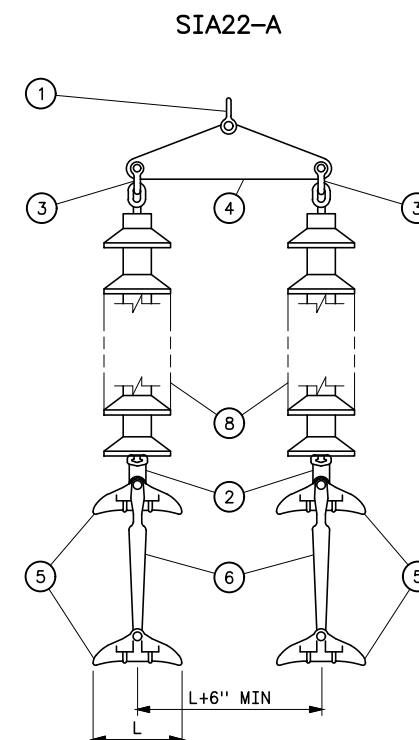
- ONE (1) OR TWO (2) SUBCONDUCTORS
- SINGLE (1) OR DOUBLE (2) INSULATOR STRING
- RUNNING ANGLE APPLICATION
15° - 60° LINE ANGLE
- "I-STRING"
- SUSPENSION ASSEMBLY

SINGLE STRING, COMPOSITE
SUSPENSION INSULATOR ASSEMBLIES
ULTIMATE INSULATOR ASSEMBLY STRENGTH AS SPECIFIED

(NOTE 2)

SUPERSEDES DWG NO. 41-1020		
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION HEADQUARTERS - LAKEWOOD, COLORADO		
TRANSMISSION LINE STANDARDS SUSPENSION INSULATOR ASSEMBLIES SINGLE STRING, COMPOSITE TYPES SI- AND SIA1-		
DESIGNED <u>ALLEN TURNER</u>	APPROVED <u>KYLE VAUGHN</u> ELECTRICAL ENGINEERING MANAGER	
C _A E	AUGUST 21, 2025	41 1020-2

COMPOSITE



(NOTE 2)

ITEM NO.	DESCRIPTION
1	ANCHOR SHACKLE, BNK
2	SOCKET EYE
3	CLEVIS BALL, BNK
4	YOKE PLATE
5	SUSPENSION CLAMP, BNK
6	VERTICAL BUNDLE YOKE, 18" SPACING
7	INSULATOR STRING, PORCELAIN OR GLASS UNITS
8	INSULATOR COMPOSITE, OVAL EYE-BALL (RATINGS AS SPECIFIED)

1. BNK INDICATES BOLT, NUT AND STAINLESS STEEL COTTER KEY REQUIRED.
2. STRENGTH OF HARDWARE COMPONENTS SHALL BE EQUAL TO OR GREATER THAN THE INSULATOR ASSEMBLY ULTIMATE STRENGTH, EXCEPT THAT PARALLEL COMPONENTS IN INSULATOR ASSEMBLIES STA21 AND STA22 MAY HAVE 50% OF ASSEMBLY ULTIMATE STRENGTH.

VOLTAGE (KV)	UNIT QUANTITY PER ASSEMBLY	
	SIA21 AND SIA22	
	WOOD STRUCTURES	STEEL STRUCTURES
69	12	12
115	18	18
138	20	20
161	22	22
230	26	28

EXAMPLE: SIA22 - B

- TYPE OF STRUCTURE ATTACHMENT
HARDWARE
- ONE (1) OR TWO (2) SUBCONDUCTORS
- SINGLE (1) OR DOUBLE (2) INSULATOR
STRING
- RUNNING ANGLE APPLICATION
15° - 60° LINE ANGLE
- "I-STRING"
- SUSPENSION ASSEMBLY

D	8-21-25 A7-AT	ADDED COMPOSITE INSULATOR STRING EXAMPLES.
C	3-4-16 A7-RC	ADDED GLASS AND CHANGED POLYMER FIBERGLASS TO COMPOSITE.
B	7-15-03 A7-RC	REVISED TITLE BLOCK ONLY.
A	6-29-00 A2-RMC	REVISED ULTIMATE STRENGTH REQUIREMENT. MINOR REVISIONS.

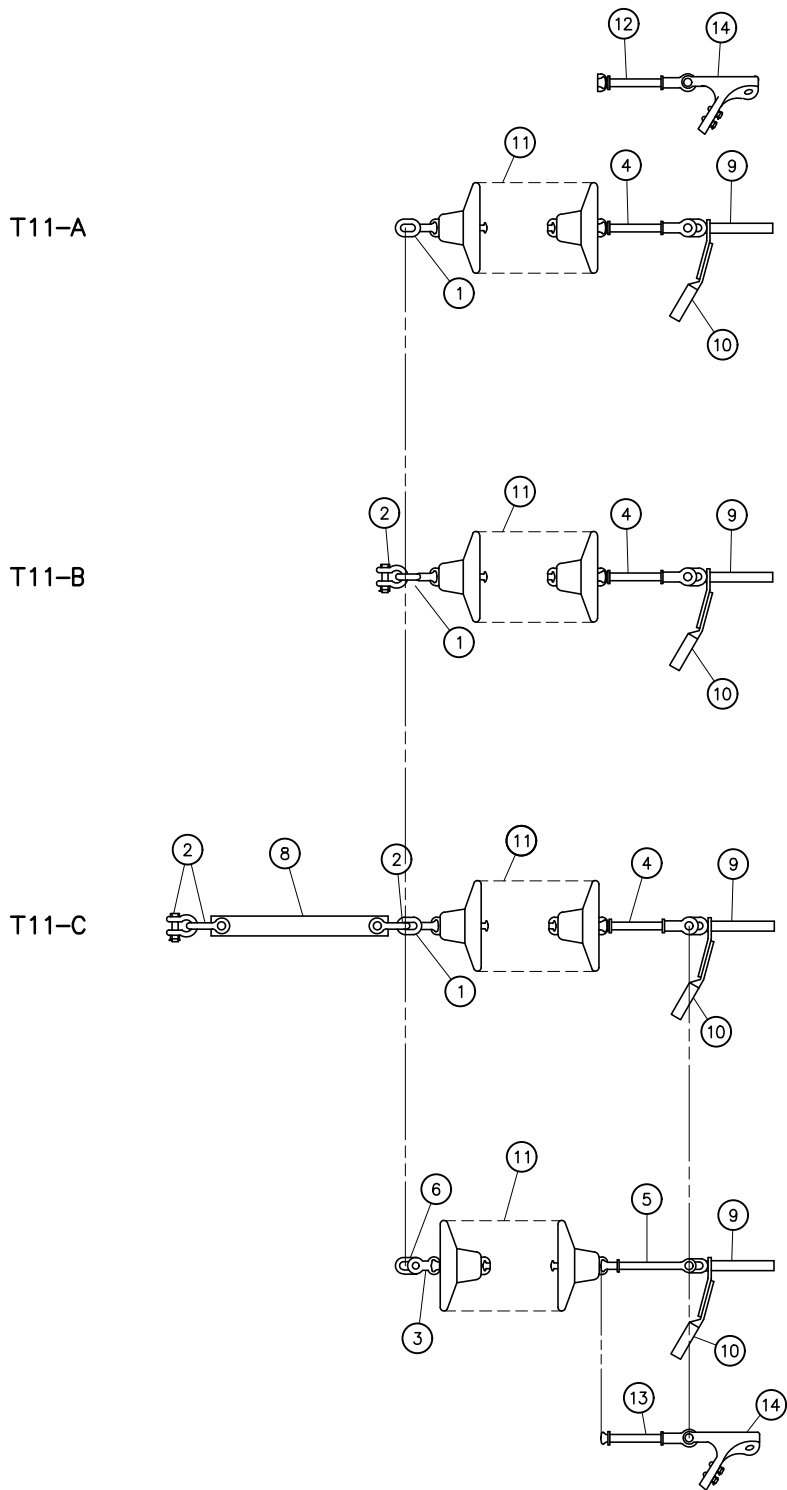
UNITED STATES DEPARTMENT OF ENERGY
WESTERN AREA POWER ADMINISTRATION
CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO

TRANSMISSION LINE STANDARDS SUSPENSION INSULATOR ASSEMBLIES DOUBLE STRING, PORCELAIN, GLASS OR COMPOSITE - TYPES SIA2-

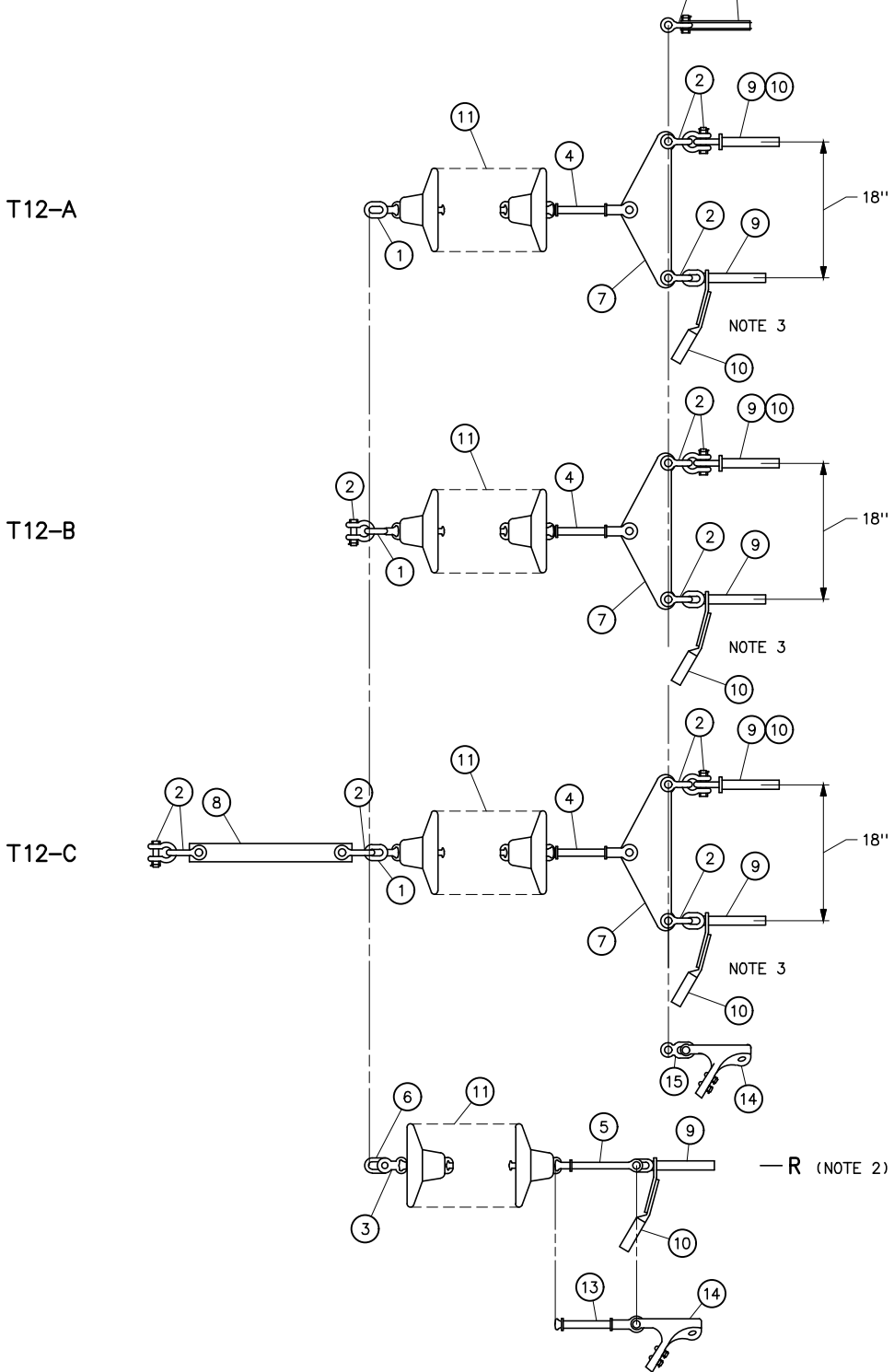
DESIGNED F.S. COOK _____ APPROVED ROSS CLARK _____
ELECTRICAL ENGINEERING MANAGER

C_{AF}	OCTOBER 10, 1997	41	1021
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IMAGES:



TYPE T11
SINGLE INSULATOR STRING, ONE SUBCONDUCTOR



TYPE T12
SINGLE INSULATOR STRING, TWO SUBCONDUCTORS

SINGLE STRING, PORCELAIN OR GLASS
TENSION INSULATOR ASSEMBLIES
ULTIMATE INSULATOR ASSEMBLY STRENGTH AS SPECIFIED
(NOTE 4)

MATERIALS LIST	
ITEM NO.	DESCRIPTION
1	OVAL EYE BALL
2	ANCHOR SHACKLE, BNK
3	SOCKET CLEVIS, BNK
4	SOCKET CLEVIS, HOT LINE, BNK
5	CLEVIS BALL, HOT LINE, BNK
6	CHAIN LINK
7	YOKE PLATE
8	EXTENSION STRAP (LENGTH AS SPECIFIED)
9	COMPRESSION DEAD END FITTING, EYE, SINGLE TONGUE
10	COMPRESSION JUMPER TERMINAL
11	INSULATOR STRING, PORCELAIN OR GLASS UNITS
12	SOCKET EYE, HOT LINE (ONLY IF SPECIFIED)
13	BALL EYE, HOT LINE (ONLY IF SPECIFIED)
14	STRAIN CLAMP, BNK (ONLY IF SPECIFIED)
15	CLEVIS EYE, BNK (ONLY IF SPECIFIED)

PORCELAIN OR GLASS UNITS		
VOLTAGE (KV)	UNIT QUANTITY PER ASSEMBLY	
	T11 AND T12	
	WOOD STRUCTURES	STEEL STRUCTURES
69	5	7
115	8	10
138	10	11
161	11	12
230	13	15

NOTES

1. BNK INDICATES BOLT, NUT AND STAINLESS STEEL COTTER KEY REQUIRED.
2. ASSEMBLIES DESIGNATED WITH AN R SUFFIX SHALL HAVE THE INSULATOR CAPS AT THE CONDUCTOR END OF THE ASSEMBLY AS SHOWN, AND ARE FOR USE WHEN THE CONDUCTOR ATTACHMENT POINT IS AT A HIGHER ELEVATION THAN THE STRUCTURE ATTACHMENT POINT.
3. FOR TWO SUBCONDUCTOR ASSEMBLIES, THE PADS ON THE CONDUCTOR DEADENDS SHALL BE TURNED OUT TO EACH SIDE IN ORDER TO CLEAR HARDWARE AND PROVIDE A SMOOTH TRANSITION INTO A BUNDLE AT THE JUMPER INSULATOR ASSEMBLY.
4. DUE TO TORSIONAL STRESS, COMPOSITE INSULATORS SHALL NOT BE USED IN SINGLE STRING TENSION CONFIGURATIONS.

INSULATOR ASSEMBLY TYPE DESIGNATOR

TYPE OF STRUCTURE ATTACHMENT HARDWARE
FOR REVERSE INSULATORS (NOTE 2)

EXAMPLE: T12 - B - R

ONE (1) OR TWO (2) SUBCONDUCTORS
SINGLE (1) OR DOUBLE (2) INSULATOR STRING
TENSION ASSEMBLY

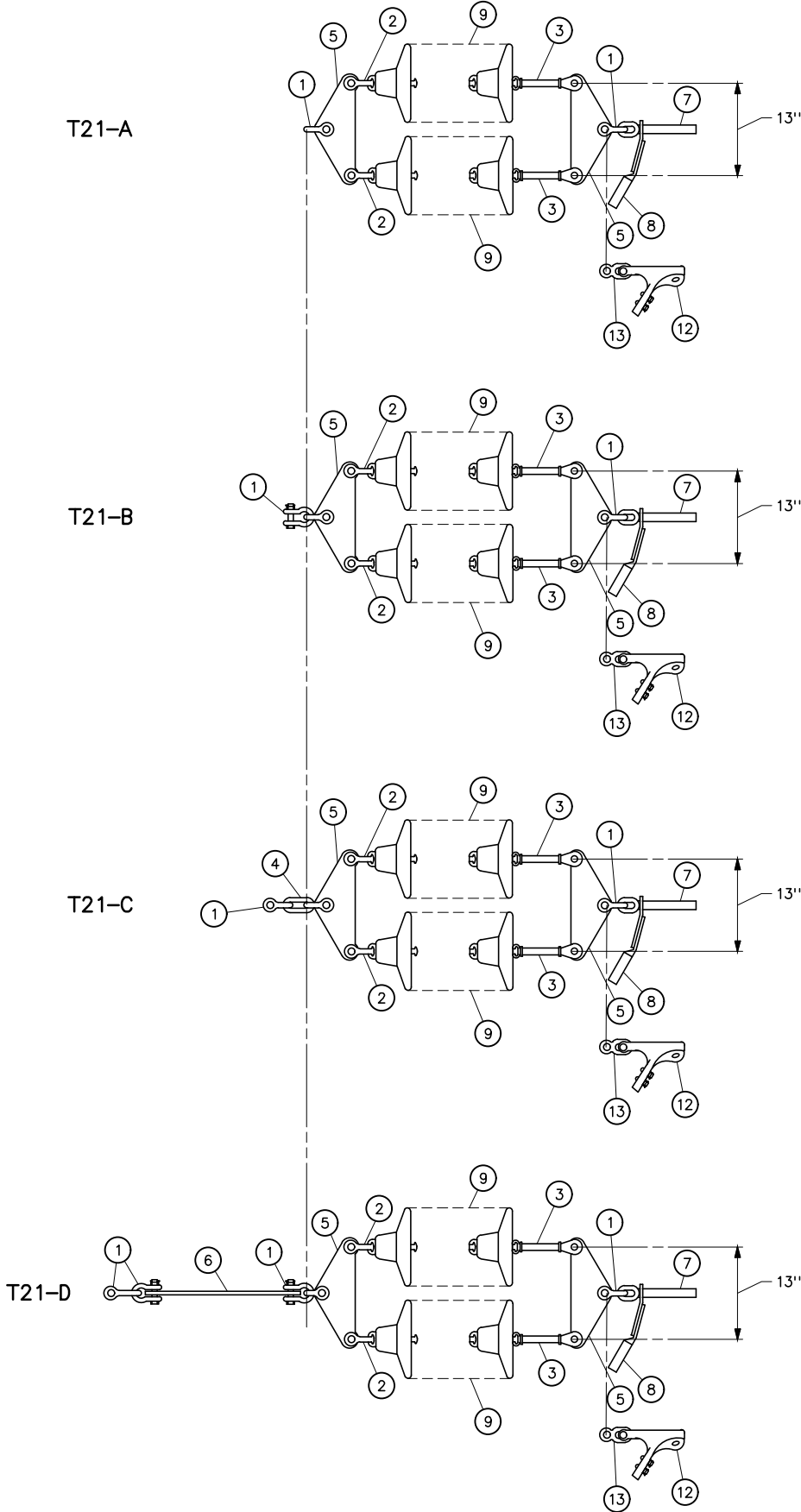
E	9-24-26 A7-CN	MINOR REVISIONS.
D	8-21-25 A7-AT	REDRAWN TO SHOW ALL VARIATIONS. REVISED TITLE BLOCK.
C	3-24-25 A7-RC	ADDED GLASS AND CHANGED POLYMER FIBERGLASS TO COMPOSITE.
B	7-15-03 A7-RC	REVISED TITLE BLOCK ONLY.
A	6/13/00 A3-RMC	ADDED STRAIN CLAMPS.

UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION HEADQUARTERS - LAKEWOOD, COLORADO		
TRANSMISSION LINE STANDARDS TENSION INSULATOR ASSEMBLIES SINGLE STRING, PORCELAIN OR GLASS TYPES T11- AND T12-		
DESIGNED E.S. COOK	APPROVED ROSS CLARK ELECTRICAL ENGINEERING MANAGER	
C _A E	OCTOBER 10, 1997	41 1022

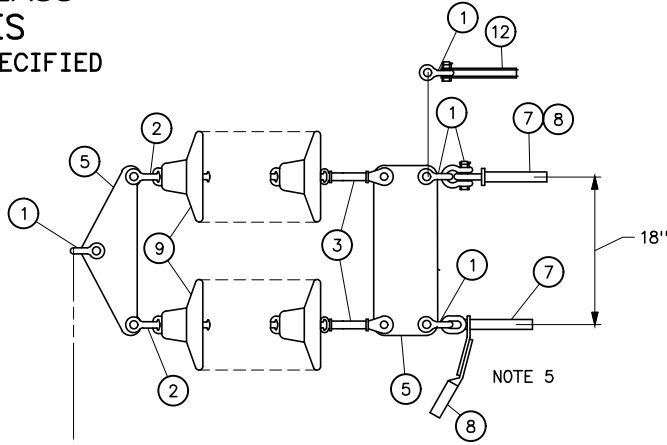
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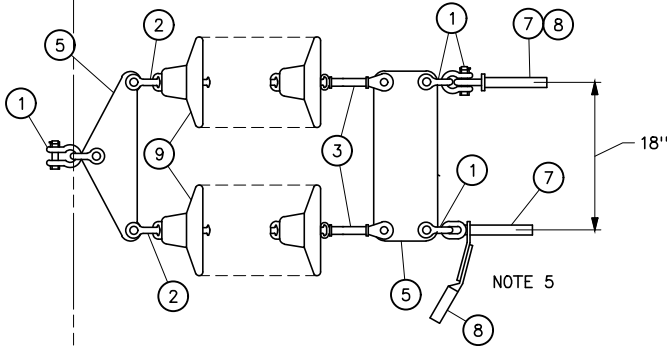
DOUBLE STRING, PORCELAIN OR GLASS
TENSION INSULATOR ASSEMBLIES
ULTIMATE INSULATOR ASSEMBLY STRENGTH AS SPECIFIED
(NOTE 2)



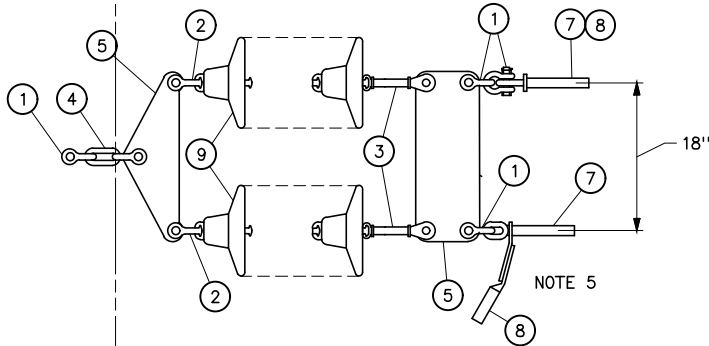
T22-A



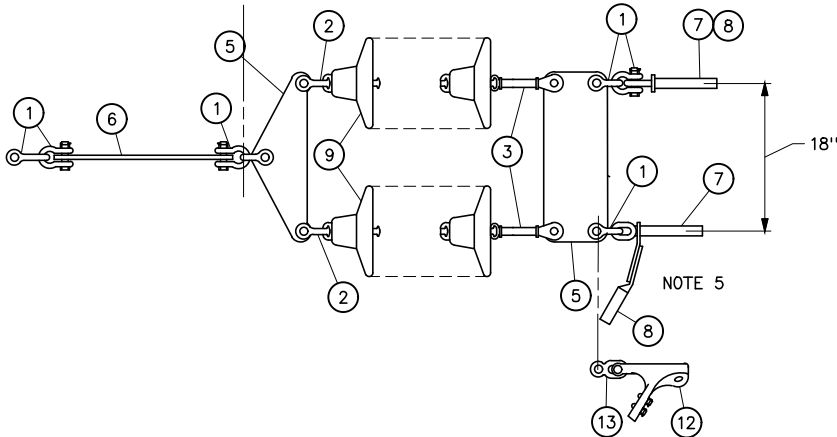
T22-B



T22-C



T22-D



MATERIALS LIST

ITEM NO.	DESCRIPTION
1	ANCHOR SHACKLE, BNK
2	CLEVIS BALL, BNK
3	SOCKET CLEVIS, HOT LINE, BNK
4	CHAIN LINK
5	YOKE PLATE, WITH WORKING HOLE
6	EXTENSION STRAP (LENGTH AS SPECIFIED)
7	COMPRESSION DEAD END FITTING, EYE, SINGLE TONGUE
8	COMPRESSION JUMPER TERMINAL
9	INSULATOR STRING, PORCELAIN OR GLASS UNITS
10	INSULATOR STRING, COMPOSITE, OVAL EYE-BALL (LENGTH AS SPECIFIED)
12	STRAIN CLAMP, BNK (ONLY IF SPECIFIED)
13	CLEVIS EYE, BNK (ONLY IF SPECIFIED)

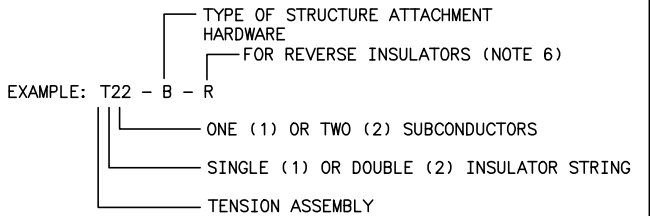
NOTES

1. BNK INDICATES BOLT, NUT AND STAINLESS STEEL COTTER KEY REQUIRED.
2. STRENGTH OF HARDWARE COMPONENTS SHALL BE EQUAL TO OR GREATER THAN THE INSULATOR ASSEMBLY ULTIMATE STRENGTH, EXCEPT THAT PARALLEL COMPONENTS IN DOUBLE INSULATOR ASSEMBLIES T21, AND T22 MAY HAVE 50% OF ULTIMATE ASSEMBLY STRENGTH.
3. DOUBLE STRING, SINGLE CONDUCTOR ASSEMBLIES SHALL HAVE THE INSULATOR STRING PARALLEL IN A HORIZONTAL PLANE.
4. DOUBLE STRING, TWO SUBCONDUCTOR ASSEMBLIES SHALL HAVE THE INSULATOR STRINGS PARALLEL IN THE SAME PLANE AS THE CONDUCTORS (USUALLY VERTICAL).
5. FOR TWO SUBCONDUCTOR ASSEMBLIES, THE PADS ON THE CONDUCTOR DEADENDS SHALL BE TURNED OUT TO EACH SIDE IN ORDER TO CLEAR HARDWARE AND PROVIDE A SMOOTH TRANSITION INTO A BUNDLE AT THE JUMPER INSULATOR ASSEMBLY.
6. ASSEMBLIES DESIGNATED WITH AN -R SUFFIX SHALL HAVE THE INSULATOR CAPS AT THE CONDUCTOR END OF THE ASSEMBLY AS SHOWN, AND ARE FOR USE WHEN THE CONDUCTOR ATTACHMENT POINT IS AT A HIGHER ELEVATION THAN THE STRUCTURE ATTACHMENT POINT.

PORCELAIN OR GLASS UNITS

VOLTAGE (KV)	UNIT QUANTITY PER ASSEMBLY	
	T21 AND T22	
	WOOD STRUCTURES	STEEL STRUCTURES
69	10	14
115	16	20
138	20	22
161	22	24
230	26	30

INSULATOR ASSEMBLY TYPE DESIGNATOR



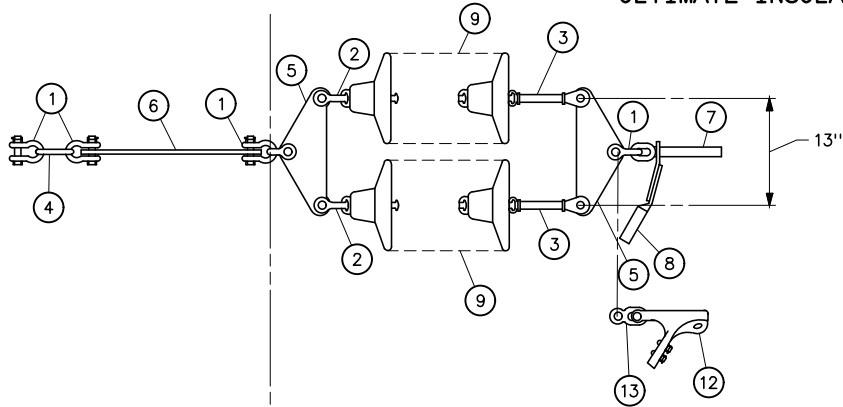
A	9-24-26 A7-CN	MINOR REVISIONS.
SUPERSEDES DWG NO. 41 1023		
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION HEADQUARTERS - LAKEWOOD, COLORADO		
TRANSMISSION LINE STANDARDS TENSION INSULATOR ASSEMBLIES DOUBLE STRING, PORCELAIN OR GLASS TYPES T21- AND T22- A THROUGH D SHEET 1 OF 4		
DESIGNED ALLEN TURNER ----- APPROVED KYLE VAUGHN ELECTRICAL ENGINEERING MANAGER		
C _A E	AUGUST 21, 2025	41 1023-1

Plotted By: court Sep 24, 2026- 6:24am
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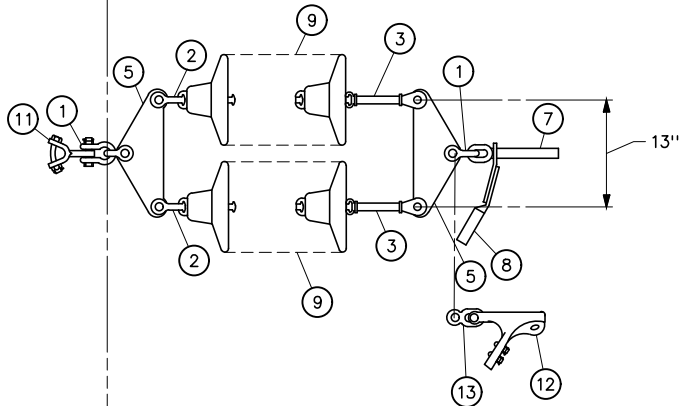
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TENSION INSULATOR ASSEMBLIES
ULTIMATE INSULATOR ASSEMBLY STRENGTH AS SPECIFIED
(NOTE 2)

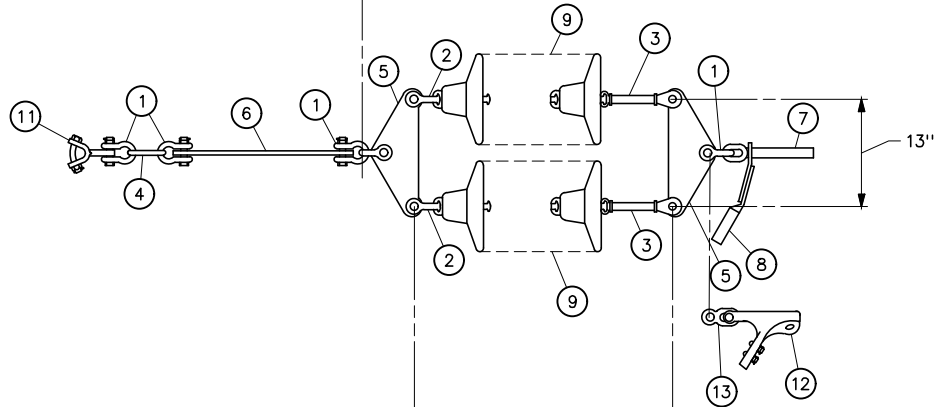
T21-E



T21-F



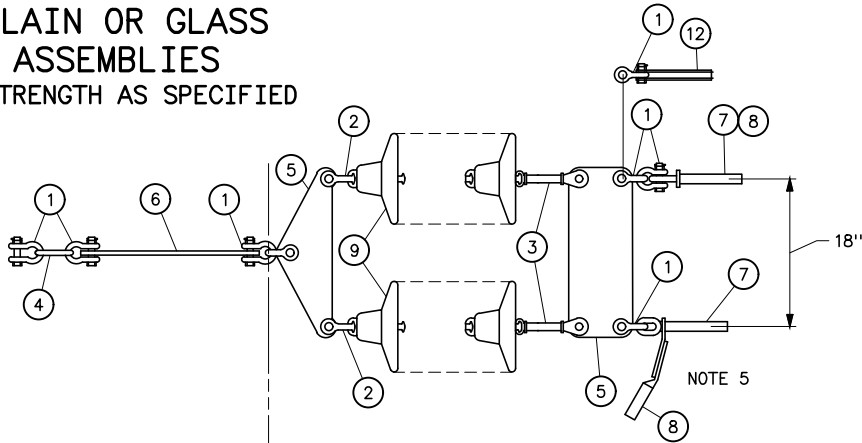
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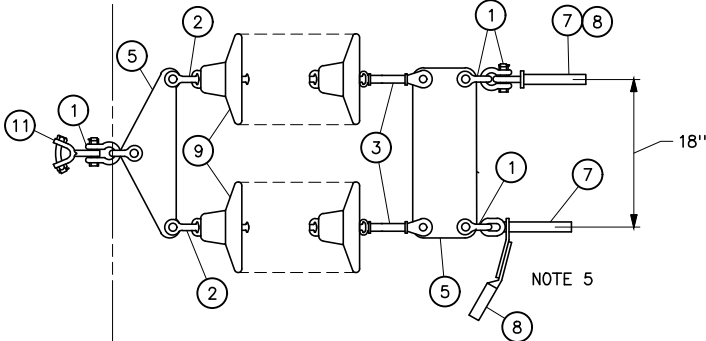
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DOUBLE INSULATOR STRING, ONE SUBCONDUCTOR
(NOTE 3)

- R (NOTE 6)

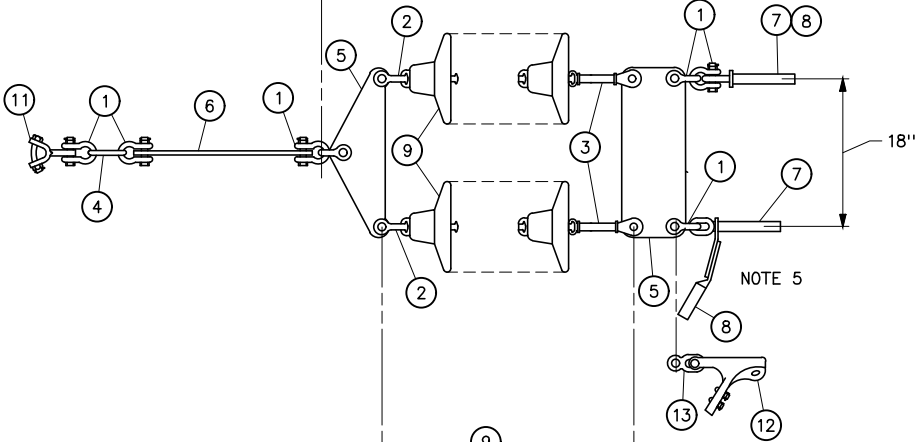
T22-E



T22-F



T22-G



T22
DOUBLE INSULATOR STRING, TWO SUBCONDUCTORS
(NOTE 4)

- R (NOTE 6)

MATERIALS LIST

ITEM NO.	DESCRIPTION
1	ANCHOR SHACKLE, BNK
2	CLEVIS BALL, BNK
3	SOCKET CLEVIS, HOT LINE, BNK
4	CHAIN LINK
5	YOKE PLATE, WITH WORKING HOLE
6	EXTENSION STRAP (LENGTH AS SPECIFIED)
7	COMPRESSION DEAD END FITTING, EYE, SINGLE TONGUE
8	COMPRESSION JUMPER TERMINAL
9	INSULATOR STRING, PORCELAIN OR GLASS UNITS
11	Y-CLEVIS EYE, BNK
12	STRAIN CLAMP, BNK
13	CLEVIS EYE, BNK

NOTES

1. BNK INDICATES BOLT, NUT AND STAINLESS STEEL COTTER KEY REQUIRED.
2. STRENGTH OF HARDWARE COMPONENTS SHALL BE EQUAL TO OR GREATER THAN THE INSULATOR ASSEMBLY ULTIMATE STRENGTH, EXCEPT THAT PARALLEL COMPONENTS IN DOUBLE INSULATOR ASSEMBLIES T21, AND T22 MAY HAVE 50% OF ULTIMATE ASSEMBLY STRENGTH.
3. DOUBLE STRING, SINGLE CONDUCTOR ASSEMBLIES SHALL HAVE THE INSULATOR STRING PARALLEL IN A HORIZONTAL PLANE.
4. DOUBLE STRING, TWO SUBCONDUCTOR ASSEMBLIES SHALL HAVE THE INSULATOR STRINGS PARALLEL IN THE SAME PLANE AS THE CONDUCTORS (USUALLY VERTICAL).
5. FOR TWO SUBCONDUCTOR ASSEMBLIES, THE PADS ON THE CONDUCTOR DEADENDS SHALL BE TURNED OUT TO EACH SIDE IN ORDER TO CLEAR HARDWARE AND PROVIDE A SMOOTH TRANSITION INTO A BUNDLE AT THE JUMPER INSULATOR ASSEMBLY.
6. ASSEMBLIES DESIGNATED WITH AN R SUFFIX SHALL HAVE THE INSULATOR CAPS AT THE CONDUCTOR END OF THE ASSEMBLY AS SHOWN, AND ARE FOR USE WHEN THE CONDUCTOR ATTACHMENT POINT IS AT A HIGHER ELEVATION THAN THE STRUCTURE ATTACHMENT POINT.

PORCELAIN OR GLASS UNITS

VOLTAGE (KV)	UNIT QUANTITY PER ASSEMBLY	
	T21 AND T22	
	WOOD STRUCTURES	STEEL STRUCTURES
69	10	14
115	16	20
138	20	22
161	22	24
230	26	30

INSULATOR ASSEMBLY TYPE DESIGNATOR

EXAMPLE: T22 - F - R

TYPE OF STRUCTURE ATTACHMENT
HARDWARE
FOR REVERSE INSULATORS (NOTE 6)

ONE (1) OR TWO (2) SUBCONDUCTORS

SINGLE (1) OR DOUBLE (2) INSULATOR STRING

TENSION ASSEMBLY

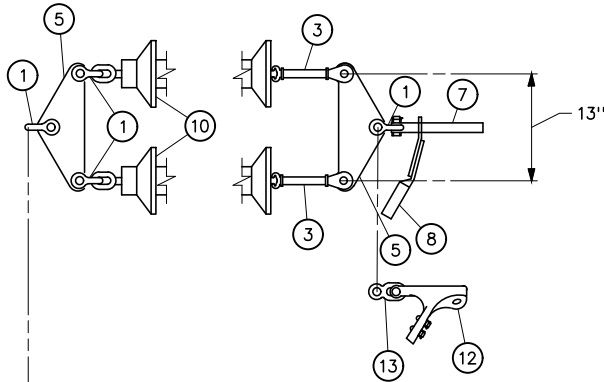
A	9-24-26 A7-CN	MINOR REVISIONS.
SUPERSEDES DWG NO. 41 1023		
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION HEADQUARTERS - LAKEWOOD, COLORADO		
TRANSMISSION LINE STANDARDS TENSION INSULATOR ASSEMBLIES DOUBLE STRING, PORCELAIN OR GLASS TYPES T21- AND T22- E THROUGH G SHEET 2 OF 4		
DESIGNED ALLEN TURNER _____ APPROVED KYLE VAUGHN ELECTRICAL ENGINEERING MANAGER		
C _A E	AUGUST 21, 2025	41 1023-2

Plotted By: court Sep 24, 2026- 6: 25am
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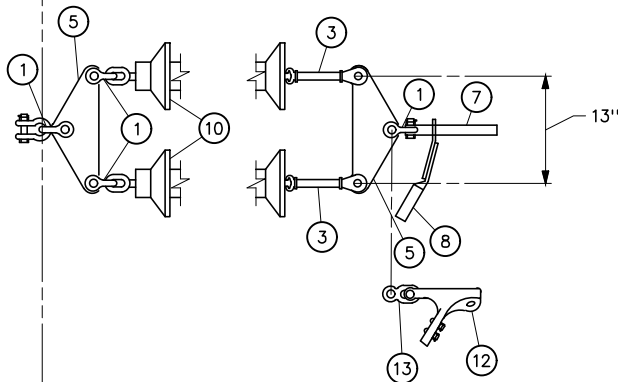
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DOUBLE STRING, COMPOSITE
TENSION INSULATOR ASSEMBLIES
ULTIMATE INSULATOR ASSEMBLY STRENGTH AS SPECIFIED
(NOTE 2)

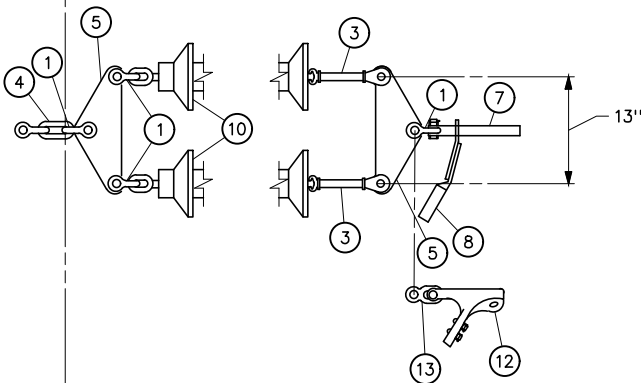
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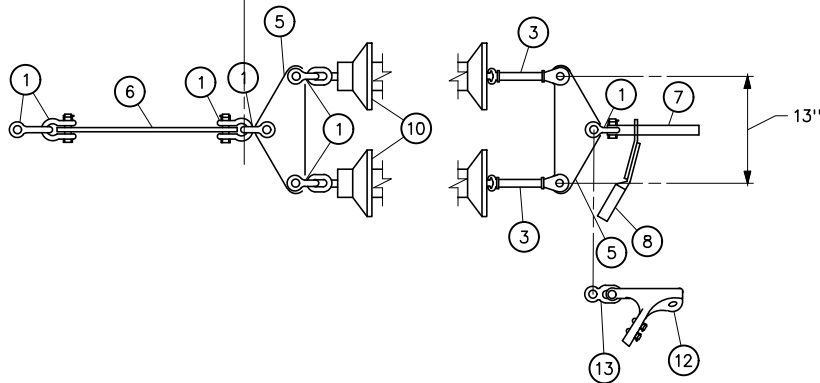
T21-B



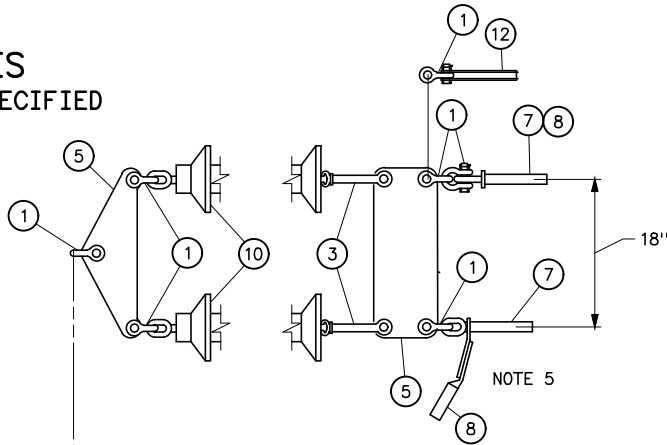
T21-C



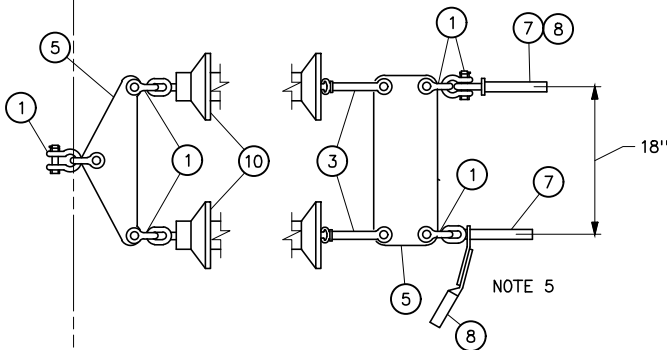
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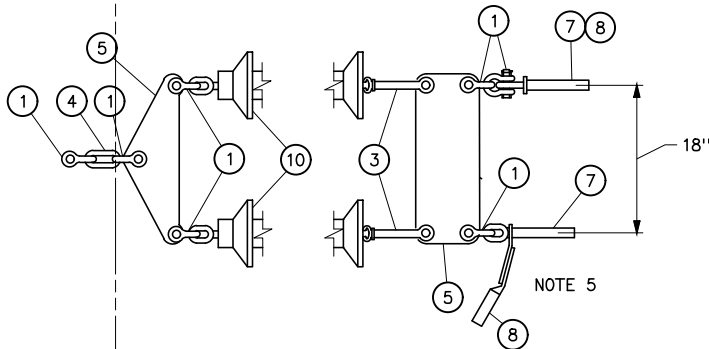
T22-A



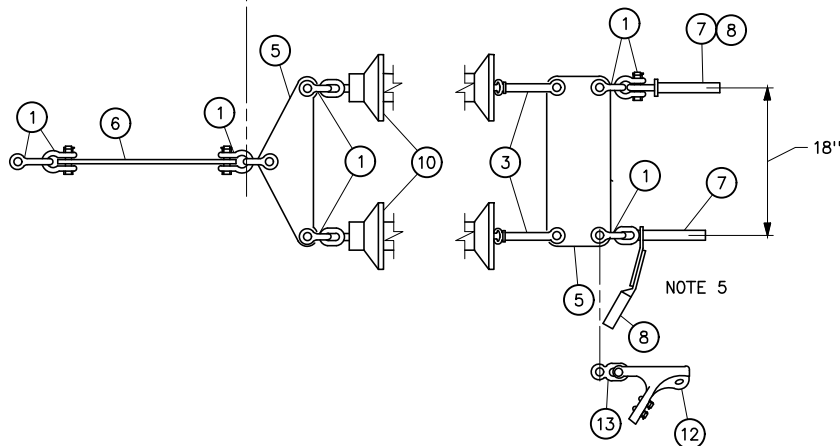
T22-B



T22-C



T22-D



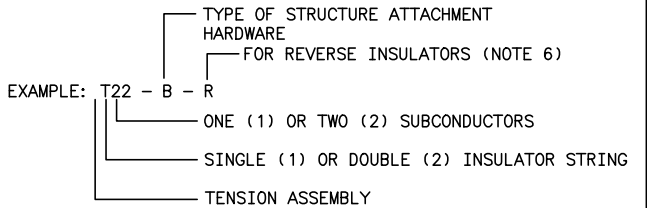
MATERIALS LIST

ITEM NO.	DESCRIPTION
1	ANCHOR SHACKLE, BNK
2	CLEVIS BALL, BNK
3	SOCKET CLEVIS, HOT LINE, BNK
4	CHAIN LINK
5	YOKE PLATE, WITH WORKING HOLE
6	EXTENSION STRAP (LENGTH AS SPECIFIED)
7	COMPRESSION DEAD END FITTING, EYE, SINGLE TONGUE
8	COMPRESSION JUMPER TERMINAL
10	INSULATOR, COMPOSITE, OVAL EYE-BALL (RATINGS AS SPECIFIED)
11	Y-CLEVIS EYE, BNK
12	STRAIN CLAMP, BNK (ONLY IF SPECIFIED)
13	CLEVIS EYE, BNK (ONLY IF SPECIFIED)

NOTES

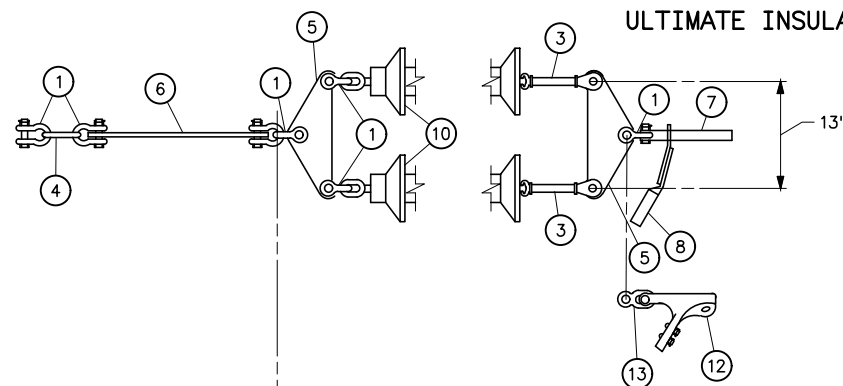
1. BNK INDICATES BOLT, NUT AND STAINLESS STEEL COTTER KEY REQUIRED.
2. STRENGTH OF HARDWARE COMPONENTS SHALL BE EQUAL TO OR GREATER THAN THE INSULATOR ASSEMBLY ULTIMATE STRENGTH, EXCEPT THAT PARALLEL COMPONENTS IN DOUBLE INSULATOR ASSEMBLIES T21, AND T22 MAY HAVE 50% OF ULTIMATE ASSEMBLY STRENGTH.
3. DOUBLE STRING, SINGLE CONDUCTOR ASSEMBLIES SHALL HAVE THE INSULATOR STRING PARALLEL IN A HORIZONTAL PLANE.
4. DOUBLE STRING, TWO SUBCONDUCTOR ASSEMBLIES SHALL HAVE THE INSULATOR STRINGS PARALLEL IN THE SAME PLANE AS THE CONDUCTORS (USUALLY VERTICAL).
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6. ASSEMBLIES DESIGNATED WITH AN -R SUFFIX SHALL HAVE THE INSULATOR CAPS AT THE CONDUCTOR END OF THE ASSEMBLY AS SHOWN, AND ARE FOR USE WHEN THE CONDUCTOR ATTACHMENT POINT IS AT A HIGHER ELEVATION THAN THE STRUCTURE ATTACHMENT POINT.

INSULATOR ASSEMBLY TYPE DESIGNATOR

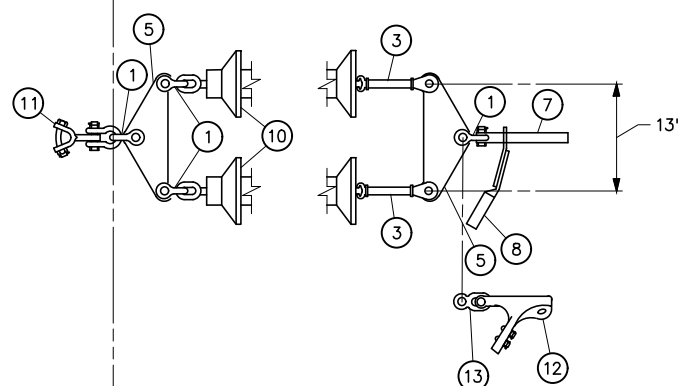


A	9-24-26 A7-CN	MINOR REVISIONS.
SUPERSEDES DWG NO. 41 1023		
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION HEADQUARTERS - LAKEWOOD, COLORADO		
TRANSMISSION LINE STANDARDS TENSION INSULATOR ASSEMBLIES DOUBLE STRING, COMPOSITE TYPES T21- AND T22- A THROUGH D SHEET 3 OF 4		
DESIGNED ALLEN TURNER APPROVED KYLE VAUGHN ELECTRICAL ENGINEERING MANAGER		
DATE	AUGUST 21, 2025	41 1023-3

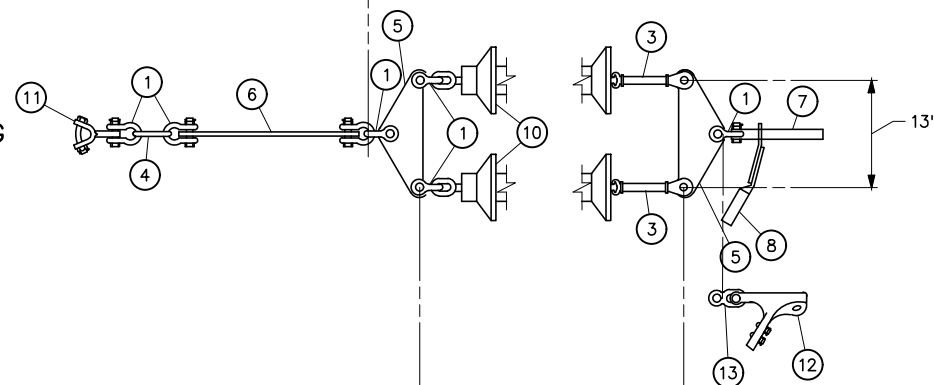
T21-E



T21-F



T21-G

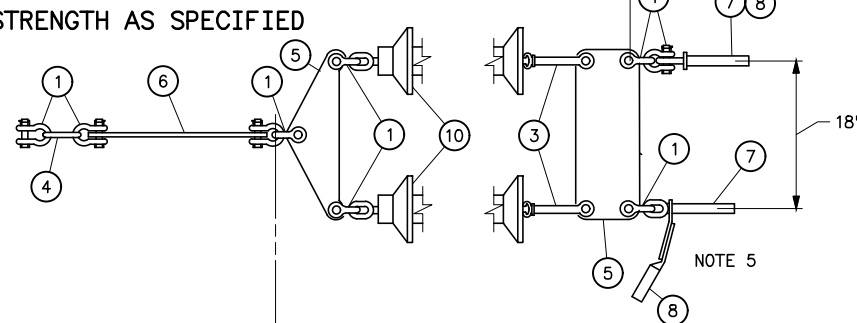


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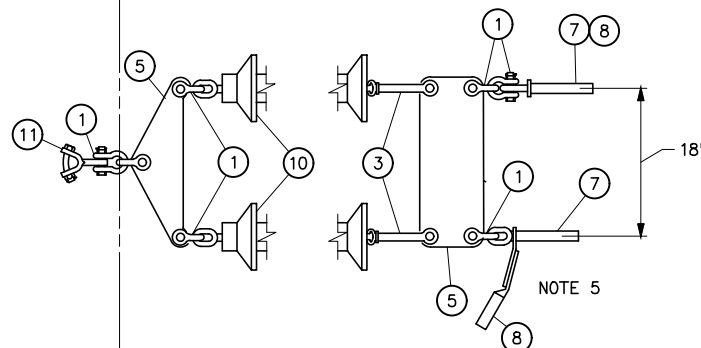
DOUBLE INSULATOR STRING, ONE SUBCONDUCTOR
(NOTE 3)

- R (NOTE 6)

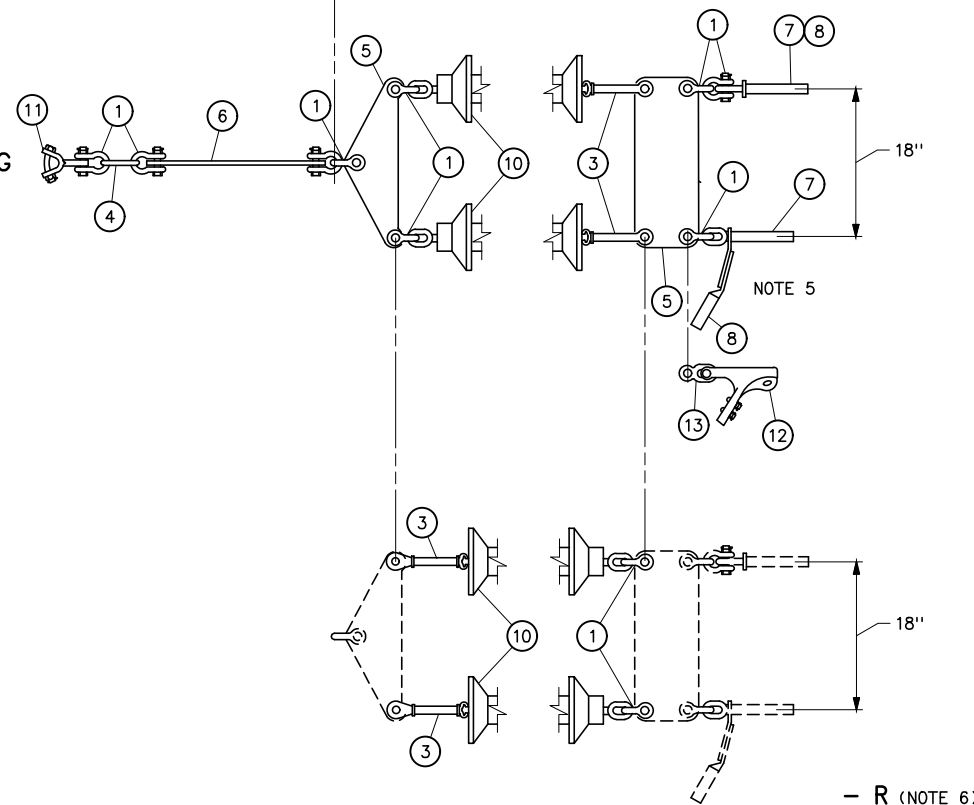
T22-E



T22-F



T22-G



T22

DOUBLE INSULATOR STRING, TWO SUBCONDUCTORS
(NOTE 4)

- R (NOTE 6)

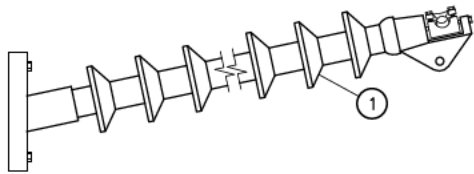
ITEM NO.	DESCRIPTION
1	ANCHOR SHACKLE, BNK
2	CLEVIS BALL, BNK
3	SOCKET CLEVIS, HOT LINE, BNK
4	CHAIN LINK
5	YOKE PLATE, WITH WORKING HOLE
6	EXTENSION STRAP (LENGTH AS SPECIFIED)
7	COMPRESSION DEAD END FITTING, EYE, SINGLE TONGUE
8	COMPRESSION JUMPER TERMINAL
10	INSULATOR, COMPOSITE, OVAL EYE-BALL (RATINGS AS SPECIFIED)
11	Y-CLEVIS EYE, BNK
12	STRAIN CLAMP, BNK (ONLY IF SPECIFIED)
13	CLEVIS EYE, BNK (ONLY IF SPECIFIED)

1. BNK INDICATES BOLT, NUT AND STAINLESS STEEL COTTER KEY REQUIRED.
2. STRENGTH OF HARDWARE COMPONENTS SHALL BE EQUAL TO OR GREATER THAN THE INSULATOR ASSEMBLY ULTIMATE STRENGTH, EXCEPT THAT PARALLEL COMPONENTS IN DOUBLE INSULATOR ASSEMBLIES T21, AND T22 MAY HAVE 50% OF ULTIMATE ASSEMBLY STRENGTH.
3. DOUBLE STRING, SINGLE CONDUCTOR ASSEMBLIES SHALL HAVE THE INSULATOR STRING PARALLEL IN A HORIZONTAL PLANE.
4. DOUBLE STRING, TWO SUBCONDUCTOR ASSEMBLIES SHALL HAVE THE INSULATOR STRINGS PARALLEL IN THE SAME PLANE AS THE CONDUCTORS (USUALLY VERTICAL).
5. FOR TWO SUBCONDUCTOR ASSEMBLIES, THE PADS ON THE CONDUCTOR DEADENDS SHALL BE TURNED OUT TO EACH SIDE IN ORDER TO CLEAR HARDWARE AND PROVIDE A SMOOTH TRANSITION INTO A BUNDLE AT THE JUMPER INSULATOR ASSEMBLY.
6. ASSEMBLIES DESIGNATED WITH AN R SUFFIX SHALL HAVE THE INSULATOR CAPS AT THE CONDUCTOR END OF THE ASSEMBLY AS SHOWN, AND ARE FOR USE WHEN THE CONDUCTOR ATTACHMENT POINT IS AT A HIGHER ELEVATION THAN THE STRUCTURE ATTACHMENT POINT.

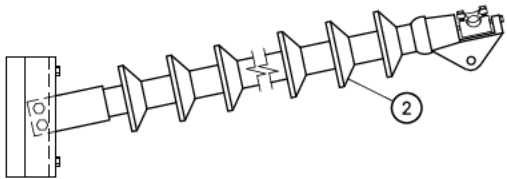
EXAMPLE: T22 - F - R

- TYPE OF STRUCTURE ATTACHMENT HARDWARE
 - FOR REVERSE INSULATORS (NOTE 6)
- ONE (1) OR TWO (2) SUBCONDUCTORS
- SINGLE (1) OR DOUBLE (2) INSULATOR STRING
- TENSION ASSEMBLY

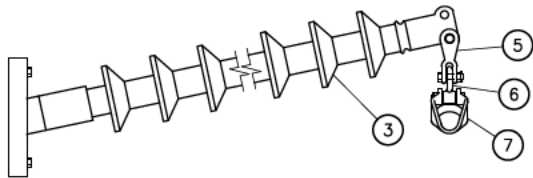
A	9-24-26 A7-CN	MINOR REVISIONS.
SUPERSEDES DWG NO. 41 1023		
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION HEADQUARTERS - LAKEWOOD, COLORADO		
TRANSMISSION LINE STANDARDS TENSION INSULATOR ASSEMBLIES DOUBLE STRING, COMPOSITE TYPES T21- AND T22- E THROUGH G SHEET 4 OF 4		
DESIGNED <u>ALLEN TURNER</u> _____ APPROVED <u>KYLE VAUGHN</u> _____ ELECTRICAL ENGINEERING MANAGER		
C _A =	AUGUST 2, 1975	41 1023-4



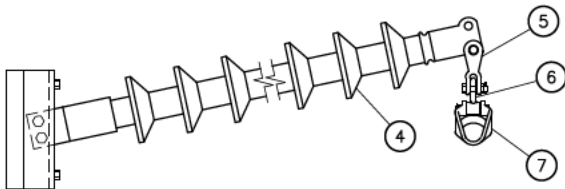
ASSEMBLY TYPE HF1-F
SINGLE CONDUCTOR
FIXED
FLAT BASE



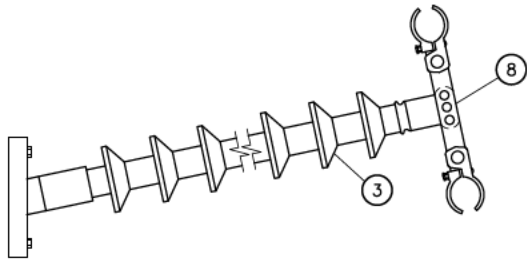
ASSEMBLY TYPE HF1-G
SINGLE CONDUCTOR
FIXED
GAIN BASE



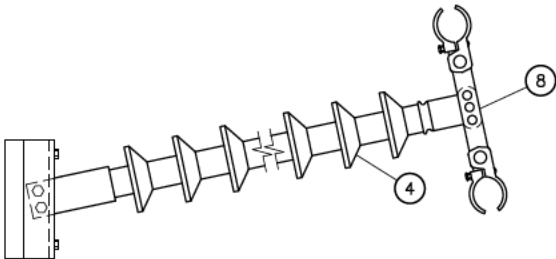
ASSEMBLY TYPE HS1-F
SINGLE CONDUCTOR
SUSPENSION
FLAT BASE



ASSEMBLY TYPE HS1-G
SINGLE CONDUCTOR
SUSPENSION
GAIN BASE



ASSEMBLY TYPE HF2-F
DOUBLE CONDUCTOR
FIXED
FLAT BASE



ASSEMBLY TYPE HF2-G
DOUBLE CONDUCTOR
FIXED
GAIN BASE

HORIZONTAL POST INSULATOR ASSEMBLIES
(NOTE 2)

MATERIALS LIST	
ITEM NO.	DESCRIPTION
1	HORIZONTAL POST INSULATOR, COMPOSITE CLAMP - TOP ADAPTER, FLAT BASE
2	HORIZONTAL POST INSULATOR, COMPOSITE CLAMP - TOP ADAPTER, GAIN BASE
3	HORIZONTAL POST INSULATOR, COMPOSITE, TWO-HOLE END FITTING, FLAT BASE
4	HORIZONTAL POST INSULATOR, COMPOSITE, TWO-HOLE END FITTING, GAIN BASE
5	Y-CLEVIS - CLEVIS, 90°, BNK
6	OVAL EYE - EYE
7	SUSPENSION CLAMP, BNK
8	VERTICAL JUMPER YOKE

NOTES

1. BNK INDICATES BOLT, NUT AND STAINLESS STEEL COTTER KEY REQUIRED.
2. SEE SPECIFICATIONS FOR INSULATOR AND HARDWARE ELECTRICAL AND MECHANICAL RATINGS.

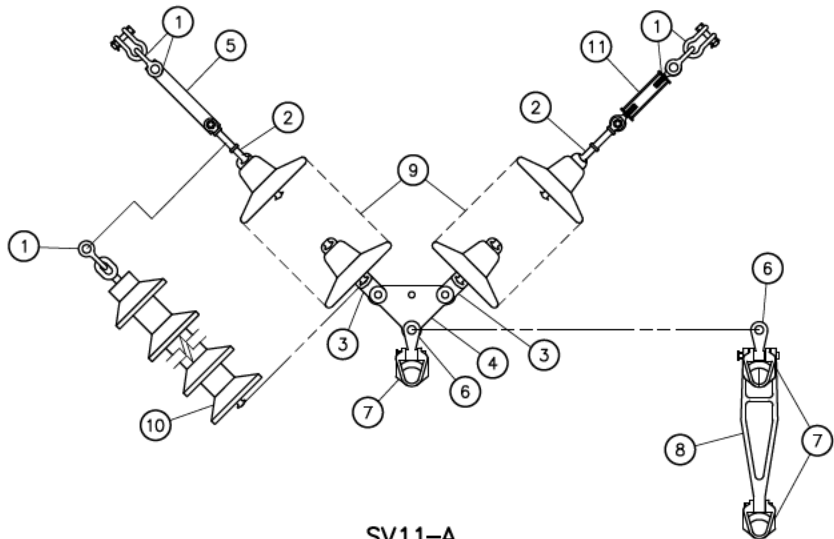
INSULATOR ASSEMBLY TYPE NO.

TYPE OF STRUCTURE ATTACHMENT
FLAT (F) OR GAIN (G) BASE

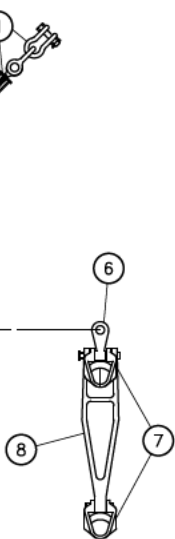
EXAMPLE: HF1 - G

- ONE (1) OR TWO (2) SUBCONDUCTORS
- CONDUCTOR ATTACHMENT, FIXED (F) OR SUSPENSION (S)
- HORIZONTAL POST INSULATOR ASSEMBLY

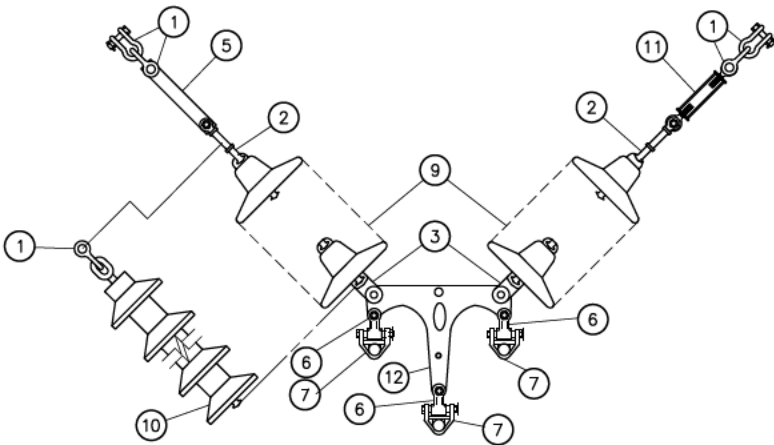
B	9-29-16 A7-RC	CHANGED POLYMER FIBERGLASS TO COMPOSITE.
A	7-15-03 A7-RC	REVISED TITLE BLOCK ONLY.
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
TRANSMISSION LINE STANDARDS HORIZONTAL POST INSULATOR ASSEMBLIES		
DESIGNED E.S. COOK _____ APPROVED ROSS CLARK _____ ELECTRICAL ENGINEERING MANAGER		
A	OCTOBER 10, 1997	41 1024



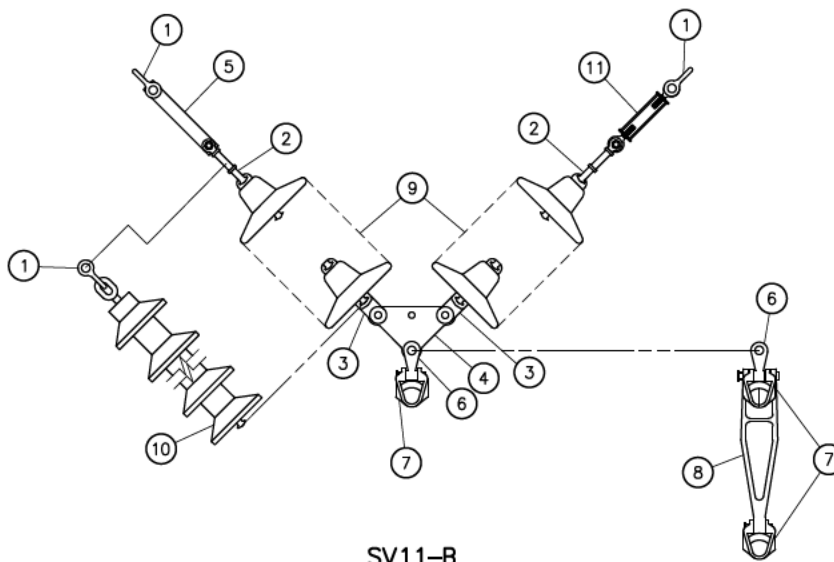
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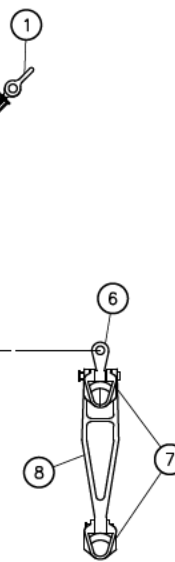
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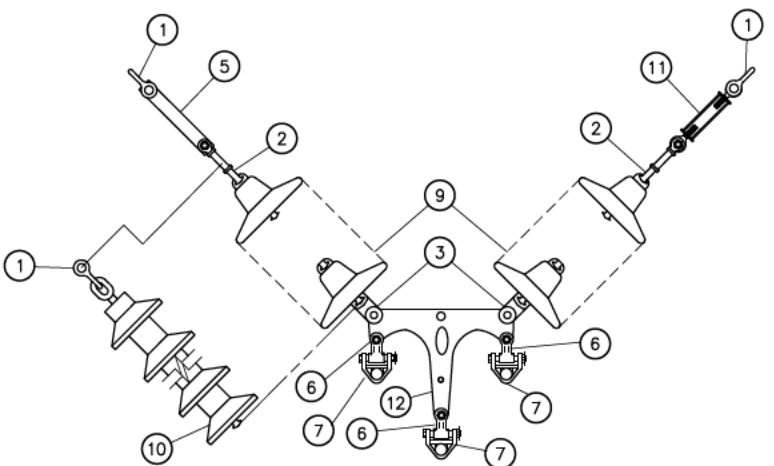
SV13-A



SV11-B



SV12-B



SV13-B

VEE STRING INSULATOR ASSEMBLIES
ULTIMATE INSULATOR ASSEMBLY STRENGTH AS SPECIFIED
(NOTE 2)

VEE STRING INSULATOR ASSEMBLIES
ULTIMATE INSULATOR ASSEMBLY STRENGTH AS SPECIFIED
(NOTE 2)

MATERIALS LIST	
ITEM NO.	DESCRIPTION
1	ANCHOR SHACKLE, BNK
2	HOT LINE Y-CLEVIS BALL, BNK
3	SOCKET Y-CLEVIS, BNK
4	YOKE PLATE
5	EXTENSION STRAP, EYE-EYE (LENGTH AS REQUIRED)
6	Y-CLEVIS EYE, 90°, BNK
7	SUSPENSION CLAMP, BNK
8	VERTICAL BUNDLE YOKE, 18" SPACING
9	INSULATOR STRING, PORCELAIN OR GLASS UNITS
10	INSULATOR STRING, COMPOSITE, OVAL EYE-BALL (LENGTH AS SPECIFIED)
11	TURNBUCKLE, OVAL EYE - OVAL EYE, LENGTH AS REQUIRED
12	YOKE PLATE, TRIPLE BUNDLE, 18" SPACING

NOTES

1. BNK INDICATES BOLT, NUT AND STAINLESS STEEL COTTER KEY REQUIRED.
2. STRENGTH OF HARDWARE COMPONENTS SHALL BE EQUAL TO OR GREATER THAN THE SPECIFIED INSULATOR ASSEMBLY ULTIMATE STRENGTH, EXCEPT THAT COMPONENTS DUPLICATED BELOW THE TRIANGULAR YOKE PLATE MAY HAVE 50% OF ASSEMBLY ULTIMATE STRENGTH FOR TYPE SV12 AND 33% OF ASSEMBLY ULTIMATE STRENGTH FOR THE TYPE SV13.

TABLE A - PORCELAIN OR GLASS UNITS			
VOLTAGE (KV)	UNIT QUANTITY/ASSEMBLY TYPE		
	STEEL STRUCTURES		
	SV11	SV12	SV13
69	12	12	12
115	18	18	18
138	20	20	20
161	22	22	22
230	28	28	28
345	36	36	36
500	62	62	62

INSULATOR ASSEMBLY TYPE NO.

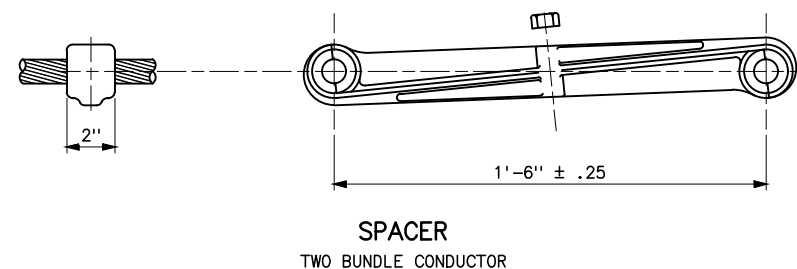
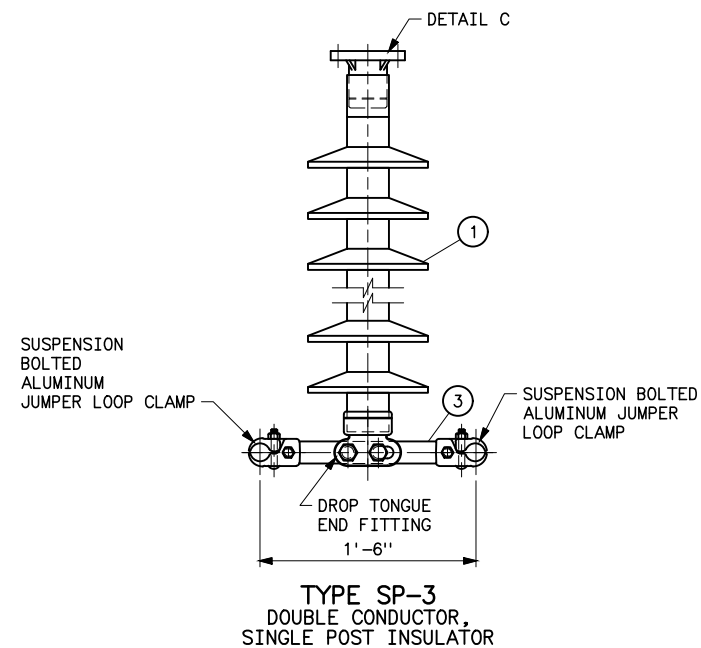
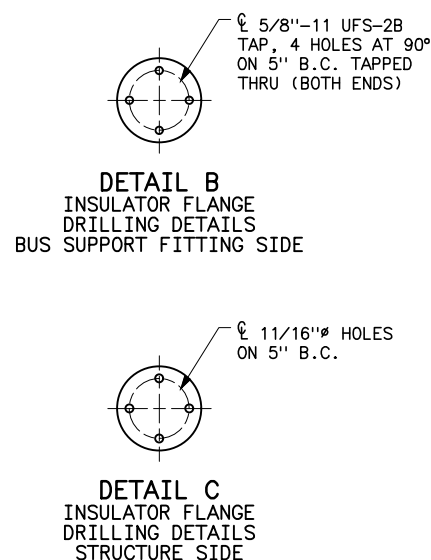
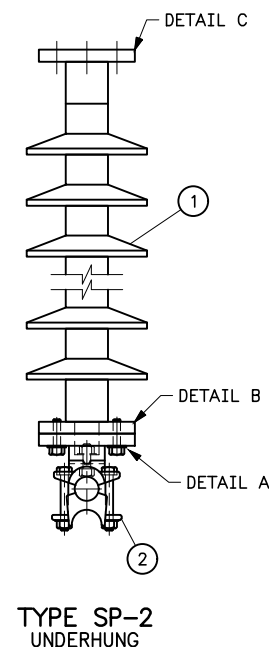
TYPE OF STRUCTURE ATTACHMENT
HARDWARE

EXAMPLE: SV13 - A

- ONE (1), TWO (2), OR (3) THREE SUBCONDUCTORS
- SINGLE (1) OR DOUBLE (2) INSULATOR STRING
- "VEE" STRING
- SUSPENSION ASSEMBLY

C	9-29-16 A7-RC	ADDED GLASS AND CHANGED POLYMER FIBERGLASS TO COMPOSITE.
B	9-14-06 A7-FSC	MODIFIED TITLE BLOCK, MATERIALS LIST, NOTES, TABLE A, AND ADDED TRIPLE BUNDLE ASSEMBLIES.
A	7-15-03 A7-RC	REVISED TITLE BLOCK ONLY.

UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
TRANSMISSION LINE STANDARDS SUSPENSION INSULATOR ASSEMBLIES VEE STRING, SINGLE STRING		
DESIGNED E.S. COOK _____ APPROVED ROSS CLARK _____ ELECTRICAL ENGINEERING MANAGER		
C/A	OCTOBER 10, 1997	41 1025



MATERIAL LIST	
ITEM NO.	DESCRIPTION
1	STATION POST INSULATOR, COMPOSITE, FLANGE END FITTING (BOTH ENDS)
2	HORIZONTAL BUS SUPPORT FITTING (ANDERSON ACS OR EQUAL)
3	YOKE/CLAMP ASSEMBLY

NOTES

1. SEE SPECIFICATION FOR INSULATOR ELECTRICAL AND MECHANICAL RATINGS.
2. WHERE TWO CONDUCTOR SPACERS ARE REQUIRED, THEY SHALL BE INSTALLED HALF-WAY BETWEEN THE JUMPER PADS AND THE JUMPER INSULATOR ASSEMBLY.

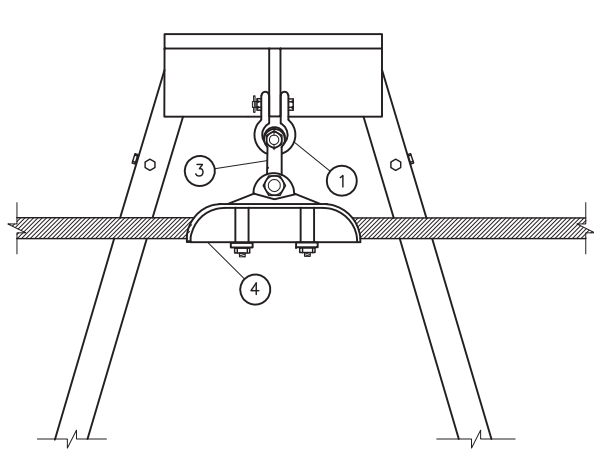
E	5-16-18 A7-CN	CHANGED SP-1 TO OVERHUNG DESCRIPTION.
D	1-19-18 A7-CN	ADDED DETAIL C FOR STRUCTURE ATTACHMENT.
C	9-29-16 A7-RC	DELETED REFERENCE TO POLYMER FIBERGLASS.
B	6-9-09 A7-MK	ADDED NEW ASSEMBLY AND SPACER.
A	7-15-03 A7-RC	REVISED TITLE BLOCK ONLY.

UNITED STATES DEPARTMENT OF ENERGY
WESTERN AREA POWER ADMINISTRATION
CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO

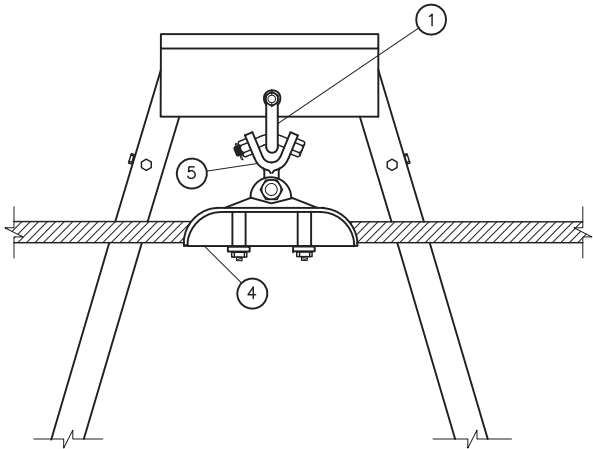
TRANSMISSION LINE STANDARDS
STATION POST
JUMPER INSULATOR ASSEMBLIES

DESIGNED F.S. COOK _____ APPROVED R.M. CLARK _____
ELECTRICAL ENGINEERING MANAGER

C_{AF}	APRIL 15, 2003	41	1033
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SUSPENSION ASSEMBLY OGW-SL
FOR ATTACHMENT PLATE AT RIGHT ANGLE TO OGW

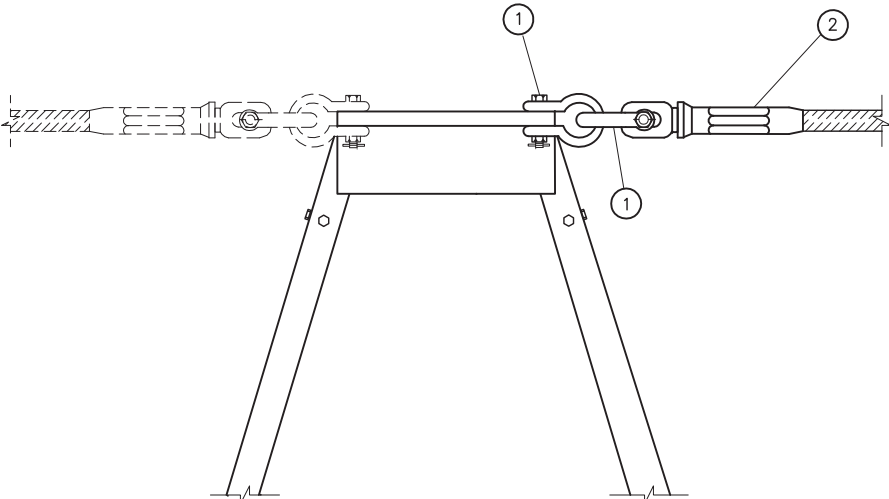


SUSPENSION ASSEMBLY OGW-SP
FOR ATTACHMENT PLATE IN PLANE OF OGW

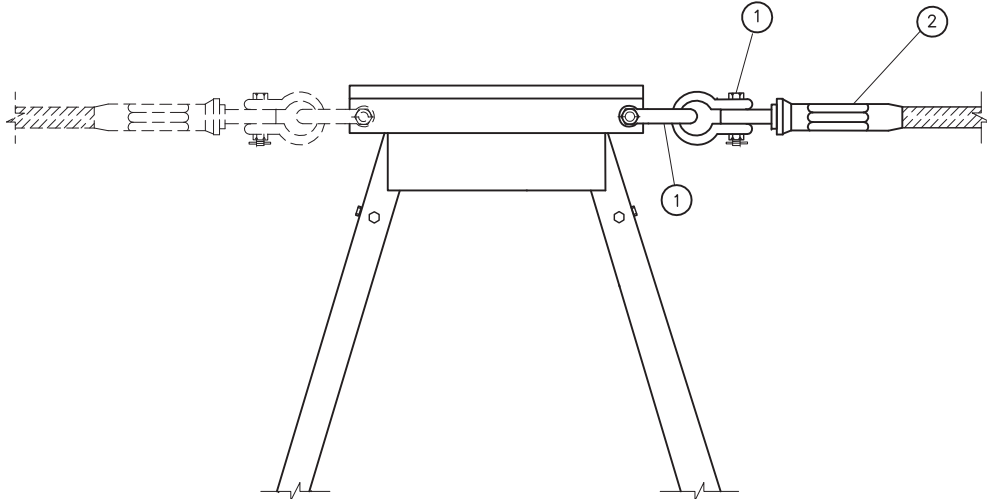
MATERIAL LIST					
ITEM NO.	OGW ASSEMBLY QUANTITY				DESCRIPTION
SL	SP	TV	TH		
1	1	1	2	2	ANCHOR SHACKLE, BNK
2			1	1	COMPRESSION DEADEND, EYE TYPE
3	1				Y-CLEVIS EYE, BNK
4	1	1			SUSPENSION CLAMP, BNK
5		1			Y-CLEVIS EYE 90°, BNK

NOTES

1. BNK INDICATES BOLT, NUT, AND STAINLESS STEEL
COTTER KEY REQUIRED.



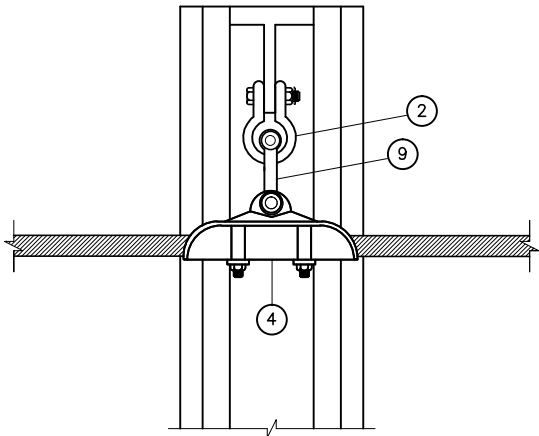
TENSION ASSEMBLY OGW-TV
FOR HORIZONTAL ATTACHMENT PLATE



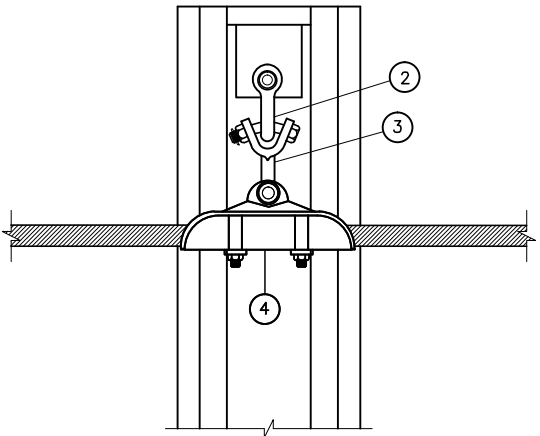
TENSION ASSEMBLY OGW-TH
FOR VERTICAL ATTACHMENT PLATE

C A7-FSC	7-6-04	REVISED TENSION ASSEMBLIES TO BE CONSISTENT WITH MATERIAL LIST QUANTITIES. ADDED QUANTITIES AND TYPE DESIGNATIONS.
	A7-FSC	
B	7-15-03	REVISED TITLE BLOCK ONLY.
	A7-RC	
A	5-17-95	REMOVED STRUCTURE GROUNDING
	A2-RMC	
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
TRANSMISSION LINE STANDARDS STEEL TOWERS OVERHEAD GROUND WIRE ASSEMBLY		
DESIGNED <u>SRR</u> APPROVED <u>ROSS M. CLARK</u> CHIEF, TRANSMISSION LINE ELECTRICAL BRANCH		
C A7-F	MARCH 9, 1993	41 1017

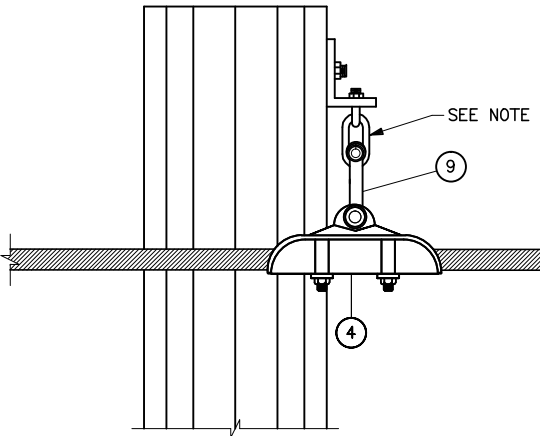
NOT TO SCALE



SUSPENSION ASSEMBLY OGW-SL
FOR ATTACHMENT HOLE IN-LINE WITH OGW



SUSPENSION ASSEMBLY OGW-SP
FOR ATTACHMENT HOLE PERPENDICULAR TO OGW

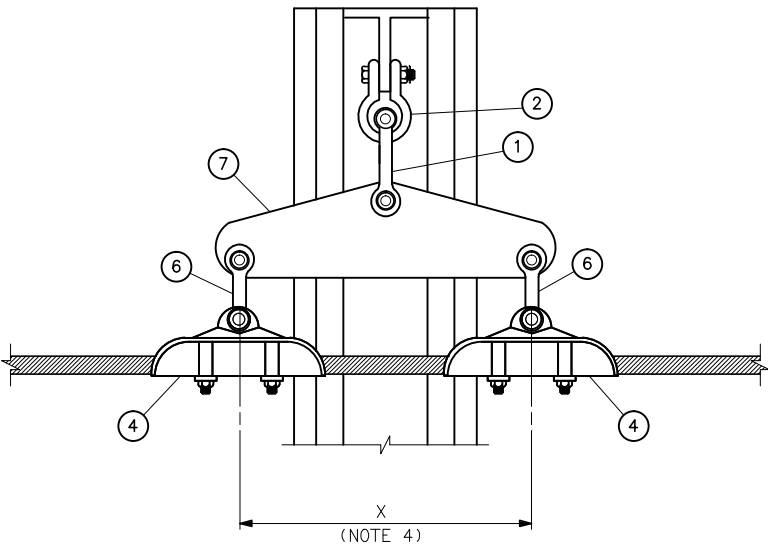


SUSPENSION ASSEMBLY OGW-SH
FOR ATTACHMENT TO STEEL ANGLE

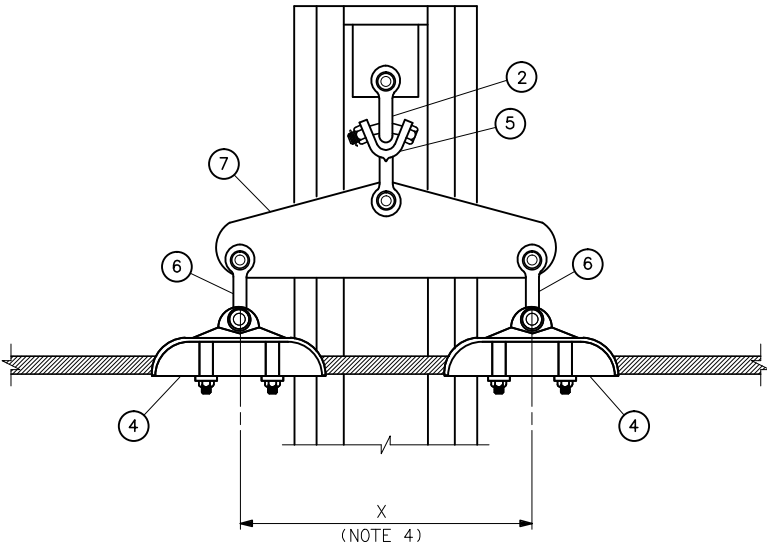
MATERIALS LIST									
ITEM NO.	OGW ASSEMBLY QUANTITY							DESCRIPTION	
	SL	SP	SH	SYL	SYP	TV	TH		
1				1				Y-CLEVIS CLEVIS, BNK	
2	1	1		1	1	2	2	ANCHOR SHACKLE, BNK	
3		1						Y-CLEVIS EYE 90°, BNK	
4	1	1	1	2	2			SUSPENSION CLAMP, BNK	
5					1			Y-CLEVIS CLEVIS 90°, BNK	
6				2	2			CLEVIS EYE, BNK	
7				1	1			YOKE PLATE	
8						1	1	COMPRESSION DEADEND, EYE TYPE	
9	1		1					Y-CLEVIS EYE, BNK	

NOTES

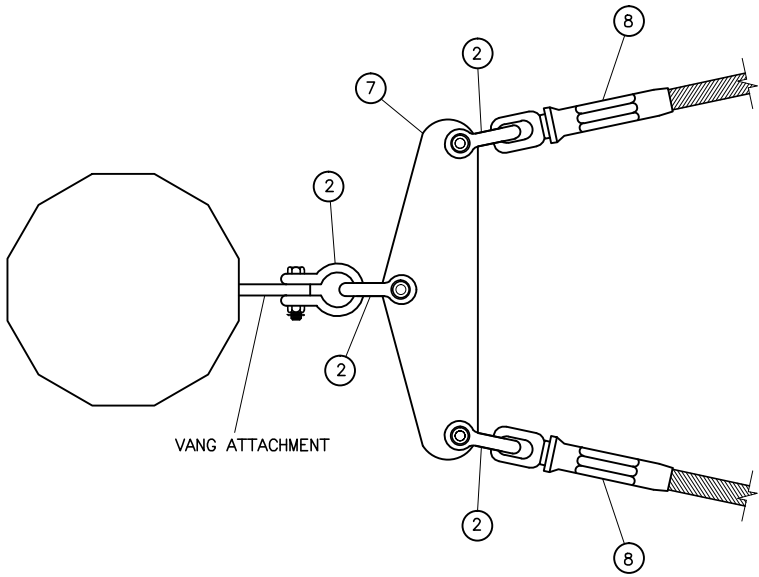
1. BNK INDICATES BOLT, NUT AND STAINLESS STEEL COTTER KEY REQUIRED.
2. SEE SPECIFICATIONS FOR STRENGTH RATING OF COUPLING HARDWARE.
3. ASSEMBLIES OGW-SYL AND OGW-SYP ARE USED FOR RUNNING ANGLES OF 30° TO 60°.
4. LENGTH OF SUSPENSION CLAMP PLUS 3 INCHES MINIMUM.
5. FURNISHED AS PART OF STRUCTURE.



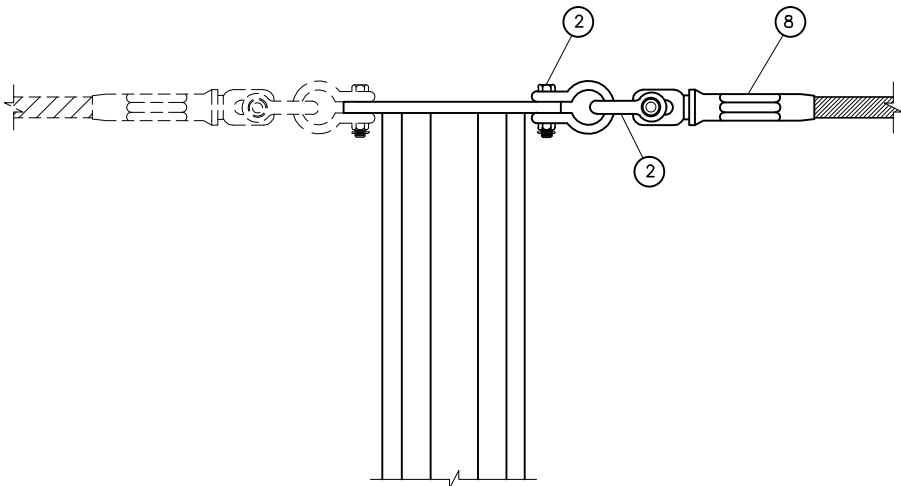
SUSPENSION ASSEMBLY OGW-SYL
FOR ATTACHMENT HOLE IN-LINE WITH OGW



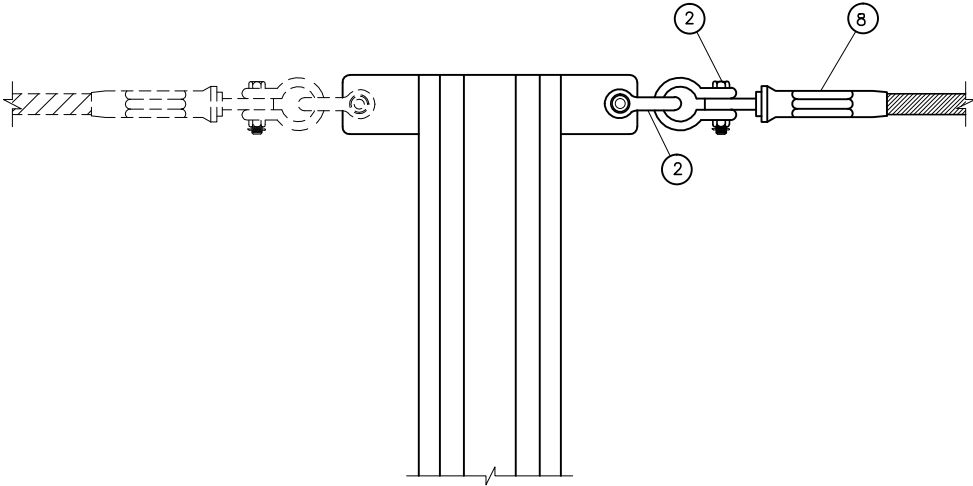
SUSPENSION ASSEMBLY OGW-SYP
FOR ATTACHMENT HOLE PERPENDICULAR TO OGW



TENSION ASSEMBLY OGW-TY
FOR HORIZONTAL ATTACHMENT HOLE
(OVERHEAD VIEW)



TENSION ASSEMBLY OGW-TV
FOR VERTICAL ATTACHMENT HOLE

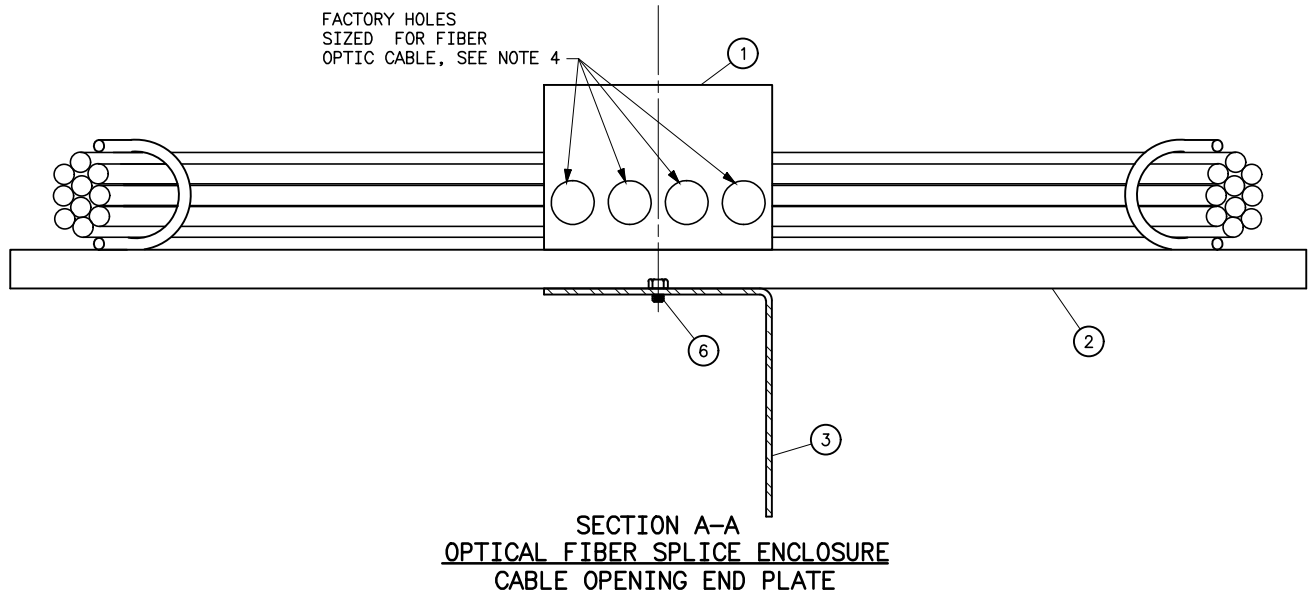
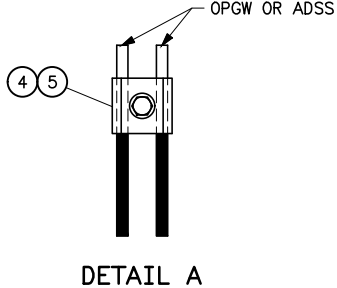
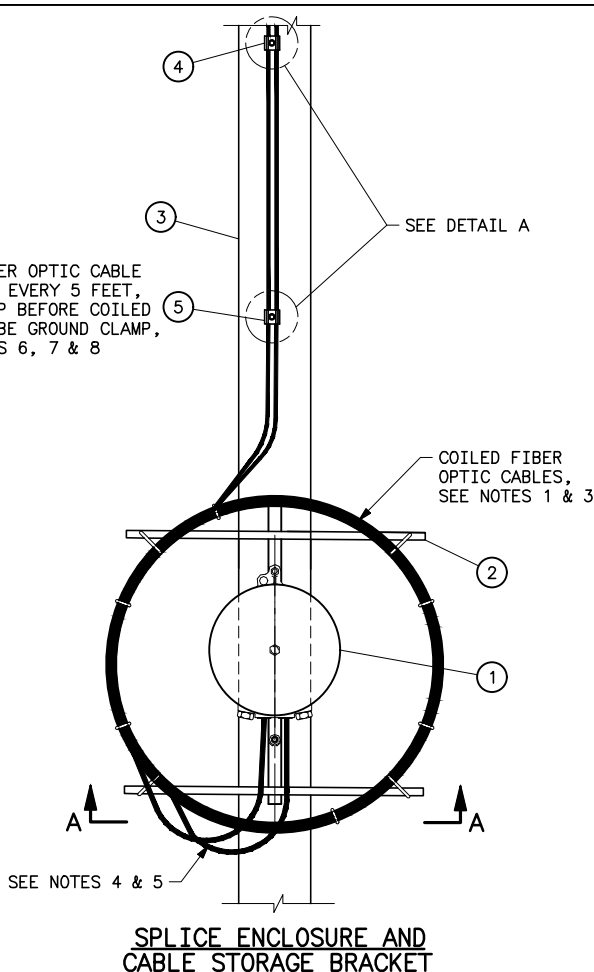
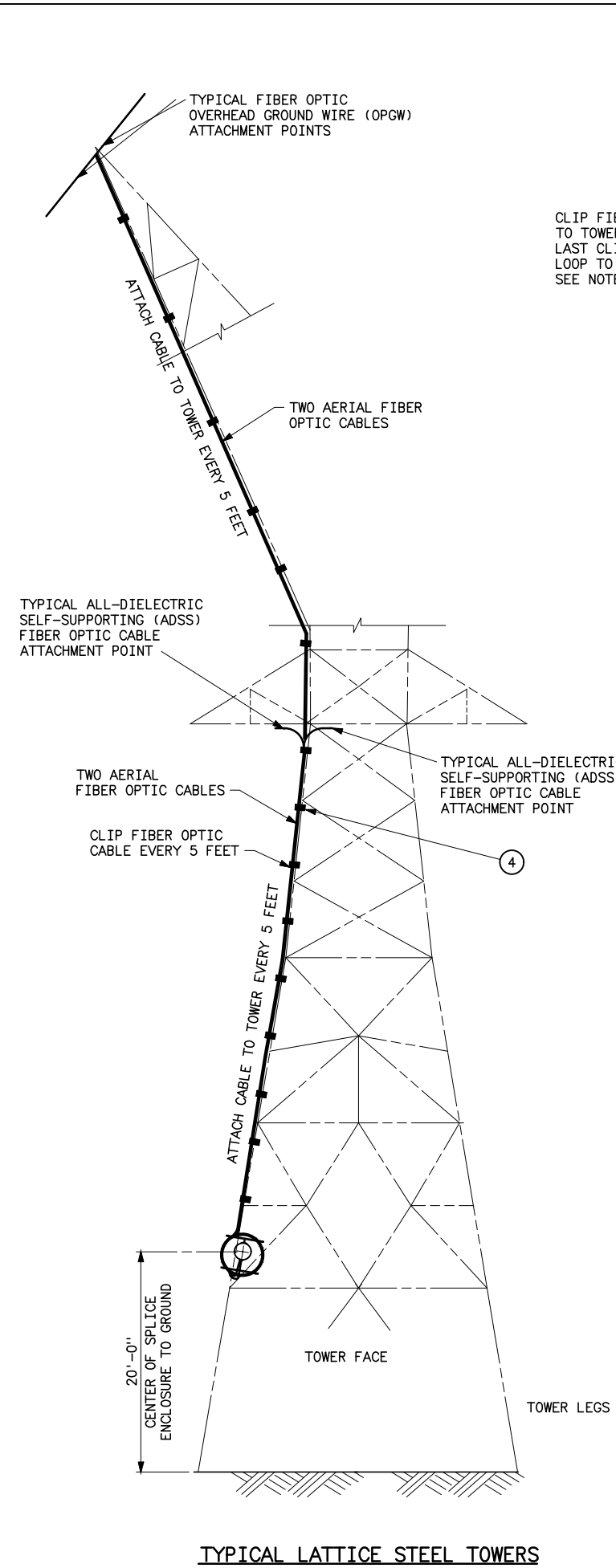


TENSION ASSEMBLY OGW-TH
FOR HORIZONTAL ATTACHMENT HOLE

NOT TO SCALE

C	7-15-03 A7-RC	REVISED TITLE BLOCK ONLY.
B	3-1-00 A3-RMC	MINOR CHANGES.
A	11-20-98 A3-RMC	ATTACHMENT TYPES OGW-SH AND OGW-TY WERE ADDED.
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
TRANSMISSION LINE STANDARDS STEEL AND CONCRETE POLE STRUCTURES OVERHEAD GROUND WIRE ASSEMBLY		
DESIGNED SRR _____ APPROVED ROSS W. CLARK CHIEF, TRANSMISSION LINE BRANCH		
A-F	NOVEMBER 14, 1995	41 1018

Plotted By: denton Jan 28, 2020 - 7:37am
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ITEM NO.	ITEM DESCRIPTION	PART NUMBER (OR EQUAL)	MANUFACTURER (OR EQUAL)	QUANTITY
1	FIBER OPTIC SPLICE ENCLOSURE	SB01	ACA (AFL)	1
2	3-PIECE EXTERNAL COIL BRACKET	CB-44-3AL	ACA (AFL)	1
3	TOWER LEG, STEEL ANGLE			1
4	DOWNLEAD CLAMP	SEE NOTE 7		AS REQD
5	GROUND BONDING CLAMP (ONE GROOVE SIZE)		ACA (AFL)	1
6	5/8" MACHINE BOLT W/NUT & LOCKNUT			2

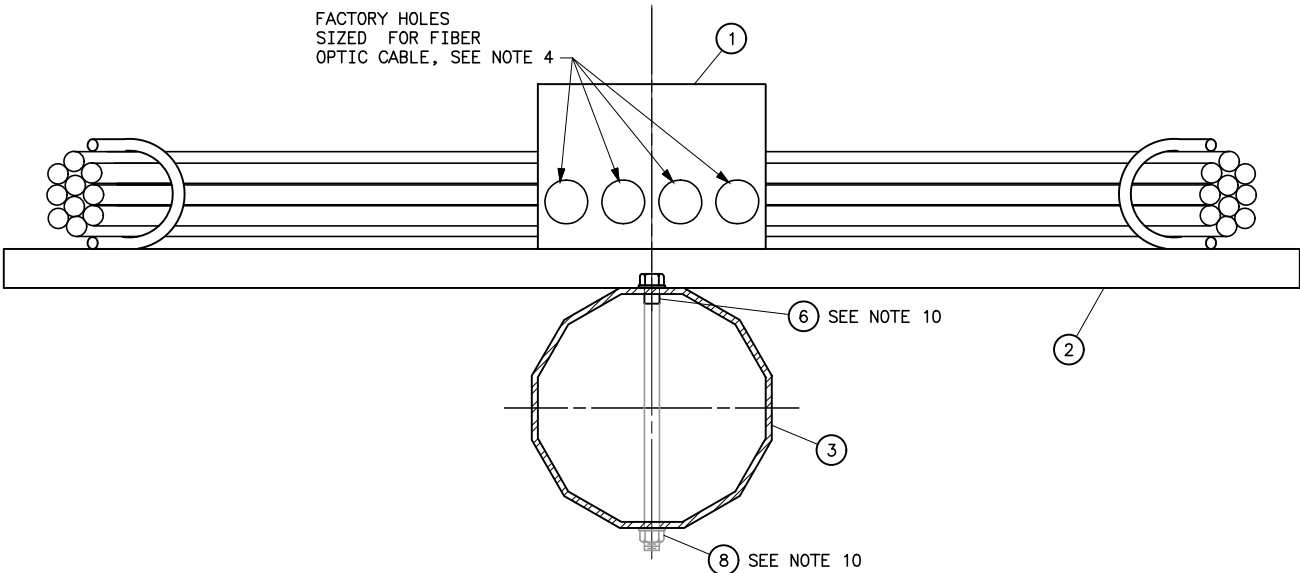
- NOTES**
- REMOVE 25 FEET OF CABLE DAMAGED DURING STRINGING OPERATIONS. THE AMOUNT OF SPARE CABLE TO BE COILED IS 60 FEET OF EACH CABLE, OR AS DIRECTED BY THE COR DUE TO ACCESS FOR THE SPLICE VAN. LENGTHS ARE MINIMUM.
 - PERMANENTLY ATTACH EXTERNAL COIL BRACKET TO TOWER USING 5/8" HARDWARE. SPRAY COLD GALVANIZING IN NEW HOLE TO PREVENT RUST.
 - FIBER CABLE COIL TO BE SECURED USING PANDUIT, STAINLESS STEEL, MLT-H SERIES CABLE TIES, OR EQUIVALENT. COIL TO BE SECURED WHERE CABLE ENTERS AND EXITS COIL.
 - FIBER OPTIC CABLE SHALL ENTER THE BOTTOM OF THE SPLICE ENCLOSURE WITH DRIP LOOPS AT THE BOTTOM ENTRANCE. UNUSED ENTRANCE HOLES SHALL BE SEALED WATERTIGHT.
 - DRIP LOOP MINIMUM BEND RADIUS SHALL NOT EXCEED MANUFACTURER'S SPECIFICATION.
 - THE OPGW SHALL BE SECURELY BONDED TO THE GROUND CLAMP AND THE GROUND CLAMP SECURELY BONDED TO THE STEEL STRUCTURE.
 - SEE DRAWING 41 1030 FOR FIBER OPTIC CABLE DOWNLEAD CLAMP AND BONDING CLAMP.
 - DRILL HOLE AND SECURE GROUND BONDING CLAMP TO STRUCTURE USING NUT AND LOCK WASHER. SPRAY COLD GALVANIZING IN NEW HOLE TO PREVENT RUST.

REFERENCE DRAWING
FIBER OPTIC CABLE MOUNTING
DOWNLEAD CLAMPS AND BANDS ----- 41 1030

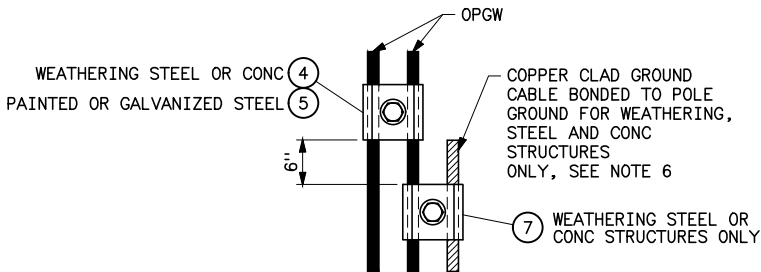
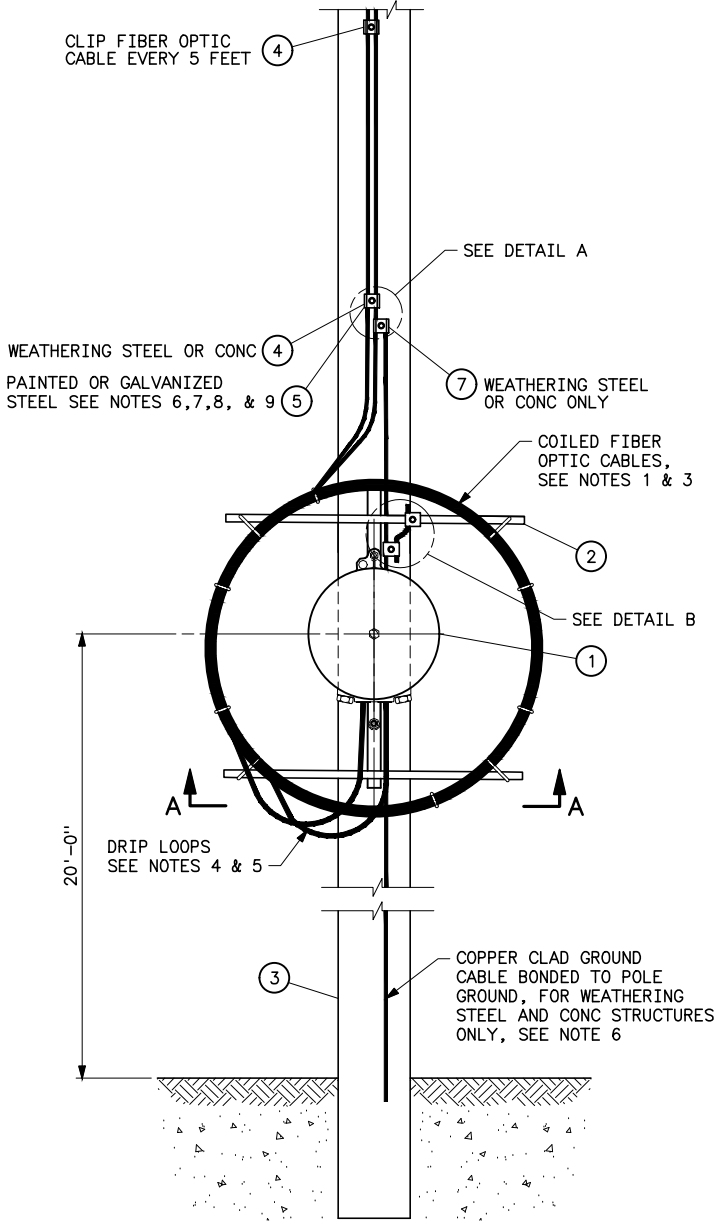
F	1-28-20 A7-SR	REMOVED DETAIL A AND RELABELED DETAIL B TO DETAIL A.
E	9-29-16 A7-JAM	GENERAL REVISIONS TO DRAWING, MATERIAL AND NOTES.
D	1-14-11 A7-JSR	REVISED NOTE 3.
C	5-15-09 A7-MK	REMOVED NOTE 10.
B	3-17-09 A7-RC	ADDED STEEL CHANNEL STRUT OPTION.
A	7-15-03 A7-RC	REVISED TITLE BLOCK ONLY.

UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO			
TRANSMISSION LINE STANDARDS LATTICE STEEL STRUCTURES FIBER OPTIC CABLE MOUNTING			
DESIGNED STEVE ROCK ----- APPROVED ROSS CLARK ELECTRICAL ENGINEERING MANAGER			
CAE	AUGUST 1, 2000	41	1027

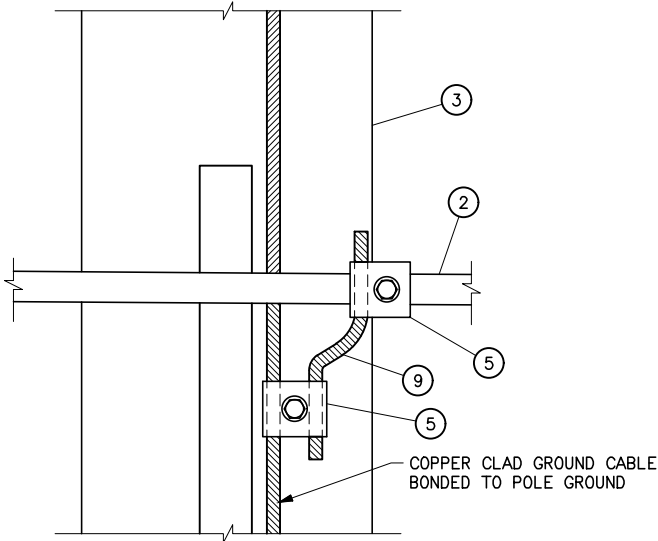
ITEM NO.	ITEM DESCRIPTION	PART NUMBER (OR EQUAL)	MANUFACTURER (OR EQUAL)	QUANTITY
1	FIBER OPTIC SPLICE ENCLOSURE	SB01	ACA (AFL)	1
2	3-PIECE EXTERNAL COIL BRACKET	CB-44-3AL	ACA (AFL)	1
3	CONCRETE OR STEEL POLE STRUCTURE			
4	STRUCTURE DOWNLEAD CLAMP	SEE NOTE 7	ACA (AFL)	AS REQD
5	GROUND BONDING CLAMP (ONE GROOVE SIZE)		ACA (AFL)	AS REQD
6	5/8" BOLT, LOCK WASHER			AS REQD
7	GROUND BONDING CLAMP (TWO GROOVE SIZES)		ACA (AFL)	AS REQD
8	5/8" THREADED ROD W/NUTS, SQUARE WASHERS & LOCKNUTS			AS REQD
9	NO. 2 AWG, 30% CONDUCTIVITY COPPER CLAD WIRE			AS REQD



SECTION A-A
OPTICAL FIBER SPLICE ENCLOSURE
CABLE OPENING END PLATE



DETAIL A
GROUND BONDING CLAMP



DETAIL B
COIL BRACKET GROUNDING FOR
WEATHERING STEEL AND CONC STRUCTURES

NOTES

1. REMOVE 25 FEET OF CABLE DAMAGED DURING STRINGING OPERATIONS. THE AMOUNT OF SPARE CABLE TO BE COILED IS 60 FEET OF EACH CABLE, OR AS DIRECTED BY THE COR DUE TO ACCESS FOR THE SPLICE VAN. LENGTHS ARE MINIMUM.
2. PERMANENTLY ATTACH EXTERNAL COIL BRACKET TO STRUCTURE USING 5/8" HARDWARE. ON STEEL POLES, SPRAY COLD GALVANIZING IN NEW HOLE TO PREVENT RUST.
3. FIBER CABLE COIL TO BE SECURED USING PANDUIT, STAINLESS STEEL, MLT-H SERIES CABLE TIES, OR EQUIVALENT. COIL TO BE SECURED WHERE CABLE ENTERS AND EXITS COIL.
4. FIBER OPTIC CABLE SHALL ENTER THE BOTTOM OF THE SPLICE ENCLOSURE WITH DRIP LOOPS AT THE BOTTOM ENTRANCE. UNUSED ENTRANCE HOLES SHALL BE SEALED WATERTIGHT.
5. DRIP LOOP MINIMUM BEND RADIUS SHALL NOT EXCEED MANUFACTURER'S SPECIFICATION.
6. THE OPGW AND COIL BRACKET SHALL BE SECURELY BONDED TO THE GROUND CLAMP AND THE GROUND CLAMP SECURELY BONDED TO THE STRUCTURE GROUND. FOR PAINTED AND GALVANIZED STEEL STRUCTURES, THE STRUCTURE STEEL IS THE STRUCTURE GROUND.
7. SEE DRAWING 41 1030 FOR FIBER OPTIC CABLE DOWNLEAD CLAMP AND BONDING CLAMP.
8. FOR CONCRETE POLES USE BANDING CLAMPS TO SECURE FIBER OPTIC CABLE AND COIL BRACKET TO THE POLE. SEE DRAWING 41 1030.
9. ON PAINTED OR GALVANIZED TUBULAR STEEL STRUCTURES, DRILL AND TAP HOLE FOR SECURING GROUND BONDING CLAMP TO STRUCTURE. SPRAY COLD GALVANIZING IN NEW HOLE TO PREVENT RUST.
10. SEE PROJECT SPECIFICATIONS FOR USE OF DRILLED AND TAPPED BOLT (ITEM 6) OR THRU BOLT (ITEM 8).

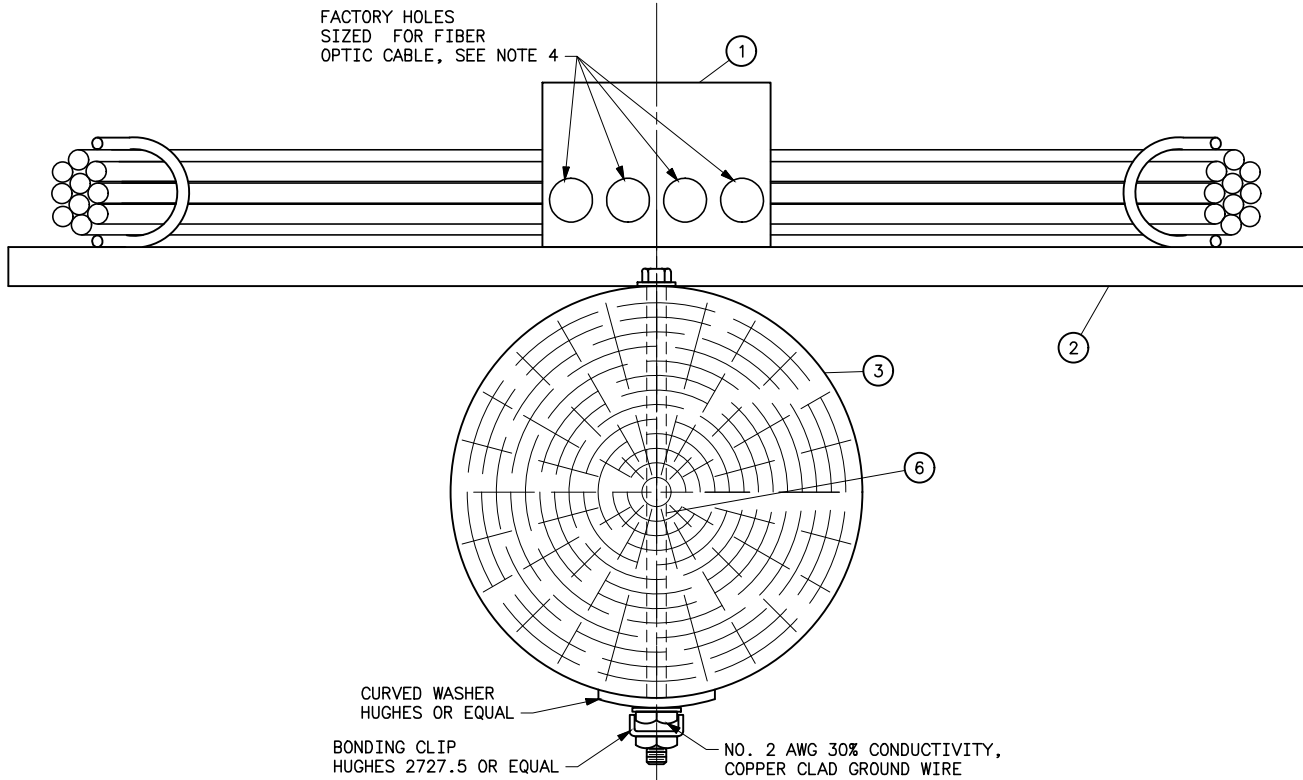
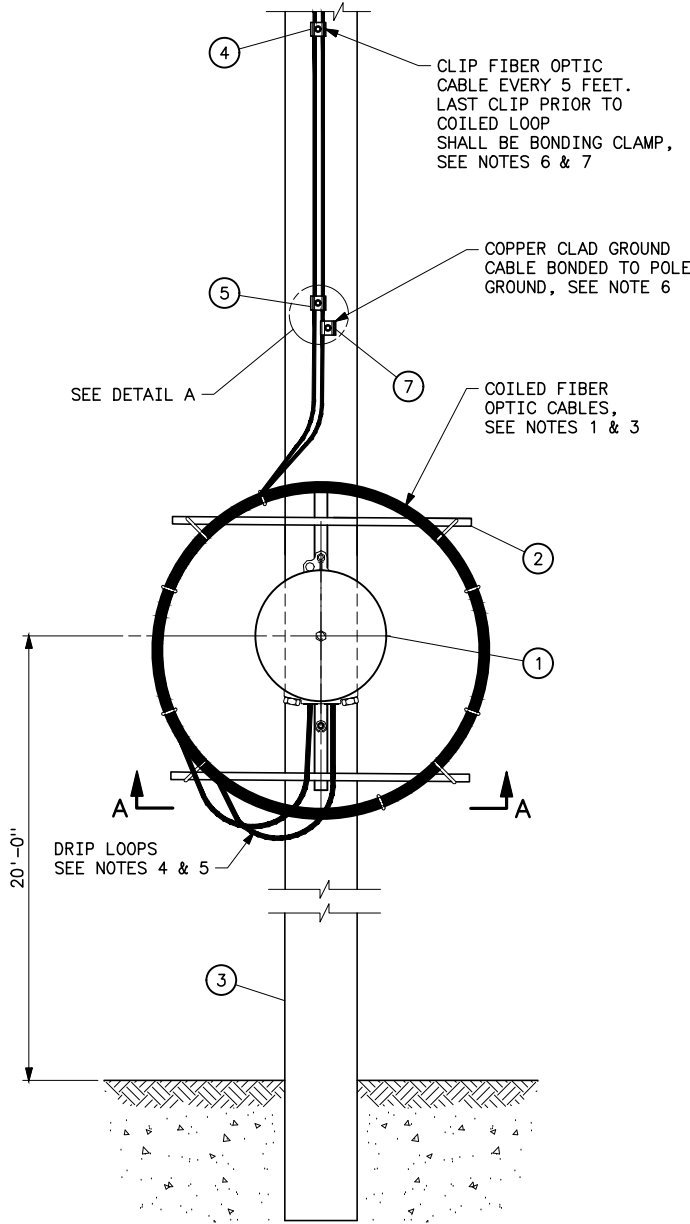
REFERENCE DRAWING

FIBER OPTIC CABLE MOUNTING
DOWNLEAD CLAMPS AND BANDS_41 1030

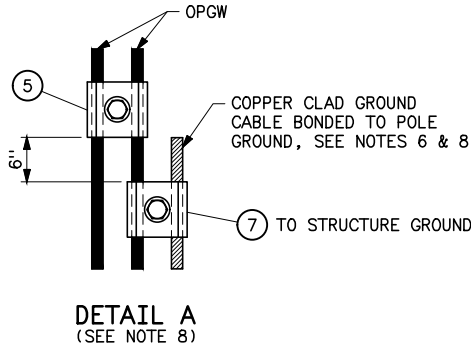
F	12-17-18 A7-CN	REVISED DETAILS AND NOTES.
E	9-29-16 A7-JAM	GENERAL REVISIONS TO DRAWING, MATERIAL AND NOTES.
D	1-14-11 A7-JSR	REVISED MATERIAL LIST
C	5-15-09 A7-MK	REVISED BONDING CLAMP & MATERIAL LIST
B	6-8-06 A7-RC	REVISED SPARE COIL QUANTITY, LOOP, AND ATTACHMENT TO STEEL POLE.

UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
TRANSMISSION LINE STANDARDS STEEL AND CONCRETE POLE STRUCTURES FIBER OPTIC CABLE MOUNTING		
DESIGNED STEVE ROCK	APPROVED ROSS CLARK ELECTRICAL ENGINEERING MANAGER	
C/AE	AUGUST 1, 2000	41 1028

ITEM NO.	ITEM DESCRIPTION	PART NUMBER (OR EQUAL)	MANUFACTURER (OR EQUAL)	QUANTITY
1	FIBER OPTIC SPLICE ENCLOSURE	SB01	ACA (AFL)	1
2	3-PIECE EXTERNAL COIL BRACKET	CB-44-3AL	ACA (AFL)	1
3	WOOD POLE STRUCTURE			1
4	DOWNLEAD CLAMP	SEE NOTE 7		AS REQD
5	GROUND BONDING CLAMP (ONE GROOVE SIZE)		ACA (AFL)	1
6	5/8" MACHINE BOLT W/NUT, SQUARE WASHER & LOCKNUT			2
7	GROUND BONDING CLAMP (TWO GROOVE SIZE)			1



SECTION A-A
OPTICAL FIBER SPLICE ENCLOSURE
CABLE OPENING END PLATE



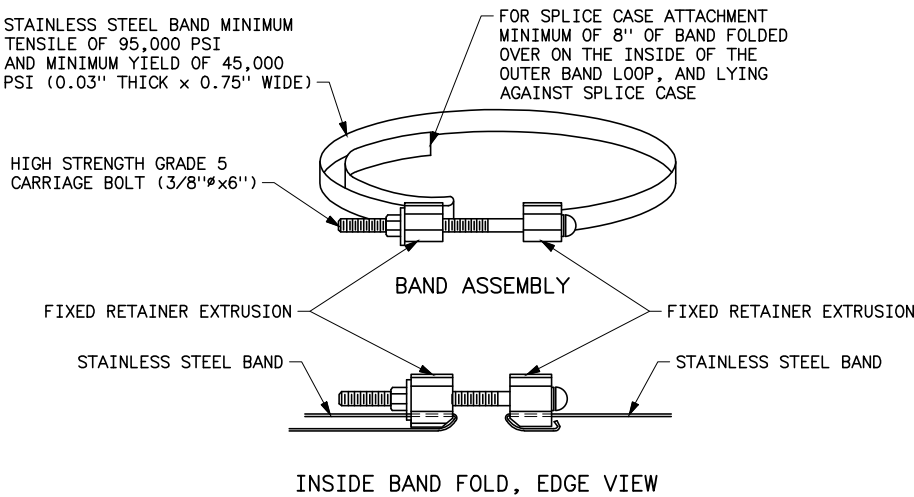
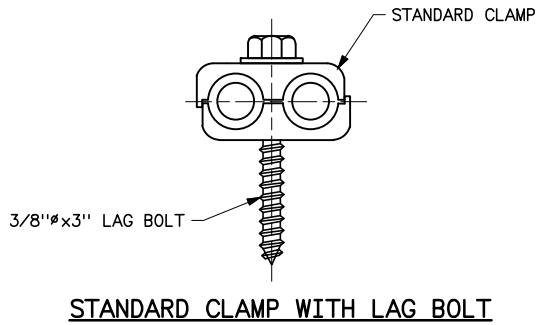
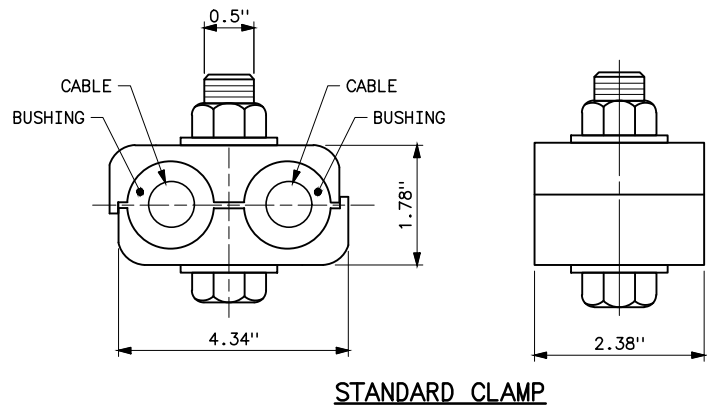
- NOTES**
- REMOVE 25 FEET OF CABLE DAMAGED DURING STRINGING OPERATIONS. THE AMOUNT OF SPARE CABLE TO BE COILED IS 60 FEET OF EACH CABLE, OR AS DIRECTED BY THE COR DUE TO ACCESS FOR THE SPLICE VAN.
 - PERMANENTLY ATTACH EXTERNAL COIL BRACKET TO STRUCTURE USING 5/8" HARDWARE.
 - FIBER CABLE COIL TO BE SECURED USING PANDUIT, STAINLESS STEEL, MLT-H SERIES CABLE TIES, OR EQUIVALENT. COIL TO BE SECURED WHERE CABLE ENTERS AND EXITS COIL.
 - FIBER OPTIC CABLE SHALL ENTER THE BOTTOM OF THE SPLICE ENCLOSURE WITH DRIP LOOPS AT THE BOTTOM ENTRANCE. UNUSED ENTRANCE HOLES SHALL BE SEALED WATERTIGHT.
 - DRIP LOOP MINIMUM BEND RADIUS SHALL NOT EXCEED MANUFACTURER'S SPECIFICATION.
 - THE OPGW SHALL BE SECURELY BONDED TO THE GROUND CLAMP AND THE GROUND CLAMP SECURELY BONDED TO THE STRUCTURE GROUND.
 - SEE DRAWING 41 1030 FOR FIBER OPTIC CABLE DOWNLEAD CLAMP AND BONDING CLAMP.
 - IF LAG BOLT IS USED TO SECURE GROUND BONDING CLAMP TO STRUCTURE, A SECOND GROUND CLAMP IS REQUIRED.

REFERENCE DRAWING

WOOD POLE GROUNDING DETAILS	41 1012
FIBER OPTIC CABLE MOUNTING	
DOWNLEAD CLAMPS AND BANDS	41 1030

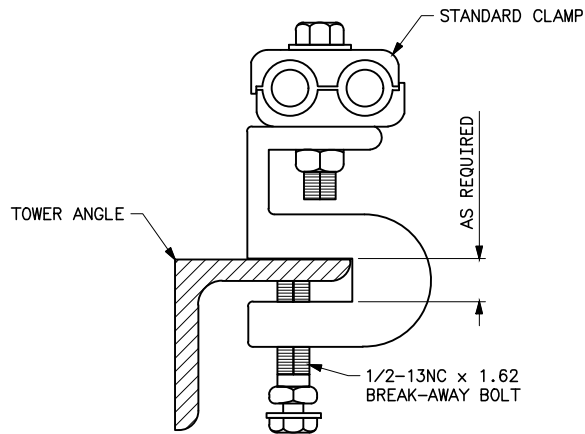
I	12-20-18 A7-SR	REVISED REFERENCE DRAWINGS LIST.
H	12-17-18 A7-SR	MINOR REVISIONS.
G	9-29-16 A7-JAM	GENERAL REVISIONS TO DRAWING, MATERIAL AND NOTES.
F	1-14-11 A7-JSR	REVISED NOTE 1 AND NOTE 7. REVISED TABLE NUMBERS AND ITEMS
E	5-15-09 A7-MK	REVISED BONDING CLAMP & MATERIAL LIST.
D	6-8-06 A7 - RC	REVISED SPARE COIL QUANTITY, LOOP, AND ATTACHMENT TO WOOD POLE.

UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
TRANSMISSION LINE STANDARDS WOOD POLE STRUCTURES FIBER OPTIC CABLE MOUNTING		
DESIGNED STEVE ROCK	APPROVED ROSS CLARK ELECTRICAL ENGINEERING MANAGER	
CAC	AUGUST 1, 2000	41 1029

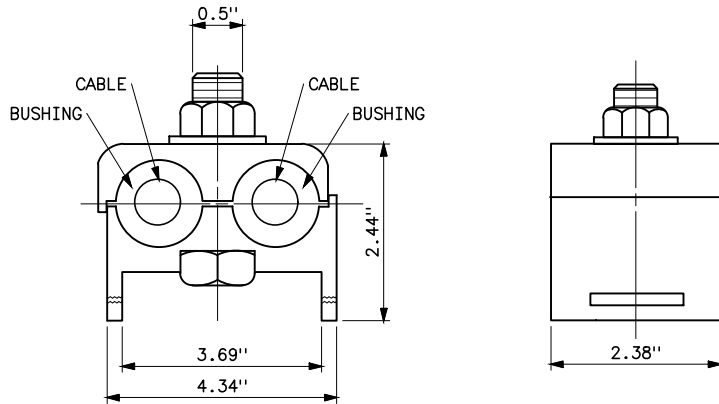


INSIDE BAND FOLD, EDGE VIEW

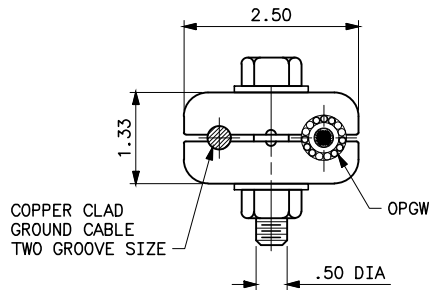
STAINLESS STEEL BAND



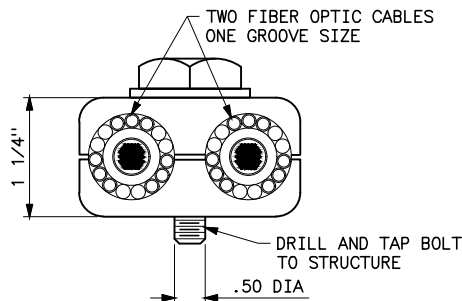
STANDARD CLAMP WITH ANGLE ATTACHMENT



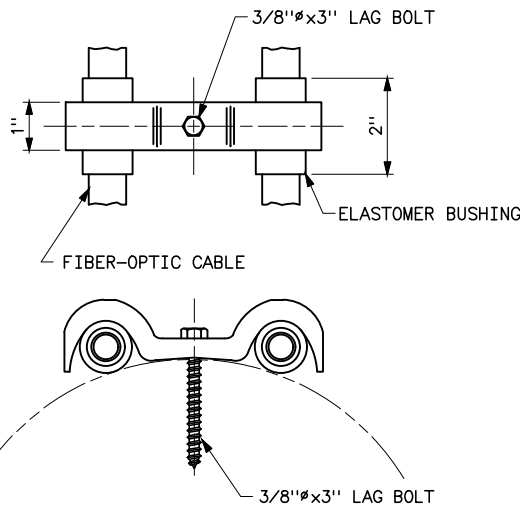
BANDING CLAMP
SECURE BANDING CLAMP TO
STRUCTURE USING 1/2" STAINLESS STEEL BANDING



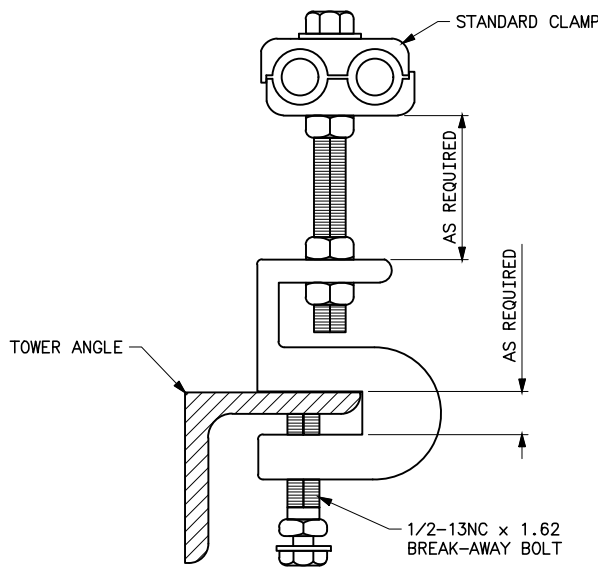
BONDING CLAMP FOR GROUNDING
WOOD, CONCRETE AND WEATHERING STEEL STRUCTURES



BONDING CLAMP FOR GROUNDING
GALVANIZED AND PAINTED STEEL STRUCTURES



DOWNLEAD CLAMP FOR WOOD POLE STRUCTURE



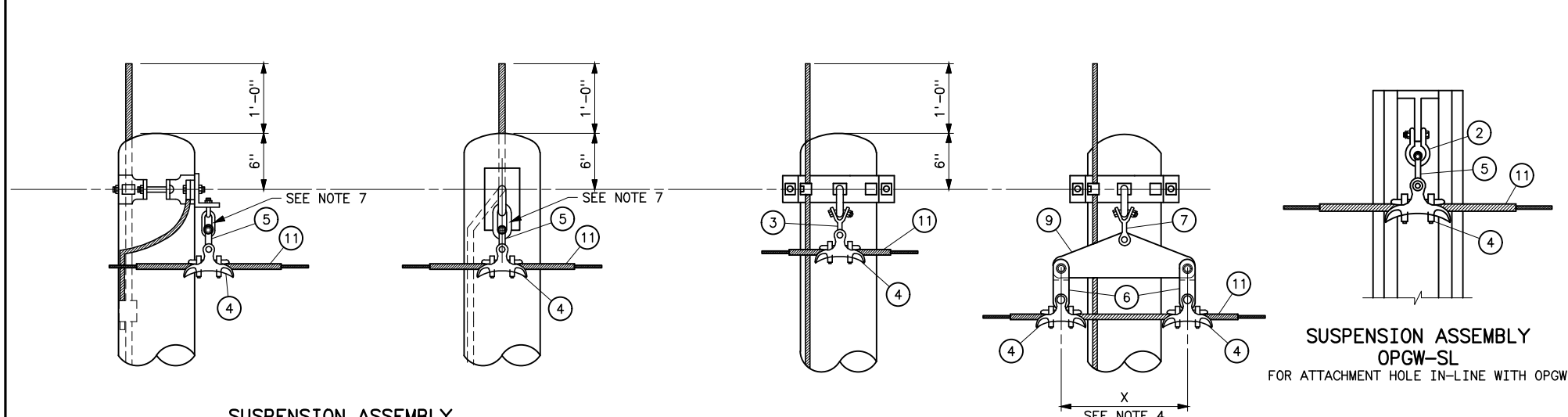
**STANDARD CLAMP WITH ANGLE ATTACHMENT
AND STANDOFF BOLT**

REFERENCE DRAWINGS

SUBSTATION STANDARDS FIBER OPTIC CABLE MOUNTING	31	1097
LATTICE STEEL STRUCTURES FIBER OPTIC CABLE MOUNTING	41	1027
STEEL AND CONCRETE POLE STRUCTURES FIBER OPTIC CABLE MOUNTING	41	1028
WOOD POLE STRUCTURES FIBER OPTIC CABLE MOUNTING	41	1029
FIBER OPTIC CABLE OVERHEAD TO UNDERGROUND TRANSITION	41	1035

F	12-17-18 A7-SR	ADDED STAINLESS STEEL BAND DETAIL AND BONDING CLAMP DETAIL SHOWING TWO FIBER OPTIC CABLES.
E	9-29-16 A7-JAM	GENERAL REVISIONS. REMOVED STAINLESS STEEL BAND FOR SECURING SPLICE ENCLOSURE.
D	4-7-11 A7-RC	ADDED STANDOFF BOLT OPTION.
C	5-15-09 A7-MK	REVISED BAND NOTE AND ADDED BONDING CLAMP.
B	01-31-05 A7-KKR	ADDED BONDING CLAMP FOR WOOD POLE STRUCTURE DETAIL.
A	07-15-03 A7-RC	REVISED TITLE BLOCK.

UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
TRANSMISSION LINE STANDARDS FIBER OPTIC CABLE MOUNTING DOWNLEAD CLAMPS AND BANDS		
DESIGNED STEVE ROCK	APPROVED ROSS CLARK ELECTRICAL ENGINEERING MANAGER	
C/AE	AUGUST 01, 2000	41 1030



SUSPENSION ASSEMBLY
OPGW-SA
FOR ATTACHMENT TO STEEL ANGLE
OR SUPPORT BRACKET

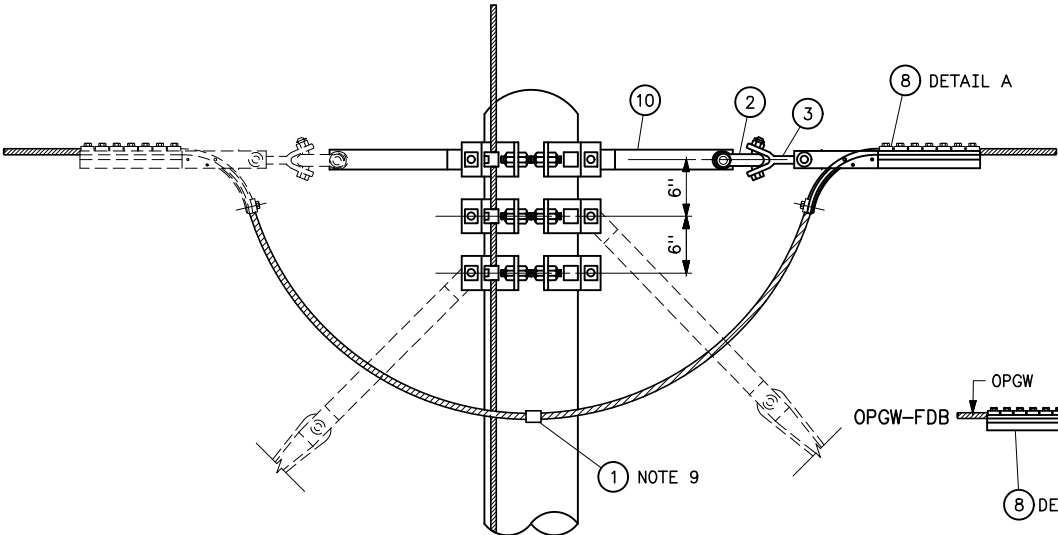
SUSPENSION ASSEMBLY
OPGW-PB
FOR ATTACHMENT TO POLE BAND

SUSPENSION ASSEMBLY
OPGW-PBY
FOR ATTACHMENT HOLE IN-LINE WITH OPGW

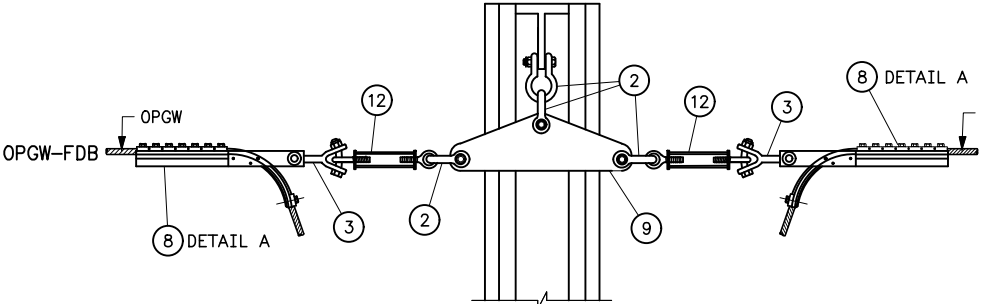
SUSPENSION ASSEMBLY
OPGW-SL
FOR ATTACHMENT HOLE IN-LINE WITH OPGW

SUSPENSION ASSEMBLY OPGW-SP
FOR ATTACHMENT HOLE PERPENDICULAR TO OPGW

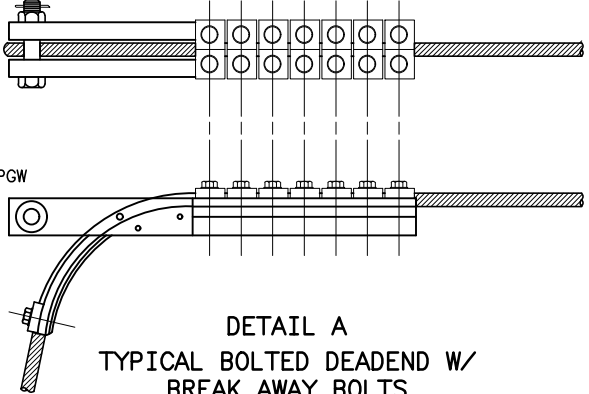
SUSPENSION ASSEMBLY OPGW-SYL
FOR ATTACHMENT HOLE IN-LINE WITH OPGW



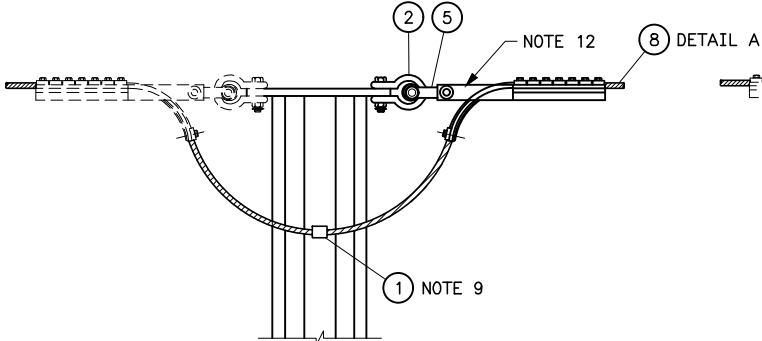
TENSION ASSEMBLY
OPGW-TW
FOR ATTACHMENT TO EXTENSION LINK,
EACH WAY



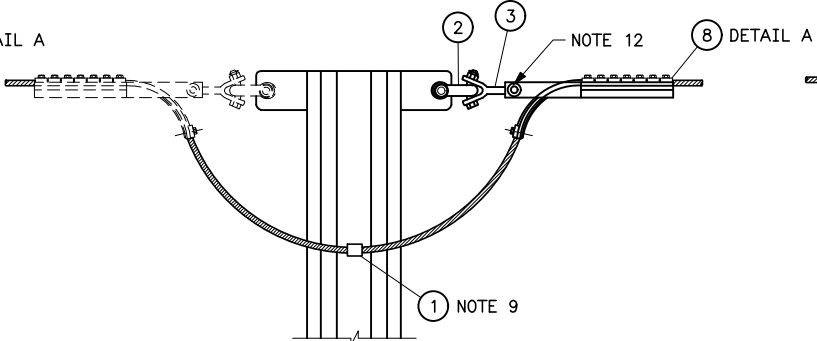
FLOATING DEADEND ASSEMBLIES
FOR ATTACHMENT HOLE IN-LINE WITH OPGW AND OGW



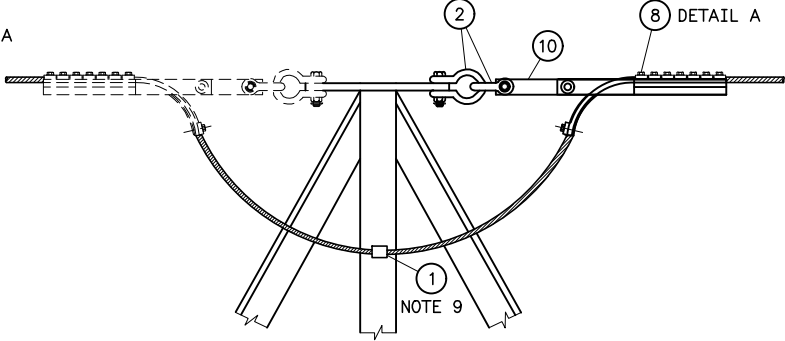
DETAIL A
TYPICAL BOLTED DEADEND W/
BREAK AWAY BOLTS



TENSION ASSEMBLY
OPGW-TV
FOR VERTICAL ATTACHMENT HOLE
(NOTE 14)



TENSION ASSEMBLY
OPGW-TH
FOR HORIZONTAL ATTACHMENT HOLE



TENSION ASSEMBLY
OPGW-TLV
FOR VERTICAL ATTACHMENT HOLE ON
LATTICE TYPE TOWERS

MATERIAL LIST													
ITEM NO.	OPGW ASSEMBLY QUANTITY											DESCRIPTION	
	SA	PB	PBY	SL	SP	SYL	TW	TV	TH	TLV	FDB		
1							NOTE 9						GUIDE CLAMP
2				1	1	2	1	1	1	2	4✖		ANCHOR SHACKLE, BNK
3		1			1		1		1		2✖		Y-CLEVIS EYE 90°, BNK (NOTE 13)
4	1	1	2	1	1	2							SUSPENSION CLAMP, BNK (NOTE 13)
5	1			1				1					Y-CLEVIS EYE, BNK (NOTE 13)
6			2			2							CLEVIS EYE, BNK
7			1										Y-CLEVIS CLEVIS 90°, BNK
8							1	1	1	1	2		OPGW DEADEND, BNK
9			1			1					1		YOKE PLATE
10							1			1	2✖		CONNECTING LINK
11	1	1	1	1	1	1							ARMOR ROD
12											2✖		OVAL EYE-OVAL EYE TURNBUCKLE (16"

* QUANTITY DEPENDS UPON HARDWARE OPTION THAT WILL BE USED.

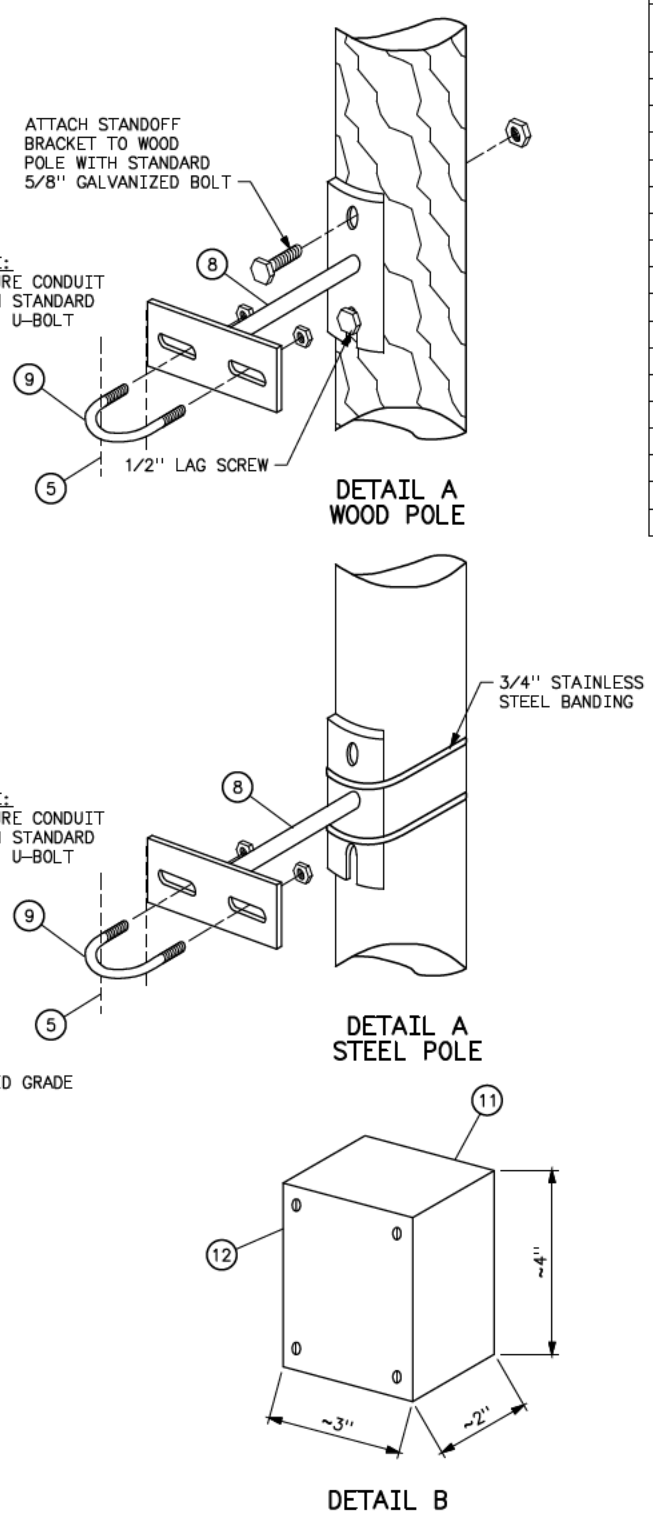
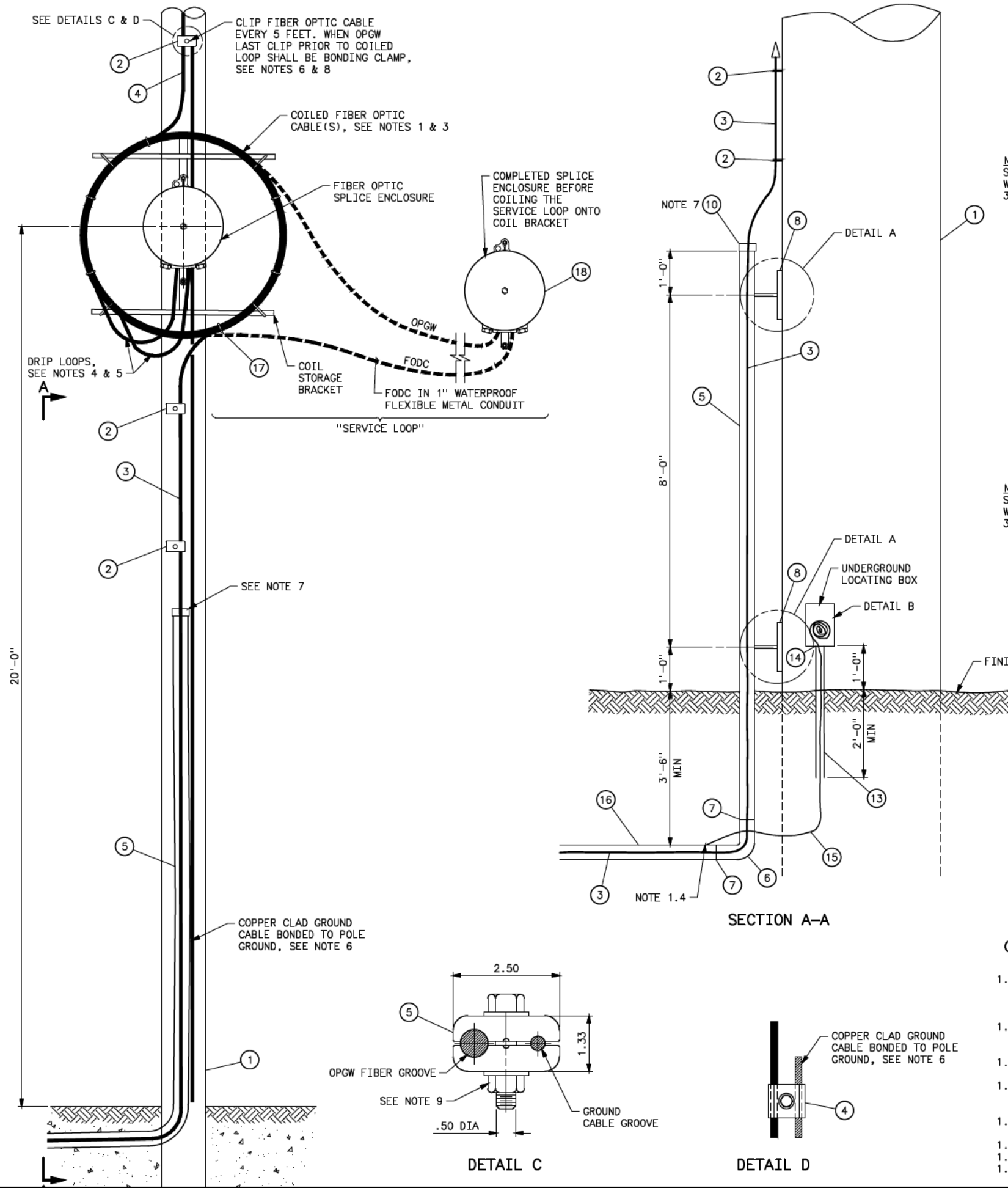
NOTES

- BNK INDICATE BOLT, NUT AND STAINLESS STEEL COTTER KEY REQUIRED.
- SEE SPECIFICATIONS FOR STRENGTH RATING OF COUPLING HARDWARE.
- ASSEMBLIES OPGW-PBY AND OPGW-SYL SHALL BE USED FOR LINE ANGLES OF 30° TO 60°.
- LENGTH OF SUSPENSION CLAMP PLUS 3 INCHES MINIMUM.
- OPGW REFERS TO THE OPTICAL GROUND WIRE.
- GROUNDING OF THE OPGW ATTACHMENT ASSEMBLIES SHALL BE IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS.
- CHAIN LINK FURNISHED AS PART OF THE STRUCTURE FOR NEW CONSTRUCTION.
- THE SHACKLE TO Y-CLEVIS CONNECTION IS REQUIRED TO PROVIDE 360° MOVEMENT.
- PREVENT THE OPGW FROM CLASHING WITH ALL POLES AND TOWERS BY PROVIDING SUFFICIENT NUMBER OF GUIDE CLAMPS TO ATTACH THE LOOP TO THE STRUCTURE OR BY LOOPING THE CABLE OVER THE TOP OR AROUND THE SIDES OF POLES.
- ANY PROPOSED CHANGE OF HARDWARE SHALL REQUIRE THE CONTRACTOR TO RECEIVE APPROVAL FROM ENGINEERING PRIOR TO THE CHANGE.
- HARDWARE SHALL HAVE MINIMUM RATED STRENGTH OF 17,000 LBS.
- ADD 9-INCH CONNECTING LINK FOR USE WITH DEAD-END TEES.
- SIZE WIDTH OF EYE ON Y-CLEVIS TO FIT BETWEEN EARS OF SUSPENSION CLAMP.
- USE OPGW-TV FOR GLUED LAMINATED WOOD TENSION STRUCTURES WITH LINE ANGLES GREATER THAN 1°.

G	8-16-22 A7-CN	ADDED ARMOR ROD. REMOVED FDA ASSEMBLY.
F	4-19-11 A7-KKR	ADDED SUPPORT BRACKET ASSEMBLY. ADDED NOTES 12, 13 AND 14.
E	9-20-10 A7-RC	ADDED BNK TO ITEM 8.
D	5-15-09 A7-MK	REVISED FLOATING DEADEND AND NOTE 9.
C	7-2-04 A7-FSC	REVISED TURNBUCKLE FITTINGS, NOTE 7 AND ADDED OPGW-SP
B	7-15-03 A7-RC	REVISED TITLE BLOCK ONLY.
A	7-1-02 A79-JGW	MINOR REVISIONS.

UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO			
TRANSMISSION LINE STANDARDS			
OPTICAL GROUND WIRE ASSEMBLIES			
DESIGNED <u>JEFF WILD</u>		APPROVED <u>ROSS CLARK</u> ELECTRICAL ENGINEERING MANAGER	
A	MARCH 1, 2000	41	1031

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IMAGES:



- GUIDELINES FOR THE INSTALLATION OF THE UNDERGROUND LOCATING BOX**
- 1.1 INSTALL 3'-0" OF 1/2" PVC CONDUIT UP THE BASE OF THE POLE TO 12" (1'-0") ABOVE THE GROUND LINE. ATTACH PVC CONDUIT TO THE POLE WITH 1/2" EMT STRAP.
 - 1.2 ATTACH WEATHERPROOF PVC ELECTRICAL BOX TO TOP OF CONDUIT WITH PVC CONNECTOR AND TO THE POLE NEXT TO THE RISER.
 - 1.3 PLACE TRACER WIRE IN 1/2" PVC CONDUIT AND ELECTRICAL BOX.
 - 1.4 BOND TRACER WIRE TO TONEABLE DUCT TRACER WIRE. PROTECT CONNECTION FROM MOISTURE USING HEAT-SHRINK.
 - 1.5 STRIP THE END OF THE TRACER WIRE BACK ONE INCH (1"), AND COVER W/WIRE NUT.
 - 1.6 COIL THE TRACER WIRE IN THE ELECTRICAL BOX.
 - 1.7 PLACE WATERPROOF COVER ON ELECTRICAL BOX.
 - 1.8 LABEL THE COVER.

MATERIAL LIST		
ITEM NO.	ITEM DESCRIPTION	QUANTITY
1	WOOD, STEEL OR CONCRETE POLE STRUCTURE	
2	STRUCTURE DOWNLOAD CLAMP (5'-0" SPACING)	AS REQD
3	FODC IN WATERPROOF METALLIC CONDUIT	
4	AERIAL FIBER CABLE	
5	RIGID CONDUIT RISER, 10'-0"	1 EA
6	90° SWEEP-RIGID	1 EA
7	TRANSITION COUPLER	2 EA
8	6" STANDOFF BRACKET	2 EA
9	3/8" U-BOLT w/ 2 LOCKWASHERS & 2 NUTS	2 EA
10	WATER TIGHT ADAPTER AND REDUCER	AS REQD
11	WEATHERPROOF PVC ELECTRICAL UTILITY BOX	1 EA
12	WEATHERPROOF PVC BLANK ELECTRICAL BOXCOVER	1 EA
13	1/2" PVC CONDUIT	3 LF
14	1/2" - PVC CONNECTOR	1 EA
15	14ga THHN WIRE	LF
16	TONEABLE HDPE CONDUIT	
17	PANDUIT STAINLESS STEEL TIES	6 EA
18	FIBER OPTIC SPLICE ENCLOSURE (AFL-SB01)	1 EA

- NOTES**
1. REMOVE 25 FEET OF CABLE DAMAGED DURING STRINGING OPERATIONS. THE AMOUNT OF SPARE CABLE TO BE COILED IS 60 FEET OF EACH CABLE, OR AS DIRECTED BY THE COR DUE TO ACCESS FOR THE SPLICE VAN. LENGTHS ARE MINIMUM.
 2. PERMANENTLY ATTACH EXTERNAL COIL BRACKET TO STRUCTURE USING 5/8" HARDWARE. ON STEEL POLES, SPRAY GALVANOX IN NEW HOLE TO PREVENT RUST. FOR CONCRETE POLES USE CARE TO NOT CUT STEEL STRANDING MEMBERS WHEN DRILLING POLE.
 3. FIBER CABLE COIL TO BE SECURED USING PANDUIT, STAINLESS STEEL, MLT-H SERIES CABLE TIES, OR EQUIVALENT. COIL TO BE SECURED WHERE CABLE ENTERS AND EXITS COIL.
 4. FIBER OPTIC CABLE SHALL ENTER THE BOTTOM OF THE SPLICE ENCLOSURE WITH DRIP LOOPS AT THE BOTTOM ENTRANCE. UNUSED ENTRANCE HOLES SHALL BE SEALED WATERTIGHT.
 5. DRIP LOOP MINIMUM BEND RADIUS SHALL NOT EXCEED MANUFACTURER'S SPECIFICATION.
 6. THE OPGW SHALL BE SECURELY BONDED TO THE GROUND CLAMP AND THE GROUND CLAMP SECURELY BONDED TO THE STRUCTURE GROUND.
 7. WATERPROOF ADAPTOR AND REDUCER CONNECTOR ARE REQUIRED TO CONNECT THE 2 INCH RIGID CONDUIT TO THE 1 INCH FLEXIBLE WATERPROOF METALLIC CONDUIT.
 8. SEE DRAWING 41 1030 FOR FIBER OPTIC CABLE DOWNLOAD CLAMP AND BONDING CLAMP. BANDING CLAMP CAN BE USED IN PLACE OF STANDARD CLAMP UPON APPROVAL BY THE COR.
 9. ON WOOD POLES, USE LAG SCREW TO SECURE GROUND BONDING CLAMP TO STRUCTURE. ON TUBULAR STRUCTURES, DRILL AND TAP HOLE FOR SECURING GROUND BONDING CLAMP TO STRUCTURE. ON LATTICE STRUCTURES, DRILL HOLE AND SECURE GROUND BONDING CLAMP TO STRUCTURE USING NUT AND LOCK WASHER. SPRAY GALVANOX IN NEW HOLE TO PREVENT RUST.
 10. ORIENTATE 90° RIGID SWEEP TO MATE WITH THE TONEABLE DUCT.

THIS APPLICATION IS FOR USE ONLY OUT ON THE LINE, AND IS NOT TO BE USED FOR TAKING UNDERGROUND FIBER INTO A SUBSTATION

REFERENCE DRAWINGS

TRANSMISSION LINE STANDARDS STEEL AND CONCRETE POLE STRUCTURES FIBER OPTIC CABLE MOUNTING	41 1028
TRANSMISSION LINE STANDARDS WOOD POLE STRUCTURES FIBER OPTIC MOUNTING	41 1029
TRANSMISSION LINE STANDARDS FIBER OPTIC CABLE MOUNTING DOWNLOAD CLAMPS AND BANDS	41 1030

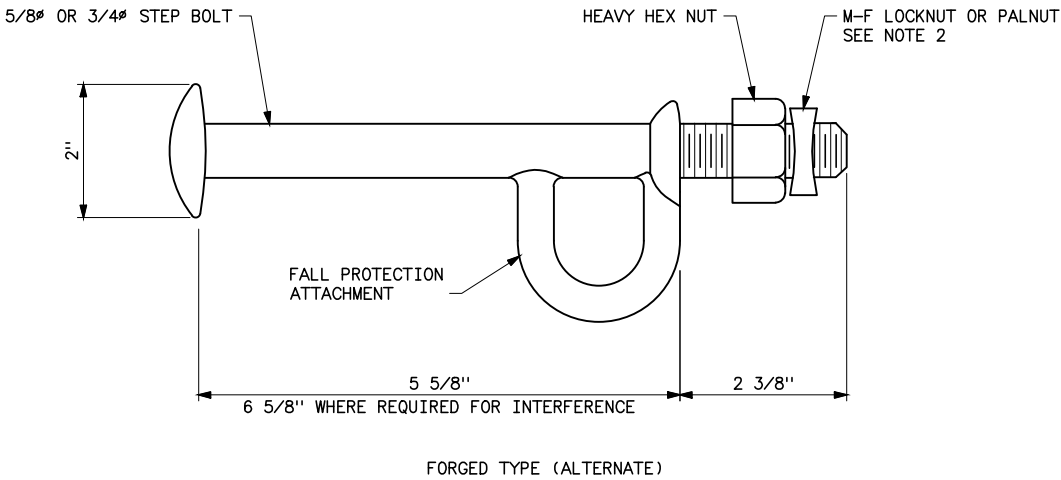
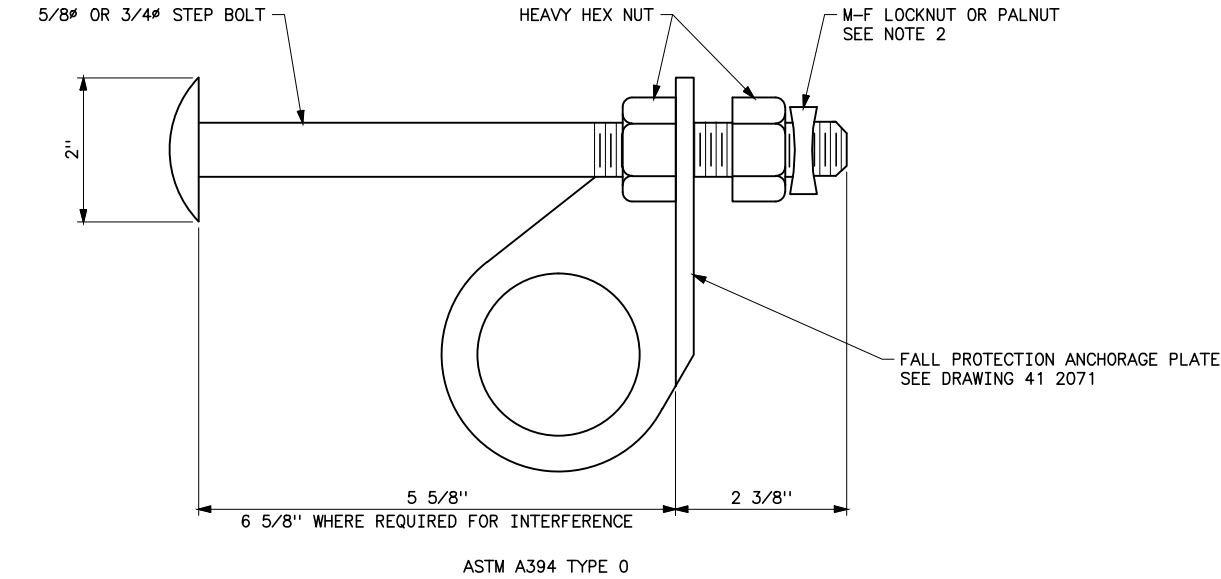
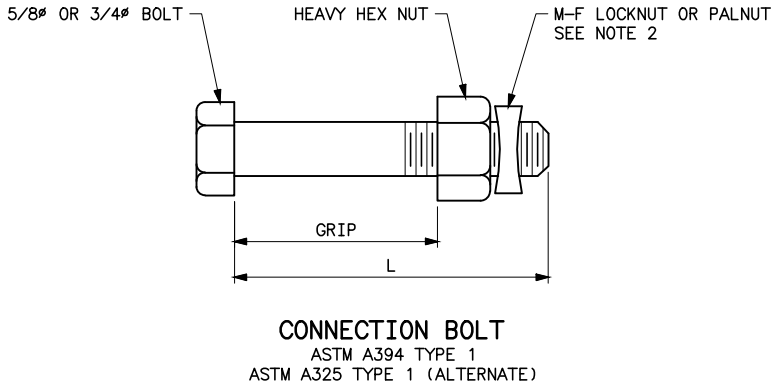
UNITED STATES DEPARTMENT OF ENERGY
WESTERN AREA POWER ADMINISTRATION
HEADQUARTERS - LAKEWOOD, COLORADO

**TRANSMISSION LINE STANDARDS
FIBER OPTIC CABLE
OVERHEAD TO UNDERGROUND TRANSITION**

DESIGNED JEFFREY A. MILLER, P.E. APPROVED STEVEN ROCK
ELECTRICAL ENGINEERING MANAGER

C/A	OCTOBER 18, 2016	41	1035
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STEP BOLT

NOTES

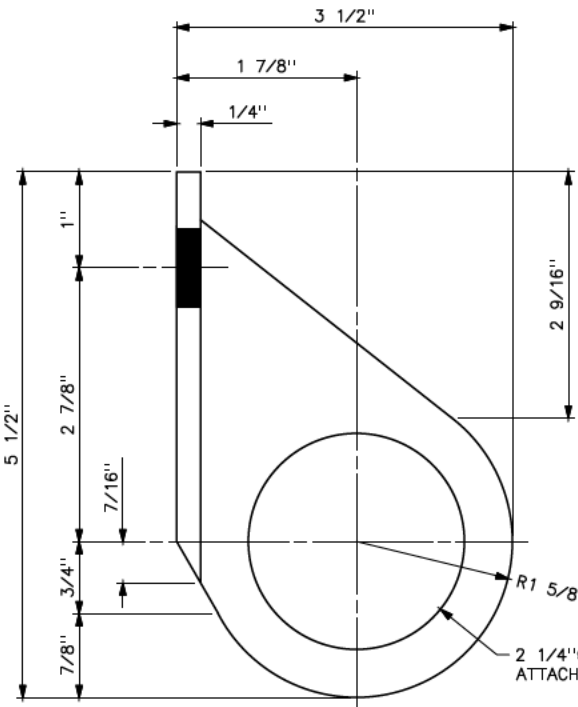
1. GRIP INCLUDES FILLS AND WASHERS WHEN USED.
2. SELF-LOCKING HEAVY HEX NUTS (ANCO STYLE OR EQUAL) MAY BE USED IN LIEU OF HEAVY HEX NUT AND LOCKNUT.

BOLT LENGTHS REQUIRED FOR VARIOUS GRIPS

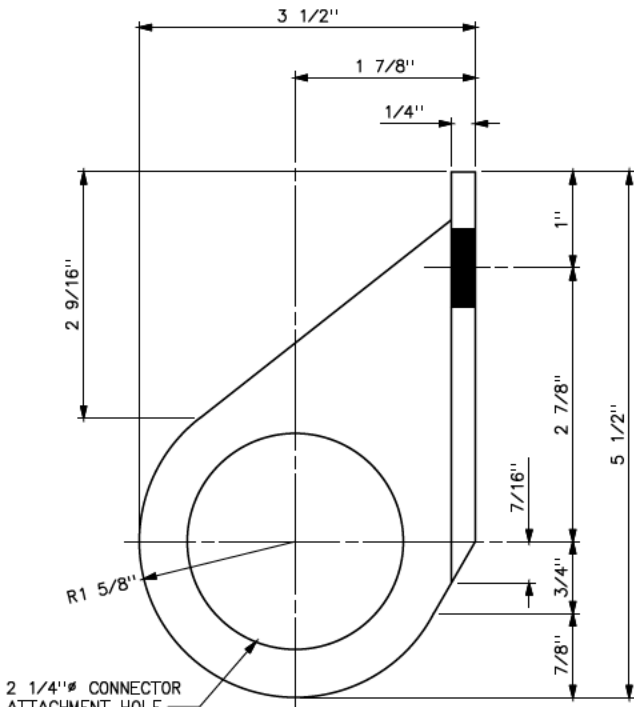
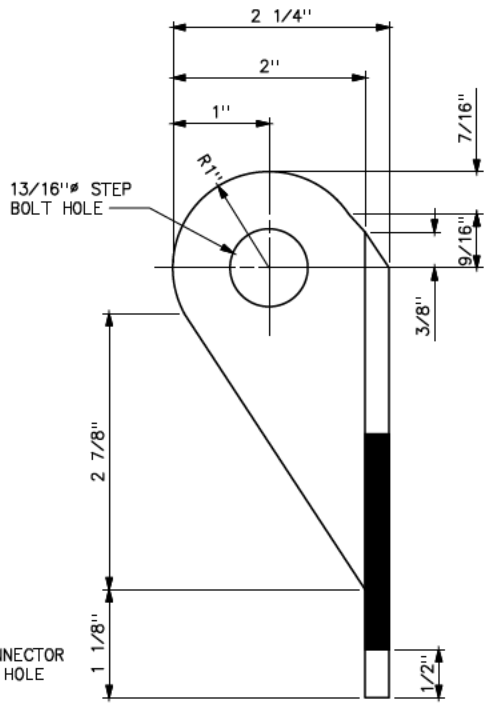
L FOR 3/4" BOLTS	1 1/2"		1 3/4"				2"				2 1/4"				2" 1/2"				2 3/4"	
GRIP	1/4"	5/16"	3/8"	7/16"	1/2"	9/16"	5/8"	11/16"	3/4"	13/16"	7/8"	15/16"	1"	1 1/16"	1 1/8"	1 3/16"	1 1/4"	1 5/16"	1 3/8"	1 7/16"
L FOR 5/8" BOLTS	1 1/2"				1 3/4"				2"				2 1/4"				2" 1/2"			

L FOR 3/4" BOLTS	2 3/4"		3"				3 1/4"				3 1/2"				3 3/4"			
GRIP	1 1/2"	1 9/16"	1 5/8"	1 11/16"	1 3/4"	1 13/16"	1 7/8"	1 15/16"	2"	2 1/16"	2 1/8"	2 3/16"	2 1/4"	2 5/16"	2 3/8"	2 7/16"	2" 1/2"	
L FOR 5/8" BOLTS	2 3/4"				3"				3 1/4"				3 1/2"				3 3/4"	

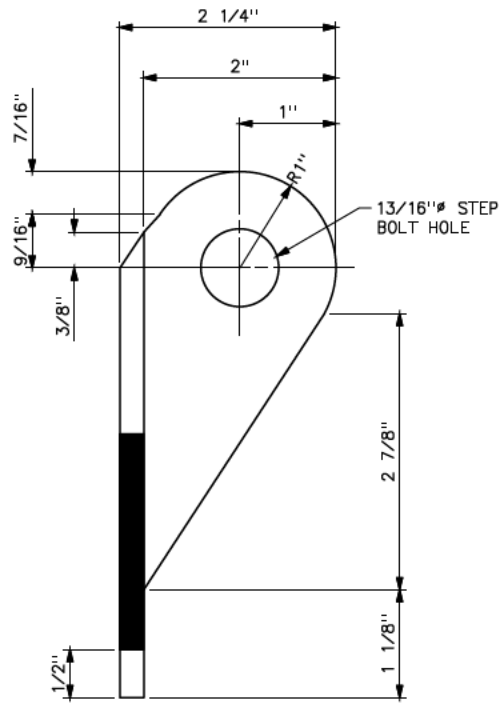
D	8-9-16 A7-CN	REVISED CONNECTION BOLT, STEP BOLT, AND BOLT LENGTH TABLE
C	7-15-03 A7-DH	REVISED TITLE BLOCK ONLY.
B	7-13-99 A3-DH	REDRAWN.
SUPERSEDES DWG NO. 40-D-5672		
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
TRANSMISSION LINE STANDARDS		
TOWER BOLTS		
DESIGNED BUREC _____ APPROVED DOUG HANSON _____ CIVIL ENGINEERING MANAGER		
CAE	APRIL 10, 1979	41 2001



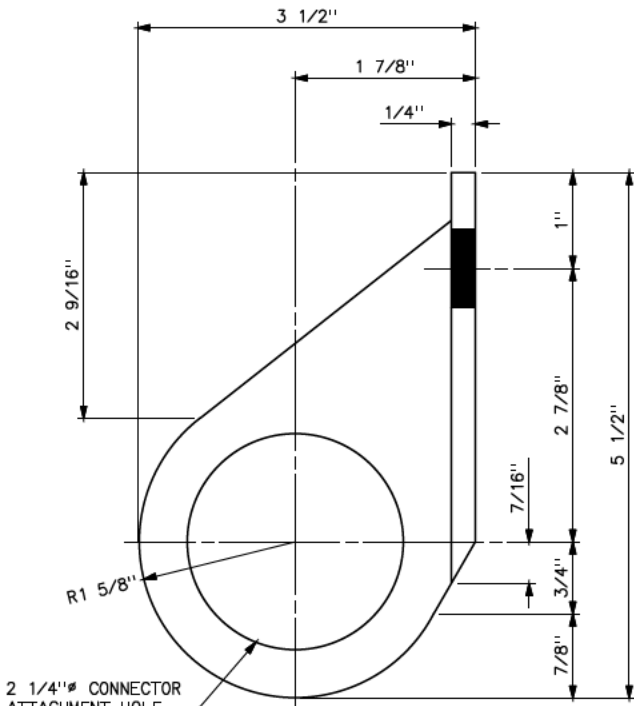
RIGHT ANCHORAGE PLATE
FOR 3/4"Ø STEP BOLTS
(STEEL POLE STRUCTURES)
MARK 1FP-5R
(NOTE 5)



LEFT ANCHORAGE PLATE
FOR 3/4"Ø STEP BOLTS
(STEEL POLE STRUCTURES)
MARK 1FP-5L
(NOTE 5)



RIGHT ANCHORAGE PLATE
FOR 5/8"Ø STEP BOLTS
(LATTICE TOWERS)
MARK 2FP-5R
(NOTE 5)



LEFT ANCHORAGE PLATE
FOR 5/8"Ø STEP BOLTS
(LATTICE TOWERS)
MARK 2FP-5L
(NOTE 5)

QTY.	MATERIAL	LENGTH		MARK	WEIGHT EACH (LB)
		FEET	INCHES		
1	PL 1/4x6 1/2	0	3 7/8	1FP-5R	1.3
1	PL 1/4x6 1/2	0	3 7/8	1FP-5L	1.3
1	PL 1/4x6 3/8	0	3 7/8	2FP-5R	1.3
1	PL 1/4x6 3/8	0	3 7/8	2FP-5L	1.3

NOTES

1. STEEL PLATE:
 - GALVANIZED STRUCTURES: ASTM A572.
 - GALVANIZE ALL MATERIAL AFTER FABRICATION.
 - WEATHERING STEEL STRUCTURES: ASTM A242, ASTM A588, OR ASTM A871.
2. INSIDE BEND RADIUS FOR 1/4" PLATE: 3/8"
3. ANCHORAGE PLATE MARK NUMBER - KEY TO DESIGNATIONS:
 - FP DENOTES "FALL PROTECTION".
 - 5 DENOTES STRENGTH OF PLATE GREATER THAN 5 KIPS.
 - R AND L DENOTES RIGHT AND LEFT STEP BOLT ATTACHMENT.
4. MAXIMUM SHEAR STRENGTH FOR ASTM A325 BOLTS, THREADS EXCLUDED FROM SHEAR PLAIN:
 - 5/8"Ø=15.3 KIPS.
 - 3/4"Ø=22.1 KIPS.FOR ASTM A394 BOLTS, THREADS EXCLUDED FROM SHEAR PLAIN:
 - 5/8"Ø=15.3 KIPS.NOTE: SHEAR STRENGTHS ARE 69% OF ABOVE VALUES WHEN PLATE IS IN THE SHEAR PLAIN OF THE BOLT.
5. INSTALLATION INSTRUCTIONS:
 - STEEL POLE STRUCTURES: INSTALL ANCHORAGE PLATES FLUSH WITH CENTER SUPPORT OF PERMANENT LADDERS WITH NO WASHERS BETWEEN NUT AND ANCHORAGE PLATE NOR BETWEEN ANCHORAGE PLATE AND CENTER LADDER SUPPORT.
 - LATTICE TOWERS: INSTALL ANCHORAGE PLATES FLUSH WITH LEG ANGLES WITH NO WASHERS BETWEEN NUT AND ANCHORAGE PLATE NOR BETWEEN ANCHORAGE PLATE AND LEG ANGLES.
 - INSTALL PLATES WITH BOLT HOLE UP TOWARDS TOP OF STRUCTURE, IN THE VERTICAL DIRECTION ONLY. NEVER MOUNT PLATES WITH THE PLANE OF THE BOLT HOLE AND ATTACHMENT HOLE PARALLEL TO GROUND SURFACE, UNLESS THE LOAD IS ONLY IN THE HORIZONTAL DIRECTION. SEE ENGINEER FOR SPECIFIC DETAILS.
 - INSTALL NUT AND LOCKNUT OR LOCK WASHER ON "BACK SIDE" OF CONNECTION.
 - ENSURE THAT PLATES DO NOT MOVE AFTER INSTALLATION.

B	4-26-16 A7-CTG	MODIFIED NOTES 3, 4 AND 5.
A	5-27-15 A7-BGH	REDRAWN AND REVISED MARK NOS. AND TITLE BLOCK. ADDED LEFT ANCHORAGE PLATES.
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
TRANSMISSION LINE STANDARDS STEEL POLE STRUCTURES AND LATTICE TOWERS FALL PROTECTION ANCHORAGE PLATES		
DESIGNED CHARLES GARCIA _____ APPROVED DOUG HANSON _____ CIVIL ENGINEERING MANAGER		
C _A E	APRIL 7, 2015	41 2071

Plotted By: Seela, Aug 22, 2016- 10:55am
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IMAGES:

XREF(S):

NOTES

1. STEEL PLATE:
 - GALVANIZED STRUCTURES: ASTM A572.
 - GALVANIZE ALL MATERIAL AFTER FABRICATION.
 - WEATHERING STEEL STRUCTURES: ASTM A242, ASTM A588, OR ASTM A871.
2. INSIDE BEND RADIUS FOR 1/4" PLATE: 3/8"
3. ANCHORAGE PLATE MARK NUMBER - KEY TO DESIGNATIONS:
 - FP DENOTES "FLANGE PLATES";
 - 5 DENOTES STRENGTH OF PLATE IN KIPS;
 - R AND L DENOTES RIGHT AND LEFT STEP BOLT ATTACHMENT.
4. ALLOWABLE SHEAR STRENGTH FOR ASTM A325 BOLTS, THREADS EXCLUDED FROM SHEAR PLANS:
 - $3/4" \phi = 13.3$ KIPS.

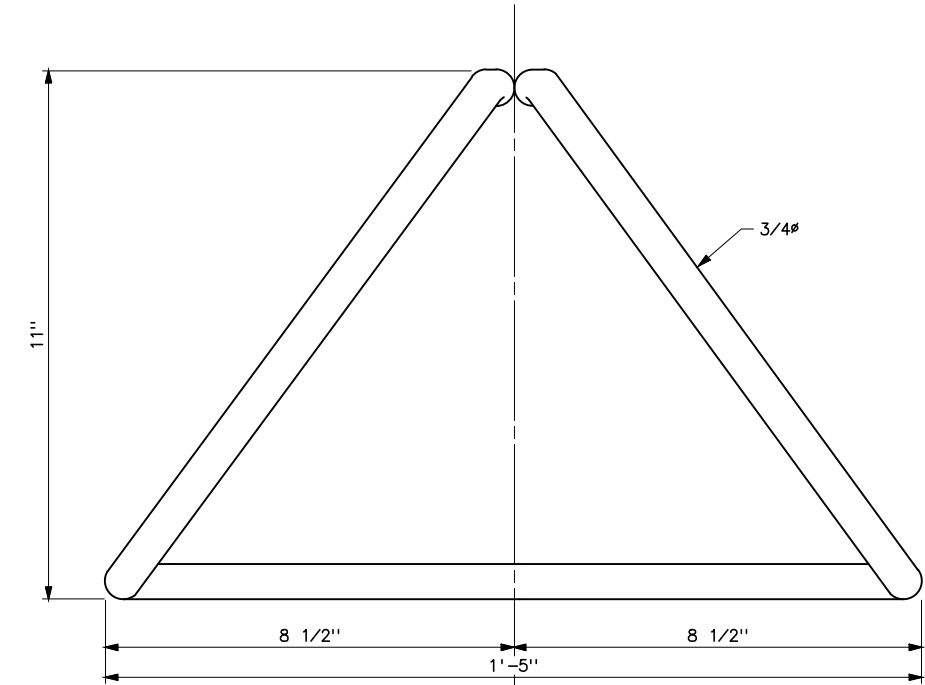
NOTE: ASTM A394 BOLT SHEAR STRENGTHS ARE 60% OF ABOVE VALUES.

5. INSTALLATION INSTRUCTIONS:
 - STEEL POLE STRUCTURES: INSTALL ANCHORAGE PLATES FLUSH WITH CENTER SUPPORT OF PERMANENT LADDERS WITH NO WASHERS BETWEEN NUT AND ANCHORAGE PLATE NOR BETWEEN ANCHORAGE PLATE AND CENTER LADDER SUPPORT.
 - INSTALL PLATES WITH STEP BOLT HOLE TOWARDS TOP OF STRUCTURE. NEVER MOUNT PLATES WITH THE PLANE OF CONNECTOR ATTACHMENT HOLE PARALLEL TO GROUND SURFACE.
 - INSTALL NUT AND LOCKNUT OR LOCK WASHER ON "BACK SIDE" OF CONNECTION.
 - ENSURE THAT PLATES DO NOT MOVE AFTER INSTALLATION.

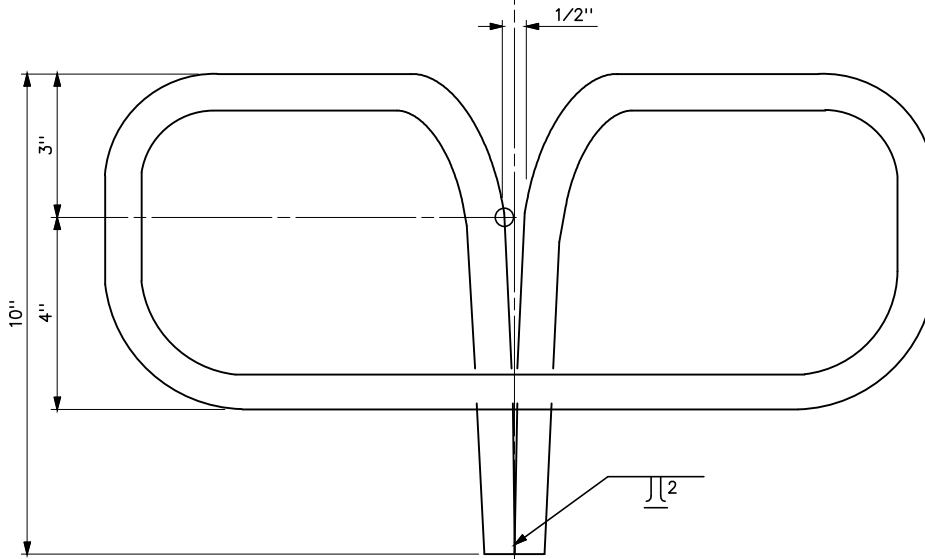
MAINTENANCE PROVISIONS -
 DETAILS-----43 2210
 OUTLINES-----43 2206 THRU 2209, & 2214

UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO			
TRANSMISSION LINE STANDARDS STEEL POLE STRUCTURES FALL PROTECTION ANCHORAGE PLATES			
DESIGNED <u>CHARLES GARCIA</u>		APPROVED <u>DOUG HANSON</u> CIVIL ENGINEERING MANAGER	
CAE	APRIL 7, 2015	41	2701

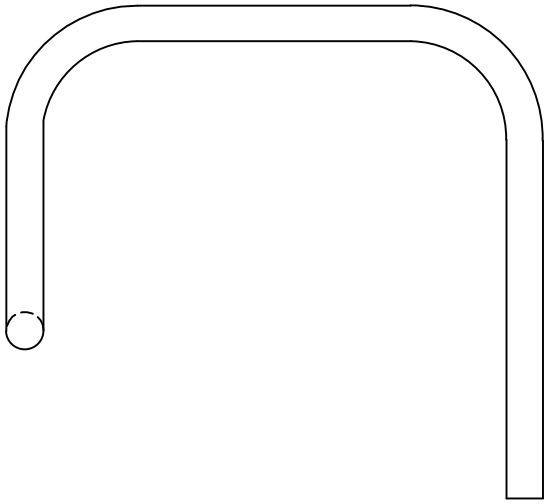




PLAN



ELEVATION



SIDE VIEW

NOTES

- 1. GALVANIZE MATERIAL AFTER FABRICATION.
- 2. MINIMUM INSIDE COLD BENDING RADIUS : 2 1/4 INCHES.

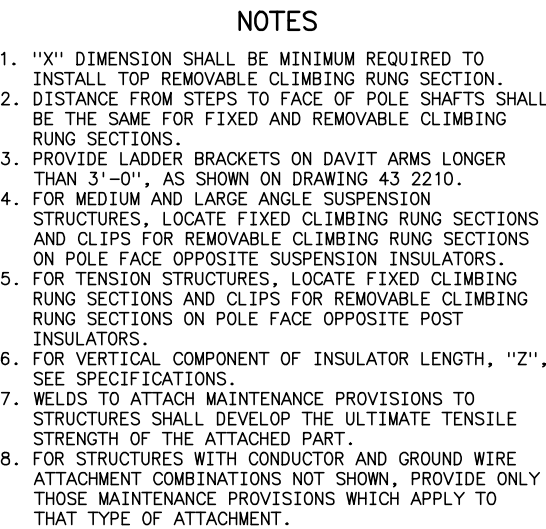
REFERENCE DRAWINGS

MAINTENANCE PROVISIONS-
OUTLINES-----43 2206 THRU 2209, & 2214
DETAILS-----43 2210

C	10-8-20 A7-BEP	REVISED REFERENCE DRAWINGS.
B	7-15-03 A7-DH	REVISED TITLE BLOCK ONLY.
A	7-10-92 A2-WCC	REVISED REFERENCE DRAWINGS.
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION HEADQUARTERS - GOLDEN, COLORADO		
TRANSMISSION LINE STRUCTURES STEEL POLE STRUCTURES MAINTENANCE PROVISIONS - WORK RING		
DESIGNED <u>B.G. HAGLER</u> RECOMMENDED <u>B.G. HAGLER</u> DRAWN <u>G.R. MANALO</u> APPROVED <u>W.C. COWAN</u> CHECKED <u>B.G. HAGLER</u> DIRECTOR, DIVISION OF TRANSMISSION LINE AND BUILDING DESIGN		
C	A7	MARCH 31, 1989
43		2203

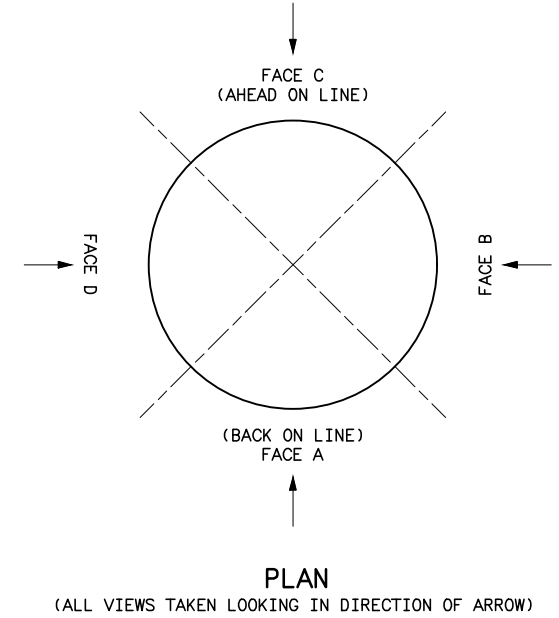
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XREF(S):



MAINTENANCE PROVISIONS - DETAILS_____43 2210

I	11-30-23 A7-RBP	REVISED TO CHANGE TO 3 REMOVABLE LADDER SECTIONS.
H	09-12-06 A7-BGH	REVISED LADDER BRACKETS.
G	3-1-06 A7-RMC	CORRECTED MISSPELLED WORD IN NOTE 5.
F	7-15-03 A7-DH	REVISED TITLE BLOCK ONLY.
E	10-11-02 A7-BGH	REDRAWN AND MINOR REVISIONS.
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO TRANSMISSION LINE STRUCTURE STANDARDS STEEL POLE STRUCTURES MAINTENANCE PROVISIONS - OUTLINES		
DESIGNED <u>BOBBY HAGLER</u> _____ APPROVED <u>DOUG HANSON</u> _____ CIVIL ENGINEERING MANAGER		
CAE	OCTOBER 11, 2002	43 2206

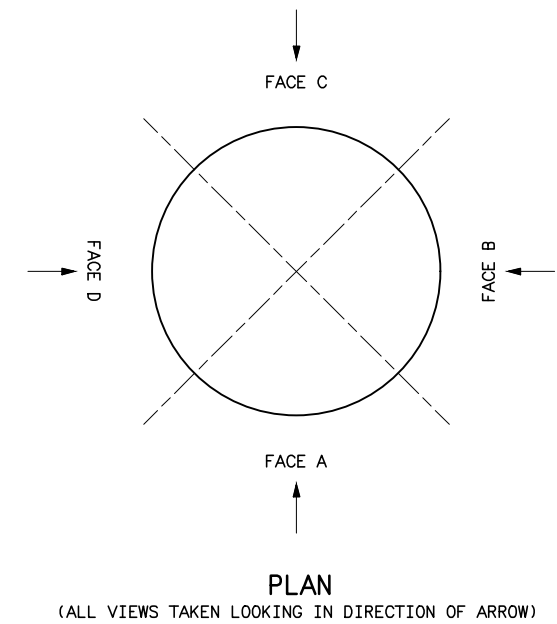


1. "X" DIMENSION SHALL BE MINIMUM REQUIRED TO INSTALL TOP REMOVABLE CLIMBING RUNG SECTION.
2. DISTANCE FROM STEPS TO FACE OF POLE SHAFTS SHALL BE THE SAME FOR FIXED AND REMOVABLE CLIMBING RUNG SECTIONS.
3. PROVIDE LADDER BRACKETS ON DAVIT ARMS LONGER THAN 3'-0", AS SHOWN ON DRAWING 43 2210.
4. FOR VERTICAL COMPONENT OF INSULATOR LENGTH, "Z", SEE SPECIFICATIONS.
5. WELDS TO ATTACH MAINTENANCE PROVISIONS TO STRUCTURES SHALL DEVELOP THE ULTIMATE TENSILE STRENGTH OF THE ATTACHED PART.
6. FOR STRUCTURES WITH CONDUCTOR AND GROUND WIRE ATTACHMENT COMBINATIONS NOT SHOWN, PROVIDE ONLY THOSE MAINTENANCE PROVISIONS WHICH APPLY TO THAT TYPE OF ATTACHMENT.

MAINTENANCE PROVISIONS - DETAILS_____43 2210

H	11-30-23 A7-RBP	REVISED TO CHANGE TO 3 REMOVABLE LADDER SECTIONS.
G	09-12-06 A7-BGH	REVISED LADDER BRACKETS.
F	7-15-03 A7-DH	REVISED TITLE BLOCK ONLY.
E	10-16-02 A7-BGH	REDRAWN AND MINOR REVISIONS.
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
TRANSMISSION LINE STRUCTURE STANDARDS STEEL POLE STRUCTURES MAINTENANCE PROVISIONS - OUTLINES		
DESIGNED <u>BOBBY HAGLER</u> _____ APPROVED <u>DOUG HANSON</u> _____ CIVIL ENGINEERING MANAGER		
DATE	OCTOBER 16, 2002	43 2207

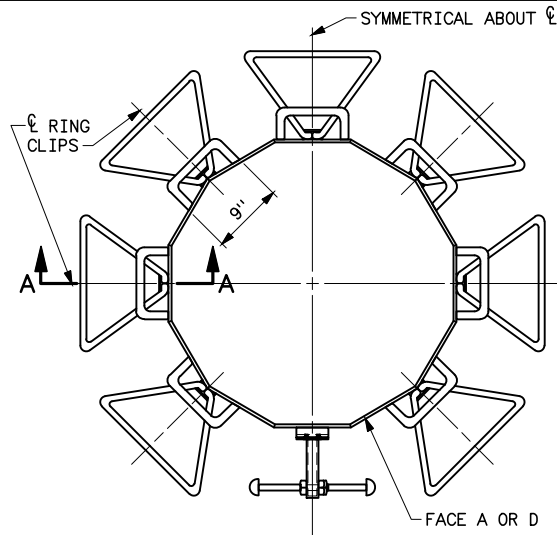
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE — LAKEWOOD, COLORADO			
TRANSMISSION LINE STRUCTURE STANDARDS STEEL POLE STRUCTURES MAINTENANCE PROVISIONS — OUTLINES			
DESIGNED <u>BOBBY HAGLER</u> — — — — —		APPROVED <u>DOUG HANSON</u> CIVIL ENGINEERING MANAGER — — —	
CAE	OCTOBER 10, 2002	43	2208



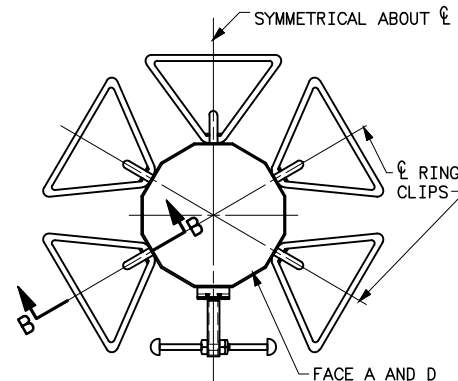
1. "X" DIMENSION SHALL BE MINIMUM REQUIRED TO INSTALL TOP REMOVABLE CLIMBING RUNG SECTION.
2. DISTANCE FROM STEPS TO FACE OF POLE SHAFTS SHALL BE THE SAME FOR FIXED AND REMOVABLE CLIMBING RUNG SECTIONS.
3. FOR SWITCH STRUCTURES, LOCATE FIXED CLIMBING RUNG SECTIONS AND CLIPS FOR REMOVABLE CLIMBING RUNG SECTIONS ON POLE FACE OPPOSITE SWITCHES.
4. WELDS TO ATTACH MAINTENANCE PROVISIONS TO STRUCTURES SHALL DEVELOP THE ULTIMATE TENSILE STRENGTH OF THE ATTACHED PART.
5. DO NOT PROVIDE RING CLIPS OR BELT LOOPS ON FACE B DIRECTLY UNDER SWITCH FRAMES.

MAINTENANCE PROVISIONS - DETAILS_____43 2210

[Return to TOC](#)

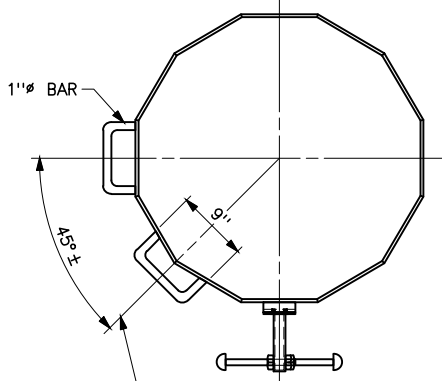


POLE DIAMETER > 36"



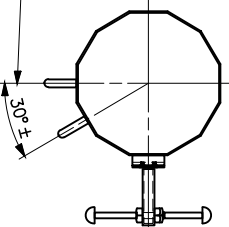
POLE DIAMETER ≤ 36"

TYPICAL BELT LOOP AND WORK RING PLANS (NOTE 4)



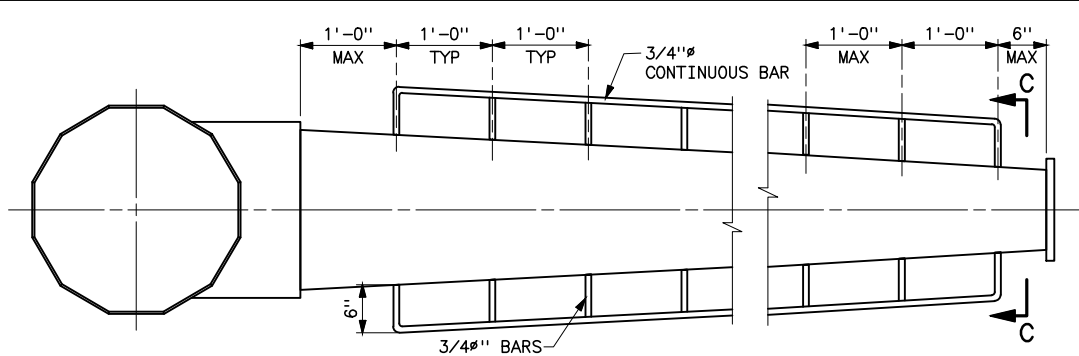
POLE DIAMETER > 36"

HAND LOOPS ON DAVIT ARM SIDE(S) OF STRUCTURE

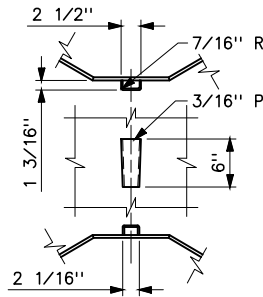


POLE DIAMETER ≤ 36"

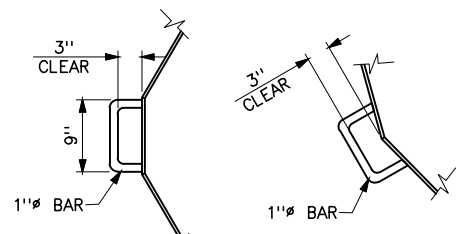
HAND LOOP PLANS



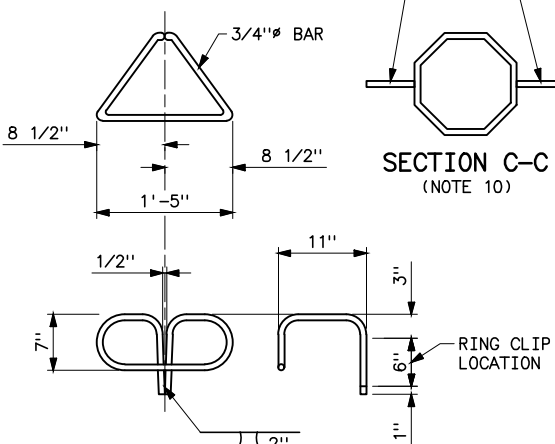
LADDER BRACKET PLAN FOR DAVIT ARMS LONGER THAN 3'-0" (NOTES 9 AND 10)



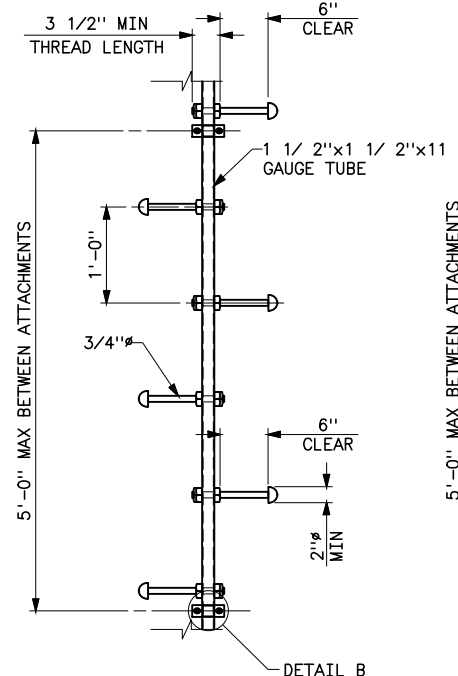
RING CLIP



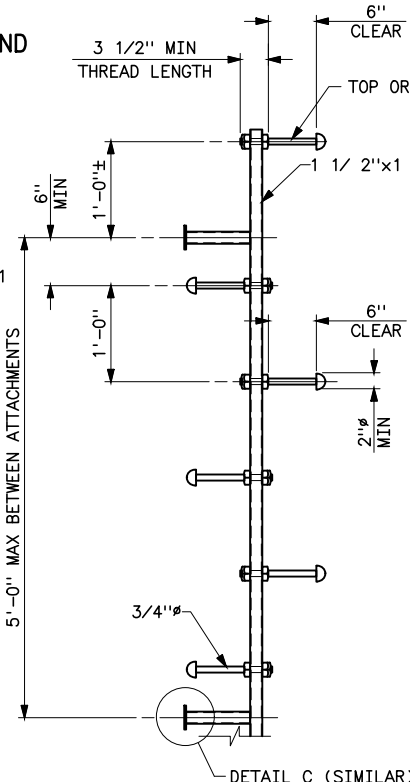
CLEARANCE FOR HAND AND BELT LOOPS



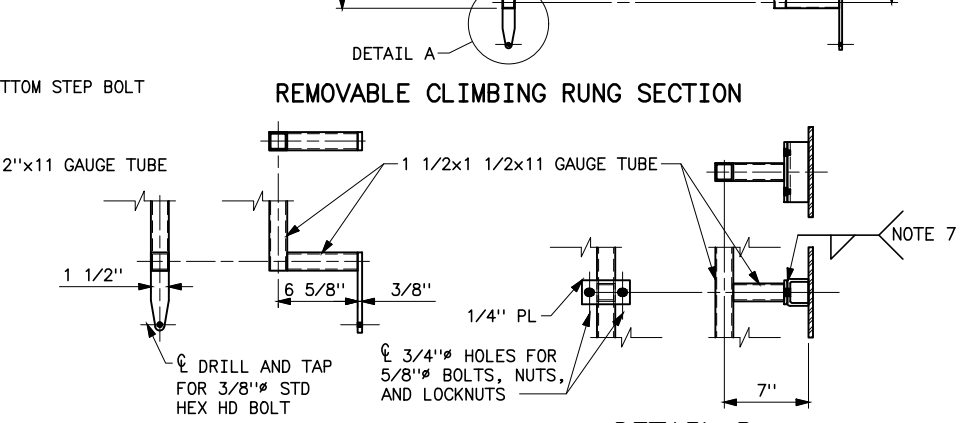
WORK RING



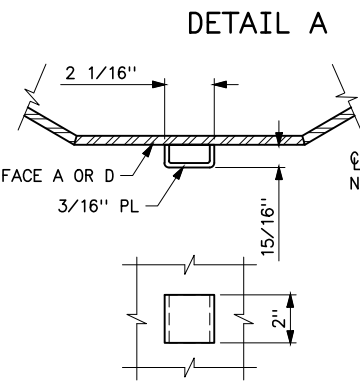
FIXED CLIMBING RUNG SECTION (NOTES 5 AND 6)



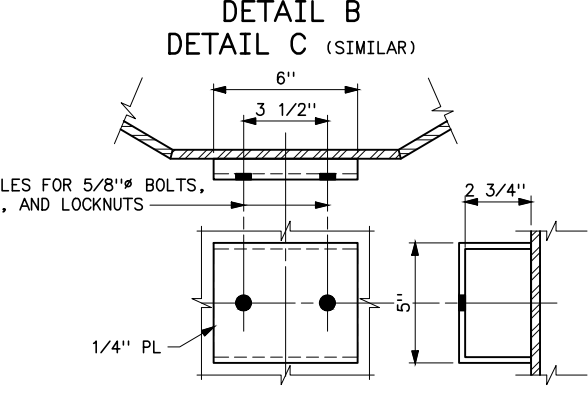
INCLINED CLIMBING RUNG SECTION



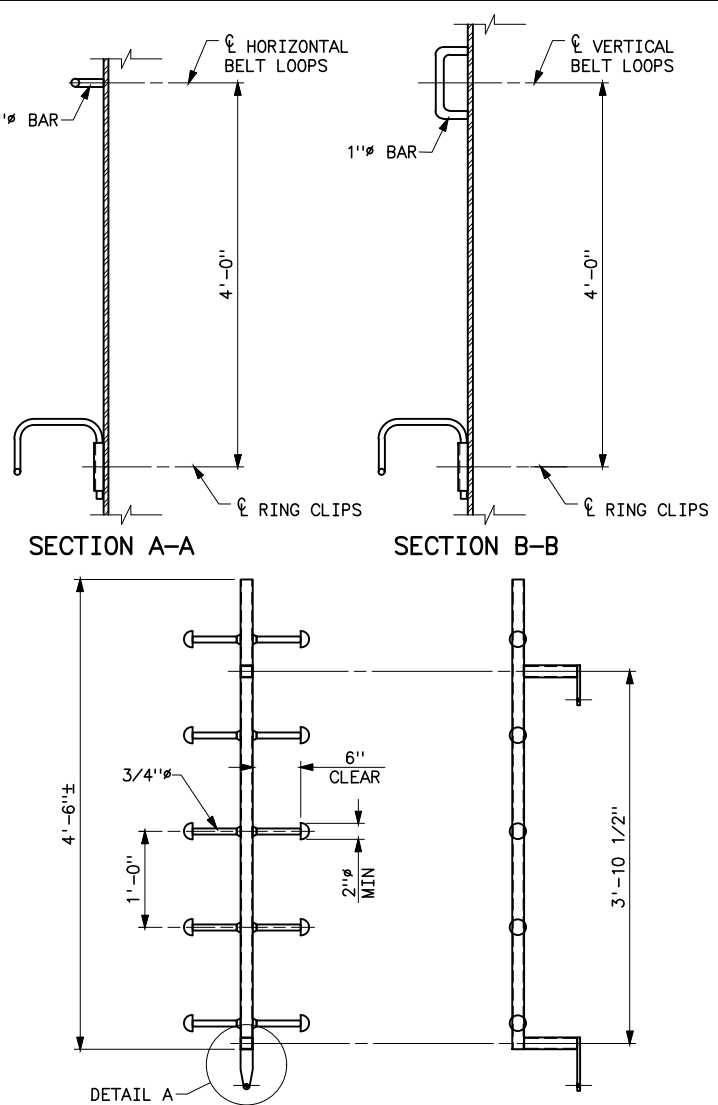
REMOVABLE CLIMBING RUNG SECTION



CLIP FOR REMOVABLE CLIMBING RUNG SECTIONS



ATTACHMENT FOR FIXED AND INCLINED CLIMBING RUNG SECTIONS (NOTE 8)



NOTES

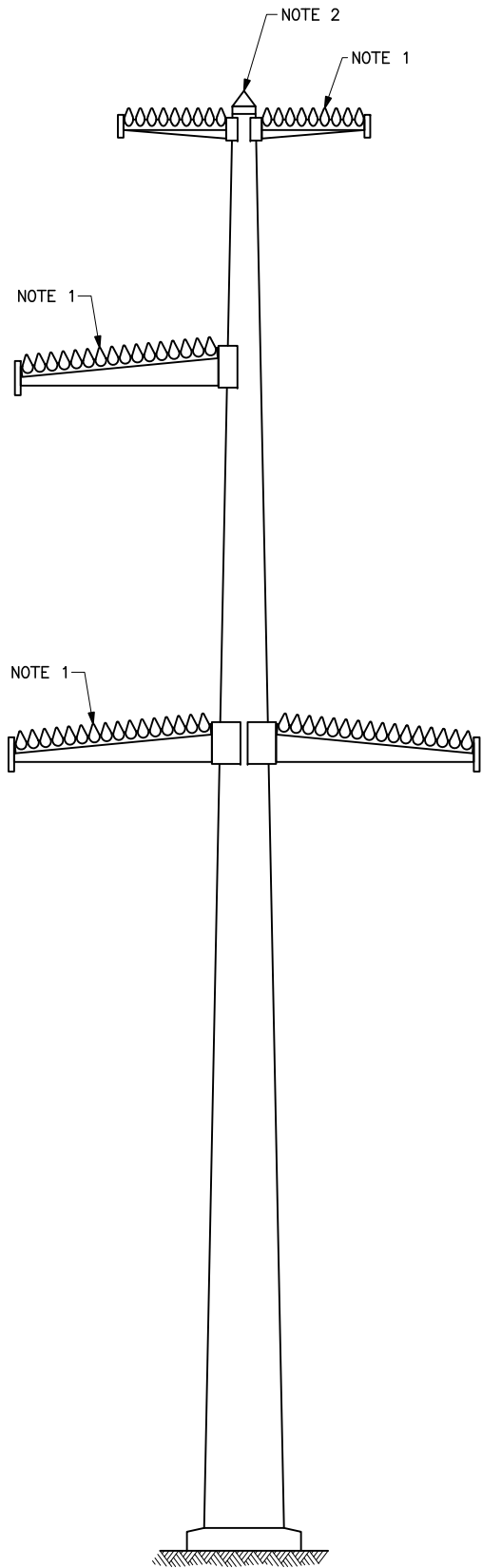
1. MINIMUM INSIDE COLD BENDING RADII (INCHES):
3/4" BAR=2 1/4"
1" BAR=3"
2. WELDS TO ATTACH MAINTENANCE PROVISIONS TO STRUCTURES SHALL DEVELOP THE ULTIMATE TENSILE STRENGTH OF THE ATTACHED PART.
3. DISTANCE FROM CENTERLINE OF STEP BOLTS TO FACE OF POLE SHAFTS FOR FIXED AND REMOVABLE CLIMBING RUNG SECTIONS SHALL BE 7 INCHES.
4. PROVIDE ONE BELT LOOP ABOVE EACH RING CLIP.
5. FIXED CLIMBING RUNG SECTIONS SHALL BE SPLICED TOGETHER TO FORM A CONTINUOUS CENTER SUPPORT FOR THE FULL HEIGHT OF THE STRUCTURE. SPLICES SHALL BE DESIGNED TO ENSURE FULL STRUCTURAL CONTINUITY OF THE CENTER SUPPORT. SMALL GAPS IN THE CENTER SUPPORT ACROSS SLIP JOINTS ARE ACCEPTABLE.
6. TOP OR BOTTOM CANTILEVERED EXTENSIONS OF FIXED CLIMBING RUNG SECTIONS SHALL NOT EXTEND MORE THAN 27 INCHES BEYOND THE NEAREST CLIP.
7. FOR WEATHERING-STEEL STRUCTURES, AFTER INSTALLING FIXED AND INCLINED CLIMBING RUNG SECTIONS WITH BOLTS, NUTS, AND LOCKNUTS, SPOT WELD THE RUNG SECTION MOUNTING PLATES TO THE ATTACHMENTS ON THE POLE SHAFTS. WELDING SHALL BE SUFFICIENT TO PROVIDE ELECTRICAL CONTINUITY BETWEEN CLIMBING RUNG SECTIONS AND THE POLE SHAFT. PREFERRED WELDING ROD SERIES IS E8018-C3. OTHER ACCEPTABLE SERIES ARE E8018-C1 AND E8018-C2.
8. ALTERNATIVE METHODS FOR ATTACHING FIXED AND INCLINED CLIMBING RUNG SECTIONS MAY BE SUBMITTED FOR APPROVAL.
9. FOR STRUCTURES WITH TENSION OGW AND INSULATOR ATTACHMENT PLATES STOP LADDER BRACKET 3" FROM INSIDE EDGE OF PLATE.
10. LADDER BRACKETS SHALL BE LOCATED 180° FROM EACH BRACKET TO ENSURE LEVEL PLATFORM FOR MAINTENANCE PERSONNEL.

REFERENCE DRAWINGS

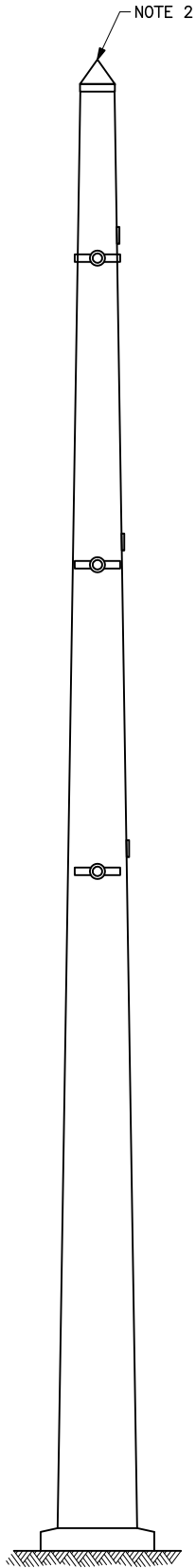
MAINTENANCE PROVISIONS-
WORK RING-----43 2203
OUTLINES-----43 2206 THRU 2209, & 2214

J	12-20-19 A7-BEP	ADDED NOTES 9 AND 10 AND DETAIL FOR LADDER BRACKET POSITION.
I	9-11-15 A7-BGH	REVISED STEP BOLTS AND ADDED DIMENSIONS FOR ATTACHMENTS FOR FIXED AND INCLINED CLIMBING RUNG SECTIONS. REVISED NOTES 6 AND 7.
H	12-22-05 A7-BH	REVISED LADDER BRACKET PLAN.
G	7-15-03 A7-DH	REVISED TITLE BLOCK ONLY.
F	10-28-02 A7-BGH	REDRAWN. ADDED NOTES 5, 6, AND 8. MINOR REVISIONS.
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION HEADQUARTERS - LAKEWOOD, CO		
TRANSMISSION LINE STRUCTURE STANDARDS STEEL POLE STRUCTURES MAINTENANCE PROVISIONS - DETAILS		
DESIGNED BOBBY HAGLER APPROVED DOUG HANSON CIVIL ENGINEERING MANAGER		
C _A E	OCTOBER 28, 2002	43 2210

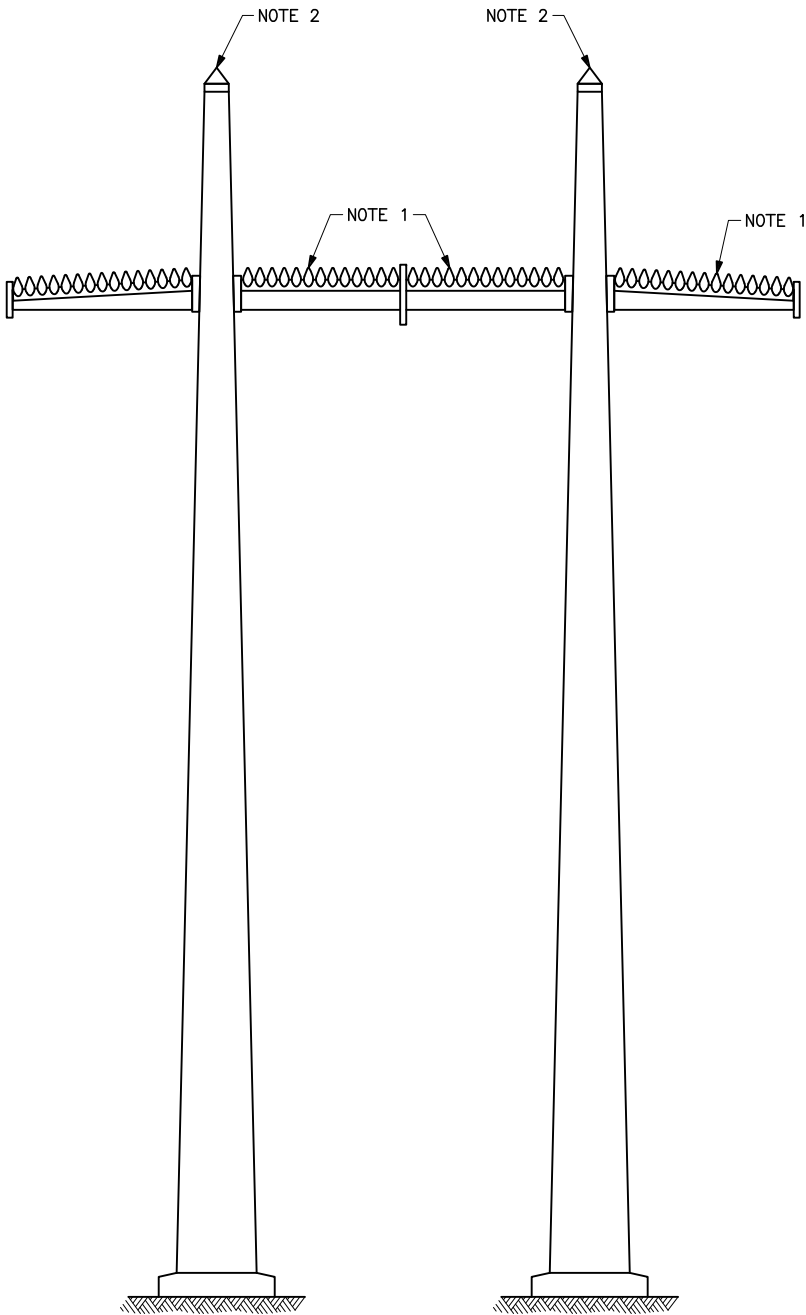
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XREF (S):



SINGLE POLE STRUCTURE
WITH DAVIT ARMS



SINGLE POLE STRUCTURE
WITHOUT DAVIT ARMS



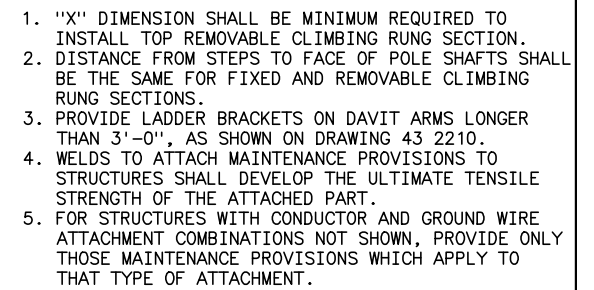
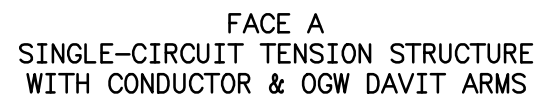
H-FRAME STRUCTURE
(Y-TYPE STRUCTURE SIMILAR)

NOTES

1. ANTI PERCH DEVICES FOR STEEL POLE DAVIT ARMS SHALL BE BLACK POLYETHYLENE WITH UV STABILIZER AND CONICAL IN SHAPE APPROXIMATELY 6" TALL. PERMANENTLY ATTACH THE DEVICES TO THE TOPS OF ALL OVERHEAD GROUNDWIRE AND CONDUCTOR DAVIT ARMS AND CROSSARMS WITH STAINLESS STEEL STRAPS. ANTI PERCH DEVICES SHALL COVER THE ENTIRE LENGTH OF THE ARMS AND SHALL BE EQUAL TO: ZENA PERCH PREVENTER MANUFACTURED BY ZENA OF PROMMEL ENTERPRISES INC., 12551 174TH COURT N., JUPITER. FL 33478.
2. ANTI PERCH DEVICES FOR THE POLE TOPS SHALL BE BLACK POLYETHYLENE WITH UV STABILIZER AND SHALL BE CONE-SHAPED APPROXIMATELY 17" TALL. PERMANENTLY ATTACH THE DEVICES TO ALL POLE TOPS WITH STAINLESS STEEL STRAPS OR BOLTS. DEVICES SHALL BE EQUAL TO: ZENA CONE MANUFACTURED BY ZENA OF PROMMEL ENTERPRISES INC., 12551 174TH COURT N., JUPITER. FL 33478.

EXCEPTION: ANTI PERCH DEVICES FOR THE POLE TOPS ARE NOT REQUIRED ON STRUCTURES WITH AERIAL PATROL MILE MARKER OR WARNING SIGNS MOUNTED TO POLE TOPS.

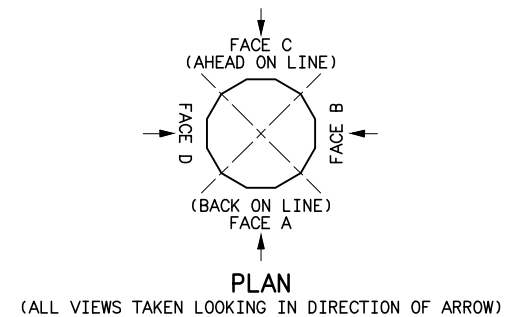
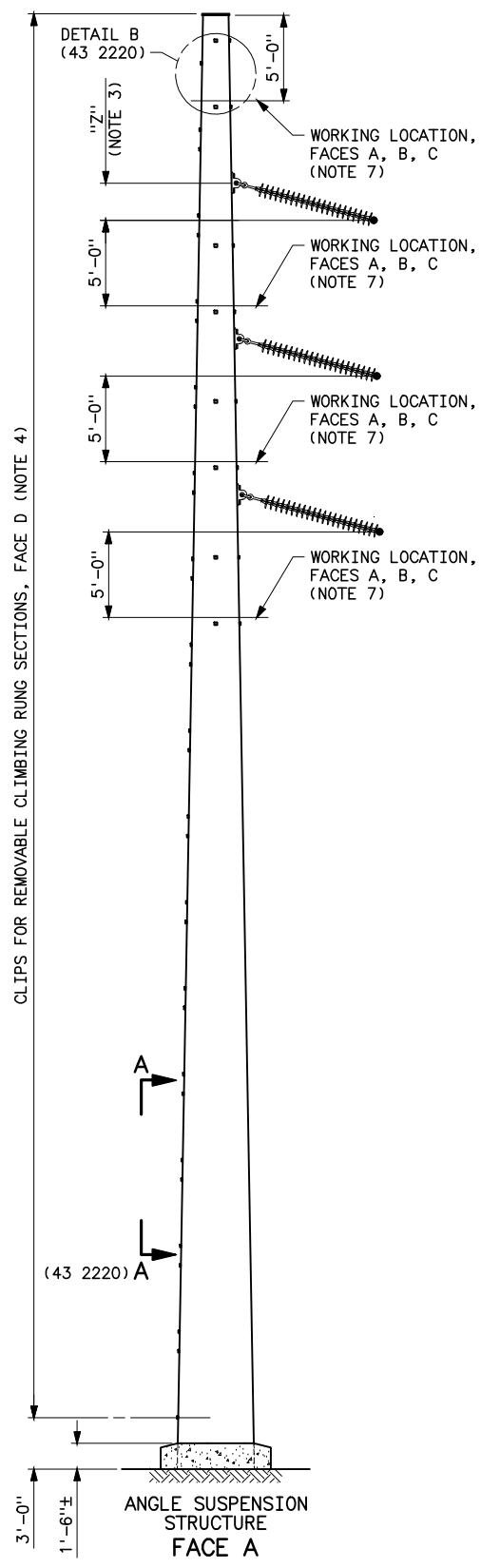
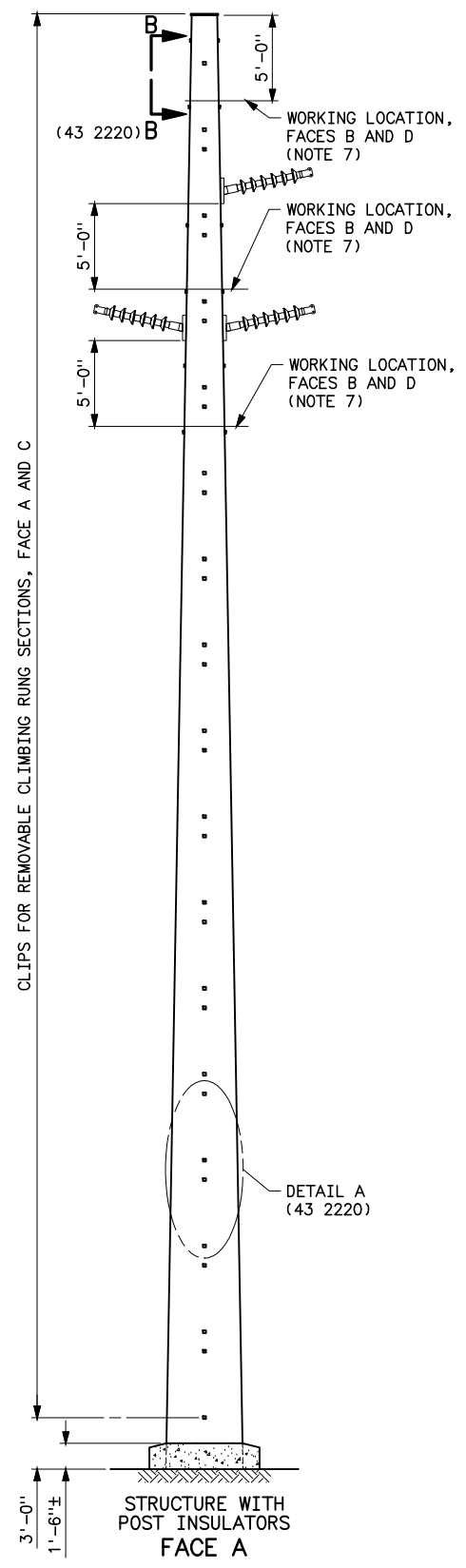
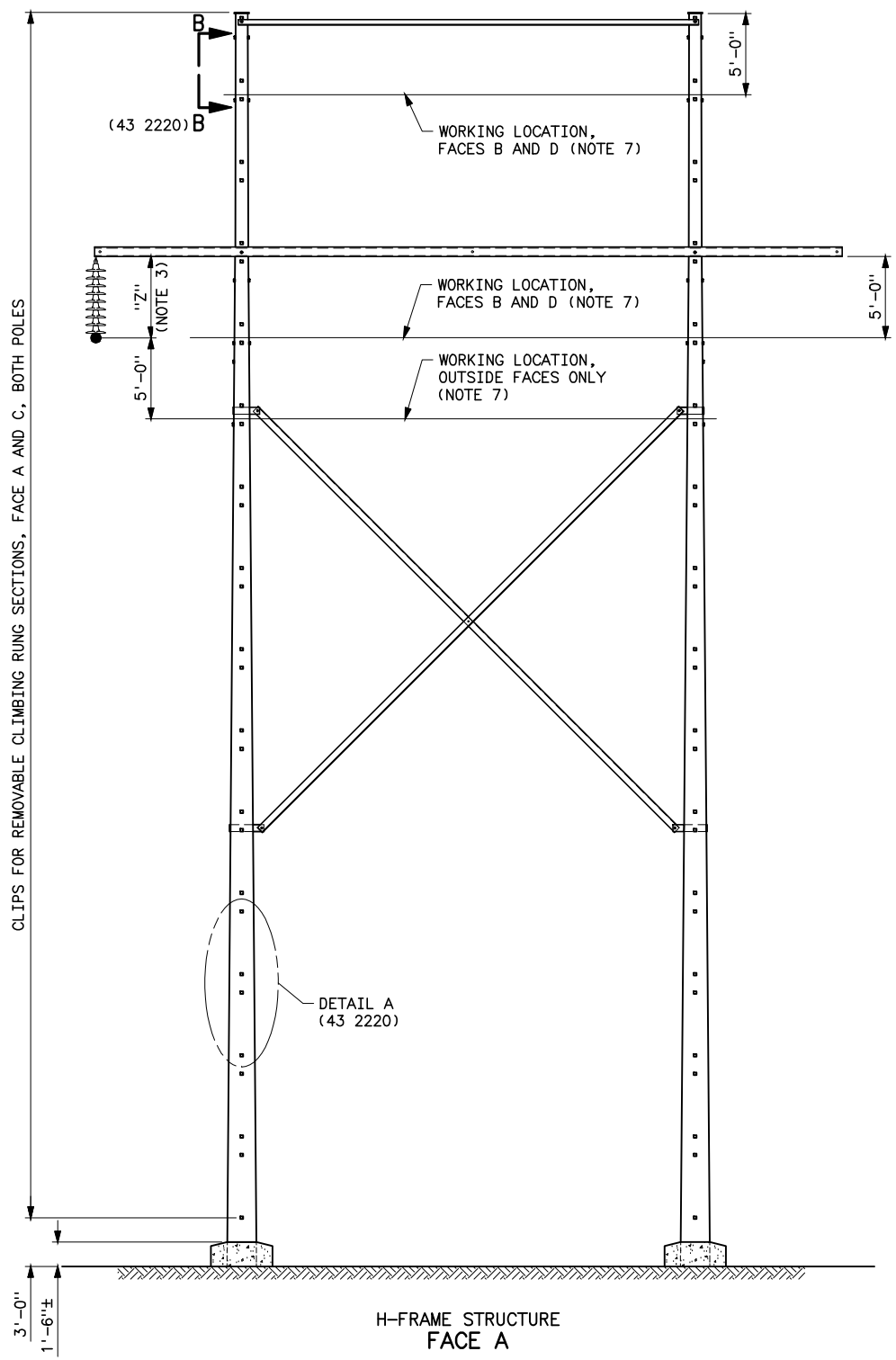
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	UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
TRANSMISSION LINE STRUCTURE STANDARDS STEEL POLE STRUCTURES ANTI PERCH PROVISIONS			
DESIGNED <u>BOBBY HAGLER</u> _ _ _ _ _		APPROVED <u>DOUG HANSON</u> CIVIL ENGINEERING MANAGER _ _ _	
CA/E	JANUARY 13 ,2003	43	2213



MAINTENANCE PROVISIONS - DETAILS_____	43	2210
PERMANENT FALL PROTECTION - DETAILS_____	43	2215

A	2-4-15 A7-BGH	ADDED SINGLE-CIRCUIT TENSION STRUCTURE WITH CONDUCTOR DAVIT ARMS.	
	UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
TRANSMISSION LINE STRUCTURE STANDARDS STEEL POLE STRUCTURES MAINTENANCE PROVISIONS - OUTLINES			
DESIGNED <u>BOBBY HAGLER</u>		APPROVED <u>DOUG HANSON</u> CIVIL ENGINEERING MANAGER	
CAE	JUNE 10, 2014	43	2214

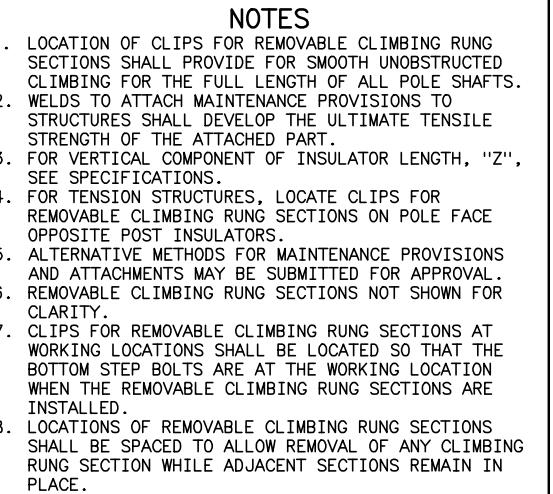
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IMAGES:



- NOTES**
1. LOCATION OF CLIPS FOR REMOVABLE CLIMBING RUNG SECTIONS SHALL PROVIDE FOR SMOOTH UNOBSTRUCTED CLIMBING FOR THE FULL LENGTH OF ALL POLE SHAFTS.
 2. WELDS TO ATTACH MAINTENANCE PROVISIONS TO STRUCTURES SHALL DEVELOP THE ULTIMATE TENSILE STRENGTH OF THE ATTACHED PART.
 3. FOR VERTICAL COMPONENT OF INSULATOR LENGTH, "Z", SEE SPECIFICATIONS.
 4. FOR ANGLE SUSPENSION STRUCTURES, LOCATE CLIPS FOR REMOVABLE CLIMBING RUNG SECTIONS ON POLE FACE OPPOSITE SUSPENSION INSULATORS.
 5. ALTERNATIVE METHODS FOR MAINTENANCE PROVISIONS AND ATTACHMENTS MAY BE SUBMITTED FOR APPROVAL.
 6. REMOVABLE CLIMBING RUNG SECTIONS NOT SHOWN FOR CLARITY.
 7. CLIPS FOR REMOVABLE CLIMBING RUNG SECTIONS AT WORKING LOCATIONS SHALL BE LOCATED SO THAT THE BOTTOM STEP BOLTS ARE AT THE WORKING LOCATION WHEN THE REMOVABLE CLIMBING RUNG SECTIONS ARE INSTALLED.
 8. LOCATIONS OF REMOVABLE CLIMBING RUNG SECTIONS SHALL BE SPACED TO ALLOW REMOVAL OF ANY CLIMBING RUNG SECTION WHILE ADJACENT SECTIONS REMAIN IN PLACE.

REFERENCE DRAWING
MAINTENANCE PROVISIONS - DETAILS-----43 2220

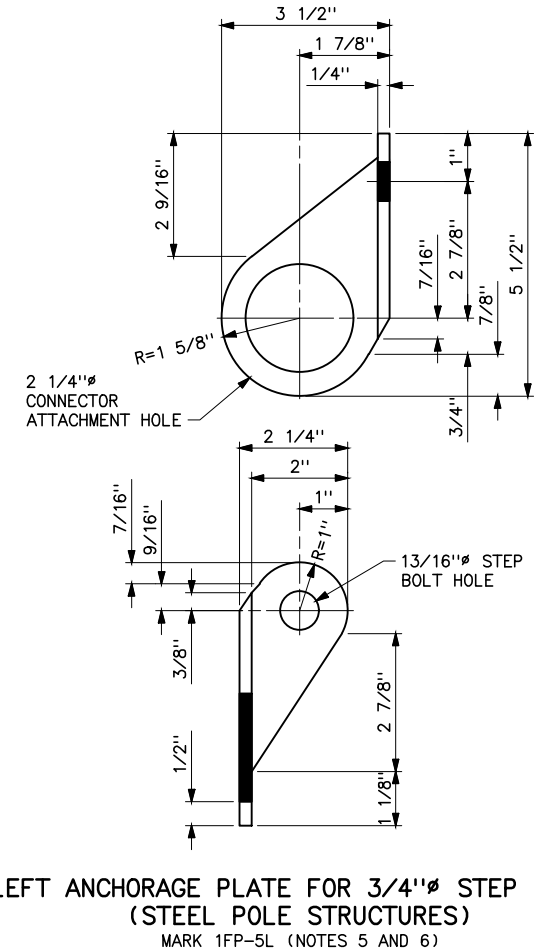
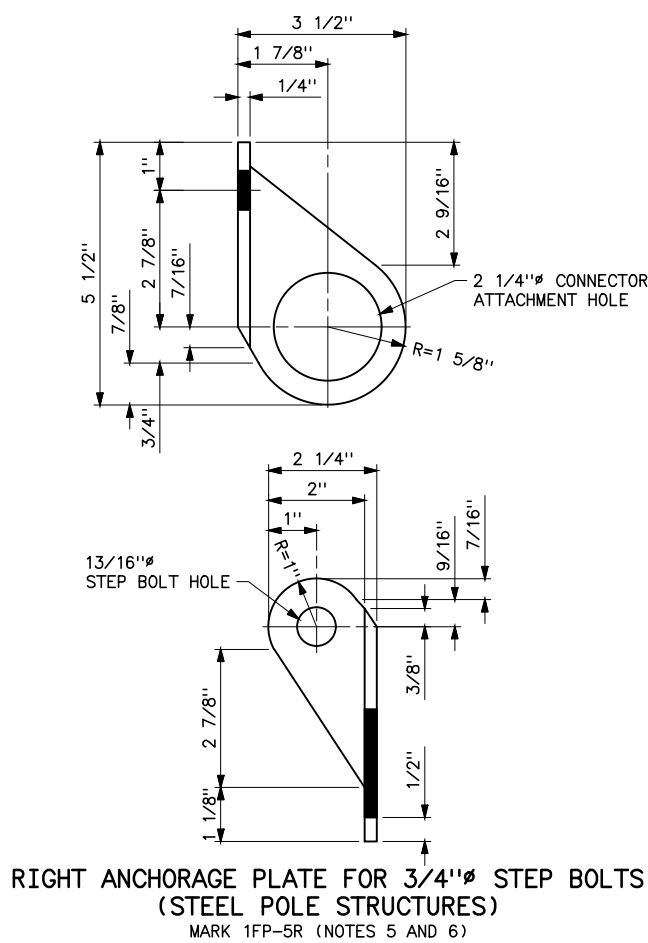
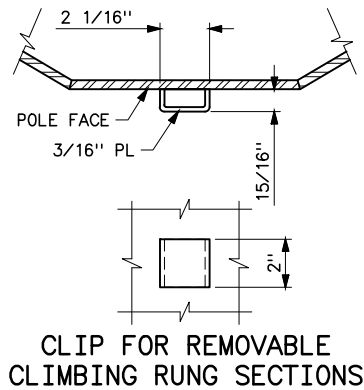
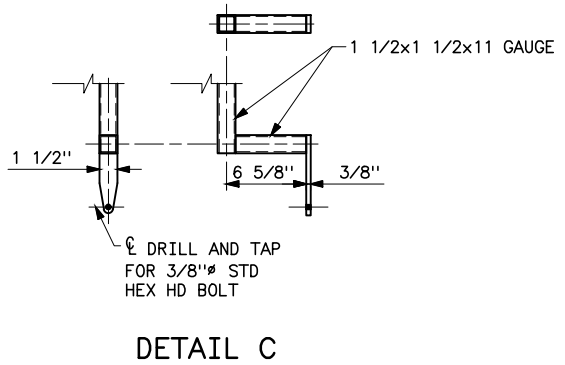
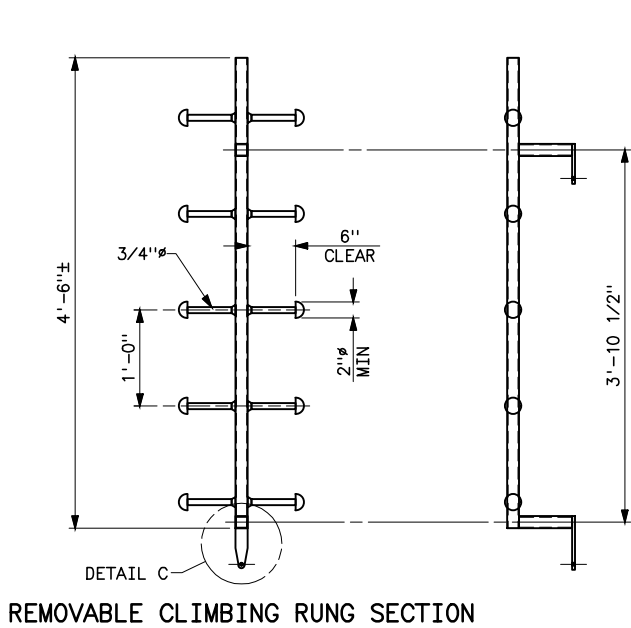
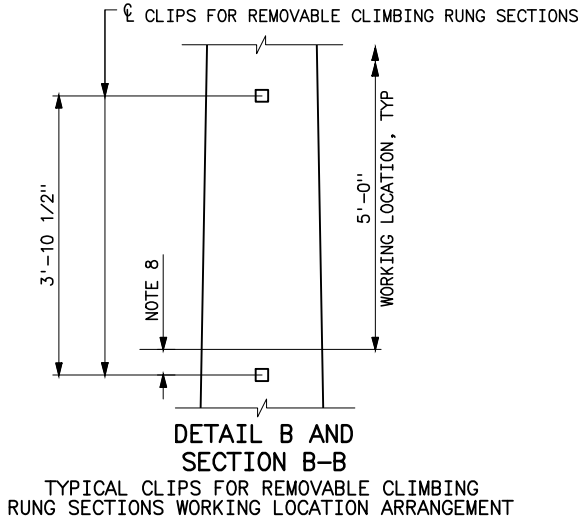
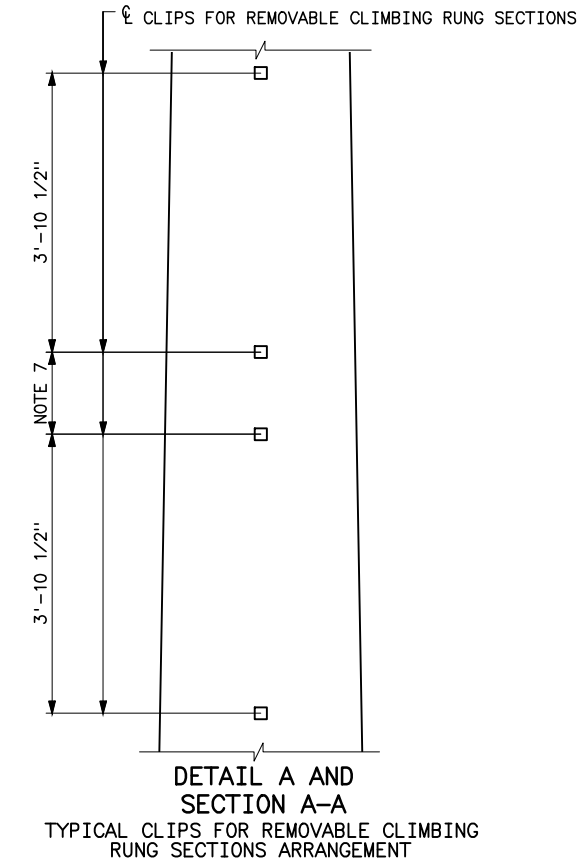
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION HEADQUARTERS - LAKEWOOD, COLORADO		
TRANSMISSION LINE STRUCTURE STANDARDS LIGHT DUTY STEEL POLE STRUCTURES MAINTENANCE PROVISIONS - OUTLINES		
DESIGNED BRONSON PERRY	APPROVED GINA CRAWFORD CIVIL ENGINEERING MANAGER	
C A E	APRIL 23, 2021	43 2218



MAINTENANCE PROVISIONS - DETAILS_____43 2220

UNITED STATES DEPARTMENT OF ENERGY			
WESTERN AREA POWER ADMINISTRATION			
HEADQUARTERS - LAKEWOOD, COLORADO			
TRANSMISSION LINE			
STRUCTURE STANDARDS			
LIGHT DUTY STEEL POLE STRUCTURES			
MAINTENANCE PROVISIONS - OUTLINES			
DESIGNED <u>BRONSON PERRY</u>		APPROVED <u>GINA CRAWFORD</u>	
		CIVIL ENGINEERING MANAGER	
C A F	APRIL 23, 2021	43	2219

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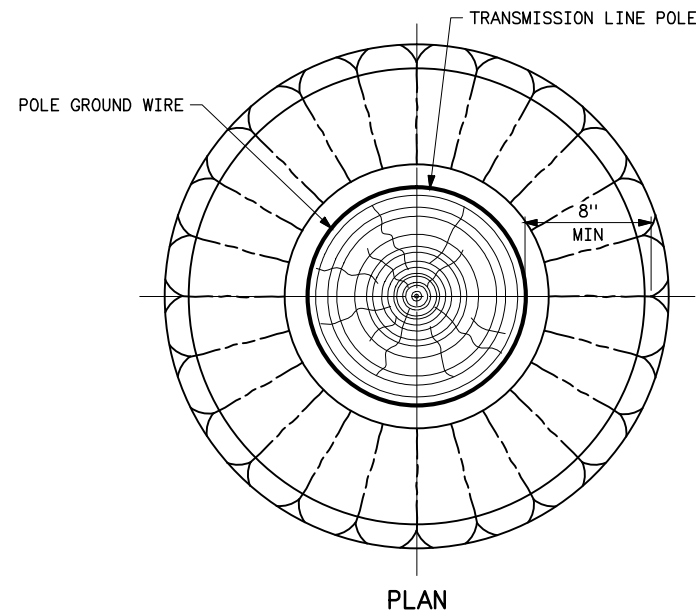


- NOTES**
1. WELDS TO ATTACH MAINTENANCE PROVISIONS TO STRUCTURES SHALL DEVELOP THE ULTIMATE TENSILE STRENGTH OF THE ATTACHED PART.
 2. STEP BOLTS SHALL BE CORRUGATED, KNURLED, DIMPLED, OR OTHERWISE TREATED TO MINIMIZE SLIPPING. COATING WITH SKID-RESISTANT MATERIAL IS NOT ACCEPTABLE.
 3. DISTANCE FROM CENTERLINE OF STEP BOLTS TO FACE OF POLE SHAFTS FOR REMOVABLE CLIMBING RUNG SECTIONS SHALL BE 7 INCHES.
 4. INSIDE BEND RADIUS FOR 1/4" PLATE: 3/8".
 5. ANCHORAGE PLATE MARK NUMBER - KEY TO DESIGNATIONS:
 - FP DENOTES "FLANGE PLATES";
 - 5 DENOTES STRENGTH OF PLATE IN KIPS;
 - R AND L DENOTE RIGHT AND LEFT ANCHORAGE PLATE.
 6. INSTALLATION INSTRUCTIONS:
 - INSTALL ANCHORAGE PLATES FLUSH WITH CENTER OF ATTACHMENT.
 - SECURE ANCHORAGE PLATE TO ATTACHMENT USING 3/4" STEP BOLT, 1 NUT ON THE OUTSIDE OF THE PLATE AND 1 NUT AND LOCKNUT ON THE INSIDE OF THE ATTACHMENT.
 - ENSURE THAT PLATES DO NOT MOVE AFTER INSTALLATION.
 7. LOCATIONS OF REMOVABLE CLIMBING RUNG SECTIONS SHALL BE SPACED TO ALLOW REMOVAL OF ANY CLIMBING RUNG SECTION WHILE ADJACENT SECTIONS REMAIN IN PLACE.
 8. CLIPS FOR REMOVABLE CLIMBING RUNG SECTIONS AT WORKING LOCATIONS SHALL BE LOCATED SO THAT THE BOTTOM STEP BOLTS ARE AT THE WORKING LOCATION WHEN THE REMOVABLE CLIMBING RUNG SECTIONS ARE INSTALLED.

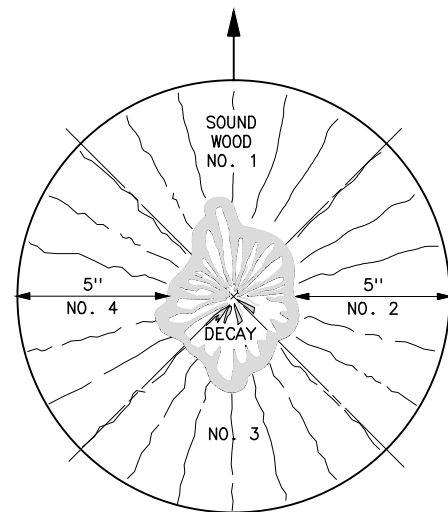
REFERENCE DRAWING
MAINTENANCE PROVISIONS -
OUTLINES ----- 43 2218 & 2019

UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION HEADQUARTERS - LAKEWOOD, COLORADO		
TRANSMISSION LINE STRUCTURE STANDARDS LIGHT DUTY STEEL POLE STRUCTURES MAINTENANCE PROVISIONS - DETAILS		
DESIGNED BRONSON PERRY	APPROVED GINA CRAWFORD CIVIL ENGINEERING MANAGER	
C/AE	APRIL 23, 2021	43 2220

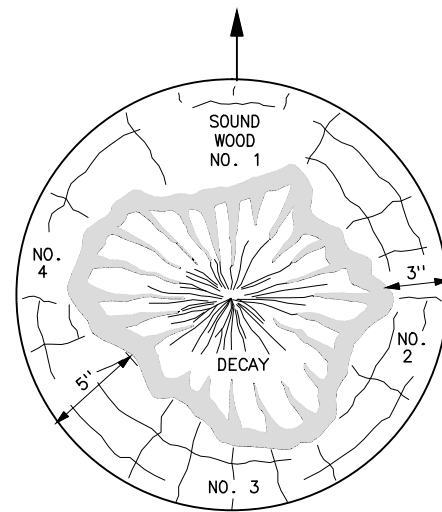
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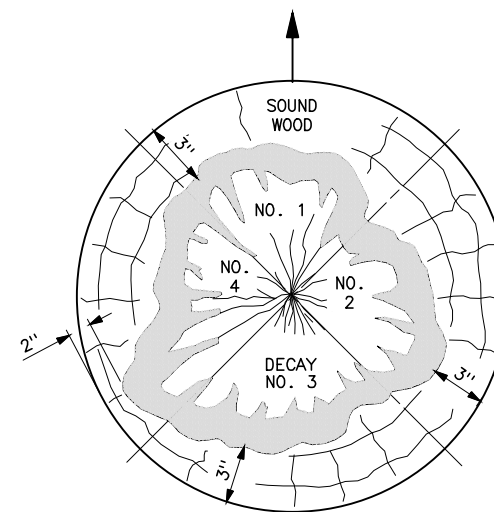
EXCAVATION FOR INSPECTION AND TREATMENT



POLE WITH MINOR DECAY



POLE WITH ADVANCED DECAY POCKET

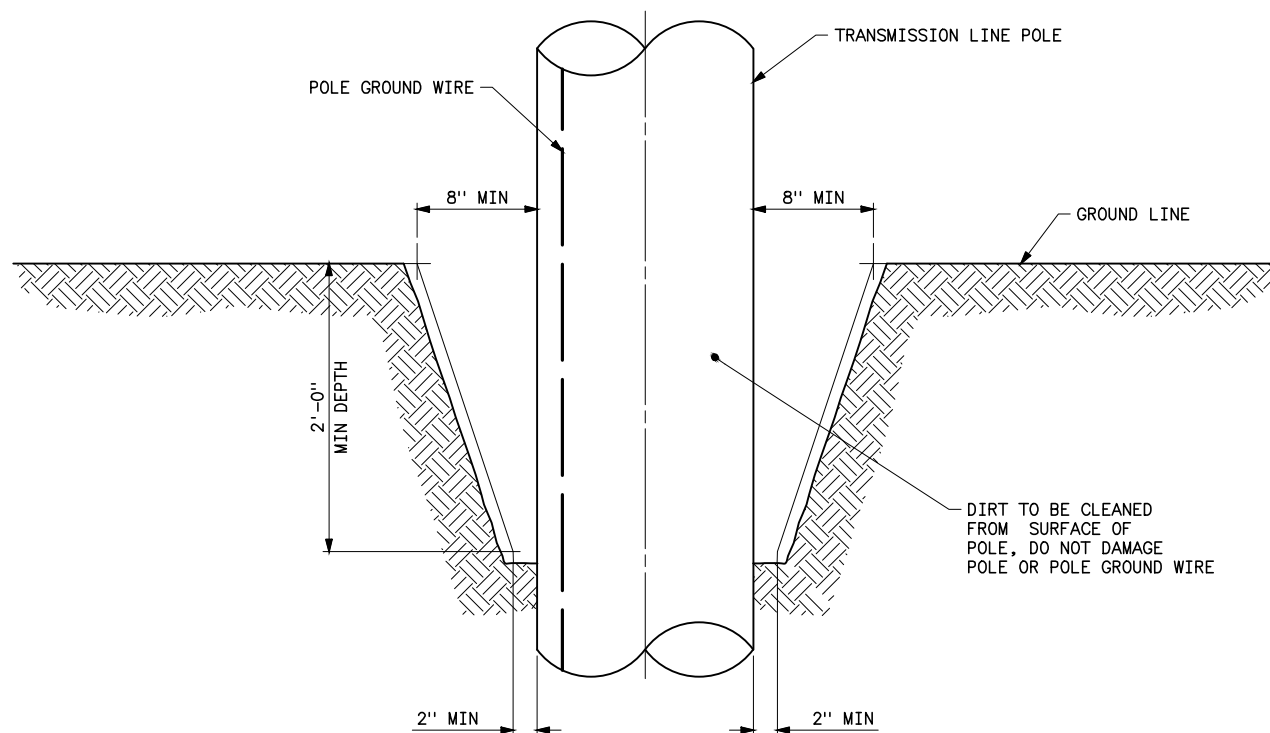


SEVERELY DECAYED POLE

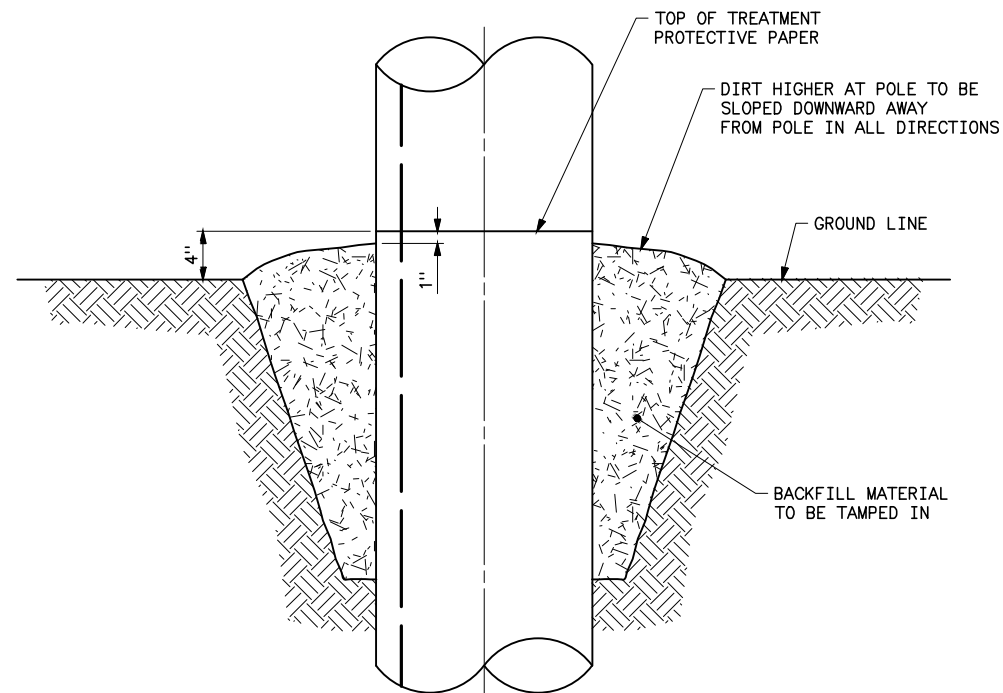
REPORTING STATE OF DECAY

NOTE

1. NUMBER QUADRANTS ON REPORTS AS SHOWN FACING AHEAD OF LINE.

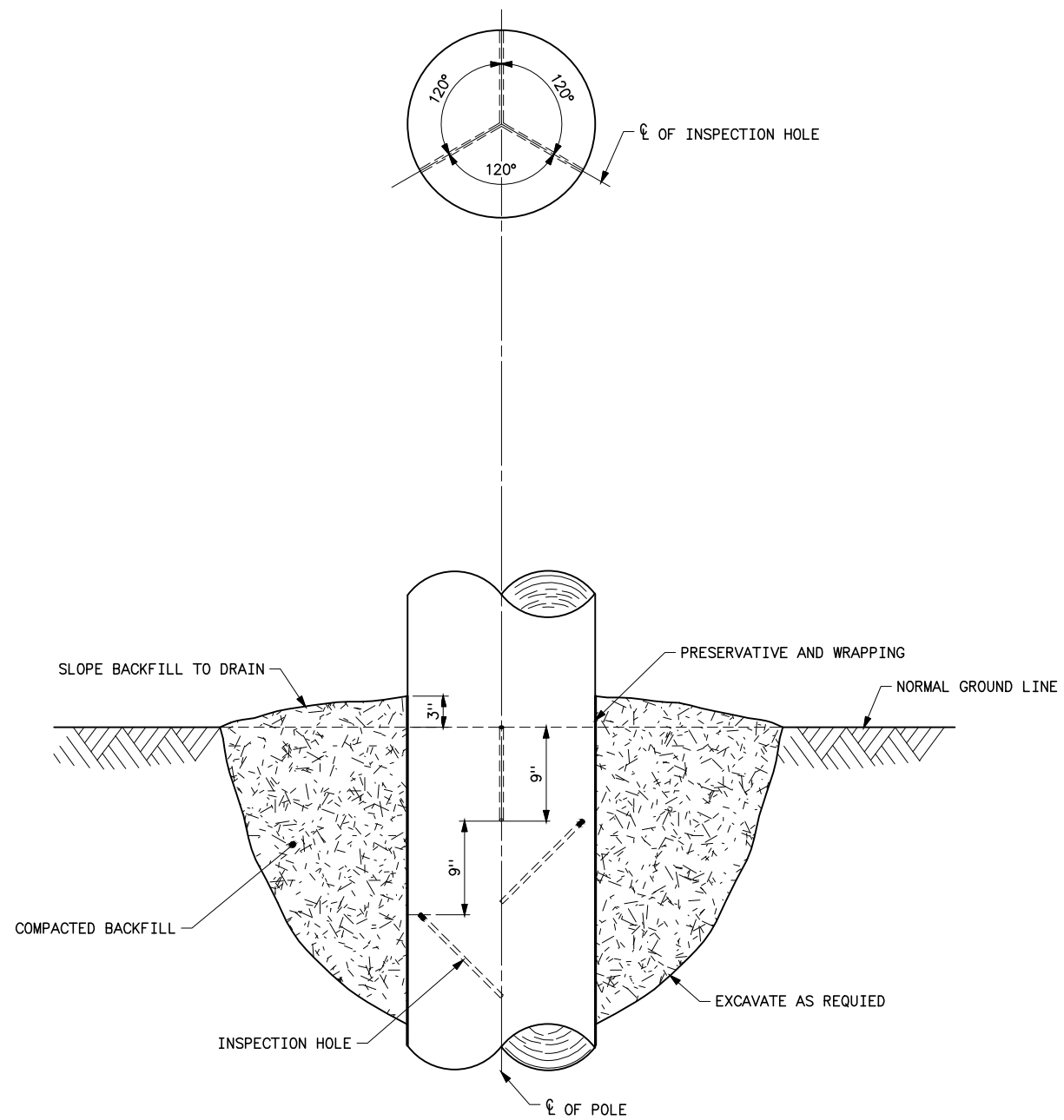


EXCAVATION FOR INSPECTION AND TREATMENT



BACKFILL

A	5-28-14 A7-DDD	REDRAWN.
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
STANDARD DESIGNS TRANSMISSION LINES INSPECTION AND TREATMENT OF WOOD POLE STRUCTURES PLANS-ELEVATIONS-DETAILS		
DESIGNED _____ APPROVED ALAN P. PESCHONG _____		
C A F	AUGUST 6, 1979	41 9012



NOTES

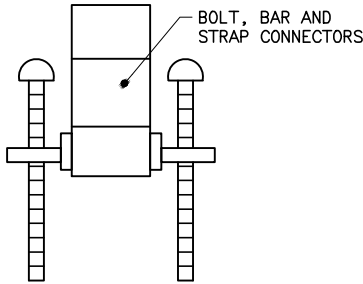
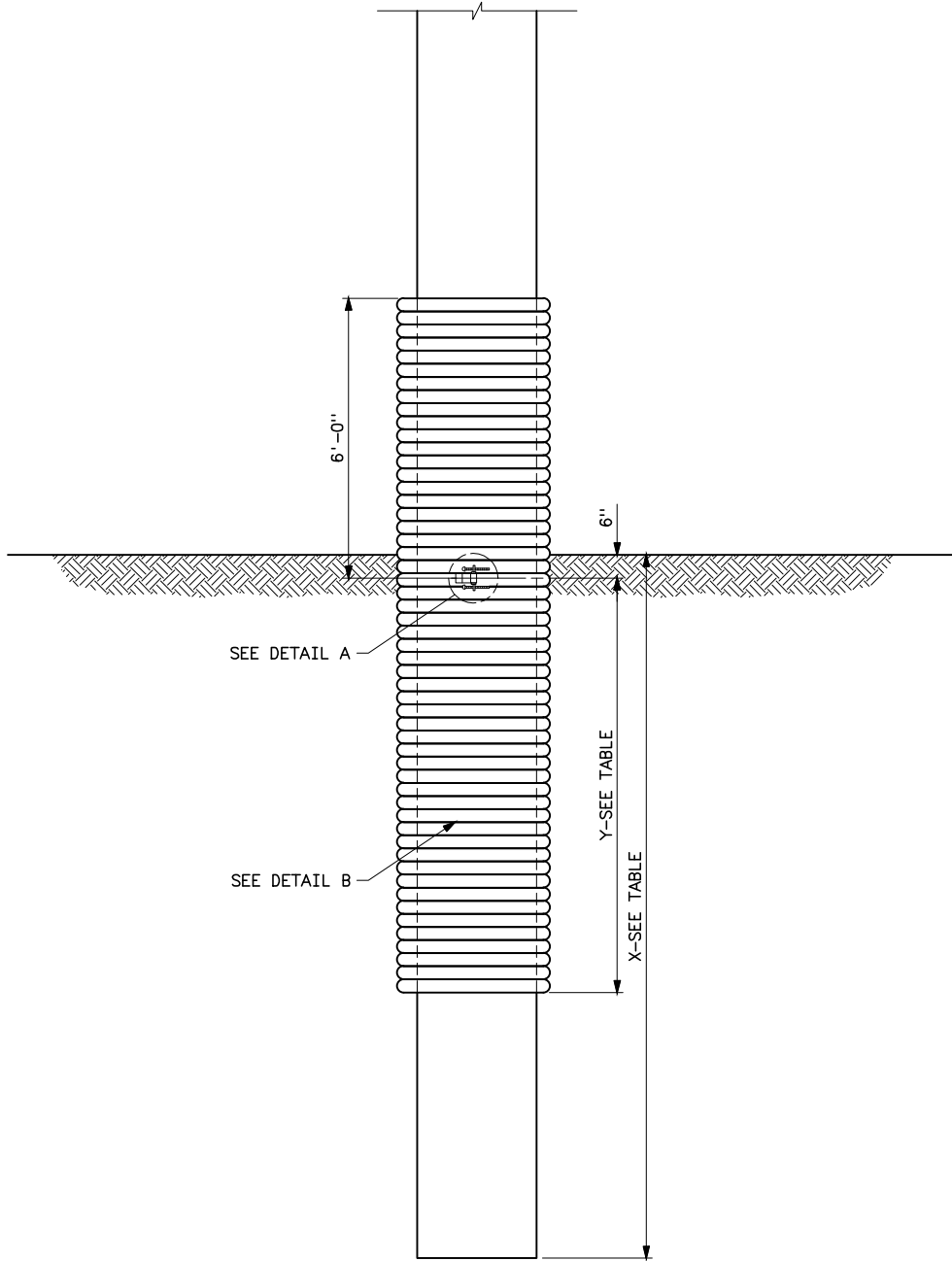
1. INSPECTION HOLE SHALL BE 3/8" DIAMETER (APPROX) INCREMENT BORE, CORE DIAMETER 0.2", AND BORED AT A 45° ANGLE TO THE HORIZONTAL.
2. INJECT ALL BORED HOLES WITH A SPECIFIED TREATMENT AND PLUG IF POLE IS NOT REJECTED.
3. PRESERVATIVE SHALL BE APPLIED FROM THE BOTTOM OF EXCAVATION, 18" MINIMUM, TO 3" ABOVE GROUND LINE; POLYETHYLENE-BACKED PAPER SHALL EXTEND AT LEAST 1" ABOVE TREATED AREA.

D	5-28-14 A7-DDD	REDRAWN.		
	UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO			
D	STANDARD DESIGNS TRANSMISSION LINES INSPECTION AND TREATMENT OF WOOD POLES-DETAILS			
	DESIGNED <u>AL HARDING</u> _____ APPROVED <u>MCCONNELL STEWART</u> _____			
C A F	JUNE 8, 1983	41	9013	

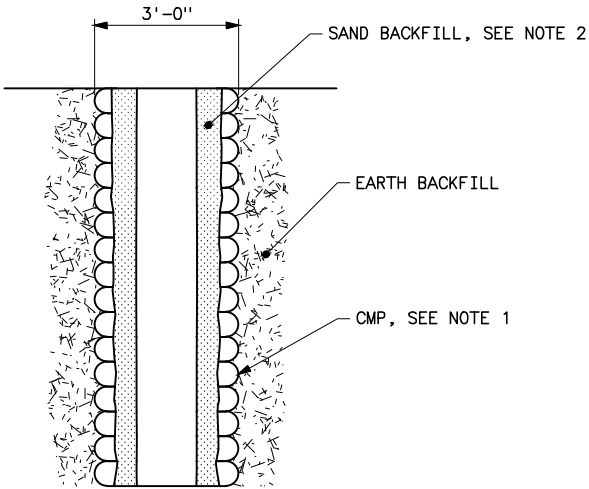
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XREF(S):

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IMAGES:



DETAIL A
CONNECTION DETAIL
SINGLE HARNESS



DETAIL B
BACKFILL DETAILS

POLE LENGTH	X	Y
55'-0"	12'-0"	6'-6"
60'-0"	12'-6"	7'-0"
65'-0"	13'-0"	7'-6"
70'-0"	13'-6"	8'-0"
75'-0"	14'-0"	8'-6"
80'-0"	14'-6"	9'-0"
85'-0"	15'-0"	9'-6"
90'-0"	15'-6"	10'-0"
95'-0"	16'-0"	10'-6"

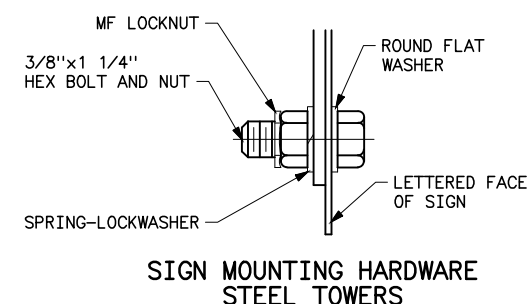
NOTES

1. CORRUGATED-METAL PIPE, INCLUDING COUPLING BANDS, SHALL BE IN ACCORDANCE WITH FEDERAL SPECIFICATION WW-P-405B, CLASS I OR II, SERIES A, SHAPE 1. PIPE ENDS SHALL BE BEVELED WHERE REQUIRED.
2. SAND BACKFILL SHALL EXTEND TO TOP OF CMP.
3. CMP SHALL BE IN TWO SECTIONS COUPLED TOGETHER AS SHOWN IN DETAIL A.

A	5-28-14 A7-DDD	REDRAWN.	
	UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
	TRANSMISSION LINE STANDARD CMP-TYPE CASING FOR SETTING WOOD POLES		
	DESIGNED <u>F.S. COOK</u> _____ APPROVED <u>C.A. CABRAL</u> _____ DIRECTOR, DIVISION OF ELECTRICAL DESIGN		
C _A F	JANUARY 17, 1980	41	9014

XREF(S):

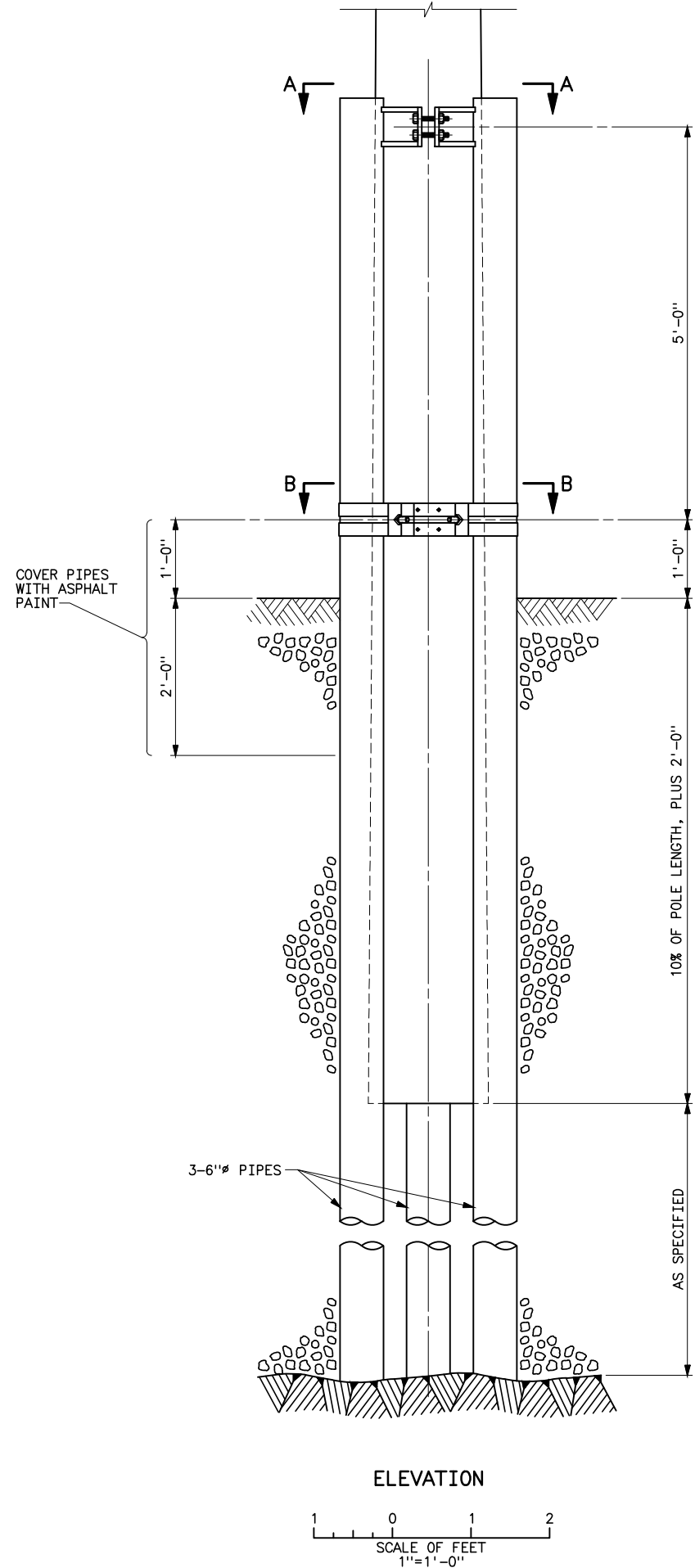
(TELEPHONE NO.)
(TELEPHONE NO.)



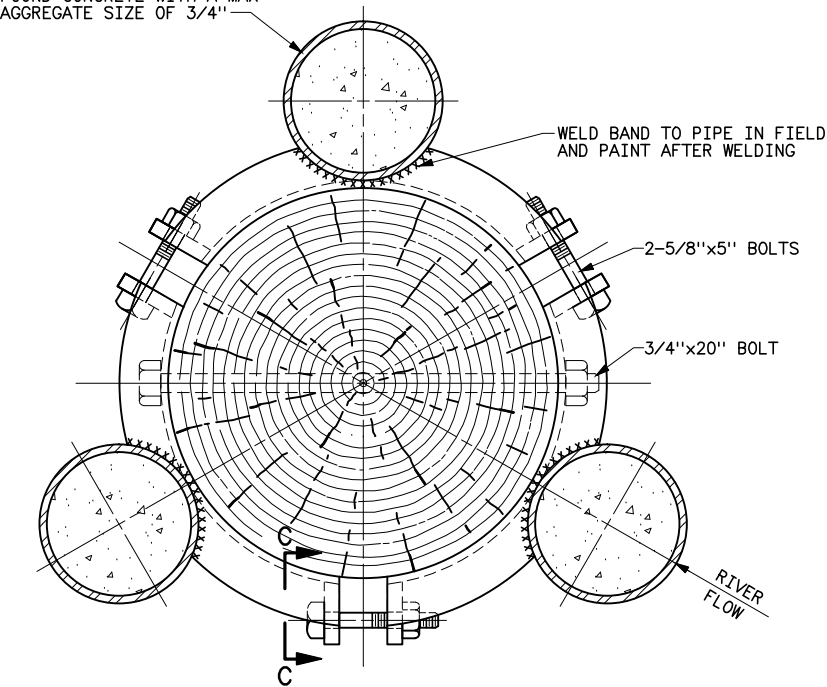
1. SIGNS SHALL BE MADE OF NO. 16 GAUGE SHEET. HEIGHT AND WIDTH DIMENSIONS SHALL BE 17"x18" RESPECTIVELY.
2. FINISH SHALL BE PORCELAIN ENAMEL.
3. EACH SIGN SHALL HAVE SIX FINISHED HOLES LARGE ENOUGH TO TAKE 3/8" BOLTS. HOLES IN SIGNS SHALL BE FITTED WITH BRASS EYELETS.
4. THE PORCELAIN ENAMEL SHALL BE IN ACCORDANCE WITH THE RECOMMENDED STANDARDS FOR MANUFACTURE OF PORCELAIN ENAMEL SIGNS (PE11S-103) OF THE PORCELAIN ENAMEL INSTITUTE, INC.
5. SIZE OF LETTERING AND BACKGROUND SHALL BE PROPORTIONAL TO THOSE SHOWN.
6. ALL FERROUS HARDWARE SHALL BE GALVANIZED.
7. ENCRACEMENT LIMIT, X, TO BE SPECIFIED.
8. CITIES, STATES AND TELEPHONE NUMBERS TO BE SPECIFIED.
9. SIGNS SHALL BE MOUNTED AT 7 FEET ±2 FEET ABOVE GROUND.

B	5-28-14 A7-DDD	REDRAWN.
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
TRANSMISSION LINE STANDARDS RIGHT OF WAY ENCROACHMENT WARNING SIGN DETAILS AND LOCATION		
DESIGNED <u>BRIAN C. MORRIS</u> _____		APPROVED <u>C.A. CABRAL</u> DIRECTOR, DIVISION OF ELECTRICAL DESIGN
CAL	FEBRUARY 13, 1980	41 9016

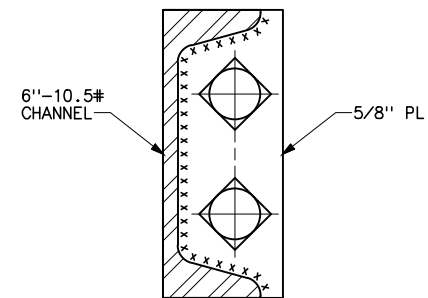
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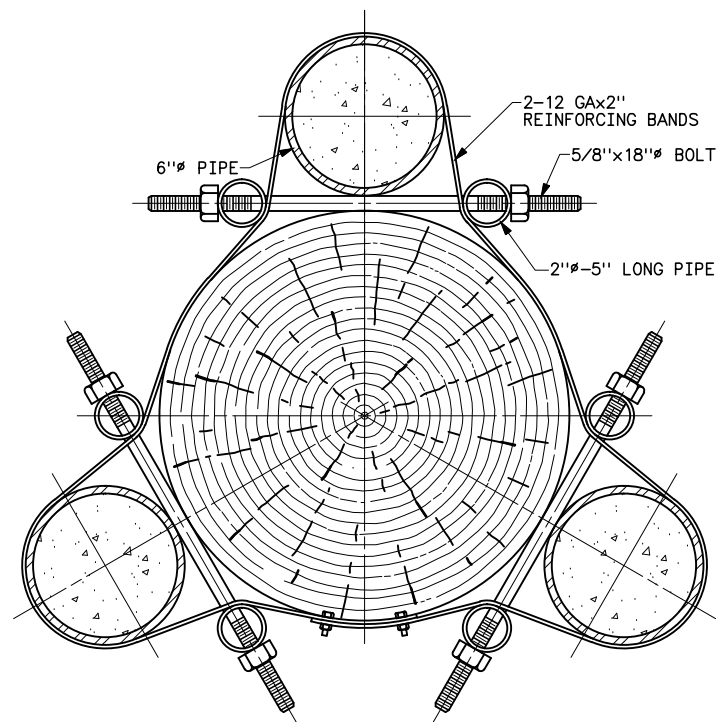
6"Ø PIPE FILLED WITH 3000 POUND CONCRETE WITH A MAX AGGREGATE SIZE OF 3/4"



SECTION A-A



SECTION C-C



SECTION B-B

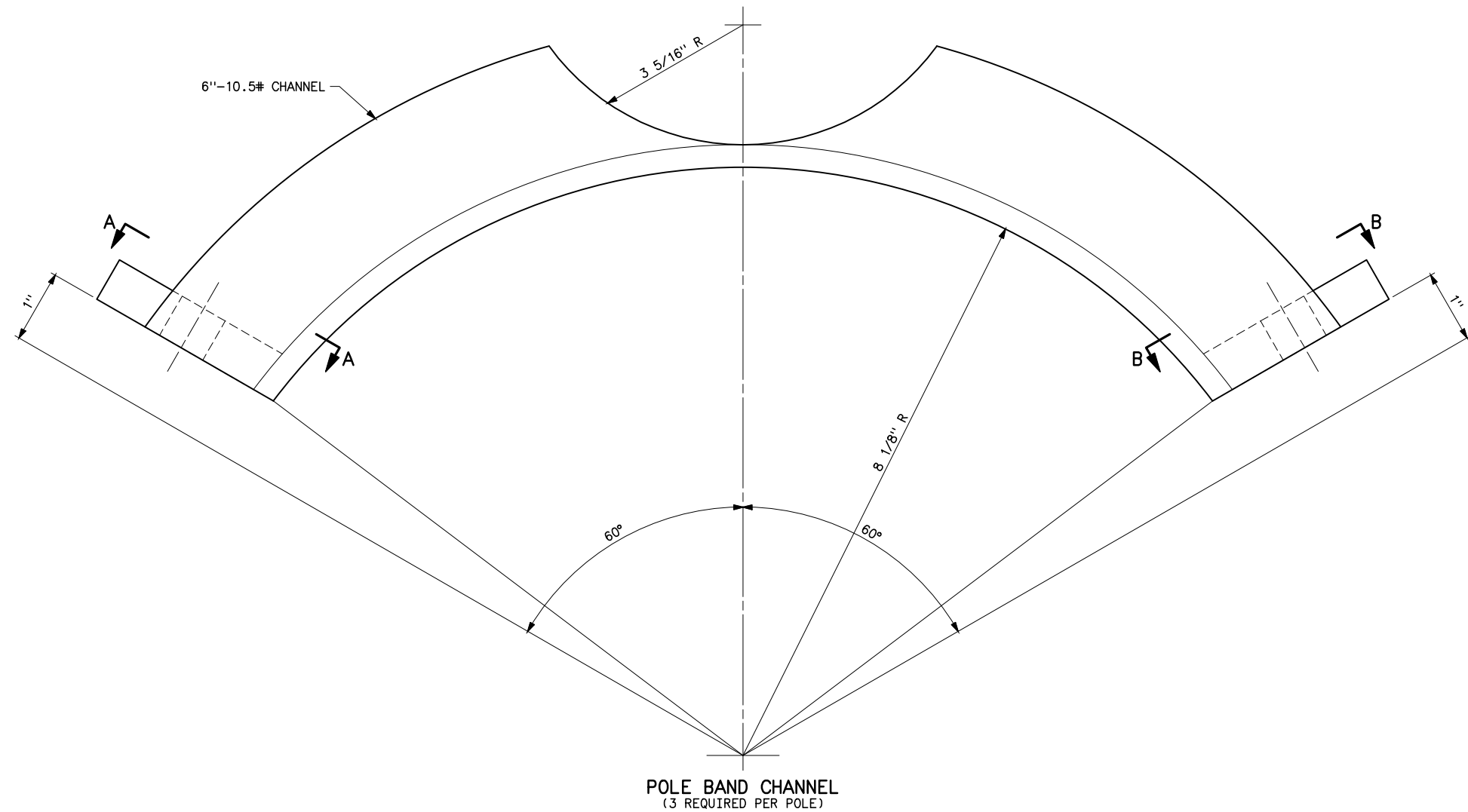
NOTES

1. EXTRA STRONG 6"Ø STEEL PIPE TO BE FURNISHED AND BUTT WELDED IN THE FIELD TO THE REQ LENGTH.
2. ALL BANS AND BOLTS SHALL BE GALVANIZED IN ACCORDANCE WITH ASTM DESIGNATION A-153.

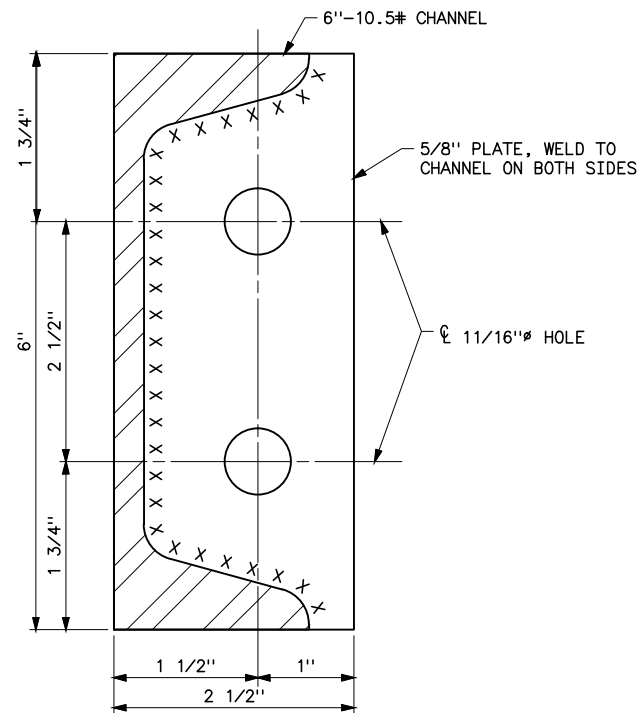
REFERENCE DRAWING

POLE BAND CHANNEL FOR PILE-TYPE FOUNDATIONS _____ 41 9018

A	5-28-14 A7-DDD	REDRAWN.
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
TRANSMISSION LINE STANDARDS PILE - TYPE FOUNDATIONS FOR WOOD POLES		
DESIGNED HENRY JAMES KIENTZ	APPROVED GERALD D. BIRNEY	
DIRECTOR, DIVISION OF ELECTRICAL DESIGN		
MAY 5, 1980	41	9017



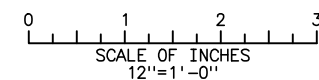
POLE BAND CHANNEL
(3 REQUIRED PER POLE)



SECTION A-A - AS SHOWN
SECTION B-B - OPPOSITE HAND

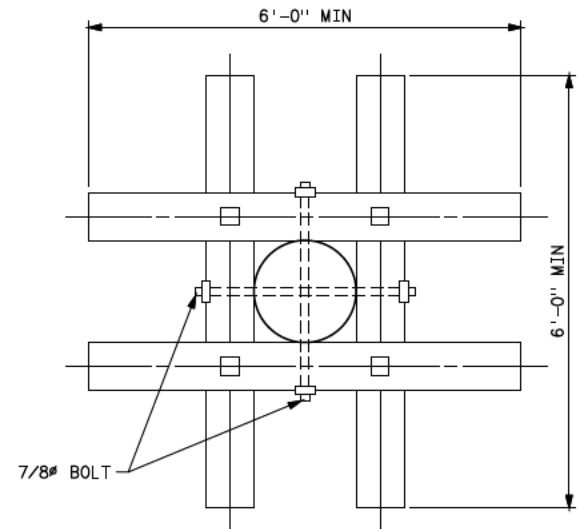
NOTE
1. BAND SHALL BE GALVANIZED AFTER DRILLING, BENDING AND WELDING IN ACCORDANCE WITH ASTM DESIGNATION A-153.

REFERENCE DRAWING
PILE-TYPE FOUNDATIONS FOR WOOD POLES----- 41 9017

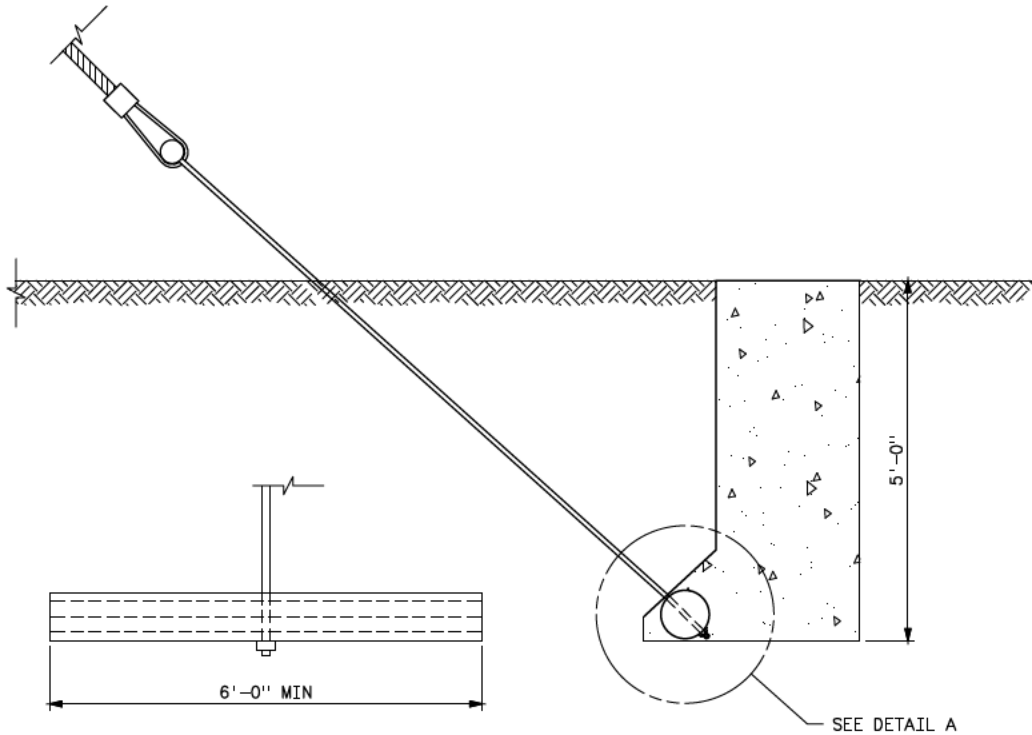


B	5-28-14 A7-DDD	REDRAWN.	
	SUPERSEDES DWG NO. 245-D-2351		
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO			
STANDARD DRAWINGS TRANSMISSION LINES POLE BAND CHANNEL FOR PILE-TYPE FOUNDATIONS			
DESIGNED <u>BUREC</u> _____ APPROVED <u>BUREC</u> _____			
C A	MAY 16, 1980	41	9018

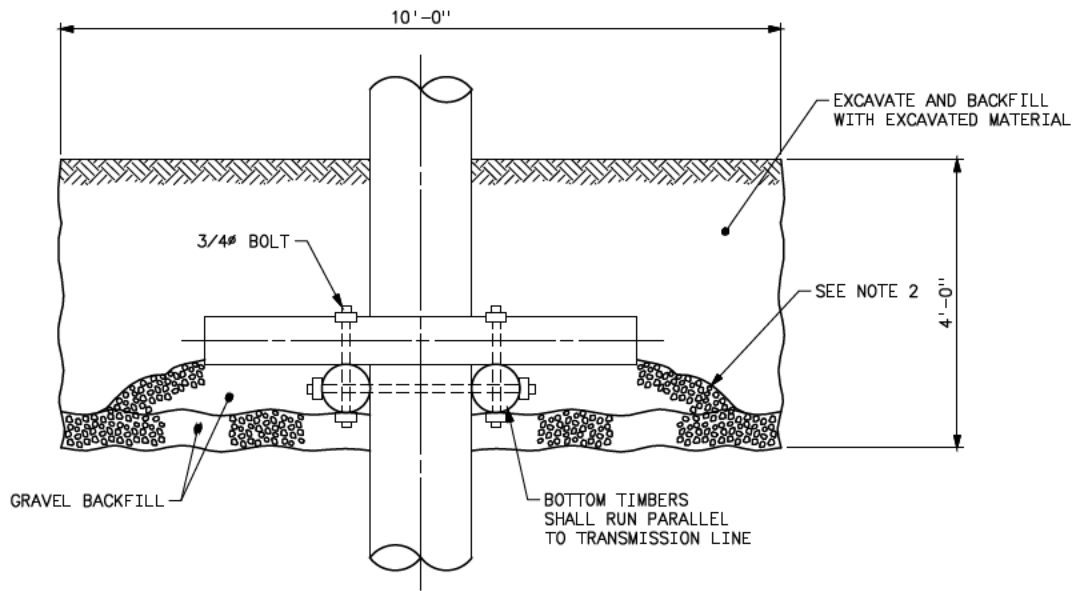
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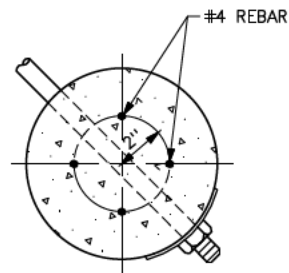
TOP VIEW OF BOG SHOE



BOG ANCHOR



BOG SHOE



DETAIL A



ALUMINUM DISC
(SEE NOTE 5 AND 6)

LIST OF MATERIALS

BOG SHOE

NO. REQD	DESCRIPTION
4	BOG SHOE, WOOD, 8x6-0
2	7/8x42 DOUBLE ARMING BOLT
12	4x4x1/4 SQUARE CURVED WASHER
4	3/4x24 DOUBLE ARMING BOLT

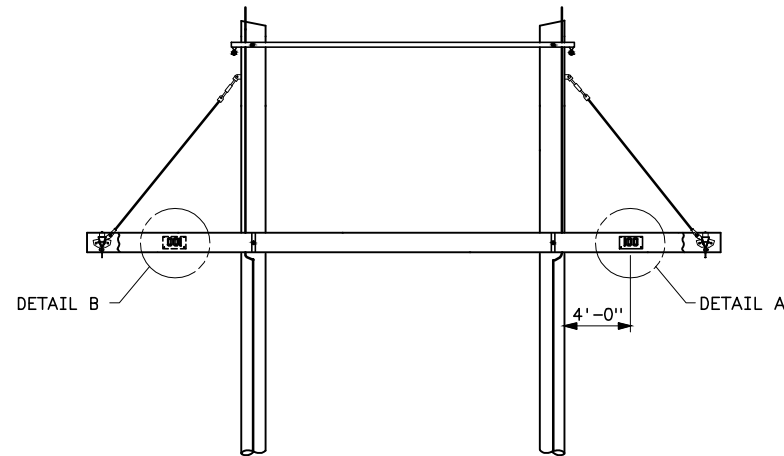
BOG ANCHOR

NO. REQD	DESCRIPTION
1	CONCRETE ANCHOR
1	ANCHOR ROD, 3/4x8-0
1	3x3x1/4 CURVED WASHER, GALVANIZED
4	#4 REINFORCING BARS PER DETAIL A

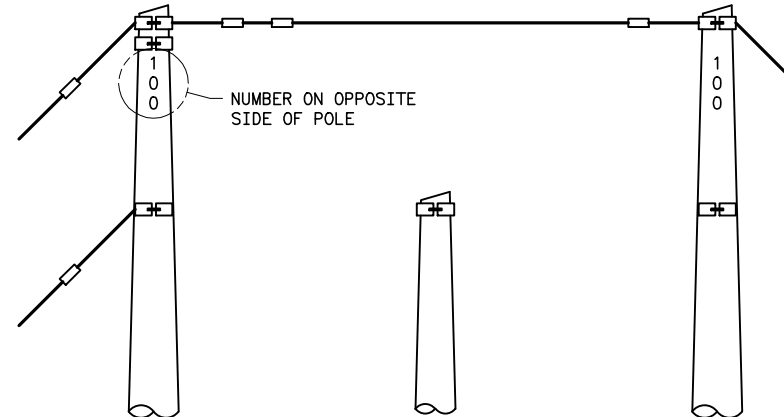
NOTES

1. BOG SHOES SHALL BE PACIFIC COAST DOUGLAS FIR AND SHALL HAVE A MINIMUM OF 6 FEET IN LENGTH BY 8 INCHES IN DIAMETER AND SHALL HAVE THE SAME FULL-LENGTH PRESSURE PRESERVATIVE TREATMENT AS THAT REQUIRED FOR THE POLES.
2. BOTTOM AND TOP TIMBERS SHALL BE PLACED ON LEVEL BEARING SURFACES.
3. TREAT ALL FIELD DRILLED HOLES IN ACCORDANCE WITH THE SPECIFICATIONS.
4. BOG ANCHORS SHALL BE REINFORCED CONCRETE WITH A MINIMUM SIZE OF 6 FEET IN LENGTH BY 8 INCHES IN DIAMETER.
5. POLES WITH BOG SHOES OR BOG ANCHORS INSTALLED SHALL BE TAGGED WITH 24 GAGE, 2 INCHES DIAMETER, ALUMINUM DISCS. THE DISCS SHALL BE ATTACHED WITH TWO 2 INCH ALUMINUM TWIST NAILS. ALTERNATE TAGS MAY BE SUBMITTED FOR APPROVAL BY CONTRACTOR. TAGS SHALL BE MOUNTED APPROXIMATELY 5 FEET ABOVE THE GROUNDLINE.
6. THE DISCS FOR POLES WITH BOG SHOES SHALL BE EMBOSSED WITH A BS AND THE DISCS FOR POLES WITH BOG ANCHORS SHALL BE EMBOSSED WITH A BA ALONG WITH THE YEAR INSTALLED.
7. GRAVEL SHALL BE PIT-RUN, FREE-DRAINING MATERIAL WITH A MAXIMUM SIZE OF 2 1/2 INCHES.

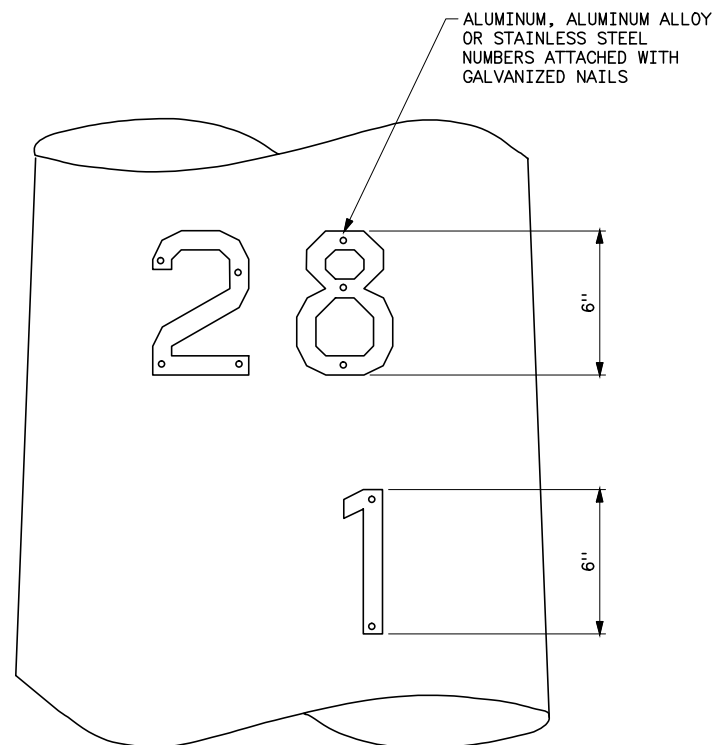
C	7-15-03 A7-RC	REVISED TITLE BLOCK ONLY.
B	2-7-95 A2-RMC	REVISED AND REDRAWN ON CAE.
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
TRANSMISSION LINE STANDARDS WOOD POLE STRUCTURES BOG SHOE AND BOG ANCHOR		
DESIGNED K.K. ROME _____ APPROVED ROSS CLARK CHIEF, TRANSMISSION LINE BRANCH		
C	A	F
JULY 17, 1980	41	9019



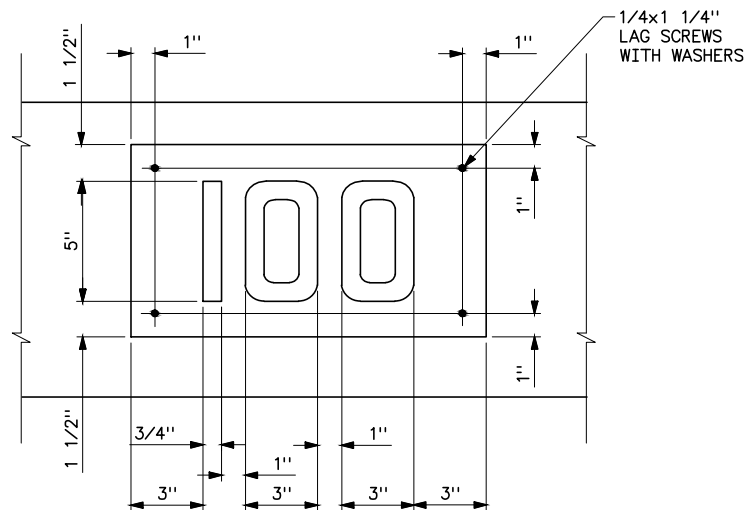
AERIAL PATROL MILE MARKER SIGN LOCATION
H-FRAME STRUCTURE



AERIAL PATROL MILE MARKER SIGN LOCATION
3-POLE OR SINGLE POLE STRUCTURES
(SEE NOTE 8)



STRUCTURE NUMBER SIGNS
(MOUNT 8 FOOT ABOVE GROUNDLINE
ON RIGHT POLE WHEN LOOKING
AHEAD AND BACK ON LINE)



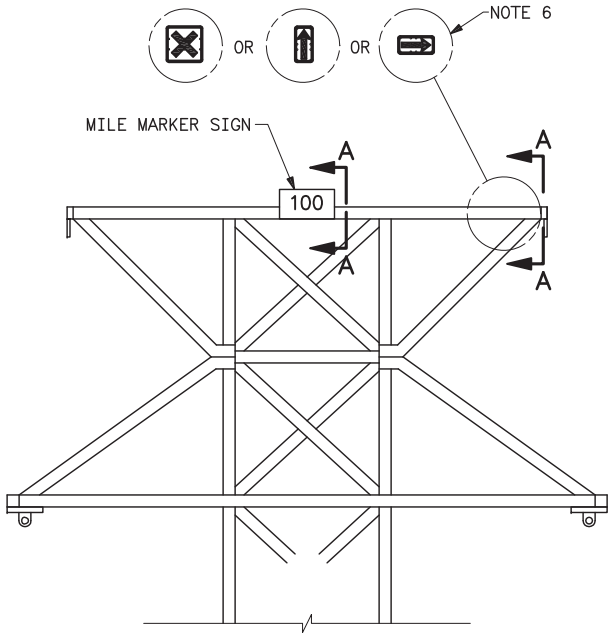
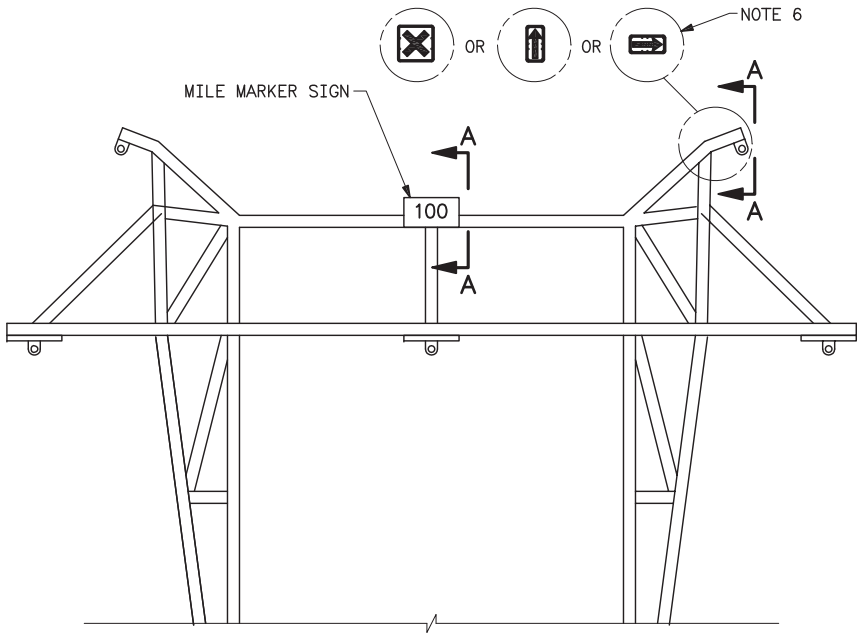
AERIAL PATROL MILE MARKER SIGNS
(ONLY ON FIRST STRUCTURE OF EACH MILE SECTION OF LINE)

DETAIL A (FRONT FACE)
DETAIL B (BACK FACE)

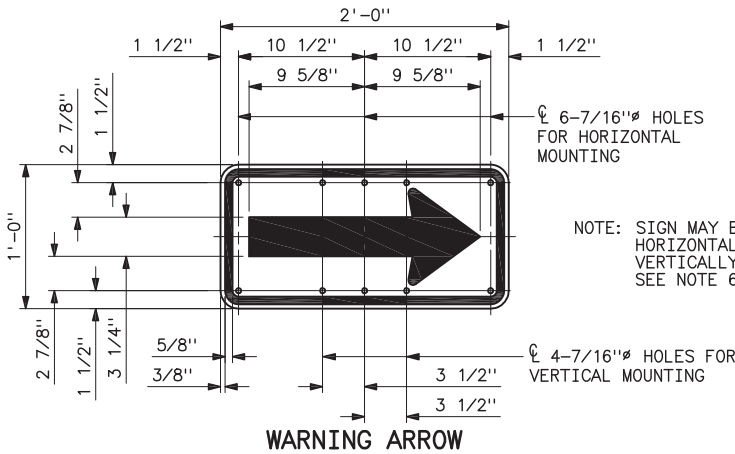
NOTES

1. SIGNS SHALL BE MADE OF NO. 18 U.S. GAGE SHEET STEEL.
2. FINISH SHALL BE PORCELAIN ENAMEL. BACKGROUND COLOR SHALL BE YELLOW, FIGURES SHALL BE BLACK.
3. FIGURES SHALL BE OF THE "BLOCK" TYPE, 5-INCHES HIGH AND 3-INCHES WIDE. BODY LINES SHALL BE 3/4-INCH WIDE.
4. EACH SIGN SHALL HAVE FOUR FINISHED 1/2-INCH HOLES. HOLES IN SIGNS SHALL BE FITTED WITH BRASS EYELETS.
5. EACH SIGN SHALL BE 8-INCHES HIGH, WIDTH MAY VARY AS FOLLOWS:
FOR THREE DIGIT SIGNS SUCH AS 200, WIDTH SHALL BE 17-INCHES;
FOR THREE DIGIT SIGNS SUCH AS 100, WIDTH SHALL BE 15-INCHES;
FOR TWO DIGIT SIGNS SUCH AS 20, WIDTH SHALL BE 13-INCHES;
FOR ONE DIGIT SIGNS SUCH AS 2, WIDTH SHALL BE 9-INCHES.
6. THE PORCELAIN ENAMEL SHALL BE IN ACCORDANCE WITH THE RECOMMENDED STANDARDS FOR MANUFACTURE OF PORCELAIN ENAMEL SIGNS (PEI:S-103) OF THE SIGN DIVISION OF THE PORCELAIN ENAMEL INSTITUTE, INC.
7. ALL FERROUS HARDWARE SHALL BE GALVANIZED.
8. 6-INCH HIGH NUMBERS SHALL BE ATTACHED ONE FOOT BELOW LOWEST POLE BAND ON RIGHT HAND POLE SIMILAR TO STRUCTURE NUMBER SIGNS.

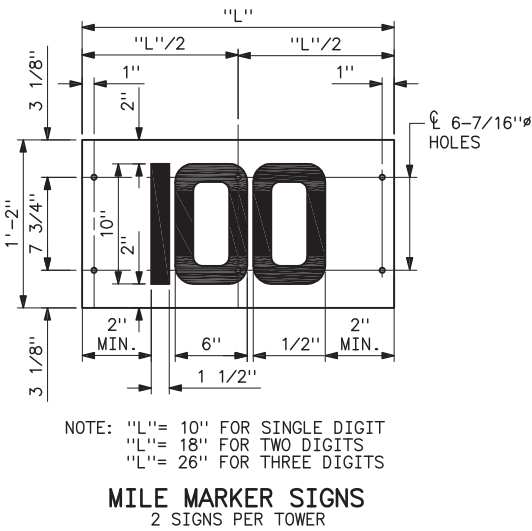
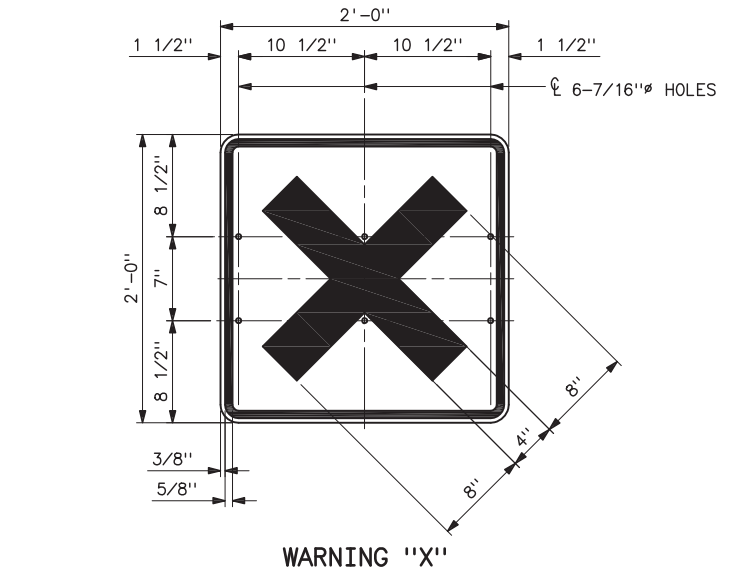
E	11-8-13 A7-KKR	CHANGED NOTE ON STRUCTURE NUMBER SIGNS.
	7-15-03 A7-RC	REVISED TITLE BLOCK ONLY.
C	8-21-95 A2-RMC	REVISED AND REDRAWN.
SUPERSEDES DWG NO. 40-D-5174		
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
TRANSMISSION LINE STANDARDS WOOD POLE STRUCTURES AERIAL PATROL MILE MARKER AND NUMBER SIGNS		
DESIGNED K. ROWE ----- APPROVED ROSS CLARK CHIEF, TRANSMISSION LINE BRANCH		
A-F	AUGUST 21, 1995	41 9004



LOCATION AND MOUNTING DETAILS FOR SIGNS ON LATTICE STEEL TOWERS

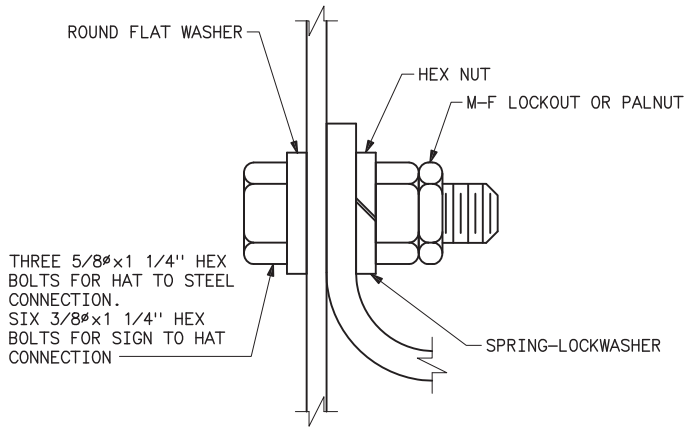


NOTE: SIGN MAY BE MOUNTED EITHER HORIZONTALLY AS SHOWN OR VERTICALLY, AS INDICATED. SEE NOTE 6.

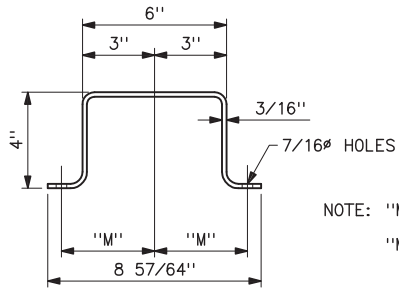


NOTE: "L" = 10" FOR SINGLE DIGIT
"L" = 18" FOR TWO DIGITS
"L" = 26" FOR THREE DIGITS

MILE MARKER SIGNS
2 SIGNS PER TOWER



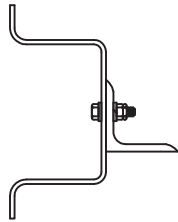
DETAIL B
SIGN MOUNTING HARDWARE
(SEE NOTE 2)



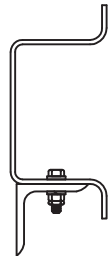
NOTE: "M" = 3 7/8" FOR MILE MARKER SIGN
"M" = 3 1/2" FOR WARNING SIGNS

HAT SECTION

LEGNTH OF HAT SHALL BE SAME AS SIGN

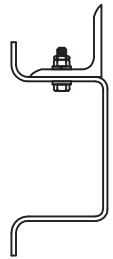


DETAIL X

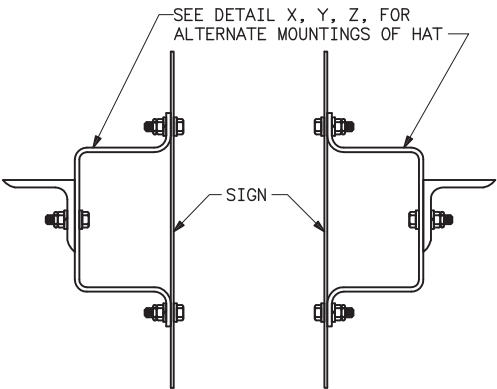


DETAIL Y

SEE DETAIL B FOR MOUNTING HARDWARE



DETAIL Z



SECTION A-A

MATERIAL SPECIFICATIONS
(FOR MILE MARKER SIGNS)

1. SIGNS SHALL BE MADE OF NO. 16 US GAUGE SHEET STEEL.
2. FINISH SHALL BE PORCELAIN ENAMEL. BACKGROUND COLOR SHALL BE YELLOW. FIGURES SHALL BE BLACK.
3. FIGURES SHALL BE OF THE "BLOCK" TYPE, 10 INCHES HIGH AND 6 INCHES WIDE. BODY LINES SHALL BE 1 1/2 INCHES WIDE.
4. THE PORCELAIN ENAMEL SHALL BE IN ACCORDANCE WITH THE RECOMMENDED STANDARDS FOR MANUFACTURE OF PORCELAIN ENAMEL SIGNS (PEI:S-103) OF THE SIGN DIVISION OF THE PORCELAIN ENAMEL INSTITUTE, INC.
5. ALL FERROUS HARDWARE SHALL BE GALVANIZED.

NOTES

1. FIRST STRUCTURE OF EACH MILE SECTION SHALL BE MARKED WITH TWO METAL AERIAL PATROL NUMBER SIGNS, ONE MOUNTED EACH SIDE OF TOWER AS SHOWN ABOVE. LOCATION AND MOUNTING DETAILS ARE GENERAL AND MAY BE MODIFIED TO SUIT LOCAL CONDITIONS.
2. HOLES FOR MOUNTING HARDWARE SHALL BE 1/16" LARGER THAN SIZE OF BOLT USED. HOLES IN SIGNS SHALL BE FURNISHED AND FITTED WITH BRASS EYELETS. LONGITUDINAL SPACING OF ALL HOLES IN HAT SECTIONS INCLUDING THOSE FOR HAT SECTIONS TO STEEL CONNECTIONS SHALL BE THE SAME AS USED FOR SIGNS.
3. WARNING "X" SIGN SHALL BE STANDARD UNITED STATES DEPARTMENT OF TRANSPORTATION (DOT) FEDERAL HIGHWAY SIGN, DESIGNATION W2-1, TURNED ONE-FOURTH OF A TURN TO BECOME AN "X".
4. WARNING ARROW SIGN SHALL BE STANDARD DOT SIGN DESIGNATION W1-6.
5. BACKGROUND COLOR FOR WARNING SIGNS SHALL BE ENGINEER GRADE YELLOW IN ACCORDANCE WITH ASTM D 4956. "X" OR ARROW SHALL BE BLACK.
6. FOR STRUCTURE LOCATIONS AND REQUIRED TYPE OF WARNING SIGN, SEE SPECIFICATIONS AND PLAN AND PROFILE DRAWINGS.

REFERENCE DRAWING

AERIAL PATROL WARNING SIGNS
AND MARKER BALL MARKING DIAGRAMS_-----41 9029

D	7-15-03 A7-RC	REVISED TITLE BLOCK ONLY.
C	11-7-00 A3-RMC	REDRAWN, ADDED WARNING SIGNS, NOTES, AND REFERENCE DRAWING NUMBER.
B	7-13-99 A3-RMC	REDRAWN.

SUPERSEDES DWG NO. 40-D-6045

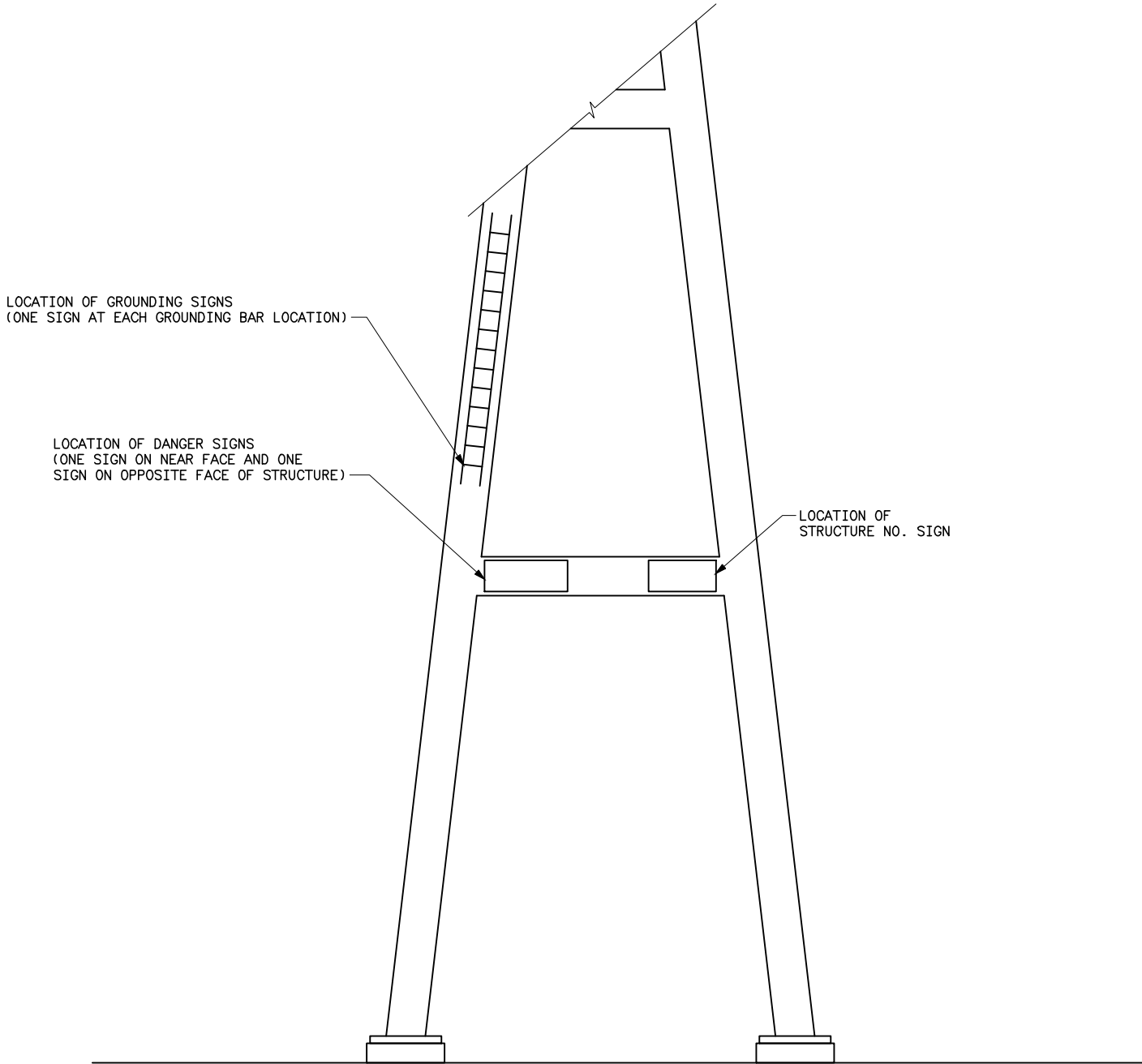
UNITED STATES DEPARTMENT OF ENERGY
WESTERN AREA POWER ADMINISTRATION
CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO

TRANSMISSION LINE STANDARDS
LATTICE STEEL TOWERS
AERIAL PATROL MILE MARKER
NUMBER AND WARNING SIGNS

DESIGNED BUREC_----- APPROVED ROSS M. CLARK
ELECTRICAL ENGINEERING MANAGER

C	AUGUST 6, 1979	41	9005
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Plotted By: denton May 29, 2014- 1:56pm
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IMAGES:



NOTES

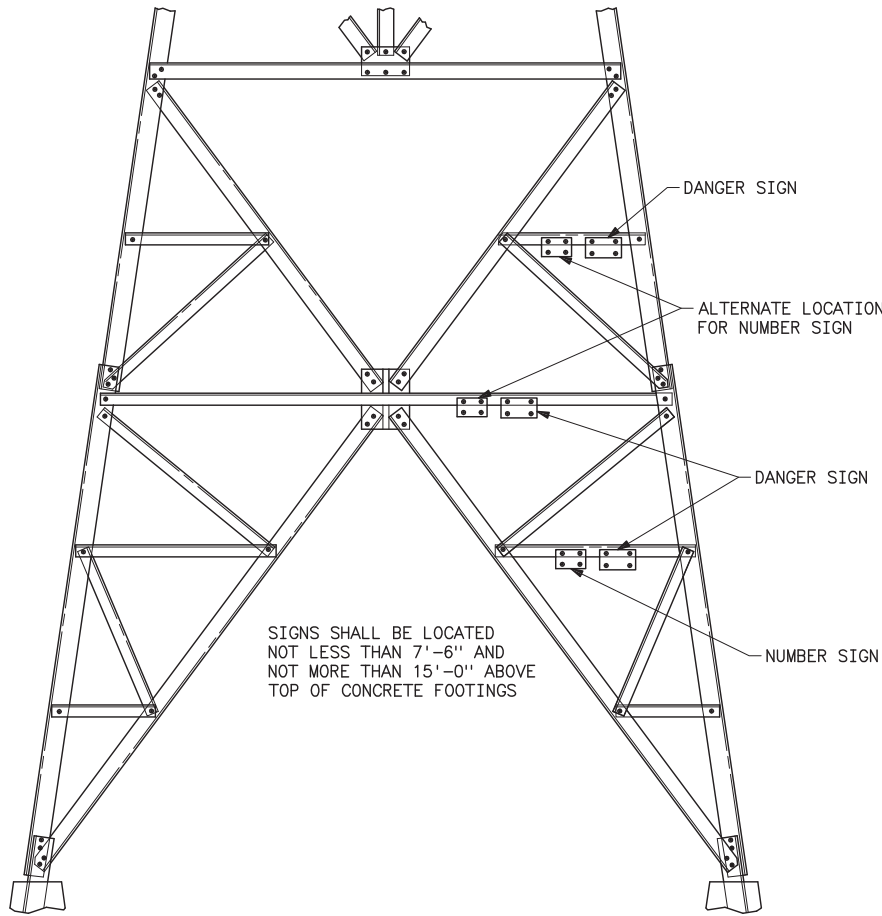
1. DANGER AND STRUCTURE NUMBER SIGNS SHALL BE FASTENED BY MEANS OF FOUR HOLES WHERE POSSIBLE AND BY THE TWO TOP HOLES IN OTHER INSTANCES.
2. SIGNS SHALL BE ATTACHED TO STRUCTURES BY USE OF POWER-DRIVEN FASTENERS EQUAL TO THOSE MANUFACTURED BY RAMSET FASTENING SYSTEM.
3. GROUNDING SIGNS SHALL BE MOUNTED ON THE LADDER ATTACHMENT BOLT OVER THE END OF EACH GROUNDING BAR ON THE SIDE ADJACENT TO THE CLIMBING FACE OF THE STRUCTURE.

REFERENCE DRAWINGS

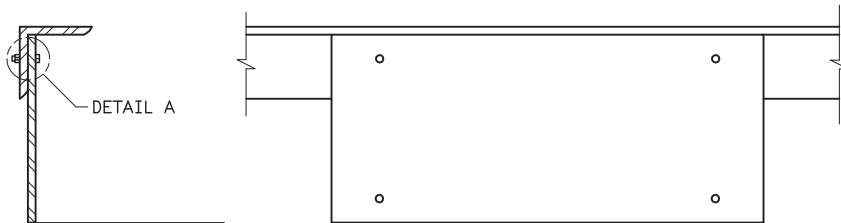
STRUCTURE NUMBER SIGNS	
DETAILS AND LOCATIONS	41 9007
DANGER SIGN FOR STEEL TOWER	41 9008
GROUNDING SIGNS FOR TUBULAR	
STEEL STRUCTURES	41M 9000

C	5-28-14 A7-DDD	REDRAWN.
SUPERSEDES DWG NO. 40-D-6288		
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
STANDARD DESIGNS TRANSMISSION LINES A-TYPE TUBULAR STEEL STRUCTURE LOCATION OF STRUCTURE SIGNS		
DESIGNED BUREC _____ APPROVED BUREC _____		
C A F	AUGUST 6, 1979	41 9006

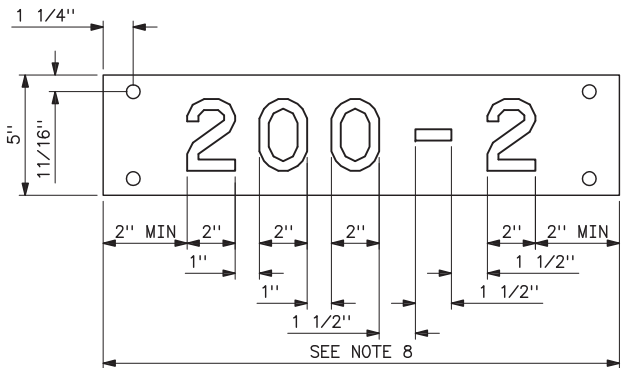
XREF(S):



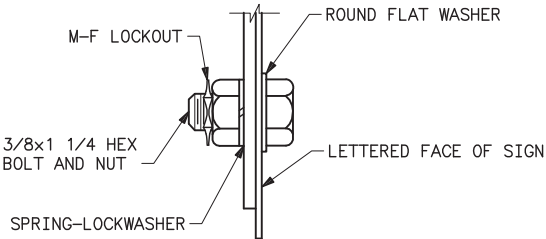
STRUCTURE NUMBER LOCATION



SIGN FASTENING DETAIL



NUMBER SIGN SPECIFICATIONS



DETAIL A
SIGN MOUNTING HARDWARE

NOTES

1. SIGNS SHALL BE FASTENED BY MEANS OF EITHER THE TOP OR THE BOTTOM TWO HOLES.
2. ALL FERROUS HARDWARE SHALL BE GALVANIZED.
3. SEE DRAWING NO. 41 9027 FOR LOCATION OF SIGNS ON TUBULAR STEEL STRUCTURES.
4. SIGNS SHALL BE MADE OF NO. 18 US GAUGE SHEET STEEL.
5. FINISH SHALL BE PORCELAIN ENAMEL. BACKGROUND COLOR SHALL BE YELLOW. FIGURES SHALL BE BLACK.
6. FIGURES SHALL BE OF THE "BLOCK" TYPE, 3-INCHES HIGH AND 2-INCHES WIDE. BODY LINES SHALL BE 1/2-INCH WIDE.
7. EACH SIGN SHALL HAVE FOUR FINISHED HOLES LARGE ENOUGH TO TAKE 3/8-INCH BOLTS. HOLES IN SIGNS SHALL BE FITTED WITH BRASS EYELETS.
8. EACH SIGN SHALL BE 5-INCHES HIGH, WIDTH MAY VARY AS FOLLOWS:
FOR FOUR DIGIT SIGNS SUCH AS 200-2, WIDTH SHALL BE 18 1/2-INCHES.
FOR FOUR DIGIT SIGNS SUCH AS 100-2, WIDTH SHALL BE 17-INCHES.
FOR THREE DIGIT SIGNS SUCH AS 20-2, WIDTH SHALL BE 15 1/2-INCHES.
FOR TWO DIGIT SIGNS SUCH AS 2-2, WIDTH SHALL BE 12 1/2-INCHES.
9. THE PORCELAIN ENAMEL SHALL BE IN ACCORDANCE WITH THE RECOMMENDED STANDARDS FOR MANUFACTURE OF PORCELAIN ENAMEL SIGNS (PEI:S-103) OF THE SIGN DIVISION OF THE PORCELAIN INSTITUTE, INC.
10. TWO SIGNS PER STRUCTURE ONE AHEAD ON LINE AND ONE BACK.

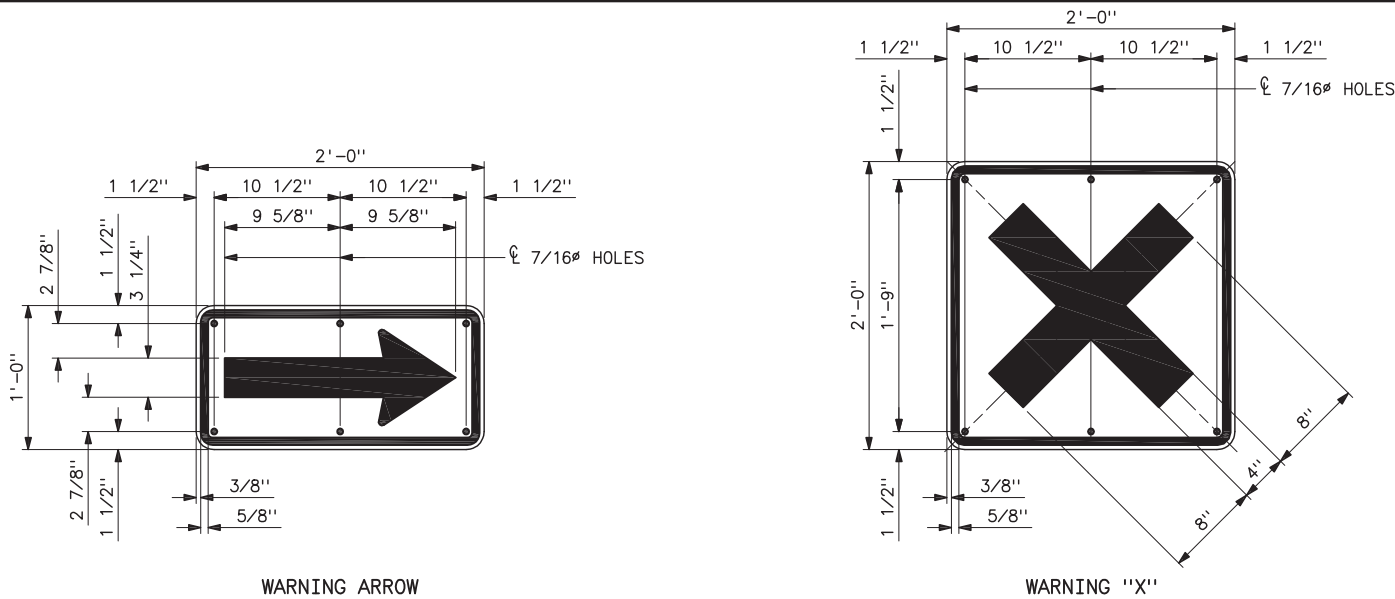
F E D	7-15-03 A7-RC	REVISED TITLE BLOCK ONLY.
	01-29-03 A7-RMC	REVISED DRAWING NUMBER IN NOTES AND ADDED NOTE 10.
	7-13-99 A3-RMC	REDRAWN.
SUPERSEDES DWG NO. 40-D-5762		
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
TRANSMISSION LINE STANDARDS STRUCTURE NUMBER SIGNS DETAILS AND LOCATION		
DESIGNED BUREC _____ APPROVED ROSS M. CLARK ELECTRICAL ENGINEERING MANAGER		
C E	AUGUST 6, 1979	41 9007



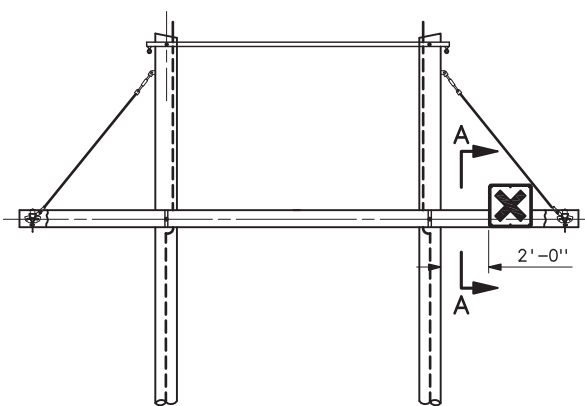
1. SIGNS SHALL BE MADE OF POLYPROPYLENE PLASTIC OR NO. 16 US GAUGE SHEET STEEL WITH A PORCELAIN ENAMEL FINISH.
2. THE PORCELAIN ENAMEL SHALL BE IN ACCORDANCE WITH THE RECOMMENDED STANDARDS FOR MANUFACTURE OF PORCELAIN ENAMEL SIGNS (PEI:S-103) OF THE SIGN DIVISION OF THE PORCELAIN ENAMEL INSTITUTE, INC.
3. HEIGHT AND WIDTH DIMENSIONS MAY VARY FROM 10 TO 12 INCHES AND 14 TO 18 INCHES, RESPECTIVELY.
4. EACH SIGN SHALL HAVE FOUR FINISHED HOLES LARGE ENOUGH TO TAKE 3/8 IN. BOLTS. HOLES IN SIGNS SHALL BE FITTED WITH BRASS EYELETS.
5. SIZE OF LETTERING AND BACKGROUND SHALL BE PROPORTIONAL TO THOSE SHOWN.
6. ALL FERROUS HARDWARE SHALL BE GALVANIZED.
7. SIGNS SHALL BE FASTENED BY MEANS OF EITHER THE TOP OR THE BOTTOM TWO HOLES.



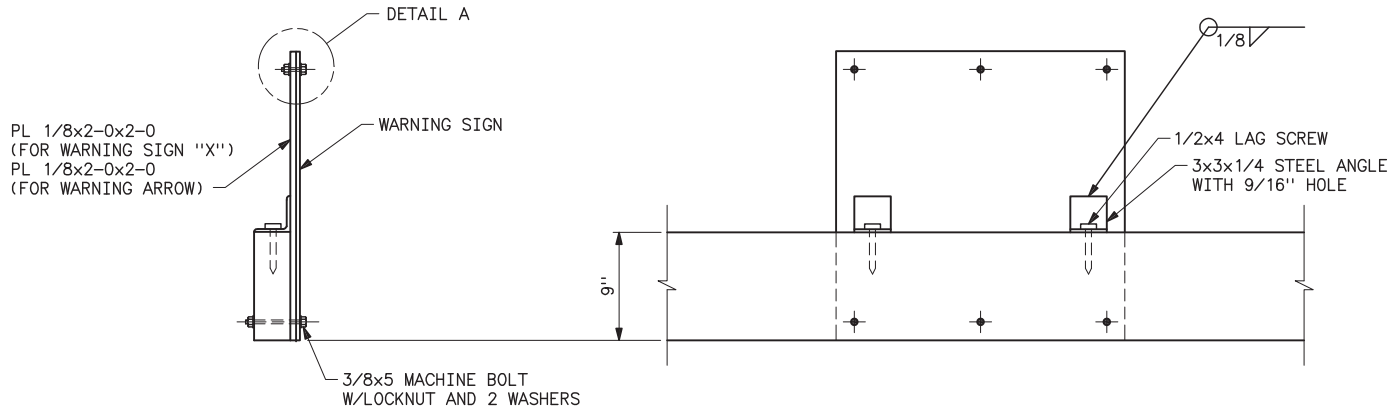
[Return to TOC](#)



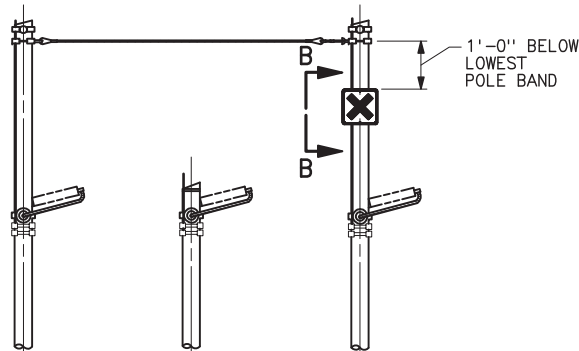
AERIAL PATROL WARNING SIGNS



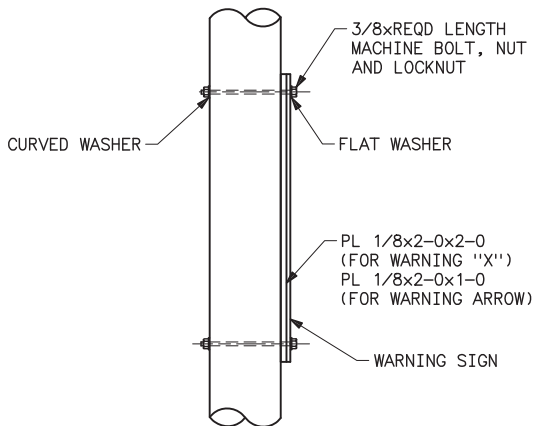
H-FRAME STRUCTURE



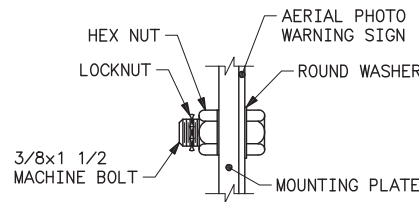
SECTION A-A



3-POLE STRUCTURE
(SIMILAR FOR 1-POLE STRUCTURES)



SECTION B-B



DETAIL A

NOTES

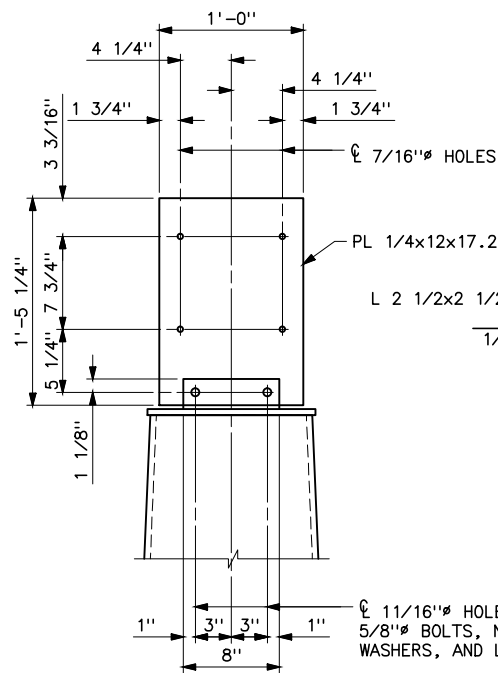
1. WARNING "X" SIGN SHALL BE STANDARD UNITED STATES DEPARTMENT OF TRANSPORTATION (DOT) FEDERAL HIGHWAY SIGN, DESIGNATION W2-1, TURNED ONE-FOURTH OF A TURN TO BECOME AN "X".
2. WARNING ARROW SIGN SHALL BE STANDARD DOT SIGN DESIGNATION W1-6.
3. SIGNS SHALL BE MADE OF NO. 18 U.S. GAGE SHEET METAL.
4. FINISH SHALL BE PORCELAIN ENAMEL. BACKGROUND SHEETING COLOR SHALL BE ENGINEER GRADE YELLOW IN ACCORDANCE WITH ASTM D 4956-94. "X" OR ARROW SHALL BE BLACK.
5. EACH SIGN SHALL HAVE HOLES FITTED WITH BRASS EYELETS. FINISHED HOLES SHALL BE LARGE ENOUGH TO TAKE 3/8-INCH BOLTS.
6. MOUNTING PLATES SHALL CONFORM TO ASTM A 36.
7. ALL ATTACHMENT HARDWARE SHALL BE GALVANIZED.
8. HOLES THROUGH CROSSARM SHALL BE FIELD DRILLED 1/8 INCH LARGER THAN BOLT DIAMETER.
9. CLEARANCE SHALL BE MAINTAINED BETWEEN AERIAL WARNING SIGNS AND ALL GUYS AND GROUNDING HARDWARE.
10. FOR STRUCTURE LOCATIONS AND REQUIRED TYPE OF WARNING SIGN, SEE SPECIFICATIONS AND PLAN AND PROFILE DRAWINGS.

REFERENCE DRAWING

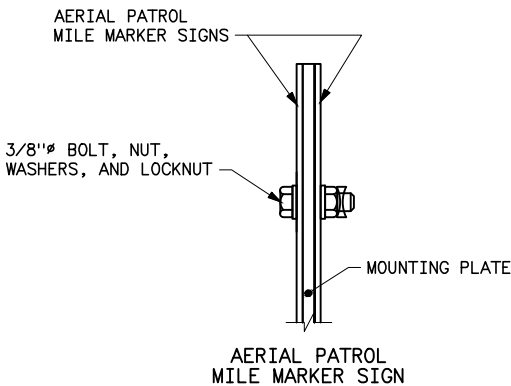
AERIAL PATROL WARNING SIGNS AND
MARKER BALL MARKING DIAGRAMS----- 41 9029

C	7-15-03 A7-RC	REVISED TITLE BLOCK ONLY.
B	11-7-00 A3-RMC	ADDED REFERENCE DRAWING
A	11-17-95 A2-RMC	UPDATED SIGN DETAILS TO NEW STANDARD
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
TRANSMISSION LINE STANDARDS WOOD POLE STRUCTURES AERIAL PATROL WARNING SIGNS DETAILS AND LOCATIONS		
DESIGNED K. ROWE ----- APPROVED ROSS CLARK CHIEF, TRANSMISSION LINE BRANCH		
C A	AUGUST 21, 1995	41 9026

THIS SHEET COVERS AERIAL PATROL MILE MARKER
SIGNS AND MOUNTING PLATES FOR NEW STRUCTURES



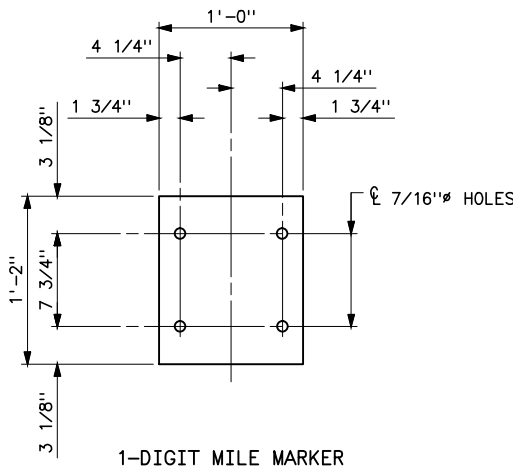
AERIAL PATROL MILE MARKER SIGN MOUNTING PLATE



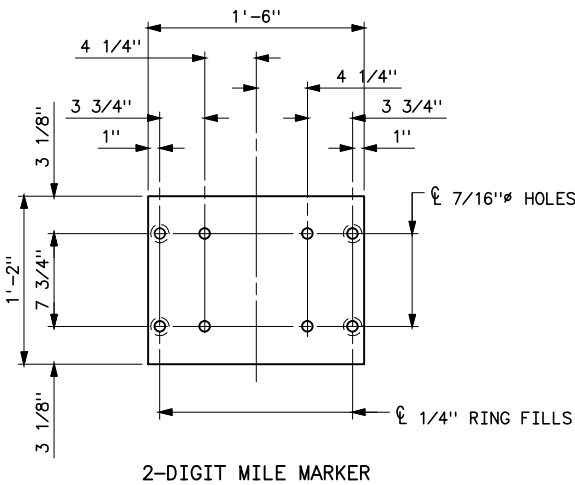
ATTACHMENT DETAILS
NOTE 7

NOTES

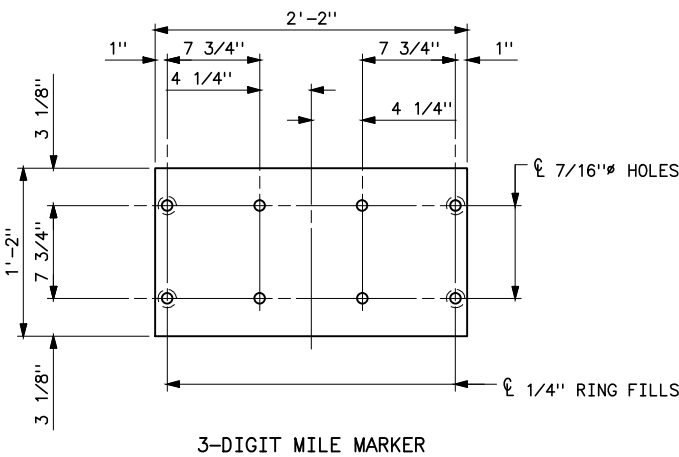
1. AERIAL PATROL MILE MARKER SIGNS SHALL BE NO 18 U.S. GAGE SHEET STEEL.
2. FINISH FOR SIGNS SHALL BE PORCELAIN ENAMEL. BACKGROUND COLOR SHALL BE YELLOW AND FIGURES SHALL BE BLACK.
3. PORCELAIN ENAMEL SHALL BE IN ACCORDANCE WITH THE RECOMMENDED STANDARDS FOR MANUFACTURE OF PORCELAIN ENAMEL SIGNS (PEI: S-103) OF THE SIGN DIVISION OF THE PORCELAIN ENAMEL INSTITUTE, INC.
4. FIGURES SHALL BE "BLOCK" TYPE.
5. HOLES IN SIGNS SHALL BE FURNISHED AND FITTED WITH BRASS EYELETS.
6. AERIAL PATROL MILE MARKER SIGN MOUNTING PLATES SHALL BE THE SAME TYPE OF MATERIAL AND FINISH AS THE STEEL POLE.
7. INSTALL TWO AERIAL PATROL MILE MARKER SIGNS ON THE FIRST STRUCTURE OF EACH MILE SECTION. MOUNTING PLATE SHALL BE PERPENDICULAR TO THE DIRECTION OF THE TRANSMISSION LINE. MOUNT SIGNS BACK-TO-BACK ON MOUNTING PLATE.
8. DRAWING 41 9027-2 COVERS DETAILS FOR STRUCTURE NUMBER SIGNS AND MOUNTING PLATES FOR NEW STRUCTURES.
9. DRAWING 41 9027-3 COVERS DETAILS FOR STRUCTURE NUMBER SIGNS AND MOUNTING PLATES FOR EXISTING STRUCTURES TO BE RETROFITTED.



1-DIGIT MILE MARKER

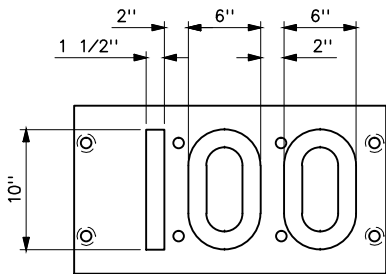


2-DIGIT MILE MARKER



3-DIGIT MILE MARKER

AERIAL PATROL MILE MARKER SIGNS



LETTERING TO BE CENTERED HORIZONTALLY
AND VERTICALLY

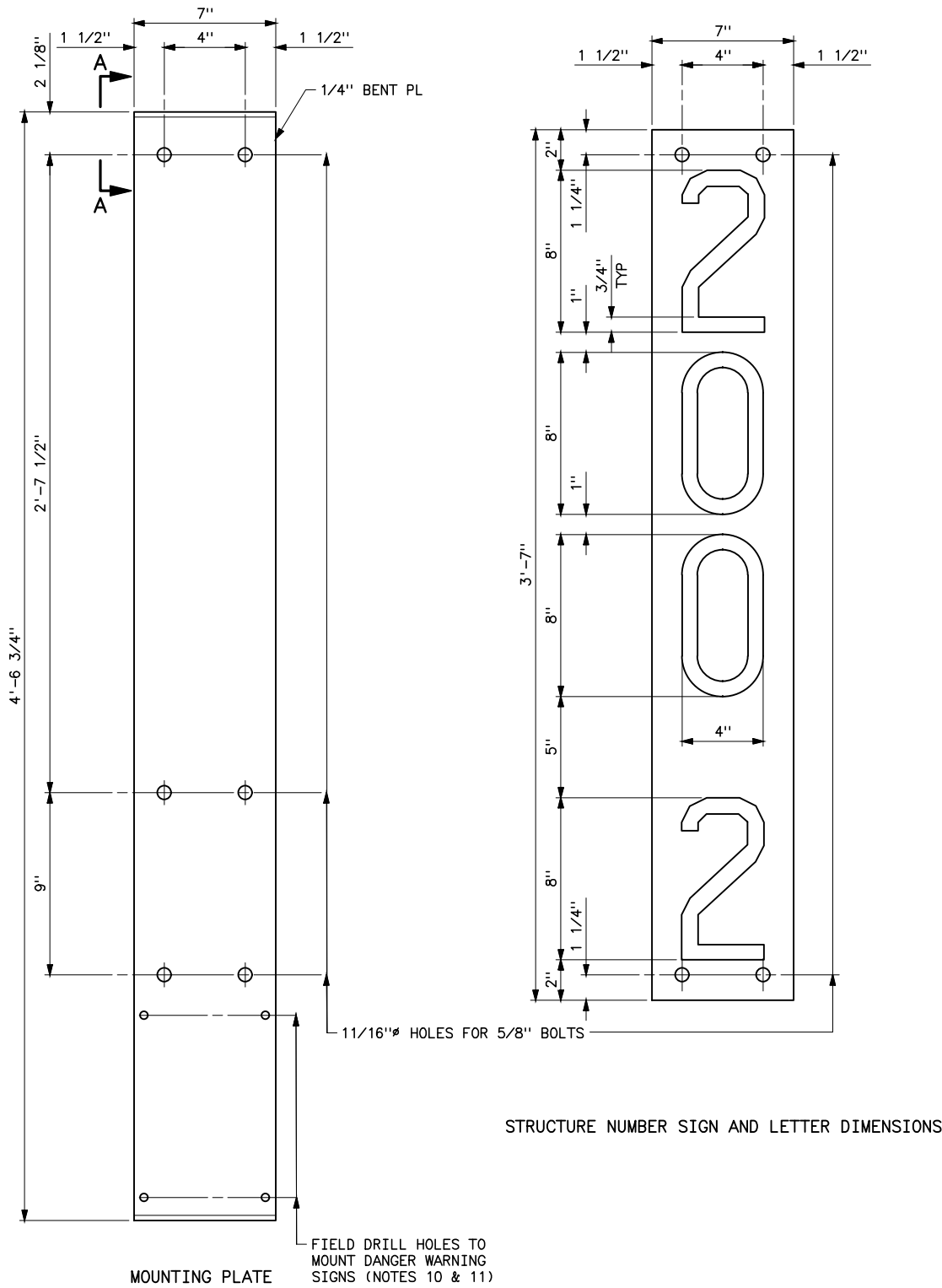
AERIAL PATROL MILE MARKER
SIGN LETTER DIMENSIONS

REFERENCE DRAWINGS

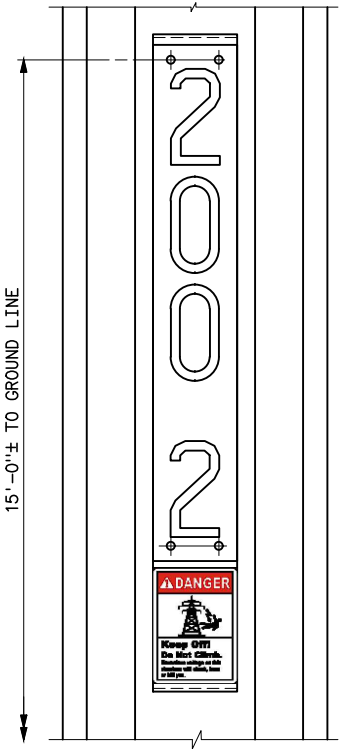
AERIAL PATROL MILE MARKER AND STRUCTURE
NUMBER SIGNS (SHEET 2 OF 3) _____ 41 9027-2
AERIAL PATROL MILE MARKER AND STRUCTURE
NUMBER SIGNS (SHEET 3 OF 3) _____ 41 9027-3

A	07-19-16 A7-BGH	REVISED TITLE BLOCK. ADDED NOTES 8 AND 9. ADDED REFERENCE DRAWINGS.	
	SUPERSEDES DWG NO. 41 9027E (IN PART)		
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION HEADQUARTERS - LAKEWOOD, COLORADO			
TRANSMISSION LINE STANDARDS STEEL POLE STRUCTURES AERIAL PATROL MILE MARKER AND STRUCTURE NUMBER SIGNS (SH. 1 OF 3)			
DESIGNED <u>BOBBY HAGLER, P.E.</u> _____ APPROVED <u>DOUG HANSON</u> _____ CIVIL ENGINEERING MANAGER			
C/A	NOVEMBER 18, 2015	41	9027-1

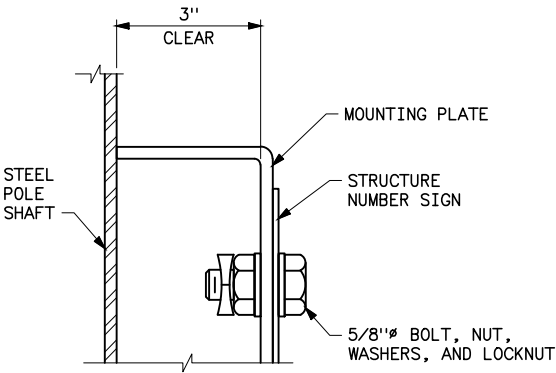
THIS SHEET COVERS STRUCTURE NUMBER SIGNS
AND MOUNTING PLATES FOR NEW STRUCTURES



STRUCTURE NUMBER SIGN, LETTER DIMENSIONS, AND MOUNTING PLATE



STRUCTURE NUMBER
SIGN LOCATION
(NOT TO SCALE)



SECTION A-A
MOUNTING PLATE
FOR NEW STRUCTURES
ATTACHMENT DETAILS

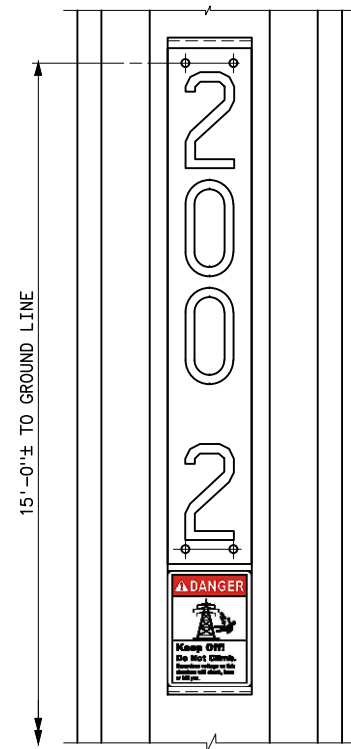
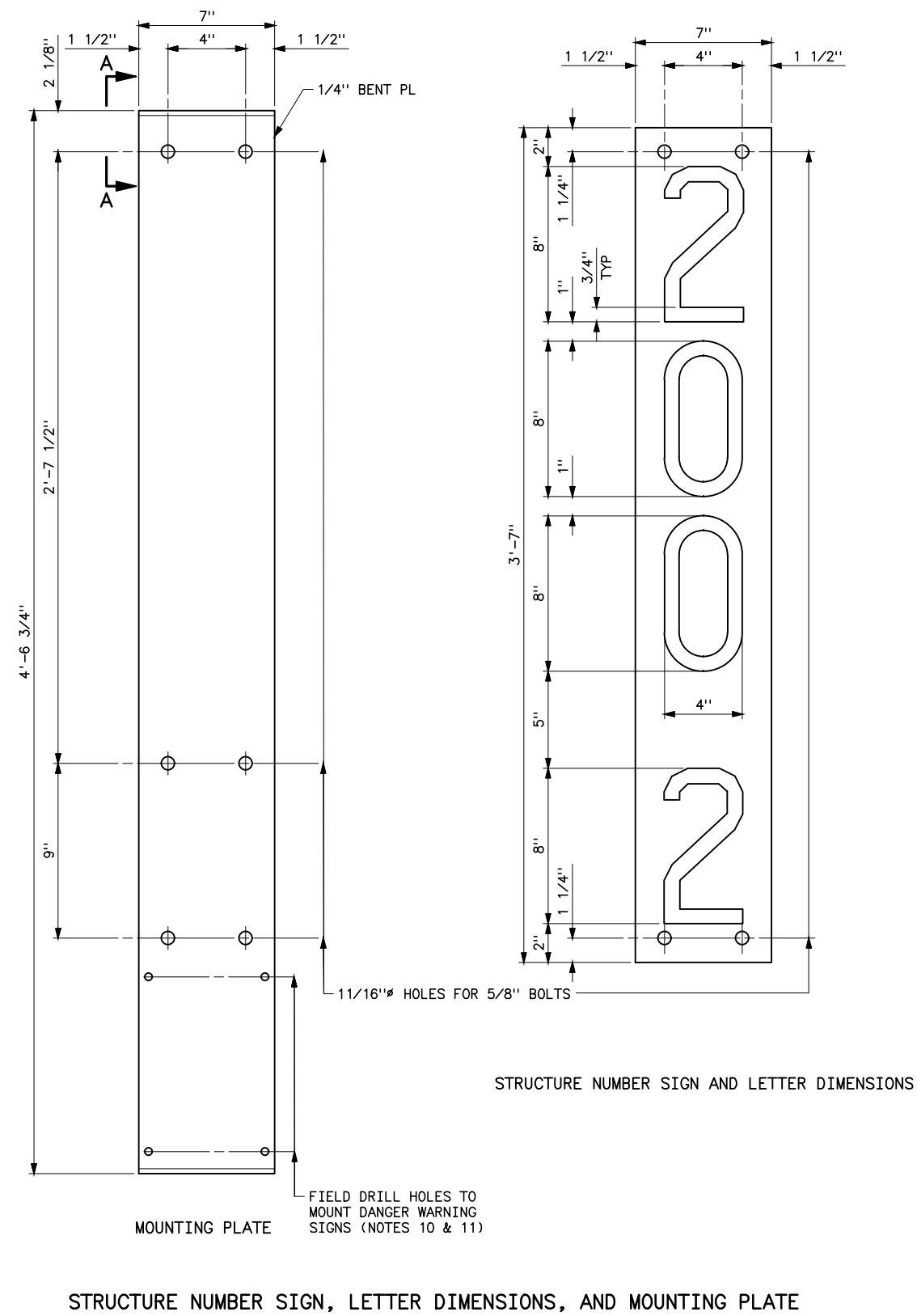
NOTES

1. STRUCTURE NUMBER SIGNS SHALL BE NO 18 U.S. GAGE SHEET STEEL.
2. FINISH FOR STRUCTURE NUMBER SIGNS SHALL BE PORCELAIN ENAMEL. BACKGROUND COLOR SHALL BE YELLOW AND FIGURES SHALL BE BLACK.
3. PORCELAIN ENAMEL SHALL BE IN ACCORDANCE WITH THE RECOMMENDED STANDARDS FOR MANUFACTURE OF PORCELAIN ENAMEL SIGNS (PEI: S-103) OF THE SIGN DIVISION OF THE PORCELAIN ENAMEL INSTITUTE, INC.
4. FIGURES SHALL BE "BLOCK" TYPE.
5. HOLES IN SIGNS SHALL BE FURNISHED AND FITTED WITH BRASS EYELETS.
6. STRUCTURE NUMBER SIGN MOUNTING PLATES SHALL BE THE SAME TYPE OF MATERIAL AND FINISH AS THE STEEL POLE.
7. INSTALL STRUCTURE NUMBER SIGNS ON BOTH THE AHEAD AND BACK SPAN SIDES OF EACH STRUCTURE.
8. BLANK SPACES ON STRUCTURE NUMBER SIGNS WITH 2 OR 3 DIGITS (E.G., 2/2 OR 20/2) ARE ACCEPTABLE.
9. FOR STRUCTURE NUMBER SIGNS REQUIRING 5 DIGITS; E.G., 135/2A, DIMENSIONS FOR FIGURES SHALL BE 4" WIDE BY 6 1/4" HIGH IN LIEU OF 4" WIDE BY 8" HIGH. 5-DIGIT SIGN DIMENSIONS SHALL BE IN ACCORDANCE WITH THE 3-DIGIT MILE NUMBER DETAIL.
10. DANGER WARNING SIGNS SHALL BE 7" WIDE BY 10" HIGH. THE SIGNS SHALL BE ALUMINUM, POLYPROPYLENE PLASTIC, OR NO. 16 US GAUGE SHEET STEEL WITH A PORCELAIN ENAMEL FINISH. THE SIGNS SHALL INCLUDE THE WORDS "DANGER", "HIGH VOLTAGE", AND "DO NOT CLIMB" OR "KEEP OFF". SEE BRIMAR INDUSTRIES ITEM #E3418-FB OR EQUAL.
11. INSTALL DANGER WARNING SIGNS TO THE MOUNTING PLATES BELOW THE STRUCTURE NUMBER SIGN ON BOTH THE AHEAD AND BACK SPAN SIDES OF EACH STRUCTURE. REPAIR GALVANIZING DAMAGED DURING FIELD DRILLING WITH A ZINC RICH PAINT IN ACCORDANCE WITH WAPA CONSTRUCTION STANDARDS.
12. DRAWING 41 9027-1 COVERS DETAILS FOR AERIAL PATROL MILE MARKER SIGNS AND MOUNTING PLATES.
13. DRAWING 41 9027-3 COVERS DETAILS FOR STRUCTURE NUMBER SIGNS AND MOUNTING PLATES FOR EXISTING STRUCTURES TO BE RETROFITTED.

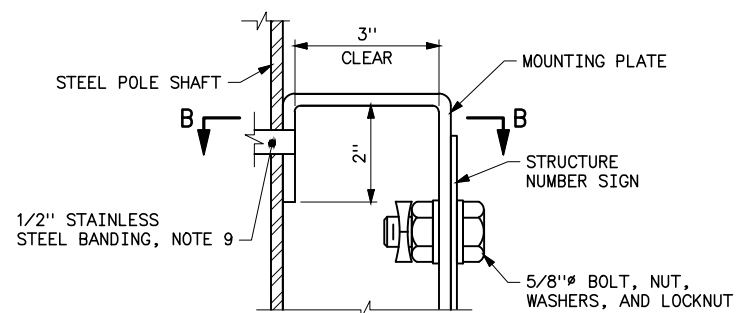
REFERENCE DRAWINGS

- AERIAL PATROL MILE MARKER AND STRUCTURE
NUMBER SIGNS (SHEET 1 OF 3).....41 9027-1
AERIAL PATROL MILE MARKER AND STRUCTURE
NUMBER SIGNS (SHEET 3 OF 3).....41 9027-3

C	3-11-26 A7-PC	REVISED TO SINGLE STRUCTURE NUMBER SIGN TYPE AND ADDED DANGER SIGN TO MOUNTING PLATE.
B	4-9-24 A7-RBP	REVISED TO MOVE STR SIGN 5FT UP TO 15 FT ABOVE GROUND LINE.
A	07-19-16 A7-BGH	REVISED TITLE BLOCK. ADDEDNOTES 10 AND 11. ADDED REFERENCE DRAWINGS.
SUPERSEDES DWG NO. 41 9027E (IN PART)		
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION HEADQUARTERS - LAKEWOOD, COLORADO		
TRANSMISSION LINE STANDARDS STEEL POLE STRUCTURES AERIAL PATROL MILE MARKER AND STRUCTURE NUMBER SIGNS (SH. 2 OF 3)		
DESIGNED BOBBY HAGLER, P.E. --- APPROVED DOUG HANSON CIVIL ENGINEERING MANAGER ---		
C _A E	NOVEMBER 18, 2015	41 9027-2

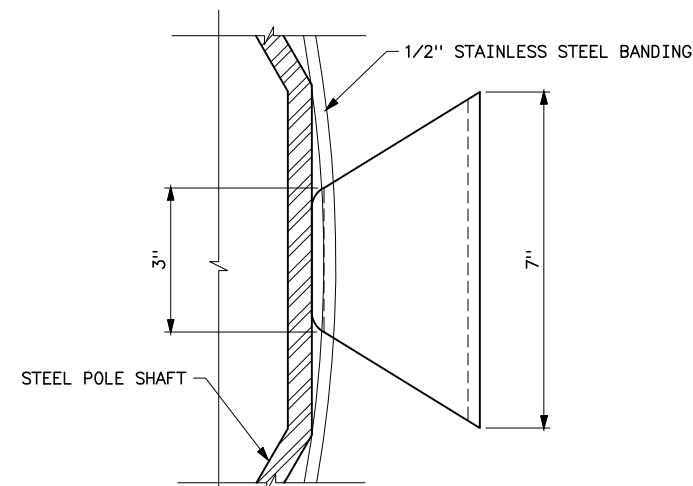


STRUCTURE NUMBER SIGN LOCATION
(NOT TO SCALE)



SECTION A-A (SIM)
MOUNTING PLATE FOR EXISTING STRUCTURES

ATTACHMENT DETAILS



SECTION B-B

THIS SHEET COVERS STRUCTURE NUMBER SIGNS AND MOUNTING PLATES FOR EXISTING STRUCTURES

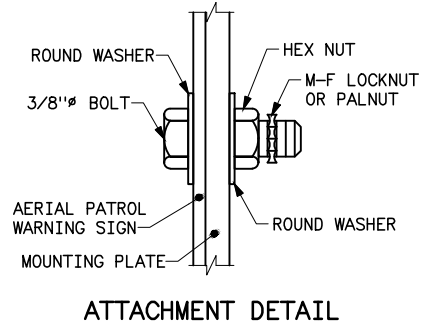
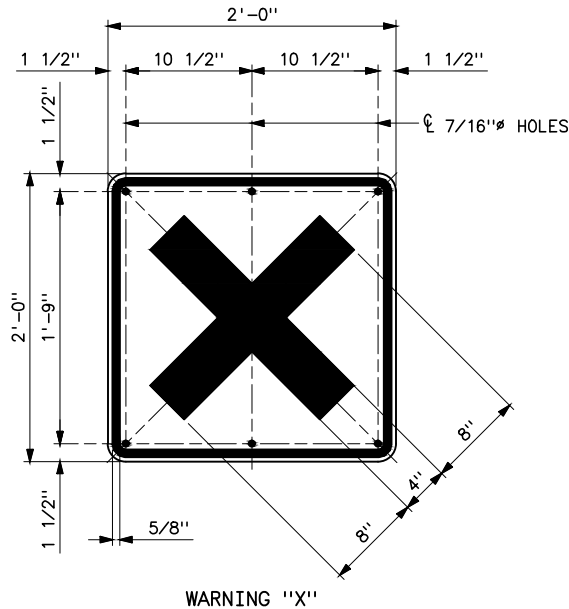
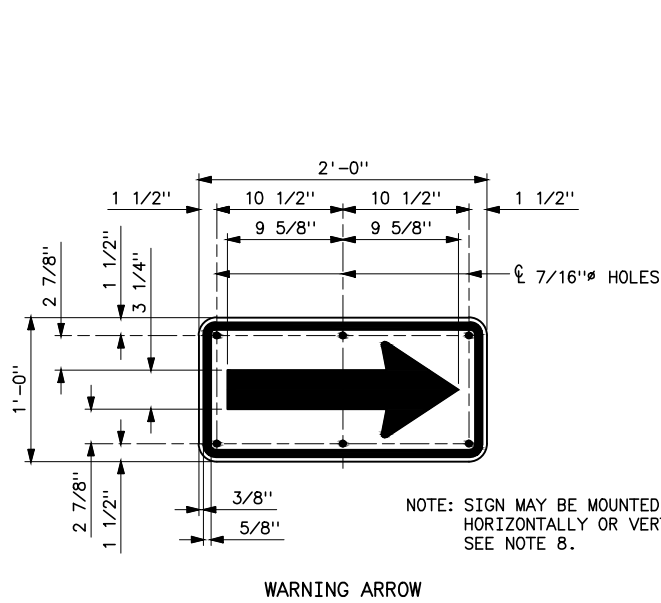
NOTES

1. STRUCTURE NUMBER SIGNS SHALL BE NO 18 U.S. GAGE SHEET STEEL.
2. FINISH FOR STRUCTURE NUMBER SIGNS SHALL BE PORCELAIN ENAMEL. BACKGROUND COLOR SHALL BE YELLOW AND FIGURES SHALL BE BLACK.
3. PORCELAIN ENAMEL SHALL BE IN ACCORDANCE WITH THE RECOMMENDED STANDARDS FOR MANUFACTURE OF PORCELAIN ENAMEL SIGNS (PEI: S-103) OF THE SIGN DIVISION OF THE PORCELAIN ENAMEL INSTITUTE, INC.
4. FIGURES SHALL BE "BLOCK" TYPE.
5. HOLES IN SIGNS SHALL BE FURNISHED AND FITTED WITH BRASS EYELETS.
6. STRUCTURE NUMBER SIGN MOUNTING PLATES SHALL BE THE SAME TYPE OF MATERIAL AND FINISH AS THE STEEL POLE.
7. INSTALL STRUCTURE NUMBER SIGNS ON BOTH THE AHEAD AND BACK SPAN SIDE OF EACH STRUCTURE.
8. BLANK SPACES ON STRUCTURE NUMBER SIGNS WITH 2 OR 3 DIGITS (E.G. 2/2 OR 20/2) ARE ACCEPTABLE.
9. FOR STRUCTURE NUMBER SIGNS REQUIRING 5 DIGITS; E.G., 135/2A, DIMENSIONS FOR FIGURES SHALL BE 4" WIDE BY 6 1/4" HIGH IN LIEU OF 4" WIDE BY 8" HIGH. 5-DIGIT SIGN DIMENSIONS SHALL BE IN ACCORDANCE WITH THE 3-DIGIT MILE NUMBER DETAIL.
10. DANGER WARNING SIGNS SHALL BE 7" WIDE BY 10" HIGH. THE SIGNS MUST BE ALUMINUM, POLYPROPYLENE PLASTIC, OR NO. 16 US GAUGE SHEET STEEL WITH A PORCELAIN ENAMEL FINISH. THE SIGNS SHALL INCLUDE THE WORDS "DANGER", "HIGH VOLTAGE", AND "DO NOT CLIMB" OR "KEEP OFF". SEE BRIMAR INDUSTRIES ITEM #E3418-FB OR EQUAL.
11. FOR EXISTING STRUCTURES, SECURE BACKER PLATE TO STRUCTURE WITH 1/2" STAINLESS STEEL BANDING AT TOP AND BOTTOM OF BACKER PLATES.
12. INSTALL DANGER WARNING SIGNS TO THE MOUNTING PLATES BELOW THE STRUCTURE NUMBER SIGN ON BOTH THE AHEAD AND BACK SPAN SIDES OF EACH STRUCTURE. REPAIR GALVANIZING DAMAGED DURING FIELD DRILLING WITH A ZINC RICH PAINT IN ACCORDANCE WITH WAPA CONSTRUCTION STANDARDS.
13. DRAWING 41 9027-1 COVERS DETAILS FOR AERIAL PATROL MILE MARKER SIGNS AND MOUNTING PLATES.
14. DRAWING 41 9027-2 COVERS DETAILS FOR STRUCTURE NUMBER SIGNS AND MOUNTING PLATES FOR NEW STRUCTURES.

REFERENCE DRAWINGS

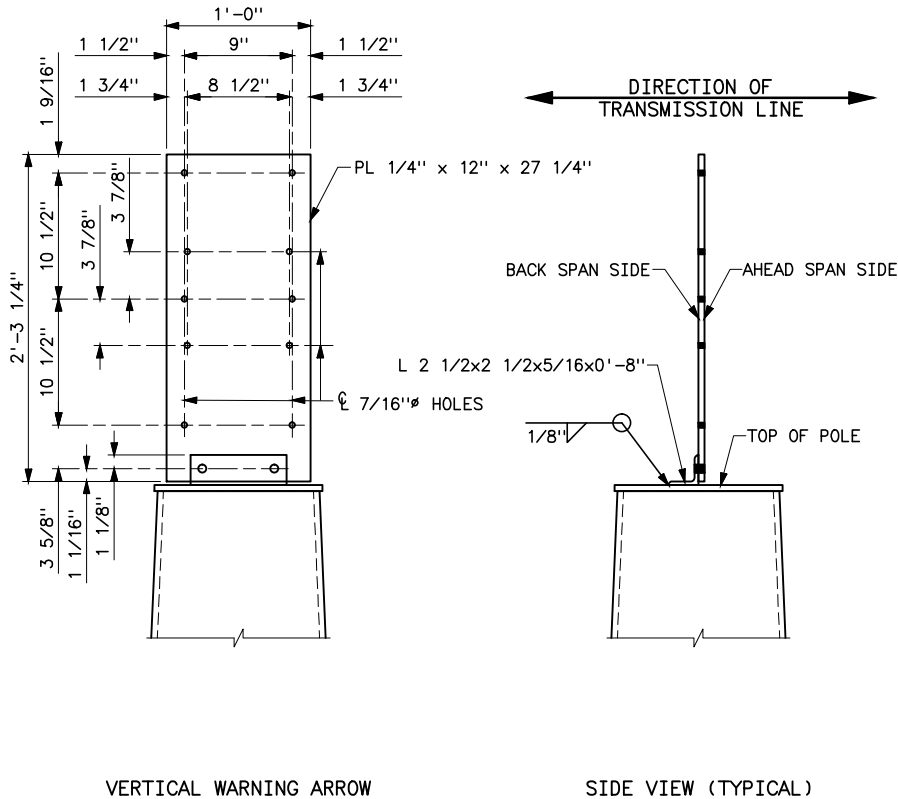
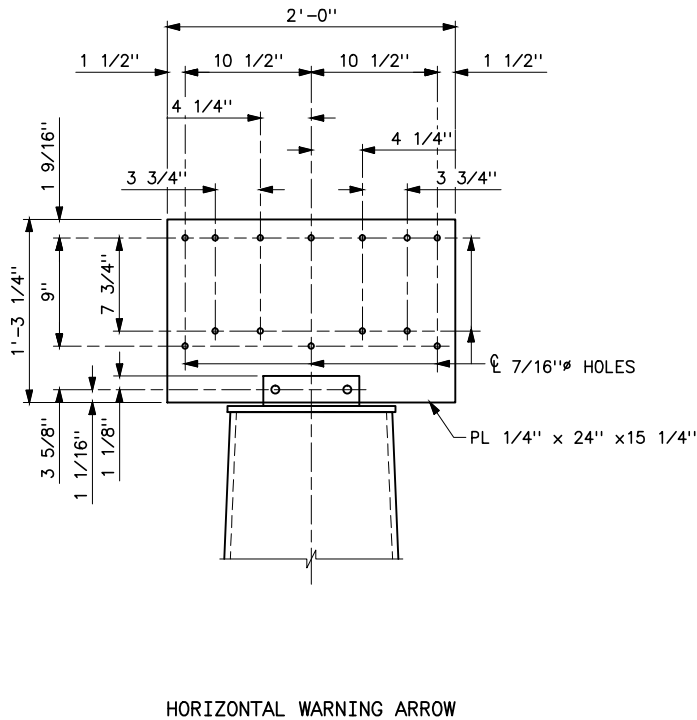
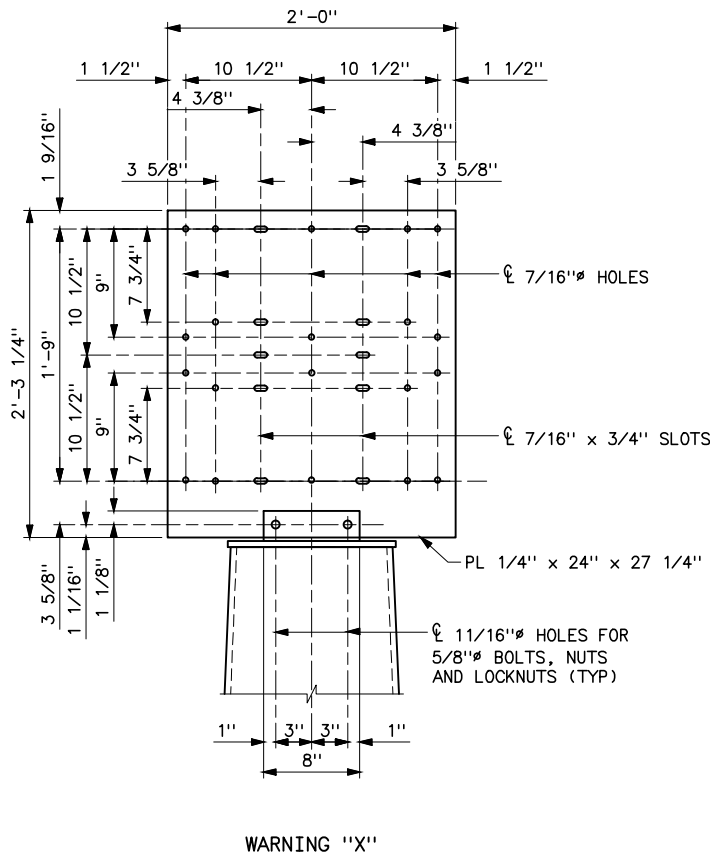
- AERIAL PATROL MILE MARKER AND STRUCTURE NUMBER SIGNS (SHEET 1 OF 3) _____ 41 9027-1
- AERIAL PATROL MILE MARKER AND STRUCTURE NUMBER SIGNS (SHEET 2 OF 3) _____ 41 9027-2

B	3-11-26 A7-PC	REVISED TO SINGLE STRUCTURE NUMBER SIGN TYPE AND ADDED DANGER SIGN TO MOUNTING PLATE.
	A	4-9-24 A7-RBP
SUPERSEDES DWG NO. 41 9027E (IN PART)		
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION HEADQUARTERS - LAKEWOOD, COLORADO		
TRANSMISSION LINE STANDARDS STEEL POLE STRUCTURES AERIAL PATROL MILE MARKER AND STRUCTURE NUMBER SIGNS (SH. 3 OF 3)		
DESIGNED <u>JEFFREY A. MILLER, P.E.</u> APPROVED <u>DOUG HANSON</u> CIVIL ENGINEERING MANAGER		
C/A	JULY 19, 2016	41 9027-3



- NOTES**
1. WARNING "X" SIGN SHALL BE STANDARD UNITED STATES DEPARTMENT OF TRANSPORTATION (DOT) FEDERAL HIGHWAY SIGN, DESIGNATION W2-1, TURNED ONE-FOURTH OF A TURN TO BECOME AN "X".
 2. WARNING ARROW SIGN SHALL BE STANDARD DOT SIGN DESIGNATION W1-6.
 3. SIGNS SHALL BE NO. 18 U.S. GAGE SHEET STEEL.
 4. FINISH FOR SIGNS SHALL BE PORCELAIN ENAMEL. BACKGROUND COLOR SHALL BE ENGINEER GRADE YELLOW IN ACCORDANCE WITH ASTM D 4956. "X" OR ARROW SHALL BE BLACK.
 5. HOLES IN SIGNS SHALL BE FURNISHED AND FITTED WITH BRASS EYELETS. FINISHED HOLES SHALL BE LARGE ENOUGH TO TAKE 3/8" BOLT.
 6. MOUNTING PLATES SHALL CONFORM TO ASTM A36, AND SHALL BE PERPENDICULAR TO THE DIRECTION OF TRANSMISSION LINE.
 7. ALL ATTACHMENT HARDWARE SHALL BE GALVANIZED; EXCEPT ANGLES WELDED TO WEATHERING STEEL STRUCTURES SHALL CONFORM TO ASTM A242 OR ASTM A588.
 8. FOR STRUCTURE LOCATIONS AND REQUIRED TYPE OF WARNING SIGN, SEE SPECIFICATIONS AND PLAN AND PROFILE DRAWINGS.

AERIAL PATROL WARNING SIGNS

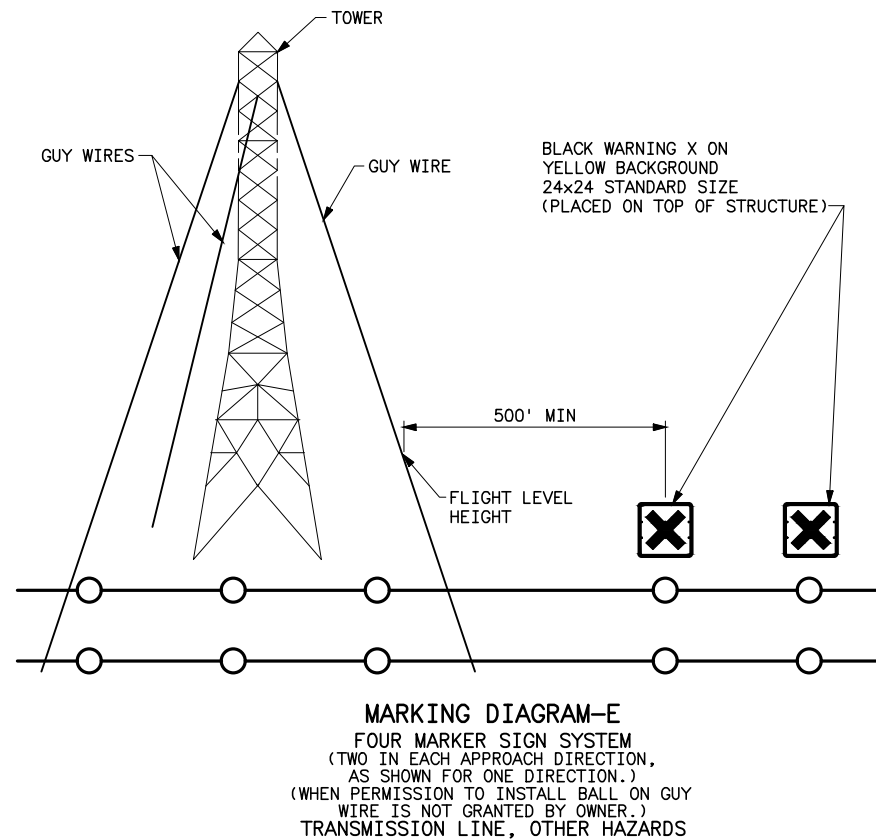
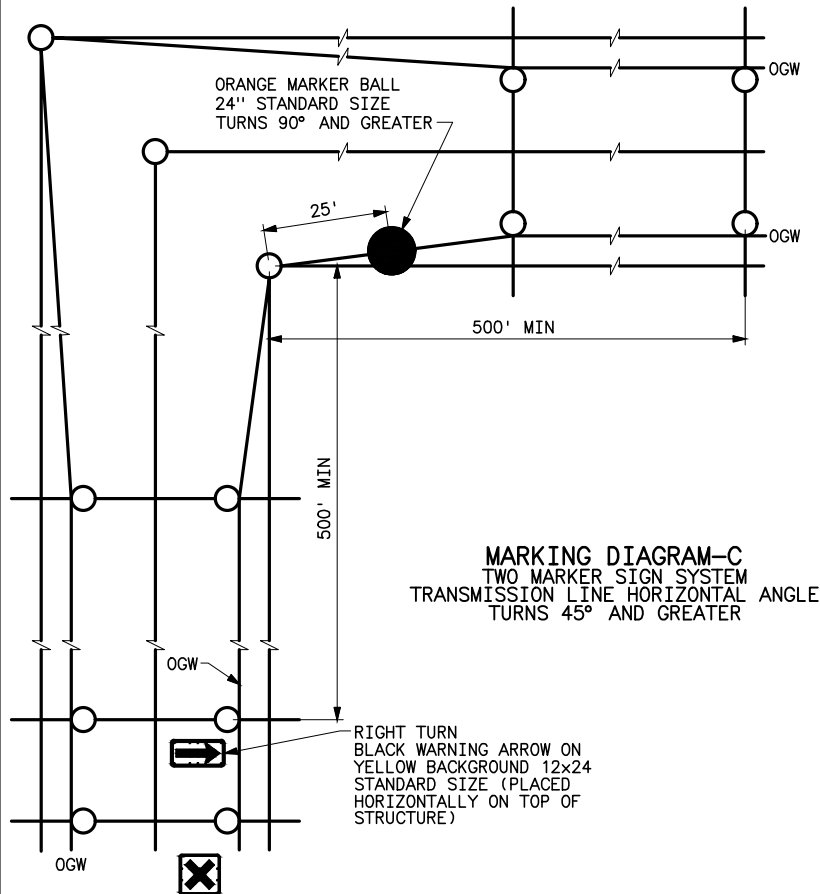


AERIAL PATROL WARNING SIGN MOUNTING PLATES

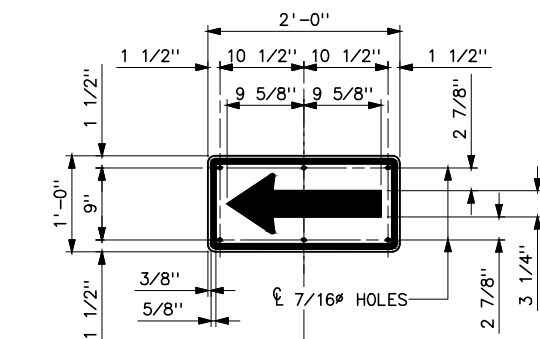
- REFERENCE DRAWINGS**
- AERIAL PATROL MILE MARKER AND STRUCTURE NUMBER SIGNS.....41 9027
 - AERIAL PATROL WARNING SIGNS AND MARKER BALL MARKING DIAGRAMS.....41 9029

E	1-9-15 A7-BGH	ADDED HOLES IN WARNING "X" MOUNTING PLATE TO ACCOMMODATE WARNING ARROW SIGNS.
D	4-22-09 A7-BGH	ADDED HOLES FOR AERIAL PATROL MILE MARKER SIGNS TO MOUNTING PLATES
C	7-15-03 A7-RC	REVISED TITLE BLOCK ONLY.
B	11-30-01 A7-BH	REVISED NOTE 6.
A	11-7-00 A3-RMC	ADDED REFERENCE DRAWING

UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
TRANSMISSION LINE STANDARDS STEEL POLE STRUCTURES AERIAL PATROL WARNING SIGNS DETAILS AND LOCATIONS		
DESIGNED BOBBY HAGLER	APPROVED ROSS CLARK CHIEF, TRANSMISSION LINE BRANCH	
DECEMBER 15, 1995	41	9028

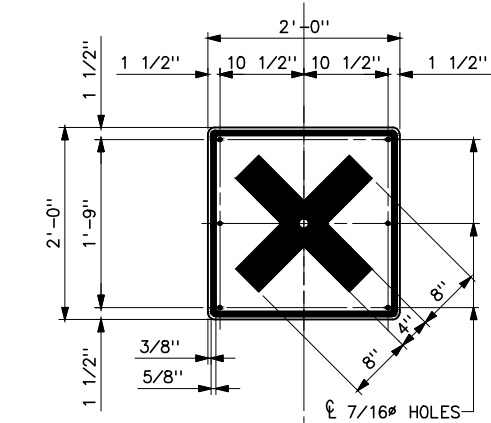


[Return to TOC](#)



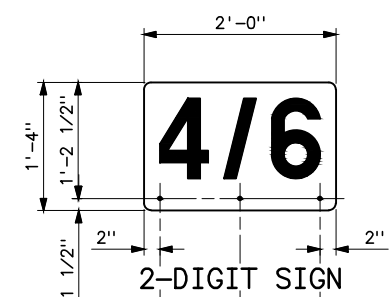
NOTE: SIGN MAY BE MOUNTED EITHER HORIZONTALLY OR VERTICALLY, SEE NOTE 10.

WARNING ARROW

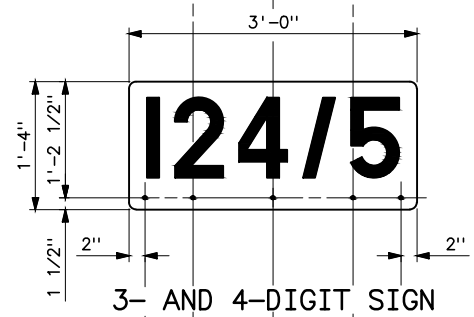


NOTE: FIELD DRILL 7/16" HOLE IN CENTER OF WARNING "X" SIGN.

WARNING "X"



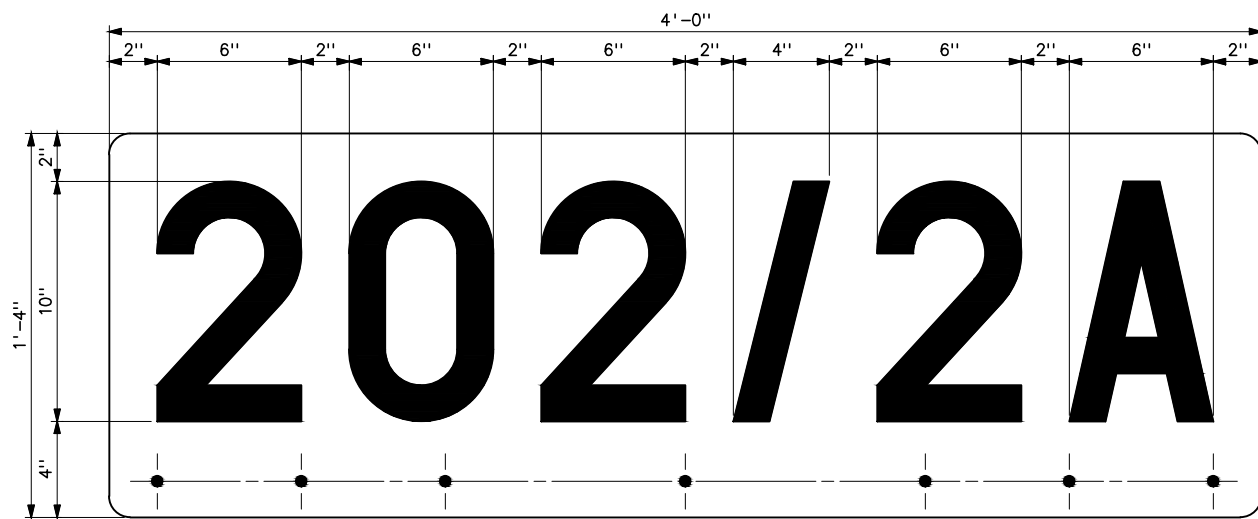
2-DIGIT SIGN



3- AND 4-DIGIT SIGN



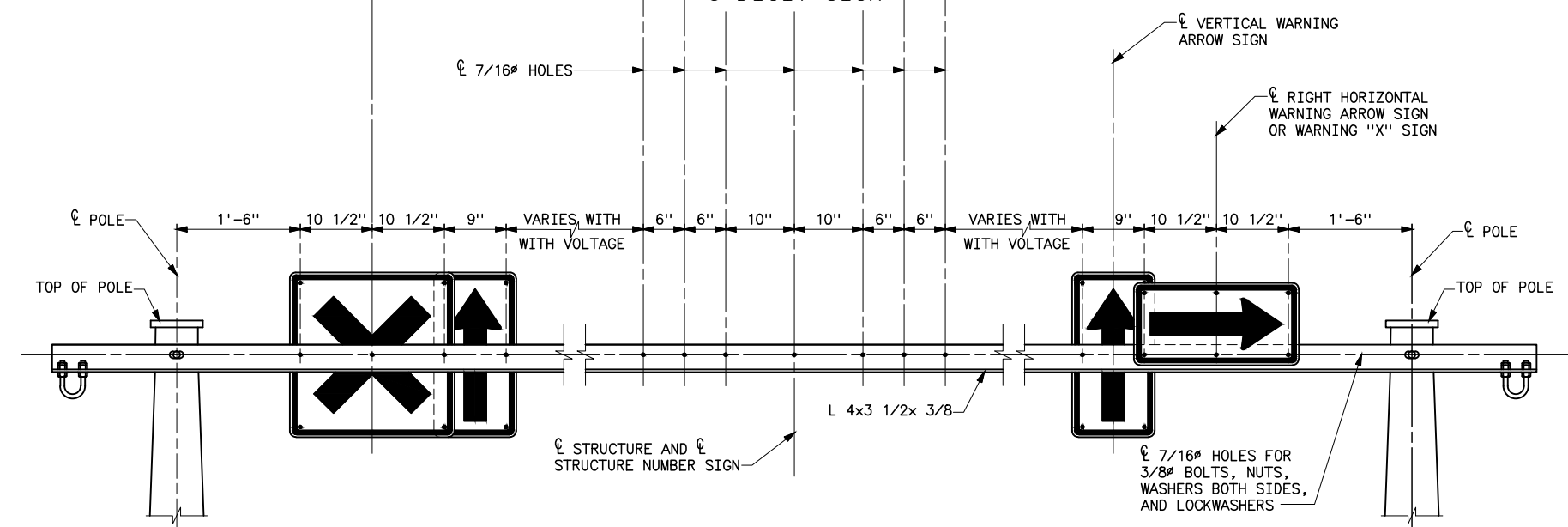
5-DIGIT SIGN



STRUCTURE NUMBER SIGN FIGURE DIMENSIONS
(NOTES 5 AND 6)

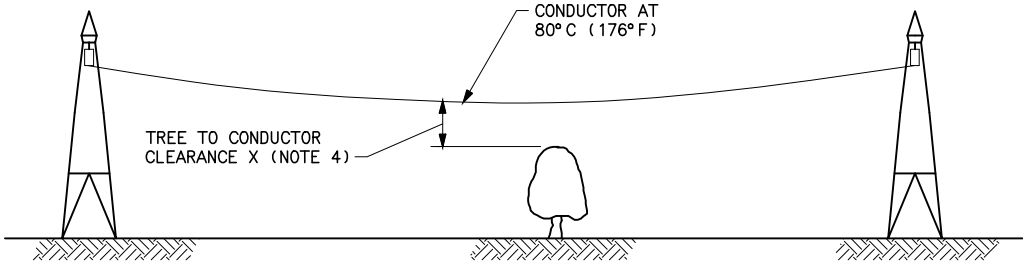
NOTES

1. SIGNS SHALL BE NO. 18 U.S. GAGE STEEL.
2. FINISH FOR SIGNS SHALL BE PORCELAIN ENAMEL. BACKGROUND COLOR SHALL BE YELLOW AND FIGURES SHALL BE BLACK.
3. PORCELAIN ENAMEL SHALL BE IN ACCORDANCE WITH THE RECOMMENDED STANDARDS FOR MANUFACTURE OF PORCELAIN ENAMEL SIGNS (PEI: S-103) OF THE SIGN DIVISION OF THE PORCELAIN ENAMEL INSTITUTE, INC.
4. FIGURES SHALL BE "BLOCK" TYPE.
5. STRUCTURE NUMBER SIGNS SHALL HAVE IDENTICAL HORIZONTALLY-CENTERED FIGURES ON FRONT AND BACK SIDES.
6. DIMENSIONS FOR THE NUMBER "1" SHALL BE 1 1/2" WIDE BY 10" HIGH. DIMENSIONS FOR ALL OTHER FIGURES SHALL BE 6" WIDE BY 10" HIGH. DIMENSION FOR THE "/" SYMBOL SHALL BE 4" WIDE AND 10" HIGH. ALL FIGURES AND SYMBOLS SHALL BE SEPARATED BY 2" SPACES.
7. WARNING "X" SIGN SHALL BE STANDARD UNITED STATES DEPARTMENT OF TRANSPORTATION (DOT) FEDERAL HIGHWAY SIGN, DESIGNATION W2-1, ROTATED 45° TO BECOME AN "X".
8. WARNING ARROW SIGN SHALL BE STANDARD DOT SIGN DESIGNATION W1-6.
9. ALL SIGN MOUNTING HOLES SHALL BE 7/16". SIGNS SHALL BE MOUNTED TO PREDRILLED 4" LEG OF L 4x3 1/2x3/8 WITH GALVANIZED 3/8" BOLTS, NUTS, WASHERS BOTH SIDES, AND LOCKNUTS.
10. FOR SIGN LOCATIONS AND REQUIRED TYPE OF WARNING SIGNS, SEE SPECIFICATIONS AND PLAN AND PROFILE DRAWINGS.



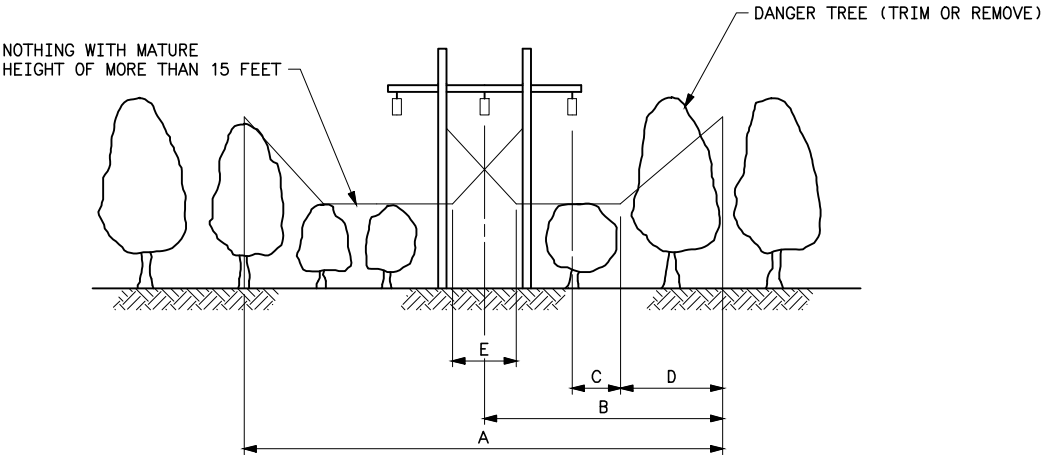
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO			
TRANSMISSION LINE STANDARDS LIGHT DUTY STEEL POLE H-FRAMES STRUCTURE SIGNS DETAILS AND LOCATIONS			
DESIGNED BOBBY HAGLER	APPROVED DOUG HANSON	CIVIL ENGINEERING MANAGER	
CAE	JULY 22, 2002	41	9030

Aug 28, 2014 8:59am Plotted By: See to S:\projects\Transmission\Lines\Power\G1\Drawings\Tna\41_9030.dwg Last Saved By: denton IMAGES:



RIGHT-OF-WAY CLEARING

VOLTAGE KV	X
69	20
115	21
138-161	22
230	23
345	26
500	29

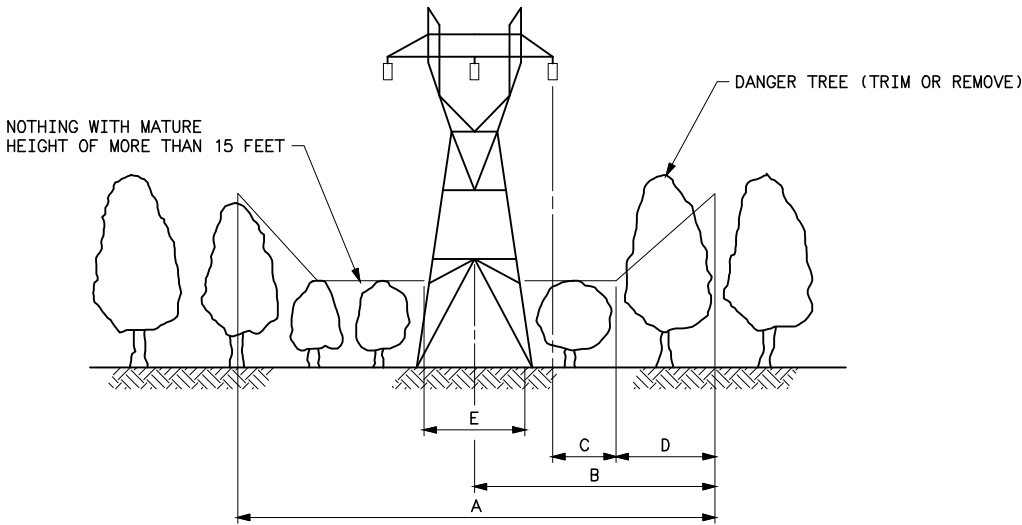


H-FRAME CONSTRUCTION

VOLTAGE KV	DIMENSION - FT				
	A	B	C	D	E
69	75'-0"	37'-6"	10'-0"	15'-5"	10'-0"
115	80'-0"	40'-0"	10'-0"	15'-5"	12'-0"
138-161	80'-0"	42'-6"	10'-0"	16'-0"	15'-0"
230	80'-0"	52'-6"	10'-0"	20'-6"	15'-0"

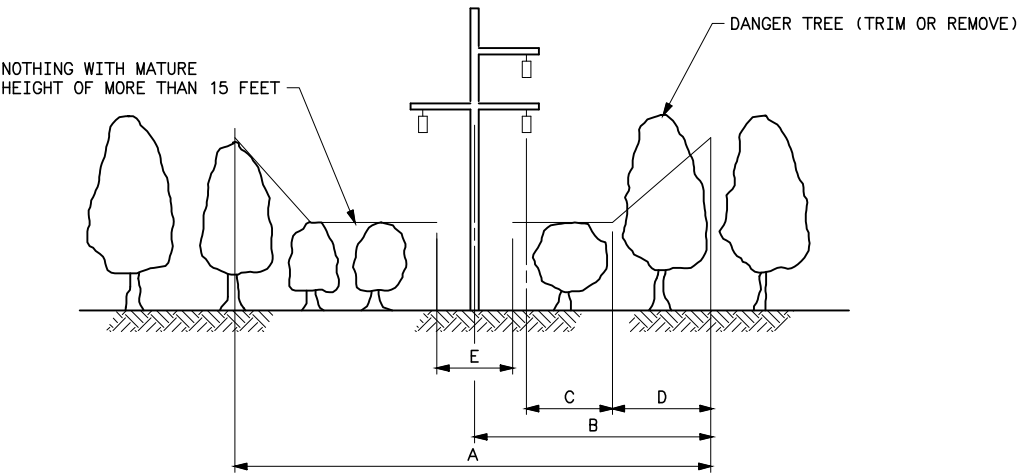
NOTES

1. THE TRANSMISSION LINE EASEMENT IS A RESTRICTED AREA. NO PERMANENT STRUCTURES, BUILDINGS, STREET LIGHTS, TALL TREES OR EQUIPMENT WHICH MAY CONTACT THE CONDUCTORS WILL BE PERMITTED ON THE EASEMENT AREA. PARKING FACILITIES, TEMPORARY MOVABLE EQUIPMENT AND LOW GROWING SHRUBS, SUBJECT TO TRIMMING OR REMOVAL MAY BE LOCATED ON THE EASEMENT. WESTERN AREA POWER ADMINISTRATION (WAPA) MUST HAVE FREE ACCESS TO ALL POINTS ON THE TRANSMISSION LINE EASEMENT AND GATES AT LOCATIONS ACCEPTABLE TO WAPA MUST BE PROVIDED IN ALL FENCING CONSTRUCTED ON THE EASEMENT. BRUSH AND TREES ARE SUBJECT TO DAMAGE OR REMOVAL WHEN EQUIPMENT IS REQUIRED ON THE EASEMENT FOR MAINTENANCE ON LINE.
2. RIGHT-OF-WAY DIMENSIONS ARE TYPICAL. REFER TO SPECIFICATIONS FOR ACTUAL EASEMENT WIDTHS (DIMENSION A).
3. DANGER TREES ARE TREES WITHIN OR NEAR THE RIGHT-OF-WAY WHICH HAVE THE POTENTIAL OF ENCROACHING WITHIN THE SAFE DISTANCE OF THE STRUCTURE OR CONDUCTOR AS A RESULT OF BENDING, GROWING, SWINGING OR FALLING. SEE DIMENSION "X" FOR EACH VOLTAGE.
4. CONDUCTOR CLEARANCE "X" INCLUDES ALLOWANCE FOR FIVE FEET OF GROWTH. REFER TO WAPA 0 450.3C LATEST EDITION.



LATTICE CONSTRUCTION

VOLTAGE KV	DIMENSION - FT				
	A	B	C	D	E
69	150'-0"	75'-0"	10'-0"	40'-0"	15'-0"
115	175'-0"	87'-6"	12'-0"	42'-6"	20'-0"
138-161	200'-0"	100'-0"	15'-0"	45'-0"	20'-0"



POLE CONSTRUCTION

VOLTAGE KV	DIMENSION - FT				
	A	B	C	D	E
69	50'-0"	25'-0"	10'-0"	8'-0"	10'-0"
115	80'-0"	40'-0"	10'-0"	23'-0"	12'-0"
138-161	85'-0"	42'-6"	10'-0"	23'-6"	15'-0"
230	95'-0"	47'-6"	10'-0"	25'-6"	15'-0"
230	140'-0"	70'-0"	12'-0"	41'-0"	20'-0"

A5-16-19A7-KKR

UPDATED TO MATCH WAPA 0 450.3C, 02-06-2017.

UNITED STATES DEPARTMENT OF ENERGY

WESTERN AREA POWER ADMINISTRATION

CORPORATE SERVICES OFFICE - GOLDEN, COLORADO

STANDARD DESIGNS

TRANSMISSION LINES

RIGHT-OF-WAY CLEARING

DETAILS

DESIGNED E.S. COOK

APPROVED ROSS CLARK

ELECTRICAL ENGINEERING MANAGER

C_AE

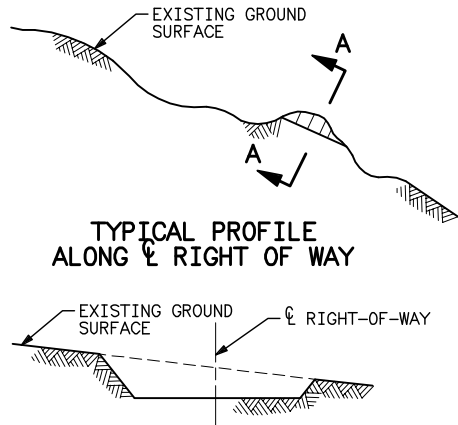
OCTOBER 1, 1998

41

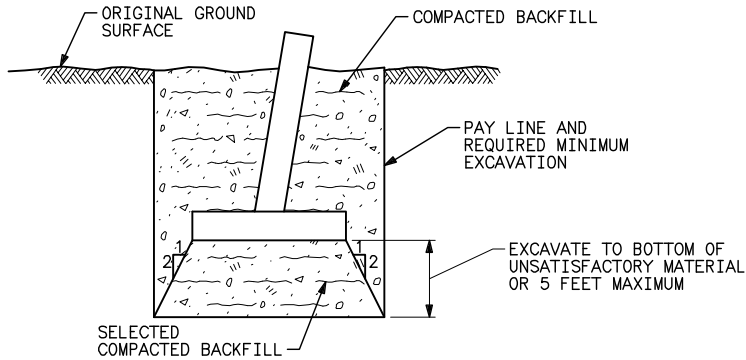
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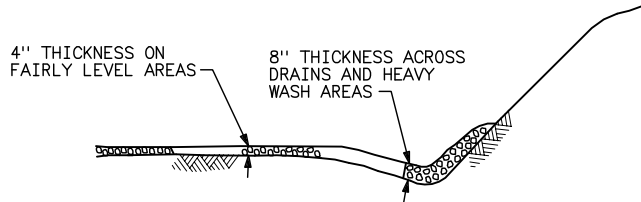
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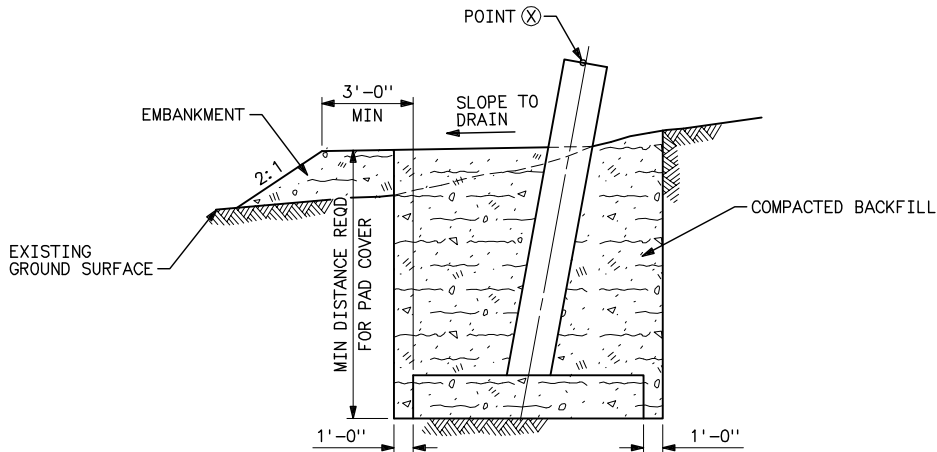
SECTION A-A
TYPICAL LINE CLEARANCE EXCAVATION
LOCATIONS AND DIMENSIONS OF CUT TO BE AS DIRECTED



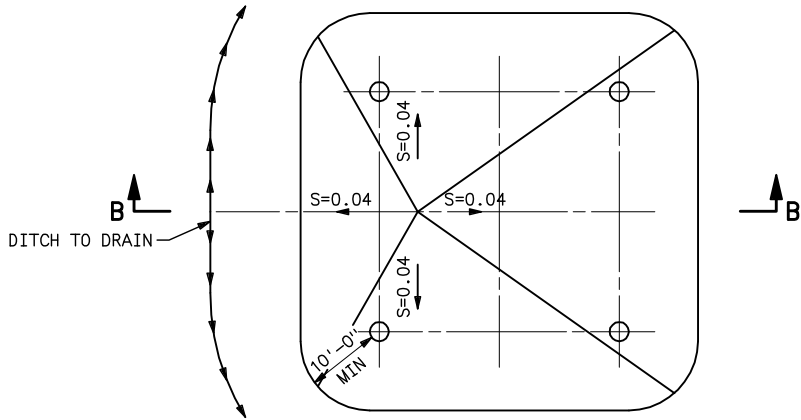
SPECIAL EXCAVATION AND COMPACTED BACKFILL
FOR TYPES D OR F FOOTINGS
FOR USE AS DIRECTED WHERE UNSATISFACTORY MATERIALS,
WHICH DO NOT MEET THE REQUIRED BEARING CLASSIFICATION
FOR FOUNDATION MATERIALS, ARE ENCOUNTERED AT THE
BOTTOM OF NORMAL EXCAVATION



TYPICAL SECTION
OF
GRAVEL BLANKET PROTECTION FOR TOWER SITES
LOCATIONS AND EXTENT OF PROTECTED
AREA TO BE AS DIRECTED

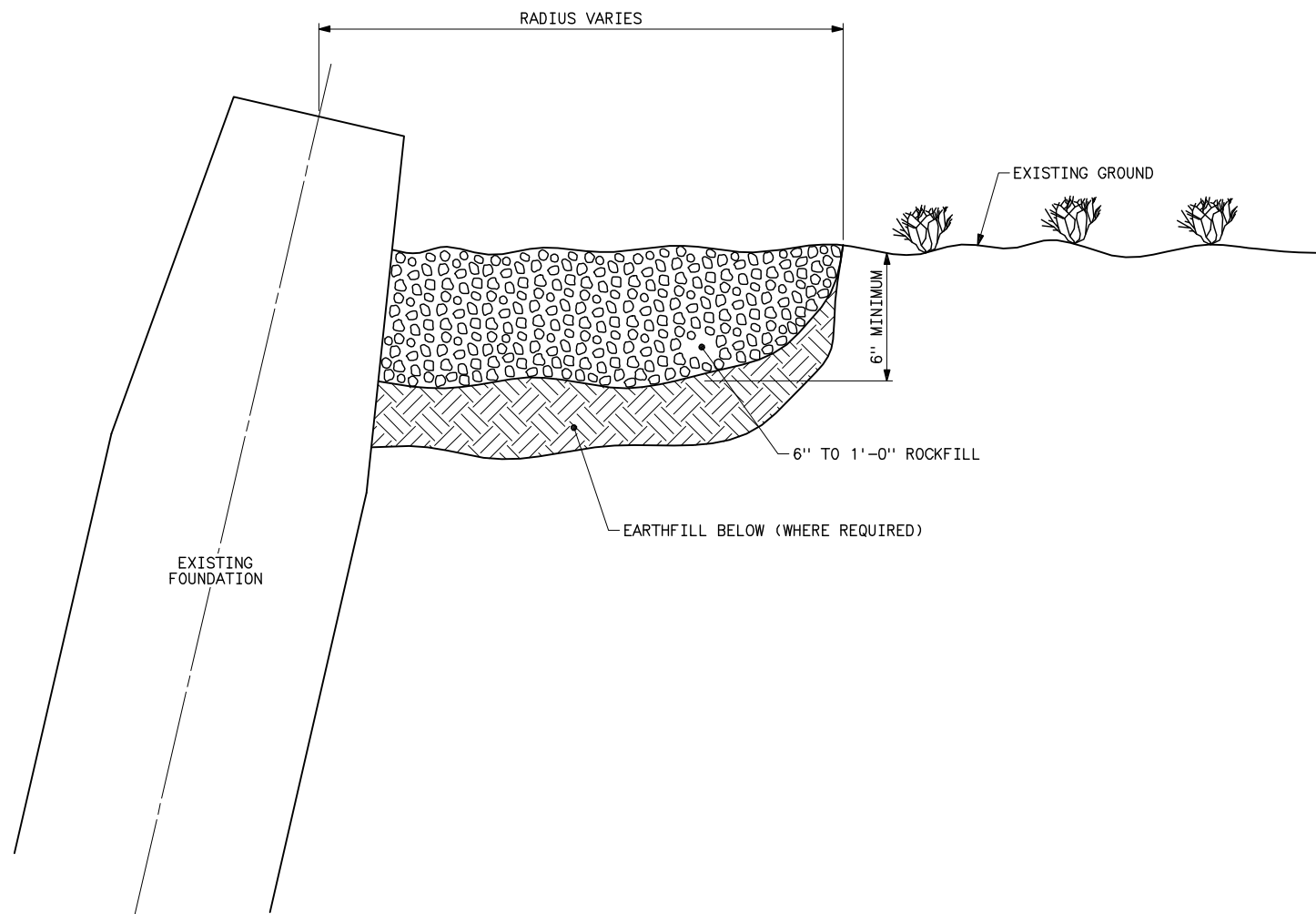


TYPICAL FOOTING COVER EMBANKMENT
FOR USE AS DIRECTED WHEN COMPACTED BACKFILL TO
EXISTING GROUND SURFACE DOES NOT PROVIDE REQUIRED
FOOTING PAD COVER (NOT TO BE USED ON GROUND
SLOPE STEEPER THAN 3 TO 1)



SECTION B-B
EMBANKMENT IN LOESS
FOR USE AS DIRECTED WHEN TYPE "AL" FOOTING IS REQUIRED
NOT REQUIRED WHERE GROUND SLOPE IS $\geq$ 0.04

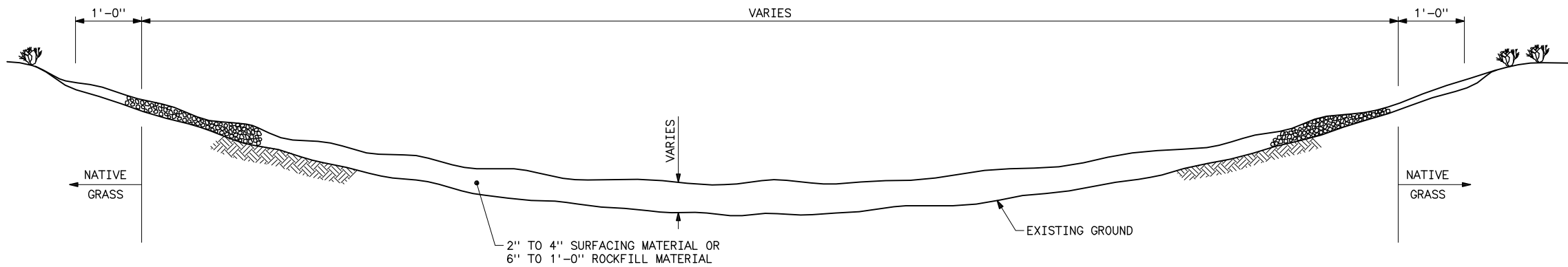
D	9-12-12 A7-DH	CORRECTED SPELLING ERRORS.
C	7-15-03 A7-DH	REVISED TITLE BLOCK ONLY.
B	7-13-99 A3-DH	REDRAWN.
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - GOLDEN, COLORADO		
TRANSMISSION LINE STANDARDS SPECIAL EARTHWORK		
DESIGNED BUREC _____ APPROVED DOUG HANSON _____ CIVIL ENGINEERING MANAGER		
CAE	JANUARY 29, 1982	41 2017



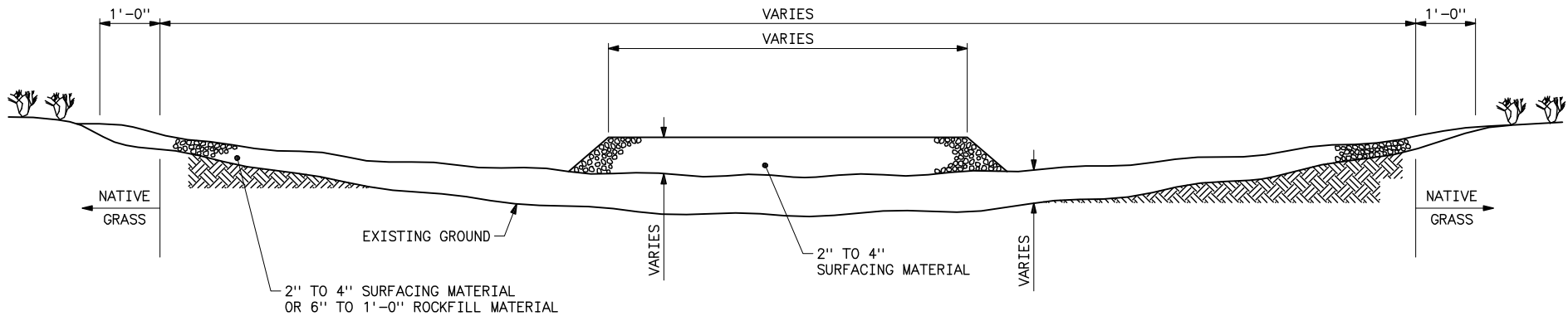
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A	11-16-11 A7-DDD	REDRAWN.	
	UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
TRANSMISSION LINE EROSION CONTROL TYPICAL SECTION TOWER FOUNDATION			
DESIGNED <u>T. TRUJILLO</u> _____ APPROVED <u>MC CONNELL STEWART</u> _____			
C A	JANUARY 24, 1985	41	2020

Plotted By: denton Nov 17, 2011- 6:43am
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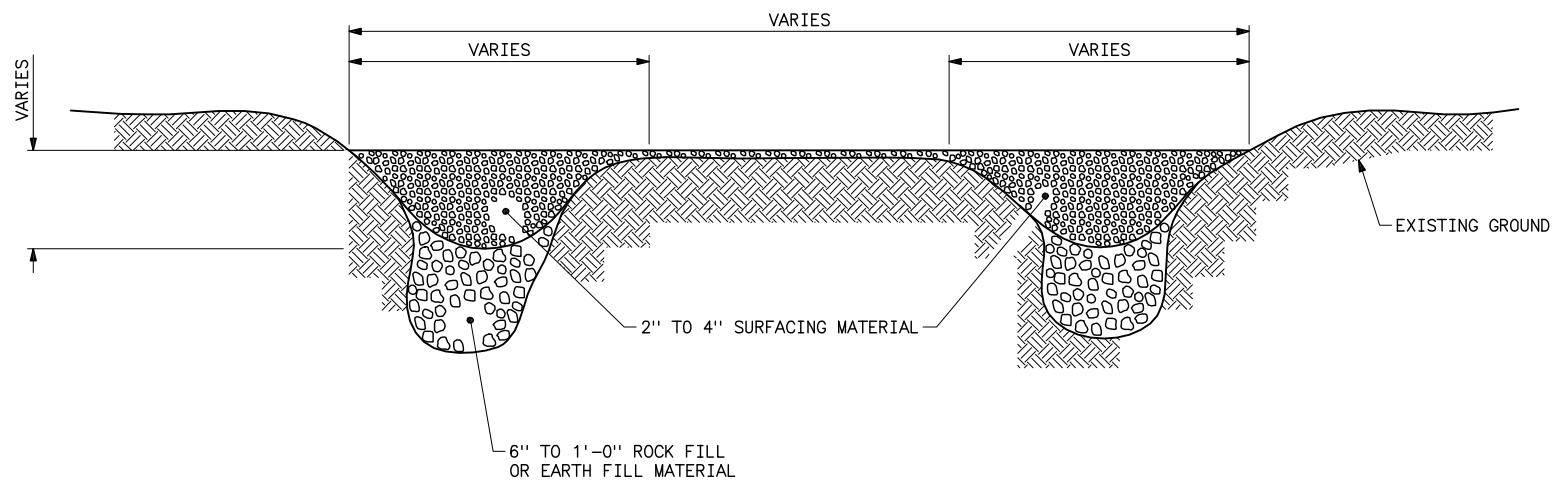


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TRANSMISSION LINE EROSION CONTROL TYPICAL SECTION SURFACE EROSION			
DESIGNED <u>T. TRUJILLO</u> _____ APPROVED <u>MC CONNELL STEWART</u> _____			
C A-E	JANUARY 24, 1985	41	2021



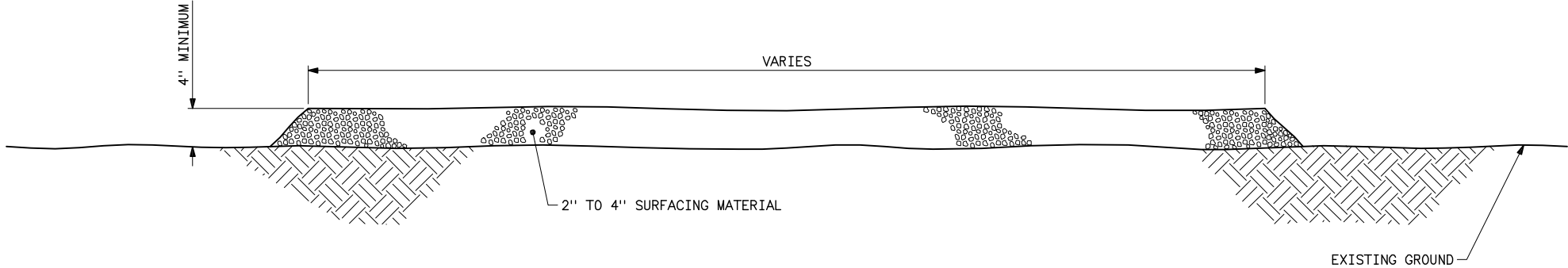
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TRANSMISSION LINE EROSION CONTROL TYPICAL SECTION SURFACE EROSION & ROADWAY			
DESIGNED <u>T. TRUJILLO</u> _____ APPROVED <u>MC CONNELL STEWART</u> _____			
C A-E	JANUARY 23, 1985	41	2022

Plotted By: denton Nov 17, 2011- 6:43am
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TRANSMISSION LINE EROSION CONTROL TYPICAL SECTION ROADWAY RUTS			
DESIGNED <u>T. TRUJILLO</u> _____ APPROVED <u>MC CONNELL STEWART</u> _____			
C A-E	JANUARY 23, 1985	41	2023

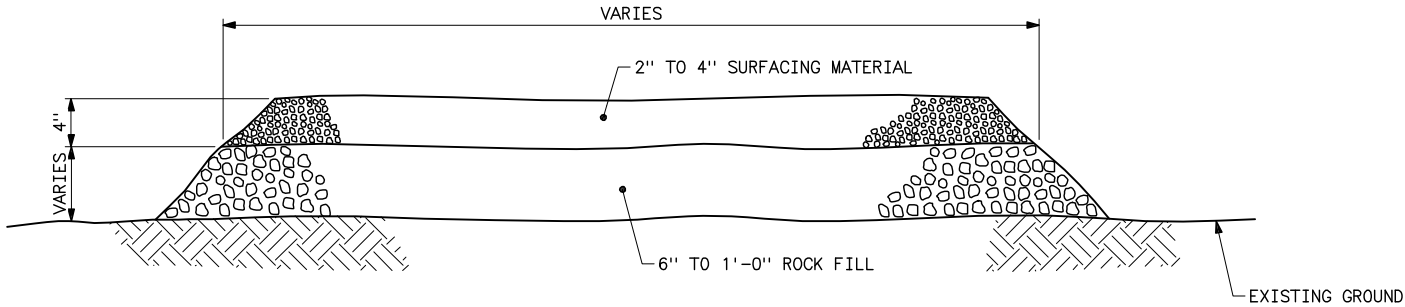
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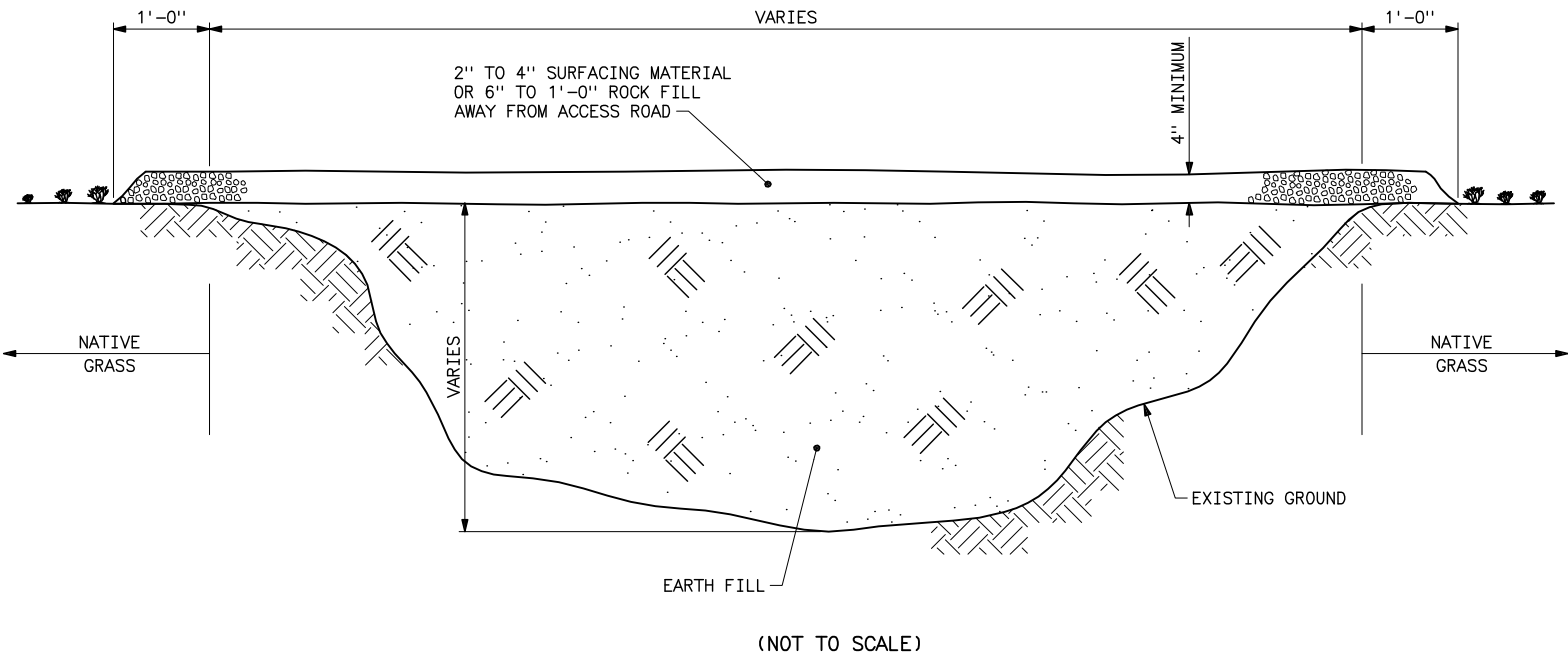
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TRANSMISSION LINE EROSION CONTROL TYPICAL SECTION 2" TO 4" ROADWAY SURFACING			
DESIGNED <u>T. TRUJILLO</u> _____ APPROVED <u>MC CONNELL STEWART</u> _____			
C A-E	JANUARY 22, 1985	41	2024

Plotted By: denton Nov 17, 2011- 6:43am
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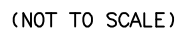


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TRANSMISSION LINE EROSION CONTROL TYPICAL SECTION 6" TO 12" ROADWAY SURFACING			
DESIGNED <u>T. TRUJILLO</u> _____ APPROVED <u>MC CONNELL STEWART</u> _____			
C A-E	JANUARY 22, 1985	41	2025

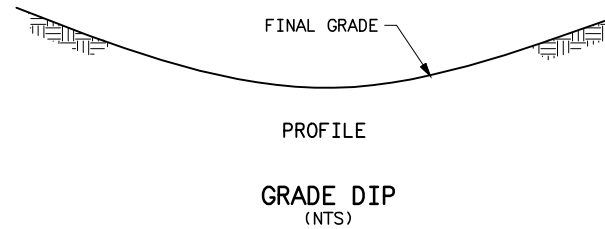
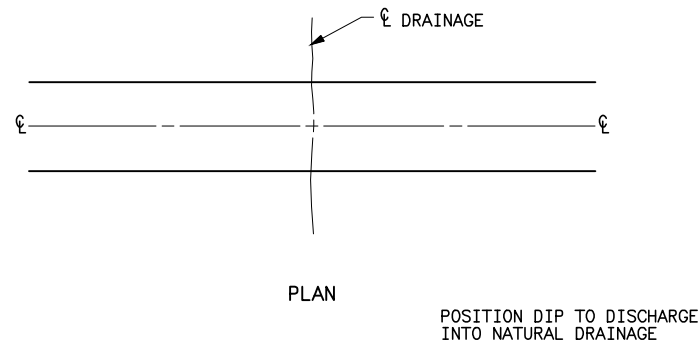
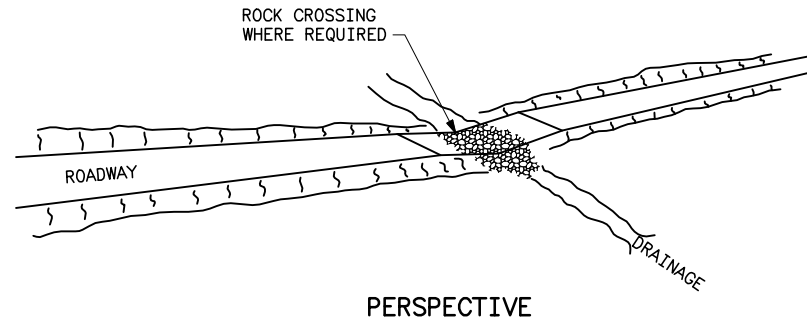
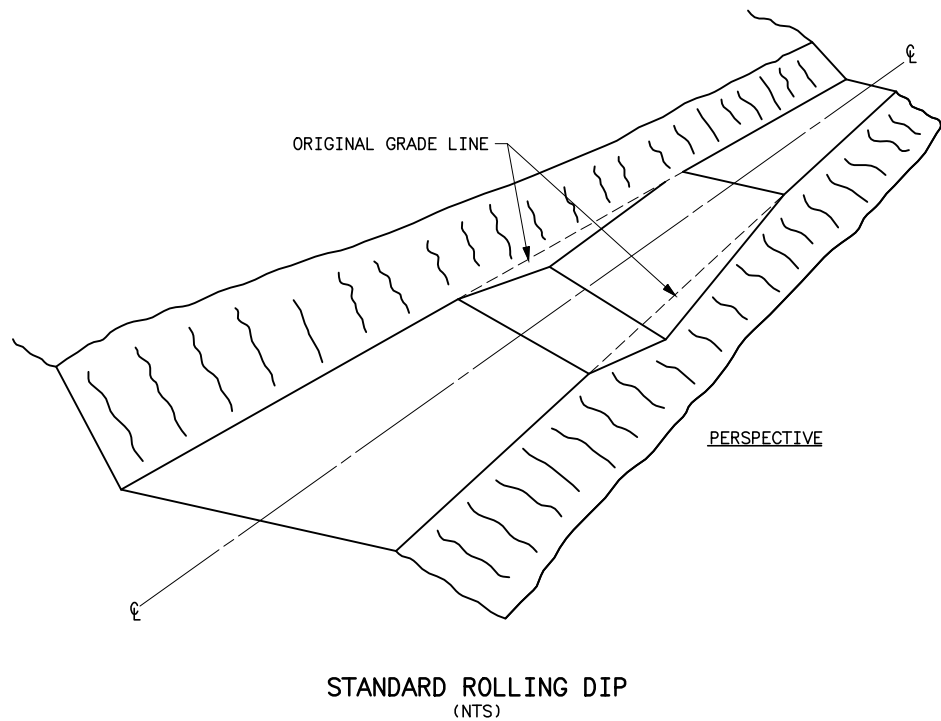
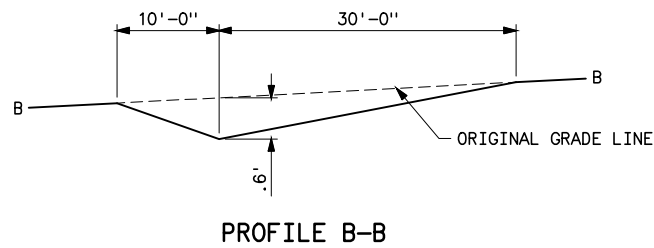
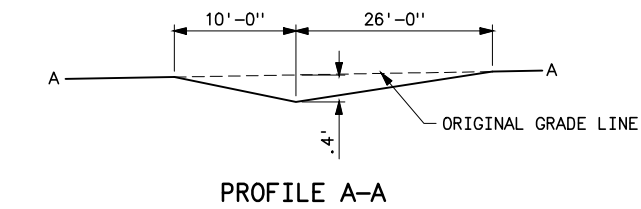
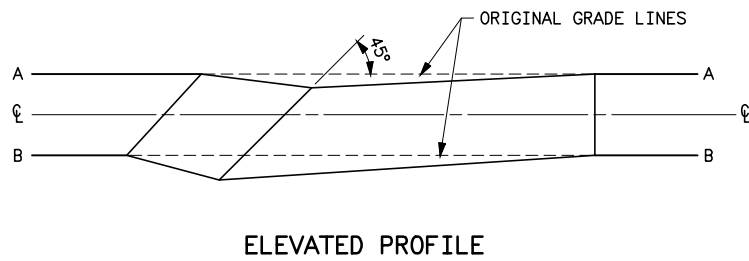
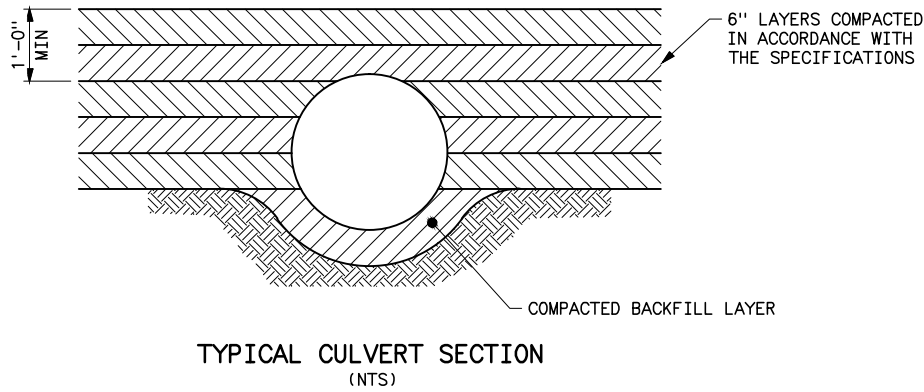


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TRANSMISSION LINE EROSION CONTROL TYPICAL SECTION EARTH FILL			
DESIGNED <u>T. TRUJILLO</u> _____ APPROVED <u>MC CONNELL STEWART</u> _____			
C/A	JANUARY 22, 1985	41	2026

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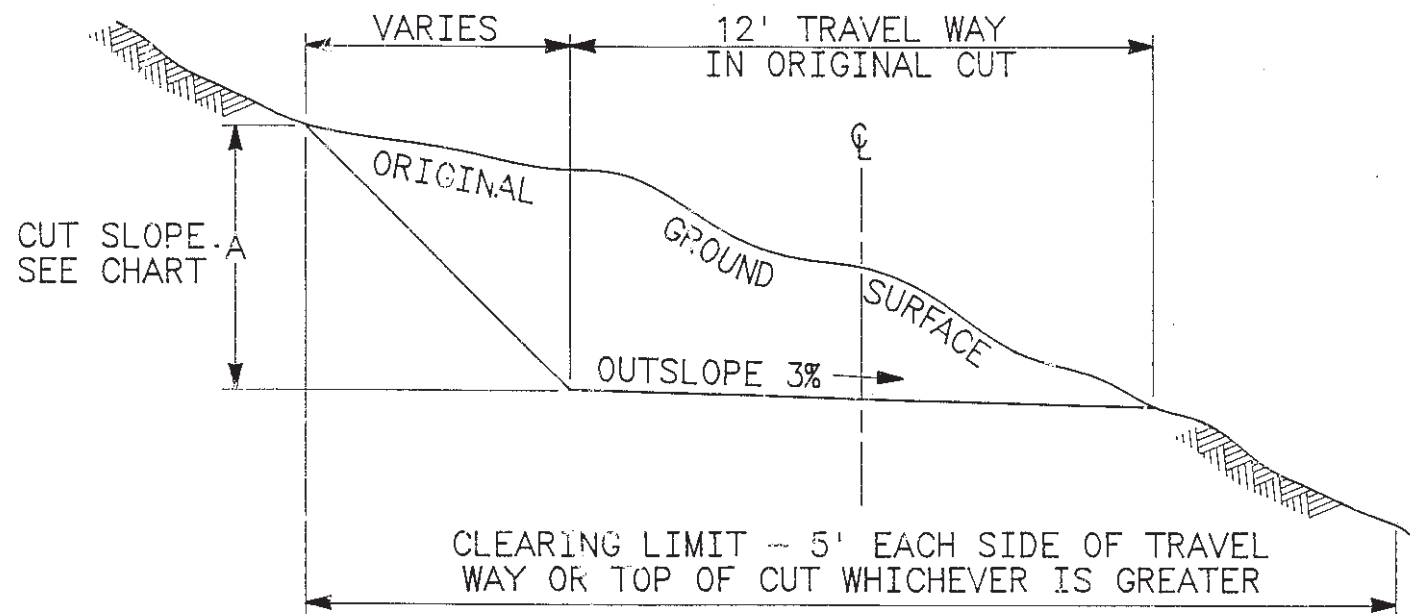
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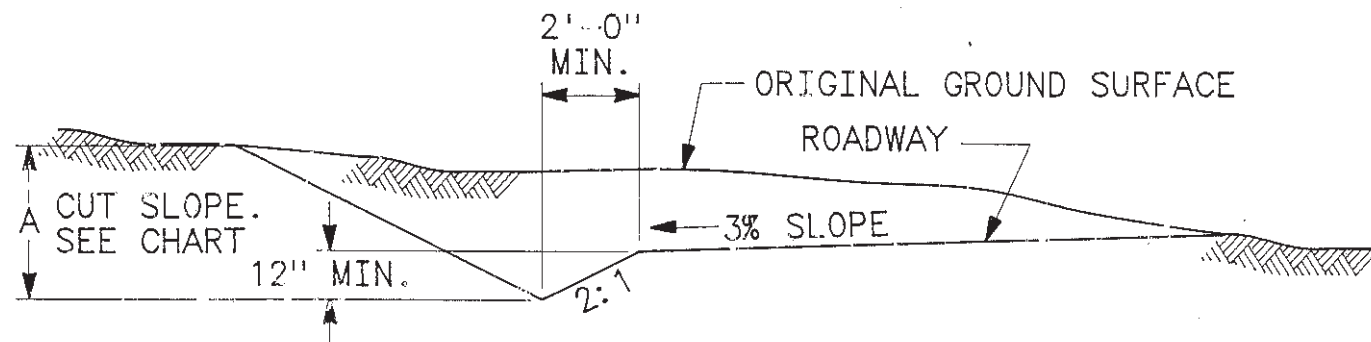
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TRANSMISSION LINE EROSION CONTROL TYPICAL SECTION ROAD STRUCTURES		
DESIGNED <u>ERNEST T. TRUJILLO</u> _ _ _ _ _ APPROVED <u>McCONNELL STEWART</u> _ _ _ _ _		
CA F	FEBRUARY 15, 1985	41
		2028

Plotted By: lampman Jan 27, 2014 - 10:04am
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IMAGES:

XREF(S):



TYPICAL ROADWAY SECTION



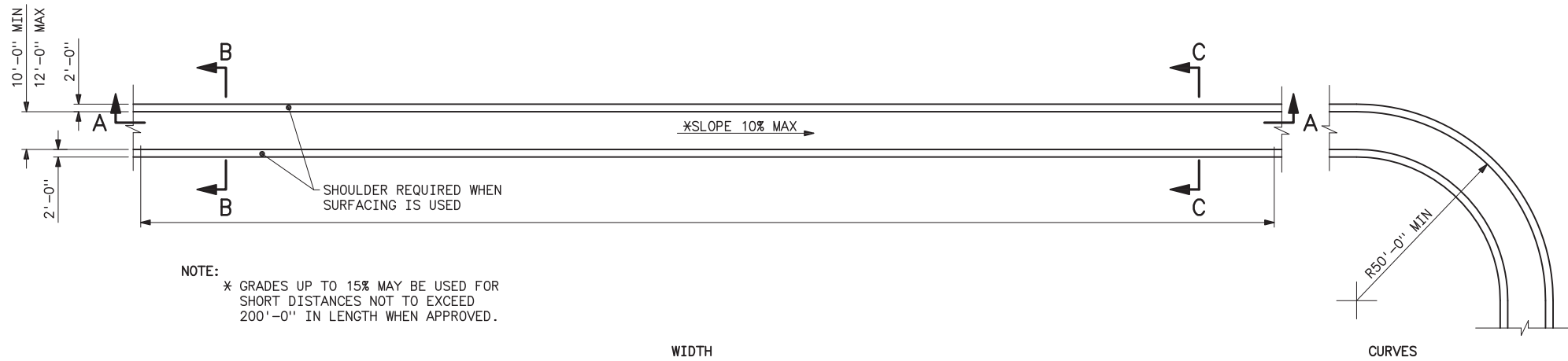
TYPICAL V-SHAPE DITCH

CUT SLOPE	
A DISTANCE (FT.)	SLOPE
0-5	3:1
5-10	2:1
10-20	1:1
> 20	1/2:1 *

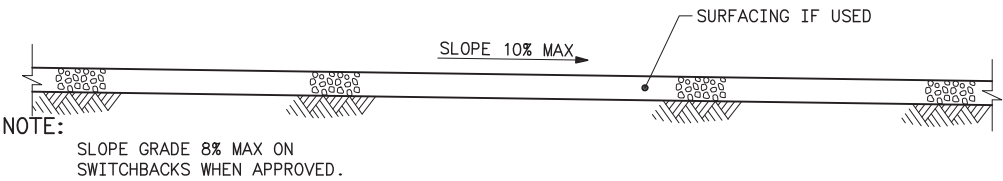
* OR ANGLE OF REPOSE

UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION SALT LAKE CITY CONSTRUCTION - MONTROSE, COLORADO		
TRANSMISSION LINE EROSION CONTROL TYPICAL ROADWAY CUT AND V-SHAPE DITCH SECTIONS		
DESIGNED <i>[Signature]</i>	RECOMMENDED <i>[Signature]</i>	
DRAWN <i>[Signature]</i>	APPROVED <i>[Signature]</i>	
CHECKED <i>[Signature]</i>	ASSISTANT AREA MANAGER FOR CONSTRUCTION	
DATE APRIL 22, 1993	41	2033

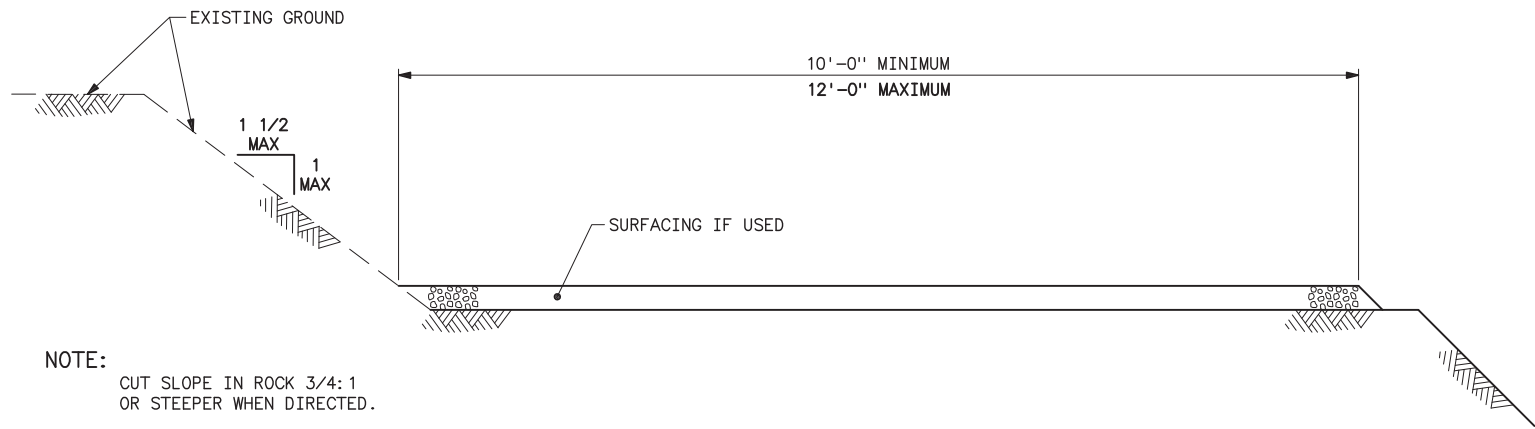
FILMED AUG 20 1995



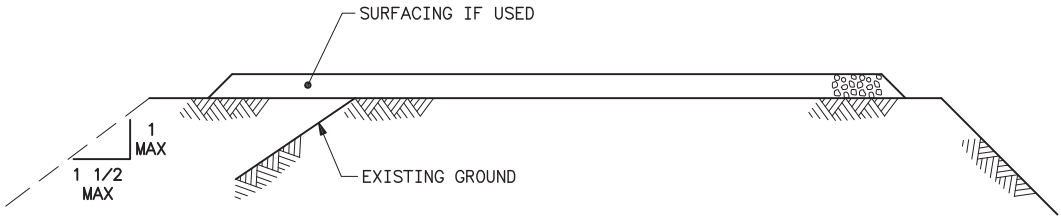
ACCESS ROADS



SECTION A-A



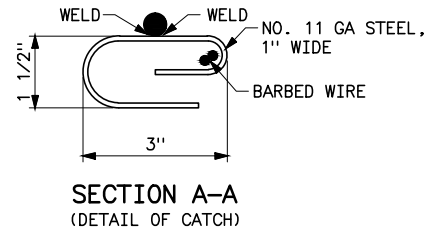
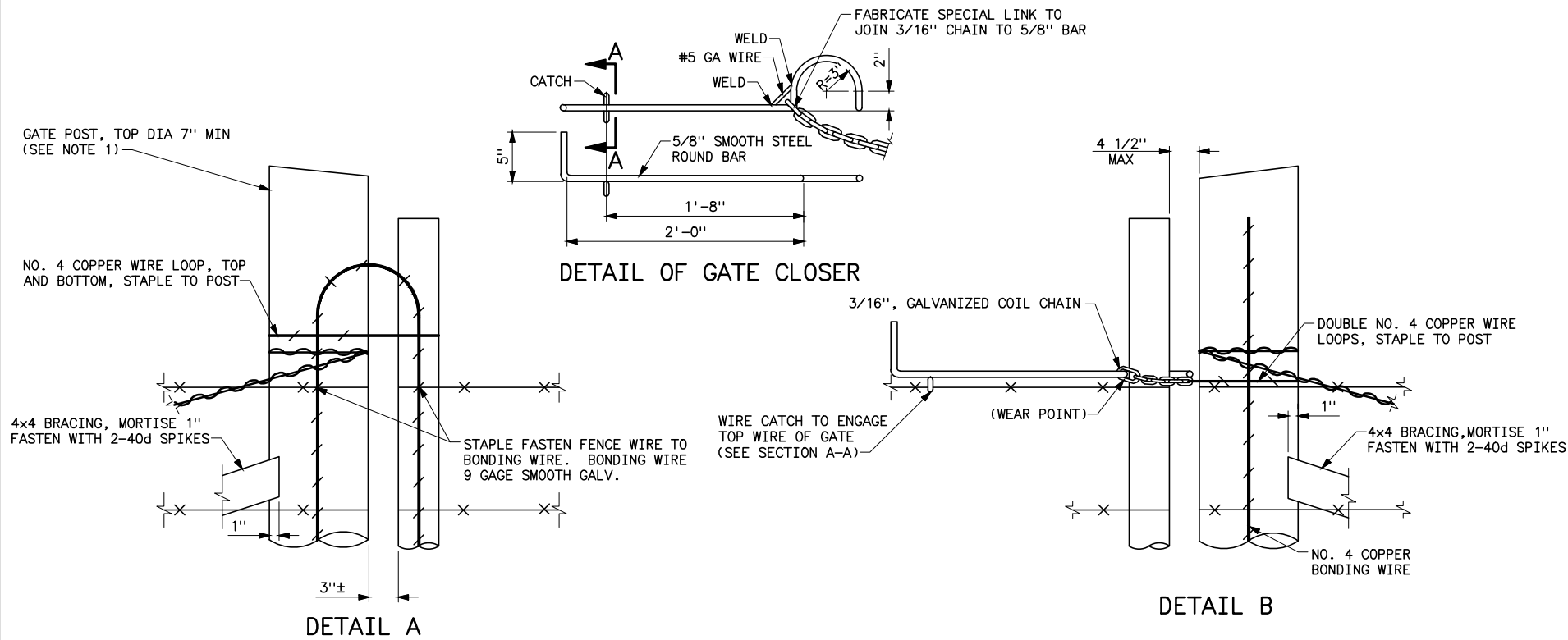
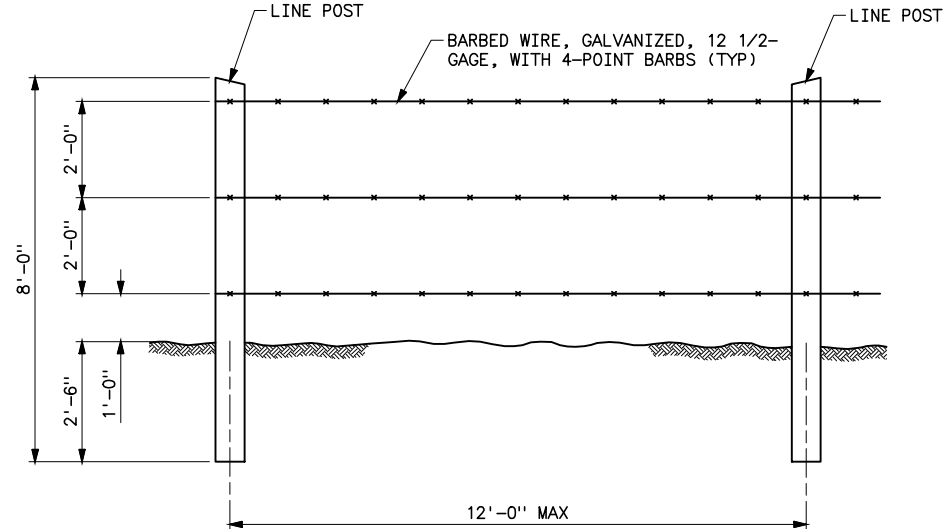
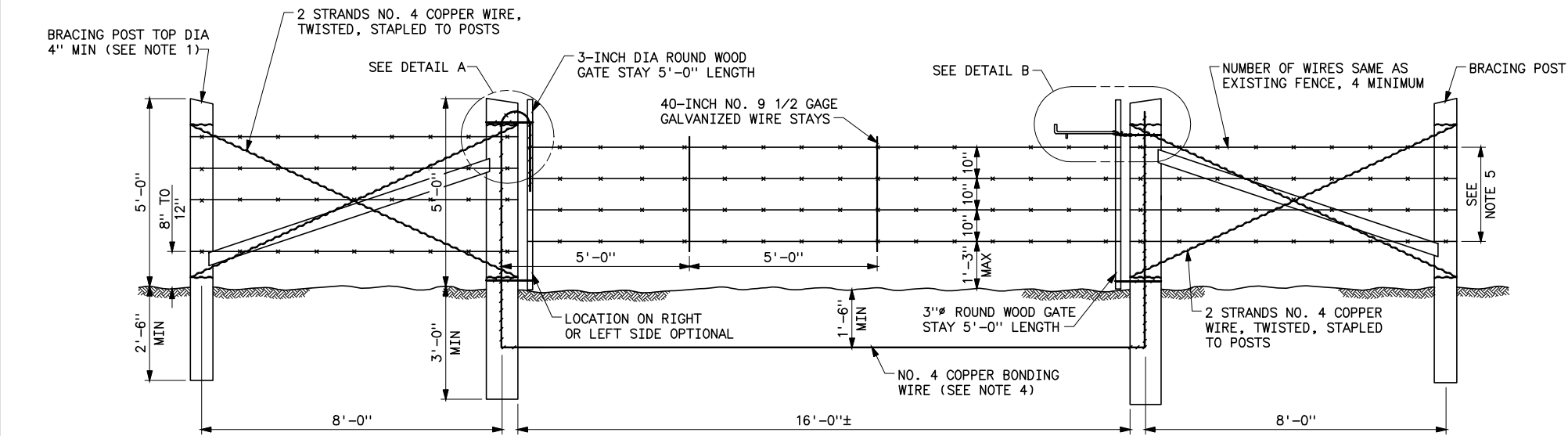
SECTION B-B



SECTION C-C

A	7-15-03 A7-DH	REVISED TITLE BLOCK ONLY.	
SUPERSEDES DWG NO. 43 2212			
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO			
TRANSMISSION LINE STANDARDS ACCESS ROADS GENERAL REQUIREMENTS			
DESIGNED <u>DOUG HANSON</u> _____ APPROVED <u>DOUG HANSON</u> _____ CIVIL ENGINEERING MANAGER			
CAE	APRIL 28, 2003	41	2035

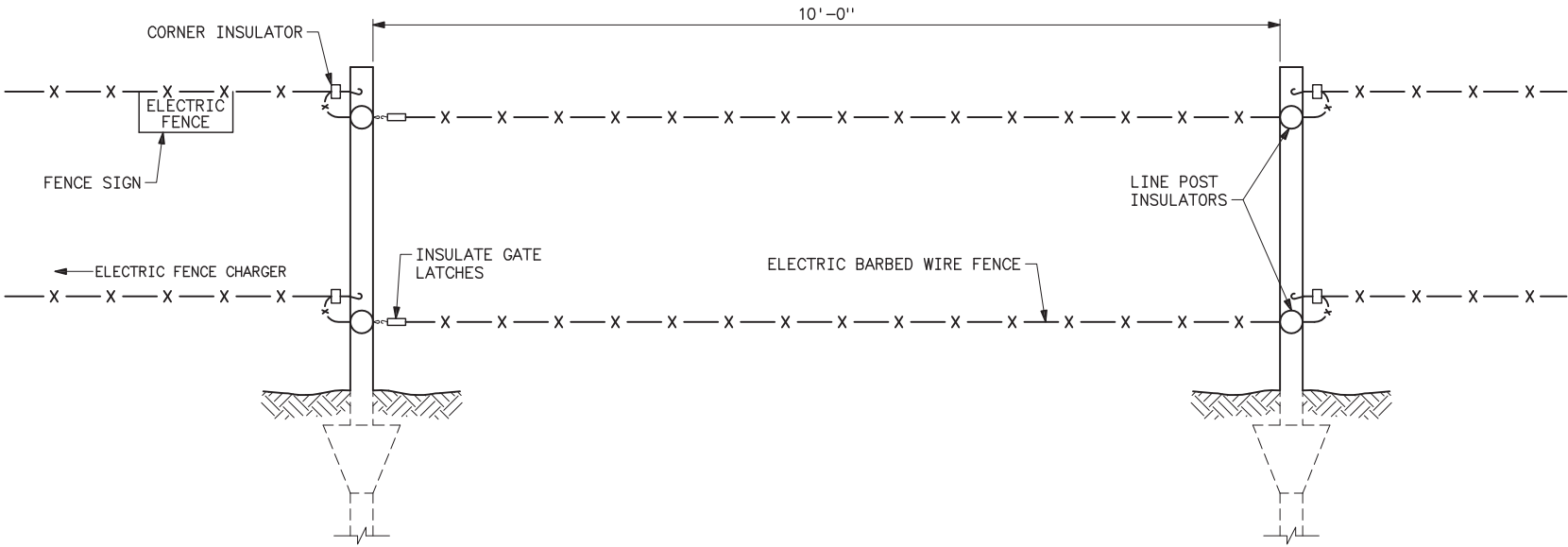
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IMAGES: S:\Projects\Misc\StandardDrawings\Drawings\DrawingsReadyForFinal\Scripts\41_9002n.dwg Last Saved By: Holly Seela on 10/26/2011 1:32 PM



NOTES

1. GATE CONSTRUCTION INCLUDES POSTS AND BRACING.
2. POSTS AND BRACES SHALL BE PRESSURE-TREATED TIMBER.
3. GATE CLOSER SHALL BE GALVANIZED IN ACCORDANCE WITH ASTM DESIGNATION A-153.
4. INSTALL BOTTOM COPPER BONDING WIRE BETWEEN GATE POSTS ONLY IF GATE IS WITHIN A FENCE WHICH CROSSES UNDER OR IS PARALLEL TO AND WITHIN 150 FEET OF TRANSMISSION LINE CENTERLINE.
5. CONNECT EACH NEW FENCE WIRE TO EXISTING FENCE WIRE FOR ELECTRICAL GROUNDING.

N	10-26-11 A7-KR	MINOR RRVISIONS
M	7-21-10 A7-DH	MINOR REVISIONS.
L	5-15-07 A7-DH	MINOR REVISIONS.
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
TRANSMISSION LINE STANDARDS BARBED WIRE GATE FOR RIGHT-OF-WAY FENCES		
DESIGNED K. ROWE APPROVED W.C. COWAN CHIEF, TRANSMISSION LINE STRUCTURAL BRANCH		
A	APRIL 25, 1994	41 9002

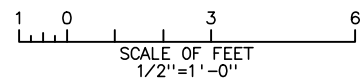
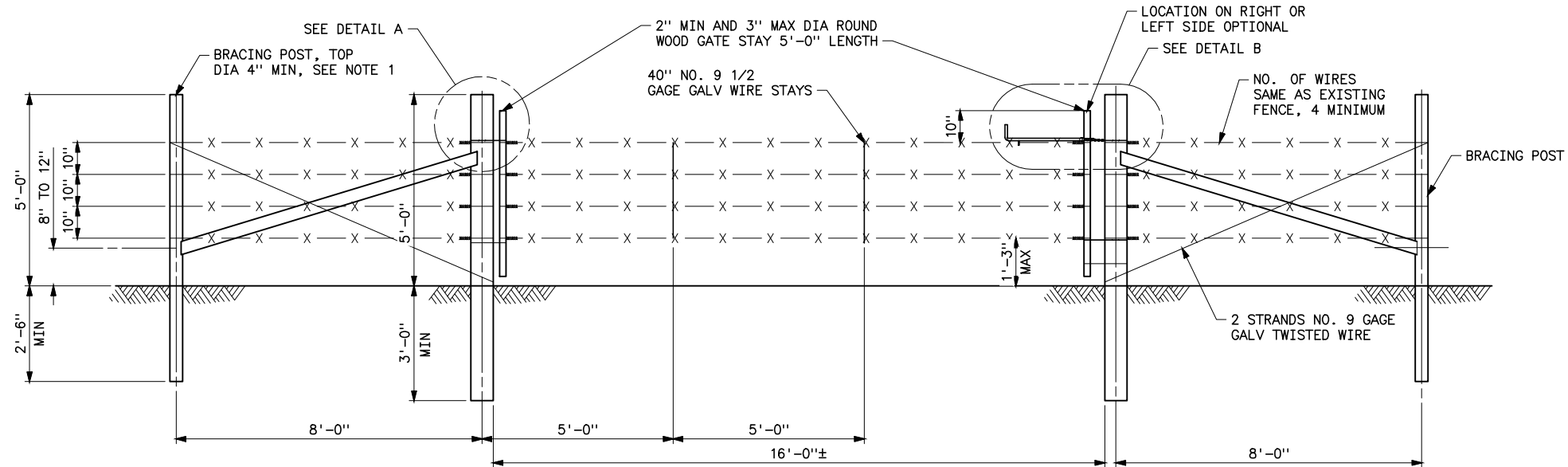


NOTE

1. WHERE SINGLE WIRE FENCES EXIST, FURNISH AND INSTALL MATERIALS FOR SINGLE WIRE GATE.

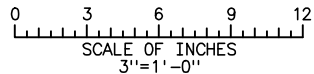
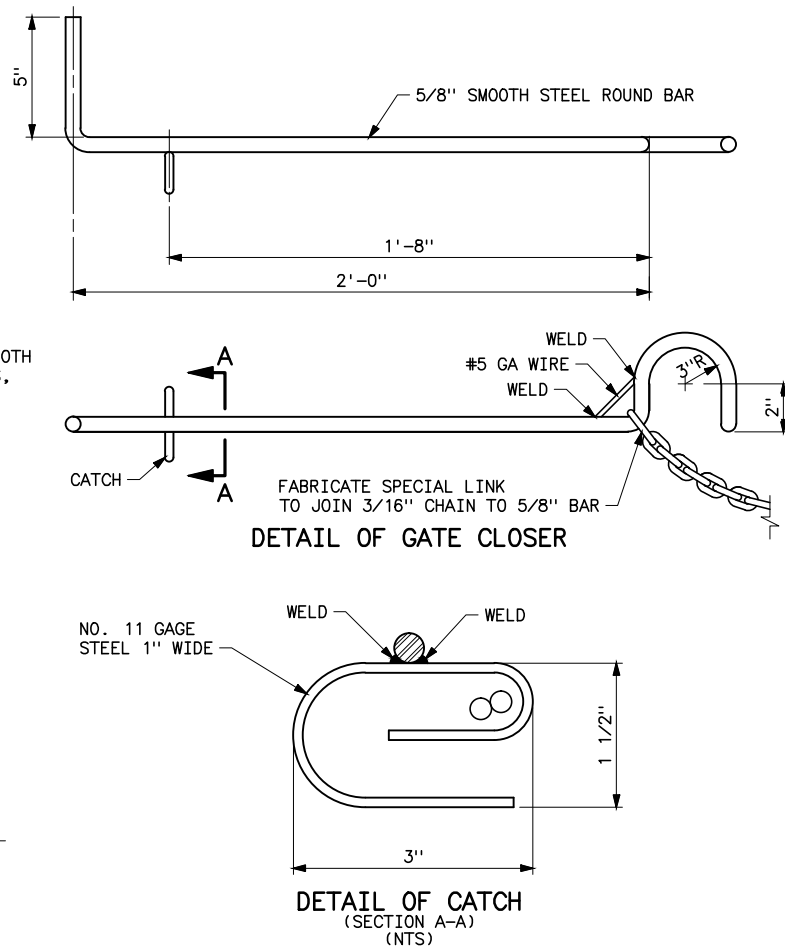
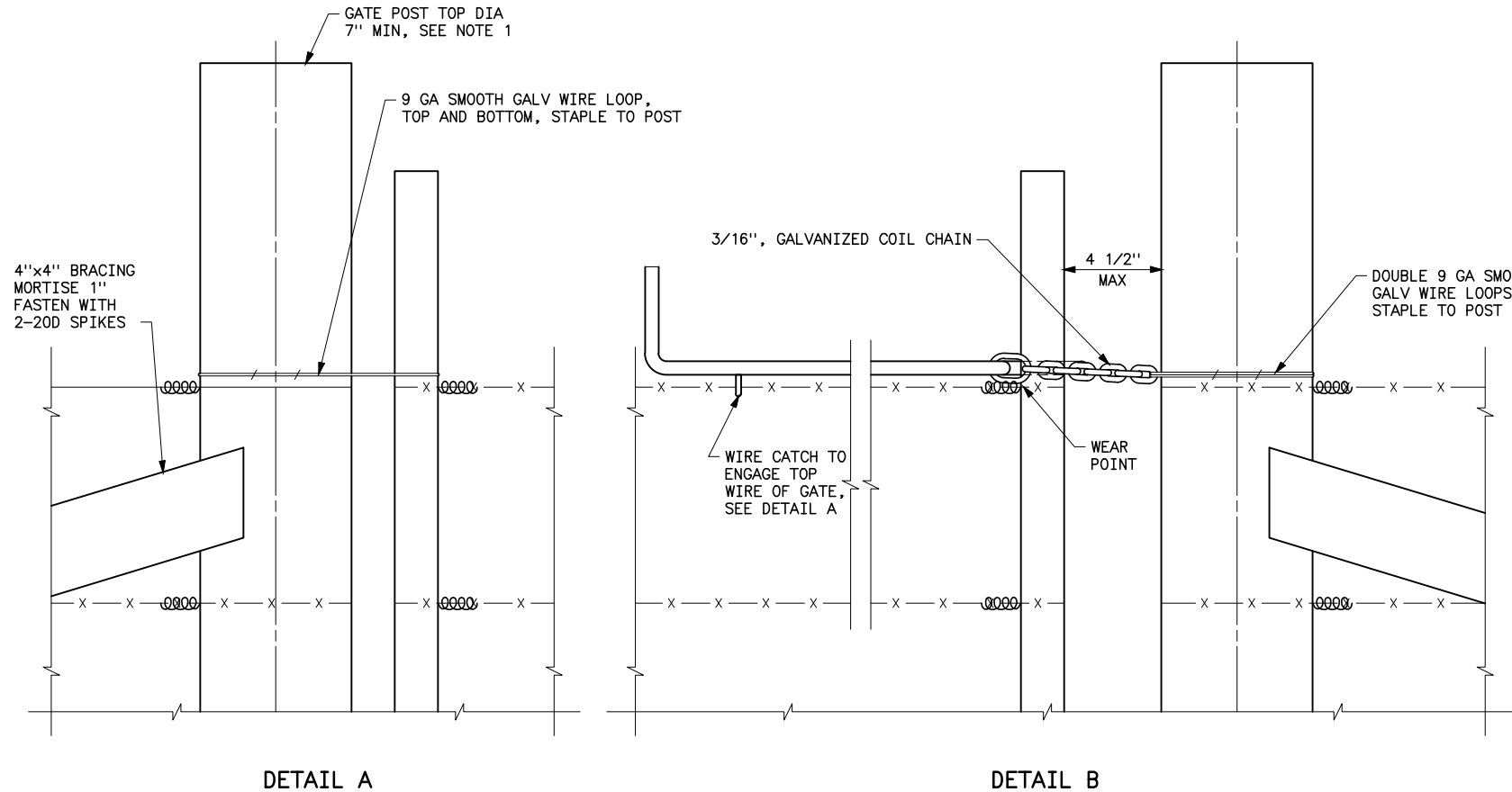
LIST OF MATERIALS	
QTY	DESIGNATION
4	BOLT, "J" TYPE, WITH WING NUT
4	INSULATOR, CORNER
4	INSULATOR, LINE POST
2	LATCH, GATE INSULATED
2	POST, ANGLE, 3/4x3/4x7/64 - 4 1/2 FEET HIGH
1	SIGN, ELECTRIC FENCE, 4x8
20'	WIRE, BARBED, 18-GA GALV STEEL FOR ELEC FENCE

C	7-15-03 A7-RC	REVISED TITLE BLOCK ONLY.
	B	7-13-99 A3-RMC
SUPERSEDES DWG NO. 40-D-5910		
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
TRANSMISSION LINE STANDARDS ELECTRIC BARBED WIRE GATE FOR RIGHT-OF-WAY FENCES		
DESIGNED BUREC _____ APPROVED ROSS M. CLARK ELECTRICAL ENGINEERING MANAGER		
CAE	JUNE 24, 1981	41 9003

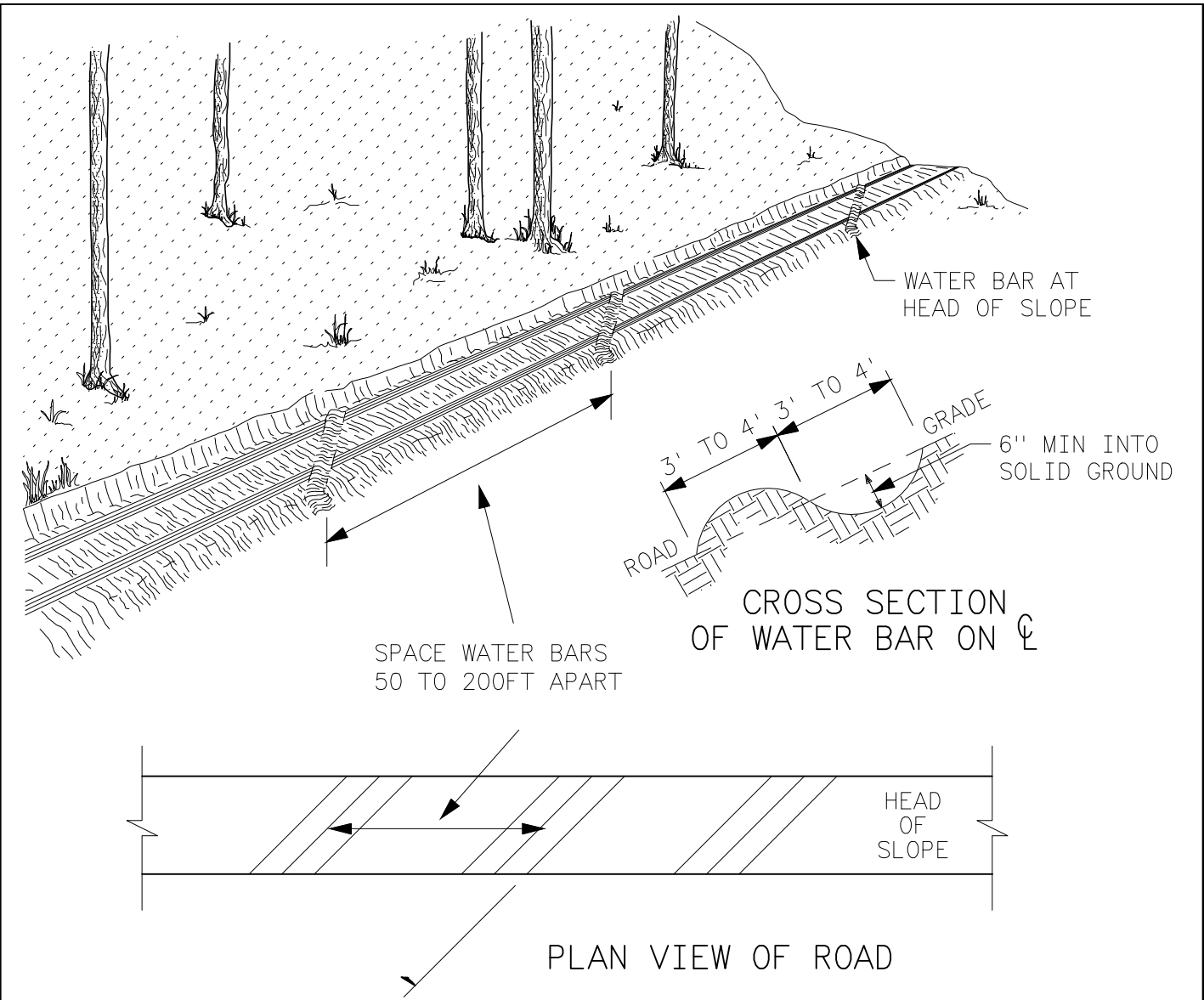


NOTES

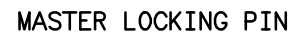
1. GATE POSTS AND BRACING POSTS ARE INCLUDED AS PART OF CONSTRUCTION OF THE GATE AND SHALL BE WELL-SEASONED CEDAR OR A TYPE THAT HAS BEEN PRESSURE TREATED WITH A PRESERVATIVE. THE PRESSURE TREATED POSTS SHALL BE DOUGLAS FIR, WESTERN LARCH, LODGE-POLE PINE OR SOUTHERN YELLOW PINE.
2. GATE CLOSER SHALL BE GALVANIZED IN ACCORDANCE WITH ASTM DESIGNATION A-153.



A	5-28-14 A7-DDD	REDRAWN.
	UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO	
	STANDARD DESIGNS TRANSMISSION LINES BARBED WIRE GATE FOR OFF RIGHT-OF-WAY ACCESS FENCES	
	DESIGNED G.O.D. _____	APPROVED ROBERT H. JONES ASST AREA MGR FOR CONST
NOVEMBER 30, 1982	41	9020



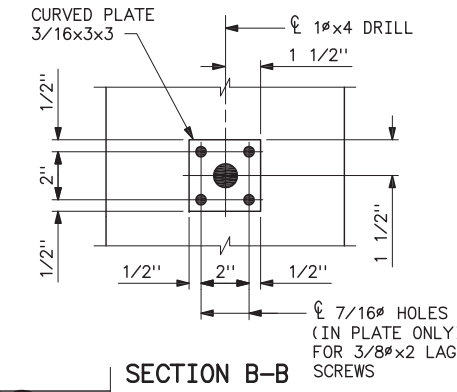
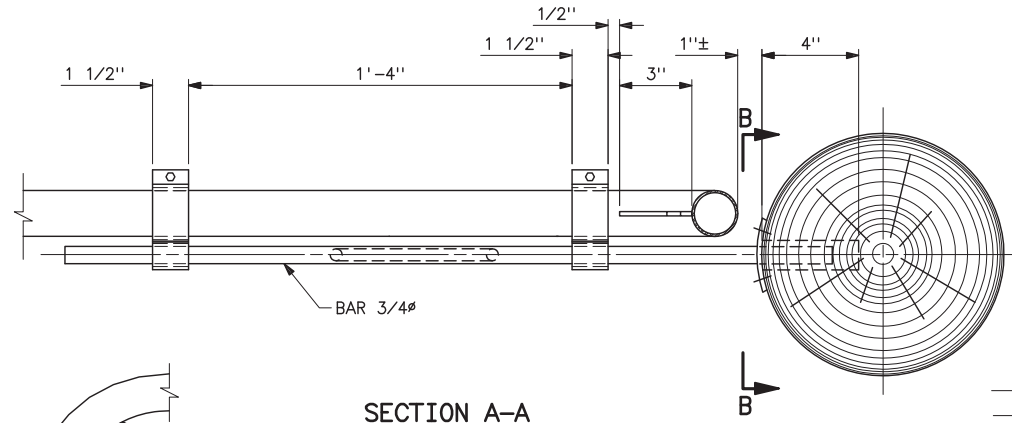
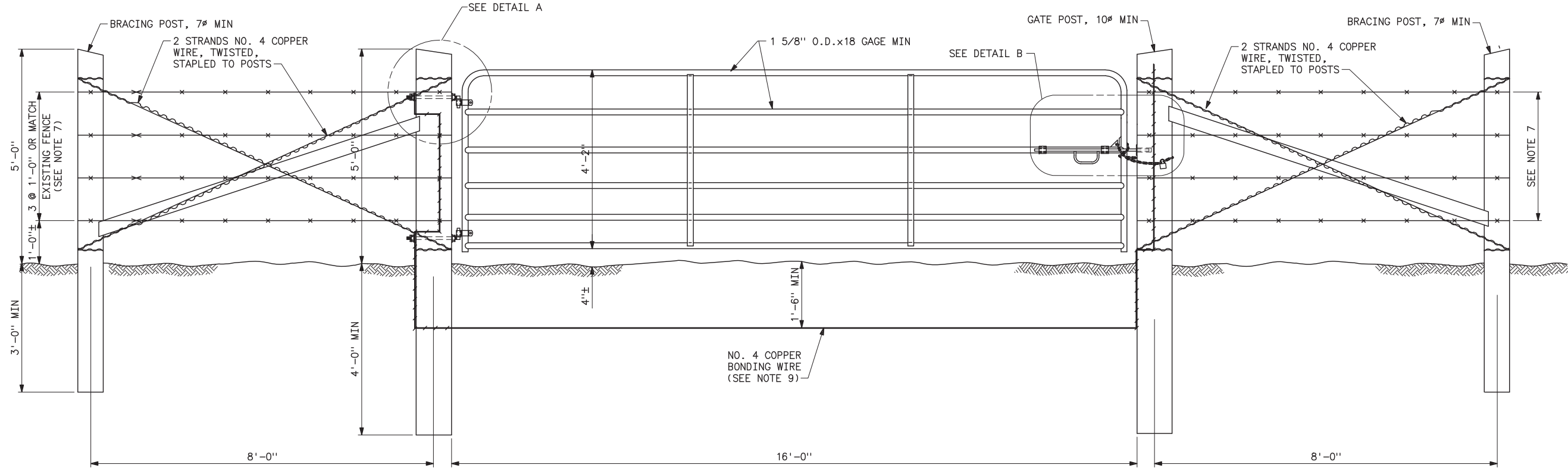
A	7-15-03 A7-DH	REVISED TITLE BLOCK ONLY.	
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO			
TRANSMISSION LINE STANDARDS ACCESS ROAD REHABILITATION WATER BAR CONSTRUCTION			
DESIGNED <u>KAREN ROWE</u> — — APPROVED <u>DOUG HANSON</u> CIVIL ENGINEERING MANAGER			
C A/E	DECEMBER 31, 1996	41	9021



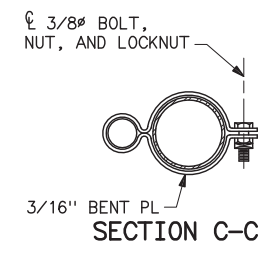
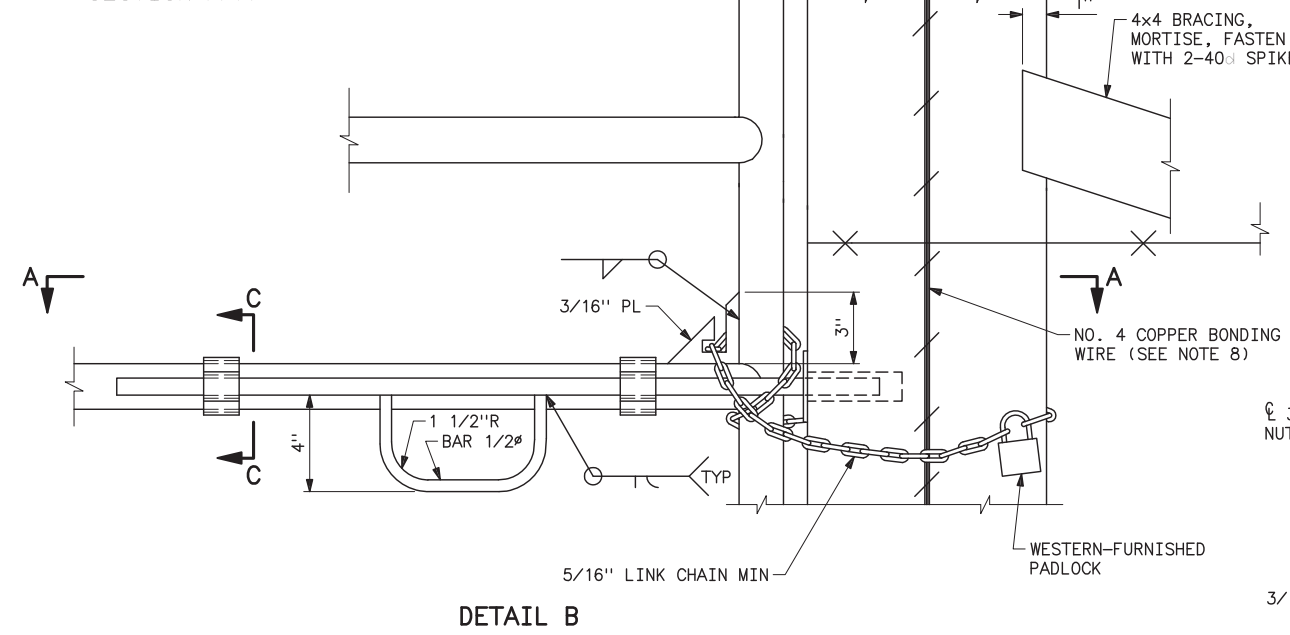
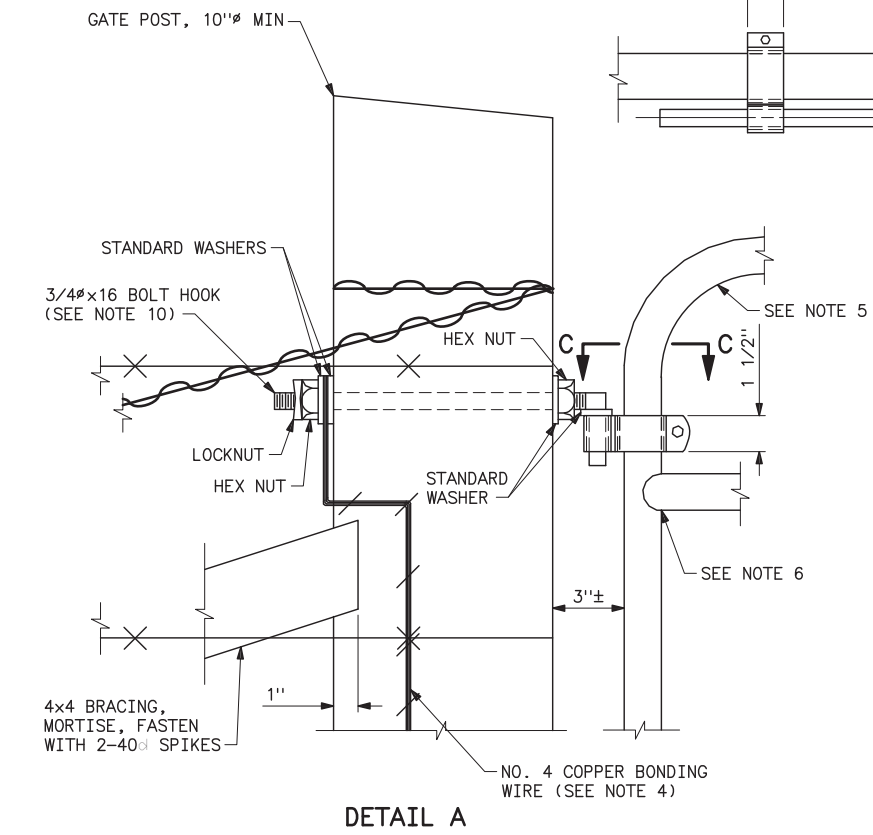
1. ALL MEMBERS OF THE GATE ASSEMBLY SHALL BE FABRICATED FROM STANDARD STEEL SECTIONS. FABRICATED MEMBERS SHALL RECEIVE ONE SHOP COAT OF ALUMINUM PAINT AFTER FABRICATION. ALUMINUM PAINT SHALL CONFORM TO AASHTO SPECIFICATION M69-70. HARDWARE SHALL BE CADMIUM PLATED.
2. THE CLOSURE GATE PAY ITEM INCLUDES ALL REQUIRED ATTACHED SIGNS.
3. CONCRETE SHALL BE IN ACCORDANCE WITH DIVISION 3.
4. ATTACH ALL SIGNS WITH VANDAL-PROOF BOLTS.



[Return to TOC](#)

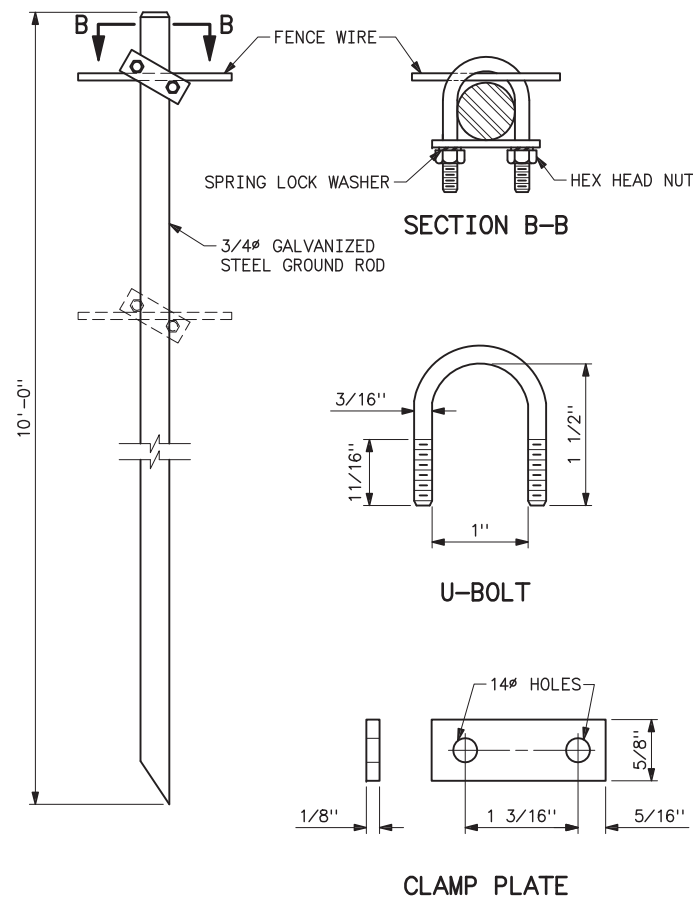


- NOTES**
1. GATE CONSTRUCTION INCLUDES POSTS AND BRACING.
 2. GATE, HARDWARE, AND WIRE SHALL BE ZINC COATED.
 3. POSTS AND BRACING SHALL BE PRESSURE-TREATED TIMBER.
 4. CONNECT BONDING WIRE TO TOP AND BOTTOM BOLT HOOKS AND STAPLE INTERSECTIONS OF FENCE WIRE AND BONDING WIRE TO GATE POSTS FOR ELECTRICAL GROUNDING.
 5. DIAMETER OF TUBING SHALL BE APPROXIMATELY MAINTAINED WHEN BENDING TOP TWO CORNERS OF OUTSIDE GATE FRAME.
 6. INTERIOR CROSS TUBES SHALL BE MITERED TO OUTSIDE GATE FRAME.
 7. CONNECT EACH NEW FENCE WIRE TO EXISTING FENCE WIRE FOR ELECTRICAL GROUNDING.
 8. STAPLE INTERSECTIONS OF FENCE WIRE AND COPPER BONDING WIRE TO GATE POSTS FOR ELECTRICAL GROUNDING.
 9. INSTALL BOTTOM COPPER BONDING WIRE BETWEEN GATE POSTS ONLY IF GATE IS WITHIN A FENCE WHICH CROSSES UNDER OR IS PARALLEL TO AND WITHIN 150 FEET OF TRANSMISSION LINE CENTERLINE.
 10. INSTALL TOP BOLT HOOK POINTING UPWARD OR DOWNWARD, AS DIRECTED BY THE COR.

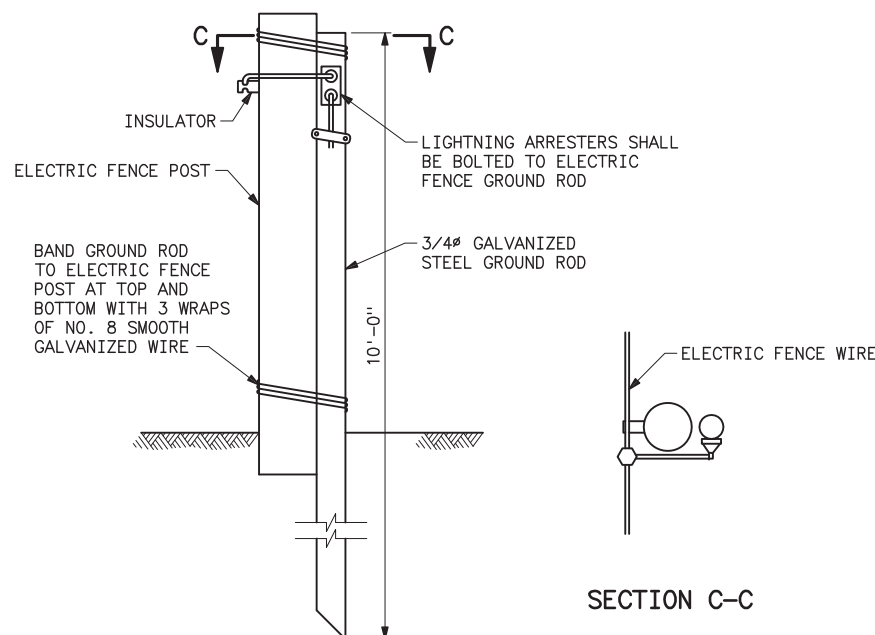


D	8-1-05 A7-DH	CHANGED GALVANIZED WIRE TO COPPER AND REVISED NOTES 8, 9, AND 10.
C	7-15-03 A7-DH	REVISED TITLE BLOCK ONLY.
B	8-26-94 A2-WCC	MINOR REVISIONS.
A	3-22-94 A2-WCC	ADDED BURIED BONDING WIRE. MINOR REVISIONS.
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
TRANSMISSION LINE STANDARDS PREFABRICATED TUBULAR STEEL GATE		
DESIGNED B.G. HAGLER _____ APPROVED G.O. THOMAS DIRECTOR, DIVISION OF TRANSMISSION LINE AND BUILDING DESIGN		
C.A.F.	JANUARY 23, 1991	41 9024

Mar 23, 2006- 11:15am Plotted By: Seila, IMAGES: P:\41_19024c.dwg Last Saved By: Dave Sanchez on Jun 17, 2005- 12:22pm



NON-ELECTRIC FENCE GROUNDING



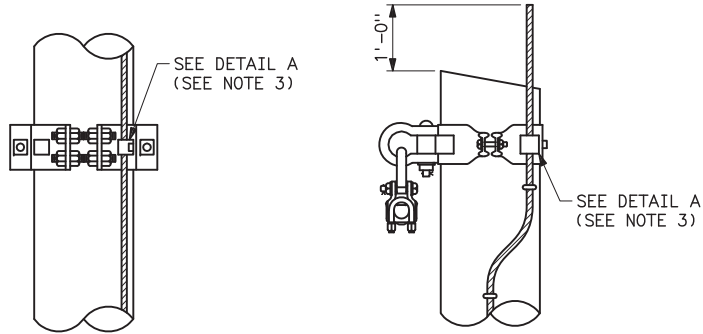
ELECTRIC FENCE GROUNDING

NOTES

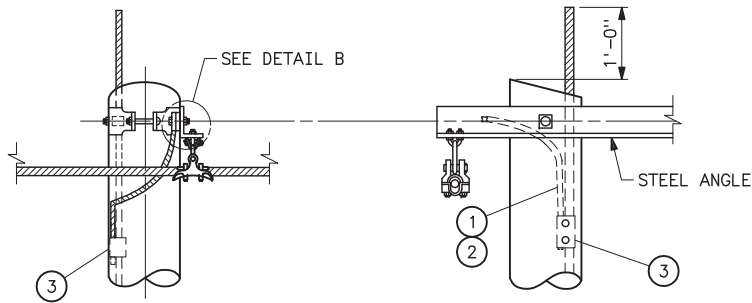
- 1. GROUND RODS AND HARDWARE SHALL BE MADE OF STEEL AND GALVANIZED IN ACCORDANCE WITH ASTM DESIGNATION A 153.
- 2. CLAMP ASSEMBLY INCLUDES U-BOLT, CLAMP PLATE, TWO SPRING LOCKWASHERS AND TWO HEX NUTS.
- 3. USE ONE CLAMP ASSEMBLY, FOR EACH FENCE WIRE.
- 4. ELECTRIC FENCES SHALL BE GROUNDED ONLY THROUGH LIGHTNING ARRESTERS AS SHOWN. LIGHTNING ARRESTERS SHALL BE ESPECIALLY DESIGNED FOR USE WITH ELECTRIC FENCES. GROUND RODS SHALL BE DRIVEN AS CLOSE AS POSSIBLE TO, AND BONDED TO, ELECTRIC FENCE POSTS.
- 5. REMOVE SCALE AND RUST AND THEN COAT WITH NO-OXIDE COMPOUND, ALL FENCE WIRE SURFACES WHICH CONTACT CLAMP ASSEMBLIES.

C	7-15-03 A7-RC	REVISED TITLE BLOCK ONLY.
B	7-13-99 A3-RMC	REDRAWN.
SUPERSEDES DWG NO. E40-D-5017		
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
TRANSMISSION LINE STANDARDS TRANSMISSION LINES FENCE GROUNDING HARDWARE		
DESIGNED BUREC _____ APPROVED ROSS M. CLARK ELECTRICAL ENGINEERING MANAGER		
C A E	AUGUST 6, 1979	41 1011

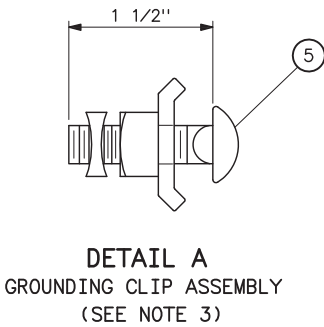
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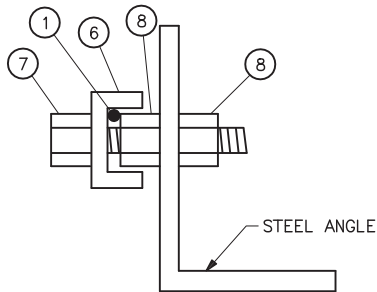
POLE BAND BONDING



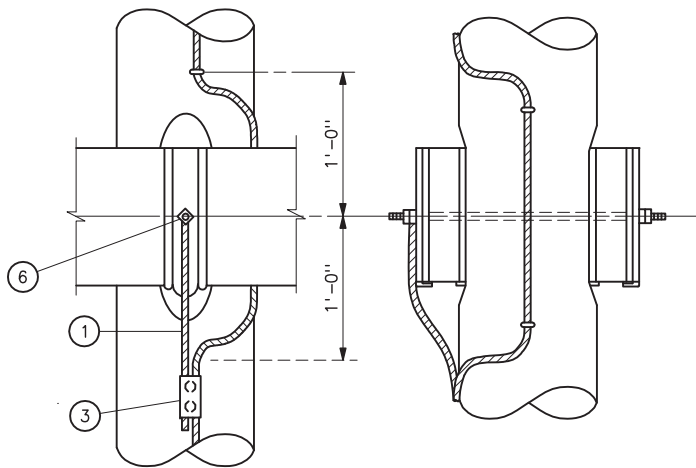
STEEL ANGLE BONDING



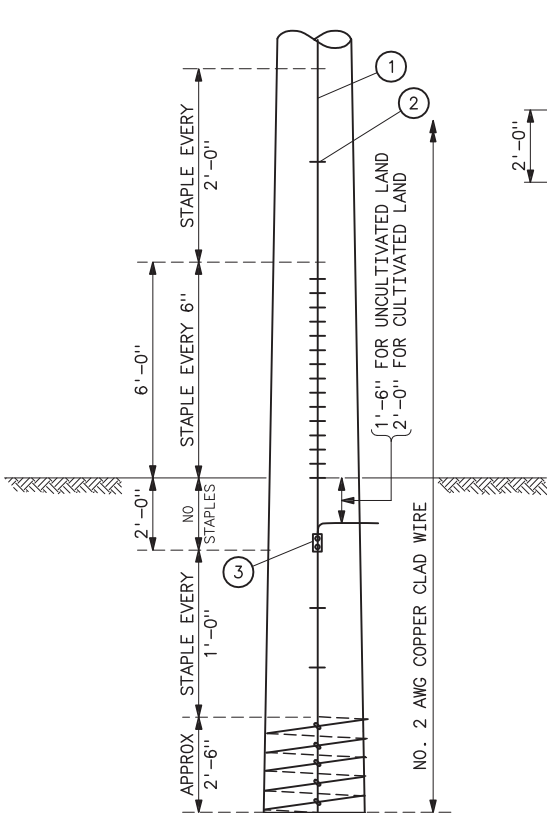
DETAIL A
GROUNDING CLIP ASSEMBLY
(SEE NOTE 3)



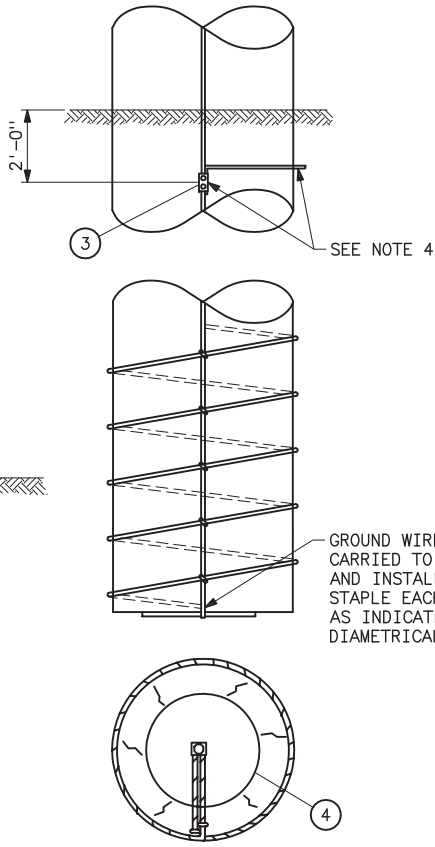
DETAIL B
BONDING CLIP ASSEMBLY



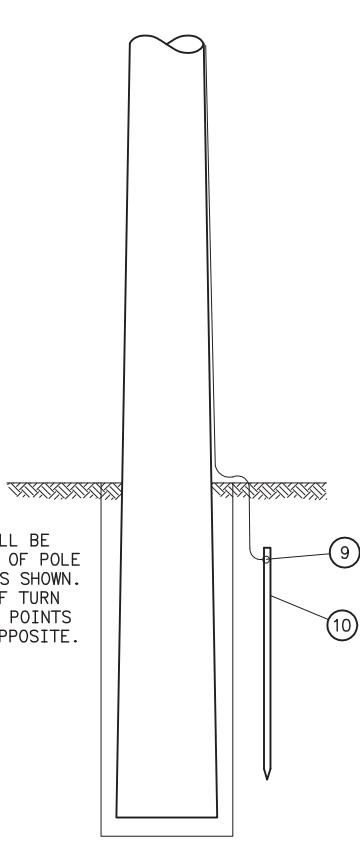
CROSSARM DETAIL
AND BONDING
FOR STRUCTURE WITH OGW
(SEE NOTE 2)



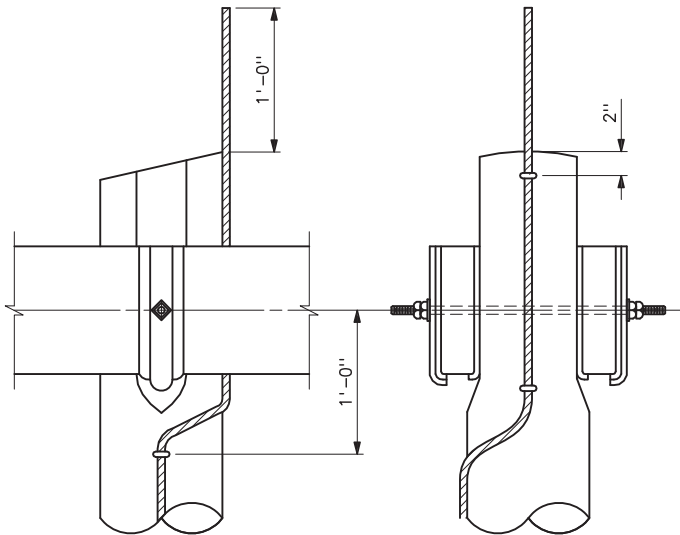
GROUND WIRE ATTACHMENT DETAILS



POLE BUTT
WRAPPING DETAIL



GROUND ROD DETAIL
SEE NOTE 5



CROSSARM DETAIL AND BONDING
FOR STRUCTURE WITHOUT OGW

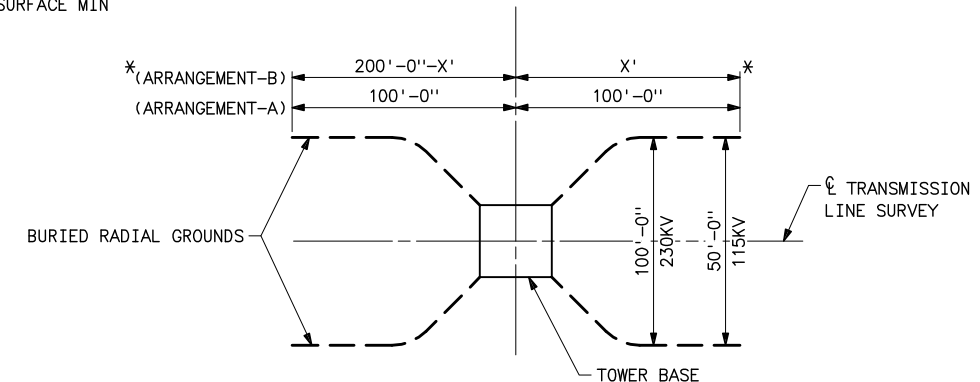
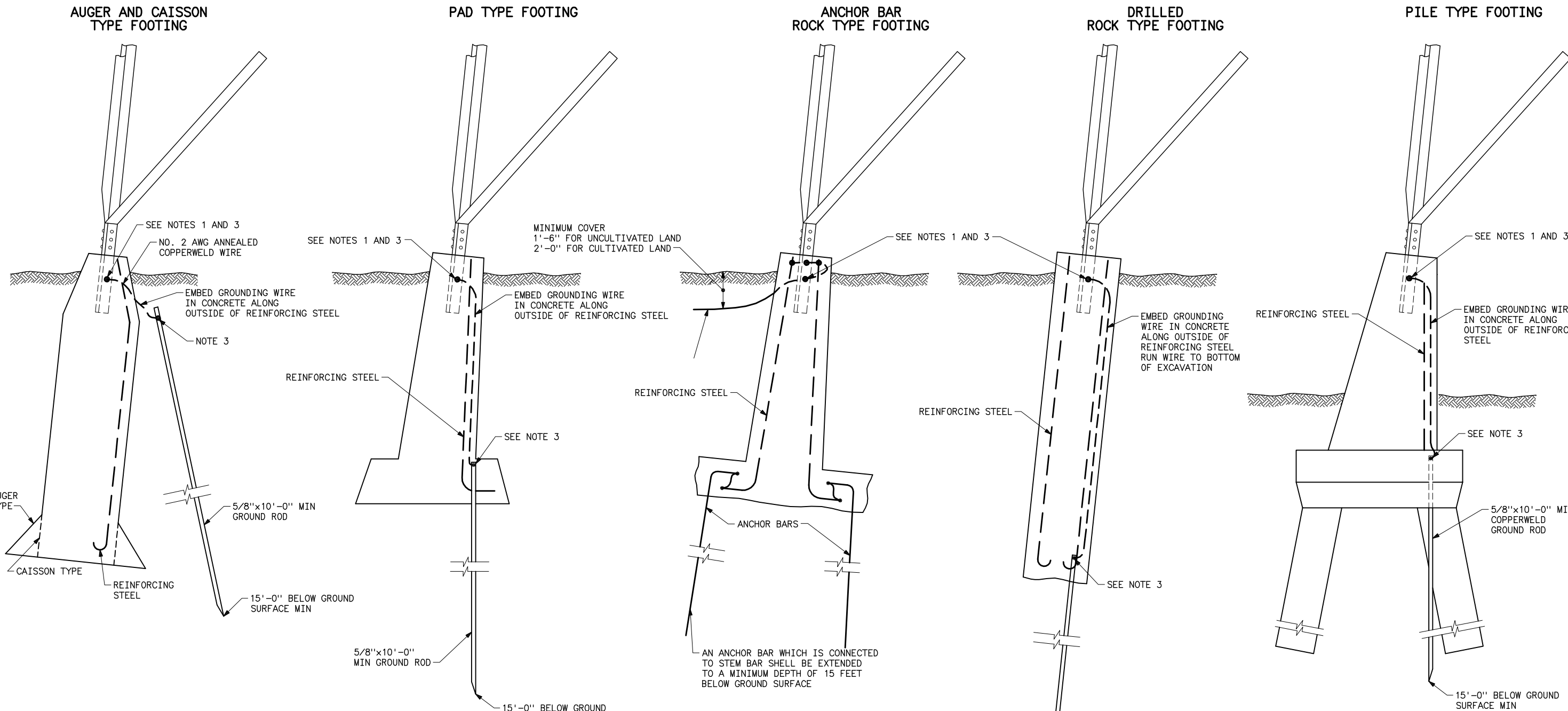
MATERIALS LIST	
ITEM NO.	DESCRIPTION
1	NO.2 AWG, 30% CONDUCTIVITY, COPPER CLAD WIRE
2	GALVANIZED 2-INCH BARBED STAPLES
3	CLAMP, PARALLEL GROOVE, 2-BOLT COPPER ALLOY
4	POLE BOTTOM PLATE (BLACKBURN NO. GP 110 OR EQUAL) ATTACHED TO POLE
5	GROUNDING CLIP ASSEMBLY (INCLUDES BONDING CLIP, CARRIAGE BOLT, NUT, AND LOCKNUT)
6	BONDING CLIP (EQUAL TO BROOKS MANU. BC SERIES OR HUGHES BROS. NO. 2727)
7	MACHINE BOLT, 1/2x3
8	LOCKNUT FOR 1/2" BOLT
9	CADWELD, THERMOWELD OR EQUAL EXOTHERMIC TYPE CONNECTION
10	GROUND ROD, COPPER-CLAD STEEL 5/8x8 FT

NOTES

1. INSTALL GROUND WIRE AS INDICATED ON INDIVIDUAL STRUCTURE DRAWINGS.
2. PARALLEL GROOVE CLAMP, BONDING CLIP AND JUMPER FOR BONDING TO CROSSARM IS REQUIRED FOR 230KV STRUCTURES ONLY.
3. USE ONE GROUNDING CLIP ASSEMBLY PER POLE BAND.
4. UNDERGROUND POLE-TO-POLE GROUND WIRE TIE IS REQUIRED FOR ALL STRUCTURES EXCEPT FOR THOSE THAT HAVE STEEL ANGLE BONDING.
5. USE GROUND ROD ONLY WHEN SPECIFIED. THE TOP OF THE GROUND ROD SHALL BE PLACED A MINIMUM OF 6 INCHES BELOW GROUND LEVEL.

C	7-15-03 A7-RC	REVISED TITLE BLOCK ONLY.	
B	5-18-95 A2-RMC	REDRAWN.	
SUPERSEDES DWG NO. 40-D-4978			
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO			
TRANSMISSION LINE STANDARDS WOOD POLE STRUCTURES GROUNDING DETAILS			
DESIGNED <u>SRR</u> _____		APPROVED <u>ROSS M. CLARK</u> CHIEF, TRANSMISSION LINE BRANCH	
C/A	AUGUST 6, 1979	41	1012

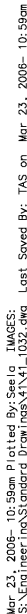
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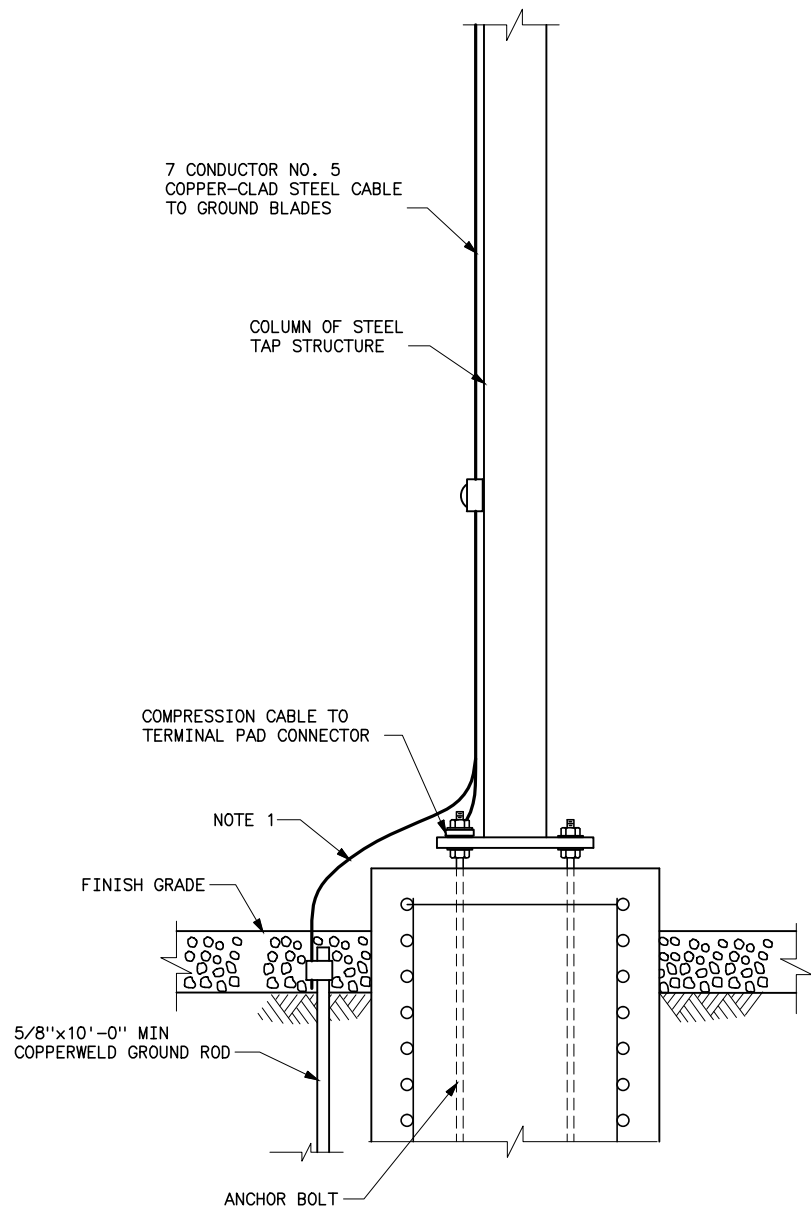


DETAIL B
* USE ONLY WHERE IT IS IMPRACTICAL TO USE ARRANGEMENT-A

- NOTES**
1. CONNECT TO STUB ANGLE BELOW TOP OF CONCRETE.
 2. INSTALL ONE GROUND ROD FOR EACH TOWER LEG AS SHOWN IN THE DETAILS.
 3. THE CONNECTIONS FOR CONNECTING THE NO. 2 AWG COPPERWELD WIRE TO GROUND RODS, STUB ANGLES, AND ANCHOR BARS SHALL BE MADE BY THE HEAVY DUTY TYPE CADWELD OR THERMOWELD PROCESS.
 4. ALL GROUND RODS SHALL BE DRIVEN TO A MINIMUM OF 15'-0" BELOW GROUND SURFACE.

B	11-16-11 A7-DDD	REDRAWN.	
	SUPERSEDES DWG NO. 40-D-4581 (IN PART)		
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO			
STANDARD DESIGNS TRANSMISSION LINES TOWER GROUNDING DETAILS			
DESIGNED <u>BUREC</u> _____ APPROVED <u>BUREC</u> _____			
A	AUGUST 22, 1983	41	1013



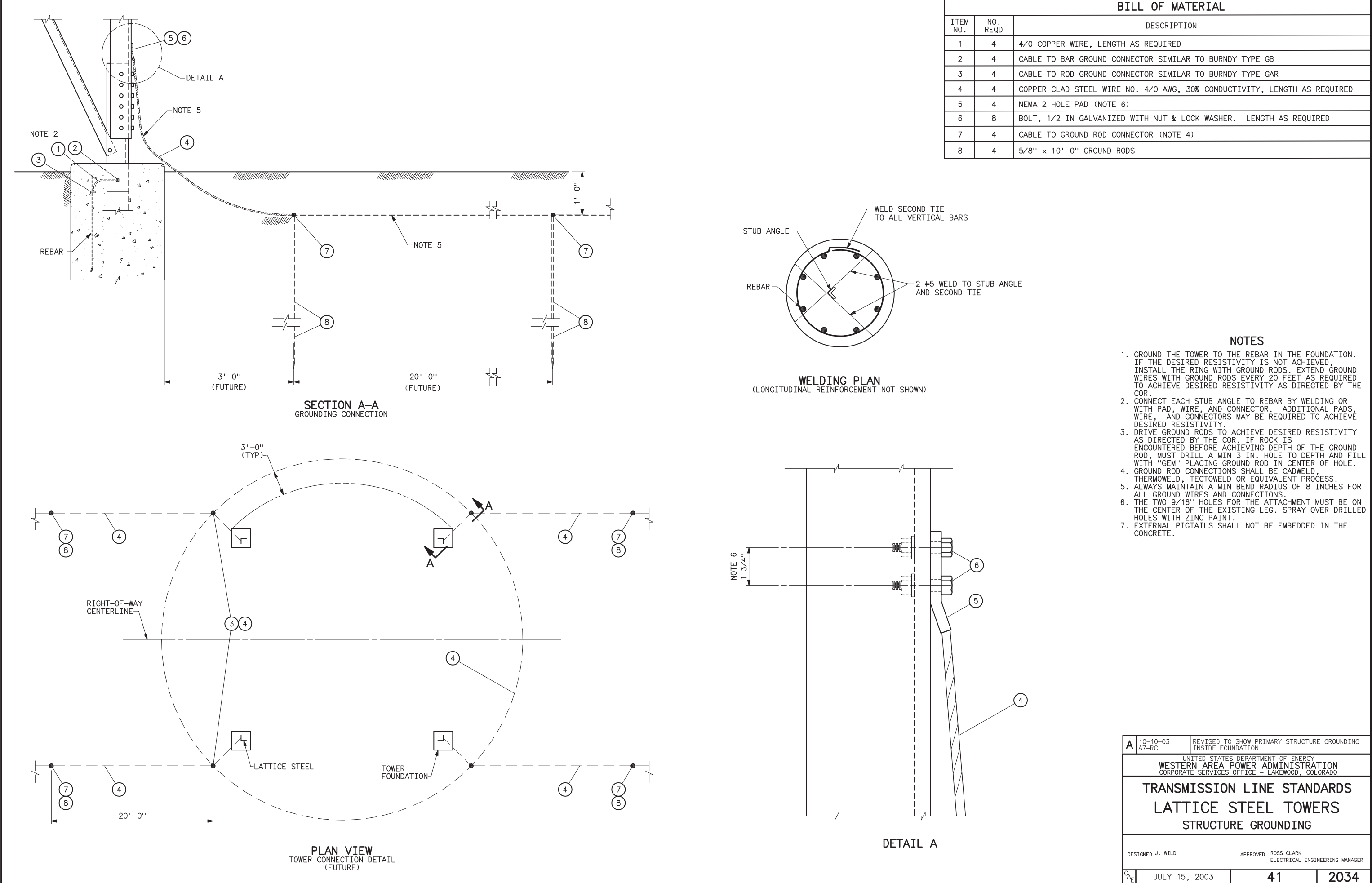


TYPICAL FOR ALL LEGS OF BOX STRUCTURE

NOTE
1. 4/0 COPPER-CLAD LEAD BONDED TO ALL STRUCTURE LEGS.

REFERENCE DRAWING	
GROUNDING PLANS-TYPICAL COMPONENTS	31 1500
SWITCH OPERATING AND EQUIPMENT PLATFORMS	
ELECTRICAL DESIGN AND DETAILS	31 1075

UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION HEADQUARTERS - LAKEWOOD, COLORADO		
TRANSMISSION LINE STRUCTURE 115KV TAP SWITCH STRUCTURE GROUNDING DETAILS		
DESIGNED C. KNEZEL	APPROVED STEVE ROCK ELECTRICAL ENGINEERING MANAGER	
NOVEMBER 10, 2015	41	1034



Mar 23, 2006- 11:00am Plotted By: Seela S:\Engineering\Standard Drawings\41_2034a.dwg Last Saved By: Cox IMAGES:

The diagram illustrates three types of suspension insulator connections for armor rods and conductors:

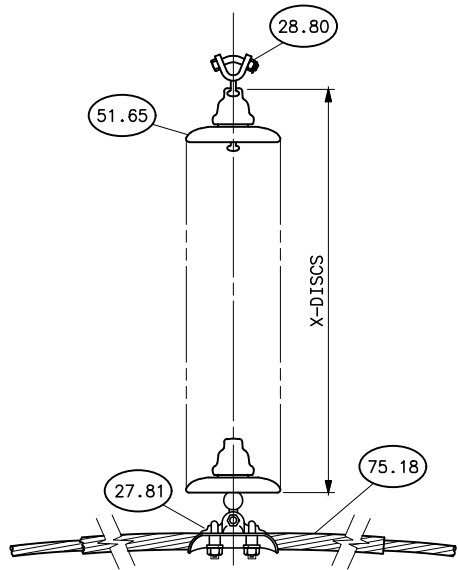
- BALL EYE CONNECTION:** Shows a ball eye fitting attached to a suspension hook. The height from the top of the hook to the center of the ball eye is dimensioned as $3 \frac{1}{2}"$.
- BALL CLEVIS CONNECTION:** Shows a ball clevis fitting attached to a suspension hook. The height from the top of the hook to the center of the ball clevis is dimensioned as $2 \frac{7}{8}"$.
- STANDARD SUSPENSION CONNECTION:** Shows a vertical stack of six standard suspension insulator units. The top unit is connected to a suspension hook. The height from the top of the hook to the bottom of the stack is dimensioned as $1 \frac{7}{8}"$. A break symbol (X) is shown in the middle of the stack, indicating it is a standard unit.

Labels and dimensions include:

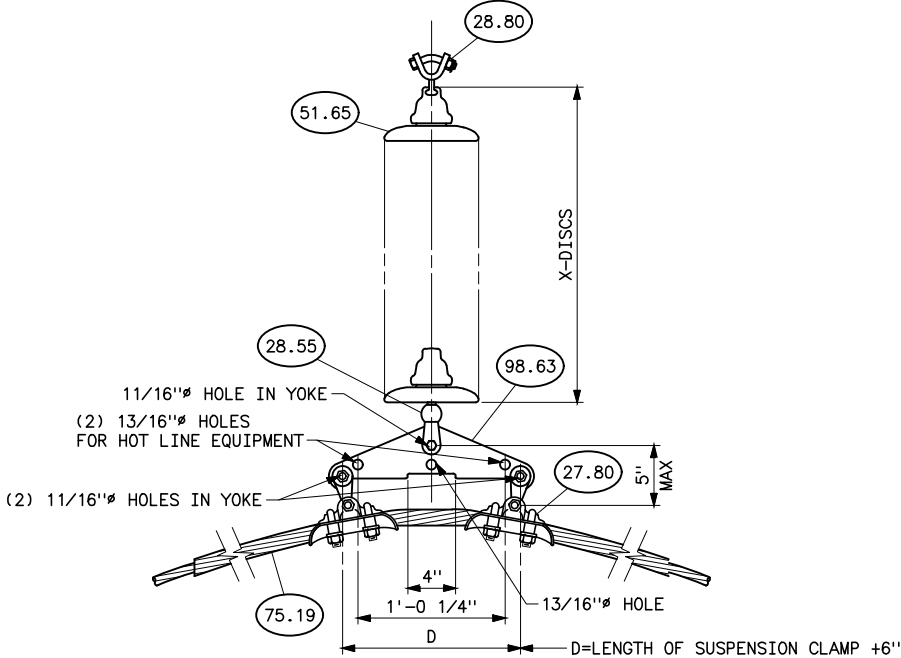
- SUSPENSION HOOK
- $3 \frac{1}{2}"$
- $1 \frac{7}{8}"$
- $2 \frac{7}{8}"$
- BALL EYE CONNECTION
- BALL CLEVIS CONNECTION
- SUSPENSION INSULATOR - STANDARD $5 \frac{3}{4}" \times 10"$ UNITS. ADD ONE EXTRA DISC FOR SPECIAL CROSSINGS, AS SPECIFIED
- ARMOR ROD CLIP OR CLAMP, AS SPECIFIED (NOT REQUIRED ON PREFORMED RODS)
- SUSPENSION CLAMP
- SOCKET FITTING
- ARMOR RODS
- CONDUCTOR

1. WHEN HOLD-DOWN BRACKETS AND WEIGHTS ARE NECESSARY
THEY WILL BE SPECIFIED ON THE STRUCTURE LIST.
SEE DWGS 41 1009 AND 41 1010.

FOR INFORMATION ONLY



SINGLE STRING SUSPENSION ASSEMBLY
ULTIMATE STRENGTH 30,000 POUNDS

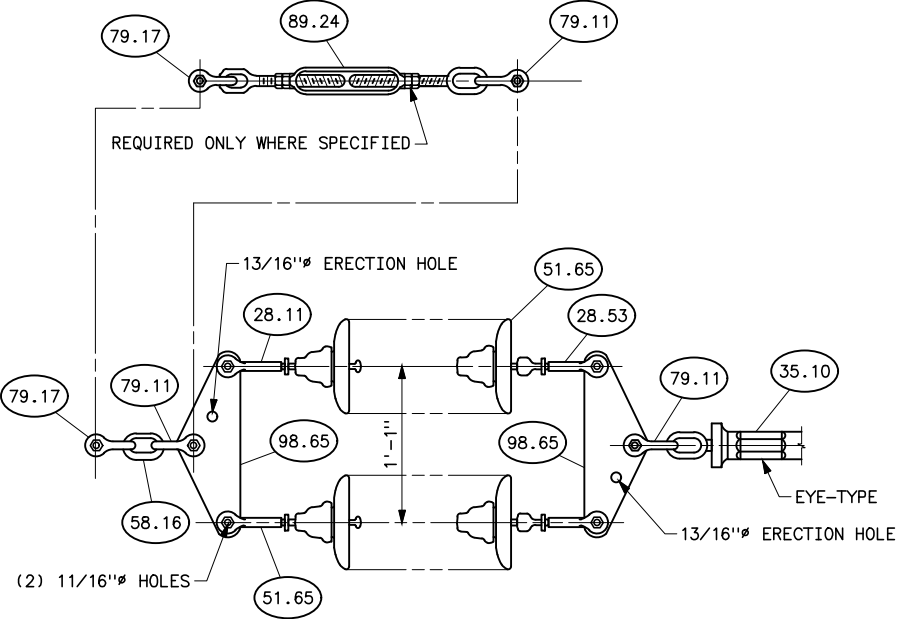


SINGLE SUSPENSION INSULATOR WITH YOKE
ULTIMATE STRENGTH 30,000 POUNDS

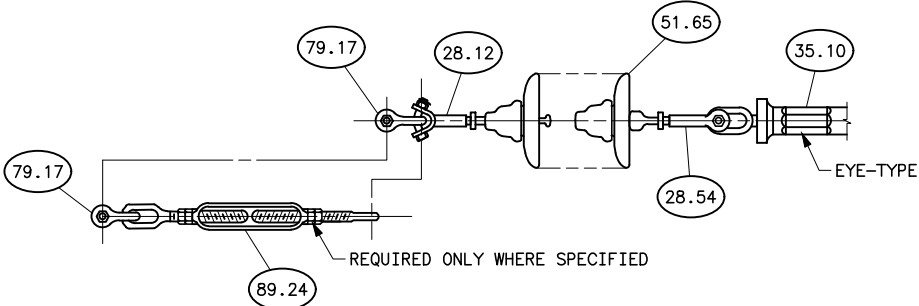
- LEGEND**
- △-----YOKES SHALL HAVE FULL RADIUS EDGES AND CORNERS
 - *-----ALL HARDWARE FITTINGS TO BE FURNISHED WITH HEXBOLT, HEXNUT AND KEY
 - ≠-----USED ONLY WHEN SPECIFIED

LIST OF MATERIALS		
* ITEM NO.	DESCRIPTION	REFERENCE
27.80	CLAMP, SUSPENSION, WITH CLEVIS FITTING, FOR CONDUCTOR	
27.81	CLAMP, SUSPENSION, WITH SOCKET FITTING, FOR CONDUCTOR	
28.11	CLEVIS-BALL, HOT LINE TYPE FITTING, FOR CONDUCTOR	BT-3094-1
28.12	Y-CLEVIS-BALL, HOT LINE TYPE	BT-3091
28.53	SOCKET-CLEVIS, HOT LINE TYPE	BT-3087
28.54	SOCKET-Y-CLEVIS, HOT LINE TYPE	BT-3096
28.80	CLEVIS, Y-BALL	41 1005
35.10	COMPRESSION DEADEND, EYE FITTING (CHAIN TYPE)	
51.65	INSULATOR, SUSPENSION TYPE, 10" DIAMETER, 5 3/4" SPACING	
58.16	CHAIN LINK	41 1005
≠ 75.18	RODS, ARMOR, PREFORMED, SINGLE SUPPORT	
≠ 75.19	RODS, ARMOR, PREFORMED, DOUBLE SUPPORT	
79.17	V-SHACKLE, LINDSEY CAT. NO. 3203 OR EQUAL	
89.24	TURNBUCKLE, EYE-EYE, 1'-0" TAKEUP, WITH JAM NUTS	BT-3177
△ 98.63	YOKE, 5/8" THICK	
△ 98.65	YOKE, 5/8" THICK	BT-8511HT
79.11	SHACKLE, ANCHOR TYPE	BT-3025
28.55	SOCKET-CLEVIS	BT-3040

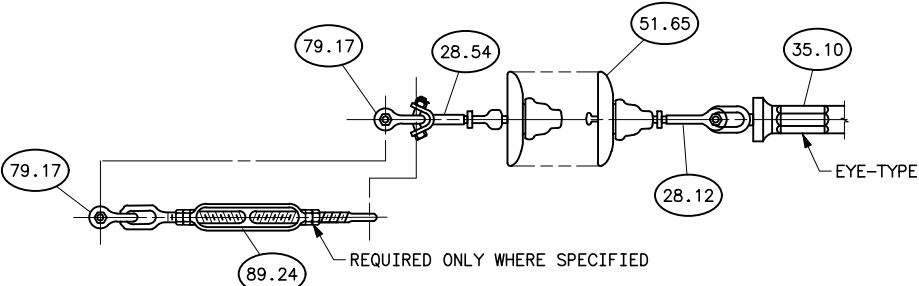
- NOTES**
- ALL FERROUS HARDWARE SHALL BE HEAT TREATED, EXCEPT THAT YOKE PLATES MAY BE HEAT TREATED AT THE CONTRACTOR'S OPTION.
 - ALL FERROUS MATERIAL SHALL BE GALVANIZED AFTER DRILLING AND FORGING IN ACCORDANCE WITH ASTM DESIGNATION A-153.
 - STRENGTH OF HARDWARE COMPONENTS IN A SUB-ASSEMBLY SHALL BE EQUAL TO OR GREATER THAN THE STRENGTH OF THE INSULATOR UNITS IN THAT SUB-ASSEMBLY. THE OVERALL STRENGTH OF THE COMPLETE INSULATOR ASSEMBLIES SHALL BE AS INDICATED.



DOUBLE STRING TENSION ASSEMBLY
FOR SINGLE CONDUCTOR
ULTIMATE STRENGTH 45,000 POUNDS

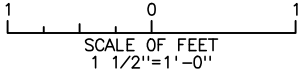


SINGLE TENSION INSULATOR ASSEMBLY WITH
CAPS TOWARD STRUCTURE
ULTIMATE STRENGTH 30,000 POUNDS
(USE ONLY WHEN SPECIFIED)



SINGLE TENSION INSULATOR ASSEMBLY WITH
CAPS AWAY FROM STRUCTURE
ULTIMATE STRENGTH 30,000 POUNDS
(USE ONLY WHEN SPECIFIED)

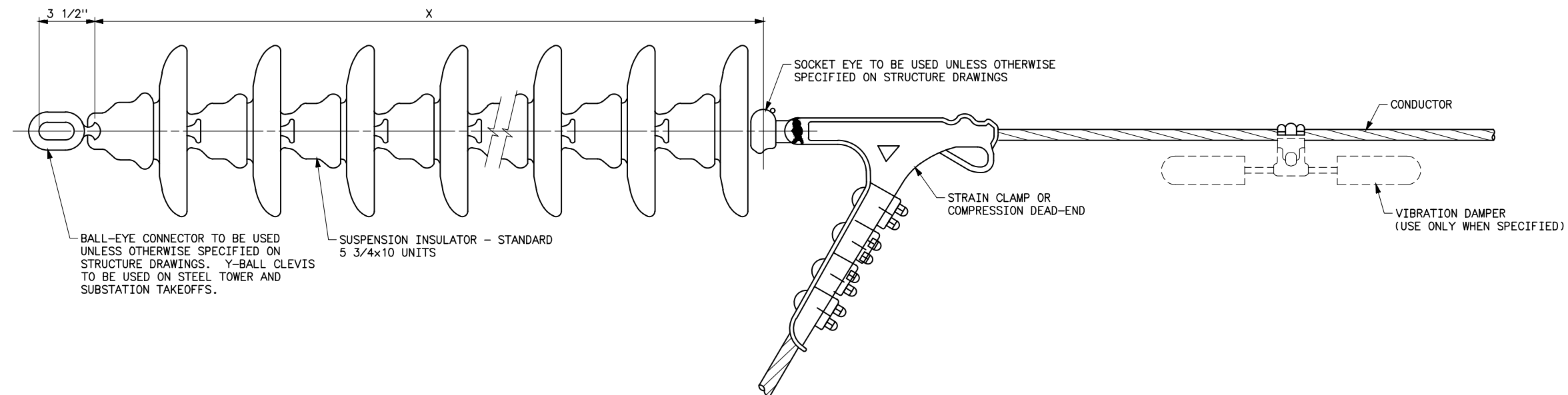
VOLTAGE KV	X-DISCS PER STRING	
	TENSION ASSEMBLY	SUSPENSION ASSEMBLY
34.5	5	4
69	7	6
115	10	9
138	11	10
161	12	11
230	15	14



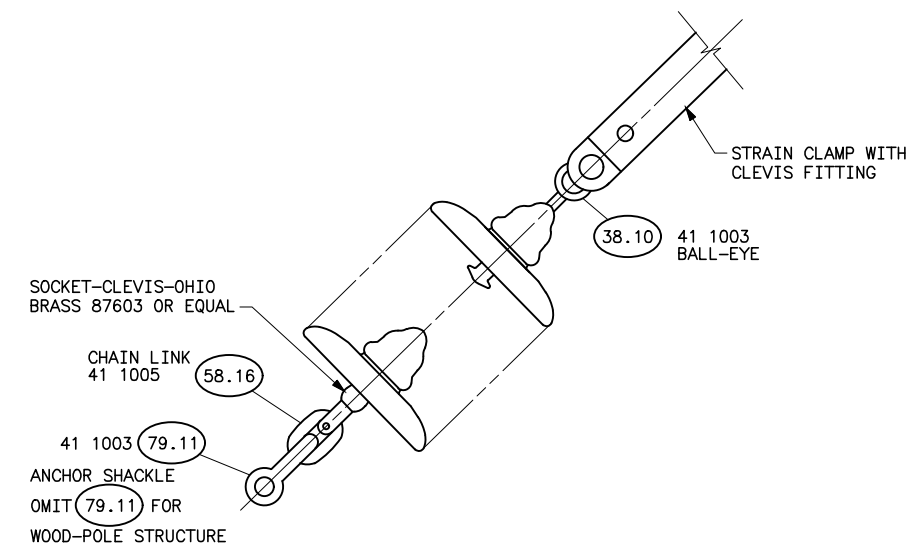
**HISTORICAL REFERENCE ONLY
NOT TO BE USED FOR NEW CONSTRUCTION**

FOR INFORMATION ONLY

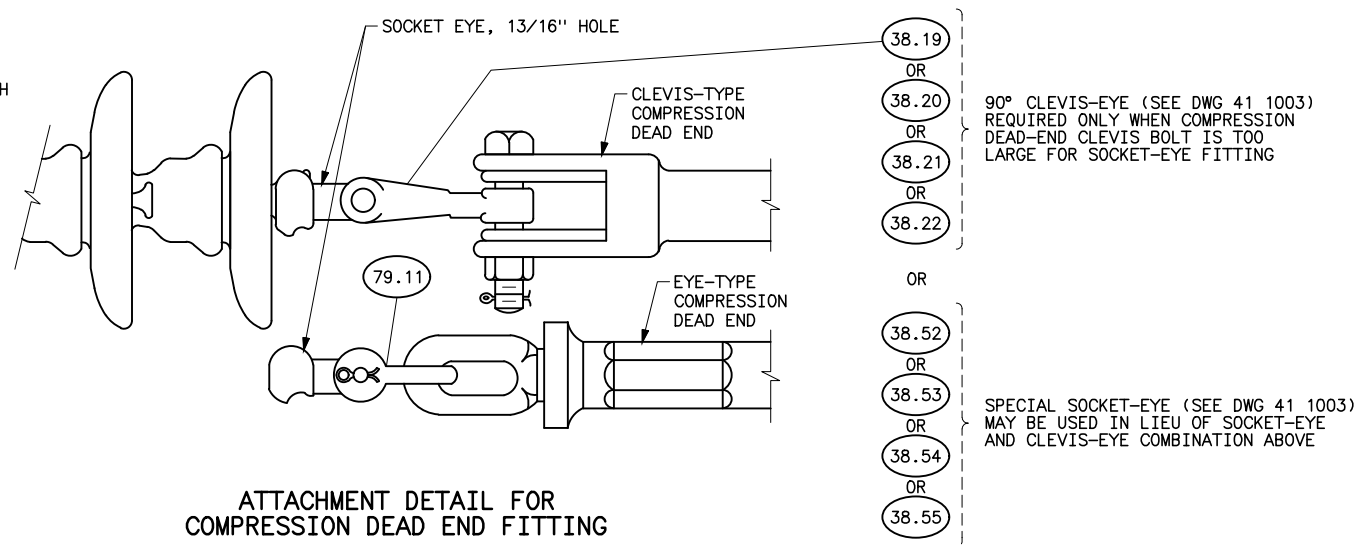
12-9-11 A7-DDD	REDRAWN.
SUPERSEDES DWG NO. 40-D-4683	
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO	
STANDARD DESIGN TRANSMISSION LINES INSULATOR ASSEMBLY DETAILS FOR STEEL TOWERS	
DESIGNED BUREC	APPROVED BUREC
AUGUST 6, 1979	41 1001



TENSION INSULATOR ASSEMBLY - DETAIL A



TENSION INSULATOR ASSEMBLY WITH CAPS AWAY FROM STRUCTURE - DETAIL B
(TO BE USED AT THE LOWER SUPPORT OF INCLINED SPANS WHEN SPECIFIED)



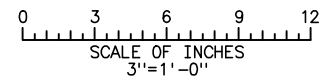
ATTACHMENT DETAIL FOR COMPRESSION DEAD END FITTING

- 38.19 OR 38.20 OR 38.21 OR 38.22
- 90° CLEVIS-EYE (SEE DWG 41 1003) REQUIRED ONLY WHEN COMPRESSION DEAD-END CLEVIS BOLT IS TOO LARGE FOR SOCKET-EYE FITTING
- OR
- 38.52 OR 38.53 OR 38.54 OR 38.55
- SPECIAL SOCKET-EYE (SEE DWG 41 1003) MAY BE USED IN LIEU OF SOCKET-EYE AND CLEVIS-EYE COMBINATION ABOVE

HISTORICAL REFERENCE ONLY
NOT TO BE USED FOR NEW CONSTRUCTION

WOOD POLE STRUCTURES			
VOLTAGE KV	TYPE OF STRUCTURE	DISCS PER STRING	X-DIMENSION INCHES
22-33	HT, ST, SAT, SBT, & HSWT, 3TA	3	17 1/4
44	HT, ST, SAT, SBT, & HSWT, 3TA	4	23
69	ST, 3TA	5	28 3/4
	SAT, 3AT, 3DE, 3T, 3TX, 3BT/4BT, HSWT	6	34 1/2
115	WT, 3TA	8	46
	SAT, 3AT, 3DE, 3T, 3TX, 3BT/4BT, 4SWT	9	51 3/4
138	3AT, 3T, 3TX, 3TA	10	57 1/2
161	3AT, 3DE, 3T, 3TX, 4BT, & 4SWT, 3TA	11	63 1/4
230	3AT, 3T, 3DE, & 3TR, 3TA	13	74 3/4

STEEL TOWER AND SUBSTATION TAKEOFFS			
VOLTAGE KV	TYPE OF STRUCTURE	DISCS PER STRING	X-DIMENSION INCHES
34.5	DEAD ENDS ON STEEL TOWERS OR SUBSTATIONS	5	28 3/4
69		7	40 1/4
115		10	57 1/2
138		11	63 1/4
161		12	69
230		15	86 1/4



FOR INFORMATION ONLY

12-9-11
A7-DDD

REDRAWN.

SUPERSEDES DWG NO. 40-D-2809

UNITED STATES DEPARTMENT OF ENERGY
WESTERN AREA POWER ADMINISTRATION
CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO

STANDARD DESIGNS
TRANSMISSION LINES
WOOD POLE STRUCTURES
TENSION INSULATOR ASSEMBLIES

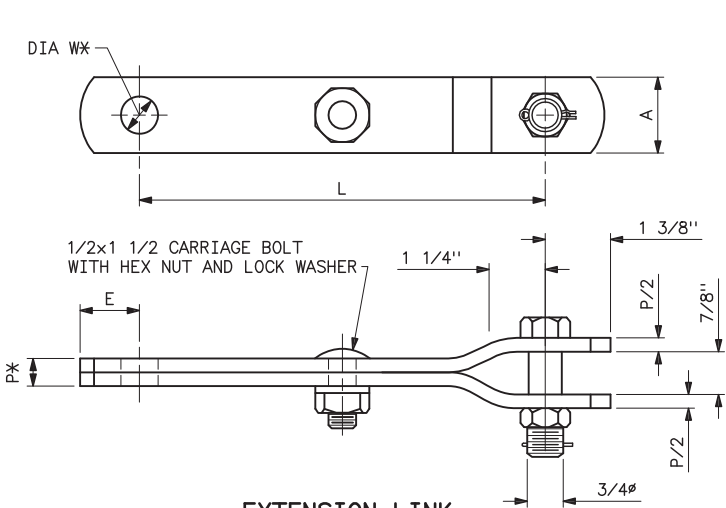
DESIGNED BUREC _____ APPROVED BUREC _____

AUGUST 6, 1979411002

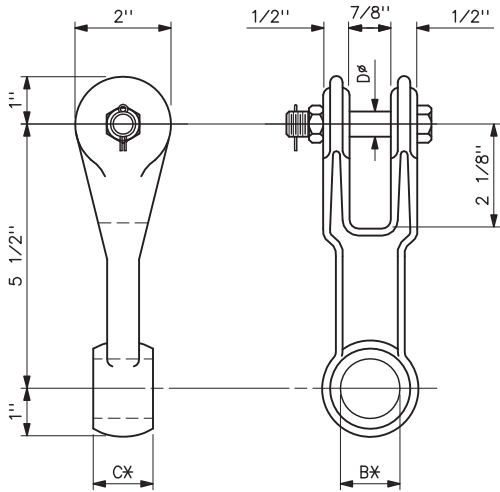
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IMAGES: S:\Projects\Misc\StandardDrawings\Drawings\DesignDrawings\DrawingsReadyForFinal\Scripts\41-1002-11.dwg Last Saved By: Court, Donita (CONTR) on 9/24/2026 6:14 AM

EXPLANATION

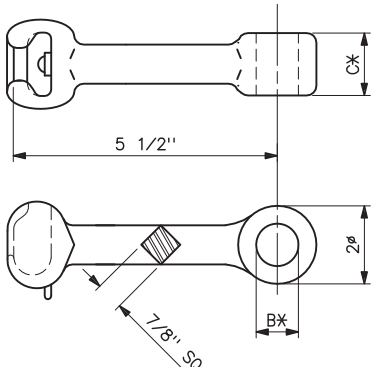
* --- DIMENSIONS P*, W*, B*, AND C*, ARE BASED ON ALUMINUM CO OF AMERICA COMPRESSION DEAD-ENDS. FOR USE WITH STRAIN CLAMPS, DIMENSIONS W* AND B* SHALL BE 1/16 INCH MORE THAN THE BOLT SIZE OF CLEVIS FITTING. DIMENSION C* AND E* SHALL BE ADEQUATE TO INSURE PROPER FIT IN CLEVIS FITTING.



EXTENSION LINK
PART NO. 1 THRU 16
SEE TABLE BELOW FOR DIMENSIONS



CLEVIS EYE
PART NO. 17 THRU 22
ULTIMATE STRENGTH 30,000 LBS
SEE TABLE BELOW FOR DIMENSION



SOCKET EYE
PART NO. 23 THRU 26
ULTIMATE STRENGTH 30,000 LBS
SEE TABLE BELOW FOR DIMENSION

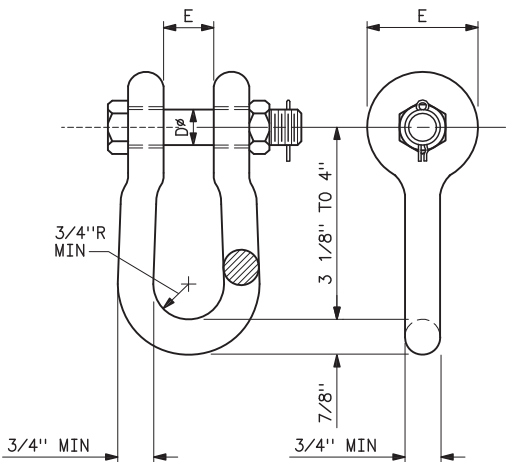
TYPE DEAD END	CONDUCTOR	STRANDING	P*	W* DIAMETER	A MIN WIDTH	E* MAX	EXTENSION LINKS, LENGTH L FOR THE FOLLOWING DEFLECTION ANGLES				PART NO.	L	ULTIMATE STRENGTH
							40°-52°	52°-60°	60°-70°	70°-90°			
STRAIN CLAMP OR COMPRESSION DEAD END	4/0	6/1	1/2"	11/16"	1 3/4"	1"	34	24	14	11	1	11	25,000
	266,800	26/7									2	14	
	300,000	26/7									3	24	
	336,400	26/7	3/4"	13/16"	2"	1 1/2"	34	24	14	11	4	34	25,000
	397,500	26/7									5	11	
	477,000 TO 636,000	24/7 & 26/7									6	14	
COMP DEAD END	795,000	45/7	1"	1 1/16"	2"	1 1/2"	34	24	14	11	7	24	30,000
	795,000	45/7									8	34	
	795,000	45/7									9	11	
	954,000 TO 1,192,500	ALL	1 1/4"	1 3/16"	2"	1 1/2"	34	24	14	11	10	14	30,000
	954,000 TO 1,192,500	ALL									11	24	
	954,000 TO 1,192,500	ALL									12	34	

TABLE OF DIMENSIONS FOR CLEVIS-EYE AND SOCKET-EYE						
CONDUCTOR SIZE	STRANDING	TYPE DEADEND	PART NO.	B*	C*	D
266.8, 300.0	26/7	COMPRESSION	17, 23	11/16"	11/16"	3/4"
336.4, 397.5	26/7	COMPRESSION	18, 24	13/16"	3/4" TO 13/16"	3/4"
477.0 TO 636.0	24/7 & 26/7	COMPRESSION	19, 25	1 1/16"	1" TO 1 1/16"	3/4"
795.0	45/7	COMPRESSION	20, 26	1 3/16"	1 1/4"	3/4"
795.0	26/7	COMPRESSION	21	1 3/16"	1 1/4"	7/8"
954.0 TO 1122.5	ALL	COMPRESSION	22	*	*	3/4"
SPECIAL		STRAIN CLAMP				
ALL		STRAIN CLAMP				

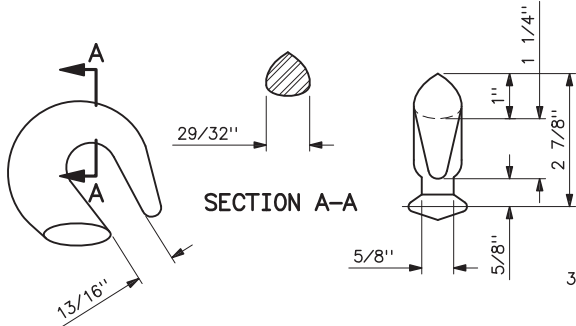
NOTES

- FITTINGS ARE TO BE FORGED STEEL (EXCEPT EXTENSION LINK).
- ALL MATERIAL SHALL BE GALVANIZED AFTER DRILLING AND FORGING IN ACCORDANCE WITH ASTM DESIGNATION A153.
- ALL BOLT HOLES SHALL BE 1/16 IN. MORE THAN SPECIFIED BOLT SIZE.

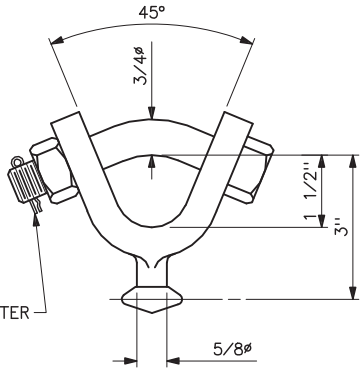
HISTORICAL REFERENCE ONLY
NOT TO BE USED FOR NEW CONSTRUCTION



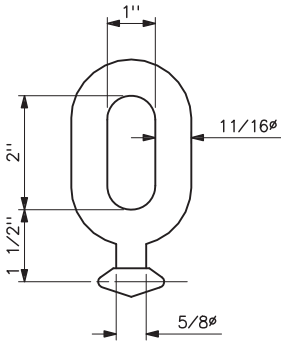
ANCHOR SHACKLE
PART NO. 27 AND 28
ULTIMATE STRENGTH 30,000 LBS



SUSPENSION HOOK
(LOCKING TYPE)
PART NO. 29
ULTIMATE STRENGTH 25,000 LBS



Y-BALL CLEVIS
PART NO. 30
ULTIMATE STRENGTH 25,000 LBS



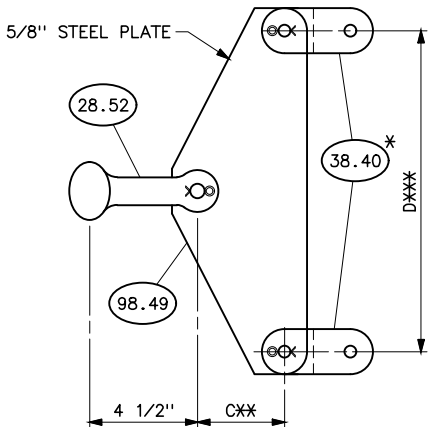
BALL EYE CONNECTOR
PART NO. 31
ULTIMATE STRENGTH 25,000 LBS

TABLE OF DIMENSIONS FOR ANCHOR SHACKLE			
PART NO.	C	D	E
27	7/8"	3/4"	1 3/4"
28	1 3/8"	1"	2 1/8"

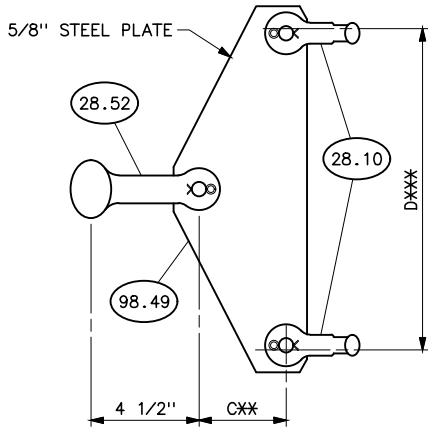
FOR INFORMATION ONLY

B	7-17-92 A2-	REDRAWN.
	FORMERLY DWG NO. 40-D-3182	
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION HEADQUARTERS - GOLDEN, COLORADO		
TRANSMISSION LINE STANDARDS WOOD POLE LINES INSULATOR HARDWARE DETAILS		
DESIGNED <u>BU REC</u>		RECOMMENDED _____
DRAWN <u>S.L. HARMON</u>		APPROVED _____
CHECKED _____		DIRECTOR, DIVISION OF TRANSMISSION LINE AND BUILDING DESIGN
A	AUGUST 6, 1979	41 1003

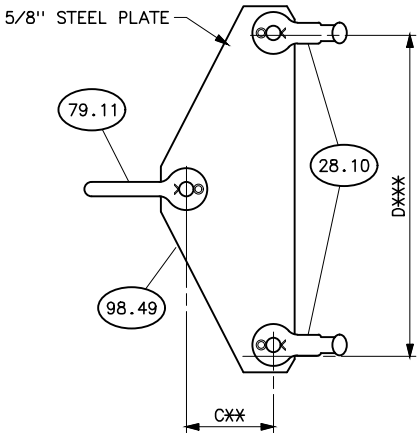
Plotted By: court Sep 24, 2026- 6: 15am
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PART NO. 98.53
FOR TYPE 3A AND 3AB STR'S
SINGLE STRING - FOR ANGLE
20° TO 60°

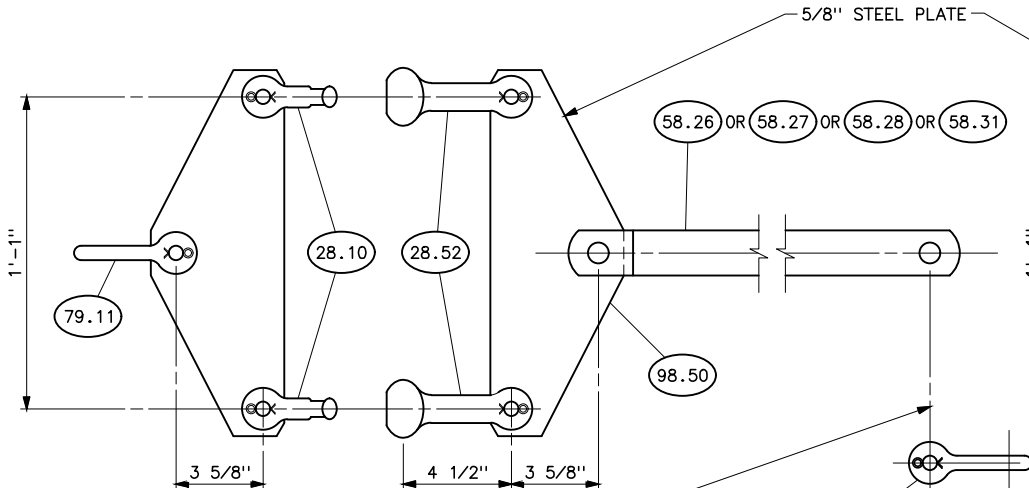


PART NO. 98.54
FOR TYPE 3AB STRUCTURE
DOUBLE STRING



PART NO. 98.55
FOR TYPE 3A STRUCTURE
DOUBLE STRING

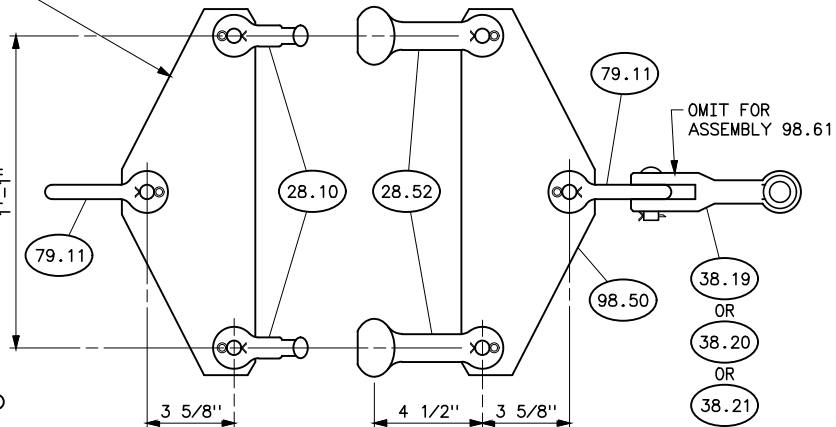
SINGLE YOKE ASSEMBLIES



PART NO. 98.56
FOR TYPE 3TA AND 3AT STRUCTURES WITH
STRAIN CLAMPS OR CLEVIS TYPE COMPRESSION DEADENDS

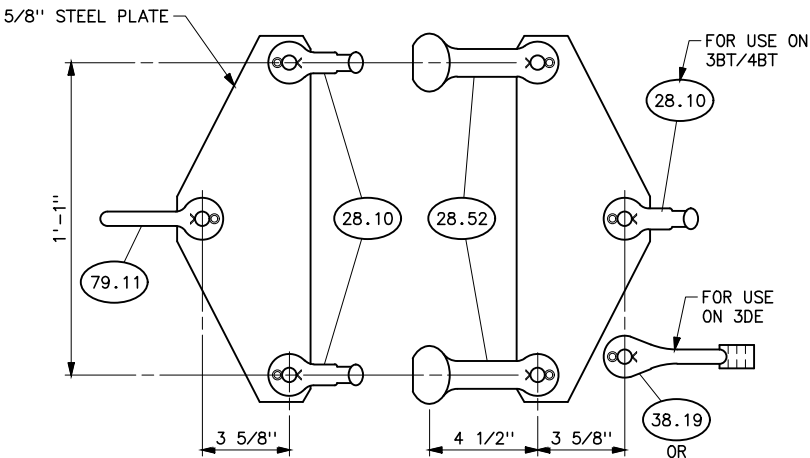
PART NO. 98.62
FOR TYPE 3TA AND 3AT STRUCTURES WITH
EYE-TYPE COMPRESSION DEADENDS

NOTE: ALL MATERIAL SHALL BE GALVANIZED AFTER
DRILLING AND FORGING IN ACCORDANCE WITH
ASTM DESIGNATION A153.
ULTIMATE STRENGTH OF COMPLETED ASSEMBLIES
SHALL BE NOT LESS THAN 25,000 LBS FOR
397,500 CM ACSR, AND SMALLER, AND 30,000 LBS
FOR ACSR LARGER THAN 397,000 CM.
* THICKNESS OF EYE END OF PART NO. 38.40 SHALL BE
ADEQUATE TO INSURE PROPER FIT CONDUCTOR
SUSPENSION CLAMP.
** WIDTH AS REQUIRED TO OBTAIN SPECIFIED STRENGTH.
*** LENGTH OF SUSPENSION CLAMP PLUS 10 INCHES.



PART NO. 98.57
FOR TYPE 3TA, 3T AND 3TX STRUCTURES (AS SHOWN)
FOR TYPE 4SWT STRUCTURE (HARDWARE
ARRANGEMENT PER DWG NO. 41 6005)

PART NO. 98.61
(SAME AS PART NO. 98.57, EXCEPT OMIT 90°
CLEVIS-EYE)
FOR USE WITH EYE TYPE COMPRESSION DEAD
ENDS ONLY, IN LIEU OF PART NO.'S 98.57,
98.58 AND 98.59

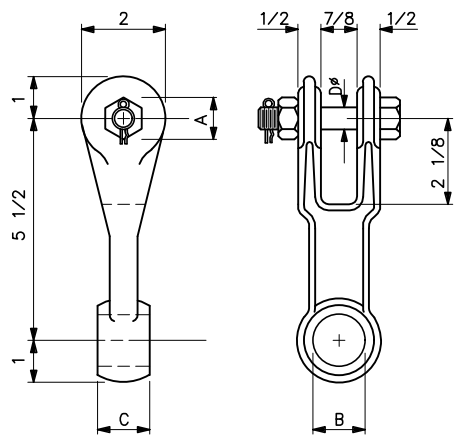


PART NO. 98.58
FOR TYPE 3BT/4BT STRUCTURE
PART NO. 98.59
FOR TYPE 3DE STRUCTURE

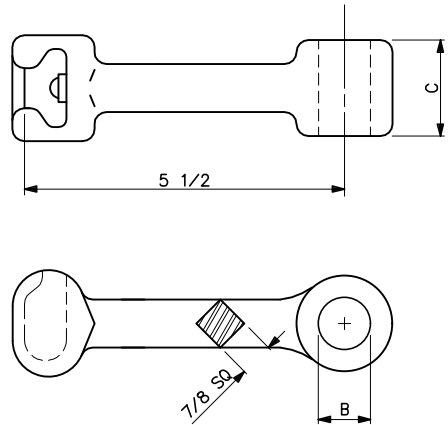
DOUBLE YOKE ASSEMBLIES

LIST OF MATERIAL										
PART NO.	ASSEMBLY PART NO.								DESCRIPTION	DWG NO. 41
	98.53	98.54	98.55	98.56	98.57	98.58	98.59	98.62		
79.11 OR 79.15								1	USE 79.11 WITH 58.28 USE 79.15 WITH 58.31	1003
28.10	2	2	2	2	2	2	2	2	CLEVIS, BALL	
28.52	1	1		2	2	2	2	2	CLEVIS, SOCKET, 4 1/2" LONG	
38.40	2								EYE, CLEVIS *	
58.26 58.27 58.28 OR 58.31				1				1	LINK, EXTENSION	1003
79.11		1	1	2	1	1	2	1	SHACKLE, ANCHOR	1003
98.49	1	1	1						YOKE PLATE	
98.50				2	2	2	2	2	YOKE PLATE, STRAIN	
38.19 OR 38.20 OR 38.21 OR 38.22 OR 38.24					1		1		EYE, CLEVIS, 5 1/2" LONG, 90°	1003

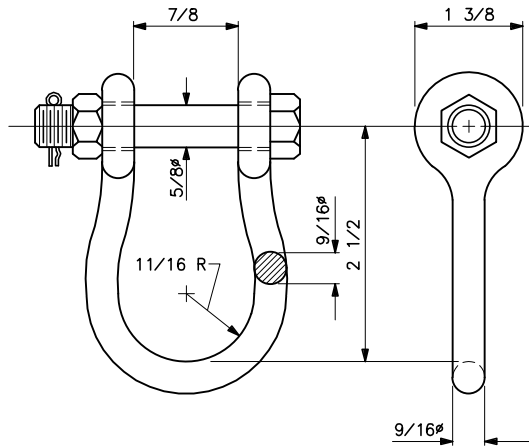
HISTORICAL REFERENCE ONLY NOT TO BE USED FOR NEW CONSTRUCTION			
FOR INFORMATION ONLY			
C	11-16-11 A7-DDD	REDRAWN.	
SUPERSEDES DWG NO. 40-D-5280			
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO			
STANDARD DESIGNS TRANSMISSION LINES STRAIN YOKES AND YOKE ASSEMBLIES			
DESIGNED <u>BUREC</u> _____		APPROVED <u>BUREC</u> _____	
CAE	AUGUST 6, 1979	41	1004



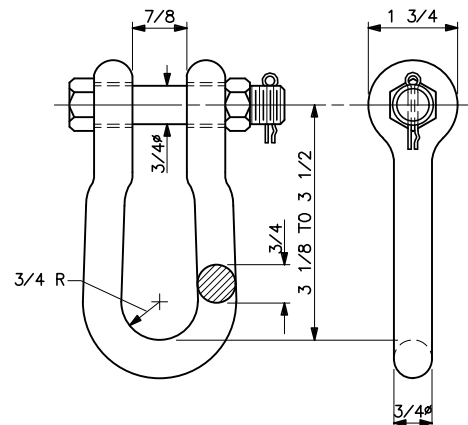
CLEVIS EYE
PART NO. 4, 5, 6, 7, 8
ULTIMATE STRENGTH 33,000 LBS
SEE TABLE-A FOR DIMENSIONS



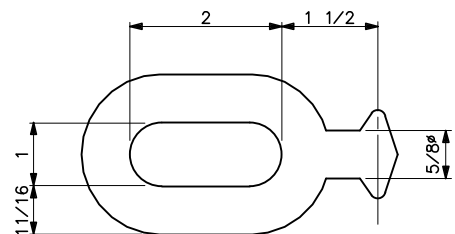
SOCKET EYE
PART NO. 19, 20, 21, 22
ULTIMATE STRENGTH 33,000 LBS
SEE TABLE-A FOR DIMENSIONS



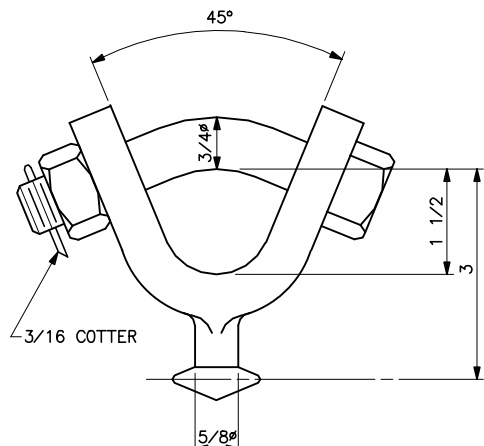
ANCHOR SHACKLE
PART NO. 11
ULTIMATE STRENGTH 25,000 LBS



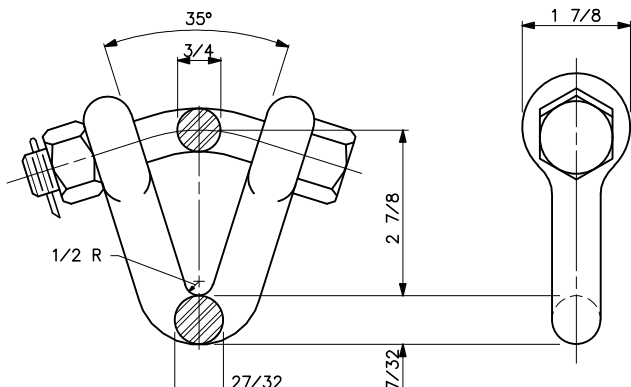
ANCHOR SHACKLE
PART NO. 12
ULTIMATE STRENGTH 36,000 LBS



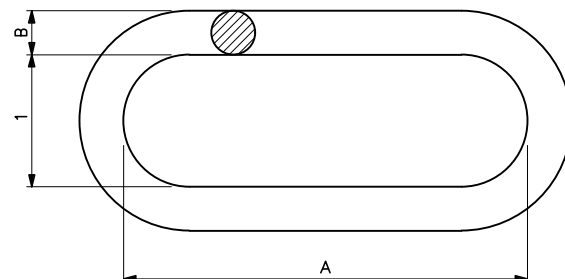
BALL EYE
PART NO. 18
ULTIMATE STRENGTH 25,000 LBS



Y-BALL CLEVIS
PART NO. 3
ULTIMATE STRENGTH 25,000 LBS



VEE SHACKLE
PART NO. 13
ULTIMATE STRENGTH 50,000 LBS



CHAIN LINK PART NO. 9, 10			
PART NO.	A (MIN)	B (MIN)	ULT STRENGTH
9	2 1/4	1/2	25,000 LBS
10	2 7/8	5/8	33,000 LBS

PART NO.	DESCRIPTION
1	CLEVIS, BALL, HOT LINE TYPE
2	CLEVIS, SOCKET, HOT LINE TYPE
3	CLEVIS, Y-BALL
4-8	EYE, CLEVIS, 5 1/2 IN. LONG, 90°, SEE TABLE-A
9-10	LINK, CHAIN
11-12	SHACKLE, ANCHOR TYPE
13	V-SHACKLE
14	TURNBUCKLE, CLEVIS-EYE, 7/8 IN., 12 IN. TAKE-UP
15	TURNBUCKLE, CLEVIS-CLEVIS, 1 IN., 12 IN. TAKE-UP
16	YOKE, STRAIN, DOUBLE ASSEMBLY, WITH TURNBUCKLE
17	YOKE, STRAIN, DOUBLE ASSEMBLY, WITHOUT TURNBUCKLE
18	EYE, BALL
19-22	EYE, SOCKET, 5 1/2 IN. LONG, SEE TABLE-A
23	YOKE, STRAIN, DOUBLE ASSEMBLY, WITH TURNBUCKLE
24	YOKE, STRAIN, DOUBLE ASSEMBLY, WITHOUT TURNBUCKLE

TABLE A DIMENSIONS FOR CLEVIS-EYE AND SOCKET-EYE				
PART NO.	A	B	C	D
4, 19	13/16	11/16	11/16	3/4
5, 20	13/16	13/16	3/4 TO 13/16	3/4
6, 21	13/16	1 1/16	3/4 TO 1 1/16	3/4
7, 22	13/16	1 3/16	1 1/4	3/4
8	13/16	**	**	3/4

EXPLANATION

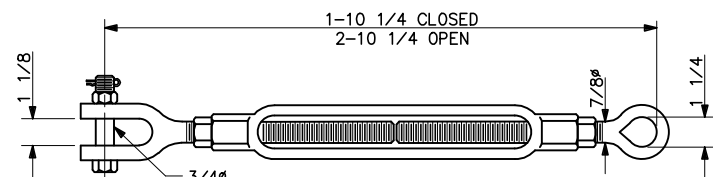
--- ** --- FOR USE WITH STRAIN CLAMPS, DIMENSIONS "B" AND "C" SHALL BE SUITABLE AND ADEQUATE TO FIT CLEVIS END OF STRAIN CLAMP.

--- * --- TURNBUCKLES REQUIRED ONLY WHERE SPECIFIED. ALL MATERIAL SHALL BE GALVANIZED AFTER DRILLING AND FORGING IN ACCORDANCE WITH ASTM DESIGNATION A-153.

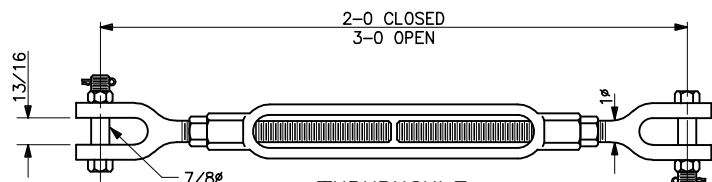
Δ --- FITTINGS BASED ON ALCOA CONDUCTOR DEAD-ENDS.

⊕ --- YOKES SHALL HAVE FULL RADIUS EDGES AND CORNERS, HOT-LINE FITTINGS SHALL BE HEAT TREATED, WITH 30,000 LBS ULTIMATE STRENGTH.

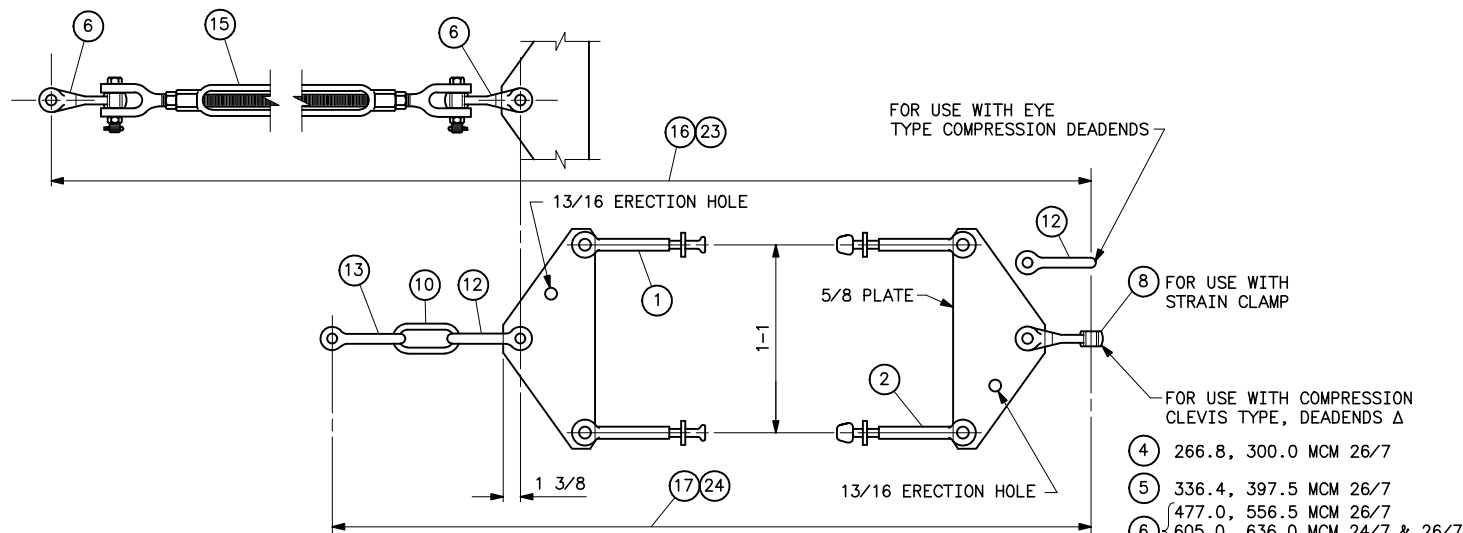
**HISTORICAL REFERENCE ONLY
NOT TO BE USED FOR NEW CONSTRUCTION**



TURNBUCKLE
PART NO. 14
ULTIMATE STRENGTH 25,000 LBS



TURNBUCKLE
PART NO. 15
ULTIMATE STRENGTH 33,000 LBS



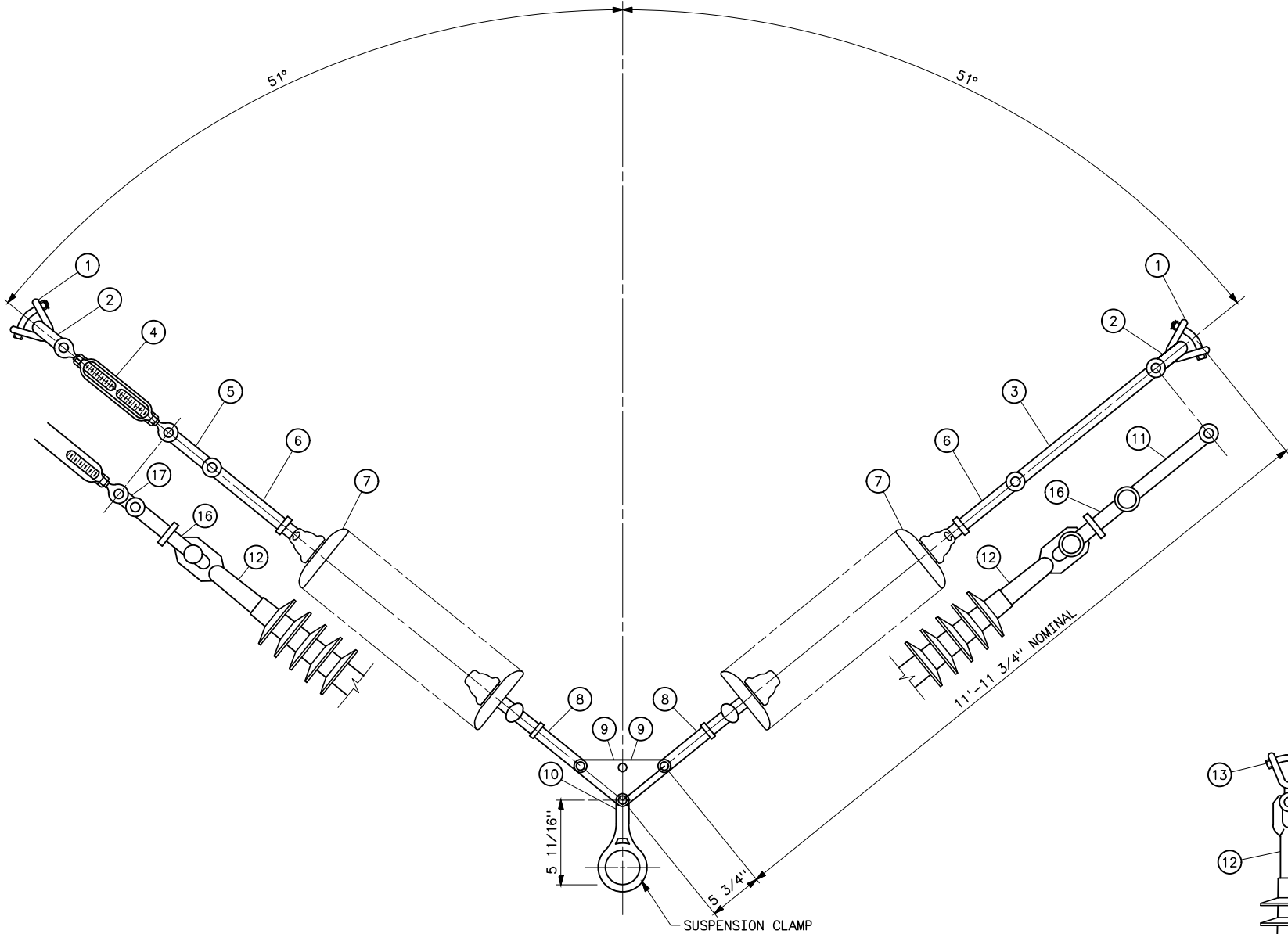
DOUBLE YOKE ASSEMBLIES
PART NO. 15, 16, 22, 23
ULTIMATE STRENGTH 33,000 LBS

- FOR USE WITH EYE TYPE COMPRESSION DEADENDS
- FOR USE WITH COMPRESSION CLEVIS TYPE, DEADENDS Δ
- ④ 266.8, 300.0 MCM 26/7
 - ⑤ 336.4, 397.5 MCM 26/7
 - ⑥ 477.0, 556.5 MCM 26/7
 - ⑦ 605.0, 636.0 MCM 24/7 & 26/7
 - ⑧ 795.0 MCM 45/7
 - ⑨ 795.0 MCM 26/2
 - ⑩ 954.0 TO 1272 MCM
 - ⑪ ALL STRANDINGS

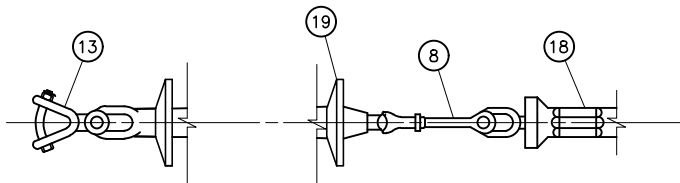
FOR INFORMATION ONLY

7-17-92 12-BH	REDRAWN.
FORMERLY DWG NO. 40-D-5271	
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION HEADQUARTERS - GOLDEN, COLORADO	
TRANSMISSION LINE STANDARDS STEEL TOWER LINES CONDUCTOR AND OVERHEAD GROUND WIRE HARDWARE DETAILS	
DESIGNED BUREC	APPROVED DOUG HANSON CIVIL ENGINEERING MANAGER
AUGUST 6, 1979	41
	1005

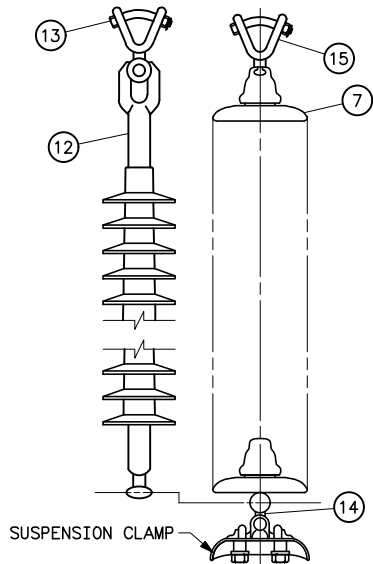
Plotted By: court Sep 24, 2026- 6: 19am
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VEE-STRING
INSULATOR ASSEMBLY



TENSION ASSEMBLY



SUSPENSION ASSEMBLY

REFERENCE MATERIALS

ITEM NO.	DESCRIPTION
1	"V" SHACKLE (B.T. CAT. NO. 3078 OR EQUAL) B.N.K. (SEE NOTE 1)
2	ANCHOR SHACKLE (B.T. CAT. NO. 3022 OR EQUAL) B.N.K.
3	EYE-EYE STRAP (B.T. CAT. NO. 3070E OR EQUAL, LENGTH AS REQUIRED)
4	TURNBUCKLE, JAW-EYE, 6" TAKE UP, B.N.K.; 20,000 LB STRENGTH.
5	EYE-EYE STRAP (B.T. CAT. NO. 3070E OR EQUAL, LENGTH AS REQUIRED)
6	CLEVIS-BALL, HOT LINE (B.T. CAT. NO. 3094 OR EQUAL) B.N.K.
7	SUSPENSION INSULATOR (ANSI CLASS 52-3) 14 UNITS/LEG OR STRING
8	SOCKET-Y-CLEVIS, HOTLINE (B.T. CAT. NO. 3096 OR EQUAL) B.N.K.
9	YOKE PLATE (B.T. CAT. NO. 8571 OR EQUAL)
10	"Y"-CLEVIS-EYE (B.T. CAT. NO. 3097A EYE WIDTH-2 1/8" OR EQUAL) B.N.K.
11	CLEVIS-EYE STRAP (B.T. CAT. NO. 3071C, OR EQUAL, LENGTH AS REQD) B.N.K.
12	SUSPENSION INSULATOR (O.B. HI LITE NO. 232013, 10,000 LB)
13	"Y"-CLEVIS-CLEVIS (B.T. CAT. NO. 3005 OR EQUAL) B.N.K.
14	SOCKET-EYE (B.T. CAT. NO. 3046A, EYE WIDTH-2 1/8" OR EQUAL)
15	"Y"-CLEVIS-BALL (B.T. CAT. NO. 3030 OR EQUAL) B.N.K.
16	CLEVIS-EYE, HOT LINE (B.T. CAT. NO. 3089A OR EQUAL) B.N.K.
17	CLEVIS-EYE STRAP (B.T. CAT. NO. 3071C OR EQUAL, LENGTH AS REQD) B.N.K.
18	COMPRESSION DEADEND, EYEFITTING (CHAIN TYPE)
19	TENSION INSULATOR (O.B. HI LITE 2320022, 20,000 LB)

NOTES

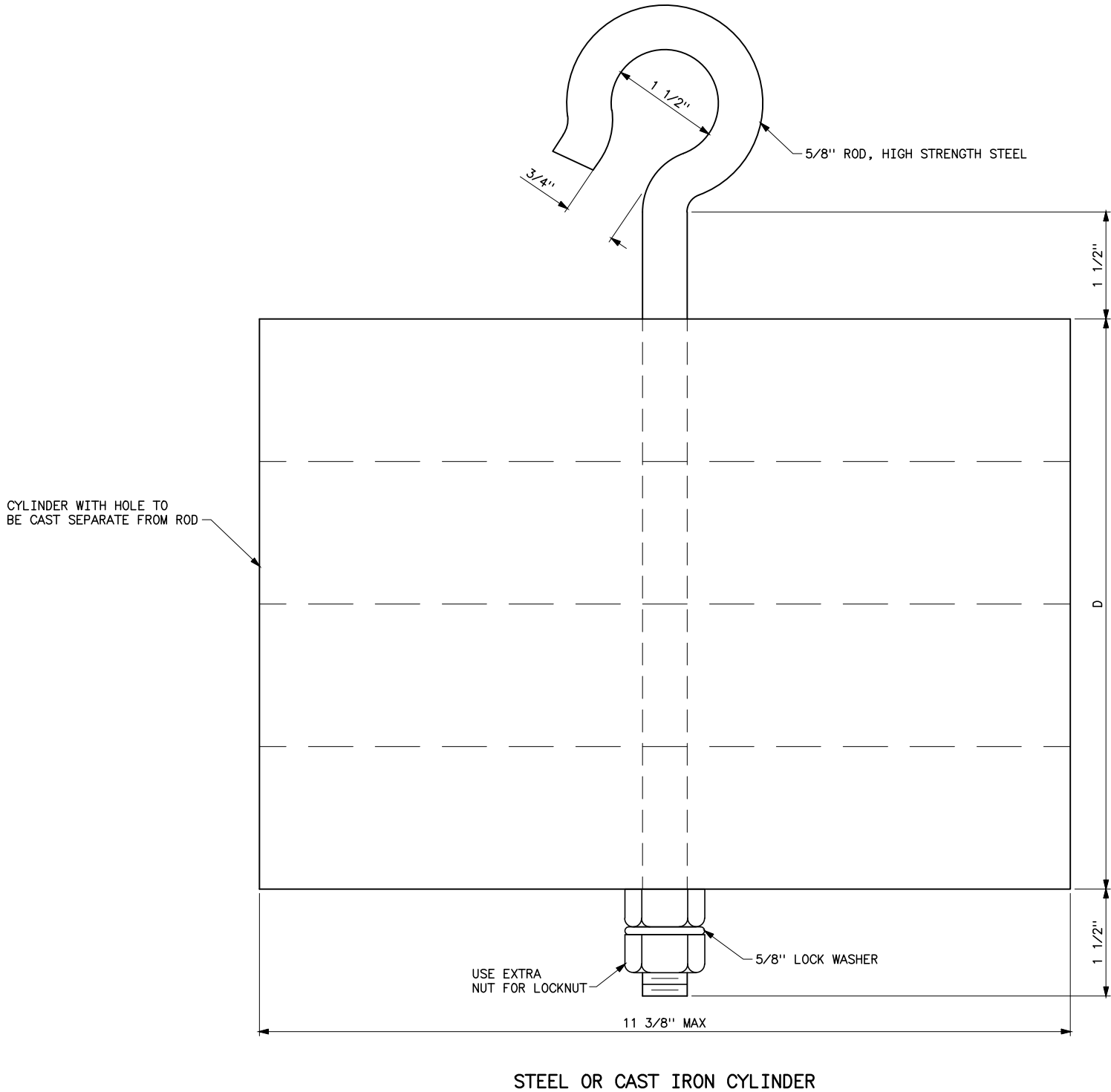
1. B.N.K. INDICATES BOLT, NUT AND STAINLESS STEEL COTTER KEY REQUIRED.
2. ALL FERROUS HARDWARE SHALL BE HEAT TREATED, EXCEPT THAT YOKE PLATES MAY BE HEATED AT CONTRACTORS OPTION.
3. ALL FERROUS MATERIALS SHALL BE GALVANIZED AFTER DRILLING AND FORGING IN ACCORDANCE WITH ASTM DESIGNATION A-153.
4. STRENGTH OF HARDWARE COMPONENTS SHALL BE EQUAL TO OR GREATER THAN THAT OF THE REFERENCE ITEM OR AS OTHERWISE INDICATED IN THE LIST OF MATERIALS.
5. YOKE PLATE MAY BE MANUFACTURED OF EITHER FERROUS OR ALUMINUM ALLOY.
6. TURNBUCKLES SHALL BE ADJUSTED UNTIL YOKE PLATES ASSUME A HORIZONTAL POSITION.
7. THE CONTRACTOR SHALL FURNISH HARDWARE ITEMS IN LENGTHS WHICH WILL RESULT IN A 102° V-STRING AND DIMENSIONS AS SHOWN.

HISTORICAL REFERENCE ONLY
NOT TO BE USED FOR NEW CONSTRUCTION

FOR INFORMATION ONLY

11-16-11 A7-DDD	REDRAWN.
SUPERSEDES DWG NO. 104-D-996	
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO	
TRANSMISSION LINE STANDARDS SUSPENSION, TENSION AND VEE STRING INSULATOR ASSEMBLIES	
DESIGNED BUREC	APPROVED BUREC
AUGUST 4, 1980	41
1007	

TABLE OF WEIGHTS		
PART NO.	NOMINAL DESIGNATION	DIMENSION D-MAX
92.10	50#	2"
92.11	100# Δ	4"
92.12	150# Δ	6"
92.13	200# Δ	8"



NOTES

- 1. CAST IRON CYLINDERS SHALL BE GIVEN ONE COAT ALUMINUM PAINT.
- 2. ALL HARDWARE AND STEEL CYLINDERS SHALL BE HOT DIP GALVANIZED IN ACCORDANCE WITH ASTM DESIGNATION A-153.
- 3. ALL WEIGHTS SHALL BE MARKED SHOWING NOMINAL WEIGHT.
- 4. Δ ONE WEIGHT OR SERIES OF 50 LB WEIGHTS STACKED TO OBTAIN REQUIRED WEIGHT.

HISTORICAL REFERENCE ONLY
NOT TO BE USED FOR NEW CONSTRUCTION

FOR INFORMATION ONLY

B	11-16-11 A7-DDD	REDRAWN
	SUPERSEDES DWG NO. 40-D-5996	
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
STANDARD DESIGNS TRANSMISSION LINES CYLINDRICAL HOLD DOWN WEIGHT		
DESIGNED <u>BUREC</u> _____ APPROVED <u>BUREC</u> _____		
C A E	AUGUST 6, 1979	41 1008

Plotted By: court Sep 24, 2026- 6: 20am
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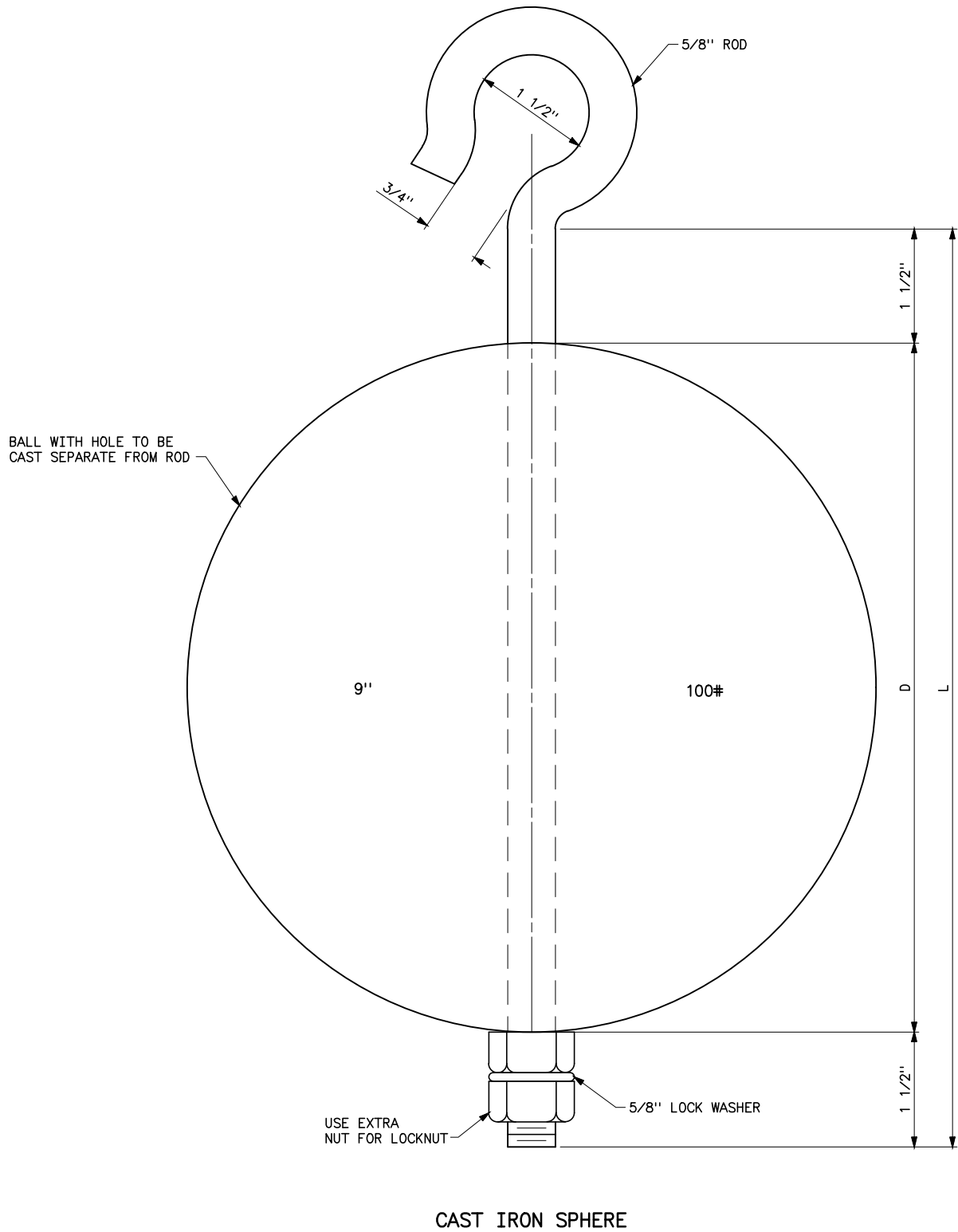


TABLE OF WEIGHTS			
PART NO.	NOMINAL DESIGNATION	DIAMETER D	DIMENSION L
92.10	7"-50#	7"	10"
92.11	9"-100#	9"	12"
92.12	11"-180#	11"	14"

NOTE
1. ASSEMBLY SHALL BE GIVEN ONE COAT OF ALUMINUM PAINT, AND SHALL BE MARKED SHOWING DIAMETER AND NOMINAL WEIGHT.

HISTORICAL REFERENCE ONLY
NOT TO BE USED FOR NEW CONSTRUCTION

FOR INFORMATION ONLY

B

11-16-11
A7-DDD

REDRAWN.

SUPERSEDES DWG NO. 40-D-2767

UNITED STATES DEPARTMENT OF ENERGY
WESTERN AREA POWER ADMINISTRATION
CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO

STANDARD DESIGNS
TRANSMISSION LINES
SUSPENSION INSULATOR HOLD DOWN WEIGHT

DESIGNED BUREC _____ APPROVED BUREC _____

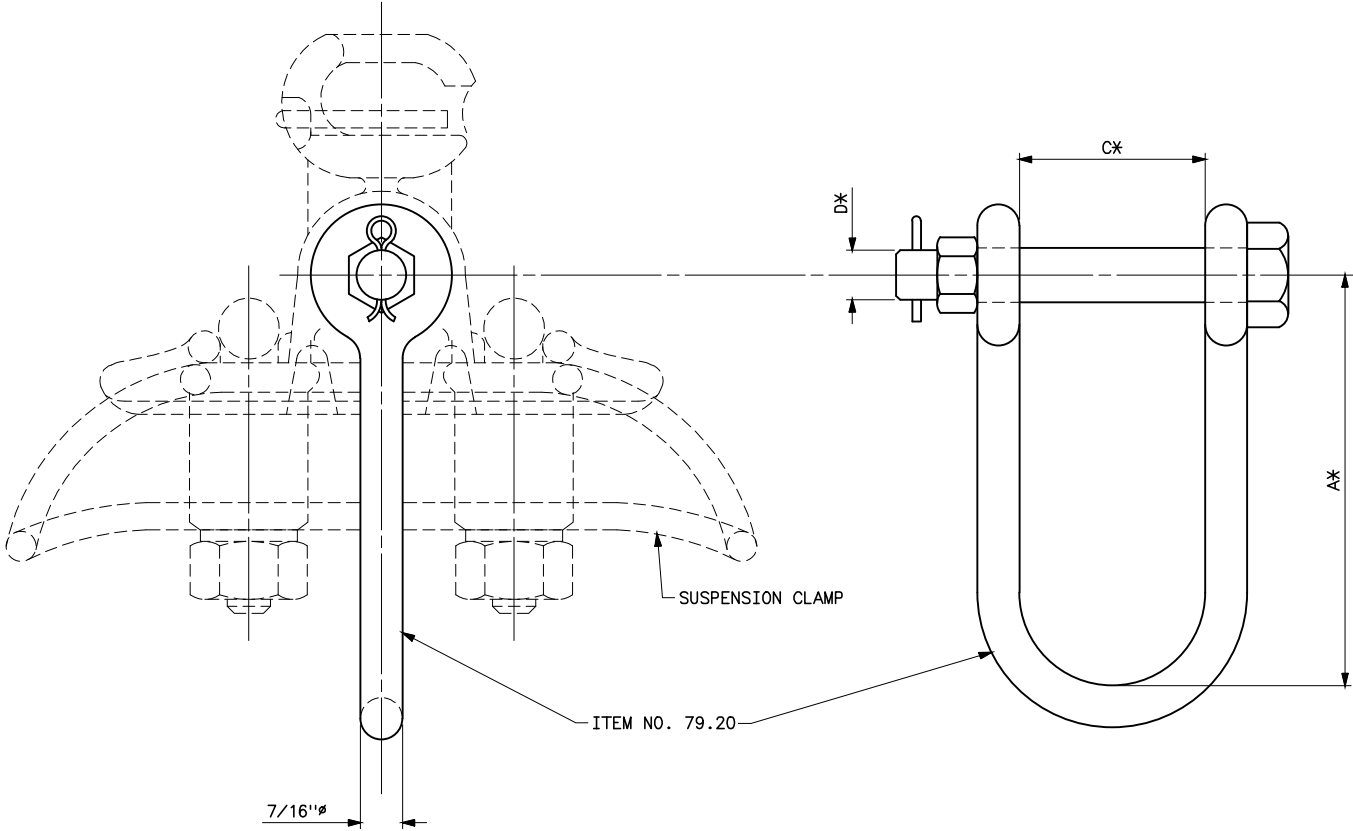
C
A

E

AUGUST 6, 1979

41

1009



GALVANIZED AFTER BENDING IN ACCORDANCE WITH
ASTM DESIGNATIONS A-153.

- NOTES
1. FOR HOLDDOWN WEIGHT REFER TO DWG 41 1008.
 2. *DIMENSIONS "A", "C" AND "D" SHALL BE DETERMINED FROM SUSPENSION CLAMP FURNISHED.

HISTORICAL REFERENCE ONLY
NOT TO BE USED FOR NEW CONSTRUCTION

FOR INFORMATION ONLY

C	12-9-11 A7-DDD	REDRAWN.	
	SUPERSEDES DWG NO. 40-D-3163		
	UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
	STANDARD DESIGN TRANSMISSION LINES SUSPENSION INSULATOR HOLDDOWN WEIGHT SHACKLE		
DESIGNED <u>BUREC</u> _____ APPROVED <u>BUREC</u> _____			
A	AUGUST 6, 1979	41	1010



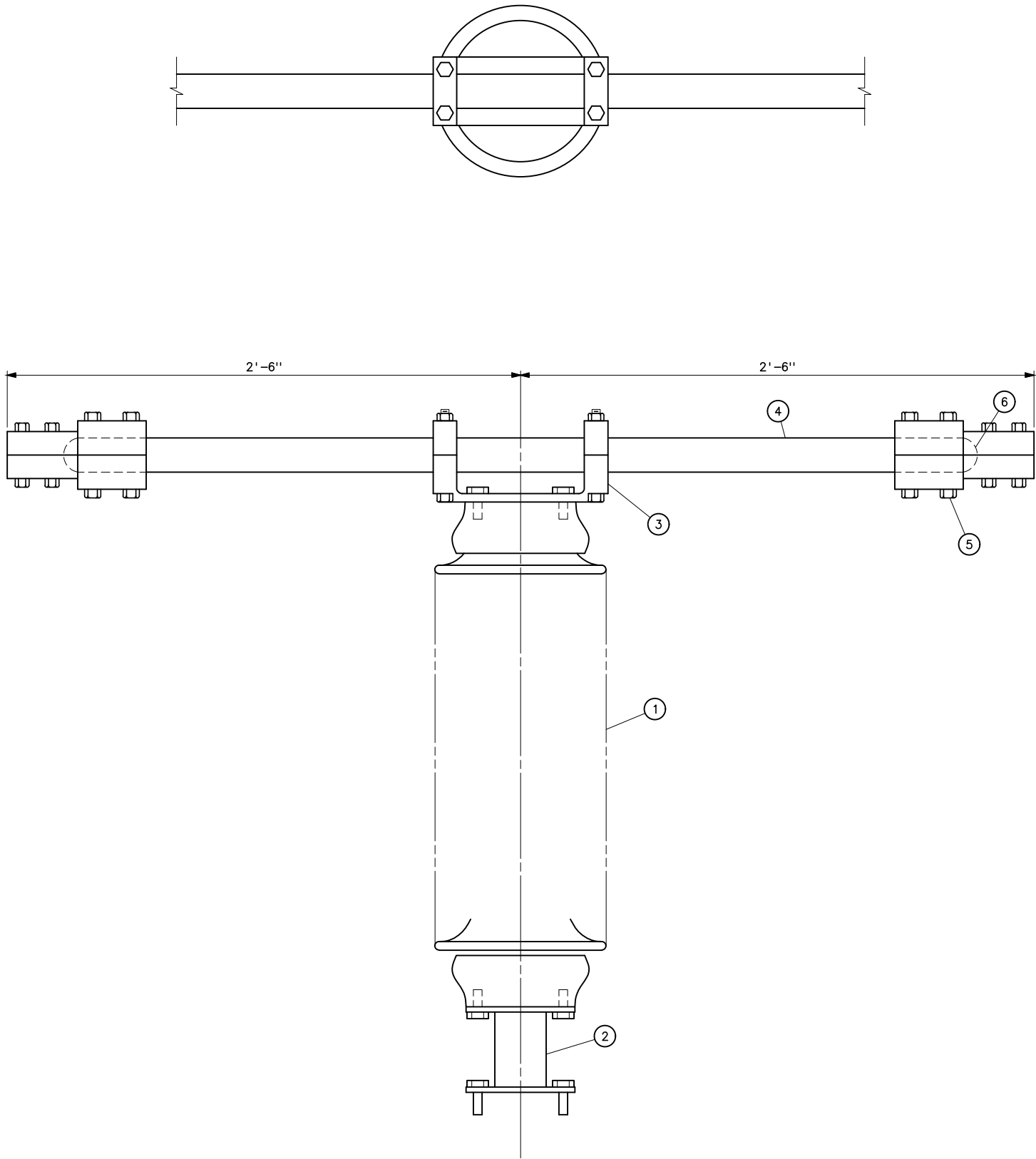
MATERIAL LIST	
PART NO.	DESCRIPTION
27.80	CLAMP, SUSPENSION, WITH CLEVIS FITTING, FOR CONDUCTOR
28.52	SOCKET-CLEVIS, ULTIMATE STRENGTH, 30,000 POUNDS
28.80	CLEVIS, Y-BALL, DWG. 41 1005
51.65	INSULATOR, SUSPENSION TYPE, 10" DIAMETER, 5 3/4" SPACING, 30,000 POUNDS
75.19	ROD, ARMOR, PREFORMED, DOUBLE SUPPORT (ACSR) SET
98.63	YOKE, 5/8-INCH THICK, ULTIMATE STRENGTH - 30,000 POUNDS

**HISTORICAL REFERENCE ONLY
NOT TO BE USED FOR NEW CONSTRUCTION**

FOR INFORMATION ONLY

B	11-16-11 A7-DDD	REDRAWN.
	SUPERSEDES DWG NO. 40-D-5841 (IN PART)	
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
STANDARD DESIGNS TRANSMISSION LINES DETAILS FOR SINGLE STRING INSULATOR ASSEMBLY WITH YOKE		
DESIGNED <u>BUREC</u> ----- APPROVED <u>BUREC</u> -----		
C A F	JANUARY 1984	41 1014

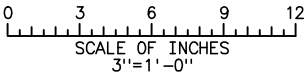
ITEM NO.	DESCRIPTION	EQUAL TO
1	POST INSULATOR	T.R. NO. 278
2	SPACER, 5 INCH	ROYAL, TYPE FA
3	CLAMP	BURNDY, TYPE UHG-A
4	2-INCH IPS AL. TUBE	
5	END CONNECTOR	BURNDY, TYPE NNE-A
6	CORONA BELL	BURNDY, TYPE LB-A



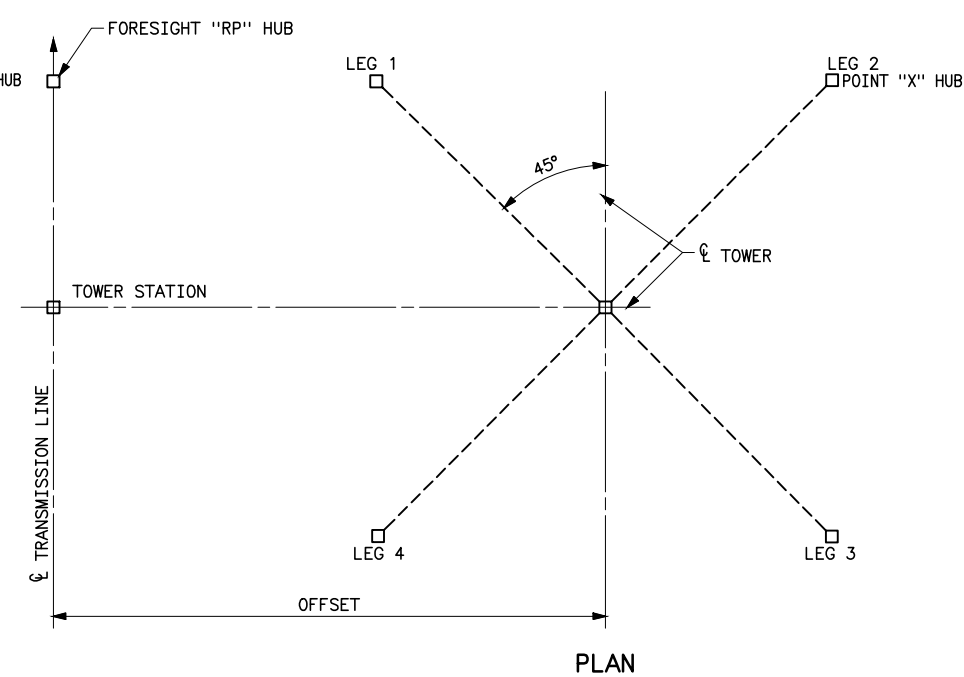
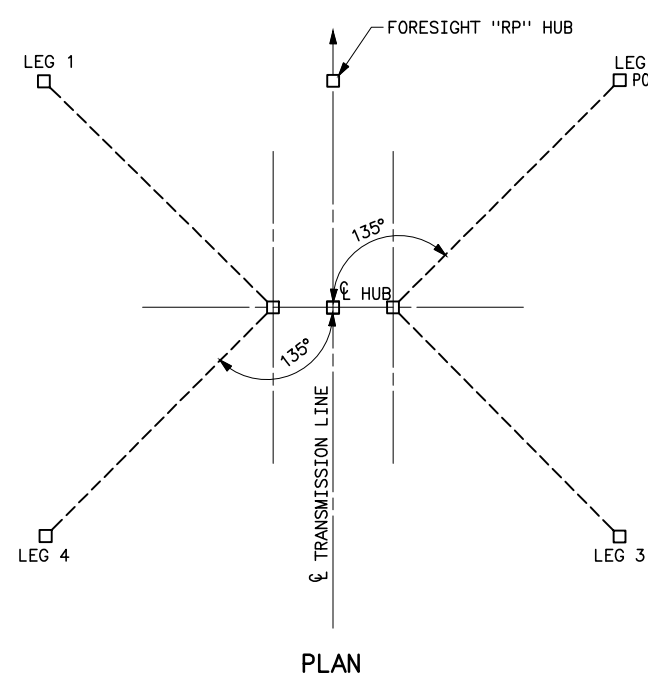
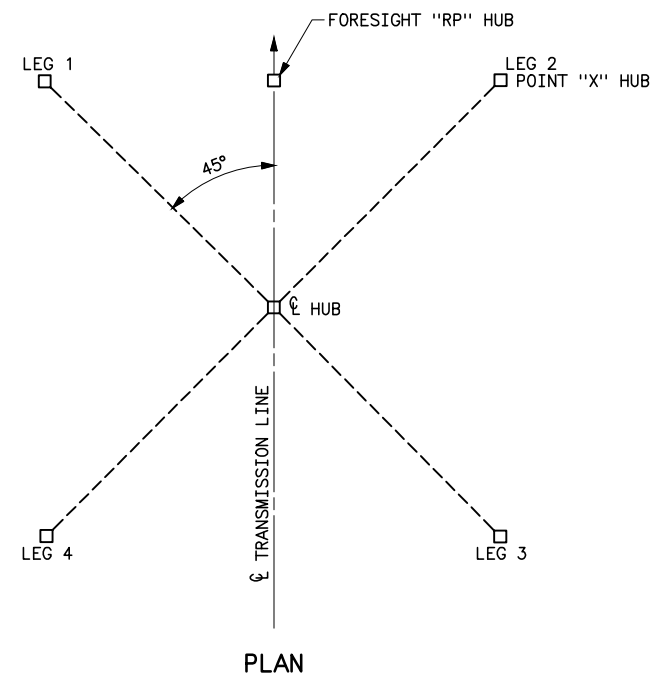
HISTORICAL REFERENCE ONLY
NOT TO BE USED FOR NEW CONSTRUCTION

FOR INFORMATION ONLY

B	11-16-11 A7-DDD	REDRAWN.
	SUPERSEDES DWG NO. 466-D-9855	
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
STANDARD DESIGNS 69KV TRANSMISSION LINES POST INSULATOR JUMPER ASSEMBLY		
DESIGNED <u>BUREC</u> _____ APPROVED <u>BUREC</u> _____		
C A	FEBRUARY 15, 1985	41 1016

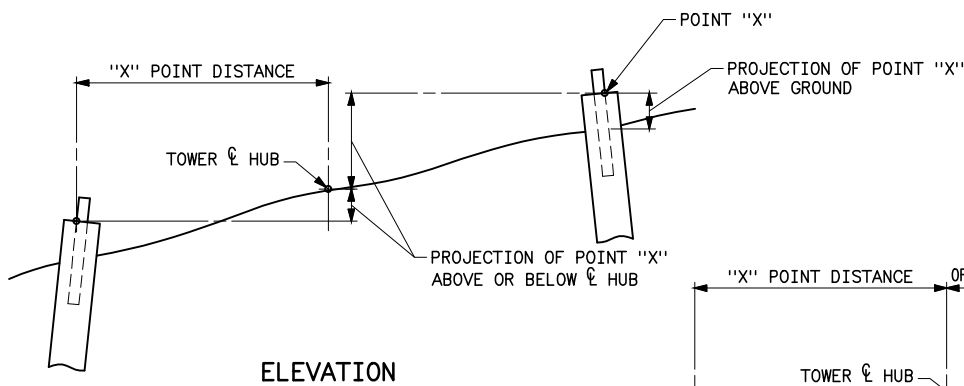


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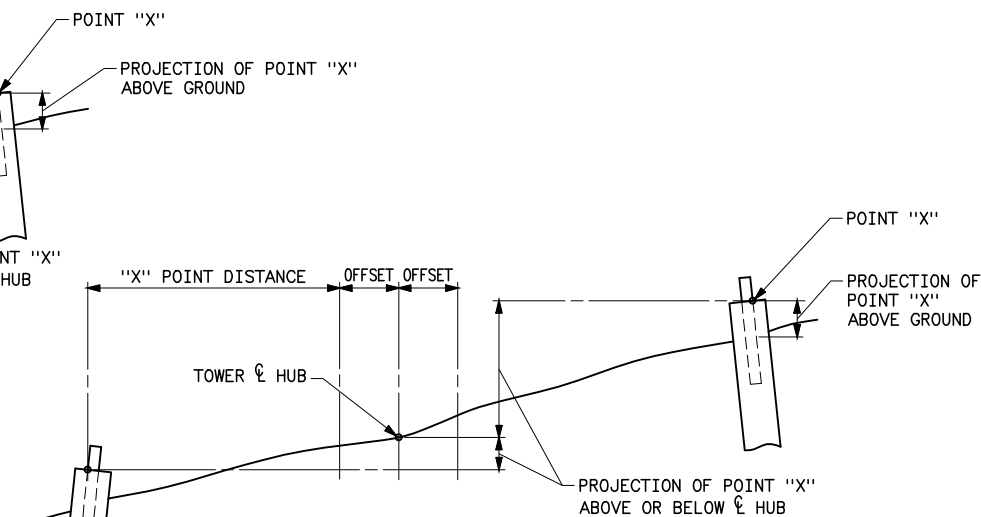


NOTES

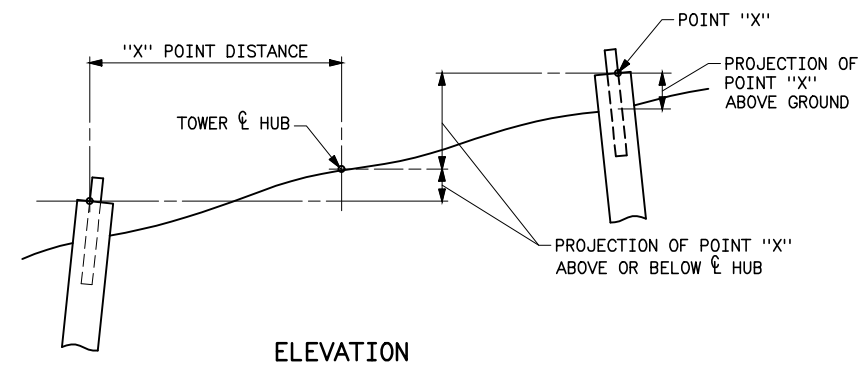
1. FORESIGHT HUB NORMALLY 25 FT AHEAD OF HUB.
2. ON ANGLE STRUCTURES, FORESIGHT HUB IS SET AT ANGLE EQUAL TO HALF OF THE LINE DEFLECTION ANGLE UNLESS OTHERWISE DIRECTED.
3. GUARD STAKE INFORMATION INCLUDES THE FOLLOWING:
FORESIGHT HUB-STATION AND ELEVATION.
"X" POINT HUB-LEG NO. AND "X" POINT PROJECTION,
HUB-STATION, TOWER TYPE, ELEVATION.
"X" POINT DISTANCE TO EACH LEG AND "X" POINT PROJECTION ABOVE OR BELOW TOWER HUB.
4. OFFSET FOR TRANSPOSITION TOWER MAY BE ON EITHER SIDE OF TRANSMISSION LINE-SEE PLAN AND PROFILE DRAWING FOR ORIENTATION.



ELEVATION



ELEVATION



ELEVATION

SQUARE BASE TOWER

RECTANGULAR BASE TOWER

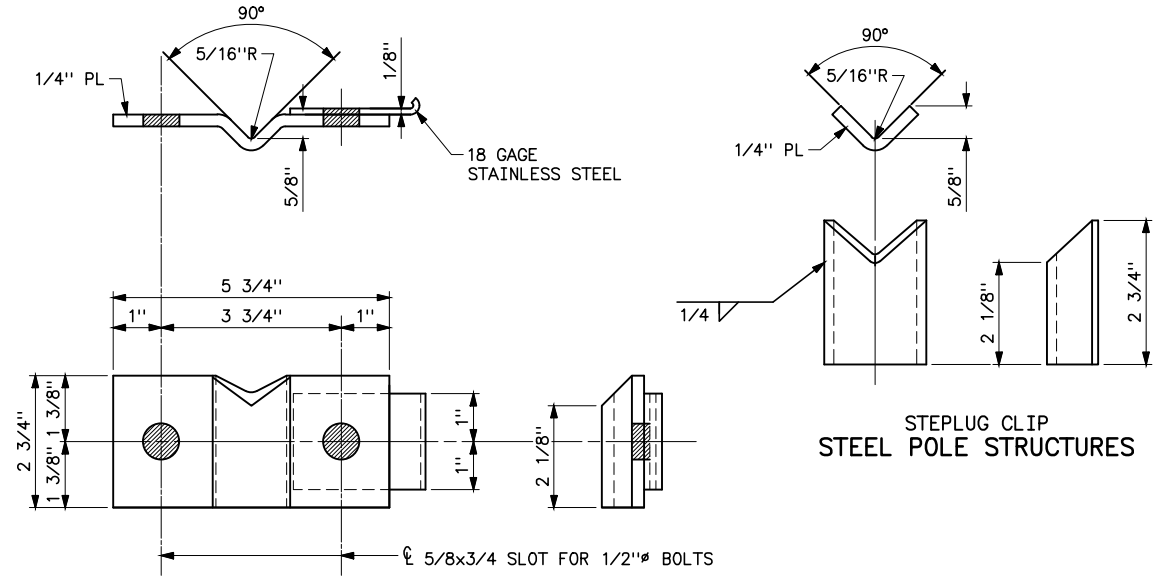
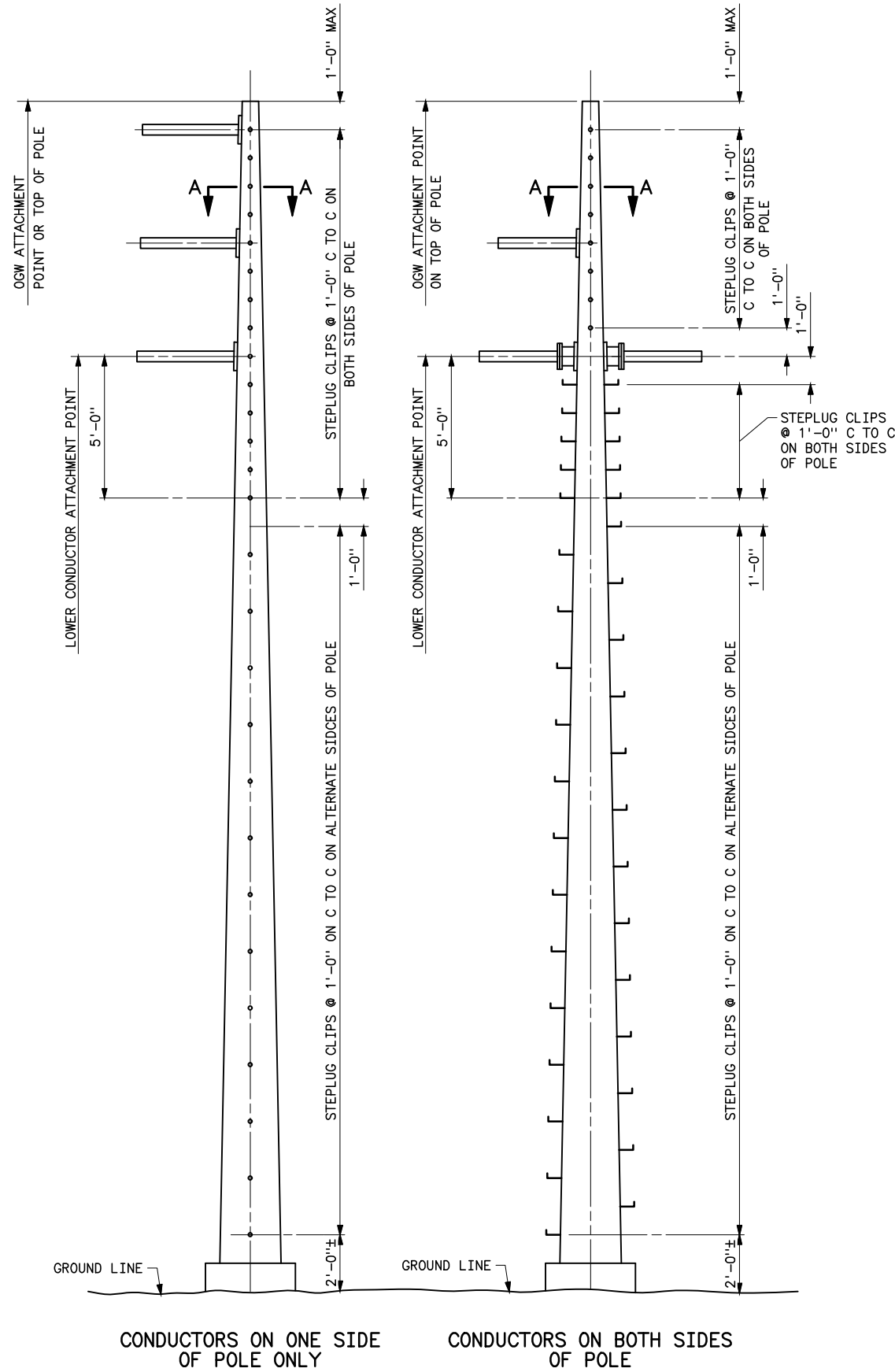
TRANSPOSITION TOWER WITH OFFSET

HISTORICAL REFERENCE ONLY
NOT TO BE USED FOR NEW CONSTRUCTION

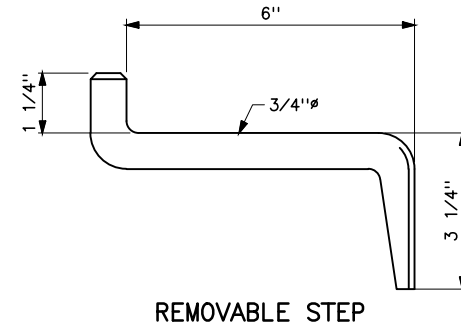
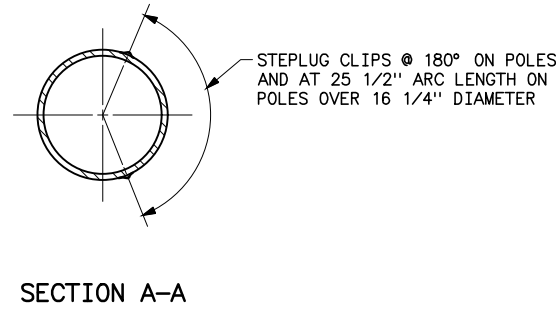
FOR INFORMATION ONLY

11-16-11 A7-DDD	REDRAWN.
SUPERSEDES DWG NO. 40-D-5821	
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO	
STANDARD DESIGNS TRANSMISSION LINES SURVEY LAYOUT FOR FOOTINGS	
DESIGNED BUREC	APPROVED BUREC
APRIL 10, 1979	41
2000	

Plotted By: court Sep 24, 2026- 6:27 am
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STEPLUG AND GROUNDWIRE CLIPS FOR CONCRETE POLE STRUCTURES



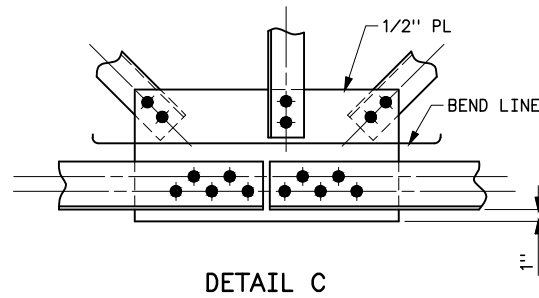
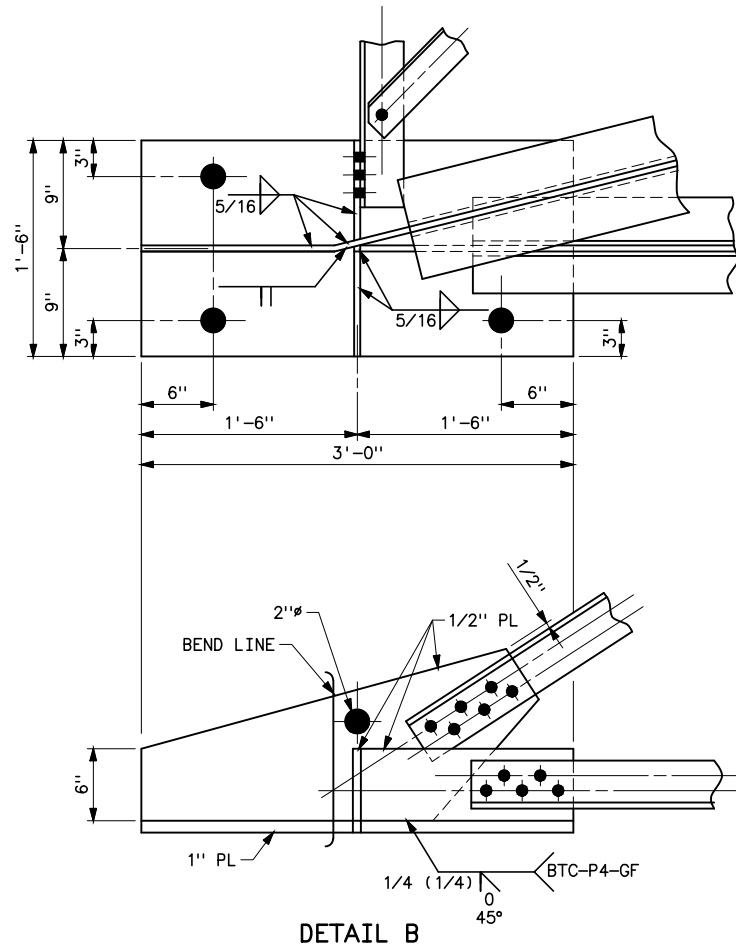
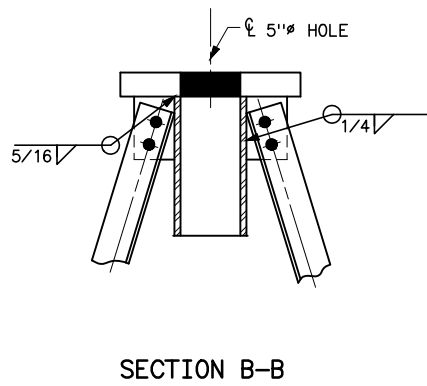
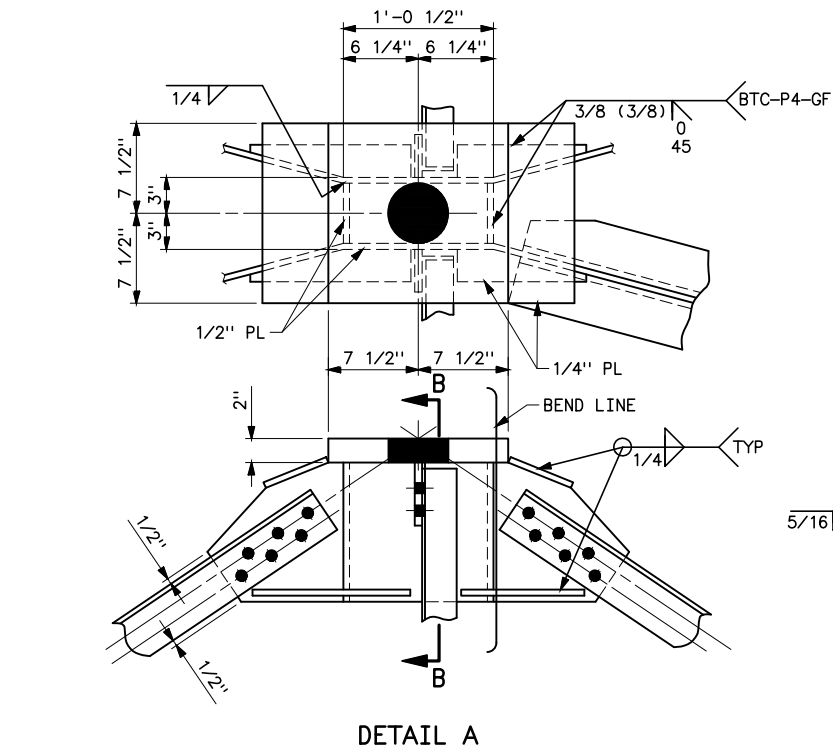
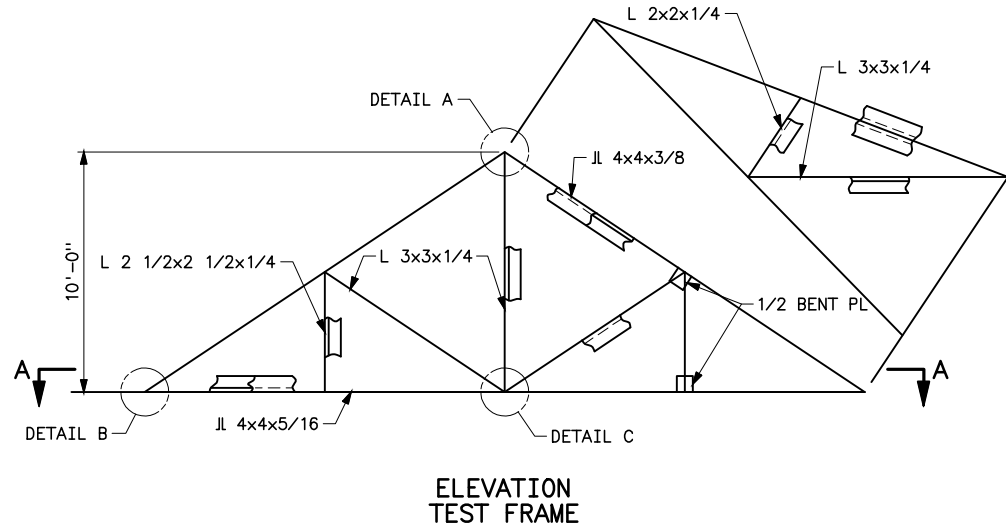
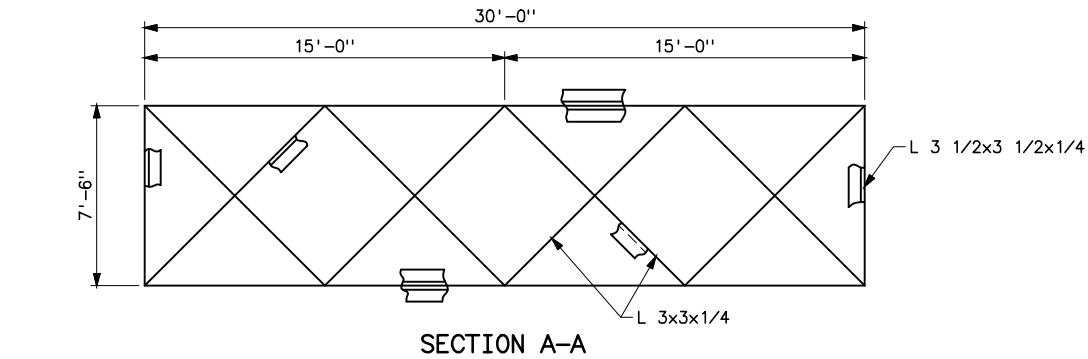
NOTES

1. ALL STEEL FOR CONCRETE POLE STRUCTURES SHALL BE GALVANIZED AFTER FABRICATION UNLESS OTHERWISE SPECIFIED.
2. ALL STEEL FOR STEEL POLE STRUCTURES, EXCEPT FOR REMOVABLE STEPS, SHALL BE ASTM A588 WEATHERING STEEL.
3. REMOVABLE STEPS SHALL BE GALVANIZED FORGED STEEL.

HISTORICAL REFERENCE ONLY
NOT TO BE USED FOR NEW CONSTRUCTION

FOR INFORMATION ONLY

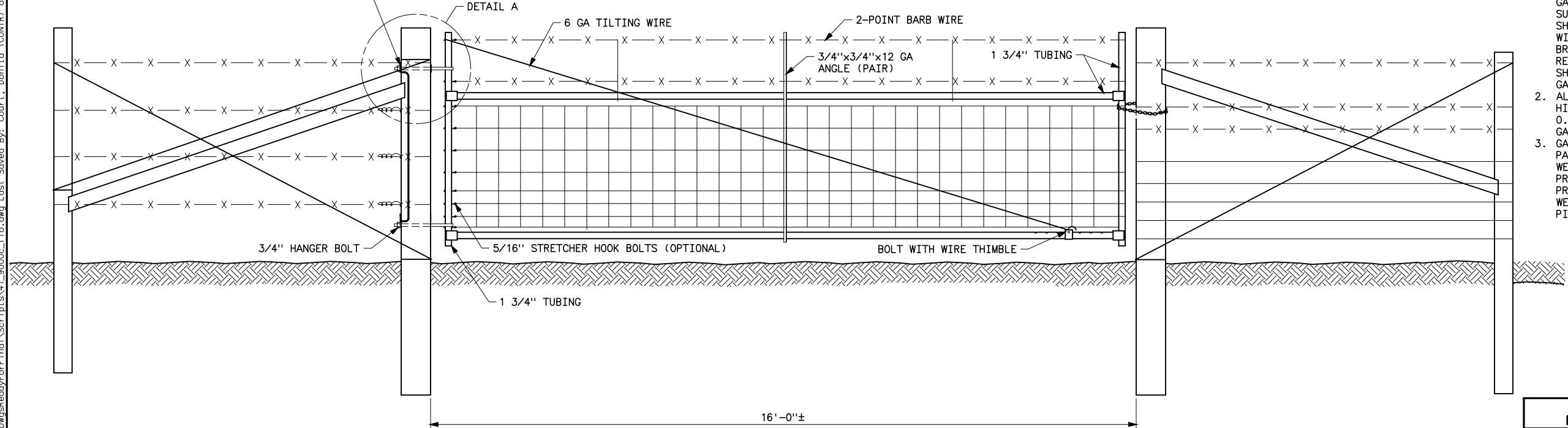
11-16-11 A7-DDD		REDRAWN.
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
STANDARD DESIGNS TRANSMISSION LINES POLE STRUCTURES-CLIMBING FACILITIES		
DESIGNED B.G. HAGLER		APPROVED R.M. McCAFFERTY DIRECTOR, DIVISION OF CIVIL DESIGN
41	OCTOBER 8, 1982	2018



- NOTES
1. STEEL ASTM A 36.
 2. BOLTS ASTM A 394 3/4"Ø, HOLES 13/16"Ø UNLESS NOTED.
 3. GALVANIZE MATERIAL AFTER FABRICATION.
 4. ESTIMATED WEIGHT=4700 LBS.
 5. DESIGN BASED ON ±200 KIPS APPLIED AT TOP OF FRAME, OLF=1.5.

HISTORICAL REFERENCE ONLY
NOT TO BE USED FOR NEW CONSTRUCTION

FOR INFORMATION ONLY		
C	11-16-11 A7-DDD	REDRAWN.
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
STANDARD DESIGNS TRANSMISSION LINES FOOTING TEST FRAME		
DESIGNED R. A. SUTTON APPROVED R. M. M. CAFFERY DIRECTOR, DIVISION OF CIVIL DESIGN		
A	NOVEMBER 1, 1984	41 2019



Technical drawing of a gate post assembly. The drawing shows a vertical gate post with a horizontal top section. Key dimensions and components are labeled:

- GATE POST TOP DIA 7" MIN**: Dimension for the top diameter of the gate post.
- 10"**: Dimension for the height of the gate post.
- 1/8" x 2" WASHERS**: Label for the washers used in the assembly.
- 3/4" EYE BOLT THREAD 2"**: Label for the eye bolt used in the assembly.
- 4" x 4" BRACING**: Label for the bracing used to support the gate post.
- BONDING WIRE**: Label for the wire used to bond the gate post.
- MORTISE 1" FASTEN WITH 2-20d SPIKES**: Label for the mortise and fasteners used in the assembly.

Diagram illustrating the assembly of a gate post:

- GATE POST TOP DIA 7" MIN**: Points to the top of the vertical post.
- SNAP**: Points to the top of the chain.
- EMBER**: Points to the bottom of the chain.
- 4"x4" BRACING MORTISE 1" FASTEN WITH 2-20d SPIKES**: Points to the horizontal brace.
- STAPLE CHAIN TO POST**: Points to the chain connecting the brace to the post.

NOTES

1. ALL MATERIALS USED IN THE GATE SHALL BE ZINC COATED (GALVANIZED) EXCEPT THAT GALVANIZING REPAIR PAINT MAY BE USED OVER WELDS OR TO REPAIR GALVANIZING DAMAGED BY WELDING OPERATIONS. SURFACES TO WHICH REPAIR PAINT IS TO BE APPLIED SHALL BE CLEANED BY WIPING WITH A CLOTH SATURATED WITH MINERAL SPIRITS OF XYLENE, FOLLOWED BY WIRE BRUSHING. AFTER WIRE BRUSHING, THE AREA SHALL BE RECLEANED WITH SOLVENT TO REMOVE RESIDUE, AND SHALL BE GIVEN ONE HEAVY BRUSH COAT OF GALVANIZING REPAIR PAINT.
2. ALL TUBING USED IN THE GATE FRAME SHALL BE 1 3/4" HIGH CARBON STEEL WITH A MINIMUM THICKNESS OF 0.090"; SHALL BE CONTINUOUS WELDED; AND SHALL BE GALVANIZED INSIDE AND OUT.
3. GATE POSTS AND BRACING POSTS ARE INCLUDED AS A PART OF CONSTRUCTION OF THE GATE AND SHALL BE WELL-SEASONED CEDAR OR A TYPE THAT HAS BEEN PRESSURE TREATED WITH A PRESERVATIVE. THE PRESSURE TREATED POSTS SHALL BE DOUGLAS FIR, WESTERN LARCH, LODGEPOLE PINE OR SOUTHERN YELLOW PINE.

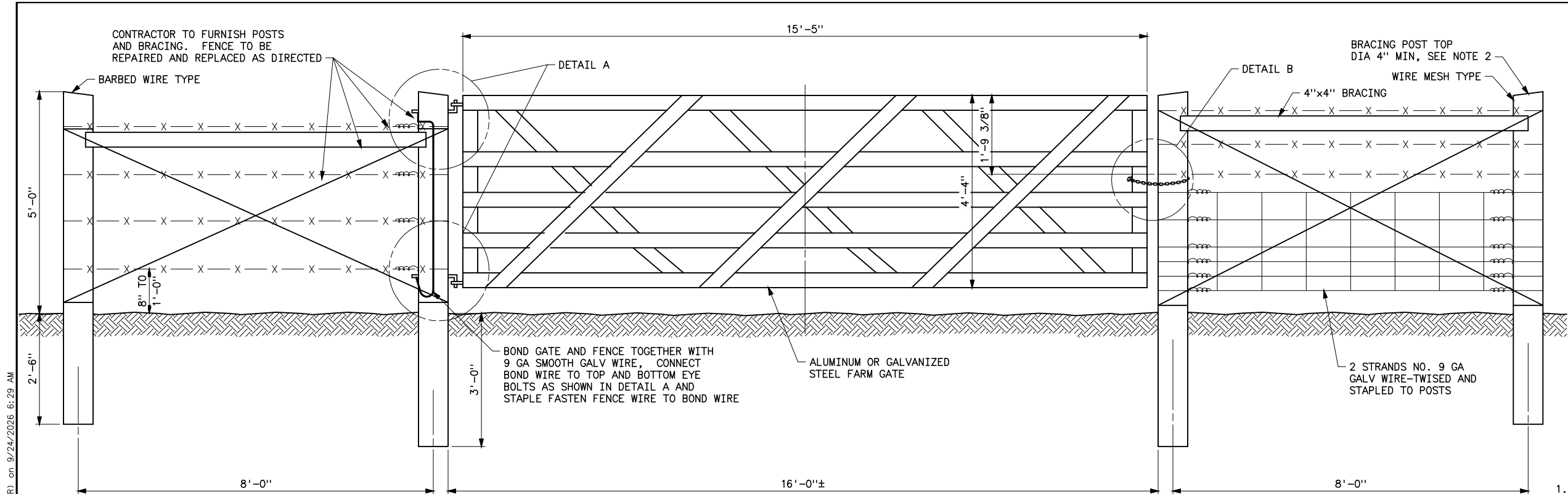
HISTORICAL REFERENCE ONLY
NOT TO BE USED FOR NEW CONSTRUCTION

FOR INFORMATION ONLY

C	5-28-14 A7-DDD	REDRAWN.
SUPERSEDES DWG NO. 40-D-4947		
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
STANDARD DESIGNS TRANSMISSION LINE STANDARDS PREFABRICATED STEEL GATES FOR RIGHT-OF-WAY FENCES		
DESIGNED <u>BUREC</u> _____ APPROVED <u>BUREC</u> _____		
C A F	AUGUST 6, 1979	41 9000

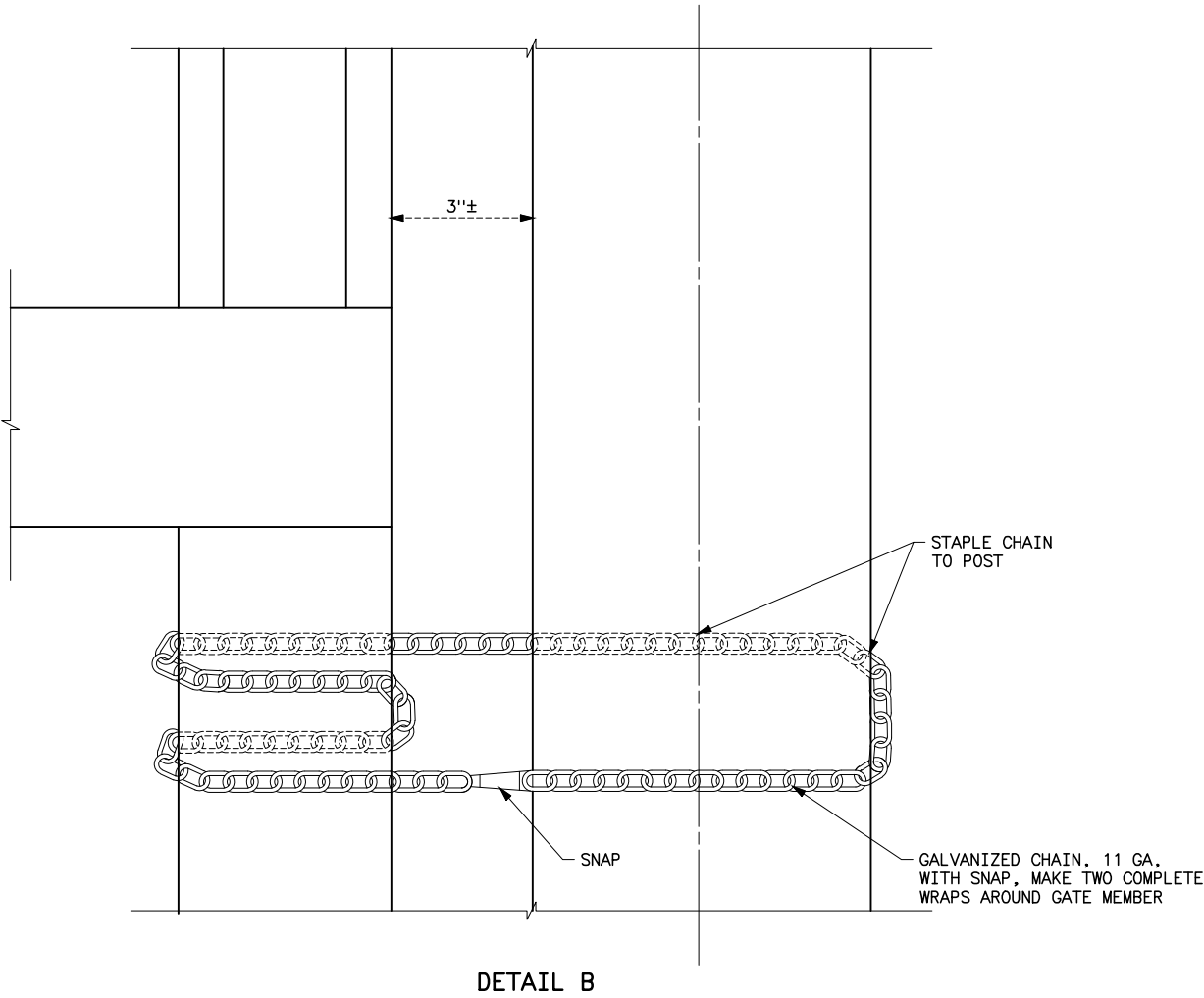
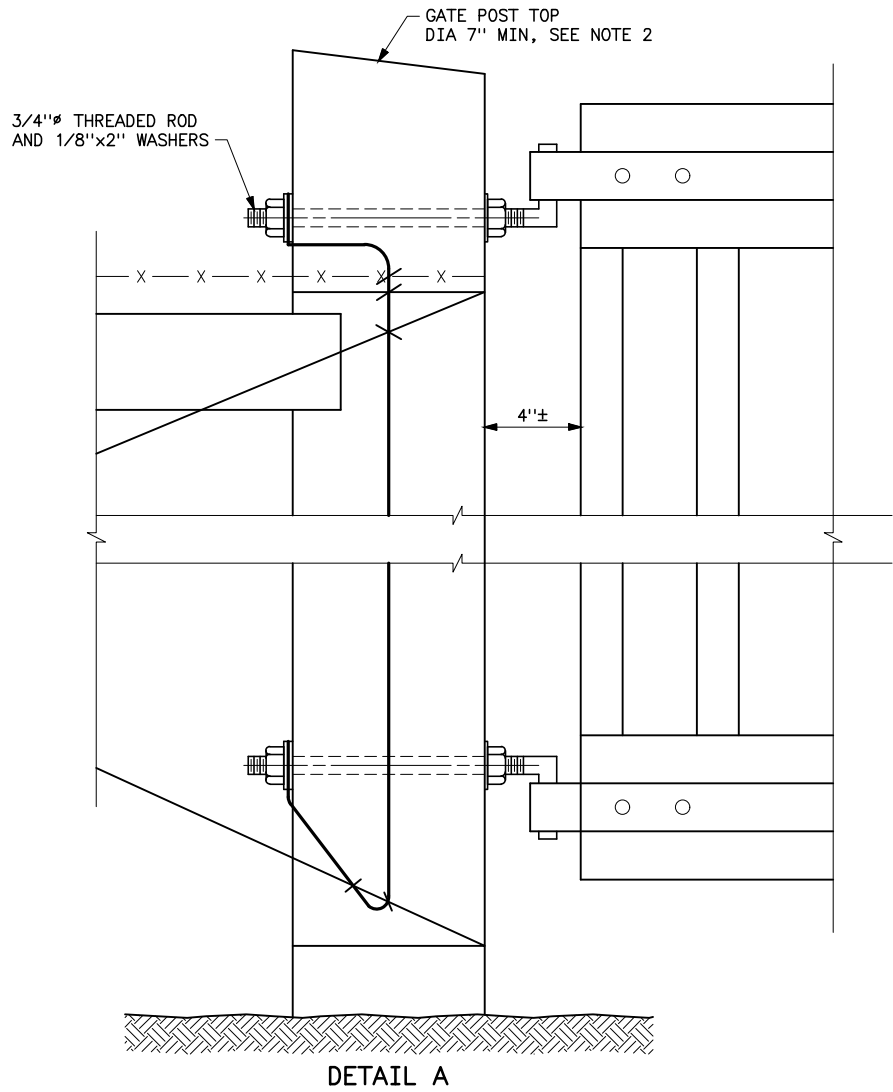
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XREF(S):



NOTES

1. ALL HARDWARE AND WIRE FENCING SHALL BE GALVANIZED.
2. GATE POSTS AND BRACING POSTS ARE INCLUDED AS PART OF CONSTRUCTION OF THE GATE AND SHALL BE WELL-SEASONED CEDAR OR A TYPE THAT HAS BEEN PRESSURE TREATED WITH A PRESERVATIVE. THE PRESSURE TREATED POSTS SHALL BE DOUGLAS FIR, WESTERN LARCH, LODGEPOLE PINE, OR SOUTHERN YELLOW PINE.
3. STEEL PANEL GATES SHALL BE GALVANIZED.

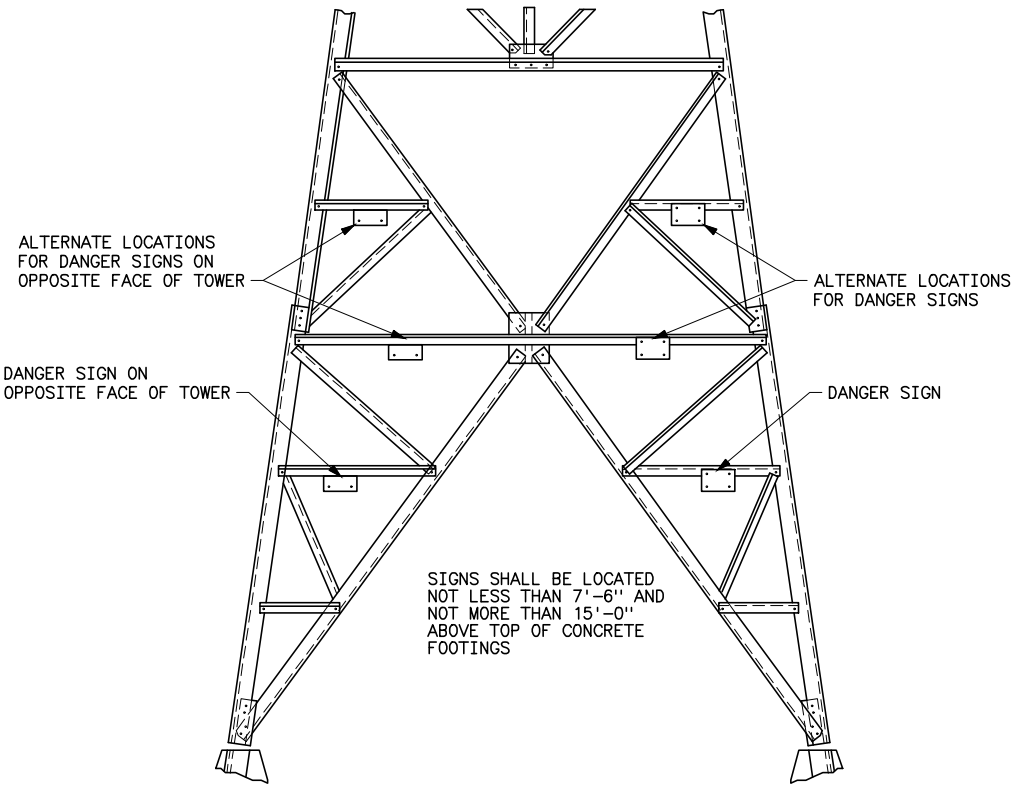


HISTORICAL REFERENCE ONLY
NOT TO BE USED FOR NEW CONSTRUCTION

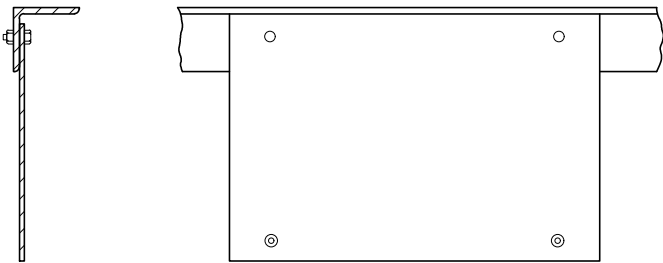
FOR INFORMATION ONLY

B	5-28-14 A7-DDD	REDRAWN.
	SUPERSEDES DWG NO. 40-D-5645	
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
TRANSMISSION LINE STANDARDS PREFABRICATED PANEL GATE FOR RIGHT-OF-WAY FENCES		
DESIGNED <u>BUREC</u> _____ APPROVED <u>BUREC</u> _____		
A	JUNE 25, 1981	41 9001

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IMAGES:



DANGER SIGN LOCATION



SIGN FASTENING DETAIL

NOTE

1. SIGNS SHALL BE FASTENED BY MEANS OF EITHER THE TOP OR BOTTOM TWO HOLES.

REFERENCE DRAWING

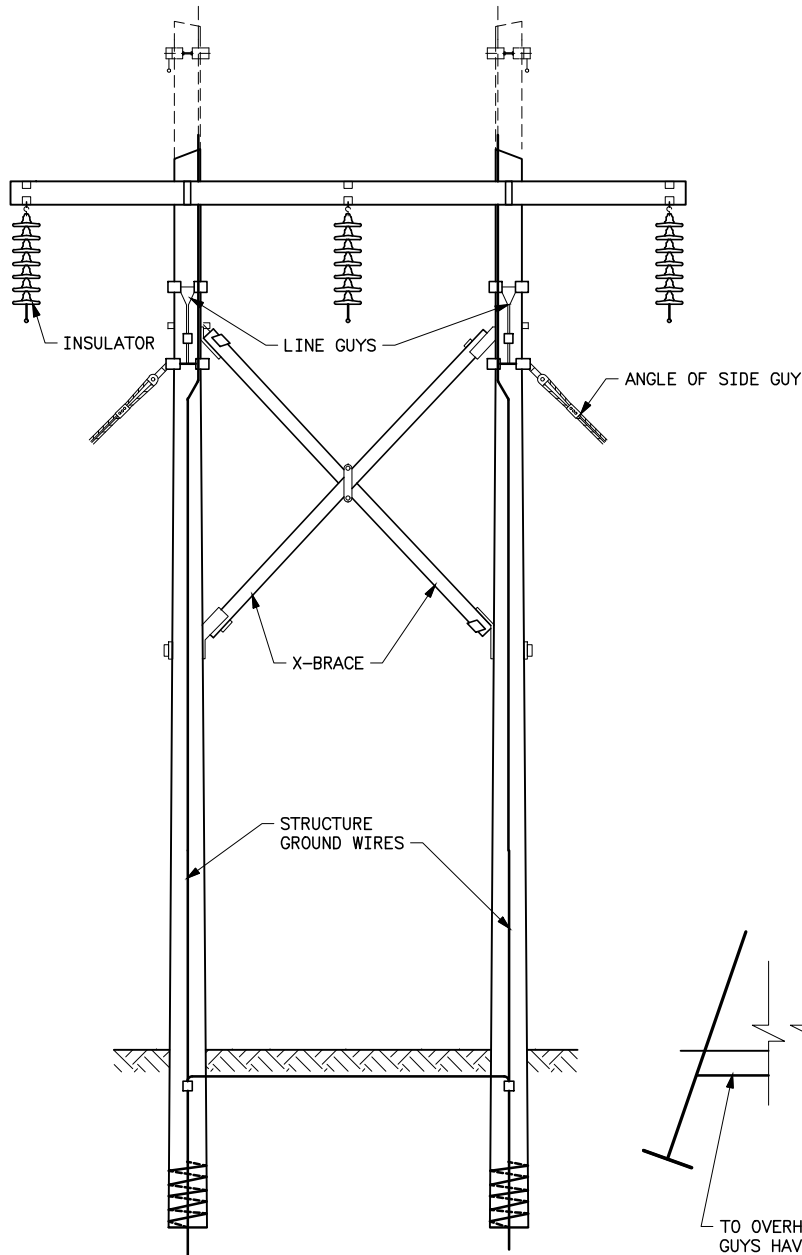
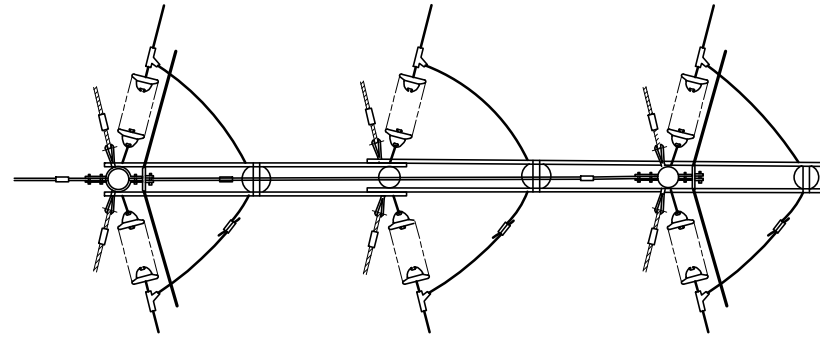
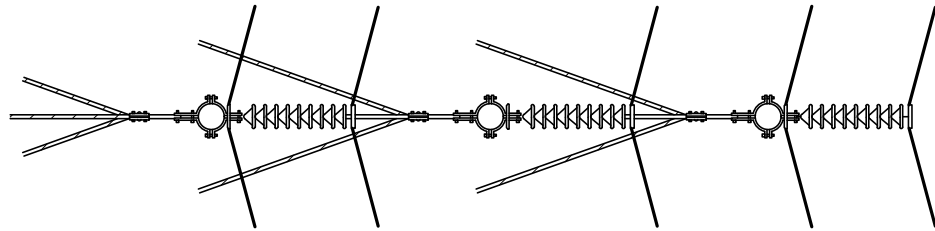
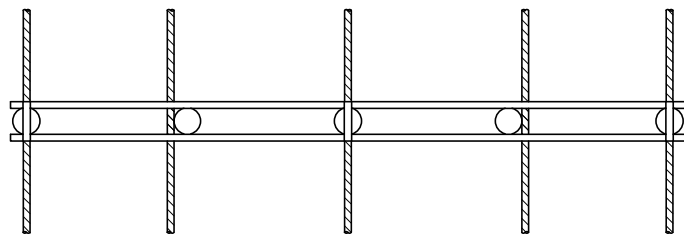
DANGER SIGN FOR STEEL TOWER----- 41 9008

HISTORICAL REFERENCE ONLY
NOT TO BE USED FOR NEW CONSTRUCTION

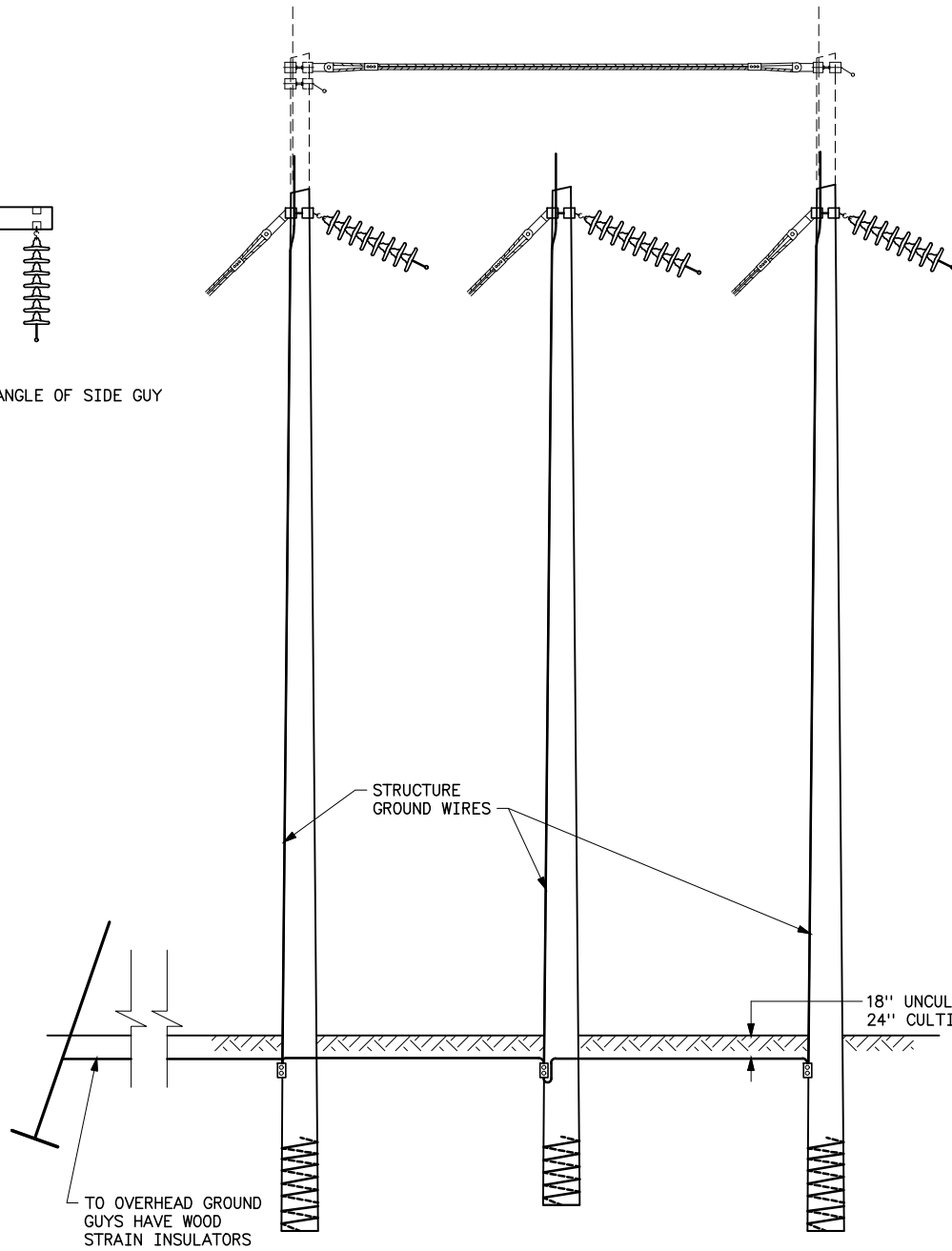
FOR INFORMATION ONLY

C A E	5-28-14 A7-DDD	REDRAWN.	
	SUPERSEDES DWG NO. 40-D-5623		
	UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
	STANDARD DESIGNS TRANSMISSION LINES LOCATION OF DANGER SIGNS ON STEEL TOWER		
DESIGNED <u>BUREC</u> ----- APPROVED <u>BUREC</u> -----			
	AUGUST 6, 1979	41	9009

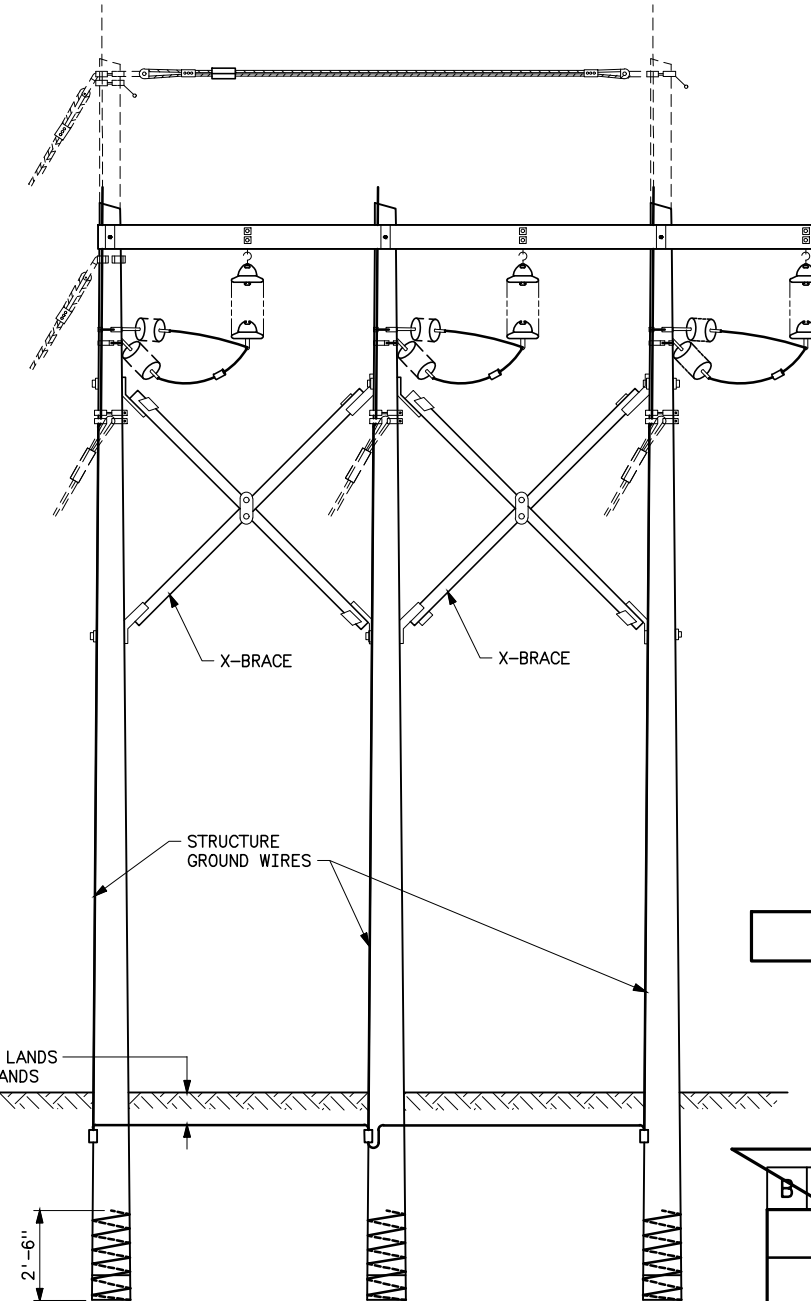
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TYPICAL IN LINE "H" STRUCTURE



TYPICAL ANGLE STRUCTURE



TYPICAL DEAD END STRUCTURE

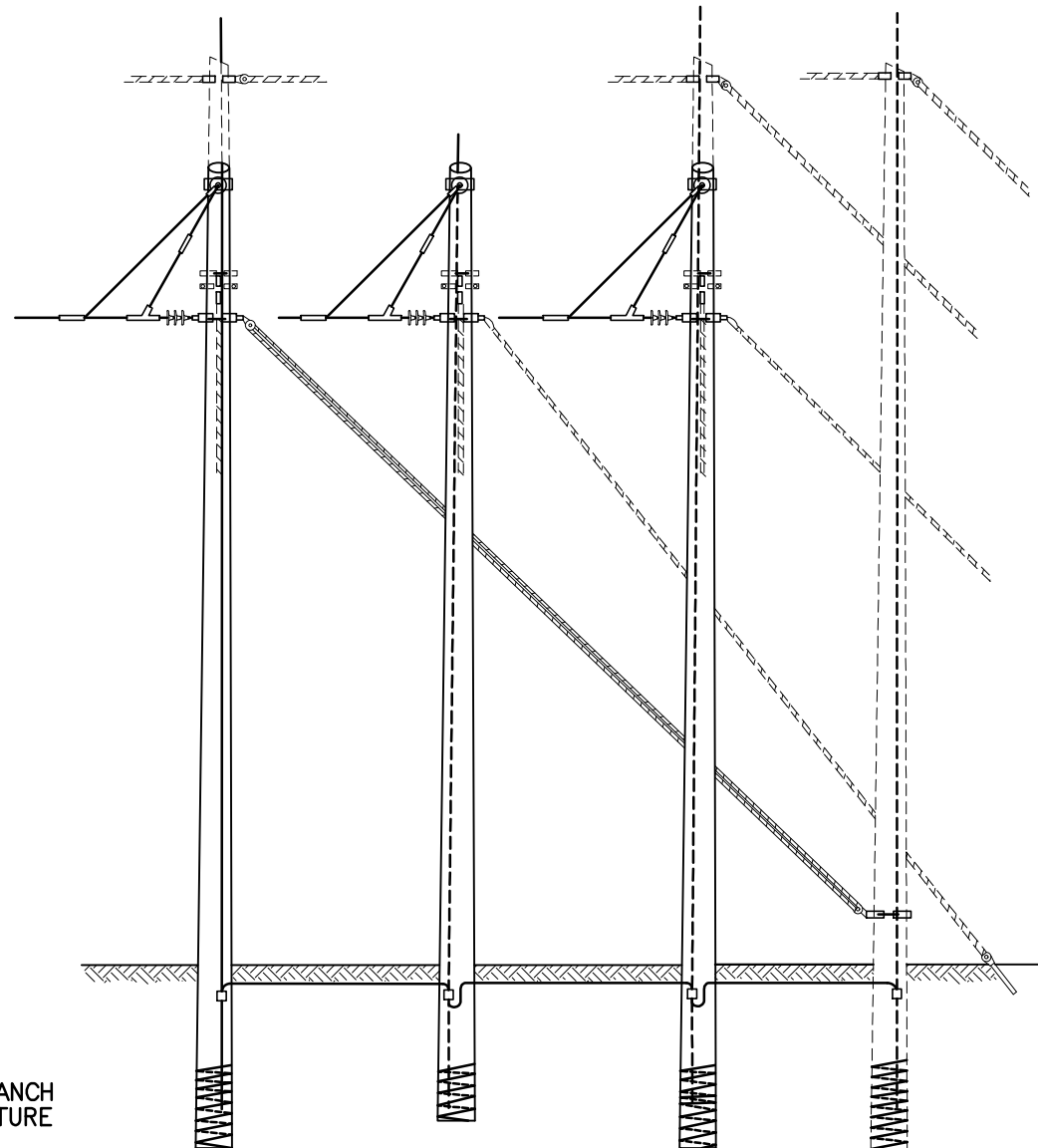
HISTORICAL REFERENCE ONLY
NOT TO BE USED FOR NEW CONSTRUCTION

FOR INFORMATION ONLY

5-28-14 47-DDD		REDRAWN.
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
STANDARD DESIGNS TRANSMISSION LINES WOOD-POLE STRUCTURES, TYPICAL IN-LINE, ANGLE, & DEAD END STRUCTURES		
DESIGNED	APPROVED ALAN P. PESHONG ELECTRICAL ENGINEERING MANAGER	
AUGUST 6, 1979	41	9010

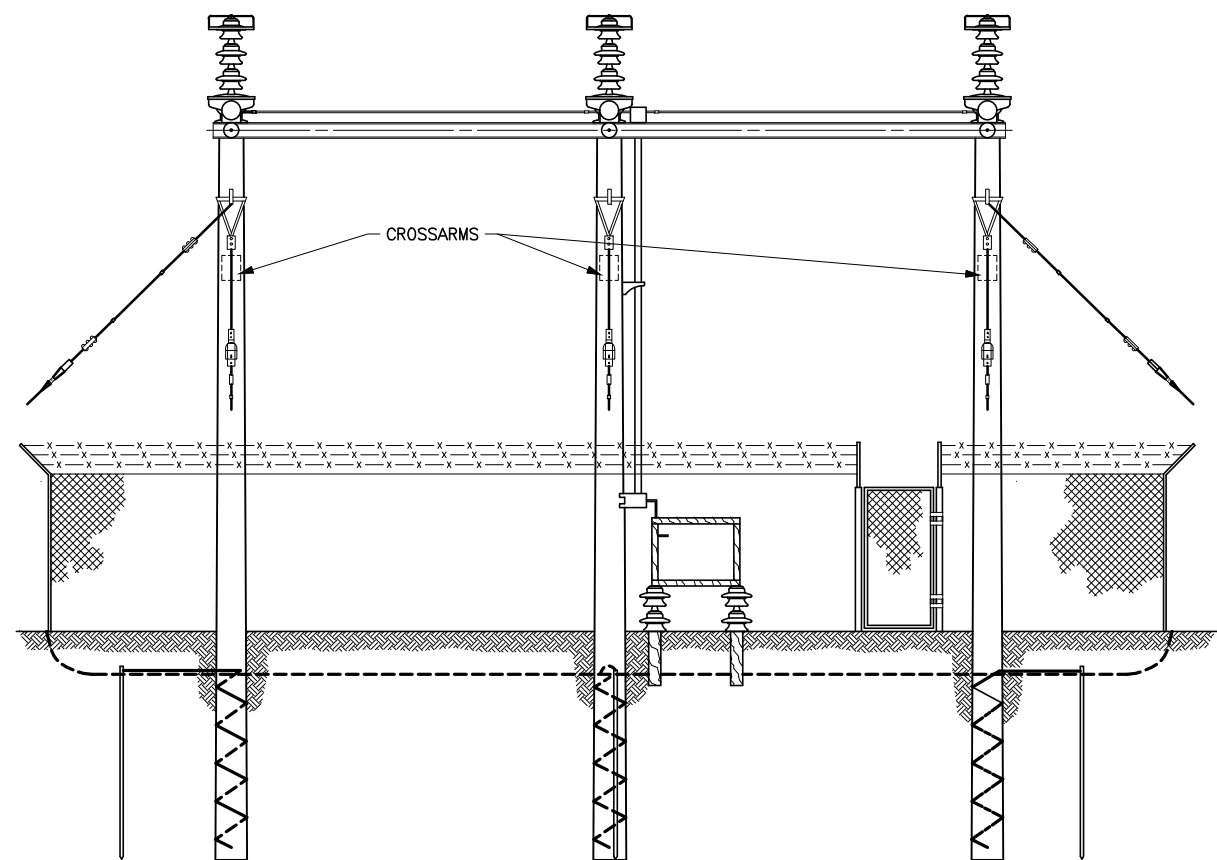
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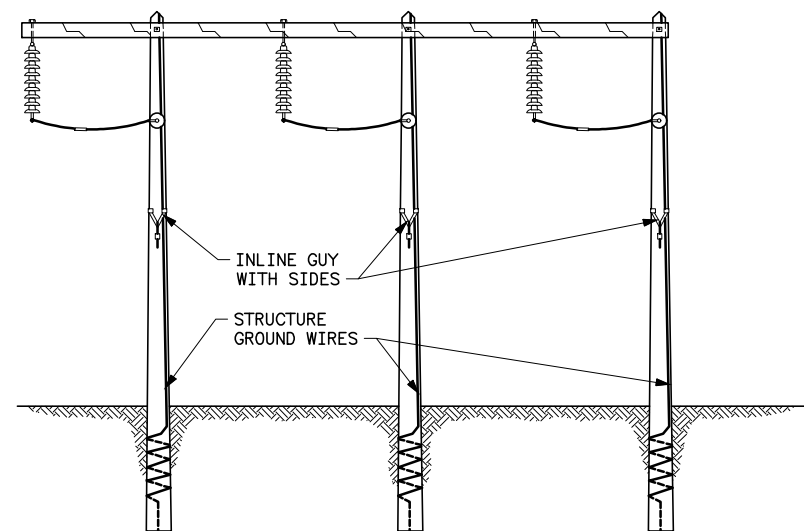


FOR INFORMATION ONLY

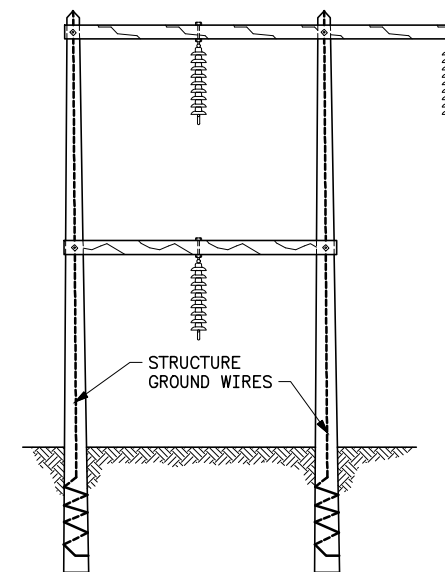
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	UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO	
STANDARD DESIGNS TRANSMISSION LINES WOOD-POLE STRUCTURES TYPICAL BRANCH LINE STRUCTURES		
DESIGNED _____		APPROVED <u>ALAN P. PESCHON</u> _____
DATE	AUGUST 6, 1979	41 9011



TYPICAL TRANSPOSITION STRUCTURE



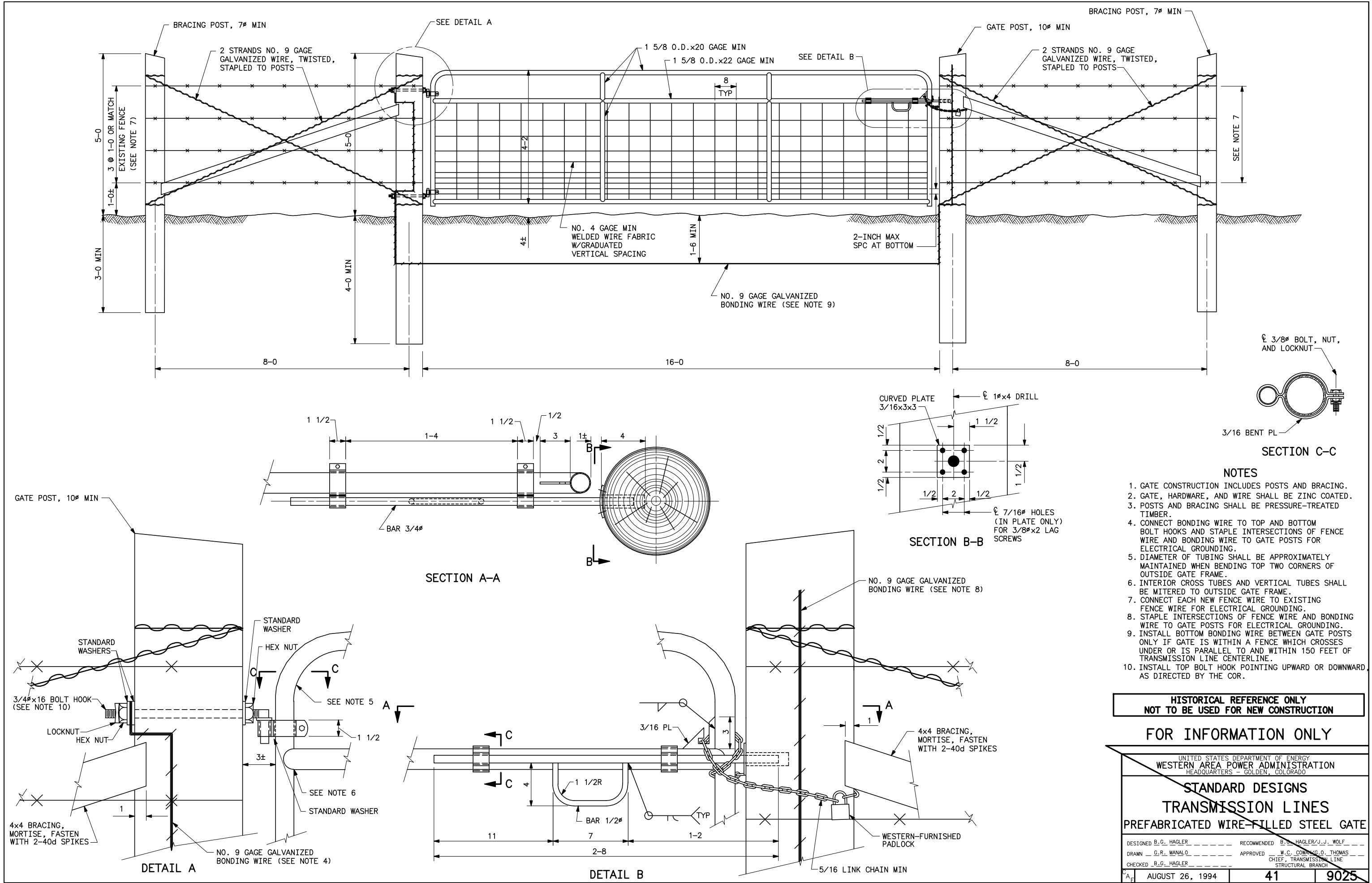
TYPICAL FULL STRAIN STRUCTURE



TYPICAL TRANSPOSITION STRUCTURE

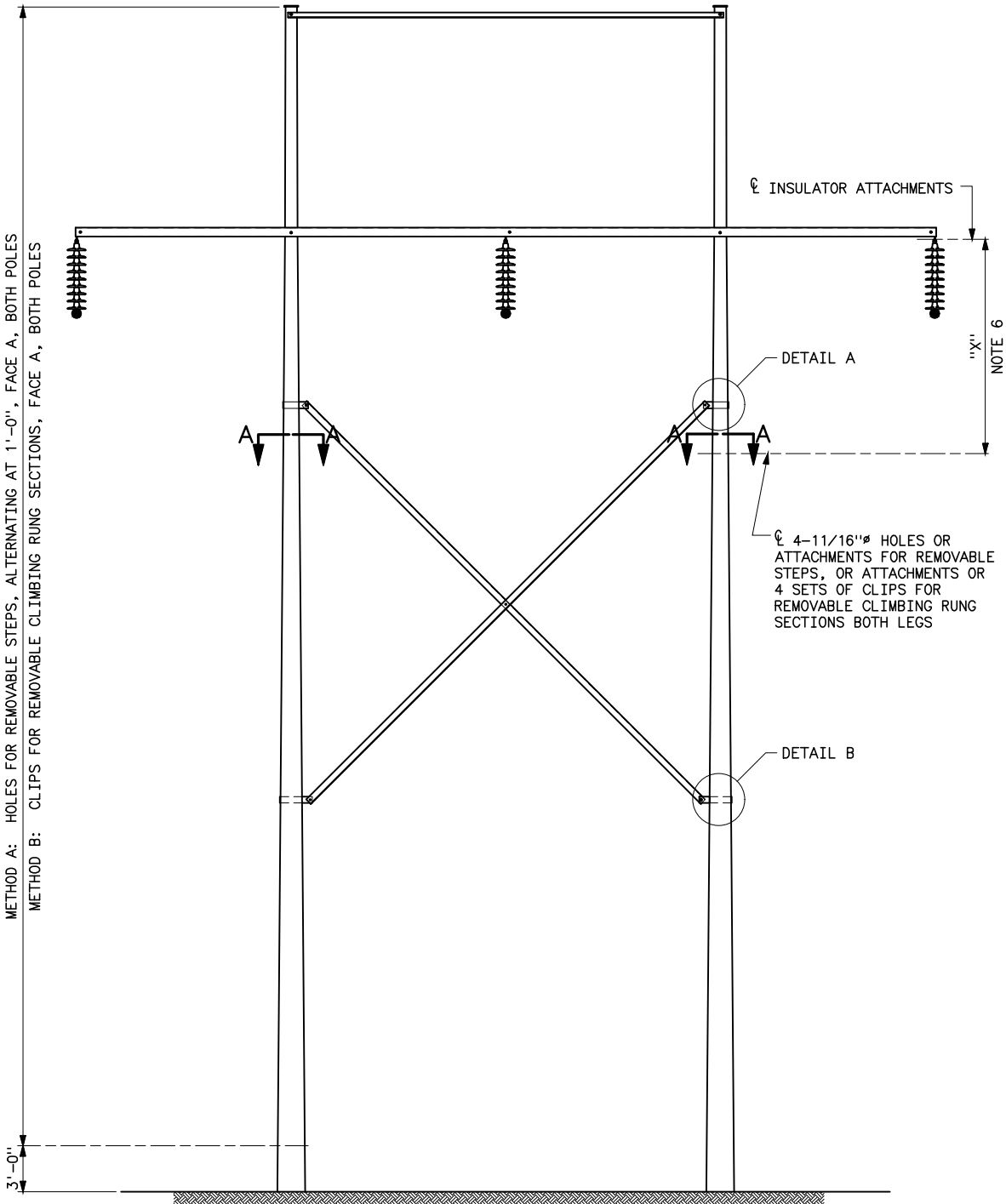
FOR INFORMATION ONLY

A	5-28-14 A7-D-DDD	REDRAWN.
	UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO	
STANDARD DESIGN TRANSMISSION LINES WOOD-POLE STRUCTURES, TYPICAL STRAIN POSITION, AND SWITCH STRUCTURE		
DESIGNED <u>DAN A. MAGSTADT</u> _____		APPROVED <u>ROBERT S. FODNESS</u> DISTRICT MANAGER
DATE	JANUARY 29, 1980	41 9015



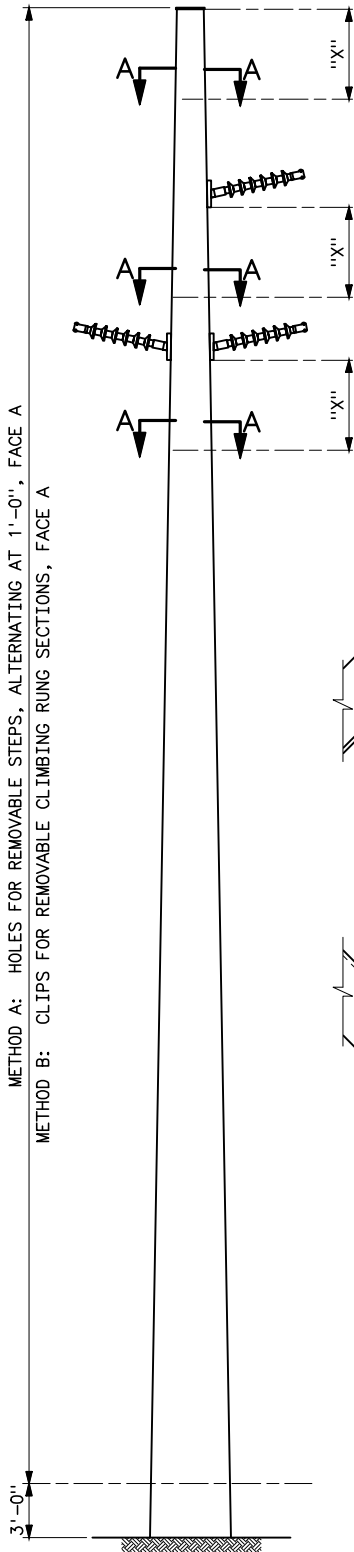
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METHOD A: HOLES FOR REMOVABLE STEPS, ALTERNATING AT 1'-0", FACE A, BOTH POLES
METHOD B: CLIPS FOR REMOVABLE CLIMBING RUNG SECTIONS, FACE A, BOTH POLES

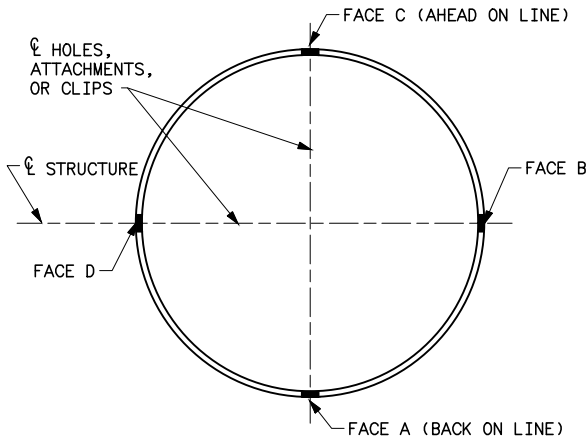


H-FRAME STRUCTURE
FACE A

METHOD A: HOLES FOR REMOVABLE STEPS, ALTERNATING AT 1'-0", FACE A
METHOD B: CLIPS FOR REMOVABLE CLIMBING RUNG SECTIONS, FACE A

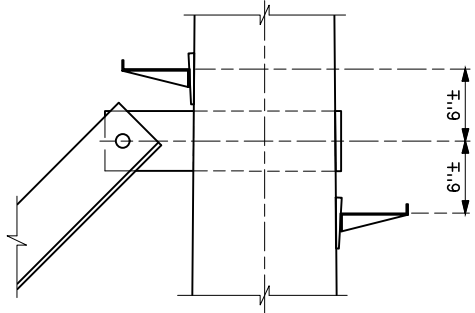


SINGLE POLE
FACE A

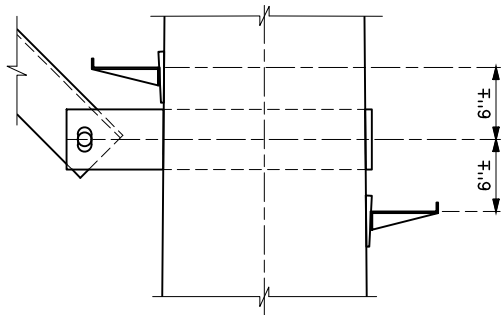


SECTION A-A

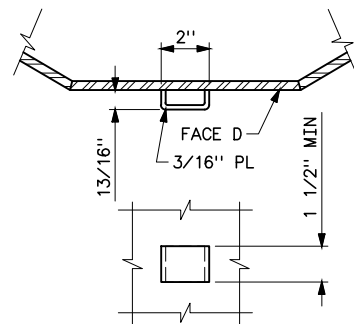
METHOD A
4-11/16" HOLES FOR REMOVABLE STEPS
METHOD B
4 SETS OF CLIPS FOR REMOVABLE CLIMBING RUNG SECTIONS



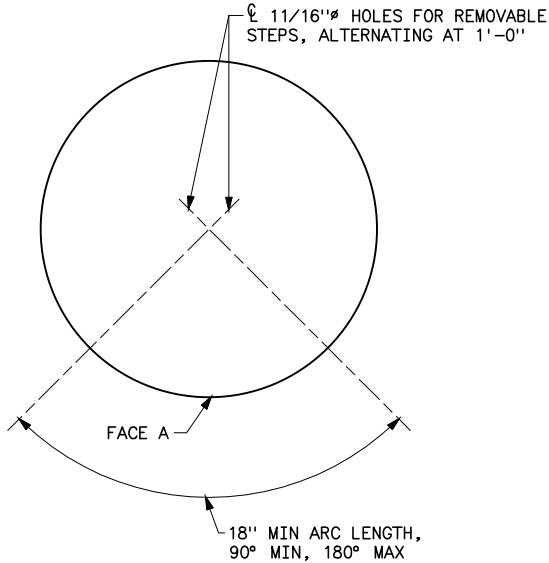
DETAIL A
METHOD A
REMOVABLE STEP SPACING TO LOWER X-BRACE ATTACHMENT



DETAIL B
METHOD A
REMOVABLE STEP SPACING TO LOWER X-BRACE ATTACHMENT



METHOD B
CLIP FOR REMOVABLE CLIMBING RUNG SECTIONS



METHOD A
REMOVABLE STEP DETAIL

NOTES

METHOD A:

1. REMOVABLE STEPS AND ATTACHMENTS SHALL BE EQUAL TO SUREFOOT STEPS AND LOCKING WEDGES AS MANUFACTURED BY NORTHPOWER LIMITED, 13 POLARIS PLACE, EAST TAMAKI, NEW ZEALAND, TELEPHONE 0-9-274-4545, FAX 0-9-274-4549.
2. ATTACH STEPS AND WEDGES DIRECTLY INTO 11/16" HOLES IN POLE SHAFT WALLS.
3. LOCATION OF HOLES FOR REMOVABLE STEPS SHALL PROVIDE FOR SMOOTH UNOBSTRUCTED CLIMBING FOR THE FULL LENGTH OF ALL POLE SHAFTS.
4. ALTERNATING SPACING FOR HOLES FOR REMOVABLE STEPS = 12" PLUS OR MINUS 1". STEP SPACING MAY VARY WITHIN ALLOWABLE TOLERANCES TO PROVIDE FOR UNOBSTRUCTED CLIMBING ACROSS X-BRACES.

ALTERNATIVE METHOD A:

5. CONTRACTOR PROPOSED AND WESTERN APPROVED EQUIVALENT CLIMBING SYSTEM.
- METHODS A AND B:
FOR "X" DIMENSIONS, SEE SPECIFICATIONS.
6. OVERSLIP OF SLIP JOINTS SHALL NOT INTERFERE WITH
 7. HOLES FOR REMOVABLE STEPS OR INSTALLATION OF REMOVABLE CLIMBING RUNG SECTIONS.

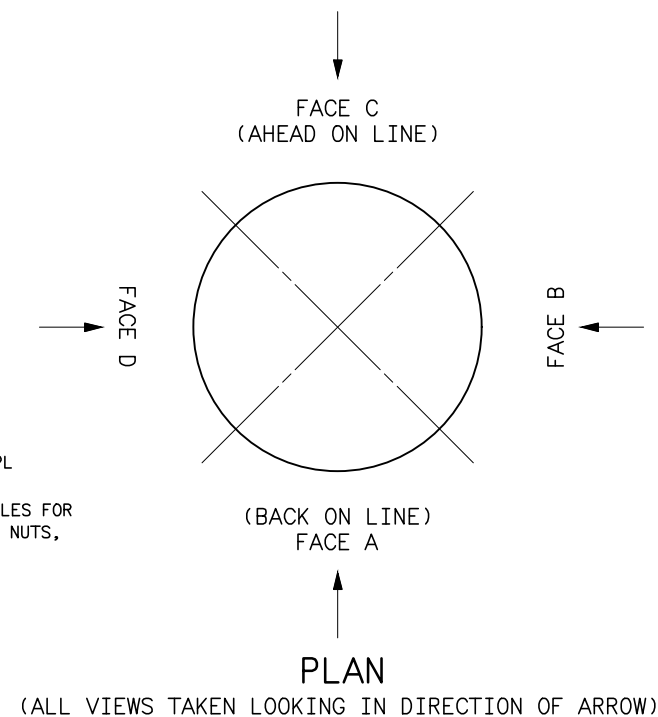
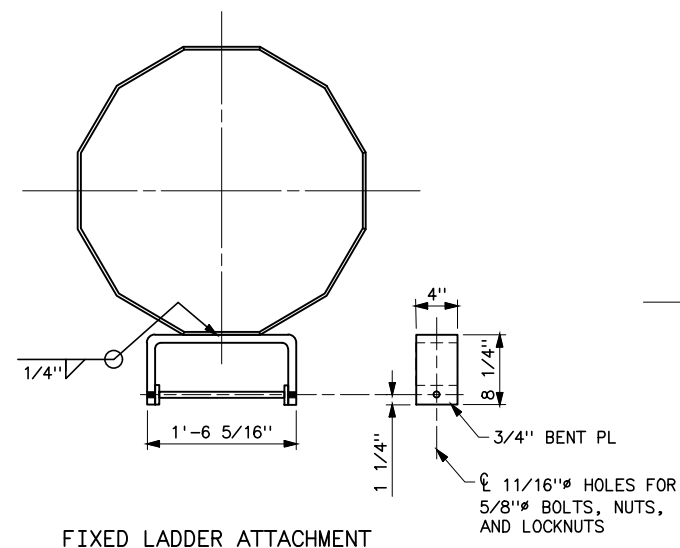
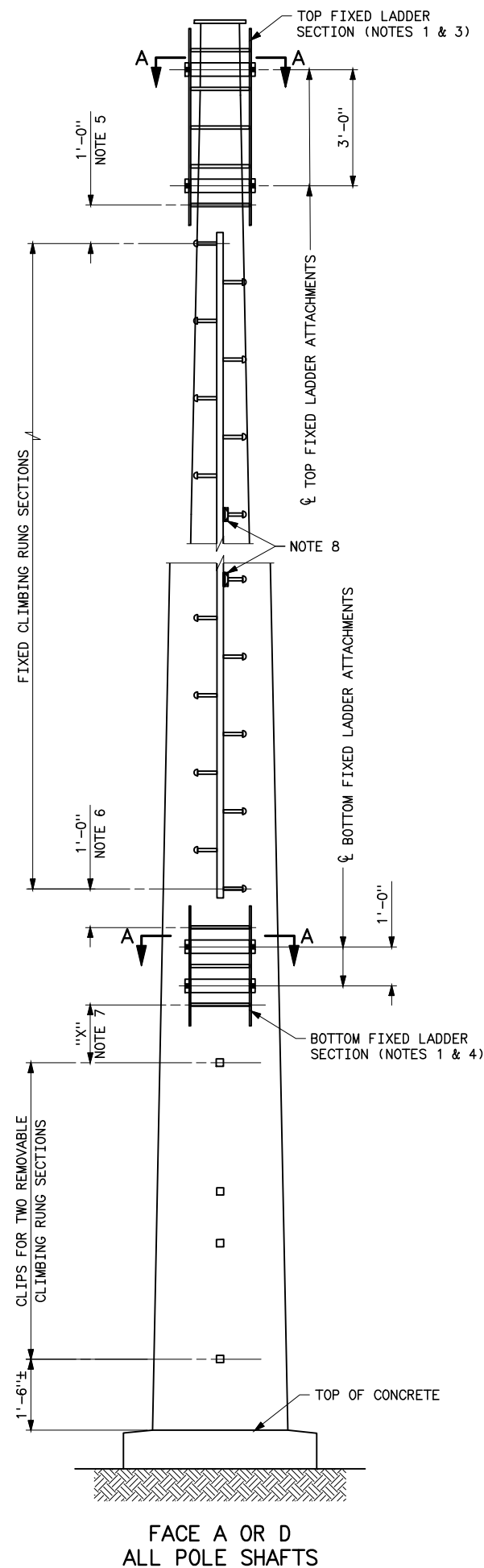
REFERENCE DRAWING

CLASS 2 EQUIVALENT STEEL
POLE H-FRAMES _____ 43-HS 2200

HISTORICAL REFERENCE ONLY
NOT TO BE USED FOR NEW CONSTRUCTION

FOR INFORMATION ONLY

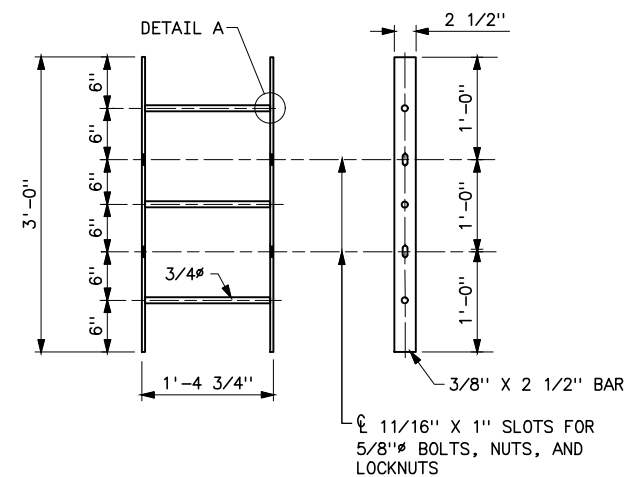
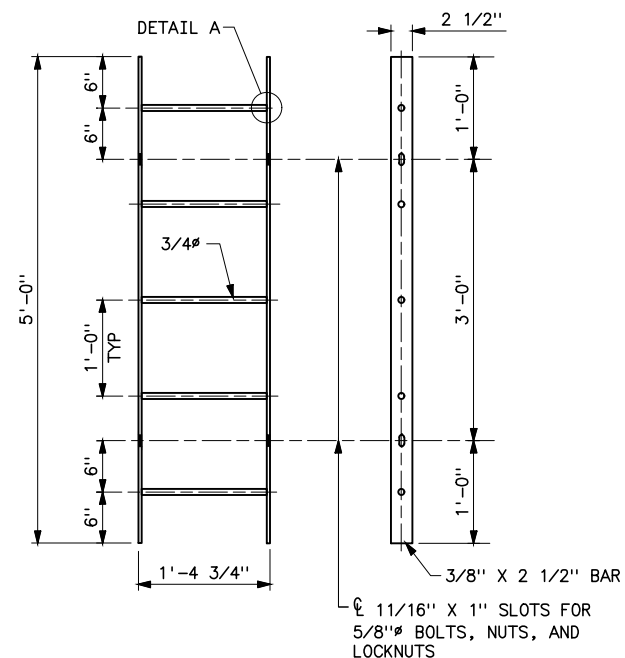
B	02-11-05 7-BGH	ADDED ALTERNATIVE METHOD A.
	03-06-03 A7-BGH	REVISED REMOVABLE STEP METHOD A TO SUREFOOT STEP AND LOCKING WEDGE SYSTEM.
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
LIGHT DUTY TRANSMISSION LINE STEEL POLE STRUCTURES CLIMBING PROVISIONS		
DESIGNED BOBBY HAGLER _____ APPROVED DOUG HANSON CIVIL ENGINEERING MANAGER		
CAE	DECEMBER 07, 2000	43 2211



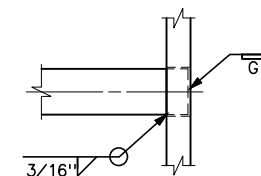
- ## NOTES
1. ATTACH VERTICAL CABLE LIFELINE SYSTEM EQUAL TO MILLER VI-GO AUTOMATIC PASS-THROUGH VERTICAL CABLE LIFELINE SYSTEM TO TOP AND BOTTOM FIXED LADDER SECTIONS.
 2. WHEN PERMANENT FALL PROTECTION IS REQUIRED, PROVIDE ALL MAINTENANCE PROVISIONS SHOWN ON MAINTENANCE PROVISIONS OUTLINES AND DETAILS DRAWINGS, EXCEPT WITH THE MODIFICATIONS LISTED IN NOTES 3 AND 4 BELOW.
 3. REPLACE THE TOP 5 FEET OF FIXED CLIMBING RUNG SECTIONS SHOWN ON OUTLINE DRAWINGS WITH A 5-FOOT TOP FIXED LADDER SECTION AND TWO FIXED LADDER ATTACHMENTS. ATTACH TOP BRACKET ASSEMBLY OF FALL PROTECTION SYSTEM TO TOP FIXED LADDER SECTION.
 4. REPLACE THE BOTTOM 3 FEET OF FIXED CLIMBING RUNG SECTIONS SHOWN ON OUTLINE DRAWINGS WITH A 3-FOOT BOTTOM FIXED LADDER SECTION AND TWO FIXED LADDER ATTACHMENTS. ATTACH BOTTOM BRACKET ASSEMBLY OF FALL PROTECTION SYSTEM TO BOTTOM FIXED LADDER SECTION.
 5. DISTANCE FROM BOTTOM RUNG OF TOP FIXED LADDER SECTION TO TOP STEP OF TOP FIXED CLIMBING RUNG SECTION SHALL BE 1 FOOT.
 6. DISTANCE FROM TOP RUNG OF BOTTOM FIXED LADDER SECTION TO BOTTOM STEP OF BOTTOM FIXED CLIMBING RUNG SECTION SHALL BE 1 FOOT.
 7. "X" DIMENSION SHALL PROVIDE A DISTANCE OF 1 FOOT FROM BOTTOM RUNG OF BOTTOM FIXED LADDER SECTION TO TOP STEP OF TOP REMOVABLE CLIMBING RUNG SECTION.
 8. INSTALL INTERMEDIATE AUTOMATIC PASS-THROUGH CABLE GUIDES AT 25-FOOT MAXIMUM INTERVALS ALONG THE CABLE FROM TOP BRACKET TO BOTTOM BRACKET. ATTACH GUIDES TO STEPS ON FIXED CLIMBING RUNG SECTIONS.

REFERENCE DRAWINGS

MAINTENANCE PROVISIONS-
OUTLINES-----43 2206 THRU 2209, & 2214
DETAILS-----43 2210



BOTTOM FIXED LADDER SECTION



DETAIL A

**HISTORICAL REFERENCE ONLY
NOT TO BE USED FOR NEW CONSTRUCTION**

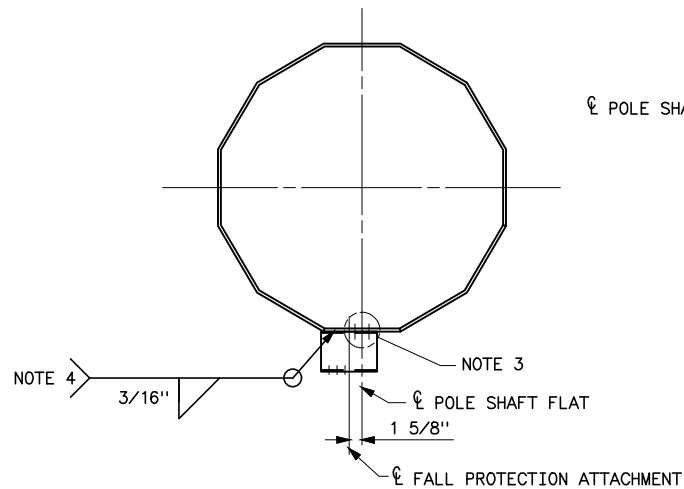
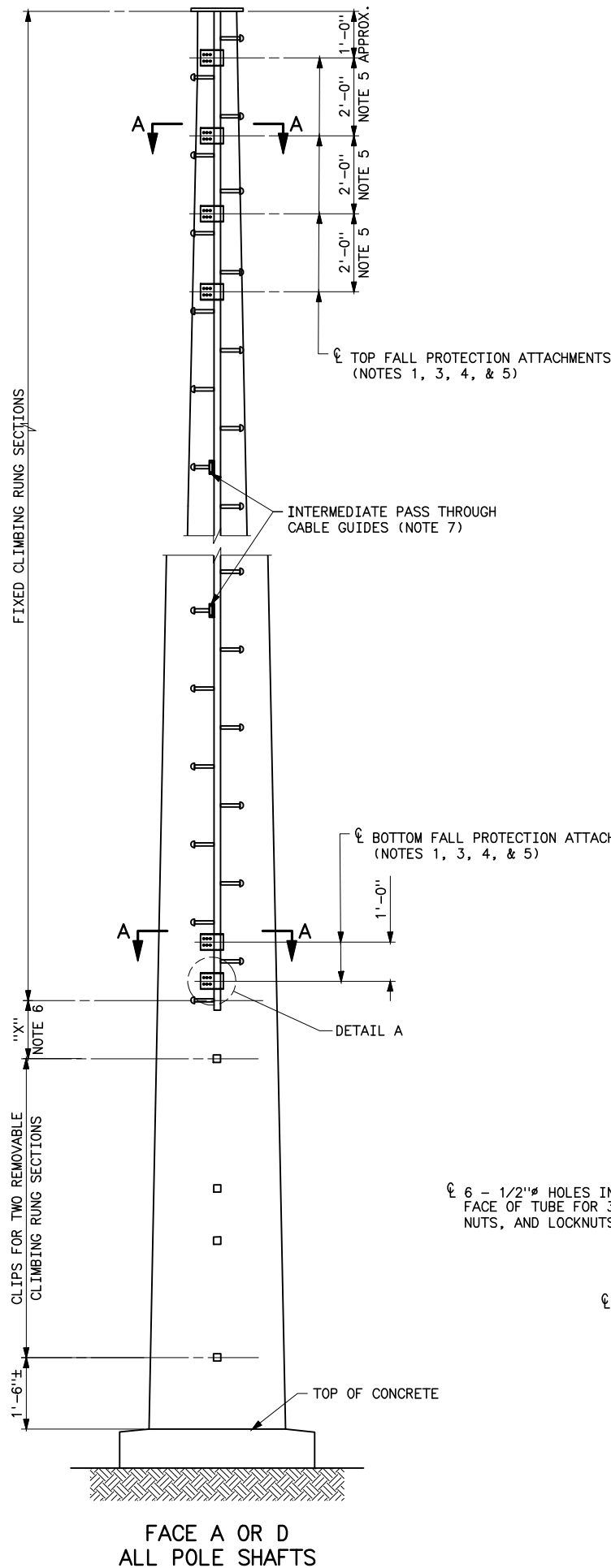
FOR INFORMATION ONLY

UNITED STATES DEPARTMENT OF ENERGY
WESTERN AREA POWER ADMINISTRATION
CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO

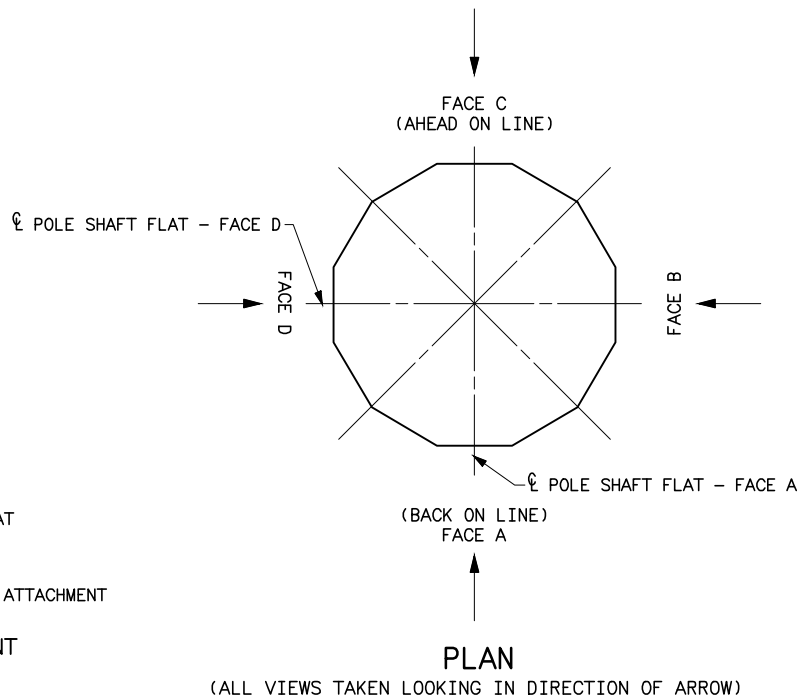
**TRANSMISSION LINE STEEL POLE
STRUCTURE STANDARDS
MAINTENANCE PROVISIONS
PERMANENT FALL PROTECTION - DETAILS**

DESIGNED BOBBY HAGLER _____ APPROVED DOUG HANSON _____
CIVIL ENGINEERING MANAGER

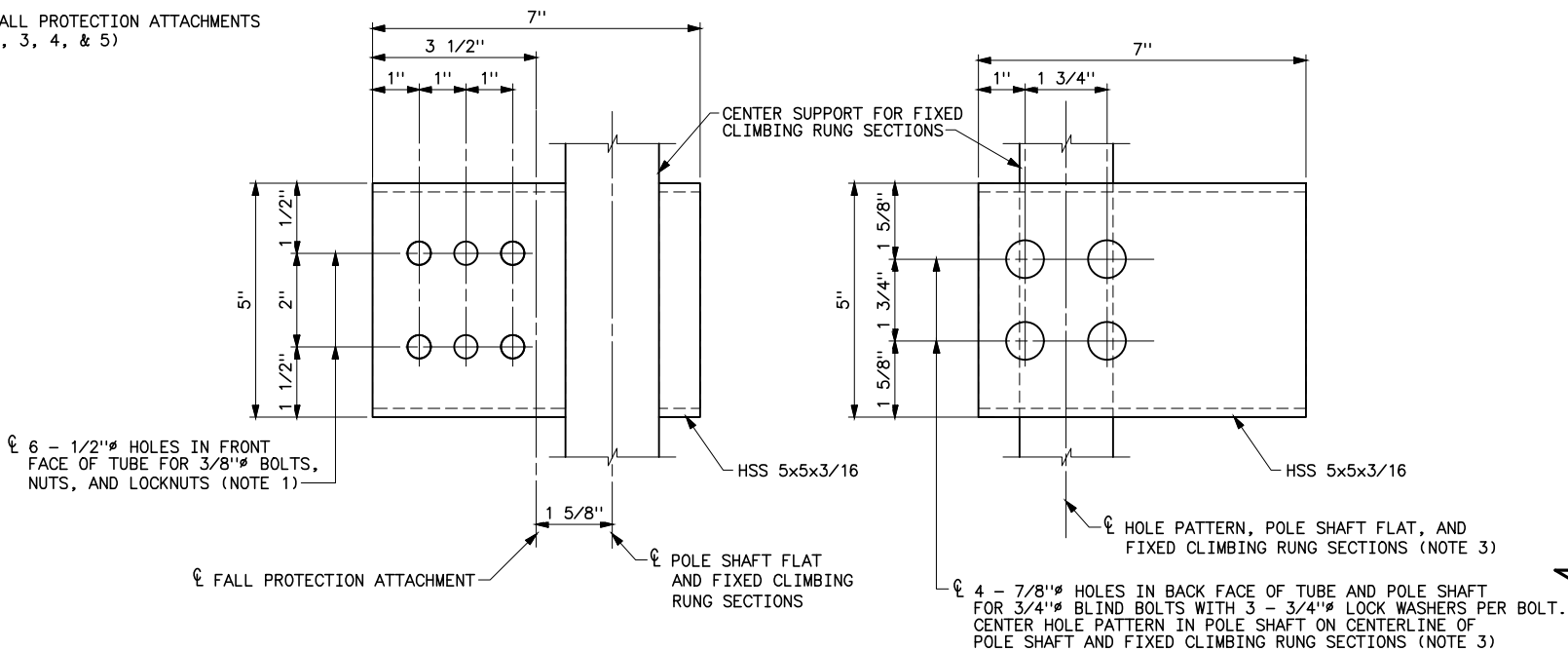
CA	FEBRUARY 5, 2015	43	2215
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HSS TUBE FALL PROTECTION ATTACHMENT
SECTION A-A
(FIXED CLIMBING RUNG SECTIONS NOT SHOWN)



PLAN
(ALL VIEWS TAKEN LOOKING IN DIRECTION OF ARROW)



HSS TUBE FALL PROTECTION ATTACHMENT
DETAIL A

- NOTES**
1. ATTACH MILLER VI-GO AUTOMATIC PASS-THROUGH VERTICAL CABLE LIFELINE SYSTEM, OR APPROVED EQUAL, TO TOP AND BOTTOM HSS TUBE FALL PROTECTION ATTACHMENTS WITH 3/8" BOLTS, NUTS, AND LOCKNUTS.
 2. PROVIDE ALL APPLICABLE MAINTENANCE PROVISIONS SHOWN ON MAINTENANCE PROVISIONS REFERENCE DRAWINGS LISTED BELOW.
 3. FOR RETROFIT STRUCTURES ONLY:
BLIND BOLT ATTACHMENT METHOD:
SIX (6) FALL PROTECTION ATTACHMENTS ARE REQUIRED FOR EACH POLE SHAFT FACE WITH FIXED CLIMBING RUNG SECTIONS.
DRILL FOUR (4) 7/8" HOLES FOR EACH FALL PROTECTION ATTACHMENT IN POLE SHAFT FLAT DIRECTLY BEHIND FIXED CLIMBING RUNG SECTIONS. HOLE PATTERN SHALL BE AS SHOWN IN DETAIL A - BACK VIEW.
ATTACH FALL PROTECTION ATTACHMENTS TO POLE SHAFT WITH FOUR (4) - 3/4" HIGH TENSILE BLIND BOLTS WITH DACRALON CORROSION RESISTANCE FINISH AS MANUFACTURED BY ABRAFAST, OR APPROVED EQUAL. INSTALL THREE (3) 3/4" GALVANIZED LOCK WASHERS PER BLIND BOLT ON INSIDE OF HSS TUBE PRIOR TO TIGHTENING NUTS. TWENTY-FOUR (24) BLIND BOLTS AND SEVENTY-TWO (72) LOCK WASHERS ARE REQUIRED FOR EACH POLE SHAFT FACE WITH VERTICAL CABLE LIFELINE SYSTEM. INSTALL BLIND BOLTS IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS.
OPTIONAL WELDING ATTACHMENT METHOD:
WELD FALL PROTECTION ATTACHMENTS TO POLE SHAFT IN ACCORDANCE WITH NOTE 4. FOR GALVANIZED STRUCTURES, GRIND AREAS TO BE WELDED AND REPAIR IN ACCORDANCE WITH ASTM A 780.
 4. FOR NEW STRUCTURES ONLY:
WELD SIX (6) FALL PROTECTION ATTACHMENTS TO EACH POLE SHAFT FACE WITH FIXED CLIMBING RUNG SECTIONS. WELD EACH ATTACHMENT ALL AROUND WITH 3/16" FILLET WELD IN ACCORDANCE WITH AWS D1.1. LOCATE FALL PROTECTION ATTACHMENTS DIRECTLY BEHIND FIXED CLIMBING RUNG SECTIONS AS SHOWN IN FRONT VIEW OF DETAIL A.
 5. LOCATE TOP AND BOTTOM FALL PROTECTION ATTACHMENTS AS CLOSE AS POSSIBLE TO TOP AND BOTTOM OF FIXED CLIMBING RUNG SECTIONS TO NOT INTERFERE WITH ATTACHMENTS FOR FIXED CLIMBING RUNG SECTIONS.
 6. "X" DIMENSION SHALL PROVIDE A DISTANCE OF 1 FOOT FROM BOTTOM RUNG OF BOTTOM FIXED LADDER SECTION TO TOP STEP OF TOP REMOVABLE CLIMBING RUNG SECTION.
 7. INSTALL INTERMEDIATE AUTOMATIC PASS-THROUGH CABLE GUIDES AT 25-FOOT MAXIMUM INTERVALS ALONG THE CABLE FROM TOP BRACKET ASSEMBLY TO BOTTOM BRACKET ASSEMBLY. ATTACH GUIDES TO STEPS ON FIXED CLIMBING RUNG SECTIONS. ALIGN GUIDES WITH CABLE ON VERTICAL CABLE LIFELINE SYSTEM

REFERENCE DRAWINGS

MAINTENANCE PROVISIONS-
OUTLINES _____ 43 2206 THRU 2209, & 2214
DETAILS _____ 43 2210

**HISTORICAL REFERENCE ONLY
NOT TO BE USED FOR NEW CONSTRUCTION**

FOR INFORMATION ONLY

A	3/4/2015 17-BEP	ADDED ADDITIONAL FALL PROTECTION ATTACHMENTS	
	UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
TRANSMISSION LINE STEEL POLE STRUCTURE STANDARDS MAINTENANCE PROVISIONS PERMANENT FALL PROTECTION - DETAILS			
DESIGNED <u>BRONSON PERRY</u> -----		APPROVED <u>DOUG HANSON</u> CIVIL ENGINEERING MANAGER -----	
CA	FEBRUARY 20, 2015	43	2210