

MINNESOTA NRCS CONSERVATION PRACTICE 382

Minnesota Technical Note for Fence Installation



Figure 1. H-Brace End Assembly

TABLE OF CONTENTS

| <u>SECTION</u> | <u>PAGE</u> |
|--|-------------|
| Introduction..... | 3 |
| H-Brace End Assembly | 4 |
| H-Brace Corner Assembly..... | 5 |
| Double H-Brace End Assembly..... | 6 |
| Double H-Brace Corner Assembly | 7 |
| Pull Assembly | 8 |
| Double Pull Assembly | 9 |
| Power Fence..... | 10 |
| Power Fence-Interior, Single Post, Single Wire..... | 11 |
| Diagonal End Brace Assembly..... | 12 |
| Diagonal Corner Brace Assembly | 13 |
| Barbed Wire Fence | 14 |
| Woven Wire Fence | 15 |
| Rock Crib Corner..... | 16 |
| Safety Fence, Other Fencing Materials, Considerations in Planning..... | 17 |
| Illustrations | 19 |
| References..... | 27 |

Introduction

Use this technical note as a guide to installation of fence with an intended lifespan of 20 years.

This document diagrams installation methods that follow industry standards. Other installation methods MAY be approved if they have been demonstrated to meet the 20 year lifespan of the practice under the planned conditions of use and in a similar environmental setting. Deviations from the installation methods in this document will be approved by the Regional Grazing Specialist or Area Resource Conservationist. Deviations will be documented using the Fence Standard Exception Form ([form](#)) if the installation is connected to a conservation financial assistance contract.

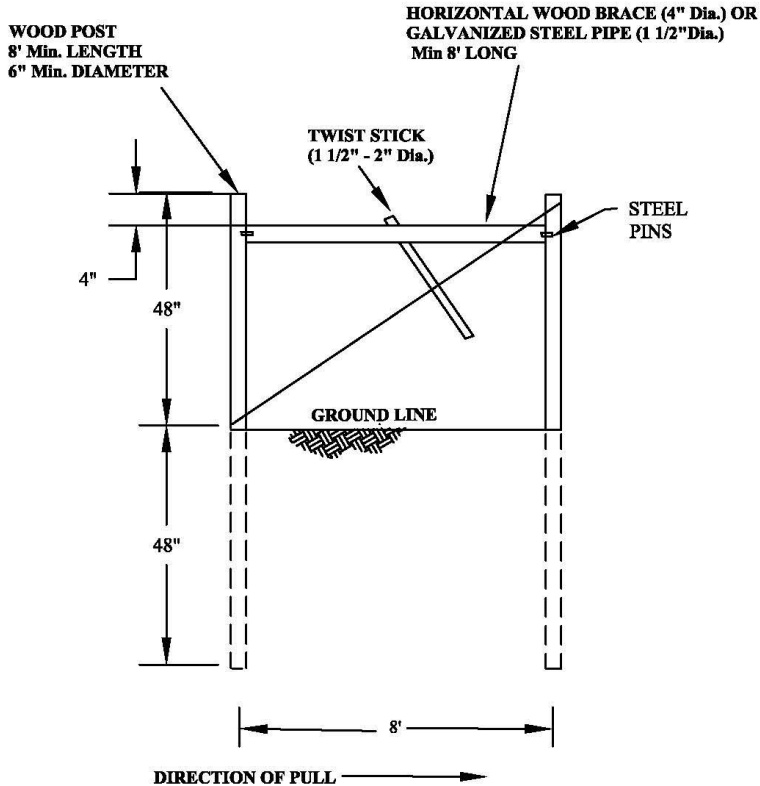
Other construction methods that meet the 20 year lifespan requirements may be found in the BLM/USFWS/FS “Fences” manual available from the NRCS Regional Grazing Specialist



Figure 2. Floating Brace Assembly

Minnesota NRCS

END BRACE ASSEMBLY



POSTS

ALL WOOD POSTS EXCEPT RED CEDAR, BLACK LOCUST, TAMARACK, WHITE CEDAR, REDWOOD, WHITE OAK, AND BURR OAK SHALL BE TREATED BY A METHOD SUCH THAT COMPLETE SATURATION OF THE SAPWOOD IS OBTAINED.

USED RAILROAD TIES OR HIGHLINE POLES IN SOUND CONDITION MAY BE UTILIZED FOR POSTS IF FREE FROM CRACKING OR DECAY.

BRACE WIRE

2 COMPLETE LOOPS OF 9 Ga. WIRE OR 1 COMPLETE LOOP OF 12.5 Ga. HIGH TENSILE WIRE.

ALL WIRE SHALL HAVE A SUFFICIENT COATING TO PROTECT THE WIRE FOR THE MINIMUM LIFE EXPECTANCY OF 20 YEARS.

BRACING IS REQUIRED WHERE THE FENCE ENDS AND ON HINGED SIDES OF GATE OPENINGS

PRACTICE MEETS MN NRCS STANDARDS AND SPECIFICATIONS:

YES _____ NO _____

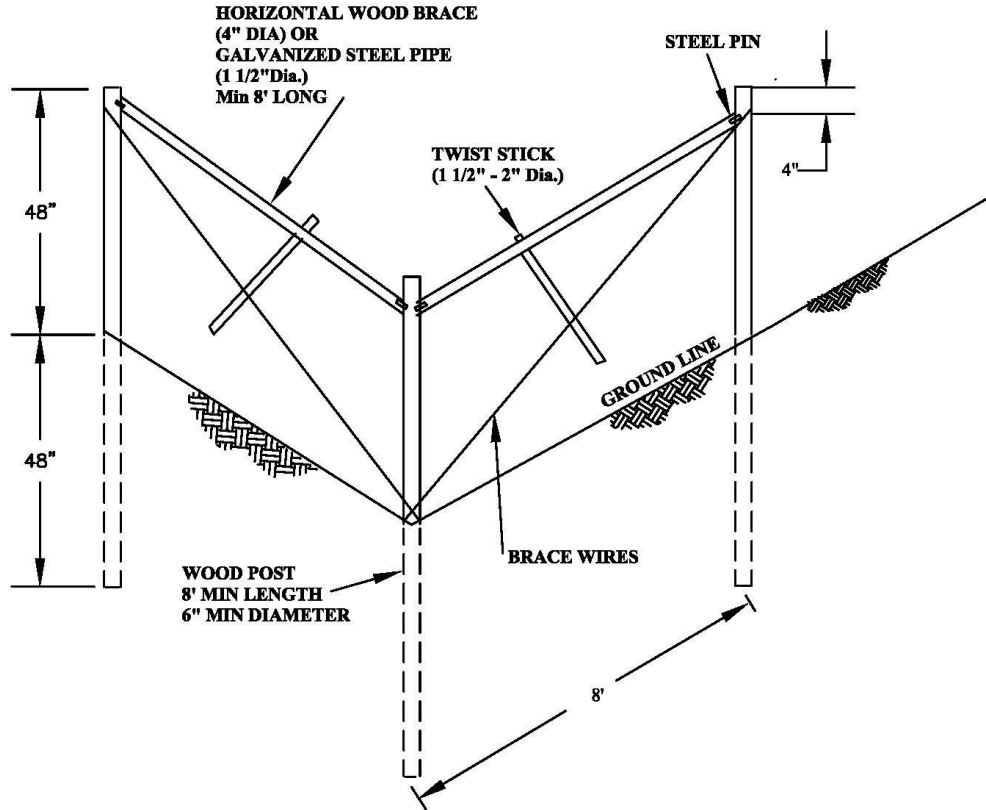
CERTIFIED BY:

Name and Date

MN-ECS-021
5-06

"State law and NRCS policy require that the excavator contact Gopher State One Call at (800) 252-1166 for utility locations 48 hours prior to the start of excavation work."

CORNER BRACE ASSEMBLY



POSTS

ALL WOOD POSTS EXCEPT RED CEDAR, BLACK LOCUST, TAMARACK, WHITE CEDAR, REDWOOD, WHITE OAK, AND BURR OAK SHALL BE TREATED BY A METHOD SUCH THAT COMPLETE SATURATION OF THE SAPWOOD IS OBTAINED.

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BRACE WIRE

2 COMPLETE LOOPS OF 9 Ga. WIRE OR 1 COMPLETE LOOP OF 12.5 Ga. HIGH TENSILE WIRE.

ALL WIRE SHALL HAVE A SUFFICIENT COATING TO PROTECT THE WIRE FOR THE MINIMUM LIFE EXPECTANCY OF 20 YEARS.

CORNERS ARE REQUIRED AT ALL POINTS WHERE THE FENCE ALIGNMENT CHANGES 15 DEGREES OR MORE.

PRACTICE MEETS MN NRCS STANDARDS AND SPECIFICATIONS

YES _____ NO _____

CERTIFIED BY:

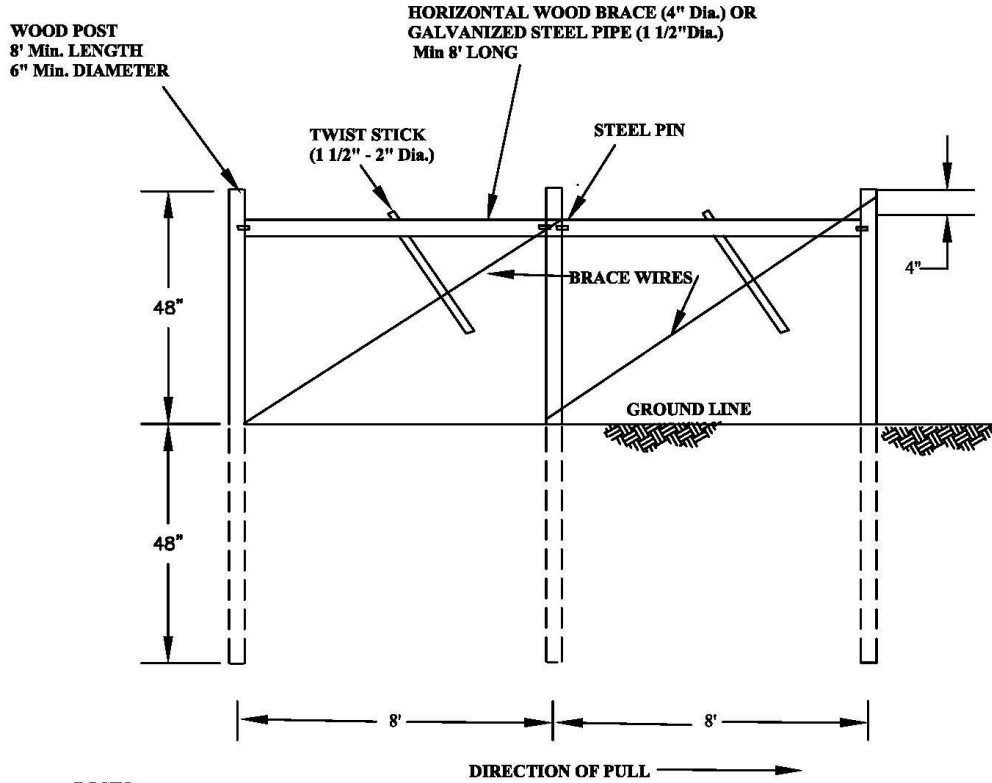
Name and Date

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"State law and NRCS policy require that the excavator contact Gopher State One Call at (800)

Minnesota NRCS

DOUBLE END BRACE ASSEMBLY



POSTS

ALL WOOD POSTS EXCEPT RED CEDAR, BLACK LOCUST, TAMARACK, WHITE CEDAR, REDWOOD, WHITE OAK, AND BURR OAK SHALL BE TREATED BY A METHOD SUCH THAT COMPLETE SATURATION OF THE SAPWOOD IS OBTAINED.

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BRACING IS REQUIRED WHERE THE FENCE ENDS AND ON HINGED SIDES OF GATE OPENINGS

PRACTICE MEETS MN NRCS STANDARDS AND SPECIFICATIONS

YES _____ NO _____

CERTIFIED BY:

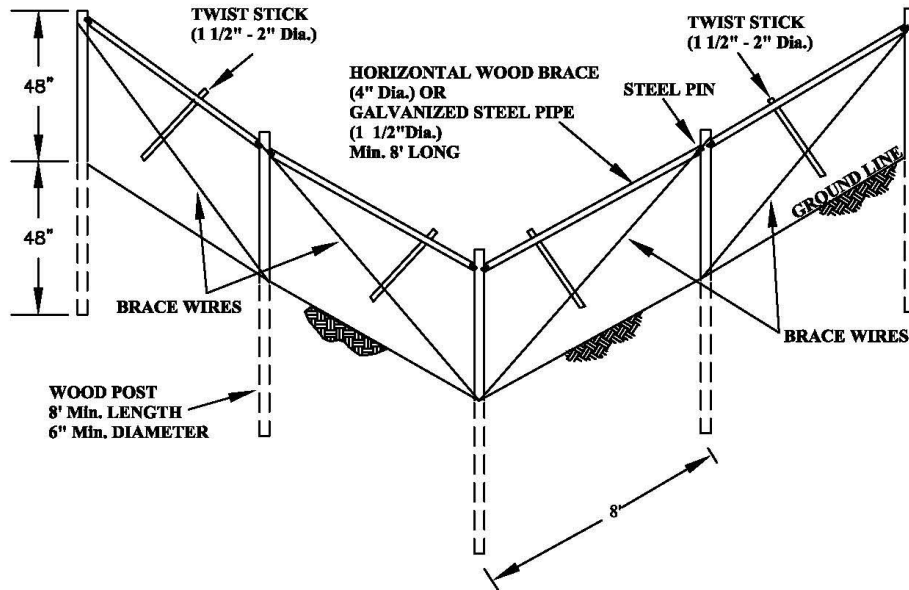
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DOUBLE CORNER BRACE ASSEMBLY



POSTS

ALL WOOD POSTS EXCEPT RED CEDAR, BLACK LOCUST, TAMARACK, WHITE CEDAR, REDWOOD, WHITE OAK, AND BURR OAK SHALL BE TREATED BY A METHOD SUCH THAT COMPLETE SATURATION OF THE SAPWOOD IS OBTAINED.

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YES _____ NO _____

CERTIFIED BY:

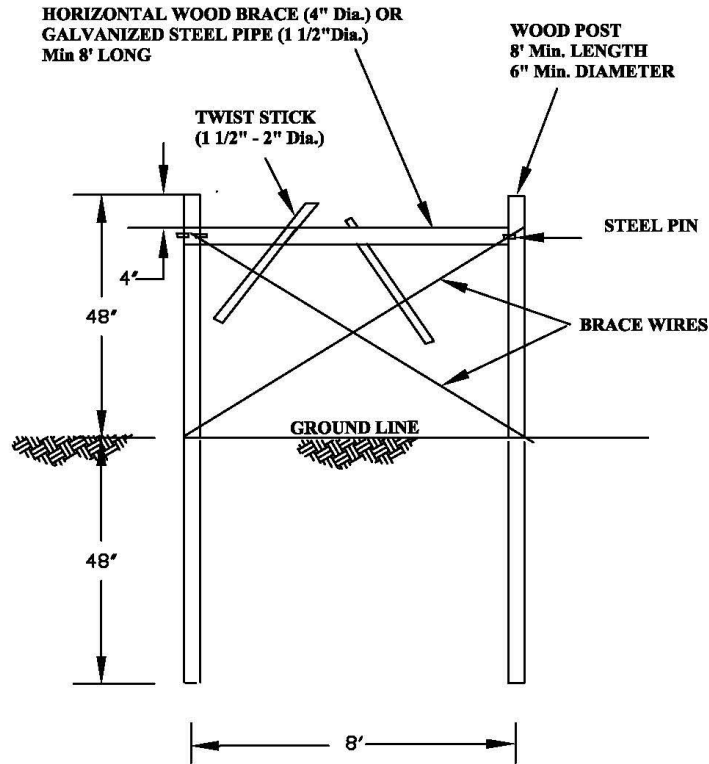
Name and Date

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PULL BRACE ASSEMBLY



POSTS

ALL WOOD POSTS EXCEPT RED CEDAR, BLACK LOCUST, TAMARACK, WHITE CEDAR, REDWOOD, WHITE OAK, AND BURR OAK SHALL BE TREATED BY A METHOD SUCH THAT COMPLETE SATURATION OF THE SAPWOOD IS OBTAINED.

USED RAILROAD TIES OR HIGHLINE POLES IN SOUND CONDITION MAY BE UTILIZED FOR POSTS IF FREE FROM CRACKING OR DECAY.

PULL ASSEMBLIES ARE REQUIRED IN STRAIGHT SECTIONS OF THE FENCE SO THAT THE MAXIMUM DISTANCE BETWEEN BRACES DOES NOT EXCEED:

- 330 Ft. WOVEN WIRE FENCE
- 660 Ft. BARB WIRE FENCE
- 1320 Ft. HIGH TENSILE WOVEN WIRE
- 2640 Ft. POWER FENCE

BRACE WIRE

2 COMPLETE LOOPS OF 9 Ga. WIRE OR 1 COMPLETE LOOP OF 12.5 Ga. HIGH TENSILE WIRE.

ALL WIRE SHALL HAVE A SUFFICIENT COATING TO PROTECT THE WIRE FOR THE MINIMUM LIFE EXPECTANCY OF 20 YEARS.

PRACTICE MEETS MN NRCS STANDARDS AND SPECIFICATIONS

YES _____ NO _____

CERTIFIED BY:

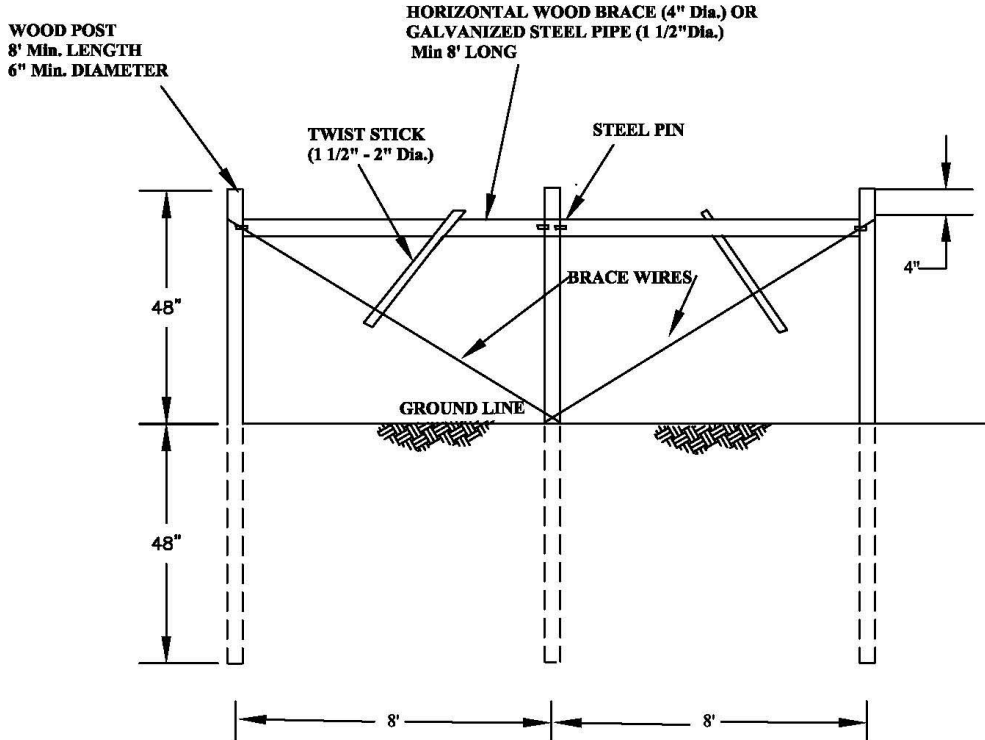
Name and Date

"State law and NRCS policy require that the excavator contact Gopher State One Call at (800) 252-1166 for utility locations 48 hours prior to the start of excavation work."

MN-ECS-022
5-06

Minnesota NRCS

DOUBLE PULL BRACE ASSEMBLY



POSTS

ALL WOOD POSTS EXCEPT RED CEDAR, BLACK LOCUST, TAMARACK, WHITE CEDAR, REDWOOD, WHITE OAK, AND BURR OAK SHALL BE TREATED BY A METHOD SUCH THAT COMPLETE SATURATION OF THE SAPWOOD IS OBTAINED.

USED RAILROAD TIES OR HIGHLINE POLES IN SOUND CONDITION MAY BE UTILIZED FOR POSTS IF FREE FROM CRACKING OR DECAY.

BRACE WIRE

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PULL ASSEMBLIES ARE REQUIRED IN STRAIGHT SECTIONS OF THE FENCE SO THAT THE MAXIMUM DISTANCE BETWEEN BRACES DOES NOT EXCEED:

- 330 Ft. WOVEN WIRE FENCE
- 660 Ft. BARB WIRE FENCE
- 1320 Ft. HIGH TENSILE WOVEN WIRE
- 2640 Ft. POWER FENCE

PRACTICE MEETS MN NRCS STANDARDS AND SPECIFICATIONS:

YES _____ NO _____

CERTIFIED BY:

Name and Date

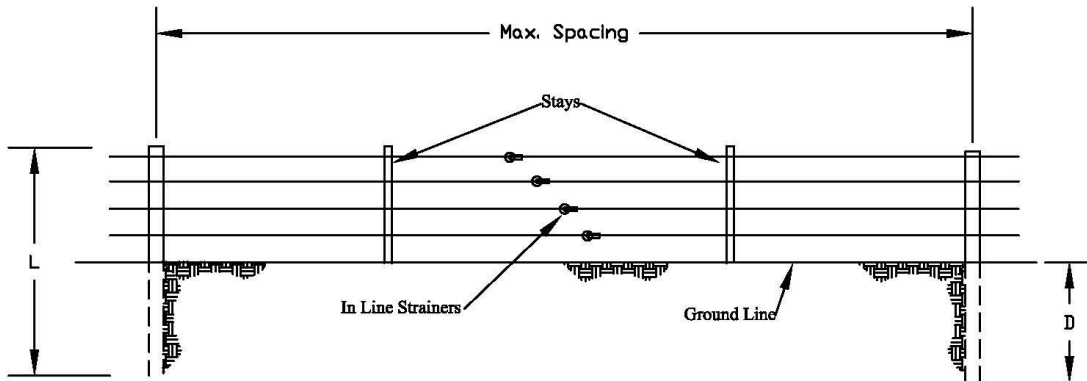
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POWER FENCE

50' w/ out stay _____
 100' w/ 1 stay _____
 150' w/ 2 stays _____



POSTS

Wood: L = 6.5 Ft. Min.
 D = 2.5 Ft. Min.
 Dia = 4 In. Min.

ALL WOOD POSTS EXCEPT RED CEDAR, BLACK LOCUST, TAMARAC, WHITE CEDAR, REDWOOD, WHITE OAK, AND BURR OAK SHALL BE TREATED BY A METHOD SUCH THAT COMPLETE SATURATION OF THE SAPWOOD IS OBTAINED.

STEEL: L = 5.5 Ft. Min.
 D = 1.5 Ft. Min.
 Standard "T" ≥ 1.25 Lbs/Ft.

ALL STEEL POSTS WILL HAVE AN ANCHOR PLATE ATTACHED AND WILL BE EITHER GALVANIZED OR PAINTED.

FIBERGLASS: L = 5.5 Ft. Min.
 D = 1.5 Ft. Min.
 Dia = 7/8 In. Min.

ALL FIBERGLASS SHALL HAVE ULTRAVIOLET PROTECTIVE COATING FOR THE MINIMUM LIFE EXPECTANCY OF 20 YEARS.

WIRE

PERIMETER: 12.5 Ga. Min. HIGH TENSILE
 135,000 Psi. Min. TENSILE STRENGTH

INTERIOR: 14 Ga. Min. HIGH TENSILE

ALL WIRE SHALL HAVE SUFFICIENT COATING TO PROTECT THE WIRE FOR THE MINIMUM LIFE EXPECTANCY OF 20 YEARS.

FASTENERS

STAPLES: 1 = 1.5" Min. FOR SOFTWOODS
 L = 1" Min. FOR HARDWOODS
 SPACE SHALL BE LEFT BETWEEN POSTS AND STAPLES TO PERMIT FREE MOVEMENT OF THE WIRE
 WIRE CLIPS WILL BE PROVIDED BY OR GALVANIZED WIRE 12 Ga. Min.

ENERGIZER

PER MANUFACTURERS RECOMMENDATIONS WITH THE FOLLOWING MINIMUM REQUIREMENTS:
 3 GROUND RODS PER ENERGIZER.
 6 Ft. X 1/2 in., GALVANIZED ROD.
 SPACING NOT LESS THAN 10 FEET.
 65 ft. FROM FARMSTEAD ELECTRICAL SYSTEM GROUND RODS.

LIGHTING DIVERTERS / ARRESTORS

1 PER ENERGIZER, MINIMUM.
 65 Ft. FROM EARTH RETURN RODS.

PERIMETER _____ INTERIOR _____

| | PLANNED | APPLIED |
|-------------|---------|---------|
| # WIRES | _____ | _____ |
| LINEAR FEET | _____ | _____ |
| FIELD # | _____ | _____ |
| CIN | _____ | _____ |

PLANNING ASSISTANCE BY

 Name and Date
 PRACTICE MEETS MN NRCS STANDARDS AND SPECIFICATIONS
 YES _____ NO _____

CERTIFIED BY:

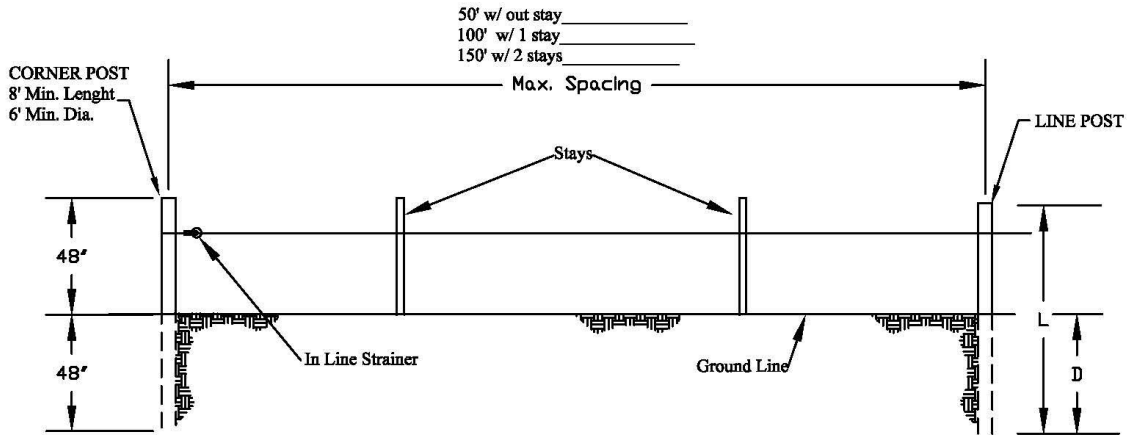
 Name and Date

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MN-ECS-016
 4-11

Minnesota NRCS

POWER FENCE - INTERIOR Single End Post - Single Wire



LINE POSTS

Wood: L = 6.5 Ft. Min.
D = 2.5 Ft. Min.
Dia = 4 In. Min.

ALL WOOD POSTS EXCEPT RED CEDAR, BLACK LOCUST, TAMARAC, WHITE CEDAR, REDWOOD, WHITE OAK, AND BURR OAK SHALL BE TREATED BY A METHOD SUCH THAT COMPLETE SATURATION OF THE SAPWOOD IS OBTAINED.

STEEL: L = 5.5 Ft. Min.
D = 1.5 Ft. Min.
Standard "T" ≥ 1.25 Lbs/Ft.

ALL STEEL POSTS WILL HAVE AN ANCHOR PLATE ATTACHED AND WILL BE EITHER GALVANIZED OR PAINTED.

FIBERGLASS: L = 5.5 Ft. Min.
D = 1.5 Ft. Min.
Dia = 7/8 In. Min.

ALL FIBERGLASS SHALL HAVE ULTRAVIOLET PROTECTIVE COATING FOR THE MINIMUM LIFE EXPECTANCY OF 20 YEARS.

INTERIOR: 14 Ga. Min. HIGH TENSILE

ALL WIRE SHALL HAVE SUFFICIENT COATING TO PROTECT THE WIRE FOR THE MINIMUM LIFE EXPECTANCY OF 20 YEARS.

ENERGIZER

PER MANUFACTURERS RECOMMENDATIONS WITH THE FOLLOWING MINIMUM REQUIREMENTS:
3 GROUND RODS PER ENERGIZER.
6 Ft. X 1/2 In., GALVANIZED ROD.
SPACING NOT LESS THAN 10 FEET.
65 Ft. FROM FARMSTEAD ELECTRICAL SYSTEM GROUND RODS.

LIGHTING DIVERTERS / ARRESTORS

1 PER ENERGIZER, MINIMUM.
65 Ft. FROM EARTH RETURN RODS.

| | PLANNED | APPLIED |
|-------------|---------|---------|
| LINEAR FEET | _____ | _____ |
| FIELD # | _____ | _____ |
| CIN | _____ | _____ |

PLANNING ASSISTANCE BY

Name and Date
PRACTICE MEETS MN NRCS STANDARDS AND SPECIFICATIONS
YES _____ NO _____

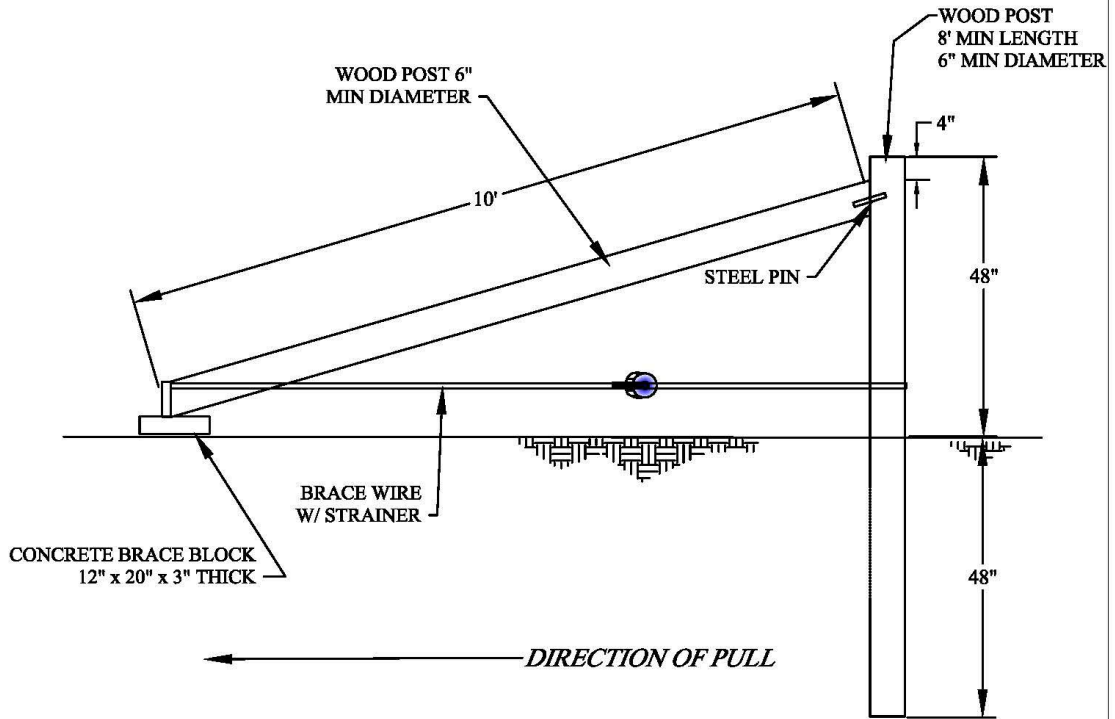
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MN-ECS-026
6-12

Minnesota NRCS
DIAGONAL END BRACE ASSEMBLY



POSTS

ALL WOOD POSTS EXCEPT RED CEDAR, BLACK LOCUST, TAMARACK, WHITE CEDAR, REDWOOD, WHITE OAK, AND BURR OAK SHALL BE TREATED BY A METHOD SUCH THAT COMPLETE SATURATION OF THE SAPWOOD IS OBTAINED.

USED RAILROAD TIES OR HIGHLINE POLES IN SOUND CONDITION MAY BE UTILIZED FOR POSTS IF FREE FROM CRACKING OR DECAY.

BRACE WIRE

ONE COMPLETE LOOP OF 12.5 Ga. HIGH TENSILE WIRE

ALL WIRE SHALL HAVE A SUFFICIENT COATING TO PROTECT THE WIRE FOR THE MINIMUM LIFE EXPECTANCY OF 20 YEARS.

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BRACING IS REQUIRED WHERE THE FENCE ENDS AND ON HINGED SIDES OF GATE OPENINGS

PRACTICE MEETS MN NRCS STANDARDS AND SPECIFICATIONS

YES _____ NO _____

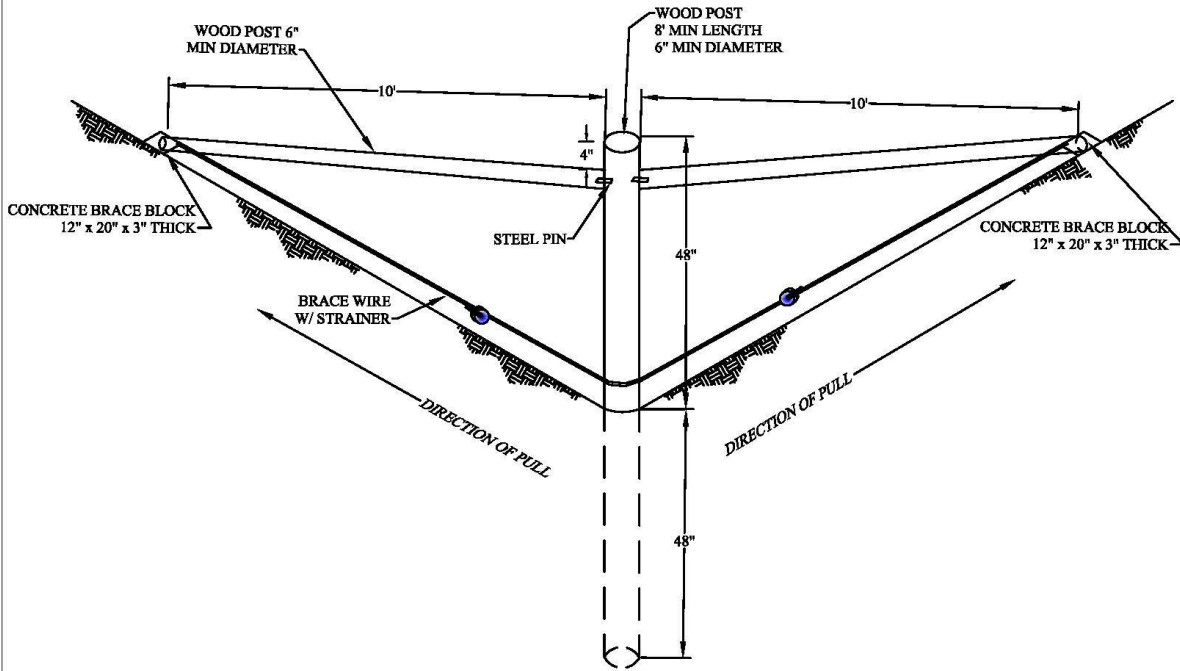
CERTIFIED BY:

 Name and Date

MN-ECS-019
 5-06

Minnesota NRCS

DIAGONAL CORNER BRACE ASSEMBLY



POSTS

ALL WOOD POSTS EXCEPT RED CEDAR, BLACK LOCUST, TAMARACK, WHITE CEDAR, REDWOOD, WHITE OAK, AND BURR OAK SHALL BE TREATED BY A METHOD SUCH THAT COMPLETE SATURATION OF THE SAPWOOD IS OBTAINED.

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ALL WIRE SHALL HAVE A SUFFICIENT COATING TO PROTECT THE WIRE FOR THE MINIMUM LIFE EXPECTANCY OF 20 YEARS.

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CORNERS ARE REQUIRED AT ALL POINTS WHERE THE FENCE ALIGNMENT CHANGES 15 DEGREES OR MORE.

PRACTICE MEETS MN NRCS STANDARDS AND SPECIFICATIONS

YES _____ NO _____

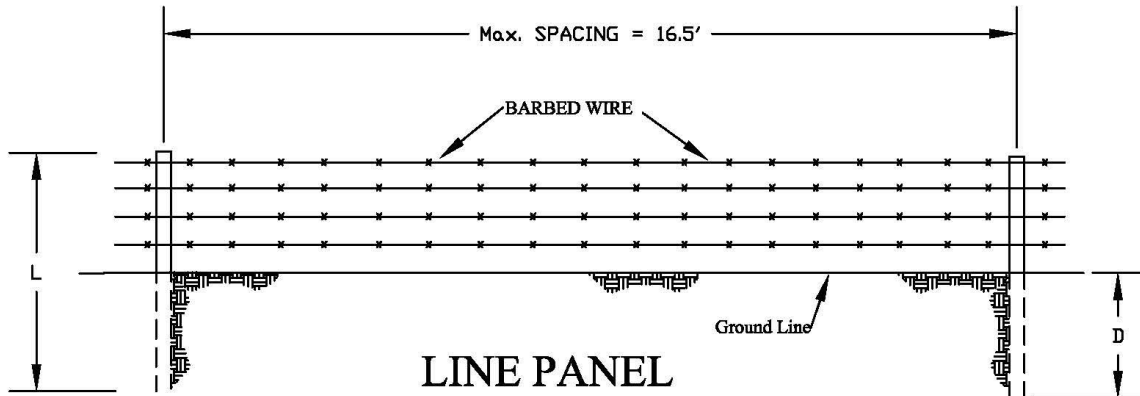
CERTIFIED BY:

Name and Date

MN-ECS-028
5-06

Minnesota NRCS

BARBED WIRE FENCE



LINE PANEL

POSTS

Wood: L = 7 Ft. Min.
 D = 3 Ft. Min.
 Dia = 4 In. Min.

ALL WOOD POSTS EXCEPT RED CEDAR, BLACK LOCUST, TAMARAC, WHITE CEDAR, REDWOOD, WHITE OAK, AND BURR OAK SHALL BE TREATED BY A METHOD SUCH THAT COMPLETE SATURATION OF THE SAPWOOD IS OBTAINED.

STEEL: L = 5.5 Ft. Min
 D = 1.5 Ft. Min
 Standard "T" \geq 1.25 lbs/ft.

ALL STEEL POSTS WILL HAVE AN ANCHOR PLATE ATTACHED AND WILL BE EITHER GALVANIZED OR PAINTED.

FASTENERS

STAPLES: L = 1.5" Min. FOR SOFTWOODS
 L = 1.0" Min. FOR HARDWOODS

SPACE SHALL BE LEFT BETWEEN POSTS AND STAPLES TO PERMIT FREE MOVEMENT OF THE WIRE

WIRE CLIPS WILL BE PROVIDED BY MANUFACTURER
 OR GALVANIZED WIRE 12 Ga. Min.

WIRE

BARBED: 12.5 Ga. Min. CONVENTIONAL
 15.5 Ga. HIGH TENSILE

14 Ga. OR HEAVIER TWO POINT BARBS ON APPROXIMATE 5 In. CENTERS

ALL WIRE SHALL HAVE SUFFICIENT COATING TO PROTECT THE WIRE FOR THE MINIMUM LIFE EXPECTANCY OF 20 YEARS.

PERIMETER _____ INTERIOR _____

| | PLANNED | APPLIED |
|-------------|---------|---------|
| # WIRES | _____ | _____ |
| LINEAR FEET | _____ | _____ |
| FIELD # | _____ | _____ |
| CIN | _____ | _____ |

PLANNING ASSISTANCE BY

 Name and Date

PRACTICE MEETS MN NRCS STANDARDS AND SPECIFICATIONS
 YES _____ NO _____

CERTIFIED BY:

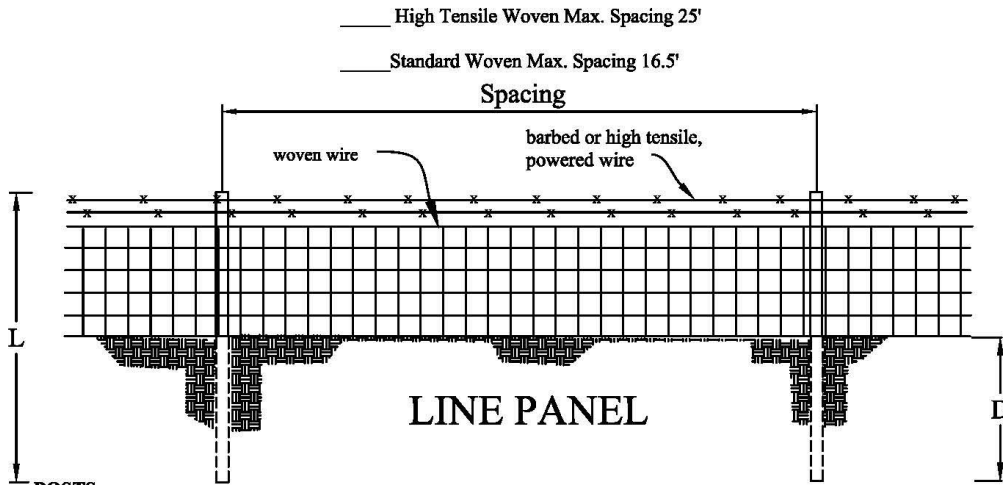
 Name and Date

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 4-11

Minnesota NRCS

WOVEN WIRE FENCE



LINE PANEL

POSTS

WOOD: L= 7 Ft. Min.
D= 3 Ft.Min.
Dia= 4 In. Min.

ALL WOOD POSTS EXCEPT RED CEDAR, BLACK LOCUST, TAMARACK, WHITE CEDAR, REDWOOD, WHITE OAK, AND BURR OAK SHALL BE TREATED BY A METHOD SUCH THAT COMPLETE SATURATION OF THE SAPWOOD IS OBTAINED.

STEEL: L= 5.5 Ft. Min.
D= 1.5 Ft. Min.

Standard "T" > 1.25 Lbs./ Ft.
ALL STEEL POSTS WILL HAVE AN ANCHOR PLATE ATTACHED AND WILL BE EITHER GALVANIZED OR PAINTED.

FASTENERS

STAPLES: L= 1.5 In. Min. FOR SOFTWOODS
L= 1 In. Min. FOR HARDWOODS

SPACE SHALL BE LEFT BETWEEN POSTS AND STAPLES TO PERMIT FREE MOVEMENT OF THE WIRE.

WIRE CLIPS: WILL BE PROVIDED BY MANUFACTURERS OR GALVANIZED WIRE 12 Ga. Min.

WIRE

BARBED: 12.5 Ga. CONVENTIONAL
15.5 Ga. HIGH TENSILE
14 Ga. OR HEAVIER TWO POINT BARBS ON APPROX. 5 In. CENTERS.
HIGH TENSILE: 12.5 Ga. Min.
135,000 Psi Min. TENSILE STRENGTH

WOVEN: 11 Ga. Min. TOP & BOTTOM WIRES
12.5 Ga. Min. LINE & STAY WIRES
12.5 Ga. Min. HIGH TENSILE
DO NOT MIX BARBED AND HIGH TENSILE WIRE.
DO NOT ELECTRIFY BARBED WIRE.

ALL WIRE SHALL HAVE SUFFICIENT COATING TO PROTECT THE WIRE FOR THE MINIMUM LIFE EXPECTANCY OF 20 YEARS.

PERIMETER _____ INTERIOR _____

32" WOVEN W/ 2 BARB OR 2 HT POWERED _____
36" WOVEN W/ 1 BARB OR 1 HT POWERED _____

PLANNED APPLIED

LINEAR FEET _____
FIELD # _____
CIN _____

PLANNING ASSISTANCE BY:

Name and Date

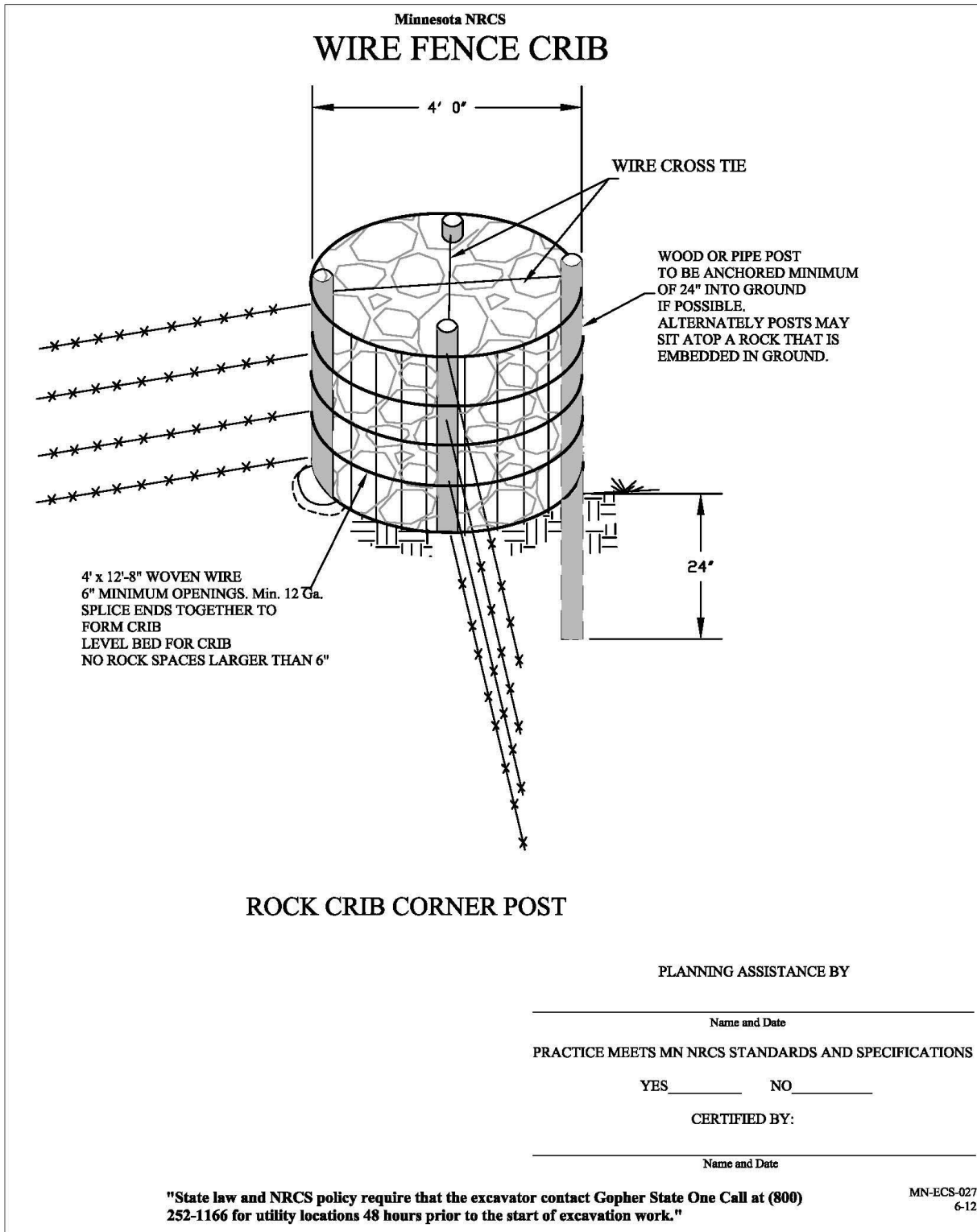
PRACTICE MEETS MN NRCS STANDARDS AND SPECIFICATIONS

YES _____ NO _____

CERTIFIED BY:

Name and Date

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Safety Fence/Special Purpose Fence

Safety fences keep people and animals out of dangerous locations, usually manure storage structures. Use this link for drawings containing details for safety fences built from cattle panels, woven wire or chain link:

<http://www.mn.nrcs.usda.gov/technical/eng/cadd.html>

Special Purpose fence design will be pre-approved prior to installation by an individual with adequate Technical Approval Authority. The design will achieve the intended purpose of the fence and the construction methods and materials will meet the 20 year lifespan requirements of the Fence (382) Standard.

Other Fencing Materials

Manufactured corner and brace assemblies built by the Geotek Company, commonly referred to as “Common Sense Fence, meet the 20 year lifespan requirements of the 382 Standard, based on a statement on file from the company. Other manufactured materials do not have statements on file but may meet the lifespan based on written guarantees. If you have questions about the lifespan characteristics of manufactured braces or materials consult your Regional Grazing Specialist or Area Resource Conservationist.

Considerations When Planning Fence

Species Specific Considerations

Sheep and goats need 4 or more wire high tensile fence or woven wire fences to contain them and keep predators away. The bottom of the fence needs to be low enough to prevent predators from burrowing underneath the fence.

Deer or elk require multiple strand high tensile electric or woven wire built tall enough to keep them from jumping out, usually 8 feet tall or more.

Bison usually require multiple strands of high tensile electrified fence, woven wire fence a minimum of eight feet tall or a combination of materials. To reduce costs consider using the 8 foot tall fences on the perimeter and shorter fences on the interior.

Docile animals such as mature dairy cows may be contained with one wire electric fences for interior fence.

The producer’s preference determines the number of wires for interior electric fences with beef cattle. Some will insist on keeping calves with the mothers at all times while others will allow the calves to freely move into an adjacent paddock and then return to their mothers to nurse.

Temporary or Portable Fence

Producers use temporary or portable fence to subdivide paddocks into smaller units. Portable fence wire consists of a blend of plastic and metal fibers woven into strands of varying diameters or woven into a mesh netting. The products with a high metal content produce a higher charge carrying capacity and shocking power. These products do not meet the lifespan requirements for this standard. Step in fence posts support the wire or mesh and also do not meet the lifespan requirements for permanent fence materials.

Construction Details

High tensile electric fence with more than six wires or fences that will be constructed in sandy loam or loamy sand or other unstable soil conditions will need double bracing. Consider adding cut off switches to isolate sections of the fence for troubleshooting short circuits or for fence maintenance. Adding a surge protector at the fence energizer plug in is good insurance against energizer damage from lightning strikes along with a lightning diverter/arrestor installed to the energizer manufacturer's specifications.

Illustrations

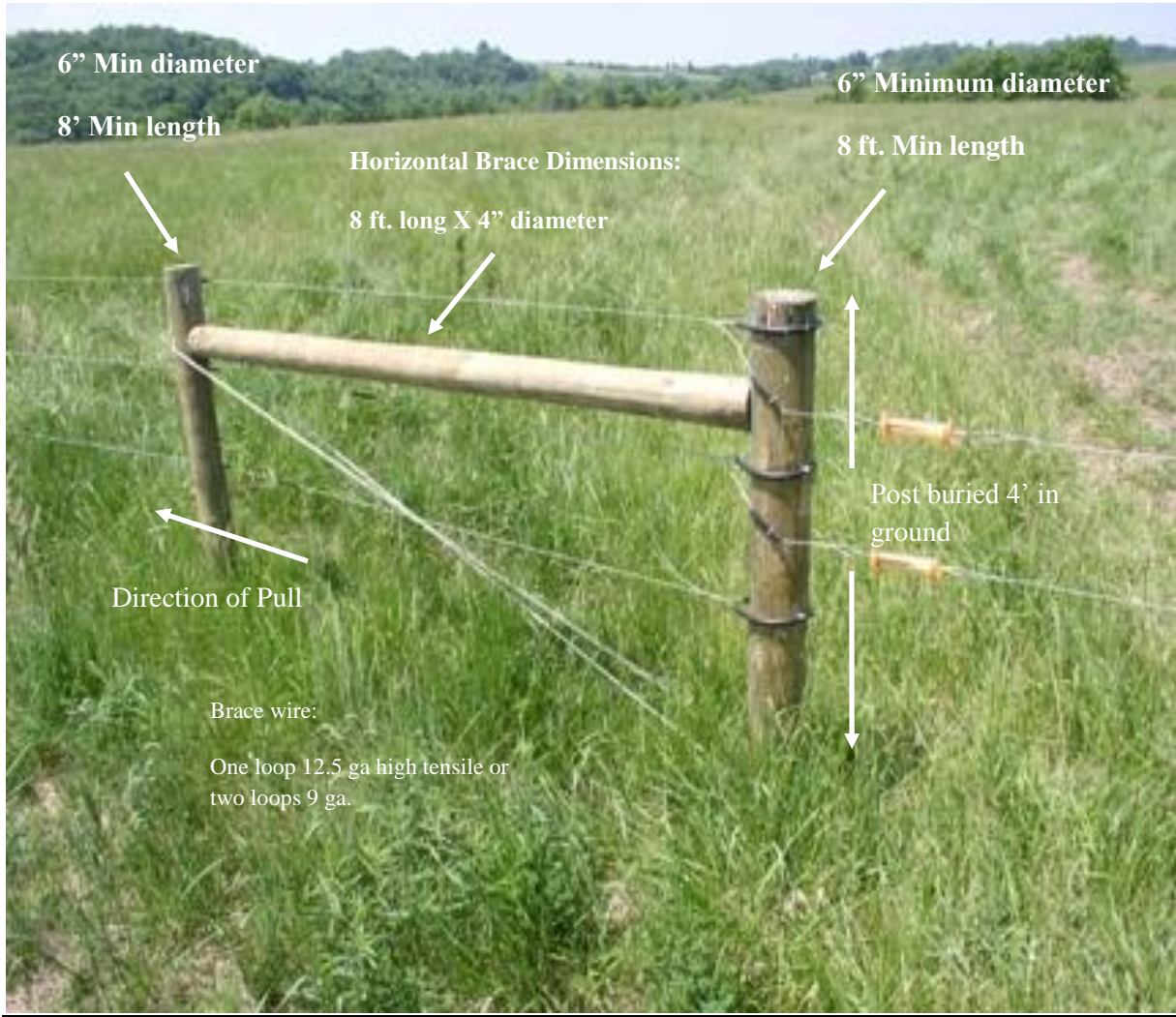


Figure 3. H-Brace Construction Details

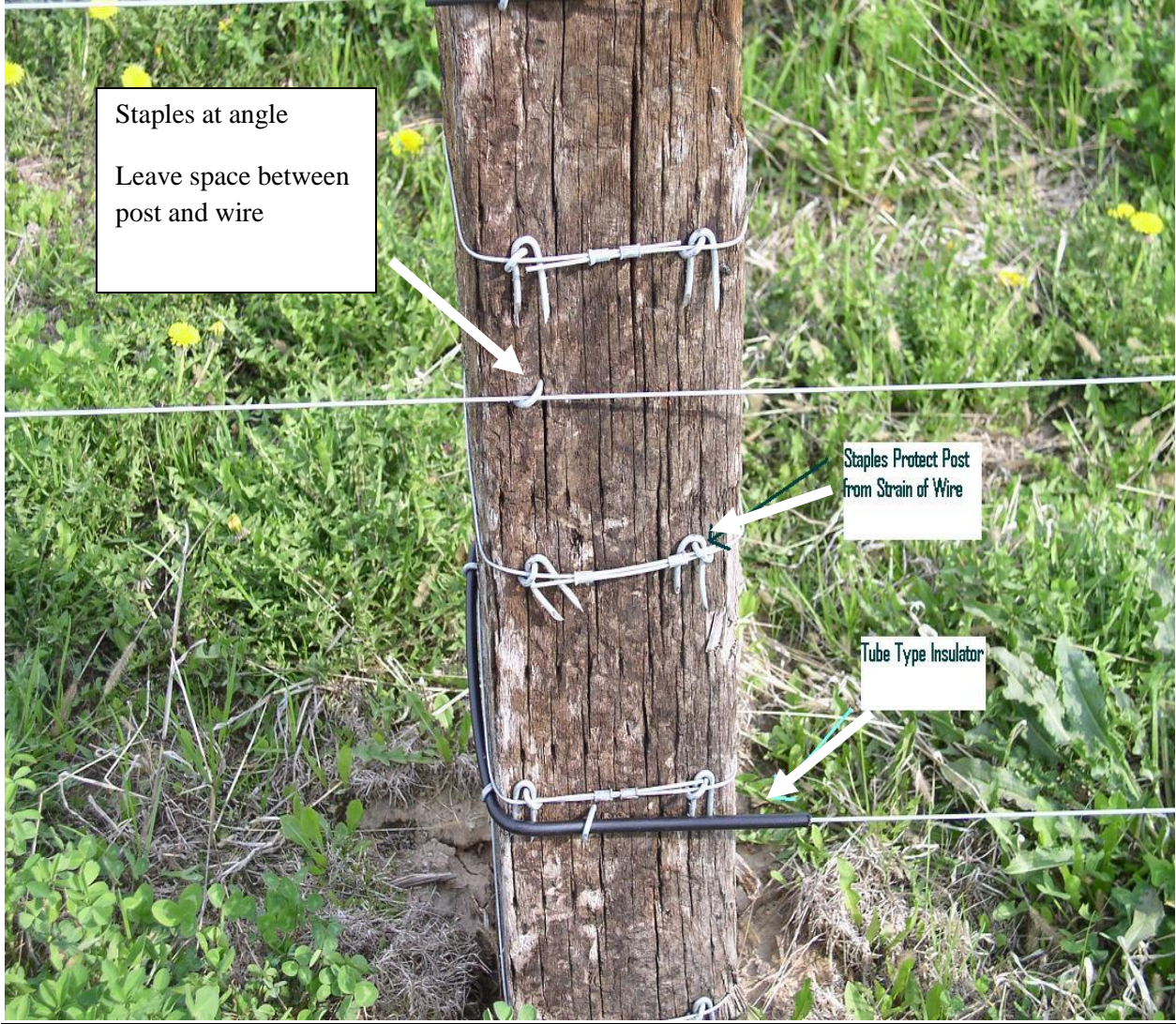


Figure 4. HT Wire Construction Details

Figure 5. Steps in Building H-Brace



Dig in post hole and tamp earth in lifts or drive post



Drill hole to attach horizontal brace with pin

Figure 5. Steps in Building H- Brace (cont)



Attaching 10” Brace Pin



Attaching and tightening brace wire with twitch stick. Also may use ratchet tightener



Figure 6. Manufactured Fiberglass Corner with 20 year lifespan

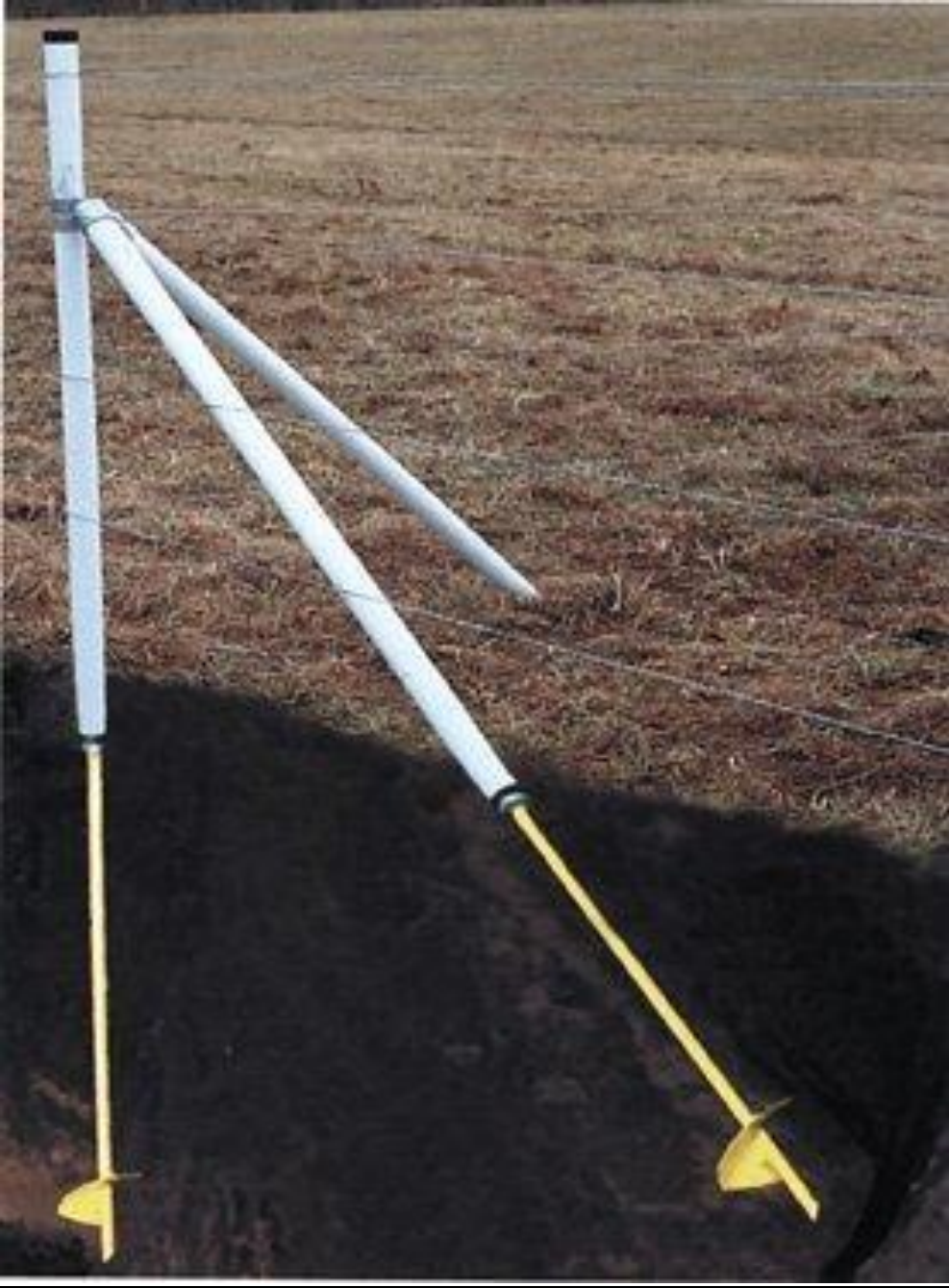


Figure 7. Method of anchoring manufactured brace system



Figure 8. Double Floating Brace

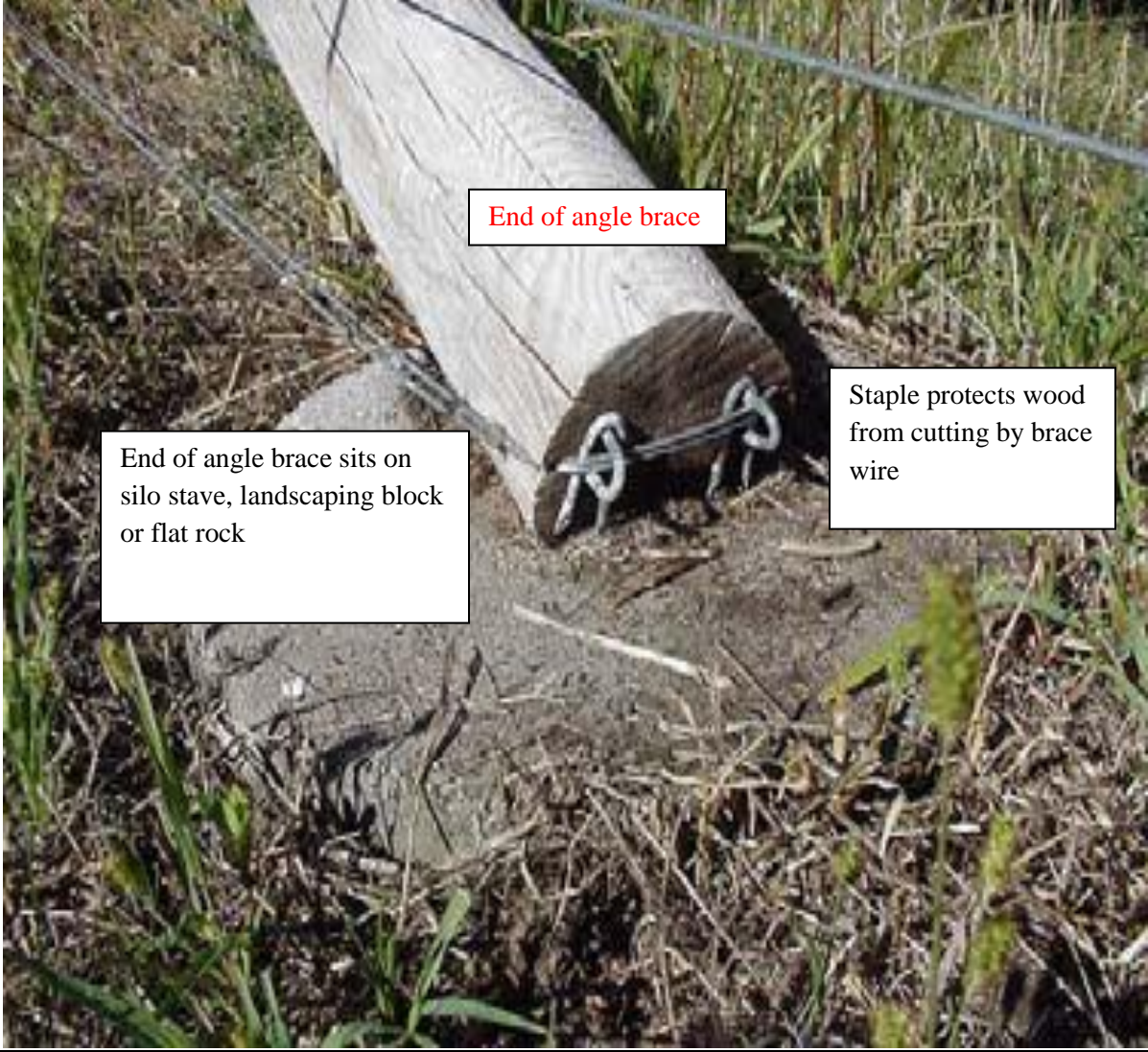


Figure 9. Floating Brace Construction Details

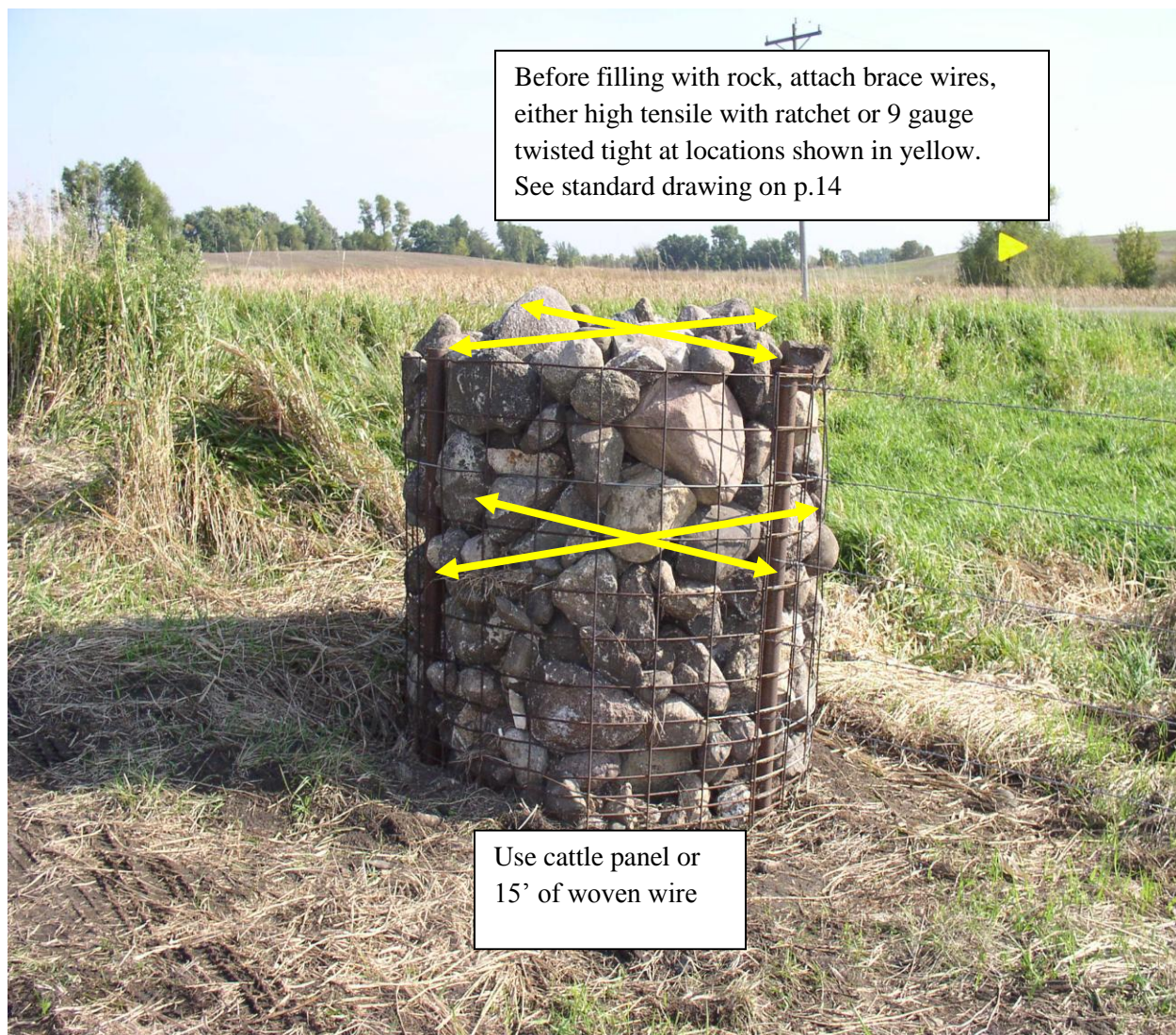


Figure 10. Rock Basket End Post

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